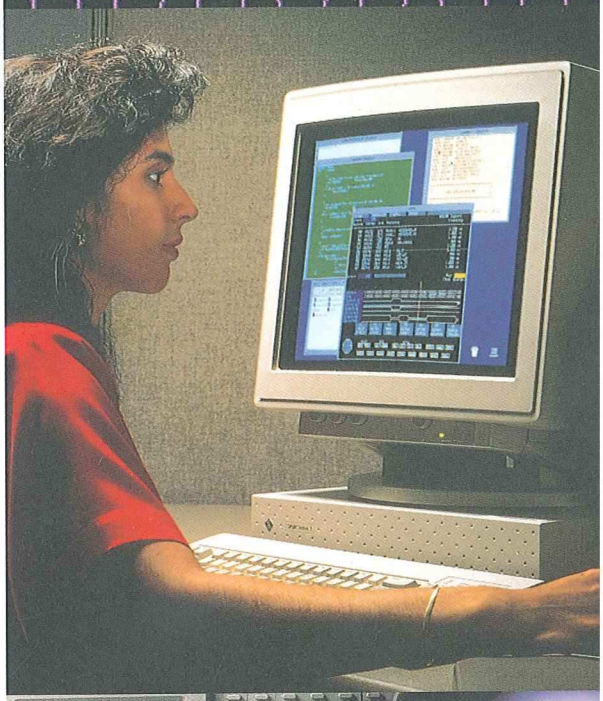
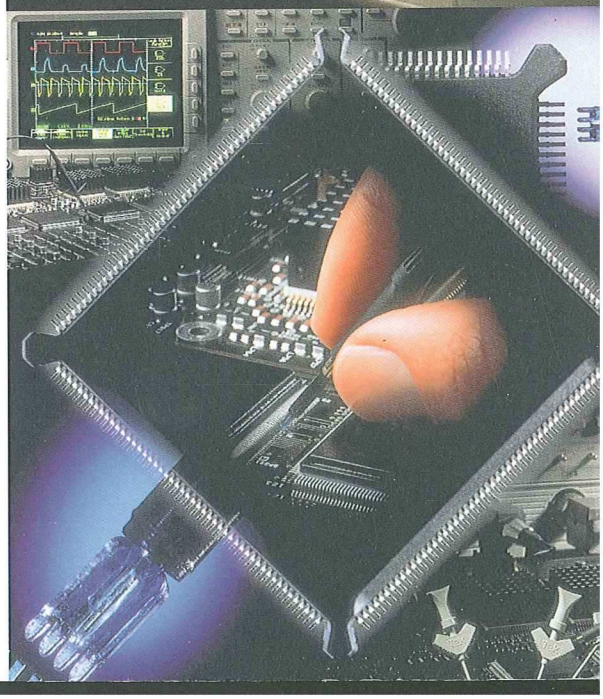
Tektronix

Measurement Products Catalog 1995







Tektronix: A Lifetime of Value

The 1995 Tektronix Measurement Products Catalog features a wide range of new products and enhancements to many of our proven instruments.

Customer Support

No other test and measurement supplier can match the remarkable depth of customer support offered by Tektronix. We offer technical support, service training, and service warranties. For additional information and the Tektronix representative nearest you, see the listing in the back of this catalog.



Literature Available Via Fax

You can now receive information via fax—ideal for technical information you need immediately. Product information or application notes are available any time of the day via Tektronix INFOfax. See page 584 for complete information.

Tektronix/Advantest

In 1993 Tektronix became the exclusive distributor of Advantest test and measurement products in North America. Featured in this catalog are a wide-range of Advantest products in the RF/Microwave and Telecommunications areas. These exciting products are highly complementary to the Tektronix instrument portfolio. So look for the Advantest logo throughout this catalog to identify new high-performance, high-quality products from another leading company in the Test and Measurement industry: ADVANTEST.

Tektronix/Rohde&Schwarz

Also, in 1993, Tektronix has assumed exclusive marketing, distribution, service, and support for Rohde&Schwarz Test and Measurement products in the U.S. Similarly, Rohde&Schwarz has assumed marketing, distribution, service and support responsibility for Tektronix Test and Measurement, Telecommunications, and Television Test products in Eastern Europe, most of the Mediterranean and Middle East, and the CIS. **ROHDE&SCHWARZ**

Tektronix/Analogic

In 1994 Tektronix assumed exclusive marketing, distribution, service, and support for Analogic VXI products world-wide. Listed in the VXI selection guide are the VXI products from Analogic.

Tektronix Sales/Service Offices

We have a worldwide network of sales and service offices. To find the office nearest you, see the listing in the back of this catalog.

Tektronix TeleBusiness Center (TBC)

The same quality support found in our sales and services offices is available toll free. Call 1-800-426-2200, Ext. 99, Monday through Friday, 8:00 a.m. Eastern Time to 5:00 p.m. Pacific Time.

Distributor & Manufacturers Representatives

We have Authorized Tektronix Distributors and Manufacturers Representatives for selective products and geographic areas. To find the office nearest you, see the listing in the back of this catalog.

Federal Administration Office

Federal Agencies should obtain price and delivery from, and place orders directly with, Tektronix Federal Order Administration. See page 574 for information.

Reconditioned Products

Tektronix has a variety of quality, previously used products at prices significantly lower than our catalog prices. These products have been fully refurbished, tested and calibrated. Each comes with a warranty equivalent to our new products. See page 580 for information.

Copyright ® 1994 Tektronix, Inc. All rights reserved. Printed in U.S.A. Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supersedes that in all previously published material. Specification and price change privileges reserved. TEKTRONIX and TEK are registered trademarks.

For further information, contact: Tektronix, Inc., Corporate Offices, 26600 SW Parkway, PO Box 1000, Wilsonville, Oregon 97070-1000. Phone (503) 682-3411, (800) 426-2200. Subsidiaries and distributors worldwide.

Prices and Specifications Subject to Change.

All prices, specifications and characteristics set forth in this catalog are subject to change without notice. Prices current at the time an order is accepted by Tektronix will apply. Check with your local Tektronix representative for current price and specification information.

Recycled paper used for packaging and the body of this catalog.

Table of Contents

Alphanumeric Index **2-9**
Functional Index **10-16**
Product/Function Focus **17-19**
New Products Section **20-32**
Measurement Products **33-536**
- Oscilloscopes 33
  - Reference 34
  - Digitizing/Digital + Analog Storage 40
  - Analog Storage 112
- Digitizers 125
- Logic Scope 142
- Logic Analyzers 147
- Spectrum Analyzers 175
- Network Analyzers 256
- Communication Test Sets 269
- Signal Sources 287
- RF Meters 303
- Telecommunications Instruments 322
- Systems, Controllers, Software 379
- Modular Bench Test Instruments 397
- Arbitrary Generators 398
- Stimulus Systems 410
- Digital Multimeters 414, 422
- TekMeter 416
- Digital Counters 424
- Function Generators 426
- Power Supplies 428
- Photometer/Radiometer 432
- Education Market Program 434
- Semiconductor Testers 437
- Accessories 446
  - Probes/Probe Accessories 447
  - Plotter/Printer, Film-based Camera 524
  - Carts 528
  - Other Accessories 432

Television Products **537**
Color Printing and Imaging **560**
Network Displays **569**
General Customer Information **573**
- General Business Information 574
  - Sales/Service Offices 585
  - TeleBusiness Center 574
  - Rental/Leasing Programs 574
  - Federal Government Customers 574
- Technical Support 575
- Service Programs 576
  - Service Assurance 576
  - Comprehensive System Services 577
  - Service Agreements 579
- Reconditioned Instruments 580
- Training/Seminars 581
- Terms and Methods of Payment 582
- Power Cords/Plugs 583
- Application/Technical Notes 584
- Sales/Service Offices 585
  - Worldwide 585
  - Distributors/Representatives/Rental/Leasing Companies 590
  - U.S. ..... Inside Back Cover

Tektronix continues its commitment of providing the best, most cost-effective solutions for your acquisition, analysis, and measurement needs.

Alphanumeric Index

AA 5001	Programmable Distortion Analyzer	397
ADA 400	*Differential Amplifier*	*68, 501*
ADS	Signal Sources	288
AFG 2020	Arbitrary Function Generator	408
AM 503B	*Current Probe Amplifier*	*512*
AM 503S	Current Probe Amplifier System	512
AM 5030	Pgm. Current Probe Amplifier	512
AM70	*Handheld Analyzer/Generator*	*554*
AM700	Mixed Signal Audio Measurement Set	553
ASG 100	Audio Signal Generator	555
ASG 140	Audio Signal Generator	555
ASSET™	VXI Boundary Scan Diagnostic System	392
ASW100F	*Audio Switcher, Input*	*554*
ASW100M	*Audio Switcher, Output*	*554*
AVTIME	Audio to Video Delay Measurement Pkg.	539
AWG 2005	*Aritrary Waveform Generator*	*406*
AWG 2021	*Aritrary Waveform Generator*	*404*
AWG 2040	*Aritrary Waveform Generator*	*402*
AWG5105	Arbitrary Waveform Generator	397
A01905	Sensor Cable	369
A08012	Connector Adatper, FC	373
A08013	Connector Adatper, D4	369
A08014	Connector Adatper, OF2	369
A08017	AC Power Adatper	369
A08019	AC Power Adatper	369
A08020	Bare Fiber Adapter	369
A08021	Adapter Cap	369
A08024	Bare Fiber Adapter, FC	369
A08025	Connector Adapter, AT&T Biconical	369
A08026	Connector Adapter, Diamond 2.5	369
A08027	Connector Adapter, Diamond 3.5	369
A08028	Connector Adapter, SMA	369
A08029	Connector Adapter, Siemens	369
A08030	Connector Adapter, Sumitomo	369
A08031	Connector Adapter, MBO	369
A08032	Connector Adapter, HFBR-4000	369
A08081	Connector Adapter, FC/PC	369
A08082	Connector Adapter, SC	369
A08083	Connector Adapter, ST	369
A08084	Connector Adapter, DIN	369
A08087	Connector Adapter, D4	369
A08090	Connector Adapter, SC	369
A08095	Connector Adapter, SMA 2.5	369
A08096	Connector Adapter, ST	369
A08161	Connector Adapter, FC	369
A08162	Connector Adapter, SC	369
A08163	Connector Adapter, ST	369
A08186	Connector Adapter, Low Return Loss,	369
A08187	Connector Adapter, FC	369
A1001	Blank Adapter	444
A1002	In-Line Adapter	444
A1003	TD3/TD66 Power Transistor Adapter	444
A1004	Offset Lead Adapter	444
A1005	Axial Lead Diode Adapter	444
A1006	Long Lead Transistor Adapter	444
A1007	Transistor Adapter	444
A1009	FET Adapter	444
A1010	IC Adapter	444
A1023	SMT Device Adapter	444
A1024	TD/SMT Device Adapter	444
A603	Current Probe	418-419
A605	Current Probe	418-419
A610	Current Probe	418-419
A620	AC Current Probe	418-419
A621	Current Probe	418-419
A622	Current Probe	418-419
A6302	50 MHz AC/DC Current Probe	514
A6302XL	*Current Probe*	*514*
A6303XL	*Current Probe*	*514*
A6304XL	*Current Probe*	*514*
A6303	15 MHz AC/DC Current Probe	514
A6905S	Fiber Optic Isolation System	508
A6906S	Fiber Optic Isolation System	508
A6907	*Monolithic Isolator*	*506*
A6909	*Monolithic Isolator*	*506*
BAT200	Battery Kit	420
CableScout™	*TDR Cable Tester for CATV*	*336*
CAT200	Virtual Instrument Software	420
CDC250	Universal Counter	424
CDM250	Digital Multimeter	422
CFC250	Frequency Counter	424
CFG250	Function Generator	426
CFG253	Function Generator	426
CFG280	Function Generator w/Counter	426
CG 5011	Programmable Calibration Generator	397
CMC250	Multifunction Counter	424
CMC251	Frequency Counter w/Time Base	424
CMD55	Rohde & Schwarz Communications Test Set	279
CMP100	*Cable Measurement Pkg.*	*557*
CMP200	*Cable Measurement Pkg.*	*557*
CMP500	Cable TV Measurement Pkg.	557
CMS50	Rohde & Schwarz Communications Test Set	272
CMS52	Rohde & Schwarz Communications Test Set	272
CMS54	Rohde & Schwarz Communications Test Set	275
CMS57	Rohde & Schwarz Communications Test Set	275
CMTA	Rohde & Schwarz Communications Test Set	281
CRTP24	Rohde & Schwarz Communications Test Set	284
CSS500	Cable TV Measurement Pkg. Software	557
CPS250	Power Supply	428
CrafTek™	Subscriber Loop Portable Test Set	338
CSA 404	Communications Signal Analyzer	350
CSA 803A	Communications Signal Analyzer	346
CSA 907A	Bit Error Rate Tester	364
CTS 710	SONET Test Set	340

Italics and color identifies NEW products.

Alphanumeric Index

CTS 750 SDH Test Set 340
CT-1 1 GHz Current Transformer 516
CT-100 CrafTek™ Portable Subscriber Loop Test Set 338
CT-2 200 MHz Current Transformer 516
CT-4 1,000 A Current Probe 516
C-30BP Camera for Portable Instruments 527
C-9 Low Cost Camera 526
DAS/NT Digital Analysis System 154
DAS/XP Digital Analysis System 154
DAS9200 Digital Analysis System 535
DAS9221 Digital Analysis Mainframe-Speed Enhanced 157
DBS8250 Arbitrary Waveform Generator 389
DBS8251 Arbitrary Waveform Generator 389
DBS8252 Arbitrary Waveform Generator 389
DBS700 Digitizer 394
DBS701 Digitizer 394
DBS8700 8-CH, 200 kS/s Multiplexed Analog to Digital Converter/Digitizer 395
DBS8701 8-CH, 400 kS/s Multiplexed Analog to Digital Converter/Digitizer 395
DBS8710 VXI S/H Mux 388
DBS8720 VXI Multiplier 388
DBS8750 2-CH, 400 kS/s Arbitrary Waveform Synthesizer 395
DBS8751 (Low Output) 4-CH, 200 kS/s Digital to Analog Converter/Waveform Generator 395
DBS8752 (High Output) 4-CH, 200 kS/s Digital to Analog Converter/Waveform Generator 395
DC 5010 Programmable 350 MHz Universal Counter/Timer 397
DC 503A 125 MHz Universal Counter 397
DL-11 Delay Line 110
DMM155 Handheld Digital Multimeter 414
DMM156 Handheld Digital Multimeter 414
DMM157 Handheld Digital Multimeter 414
DMM250 Handheld Digital Multimeter 414
DMM251 Handheld Digital Multimeter 414
DMM252 Handheld Digital Multimeter 414
DMM254 Handheld Digital Multimeter 414
DMM353 Handheld Digital Multimeter 414
DM2510 Programmable Digital Multimeter 422
DM2510G Programmable Digital Multimeter 422
DM 5110 Programmable Digital Multimeter 392, 397
DocuWave™ Oscilloscope Waveform Software 73
DSA 602A Digitizing Signal Analyzer 80
DS1200 *Low Cost TV Demodulator System 558*
DTB Digital Toolbox for VX4820 404
D3173A Advantest Pulse Pattern Generator, 3 Gbit/s 378
D3186 Advantest Pulse Pattern Generator 377
D3273 Advantest Error Detector, 13Gbit/s 378
D3286 Advantest Pulse Pattern Generator 377
ECO 422 Changeover Unit 544
EPC-2 C-Size Controller 345, 404
EPC-7 C-Size Controller 345, 404
ESAI Rohde & Schwarz EMI Test Receiver 237
ESBI Rohde & Schwarz EMI Test Receiver 237
ESHS Rohde & Schwarz EMI Test Receiver 237
ESMI Rohde & Schwarz EMI Test Receiver 237
ESN Rohde & Schwarz EMI Test Receiver 237
ESS Rohde & Schwarz EMI Test Receiver 237
ESVB Rohde & Schwarz EMI Test Receiver 237
ESVD Rohde & Schwarz EMI Test Receiver 237
ESVN Rohde & Schwarz EMI Test Receiver 237
ESVS Rohde & Schwarz EMI Test Receiver 237
ES-K1 Rohde & Schwarz EMI Test Software 255
FG 501A 2 MHz Function Generator 397
FG 5010 Programmable 20 MHz Function Generator 397
FG 504 40 MHz Function Generators 397
FiberChamp™ Optical Power Meter 332
FiberMaster™ Optical Time Domain Reflectometer 324
FiberMini™ Mini Optical Time Domain Reflectometer 328
FiberScout® Handheld Optical Fault Finder 330
FlexLead™ Fine Pitch Surface Mounted Devices Adapters 474
FMTAP FiberMaster™ Trace Analysis Pkg. 326
FSA *Rohde & Schwarz Spectrum Analyzer 195*
FSAS *Rohde & Schwarz Spectrum Analyzer with Tracking Generator 195*
FSB *Rohde & Schwarz Spectrum Analyzer 195*
FSBS *Rohde & Schwarz Spectrum Analyzer with Tracking Generator 195*
FSM *Rohde & Schwarz Spectrum Analyzer 195*
FSMS *Rohde & Schwarz Spectrum Analyzer with Tracking Generator 195*
GRASP General RF Applications Software 228
HC100 Color Plotter 524
HC220 Bubble Jet Printer 524
HFS 9DG1 Data Time Generator Card 410
HFS 9DG2 Data Time Generator Card 410
HFS 9003 Stimulus System 410
HFS 9009 Stimulus System 410
Insta-Vu™ *Acquisition Mode 54*
IQSIM-K Rohde & Schwarz Signal Source 302
IPA 310 Interconnect Parameter Analyzer 102
J17 Digital Photometer/Radiometer 432
J18 *Digital Photometer/Radiometer 432*
J1803 Luminance Probe 432
J1805 Head for LEDs 432
J1806 Radiance/Radiant Head 432
J1810 Chromaticity/Luminance Head 432
J1811 Illuminance Head 432
J1812 Irradiance Head 432
J1820 Chromaticity Head 432
J1823 Luminance Probe 432
K212 Portable Instrument Cart 531
K415 Transport Cart 530
K420 Work Bench Cart 529
K465 Instrument Tower 529
K475 Workstation Tower 530

Italics and color identifies NEW products.

Alphanumeric Index

LAView	*Offline Analysis Software*	*159*
LabView®	Graphical Programming Software	383
LabWindows®	Programming Environment Software	383
LVWIN	LabVIEW®	395
LWDOS	LabWindows®	395
LWCVI	LabWindows®	395
LADM923	Microprocessor Support – Power PC 60X	161
METRICS™	Software	441, 442
MXIEXT	VXI-MXI Mainframe Extender	395
MXIWIN	Standard VXI-MXI AT2010 without Cables	395
NRVD	Rohde & Schwarz RF Meter	306
NRVS	Rohde & Schwarz RF Meter	308
OA5002	Optical Attenuator	363
OA5012	Optical Attenuator	363
OA5022	Optical Attenuator	363
OA5032	Optical Attenuator	363
OCP 5002	Optical Converter/Power Meter	358
OCP 5502	Optical Converter/Power Meter	358
OIG 501	Optical Impulse Generator	362
OIG 502	Optical Impulse Generator	362
ORS156	SDH/SONET Reference Receiver	356
ORS2488	SDH/SONET Reference Receiver	356
ORS52	SDH/SONET Reference Receiver	356
ORS622	SDH/SONET Reference Receiver	356
PDR100	*Professional Disk Recorder*	*556*
PDR101	*Professional Disk Recorder*	*556*
PDT	Software/Hardware Integration	167
PE1000	PAL Encoder	550
PE22638	FlexLead™ EIAJ Adapters	476
PE50X20	FlexLead™ EIAJ Adapters	476
PE50X25	FlexLead™ EIAJ Adapters	476
PE50X26	FlexLead™ EIAJ Adapters	476
PE50X36	FlexLead™ EIAJ Adapters	476
PE50X38	FlexLead™ EIAJ Adapters	476
PE50X40	FlexLead™ EIAJ Adapters	476
PE50X48	FlexLead™ EIAJ Adapters	476
PE50X52	FlexLead™ EIAJ Adapters	476
PE50X60	FlexLead™ EIAJ Adapters	476
PE50X64	FlexLead™ EIAJ Adapters	476
PE50X75	FlexLead™ EIAJ Adapters	476
PE50X76	FlexLead™ EIAJ Adapters	476
PE65X20	FlexLead™ EIAJ Adapters	476
PE65X28	FlexLead™ EIAJ Adapters	476
PE65X36	FlexLead™ EIAJ Adapters	476
PE65X40	FlexLead™ EIAJ Adapters	476
PE65X46	FlexLead™ EIAJ Adapters	476
PE65X52	FlexLead™ EIAJ Adapters	476
Phaser™	*200 Color Printer*	*562*
Phaser™	300 Color Printer	563
Phaser™	400 Color Printer	563
Phaser™	IIsdx Color Printer	564
Phaser™	IIIPXi Color Printer	563
PJ21624	FlexLead™ JEDEC Adapters,	476
PJ22030	FlexLead™ JEDEC Adapters,	476
PJ25X16	FlexLead™ JEDEC Adapters,	476
PJ25X17	FlexLead™ JEDEC Adapters,	476
PJ25X20	FlexLead™ JEDEC Adapters,	476
PJ25X21	FlexLead™ JEDEC Adapters	476
PJ25X24	FlexLead™ JEDEC Adapters,	476
PJ25X25	FlexLead™ JEDEC Adapters	476
PJ25X30	FlexLead™ JEDEC Adapters,	476
PJ25X33	FlexLead™ JEDEC Adapters	476
PJ25X41	FlexLead™ JEDEC Adapters	476
PJ25X49	FlexLead™ JEDEC Adapters	476
PJ25X52	FlexLead™ JEDEC Adapters,	476
PJ25X60	FlexLead™ JEDEC Adapters	476
PPMS100	*Probing Station*	*480*
PPMS200	*Probing Station*	*480*
PPMS201B	*Articulated Arm*	*480*
PPMS201C	*Articulated Arm*	*480*
PPMS203B	*Articulated Arm*	*480*
PPMS203C	*Articulated Arm*	*480*
PQFP100	Converter Clip	478
PQFP132	Converter Clip	478
PR326150	Advantest Memory Card	236
PR326160	Advantest Memory Card	236
PR326170	Advantest Memory Card	236
Profile™	*Professional Disk Recorder*	*556*
PS2510	Programmable Power Supply	430
PS2510G	Programmable Power Supply	430
PS2511	Programmable Power Supply	430
PS2511G	Programmable Power Supply	430
PS2520	Programmable Power Supply	430
PS2520G	Programmable Power Supply	430
PS2521	Programmable Power Supply	430
PS2521G	Programmable Power Supply	430
PS280	Triple Output Power Supply	428
PS281	Single Output Power Supply	428
PS282	Single Output Power Supply	428
PS283	Triple Output Power Supply	428
PS 5004	Power Supply	397
PS 5010	Programmable Triple Power Supply	397
PS 503A	Triple Power Supply	397
P400	1X Voltage Probe for 22X Oscilloscopes	420, 496
P5100	*250 MHz, 2.5 kV, 100X Probe*	*496*
P5135	*150 MHz, 100X Differential Probe Pair*	*503*
P5200	*Active Differential Probe*	*68, 502*
P6007	20 MHz, 1.5 kV, 100X Probe	497
P6008	100 MHz, 10X Environment Probe	518
P6009	120 MHz, 1.5 kV, 100X Probe	497
P6015A	75 MHz, 40 kV, 1000X Probe	496
P6021	60 MHz Current Probe	517
P6022	120 MHz Current Probe	517
P6046	Active Differential Probe	500

Italics and color identifies NEW products.

Alphanumeric Index

P6062B 100 MHz, 10X or 1X Probe....470
P6063B 200 MHz, 10X or 1X Probe....470
P6101B 15 MHz, 1X Probe....468
P6103B 50 MHz, 10X Probe....468
P6105A 100 MHz, 10X Probe....470
P6106A 250 MHz, 10X Probe....470
P6109B 150 MHz, 10X Probe....468
P6111B 1X/10X Switchable Probe....468
P6119B 1X/10X Switchable Probe....468
P6122 100 MHz, 10X Probe....470
P6129B 1X/10X Probe....468
P6131 300 MHz, 10X Probe....472
P6133 150 MHz, 10X Probe....472
P6134C 10X Probe....472
P6135A 150 MHz, 10X Passive Differential Probe Pair....504
P6136 350 MHz, 10X Probe....472
P6137 400 MHz, 10X Probe....472
P6138 350 MHz, 10X Probe....472
P6139A 500 MHz, 10X Probe....472
P6150 9 GHz, High BW, Low....466
P6156 3.5 GHz, Low Z....466
P6201 900 MHz, 1X/10X/100X, FET Probe....464
P6202A 500 MHz, 10X/100X, FET Probe....464
P6204 1 GHz, 10X, FET Probe....460
P6205 750 MHz, 10X, FET Probe....460
P6207 4 GHz, SMA FET Probe....462
P6217 4 GHz, TEKPROBE™ FET Probe....460
P6231 1.5 GHz, 10X, Bias-Offset Probe....460
P6245 *1.5 GHz, FET Probe....458, 474*
P6302 Current Probe (see A6302)....514
P6303 Current Probe (see A6303)....514
P6407 Word Recognizer Probe....519
P6408 Word Recognizer Probe....519
P6420 1 GHz, 1X RF Probe....518
P6480 Data Acquisition Probe....170
P6486 Data Acquisition Probe....170
P6487 Data Acquisition Probe....170
P6490 Data Acquisition Probe....170
P6561AS 200 MHz, 10X SMD Probe....474
P6562AS 200 MHz, 10X SMD Probe....474
P6563AS 200 MHz, 10X SMD Probe....474
P6602 Temperature Probe....518
P6701A Optical-Electrical Converter....354
P6703A Optical-Electrical Converter....354
P6711 Optical-Electrical Converter....354
P6713 Optical-Electrical Converter....354
P6721 Optical-Electrical Converter....354
P6751 Spatial Input Head....354
P850 10X Voltage Probe for 22X Oscilloscopes....420, 496
Q32605 Advantest Optical Receiver Plug-in....366
Q81201 *LED Source....373*
Q81202 *LED Source....373*
Q81203 *LED Source....373*
Q81204 *LED Source....373*
Q81205 *LED Source....373*
Q81206 *LED Source....373*
Q81207 *LED Source....373*
Q81211 *LED Source....373*
Q81212 *LED Source....373*
Q82202 *Interface Plug-in....373*
Q82208 *Power Sensor, High Sensitivity....373*
Q8221 Advantest Optical Power Multimeter Mainframe....373
Q82214 *Power Sensor, Short Wavelength....373*
Q82215 *Power Sensor, Long Wavelength....373*
Q82216 *Power Sensor, Large Area, High Sensitivity....373*
Q82226 *Power Sensor, High Power....373*
Q8344A Advantest Optical Spectrum Analyzer....367
Q8347 Advantest Optical Spectrum Analyzer....371
Q8381A Advantest Optical Spectrum Analyzer....367
Q8383 Advantest Optical Spectrum Analyzer....367
RFM150 *Signal Level Meter....558*
RF160 Down Converter....320
RTD 710A Programmable Waveform Digitizer....136
RTD 720A Fast Transient Digitizer....133
R2465A/B Communications Test Set....270
R2471A/B Communications Test Set....270
R3261C Advantest Spectrum Analyzer....215
R3261CN Advantest Spectrum Analyzer....215
R3261D Advantest Spectrum Analyzer....215
R3265A Advantest Spectrum Analyzer....202
R3271A Advantest Spectrum Analyzer....202
R3361B Advantest Spectrum Analyzer....215
R3361C Advantest Spectrum Analyzer....215
R3361CN Advantest Spectrum Analyzer....215
R3361D Advantest Spectrum Analyzer....215
R3365A Advantest Spectrum Analyzer....202
R3371A Advantest Spectrum Analyzer....202
R3752A Advantest Vector Network Analyzer....260
R3753A Advantest Vector Network Analyzer....260
R3762AH Advantest Network Analyzer....261
R3763B Advantest Network Analyzer....264
R3961B Advantest Network Analyzer....261
R3961BN Advantest Network Analyzer....261
R4131D Advantest Spectrum Analyzer....221
SA-42 Optical to Electrical Converter....360
SA-46 Optical to Electrical Converter....360
SCD5000 Ultra High Speed Transient Digitizer....130
SDA 601 *Handheld Serial Digital Analyzer....548*
SD-14 High Impedance Probe Sampler....106
SD-20 Loopthrough Sampling Head....106
SD-22 Low Noise Sampling Head....106
SD-24 TDR Sampling Head....106
SD-26 Sampling Head....106
SD-30 Sampling Head....106

Italics and color identifies NEW products.

Alphanumeric Index

SD-32	Sampling Head	106
SD-42	Optical to Electrical Converter	106, 360
SD-46	Optical to Electrical Converter	106, 360
SD-51	20 GHz Trigger Head	106
SF201	SureFoot™ Interconnect for FET Probes	478
SF202	SureFoot™ Interconnect for FET Probes	478
SF203	SureFoot™ Interconnect for FET Probes	478
SG 5010	Programmable Low Distortion Oscillator	397
SG 5030	Programmable Leveled Sinewave Generator	397
SignalScout™	*Signal Level Meter*	*558*
SIU 800	Static Isolation Unit	110
SMCK1	SOIC Clips	478
SME	Rohde & Schwarz Signal Sources	292
SME02	Rohde & Schwarz Signal Sources	295
SME03	Rohde & Schwarz Signal Sources	295
SMHU58	Rohde & Schwarz Signal Sources	293
SMG50	SMT KlipChip Pkg	478
SMQK1	PLCC Quad Kits	478
SMP	Rohde & Schwarz Signal Sources	296
SMT	Rohde & Schwarz	298
SMY	Rohde & Schwarz Signal Sources	299
SM-11	Multichannel Unit	110
SPG 1000	HDTV Sync Generator	550
SPG 422	*Component Digital Master Sync Generator*	*544*
SureFoot™	Surface Mount Device Interconnects	478
SX4610	SDH/SONET Analyzer	342
S26EM00	EMI Prequalification Software	233
S26EM12	Commercial EMI Test Software	233
S26RF00	General RF Applications (GRASP)	228
S3FG210	PC-GPIB Interface Card	395
S3FG220	AT-GPIB Interface Card	395
S3FG222	EXM AT/GPIB	395
S59ADGS	ASSET_VXI Boundary Scan Diagnostic System	395
S59AITP	ASSET_Interconnect Test Product	395
S59ASFL	ASSET_Scan Function Library	395
S60DWAV	DocuWave™	73
S60G220	DocuWave™/PC-GPIB	73
S60G210	DocuWave™/AT-GPIB	73
TAS 220	*20 MHz Analog Oscilloscope*	*118*
TAS 250	*50 MHz Analog Oscilloscope*	*118*
TAS 465	100 MHz Analog Oscilloscope	118
TAS 475	100 MHz Analog Oscilloscope	118
TAS 485	200 MHz Analog Oscilloscope	118
TDS 310	50 MHz Digitizing Analog Oscilloscope	70
TDS 320	100 MHz Digitizing Oscilloscope	70
TDS 350	200 MHz Digitizing Oscilloscope	70
TDS 410	*150 MHz Analog Digitizing Oscilloscope*	*64*
TDS 420	150 MHz Digitizing Oscilloscope	64, 113
TDS 460	350 MHz Digitizing Oscilloscope	64
TDS 520A	500 MHz Digitizing Oscilloscope	61, 113
TDS 524A	500 MHz Digitizing Oscilloscope	61
TDS 540A	500 MHz Digitizing Oscilloscope	61
TDS 620A	500 MHz Digitizing Oscilloscope	58
TDS 640A	500 MHz Digitizing Oscilloscope	58
TDS 644A	500 MHz Digitizing Oscilloscope	58
TDS 684A	1 GHz Digitizing Oscilloscope	58
TDS 744A	*500 MHz Digitizing Oscilloscope*	*55*
TDS 784A	*1 GHz Digitizing Oscilloscope*	*55*
TDS 684A	*1 GHz Digitizing Oscilloscope*	*58*
TDS 820	6 GHz Digitizing Oscilloscope	48
TelScout™	TDR Telephone Cable Tester	334
Test Station	Instrument Workstation	531
TFC200	FiberChamp™ Handheld Optical Power Meter	332
TFP2	FiberMaster™	325
TFS2020	FiberScout® Fault Finder	330
TFS3030	Mini Optical Time Domain Reflectometer	328
TG 501A	Time Mark Generator	397
THMCOM1	Communications Pack	418-419
TXMDXPB	Deluxe Probe Set	418-419
THM5AC	Power Adapter	418-419
THM5BAT	Battery Pack	418-419
THM5CHG	Battery Charger	418-419
THM5HC	Transport Case	418-419
THM5SCA	Soft Case	418-419
THM 550	*TekMeter™*	*416*
THM 560	*TekMeter™*	*416*
THM 565	*TekMeter™*	*416*
TLA510	*Logic Analyzer*	*150*
TLA520	*Logic Analyzer*	*150*
TLS216	Logic Scope	142
TM 5003	Three-Wide Mainframe	397
TM 5006A	Six-Wide Mainframe	397
TM 502A	Two-Wide Mainframe	397
TM 503B	Three-Wide Mainframe	397
TPG 20	*Test Pattern Generator*	*550*
TPG 625	Pattern Generator	550
TQ8210	Advantest Handheld Optical Power Meter	369
TQ82014	Power Sensor, Short Wavelength	369
TQ82015	Power Sensor, Ge	369
TQ82017	Power Sensor, Thin Wand	369
TQ82018A	Power Sensor, InGaAs	369
TQ8325	Advantest Optical Wavelength Meter	376
TR4153B	Advantest Tracking Generator	226
TR4154	Advantest Tracking Generator	226
TR 503	Tracking Generator	225
TSG 100	NTSC Signal Generator	537, 546, 549
TSG 1001	Programmable Generator	550
TSG 111	PAL Signal Generator	546
TSG 120	YC/NTSC Signal Generator	546
TSG 130A	NTSC Multiformat Generator	547
TSG 131A	PAL Multiformat Generator	547
TSG 170A	TV Test Signal Generator	548
TSG 170D	Digital Composite Generator	544
TSG 200	NTSC Signal Generator	547

Italics and color identifies NEW products.

Alphanumeric Index

TSG 271 PAL TV Generator....548
TSG 273 PAL Composite Digital Signal Generator....544
TSG 300 Component TV Generator....549
TSG 371 Component/Composite TV Generator....549
TSG 422 Digital Component Generator....544
TSG 601 *Handheld Serial Component Generator....548*
TSG 95 *Handheld Signal NTSC/PAL Generator....546*
TSG 100 NTSC Test Signal Generator....546
TS100 TDR Telephone Cable Tester....334
TV1350 *TV Demodulator....558*
TVS521 *VXI Waveform Analyzer....126, 394*
TVS525 *VXI Waveform Analyzer....126, 394*
TVS541 *VXI Waveform Analyzer....126, 394*
TVS545 *VXI Waveform Analyzer....126, 394*
TV110 TDR Cable Tester for CATV....336
TWD120 *Laptop Digital Oscilloscope....420*
URE 2 Rohde & Schwarz RF Meter....310
URE 3 Rohde & Schwarz RF Meter....310
URV 5 Rohde & Schwarz RF Meter....304
URV 35 Rohde & Schwarz RF Meter....304
UL4941 *Tektronix/Advantest Spectrum Analyzer....218*
UL4941N *Tektronix/Advantest Spectrum Analyzer....218*
VITS 100 NTSC Generator/Inserter....550
VITS 200 NTSC Generator/Inserter....550
VITS 201 Insertion Generator....550
VMBKUP Backup and Remote Control Software....539
VMREMGR Remote Graphics Software....539
VMT Remote Control Software....539
VM 700A Video Measurement Set....538
VS 210 NTSC Video Synchronizer....552
VS 211A PAL Video Synchronizer....552
VXIGPIB Resource Manager....395
VXI566 VXI Controller....395
VXI599 VXI Controller....395
VXIpc-486 VXI Controller Model 200....395
VXIpc-486 VXI Controller Model 500....395
VXI-AT2000 MXI Interface for DOS....395
VXI-AT2010 MXI Interface for Windows....395
VXI-AT2020 MXI Interface for Sun....395
VXI-MXI VXI-MXI Mainframe Extender....395
VXI 428 ARINC Receiver....393
VXI 468A ARINC Simulator....393
VX0A41 VXI Programmable Optical Attenuator....344
VX1401 VXI C-Size Mainframe....386
VX1405 VXI C-Size Mainframe....345, 404
VX1406 VXI C-Size Mainframe....386
VX1410 VXI C-Size Mainframe....386
VX1811A RF Diode Sensor....395
VX1812A RF Diode Sensor....395
VX1813 Remote Calibrator Head for VX4281....395
VX1814A 18 GHz RF Diode Sensor....395
VX1815A 40 GHz RF Diode Sensor....395
VX1817A 18 GHz 5W Power Sensor....395
VX4223 VXI C-Size Counter/Timer....404
VX4224 VXI C-Size Counter/Timer....388
VX4234 VXI 4.5 Digit Digital Multimeter....388
VX4236 VXI 6.5 Digit Digital Multimeter....404
VX4237 VXI 6.5 Digit Digital Multimeter....388
VX4240 VXI Waveform Digitizer/Analyzer Module....394
VX4244 Digitizer....394
VX4250 VXI Waveform Digitizer/Analyzer Module....404
VX4281 Power Meter....388
VX4286 Digital Input/Analog Comparator....388
VX4287 VXI Differential Input A/D Convertor....388
VX4320 Six 1x4 RF Multiplexer....395
VX4330 Scanner....390
VX4332 2 Wire Scanner Master....390
VX4334 4 Wire Scanner Slave....390
VX4342 Programmable Resistance....389
VX4350 Switching Module....390
VX4353 SPST Relay Switch....390
VX4355 DPST/SPST Relay Switch....390
VX4356 DPDT Relay Switch....390
VX4357 SPDT Relay Switch....390
VX4363 SPST Low Cost Switch....390
VX4365 Low Cost Relay Switching....390
VX4366 DPDT Low Cost Switch....390
VX4367 SPDT Low Cost Switch....390
VX4372 2 Wire Scanner Slave....390
VX4374 4 Wire Scanner Slave....390
VX4380 Matrix....390
VX4385 128 Relay Switch Matrix....390
VX4386 128 Latching Relay Switch Matrix....390
VX4428 ARINC 429 Quad Transmitter/Receiver....395
VX4440 VXI C-Size Scanner Master....390
VX4456 MIL-STD-1553 Simulator Tester....393
VX4457 MIL-STD-1553 Intell. Bus Analyzer Monitor....393
VX4469A ARINC 629 Simulator w/ Enhanced Error Injection....395
VX4491 Serial Test Module....392
VX4521 VXI Advanced Resource Manager....345, 404
VX4610 SDH/SONET Generator/Receiver....395
VX4730 12 Channel DAC....389
VX4750 Function Generator....389
VX4790A Arbitrary Waveform Generator....389
VX4792 Arbitrary Waveform Generator....389
VX4801 Isolated Digital I/O....392
VX4802 Pgm. Digital I/O....392
VX4820 Digital Test Module....392
WaveWriter Waveform Creation & Editing Software....398
WFM 300A Component/Composite TV Waveform Monitor....542
WFM 601 Serial Component Monitor....542
WFM 601i Serial Component Monitor (Eye Pattern)....542
WFM 90 Waveform/Vector/Picture/Audio Monitor (NTSC)....542
WFM 91 *Waveform/Vector/Picture/Audio Monitor (PAL)....542*

Italics and color identifies NEW products.

Alphanumeric Index

WM780 Waveguide Mixers....194
WM782 Waveguide Mixers....187
WP 200 Printer Interface....420
WVR 500 *Waveform/Vector Rasterizer....543*
XP350 X Terminal....570
XP200 X Terminal....570
11A16 50 MHz Current Amplifier....95
11A32 400 MHz Amplifier....93
11A33 150 MHz Differential Comparator....94
11A34 300 MHz Amplifier....93
11A52 600 MHz Amplifier....92
11A72 1 GHz Amplifier....92
11A81 3 GHz Amplifier....91
1101A Probe Power Supply....464
1103 TEKPROBE™ Power Supply....460
11403A 3 GHz Digitizing Oscilloscope....84
118-AS Audio Synchronizer....552
11801B Digital Sampling Oscilloscope....97
119-4839-00 *Microscope Assembly....480*
1200C01 Comm Pack....170
1405 TV Sideband Adapter....223
1502B TDR Cable Testers....333
1502C TDR Cable Testers....333
1503B TDR Cable Testers....333
1503C TDR Cable Testers....333
1705A Spectrum Monitor....559
1710B NTSC Waveform Monitor....540
1711B PAL Waveform Monitor....540
1720 Vectorscope....540
1720 SCH NTSC Vectorscope....540
1721 Vectorscope....540
1721 SCH PAL Vectorscope....540
1725 PAL/NTSC Vectorscope....540
1730 NTSC Waveform Monitor....540
1730 D NTSC Serial Digital Waveform Monitor....540-541
1731 PAL Waveform Monitor....540
1731 D PAL Serial Digital Waveform Monitor....540
1735 PAL/NTSC Waveform Monitor....540
1735 HD Multiformat Waveform Monitor....539-541
1740A NTSC Waveform/Vector Monitor....540
1741A PAL Waveform/Vector Monitor....540
1745A NTSC/PAL Waveform/Vector Monitor....540
1750A NTSC Waveform/Vector Monitor....540
1751A PAL Waveform/Vector Monitor....540
1755A NTSC/PAL Waveform/Vector Monitor....540
1760 NTSC Composite/Component Waveform/Vector Monitor....540
1761 PAL Composite/Component Waveform/Vector Monitor....541
1765 PAL Composite/Component Waveform/Vector Monitor....540
1780R Video Measurement Set....539
1781R Video Measurement Set....539
1910 Digital Generator/Inserter....550
2212 60 MHz Digital + Analog Scope....116
2216 *60 MHz Digital + Analog Scope....116*
222A 10 MHz Handheld Oscilloscope....114
222PS 10 MHz Handheld Oscilloscope....114
224 60 MHz Handheld Oscilloscope....114
2465B 400 MHz Four Channel Oscilloscope....120
2467B 400 MHz High Writing Speed Oscilloscope....120
2704 Inverter....227
2705 Battery Pack....227
2706 Stepping RF Selector....234
2707 External Tracking Generator....224
2711 Portable Spectrum Analyzer....206
2712 Portable Spectrum Analyzer....206
27120 EMC Measurement System....232
2714 Cable TV Spectrum Analyzer....210, 559
2715 *Portable Spectrum Analyzer....210*
2721A Non-interfering Sweep Transmitter....559
2722A Non-interfering Sweep Receiver....559
2782 High Performance Microwave Spectrum Analyzer....181
2784 High Performance Microwave Spectrum Analyzer....181
2792 Programmable Spectrum Analyzer....188
2794 Programmable Spectrum Analyzer....188
2795 Programmable Spectrum Analyzer....188
2797 Programmable Spectrum Analyzer....188
30C02 Comm Pack....170
30DSM Digitizing Oscilloscope Module....166
30HSM High-Speed Acquisition Module....165
30MPX Microprocessor Analysis....164
30RP2 Prototype Debug Tool Support Pkg....171
3001GPX 80 CH General Purpose Logic Analyzer....168
3001HSM High-Speed Logic Analyzer....168
3001MPX 8/16/32 Bit Logic Analyzer....168
3002C Modular 3000 Series Color Mainframe....162, 168
3002CG 80 CH General Purpose Logic Analyzer....168
3002CGD General Purpose/DSO Logic Analyzer....168
3002CGG 160 CH General Purpose Logic Analyzer....168
3002CGH General Purpose/High Speed Timing Logic Analyzer....168
3002CH Logic Analyzer....168
3002CHD Logic Analyzer....168
3002CHH Logic Analyzer....168
3002CX Logic Analyzer....168
3002CXD Logic Analyzer....168
3002CXH Logic Analyzer....168
3002CXX Logic Analyzer....168
3002E 3000 Series Expansion Mainframe....168
3002P Modular 3000 Series Portable Mainframe....168
3054 Digital Signal Processing System....315
32DM02 Prototype Debug Tool Support Pkg....171
32DM04 Prototype Debug Tool Support Pkg....171
32DM06 Prototype Debug Tool Support Pkg....171
32DM07 Prototype Debug Tool Support Pkg.–8031/8051....171

Italics and color identifies NEW products.

Alphanumeric Index

32DM08 Prototype Debug Tool Support Pkg.–286 171
32DM09 Prototype Debug Tool Support Pkg.–386 171
32DM10 Prototype Debug Tool Support Pkg.–386SX 171
32DM12A Disassembly Software – 80486DX/DX2/486SX/487SX 171
32DM13A Disassembly Software – Pentium 171
32DM21 Disassembly Software – 6800/2/8 171
32DM24 Prototype Debug Tool Support Pkg.–6809 171
32DM27 Prototype Debug Tool Support Pkg.–68K 171
32DM31 Prototype Debug Tool Support Pkg.–68020 171
32DM33 Prototype Debug Tool Support Pkg.–68030 171
32GPD Logic Analyzer 170
32GPX General Purpose Acquisition Module 163
32PA Performance Analysis Software 169-170
370A Programmable Curve Tracer 440
371A Programmable Curve Tracer 442
372 Semiconductor Workbench 438
53A-220 Strain Gauge Amplifier 404
53A-242 Arbitrary Waveform Generator 404
53A-258 Octal DAC 404
53A-260 Pulse Burst Generator 404
53A-262 Pgm. Rate Generator/Pacer 404
53A-286 Pgm. Isolated Amplifier 404
53A-333 Reed Relay Scanner 404
53A-412 Pgm. Digital I/O 404
53A-431B Quad UART 404
53A-518 Transient Digitizer 404
53A-519B 16 Channel Digitizer 404
53A-525 Waveform Analyzer 404
53A-530 Bit Error Rate Transmitter 404
53A-531 Bit Error Rate Receiver 404
53A-540B Totalizing Counter 404
559ADGS ASSET™ VXI Boundary Scan Diagnostic System 404
571 Curve Tracer 443
73A-151B Resource Manager Module 404
73A-156 Resource Manager Module 393
73A-270 VXI Pulse/Pattern Generator 392
73A-308 VXI Relay Driver Module 390
73A-425 ARINC Transmitter 393
73A-426 ARINC Receiver 393
73A-451 Wire Wrap Module 395
73A-452 Blank Wire Wrap 395
73A-453 MIL-STD-1553 Simulator Tester 393
73A-455 MIL-STD-1553 Simulator Tester 393
73A-541 VXI Universal Digitizer Counter 388
73A-850 Extender 395
73A-851 VME to VXI Adapter Module 395
760A Stereo Audio Monitor 555
760D Stereo Audio Monitor 555
760N Stereo Audio Monitor 555
92A96 100 MHz Acquisition Card 159, 172-174
92C96D *100 MHz Acquisition Card 156*
92C96XD *100 MHz Acquisition Card 156*
92C96SD *100 MHz Acquisition Card 156*
92LANP LAN Pgm. Control Language Software 158-159
92CART Instrument Cart 161
92DM04A Microprocessor Support – 8086/8 161
92DM06A Microprocessor Support – 80/86/8 161
92DM08A Microprocessor Support – 80286 161
92DM09B Microprocessor Support – 80386DX 161
92DM10A Microprocessor Support – 80386SX 161
92DM11 Microprocessor Support – 80386EX 161
92DM12A Microprocessor Support – 80486 161
92DM13A Microprocessor Support Pkg. – Pentium 161
92DM14 Microprocessor Support – P54C 161
92DM31B Microprocessor Support – 68020 161
92DM33B Microprocessor Support – 68030 161
92DM17 Microprocessor Support Pkg. – 80960 161
92DM34A Microprocessor Support Pkg. – 68040 161
92DM35A Microprocessor Support Pkg. – 88100 161
92DM36 Microprocessor Support Pkg. – 68060 161
92DM55 Microprocessor Support Pkg. – SCSI 192 161
92DM72A Microprocessor Support Pkg. – 29000/050 161
92DM74 Microprocessor Support Pkg. – R3000 161
92DM75A Microprocessor Support Pkg. – R4000 161
92DM77A Microprocessor Support Pkg. – SPARC 161
92DM81 Microprocessor Support Pkg. – 8096/C16 161
92DM93A Microprocessor Support Pkg. – CPU32 161
92DM94 Microprocessor Support Pkg. – 68360 161
92DM901 Microprocessor Support Pkg. – MCS-51 161
92DM902 Microprocessor Support Pkg. – 8085 161
92DM911 Microprocessor Support Pkg. – Futurebus+ 161
92DM912 Microprocessor Support Pkg. – 68000/10 161
92DM913 Microprocessor Support Pkg. – Z80 161
92DM914 Microprocessor Support Pkg. – 96002 161
92DM916 Microprocessor Support Pkg. – 80960KA/KB/MC 161
92DM920 Microprocessor Support Pkg. – TMS320C3X 161
92DM921 Microprocessor Support Pkg. – TMS320C40 DSP 161
92DM923 Microprocessor Support Pkg. – 88110 RISC 161
92DM925 Microprocessor Support Pkg. – R3051/52/81 RISC 161
92DM926 Microprocessor Support Pkg. – DSP3210 DSP 161
92DM927 Microprocessor Support Pkg. – 29205 RISC 161
92DM930 Microprocessor Support Pkg. – 1553A/B 161
9504 Fast Data Cache Unit 140

Italics and color identifies NEW products.

Functional Index

A

Accessories.....186-218, 235, 354-361, 366, 428-431, 444, 446-536
- Accessory Pouch.....532
- Antennas.....235
- Attenuators.....522
- Cables.....355, 520
- Camera.....526
- Capacitors, Coupling.....522
- Carrying Cases.....532
- Carts.....528-531
- Coaxial Cables.....520
- Connectors, Coaxial.....521
- Converter Probes (Optical).....354
- Delay Lines (SMA).....522
- Documentation Devices *see Cameras, Plotters & Printers*
- EMC Screen Filters.....536
- Filters, Light/Mesh.....536
- GPIB Cables.....520
- Ground Leads, Probes.....482-523
- Interface Cables (RS-232C, GPIB, Centronics).....520
- Isolators.....505-509
- Light Filters.....536
- Meter Leads.....520
- Optical-to-Electrical Converter.....354-361, 366
- PLCC, SOIC Clips.....474-479
- Plotter/Printer.....524
- Power Dividers (SMA).....522
- Power Supplies.....428-431, 460, 464
- Probe Accessories.....482-494, 520-523
- Product Accessories.....186-218, 235, 354, 444, 446-536
  - Curve Tracers.....444
  - Digitizers.....446-536
  - Logic Analyzers.....446-536
  - Oscilloscopes.....446-536
  - Plotter.....525
  - Printer.....524-525
  - Spectrum Analyzers.....186-218, 235, 446-536
  - Telecommunications.....354, 446-536
  - Television.....446-536
- Rackmount Kits.....535
- SMD Attachments.....474-479
- TekTools.....318
- Terminations.....523
- Test Leads.....520
- Transit (Carrying) Cases.....532
- Viewing Hoods.....534

Active Probes (FET, Bipolar, Bias/Offset).....456, 458, 474

Adapters.....355, 369, 373, 488, 520-523, 527
- Bare Fiber, Optical.....369, 373
- BNC.....521-523
- Cables, Fiber Optic.....355
- Camera Mounting.....527
- Connector, Optical Fiber.....369, 373
- F.....521
- GR.....521-523
- Kits.....520-521
- N.....522
- Optical Fiber.....369, 373
- Probe.....482-493
- SMA (3 mm and 3.5 mm).....488

Amplifiers, Plug-In.....68, 91-95, 501
- Current Probe.....95
- Differential/Comparator.....94
- Differential Preamplifier.....68, 501
- Dual Channel/Trace.....92-93
- Four Channel/Trace.....93
- Operational.....512
- Single Channel/Trace.....91

Analyzers.....77-91, 102-105, 130, 147-255, 315, 342-343, 346, 350, 364, 366, 371, 538, 553, 554, 559
- Cable TV Spectrum.....210, 559
- Communications Signal.....80, 346, 350, 364
- Digital Signal.....80
- Digitizing Signal.....77-89
- Distortion.....77-89
- Eye Diagram.....346
- Fourier (FFT).....77-89, 315
- Frequency.....77-89, 315
- Handheld, Audio Monitor.....554
- Interconnect Parameter.....102-105, 480
- Logic.....147-174
- Measurement Sets.....538, 553
- Network.....256-267
- Optical Spectrum.....366, 371
- RF Spectrum, Optical.....366
- SDH/SONET.....342-343
- Spectrum.....175-255, 366
- Waveform.....80, 130

Antennas.....235

Application Notes Listing.....584

Arbitrary Generators.....288, 398-409

Attenuators.....363, 379, 522
- Electrical.....522
- Optical.....363, 379

Audio.....538, 544-550, 553-556
- Analyzer/Generator, Digital.....554
- Audio Measurement Set.....538, 553
- Disk Recorder.....556
- Handheld Monitor.....554
- Signal Generators.....544-550, 555
- Stereo Audio Monitors.....555
- Switchers.....554

B

Battery Pack.....227

Bench Test Instruments.....413

Bit Error Rate Testers.....77, 364, 378

BNC.....520-523
- Adapters.....521-523
- Attenuators.....522-523
- Cables.....520

Boundary Scan Diagnostic System.....392

C

Cable/RF.....546, 558
- Demodulators.....558
- Signal Generator.....546
- Signal Level Meter.....558

Cable TV Measurement Spectrum Analyzer.....366

Cable TV Measurement Packages/System Software.....557

Cable TV Measurements.....210, 559

Cable TV, RF Spectrum Analyzer Optical Plug-in.....366

Cable TV Sweep System.....559

Cable Testers.....210, 333, 559
- Metallic.....333
- CATV/Broadband Sweep.....210, 559

Functional Index

Cables **355, 520**
- BNC, BSM, SMA (3 mm and 3.5 mm) 458, 520
- Coaxial 520
- GPIB 520
- Interface (RS-232, GPIB, Centronics) 520
- Optical Fiber 354
- Patch Cords 520

Calibration Services **576-579**

Camera **526-527**
- Accessories 527
- Film 527
- Hoods, Scope and Video 527, 530
- Mounting Adapters 527

Camera Measurement Set **538**

Capacitors, Coupling (SMA) **522**

Card Modular Systems (VXI) **379-395**

Carrier-to-Noise Measurement, Optical **366**

Carrying Cases **532**

Carts **528**

CATV **210, 559**

Centronics Cables **520**

Changeover Unit, Digital **544**

Coaxial Cables **520**

Color Printing and Imaging **560-567**

Color Printers **560-567**

Communication Interfaces
- GPIB
  - Logic Analyzers 147-174
  - Logic Scope 142-146
  - Oscilloscopes/Digitizers 33-124
  - Spectrum Analyzers 175-321
- VXI 379-395

Communications Signal Analyzers 77-89, 315-321, 346-353

Communications Test Equipment *see Telecommunications*

Communications Test Sets **269-286**

Component Checker, Handheld **414, 422**

Component Tester **414, 422**

Computer **560-571**
- Color Printers 560-567
- Graphics Terminals 570-571
- X Terminals 570-571

Connectors **521**

Controllers **379-382, 385**

Converters **342, 354, 362, 558**
- Electrical-to-Optical 362
- Optical-to-Electrical 342, 354
- Tunable/Fixed Down Converter, Television RF 558

Counters **424-425**
- Oscilloscope 120

Coupling Capacitors (SMA) **522**

Current Probes **510-517**

Curve Tracers **437-444**
- Adapters 444
- Probes 446-523

Custom Systems **379-395**

Customer Information **573-595**
- Application/Technical Notes 584
- Federal Customers 574
- General Business Information 574-575
- Leasing Program 582
- Order Information *see Individual Product Pages*
- Power Cords/Plugs 583
- Reconditioned Instruments 580
- Rental Program 582
- Sales & Service Location Listing 585-595
- Service 576-579
- Technical Support 575, 577
- TeleBusiness Center 574
- Terms and Methods of Sale 582
- Training/Seminars 581

Customer Service/Support **573-595**

Customer Training/Seminars **581**

D

Data Generators *see Generators*

Data Time Generators *see Generators*

Delay Lines (SMA) **522**

Demodulators, Television **558**

Diagnostic System, Boundary Scan **392**

Differential Preamplifier **501**

Differential Probes **424-425, 502-503**

Digital Data Cache **140**

Digital Multimeters (DMM) **414, 422**
- Handheld Digital Multimeters 414

Digital Photometer/Radiometer **432**

Digital Signal Analyzers **78-89, 97-101, 346-353**

Digital Signal Processing Systems **315**
- Analyzers 315-321
- Oscilloscopes 346-353
  - Software 73, 383-384
- Spectrum Analyzers 175-314

Digital Test Instruments **379**

Digitizers *also see Oscilloscopes* **125-141**
- Accessories 446-536
- Fast Data Cache 140
- GPIB 80-89, 130-139
- High Speed Buffer 140
- Logic Analyzer Based 147, 162
- Multi-Channel 77-89, 130-139
- Programmable 77-89, 130-139
- Scan Converter 130-132
- Systems 125, 136
- Transient Capture 77-89, 130-139
- VXI 379
- Waveform 77-89, 130-139, 379

Digitizing Signal Analyzers **77-89**

Diode, Edge Emitting **373**

Disk-based Recorders, Audio/Video **556**

Display Devices *also see Monitors* **570-571**
- X Terminals 570-571

Distortion Analyzers **77-89**

Distributors **590-595**

Down Converters **320**

Down Converters, Television RF **210, 559**

E

Education Support **434-436**
- Hands-on Instruction 435-436
- Self-Study 435
- Seminars 581
- Training 581
- Video Tapes 436

Functional Index

EE LED **373**
EMC Screen Filters **536**
EMI Systems **232**
EMI Test Receivers **237**
EMI Test Software **233, 236**
Encoder, PAL **550**
Environmental Probe **518**

F

FET Probes **458-465, 474**
FFT **315, 460**
Fiber Adapter, Optical **369, 373**
Fiber Optic Power Meter **369-373**
Fiber Optic, RF Spectrum Analyzer Plug-in **366**
Fiber Optic Spectrum Analyzer **371**
Fiber Optics **322, 363, 366-378**
Film-Based Camera ***see Camera***
Filter Bank Analyzer **315**
Filters **195, 536**
- EMC Screen 195
- Light 536
- Mesh 536

Fixtured Probes **474-479**
Floating Measurements **505-509**
Fourier Analyzers **77-89, 315**
Frequency Analyzers **77-89**
Frequency Counter, Optical Wavelength **376**
Frequency Counters **424**
Function Generators **426-427**
Furniture ***also see Carts***
- Carts 528
- Work Station 528

G

Generator, Optical Impulse **362**
Generators, Signal **147, 154, 287-288, 292-293, 298, 302, 362-364, 398-412, 544-550, 554-555**
- Arbitrary Waveform 288, 302, 398-409
- Audio 544-550, 554-555
- CATV 546
- Component-Serial, Analog, NTSC, PAL,Digital 544, 547-549
- Data 364, 378, 410
- Data Time 410
- Digital to Analog Converter 363
- Digital Composite, NTSC, PAL 544
- Digital Word 147, 154
- Function 546-550
- Ghost Canceler Reference 550
- Handheld 548, 554
- High Definition Sync, Test Signal, Waveform Monitor 541, 550
- Insertion 550
- Microwave Signal 287, 288, 292, 293, 298
- Optical Impulse 362
- Pattern 364, 378, 410, 544, 550
- Programmable 550
- Pulse 364, 378, 398-412
- Pulse/Function 410
- SDH/SONET 342
- Sync 544, 550
- Television Test Signal 548, 550
- Tracking 206, 225
- Word 410

GPIB Cables **520**
Graphics
- Plotter, 4 pen 524
- Printers 560-567
- X Terminals 570-571

Ground Leads, Probe **482-523**

H

Handheld Products **114, 332, 369, 414, 418-422, 542, 548, 554**
- Accessories 418-421
- Analyzer 548
- Audio Analyzer/Generator 554
- Generator 546, 548
- Monitor 542
- Multimeters 414, 422
- Optical Power Meter 332, 369
- Oscilloscopes 114, 420

High Definition
- Programmable TV Generator 550
- Television Oscilloscope 120
- Television Sync Generator 550, 552
- Waveform Monitor 540

High Resolution Spectrum Analyzer, Optical **371**
High Voltage Probes **460, 496, 502**
Hoods, Scope and Video Viewing **534**

I

IC Clips **474-479**
- FlexLead™ 476
- PLCC Packages 474-479
- PQFP Packages 474-479
- SOIC Packages 474-479

Indices **2-16**
- Alphanumeric 2
- Functional 10

Inkjet Printers **524, 561-567**
Instrument/System Controllers **379-395**
Instrument/Probe Reference Chart **450-451**
Instruments, Reconditioned **580**
Instruments, Stimulus **379, 385**
Instruments, Switching and Scanning **379**
Interface Cables **520**

L

Leasing Program **582**
Light Emitting Diode **373**
Light Filters **536**
Light Measurement **322, 367, 369, 373, 376, 432**
- Fiber Optic 322, 367, 369, 373, 376
- Radiometer/Photometer 432

Line Impedance Stabilization Network (LISN) **235**
Literature, Application Notes **584**
Logic Analyzers **147-174**
- Accessories 446
- Digital Analysis Systems 154
- GPIB 173
- High Speed Timing 173
- Microprocessor 147, 174
  - Disassembly 154, 173
  - Control 162
  - Support 173
- Oscilloscope, Digitizing 162
- Performance Analysis 162

Functional Index

Logic Analyzers *continued*
- Selection Guide 148
- State Analysis 162-179
- Timing Analysis 162-179

Logic Scope 142-146
Low Capacitance Probes 466
Low Impedance Voltage Probes 466

M

Mainframes
- Digitizing Analyzers 77-89
- Logic Analyzers 154, 162
- Modular Instruments 397
- Oscilloscopes 77-89, 97, 350
- Systems 386

Measurement Instruments, Systems 379, 388, 395
Meter, Optical Power 369, 373
Meter Leads 520-523
Microwave & RF Instruments 175-321
- Accessories 175-321, 446
- Network Analyzers 256-267
- Signal Generators 287
- Software 228
- Spectrum Analyzer Optical Plug-in 366
- Spectrum Analyzers 175-266
- Spectrum Monitor 559
- Sweep Generator 287
- Waveguide Mixers 187, 194

Modular Instruments 397
- Optical Converter/Power Meter 358, 373
- Optical Impulse Generator 362
- SDH/SONET Generator Receiver 342
- SDH/SONET Reference Receivers 356
- Signal Sources 410

Monitors
- Aural Modulation (BTSC) 555
- Spectrum 559
- Stereo Audio 555
- Waveform 540
- X Terminals 570-571

Multimeter, Optical Power 373

N

Network Analyzers 256-267
Network Displays 570-571
New Products 17-32

O

Operational Products 556
Optical *see Opto-Electronic Instruments*
Optical Attenuators 344, 363
Optical to Electrical Converters 106, 342, 354, 360
Optical Power Meter 369, 373
Optical Receiver, RF Spectrum Analyzer Plug-in 366
Optical Reference Receivers, SDH/SONET 356
Optical RF Spectrum Analyzer Plug-in 366
Optical Source 373
Optical Spectrum Analyzers 366, 371
Optical Wavelength Meter 376
Opto-Electronic Instruments
- Cable Testing, Optical 324-337, 362
- Digital Photometer/Radiometer 432
- Generator, Optical Impulse 362
- Optical Attenuator 344, 363
- Optical-to-Electrical Converters 106, 342, 354, 360, 367
  - Heads 360
  - Instruments 358
  - Modules 360
  - Probes 354
- Power Meter, Optical 358, 369, 373
- Spatial Optical Fiber Input Head 354

Oscilloscopes 33-124
- Accessories 446-536
- Amplifiers 91-95
- Analog 117-124
- Analog Plus Digital 112-116
- Battery Operated 114-115
- BrightEye® Transient Intensifying 120
- Camera 526
- Carts 528
- Communications Signal Analyzer 77-89, 346-353
- Counter/Timer 120
- Counter/Timer/DMM 120
- Digital Sampling 80-89, 130-139, 346-353
- Digital Storage 40-90, 97-105, 112-116, 120, 130-139
- Digital/Optical Communications 77, 346-353, 364
- Digitizer, Programmable 80-89, 130-139
- Digitizing Signal Analyzers 80-89
- DMM 120
- FFT Capability (Frequency Domain) 77-83
- Handheld 74, 114-115
- Hardcopy Output *see Printers/Plotters*
- HDTV 120
- Laptop Digital 120
- Logic Analyzer Based 147-172
- Mainframes for Modular Plug-Ins 80-89, 97-105, 346-353
- Modular 346-353
- Optical-to-Electrical 322, 346-353
- Plug-Ins 90-95, 106-111
- Portable 40-89, 97-105, 112-116
- Printers/Plotters 524-525, 560-567
- Probes 446-524
- Rackmount 48, 97-101
- Rackmount Kits 535
- Ruggedized 114
- Sampling
  - Accessories 110
  - Delay Line 110
  - Digital 80, 346
  - Heads 106
  - Multi-Channel Unit 110
- Software 73, 383, 384
- Storage
  - CRT 114
  - Digital 41-116
  - Equivalent-Time DSO 80-89
  - Real-Time DSO 40, 80
  - Variable Persistence 80, 346-353
- Telecommunications 41, 48, 346
- Television 120
- Training 434, 581
- Travel Accessories 532-533
- Viewing Accessories 534

P

Passive Voltage Probes 467
Patch Cords 520
Pattern Generator 364, 377, 410

Functional Index

Phaser™ Color Printers **560-567**
Photometer/Radiometer **432**
Physical Measurement Instruments
- Fourier Analyzers 80, 315, 367
- Temperature Probes 518

Picture Monitor, Handheld **542**
Plotter, Four Color **524-525**
Plug-in, RF Spectrum Analyzer, Optical **366**
Plug-ins **90, 106**
Power Dividers (SMA) **522**
Power Meter, Optical **358, 369, 373**
Power Plug Options **583**
Power Supplies **428-431, 460**
Pre-/Post-Certification Software **233**
Pre-/Post-Certification System **232**
Prequalification Software **233**
Preselector, RF Stepping **234**
Printers
- Color 560-567
- Ink-Jet 525

Probes **446-523**
- 1X-10X Switchable 468, 470
- Accessories 520-527
- Active (FET, Bipolar, Bias/Offset) 146, 456-465, 474
- Adapters/Attenuators 521-523
- Articulated Arms/Probing Stations 480
- Current 510-517
- Current Amplifiers 512
- Differential 500-504
- Digital Photometer/Radiometer 432
- EMI Probes 235
- Environmental 518
- FET 146, 458-465, 474
- Ground Leads 482-523
- High Current 510-517
- High Frequency 456-465
- High Voltage 496, 502
- Instrument/Probe Reference Chart 450-451
- Isolators 505-509
- Low Capacitance 466
- Low Impedance 466
- Low Loading 456, 466
- Obsolete Probe to Replacement Probe Cross Reference 454
- Optical-to-Electrical Converters 354
- Oscilloscope to Probe Cross Reference 450
- Passive Voltage 467-473
- Probing Stations/Articulated Arms 480
- Replacement parts 482
- RF 518
- SMT Device Probe/Interconnects 474-479
- Specification Chart 452
- Temperature 518
- Voltage
  - Active 146, 456, 458, 474
  - Low Impedance 466
  - Passive 467
  - Reference Chart 452
- Word Recognizer/Trigger 519

Probing Stations/Articulated Arms **480**
Programmable DMM **414, 422**
Pulse Generators **410**

R

Rackmount Products
- Carts 528-531
- Kits 535
- Oscilloscopes 97
- Spectrum Analyzer 175, 181, 188, 202, 206, 210, 215, 218, 221

Radiometer/Photometer **432**
Rasterizer, Waveform/Vector **543**
Receiver, Spectrum Analyzer Optical Plug-in **366**
Receivers, Error Detectors **364, 378**
Receivers, SDH/SONET **342, 356**
Reconditioned Instruments **580**
Reference Information
- Arbitrary Generators 398
- Attenuator Selection Guide 523
- Camera Adapters Selection Chart 527
- Cart Selection Guide 528
- Communication Test Sets 269
- Digital Counter Selection Guide 425
- Digital Multimeter Selection Guide 415, 423
- Function Generator Selection Guide 427
- Instrument/Probe Chart 450
- Logic Analyzer 148
- Microprocessor Support Selection Guide 173
- Microwave and RF 176
- Network Analyzers 256
- Obsolete Probes to Replacement Probes 454
- Oscilloscopes 33, 42, 50, 78
- Oscilloscope to Probe Cross Reference 450
- Power Plug Options 583
- Power Supplies 428
- RF Meters 303
- Self-Study Programs 434-436
- Signal Sources 287
- Spectrum Analyzers 176
- Systems 379
- TekMeter 417
- Voltage Probe Reference Chart 452
- X-Terminals 570

Reference Receivers, SDH/SONET **342**
Relative Intensity Noise, Spectrum Analyzer Plug-in **366**
Rental Companies **582**
Rental Program **582**
Repair Protection **576-579**
Representatives **595**
RF Meters **303-321**
RF Products
- Cable TV Measurement Packages/System Software 557-559
- Cable TV Spectrum Analyzer 146, 210, 559
- Demodulator 558
- DMM Probes 518
- Down Converter 320
- Probes 235
- Signal Level Meter 558
- Spectrum Monitor 210, 559
- Spectrum, Optical 366
- Sweep Transmitter 210, 559
- Sweep Receiver 210, 559
- Tunable Down Converter 320

RF Spectrum, Optical **366**

Functional Index

RIN (Relative Intensity Noise, Spectrum Analyzer Plug-in **366**
RS-232-C Cables **520**

S

Sales & Service Offices **585-595**
Sampling
- Accessories 110
- Oscilloscopes 80-89
- Delay Line 110
- Digital 80, 346, 364
- Heads 106
- Multi-Channel Unit 110
- Optical to Electrical Head 106, 360

Scanners, VXI **379**
SDH Portable Test Set **340**
SDH/SONET Analyzer **342**
SDH/SONET Generator/Receiver Module **342**
SDH/SONET Reference Receivers **356**
Selection Guides ***see Reference Information***
Self-Study Programs **434-436**
Semiconductor Testers **437-444**
- Curve Tracers 437-444
- Socket Adapters 444
- Software 383-384, 441-442

Seminars **581**
Serial Digital
- Video Interface 546
- Waveform Monitor 540

Service Information **576-579**
Service Oscilloscopes **114**
Service Training/Seminars **581**
Signal Analyzers **77-89, 97-105, 315, 346-353**
Signal Generators ***see Generators***
Signal Level Meter **558**
Signal Processing Systems **315**
Signal Sources **287-302, 400-412**
- Software 302

SMA
- Adapters 521
- Attenuators 522

Cables **520**
SMD Probe/Interconnects **474-481**
Software
- EMI Testing 233, 255
- EMI Prequalification 233
- Arbitrary Generators 398
- Oscilloscope 73, 383
- Remote Site Monitoring 228
- Signal Acquisition and Analysis 398
- Spectrum Analyzer 233, 255, 302
- System 379, 383
- Technical Support 379, 383
- VM700A Remote Graphics 539
- VM700A Backup and Remote Control 539
- VM700A Remote Control 539
- VXI 379, 383
- Waveform Generation 398

SONET Portable Test Set **340**
Spectrum Analyzers **175-255**
- Accessories 235, 446-536
- Cable TV Analyzer 210, 559
- Cable TV Measurement Packages/System Software 557
- Digital 80-89
- Down Converters 320
- Filter Bank 315
- Full-Range Microwave 181, 189, 195, 202, 215, 220
- Microwave Comb Generator 188
- Optical-to-Electrical Converter 106, 360
- Optical Spectrum 366, 371
- PC-Based Systems 232
- Plug-in, Optical 366
- Portable 175, 181, 188, 202, 206, 210, 215, 218, 221
- Preselector 234
- Probes, Quasi-Microwave 188, 195, 202, 215, 220
- Probes, RF 235
- RF/VHF/UHF Spectrum Analyzers 189, 195, 206, 210, 218
- Software 228, 233, 255
- Tracking Generator 195, 202, 215, 225
- TV Sideband Adapter 223
- Waveguide Mixers 187, 194

State Analyzer **147**
Stimulus Systems/Instruments **379, 410**
Switching and Scanning Instruments **379, 390**
Synchronizers, Audio and Video **552**
System Controllers **379, 385**
Systems **379-395**
- Avionics 393
- Digital B-Scan 392
- Digitizers 394
- Controller/Interface 385
- General Information 380
- Instruments 388
- Mainframes 386
- Software 383
- Sources 389
- Summary 395
- Support/Service 381
- Switching/Scanning 390
- System Architecture 381
- System Integration Service 382

T

Technical Support **575, 577, 581**
TekMeter **416**
Telecommunications Test Equipment **322-378**
- Accessories 354, 446-536
- Bit Error Rate Test Set 364, 378
- Cable Testing, Optical 350, 362-363
- Communications Signal Analyzer 80, 315, 346-353, 364, 380
- LAN Media Testing 333
- Metallic Cable Testers 333
- Optical Attenuator 363, 379
- Optical Cable Testing 362
- Optical-to-Electrical Converters 342, 354-360, 366
- Optical Probes 354
- Optical Spectrum Analyzers 367, 371
- Optical Wavelength Meter 376
- Probes 446
- RS-232 Analyzer 147
- SDH Test Set 340
- SDH/SONET Analyzer 342
- SDH/SONET Generator/Receiver Module 342
- SONET Test Set 340
- Spectrum Analyzers 175-235
- Waveform Analyzer 147

Functional Index

Telecommunications Testing 340-342
Television Test Equipment 537-560
- Accessories 520-523
- Audio Measurement Set 553
- Cable TV Spectrum Analyzer 210, 366, 559
- Demodulators 558
- Sideband Analyzer 223
- Generators
  - Audio Signal 544-550, 554
  - Handheld Test Signal 546
  - Insertion 550
  - Serial Digital Video Interface 548
  - Synchronizers 552
  - Test Signal Generators/Inserters 544-550
- Spectrum Monitor 559
- Stereo Audio Monitors 555
- Sweep System 559
- Synchronizers 552
- Vectorscopes 540-543
- Video Measurement Sets 538-539
- Waveform Monitors 540-543

Temperature Probes 518
Terminals, Graphics 570-571
Terms and Methods of Sale 582
Test Leads 520
Test & Measurement Software 73, 383, 398
Test Systems 379-395
- Avionics 393
- Digital B-Scan 392
- Digitizers 394
- Controller/Interface 385
- General Information 380
- Instruments 388
- Mainframes 386
- Software 383
- Sources 389
- Summary 395
- Support/Service 381
- Switching/Scanning 390
- System Architecture 381
- System Integration Service 382

Time Domain Reflectometry (TDR) Systems
- Metallic TDRs 333
- Optical TDRs 324, 338, 362
- Oscilloscope 77, 346
- Probes, Low Frequency 466

Time Frequency Analyzer 315
Timing Analyzer 147
Tracking Generator For Spectrum Analyzers 206, 224, 226
Training/Seminars 581
Transient Digitizers/Recorders 80, 130, 133, 136
Travel Accessories 532

V

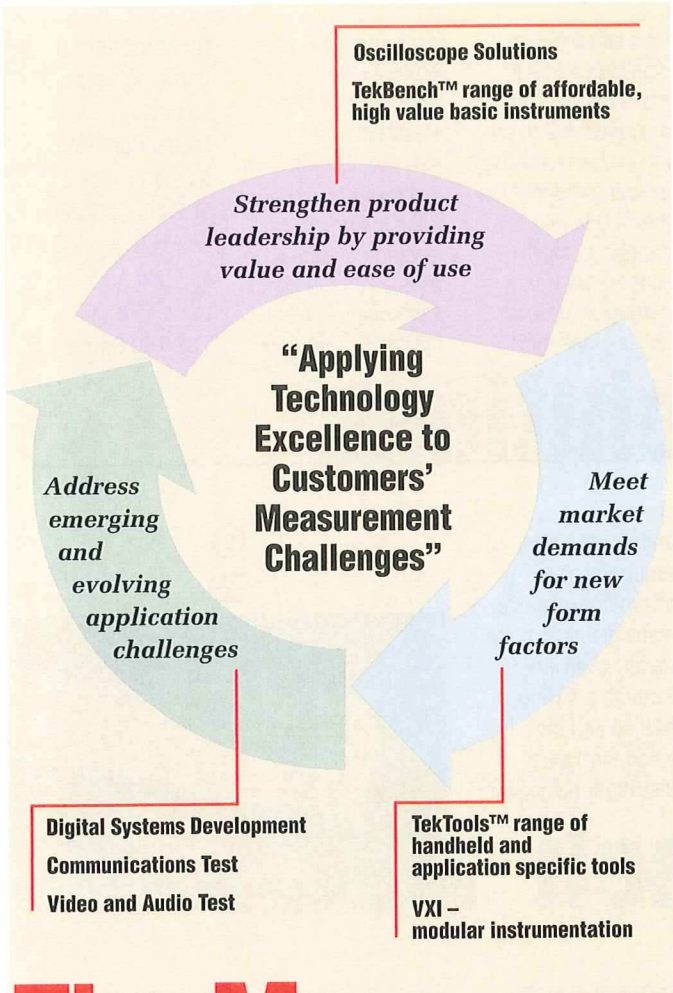
Vectorscopes 540-543
Video Measurement Sets 538-539
Viewing Hoods 534
VITS/ITS Inserter 550-551
Voltage/Probe Reference Chart 452
VXI 379-395
- Avionics 393
- Digital B-Scan 392
- Digitizers 394
- Controller/Interface 385
- General Information 380
- Instruments 388
- Mainframes 386
- Software 383
- Sources 389
- Summary 395
- Support/Service 381
- Switching/Scanning 390
- System Architecture 381
- System Integration Service 382

W

Waveform Analyzers 126
Waveform Digitizers 125-141
Waveform Monitors 542
Waveguide Mixers 187, 194
Wavelength Meter, Optical 376
Word Recognizer/Trigger Probes 519
Workstation, Carts 528-531

X

X Terminals 570-571



The Measurement Business

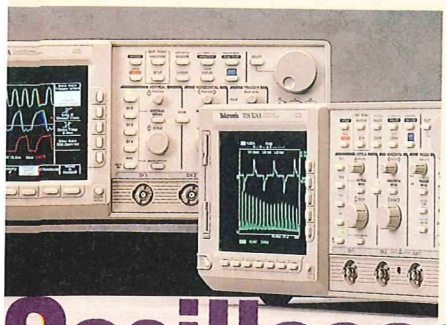
The Tektronix name has been synonymous with providing solutions to customers' electronic measurement challenges for almost 50 years. On a global basis, the measurement business has been through a period of rapid change over the last few years. In order to be successful during this time, Tektronix has had to be able to anticipate changes and develop products that will meet new challenges as they arise. The products shown in this catalog attest to the success of a strategy that identifies trends and technical needs and deploys resources to meet these customer-driven requirements.

At Tektronix we continue to focus our efforts in areas that customers tell us are important to them. We believe that our continued leadership in the measurement industry must be earned by applying our technology excellence to customers' measurement challenges in three distinct sectors, as shown in the adjacent diagram: delivering superior value and easy-to-use products, creating measurement solutions in new form factors, and addressing emerging and evolving challenges in global markets. Further analysis defines our measurement business in terms of the seven key areas shown, as defined by customer needs and Tektronix capabilities. The following sections briefly describe these seven areas and Tektronix' role in serving customers in each.

Functional Index of Products by Focus Areas

	Focus Area	Products	Pages
O	Oscilloscope Solutions	Oscilloscopes, Digitizers, Signal Sources, Probes & Accessories	33, 40, 125, 446
B	TekBench™ Instruments	Low-cost Oscilloscopes, Power Supplies, Counter/Timers, DMMs, Function Generators, Probes & Accessories	413, 446
T	TekTools™ Instruments	Handheld DMMs, Handheld DMM/scopes, Handheld Scopes, Light Meters, Accessories	114, 413, 446
V	VXI	VXI Chassis, Modules, Communications test products, Waveform Analyzers, Boundary Scan, Switching and Scanning, Avionics Bus Testers	379
D	Digital System Development	Digital Analysis Systems, Logic Analyzers, Logic Scopes, Oscilloscopes, Boundary Scan Testers, Probes & Accessories	33, 40, 142, 147, 379, 446
V/A	Video and Audio Test	Waveform Monitors, Test Signal Generators, Video Measurement Sets, Frame Synchronizers, Audio Analyzers/Generators, Audio Routing Switchers, Audio Monitors, Cable TV Sweep Systems, Cable TV Signal Level Meters	537
C	Communications Test	Communications Signal Analyzers, EMI Systems, ISDN Test Sets, SDH/SONET Testers, Metallic Cable Testers, Fiber Cable Testers, Spectrum Analyzers, Optical/Electrical Converters	175, 322

O



Oscilloscope Solutions

Tektronix has been the leader in oscilloscopes for almost 50 Years and is widely recognized as the leader in oscilloscope solutions worldwide.

Tektronix offers more high performance oscilloscopes than all other companies combined; these are the scopes of choice due to the innovative technology used in products like the TDS family of digitizing oscilloscopes. Tektronix is particularly known for its pioneering in user interface technology – the TDS interface is widely regarded as an industry standard.

Tektronix is actively driving and supporting the migration from analog to digital technology in oscilloscopes. Tektronix breakthroughs in digitizing scope technology include Digital Real Time, as seen in the TDS 300, TDS 600 and TLS 200 Series, and InstaVu™, as used in the TDS 700 Series.

B



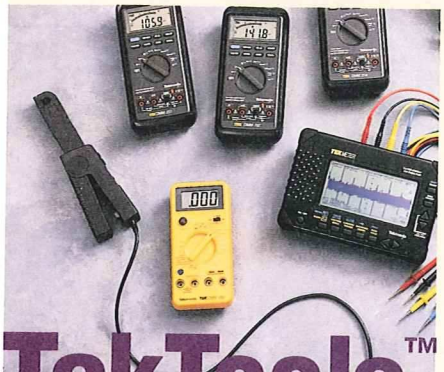
TekBench™ Basic Instrumentation

Tektronix has a broad portfolio of TekBench™ basic instrumentation that addresses the needs of customers engaged in fields such as training, manufacturing production, bench and field service and product design.

The oscilloscope remains the centerpiece to the TekBench™ range of products, supported by the fact that Tektronix has a key technological differentiator in affordable oscilloscopes with Digital Real-Time technology in the TDS300 Series.

TekBench™ products are designed to address the key requirement of affordable, capable instruments that are readily available through a strong, trained and motivated third party distribution channel.

T



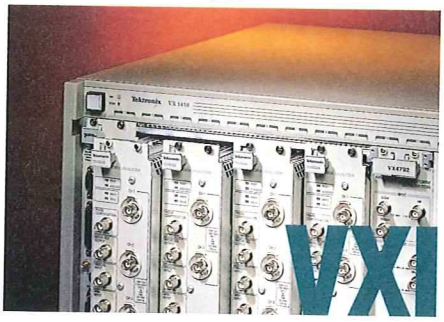
TekTools™ Electronic Measurement Instruments

TekTools™ is a new brand of Tektronix for a new range of leading-edge affordable, smart, handheld, battery-operated electronic measurement tools for service professionals. These products take advantage of the Tektronix reputation for advanced measurement and manufacturing technology and are designed to address the new proliferation of electronic technology in many segments of industry. They offer the quality, reliability and support that service applications demand.

Tektronix has provided products to the service industry for nearly 50 years and now is able to offer a growing portfolio of TekTools™ products that include digital multimeters, compact oscilloscopes, specialized accessories and environmental monitoring tools such as light meters.

TekTools™ are designed to be available through third party distribution channels – particularly those that address markets in which Tektronix is not widely known and electronic measurement tools in general are "non-traditional".

V



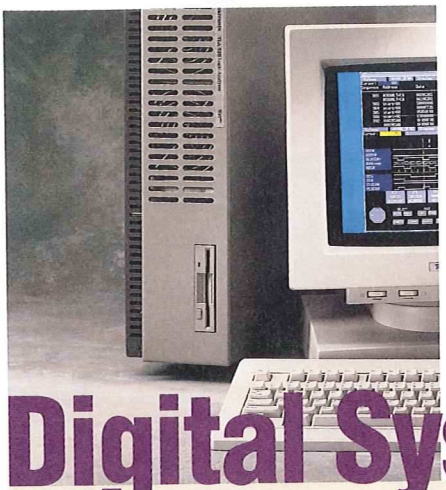
VXI

Tektronix has been in the VXI market since 1987 and was a leader in defining the VXIbus standard. As a founding member of both the VXI*plug&play* alliance and the VXIbus Consortium, Tektronix continues to be a driving force for creating and supporting open systems architecture.

The broad Tektronix portfolio of VXI hardware and software products entirely supports the open architecture of the VXIbus and VXI*plug&play* standards.

Tektronix VXI products continually set the price/ performance benchmark in their class, thus supporting the accelerating migration to VXI and away from conventional GPIB-based ("rack-and-stack") test systems.

Tektronix' commitment to VXI technology is evidenced by the company's use of VXIbus standards in designing instruments to address certain applications, notably SDH/SONET production testing.



Digital Systems Development

Tektronix is a leading supplier of instruments for digital systems development, with a range of products designed to help engineers meet productivity and time-to market challenges. The Digital Systems Development initiative addresses customers' unique hardware and software debugging and measurement challenges in the development of microprocessor-based, software-intensive digital systems.

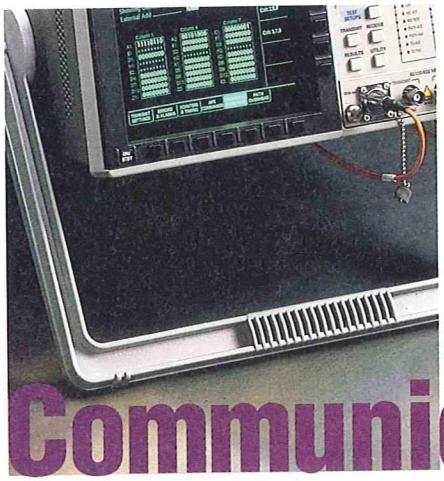
The Tektronix Digital Analysis Systems are leaders in a new form of networked, or "Enterprise," instrumentation for the digital systems designer, offering factory-wide linkages to software tools and software performance analysis capability. The Tektronix Logic Scope is a unique tool that bridges the gap between oscilloscopes and logic analyzers, while Tektronix oscilloscopes offer the performance and application-specific features to address high speed digital designs. To complete the portfolio, Tektronix probing solutions meet the challenge of accessing today's fine-pitch hybrids, surface mount devices and integrated circuits.



Video and Audio Test

Tektronix is the worldwide leader in test equipment for video and audio signal applications from capture to transmission and has provided products to the television industry for 40 Years. Recognized by the television industry for technical leadership, Tektronix has won several Emmy awards, and is an active member on worldwide standards committees.

Tektronix offers video and audio test instruments for signal processing and generation, and measurement equipment for broadcast, cable, production, manufacturing and transmission applications. Tektronix television products are widely recognized as "industry standards:" innovative, easy to use and based on an in-depth understanding of customer needs. In addition, Tektronix has allied itself with other leading vendors to offer the broadest line of video and audio test instrumentation available.



Communications Test

In the communications test area, Tektronix supplies diverse and innovative test solutions for emerging networks. Some of these products are designed to ensure network integrity and optimize performance; others verify new designs and assure product quality in communications equipment. Building on its leadership position in cable testing, Tektronix is expanding its commitment in broadband transmission testing and RF & wireless test instrumentation as well. Every one of these products benefits from Tektronix' proven competencies in high-speed data acquisition, processing, and display, as well as fiber optics and video.

Tektronix is known and respected among communications equipment manufacturers for its test and measurement and TV/video products, where the company has a record of innovation, quality, flexibility and support. To address Network Operators, Tektronix has focused on emerging technologies, such as SDH/SONET and ATM. Tektronix also participates in many standards organizations in the communications industry.

Oscilloscopes

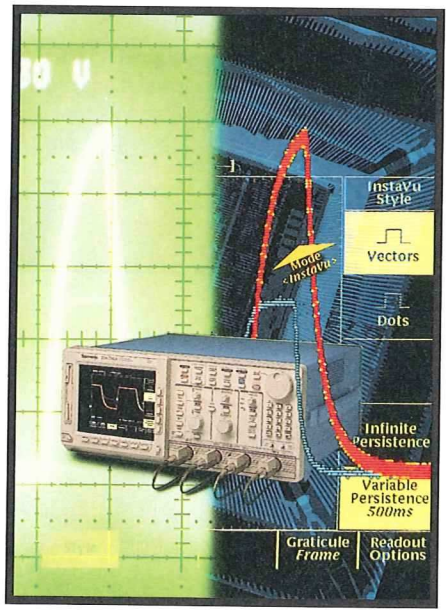
Boasting the world's fastest capture rate, these powerful new scopes are the founding members of Tek's TruCapture™ family of instruments. Today's high-speed signal environments – computers, peripherals, and telecommunications equipment, for example – can harbor minute glitches or irregular signals that evade viewing on conventional DSOs or even wideband analog scopes. The TruCapture scopes expose these unpredictable waveforms with a clarity unequalled in the instrumentation field.

See page 54.


TDS744A/784A Oscilloscopes

TECHNOLOGY spotlight

Digitizing Storage Oscilloscopes have become the prevailing signal-viewing technology, and rightly so: their ability to store and analyze waveform data is crucial to today's measurement methodologies. But fast-writing analog scopes have remained the preferred platform for capturing infrequent or irregular signals hidden within a periodic waveform. With the advent of InstaVu acquisition in Tek's TruCapture scope family, this difficult task has finally yielded to the DSO.



InstaVu™ Acquisition Unveils Hidden Signals

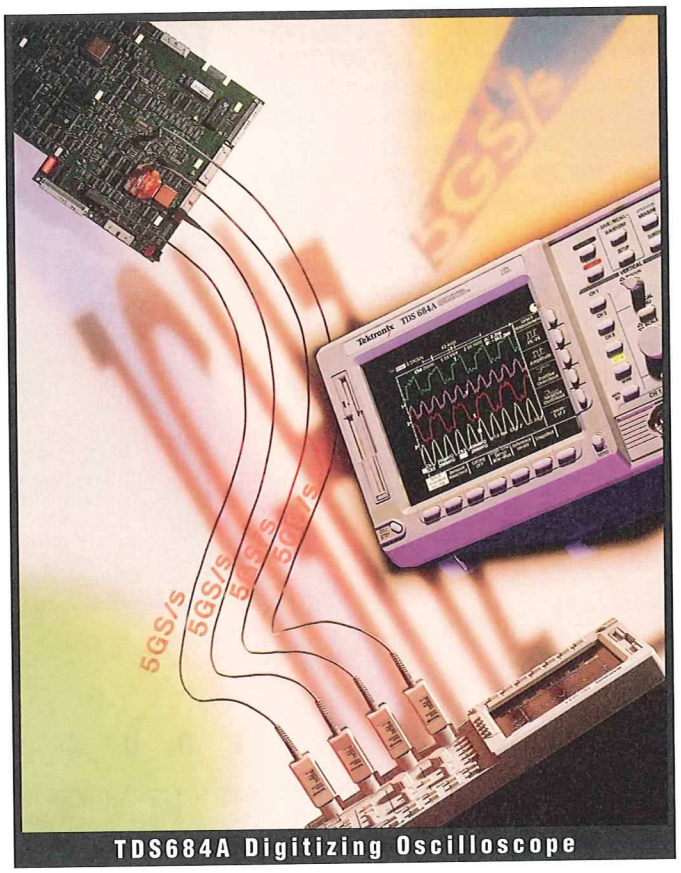
InstaVu acquisition sets a new benchmark in waveform capture rate for DSOs. TruCapture scopes can display more than 400,000 acquisitions per second – a rate 2,500 times faster than the most advanced DSOs available. InstaVu acquisition is an entirely new DSO scheme that builds the display image within the acquisition system, then moves the finished pixel map to the screen. In contrast, conventional DSOs accumulate data and build the image in a separate, slower display subsystem.

InstaVu acquisition provides a new level of visibility into the "one in a million" pulses that lie beneath the scope's main triggered waveform. The photograph shows a secondary waveform (right image, blue trace) that would be completely lost on all but the most advanced analog scopes, and even then barely visible (left image). But InstaVu acquisition reveals the signal immediately. Seeing details like this, clearly and repeatably, can make the difference between a fruitless trial-and-error search for a circuit problem, and taking the most direct path toward the solution.

Oscilloscopes

The TDS684A, like its predecessors in the TDS Series, sets new standards for scope performance. Designed for digital development and telecommunications applications as well as high-speed transient event capture, the TDS684A offers uncompromised 1GHz acquisition on four channels simultaneously. With its color display and wide choice of triggering options, the TDS684A is the right tool for the most advanced research and design requirements.

See page 58.



TDS684A Digitizing Oscilloscope

Signal Sources

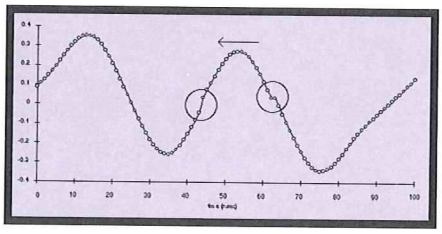
With three new models ranging from 20 MS/s to 1 GS/s, the 2000 Series embraces engineering applications including the design of telecommunications equipment, disk drives, power supplies, biomedical equipment, and automotive sensors. Each model shares the same easy-to-use graphical user interface and built-in controller that speeds the creation and editing of complex waveforms. And these products' ability to transfer waveforms directly from an oscilloscope over GPIB makes it easy to deliver "golden" waveforms to a Unit Under Test.

See page 398.


2000 Series Arbitrary Waveform Generators

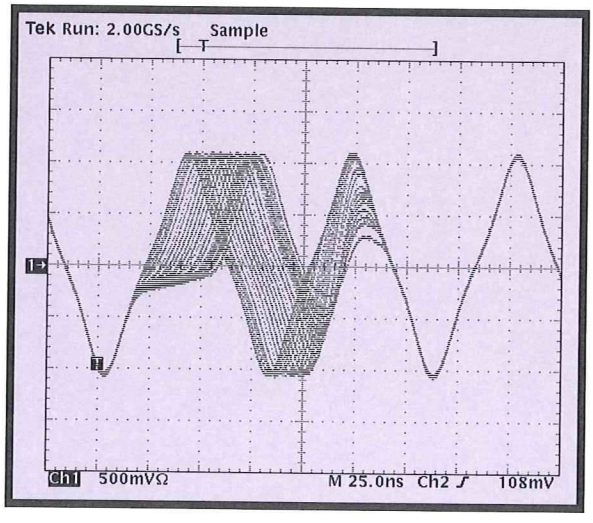
APPLICATIONS spotlight

As evolving disk drive technology packs more and more information into less physical space, once-minor circuit and mechanical variations have a larger effect. For example, instantaneous spindle speed variations during reading or writing produce jitter, making it difficult to reliably acquire the transitions that embody the data. Circuit tolerance for jitter must be tested during the design of the drive. Increasingly, engineers are using arbitrary waveform generators (AWGs) to simulate disk data waveforms and jitter.



Arbitrary Waveform Generator Simulates Jitter in Disk Drives

A common means of simulating jitter with an AWG is to move a segment of the stored waveform forward or backward in time – a trivial exercise solved with a simple cut and paste operation on any graphical waveform development tool. As the upper figure indicates, this approach does indeed shift the waveform peak but it also produces abrupt transitions where the splices occur. These discontinuities can themselves cause unrealistic, unrepeatable test results.



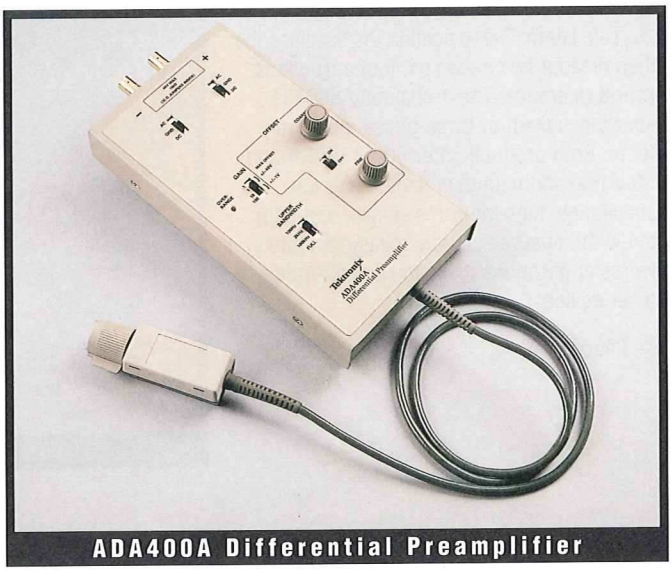
The Tektronix 2000 Series AWGs include a new feature, "Region Shift," that allows the user to automatically modify a waveform's placement in time. The technique applies a minute amplitude shift to each point in the selected waveform region, with the net effect of making it seem earlier or later in time relative to other, unmodified pulses surrounding it. The lower figure shows a jittery waveform produced by region shifting. The 2000 Series' high vertical resolution permits time shifts that far surpass the instrument's actual clock resolution. The AWG 2021, for instance, provides shifts as small as 4 ps.

In addition to disk drive testing, Region Shift is a valuable tool in testing jitter behavior and margins in serial transceivers and other telecommunications components, in testing digital system clock circuitry, and in numerous other applications.

Accessories

The ADA400A brings low-level differential measurement capability to any Tek oscilloscope. Designed to make low-frequency or low-amplitude measurements in noisy environments, the ADA400A is ideal for applications in the design of medical diagnostic and imaging equipment, mechanical transducers, and audio equipment.

See page 501.



ADA400A Differential Preamplifier

With a 2,500 V maximum input voltage, the P5100 High Voltage Passive Probe provides an affordable means of observing the circuit behavior of switch mode power devices. The P5100 has 250 MHz bandwidth and offers automatic scaling when used with the Tektronix TDS 460 oscilloscope system. The product's rugged probe head can survive harsh field environments, and can clip to bus bars up to 1/4" (6.3 mm) without extra wires or adapters.

See page 496.



P5100 High Voltage Passive Probe

The P5200 probe makes floating measurement with the oscilloscope grounded. With its 1000 V floating voltage capacity and 1300 V maximum differential input voltage, it's the right solution for safe, accurate measurements in high voltage/current applications like power supply and motor drive design.

See page 502.



P5200 High Voltage Differential Probe

Accessories

The A6907/09 Voltage Isolators provide a safe alternative to floating the oscilloscope when measuring circuits without a true local ground reference. The 4-channel A6907 is especially suited for three-phase measurements. Both products offer 60 dB CMRR and 850 V maximum input voltage. Their low capacitance, high input resistance, and high bandwidth ensure accurate measurements in diverse applications involving switch-mode power devices.

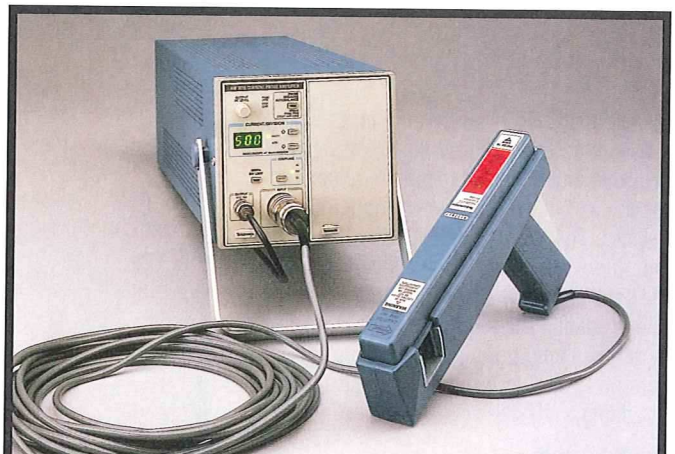
See page 506.



A6907/09 Voltage Isolators

The AM503B non-programmable current probe amplifier operates in either a TM 500 or TM 5000 Series power module. It supports five different current probes, including the new A6300XL Series with an 8 m cable length. The new A6304XL current probe enables measurements of continuous AC/DC current up to 500 Amps and 700 Amps peak.

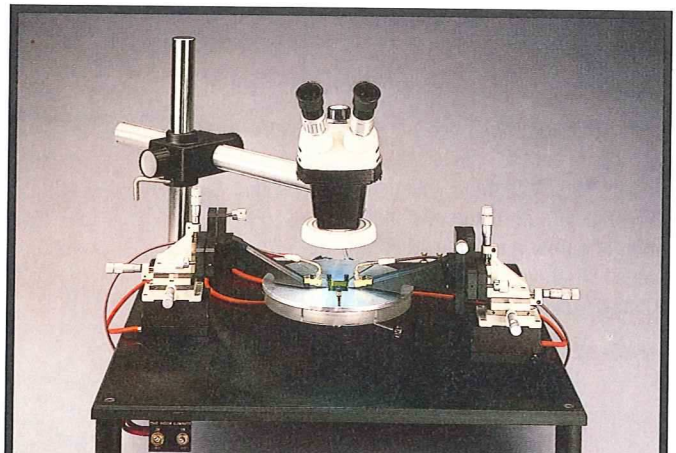
See page 512.



AM503B Current Probe Amplifier and Probes

The new PPMS Series of probing stations and articulating arms allows designers to guide standard handheld and microwave probes onto the small geometry of fine-pitch interconnects, SMD packages, multi-chip modules, hybrids and ICs. This complete series provides designers with highly accurate, mechanically-assisted probe positioning.

See page 480.

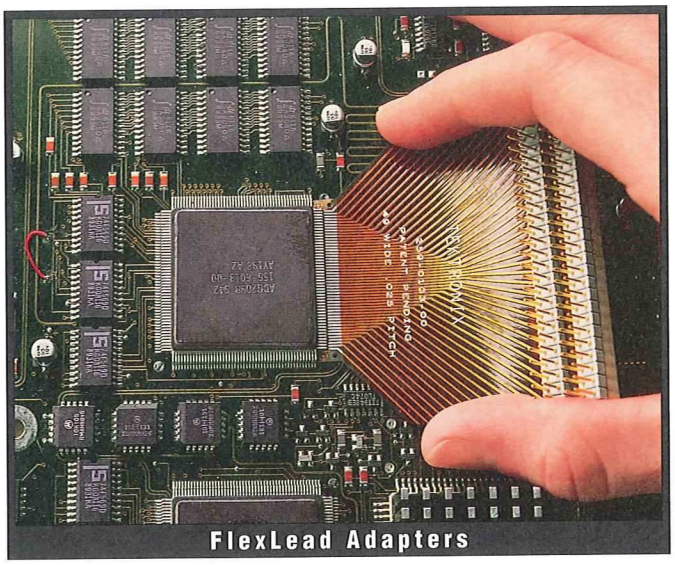


PPMS Probing Stations

Accessories

The FlexLead series of probing adapters mates fine pitch components to conventional oscilloscope probes or logic analyzer podlets. The series has added 19 new configurations to its line, for a total of 32. FlexLead products now address virtually all of the prevailing fine pitch, gull wing and quad flat pack (QFP) packages in the market today.

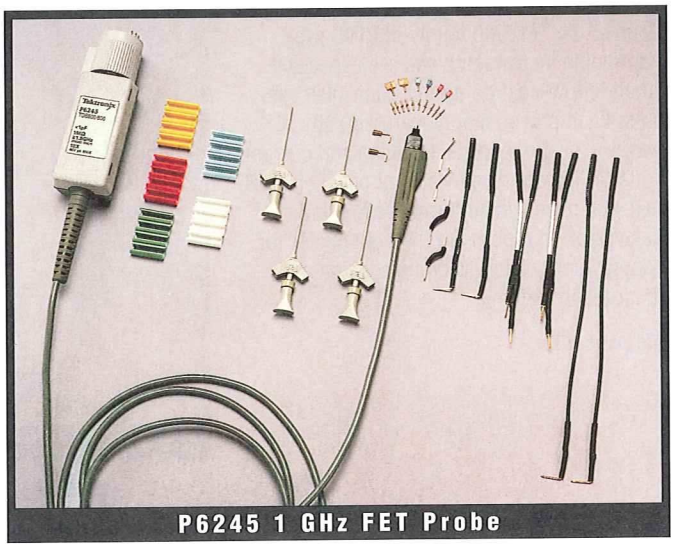
See page 476.



FlexLead Adapters

Designed to deliver sub-nanosecond signal edges to the latest TDS scopes, the P6245 lets you take full advantage of the TDS 684A's 1 GHz bandwidth. It applies a minimal load to the device under test (less than 1 pF input capacitance, 1 MΩ impedance), and doesn't degrade risetime or add speed related distortions. The P6245 is also extremely compact. Its small size and low-mass design make it ideal for probing densely-packed SMD circuits, and it won't damage delicate traces or through-holes.

See page 458.



P6245 1 GHz FET Probe

The P5135 is essential for making high voltage differential measurements with Tektronix scope system preamplifiers like the 11A33 and the 7A13, as well as other scopes having 1MΩ, 7-30 pF input characteristics. Its 2500 V maximum input voltage is well suited for demanding switching power device measurements when bandwidths up to 150 MHz are called for.

See page 503.

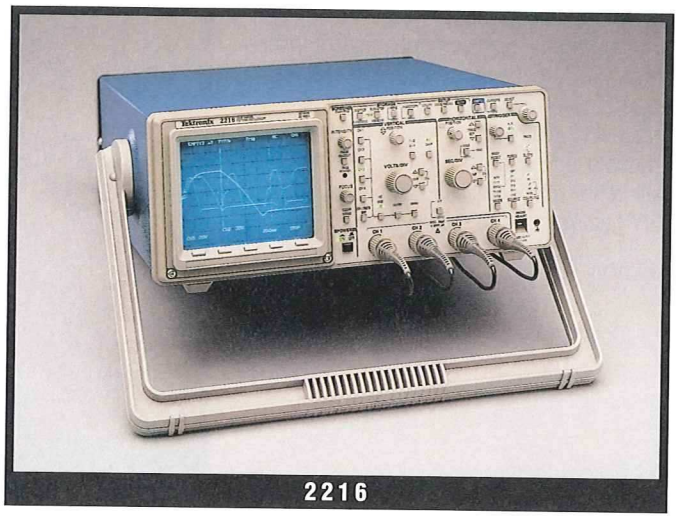


P5135 High Voltage Differential Probe Pair

Bench Instruments

The four channel 2216 digital+analog oscilloscope provides readouts, on-screen cursors, X-Y store and non-store operation and parallel printer ports in a low-priced package. The 2216 offers an optional 128 K per channel record length.

See page 116.



2216

Four new benchtop power supplies, including the PS2510(G) and PS2511(G) broaden the TM2500 family of GPIB programmable instruments and are especially suited to low-cost computer controlled systems. Each power supply features 100 memory locations to save voltage and current limits for instant recall via front panel or GPIB. Built with price and performance in mind, these power supplies are the right choice for manufacturing, basic electronic design and training applications.

See page 430.

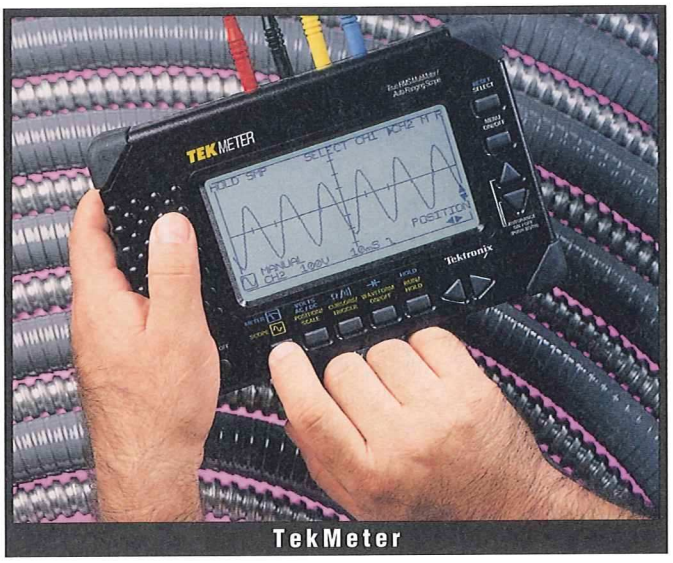


PS2510(G) and PS2511(G) Power Supplies

Bench Instruments

The new TekMeter integrates the usability of a digital multimeter with the waveform display of an oscilloscope in a compact, easy-to-use, battery-operated package. TekMeter family members have 25 Ms/sec digitizers, automatic setup, spike detect and cursors and are ideal for making power quality measurements such as harmonic and AC drive testing, line monitoring and true power.

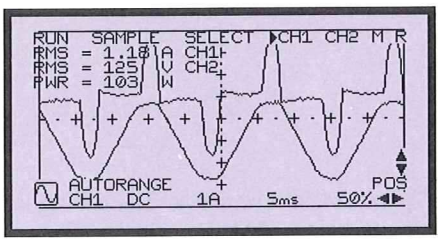
See page 416.

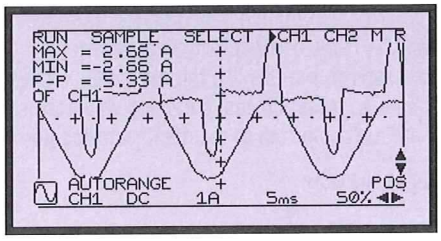


TekMeter

APPLICATIONS spotlight

With the abundance of nonlinear loads and sensitive electronics used in industry today, it is often necessary to track down problems like false tripping in relays and breakers. Analysis of the power line signal can point out current peaks that elude RMS measurements made with conventional DMMs. The TekMeter delivers all the functionality needed to perform this task, and its powerful waveform viewing capability can help predict possible problem conditions.





TekMeter Homes In On Peak-Current Problems

Examining the power waveform (upper TekMeter screen photo) reveals a possible cause of false relay tripping: a nonlinear and "peaky" current waveform (top trace). This can be confirmed by computing the crest factor (CF), defined as Peak Value/RMS Value. A perfect sine wave yields a CF of 1.414, while higher crest factors are evidence of harmonic distortion.

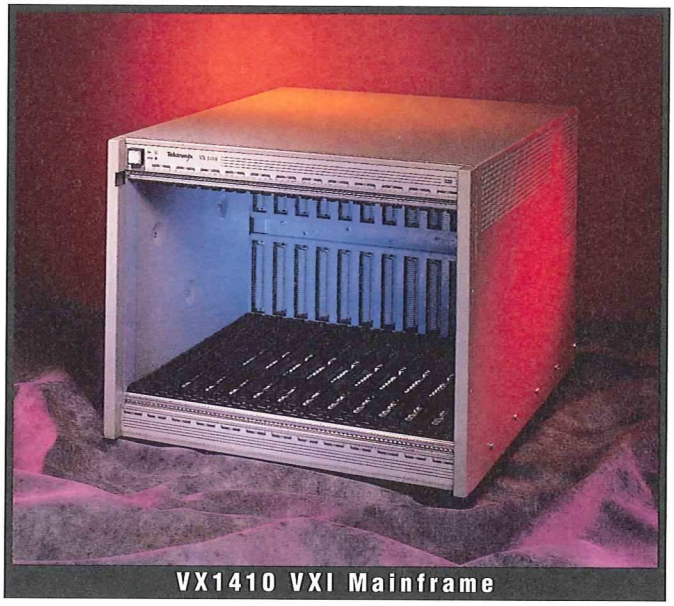
Again looking at the upper screen photo, RMS current and voltage readings were recorded concurrently with the original waveform capture. Peak current measurements (lower screen photo) are only one TekMeter menu away. Dividing the peak current (2.67A; one-half the p-p current) by the RMS current (1.18A) produces a crest factor of 2.23, implying that the distorted current peaks seen on the TekMeter are indeed the source of the relay tripping problem.

VXI

Tektronix is a founding member of the VXI*plug&play* Alliance, which was formed in 1993 to promote open system standards within the VXI industry. VXI*plug&play* compliance ensures that instruments and software integrate easily and quickly, and that instruments from diverse providers do indeed "play" together. Every new Tek VXI product is fully VXI*plug&play* compliant, and is bundled with front panel software compatible with both graphical and text-based user interfaces.

The world's first "intelligent" VXI mainframe, the VX1410 ushers in a new era of system versatility, reliability, and ease of use. Its power supply offers plenty of overhead for even the most power-hungry VXI modules, and autoranges for the appropriate AC input voltage and line frequency. With an intelligent, adaptive cooling system and auto-configurable backplane, the VX1410 redefines the VXI mainframe concept.

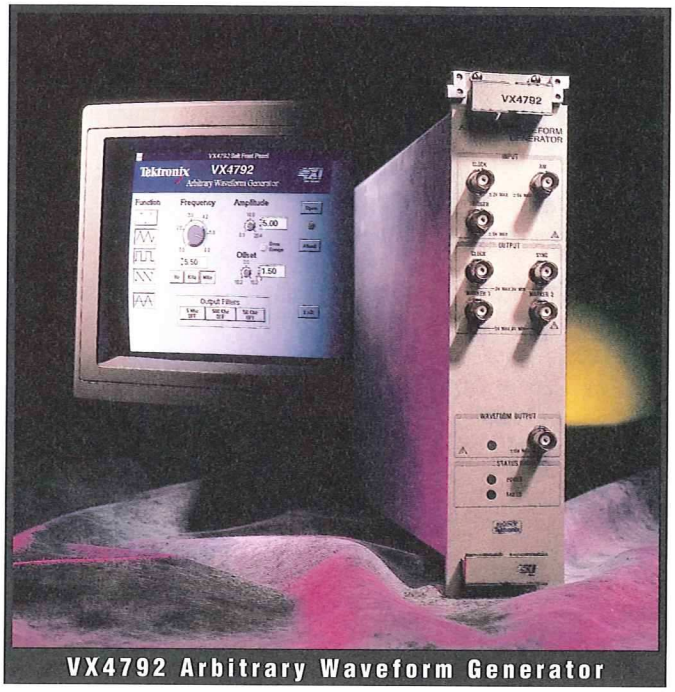
See page 386.



VX1410 VXI Mainframe

The VX4792 is yet another Tek performance leader in the VXI field. With its 1 GS/s sample rate, it leaps far ahead of conventional VXI arb performance benchmarks. Moreover, the VX4792's compatibility with Tektronix desktop arb models like the AWG2021 makes it easy to transport test code and waveforms from the design lab to the manufacturing floor.

See page 386.

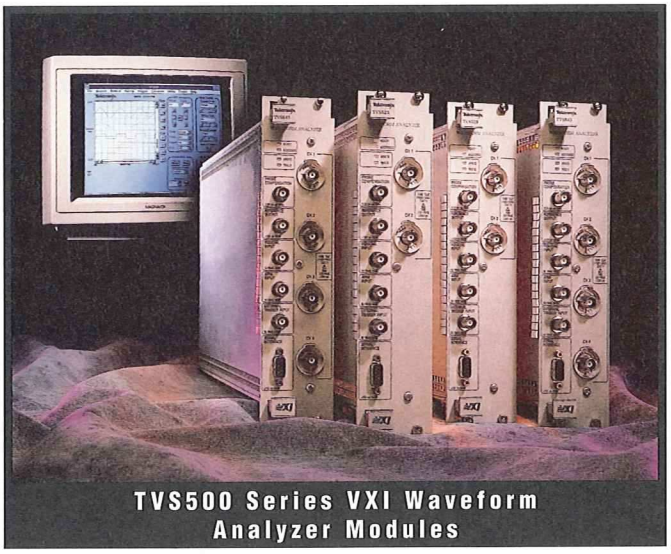


VX4792 Arbitrary Waveform Generator

VXI

The four models in the TVS500 Series bring uncompromised oscilloscope performance to the VXI realm and also bear out the full potential of VXI A host of unique productivity features makes the TVS500 Series the tool of choice for high-throughput production test. And the high sample rate and bandwidth, long record length, and advanced triggering facilities of these products suit them equally well for design verification and research.

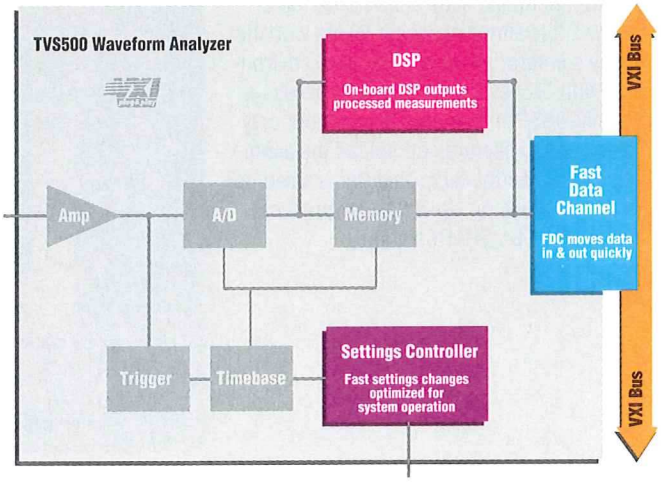
See page 126.



TVS500 Series VXI Waveform Analyzer Modules

TECHNOLOGY spotlight

Every manufacturing test system has to earn its keep. It must deliver the highest possible throughput, since high throughput means lower capital and operating costs and thus lower manufacturing cost. Until now, VXI digitizers have traded off instrument throughput in return for measurement performance, limiting total system throughput. Tektronix' new TVS500 Series VXI digitizers are powerful "scopes on a card" that take aim at the heart of this problem.



TVS500 Series Digitizers Set the Pace in Throughput

The TVS500 products are designed from the outset as production tools. They are meant to interact with a computer. Where a bench instrument is geared toward the responses of the human eye and hand, the TVS500 modules act on settings changes instantly. A new Settings Controller architecture, working in conjunction with the other optimized features in the module, improves the response speed from seconds to milliseconds.

Unique among products of their kind, TVS500 Waveform Analyzers are equipped with on-board digital signal processing (DSP) to extract measurements like risetime, voltage, etc., rather than sending volumes of uncollated data to the system controller. This key throughput-building feature cuts the number of controller interventions and reduces the amount of data that must be exchanged on the bus, saving test time.

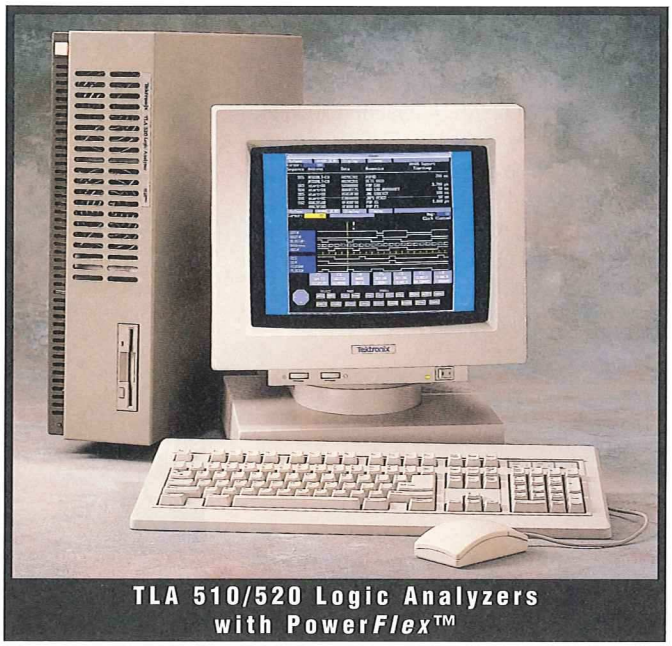
Even with the data reduction provided by on-board DSP, masses of information must be delivered to the system controller. The TVS500 modules are equipped with Tek's Fast Data Channel, a much-enhanced port for such transfers. The result? Data rates many times higher than conventional VXI bus transactions normally permit.

The Tektronix TVS500 Series products are unmatched in throughput, performance, and cost-effectiveness for the broadest possible range of production and engineering applications.

Logic Analyzers/ Telecommunications

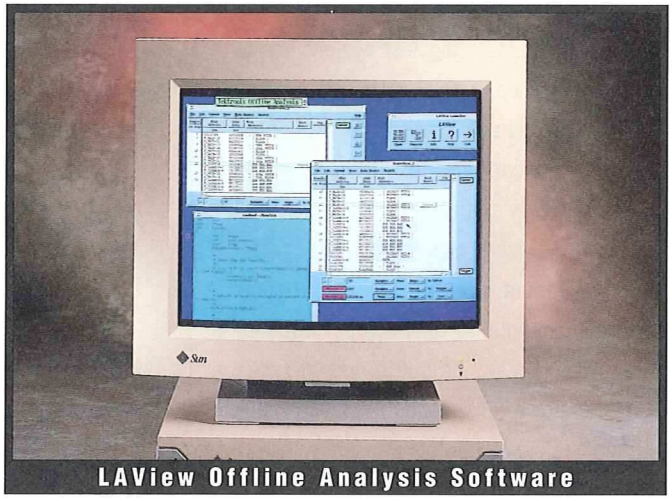
(D) The TLA 510/520 products are designed to provide a cost-effective entry into embedded system development now, and to expand with growing performance needs later. With up to 192 channels (TLA 520) and extensive high-level language support, these PowerFlex-equipped models provide an upgrade path that takes you from 8 K of acquisition memory to 512 K as your system requirements evolve. Both models can be networked and remotely controlled, making the TLA 510/520 an ideal engineering team tool.

See page 150.



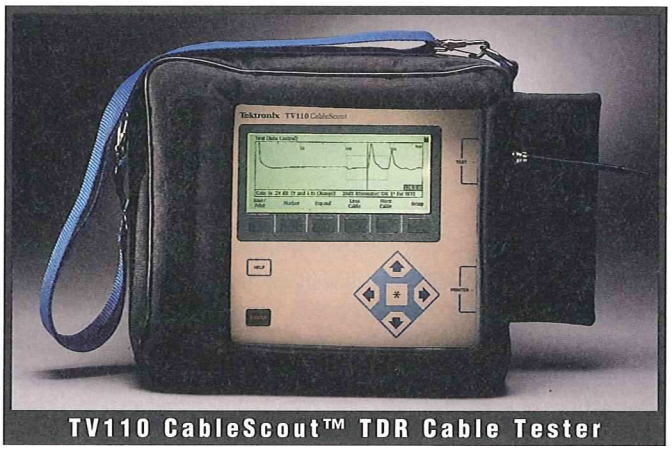
(O) LAView is the world's first full implementation of offline state analysis for logic analyzers. It is aimed at design teams working in today's enterprise-wide networked environment. With LAView, users remotely access a Tektronix DAS® or TLA over the network only long enough to capture and upload the acquisition data. Then the logic analyzer is freed up to serve other users, while LAView presents the data on a Sun SPARCstation.

See page 159.



(C) The TV110 is an optimized high-performance TDR aimed specifically at finding faults in CATV and similar coaxial cables. It's meant to make the job easy – simply select the type of cable to be tested and the TD100 does the rest. It automatically selects and adjusts pulse width, gain, and other parameters as the cable is scanned. The TV100's internal waveform memory stores standard reference waveforms and cable profiles to help you quickly identify problems the instrument has spotted.

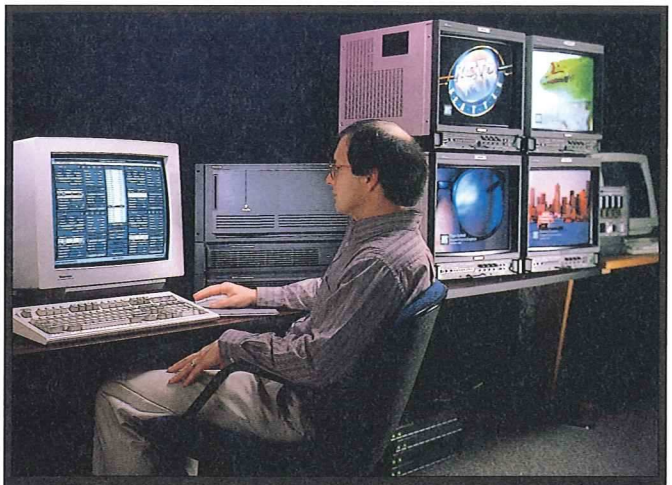
See page 336.



Television Test

Pro*file*™ is a disk-based platform for the storage and manipulation of video and audio. Its unique features include bi-directional channels, equal access across all channels, multiformat I/O, and internal combiner/mixer effects boards. With picture quality equivalent to a Sony Betacam-SP with metal tape, Pro*file*™ sets a new price/performance standard for disk recorders.

See page 556.



PDR100/101 Pro*file*™ Professional Disk Recorder

The AM700 is a fully integrated test instrument whose on-board digital and analog measurement capability, processing power, programmability, and rapid-access interface make it the most versatile product for combined analog and digital audio testing.

See page 553.



AM700 Audio Measurement Set

The RFM150 SignalScout is a high-performance RF level meter for demanding cable TV applications. While the SignalScout offers excellent performance with its basic signal level measurements, its capabilities do not end there. In-service carrier-to-noise ratio, hum, frequency spectrum, and FM deviation measurement functions are also built in. This durable and weather-resistant unit is meant to spend its life delivering accurate measurements under rugged field conditions.

See page 558.

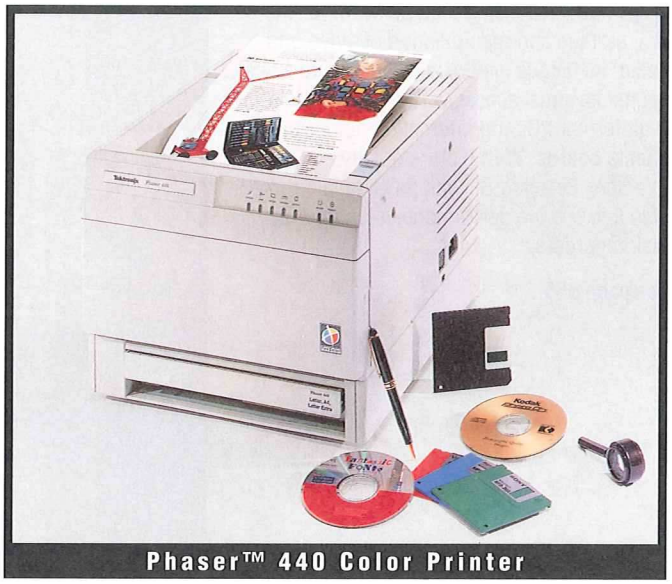


RFM150 SignalScout Signal Level Meter

Color Printers

The Phaser™ 440, a Letter Extra-size dye sublimation color printer, is optimized for engineering and scientific applications. Its continuous-tone output meets the needs of workgroups that demand photographic-quality color. The Phaser™ 440's capacity for Letter Extra-size prints allows image areas larger than 8.5 x 11 in., making it easy to produce pages with a bleed to any and all edges.

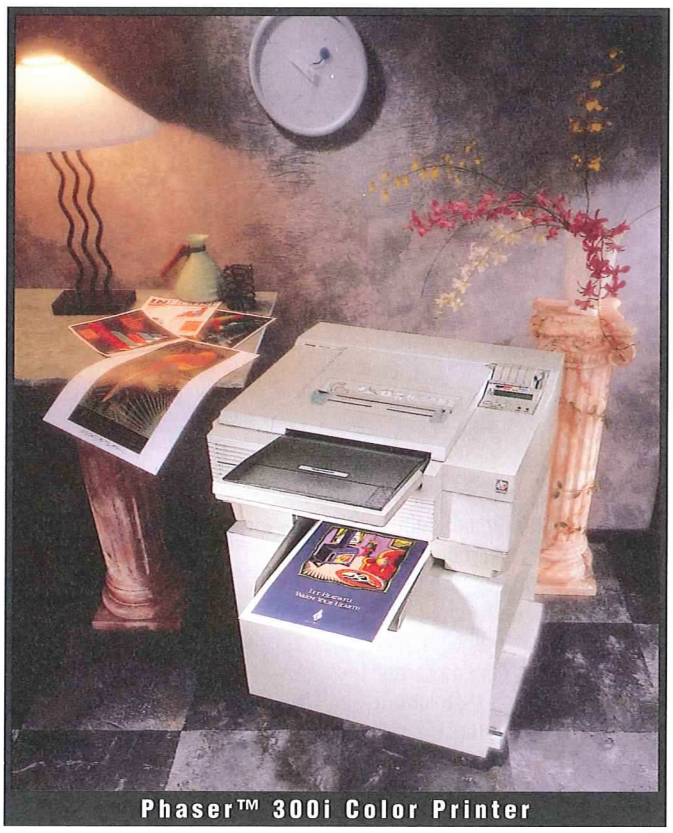
See page 564.



Phaser™ 440 Color Printer

With the recent announcement of the Phaser™ 300i, Tektronix has taken the world's most award-winning color printer and made it even better. Like its popular predecessors, the Phaser™ 300i has full-bleed tabloid capability and can print on nearly any paper from vellum to card stock.

See page 563.



Phaser™ 300i Color Printer

Oscilloscopes

From the highest performance to the most cost-effective solution, Tektronix offers a broad range of test and measurement instrumentation. Tektronix instruments provide the best connection to your device-under-test, the most accurate signal acquisitions, the sharpest waveform displays, and the most comprehensive on-board waveform measurements available.

Whether you choose analog or digital technologies, each has benefits and tradeoffs. The following pages present Tektronix' analog and digitizing oscilloscope solutions.

The oscilloscope section begins with a general reference section on Pages 34-39. Our digitizing oscilloscopes begin on page 41, providing information for the TDS Series, 11000 Series, (including plug-ins), DSA Series, 2200 Series, and 200 Series Oscilloscopes.

The analog oscilloscopes begin on page 118 with the TAS Series, followed by the 2400 Series.

It takes a broad range of oscilloscope products to satisfy the spectrum of measurement applications throughout the world today... and Tektronix delivers that product line breadth sought after by customers worldwide.

CONTENTS

REFERENCE 34

DIGITIZING OSCILLOSCOPES

TDS Series 41
11000 Series 77, 97
DSA Series 80
CSA Series 346
11000 Series Plug-ins 90, 106
200 Series 114
2200 Series 116

ANALOG OSCILLOSCOPES

TAS Series 118
2400 Series 120

LOGIC SCOPE 142

ACCESSORIES

Probes 446
SMD Adapters 474
Probe and Instrument Accessories 520
Plotter/Printer 524
Cameras 526
Instrumentation Carts 528

Oscilloscope Reference

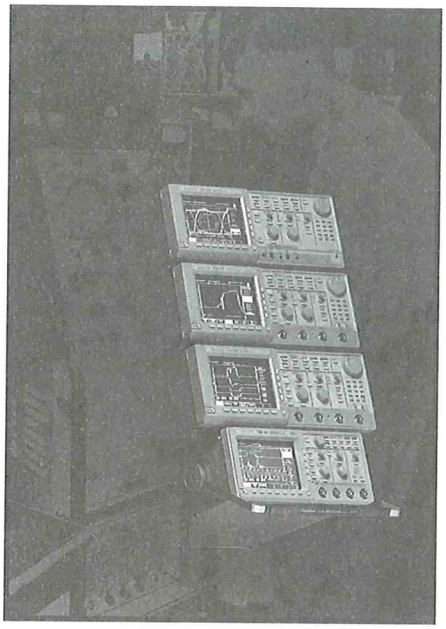
CONTENTS

DIGITAL OSCILLOSCOPES
TDS Series 41
11000 Series 77, 97
DSA Series 80
CSA Series 346
11000 Series Plug-ins 90, 106
200 Series 114
2200 Series 116

ANALOG OSCILLOSCOPES
TAS 400 Series 118
2400 Series 120

LOGIC SCOPE 142

ACCESSORIES
Probes 450
SMD Adapters 474
Probe and Instrument Accessories 520
Plotter/Printer 524
Cameras 526
Instrumentation Carts 528



Tektronix Quality and Reliability

Tektronix' oscilloscope quality and reliability are unmatched. Designs are thoroughly scrutinized and tested to ensure compliance with all applicable safety and environmental standards. Calibration is traceable to national standards and conforms to military procedures. Our service network is designed to help you keep your oscilloscope calibrated and working with fast turnaround.

Selecting an Oscilloscope

Sometimes the application dictates the oscilloscope selection. Other times it's purely a matter of personal preference or budget. In any case, we can help you make the right decision. The following decision tree will help steer you in the right direction. Refer to the following pages for detailed descriptions of the families and individual models of Tektronix oscilloscopes and digitizers. Or simply call an authorized Tektronix representative to get some expert assistance.

OSCILLOSCOPE SELECTION GUIDE

Storage/Analog	Bandwidth	Repetition Rate	Models
Storage	>500 MHz	Repetitive	11801A, 11403A, CSA 803A, CSA 404, TDS 820, TDS 784A, DSA 602A
		Nonrepetitive	SCD 5000, DSA 602A RTD 720A, TDS 784A, TDS 684A
	≤500 MHz	Repetitive	TDS 744A, TDS 520A, TDS 524A, TDS 540A TDS 460, TDS 420, TDS 410 TDS 310, TDS 320, TDS 350 2212, 222A, 222PS, 224
		Nonrepetitive	RTD 710A, TDS 744A, TDS 520A, TDS 524A, TDS 540A TDS 460, TDS 420, TDS 410 TDS 620A, TDS 640A TDS 310, TDS 320, TDS 350 2212, 222A, 222PS, 224
Non-storage	≤500 MHz	Repetitive	TAS 465, TAS 475, TAS 485 2465B
		Nonrepetitive	2467B

Oscilloscope Reference

DIGITIZING OSCILLOSCOPES AND WAVEFORM DIGITIZERS

Model	Bandwidth	Sample Rate	Vertical Resolution	Record Length	Channels	Data I/O Ports	Page
CSA 803A	3 GHz to 50 GHz	200 kS/s	8-Bits	5 K points	1 to 4	GPIB, RS-232C, Centronics	346
CSA 404	up to 3 GHz	20 MS/s	10-Bits	10 K points	1 to 12	GPIB, RS-232C, Centronics	350
11801B	DC to 50 GHz	200 kS/s	8-Bits	500 to 5 K points	1 to 136	GPIB, RS-232C, Centronics	97
DSA 600A	up to 1 GHz	1 to 2 GS/s maximum	8-Bits	20 K to 30 K points	1 to 8	GPIB, RS-232C, Centronics	80
11403A	up to 3 GHz	20 MS/s maximum	10-Bits	10 K points	1 to 8	GPIB, RS-232C, Centronics	84
TDS 800	6 to 8 GHz	n/a	14-Bits	500 to 15 K points	2	GPIB (RS-232C, Centronics opt.)	48
TDS 700A	500 Hz to 1 GHz	2 GS/s to 4 GS/s maximum	8-Bits, up to 13 Bits with Hi-Res	500 to 500 K points	4	GPIB, RS-232, Centronics	54
TDS 600A	500 MHz	5 GS/s maximum	8-Bits	2 K to 15 K points	2 to 4	GPIB, RS-232, Centronics	58
TDS 500A	500 MHz	1 GS/s maximum	8-Bits	15 K to 50 K points	2 to 4	GPIB, RS-232, Centronics	61
TDS 400	150 to 350 MHz	100 MS/s	8-Bits, up to 12-Bits with Hi-Res	15000 to 60 K points	2 to 4	GPIB, (RS-232, Centronics opt.)	64
TDS 310	50 MHz	200 MS/s	8-Bits	1 K points	2	GPIB, RS-232 Centronics	70
TDS 320	100 MHz	500 MS/s	8-Bits	1 K points	2	GPIB, RS-232 Centronics	70
TDS 350	200 MHz	1 GS/s	8-Bits	1 K points	2	GPIB, RS-232 Centronics	70
222A/222PS	10 MHz	10 MS/s	8-Bits	512 K points	2	RS-232	114
224	60 MHz	10 MS/s	8-Bits	1 K points	2	RS-232	114
RTD 710A RTD 720A	500 MHz	200 MS/s to 2 GS/s	8 to 10-Bits	128 K points to 32 M points	2	GPIB	133
SCD 5000	1 GHz to 4.5 GHz	200 GS/s	11-Bits	1 K points	2	GPIB	130

ANALOG PLUS DIGITAL OSCILLOSCOPES

Model	Bandwidth	Sample Rate	Record Length	Vertical Resolution	Channels	Computer Interfaces	Time Bases	Page
2212	60 MHz analog	20 MS/s	4 K points	8-Bits	2	GPIB & RS-232 opt.	single	116
2216	60 MHz analog	20 MS/s	16 K points	8 Bits	4	GPIB & RS-232 opt.	single	116

ANALOG OSCILLOSCOPES

Model	Bandwidth	Channels	Time Base	Basic Cursors Setup	Computer Interfaces	Page
2400B	400 MHz	2 + 2 AUX	dual	yes	GPIB opt.	120
TAS 400	100 to 200 MHz	2 or 4	dual	yes	no	118
TAS 200	20 MHz	2	single	yes	no	118

Oscilloscope Reference
Data Management

Data Management Solutions for Oscilloscopes

Digitizing oscilloscopes produce incredible amounts of data and information about waveforms. So much, in fact, that it is often hard to make the best use of it. In addition, programmable scopes open doors to a wide range of possibilities for test and procedure automation.

Tektronix offers several software solutions to these data management and control problems with software for:

- Saving and recalling waveforms and settings
- Handling graphic images of screens and waveforms for documentation
- Data logging
- Procedure generation and execution
- Data analysis and graphics
- Remote control

Here's a brief summary of the packages and the products that they support.

Product Name	Product Number	Description	Oscilloscopes Supported
Tektronix TMS/IPG	S3FT100	interactive procedure generator	TDS Series, 11400A, CSA 404, 2200 DSOs
Tektronix TMS/RTG	S3FT110	run time generator	TDS Series, 11400A, CSA 404, 2200 DSOs
Tektronix TMS GPIB/VXI Instrument Libraries	S3FT300/200	front-panel editor	TDS Series, 11400A, CSA 404, 2200 DSOs
LabWindows®/ Advanced Analysis Libraries	S3FG910/912	data acquisition, analysis, and instrument control	TDS Series, 11400A, CSA 404, 2200 DSOs, RTD 710
LabVIEW® PC Windows LabVIEW® SunSPARC	S3F6919 S3F6920	data acquisition, analysis, and graphics	TDS Series, DSA 600, 11801B, CSA 803A, 11400A, CSA 404, 2200 DSOs, 220 Family DSOs, RTD 710A RTD 720A
WaveWriter™	S3FT400	waveform capture generation and editing	TDS Series, 11400A, CSA 404, 2200 DSOs
TDS Data Manager	S34TDS1	waveform and settings storage, graphics and data management	all TDS Series
CAT 200	CAT 200	remote control for field service	222A, 222PS, 224
DocuWave™	S60DWAV	links DSO to desktop publishing and spreadsheet analysis tools	2200 Series TDS 300/400/500A/ 600A/700A/800 Series CSA, DSA and 1100 Series

Oscilloscope Reference

Tektronix Oscilloscopes and Communication Signal Analyzers

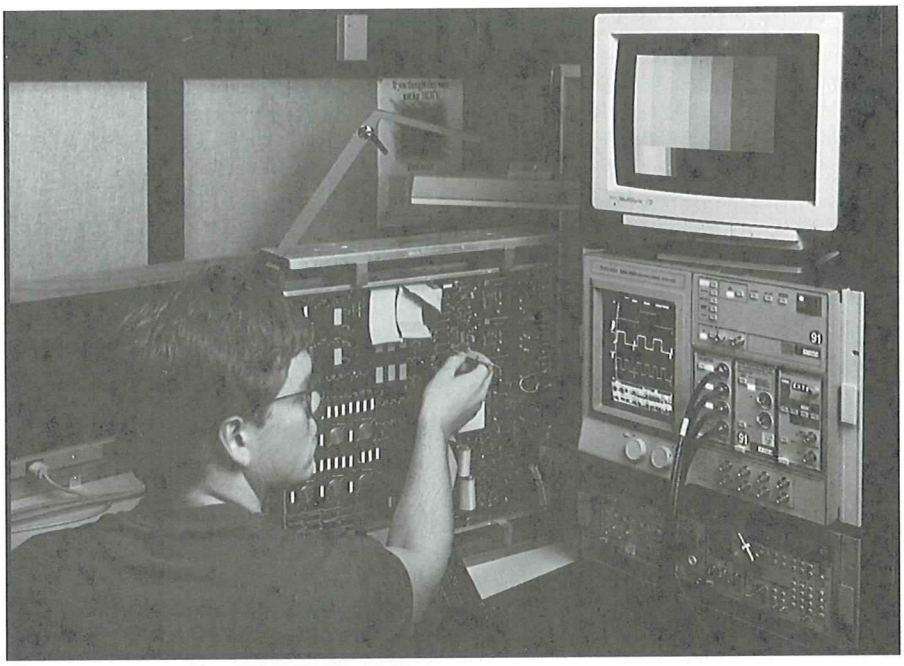
These products include many innovative features designed to help our customers improve their productivity and reduce operating costs. The TDS Series of digitizing oscilloscopes and the TAS Series of analog oscilloscopes represent the best combination of performance features, human factors and price on the market today. There are other vital technologies only available from Tektronix such as:

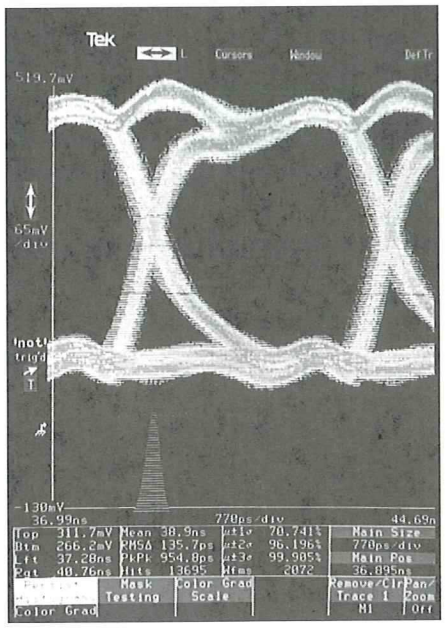
- DC to 60 MHz Current Measurements
- Affordable Digital Signal Processing
- BrightEye® Microchannel Plate CRTs to clearly show infrequent events
- Color-graded displays which give a statistical look at jitter and noise
- Low cost analog oscilloscopes for the service technician and home hobbyist
- Combination analog and digital storage technologies for flexibility in a single instrument
- Digitizing oscilloscopes with extraordinary power to capture fast transient signals, process them on the fly and measure their parameters
- The TDS 600A/700A helps digital designers quickly zero in on complex logic problems in highspeed digital systems
- The CSA communication channel analyzers that can give an accurate assessment of noise, jitter and compliance to CCITT and ANSI Standards. Up to 50 GHz bandwidth with 2.0 ps RMS jitter (1.3 ps typically) is available in the CSA 803A
- High-performance analog scopes like the 2467B BrightEye® with a Microchannel plate CRT to brightly display single shot or low repetition rate signals up to 400 MHz
- The High Bandwidth (50 GHz) 11801B offers the highest timing resolution and measurement repeatability. While the TDS 800 combines the sequential equivalent-time sampling technology of the 11801B with the mid-range TDS platform for DC-8 GHz Bandwidth in a portable monolithic instrument

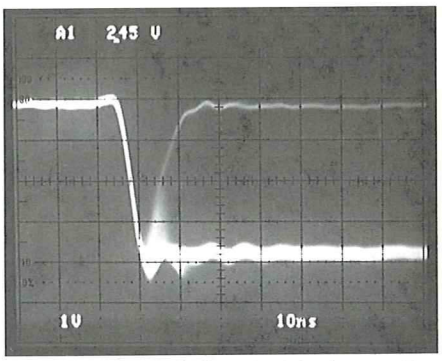
For complete information on all Tektronix oscilloscope accessories, please see page 446.

General Trends in Oscilloscope Development

Today you will find more and more special purpose oscilloscopes. Examples include the 222 PowerScout, a handheld digitizing scope with isolated inputs for safe and accurate troubleshooting of AC power distribution systems, and the CSA 803A and 11801B with bandwidth to 50 GHz and color graded display for thorough analysis of highspeed communication channels and standards testing.







The Microchannel plate CRT in the 2467B BrightEye® displays low repetition rate. events and helps uncover elusive problems in digital circuits.

Scopes are smarter today. Our new low-cost TAS analog scopes have autoset for one-button signal capture and cursors to measure time and amplitude.

Our TDS Series scopes and the DSA 600 include powerful digital signal processing engines which can give you simultaneous time and frequency domain displays with fast updates.

Our scopes are getting easier to use. We've reversed the trend toward more buttons and menus. Our new TDS and TAS models achieve a balance between performance and ease of use. We've done our homework, tested our ideas and greatly improved access to important new features without making the basic functions hard to find. Volts/division, time/division and trigger level have dedicated knobs so you can just grab and turn.

Measurement, trigger modes, hard copy setups and acquisition control lie within easy reach behind a graphic user interface (GUI). Information packed displays are made easy to read with a high-resolution color monitor. Documentation of waveforms is simplified by direct storage of screens (in common file formats) to floppy disk for cut and paste into word processing software.

Oscilloscope Reference
Selection Guide

New Models for 1995

The new TDS 700A provides the same high-performance acquisition, flexible triggering, powerful processing, and easy-to-learn graphical user interface and has added several exciting new capabilities.

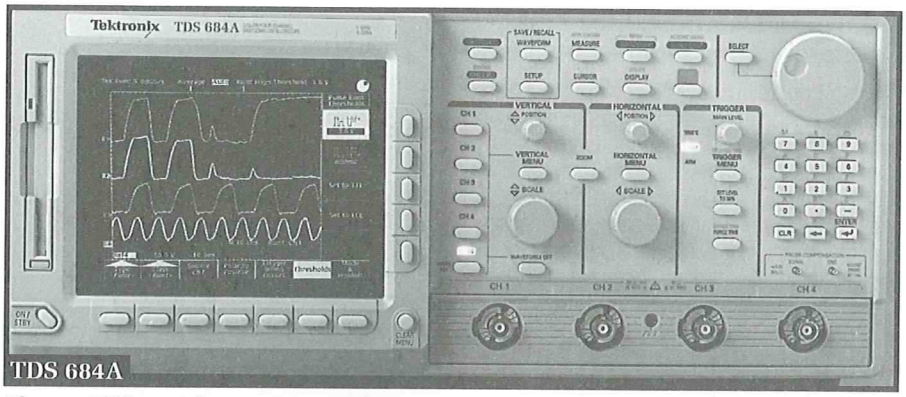
The TDS 524A, 644A, 684A, 744A, and 784A are full-feature models with a color display, floppy disk drive, and several new capabilities such as HDTV video trigger and segmented memory. You can even make color hardcopies with the optional Tektronix Phaser™ 200e color printer, or cut and paste screen images directly into word processing documents. The TDS 520A, 540A, 620A, and 640A are monochrome versions offering the same features at an even lower price.

The TAS Series user interface simplifies scope operation. Both the TAS 400 Series and TAS 200 Series front panels are similar in operation and the important, frequently used functions are controlled directly with knobs or buttons. On the TAS 400 Series a menu provides access to secondary functions.

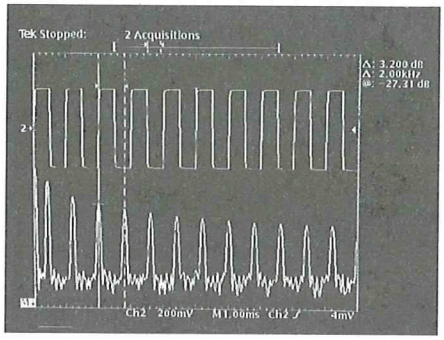
Both the TAS 200 Series and TAS 400 Series provide measurement cursors and readouts to improve user productivity. Refer to the key specification selection chart and choose the analog scope best suited for your performance needs. And buy with confidence that these products are backed by the leader in oscilloscope technology, Tektronix.



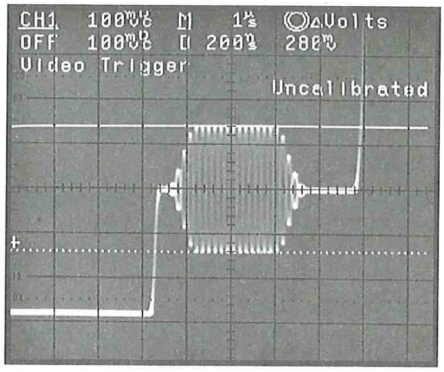
The 220 family of handheld DSOs helps make measurements in difficult environments safely and accurately.



The new TDS 684A features powerful logic triggering and 5 GS/s sampling on all four channels at once. A color monitor and graphic user interface helps make it a powerfully simple digital design tool.

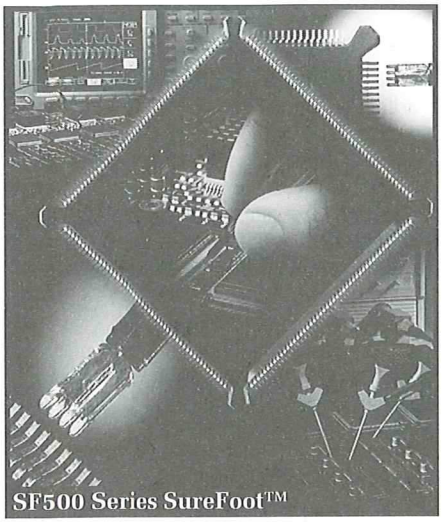


Tektronix' exclusive TriStar™ DSP engine brings simultaneous time and frequency domain analysis to mid-range scopes in the TDS 400, TDS 500A, TDS 600A, TDS 700A and TDS 800 products.



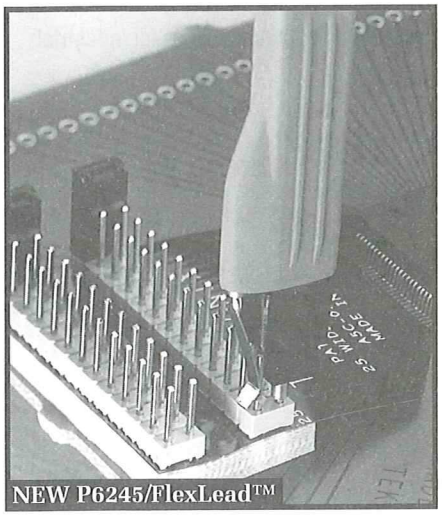
The TAS 400A Series of analog scopes provides powerful features such as cursor measurements and auto-setup in an easy to operate and low-cost package.

Oscilloscope Reference
Accessories


SF500 Series SureFoot™

New Probes and Accessories

Tektronix continues to dedicate research and development resources to helping customers find ways to connect instrumentation to the changing variety of today's new devices and packages. You will find some innovative new probes and connecting schemes that quickly and cleanly couple to all kinds of devices.


NEW P6245/FlexLead™

Active FET Probe for Small Geometries

The new P6245 is a low capacitance/low mass probe that allows the digital designer an "off-the-shelf" direct access solution for probing surface mount packages. The P6245 SMD Active FET Probe is designed for Tektronix Oscilloscopes forming a measurement system optimized for low circuit loading, fast transient response and maximum bandwidth.

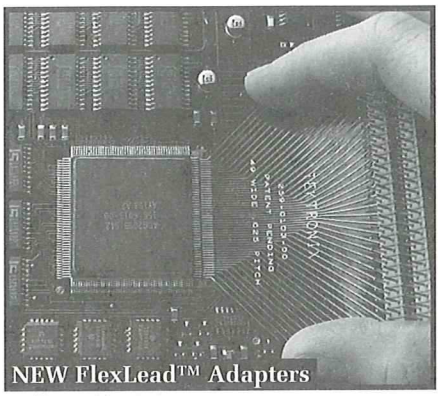
See page 458.

FlexLead™ Adapters

THE PJ(JEDEC) AND PE(EIAJ SERIES)

Nineteen (19) new FlexLead Adapters have been added to provide quicker and convenient access to those frequently probed fine pitched QFD packages. FlexLead provides a standard 100 mil interface (signal-ground pairs) allowing easy access for instrumentation probes and logic analyzer podlets.

See page 476.

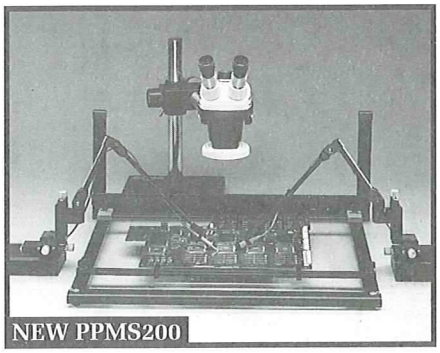

NEW FlexLead™ Adapters

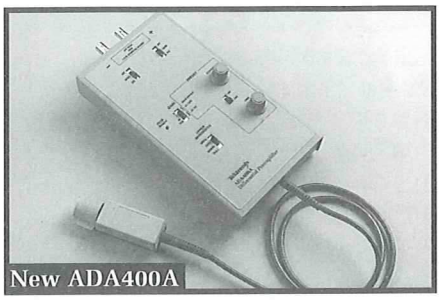
Hands-Free Probing

PROBING STATIONS AND ARTICULATED ARMS

Today's high speed densely populated circuitry requires assisted probing capability. The new PPMS series Probing Stations and Articulated Arms allows the designer to position microwave and traditional hand-held probes onto the small lead geometries of fine-pitch interconnects, SMD packages, MCM's (multi-chip-modules), hybrids and IC's. The PPMS family includes a High Resolution Probing Station, a Fine Pitch General Purpose Probing System, 1 Axis and 3 Axis Articulated Arms for use with microwave or traditional hand-held probes, and a Stereo Zoom Microscope when vision assisted probing is required.

See page 480.


NEW PPMS200

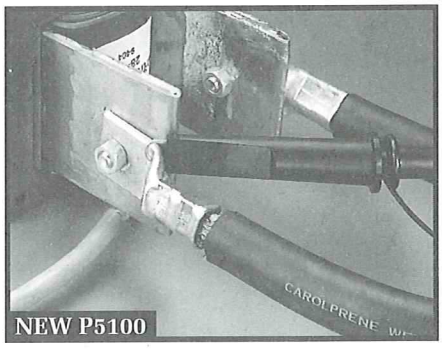

New ADA400A


NEW P5200

Differential Signal Acquisition

Three new products are available for acquiring differential signals. The ADA400A 1 MHz differential preamplifier allows single-ended oscilloscope measurements of very low signal levels (<10 uV) that are not ground referenced. The P5200 differential probe measures differential voltages up to 1,300 V. With a bandwidth of 25 MHz the P5200 probe easily measures those fast dV/dt transitions in switching power devices. The P5135 High Voltage Probe Pair provides up to 20,000:1 CMRR for voltage levels of 2.5 kV. This 100X passive probe pair is matched to the 11A33 and 7A13 differential amplifier/comparator plug-ins.

See pages 501 thru 503.


NEW P5100

Safely & Quickly Measure 2.5 kV

The new P5100 High Voltage Probe allows measurements of up to 2,500 VDC + PK AC. Screw on accessories allow quick connection to most devices under test. The P5100 provides a bandwidth of DC to 250 MHz.

See page 496.

Digitizing Oscilloscopes
TDS, 11000, DSA, CSA, 2200, 200 Series

CONTENTS

TDS SERIES OSCILLOSCOPES
General Information 41
TDS 820 8 GHz 48
TDS 784A 1 GHz 54
TDS 744A 500 MHz 54
TDS 684A 1 GHz 58
TDS 644A 500 MHz 58
TDS 640A 500 MHz 58
TDS 620A 500 MHz 58
TDS 540A 500 MHz 61
TDS 524A 500 MHz 61
TDS 520A 500 MHz 61
TDS 460 350 MHz 64
TDS 420 150 MHz 64
TDS 410 150 MHz 64
TDS 350 200 MHz 70
TDS 320 100 MHz 70
TDS 310 50 MHz 70
DocuWave™ 73

1100 SERIES OSCILLOSCOPES/PLUG-INS
11403A 3 GHz Color 84
11000/DSA Series Plug-in Amplifiers 90
11801B 50 GHz Digital Sampling 97
IPA 310 Interconnect Parameter Analyzer 102
Sampling Heads 106

DSA SERIES DIGITIZING SIGNAL ANALYZERS
DSA 602A 1 GHz 80

CSA SERIES COMMUNICATIONS SIGNAL ANALYZERS
CSA 404 3 GHz Color 350
CSA 803A Up to 50 GHz Color 346
CSA 907A Bit Error Rate Tester 364

2200 SERIES DIGITAL STORAGE + ANALOG REAL TIME
2212 60 MHz 116
2216 60 MHz 116

200 SERIES HANDHELD DIGITAL STORAGE
222A 10 MHz 114
222PS 10 MHz 114
224 60 MHz 114

ACCESSORIES 446

TDS Series
An innovative series of oscilloscopes built upon Tektronix' digitizing oscilloscope platform, featuring multi-processor speed and flexibility, advanced acquisition and triggering capabilities and a unique graphical user interface for intuitive operation.

11000 Series
The Tektronix 11000 Series is a powerful set of analysis tools that alters your fundamental expectations of an oscilloscope. Accuracy, sensitivity, bandwidth, offset, and overdrive recovery are provided by a well-planned instrument family having plug-in versatility and performance.

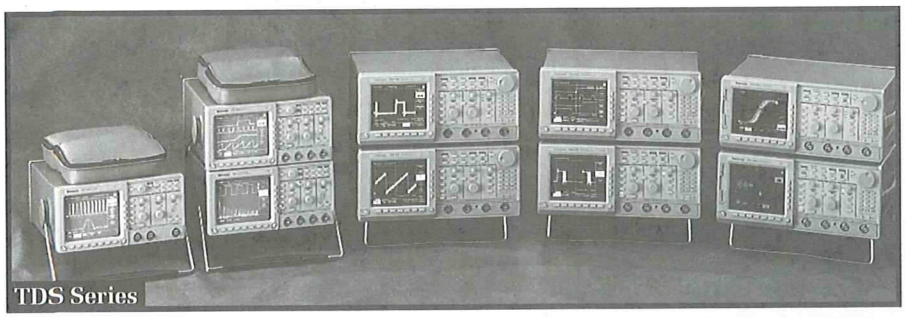
DSA Series
The Digitizing Signal Analyzer (DSA) Series incorporates a dedicated digital signal processor (DSP). The DSA Series provides the fastest and most accurate real-time digitizer plus provides signal processing capability previously found only in large computer systems.

CSA Series
The Communications Signal Analyzer (CSA) Series offers signal analysis and the powerful measurement capabilities required to analyze high-speed digital communication signals. Features include histograms, mask testing, and a color-graded display. The CSA Series allows you to perform accurate measurements such as jitter, noise, phase and extinction ratio.

2200 Series
The 2200 Series offers digital storage and analog familiarity plus documentation at an affordable price.

200 Series
The compact size and battery operation make the 200 Series optimum scopes for industrial maintenance and field service.

Digitizing Oscilloscopes


TDS Series

TDS Series

An innovative series of oscilloscopes built upon Tektronix' digitizing oscilloscope platform, featuring multi-processor speed and flexibility, advanced acquisition and triggering capabilities and a unique graphical user interface for intuitive operation.

With the TDS Series, Tektronix introduced a new and innovative generation of digitizing oscilloscopes designed to keep pace with current and evolving needs across the electronics industry. TDS combines the performance needed with the ease of use demanded by customers in digital design; research and development; electromechanical design; power supply design, biophysical/biomedical, high-speed component development and characterization; and telecommunications design and automated test.

The TDS Series offers significant advantages over other oscilloscopes in four major areas:

HIGH-FIDELITY SIGNAL ACQUISITION

TDS offers sample rates ranging from 100 MS/s to 5 GS/s and bandwidths from 50 MHz to 8 GHz. TDS couples this performance with wide dynamic range, vertical resolution up to 13-bits, fast overdrive recovery and 1 mV/div sensitivity. You'll find a model that precisely fits your needs.

POWERFUL AND FLEXIBLE TRIGGERING

TDS 500A, 600A and 700A models feature very innovative and accessible logic triggering features that can isolate glitches, runts and timing problems quickly and reliably. Video triggering for NTSC, PAL, SECAM and custom video standards makes the TDS 400 an excellent choice for video and display system design. Specialized HDTV triggering is available on the TDS 500A, TDS 600A and TDS 700A. 2 GHz trigger bandwidth in the TDS 800 and very low jitter make it ideal for high-speed component characterization and for telecommunications manufacturing, installation and maintenance.

MULTIPROCESSOR ARCHITECTURE

Our TriStar™ Digital Signal Processor complements a multi-processor design in all TDS Scopes to permit more measurement flexibility, instant response to commands and live waveform math including FFT and waveform pass/fail testing in the TDS 400, 500A, 600A, 700A and 800. Displays may be sent directly to a printer or plotter or exported as EPS (Encapsulated PostScript) or PCX (Microsoft Windows) files for use with common graphics and word processing software.

AFFORDABLE PERFORMANCE THAT IS EASY TO USE

A graphical user interface (GUI) makes operation intuitive. A familiar front-panel layout puts dedicated knobs for vertical, horizontal and trigger controls right where you expect to see them. This layout makes it easy for casual users to operate the basic oscilloscope features. Explanatory icons, pop-up menus, on-line help and the VGA-quality display quickly guide users to even the most powerful measurement features. A color VGA display is available with the TDS 500A, 600A, and 700A.

TDS SERIES

- 50 MHz to 8 GHz Bandwidth
- 100 MS/s to 5 GS/s Sample Rates
- 2 and 4 Input Channels
- Advanced Logic Pattern and State Triggering
- Runt and Glitch Triggering
- HDTV Video Triggering
- Infinite and Variable Persistence Displays
- High-resolution Color Display
- Record Lengths to 500,000 Points
- 8 to 13-bit Vertical Resolution
- Tektronix TriStar™ DSP for Fast Waveform Processing and Live Measurement Updates
- DSP Math Including FFT, Integration, and Differentiation
- Automatic Measurements
- Pass/Fail Testing
- Easy Documentation with Saving of Image Files to Floppy Disk or Hardcopies Directly to Printer
- Full GPIB Programmability

The breakthrough TDS architecture lends itself to an almost limitless range of price and performance variations.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The TDS Series complies with IEEE Standard 488.2-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

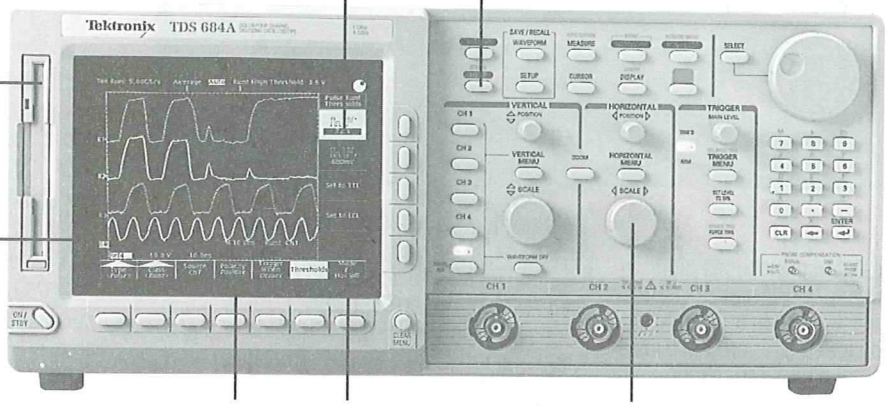
Tektronix Measurement products are manufactured in ISO registered facilities.

APPLICATIONS

- **Component Development and Characterization**
- **Research and Development**
- **Electromechanical Design**
- **Telecom Service and Manufacturing**
- **Biophysical, Biomedical Research**
- **Power Supply Design**

TDS SERIES

Digitizing Oscilloscopes

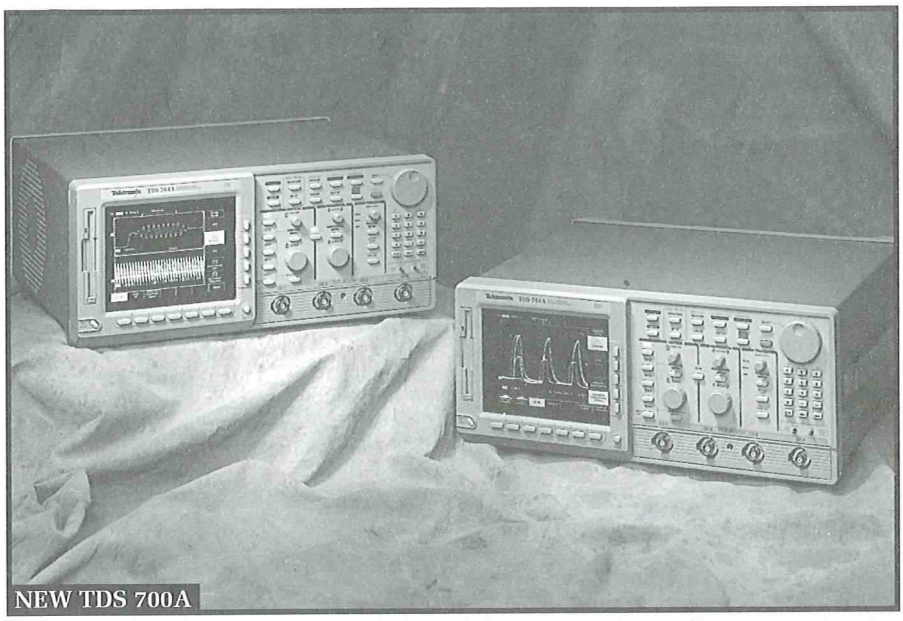


NEW TDS 684A

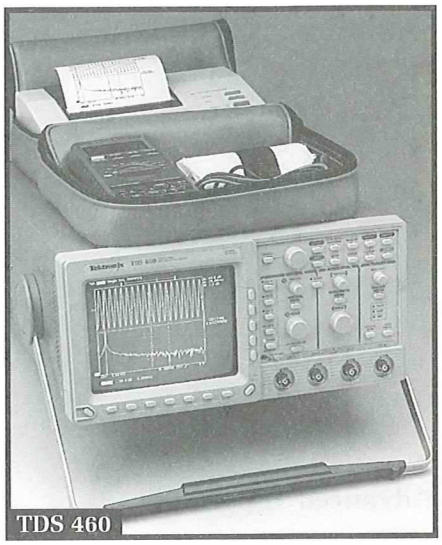
TDS SELECTION GUIDE

	TDS 310	TDS 320	TDS 350	TDS 410	TDS 420	TDS 460
Signal Acquisition System						
Bandwidth	50 MHz	100 MHz	200 MHz	150 MHz	150 MHz	350 MHz
No. of Channels	2	2	2	2	4	4
Vertical Resolution	8-bits			8-bits; ≥12-bits with Hi-Res; 11-bits with averaging		
Vertical Sensitivity	2 mV – 10 V/div			1 mV – 10 V/div		
Accuracy	±2%			±1.5%		
Sample Rate	200 MS/s on all channels	500 MS/s on all channels	1 GS/s on all channels	100 MS/s on all channels		
Record Length Per Channel	1000 pts.			15,000 pts. (60 K Opt.)		
Peak Detection	10 ns			10 ns		
New InstaVu™ Acquisition Mode	N/A			N/A		
Signal Processing Functions						
Common	Add, Subtract, Average, Envelope			Add, Average, Envelope, Interpolation (Sin x/x & linear), Multiply, Subtract (FFT, Int., Diff. Optional)		
Unique	–			Hi-Res	Hi-Res	Hi-Res
Triggering						
Trigger Conditioning	HF, LF & Noise Reject			HF, LF & Noise Reject		
Trigger Types: Common	Edge, Auto, NTSC, PAL, SECAM video			Edge, Auto, Init 50%; Opt. NTSC, PAL, SECAM video		
Trigger Types: Unique	–			–		
User Interface						
Monitor	Monochrome			Monochrome		
Disk Drive	N/A			N/A		
Desktop Publishing	TIFF, PCX, BMP, EPS, Interleaf			TIFF, PCX, BMP, EPS, Interleaf		
Page	**70**	**70**	**70**	**64**	**64**	**64**

Digitizing Oscilloscopes



The new TDS 700A oscilloscopes.



Shown with printer pack and advanced waveform options.

TDS SELECTION GUIDE

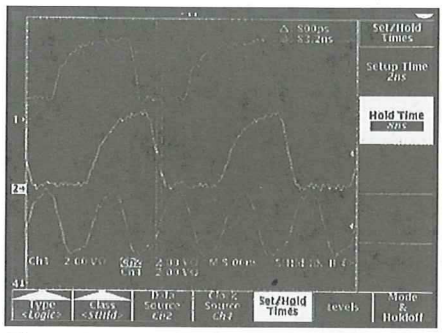
	TDS 520A/ TDS 524A	TDS 540A	TDS 620A	TDS 640A/ TDS 644A	New TDS 684A	New TDS 744A	New TDS 784A	TDS 820
Signal Acquisition System								
Bandwidth	500 MHz		500 MHz	500 MHz	1 GHz	500 MHz	1 GHz	6 – 8 GHz
No. of Channels	2	4	2	4	4	4	4	2
Vertical Resolution	8-bits; ≥12-bits w/Hi-Res; 11-bits w/averaging			8-bits; ≥11-bits w/averaging		8-bits; ≥13-bits w/Hi-Res; 11-bits w/averaging		14-bits
Vertical Sensitivity	1 mV – 10 V/div			1 mV – 10 V/div		1 mV – 10 V		2 mV – 200 mV/div
Accuracy	±1%			±1.5%		±1%		±0.7%
Sample Rate	500 MS/s (1-CH); 250 MS/s (2-CH)	1 GS/s (1-CH); 500 MS/s (2-CH); 250 MS/s (4-CH)	2 GS/s on all channels	2 GS/s on all channels	5 GS/s on all channels	2 GS/s (1-CH); 1 GS/s (2-CH); 500 MS/s (4-CH)	4 GS/s (1-CH); 2 GS/s (2-CH); 1 GS/s (4-CH)	N/A
Record Length Per Channel	15 K pts.	50 K pts.	2000 pts.	2000 pts.	15 K pts.	500-50 K pts. (500 K/1-CH, 250 K/2-CH, 130 K/4-CH Opt.)		15 K pts.
Peak Detection	4 ns			N/A		1 ns		N/A
New InstaVu™ Acquisition Mode	N/A			N/A		Standard		N/A
Signal Processing Functions								
Common	Add, Average, Envelope Interpolation (Sin x/x & linear), Multiply, Subtract, (FFT, Int., Diff.)							
Unique	Hi-Res	Hi-Res	–	–	–	Hi-Res	Hi-Res	–
Triggering								
Trigger Conditioning	HF, LF & Noise Reject			HF, LF & Noise Reject		HF, LF & Noise Reject		–
Trigger Types: Common	Edge, Auto, Init 50%; 4 Input Pattern, State; Glitch and Width; Runt; Opt. HDTV, NTSC, PAL, SECAM video							Edge, Auto, Init 50%
Trigger Types: Unique	–	–	–	–	Setup/hold, slew rate	Setup/hold, slew rate		–
User Interface								
Monitor	Monochrome/ color	Monochrome	Monochrome	Monochrome/ color	Color	Color		Monochrome
Disk Drive	Standard with color			Standard with color		Yes		–
Desktop Publishing	TIFF, PCX, BMP, EPS, Interleaf			TIFF, PCX, BMP, EPS, Interleaf		TIFF, PCX, BMP, EPS, Interleaf		TIFF, PCX, BMP, EPS, Interleaf
Page	**61**	**61**	**58**	**58**	**58**	**54**	**54**	**48**

TDS SERIES

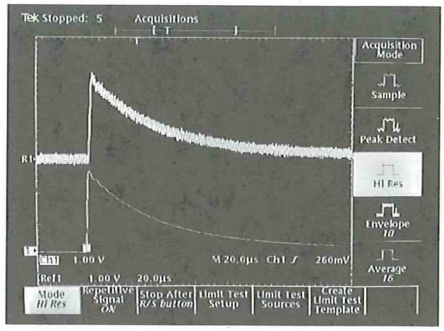
Digitizing Oscilloscopes

Powerful Acquisition

- Four Channels of 5 GS/s (TDS 684A)
- Record Lengths of 500,000 Points (TDS 700A Opt. 1M)
- Up to 8 GHz Bandwidth (TDS 820 Opt. 1D)



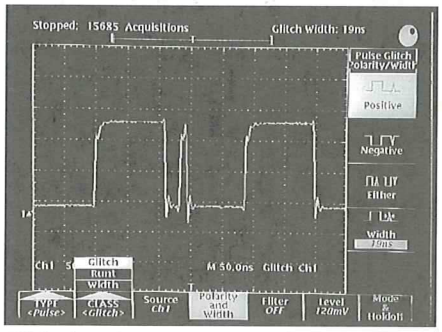
The TDS 684A provides four channels of 5 GS/s acquisition to capture events with high single-shot resolution.



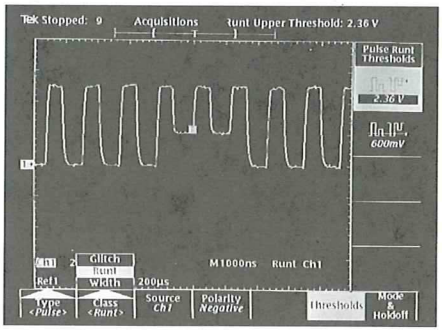
Hi-Res acquisition mode achieves extremely high signal to noise ratios (SNR) on single-shot events by oversampling the input signal (all TDS 400, TDS 500A, and TDS 700A models).

Advanced Triggering

- Glitch Triggering (TDS 500A/TDS 600A/TDS 700A)
- Exclusive Runt Triggering (TDS 500A/TDS 600A/TDS 700A)
- HDTV Video Triggering (TDS 500A/TDS 600A/TDS 700A)
- Setup and Hold Time Violation Triggering (TDS 684A/TDS 700A)
- Slew Rate Triggering (TDS 684A/TDS 700A)



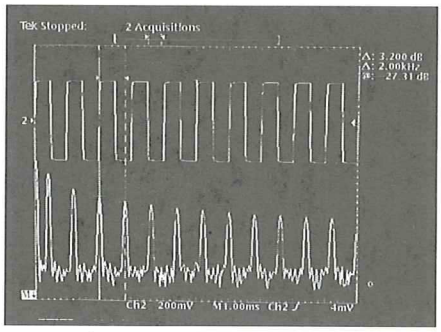
TDS triggering can capture glitches as narrow as 1 ns to help solve prototype circuit problems quickly (TDS 684A and TDS 700A models).



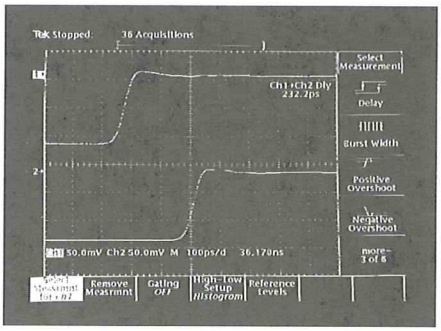
TDS exclusive runt triggering helps isolate invalid logic levels such as those caused by setup and hold violations (all TDS 500A, TDS 600A and TDS 700A models).

Powerful Processing

- FFT Analysis
- Manufacturing Pass/Fail Testing
- On-board Mask Drawing (TDS 820)



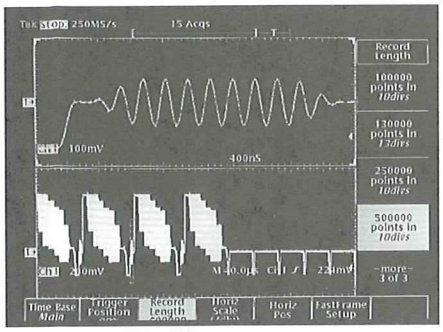
FFT analysis provides an extra dimension of performance with simultaneous displays in the time and frequency domains (optional on TDS 400, monochrome TDS 500A/600A and the TDS 820, standard on color TDS 500A/600A/700A).



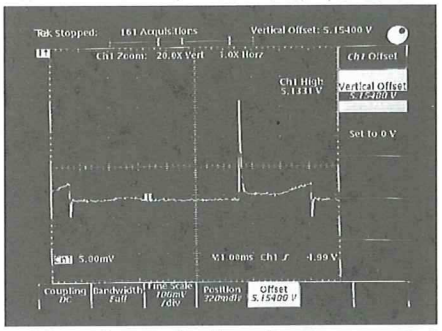
The TDS 820 provides 0.4 ps timing resolution and channel deskew capability to accurately measure delays in today's high-speed digital systems.

Digitizing Oscilloscopes

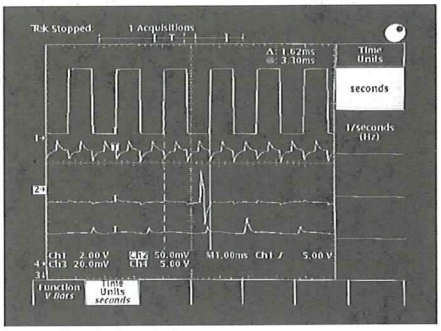
Powerful Acquisition



Record lengths of up to 500,000 points (TDS 700A Opt. 1M) enable very high timing resolution on even the most complex waveforms. Or capture unexpected events that happen well before or long after the trigger event (60 K points on TDS 400 Opt. 1M).

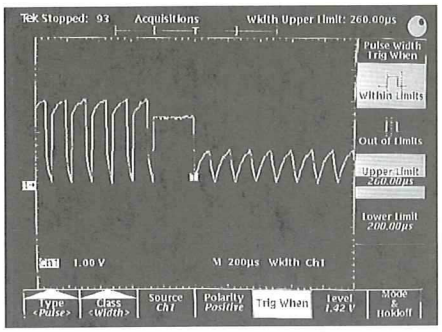


Calibrated vertical offset allows capture and analysis of small signals riding on top of large DC offsets (all TDS 400, TDS 500A, TDS 600A and TDS 700A models).

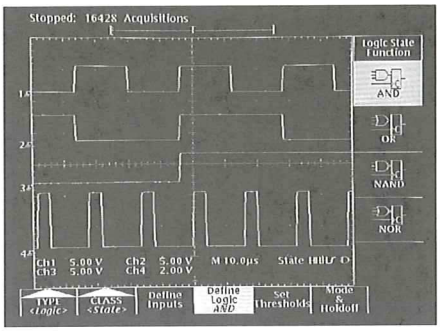


Four channels help show a time-correlated display of both digital control and analog feedback signals (TDS 420, TDS 460, TDS 540A, TDS 640A/644A and TDS 700A).

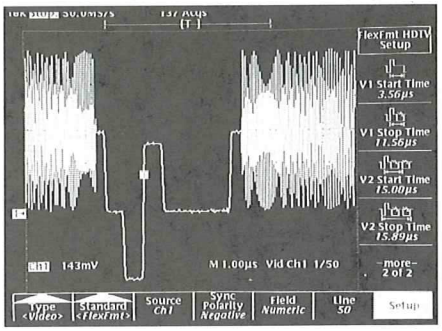
Advanced Triggering



Pulse width triggering can single out faults caused by pulses which are either too narrow or too wide (all TDS 500A, TDS 600A and TDS 700A models).

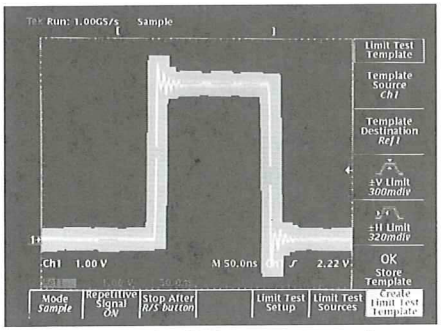


Logic timing analysis is clearly faster and easier with icon-driven state triggering (all TDS 500A, TDS 600A and TDS 700A models).

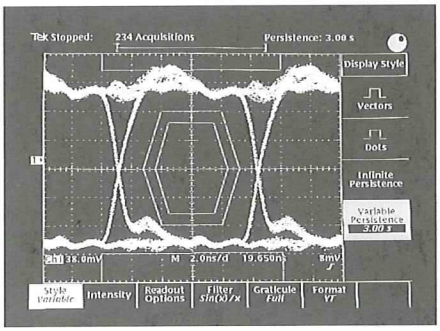


An optional video trigger features line and field selection on standard and user definable HDTV formats (TDS 500A, TDS 600A and TDS 700A models).

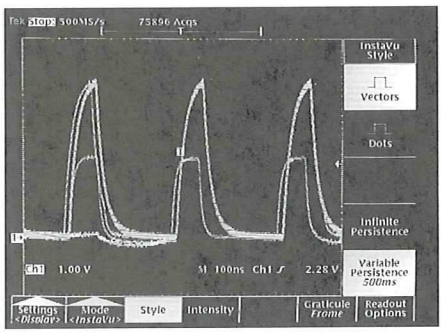
Powerful Processing



Automatic on-the-fly limit testing makes manufacturing pass/fail testing an easy task (all TDS 400, TDS 500A, 600A, 700A and 800 models).



On-board mask drawing capability allows visual comparison of signals to standard masks in communication systems (TDS 820).



The new InstaVu™ acquisition mode adds a third dimension to your waveforms. InstaVu™ has the fastest waveform capture rate – over 400,000 waveforms per second, and it provides a color-graded historical view of waveform changes in 16 levels of color (TDS 700A).

Continued on next page.

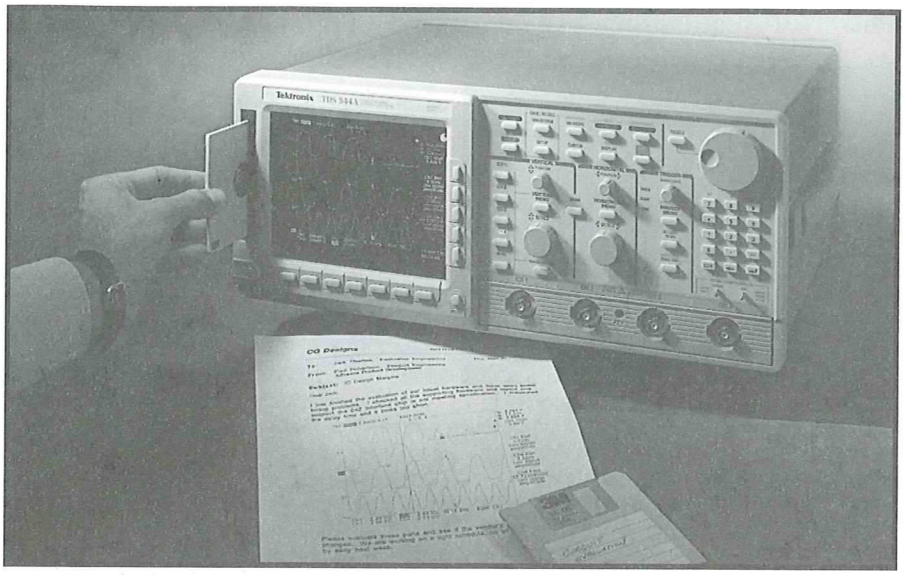
TDS SERIES

Digitizing Oscilloscopes
Documentation

TDS makes documentation easy.

TDS SERIES

- Hardcopies Directly to Common Printers Including Tektronix Color Printers
- Save Screen Shots in Common Desktop Publishing Formats for Importing Into Documents
- View Waveforms on Large VGA Displays and Overhead Projectors
- Use Raw Data for Additional Analysis



Print directly to a Postscript color printer, such as the Tektronix Phaser™ 200e, or use the DOS format floppy drive to cut and paste screen shots into word processing documents.

TDS Documentation

TDS scopes provide extensive capabilities which make documentation and presentation of data faster and simpler than ever. You have the choice of making hardcopies of the display directly to a printer, saving them to floppy disk in standard file formats for cut and paste into reports, or transferring the raw data to a PC for analysis. The TDS also allows you to connect directly to a large VGA monitor or overhead projection system for viewing of live waveforms. Moreover, these documentation/presentation capabilities do not require extensive setup and are as easy to use as pushing a button.

IMPORTING SCREEN SHOTS INTO REPORTS

What you see on the TDS display can be imported directly into word processing application software such as Microsoft Word or WordPerfect. TDS with an internal floppy drive can save the display in common file formats to a DOS format 3.5 in. floppy disk which can be used to transfer these files to a PC and then import them into documentation. File formats include PCX (Paintbrush), BMP (Windows), TIFF, EPS, and Interleaf. Color TDS can even save their displays as color images to match what you see on the scope. TDS without an internal floppy drive can transfer image files to a PC via GPIB or by saving to an external controller's floppy drive.

DIRECT PRINTER ACCESS

Hardcopies of TDS displays can also be made by hooking up a printer directly to the scope's GPIB, RS-232, or Centronics ports. Then it's as simple as pressing the hardcopy button. A buffer in the TDS allows you to print several screens without tying up the scope while waiting for the printer to finish. The TDS supports most popular printers, and the color TDS can even print to a Tektronix color printer.

GROUP PRESENTATIONS

TDS scopes can make presentation of your data fast and simple. Data can be presented in overhead transparencies and printed in color on the Phaser™ 200e with the color TDS. For presentation of live waveforms, the TDS 400/500A/600A/700A allow viewing on large monitors or even on LCD overhead projection systems. Simply connect a VGA monitor directly to the TDS VGA-output port. What you see on the scope screen will also be seen on the external display, even in color! This can be extremely valuable for educational applications.

ANALYSIS OF RAW DATA

For applications that require raw acquisition data for manipulation by specialized software, the TDS 400/500A/600A/700A provide the capability to import this data into your PC. Waveforms are saved to floppy disk as reference waveforms, and a utility program called CNVRTWFM converts the reference waveform into ASCII, Spreadsheet, 8-bit binary, or 16-bit binary data formats. TDS 400 and TDS 800 data can be saved to an external controller's floppy drive or transmitted via GPIB directly to a PC for conversion by CNVRTWFM. TDS 700A data can be saved in MathCAD or spreadsheet formats directly to disk.

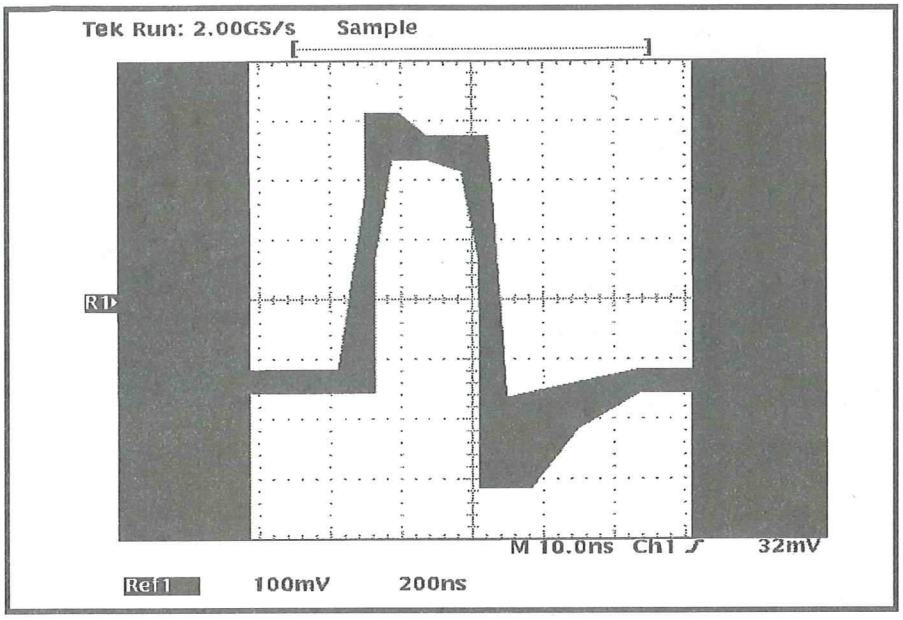
Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The TDS Series complies with IEEE Standard 488.2-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Digitizing Oscilloscopes
TTiP Telecommunication Package



DS1 Template

TTiP

- Compare Live Signals to Industry Standard Templates
- Oscilloscope Setup Files Provided for Convenience
- Pass/Fail Testing of Acquired Signal
- i-Pattern™ Software for Statistical Measurement, Examination of Signal Noise and Timing Jitter
- Set of Nine Optical Standard Masks Provided with i-Pattern™ Software

TDS simplifies complicated telecommunications measurement and analysis tasks.

TDS Telecommunication Package

One of the most frequently performed tasks in the design, manufacture and service of telecommunications equipment is comparing the live signals to a predefined industry standard template. The TTiP telecommunications package for the TDS 400/500A/600A/700A models provides the user with the capability to make this comparison. In addition, the i-Pattern™ software lets you analyze and visually examine signal noise and timing jitter on IBM compatible PCs.

PRE-DEFINED TEMPLATES AND SCOPE SETUPS

The TTiP package includes twenty-seven pre-defined templates, simplifying what used to be a time-consuming and inaccurate measurement task.

Appropriate oscilloscope setup files for the TDS 400/500A/600A/700A scopes are also provided. These setup files simplify the task of aligning the signal with the templates. For TDS without internal disk drives, the templates and setup files are available in GPIB formats.

PASS-FAIL TESTING

Once the signal is aligned and scaled, you can choose to perform the Pass/Fail test on the acquired signal. The TDS oscilloscope's limit testing capability makes it simple to determine if the signal passes or fails to meet the standard.

i-Pattern™ Software and Telecommunication Masks

The i-Pattern™ software provides statistical measurements and visual examination of signal noise and timing jitter by importing captured waveforms from the oscilloscope via GPIB to the PC. There the waveforms can be stored and analyzed.

The operation of the i-Pattern™ software is simplified by the integration of "drop-down" menus and pop-ups, intuitive use of arrow keys, use of "hot-keys," command short cuts, and extensive on-line HELP.

A set of nine Optical Standard Masks to be used with the software is provided.

REQUIRED CONFIGURATION

The i-Pattern™ software requires a GPIB connection to the TDS scope for waveform retrieval. The following configuration is recommended for the normal operation of i-Pattern™ software: a TDS oscilloscope connected via GPIB cable to a IBM-PC/AT or compatible controller with a National Instruments GPIB interface card: GPIB-PC, GPIB-PC2, GPIB-PC2A, MC-GPIB, AT-GPIB or GPIB PCIII and a 3.5 in. floppy disk drive.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The TDS Series complies with IEEE Standard 488.2-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

TTiP
Telecommunication Package and i-Pattern™ Software.....**$499**

Includes: TDS Template and Setup Files on 3.5 in. Floppy; GPIB Templates and Setup Files and i-Pattern™ Software with Predefined Telecommunication Masks on 3.5 in. Floppy; User Manuals.

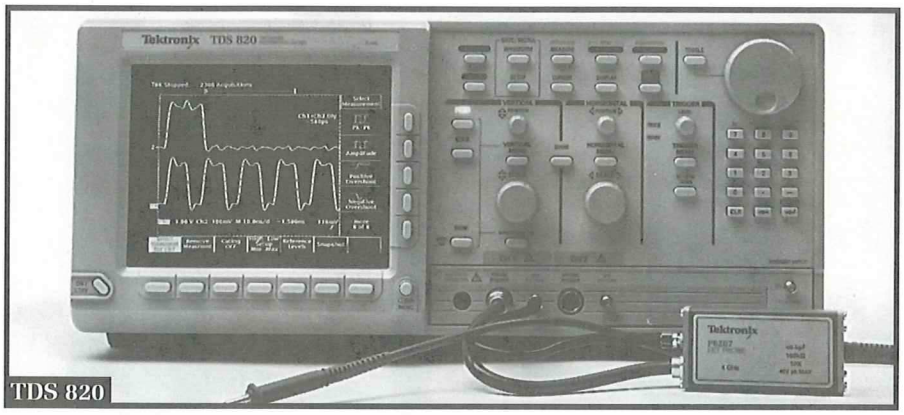
TDS 820

Digitizing Oscilloscopes

This high bandwidth, high resolution oscilloscope is ideal for precise device characterization applications and for telecommunications service, manufacturing and installation.

TDS 820

- 6-8 GHz BW
- 0.4 ps Timing Resolution
- 2 Input Channels
- 20 ps/div to 2 ms/div Sweep Speeds in 5 ps Steps
- 2 GHz External Trigger Bandwidth
- 3 ps RMS Jitter
- Infinite and Variable Persistence Displays
- 14-Bit Vertical Resolution
- 27 Automatic Measurements
- Electronic Mask Drawing and Display
- Automatic Pass/Fail Limit Testing
- Full GPIB Programmability
- Optional Hardcopy Interface
- Optional Advanced DSP Waveform Math Including FFT, Integration and Differentiation
- 0.4 pF FET Probes Standard



SIGNAL ACQUISITION SYSTEM	TDS 820	TDS 820 Opt. 1D
Channels	2	2
Rise time	58.3 ps	43.8 ps
Bandwidth (0.35/rise time)	6 GHz	8 GHz
Max operating input voltage	2 V p-p; ±3 V DC	1 V p-p; ±1.5 V DC
Sensitivity	2 m V/div to 200 mV/div	1 mV/div to 100 mV/div
Random noise	1.2 mV max, 600 µV typical	600 µV max, 300 µV typical

DC Gain Accuracy – ±0.7% after user-initiated automatic vertical calibration.

Vertical Resolution – 14-bits (Approx. 16,384 levels over 10.24 vertical divisions).

Input Impedance – 50 Ω.

ACQUISITION MODES

Normal – New data acquired on each sweep.

Envelope – Max/min values acquired over one or more acquisitions.

Average – Waveform averages selectable from 2 to 10,000.

TIME BASE SYSTEM

Time Bases – Main, Delayed.

Time/Division Range – 20 ps/division to 5 ms/division in 1-2-5 steps or settable from the numeric keypad in 5 ps steps.

Delta Time Measurement Accuracy –

Time interval	Accuracy
Ti≥ 1 ns	0.1% x interval +15 ps
100 ps	5 ps
10 ps	2 ps

Record Length – 500, 1000, 2000, and 5000, and 15,000 samples per channel.

Pre-Trigger View Time – 1.5 ns (not available with option 1D).

Minimum Trigger to Sample Delay: TDS 820 with Opt. 1D – 16 ns.

TRIGGERING SYSTEM

Trigger Sources – External input, internal rate generator, CH 1, CH 2 (CH 1 and CH 2 sources not available with Opt. 1D).

External Trigger Sensitivity – 40 mV p-p from DC to 200 MHz, increasing linearly to 200 mV p-p at 2 GHz.

External Trigger Minimum Pulse Width – 0.25 ns.

Internal Trigger Sensitivity – 80 mV p-p from DC to 200 MHz, increasing linearly to 400 mV p-p at 1 GHz (Internal trigger source is not available with Opt. 1D).

Trigger Delay Jitter – 3 ps RMS + 30 ppm of time base delay.

Holdoff Range – 15 µs to 2 s.

DISPLAY

Waveform Style – Dots or vectors. Infinite and variable persistence from 250 ms to 10 s.

Gray Scaling – With variable persistence selected, waveform points gradually decay through 16 levels of intensity, providing "z-axis" information about rapidly changing waveforms.

Graticules – Full, grid, cross hair, frame.

Format – YT and XY.

CRT Type – 7 in. diagonal, magnetic deflection. Horizontal raster-scan. P4 White phosphor.

CRT Resolution – 640 horizontal by 480 vertical displayed pixels.

APPLICATIONS

- **Telecom Service and Manufacturing**
- **Semiconductor Characterization**
- **Digital System Design and Characterization**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The TDS Series complies with IEEE Standard 488.2-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Digitizing Oscilloscopes

MEASUREMENT SYSTEM

Automatic Waveform Measurements –

Period	Frequency
High	Low
+ Width	– Width
Maximum	Minimum
Rise	Fall
Peak to Peak	Amplitude
+ Duty Cycle	– Duty Cycle
+ Overshoot	– Overshoot
Propagation Delay	Burst Width
Mean	Cycle Mean
RMS	Cycle RMS
Phase	Cycle Area
+ Cross	– Cross
Area	

Continuous update of up to four measurements on any combination of waveforms. Snapshot mode shows all measurements on the selected waveforms.

Thresholds – Settable in percentage or voltage.

Cursor Measurements – Absolute, Delta; Volts, Time, Frequency.

Cursor Types – Horizontal bars (volts); Vertical bars (time); Paired (volts and time).

WAVEFORM PROCESSING

Waveform Functions – Interpolate-selectable sin(x)/x or linear, Average.

Arithmetic Operators – Add, Subtract, Multiply, Invert.

Autosetup – Single button, automatic setup on selected input signal for vertical, horizontal and trigger systems.

Optional Advanced DSP Math Package – Includes FFT, integrate, and differentiate.

COMPUTER INTERFACE

GPIB (IEEE-488.2) Programmability – Full talk/listen modes. Control of all modes, settings, and measurements.

HARD COPY

Formats – HP ThinkJet, Epson, PostScript, Interleaf, DeskJet, LaserJet, EPS Monochrome, EPS Color, TIFF, PCX, BMP, HPGL.

Optional Hardcopy Interface – Centronics and RS-232C.

STORAGE

Waveforms – Up to 15 K points.

Setups – 10 front-panel setups.

POWER REQUIREMENTS

Line Voltage Range – 90 to 250 V RMS.

Line Frequency – 47 to 63 Hz.

Power Consumption – 250 W max.

ENVIRONMENT AND SAFETY

Temperature – Operating: 0 to +50°C. Nonoperating: –40 to +75°C.

Humidity – Operating and nonoperating: Up to 95% relative humidity at or below +40°C; to 75% relative humidity from +41°C to 50°C.

Altitude – Operating: 15,000 ft. Nonoperating: 40,000 ft.

Electromagnetic Compatibility – Meets MIL-STD-461C, CE-03, Part 4, Curve # 1, RE-02, Part 7; meets VDE 0871, Category B, FCC rules and regulations, Part 15, Subpart B, Class A.

Safety – Listed UL 1244. Certified to CAN/CSA-C22.2 No. 231-M89.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	193	7.6
with acc. pouch	236	9.3
Width	445	17.5
Depth with front cover	432	17.0
Weight	**kg**	**lb.**
Net	13.2	29.1
Shipping	23.6	52.0

ORDERING INFORMATION

TDS 820
2-CH, 6 GHz Digitizing Oscilloscope.....**$20,990**
Includes: Two P6207 Probes; Reference (070-8511-01), User Manual (070-8512-01), Programmer Manual (070-8513-01), Performance Verification Manual (070-8696-00), U.S. Power Cord (161-0230-01), Two 12-inch 50 Ω Male-to-male SMA Cables (174-1364-00), 60-inch 50 Ω Male-to-Male SMA Cable (174-1428-00), Antistatic Grounding Wrist Strap (006-3415-04), SMA "T" (015-1016-00), SMA Female-to-female Adapter (015-1012-00), Two SMA Short Circuit Male Terminations (015-1020-00), Front Cover (200-3696-00).

Opt. 1D – Delete Delay Lines.....**–$450**
Opt. 2D – Delete Two P6207 Probes.....**–$3,300**
Opt. 2F – Add Advanced DSP Math.....**+$1,495**
Opt. 13 – RS232/CENTRONICS Hardcopy Interface.....**+$495**
Opt. 1K – K420 Scope Cart.....**+$730**
Opt. 1P – HC100 Plotter with Opt. 1.....**+$1,380**
Opt. 1R – Rackmount.....**+$410**
Opt. 1S – Add one static isolation unit SIU800.....**+$1,995**
Opt. B1 – Service Manual.....**+$150**

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1–A5 available.
See General Customer Information Section for description.

SERVICE ASSURANCE OPTIONS

Opt. R2 – Adds two years of post-warranty Repair Protection.....**+$590**
Opt. C5 – Adds five years of Calibration Services.....**+$1,225**

RECOMMENDED ACCESSORIES

See page 446 for complete selection information.

PROBES

Active – 3.5 GHz, 0.4 pF/100 kΩ, 1 m. Order P6207.....**$3,595**
Differential – 100 MHz, Active Differential, 6 ft. Order P6046.....**$2,395**
50 Ω Divider – 9 GHz, 0.15 pF/500 Ω, Tips 1X, 10X. 1 m. Order P6150.....**$995**
CARTS – K420 Scope Cart.....**$730**

HARDCOPY DEVICE

Plotter – Order HC100 Opt. 01.....**$1,380**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The TDS Series complies with IEEE Standard 488.2-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

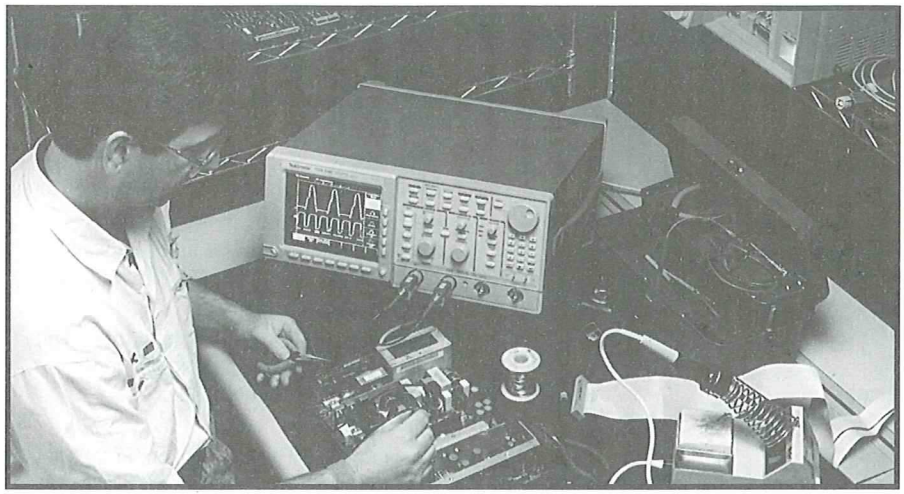
TDS 500A SERIES
TDS 600A SERIES
TDS 700A SERIES

TDS Reference

TDS 500A, TDS 600A and TDS 700A Series

Common characteristics of all members in the TDS 500A, TDS 600A and TDS 700A Series.

- 500 MHz and 1 GHz Bandwidths
- Sample Rates to 5 GS/s
- 2 and 4 Input Channels
- Record Lengths to 500,000 Points
- 8-bit Vertical Resolution
- Color and Monochrome Displays
- Infinite and Variable Persistence Displays
- FFT, Integration and Differentiation
- Waveform Pass/Fail Testing
- 25 Automated Measurements
- 3.5 in. DOS Format Floppy Disk Drive
- GPIB, RS-232, Centronics and VGA I/O Ports



The TDS Series instruments can be used for a variety of applications including power supply development, embedded microprocessor design, laser diode research and more.

TDS Series

A common instrument platform is the foundation of the TDS 500A, TDS 600A and TDS 700A Series digitizing oscilloscopes. Each instrument in these series offers a lively update rate, quick response to front-panel button or knob changes, a common, icon-enhanced user interface, on-line, context sensitive help and more. Control of all instruments uses the same human and computer interface. Moving between any of the nine models is simple once you have learned the operating basics of any instrument in the Family.

Need performance but have a restricted budget? Consider the TDS 520A. A two-channel, 500 MHz instrument, the TDS 520A is available without the floppy disk drive and I/O interfaces to keep your initial investment low. You can enhance your instrument and extend its useful life at any time in the future by adding either item later. Are you working with high-speed digital hardware? Consider the 1 GHz bandwidth TDS 684A. With 5 GS/s simultaneous sampling on four channels, the TDS 684A makes short work out of characterizing digital hardware timing violations. Regardless of your application, there is a TDS digitizing oscilloscope ideally suited to your needs.

TDS SELECTION GUIDE

	TDS 500A	TDS 600A	TDS 700A
Total Channels	2 or 4	2 or 4	4
Maximum Real-Time Channels	1	4	1
Bandwidth	500 MHz	500 MHz and 1 GHz	500 MHz and 1 GHz
Sample Rate (max)	1 GS/s*2	5 GS/s	4 GS/s
Record Length (max)	50,000 points	15,000 points	500,000 points
Vertical Resolution	8-bits >11-bits w/ averaging	8-bits >11-bits w/ averaging	8-bits >11-bits w/ averaging
Hi-Res	>12-bits	–	>13-bits
Vertical Accuracy	1%	1.5%	1%
Peak Detect	4 ns	–	1 ns
InstaVu™	–	–	Standard
FastFrame™	Standard	–	Standard
Dual Window Zoom	–	–	Standard
Runt Pulse Trigger	Standard	Standard	Standard
Setup/Hold Time Violation Trigger	–	Standard*1	Standard
Slew Rate Trigger	–	Standard*1	Standard
Display Type	Color/Monochrome	Color/Monochrome	Color
Floppy Disk Drive	Optional	Standard*1	Standard
GPIB, VGA	Standard	Standard	Standard
RS-232, Centronics	Optional	Standard*1	Standard

*1 *Only available on selected models.*

*2 *500 MS/s on 2 channel models.*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The TDS Series complies with IEEE Standard 488.2-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

TDS Series Reference

TDS 500A, TDS 600A and TDS 700A Series

ACQUISITION MODES

Peak Detect – High frequency and random glitch capture. Captures glitches using hardware at all real-time sampling rates.

Sample – Sample data only.

Envelope – Max/min values acquired over one or more acquisitions.

Average – Waveform averages selectable from 2 to 10,000.

Hi-Res – Vertical resolution improvement and noise reduction on low frequency signals, e.g., 13-bits at 5 ms/div and slower. (Not available on the TDS 600A Series.)

FastFrame™ – Segment acquisition memory into as many as 910 segments. Trigger rate over 50,000 per second. (Not available on the TDS 600A Series.)

InstaVu™ – Custom hardware increases update rate to over 400,000 waveforms per second. Instantly displays small signal variations and infrequent glitches. Color is used to indicate rate of occurrence of events.

WAVEFORM PROCESSING

Waveform Functions – Interpolate (selectable as either sin x/x or linear), Average or Envelope.

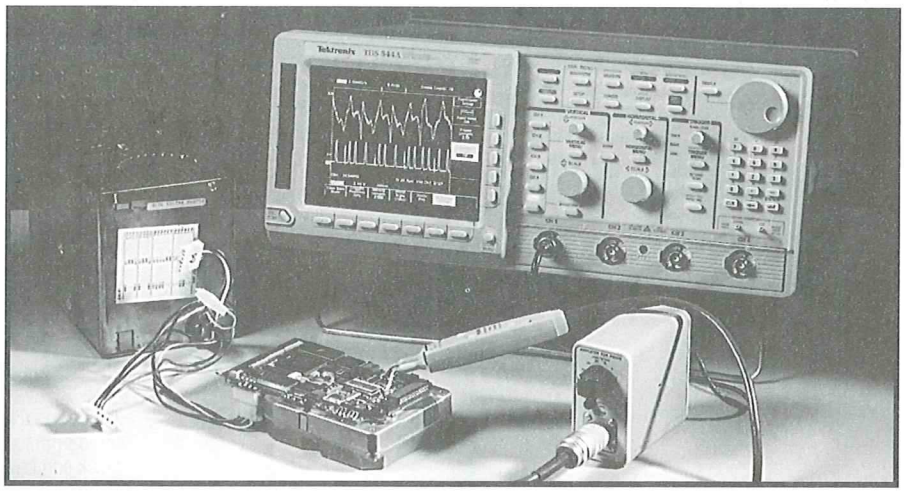
Advanced Waveform Functions – FFT, Integration, Differentiation.

FFT – Frequency Range: DC to 500 MHz. Amplitude Display: power is dBV RMS, Linear RMS. Phase is degrees or radians. Signal to Noise: 55 to 65 dB (Avg. or Hi-Res). Transform Size: 500 to 10,000 points selectable. Windowing, Rectangular, Hamming, Hanning, Blackman-Harris.

Arithmetic Operations – Add, Subtract, Multiply, Divide, Invert.

Autosetup – Single button, automatic setup on the selected input for vertical, horizontal and trigger systems.

Waveform Limit Testing – Compares incoming or math waveform to a reference waveform's upper and lower limits.



Features such as 500,000-point record length, FastFrame™, dual waveform zoom, FFT analysis, runt pulse triggering and pulse width violation triggering make these instruments ideal for researchers, engineers and technicians working with disk drives.

MEASUREMENT SYSTEM

Automatic Waveform Measurements

Period	Frequency
High	Low
+ Width	– Width
Maximum	Minimum
Rise Time	Fall Time
Peak to Peak	Amplitude
+ Duty Cycle	– Duty Cycle
+ Overshoot	Undershoot
Mean	Cycle Mean
RMS	Cycle RMS
Area	Cycle Area
Phase	Burst Width
Propagation Delay	Continuous update of up to four measurements on any combination of waveforms.

Measurement Thresholds – Settable in percentage or absolute voltage.

Gated Measurements – Any region of the record between the vertical bar cursors.

Measurement Snapshot – Performs all measurements on any one waveform showing results from one instant in time.

CURSORS

Cursor Types – Horizontal bars (volts); Vertical bars (time); operate tracking or independently.

Cursor Measurement Types – Absolute, delta; Volts, Time, Frequency; IRE and line number with video trigger option.

DISPLAY

Waveform Style – Dots or vectors. Infinite and variable persistence from 250 ms to 10 s.

Gray Scaling – With variable persistence selected, waveform points gradually decay through 16 levels of intensity, providing "z-axis" information about rapidly changing waveforms.

Color Grading – With variable persistence selected, waveform points gradually decay through the selected color spectrum, providing historical information.

Update Rate – Over 400,000 waveforms/sec with InstaVu™ selected (TDS 700A only). 150 waveforms/sec (TDS 500A and TDS 700A) or 100 waveforms/sec (TDS 600A) [500 point record length and infinite persistence selected].

Graticules – Full, grid, cross hair, frame; NTSC and PAL with video trigger option.

Formats – YT and XY.

Fit to Screen – Display all points in the record on screen.

CRT TYPES

Monochrome – 7 in. diagonal, magnetic deflection. Horizontal raster-scan. P4 white phosphor (TDS 520A, TDS 540A, TDS 620A, TDS 640A).

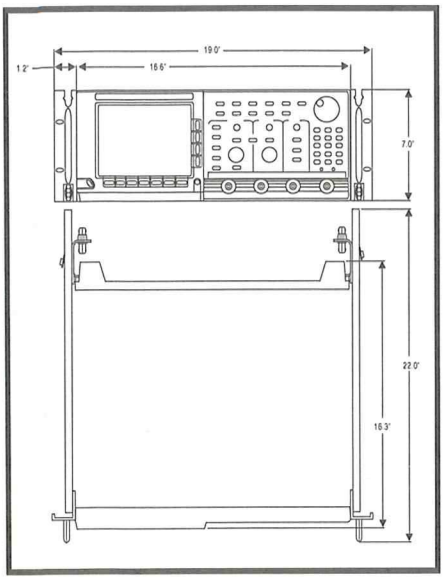
Color – 7 in. diagonal, NuColor™ liquid crystal shutter with 256 color levels (TDS 524A, TDS 644A, TDS 684A, TDS 744A, TDS 784A).

Resolution – 640 x 480 pixels for both monochrome and color displays.

TDS 500A SERIES
TDS 700A SERIES
TDS 600A SERIES

TDS Series Reference

TDS 500A, TDS 600A and TDS 700A Series



ZOOM

Allows waveforms to be expanded, compressed and positioned in both vertical and horizontal axis. Allows precise comparison and study of fine waveform detail without effecting ongoing acquisitions. Zoom provides an effective vertical dynamic range of 1,000 divisions or 100 screens when used with Hi-Res or average mode.

Dual Window Zoom – Allows that portion of a waveform within the one or two zoom boxes to be displayed in a separate graticule (TDS 700A only).

TRIGGERING SYSTEM

Triggers – Main and Delayed.

Main Trigger Modes – Auto, Normal, Single.

Delayed Trigger – Delay by time and/or events.

Delay Time Range – 16 ns to 250 s (time/div ≤10 µs); 15.1 ns to 250 s (time/div ≥25 µs).

Delay Event Range – From 1 to 9,999,999 events.

External Trigger – >1.5 kΩ; Max input voltage is ±20 V (DC + peak AC). (Not available on the TDS 520A/524A).

TRIGGER TYPES

Edge		Conventional level driven trigger. Positive or negative slope. Coupling selections: DC, AC, noise reject, HF reject, LF reject.
		Trigger on a positive, negative or either edge that is slower than or faster than the selectable slew rate: settable from 1 ns to 1 second.
Pulse	Width	Trigger on the width of a positive or negative pulse either within or not within selectable time limits: settable from 2 ns to 1 second.
	Glitch	Trigger on or reject glitches of positive, negative, or either polarity: Minimum detectable glitch width 2 ns settable with 200 ps resolution.
	Runt Slew Rate (Selected models)	Trigger on a positive, negative or either polarity pulse that crosses one threshold but fails to cross a second threshold before returning across the first.
Logic	Pattern	Trigger on a logical combination (AND, OR, NAND, NOR) of the four input channels (Hi, Lo, Don't Care) when the pattern stays true or false for a user specified time: settable from 2 ns to 1 second.
	State	Trigger on a logical combination (AND, OR, NAND, NOR) of the three primary input channels (Hi, Lo, Don't Care) when the active clock edge (positive or negative slope) occurs on the clock channel.
	Setup/Hold Time (Selected models)	Trigger when the time between any transition of the defined data input occurs within the specified setup and hold time window when the active clock edge (positive or negative slope) occurs on the clock channel. Settable from –1 ns to +100 ns min $t_{su} + t_h = 2$ ns.
Video (Optional), NTSC, PAL, HDTV, FlexFormat™		Trigger on a specific line of individual field, odd/even or all fields. Trigger on a specific pixel of a line by using video trigger with delay by events. Choose horizontal sync polarity. Choose from popular HDTV formats (1125/60, 1050/60, 1250/50, 787.5/60) or use FlexFormat™ for other HDTV-type formats by defining frame rep rate, number of lines and fields and sync timing structure.

COMPUTER INTERFACE

GPIB (IEEE-488.2) Programmability – Full talk/listen modes. Control of all modes, settings and measurements.

HARD COPY/DESKTOP PUBLISHING

Printer Support – Tektronix Phaser™, HP ThinkJet, DeskJet, LaserJet, Epson, PostScript, DPU 411/412.

Plotter Support – HPGL.

Export File Formats – BMP, EPS, PCX, RLE, TIFF and Interleaf. MathCad and spreadsheet on TDS 700A.

I/O Ports – GPIB, Centronics, RS-232 (talk only). (Centronics and RS-232 are optional on the TDS 520A, TDS 540A, TDS 620A and TDS 640A.)

Floppy Disk Drive – 3.5 in. 1.44 MB DOS format. (Optional on the TDS 520A, TDS 540A, TDS 620A and TDS 640A.)

VGA Output – 15-Pin analog output. Monochrome or color, depending on instrument display type.

NON-VOLATILE STORAGE

Waveforms – 4 full length waveforms internally. 119,008 500-point waveforms on 1.44 MB diskette.

Setups – 10 front-panel setups internally. 78,947 setups on 1.44 MB diskette.

ENVIRONMENTAL AND SAFETY

Temperature – Operating: +4°C to +50°C (floppy not used); +10°C to +45°C (floppy in use). Nonoperating: –22°C to +60°C.

Humidity – Operating: To 80% RH at ≤32°C; Derates to 30% RH at +45°C. Nonoperating: To 90% RH at ≤ 40°C; Derates to 30% RH at +60°C.

Altitude – Operating: 15,000 ft. (4,573 m). Nonoperating: 40,000 ft. (12,195 m).

TDS Series Reference

TDS 500A, TDS 600A and TDS 700A Series

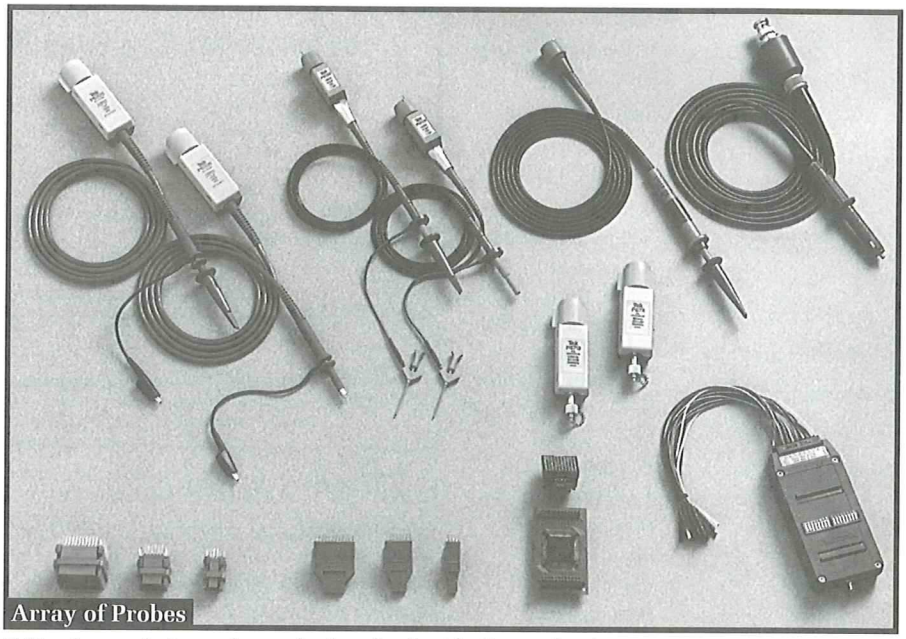


The recommended instrument cart (K420) is designed specifically for the TDS Series instruments. It provides adjustable height, tiltable shelf and a large drawer for accessories. HC220 shown on second shelf.

Electromagnetic Compatibility – Meets or exceeds Vfg. 243/1991 amended per Vfg. 46/1992; FCC 47 CFR, Part 15, Subpart B, Class A; EN 50081-1; and EN 50082-1.

Safety – Listed UL 1244; CSA-C22 No. 23; Tektronix self-certification to comply with IEC 348 recommendations.

Power Requirements –
Line Voltage Range: 90 to 250 V RMS.
Line Frequency: 45 to 440 Hz.
Power Consumption: 300 W maximum.



Tektronix manufactures a large selection of probes ideally suited to the TDS instruments. Complimenting these probes are accessories that make it easy to attach to today's modern circuits including ICs in 25-mil and 20-mil QFP packages.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height with feet	236	9.3
without feet	193	7.6
Width with handle	445	17.5
Depth with front cover installed	432	17.0
Weight	**kg**	**lb.**
Net approx.	12.3	27
Shipping approx.	20	44

ORDERING INFORMATION

RECOMMENDED ACCESSORIES
See page 446 for complete selection information.

PROBES

Active Probes –
750 MHz, 2pF/1M, 10X, 1.5 m. Order P6205 ..... **$595**
1.5 GHz, 1pF/1M, 10X, 1.5 m. Order P6245 ..... **$1,395**

Passive Probes –
500 MHz, 8pF/10M, 10X, 1.3 m. Order P6139A **$280**
500 MHz, 5pF/9.5M, 20X, 1.5 m.
For Fine Pitch/Surface Mount Devices. Order P6563AS **$825**

Differential Probes –
100 MHz, 10,000:1 CMRR, 1X/10X, 2 m. Order P6046 ..... **$2,395**
1 MHz, 100,000:1 CMRR, 1X/10X/100X,
Differential Amplifier. Order ADA400A *1

High Voltage Probes –
2.5 kV, 25 MHz, 2.75 pF/10M, 100X. Order P5100 ..... **$285**
20 kV, 75 MHz, 3pF/100M, 1000X, 3.1 m. Order P6015A **$170**

Word Recognizer Probes –
20 MHz, 17-bit TTL, 40 ns word. Order P6408 ..... **$555**

Current Probes, AC Only –
120 Hz to 60 MHz, 7.5 A peak. Order P6021 ..... **$575**
965 kHz to 120 MHz, 3 A peak. Order P6022 ..... **$610**

Current Probes, AC and DC –
DC to 50 MHz, 20 A DC/50 A peak. Order AM503S **$2,795**

PLOTTERS/PRINTERS

Plotter – With GPIB and Centronics interface.
Order HC100 with Opt. 01 ..... **$1,380**

Monochrome Printer – With Centronics interface.
Order HC220 ..... **$445**

Color Printer – With RS-232, Centronics, AppleTalk
Order Phaser™ 200e **$2,995**

CART
Order K420 ..... **$730**

U.S. Power Strip – For K420. Four outlet, 6 ft., noise/surge suppression. Order 131-5342-01 ..... **$48**

TRANSIT CASES

Soft-sided Carrying Case – Order 016-0909-00 ..... **$210**

Hard Transit Case – Order 016-1157-00 ..... **$625**

Accessory Pouch – For any TDS 500/500A, 600/600A, or 700/700A Series instrument. Order 016-1268-00 ..... **$95**

QuickStart III Tutorial – Includes lab manual, circuit board and 9 V power source.
With U.S. Power Cord. Order 020-2024-00 ..... **$225**
With Universal European Power Cord. Order 020-2025-00 .... **$225**

**1 Contact your Tektronix representative for price information.*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 — The TDS Series complies with IEEE Standard 488.2-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 — ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

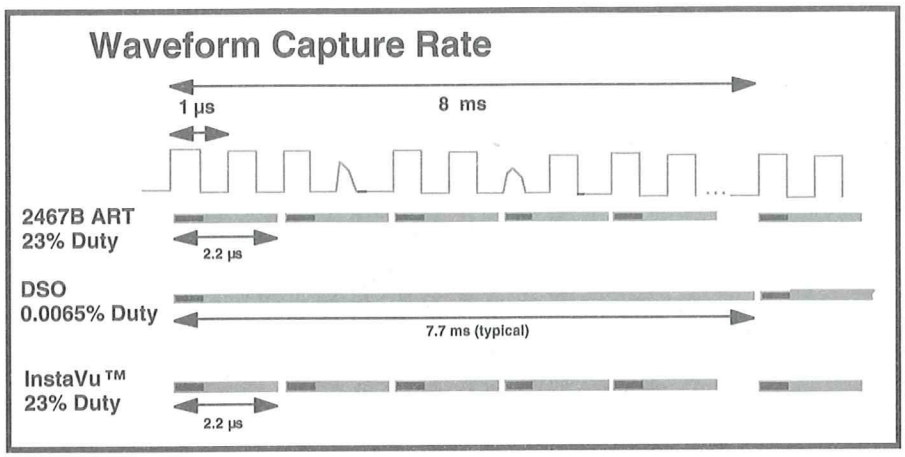
Tektronix Measurement products are manufactured in ISO registered facilities.

InstaVu™ Acquisition Mode

Featuring the waveform capture rate of the fastest analog oscilloscopes in a state-of-the-art DSO for advanced digital design, analog design, and R&D applications.

BULLETS

- 1 GHz and 500 MHz Bandwidth
- Sample Rates to 4 GS/s
- 4 Input Channels
- InstaVu™ Acquisition Mode
- Pulse Width, 1 ns Glitch, Runt, Pattern and State, Setup & Hold Violation, and Slew Rate Triggering
- HDTV Video Triggering
- 1 mV/div to 10 V/div Sensitivity
- Infinite and Variable Persistence Displays
- Record Lengths to 500,000 Points
- 8-bit Vertical Resolution and up to 13-bit Resolution with Hi-Res Acquisition Mode
- Vertical Accuracy to 1%
- FFT, Integration and Differentiation
- 25 Automatic Measurements
- High Resolution Color Monitor
- 3.5 in. DOS Format Floppy Drive
- VGA-Output to External Monitor
- Waveform Pass/Fail Testing
- 1 ns Peak Detect
- FastFrame™ Acquisition Mode
- 3 Year Warranty

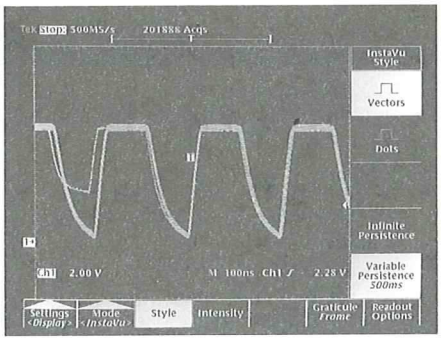


InstaVu™ Acquisition Mode

The TDS700A family introduces InstaVu™ Acquisition mode which provides the world's fastest waveform capture rate. Prior to InstaVu™ Acquisition mode, sporadic signal events could only be captured with a Tektronix 2467B and 7104 with their Multi Channel Plate (MCP) display. The TDS700A oscilloscopes with InstaVu™ Acquisition mode can capture waveforms even faster than world's fastest analog scopes.

With waveform capture rates exceeding 400,000 waveforms per second, InstaVu™ allows you to instantaneously capture glitches and signal anomalies that could take hours for a state-of-the-art digitizing oscilloscope in persistence mode to capture or that would be completely missed by common analog scopes. Today's state-of-the-art DSO's can only capture a maximum of a couple hundred real-time waveforms per second which translates to about an 8 ms hold-off between acquisitions or 0.0065%of the time actually spent on acquiring data. In comparison, InstaVu™ has a minimum hold-off between acquisitions of only 1.7 µs which means that it is acquiring a signal 23% of the time – a 3500 times increase over a state-of-the-art DSO! Therefore, with InstaVu™ you will instantly capture glitches that you've either had to wait a long time for, or that you never knew existed.

A new button dedicated to InstaVu™ has been added to the enduring TDS front panel. This button instantly moves you between standard DSO acquisition modes and InstaVu. Push the InstaVu™ button to instantly see what is going on in your system, and then push the button again to go back to standard DSO modes to isolate and analyze any anomalies found with InstaVu™ by using the TDS700A's specialized triggers and advanced math. Like an analog scope, InstaVu™ provides a single screen of data, and it shows intensity information (relative occurrence of events) using color grading. Unlike an analog scope, InstaVu™ can perform automatic measurements and save screen images to disk or to a printer. Moreover, you also have the full utility of the world's most advanced digitizing oscilloscopes at the push of a button.



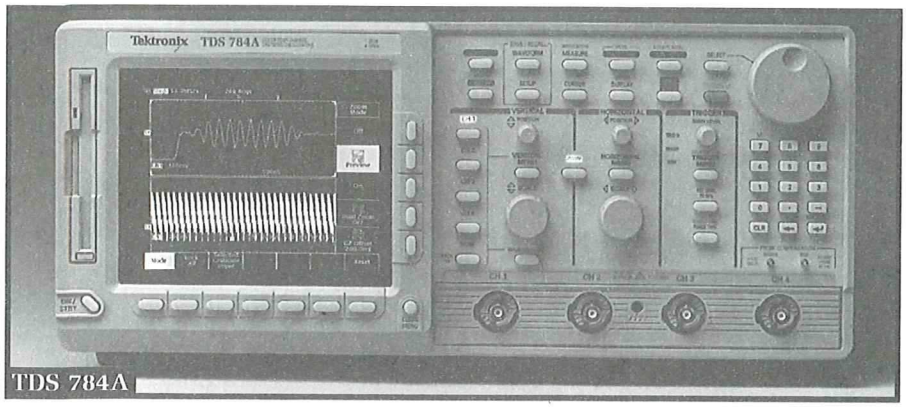
Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001

Tektronix Measurement products are manufactured in ISO registered facilities.

Digitizing Oscilloscopes

TDS 784A
TDS 744A



TDS 784A/TDS 744A

- 1 GHz and 500 MHz Bandwidth
- Sample Rates to 4 GS/s
- 4 Input Channels
- InstaVu™ Acquisition Mode
- Pulse Width, 1 ns Glitch, Runt, Pattern and State, Setup & Hold Violation, and Slew Rate Triggering
- HDTV Video Triggering
- 1 mV/div to 10 V/div Sensitivity
- Infinite and Variable Persistence Displays
- Record Lengths to 500,000 Points
- 8-bit Vertical Resolution and up to 13-bit Resolution with Hi-Res Acquisition Mode
- Vertical Accuracy to 1%
- FFT, Integration and Differentiation
- 25 Automatic Measurements
- High Resolution Color Monitor
- 3.5 in. DOS Format Floppy Drive
- VGA-Output to External Monitor
- Waveform Pass/Fail Testing
- 1 ns Peak Detect
- FastFrame™ Acquisition Mode
- 3 Year Warranty

Featuring the waveform capture rate of the fastest analog oscilloscopes in a state-of-the-art DSO for advanced digital design, analog design, and R&D applications.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 — The TDS Series complies with IEEE Standard 488.2-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 — Accredited by the Dutch Council for Certification

Tektronix Measurement products are manufactured in ISO registered facilities.

Characteristics

SIGNAL ACQUISITION SYSTEM

	TDS 744A	TDS 784A
Channels	4	4
Samplers	4	4
Bandwidth	500 MHz	1 GHz
Maximum Sample Rate		
1 Channel	2 GS/s	4 GS/s
2 Channels	1 GS/s	2 GS/s
3, 4 Channels	500 MS/s	1 GS/s

MAXIMUM RECORD LENGTH

TDS 784A/744A	Standard	Optional
1 Channel	50,000 pts	500,000 pts
2 Channels	50,000 pts	250,000 pts
3, 4 Channels	50,000 pts	130,000 pts

TIME BASE SYSTEM

Time Bases – Main, Delayed.

Time/Division Range –
TDS744A: 500 ps to 10 s/div.
TDS784A: 200 ps to 10 s/div.

Time Base Accuracy – ±25 ppm over any interval ≥1 ms.

Pre-Trigger Position – 0 to 100% of record.

Delay Between Channels – ≤50 ps between any two channels with equal V/div and coupling.

VERTICAL SYSTEM

DC Gain Accuracy – ±1.0%.

Vertical Resolution – 8-bits (256 levels over 10.24 vertical divisions), >13-bits with Hi-Res, 11-bits with averaging.

Analog Bandwidth Selections – 20 MHz, 100 MHz, and full.

Input Coupling – AC, DC or GND.

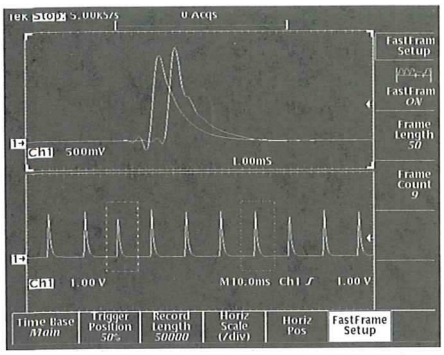
Input Impedance Selections – 1 MΩ in parallel with 10 pF, or 50 Ω (AC and DC coupling).

APPLICATIONS

- **Digital Design and Debug**
- **Analog Design and Debug**
- **Research and Development**

TDS 784A
TDS 744A

Digitizing Oscilloscopes



Dual window zoom is effective for managing the 500 K acquisition memory. FastFrame™ allows you to capture multiple events in a single record.

Maximum Input Voltage – ±400 V (DC + peak AC). Derate at 20 dB/decade above 1 MHz. 1 MΩ or GND coupled.

Channel Isolation – >100:1 at 100 MHz and >30:1 at bandwidth for any two channels having equal V/div settings.

AC Coupled Low Frequency Limit – ≤10 Hz when AC 1 MΩ coupled. ≤200 kHz when AC 50 Ω coupled.

Effective Bits –
TDS 784A: 6.0-bits (1 GHz at 4 GS/s), 9.3-bits with Hi-Res (1 MHz at 25 MS/s).
TDS 744A: 6.6-bits (500 MHz at 2 GS/s); 9.3-bits with Hi-Res (1 MHz at 25 MS/s).

Step Response Setting – ≤0.5% error within 20 ns of a ≤2 V step.

Sensitivity – 1 mV to 10 V/div.

Position Range – ±5 Divisions.

Offset – ±1 V from 1 to 100 mV/div. ±10 V from 101 mV to 1 V/div. ±100 V from 1.01 to 10 V/div.

ACQUISITION MODES
1 ns Peak Detect, Sample, Single Sequence, Envelope, Average, Hi-Res, FastFrame™, InstaVu™ acquisition.

TRIGGERING SYSTEM
Triggers – Edge (main and developed), Pulse (Width, 1 ns Glitch, Runt and Slew Rate), Logic (Pattern, State, and Setup & Hold Time Violation), HDTV Video (optional).

Main Trigger Modes – Auto, Normal, Single.

Delayed Trigger– Delay by time, events, or events and time.

DISPLAY
Monitor – 7 in. NuColor™ liquid crystal full-color shutter, 256 levels.

Waveform Style – Dots, vectors, variable persistence with color grading, infinite persistence, and intensified real samples.

Format – YT, XY, Zoom, Fit-to-Screen, Zoom, Dual Window Zoom.

Waveform Capture Rate –
InstaVu™ acquisition: >400,000 wfm/sec.
Infinite persistence (500 pts): 150 wfm/sec.

MEASUREMENT SYSTEM
Automatic Measurements – 25 (on entire record or in gated region).

Measurement Accuracy – TDS 744A: <80 ps typical @ 2 GS/s single shot, TDS 784A: <38 ps typical @ 4 GS/s single shot.

Cursors Measurements – Absolute, Delta; volts, time, frequency. NTSC IRE units and line number with video trigger option.

WAVEFORM PROCESSING
Waveform Functions – Interpolation (sin(x)/x or linear), Average, Envelope, Autosetup.

Advanced Waveform Functions – FFT, Integration, Differentiation, Waveform (math or acquired) Limit Testing.

Arithmetic Operations– Add, Subtract, Multiply, Divide, Invert.

Digitizing Oscilloscopes

HARDCOPY/DESKTOP PUBLISHING
Hardcopy Ports – GPIB, RS-232, Centronics.

Hardcopy Formats – Epson, ThinkJet, DeskJet, LaserJet, PostScript, TIFF, PCX, BMP, DPU 411/412, RLE, HPGL, Interleaf.

Floppy Drive – 3.5 in. 1.44 MB or 730 kB DOS compatible.

DATA FORMATS
MathCad and spreadsheet.

COMPUTER INTERFACE
GPIB (IEEE 488.2) – Full Programmability.

AUXILIARY INPUTS/OUTPUTS
Video output (15-Pin VGA, full color); External Trigger input; Main and Delay Trigger outputs; CH 3 Signal output.

STORAGE
Waveform Storage – NVRAM: Four 50 K pt. waveforms. Two full 130 K pt., one full 250 K pt., or one compressed 500 K pt. waveform with Option 1M. 1.44 MB Floppy Disk: 1,436 50 K pt. to 119,008 500 pt. waveforms.

AutoSave – Automatic storage of single sequence waveforms to NVRAM.

Setup Storage – 10 front panel setups.

POWER REQUIREMENTS
Line Voltage Range – 90 to 250 V RMS.

Line Frequency – 45 to 440 Hz.

Power Consumption – 300 W.

PROBES
Passive P6139A (Standard with TDS 744A) – 10 X, 8 pF, 500 MHz.

Accessories

P6139A

Passive Probing

- 500 MHz
- 10X, 8 pF/1 MΩ
- 1.3 m

P6205

Active Probing

- 750 MHz
- 10X, 1 pF/1 MΩ
- 1.35 m

NEW P6245

Active Probing

- 1 GHz
- 10X, 1 pF/1 MΩ
- 1.5 m

ORDERING INFORMATION

TDS 784A
Four-channel Color 1 GHz Digitizing Oscilloscope **$34,495**

TDS 744A
Four-channel Color 500 MHz Digitizing Oscilloscope **$17,750**

TDS 700A includes: Four each P6139A Passive Probes (TDS 744A only); Quick Reference Guide (070-8999-01); User Manual (070-8991-01); Programmer's Manual (070-8709-06); Technical Reference Manual (070-8990-02); Front Cover (200-3696-01); Accessory Pouch (016-1268-00); U.S. Power Cord (161-0230-01).

Opt. 05 – Video Trigger, NTSC, PAL, HDTV, FlexFormat™ ..... **+$1,495**

Opt. 1K – K420 Scope Cart ..... **+$730**

Opt. 1M – 500 K Memory Length
TDS 784A ..... **+$2,995**
TDS 744A ..... **+$2,495**

Opt. 1R – Rackmount ..... **+$400**

Opt. 2P – Tektronix Phaser™ 200e Thermal Wax Transfer Color Printer ..... **+$2,695**

Opt. 23 – (TDS 744A only) Additional Two each P6205 Active Probes ..... **+$1,190**

Opt. 24 – (TDS 784A only) Four each P6139A 10 X Passive Probes ..... **+$1,120**

Opt. 26 – (TDS 784A only) Four each P6245 Active Probes ..... **+$5,580**

Opt. 95 – NIST, MIL-STD 45332A, and ISO 9000 Calibration Certification ..... **+$150**

Opt. 96 – Calibration Data ..... **+$50**

RECOMMENDED ACCESSORIES
See page 446 for complete selection information.

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – A5 ..... **NC**

See General Customer Information Section for additional description.

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection ..... **+$590**

Opt. C5 – Adds five years of Calibration Services ..... **+$1,225**

PRODUCT UPGRADES
HDTV Video Trigger – TDS7F05 ..... **$1,995**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The TDS Series complies with IEEE Standard 488.2-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

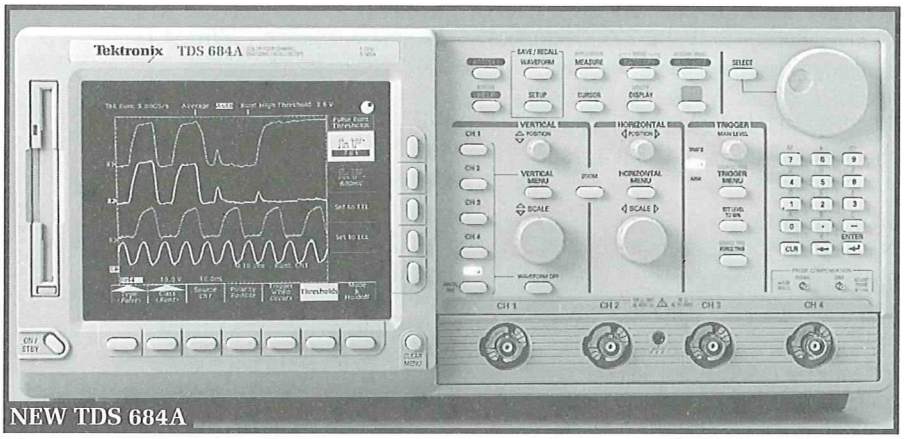
TDS 684A
TDS 644A
TDS 640A
TDS 620A

Digitizing Oscilloscopes

High-performance, digital real-time oscilloscopes combine high bandwidth with ultra fast sampling across all channels to streamline performance verification and debug of high speed digital circuits.

TDS 684A/TDS 644A/ TDS 640A/TDS 620A

- 1 GHz and 500 MHz Bandwidth
- 5 GS/s and 2 GS/s Sample Rates
- 4 and 2 Input Channels
- 8-bit Vertical Resolution
- Greater than 11-bits with Averaging
- Record Length to 15,000 Points
- 1 mV/div to 10 V/div Sensitivity
- 1.5% Vertical Accuracy
- Waveform Math and Advanced Waveform DSP
- Fully Automated Measurement System
- Waveform Pass/Fail Template Testing
- Color VGA Display
- 3.5 in. DOS Format Floppy Drive
- RS-232, Centronics, GPIB and VGA I/O Ports



The newest addition to the TDS 600A Series is the TDS 684A. The 1 GHz bandwidth is supported by 5 GS/s sampling on all channels making it the fastest 4-channel digital real-time oscilloscope available.

Your designs may be digital but at today's speeds, many of your toughest problems aren't. Crosstalk. Noise. Transmission effects. Ground bounce. Not to mention sub-nanosecond edges. Today's design problems require high bandwidth oscilloscopes that can measure up. The Digital Real-Time architecture of the TDS 600A Series simplifies capturing intermittent signals or non-recurring problems like glitches or metastables caused by setup and hold time violations.

Additional features and specifications of the TDS 600A Series are explained in the TDS Reference section beginning on page 50.

CHARACTERISTICS

	TDS 620A	TDS 640A	TDS 644A	TDS 684A
Total Channels	2 + 2 aux.	4	4	4
Sample Rate (all channels simultaneously)	2 GS/s	2 GS/s	2 GS/s	5 GS/s
Real-Time Bandwidth	500 MHz	500 MHz	500 MHz	1 GHz
Maximum Record Length per Channel	2,000 pts	2,000 pts	2,000 pts	15,000 pts
Vertical Resolution	8-bits; >11-bits with averaging			
Time Measurement Accuracy	<110 ps @ 2 GS/s	<110 ps @ 2 GS/s	<110 ps @ 2 GS/s	<50 ps @ 5 GS/s
Advanced Waveform DSP/Math	Opt.	Opt.	Std.	Std.
Standard Probes	2 P6205	4 P6205	4 P6205	None
Display Type	7 in. mono	7 in. mono	7 in. color	7 in. color
Disk Drive	Opt.	Opt.	Std.	Std.
GPIB Port	Std.	Std.	Std.	Std.
RS-232 & Centronics Printer Ports	Opt.	Opt.	Std.	Std.
VGA I/O Port	Std. Mono	Std. Mono	Std. Color	Std. Color

APPLICATIONS

- **Digital Design and Debug**
- **Telecommunications**
- **Transient Event Capture**
- **High Energy Physics**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The TDS Series complies with IEEE Standard 488.2-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Digitizing Oscilloscopes

TDS 684A
TDS 644A
TDS 640A

TRIGGERING TYPES COMPARISON

	TDS 620A	TDS 640A	TDS 644A	TDS 684A
Edge	Yes	Yes	Yes	Yes
Time Qualified Edge (Slew Rate)	–	–	–	Yes
Pulse Width, Runt Pulse, Glitch	Yes	Yes	Yes	Yes
Time Qualified Pattern	Yes	Yes	Yes	Yes
Clock Qualified State	Yes	Yes	Yes	Yes
Setup/Hold Time	–	–	–	Yes
Triggering Conditioning				
HF, LF and Noise Reject	Yes	Yes	Yes	Yes
Triggering Modes				
Main Trigger Auto, Normal, Single	Yes	Yes	Yes	Yes
Delay Trigger Delay by Time, Delay by Events, Delay by Time and Events	Yes	Yes	Yes	Yes
Delay by Time Range	16 ns to 250 S for t/div setting <10 us 15.1 ns to 250 S for t/div setting >25 us			
Delay by Events Range	1 to 9,999,999 events			
External Trigger Input				
Input Impedance	> 1.5 kΩ			
Maximum Input Voltage	±20 V (DC plus Peak AC)			

TIME BASE SYSTEM

	TDS 620A/640A/644A	TDS 684A
Time Bases	Main and Delayed	Main and Delayed
Time/div Range	500 ps/div to 5 s/div	200 ps/div to 10 s/div
Time Base Accuracy over any interval >1ms	±100 ppm	±100 ppm
Record Length per Channel	500 to 2,000 pts	500 to 15,000 pts
Pre-Trigger Position	20% to 80% of Record	20% to 80% of Record

VERTICAL SYSTEM

Vertical Resolution – 8-bits (<11-bits with averaging).

Vertical Sensitivity – 1 mV/div to 10 V/div.

Maximum Input Voltage – ±400 V (DC + peak AC). Derate at 20 dB/decade above 1 MHz.

DC Gain Accuracy – 1.5%

Position Range – ±5 divs.

Offset – Primary channels ±1 V from 1 to 99.5 mV/div, ±10 V from 100 mV to 995 mV/div, ±100 V from 1 V to 10 V/div. Aux. 1, Aux. 2 (TDS 620A only) ±10 V from 100 mV to 995 mV/div, ±100 V from 1 V to 10 V/div.

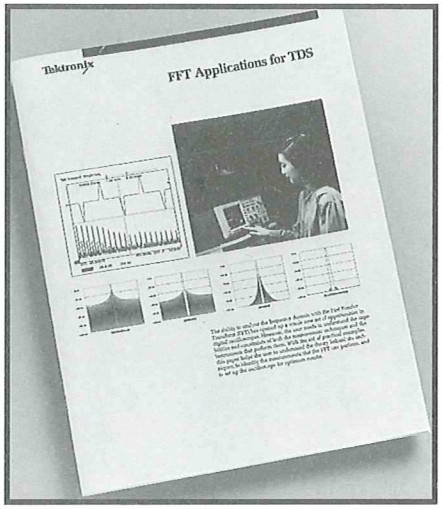
Bandwidth Selections – 20 MHz, 100 MHz (250 MHz TDS 684A), and Full.

Input Impedance Selections – 1 MΩ in parallel with 10 pF, or 50 Ω (AC and DC coupling).

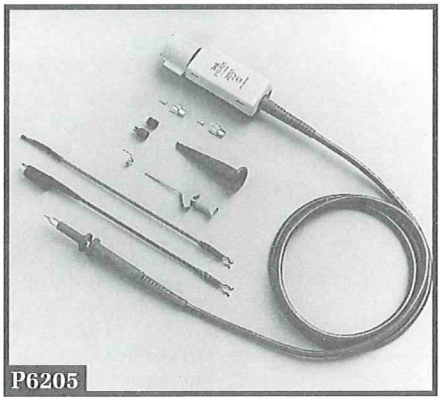
Input Coupling – AC, DC or GND.

AC Coupled Low Frequency Limit – <10 Hz when AC , 1 MΩ coupled. <200 kHz when AC, 50 Ω coupled.

Channel Isolation – >100:1 at 100 MHz and >30:1 at BW for any two channels having equal V/div settings.



A wide selection of application notes and technical briefs have been written to help ease your understanding and use of specific instrument features. Contact your local sales office for details.



Accessory

P6205

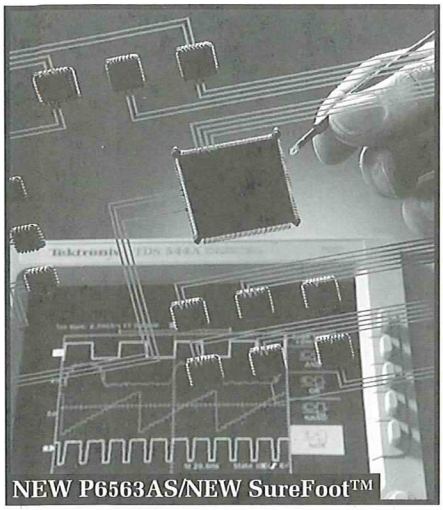
Lower Circuit Under Test Loading

- FET Probe performance at a lower cost
- <2 pF/1 MΩ provides lower circuit loading than conventional passive probes
- Wide bandwidth (DC to 750 MHz)

For complete selection information on all Accessory products, see page 446.

TDS 684A
TDS 644A
TDS 640A
TDS 620A

Digitizing Oscilloscopes



Accessories

P6563AS

Direct Access to SMD Packages

- SMD package support: 50 mil, 25 mil JEDEC, 0.65 mm, 0.5 mm EIAJ
- Low mass probe body and cable system
- DC to 500 MHz bandwidth, 5 pF/9.5 MΩ loading, 20X attenuation

P6245

Active FET Probe for SMDs

- Low DUT loading (≤1 pF/1 MΩ)
- Low mass probe head/cable
- 1.5 GHz bandwidth

SureFoot™

Easier Access to SMT Circuitry

- Handheld probing made easier
- No shorting
- No slipping off
- Direct tip connection

For complete selection information on all Accessory products, see page 446.

ORDERING INFORMATION

TDS 684A
5 GS/s, 1 GHz, 4 Channel **$29,495**

TDS 644A
2 GS/s, 500 MHz, 4 Channel **$19,895**

TDS 640A
2 GS/s, 500 MHz, 4 Channel **$18,250**

TDS 620A
2 GS/s, 500 MHz, 2 Channel **$11,995**

All Include (except where noted): Four Each P6205 FET Probes (TDS 644A/TDS 640A); Two Each P6205 FET Probes (TDS 620A); Reference Manual (TDS 644A/640A/620A: 070-8711-01,TDS 684: 070-8999-00); User Manual (TDS 644A/640A/620A: 070-8711-01, TDS 684A: 070-8991-01); Programmer's Manual (070-8709-04); Front Cover (200-3696-00); North American Power Cord (161-0230-01); Accessory Pouch (TDS 684A: 016-1268-00).

Opt. 05 – Video Trigger, NTSC, PAL, HDTV, FlexFormat™ ..... **+$1,495**

Opt. 13 – (TDS 640A/620A only) RS-232C/Centronics Hardcopy Ports ..... **+$495**

Opt. 1F – (TDS 640A/620A only) 3.5 in. 1.44 MB Floppy Drive ..... **+$495**

Opt. 1K – Model K420 Instrument Cart ..... **+$730**

Opt. 1R – Rackmount Kit ..... **+$400**

Opt. 2D – (TDS 620A only) Delete Standard Two P6205 Probes ..... **–$1,190**

Opt. 22 – (TDS 620A only) Add Two P6139A 10X Passive Probes ..... **+$560**

Opt. 23 – (TDS 620A only) Add Two P6205 10X, 2pF FET Probes ..... **+$1,190**

Opt. 24 – (TDS 684A/644A/640A only) Add Four P6139A 10X Passive Probes ..... **+$1,120**

Opt. 25 – (TDS 644A/640A only) Add Four P6563AS 20X SMD Probes ..... **+$825**

Opt. 26 – (TDS 684A only) Add Four P6245 1 GHz, 1pF FET Probes ..... **+$5,580**

Opt. 2F – (TDS 640A/620A only) Advanced Waveform DSP Math ..... **+$995**

Opt. 2P – (TDS 684A/644A only) Color Printer, Tektronix Phaser™ 200e Thermal Wax Transfer ..... **+$2,695**

Opt. 4D – (TDS 644A/640A only) Delete Standard Four P6205 Probes ..... **–$2,380**

Opt. 95 – Calibration Data Report ..... **+$150**

Opt. 96 – Calibration Certificate ..... **+$50**

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**

Opt. A2 – UK 240 V, 50 Hz ..... **NC**

Opt. A3 – Australian 240 V, 50 Hz ..... **NC**

Opt. A4 – North American 240 V, 60 Hz ..... **NC**

Opt. A5 – Switzerland 220 V, 50 Hz ..... **NC**

See General Customer Information Section for additional description.

SERVICE ASSURANCE OPTIONS

Opt. R2 – Adds two years of post-warranty Repair Protection
TDS 620A ..... **+$400**
TDS 640A/644A/684A ..... **+$590**

Opt. C5 – Adds five years of Calibration Services
TDS 620A ..... **+$1,050**
TDS 640A/644A/684A ..... **+$1,225**

PRODUCT UPGRADES

Advanced DSP Math – FFT, integration, differentiation. For TDS 620/620A or TDS 640/640A. Order TDS6F2F **$1,295**

Hardcopy I/O Ports – RS-232 and Centronics. For TDS 620/620A or TDS 640/640A. Order TDS6F13 ..... **$595**

Disk Drive – 3.5 in., 1.44 MB DOS format. For TDS 620/620A or TDS 640/640A. Order TDS6F05 ..... **$1,995**

Video Trigger – NTSC, PAL, HDTV, and FlexFormat™. For any TDS 600/600A Series. Order TDS6F1F **$595**

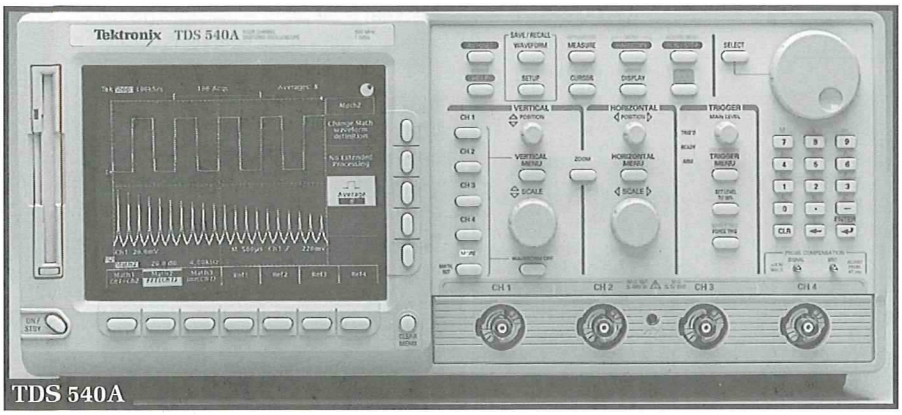
Video Clamp Pod – Back pouch clamp. Included in TDS6F1F. Order 013-0278-00 ..... **$335**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 — The TDS Series complies with IEEE Standard 488.2-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 — Tektronix Measurement products are manufactured in ISO registered facilities.

Digitizing Oscilloscopes



TDS 540A

The TDS 500A is the world standard for digitizing oscilloscopes, having been awarded EDN magazine's prestigious 1993 Product of the Year award. The TDS 500A Series is excellent for circuit design, R&D, manufacturing test, and telecommunication applications.

Characteristics

MAXIMUM SAMPLE RATE

	TDS 520A/524A	TDS 540A
Single Channel	500 MS/s	1 GS/s
Dual Channels	250 MS/s	500 MS/s
Four Channels		250 MS/s

TIME BASE SYSTEM

Time Bases – Main, Delayed.

Time/Division Range – 500 ps to 10 s/div.

Time Base Accuracy – ±25 ppm over any interval ≥1 ms.

Record Length – TDS 520A/524A: 500 to 15,000 pts. (50 K pts. optional). TDS 540A: 500 to 50,000 pts.

Pre-Trigger Position – 0 to 100% of record.

Delay Between Channels – ≤250 ps (Any two channels with equal V/div and coupling).

CONFIGURATION

Feature	TDS 520A/540A	TDS 524A
Monitor	Mono	Color
VGA-out	Mono	Color
Floppy Drive	Optional	Standard
DSP Math	Optional	Standard
RS-232 and Centronics	Optional	Standard

SIGNAL ACQUISITION SYSTEM

	TDS 520A/524A	TDS 540A
Channels	2 + 2 auxiliary	4
Samplers	2	4
Bandwidth	500 MHz	500 MHz
Sensitivity		
CH 1, CH 2	1 mV to 10 V/div	1 mV to 10 V/div
CH 3, CH 4	–	Same as CH 1 and CH 2
AUX 1, AUX 2	100 mV, 1.0 V, 10 V/div	–
Position Range	±5 Divisions	±5 Divisions
Offset		
CH 1, CH 2	±1 V from 1 to 99.5 mV/div ±10 V from 100 mV to 995 mV/div ±100 V from 1 to 10 V/div	±1 V from 1 to 99.5 mV/div ±10 V from 100 mV to 995 mV/div ±100 V from 1 to 10 V/div
CH 3, CH 4	–	Same as CH 1 and CH 2
AUX 1, AUX 2	100 mV/div ±5 V 1 V/div ±5.0 V; 10 V/div ±50 V	–

TDS 540A/TDS 524A/ TDS 520A

- 500 MHz Bandwidth
- Sample Rates to 1 GS/s
- 2 and 4 Input Channels
- Pulse Width, 2 ns Glitch, Runt, Pattern and State Triggering
- HDTV Video Triggering
- 1 mV/div to 10 V/div Sensitivity
- Infinite and Variable Persistence Displays
- Record Lengths to 50,000 Points
- 8-bit Vertical Resolution and Up to 12-bit Resolution with Hi-Res Acquisition Mode
- 1% Vertical Accuracy
- FFT, Integration and Differentiation
- 25 Automatic Measurements
- 500 MHz Standard Probes
- Color Monitor
- 3.5 in. DOS Format Floppy Drive
- VGA-Output to External Monitor
- Waveform Pass/Fail Testing
- 3 Year Warranty

General purpose oscilloscopes designed to keep pace with evolving needs in digital design as well as manufacturing test, R&D and telecommunication applications.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The TDS Series complies with IEEE Standard 488.2-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

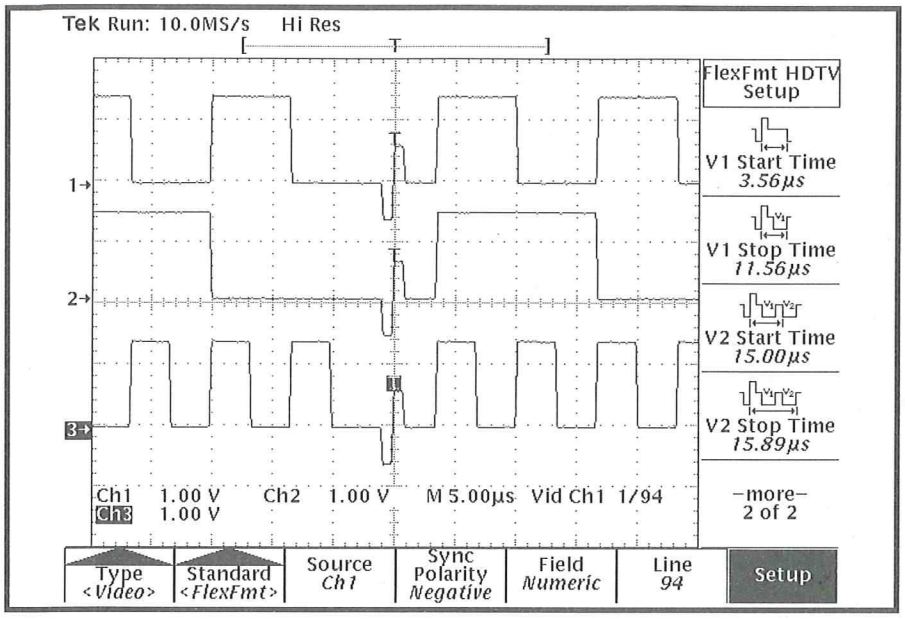
Tektronix Measurement products are manufactured in ISO registered facilities.

APPLICATIONS

- **Digital Design and Debug**
- **Analog Design and Debug**
- **Manufacture Testing**
- **Research**

TDS 540A
TDS 524A
TDS 520A

Digitizing Oscilloscopes



VERTICAL SYSTEM

DC Gain Accuracy – ±1.0%.

Vertical Resolution – 8-bits (256 levels over 10.24 vertical divisions). >12-bits with Hi-Res mode, 11-bits with averaging.

Analog Bandwidth Selections – 20 MHz, 100 MHz, and full (except Aux. 1 and Aux. 2 on TDS 520A/524A are full BW only).

Input Coupling – AC, DC or GND.

Input Impedance Selections – 1 MΩ in parallel with 10 pF, or 50 Ω (AC and DC coupling).

Maximum Input Voltage – ±400 V (DC + peak AC). Derate at 20 dB/decade above 1 MHz. 1 MΩ or GND coupled.

Channel Isolation – >100:1 at 100 MHz and >30:1 at bandwidth for any two channels having equal V/div settings.

AC Coupled Low Frequency Limit – ≤10 Hz when AC 1 MΩ coupled. ≤200 kHz when AC 50 Ω coupled.

Effective Bits – 5.0 (500 MHz @ 1 GS/s). Hi-Res: 6.7 (1 MHz @ 20 MS/s).

Step Response Settling – ≤0.5% Error within 20 ns of a ≤2 V step.

ACQUISITION MODES

4 ns Peak Detect, Sample, Single Sequence, Envelope, Average, Hi-Res, and FastFrame™.

TRIGGERING SYSTEM

Triggers – Edge (main, delayed), Pulse (width, 2 ns glitch, and runt), Logic (pattern and state), HDTV Video Optional.

Main Trigger Modes – Auto, Normal, Single.

Delayed Trigger – Delay by time, events, or events and time.

External Rear Input – (except TDS 520A/524A) >1.5 kΩ; Max input voltage is ±20 V (DC + AC peak).

DISPLAY

Waveform Style – Dots, vectors, variable persistence (color graded with TDS 524A, grey scaled with TDS 520A/540A), infinite persistence, and intensified real samples.

Waveform Capture Rate – (For 500 point waveforms with infinite persistence display mode selected) 130 waveforms per sec.

Format – YT, XY, ZOOM, and Fit-to-Screen.

Monochrome CRT Type (TDS 520A/540A) – 7 in. diagonal, magnetic deflection. Horizontal raster-scan. P4 White phosphor.

Color CRT Type (TDS 524A only) – 7 in. diagonal NuColor™ liquid crystal full-color shutter with 256 levels.

MEASUREMENT SYSTEM

Automatic Waveform Measurements – 25 (on entire record or in gated region).

Time Measurement Accuracy –
TDS 540A: <160 ps @ 1 GS/s.
TDS 520A/524A: <305 ps @ 500 MS/s.

Cursor Measurements – Absolute, Delta; volts, time, frequency. NTSC IRE units and line number with video trigger option.

Digitizing Oscilloscopes

WAVEFORM PROCESSING
Waveform Functions – Interpolation (sin(x)/x or linear), Average, Envelope, Autosetup.

Advanced Waveform Functions (Optional on TDS 520A/540A) – FFT, Integration, Differentiation, Waveform (math or acquired) Limit Testing.

Arithmetic Operations– Add, Subtract, Multiply, Divide, Invert.

HARDCOPY/DESKTOP PUBLISHING
Auxiliary Inputs/Outputs – Video output (15-Pin VGA, full color on TDS 524A, mono on TDS 520A/540A); External Trigger input; Main and Delay Trigger outputs; CH-3 Signal output (TDS 540A only).

Hardcopy Ports – GPIB, RS-232, Centronics.

Hardcopy Formats – Epson, ThinkJet, DeskJet, LaserJet, PostScript, TIFF, PCX, BMP, DPU 411/412, RLE, HPGL, Interleaf.

Floppy Drive (Optional on TDS 520A/540A) – 3.5 in. 1.44 MB or 730 kB DOS compatible.

COMPUTER INTERFACE
GPIB (IEEE 488.2) – Full Programmability.

STORAGE
Waveform Storage – NVRAM: Four 50 K pt. waveforms. 1.44 MB Floppy Disk: 1,436 50 K pt. to 119,008 500 pt. waveforms.

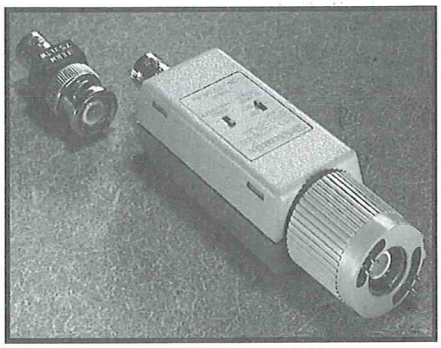
Setup Storage – 10 front panel setups.

POWER REQUIREMENTS
Line Voltage Range – 90 to 250 V RMS.

Line Frequency – 45 to 440 Hz.

Power Consumption – 300 W.

PROBES
Passive P6139A –
10 X, 8 pF, 500 MHz.



Accessory

P6563AS
- SMD package support: 50 mil, 25 mil JEDEC, 0.65 mm, 0.5 mm EIAJ
- DC to 500 MHz bandwidth, 5 pF/9.5 MΩ loading, 20X attenuation

For complete selection information on all Accessory products, see page 446.

ORDERING INFORMATION

TDS 540A
Four-channel Digitizing Oscilloscope **$14,340**

TDS 524A
Four-channel Color Digitizing Oscilloscope **$10,900**

TDS 520A
Two-channel Digitizing Oscilloscope **$8,895**
All include: Four Each P6139A 10X Passive Probes (TDS 540A); Two P6139A 10X Passive Probes (TDS 524A/TDS 520A); Quick Reference Guide (070-8711-01); User Manual (070-8710-01); Programmer's Manual (070-8709-01); Performance Verification Document (070-8712-01); Front Cover (200-3696-00); U.S. Power Cord (161-0230-01).

Opt. 05 – TV/HD Video Trigger ..... **+$1,495**

Opt. 13 – (TDS 540A/TDS 520A only)
RS-232/Centronics Hardcopy Port ..... **+$495**

Opt. 1F – (TDS 540A/TDS 520A only)
3.5 in. 1.44 MB Floppy Disk Drive ..... **+$495**

Opt. 1K – K420 Scope Cart ..... **+$695**

Opt. 1M – (TDS 524A/TDS 520A only)
50 K Point Record Length ..... **+$995**

Opt. 1R – Rackmount Kit ..... **+$400**

Opt. 2D – (TDS 524A/TDS 520A only)
Delete Two Standard P6139A Probes ..... **–$550**

Opt. 2F – (TDS 520A/TDS 540A only)
Advanced Waveform DSP Math ..... **+$995**

Opt. 2P – (TDS 524A only)
Tektronix Phaser™ 200e Color Printer ..... **+$2,695**

Opt. 4D – (TDS 540A only)
Delete Four Standard P6139A Probes ..... **–$1,100**

Opt. 22 – (TDS 524A/TDS 520A only)
Add Two Each P6139A Probes ..... **+$560**

Opt. 23 – Add Two P6205 Probes ..... **+$1,190**

Opt. 95 – Calibration Certificate ..... **+$150**

Opt. 96 – Calibration Data ..... **+$50**

RECOMMENDED ACCESSORIES
See page 446 for complete selection information.

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection
TDS 520A ..... **+$260**
TDS 524A/540A ..... **+$400**

Opt. C5 – Adds five years of Calibration Services
TDS 520A ..... **+$725**
TDS 524A/540A ..... **+$1,050**

INTERNATIONAL POWER PLUG OPTIONS
See General Customer Information Section for additional description.

PRODUCT UPGRADES
DSP Math – FFT, Integration, Differentiation
TDS 500A/TDS 500. Order TDS5F2F **$1,295**

Hardcopy Ports – RS-232/Centronics
TDS 500A/TDS 500. Order TDS5F13 ..... **$595**

Disk Drive – 3.5 in. Floppy TDS 500A. Order TDS5F05 ..... **$595**

Video Trigger – HDTV TDS 500A. Order TDS5F1F **$1,995**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The TDS Series complies with IEEE Standard 488.2-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

TDS 410
TDS 420
TDS 460

Digitizing Oscilloscopes

TDS 400 Scopes are ideal for precision analysis in biophysical and bio-medical research, electro-physical and electro-mechanical design, power-related measurements, electronic product service, and manufacturing test.

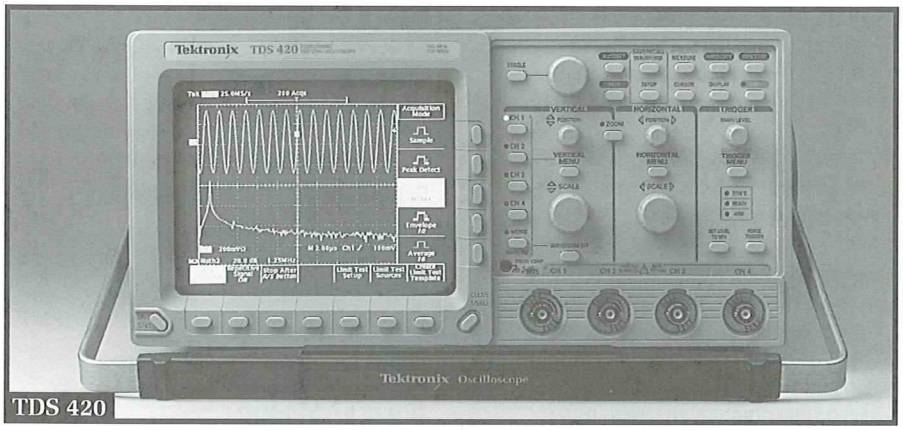
TDS 410/TDS 420/ TDS 460

- 150 and 350 MHz Bandwidths
- 100 MS/s Sampling Rate on 4 Channels
- 15 K Records Standard, 60 K Optional
- 1.5% Accuracy 1 mV/div – 10 V/div
- Proprietary Hi-Res Mode for up to 12-bits of Single Shot Vertical Resolution
- Extended Waveform Math/FFT (Option)
- 10 ns Peak Detect Mode for Glitch Capture
- 25 Automatic Measurements
- Pass/Fail (Template) Waveform Testing
- Roll and Triggered Roll Modes
- RS-232 and Centronics Type Interfaces
- Tek Secure®

DIFFERENTIAL MEASUREMENTS

- ADA400A Analog Differential Amplifier (10 µV/div sensitivity)
- P5200 High Voltage Differential Probe (up to 1300 V) for floating measurements

(Please see pages 501 and 502 for details on ADA400A and P5200)



The 4 channel TDS 420.

TDS 400 Digitizing Oscilloscopes

For demanding precision measurement applications requiring high accuracy and acquisitions confidence, the simple to use portable TDS 400 family offers a choice of two channel and four channel models ranging from 150 to 350 MHz. 100 MS/s on all channels coupled with a choice of FFT Math, Video, Long Record Length options makes analysis work extremely simple.

Characteristics

SIGNAL ACQUISITION SYSTEM

Bandwidth – 150 MHz (TDS 410, TDS 420), 350 MHz (TDS 460).

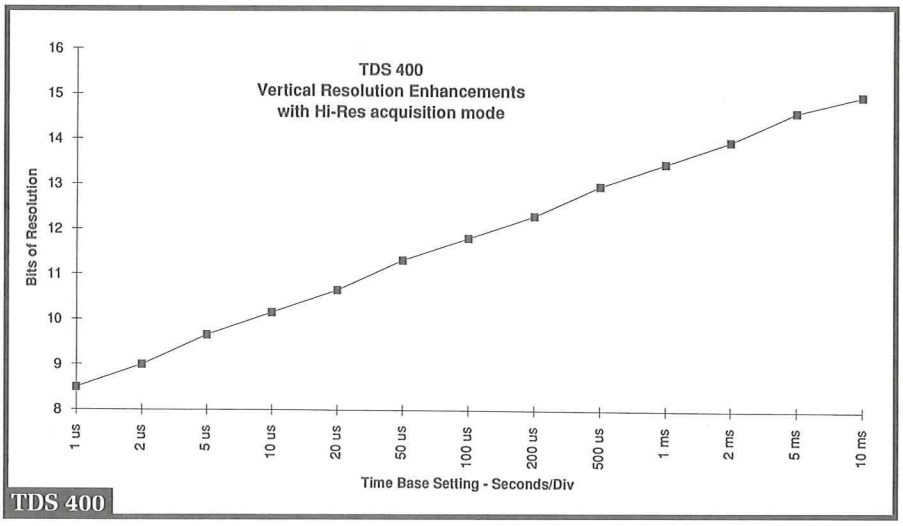
Channels – 4 (2 on TDS 410).

Digitizers – 4 (2 on TDS 410).

Sample Rate – 100 MS/s on all channels.

Sensitivity – 1 mV to 10 V/div (with calibrated fine adjust).

Position Range – ±5 Divisions.



Theoretically achieveable resolution with TDS 400 Hi-Res Mode.

APPLICATIONS

- **Biophysical Research**
- **Biomedical Research**
- **Electrophysical and Electromechanical System Design**
- **Audio System Measurement and Analysis**
- **Manufacturing Test and Quality Control**
- **Power Supply and Power-related Design**
- **Product Service and Maintenance**

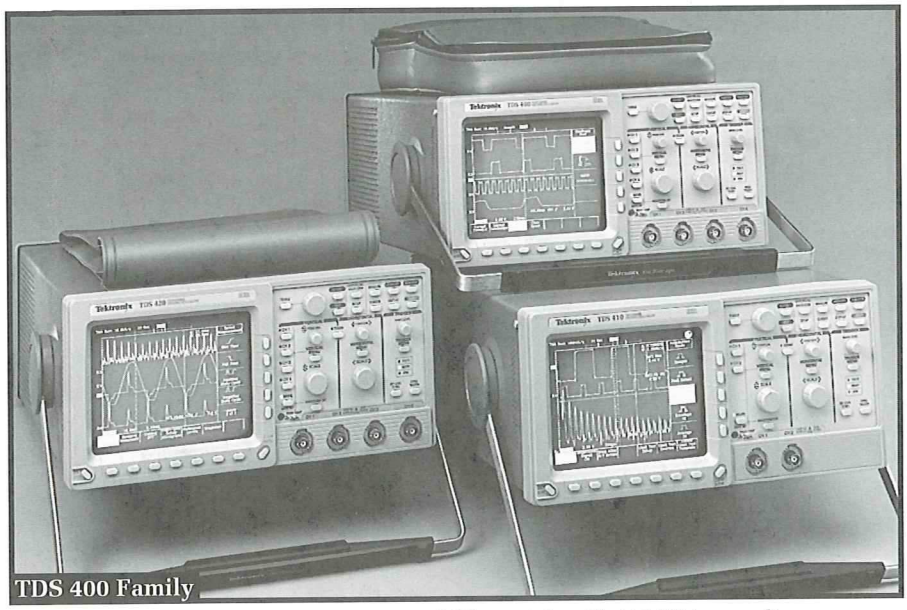
Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The TDS Series complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

Digitizing Oscilloscopes

TDS 410
TDS 420
TDS 460



The TDS 400 Family offers 150 MHz to 350 MHz models with 100 MS/s sampling on all channels.

Offset Range – ±1 V from 1 to 99.5 mV/div; ±10 V from 100 mV to 995 mV/div; ±100 V from 1 to 10 V/div.

DC Gain Accuracy – ±1.5%.

Vertical Resolution – 8-bits (256 levels over 10.24 vertical divisions).

Analog Bandwidth Selections – 20 MHz, 100 MHz, and full.

Input Coupling – AC, DC or GND.

Input Impedance Selections – 1 MΩ in parallel with 15 pF, or 50 Ω (AC and DC coupling).

Maximum Input Voltage – ±400 V (DC + peak AC). Derate at 20 dB/decade above 1 MHz. 1 MΩ or GND coupled.

Channel Isolation – >100:1 at 100 MHz for any two channels.

AC Coupled Low Frequency Limit – ≤10 Hz when AC 1 MΩ coupled. ≤200 kHz when AC 50 Ω coupled.

ACQUISITION MODES

Peak Detect – High frequency and random glitch capture. Captures glitches of 10 ns using acquisition hardware at all real-time sampling rates.

Sample – Sample data only.

Envelope – Max/min values acquired over one or more acquisitions, selectable from 2 to 2000, infinite.

Average – Waveform averages selectable from 2 to 10,000.

Hi-Res – Vertical resolution improvement and noise reduction on low-frequency signals, e.g.12-bits at 10 ms/div and slower. Enhanced vertical resolution (>12-bits) for noise reduction, on low frequency signals. Make precise low-level signal measurements (up to 5 µV) with differential amplifier (ADA 400A).

TIME BASE SYSTEM

Time Bases – Main, Delayed.

Time/Division Range – 1 ns to 20 s/div.

Time Base Accuracy – 0.005% over any interval ≥1 ms.

Record Length (real time and equivalent time) – Sample points per channel: 500 to 15,000. Opt. 1M offers 60,000 points.

Pre-Trigger Position – Selectable from 0 to 100% of record.

TRIGGERING SYSTEM

Triggers – Main, Delayed.

Main Trigger Modes – Auto, Normal, Single Sequence.

Delayed Trigger – Delayed by time or events.

Time Delay Range – 0 ns to 20 s.

Events Delay Range – 2 to 10,000,000 events.

External Rear Input – >1.5 kΩ; Max input voltage is ±6 V (DC + AC peak).

Video Trigger Types – NTSC, PAL, SECAM, and Custom; TV Field, field 2 or both, Any line within a field. Line Rates –10 kHz to 64 kHz, interlaced, non-interlaced, composite.

Video Trigger Sensitivity – 0.6 divisions of composite sync will achieve a stable display.

DISPLAY

Waveform Style – Dots or vectors. Infinite and variable persistence from 250 ms to 10 s.

Gray Scaling – With variable persistence selected, waveform points gradually decay through 16 levels of intensity, providing "z-axis" information about rapidly changing waveforms.

Update Rate – 200 ea. 500 point waveforms per sec with infinite persistence mode selected.

Graticules – Full, grid, cross hair, frame.

Format – YT and XY.

VGA Out – Drives VGA display monitors.

ZOOM

The zoom feature allows waveforms to be expanded, compressed and positioned in both vertical and horizontal axes. Allows precise comparison and study of fine waveform detail without affecting ongoing acquisitions. When used with Hi-Res or Average acquisition modes, Zoom provides an effective vertical dynamic range of 1000 divisions or 100 screens.

MEASUREMENT SYSTEM

Automatic Waveform Measurements –

Period	Frequency
High	Low
+ Width	– Width
Maximum	Minimum
Rise	Fall
Peak to Peak	Amplitude
+ Duty cycle	– Duty cycle
+ Overshoot	– Overshoot
Propagation delay	Burst Width
Mean	Cycle Mean
RMS	Cycle RMS
Area	Cycle Area
Phase	

Continuous update of up to four measurements on any combination of waveforms.

Thresholds – Settable in percentage or voltage.

Gated – Any region of the record may be isolated for measurement using vertical bars.

Snapshot – Performs all measurements on any one waveform showing results from one instant in time.

Cursor Measurements – Absolute, Delta, Volts, Time, Frequency.

Cursor Types – Horizontal bars (volts); Vertical bars (time); paired; operated independently or in tracking mode.

Continued on next page.

TDS 410
TDS 420
TDS 460

Digitizing Oscilloscopes

WAVEFORM PROCESSING

Waveform Functions – Interpolate-selectable sin(x)/x or linear, Average, Envelope.

Advanced Waveform Functions – FFT, Integration, Differentiation (optional).

Arithmetic Operators – Add, Subtract, Multiply, Invert.

Autosetup – Single button, automatic setup on selected input signal for vertical, horizontal and trigger systems.

Waveform Limit Testing – Compares incoming waveform to a reference waveform's upper and lower limits.

COMPUTER INTERFACE

GPIB (IEEE 488.2) Programmability – Full talk/listen modes. Control of all modes, settings, and measurements.

HARDCOPY/DESKTOP PUBLISHING

Printer – HP ThinkJet, Epson, PostScript, Interleaf, DeskJet, LaserJet, TIFF, PCX, BMP (Microsoft Windows).

Plotter – HPGL.

Interface – GPIB standard.

Optional Hardcopy Interface – Centronics Type and RS-232.

Optional Printer Pack – 4 in. thermal printer and storage pouch.

STORAGE

Waveforms – 15,000 waveform points of non-volatile storage, 60,000 points optional.

Setups – 10 front-panel setups.

CRT

Type – 7 in. diagonal, magnetic deflection. Horizontal raster-scan. P31 green phosphor.

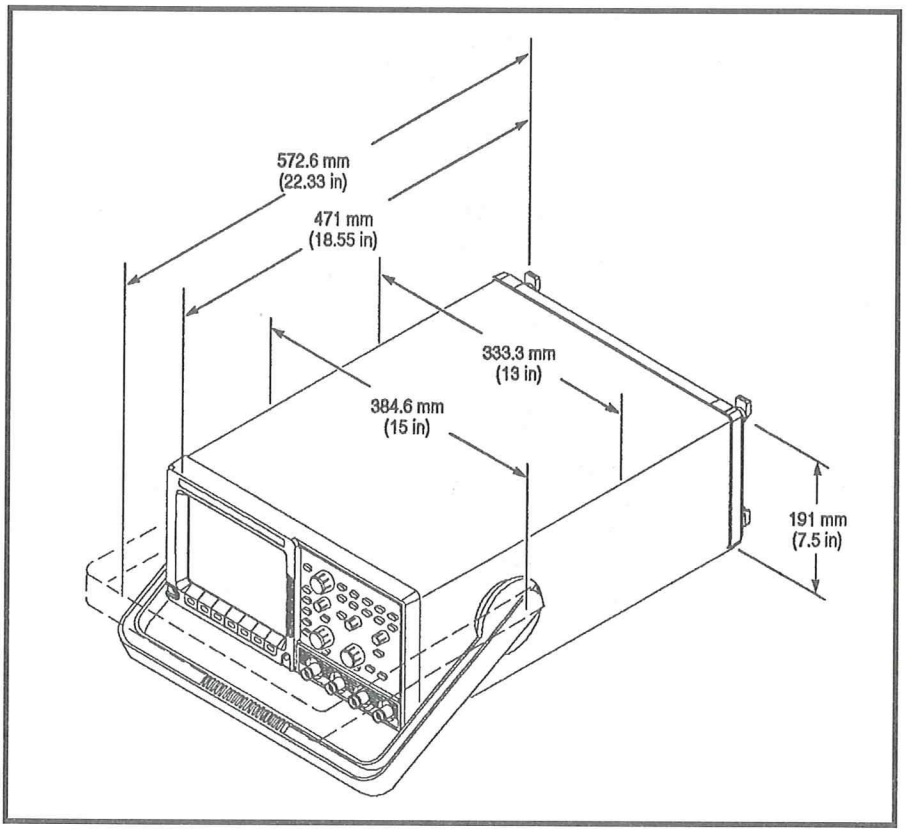
Resolution – 640 horizontal by 480 vertical displayed pixels.

POWER REQUIREMENTS

Line Voltage Range – 90 to 250 V RMS.

Line Frequency – 48 to 63 Hz.

Power Consumption – 240 W max.



TDS 400 Dimensional drawing.

ENVIRONMENTAL AND SAFETY

Temperature – Operating: 0°C to +50°C. Nonoperating: –40°C to +75°C.

Humidity – Operating and nonoperating: Up to 95% relative humidity at or below +40°C; to 75% relative humidity from +41°C to +50°C.

Altitude – Operating: 15,000 ft., nonoperating: 40,000 ft.

Electromagnetic Compatibility – Meets MIL-STD-461C, CE-03, Part 4, Curve # 1, RE-02, Part 7; meets VDE 0871, Category B, FCC rules and regulations, Part 15, Subpart J, Class A.

Safety – Listed UL 1244, certified to CAN/CSA – C22.2 No. 231-M89; Tektronix self-certification to comply with IEC 348 recommendations.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	164	6.4
w/acc. pouch	177	7.5
Width	362	14.25
Depth		
w/front cover installed	491	19.25
w/handle extended	576	22.2
Weight	**kg**	**lb.**
Net ≈	9.1	22.5
Shipping ≈	12.5	32

Digitizing Oscilloscopes

ORDERING INFORMATION

TDS 410
Two-channel Digitizing Oscilloscope.....**$4,950**

TDS 420
Four-channel Digitizing Oscilloscope **$6,295**

TDS 460
Four-channel Digitizing Oscilloscope **$7,495**
All include: Two P6138 10X Passive Probes; Reference Manual (070-8035-01); User Manual (070-8034-01); Programmer's Manual (070-8318-05); Performance Verification Document (070-8721-00); U.S. Power Cord (161-0230-01).

Opt. 02 – Front Cover and Accessories Pouch .....**+$60**
Opt. 05 – Video Trigger with Video Clamp Pod .....**+$995**
Opt. 13 – RS-232 and Centronics Type Hardcopy.....**+$495**
Opt. 1M – 60 K Point Record Length
TDS 460/TDS 420.....**+$995**
TDS 410 .....**+$740**
Opt. 1R – Rackmount.....**+$350**
Opt. 2A – Video Trigger and 60,000 Point Record Length
TDS 460/TDS 420 .....**+$1,500**
TDS 410.....**+$1,245**
Opt. 2F – Extended Waveform Math (FFT, Integration, Differentiation) .....**+$995**
Opt. 22 – Two Additional P6138 Probes .....**+$380**
Opt. 23 – Two P6205 FET Probes.....**+$1,190**
Opt. 25 – Four each P6562A SMD Probes (P6562AS).....**+$775**
Opt. 3P – Printer Pack with Thermal Printer and RS-232 & Centronics Type Interfaces .....**+$150**
Opt. 95 – Test Data .....**+$150**
Opt. 96 – Certificate of Traceable Calibration .....**+$50**

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz .....**NC**
Opt. A2 – UK 240 V, 50 Hz.....**NC**
Opt. A3 – Australian 240 V, 50 Hz .....**NC**
Opt. A4 – North American 240 V, 60 Hz .....**NC**
Opt. A5 – Switzerland 220 V, 50 Hz.....**NC**
See General Customer Information Section for description.

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection.....**+$260**
Opt. C5 – Adds five years of Calibration Services.....**+$725**

SOFTWARE
DocuWave™ – See page 73. Order S60DWAV.....**$195**
TDS Data Manager Software – For TDS 400, TDS 500A, TDS 600A, TDS 700A, and TDS 800 Series Oscilloscopes. For use on DOS computers that have National Instruments PCII/PCIIA GPIB cards. Does not support National Instrument PC-AT or PC-MC GPIB cards. Includes: Reference Manual.
Order S34TDS1. .....**$795**

PROBES
Active – 750 MHz, 2 pF/1 MΩ, 1.5 m. Order P6205 .....**$595**
Differential –
100 MHz, Active Differential, 6 ft. Order P6046.....**$2,395**

RECOMMENDED ACCESSORIES
Differential Amplifier – Order ADA 400A*1 .....*2
High Voltage Differential Probe – Order P5200*1.....*2
High Voltage –
100X, 250 MHz, 2500 V, 2.75 pF/10 MΩ, 9 ft.
Order P5100.....**$199**
1000X, 75 MHz, 20 kV, 3.0 pF/100 MΩ, 10 ft.
Order P6015A **$1,040**
SMD – 10X, 350 MHz. Four Probe Set. Order P6562AS **$775**
General Purpose –
1X, 15 MHz, 54 pF/1 MΩ, 2m. Order P6101B **$60**
10X, 350 MHz, 10.0 pF/10 MΩ, 1.3m. Order P6138 .....**$190**
50 Ω Divider – 50 Ω Inputs, 2 Tips: 10X, 100X.
10X: 3.5 GHz, 1 pF/500 Ω, 1.5m 100X: 3 GHz,
1.1 pF/5000 Ω, 1.5m. Order P6156 with Opt. 25.....**$350**
Logic – 20 MHz, 17-bit, Word Recognizer/Trigger.
Order P6408.....**$555**
Current –
(AC only), 120 Hz to 60 MHz, 7.5 A peak. Order P6021 .....**$575**
(AC only), 935 Hz to 120 MHz, 3 A peak. Order P6022 .....**$610**
(DC & AC), DC-50 MHz System, Includes AM503A, A6302 20A probe. Order AM503S.....**$2,795**

CARTS
Portable Instrument Cart – Order K212 .....**$420**

CAMERAS/HARDCOPY DEVICE
Camera – Order C9 with Opt. 1A and Opt. 04.....**$945**
Hood Adapter – Order 016-1154-00 .....**$75**
Plotter – with GPIB and Centronics Type Interface.
Order HC100 with Opt. 01 .....**$1,380**

ADDITIONAL ACCESSORIES
Video Display Clamp – Back Porch Clamp. Order 013-0278-00..**$335**
Power Strip – Four Outlet, 6 ft., Noise/Surge Suppression. Order 131-5342-00.....**$45**
Soft-sided Carrying Case – Order 016-1158-01 .....**$140**

**1 See pages 501 and 502 for detailed specifications on ADA400A and P5200.*
**2 Contact your Tektronix representative for price information.*

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The TDS Series complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

TDS 400 Measurement Solutions

ADA 400A

New ADA 400A adds microvolt differential and measurement capability to the TDS 400 Scope family; this combination is a valuable tool for vibration analysis, mechanical stress analysis, neuron firing, muscle fiber response, and low amplitude analog design.

P5200

High voltage elevated floating measurements to 1300 Volts.

Safely measure switching characteristics of power devices, characterize IGBTs, and test line powered devices.

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

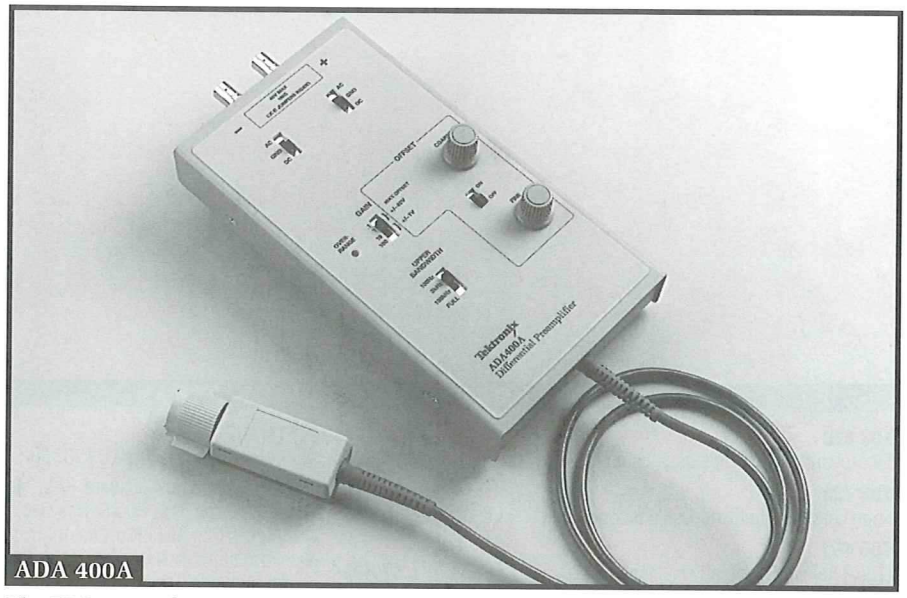
ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ADA 400A DIFFERENTIAL PREAMPLIFIER

- 10 µV Sensitivity (with 12-bits Resolution in Hi-Res Mode)
- Input R = 1 MΩ or selectable for ∞
- CMRR: DC - 10 KHz, 100dB (100,000:1); 100 kHz: 90 dB (31,000:1)

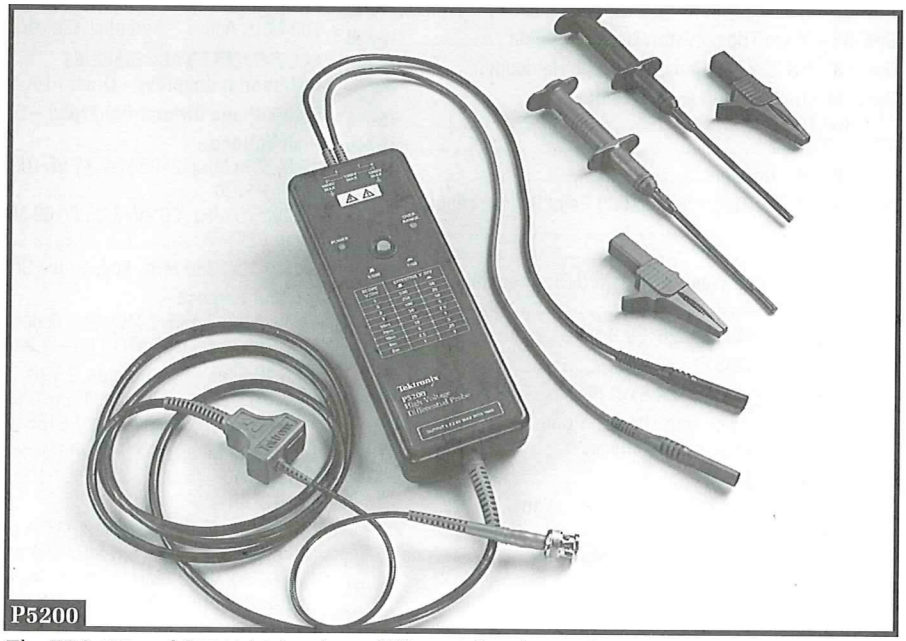


ADA 400A

The TDS 400 and ADA 400 Analog Differential Amplifier enable microvolt signal measurements (10 µV/div sensitivity) in noisy environments. This combination is well suited for bioscience and mechanical research applications. ***(See page 501 for details.)***

P5200 FLOATING MEASUREMENTS

- Maximum Differential Input Voltage: 1300 V
- Input R = 4 MΩ Each Input
- CMRR: DC: 60 dB (1,000:1); 1 MHz: 40 dB (100:1)
- Safety: UL 1244, CSA C22.2, IEC 1010
- No More Floating Your Scope
- Safe for User and DUT



P5200

The TDS 400 and P5200 high voltage differential probe combination ensures safe floating measurements up to 1300 V. This combination eliminates the dangerous practice of floating an oscilloscope when making certain high voltage measurements. ***(See page 502 for details.)***

APPLICATIONS

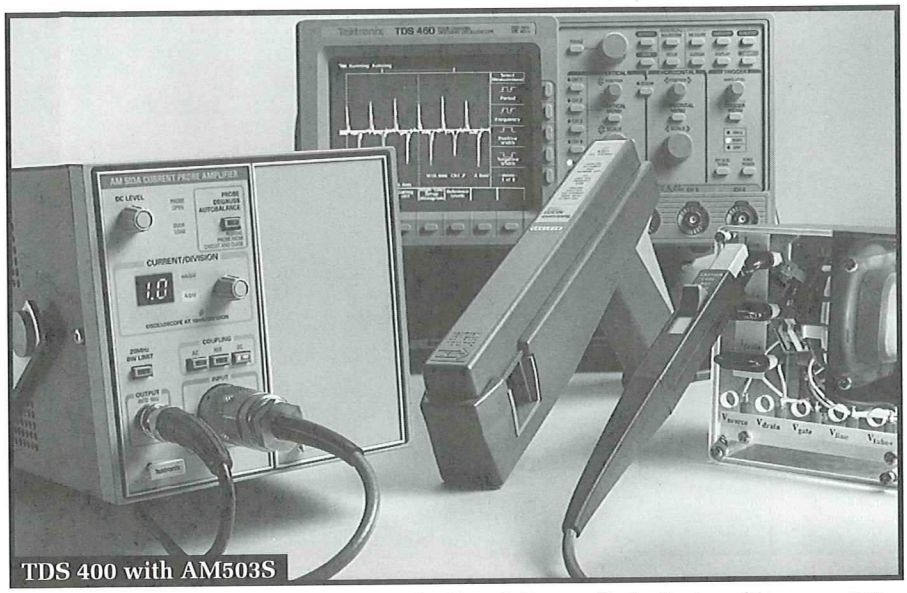
BIOPHYSICAL/BIOMEDICAL
ADA 400A Differential Preamplifier

- **Medical/Biophysical Research**
- **Mechanical Analysis**
- **Medical Equipment Design**
- **Audio Design**

DIFFERENTIAL INPUT
P5200 High Voltage Floating Measurements

- **Switching Power Supply Design**
- **Control System Design**
- **Electric Vehicle Design**
- **Motor Drive Design**

TDS 400 Measurement Solutions



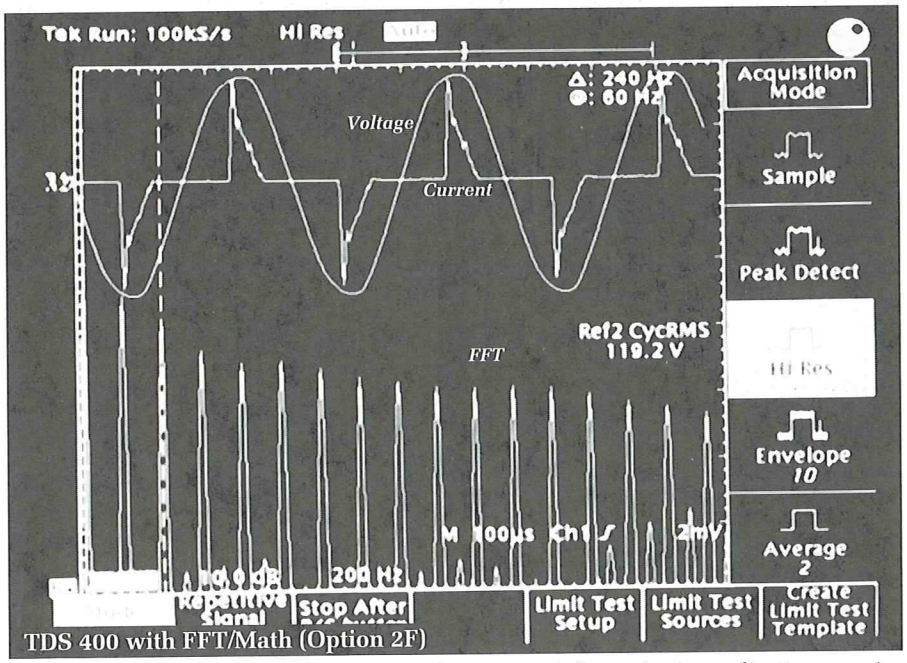
The TDS 400 Digitizing Oscilloscopes and AM503S Current Probe System. ***(See page 512 for details.)***

AM503S CURRENT MEASUREMENT SYSTEM

- DC to 50 MHz (20 A Continuous/ 100 A Peak) with A6302 Probe
- DC to 15 MHz (100 A Continuous/ 500 A Peak) with A6303 Probe
- DC to 2 MHz (500 A Continuous) with A6304XL Probe

AM503S

Well suited for measuring currents in switching power supplies, motor controllers and disk drives.



"Live FFT" provides real-time harmonic and resonance information in applications ranging from power supply design to vibrations and mechanical analysis.

FFT/MATH (OPTION 1F)

- Offers "Live" FFT with Windows
- Waveform Integration and Differentiation

FFT/Math (Option 1F)

Detailed waveform analysis in the frequency domain.

APPLICATIONS

CURRENT MEASUREMENT SYSTEMS
- **Broad Range of Current Measuring**
- **AC/DC Current**

MECHANICAL TESTING
- **Shock Testing**
- **Stress Analysis**
- **Vibrations**

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001

Tektronix Measurement products are manufactured in ISO registered facilities.

TDS 310
TDS 320
TDS 350

Digital Real Time Oscilloscopes

50 MHz, 100 MHz, and 200 MHz

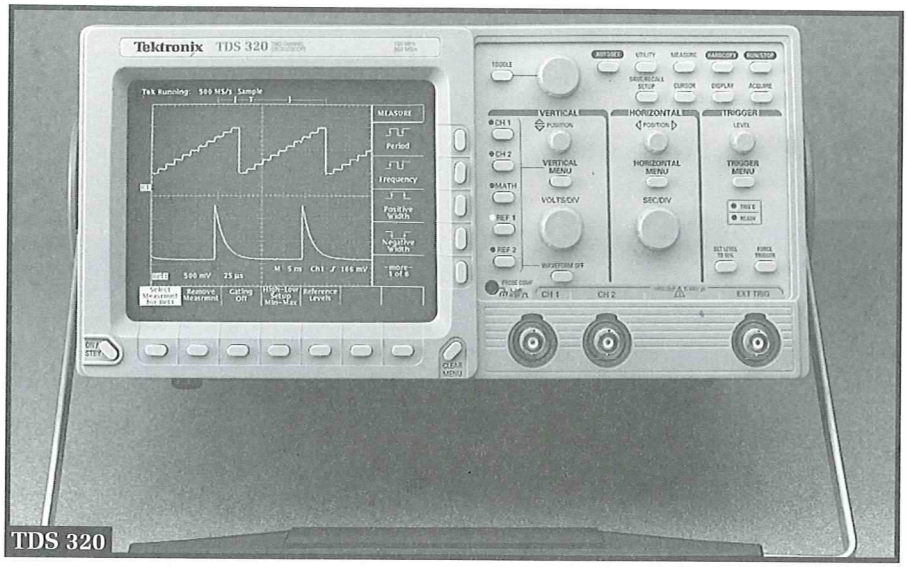
Acquire high speed transient or single-shot events to their full bandwidth and fastest sweep speed.

TDS 310
- 50 MHz Bandwidth
- 200 MS/s Sampling Rate

TDS 320
- 100 MHz Bandwidth
- 500 MS/s Sampling Rate

TDS 350
- 200 MHz Bandwidth
- 1 GS/s Sampling Rate

COMMON FEATURES
- Two Input Channels
- 2 mV/div to 10 V/div
- GPIB/RS-232 Programmability, Parallel Printer Interface and VGA Output with Opt. 14
- 8-Bit Vertical Resolution
- 1K Record Length
- Roll Mode
- Printer Pack Option
- Vector Accumulate and Dot Accumulate Display Modes
- 2% Vertical Accuracy
- 21 Automatic Measurements
- 10 ns Peak Detect Mode for High-Speed Glitch Capture
- Autosetup



TDS 320

TDS 300 Series

The TDS 300 Series redefines the low-cost digital oscilloscope. By sampling the signal at up to five times the analog bandwidth on both channels simultaneously, you can be assured of true acquisitions, minimizing aliasing or other digital sampling effects. Unlike other DSOs, the TDS 300 Series easily gathers enough samples to display waveforms accurately to their full bandwidth. They are the only scopes in their class that can reliably acquire high-speed transient or single-shot events to their fastest sweep speed.

Many low-cost DSOs offer only dot displays, which can be hard to interpret by those used to analog scopes. The TDS 300 Series has Dot, Dot Accumulate, Vector, and Vector Accumulate display modes – another advantage over the competition.

The Accumulate modes gather multiple waveforms for a user-defined time (500 ms to ∞), after which the screen is cleared. Vector Accumulate mode uses bright vectors to superimpose the current acquisition over the accumulated waveforms. Dot accumulate mode is recommended for viewing video and other complex waveforms. The display is erased at the time set or when the acquisition setting is changed. These modes are useful for doing worst-case analysis or signal monitoring. Long-term monitoring may be done easily by setting the erase time to infinity.

OVERSAMPLING MINIMIZES ALIASING

When aliasing occurs, the scope displays a waveform record with a lower frequency than the actual input signal. Aliasing occurs because the oscilloscope cannot acquire the signal fast enough to construct an accurate waveform record. To acquire a signal, it must be sampled at least twice as fast as the highest frequency component. For example, with a 500 MS/s sampling rate, the TDS 320 gathers two and a half times the number of samples needed to acquire a 100 MHz signal in real time, assuring users of accuracy up to the fastest sweep speed. This degree of oversampling not only minimizes aliasing, it provides a higher resolution waveform.

ACQUISITION POWER

With edge triggering and basic video triggering as standard features, the TDS 300 Series can capture the waveforms that designers and service technicians most need to see. In addition to 21 automatic waveform measurements, the TDS 300 Series offers four acquisition modes: Sample, Peak Detect, Envelope, and Average. Sample mode provides real-time sampling and has the highest throughput rate. Peak Detect locates glitches as small as 10 ns and reveals aliasing. Envelope mode, by including the highest and lowest points over many acquisitions, shows variations in the signal over time. Average mode uses several acquisitions to calculate an average value for each waveform point, reducing random noise in repetitive signals.

Continued on next page.

APPLICATIONS
- **Service**
- **Education**
- **Design**

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

GPIB IEEE-488 The TDS Series complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Digital Real Time Oscilloscopes

50 MHz, 100 MHz, and 200 MHz

TDS 310
TDS 320
TDS 350

ANALOG SIMPLICITY, DIGITAL PRODUCTIVITY
By balancing the use of on-screen menus with dedicated buttons and knobs, the user-friendly interface retains traditional analog simplicity yet gives quick access to the wide range of digital functions. Frequently used functions, like position and trigger level, are controlled directly with knobs; secondary functions are menu driven, eliminating the profusion of buttons found on most low-cost scopes.

This modern interface dramatically flattens the learning curve, appealing to users regardless of their digital experience. The TDS 300 Series interface simplifies scope operation without limiting the instrument's capabilities.

COMMUNICATION OPTION
The I/O Interface (Option 14) includes GPIB, RS-232 I/O interface and a Centronics-type parallel printer port. With this option you can use a remote computer to control the scope for automated testing, or to exchange waveform or measurement data for documentation and analysis. In addition, a VGA monitor output is provided for classroom viewing or other applications requiring a monitor.

Interleaf (.img), TIFF, PCX, BMP, and EPS file formats allow screen captures to be placed directly into desktop publishing documents. Or, at the push of a button, a screen shot can be output directly to a variety of compatible printers.

The Printer Pack, Option 3P, provides a single-handle solution to the portable printer problem. A quiet thermal printer, mounted in a pouch attached to the scope, makes clear four-inch hardcopies while you continue working. Option 14 is included in Option 3P.

For service, education, and design work, the TDS 300 Series is without peer among low-cost DSOs.

Characteristics

SIGNAL ACQUISITION SYSTEM
Bandwidth – 50 MHz (TDS 310), 100 MHz (TDS 320), 200 MHz (TDS 350).

Sample Rate – 200 MS/s on each channel (TDS 310), 500 MS/s on each channel (TDS 320), 1 GS/s on each channel (TDS 350).

Channels – Two identical channels, each with invert function.

Sensitivity – 2 mV to 10 V/div (with calibrated fine adjust).

Position Range – ±5 divisions.

Calibrated Offset Ranges –

V/div setting	Offset Range
2 mV – 99.5 mV/div	±1 V
100 mV – 995 mV/div	±10 V
1 V/div – 10 V/div	±100 V

DC Gain Accuracy – ±2%.

Vertical Resolution – 8-bits (256 levels over 10.24 vertical divisions).

ACQUISITION MODES
Sample, Envelope, Average, Peak Detect – High frequency and random glitch capture. Captures glitches as narrow as 10 ns using acquisition hardware at all time/div settings between 25 µs/div and 2.5 s/div (inclusive).

TIME BASE SYSTEM (MAIN AND DELAYED)
Time/Division Range – 10 ns to 5 s/div (TDS 310), 5 ns to 5 s/div (TDS 320), 2.5 ns – 5 s/div (TDS 350).

Record Length –1000 sample points per channel.

Time Base Accuracy – ±0.01%.

TRIGGERING SYSTEM (MAIN ONLY)
Trigger Types – Edge, Video.

Trigger Modes – Auto, Normal.

Video Trigger Types – Triggers on Field 1, Field 2, or Lines; from sync-negative composite video, 525 to 625 lines, 50 MHz to 60 Hz, interlaced or noninterlaced systems, such as NTSC and PAL.

DISPLAY
Vector – Connects sample points to display a continuous waveform.

Dots – Displays sample dots only.

Vector Accumulate Mode – Accumulates waveform points over a pre-set period of time (500 ms to ∞) and superimposes the current waveform with bright vectors.

Dot Accumulate Mode – Accumulates waveform points over a pre-set period of time (500 ms to ∞).

Format – YT and XY.

AUTOMATIC MEASUREMENTS
Period, Frequency, + Width, – Width, Rise Time, Fall Time, + Duty Cycle, – Duty Cycle, + Overshoot, – Overshoot, High, Low, Max, Min, Pk-Pk, Amplitude, Mean, Cycle Mean, RMS, Cycle RMS, Burst Width.

Cursors – Horizontal bars, vertical bars, paired (volts @ time).

Readouts – Absolute volts, Δ volts, time, and frequency.

WAVEFORM PROCESSING
Arithmetic Operators – Add, Subtract., Multiply.

Autosetup – Single button automatic setup on selected input signal for vertical, horizontal, and trigger systems.

OPT. 14 (I/O INTERFACE): COMPUTER INTERFACE AND HARDCOPY CAPABILITY
GPIB (IEEE-488.2) Programmability – Full talk/listen modes. Control of all modes, settings, and measurements.

RS-232 Interface Programmability – Full talk/listen modes. Control of all modes, settings, and measurements. Baud Rate up to 19,200. 9-Pin, DTE.

Video Output – Standard analog VGA output to external monitors.

Hardcopy Port – Centronics-type parallel or RS-232.

Graphics Interface File Formats – Interleaf (.img), TIFF, PCX (PC Paintbrush), BMP (Microsoft Windows), and Encapsulated Postscript (EPS).

Printer Formats – ThinkJet, DeskJet, LaserJet, Epson (9 & 24-Pin), Seiko DPU 411/II, DPU 412. DC power provided for Seiko printers.

WAVEFORM STORAGE
Waveforms – Two 1000 point reference waveforms.

Setups – 10 front-panel setups.

POWER REQUIREMENTS
Maximum Power Consumption – 65 watts.

MECHANICAL
Cooling Method – Forced air circulation with no air filter.

ENVIRONMENTAL AND SAFETY
Temperature –
–10°C to +55°C (operating);
–51°C to +71°C (nonoperating).

Humidity – Up to 95% RH at or below +40°C; up to 75% RH from 41°C to 55°C (operating and nonoperating).

Altitude – To 15,000 ft./4570 m (operating); To 40,000 ft./12,190 m (nonoperating).

Electromagnetic Compatibility – Meets EN50081-1; VFG 0243; FCC Rules and Regs, 47 CFR, Part 15, Subpart B, Class A.

Safety – UL 1244 Listed, Category Certified CAN/CSA C-22.2 no. 231 Series M89.

TDS 310
TDS 320
TDS 350

Digital Real Time Oscilloscopes

50 MHz, 100 MHz, and 200 MHz

PHYSICAL CHARACTERISTICS

	TDS 310/TDS 320/TDS 350		Rackmount	
Dimensions	**mm**	**in.**	**mm**	**in.**
Width with handle	362	14.25	483	19
Height with feet, pouch	191	7.5	–	–
without pouch	165	6.5	178	7
Depth (stand alone)	471	18.6	472	18.6
with front cover	490	19.3	–	–
with handle(s)	564	22.2	517	20.4
Weight	**kg**	**lb.**	**kg**	**lb.**
Stand alone	6.8	15	–	–
Net with accessories, cover and pouch	8.4	18.5	4.5*1	10*1
Domestic Shipping	12.7	28	14.5	32

*1 *Weight of conversion kit only.*

Accessory

DocuWave™ SOFTWARE (S60DWAV)

- Easy to use – learn in less than 30 minutes.
- Sends, receives, saves waveforms/settings for Tektronix DSOs and Digitizers with GPIB or serial interfaces.
- Sends formatted waveforms to: printer, spreadsheet, desktop publishing software.

See pages 73-75 for complete information on DocuWave™.

For complete selection information on all Accessory products, see page 446.

ORDERING INFORMATION

Contact your Tektronix representative for price and ordering information.

TDS 310 – 50 MHz Oscilloscope

TDS 320 – 100 MHz Oscilloscope

TDS 350 – 200 MHz Oscilloscope
Includes: Two P6109B 10X Probes (P6111B – TDS 350), Instruction Manual, Reference Guide, US Power Cord, XYZs of Analog and Digital Oscilloscopes

INSTRUMENT OPTIONS

Opt. 14 – I/O Interface (includes GPIB, RS-232 interfaces, VGA output and Centronics-type parallel port, plus Programmer Manual)

Opt. 3P – 120 V Printer Pack: includes Opt. 14, Thermal Printer, 5 rolls paper (006-7580-00), Pouch, Printer Cable

SERVICE ASSURANCE OPTIONS

These products covered by the following service assurance option

REP4300 – Provides One Year of Post-Warranty Repair Protection

CAL4300 – Provides One Year of Calibration Services

AVAILABLE ACCESSORIES

TD3F14A – Opt. 14 Field Upgrade Kit

TDS4F5P – 120 V Printer Pack Field Upgrade Kit (includes Pouch, requires Opt. 14)

TDS4F6P – 220 V Printer Pack Field Upgrade Kit (includes Pouch, requires Opt. 14) Digital Real Time Oscilloscope

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz

Opt. A2 – United Kingdom 240 V, 50 Hz

Opt. A3 – Australia 240 V, 50 Hz

Opt. A4 – North America 240 V, 60 Hz

Opt. A5 – Switzerland 220 V, 50 Hz

SOFTWARE

DocuWave™ – See page 73. Order S60DWAV

RECOMMENDED ACCESSORIES

See pages 446 for complete selection information.

PROBES

High Voltage – Order P5100
1X Passive. Order P6101B
1X-10X Switchable Passive. Order P6129B
TTL Logic – Order P6408
SMD – Order P6561AS
DC/AC Current Probe System – Order AM503S

CAMERAS/PRINTERS

Camera – C-9, Option 04, includes 016-1154-00 Hood.

Bubble Jet Printer – Order HC220

Thermal Printer Pack – Order TDS4F5P

CART

Order K212

ADDITIONAL ACCESSORIES

Soft-sided Carrying Case – Order 016-1158-00

Transit Case – Order 016-0792-01

Deluxe Transit Case with Retractable Wheels/Handle – Order 016-1157-00

Front Cover– Order 200-3232-01

Accessories Pouch – Order 016-1159-00

Rackmount Kit – Order 016-1166-00

Cables, RS-232 –
To connect to a computer with a 9-Pin RS-232 connector, 2M, null modem. Order 012-1379-00
To connect to a computer with a 25-Pin RS-232 connector, 1M, null modem. Order 012-1380-00
To connect to a RS-232 printer or plotter, 9ft., 25-Pin, straight through. Order 012-1398-00

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Scope Data Management Software

DocuWave™ Software

New DocuWave™ makes publishing and archiving your waveform information simple. Using an intuitive user interface, turn waveforms captured on almost any Tektronix digital storage oscilloscope into a desktop publishing image, an export file that's readable by an analysis program, or a hardcopy. This DOS application will run on just about any PC compatible.

Images, waveforms, and scope setups can be stored and recalled with simple mouse selections. DocuWave™ provides six capabilities that are essential for documentation and archival of captured waveform data:

- Saves images for desktop publishing
- Outputs images to a printer or plotter
- Reads waveforms from most popular Tektronix digital scopes using GPIB or RS-232 interfaces with full Talk-Listen modes
- Exports waveforms to be imported by analysis and spreadsheet programs
- Displays up to four waveforms with cursors and graphic zoom
- Sends waveforms back to the scope

DOCUMENT THE REAL WORLD

Image Is Everything

The signals that you capture on your digital scope represent test results. They can be used as illustrations for articles, data sheet images or other important information that needs to be documented. DocuWave™ saves screen images in popular graphic formats including TIFF, PCX, BMP, HPGL, and Postscript. If the scope has image formats (e.g., TDS Series), the scope image can also be saved from within DocuWave™.

Many word processing, drawing, and presentation programs will directly import these images to be manipulated, stored and printed along with the rest of the document. Figure 1 shows a DocuWave™ image that was directly imported into a word processing program.

DocuWave™

- Publish Waveform Screen Images Easily
- Print Images to a Wide Variety of Printers and Plotters
- Read Waveforms from Most Tektronix Digital Scopes
- Save and Recall Waveforms
- Export Waveform Data for Easy Importation by Analysis and Spreadsheet Programs
- Save and Recall Scope Settings
- Graph Up to Four Waveforms on the PC Monitor with Cursors and Zoom

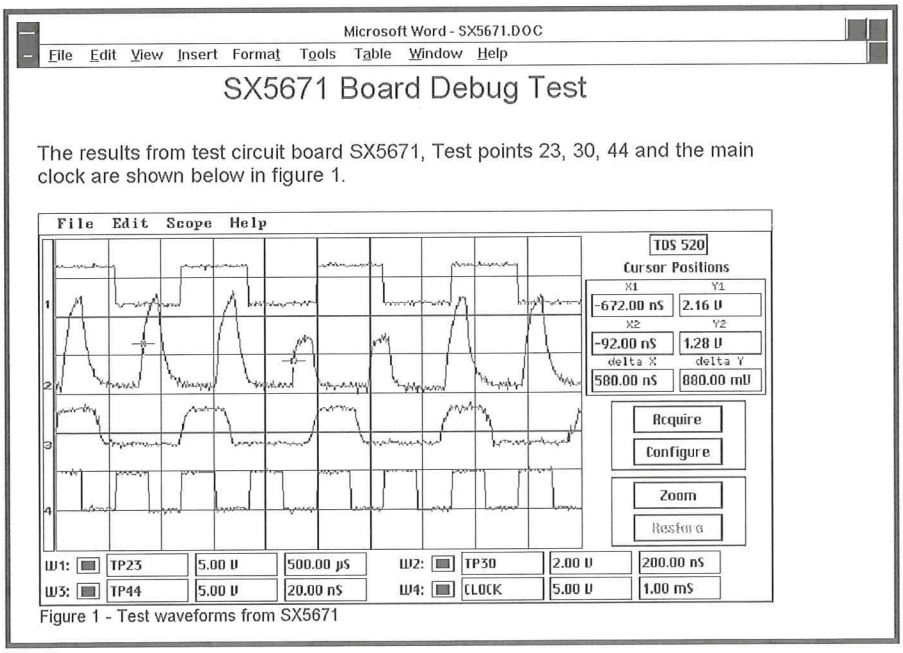


Figure 1. DocuWave™ screen image in word processing document.

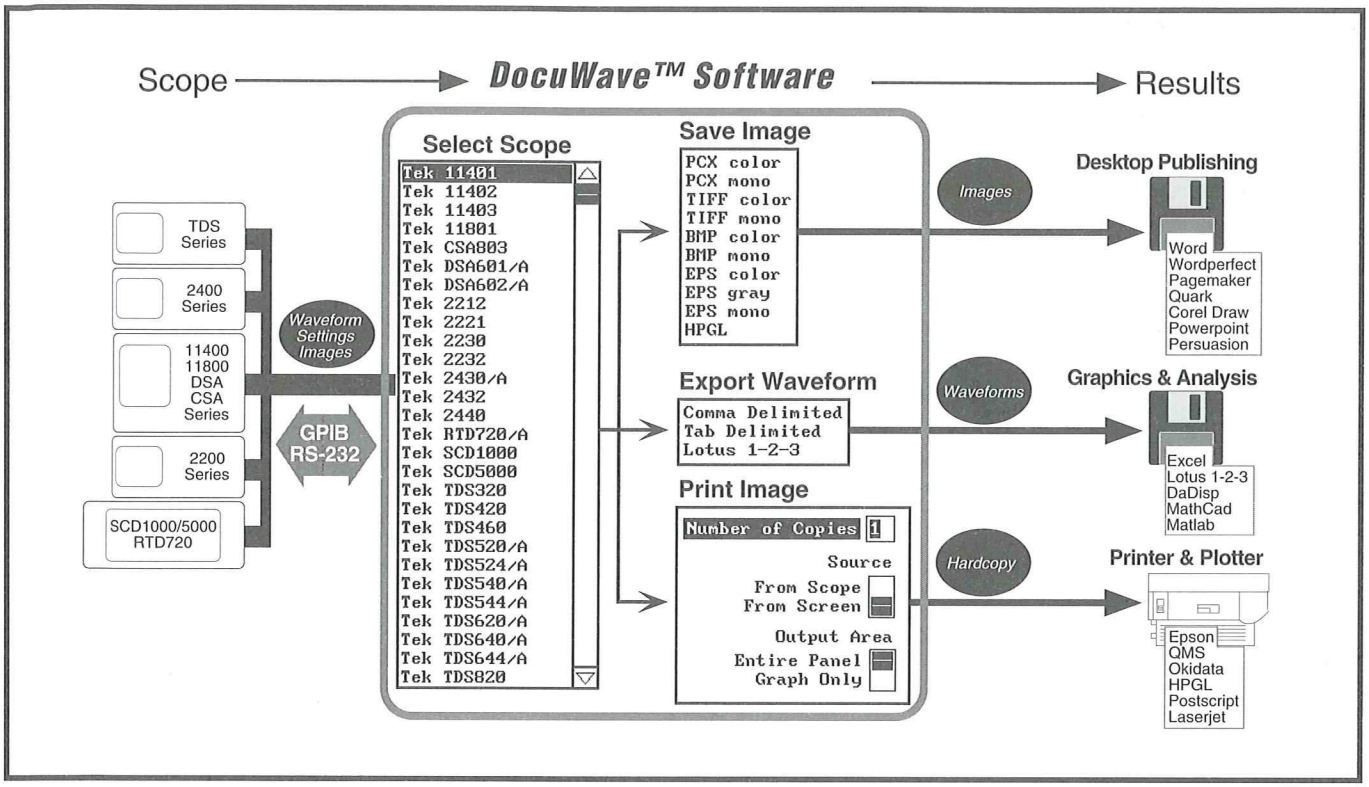
Makes publishing and archiving your waveform information simple.

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

DocuWave™

Scope Data Management Software



HARDCOPY THAT'S NOT HARD

DocuWave™ can print to popular printers like Epson, Okidata, HP, NEC and plotters using the serial, parallel or GPIB port on your PC. If your scope has printer formats, you can also print the scope images through DocuWave™.

SO MANY SCOPES, ONLY ONE SOFTWARE NEEDED

Changing from one scope to another is simple. Let's say that you have a 2340 and a TDS 320 scope. To switch between them, simply pull down a menu and select the scope you want. GPIB and RS-232 interfaces with full Talk-Listen modes are supported; you can select the instrument interface best suited for your application.

Scope Data Management Software

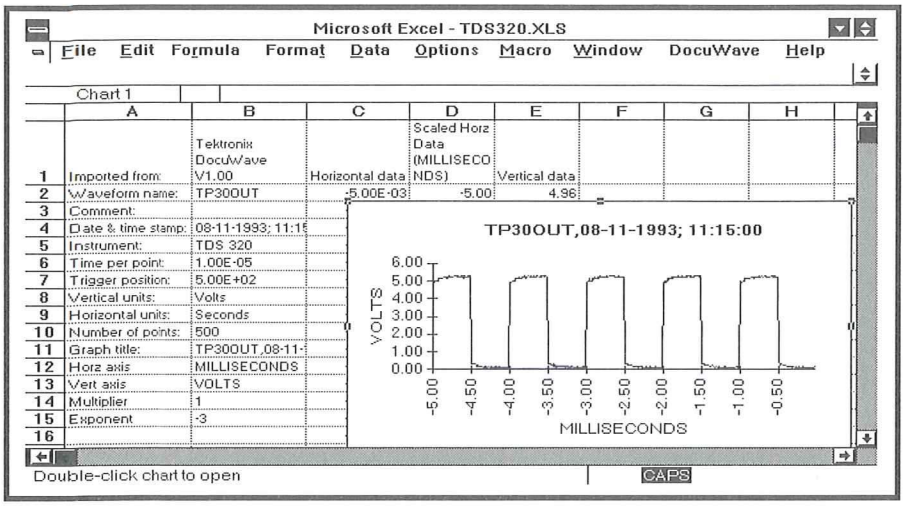


Figure 2. Exported DocuWave™ waveform in spreadsheet

EXPORT WITH NO TARIFFS

Waveform data can be exported as tab/comma delimited ASCII text or Lotus 1-2-3 format for importation into analysis and graphics programs. These programs provide additional capabilities that manipulate, analyze and graph the data while providing additional measurements like Fast Fourier Transform (FFT), pulse parameter analysis, differentiation, and more. Figure 2 shows a waveform that was imported into a spreadsheet.

DISPLAY AND MEASURE WITH EASE

Up to four waveforms can be displayed on your PC screen. DocuWave's drag-zoom and absolute/delta cursors allow you to view and measure intricate details of the information you have captured. Each waveform can have an eight-character label attached to it so hard-copies and images have names you recognize.

CONCLUSION

DocuWave™ is the only software you need to turn the waveforms you have captured on your digital storage oscilloscope into the final result, be it a waveform image that's incorporated into a word processing document or waveform data that is imported into an analysis program.

Characteristics

Minimum Computer Configuration: IBM PC compatible with DOS 3.2 or greater, ≥540 K of free memory, ≥1 MB free hard disk space, EGA/VGA display. National Instruments IEEE-488.2 interface card if using GPIB.

Please Note: Older GPIB interface cards do not support the IEEE-488.2 standard. They can be traded in for a new card by calling National Instruments at 1-800-433-3488.

Instrument Interface Support: GPIB, National Instruments IEEE-488.2 and RS-232 interfaces with full Talk-Listen modes.

Desktop Publishing Formats: Monochrome and color TIFF, monochrome and color PCX, monochrome and color BMP, monochrome, greyscale and color EPS, and HPGL.

Printer/Plotter Support: A wide variety of popular printers and plotters are supported on RS-232 or parallel interfaces.

Waveform Export Formats: Tab delimited ASCII text (.TAB), Comma delimited ASCII text (.CSV) and Lotus 1-2-3 format (.WK1).

DIGITAL OSCILLOSCOPES SUPPORT

11K/DSA	GPIB	RS-232
11401	Y	Y
11402	Y	Y
11403	Y	Y
11801	Y	Y
11802	Y	Y
CSA803	Y	Y
DSA601/A	Y	Y
DSA602/A	Y	Y
2200/2400	**GPIB**	**RS-232**
2212	Y /Opt. 10	Y /Opt. 12
2221/A	Y /Opt. 10	Y /Opt. 12
2230	Y /Opt. 10	Y /Opt. 12
2232	Y /Opt. 10	Y /Opt. 12
2430/A	Y	N
2432	Y	N
2440	Y	N
RTD/SCD	**GPIB**	**RS-232**
RTD720/A	Y	N
SCD1000	Y	N
SCD5000	Y	N
TDS	**GPIB**	**RS-232**
TDS310	Y /Opt 14	Y /Opt 14
TDS320	Y /Opt 14	Y /Opt 14
TDS350	Y /Opt 14	Y /Opt 14
TDS420	Y	N (Printer Only)
TDS460	Y	N (Printer Only)
TDS520/A	Y	N (Printer Only)
TDS524/A	Y	N (Printer Only)
TDS540/A	Y	N (Printer Only)
TDS544/A	Y	N (Printer Only)
TDS620/A	Y	N (Printer Only)
TDS640/A	Y	N (Printer Only)
TDS644/A	Y	N (Printer Only)
TDS684/A	Y	N (Printer Only)
TDS820	Y	N (Printer Only)
THM	**GPIB**	**RS-232**
THM550	N	Y
THM560	N	Y
THM565	N	Y
THM571 (ET2020)	N	Y

ORDERING INFORMATION

S60DWAV
DocuWave™ Software on 3.5 in. and 5.25 in. Floppies with user manual **$195**

S60G210
DocuWave™ Software Bundled with National Instruments PC GPIB IEEE 488.2 Interface Card **$495**

S60G220
DocuWave™ Software Bundled with National Instruments AT GPIB IEEE 488.2 Interface Card. **$595**

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

11000, DSA, CSA Series Digitizing Oscilloscopes

11000 Series

The Tektronix 11000 Series is a powerful set of analysis tools that alters your fundamental expectations of an oscilloscope. Most revolutionary is the simplification and automation of the entire measurement and analysis process. Accuracy, sensitivity, bandwidth, offset, and overdrive recovery are provided by a well-planned instrument family having plug-in versatility and performance. Multiprocessor architecture allows for simultaneous display of up to eight waveforms and up to six dynamic, "live" measurement readouts. The automation needs of scientific and production environments are easily met by integrating these instruments into a measurement system through RS-232-C or GPIB interfaces.

DSA Series

The Digitizing Signal Analyzer (DSA) Series incorporates a dedicated digital signal processor, (DSP) making it the most powerful instrument in the 11000 Series. The power of this new class of instrument is two-fold: It provides the fastest and most accurate real-time digitizer, and it provides signal processing capability previously found only in large computer systems. The dedicated DSP allows simultaneous real-time FFT and time domain display, fast averaging at 180 waveforms/second, signal dejitter, and much more.

CSA Series

The Communications Signal Analyzer (CSA) Series offers signal analysis and the powerful measurement capabilities required to analyze high-speed digital communication signals. Features of the CSA 803A and CSA 404 include histograms, mask testing, and a color-graded display, allowing you to perform accurate measurements such as jitter, noise, and phase.

11000, DSA, CSA SERIES SELECTION GUIDE

11400 Series	High Accuracy	11403A
11800 Series	High Bandwidth, High Resolution, High Accuracy	11801B
CSA Series	High-speed, Digital/Optical, Communications, TDR (CSA 803A)	CSA 803A CSA 404
DSA Series	High-speed, Single-shot with DSP	DSA 602A

CONTENTS

11000 SERIES OSCILLOSCOPES/PLUG-INS

11403A 3 GHz Color 84
11000/DSA Series Plug-in Amplifiers 90
11801B 12.5 to 50 GHz Digital Sampling.....97
IPA310A Interconnect Parameter Analyzer.....102
11801B/CSA 803A Sampling Heads.....106

DSA SERIES DIGITIZING SIGNAL ANALYZER

DSA 602A 1 GHz.....80

CSA SERIES COMMUNICATIONS SIGNAL ANALYZERS

CSA 404 3 GHz Color.....350
CSA 803A Up to 50 GHz Color.....346
CSA 907A Bit Error Rate Tester 364

ACCESSORIES

Probes 450
SMD Adapters.....474
Probe and Instrument Accessories.....486
Plotter/Printer 524
Cameras.....526
Instrumentation Carts 528

11000 Series DSA Series CSA Series High Performance Digitizing Oscilloscopes

A technology for every application.

Power and flexibility through modular architecture.

11403A
- 3 GHz Bandwidth
- 10-Bit Vertical Resolution
- Up to 12 Acquisition Channels
- Powerful Processing

11801B
- DC to 50 GHz Bandwidth (7 ps Rise Time)
- 8 Channels, Expandable to 136
- Automatic Statistical Measurements, Histograms and Mask Testing

DSA 602A
- 1 GHz Bandwidth
- 2 GS/s Single-shot Acquisition
- Fast and Extensive Signal Processing

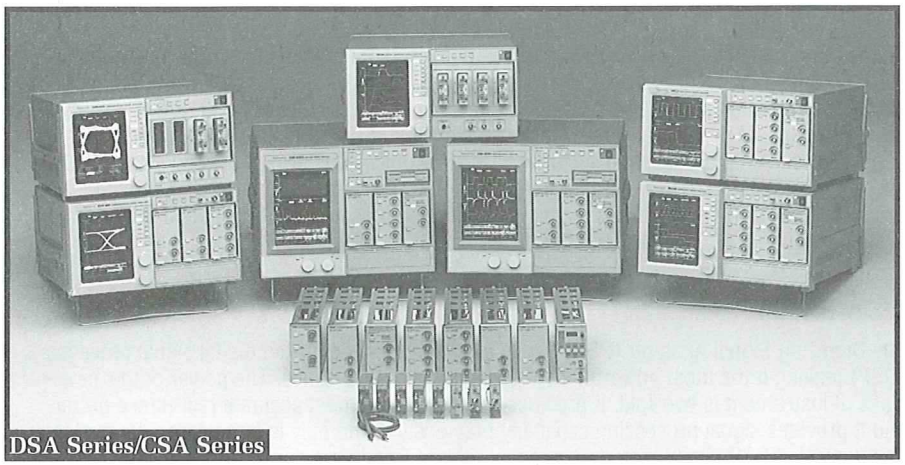
CSA 404
- Input Signal Conditioning
- 3 GHz Bandwidth

CSA 803A
- DC to 50 GHz Bandwidth (7 ps Rise Time)
- High Resolution and Repeatability
- Automatic Statistical Analysis
- 38 Standard Communication MASKS
- 10 GHz Triggering
- TDR and FFT

CSA 907A
- SDH/SONET, FDDI Pattern Generation
- 150 kHz to 700 MHz Internal PLL Clock Source
- PRBS Patterns: $2^{(7,15,17,20,23)}-1$
- Optional 128 Kbit Programmable Word Memory
- PC Based Frame Editing Software

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 11000, DSA, CSA Series complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.


DSA Series/CSA Series

11403A

The 11400A Series Digitizing Oscilloscopes use Random equivalent-time sampling technology to digitize and display repetitive signals with up to 14-Bit resolution and 1% vertical accuracy. Continuously updated measurements and statistics provide the confidence required in automated test environments.

11801B

The 11801B uses sequential equivalent-time sampling technology to achieve bandwidths of up to 50 GHz. Sampling head modularity provides a variety of acquisition methods including TDR, optical coupling, loopthrough sampling, low-noise sampling, triggering, and probe sampling. Up to 136 channels of acquisition and TDR measurements can be achieved with an 11801B. The 11801B provides the highest timing resolution and measurement repeatability of any of the 11000 Series.

DSA 602A

Providing real-time digitizing at 2 GS/s, the Digitizing Signal Analyzers are the most powerful members of the 11000 Series. These instruments contain a dedicated digital signal processor that processes waveforms at unprecedented speeds.

The DSA offers live FFT, signal dejitter, fast averaging at more than 180 waveforms per second, and more. For the highest level of performance in single-shot acquisition and signal processing, the DSA Series provides the measurement solution.

CSA 404 and CSA 803A

The CSA 404 and CSA 803A Communications Signal Analyzers are designed for viewing communication signals up to 3 GHz and 50 GHz respectively.

Histogram, masking testing, and a colorgraded display are included to form an ideal tool for analyzing eye diagrams.

The CSA 803A provides many automatic measurements analyses, including Extinction Ratio, FFT, and Autoset to industry standard Masks. The CSA 803A offers TDR, 10 GHz triggering and 2.0 ps RMS jitter (1.3 ps typical).

CSA 907A

The CSA 907A Bit Error Rate Tester is a stimulus-response system that features a high-speed serial pattern generator, the CSA 907A Tx, and a companion error detector, the CSA 907A Rx. Each unit is portable, and can be used in a lab, in production testing, or field environment. The CSA 907A Bit Error Rate Tester can be used to evaluate transmission quality of high-speed modules and systems for a variety of testing applications, including SDH/SONET, FDDI, and satellite communications.

ACCURACY

Measurement accuracy sets the 11000 Series apart from all other oscilloscopes. The analog input circuitry is the most advanced in any oscilloscope–digital or analog. The plug-in amplifiers are built to maintain signal integrity over a wide dynamic range. The 11000 Series delivers accuracy across widely varying conditions of signals and settings; you don't have to worry about whether you're viewing your signal or seeing the oscilloscope's amplifier anomalies.

The Enhanced Accuracy feature of the 11000 Series provides worry-free and effortless automatic internal calibration of the instrument. The instruments continually monitor themselves for accuracy.

High Performance Digitizing Oscilloscopes

FLEXIBILITY AND POWER

The 11000 Series provides plug-in versatility. Nine plug-in amplifiers, ten sampling heads, and a variety of probes are currently available to tailor a signal conditioning solution to your measurement needs.

Whether it is multi-channel (up to 136), 50 Ω/1 MΩ inputs, differential, high bandwidth or optical, the 11000 Series of oscilloscopes offers more versatility than any other oscilloscope. No other oscilloscope can provide the performance, accuracy, sensitivity, bandwidth, filtering, offset, or overdrive recovery of the 11000 Series amplifiers and probes.True dual time bases let you view portions of a waveform at much higher resolution than the main trace. This provides measurement flexibility and improved accuracy. Record lengths (up to 32 K points in the DSA 600A) can be specified separately for main waveforms and window waveforms, as the application dictates. Two windows allow you to view and measure two separate events at fast sweep speed, improving the accuracy of measurements of those events.

The DSA 600A Series uses the Tektronix TriStar™ Digital Signal Processor (DSP). These processors provide unsurpassed signal acquisition and analysis. This not only yields very fast waveform update rates, but also provides the power to define and display, at "live" speeds, new waveforms based on complex mathematical relationships to other waveforms. Nowhere else will you find this power and flexibility.

The CSA 803A and CSA 404 offer histograms and mask testing to specifically perform the measurements on signals that are typical in communication applications. Histograms are powerful measurement tools for measuring jitter and noise. Mask testing is a very beneficial tool in ATE applications for measuring noise margin and jitter tolerance.

The CSA 803A includes outstanding analysis and acquisition capabilities including FFT, Extinction Ratio, 38 industry standard Masks (CCITT + ANSI), TDR, 10 GHz triggering and 1.3 ps RMS (typical) jitter.

DIGITAL SIGNAL PROCESSING

The 11000 Series provides capability far beyond the basic four math functions of +, –, x, and ÷. It also provides more complex waveform processing such as differentiation, integration, square root, logarithms and more. In all, more than ten different signal processing options are available. The DSA 600A Series with its TriStar™ Digital Signal Processor provides 14 different options, including averaging at 180 waveforms per second, signal 2, "live" FFT, and single-shot smoothing.

The architecture has the power to display these defined waveforms in real time and make measurements directly on the complex waveforms.

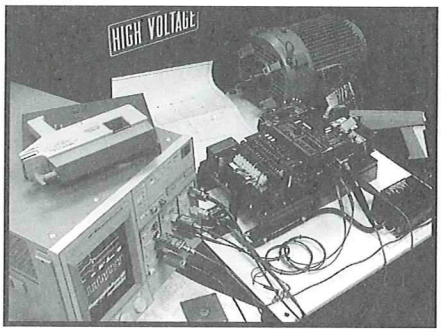
AUTOMATION

Each 11000 Series Oscilloscope provides both RS-232-C and IEEE 488 Standard interfaces. The 11000 Series provides ideal solutions for both low cost benchtop automation and rackmount production applications.

Tektronix offers several compatible software packages to support the 11000 Series in scientific and production applications. Scientists will find that the series is supported by many of the most popular controllers and software packages. Template software from Tektronix supports both process and production environments.

HARDCOPY SUPPORT

You can also print date and timestamped copies of the screen at the push of a button or a bus command, using Tektronix color printers, Tektronix HC100 plotter, Epson printer, Centronics printer, HP Inkjet/Laserjet printers or HPGL plotters. Support for electronic import of hardcopies is also provided.



11000 SERIES SELECTION GUIDE

Instrument	Bandwidth	Maximum # of Channels	Sample Rate	Maximum Record Length	Vertical Resolution	Digitizing Technology
DSA 602A	1 GHz	1 to 8	2 GS/s	3 K	8-Bits	–
11801B	50 GHz	136	200 kS/s	5 K	8-Bits	sequential
CSA 803A	50 GHz	4	200 kS/s	5 K	8-Bits	equivalent time
11403A/CSA 404	3 GHz	1 to 8	20 MS/s	10 K	10-Bits	random

Accessory

A6302/A6303/P6135A

Voltage times Current = Power

- Capture current with the A6302 or A6303 and an 11A16
- Capture voltage with a P6135A pair combined with an 11A33

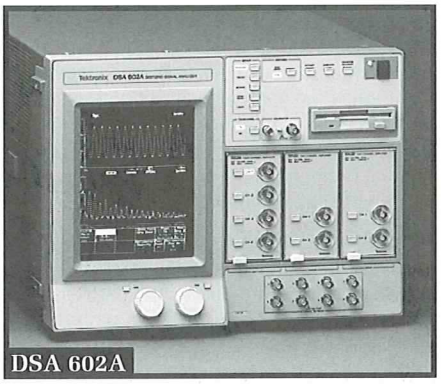
For complete selection information on all Accessory products, see page 446.

Digitizing Signal Analyzers

The DSA 600A Series Analyzers provide the ultimate combination of signal acquisition, processing and display performance for repetitive and high-speed transient-capture applications.

DSA 602A

- 1 GHz Bandwidth
- 1 mV/Div to 10 V/Div
- 2 GS/s Sampling Rate
- 150 MHz Differential Amplifier
- 50 MHz Current Amplifier
- Multi-standard Video Trigger
- Bandwidth and Number of Channels Are Based on Amplifier Selected
- Operating Mode and Amplifiers Selected Determine Number of Channels That Can Be Acquired



DSA 602A

The DSA 602A Digitizing Signal Analyzers provide the ultimate combination of signal acquisition, processing and display performance for repetitive and high-speed transient-capture applications.

Their 1 GHz bandwidth, 2 GS/s single-shot sample rate, long waveform memory, 1 to 8 channel versatility and superb amplifier performance capture events with unsurpassed accuracy. Sophisticated signal processing features transform and combine signals to reveal key phenomena at visually live speeds. The DSA often replaces combinations of instruments through its plug-in flexibility and high-speed signal processing and display features.

In research applications, the DSA provides the bandwidth, sample rate and signal fidelity necessary to deliver accurate results. Signal processing features such as FFT and histograms present the data in the most revealing formats. For circuit design and system debugging, the sophisticated trigger system quickly isolates anomalies such as runt pulses, metastable logic states, setup/hold time violations and slew-rate errors.

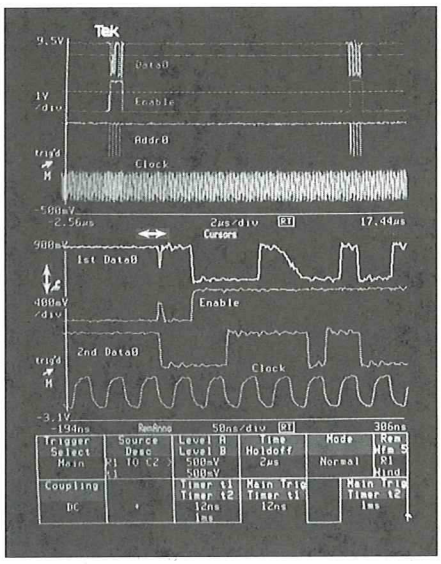


Figure 1. Isolate setup/hold time violations, metastable states and glitches quickly with time-qualified triggering. Apply the window time base to zoom in for more details. Signal paths are time-matched to probe tips for accuracy.

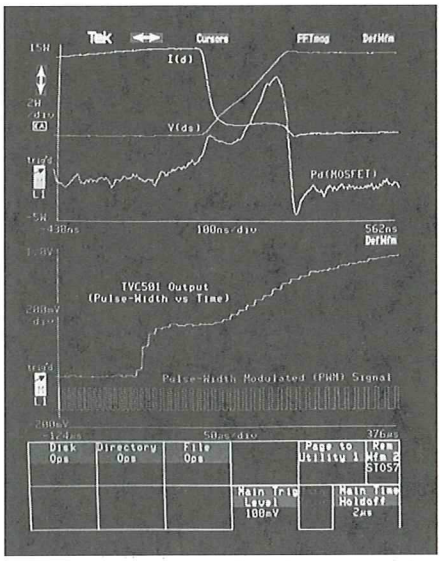


Figure 2. Capture periodic or transient current and voltage signals and accurately compute instantaneous power. Apply FFT to examine harmonics or switching noise. The TVC 501 directly demodulates pulse-by-pulse PWM.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The DSA Series complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

APPLICATIONS

- **Research**
- **Design and Debug**
- **Characterization**
- **Automated Testing**

Digitizing Signal Analyzers

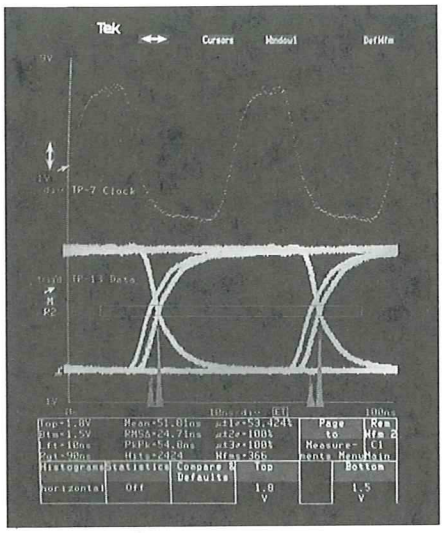


Figure 3. Analyze digital communications using variable persistence display modes. View in X-Y format for constellation display. Apply horizontal or vertical histograms to analyze jitter. Use cross-correlation for accurate propagation time measurements in extreme-noise environments.

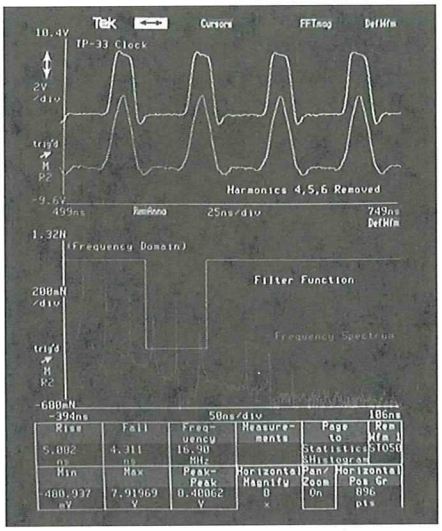


Figure 4. Apply signal processing to perform simulations. Edit the frequency spectrum of a live signal by multiplying its FFT by a filter function. Transform the result back to time-domain using FFT and see the effects of the digital filter on the live signal. Convolution is also available for filtering.

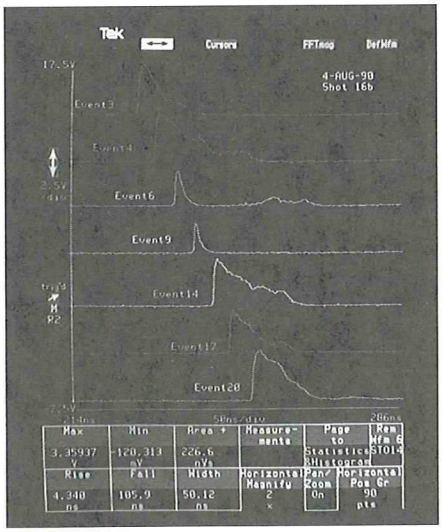


Figure 5. Rapidly capture a sequence of transient events and store them in non-volatile memory. Scan for significant events and apply measurements to individual waveforms or the entire collection. Annotate, hardcopy and transport publication-ready results on 1.44M MS-DOS compatible floppy disk.

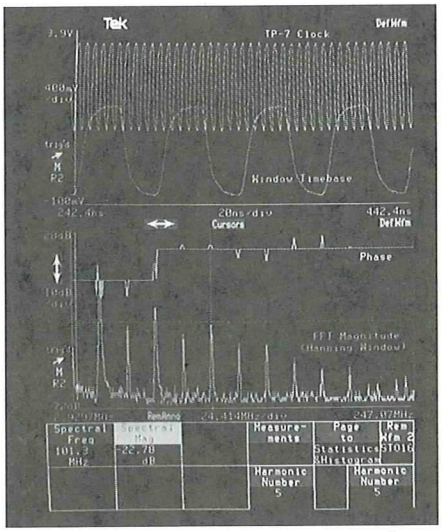


Figure 6. Simultaneously view time and frequency-domain displays of signals at live speeds. Apply harmonic or peak-search cursors for efficient, high-accuracy readout of spectral magnitudes and frequencies. Display magnitude and phase information for repetitive or transient events.

In sequential event applications such as pulsed-laser, radar and ultrasonics, partitioned, non-volatile memory captures each event for further analysis. Display-scan events from memory to find and analyze significant features or examine statistics of the entire collection to determine trends. Transport publication-ready results with the built-in floppy disk.

QUICKSTART TRAINING PACKAGE
QuickStart contains application examples and is a complete and portable training package. It can serve several users for thorough self-study or as a quick, easy reference.

The package comes complete with the QuickStart board, workbook, board reference, and power plug. This package is available to purchasers at no additional charge.

Characteristics

VERTICAL SYSTEM
Delta DC Volt Accuracy – ≤1% for an 8-division signal.

Vertical Resolution – 8-Bits. Resolution can be increased to 14-Bits with signal averaging or smoothing.

Bandwidth – To 1 GHz. Determined by the plug-in used. See page 90.

Wide Dynamic Range – 1 mV/div to 10 V/div.

HORIZONTAL SYSTEM
Time Bases (Main and Window)
Sweep Speeds – 50 ps/div to 100 s/div.

Record Duration – 512 ps to 1024 s in 1-2-5 sequence.

Time Base Accuracy – +0.005%, –0.015%: 0 to 45°C. ±0.005%: 20° to 30°C.

Record Length – 512 to 32,768 pts (both single-shot and repetitive).

Sampling Rate – 2 GS/s max.

Main Record Positioning – The main record is positioned with respect to the main trigger point. At maximum pretrigger, all points except the last point in the main record precede the trigger point. At maximum post trigger, all points except the first point in the main record follow the trigger point.

Window Time Base – The main record plus two window records may be acquired and displayed. The window records may be different lengths and can have a different time/div than the main record.

Window Record Positioning – The window records may be positioned with respect to their own trigger points on the main record. Window triggers may be delayed from the main trigger by time or events.

Continued on next page.

DSA 602A

Digitizing Signal Analyzers

Multi-trace Pan and Zoom – Multiple traces may be panned and zoomed simultaneously.

Display Interpolation – Zoomed waveforms can be displayed using either sin (x)/x or linear interpolation, or using a dots-only display without any interpolation.

Waveform Memory – More than 210 K points of volatile memory shared between acquired and stored waveforms.

Settings Memory – Non-volatile memory for approximately five settings.

TRIGGERING SYSTEM

Range – ±Full Screen.

Bandwidth – 1 GHz max: 500 MHz for extended triggering.

Coupling and Sensitivity – DC Coupled: 0.4 div from DC to 10 MHz, increasing to 1 div at maximum trigger bandwidth.

DC Noise Reject Coupled: 1.2 divs from DC to 10 MHz, increasing to 3 divs at maximum trigger bandwidth.

DC HF Reject Coupled: 0.5 divs from DC to 30 kHz.

AC Coupled: 0.4 div from 60 Hz to 10 MHz, increasing to 1 div at maximum trigger bandwidth.

AC Noise Reject Coupled: 1.2 divs from 60 Hz to 10 MHz, increasing to 3 divs at max trigger bandwidth.

AC HF Reject Coupled: 0.5 div from 60 Hz to 30 kHz.

AC LF Reject Coupled: 0.5 div from 80 kHz to 10 MHz, increasing to 1 div at max trigger bandwidth.

Holdoff Range – Main Record Min: 2 µs or less; max: 500 s. Window Record Min: 35 ns; max: 1000 s.

WAVEFORM PROCESSING

Waveform Functions – Absolute value, average (exponential and summation), convolution, correlation, delay, dejitter, differentiate, envelope, exponential, FFT filter, FFT integrate, interpolate, logarithm, natural log, pulse, signum, smooth, and square root. Live waveforms can be changed by using adjustable parameters.

Arithmetic Operators – Add, subtract, multiply and divide.

FFT – Magnitude and phase; real and imaginary; inverse FFT, correlation, and convolution; six window functions; Typical Noise Floor: –60 dB; –70 dB with averaging.

Act on Delta – Save, repeat, chime, SRQ, and hardcopy.

Histograms – Vertical or horizontal histograms generated from a user-defined portion of any waveform. Statistical information is provided for histogram data.

MEASUREMENT SYSTEM

Amplitude – Min, max, mid, mean, p-p, gain, RMS, overshoot, undershoot, area +, area –, and energy.

Timing – Rise, fall, width, delay, main-to-window trigger time, period, propagation delay, cross, phase, frequency, duty cycle, and skew.

FFT – Fundamental track, harmonic amplitude, frequency, and total harmonic distortion.

Statistics – Available for any measurement listed above for both live acquisitions and groups of stored waveforms.

Cursors – Single or dual dots, split or paired mode, horizontal and vertical bars, and measurement-zone delimiters. Delta volts, delta time, 1/delta time, and slope.

INPUT/OUTPUT SYSTEM

Ports – Centronics, GPIB, and RS-232-C ports standards. Fully GPIB and RS-232-C programmable.

Data Transfer Rates – Up to 100 waveforms per second. Up to 60 measurements per second.

DISK DRIVE

One 3.5 in. microfloppy disk drive, 1.44 MB or 720 KB formatted capacity, depending on disk used. MS-DOS compatible formatting.

CRT AND DISPLAY FEATURES

CRT – 10 in. diagonal, color, magnetic deflection. Vertical raster-scan orientation.

Resolution – 552 horizontal by 704 vertical displayed pixels.

POWER REQUIREMENTS

Line Voltage Ranges – 90 to 132 V RMS; 180 to 250 V RMS.

Line Frequency – 48 to 72 Hz.

Maximum Power Consumption – 585 W max.

ENVIRONMENTAL AND SAFETY

Temperature (Mainframe) – Operating: 0° to +45°C. Nonoperating: –40° to +75°C.

Disk Drive – Operating: 5° to +45°C. Nonoperating: –22° to +60°C.

Humidity (Mainframe) – Operating and Nonoperating: Up to 95% relative humidity; up to +45°C.

Disk Drive – Operating: Up to 80% relative humidity; up to +30°C. Nonoperating: Up to 90% relative humidity; up to +40°C.

Altitude, Vibration, Shock, Bench Handling – Operating and Nonoperating: meets MIL-T-28800C, Type III, Class 5.

Electromagnetic Compatibility – Referenced to MIL-STD-461B. Meets FCC part 15, subpart J, class A. Meets VDE 0871/6.78 for Class "B."

Safety – Listed UL 1244; Certified to CSA C22.2 No. 231-M89.

PHYSICAL CHARACTERISTICS

	Benchtop		Rackmount	
Dimensions	**mm**	**in.**	**mm**	**in.**
Width	457	18.0	482	19.0
Height	328	12.9	311	12.3
Depth	678	26.7	678	26.7
Weight≈	**kg**	**lb.**	**kg**	**lb.**
Net	32.7	72.0	38.6	85.0
Shipping (domestic)	49.4	109.0	56.7	125.0

SINGLE-SHOT ACQUISITIONS

Sample Rate	500 MS/s	1 GS/s	2 GS/s
Number of Channels	4	2	1
Time Resolution	2 ns	1 ns	500 ps
Record Length	512 to 10 K pts	512 to 20 K pts	512 to 32 K pts

Digitizing Signal Analyzers

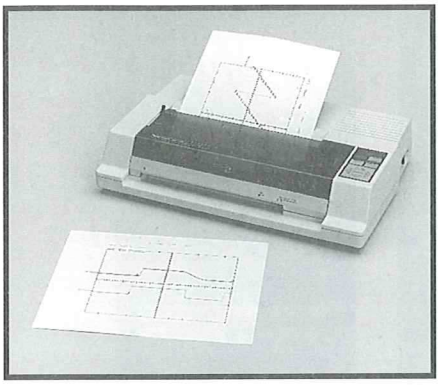
Accessory

HC100

Low-cost, Four-color Plotting

- Compatible with GPIB, RS-232, Centronics interfaces
- Plots both U.S. and A4 formats on paper, mylar and overhead material
- Graphics and text capability
- Compact package

For complete selection information on all Accessory products, see page 446.



ORDERING INFORMATION

DSA 602A
Digitizing Signal Analyzer **$34,600**
Includes: Tutorial Manual (070-7249-01), User Reference (070-7250-01), Programmer Ref. (070-7251-01), Command Ref. (070-7252-02), Service Reference (070-7254-01), Compact (3.5 mm) Probe Tip-to-BNC Adapter (013-0226-00), Power Cord, U.S., 120 V (161-0066-00).

Opt. 1C – Cable Feedthrough Connectors. ..... **+$300**

Opt. 1R – Rackmount ..... **+$300**

Opt. 4C – Non-volatile RAM. Adds over 450,000 points of non-volatile storage ..... **+$1,000**

Opt. 1P – HC100 Four-color Plotter with Opt. 01 ..... **+$1,380**

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**

Opt. A2 – United Kingdom 240 V, 50 Hz ..... **NC**

Opt. A3 – Australian 240 V, 50 Hz ..... **NC**

Opt. A4 – North American 240 V, 60 Hz ..... **NC**

Opt. A5 – Switzerland 220 V, 50 Hz ..... **NC**

See General Customer Information Section for additional description.

RECOMMENDED ACCESSORIES

See page 446 for complete selection information.

PROBES

Passive Probe (1 MΩ input) –
400 MHz, 11.3 pF/10 MΩ, 1.5 m (11A32, 11A33, 11A34 only). Order P6134C **$250**

6 MHz, 105 pF/1 MΩ, 6 ft.; 200 MHz, 14 pF/10 MΩ, 6 ft. (11A32, 11A33, 11A34 only). Order P6063B **$350**

50 Ω Divider (Zo) Probe Set –
Includes: 3.5 GHz, 1 pF/500 Ω, 10X; 3 GHz, 1.1 pF/5000 Ω, 100X; 1.5 m. Order P6156 Opt. 25 ..... **$350**

Bias-offset Probe – 10X, 1.5 GHz, 1.6 pF/500 Ω; 1.5 m. Order P6231 ..... **$799**

Active Probes –
10X, 750 MHz, 2 pF/1 MΩ, 1.5 m. Order P6205 ..... **$595**
10X, 1 GHz, 1.9 pF/10 MΩ, 1.5 m. Order P6204 ..... **$1,595**
10X, 1.5 GHz, 1 pF/1 MΩ, 1.3 m. Order P6245 ..... **$1,395**
10X, 4 GHz, 0.4 pF/100 kΩ, 1 m. Order P6217 ..... **$3,595**

Differential Probe –
10X, 150 MHz Differential Pair, 1.5 m. (11A33 only) Order P6135A **$795**
FET 1X/10X, DC – 100 MHz, 1000:1 CMRR. Order P6046 ..... **$2,395**

Current Probe – (11A16 only)
DC – 50 MHz, 0-20 A (DC + peak AC). Order A6302 ..... **$795**
DC – 15 MHz, 0-100 A (DC + peak AC). Order A6303 ..... **$1,495**
25 kHz – 1 GHz, 0.7 A peak pulse. Order CT-1 ..... **$295**

Optical-to-Electrical Converters[*2]
DC – 1 GHz, 1100-1700 nm. Order P6703A[*1] **$3,677**
DC – 700 MHz, 450-1050 nm. Order P6701A **$2,678**
DC – 300 MHz, 1000-1700 nm, High Gain. Order P6713 ..... **$2,550**
DC – 250 MHz, 450-1050 nm, High Gain. Order P6711 ..... **$2,142**

CART
Order K475 ..... **$940**

Power Strip – Four Outlet, 6 ft., Noise/Surge Suppression. Order 131-5342-01 ..... **$48**

Cables –
GPIB, 2 m. Order 012-0630-01 ..... **$150**
GPIB, 2 m. Order 012-0991-00 ..... **$195**
RS-232-C, 10 ft. Order 012-0911-00 ..... **$100**
Centronics, 10 ft. Order 012-0555-00 ..... [*2]

Blank Panels – Plug-in. Order 016-0829-00 ..... **$195**

CAMERA/HARD COPY OUTPUT PRINTER
Pen Plotter – Four Color. Order HC100 with Opt. 01 ..... **$1,380**
Camera – Order C9 with Opt. 11 ..... **$695**
Printer – Monochrome, Cannon BJ-10EX Bubble Jet. Order HC220 ..... **$445**

[*1] *See page 354 for complete selection information.*

[*2] *Contact your Tektronix representative for price information.*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 — The DSA 602A complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

ISO 9001 — ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

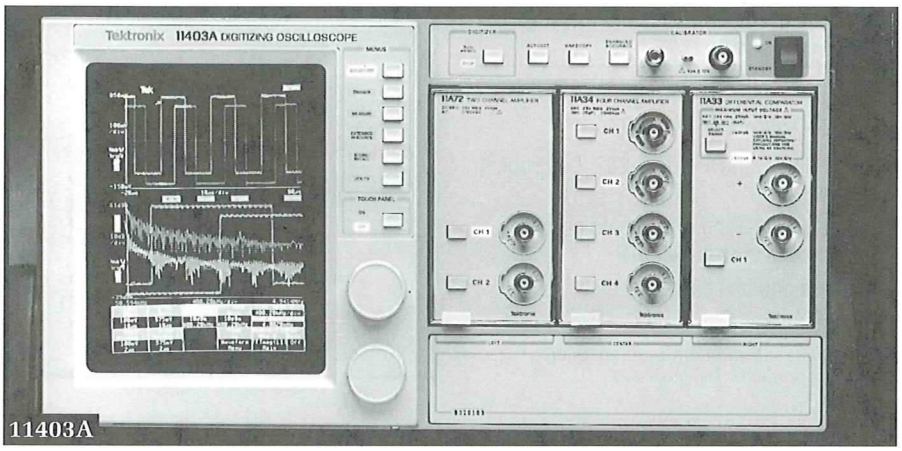
Tektronix Measurement products are manufactured in ISO registered facilities.

Digitizing Oscilloscopes
3 GHz

The 11400 Series combines high bandwidth and exceptional accuracy with excellent vertical and horizontal resolution.

11403A

- 3 GHz Bandwidth
- 2 GHz Trigger Bandwidth
- 10-Bit Vertical Resolution, 14-Bits with Averaging
- Acquire up to Six Channels at 1 GHz Concurrently
- Deskew Nulls out Channel Timing Differences – Including Probes
- Internal Calibration Capability for a Vertical Error of 1% or Less
- Bandwidth and Number of Channels Are Based on Amplifiers Selected
- Operating Mode and Amplifiers Selected Determine Number of Channels that Can Be Acquired



11403A

The Tektronix 11400 Digitizing Oscilloscope Series is as much a milestone in oscilloscope simplicity as it is in oscilloscope performance. It lets you concentrate on the measurement without having to understand the internal operation of an oscilloscope.

The 11400 Series are fully programmable oscilloscopes whose dual time bases, 10 ps horizontal resolution and 10-Bit vertical resolution – up to 14-Bit with averaging – help redefine the standards of oscilloscope accuracy. Now with the introduction of the 11403A, the standard is higher than ever. It now offers even more convenience and power with built-in FFT, automatic Pass/Fail testing, and measurements on multiple waveforms.

The 11400 Series approach to user interfaces promises more thorough analysis in fewer steps. The touch screen, intuitive menu system, one-button autoset, sequencing capability and large waveform display let you think more about the measurement and less about how the oscilloscope works.

Controls are grouped around the display screen to minimize distractions. Most controls are built into a menu system on the touch screen. Touch the "Define Waveform" icon, for example, to get selections for averaging, differentiation, integration, envelope, signum, smoothing, and square root.

Select a trace, a trigger, a measurement or other function by just touching the appropriate area of the screen or by selecting from the menus. As your selection changes, the functions of the two front-panel knobs change accordingly – to let you set time per division, set record lengths, or zoom and pan around a digitized record.

Even with eight traces, the update rate is faster than that of other digitizing oscilloscopes.

Press the Autoset button and the oscilloscope will autoset on a signal vertically and horizontally, and obtain a stable trigger. You can get a triggered display of either multiple cycles or a rising edge without knowing anything about the signal. Or, assign the IDENT button on the oscilloscope's probes to initiate an autoset or to sequence through a series of stored test setups – your hands and eyes never leave the job.

If accuracy is the bottom line in your application, the 11400 Series Oscilloscopes are clearly the instruments to consider first.

11403A APPLICATIONS

Device Characterization	With precision equivalent-time sampling of repetitive signals and unsurpassed accuracy and repeatability, these oscilloscopes are ideal tools for the component engineer and device designer.
Power Supply Design	With AC coupling, fast overdrive recovery, high vertical resolution, and one-touch measurements, these oscilloscopes are an excellent choice for power supply design. 11000 Series plug-in amplifiers have a wide range of calibrated offset and can recover quickly from up to 8000 divisions of overdrive. The new 11A16 Current Amplifier plug-in gives direct reading of current, and its deskew capabilities allow high-accuracy instantaneous power calculations using the waveform processing capabilities of the 11403A.
Production Testing	High accuracy, full programmability, the flexibility and performance of 11000 Series plug-ins, and fast ATE throughput give the production test user significant cost savings. Speed manual adjustment of circuit performance with the Pass/Fail testing feature. Coupled with the multiple waveform measurement capabilities, the Pass/Fail testing feature makes the 11400 a standalone testing system.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 11403A complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Digitizing Oscilloscopes
3 GHz

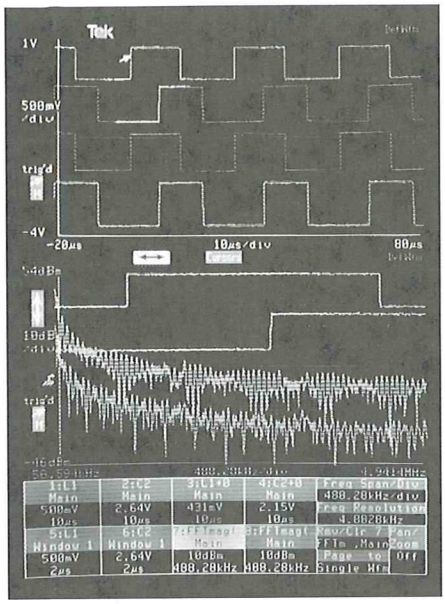


Figure 1. FFT display and measurements in the 11403A offer additional analysis power to the engineer or scientist.

Acquisition and Analysis Power

From the engineering bench to the production line, the 11403A gives you the power to acquire, measure, process and output waveforms with a standard of accuracy exclusive to the 11400 Series.

The 11403A has a full-color display that lets you easily distinguish between multiple waveforms. Main waveforms are displayed in up to four different colors, with one additional color designated for window waveforms.

Equipped with three plug-in compartments and dual time bases, the 11403A can continuously acquire and display eight signals from up to 12 input channels. Dual time bases permit simultaneous capture and display of up to two window records for each main record acquired. Main and window records in the 11400 oscilloscopes are analogous to main sweep and delayed sweep acquisitions in analog oscilloscopes. Window acquisitions can be positioned anywhere within the main record and allow detailed analysis of critical areas of the main waveform.

The 11403A incorporates extensive triggering capabilities including selectable AC or DC coupling and AC or DC noise reject, as well as high and low frequency reject. Pre-trigger or post-trigger details can be viewed on the main trace. 2 GHz trigger bandwidth (11A81) lets you trigger on extremely fast transitions.

THE USER INTERFACE

The 11403A's comprehensive analysis functions and instrument controls – including plug-ins and probes – are accessible to the user through a minimum of front-panel buttons, two user-assignable control knobs, and an easy-to-operate touch-screen interface.

ADVANCED ANALYSIS WITHOUT DELAY

"Live" update of the display and waveform measurement parameters lets you observe phenomena as they occur and allows complex mathematical transformations and functions to be applied to the acquired data in near real time.

Advanced waveform calculations such as differentiation, integration, square root, logarithm, and absolute value are available at the touch of an on-screen selector. No more waiting for results while an external processor works on the acquired data. All measurements and calculations are continuously updated as the instrument acquires the signal.

Built-in statistical analysis capability lets you get a better picture of how a signal varies over time – providing min, max, mean, and standard deviation for all selected measurements. Dedicated digital signal processing hardware provides acquisition enhancement functions such as averaging and smoothing to selectively remove noise from the display, giving you visibility into the true behavior of circuits and devices never before seen without extensive delayed signal processing.

The 11403A offers additional analysis power. It adds FFT display and measurements – a useful tool for the design engineer and scientist. You can create FFT magnitude or phase displays of the acquired waveform and use the automatic Spectral Frequency, Spectral Magnitude, and THD (Total Harmonic Distortion) measurements for a complete analysis of your signals.

MEASUREMENT SYSTEM

The 11403A offers one of the most comprehensive sets of automatic measurements available today. All measurements can be programmed over the GPIB or RS-232-C interfaces, eliminating operator error and enhancing test repeatability.

The 11403A measurement system is especially useful in automated test applications where the oscilloscope can acquire waveforms, make the measurements, and report the results to the host controller. Measurement results can be processed more rapidly and use much less memory space than the raw waveform data.

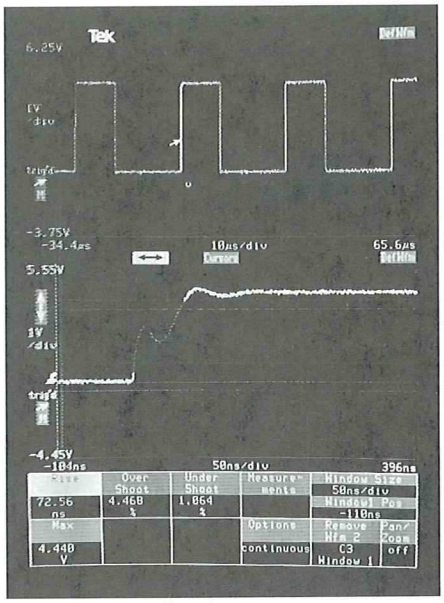


Figure 2. In the Annotation Mode, horizontal cursor bars and highlighting serve to focus your attention on the portion of the waveform being measured.

ANNOTATIONS

All of the 11403A measurements are fully annotated to clearly identify the portion of the waveform being measured and to show the locations of the measurement thresholds (see Figure 2). The measured portion of the waveform is highlighted and horizontal and vertical lines are used to track the upper and lower limits of the measured portion, as well as the 10% and 90% values.

All critical measurement limits are easily adjusted and displayed in the measurement pop-up menus. For example, if you want rise time measurements from 20% to 80% instead of from 10% to 90%, you simply set these levels with the control knobs or with an on-screen numeric key pad. Values can be set in relative (percent) or absolute terms.

Continued on next page.

Digitizing Oscilloscopes
3 GHz

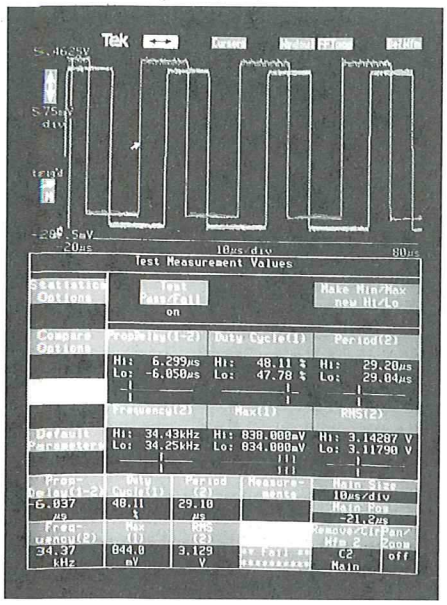


Figure 3. Pass/Fail testing offers a fast, easy method of adjusting circuit operation or sorting parts in production applications.

PASS/FAIL TESTING

The 11403A offers Pass/Fail testing on measurements. ATE and production test applications can use Pass/Fail testing to speed throughput and simplify circuit adjustment. Maximum and minimum limits are set for each active measurement; then the instrument gives indication of whether the signals Pass or Fail. A horizontal scale with a vertical bar serves as visual indication of where the measurement falls between the set limits. If the test fails, the scale indicates whether the signal was high or low.

MULTIPLE WAVEFORM MEASUREMENTS

Adding to the capabilities of the 11403A measurement system is the ability to make any measurement on any waveform. You can assign measurements to specific waveforms, use the same measurement for several waveforms, and have the results all on one display. For example, you could measure the skew on all four outputs of a buffer simultaneously. When you combine multiple waveform measurements with Pass/Fail testing, you can greatly simplify production testing and circuit adjustment.

PLUG-IN MODULARITY

The 11403A is equipped to handle up to three 11000 Series plug-ins. Several plug-ins are available, offering a range of bandwidths, channels, and input impedances to choose from. (For a list of plug-ins and characteristics, see page 90.) Plug-in installation is a simple matter of sliding each unit into place. Plug-ins are controlled through the mainframe, either from the touch screen interface or via the IEEE 488 or RS-232-C.

RECORD LENGTH

Record length is selectable from 512 to 10,240 points, providing the ability to capture and analyze repetitive events in high detail.

WAVEFORM MEMORY AND NON-VOLATILE STORAGE

The standard 11403A is equipped with 512 K of volatile waveform acquisition and display memory, and 128 K of non-volatile memory for storage of waveforms and settings. These memories are independent; that is, the number of waveforms being acquired has no impact on the memory available for stored waveforms and settings.

For users who require additional memory, Option 2D adds an additional 768 K of non-volatile memory for storage of waveforms and settings. This provides a total of 896 K of non-volatile memory – enough for approximately 450 waveforms of 1 K point record length.

DOCUMENTATION

Documenting your results with the 11403A is as easy as pressing one button. HARDCOPY sends a high-resolution copy of the current screen, complete with label and time and date stamp, through your choice of a standard Centronics parallel printer, RS-232-C, or GPIB port to any compatible printer or plotter – including the Tektronix 4696 and 4693D color printers, and HC100 color plotter (see Figure 4).

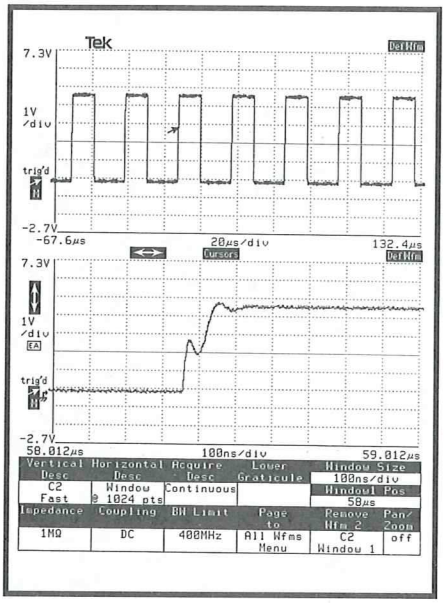


Figure 4. 11400 hardcopy output.

Applications

DEVICE CHARACTERIZATION

The 11403A is designed for precision, equivalent-time sampling of repetitive signals. Their unsurpassed accuracy and repeatability make them the ideal tools for the component engineer and device designer.

Dual built-in time bases allow windowing for detailed timing analysis of devices. Time A to B measurements can be made with 200 ps resolution single shot, or 10 ps resolution with repetitive acquisitions. Multiple signal acquisition and display eliminates the need to multiplex channels and allows you to see cause and effect relationships on the same screen. For critical applications, the 10-Bit vertical resolution can be increased to 14-Bits with averaging.

The 11403A offers a unique level of analysis power when Option 1S, Statistical Database Analysis Package, is added. With this option, the 11403A can make direct jitter and noise measurements on your incoming signals. It builds up a history – a statistical database – of acquisitions and provides histograms, measurements, special color graded displays, and mask testing options that allow you to more fully characterize and analyze your circuitry than ever before. These techniques are excellent for analyzing random data such as computer bus data streams, making timing analysis on digital signals, and characterizing metastability. And the color display of the 11403A lets you easily distinguish among multiple waveforms.

Digitizing Oscilloscopes
3 GHz

POWER SUPPLY DESIGN

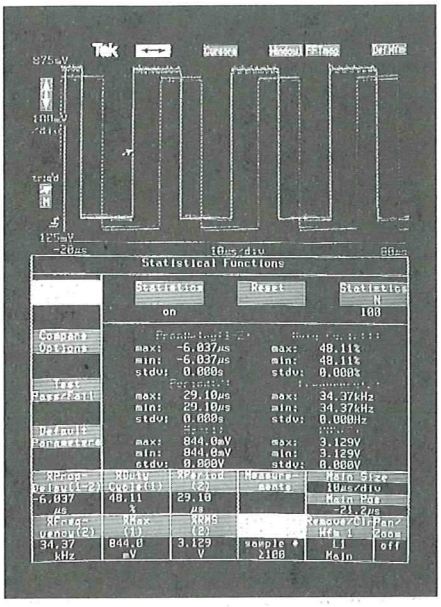
The 11403A with 11000 Series plug-ins provides AC coupling, fast overdrive recovery, high vertical resolution, and one-touch measurements, making this combination an ideal tool for power supply design. 11000 Series plug-in amplifiers have a wide range of calibrated offset and are unsurpassed in their ability to recover quickly from up to 8000 divisions*[1] of overdrive.

The 11403A can extend the sensitivity and offset of the plug-ins by increasing their normal 10-Bit vertical resolution to 14-Bits with high-precision averaging. With this kind of resolution, and the 11A33 Differential Comparator plug-in, small signals riding on larger signal swings or high DC voltages (such as ripple and noise) can be easily spotted and isolated. The 11A16 current amplifier provides AC + DC current measurement with scaled and calibrated results. Directly measure current waveforms or multiply voltage and current to create an instantaneous power trace. Time deskew at the probe tips eliminates phase errors between voltage and current traces, maintaining accuracy even on fast switching transitions.

PRODUCTION TESTING

ATE and production test users reap many benefits from the 11403A. Full programmability and commands optimized for fast operation ensure the highest throughput in ATE applications. Flexibility of configuration and high performance of 11000 Series plug-ins mean a production testing system can be tailored to fit your needs today – and expanded tomorrow as your needs change and grow. Special features like Pass/Fail testing, multiple waveform measurements, and a full range of automatic measurements give the 11403A the ability to perform many more functions than ordinary oscilloscopes and can even replace other test equipment. The high accuracy of the 11403A provides an extra margin of safety for your tests, and its fast measurements reduce test times, which saves you money.

*[1] With an 11A33.



STATISTICAL ANALYSIS

Statistical analysis of measurements provides maximum, minimum, mean, and standard deviation for up to six measurements at once. This feature is useful for statistical quality control, ATE test development, and device characterization.

Characteristics

VERTICAL SYSTEM
WITH ENHANCED ACCURACY:

ΔVDC Accuracy – ≤1% for an 8-division signal.

Absolute DC Accuracy – ≤0.6% when using full scale of the plug-in offset range.

ENHANCED ACCURACY automatically expires when the instrument temperature changes by approximately ±5°C from the temperature of the last calibration. Even if the ENHANCED ACCURACY is not renewed, the accuracy typically remains ≤2%.

11000 Series Probes can be included in calibration. The instrument will prompt you to connect the probes to the CALIBRATOR.

Vertical Resolution – 10-Bits (1024 levels). Resolution can be increased to 14-Bits (16384 levels) with signal averaging.

Equivalent-Time Bandwidth – 3 GHz max determined by plug-in. See page 90.

HORIZONTAL SYSTEM

Time Bases – Two identical, independent, built-in time bases.

Record Duration – 5.11 ns to 1024 s in 1-2-5 sequence.

Time Base Accuracy – 100 ps +0.002% of measurement interval.

Record Length – 512, 1024, 2048, 4096, 5120, 8192, and 10240 points.

Sampling Rate – 20 MS/s max. (single-shot).

Main Record Positioning – The main record is positioned with respect to the main trigger point. Pre-trigger: One record duration. Post-trigger: One record duration. Resolution: One main record point.

Continued on next page.

Digitizing Oscilloscopes
3 GHz

Windows – The main record plus two window records can be acquired and displayed. The window records can be of a different length (duration) and can have a shorter time/div than the main record. If two window records are used, they have the same duration and time/div settings but can be positioned independently.

Window Record Positioning – The window records are positioned relative to a window trigger point that can be delayed by either time or events relative to the main record's trigger point.

Main-to-Window Trigger Time Measurements – The time between the Main record trigger and the Window trigger can be measured precisely, even if each trigger occurs only once. Repetitive events allow this measurement to be averaged for better resolution and accuracy.
Single Trigger Resolution: 200 ps
Repetitive Resolution: 10 ps with averaging
Accuracy: 250 ps +0.002% of measured interval.

TRIGGERING SYSTEM

Range – ±Full Scale.

Main Trigger, Coupling and Sensitivity:
Jitter (Typical, CSA 404 only) – 10 ps RMS; 70 ps p-p.

DC Coupled – 0.5 div from DC to 50 MHz; 1.5 div from 50 MHz to 1 GHz.*1

Noise Reject Coupled – ≤1.2 div or less from DC to 50 MHz; 3 div from 50 MHz to 1 GHz.*1

AC Coupled – 0.5 div from 60 Hz to 50 MHz; 1.5 div from 50 MHz to 1 GHz.*1 Attenuates signals below 60 Hz.

HF Reject Coupled – 0.65 div from DC to 30 kHz.

LF Reject Coupled – 0.65 div from 80 kHz to 50 MHz; 1.5 div from 50 MHz to 1 GHz.*1

Window Trigger, Coupling and Sensitivity:
DC Coupled – 0.5 div from DC to 50 MHz; 1.5 div from 50 MHz to 500 MHz.*1

Note: Using the 11A81 External Trigger Input provides ≥2GHz trigger Bandwidth.

Noise Reject Coupled – ≤1.2 div or less from DC to 50 MHz; 3 div from 50 MHz to 500 MHz.*1

AC Coupled – 0.5 div from 60 Hz to 50 MHz; 1.5 div from 50 MHz to 500 MHz.*1 Attenuates signals below 60 Hz.

HF Reject Coupled – 0.65 div from DC to 30 kHz.

LF Reject Coupled – 0.65 div from 80 kHz to 50 MHz; 1.5 div from 50 MHz to 500 MHz.*1

Holdoff Range:
Main Record – Min: 490 ns; max: 10 s.

Window Record – Min: 20 ns; max: 811 s.

MEASUREMENT SYSTEM

Waveform Processing Functions:
Waveform Functions – Differentiate, integrate, interpolate, smooth, average, envelope, square root, signum, logarithm, natural log, absolute value, and exponential.

Arithmetic Operators – Add, subtract, multiply, divide.

MEASUREMENT SET

Amplitude – Min, max, mid, mean, gain, p-p, undershoot, overshoot, amplitude, noise*2, extinction ratio, and RMS.

Timing – Rise, fall, width, delay, main-to-window trigger time, phase, period, duty cycle, skew, jitter*2, propagation delay, cross, and frequency.

Area and Energy – Area +, area –, and energy.

FFT – Spectral frequency, spectral magnitude, THD (Total Harmonic Distortion).

Measurement Statistics – Min, max, mean, and standard deviation of all active measurements.

Cursors – Dual dots in split or paired mode, horizontal and vertical bars, measurement zone delimiters.

INPUTS/OUTPUTS

Centronics, Type GPIB, and RS-232-C ports standard. Fully GPIB and RS-232-C programmable.

Hardcopy Drivers – Support for 9-Pin and 24-Pin Epson-graphics-compatible printers; Tektronix HC100 and HPGL-compatible plotters; Tektronix 4693, 4696, 4697 color printers; alternate inkjet printers; Bitmap transfer to computers. Draft, high resolution, and reduced modes.

CRT AND DISPLAY FEATURES

CRT – Magnetic deflection, vertical raster-scan orientation. 7.5 in. diagonal color CRT in 11403A and CSA 404.

Colors (11403A and CSA 404) – Eight-color set; selectable from a palette of 262,144 colors.

Video Resolution – 552 horizontal by 704 vertical displayed pixels.

ENVIRONMENTAL AND SAFETY

Temperature – Operating: 0° to +50°C. Nonoperating: –40° to +75°C.

Humidity – Operating and Nonoperating: Up to 95% relative humidity, up to +50°C.

Altitude – Operating and Nonoperating: meets MIL-T-28800C, Type Class 5.

Shock – Nonoperating: meets MIL-T-28800C, Section 4.5.5.4.1, Type Class 5.

Bench Handling – Operating: meets MIL-T-28800C, Section 4.5.5.4.3, Type Class 5.

Electromagnetic Compatibility – Meets the following requirements of MIL-STD-461B - CE-03, Part 4, Curve 1; CS-01, Part 7; CS-02, Part 4; CS-06, Part 5; RE-02, Part 7; RS-01, Part 4; RS-02, Part 5; RS-03, Part 7 (limited to 1 GHz). Meets FCC part 15, subpart J, Class A. Meets VDE 0871/6.78 for Class B.

**1 At minimum holdoff setting.*
**2 CSA 404 and 11403A option 1S only.*

Digitizing Oscilloscopes
3 GHz

PHYSICAL CHARACTERISTICS

	Benchtop		Rackmount	
Dimensions	**mm**	**in.**	**mm**	**in.**
Width	448	17.6	482	19.0
Height	238	9.4	222	8.8
Depth	599	23.6	550	21.6
Weight ≈	**kg**	**lb.**	**kg**	**lb.**
Net	19.0	41.6	22.0	48.0
Shipping (domestic)	28.0	62.0	31.4	68.0

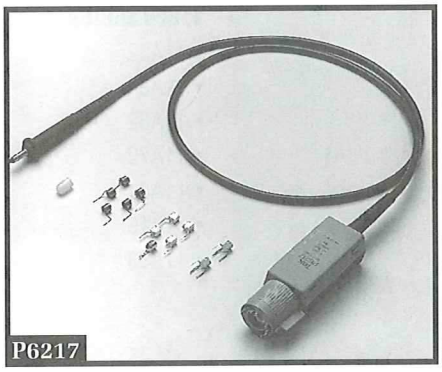
Accessory

K465

Instrument Cart

- Ergonomic design
- Simple height, angle, and shelf adjustments
- Durable steel and aluminum construction
- Large diameter smooth rolling casters
- Nylon safety straps included

For complete selection information on all Accessory products, see page 446.



Accessory

P6217 FET PROBE

Maximize Your Signal Acquisition Performance

- Wide Bandwidth (DC to >4 GHz)
- Minimal DUT Loading <0.4 pF capacitive/>100 kΩ resistive
- Requires no additional cables or power supplies
- Smaller size than traditional active FET Probes

For complete selection information on all Accessory products, see page 446.

ORDERING INFORMATION

11403A
1-GHz Color Digitizing Oscilloscope **$19,950**
Includes: Tutorial (070-8190-00); User Reference (070-8191-00); Programmer Reference (070-8192-00); Quick Reference (070-8193-00); Service Reference (070-8194-00); Power Cord, U.S. 120 V (161-0066-00).
Opt. 1C – Cable Feedthrough ..... **+$300**
Opt. 1R – Rackmount Kit ..... **+$250**
Opt. 1S – Data Base Measurements ..... **+$1,500**
Opt. 2D – Expanded Memory ..... **+$1,000**
Opt. 4D – High-speed GPIB ..... **+$400**

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**
Opt. A2 – United Kingdom 240 V, 50 Hz ..... **NC**
Opt. A3 – Australian 240 V, 50 Hz ..... **NC**
Opt. A4 – North American 240 V, 60 Hz ..... **NC**
Opt. A5 – Switzerland 220 V, 50 Hz ..... **NC**
See General Customer Information Section for additional description.

RECOMMENDED ACCESSORIES
See page 446 for complete selection information.

CART
Instrument Tower. Order K465 ..... **$835**
Power Strip – Four Outlet, 6 ft., Noise/Surge Suppression. Order 131-5342-01 ..... **$48**
Cables – GPIB, 2 m. Order 012-0991-00 ..... **$195**
RS-232-C, 10 ft. Order 012-0911-00 ..... **$100**
Centronics, 10 ft. Order 012-1233-00 ..... **$180**
Blank Panels – Plug-in. Order 016-0829-00 ..... **$195**

CAMERA/PLOTTER
Camera – Order C9 with Opt.11 ..... **$695**
Four-color Pen Plotter – Order HC100, Opt. 01 ..... **$1,380**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 11403A complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

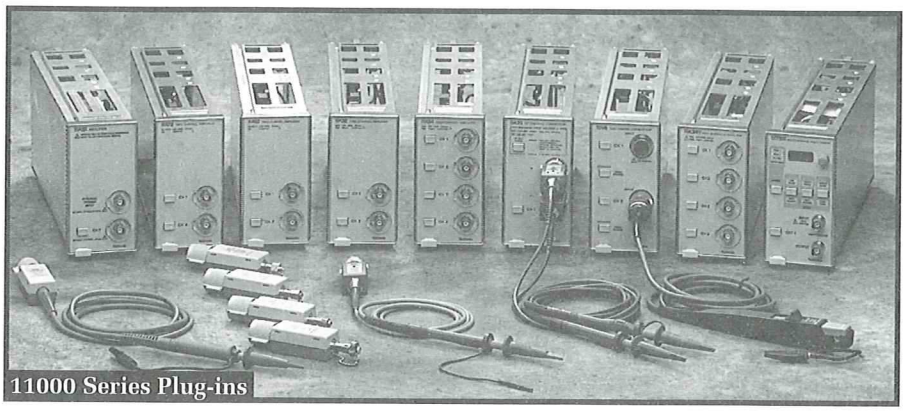
Tektronix Measurement products are manufactured in ISO registered facilities.

Plug-in Information

Wide bandwidth, unsurpassed accuracy, clean response, low noise, and calibrated DC offset with fast overdrive recovery.

11000 SERIES

- 11A32
- 11A34
- 11A52
- 11A72
- 11A81
- 11A16
- 11A33


11000 Series Plug-ins

11000 DSA Series Plug-ins

A variety of bandwidths, number of channels, coupling and input choices are available. From the 11A72, with 2 channels at 1 GHz bandwidth, to the 11A33 differential comparator with 150 MHz bandwidth and 10,000:1 CMRR, the 11000 Series plug-ins offer capabilities for virtually any need. The chart below shows the bandwidth of each of the plug-in units in each of the 11000 Series and DSA 600A Series mainframes.

Control of the 11000 Series plug-ins is accomplished through the mainframe controls, either manually or over the IEEE Standard 488 or RS-232-C bus. A single pushbutton for each channel is the only control on the amplifier plug-in. This button turns the display of the associated channel on and off.

Each of the input channels on all amplifier plug-ins uses the TEKPROBE™ interface. This interface allows the mainframe to supply power to active probes (such as the P6204 or P6703A) to sense the type (and, with some probes, the serial number) of the probe, to supply offset voltage to probes so equipped, to detect activation of the probe's ID pushbutton, and to provide other communication between the probe and the oscilloscope as appropriate to the type of probe.

Three new plug-ins extend the capabilities of the 11000 Series and DSA 600 Series even further. The 11A16 Current Amplifier provides direct measurement of current waveforms. Analysis of power circuits can be more complete than ever before.

The 11A33 Differential-Comparator Amplifier bandwidth is 150 MHz with any combination of probe and mainframe. The recommended probe for this amplifier is the P6135A matched probe pair.

11000 SERIES PROBE PLUG-IN MAINFRAME BANDWIDTH MATRIX

All values are in MHz and are rounded to nearest 25 MHz increment.

	No probe	P6134C	P6562AS	P6245	P6204	P6156	P6701A*1	P6703A*1	P6711*1	P6713*1	P6205	P6217
		passive 10 MΩ 11.3 pF 10X	SMD 10 Ω 11 pF 10X	active 1 MΩ <1 pF 10X	active 10 MΩ 1.9 pF 10X	passive 500, 5 kΩ <1 pF, 10X, <1.1 pF 100X	optical – – –	optical – – –	optical – – –	optical – – –	active 1 MΩ <2 pF 10X	active 100 kΩ 0.4 pF 10X
11A32	400	400	350	375	375	400	300	350	175	175	350	375
11A34	300	300	300	300	275	300	250	275	150	175	275	275
11A52	600	–	–	550	500	600	375	475	175	200	475	575
11A72	1000	–	–	825	700	1000	450	575	175	200	600	950
11A81	3000	–	–	850	700	–	–	–	–	–	–	2400

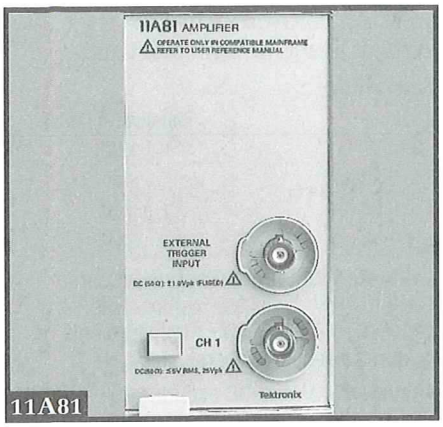
**1 The bandwidths in this chart correspond to –3 dB electrical net system bandwidth. Optical-to-Electrical Converters are often specified at a –3 dB optical point (= –6 dB electrical). To convert to –3 dB optical bandwidth, multiply the bandwidths in this chart by 1.4. For more details on Optical-to-Electrical Converters, see page 354.*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Plug-in Amplifiers
3 GHz



11A81 3 GHz Amplifier

The 11A81 is a single-channel, high-bandwidth, presampler plug-in designed specifically for the 11403A Digitizing Oscilloscope and the CSA 404 Communications Signal Analyzer. The unique presampler architecture of the plug-in triples the system bandwidth of these mainframes to 3 GHz. A separate trigger input with 2 GHz bandwidth effectively doubles their trigger bandwidth.

Up to three 11A81s can be used together in the 11403A/CSA404 to form a powerful, high-bandwidth measurement system for high-speed GaAs or ECL logic device development. Perform voltage measurements to 1% accuracy, sophisticated jitter and noise analysis with histograms, or precise pass/fail evaluations.

Coupled with the CSA 404, the 11A81 allows accurate testing of communications devices, modules and systems with data rates to 625 MB/sec This makes the 11A81/CSA 404 combination ideally suited to FDDI and SONET applications. With this comprehensive communications measurement system, you can perform eye pattern analysis, create masks for pass/fail testing, or generate constellation diagrams for analysis of digital RF circuits.

The input channel and external trigger input connectors of the 11A81 are standard BNC with TEKPROBE™ interfaces to ensure compatibility with a wide selection of high performance probes.

Characteristics

Bandwidth – 3 GHz typical (calculated from rise time using the formula BW = 0.38/TR).

Rise Time – ≤130 PS.

Deflection Factor – 10 mV to 1 V/div in 1-2-5 sequence.

Accuracy – ΔV: ±(1.0 + 0.01 div); Offset: ±(0.6% + 0.01 div); DC Balance: ±0.1 div.

Offset Range – ±50 divisions. Resolution: Coarse – 0.25 div; Fine – 0.025 div.

Overdrive Recovery – At 10 and 20 mV/div: to within ±(2.0% +0.1 div) within 10 ns from ±1 V step.

Typical Displayed Noise (RMS) – 0.025 div from 10 mV/div to 1 V/div.

Input Impedance – 50 Ω ±1.0%; VSWR ≤1.45:1 at 10 mV/div, DC to 2 GHz; VSWR ≤1.25:1 at 20 mV/div to 1 V/div, DC to 2 GHz.

Disconnect Threshold – DC signal: ±(6 V±1 V); AC signal: 5 V RMS typical (DC to 100 MHz).

Input Coupling Modes – DC and OFF.

Maximum Input Voltage – 5 V RMS (0.5 W) or 0.25 watt-second pulses not exceeding 25 V peak.

External Trigger – Range: ±1 V. Resolution: Fine: ±2 mV/step; Coarse: ±20 mV/step. Accuracy: ±5% of trigger level range. Sensitivity: 40 mV p-p from DC to 200 MHz; increasing to 150 mV p-p at 800 MHz; increasing to 200 mV p-p at 2 GHz. Maximum Safe Input Level: ±1 V.

Internal Trigger – Sensitivity: 2.0 div p-p from DC to 625 MHz, typically increasing to 4.5 div p-p at 1 GHz.

ENVIRONMENTAL CHARACTERISTICS

Temperature – Operating: 0°C to 50°C; Nonoperating: –40°C to +75°C.

Altitude – Operating: to 4.57 km (15,000 ft.); Nonoperating: to 15.2 km (50,000 ft.).

MIL Specs – Meets requirements of MIL-T-28800D, Type III, Class 5 for humidity, shock and vibration. Meets requirements of MIL-STD-461B; FCC Part 15, subpart J, Class A; and VDE 0871/6.78 Class B for electromagnetic compatibility.

11A81

- Single Channel
- High-bandwidth, 3 GHz
- 2 GHz Trigger Bandwidth

Extreme bandwidth for device characterization or analysis of communications systems to 625 Mbit/s.

ORDERING INFORMATION

11A81
Single-channel Amplifier **$6,000**
Includes: User Ref. (070-8147-00) and Service Ref. (070-8148-00).
Opt. 20 – Includes P6217 Active Probe ..... **+$3,595**

RECOMMENDED ACCESSORIES
See page 446 for complete selection information.

PROBES
Active –
1 GHz, 1.9 pF/10 kΩ, 1.5 m. Order P6204 ..... **$1,595**
1.5 GHz, 1 pF/1 MΩ, 1.3 m. Order P6245 ..... **$1,395**
4 GHz, 0.4 pF/100 kΩ, 1 m. Order P6217 ..... **$3,595**
50 Ω Divider (Zo) – 3.5 GHz, 1 pF/500 Ω, 10X; 3 GHz, 1 pF/5000 Ω, 100X;1.5 m. Order P6156 with Opt. 25 ..... **$350**
Current –
25 kHz – 1 GHz. Order CT-1 ..... **$295**
1.2 kHz – 200 MHz. Order CT-2 ..... **$270**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

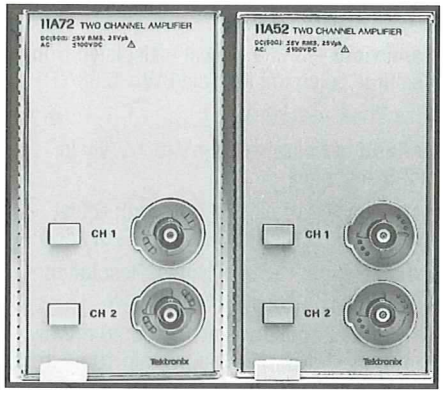
11A72
11A52

Plug-in Amplifiers
High Bandwidth

High bandwidth amplifiers combined with active probes preserve critical signal phenomena in research and design.

11A72
- 1 GHz
- Two Channels
- 50 Ω Input Impedance
- DC to 1 GHz Bandwidth
- 10 mV to 1 V/Div Calibrated Deflection Factors
- ±25 Division Offset

11A52
- 600 MHz
- Two Channels
- 50 Ω Input Impedance
- DC to 600 MHz Bandwidth
- 1 mV to 10 V/Div Calibrated Deflection Factors in 1% Increments
- High-resolution Calibrated DC Offset
- Fast Overdrive Recovery



11A72 Two-channel Amplifier Characteristics

Bandwidth – 1 GHz.

Deflection Factor – 10 mV to 1 V/div in 1-2-5 sequence.

Accuracy – ΔVolts DC accuracy: With 11400: ±(0.9% +0.01 div) . With DSA 600: ±(1.0% +0.02 div). DC Balance, ±0.1 div. Offset Accuracy, ±(0.4% +0.01 div).

Offset Range – ±25 div, 0.025 div resolution.

Typical Noise (RMS) – 0.022 div.

Input Impedance – 50Ω ±0.5%; VSWR ≤1.45:1 @10 mV/div, DC to 1 GHz; VSWR ≤1.25:1 for deflection factors ≥ 20 mV/div, DC to 1 GHz.

Disconnect Threshold – 5 V RMS typical (DC to 100 MHz).

Input Coupling Modes – AC, DC, OFF.

AC Coupled Low Frequency – –3 dB point; 1 kHz or less from 50 Ω source.

Max Input Voltage – DC Coupled: 25 V pk or 5 V rms. AC Coupled: ±100 V DC additional. Input coupling is set to off when coupled signal exceeds safe limits. Manual reset by selecting either AC or DC coupling.

11A52 Two-channel Amplifier Characteristics

Bandwidth –

V/div	Bandwidth (MHz)
>10 mV	600
5 to 9.95 mV	400
2 to 4.98 mV	250
1 to 1.99 mV	200

Calibrated Deflection Factors – Coarse: 1 mV to 10 V/div in 1-2-5 steps. Fine: between coarse steps in 1% increments of next more sensitive coarse step.

Accuracy – ΔVolts DC accuracy: With 11400: ±(0.8% +0.01 div). With DSA 600: ±(0.9% +0.02 div). DC Balance, 1 to 99.5 mV/div: ±(0.2 mV + 0.10 div). Offset Accuracy, 1 to 99.5 mV/div (±1 V range): (0.15% + 0.4 mV).

Offset Range – 1 to 99.5 mV/div: ±1 V; Resolution: 25 µV. 100 mV to 0.995 V/div: ±10 V; Resolution: 250 µV .1 to 10 V/div: ±100 V; Resolution: 2.5 mV.

Overdrive Recovery – 1 to 99.5 mV/div: To within ±(0.2% +0.1 div) within 20 ns from ±2 V step.

Typical Noise (RMS) – 1 to 1.99 mV/div: 0.087 div. 2 to 4.98 mV/div: 0.04 div. 5 to 9.95 mV/div: 0.02 div. 10 mV to 10 V/div: 0.012 div.

Input Impedance – 50 Ω ±0.5%; VSWR: < 1.3:1 DC to 500 MHz.

Input Coupling Modes – AC, DC, and OFF.

AC Coupled Low Frequency – –3 dB point; 1 kHz or less from 50 Ω source.

Max Input Voltage – DC Coupled: 25 V pk or 5 V rms. AC Coupled: ±100 V DC additional. Input coupling is set to off when coupled signal exceeds safe limits. Manual reset by selecting either AC or DC coupling.

ORDERING INFORMATION

11A72
Two-channel Vertical Amplifier **$4,900**
Includes: User Reference (070-7255-00), Service Reference (070-7257-00).
Opt. 25 – Includes two P6231 Bias-offset Probes. ..... **+$1,598**
Opt. 27 – Includes two P6204 Active Probes..... **+$3,190**
Opt. 28 – Includes two P6217 Active Probes..... **+$7,190**

11A52
Two-channel Vertical Amplifier **$3,700**
Includes: User Reference (070-6114-00), Service Reference (070-6786-00).
Opt. 25 – Includes two P6231 Bias-offset Probes. ..... **+$1,598**
Opt. 27 – Includes two P6204 Active Probes..... **+$3,190**

RECOMMENDED ACCESSORIES

See page 446 for complete selection information.

PROBES

Active –
1 GHz, 1.9 pF/10 MΩ, 1.5 m. Order P6204 ..... **$1,595**
1.5 GHz, 1 pF/1 MΩ, 1.3 m. Order P6245 ..... **$1,395**
4 GHz, 0.4 pF/100 kΩ, 1 m. Order P6217 ..... **$3,595**
750 MHz, 2 pF/1 MΩ, 1.5 m. Order P6205..... **$595**

50 Ω Divider (Zo) – 3.5 GHz, 1 pF/500 Ω, 10X; 3 GHz, 1.1 pF/5000 Ω, 100X; 1.5 m. Order P6156 with Opt. 25 ..... **$350**

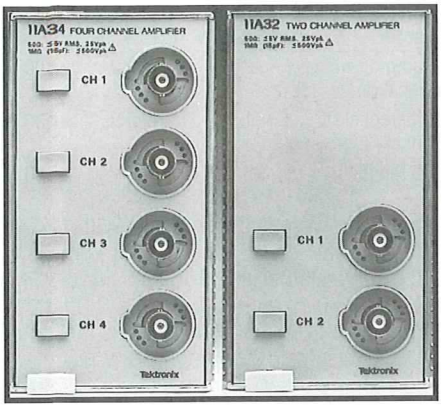
Current –
25 kHz to 1 GHz. Order CT-1 ..... **$295**
1.2 kHz to 200 MHz. Order CT-2..... **$270**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Plug-in Amplifiers
High Impedance



11A32 and 11A34 Amplifiers

The 11A32/11A34 amplifiers offer switchable 1 MΩ/50 Ω input impedance, fast overdrive recovery and wide offset ranges. The 11A32 is a 2-CH unit, and the 11A34 is a 4-CH unit.

Two built-in four-pole bandwidth-limit filters (100 MHz and 20 MHz) may be activated to reduce unwanted high-frequency noise at 24 dB/octave for each channel.

Both coarse and fine deflection-factor steps are fully calibrated. At 1 mV/div, the calibrated DC offset can be set with a resolution of 25 µV and a range of ±1 V (equivalent to 16-Bits), giving an effective screen height of 2,000 divisions and permitting absolute DC measurement accuracies to ±0.4%.

Characteristics

Number of Channels – 11A32: Two; 11A34: Four.

Calibrated Deflection Factors – Coarse steps: 1 mV to 10 V/div in 1-2-5 sequence. Fine steps: Between coarse steps in 1% increments of next more-sensitive coarse step.

Bandwidth –

V/div	11A32 Bandwidth (MHz)	11A34 Bandwidth (MHz)
>10 mV	400	300
5 to 9.95 mV	350	250
2 to 4.98 mV	250	200
1 to 1.99 mV	200	150

Accuracy – ΔVolts DC accuracy: With 11400: ±(0.9% + 0.012 div). With DSA 600: ±(1.0% + 0.02 div). DC Balance, 1 to 99.5 mV/div: ±(1.0 mV + 0.10 div). Offset Accuracy, 1 to 99.5 mV/div (±1 V range): (±0.2% + 0.5 mV). For absolute DC accuracy of single-point measurements using offset, add the Offset Accuracy and DC Balance terms.

Offset Range – 1 to 99.5 mV/div: ±1 V; Resolution: 25 µV. 100 mV to 0.995 V/div: ±10 V; Resolution: 250 µV. 1 to 10 V/div: ±100 V; Resolution: 2.5 mV.

Overdrive Recovery – 1 to 99.5 mV/div: To within ±(0.3% +0.2 div) within 50 ns from ±2 V step. 100 to 995 mV/div: To within ±1% within 50 ns from ±20 V step. 1 to 10 V/div: To within ±1% within 50 ns from ±200 V step.

Typical Noise (RMS) – 1 to 1.99 mV/div: 0.12 div. 2 to 4.98 mV/div: 0.06 div. 5 to 9.95 mV/div: 0.025 div. 10 mV to 10 V/div: 0.014 div.

Input Impedance – Switchable: 1 MΩ in parallel with 15 pF, or 50 Ω ±0.5%.

Input Coupling Modes – AC, DC, and OFF.

AC Coupled Low Frequency – –3 dB point, driven from 50 Ω source: less than 10 Hz.

Maximum Input Voltage – 1 MΩ mode: 500 V (DC + peak AC). 50 Ω mode: The input impedance is switched to 1 MΩ when the input signal exceeds safe limits. Manual reset by re-selecting 50 Ω input impedance.

11A32/11A34

- DC to 400 MHz Bandwidth (11A32)
- Two Channels (11A32) or Four Channels (11A34)
- 1 mV to 10 V/Div Calibrated Deflection Factors in 1% Increments
- Switchable 50 Ω or 1 MΩ Input Impedance
- High-resolution Calibrated DC Offset
- Fast Overdrive Recovery

Excellent, medium bandwidth amplifiers. They offer switchable 1 MΩ/50 Ω input impedance, fast overdrive recovery, and wide offset range.

ORDERING INFORMATION

11A34
Four-channel Vertical Amplifier **$5,300**
Includes: User Reference (070-5921-01), Service Reference (070-6785-02).

11A32
Two-channel Vertical Amplifier **$3,000**
Includes: User Reference (070-5922-01), Service Reference (070-6782-03).

Opt. 3P – (11A32, 11A34) Includes P6408 Word, Recognizer/Trigger Probe ..... **+$555**

Opt. 22 – (11A32) Includes two P6134C probes ..... **+$500**

Opt. 23 – (11A34) Includes four P6134C probes ..... **+$1,000**

RECOMMENDED ACCESSORIES
See page 446 for complete selection information.

PROBES

Active –
1 GHz, 1.9 pF/10 MΩ, 1.5 m. Order P6204 ..... **$1,595**
1.5 GHz, 1 pF/1 MΩ, 1.3 m. Order P6245 ..... **$1,395**
750 MHz, 2 pF/1 MΩ, 1.5 m. Order P6205 ..... **$595**

Differential – 100 MHz, Active Differential, 6 ft. Order P6046 ..... **$2,395**

High Voltage –
250 MHz, 2500 V, 2.5 pF/10 MΩ. Order P5100 ..... **$199**
75 MHz, 20 kV, 3.0 pF/100 MΩ, 10 ft. Order P6015A Opt. 1R **$1,040**

General Purpose –
1X, 15 MHz, 100 pF/1 MΩ, 2m. Order P6101B **$60**
1X/10X Switchable, 1X: 6 MHz, 105 pF/1 MΩ, 6 ft.; 10 X: 200 MHz, 14 pF/10 MΩ, 6 ft. Order P6063B **$350**

Current –
120 Hz – 60 MHz, 7.5A peak. Order P6021 ..... **$575**
935 Hz – 120 MHz, 3A peak. Order P6022 ..... **$610**
1.2 kHz – 200 MHz. Order CT-2 ..... **$270**
DC – 50 MHz System. Includes AM503A, A6302. Order AM503S **$2,795**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

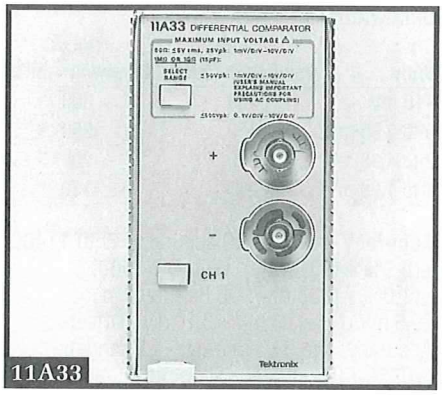
Tektronix Measurement products are manufactured in ISO registered facilities.

Plug-in Amplifiers
Differential Comparator

Balanced (+ and –) input for applications requiring rejection of common mode signal.

11A33

- DC to 150 MHz Bandwidth
- 1 mV to 10 V/Div Calibrated Deflection Factors in 1% Increments
- Very High Resolution, Calibrated DC Offset 16,000-Division Effective Screen Height
- Differential DC Offset range of ±1 V at 1 mV/Div
- High Common-mode Rejection
- Fast Overdrive Recovery from Large Input Signals
- Selectable 50 Ω, 1 MΩ, or 1 GΩ Input Impedance



11A33 Differential Comparator

As a differential amplifier, the 11A33 provides a balanced (+ and –) input for applications requiring rejection of a common-mode signal. The unit can reject up to 8 V p-p of common-mode signal with a CMRR of 10,000:1 from DC to 1 MHz, (derating to 500:1 at 20 MHz 1 V p-p) at a deflection factor setting of 1 mV/div. Differential DC offset is available to null out DC offsets between the two inputs. This offset capability can be used with DC coupling at 1 mV/div to measure a bipolar transistor's Vbe change from self-heating caused by signal changes.

As a comparator amplifier, the 11A33 loses its differential capability but provides an accurate (0.15%) positive or negative internal offsetting voltage covering the amplifier's common-mode signal range. This mode is also known as slideback comparison. A signal of up to ±8 V may be applied to an input at a deflection factor setting of 1 mV/div, and with an opposing VC (offset voltage), small segments of the signal may be observed.

Characteristics

Number of Channels – One.

Bandwidth – DC to 150 MHz (DC to 120 MHz at 1 mV/div).

Calibrated Deflection Factors – Coarse steps: 1 mV to 10 V/div in 1-2-5 sequence. Fine steps: Between coarse steps in 1% increments of next more-sensitive coarse step.

VC Range – 1 to 99.5 mV/div: ±8 V; Resolution: 25 µV; 100 mV to 0.995 V/div: ±80 V; Resolution: 250 µV. 1 to 10 V/div: ±500 V; Resolution: 2.5 mV.

Deflection Factor	1 mV to 99.5mV/div	100 mV to 0.99 V/div	1 V to 10 V/div
Common-mode Signal range	±8 V	±80 V	±500 V
Differential DC Offset range	±1 V	±10 V	±100 V
VC range	±8 V	±80 V	±500 V

Accuracy – ΔVolts DC accuracy: With 11400: ±(0.9% +0.01 div). With DSA 600: ±(1.0% +0.02 div). DC Balance, 1 to 99.5 mV/div: ±(0.5 mV +0.10 div). Differential DC Offset Accuracy, 1 to 99.5 mV/div: ±(0.25% + 0.7 mV). VC Accuracy, 1 to 99.5 mV/div (8 V range): ±(0.15% + 0.6 mV). For absolute DC accuracy of single point measurements using VC, add the VC Accuracy and DC balance terms.

Differential DC Offset Range – 1 to 99.5 mV/div: ±1 V; 100 mV to 0.995 V/div: ±10 V;1 to 10 V/div: ±100 V.

Overdrive Recovery – Recovers to within 0.25% of overdriving signal within 40 ns; to within 2 mV in 100 µs; to within 1 mV in 300 µs. Conditions: 1 to 99.5 mV/div; Overdriving signal steps to 0.0 V from ±8.0 V; Slew rate ≤ 0.5 V/ns.

Typical Noise (RMS) – 1 to 1.99 mV: 0.24 div. 2 to 4.98 mV: 0.12 div. 5 to 9.95 mV/div: 0.05 div. 10 mV to 10 V/div: 0.03 div.

Common-mode Rejection Ratio – 1 to 99.5 mV/div: 10,000:1, DC to 1 MHz; 2000:1 at 5 MHz (8 V p-p signal). 100 mV to 0.995 V/div: 1000:1, DC to 1 MHz; 100:1 at 10 to 20 MHz (30 V p-p signal). 1 to 10 V/div: 500:1, DC to 250 kHz (100 V p-p signal).

Input Impedance – 50 Ω, 1 MΩ in parallel with 15 pF, or 1 GΩ in parallel with 15 pF from 1 to 99.5 mV/div.

Input Coupling Modes – DC, AC, VC, and OFF for each input. VC Coupling internally connects an amplifier input to the comparison voltage.

Max Input Voltage–1MΩ mode:1 to 99.5 mV/div: 50 V (DC + peak AC); 0.1 to 10 V/div: 500 V (DC + peak AC). (At 1 to 99.5 mV/div, derate maximum input voltage at 20 dB/decade above 3 MHz; at 100 mV to 10 V/div, derate maximum input voltage at 20 dB/decade above 1 MHz.) 50 Ω Mode: The input impedance is switched to 1 MΩ when the input signal exceeds safe limits. Manual reset by re-selecting 50 Ω input impedance. LF Step Response Aberrations: 0.1 V/div – 110 V/div: less than ±1% after the first 20 ns of input step.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

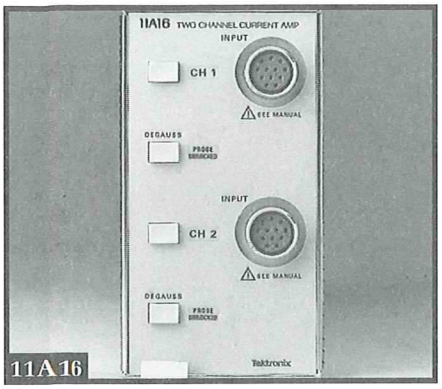
Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

11A33
Differential Comparator **$4,350**
Includes: User Reference (070-6119-00), Service Reference (070-6784-01).
Opt. 24 – Includes a P6135A Probe Pair. ..... **+$795**

RECOMMENDED ACCESSORIES
See page 446 for complete descriptions and full line of probes and accessories.

Plug-in Amplifiers
Current Amplifier



11A16 Amplifier

The 11A16 is a two-channel current amplifier plug-in designed to operate with the A6302 and A6303 current probes. With the 11A16 you get a versatile and powerful current analysis and measurement system. It provides direct readout of current levels, and calibration – including timing deskew – of the probe path. Deskewing the current channel means you can now make instantaneous power measurements with higher accuracy than ever before. And those measurements can be programmed over the GPIB for a totally automated system.

Characteristics

(With A6302 Current Probe.)

Number of Channels – Two.

Bandwidth – 50 MHz (limited by probe).

Rise Time – 7 ns or less.

Deflection Factor – 1 mA/div to 2 A/div in 1-2-5 sequence.

Offset Range – 1 mA/div to 99.5 mA/div: ±1 A; Resolution: 25 µA. 0.1 A/div to 2 A/div: ±10 A; Resolution: 0.025 div.

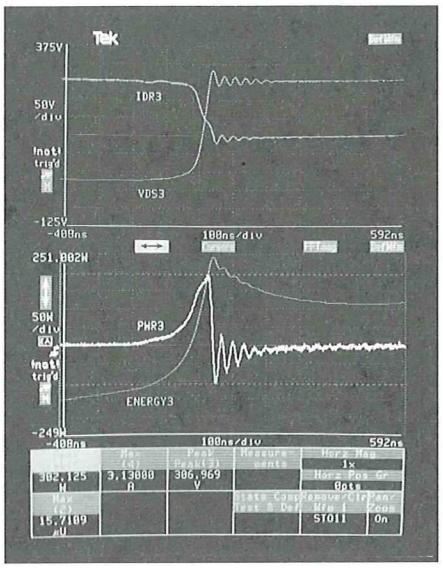
Input Coupling Modes – AC, DC, and OFF.

ENVIRONMENTAL CHARACTERISTICS

Temperature – Operating: 0° to 50°C; Nonoperating: – 40° to +75°C.

Altitude – Operating: to 4.5 km (15,000 ft.); Nonoperating: to 15 km (50,000 ft.).

MIL Specs – MIL-T-28800C, Type III, Class 5.



Make accurate, high-bandwidth power measurements and energy calculations with the 11A16 Programmable Current Amplifier and 11A33 Differential Comparator. Current and Voltage maintain their proper phase relationship to 50 MHz.

With a sensitivity range of 1 mA/div to 2 A/div (with the A6302 probe) the 11A16 supports a wide variety of applications, from medical monitors to machine control to power systems. The 11A16 is an excellent tool for power supply designers. With it, the engineer can make simultaneous measurements on current and voltage waveforms and use the waveform math capability of the 11000 Series and DSA 600 Series mainframes to calculate instantaneous power. You can verify power circuit design or monitor variations in power use by your target system.

Accessory

A6302

Voltage times Current = Power

- Capture current with the A6302/11A16 combination
- Capture voltage with a P6135 pair and 11A33

For complete selection information on all Accessory products, see page 446.

11A16

- Two Separate Channels
- 50 MHz Bandwidth at Probe Tip
- Automatic Deskew, Including Probe, for High Accuracy Power Measurements
- Programmability via IEEE 488.1 (GPIB) and RS-232
- Increased Accuracy from On-board Amplitude Calibration
- Fully Compatible with 11000/ DSA Series
- Full Use of All 11000 Series Measurements
- Compatible with Tektronix A6302 and A6303 Current Probes
- One-button Probe Degaussing and Offset Adjustment
- Bandwidth Limiting
- AC or DC Coupling

Fully integrated measurements of AC + DC current. Excellent power measurement system when combined with 11A33 differential amplifier.

ORDERING INFORMATION

11A16

Two-channel Current Amplifier **$3,500**

Includes: User Reference (070-7763-00), Service Reference (070-7764-00), Current Loop Adapter (015-0601-00), Voltage Converter (015-0598-00).

Opt. 20 – Includes Two A6302 Probes. ..... **+$1,590**

RECOMMENDED ACCESSORIES

See page 446 for complete selection information on all Accessories.

CURRENT PROBES

DC to 15 MHz, 0-52.5A (DC to pk AC). Order A6303 ..... **$1,495**

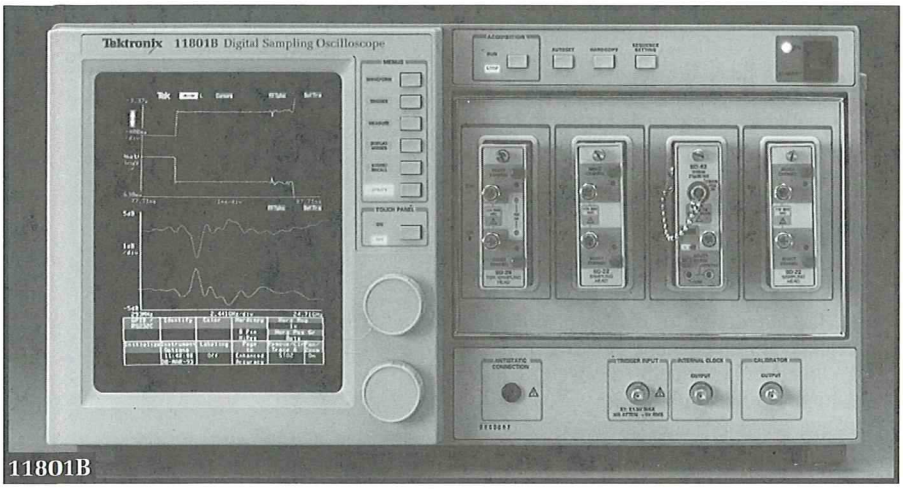
Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Digital Sampling Oscilloscope



High resolution capable of viewing very fast digital signals.

11801B Digital Sampling Oscilloscope

The 11801B Digital Sampling Oscilloscope offers the widest range of on-board measurement and waveform processing capabilities of any multi-gigahertz scope. With excellent measurement repeatability, exceptional vertical resolution and the fastest display update rate, the 11801B is a powerful measurement tool for semiconductor testing, TDR characterization of circuit boards, IC packages and cables, and high-speed digital data communications. An easy-to-use touch screen display gives you instant access to the 11801B's extensive waveform processing and measurement functions.

MODULARITY MEETS YOUR NEEDS NOW AND IN THE FUTURE

The modular microprocessor-based architecture of the 11801B not only allows you to select the right configuration for your application, but also allows expandability to meet your future measurement needs. The 11801B accepts up to four dual-channel sampling heads and can be expanded through the SM-11 Multi-Channel Units to 136 channels.

There are currently ten sampling heads to choose from:

SD-14	2.5 GHz high impedance (100 kΩ/0.475 pF) dual-channel probe sampler
SD-20	20 GHz single-channel loop-through head
SD-22	12.5 GHz dual-channel low noise head
SD-24	20 GHz dual-channel TDR/sampling head
SD-26	20 GHz dual-channel sampling head
SD-30	40 GHz single-channel sampling head
SD-32	50 GHz single-channel sampling head
SD-42	6.4 GHz O/E converter (55 ps optical pulse response FWHM)
SD-46	20 GHz O/E converter (22 ps optical pulse response FWHM)
SD-51	20 GHz trigger head

11801B FEATURES

- DC to 50 GHz Bandwidth
- 7 ps Rise Time
- 8 Channels, Expandable to 136 (with SM-11)
- 10 fs Sampling Interval (0.01 ps)
- Modular Architecture
- 200 kS/s Sample Rate
- Dual Time Base
- Non-volatile Waveform and Setting Storage
- FFT
- Predefined Telecom Masks (Opt. 1T)
- TDR
- Automatic Measurements:
  - Jitter/ Noise, Statistical, Histograms, Mask Testing, Pulse with Statistics
- Programmable for ATE Applications
- Color Display

BENEFITS

- Comprehensive Waveform Processing

APPLICATIONS

- **Semiconductor Testing**
- **TDR Characterization of Circuit Boards, IC Packages and Cables**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 — The 11801B Series complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 — ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

11801B Digital Sampling Oscilloscope

STATE-OF-THE-ART WAVEFORM ACQUISITION

The state-of-the-art timebase provides equivalent-time sweep rates from 1 ps/div to 5 ms/div, with record lengths from 512 points to 5120 points, and a sample interval of 10 femtoseconds (0.01 ps). The 11801B also offers true windowing, whereby sections of a main trace are re-acquired at higher resolution for close examination of details. The windows are not just a digital zoom as in some competitive instruments. Only Tektronix sampling scopes offer such high resolution viewing of the main acquisition. The acquisition system provides 8-Bit vertical resolution at all deflection factors (78 µV/LSB at 2 mV/div). Powerful on-board waveform processing allows usable deflection factors down to 100 µV/div, giving resolution well beyond the basic 2 mV/div sensitivity of the sampling system itself. The 11801B boasts the fastest sample rate among sampling scopes. The 200 kHz sampling rate gives "real-time" feel for waveform manipulation and increases throughput on data capture for histograms and measurements.

A POWERFUL MEASUREMENT TOOL ON YOUR BENCH

The 11801B offers a comprehensive, accurate and automatic measurement system. A total of 28 on-board measurements can be conveniently selected through the touch screen measurement menu. Results of up to six measurements may be simultaneously displayed on the screen, continuously updated to follow changing signal conditions. However, any number of measurements may be made over GPIB or RS-232-C interfaces. There are three different modes of measurements: hardware, software and statistics. Hardware mode allows high throughput on timing measurements and simultaneous measurements on up to 68 channels at once. Statistics mode uses the statistical database to make all the measurements based on the statistical distribution of the data over multiple acquisitions. It provides very stable and accurate measurements even in the presence of jitter or noise. With the statistical measurement mode, direct automatic jitter and noise measurements are possible (see Figure 1). This eliminates the human judgment and error that comes with manual measurements from histograms. As in all the other 11000 Series instruments, software measurement mode uses IEEE algorithms to make measurements based on digitized waveforms. An alternate Tektronix proprietary algorithm that is optimized for pulses with ringing and other anomalies is also selectable.

FFT

The 11801B offers FFT display and measurements as a useful tool for the design engineer and scientist. FFT magnitude or phase displays can be created of the acquired waveform and the automatic Spectral Frequency, Spectral Magnitude, and THD (Total Harmonic Distortion) measurements can be used for a complete analysis (see Figure 2).

COLOR GRADING AND MASK/TEMPLATE TESTING

The power of the measurement capabilities of the 11801B can be extended even further with color graded display, histogramming capabilities and mask testing. Both vertical and horizontal histograms, with periodically updated measurements such as mean, RMS and peak-to-peak allow statistical distributions to be analyzed at any point on the signal. The statistical database, available in the color graded display, not only adds a third dimension to your waveforms (by showing a point density of the samples), but also avoids time consuming re-acquisitions or repeated histogram analysis and statistical measurements. The mask testing capability of the 11801B provides an easy, yet powerful and quantitative way to characterize metastability in your device or system. In addition to custom mask editing, the 11801B offers AutoMask – 38 standards-defined masks in memory for instant recall (Option 1T, Predefined Telecom Masks). This option, together with automatic waveform scaling, gives a rapid verification of a digital bit stream's conformance to pulse templates or eye pattern masks (see Figure 3, on following page).

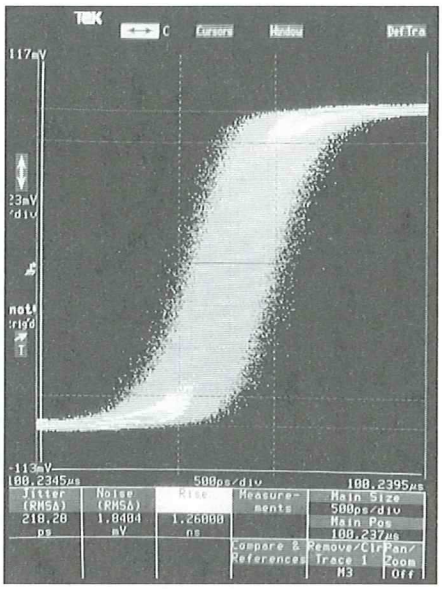


Figure 1. Direct and automatic jitter, noise and rise time measurement using the statistical measurement mode.

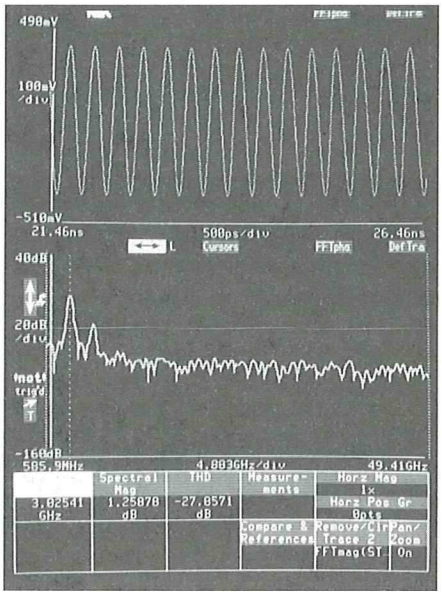


Figure 2. FFT display and measurements in the 11801B offer additional analysis power to the engineer or scientist.

Digital Sampling Oscilloscope

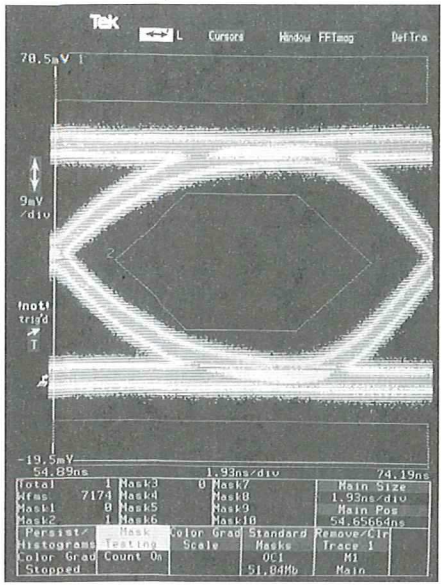


Figure 3. Predefined Telecom masks make verifying digital stream conformance simple.

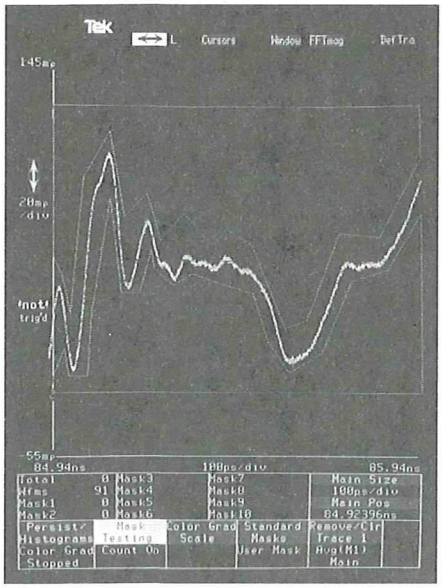


Figure 4. TDR go/no-go impedance measurement using masks.

UNMATCHED TDR CAPABILITIES

With the SD-24 Dual-Channel TDR/Sampling Head, the 11801B offers full 20 GHz acquisition and unmatched TDR performance on up to 136 channels. Each channel has an independent polarity-selectable (positive-going or negative-going) TDR step generator. The TDR outputs can also be precisely matched at a reference plane, providing the only true integrated differential TDR system available today. Differential TDR offers an accurate picture of the performance of balanced or unbalanced differential systems such as twisted pair cables, coupled microstrips, or differential inputs in active devices. Tektronix' differential TDR system is the only system available today that offers true differential TDR with live waveform updates and simple direct readout of impedance. Other systems require complex and error-prone computations and do not provide direct readout in ohms.

The step generator of the SD-24 also represents state-of-the-art technology, offering unmatched 35 ps reflected rise time*1, with the flattest step in the industry. TDR is also simple to use, with one-touch preset functions for both single-ended and differential TDR. There is direct readout of impedance in rho and ohms, as well as readout of one-way or round trip distance in meters, feet, or inches. Using the mask testing capability of the 11801B, you can perform go/no-go testing of impedances in circuit board runs, IC packages and cables (see Figure 4).

Single-ended and differential TDT (Time Domain Transmission) is also possible with the 11801B and SD-24. This type of testing may involve transmission testing (an end-to-end measurement through a cable or conductor), or crosstalk testing (signals induced on one or more adjacent cables or conductors). The ability to apply a step on any channel of the 11801B means that both forward and reverse testing is possible without switching test channels or relay multiplexing, which can be prone to errors. Also, as with differential TDR, Tektronix' system is the only system offering true differential TDT. Any of the above measurements may be performed single-ended or true differential.

The 11801B allows quick real-time viewing of the TDR response to a user-selected rise time with the filter function. Simply enter the filter rise time, and the 11801B displays a live trace that shows the response at the filtered rise time. Waveform math can also be used to subtract a reference trace acquired with a 50 Ω terminator for removal of unwanted aberrations due to cabling and fixturing.

WAVEFORM MEMORY AND NON-VOLATILE STORAGE

The 11801B is equipped with 512 KB of volatile waveform acquisition and display memory, and 256 KB of non-volatile memory for storage of waveforms and settings. These memories are independent; that is, the number of waveforms being acquired has no impact on the memory available for stored waveforms and settings.

MULTI-CHANNEL CAPABILITIES

The SM-11 Multi-channel Unit provides the means of expanding the 11801B's measurement system to 136 channels. Each SM-11 accepts up to 16 SD-Series sampling heads for 32 channels (with dual-channel heads). An 11801B mainframe with Option 1M is capable of driving up to four SM-11s. The entire system can then be driven through a single GPIB address. The 11801B acquisition system is designed to simultaneously acquire half of all active channels in a single acquisition cycle. Thus, in two acquisition cycles, all 136 channels can be acquired, and measurements performed on them. All channels, whether in the 11801B or SM-11 mainframes, offer the full specified performance. There is no loss of performance throughput or reliability as is the case in relay-multiplexed systems.

EASY-TO-USE HUMAN INTERFACE

The power of the 11801B is accessed through a simple menu structure with pop-up menus and two control knobs. In addition, common functions such as time/div and volts/div, are accessed through on-screen icons which are always accessible. For ATE applications, the 11801B is completely programmable through its IEEE 488 and RS-232-C interfaces.

DOCUMENTATION

The 11801B provides extensive hardcopy support. Documenting your results, complete with labels and time and date stamp, is as easy as pressing the HARDCOPY button. A variety of printers and plotters, including Tektronix color printers, are supported. TIFF (Tagged Image File Format) output is also supported for exporting hardcopy to word processors.

**1 The observed rise time of a reflection from a short circuit.*

Accessory

AK02

- Provides adaptability to most signal sources for 50 Ω termination
- Includes 50 Ω attenuators, 50 Ω cables, gender adapters

For complete information on all Accessory products, see page 446.

11801B Digital Sampling Oscilloscope

Characteristics

VERTICAL SYSTEM*1

Rise Time/Bandwidth – Determined by the sampling head used.

Vertical Resolution – 8-Bits full screen (78 µV/LSB at 2 mV/div deflection factor).

Amplifier Gain Accuracy – ±1% of all settings.

Deflection Factors – 2 to 255 mV/div in 1 mV/div increments.

Offset Range – ±2 V.

HORIZONTAL SYSTEM

Main and Window Time Base – 1 ps/div to 5 ms/div, settable to 1-2-5 sequence or in 1 ps increments.

Record Length – 512, 1024, 2048, 4096, and 5120 samples.

Windows – Any number of window records may be placed on any number of main records, up to a maximum of eight displayed traces. All window records have the same duration, but may be independently positioned on any main record. Windows may be set to automatically track a moving edge on the main record.

Maximum Sample Rate – 200 kS/s.

TRIGGER SYSTEM*4

Trigger Bandwidth – 3 GHz.

Trigger Sensitivity –
DC, 1X ≤3 GHz: 100 mV;
AC, 1X 300 kHz to 3 GHz: 100 mV;
DC, 10X ≤3 GHz: 1 V;
AC, 10X 300 kHz to 3 GHz: 1 V.

Delay Jitter – 1.3 ps +4 ppm of a position typical. 2.0 ps +5 ppm of position maximum (RMS).

Internal Clock – 100 kHz (drives TDR, Internal Clock Output, and Calibrator).

Trigger Level Range – ±1.0 V (±10 V with 10X trigger attenuator activated).

Trigger Input Range – ±1.5 V (+15 V, 5 V RMS maximum with 10X).

Trigger Holdoff – 5 µs to 2.5 s.

MEASUREMENT SYSTEM

Waveform Processing Functions – Add, subtract, multiply, divide, absolute, average, differentiate, envelope, exponent, integrate, natural log, log, signum, square root, smoothing, and filter.

Measurement Set – Max, min, mid, p-p, mean, RMS, amplitude, extinction ratio, overshoot, undershoot, noise*5, rise, fall, spectral magnitude, spectral frequency, THD, SNR, frequency, period, prop delay, cross, width, phase, duty cycle, jitter*5, area +, area –, and energy. Measurements are constantly updated; mean and standard deviation available on all measurements.

Measurement Parameters – (Proximal, mesial, distal, and start/stop levels): May be set to absolute levels.

Cursors – Paired or split dots, vertical bars, and horizontal bars.

TDR SYSTEM (SD-24 ONLY)

Combined TDR/Acquisition Reflected Rise Time – 35 ps or less.

TDR Step Amplitude – Adjustable to ±250 mV (polarity of either step may be inverted).

Time Coincidence Between TDR Steps – Adjustable to less than 1 ps.

Source Resistance – 50 ±0.5 Ω.

Typical Aberrations – (at ±250 mV Amplitude) 10 ns to 20 ps before step: ±3% or less; Less than 300 ps after step: +10%, –5% or less; 300 ps to 5 ns after step: ±3% or less; Elsewhere: ±1% or less.

CRT AND DISPLAY FEATURES

CRT – 9 inch diagonal, magnetic deflection, vertical raster scan orientation. Color.

Colors – Eight-color default color set included; or colors are user-selectable from palette of 262,144 colors.

Video Resolution – 552 horizontal by 704 vertical displayed pixels.

POWER REQUIREMENTS

Line-voltage Ranges – 90 to 132 V RMS, 180 to 250 V RMS.

Line Frequency – 48 to 440 Hz.

Maximum Power Consumption – 214 W.

ENVIRONMENTAL AND SAFETY

Temperature – Operating: 0°C to +50°C; Nonoperating: –40°C to +75°C.

Humidity – Operating and Nonoperating: up to 95% relative humidity, up to 50°C. Per MIL-T-28800E, Type III, Class 5.

Altitude, Vibration, Shock Nonoperating, Bench Handling – Meets MIL-T-28800E, Type III, Class 5.

Electromagnetic Compatibility – (with sampling heads or optional blank panels installed in all sampling head compartments) Meets the Requirements of: MIL-STD-461B; FCC Part 15, subpart J, Class A; VDE 0871/6.78 Class B.

Safety – Listed UL 1244, CSA Bulletin 556B September 1973.

PHYSICAL CHARACTERISTICS

	Cabinet		Rackmount	
Dimensions	**mm**	**in.**	**mm**	**in.**
11801B				
Width	448	17.6	483	19.0
Height	238	9.4	222	8.8
Depth	599	23.6	550	21.6
SM-11				
Width	448	17.6	483	19.0
Height	238	9.4	222	8.8
Depth	558	22.0	550	21.6
Weight	**kg**	**lb.**	**kg**	**lb.**
11801B				
Net	22.3	49	23.2	51
Shipping	25.9	57	26.8	59
SM-11				
Net	20.0	44	20.9	46
Shipping	23.6	52	24.5	54

TIME BASE ACCURACY – TYPICAL SPECIFICATIONS

Range*2, *3	Base	+	Interval Specification	+	Position Specification
Interval ≥1 ns	4 ps		0.004%* Interval		0.0004%* Position
Interval =100 ps	2.5 ps		–		0.0004%* Position
Interval ≤10 ps	1 ps		–		0.0004%* Position

*1 *Vertical system specifications of 11801B with SD-14 non-applicable. See 11800 Series Sampling Head specifications.*

*2 *For intervals <100 ps, the above holds for time/div ≤20 ps/div.*

*3 *For other intervals not listed above, linearly interpolate the cardinal points.*

*4 *11801B external trigger requires 23 ns pre-trigger or DL 11 Delay Lines to view trigger point (45.5 ns with Option 1M).*

*5 *Available only in statistical measurement mode.*

Digital Sampling Oscilloscope

ORDERING INFORMATION

11801B
Digital Sampling Oscilloscope **$25,000**
Includes: User Manual (070-8783-00), Programmer Manual (070-8784-00), Service Manual (070-8781-00), 12 inch SMA-SMA Cable, 2 ea. 8 1/2 inch SMA-SMA Cable, 1 Wrist Strap.

Opt. 1R – Rackmount ..... **+$255**
Includes: Hardware, tooling, and instructions for converting Bench Model to Rackmount Configuration. Available with 11801B and SM-11.

Opt. 1M – Multi-channel Conversion. Modifies 11801B to permit operation with up to four SM-11 Multi-channel Units. ..... **+$1,200**

Opt. 1T – Predefined Telecom Masks. AutoMask offers 38 standards-defined masks in memory for instant recall. ..... **NC**

SM-11
Multi-channel Unit **$25,500**
Includes: Installation/User Manual (070-7048-01), Service Reference (070-7049-01), Power Cord, U.S., 120 V (161-0066-00).

DL-11
Delay Line **$4,295**
Includes: Installation/User Manual (070-7050-01), Instruction Sheet (070-7051-01), 20 in. Coaxial Cable, RF 50 Ω (174-1427-00), 60 in. Coaxial Cable, RF 50 Ω (174-1428-00).

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**
Opt. A2 – United Kingdom 240 V, 50 Hz ..... **NC**
Opt. A3 – Australian 240 V, 50 Hz ..... **NC**
Opt. A4 – North American 240 V, 60 Hz ..... **NC**
Opt. A5 – Switzerland 220 V, 50 Hz ..... **NC**
See Customer Information Section for additional information.

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection *2
Opt. C5 – Adds five years of Calibration Services *2

RECOMMENDED ACCESSORIES
See page 446 for complete selection information.

PROBES
50 Ω Divider (Z0) Probe – 9 GHz. Order P6150 ..... **$995**
Active Probes (requires 1103 power supply) –
10X, DC – 1 GHz, ≥10 MΩ Input Impedance, 1.9 pF.
Order P6204 ..... **$1,595**
10X, DC – 4 GHz, ≥100 kΩ Input Impedance, 0.4 pF.
Order P6217 ..... **$3,595**
1103 Power Supply **$655**
Current Probe – (requires BNC to SMA Adapter)
DC – 50 MHz, 0-20 A (DC + peak AC). Order AM 503S **$2,795**
DC – 15 MHz, 0-100 A (DC + peak AC).
Order AM 503S Opt. 03 ..... **$3,445**
25 kHz-1 GHz, Max Current of 0.5. A RMS. Order CT-1 ..... **$295**
Optical-to-Electrical Converters – (See page 354-360)
DC – 6.4 GHz, 1000-1700 nm. Order SD42 ..... **$3,995**
DC – 20 GHz, 1200-1650 nm. Order SD46 ..... **$6,995**
DC – 1 GHz, 1100-1700 nm. Order P6703A*1 ..... **$3,677**
DC – 700 MHz, 450-1050 nm. Order P6701A*1 ..... **$2,678**
DC – 300 MHz, 1000-1700 nm, High Gain. Order P6713*1 **$2,550**
DC – 250 MHz, 450-1050 nm, High Gain. Order P6711*1 ... **$2,142**

*1 *See pages 108, 354 for complete selection information.*

*2 *Contact your local Tektronix representative for price and ordering information.*

CALIBRATION STEP GENERATOR
U.S. – Order 067-1338-00 ..... **$8,140**
Includes: Instruction Sheet; Test Report; SMA Female Short-circuit Termination.
Universal European – (240 V, 50 Hz).
Order 067-1338-01 ..... **$8,140**
UK – (240 V, 50 Hz). Order 067-1338-02 ..... **$8,140**
Australia – (240 V, 50 Hz). Order 067-1338-03 ..... **$8,140**
Switzerland – (240 V, 50 Hz). Order 067-1338-05 ..... **$8,140**
Japan – (100 V, 50-60 Hz). Order 067-1338-06 ..... **$8,140**

CART
Order K465 ..... **$835**

ADDITIONAL ACCESSORIES
Power Strip – Four Outlet, 6 ft., Noise/Surge Suppression.
Order 131-5342-01 ..... **$48**
SMA Accessory Kit – 2 ea. 2X and 5X Attenuators; 2 ea. SMA Terminations, Male Short Circuit, Female Short Circuit, Male 50 Ω, Female 50 Ω, 2 ea. 50 Ω Signal Cables (2 ns), 2 ea. 500 ps Semi-rigid Cable, 2 ea. Male-to-Male adapters, 2 ea. SMA Male-to-BNC Female, 2 ea. Female-to-Female, 1 ea. 50 Ω Power Divider, 1 ea. Combination Wrench (.312, 6 point).
Order 020-1693-00 ..... **$2,605**
3.5 mm Accessory Kit – 1 ea. 50 Ω Reference Air Line, 1 ea. Male-to-Male Adapter, 1 ea. Female-to-Female Adapter, 1 ea. 26.5 GHz 50 Ω Terminator (Male), 1 ea. 26.5 GHz 50 Ω Terminator (Female), 1 ea. 26.5 GHz Short Circuit (Male), 1 ea. 26.5 GHz Short Circuit (Female), 2 ea. 50 Ω Attenuators (6 dB 26.5 GHz, 2.9 mm), 2 ea. 50 Ω Attenuators (20 dB 26.5 GHz, 2.9 mm), 1 ea. Power Divider (26.5 GHz, 2.9 mm), 2 ea. Flexible Signal Cables (2 ns, Male-to-Male), 2 ea. Signal Cables (500 ps, Male-to-Male, 2.9 mm Semi-rigid), 1 ea. Torque Wrench, 1 ea. Combination Wrench (0.312, 6 point), 1 ea. Combination Wrench (0.281, 6 point).
Order 020-1692-00 ..... **$8,365**
2X Attenuator – SMA Male-to-Female. Order 015-1001-00 ..... **$225**
5X Attenuator – SMA Male-to-Female. Order 015-1002-00 ..... **$210**
Power Divider – Order 015-1014-00 ..... **$315**
Blank Sampling Head – Order 200-3395-00 ..... **$1.15**
ECL Terminator – Provides the bias and termination for ECL device outputs. At 10 GHz bandwidth and 1% precision attenuation, accurate AC and DC measurements are ensured. Attenuation: 10X ±1.0% @ DC, 20 dB ±3 dB, DC to 10 GHz Aberrations: ±3% max with 100 ps rise time.
Order 015-0558-00 ..... **$1,285**
DC Block (Coupling Capacitor) – Order 015-1013-00 ..... **$390**
Slip-on Connector – Order 015-0553-00 ..... **$46**
Connector Savers – (SMA) Order 015-0549-00 ..... **$185**
(APC) Order 015-0552-00 ..... **$280**
DL-11 Service Manual – Order 070-7050-01 ..... **$25**
SM-11 Service Manual – Order 070-7049-01 ..... **$165**

CABLES AND EXTENDERS
Sampling Head Extender Cable –
1 m. Order 012-1220-00 ..... **$850**
2 m. Order 012-1221-00 ..... **$935**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 11801B Series complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

IPA 310A

Interconnect Parameter Analyzer

Tektronix IPA 310A bridges the gap between measurement and simulation for high-accuracy interconnect characterization and modeling.

IPA 310A FEATURES

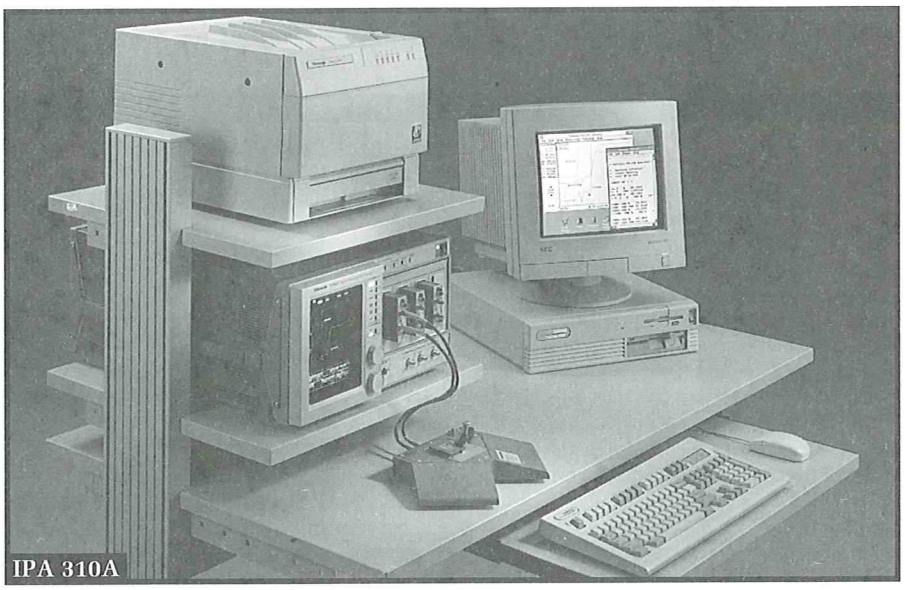
- Automatic SPICE Model Generation and Verification
- Direct Measurement of L, C, Z, t
- Enhanced TDR Resolution Using Z-Profile™ Algorithm
- Lumped, Distributed, and Coupled Model Extraction
- Multi-channel and Differential TDR
- Model Verification at Rise Time of Interest
- Supports Industry Standard Simulators

BENEFITS

- Simulate/Predict System Performance Early in the Design Process
- Improved Simulation Accuracy
- Predict Crosstalk, Reflections, and Ground-bounce Using Models Generated by the IPA 310A

TYPICAL USERS

- High-speed IC Designers and System Designers
- MCM Designers and Process Engineers
- Signal Integrity Engineers



IPA 310A Interconnect Parameter Analyzer

The IPA 310A Interconnect Parameter Analyzer is the first system to offer a complete, turnkey solution for modeling IC interconnects. With a combination of superior hardware and software capabilities, the IPA 310A supports the measurement, model creation, simulation, and verification of interconnects – all in the familiar time domain.

The IPA Methodology

The IPA methodology involves using a high-bandwidth, high accuracy acquisition instrument (the 11801B equipped with TDR) to extract a reflection profile of the interconnect. Through special processing algorithms, one of a number of different model types can then be extracted. By automatically creating a simulation environment that represents the measurement environment, the simulated and measured results can be directly compared, allowing direct model verification. This closed-loop process results in high confidence in the accuracy of the model. The interconnect model can then be combined with active circuitry to predict performance at the package or system level.

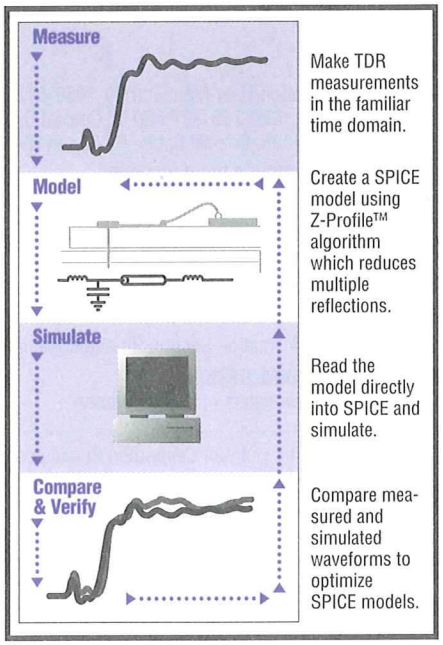


Figure 1. The IPA 310A integrates measurement and simulation domains into a single, turnkey system.

APPLICATIONS

- **Extraction and Verification of IC Package SPICE Models**
- **DUT Load Board Characterization and Modeling**
- **Design and Modeling of Connectors, Sockets and Backplanes**
- **MCM and Circuit Board Trace Modeling**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Interconnect Parameter Analyzer

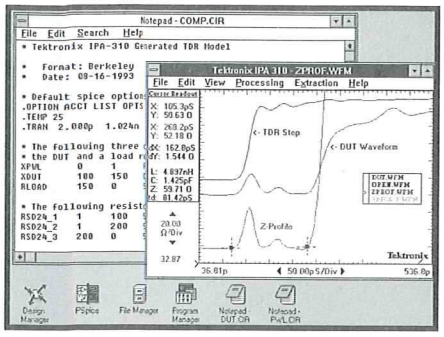


Figure 2. Create and verify SPICE simulation models of IC packages and interconnect used in high-speed systems.

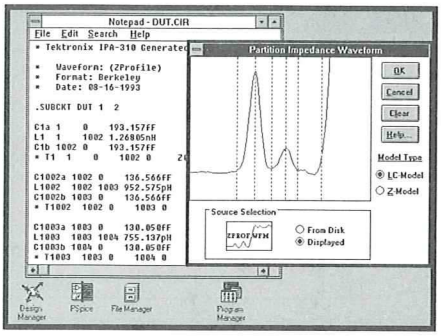


Figure 3. The IPA 310A automatically creates SPICE models from a user defined segmentation of the Z-Profile™ waveform.

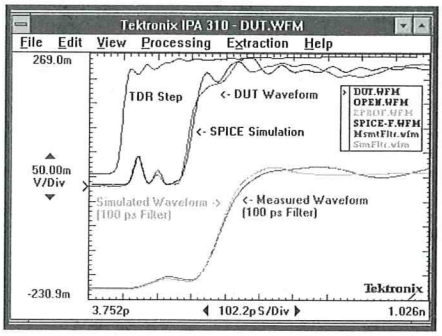


Figure 4. Verify models by comparing simulated and measured waveforms. Filter the measured and simulated waveforms to verify the model at a user specified signal rise time.

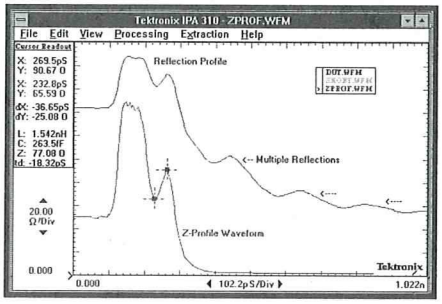


Figure 5. Z-Profile™ reduces the effects of multiple reflections. The resulting waveform is scaled directly in ohms, not rho. This allows for inductance, capacitance, and impedance to be measured over any portion of the waveform.

MEASUREMENT

The first step in the process of extracting a SPICE model involves using Time Domain Reflectometry (TDR) to get a reflection profile of the interconnect. The 11801B Digital Sampling Oscilloscope is an integral part of the IPA system. Combined with the SD-24 dual channel TDR/sampling head, the IPA 310A has unsurpassed TDR performance. The fast 35 ps reflected rise time (typically 28 ps) of the SD-24 ensures the highest resolution and accuracy. The IPA Nexus and high quality cables provided with the system ensure signal fidelity at the DUT interface.

The 11801B is used to provide the fast rise time stimulus and to capture the reflection profile of the IC package or other interconnect. This reflection profile, along with the open circuit or short circuit reflection at the DUT interface, is transferred to the IPA software residing on the PC.

MODELING

Using special algorithms built in to the IPA software, a number of different model types can be extracted. The Z-Profile™ algorithm is used to reduce the effects of multiple reflections inside the interconnect structure that degrade resolution and make it difficult to extract model parameters. The result of using Z-Profile™ is a true impedance profile, scaled in ohms. Cursors can then be used to extract inductance, capacitance, average impedance, and time delay over any section of the waveform. In addition, a SPICE model consisting of LC lumped elements or transmission line segments can be automatically extracted and written to disk as a standard, Berkeley-compatible SPICE file. Other models such as lumped coupled, coupled transmission lines, and lossy elements can also be extracted.

SIMULATION

Once an interconnect model has been created from the measured data, the model must be simulated in order to proceed to the verification process. Because the models created with the IPA 310A are standard Berkeley SPICE subcircuits, virtually any SPICE simulator can use them. The IPA 310A automatically generates the necessary simulation support files to create a simulation environment that represents the measurement environment. The IPA 310A automatically generates a SPICE Piece-wise Linear voltage source to model the incident TDR waveform to act as the simulation stimulus. A Berkeley-compatible composite SPICE file combines the model of the TDR step with the interconnect model. By using PSPICE® resident on the PC, the composite SPICE file can be run very quickly. The resulting waveform can then be imported into the IPA for verification.

VERIFICATION: THE KEY TO ACCURATE SIMULATION

For the first time, you can directly overlay measured and simulated responses to instantly verify the accuracy of interconnect models. Optimization involves the simple process of adjusting parameters or modifying the model and re-simulating. By filtering the measured and simulated waveforms, the model performance can be evaluated at the rise time of interest. Users can add models of active circuitry to predict the real performance of devices including the effects of interconnect.

Direct model verification through comparison with measured results means greater confidence in the design of high-speed systems, ICs, and interconnect. With more accurate simulation you can expect to shorten your time to market by eliminating design turns, reducing the cost and improving the quality of your designs through a better understanding of noise and timing margins.

The Z-Profile™ Advantage

The IPA 310A's proprietary Z-Profile™ algorithm overcomes two major limitations of traditional TDR measurements. First, traditional TDR returns data scaled in units of rho – the reflection coefficient. Extraction model parameters, such as inductance and capacitance, from data scaled in rho requires additional calculations to first scale the data in ohms.

Calculating ohms from the reflection coefficient is relatively simple and is accurate for a response with only one significant reflection. However, for a DUT with two or more discontinuities, multiple reflections and re-reflections between the discontinuities make the TDR results very difficult to interpret. In addition, calculating impedance directly from rho is no longer valid. To accurately measure impedance in the presence of multiple reflections requires special processing.

The Z-Profile™ algorithm minimizes the effects of multiple reflections and provides results scaled in ohms. The output of the Z-Profile™ algorithm can be used to automatically extract lumped inductance and capacitance values for a SPICE model. To streamline manual adjustment of model values, the IPA 310A also provides cursors with direct readout of inductance, capacitance and impedance. The end result is faster model development and more accurate models, verified with actual measurements.

Interconnect Parameter Analyzer

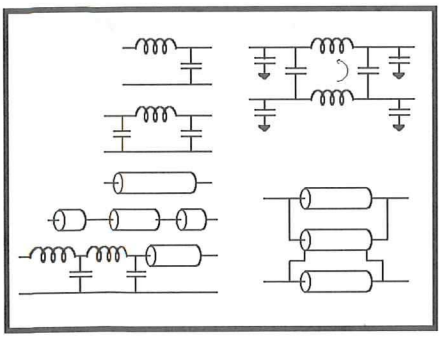


Figure 6. The IPA supports a variety of model types that can be used with any SPICE simulator.

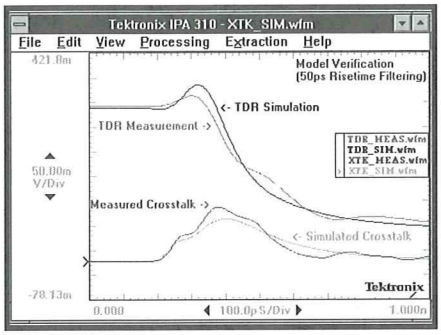


Figure 7. The IPA 310A can create coupled models to predict crosstalk. These models can be verified by comparing the simulated and measured waveforms.

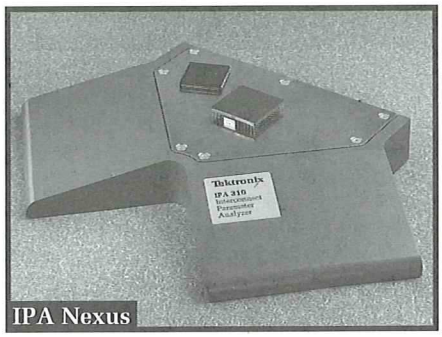


Figure 8. The IPA Nexus is a precision multi-line interface to standard IC packages.

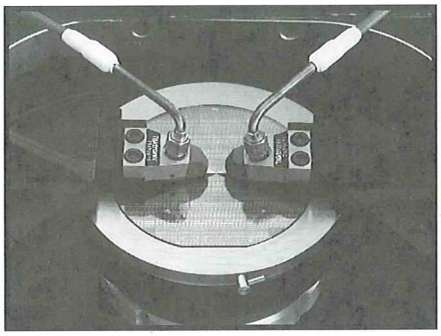


Figure 9. Characterize MCMs, hybrids, and wafers using microwave probes.

Coupled Model Extraction

When coupling exists between nearby conductors, crosstalk is a concern. The IPA 310A can create a coupled model that allows the designer to simulate crosstalk. This is accomplished by using both channels of the SD-24 TDR/Sampling head to launch a step down one conductor while monitoring another for crosstalk. The IPA 310A can then extract the self inductance, mutual inductance, total capacitance and mutual capacitance for the two conductors. The coupled model can be verified by comparing the simulated and measured crosstalk and the simulated and measured TDR responses. Once again, filtering can be used to verify the model at the rise time of interest.

Reliable, Repeatable DUT Connection

The IPA 310A comes standard with a precision, multi-line interface called the IPA Nexus, making the IPA 310A a complete, turnkey system for modeling and verifying high-speed interconnect. The Nexus accommodates established high-speed IC packages, including pin-grid arrays, quad flat packs and other popular packages.

The IPA Nexus supports up to 12 signal lines and pin spacing ranging from 100 to 15 mils. Its careful design creates a high-performance environment that ensures outstanding signal integrity. Quality cabling, accessories and options add flexibility to the IPA 310A's fixture.

For newer technologies that require microwave probing such as Multichip Modules, the IPA 310A supports a probe station and microwave probes.

Included with the IPA 310A is an interconnect accessory kit containing two high-quality SMA cables, 50 Ω terminators, shorts, cable wrench, and a torque wrench.

A Complete Solution

The IPA 310A is the first complete time-domain solution for creating and verifying SPICE models of interconnect. These models, combined with active circuit models, can be used to predict system level performance early in the design process, reducing design turns and improving product quality.

IPA 310A Capabilities

MODEL TYPES

- Models built from multiple LC segments
- Distributed models consisting of multiple transmission line segments
- Coupled LC models for simulating crosstalk
- Coupled transmission lines
- Automatic Piece-wise Linear voltage sources of waveforms
- Automatic generation of composite SPICE file

PROCESSING CAPABILITIES

- Z-Profile™ for enhanced TDR resolution and true impedance profile
- Filtering to view measured and simulated response at user-specified rise time
- Waveform math includes integration, add, subtract, multiply, and divide on any two waveforms
- Calculation of self inductance, mutual inductance, total capacitance, and mutual capacitance
- 11801B Digital Sampling Oscilloscope provides many additional waveform math functions
- 11801B includes the powerful 11000 Series measurement system including statistical database, statistical measurements, mask testing, timing, voltage, and area/energy measurements

HIGH-SPEED INTERFACE TO DEVICE

- IPA Nexus for interfacing to PGA, QFP, SOIC, LCC, CC and DIP package styles
- Support for probe station and microwave probes
- Direct connection to SMA interface for characterizing cables or connectors
- Interface to PCB interconnect using coaxial probes

CURSOR CAPABILITIES

- Volts, time, delta-V and delta-t
- Inductance, capacitance, average impedance, point impedance, round trip and one-way time
- Single or double cursors
- Ability to lock cursors to waveform or float on waveform display
- Cursor types include vertical, horizontal, or cross-hair including dot or solid options

Interconnect Parameter Analyzer

USER INTERFACE
- On-line, context sensitive help
- Annotation labels for waveforms and comments
- Cut and paste of waveform display for use in other applications
- Microsoft Windows environment
- User-definable waveform color
- User-selectable graticule options
- Waveform legend for selecting, viewing or hiding waveforms
- Auto-scale, zoom and lock-waveform-scaling options
- Ability to drag and overlay waveforms for comparing simulated and measured results

FILE FORMATS
- Waveform formats: Tektronix 11 K or time-voltage
- Scope settings saved on disk in Tektronix 11 K format
- PSPICE® ".out" format converted to IPA ".wfm" format
- Berkeley SPICE compatible net-lists
- IPA setups saved and recalled in ".ipa" ASCII format

STORAGE CAPABILITIES
- Save and load waveforms on disk
- Save and load 11801B scope settings on disk
- Save and load IPA software setups on disk

PRINTER SUPPORT
- Support for the Phaser™ 200e Color Printer provided with the system
- Any graphics printer with a Windows print driver installed (except pen plotters)

Recommended Configuration

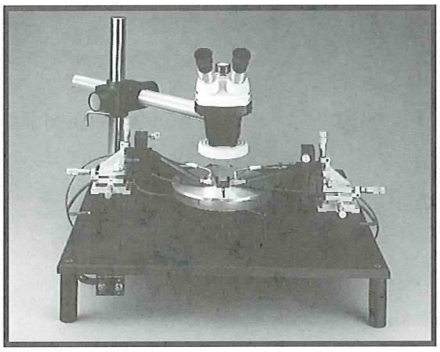
INSTRUMENTATION AND FIXTURING
- 11801B Digital Sampling Oscilloscope, Opt. 26
- SD-24 Dual Channel TDR/Sampling Head, Opt. 27
- IPA Nexus (High-speed Fixture for PGA Packages), Opt. 28
- QFP-25 Quad Flat Pack Adapter (or substitute), Opt. 29
- Coaxial Adapter Kit. Includes: 2 ea. High-quality SMA Cables, standard
- Torque Wrench, standard

SYSTEM SOFTWARE
- IPA 310A Interconnect Parameter Analyzer Software
- PSPICE® Evaluation Only Software, by MicroSim
- GPIB Driver Software
- DOS and Windows

CONTROLLER AND PRINTER
- Compaq Pentium PC or better; 525 MB Hard Drive; 16 MB RAM; 3.5 in. Floppy; Mouse; Keyboard; Tape Backup
- NEC SVGA Monitor, Opt. 02 or 03
- Tektronix Phaser™ 200e Color Printer, Opt. 2P
- National Instruments GPIB Card, Opt. 1G

OTHER
- Sample IC Packages, Copper Tape
- GPIB Cable
- Printer Cable

SYSTEM INTEGRATION AND INSTALLATION
- System Integration by Tektronix Integration Center, Part of Opt. 1S
- On-site Installation and Product Verification, Part of Opt. 1S



ACCESSORY

PPMS 100
HIGH RESOLUTION PROBING STATION
- Conveniently Position Microwave or Conventional Oscilloscope Probes
- HANDS-Free Access to MCM's, Hybrids, Interconnects, SMT Packages and IC's

PSPICE® is a registered trademark of MicroSim Corporation.

ORDERING INFORMATION

IPA 310A
System Software **$26,420**
Includes: PSPICE, Evaluation Software, Torque Wrench, Manual, Coax Adaptor Kit

Opt. 1S*1 – System Integration and Computer ..... **+$1995**
Opt. 26 – Add 11801B Sampling Oscilloscope ..... **+$25,000**
Opt. 27 – Add SD-24 TDR Sampling Head ..... **+$4,250**
Opt. 28 – Add the IPA Nexus ..... **+$9,995**
Opt. 29 – QFP2-25 Adapter ..... **+$1,650**
Opt. 30 – QFP4-25 Adapter ..... **+$1,650**
Opt. 31 – QFP2-50 Adapter ..... **+$1,650**
Opt. 32 – QFP4-50 Adapter ..... **+$1,650**
Opt. 02 – Add NEC 5FG 17 in. SVGA Monitor ..... **+$1,600**
Opt. 03 – Add NEC 4FG 15 in. SVGA Monitor ..... **+$950**
Opt. 1C – Add Tektronix Test Station Table ..... **+$1,195**
Opt. 2P – Add Tektronix Phaser™ 200e (4681PXE) Color Printer ..... **+$2,995**
Opt. 1E – Add a Coax Adapter Kit (Additional) ..... **+$1,245**
Opt. 1G – Add National Instruments AT-GPIB/TNT Card and Cable ..... **+$615**

RECOMMENDED SYSTEM
Includes: Options 1S, 26, 27, 28, 29, 03, 1C, 2P.
Total Recommended System **$74,450**

11801B OPTIONS
Opt. 1R – Rackmount ..... **+$250**
Opt. 1M – Multi-channel Conversion. Modifies 11801B to permit operation with up to four SM-11 Multi-channel Units. ..... **+$1,000**

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal European 220 V, 50 Hz ..... **NC**
Opt. A2 – UK 240 V, 50 Hz ..... **NC**
Opt. A3 – Australia 240 V, 60 Hz ..... **NC**
Opt. A4 – North America 240 V, 60 Hz ..... **NC**
Opt. A5 – Switzerland 220 V, 50 Hz ..... **NC**

RECOMMENDED ACCESSORIES
Probing Station/Articulated Arms –
For complete information see page 480 ..... **NC**

**1 If option 1S is not selected. (National Instruments AT-GPIB Card, NI-488.2 Software for Windows is required.) Customer may order Opt. 1G to meet this requirement if not presently owned.*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

SD-14/-20
SD-22/-24
SD-26/-30
SD-32/-42
SD-46/-51

Sampling Heads

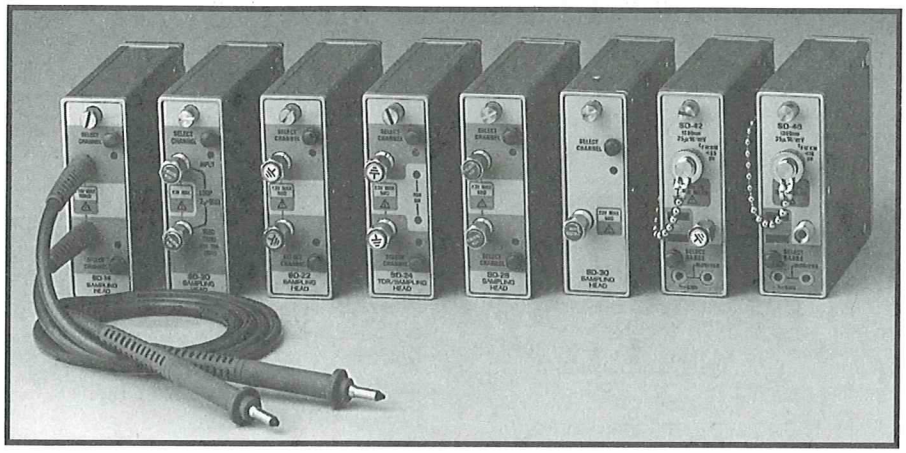
CSA 803A/11801B Series

High performance sampling heads provide high bandwidth sampling for a multitude of applications.

SD-14
- 100 kΩ, 0.475 pF Typical
- 7 V p-p Dynamic Range
- 3 GHz Bandwidth
- ECL, CMOS and GaAs Device Characterization

SD-20
- Loopthrough Sampling Head
- Non-terminated
- General-purpose TDR

SD-22
- 12.5 GHz Bandwidth
- Low-noise
- Digital Data Communications
- Dual-channel



SD-14 High Impedance Probe Sampler

The SD-14 is a dual-channel, 3 GHz probe sampler designed for high impedance signal acquisition where a 50 Ω acquisition system is not the optimal solution. The SD-14 is ideal for high-speed device characterization such as ECL, CMOS, ACL, and GaAs testing. The 100 kΩ input impedance and 0.475 pF capacitance results in very low loading of the device under test. The 7 V dynamic range and ±3.5 V offset range, makes the SD-14 suitable for testing all digital logic families as well as most analog circuits.

The SD-14 consists of two samplers, each attached at the end of a 1.0 meter cable for easy circuit probing. The modular architecture of the CSA 803A/11801B enables the use of extended samplers, bringing a new level of performance to sampling scopes. In conjunction with the 11801B and SM-11 multi-channel unit, it is possible to configure up to 136 channels of high-impedance, high-bandwidth acquisition with measurement accuracy approaching 140 ps.

Option 01 adds a longer probe tip, two probe-to-ECB (etched circuit board) adapters, and two probe-to-SMB adapters. These ease probing of plated holes (as found in Outboards for IC testers) and semi-permanent connections.

SD-20 Loopthrough Sampling Head

The SD-20 is a single-channel, 20 GHz loopthrough sampling head designed for low-loss testing in applications such as microwave systems research and development, digital device characterization, and high-speed digital communications circuit design. It provides an acquisition rise-time of 17.5 ps, with typically 750 µV RMS of noise (350 µV with smoothing) to ensure clean, undistorted signals.

The SD-20 is non-terminated and keeps losses to a minimum by routing the signal of interest directly through the sampling head – without the need of a power divider. The SD-20 can also be used for customized TDR measurements of transmission lines and controlled impedance devices. An external signal generator may be used, instead of the SD-24 step generator, to tailor the TDR stimulus to fit a particular situation. For instance, slower slew rates or higher amplitude may be utilized, or you may perform half-sine or impulse testing.

In digital communications, the SD-20 is useful for viewing and triggering on the clock signal without the use of a power divider.

SD-22 Low-noise Sampling Head

The SD-22 is a dual-channel, 12.5 GHz sampling head specifically designed for low-noise measurement in digital communications and device characterization applications. It provides an acquisition rise-time of 28 ps, and typically 450 µV RMS of displayed noise. With smoothing, noise levels are 180 µV RMS.

In order to precisely capture and display the switching characteristics of high-speed communications circuits, to make accurate statistical measurements of signal noise and signal timing jitter, or to obtain stable timing measurements of fast digital ICs, the noise floor of the test equipment must be kept to a minimum. The SD-22 is the ideal instrument for these low-noise applications.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Sampling Heads
CSA 803A/11801B Series

SD-24 TDR/Sampling Head

The SD-24 is a dual-channel TDR/Sampling Head. This sampling head has a rise time of 17.5 ps or less, with a typical 20 GHz equivalent bandwidth.

Each channel of the SD-24 is also capable of generating a fast rising step for use in Time Domain Reflectometry (TDR). In TDR mode, the acquisition portion of the sampling head monitors the incident step and any reflected energy. The reflected rise-time of the TDR step is 35 ps or less. The polarity of each channel's TDR step can be selected independently of the other channel. This allows for differential or common-mode testing of two coupled lines, in addition to the independent testing of isolated lines. The SD-24 can be used to characterize crosstalk by using the TDR step to drive one line while monitoring a second with the other channel.

The "filter" function on the CSA 803A/11801B can be used with TDR or crosstalk measurements to characterize a system at a slower rise time.

SD-26 Sampling Head

The SD-26 is a dual-channel, 20 GHz equivalent bandwidth sampling head. This sampling head has the same acquisition capability as the SD-24 TDR/Sampling Head but does not include the TDR step generators.

SD-30 Sampling Head

The SD-30 is a single-channel, 40 GHz bandwidth sampling head for use in high bandwidth applications. This sampling head was specifically designed for characterizing high-speed devices used in advanced data communications and microwave systems research. This performance is available for any new or existing CSA 803A/11801B mainframe without having to upgrade to a new system, a result of the modular architecture of the CSA 803A/11801B family. The SD-30 has a measured bandwidth of greater than 40 GHz and a calculated rise-time of less than 8.8 ps. The front-panel connector is female 2.4 mm, and an adaptor is provided (011-0157-00; 2.4 mm male to 2.92 mm female) in order to maintain compatibility with SMA connector systems.

SD-32 Sampling Head

The SD-32 is a single-channel, 50 GHz bandwidth sampling head. The SD-32 performance is available for any new or existing CSA 803A/11801B mainframe. The SD-32 has measured bandwidth of greater than 50 GHz and calculated rise time less than 7.0 ps.

SD-42 Optical-to-Electrical Converter

The SD-42 Optical-to-Electrical Converter head can be used to analyze optical signals in the 1000 nm to 1700 nm wavelength range. The pulse response of the measurement system is less than 55 ps FWHM (Full-width, Half-maximum), which is equivalent to a calculated bandwidth of DC to 6.4 GHz. The electrical output on the front panel is coupled to the adjacent sampling head via the semi-rigid coaxial link provided.

The SD-42 is also equipped with an optical power meter for average power monitoring through a pair of voltage outputs on the front panel. Power from 5 nW to 5 mW can be measured.

For more information on this product, see the Opto-Electronics Instruments section of this catalog.

SD-46 Optical-to-Electrical Converter

The SD-46 is an Optical-to-Electrical converter for use with the CSA 803A/11801B Series Oscilloscopes equipped with an SD-22, SD-24, SD-26, SD-30, or SD-32 Sampling Head. The SD-46 is linear up to 25 mW peak input with a calibrated deflection factor from 50 µW/div to 5 mW/div at 1300 nm. This head has a 25 ps optical pulse response (maximum FWHM) with the SD-24 and SD-26.

For more information on this product, see the Opto-Electronics Instruments section of this catalog.

SD-51 Trigger Head

The SD-51 Trigger-countdown Head provides stable displays of signals from 1 to 20 GHz with less than 6 ps RMS jitter.

The SD-51 is a free-running tunnel diode oscillator with a front-panel control to synchronize the oscillator to a subharmonic of the input signal and the output oscillator to a subharmonic of the input signal. The output from the SD-51 is coupled to the CSA 803A/11801B Series trigger input connector. The output signal is a direct countdown of the input (and the input connector) and permits triggering by the sampling time base unit.

Continued on next page.

SD-24
- TDR/Sampling Head
- Dual-channel, Differential TDR
- 20 GHz Bandwidth
- 35 ps Reflected Rise Time
- Line Impedance and Crosstalk Characterization

SD-26
- 20 GHz Bandwidth
- Dual-channel

SD-30
- 40 GHz Bandwidth
- Single-channel
- High Bandwidth Communications and Microwave Applications
- 2.9 mm Connector

SD-32
- 50 GHz Bandwidth
- Single-channel
- 2.4 mm Connector

SD-42
- Optical-to-Electrical Converter
- DC to 6.4 GHz Optical Bandwidth
- 1000-1700 nm Wavelength Range

SD-46
- Optical-to-Electrical Converter
- 20 GHz Optical Bandwidth
- 1200 nm to 1650 nm Spectral Response

SD-51
- Trigger-countdown Head
- 1 to 20 GHz Bandwidth
- Less Than 6 ps RMS Jitter

High performance sampling heads provide high bandwidth sampling for a multitude of applications.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

SD-14/-20
SD-22/-24
SD-26/-30
SD-32/-42
SD-46/-51

Sampling Heads

CSA 803A/11801B Series

SAMPLING HEAD CHARACTERISTICS

	Channels	Bandwidth	Rise time	Impedance	Noise	Applications (Typical)
SD-14	2	3 GHz (typical)	140 ps	100 kΩ/0.475 pF 0.55 pF Opt. 01	2 mV	ECL, CMOS, ACL GaAs Dev. Characterization
SD-20	1	20 GHz	17.5 ps	50 Ω unterm.	750 µV	Special TDR, Communications
SD-22	2	12.5 GHz	28 ps	50 Ω	450 µV	Communications
SD-24	2	20 GHz	17.5 ps	50 Ω	750 µV	TDR/TDT Crosstalk
SD-26	2	20 GHz	17.5 ps	50 Ω	750 µV	Device Characterization
SD-30	1	40 GHz	8.8 ps	50 Ω	1.8 mV	High Bandwidth Communications & Microwave
SD-32	1	50 GHz	7.0 ps	50 Ω	1.8 mV	High Bandwidth Communications & Microwave
SD-42	1	6.4 GHz	–	–	–	Optical-to-Electrical
SD-46	1	20 GHz	–	–	–	Optical-to-Electrical
SD-51	–	20 GHz	–	50 Ω	–	Trigger Countdown Head

Characteristics

Acquisition System – SD-14, SD-22, SD-24, SD-26: dual channel; SD-20, SD-30, SD-32: single channel.

Rise Time – SD-14: 140 ps; SD-20, SD-24, SD-26: 17.5 ps; SD-22: 28 ps, all from 10% to 90%.

Bandwidth – 3 GHz (typical) for the SD-14; 20 GHz for the SD-20, SD-24, and SD-26; 12.5 GHz for the SD-22; 40 GHz for the SD-30; 50 GHz for SD-32.

Dynamic Range – 1 V p-p within a ±1.6 V range for the SD-20, SD-22, SD-24, SD-30, SD-32; 7 V p-p within a ±3.5 V offset range for the SD-14.

Dot Transient Response – Accuracy after calibration at operating temperature is ±5% for signals up to 0.5 V p-p. Adjustable to unity for signals up to 1.0 V p-p.

Input Impedance – SD-22, SD-24, SD-26, SD-30, SD-32: 50 Ω ±0.5 Ω. SD-14 is 100 kΩ and 0.475 pF (0.55 pF for Option 01). SD-20 is not terminated and not rated.

Displayed Noise –

With unity dot response:	Maximum	Typical
SD-20, SD-24, SD-26	1.2 mV	750 µV
SD-22	800 µV	450 µV
SD-14	8 mV	7 mV
SD-30	2.3 mV	1.8 mV
SD-32	2.3 mV	1.8 mV
With smoothing:		
SD-20, SD-24, SD-26	550 µV	350 µV
SD-22	400 µV	180 µV
SD-30	1 mV	700 µV
SD-32	1 mV	700 µV

Aberrations (typical) (SD-20, SD-22, SD-24, SD-26 only) – The following are acquisition aberrations. 10 ns to 20 ps before step: ±3% or less. < 300 ps after step: +10%, –5% or less. 300 ps to 5 ns after step: ±3% or less. 300 ps to 5 ns after step: ±4 or less (SD-20 only). 5 ns to 100 ns after step: ±1% or less. Elsewhere: ±0.5% or less.

Aberrations (typical) (SD-14 only) – <1.5 ns after step: +12%, –25%, 1.5 ns to 4 ns after step: +1%, –3%, 4 ns to 30 ns after step: ±2%. Elsewhere: ±1%.

Maximum Input Voltage – ±3 V. SD-14: ±15 V; SD-30, SD-32: ±2 V.

Isolation Between Channels – 1% p-p voltage transmission from the channel driven by the 067-1338-00, to the quiescent channel (see page 110 in this catalog).

Time Coincidence Between Channels – 10 ps accuracy; <0.2 ps/°C stability.

TDR SYSTEM (SD-24 ONLY)
Displayed Rise Time.

Incident – 28 ps typical, 10% to 90%, at +250 mV or –250 mV output, elsewhere ±1%.

Reflected – 35 ps or less, 10% to 90%, at +250 mV or –250 mV output.

TDR Step Amplitude – Adjustable to ±250 mV (polarity of either step may be inverted).

Time Coincidence Between TDR steps – Adjustable to less than 1 ps.

Source Resistance – 50 ±0.5 Ω.

Aberrations (at ±250 mV amplitude) – The following are TDR aberrations. 10 ns to 20 ps before step: ±3% or less. < 300 ps after step: +10%, –5% or less. 300 ps to 5 ns after step: ±3% or less. Elsewhere: ±1% or less.

ENVIRONMENTAL AND SAFETY CHARACTERISTICS
(11801B, CSA 803A, SM-11, SD-Series Heads)

Temperature – Operating: 0°C to +50°C; Nonoperating: –40°C to +75°C.

Altitude, Vibration, Shock, Bench Handling – Operating and nonoperating: meets MIL-T-28800C, Type III, Class 5.

Safety – Listed UL 1244 (not SD-14, SD-30, SD-32, SD-42, SD-46), CSA Bulletin 556B, September 1973.

Electromagnetic Compatibility (not SD-14) – Meets the following requirements of MIL-STD-461C: CE-03 Pt 4 Curve 1, CS-01 Pt 7, CS-02 Pt 4, CS-06 Pt 5, RE-02 Pt 7, RS-01 Pt 4, RS-02 Pt 5, RS-03, Pt 7 (limited to 1 GHz). Meets FCC Part 15, subpart J, Class A. For Germany: Meets VDE 0871/6.78 Class B. (Not all for SD-14.)

Humidity – To 95% RH at up to 50°C.

Characteristics (SD-51)

Input Signal – Frequency range is 1 to 20 GHz. Stable synchronization on signals of at least 100 mV p-p, as measured separately into 50 Ω, 5 V p-p max.

Input Characteristics – 50 Ω SMA (3 mm) connector. Open termination paralleled by 1 pF.

Trigger Output – Approximately 200 mV into 50 Ω. Jitter is 6 ps RMS or less with signals from 5 to 20 GHz; 7 ps RMS or less with signals from 1 to 5 GHz. Kickout at signal input is 180 mV peak; kickout occurs between successive samples.

Sampling Heads
CSA 803A/11801B Series

ORDERING INFORMATION

SD-14
High Impedance Probe Sampler.....**$4,500**
Includes: Installation/User Manual (070-8286-01); Service Manual (070-8285-01); 4-post ECB Mount Ground Socket; Edge Tab Ground Socket; 10 ea. Wire-form Ground, .050 Spacing; 10 ea. Wire-form Ground, .040 Spacing; Plastic Accessories Case.
Opt. 01 – Longer Probe Tip, Probe to ECB Adapters, Probe to SMB Adaptors .....**+$250**

SD-20
Loopthrough Sampling Head **$4,400**
Includes: Installation/User Reference (070-7531-01), Service Reference (070-7528-01), Precision 3.5-mm Termination (011-0155-00), 2 SMA Short-circuit Terminations (015-1020-00).

SD-22
Low-Noise Sampling Head.....**$3,780**
Includes: Installation/User Reference (070-7226-02), Service Reference (070-7227-02), 2 SMA Short-circuit Terminations (015-1020-00).

SD-24
Dual TDR/Sampling Head.....**$5,250**
Includes: Installation/User Reference (070-7052-01), Service Reference (070-7053-01), SMA Short-circuit Terminations (015-1020-00).

SD-26
Dual Sampling Head.....**$3,780**
Includes: Installation/User Reference (070-7226-02), Service Reference (070-7227-02), 2 SMA Short-circuit Terminations (015-1020-00).

SD-30
Sampling Head.....**$9,450**
Includes: Installation/User Manual (070-7904-01); Service Manual (070-7905-01); 1 SMA Short-circuit Termination (015-1020-00).

SD-32
Sampling Head.....**$12,500**
Includes: Installation/User Reference (070-8268-01); Service Reference (070-8269-01); 1 SMA Short-circuit Termination (015-1020-00); 2.4 mm male to 2.92 mm female adapter (011-0157-00).

SD-42
Optical-to-Electrical Converter.....**$3,995**
See the Telecommunication Instruments section for complete information.

SD-46
Optical-to-Electrical Converter **$6,995**
See the Telecommunication Instruments section for complete information.

SD-51
Trigger Head **$4,200**
Includes: Installation/User Manual (070-7338-01), Service Reference (070-7339-01), 12 in. SMA Male-to-male (174-1364-00).

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection
SD-14, SD-20, SD-22, SD-26.....**+$160**
SD-24, SD-30, SD-32.....**+$260**

Opt. C5 – Adds five years of Calibration Services
SD-14, SD-20, SD-22, SD-26.....**+$475**
SD-24, SD-30, SD-32.....**+$725**

RECOMMENDED ACCESSORIES
See page 446 for complete selection information.

PROBES
50 Ω Divider Probes –
2 tips: 1X, 10X. 1X: 3 GHz, 50 Ω; 10X. 9 GHz, 0.15 pF/500 Ω, 1 m. Order P6150.....**$995**
3.5 GHz, 1 pF/500 Ω, 10X 3 GHz, 1.1 pF/ 5000 Ω, 100X, 1.5 m. Order P6156 Opt. 25.....**$350**
Optional Tips: 1X, 10X, 20X, 100X, See page 446.
Requires SMA male-to-BNC female adapter when attached to SMA-type inputs. Order 015-0554-00.....**$47**

ADDITIONAL ACCESSORIES
SMA Accessory Kit – 2 ea. 2X and 5X Attenuators; 2 ea. SMA Terminations, Male Short Circuit, Female Short Circuit, Male 50 Ω, Female 50 Ω, 2 ea. 50 Ω Signal Cables (2 ns), 2 ea. 500 ps Semi-rigid Cable, 2 ea. Male-to-male Adapters, 2 ea. SMA Male-to-BNC Female, 2 ea. Female-to-female, 1 ea. 50 Ω Power Divider, 1 ea. Combination Wrench (.312, 6 point). Order 020-1693-00.....**$2,605**

3.5 mm Accessory Kit – 1 ea. 50 Ω Reference Air Line, 1 ea. Male-to-male Adapter, 1 ea. Female-to-female Adapter, 1 ea. 26.5 GHz 50 Ω Terminator (Male), 1 ea. 26.5 GHz 50 Ω Terminator (Female), 1 ea. 26.5 GHz Short Circuit (Male), 1 ea. 26.5 GHz Short Circuit (Female), 2 ea. 50 Ω Attenuators (6 dB 26.5 GHz, 2.9 mm), 2 ea. 50 Ω Attenuators (20 dB 26.5 GHz, 2.9 mm), 1 ea. Power Divider (26.5 GHz, 2.9 mm), 2 ea. Flexible Signal Cables (2 ns, Male-to-male), 2 ea. Signal Cables (500 ps, Male-to-male, 2.9 mm Semi-rigid), 1 ea. Torque Wrench, 1 ea. Combination Wrench (0.312, 6 point), 1 ea. Combination Wrench (0.281, 6 point). Order 020-1692-00.....**$8,365**

2X Attenuator – SMA Male-to-female. Order 015-1001-00.....**$225**

5X Attenuator – SMA Male-to-female. Order 015-1002-00.....**$210**

75 Ω to 50 Ω Min Loss Attenuator – BNC. Order 011-0112-00.....**$110**

Power Divider – Order 015-1014-00.....**$315**

Blank Sampling Head – Order 200-3395-00 .....**$1.15**

ECL Terminator – Provides the bias and termination for ECL device outputs. At 10 GHz bandwidth and 1% precision attenuation, accurate AC and DC measurements are ensured. Attenuation: 10X ±1.0% @ DC, 20 dB ±3 dB, DC to 10 GHz. Aberrations: ±3% max with 100 ps rise time. Order 015-0558-00.....**$1,285**

DC Block (Coupling Capacitor) – BNC. Order 015-1013-00.....**$390**

Slip-on Connector – Order 015-0553-00.....**$46**

Connector Savers – (SMA) Order 015-0549-00 .....**$185**
(APC) Order 015-0552-00 .....**$280**

CABLES AND EXTENDERS
Sampling Head Extender Cables –
(1 m) Order 012-1220-00.....**$850**
(2 m) Order 012-1221-00.....**$935**

Acquisition Extender – Order 067-1324-00 .....**$160**

Acquisition System Extender – Order 067-1323-00 .....**$2,030**

Card Cage Extender – Order 067-1267-00.....**$1,430**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

SM-11
DL-11
SIU 800

Multi-channel Unit Delay Line

Developed for use in applications such as TDR circuit board testing and cable testing.

SM-11

- Multi-channel TDR and Simultaneous Acquisition
- Up to 136 Acquisition Channels when Connected to the 11801B Digital Sampling Oscilloscope

DL-11

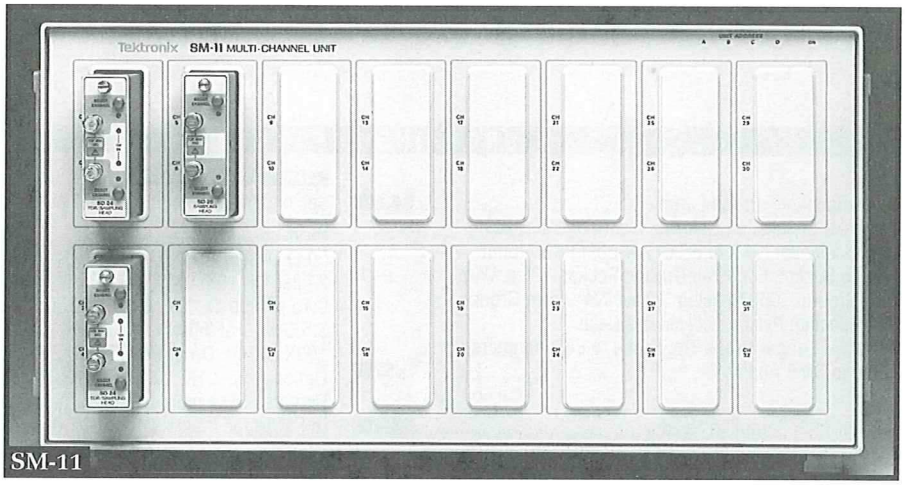
- 47.5 ns Compensated Dual Delay Line
- 5 GHz Bandwidth

CALIBRATION STEP GENERATOR

- 250 mV
- Verifies Specifications of SD-14, SD-20, SD-22, SD-24, SD-26 Sampling Heads

SIU 800

- <40 ps Reflected Rise Time when Used with SD-24
- <80 mp Reflection Coefficient



The SM-11 Multi-channel Unit can accept up to 16 SD-Series Sampling Heads.

SM-11 Multi-channel Unit

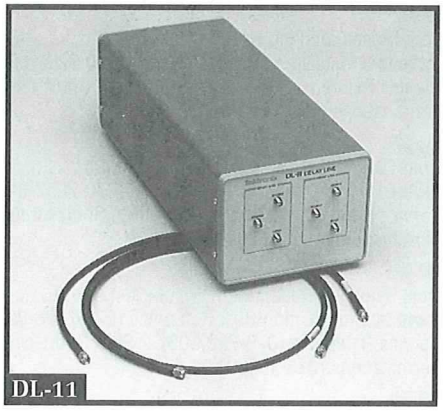
The SM-11 Multi-channel Units expand the 11801B Digital Sampling Oscilloscope to 136 channels. Each SM-11 accepts up to 16 of the SD-Series Sampling Heads; an 11801B mainframe, with Option 1M added, is capable of driving up to four SM-11 Units. The entire system can then be driven through a single GPIB address.

The 11801B/SM-11 acquisition system is designed to acquire up to 68 channels in a single acquisition. Thus, in two acquisition cycles, all 136 channels can be acquired.

The hardware measurement capability of the 11801B system allows timing measurements to be taken in a single acquisition cycle. This greatly increases the throughput of a large multi-channel system over that of a system where the signals must be multiplexed through a small number of acquisition channels and then processed in software to determine measurement results.

PHYSICAL CHARACTERISTICS

	Cabinet		Rackmount	
Dimensions	**mm**	**in.**	**mm**	**in.**
Width	448	17.6	483	19.0
Height	238	9.4	222	8.8
Depth	558	22	550	21.6
Weights	**kg**	**lb.**	**kg**	**lb.**
Net	20.0	44	20.9	46
Shipping	23.6	52	24.5	54



DL-11 Delay Line

The DL-11 Delay Line provides approximately 47.5 ns of delay from the signal input to the signal output. The DL-11 contains two delay lines that when connected, allow you to view the triggering event through the 11801B or CSA 803A. The DL-11 has approximately 5 GHz bandwidth and attenuates the signal by 50%.

A delay line can reduce horizontal jitter and provide more accurate measurements because it lets you take measurements on the first rising edge of the triggering event.

The DL-11 Delay Line contains two delay lines each with 47.5 ns delay. The DL-11 is used for showing the triggering event of a signal displayed on an 11801B or a CSA 803A.

PHYSICAL CHARACTERISTICS

Dimensions	**mm**	**in.**
Width	159	6.3
Height	119	4.7
Depth	356	14.0
Weight	**kg**	**lb.**
Net	2.2	10
Shipping	3.08	14

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Static Isolation Unit Calibration Step Generator

SM-11
DL-11
SIU 800

Calibration Step Generator

The Calibration Step Generator is a very fast rise time, 250 mV step generator that verifies specifications of the SD-14, SD-20, SD-22, SD-24, and SD-26 sampling heads. It is supplied with a certificate and test report, stating the rise time of the step based on a measurement-controlled, internal Tektronix acquisition standard, to a tolerance of 2.5 ps typically. This reported rise time will not exceed 19.5 ps.

The output connector is a precision 3.5 mm male that allows direct interface to the SD-Series head. The step generator is triggered directly from the Internal Clock Output on a CSA 803A/11801B Series mainframe.

SIU 800 Static Isolation Unit

The SIU 800 protects the sampling bridge from damage due to static discharge from circuit boards and cables. The SIU 800 is intended for use in applications such as TDR circuit board testing and cable testing where large static charges can be stored. When used with the SD-24 TDR/Sampling Head, the SIU 800 provides a reflected rise time of less than 40 ps and a reflection coefficient of less than 80 mp.

The SIU 800 is installed between the DUT and sampling head and is controlled manually by a foot switch or under program control through a TTL-compatible input. When the foot switch is in the normal position (not pressed), the DUT is grounded through a 50 Ω termination resistor. This will discharge any static charge stored in the DUT. Pressing the foot switch connects the DUT to the sampling head input, allowing a measurement to be made. Both channels are controlled simultaneously by the foot switch or TTL input.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	23.28	0.95
Height	71.05	2.9
Depth	91.39	3.8
Weight	**kg**	**lb.**
Net	0.205	0.69
Shipping	0.441	2.0

ORDERING INFORMATION

SM-11
Multi-channel Unit.....**$25,500**
Includes: Installation/User Manual (070-7048-01), Service Reference (070-7049-01), Power Cord, U.S., 120 V (161-0066-00).
Opt. 1R – Rackmount.....**+$275**

INTERNATIONAL POWER PLUG OPTION
Opt. A1 – Universal Euro 220 V, 50 Hz.....**NC**
Opt. A2 – United Kingdom 240 V, 50 Hz.....**NC**
Opt. A3 – Australian 240 V, 50 Hz.....**NC**
Opt. A4 – North American 240 V, 60 Hz.....**NC**
Opt. A5 – Switzerland 220 V, 50 Hz.....**NC**
See Customer Information Section for additional description.

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection.....**+$590**
Opt. C5 – Adds five years of Calibration Services.....**+$1,225**

RECOMMENDED ACCESSORIES
See page 446 for complete selection information.

PROBES
50 Ω Divider –
10X, DC to 9 GHz. Order P6150.....**$995**
3.5 GHz, 1 pF/500 Ω, 10X, 3 GHz, 1.1 pF/ 5000 Ω, 100X, 1.5 m. Order P6156 Opt. 25.....**$350**
Requires SMA Male-to-BNC Female adapter when attached to SMA-type inputs. Order 015-0554-00.....**$47**

ADDITIONAL ACCESSORIES
SMA Accessory Kit – 2 ea. 2X and 5X Attenuators; 2 ea. SMA Terminations, Male Short Circuit, Female Short Circuit, Male 50 Ω, Female 50 Ω, 2 ea. 50 Ω Signal Cables (2 ns), 2 ea. 500 ps Semi-rigid Cable, 2 ea. Male-to-male Adapters, 2 ea. SMA Male-to-BNC Female, 2 ea. Female-to-female, 1 ea. 50 Ω Power Divider, 1 ea. Combination Wrench (.312, 6 point). Order 020-1693-00.....**$2,605**
3.5 mm Accessory Kit – 1 ea. 50 Ω Reference Air Line, 1 ea. Male-to-male Adapter, 1 ea. Female-to-female Adapter, 1 ea. 26.5 GHz 50 Ω Terminator (Male), 1 ea. 26.5 GHz 50 Ω Terminator (Female), 1 ea. 26.5 GHz Short Circuit (Male), 1 ea. 26.5 GHz Short Circuit (Female), 2 ea. 50 Ω Attenuators (6 dB 26.5 GHz, 2.9 mm), 2 ea. 50 Ω Attenuators (20 dB 26.5 GHz, 2.9 mm), 1 ea. Power Divider (26.5 GHz, 2.9 mm), 2 ea. Flexible Signal Cables (2 ns, Male-to-male), 2 ea. Signal Cables (500 ps, Male-to-male, 2.9 mm Semi-rigid), 1 ea. Torque Wrench, 1 ea. Combination Wrench (0.312, 6 point), 1 ea. Combination Wrench (0.281, 6 point).
Order 020-1692-00.....**$8,365**
2X Attenuator – SMA Male-to-female. Order 015-1001-00.....**$225**
5X Attenuator – SMA Male-to-female. Order 015-1002-00.....**$210**
Power Divider – Order 015-1014-00.....**$315**
Blank Sampling Head – Order 200-3395-00.....**$1.15**
ECL Terminator – Provides the bias and termination for ECL device outputs. At 10 GHz bandwidth and 1% precision attenuation, accurate AC and DC measurements are ensured. Attenuation: 10X ±1.0% @ DC, 20 dB ±3 dB, DC to 10 GHz. Aberrations: ±3% max with 100 ps Rise Time.
Order 015-0558-00.....**$1,285**
DC Block (Coupling Capacitor) – Order 015-1013-00.....**$390**
Slip-on Connector – Order 015-0553-00.....**$46**
Connector Savers – (SMA) Order 015-0549-00.....**$185**
(APC) Order 015-0552-00.....**$280**

CABLES AND EXTENDERS
Sampling Head Extender Cables
(1 m) Order 012-1220-00.....**$850**
(2 m) Order 012-1221-00.....**$935**
Acquisition Extender – Order 067-1324-00.....**$160**
Acquisition System Extender – Order 067-1323-00.....**$2,030**
Card Cage Extender – Order 067-1267-00.....**$1,430**

DL-11
Delay Line.....**$4,295**
Includes: Installation/User Manual (070-7050-01), Instruction Sheet (070-7051-01), 20 in. Coaxial Cable, RF 50 Ω (174-1427-00), 60 in. Coaxial Cable, RF 50 Ω (174-1428-00).

CALIBRATION STEP GENERATOR
U.S. – Order 067-1338-00.....**$8,140**
Includes: Instruction Sheet, Test Report, SMA Female Short-circuit Termination.
Universal Euro – 220 V, 50 Hz – Order 067-1338-01.....**$8,140**
United Kingdom – 240 V, 50 Hz – Order 067-1338-02.....**$8,140**
Australia – 240 V, 50 Hz – Order 067-1338-03.....**$8,140**
Switzerland – 240 V, 50 Hz – Order 067-1338-05.....**$8,140**
Japan – 100 V, 50-60 Hz – Order 067-1338-06.....**$8,140**

SIU 800
Static Isolation Unit.....**$1,950**
Includes: 12 V DC Power Supply, Two SMA, Male-to-female Adapters, Foot Switch, Two 50 Ω Terminators, and an Instruction/Performance Verification Manual.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

Digital Storage + Analog Real Time Oscilloscopes

CONTENTS

2400 SERIES
2430A 150 MHz 113
2440 300 MHz 113

200 SERIES
224 60 MHz 114
222PS 10 MHz 114
222A 10 MHz 114

2200 SERIES
2212 60 MHz 116
2216 60 MHz 116

ACCESSORIES
Probes 446
SMD Probes/Adapters 474
Probe and Instrument Accessories 520
Plotter/Printer 524
Cameras 526
Instrumentation Carts 528

How To Choose The Right Portable Scope For Your Measurement Needs.

The Tektronix 2200 Series digital plus analog scopes span a performance range from 20 MHz to 100 MHz.

To choose the right scope, first characterize your signal and decide if you need full-featured advanced performance or economical standard performance. An advanced 100 MHz oscilloscope is the most popular choice for most service and repair needs. With the addition of digital display technology, you can capture and analyze more types of signals. Finally, select a product class that meets your productivity needs and offers features to improve your measurement confidence. These enhancements make it easy to get fast and accurate results. The best in class products represent the latest offerings in each performance level.

The oscilloscope reference section provides additional information to assist you in your selection process.

ANALOG PLUS DIGITAL OSCILLOSCOPES

Model	Bandwidth	Sample Rate	Record Length	Vertical Resolution	Channels	Interfaces	Time Bases	Page
2430A*1	150 MHz	100 MS/s	1K	8-Bits	2	GPIB	Dual	113
2440*1	300 MHz	500 MS/s	1K	8-Bits	2	GPIB	Dual	113
2212	60 MHz*2 (Analog)	20 MS/s	4K points	8-Bits	2	GPIB & RS-232 Opt.	Single	116
2216	60 MHz	20 MS/s	16K points	8-Bits	2	GPIB & RS-232 Opt.	Single	116

*1 *See page 113 for replacement products for 2430A and 2440.*
*2 *Digital storage bandwidth limited by maximum sample rate.*

Digitizing Oscilloscopes

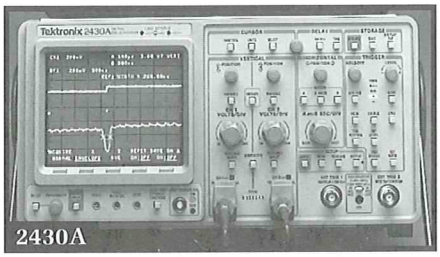
2430A/2440 Replacements

Note to our Valued 2430A and 2440 DSO customers:

The 2430A and 2400 DSOs have served their markets very well, and have been replaced by the new generation of TDS series. The TDS Digitizing oscilloscopes offer numerous performance advantages over the 2400 series in terms of *Accuracy, Acquisition* Flexibility, *Input/Output* Capability, Easy to use *Graphical User Interface,* and *Lower Price!*

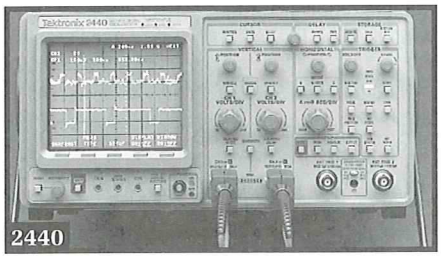
The following summary tables highlight the key performance differences between the TDS family and 2400 series DSOs. We at Tektronix are proud to continuously deliver superior value to our customers.

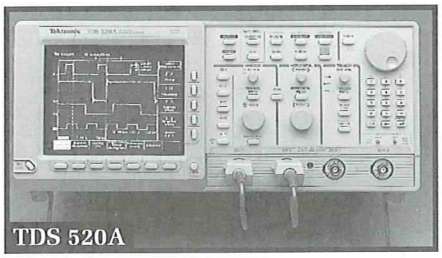
Please contact us for any assistance you require in making your Digitizing Oscilloscope selection. In U.S., call toll free: 1-800-835-9433, Ext. 2400 or contact your nearest Tektronix representative. Please refer to the pages in the back of the catalog for Tektronix contacts in your region.





	2430A	→	TDS 420
Bandwidth	150 MHz		150 MHz
Sample Rate	100 MS/sec		100 MS/sec
Channels	2 Channels		4 Channels
Vertical Accuracy	2% Vertical Accuracy		1.5% Vertical Accuracy
Single Shot BW	40 MHz		40 MHz
Auto Measure	21 Auto Measurements		25 Auto Measurements
Auto Setup	Yes		Yes
Record Length	1K		15K (60K Optional)
Update Rate	30 Hz		150 Waveforms/sec
I/O Transfer	GPIB only		GPIB, RS-232, Centronics
Roll Mode	Yes		Yes + Triggered Roll
Horizontal Range	5 ns-5 seconds		1 ns-20 seconds
Display Size	5 in. CRT Size		7 in. CRT Size
User Interface	Normal		Graphical User Interface
Advanced Math	None		FFT, Differentiate, Integrate (Optional)
Printer Pack	None		Optional
Price	**Supply Depleted**		**$6,295**





	2440	→	TDS 520A
Bandwidth	300 MHz		500 MHz
Sample Rate	500 MS/sec		500 MS/sec
Channels	2 Channels		2 + 2 Channels
Vertical Accuracy	1.5% Vertical Accuracy		1% Vertical Accuracy
Single Shot BW	200 MHz		200 MHz
Auto Measure	21 Auto Measurements		25 Auto Measurements
Auto Setup	Yes		Yes
Record Length	1K Memory		15K (50K Optional)
Update Rate	30 Hz		200 Hz
I/O Transfer	GPIB only		GPIB, RS-232, Centronics
Roll Mode	Yes		No
Horizontal Range	5 ns-5 seconds		1 ns-20 seconds
Display Size	5 in. CRT Size		7 in. CRT Size
User Interface	Normal		Graphical User Interface
Advanced Math	None		FFT, Differentiate, Integrate (Optional)
Price	**Supply Depleted**		**$8,895**

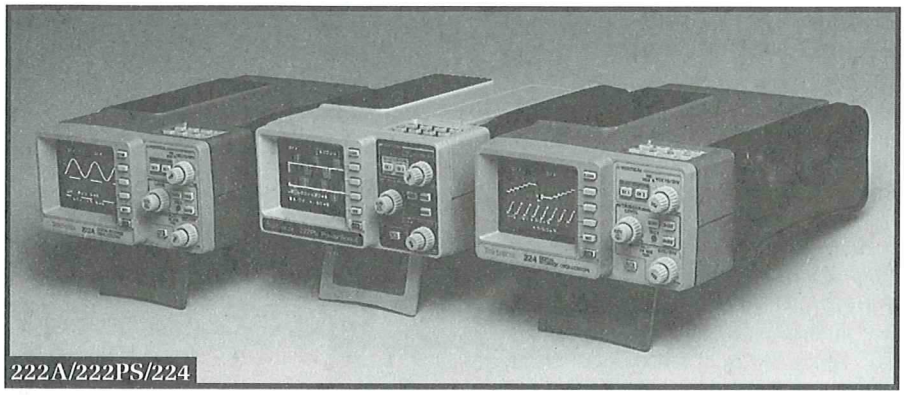
222A
222PS
224

Handheld Digitizing Oscilloscopes

Capture your measurements in out of the way places with these battery operated, compact, industrial service digitizing scopes.

222A/222PS/224

- Isolated Channel Architecture
- Floatable to ±850 V/channel (222PS, 224) ±400 V/channel (222A)
- 10 MHz 222A, 10 MHz 222PS, 60 MHz 224
- 100 ns Glitch Capture
- 6 kV Peak Surge Rating (222PS, 224)
- Exclusive Motor Trigger (222PS)
- Video Line Trigger (224)
- Auto Trigger
- Save Reference Memory
- Dual 10 MS/s Digitizers
- Programmable via RS-232-C
- Auto Setup
- Save Setup
- Detachable 1X/10X Probes
- Rugged Construction
- Battery Operated
- 4.4 lbs


222A/222PS/224

222A/222PS/224

The 220 Series of scopes provides unsurpassed power in the world of handheld oscilloscopes. The 60 MHz 224 and the 10 MHz 222A and 222PS sample at 10 MS/s for each channel, have an RS-232-C interface, and are fully programmable. Internal batteries eliminate the need for external power. These handheld scopes can also charge and operate from 12-28 V DC or 16-20 V AC.

UNMATCHED SAFETY

To ensure ultimate operator safety, the channels are fully isolated from each other and the casing is double insulated. Because they are floatable to ±850 V per channel, the 224 and the 222PS can make measurements safely on industrial power systems. They are the first scopes to be UL listed for line voltage measurements to 600 V AC, and are specified to withstand peak surges as high as 6 kV. The 222A can safely measure ±400 V per channel or 800 V p-p.

UNMATCHED VERSATILITY

The 224, because of its size, bandwidth, and portability, is a perfect tool for high-speed electronics that can't be easily returned to a repair shop, such as ATMs or avionics. The 224's exclusive TV trigger makes it just the thing for servicing medical imaging systems or closed-circuit surveillance equipment.

UNMATCHED FEATURES

Auto Setup and Save/Recall limit the need for manipulation of the front panel. Pushing the Auto Setup button selects all the input parameters for you. Save/Recall boosts productivity in repetitive testing at different locations by saving up to four front-panel setups.

After you've acquired a waveform using Auto Setup, you may save it in one of four 512 byte records. Then, recall a known good signal for comparison and make the necessary adjustments to bring the equipment on line.

To make a permanent record, simply connect the scope to your PC via the RS-232-C interface and transfer waveforms and setups using the optional CAT200 Software. Send them back to the scope when that same job is due again. With CAT200 Software, you can control the entire front panel from a remote location using the RS-232-C port, a modem, and a phone line.

The WP200 Intelligent Printer Interface allows you to make a hardcopy of a displayed waveform on an Epson-compatible printer – without using a PC and dedicated software.

UNMATCHED RUGGEDNESS

The 220 Series is packaged in impact-resistant plastic, capable of withstanding 50 g's of shock. They can operate accurately to temperatures as low as –10°C. The batteries allow a minimum of three hours of operation. Each scope comes complete with a ballistic nylon carrying case with a neck strap for hands-free operation.

APPLICATIONS

- **Power Measurements**
- **Motor Drive Test**
- **Electronic Device Debug**
- **TV and Video Signal Troubleshooting**
- **Safe High-voltage Measurements**
- **Remote Signal Monitoring and Service (with CAT200 software)**
- **Useful in Low Temperature environments**

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Handheld Digitizing Oscilloscopes

222A
222PS
224

KEY SPECIFICATIONS

	222A	222PS	224
Bandwidth	10 MHz	10 MHz	60 MHz
Digitizers/Channels	2	2	2
Rise Time	35 ns	35 ns	5.8 ns
Sample Rate (each channel)	10 MS/s	10 MS/s	10 MS/s
Vertical Resolution	8-Bit	8-Bit	8-Bit
Vertical Sensitivity	5 mV to 50 V/div	50 mV to 500 V/div	50 mV to 500 V/div
Sweep Speed	5 ns to 20 s/div	5 ns to 20 s/div	5 ns to 20 s/div
Time Base	Single	Single	Single
Acquisition Modes	Normal, Averaging, Peak Detect, Accumulated Peak	Normal, Averaging, Peak Detect, Accumulated Peak	Normal, Averaging, Peak Detect, Accumulated Peak
Peak Detect/Glitch Capture	100 ns	100 ns	100 ns
Record Length	512 bytes	512 bytes	512 bytes
Independently Floatable Isolated Channels	±400 V (DC or pk AC)	±850 V (DC or pk AC) or 600 V AC	±850 V (DC or pk AC) or 600 V AC
Motor Trigger	–	Yes	–
Video Field and Line Trigger	–	–	Yes
I/O Interface	RS-232-C	RS-232-C	RS-232-C
Minimum Battery Life	3 hours	3 hours	3 hours
Battery Charge Time	3 hours	3 hours	3 hours
Warranty	3 years	3 years	3 years
Safety Certification	UL, CSA	UL, CSA	UL, CSA

ORDERING INFORMATION

222A
10 MHz Handheld DSO
Includes: Operator's Manual, Quick Reference Guide, RS-232-C Guide, AC Adapter, Two P400 1X Replaceable Probes, Pouch, Feet, Probe Accessory Kit

222PS
10 MHz Handheld DSO
Includes: Operator's Manual, Quick Reference Guide, RS-232-C Guide, AC Adapter, Two P850 10X Replaceable Probes, Pouch, Feet, Probe Accessory Kit, Industrial Lead Set

224
60 MHz Handheld DSO
Includes: Operator's Manual, Quick Reference Guide, RS-232-C Guide, AC Adapter, Two P850 Replaceable Probes, Pouch, Feet, Probe Accessory Kit

Opt. 02 – Delete AC adapter

Opt. 03 – Substitute P850 Probes for P400 (222A only)

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Univ Euro 220 V, 50 Hz

Opt. A2 – United Kingdom 220 V, 50 Hz

SERVICE ASSURANCE OPTIONS
These products covered by the following service assurance options:

REP4200 – Provides One Year of Post-Warranty Repair Protection

CAL4200 – Provides One Year of Calibration Services

AVAILABLE ACCESSORIES
Virtual Instrument Software – Order CAT200

External Battery Charger – Order BAT200

Pouch for Battery/AC Adapter – Order 016-0993-00

Viewing Hood – Order 016-1021-00

EXT Trig to BNC Adapter – Order 103-0090-00

US 120 V Power Adapter – Order 120-1807-00

Spare Battery – Order 146-0075-00

RS-232 Cable – Order 174-1453-00

Cigarette Lighter Adapter – Order 174-1734-00

Intelligent Printer Interface – Order WP200

X10 BNC Adapter – Order 206-0445-00

Industrial Lead Set – Order 012-1392-00

BNC Probe Head – Order 206-0451-00

OPERATION VIDEOTAPE
NTSC – Order 068-0344-04

PAL – Order 068-0344-06

SECAM – Order 068-0344-07

PROBES
Voltage –
1X. Order P400
10X. Order P850

Current – AC Current, 2000 A pk. Order A620

External Trigger – Order P6122

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

2212
2216

Digital + Analog Oscilloscopes

Full-featured dual and four channel analog and digital capability with programmability at a low price.

2212

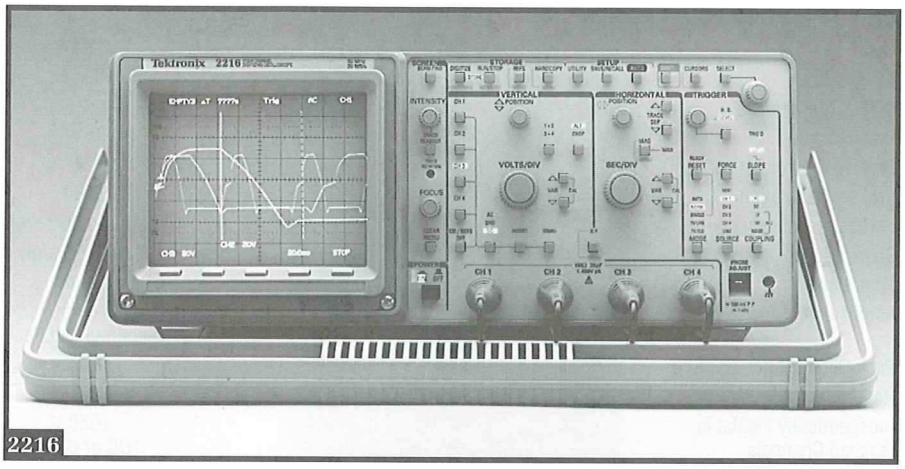
- Two Channels
- 2 mV/div to 5 V/div Sensitivity
- 4 K per Channel Records; 128 K per Channel Opt. 1M
- Store Two Waveforms (One per Channel)
- TV Line Select and Backporch Clamp with Opt. 05

2216

- Four Channels
- 1 mV/div to 10 V/div Sensitivity
- 16 K per Channel Records; 128 K per Channel Opt. 1M
- 15 Automatic Measurements
- Store 16 Waveforms

COMMON FEATURES

- 60 MHz Analog Bandwidth
- 20 MS/s
- Auto Setup
- Parallel Printer Port
- Programmable via GPIB (Opt. 10) and RS-232-C (Opt. 12)



2216

2212/2216

The two-channel 2212 and four-channel 2216 are inexpensive digital storage plus analog oscilloscopes with readouts, on-screen cursors, X-Y store and non-store operation, and a parallel printer port.

The front-panel setup can be saved in non-volatile memory, and two waveforms (2212) or 16 waveforms (2216) can be saved and recalled.

A useful horizontal magnifier feature allows you to alternate between the magnified and unmagnified sweep on the display.

CURSORS AND READOUTS

Several on-screen readouts help you keep track of the settings for functions such as vertical scale, horizontal scale, and trigger level. On-screen cursors are provided to help in making voltage, time, and frequency measurements on the displayed waveform.

COMPUTER INTERFACES

GPIB and RS-232-C interfaces are available as options or are field installable. They allow remote operation and make the 2212 ideal for automated measurements in production or research settings calling for repetitive data taking.

APPLICATIONS

- **Training**
- **Manufacturing Production Test**
- **Field Repair**
- **Bench Calibration and Repair**
- **Product Design**

ORDERING INFORMATION

2212
60 MHz Oscilloscope

2216
60 MHz Oscilloscope
Includes: Two P6103B (2216, P6109B) 10X Voltage Probes, Power Cord, Fuse, User Manual, Reference Guide, Flat Washer, Loop Clamp

Opt. 05 (2212 only) – Video Trigger, Line Select, Backporch Clamp

Opt. 10 – GPIB Interface

Opt. 12 – RS-232-C Interface

Opt. 1M – Long Record Length (128 k points per channel)

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – A5 available – See customer information section for description.

SERVICE ASSURANCE OPTIONS

These products covered by the following service assurance options:

REP4300 – Provides One Year of Post-Warranty Repair Protection

CAL4300 – Provides One Year of Calibration Services

Passive Probes –
15 MHz, 1X Ruggedized. Order P6101B
100 MHz, 10X Ruggedized with Readout. Order P6109B

Current Probes –
20 A max. DC to 50 MHz with A6302 Current Probe. Order AM503S
100 A max. DC to 15 MHz with A6303 Current Probe.
Order AM503S Opt. 03

High Voltage –
1.5 kV, 100X, 120 MHz with Readout. Order P6009
40 kV, 1000X, 75 MHz with Readout. Order P6015A Opt. 1R

2212 Service Manual – Order 070-8439-00

2212 Programmer Manual – Order 070-8440-01

2216 Service Manual – Order 070-8902-00

2216 Programmer Manual – Order 070-8905-00

Transit Case – Order 016-0792-01

Rackmount Kit – Order 016-1204-00

Front-Panel Cover – Order 200-3397-00

Accessory Pouch – Order 016-0677-02

Fuse, 1.6 A, 250 V, Slow – Order 159-0003-00

25-Pin PC to Centronics Cable – Order 012-1214-00

Bubble Jet Printer – Order HC220

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Analog Oscilloscopes

TAS 400 Series

The Tektronix TAS 400 Series Portable Analog Oscilloscopes are built on a new low cost platform. Modeled after the successful TDS Series, the TAS user interface simplifies scope operation. This new platform design significantly reduces parts count and provides a three times improvement in reliability over previous analog scopes.

TAS 200 Series

The Tektronix TAS 200 Series Portable Analog Oscilloscopes provide basic functionality and operate using direct access controls. This new series of analog scopes address the basic needs in Education and other industries that require basic measurement performance for such applications as electronics training and basic troubleshooting.

2400 Series

The Tektronix 2400 Series Portable Analog Oscilloscopes represent the most widely used and accepted line in the industry. The 2467B BrightEye® offers unsurpassed writing rate for the ultimate in fast event capture. The 2465B sets the standard against which other general-purpose portable scopes are measured.

All 2400 Series Oscilloscopes offer convenient and easy automatic setup and measurements, a broad range of functionality, and the depth of performance that set the standards for high-performance portable scopes.

ANALOG OSCILLOSCOPES

Model	Bandwidth	Channels	Time Base	Cursors	Auto Setup	Computer Interfaces	Pages
TAS 400	100 to 200 MHz	2 or 4	dual	yes	yes	no	118
TAS 200	20 to 50 MHz	2	single	yes	no	no	118
2467B 2465B	400 MHz	2+2 aux.	dual	yes	yes	GPIB Opt.	120

CONTENTS

TAS SERIES OSCILLOSCOPES

General Information 118
TAS 465 100 MHz 118
TAS 475 100 MHz 118
TAS 485 200 MHz 118
TAS 250 50 MHz 118
TAS 220 20 MHz 118

2400 SERIES OSCILLOSCOPES

General Information 120
2467B 400 MHz, High Writing Speed 120
2465B 400 MHz 120

ACCESSORIES

Probes 446
SMD/Adapters 474
Probe and Instrument Accessories 486
Plotter/Printer 524
Cameras 526
Instrumentation Carts 528

TAS 220 TAS 250 TAS 465 TAS 475 TAS 485 Analog Oscilloscopes

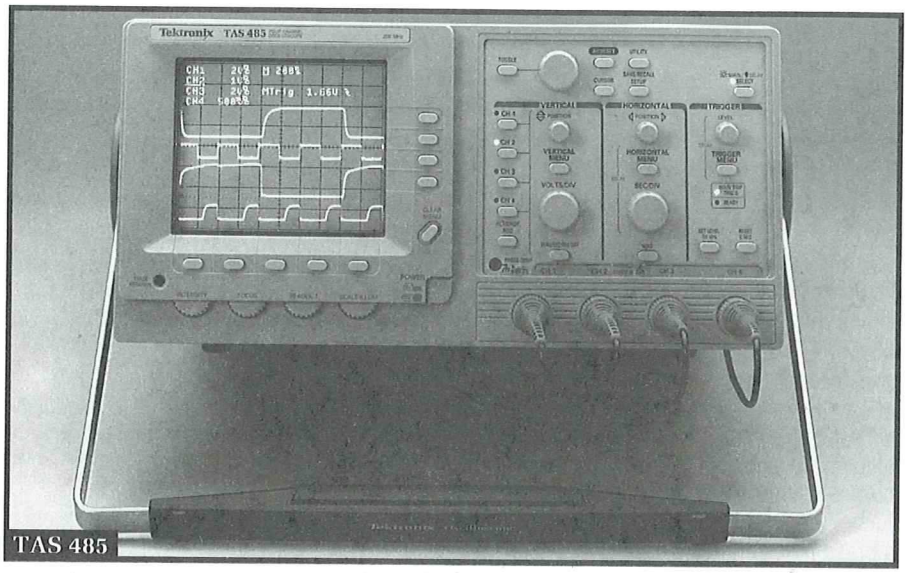
New level of power and flexibility for general purpose measurements at affordable prices.

TAS 200 SERIES FEATURES

- 20 MHz TAS 220
- 50 MHz TAS 250
- Single Time Base
- Two Channels
- Measurement Cursors
- CRT Readout
- Channel 1 Output
- Video Trigger
- Direct Access Controls

TAS 400 SERIES FEATURES

- 100 MHz @ Two Channels TAS 465
- 100 MHz @ Four Channels TAS 475
- 200 MHz @ Four Channels TAS 485
- Dual (Delayed) Time Base
- Measurement Cursors
- CRT Readout
- Auto Setup
- Store/Recall of Setups
- Video Trigger
- Trigger/Ground Reference Indicator
- Combination Menu/Direct Access Controls



TAS 485

Easy to Use Interface

The TAS Series user interface simplifies scope operation. Both the TAS 400 Series and TAS 200 Series front panels are similar in operation and the important, frequently used functions are controlled directly with knobs or buttons. On the TAS 400 Series a menu provides access to secondary functions.

Productivity Features

The TAS 400 Series offers auto setup to instantly deliver a triggered display. Pressing the AUTOSET button automatically adjusts the horizontal, vertical and trigger controls so that a stable signal is displayed. In addition, the TAS 400 Series front panel settings can be stored in up to four memory locations for easy recall.

Both the TAS 200 Series and TAS 400 Series provide measurement cursors and readouts to improve user productivity. Refer to the key specification selection chart and choose the analog scope best suited for your performance needs. And buy with confidence that these products are backed by the leader in oscilloscope technology, Tektronix.

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

APPLICATIONS

- **Training**
- **Manufacturing Production Test**
- **Field Repair**
- **Bench Calibration and Repair**
- **Product Design**

Analog Oscilloscopes

TAS 220 **TAS 250** **TAS 465** **TAS 475** **TAS 485**

KEY SPECIFICATIONS

	Available February 1995 **TAS 220**	*Available February 1995* **TAS 250**	**TAS 465**	**TAS 475**	**TAS 485**
Bandwidth	20 MHz	50 MHz	100 MHz	100 MHz	200 MHz
Input Channels	2	2	2	4	4
Rise Time	<17.5 ns	<7 ns	≤3.5 ns	≤3.5 ns	≤1.8 ns
Time Base	single	single	Dual	Dual	Dual
Main Sweep Range	0.5 s/div to 0.1 µs/div	0.5 s/div to 0.1 µs/div	0.5 s/div to 20 ns	0.5 s/div to 20 ns	0.5 s/div to 20 ns
Delayed Sweep Range	N/A	N/A	5 ms/div to 20 ns	5 ms/div to 20 ns	5 ms/div to 20 ns
Vertical Accuracy	±3%	±3%	±2.5%	±2.5%	±2.5%
Vertical Sensitivity	5 mV to 5 V/div	5 mV to 5 V/div	2 mV/div to 5 V/div	2 mV/div to 5 V/div	2 mV/div to 5 V/div
Horizontal Accuracy	±3%	±3%	±2%	±2%	±2%
X10 Horizontal Accuracy	±5%	±5%	±3%	±3%	±3%
Sweep Speed (X10 mag.), Main	10 ns	10 ns	2 ns/div	2 ns/div	1 ns/div
Sweep Speed (X10 mag.), Delayed	N/A	N/A	2 ns/div	2 ns/div	1 ns/div
Trigger Modes	AUTO, NORMAL, TV, SGL Sweep	AUTO, NORMAL, TV, SGL Sweep	AUTO LEVEL, AUTO, NORMAL, TV LINE, TV FIELD (odd, even, or both), SGL SEQ	AUTO LEVEL, AUTO, NORMAL, TV LINE, TV FIELD (odd, even, or both), SGL SEQ	AUTO LEVEL, AUTO, NORMAL, TV LINE, TV FIELD (odd, even, or both), SGL SEQ
Trigger Delay	N/A	N/A	RUNS AFTER DELAY, TRIGGERS AFTER DELAY, TV LINE (from MAIN source)	RUNS AFTER DELAY, TRIGGERS AFTER DELAY, TV LINE (from MAIN source)	RUNS AFTER DELAY, TRIGGERS AFTER DELAY, TV LINE (from MAIN source)
Trigger Coupling (both Main and Delayed)	AC, DC	AC, DC	AC, DC, Noise Reject, HF Reject, LF Reject	AC, DC, Noise Reject, HF Reject, LF Reject	AC, DC, Noise Reject, HF Reject, LF Reject
Auto Setup	No	No	Yes	Yes	Yes
Store/Recall	No	No	4 front panel setups	4 front panel setups	4 front panel setups
Cursors and Readouts	Yes	Yes	Yes	Yes	Yes
CRT	2 kV	12 kV	14 kV	14 kV	14 kV
Warranty	One year	One year	Three years	Three years	Three years
Safety Certification	ETL, CSA	ETL, CSA	UL, CSA, IEC348	UL, CSA, IEC348	UL, CSA, IEC348

ORDERING INFORMATION

TAS 220 (Available 2/95)
20 MHz Two Channel Oscilloscope.

TAS 250 (Available 2/95)
50 MHz Two Channel Oscilloscope.

Both Include: Two 1X/10X 1.5 m Probes, Instruction Manuals

TAS 465
100 MHz Two Channel Oscilloscope

TAS 475
100 MHz Four Channel Oscilloscope
Both Include: Two P6109B 10X Voltage Probes, Instruction Manual, Reference, XYZs of Oscilloscopes: Analog and Digital Concepts

TAS 485
200 MHz Four Channel Oscilloscope
Includes: Two P6111B 10X Voltage Probes, Instruction Manual, Reference, XYZs of Oscilloscopes: Analog and Digital Concepts.

TAS 400 INSTRUMENT OPTIONS
Front Cover – Order 016-1158-00

Pouch – Order 200-3732-01

Rackmount Kit – Order 016-1166-00

SERVICE ASSURANCE OPTIONS
These products covered by the following service assurance options:

REP4200 – Provides One Year of Post-Warranty Repair Protection

CAL4200 – Provides One Year of Calibration Services

PROBES
Differential – 100 MHz, active differential, 6 ft. Order P6046.

High Voltage –
100X, 250 MHz, 2500 V 2.75pf/10MΩ, 10 ft. Order P5100.
100X, 120 MHz, 1500 V, 2.5 pF/10 MΩ, 9 ft. Order P6009.
1000X, 75 MHz, 20 kV, 3.0 pF/100 MΩ, 10 ft. Order P6015A.

General Purpose –
1X, 15 MHz, 100 pF/1 MΩ, 2 m. Order P6101B.
10X, 100 MHz, 13.2 pF/10 MΩ, 2 m. Order P6109B.
1X-10X Switchable, 1X: 10 MHz, 100 pF/1 MΩ; 10X: 100 MHz, 18 pF/10 MΩ, 2 m. Order P6129B.

Surface Mount–
10X, 200 MHz, SMD Probe (2 each). Order P6561AS.

Logic –
20 MHz, 17 bit, word recognizer/trigger. Order P6408.

Current –
935 Hz to 120 MHz, 3 A continuous AC. Order P6022.
120 Hz to 60 MHz, 7.5 A continuous AC. Order P6021.
DC to 50 MHz System (includes AM503A, A6302 20A probe,TM502A). Order AM503S.

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

2465B
2467B

Analog Oscilloscopes
400 MHz

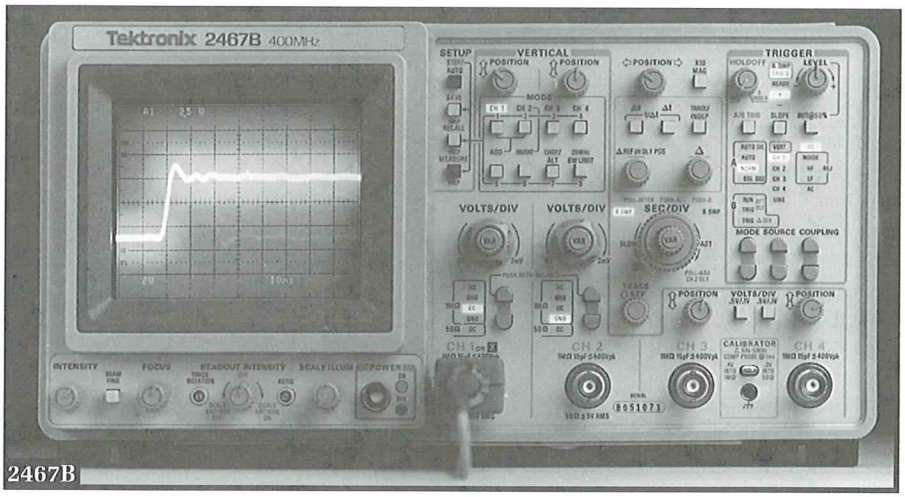
Convenient setup and simplified measurements.

2465B

- Four Channels
- 400 MHz Bandwidth
- Up to 500 ps/div Timing Resolution
- Auto Setup
- Automatic Measurements
- Save and Recall Front-panel Setups
- Cursor Measurements
- 1% Timing Accuracy
- 3-Year Warranty

2467B

- Includes All the 2465B Functionality
- Bright Microchannel Plate Display (MCP)
- Option 5H Tri-Level Sync Triggering for HDTV Video Signals

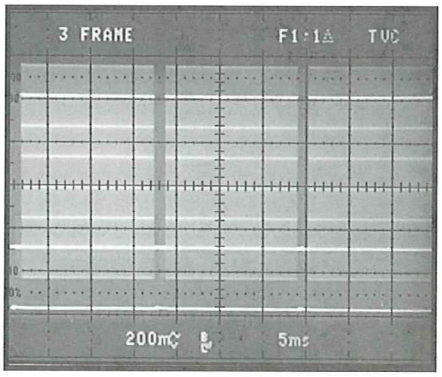


400 MHz Microchannel Plate Display.

Power of Analog

Recognizing that digital and analog scopes have different strengths, Tektronix designs and manufactures both analog and digitizing oscilloscopes so you can choose the right scope for your application and budget.

Although digital scopes feature many attractive capabilities, for a variety of applications analog scopes offer unique benefits that most digitizing scopes can't match.



Grey Scaling and Persistence

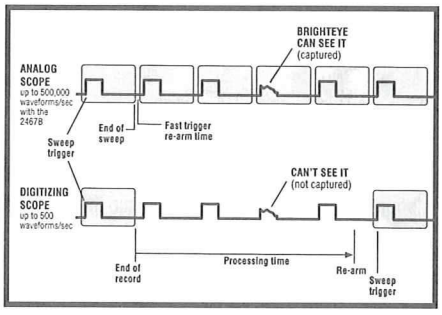
With an analog display, faster signals appear fainter than slower signals. Called grey scaling, this phenomenon gives important clues about relative frequencies when analyzing mixes or overlayed signals like video waveforms.

Or when an event only occurs occasionally in a repetitive signal, the anomaly will fade quicker and look dimmer than the rest of the waveform. This persistence effect reveals critical information when analyzing and debugging complex analog designs, such as switching power supplies.

Real Time Display

The display on an analog scope responds instantly to changing signal conditions. Unlike digital scopes that need to acquire and process signal information before displaying, analog scopes simply attenuate or amplify the input signal directly onto the display.

As a result, analog scopes can trigger on many more waveforms per second than a digital scope. For instance, the 2467B BrightEye® acquires up to 500,000 waveforms/sec. As a result, an analog scope updates its display so quickly that you literally see waveform behavior as it happens.



APPLICATIONS

- **Troubleshooting (2400B Series)**
- **Laser and Radar Pulses (2400B Series)**
- **Video Equipment Design (with Option 5H/Option 06)**
- **Disk Drive Testing (2467B)**
- **Service (2400B Series)**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 2467B and 2465B comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Analog Oscilloscopes
400 MHz

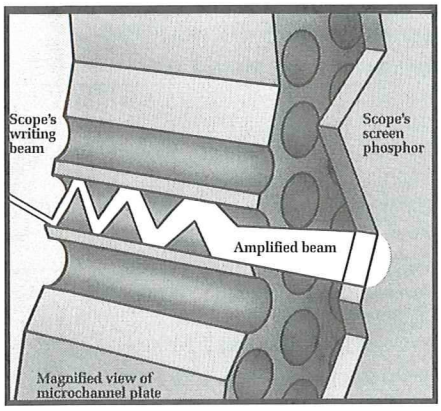
2465B
2467B

BrightEye® Display

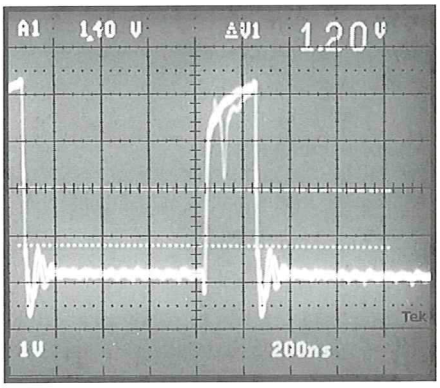
Sometimes grey scaling and persistence create such faint signals, you can have difficulty seeing them on ordinary scopes. In response to this problem, the 2467B BrightEye® includes a revolutionary new display, the Microchannel plate (MCP), that can increase the intensity of a dim waveform up to a thousand times.

Fully Independent Cursors

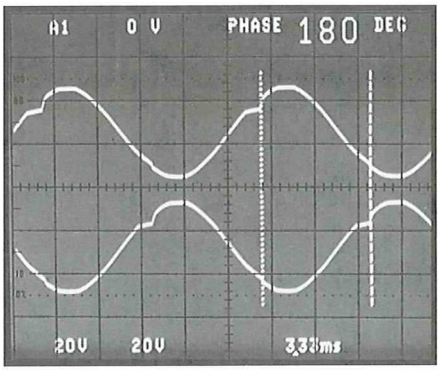
Fully independent delta-time and voltage cursors with readouts streamline display measurements.



This MCP technology makes it possible to see a single sweep even at 500 ps/div without a viewing hood. Even those difficult to find logic errors or metastability problems in a repetitive signal environment are easily seen.



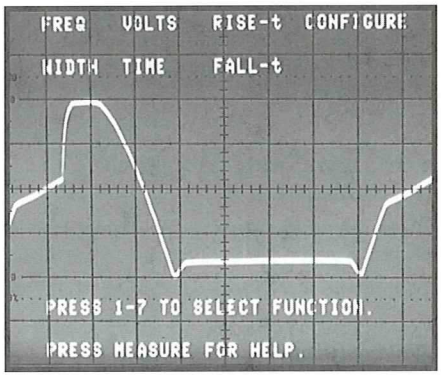
Metastability in this flip-flop occurs only once in a million normal cycles, yet it is clearly visible due to the 2467B's high visible writing speed.



With the delta-time and voltage cursors, you can measure a waveform's parameters including phase.

The Simplicity of Automated Control

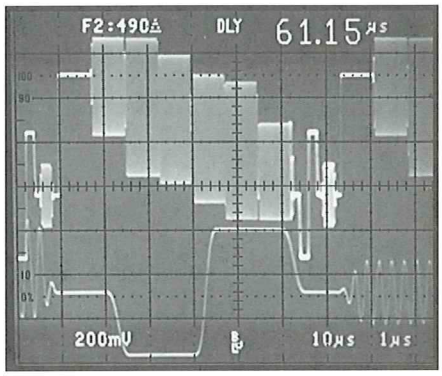
2400B series automates several key functions so you can easily access the powerful capabilities of these scopes.



Select from a variety of automatic measurement choices included with all the 2400B series scopes.

STRAIGHTFORWARD SETUP

To quickly locate and display undefined or complex signals, simply press AUTO SETUP. This function automatically triggers, scales and positions waveforms from any or all of the input channels.



The 2467B/Option 06/Option 5H automatically triggers on tri-level sync pulses used in high-definition video signals. Note: Line Count Readout Displays Field 2 – Line #490.

ADVANCED TRIGGERING

With a complete selection of trigger modes, the 2400B Series scopes can display any signal regardless of its complexity. The auto level function maintains a stable waveform display even as input signals change so you can view variable-voltage signals clearly without irritating jitter.

To noticeably improve the accuracy of timing measurements, press the INIT at 50% selection and the scope will maintain the trigger level at the input signal's 50% voltage level.

Choose AC or DC coupling and reject high or low frequencies or noise to clarify the waveform display.

HDTV Analysis Made Easy

Built on the BrightEye® platform, the 2467B applies the power of MCP technology to the acquisition of high-definition video signals with Option 5H/Option 06.

The 400 MHz 2467B with Option 5H/Option 06 can automatically recognize tri-level sync pulses on any of the proposed HDTV standards, including 1250/50, 1125/60 and 1050/60 formats.

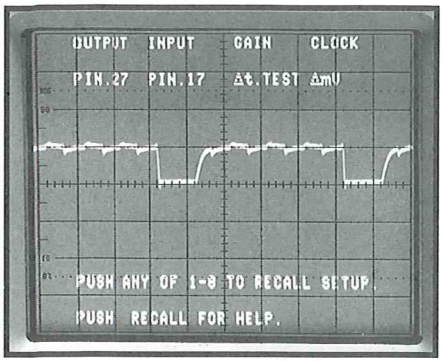
This scope, by including Option 5H, clearly displays high-definition video signals with an unequaled frequency response flatness rating of ±2% over the first 30 MHz. To display signals even more clearly, you can significantly attenuate noise or clock frequency interference with the 50 MHz bandwidth limit selection.

A built-in counter/timer/trigger (Option 06) will help you make vital timing measurements as accurately as possible. And with its 500 ps/div sweep rate, the 2467B with Option 5H/Option 06 will capture and display a high-definition signal's fastest transients.

Continued on next page.

2465B
2467B

Analog Oscilloscopes
400 MHz



Create measurement sequences using the front-panel controls for semi-automated testing.

Streamlined Front-Panel Setups

Just press SAVE SETUP to save a front-panel setup instead of recreating it again and again. The scope instantly stores all front-panel information, including intensity, cursor locations and control settings. And you label each setup with a descriptive name.

The 2400B Series scopes will retain up to 30 front-panel setups in non-volatile memory until you decide to replace or delete them.

Easy Automation

With built-in sequencing, you can develop a custom test series without writing a line of code. First save and label a series of front-panel setup, each representing a step in the test procedure. Then link the steps in any order you want.

To execute your custom test series, press STEP to sequence through the individual steps. This is extremely useful for manufacturing evaluation and device characterization. You'll appreciate the ease and efficiency of the 2400B Series automatic sequencing.

2400B Series Options

The following options are not retrofittable on standard products after purchase.

VIDEO WAVEFORM MEASUREMENT SYSTEM (OPTION 05)
Tailors the 2465B and 2467B for applications involving broadcast and cable television, graphics displays and raster-scan systems. It enables CRT readout of the line number of field selected for triggering, so the operator knows exactly what the display represents.

Sync Separation – Stable sync separation from sync-positive or sync-negative composite video on systems with 525 to 1280 lines, 50 Hz or 60 Hz, interlaced or noninterlaced.

Trigger Modes – Lines, FLD 1, FLD 2, ALT (FLD 1/FLD 2).

Back Porch Clamp – Within 1.0 div of the ground reference.

HIGH-DEFINITION TELEVISION (OPTION 5H)
Only available with the 2467B scope, this option lets you trigger on tri-level sync pulses, automatically senses the HDTV standard being used and autosets itself accordingly.

Stable Sync Separation – From tri-level and bi-level sync-positive or sync-negative composite or component video on systems with 525 to 1280 lines per frame, 50 Hz or 60 Hz field rate, interlaced or noninterlaced.

HD Video Triggering Modes – Lines, FLD 1, FLD 2, ALT (FLD 1/FLD 2), and the Active Video Mode.

Standard TV Presets – Lines, fields, frames, line select, active video, horizontal blanking, vertical blanking, pixel and TSG triggering.

Bandwidth Limiter – Reduces the upper –3 dB to 50 MHz.

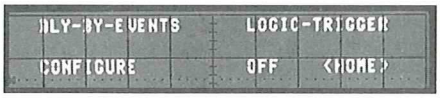
Frequency Response (–3 dB 400 MHz) Flatness – ±1% for 50 kHz to 100 MHz, ±1%–2% for 10 MHz to 20 MHz, ±2% for 20 MHz to 30 MHz.

Counter/Timer/Trigger (CTT) (Option 06)

These options feature a crystal-controlled timebase with 0.001% accuracy.

These options also feature a 7-digit CRT readout display for Frequency (0.5 Hz to 150 MHz), Period (6.666667 ns to 2 s), Totalize (to 9,999,999) and Delay by Events triggering (up to 4,194,303).





GPIB Interface (Option 10)

Functions implemented include SH1, AH1, T6, L3, SR1, RL1, CD1, E1, DT0, C0 and PP0.

Characteristics

For more detailed specifications, contact any Tektronix Sales Office or authorized Tektronix distributor near you.

VERTICAL SYSTEM

Deflection Factor – 2 mV/div to 5 V/div, continuously variable between V/div settings (CH 1 and CH 2). 100 mV/div and 500 mV/div (CH 3 and CH 4).

Deflection Factor Basic Accuracy – ±2%, measured at any V/div with a 4- or 5-div signal, centered on screen (CH 1 and CH 2). ±10% (CH 3 and CH 4) between 15°C and 35°C.

Frequency and Step TR Response (–3 dB Bandwidth)/(TR = 0.35/BW)

Instrument	BW/Rise Time
2465B/ 2467B/	400 MHz/0.875 ns (≥5 mV/div), and 350 MHz/1 ns (2 mV/div)

Measured with a standard accessory probe or internal 50 Ω termination.

Bandwidth Limiter – Reduces upper –3 dB to 20 MHz for 2465B and 2467B.

Input Coupling and Max Voltage – (1 MΩ) AC, DC, GND; Max input voltage: 400 V (DC + peak AC). (50 Ω) Max input voltage: 5 V RMS average for 1 sec, ±50 V peak.

Input R and C – 1 MΩ ±5% and 15 pF ±2 pF or 50 Ω (nominal).

Channel Isolation – ≥100:1 at 100 MHz, ≥50:1 at nominal bandwidth (CH 1, CH 2), ≥50:1 at 100 MHz (CH 3, CH 4).

AC-Coupled Lower –3 dB Point: 10 Hz or less. 1 Hz or less with standard accessory probe.

Chop Mode Switching Rate: 2.5 MHz ±0.2% (20 µs/div to 2 µs/div). 1 MHz ±0.2% for all other sweep speeds.

A Sweep Timing Accuracy
For 100 MS/div and faster settings, +15°C to +35°C, X10 magnification not enabled.

Method	Accuracy
A Sweep	±(0.7% of time interval +0.6% of full scale)
ΔT using cursors	±(0.5% of time interval +0.3% of full scale)
ΔT using delay	±(0.3% of time interval sweep +0.1% of full scale +200 ps)
Delay from A trig to B sweep	±(0.3% of time interval +0.6% of full scale +0 to –25 ns)

Analog Oscilloscopes
400 MHz

2465B
2467B

HORIZONTAL SYSTEM

Display Modes – A (main sweep), A INTENsified, ALTernate, A INTEN with B (delayed sweep) and B. In X-Y mode, CH 1 provides X-axis (horizontal) deflection.

A Sweep Time Base Range – 2465B/2467B: 500 ms/div to 5 ns/div (to 500 ps/div with X10 magnification).

B Sweep Time Base Range – 2465B/2467B: 50 MS/div to 5 ns/div (to 500 ps/div with X10 magnification).

Variable Timing Control – Continuously variable and calibrated (add 2% of time interval timing accuracy) between SEC/DIV settings. Extends slowest A Sweep to 1.5 s/div. Change the A sweep's sec/div setting with the A display mode selected. Change the B sweep's sec/div with INTEN, ALT and B Modes selected. When VAR control is out of detent, the ΔT cursors measure RATIO (with 5 divisions being 100%) and 1/ΔT cursors measure PHASE (five divisions being 360°).

Displayed CH 2 Signal Delay with Respect to CH 1 – Adjustable ±500 ps.

Delay Jitter – Within 0.004% (one part or less in 25,000) of maximum available delay plus 50 ps (2465B). Within 0.01% (one part or less in 10,000) of maximum available delay plus 100 ps (2467B).

ACCURACY SPECIFICATIONS FOR AUTOMATIC MEASUREMENTS

For +15°C to +35°C, specifications are based on noise less than 0.1% of a peak-to-peak input waveform.

Period – 0.5% +500 ps + jitter error.

Volts – 5% +5 mV + (0.5 mV times probe attenuation) + signal aberrations + 1 LSD to 1 MHz (minimum width at peak amplitude ≤10 ns).

Rise Time, Fall Time – 5% +3 ns (for transition times greater than 5 ns). These rise and fall times are based on measurements of 20% to 80%, extrapolated to 10% and 90% (pulse overshoot and pulse undershoot less than 5% of peak-to-peak signal).

Time A-B (from % to %) – 0.5% +3 ns (+0.5 ns if measuring from CH 1 to CH 2) +5% of start event + 5% of stop event transition times.

Time A-B (between two voltages) – 0.9% +3 ns (+0.5 ns if measuring from CH 1 to CH 2) +5% of start event +5% of stop event transition.

Pulse Width – 0.9% +1 ns + jitter error +2X offset error (transition times less than 10% of measured interval).

TRIGGERING

A and B Trigger Coupling – DC, Noise Reject, HF Reject, LF Reject, AC.

Trigger Level Range – ±18 times V/div setting for CH 1 and CH 2. ±9 times V/div setting for CH 3 and CH 4.

Trigger Sensitivity to 50 MHz from CH 1 or CH 2 – 0.35 div DC coupled; ≤1.2 div noise reject coupled; 0.5 div from DC to 30 kHz HF reject coupled; 0.5 divs from 80 kHz LF reject coupled; 0.35 divs from 60 Hz AC coupled.

For above 50 MHz, DC, LF reject and AC coupling, the triggering signal requirement increases to 1.5 divs at 500 MHz.

For noise reject coupling above 50 MHz, the triggering signal requirement increases to 4.5 divs at 500 MHz.

Triggering Sensitivity from CH 3 or CH 4 – One half the CH 1 or CH 2 requirements.

LEVEL Control Range – ±18 times the V/div setting for CH 1 or CH 2; ±9 times the V/div setting for CH 3 or CH 4.

LEVEL Readout Basic Accuracy – ±[3% of setting +3% of p-p signal + 0.2 div + 0.5 mV + (0.5 mV times probe attenuation factor)] for CH 1 or CH 2; ±[3% of setting + 4% of p-p signal + 0.1 div + (0.5 mV times probe attenuation factor)] for CH 1 or CH 2.

Basic accuracies apply from +15°C to +35°C and are measured with triggering signals having transition times greater than 20 ns with 1 MΩ input, DC trigger coupling.

X-Y OPERATION

X-Axis Deflection Factor Range, Variable Range, and Accuracy – Same as CH 1.

X-Axis Bandwidth – DC to 3 MHz.

Phase Difference Between X and Y – ≤1° from DC to 1 MHz. ≤3° from 1 MHz to 2 MHz.

OTHER SIGNAL INPUTS AND OUTPUTS

Inputs Include – Z-axis and AUTO/SETUP control.

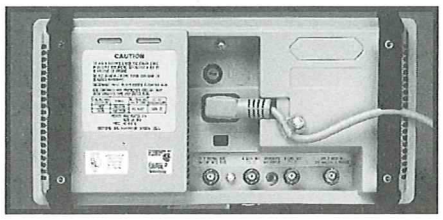
Outputs Include – CH 2 Signal Out, A Gate Out, B Gate Out and Calibrator/Probe Compensation output.

DISPLAY

Graticule Size – 2465B: 80 mm x 100 mm 2467B: 68 mm x 85 mm.

Standard Phosphor – GH(P31).

Cursors – ΔVolts, ΔTime, 1/ΔTime, Ratio, Phase, and %.



POWER REQUIREMENTS

Line-Voltage Ranges – 115 V: 90 to 132 VAC. 230 V: 180 to 250 VAC.

Line Frequency – 48 to 440 Hz.

Maximum Power Consumption – 120 W (180 VA) for a fully optioned instrument.

ENVIRONMENTAL AND SAFETY

The 2400B scopes meet the environmental conditions described in MIL-T-28800D for Type III, Class 3, Style D equipment as specified below. Other environmental specifications are available.

Temperature – –15°C to +55°C (operating); –62°C to +85°C (nonoperating).

Humidity – Operating and nonoperating, up to 95% RH at or below +40°C; to 75% RH from +41° to +50°C.

Altitude – 15,000 ft. (operating); 50,000 ft. (nonoperating).

Safety – UL 1244 Listed, Certified to CSA C22.2 No. 231-M89.

PHYSICAL CHARACTERISTICS

	2465B	2467B	Rackmount*[1]
Dimensions	**mm/in.**	**mm/in.**	**mm/in.**
Width w/handle	338/13.3	338/13.3	483/19.0
Height with feet & pouch	190/7.5	190/7.5	178/7.0
w/o pouch	160/6.3	160/6.3	
Depth with front cover	434/17.1	472/18.6	419/16.5
Handle extended	508/20.0	533/21.0	
Weight	**kg/lb.**	**kg/lb.**	**kg/lb.**
Net with accessories and pouch	10.2/22.5	10.9/24.0	4.0/8.8
w/o accessories & pouch	9.3/20.5	9.7/21.3	
Domestic shipping	12.8/28.2	14.6/32.1	6.3/13.8

*[1] *Weight of conversion kit only. Rear support kit weight is an additional 6.3 kg/13.8 lb.*

Continued on next page.

2465B
2467B

Analog Oscilloscopes
400 MHz

ORDERING INFORMATION

2465B
400 MHz Oscilloscope.....**$7,550**

Includes: Two P6137 10X Probes with Accessories Fuse (159-0021-00); Banana Plug/Binding Post Adapter (134-0016-01); Snap Accessory Pouch (016-0692-01); Operator's Manual (070-6860-00); CRT Filter/Clear (378-0208-00); Front Cover (200-3199-01); Power Cord (161-0104-00).

2467B
400 MHz Oscilloscope with Microchannel Plate Display ...**$14,200**
Includes: Four P6137 10X Probes with Accessories Fuse (159-0021-00); Banana Plug/Binding Post Adapter (134-0016-01); Snap Accessory Pouch (016-0692-01); Operator's Manual (070-6861-01); Front Cover (200-3199-01).

NOTE: INSTRUMENT OPTIONS ARE NOT RETROFITTABLE AFTER PURCHASE.

Opt. 05 – Video Waveform Measurement System for bi-level sync formats .....**+$1,045**
Opt. 5H – High-Definition Television (2467B only) .....**+$1,595**
Opt. 06 – Counter/Timer/Trigger.....**+$1,395**
Opt. 10 – IEEE 488 GPIB Interface .....**+$995**
Opt. B1 – Service Manual for standard 2465B and 2467B (070-6863-00).....**+$120**
Opt. B2 – Service Manual for any of the above options.....**+$120**
Opt. 1R – Instrument configured for rackmount. Includes slideout assemblies.....**+$405**
Opt. 1T – Transit Case (202-0302-00) with telescoping handle and retractable wheels.....**+$570**
Opt. 22 – Two additional matching probes (P6137). (standard with 2467B).....**+$440**

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz. .....**NC**
Opt. A2 – United Kingdom 240 V, 50 Hz.....**NC**
Opt. A3 – Australian 240 V, 50 Hz. .....**NC**
Opt. A4 – North American 240 V, 60 Hz. .....**NC**
Opt. A5 – Swiss 220 V, 50 Hz.....**NC**

See General Customer Information Section for additional description.

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection
2465B.....**+$160**
2467B.....**+$400**
Opt. C5 – Adds five years of Calibration Services
2465B.....**+$475**
2467B .....**+$1,050**

SOFTWARE
Additional information in the Software Section.

EZ-TEST PC Test Development Software – Requires GPIB-equipped instruments; used with Tektronix 2402A or IBM PC/XT/AT and compatibles (computer must also have GPIB). Order S45F030 .....**$995**

RECOMMENDED ACCESSORIES
See page 446 for complete selection information.

PROBES
Passive (1 MΩ) – 10X, 400 MHz, compact tip. Order P6137 .....**$220**
Active – 1X, 10X, 100X FET Probe, 900 MHz. Order P6201.....**$1,599**
Low Impedance (50 Ω) – 10X Low Impedance, 3.5 GHz, 1X, 20X, 100X. Order P6156 Opt. 28.....**$500**
Current – 50A MHz, 20A (DC + pk AC). Order AM 503S **$2,795**
15 MHz, 100A (DC + pk AC) Order AM 503S Opt. 03.....**$3,445**
15A (p-p). Order P6021.....**$575**
6A (p-p). Order P6022.....**$595**
High Voltage –
250 MHz, 2500 V, 2.75 pF/10 MΩ 9 ft.. Order P5100 .....**$199**
120 MHz, 1500 V pk. Order P6009.....**$285**
75 MHz, 40 kV pk. Order P6015A Opt. 1R **$1,040**
Differential – Order P6046.....**$2,395**

CAMERAS
High Performance – Order C-9 Opt. 20.....**$665**

CARTS
Portable Instrument – Order K212 .....**$420**
with Plotter Shelf – Order K212 Opt. 22 .....**$580**

ADDITIONAL ACCESSORIES
Optical-to-Electrical Converters – 450-1050 nm, 700 MHz (requires 1103 Probe Power Supply). Order P6701A*1
450-1050 nm, 250 MHz, High Gain, (requires 1103 Probe Power Supply). Order P6711*1
1000-1700 nm, 500 MHz (requires 1103 Probe Power Supply). Order P6703A*1
1100-1700 nm, 300 MHz, High Gain, (requires 1103 Probe Power Supply). Order P6713*1
Power Supply – For up to two optical probes. Order 1103.....**$655**

ISOLATORS
See page 505.

SMT Interconnects – See page 474 for complete line of attachment products.

Carrying Cases – Telescoping handle, retractable wheels. Order 202-0302-00 .....**$820**

1 See page 354 for complete selection information.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 2467B, 2465B comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

Digitizers

TVS521, TVS525, TVS541, TVS545

The TVS500 Series Waveform acquisition and analysis products are optimized for VXI system applications.

SCD 5000

The SCD Transient Waveform Digitizer provides the unique capability of high time and amplitude resolution single-shot capture of low nanosecond and picosecond events. This technology allows high time resolution even on the fastest events.

RTD720A/RTD710A

The 720A provides high fidelity capture of transient events. This high fidelity is maintained without the need for post acquisition correction, enhancement, filtering or averaging of the acquired waveform data. This quality of the acquired signal translates directly to the effective resolution that the acquisition system provides.

The RTD 710A provides high resolution, accuracy, and speed. With four times the resolution of an 8-Bit digitizer and 60 dB of dynamic range, the RTD 710A provides excellent resolution of fine signal details.

9504

The 9504 provides storage of long data records obtained from the high-speed analog-to-digital converter. In conjunction with the RTD 710A Waveform Digitizer, they provide the fastest real-time data logging capability for multiple, complex waveforms.

CONTENTS

DIGITIZERS

TVS521 VXI Waveform Analyzer.....126
TVS525 VXI Waveform Analyzer.....126
TVS541 VXI Waveform Analyzer.....126
TVS545 VXI Waveform Analyzer.....126
SCD 5000 4.5 GHz, Transient Event.....130
RTD 720A Transient Waveform 133
RTD 710A Transient Event.....133
9504 Fast Data Cache 140

ACCESSORIES

Probes 446
SMD Adapters.....474
Probe and Instrument Accessories 520
Plotter/Printer 524
Cameras.....526
Instrumentation Carts 528

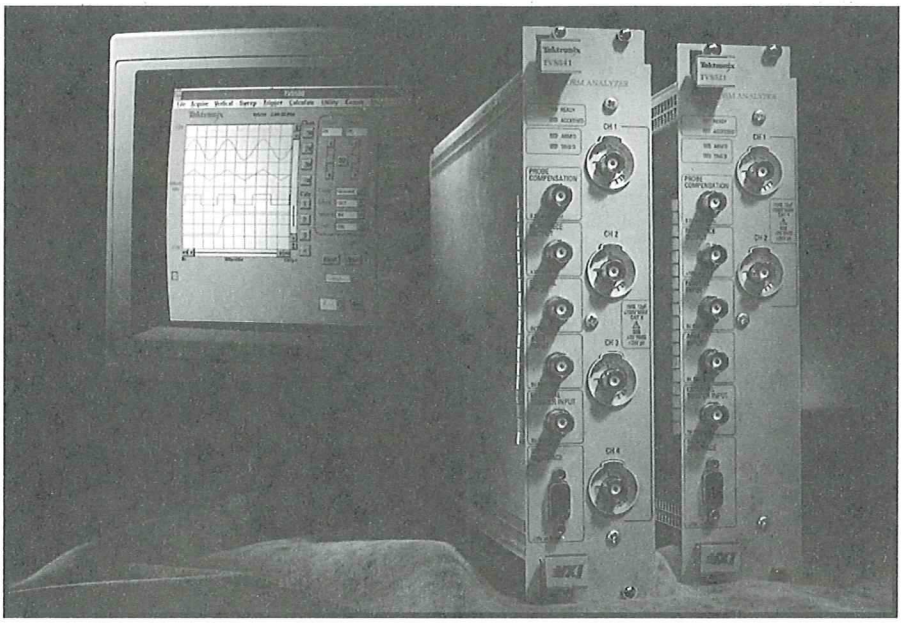
TVS521
TVS525
TVS541
TVS545

VXI Waveform Analyzer
Preliminary Specifications

Optimized for VXI system application.

TVS500 SERIES

- 4 GS/s Single-shot Sample Rate
- 1 GHz Bandwidth
- 10-Bit Vertical Resolution (1024 Digitized Levels)
- Record Lengths to 64 K
- High Throughput for Waveform Transfers, Settings Changes, and Measurements
- 10 Picoseconds per Point for Repetitive Waveforms
- Extensive and Flexible Waveform Processing and Measurements
- FFT, Integration, and Differentiation
- Digital Filtering – Highpass, Lowpass, Bandpass, and Notch
- Auto-advance Acquisitions with Time Stamping
- Battery Backed-up Acquisition Memory
- "C" Size VXI
- Message Based
- VXI*plug&play*



TVS500 Series

These high performance waveform acquisition and analysis products are optimized for VXI system applications, in order to deliver on the promises of VXI.

- High Performance
- High Throughput
- Compact Physical Size
- Optimized for System Applications
- High Performance to Price Ratio

The Tektronix TVS500 Series of VXI Waveform Analyzer products deliver on the improved system performance promise of VXI.

HIGH PERFORMANCE INSTRUMENTS

High performance starts with acquiring the waveform. The TVS500 Series provides fast transient or repetitive events capture, with both high time and amplitude resolution.

Supporting this high resolution waveform capture capability are high fidelity input signal conditioning and analog to digital conversion.

The instruments' hardware and firmware flexibility assures successful waveform capture, thus delivering on the VXI promise of high performance instrumentation.

HIGH THROUGHPUT

The choice of VXI is a first step towards achieving high throughput, but the key to achieving success is an instrument optimized for VXI. The TVS500 Series uses throughput tuned capabilities such as Fast Data Channel, firmware and instrument architecture, and hardware to deliver on the VXI throughput promise.

APPLICATIONS

MANUFACTURING TEST

- **Computers and Peripherals**
- **Mil-Aero ATE Systems**
- **Functional Board, Hybrid and Component Testing**
- **Avionics**
- **System and Device Characterization**

R&D

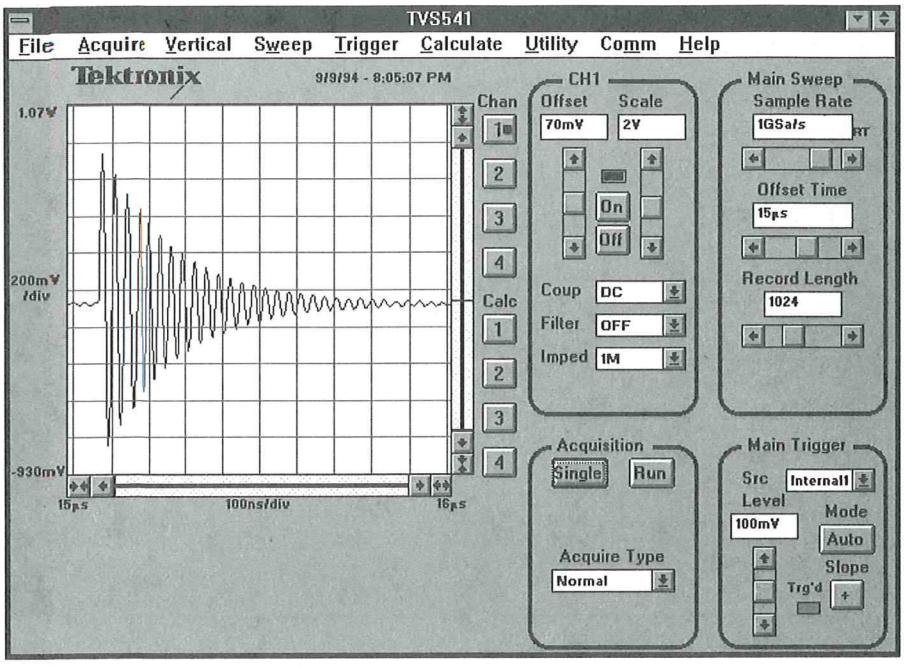
- **EMP and Radiation Simulators**
- **Pulsed Power Sources**
- **Electronic Warfare**
- **Radar**
- **Lidar**
- **Accelerators**
- **Intelligence Data Collection**
- **Laser Induced Phenomena**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

VXI Waveform Analyzer

Preliminary Specifications

TVS521
TVS525
TVS541
TVS545



COMPACT PHYSICAL SIZE
The TVS500 Series VXI "C" size format allows for high functional density delivering on this promise of VXI.

OPTIMIZED FOR SYSTEM APPLICATIONS
VXI is a system environment. The TVS500 Series products are designed as system products. The use of industry standards, the attention to high throughput requirements, and support for VXI*plug&play* are examples to the way the TVS500 Series delivers on the promise of VXI.

HIGH PERFORMANCE-TO-PRICE RATIO
Please explore the following instrument specifications and characteristics, to determine how well Tektronix has met this promise of VXI.

Characteristics

VERTICAL

Input Channels – Single ended BNCs with Tektronix TEKPROBE™ Interface supporting Active, Passive, and Optical Probes. Multi-channel acquisitions are acquired simultaneously .

TVS545 – 4 acquisition channels

TVS541 – 4 acquisition channels

TVS525 – 2 acquisition channels

TVS521 – 2 acquisition channels

Bandwidth – (DC coupled)

Full Scale Input	Bandwidth
100 mV to 10 V	DC to 1 GHz
50 mV to 99.5 mV	DC to 900 MHz
20 mV to 49.8 mV	DC to 700 MHz
10 mV to 19.9 mV	DC to 500 MHz
10.1 V to 100 V	DC to 500 MHz

Input Ranges – 10 mV to 100 V full scale in 1400 steps.

Vertical Resolution – 10-Bits (1024 digitized levels) Resolution can be increased with averaging or signal processing.

Input DC Gain Accuracy – 1% for input ranges ≥ 100 mV full scale. 2% for input ranges < 100 mV full scale.

Offset Range –

Full Scale Input	Offset Range
10 mV to 1 V	± 1 V
1.01 V to 10 V	± 10 V
10.1 V to 100 V	± 100 V

Offset Accuracy – ±(1% offset setting + 1% full scale input range).

Input Impedance – 1MΩ – 50 Ω Switchable.

Input Coupling – DC, AC, or Off.

Input Noise Filter – Full, 250 MHz, and 20 MHz Bandwidth user-selectable.

Fiducial Input – ≤ 1 nsec risetime superimposed on CH 1 acquisition for time aligning multiple acquisition units.

SAMPLE RATE
Maximum Single-shot –

TVS545	1 CH @ 4 GS/s 2 CH @ 2 GS/s 4 CH @ 1 GS/s
TVS541	2 CH @ 1 GS/s 4 CH @ 500 MS/s
TVS525	1 CH @ 2 GS/s 2 CH @ 1 GS/s
TVS521	1 CH @ 1 GS/s 2 CH @ 500 MS/s

Equivalent Time Acquisition – To 10 psec per point (requires repetitive signals).

Real-Time Acquisitions – From "Maximum Single-Shot Sample Rate" to 1 sample per second.

Record Length Maximum –

TVS545	1 CH to 64 K 2 CH to 32 K 4 CH to 16 K
TVS541	2 CH to 16 K 4 CH to 8 K
TVS525	1 CH to 32 K 2 CH to 16 K
TVS521	1 CH to 16 K 2 CH to 8 K

Record Length Range – 256 points to maximum in binary sequence.

Pre & Post Trigger Acquisition – Pre-Trigger (capture of data prior to the trigger event) 0% to ≈ 100% of record length. Post-Trigger (capture of data after the trigger event) 0 seconds to 2.2 years.

Acquisition Modes – Normal, Average, Envelope, Auto-Advance.

Auto-advance Acquisition – Standard instrument 1000 records of 256 points to 4 records of 64 K points.
With Option 10: 25,000 records of 256 points to 100 records of 64 K points. Each record is Time Stamped.

TVS521
TVS525
TVS541
TVS545

VXI Waveform Analyzer
Preliminary Specifications

TRIGGERING

Sources – Internal (any channel), external, or VXI TTL and ECL trigger bus.

Types – Main, Edge or Pulse (time qualified), Delayed, Delay by Time: 16 ns to 250 sec, Delay by Events: 1 to 10,000,000 events with a maximum rate of 250 MHz.

Modes – Normal, Single, or Auto.

Range Internal – ± 100% of Full Scale Input Range settable in steps of 0.1%.

Range External – ± 3 V settable in steps of 6 mV.

Sinewave Sensitivity Internal – 3.5% Full Scale DC to 50 MHz increasing to 10% Full Scale at 1 GHz.

Sinewave Sensitivity External – 0.25 V DC to 50 MHz increasing to 1 V at 1 GHz.

Trigger Coupling – Internal: DC, AC, LF Reject, HF Reject, and Noise Reject. External: DC – 50 Ω.

Trigger Slope – Positive or negative.

Pulse Triggering –
Width: Trigger event time either in or out (user selected) of user specified time window.
Glitch: Trigger event either greater than or less than (user selected) of user specified time window.
Minimum Trigger Event Width: 1 nsec.
Rearm Latency: 2 nsec + 5% of setting.
Range: 1 nsec to 1 sec.

Arm Input – Internal, External, or from the VXI TTL or ECL trigger bus. External (front-panel connector) is TTL compatible and arms on switch closure to ground or 0 V level. 1 K pull-up to +5 V provided.

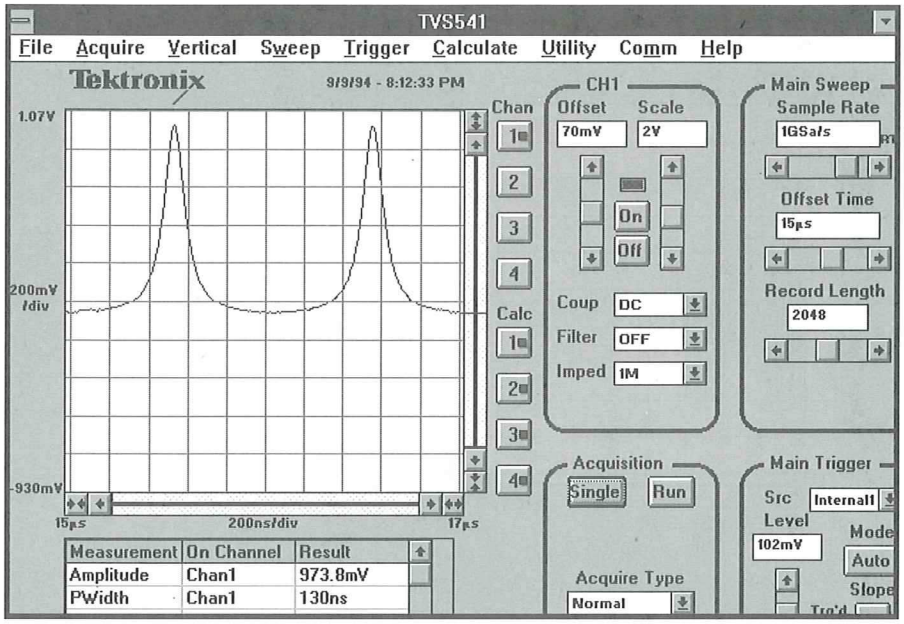
OTHER FRONT-PANEL CONNECTORS

Probe Compensation – Allows adjusting passive probes for use with 1 MΩ input impedance.

Reference Output – Allows verifying accuracy of internal amplitude and time sources.

Serial Interface – RS-232-C DTE Interface provides an alternative computer interface for instrument control and waveform data transfer.

Performance Assurance –
- Auto-Cal with user verifiable references
- Tested to IEEE-1057 Standard for Digitizing Waveform Recorders
- 3-year product warranty
- Environmentally rugged



Waveform with measurements.

ENVIRONMENTAL, PHYSICAL AND SAFETY

VXI – "C" size, 2 slots wide.

Temperature (operating) – 0°C to +50°C.

Humidity (operating) – 95% relative (non-condensing) ≤ 30°C. 45% relative to +50°C.

Vibration (operating) – MIL-T-28800E Type III Class 3.

Shock (nonoperating) – 60g, 11 msec, half-sine, 3 shocks per side.

Altitude (operating) – to 4.5 km (15,000 ft.).

Airflow – For a 15°C average exit air temperature rise: 4 liters per second with ≤0.1 mm H_2O pressure.

Current Requirements –

+12 V	1 A
+5 V	10 A
–2 V	0.25 A
–5.2 V	6 A
–12 V	0.25 A

Maximum Power – 98 W.

EMC

EMC performance in VXI mainframe dependent with testing for the TVS500 Series tested in a Tektronix VX1410 mainframe.

Emissions (complies with) – Enclosure: EN55022 Class B for radiated emissions; AC Mains: EN60555-2 for power line harmonics, EN55022 Class B for conducted emissions.

Immunity – Complies with EN50082-1 (IEC 801-2).

Immunity ESD – Complies with EN50082-1 (IEC 801-2).

Immunity Fast Transient – Complies with EN50082-1 (IEC 801-4).

Immunity Line Surge – Complies with IEC 801-5.

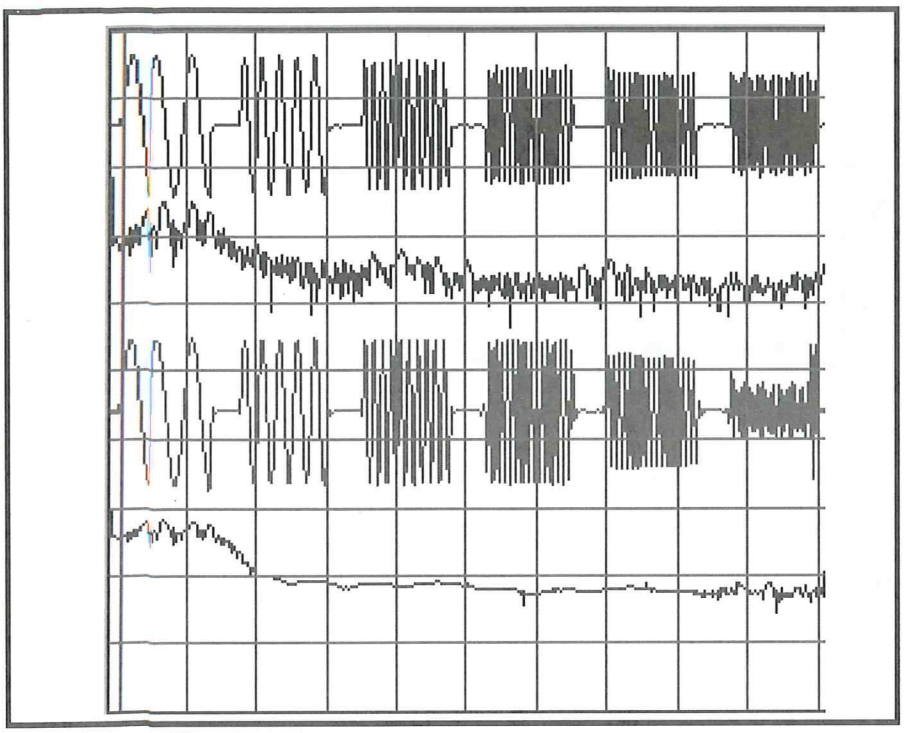
Complies – With VFG243, FCC CFR 47, Part 15 Subpart B, Class A, MIL-STD-461.

Safety – Complies with: UL 1244, CSA 22.2 no. 231, and IEC 1010-1.

VXI Waveform Analyzer

Preliminary Specifications

TVS521
TVS525
TVS541
TVS545



FFT of low pass filter of waveform.

COMMAND SET

Message Based – SCPI (Standard Commands for Programmable Instruments).

Throughput Enhancements –

- Fast Data Channel for waveform and measurement transfers
- 10 complete instrument settings stored in the instrument (battery backed-up)
- Low level (binary) settings query and return
- Fast instrument settings changes
- Acquisition and Waveform Data Transfer Looping
- Auto-advance with Time Stamping
- Waveform Measurements, Math, and Transforms executed in hardware DSP
- Answers not just waveform data for further processing in the system computer
- Instrument status signaling (e.g., operation complete, triggered, waveform data available) using the VXI TTL and ECL trigger bus

Waveform Math – Between waveforms, or a waveform and a scalar. Operators: Add, Subtract, Multiply, and Divide.

Waveform Transforms –

- Integrate
- Differentiate
- Smooth with user-selected number of points
- FFT with user selection of six Window functions and scaling (e.g., linear, logarithmic)

Waveform Measurements –

Period	Frequency
High	Low
+ Width	– Width
Maximum	Minimum
Rise Time	Fall Time
Peak to Peak	Amplitude
+ Duty Cycle	– Duty Cycle
Mean	Cycle Mean
RMS	Cycle RMS
Area	Cycle Area
Mid	Standard Deviation

Measurement flexibility is provided through independent user selection of functions such as Base-top method, and crossing levels for making risetime measurements.

Digital Filtering –

- Lowpass
- Highpass
- Bandpass
- Notch

User selection of start, stop, center frequency, span, stopband rejection, and transition width.

Processing Power – Waveform math, transforms, measurements, and digital filtering can be intermixed in an algebraic expression to act on acquired waveform data.
For example: Risetime (Smooth (CH1 * CH2)).

VXI*plug&play* – The TVS500 Series is VXI*plug&play* compatible.

ORDERING INFORMATION

TVS545
4 CH, 1 GHz, 4 GS/s, 64 K Waveform Analyzer **$17,900**
Includes: User Manual, Quick Reference Guide, and Plug & Play software.

TVS541
4 channel, 1 GHz, 1 GS/s, 32 K Waveform Analyzer..... **$12,900**
Includes: User Manual, Quick Reference Guide, and Plug & Play software.

TVS525
2 CH, 1 GHz, 2 GS/s, 32 K Waveform Analyzer **$9,900**
Includes: User Manual, Quick Reference Guide, and Plug & Play software.

TVS521
2 channel, 1 GHz, 1 GS/s, 16 K Waveform Analyzer..... **$7,900**
Includes: User Manual, Quick Reference Guide, and Plug & Play software.

Opt. 10 – Additional Auto-advance Memory **$4,500**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

SCD 5000

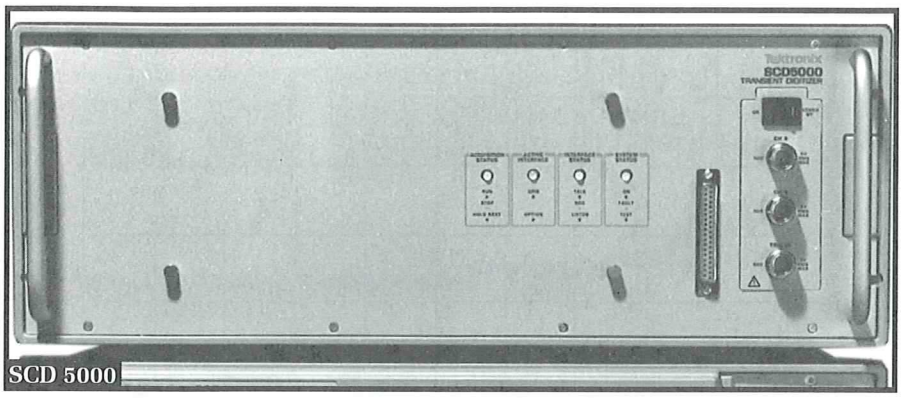
Transient Event Digitizer

4.5 GHz Bandwidth

High performance transient event capture.

SCD 5000

- High Single-shot Sample Rate to 200 GS/s (5 ps/pt)
- High Analog Bandwidth 4.5 GHz
- 11-Bit Vertical Resolution (2048 Levels of Resolution)
- Variable Record Lengths 256, 512, 1024
- Display Unit for Easy Control, Viewing, and Measurements



SCD 5000

SCD 5000

The Tektronix SCD Transient Waveform Digitizers provide the unique capability of high time and amplitude resolution single-shot capture of low nanosecond and picosecond events. For electrical signals the SCD 5000 provides the highest bandwidth and sample rates for transient event capture. Designed for the capture of very fast transition single-shot events, this technology allows a large number of waveform data points, even on the fastest events.

STANDALONE SUPPORT

The SCD Family, while designed as a system product, has a feature set and capabilities to meet application requirements as a standalone instrument. These include a display unit for waveform viewing that also provides for full instrument control. The display provides viewing of up to four waveforms with horizontal and vertical expansion for finer detail visual examination. Cursors that can be placed on the same waveform or different waveforms allow for absolute and delta time and amplitude values on any part of the waveform(s).

Further supporting this capability is a set of on-board time and amplitude measurements. These measurements' routines also provide a high degree of flexibility for how measurements are made and over what part of the waveform the measurements are made. Up to eight of the 21 measurements that are made can be displayed on the Display Unit (all 21 measurements, plus additional information are available over the GPIB).

For benchtop use the SCD Family Display Unit provides waveform viewing and full instrument control. There is hardcopy capability using either a video copier or to a plotter using the GPIB. Hardcopies can be initiated from either the display unit or over the GPIB.

SYSTEM SUPPORT

The SCD Family is designed as a system product. Besides the hardware and firmware capabilities described above, the SCD Family has additional features addressing system applications. These include:

- External Arming
- External Triggering
- Gate Out Signal effectively providing a trigger output
- Ten stored (and battery backed-up) instrument settings
- Rackmounting hardware a standard part of the instrument
- As an option, rear signal inputs and signal feed-through
- Display Unit that can be moved from instrument to instrument

These capabilities are further supported with an "Engineering English-like" command set that eases the task of software development. The optional Display Unit also has a Debug mode that allows viewing of the GPIB traffic to the instrument with error and event condition reporting.

APPLICATIONS

- **Nuclear Events**
- **EMP and Radiation Simulators**
- **ESD (Electro-static Discharge)**
- **Laser Induced Phenomena**
- **Pulsed Power Sources**
- **Analysis of Fast Pulsed Events**
- **High Energy Physics**
- **Fluorescence Decay**
- **Radar and Lidar**
- **High Frequency Ultrasonics**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The SCD5000 complies with IEEE Standard 488.1 and Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Transient Event Digitizer

4.5 GHz Bandwidth

Another important system capability is the maintaining of the highest accuracy and signal fidelity. The SCD Family provides a Standardize function, instrument diagnostics, and power-on diagnostics (power-on diagnostics can be turned off by the user) to meet these requirements. The Standardize function (executing only upon user request either over the GPIB or from the Display Unit) is used to maintain the highest accuracy. Power-on and instrument diagnostics are used to verify the proper functioning and performance of the instrument.

HIGH FIDELITY WAVEFORM CAPTURE

The SCD 5000 provides high time and amplitude resolution capture of extremely fast transient events. Offering an unmatched combination of bandwidth and sample rate performance required for the capture of the fastest transient signals.

Characteristics

HORIZONTAL

Time per Point – 5 ps/pt (5 ns time window with 1024 point record length) to 400 ns/pt (100 µsec time window with 256 point record length).

Time Windows – 5 ns to 100 microseconds in a 1-2-5 sequence.

Record Length – 256, 512, or 1024 waveform data points.

Trigger Delay – 0% to 900% of time window.

Multiple Records (Auto-advance) – 16 waveform locations (first four locations are battery backed-up).

Time Stamping – Time and date are stored with each acquisition.

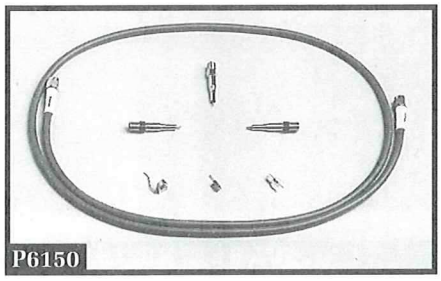
Arming – Internal or External. Triggers are not recognized until the unit is armed. External Arm is a BNC input that arms on a switch closure to ground (internal pull-up provided to 5 V).

Gate Out Signal – A TTL low level (≤0.8 V) output at the BNC for the duration of the sweep.

VERTICAL (Continued)

Input Channel – Each SCD provides a single channel of transient event waveform digitizing.

Parameter	SCD 5000	SCD 5000 Opt. 01
Analog Bandwidth (–3 dB)	≥4.5 GHz	≥3.0 GHz
Rise time (from Calculation) Tr = 0.35/Bandwidth	≤80 ps	≤120 ps
Vertical Resolution	11-Bits / 2048 levels	11-Bits / 2048 levels
Averaging	Averaging to 14-Bits	Averaging to 14-Bits
Input Range(s)	5 V Full Scale	10 V Full Scale
Resolution per Bit	2.44 mV/Bit	4.88 mV/Bit
Offset Range	±4 V	±8 V
Input Impedance and Coupling	DC Coupled: 50 Ω	DC Coupled: 50 Ω
TRIGGERING		
Sources	External	External or Internal
Coupling	AC	AC
Slope	Positive or Negative	Positive or Negative
Range	±0.5 V	±0.5 V External ±1.0 V Internal
Sensitivity (Sinewave) Internal	N/A	500 mV 20 KHz to 50 MHz 1.5 V 50 MHz to 500 MHz 3.5 V 500 MHz to 1 GHz
Sensitivity (Sinewave) External	50 mV 20 KHz to 50 MHz 150 mV 50 MHz to 500 MHz 350 mV 500 MHz to 1 GHz	50 mV 20 KHz to 50 MHz 150 mV 50 MHz to 500 MHz 350 mV 500 MHz to 1 GHz
Sensitivity (Pulse) External	≤150 mV with 500 ps HAD (half duration amplitude) pulse	≤150 mV with 500 ps HAD (half duration amplitude) pulse
Pretrigger View Time	N/A	≥2 ns



Accessory

P6150

Lowest Capacitive Loading Available

- <0.15 pF/500 Ω provides lowest circuit loading for 50 Ω circuitry
- Extremely wide bandwidth (>9 GHz)
- Interchangeable attenuator tips (1X, 10X)
- Useful in high-speed sampling TDR applications
- SMA style connection

For complete information on all Accessory products, see page 446.

SCD 5000

Transient Event Digitizer

4.5 GHz Bandwidth

COMPUTER INTERFACES

GPIB IEEE 488 – Interface is standard for instrument control and waveform data transfer. Maximum transfer rate ≥500 KB/sec.

Parallel Port – As an Option (2F) a waveform data output only, 16-Bit wide parallel port is provided capable of two Mwords (4 MB) data transfer rates. This provides TTL level outputs and has several operating modes to allow use with a wide range of computer interface cards.

Calibrator Output – BNC providing the time and amplitude signals required for the Auto-Cal function. This can also be used to verify the performance of the internal Auto-Cal signals.

DISPLAY AND INSTRUMENT CONTROL

Display – Provides for waveform viewing and instrument control. The waveform data display provides viewing of up to four waveforms at one time, with cursor measurement capability and waveform display expansion in both time and amplitude. The waveform expansion capability enables viewing of the full waveform or zooming in for closer examination of details of interest. User selection of up to eight of the 21 on-board time and amplitude measurements can also be displayed.

Hardcopy – The instrument also supports a video hardcopy capability (EGA compatible) and, with the Display Unit plotter output over the GPIB, is available without the need for a controller/computer. Using either hardcopy method, a representation of the information on the Display Unit is provided. The EGA compatible output can also be used to drive an EGA compatible monitor.

ENVIRONMENTAL (WITHOUT DISPLAY UNIT)

Temperature Range – Operating 0°C to 50°C.

Humidity – 0% to 95% relative humidity (non-condensing).

Altitude – Operating to 4.5 km (15,000 ft.) maximum; nonoperating to 15 km (50,000 ft.) maximum.

POWER REQUIREMENTS

Line Frequency – 48 to 440 Hz.

Voltage Range – Selected by rear panel switch 90 to 132 VRMS or 180 to 250 VRMS.

Power Consumption – SCD 5000 is fully optioned ≤300 W.

Warranty – The SCD 5000 carries a standard Tektronix one-year warranty covering labor and replacement parts for the instrument.

Safety – UL Listed 1244, Certified CSA C22.2 No. 231-M89.

Accessory

NEW P6245

Active Probing

- 1 GHz
- 10X, 1 pF/1 MΩ
- 1.5 m

For complete information on all Accessory products, see page 446.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The SCD5000 Series of Digitizers complies with the IEEE Standard 488.1 and Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

SCD5000

4.5 GHz Bandwidth Transient Event Digitizer **$46,900**
Includes: Instrument with Type N Connectors and Detachable Display with Power Cord; Fuses; User's Manual (070-6960-01); Instrument Interfacing Guide (070-7315-01); Quick Reference Guide (070-7316-01); and Rackmount Kit.

Opt. 1P – Increase waveform capture and transfer rate from one to ten 512 point waveforms per second ..... **+$3000**
Opt. 2E – Change Type N Input Connectors to SMA ..... **+$250**
Opt. 2F – Parallel Waveform Data Output Port with Battery Back-up of Linear Array Data..... **+$3500**
Opt. 20 – Delete Display Unit ..... **–$2000**
Opt. 01 – Add Delay Line with Internal Trigger Pick-off ..... **+$3000**
Opt. 9E – Change position of the Input Connectors to rear of the instrument (Type N connectors only) with signal feed-through and external termination (mutually exclusive with Opt. 01 and 2E)..... **+$1000**

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**
Opt. A2 – United Kingdom 240 V, 50 Hz..... **NC**
Opt. A3 – Australian 240 V, 50 Hz ..... **NC**
Opt. A4 – North American 240 V, 60 Hz ..... **NC**
Opt. A5 – Switzerland 220 V, 50 Hz..... **NC**

RECOMMENDED ACCESSORIES

See page 446 for complete selection information.

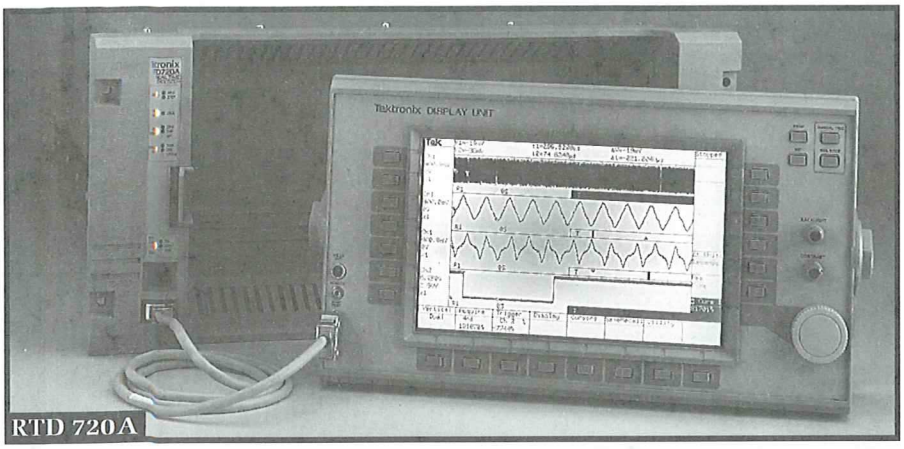
PROBES

Active – 4 GHz, 0.4 pF/100 kΩ, 1 m. (Requires Opt. 1E or 1103 Power Supply). Order P6217 ..... **$3,595**
50 Ω Divider (Zo) – 3.5 GHz, 1 pF/500 Ω; 10X, 3 GHz, 1.1 pF/5000 Ω, 100X, 1.5 m. Order P6156 with Opt. 25 ..... **$350**
9 GHz, 0.15 pF/500 Ω; SMA Compatible. Order P6150..... **$995**

CAMERAS/PLOTTERS/PRINTERS

Plotter – Four Color. Order HC100 with Opt. 01 ..... **$1,380**

Transient Waveform Digitizer



Signal Fidelity

The Tektronix RTD 720A Transient Waveform Digitizer provides high fidelity capture of transient events. Signal fidelity is another name for high resolution capture of signals. Base resolution is of little value if the characteristics of the signal are lost. The RTD 720A provides input signal conditioning and Analog to Digital conversion that maintains the characteristics of the signal of interest. Factors affecting signal quality include bandwidth, transient response, accuracy, input range and offset, overdrive recovery, and a measure of the complete digitizing process (i.e., IEEE-1057) Effective Bits measurement. The RTD 720A maintains the high fidelity required without the need for post-acquisition correction, enhancement, filtering, or averaging of the acquired waveform data. This quality of the acquired signal translates directly to the effective resolution that the acquisition system provides.

The digitizing process and the quality of the waveform data provided are the starting point for high resolution and fidelity capture of transient events. Sample rate is another key parameter, since it determines the maximum signal frequency that can be accurately captured. The RTD 720A provides sample rates from 2 GS/s (500 picoseconds/point) to 5 MS/s (200 micro-seconds/point) for fine time resolution and accurate capture of the signals of interest. With up to four channels of acquisition (requires Opt. 06) the RTD 720A provides high amplitude and time resolution and fidelity signal capture of multiple events. The long record length capability of the RTD 720A provides the needed final characteristic for high resolution and fidelity capture of transient events.

Long Acquisition Memory with Intelligent Utilization of the Memory

The waveform memory of the RTD 720A allows capture of even long duration events at the sample rate needed to accurately represent the signal to be captured. The RTD 720A's standard acquisition memory is 128 K waveform data points (131,072 sample or >65 µsec time window at 2 GS/s). Optional acquisition memory is available for the RTD 720A of 512 K of battery backed-up memory, 1 MB of memory, and 4 MB of memory. Memory can be assigned entirely to one channel or shared equally among the active channels (1, 2, or 4), with simultaneous acquisition on all channels.

Continued on next page.

RTD 720A

- 2 GS/s Single-channel Mode
- 1 GS/s Dual-channel Mode
- 500 MS/s Four Channel Mode
- Long Waveform Memory – 128 K Standard
  - 512 K Battery Backed-up Memory Option
  - 1 MB Memory Option
  - 4 MB Memory Option
- Intelligent Memory Usage
  - User Selection of Memory Size
  - Extremely Fast Multiple Event Capture
- 500 MHz Analog Bandwidth
- 8-Bit Vertical Resolution
- Optional Removable Display with Remote Operation Capability

High fidelity capture of transient events.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The RTD 720A complies with the IEEE Standard 488.1, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

APPLICATIONS

IMPULSE PHENOMENA
- Nuclear Events
- EMP and Radiation Simulators
- Laser Induced Phenomena
- Pulsed Power Sources
- Analysis of Multiple Fast Pulsed Events
- High Energy Physics

PULSE ECHO EVENTS
- Radar and Lidar
- High Frequency Ultrasonics

LONG RECORD LENGTH APPLICATIONS
- Intelligence/Electronic Warfare
- Spectroscopy (Time-of-Flight)
- Computer Mass Storage Device and Media Characterization

RTD 720A

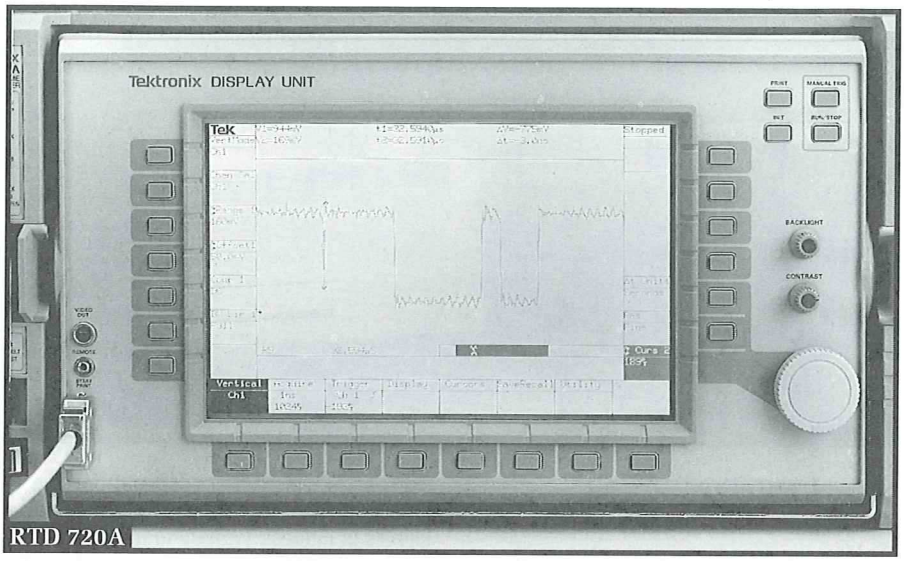
Transient Waveform Digitizer

Not only does the RTD 720A provide long memory for contiguous acquisition of waveforms, it also provides flexibility in memory usage. Memory can be configured for shorter acquisitions to match the total time of the event of interest. Furthermore, with shorter record length acquisitions, memory can be partitioned to capture multiple independent events.

Using the internal acquisition memory partitioned for the capture of many independent events provides a rapid signal capture capability. Auto-advance mode captures a sequence of up to 1024 events on each channel with only 5 µs re-arm time between events. Time-of-Arrival of each event is also captured with time resolution as fine as 500 ps.

Further extending the usefulness of the memory is pre-trigger and post-trigger acquisition. With pre-trigger to approximately 100% of the record, it is possible to capture events prior to the triggering event. Post-triggering, to 99,999,999 sample intervals, allows capturing events occurring significantly after the trigger event.

Flexibility in choosing the amount of pre-trigger or post-trigger, coupled with user selection of record length, allows positioning of the acquisition over the event of interest.



High-speed Waveform Data Transfers

Complimenting the high capture rate of the RTD 720A, a fast and efficient data transfer capability is provided by both hardware and instrument firmware. The RTD 720A is designed to transfer data to a computer very rapidly.

The digitizer's GPIB (IEEE 488) computer interface provides efficient instrument control and waveform data transfer. In burst mode (such as when transferring waveform data) the maximum transfer rate is ≥500 KB per second (dependent on the transfer speed capability of the computer). For even faster transfer of waveform data a 16-Bit parallel port is provided that is capable of transferring 4 MB per second (two Mwords per second). The parallel port operates with TTL levels supporting both a handshaked and clocked mode of operation.

To take advantage of the hardware speed the RTD 720A's command set is also designed to provide high-speed transfers to a computer. These commands allow defining: which acquired channels are to transfer data; whether the full set of waveform data or part of a record is to be transferred; and how many records to transfer if in Auto-advance mode. This capability allows all acquired data to be transferred with a single command, which significantly lessens the time addressing and unaddressing the instrument. For applications requiring repeated transfers (i.e., acquire, transfer, acquire, transfer,...) the RTD 720A provides a command that allows waveform data transfer without the need to issue commands to the instrument for each transfer. Again, this lessens the time required to issue commands and for the instrument to decode the commands, which speeds the data transfer process. These capabilities are available for both the GPIB and parallel ports.

System Support

The RTD 720A is designed as a system product. Besides the hardware and firmware capabilities described above, the RTD 720A has additional features addressing system applications. These include:

- Fiducial Input
- External Arming
- External Clocking
- External Triggering
- Trigger Out Signal
- Optional Display Unit that can be moved from instrument to instrument and can be used for controlling the instrument and waveform viewing

These capabilities are further supported with an "Engineering English-like" command set that eases the task of software development. The optional Display Unit also has a Debug mode that allows viewing of the GPIB traffic to the instrument with error and event condition reporting.

Another important system capability is maintaining highest accuracy and signal fidelity. The RTD 720A provides a Standardize function, instrument diagnostics, and power-on diagnostics (power-on diagnostics can be turned off by the user) to meet these requirements. The Standardize function (executing only upon user request either over the GPIB or from the Display Unit) is used to maintain the highest accuracy. Power-on and instrument diagnostics are used to verify the proper functioning and performance of the instrument.

For benchtop use the RTD 720A Display Unit provides waveform viewing and full instrument control. There is hardcopy capability using either a video copier attached to the Display Unit or to a plotter using the GPIB (Talk Only mode) initiated from the Display Unit. The RTD 720A also supports Tektronix TEKPROBE™ I/F, allowing the use of active (FET) and optical probes, as well as passive probes.

High Fidelity Waveform Capture

The RTD 720A provides high fidelity capture of transient events, offering an unmatched combination of signal quality, sample rates, and record lengths, providing the performance needed for the capture of fast transient signals.

Characteristics

VERTICAL

Input Channels – Two (optionally four) single-ended BNCs with Tektronix TEKPROBE™ Interface. Simultaneous digitizing on all channels, in Dual and Quad modes of operation. Four input channels (Quad Mode) requires Option 06.

Input Ranges, Offsets – 50 mV full scale to 12.5 V full scale in 25 ranges with each range 1.25 times the previous range. Each range provides an independent ±100% offset capability with fast overdrive recovery (≤20 ns from a two times overdrive signal).

Transient Waveform Digitizer

Bandwidth (–3 dB) – DC coupling: DC to ≥500 MHz; AC coupling: ≤1.5 kHz to ≥500 MHz.

Input Accuracy (after Standardization) – Mean Value: –ΔDC Volts: ±(1% of Signal +1% of Full Scale Input Range); Offset: ±(1% of Full Scale Input Range + 0.5% of Offset Range +1% of Offset Value).

Maximum Input Voltage and Input Protection – DC coupled 5 VRMS (0.5 W into 50 Ω or 0.25 Watt-second pulses not to exceed 25 V peak. AC coupled same as DC with ±100 VDC + peak AC.

Fiducial Input – BNC signal input in parallel with CH 1 for providing a time marker to allowing cross timing references between multiple units.

Vertical Resolution – 8-Bits providing 256 discrete levels (≈ 50 dB dynamic range).

Sample Rates – 2 GS/s (500 ps/point) to 5 MS/s (200 ms/point).

ACQUISITION MEMORY

Standard instrument 128 K waveform data points.

Opt. 10: 512 K waveform data point with battery backed-up.
Opt. 11: 1 MB waveform data points.
Opt. 15: 4 MB waveform data points.

All memory is shared equally among active channels (1, 2, or 4) with user selection of active channels. User also has control of record size selection from 512 waveform data points to the full memory available, in a binary sequence (i.e., 512, 1024, 2048,...).

Multiple Records (Auto-Advance) – Memory can be further segmented in up to 1024 records per channel. Maximum number of records equals: Total Acquisition Memory ÷ (# of Active Channels x Record length). Re-arm time between records in Auto-advance Mode is 6.5 to 25 µsec plus pre-trigger fill time.

TRIGGERING

Sources – Internal from any channel (active or inactive) or External.

Trigger Coupling and Impedance – DC and AC. Impedance for Internal is the same as input channel coupling (50 Ω); for External 50 Ω ±5%.

Trigger Slope – Positive or Negative.

Trigger Modes – Normal (unit will wait indefinitely until a valid trigger occurs) and Auto (a trigger will be generated after approximately 60 Ms if a valid trigger does not occur).

Trigger Time Accuracy (including jitter) – CH 1: 1 sample interval RMS; Dual Channel: 0.5 sample interval RMS; Quad Channel: 0.25 sample interval RMS.

Pre-Trigger Capture (Waveform data captured prior to the Trigger event) – From ≈100% of the Record Length to 0% in increments of 64 sample intervals.

Post-Trigger Capture (Waveform data captured after the Trigger event) – From 0% of the Record Length to 99,999,999 sample intervals after the trigger. For post-trigger mode, acquisition begins after the post-trigger delay set and captures the full defined record length.

Arming – Internal or External. Triggers are not recognized until the unit is armed. External Arm is a BNC input that arms on a switch closure to ground (internal pull-up provided to 5 V).

Trigger Out Signal – A TTL low level (≤0.8 V) output at the BNC after trigger and remains low during the acquisition cycle.

COMPUTER INTERFACES

GPIB – IEEE 488-1 interface is standard for instrument control and waveform data transfer. Maximum transfer rate ≥500 KB/sec.

Parallel Port – A waveform data output only 16-Bit wide TTL level parallel port is provided capable of two Mwords (4 MB) data transfer rates.

DISPLAY AND INSTRUMENT CONTROL

Optional Display – Provides for waveform viewing and instrument control. Display can be remotely mounted and moved from instrument to instrument by simply moving the connecting cable.

Hardcopy – The display also supports a video hardcopy capability (EGA compatible) and with the Display Unit plotter output over the GPIB is available without the need for a controller/computer.

ENVIRONMENTAL (STANDARD INSTRUMENT)

Temperature Range – Operating: –10°C to +55°C; Nonoperating: –51°C to +71°C.

Humidity – 0% to 95% relative humidity (non-condensing).

Altitude – Operating to 4.5 km (15,000 ft.) maximum; Nonoperating to 15 km (50,000 ft.) maximum.

POWER REQUIREMENTS

Line Frequency – 48 to 440 Hz.

Voltage Range – Selected by rear panel switch 90 to 132 VRMS or 180 to 250 VRMS.

Power Consumption – ≤500 W fully optioned (typical ≤350 W).

Warranty – The RTD 720A carries a standard Tektronix one-year warranty covering labor and replacement parts for the instrument.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	482.6	19
Height	225.25	8.75
Depth	635	25
Weight ≈	**kg**	**lb.**
Net	19	49

ORDERING INFORMATION

RTD 720A
Transient Event Digitizer **$23,200**
Includes: Two Input Channels and 128 K Acquisition Memory; Power Cord; Fuses; User's Manual (070-8516-00); Programmer's Manual (070-8518-00); Quick Reference Guide (070-8517-00); and Rackmount Kit.

Opt. 06 – Four (4) Acquisition Channels (adds two additional full function channels) ..... **+$2,500**

Opt. 10 – 512 K Battery Backed-up Acquisition Memory ..... **+$5,500**

Opt. 11 – 1 MB Acquisition Memory ..... **+$5,000**

Opt. 15 – 4 MB Acquisition Memory ..... **+$12,500**

Opt. 19 – Optional remote mountable display for waveform viewing and instrument control. ..... **+$2,900**

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1-A5 – See General Customer Information Section for additional description.

RECOMMENDED ACCESSORIES

See page 446 for complete selection information.

PROBES

Active – 1 GHz, 1.9 pF/10 MΩ, 1.5 m. Order P6204 ..... **$1,595**
10X, 1.5 GHz, 1 pF/1 MΩ, 1.3 M. Order P6245 ..... **$1,395**
750 MHz, 2 pF/1 MΩ, 1.5 m. Order P6205 ..... **$595**
4 GHz, 0.4 pF/100 kΩ. Order P6217 ..... **$3,595**

Differential – 100 MHz, Active Differential. Order P6046 ..... **$2,395**

50 Ω Divider (Zo) – 53.5 GHz, 1 pF/500 Ω, 10X; 3 GHz, 1 pF/5000 Ω, 100X, 1.5 m. Order P6156 with Opt. 25 ..... **$350**

Current –
DC – 50 MHz System. Includes AM503A, A6302, TM502A. Order AM503S **$2,795**

CAMERAS/PLOTTERS/PRINTERS

Plotter – Order HC100 with Opt. 01 ..... **$1,380**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 — The RTD 720A complies with the IEEE Standard 488.1 and Tektronix Standard Codes and Formats.

ISO 9001 — ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

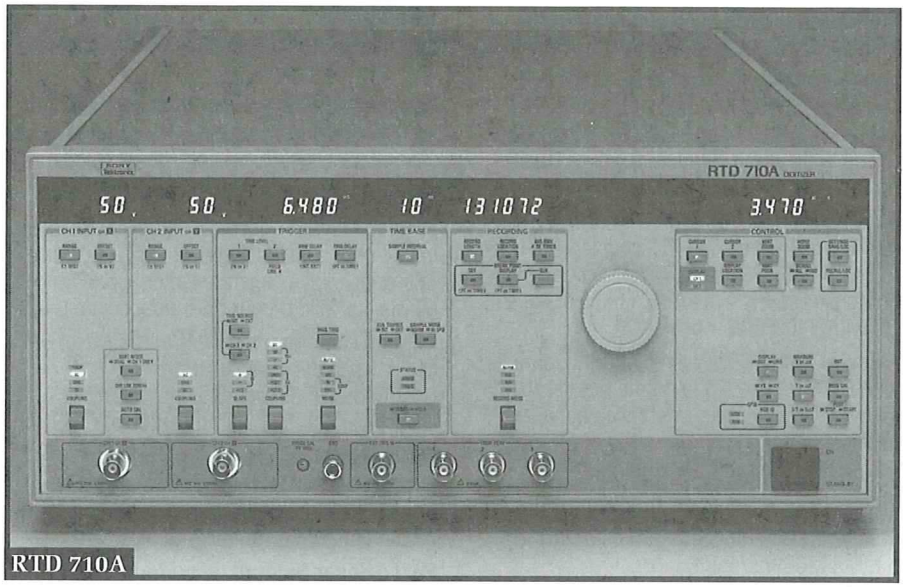
Tektronix Measurement products are manufactured in ISO registered facilities.

RTD 710A Transient Digitizer

High resolution, accuracy and speed

RTD 710A

- 10-Bit Vertical Resolution
- 200 MS/s Single Channel
- 100 MS/s Dual Channel
- 100 MHz Analog Bandwidth
- 256 K Word Waveform Memory
- Hardware Signal Averaging
- Internal/External A/D Clocking
- Cursor Measurements of Time, Voltage and Frequency



Programmable Waveform Digitizer

RTD 710A Waveform Digitizer

- High Resolution and Accuracy
- Synchronized Clocking
- Long Record Length
- Expandable Waveform Memory

HIGH RESOLUTION, ACCURACY AND SPEED

The RTD 710A Waveform Digitizer provides 10-Bit vertical resolution at sample rates up to 200 Megasamples per second (MS/s). With four times the resolution of an 8-Bit digitizer and 60 dB of dynamic range, the RTD 710A provides excellent resolution of fine signal details.

The RTD 710A provides real-time digitizing up to 200 MS/s in the single-channel mode and to 100 MS/s in dual-channel mode. The high performance amplifier and attenuator system, along with Autocal circuitry, provides excellent signal fidelity prior to conversion from analog to digital form. The input system also provides fine control of full scale input range and offset, maximizing use of the 1024 available digitizing levels.

Other key features of the input system are accurate step response and rapid overdrive recovery. Clean step response is important for accurate capture of transient events. The fast overdrive recovery allows accurate recording of small events occurring near large impulses, such as in pulse-echo applications and decaying exponential signals.

LONG MEMORY AND FLEXIBLE RECORDING

The RTD 710A contains 256 K (262, 144) words of high speed memory for storing waveform data. Memory can be allocated entirely to one channel or split between channels for simultaneous dual-channel digitizing.

Record length can be selected from 1024 points to the full 262, 144, in powers of two. When using shorter lengths, a correspondingly larger number of records are available. With a record length of 1024 points, up to 128 records per channel are available in the dual-channel mode, or up to 256 records if single channel is used.

DIRECT OUTPUT OF A/D DATA

For applications where the large internal memory of the RTD 710A is not enough, an external output port is provided. The output of both A/D converters is available up to the full 200 MS/s rate. External memory cache, such as the Tektronix 9504 FDC, may be added for capture of extremely long time windows with high resolution. Contact your Tektronix Sales Engineer for further information on memory cache products.

APPLICATIONS

- **Video and HDTV**
- **Ultrasonics, Radar, Lidar**
- **High Voltage Impulse Testing**
- **Power Supply and Power Conversion**
- **Communications and EW**
- **CCD Development**
- **Semiconductor and Hybrid Test**
- **ATE Systems**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

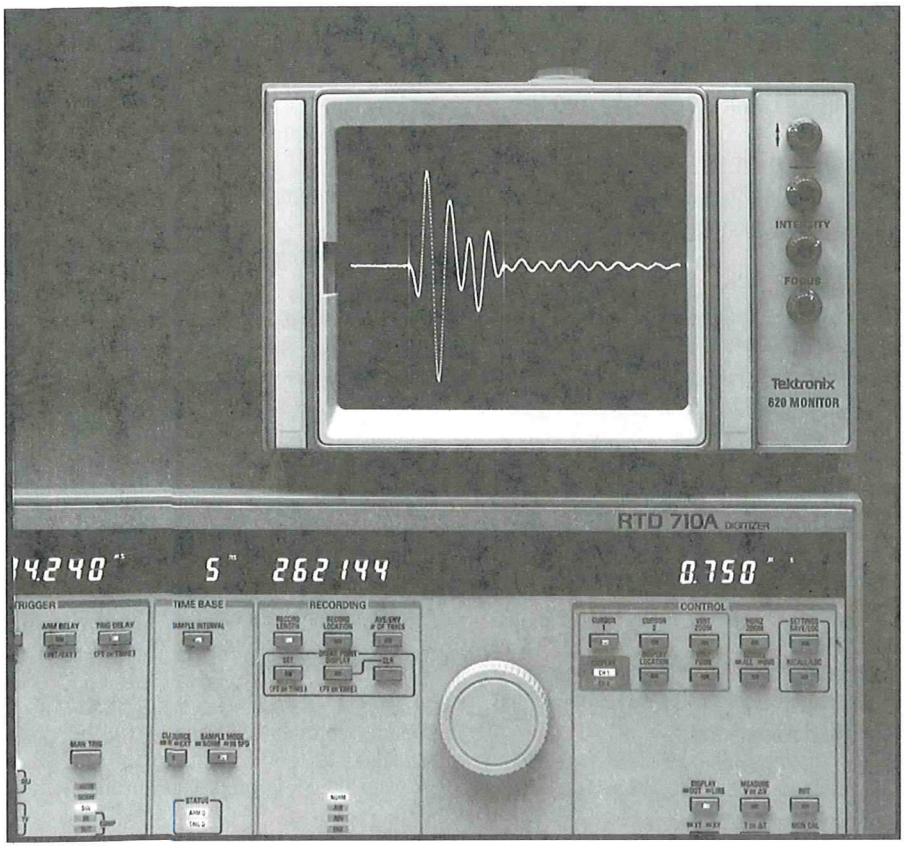
GPIB IEEE-488 The RTD 710A complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Transient Digitizer

RTD 710A



OTHER RECORDING MODES

The Auto-advance recording mode takes advantage of multiple records by capturing new waveform data on successive trigger events. In this manner a series of transient events can be captured in rapid succession and held for later analysis. Auto-advance recording is very powerful for capturing a series of lightning strikes, monitoring the time-varying output of a laser system, or recording other sequential transient phenomena.

In addition to the transient recording modes, the RTD 710A has built-in hardware signal averaging capability. This provides selectable powers-of-two averaging up to 16 K times to reduce random signal noise.

Envelope capture mode records minimum and maximum values for each data point over successive acquisitions. This offers a powerful technique for capturing spurious events and for monitoring signal drift.

INTERNAL AND EXTERNAL SAMPLE CONTROL

In addition to 66 internal time base settings, external strobing of the A/D converter system is supported. This provides the ability to synchronize sampling with external phenomena. The RTD 710A can be strobed from DC to 200 MHz. One typical application is CCD development where sampling can be synchronized with the CCD shift clock. Other applications are storage media testing and multiplexed data systems.

Sample rate switching is a unique feature provided to optimize usage of waveform memory. With sample rate switching it is possible to perform fast sampling during periods of interest and switch to a slower rate during quiescent periods. Up to five breakpoints (sample rate changes) are available within a record. One application is ultrasonics, where dead time between impulse and echo events can be sampled at a low rate while maintaining fast sampling over the events of interest. This can significantly reduce the amount of data transferred for processing in a computer.

VERSATILE TRIGGERING MODES

The RTD 710A offers many trigger modes to simplify the capture of complex signals. Standard oscilloscope-like triggering is provided along with enhancements such as LF or HF Reject, Bislope triggering and a Hysteresis trigger mode. Hysteresis mode allows the user to set an analog qualifying level as well as a trigger level, providing noise immunity and additional trigger selectivity.

A Video Trigger Option is available to allow the user to trigger on horizontal or vertical video SYNC pulses. This option makes it possible to trigger on a specific line number within a video field. Back porch clamp is provided.

In Comparison triggering mode, the RTD 710A continuously acquires events and compares them to reference-waveform values. If an event deviates from the range of values (Compare Out mode) or lies entirely within them (Compare In mode), the waveform is held for further analysis.

WAVEFORM ZOOM AND CURSOR MEASUREMENTS

When used in conjunction with an optional X-Y-Z monitor, captured waveforms can be viewed and measured in several ways. Cursors offer the capability to measure time, voltage and frequency. The RTD 710A offers horizontal and vertical display zoom, vertical positioning, and horizontal scrolling for easy viewing of the entire waveform or expansion of smaller portions. Both YT and XY types of displays are available.

Continued on next page.

Accessory

AM503S

Current Measurement Power

- Simultaneous AC/DC broadband current measurement system
- DC to 50 MHz (20A continuous/100A peak) with A6302 probe
- DC to 515 MHz (100A continuous/500A peak) with A6303 probe
- Clips onto conductor without having to break current

For complete selection information on all Accessory products, see page 446.

RTD 710A Transient Digitizer

STANDALONE OR SYSTEM DIGITIZER
The RTD 710A is fully programmable via the GPIB IEEE-488 and conforms to Tektronix Standard Codes and Formats. It also contains several useful waveform analysis commands, such as Min, Max, and Cross to increase throughput in test systems.

Hardcopies of the display can be made with the HC100 Color Plotter via the GPIB. Option 19 provides a blank instrument front panel. This eliminates the RTD 710A front-panel controls, reducing power consumption, instrument cost and susceptibility to undesired operator adjustment. This is particularly important in test-system environments.

Quicker system set-up time and the convenience of choosing from several previous instrument states is standard on the RTD 710A via non-volatile settings storage. Up to 20 different instrument states can be stored and recalled by either a front-panel push button or under computer control.

Measurement accuracy and proper functioning of the RTD 710A are confirmed by auto-calibration and self-test procedures. Self-test is automatically performed at power-on, and can be user-activated during operation.

Characteristics

VERTICAL
Input Channels – Two, single-ended. Supports X10 and X100 encoded probes for high input-voltage applications. Simultaneous digitizing in dual-channel mode.

Input Ranges – ±100 mV to ±50 V (200 mV to 100 V p-p) in 28 steps.

Autocal Internal Reference – Provides calibration of range accuracy and zero-offset. Range accuracy is ±0.4% at 1 kHz and 97% full-scale, zero volt offset is ±0.2%.

Input Offset – ±199% of input range, selectable in either percent or volts. Accuracy ±1.5% at ±100% DC offset.

Analog Bandwidth – DC to 100 MHz, 0°C to 40°C; DC to 90 MHz, 40°C to 50°C. Selectable bandwidth limiting at 20 MHz.

AC-Coupled Lower – 3 dB Point – 10 Hz or less.

Input R and C – 1 MΩ ±2%, ≈24 pF.

Maximum Input Voltage – 250 V (DC + peak AC); AC component, 500 V p-p maximum at 1 kHz or less.

TIME BASE
Internal Clock Frequency – 200 MHz ±0.001%.

Sample Rate: Internal Clock – CH 1 Only Mode: 200 MS/s to 5 S/s, 66 sampling steps. Dual-Channel Mode: 100 MS/s to 5 S/s, 65 sampling steps.

External Clock – CH 1 Only Mode: DC to 200 MHz, Dual-Channel Mode: DC to 100 MHz. ECL levels, periodic or non-periodic clock rate.

Sample Rate Switching – Up to five breakpoints within a record.

DIGITIZING
Vertical Resolution – 10-Bits provide 1024 discrete levels (60 dB dynamic range).

Maximum Sample Rate – Single-Channel Mode: 200 MS/s. Dual-Channel Mode: 100 MS/s.

Record Length per Channel –

CH 1 Only Mode		Dual-CH Mode	
Records	Length	Records/CH	Length/CH
1	262144	1	131072
2	131072	2	65536
4	65536	4	32768
8	32768	8	16384
16	16384	16	8192
32	8192	32	4096
64	4096	64	2048
128	2048	128	1024
256	1024	–	–

Averaging – Selectable from 2 to 16384 in a 2-4-8 binary sequence, 8 K per channel maximum record length averaged.

Enveloping – Selectable from 1 to 16384 in a 2-4-8 binary sequence or infinite.

TRIGGERING
Sources – Internal from CH 1 or CH 2, or External.

Trigger Coupling – AC, AC LF Reject, DC HF Reject, DC.

Slope – Positive, Negative, Bislope.

Modes – Auto, Normal, Single, Compare In, Compare Out, Hysteresis.

Post-Trigger Delay – From 0 to 262136 samples in Normal Mode, from 0 to 262128 samples in high speed (200 MS/s) mode.

Pre-Trigger Capture – To full record length less 8 samples for normal mode and full record length less 16 samples for high speed (200 MS/s) mode.

Arming Delay – Internal: 0, 10 Ms to 10 s in a 1-2-5 sequence; External arm input on rear panel.

TV Trigger – Selectable system-M and non-system-M protocols. Selectable triggering on any line (1 to 1280) within a field (1 or 2). TV blanking-level clamp (back porch).

DISPLAYS
Cursor Readout – 7-digit LED display for time, voltage and frequency.

Trigger Readout – 6-digit LED display for trigger level.

Record Length Readout – 6-digit LED display for record length and breakpoint location.

Range/Offset Readout – 4-digit LED display for range and offset settings; two displays, one for each channel.

COMPUTER INTERFACE
GPIB – IEEE-488.1 interface is standard for instrument control and waveform data transfer. Maximum transfer rate ≥250 KB/s. All instrument functions, settings, and operating modes are programmable, with the exception of the power switch.

Plotter Interface – HPGL Protocol, IEEE-488 interface.

Waveform Analysis Commands – Window, Minimum, Maximum, Base, Top, Positive Cross, Negative Cross, Mid, Mean, Peak to Peak.

Transient Digitizer

RTD 710A

EXTERNAL SIGNALS

CRT Display – X,Y,Z: ±1 and ±5 V p-p, internally selectable (set to ±1 V at factory).

Trigger Output – Positive True, TTL.

External Arm Input – TTL Compatible.

External Clock Input – ECL Signal Level, 50 Ω. DC to 200 MHz.

Clock Output – ECL signal level (open emitter out into 50 Ω).

Probe Calibration Output – 0 to +4 V ±1% square wave at 1 kHz ±0.005% into 1 MΩ.

Feed-through Connectors – Three 50 Ω coaxial cables for front-to-rear signal connections.

Direct A/D Output – 50-Pin AMPMODU MT connector. CH 1 and CH 2 digitized signals available. ECL-compatible signal levels. Maximum data rate is 100 Mwords/s (20-Bit word). Contact a Tektronix sales engineer for information on memory cache products and interfacing information.

ENVIRONMENTAL

Temperature Range – Operating: 0° to 50°C; Nonoperating: –30° to +70°C.

Humidity – 0 to 95% relative humidity (noncondensing).

Altitude – Operating: 4,570 m (15,000 ft.) max. Nonoperating: 15,240 m (50,000 ft.) max.

POWER

Line Frequency – 48 Hz to 440 Hz.

Power Consumption – 350 W fully optioned.

Line Voltage Range – 90 V AC to 132 V AC (115 V); 180 V AC to 250 V AC (230 V).

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	429	16.9
Height	177	7.0
Depth	643	25.3
Weight ≈	**kg**	**lb.**
Net	23.5	51.8

ORDERING INFORMATION

RTD 710A
Waveform Digitizer.....**$22,995**
Includes: (161-0123-00); Fuses (8A & 4A); Instruction Manual (070-7204-00); RTD 710A Instrument Interfacing Guide (070-7207-00).

Opt. 05 – Video Trigger.....**+$1,495**

Opt. 11 – Adds 9504 Fast Data Cache for 8 Mwords Total Memory.....**+$3,800**

Opt. 19 – Blank Front Panel (Includes Rackmount Assembly).....**–$200**

Opt. 1R – Rackmount Package.....**+$395**

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz.....**NC**

Opt. A2 – United Kingdom 240 V, 50 Hz.....**NC**

Opt. A3 – Australian 240 V, 50 Hz.....**NC**

Opt. A4 – North American 240 V, 60 Hz.....**NC**

Opt. A5 – Switzerland 220 V, 50 Hz.....**NC**

See General Customer Information Section for additional description.

RECOMMENDED ACCESSORIES

See page 446 for complete selection information.

PROBES

Differential – 100 MHz, Active Differential, 6 ft. Order P6046.....**$2,395**

Passive – 100 MHz, 13 pF/10 MΩ, 10X. Order P6109B.....**$85**

100 MHz, 18 pF/10 MΩ, 1X/10X. Order P6129B.....**$105**

High Voltage –
250 MHz, 2500 V, 2.5 pF/10 MΩ, Order P5100.....**$199**
75 MHz, 20 kV, 3.0 pF/100 MΩ, 10 ft. Order P6015A (Opt. 1R).....**$1,040**

Current – 120 Hz – 60 MHz, 7.5 A peak. Order P6021.....**$575**
935 Hz – 120 MHz, 3 A peak. Order P6022.....**$610**
DC – 50 MHz System. Includes AM503A, A6302. Order AM503S.....**$2,795**

CAMERAS/PLOTTERS

Plotter– Four color. Order HC100 with Opt. 01.....**$1,380**

CARTS

Order K475.....**$940**

ADDITIONAL ACCESSORIES

RTD 710A Service Manuals –
Vol. 1 Procedures. Order 070-7205-00.....**$85**
Vol. 2 Schematics. Order 070-7206-01.....**$75**
Rackmount Kit – Order 016-0886-02.....**$520**

Power Strip – Four Outlet, 6 ft., Noise/Surge Suppression. Order 131-5342-01.....**$48**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The RTD 710A Digitizer complies with the IEEE Standard 488.1 and Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

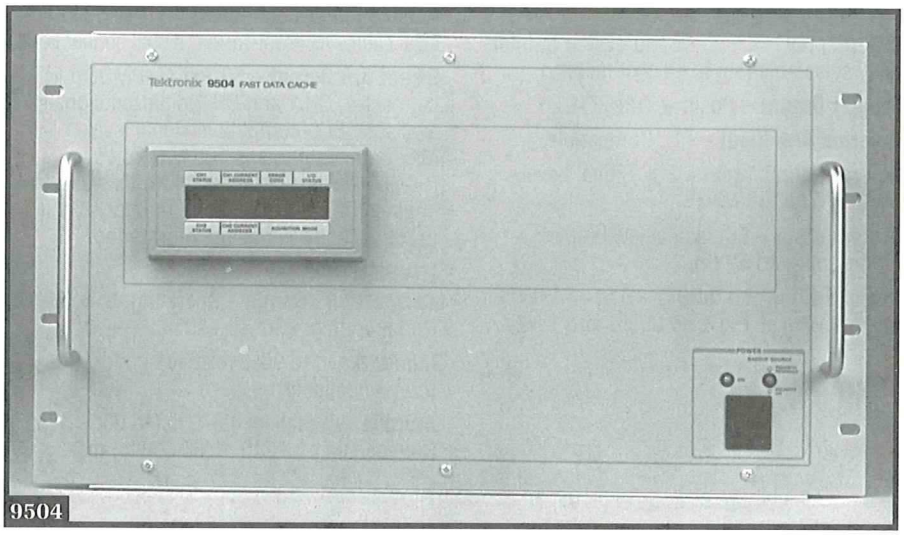
Tektronix Measurement products are manufactured in ISO registered facilities.

Fast Data Cache

Extremely high speed digital data storage.

9504

- Long Record Length
  – 4 Mwords Standard
  – Up to 32 Mwords
- Data Rates to 100 Mwords/s, Dual Channel or Inter-leaved for 200 Mwords/s, Single Channel
- 16-Bit or 8-Bit Word Width Selectable
- GPIB Controlled
- ECL or TTL Data Inputs (25 Mwords/sTTL)



9504 Fast Data Cache

- Extremely Long Record Length
- Data rates to 100 Mwords
- Partitionable Memory
- Very Fast Data Logging

The 9504 Fast Data Cache buffer memories provide significant record length augmentation for high speed, real-time digitizers. The 9504 is an expandable memory buffer that starts with four megawords total memory and can be increased to a total of 32 megawords.

LONG RECORD CAPTURE

They provide the economical solution to your digitized data storage needs for the logging of high speed, real-time data records. The 9504, in conjunction with the RTD 710A waveform digitizer, provide the fastest real-time data logging capability for multiple, complex waveforms in their class. The 9504 supports the high speed single-channel mode of the RTD 710A to capture data up to 200 megawords/s.

The 9504 provides storage of long data records obtained from high speed analog-to-digital converters. Each product accepts up to 16-Bit-wide words plus clock, at up to 100 megawords (samples) per second. Record lengths may be from 256 words to 16 megawords per channel. In either product, the two channels may be concatenated into one long memory.

FULL DIGITIZER COMPATIBILITY

Full dual-channel operation makes the 9504 fully compatible with the A/D outputs of the RTD 710 and RTD 710A waveform digitizers. They also accept data from the RTD 710A operating in the high speed mode to provide data storage at an effective sampling rate of 200 megawords/s. The standard configuration for either product provides two megawords of memory per channel.

The 9504 can be configured with additional two megaword memory cards, to provide a maximum of 16 megawords of memory per channel.

ECL DIFFERENTIAL OR TTL LEVEL INPUTS

The 16-Bit inputs are selectable in groups of four, and can be programmed for either ECL or TTL. Rear-panel BNC connectors allow control of start and trigger of data collection. The trigger input can also be connected to use the highest of the 16-Bits as an information flag.

MULTIPLE RECORDS CAPABILITY

Memory can be divided into a user-specified number of records with record length specified in segments of 256 words. Each record may be any number of 256-word segments up to the maximum size of the memory in that channel. Up to 64 K separate records (256 words each) may be stored per channel in the 9504. Multiple records capability is supported in all operation modes except pretrigger.

APPLICATIONS

- **Acquisition Memory Extension for the RTD 710A**
- **High Resolution Video and CCD Test Systems**
- **"Deep Record" Ultrasonic, Radar, and Lidar Signal Acquisitions**
- **EW and EMC Signal Capture**
- **Storage Media Test Systems**
- **Tempest Applications**
- **Fast Data Logging of Complex Waveforms**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 9504 complies with the IEEE Standard 488.2 and Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Fast Data Cache

OPERATIONAL MODES

The 9504 Fast Data Cache units allow the storage of very long data streams which have been acquired and digitized by high speed, real-time waveform digitizers, such as the RTD 710A. These system units are GPIB-controlled, and stored data is output via GPIB or over the high speed parallel port.

Normal (Independent) Mode – Both channels accept independent data streams and triggers.

Interleave Mode – Allows storage of data from CH 1 memory to be interleaved with data from CH 2 memory. Supports the RTD 710A high speed mode at 200 Mwords/s single channel. Assumes RTD 710A CH 1 data point zero to be first in combined record.

Sequential Mode – Data is stored in CH 1 memory until it is full; data storage then continues in the CH 2 memory. This mode provides for all available memory to be continuous without any break in timing. The data inputs to CH 1 and 2 must be identical.

Pre-trigger Mode – This mode connects the available channel memory into a circular buffer. The number of data words to be stored after the "trigger" is user selectable in 256 word increments.

FAST THROUGHPUT CAPABILITY

The 9504, when used in conjunction with the RTD 710A or other digitizers having continuous digitized signal output capability, allows the capture and storage of large quantities of signal waveforms at very rapid rates. The following chart shows typical waveform capture rates (data logging throughput) for representative record sizes and sampling rates. A TTL level trigger signal is required for each record.

TYPICAL WAVEFORM ACQUISITION RATES/SEC

Record Size	Max*1 No. of Records Stored	Input Sample Rate 100 MHz	50 MHz	10 MHz
	(9504)	(10 ns)	(20 ns)	(100 ns)
256	65,536	>380 K	>190 K	>38 K
512	32,768	>190 K	>95 K	>19 K
1,024	16,384	>95 K	>48 K	>9.5 K
2,048	8,192	>48 K	>24 K	>4.5 K
8,192	2,048	>12 K	>6 K	>1.2 K
16,384	1,024	>6 K	>3 K	>0.6 K

**1 Each channel (2X for single-channel mode).*

Characteristics

DIGITAL INPUT/OUTPUT SIGNALS

Number of Channels – Two independent channels.

Data Inputs – 16-Bits, clock, ground; Selectable between ECL and TTL, in groups of 4-Bits.

Data Input Rates – Up to 100 MHz: ECL. Up to 25 MHz: TTL.

Start Input – Starts data capture in Pre-trigger Mode; TTL signal into BNC.

Trigger Input – Starts data capture in all modes except Pre-trigger and marks trigger location on data. TTL signal into BNC.

Arm Out – TTL signal from BNC. TTL low while filling data record. Inhibits RTD 710A rearm while 9504 record is filling.

MEMORY SIZE

2 Mwords/CH; Expandable to 16 Mwords/CH or 32 Mwords total.

COMPUTER INTERFACES

GPIB – IEEE-488.2 and Tektronix Standard Codes and Formats.

Parallel Port – A waveform data (output only) 16-Bit parallel port is provided capable of 5 MB (2.5 Mwords/s). This provides TTL level outputs and has operating modes to allow use with a wide range of computers.

ENVIRONMENTAL

Temperature Range – Operating: 0°C to 50°C. Nonoperating: –20°C to +60°C.

Relative Humidity – 0 to 95%; noncondensing.

Altitude – Operating: 4,750 m (15,000 ft.) max. Nonoperating: 15,240 m (50,000 ft.) max.

POWER

Line Frequency – 48 to 63 Hz.

Maximum Power Consumption – Max 735 W (580 W typical) for maximum memory.

Battery Backup – Connector for battery on rear of instrument. 4.75 to 15 V DC, 450 mA maximum (fused).

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	267	10.5
Rack Depth	574	22.6
Overall Depth	622	24.5
Width	483	19.0
Weight ≈	**lb.**	**kg**
Net	17.3	38

9504F01 Fast Data Cache Memory Module

Two Mwords (4 MB). Adds two Mwords of additional storage to one channel of the 9504 Fast Data Cache unit. Order in pairs to extend both channels by the same amount.

ORDERING INFORMATION

9504
Fast Data Cache Unit **$25,750**

9504F01
Fast Data Cache. Two-megaword Memory Module **$8,300**

INSTRUMENT OPTIONS

Opt. 11 – (8 MW total) Adds 2 ea. 9504F01 ..... **+$14,000**
Opt. 12 – (12 MW total) Adds 4 ea. 9504F01 ..... **+$28,000**
Opt. 13 – (16 MW total) Adds 6 ea. 9504F01 ..... **+$42,000**
Opt. 14 – (20 MW total) Adds 8 ea. 9504F01 ..... **+$56,000**
Opt. 15 – (24 MW total) Adds 10 ea. 9504F01 ..... **+$70,000**
Opt. 16 – (28 MW total) Adds 12 ea. 9504F01 ..... **+$84,000**
Opt. 17 – (32 MW total) Adds 14 ea. 9504F01 ..... **+$98,000**

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**
Opt. A2 – United Kingdom 240 V, 50 Hz ..... **NC**
Opt. A3 – Australian 240 V, 50 Hz ..... **NC**
Opt. A4 – North American 240 V, 60 Hz ..... **NC**
Opt. A5 – Switzerland 220 V, 50 Hz ..... **NC**

See General Customer Information Section for additional description.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 9504 complies with the IEEE Standard 488.2 and Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

TLS 216

Logic Scope

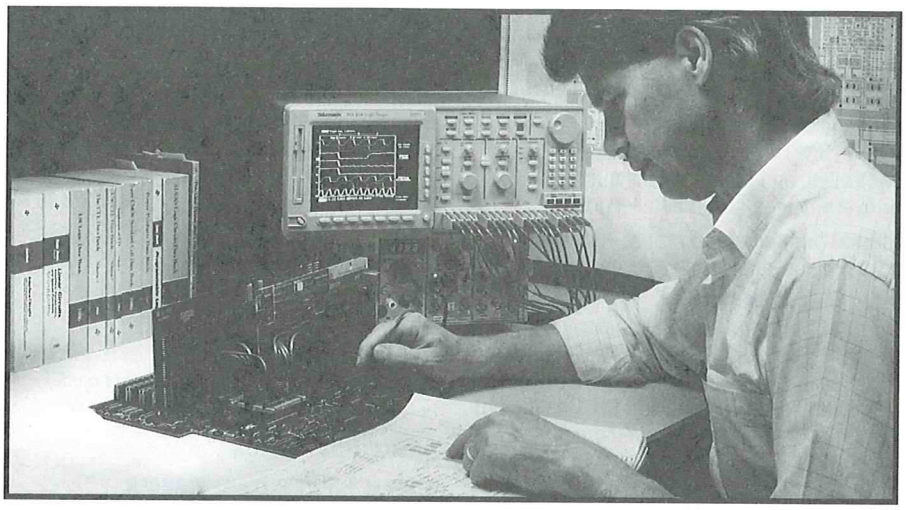
A new class of test instrument designed to simplify the task of debugging digital hardware.

TLS 216 FEATURES

- 2.5 pF, 1 MΩ Podlet Style FET Probes
- Display Modes: Analog, Timing Diagram and BusForm™
- <±100 ps Timing Resolution
- 16 Input Channels
- 2 GS/s Simultaneous Sampling on All Channels
- 500 MHz Real-time Bandwidth
- Logic Family Presets for TTL, ECL and CMOS
- Sophisticated Time Qualified Triggering with Four Word Recognizers
- 3-Year Warranty

BENEFITS

- Facilitates Hands-free Connection to SMT Devices
- Low Capacitance Probe for Non-intrusive Probing
- Powerful Triggering Reduces Time to Identify Problems
- Flexible Display Modes Simplify Recognition of Timing Faults
- High-speed Acquisitions on All Channels Facilitate Analysis of Complex System Interactions



TLS 216 Logic Scope

The TLS 216 Logic Scope is a new class of instrument designed to simplify the task of debugging digital hardware. The Logic Scope seamlessly combines in a single instrument the analog acquisition system of a high-speed digital storage oscilloscope (DSO) with the triggering and display systems of a logic analyzer. The 500 MHz bandwidth Logic Scope samples all channels simultaneously at 2 GS/s and has sophisticated time-qualified triggering, a high resolution color display, and an integrated MS-DOS compatible 3.5 inch floppy disk drive.

2.5 pF, LOW-MASS FET PROBES ENSURE NON-INTRUSIVE CONNECTION

The Logic Scope includes a set of 16 specially designed probes that have extremely low probe-tip mass (1.5 grams) and input capacitance (2.5 pF). The low probe-tip mass ensures that connections made to surface mount and fine pitch ICs will be reliable. The low input capacitance, combined with the 1 MΩ input resistance, decreases the effect of the probe on the DUT's operation, allowing very accurate measurements to be made with confidence.

These characteristics are made possible by using a "podlet-style" probe-tip design instead of the "pencil-style" design of traditional oscilloscope probes. Employing the de facto industry standard of 0.1 inch spacing between the signal and ground inputs, each 0.1 inch thick podlet can directly attach to the hundreds of readily available IC adapters and clips.

SOPHISTICATED TRIGGERING TO IDENTIFY COMPLEX DIGITAL PROBLEMS

In addition to edge trigger, most digital signals can be easily captured using pulse, glitch and pattern triggers. The Logic Scope provides two new trigger resources that allow the instrument to directly trigger on common digital circuit behavior. The industry's first time-interval or sequence trigger type monitors the time between two events, allowing the instrument to easily trigger on setup time violations, hold-time violations, or unexpected propagation delay. The powerful "Time-out" trigger type can be used to capture incomplete handshake sequences or to trigger the instrument when the DUT "hangs."

All of these trigger types let developers identify channel-to-channel relationships, including 16-bit patterns and time-related/time-qualified system faults. The Logic Scope's external trigger-input can be used as a "Trigger Arm" to enhance cross-triggering between two instruments, simplifying the task of using a Logic Scope with other test equipment.

APPLICATIONS

- **Hardware Performance Verification**
- **Multi-channel Data Acquisition**
- **Mixed Signal Analysis**
- **A/D and D/A Analysis**
- **Hardware Timing Analysis**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The TLS 216 complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

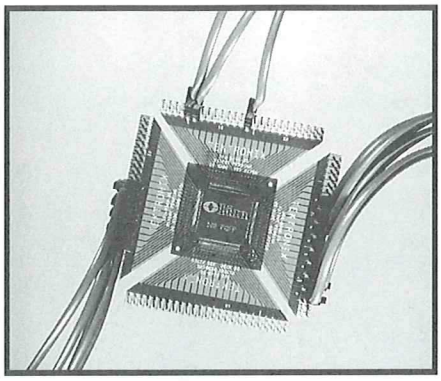
ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

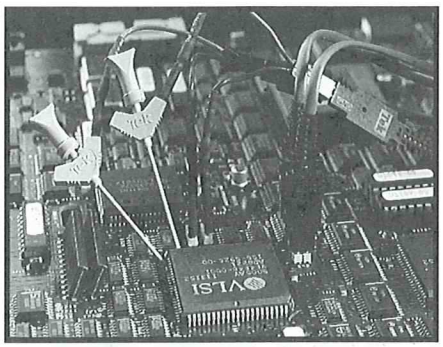
Logic Scope

Connect to the Design

- Low Mass Podlet Probes
- Low Capacitance, 2.5 pF
- 20 mil and 25 mil FlexLead™ Adapters
- Handheld Adapter and Probing Accessories
- 50 Ω Coax Adapter



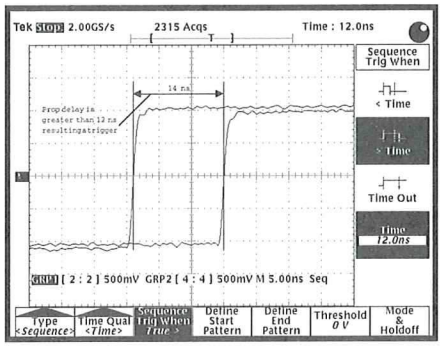
FlexLead™ Adapter offers connection to SMT devices of 20 and 25 mil spacing.



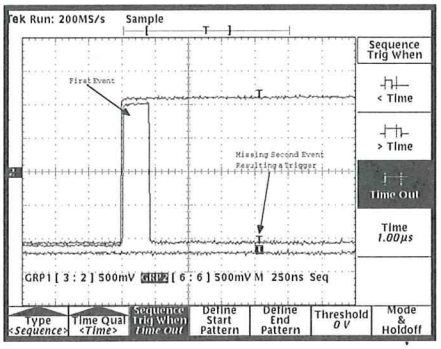
The array of probing accessories provides flexible connections to DUT. The podlet-style low-mass probe head simplifies hands-free probing.

Set up and Identify the Problem

- Powerful Triggering System: Edge, State, Pattern, Pulse, Sequence, Time-out, and Time-qualified
- NuColor™ Display
- Graphical User Interface



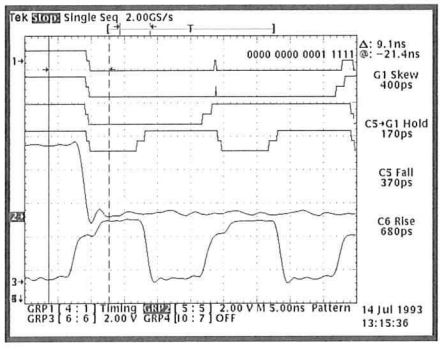
The triggering system of Logic Scope can trigger on setup time, hold time, or propagation delay violations.



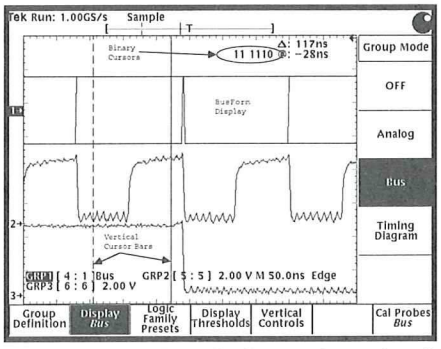
The time-out trigger simplifies detection of incomplete or missing system events.

Capture and Visualize the Cause

- 2 GS/s Sample Rate on All Channels
- 500 MHz Bandwidth
- 8-bit Vertical Resolution
- ±100 ps Timing Accuracy
- Multiple Display Formats: Analog, Timing, and BusForm™
- Binary Cursor Readouts



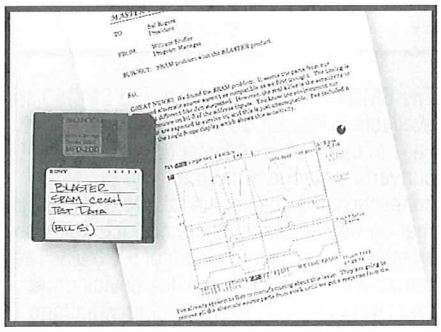
The dual-threshold Timing Diagram provides visual information at each transition.



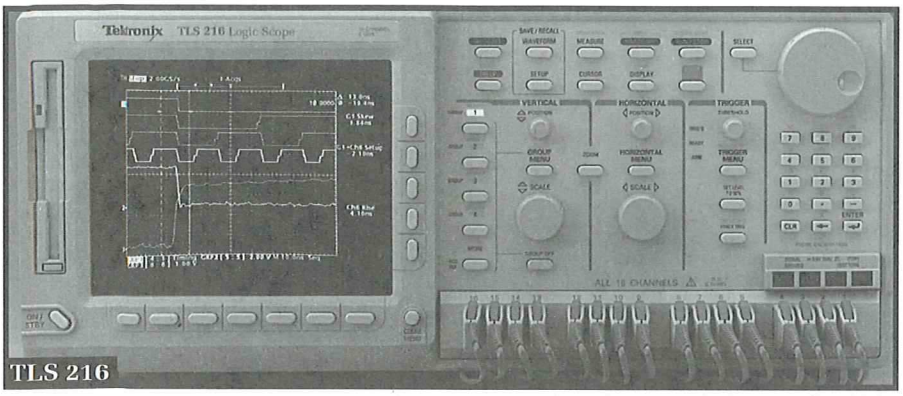
Binary cursors show the logic values of each waveform at the vertical cursor.

Analyze and Solve the Problem

- 28 Automatic Measurements including Setup Time, Hold Time, and Skew
- Desktop Documentation Formats: PCX, BMP, TIFF, EPS, etc.



TLS 216 Logic Scope



MULTIPLE DISPLAY FORMATS SIMPLIFY PROBLEM IDENTIFICATION

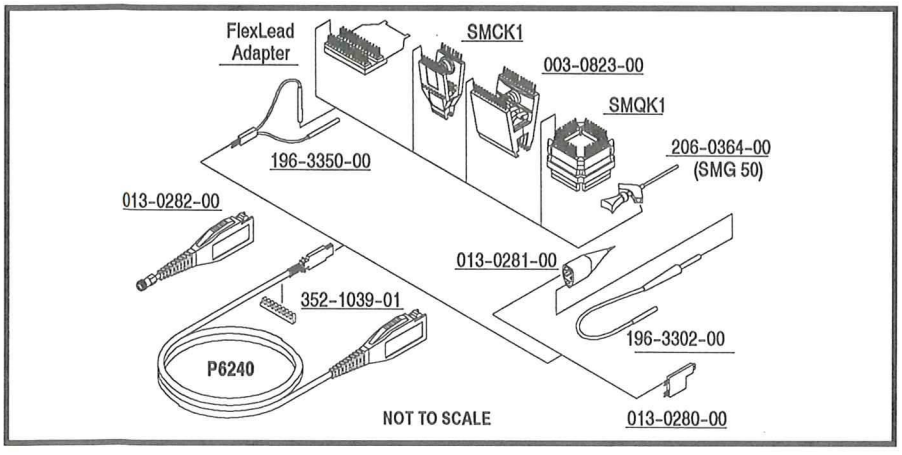
The Logic Scope integrates the analog acquisition system of a modern DSO with the display flexibility of a logic analyzer. The Logic Scope offers three display formats to simplify the process of identifying logic timing anomalies or violations. Acquired data can be displayed as either 8-bit analog waveforms, like a traditional DSO, or as dual threshold timing diagrams or BusForm™, similar to a logic analyzer. The operator can easily change the display format without having to reacquire data, a feature that is critical when debugging elusive, infrequent problems. Dual threshold timing diagrams and BusForm™ show the transition time of a signal, which eases identification of such problems as ground bounce, signal contention or noise margin violations.

Characteristics

SIGNAL ACQUISITION SYSTEM

Sample Rate	2 GS/s
Bandwidth	500 MHz
Channels	16
Samplers	16
Sensitivity	50 mV to 10 V/div*[1]
Position Range	±5 Div
Offset	±1 V from 1 to 99.5 mV/div

[1] Magnification used above 2 V/div range.



P6240 PROBE ACCESSORIES

The TLS 216 is shipped with 16 P6240 FET probes and associated accessories. The figure above shows the P6240 and how it may be used with each of the included accessories. The FlexLead™ Adapter provides convenient probing of 25 mil, 0.65 mm and 0.5 mm pitch devices (see page 484 for a total package listing).

The SMQK1/SMCK1 adapters and SMG50 are available in kits for 50 mil pitch devices (see page 478). The Coax Adapter (PN: 013-0282-00) converts a standard input to a 50 Ω SMA connection. The adapter also scales the signal so that on-screen readings are correct. The coax adapter has a maximum input of 5 V RMS. The remaining accessories provide device under test access for handheld probing situations.

VERTICAL SYSTEM

DC Gain Accuracy – ±1.5% after probe calibration.

Vertical Resolution – 8-bits (256 levels over 10.24 vertical divisions), 11-bits with averaging.

Analog Bandwidth Selection – 20 MHz and full.

Input Coupling – DC.

Input Impedance – 50 Ω with coax adapter, 1 MΩ with probe.

Maximum Input Voltage – Max non-destructive input ±25 V (DC + Peak AC).

Dynamic Range – +15 V to –12 V with probe.

TIME BASE SYSTEM

Time Bases	Main, Delayed
Time/Division Range	500 ps to 5 s/div
Time Base Accuracy	0.01% over any interval ≥1 ms
Record Length	500 to 2,000 pts
Pre-trigger Position	20% to 80% of record

ACQUISITION MODES

Sample – Sample data only.

Envelope – Max/min values acquired over one or more acquisitions.

Average – Waveform averages selectable from 2 to 10,000.

DISPLAY

Mixed-mode Data Display – Logic Scope offers Analog, Timing, and BusForm™ display formats that simplify recognition of digital timing faults and signal anomalies. BusForm™ display compresses many input signals into the least amount of display area. The acquired data can be displayed in any of the three display modes without re-acquiring.

Waveform Style – Dots, vectors, variable persistence selectable from 250 ms to 10 s, infinite persistence, and intensified samples.

Color – Standard palettes and user definable colors for waveforms, text, graticules, and cursors. Measurement text and cursor colors matched to waveform. Waveform collision areas highlighted with different color. Statistical waveform distribution shown with color grading through variable persistence.

Color Grading – With variable persistence selected, historical timing information is represented by temperature or spectral color scheme providing "z-axis" information about rapidly changing waveforms.

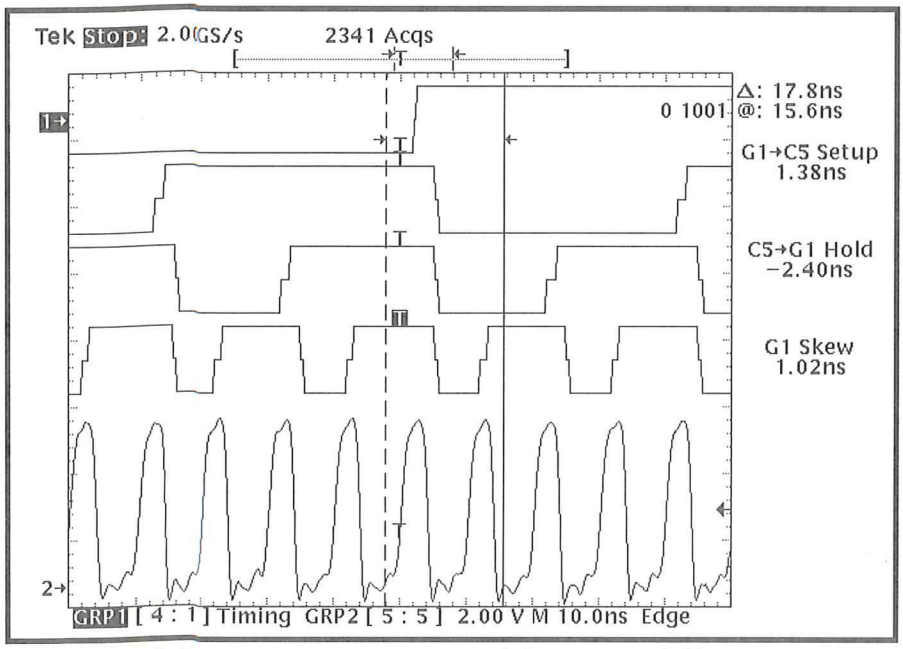
Graticules – Full, grid, cross hair, frame.

Format – YT.

Fit to Screen – Entire acquisition memory displayed on screen.

TRIGGER TYPES (MAIN AND DELAYED)

Edge	Trigger when either a rising or falling edge (positive or negative slope) is detected.
Pulse	The pulse may be positive or negative and defined by a duration.
Width (<Time, >Tim	Trigger when the duration of either a positive or negative pulse is less than or greater than the user-defined input.
Range (In Range, Out of Range)	Trigger when the duration of either a positive or negative pulse is either between the upper and lower limits or outside the limits.
Time-out	Trigger at the end of a user-defined time period if the trailing edge of either a positive or negative pulse is not detected.
Pattern	Each input may be defined as a low (logic 0), high (logic 1), or don't care (X). Inputs can be ANDed or ORed. The pattern may be positive true or positive false.
Width (<Time, >Tim	Trigger when the duration of a user-defined logical pattern is less than or greater than the user-defined input.
Range (In Range, Out of Range)	Trigger when the duration of a user-defined logical pattern is either between the upper and lower limits or outside the limits.
Time-out	Trigger at the end of a user-defined time period if the user-defined logical pattern of a specified duration does not occur.
Sequence	The sequence is defined by a set of start and end events. The start or end event can be either a pattern or an edge (positive or negative slope).
Width (<Time, >Tim	Trigger when the duration between the user-defined start and end events is less than or greater than the user-defined input.
Range (In Range, Out of Range)	Trigger when the duration between the user-defined start and end events is either between the upper and lower limits or outside the limits.
Time-out	Trigger at the end of a user-defined time period if the user-defined end event does not occur within the specified time after the start event.
State	Trigger when a user-specified logical pattern is detected and the input defined as the clock goes true or goes false. Each input may be specified as a low (logic 0), high (logic 1), or don't care (X). Inputs can be ANDed or ORed.



The Logic Scope features 28 automatic measurements, including setup time, hold time and skew measurements.

TRIGGERING SYSTEM

Triggers – Main, Delayed.

Main Trigger Modes – Auto, Normal, Single.

Delayed Trigger – Delayed by time and/or events.

Time Delay Range – 16 ns to 250 s (time/div ≤10 µs); 15.1 ns to 250 s (time/div ≤25 µs).

Events Delay Range – 1 to 9,999,999 events.

AUX Trigger Input – TTL compatible; Max input voltage is –1 V to +6 V.

MEASUREMENT SYSTEM

The Logic Scope provides a comprehensive suite of automatic measurements specifically designed to improve efficiency when troubleshooting digital hardware. Twenty-eight on-board measurements, including setup time, hold time, and skew, speed identification of common digital problems. Whereas traditional DSOs confine waveform measurements to establishing the relationship of a single channel to a clock, the Logic Scope simultaneously samples on all channels, so you can see the relationships between multiple channels.

Automatic Waveform Measurements –

Period	Frequency
High	Low
+ Width	– Width
Maximum	Minimum
Rise	Fall
Peak to Peak	Amplitude
+ Duty Cycle	– Duty Cycle
+ Overshoot	– Overshoot
Propagation Delay	Burst Width
Mean	Cycle Mean
RMS	Cycle RMS
Area	Cycle Area
Phase	Setup Time
Hold Time	Skew

Continuous update of up to four measurements on any combination of waveforms.

Gated – Any region of the record may be isolated for measurement using vertical bars.

Snapshot – Performs all measurements on any one waveform, showing results from one instant in time.

Cursor Measurements – Absolute, Delta; Volts, Time, Frequency, Binary Readout.

Cursor Types – Horizontal bars (volts); Vertical bars (time); operated independently or in tracking mode.

TLS 216 Logic Scope

COMPUTER INTERFACE
GPIB (IEEE 488.2) Programmability – Full talk/listen modes. Control of all modes, settings, and measurements.

HARD COPY/DESKTOP PUBLISHING
Printer – HP ThinkJet, Epson, PostScript, DeskJet, LaserJet, DPU 411/412.

Export File Formats – EPS (Encapsulated PostScript), Interleaf, TIFF, PCX, BMP, RLE.

Plotter Support – HPGL.

I/O Ports – GPIB, Centronics, RS-232 (Talk only).

Floppy Disk Drive – 3.5 in., 1.44 MB DOS format.

VGA Output – 15-Pin analog output (Color).

STORAGE
Waveforms – 16 full 2,000 pt waveforms. 119,008 500 pt waveforms on 1.44 MB floppy disk.

Setups – 10 front-panel setups. 78,947 setups on 1.44 MB floppy disk.

POWER REQUIREMENTS
Line Voltage Range – 90 to 250 V RMS.

Line Frequency – 47 to 63 Hz.

Power Consumption – 300 W max.

ENVIRONMENTAL AND SAFETY
Temperature – Operating: +4°C to +50°C. Nonoperating: –22°C to +60°C

Humidity – Operating and Nonoperating: Operating to 80% at or below 29°C, to 20% from +30°C to +50°C. Nonoperating to 90% at or below 41°C to 5% from +41°C to 50°C.

Altitude – Operating: 15,000 ft., Nonoperating: 40,000 ft.

Electromagnetic Compatibility – Meets MIL-STD-461C, CE-03, Part 4, Curve # 1; meets VDE 0871, Category B, FCC rules and regulations, Part 15, Subpart B, Class A.

Safety – Listed UL 1244, certified CSA C 22.2 No. 231-M89.

PROBES
Active Probes – 2.5 pF, 1 MΩ FET.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height with feet	236	9.3
without feet	193	7.6
Width with handle	445	17.5
Depth with front cover installed	432	17.0
Weight	**kg**	**lb.**
Net ≈	12.3	27
Shipping ≈	20.0	44

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The TLS 216 complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

TLS 216
Logic Scope **$26,900**
Includes: 16 each P6240 2.5 pF, FET Probes, 2 each Handheld Adapters (013-0281-00), 2 each 7 in. Ground Leads (196-3302-00), 2 Packages of 10 each Y-leadsets (020-2008-00), 3 Packages of 12 each KlipChip™ (020-1386-01), 2 each 2-to-1 Podlet Adapters (013-0280-00), 1 Package of 6 Probe Cable Looms (352-0139-00), 3 Cards of Channel ID Labels (334-8632-00), Instrument Front Cover (200-3696-00), U.S. Power Cord (161-0230-01), Quick Reference Guide (070-8833-00), User Manual (070-8834-00), Programmer Manual (070-8835-00).

Opt. 1B – Package of 16 50 Ω Coax Adapters ..... **+$1,495**
Opt. 1K – K420 Instrument Cart Without Power Strip ..... **+$730**
Opt. 1R – Rackmount Kit ..... **+$400**
Opt. 1S – Substitute 16 Coax Adapters for Standard Probes ..... **NC**
Opt. 2P – Phaser™ 200e Color Printer ..... **+$2,695**
Opt. 24 – Four Extra P6240 Probes ..... **+$740**
Opt. 95 – Calibration Data Report ..... **+$150**
Opt. 96 – Calibration Certificate ..... **+$50**

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**
Opt. A2 – United Kingdom 240 V, 50 Hz ..... **NC**
Opt. A3 – Australian 240 V, 50 Hz ..... **NC**
Opt. A4 – North American 240 V, 60 Hz ..... **NC**
Opt. A5 – Switzerland 220 V, 50 Hz ..... **NC**

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection ..... **+$590**
Opt. C5 – Adds five years of Calibration Services ..... **+$1,225**

PROBES
FET Probes Only – Order P6240. 2.5 pF, 1 MΩ, 800 MHz, 20X, 1.5m **$185**

CAMERAS/PLOTTERS/PRINTERS
BW Printer – Cannon BJ-10ex BubbleJet Order HC220 ..... **$445**

CARTS
Instrument Cart – Order K420 ..... **$730**

ADDITIONAL ACCESSORIES
Service Manual – Order 070-8836-00 ..... **$150**
Soft Carrying Case – Order 016-0909-00 ..... **$210**
Hard Transit Case – Order 016-1157-00 ..... **$625**
U.S. Power Strip – Four Outlet, 6 ft., Noise/Surge Suppression. Order 131-5342-01 ..... **$48**

Logic Analyzers
and Digital Analysis Systems

Tektronix offers solutions to support the system analysis of large complex systems (DAS®)to general purpose logic analysis of medium sized designs.

TLA510 and TLA520 Logic Analyzers

The TLA500 Series offers mid-priced logic analysis at performance levels previously available only in high end system analysis tools. The TLA supports the most advanced high-speed RISC/CISC microprocessors and multiple microcontroller embedded systems. The Tektronix Power*Flex*™ capability allows the TLAs to grow in capability as the testing demands increase.

The TLA series provides 100 MHz synchronous acquisitions at depths from 8 K to 512 K sequences. The TLA510 has 100 channels of acquisition with an optional pattern generator. The TLA520 has 150 or 200 acquisition channels. The X-window style interface is available on a standard 14-inch or optional 17-inch terminal.

The Enterprise Digital Analysis System – DAS/NT™

The global effort toward "Enterprise Computing" centers on efficient exchange and reuse of data across multiple tool sets. To this environment Tektronix brings the DAS/NT™ Digital Analysis System as enterprise instrumentation. A fully networked real-time analysis system that supports both software and hardware design and optimization. The workstation-based interactive interface provides control, data presentation and automated data exchange with other design tools such as logic simulators and compilers.

The DAS/NT™ Digital Analysis System is the unrivaled performance leader in the analysis of complex digital systems. The DAS/NT™ has super deep memory of up to 512 K Bits per channel, up to 1536 channels of 100 MHz synchronous acquisition, pattern generation, high-speed timing, support for multiple microprocessors, the most intelligent disassembly available, links to high level debug tools and languages, and is networked to your X-Window based workstation for easier and faster operation.

DAS/XP™ Digital Analysis System

The DAS/XP™ Digital Analysis System provides much of the capability of the DAS/NT™ system in a standalone environment. A Tektronix X terminal provides the same X-Window interface as the DAS/NT™ and can be independent of any network.

3000 Series GPX Logic Analyzer

The 3000 Series is Tektronix' mid-range logic analyzer targeted at medium sized designs. The cornerstone of the 3000 Series is the GPX Logic Analyzer. The GPX, with eight tools in one module, offers an outstanding value in a general purpose logic analyzer. In addition, the GPX supports today's leading microprocessors, including the Intel 66 MHz Pentium, and is available in three different mainframe configurations. Other modules add a digital oscilloscope, high-speed timing analyzer, and low cost microprocessor support capabilities. GPX is also available in a deep memory version.

CONTENTS

LOGIC ANALYZERS
Overview 148
TLA510/520 150
DAS® Digital Analysis System 154
LAView 159
3000 Series Logic Analyzers 162
Microprocessor Support 173
ACCESSORIES 446

Logic Analyzers
and Digital Analysis Systems

Performance Leader in Digital Analysis tools.

ENTERPRISE DIGITAL ANALYSIS SYSTEMS

- The Unrivaled Performance Leader in Systems Analysis of Complex Designs
- The First Networked Analysis System
- Automated Data Exchange with Other Design Tools

TLA500 SERIES

- Optimized for Complex Embedded Software Debug
- Scalable Architecture to Address Your Present and Future Needs
- Enterprise Instrumentation Technology

3000 SERIES LOGIC ANALYZERS

- Best Value
- Comprehensive Microprocessor Support
- Portable and Benchtop Configurations

At the Leading Edge of Technology

Tektronix is a performance leader in digital analysis tools. Our products are different from others on the market in fundamental and important ways. Our logic analyzer products embody our beliefs about how to design, manufacture, and market logic analyzers to achieve long term customer satisfaction.

Banner specs are necessary, but not always sufficient to ensure getting your job done. We want you to know as much as possible about our market emphasis and products before choosing us as your logic analyzer vendor.

Times Change... and So Do Your Needs

A few short years ago acquiring data from a microprocessor was not much different than acquiring data from digital sources in general. As digital systems become faster and incorporate more powerful microprocessors, the task of integrating hardware and software becomes much more difficult. Today's embedded systems use all types of processors, from simple microcontrollers to high-speed, 32-Bit, RISC/CISC microprocessors and DSPs with many megabytes of memory. In addition to the increased complexity of hardware, today's embedded software is almost entirely written in high level languages such as C, C++, Pascal, or Ada, adding another level of abstraction to the debug process.

As memory costs decrease, it makes economical sense to add more functionality to designs through software. The downside to this trend is that software becomes very complex and much more difficult to manage. When applications get very large, it becomes difficult to see the "big picture" of what your software is doing. Also, as more features get added, the design can get "bogged down" in its own functionality and the software becomes sluggish.

The software development process used by most teams concentrates on getting the logic of the program working first and worries about performance later. Often, the time in a schedule set aside to work on performance issues gets used up in debugging the logic of the program.

We have kept these concepts in mind so that your problems become our problems and our products can deliver the solutions that you need readily and conveniently. Our products deliver the performance that has made us one of the premium suppliers of logic analysis tools in the market for a number of years.

Solutions for Your Ever-changing Needs...

The Tektronix family of logic analyzers – the 3000 Series, TLA500, and the DAS® – offers a variety of solutions to help you get your product to the market faster. Our broad offering can address basic timing problems to the most complex hardware-software integration applications. Or, if you prefer a monolithic, portable, or a card modular system that is capable of being networked and operated from a remote location, we have the form factor compatible to fit with your working environment.

DETERMINING A LOGIC ANALYSIS SOLUTION

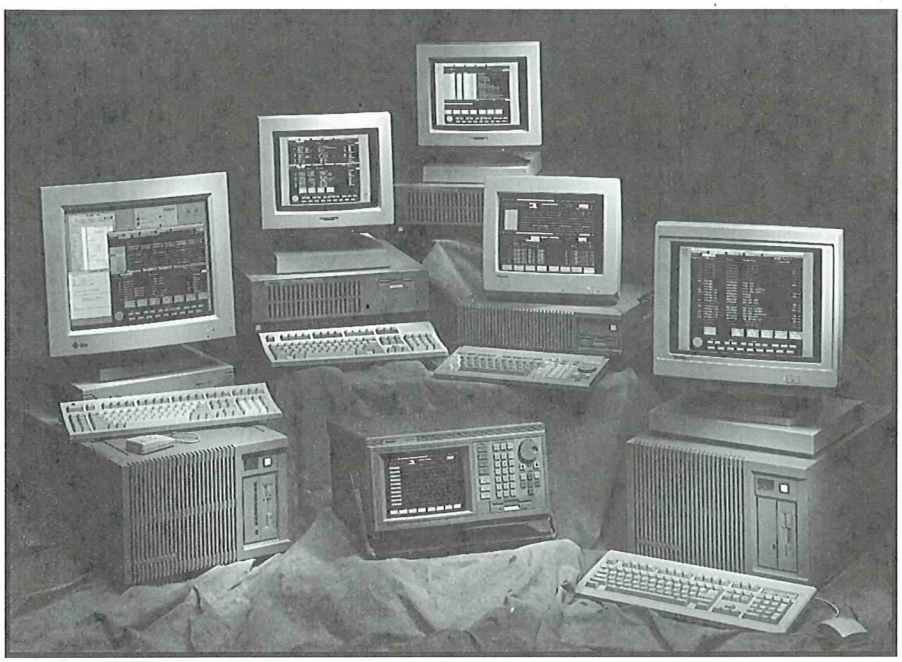
# micros under test	0-1	1-2	up to 10
Micro Bus Size	8/16	16/32	16/32
Team Size	small	medium	large
Application	timing/disassembly	HW/SW integration	HW/SW integration
Environment	standalone	standalone/networked	networked/standalone
Recommended Solution	**3000 Series (page 172)**	**TLA500 (page 160)**	**DAS® (page 162)**
Synchronous Speed	80 MHz	100 MHz	100 MHz
Asynchronous Speed	200 Ms/IGs	400 Ms	400 Ms
# Channels	20-320	100-200	100-1600
Memory Depth	8 K-32 K	8 K-512 K	32 K-512 K
Performance Analysis	√	√	√

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Logic Analyzers
and Digital Analysis Systems



It All Starts at the Probe Tip...

With today's smaller and denser IC package, it becomes increasingly difficult to get to the signal source without compromising fidelity. Our NiCR Coax 7 component passive hybrids embedded in each podlet probing standard ensure the purest of signals delivered to the logic analyzer interface.

The fact that we offer the unique capability of delivering state as well as timing information using the same probe ensures that your task is performed quickly and accurately with as little stress as possible to the system under test.

Disassembly... Much More Than Inverse Assembly

In years past, if one acquired state data off a microprocessor bus it was impossible to simply look up instruction mnemonics in a table ("inverse assembly") with good results. Today's microprocessors include deep pipelines, prefetch queues, caches, and other architectural structures that have created a "many-to-one" relationship between bus activity and object code. A look-up table approach is now totally inadequate.

As part of our logic analysis solution, we offer disassemblers that intelligently predict branches, queue flushing, and other microprocessor specific operational idiosyncrasies. Our disassemblers also support modes of data display configurable for individual needs with varying levels of data abstraction.

Triggering is Key

The most fundamental distinction between having good banner specs and being able to solve real problems is in the area of triggering. Logic analysis triggering is a classic example of what at the surface can appear to be an inevitable trade off between power and ease of use. Tektronix has developed a fresh approach to this area.

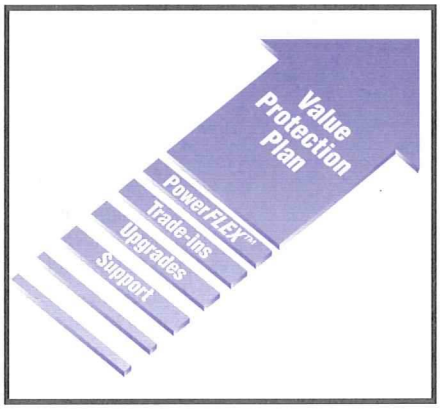
We use a patented triggering state machine architecture that provides a rich triggering toolset. We combine the versatility of the true state machine triggering with extensive on-line libraries which can be modified for your individual situation.

"Level oriented" trigger paradigms are confining, difficult to drive, and often lack the horsepower to describe the unique symptoms you may wish to trigger on. As a general rule, one state equates to several levels in raw triggering power and is generally easier to use.

The Value Protection Plan – A Commitment for Preserving Your Investment over Time

The need to invest in logic analysis tools is typically driven by your current needs. However, as your needs grow in the future, your tools become obsolete.

The Value Protection Plan is a long term policy that provides you with an upgrade path to the latest logic analysis tools from Tektronix. This unique policy will protect your existing investment by enabling you to upgrade or replace your current system to one of increased performance when you need it.



PowerFlex™ Industry's First Scalable Architecture

In most situations logic analyzers are set up to trigger on a visible symptom of a problem. With microprocessor based designs the cause of the problem is often separated from the symptom by long periods of time.

We believe a most important but often least considered specification for a logic analyzer is the acquisition memory depth. It is often the factor between capturing the problem in the first acquisition or having to make multiple acquisitions. This is one reason we introduced PowerFlex™ in the TLA and DAS® products – a scalable architecture that allows you to increase the depth in acquisition memory in a convenient manner.

Each of our products is backed by our commitment to quality, support and convenience. Our logic analyzers are supported by a staff of field specialists and application engineers as well as a toll-free telephone hotline support. We are equipped to serve you at a personal level to ensure that our products are well made and are addressing your needs today and in the future.

TLA510
TLA520

TLA Logic Analyzers

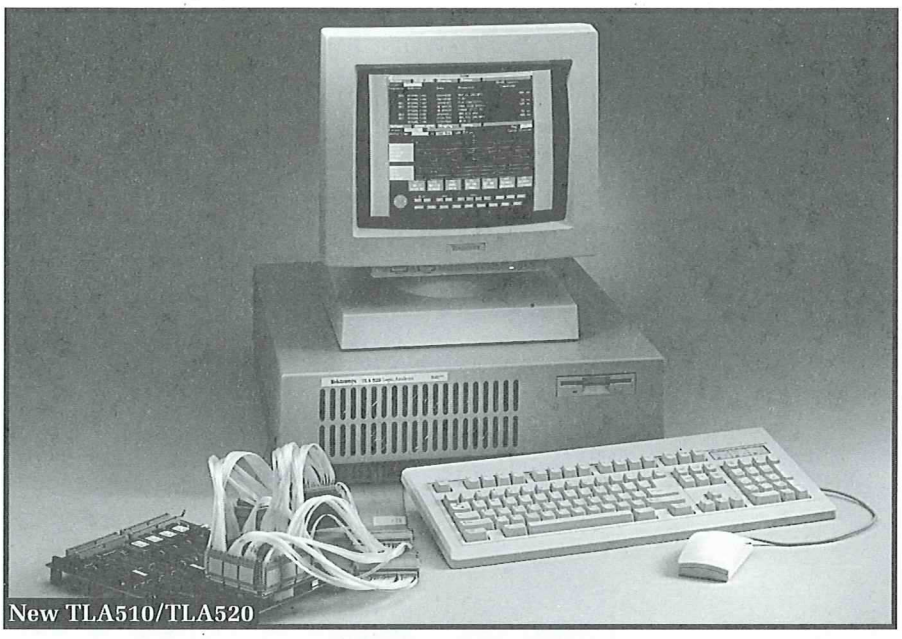
Flexible performance at an affordable price.

Excellent price/performance for software debug and integration.

The TLA Series has the ability to grow in performance as the debug problems grow in complexity.

New TLA510/TLA520

- 100 MHz State Analysis
- 400 Ms Timing Analysis
- 8 K, 32 K, 128 K, 512 K Acquisition Memory Depths
- 100, 150 and 200 Channel Widths Models
- High Performance RISC/CISC Microprocessor Support
- Advanced Performance Analysis
- Links to High Level Languages for Software Debug
- Compliant with CISPR IIA Radiated and Conducted Emissions Requirements
- 18-CH, 50 MHz Algorithmic Pattern Generator



The TLA 500 Series user interface can be displayed and controlled from any X11 Windows compatible workstation or terminal.

Excellent Price/Performance

The TLA series has the performance necessary to solve the tough software/hardware integration and software debug problems previously available only in high-performance analysis systems.

SIZED TO THE TASK

The TLA510 includes 100 channels (96 data and four clock) of 100 MHz acquisition. This is ideal for most single processor applications. The TLA520 includes 200 channels of 100 MHz acquisition that can be divided to support two processors time correlated, or combined to support one advanced processor. The TLA520 can optionally be configured as one 100 channel and one 50 channel acquisition. This is convenient when the integration task requires single processor support with separate, but time correlated, state or timing channels.

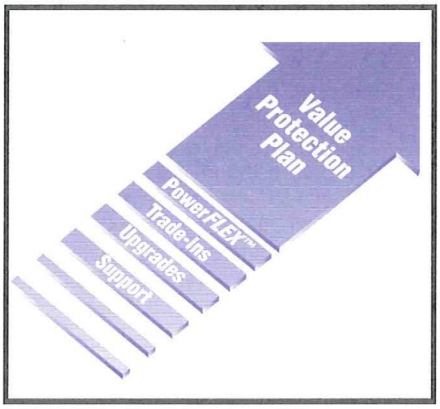
ROBUST COMMUNICATION CAPABILITY

LAN Ethernet and RS-232 communication comes standard with each TLA. Optional and accessory application software offers full remote control capability across the LAN network.

NEW POWER*FLEX*™, THE FIRST SCALABLE ARCHITECTURE

The Power*Flex*™ technology allows the TLA to grow in memory depth and channels without throwing away major portions of your investment. The capability of the instrument can quickly and economically grow as the debug complexity of the target system increases.

All TLA acquisition modules come standard with 8 K of memory. Memory depths of 32 K, 128 K and 512 K are optionally available. Both channel count and memory depth can be easily upgraded in the future using the Power*Flex*™ capability.

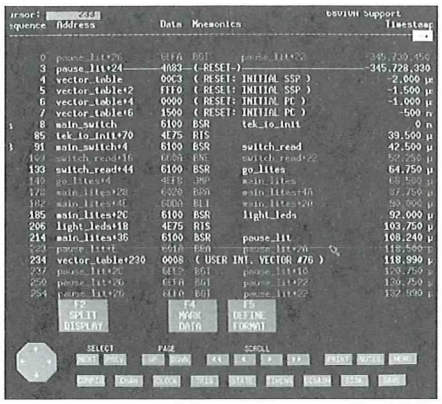


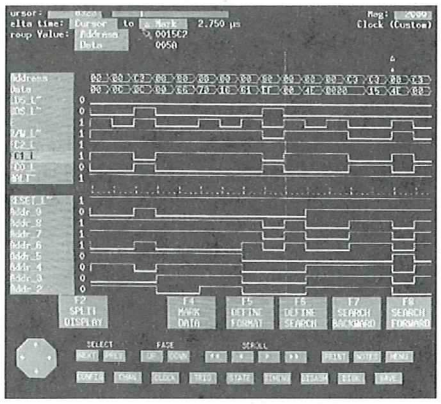
Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

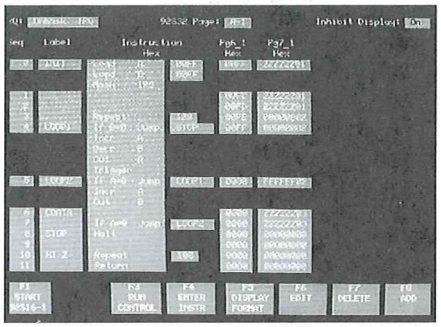
Tektronix Measurement products are manufactured in ISO registered facilities.

TLA Logic Analyzers





The point-and-click X-windows user interface provides efficient setup and rapid display selections. Various modes of displays can be displayed simultaneously, e.g., Disassembly and Timing.



The 50 MHz pattern generation capability offers efficient, real-time hardware simulation, external event simulation or fault injection.

MULTIPLE DATA DISPLAYS

Beyond the basic state and timing data displays there are four levels of disassembly display available with high level language symbols for software debug.

The Graph display plots acquired data value versus sequence. This is useful to spot errant software execution and for A/D display applications.

ADVANCED PRINT SUPPORT

Both screen images and data files are efficiently printed. Postscript, LaserJet, PCX and BMP are all supported formats. The images can be output to either a local printer or a printer on the LAN network. Alternatively the images are stored in either a local file or transferred across the network to a remote file.

PATTERN GENERATION FOR SIMULATION AND FAULT INJECTION

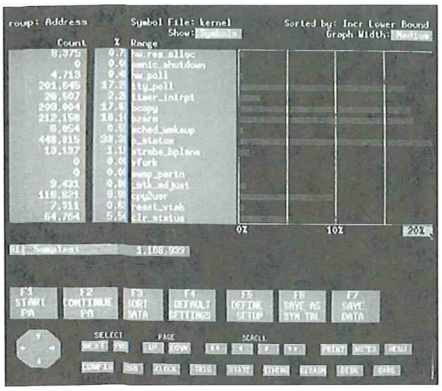
The TLA510 offers optional 50 MHz algorithmic pattern generation support TTL signals with Tristate. The 18 channels of TTL signals, with Tristate, can be programmed with specific data values or driven from internal registers that can be loaded, incremented and decremented. Robust branching and looping capability allows full programming of up to 1000 sequences.

Optional accessory probes are available to control the program sequencing from external events and/or add fully programmable pulse timing capability. ECL probe capability is also available.

The pattern generator can be used to simulate hardware that is not available or real-time events on an external bus. It can also inject real-time faults into a target for system analysis.

TLA510
TLA520

TLA Logic Analyzers



The performance analysis software includes address binning and event timing modes to quickly determine where performance improvements are needed. Support for 5000 ranges, symbolic representation and data output coupled with deep memory make this a powerful analysis tool.

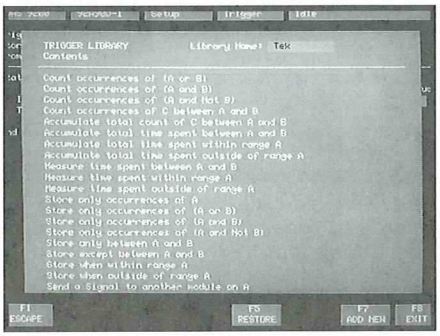
SYMBOLIC PERFORMANCE ANALYSIS

It has become vitally important to know how well your embedded system is performing. The optional performance analysis software charts a histogram of the percentage of execution time spent in each range of software. The screen updates rapidly and the ranges can be sorted while running. The display quickly shows where the bulk of the execution time is being spent. An alternate analysis mode displays a histogram of the range of time required for a particular event, e.g., interrupt latency.

Data can be sorted into 5,000 ranges allowing concise range placement. Data for the ranges can be imported directly from your computer, easing the definition of ranges. The output can be saved as an ASCII file for further analysis.

SIMPLIFIED TRIGGER SETUP

A robust set of pre-programmed triggers address the common types of desired trigger definitions. Just select the trigger type and enter the specific data, e.g., address value. Users can also define libraries of trigger definitions commonly used in their environment.



TLA Logic Analyzers

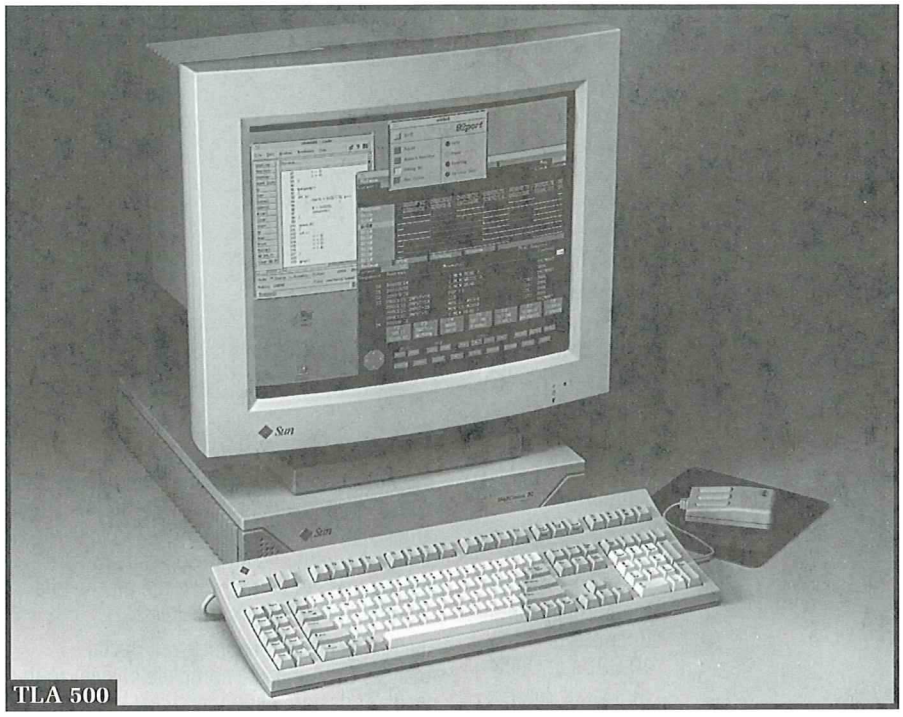
ENTERPRISE INSTRUMENTATION CAPABILITIES

It is becoming increasingly important to connect the logic analyzer into the engineering network to maximize the efficiency of the debug and integration cycle. The TLA series offers two levels of enterprise capability. An optional 17-inch X terminal display can replace the standard 14-inch model. The larger display provides a larger TLA user interface or additional display room for other X applications across the network. The standard Telnet software provides remote log in to other workstations.

The second level of enterprise integration replaces the local X terminal display with a full interactive X display on the user's workstation. The TLA can be accessed, single user, from any X11 compatible workstation on the network.

LONG TERM PRODUCT SUPPORT

Every TLA 500 is delivered to you with a full one year on-site Service Assurance. (This support may not be available in all geographic areas. Check with your local Tektronix sales engineer.) Service Assurance service options may be purchased to extend coverage to two, three, or four years at the time you purchase your system.



The TLA 500 user interface can optionally be displayed and controlled from any X11 Windows compatible workstation or terminal.

ORDERING INFORMATION

TLA510
100-CH, 8 K Memory, 100 MHz Acquisition.....**$18,000**
Includes: LAN Ethernet and RS-232 Standard, 170 MB Hard Disk, 1.4 MB 3.5 in. Floppy Drive.
Opt. 01 – 32 K Memory .....**+$4,000**
Opt. 02 – 128 K Memory .....**+$8,000**
Opt. 03 – 512 K Memory .....**+$12,000**
Opt. 04 – Performance Analysis Software .....**+$1,500**
Opt. 30 – 18-CH, 50 MHz Pattern Generator.....**+$7,980**
Opt. Q0 – On-site Installation .....**+$300**

TLA520
200-CH, 8 K Memory, 100 MHz Acquisition.....**$30,000**
Includes: LAN Ethernet and RS-232 Standard, 170 MB Hard Disk, 1.4 MB 3.5 in. Floppy Drive.
Opt. 01 – 32 K Memory .....**+$8,000**
Opt. 02 – 128 K Memory .....**+$16,000**
Opt. 03 – 512 K Memory .....**+$24,000**
Opt. 04 – Performance Analysis Software .....**+$1,500**
Opt. 1S – Delete 50-CH of Acquisition .....**–$3,500**
Opt. Q0 – On-site installation .....**+$350**

SERVICE ASSURANCE OPTIONS

TLA510
Opt. K1 – Adds one year of post-warranty Customer-Site Repair Protection and Software Subscription Services, as appropriate .....**+$320**
Opt. K2 – Adds two years of post-warranty Customer-Site Repair Protection and Software Subscription Services, as appropriate .....**+$640**
Opt. K3 – Adds three years of post-warranty Customer-Site Repair Protection and Software Subscription Services, as appropriate .....**+$960**

TLA520
Opt. K1 – Adds one year of post-warranty Customer-Site Repair Protection and Software Subscription Services, as appropriate .....**+$415**
Opt. K2 – Adds two years of post-warranty Customer-Site Repair Protection and Software Subscription Services, as appropriate .....**+$830**
Opt. K3 – Adds three years of post-warranty Customer-Site Repair Protection and Software Subscription Services, as appropriate.....**+$1,245**

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz .....**NC**
Opt. A2 – United Kingdom 240 V, 50 Hz.....**NC**
Opt. A3 – Australian 240 V, 50 Hz .....**NC**
Opt. A4 – North American 240 V, 60 Hz .....**NC**
Opt. A5 – Switzerland 220 V, 50 Hz.....**NC**
See Customer Information Section for additional description.

CART
Workbench Cart. Order K420.....**$730**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

DAS/NT™
DAS/XP™

Digital Analysis System

DAS/NT™ provides workstation-based analysis.

DAS/XP™ provides non-network support on a local X terminal.

DAS/NT™
DAS/XP™

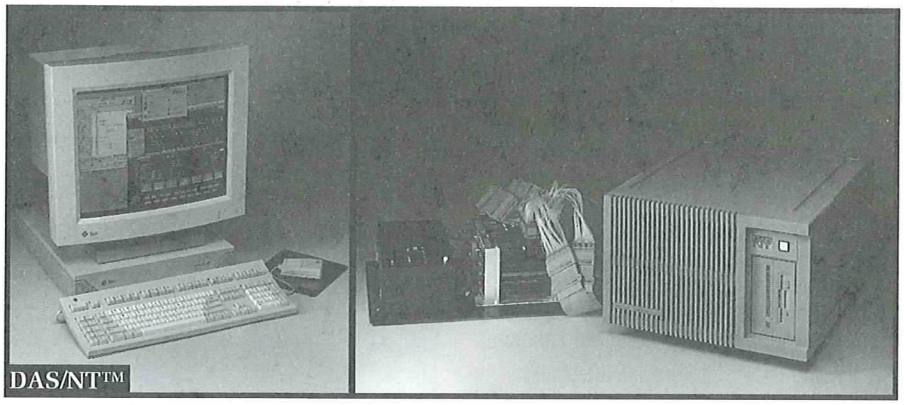
- 100 MHz State Analysis
- 400 Ms, Timing Analysis
- Up to 1536 Channels with 10 ns Resolution
- More than 500 Channels of 50/100 MHz Pattern Generation
- Acquisition Memory Depth of 32 K, 128 K, 512 K
- Support for Most Popular RISC and CISC Microprocessors
- Multiprocessor Support for up to 10 CPUs at Once
- UL Listed 1244
- Certified to CSA C22.2 No. 231-M89

DAS/NT™

- Operates on Any XII/R4 Window Server
- Optional 14 in. and 17 in. Local X Terminal

DAS/XP™

- 14 in. X Terminal Standard
- Optional 17 in. X Terminal



The System Challenge

The design and debug of new multiprocessor systems with faster clocks, wider buses, and larger memories is a difficult task to undertake. Complete solutions to these problems are hard to find, and integrating the pieces of a solution are almost impossible.

The DAS/NT™ set of configured Digital Analysis Systems is a complete answer to the needs of design, debug, and test. The advanced architecture of the DAS/NT™ allows you to install all the data acquisition and pattern generation modules you need today without limiting your future demands. You can easily expand or reconfigure as your requirements change.

CONFIGURABLE INSTRUMENT FOR A BROAD RANGE OF APPLICATIONS

Multiple data acquisition and pattern generation cards can be added to a DAS/NT™ system. The cards you select can be grouped into subsystems, allowing you to create virtual instruments within the DAS®. These separate instruments can be controlled independently to observe multiple circuits at once. You can also increase channel widths by grouping like cards into a larger virtual card.

Cards can also interact in real time. For example, two acquisition modules running at different clock speeds can display the acquired data in a time-correlated format, simplifying the debug of multiprocessor designs. Or an acquisition module could wait for a specific event and then start a pattern generator.

THE EFFICIENCY AND PERFORMANCE OF ANALYSIS ON THE WORKSTATION

Many of the tools and most of the data used by designers today are resident on their personal workstations. The DAS/NT™ brings the power of the DAS® to that same interface. All the power of the DAS® is available on an interactive X-window on the workstation. Data from the DAS® can be viewed simultaneously with data from other tools presented in other windows on the workstation. The X-window display is certified to be fully compatible with a SUN SPARC station running X. Compatible with X11/R4 and R5 servers, the display has been demonstrated on many other workstations offering compatible X servers.

COMPLEX DESIGNS REQUIRE PROBING OF MANY SIGNALS

As digital designs become more complex, more signals in the SUT (System Under Test) need to be observed to ensure proper operation. To probe those signals, an adequate number of acquisition channels must be available. Having almost enough channels means limiting data acquired, re-probing, or re-acquiring data.

Viewing the whole problem in context is the reason for a digital analysis system. But along with channel count, you require greater measurement performance and the ability to display the data in an intelligible format. The DAS/NT™ display is designed to display large amounts of acquired data with powerful search, format, and symbol capabilities.

Since most logic analyzers can't handle hundreds of timing channels, they don't worry about displaying more than a few channels at a time. With the DAS/NT™ bus waveform display, multiple 32-Bit buses can easily fit on the same timing diagram. Even the buses are cross-correlated to other displays.

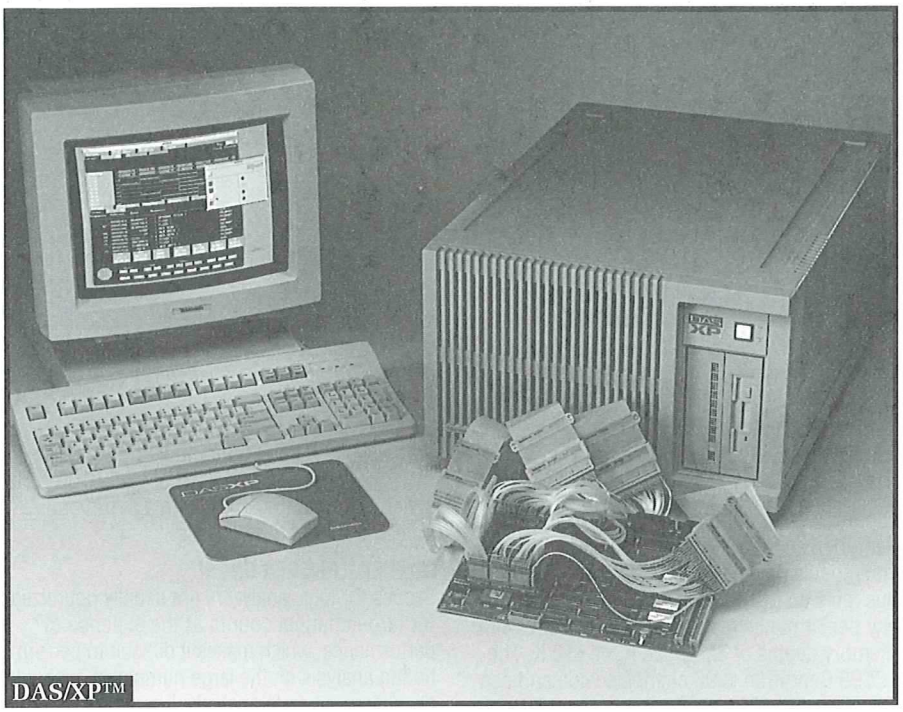
Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Digital Analysis System

DAS/NT™
DAS/XP™


DAS/XP™

ADVANCED PRINT SUPPORT
Both screen images and data files are efficiently output. Postscript, LaserJet, PCX and BMP are all supported formats. The images can be output to either a local printer or a printer on the LAN network. Alternatively the images are stored in either a local file or transferred across the network to a remote file.

SIMPLIFIED TRIGGER SETUP
A robust set of pre-programmed triggers address the common types of desired trigger definitions. Just select the trigger type and enter the specific data, e.g., address value. Users can also define libraries of trigger definitions commonly used in their environment.

A MODERN USER INTERFACE FOR THE STANDALONE USER
The DAS® offers powerful analysis capability into applications that do not require the workstation environment. The DAS/XP™ set of configured systems includes a Tektronix X terminal that provides the same powerful user interface as the DAS/NT™ without requiring a network interface. All DAS® control and display functions are present with the DAS/XP™.

HIGH-PERFORMANCE MAINFRAMES THAT OFFER CHOICES
The high-performance DAS® systems are controlled by a 40 MHz, 32-Bit CPU and contain 16 MB of system RAM, a 170 MB Hard Disk, a PC compatible 1.4 MB Floppy Drive and seven instrument slots. A removable hard disk is also available. The communications ports on the DAS® systems include Ethernet LAN capability, three RS-232 I/O ports and an optional GPIB interface.

The DAS® systems can also be controlled in a lab environment by using PCL, a complete, high level remote control language. PCL can be used to remotely control a DAS® from another computer or controller, over Ethernet LAN, GPIB or RS-232.

Acquired data is easily documented for future reference. Full color printouts of any screen are available on the workstation by using SNAPSHOT or a similar window capture package. Module setups and acquired data can be printed to the DAS® serial printer port in ASCII, Epson FX, Epson LQ, IBM Proprinter, and Postscript formats. This data can also be output to a file for printing on a network printer.

The DAS®92E9 expansion chassis is used to expand the number of instrument card slots, available with a DAS® mainframe. The expansion chassis includes an expansion receiver card and cabling, and offers eight additional instrument card slots. A system maximum of 28 card slots are available in a fully expanded system consisting of one mainframe and three DAS®92E9 expansion chassis.

SYMBOLIC PERFORMANCE ANALYSIS
With increasingly complex software, speed and size become harder to manage. When software begins to bog down, you need to know where it's spending its time. With 92PA Performance Analysis, you can chart the ranges where software is running. The screen updates rapidly and data can be sorted while running. A histogram of the execution time of a particular event can be displayed with minimum, maximum and average values continuously updated.

Data can be sorted into 5000 ranges, so everything can be measured in one pass. Data for the ranges can be imported directly from your compiler, easing the definition of ranges. The output of the 92PA can be saved as an ASCII file for later analysis.

PATTERN GENERATION AT UP TO 100 MHZ
For stimulus requirements you can choose between the 92S16/S32 and the 92SX109/SX118. These subsystems generate data rates of up to 50 MHz and 100 MHz respectively. Patterns can be output either sequentially or algorithmically using a command structure that includes subroutine calls. These pattern generators can be combined with any of the acquisition cards to provide powerful stimulus/response systems.

LONG TERM PRODUCT SUPPORT
Every DAS® mainframe and instrument card is delivered to you with a full one year on-site Service Assurance. (This support may not be available in all geographic areas. Check with your local Tektronix sales engineer.) Service Assurance service options may be purchased to extend coverage to two, three, or four years at the time you purchase your system.

92C96D
92C96XD
92C96SD

Digital Analysis System
100 MHz Acquisition

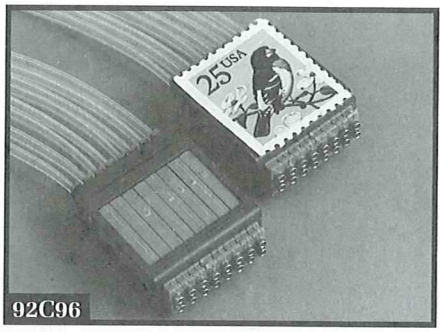
The 92C96 offers the first scalable acquisition module. Deeper memory is just a phone call away.

New 92C96D/XD/SD MODULE

- PowerFlex™
- 96-384 Channels @ 100 MHz Sync or Async
- 400 MHz Async
- 100 MHz Clocking State Machine Tracks Fast, Complex Buses
- 100 MHz, 16 State Triggering State Machine
- 100 MHz Time Stamp
- Available in 32 K, 128 K, or 512 K Memory Depths
- Time-Correlated to Other State/Timing Modules
- Bus-Form Timing Display
- Compact, High Bandwidth Probes
- Provides Timing Analysis Through Same Probes



The 92C96SD offers memory depth of 512 K Bits per channel.



The 92C96 provides accessibility to signals with 8-channel probes as small as a US postage stamp.

State Analysis or Microprocessor Support

For high-speed state analysis or microprocessor support, the solution is the family of 92C96 Centurion acquisition cards. The 92C96 acquisition module of various depths handles clock and bus rates up to 100 MHz without compromising any performance features and is available with memory depths of 32 K, 128 K, or 512 K. The 92C96 Centurion is 96 channels wide and can be extended to 384 channels in one mainframe.

TIMING AND HIGH-SPEED STATE ANALYSIS

In timing mode, 92C96 modules can be expanded to a system total of 1536 channels, with 100 MHz sampling on all channels. These cards can also sample at up to 400 MHz on a reduced number of channels. There are no speed or memory compromises when you add time stamping or select disassembly.

WHY HIGH BANDWIDTH PROBES?

Probes are the highest volume component in a logic analyzer and represent a large fraction of the total cost. Probes for the 92C96 use precision NiCr coax and hybrids embedded in the podlets. The specifications are at the probe tip, not at the connector on the acquisition card. Tektronix probes will not add to the uncertainty in your system under test.

The 92C96 has analog bandwidth greater than 150 MHz and can easily handle 100 MHz synchronous acquisition with a setup and hold window of 5 ns or less.

CONNECT PROBES ONCE!

Probes for logic analyzers are usually optimized for large channel counts at the expense of performance, which makes it difficult to perform timing analysis on the large number of channels necessary for state analysis. The compact 8-CH probes of the 92C96 allow convenient connection to wide buses without compromising timing performance. You can connect to a microprocessor bus for state analysis with disassembly and change to fast asynchronous bus timing without switching probes!

WHY DEEP MEMORY?

In most situations, triggering starts on a visible symptom of a problem. With microprocessor-based designs, the cause of a problem is often separated from the symptom by a long period of time and a lot of bus activity. To trace down the cause of the symptom, you need to go backwards in acquisition memory to the time of the cause. Only a deep trace buffer with full trigger positioning can prepare you for this kind of problem.

Instrument Module Selection Guide

The following instrument cards include probes. A maximum of seven instrument cards may be installed in a DAS® mainframe, depending on the cards. A maximum of eight instrument cards may be installed in a DAS®92E9 expansion mainframe, depending on the cards. Each mainframe includes sufficient power for all card slots. Additional options are available.

MODULE TYPE

Acquisition	Description	Fastest Internal Clock	Fastest External Clock	Maximum per Card	Channels per System	Memory Depth (per CH)	Price
92C96D	Master or Expander	2.5 ns	10 ns	96	1,536	32 K	**$17,950**
92C96XD	Master or Expander	2.5 ns	10 ns	96	1,536	128 K	**$21,950**
92C96SD	Master or Expander	2.5 ns	10 ns	96	1,536	512 K	**$25,950**
Pattern Generator							
92S16	Algorithmic	20 ns	20 ns	18	936	1 K	**$7,290**
92S32	Sequential or Expander	20 ns	20 ns	36	1008	8 K	**$9,430**
92SX109	Algorithmic	10 ns	10 ns	9	468	2 K	**$9,800**
92SX118	Sequential or Expander	10 ns	10 ns	18	504	16 K	**$12,850**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Digital Analysis System
Instrument Modules and Extended Support

ORDERING INFORMATION

PowerFlex™ UPGRADES

92FXNET
Upgrades DAS®9219/9220 Mainframe to Workstation Compatible DAS®9221 (DAS/NT™) **$11,900**
Includes: 92FXSE and DAS/NT™ Software.

92FXSE
Upgrades DAS®9219/9220 Mainframe to DAS®9221 (DAS/XP™). **$9,500**
Includes: CPU card, DAS®/OS, 100 MB HDD, and X Terminal.

9204XT
14 in. X Terminal and DAS/XP™ Software **$2,700**

9205XT
17 in. X Terminal and DAS/XP™ Software **$4,500**

92F11
3.5 in. Floppy Disk Drive **$400**

92LANSE
Ethernet LAN Interface **$950**

COMMUNICATION INTERFACES

92C02
GPIB/Mainframe Expansion Interface **$1,950**

DAS® ACQUISITION CARDS

92C96D – 32 K Deep Card **$17,950**
92C96XD – 128 K Deep Card **$21,950**
92C96SD – 512 K Deep Card **$25,950**
LAF01 – 8 K to 32 K memory upgrade **$6,500**
LAF02 – 8 K to 128 K memory upgrade **$10,500**
LAF03 – 8 K to 512 K memory upgrade **$14,500**
LAF04 – 32 K to 128 K memory upgrade **$6,500**
LAF05 – 32 K to 512 K memory upgrade **$10,500**
LAF06 – 128 K to 512 K memory upgrade **$6,500**

WORKSTATION OPERATION (X TERMINAL OPTIONAL)

DAS®NTD1
96-CH High-Performance Processor Support **$29,950**
Includes: One 92C96D with a DAS®9221 Mainframe.

DAS®NTD2
96-CH High-Performance Processor Support **$46,860**
Includes: Two 92C96Ds with a DAS®9221 Mainframe.

DAS®NTX1
96-CH High-Performance Processor Support **$33,950**
Includes: One 92C96XD with a DAS®9221 Mainframe.

DAS®NTX2
96-CH High-Performance Processor Support **$53,860**
Includes: Two 92C96XDs with a DAS®9221 Mainframe.

DAS®NTS1
96-CH High-Performance Processor Support **$37,950**
Includes: One 92C96SD with a DAS®9221 Mainframe.

DAS®NTS2
96-CH High-Performance Processor Support **$62,860**
Includes: Two 92C96SDs with a DAS®9221 Mainframe.

STANDALONE OPERATION

DAS®XPD1
96-CH High-Performance Processor Support **$29,950**
Includes: One 92C96D with a DAS®9221 Mainframe.

DAS®XPD2
96-CH High-Performance Processor Support **$46,860**
Includes: Two 92C96Ds with a DAS®9221 Mainframe.

DAS®XPX1
96-CH High-Performance Processor Support **$33,950**
Includes: One 92C96XD with a DAS®9221 Mainframe.

DAS®XPX2
96-CH High-Performance Processor Support **$53,860**
Includes: Two 92C96XDs with a DAS®9221 Mainframe.

DAS®XPS1
96-CH High-Performance Processor Support **$37,950**
Includes: One 92C96SD with a DAS®9221 Mainframe.

DAS®XPS2
96-CH High-Performance Processor Support **$62,860**
Includes: Two 92C96SDs with a DAS®9221 Mainframe.

DAS® MAINFRAMES

DAS9221
Basic Mainframe **$14,750**
Includes: 40 MHz CPU, 16 MB RAM, 170 MB Hard Disk, 1.4 MB Floppy Drive and Ethernet LAN Interface.

DAS®9229
Basic System **$16,500**
Includes: DAS®9221 Mainframe and X Terminal Display.

DAS®92E9
8 Card Slot Expansion Mainframe **$6,850**

OPTIONS COMMON TO ALL DAS® MAINFRAMES AND CONFIGURED SYSTEMS

Opt. 04 – EMI Shielding ..... **+$3,000**
Opt. 05 – Rackmount Kit ..... **+$400**
Opt. 1A – 115 V/15 A Power Cord ..... **NC**
Opt. 1B – 125/208 V 3-Phase Power Supply ..... **+$180**
Opt. 10 – Sub. 5.25 in. Floppy Drive ..... **NC**
Opt. 18 – Sub. Removable HD for Std. HD ..... **+$350**
Opt. 2C – GPIB/Expansion Interface (92C02) ..... **+$1,950**
Opt. 4X – Sub. 17 in. X Terminal (TLA & DAS/XP) ..... **+$1,800**

DAS® PATTERN GENERATOR CARDS

92S16
18-CH, 50 MHz Algorithmic Pat. Gen., 1 K Deep. **$7,290**
Includes: Two P64643A Probe and Leads.
Opt. 2S – Sub. Two P6465 Probes for Two P64643A Probes .... **+$3,500**

92S32
36-CH, 50 MHz Sequential Pat. Gen., 8 K Deep **$9,430**
Includes: Four P64643A Probes and Leads.
Opt. 1S – Sub. One P6465 Probe for One P64643A Probe .... **+$1,750**
Opt. 2S – Sub. Four P6465 Probes for Four P64643A Probes ..... **+$3,500**

92SX109
9-CH, 100 MHz Algorithmic Pat. Gen., 2 K Deep. **$9,800**
Includes: One Pat. Gen. Multiplexer, and One P6465 Probe and Leads.
Opt. 09 – Add One P6465 Output Data Probe ..... **+$2,500**
Opt. 11 – Add One P6460 External Control Probe ..... **+$750**

92SX118
18-CH, 100 MHz Sequential Pat. Gen., 16 K Deep **$12,850**
Includes: Two Pat. Gen. Multiplexers, and Two P6465 Probe and Leads.
Opt. 09 – Add Two P6465 Output Data Probe ..... **+$5,000**

SERVICE ASSURANCE OPTIONS

Opt. K1 – Adds one year of post-warranty Customer-Site Repair Protection and Software Subscription Services, as appropriate
Opt. K2 – Adds two years of post-warranty Customer-Site Repair Protection and Software Subscription Services, as appropriate

Note: Opt. 88, Factory Installation and Test, is a no charge option available for all DAS® instrument cards ordered with a new mainframe.

Note: On-site installation is also available as an option to your system. When you purchase on-site installation, the service technician will:

- Set up and configure your system.
- Configure and integrate all optional accessories.
- Run diagnostics to completely verify functionality.

DAS®

- One Year Warranty
- Extended Support
- On-site Installation Available

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

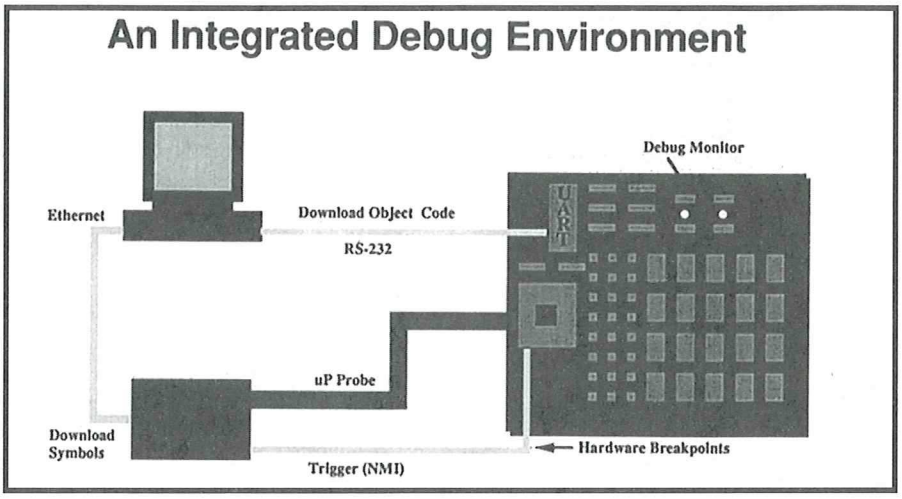
Tektronix Measurement products are manufactured in ISO registered facilities.

TLA510 TLA520 DAS/NT™ DAS/XP™ Applications Software

Applications which add capability to all the DAS® Series and TLA Series of products.

Tools that are valuable for integration and software debug tasks.

- Remote Prototype Control
- Links to Software Debug Packages
- Links to Logic Simulators
- Offline Analysis Software



LACONNECT combines a logic analyzer, a debug monitor, and a source level debugger to provide a real-time debug environment for today's fastest and most complex microprocessors.

LACONNECT – An Alternative to In-circuit Emulation

To maximize the functionality of your logic analyzer, Tektronix has teamed up with leading vendors of embedded software development tools to integrate the logic analyzer into their environment. This approach, called LACONNECT, combines tools that you may already be using into a cost effective debug environment with functionality that exceeds many emulators. C, C++, Pascal, Ada, and other high level languages can be debugged with a logic analyzer when connected in an LACONNECT environment.

By combining a debug monitor, a source level debugger and a logic analyzer, a user can sit at a workstation screen and control all of his tools, including the logic analyzer. Tools are available to allow full remote debugging completely over the local area network.

Currently, tools from Microtec Research, Inc. and Concurrent Sciences, Inc. are fully supported. New vendors' capabilities are constantly being added. Contact your local Tektronix salesperson for the latest support.

FULL REMOTE CONTROL OVER LAN ETHERNET

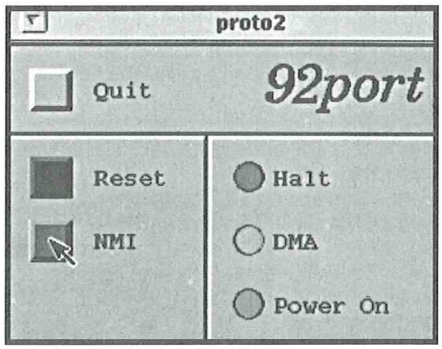
The 92LANP applications software provides full remote programming of DAS® and TLA systems with the Tektronix Programmatic Control Language (PCL). Setup, control, status, patterns and results can be exchanged over LAN.

LINKS TO LOGIC SIMULATORS

The CADLINK application software provides a link between logic simulation software data and the DAS stimulus and acquisition instrumentation. The 92SIMLK application software offers translations for specific simulator outputs. The acquired data can be compared to the expected results on the DAS.

LINKS TO ASIC EMULATION

The 92QTURN application software provides full remote programming from the Quickturn Systems Enterprise ASIC emulation system. Through this interface, the channels and clocks for access to internal signals are automatically generated by the Quickturn Systems LAX software package. 92QTURN includes the 92LANP applications software.



CONTROL YOUR TARGET SYSTEM FROM THE WORKSTATION

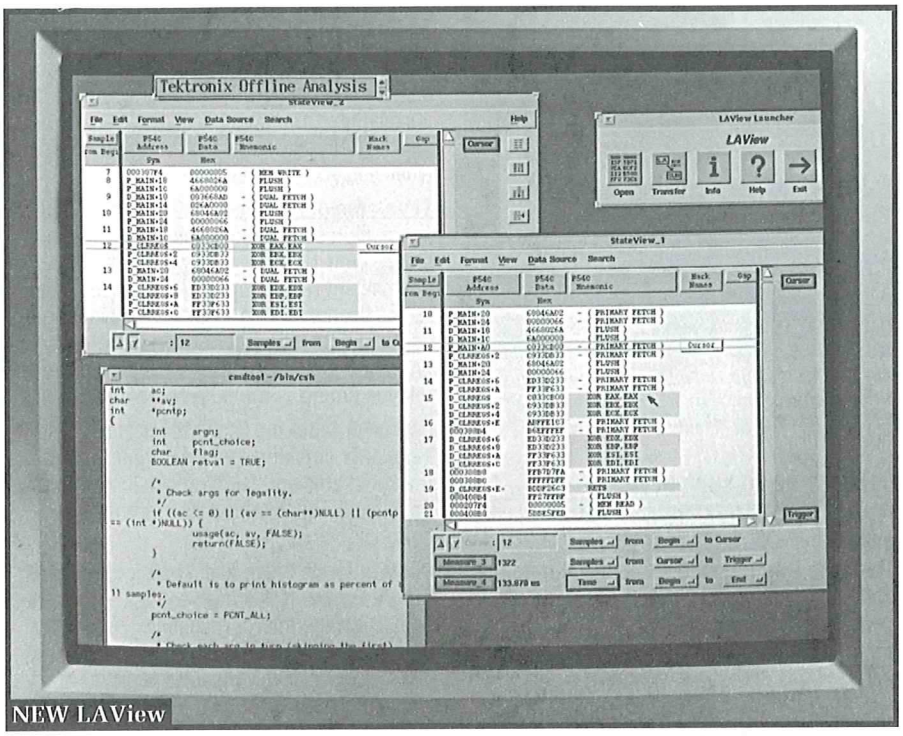
The 92PORT application software provides control and monitoring of the target system through a port on the DAS® mainframe. Eight output bits and eight input bits are displayed in an X-window on the workstation (DAS/NT™) or X terminal (DAS/XP™) as soft "buttons" or indicators. With this, static functions of the target system can be controlled or monitored, e.g., RESET or INTERRUPT and READY or FAULT. Each indicator and button can be individually labeled and programmed for the desired logic sense and function. The 92PORT operates as X client software on the DAS® mainframe and is compatible with any X11/R4 server software on a workstation or X terminal.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Offline Analysis Software



NEW LAView

New LAView

- Free the Instrumentation for Other Users
- Full X11/Motif User Interface
- Takes Advantage of the Workstation Computation Capabilities
- Automated Upload from the Instrumentation
- Wide Range of Microprocessor Support
- Multi-window and Multiprocessor Support
- Flexible Symbolic Data Search

Offline analysis of state and disassembly data completely independent of the instrumentation. Compatible with DAS® and TLA instruments.

Free up the Instrumentation

The LAView software operates completely independent of the instrumentation. Once the data is acquired it can be automatically uploaded to the workstation for independent analysis.

LAView is compatible with any SUN SPARCstation running SUN/OS4.2 (or a compatible SOLARIS mode) and supporting X11/R4 server capability. LAView supports 92A96 or 92C96 acquisition data from either DAS® or TLA systems.

ROBUST DATA ANALYSIS CAPABILITY

The X-windows environment offers rich data analysis capability Standard X11 windows paradigms are used as elevators for data scrolling, pull down menus, window resizing The data may be displayed in multiple windows using different display formats, window sizes and fonts. Correlated acquisitions are displayed in multiple windows with the cursors locked together in time.

Advanced features include symbolic search capability and ASCII file output for further analysis.

ORDERING INFORMATION

All listed application software is compatible with TLA and DAS® instruments.

LALINK
High level language links **$465**

92PORT
DAS® Target Control Software **$950**

CADLINK
Simulation Vector Sampling Software **$950**

92SIMLK
Simulation Translation Software **$1,000**

92QTURN
Link to Quickturn Systems **$5,000**

92LANP
LAN Programmatic Control Language (PCL) SW **$950**

92PA
Performance Analysis Software **$1,500**

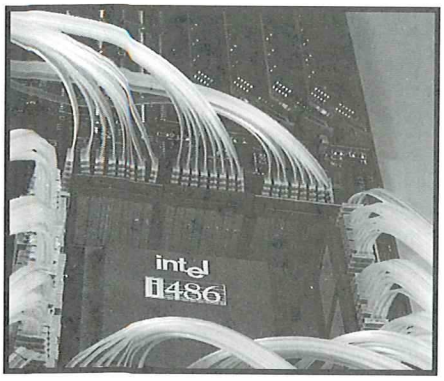
LAView
Offline Disassembly Analysis Software **$4,950**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

DAS® and TLA Family Microprocessor Support



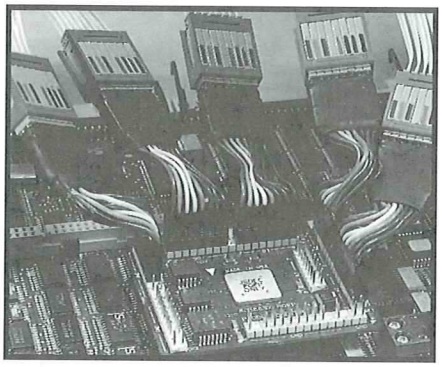
Over 40 custom probe adapters are available for probing today's dense microprocessor package styles. This shows a PGA probe adapter for the Intel 80486 family.

Timely Support of the Newest Devices

As microprocessors become an increasingly critical factor in system design time and product differentiation, the proliferation of new microprocessor devices is growing explosively. The most important question in the minds of many designers is, "If I use the latest processor, can I find the development tool support I need?"

Tektronix is committed to delivering timely support of key new devices as they appear in the market. This is accomplished through close cooperation with microprocessor vendors, beginning long before the latest devices are fabricated.

Highly integrated hardware and software development techniques and a wide variety of design channels ensure the ability to respond to your unique requirements. The Tektronix factory, OEM suppliers, customer technical support and independent contractors are all sources of microprocessor and bus support products.



The LAPIKPV 8-CH leadsets can be used to provide a low-profile connection between your GPX probes or DAS® 92C96 probes and your System Under Test (SUT).

CONNECTING TO YOUR DEVICE? – NO PROBLEM WITH TEKTRONIX PROBE ADAPTERS AND ACCESSORIES

There are two methods for connecting to the processor: (1) custom probe adapters, (2) general purpose probing.

Custom Probe Adapters offer a quick and reliable connection to your microprocessor. Tektronix offers a variety of custom probe adapters for a wide assortment of soldered or socketed package styles including DIP, PLCC, LCC, PGA, PQFP (JEDEC) and CQFP (JEDEC).

Each signal on the probe adapter has an adjacent ground pin connected to an internal ground which keeps noise and crosstalk to a minimum. If vertical height is a concern, low profile connections are available (LAPIKPV).

General Purpose Probing allows you to connect to test pins on your prototype or to your own custom test clip when a custom probe adapter is not available.

Tektronix podlets with 25 mil² spacing easily interface to a wide variety of test clips and probing accessories. You can use the podlets either individually with a podlet ground lead or in groups of eight with an 8-CH podlet holder.

Memory Depth with No Trade-offs. There are three memory depths available on the 92C96. There is 32 K, 128 K or 512 K behind each channel, fully time-stamped for accurate data correlation. Other logic analyzers force you to lose half of your memory *and* reacquire data when you enable time stamps.

Time-stamping with No Trade-offs. Each acquisition sample includes a time stamp stored with 10 ns resolution. There is no decrease in resolution or overflow for measuring events as long as two days. No memory depth is compromised. Several formats of time stamp display make it easy to measure relative timing of multiple complex events.

Powerful Clocking State Machine. The Tektronix clocking state machine makes the most efficient use of acquisition memory possible by qualifying data and tracking complex bus cycles.

Simultaneous State and Timing Through a Single Probe. If you need to look at individual signals on the microprocessor, you simply change the time base and you can view it at rates of up to 100 MHz. *This is done without moving probes or double probing.*

VIEWING YOUR DATA – TEKTRONIX DOES THE WORK FOR YOU

Tektronix logic analyzers offer the most powerful disassembly in the industry.

Four Modes of Disassembly:

- **Hardware Display** – shows all bus cycles. Automatically disassembles executed instructions and shows unexecuted instructions as FLUSHED.
- **Software Display** – shows only executed instructions. Unexecuted instructions are filtered out.
- **Control Flow Display** – shows instructions that change the flow of your program such as branches, jumps, and returns instructions.
- **Subroutine Display** – shows only subroutine call and return instructions.

Microprocessor support packages come standard with setup software that fully configures the analyzer with individual signal names, channel grouping, comprehensive state clocking and symbol files for bus cycle, simplifying triggering and data display.

Digital & TLA Analysis System
Microprocessor Support

EDITABLE AND DOWNLOADABLE SYMBOL TABLES

The DAS® and TLA have a Symbol Editor which can enter or modify symbols, or enter a base offset for relocatable code, or even download symbols from another computer. It supports multiple files with thousands of symbols per file. LALINK and CSILINK software will extract symbol information from the output of various compilers and convert it to Tektronix symbol format. This allows the linking of a high-level language trace display to the data acquired by the logic analyzers.

THE MOST USEFUL DATA ACQUISITION IN THE INDUSTRY

Once connected to your microprocessor, you need to consider what impact the logic analyzer has on your systems. The Tektronix probing system is the best in the industry with many advantages over other analyzers.

- Extremely low AC Loading of <10 pF (at the probe tip)
- Ability to acquire both state and timing data through the same probe connections
- Probes are small and lightweight to probe wt mil² pins
- Color coded for easy podlet identification

Most microprocessors do not need all of the acquisition channels. These unused channels can be used to probe other parts of your system under test.

ORDERING INFORMATION

92DM04A – 8086/8 Support **$2,500**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$650**

92DM06A – 80/86/8Support **$2,500**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$650**
Opt. 1S – PLCC Support ..... **NC**

92DM08A – 80286 Support **$2,500**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$650**
Opt. 1S – Sub. Soldered 100-Pin PQFP Probe Adapter ..... **NC**

92DM09B – 80386DX Support **$2,500**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$700**

92DM10A – 80386SX Support **$2,500**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$950**
Opt. 1S – Sub. Soldered 100-Pin PQFP Probe Adapter ..... **NC**
Opt. 3S – Sub. AMP 100-Pin PQFP Adapter ..... **+$225**

92DM11 – 80386EX Support *1
Opt. 1D – Delete Probe Adapter (Software only) *1

92DM12A – 80486 Support **$4,950**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$750**
Opt. 2S – Sub. Low Profile Probe Adapter ..... **NC**

92DM13A – Pentium Support **$6,000**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$1,500**

92DM14 – P54C Support **$6,000**
Opt. 1D – Delete Probe Adapter ..... **–$1,500**

92DM17 – 80960 Support **$4,950**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$750**
Opt. 2S – Sub. Low Profile Probe Adapter ..... **NC**

92DM31B – 68020 Support **$2,500**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$700**

92DM33B – 68030 Support **$2,500**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$700**

92DM34A – 68040 Support **$4,950**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$750**

92DM35A – 88100 Support **$4,950**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$1,950**
Opt. 04 – (2) 90-CH Interfaces ..... **+$1,900**
The 92DM35A requires two acquisition modules.

92DM36 – 68060 Support *1
Opt. 1D – Delete Probe Adapter (Software only) *1

92DM55 – SCSI 192 Support **$3,500**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$1,500**

92DM72A – AMD 29000/050 Support **$4,950**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$750**
The 92DM72A requires two acquisition modules.

92DM74 – MIPS R3000/A Support **$4,950**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$750**
Opt. 2S – Sub. Low Profile Probe Adapter ..... **NC**

92DM75A – R4000 Support **$4,950**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$750**
Opt. 2S – Sub. R4000SC/MC Probe Adapter ..... **+$250**

92DM77A – SPARC CY7C601/L64811/MB86903 Support **$4,950**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$750**

92DM81 – 8096/C16 Support **$2,500**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$650**
Opt. 2S – Sub. PLCC-68 Probe Adapter ..... **NC**

92DM93A – CPU32 Support **$2,500**
Opt. 1A – BCC/EVS Support ..... **+$750**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$750**
Opt. 2S – 68340 Support ..... **NC**

92DM94 – 68360 Support **$4,950**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$1,500**

92DM901 – MCS-51 Support **$800**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$550**

92DM902 – 8085 Support (DIP) **$450**
Opt. 1D – Delete Probe Accessories (Software only) ..... **–$200**

92DM911 – Futurebus+ Support **$9,950**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$8,000**

92DM912 – 68000/10 Support **$1,200**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$650**
Opt. 2S – Sub. PGA Probe Adapter ..... **NC**
Opt. 3S – Sub. PLCC Probe Adapter ..... **NC**

92DM913 – Z80 Support **$800**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$550**

92DM914 – 96002 Support **$1,500**
Opt. 1D – Delete Probe Accessories (Software only) ..... **–$750**

92DM916 – 80960KA/KB/MC Support **$1,500**
Opt. 1D – Delete Probe Accessory (Software only) ..... **–$750**

92DM920 – TMS320C3X Support **$1,500**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$750**
Opt. 2S – Sub. PGA Probe Adapter ..... **NC**

92DM921 – TMS320C40 DSP Support **$2,700**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$1,950**

92DM923 – 88110 RISC Support **$2,700**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$1,950**

92DM925 – R3051/52/81 RISC Support **$1,500**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$750**
Opt. 2S – Sub. PLCC-84 Probe Adapter ..... **NC**

92DM926 – DSP3210 DSP Support **$1,000**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$750**

92DM927 – 29205 RISC Support **$1,000**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$750**

92DM930 – 1553A/B Bus Support **$7,950**
Opt. 1D – Delete Probe Adapter (Software only) ..... **–$7,700**

LADM923 – PowerPC 60X Support (Software only) **$750**

ADDITIONAL ACCESSORIES

CART
92CART **$355**

*1 *Contact your Tektronix representative for price information.*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

3000 SERIES

GPX Logic Analyzers

Eight tools in one low cost instrument. The GPX Logic Analyzer provides a complete set of features for the whole design team. Multiple tools are available in three mainframes to customize your system to your exact needs.

GPX LOGIC ANALYZER

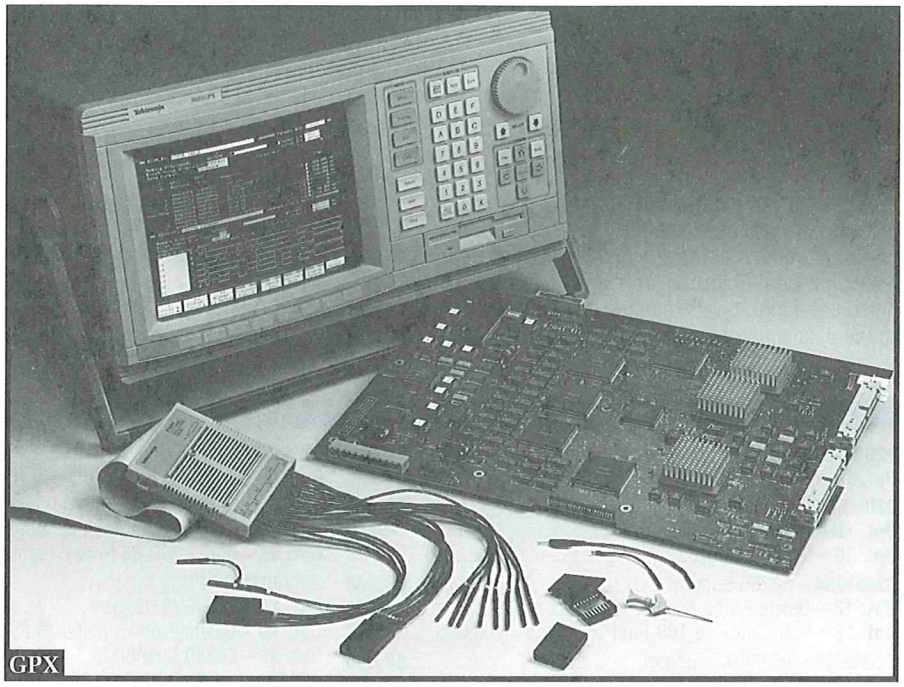
- 1 GHz High-speed Timing Analysis
- 200 MHz Timing Analysis
- 80 MHz State Analysis
- 8 K or 32 K Acquisition Memory Depths
- 20 to 360 Channels Available in 20 Channel Increments
- Simultaneous State and Timing – No Double Probing
- Comprehensive Microprocessor Support
- Real-time Performance Analysis
- ROM Emulation
- Links to High Level Languages for Software Debug
- Industry Standard File Outputs

ADDITIONAL MODULES

- 2 GHz High-speed Timing Analysis Module (30HSM)
- 400 MS/s Digitizing Oscilloscope (30DSM)
- Lower Cost Microprocessor Analysis Module (30MPX)

MULTIPLE MAINFRAMES

- 3001 Portable Mainframe
- 3002C Color Modular Mainframe
- 3002P Portable Modular Mainframe



3000 Series Logic Analyzers

The 3000 Series Logic Analyzers are an outstanding value in general purpose logic analysis. The monolithic 3001 is designed for medium size applications or where portability is important. The modular 3002 based systems can house up to four modules in a single system and is suited for larger, more complex applications.

THE GPX ACQUISITION CARD

The 32GPX has 8 K of acquisition memory and the 32GPD has all of the same features of the 32GPX but with 32 K of acquisition memory. Both modules are available in the 3001 or the 3002 based systems.

20, 40, 60, 80 CHANNEL MODULES

The 32GPX and 32GPD modules can be configured in 20 channel increments from 20 to 80 channels per module and up to 320 channels per system.

COMPLETE SOLUTION FOR THE WHOLE DESIGN TEAM

The GPX Logic Analyzer is designed to offer capability that everyone on the design team needs. The GPX provides specific features for:

- Hardware Debug
- Software Debug
- HW/SW Integration
- Evaluation
- System Test
- System Optimization

If your budgets are tight and you can afford only one instrument, the GPX is the one to choose.

3000 SERIES APPLICATION MODULE SELECTION GUIDE

Product	Application	Channels/Card	Rate	Clock Type	Memory*3	Triggering
32GPX (page 163)	general purpose microprocessor hardware/software integration	80-160*1 80-160*1 16-32*1	80 MHz 200 MHz 1 GHz	synchronous transitional conventional	4 K/16 K 8 K/32 K 40 K/160 K	4 states/16 levels 4 word/range recognizers 2 counter/timers
30MPX (page 164)	8/16/32-Bit microprocessor hardware/software integration	96 9	16 MHz*2 200 MHz or 90 MHz	synchronous transitional synchronous	8 K 2 K 2 K	7 states 8 word/ range recognizers 8 counter/timers
30HSM (page 165)	high-speed hardware analysis	20 or 4 or 20 or 18	400 MHz 2 GHz 200 MHz 95 MHz	transitional transitional dual threshold synchronous	24 K 120 K 12 K 6 K	15 trigger tests 4 levels 2 counter/timers 4 word recognizers 4 TekLink signals
30DSM (page 166)	analog waveform analysis	1 or 2	400 MS/s 200 MS/s	NA NA	32 K 16 K	edge: rising/falling external trigger

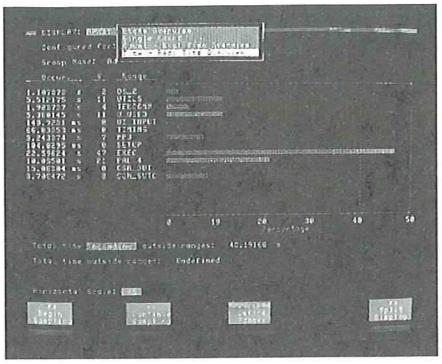
**1 Channels can be doubled by welding two GPX modules in a 3002 or 3002E mainframe.*
**2 Supports microprocessor clock rates up to 33 MHz.*
**3 Two memory depths modules are available, 32GPX and the deep 32GPD.*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

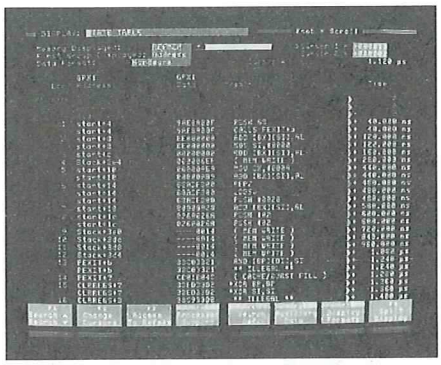
ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

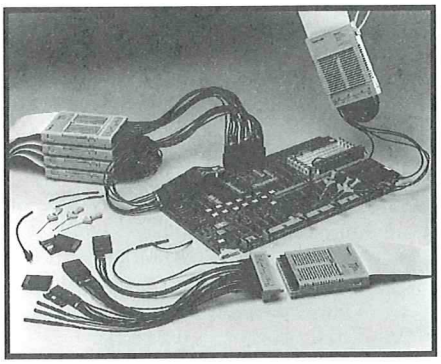
GPX Logic Analyzers



Real-time PA provides you the capability to easily determine how to optimize your system for better performance.



GPX offers four modes of disassembly: Hardware, Software, Control Flow, and Subroutine. All disassemblers include automatic fetch prediction, capability to display high level symbols, and automatic time stamps for measuring time.



The GPX probing is comprised of four 20 channel lightweight probes. Eight channels can be grouped together in a podlet holder. Each podlet is 100 mil square and easily interfaces to a wide variety of test clips and probing accessories.

It All Starts at the Probe Tip

The GPX emphasizes a "single-probe-multi-measurement" connection so you can make a wide variety of measurements without changing probes or double-probing. The GPX offers a powerful simultaneous state and timing capability with two time bases to acquire a signal both synchronously and asynchronously at the same time, through a single probe.

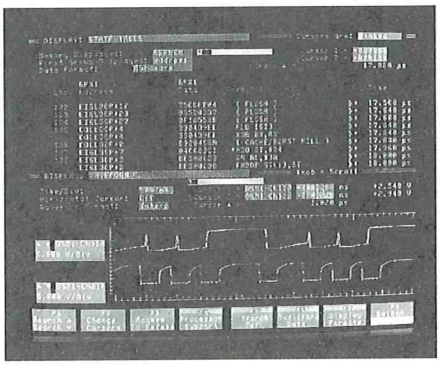
COMPREHENSIVE MICROPROCESSOR SUPPORT

In addition to being a powerful general purpose logic analyzer, the GPX offers support for today's popular microprocessors including the 66 MHz Pentium, DSPs, microcontrollers and RISC chips. Its low load probing system (5 pF) and custom probe adapters allows you to look at all of the microprocessor's lines both synchronously and asynchronously at the same time. In addition, the 1 GHz timing channels of the GPX are connected to the microprocessor's control lines to allow a detailed analysis of key signals.

MULTIPLE DATA DISPLAYS

Acquiring data is just one half of the problem. For quick and accurate analysis you need to look at your data in a mode that makes the problem easy to find. The GPX offers a wide variety of displays:

- 4 Modes of disassembly with high level language symbols for software debug
- Graph Mode plots acquired data value vs. time which is useful for A/D and HDTV applications
- Real-time Performance Analyzer histograms show you where your program is spending its time
- GPX ROM emulator (see page 178) lets you examine and change memory for quick patches to your program



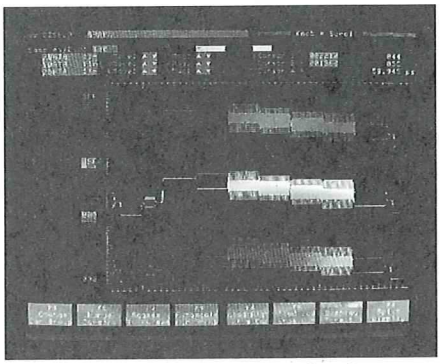
Complimentary modules are available such as a DSO (above) and a high-speed module. Split screen displays allow you to view your data simultaneously, time-correlated.

TRIGGERING MADE EASY

The most difficult aspect of a logic analyzer for a new user is setting up the trigger. The GPX solves this problem by offering 27 pre-programmed trigger setups that can be used in the majority of cases. You can easily customize any of these setups for your specific application.

REAL-TIME PERFORMANCE ANALYSIS

A unique feature to the 3000 Series is real-time PA. The GPX offers 12 ranges (expandable to 48 ranges) that monitor your microprocessor's BUS activity in real time – meaning that no BUS cycle is missed. Traditional statistical Performance Analyzers sample the BUS missing significant amounts of activity. Real-time PA is crucial if you are looking for a random glitch or other single-shot anomaly.



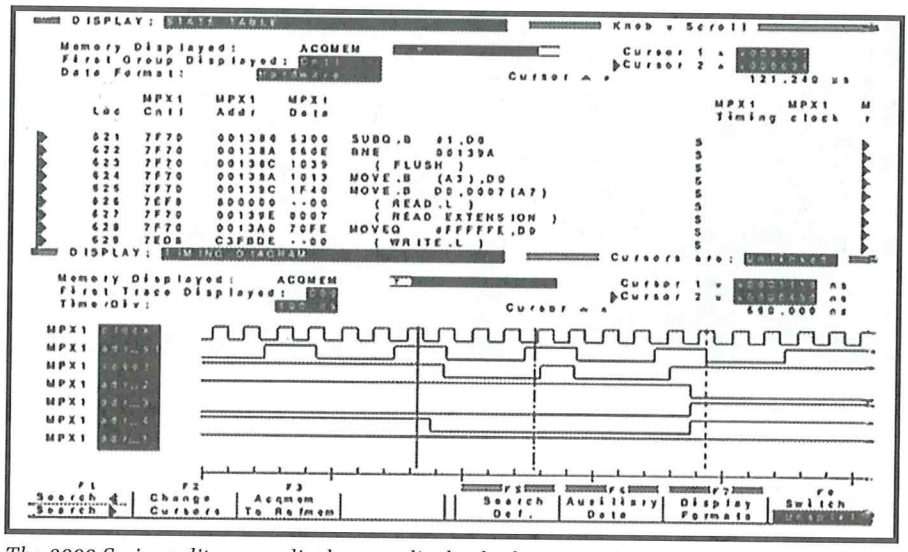
With Graph Display, you can plot the "value" of your acquired data vs. memory location. You can simultaneously view up to three groups as separate, overlaid, or with an offset. Display features include autoscaling, interpolation (linear or sin(x)/x), and data as signed or unsigned.

Microprocessor Analysis

The 30MPX module provides the support you need for developing a microprocessor based design in one low cost module.

30MPX

- Combined State and Timing Analysis
- 96 State Channels, 8 K Deep
- Support 8/16/32-Bit Devices up to 33 MHz
- 9 Transitional Timing Channels, 2 K Deep
- 200 MHz Transitional Timing or 90 MHz Synchronous
- Real-time Performance Analysis



The 3000 Series split screen display can display both state and timing at the same time. The "link cursor" option links the two displays together so as one display scrolls, the second display stays in sync.

Microprocessor Analysis Module

The 30MPX module offers the functionality needed for designers of microprocessor based systems on a single, low cost module. Microprocessor analysis, timing analysis, real-time performance analysis and microprocessor control are combined on a single card.

The 30MPX provides 96 channels of state analysis. Each channel has an 8 K memory depth making it ideal for tracing complex program flow and capturing both the cause and the visible effect of software problems.

MULTIPLE DISASSEMBLY FORMATS FOR RAPID ANALYSIS

Four disassembly display formats support rapid analysis of microprocessor activity. You can switch between hardware, software, control flow, or subroutine display without reacquiring data.

SIMULTANEOUS SUPPORT FOR UP TO FOUR MICROPROCESSORS

For analysis of multiple microprocessor based designs, up to four 30MPX modules can be used simultaneously. As data is acquired from each microprocessor, it is time-stamped and stored. You can then split the screen to display data from each processor. This powerful feature enables you to solve complex problems related to the interaction of multiple microprocessors.

200 MHZ TIMING ANALYSIS ON THE SAME MODULE

The 30MPX module provides nine additional channels of 200 MHz transitional or 90 MHz synchronous acquisition with each channel storing 2 K transitions.

High-speed timing analysis compliments the state analyzer by giving you detailed visibility of other parts of your circuitry such as control lines, I/O and clocks.

TIME CORRELATION TIES EVERYTHING TOGETHER

All data acquired by the 30MPX's state and timing sections (or from any other 3000 Series module) is automatically time-stamped by the system's high-speed master clock. This time stamp is used to time-correlate *all* of your data as it is displayed in the split screen display.

The advantage of time-correlation is that you can easily and accurately correlate the activity of the microprocessor to high-speed activity of your other circuits.

REAL-TIME PERFORMANCE ANALYSIS

The 30MPX offers real-time performance analysis capability similar to the 32GPX/32GPD. Real-time PA gives you the ability to profile the performance of your software. A key aspect of *Real-time PA* over the traditional statistical approach is that *all* activity is captured. No data is lost while the analyzer is processing the acquired data. This is especially vital in optimizing real-time embedded control systems or looking for single-shot events.

With real-time performance analysis you can identify where in your program you should focus your efforts to fine tune your system for its optimum performance.

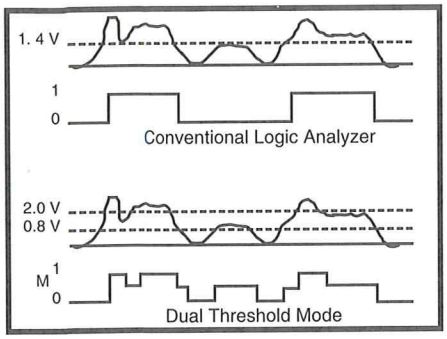
Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

High-speed Analysis



The TTL Signal above rises in the middle of the waveform and exceeds the logic low switching level (0.8 V) forcing unwanted changes in the devices output. It does not, however, exceed the threshold of the logic analyzer and would not be detected by the instrument. The 30HSM assures this condition can be detected and displayed by providing two thresholds which can be set to the logic high and logic low switching levels.

High-speed Hardware Analysis

The 30HSM module is a complete high-speed acquisition system for capturing and analyzing hardware faults in digital circuitry. A range of data acquisition modes, including 2 GHz transitional timing and Dual Threshold Mode, provide the ability to analyze a wide range of potential hardware problems.

The 30HSM's fault triggering lets you quickly locate hardware faults. Trigger selections include tests for set-up and hold time violations, pulse duration violations, and metastability. To save you time, these and other tests are pre-programmed in the 30HSM.

PROBLEMS DETECTED BY THE HSM

The many features of the 30HSM enables the design engineer to detect complex problems such as:

- Bus Contention
- Handshaking Errors
- DMA Problems
- Races and Hazards
- Glitches
- Setup and Hold Violations
- Propagation Delays
- Metastability
- Cross Talk
- Ringing

ACQUISITION MODES

The 30HSM incorporates four acquisition modes which provide you with the resources you need to efficiently solve the most demanding problems or make detailed measurements of your design's operation.

- **400 MHz High Resolution Mode** provides 2.5 ns timing across 20 channels. Each channel can record 24,000 transitions.
- **Unique 200 MHz Dual Threshold Mode.** Not only will you see high and low data, but middle or tri-state data as well. It will help you detect bus contentions, race conditions or metastable states.
- **95 MHz Synchronous Mode** provides 18 channels that can accept an external clock from the system under test.
- **Transitional Storage** enables you to capture up to 60 minute long periods of time by storing data only when the state of the input signal changes.

400 MHZ HIGH RESOLUTION MODE

The high resolution mode provides 400 MHz timing (2.5 ns) across 20 channels. Each channel can record 24 K transitions. This mode makes it easy to debug problems caused by race conditions, setup/hold time violations, and propagation delays.

DUAL THRESHOLD MODE

The unique dual threshold mode provides 200 MHz timing (5 ns) across 20 channels. Each channel can record 12 K transitions. This mode is uniquely suited to exposing difficult intermittent problems such as those caused by slow rise/fall times, bus contention, low drive or runt pulses, reflections, crosstalk, tri-state conditions, and excessive system noise.

2 GHZ MODE

The 2 GHz mode provides 4 channels of 500 ps resolution for resolving very fine timing relationships. Each channel can record 120 K transitions.

95 MHZ SYNCHRONOUS MODE

The synchronous mode provides 18 channels that can accept an external clock from the system under test up to 95 MHz. Each channel has 6 K of memory for data storage.

TRANSITIONAL STORAGE

In timing mode the 30HSM stores data only when the state of the input signals change. This transitional storage can be contrasted with conventional storage where data is stored at every sample interval. By using transitional storage, the 30HSM enables you to capture long periods of time (up to 60 minutes) while maintaining maximum sampling resolution.

TRIGGERING

The 30HSM makes setting up triggers easy by providing 15 predefined trigger tests for measuring timing related problems. Trigger resources include four 20-Bit word recognizers, two counter/timers, and four intermodule TekLink signals.

30HSM

- 2 GHz, 4 Channels
- 400 MHz, 20 Channels
- 95 MHz Synchronous, 18 Channels
- Dual Thresholds
- 24 K Transitionally Stored Memory
- 15 Preset Trigger Tests
- 2.5 ns Glitch Detection

High-speed Acquisition Module for accurate timing analysis.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

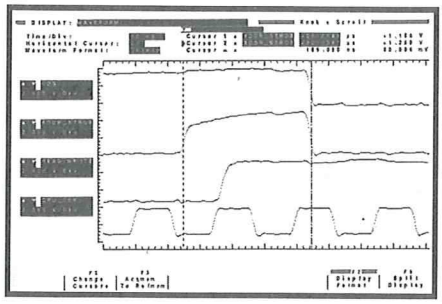
Tektronix Measurement products are manufactured in ISO registered facilities.

Waveform Analysis

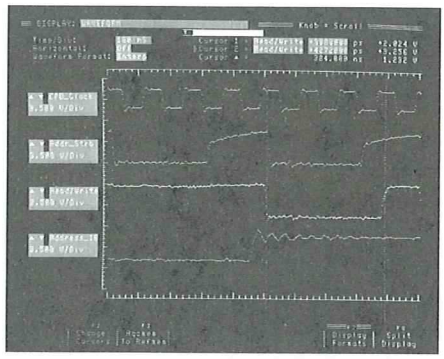
Multichannel Digital Storage Oscilloscope for solving tough analog problems.

30DSM

- 400 MS/s Digitizing
- 100 MHz Single Shot Bandwidth
- 32 K Bit Record Length
- 8-Bit Vertical Resolution



The 30DSM module is a powerful addition to the 3002 system. Designers can now look at the analog aspects of their system in conjunction with the digital information.



Multiple waveforms can be freely moved and sized on screen. Not only can you see the time relationship between these waveforms, but the quality of the signals as well.

Analog Problem Solving in a Digital Instrument

A powerful, multichannel digital storage oscilloscope (DSO), the 30DSM has been tightly integrated into the 3000 Series Logic Analyzer. It provides highly accurate analog measurement capability to address the needs of engineers involved in the design and test of sophisticated digital electronic products.

DESIGNED FOR THE DEMANDS OF TODAY'S HIGH-SPEED LOGIC FAMILIES

Each 30DSM contains two high-speed A/D converters and 32 K of acquisition RAM. Measurement accuracy is insured by 8-Bit vertical resolution, 350 MHz bandwidth triggering, user selectable interpolation and bandwidth limit filters, and a high-fidelity probe/attenuator combination. You can easily measure the worst-case propagation delay across a printed circuit board or make repeated measurements to determine the setup and hold margin of a memory system.

FLEXIBLE ACQUISITION MODES PUT YOU IN CONTROL OF YOUR MEASUREMENTS

Select between the single channel, 400 MS/s acquisition mode with a 32 K record length or the dual channel, 200 MS/s mode with a 16 K record length. In the single channel acquisition mode, acquire single-shot events up to 100 MHz (50 MHz in the dual channel mode).

Multiple 30DSMs can be integrated into your 3000 Series system to provide up to eight fully attenuated DSO channels. All channels are digitized simultaneously so you can determine exactly both the time and voltage relationships between them. Add a 30DSM to any 3000 Series system to increase the general-purpose utility for troubleshooting both the digital and analog sections of your design.

CURSOR MEASUREMENTS MAKE IT EASY FOR YOU TO SEE WHAT HAPPENED

Every waveform captured can be displayed to nearly the full 14-inch height of the display. You can easily overlap signals by moving them up or down in the display field. Four waveforms can be displayed at one time, selectable from any input probe or saved reference waveforms. You can even display multiple copies of the same signal.

There are two on-screen measurement cursors that can have either a vertical or a horizontal orientation. The voltage and time at the position of each cursor is always displayed on screen. The cursors can be assigned to any of the displayed waveforms. For example, you can assign Cursor 1 to CH 1 and Cursor 2 to CH 2 and then measure the difference in voltage between the waveforms at any instant in time.

TIME CORRELATED DATA TAKES THE PAIN OUT OF MIXED-MODE PROBLEM FINDING

It's nearly impossible to troubleshoot today's complex digital designs using only an oscilloscope. The 3000 Series helps you overcome this limitation by combining the power of the 32GPX, 32GPD, 30MPX or 30HSM with the high-speed digitizing offered by the 30DSM. You can trigger on, acquire, and display microprocessor execution, setup and hold time violations, or control line signal integrity. The system automatically correlates all acquired data, regardless of the acquisition module.

ANALOG PROBLEM SOLVING IN A DIGITAL INSTRUMENT

The 30DSM is a powerful, multichannel digital storage oscilloscope, tightly integrated into the 3002 logic analysis system. The 30DSM allows you to make analog measurements and digital measurements simultaneously.

DESIGNED TO MEET THE DEMANDS OF TODAY'S HIGH SPEED LOGIC

The 30DSM can capture signals from TTl, CMOS and other mainstream logic families. Easily detect logic glitches, spurious clocks, or measure setup/hold times with greater accuracy.

ACCURACY AND PRECISION YOU NEED

The 30DSM captures single-shot signals up to 100 MHz bandwidth. Measurement accuracy is enhanced by 8-Bit vertical resolution, selectable interpolation, and a high fidelity probe/attentuator combination.

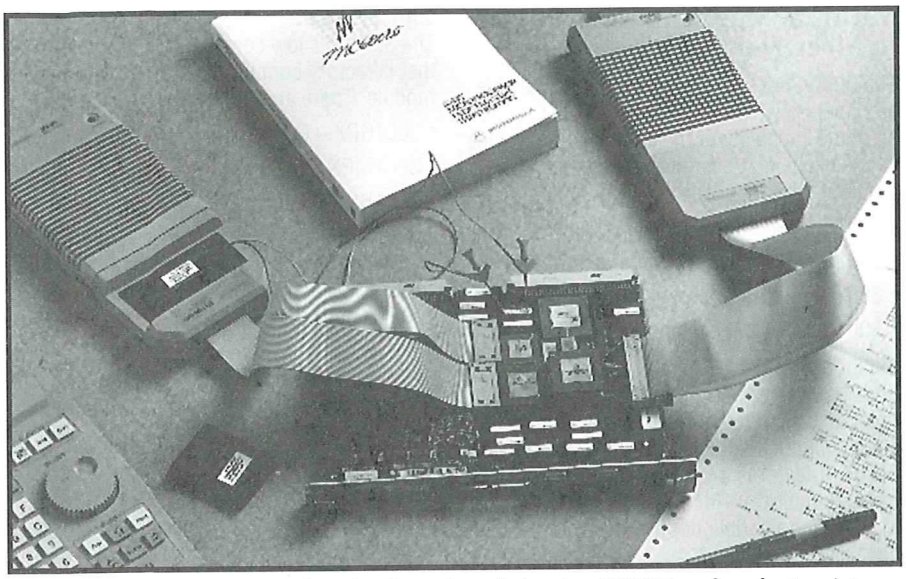
Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Software/Hardware Integration



Connection to your prototype is a simple matter of plugging EPROM probe adapters into your ROM sockets.

PDT

- Adds ROM Emulation Capability
- Real-time Operation
- Assembly Level Debug
- Ideal for ROM Based Systems Development
  - Device Drivers
  - Diagnostic Code
  - Boot Code
- Ideal for Bringing up Prototypes
- Debug New Kernels

Low cost option to the 32GPX, 32GPD, or 30MPX – ROM Emulation.

The PDT Advantage

When logic analyzer users were asked what features they would most like to add to their logic analyzer, the majority answered that they would like a way to control the microprocessor. Tektronix responded to this challenge with the Prototype Debug Tool (PDT).

PDT adds ROM emulation capability to the 32GPX, 32GPD, and the 30MPX modules through an innovative EPROM probe adapter (30RP2 probe). General Purpose PDT supports any microprocessor by plugging the 30RP2 probes into your system's EPROM sockets. With General Purpose PDT you can:

- Emulate your system EPROM
- Download code
- Set hardware breakpoints
- Patch EPROM memory
- Stop your application program

To add microprocessor control to your 32GPX, 32GPD or 30MPX module, you simply add the appropriate number of 30RP2 EPROM probe adapters and PDT software (standard with the 30RP2).

SOFTWARE/HARDWARE INTEGRATION WITH PDT

Many people integrate their hardware and software by simply using a logic analyzer along with an EPROM burner. They burn an EPROM, plug it into their circuit, connect a state analyzer to the microprocessor, start their program with the reset button, and trace their program flow with the logic analyzer.

For many applications this is a tedious but adequate process. With PDT, the above process can be improved by an order of magnitude without expensive new tools.

By adding the PDT option to your logic analyzer you can bring up new hardware and perform all of your initial hardware and software integration with a single instrument.

INTEGRATION WITH OTHER 3000 SERIES MODULES

PDT links with all other parts of the system through TekLink. This means you can use PDT with the 30HSM High-speed Timing Analyzer or the 30DSM Digitizing Oscilloscope to bring up new boards and verify signal integrity. In addition you can use up to four 30MPX, 32GPX, or 32GPD modules with PDTs to control up to four microprocessors at the same time.

The *key* advantages of PDT over other types of microprocessor debug tools is its real-time operation, high-speed timing analysis, real-time performance analysis, and tight integration with other engineering tools, all in one system.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Configurations

Multiple mainframes and options allow you to select the most appropriate configuration for your application.

3000 SERIES

- 100 MB Hard Disk
- MS-DOS Compatible, 3.5 in. Disk
- Postscript/EPSON Printer Support
- GOSCRIPT Formats
- Full Size QWERTY Keyboard
- RS-232 and GPIB Support

Multiple Mainframes to Meet Your Needs

The 3000 Series was designed with a flexible architecture which enables Tektronix to offer all of the capability of the application modules in a package that best fits your needs. The different packages are:

- 3002C – Benchtop, two-slot color mainframe
- 3002P – Portable, two-slot mainframe
- 3002E – Two-slot expansion mainframe
- 3001 – Low cost portable system

3002C MAINFRAME

The 3002C is a two-slot benchtop mainframe that can be extended to add two additional slots with the 3002E expansion mainframe. This unit features a full QWERTY keyboard, a high resolution 14-inch color display, 3.5 in. MS-DOS compatible floppy, and a 100 MB hard disk.

3002P MAINFRAME

The 3002P is a combination of the portability features of the 3001 with the expansion capability of the 3002C. The 3002P is identical to the 3002C except that the high resolution color CRT is replaced with a nine-inch high resolution flat panel display. The display folds down and is secured to the top of the mainframe and the keyboard is stored safely under the mainframe, making it easy to move from one location to another.

3002E EXPANSION MAINFRAME

The 3002E is a two-slot expansion mainframe that contains a power supply and interconnect cables. This low cost expansion enables you to add two additional application modules to either a 3002 or 3001 mainframe.

3001 SYSTEMS

The 3001 is a low cost standalone mainframe that is factory configured with one application module. There are three versions available:

- 3001GPX – General Purpose and µP analysis
- 3001MPX – 8/16/32-Bit µP analysis
- 3001HSM – High-speed timing analysis

These traditional logic analyzers contain a nine-inch CRT, function key pads and control knob (a keyboard is optional), an optional 100 MB hard disk, and a MS-DOS compatible floppy.

For use in the lab, the 3001 can be expanded with a 3002E mainframe for an additional two slots.

3002 SYSTEMS

Eleven pre-configured 3002 systems are available. Each system can be expanded by adding the 3002E expansion mainframe for an additional two slots.

DIFFERENT MAINFRAMES, SAME USER INTERFACE

To make your design team more productive, the 3001 and 3002 configurations share the same user interface and operation. Thus, you can use a 3002 in the lab for design, and a 3001 in the field for repair without having to learn a new instrument.

HELP IS JUST A BUTTON AWAY

If you ever have a question about how a certain function works or what an option does, simply press the NOTES key and a detailed description will be displayed.

3000 SERIES SYSTEM SELECTION GUIDE

Product	Description	Module	Display	Mass Storage	Price
3001GPX*1	1-slot portable	one 32GPX or one 32GPD	9 in. mono	3.5 in. FD (std.)/HD (opt.)	**$8,995**
with Opt. 1S					**$10,995**
3001MPX	1-slot portable	one 30MPX	9 in. mono	3.5 in. FD (std.)/HD (opt.)	**$6,995**
3001HSM	1-slot portable	one 30HSM	9 in. mono	3.5 in. FD (std.)/HD (opt.)	**$8,995**
3002CG*1	2-slot system	one 32GPX or one 32GPD	14 in. color	3.5 in. FD (std.)/HD (opt.)	**$13,995**
with Opt. 1S					**$15,995**
3002CGG*1	2-slot system	two 32GPX or two 32GPD	14 in. color	3.5 in. FD (std.)/HD (opt.)	**$21,990**
with Opt. 1S					**$25,990**
3002CGH*1	2-slot system	one 32GPX or one 32GPD, one 30HSM	14 in. color	3.5 in. FD (std.)/HD (opt.)	**$19,995**
with Opt. 1S					**$21,995**
3002CGD*1	2-slot system	one 32GPX or one 32GPD, one 30DSM	14 in. color	3.5 in. FD (std.)/HD (opt.)	**$19,995**
with Opt. 1S					**$21,995**
3002CX	2-slot system	one 30MPX	14 in. color	3.5 in. FD (std.)/HD (opt.)	**$9,995**
3002CXX	2-slot system	two 30MPX	14 in. color	3.5 in. FD (std.)/HD (opt.)	**$15,995**
3002CH	2-slot system	one 30HSM	14 in. color	3.5 in. FD (std.)/HD (opt.)	**$9,995**
3002CHH	2-slot system	two 30HSM	14 in. color	3.5 in. FD (std.)/HD (opt.)	**$15,995**
3002CXH	2-slot system	one 30MPX, one 30HSM	14 in. color	3.5 in. FD (std.)/HD (opt.)	**$15,995**
3002CXD	2-slot system	one 30MPX, one 30DSM	14 in. color	3.5 in. FD (std.)/HD (opt.)	**$15,995**
3002CHD	2-slot system	one 30HSM, one 30DSM	14 in. color	3.5 in. FD (std.)/HD (opt.)	**$15,995**

**1 The 32GPX and 32GPD modules can be configured for 20, 40, 60, or 80 channels. Prices are for fully configured 80 channel modules.*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 3000 Series complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Configurations

ORDERING INFORMATION

Our most popular configurations are listed here. For complete ordering information please see configuration guide. Part number 5EA 8297-3 (U.S.) or 5EW 8297-3 (International).

3001 SERIES LOGIC ANALYZERS

3001GPX
General Purpose and Microprocessor Analysis Instrument **$8,995**
Includes: 16-CH @ 1 GHz Timing, 80-CH @ 200 MHz Timing, 80-CH @ 80 MHz State, 8 K Acquisition Memory, 4 P6490 Probes, and 720 KB Floppy.

Opt. 1A – 32PA Performance Analysis Software ..... **+$650**
Opt. 1D – Delete 20 Channels (60 total) ..... **–$1,000**
Opt. 2D – Delete 40 Channels (40 total) ..... **–$2,000**
Opt. 3D – Delete 60 Channels (20 total) ..... **–$3,000**
Opt. 1K – Add QWERTY Keyboard ..... **+$500**
Opt. 1M – Add Hard Disk ..... **+$840**
Opt. 1S – Substitute 32 K Acquisition Memory ..... **+$2,000**
Opt. 1Z – Add Keyboard and Hard Disk (Value Pack) ..... **+$995**

3001MPX
8/16/32-Bit Microprocessor Analysis Instrument **$6,995**
Includes: 96-CH State and 9-CH @ 200 MHz Timing (req. Opt. 1H), P6480 State Probe without Leadset, and 720 KB Floppy.

Opt. 1A – 30DA01 Performance Analysis Software ..... **+$650**
Opt. 1F – P6480 General Purpose Probe Adapter ..... **+$450**
Opt. 1H – One P6486 Timing Probe ..... **+$1,000**
Opt. 1K – Add QWERTY Keyboard ..... **+$500**
Opt. 1L – One P6486 High Performance Leadset ..... **+$500**
Opt. 1M – Add Hard Disk ..... **+$840**

3001HSM
High-speed Acquisition Instrument **$8,955**
Includes: 20-CH @ 400 MHz, or 4-CH @ 2 GHz, or 20-CH @ 200 MHz Dual Threshold Timing, Two P6487 High-speed Probes with Standard Leadsets, and 720 KB Floppy.

Opt. 1K – Add QWERTY Keyboard ..... **+$500**
Opt. 1L – Add Two 400 MHz Leadsets ..... **+$1,000**
Opt. 4L – Add One 2 GHz Leadset ..... **+$1,200**
Opt. 5L – Add Two 2 GHz Leadsets ..... **+$2,400**
Opt. 1M – Add Hard Disk ..... **+$840**
Opt. 2A – Add 18-CH 95 MHz Sync Mode (req. 1L) ..... **+$750**

PRECONFIGURED 3002 LOGIC ANALYZERS

3002CG
3002C M/F with One 32GPX **$13,995**
Includes: 3002C, 14 in. Color Monitor, HDD, 720 KB Floppy, Keyboard, One 32GPX, Four P6490s and Performance Analysis SW.

Opt. 1S – Substitute one 32GPD with 32 K Acquisition Memory ..... **+$2,000**

3002CGG
3002C M/F with Two 32GPXs **$21,990**
Includes: 3002C, 14 in. Color Monitor, HDD, 720 KB Floppy, Keyboard, Two 32GPXs, Eight P6490s and Performance Analysis SW.

Opt. 1S – Substitute two 32GPDs with 32 K Acquisition Memory ..... **+$4,000**

3002CGH
3002C M/F with One 32GPX and One 30HSM **$19,995**
Includes: 3002C, 14 in. Color Monitor, HDD, 720 KB Floppy, Keyboard, One 32GPX, Four P6490s , One 30HSM, Two P6487s and Performance Analysis SW.

Opt. 1S – Substitute one 32GPD with 32 K Acquisition Memory ..... **+$2,000**

3002CGD
3002C M/F with One 32GPX and One 30DSM **$19,995**
Includes: 3002C, 14 in. Color Monitor, HDD, 720 KB Floppy, Keyboard, One 32GPX, Four P6490s, One 30DSM, Two P6109Bs, and Performance Analysis SW.

Opt. 1S – Substitute One 32GPD with 32 K Acquisition Memory ..... **+$2,000**

3002CX
3002C M/F with One 30MPX **$9,995**
Includes: 3002C, 14 in. Color Monitor, HDD, 720 KB Floppy, Keyboard, One 30MPX, One P6480 and Performance Analysis SW.

3002CXX
3002C M/F with Two 30MPXs **$15,995**
Includes: 3002C, 14 in. Color Monitor, HDD, 720 KB Floppy, Keyboard, Two 30MPXs, Two P6480s, and Performance Analysis SW.

3002CH
3002C M/F with One 30HSM **$9,995**
Includes: 3002C, 14 in. Color Monitor, HDD, 720 KB Floppy, Keyboard, One 30HSM, and Two P6487s.

3002CHH
3002C M/F with Two 30 HSMs **$15,995**
Includes: 3002C, 14 in. Color Monitor, HDD, 720 KB Floppy, Keyboard, Two 30HSMs, and Four P6487s.

3002CXH
3002C with One 30MPX and One 30HSM **$15,995**
Includes: 3002C, 14 in. Color Monitor, HDD, 720 KB Floppy, Keyboard, One 30MPX, One P6480, One 30HSM, Two P6487s and Performance Analysis SW.

3002CXD
3002C with One 30MPX and One 30DSM **$15,995**
Includes: 3002C, 14 in. Color Monitor, HDD, 720 KB Floppy, Keyboard, One 30MPX, One P6480, One P6486, One 30DSM, Two P6109Bs, and Performance Analysis SW.

3002CHD
3002C with One 30HSM and One 30DSM **$15,995**
Includes: 3002C, 14 in. Color Monitor, 100 MB HDD, 720 KB Floppy, Keyboard, One 30HSM, Two P6487s, One 30DSM, and Two P6109Bs.

The above 3002 systems have options to substitute the color monitor with a flat panel display, add additional leadsets, and other options to customize the systems to your needs.

3002 SERIES MAINFRAMES

3002C
Two-slot System Mainframe with Color Monitor **$6,000**
Includes: 14 in. Color Monitor, Hard Disk, 720 KB Floppy, QWERTY Keyboard.

3002P
Two-slot System Mainframe with EL Flat-panel Display **$6,700**
Includes: 9 in. Electroluminescent Flat-panel Display, Hard Disk, 720 KB Floppy, and QWERTY Keyboard.

3002E
Two-slot System Expansion Mainframe **$2,000**
Includes: 9 in. and 4 ft. TekLink Cable, Mainframe Mounting Plate.

INTERNATIONAL POWER PLUGS OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**
Opt. A2 – United Kingdom 240 V, 50 Hz ..... **NC**
Opt. A3 – Australian 240 V, 50 Hz ..... **NC**
Opt. A4 – North American 240 V, 60 Hz ..... **NC**
Opt. A5 – Switzerland 220 V, 50 Hz ..... **NC**

See Customer Information Section for additional description.

Continued on next page.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 3000 Series complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Configurations

ORDERING INFORMATION

3002 SERIES INSTRUMENT MODULES

32GPX
General Purpose and Microprocessor Analysis Module **$7,995**
Includes: 8 K Acquisition Memory and Four P6490 Probes and Leadsets.
Opt. 1A – 32PA Performance Analysis Software ..... **+$650**
Opt. 2W – Add One Welding Connector ..... **+$35**

32GPD
General Purpose and Microprocessor Analysis Module **$9,995**
Includes: 32 K Acquisition Memory and Four P6490 Probes and Leadsets.
Opt. 1A – 32PA Performance Analysis Software ..... **+$650**
Opt. 2W – Add One Welding Connector ..... **+$35**

30MPX
8/16/32-Bit Microprocessor Analysis Application Module **$6,000**
Includes: P6480 State Probe without Leadset.
Opt. 1A – 30DA01 Performance Analysis Software ..... **+$650**
Opt. 1F – P6480 General Purpose Probe Adapter ..... **+$450**
Opt. 1H – One P6486 Timing Probe ..... **+$1,000**
Opt. 1L – One P6486 High-performance Leadset ..... **+$500**

30HSM
High-speed Application Module **$6,000**
Includes: Two P6487 with Standard Leadset.
Opt. 2A – 18-CH 95 MHz Sync Mode Adapter (req. Opt. 1L) .. **+$750**
Opt. 1L – Add Two High-performance Leadsets ..... **+$1,000**
Opt. 4L – Add One 2 GHz Leadset ..... **+$1,200**
Opt. 5L – Add Two 2 GHz Leadsets ..... **+$2,400**

30DSM
Digitizing Oscilloscope Module **$6,000**
Includes: Two P6109B – 10:1 Probes.

SERVICE ASSURANCE OPTIONS

Opt. R2 – Adds two years of post-warranty Repair Protection
30DSM/30HSM/30MPX, ... **+$260**
3001GPX/3001HSM ..... **+$400**
3001MPX ..... **+$260**
3002C ..... **+$260**
3002CG ..... **+$400**
3002CGD/3002CGG/3002CGH ..... **+$590**
3002CH/3002CHD3002CHH/3002CX/3002CXD/ 3002CXH/3002CXX ..... **+$400**
3002E ..... **+$100**
3002ED ..... **+$260**
3002P ..... **+$260**
32GPD ..... **+$400**
32GPX ..... **+$260**

Opt. Q0 Onsite Installation –
32GPX ..... **+$495**
32GPD ..... **+$495**

ADDITIONAL ACCESSORIES

P6490
32GPX Data Acquisition Probe **$1,200**

P6480
30MPX State Data Acquisition Probe Without Lead **$750**
Opt. 1F – Add General Purpose Probe Adapter ..... **+$450**

P6486
High-speed Data Acquisition Probe with Standard Leadset for 30MPX **$1,000**
Opt. 1L – Add One High-performance Leadset ..... **+$500**

P6487
High-speed Data Acquisition Probe with Standard Leadset for 30HSM **$1,100**
Opt. 1L – Add One High-performance Leadset ..... **+$500**
FasTrak – Micro-Training Package **$450**
CenTrak – High-speed Demo Fixture **$450**

1200C01
RS-232 COMM Pack **$750**

30C02
GPIB COMM Pack **$850**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 3000 Series complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

Configurations

ORDERING INFORMATION

PROTOTYPE DEBUG TOOL SUPPORT PACKAGES

30RP2
General Purpose PDT with ROM Probe **$2,000**

Opt. 01 – Add 24/28/32-Pin General Purpose ROM Probe Adapter ..... **+$350**

Opt. 02 – Add 40-Pin DIP ROM Probe Adapter ..... **+$350**

32GPX/32GPD MICROPROCESSOR SUPPORT PACKAGES

32DM02
8085 Disassembly Software, Socketed 40-Pin DIP **$1,000**

32DM04
8086/8088/80C86/80C88 Disassembly Software, Socketed 40-Pin DIP **$1,500**

32DM06
80186/80188/80C186/80C188 Disassembly Software, Socketed 68-Pin PGA **$1,500**

Opt. 1S – Substitute Socketed 68-Pin PLCC ..... **NC**

32DM07
8031/8051 Disassembly Software, Socketed 40-Pin Dip **$1,000**

32DM08
80286/80C286 Disassembly Software, Supports Socketed 69-Pin PGA **$1,500**

Opt. 1S – Substitute Socketed 68-Pin PLCC ..... **NC**

32DM09
80386DX Disassembly Software, Socketed 132-Pin PGA **$2,000**

Opt. 1S – Substitute Soldered 132-Pin JEDEC PQFP (AMD Devices only) ..... **NC**

32DM10
80386SX Disassembly Software, Soldered 100-Pin JEDEC PQFP **$2,000**

32DM12A
80486DX/DX2/486SX/487SX Disassembly Software, Socketed 168-Pin PGA **$2,000**

32DM13A
Pentium Disassembly Software, Socketed 273-Pin PGA **$4,000**

32DM21
6800/2/8 Disassembly Software, Socketed 40-Pin DIP **$1,000**

32DM24
6809/6809E Disassembly Software, Socketed 40-Pin DIP **$1,000**

32DM27
68000/68010/68HC000/68HC001/68EC000 Disassembly SW, Socketed 64-Pin DIP (68000/010/HC000) **$1,500**

Opt. 1S – Substitute Socketed 68-Pin PGA (68000/010/HC000/HC001) ..... **NC**

Opt. 2S – Substitute Socketed 68-Pin PLCC (68EC000) ..... **NC**

Opt. 3S – Substitute Socketed 68-Pin PLCC (68HC000) ..... **NC**

32DM31
68020/68EC020 Disassembly Software, Socketed 114-Pin PGA (68020) **$2,000**

Opt. 1S – Substitute Socketed 100-Pin PGA (68EC020) ..... **NC**

Opt. 2S – Substitute Soldered 132-Pin JEDEC CQFP (68020) ... **NC**

32DM33
68030/68EC030 Disassembly Software, Socketed 128-Pin PGA **$2,000**

Opt. 1S – Substitute Soldered 132-Pin JEDEC CQFP ..... **NC**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 3000 Series complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Microprocessor Support Chart

MICROPROCESSOR SUPPORT SELECTION GUIDE

Microprocessor Type & Package	TLA 500/DAS® 92A96/C96 D/XD/SD	3000 Series 32GPX/GPD	3000 Series 30MPX
AMD			
AM80386DX QFP-132 (soldered)	√	√	√
AM80486DX PGA-168 (socketed)	√	√	
AM80486SX PGA-168 (socketed)	√	√	
29000 PGA-169 (socketed)	√		
29050 PGA-169 (socketed)	√		
29205 QFP-100 (soldered)	√	√	
AT&T			
DSP3210 QFP-132 (soldered)	√	√	
CYPRESS SEMICONDUCTOR			
CY7C601 Sparc PGA-208 (socketed)	√		
DIGITAL EQUIPMENT CORP.			
Alpha AXP 21064 PGA-431 (socketed)	√		
FUJITSU			
MB86903 Sparc PGA-208 (socketed)	√		
SparcLite 86930 PGA-179 (socketed)	√	√	
INTEGRATED DEVICE TECHNOLOGY (IDT)			
R3000 PGA-145 (socketed)	√		
R3000A PGA-175 (socketed)	√		
R3051 PGA-88 (socketed)	√	√	
R3051 PLCC-84 (socketed)	√	√	
R3052 PGA-88 (socketed)	√	√	
R3052 PLCC-84 (socketed)	√	√	
R3081 PGA-88 (socketed)	√	√	
R3081 PLCC-84 (socketed)	√	√	
R4000PC PGA-179 (socketed)	√		
R4000SC PGA-447 (socketed)	√		
R4000MC PGA-447 (socketed)	√		
R4400PC PGA-179 (socketed)	√		
R4400SC PGA-447 (socketed)	√		
R4400MC PGA-447 (socketed)	√		
INTEL			
8031 DIP-40 (soldered)	√	√	√
8031 DIP-40 (socketed)	√	√	√
8031 PLCC-44 (socketed)	√	√	√
8031 PLCC-44 (soldered)	√	√	√
8032 DIP-40 (soldered)	√	√	√
8032 DIP-40 (socketed)	√	√	√
8032 PLCC-44 (socketed)	√	√	√
8032 PLCC-44 (soldered)	√	√	√
8051 DIP-40 (soldered)	√	√	√
8051 DIP-40 (socketed)	√	√	√
8051 PLCC-44 (socketed)	√	√	√
8051 PLCC-44 (soldered)	√	√	√
8052 DIP-40 (soldered)	√	√	√
8052 DIP-40 (socketed)	√	√	√
8052 PLCC-44 (socketed)	√	√	√
8052 PLCC-44 (soldered)	√	√	√
80C152 DIP-48 (socketed)	√	√	√
80C152 DIP-48 (soldered)	√	√	√
80C152 PLCC-68 (socketed)	√	√	√
80C152 PLCC-68 (soldered)	√	√	√
80C452 PLCC-68 (socketed)	√	√	√
80C452 PLCC-68 (soldered)	√	√	√
80515 PLCC-68 (socketed)	√	√	√
80515 PLCC-68 (soldered)	√	√	√
80532 PLCC-68 (socketed)	√	√	√
80532 PLCC-68 (soldered)	√	√	√
80535 PLCC-68 (socketed)	√	√	√
80535 PLCC-68 (soldered)	√	√	√
83C152 DIP-48 (socketed)	√	√	√
83C152 DIP-48 (soldered)	√	√	√
83C152 PLCC-68 (socketed)	√	√	√
83C152 PLCC-68 (soldered)	√	√	√
83C452 PLCC-68 (socketed)	√	√	√
83C452 PLCC-68 (soldered)	√	√	√
83C537 PLCC-84 (socketed)	√	√	√
83C537 PLCC-84 (soldered)	√	√	√
8096BH PLCC-68 (socketed)	√	√	
8096BH PLCC-68 (soldered)	√	√	
8096BH PGA-68 (socketed)	√	√	
8396BH PLCC-68 (socketed)	√	√	
8396BH PLCC-68 (soldered)	√	√	
8396BH PGA-68 (socketed)	√	√	
8097BH PLCC-68 (socketed)	√	√	
8097BH PLCC-68 (soldered)	√	√	
8097BH PGA-68 (socketed)	√	√	
8097JF PLCC-68 (socketed)	√	√	
8097JF PLCC-68 (soldered)	√	√	
8097JF PGA-68 (socketed)	√	√	
8397BH PLCC-68 (socketed)	√	√	
8397BH PLCC-68 (soldered)	√	√	
8397BH PGA-68 (socketed)	√	√	
8397JF PLCC-68 (socketed)	√	√	
8397JF PLCC-68 (soldered)	√	√	
8397JF PGA-68 (socketed)	√	√	
8797BH PLCC-68 (socketed)	√	√	
8797BH PLCC-68 (soldered)	√	√	
8797BH PGA-68 (socketed)	√	√	
8797JF PLCC-68 (socketed)	√	√	
8797JF PLCC-68 (soldered)	√	√	
8797JF PGA-68 (socketed)	√	√	
80C196KB PLCC-68 (socketed)	√	√	
80C196KB PLCC-68 (soldered)	√	√	
80C196KB PGA-68 (socketed)	√	√	
87C196KB16 PLCC-68 (socketed)	√	√	
87C196KB16 PLCC-68 (soldered)	√	√	
87C196KC PLCC-68 (socketed)	√	√	
87C196KC PLCC-68 (soldered)	√	√	
87C196KD PLCC-68 (socketed)	√	√	
87C196KD PLCC-68 (soldered)	√	√	
8085 DIP-40 (socketed)	√	√	
8085 DIP-40 (soldered)	√	√	
8086 DIP-40 (socketed)	√	√	√
8086 DIP-40 (soldered)	√	√	√
8086 PLCC-44 (socketed)	√	√	√
8086 PLCC-44 (soldered)	√	√	√

SUPPORT FOR DAS®, TLA AND 3000 SERIES PRODUCTS

Exclusive microprocessor support with many features not found on other logic analyzers is available for the DAS®, TLA and 3000 Series Products.

When selecting microprocessor support there are three areas that you should consider: (1) connecting your device, (2) acquiring data, and (3) viewing your data.

PLEASE NOTE: Support for new microprocessors is constantly being introduced and our support is continually expanding and being updated. Please consult your local sales engineer if the device or package that you are using is not listed.

Microprocessor Support Chart

Microprocessor Type & Package	TLA 500/DAS® 92A96/C96 D/XD/SD	3000 Series 32GPX/GPD	3000 Series 30MPX
80C86 DIP-40 (socketed)	√	√	√
80C86 DIP-40 (soldered)	√	√	√
80C86 PLCC-44 (socketed)	√	√	√
80C86 PLCC-44 (soldered)	√	√	√
8088 DIP-40 (socketed)	√	√	√
8088 DIP-40 (soldered)	√	√	√
8088 PLCC-44 (socketed)	√	√	√
8088 PLCC-44 (soldered)	√	√	√
80C88 DIP-40 (socketed)	√	√	√
80C88 DIP-40 (soldered)	√	√	√
80C88 PLCC-44 (socketed)	√	√	√
80C88 PLCC-44 (soldered)	√	√	√
80186 PGA-68 (socketed)	√	√	√
80186 LCC-68 (socketed)	√	√	√
80186 PLCC-68 (socketed)	√	√	√
80186 PLCC-68 (soldered)	√	√	√
80186 QFP-80 (soldered)	√	√	√
80C186/EA/XL PGA-68 (socketed)	√	√	√
80C186/EA/XL LCC-68 (socketed)	√	√	√
80C186/EA/XL PLCC-68 (socketed)	√	√	√
80C186/EA/XL PLCC-68 (soldered)	√	√	√
80C186/EA/XL QFP-80 (soldered)	√	√	√
80188 PGA-68 (socketed)	√	√	√
80188 LCC-68 (socketed)	√	√	√
80188 PLCC-68 (socketed)	√	√	√
80188 PLCC-68 (soldered)	√	√	√
80188 QFP-80 (soldered)	√	√	√
80C188/EA/XL PGA-68 (socketed)	√	√	√
80C188/EA/XL LCC-68 (socketed)	√	√	√
80C188/EA/XL PLCC-68 (socketed)	√	√	√
80C188/EA/XL PLCC-68 (soldered)	√	√	√
80C188/EA/XL QFP-80 (soldered)	√	√	√
80286 PGA-68 (socketed)	√	√	√
80286 LCC-68 (socketed)	√	√	√
80286 PLCC-68 (socketed)	√	√	√
80286 PLCC-68 (soldered)	√	√	√
80376 PQFP-100 (3M/T socketed)	√		√
80376 PQFP-100 (Amp. socketed)	√		√
80376 PQFP-100 (soldered)	√	√	√
80376 PGA-100 (socketed)	√	√	√
80386EX	√	√	√
80386SX PQFP-100 (3M/T socketed)	√		√
80386SX PQFP-100 (Amp. socketed)	√		√
80386SX PQFP-100 (soldered)	√	√	√
80386DX PGA-132 (socketed)	√	√	√
80486SX PGA-168 (socketed)	√		
80486DX PGA-168 (socketed)	√		
80486DX-50 PGA-168 (socketed)	√		
80486DX2 PGA-168 (socketed)	√		
80486DX4 PGA-168 (socketed)	√	√	
80487SX PGA-168 (socketed)	√	√	
Pentium™ 60/66 PGA-273 (socketed)	√	√	
Pentium™ 90/100 PGA-296 (socketed)	√	√	
80960KA PGA-132 (socketed)	√		
80960KA QFP-164 (soldered)	√		
80960KB PGA-132 (socketed)	√		
80960KB QFP-164 (soldered)	√		
80960MC PGA-132 (socketed)	√		
80960MC QFP-164 (soldered)	√		
80960CA QFP-196 (socketed)	√	√	
80960CA PGA-168 (socketed)	√	√	
80960CF PGA-168 (socketed)	√	√	
80960CF QFP-196 (soldered)	√	√	

Microprocessor Type & Package	TLA 500/DAS® 92A96/C96 D/XD/SD	3000 Series 32GPX/GPD	3000 Series 30MPX
i860XR PGA-168 (socketed)	√		
i860XP	√		
LSI LOGIC			
64811 Sparc PGA-208 (socketed)	√		
R3000 PGA-145 (socketed)	√		
R3000A PGA-175 (socketed)	√		
R4000PC PGA-179 (socketed)	√		
R4000SC PGA-447 (socketed)	√		
R4000MC PGA-447 (socketed)	√		
R4400PC PGA-179	√		
R4400SC PGA-447	√		
R4400MC PGA-447	√		
MOTOROLA			
6800 DIP-40 (socketed)		√	
6800 DIP-40 (soldered)		√	
6802 DIP-40 (socketed)		√	
6802 DIP-40 (soldered)		√	
6805 DIP-40 (Eval. Board)		√	
6809 DIP-40 (socketed)		√	
6809 DIP-40 (soldered)		√	
6809 PLCC-44 (socketed)		√	
6809E DIP-40 (socketed)		√	
6809E DIP-40 (soldered)		√	
68HC11 DIP-40 (socketed)	√	√	√
68HC11 DIP-40 (soldered)	√	√	√
68HC11 DIP-48 (socketed)	√	√	√
68HC11 DIP-48 (soldered)	√	√	√
68HC11 PLCC-44 (socketed)	√	√	√
68HC11 PLCC-44 (soldered)	√	√	√
68HC11 PLCC-52 (socketed)	√	√	√
68HC11 PLCC-52 (soldered)	√	√	√
68HC11 PLCC-68 (socketed)	√	√	√
68HC11 PLCC-68 (soldered)	√	√	√
68HC11 PLCC-84 (socketed)	√	√	√
68HC11 PLCC-84 (soldered)	√	√	√
68HC16 QFP-132 (soldered)	√	√	
68HC16 Eval. Brd.	√	√	
68302 PGA-132 (socketed)	√	√	√
68302 QFP-132 (soldered)	√	√	√
68331 QFP-132 (socketed)	√	√	√
68332 QFP-132 (socketed)	√	√	√
68340 PGA-145 (socketed)	√	√	
68340 QFP-144 (soldered)	√	√	
68349 QFP-160 (soldered)	√	√	
68360 PGA-241 (socketed)	√	√	
68360 QFP-240 (soldered)	√	√	
CPU-32 BCC	√	√	
68000 DIP-64 (socketed)	√	√	√
68000 PGA-68 (socketed)	√	√	√
68000 PLCC-68 (soldered)	√	√	√
68000 PLCC-68 (socketed)	√	√	√
68EC000 PLCC-68 (socketed)		√	
68EC000 PLCC-68 (soldered)		√	
68HC000 PGA-68 (socketed)	√	√	√
68HC000 DIP-64 (socketed)	√	√	√
68HC000 PLCC-68 (soldered)	√	√	√
68HC000 PLCC-68 (socketed)	√	√	√
68HC001 PGA-68 (socketed)		√	
68HC001 PLCC-68 (socketed)		√	
68HC001 PLCC-68 (soldered)		√	

Continued on next page.

Microprocessor Support Chart

Microprocessor Type & Package	TLA 500/DAS® 92A96/C96 D/XD/SD	3000 Series 32GPX/GPD	3000 Series 30MPX
68010 DIP-64 (socketed)	√	√	√
68010 PGA-68 (socketed)	√	√	√
68010 PLCC-68 (soldered)	√	√	√
68010 PLCC-68 (socketed)	√	√	√
68020 PGA-114 (socketed)	√	√	√
68020 QFP-132 (soldered)	√	√	
68020 QFP-132 (socketed)	√	√	
68EC020 PGA-100 (socketed)	√	√	
68EC020 QFP-100 (socketed)	√	√	
68030 PGA-128 (socketed)	√	√	√
68030 QFP-132 (soldered)	√	√	
68030 QFF-132 (socketed)	√	√	
68EC030 PGA-128 (socketed)	√	√	
68040 PGA-179 (socketed)	√	√	
68EC040 PGA-179 (socketed)	√	√	
68LC040 PGA-179 (socketed)	√	√	
68060 PGA-223 (socketed)	√	√	
88100 PGA-181 (socketed)	√		
88110 PGA-300 (socketed)	√	√	
56000 PGA-88 (socketed)	√	√	√
56000 QFP-132 (soldered)	√	√	
56001 PGA-88 (socketed)	√	√	√
56001 QFP-132 (soldered)	√	√	
56002 PGA-132 (socketed)		√	
56002 QFP-132 (soldered)		√	
96002 PGA-223 (socketed)	√		
MPC601	√	√	
MPC603	√	√	
MPC604	√	√	
NEC			
R3000 PGA-145 (socketed)	√		
R3000A PGA-175 (socketed)	√		
R4000PC PGA-179 (socketed)	√		
R4000SC PGA-447 (socketed)	√		
R4000MC PGA-447 (socketed)	√		
R4200PC PGA-179 (socketed)	√		
R4400PC PGA-179 (socketed)	√		
R4400SC PGA-447 (socketed)	√		
R4400MC PGA-447 (socketed)	√		
PERFORMANCE SEMICONDUCTOR			
R3000 PGA-145 (socketed)	√		
R3000A PGA-175 (socketed)	√		
R3400 PGA-145 (socketed)	√		
R3400A PGA-175 (socketed)	√		
R4000PC PGA-179 (socketed)	√		
R4000SC PGA-447 (socketed)	√		
R4000MC PGA-447 (socketed)	√		
R4400PC PGA-179 (socketed)	√		
R4400SC PGA-447 (socketed)	√		
R4400MC PGA-447 (socketed)	√		
ROCKWELL			
6502 (S/W only)	√		
65C02 (S/W only)	√		
65RC02 (S/W only)	√		
65802 (S/W only)	√		
TEXAS INSTRUMENTS			
TMS32020 PGA-68 (socketed)	√	√	
TMS32020 PLCC-68 (socketed)	√	√	
TMS320C25 PGA-68 (socketed)	√	√	
TMS320C25 PLCC-68 (socketed)	√	√	
TMS320C26 PLCC-68 (socketed)	√	√	

Microprocessor Type & Package	TLA 500/DAS® 92A96/C96 D/XD/SD	3000 Series 32GPX/GPD	3000 Series 30MPX
TMS320C30 PGA-181 (socketed)	√	√	
TMS320C31 QFP-132 (soldered)	√	√	
TMS320C40 PGA-325 (socketed)	√	√	
TMS320C50 QFP-132 (soldered)	√		
SuperSparc MBus	√	√	
ZILOG			
Z80 DIP-40 (socketed)	√	√	√
Z80 DIP-40 (soldered)	√	√	√
MIL-STD 1750A			
PACE 1750	√	√	
PACE 1750A (S/W only)	√	√	
Bendix BX1750A (S/W only)	√	√	
Generic 1750A (S/W only)	√	√	
BUS Support			
IEEE-488 (GPIB)	√	√	
Futurebus+	√		
MIL-STD 1553	√	√	
SCSI I/II "A" (8-Bit unshielded ribbon)	√	√	
SCSI I/II "A" (8-Bit shielded ribbon)	√	√	
SCSI I/II "A" (8-Bit shielded high-density)	√	√	
SCSI III "P" (8-Bit shielded high-density)	√	√	
VME	√	√	
ISA	√	√	
EISA	√	√	
Micro Channel	√	√	
PCI	√	√	

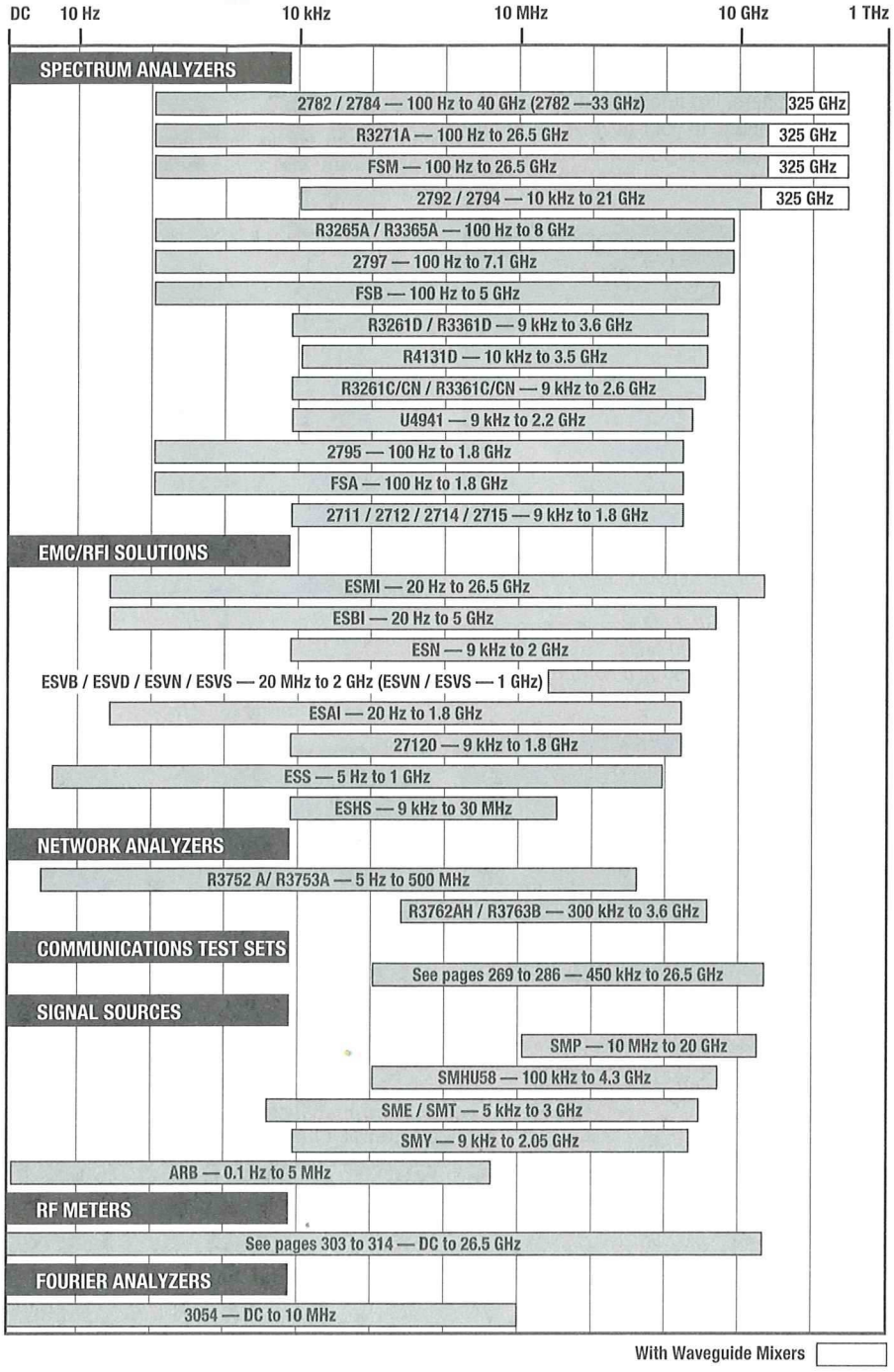
Package Type	Nomenclature (Package of 8)
JEDEC, 0.025 in. Pitch 68 lead (17 x 17) (soldered)	PJ25X17
JEDEC, 0.025 in. Pitch 84 lead (21 x 21) (soldered)	PJ25X21
JEDEC, 0.025 in. Pitch 100 lead (25 x 25) (soldered)	PJ25X25
JEDEC, 0.025 in. Pitch 132 lead (33 x 33) (soldered)	PJ25X33
JEDEC, 0.025 in. Pitch 164 lead (41 x 41) (soldered)	PJ25X41
JEDEC, 0.025 in. Pitch 196 lead (49 x 49) (soldered)	PJ25X49
EIAJ, 0.5 mm Pitch 80 lead (20 x 20) (soldered)	PE50X20
EIAJ, 0.5 mm Pitch 100 lead (25 x 25) (soldered)	PE50X25
EIAJ, 0.5 mm Pitch 144 lead (36 x 36) (soldered)	PE50X36
EIAJ, 0.5 mm Pitch 208 lead (52 x 52) (soldered)	PE50X52
EIAJ, 0.5 mm Pitch 304 lead (76 x 76) (soldered)	PE50X76
EIAJ, 0.65 mm Pitch 112 lead (28 x 28) (soldered)	PE65X28
EIAJ, 0.65 mm Pitch 144 lead (36 x 36) (soldered)	PE65X36

RF and Wireless Test Products

Tektronix RF and Wireless Test Capabilities Cover a Broad Spectrum!

Tektronix offers a value-packed line of RF and microwave products. The list includes a wide selection of spectrum analyzers, signal analyzers, network analyzers, signal sources, communications test sets, RF meters, frequency counters, along with complementary ancillary equipment and software The chart below provides an overview of the span of frequencies covered by these products. For further information on specific products, refer to the following catalog pages.

RF AND WIRELESS TEST PRODUCTS PERFORMANCE CHART



CONTENTS

FULL RANGE MICROWAVE SPECTRUM ANALYZERS
100 Hz to 40 GHz.....181, 188, 195, 202

QUASI MICROWAVE SPECTRUM ANALYZERS
100 Hz to 8 GHz.....188, 195, 202, 215, 220

RF/VHF/UHF SPECTRUM ANALYZERS
100 Hz to 2.2 GHz.....188, 195, 206, 210, 218

CABLE TV MEASUREMENT SPECTRUM ANALYZERS
9 kHz to 1.8 GHz.....210

TRACKING GENERATORS.....224
EMI, RFI SOLUTIONS.....231
NETWORK ANALYZERS.....256
COMMUNICATION TEST SETS.....269
SIGNAL SOURCES.....287
RF METERS.....303
FOURIER ANALYZERS.....315
ANCILLARY INSTRUMENTS.....235
SPECTRUM ANALYZER SOFTWARE.....233
WAVEGUIDE MIXERS.....187, 194

RF and Wireless Test Products

Complete line of RF and microwave instruments to cover your measurement needs.

APPLICATIONS

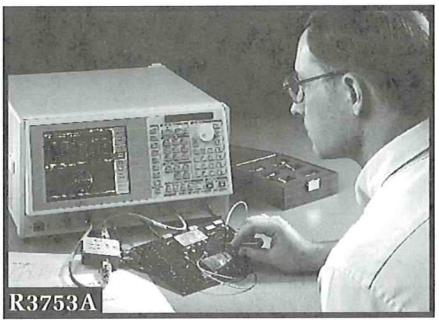
- Bio-medical
- Cable TV
- Education
- EMC
- Design and Development
- Manufacturing Test
- Research
- Satellite Communication
- Service
- Wireless Communications
- TV/Radio Broadcasting

Tektronix Microwave and RF Products – At Home Where Your Measurements Are!

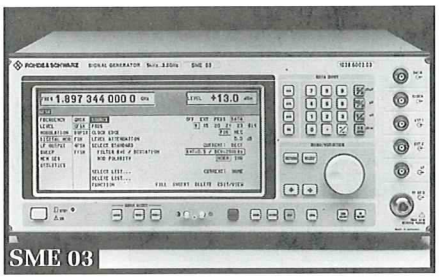
Tektronix Microwave and RF Products are versatile performers – they're at home wherever your measurements are – in the lab, in the field, or on the manufacturing floor.

Tektronix products cover a broad spectrum of applications in the time and frequency domain – Bio-medical, Cable TV, Education, EMC, Design and Development, Manufacturing Test, Research, Service, Satellite Communication, to name only a few.

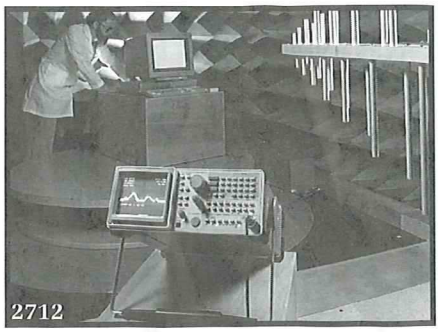
We've only shown a few of the hundreds of applications here. For information about Tektronix solutions to your microwave and RF or other test needs, call your local Tektronix sales representative or call (800) 426-2200.



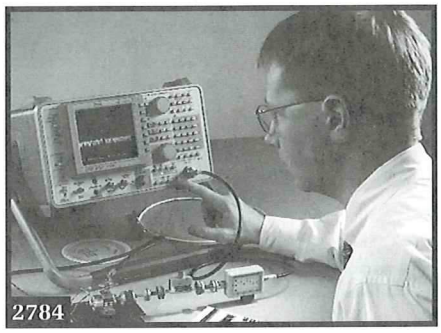
Combining high speed and a wide dynamic range, the R3753A Network Analyzer is an ideal measurement tool for fully characterizing a wide variety of electronic components from 5 Hz to 500 MHz. This photo shows an engineer making a complex impedance measurement on an RF sub-assembly.



Designed with digital communications in mind, the 5 kHz to 3 GHz SME03 Signal Generator provides frequency accuracy, spectral purity, and all common digital modulation modes.



Tektronix spectrum analyzers offer solutions for all phases of EMC testing. The 2712 shown here is available as part of the 27120 EMC Pre-/Post-Certification Measurement System which provides a comprehensive and affordable means of significantly improving the probability of formal EMC certification on the first try. The system is designed for testing to FCC, VDE, VCCI, EC, and other EMC requirements.



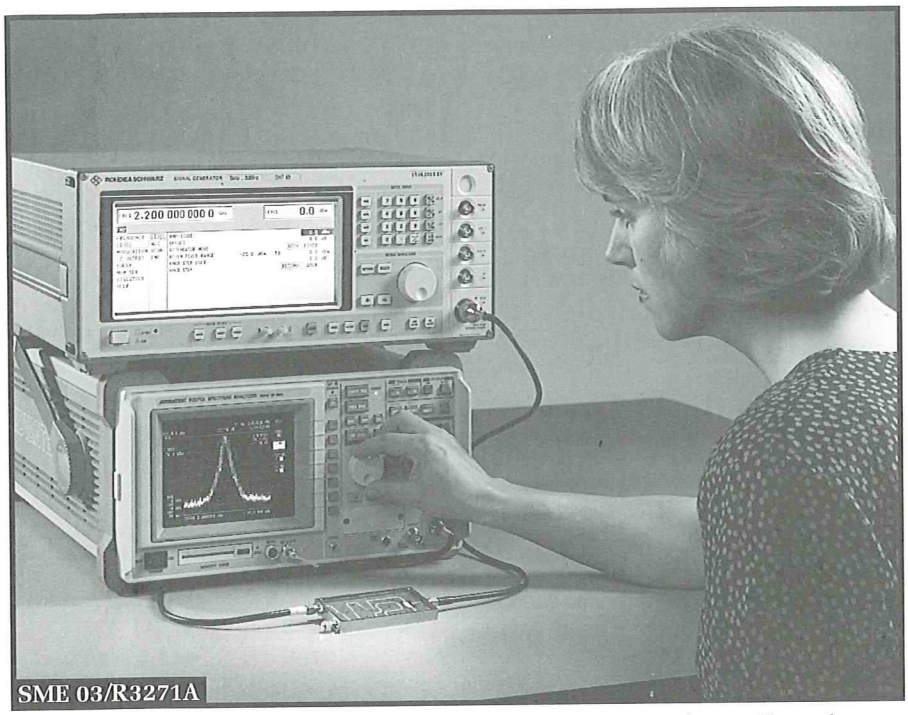
The 2784 Spectrum Analyzer is available with a full range of millimeter waveguide mixers to 325 GHz. Shown here, an engineer is measuring the spectral purity of an Impatt oscillator at 75 GHz.



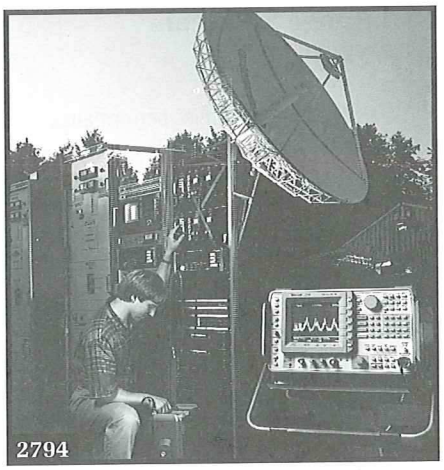
The lightest weight and smallest size of any spectrum analyzer in its class, the U4941 is the world's first spectrum analyzer with a flat-panel color display. The U4941 covers a frequency range from 9 kHz to 2.2 GHz and weighs just 14.3 lbs. (6.5 kg).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

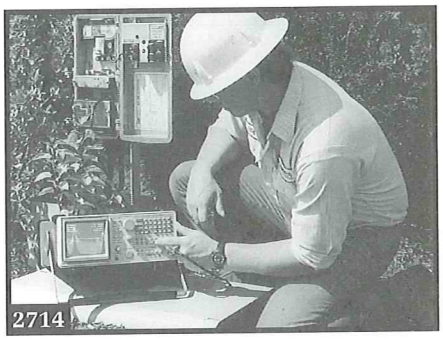
RF and Wireless Test Products



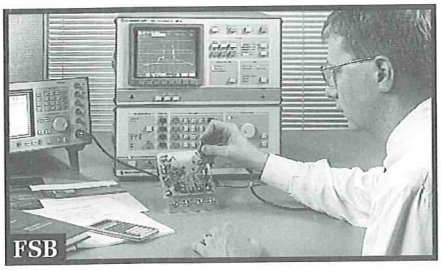
Simulating burst transmission (TDMA) is critical for cellular system design. Shown here, the engineer is using instruments designed for burst transmission simulation and recovery; the SME03 Signal Generator and R3271A Spectrum Analyzer.



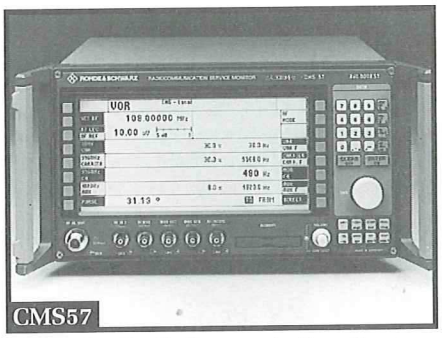
A frequency range of 10 kHz through 325 GHz makes the Tektronix 2794 ideal for satellite communication system installation and maintenance.



Cable TV proof-of-performance measurements in the field have never been easier. With the 2714 or 2715 Cable TV Spectrum Analyzer, all commonly needed cable TV measurements can be preconfigured for simple push-button execution and data collection. High portability allows the automatic measurement power to be applied anywhere in the field. Back at the office, measurements can be downloaded from memory to the accompanying PC software for report generation.



The engineer in this photo is making a critical measurement on a digital subassembly with the laboratory standard FSB 100 Hz to 5 GHz Spectrum Analyzer.



The CMS57 Radio Communications Service Monitor covers the 0.4 to 1,000 MHz frequency range and can be used for all transmitter and receiver measurements on transceivers with AM, FM, SSB, and phase modulation. The CMS57 can also generate all avionics test signals for VOR, ILS, and MB.

Spectrum Analyzers

Full Range Spectrum Analyzers

2784
- 100 Hz to 40 GHz premier performance portable spectrum analyzer

2782
- 100 Hz to 33 GHz premium performance portable spectrum analyzer

R3271A
- 100 Hz to 26.5 GHz digital wireless featured portable spectrum analyzer

R3371A
- 100 Hz to 26.5 GHz digital wireless featured portable spectrum analyzer with tracking generator

FSM
- 100 Hz to 26.5 GHz laboratory measurement standard spectrum analyzer

FSMS
- 100 Hz to 26.5 GHz laboratory measurement standard spectrum analyzer with tracking generator

2794
- 10 kHz to 21 GHz MIL-T-28800 Class 3 laboratory-grade portable spectrum analyzer

2792
- 10 kHz to 21 GHz MIL-T-28800 Class 3 economical wide-range portable spectrum analyzer

SPECTRUM ANALYZER SELECTION GUIDE

FULL RANGE MICROWAVE SPECTRUM ANALYZERS

Specifications	2784	2782	R3271A R3371A	FSM FSMS	2794	2792
Frequency Range	100 Hz to 40 GHz	100 Hz to 33 GHz	100 Hz to 26.5 GHz	100 Hz to 26.5 GHz	10 kHz to 21 GHz	10 kHz to 21 GHz
Frequency Measurement Accuracy	±145 Hz @ 20 GHz CF	±145 Hz @ 20 GHz CF	±210 Hz @ 10 GHz CF	±25 Hz @ 10 GHz CF	±18 Hz @ 10 GHz CF	±1010 Hz, Opt. 03 @ 10 GHz CF
Resolution BW Range	3 Hz to 10 MHz 1, 3, 10 sequence	3 Hz to 10 MHz 1, 3, 10 sequence	10 Hz to 3 MHz 1, 3, 10 sequence	10 Hz to 3 MHz 1, 3, 10 sequence	10 Hz to 3 MHz 1, 10 sequence	1 kHz to 3 MHz 1, 10 sequence
Residual FM	≤1 Hz	≤1 Hz	3 Hz	≤1 Hz p-p in 10 s +0.6 Hz/GHz >2 GHz	≤3 Hz	≤12 Hz
Phase Noise	–105 dBc/Hz @ 20 GHz CF, 10 kHz offset	–105 dBc/Hz @ 20 GHz CF, 10 kHz offset	–102 dBc/Hz @ 10 GHz CF, 10 kHz offset	–98 dBc/Hz @ 20 kHz CF, 10 kHz offset	–94 dBc/Hz @ 10 GHz CF, 10 kHz offset	–94 dBc/Hz @ 10 GHz CF, 10 kHz offset
CRT Display Range	100 dB	100 dB	100 dB	100 dB	90 dB	80 dB
Frequency Response	±5.0 dB	±4.5 dB	±4.0 dB 5.4 to 26.5 dB	±2.5 dB to 26.5 GHz	±3.5 dB 5.4 to 18 GHz	±4.0 dB 5.4 to 18 GHz
Sensitivity	–125 dBm @ 20 GHz CF	–125 dBm @ 20 GHz CF	–123 dBm @ 10 GHz CF	–135 dBm to 26.5 GHz	–111 dBm @ 10 GHz CF	–94 dBm @ 10 GHz CF
Environmental	MIL-T-28800C Class 3	MIL-T-28800C Class 3	MIL-T-28800 Class 5	0 to 55°C 80% RH	MIL-T-28800C Class 3	MIL-T-28800C Class 3
Weight	20 kg (44 lb.)	20 kg (44 lb.)	22 kg (48.5 lb.)	60 kg (145 lb.)	22.2 kg (48 lb.)	21.3 kg (46 lb.)
Features/Options						
Intelligent Markers	2	2	8	4	2	2
Tracking Generator	No	No	Yes, R3371A	Yes, FSMS	Yes, external TR503	Yes, external, TR503
Card Reader	No	No	Yes	No	No	No
Preamplifier	No	No	No	No	No	No
Quasi Peak Detector	No	No	Yes	No	No	No
CISPR Bandwidths	No	No	Yes	No	No	No
Frequency Counter	Yes	Yes	Yes	Yes	Yes	Yes
Analog Display	Yes	Yes	No	No	Yes	Yes
75 Ω Input	No	No	No	No	Yes, Opt. 07	Yes, Opt. 07
AM/FM Demodulator	No	No	Yes	Yes	No	No
GPIB	Yes, 2 ports	Yes, 2 ports	Yes	Yes	Yes	Yes
RS-232	No	No	No	Yes	No	No
Page	**181**	**181**	**202**	**195**	**188**	**188**
Prices Begin at	**$57,900**	**$49,900**	**$35,500**	**$73,030**	**$34,000**	**$24,200**

Spectrum Analyzers

Quasi Microwave Spectrum Analyzers

R3265A
- 100 Hz to 8 GHz digital wireless featured portable spectrumanalyzer

R3365A
- 100 Hz to 8 GHz digital wireless featured portable spectrumanalyzer with tracking generator

2797
- 100 Hz to 7.1 GHzMIL-T-28800 Class 3 laboratory-grade portable spectrum analyzer

FSB
- 100 Hz to 5 GHz laboratory measurement standard spectrum analyzer

FSBS
- 100 Hz to 5 GHz laboratory measurement standard spectrum analyzer with tracking generator

R3261D
- 9 kHz to 3.6 GHz digital wireless featured portable spectrum analyzer

R3361D
- 9 kHz to 3.6 GHz digital wireless featured portable spectrum analyzer with tracking generator

R4131D
- 10 kHz to 3.5 GHz versatile, economical 1 kHz RBW spectrum analyzer

R3261C/R3261CN
- 9 kHz to 2.6 GHz digital wireless featured portable spectrum analyzer

R3361C/R3261CN
- 9 kHz to 2.6 GHz digital wireless featured portable spectrum analyzer with tracking generator

SPECTRUM ANALYZER SELECTION GUIDE

QUASI MICROWAVE SPECTRUM ANALYZERS

Specifications	R3265A R3365A	2797	FSB/FSBS	R3261D R3361D	R4131D	R3261C/CN R3361C/CN
Frequency Range	100 Hz to 8 GHz	100 Hz to 7.1 GHz	100 Hz to 5 GHz	9 kHz to 3.6 GHz	10 kHz to 3.5 GHz	9 kHz to 2.6 GHz
Frequency Measurement Accuracy	±106 Hz @ 5 GHz CF	±11 Hz, Opt. 02 @ 5 GHz CF	±22 Hz @ 5 GHz CF	±25 Hz @ 1 GHz CF	100 kHz ±1 kHz @ 1 GHz CF	±25 Hz @ 1 GHz CF
Resolution BW Range	10 Hz to 3 MHz 1, 3, 10 sequence	10 Hz to 3 MHz 1, 10 sequence	10 Hz to 3 MHz 3 MHz 1, 3, 10 sequence	30 Hz to 1 MHz 1, 3, 10 sequence	1 kHz to 1 MHz 1, 3 sequence	30 Hz to 1 MHz 1, 3, 10 sequence
Residual FM	≤3 Hz	≤3 Hz	≤1 Hz p-p in 10 s	≤20 Hz	≤2 kHz p-p	≤20 Hz
Phase Noise	–108 dBc/Hz @ 5 GHz CF, 10 kHz offset	–103 dBc/Hz @ 5 GHz CF, 10 kHz offset	–109 dBc/Hz @ 5 GHz CF, 10 kHz offset	–105 dBc/Hz @ 1 GHz CF, 20 kHz offset	–110 dBc/Hz @1 GHz CF, 20 kHz offset	–105 dBc/Hz @ 1 GHz CF, 20 kHz offset
CRT Display Range	100 dB	90 dB	100 dB	80 dB	80 dB	80 dB
Frequency Response	±2.0 dB	±2.5 dB	±1.0 dB to 5.0 GHz	±1 dB	±1 dB 100 kHz to 2 GHz	±0.5 dB
Sensitivity	–135 dBm @ 5 GHz CF	–127 dBm @ 5 GHz CF	–137 dBm to 5.0 GHz	–119 dBm @ 1 GHz CF	–116 dBm 10 kHz to 1 GHz	–119 dBm @ 1 GHz CF
Environmental	MIL-T-28800 Class 5	MIL-T-28800 Class 3	0 to 55°C 80% RH	MIL-T-28800 Class 5	0 to +50°C	MIL-T-28800 Class 5
Weight	22 kg (48.5 lb.)	20.8 kg (45 lb.)	60 kg (145 lb.)	15 kg (33.1 lb.)	10 kg (22 lb.)	15 kg (33.1 lb.)
Features/Options						
Intelligent Markers	8	2	6	2	2	2
Tracking Generator	Yes, R3365A	Yes, external TR503	Yes, FSBS	Yes, R3361D	Yes, external TR4153A	Yes, R3361C, R3361CN
Card Reader	Yes	No	No	Yes	No	Yes
Preamplifier	No	No	Yes, Opt. 03	No	Yes, external R14601	No
Quasi Peak Detector	Yes	No	No	Yes	Yes	Yes
CISPR Bandwidths	Yes	No	No	Yes	9 kHz, 120 kHz	Yes
Frequency Counter	Yes	Yes	Yes	Yes	No	Yes
Analog Display	No	Yes	No	No	No	No
75 Ω Input	No	Yes, Opt. 07	No	No	Yes, R4131DN	Yes, R3261CN
AM/FM Demodulator	Yes	No	Yes	Yes	No	Yes
GPIB	Yes	Yes	Yes	Yes	Yes	Yes
RS-232	No	No	Yes	Yes, Opt. 02	No	Yes, Opt. 02
Page	**202**	**188**	**195**	**215**	**220**	**215**
Prices Begin at	**$30,475**	**$28,900**	**$58,610**	**$18,200**	**$9,200**	**$12,900**

Spectrum Analyzers

RF/VHF/UHF Spectrum Analyzers

U4941/U4941N
- 9 kHz to 2.2 GHz lightweight battery-operated portable spectrum analyzer

2795
- 100 Hz to 1.8 GHz MIL-T-28800 Class 3 laboratory-grade portable spectrum analyzer

FSA
- 100 Hz to 1.8 GHz laboratory measurement standard spectrum analyzer

FSAS
- 100 Hz to 1.8 GHz laboratory measurement standard spectrum analyzer with tracking generator

2712
- 9 kHz to 1.8 GHz full-featured portable spectrum analyzer

2714/2715
- 9 kHz to 1.8 GHz CATV measurement portable spectrum analyzer

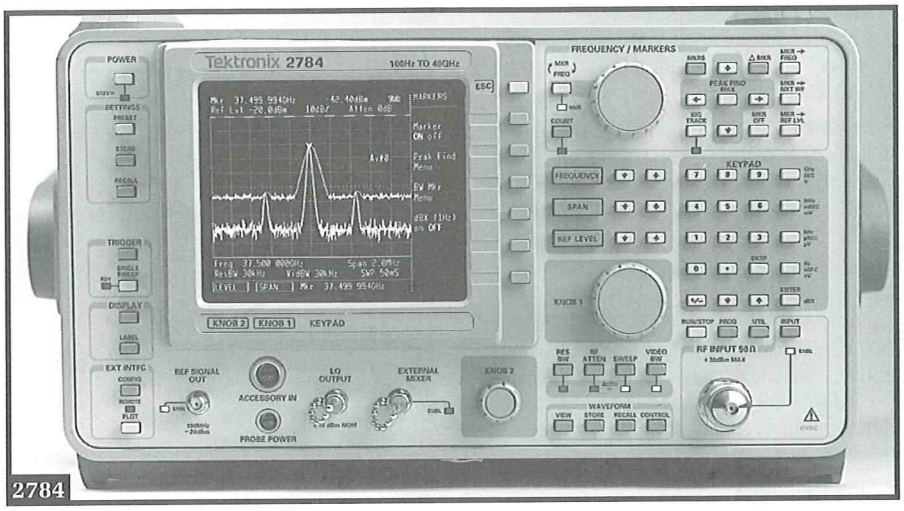
2711
- 9 kHz to 1.8 GHz versatile, economical portable spectrum analyzer

SPECTRUM ANALYZER SELECTION GUIDE

RF / VHF / UHF SPECTRUM ANALYZERS

Specifications	U4941/U4941N	2795	FSA/FSAS	2712	2714/2715	2711
Frequency Range	9 kHz to 2.2 GHz	100 Hz to 1.8 GHz	100 Hz to 1.8 GHz	9 kHz to 1.8 GHz	9 kHz to 1.8 GHz	9 kHz to 1.8 GHz
Frequency Measurement Accuracy	±2 kHz @1 GHz	±6 Hz @ 1 GHz CF	±20 Hz @ 1 GHz CF	±510 Hz @ 1 GHz CF	±510 Hz @ 1GHz CF	±15 kHz @ 1 GHz CF
Resolution BW Range	1 kHz to 3 MHz 1, 3 sequence	10 Hz to 3 MHz 1, 3 sequence	10 Hz to 3 MHz 1, 3, 10 sequence	300 Hz, 3 kHz 30 kHz, 300 kHz 5 MHz	300 Hz to 5 MHz 1, 3, 10 sequence	3 kHz, 30 kHz, 300 kHz, 5 MHz
Residual FM	3 kHz p-p	≤3 Hz	≤1 Hz p-p in 10 s	≤100 Hz	≤100 Hz	≤2 kHz
Phase Noise	–100 dBc/Hz @ 1 GHz CF, 20 kHz offset	–105 dBc @ 1 GHz CF, 10 kHz offset	–115 dBc/Hz @ 1 GHz CF, 10 kHz offset	–97 dBc @ 1 GHz CF, 10 kHz offset	–97 dBc @ 1 GHz CF, 10 kHz offset	–97 dBc @ 1 GHz CF, 10 kHz offset
CRT Display Range	90 dB	90 dB	100 dB	80 dB	80 dB	80 dB
Frequency Response	±1.0 dB 100 kHz to 2 GHz	±1.5 dB	±0.6 dB to 1.8 GHz	±1.5 dB	±1.5 dB	±1.5 dB
Sensitivity	–117 dBm 9 kHz to 2.2 GHz	–131 dBm @ 1 GHz CF	–145 dBm to 1.8 GHz	–127 dBm, –139 dBm with Preamp @1 GHz CF	–80 dBmV, –92 dBmV with Preamp @1 GHz CF	–117 dBm, –129 dBm with Preamp @1 GHz CF
Environmental	0 to 50°C 85% RH	MIL-T-28800 Class 3	0 to 55°C 80% RH	MIL-T-28800 Class 5	MIL-T-28800 Class 5	MIL-T-28800 Class 5
Weight	6.5 kg (14 lb.)	19.44 kg (42 lb.)	60 kg (140 lb.)	9.5 kg (21 lb.)	9.5 kg (21 lb.)	9.5 kg (21 lb.)
Features/Options						
Intelligent Markers	2	2	6	2	2	2
Tracking Generator	No	Yes, external TR503	Yes, FSAS	Yes, Opt. 04 internal, Opt. 05 external	Yes, Opt. 05 external	Yes, Opt. 04 internal, Opt. 05 external
Card Reader	Yes	No	No	No	No	No
Preamplifier	Yes, internal	No	Yes, Opt. 03	Yes	Yes	Yes
Quasi Peak Detector	Yes	No	No	Yes, Opt. 12	No	No
CISPR Bandwidths	9 kHz, 120 kHz	No	No	Yes, Opt. 12	No	No
Frequency Counter	Yes	Yes	Yes	Yes	Yes	Opt. 02
Analog Display	No	Yes	No	Yes	Yes	Yes
75 Ω Input	Yes, U4941N	Yes, Opt. 07	No	Yes, external matching pad	Yes	Yes, external matching pad
AM/FM Demodulator	Yes	No	Yes	Yes	Yes	Yes
GPIB	Yes	Yes	Yes	Yes	Yes, Opt. 03	Yes, Opt. 03
RS-232	Yes	No	Yes	Yes, Opt. 08 (N/C)	Yes, Opt. 08 (N/C)	Yes, Opt. 08
Page	**218**	**188**	**195**	**206**	**210**	**206**
Prices Begin at	**$14,200**	**$25,000**	**$44,190**	**$11,950**	**$13,950/ $15,900**	**$8,750**

Spectrum Analyzers



2784

2782/2784 Spectrum Analyzers

The Tektronix 2782 and 2784 offer exceptional measurement performance. Whatever you need to measure, from close-in phase noise to demodulated pulsed RF, the 2782 and 2784 provide the capabilities – such as substantially better phase noise, and resolution bandwidth selections from 3 Hz to 10 MHz. This is further backed with standard-setting dynamic range and improved sensitivity from direct fundamental mixing to 28 GHz, plus a host of other performance firsts. For example, a +15 dBm TOI, a 0 dBm –1 dB compression point, and a compression-to-noise dynamic range of more than 100 dB at 40 GHz.

When you need to go above 40 GHz (33 GHz 2782) and external mixers are used, the 2782 and 2784 provide as much as 25 dB better measurement sensitivity than ever before possible. Setup is simple as well. All you need is one cable and the WM782 Waveguide Mixers and you are set; you don't even have to peak these mixers.

SOFT KEY, MENU, AND MACRO CONVENIENCE
The 2782 and 2784 are rich in measurement features that are quickly and easily accessible through softkeys and menus that rarely go three deep. Often, your most frequently used feature can be assigned to one of two soft knobs for immediate access and control.

Additionally, you can store front-panel keystroke sequences to simplify complex measurements, or even create single-key executable macros for the most complex applications.

GPIB CAPABILITY WITH DUAL LANGUAGES
The 2782 and 2784 provide GPIB interfacing with dual language capability – Tektronix Codes and Formats and HP8566B. This means you can write new software with full Tektronix Codes and Formats compatibility with other test equipment. It also means you can use many existing HP8566B compatible programs with minimal modification.

HIGHLY EFFICIENT SYSTEMS COMPONENT
With full programmability and two GPIB ports, the 2782 and 2784 offer a new level in systems convenience and efficiency. For example, the 2782 and 2784 can communicate with the system host on one GPIB port and control a synthesizer on its other port. The host never has to deal with the synthesizer. The measurement host can be unburdened even further by downloading measurement-specific macros and key sequences to the 2782 and 2784. And with its small size, the 2782 and 2784 provide more performance in less rack space than any other spectrum analyzer on the market.

2782/2784

- 100 Hz to 40 GHz (33 GHz, 2782) Coaxial Frequency Range
- External Waveguide Mixer Support to 325 GHz
- Full-range Sweep from 0 Hz to 40 GHz (33 GHz, 2782)
- Resolution BW from 3 Hz to 10 MHz in a 1, 3, 10 Sequence
- 100 dB Display Dynamic Range
- Phase Noise Performance as Low as –105 dBc/Hz at 10 kHz Offset up to 21 GHz
- Built-in Math Functions
- Intelligent Markers/ Signal Processing: Search, Sort, and Mark CW, Pulse, or All Signals
- Occupied Bandwidth Mode
- Signal Tracking
- Built-in 100 Hz to 1.2 THz Frequency Counter with Frequency Measurement Accuracy of ≤400 Hz at 40 GHz
- Fully Programmable with Two GPIB Interfaces
- Built-in Automation
- Macro Downloading to 40 K of NVRAM
- Store up to 20 Front-panel Key Sequences
- Store up to 20 Waveforms with Readout Information
- Store up to 20 Instrument States

Premium Microwave performance in a ruggedized portable with color display.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 2782, 2784 comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

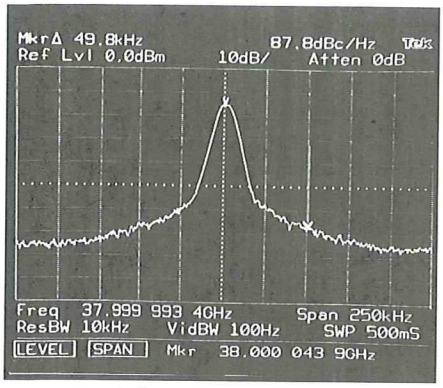
ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

APPLICATIONS

- **Digital Microwave Radio**
- **Satellite Communication**
- **Microwave and RF Source Design**
- **Avionics**
- **Millimeter Wave R&D**

2782
2784

Spectrum Analyzers



Exceptional close-to-carrier spectral purity.

Characteristics

Except as noted, the following tables of electrical characteristics and features apply after a 30-minute warm-up.

ELECTRICAL CHARACTERISTICS

Direct coaxial input for the 2782 applies to 33 GHz. All performance specifications from 33 GHz to 40 GHz are for the 2784 only.

FREQUENCY RELATED

Frequency Range – 100 Hz to 40 GHz in coax, to 325 GHz with external waveguide mixers.

Frequency Readout Accuracy –
$\pm[F(RE + 10^{-10})] + D + (M \times N)$
F = center frequency.
RE = reference error.
D = 2% of span or 20% of resolution bandwidth, whichever is greater.
M>2 MHz span = (100N) KHz.
M≤2 MHz span = (10N) Hz.
N = L.O. harmonic.

Counter – Range: 100 Hz to 1.2 THz. Resolution: Selectable from 1 Hz to 1 GHz
$\pm[F(RE + 10^{-10})] + 15N$ Hz + 1 LSD.
Δ Count Accuracy (S/N≥20 dB):
$\pm[\Delta F (RE + 10^{-10})] + 30N$ Hz + 2 LSD.
F = counter frequency.
RE = reference error.
N = L.O. harmonic.
LSD = least significant digit.

Frequency Reference Accuracy – Aging <1 x 10^{-6}/year <7 x 10^{-9}/day. Drift <5 x 10^{-7} over instrument temperature range of –10°C to +40°C.

Frequency Span – Range: 0, 10 Hz to 40 GHz in coax to 600 GHz in external mixer bands. Resolution: ≥100 Hz, selectable in 1% increments. Accuracy: >2 MHz, ±2%, 1 kHz to 2 MHz, ±1%, 100 Hz to 1 kHz, ±7%.

Resolution Bandwidth (6 dB) – 3 Hz to 10 MHz in 1, 3, 10 sequence. Accuracy: 10 MHz, 3 MHz ±20%, 1 MHz to 100 Hz ±15%, 30 Hz, 10 Hz ±20%, 3 Hz +50%, –10% (Typical). Selectivity (–60 dB/–6 dB): <10:1. Shape: Synchronously tuned, six-pole filters.

Video Bandwidth – Range: 0.03 Hz to 7 MHz (Nominal).

Stability – Residual FM: ≤2 MHz span, 1N Hz p-p over one second; >2 MHz span, 25N kHz p-p over 500 ms. Drift (after one hour warm-up): ≤2 MHz span 5N kHz/minute of sweep time, >2 MHz span 5N kHz/minute of sweep time (Typical).

Notes: N=L.O. Harmonic. Errors due to drift are not cumulative from sweep to sweep.

2782 and 2784
Resolution Filter Bandwidths –

(Specified) 6 dB	(Typical) 3 dB	(Typical) Random Noise	(Typical) Impulse
3 Hz	2.1 Hz	2.3 Hz	3 Hz
10 Hz	6.9 Hz	7.6 Hz	10 Hz
30 Hz	21 Hz	23 Hz	30 Hz
100 Hz	69 Hz	76 Hz	100 Hz
300 Hz	206 Hz	227 Hz	300 Hz
1000 Hz	686 Hz	758 Hz	1 kHz
3 kHz	2.1 kHz	2.3 kHz	3 kHz
10 kHz	6.9 kHz	7.6 kHz	9 kHz
30 kHz	21 kHz	23 kHz	30 kHz
100 kHz	69 kHz	76 kHz	100 kHz
300 kHz	206 kHz	227 kHz	270 kHz
1 MHz	686 kHz	758 kHz	720 kHz
3 MHz	2.1 MHz	2.3 MHz	2.5 MHz
10 MHz	6.9 MHz	7.6 MHz	4.5 MHz

Spectral Purity –

Noise Sidebands dBc/Hz	Center Frequency				
Freq. Offset	Spec. 6.5 GHz	Spec. 12 GHz	Typical 21 GHz	Typical 33 GHz	Typical 40 GHz
100 Hz	–85	–80	–75	–70	–65
1 kHz	–97	–95	–90	–86	–81
10 kHz	–105	–105	–105	–97	–94
100 kHz	–105	–105	–105	–97	–94
1 MHz	–112	–112	–112	–102	–99

AMPLITUDE RELATED

Maximum Amplitude Range – –135 dBm to +30 dBm.

Displayed Average Noise Level (10 Hz RBW, 0 dB attn.) –

Frequency	Level
100 Hz to 50 kHz	–78 dBm
50 kHz to 10 MHz	–105 dBm
10 MHz to 2.5 GHz	–135 dBm
2.5 GHz to 6.5 GHz	–132 dBm
6.5 GHz to 21.25 GHz	–125 dBm
21.25 GHz to 28 GHz	–120 dBm
28 GHz to 40 GHz	–107 dBm

Using WM782 Waveguide Mixer Series (10 Hz RBW) –

Band	Frequency	Harmonic No.	Level
A	26.5 to 40 GHz	2/4	–135 dBm
Q	33 to 50 GHz	4	– 135 dBm
U	40 to 60 GHz	4	– 135 dBm
V	50 to 75 GHz	6	–130 dBm
E	60 to 90 GHz	6	–125 dBm
W	75 to 110 GHz	8	–125 dBm
Typical with 100 Hz RBW			
F	90 to 140 GHz	8	–105 dBm
D	110 to 170 GHz	10	–100 dBm
G	140 to 220 GHz	14	–95 dBm
J	220 to 325 GHz	20	–85 dBm

Display Range – Log amplifier: 100 dB. Display Law Range – Log: 1 dB/div to 15 dB/div. Linear: 5 nV/div to 22 V/div. Square Law: 2 aW/div to 100 W/div. Reference Level Range: –140 dBm to +30 dBm. Resolution: 0.1 dB.

Accuracy – Log (measurements marker): 0.2 dB/1 dB incremental, ±1.5 dB cumulative over 90 dB range, +2/ –3.5 dB cumulative over 100 dB range at self-correcting temp.

Accuracy – Lin: ±5%. Square Law: ±8%.

Frequency Response (≥10 dB RF attenuation) – 20° to 30°C.

Frequency Range	Variation
100 Hz to 6.5 GHz	±1.0 dB
6.5 GHz to 28 GHz	±4.0 dB
28 GHz to 33 GHz	±4.5 dB
33 GHz to 40 GHz	±5.0 dB

(Attenuator accuracy over frequency included in frequency response.)

Attenuator – Range: 0 to 70 dB, 10 dB steps. Accuracy @ 100 MHz: ±0.5 dB.

IF Gain – Range: 0 to 140 dB. Resolution: 0.1 dB. Accuracy: ±1.0 dB, 0 to 50 dB; ±1.5 dB, 0 to 100 dB; at self-correction temperature.

Gain Variation Between Resolution Filters – (Measured at –20 dBm reference level, 10 dB RF attn., and after two-hour warmup at self-correction temperature).

Frequency –

10 MHz to 30 Hz	0.5 dB p-p
10 MHz to 10 Hz	0.75 dB p-p
10 MHz to 3 Hz	2.0 dB p-p

Reference Level Calibration Error – ±0.25 dB (Ref. level –20 dBm, with respect to –20 reference in 3 MHz RBW at self-correction temperature).

Band Switching Uncertainty – ±1.5 dB referred to 100 MHz reference signal.

SPURIOUS RESPONSES

Spurious Responses – <–80 dBc + 20 Log N except as noted below.
Residual Signals: <–77 dBm, 100 Hz to 10 MHz; Mixer Level: –30 dBm: <–70 dBm at 2 MHz with 10 kHz and wider resolution bandwidth;
<–100 dBm, 10 MHz to 6.5 GHz;
<–92 dBm, 6.5 GHz to 21 GHz;
<–82 dBm, 21 GHz to 28 GHz;
<–80 dBm, 28 GHz to 40 GHz.

Maximum Dynamic Range – Compression-to-Noise: 132 dB (10 MHz to 6.5 GHz); 117 dB (to 28 GHz); 101 dB (to 40 GHz). Signal-to-Harmonic Distortion: 80 dB (50 MHz to 6.5 GHz); 100 dB (6.5 GHz to 40 GHz). Signal-to-Intermodulation Distortion: 98 dB (10 MHz to 6.5 GHz); 83 dB (to 28 GHz); 81 dB (to 40 GHz).

1 dB Gain Compression –
100 Hz to 21 GHz: 0 dBm.
21 GHz to 28 GHz: –3 dBm.
28 GHz to 40 GHz: –6 dBm.

Intermodulation Rejection – Second Order Intercept: >+28 dBm, 1 MHz to 6.5 GHz. Third Order Intercept: With signal separation <150 MHz and >20 kHz. Mixer Level –30 dBm: >+15 dBm, 1 MHz to 6.5 GHz, (–90 dBc); >+10 dBm, 6.5 GHz to 28 GHz (–80 dBc).

Second Harmonic Distortion – Mixer Level: –40 dBm; <–70 dBc, 50 MHz to 6.5 GHz; <–100 dBc (Typical), 6.5 GHz to 40 GHz.

Out of Band Responses for Input Frequencies <35 GHz –

	Center Frequency Range	
	100 Hz to 28 GHz	28 to 40 GHz
Image Response	<–65 dBc	<–65 dBc
Harmonic	(Typical)	(Typical)
Conversions	<–65 dBc	<–55 dBc

SWEEP GENERATOR AND TRIGGERING

Sweep Generator – Sweep Speed Range: 200 s to 2 µs. Accuracy: ±5%, 50 µs and slower; ±10%, 20 µs and faster.

Triggering – Adjustable trigger level and slope. Internal: AC coupled; 10 Hz to 1 MHz. External: DC coupled; 0 Hz to 5 MHz or 0 Hz to 1.5 kHz. Line: Copy of AC line.

DISPLAY RELATED

Display Type – Liquid Crystal color shutter, 10 x 10 division graticule.

Digital Storage – Maximum Sweep Rate: 10 ms with 10-Bit resolution, 2 ms with reduced horizontal resolution. Vertical Digitizer Uncertainty: ±0.4%.

Spectrum Analyzers

Non-volatile Memory – CMOS battery backed-up RAM, memory retention guaranteed to –10°C. Battery Type: Lithium cells. Battery Life (Typical): 1.8 years @ 20°C, 1 year @ 50°C. (Batteries are not used when instrument is connected to power source.) Waveforms: 20 waveforms with screen readouts and labels or date/time stamps. Front-panel Setups: 20 complete front-panel setups. Front-panel Sequences: 20 sequences, 64 keystrokes/ sequence. Macros: 40 K of RAM. Instrument Calibration Data: Separate EEPROM.

Inputs and Outputs:

RF Input – Frequency Range: 100 Hz to 33 GHz (2782), 100 Hz to 40 GHz (2784). Coupling: DC. Connector: Planar crown system connector with K compatible and N-type adapters as standard accessories. Impedance: 50 Ω.

VSWR	Center Frequency Ranges			
RF Attn.	100 Hz to 6.5 GHz	6.5 GHz to 28 GHz	28 GHz to 33 GHz	33 GHz to 40 GHz
≥10 dB	<1.4:1	<1.7:1	<2.0:1	<2.25:1

Maximum Safe Input Power – AC Average Power: +30 dBm with ≥10 dB attenuation. Pulse Power: 50 W peak, 1 µs and <0.005 duty factor with ≥50 dB attenuation. DC: 0 V, <100 mA.

Local Oscillator Emission (at 0 dB RF attenuation) – ≤–75 dBm, 100 Hz to 6.5 GHz; ≤–65 dBm, 6.5 GHz to 40 GHz.

External Mixer Input (diplexer built in) – Impedance: 50 Ω; VSWR <1.9:1 at 525 MHz and <2.2:1 at 3.525 GHz (Typical). LO Output Power: ≥15 dBm at 8.1 to 17.9 GHz.

LO Output – Provides access to output of 1st LO at +4 dBm (Typical).

Reference Signal Out – Amplitude: –20 dBm. Amplitude Accuracy: ±0.3 dB. Frequency: 100 MHz (derived from reference oscillator).

Ref. In/Out – Impedance: 50 Ω nominal. Input Frequency: 10 MHz ±5 Hz. Input Signal Amplitude Range: 0 dBm minimum to +15 dBm maximum. Output Signal (when selected): Nominally 0 dBm at 10 MHz. Allowable Phase Noise: ≤–100 dBc/Hz at 1 Hz offset (without degrading instrument phase noise performance).

Ext. Trig/Horiz – External Trigger input, or external sweep input.

Accessory Connector – 15-Pin connector for external inputs and outputs. Ext. in Display Blanking: Provides external access to CRT beam blanking. Ext. in Display Horizontal and Vertical: Provides external access to real-time channel of the instrument; DC coupled; Vert –5 MHz bandwidth (Typical). Sweep Output: Provides copy of analog sweep. Ext. in Video: Provides external access to instrument's video processing system; 7.5 MHz bandwidth (Typical). Penlift: TTL level output to lift plotter pen. YIG Coil Tune Voltage and Return: Provides external output of the YTO coil tuning voltage and a return path.

Ext. V Out – External display horizontal signal output; jumper selectable between full deflection amplifier signal or the real-time signal.

Ext. H Out – External display horizontal signal output; jumper selectable between full deflection amplifier signal or the real-time signal.

Ext. Z Out – External display blanking signal output.

IF Output – Frequency: 25 MHz (3 MHz and 10 MHz resolution bandwidth). Amplitude: 3 dBm nominal (–30 dBm reference level, 0 dB RF attenuation, –30 dBm RF input). Frequency: 4 MHz (1 MHz or less resolution bandwidth). Amplitude: +9 dBm nominal (–30 dBm reference level, 0 dB attenuation, –30 dBm RF input). Impedance: Nominal 50 Ω. VSWR: ≤1.5:1 (Typical).

EXTERNAL INTERFACE PORTS

Two GPIB ports (IEEE Std. 488-1978) are standard.

GPIB Interface – Port 1: SH1, AH1, T5, L3, SR1. Functions: RLO/RL1, PPO, DC1, DT1, CO. Port 2: SH1, AH1, T5, L3, SRO, RLO, PPO, DCO, DTO, C1, C2, C3, C27, (CO selectable).

Probe Power – Provides operating voltage for active probes; output voltages are:
pin 1: +5 V ±5% @ 100 mA max
pin 2: ground
pin 3: –15 V ±5% @100 mA max
pin 4: +15 V ±5% @ 100 mA max.

Power Requirements –
Input Voltage: 90 to 132 VAC, 47 to 440 Hz, 180 to 250 VAC, 47 to 63 Hz. Power: at 115 VAC, 60 Hz, 250 W maximum, 2.8 A. Standby Power: 25 W maximum. Leakage Current: 3.5 mA maximum.

ENVIRONMENTAL CHARACTERISTICS

(Per MIL-T-28800C, Type III, Class 3, Style C)

Temperature – Operating: –10°C to +55°C. Nonoperating: –62°C to +85°C.

Humidity – 5 cycles per MIL-STD 810D Procedure III (modified).

Altitude – Operating: 15,000 ft. Nonoperating: 40,000 ft.

Vibration – Resonant search in all axes from 5 to 15 Hz with displacements up to 0.060 inch, 15 to 25 Hz with displacements up to 0.040 inch, and 25 to 55 Hz with displacements up to 0.020 inch.

Shock – Operating and Nonoperating: Tested to withstand three shocks of 30 g, one-half sine, 11 ms duration each direction along each major axis.

Transit Drop – Tested to withstand eight-inch drops, one per each of six faces and eight corners.

ELECTROMAGNETIC INTERFERENCE
MIL-STD 461C Part 4 –
Conducted Emissions: CE01 – 60 Hz to 15 kHz, 15 dB relaxation below 2 kHz; CE03 – 15 kHz to 50 MHz power leads; narrowband and broadband full limits (Navy).

Conducted Susceptibility: CS01 – 30 Hz to 50 kHz power leads, full limits; CS02 – 50 kHz to 400 MHz power leads, 10 dB relaxation at the IF frequencies; CS06 – Spike power leads, full limits.

Radiated Emissions: RE01 – 30 Hz to 50 kHz magnetic field, 5 dB relaxation below 1 kHz and 10 dB relaxation from 1 kHz to 50 kHz; RE02 – 14 kHz to 1 GHz; meets MIL-STD 461C Part 7 to full limits.

Radiated Susceptibility: RS01 – 30 Hz to 50 kHz magnetic field, full limits; RS02 – magnetic induction, 30 dB relaxation at 60 Hz; 20 dB @ 440 Hz; RS03 – limited to 1 V/m from 14 kHz to 1 GHz, with 20 dB relaxation at IF frequencies.

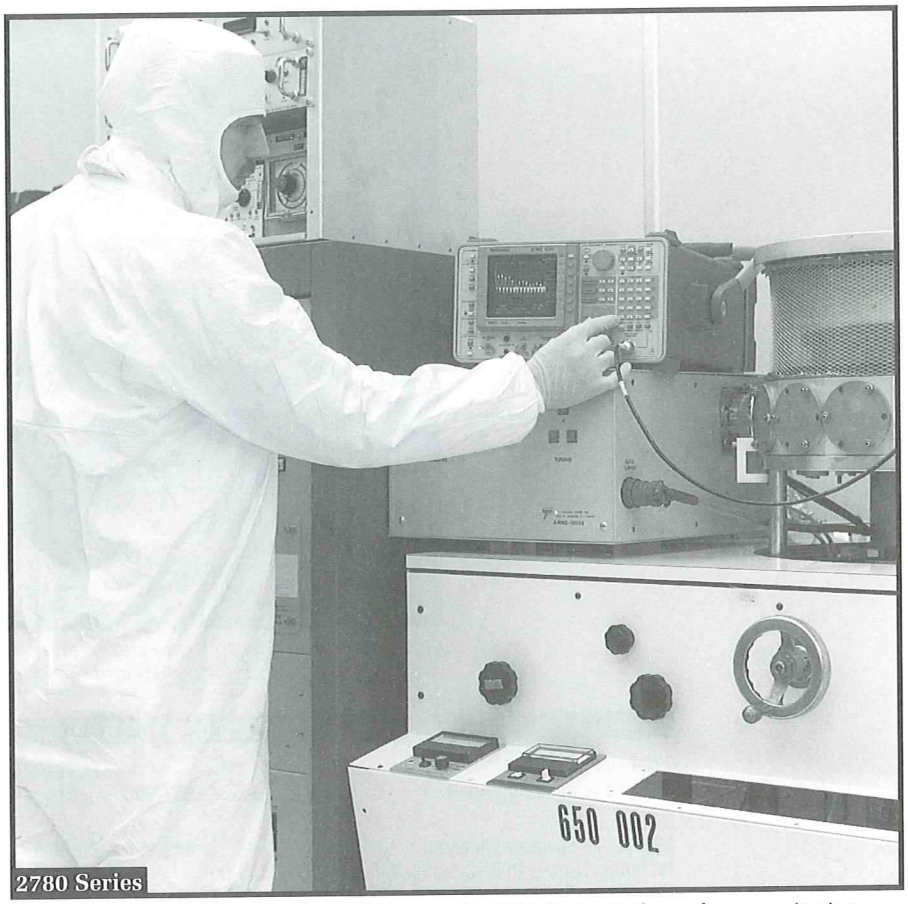
VDE – Meets VDE 0871 Class 1B – Regulations for RFI Suppression of High Frequency Apparatus and Installations.

FCC – Meets FCC Part 15 Subpart J Class A – EMI Compatibility.

German RöV – Meets German RöV, X-Ray Decree, Section 5, March 1973.



Convenient rackmounting with the rack adapter or Option 30.



Microwave Chip Research and Development: the 2780 Series is shown here monitoring microwave component research and development in a lab clean room.

PHYSICAL CHARACTERISTICS

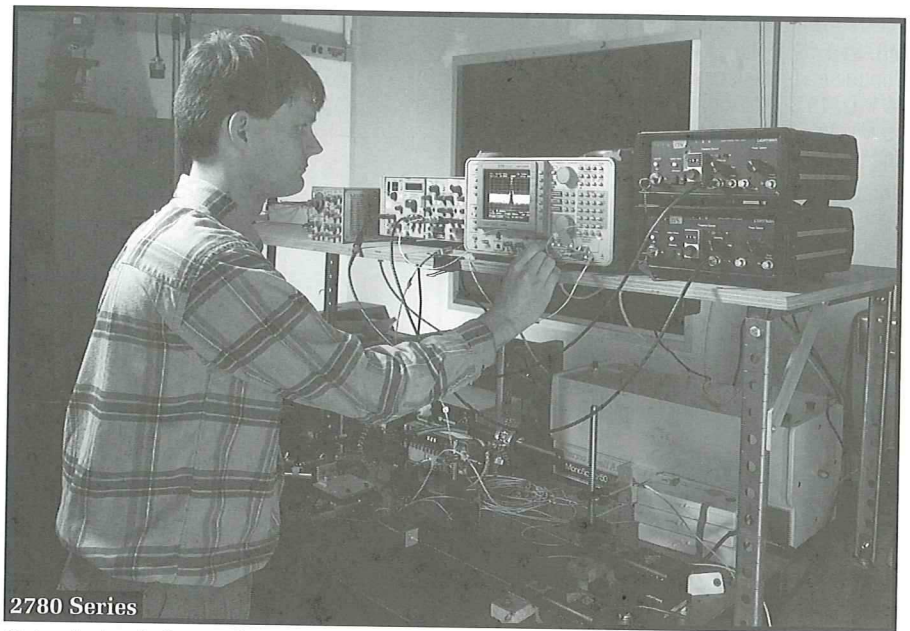
Dimensions	in.	mm
Height	8.05*1	204.47*1
	8.05*2	213.36*2
	8.05*3	204.47*3
Width	12.90*1	327.66*1
	15.75*2	400.05*2
	15.75*3	400.05*3
Depth	18.59*1	472.19*1
	21.64*2	549.11*2
	24.75*3	624.28*3
Weight	**lb.**	**kg**
Net	44*4	20*4

*1 *Without front cover, handle, or feet.*
*2 *With front cover, handle folded back, and feet.*
*3 *With front cover, handle fully extended, and feet.*
*4 *With standard accessories, cover, and no manuals.*

Safety – Meets the following industry safety standards:
CSA Standard C22.2 No. 231 – Electrical and Electronic Measurement and Testing Equipment.
ANSI/ISA S82 – Safety Requirements for Electronic Measuring and Controlling Instrumentation.
IEC 348, 2nd Edition – Safety Requirements for Electronic Measuring Apparatus.
FM – Electrical Utilization Standard Class 3810.
UL 1244, 2nd Edition – Electrical and Electronic Measuring and Testing Equipment.

2782
2784

Spectrum Analyzers



Opto-electronic Research and Development: The 2780 Series finds wide use in opto-electric modulator-demodulator design and development.

ORDERING INFORMATION

2784
Microwave Spectrum Analyzer **$57,900**

2782
Microwave Spectrum Analyzer **$49,900**
Includes: N-male to BNC-female Adapter (103-0045-00); N to Planar Crown Adapter (131-4329-00); 50 Ω SMA Cable (012-0649-00); Line Fuses: 4 A, 125 VAC (159-0319-00); 4 A, 250 VAC (159-0320-00); Power Cord (161-0104-00). Operator's Manual (070-8240-00); Operator's Reference Guide (070-8249-00); Programmer's Manual (070-8241-00); Programmer's Reference Guide (070-8242-00); Installation and Performance Verification Manual (070-8067-00).

Opt. 04 – If output tailored for 3050 Series DSP System ..... **+$2,500**
Opt. 16 – 49X/275X/279X Series GPIB Language ..... **NC**
Opt. 18 – WM782 Bands Q, U, V, E, and W (frequency coverage from 33-110 GHz) ..... **+$14,125**
Opt. 19 – WM782 Bands A, U, E, F, G, and J (frequency coverage from 26-325 GHz) ..... **+$22,870**
Opt. 20 – Utility Software for PC, includes GPIB Card ..... **+$1,530**
Opt. 30 – Rackmount Adapter (19 in.) ..... **+$525**

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**
Opt. A2 – United Kingdom 240 V, 50 Hz ..... **NC**
Opt. A3 – Australian 240 V, 50 Hz ..... **NC**
Opt. A4 – North American 240 V, 60 Hz ..... **NC**
Opt. A5 – Switzerland 220 V, 50 Hz ..... **NC**
See Customer Information Section for additional description.
Opt. B1 – Service Manual prepared to module level ..... **+$250**
Opt. B2 – Complete set of manuals, including Service Manual ..... **+$350**

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection ..... **+$1,130**

SOFTWARE
See page 233 for complete description.
2782/2784 PC Utility – Order S26UT00 ..... **$1,400**

RECOMMENDED ACCESSORIES
See page 446 of Accessories section for complete selection information.

PROBES
Active –
P6201 – 900 MHz, 1.5 pF/100 KΩ **$1,599**
P6217 – 4 GHz, 0.4 pF/100 KΩ, (Requires 1103 Power Supply) **$3,495**
1103 – Power Supply **$655**

CAMERAS/PLOTTERS/PRINTERS
Camera – Low Cost. Order C-9 Opt. 1A and Opt. 20 ..... **$925**
Plotter – Four Color. Order HC100 Opt. 01 ..... **$1,380**
Cart – Order K420 ..... **$730**

GPIB Cables –
0.5 m Order 012-1282-00 ..... **$170**
1 m Order 012-0991-01 ..... **$195**
2 m Order 012-0991-00 ..... **$195**
4 m Order 012-0991-02 ..... **$315**
Waveguide Mixer Cables – Use with WM782 Waveguide Mixers. Order 012-1346-00 ..... **$115**

GPIB CARDS
PC-GPIB Card – IBM PC, AT, and Compatibles. Order S3FG210 ..... **$395**
AT-GPIB Card – IBM AT Bus (High-speed Card). Order S3FG220 ..... **$495**
MC-GPIB Card – IBM PS/2 with Microchannel Bus. Order S3FG230 ..... **$450**

ADDITIONAL ACCESSORIES
EMC Ancillary Devices – See page 235.
Rackmount Adapter – Order 016-1019-00 ..... *1
Optical-to-electrical Converter – Order SA-42 ..... **$3,995**
Service Manual – Module Level. Order 070-8244-00 ..... *1
Transit Case – Order 016-0658-00 ..... **$1,180**
Soft Side Case – Order 016-0659-00 ..... **$190**

[1] Contact your Tektronix representative for price information.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 — The 2782, 2784 comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 — Tektronix Measurement products are manufactured in ISO registered facilities.

Waveguide Mixers

WM782 Series Waveguide Mixers

The Tektronix WM782 Series of Waveguide Mixers are high-performance, broadband, zero DC bias, anti-parallel dual-diode type mixers designed specifically for use with the Tektronix 2782 and 2784. The mixer series covers the standard waveguide bands from 26 GHz to 325 GHz. Each mixer has its own conversion loss chart on the back for easy reference.

The WM782 mixers are of uniform size and shape, and consist of a gold-plated solid brass core with a tough protective outer shell of LEXAN plastic.

Characteristics

Tektronix Model No.	Band Desig.	Freq. Range (GHz)	Sensitivity*1 (dBm)	Freq. Response*2 (dB)	Conv. Loss (dB)	1 dB Compression	Low-pass Cut-Off Freq. *4
WM782A	A	26 to 40	–115	–	20	0 dBm	16 GHz
WM782Q	Q	33 to 50	–115	±3	20	0 dBm	20 GHz
WM782U	U	40 to 60	–115	±3	20	0 dBm	20 GHz
WM782V	V	50 to 75	–110	±3	25	0 dBm	28 GHz
WM782E	E	60 to 90	–105	±3*3	35	0 dBm	28 GHz
WM782W	W	75 to 110	–105	±3*3	35	0 dBm	28 GHz
WM782F	F	90 to 140	–95	±3*3	40	0 dBm	32 GHz
WM782D	D	110 to 170	–90	±3*3	45	0 dBm	40 GHz
WM782G	G	140 to 220	–85	±3*3	60	0 dBm	40 GHz
WM782J	J	220 to 325	–75	±3*3	70	0 dBm	40 GHz

*1 *Equivalent average noise level using 2782 and 2784 Spectrum Analyzer in 1 kHz resolution bandwidth.*
*2 *Maximum amplitude variation across each waveguide mixer band using a 2782 and 2784 Spectrum Analyzer.*
*3 *Over any 5 GHz bandwidth for millimeter wave mixers above 60 GHz.*
*4 *Low-pass filters in LO/IF path.*

Tektronix Product	Waveguide (EIA)	(JAN)	Dimensions Flange LxWxH (cm)	Weight (g)
WM782A 26 to 40 GHz	WR-28	UG-599/U	9.525x2.54x4.32 3.75x1.00x1.70	113.4 4.0
WM782Q 33 to 50 GHz	WR-22	UG-383/U	8.89x2.54x4.32 3.50x1.00x1.70	113.4 4.0
WM782U 40 to 60 GHz	WR-19	UG-383/U-M	8.89x2.54x4.32 3.50x1.00x1.70	113.4 4.0
WM782V 50 to 75 GHz	WR-15	UG-385/U	8.89x2.54x4.32 3.50x1.00x1.70	113.4 4.0
WM782E 60 to 90 GHz	WR-12	UG-387/U	8.89x2.54x4.32 3.50x1.00x1.70	113.4 4.0
WM782W 75 to 110 GHz	WR-10	UG-387/U-M	8.89x2.54x4.32 3.50x1.00x1.70	113.4 4.0
WM782F *1 90 to 140 GHz	WR-08	UG-387/U-M	8.89x2.54x4.32 3.50x1.00x1.70	113.4 4.0
WM782D *1 110 to 170 GHz	WR-06	UG-387/U-M	8.89x2.54x4.32 3.50x1.00x1.70	113.4 4.0
WM782G *1 140 to 220 GHz	WR-05	UG-387/U-M	8.89x2.54x4.32 3.50x1.00x1.70	113.4 4.0
WM782J 220 to 325 GHz	WR-03	–	–	–

*1 *All mixers have standard UG-xxx/U-type flanges. MIL-F-3022-type flanges available in F, D, & G bands.*

WM782 SERIES

- 26 to 325 GHz Frequency Range
- Frequency Response is ±3 dB *2
- Lowest Conversion Loss Waveguide Mixers Available
- Zero DC Bias
- Individually Calibrated with Quick Reference Conversion Loss Calibration Chart
- Anti-parallel Diodes Reduce Vulnerability to ESD
- Uniform Size
- Precision Gold-plated Brass Body

APPLICATIONS

- Spectrum Analysis for Millimeter Wave Frequencies
- Swept Frequency Response Measurements
- Power Level Measurements for Millimeter Wave Frequencies
- Harmonic Generator/ Frequency up/down Conversion

High performance waveguide mixers for 2782 and 2784 Spectrum Analyzers.

ORDERING INFORMATION

WM782 WAVEGUIDE MIXERS AND SETS

26 to 40 GHz – Order WM782A **$2,370**
33 to 50 GHz – Order WM782Q **$2,760**
40 to 60 GHz – Order WM782U **$3,275**
50 to 75 GHz – Order WM782V **$3,710**
60 to 90 GHz – Order WM782E **$4,220**
75 to 110 GHz – Order WM782W **$4,130**
90 to 140 GHz – Order WM782F **$4,640**
110 to 170 GHz – Order WM782D **$6,460**
140 to 220 GHz – Order WM782G **$5,765**
220 to 325 GHz – Order WM782J **$8,540**
26 to 60 GHz Set – Includes WM782A and WM782U. Order WM7826 ..... **$5,375**
26 to 90 GHz Set – Includes WM7826 plus WM782E. Order WM7827 ..... **$8,010**
26 to 140 GHz Set – Includes WM7827 plus WM782F. Order WM7828 ..... **$11,680**
26 to 220 GHz Set – Includes WM7828 plus WM782G. Order WM7829 ..... **$16,915**
33 to 75 GHz Set – Includes WM782Q and WM782V. Order WM78210 ..... **$6,150**
33 to 110 GHz Set – Includes WM78210 plus WM782W. Order WM78211 ..... **$10,100**
33 to 170 GHz Set – Includes WM78211 plus WM782D. Order WM78212 ..... **$15,975**
Cable – Required for use. Order 012-1346-00 ..... **$115**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

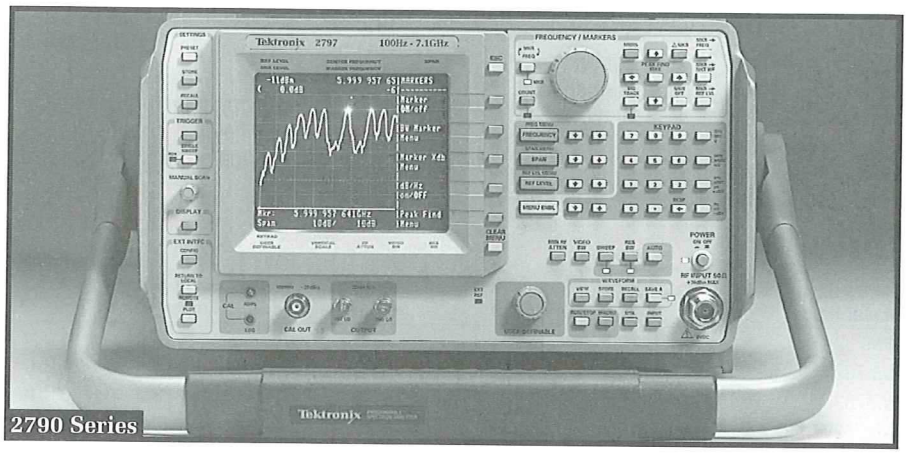
Tektronix Measurement products are manufactured in ISO registered facilities.

2794 2797 2792 2795 Spectrum Analyzers

Field proven rugged portables with application-oriented frequency ranges.

2794/2792
2797/2795

- 100 Hz to 325 GHz Frequency Coverage
- Continuous-Resolution Frequency Tuning
- Up to 90 dB Viewable Dynamic Range
- Built-in Frequency Counters Provide Frequency Determination to Within 0.0000001% ($1x10^{-9}$/day ref.)
- Sensitivities to –134 dBm
- Built-in Intelligence for Signal Processing/Marker Functions
- Push Button Noise-Normalization Functions
- Macro Capability with Non-volatile Memory
- Optional Switch-Selectable 50/75 Ω Impedances
- Non-volatile Memory for up to Nine Waveforms and Ten Front-panel Settings
- GPIB Programmability with Tektronix Codes and Formats



2790 Series

2790

The Tektronix 2790 Series Spectrum Analyzers are proud successors to the venerable Tektronix 490 Series which has proven itself in years of reliable, rugged service around the world. All units provide full IEEE-488 (GPIB) programmability, which means you can change front-panel settings, read data from the CRT display, and send waveforms from internal digital source memory to other GPIB devices. Frequency ranges of the instruments are as follows:

2794: 10 kHz to 325 GHz
2792: 10 kHz to 325 GHz
2797: 100 Hz to 7.1 GHz
2795: 100 Hz to 1.8 GHz

Built to rugged MIL-T-28800C environmental specifications, these units can withstand transportation shock and vibration to a remote site. Or they can simply be moved from the engineering lab to the production floor with complete confidence in measurement accuracy.

A wide array of price/performance alternatives are available. If you need 10 Hz resolution for an exacting close-in spectral purity measurement, consider the 2794. For more routine uses, such as microwave transmitter maintenance, the 2792 may be the most cost-effective solution.

A WIDE ARRAY OF INTELLIGENT FEATURES

Downloadable programming (macro) capability lets you execute your frequently-used measurement routines from the Spectrum Analyzer's non-volatile memory. In addition, these Spectrum Analyzers can store up to ten complete front-panel measurement parameter setups in nonvolatile memory to save measurement time. You can also save up to nine waveform displays, a real benefit when data analysis must be delayed.

Tedious, time-consuming, and often incorrect carrier-to-noise ratio calculations are eliminated; the instrument handles it all with a single keystroke, with automatic noise normalization to 1 Hz and automatic conversion for reference units such as dBm, dBmV, dBV, dBμV, and dB/Hz.

An internal high-stability reference provides marker or center frequency accuracy approaching 10^{-9}/day in the 2794. For added confidence in measurements, a built-in microwave signal counter in the 2794 with 134 dB compression-to-noise dynamic range means you can determine the exact frequency of marked signals only 30 Hz apart – or count the exact delta-frequency between two marked signals – even with greatly differing amplitudes. You also have the flexibility of tying in with a system clock, using the external reference lock capacity.

A permanent record of CRT displays can be obtained at the push of a button, without a controller, using the direct plot capability and a GPIB plotter such as the Tektronix HC100.

APPLICATIONS

- **Manufacturing ATE**
- **Avionics**
- **Broadcasting**
- **CATV**
- **Cellular Radio**
- **Design and Engineering**
- **Nuclear Physics**
- **Radio Astronomy**
- **Satellite Communications**
- **Terrestrial Microwave**
- **Two-way Radio**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

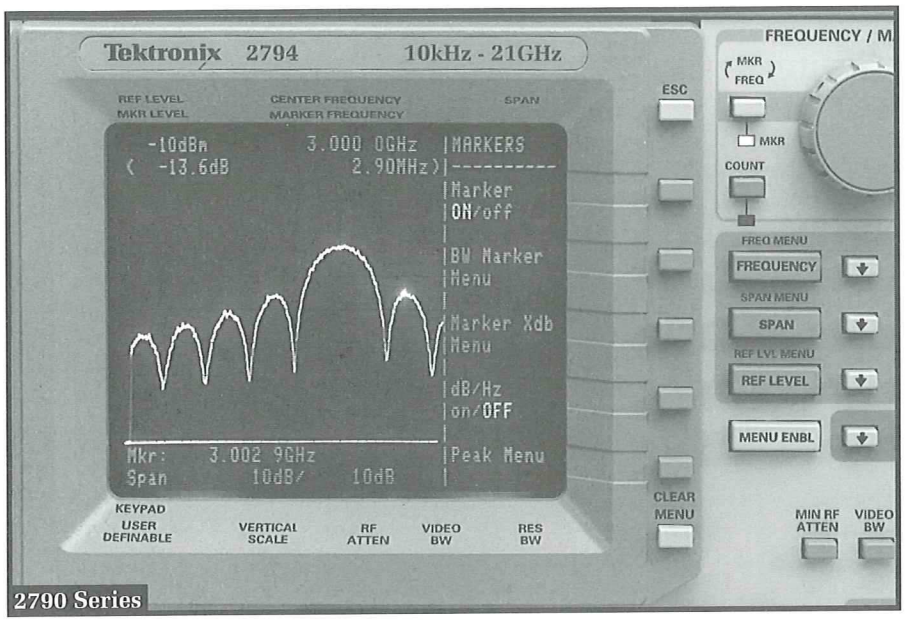
GPIB IEEE-488 The 2790 Series complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Spectrum Analyzers

2797	2794
2795	2792



2790 Series

Menu-selected dynamic markers automatically update frequency and amplitude data with every sweep. Unprecedented signal processing power results when you use these markers in conjunction with the built-in intelligence. With PULSE Mode, you can mark the peak of a main lobe and peaks of side lobes at the push of a button. The CW Mode locates signals that exhibit CW characteristics and ignores all other signals. The SPUR Mode marks all signals that meet user-defined or automatic threshold criteria. User-definable threshold criteria are available for all signal processing modes.

MENU POWER

The 2790 Series is primarily menu-driven. Pressing one of the four front-panel menu keys brings up a selection menu on the right portion of the display. Each menu selection is assigned to a bezel-mounted selection key; simply press the associated key to make a menu selection. When numeric data is required, it can be entered using the keypad. When menu selection is complete, the menu area is used by the waveform to provide a full-screen display.

Some of the common functions are performed by dedicated function keys or knobs. For example, the FREQUENCY/MARKERS knob provides frequency or marker tuning; the function is shifted between marker or frequency by alternately pressing MKR ⇔ FREQ.

A unique and powerful feature is the USER DEFINABLE knob which can be assigned to many of the front-panel functions; Span, Reference Level, Resolution Bandwidth, Sweep Speed, Minimum RF Attenuation, plus other functions. This allows you to customize the front panel for measurement convenience.

OPERATOR CONVENIENCE

These instruments also offer operator convenience for measuring the bandwidth of filters, amplifiers, and other networks. Just enter the desired bandwidth point and select BANDWIDTH Mode, and the markers automatically update to display the new value.

Dedicated direct keypad data entry of major measurement parameters enables fast, accurate instrument setup. The unique marker keypad allows Right and Left Next, Next Higher and Lower, Marker to Ref. Level, and Peak Find and Center operations to be executed directly from the front panel. This makes signal searches much easier.

Optional switch-selectable 50 Ω and 75 Ω impedances add versatility. For applications such as baseband and CATV, 75 Ω/dBmV greatly simplifies spectrum analysis.

PRICE/PERFORMANCE SELECTION

The performance leader is the 2794, which offers frequency coverage from 10 kHz to 21 GHz with its internal mixer, and to 325 GHz with external mixers such as the Tektronix WM780 Series (each WM780 Series mixer is individually calibrated). Signal sensitivity is an impressive –134 dBm. The 2794 is optimized for use in baseband through millimeter-wave measurements, where the ability to identify and process signal frequencies and amplitudes over wide dynamic ranges with high accuracy is critical. The 2794 offers full high-resolution and frequency coverage for RF/Microwave component design and test.

The 2792 covers the same coaxial frequency range as the 2794, and provides nearly the same set of outstanding features and state-of-the-art specifications. It is designed as a cost-effective and productive solution to engineering needs. The 2792's frequency range of 10 kHz to 21 GHz is ideal for cost-sensitive applications that still require most of the powerful features of the product family, but can get by with slightly-reduced performance specifications. The 2792 is also ideal for personal communications network testing to 26.5 GHz.

The 2795 features the same functionality and high level of performance as the 2794, but over a frequency range of 100 Hz to 1.8 GHz. It is optimized for stand-alone or automated operation in baseband through UHF measurements, where the ability to identify and process weak signals is critical. The 2795 used with the TR503 Tracking Generator forms a swept frequency system for passive and active component design and test.

The 2797 provides the same cost-effective performance as the 2794, but over a frequency range of 100 Hz to 7.1 GHz. The 2797 is well suited for land, sea, and air mobile communications system design and testing.

REMOTE OPERATION AND COMPLETE SPECTRUM ANALYSIS PACKAGES

Full GPIB-programmability lets you automate your spectrum analysis system needs. Programming is simplified and measurement repeatability ensured. Under program control, you can operate the instrument, change front-panel settings, read data from the CRT display, and send waveforms from internal memory to other GPIB devices. Tektronix' Standard Codes and Formats keep commands clear, consistent, and universally understood.

Tektronix spectrum analyzer software lets you use the 2790 Series Spectrum Analyzers as system components, controlling them with popular instrument controllers such as the PC compatibles. Coupling the computer to the Spectrum Analyzer via the IEEE 488 bus lets you take advantage of the PC's capability, as well as the power and versatility of the Spectrum Analyzer.

Tektronix' General RF Applications Software Package (GRASP) offers many different applications and utility routines, which are selected through easy menu-driven operation. Also, EMI software is available for FCC, VDE, CISPR, and MIL-STD testing.

2797 2794 2795 2792 Spectrum Analyzers

CHARACTERISTICS

Frequency-related	2794	2792	2797	2795
Frequency Range with Internal Mixers	10 kHz to 21 GHz	10 kHz to 21 GHz	100 Hz to 7.1 GHz	100 Hz to 1.8 GHz
Frequency Range with External Mixers	10 kHz to 325 GHz	325 GHz (Opt. 04)	NA	NA
Frequency Readout Accuracy (center or marker), ±[2% span + (CF x Ref.) + (2N + 25) Hz]	±20 kHz @ 1 GHz with 1 MHz span	±30 kHz @ 1 GHz with 1 MHz span	±21 kHz @ 1 GHz with 1 MHz span	±20 kHz @ 1 GHz with 1 MHz span
Frequency Counter Accuracy, ±[(CF x Ref.) + (5 + N) Hz + 1 LSD]	±7 Hz @ 1 GHz	±10.013 kHz @ 1 GHz, ±9 Hz @ 1 GHz (Opt. 03)	±1 kHz @ 1 GHz, ±7 Hz @ 1 GHz (Opt. 02)	±7 Hz @ 1 GHz
Delta Count Accuracy, ±[(D-F x Ref.) + (10 + 2N) + 1 LSD]	±13 Hz for 1 MHz ΔF	±65 Hz for 1 MHz ΔF	±14 Hz for 1 MHz ΔF	±13 Hz for 1 MHz ΔF
Frequency Reference Accuracy	≤1x10^{-9}/day (aging)	≤2x10^{-9}/day (aging) Opt. 03	≤1x10^{-9}/day (aging) Opt. 02	≤1x10^{-9}/day (aging)
Frequency Stability (residual FM)	≤3 Hz @ 1 GHz	≤12 Hz @ 1 GHz	≤3 Hz @ 1 GHz	≤3 Hz @ 1 GHz
Frequency Stability (drift)	<50 Hz/minute	<50 Hz/minute	<50 Hz/minute	<50 Hz/minute
Single Sideband Phase Noise (30 kHz offset and N=1)	–105 dBc/Hz @ 1 GHz	–103 dBc/Hz @ 1 GHz	–105 dBc/Hz @ 1 GHz	–105 dBc/Hz @ 1 GHz
Frequency Span Range (plus 0 Hz and MAX)	100 Hz to 150 GHz	2 kHz to 12 GHz	100 Hz to 4 GHz	100 Hz to 1.7 GHz
Frequency Span Accuracy	±5%	±5%	±5%	±5%
Delta Frequency Accuracy Marker Mode	1% of span	1% of span	1% of span	1% of span
Resolution Bandwidth (6 dB) Range	10 Hz to 3 MHz	1 kHz to 3 MHz	10 Hz to 3 MHz	10 Hz to 3 MHz
Resolution Bandwidth Selectivity (–60 dB/–6 dB)	≤7.5:1 except 15:1 @ 10 Hz	≤7.5:1	≤7.5:1 except 15:1 @ 10 Hz	≤7.5:1 except 15:1 @ 10 Hz
Video Bandwidth Range	0.3 Hz to 30 kHz	3 Hz to 30 kHz	0.3 Hz to 30 kHz	0.3 Hz to 30 kHz
Amplitude-related				
Reference Level Range	–117 to +30 dBm	–117 to +30 dBm	–117 to +30 dBm	–117 to +30 dBm
Maximum Safe Input Power, CW	1 W (+30 dBm)	1 W (+30 dBm)	1 W (+30 dBm)	1 W (+30 dBm)
Maximum Safe Input Power, Pulse	75 W Pk (1 µS pulse, 0.1% duty factor)	75 W Pk (1 µS pulse, 0.1% duty factor)	75 W Pk (1 µS pulse, 0.1% duty factor)	75 W Pk (1 µS pulse, 0.1% duty factor)
CRT Display Range, Log	1 to 15 dB/div	1 to 15 dB/div	1 to 15 dB/div	1 to 15 dB/div
CRT Display Range, Linear	39.6 nV/div to 2.8 V/div	39.6 nV/div to 2.8 V/div	39.6 nV/div to 2.8 V/div	39.6 nV/div to 2.8 V/div
Input Attenuator Range	0 to 60 dB in 10 dB steps	0 to 60 dB in 10 dB steps	0 to 60 dB in 10 dB steps	0 to 60 dB in 10 dB steps
Dynamic Range (maximums):				
Compression to noise	134 dB	110 dB	130 dB	130 dB
Signal to distortion harmonic	77 dB to 1.7 GHz ≥100 dB 1.7 to 21 GHz	65 dB to 1.7 GHz ≥100 dB 1.7 to 21 GHz	75 dB to 1.7 GHz ≥100 dB 1.7 to 21 GHz	75 dB
Signal to distortion intermodulation	93 dB to 1.7 GHz ≥100 dB 1.7 to 21 GHz	76 dB to 1.7 GHz ≥100 dB 1.7 to 21 GHz	90 dB to 1.7 GHz ≥100 dB 1.7 to 7.1 GHz	90 dB
Viewable on CRT screen	90 dB	80 dB	90 dB	90 dB
Residual Response (no signal and zero RF attenuation)	–100 dBm (input terminated)	–95 dBm (input terminated)	–100 dBm (input terminated)	–100 dBm (input terminated)
Second Harmonic Distortion, RF Frequency Range	–60 dBc (mixer level –40 dBm)	–60 dBc (mixer level –40 dBm)	–60 dBc (mixer level –40 dBm)	–60 dBc (mixer level –30 dBm)
Second Harmonic Distortion Microwave Frequency Range	–100 dBc (mixer level –20 dBm)	–100 dBc (mixer level –20 dBm)	–100 dBc (mixer level –20 dBm)	NA
Third Order Intermodulation Distortion	–70 dBc (mixer level –27 dBm)	–70 dBc (mixer level –27 dBm)	–70 dBc (mixer level –27 dBm)	–70 dBc (mixer level –27 dBm)
Calibrator Accuracy	±0.3 dB	±0.3 dB	±0.3 dB	±0.3 dB
Gain Compression (1 dB)	0 dBm	0 dBm	0 dBm	0 dBm
Frequency Response (10 dB RF attenuation referred to cal signal):				
Band 1 (10 kHz to 1.8 GHz)	±2.5 dB	±3.0 dB	±2.5 dB	±2.0 dB (100 Hz to 1.8 GHz)
Band 2 (1.7 GHz to 5.5 GHz)	±3.5 dB	±4.0 dB	±3.5 dB	NA
Band 3 (3.0 GHz to 7.1 GHz)	±3.5 dB	±4.0 dB	±3.5 dB	NA
Band 4 (5.4 GHz to 18 GHz)	±4.5 dB	±5.0 dB	NA	NA
Band 5 (15 GHz to 21 GHz)	±6.5 dB	±7.0 dB	NA	NA
In-band Flatness (with 10 dB RF attenuation):				
Band 1 (10 kHz to 1.8 MHz)	±1.5 dB	±2.0 dB	±1.5 dB (100 Hz to 1.8 GHz)	±1.0 dB (100 Hz to 1.8 GHz)
Band 2 (1.7 GHz to 5.5 GHz)	±2.5 dB	±3.0 dB	±2.5 dB	NA
Band 3 (3.0 GHz to 7.1 GHz)	±2.5 dB	±3.0 dB	±2.5 dB (5.4 GHz to 7.1 GHz)	NA
Band 4 (5.4 GHz to 18 GHz)	±3.5 dB	±4.0 dB	NA	NA
Band 5 (15 GHz to 21 GHz)	±5.0 dB	±5.5 dB	NA	NA

Continued on next page.

Spectrum Analyzers

2797	2794
2795	2792

Amplitude-related (continued)	2794	2792	2797	2795
Displayed Average Noise Level (input terminated, narrowest resolution bandwidth, and video filter):				
Band 1 (100 Hz)	–80 dBm (typical)	NA	–75 dBm (typical)	–75 dBm (typical)
Band 1 (1 kHz to 10 kHz)	–90 dBm (typical)	–60 dBm (typical)	–95 dBm	–95 dBm
Band 1 (10 kHz to 100 kHz)	–95 dBm	–70 dBm	–115 dBm	–100 dBm
Band 1 (100 kHz to 1 MHz)	–115 dBm	–90 dBm	–120 dBm	–115 dBm
Band 1 (1 MHz to 1.8 GHz)	–134 dBm	–110 dBm	–130 dBm	–131 dBm
Band 2 (1.7 GHz to 5.5 GHz)	–125 dBm	–108 dBm	–127 dBm	NA
Band 3 (3.0 GHz to 7.1 GHz)	–125 dBm	–108 dBm	–126 dBm	NA
Band 4 (5.4 to 12 GHz/12 to 18 GHz)	–111/–107 dBm	–94/–89 dBm	NA	NA
Band 5 (15 GHz to 21 GHz)	–106 dBm	–88 dBm	NA	NA
IF Gain Uncertainty	±2 dB max over 107 dB range	±2 dB max over 107 dB range	±2 dB max over 107 dB range	±2 dB max over 107 dB range
Scale Fidelity, Log (80 dB range/90 dB range)	±2 dB max/ ±4 dB max	±2 dB max	±2 dB max/ ±4 dB max	±2 dB max/ ±4 dB max
Scale Fidelity, Linear	±5% of full scale	±5% of full scale	±5% of full scale	±5% of full scale
Input Attenuator Switching Accuracy (20 dB to 60 dB settings):				
0 to 1.8 GHz	±0.5 dB/10 dB; ±1.0 dB max	±0.5 dB/10 dB; ±1.0 dB max	±0.5 dB/10 dB; ±1.0 dB max	±0.5 dB/10 dB; ±1.0 dB max
1.8 to 18 GHz	±1.5 dB/10 dB; ±3.0 dB max	±1.5 dB/10 dB; ±3.0 dB max	±1.5 dB/10 dB; ±3.0 dB max (1.8to 7.1 GHz)	NA
18 to 21 GHz	±3.0 dB/10 dB; ±6.0 dB max	±3.0 dB/10 dB; ±6.0 dB max	NA	NA
Resolution Bandwidth Switching Uncertainty (reference BW = 3 MHz)	±0.4 dB	±0.4 dB	±0.4 dB	±0.4 dB
Time-related				
Sweep Time Range	200 µsec/div to 100 sec/div	200 µsec/div to 100 sec/div	200 µsec/div to 100 sec/div	200 µsec/div to 100 sec/div
Sweep Time Accuracy	±5%	±5%	±5%	±5%
Marker Time Measurement Accuracy	±10%	±10%	±10%	±10%
Delta Marker Time Measurement Accuracy	±5%	±5%	±5%	±5%
Sweep Trigger	Free Run, Line, Video, Single, Ext.	Free Run, Line, Video, Single, Ext.	Free Run, Line, Video, Single, Ext.	Free Run, Line, Video, Single, Ext.
External Input				
RF Input Impedance	50 Ω nominal	50 Ω nominal	50 Ω nominal	50 Ω nominal
VSWR (10 dB input attenuation):				
<2.5 GHz	1.3:1 max	1.3:1 max	1.3:1 max	1.3:1 max
2.5 GHz to 6.0 GHz	1.7:1 max	1.7:1 max	1.7:1 max	NA
6.0 GHz to 18 GHz	2.3:1 max	2.3:1 max	NA	NA
18 GHz to 21 GHz	3.5:1 max	3.5:1 max	NA	NA
Local Oscillator Emission Level (0 dB input attenuation)	≤–70 dBm	≤–70 dBm	≤–70 dBm	≤–70 dBm
External Mixer Input	Approx. 2 GHz IF	NA	NA	NA
External Reference Input	1, 2, 5, or 10 MHz	NA	1, 2, 5, or 10 MHz	1, 2, 5, or 10 MHz
Horizontal Input/Trigger Input	0 to +10 V/1 to 50 V	0 to +10 V/1 to 50 V	0 to +10 V/1 to 50 V	0 to +10 V/1 to 50 V
Video Input/Marker Input	0 to +4 V/0 to –10 V	0 to +4 V/0 to –10 V	0 to +4 V/0 to –10 V	0 to +4 V/0 to –10 V
External Output				
Calibrator	100 MHz ±10 Hz, –20 dBm ±0.3 dB	100 MHz ±1 kHz, –20 dBm ±0.3 dB	100 MHz ±100 Hz, –20 dBm ±0.3 dB	100 MHz ±10 Hz, –20 dBm ±0.3 dB
1st Local Oscillator	2 to 6 GHz, +7.5 to +20 dBm	2 to 6 GHz, +7.5 to +20 dBm	2 to 6 GHz, +6 to +20 dBm	2 to 4 GHz, +6 to +20 dBm
2nd Local Oscillator	–12 dBm to +5 dBm	–12 dBm to +5 dBm	–12 dBm to +5 dBm	–10 dBm to +15 dBm
Video Output (CRT center reference)	0.5 V of signal per div of video	0.5 V of signal per div of video	0.5 V of signal per div of video	0.5 V of signal per div of video
Sweep Output (CRT center reference)	0.5 V/div; ±2.5 V max	0.5 V/div; ±2.5 V max	0.5 V/div; ±2.5 V max	0.5 V/div; ±2.5 V max
Pen Lift	+5 V nominal; TTL-compatible	+5 V nominal; TTL-compatible	+5 V nominal; TTL-compatible	+5 V nominal; TTL-compatible

Continued on next page.

2797 2794 2795 2792 Spectrum Analyzers

External Output (continued)	2794	2792	2797	2795
2nd IF Output (Opt. 42)	110 MHz, 0 dBm; 3 dB BW is 4.5 MHz	110 MHz, 0 dBm; 3 dB BW is 4.5 MHz	110 MHz, 0 dBm; 3 dB BW is 4.5 MHz	110 MHz, 0 dBm; 3 dB BW is 4.5 MHz
3rd IF Output	10 MHz, –5 dBm	10 MHz, –5 dBm	10 MHz, –5 dBm	10 MHz, –5 dBm
Probe Power	+5 V, –15 V, +15 V; 100 mA max each	+5 V, –15 V, +15 V; 100 mA max each	+5 V, –15 V, +15 V; 100 mA max each	+5 V, –15 V, +15 V; 100 mA max each
General Specifications				
Power Requirements: Voltage Frequency Power	90-132/180-250 VAC 47-63 Hz 210 W max @ 115 VAC, 60 Hz	90-132/180-250 VAC 47-63 Hz 210 W max @ 115 VAC, 60 Hz	90-132/180-250 VAC 47-63 Hz 210 W max @ 115 VAC, 60 Hz	90-132/180-250 VAC 47-63 Hz 210 W max @ 115 VAC, 60 Hz
Weight (carrying), Nominal	22.2 kg (48 lb.)	21.3 kg (46 lb.)	20.83 kg (45 lb.)	19.44 kg (42 lb.)
Dimensions (without handle, feet, or cover), mm/inches	175 x 327 x 499/ 6.9 x 12.87 x 19.65	175 x 327 x 499/ 6.9 x 12.87 x 19.65	175 x 327 x 499/ 6.9 x 12.87 x 19.65	175 x 327 x 499/ 6.9 x 12.87 x 19.65
Digital Storage	1000 pts horizontal, 250 pts vertical	1000 pts horizontal, 250 pts vertical	1000 pts horizontal, 250 pts vertical	1000 pts horizontal, 250 pts vertical
Digitizing Rate	9 µS	9 µS	9 µS	9 µS
Macro Programming	8 K	8 K	8 K	8 K
Non-volatile Memory	9 waveforms, 10 control settings	9 waveforms, 10 control settings	9 waveforms, 10 control settings	9 waveforms, 10 control settings
Environmental (Per MIL-T-28800C, Type III, Class 3, Style C)				
Electromagnetic Compatibility (consult data sheet for compliance details)	MIL-STD-461B	MIL-STD-461B	MIL-STD-461B	MIL-STD-461B
Calibration Interval	1 Year	1 Year	1 Year	1 Year
IEEE 488 (GPIB)				
Interface Functions	SH1, AH1, T5, L3, SR1, RL1, PP1, DC1, DT1, and C0	SH1, AH1, T5, L3, SR1, RL1, PP1, DC1, DT1, and C0	SH1, AH1, T5, L3, SR1, RL1, PP1, DC1, DT1, and C0	SH1, AH1, T5, L3, SR1, RL1, PP1, DC1, DT1, and C0
Direct Plotter Output	Supports Tektronix HC100, HP7470A	Supports Tektronix HC100, HP7470A	Supports Tektronix HC100, HP7470A	Supports Tektronix HC100, HP7470A
Waveform Transfer Speed	165 msec/1000 pts	165 msec/1000 pts	165 msec/1000 pts	165 msec/1000 pts
Safety	Listed FM 3810 Certified CSA	Listed FM 3810 Certified CSA	Listed FM 3810 Certified CSA	Listed FM 3810 Certified CSA

ORDERING INFORMATION

2794
Programmable Spectrum Analyzer **$34,000**
Includes: Operator's Manual; Programmer's Manual; 6 ft., 50 Ω Coaxial Cable, N-N (012-0114-00); 18 in., 50 Ω Coaxial Cable, BNC-BNC (012-0076-00); N Male-to-BNC Female Adapter (103-0045-00); Rear Connector Shield (337-3274-00); Power Cord and Spare Fuses.

2792
Programmable Spectrum Analyzer **$24,200**
Includes: Same as 2794.

2797
Programmable Spectrum Analyzer **$28,900**
Includes: Same as 2794.

2795
Programmable Spectrum Analyzer **$25,000**
Includes: Same as 2794.

Opt. 02 – (2797) Precision Freq. Reference. 1 x 10^{-7}/yr aging ..... **+$2,200**

Opt. 03 – (2792) Precision Freq. Reference. 5 x 10^{-7}/yr aging ..... **+$1,500**

Opt. 04 – (2792) Freq. range extension to 325 GHz ..... **+$750**

Opt. 07 – 75 Ω dBmV input and calibration in addition to the normal 50 Ω dBm input and calibration. (Not combinable with Opt. 04 and Opts. 10 through 14.) Includes: 42 in., 75 Ω BNC-BNC Coax Cable (012-0074-00) and BNC Male to "F" Female Adapter (013-0126-00) ..... **+$750**

Opt. 10 – (2794) Freq. range extension to 26.5 GHz ..... **+$2,000**

Opt. 11 – (2794) Freq. range extension to 40 GHz ..... **+$3,500**

Opt. 12 – (2794) Freq. range extension to 60 GHz ..... **+$5,500**

Opt. 13 – (2794) Freq. range extension to 140 GHz ..... **+$10,500**

Opt. 14 – (2794) Freq. range extension to 325 GHz ..... **+$14,500**

Opt. 23 – GRASP Software (S26RF00), PC2A Interface, GPIB Cable. ..... **+$1,530**
NOTE: The PC2A is a National Instruments GPIB Interface Card.

Opt. 30 – Rackmount with handles for 19 in. rack ..... **+$525**

Opt. 39 – Non-lithium (silver) Batteries for Battery-backed Memory ..... **+$50**

Opt. 41 – (2792 and 2794) Digital Microwave Radio Measurement Enhancement package ..... **+$450**

Opt. 42 – Replaces MARKER/VIDEO input port on the rear panel with a 110 MHz IF output port that provides a 3050-Series DSP System compatible 3 dB signal bandwidth ≥4.5 MHz ..... **+$750**

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**

Opt. A2 – United Kingdom 240 V, 50 Hz ..... **NC**

Opt. A3 – Australian 240 V, 50 Hz ..... **NC**

Opt. A4 – North American 240 V, 60 Hz ..... **NC**

Opt. A5 – Switzerland 220 V, 50 Hz ..... **NC**

See Customer Information Section for additional description.

Continued on next page.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 2790 Series complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Spectrum Analyzers

1405/TV Sideband Adapter

Works with the 279X and 271X Series Spectrum Analyzers to analyze the sideband and in-band response of a television transmitter.

See page 223 for details.

TR503 Tracking Generator

Works with all 2790 Series spectrum analyzers to provide constant level, calibrated sources for swept frequency tests.

See page 225 for detail.

ORDERING INFORMATION

Opt. B1 – Service Manual.....**+$250**
Opt. B2 – Additional Set of Manuals.....**+$300**

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection.....**+$590**
Opt. C5 – Adds five years of Calibration Services .....**+$1,225**

SOFTWARE
See page 233 for complete description.
GRASP (General RF Applications) Software – Order S26RF00.....**$875**
RSM (Host Site) Software – Order S26RM00 .....**$300**
RSM (Remote Site) Software – Order S26RM01 .....**$750**
EMI Prequalification Software – Order S26EM00 .....**$1,475**

RECOMMENDED ACCESSORIES
See page 446 for complete selection information.

PROBES
FET Probe – DC to 900 MHz. Order P6201 .....**$1,599**
FET Probe – DC to 500 MHz. Order P6202A.....**$1,115**
50 Ω Divider Probe – DC to 3.5 GHz, 6 ft. Order P6156.....**$275**
Current Probe – 935 Hz to 120 MHz. Order P6022 .....**$610**

PLOTTER
Plotter – Four Color. Order HC100 Opt. 01.....**$1,380**

CARTS
K420 Instrument Cart.....**$730**

POWER SPLITTER (6 dB)
50 Ω, SMA, 18 GHz. Order 015-0565-00 .....**$445**

CABLES, PADS AND ADAPTERS
50 Ω Coaxial Cable –
BNC to BNC 5.5 in. Order 012-0214-00.....**$80**
BNC to BNC 18 in. Order 012-0076-00.....**$34**
BNC to BNC 42 in. Order 012-0057-01.....**$31**
75 Ω Coaxial Cable – BNC to BNC 42 in. Order 012-0074-00 .....**$34**
GPIB Cables –
0.5 m Order 012-1282-00 .....**$170**
1 m Order 012-0991-01 .....**$195**
2 m Order 012-0991-00 .....**$195**
4 m Order 012-0991-02 .....**$315**
75 Ω to 50 Ω Minimum Loss Attenuator – With DC block, 5.7 dB loss. Order 011-0112-00.....**$110**
75 Ω to 50 Ω Matching Attenuator – With 11.25 dB conversion factor from dBm to dBV with DC block. Order 011-0118-00 .....**$140**
"F" Female to BNC Male Adapter – Order 013-0126-00 .....**$25**
BNC Female to "F" Male Adapter – Order 103-0158-00...**$15.50**
"N" Female to BNC Male Adapter – Order 103-0058-00...**$19.75**
75 Ω to 50 Ω Matching Transformer – 0.5 dB loss.
50 kHz to 300 MHz. Order 120-1883-00 .....**$250**
5 MHz to 1 GHz. Order 120-1884-00.....**$250**

DC BLOCKS
N to N – DC Block 015-0509-00 is rated over the coaxial frequency range of 10 kHz to 21 GHz. Its electrical characteristics, rugged construction, and type "N" connectors make it the preferred solution for EMI/RFI and other applications requiring the blocking of 2790 front ends. Characteristics – Operating Frequency: 10 kHz to 21 GHz. Insertion Loss: 1.0 dB maximum. VSWR: 1.4:1 maximum, 10 kHz to 18 GHz; 1.6:1 maximum 18 to 21 GHz. Voltage Rating: 50 VDC maximum. Impedance: 50 Ω Connectors: Type "N" male and female. Order 015-0509-00 .....**$490**
BNC to BNC – Maximum DC potential 50 V. Order 015-0221-00 .....**$160**

GPIB CARDS
PC-GPIB Card – IBM PC, AT, and Compatibles. Order S3FG210.....**$395**
AT-GPIB Card – IBM AT Bus (High-speed Card). Order S3FG220.....**$495**
MC-GPIB Card – IBM PS/2 with Microchannel Bus. Order S3FG230.....**$450**

ADDITIONAL ACCESSORIES
EMI Ancillary Devices – See page 235.
Service Manuals –
2797, Volume I. Order 070-8638-00 .....**$95**
2797, Volume II. Order 070-8642-00 .....**$180**
2795, Volume I. Order 070-8637-00 .....**$95**
2795, Volume II. Order 070-8641-00 .....**$180**
2794, Volume I. Order 070-8636-00 .....**$95**
2794, Volume II. Order 070-8640-00 .....**$180**
2792, Volume I. Order 070-8635-00 .....**$95**
2792, Volume II. Order 070-8639-00 .....**$160**
Service Kit – Order 006-3286-01 .....**$1,995**
Diplexer Assembly – For 2790 Series and WM780 Waveguide Mixers. Order 015-0385-00 .....**$385**
Diplexer Interconnecting Cable – Required for use with Diplexer Assembly. 50 Ω, SMA-to-SMA. Order 012-0649-00 .....**$50**
Rack Adapter – 19 in. Order 016-0844-01 .....*1
Rear Panel Connector Cover – Order 337-3274-00 .....**$6.50**
Soft Side Case – Order 016-0659-00.....**$190**
Transit Case – Order 016-0658-00.....**$1,180**
TV Sideband Analyzer Adapter – 525/60 Markers. Order 1405.....**$7,175**
Tracking Generator – 100 Hz to 1800 MHz. Order TR503 .....**$8,500**
Microwave Comb Generator – TM500 Series Compatible. Order 067-0885-00 .....**$3,455**

[1] Contact your Tektronix representative for price information.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 2790 Series complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Waveguide Mixers

Extended spectrum analyzer measurement capability from 18 GHz to 325 GHz.

WM780 SERIES

- 18 to 325 GHz Frequency Range
- Frequency Response Is ±2 dB*2
- Individual Frequency Characterization Curves Attached to Housing
- Custom Characterization Available
- Precision Gold-plated Brass Body

WM780 Series Waveguide Mixers

The Tektronix WM780 Series Waveguide Mixers cover a frequency range of 18 to 325 GHz with optimum flatness. Although designed specifically for use with the Tektronix 2790 Series Spectrum Analyzers, they are also compatible with most other spectrum analyzers. They can serve a wide variety of general-purpose uses, such as down-conversion for noise figure and network analysis measurements.

WM780 Series Waveguide Mixers feature individual frequency characterization curves attached to the housing for improved measurement accuracy.

All mixers are gold-plated brass, conforming to MIL-G-45204 Class I, Type 1 specifications, and will withstand harsh environments.

ELECTRICAL CHARACTERISTICS

Tektronix Model No.	Band Desig.	Frequency Range (GHz)	Sensitivity*1 (dBm)	Frequency*2 Response (dB)	Conversion*3 Loss Typical (dB)	Low-pass*6 Cut-off Frequency
WM780K	K	18-26.5	–100	±2	30	12 GHz
WM780A	A	26.5-40	–95	±2	30	16 GHz
WM780Q	Q	33-50	–90	±2	35	21 GHz
WM780U	U	40-60	–90	±2.5	35	16 GHz
WM780V	V	50-75	–90 @ 50 GHz –85 @ 75 GHz typ	±3*4 typical	35 @ 50 GHz 40 @ 75 GHz	28 GHz
WM780E	E	60-90	–80 @ 60 GHz –80 @ 90 GHz typ	±3*4 typical	35 @ 60 GHz 45 @ 90 GHz	28 GHz
WM780W	W	75-110	–80 @ 75 GHz –70 @ 110 GHz typ	±3*4 typical	45 @ 75 GHz 55 @ 110 GHz	30 GHz
WM780F	F	90-140	–75 @ 90 GHz –65 @ 140 GHz typ	±3*4 typical	50 @ 90 GHz 60 @ 140 GHz	32 GHz
WM780D	D	110-170	–70 @ 110 GHz –60 @ 170 GHz typ	±3*4 typical	50 @ 110 GHz 60 @ 170 GHz	40 GHz
WM780G	G	140-220	–65 @ 140 GHz –55 @ 220 GHz typ	±3*4 typical	55 @ 140 GHz 65 @ 220 GHz	40 GHz
WM780J	J	220-325	–55 @ 220 GHz,*5 –45 @ 325 GHz typ	±3*4 typical	65 @ 220 GHz 75 @ 325 GHz	40 GHz

*1 *Equivalent average noise level (using a 2790 Series Spectrum Analyzer in 1 kHz resolution bandwidth).*

*2 *Maximum amplitude variation across each waveguide mixer band (using a 2790 Series Spectrum Analyzer with peaking control optimized at each frequency in response to a –30 dBm CW input signal to the mixer).*

*3 *LO drive ±10 dBm peaking control optimized.*

*4 *Over any 5 GHz bandwidth for millimeter wave mixers above 60 GHz.*

*5 *Value estimated at 325 GHz.*

*6 *These low-pass filters are in LO/IF connector.*

APPLICATIONS

- **Radar**
- **Millimeter Wave R&D**
- **Communications**

ORDERING INFORMATION

WM780 WAVEGUIDE MIXERS AND SETS

18 to 26.5 GHz – Order WM780K **$2,140**
26.5 to 40 GHz – Order WM780A **$2,155**
33 to 50 GHz – Order WM780Q **$2,475**
40 to 60 GHz – Order WM780U **$2,945**
50 to 75 GHz – Order WM780V **$3,335**
60 to 90 GHz – Order WM780E **$3,620**
75 to 110 GHz – Order WM780W **$3,725**
90 to 140 GHz – Order WM780F **$3,975**
110 to 170 GHz – Order WM780D **$5,550**
140 to 220 GHz – Order WM780G **$5,700**
220 to 325 GHz – Order WM780J **$7,200**

18 to 40 GHz Set – Includes WM780K, WM780A. Order WM7802 ..... **$3,990**
18 to 60 GHz Set – Includes WM780K, WM780A, WM780U. Order WM7803 ..... **$6,735**
33 to 170 GHz Set – Includes WM780Q, WM780V, WM780W, WM780D. Order WM78012 ..... **$15,085**

ACCESSORIES

Diplexer Assembly – Required for 2790 Series. Order 015-0385-00 ..... **$320**
Diplexer Interconnecting Cable – Required for 2790 Series. 50 Ω, SMA-to-SMA. Order 012-0649-00 ..... **$41**
Case – Order 006-7340-00 ..... **$60**

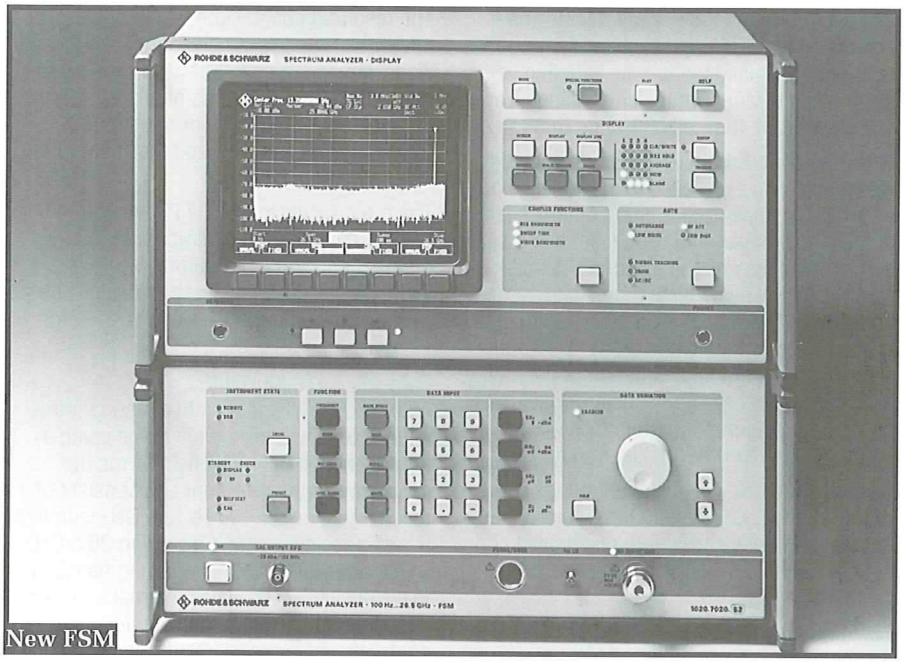
Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Spectrum Analyzers

FSAS FSA
FSBS FSB
FSMS FSM



New FSM

FSA/FSB/FSM Spectrum Analyzers

The FS-Series spectrum analyzers consist of the 100 Hz to 1.8 GHz FSA, 100 Hz to 5 GHz FSB, and 100 Hz to 26.5 GHz FSM. These spectrum analyzers are used to measure the spectral distribution of signals. The quasi-continuously variable frequency resolution and the precise synthesizer tuning with long-term stability allow the FS Series to be used both as a spectrum analyzer in swept-frequency analysis and as selective level meters in fixed-frequency mode.

The large range of resolution bandwidths, the frequency span, and the level display with wide dynamic range make the FSA, FSB, and FSM ideal for all selective level measurements.

The FSA, FSB, and FSM provide the following:

- Numerous automatic test routines such as marker functions, level frequency and bandwidth correction, self-test, and adaptation to signal type
- Integrated AM/FM demodulator for identification of unknown signals via headphones
- Clear color display; one or several external color monitors or an oscilloscope can be connected
- Hardcopy output on printer, video printer, or plotter (labeling via external keyboard)
- Remote-control capability via IEC bus (IEC625-1, IEEE 488), programmable user port
- Broadband (output) power meter
- Selective voltmeter
- AM measuring and calibration instrument
- Adjacent-channel power meter
- SSB measuring instrument
- Linearity measuring instrument
- Selective, highly sensitive frequency counter
- Two-port measuring instrument (in conjunction with a signal generator)
- VSWR meter (in conjunction with a directional coupler and signal generator)
- Measuring instrument for thermal noise (in conjunction with a noise source)

FSA/FSB/FSM

- Exceptional High Sensitivity
- Large Dynamic Range
- Flat RF Frequency Range
- Extremely Low Phase Noise
- High Frequency Accuracy
- Quasi-continuously Variable Resolution Bandwidth
- Single-knob Operation
- Mono-function Hardkeys
- Softkey-controlled Menus
- Parameter Entry on Keyboard or Variation Using Spinwheel
- Status Display

FSAS/FSBS/FSMS

- Built-in Tracking Generator
- Selective Scalar Network Analysis for Measuring Transmission and Reflection Parameters as Well as Voltage and Power

Exceptional RF characteristics, as well as high measurement and operating convenience.

Built-in tracking generator with FSAS, FSBS, and FSMS.

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

APPLICATIONS

FSA/FSB/FSM

- **Satellite Communications Design and Test**
- **Radar Systems**
- **EW Systems**
- **Mobile Radio and Terrestrial Microwave Systems**

FSAS/FSBS/FSMS

- **Measurements on (Coaxial) Cables**
- **Measurements on Circuits with Low Input Levels**
- **Filter Measurements (Drift Measurements)**
- **Antenna Measurements**

FSA FSB FSM

FSAS FSBS FSMS

Spectrum Analyzers

FS-SERIES CAPABILITIES

The FSA provide the features required for state-of-the-art testing. Wide dynamic range, fast sweep rates, clear-cut operating concept, and flexible software make the FSA ideal for current and future measurement needs. It provides measurement accuracy and repeatability plus measuring convenience such as eight markers, parameter corrections, and selectable operating modes. An external keyboard provides even greater convenience for screen documentation. Results are displayed on a 9-inch color screen.

The FSB adds to the basic features of the FSA to open up a wide variety of uses in communications measurements that place extremely high demands on the dynamic range, operating range, spectral purity, and sensitivity of the measuring instrument. The expanded frequency range up to 5 GHz covers many different applications such as satellite, navigation and radiocommunication service, radio-astronomy research, industry, and medicine.

The FSM is a top-class instrument for microwave measurements building upon the foundation of the FSA and FSB. Excellent RF and system characteristics make the FSM an all-around measuring instrument for every RF and microwave laboratory. Directional and mobile radio are typical fields of application for the FSM, as well as measurements in the sub-millimeter range with the aid of optional input mixers. Broadband measurements are supported by extremely fast sweep rates (typically 80 ms for 26.5 GHz sweep width), dynamic correction of the preselector tuning voltage being the necessary precondition. The microwave synthesizer features excellent spectral purity. This allows phase noise measurements to be conveniently performed, even in the microwave range.

COMMON FEATURES

The FSA, FSB, and FSM share the following common features except where exceptions are noted.

Frequency Accuracy and Stability – The use of a modern synthesizer concept allows a frequency resolution of 0.1 Hz at extremely low phase noise. For frequency spans equal to or less than 5 MHz, the frequency variation is obtained by very small phase-synchronized frequency steps (0.003 Hz). For spans greater than 5 MHz, high frequency accuracy is achieved by synchronization with the start and stop frequencies.

Quasi-continuous Frequency Resolution – The five-stage electronic analyzer filter allows the resolution bandwidth to be varied in very small steps throughout the entire range from less than 10 Hz (typically 6 Hz) up to 3 MHz.

Wide Dynamic Range with Flat Frequency Response – An excellent thermal noise characteristic has been achieved by optimization of the signal/noise ratio of all stages in the RF and IF branches and the use of a balanced mixer with a wide dynamic range and a low-noise GaAs FET amplifier. The RF attenuation is adjustable in 1-dB steps (FMS: 5-dB steps) and enables optimum adaptation of the input level to the most favorable mixer level. The balanced configuration of this mixer largely suppresses even-order noise products.

The mixer loss which is almost independent of the frequency, together with electronic frequency-response correction, results in a constant-amplitude display over the complete frequency range

Level Display Range – The level display range can be modified from a high-level resolution (LIN or 0.1 dB per division) up to a high-level range display (LOG 100 or 110 dB). The high resolution of the internal A/D converter also results in a high and useful resolution of the measured levels. Level display is possible in all common units. Transducers of all types connected at the input can be considered in the level display by way of a level offset.

FS-SERIES OPERATION

The FS-series spectrum analyzers are easy to operate, even for complex measurements. A single spinwheel, a clearly divided front panel, and softkeys at the bottom edge of the screen simplify operation, reduce the error liability, and speed up measurements. Parameters are entered via the numeric keypad and varied with the step keys or spinwheel.

The status display provides an overview of the currently active settings using the help menus. The status list can be output as a hardcopy just as the display contents. All device functions can be remotely controlled via the IEC/IEEE-bus interface.

FS-SERIES DESIGN FEATURES

The FS-series operate on the principle of search-tone analysis. This means that the frequency range to be analyzed can be scanned by varying the internal oscillator frequency with the aid of an analysis filter with matched resolution bandwidth. The scan can be defined by any combination of start, center, and stop frequency, as well as span.

The resolution bandwidth, video bandwidth, and sweep-time parameters are linked by an algorithm as a function of the displayed frequency range. The results of analysis are displayed on the built-in color monitor – frequency on the X axis and the associated amplitudes on the Y axis.

The modular design of the FS-series provides the flexibility that is required for measurements today and in the future. For example, an internal tracking generator enables selective network analysis (see details of FSAS, FSBS, and FSMS)

FSM-SPECIFIC FEATURES

A six-section YIG filter with a resonant frequency tunable over a wide range using a homogeneous magnetic field forms the microwave core. The front end consists of a receive section for 100 Hz to 5 GHz with high IF and a receive section from 5 to 26.5 GHz. Switchover between the receiving bands is made electronically via an internal diplexer. Fundamental mixing in conjunction with comprehensive preselection covers all applications in the RF and microwave range.

In addition to its high-level measurement accuracy and wide dynamic range, the FSM features an exceptional sensitivity throughout the entire frequency range from 100 Hz up to 26.5 GHz.

For high sensitivity and level measurements, the optional FS-Z15 Adapter System provides extremely short connections in the microwave circuitry to ensure low insertion loss and to avoid multiple reflections. This allows the user to install the preferred connector system as the FSM device interface. Low-loss test cables, specially tailored to the adapters, are also available. With optional mixers, the FSM can make measurements up to the millimeter band.

BUILT-IN TRACKING GENERATOR WITH FSAS/FSBS/FSMS

The FSAS, FSBS, and FSMS add tracking generator capability to the comparable FSA, FSB, and FSM. The tracking generator provides high level accuracy, wide dynamic range, and excellent frequency stability for reproducible measurements of passband and stopband characteristics.

Spectrum Analyzers

FSAS	FSA
FSBS	FSB
FSMS	FSM

CHARACTERISTICS

Specification	FSA/FSAS	FSB/FSBS	FSM/FSMS
Frequency-related			
Frequency Range			
Internal Mixer	100 Hz to 1.8 GHz	100 Hz to 5.2 GHz	100 Hz to 26.5 GHz
External Mixers			26.5 to 110 GHz
Readout Accuracy (Center or Markers)	3.5 kHz @ 1 GHz, 1 MHz SPAN, 1 kHz RBW	3.5 kHz @ 1 GHz 1 MHz SPAN, 1 kHz RBW	3.5 kHz @ 1 GHz, 1 MHz SPAN, 1 kHz RBW
Frequency Measurement Accuracy (Counter Mode)	±20 Hz @ 1 GHz CF	±20 Hz @ 1 GHz CF	±20 Hz @ 1 GHz CF
Delta (Δ) Frequency Measurement Accuracy (Counter Mode)	104 Hz @ 1 GHz, 1 MHz Δ frequency	104 Hz @ 1 GHz, 1 MHz Δ frequency	104 Hz @ 1 GHz, 1 MHz Δ frequency
Reference Frequency			
Stability	1 x 10^{-7}/yr aging	1 x 10^{-7}/yr aging	1 x 10^{-7}/yr aging
Settability	1 x 10^{-8}	1 x 10^{-8}	1 x 10^{-8}
Frequency Stability			
Residual FM	1 Hz p-p in 10 s	1 Hz p-p in 10 s	1 Hz p-p in 10 s +0.6 Hz/GHz above 2 GHz
Drift	5 x 10^{-10}/day 5 MHz span	5 x 10^{-10}/day 5 MHz span	5 x 10^{-10}/day 5 MHz span
Phase Noise	–109 dBc/Hz @ 10 kHz offset, 1 GHz CF	–104 dBc/Hz @ 10 kHz offset, 5 GHz CF	–98 dBc/Hz @ 10 kHz offset, 20 GHz CF
Frequency Span			
Range (Per Div)	0 Hz, 10 Hz to 200 MHz	0 Hz, 10 Hz to 200 MHz	0 Hz, 10 Hz to 26.5 GHz total span
Accuracy	<0.5%	<0.5%	<0.5%
Resolution BW (RBW)			
Selection	10 Hz to 3 MHz	10 Hz to 3 MHz	10 Hz to 3 MHz
Range	3 dB, 10 Hz to 3 MHz 1, 3, 10 sequence	3 dB, 10 Hz to 3 MHz 1, 3, 10 sequence	3 dB, 10 Hz to 3 MHz 1, 3, 10 sequence
Resolution Selectivity	12:1 (–60 dB/–6 dB)	12:1 (–60 dB/–6 dB)	12:1 (–60 dB/–6 dB)
Video Bandwidth Range	1 Hz to 3 MHz 1, 3, 10 sequence	1 Hz to 3 MHz 1, 3, 10 sequence	1 Hz to 3 MHz 1 ,3, 10 sequence
Amplitude-related			
Reference Level Range	–140 to +30 dBm	–140 to +30 dBm	–140 to +30 dBm
Maximum Safe Input Power			
CW	0.1 W (+20 dBm) 0 RF Attn.	0.1 W (+20 dBm) 0 RF Attn.	0.1 W (+20 dBm) 0 RF Attn.
PULSE	225 W, 150 V 10 dB RF Attn.	225 W, 150 V 10 dB RF Attn.	225 W, 150 V 10 dB RF Attn.
CRT Display Range (LOG)	1, 2, 5, 10 dB/div	1, 2, 5, 10 dB/div	1, 2, 5, 10 dB/div
CRT Scale Fidelity (LOG)	±1 dB over 100 dB range	±1 dB over 100 dB range	±1 dB over 100 dB range
CRT Display Range (LINEAR)	–130 to +30 dBm	–130 to +30 dBm	–130 to +30 dBm
CRT Scale Fidelity (LINEAR)	5% of full scale, 10 Hz RBW	5% of full scale, 10 Hz RBW	5% of full scale, 10 Hz RBW
Input Attenuator Range	0 to 81 dB in 1 dB steps	0 to 81 dB in 1 dB steps	0 to 81 dB in 1 dB steps
Dynamic Range (maximum)			
Compression to Noise	145 dB	145 dB	145 dB
Signal to Distortion			
Harmonic	80 dB	80 dB	80 dB
Intermod	100 dB	100 dB	100 dB
Viewable on CRT Screen	100 dB	100 dB	100 dB
Residual Response (0 Signal/0 ATTN)	–110 dBm	–110 dBm	–110 dBm

Continued on next page.

FSA FSAS
FSB FSBS
FSM FSMS

Spectrum Analyzers

Specification	FSA/FSAS	FSB/FSBS	FSM/FSMS
Amplitude-related (Continued)			
2nd Harmonic Distortion (mixer level –30 dBm)	100 Hz to 1.8 GHz ≤20 MHz: –65 dBc, ≥20 MHz: –80 dBc	100 Hz to 5 GHz f <40 MHz: –60 dBc, f ≥40 MHz: –70 dBc	100 Hz to 26.5 GHz f <40 MHz: –60 dBc, f 40 MHz to 5 GHz: –70 dBc, f >5 GHz: –95 dBc,
3rd Order Intermod Distortion	–75 dBc, mixer level –30 dBm –100 dBm mixer level, –40 dBm	–75 dBc, mixer level –30 dBm –100 dBm mixer level, –40 dBm	–75 dBc, mixer level –30 dBm
3rd Order Intercept (TOI)	+7.5 dBm @ –30 dBm mixer input	+7.5 dBm @ –30 dBm mixer input, +10 dBm @ –40 dBm	+7.5 dBm @ –30 dBm mixer input
Calibrator Accuracy	±0.2 dB	±0.2 dB	±0.2 dB
Gain Compression Level	0 dBm	–10 dBm input	–5 dBm input (f > 5 GHz)
Frequency Response (10 dB Attenuator Calibrator Reference)			
100 kHz to 1.8 GHz	<±1 dB	<±1 dB	<±1 dB
100 kHz to 5 GHz	N/A	<±1 dB	<±1 dB
5 GHz to 26.5 GHz	N/A	N/A	<±2.5 dB
Displayed Inherent Noise Level (10 Hz RBW, VBW 1 Hz, RF ATTN 0 dB)			
200 Hz to 1 kHz	<–100 dBm	<–85 dBm	–185 dBm
1 kHz to 10 kHz	<–110 dBm	<–105 dBm	–105 dBm
10 kHz to 100 kHz	<–115 dBm	<–110 dBm	–110 dBm
100 kHz to 1 MHz	<–120 dBm	<–115 dBm	–115 dBm
1 MHz to 40 MHz	<–130 L.C.M.	<–130 L.C.M.	–140 L.C.M.
40 MHz to 4.8 GHz	<–145 dBm	<–140 dBm	–135 dBm
4.8 GHz to 6 GHz	N/A	<–137 dBm (4.8 to 5 GHz)	<–135 dBm
6 GHz to 21 GHz	N/A	N/A	<–138 dBm
21 GHz to 26.5 GHz			<–135 dBm
IF Gain Switching Uncertainty	1 dB to –60 dBm, 1.3 dB to –120 dBm	1 dB to –60 dBm, 1.3 dB to –120 dBm	1 dB to –60 dBm, 1.3 dB to –120 dBm
RF Attenuator Switching Accuracy			
0 to 1.8 GHz	±0.2 dB/5 dB, 1.6 dB max	±0.2 dB/5 dB, 1.6 dB max	±0.2 dB/5 dB, 1.6 dB max
1.8 to 18.0 GHz	N/A	2 dB max to 5 GHz	2.5 dB max
18.0 to 26.5 GHz	N/A	N/A	2.5 dB max
RBW Switching Uncertainty	±0.3 dB ≥10 Hz RBW, ±1.0 dB <10 Hz RBW	±0.3 dB ≥10 Hz RBW, ±1.0 dB <10 Hz RBW	±0.3 dB ≥10 Hz RBW, ±1.0 dB <10 Hz RBW
Sweep Time Range			
Frequency Display	20 ms to 1,980 s	20 ms to 1,980 s	20 ms to 1,980 s
Time Display	100 µs to 1,980 s	100 µs to 1,980 s	100 µs to 1,980 s
Sweep Time Accuracy	$\pm 10^{-3}$	$\pm 10^{-3}$	$\pm 10^{-3}$
Marker Time Measurement Accuracy	1% 100 µs to 10 ms, 0.3% 20 ms to 1,980 s	1% 100 µs to 10 ms, 0.3% 20 ms to 1,980 s	1% 100 µs to 10 ms, 0.3% 20 ms to 1,980 s
Delta Marker Time Measurement Accuracy	1% 100 µs to 10 ms, 3% 20 ms to 1,980 s	1% 100 µs to 10 ms, 0.3% 20 ms to 1,980 s	1% 100 µs to 10 ms, 0.3% 20 ms to 1,980 s
Sweep Trigger Modes	Free Run, Line, Video, External	Free Run, Line, Video, External	Free Run, Line, Video, External

Continued on next page.

Spectrum Analyzers

FSAS	FSA
FSBS	FSB
FSMS	FSM

Specification	FSAS	FSBS	FSMS
Tracking Generator-related			
Frequency	100 Hz to 2 GHz	100 Hz to 5 GHz	100 Hz to 26.5 GHz
Output			
Range (adjustable)	–100 to –5 dBm	–81 to 0 dBm	–75 to 0 dBm
Level (mechanical)	1-dB steps	1-dB steps	5-dB steps
Level (electronic)	0.1-dB steps	0.1-dB steps	N/A
Suppression of Spurious (frequency offset 0 Hz)			
Harmonics			
1 kHz to 2 GHz	>25 dB	>25 dB	>25 dB
2 GHz to 5 GHz	N/A	>20 dB	>20 dB
4.8 GHz < f >13.25 GHz	N/A	N/A	>7 dB
Other (carrier offset >20 kHz)	>30 dB	>30 dB	>30 dB
Residual FM, rms			
Measurement BW 30 Hz to 3 kHz	<300 Hz	<300 Hz	<300 Hz
Measurement BW 30 Hz to 20 kHz	<1 kHz	<1 kHz	<1 kHz
Level control (selected with softkey)	Internal/External	Internal/External	Internal/External
Modulation (AM <30%)			
Frequency (external AF source, softkey selection)	10 Hz to 20 kHz	10 Hz to 20 kHz	10 Hz to 20 kHz

Input/Output Characteristics	FSA/FSAS	FSB/FSBS	FSM/FSMS
RF Input Impedance	50 Ω	50 Ω	50 Ω
VSWR (10 dB RF Attenuation)			
<2.5 GHz	<1.5:1	<1.5:1	<1.5:1
2.5 to 5 GHz	N/A	<1.8:1	<1.8:1
5 to 26.5 GHz	N/A	N/A	<2.0:1 (with 20 dB RF attn.)
External Mixer Input Frequency	N/A	N/A	221 MHz
External Reference Input Frequency	10 MHz	10 MHz	10 MHz
Horizontal/Trigger Input Level	5 V	5 V	5 V
Calibrator	100 MHz, ±0.2 dB	100 MHz, ±0.2 dB	100 MHz, ±0.2 dB
1st L.O.	5.1 to 13.4 GHz, –5 dBm	5.1 to 13.4 GHz, –5 dBm	5.1 to 13.4 GHz, –5 dBm
Video Output	0 to +5 V into 75 Ω	0 to +5 V into 75 Ω	0 to +5 V into 75 Ω
Sweep Output	0 to +5 V into 500 Ω	0 to +5 V into 500 Ω	0 to +5 V into 500 Ω
I.F. Output			
Narrow Bandwidth	21.4 MHz (BW = RBW)	21.4 MHz (BW = RBW)	21.4 MHz (BW = RBW)
Wide Bandwidth	21.4 MHz (BW ≥10 MHz)	221.4 MHz (BW ≥36 MHz)	221.4 MHz (BW ≥36 MHz)
Probe Power	10 V @ 100 ma	10 V @ 100 ma	10 V @ 100 ma
IEEE Std. 488 Interface Functions	AHI, SHI, T6, L4, SRI, RLI, PPI, DCI	AHI, SHI, T6, L4, SRI, RLI, PPI, DCI DTI, CIC2, C3, C27	AHI, SHI, T6, L4, SRI, RLI, PPI, DCI DTI, CIC2, C3,C27

Continued on next page.

FSA FSAS
FSB FSBS
FSM FSMS

Spectrum Analyzers

Specification	FSA/FSAS	FSB/FSBS	FSM/FSMS
Other Features			
RS-232C Interface	YES	YES	YES
Direct Plot Output	YES	YES	YES
Digital Storage	1000 points Horizontal, 512 points Vertical	1000 points Horizontal, 512 points Vertical	1000 points Horizontal, 512 points Vertical
Digitizing Rate	8.9 µs	8.9 µs	8.9 µs
Non-volatile Memory Capability	YES	YES	YES
Help Mode (ROM)	YES	YES	YES
Intelligent Markers	YES, 6	YES, 6	YES, 6
Tracking Generator	YES, FSAS 100 Hz to 1.8 GHz	YES, FSBS 100 Hz to 5.2 GHz	YES, FSMS26 100 Hz to 26.5 GHz
Waveguide Mixers	N/A	N/A	26.5 to 110 GHz
Download Programs	YES (with FS-Z4)	YES (with FS-Z4)	YES (with FS-Z4)
Occupied BW Measurement	YES	YES	YES
Direct Plot	YES	YES	YES
Color Display	YES	YES	YES
Preamplifier	YES (FSAC) 20 MHz to 1.8 GHz	YES (FSBC) 40 MHz to 5 GHz	N/A
Quasi Peak Detector	Incorporated in ESAI EMI Test Receiver	Incorporated in ESBI EMI Test Receiver	Incorporated in ESMI Test Receiver
CISPR Bandwidths	Incorporated in ESAI EMI Test Receiver	Incorporated in ESBI EMI Test Receiver	Incorporated in ESMI Test Receiver
TV Video Out	YES	YES	YES
AM/FM Demod Speaker	YES	YES	YES
Environmental Characteristics			
Operating Temperature	0 to 55°C	0 to 55°C	0 to 55°C
Humidity	80% RH	80% RH	80% RH
Calibration Interval	1 year	1 year	1 year
Power Requirements			
Line Voltage	100 to 240 V	100 to 240 V	100 to 240 V
Line Frequency	47 to 440 Hz	47 to 440 Hz	47 to 440 Hz
Power Consumption	500 VA	500 VA	500 VA
Physical			
Dimensions (without handle, feet, cover)	**mm** / **in.**	**mm** / **in.**	**mm** / **in.**
Height	435 / 17.1	435 / 17.1	435 / 17.1
Width	413 / 16.3	413 / 16.3	413 / 16.3
Depth	590 / 23.2	590 / 23.2	590 / 23.2
Weight	**kg** / **lbs.**	**kg** / **lbs.**	**kg** / **lbs.**
(Carrying)	60 / 145	60 / 145	60 / 145

Continued on next page.

Spectrum Analyzers

FSAS	FSA
FSBS	FSB
FSMS	FSM

DEMODULATION RELATED

General – Receiver mode: Demodulation of received RF signal. Display of demodulated signal: Vertically on 10-line graticule as function of horizontal time base. Marker function for measuring: Modulation depth, frequency deviation, center frequency offset.

FM Demodulator –
Center frequency offset after AF calibration FM deviation: 2 kHz / 20 kHz / 200 kHz, <2% of deviation; 200 Hz, <40 Hz. Drift: <10 Hz/min. FM deviation display error (deviation 2 kHz, 20 kHz, 200 kHz). 100 Hz to 5 kHz modulation frequency: <3% of measured value. DC to 15 kHz modulation frequency: <5% of measured value. FM linearity error (deviation <20 kHz, modulation frequency <5 <5 kHz): <1%. Residual FM (p-p/2) averaged over 5 sweeps: <20 Hz. Incidental FM at 50% AM (modulation frequency 1 kHz, VBW 3 kHz): <500 Hz, typically <100 Hz.

AM Demodulator – Center offset of unmodulated signal: Measurement range: 100%: <2% of f_s, Measurement range: 10%: <5% or f_s.
Error of displayed modulation depth (AM <80%, plus residual AM, f_{mod} 0.4 to 10 kHz): Measurement range: 100%: <6% of measured value, Measurement range: 10%: <8% of measured value. Residual AM p-p/2: <1%. Weighted to CCITT: Typically <0.1%. Incidental AM (RBW = 3 MHz, FM deviation = 50 kHz, f_{mod} = 1 kHz): <3%.

DISPLAY RELATED

Monitor – 9-inch color CRT with 0.29 mm shadow mask pitch.

Brightness – Adjustable in 64 steps.

Colors – Selectable (16 from 4096).

Number of Display Memories – 4.

Resolution (electrical) – 1024 x 512 points.

Scaling – Electronically superimposed, calibrated graticule.

Additional Information – Alphanumeric display of essential parameters as well as hints in English.

Output to Plotter –
Interface: HP-GL.
Functions: Curve arithmetic (swap, subtract), comparison with tolerance curves, averaging, peak hold.

Markers – Reference marker, delta marker, six multimarkers.

ORDERING INFORMATION

FSA
Spectrum Analyzer **$44,190**
Includes: Power Cable, Connecting Cables (Upper-lower Unit), 3.5 mm Female Adapter, N-female Adapter, Manual.

FSB
Spectrum Analyzer **$58,610**
Includes: Power Cable, Connecting Cables (Upper-lower Unit), 3.5 mm Female Adapter, N-female Adapter, Manual.

FSM
Spectrum Analyzer **$73,030**
Includes: Power Cable, Connecting Cables (Upper-lower Unit), 3.5 mm Female Adapter, N-female Adapter, Manual.

FSAS
Spectrum Analyzer with Tracking Generator **$54,490**
Includes: Power Cable, Connecting Cables (Upper-lower Unit), 3.5 mm Female Adapter, N-female Adapter, Manual.

FSBS
Spectrum Analyzer with Tracking Generator **$65,820**
Includes: Power Cable, Connecting Cables (Upper-lower Unit), 3.5 mm Female Adapter, N-female Adapter, Manual.

FSMS26
Spectrum Analyzer with Tracking Generator **$100,840**
Includes: Power Cable, Connecting Cables (Upper-lower Unit), 3.5 mm Female Adapter, N-female Adapter, Manual.

Opt. 01 – Tracking Generator ..... **+$16,845**
Opt. 02 – RF Filter/RF Preamplifier for FSA, FSB ..... **+$19,975**
Opt. 03 – Special IF Channel Filter, Shape Factor 3:1 ..... **+$8,045**
Opt. 05 – FSA (only) Wideband IF Output ..... **+$2,330**

SERVICE ASSURANCE OPTIONS
Opt. R2 –Adds two years of post-warranty Repair Protection
FSA, FSAS, FSB,FSBS ..... **+$1,130**
FSAC, FSM, FSMS26 ..... **+$2,130**

COMMUNICATION ANALYZERS
100 Hz to 1.8 GHz – Adds Preamplifier, Tracking Generator, and RF filters to standard FSA Spectrum Analyzer capabilities. Standard FSA options apply. Order FSAC **$82,300**
100 Hz to 5.2 GHz – Adds Preamplifier, Tracking Generator, and RF filters to standard FSB Spectrum Analyzer capabilities. Standard FSB options apply. Order FSBC **$75,080**

RECOMMENDED ACCESSORIES
Computer Function Kit – Keyboard PCA-Z1, Floppy Disk Station Pz-11, two 3.5 in. Floppy Disk Drives PCA-B36, Software FS-K1. Order FS-Z4 ..... **$5,780**
Software – Computer Function, MS-DOS and BASIC. Order FS-K1 ..... **$2,475**
Noise Measurement. Order FS-K3 ..... **$3,670**
Service Kit –
Extender Boards and Coaxial Cables. Order FS-Z1 ..... **$2,610**
Cables –
Extension Cable for Servicing. Order FS-Z2 ..... **$1,025**
Microwave Cable and Adapter. Order FS-Z15 ..... **$1,155**
Mixer Sets –
26.5 to 110 GHz (Includes LO Amplifier FS-Z17). Order FS-Z16. ..... **$17,565**
16.5 to 40 GHz. Order FS-Z18 ..... **$2,730**
LO Amplifier – Order FS-Z17 ..... **$1,940**

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

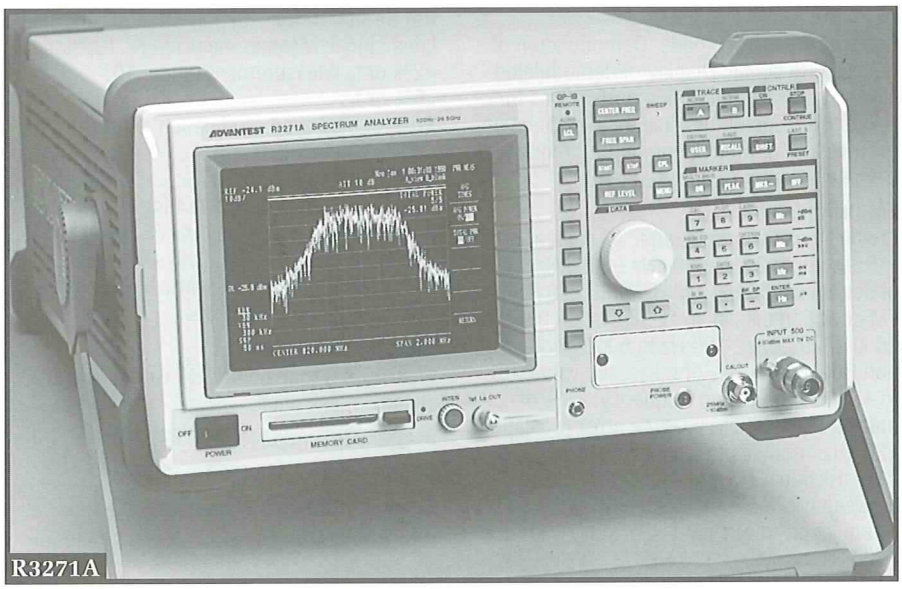
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

R3271A R3265A R3371A R3365A Spectrum Analyzers

Digital wireless test features in a rugged portable.

R3271A/R3371A, R3265A/R3365A

- Excellent Spectral Purity: –110 dBc/Hz (10 kHz away from Carrier)
- Resolution Bandwidth of 10 Hz to 3 MHz
- Built-in Frequency Counter with 1 Hz Resolution
- Audio Demodulation with Internal Speaker
- Portable System with a Large CRT Display
- High-speed 5 µs/div Sweep
- TDMA Signal Analysis
- Memory Card Function
- Multi-marker with up to Eight Points
- Extensive Built-in EMC Measurement Functions
- Confirms to MIL-T-28800 Standards
- Built-in Tracking Generator (R3365A and R3371A)



R3271A

R3271A/R3371A Spectrum Analyzer

The R3271A/R3371A spectrum analyzer is designed to analyze pulse RF signals used for radar or to analyze the spectra of microwaves and quasi-millimeter waves used for satellite broadcasting, satellite communications, and mobile communication.

The R3271A/R3371A can measure the ultra-wide frequency range of 100 Hz to 26.5 GHz in one sweep operation. It can also perform the sweep continuously and repeatedly. A newly developed high-purity synthesizer enables a high signal purity of –110 dBc/Hz at 2.6 GHz and –108 dBc/Hz at 7.5 GHz (10 kHz offset). The R3271A/R3371A spectrum analyzer is thus ideally suited for mobile radio communication, for which narrower signal bandwidths and digital transmission are being implemented. In the past, such high-performance equipment was used only for advanced research and development; however, this level of performance is now needed on a commercial level.

R3265A/R3365A Spectrum Analyzer

The R3265A/R3365A is a quasi-microwave spectrum analyzer designed to meet user needs and to ensure easy operations. The R3265A/R3365A incorporates a time domain function so it can be used for both digital and analog mobile communication. The R3265A/R3365A can measure a wide frequency range of 100 Hz to 8 GHz in one sweep over a wide dynamic range. Even at a frequency of 2.6 Hz, a newly developed high-purity synthesizer enables a high signal purity of –110 dBc/Hz (offset frequency of 10 kHz).

This unit performs especially well in measuring the spurious emission intensity of mobile communications equipment, the bandwidth of occupied frequencies, and signal leakage from adjacent channels. In the low-noise mode, the R3265A/R3365A has a high-input sensitivity of –145 dBm (1 MHz to 3.6 GHz), so it can easily measure faint signals.

In addition to its popular user-defined functions, the R3265A/R3365A incorporates a multi-marker function as well as a function to list the frequency and level displayed by the multi-marker. A memory card function can save or recall measurement settings, measurement data, and user definitions. Using this function, the time needed for measurement and panel resetting operations can be significantly shortened.

APPLICATIONS

- **Digital Mobile Radio Test**
- **Antenna and Base Station Test**
- **Radio Communications System Test**
- **Microwave Device Test**

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

GPIB IEEE-488 The R3271A complies with IEEE Standard 488.1-1987.

Spectrum Analyzers

TRACKING GENERATOR

The R3365A and R3371A are identical to the R3265A and R3271A, respectively, except that the R3365A and R3371A include a built-in tracking generator to facilitate frequency response measurements and provide scalar network analyzer capability (with an external SWR bridge).

BURST SIGNAL ANALYSIS FUNCTIONS

- **Fast Digitized Sweep.** The R3265A/R3365A, R3271A/R3371A use a high-speed digitizer to perform high-speed sweeps of 5 µs/div during zero span. This data can also be averaged. This function is ideally suited for monitoring the mean transmission power and duration of Time Division Multi-Access (TDMA) signals that are used in the Global System for Mobile Communication (GSM) systems in Europe and in the next-generation mobile telephone systems in Japan and the U.S.A. (e.g. digital mobile telephones). An arbitrary range can be expanded using the delayed sweep function.
- **Gated Sweep Function.** The burst signal (TDMA and video signals) analysis function, when combined with the high-speed sweep, can be used to monitor the transmission power in an arbitrary one-time slot of a TDMA signal or to analyze the noise in one horizontal line of a TV signal. Until now, the gated sweep function required an external gated sweep signal. Option 71 incorporates this signal, which facilitates operations considerably.
- **Delayed Sweep.** The delayed sweep (Option 71) can be used to analyze the frequency of only the portion specified in the zero-span mode (time domain) and to expand the portion specified in the zero-span mode. Any gate signal is internally produced from a trigger signal source. This gate signal enables the portion you wish to analyze to be gated, the frequency to be analyzed partially, and the time domain waveform to be expanded.

MEASUREMENT OF OCCUPIED FREQUENCY BANDWIDTHS AND ADJACENT-CHANNEL LEAKAGE POWER

By calculating the measured spectrum data, the occupied frequency bandwidth of a radio transmission characteristic and the leakage power of an adjacent channel can be easily measured. The carrier frequency is also displayed when the occupied frequency bandwidth is measured. The leakage from an adjacent channel can be measured in a dynamic range of 70 dB (typical value) with high signal purity.

INTERNAL TRACKING GENERATOR

The R3365A and R3371A include an internal tracking generator to dynamically measure the resonant characteristic of a high-Q element or the frequency response of a dielectric filter. In addition, the 120 dB dynamic-range display guarantees a 110 dB dynamic measurement range for frequency response measurement with the tracking generator. Therefore, even high stop-band attenuation can be measured.

OPTICAL MODULATION SPECTRUM ANALYZER

Addition of the Q32605 Optical Receiver plug-in allows the R3265A/R3271A to function as an optical modulation spectrum analyzer.

Optical input sensitivity with the Q32605 is –160 dBm/Hz, frequency range of 6 MHz to 2.4 GHz, and a frequency flatness of ±1.8 dB.

The R3265A/R3271A/Q32605 can be used to measure RIN (Relative Intensity Noise) of optical analog transmission LDs and optical transmitters, modulation degree, C/N, and the noise level of optical fiber amplifiers.

DIGITAL RADIO TRANSMITTER ANALYSIS

The R3265A/R3365A, R3271A/R3371A are also available in a configuration along with the R3541C Modulation Accuracy Measurement Unit specifically designed for digital radio transmitter analysis. See information on the R2465A/R2471A on page 270.

Characteristics

FREQUENCY RELATED

Frequency Range – 100 Hz to 8 GHz, R3265A. 100 Hz to 26.5 GHz, R3271A. (extended to 325 GHz, with Tektronix WM780 Series waveguide mixers – see **Page XXX**):

Harmonic Mode (N), R3265A – =1.

Harmonic Mode (N), R3271A –

Frequency Band	Harmonic Mode (N)
100 Hz to 3.6 GHz	1
3.5 GHz to 7.5 GHz	1
7.4 GHz to 15.4 GHz	2
15.2 GHz to 23.3 GHz	3
23 GHz to 26.5 GHz	4

Preselector – 3.5 GHz to 8 GHz using YIG-tuned preselector.

Frequency Readout Accuracy (Start, Stop, CF, Marker) – ±(freq. readout x freq. reference accuracy + span x span accuracy +0.15 x res BW + 10 Hz).

Span Accuracy – ±3% (span >2 MHz), ±5% (span ≤2 MHz).

Count Frequency Marker – Resolution: 1 Hz to 1 kHz. Count accuracy (S/N >25 dB): ±(marker freq. x freq. reference accuracy + 5 Hz x N+ 1 LSD). Delta marker count accuracy: (S/N ≥25 dB) ±(delta marker freq. x freq. reference accuracy + 10 Hz x N + 2 LSD).

Frequency Reference Accuracy – R3265A: $\pm 2 \times 10^{-8}$/day, $\pm 1 \times 10^{-7}$/year, $\pm 5 \times 10^{-9}$/day (Option 21). R3271A: $\pm 2 \times 10^{-8}$/day, $\pm 1 \times 10^{-7}$/year, $\pm 5 \times 10^{-9}$/day (Option 21).

Frequency Stability – Residual FM (zero span): <3 Hz x N p-p/0.1 s. Drift (after 1 hour warm-up): 50 kHz <span ≤2 MHz: <2.5 kHz x sweep time (minute) x N. Span ≤50 kHz: <60 Hz x sweep time (minute) x N.

Spectral Purity – Noise sidebands.

Offset	f ≤2.6 GHz	f ≥2.6 GHz
1 kHz	<–100 dBc/Hz	≤(–95 + 20 logN) dBc/Hz
10 kHz	<–110 dBc/Hz	≤(–108 + 20 logN) dBc/Hz
20 kHz	<–110 dBc/Hz	≤(–108 + 20 logN) dBc/Hz
100 kHz	<–114 dBc/Hz	≤(–110 + 20 logN) dBc/Hz

R3271A R3371A R3265A R3365A Spectrum Analyzers

FREQUENCY SPAN

Linear Span – Range: 200 Hz to 8 GHz (R3265A) 200 Hz to 26.5 GHz (R3271A), zero span. Accuracy: ±3% (span >2 MHz), ±5% (span ≤2 MHz).

Log Span – Range: 1 kHz to 1 GHz, 1, 2, 3 decades selected. Accuracy: ±(10% + stop freq. x 0.1%).

Resolution Bandwidth (–3 dB) – Range: 10Hz to 3 MHz 1, 3, 10 sequence. Accuracy: 100 Hz to 1 MHz: ±15%. 30 Hz to 3 MHz (25°C ±10°C): ±25%. 10 Hz to 100 Hz (digital IF): ±50%. Selectivity (–60 dB/–3 dB): 100 Hz to 3 MHz: <15:1. 30 Hz: <20:1. 10 Hz to 100 Hz (digital IF): 5:1 (nominal). Bandwidth (–6 dB): 200 Hz, 9 kHz, 120 kHz. Conformed to CISPR standard.

Video Bandwidth Range – 1 Hz to 3 MHz, 1, 3, 10 sequence.

AMPLITUDE RELATED

Amplitude Range – +30 dBm to noise level.

Maximum Input – Average continuous power: +30 dBm (1 W) (Input attenuation. ≥10 dB). DC: 0V.

Display Range – Scale calibration: 10x10 division graticule. Log: 10, 5, 2, 1, 0.5, 0.2, 0.1 dB/div Linear: 10% of reference level/div QP log: 40 dB (5 dB/div).

Input Attenuator Range – 0 to 70 dB (10 dB step).

DYNAMIC RANGE

Maximum Dynamic Range – 1 dB gain compression to noise level: 130 dB – 1.55f (GHz) dB, 10 MHz to 3.6 GHz.

Signal Distortion Harmonic – >10 MHz to 3.8 GHz: 85 dB. >3.5 GHz: 110 dB.

Third Order Intermodulation – >10 MHz: 90 dB.

Displayed Average Noise Level (10 Hz Res BW, 0 dB input attenuation, 20 times average) – 1 kHz: –100 dBm. 10 kHz: –110 dBm. 100 kHz: –111 dBm. 1 MHz to 3.6 GHz:–(135 – 1.55f (GHz)) dBm. 3.5 GHz to 7.5 GHz: –130 dBm. (R3271A) 7.4 GHz to 15.4 GHz: –123 dBm. 15.2 GHz to 23.3 GHz: –116 dBm. 23 GHz to 26.5 GHz: –110 dBm.

Gain Compression (1 dB) – –5 dBm mixer input level. >10 MHz.

SPURIOUS RESPONSE

Second Harmonic Distortion – <–70 dBc; Freq. Range: 10 MHz to 3.6 GHz. Mixer Level: –30 dBm. <–100 dBc; Freq. Range: >3.5 GHz. Mixer Level: –10 dBm.

Third Order Intermodulation Distortion – <–70 dBc; Freq. Range: 10 MHz to 3.6 GHz. Mixer Level: –30 dBm, <–75 dBc; Freq. Range: >3.6 GHz. Mixer Level: –30 dBm.

Residual Responses – <–100 dBm; Freq. Range: 1 MHz to 3.6 GHz. <–90 dBm; Freq. Range: 300 kHz to 26.5 GHz.

AMPLITUDE ACCURACY

Frequency Response – In band flatness (10 dB input attenuation): 100 Hz to 3.6 GHz: ±1.5 dB. 50 MHz to 2.6 GHz: ±1.0 dB. 3.5 GHz to 7.5 GHz: ±1.5 dB.
R3271A, 7.4 GHz to 15.4 GHz: ±3.5 dB. 15.4 GHz to 23.3 GHz: ±4.0 dB. 23 GHz to 26.5 GHz: ±4.0 dB.

Additional Uncertainly Due to Band Switching – ±0.5 dB.

Frequency Response Referenced to CAL Signal – ±5 dB.

Calibrator Accuracy – –10 dBm ±0.3 dB.

IF Gain Uncertainty (after automatic calibration) – 0 dBm to –50 dBm: ±0.5 dB. 0 dBm to –80 dBm: ±0.7 dB.

Scale Fidelity – Log: ±0.2 dB/1 dB, ±1 dB/10 dB, ±1.5 dB/90 dB. Linear: ±5% of reference level. QP mode log: ±1.0 dB/30 dB, ±2 dB/40 dB, ±1.0 dB/40 dB (25°C ±10°C).

Input Attenuator Switching Accuracy (20 to 70 dB settings referenced to 19 dB) – ±1.1 dB/10 dB step, 2.0 dB max., 0 to 12.4 GHz. ±1.3 dB/10 dB step, 2.5 dB max., 12.4 GHz to 18 GHz. ±1.8 dB/10 dB step 3.5 dB max., 18 GHz to 26.5 GHz.

Resolution Bandwidth Switching Uncertainty (at reference BW, 300 kHz, after automatic calibration) – 100 Hz to 3 MHz: ≤±0.3 dB. 30 Hz: ≤±1 dB. 10 Hz to 100 Hz (digital IF): ≤±1.5 dB.

Pulse Digitization Uncertainty (pulse response mode PRF >700/sweep time) Peak-to-Peak – Log: RBW ≤1 MHz: 1.2 dB. RBW ≤3 MHz: 3 dB. Linear: RBW ≤1 MHz: 4% of reference level. RBW ≤3 MHz: 12% of reference level.

SWEEP RELATED

Sweep Time – SPAN = 0: 50 µs to 1000 s and manual sweep. SPAN ≥200 Hz: 20 ms to 1000 s and manual sweep. Accuracy: ±3%.

Sweep Trigger – Free run, line, single, video, TV-H, TV-V, external.

Demodulation – Spectrum demodulation: Modulation type: AM and FM. Audio output: Speaker and phone jack with volume control. Marker pause time: 100 ms to 1000 s.

DELAYED SWEEP WITH OPTION 71

Trigger Signal Source – External trigger signal (input from the external trigger input connector). VIDEO and TV-V.

Delay Time – 200 ns to 1.5 s with a resolution of 100 ns.

Delayed Sweep Time – 50 µs to 1000 s (resolution is the same as that set in the sweep time).

Spectrum Analyzers

R3271A **R3371A**
R3265A **R3365A**

Gated Sweep Specifications – Trigger signal source: Produces a gate signal. Input from the external trigger input connector or gate input connector.

Frequency Domain Analysis – External trigger input and gate input.

Time Domain Analysis – External trigger input, gate input, VIDEO and TV-V.

Gate Position – 300 ns to 100 ns with resolution of 100 ns.

Gate Width – 1 µs to 1.5 s with resolution of 100 ns.

TRACKING GENERATOR (R3365A/R3371A)

Frequency Range – 100 kHz to 3.6 GHz.

Output Level Range – –3 dBm to –30 dBm (0.1 dB steps).

Output Level Accuracy – ±0.5 dB (25 MHz, –10 dBm, 25°C, ±10°C).

Vernier Accuracy – ±0.5 dB (25 MHz, –10 dBm, 25°C, ±10°C).

Dynamic Range – 1 MHz to 3 GHz: –110 dBm. 3 GHz to 3.6 GHz: –100 dBm.

Power Sweep Range – 30 dB (in 0.1 dB steps).

INPUTS/OUTPUTS

External Memory Function – IC memory card.

RF Input – Connector type: N type (adaptable to SMA type). Impedance: 50 Ω (nominal). VSWR (input Attenuation ≥10 dB, at tuned frequency): ≤3.6 GHz(nominal): <1.5 : 1. >3.6 GHz (nominal) <2.5 : 1. LO emission level (average): <–80 dBm (nominal), 10 dB input attenuation, 0 to 26.5 GHz.

Video Output – Connector: BNC female, rear panel. Impedance (AC coupled): 75 Ω (nominal). Amplitude: Approx. 1 V p-p (composite video signal).

Probe Power – Connector: 4-Pin, front panel. Voltage: +15 V, –15 V. Current: 150 mA max., each.

Demodulated Audio Output – Connector: Subminiature monophonic jack, front panel. Power output: 0.2 W 8 Ω (nominal).

Phone Output – Demodulated audio. Connector: Subminiature monophonic jack, front panel. Power output: 0.2 W, 8 Ω (nominal).

GPIB Interface – Standard GPIB function enables remote operation and data input/output. Connector: IEEE-488 bus connector. Direct Plotter Output: Supports Tektronix HC100 Option 01, HP7470A, HP7475A, HP7440A, and HP7550A, or other HPGL plotters.

POWER REQUIREMENTS

Operating Voltage – Automatically selects between 100 VAC and 220 VAC. 100 VAC: 90 V to 132 V. 220 VAC: 198 V to 250 V.

Power Consumption – Max. 400 VA.

Frequency – 100 VAC: 48 to 440 Hz. 200 VAC: 48 to 66 Hz.

GENERAL SPECIFICATIONS

Environmental – Operating temperature: 0°C to +50°C. Nonoperating temperature: –20°C to +60°C. Humidity: 85% RH.

Safety – This product has been safety tested by Advantest to IEC 348 specifications.

PHYSICAL CHARACTERISTICS

Dimensions*1	mm	in.
Height	177	7.0
Width	353	13.9
Depth	450	17.7
Weight	**kg**	**lb.**
Nominal	22	48.5

**1 Without handle, feet, and front cover.*

ORDERING INFORMATION

R3265A
Spectrum Analyzer **$30,975**
Includes: Power Cord, BNC-to-BNC Cable, N-Type-to-BNC Cable, N-to-BNC Adapter, Memory Card, Front Cover, Instruction Manual.

R3365A
Spectrum Analyzer with Tracking Generator **$39,475**
Includes: Power Cord, BNC-to-BNC Cable, N-Type-to-BNC Cable, N-to-BNC Adapter, Memory Card, Front Cover, Instruction Manual.

R3271A
Spectrum Analyzer **$35,500**
Includes: Power Cord, BNC-to-BNC Cable, N-Type-to-BNC Cable, N-to-BNC Adapter, Memory Card, Front Cover, Instruction Manual.

R3371A
Spectrum Analyzer with Tracking Generator **$45,000**
Includes: Power Cord, BNC-to-BNC Cable, N-Type-to-BNC Cable, N-to-BNC Adapter, Memory Card, Front Cover, Instruction Manual.

SERVICE ASSURANCE OPTIONS

Opt. R2 – Adds two years of post-warranty Repair Protection
R3265A, R3271A ..... **+$590**
R3365A ..... **+$1,130**

Opt. C5 – Adds five years of Calibration Services
R3265A, R3271A ..... **+$1,225**

RECOMMENDED ACCESSORIES

See page 446 for complete selection information.

Q32605A
Optical Receiver *1

R3271A Waveguide Mixers – Tektronix WM780 Series. (See page 194)

PROBES

FET Probe – DC to 900 MHz (Requires 1101A). Order P6201 ..... **$1,599**

FET Probe – DC to 500 MHz. Order P6202A **$1,115**

50 Ω Divider Probe – DC to 3.5 GHz, 6 ft. Order P6156 ..... **$275**

Current Probe – 935 Hz to 120 MHz. Order P6022 ..... **$610**

Plotter – Order Tektronix HC100 Opt. 01 ..... **$1,380**

Preamplifier – 9 kHz to 1 GHz, ≥25 dB. Order R14601 ..... **$995**

Memory Card – Set of five 32 KB Cards. Order A09505. ..... **$500**

Memory Card – Set of five 128 KB Cards. Order A09506 .... **$1,400**

Aluminum Transit Case – Order R16059 ..... **$1,000**

Rackmount Adapter – Order A02459 ..... **$300**

**1 Contact your Tektronix representative for price information*

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

GPIB IEEE-488 The R3271A complies with IEEE Standard 488.1-1987.

2712
2711

Spectrum Analyzers
Versatile, Low-Cost

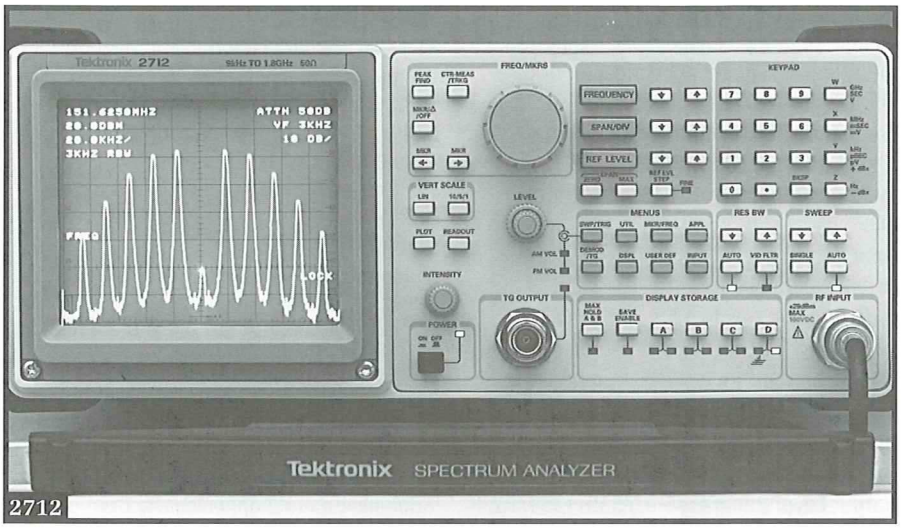
Lightweight, portable spectrum analyzers – packed with affordable measurement power.

2712

- High Value, Low Cost
- 5 x 10^{-7} Frequency Accuracy
- Sensitivity to –139 dBm (–92 dBm V) with Built-in Preamp
- Internal Frequency Counter
- 4 Trace Digital Plus True Analog Display
- 124 K of RAM
- Easy to Use
- Dedicated Numeric Keypad Plus Logically Grouped Menu Keys
- Powerful Built-in Measurement Routines
- EMC Measurements with Optional Quasi-peak Detector
- Swept Measurements to 1.8 GHz with Optional Internal or External Tracking Generator
- UL Listed 1244, Certified CSA C22.2 No. 231-M89

2711

- Economical, Can Be Configured to Meet Most Budgets
- High Portability
- Internal or External Tracking Generator Option
- Internal Frequency Counter (Option 02)
- GPIB or RS-232 Interface Option
- Excellent Frequency Accuracy and Sensitivity
- 3-Control Operation for Most Measurements
- UL Listed 1244, CSA Bulletin 556B



2712 Spectrum Analyzer

The Tektronix 2712 Spectrum Analyzer provides excellent RF performance, a built-in frequency counter, full programmability, digital and true analog displays, high portability, enough non-volatile memory for 108 saved displays, and much more.

A straightforward human interface, with conveniently-grouped, dedicated front-panel keys and simple, menu-driven functions makes the 2712 easy to learn and use. You can set frequency, span, and reference level directly from the front panel. A real-time clock provides an on-screen date and time display, plus date/time stamp capability for waveform printouts.

Frequency-corrected tuning and phaselock stabilization enhance the ability to resolve close-in signals and reliably demodulate narrowband signals. Sensitivity up to –127 dBm (–80 dBm V) at 300 Hz resolution bandwidth (RBW) lets you see weak signals. The built-in preamp can improve sensitivity another 12 dB, up to –139 dBm (–92 dBm V). Up to 80 dB on-screen dynamic range ensures visibility of weak signals in the presence of strong ones.

A 300 Hz RBW filter with a shape factor ≤7:1 means you'll see many close-in sidebands and spurious, or unexpected signals you might otherwise miss. At the other end of the spectrum, the 5 MHz RBW filter is useful when demodulating wideband signals such as actively modulated video carriers.

The built-in signal counter, with 0.5 ppm ±10 Hz accuracy, offers added power for rapidly identifying signals. The capability to choose between digital and true analog displays lets you examine signals for characteristics that are not visible on digital-only displays.

Sweep speeds of 1 µsec/div, TV Line and TV Field triggering, an internal audio amplifier and AM/FM detectors, and the optional Video Monitor Mode all make video communications measurements easier.

Bandwidth, Carrier-to-Noise, Noise Power, Signal Search, and FM Deviation modes provide additional measurement power and convenience. Occupied Bandwidth Mode, with percent settable from 1 to 99%, aids in broadcast radio measurements.

The optional internal or external tracking generator provides high dynamic range swept measurements to 1.8 GHz.

SELECTION GUIDE

Capability	2712	2711
Frequency Range	9 kHz to 1.8 GHz	9 kHz to 1.8 GHz
±0.5 ppm Freq. Accuracy	Std.	NA
Signal Counter	Std.	Opt. 02
GPIB Interface	Std.	Opt. 03
Internal Tracking Gen.	Opt. 04	Opt. 04
External Tracking Gen.	Opt. 05	Opt 05
RS-232C Interface (replaces GPIB)	Opt. 08 (no charge)	Opt. 08
Video Monitor Mode	Opt. 10	Opt. 10
EMC Pre-Certification Measurements	Opt. 12	NA
TV Sideband Adapter Interface	Opt. 15	Opt. 15
Nonvolatile Memory	124 K	28 K (124 K with Opt. 03 or 08)
High Portability	Yes	Yes
Both Digital and True Analog Displays	Yes	Yes
Dedicated Numeric Keypad	Yes	Yes
Real-Time Clock	Std.	With Opt. 03 or 08

Continued on next page.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 2712 and 2711 comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Spectrum Analyzers
Versatile, Low-Cost

2712
2711

EMC MEASUREMENT
To help simplify your EMC measurements, the 2712 offers an optional quasi-peak detector, EMI resolution bandwidth filters, and fully-corrected E-field intensity measurements to assist in pre-certification and troubleshooting. EMC ancillary devices are available to provide a complete measurement solution. See page 235.

2711 Spectrum Analyzer

The 2711 offers a wide range of features at an extremely affordable price. This value leader is well-suited for checking broadcast transmitter performance and communications system operations, looking for unwanted RF emissions, testing two-way communications equipment, maintaining industrial security, and teaching frequency domain concepts in the classroom, plus a wide variety of other applications.

The standard 2711 shares many of the 2712's valuable features such as compact size and light weight (9.5 kg, about 21 lb.). Both instruments can also be quickly converted to rack operation with optional rack-mount adapters.

Frequency accuracy is 1 x 10^{-5} and sensitivity is up to –117 dBm (–70 dBm V) at 3 kHz RBW. The built-in preamp can add another 12 dB, up to –129 dBm (–82 dBm V). Up to 80 dB on-screen dynamic range helps see weak signals, even when strong ones are present.

True analog display capability, along with fast sweep speeds and TV Line and TV Field triggering provide convenient demodulation of video carriers for making depth-of-modulation checks or looking at special baseband data, VITS, and many other signals.

An internal audio amplifier and AM/FM detectors let you hear demodulated signals, using either the built-in speaker or headphone jack, for fast signal identification and trouble-shooting in communications applications.

With the Video Monitor (Option 10) installed, you can view broadcast (AM) TV signals or down-converted satellite (FM) signals.

The 2711 can also be used with a set of near-field probes as a handy EMC diagnostic tool.

Characteristics

The following characteristics apply to both the 2712 and 2711 after a 15-minute warm-up period, unless otherwise noted.

FREQUENCY RELATED
Frequency Range – 9 kHz to 1800 MHz.

Center Frequency Accuracy – 2712: 5x10^{-7} of CF ±700 Hz; 2711: 1x10^{-5} of CF ±5 kHz.

Frequency Counter Accuracy (Std. 2712, Option 02 2711) – 2712: 5x10^{-7} of CF ±10 Hz, ±1 LSB. 2711: 1x10^{-5} of CF ±10 Hz, ±1 LSB.

Dot Marker Frequency Accuracy*1 – CF Accuracy ±3% of span.

Long-term Drift*1 – 2712: 2 ppm/yr.; 2711: 10 ppm/yr.

Short-term Drift – 2712: ≤400 Hz maximum drift between correction cycles; 2711: ≤20 kHz maximum drift between correction cycles.

Residual FM – 2712: ≤100 Hz p-p/20 msec at ≤20 kHz span/div; ≤2 kHz p-p/20 msec at >20 kHz span/div; 2711: ≤2 kHz p-p/20 msec.

Resolution Bandwidth (–6 dB) – 2712: 5 MHz, 300 kHz, 30 kHz, 3 kHz, 300 Hz; 2711: 5 MHz, 300 kHz, 30 kHz, 3 kHz; 2712 with Option 14: Add 1 MHz, 100 kHz, 10 kHz, and 1 kHz; 2712 with Option 12: add 1 MHz, 120 kHz, 9 kHz, 1 kHz – 200 Hz replaces 300 Hz filter.

Resolution Bandwidth Shape Factor – (60 dB/6 dB) – ≤7:1 for RBW ≤1 MHz.

Noise Sidebands – ≤70 dBc at 30xRBW.

Video Filter – Approx. 1/100 (Auto) of RBW. Manual Selection: 3 Hz to 300 kHz in 1-3 sequence.

Freq. Span/Div Range – 2712: 180 MHz to 1 kHz. 2711: 180 MHz to 10 kHz selected in 1-2-5 sequence or within two significant digits via menu.

Span Accuracy – ±3% over the center eight divisions.

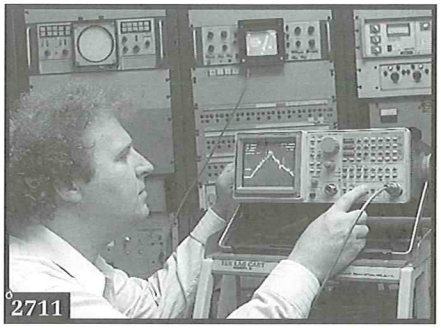
AMPLITUDE RELATED
Flatness – ±1.5 dB measured with 10 dB internal RF attenuation (preamp off).

Vertical Display Modes – 10, 5, 1 dB/div, Linear.

Measurement Range – 2712: –139 (preamp on) to +20 dBm (–92 to +67 dBm V); 2711: –129 (preamp on) to +20 dBm (–82 to +67 dBm V).

Display Dynamic Range – 80 dB max (limited to 40 dB in optional 2712 Quasi-peak Detector mode).

Reference Level Range – LOG Mode: –70 to +20 dBm (–23 to +67 dBm V), or to –90 dBm with preamp on. LINEAR Mode: 8.8 µV to 280 mV.



Reference Level Steps – LOG Mode: 1 dB or 10 dB. LINEAR Mode: 1-2-5 sequence.

Mixer Input Level – Automatically controlled by instrument for on-screen signals. Level selectable between –20 to –50 dBm (+27 to –3 dBm V).

Display Amplitude Accuracy – 10 dB/div: ±1.0 dB/10 dB to max. cum. error of ±2 dB over 70 dB range; ±2.0 dB/10 dB over 70-80 dB range. 5 dB/div: ±1.0 dB/10 dB to max. cum. error of ±2 dB over 40 dB range; 1 dB/div: 1 dB max. error over 8 dB range. Linear Mode: ±5% of full scale.

RF Attenuation Range – 0 to 50 dB, 2 dB steps.

Sensitivity – 2712: –127 dBm (–80 dBm V) at 300 Hz RBW, –139 dBm (–92 dBm V) at 300 Hz RBW with preamp on (to 600 MHz); 2711: –117 dBm (–70 dBm V) at 3 kHz RBW, –129 dBm (–82 dBm V) at 3 kHz RBW with preamp on (to 600 MHz).

SPURIOUS RESPONSE (PREAMP OFF)
Residual Spurious Response – ≤–100 dBm referenced to input of 1st mixer.

3rd Order IM Distortion – ≤–70 dBc, from any two on-screen signals within any frequency span measured with 1st mixer input level of ≤–30 dBm (+17 dBm V).

2nd Harmonic Distortion – ≤–66 dBc measured with 1st mixer input level of ≤–40 dBm (+7 dBm V).

INPUT RELATED
LO Emission – ≤–70 dBm with 0 dB RF attenuation.

RF Input – Type N connector, 50 Ω.

VSWR with 10 dB or More RF Attenuation – 1.5:1 max.

Maximum Safe Input – +20 dBm (+67 dBm V) (0.1 W) continuous peak with 0 dB RF attenuation; 100 VDC (initially applied with full attenuation).

1 dB Compression Point – ≥–15 dBm (+32 dBm V) with 0 dB RF attenuation.

**1 Typical but nonwarranted performance parameters.*

2712
2711

Spectrum Analyzers

SWEEP RELATED

Sweep Times – 1 µsec to 2 sec/div in 1-2-5 seq. (7-decade range); AUTO SWEEP mode; MANUAL SWEEP select.

Sweep Time Accuracy – ±10% over the center eight divisions.

Trigger – Free run, internal, external, line, TV field, TV line, single sweep, manual scan.

Trigger Amplitude – Internal: One division or more of signal. External: min. 1.0 V peak, (15 Hz to 1 MHz).

INPUT/OUTPUT CHARACTERISTICS

External Trigger*1 – BNC connector, 10 kΩ impedance, DC coupled 0.1 µs min. pulse width. 35 V max.

External Video Input*1 – DC coupled. 0-50 kHz, 0-1.4 V (175 mV/div typical) signal input for vertical deflection of CRT beam.

Sweep Gate Out – TTL level, HI while CRT beam sweeps.

Sweep Output – +1.3 to –1.3 V, negative-going ramp, proportional to the horizontal sweep. Source impedance ≤50 Ω.

Video Output – 0 to +1.6 V of video signal, proportional to vertical display amplitude. 0 V is top of screen. 1 kΩ impedance.

ENVIRONMENTAL SPECIFICATIONS

Temperature – Operating: 0° to 50°C (MIL-T- 28800D). Nonoperating: –55° to +75°C.

Humidity – Nonoperating: Five cycles (120 hours) per MIL-T-28800D, Class 5.

Shock – Operating and Nonoperating: Three guillotine-type shocks of 30 g, one-half sine, 11 ms duration each direction along each major axis; total of 18 shocks.

Electromagnetic Compatibility – EC92 EMC Directive 89/336/EEC:

Emissions: EN50081-I.
Radiated Emissions, 30 MHz to 1 GHz, EN55022 Class B (CISPR 22 B).
Conducted Emissions, 150 kHz to 30 MHz, EN55022 Class B (CISPR 22 B).
Conducted Emissions, power line harmonics. 0 to 2 kHz, IEC 555-213.

Immunity: EN50082-1.
Electrostatic Discharge, 8 kV, IEC 801-2.
Radiated Immunity, 27 MHz to 500 MHz, IEC 801-3. No response above –90 dBm in a 3 V/meter field.
Fast Transients, capacitive clamp, 1 kV power leads, 500 V control leads, IEC 801-4.
Power Line Surge, 1 kV differential mode, 2 kV Common mode, IEC 801-5.

Vibration – Meets MIL-T-28800E, Paragraph 4.5.5.3.1 (modified).

GENERAL CHARACTERISTICS

Power Requirements – 90 W max. (1.2 A) at 115 V, 60 Hz. Operates 48 Hz to 440 Hz, 90 to 132 VAC, or 48 Hz to 63 Hz to 250 VAC. Battery power (Option 07) available.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	137*1	5.4*1
Width	361*1	14.2*1
Depth	445*1	17.5*1
Weight	**kg**	**lb.**
Net	9.5*2	<21*2

*1 *With feet, handle, and front panel cover.*

*2 *Nominal for basic configuration.*

OTHER CAPABILITIES

Markers – Single marker/delta marker; next right, next left peaks; next lower, next higher peaks; (highest) peak find; marker to center frequency and reference level.

Non-volatile Memory – Lithium battery backup. 2712: 124 kB available; up to 108 displays saved; 36 front-panel setups, large user-definable key routines, and antenna tables (exact number and size depends on NV RAM utilization). 2711: 28 kB available; Up to 18*2 displays saved and 9*2 front-panel setups, user-definable key routines, and antenna tables.

Digital Storage Display – Selectable acquisition modes of positive peak only, positive/negative peak. SAVE A, B, C and active D trace; up to four traces on screen; MAX HOLD A, B; MIN HOLD A, B, C; B, C MINUS A; WATERFALL display mode; digital storage off provides analog sweep.

Ensemble Averaging – Provides weighted continuous or discrete averaging of display resulting in reduction of random noise.

Internal Preamp – Preamp can be switched in/out of circuit (flatness degrades above 600 MHz, provides approximately 12 dB sensitivity improvement).

Alternative Reference Level Units – dBm, dBm V, dB V, dBµ V, dBµW, dBµ V/m.

User-Definable Power-on Status – Instrument powers up to user-definable state or factory default condition.

Center Measure – Signal is centered with frequency and peak amplitude automatically read out (not a marker mode). The signal is counted in the 2712 or 2711 with Option 02.

Signal Track – Drifting signal is kept at display center with correct frequency and peak amplitude displayed.

Graticule Illumination – For CRT photography.

Direct Plot/Print – Supports Epson FX and LQ Series Printers and Tektronix HC100 Printer/Plotter via built-in GPIB interface (std. 2712, 2711 Option 03), RS-232C interface (Option 08, 2712 and 2711).

1 Typical but nonwarranted performance parameters.

2 Up to 108 saved displays, 36 front-panel setups available with Option 03 or 08.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 — The 2712 and 2711 comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 — ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

2712
Spectrum Analyzer **$11,950**
Includes: Power Cord (U.S. 115 V/60 Hz), Operator's Manual, Pocket Reference Guide, Programmers Manual, Front Cover, and N-to-BNC Adapter.

2711
Spectrum Analyzer. **$8,750**
Includes: Power Cord (U.S.115 V/60 Hz), Operator's Manual, Pocket Reference Guide, Front Cover, and N-to-BNC Adapter.

Opt. 02 – (2711 only) Add Internal Frequency Counter with Selectable 1 kHz/1 Hz Readout Resolution. ..... **+$820**

Opt. 03 – (2711 only) GPIB Interface. Full Programmability, Direct Print, additional NV RAM, and Real-time Clock. Cannot combine with Opt. 08 ..... **+$790**

Opt. 04 – Add Internal Tracking Generator, 100 kHz-1800 MHz, 0 dBm to –48 dBm in 0.1 dB steps. (Not compatible with Opt. 12 or 14/2712 only – order External Tracking Generator Opt. 05 instead.). ..... **+$3,150**

Opt. 05 – External Tracking Generator with Active Probe Power Jack. Not compatible with Opt. 04 ..... **+$3,950**

Opt. 07 – Add 2704 Inverter/2705 Battery Pack. ..... **+$1,350**

Opt. 08 – (2712 only) Replace GPIB with RS-232C Interface. ... **NC**

Opt. 08 – (2711 only, Not compatible with Opt. 03.) RS-232 Interface, Full Programmability, Direct Print, additional NV RAM, and Real-time Clock ..... **+$790**

Opt. 10 – Video Monitor Mode. ..... **+$650**

Continued on next page.

Spectrum Analyzers
Versatile, Low-Cost

ORDERING INFORMATION

Opt. 12 – (2712 only) Add Quasi-peak Detector (built-in). **Includes:** 200 Hz, 9 kHz, and 120 kHz EMC Filters; 1 kHz and 1 MHz RBW Filters. Not compatible with Opt. 04 or 14. ..... **+$1,480**

NOTE: 200 Hz EMC Filter replaces standard 300 Hz RBW Filter.

Opt. 14 – (2712 only) Add 1 kHz, 10 kHz, 100 kHz, and 1 MHz RBW Filters. Not compatible with Opt. 04 or 12..... **+$600**

Opt. 15 – 1st LO output for use with Tektronix 1405 TV Sideband Adapter Interface or 2707 Internal Tracking Generator..... **+$280**

Opt. 20 – EMC Antenna Set plus Tripod and Coax suitable for tests to 1 GHz (contact Tektronix sales engineer for more information) ..... **+$3,290**

Opt. 21 – Add 2706 Stepping RF Preselector..... **+$4,250**

Opt. 30 – Rackmount for 19 in. rack width, 5.25 in. height.... **+$250**

Opt. 33 – Travel Line Package. Includes: Accessory Pouch, Carrying Strap, Vinyl Rain Cover ..... **+$100**

Opt. 34 – Portable-to-Rackmount Adapter for 19 in. rack width, 7 in. height..... **+$590**

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**

Opt. A2 – United Kingdom 240 V, 50 Hz..... **NC**

Opt. A3 – Australian 240 V, 50 Hz ..... **NC**

Opt. A4 – North American 240 V, 60 Hz ..... **NC**

Opt. A5 – Switzerland 220 V, 50 Hz..... **NC**

See Customer Information Section for additional description.

Opt. B1 – Service Manual..... **+$135**

Opt. B2 – Additional Set of Manuals..... **+$215**

SERVICE ASSURANCE OPTIONS

Opt. R2 – Adds two years of post-warranty Repair Protection .**+$400**

Opt. C5 – Adds five years of Calibration Services ..... **+$1,050**

SOFTWARE

See pages 230 and 233 for additional information.

271x PC Utility Software – Order S26UT10..... **$650**

EMI Commercial Test Software – Order S26EMI2..... **$1,785**

EMI Ancillary Devices – See page 235.

RECOMMENDED ACCESSORIES

See page 446 for complete Selection Information.

PROBES

Active – All require 1103 Power Supply
4 GHz, 0.4 pF/100 kΩ, 1 m. Order P6217 ..... **$3,595**
750 MHz, 2 pF/1 MΩ, 1.5 m. Order P6205..... **$595**
TEKPROBE™ Power Supply. Order 1103..... **$655**

CAMERAS/PLOTTERS/PRINTERS

Camera – Low Cost. Order C-9 Opt. 1A and Opt. 20 ..... **$925**

Plotter – Four Color. (GPIB) Order HC100 Opt. 01 ..... **$1,380**
(RS-232). Order HC100 Opt. 03..... **$1,250**

CART– K212 Instrument Cart **$420**

POWER SPLITTER – 75 Ω/50 Ω BNC Output, 50 Ω BNC Input. Order 067-1232-00 ..... **$350**

CABLES, PADS, AND ADAPTERS

50 Ω Coaxial Cable –
BNC to BNC, 5.5 in. Order 012-0214-00..... **$80**
BNC to BNC, 18 in. Order 012-0076-00..... **$34**
BNC to BNC, 42 in. Order 012-0057-01..... **$31**

75 Ω Coaxial Cable – BNC to BNC, 42 in.
Order 012-0074-00 ..... **$34**

GPIB Cables –
0.5 m. Order 012-1282-00 ..... **$170**
1 m. Order 012-0991-01 ..... **$195**
2 m. Order 012-0991-00 ..... **$195**
4 m. Order 012-0991-02 ..... **$315**

RS-232 Modem Cables –
9-Pin Female to 25-Pin Male. Order 012-1241-00..... **$85**
9-Pin Female to 9-Pin Female. Order 012-1379-00 ..... **$80**
9-Pin Female to 25-Pin Female. Order 012-1380-00 ..... **$75**

75 Ω to 50 Ω Minimum Loss Adapter – With DC block, 5.7 dB loss. Order 011-0112-00..... **$110**

75 Ω BNC to 50 Ω Type N Minimum Loss Attenuator –
Order 131-4199-00 ..... **$75**

75 Ω to 50 Ω Matching Attenuator – With 11.25 dB conversion factor from dBm to dBV with DC block.
Order 011-0118-00 ..... **$140**

"F" Female to BNC Male Adapter – Order 013-0126-00 ..... **$25**

BNC Female to "F" Male Adapter – Order 103-0158-00 ... **$15.50**

"N" Female to BNC Male Adapter – Order 103-0058-00... **$19.75**

75 Ω to 50 Ω Matching Transformer – 0.5 dB loss.
50 kHz to 300 MHz. Order 120-1883-00 ..... **$250**
5 MHz to 1 GHz. Order 120-1884-00..... **$250**

GPIB CARDS

PC-GPIB Card – IBM PC, AT, and compatibles.
Order S3FG210..... **$395**

AT-GPIB Card – IBM AT Bus (High-speed Card).
Order S3FG220..... **$495**

MC-GPIB Card – IBM PS/2 with Microchannel Bus.
Order S3FG230..... **$450**

ADDITIONAL ACCESSORIES

Service Manual –
2712. Order 070-8130-01 ..... **$165**
2711. Order 070-8130-01 ..... **$165**

Front Panel Cover – Order 200-2520-00 ..... **$18**

Transit Case – Order 016-0792-02..... **$520**

Soft Side Case – Order 016-1158-00..... **$140**

Rain Cover – Order 200-2500-00 ..... **$4.50**

Accessory Pouch – Mounts on top. Order 016-0677-03 ..... **$50**

Carrying Strap – Order 346-0199-00. ..... **$30**

Viewing Hoods –
Collapsible. Order 016-0592-00 ..... **$20**
Binocular. Order 016-0566-00..... **$30**
Polarized. Order 016-0180-00..... **$100**

CRT Filter – Smoke Gray. Order 337-2775-02..... **$14.25**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 — The 2712 and 2711 comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 — ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

2714
2715

Spectrum Analyzers
Cable TV

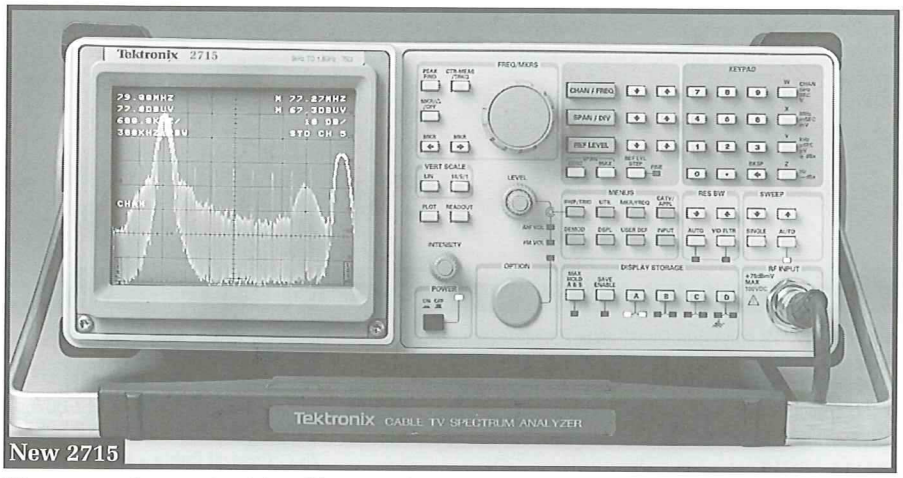
Cable ready RF testing from Tektronix. Highly portable with Selectable Digital and True Analog Display.

New 2715

- In-service, Measurements

2714/2715

- Built-in Automatic Cable TV Measurements Enhance Measurement Repeatability and Reduce Technician Training Time
- Addresses All Field FCC Proof-of-Performance Requirements
- Key Cable TV Measurements Execute Automatically from Simple, On-screen Menu Selections
- Unattended and Remote Measurement Modes Reduce Personnel Requirements in the Field
- Full Programmability over RS-232 or IEEE-488 (GPIB) Interface
- Quick-change 75 Ω F and BNC Input Connectors
- Built-in Preamp and Audio, and AM/Wideband FM Video Demodulation
- UL Listed 1244, Certified to CSA C22.2 No. 231-M89



The 2714 and 2715 simplify cable TV and broadband LAN measurements.

2714 Cable TV Spectrum Analyzer

QUICK, REPEATABLE, PUSH-BUTTON MEASUREMENTS

The Tektronix 2714 Cable TV Spectrum Analyzer provides the ultimate in ease and economy for cable TV and broadband LAN measurements. It's cable ready with a 75 Ω BNC input that can be quickly changed to a 75 Ω F-connector input. All of the common cable system spectral measurements are built in and menu selectable, including those needed to address field proof-of-performance requirements. Plus the accompanying PC software package adds measurement configuration, data collection, and automatic report generation capabilities.

What used to be complicated measurement procedures, even for engineering, are now push-button simple. Technicians can easily perform extensive cable system analysis and data collection in the field, all automatically.

Measurements and data collection can also be done remotely under computer control. Or the 2714 can be left unattended to run automatic measurements and data collection initiated by the built-in real-time clock.

Data collected in the field can be transferred from the 2714's memory via an RS-232 or GPIB interface to an MS-DOS personal computer (PC). The 2714's accompanying PC software package includes data archiving facilities as well as automatic report generation for proof-of-performance records.

2715 Cable TV Spectrum Analyzer

DEPENDABLE, IN-SERVICE RF MEASUREMENTS AT AN AFFORDABLE PRICE

The Tektronix 2715 Cable TV Spectrum Analyzer includes all the capabilities of the 2714 Cable TV Spectrum Analyzer and more! Now you can make proof of performance and other cable system measurements without disruption of service to subscribers. And you can minimize the inconvenience of making measurements at the output of set-top converters. The 2715 provides accurate and automated measurement of carrier-to-noise, in-channel response, and coherent distortion signals as well as carrier levels, frequencies, and more… without removal of carriers or modulation. In-service measurement of CTB requires an empty, adjacent channel or spectrum space.

You get all this capability in a 23 lb., compact, easy-to-carry package… at an attractive price. Similar to the Tektronix 2714, the 2715 includes the capabilities that will help you with system maintenance and toward speedy resolution of cable system problems: built-in preamplifier, audio and video demod, selectable TV line and field triggering and true, full gray-scale analog display for finding spurious signals and beats among noise and for checking modulation characteristics. Analog display is also used in the depth of modulation adjustment mode that is included with the 2715.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 2714 and 2715 comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

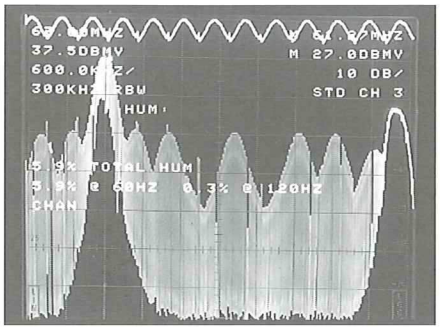
Tektronix Measurement products are manufactured in ISO registered facilities.

Spectrum Analyzers
Cable TV



A complete set of in-service measurements can be configured into a system test program that can be executed with the push of one or two front-panel keys. Results from the field can be readily transferred from the 2715's non-volatile memory to your PC via the RS-232 or GPIB communications interface. The Tektronix Spectrum Analyzer RF Measurements software package, which is included in the price of the 2715, provides a data base for your measurements and can generate reports. Data is compatible with most popular spreadsheet packages. This software also provides remote operation capability for the 2715.

The 2715 includes a convenient, field-replaceable input connector that can easily be converted from type F to BNC.

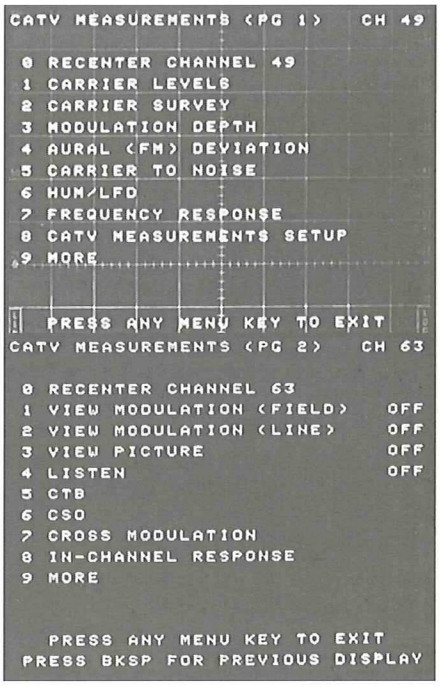


Measurement conditions and results are clearly displayed on-screen. Text can even be added, to describe measurement location for example.

BUILT-IN, AUTOMATIC MEASUREMENTS
The 2714/2715 contains the following measurements and capabilities in its CATV Application menu:

- Automatic positioning of visual and aural carriers
- Visual and aural carrier levels and frequencies for selected channels
- Visual-to-aural carrier amplitude and frequency difference measurements for selected channels
- Dual-carrier audio level and frequencies
- Survey of system visual and aural carrier levels and frequencies
- Depth-of-modulation
- Depth-of-modulation adjustment
- Aural carrier deviation measurement
- Aural carrier deviation adjustment
- Visual carrier-to-noise measurement
- In-channel response measurement
- Hum/low-frequency disturbance measurement
- System frequency response
- View baseband modulation (field and line) and demodulated video
- Aural carrier demodulation (listen mode)
- Distortion measurement – CTB and CSO
- Cross-modulation measurement

Measurements selected from the menu are automatically executed, and the results are displayed on the CRT screen. Not only are complex measurements reduced to push-button simplicity for less-experienced spectrum analyzer users, but measurement repeatability is high.



Pressing the CATV/APPL front-panel button provides easy access to the CATV Measurement Mode menu display.

Measurement results can be output to a printer or plotter connected directly to the interface port. Results can also be automatically stored in the non-volatile memory for later transfer to a PC. This, along with high portability, makes these analyzers ideal as automatic data collection tools in the field for engineers and technicians alike.

THE 2714/2715 CAPITALIZE ON PC POWER
The PC-based software package that accompanies the 2714/2715 runs automated cable TV measurements via an RS-232 or GPIB interface and provides a perpetual database for tracking system performance.

The software package provides the following capabilities:

Channel Table Generator – Create your own custom channel tuning tables in addition to the standard tables provided. Result: Data will be consistently taken on all of your system carriers including scrambled channels, aeronautical offsets, and non-standard frequencies.

High-level Test Sequences – You can configure automatic test sequences from the built-in measurements. Creating a test sequence is a simple matter of indicating the desired tests in an on-screen setup matrix.

Report Generator – You can generate test and measurement reports that can be in any of several forms. These reports are directly usable for presentation of proof-of-performance data.

2714
2715

Spectrum Analyzers
Cable TV

Remote Control – Your PC can execute tests and measurements on a remotely located 2714/2715 and receive results at the PC. Communication between the computer and the analyzer is through the RS-232 interface.

GENERAL PURPOSE CAPABILITIES
In addition to their special cable TV features, the 2714/2715 also double as highly capable, general-purpose spectrum analyzers. You get excellent RF performance, a built-in frequency counter, full programmability, enough non-volatile memory for up to 108 saved displays and 36 front-panel setups, digital and true analog displays, high portability, and numerous other features, including field-changeable F and BNC connectors.

The 2714/2715 can also be used to characterize filters, cable trunk amplifiers, line extenders, and other 2-port devices when used with the Option 05 External Tracking Generator.

Characteristics

CABLE TV MEASUREMENTS
The following specifications and features apply after a 15 minute warmup period and after all normalizations, including reference normalizations, have been performed. CATV characteristics represent typical performance and are dependent on general spectrum analyzer specifications. CATV characteristics need not be verified independently providing that all spectrum analyzer specifications are verified.

Channel Selection – Visual and aural carriers displayed when channel number is entered or front-panel selected.
Tune Configuration: STD., HRC, IRC, and custom; configured using PC software.
Channel Number Range: 0 to 999; configured using PC software.
Frequency Range: 1 MHz to 1.8 GHz; dependent on selected Channel Table.

Visual Carrier Frequency – Measured with internal counter to 1 Hz resolution with accuracy of $5x10^{-7}$ x Carrier Frequency ±10 Hz ±1 Least Significant Digit.

Visual-to-Aural Carrier Frequency – Aural carrier measured with internal counter relative to visual carrier.
Difference Range: 1 MHz to 10 MHz (depending on selected channel table) for an amplitude difference of ≤30 dB and aural carrier to noise ≥15 dB (300 kHz RBW).
Resolution: 1 Hz.
Accuracy: ±15 Hz for visual-to-aural carrier difference ≤8 MHz.

Visual Carrier Peak Level – Absolute peak amplitude measured with preamp off.
Amplitude Range: –18 dBm V to +58.8 dBm V for visual carrier to noise ≥30 dB (300 kHz RBW) and total input power ≤+70 dBm V.
Frequency Range: 15 MHz to 1015 MHz.
Resolution: 0.1 dB.
Absolute Accuracy: ±2.5 dB for visual carrier to noise ≥30 dB (300 KHz RBW); for FM signals, carrier to noise ≥33 dB (100 kHz RBW).
Relative Accuracy: ±0.5 dB relative to adjacent channel, ±1.2 dB relative to all others.
Note: This test may not be valid on some scrambled channels.

Visual-to-Aural Carrier Level Difference –
Difference Range: 0-30 dB for aural carrier to noise ≥15 dB (300 kHz RBW).
Resolution: 0.1 dB.
Accuracy: ±0.75 dB for aural carrier to noise ≥15 dB (300 kHz RBW).
Note: This test may not be valid on some scrambled channels.

Modulation Depth – % AM measured from sync tip to lowest white level in 10 sweeps (VITS line used if defined in channel table).
AM Range: 50% to 95%.
Resolution: 0.1%.
Accuracy: ±2% for visual carrier to noise ≥40 dB (300 kHz RBW).

Hum/Low-Frequency Disturbance – Power line frequency measured on an unmodulated visual carrier and low frequency disturbance measured on the modulated carrier.
AM Range: 1% to 10% peak-to-peak.
Resolution: 0.1%.
Accuracy: ±1% for hum ≤5% and visual carrier to noise ≥25 dB (300 kHz RBW); ±2% for hum, <10% and visual carrier to noise ≥25 dB (300 kHz RBW).

Carrier-to-Noise – Default noise floor is a normalized 4 MHz bandwidth measured relative to the visual carrier peak.
Normalized bandwidth is user-selectable.
Resolution: 0.3 dB.
In-service, in-channel measurement with 2715.

CTB/CSO – Measured relative to visual carrier peak according to NCTA recommendations.
Resolution: 0.3 dB.
In-service CSO measurement with 2715.

Frequency Response – For fixed-amplitude scrambling or no scrambling, system amplitude variations (flatness) are displayed relative to a reference trace stored during frequency-response reference setup.
Range: 5 dB/div.
Resolution: 0.2 dB.
Flatness Accuracy: ±0.75 dB.

In-channel Response – Expresses maximum variance in amplitude within some specified frequency range within a particular channel, given a "flat" input over that same specified range. The variance is referenced to the average of the highest and lowest amplitude within the frequency range.
In-service measurement with 2715.
Range: ±3 dB.
Resolution: 0.1 dB.
Accuracy: ±0.5 dB.

Carrier Survey – Absolute peak amplitude of each visual carrier is measured and each associated aural carrier level is measured relative to the visual carrier for the selected channel. Frequency counted only when FAST AMPL is DISABLED.
Note: This test may not be valid on some scrambled channels.

Aural (FM) Deviation – Peak FM deviation is measured for the selected channel.
Range: 10 kHz to 50 kHz; usable to 80 kHz.
Accuracy: ±4 kHz.

Cross Modulation – Peak of fundamental component of 3rd order distortion at horizontal sync frequency (AM) measured on the unmodulated visual carrier.
Range: 48 dB.
Resolution: 0.1 dB.
Accuracy: ±2 dB for cross modulation <36 dB; ±3 dB for cross modulation <48 dB.

Listen Mode – Selected channel's aural carrier is FM demodulated and output fed to speaker or headphone jacks; instantaneous peak FM deviation is displayed.

View Picture Mode – Visual carrier is demodulated and displayed.

View Modulation (Field) – One video field of the selected channel's video is displayed.

View Modulation (Line) – VITS line displayed; if VITS line isn't specified in channel table, line 17 displayed.
TV Line Selection: Via FREQ/MKRS knob.
Line Format: NTSC, PAL, SECAM.
Line Range: 1-525 (NTSC); 1-625 (PAL).
Sweep Time: 10 µsec/div.

Spectrum Analyzers
Cable TV

2714
2715

Characteristics (Spectrum Analyzer)

FREQUENCY RELATED

Frequency Range – 9 kHz to 1800 MHz.

Center Frequency Accuracy – 5 x 10^{-7} of center frequency ±700 Hz.

Frequency Counter Accuracy – 5 x 10^{-7} of center frequency ±10 Hz ±1 LSD (least significant digit).

Residual FM – ≤100 Hz p-p/20 msec at ≤20 kHz span/div; ≤2 kHz p-p/20 msec at >20 kHz span/div.

Resolution Bandwidth (–6 dB) **–** 5 MHz, 1 MHz, 300 kHz, 100 kHz, 30 kHz, 10 kHz, 3 kHz, 1 kHz, and 300 Hz.

RBW Shape Factor (60 dB/6 dB) **–** ≤7:1 for RBW ≤1 MHz.

Noise Sidebands – ≤–70 dBc at 30 x RBW for RBW ≤100 kHz.

Frequency Span/Div Range – 100 MHz to 1 kHz selected in 1-2-5 sequence or any value from 100 MHz to 1 kHz via the keypad or UTIL menu, plus 180 MHz and 0 Hz.

Span Accuracy – ±3% measured over the center eight divisions.

AMPLITUDE RELATED

Flatness – ±2 dB (relative to reference level at 100 MHz) measured with 10 dB internal RF attenuation (preamp off).

Vertical Display Modes – 10, 5, 1 dB/div, Linear.

Display Dynamic Range – 80 dB max. (Log Mode); 8 divisions maximum (Linear Mode).

RF Attenuation Range – 0 to 50 dB in 2 dB steps.

Maximum Sensitivity (at 300 Hz RBW) – –78 dBm V (–127 dBm); –90 dBm V (–139 dBm) with preamp on.

SPURIOUS RESPONSE (PREAMP OFF)

3rd Order IM Distortion – ≤–70 dBc from any two on-screen signals with any frequency span.

2nd Harmonic Distortion – ≤–66 dBc measured with 1st mixer input level of ≤+9 dBm V.

INPUT RELATED

RF Input – 75 Ω BNC with quick change to 75 Ω type F connector.

VSWR – With RF Attenuation ≥10 dB: 1.5:1 maximum to 1 GHz. With 0 dB RF Attenuation: 2:1 maximum to 1 GHz.

Maximum Safe Input – +70 dBm V (0.1 W or 2.2 V) continuous peak with 100 VDC blocking capacitor.

1 dB Compression Point – ≥+34 dBm V (–15 dBm) with 0 RF attenuation and 1st mixer at +19 dBm V (–30 dBm.)

ENVIRONMENTAL

Temperature – Operating: 0° to +50°C (MIL T-28800E). Nonoperating: –55° to +75°C.

Humidity – Nonoperating: Five cycles (120 hours) in accordance with MIL-STD 28800E, Class 5.

Vibration – Meets MIL T-28800E, Paragraph 4.5.5.3.1 (modified).

Shock – Operating and nonoperating: Three guillotine-type shocks of 30 g, one-half sine, 11 ms duration each direction along each major axis; total of 18 shocks.

Altitude – Operating: 15,000 ft. Nonoperating: 50,000 ft.

Electromagnetic Compatibility – EC92 EMC Directive 89/336/EEC:

Emissions: EN50081-I.
Radiated Emissions, 30 MHz to 1 GHz, EN55022 Class B (CISPR 22 B).
Conducted Emissions, 150 kHz to 30 MHz, EN55022 Class B (CISPR 22 B).
Conducted Emissions, power line harmonics. 0 to 2 kHz, IEC 555-213.

Immunity: EN50082-1.
Electrostatic Discharge, 8 kV, IEC 801-2.
Radiated Immunity, 27 MHz to 500 MHz, IEC 801-3. No response above –90 dBm in a 3 V/meter field.
Fast Transients, capacitive clamp, 1 kV power leads, 500 V control leads, IEC 801-4. Power Line Surge, 1 kV differential mode, 2 kV Common mode, IEC 801-5.

GENERAL CHARACTERISTICS

Power Requirements – 105 W maximum (1.4 A) at 115 V, 60 Hz: operates 48 Hz to 440 Hz, 90 to 132 VAC, or 48 Hz to 63 Hz, 90 VAC to 250 VAC.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	137*1	5.4*1
Width	361*1	14.2*1
Depth	445*1	17.5*1
Weight	**kg**	**lb.**
Net	<10.2*2	22.5*2

**1 With feet, handle, and front-panel cover.*

**2 Nominal for basic configuration.*

Note: Full specifications are available in the 2714/2715 Cable TV Spectrum Analyzer Data Sheet.

2714
2715

Spectrum Analyzers
Cable TV

ORDERING INFORMATION

2714
Cable TV Spectrum Analyzer **$13,950**
Includes: PC Software, power cord (U.S. 115 V/60 Hz), User Manual, Programmer Manual, Software Reference Manual, Front Cover, 75 Ω BNC Connector, 75 Ω F Connector, and Choice of GPIB or RS-232 Interface (Opt. 03 or Opt. 08).

2715
Cable TV Spectrum Analyzer **$15,900**
Includes: PC Software, power cord (U.S. 115 V/60 Hz), User Manual, Programmer Manual, Software Reference Manual, Front Cover, 75 Ω BNC Connector, 75 Ω F Connector, and Choice of GPIB or RS-232 Interface (Opt. 03 or Opt. 08).

Opt. 03 – Provides an IEEE-488 General Purpose Interface Bus (GPIB) as a no-cost option (not compatible with Opt. 08) ..... **NC**

Opt. 05 – 100 kHz to 1.8 GHz External Tracking Generator with Mechanical Mating Kit (includes Opt. 15) ..... **+$3,950**

Opt. 07 – Add 2704 Inverter/2705 Battery Pack ..... **+$1,350**

Opt. 08 – Provides an RS-232 Port as a no-cost option (not compatible with Opt. 03) ..... **NC**

Opt. 15 – Add 1st Local Oscillator Output for a 1405 TV Sideband Analyzer ..... **+$280**

Opt. 30 – Rackmount Adapter for 19 x 5.25 in. ..... **+$250**

Opt. 33 – Travel Line Package Includes: Rain Cover, Accessory Pouch, Gray CRT Filter, and Carrying Strap ..... **+$100**

Opt. 34 – Portable-to-rackmount Adapter for 19 x 7 in. ..... **+$540**

Opt. B1 – Service Manual ..... **+$135**

Opt. B2 – Additional Set of Manuals ..... **+$240**

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**

Opt. A2 – United Kingdom 240 V, 50 Hz ..... **NC**

Opt. A3 – Australian 240 V, 50 Hz ..... **NC**

Opt. A4 – North American 240 V, 60 Hz ..... **NC**

Opt. A5 – Switzerland 220 V, 50 Hz ..... **NC**

See Customer Information Section for additional description.

SERVICE ASSURANCE OPTIONS

Opt. R2 – Adds two years of post-warranty Repair Protection. ..... **+$400**

Opt. C5 – Adds five years of Calibration Services. ..... **+$1,050**

SOFTWARE

See page 230 for additional information.

271x PC Utility Software – Order S26UT10 ..... **$650**

RECOMMENDED ACCESSORIES

See Accessories section page 446 for complete selection information.

CAMERAS/PLOTTERS/PRINTERS

Camera – Low Cost. Order C-9 Opt. 1A and Opt. 20 ..... **$925**

Plotter – Four Color. Order HC100 Opt. 01 ..... **$1,380**

CART – K212 Instrument Cart **$420**

CABLES, PADS, AND ADAPTERS

75 Ω Coaxial Cable –
BNC to BNC 42 in. Order 012-0074-00 ..... **$34**
BNC to BNC 24 in. Order 012-1339-00 ..... **$55**

F Series Input Adapter/Connector Replacement –
Order 103-0301-00 ..... **$22**

BNC Input Adapter/Connector Replacement –
Order 103-0310-00 ..... **$58**

GPIB Cables – 0.5 m. Order 012-1282-00 ..... **$170**
1 m. Order 012-0991-01 ..... **$195**
2 m. Order 012-0991-00 ..... **$195**
4 m. Order 012-0991-02 ..... **$315**

RS-232 Modem Cables –
9-Pin Female to 25-Pin Male. Order 012-1241-00 ..... **$85**
9-Pin Female to 9-Pin Female. Order 012-1379-00 ..... **$80**
9-Pin Female to 25-Pin Female. Order 012-1380-00 ..... **$75**
25-Pin Male to 36-Pin Male. Order 012-1250-00 ..... *1

"F" Female to BNC Male Adapter – Order 013-0126-00 ..... **$25**

BNC Female to "F" Male Adapter – Order 103-0158-00 ... **$15.50**

"N" Female to BNC Male Adapter – Order 103-0058-00 ... **$19.75**

GPIB CARDS

PC-GPIB Card – IBM PC, AT, and Compatibles.
Order S3FG210 ..... **$395**

AT-GPIB Card – IBM AT Bus (High-speed Card).
Order S3FG220 ..... **$495**

MC-GPIB Card – IBM PS/2 with Microchannel Bus.
Order S3FG230 ..... **$450**

ADDITIONAL ACCESSORIES

Service Manual – Order 070-8534-00 ..... **$155**

Front Panel Cover – Order 200-2520-00 ..... **$18**

Transit Case – Order 016-0792-02 ..... **$520**

Soft Side Case – Order 016-1158-00 ..... **$140**

Rain Cover – Order 200-2500-00 ..... **$4.50**

Accessory Pouch – Mounts on top. Order 016-0677-03 ..... **$50**

Carrying Strap – Order 346-0199-00. ..... **$30**

Viewing Hoods – Collapsible. Order 016-0592-00 ..... **$20**
Binocular. Order 016-0566-00 ..... **$30**
Polarized. Order 016-0180-00 ..... **$100**

CRT Filter – Smoke Gray. Order 337-2775-02 ..... **$14.25**

*1 *Contact your Tektronix representative for price information.*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 — The 2714 and 2715 comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

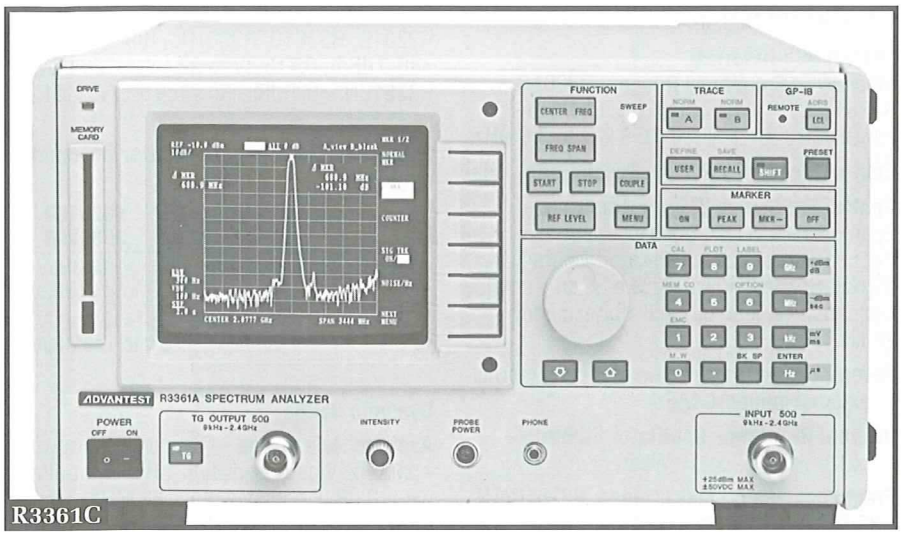
ISO 9001 — ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Spectrum Analyzers

R3361C
R3361CN
R3361D

R3261C
R3261CN
R3261D



R3361C

R3261C, R3261CN, R3261D, R3361C, R3361CN, R3361D

- Total Level Accuracy of 1 dB (Typical)
- User-defined Functions
- Measuring Window Function
- 120 dB Display Range
- Built-in Tracking Generator (R3361C, R3361CN, R3361D)
- CDMA Power Measurements (with Option 1K)

Easy-to-use portable spectrum analyzers offering high performance and unique functions.

R3261/R3361 Series Spectrum Analyzers

The R3261/R3361 Series spectrum analyzers use a synthesized technique to cover wide frequency bands; 9 kHz to 2.6 GHz (R3261C, R3361C) or 9 kHz to 3.6 GHz (R3261D, R3361B). These compact analyzers also offer high-performance functions such as the 1 Hz resolution frequency setting function and 1 Hz resolution frequency counter function.

The R3261/R3361 Series spectrum analyzers are easy to operate because they incorporate unique features such as the user-defined functions and measuring window function. Weighing only 15 kg (33 lb.) the analyzers are small and useful for measurement and analysis of all kinds, from maintenance to research and development. The EMC measuring function, field strength measuring function, and audio-visual equipment analysis function for VCRs and 8-mm video equipment are also available.

The analyzers have an internal controller function (Option 15), parallel I/0, and GPIB interface for line connection and automatic measurement, so the user can create the ideal system configuration.

1 HZ RESOLUTION SYNTHESIZER

The R3261/R3361 Series portable spectrum analyzers are based upon a synthesized system, so the center and start/stop frequencies can be set with a resolution of 1 Hz. Accurate and quick setting of the measuring frequencies is extremely useful when the frequency of a radio system already known is measured or the start/stop frequency must be set correctly. The synthesizer, featuring 1 Hz resolution, is a powerful tool ideal for waiting, receiving, or spot measurement in the zero span mode.

1V Peak to Peak video output

CHOOSE FROM SIX MODELS, DEPENDING UPON YOUR APPLICATION

The R3261/R3361 Series consists of six models. All models feature high performance and a set of features and functions for various applications.

	R3261C	R3261CN	R3261D	R3361C	R3361CN	R3361D
Frequency Range	9 kHz to 2.6 GHz	9 kHz to 2.6 GHz	9 kHz to 3.6 GHz	9 kHz to 2.6 GHz	9 kHz to 2.6 GHz	9 kHz to 3.6 GHz
Input Impedance	50 Ω	75 Ω	50 Ω	50 Ω	75 Ω	50 Ω
Internal Tracking Generator	Not available	Not available	Not available	Standard	Standard	Standard
Memory Card	Standard	Standard	Standard	Standard	Standard	Standard
Controller Function	Opt. 15	Opt. 15	Opt. 15	Opt. 15	Opt. 15	Opt. 15
Occupied Bandwidth Measurement, Adjacent-channel Leakage, Power Measurement	Opt. 04	Opt. 04	Opt. 04	Opt. 04	Opt. 04	Opt. 04
Burst Signal Analysis	Opt. 12	Opt. 12	Opt. 12	Opt. 12	Opt. 12	Opt. 12
CDMA Power Measurement	Opt. 1K	N/A	Opt. 1K	Opt. 1K	N/A	Opt. 1K

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488

The R3261C, R3261CN, R3261D, R3361C, R3361CN, R3361D comply with IEEE Standard 488.1-1987.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

R3361C R3261C
R3361CN R3261CN
R3361D R3261D

Spectrum Analyzers

1 HZ RESOLUTION FREQUENCY COUNTER

The frequency counter built into the R3261/R3361 Series features 1 Hz resolution. One of the advantages of these analyzers is that they can measure the modulated frequency or spurious frequency of a radio system that cannot be measured with an ordinary frequency counter, simply by setting a marker. The R3261/R3361 Series can measure a frequency very accurately in the counter mode even when the marker point is slightly off the peak point. In addition, the ability to measure weaker signals than a frequency counter can extend the application range from broadband panoramic measurement to weak signal measurement.

MANUAL SWEEP FUNCTION FOR SPOT MEASUREMENT

EMC measurements using the quasi-peak (QP) detector require an extended sweep time. However, the time required to measure the peak value can be shortened using the manual sweep function.

CREATE YOUR OWN UNIQUE MENU

The R3261/R3361 Series spectrum analyzers are very functional, yet very easy to use because of the user-defined functions and define functions. The built-in microprocessor (in some instruments) improves the measurement accuracy and functions but, at the same time, may make the systems very difficult to use. As a solution to this problem, the software menu method was developed. However, this method was still not satisfactory. The new concept employed in the R3261/R3361 solves these problems:

- **User-defined function.** If the user defines a necessary function on the USER key in the same way as on the function keys of a personal computer. A unique menu can be created.
- **Define function.** The define function enables the user to change the software key menu manually. With this function, you can create a unique system by changing the key functions that were defined before the system was shipped from the factory.

FAST MEASUREMENT WITH MEASURING WINDOW FUNCTION

The R3261/R3361 Series has a measuring window function. In conventional analysis, the user picks up only necessary portions from all the display data with a marker. However, you may need to specify a certain range of data for the analysis. This is accomplished by the measuring window function. The window specification may include not only a frequency but a level. The frequency and level are not fixed but can be specified to arbitrary values for flexible analysis. In addition, since marker and sweep operations are possible in a range set by the frequency and level, the measuring time can be reduced greatly.

Characteristics

FREQUENCY RELATED

Measuring Frequency Range – R3261C, R3261CN, R3361C, R3361CN: 9 kHz to 2.6 GHz. R3261D, R3361D: 9 kHz to 3.6 GHz.

Central Frequency Setting Resolution – 1 Hz.

Central Frequency Display Accuracy – Span ≤2 MHz: ±(3% of span + central frequency x reference oscillator accuracy + 20 Hz). Span >2 MHz: +(2% of span + central frequency x reference oscillator accuracy + 20 kHz).

Reference Oscillator – Switching by internal or external input (10 MHz).

Internal Reference Oscillator Stability – +2 x 10^{-8}/day, ±2 x 10^{-7}/year.

Frequency Span – Linear mode: R3261C/CN, R3361C/CN: 1 kHz to 2.6 GHz and zero. R3261D/R3361D: 1 kHz to 3.6 GHz and zero. Log mode: 1, 2, or 3 decades selected between 10 kHz and 1000 MHz.

Frequency Span Accuracy – Span < 2 MHz: ≤±3% of span. Span >2 MHz: ≤±5% of span.

Frequency Stability – Residual FM: 10 MHz ≤ span < 2 MHz: 50 kHz p-p or less. Span >2 MHz: 2 kHz p-p or less. Span ≤2 MHz: 20 Hz p-p or less. Frequency drift: Span ≤2 MHz: 300 Hz/min. or less.

Sideband Noise – At 20 kHz offset f ≤ 3.0 GHz, –105 dBc/Hz; f ≤ 3.6 GHz, –101 dBc/Hz.

Resolution – 3 dB bandwidth: 30 Hz to 1 MHz; switchable in 1 to 3 steps. 6 dB bandwidth: 200 Hz, 9 kHz, 120 kHz. Selectivity: ≤15:1 (60 dB: 3 dB). Bandwidth accuracy: ≤20%.

Marker Accuracy – Normal mode: Central frequency display accuracy + span accuracy. Counter Mode: Display frequency x reference oscillator accuracy ±1 count.

AMPLITUDE RELATED

Amplitude Measuring Range – R3261C, R3261D, R3361C, R3361D: –130 dBm to +25 dBm. R3261CN, R3361CN: –19 dBµV to +132 dBµV.

Screen Display Range – Log mode: 10 dB/div: 120 dB. 10 dB/div: 80 dB. 5 dB/div: 50 dB. 2 dB/div: 20 dB. 1 dB/div: 10 dB. Linear mode: 10 div. QP mode: 80 dB (10 dB/div) when measuring range is 70 dB.

Display Linearity – Log mode: ±2.0 dB/110 dB, ±1.5 dB/70 dB, ±1.0 dB/10 dB, ±0.2 dB/1 dB. Linear mode: ±5% of full scale. QP mode: ±2.0 dB/70 dB, ±1.0 dB/40 dB.

Reference Level Display Range – R3261C, R3261D, R3361C, R3361D: –109.9 dBm to +40.0 dBm, 0.715 µV to 22.4 V. R3261CN, R3361CN: +0.1 dBµV to +150 dBµV, 1.01 µV to 31.6 V.

Reference Level Accuracy (after automatic calibration) –

	R3261C/R3261D R3361C/R3361D	R3261CN R3361CN
<±0.3 dB	0 dBm to –50 dBm	+110 dBµV to +60 dBµV
<±0.7 dB	+20 dBm to –70 dBm	+130 dBµV to +40 dBµV

Dynamic Range

Average Noise Level – (resolution bandwidth – 300 Hz, Video bandwidth 1 Hz, Input attenuator 0 dB, Frequency range 10 MHz or more): R3261C, R3261D, R3361C, R3361D: –120 dBm + 1.55 f (GHz) dB. R3261CN, R3361CN: –10 dBµV +1.55 f (GHz) dB.

Secondary and Tertiary Distortion – ≤–70 dB at –30 dBm input, Input attenuator: 0 dB, Frequency: 10 MHz or more.

Frequency Response –

	R3261C/R3261D R3361C/R3361D	R3261CN R3361CN
100 Hz to 2 GHz	≤+0.5 dB	≤+0.5 dB
9 kHz to 2.6 GHz	≤+1.0 dB	–
9 kHz to 3.6 GHz	–	≤+1.5 dB

Residual Response – R3261C, R3261D, R3361C, R3361D: ≤–100 dBm; Termination: 50 Ω. R3261CN, R3361CN: ≤–11 dBµV; Termination: 75 Ω.

Resolution Bandwidth Switching Accuracy – ≤±0.3 dB after automatic calibration.

Video Filter – 1 Hz to 1 MHz; switchable in 1 or 10 steps.

SWEEP RELATED

Sweep Time – 50 ms to 1000 s and manual sweep.

Sweep Time Accuracy – ≤3%.

Trigger Modes – FREE RUN, LINE, VIDEO, EXT, TV-V, and SINGLE.

TRACKING GENERATOR SPECIFICATIONS (R3361C, R3361CN, R3361D)

Frequency Range – R3361C/R3361CN: 9 kHz to 2.6 GHz. R3361D: 9 kHz to 3.6 GHz.

Output Level Range – R3361C, R3361D: 0 dBm to –50 dBm. R3361CN: +105 dBµV to 55 dBµV setting in 1 dB steps.

Output Level Accuracy – ≤±0.5 dB (30 MHz, –10 dBm, 20°C to 30°C).

Spectrum Analyzers

R3361C / R3361CN / R3361D

R3261C / R3261CN / R3261D

Output Level Flatness –

	R3361C/R3361D (at –10 dBm output)	R3361CN (at +95 dBµV output)
100 kHz to 1.0 GHz	≤0.7 dB	≤0.7 dB
9 kHz to 2.6 GHz	≤1.5 dB	≤1.5 dB
9 kHz to 3.6 GHz	≤2.0 dB	≤2.0 dB

Output Level Switching Accuracy (at 0 dBm/+95 dBµV output) – 100 kHz to 1.0 GHz: ≤±1.0 dB. 9 kHz to 2.6 GHz: ≤±2.0 dB. 9 kHz to 3.6 GHz: ≤±3.0 dB.

Output Spurious (at 0 dBm/+105 dBµV output) – Harmonic spurious: ≤–20 dB. Non-harmonic spurious: ≤30 dB.

Tracking Generator Leakage – R3361C/R3361D: Frequency ≤3.0 GHz: ≤–110 dBm. Frequency ≤3.6 GHz: ≤–100 dBm. R3361CN: ≤+1 dBµV.

Output Impedance – R3361C, R3361D: Approximately 50 Ω. R3361CN: Approximately 75 Ω.

Output VSWR (at ≤–10 dBm/+95 dBµV output) – 100 Hz to 2 GHz: ≤1.5. 9 kHz to 3.6 GHz: ≤2.0.

Output Connector – N type.

INPUT RELATED

Input Impedance – R3261C, R3261D, R3361C, R3361D: 50 Ω. R3261CN, R3361CN: 75 Ω.

VSWR (at input attenuator ≥10 dB) – 100 kHz to 2 GHz: ≤1.5. 9 kHz to 3.6 GHz: ≤2.0.

Input Connector – N type.

Maximum Input Level – R3261C, R3261D, R3361C, R3361D: +25 dBm (attenuator ≥30 dB), 50 VDC max. R3261CN, R3361CN: +132 dBm (attenuator ≥30 dB), ±50 VDC max.

Input Attenuator – 0 to 50 dB in 10 dB steps.

Input Attenuator Switching Accuracy – ≤1.0 dB (≤2.0 GHz), ≤1.5 dB (≤3.6 GHz) at input attenuator 10 dB.

Detection Modes – NORMAL, POSI, NEGA, and SAMPLE.

INPUTS/OUTPUTS

External Memory Function – IC memory card.

GPIB Data Output/Remote Control – Data output and remote control through internal GPIB interface.

Direct Plotting – Hardcopy output of all display data to Tektronix HC100 Option 01, or other HPGL plotters through internal GPIB interface.

Voice Monitor Output – AM and FM with approximately, 8 Ω earphone.

Probe Power Source: – ±15 V, 4-Pin connector.

ENVIRONMENTAL

Ambient Temperature – 0°C to +50°C. Relative Humidity: 85% or less.

Storage Temperature – –20°C to +60°C.

Safety – This product has been safety tested by Advantest to IEC 348 specifications.

POWER REQUIREMENTS

Operating Voltage – Standard: 90 to 132 V. Option 40: 198 to 250 V.

Power Consumption – Less than 220 VA.

Frequency – 48 to 66 Hz.

CRT – 5.5 in.

PHYSICAL CHARACTERISTICS

Dimensions (approx.)	mm	in.
Height	177	7.0
Width	330	13.0
Depth	450	17.7
Weight	**kg**	**lb.**
R3261C/CN/D	15	33
R3361C/CN/D	17	37.5

ORDERING INFORMATION

R3261C
2.6 GHz, 50 Ω Spectrum Analyzer.....**$13,500**
Includes: Power Cord, BNC-to-BNC Cable, N-Type BNC Cable, N-to-BNC Adapter, N-Type N-to-BNC Adapter, Memory Card, Instruction Manual.

R3261CN
2.6 GHz, 75 Ω Spectrum Analyzer.....**$13,500**
Includes: Power Cord, BNC-to-BNC Cable, N-Type BNC Cable, N-to-BNC Adapter, N-Type N-to-BNC Adapter, Memory Card, Instruction Manual.

R3261D
3.6 GHz, 50 Ω Spectrum Analyzer.....**$19,110**
Includes: Power Cord, BNC-to-BNC Cable, N-Type BNC Cable, N-to-BNC Adapter, N-Type N-to-BNC Adapter, Memory Card, Instruction Manual.

R3361C
2.6 GHz, 50 Ω Spectrum Analyzer with Tracking Generator.....**$19,100**
Includes: Power Cord, BNC-to-BNC Cable, N-Type BNC Cable, N-to-BNC Adapter, N-Type N-to-BNC Adapter, Memory Card, Instruction Manual.

R3361CN
2.6 GHz, 75 Ω Spectrum Analyzer with Tracking Generator.....**$19,100**
Includes: Power Cord, BNC-to-BNC Cable, N-Type BNC Cable, N-to-BNC Adapter, N-Type N-to-BNC Adapter, Memory Card, Instruction Manual.

R3361D
3.6 GHz, 50 Ω Spectrum Analyzer with Tracking Generator.....**$24,400**
Includes: Power Cord, BNC-to-BNC Cable, N-Type BNC Cable, N-to-BNC Adapter, N-Type N-to-BNC Adapter, Memory Card, Instruction Manual.

Opt. 12 – Gated Sweep Plus RS-232 .....**+$1,000**
Opt. 15 – Gated Sweep Plus Controller Function (including Parallel I/O and Serial I/O) .....**+$2,000**
Opt. 40 – 198 to 250 VAC operation .....**NC**
Opt. 1K – CDMA Power Measurements .....**+$2,000**

SERVICE ASSURANCE OPTIONS

Opt. R2 – Adds two years of post-warranty Repair Protection
R3261C, R3261CN .....**+$400**
R3261D, R3361C, R3361CN, R3361D .....**+$590**
Opt. C5 – Adds five years of Calibration Services
R3261C, R3261CN.....**+$1,050**
R3261D, R3361C, R3361CN, R3361D .....**+$1,225**

RECOMMENDED ACCESSORIES

See page 446 for complete selection information.

PROBES

FET Probe – DC to 900 MHz (Requires 1101A). Order P6201.....**$1,599**
FET Probe – DC to 500 MHz. Order P6202A.....**$1,115**
50 Ω Divider Probe – DC to 3.5 GHz, 6 ft. Order P6156.....**$275**
Current Probe – 935 Hz to 120 MHz. Order P6022 .....**$610**
Plotter – Order Tektronix HC100 Opt. 01.....**$1,380**
Carrying Case – Order R16211A.....**$500**
Front Cover – Order A02804 .....**$200**
Transit Case – Order R16056A.....**$1,000**
Memory Card – Set of Five 32 KB Cards. Order A09505 .....**$500**
Memory Card – Set of Five 128 KB Cards. Order A09506...**$1,400**
Preamplifier – 9 kHz to 1 GHz, ≥ 25 dB. Order R14601.....**$995**
Rackmount Set – Conforms to EIA Standards. Order A02455.....**$300**

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488

The R3261C, R3261CN, R3261D, R3361C, R3361CN, R3361D comply with IEEE Standard 488.1-1987.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

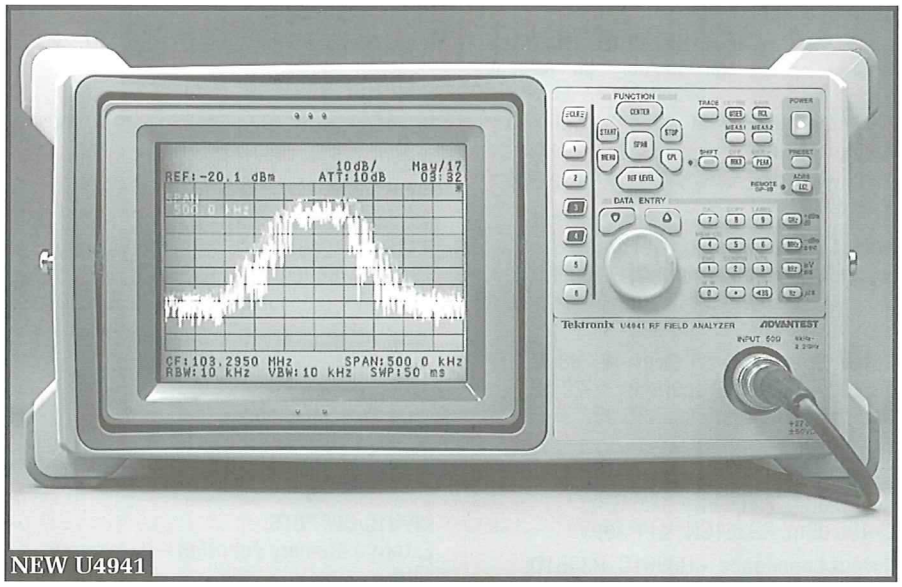
U4941
U4941N

Spectrum Analyzers

Ultimate portability for RF measurements – convenient battery power, convenient operation, high display dynamic range to measure diverse signals.

New U4941/U4941N

- 9 kHz to 2.2 GHz Frequency Range
- High Mobility – Very Light and Compact
- Operate from Attach-on Optional Battery, Standard AC Adapter, or Direct 12-V DC
- Enhanced Spectral Display Comparison using 6-inch Color TFT LCD Display
- Accurate Frequency Measurement with Built-in Counter
- 10 MHz External Frequency Reference Input Providing Added Accuracy
- Diverse Signal Measurement using 90 dB Display Dynamic Range
- EMI Measurement with Built-in Quasi-peak Detector and EMC Filters



NEW U4941

U4941/U4941N RF Field Analyzers

These 9 kHz to 2.2 GHz analyzers introduce a new level of portability and convenience to RF measurements. The 5.8 x 11.5 x 13 inch, 14.3 pound package is easily carried to hard-to-reach places. And if your measurement site lacks AC mains, the U4941/U4941N are ready to run directly from an external 12 V DC supply or from their own optional attach-on battery.

These analyzers feature a mechanical package that is designed to MIL-T-28800D environmental standards for shock, vibration, and drop – adding to your confidence to carry the U4941/U4941N into the field.

SEE YOUR RESULTS IN COLOR!

An easy-on-the-eyes, six-inch TFT LCD color display not only reduces instrument weight, size, and power requirements but also lessens user-fatigue when extended display viewing time is required. The display screen may be tilted for optimum viewing angle.

PERFORMANCE FOR TODAY'S APPLICATIONS... AND TOMORROW'S

Wide, 90 dB display dynamic range and high-sensitivity insure that you see weak signals, even in the presence of much stronger signals. Sensitivity is enhanced by a built-in 20 dB preamp. And signals can be readily identified by a built-in frequency counter.

EASY TO USE, EASY TO STORE MEASUREMENT RESULTS

Soft-key menus and three modes of data input adapt operation of the U4941/U4941N to differing user preferences. A full complement of marker functions improve speed and repeatability on a variety of measurements. Included is a window function which delimits a portion of the displayed sweep, resulting in a significantly faster update of the spectrum of interest when sweep time must be increased due to change of resolution bandwidth, video bandwidth, or span.

Measurement set-ups, limit lines, measurement results, and other data can be stored on memory cards that plug into either of two PCMCIA slots conforming to JEIDA-Ver 4.1/ PCMCIA Rel 2.0. Or, two cards may be used simultaneously for redundant storage of measurement data.

APPLICATIONS

- **EMC field measurement**
- **Broadband LAN installation**
- **Field-strength measurement**
- **Two-way and wireless communications troubleshooting**

Tektronix

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

COMPLEMENT YOUR APPLICATION WITH THESE ADDITIONAL CAPABILITIES

- AM/FM detector and built-in speaker/headphone jack for signal demodulation
- Faster measurements using built-in routines for:
  Occupied bandwidth
  Adjacent channel leakage
  Noise power
  2nd and 3rd order distortion
  Percent AM
- 10 MHz external reference input for additional frequency accuracy
- Composite video output to display spectrum on a large screen monitor or hard copy on a video printer
- 75 Ω input for broadband network applications (U4941N)

Characteristics

FREQUENCY RELATED

Frequency Range – 9 kHz to 2.2 GHz.

Frequency Readout Accuracy (Start, Stop, CF, Marker) – ±(span x span accuracy + 0.15 x RBW + 50 kHz).

Count Frequency Marker (S/N ≥ 25 dB, 50 kHz ≤ 1 GHz span, RBW ≥ 100 kHz) – Resolution: 1 Hz to 10 kHz. Count accuracy: ±(marker freq. x freq. reference accuracy +1 LSD ±5 Hz).

Frequency Reference Accuracy – ±2 x 10^{-6}/year. ±1 x 10^{-5} (at 0°C to 50°C).

Frequency Span – Range: 50 kHz to 2.4 GHz, ZERO. Accuracy: ≤±5% (SPAN ≥ 100 kHz).

Frequency Stability – Residual FM: ≤3 kHz p-p/100 ms. Frequency drift (50 ms to 5 s sweep time): ≤10 kHz after 30 minute warm-up.

Noise Sidebands – ≤100 dBc/Hz at 20 kHz offset.

Resolution Bandwidth (3 dB) – Range: 1 kHz to 3 MHz, 1, 3 sequence. Bandwidth accuracy: ≤±20% 1 kHz to 1 MHz; ≤±25% at 3 MHz. Selectivity: ≤15:1 60 dB to 3 dB. Bandwidth (6 dB): 9 kHz, 120 kHz (conforming to CISPR standard).

Video Bandwidth – 10 Hz to 3 MHz.

AMPLITUDE RELATED

Amplitude Range – +20 dBm to displayed average noise level; +130 dBµV to displayed average noise level.

Maximum Input Level – Preamplifier OFF: +27 dBm, +134 dBµV (input atten. ≥ 10 dB), ±50 VDC max. Preamplifier ON: +13 dBm, +120 dBµV, ±50 VDC max.

Display Range – Log: 10 x 10 divisions; 10, 5, 2, 1 dB/div. Linear: 10% of reference level/div. QP Log: 40 dB (5 dB/div).

Reference Level Range – Preamplifier OFF: Log, –64 dBm to +40 dBm (0.1 dB step); +46 dBµV to +150 dBµV. Linear, 141.1 µV to 22.36 V. Preamplifier ON: Log, –84 dBm to +10 dBm (0.1 dB step); +26 dBµV to + 120 dBµV. Linear, 14.11 µV to 707.1 mV, 19.95 µV to 1 V.

Input Attenuator Range – 0 to 50 dB (10 dB step).

DYNAMIC RANGE

Displayed Average Noise Level – Preamplifier OFF: –117 dBm + 2.7 f (GHz) dB; –8 dBµV + 2.7 f (GHz) dB. Preamplifier ON: –132 dBm + 3.3 f (GHz) dB; –23 dBµV + 3.3 f (GHz) dB. (RBW 1 kHz, VBW 10 Hz, Input atten. 0 dB, f ≥ 1 MHz).

Gain Compression (1 dB) – Preamplifier OFF: >–10 dBm (mixer input level, f ≥ 10 MHz); >+100 dBµV. Preamplifier ON: >–40 dBm (RF input level, f ≥ 10 MHz); >+70 dBµV.

Spurious Response, Preamplifier OFF (–30 dBm input, input atten. 0 dB, f ≥ 10 MHz) – Second harmonic distortion, ≤–70 dB. Third order intermodulation distortion, ≤–70 dB.

Residual Responses (input atten. 0 dB, f ≥ 1 MHz) – Preamplifier OFF: ≤–100 dBm; ≤+10 dBµV. Preamplifier ON: ≤–115 dBm; ≤–5 dBµV.

AMPLITUDE ACCURACY

Frequency Response – Preamplifier OFF (input atten. 10 dB, 20°C to 30° C after calibration): ≤±1 dB (100 kHz to 2 GHz); ≤±2 dB (9 kHz to 2.2 GHz). Preamplifier ON (input atten. 10 dB): ≤±1 dB (100 kHz to 2 GHz); ≤±2 dB (9 kHz to 2.2 GHz).

Calibration Signal Accuracy – –20 dBm ±0.3 dB; +78 dBµV ±0.3 dB.

IF Gain Uncertainty (after automatic calibration) – <±0.5 dB.

Scale Fidelity (after automatic calibration) – Log: ≤±1.5 dB/90 dB; ≤±1.0 dB/10 dB; ≤±0.2 dB/1 dB. Linear: ±5% of reference level.

Input Attenuator Switching Accuracy (20 to 70 dB settings referenced to 10 dB) – <±1.0 dB (100 kHz to 2 GHz); <±1.5 dB (9 kHz to 2.2 GHz).

Resolution Bandwidth Switching Uncertainty (after automatic calibration) – <±1.0 dB relative to 3 MHz RBW.

SWEEP RELATED

Sweep Time Accuracy – 50 ms to 1000 s and manual sweep ≤±5%.

Trigger Mode – FREE RUN, SINGLE, VIDEO, EXT, TV.

DEMODULATION

Spectrum Demodulation – Modulation type: AM and FM. Audio output: Speaker and phone jack with volume control.

U4941
U4941N

Spectrum Analyzers

INPUTS AND OUTPUTS

RF Input – Connector type: N type. Impedance: U4941, 50 Ω nominal; U4941N, 75 Ω nominal. VSWR, Preamplifier OFF: ≤1.5 (100 kHz to 2.0 GHz, input atten. 10 dB); ≤2.0 (9 kHz to 2.2 GHz). VSWR, Preamplifier ON: ≤2.1 (10 MHz to 2 GHz, input atten. 0 dB).

10 MHz Reference Input – Connector: BNC female, rear panel. Impedance: 50 Ω nominal. Input range: +8 dBm to +16 dBm.

Video Output – Connector: BNC female, rear panel. Impedance: 75 Ω nominal, AC coupled. Amplitude: Approx. 1 V p-p into 75 Ω (composite video signal).

External Trigger Input – Connector: BNC female, rear panel. Impedance: 10 kΩ nominal, DC coupled. Trigger level: TTL level.

Gate Input – Connector: BNC female, rear panel. Impedance: 10 kΩ nominal. Sweep step: During TTL low level. Sweep continue: During TTL high level.

Phone Output – Connector: Subminiature monophonic jack, front panel. Power output: 0.2 W into 8 Ω nominal.

GPIB Interface – IEEE-488 bus connector.

Plotter – R9833, HP7470A, HP7475A, HP7440A, HP7550A, HP2225A.

RS-232C – D-SUB 9-Pin, rear panel.

External Memory Card – Slots: 2. Connector: JEIDA-Ver. 4.1/PCMCIA Rel. 2.0.

POWER REQUIREMENTS

AC input (use AC/DC adaptor A08180) – Line voltage range: Automatically selects between 100 VAC and 200 VAC. 100 VAC operation: 90 to 120 V. 220 VAC operation, 220 to 240 V. Line frequency: 48 to 66 Hz. Power consumption: 100 VAC, 300 VA maximum. 220 VAC, 110 VA maximum. Maximum peak power consumption of AC/DC adapter: ≥300 VA.

External DC input – Connector: XLR 4-Pin. Voltage range: +10 to +15 V. Power Consumption: 50 W maximum.

GENERAL SPECIFICATIONS

Environmental – Operating temperature: 0°C to 50°C, humidity 85% or less. Nonoperating temperature: –20° C to +60°C.

PHYSICAL CHARACTERISTICS

Dimensions*1	mm	in.
Height	148	5.75
Width	291	11.375
Depth	330	13.25
Weight	**kg**	**lb.**
Net	6.2	13.6

*1 *Without feet or connector.*

Tektronix

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

ORDERING INFORMATION

U4941
RF Field Analyzer, 50 Ω Input.....**$14,500**

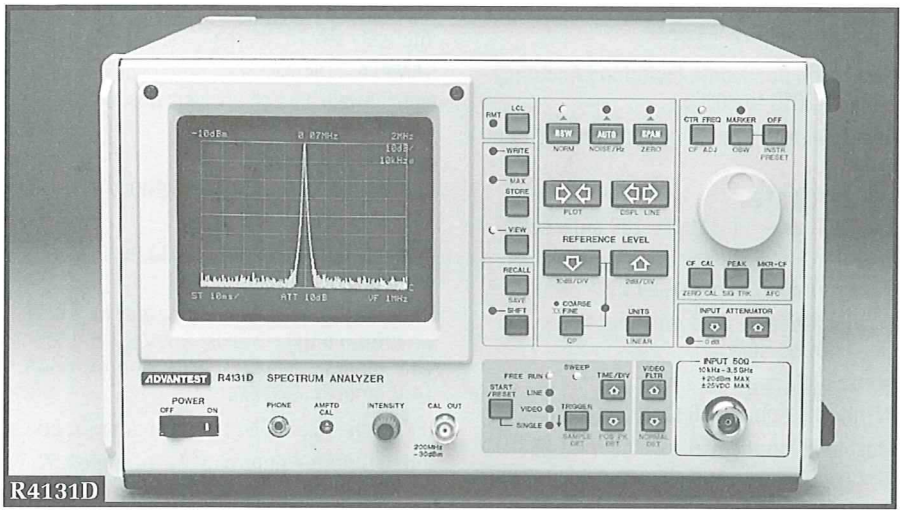
U4941N
RF Field Analyzer, 75 Ω Input.....**$14,500**
Includes: Front-panel Cover, Carrying Handle, N-to-BNC Adapter, AC/DC Adapter, AC/DC Converter/Mains Cable, Carrying Belt, Instruction Manual, Quick Guide.

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection.....**+$590**
Opt. C5 – Adds five years of Calibration Services .....**+$1,225**

RECOMMENDED ACCESSORIES
Battery – Order 146-0111-00 .....**$525**
Battery Charger – Order 119-4901-00.....**$625**
Display Hood – Order R16601 .....**$70**
External DC Power Cable – Order A01434 .....**$95**
Memory Card, 64K IC – Order A09507 .....**$125**
Soft Carrying Case – Order R16216 .....**$450**
Transit Case – Order R16072.....**$1,300**

Spectrum Analyzers

R4131D



R4131D

R4131D

- 10 kHz to 3.5 GHz Coverage
- Excellent Phase Noise Sideband Characteristics: –80 dBc @ 20X Resolution Offset
- Small and Light, Weighing Only 10 kg (22 lb.)
- Save/Recall Measurement Conditions, Including Waveforms
- Low Price

Wide frequency range, low price, and portable.

R4131D Spectrum Analyzer

The R4131D Spectrum Analyzer is small, light, and affordable. Its wide frequency range accommodates measurement of PCN MDS, and other 2 GHz band signals, plus harmonic distortion of RF signals. Maximum input sensitivity of –116 dBm, dynamic range of 70 dB, and –80 dBc phase noise characteristic enhance the range of signals that can be measured with the R4131D. AFC tuning enhances the stability of this economical spectrum analyzer.

Built-in quasi-peak detector and EMC resolution bandwidth filters enable diagnostic EMC measurement. Automated measurements and data logging are complimented by a GPIB communication interface.

SAVE/RECALL FUNCTION FOR CONDITIONS AND WAVEFORMS

The R4131D has a save/recall function which operates not only for measurement condition settings but for waveforms as well. Three sets of conditions and waveforms are stored and recalled. This enables a stored waveform to be used as a reference in comparison measurements at different locations. Independent from this function is an auto-recall function that automatically sets the desired measurement conditions when power is switched on – a great convenience in making on-site measurements.

WIDE DYNAMIC RANGE FOR FREQUENCY CHARACTERISTIC MEASUREMENTS

The R4131D can be combined with the TR4153B or TR4154 Tracking Generators to enable frequency characteristic measurements with wide dynamic range.

AUTOMATIC MEASUREMENT OF OCCUPIED BANDWIDTH

The R4131D has an optional automatic occupied-bandwidth measurement function. This function automatically determines the bandwidth within which 99% of the radiated power is contained, indicating the bandwidth markers and displaying values digitally.

Characteristics

FREQUENCY RELATED

Frequency Range – 10 kHz to 3.5 GHz.

Center Frequency Display – Displayed on the CRT with a maximum resolution of 1 kHz.

Center Frequency Display Accuracy (after zero calibration at local feed through) – ±100 kHz ±3% of span, <2.5 GHz at a sweep time of 5 ms/div to 0.5 s/div); ±10 MHz, ≥2.5 GHz.

Frequency Span – 50 kHz to 4 GHz in 10 divisions on the horizontal scale on the CRT, selectable in 1-2-5 sequence. With zero span, operates as a fixed tuned receiver.

Frequency Span Accuracy – ±5%.

Stability – Frequency stability (at fixed frequency, after 30-minute warm-up): 10 kHz max/10 minutes ≤2.5 GHz at sweep time of 5 ms/div to 0.5 s/div. Residual FM: 2 kHz p-p max/100 ms.

Noise Sideband – –80 dBc max at resolution bandwidth of 1 kHz (at 20 kHz from the carrier, with a 10 Hz video filter).

APPLICATIONS

- **EMC Diagnostic Measurement**
- **Spectrum Monitoring**

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

R4131D Spectrum Analyzers

Resolution – Resolution bandwidth (3 dB points): 1 kHz to 1 MHz in 1, 3, 10 sequence. Resolution bandwidth (6 dB points): 9 kHz, 120 kHz, when QP mode is selected. Selectivity (ratio of 60 dB:3 dB resolution bandwidths): 15:1 max. Resolution bandwidth accuracy: ±20%, CISPR standard or better in QP mode.

Marker Display – Resolution: Maximum 1 kHz (depends on span). Measurement accuracy: Center frequency display accuracy + frequency span accuracy.

AMPLITUDE RELATED

Screen Display Range – LOG mode: With respect to reference level 80 dB for a 10 dB/div display and 20 dB for a 2 dB/div display, or 40 dB for a 5 dB/div display in QP mode. LIN mode: 10 div.

Linearity – LOG mode: ±0.15 dB/1 dB, ±1 dB/10 dB, ±1.5 dB/70 dB. LIN mode: ±5% of full scale.

Reference Level – LOG mode: –69 dBm to +40 dBm (for 10 dB/div, 10 dB and 1 dB steps, and for 1 dB/div and 5 dB/div, 1 dB and 0.25 dB steps). LIN mode: 72.77 µV to 22.36 V.

Reference Level Accuracy – ±1 dB in LOG mode (in the reference level range of 0 to –59 dBm at 200 MHz, with attenuation at 10 dB after level calibration.

Reference Level Units – Selectable as dBm, dBµV, dBm V, or dBµV/m. When dBµV/m is selected, an automatic correction is made for the antenna calibration factor.

Marker Display – Resolution: 0.2 dB (for 10 dB/div) or 0.05 dB (for 2 dB/div). dBm/Hz: RMS noise level is displayed normalized with respect to the 1 Hz bandwidth noise at the marker position.

Dynamic Range – Average noise level: –116 dBm + 1.55 f (GHz) dB or less. 2nd and 3rd order distortion: 70 dB down or greater (when input level is –30 dBm, at 10 MHz or above). Frequency response (with 10 dB attenuation): ±1 dB or less (100 kHz ≤ F ≤ 2 GHz); ±2 dB or less (10 kHz ≤ F ≤ 3.5 GHz). Residual response (with attenuation 0 dB, input termination 50 Ω, frequency >100 kHz): –100 dBm or less.

Video Filter – 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 300 kHz, 1 MHz.

Resolution Bandwidth Switching Accuracy – ±1 dB (+20°C to 30°C).

Gain Compression – 1 dB max for –10 dBm input.

SWEEP RELATED

Sweep Time – 5 ms/div to 100 s/div selectable in 1-2-5 sequence.

Sweep Time Accuracy – ±15%.

Trigger Modes – Free-run, line, video, and single (reset, start).

INPUT RELATED

RF Input – Approx. 50 Ω, N connector.

Maximum Input Level – +20 dBm, ±25 VDC max (with 20 dB or greater input attenuation).

Input Attenuator – 0 to 50 dB in 10 dB steps.

Input Attenuator Switching Accuracy – ±1 dB (10 kHz ≤ F ≤ 2 GHz) or ±1.5 dB (2 GHz ≤ F ≤ 3.5 GHz) with respect to 10 dB attenuation.

Input VSWR (at 10 dB input attenuation or greater) – 1.5 max (100 kHz ≤ F ≤ 2 GHz); 2.0 max (2 GHz ≤ F ≤ 3.5 GHz).

DISPLAY RELATED

Display – Waveform, setting conditions, grid.

CRT – 5.5 inch, phosphor, amber display.

Trace – WRITE waveform and VIEW waveform (up to 2 waveforms displayed on the CRT).

WRITE – Posi-peak, sample, and posi/neg display.

MAX HOLD – For every repetition from the beginning of the function, the maximum signal level along the horizontal axis is displayed.

MARKER – Frequency and level at the marker point are measured and displayed.

PEAK SEARCH – The marker is moved to the point of maximum level on the displayed waveform.

MRK CF – The center frequency is changed to the marker frequency.

ZERO CAL – Improves the center frequency accuracy for local feed through.

PLOT – Direct plotting via GPIB.

NORMALIZE – Display of values relative to an internally stored reference response.

SAMPLE – Display of instantaneous time-signal levels at each analysis position for each sweep.

OUTPUT RELATED

Calibration Output Signal – 200 MHz ±30 kHz, –30 dBm ±0.5 dB.

Monitor Output – Approx. 8 Ω, enables monitoring using an earphone.

Recorder Outputs (analog output of WRITE waveform only) – X axis: Approx. –5 V to +5 V (approx. 10 kΩ). Y axis: Approx. 0 V to +4 V (approx. 220 Ω).

IF Output – 3.58 MHz IF output, approx. 50 Ω.

Video Output – Approx. 1 V p-p, approx. 75 Ω (composite signal for external CRT).

Probe Power Output – ±15 V, 4-Pin connector.

GPIB – Fully controllable over the GPIB for automatic testing as well as direct plotting without an external controller.

POWER REQUIREMENTS

Line Voltage – 90 to 132 V.

Line Frequency – 50/60 Hz.

Power Consumption – 120 VA max.

GENERAL SPECIFICATIONS

Save/Recall – Up to three sets of measurement conditions, including waveforms, can be stored in memory and auto-recall can be used to automatically recall stored conditions when power is applied.

Temperature – Operating: 0°C to +50°C. Storage: –20°C to +70°C.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	300	11.8
Height	177	7.0
Depth	460	18.1
Weight	**kg**	**lb.**
Net	10	22

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

ORDERING INFORMATION

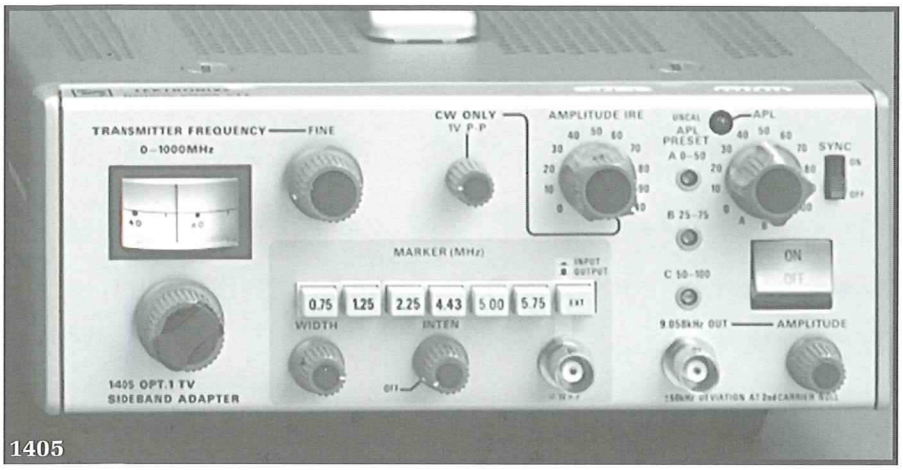
R4131D
Spectrum Analyzer **$9,200**
Includes: Power Cable, Input Cable, N-to-BNC Adaptor.

Opt. 14 – Occupied Bandwidth Measurement and 3 dB Down Measurement ..... **+$1,300**

ADDITIONAL ACCESSORIES

See page 446 for complete selection information.

TV Sideband Adapter



1405

1405 TV Sideband Adapter

The 1405 Sideband Adapter works with 279X and 271X Series Spectrum Analyzers to analyze the sideband and in-band response of a television transmitter. It generates a composite video signal, the "picture" portion of which is a constant amplitude sinusoidal signal that sweeps continuously and periodically between 0 and 15 MHz. This signal is applied as modulation to a modulator or transmitter. The output is displayed on the spectrum analyzer and appears as a response curve, typically to within ±0.2 dB, of the transmitter being tested.

The 1405/Spectrum Analyzer combination displays frequency characteristics of RF and IF circuits with frequencies to 1 GHz. Video circuits can also be analyzed.

Corrected frequency/channel dials for the 1405 are provided by Option 02 (for use with the 279X Series) and Option 03 (for use with the 271X Family).

1405

- Facilitates In-service or Out-of-Service Testing of Transmitter
- Measure Transmitter Frequency Response to Within ±0.2 dB
- Video Circuits Can Be Swept
- Check Aural FM Deviation with Built-in Bessel Null Technique
- Flexible Marker System Will Accept Standard Crystals
- UL Listed 1244, CSA Bulletin in 556B
- Frequency Range to 1 GHz
- Output Amplitude 0 to 100 IRE
- APL 0 to 100 In 10 IRE Steps
- Compatible with 525/60 or 625-50 Systems

Use with compatible spectrum analyzers to display the frequency response characteristics of RF and IF circuits in TV transmission systems.

ORDERING INFORMATION

1405
TV Sideband Adapter 525/60 Markers.....**$7,500**
Includes: Instruction Manual (070-2078-00).
Opt. 01 – TV Sideband Adapter (625/50 Markers) .....**+$200**
Opt. 02 – Dial Readout for 2790 Series Spectrum Analyzers.....**NC**
Opt. 03 – Dial Readout for 271X Series Spectrum Analyzers .....**NC**

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz .....**NC**
Opt. A2 – United Kingdom 240 V, 50 Hz.....**NC**
Opt. A3 – Australian 240 V, 50 Hz .....**NC**
Opt. A4 – North American 240 V, 60 Hz .....**NC**
Opt. A5 – Switzerland 220 V, 50 Hz.....**NC**
See Customer Information Section for additional description.
Rackmount Conversion Kit – Standard 19 in. Rack. Order 016-0489-00 .....**$880**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

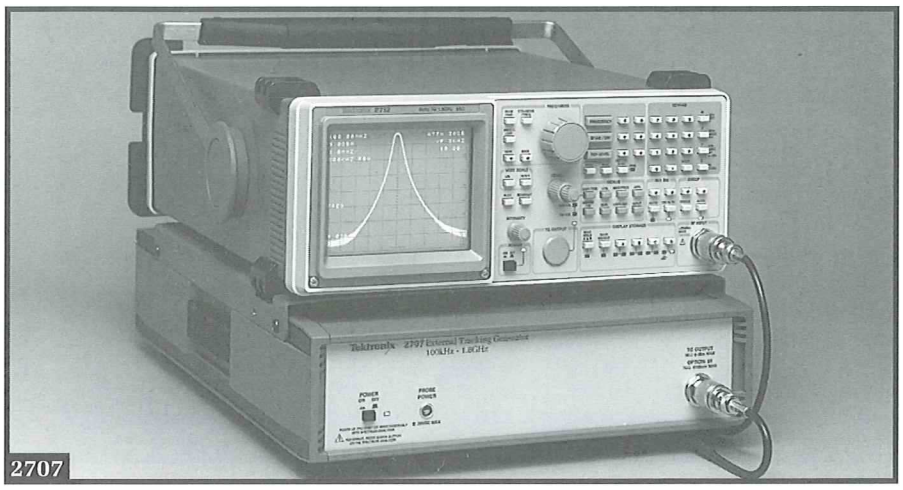
2707 2711/12 OPT. 04 — 2711/12/14 OPT. 05 Tracking Generators

2707 External Tracking Generator (271X Opt. 05) for the 2711, 2712, and 2714 Spectrum Analyzers.

2711, 2712 Opt. 04 Internal Tracking Generator.

2707, 2711/2712 OPT. 04 AND 2711/2712/ 2714 OPT. 05

- 2707 External Tracking Generator (271X Opt. 05) For 2711, 2712, and 2714 (Must be Used for Tracking Generator Capability with 2712 Opt. 12 or 14 and 2714/2715)
- Internal Tracking Generator for 2711 and 2712 (Opt. 04)
- Swept Measurements 100 kHz to 1.8 GHz
- Output from –48 dBm to 0 dBm (–1.2 dBm V to 46.8 dBm V) in 0.1 dB Steps
- Easy to Operate
- Frequency Offset Capability



Internal and External Tracking Generators

Characterize filters, check duplexers or cables, make frequency response, SWR measurements (with a return-loss bridge), EMI site attenuation tests, and much more. The 2707, 2711/2712 Option 04 (internal) and 2711/2712/2714 Option 5 (external) tracking generator systems provide swept measurements from 100 Hz to 1.8 GHz and at least 100 dB dynamic range to see filter, ultimate rejection, or circuit isolation characteristics.

Characteristics (with 271X Series)

2711/2712 Option 04 Internal Tracking Generator. 2707 External Tracking Generator (271X Option 05*[1]).

Frequency Range – 100 kHz to 1.8 GHz.

Tracking Adjust – Accommodates delay devices (long coaxial cables, etc.).

Output Range – 0 dBm to –48 dBm; Option 01: –1.2 dBm V to 46.8 dBm V.

Output Setting Resolution – 0.1 dB.

Manual Level Adjust – Continuous between attenuator steps.

VSWR – ≤2:1 or better with Output Level ≤–8 dBm.

Tracking Generator Flatness – ±1 dB from 100 kHz to 1.0 GHz and ±1.5 dB to 1.8 GHz.

User Corrected Flatness (B, C minus A) – Typically ±0.2 dB.

Dynamic Range (System) – ≥100 dB typical.

Spurious Responses (harmonically related) – ≤–20 dBc at ≥100 kHz.

Spurious Responses (non-harmonically related) – ≤–30 dBc at ≥100 kHz.

Request External Tracking Generator Data Sheet or Internal Tracking Generator Data Sheet for full characteristics.

**1 Option 15, 1st LO output, must be installed in 271X Spectrum Analyzers to be used with the 2707. See compatibility kits below.*

APPLICATIONS

- **CATV – Check Filters and Amplifiers**
- **EMI – Site Attenuation Tests, Filter Design, and Isolation Checks**
- **Broadcast – Check Traps and Filters**
- **Communications Radio Maintenance – Tune Duplexers, Check Antennas**

ORDERING INFORMATION

2707
External Tracking Generator **$4,150**

2711/2712/2714 OPTION 05
External Tracking Generator **$3,950**
Includes: Power Cord, 50 Ω SMA Cable, Type N Male-to-BNC Female Adapter, 15-Pin Male-to-15-Pin Male High Density D-sub Cable Assembly. Mounting Bracket with Mounting Hardware, Trim Strips, Instruction Manual.
Opt. 01 – 75 Ω output. ..... **NC**

2711/2712 OPTION 04
Internal Tracking Generator **$3,150**

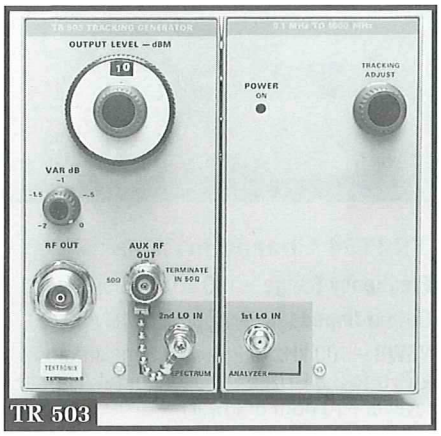
See page 208 for more information.

2707 COMPATIBILITY KITS
2711, 2712, and 2714 with Opt. 15 (1st LO output) Installed.
Order 040-1406-00 ..... **$345**
2711, 2712, and 2714 without Opt. 15 Installed.
Order 040-1407-00 ..... **$525**
2711, 2712 and 2714 1st LO Output. Order 040-1408-00..... **$280**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

Tracking Generator



TR 503

TR503 Tracking Generator

The TR 503 works with all 2790 Series spectrum analyzers to provide constant level, calibrated RF sources for swept frequency tests to 1.8 GHz. The tracking generator is a two-wide unit compatible with the TM 500 and TM 5000 Modular Instrument Series.

The low residual FM of these systems enhances narrow bandwidth frequency response measurements. When used as a CW signal source with the analyzer in a manual mode, these systems have excellent frequency stability.

The tracking generator sweep rates are controlled with the spectrum analyzer, and the output level is controlled from the tracking generator. The output frequency of the tracking generator is the same as the frequency of the analyzer at any instant of the sweep.

The TR 503 AUX RF Output may be used to drive a frequency counter package, such as the recommended DP 501, DC 509 Option 01. Frequencies up to 1.8 GHz may be measured accurately in the presence of high level adjacent signals to the sensitivity limits of the analyzer.

TR 503 Characteristics (with 2790 Series)

Frequency Range – 100 kHz to 1.8 GHz.

Output Level – (Max) 0 dBm ±0.5 dB.

Range – 0 to –59 dBm in 10 dB and 1 dB steps.

Flatness – Within ±2.25 dB Max from 100 kHz to 1.8 GHz (Typically ±1.5 dB).

Dynamic Range – ≥110 dB.

Residual FM – 10 Hz p-p.

Output Impedance – 50 Ω Nominal, VSWR 2:1 or less to 1.8 GHz.

Auxiliary Output – 0.1 V RMS into 50 Ω load. 7 dBm minimum.

TR 503

- Swept Measurements to 1.8 GHz
- Enhances Dynamic Range to Better Than 110 dB
- Very Stable – Useful As a CW Signal Source
- Auxiliary, Constant Level Output Provides for Frequency Counter Measurement Even of Signals at the Noise Floor
- UL Listed 1244

TR 503 Tracking generator for 490, 2750, and 2790 Series Spectrum Analyzers.

APPLICATIONS

- **CATV – Check Filters and Amplifiers**
- **EMI – Site Attenuation Tests, Filter Design, and Isolation Checks**
- **Broadcast – Check Traps and Filters**
- **Communications Radio Maintenance – Tune Duplexers, Check Antennas**

ORDERING INFORMATION

TR 503
Tracking Generator.....**$8,500**
Includes: Two 50 Ω Coax Cables (012-0649-00); N Male-to-BNC Female Adapter (103-0045-00); Retainer Plug-in (343-0604-00); Instruction Manual (070-3526-00).

ACCESSORIES
Power Module – Order TM 503B **$495**
Power Module – Order TM 504.....**$780**
Blank Panel – Order 016-0195-05.....**$47**
Rackmount Conversion Kit – Standard 19 in. Rack. Order 016-0489-00 .....**$735**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

TR4153B
TR4154

Tracking Generators

External Tracking Generators for Advantest R4131D Spectrum Analyzer

TR4153B/TR4154

- 100 kHz to 2 GHz (3.5 GHz, TR4154)
- 0 dBm to –59 dBm (Switchable in 1 dB Steps)
- Wide Dynamic Range Scalar Analysis Measurement



TR4153B/TR4154

The TR4153B/TR4154 Tracking Generators provide swept frequency operation for the R4131D Spectrum Analyzer.

TR4153B Characteristics

Frequency Range – 100 kHz to 2 GHz.

Output Impedance – Approximately 50 Ω.

Output VSWR – 100 kHz to 1.5 GHz: 1.5 maximum. 1.5 GHz to 2.0 GHz: 2.0 maximum.

Output Level Flatness – ±0.7 dB maximum (with respect to 200 MHz output, over an output level range of 0 to –10 dBm and frequency range of 100 kHz to 2 GHz).

Output Level Variable Range – 0 to –10 dBm or greater, continuously variable.

Spurious Output Components – Harmonics: ≤20 dBc. Nonharmonics: ≤30 dBc (at 0 dBm output).

Tracking Generator Leakage – –110 dBm.

Output Connector – Type N.

Environmental – Operating temperature: 0°C to 40°C. Humidity: 85% maximum.

Power Requirements – Line voltage: 90 to 110 V. Line frequency: 50 to 60 Hz. Power consumption: 50 VA maximum.

TR4154 Characteristics

Frequency Range – 100 kHz to 3.5 GHz.

Output Impedance – Approximately 50 Ω.

VSWR – 100 kHz to 2 GHz: 1.5 maximum. 2 GHz to 3.5 GHz: 2.0 maximum (at output level of –10 dBm or lower).

Output Level Accuracy – ±0.5 dB (at 200 MHz, –10 dB output, +20°C to +30°C).

Output Level Flatness – 100 kHz to 2 GHz, –10 dBm output: 2 dB p-p. 100 kHz to 3.5 GHz, –10 dBm output: 4 dB p-p.

Output Level Switching Accuracy (with respect to –10 dBm output, over an output level range of 0 to –59 dBm) – 100 kHz to 2 GHz, ±2 dB. 100 kHz to 3.5 GHz, ±2.5 dB.

Spurious Output Components (at 0 dBm output) – Harmonics: ≤20 dB. Nonharmonics: ≤30 dB.

Tracking Generator Leakage – –110 dBm or less.

Output Connector – Type N.

Environmental – Operating temperature: 0°C to 40°C. Humidity: 85% maximum.

Power Requirements – Line voltage: 90 to 110 V. Line frequency: 50 to 60 Hz. Power consumption: 50 VA maximum.

PHYSICAL CHARACTERISTICS

	TR4153B		TR4154	
Dimensions	**mm**	**in.**	**mm**	**in.**
Height	90	3.5	88	3.5
Width	300	11.8	424	16.7
Depth	440	17.3	440	17.3
Weight	**kg**	**lb.**	**kg**	**lb.**
Net	10	22	10	22

APPLICATIONS

- **CATV – Check Filters and Amplifiers**
- **EMI – Site Attenuation Tests, Filter Design, and Isolation Checks**
- **Broadcast – Check Traps and Filters**
- **Communications Radio Maintenance – Tune Duplexers, Check Antennas**

ORDERING INFORMATION

TR4153B
Tracking Generator.....**$4,600**
Includes: Power Cable, Output Cable, SMA Connecting Cable, BNC Connecting Cable.

TR4154
Tracking Generator.....**$11,000**
Includes: Power Cable, Output Cable, SMA Connecting Cable, BNC Connecting Cable.

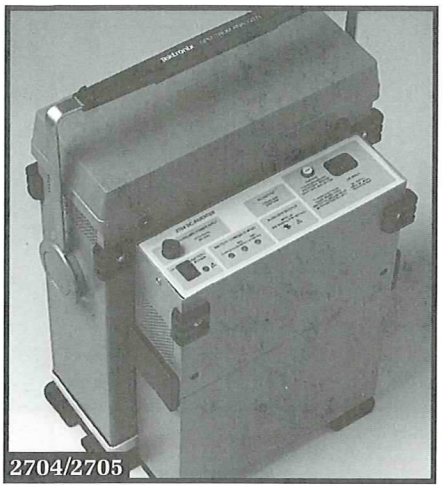
ADDITIONAL ACCESSORIES
See page 446 for complete selection information.

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

Inverter/Battery Pack



2704 Inverter/ 2705 Battery Pack

The 2704 Inverter and 2705 Battery Pack can provide for operation of 271X spectrum analyzers in locations where AC power is not available. These units mount directly on the spectrum analyzer to form a portable package.

Several 2705s can be used to provide an uninterruptible power source for the spectrum analyzer or other equipment. The 2704 includes a battery charger, and provides an auxiliary 18 volt output. The 2704 also accepts 12 volt input from other sources, such as car batteries. These units are described in more detail in the Inverter/Battery Pack Data Sheet.

Characteristics

2704 INVERTER

DC Input – (main and auxiliary) 11.25 VDC to 15 VDC.

Output Voltage – 115 VAC RMS ±10%.

Output Frequency – 60 Hz ±5%.

Output Waveform – Quasi-sinusoid.

Output Power – 115 W maximum continuous.

Battery Charger – AC input voltage (90 VAC to 250 VAC, 50/60 Hz). AC power consumption 70 W typical.

Auxiliary Output for LNB Voltage – 18 VDC ±10%. Ripple, 200 mV typical. Maximum output current 1 A (current limited).

2705 BATTERY PACK

Type – Sealed lead-acid.

Minimum Operating Time – 50 min at 10°C to 40°C, 45 minutes at 0°C to 10°C.

Charging Time (using 2704) – Eight hours typical for one battery pack, 12 hours for two battery packs, fully discharged state, 0°C to 40°C.

Cycle Life – ≥125 charge/discharge cycles to 100%.

2704/2705

- Easy Connection to Tektronix 271X Family Spectrum Analyzers
- 115 W of AC Power
- Continuous Power Using Sequential Battery Packs
- Lightweight Single Package for Easy One-handed Carrying
- Automatic Charging of Two Battery Packs Simultaneously
- Auxiliary 18 VDC LNB Power
- Low Battery Warning

Operate your 271X Spectrum Analyzer when Mains Power is not available.

ORDERING INFORMATION

2704
Inverter **$1,100**
Includes: Power Cord (U.S. 115 V, 60 Hz), Operator's Manual, Analyzer Mounting Plate.

2705
Battery Pack **$325**

1.5 Meter DC Power Cord – 2704 Inverter-to-Automotive Cigarette Lighter Plug. Order 118-8549-00 ..... **$60**

1.5 Meter DC Power Cord – 2704 Inverter-to-Alligator Clips. Order 118-8550-00 ..... **$60**

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**
Opt. A2 – United Kingdom 240 V, 50 Hz ..... **NC**
Opt. A3 – Australian 240 V, 50 Hz ..... **NC**
Opt. A4 – North American 240 V, 60 Hz ..... **NC**
Opt. A5 – Switzerland 220 V, 50 Hz ..... **NC**

See Customer Information Section for additional description.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 2704 and 2705 comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

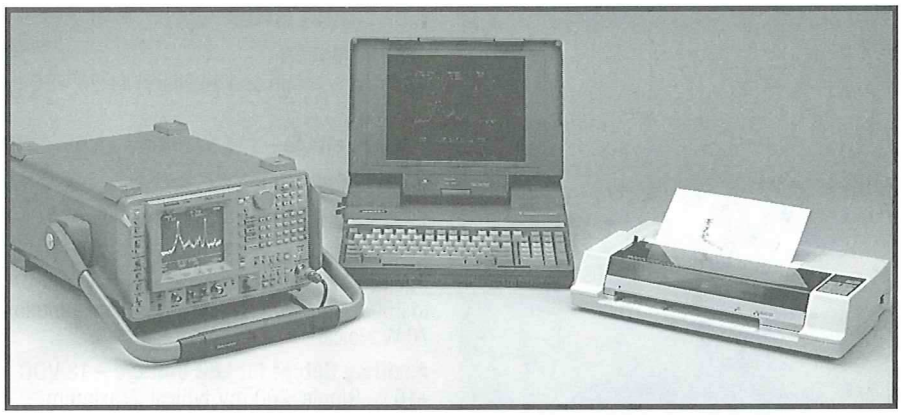
Tektronix Measurement products are manufactured in ISO registered facilities.

Spectrum Analyzer Software

Automate your measurements with Tektronix Spectrum Analyzer Software.

S26RF00
GRASP Software

- Performs Automated Spectrum Analysis on PC-compatible Computers
- Select Applications Through Easy, Menu-driven Operation
- Supports VGA, EGA, and CGA Graphics



GRASP Software runs on a wide variety of PC-compatible controllers.

S26RF00 – GRASP Software

GRASP (General RF Applications Software Package) combines the power of Tektronix' 490P/2750P/2790 Series programmable spectrum analyzers and PC-compatible controllers.

This comprehensive software offers many applications/utility routines that are selected through easy, menu-driven operation. It provides immediate access to operations such as swept-frequency measurements, waveform storage and recall, and performing various types of signal analysis. Measurements such as harmonic distortion, amplitude modulation, and signal-to-noise ratio are performed with a minimum of effort.

From the GRASP main menu, a user selects among any of the submenus for Measurements, Filter Tests, Signal Search routines, Waveform Operations, and Utilities. Selections are made by pressing the appropriate function key shown on screen. Prompts guide you through each measurement task.

For example, users can use a Cursors routine which displays the instrument CRT on their terminal screen. It calculates and displays both the absolute amplitude and frequency of one or two marked signals, plus the relative (delta) amplitude and frequency difference between the two markers.

Complete source code is provided with GRASP, thereby simplifying the task of integrating user-written routines into GRASP.

GRASP works on most MS-DOS compatible computers that are equipped with a National Instruments GPIB card.

MAIN MENU MAP

MEASUREMENTS
- Harmonic Distortion
- Amplitude Modulation
- Signal-to-Noise
- Frequency Response
- Cursors

SIGNAL SEARCH
- Fast Search
- Precise Search
- Spur Search
- Automatic Identify

UTILITIES
- Talk/Listen
- Sensitivity Test
- Resolution Filter Test
- Calibration Assistance
- Select Instrument
- Select Disk

FILTER TESTS
- Band-pass Filters
- Low-pass Filter
- High-pass Filter

WAVEFORM OPERATION
- Acquire AVIEW Waveform
- Acquire BView Waveform
- Send to Instrument
- Redraw Waveform
- Store on Disk
- Load from Disk
- Graph Waveform
- Overlay Waveform
- Normalize Waveform

The GRASP main menu lists all submenus and their routines.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

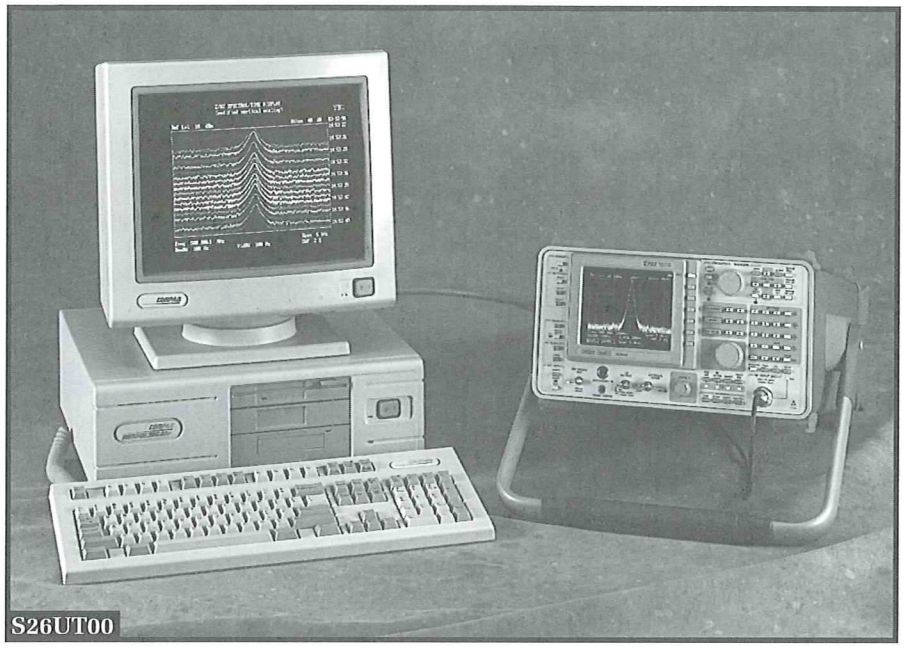
Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

S26RF00
General RF Applications Software **$895**
Includes: Software on 5.25 in. HD Diskettes.

Opt. 1A – Substitute 5.25 in. DSDD diskettes ..... **NC**
Opt. 1B – Substitute 3.5 DD in. diskettes ..... **NC**

Spectrum Analyzer Software



S26UT00

- Performs Automated Spectrum Analysis on PC-compatible Controllers
- Select Applications Routines through Pop-up Menus
- Provides Data Logging to Color Copier, Printer, or Magnetic Media

Software to automate your spectrum analyzer measurements.

S26UT00
2782/PC Utility Software

The Tektronix 2782/PC Utility Software is designed to capitalize on the power of the Tektronix 2782 and 2784 Spectrum Analyzers and PC-compatible controllers.

This software package offers applications/utility routines that are selected through pop-up menu operation. Even a non-technical operator has immediate access to operations such as waveform graphing, waveform storage and recall, harmonic distortion measurements, and performing a fast or precise signal search over a selected frequency band.

A Talk/Listen routine is also included for explicitly setting or querying any front-panel function. This is very useful for programmers who want to test certain programmable features in an interactive environment.

A particularly unique capability of this software is the waterfall routine. It continually acquires and graphs traces on screen, using a pattern of changing colors. This allows you to detect changes in spectral content that occur over specified time intervals.

All 278x tests are based on user-defined defaults. The results of the tests can then be displayed on screen, or stored to disk for later recall. Graphics drivers are included for both CGA (Color Graphics Adapter) and EGA (Enhanced Graphics Adapter) displays, and the colors of the graphs are user selectable.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

S26UT00
2782 Utility Software.....**$1,400**

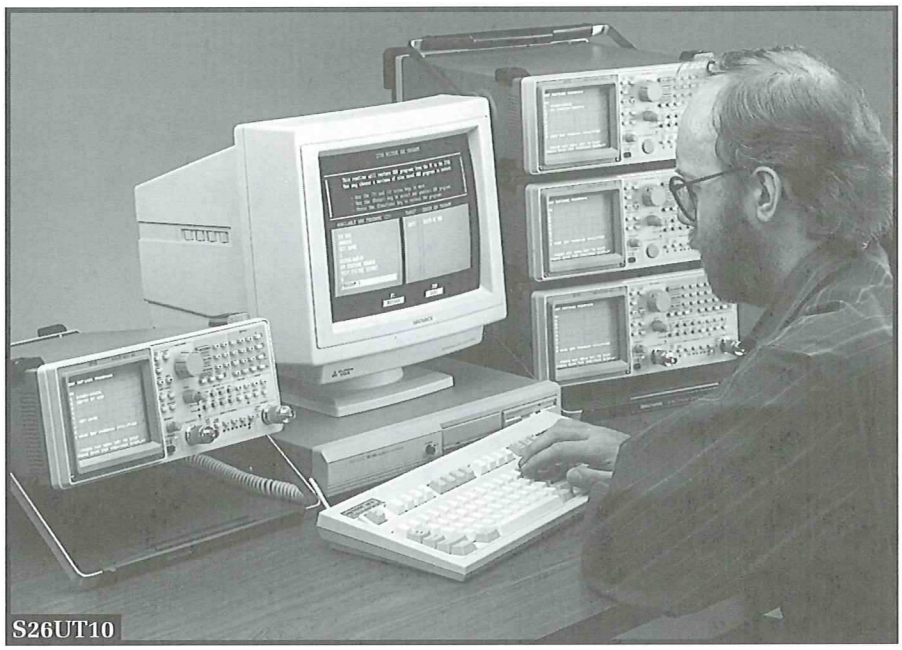
Includes: Software on 5.25 in. DS/DD Diskettes, License Agreement, and User's Manual.

Spectrum Analyzer Software

Software to automate your spectrum analyzer measurements.

S26UT10

- Performs Automated Spectrum Analysis on PC-compatible Controllers
- Measurement Data May be Stored to Disk, or Included as Part of a Report or Document



S26UT10
271X/PC Utility Software

Tektronix' 271X/PC Utility Software is designed to extend the storage capabilities as well as automate some of the more common functions of the 271X Spectrum Analyzers. These include waveform acquisition, graphing, documentation, storing to disk, comparing, subtracting, recalling from disk, and sending to the analyzer. Both single traces and groups of related traces can be manipulated.

The software provides utility routines for operations such as TALK/LISTEN (sending commands and receiving responses), selecting the color of waveform graphs and annotation, and specifying the drive or path under which waveforms and other files will be stored.

The software includes an application category which can be supplemented with user specific applications. This category contains a waterfall application, an occupied bandwidth measurement application, and an application to save, recall and transfer User Defined Programs to other 271X analyzers equipped with a communications port.

The measurement category contains a program to measure harmonic distortion and a program to check swept frequency response. The latter uses the optional, fully programmable 271X tracking generator to measure peak-to-valley response within a specified frequency range.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

S26UT10
2710 Series PC Utility Software.....**$650**
Includes: Software on 5.25 in. and 3.5 in. Diskettes.

Opt. 09 – Source Code.....**+$1,000**

EMI/RFI Solutions

EMI/RFI Solutions – An Introduction

Electrical and electronic devices may emit signals which interfere with other devices, or even with themselves. These signals are known as electromagnetic interference (EMI) or sometimes as radio frequency interference (RFI). Conversely, the ability of a device to withstand emissions from other devices or from itself is called electromagnetic susceptibility (EMS). EMS is often referred to as immunity.

As the number of electronic devices in use increases, so does the potential for these devices to interfere with each other. Electromagnetic compatibility (EMC) is a measure of how well they share their electromagnetic environment without adverse affects from EMI.

The goal of EMC is to construct electrical equipment with sufficiently low emissions and sufficiently high immunity to guarantee electromagnetic compatibility. The definition and enforcement of "sufficiently high" and "sufficiently low" becomes a matter of standards and regulations. In fact, when we refer to EMC compliance, we generally mean the ability of a system or device to meet standards regulating the amount of EMI that it can emit and its immunity to EMI.

EMC/EMI is a vital concern to manufacturers of electrical equipment subject to compliance. Their products must meet the applicable standards before they can be marketed. To ensure electromagnetic compatibility, the necessary measures should, therefore, be considered as early in the design phase as possible so they can be implemented in product development.

EMI

Electromagnetic interference or emissions from an electrical or electronic device may significantly impair radio and TV reception in the vicinity.

To prevent such a critical situation and to allow a wide variety of devices to operate next to and with each other, it's important to define interference limits ensuring a sufficient safety margin between EMI emissions and EMS limit values. Depending upon the standard being applied and the limit class required, different test conditions have to be observed in interference measurements. Test measurements are made either in shielded rooms or at an open-area test site as required. It is important that the measuring instruments themselves should not influence the result.

EMS

EMS measurements are made to test the function of a module, instrument, or system under the influence of conducted or radiated interference. These measurements must be carried out in shielded rooms or anechoic chambers. RF absorbers in the test chamber prevent erroneous results and simulate open-site conditions at high frequencies.

FIELD-STRENGTH AND RADIO MONITORING MEASUREMENTS

Radiocommunications services (PTT, broadcasting corporations, military, traffic and security authorities, as well as civil services) use field-strength meters for propagation measurements in the planning stage and for coverage measurements during operation of communication networks.

Field-strength measurements – in particular propagation and coverage measurements – are usually made in mobile mode (vehicle or aircraft). Therefore, portability and DC or battery operation are important criteria in the choice of a test receiver.

Radiomonitoring services use test receivers to check emissions for compliance with the specifications. Test parameters include: fieldstrength, wave propagation, spurious responses, frequency, occupied bandwidth, frequency deviation, amplitude modulation depth, as well as channel and band occupancy.

CONTENTS

EMC, FIELD-STRENGTH AND RADIOMONITORING INSTRUMENTS OFFERED

27120 EMC – Pre-, Post-certification Measurement System 232
S26EM00 EMI – Prequalification Software 233
S26EM12 – Commercial EMI Test Software....233
2706 – Stepping RF Preselector 234

EMC ANCILLARY DEVICES

Antennas, Transducers, and Related Devices for EMI Testing 235
PR326150/PR326160/PR326170 Software Cards 236

TEST RECEIVERS

ESAI, ESBI, ESMI EMI Test Receivers – EMI Test Receiver with Built-in Spectrum Display....237
ESHS, ESVS, ESS EMI Test Receivers – Conventional EMI test receiver for testing to all relevant commercial and MIL-STD specifications....241
ESVB, ESVD, ESVN, ESN Test Receivers – Test receivers for field strength and radio monitoring 249
ES-K1 Software – EMC compliance test software for use with all Rohde & Schwarz EMI test receivers 255

EMI/RFI Solutions

Pre-compliance measurement tools designed to meet your EMC testing needs. Available as a complete system or separate components.

27120

DIAGNOSTIC AND PRE-/POST-CERTIFICATION MEASUREMENTS

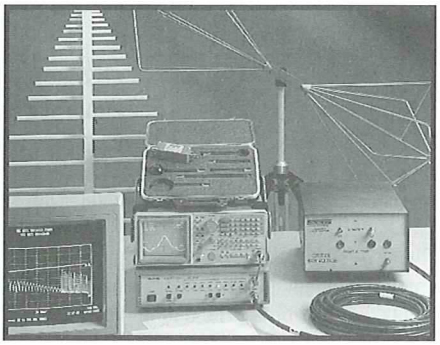
- Detect Potential Problems Early in the Design Phase
- Diagnose and Correct "Hot Spots" Prior to Building Production Prototypes
- Verify Performance Before Purchasing Expensive and Difficult-to-Schedule Certification Testing

COMPLIANCE MAINTENANCE

- Establish On-going EMC Compliance Program
- Create Benchmarks and Detect Deviations
- Make Relative and Absolute Measurements to Ensure Product Continues to Meet EMC Standards

OPTIONAL 2707 TRACKING GENERATOR

- Site Attenuation Measurements
- Filter Evaluation
- EC '92 Generic Immunity Source



Tektronix EMC Measurement Solutions Are Affordable and Effective

The time to address Electromagnetic Compliance (EMC) is before it becomes an expanding problem. Proper attention to EMC from the design stage through pre-certification testing can reduce your product development time and lower your cost to market.

Tektronix wants to share its EMC experience and expertise with you. For over 40 years Tektronix has been a world leader in the design and production of spectrum analyzers, oscilloscopes, logic analyzers, and a wide variety of other high-technology electronic devices. In support of these products, we have established and maintained an FCC approved in-house EMC testing facility, and evolved effective measurement systems and methodologies. The knowledge gained has had an important influence on the EMC measurement tools and solutions described in this section.

One result is the 27120 EMC Pre-/Post-Certification Measurement System. It can maximize the probability that your product will be certified the first time through the EMC testing lab, lowering the cost of delays from scheduling and re-testing your products. It can also ensure continued compliance in the months and years after certification.

By combining the economical 2712 Spectrum Analyzer with a variety of supporting devices and our outstanding S26EM12 EMI Test Software, Tektronix has created a pre- and post-certification system that will help you achieve these and other goals in the years ahead.

The S26EM12 PC-based EMC software package provides a straightforward means of controlling the 27120 system and managing measurement results. The software facilitates FCC, EC/'92, VDE, VCCI, and other EMI testing. The easy-to-use 9 kHz – 1.8 GHz 2712 Spectrum Analyzer includes many features helpful in identifying and measuring EMC signals: built-in pre-amp, frequency counter, AM/FM demodulator, true analog or 4-trace digital display, peak, quasi-peak, and average detection, and 200 Hz, 9 kHz, and 120 kHz EMI filters. Overload capability is enhanced and ambient signal interference is minimized by the 2706 Stepping RF Preselector. Biconical and log-periodic antennas, a tripod and feedline, and a LISN with transient limiter enable you to make radiated measurements from 30 MHz to 1 GHz and conducted measurements from 9 kHz to 30 MHz. Magnetic and electric near-field RF probes for EMC troubleshooting round out the system. All together, this is a complete but very economical package for addressing all of your EMI diagnostic and pre- and post-certification needs. More details on the 2712 Spectrum Analyzer are available on page 206. Components of the 27120 Measurement System are also available separately.

For additional information on EMC measurements using Tektronix Spectrum Analyzers, software, and associated equipment, ask your local Tektronix Sales Office for a copy of *EMC Measurement Solutions*, 2EW-8793-0.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 27120 complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

27120

EMC Pre-/Post-Certification Measurement System.....**$26,015**

Opt. 05 – Add External Tracking Generator.....**+$3,950**

Opt. 10 – Add Television Demodulator.....**+$650**

Opt. 11 – Delete Antennas, Tripod, Cable.....**–$3,290**

Opt. 16 – Delete LISN and Transient Limiter.....**–$2,870**

SERVICE ASSURANCE OPTIONS

Opt. R2 – Adds two years of post-warranty Repair Protection.....**+$590**

Opt. C5 – Adds five years of Calibration Services.....**+$1,225**

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz.....**NC**

Opt. A2 – United Kingdom 240 V, 50 Hz.....**NC**

Opt. A3 – Australian 240 V, 50 Hz.....**NC**

Opt. A4 – North American 240 V, 60 Hz.....**NC**

Opt. A5 – Switzerland 220 V, 50 Hz.....**NC**

See Customer Information Section for additional description.

S26EM00 EMI Prequalification Software

Tektronix' EMI Prequalification Software provides a low-cost time-saving approach to EMI conducted and radiated emissions testing using Tektronix' 490P, 2750P, and 2790 Series Spectrum Analyzers. It is particularly designed for engineers who require a compact system for measuring and documenting MIL-STD EMI levels during the various design stages.

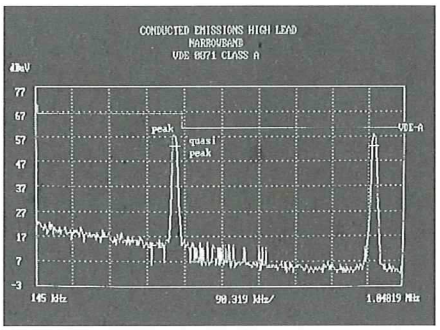
When used with a Tektronix 490P, 2750P, and 2790 programmable spectrum analyzer and an IBM or compatible PC (equipped with a National Instruments IEEE-488 interface card), this software enables a cost-effective approach for integrated EMI testing. This software package includes test routines for FCC Part 15 Subpart B, VDE 0871, and MIL-STD 461B/462 RE02 and CE03. Routines are accessed through menu-driven operation. For each class of test, routines are provided for acquiring data, graphing results (semilog plot with selected limits superimposed), and creating printouts of frequencies approaching or exceeding limits. Capability is also included for updating and displaying antenna factors.

For information about ordering antennas and other EMC test equipment, see Ancillary Devices or contact your Tektronix sales engineer.

S26EM12 EMI Test Software

Tektronix' Commercial EMI Test Software provides a powerful engineering tool for integrating EMI testing into product design cycles.

The EMI software automates the testing and data recording procedures required to analyze the Equipment Under Test (EUT) against U.S. or international test requirements, over a frequency range of 1 kHz to 1.8 GHz. Routines and provisions are included for compliance to FCC, VDE, and CISPR standards. This comprehensive software package runs radiated emissions, magnetic emissions, conducted emissions, and radiated power tests. Measurements can also be made against user-defined limits. The software supports peak, quasi-peak, and average detection methods and controls most Tektronix spectrum analyzers and the 2706 Stepping RF Preselector.



Graphic display of peak and quasi-peak measurement.

The software works with your IBM PC or compatible computer. Hardware requirements are modest: a GPIB interface, 512 KB of RAM, a hard disk, and any size flexible disk drive. Color graphics take better advantage of the software's features (EGA or VGA is recommended), but monochrome is supported too. A run-time function library module (for Microsoft QuickBASIC) is included, as well as sample test setups and results.

Tektronix S26EM12 EMI Software allows test systems to be set up in shielded rooms, at open-field sites, or at the engineering bench. All acquired test data are stored to disk, and can be viewed immediately in graphic or text formats, or archived for later review and report generation. Test results are stored as ASCII characters so they can be used by other analysis software.

Testing is completely menu-driven from the computer keyboard and display. Test results can be automatically graphed on the monitor screen, or plotted on HP-GL or Epson-compatible plotters. They can also be printed on Epson FX-compatible or HP LaserJet compatible printers. Additionally, tabular test results can be printed on an Epson-FX or compatible line printer.

A free demo disk is available by calling the Tektronix TeleBusiness Center at 1-800-426-2200.

S26EM00
EMI Software

- Cost-effective Approach to Automated EMI Testing
- Runs on IBM or Compatible PC
- Easy, Menu-driven Operation
- Pre-certification Testing for FCC/VDE, MIL-STD 461B/462 CE03 and RE02.

S26EM12
EMI Test Software

- Cost-effective Approach to Automated EMI Testing
- Runs on IBM/Compatible PC
- Easy, Menu-driven Operation
- Configure and Save Test Set-ups with User-defined Steps and Frequency Ranges
- Define and Save User-specified Test Limits
- Perform Tests to User-defined or Standardized Limits
- Define and Save User-specified Correction Factors
- Graphically Display Multiple Test Results
- Automate Spectrum Analyzer Compression Tests

Tektronix PC-based software automates tedious EMI measurements, reports results, and archives data.

Free S26EM12 demo disk available. Call the number below.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

S26EM00
EMI Prequalification Software **$1,510**
Includes: Software on DS/DD Diskettes, License Agreement, and User's Manual.

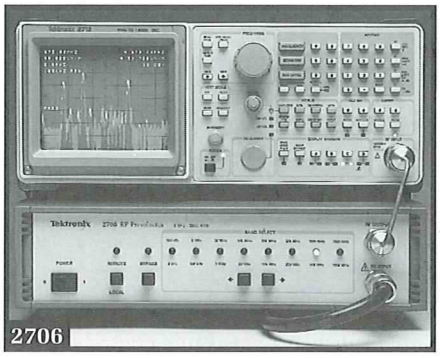
S26EM12
Commercial EMI Test Software **$1,785**
Includes: 5.25 in., 3.5 in. Media and Documentation.

EMI Ancillary Devices – See page 235.

Affordable preselection for use with any spectrum analyzer.

2706

- Low Investment
- Easy to Use
- Part of Automated Measurement System Using Tektronix S26EM12 EMI Software
- Bypass Mode Facilitates Measurement Without Preselection
- Can be Easily Taken to Remote Measurement Sites
- Can be Used As a Standalone Filter in Many Other Applications
- 9 kHz to 1800 MHz Overall Range (Bypass Mode)
- Continuous Bandpass Filtering from 9 kHz to 1800 MHz in Eight Selectable Bands
- Compact, Lightweight Design
- Attaches to the Tektronix 271X Spectrum Analyzers to Form Integrated Unit
- UL Listed 1244, Certified CSA C22.2 No. 231-M89



2706 Preselector

The 2706 Stepping RF Preselector facilitates distortion-free measurements in the presence of large signals at the spectrum analyzer input. If total signal power at the first mixer stage of the spectrum analyzer exceeds the 1 dB compression point, inaccurate amplitude measurements and spurious intermodulation products can result. The 2706 Preselector enables the spectrum analyzer user to make accurate measurements over a wider range of signal environments by:

- Significantly attenuating undesired out-of-band signals
- Reducing energy from high amplitude, short duration pulses
- Minimizing the total number of individual signals present at the analyzer input

Use of commercial RF preselectors has been limited because of high costs. Now, Tektronix offers an affordable and cost-effective solution for pre-certification testing.

The Tektronix 2706 Stepping RF Preselector is designed to be used with spectrum analyzers for EMI measurements and other applications. The 2706 can be attached to the bottom of 271X Spectrum Analyzers to form a single compact unit. Signals present at the 2706 input connector are routed directly to the spectrum analyzer when preselection is not desired. When preselection is desired, one of eight bandpass filters is switched into the circuit to limit the range of frequencies passed to the analyzer.

The 2706 is a stepping RF preselector using band switching to select the desired range of frequencies. Manual operation is possible from the front panel, and remote operation is provided via a GPIB interface which is supported by Tektronix S26EM12 EMI Software. While not equivalent to a narrow-band tracking preselector, the 2706 does an excellent job of rejecting out-of-band signals and decreasing overload susceptibility at a small fraction of the cost of a narrow-band tracker.

Characteristics

FREQUENCY RELATED

Bypass Mode – Frequency Range: 9 kHz to 1800 MHz. Insertion Loss (max): 2.0 dB.

Filters – Frequency Range: 9 kHz to 1800 MHz in eight switch-selectable ranges. Bandpass/Highpass Flatness: 1.5 dB max.

INPUT RELATED

RF Input/Output connectors – Type N.

Input/Output Impedance – 50 Ω nominal.

VSWR (max) – 1.8:1.

Ultimate Rejection, Stop Band – 60 dB typical. 40 dB min. below 500 MHz and 30 dB min. above 500 MHz.

Maximum Input – +20 dBm, 50 VDC

Switching Speed (max) – 10 ms.

IEEE 488 Interface Support – AH1, L4, SH1, T6, SR1, PP1, DC1, DT0, RL1, C0, E1, TE0, and LE0.

GENERAL CHARACTERISTICS

Power Requirements – 90 to 250 VAC, 48 to 63 Hz, 10 W maximum.

PHYSICAL CHARACTERISTICS

2706		
Weight	**kg**	**lb.**
	5.9	13 lb.
Dimensions	**cm**	**in.**
Width	32.7	12.87
Height	8.8	3.46
Depth	43.1	16.97

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 2706 complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in

ORDERING INFORMATION

2706

Stepping RF Preselector.....**$4,650**

Includes: Power Cord (U.S. 115 V, 60 Hz), Operator's Manual.

Opt. 01 – 271X Spectrum Analyzer Mounting Hardware and RF Interconnect Cable .....**+$300**

NOTE: The 2706 Opt. 01 Stepping RF Preselector is available at a reduced price when ordered as an option to the 2711 or 2712 Spectrum Analyzers (see page 208).

SERVICE ASSURANCE OPTIONS

Opt. R2 – Adds two years of post-warranty Repair Protection.....**+$160**

Opt. C5 – Adds five years of Calibration Services.....**+$475**

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz .....**NC**

Opt. A2 – United Kingdom 240 V, 50 Hz.....**NC**

Opt. A3 – Australian 240 V, 50 Hz .....**NC**

Opt. A4 – North American 240 V, 60 Hz .....**NC**

Opt. A5 – Switzerland 220 V, 50 Hz.....**NC**

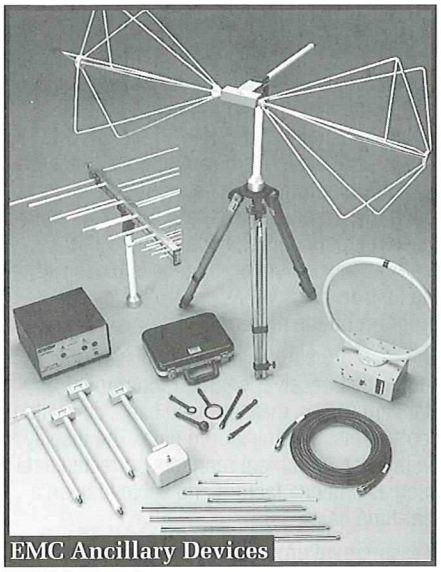
See Customer Information Section for additional description.

SOFTWARE

See page 233 for complete description.

Commercial EMI Test Software – Order S26EM12.....**$1,785**

EMI/RFI Solutions



Tektronix offers a complete line of calibrated antennas and other sensor products for EMI testing.

Sensors or transducers are required for EMI signal reception. The sensor picks up the EMI signal and couples it to the spectrum analyzer. The spectrum analyzer then displays the EMI signal as a plot of amplitude (vertically) versus frequency (horizontally).

The type of sensor needed depends on the test standard and the nature of the test (radiated, conducted electric field, or radiated magnetic field). For radiated electric (E) field tests, a biconical, log periodic, or dipole antenna may be used. Electrostatically shielded loop antennas are used for magnetic (H) field tests.

The specific transducer type required also depends on the test standard and frequency range. Tektronix has available a line of antennas and other sensors, as shown in the figure at left.

For conducted measurement, Tektronix offers a Line-Impedance Stabilization Network (LISN). It is inserted between the AC power source and the EUT. Outputs on the LISN couple the EMI emitted by the EUT to the spectrum analyzer's input.

Our complete line of ancillary devices is listed in the table below.

EMC ANCILLARY DEVICES

- Active Loop Antenna
- Adjustable-length Dipole
- Biconical Antenna
- Log-periodic Antenna
- RF Near-field Probe Set
- LISN
- Transient Limiter
- 10m Low-loss Coaxial Cable
- Adjustable Tripod

Antennas, transducers, and other devices for EMI testing.

EMC ANCILLARY DEVICE SELECTION GUIDE/ORDERING INFORMATION

Device	Frequency Range	Application Information	Order No.	Price
Loop Antenna	9 kHz to 30 MHz	Radiated H-field (magnetic) emissions. Active loop provides gain and low-frequency sensitivity.	119-4144-00	**$2,620**
Adjustable-length Dipole	28 MHz to 1 GHz	Radiated E-field emissions/CATV leakage. Ideal for EMI testing and site attenuation measurements. Includes four baluns.	119-4145-00	**$2,830**
Biconical Antenna	30 MHz to 300 MHz	Radiated E-field emissions. Broadband frequency capability eliminates need for band switching, element extension, or external tuning.	119-4148-00	**$1,360**
Log-periodic Antenna	200 MHz to 1 GHz	Radiated E-field (electric) emissions. Linearly polarized design permits separate measurement of horizontal and vertical fields. Broadband frequency.	119-4142-00	**$1,630**
RF Probe Set	9 kHz to 1.8 GHz	Locate RF "Hot Spots." Useful in diagnostic testing phase in EMI compliance investigation. Includes five probes plus extension.	119-4146-00	**$550**
LISN	10 kHz to 100 MHz	Facilitates measurement of conducted emissions on power line from equipment under test. Filters undesired signals imported on mains supply.	119-4147-00	**$2,395**
Transient Limiter	9 kHz to 100 MHz	Use with LISN to prevent inadvertent damage to spectrum analyzer input.	011-0164-00	**$475**
10 m Coaxial Cable	NA	Couple antenna to spectrum analyzer (male fittings).	012-1291-00	**$150**
Adjustable Tripod	NA	Mounting for all above antennas. Wooden frame reduces field disturbance.	016-1102-00	**$295**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

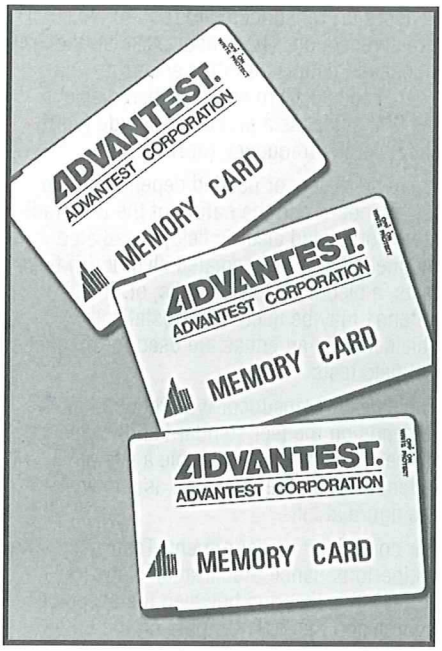
PR326150
PR326160
PR326170

EMI/RFI Solutions
Memory Cards for R3261/R3265/R3271

EMI/RFI Applications on Memory Cards.

PR326150/60/70

- Allows Quick and Easy System Set-up for Specific Measurements
- Simplified Operation
- Real-time Display of Corrected Data Such As Antenna Factors and Cable Loss



Memory cards provide automated EMI measurements.

PR326150, PR326160, PR326170 Memory Cards

The PR3261/50/60/70 memory cards allow easy system setup and operation for EMI measurements with R3261/R3265/R3271. The system design is based upon a concept of an EMC automatic measurement system aided by personal computers. However, with these memory cards, a controller is not required since all operations take place within the instrument itself as controlled by the program on the memory cards.

The memory cards can store measurement sequences, receiver setting requirements, standard values, measurement band, correction coefficients, and measured data. The display on the test instrument monitors corrected data such as antenna factors and cable loss on a real-time basis.

Measurement procedures are included in the preliminary measurement menu. A maximum noise at up to 50 points can be searched for at high speed with the aid of the peak search function of the spectrum analyzer. When the preliminary measurement is completed, final measurements can be easily performed. The display shows the preliminary and final measurement results superimposed for easy comparison.

Measurement capabilities provided include:

- PR326150 Field-Strength Measurement Card: Provides automated radiated emissions measurements in accordance with all relevant commercial EMI standards
- PR326160 Voltage Measurement Card: Provides automated line conducted emissions measurement in accordance with all relevant commercial EMI standards
- PR326170 Interfacing Power Measurements Card: Provides automated power measurement in accordance with all relevant commercial EMI standards

APPLICATIONS

- **EMC Measurements**
- **Field-Strength Measurement**
- **Voltage Measurement**
- **Interfacing Power Measurement**
- **Automated Power Measurement**

ORDERING INFORMATION

PR326150
Field-strength Measurement Card *1

PR326160
Voltage Measurement Card *1

PR326170
Interfacing Power Measurements Card *1

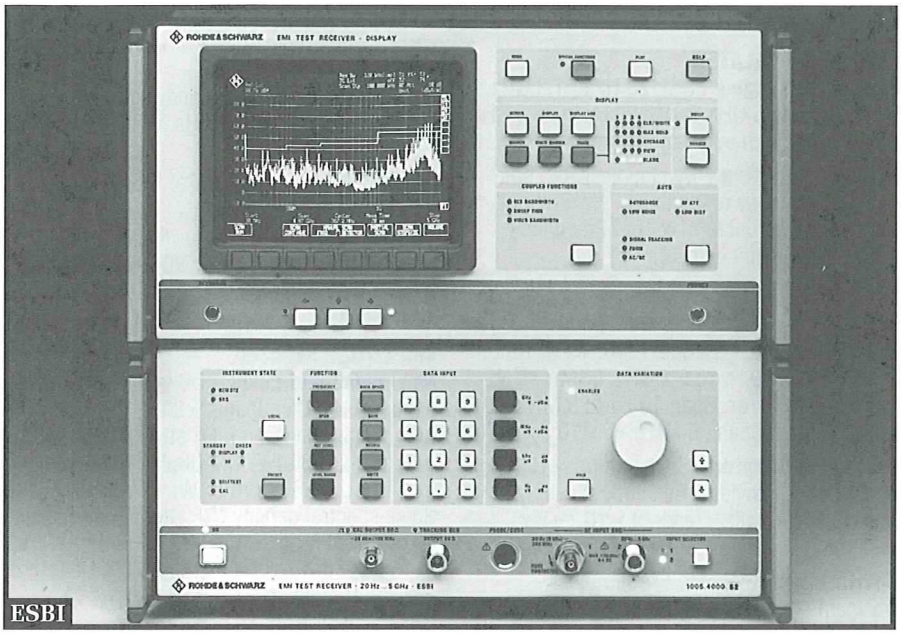
*1 *Contact you Tektronix representative for price information.*

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

EMI, Field Strength



ESBI

Introduction

The ESAI, ESBI, ESMI EMI Test Receivers combine world-class EMI specifications with the performance of high-speed spectrum analyzers. Integral measurement and analysis functions simplify and speed up measurements to the relevant commercial and military standards.

LARGE DYNAMIC RANGE AND HIGH SENSITIVITY

The ESAI, ESBI, ESMI EMI Test Receivers feature a large dynamic range and high sensitivity. Moreover, the test receiver settings completely conform to CISPR requirements, i.e., the dynamic range is large enough to allow correct weighting of single pulses.

Refined preselection filtering provides the required large dynamic range for wideband signals. A low-noise preamplifier, which can be switched after the preselector, is used to increase sensitivity. To measure high-energy pulses, a second input is provided which can handle pulses in the frequency range from 20 Hz to 200 MHz. An automatic overload detector checks sensitive points in the signal path.

SIGNAL ANALYSIS

These EMI receivers have a variety of maximum, minimum, average, RMS, and quasi-peak detectors for simultaneous signal analysis. Built-in AM/FM demodulators allow audio monitoring of interference signals.

A pulse calibration source for checking the CISPR weighting curves is provided in addition to the built-in sine calibration source. This ensures extremely high measurement accuracy. A tracking generator for EMC measurements covering the entire range of the receiver is also provided.

OVERVIEW MODE SPEEDS ANALYSIS

In the OVERVIEW mode, the whole interference spectrum is displayed on the screen of the test receivers. The IF resolution bandwidths can be adjusted to CISPR standards; the IF selectivity also has a quasi-analog setting mode to optimize the sweep time. The interference spectrum can be displayed on the screen using a linear or logarithmic frequency scale. A maximum of eight different limit lines can be displayed on the screen. Out-of-limit values are automatically detected and displayed.

ESAI/ESBI/ESMI

- 20 Hz to 1.8 GHz Frequency Range (ESAI)
- 20 Hz to 5 GHz Frequency Range (ESBI)
- 20 Hz to 26.5 GHz Frequency Range (ESMI)
- RF Level Switchable from 0 to 120 dB in 2-dB Steps (ESMI, 0 to 75 dB in 5-dB steps)
- Preselector with Eleven Filters with Fixed Tuning and Four Tracking Filters (ESAI, Ten Filters)
- Low-noise Preamplifier with Wide Dynamic Range Fitted Between Preselector and First Mixer
- Five Parallel Detectors for Peak, Quasi-peak, Average, and RMS Weighting
- Overload Detectors at the Mixers and in the RF and IF Signal Paths to Avoid Incorrect Measurements and to Ensure Optimum Setting in the Autorange Mode

Compliance EMI test receiver and general purpose spectrum analyzer all in one.

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

APPLICATIONS

Conforms to following industrial and military standards:

- **CISPR**
- **VDE**
- **FCC**
- **EN**
- **VCCI**
- **MIL-STD**
- **DEF-STAN**
- **BS**
- **DO 160**
- **GAM EG 13**

ESAI
ESBI
ESMI

EMI/RFI Solutions

FAST, FLEXIBLE SCAN

In the SCAN mode, the ESAI, ESBI, ESMI function in a way that is comparable to a conventional test receiver. In addition to measurements at the selected frequency, automatic scans between a start and a stop frequency at an adjustable step size are possible. Manual adjustments, which can be made while the scan is in progress, and repeat measurements over selectable subranges reduce the time required for complete EMI measurements.

To conform with relevant standards, measurements have to be made over various frequency ranges and bandwidths. For this purpose, the user can define a variety of frequency ranges in a configuration table. Measurements are then made over these subranges using the selected bandwidth measurement, time, step size, etc.

SPLIT-SCREEN DISPLAY

The results are displayed in two windows obtained by splitting the screen display horizontally. Different traces, and thus the results from different detectors, can be displayed in the upper and lower windows. This is ideal for showing narrowband and broadband signals simultaneously.

AUTOMATIC TRANSDUCER COMPENSATION

The test results are always displayed with correct units (dBµV, dBµV/m, dBµA, etc.). Correction factors for the transducers designed specifically for the ESAI, ESBI, ESMI are entered into a transducer table and used to automatically compensate for the frequency dependence of the transducer factor. A maximum of four correction-factor tables are available and can be used independently or combined.

DOCUMENT TEST RESULTS TO PRINTERS AND PLOTTERS

Test results can be output to a wide range of printers and plotters to provide clear documentation of measurement results. The ESAI, ESBI, and ESMI support monochrome and color hardcopy devices including laser printers and plotters.

Characteristics

FREQUENCY RELATED

Frequency Range – ESAI: 20 Hz to 1.8 GHz. ESBI: 20 Hz to 5 GHz. ESMI: 20 Hz to 26.5 GHz (to 110 GHz with external mixers).

Frequency Setting – By step keys and spinwheel. Frequency resolution: 1 Hz. Error of frequency reference: <1 x 10^{-7}. Frequency scale: Selectable LIN/LOG.

Frequency Display – Error (span >5 MHz, sweep time <100 ms): <8 x 10^{-3} x span.

Frequency Span – Range: ESAI: 10 Hz to 2 GHz. ESBI: 10 Hz to 5.2 GHz. ESMI: 10 Hz to 26.5 GHz. Error: Span 10 Hz to 5 MHz: <2 x 10^{-3} x span. Span >5 MHz: <5 x 10^{-3} x span.

Frequency Counter – Scan setting: <1000 x resolution bandwidth. Resolution: 0.1 Hz to 10 kHz. Error limit: <readout x 10^{-7} ±2 x resolution.

Spurious with Discrete Frequencies – n x mains frequency: >70 dBc. m x line frequency (26.4 kHz): >80 dBc. 100 kHz (span ≤5 MHz): >90 dBc. –10.7 MHz: >90 dBc. Other for Δf >1 MHz: >75 dBc.

Internal Spurious Response (input terminated with 50 Ω) – f >1 MHz: <–110 dBm (<–3 dBµV). ESBI, ESMI only: f <1 MHz, f >4.7 GHz, f = 1.585 GHz: <–95 dBm (<12 dBµV). Oscillator feedthrough: –25 dBm typical.

FILTERS

RF Preselector – Selectable filters (except YIG filter in ESMI), automatically switched.

	Passband frequencies from / to		Filter Type
Filter 1	DC	9 kHz	LP, fixed
Filter 2	9 kHz	150 kHz	BP, fixed
Filter 3	150 kHz	2 MHz	BP, fixed
Filter 4	2 MHz	10 MHz	BP, fixed
Filer 5	10 MHz	30 MHz	BP, fixed
Filter 6	30 MHz	50 MHz	BP, fixed
Filter 7	50 MHz	80 MHz	BP, fixed
Filter 8	80 MHz	110 MHz	BP, fixed
Filter 9	110 MHz	140 MHz	BP, fixed
Filter 10	140 MHz	260 MHz	BP, tuned
Filter 11	260 MHz	450 MHz	BP, tuned
Filter 12	450 MHz	700 MHz	BP, tuned
Filter 13	700 MHz	1 GHz	BP, tuned
Filter 14 (ESAI)	1 GHz	2 GHz	BP, fixed
Filter 14 (ESBI, ESMI)	1 GHz	1.9 GHz	BP, fixed
Filter15 (ESBI)	1.9 GHz	5.2 GHz	BP, fixed
Filter15 (ESMI)	1.9 GHz	5.0 GHz	BP, fixed
Filter16 (ESMI)	4.9 GHz	26.5 GHz	YIG filter

NOTE: The 6-dB bandwidth of the tunable bandpass filters is typically <85 MHz, that of the YIG filter increases from typically 50 MHz at 5 GHz to typically 100 MHz at 26.5 GHz.

IF Filters – Overview mode (3 dB bandwidths): <10 Hz (6 Hz typical) to 3 MHz in 5% steps (except 30 to 80 kHz).
EMI receiver mode (6 dB bandwidths): 10 Hz*[1], 100 Hz, 200 Hz, 1 kHz, 9 kHz, 10 kHz, 100 kHz, 120 kHz, and 1 MHz.
Bandwidth factor: –60 dB/–3 dB: <12.
–80 dB/–3 dB: <20.

*[1] *Ambient temperature 15 to 35°C.*

Video Filters (1st – order RC lowpass after IF rectifier) – Bandwidths (–3 dB): 1 Hz to 3 MHz in 1, 3, 10 steps.

AMPLITUDE RELATED

Maximum Input Level – DC voltage: DC coupling: <0 V. AC coupling: <20 V.
AC voltage (sinewave): RF attenuation 0 dB: <20 dBm (100 mW; 127 dBµV). RF attenuation ≥10 dB: <30 dBm (1 W; 137 dBµV).
Pulse spectral density (RF attenuation 0 dB): RF preselector on: f <150 kHz: <130 dBµV/MHz. f =150 kHz to 1 GHz: <90 dBµV/MHz. f ≥1 GHz: <61 dBµV/MHz.
RF preselector off: <61 dBµV/MHz.
Maximum pulse voltage (RF attenuation ≥10 dB): Input 1: <150 V. Input 2: <50 V.
Maximum pulse energy (τ = 10 µs, RF attenuation ≥10 dB): Input 1: ESAI, ESBI: <1 mWs (=100 W for 10 µs). ESMI: <10 mWs (=1 kW for 1- µs). Input 2: <1 mWs (=100 W for 10 µs).

Level Compression – Pulse spectral density at 1-dB compression (RF attenuation 0 dB, RF preselector on, RF preamplifier off).

	1-dB Compression for	
Frequency	ESAI	ESBI, ESMI
f <150 kHz	>102 dB µV/MHz	>110 dB µV/MHz
150 kHz to 5 MHz	>83 dB µV/MHz	>86 dB µV/MHz
5 MHz to 30 MHz	>77 dB µV/MHz	>80 dB µV/MHz
30 MHz to 300 MHz	>72 dB µV/MHz	>76 dB µV/MHz
300 MHz to 1 GHz	>72 dB µV/MHz	>75 dB µV/MHz
>1 GHz	>50 dB µV/MHz	>50 dB µV/MHz

Maximum Inherent Noise Indication in CISPR Bands – See Table 1.
RF preamplifier off, RF attenuation 0 dB, discrete spuria excluded.

Inherent Noise Indication – All units, maximum sensitivity setting in the frequency range 20 to 200 Hz (bandwidth 10 Hz, video bandwidth 1 Hz, preamplifier off): 45 dBµV.

SPECTRAL SENSITIVITY
Resolution Bandwidth 1 MHz, f >30 MHz, Peak-value Indication –

Unit	Preamplifier 0 dB	Preamplifier 10 dB
ESAI/ESBI	30 dBµV/MHz	<21 dBµV/MHz
ESMI (<18 GHz)	32 dBµV/MHz	<23 dBµV/MHz

Level Measurement Error After Internal Calibration (sum of error in indication range and in temperature range 15 to 35°C) –
ESAI (f = 9 kHz to 1 GHz): <1.5 dB.
ESBI (f = 9 kHz to 1 GHz): <1.5 dB; up to 5 GHz, 3 dB maximum typical.
ESMI (f = 9 kHz to 1 GHz): <1.5 dB; up to 26.5 GHz, 4 dB maximum typical.

SWEEP RELATED
Sweep Time – See Table 2.

Trigger Modes – Free run, line, video, external.

SCALAR NETWORK ANALYSIS
Tracking-generator Frequencies and Levels – See Table 3.

IF and Image Frequency Rejection –
IF rejection: >100 dB (>110 dB typical).
Applies to all IF frequencies used except:
ESAI, 221.4 MHz: >75 dB (90 dB typical).
ESMI, 221.4 MHz: >90 dB (110 dB typical).
Image frequency: ESAI, f + 4.4428 GHz: >90 dB (100 dB typical).
ESBI/ESMI, f + 10.8428 GHz: >80 dB (90 dB typical).
ESAI/ESBI, f + 442.8 MHz: >100 dB (115 dB typical).
ESMI, f + 442.8 MHz: >85 dB (100 dB typical).
All units, f + 42.8 MHz: >100 dB (115 dB typical).
All units, f + 8.388 MHz: >100 dB (115 dB typical).

Measurement Ranges for Gain and Attenuation –

Unit	Gain	Attenuation	Frequency Offset
ESAI	130 dB	120 dB	Not provided
ESBI	110 dB	110 dB	0 to ±1 GHz
ESMI (to 5 GHz)	105 dB	110 dB	0 to ±1 GHz
ESMI with Opt. B1 5 GHz to 18 GHz	105 dB	105 dB	Not provided
18 GHz to 26.5 GHz	105 dB	100 dB	Not provided

Demodulation – AM and FM.
Evaluation (modulation analysis): Measurement of modulation depth and frequency deviation.
Auto-monitoring: Built-in loudspeaker and headphones output.

DISPLAY RELATED
Monitor – 9-inch color CRT.

Resolution – 1024 x 512 points.

Display Mode – Full display height or 2 x 1/2 display height (split screen).

Number of Display Memories – 4.

Output to Plotter – HP-GL, pinwriter (24-Pin) laser printer.

Plotter Functions – Curve arithmetic (swap, subtract), comparison with tolerance curves, averaging, peak hold.

INPUTS AND OUTPUTS
Front Panel of RF Unit –
Input 1: Connector: BNC female, 50 Ω.
DC coupling: 20 Hz to 200 MHz.
AC coupling: 9 kHz to 200 MHz.
VSWR: RF attenuation 0 dB: <2.0. RF attenuation ≥10 dB: <1.2.
Protection: Fuse, surge arrester.
Input 2 (DC coupling only): Connector:
ESAI, ESBI: N female, 50 Ω.
ESMI: 3.5 mm SMA female.
VSWR:

Unit	RF atten. 0 dB	RF atten. ≥10 dB	RF atten. RF ≥20 dB
ESAI			
f <1 GHz	<2.0	<1.2	–
f = 1 to 1.8 GHz	<3.0.	<1.5	–
ESBI			
f <1 GHz	<2.0	<1.2	–
f = 1 to 2.7 GHz	<3.0	<1.5	–
f = 2.7 to 4.8 GHz	<3.0	<1.8	–
ESMI			
f <1 GHz	<2.0	<1.2	–
f = 1 to 2.7 GHz	<3.0	<1.5	–
f = 2.7 to 4.8 GHz	<3.0	<1.8	–
f = 4.8 to 26.5 GHz	<3.0 (typical)	–	<2

TABLE 1

Frequency Range	CISPR Band/ Bandwidth	Unit	Indication (in dBµV) Average	Quasi-peak	Peak
9 kHz to 150 kHz	A / 200 Hz	ESAI	–17	–15	–6
		ESBI, ESMI	–7	–5	+4
150 kHz to 5 MHz	B / 9 kHz	ESAI	–3	0	+8
		ESBI, ESMI	0	+3	+11
5 MHz to 30 MHz	B / 9 kHz	ESAI	–13	–10	–2
		ESBI, ESMI	–5	–2	+6
30 MHz to 300 MHz	C / 120 kHz	ESAI	0	+4	+11
		ESBI, ESMI	+5	+9	+16
300 MHz to 1 GHz	D / 120 kHz	ESAI	+5	+9	+16
		ESBI, ESMI	+8	+12	+19

NOTE: In the frequency range from 20 Hz to 1 MHz, figures for the noise indication are valid in the temperature range 15 to 35°C. Outside this temperature range, the specified values may vary by 10 dB maximum. The guaranteed sensitivity value in the CISPR bands is improved by 9 dB with the preamplifier on.

TABLE 2

Sweep Time	Span >0 Hz Step Size	Error	Span = 0 Hz (sampling rate: 1/8.9 µs) Step Size	Error
0.2 ms to 10 ms	–	–	1, 2, 4, 8, 10	<2%
20 ms to 2 s	20 ms	10^{-3}	20 ms	10^{-3}
2 s to 20 s	200 ms	10^{-3}	200 ms	10^{-3}
20 s to 1980 s	2 s	10^{-3}	2 s	10^{-3}

TABLE 3

Unit	Output Frequency Min	Max	Output Level Min	Max	Steps
ESAI	100 Hz	1.8 GHz	7 dBµV	102 dBµV	0.1 dB
ESBI	100 Hz	5 GHz	26 dBµV	107 dBµV	0.1 dB
ESMI	100 Hz	5 GHz	32 dBµV	107 dBµV	5 dB
ESMI with Opt. B1	100 Hz	26.5 GHz	32 dBµV	107 dB	5 dB

ESAI
ESBI
ESMI

EMI/RFI Solutions

Selectable preamplifier: ESAI: 100 Hz to 1.8 GHz, 10 dB and 20 dB.
ESBI: 100 Hz to 5 GHz, 10 dB.
ESMI: 100 Hz to 26.5 GHz, 10 dB.
Input divider: ESAI, ESBI: 0 to 120 dB in steps of 2 dB.
ESMI: 0 to 75 dB in steps of 5 dB.
Calibration output: Connector: BNC female, 50 Ω.
Signal: Unpulsed: 100 MHz, 87 dBµV.
Pulsed,: Pulse area to CISPR 16-1, pulse repetition frequency, 1 Hz to 1 kHz.
Coding and supply connector: Connector: 12-contact Tuchel female. Supply voltage: +10 V, –10 V, 100 mA maximum each.

Front Panel of Display Unit – PHONES: Connector: JK34 jack. Frequency range: 100 Hz to 15 kHz. EMF (V p-p maximum): 10 V. Output impedance: 30 Ω.
KEYBOARD: Connector: JK34 jack.

Rear Panel of RF Unit – IF OUTPUT 21.4 MHz: Connector: BNC female, 50 Ω. VSWR: ≤2. Gain (referenced to level at input mixer = reference level – RF attenuation) ≤–20 dBm (87 dBµV): +8 dB ±2 dB. >–20 dBm (87 dBµV): 0 dB ±2 dB. Bandwidth (–6 dB): >10 MHz.
10-MHz Reference:Connector: BNC female. Output level with internal reference (Z_{in} = 50 Ω): +10 dBm +3/–1 dB. Input level with external reference (Z_L >500 Ω): 0 to 5 V.
EXT ALC: Connector: BNC female. Input voltage: 0 to –1 V.
SWEEP OUTPUT: Connector: BNC female. Output voltage (Z_L >500 Ω): 0 to +5 V.
START-SWEEP-STOP: Connector: BNC female. Output: TTL pulse (t = 1.4 µs) occurring upon sweep start or stop.

Rear Panel Display Unit –
IF OUTPUT (narrow), 21.4 MHz: Connector: BNC female, 50 Ω. VSWR: <2. Level with reference level: –15 dBm ±3 dB.
EXT SWEEP TRIG: Connector: BNC female.
VIDEO OUTPUT: Connector: BNC female.
EXTERNAL MONITOR: Connector: BNC female. Outputs: RED, GREEN, BLUE, COMP VIDEO; V SYNC; H SYNC. Line frequency: 29.5 kHz. Sync pulse: 2 µs.
EXT FLOPPY: Connector: 37-contact Cannon D female.
RS-232-C: Connector: 25-contact Cannon D female.
PARALLEL INTERFACE: (Centronics) Connector: 36-contact Amphenol female.
USER PORT: Connector: 25-contact Cannon D female.
PHONES: Connector: JK34 jack. Frequency range (–3 dB): 100 Hz to 15 kHz. EMF: 10 V p-p. Source impedance: 30 Ω.
IEC 625 bus (IEEE 488): Connector: 24-contact Amphenol female. Bus functions: AH1, SH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C1 to C4, C11.

POWER REQUIREMENTS

Line Voltage – 100, 120, 220, 240 ±10%.

Line Frequency – 45 to 66 Hz.

Power Consumption – 500 VA.

ENVIRONMENTAL CHARACTERISTICS

Temperature – Operating: 0 to +55°C. Storage: –40 to +70°C. Relative humidity: 20 to 90% (without condensation).

EMC – To EN 50081-1 and EN 50082-1 (EEC Directive): FCC DOC 20780: Part 15, Subpart 5.

Warmup Period – Operating temperature attained after one hour after cold start at T_{amb} = 0 to 55°C.

PHYSICAL CHARACTERISTICS

	ESAI, ESBI		ESMI	
Dimensions	**mm**	**in.**	**mm**	**in.**
Width	435	17.1	435	17.1
Height	413	16.3	457	18.0
Depth	590	23.2	590	23.2
Weight	**kg**	**lb.**	**kg**	**lb.**
Net	64	141.1	68	150

ORDERING INFORMATION

ESAI
EMI Test Receiver (20 Hz to 1.8 GHz) **$63,700**
Includes: Power Cord, Manual.

ESBI
EMI Test Receiver (20 Hz to 5 GHz) **$69,900**
Includes: Power Cord, Manual.

ESMI
EMI Test Receiver (20 Hz to 26.5 GHz) **$98,800**
Includes: Power Cord, Manual.

Opt. 01– Fast A/D Converter *1

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection ..... **+$2,130**

RECOMMENDED ACCESSORIES
Tracking Generator – To 26.5 MHz *1
Service Kit – Order FS-Z1 ..... **$2,530**
Connecting Cable Kit (for servicing, 1 m) – Order FS-Z2 ..... **$995**
ES-K1 Software – EMC Compliance Test Software. See page 255 for details **$2,850**

Adapters –
N-male to BNC-female Adapter. Order 103-0045-00 ..... **$23**
N-female to BNC-male Adapter. Order 103-0058-00 ..... **$19.75**
3.5 mm Male to Male Adapter. Order 015-0551-00 ..... **$400**
3.5 mm Female to Female Adapter. Order 015-0550-01 ..... **$400**

ADDITIONAL ACCESSORIES
See page 446 for complete selection information.

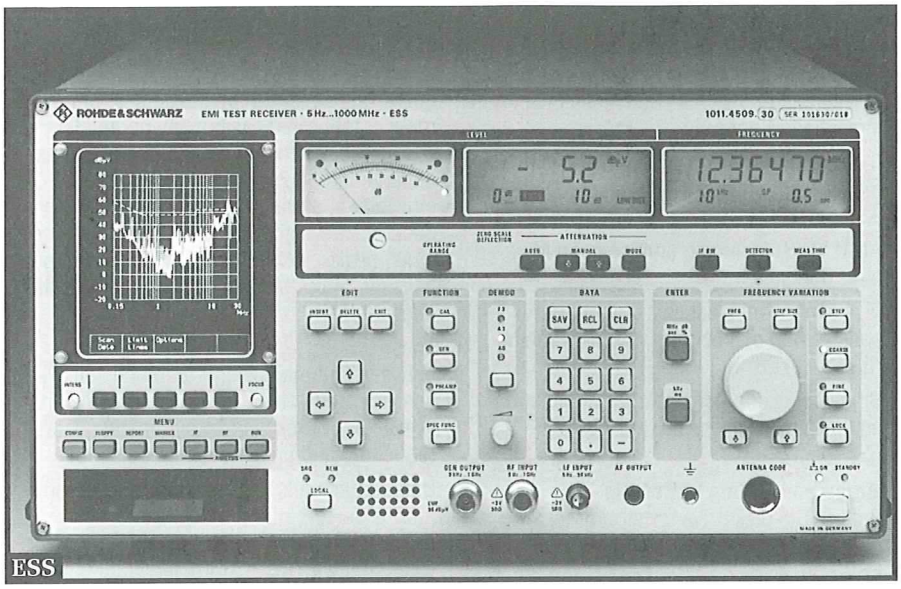
*1 *Contact your Tektronix representative for price information.*

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

EMI/RFI Solutions



ESS

Introduction

The number of measurements required to ensure electromagnetic compatibility is continuously increasing. Thanks to the built-in intelligence of the ESHS/ESVS/ESS EMI Test Receivers, the time required for such measurements is reduced considerably. These test receivers are specialized for measurements to the applicable CISPR, CEN/ELEC, ETSI, FCC, VCCI, and VDE standards. In addition, the ESS provides measurements to the relevant military standards as well – MIL, VG, DEF, and STAN.

The ESHS/ESVS/ESS feature high frequency resolution and accurate level indication in peak average and quasi-peak detection (ESS provides RMS also). The real strength, however, is the automatic measurement of RFI voltage, current, power, and field strength. After a fast pre-scan measurement, it compares the results with prescribed limits, displays the interference spectrum with the limits on the screen, and furnishes a comprehensive test report with all the necessary information. The time-consuming quasi-peak measurement is only carried out in cases where the peak value is close to the relevant limit.

EMI TEST RECEIVER FEATURES

The ESHS 10, ESHS 30, ESVS 10, ESVS 30, and ESS share the same basic design and performance characteristics. The various models provide differing features which provide full EMI measurement performance from 5 Hz to 1 GHz. All models feature an excellent price/performance ratio, compact design, high measurement speed, and great operating convenience. Following are the primary features; features are shared by all instruments unless noted otherwise:

RF Section –

- High pulse loading capacity of calibrated attenuator
- Comprehensive preselection filters
- Switchable preamplifier with wide dynamic range
- Crystal-stabilized, fast synthesizer with high resolution and sweep
- High-level mixer with high oscillator rejection
- IF filters with low delay distortion
- Complies with CISPR 16, VDE 0876, and ANSI c63.2
- Measurements to European Standards 55 011 to 55 022, ETS, FCC, VCCI, and VDE 0871 to 0879

ESHS

- Frequency Range 9 kHz to 30 MHz
- Operation from AC Supply or Internal/External Battery

ESVS

- Frequency Range 20 MHz to 1 GHz
- Operation from AC Supply or Internal/External Battery

ESS

- Frequency Range 5 Hz to 1 GHz
- Resolution Bandwidths from 2 Hz to 1 MHz
- Operation from AC Supply or External Battery
- Measurements to Military Standards MIL-STD-461, DEF STAN 59-41, GAM-EG 13, and VG 95370 and 95673

The most advanced conventional EMI test receivers available.

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

APPLICATIONS

- **EMI Measurements to All Relevant Commercial and MIL-STD Specifications**
- **Field-strength Measurements Using Test Antennas**

ESHS
ESVS
ESS

EMI/RFI Solutions

Demodulation –
- Parallel detectors for average, peak, and quasi-peak indication (ESS also provides RMS indication)
- 60 dB operating ranges for quasi-peak and average value indication
- Highly linear envelope detector
- AM and AO demodulators (ESVS and ESS also provide FM demodulation)
- Logarithmic amplifier with more than 70 dB dynamic range
- Automatic overload detection in the mixer stages and in the test channel by permanently activated peak detectors

Powerful Processor System –
- Macros for automatic and semi-automatic test runs
- 12-Bit A/D converter with short conversion time
- Measurement time selectable between 1 ms and 100 s
- High measurement accuracy as a result of automatic total calibration
- Automatic monitoring of all synthesizer loops and supply voltages during operation
- Nonvolatile storage of 10 complete instrument setups and 22 different transducer factors and limit lines

Optimal Display of Results for Every Application –
- Measurement of voltage, field strength, current, and pulse spectral density with full indication of units
- Indication of level on analog meter and digital readout with 0.1-dB resolution
- Display of interference spectra (RF ANALYSIS) including limit lines on low-emission screen
- IF analysis for visual check of interference spectrum in manual measurement mode (ESHS 30, ESVS 30, ESS)
- Built-in tracking generator for attenuation and gain measurements (ESHS 30, ESVS 30, ESS)

Storage and Listing of Results –
- Built-in 3.5 disk drive for storing test results and instrument settings (ESHS 30, ESVS 30, ESS)
- Output of results as lists and diagrams on printer or plotter including limit lines and user-definable labeling

SIMPLE OPERATION

A combination of hardkeys and softkeys ensures simple operation and fast access to the menu functions. All models have the classic test receiver controls on the right of the front panel for manual settings. The left section of the front panel is used to edit data for automatic test runs, tables for limit values and transducer factors (for example, for current and voltage probes and antennas), as well as special functions and the information required for test reports.

OPTIMIZED TEST RUNS

EMI measurements have differing degrees of complexity. The simplest case is measurement of the EMI spectrum on a data line. In the most complicated case, many parameters have to be varied and additional conditions observed to find the maximum spurious emission and then weight it correctly with quasi-peak weighting. The time-consuming quasi-peak measurement is only carried out in cases where the peak value is close to the relevant limit.

These EMI test receivers offer a choice between automatic, semi-automatic, and user-controlled test runs. Scan options are available for prescan measurements, data reduction, and final measurements.

Data reduction is the main criterion for optimizing the test run. It's the link between prescan interface measurement and correct weighting with test-parameter variation (final measurement) to reduce measurement time. Scan options are also available to take account of the test configuration, for instance measuring RFI voltage with LISNs, RFI power with an absorbing clamp, and RFI and field strength with antennas.

CHARACTERISTICS

	ESHS	ESVS	ESS
Frequency Related			
Frequency Range	9 kHz to 30 MHz	20 MHz to 1 GHz	5 Hz to 1 GHz, subdivided into following ranges:
Range I	–	–	5 Hz to 50 kHz (tunable down to 1 Hz)
Range II	–	–	9 kHz to 30 MHz
Range III	–	–	20 to 1 GHz (automatic range selection, depending upon IF bandwidth and RF input (balanced/unbalanced))
Frequency Setting			
With tuning knob	In 10 Hz, 10 kHz, or any step size (switch selectable)	In 100 Hz, 100 kHz steps or any step size selectable	Fine or coarse increments or freely selectable step size:
Range I	–	–	Fine, 0.1 Hz; Coarse, 100 Hz
Range II	–	–	Fine, 10 Hz; Coarse, 10 kHz
Range III	–	–	Fine, 100 Hz; Coarse, 100 kHz
Numerical	Via keyboard entry	Via keyboard entry	Via keyboard entry
In steps	Any selectable size	Any selectable size	Any selectable size
Automatic scanning	For RF analysis	For RF analysis	For RF analysis

	ESHS	ESVS	ESS
Frequency Related (Continued)			
Frequency Display	7-digit LCD	8-digit LCD	8-digit LCD
Resolution	10 Hz	100 Hz	–
Range I	–	–	0.1 Hz
Range II	–	–	10 Hz
Range III	–	–	100 Hz
Setting Error	$<3 \times 10^{-6} + 30$ Hz	$<3 \times 10^{-6}$	$<3 \times 10^{-6}$
RF Input			
Connector	N connector, female	N connector, female	–
5 Hz to 1 GHz, unbalanced	–	–	N connector, female
5 Hz to 50 kHz, balanced	–	–	Twinax connector, female
Impedance	50 Ω	50 Ω	50 Ω
VSWR			
≥10 dB RF attenuation	<1.2	<1.2	<1.2
0 dB RF attenuation	<2	<2	<2
Oscillator Reradiation at RF Input (0 dB RF attenuation)			
Without preamplifier	<20 dBµV	<20 dBµV	<20 dBµV
With preamplifier	<10 dBµV	<10 dBµV	<10 dBµV
Preamplifier	Switchable between input filter and 1st mixer	Switchable between preselector and 1st mixer	Switchable between preselector and 1st mixer
Gain	10 dB	10 dB	10 dB
Preselector	5 bandpass filters: 9 kHz to <150 kHz 150 kHz to <4.05 MHz 4.05 MHz to <12.8 MHz 12.8 MHz to <21.55 MHz 21.55 MHz to 30 MHz	1 fixed-tuned filter: 20 to <51.3 MHz 5 tracking filters: 51.3 to <125.3 MHz 125.3 to <273.3 MHz 273.3 to <495.3 MHz 495.3 to <717.3 MHz 717.3 to 1 GHz	–
Range I	–	–	1 fixed bandpass filter: 5 Hz to 50 kHz
Range II	–	–	5 fixed bandpass filters: 9 kHz to <150 kHz 150 kHz to <4.05 MHz 4.05 MHz to <12.8 MHz 12.8 MHz to <21.55 MHz 21.55 MHz to 30 MHz
Range III	–	–	1 fixed bandpass filter: 20 MHz to <51.3 MHz 5 tracking bandpass filters: 51.3 MHz to <125.3 MHz 125.3 MHz to <273.3 MHz 273.3 MHz to <495.3 MHz 495.3 MHz to <717.3 MHz 717.3 MHz to 1 GHz
Maximum Input Level (with and without preamplifier)			
RF attenuation 0 dB (AC-coupled)			
DC voltage	7 V	50 V	7 V
Sinewave AC voltage	130 dBµV	130 dBµV	130 dBµV
Pulse spectral density	96 dBµV/MHz	97 dBµV/MHz (100 V for 0.5 ns)	97 dBµV/MHz
RF attenuation ≥10 dB (DC-coupled)			
DC voltage	7 V (=1 W)	50 V	–
Sinewave AC voltage	137 dBµV	137 dBµV (corresponds to 1 W)	–
Maximum pulse voltage (10 µs)	700 V	150 V	–
Maximum pulse energy	100 mWs (10 µs)	10 mWs (20 µs)	–

ESHS
ESVS
ESS

EMI/RFI Solutions

RF Input (continued)	ESHS	ESVS	ESS
Maximum Input Level (Continued)			
Range I and II			
DC voltage	–	–	7 V (corresponds to 1 W)
Sinewave AC voltage	–	–	137 dBµV
Maximum pulse voltage	–	–	700 V
Maximum pulse energy (10 µs)	–	–	100 mWs
Range III			
DC voltage	–	–	7 V (corresponds to 1 W)
Sinewave AC voltage	–	–	137 dBµV
Maximum pulse voltage	–	–	1500 V
Maximum pulse energy (10 µs)	–	–	100 mWs
Interference Rejection, Non-linearities			
Image frequency rejection			
1st IF	>90 dB, 100 dB typical	>90 dB, 100 dB typical	>90 dB, 100 dB typical
2nd IF	>75 dB	>90 dB, 100 dB typical	
IF rejection	>90 dB, 100 dB typical	>90 dB, 100 dB typical	>90 dB, 100 dB typical

IF Bandwidths	Nominal Bandwidth	–3 dB (±20%)	–6 dB	Shape Factor $BW_{6dB}/BW_{50\ dB}$ (Selectable in Range)
ESHS	200 Hz*1	140 Hz	200 Hz +20/–30 Hz	1:8 typical
	10 Hz*2	7 kHz	9.5 kHz ±0.5 kHz	1:3.5 typical
ESVS	10 kHz	7 kHz	9.5 kHz ±0.5 kHz	1:4 typical
	120 kHz	90 kHz	120 kHz ±10%	1:5.5 typical
ESS	2 Hz	1.4 Hz	2 Hz	1:2.5 (I)
	5 Hz	3.5 Hz	5 Hz	1:2.5 (I)
	10 Hz	7 Hz	10 Hz	1:2.5 (I)
	20 Hz	14 Hz	20 Hz	1:2.5 (I)
	50 Hz	35 Hz	50 Hz	1:2.5 (I+II)
	100 Hz	70 Hz	100 Hz	1:2.5 (I+II)
	200 Hz	140 Hz	200 Hz	1:2.5 n(I+II)
	500 Hz	350 Hz	500 Hz	1:2.5 (I+II+III)
	1 kHz	700 Hz	1 kHz	1:2.5 (I+II+III)
	10 kHz*3	7 kHz	9.5 kHz ±10.5 kHz	1:4 (II+III)
	100 kHz	70 kHz	100 kHz	1:5 (II+III)
	120 kHz	90 kHz	120 kHz	1:5 (II+III)
	1 MHz	700 kHz	1 MHz	1:5 (II+III)

**1 Meets tolerances to CISPR 16.*

**2 Meets tolerances to CISPR 16 (minimum 8 kHz, 10 kHz maximum) and complies with MIL tolerances (10 kHz ±10%).*

**3 Complies with tolerances to CISPR and MIL tolerances of 10 kHz ±10 %.*

Noise Indication	Preamplifier off	Preamplifier on
ESHS		
Average value, BW 200 Hz		
f_{in} 9 to 50 kHz	<–24 to <–30 dBµV	<–30 to <–36 dBµV
f_{in} >50 kHz	<–30 dBµV, –35 dBµV typical	<–36 dBµV, –41 dBµV typical
Average value, BW 10 kHz		
f_{in} >50 kHz	<–14 dBµV, –17 dBµV typical	<–20 dBµV, –25 dBµV typical
Peak value (typical increase against average value)	+11 dB	+11 dB
Quasi-peak		
Band A		
9 to 50 kHz	–24 to –30 dBµV typical	–30 to –36 dBµV typical
50 to 150 kHz	–32 dBµV typical	–38 dBµV typical
Band B ≥150 kHz	–13 dBµV typical	–19 dBµV typical
PK/MHz (BW 10 kHz)	34 dBµV/MHz typical	28 dBµV/MHz typical
ESVS		
Average value		
BW 10 kHz	<–12 dBµV, –15 dBµV typical	<–16 dBµV, –21 dBµV typical
BW 120 kHz	<–1 dBµV, –4 dBµV typical	<–5 dBµV, –10 dBµV typical
Peak value		
BW 10 kHz	–4 dBµV typical	–9 dBµV typical
BW 120 kHz	+7 dBµV typical	+1 dBµV typical
Quasi-peak Band C/D	+2 dBµV typical	– 4 dBµV typical
PK/MHz (spectral density measurement, BW 120 kHz)	25 dBµV/MHz typical	21 dBµV/MHz typical
ESS		
Average value, Range I		
BW 2 kHz, f_{in} = 5 to 30 Hz	<–38 to –48 dBµV typical	<–38 to –52 dBµV typical
BW 10 kHz, f_{in} = >30 Hz	<–40 dBµV, –44 dBµV typical	<–41 dBµV, –48 dBµV typical
Average value, Range II		
BW 200 kHz, f_{in} = 9 to 50 Hz	<–24 to –30 dBµV typical	<–30 to–36 dBµV typical
BW 200 kHz, f_{in} = >50 Hz	<–30 dBµV, –35 dBµV typical	<–36 dBµV, –41 dBµV typical
Average value, Range III		
BW 120 kHz	<1 dBµV, –6 dBµV typical	<–5 dBµV, –10 dBµV typical
RMS value (typical increase vs. average reading)	+1 dB	+1 dB
Peak (PK) value (increase vs. average reading)	+11 dB	+11 dB
ESS		
Quasi-peak		
Band A		
9 to 50 kHz	–27 dBµV	–30 dBµV
50 to 150 kHz	–32 dBµV	–38 dBµV
Band B	–13 dBµV	–19 dBµV
Band C/D	+2 dBµV	–4 dBµV
PK/MHz		
Range II, BW 10 kHz	34 dBµV/MHz	28 dBµV/MHz
Range III, BW 1 MHz	16 dBµV/MHz	12 dBµV/MHz

ESHS
ESVS
ESS

EMI/RFI Solutions

Voltage Measurement Range	Preamplifier off	Preamplifier on
ESHS (f >50 kHz)		
Lower limit (additional error caused by inherent noise <1 dB)		
Average indication (AV)		
BW_{IF} 10 kHz	–6 dBµV, –10 dBµV typical	<–12 dBµV, –18 dBµV typical
BW_{IF} 200 Hz	–26 dBµV, –31 dBµV typical	<–32 dBµV, –37 dBµV typical
Peak indication (PK)		
BW_{IF} 10 kHz	–10 dBµV typical	+4 dBµV typical
BW_{IF} 200 kHz	–8 dBµV typical	–14 dBµV typical
Quasi-peak indication (QP)		
CISPR band A (25 Hz pulse repetition frequency)	–30 dBµV typical	–36 dBµV typical
CISPR band B (100 Hz pulse repetition frequency)	–11 dBµV typical	–17 dBµV typical
Spectral density (PK/MHz)	50 dBµV/MHz typical	44 dBµV/MHz typical
Upper limit (AV, PK, QP)	137 dBµV (RF attenuation ≥10 dB)	137 dBµV (RF attenuation ≥10 dB)
Inherent spurious response	<–10 dBµV (equivalent input voltage)	<–10 dBµV (equivalent input voltage)
ESVS		
Lower limit (additional error caused by inherent noise <1 dB)		
Average indication (AV)		
BW 10 kHz	<–8 dBµV, –11 dBµV typical	<–12 dBµV, –17 dBµV typical
BW 120 kHz	<+3 dBµV, 0 dBµV typical	<–1 dBµV, –6 dBµV typical
Peak indication (PK)		
BW 10 kHz	+12 dBµV typical	+7 dBµV typical
BW 120 kHz	+23 dBµV typical	+17 dBµV typical
Quasi-peak indication (QP)		
CISPR band C/D (100 Hz pulse repetition frequency)	<+10 dBµV, +6 dBµV typical	<+4 dBµV, 0 dBµV typical
Upper limit (AV, PK, QP)	137 dBµV (RF attenuation ≥10 dB)	137 dBµV (RF attenuation ≥10 dB)
Inherent spurious response	<0 dBµV (equivalent input voltage)	<0 dBµV (equivalent input voltage)
ESS		
Lower limit (additional error caused by inherent noise ≤1 dB)		
Average (AV)	4 dB above noise indication	4 dB above noise indication
RMS	5 dB above noise indication	5 dB above noise indication
Peak (PK)	15 dB above noise indication	15 dB above noise indication
Quasi-peak (QP) (25/100 Hz pulse repetition frequency)	3 dB above noise indication	3 dB above noise indication
Upper limit (AV, RMS, PK, QP)	137 dBµV (RF attenuation ≥10 dB)	137 dBµV (RF attenuation ≥10 dB)
Inherent spurious response (equivalent input voltage)		
5 Hz to 30 MHz	<–10 dBµV	<–10 dBµV
30 MHz to 1 GHz	<0 dBµV	<0 dBµV

Characteristics *(continued)*

DISPLAY RELATED

Level Display –
Digital – Digits: 3 1/2. Resolution: 0.1 dB. Units: dBµV, dBµA, dBm, dBµV/m, dBµA/m, dBµV/MHz, dBµA/MHz, dBµV/m/MHz, dBµA/m/MHz, dBpW, dBpT. Analog: Moving-coil meter in operating range of IF detector with additional digital display of lower range limit. Operating ranges – 30, 60 dB.

Screen (ESHS 30, ESVS 30, ESS)
(RF analysis) – Display: 5-inch CRT with digital video memory. Resolution: 1024 x 1024 pixels. Display range – X axis (frequency): Freely selectable, linear or logarithmic (ESS, maximum 1 GHz). Y axis (level): 10 to 200 dB, adjustable. Marker functions: Marker, delta marker, marker set to maximum, receiver frequency set to marker frequency.

Display Modes (detectors) – Average (AV), RMS (ESS only), peak (PK), spectral density measurement (PK/MHz), quasi-peak (QP). Averaging, hold, and measuring times: 1 ms to 100 s (1-2-5 steps).

Measurement Error –
(ESHS) (AV for S/N >16 dB) – Digital display: <1 dB. Analog display: <2 dB typical. Level calibration: Harmonics generator.

(ESVS) (AV for S/N >16 dB) – Digital display: 0 to +55°C: ≤1 dB. –10 to 0°C: <1.5 dB. Analog display: <2 dB typical.

(ESS) (AV for S/N >16 dB) – Digital display: Range I and II: <1 dB. Range III:0 to +55°C: <1 dB. –10 to 0°C: ≤1.5 dB. Analog display: <2 dB typical. Level calibration: Sinewave and harmonics generator.

Demodulation Modes –
(ESHS) – A0 (zero beat); A3 (for A3E emissions).

(ESVS, ESS) – A0 (zero beat); A3 (for A3E emissions); F3 (for F3E).

IF Analysis (ESHS 30, ESVS 30, ESS Range II and III) – Display range: 10 kHz to 2 MHz (in 1-2-5 steps). Input attenuation: 0/20 dB, selectable.

Nominal bandwidth	Resolution –3 dB (±20%)	Shape Factor BW6 dB:BW60 dB
10 kHz	10 kHz	1:4
3 kHz	3 kHz	1:6
1 kHz	1 kHz	1:9

Sweep time: 50 ms to 10 s (1-2-5 steps). Level display range: 80 dB. Level display (ESS only): Normal and normal + max hold. Marker functions: Marker, delta marker, marker set to maximum, marker set to center frequency (receiver frequency).

Date, Time of Day – Internal clock, permanently operated from internal battery.

INPUT/OUTPUT

Floppy Disk Drive (ESHS 30 , ESVS 30, ESS) – 3.5-inch, 1.44 MB formatted. Formatting: MS-DOS compatible. Data format HP-GL or binary.

Remote Control – IEC 625-2 (IEEE 488). Connector: 24-contact Amphenol connector. Interface functions: AH1, L4, SH1, T6, SR1, PP1, RL1, DC1, DT1, C1, C2, C3, C11. Plotter language: HP-GL (via IEC/IEEE-bus interface).

Front-panel Outputs – Supply and coding connector for antennas, etc.: 12-contact Tuchel connector.

AF output – Connector: JK34 jack. Impedance: 10 Ω. EMF: Adjustable up to 1.5 V.

Generator output 9 kHz to 1 GHz; (ESHS 30, ESS) – Connector: N female. Impedance: 50 Ω. EMF: 96 dBµV ±1 dB.

Rear-panel Outputs –
IF 74.7 MHz (ESHS 10, ESVS 10) – Connector: BNC female. Impedance: 50 Ω. Gain referred to RF input (RF attenuation 0 dB): 10 dB without preamplifier, 20 dB with preamplifier. Bandwidth (–3 dB): 2 MHz or bandwidth of preselector.

IF 10.7 MHz (ESVS, ESS) – Connector: BNC female. Impedance: 50 Ω. EMF in range of analog level display for unmodulated sinewave signal: Operating range 30 dB, 1 to 30 mV; Operating range 60 dB, 1 mV to 1 V. Bandwidth (–3 dB): IF bandwidth.

IF 80 kHz (ESHS) – Connector: BNC female. Impedance: 50 Ω. EMF in range of analog level display for unmodulated sinewave signal: Operating range 30 dB, 1 to 30 mV; Operating range 60 dB, 1 mV to 1 V. Bandwidth: IF bandwidth.

Video output (envelope detector) – Connector: BNC female. EMF in range of analog level display: Operating range 30 dB, 4 to 126 mV; Operating range 60 dB, 4 mV to 4 V.

User interface – Connector: 25-contact Cannon connector. Function: Six control lines for an external device (e.g., artificial mains network), display voltage with and without meter simulation, input for external triggering, RS-232-C interface for firmware updating.

Printer connection – Connector: 15-contact Cannon connector. Function: Parallel interface.

Keyboard connector – Connector: 5-contact DIN connector. Function: For MF2 keyboard.

Rear-panel Inputs –
External reference frequency – Connector: BNC female. Required level: EMF ≥1 V from 50 Ω. Frequency: 5/10 MHz.

External battery – Connector: 3-contact connector. Required voltage: 11 to 33 V.

ESHS
ESVS
ESS

EMI/RFI Solutions

POWER REQUIREMENTS

AC Operation – Line voltage: 100 V, 120 V, 220 V, 240 V ±10% (ESS, 230 V +6%/–10%). Line frequency: 47 to 440 Hz. Power consumption: ESHS 10, 50 VA; ESVS 10, 60 VA; ESHS 30, 80 VA; ESVS 30, 90 VA; ESS, 110 VA.

DC Operation – Internal battery (ESHS 10, ESVS 10): 12 V, 10AH. Operating time: ESHS 10, approximately 4 hours; ESVS 10, approximately 2.5 hours.

External battery – Voltage range: 11 to 33 V. Current drain 24/12 V: ESHS 10, 1.2 A/2.3A; ESVS 10, 1.9 A/233A; ESHS 30, 2.1 A/3.9 A ESVS 30, 2.6 A/4.8 A; ESS, 3A/5.5A.

GENERAL SPECIFICATIONS

Environmental Characteristics – Rated temperature range: –10 to +55°C (without condensation). Temperature range for floppy disk drive: +5 to +50 °C. Storage temperature range: –25 to +70°C. Mechanical resistance: Shock-tested to MIL-STD-810 D (shock spectrum 40g), Vibration-tested to MIL-T-28800 D, Class 5; complies with IEC Publication 68-2-6. RFI suppression: Complies with VDE 0876, Part 1a, Regulation 527/1979 and MIL-STD-461 B (CE03 and RE02).

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	236	9.3
Width	435	17.1
Depth		
ESHS 10	363	14.3
ESHS 30	463	18.2
ESS	572	22.5
Weight	**kg**	**lb.**
ESHS 10 without battery	18	39.7
ESVS 10 without battery	20.4	45
ESHS 10 with battery	21	46.3
ESVS 10 with battery	23.7	52.2
ESHS 30	28.6	63.1
ESVS 30	26.4	58.2
ESS	32.1	70.8

ORDERING INFORMATION

ESHS 10
EMI Test Receiver **$20,850**
Includes: Power Cord, Manual.

ESHS 30
EMI Test Receiver **$37,310**
Includes: Power Cord, Manual.

ESVS 10
EMI Test Receiver **$25,280**
Includes: Power Cord, Manual.

ESVS 30
EMI Test Receiver **$35,700**
Includes: Power Cord, Manual.

Opt. 01 (ESVS only) – Pulse Power Attenuator. Maximum pulse voltage 1500 V ..... **+$1,150**

ESS TEST RECEIVER
EMI Test Receiver **$66,150**
Includes: Power Cable, Connector for External Battery, N-BNC Adapter, Sun Shield for Screen (ESS only), Manual.

Opt. 01 (ESS only) – OCXO Reference Oscillator. 1 x 10^{-7} setting error, 1 x 10^{-9}/day aging error and 1 x 10^{-9}/° C temperature drift ..... **+$2,480**

SERVICE ASSURANCE OPTIONS
Opt. C5 (ESVS 30 and ESS) – Adds five years of Calibration Services ..... **+$1,130**

ADDITIONAL ACCESSORIES
See page 446 for complete selection information.

ROHDE&SCHWARZ

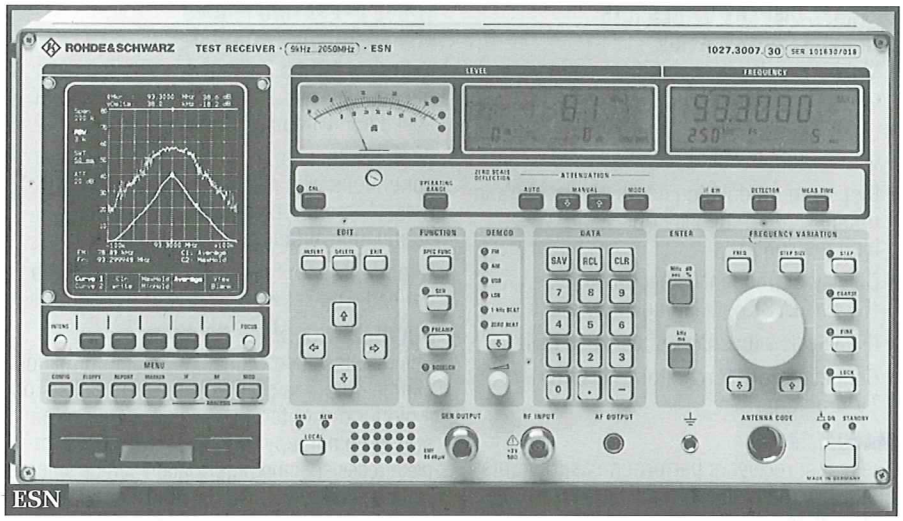
Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

EMI/RFI Solutions

ESVB
ESVD
ESVN
ESN

Built-in firmware designed specifically for radio monitoring applications.



ESN

Introduction

The ESVB/ESVD/ESVN/ESN Test receivers are ideal instruments for all applications in the fields of radio monitoring and radio network planning, civil RFI measurements to all relevant standards as well as for selective voltage and two-port measurements in manual and automatic mode. ESVB/ESVD/ESVN/ESN are used to measure and demodulate both amplitude-modulated (DSB, SSB pulse) and frequency-modulated signals, as well as narrowband and broadband interference in the range from 20 MHz to 1 GHz (ESVN), 9 kHz to 2.050 MHz (ESN), and 20 MHz to 2.05 GHz (ESVB/ESVD Option 02).

Manual operation or automatic mode with spectrum display on screen and reports of results on printer or plotter make these Test Receivers extremely versatile for many applications.

TEST RECEIVER FEATURES

The ESVB/ESVD/ESVN/ESN Test Receivers combine three different types of test receivers in one:

- A compact, manually tuned and battery-operated test receiver
- A test receiver which automatically performs measurements and reports the results
- A system compatible test receiver

Following are the primary features which are shared by both instruments unless noted otherwise:

RF UNIT

- High measurement accuracy: error <1 dB, <0.5 dB typical
- Refined preselection
- Switchable preamplifier with wide dynamic range
- Crystal-stabilized synthesizer (ESN): sweep mode for fast frequency scans, frequency resolution down to 10 and 100 Hz
- Wide dynamic range: noise figure typically 7 dB with preamplifier, 12 dB without pre-amplifier, third order intercept point typically 20 dBm (without preamplifier)
- Tracking generator for attenuation and gain measurements with ESVN 30 and ESN (9 kHz to 1 GHz)
- High-level mixer ensuring high suppression of 1st LO
- IF analysis with resolution bandwidth of 1, 3, and 10 kHz; span 0.01 to 10 MHz; runs in parallel with level measurements

ESVB

- Frequency Range 20 MHz to 1 GHz (2.05 GHz with Option 02)

ESVD

- Frequency Range 20 MHz to 1 GHz (2.05 GHz with Option 02)
- Frequency Accuracy to GSM Recommendations
- In-phase and Quadrature Output for Evaluating Any Modulated Signal

ESVN

- Frequency Range 20 MHz to 1 GHz
- Remote Control via IEEE 488 Interface
- Operation from AC Supply or Internal/External Battery

ESN

- Frequency Range 9 kHz to 1 GHz (2.05 GHz with Option 01)
- Remote Control via IEEE 488 Interface
- Operation from AC Supply or External Battery

APPLICATIONS

- **Field-strength Measurements Using Test Antennas**
- **Radio Monitoring to CCIR**
- **Coverage Measurements**
- **Selective Voltage Measurements in Labs and Test Shops**
- **Radio Interference Measurements to EN 55011 to 55022, ETS, FCC and ANSI C63.4, VCCI, and VDE 0871 to 0879**
- **Digital Audio Broadcasting Networks (ESVB)**
- **Mobile Radio Networks – GSM, PCN (ESVD)**

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

ESVB
ESVD
ESVN
ESN

EMI/RFI Solutions

DEMODULATION
- High-linearity envelope detector with dynamic range of more than 70 dB
- Peak, average, RMS, and quasi-peak detectors
- Automatic overload detection in mixer stages and in test channel by permanently activated peak detectors
- Logarithmic amplifier with dynamic range of more than 70 dB
- Frequency and frequency-offset measurements with built-in frequency counter
- Demodulators for measuring modulation depth and frequency and phase deviation
- Demodulator circuits for FM, AM, SSB (LSB and USB), zero beat, and 1-kHz beat
- Built-in loudspeakers and headphones connector; demodulation using signal processors
- Separate signal channel with 5 MHz bandwidth and demodulator for TV signals with switchover to all common TV standards

POWERFUL PROCESSOR SYSTEM
- Macros for automatic test runs
- Test runs over up to 400 freely selectable channels with programmable thresholds
- Automatic level calibration and consideration of frequency-dependent transducer factors (e.g., of antennas)
- Non-volatile storage of 10 complete instrument setups, 22 different antenna factors and limit lines
- Built-in 3.5 in. floppy disk drive
- Output of results as lists and diagrams on plotter or printer including limit lines and user-defined labeling
- 12-Bit A/D converter with short conversion time
- Measurement time adjustable between 1 ms and 100 s, 50 µs for overview measurements
- 16-Bit processor; flash EPROM allowing convenient and fast firmware updating
- Automatic calibration at a keystroke with the aid of an internal high-precision generator
- Automatic monitoring of all synthesizer loop and supply voltages during operation

OPTIMAL DISPLAY OF RESULTS FOR EVERY APPLICATION
- Measurement of voltage, field strength and current with full indication of units
- Level indication on analog meter and digital display with 0.1-dB resolution
- Display of modulation depth, deviation, and frequency or frequency offset with very high resolution
- Display of frequency spectra (RF ANALYSIS) including limit values
- IF analysis with spans of up to 10 MHz
- Connector for TV monitor to identify TV programs

MANUAL MODE

These test receivers perform measurements at a fixed frequency with the desired bandwidth, attenuation, measurement time, and display mode. Level measurement, modulation, and deviation measurement, as well as frequency and frequency offset measurement, are carried out simultaneously.

While measurements are being performed, the IF analysis function allows the spectrum about the receive frequency to be analyzed. Measurement of level, modulation, or frequency, as well as signal assessment using the built-in loudspeaker, are made at the center frequency of the extended spectrum with the settings selected. Two test curves can be displayed simultaneously on the screen, the display mode for the two curves being selectable independently of one another.

Max Hold, Max/Min, and Average display modes allow fast identification and measurement of useful and interference signals in a signal spectrum. Marker functions are provided for fast evaluation and measurement of the identified signals in the receive channel.

AUTOMATIC MODE

The receive frequency range is scanned and the result displayed as a spectrum on the screen. The measurement parameters such as start frequency, stop frequency, IF bandwidth, measurement time, attenuation, and display mode can be freely selected.

Single-shot or repetitive scanning can be selected. Two test traces can be displayed at a time. For comparison measurements, waveforms can also be loaded from a floppy disk.

THREE OPERATING MODES FOR FREQUENCY SCANNING

Overview Mode: Frequency scanning over the desired frequency range is at maximum speed and with fixed attenuation.

Scan Mode: Frequency scanning is quasi-continuous with selectable step size and measurement time as well as automatic attenuation setting.

Channel Mode: Frequency scanning over a defined data set with up to 400 frequencies.

DOCUMENTATION OF RESULTS

The results, along with all relevant information, can be output in graphical form or as lists on a plotter or printer. In addition, data can be stored on a floppy disk along with the complete receiver setup. Information can be entered via a line editor or, more conveniently, via an optional keyboard. Date, time, and receiver settings are automatically recorded.

USE IN COMPUTER-CONTROLLED SYSTEMS

Full use of the high measurement rate of these test receivers is possible only in the remote mode using a high-speed controller. In the determination of field-strength profiles, the receivers furnish 5,000 measured values per second after being triggered by a positioning system or a time base. The field strength can be determined at different frequencies with a particular frequency band at a rate of 2.5 ms per measured value. In cellular radio networks, it is thus possible to measure the field strength of several base stations according to Lee's statistical method using a single receiver at the normal speed of the test vehicle.

For radio monitoring, up to 10,000 frequencies can be stored in the receivers and scanned at high speed with range-related receiver settings. The results are then output to the process controller.

EMI/RFI Solutions

Characteristics

FREQUENCY RELATED
Frequency Range –

	ESVB/ESVD/ESVN	ESN
Range I	–	9 kHz to 30 MHz
Range II	20 MHz to 1 GHz	30 MHz to 1 GHz
Range III	1 GHz to 2.050 GHz (ESVB/ESVD)	1 GHz to 2.050 GHz (with Opt. 01)

Frequency Setting –
With tuning knob (fine, coarse or any step size selectable) – Range I: Fine, 010 Hz; Coarse, 10 kHz. Range II and III: Fine, 100 Hz; Coarse, 100 kHz. Numerical: Via keyboard entry. Step size: Any selectable size. Automatic scanning: For RF analysis.

Frequency Display – 8-digit LCD.

Resolution – Range I: 10 Hz. Range II and III: 100 Hz.

Frequency Error – ESVN: $<3 \times 10^{-6}$. ESN and ESVN with Option 01 (after 30 minutes warm-up): $<1 \times 10^{-7}$.

Temperature Drift – $<1 \times 10^{-9}$/°C.

Aging – $<1 \times 10^{-7}$/year.

RF INPUT
Connector – N connector, female.

Impedance – 50 Ω.

RF Attenuator – 0 to 120 dB, switchable in 10 dB steps.

VSWR –
9 kHz to 1 GHz – 10 dB RF attenuation: <1.2. 0 dB RF attenuation: <2.

1 GHz to 2.050 GHz – 10 dB RF attenuation: <1.35. 0 dB RF attenuation: <2.

Input Filters – Range I: Five fixed-frequency bandpass filter. Range II: One fixed-frequency and five tracking bandpass filters. Range III: Four fixed-frequency bandpass filters.

Preamplifier – Can be connected between input filter and 1st mixer. Gain: 10 dB.

TABLE 1

ESVB/ESVD Nominal Bandwidth	–3 dB (±10%)	–6 dB (±10%)	Shape Factor $BW_{6\ dB}/BW_{60\ dB}$
10 kHz	7 kHz	9.5 kHz	1:4 typ.
120 kHz	90 kHz	120 kHz	1:5 typ.
300 kHz	300 kHz	400 kHz	1:6 typ.
1 MHz	800 kHz	1 MHz	1:4 typ. (ESVD)
1.5 MHz	1.5 MHz	1.8 MHz	1:2.7 typ. (ESVB)

TABLE 2

ESVB/ESVD Noise Indication	Preamplifier off	Preamplifier on
20 to 1000 MHz		
Average value, BW - 10 kHz	< –12 dBµV, typ. –16 dBµV	< –16 dBµV, typ. –20 dBµV
BW - 120 kHz	typ. –5 dBµV	typ. –9 dBµV
BW - 300 kHz	typ. 0 dBµV	typ. –4 dBµV
BW - 1 MHz	typ. 4 dBµV (ESVD)	typ. 0 dBµV (ESVD)
BW - 1.5 MHz	typ. 7 dBµV (ESVB)	typ. 3 dBµV (ESVB)
1000 to 2050 MHz		
Average value, BW - 10 kHz	< –10 dBµV, typ. –15 dBµV	< –16 dBµV, typ. –20 dBµV
BW - 120 kHz	typ. –3 dBµV	typ. –9 dBµV
BW - 300 kHz	typ. 2 dBµV	typ. –4 dBµV
BW - 1 MHz	typ. 6 dBµV (ESVD)	typ. 0 dBµV (ESVD)
BW - 1.5 MHz	typ. 9 dBµV (ESVB)	typ. 3 dBµV (ESVB)

TABLE 3

ESN/ESVN Nominal Bandwidth	–3 dB (±20%)	–6 dB	Shape Factor $BW_{6\ dB}/BW_{50\ dB}$
1 kHz	1 kHz	1.2 kHz ±20%	1:2.8
3 kHz	3 kHz	3.15 kHz ±10%	1:1.8
9 kHz*1	7 kHz	9.5 kHz ±20%	1:2.2
15 kHz	15 kHz	17 kHz ±10%	1:1.8
120 kHz*1	90 kHz	120 kHz ±20%	1:5
250 kHz	250 kHz	330 kHz ±10%	1:3.7

**1 Meets tolerances to CISPR 16.*

TABLE 4

ESN/ESVN Noise Indication	Preamplifier off	Preamplifier on
Average value, BW 1 kHz		
Range I (f_{in} >50 kHz)	<–22 dBµV, –27 dBµV typical	<–28 dBµV, –33 dBµV typical
Range II	<–18 dBµV, –23 dBµV typical	<–22 dBµV, –28 dBµV typical
Range III	<–16 dBµV, –22 dBµV typical	<–22 dBµV, –28 dBµV typical

ESVB
ESVD
ESVN
ESN

EMI/RFI Solutions

Maximum Input Level (with and without preamplifier) –
RF attenuation 0 dB (AC-coupled) – DC voltage: 50 V. Sinewave AC voltage: 130 dBµV. Spectral pulse density: 97 dBµV/MHz.

RF attenuation >0 dB (DC-coupled) – DC voltage: 7 V (corresponds to 1 W). Sinewave AC voltage: 137 dBµV. Maximum pulse voltage: Range 1, 700 V; Range II and III, 150 V. Maximum pulse energy: Range 1, 100 mWs ; Range II and III, 1 mWs.

RF Shielding – Voltage indication at a field strength of 10 V/m with 0-dB RF attenuation ($f \neq f_{in}$): <0 dBµV. Additional error in CISPR indication range (10 V/m): <1 dB. Interference: Complies with tolerances to EN50081-1. Interference immunity: Complies with tolerances to EN50082-1.

IF Bandwidths – ESVB/ESVD: See Table 1, ESVN/ESN: See Table 3.

Noise Indication – ESVB/ESVD: See Table 2, ESN/ESVN: See Table 4.
RMS value (noise indication average value): +1 dB typical.
Peak (PK) value (noise indication average value): +12 dB typical.

Voltage Measurement Range –
Lower limit (additional error caused by inherent noise <1 dB) – Average value (AV): 4 dB above noise indication. RMS value (RMS): 5 dB above noise indication. Peak value (PK): 15 dB above noise indication. Quasi-peak (QP) (100 Hz pulse frequency): 3 dB above noise indication.

Upper limit (AV, RMS, PK, QP): 137 dBµV (RF attenuation >0 dB).

Inherent spurious response (equivalent input voltage) – Range I: <–10 dBµV. Range II and III: <0 dBµV.

DISPLAY RELATED
Level Display –
Digital – Digits: 3. Resolution: 0.1 dB. Units: dBµV, dBµA, dBm, dBµV/m, dBµA/m, dBpW.

Analog: Moving-coil meter in operating range of IF detector with additional digital display of lower range limit.

Operating ranges: 30, 60 dB.

Screen –
Display: 5-inch CRT with digital memory.

Resolution: 1024 x 1024 pixels.

Display range – X axis (frequency): Freely selectable, linear or logarithmic. Y axis (level): 10 to 200 dB, adjustable in 10-dB steps.

Test curves: Maximum 2 traces. Display modes: Clr/Write, Max Hold, View.

Frequency scan modes – Overview: Scan with fixed attenuation and step size at maximum speed. Scan: Scan with automatic attenuation setting and selectable step size. Channel: Scan at up to 400 predefinable frequency values.

Marker: 2 markers with digital display of frequency and level. Marker functions: Normal marker, delta marker, marker to peak, marker to receiver frequency.

Indication Modes – Average value (AV), RMS value (RMS), peak value (PK), quasi-peak value (QP, f_{in} >150 kHz). Measurement time: 1 ms to 100 s (1-2-5 steps).

Measurement Error (average value for S/N >16 dB) –
Digital display – Range I: <1 dB. Range II: 0 to +55° C: <1 dB. –10 to 0° C: ≤1.5 dB. Range III: <2 dB.

Internal level calibration: Short or total calibration by keystroke. Generator: Sinewave and harmonics generator.

Frequency Drift (digital in kHz) – Resolution: 0.1 to 100 Hz. Measurement range: 0.5 IF bandwidth. Measurement time: 1 ms to 100 s. Measurement error: Same as frequency error.

Frequency Deviation (digital in kHz) – Resolution: 0.1/0.01 kHz. Measurement range: Deviation + f_{mod} <0.5 IF bandwidth. Measurement frequency f_{mod}: 1<100 kHz. Measurement error (signal-to-noise >40 dB, AF = 1 kHz) – IF bandwidths 1, 3, 9, and 15 kHz: 100 Hz + 3% of measured value. IF bandwidths 120 and 1250 kHz: 2 kHz + 3% of measured value.

Phase Deviation (bandwidths 1, 3, 9, 15 kHz) – Resolution: 0.1. Maximum deviation: 8 rad. Modulation frequency: 300 Hz to 5 kHz. Measurement error (signal-to-noise >40 dB, m = 50%, AF = 1 kHz): 0.1 rad + 5% of measured value.

Modulation Depth (digital in %) – Resolution: 0.1%. Measurement range 1 to 99%. Modulation frequency f_{mod}: <100 kHz. Measurement error (signal-to-noise >40 dB, m = 50%, AF = 1 kHz): 5% (absolute).

IF Analysis –
Frequency display – Range I: 10 kHz to 2 MHz (1-2-5 steps). Range II and III: 10 kHz to 10 MHz (1-2-5 steps).

Level display range: 80 dB.

Attenuation switchover (in IF path): 0/20 dB.

Resolution bandwidth (–3 dB): 1, 3, 10 kHz.

Sweep time: 50 ms to 10 s (1-2-5 steps).

Number of test curves: Maximum 2 traces.

Display modes: Clr/Write, Max Hold, Min Hold, Average, View.

Marker: 2 markers with digital display of frequency and level.

Marker functions: Normal marker, delta marker, marker to peak, marker to center frequency (= receiver frequency).

AF Demodulation Modes – Zero beat, 1 kHz beat, AM (for A3E emissions), USB and LSB (for SSB emissions), FM (for F3E emissions). Squelch: Adjustable with front-panel knob.

Trigger Functions – External: TTL level, positive- or negative-going edge. Internal: Controlled by RF level, threshold adjustable.

Date, Time of Day – Internal clock, permanently operated from internal battery.

INPUT/OUTPUT

Remote Control – IEC 625-2 (IEEE 488). Connector: 24-contact Amphenol connector. Interface functions: AH1, L4, SH1, T6, SR1, PP1, RL1, DC1, DT1, C1, C2, C3, C11.

Plotter – Via IEC/IEEE-bus interface. Plotter language: HP-GL.

Printer – Connector: 15-contact Cannon connector. Function: Parallel interface.

Keyboard – Connector: 5-contact DIN female. Function: For keyboard.

Floppy Disk Drive – 3.5 in., 1.44 MB formatted. Formatting: MS-DOS compatible.

Front-panel Outputs – Supply and coding connector for antennas, etc.: 12-contact Tuchel connector.

AF output – Connector: JK34 jack. Impedance: 10 Ω. EMF: Adjustable up to 1.5 V.

Generator output (tracking generator): (ESVN 30, ESN) – Connector: N female. Impedance: 50 Ω. Bandwidth: ESVN 30, 20 MHz to 1 GHz; ESN, 9 kHz to 1 GHz. EMF: 96 dBµV ±1 dB.

Rear-panel Outputs –

IF 10.7 MHz (switch selected between leveled and unleveled IF voltage) – Connector: BNC female. Impedance: 50 Ω. Bandwidth (–3 dB): IF bandwidth. EMF in range of analog level display for unmodulated sinewave signal: Operating range 30 dB, 1 to 30 mV; Operating range 60 dB, 1 mV to 1 V. Regulated output: 700 mV.

AM/FM – Signal: Demodulated AF voltage. AM output voltage (EMF) (m = 50%, DC-coupled): 2 V p-p. FM (DC-coupled) – Bandwidth 1, 3 kHz: 2 V/kHz. Bandwidth 9, 15 kHz: 0.2 V/kHz. Bandwidth 120, 250 kHz: 0.3 V/10 kHz. φM (AC-coupled): 0.2 V/rad.

I/Q demodulator outputs, AC-coupled (with Option ESN-B1 only) – Connector: BNC female. Impedance: 50 Ω with external load >200 Ω. EMF (peak value regulated): 3 V, can be switched to external control). Bandwidth: 0.5 IF bandwidth. Phase error between I and Q for signal-to-noise >40 dB, output frequency 10 to 100 kHz: <1° typical.

CCVS output – Connector: BNC female. Signal: Video polarity and vision/sound carrier offset can be selected for all TV standards.

Reference output – Connector: BNC female. Function: Can be switched to input for external reference. Frequency: 10 MHz. Level: 7 dBm.

User port – Connector: 25-contact Cannon connector. Function: Six TTL control lines for an external device (e.g., driven by RF level), analog voltage indication, input for external triggering, input for IF control, RS-232-C interface for firmware update.

Rear-panel Inputs –

External battery – Connector: 3-contact connector. Required voltage: 11 to 33 V.

Reference input – Connector: BNC female. Function: Can be switched to reference output. Level required: EMF >1 V from 50 Ω. Frequency: 5/10 MHz.

POWER REQUIREMENTS

AC Operation – Line voltage: 100 V, 120 V, 220 V, 240 V ±10%: 230 V +6%/–10%. Line frequency: 47 to 440 Hz. Power consumption: ESVN, 125 VA; ESN, 155 VA.

DC Operation –

External battery (switch-on voltage >12 V) – Voltage range: 11 to 33 V. Current drain 24/12 V: ESVN, 3.7 A/6.8 A; ESN, 4.4A/8 A.

GENERAL SPECIFICATIONS

Environmental Characteristics – Rated temperature range: –10 to +55°C without condensation. Storage temperature range: –25 to +70° C. Mechanical resistance: Shock-tested to MIL-STD-810 D (shock spectrum 40 g), Vibration-tested to MIL-T-28800 D, class 5; complies with IEC Publication 68-2-6. RFI suppression: Complies with VDE 0876, Part 1a, Regulation 527/1979 and MIL-STD-461 B (CE03 and RE02).

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	236	9.3
Width	435	17.1
Depth		
ESVN	460	18.1
ESN	572	22.5
Weight	**kg**	**lb.**
ESVN	29	63.9
ESN	32	70.5

ESVB
ESVD
ESVN
ESN

EMI/RFI Solutions

ORDERING INFORMATION

ESVB
Test Receiver **$39,570**
Includes: Power Cable, Manual.
Opt. 01 – I/Q Demodulator (ESVB) ..... **+$3,050**
Opt. 02 – Frequency Extension to 2.05 GHz. (ESVB)
(Opt. 01 required) ..... **+$4,200**

ESVD
Test Receiver **$36,630**
Includes: Power Cable, Manual.
Opt. 01 – I/Q Demodulator (ESVD) ..... **+$3,050**
Opt. 02 – Frequency Extension to 2.05 GHz.
(Opt. 01 required) ..... **+$4,200**

ESVN 20
Test Receiver **$37,510**
Includes: Power Cable, Manual.
Opt. 01 – Reference Oscillator OCXO
(standard in ESN) ..... **+$2,480**

ESVN 30
Test Receiver with Tracking Generator **$42,920**
Includes: Power Cable, Manual.
Opt. 01 – Reference Oscillator OCXO ..... **+$2,480**

ESN
EMI Test Receiver **$63,500**
Includes: Power Cable, Connector for External Battery, N-BNC Adapter, Viewing Hood, Operating Manual.
Opt. 01 (ESN Only) – Frequency Extension.
1 GHz to 2.050 GHz operation ..... **+$7,250**

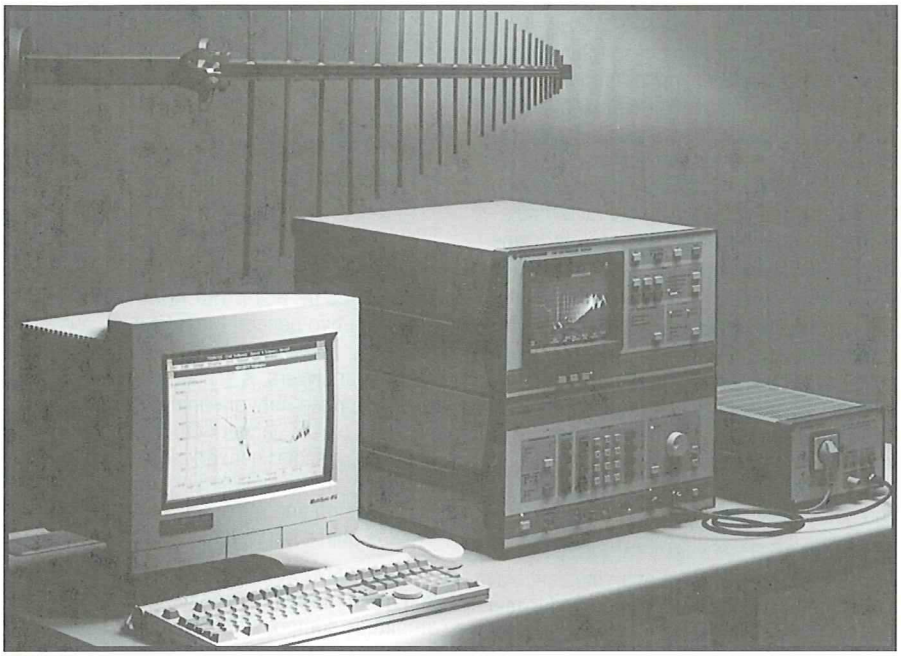
SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty
Repair Protection ..... **+$1,130**

ADDITIONAL ACCESSORIES
See page 446 for complete selection information.

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).



Fully automated EMI compliance software.

ES-K1 EMI Software

ES-K1 EMI Software is an advanced, user-friendly tool which can be used for highly effective measurements for all conducted and radiated emission measurements. The number of measurements required for ensuring electromagnetic compatibility is ever increasing – and with it the demand to make these measurements reliable, reproducible, and economical.

ES-K1 EMI Software complies with these exacting requirements for measurements to both international commercial standards (CISPR, EN, ANSI, FCC, EACL, VDE) and military standards (MIL, VG, DEF-STAN, GAM-EG13). Adaptation to other standards is possible.

When used with Rohde & Schwarz EMI test receivers and accessories, the ES-K1 EMI Test Software provides fully automatic operation. The interactive mode allows the operator to use his/her experience to the fullest for most accurate and thorough measurements. At the same time, operation under Windows provides easy access and operation for the first-time user. The friendly graphics user interface allows the operator to concentrate on the measurement at hand. Concise documentation of results in graphic and tabular forms is possible along with the associated test setup.

REQUIREMENTS

- PC compatible controller fully compatible with Windows 3.1 with a minimum of 4 MB RAM
- Windows 3.1
- Minimum storage capacity used up on hard disk 4 MB
- IEC/IEEE-bus interface with Windows driver (DLL), compatible with National Instruments IEC-bus card AT-GPIB or PCIIA

ES-K1

- Fully Automatic and Interactive Operation for Maximum Speed, Reproducibility, and User Friendliness
- Automatic Compensation of Transducers (Correction Factors) and Limit Lines
- Evaluation of Narrowband/Broadband Interference
- Test Setup Calibration
- Convenient and Flexible Result Documentation
- Easy and Open-ended Expandability for System Applications Due to Modular Design

User-friendly EMI test software running under Windows™.

APPLICATIONS

- **EMI Measurements to Commercial and Military Standards Such As CISPR, VDE, FCC, EACL, ANSI, EN; MIL, VG, DEF-STAN, GAM-EG13**
- **Can Be Adapted to Other Standards**

ORDERING INFORMATION

ES-K1
EMI Test Software **$2,850**
Includes: Program Disks, Manual.

RECOMMENDED ACCESSORIES
Script Development Kit – Order ES-K2 ..... **$3,500**
ESHS/ESVS/ESVD Driver – Order ES-K10 ..... **$3,500**
ESS Driver – Order ES-K11 ..... **$3,500**
ESAI/ESBI/ESMI Driver – Order ES-K12 ..... **$3,500**
ESVP/ESH3 Driver – Order ES-K13 ..... **$3,500**
ESVP/ESH3/EZM Driver – Order ES-K14 ..... **$4,410**
FSA/FSB/FSM Driver – Order ES-K15 ..... **$3,500**
EMCO 1050/1060 Driver – Order ES-K32 ..... **$3,500**

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Network Analyzers

CONTENTS

NETWORK ANALYZERS
R3752A.....257
R3753A.....257
R3762AH.....261
R3961B.....261
R3961BN.....261
R3763B.....264

Introduction

Network analyzers can be used to characterize a variety of devices, from components and materials to circuits, equipment, and systems. They can be used effectively even when individual components or test points cannot be accessed. Network analyzers measure the transmission and reflection characteristics of linear circuit networks by applying a sine wave to the input of the device-under-test and measuring the resultant signals at the output.

The most accurate way to analyze linear circuit networks is to measure the amplitude and phase of circuit network transmission and reflection characteristics at various frequencies. Knowing these relationships provides the information required to characterize the behavior of linear networks quickly, accurately, and completely over a broad frequency range.

NETWORK ANALYZER MEASUREMENTS

Figure 1 shows the effect of an incident wave (input signal) applied to a device-under-test (DUT). The incident wave can be divided into two parts: Reflection waves that return to the source without passing through the DUT and transmission waves that pass through the DUT.

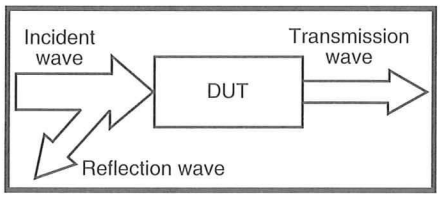


Figure 1. Relationship between Incident, Reflection, and Transmission Waves.

The reflection characteristic can be obtained by dividing the reflection wave by the incident wave:

$$\text{Reflection Characteristic} = \frac{\text{Reflection Wave}}{\text{Incident Wave}}$$

The following items can be measured from this calculation:

- Return loss
- SWR
- Impedance (R + jX, G + jB)*1
- S-parameter (S_{11}, S_{22})*1

The transmission characteristic can be obtained by dividing the transmission wave by the incident wave:

$$\text{Transmission Characteristic} = \frac{\text{Transmission Wave}}{\text{Incident Wave}}$$

The following items can be measured from this calculation:

- Amplitude
- Phase *1
- Group delay time *1
- S-parameter (S_{21}, S_{12}) *1

**1 Cannot be measured by a scalar network analyzer.*

TWO TYPES OF NETWORK ANALYZERS

There are two general types of network analyzers: scalar network analyzers and vector network analyzers. A scalar network analyzer is a low-priced network analyzer, but it only provides partial network characterization. Basically, a scalar network analyzer only measures the amplitude components of transmission and reflection. It does not provide phase information.

A vector network analyzer measures the phase and group delay times in addition to the amplitude components of transmission and reflection. This provides complete, accurate characterization of linear circuit networks.

To provide accurate network analysis, the following performance is required:

- High accuracy, high resolution
- High throughput
- Flexible application to various systems
- Abundant functions
- Easy operation

NETWORK ANALYZERS OFFERED

Each of the following vector network analyzers includes a floppy disk and built-in BASIC controller as standard features.

R3752A Vector Network Analyzer – A compact 5 Hz to 500 MHz analyzer featuring very high speed (0.1 ms/point). Intended for ATE systems, it has a 32 x 8 character alphanumeric display.

R3753A Vector Network Analyzer – A versatile 5 Hz to 500 MHz analyzer featuring very high speed (0.1 ms/point). Intended for benchtop R&D, it has a full color TFT graphics display.

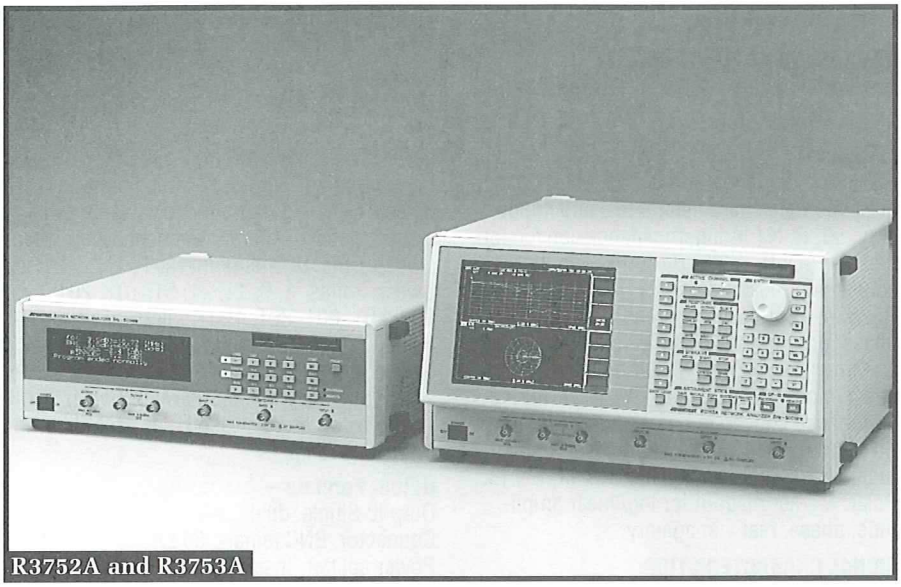
R3762AH Network Analyzer – A full-feature 300 kHz to 3.6 GHz analyzer with monochrome graphics display.

R3961B (50 Ω), R3961BN (75 Ω) Test Set – These test sets provide full S-parameter capabilities for the R3762AH Network Analyzer in forward and reverse directions.

R3763B Network Analyzer – Similar to the R3762AH but includes a simplified built-in version of the R3961B. It is not a reversing test set.

Specifications for these network analyzers are described in detail on the following pages.

Network Analyzers



R3752A and R3753A

R3752A/R3753A Network Analyzers

The R3752A/R3753A Network Analyzers are new vector network analyzers featuring unprecedented measurement speed and productivity enhancements. Both analyzers cover the frequency range of 5 Hz to 500 MHz, and are designed for testing components in the rapidly expanding field of RF and wireless communications (cellular phones, pagers, cordless phones, etc.).

The R3752A and R3753A provide very high throughput and highly reliable measurement. They feature high-speed measurement (0.1 ms/point at 10 kHz RBW), wide dynamic range measurement (115 dB), two device simultaneous measurement with 2-Channel 4-trace function, and other useful functions. Besides a conventional frequency sweep function, several new concepts have been added. First, a program sweep function allows the user to freely change resolution bandwidth or output level at any point during the sweep. Second, a high-speed level sweep uses a new semiconductor switch at the output section and is ideal for drive level performance testing of quartz oscillators.

The R3752A is designed for system use. Its compact size allows it to fit into almost any system. It features a small alphanumeric display showing instrument parameters. It is intended primarily for high-speed ATE applications. Two independent measurement channels are available so that devices with two input/output ports can be tested.

The R3753A is designed primarily for standalone benchtop use. It is very similar to the R3752A except that it features a TFT (thin film transistor) color liquid crystal display. This flat-panel display enhances visibility and operability which are important for interpreting and analyzing the results of measurements (such as data comparison and pattern recognition). On-screen menus and soft keys provide access to a wide variety of routines for both transmission and reflection measurements. These include displays of magnitude, phase, group delay, SWR, Smith charts, or combinations of these. Because the command set of the R3752A and R3753A is compatible, programs can be developed on the R3753A and then easily ported to the R3752A.

R3752A/ R3753A

- 5 Hz to 500 MHz Measuring Frequency Range
- 2-Channel, 4-trace and 2-device Simultaneous Measurement
- Wide Dynamic Range
- Programmable Sweep and High-speed Level Sweep Functions Standard
- Very High Measurement Speed: 0.1 ms/Point
- Built-in BASIC Controller and Floppy Disk
- TFT Color Display

Highest throughput with high dynamic range, optimized for network analysis in automatic test applications.

APPLICATIONS

R3752A

- **High-speed Automated Test**
- **RF and Wireless Communications**
- **Satellite Broadcasting Equipment**
- **Component Test**
- **Manufacturing Test**

R3753A

- **Research and Development**
- **Test program Development**
- **RF and Wireless Communications**
- **Satellite Broadcasting Equipment**
- **Component Test**
- **Manufacturing Test**

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

R3752A
R3753A

Network Analyzers

The R3752A/R3753A have a built-in BASIC controller function for configuration of a high-speed ATE system without using an external controller. A 3.5 in. 1.44 MB floppy disk drive is also standard. This floppy drive is MS-DOS compatible, thereby allowing programs to be written on a PC-compatible controller and easily ported to the network analyzer.

FIVE FEATURES PROVIDE HIGH THROUGHPUT AND HIGH RELIABILITY

0.1 ms/point sweep rate. Total throughput is one of the most important characteristics of an electronic component measurement system (e.g., ceramic or crystal resonators or filters). Among many factors, sweep rate has the greatest influence on total throughput. The R3752A/R3753A achieve a 0.1 ms/point sweep rate (at 10 kHz RBW) which is the fastest in its class. Additionally, the blanking time (the period from the end of a sweep to the start of the next sweep) is typically only 5 ms.

2-Channel 4-trace function enabling two device simultaneous measurement. The R3752A/R3753A has three input channels (A, B, and R) and two output channels. Thus, it can measure two devices at the same time, greatly reducing measuring time. The R3753A can display measured data for four traces on a single screen (such as broadband and narrow band, amplitude and phase, and amplitude and group delay time). Also, since it has a TFT color liquid crystal display, data can be easily recognized even when superimposed.

115 dB wide dynamic range measurement. In spite of its compact, light-weight size, the R3752A/R3753A has a wide dynamic range (115 dB), useful for evaluating ripple in the passband of MCF (monolithic crystal filter) or spurious checking in the reject band.

Program sweep function for changing RBW or output level during sweep. The program sweep function can not only set a sweep frequency band but also change the resolution bandwidth or output level during the sweep. For the evaluation of crystal characteristics, changing the resolution bandwidth in the resonance/anti-resonance characteristic range enables highly accurate measurements which can be reproduced time after time.

High-speed level sweep function enabling device level test. The R3752A/R3753A series has a semiconductor switch at the output section to enable high-speed output level change-over, which is difficult with conventional mechanical switches because of mechanical endurance. The level sweep range is from +21 dBm to –43 dBm. This is the function best suited for drive level performance testing of crystal and ceramic oscillators, and gain compression points of amplifiers.

Characteristics

MEASUREMENT FUNCTIONS

Display Channels – 2-CH (4-trace display).

Display Parameters – A/R, B/R, A/B. R, A, B.

Formats –
R3752A – Log/linear amplitude, phase, group delay, complex parameter's real and imaginary, |Z|, R, X (during impedance conversion measurement), |Y|, G, B (during admittance conversion measurement).
R3753A – Cartesian: Log/linear amplitude, phase, group delay, complex parameter's real and imaginary, |Z|, R, X (during impedance conversion measurement), |Y|, G, B (during admittance conversion measurement). Smith Chart: Marker readout for log/linear amplitude, phase, real + imaginary, R + jX, G + jB. Polar: Market readout for log/linear amplitude, phase, real + imaginary.

SIGNAL CHARACTERISTICS

Frequency –
Range: 5 Hz to 500 MHz.
Resolution: 0.1 Hz.
Accuracy: (25°C ±5°C) ±5 x 10^{-6}/day; ±20 ppm.

Output Levels –
Range: +21 dBm to –63 dBm (Output port 1).
Resolution: 0.1 dB.
Accuracy: 0.5 dB (0 dB, 50 MHz, 25°C ±5°C).
Output Level Linearity (25°C ±5°C): +21 dB to –35 dB, ±0.5 dB; –35 dB to –63 dB, ±1.5 dB.
Flatness (25°C ±5°C): 5 Hz to 1 MHz, ±2.0 dB; 1 MHz to 500 MHz, ±1.5 dB; 300 MHz to 500 MHz, ±2.0 dB.
Output Impedance: 50 Ω return loss (Output port 1); 13 dB or greater (0 dB typical).

Signal Purity –
Harmonic Distortion: ≤–20 dBc.
Non-harmonic Spurious: ≤–30 dBc or –70 dBm (whichever is greater).
Phase Noise: ≤–75 dBc/Hz (at 10 kHz offset).

Noise Level (ATT AUTO, 25°C ±5°C) –

	RBW				
	10 kHz	3 kHz	1 kHz	300 Hz	100 Hz
Frequency					
5 Hz to 500 kHz	Min f 200 kHz –100 dBm	Min f 60 kHz –105 dBm	Min f 20 kHz –110 dBm	Min f 64 Hz –115 dBm	Min f 2 kHz –115 dBm
500 kHz to 300 MHz	–105 dBm	–110 dBm	–115 dBm	–115 dBm	–115 dBm
300 MHz to 500 MHz	–105 dBm	–110 dBm	–110 dBm	–110 dBm	–110 dBm

SWEEP CHARACTERISTICS

Sweep Parameters – Frequency, signal level.

Range –
Frequency Sweep: Same as frequency characteristic.
Level Sweep: +21 dBm to –43 dBm.
Range Setting: Start/stop or center/span.
Sweep Type: Linear frequency sweep, sweep by user-defined arbitrary segment, level sweep.
Sweep Time: 0.1 ms/point (at 10 kHz RBW).
Sweep Points: 3, 6, 11, 21, 51, 101, 201, 301, 401, 601, 801, 1201 points.
Sweep Trigger: Contiguous, single, external.
Sweep Mode: Dual sweep, 2-CH sweep in the same frequency range; Alternate sweep, 2-CH sweep by different sweep types or in different frequency ranges.

Output Formats –
Output: Single, dual.
Connector: BNC female, 50 Ω.
Power splitter: Insertion loss, 6 dB; Amplitude tracking; <100 MHz, 0.1 dB typical; ≥100 MHz, 0.2 dB typical. Phase tracking, 1° typical.

RECEIVER CHARACTERISTICS

Input Characteristics –
Input Terminals: 3-CH.
Frequency Range: 5 Hz to 500 MHz.
Input Impedance: 50 Ω, 1 MΩ/20 pF.
Return Loss:

	ATT 0 dB	ATT 20 dB
<300 MHz	>20 dB	>23 dB
≥300 MHz	>15 dB	>20 dB

Maximum Input Level:

	ATT 0 dB	ATT 20 dB
50 Ω	–20 dBm	0 dBm
1 MΩ	22.4 mV	224 mV

Input Breakdown Level: 50 Ω, +23 dBm, no DC component is permitted; 1 MΩ, ±3 V.

Resolution Bandwidth (RBW): 3 Hz to 10 kHz (switchable in 1-3-10 sequence).
Input Crosstalk: 5 Hz to 100 kHz, 120 dB; 100 kHz to 300 MHz, 115 dB; 300 MHz to 500 MHz, 110 dB.
Signal Crosstalk (output level +15 dBm, ATT 0 dB): 5 Hz to 100 kHz, 105 dB; 100 kHz to 300 MHz, 110 dB; 300 MHz to 500 MHz, 105 dB.

Automatic Offset Correction –
Normalize Function: Removes amplitude variations over specified frequency range of the measurement system.
Electrical Length Correction: An equivalent electrical length (delay time) is added to the measured and group delay time.
Range: +1 to –1 second.

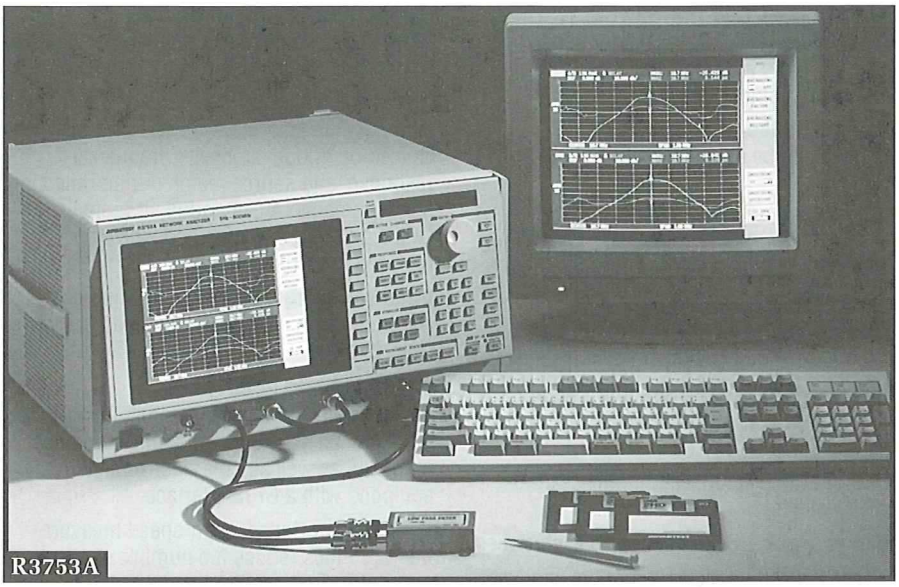
Amplitude Characteristics –
Ratio Measurement – Measurement range, 0.001 dB (RBW 1 kHz). Resolution, 0.001 dB/div. Accuracy, ±0.5 dB (50 MHz, 25°C ±5°C, maximum input level).
Frequency Response (25°C ±5°C):

	50 Ω	1 MΩ
5 Hz to 100 MHz	1 dB p-p	1.5 dB p-p
100 MHz to 300 MHz	2 dB p-p	–
300 MHz to 500 MHz	3 dB p-p	–

Dynamic Accuracy: 0 dBm to –10 dBm, ±0.10 dB; –10 dBm to –60 dBm, ±0.05 dB; –60 dBm to –70 dBm, ±0.10 dB; –70 dBm to –80 dBm, ±0.30 dB; –80 dBm to –90 dBm, ±0.90 dB.

Absolute Value Measurement –
Measurement Range (RBW 1 kHz) – ATT AUTO: 0 dBm to –120 dBm. ATT 20 dB: 0 dBm to –100 dBm. ATT 0 dB, –20 dBm to –120 dBm. Resolution: 0.001 dB/div.
Accuracy: ±0.5 dB (50 MHz, 25°C ±5°C, maximum input level).
Frequency Response (25°C ±5°C):

	50 Ω	1 MΩ
5 Hz to 100 MHz	–	2 dB p-p
5 Hz to 300 MHz	2 dB p-p	–
300 MHz to 500 MHz	3 dB p-p	–



The R3753A with built-in BASIC controller and floppy disk is ideal for standalone component test. Shown here with an external VGA monitor.

Phase Measurement –
Ratio measurement – Measurement Range: ±180° (display of data beyond ±180° is possible in continuous phase mode). Frequency Response (25°C ±5°C) (when the amount of attenuation is the same on both channels):

	50 Ω	1 MΩ
5 Hz to 100 MHz	5° p-p	10° p-p
100 MHz to 300 MHz	10° p-p	–
300 MHz to 500 MHz	20° p-p	–

Dynamic Accuracy (25°C ±5°C, RBW 3 Hz, f ≥1 kHz, ATT 20 dB): 0 dBm to –10 dBm, ±1.0 dB; –10 dBm to –50 dBm, ±0.3°; –50 dBm to –60 dBm, ±0.5°; –60 dBm to –70 dBm, ±0.1.0°; –70 dBm to –80 dBm, ±0.3°; –80 dBm to –90 dBm, ±0.8°.

Group Delay Time Characteristics –
Range: Can be calculated from the following equation:

$$t = \frac{\Delta\phi}{360 \times \Delta f}$$

where: $\Delta\phi$ = Phase
Δf = Aperture frequency (Hz)

Measurement Range: 1 ps to 250 s.
Resolution: 1 ps.
Aperture Frequency: 0.01% to 50%.

$$\text{Accuracy} = \frac{\text{Phase}}{360 \times \text{Aperture frequency (Hz)}}$$

DISPLAY CHARACTERISTICS
R3752A –
Type: Fluorescent character display tube (green).
Resolution: 256 x 64 dots (32 x 8 characters).

R3753A –
Type: 7.8 in. TFT color display.
Resolution: 640 x 480 dots.
Display Mode: Orthogonal log/linear, polar, Smith chart (impedance/admittance display).
Display Format: Single-channel display, 2-CH superimposed display, 2-CH split-screen display, enlarged scale display.
Measurement Conditions Display: Start/stop, center/span, scale/DIV, reference level, marker value, softkey function, alarm message.
Reference Line Position: Uppermost (100%) to lowermost (0%) of vertical axis scale.
AUTO Scale: Reference value and scale resolution are automatically set so that the trace measured can be displayed in optimum form.
Brightness: Backlit ON/OFF available.

R3752A
R3753A

Network Analyzers

MARKER FUNCTION (R3753A ONLY)

Marker Display – Marker readouts can be converted into a display value in agreement with measurement function.

Multiple Marker – A maximum of ten markers can be set independently for each channel.

Delta Marker – Any of the ten markers can be specified as the reference marker and the delta value between movable markers can be displayed.

Marker Coupling – Markers of different channels can be coupled or set independently.

Analysis of Arbitrarily Specified Region – Marker search is available in the region specified by a delta marker.

MKR Search – MAX search, MIN search, NEXT search.

Marker Track – Searched for on each sweep.

Target Search – Calculation of the bandwidth of X dB down point, center frequency or Q; Search of phase 0° frequency value ±X° frequency width.

MKR – MKR → reference value, MKR → START, MKR → STOP, MKR → CENTER.

ERROR CORRECTION FUNCTIONS

Normalize – Corrects for frequency response errors (amplitude, phase) during transmission measurement.

1-Port Compensation – Corrects for errors caused by bridge directivity, frequency response, and source match during reflection measurements. A calibration kit (containing OPEN, SHORT, and LOAD connectors) is required for error correction.

Data Averaging – Data (vector value) is averaged for each sweep. Averaging factors range from 2 to 999.

PROGRAMMING FUNCTIONS

BASIC Controller Function – Built-in controller function can control internal measurement functions as well as other instruments equipped with a GPIB interface.

Built-in Functions – High-speed measurement routines reduce the number of programming lines required and provide greater execution speed.

Floppy Disk Drive (FDD) – MS-DOS compatible, 3.5 in., 720 KB (DD) or 1.44 MB (HD).

CONNECTIONS TO EXTERNAL EQUIPMENT

External Display – 15-Pin D-SUB connector. Drives external VGA monitor.

GPIB – Conforms to IEEE 488 Standard.

Parallel I/O – TTL level, 8-Bit output (2 ports), 4-Bit I/O (2 ports).

Serial Port – Conforms to RS-232 standard.

Keyboard Jack – Compatible with IBM PC-AT.

External Reference Frequency Input – Input available frequency 1, 2, 5, and 10 MHz (>0 dBm).

POWER REQUIREMENTS

Line Voltage – 100 V AC to 240 V AC.

Line Frequency – 48 to 66 Hz.

Power Consumption – 350 V A or less.

GENERAL SPECIFICATIONS

Operating Conditions – When FDD Is in Use: Temperature, +5°C to +40°C; Relative humidity, 85% or less. When FDD Is Not in Use: Temperature, 0°C to +50°C; Relative humidity, 80% or less.

Storage Temperature Range – –20°C to +60°C.

PHYSICAL CHARACTERISTICS

	R3752A		R3753A	
Dimensions	**mm**	**in.**	**mm**	**in.**
Height	132	5.2	220	8.7
Width	424	16.7	424	16.7
Depth	400	15.7	400	15.7
Weight	**kg**	**lb.**	**kg**	**lb.**
(maximum)	13	28.7	20	44.1

ORDERING INFORMATION

R3752A
Vector Network Analyzer **$19,900**
Includes: Power Cord, 30 cm BNC Cable (2), 60 cm BNC Cable, BNC Through Connector, Fuse, Operator's Manual, Programmer's Manual.

R3753A
Vector Network Analyzer **$23,500**
Includes: Power Cord, 30 cm BNC Cable (2), 60 cm BNC Cable, BNC Through Connector, Fuse, Operator's Manual, Programmer's Manual.

SERVICE ASSURANCE OPTIONS

Opt. R2 – Adds two years of post-warranty Repair Protection ..... **+$590**
Opt. C5 – Adds five years of Calibration Services ..... **+$1,225**

CALIBRATION KITS

Type N, 50 Ω – Order 9617B3 ..... **$2,300**
3.5 mm, 50 Ω – Order 9617H4 ..... **$3,000**
BNC, 50 Ω – Order 9617K3 ..... **$2,100**
Type N 75 Ω – Order 9617R3 ..... **$3,500**
BNC, 75 Ω – Order 9617S3 ..... **$3,100**

RACKMOUNT KITS

R3752A – Without Handle. Order A02718 ..... **$124**
R3752A – With Handle. Order A02708 ..... **$330**
R3753A – Without Handle. Order A02720 ..... **$128**
R3753A – With Handle. Order A02710 ..... **$358**

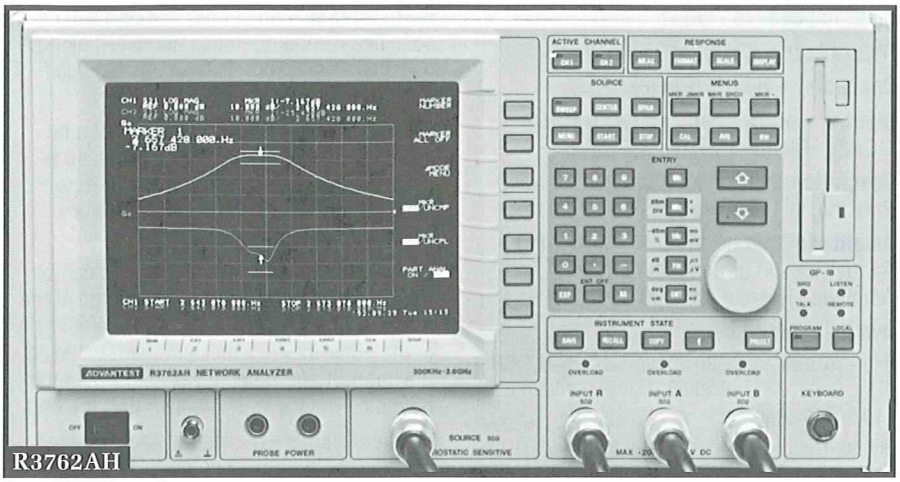
ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

Network Analyzers
with S-Parameter Test Set

R3762AH
R3961B
R3961BN



R3762AH

R3762AH, R3961B, R3961BN

- 300 kHz to 3.6 GHz Frequency Range with 1 Hz Resolution
- High-accuracy, High-resolution Measurements
- Powerful Analytical and Marker Functions
- Built-in BASIC Controller Functions
- Built-in Floppy Disk Drive

High performance network analyzer with built-in controller function for automatic testing.

R3762AH Network Analyzer

The R3762AH quasi-microwave vector network analyzer can quickly and accurately measure amplitude, phase, group delay, and impedance in the frequency range of 300 kHz to 3.6 GHz. In addition to its 0.5 ms/point measurement capability, the R3762AH provides high measurement accuracy due to unique RF analog and digital signal processing technologies. These analyzers also feature numerous useful functions such as measuring amplitude ripple and group-delay ripple values in a given interval, measuring filter bandwidths, and $Q = \Delta f/f_0$ measurements at an XdB-down point. These functions are not only easy to use, but also greatly improve the throughput of measurements.

HIGH-RESOLUTION, HIGH-ACCURACY MEASUREMENTS

The R3762AH incorporates a 1 Hz resolution signal source using a high-speed synthesizer to provide an absolute amplitude accuracy of ±1 dB. In addition, for relative value measurements, it provides such superior performance capabilities as an amplitude measurement accuracy of 0.05 dB with 0.001 dB resolution and phase measurement accuracy of 0.3° with 0.01° resolution. All this is made possible by unique analog circuit technology and powerful digital signal processing.

PHASE/GROUP DELAY MEASUREMENT FUNCTION OPENS NEW HORIZONS IN ANALYSIS

The R3762AH enables precise, phase characteristic measurements with a phase-measurement accuracy of 0.3° and resolution of 0.01°. In addition, because the electrical length can be compensated for by a simple, one-key operation, the phase reference plane can be matched to the measurement device to accurately measure the electrical length of wires and coaxial cables.

Group delay aperture can be very conveniently set with span % for optimum measurements based on the measurement frequency and band.

A unique feature of the R3762AH is the phase-zero search function. Since this function automatically searches the frequency at phase zero, it is very convenient for analyzing crystal oscillators.

R3762AH Characteristics

MEASURING FUNCTIONS

Display Channels – Two channels.

Display Parameters – A/R, B/R, A/B. Includes conversion of impedance, admittance, S-parameters. Characteristic impedance (Z_0) input is also possible.

Format – Orthogonal Display: Log/linear amplitude, phase, group delay, real number and imaginary number parts of complex parameters. IZI, R, X (for impedance conversion measurement). IYI, G, B (for admittance conversion measurement). Phase extension display function.
Smith Chart: Marker readout is log/linear amplitude, phase, real number part + imaginary number part, R+jX, G+jB.
Polar Coordinate Display: Marker readout is log/linear amplitude, phase, real number part + imaginary number part.

APPLICATIONS

- **Crystal Filters**
- **SAW Devices**
- **Amplifiers**
- **Antennas**
- **High Frequency Packages**

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The R3762AH, R3961B, R3961BN comply with IEEE Standard 488.1-1987.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

R3762AH
R3961B
R3961BN

Network Analyzers
with S-Parameter Test Set

SIGNAL SOURCE CHARACTERISTICS

Measurement Frequency – Range: 300 kHz to 3.6 GHz. Resolution: 1 Hz. Accuracy: ±10 ppm (25°C ± 5°C).

Output Level – Range: +20 dBm to –5 dBm. Resolution: 0.01 dB. Accuracy: ±0.5 dB (at 0 dBm, 50 MHz, 25°C ± 5°C). Output Level Linearity (0 dBm referenced, 25°C ± 5°C): –5 dBm to +15 dBm: ±0.4 dB. +15 dBm to +20 dBm: ±0.7 dB. Flatness (at 25°C ± 5°C): 2.0 dB p-p.

Output – Single. Connector: N type (Female), 50 Ω.

Signal Purity – Harmonic Distortion: ≤–20 dBc (at maximum output). Non-harmonic spurious; ≤25 dBc (at maximum output). Phase Noise: At 10 kHz offset, 1 Hz bandwidth: 300 kHz ≤f <3 MHz: –75 dBc. 3 MHz ≤f <40 MHz: –85 dBc. f ≥40 MHz: –85 dBc +20 log (f/40 MHz).

SWEEP FUNCTIONS

Sweep Parameters – Frequency, level.

Maximum Sweep Range – Frequency: 300 kHz to 3.6 GHz. Signal Level: –5 dBm to +20 dBm.

Setting Range – Start/stop or center/span.

Sweep Type – Can be selected from linear or logarithmic frequency, sweep, partial and given frequency sweep, level sweep, and CW (single frequency).

Sweep Time – 0.5 ms/point. Note that the minimum sweep time varies depending upon the measurement format, type of error compensation, sweep width per point, number of measuring points, and the IF bandwidth of the measurement.

Measuring Points – 3, 6, 11, 21, 51, 101, 201, 301, 601, 1201 points. However, the maximum displayed number of points is 601.

Sweep Trigger – Continuous, hold, single sweep, or set by either line trigger or external trigger.

Sweep Mode – Dual Sweep: Two channels are swept in the same frequency range. Alternate Sweep: Two channels can be swept by different sweep types in different frequency ranges.

INPUT CHARACTERISTICS

Input Terminals – 3-CH (R, A, B).

Dynamic Range – 100 dB (CH A, CH B), 30 dB (CH R).

Noise Level – –90 dBm (1 kHz bandwidth on CH A, B). –100 dBm (10 Hz bandwidth on CH A, B).

Minimum Input to R Channel – –30 dBm (minimum required level to ensure correct operation).

Maximum Input Level – 0 dBm.

Input Breakdown Level – +20 dBm.

Input Impedance – 50 Ω.

Return Loss – 20 dB (at 25°C ± 5°C).

Connector – N-type (Female) 50 Ω.

Input Crosstalk – –100 dB (300 kHz to 1 GHz). –90 dB (1 GHz to 3.6 GHz).

Resolution Bandwidth – 1 kHz to 10 Hz (Variable in 1-3-10 sequence).

Amplitude Characteristics – Measuring Range: 0 ±100 dB (amplitude ratio). Amplitude Resolution: 0.001 dB.

Dynamic Accuracy –

0 to –10 dBm	±0.30 dB (300 kHz ≤f ≤1.3 GHz) ±0.50 dB (1.3 GHz ≤f ≤3.6 GHz)
–10 to –60 dBm	±0.05 dB
–60 to –70 dBm	±0.15 dB
–70 to –80 dBm	±0.40 dB
–80 to –90 dBm	±1.00 dB (f ≥19 MHz)

Measuring Accuracy – ±0.5 dB (–10 dBm, 25°C ± 5°C), calibrated by normalizing.

Phase Measurement – Measuring Range: ±180° (Can be displayed in ±180° or more by display extension function).
Phase Resolution: 0.01°.
Frequency Characteristics: ±5° (25°C ± 5°C).

Dynamic Accuracy –

0 to –10 dBm	±5.0°
–10 to –50 dBm	±0.3°
–50 to –60 dBm	±0.4°
–60 to –70 dBm	±1.5°
–70 to –80 dBm	±4.0°
–80 to –90 dBm	±8.0° (f ≥19 MHz)

GROUP DELAY TIME CHARACTERISTICS

Linear/Logarithmic Frequency Sweeps and Sweeps with Arbitrary Frequency – Range: Derived from the following equation:

$$t = \frac{\Delta\phi}{360 \times \Delta f}$$

where: $\Delta\phi$ = Phase
Δf = Aperture frequency (Hz)

Measurement Range – 1 ps to 250 s.
Group Delay Time Resolution – 1 ps.
Aperture Frequency – Equivalent to Δf. Can be set to any desired frequencies up to 20% of frequency span.

$$\text{Accuracy} = \frac{\text{Phase accuracy}}{360 \times \text{aperture frequency (Hz)}}$$

MARKER FUNCTIONS

Marker Display – Marker readout can be converted to display values corresponding to each measurement format.

Multi-marker – Ten independent markers can be set for each channel.

Delta Marker – Any of ten markers can be specified for the reference marker, making it possible to measure delta values between moved markers.

Fixed Marker – The fixed marker can be assigned a marker value off the measurement display tube surface, making it possible to measure delta values with the reference marker.

Correction Marker – Marker points can be read in two modes. In one mode, data at the measured frequency point is displayed directly; in the other mode, a measurement value at the appropriate frequency is displayed after obtaining the value by the insertion method.

Marker Couple – Markers in each channel can be set either in a two-coupled form or entirely independent form.

Analysis in Arbitrary Specified Section – Marker search and ripple measurement in the section specified by the Δ marker are possible.

Marker Search – MAX search, MIN search, NEXT MAX search.

Marker Tracking – Marker search based on sweep-by-sweep tracking is possible.

Target Search – Bandwidth, center frequency, and Q at the X dB down point can be calculated. In addition, the frequency value with phase 0° and frequency width at ±X° can also be searched.

Marker – MKR → reference value, MKR → Start, MKR → Stop, MKR → Center, MKR → / Span, MKR → Center scale. Furthermore, markers can be moved from a data waveform to a memory waveform or vice versa.

Auto Zoom – Can be set to the span specified by Auto Zoom Span through automatic functioning of MAX search and MKR → Center.

ERROR CORRECTION FUNCTIONS

Normalize – Corrects for frequency response errors (both amplitude and phase) during transmission measurements.

1-port Calibration – Corrects errors due to bridge directivity, frequency response, and source match during reflection measurements. Short, open, and load are required for error correction.

2-port Calibration – Corrects errors caused by the directivity, frequency response, source match, reflection frequency response, and crosstalk in ports 1 and 2.

Data Averaging – Data (vector values) are averaged for every sweep. The average factor can be set to any value between 2 and 126.

Auto Offset Compensation – Electrical Length Compensation: Equivalent electrical length or delay time is added to the measured phase and group delay time. Range: 3 x 108 m to +3 x 108 m or +1 sec to –1 sec.

Network Analyzers
with S-Parameter Test Set

R3762AH
R3961B
R3961BN

INSTRUMENT STATE FUNCTIONS

Save – Instrument settings are stored in an internal register by pressing the Save Register key. In addition, when the power is turned on, the unit is set to the state immediately before power-off by the Power Off Save function. Measurement data, calibration data, and instrument settings are saved on built-in floppy disk by pressing the Store key.

Recall – Instrument settings stored in the internal register are recalled by pressing the Recall key. The measurement data, calibration data, and instrument settings saved on floppy disk are recalled by pressing the Load key.

Limit Line Function – The limit line for GO/NO-GO tests (standard value line) is defined on the CRT screen.

PROGRAMMING FUNCTIONS

BASIC Controller Function – Enables the unit to control itself and other measuring instruments equipped with a GPIB interface.

Built-in Arithmetic Functions – Provide high-speed analysis of measured data.

Floppy Disk Drive Functions – Disk capacity: 750 kB (formatted). Type of media: 3.5 in., double-sided, double-density floppy.

CONNECTION WITH EXTERNAL EQUIPMENT

Copy – Graphs displayed on the CRT and data lists can be output to a GPIB compatible plotter or printer without requiring an external controller.

Video Plotter Output Signals – Separate signal (DIN 8-Pin), Composite signal (BNC).

GPIB Data Output and Remote Control – Based on IEEE 488.

S-parameter Test Set Control – 14-Pin.

Parallel I/O Output – TTL level, 8-Bit output (2 ports), 4-Bit input/output (2 ports).

RS-232-C – Serial output based on RS-232-C standard.

External Trigger – BNC female connector, TTL level, LOW enable.

External Reference Frequency Input – Frequency 1, 2, 5, 10 MHz. Connector: BNC female connector.

GENERAL SPECIFICATIONS

Operating Environment – Temperature: When using floppy disk drive: +5°C to +40°C, relative humidity 85% or less. When not using floppy disk drive: 0°C to +40°C, relative humidity 85% or less.

Safety – This product has been safety tested by Advantest to IEC 348 specifications.

Power Requirements – Operating Voltage: Standard: 90 to 132 V. Option 40: 198 to 250 V. Power Consumption: 280 V A or less. Frequency: 48 Hz to 63 Hz.

PHYSICAL CHARACTERISTICS

Dimensions (approx.)	mm	in.
Height	221	8.7
Width	424	16.7
Depth	450	17.7
Weight	**kg**	**lb.**
	23	50.7

R3961B/R3961BN S-Parameter Test Set

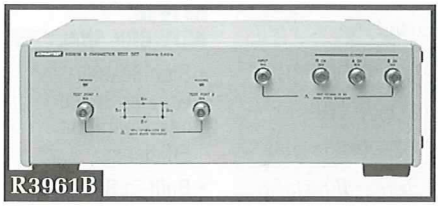
The R3961B/R3961BN S-Parameter test set is connected to the R3762AH network analyzer to measure the transmission/reflection characteristics for frequencies of 300 kHz to 3.6 GHz (for R3961B) and 300 kHz to 2 GHz (for R3961BN). The R3961B/R3961BN contain the devices necessary for measurement, such as the SWR bridge, power splitter, and switches. They can measure all S-Parameters of S_{11}, S_{12}, S_{21}, and S_{22}, without having to disconnect the device-under-test.

R3961B/R3961BN TEST SET

Frequency Range – R3961B: 300 kHz to 3.6 GHz. R3961BN: 300 kHz to 2 GHz.

Test Port Impedance – R3961B: 50 Ω. R3961BN: 75 Ω.

Directivity – R3961B: ≥25 dB, 300 kHz to 5 MHz, (≥30 dB at 25°C ± 5°C). ≥35 dB, 5 MHz to 1.3 GHz. ≥30 dB, 1.3 GHz to 3.6 GHz. R3961BN: ≥25 dB, 300 kHz to 5 MHz (≥30 dB at 25°C ± 5°C). ≥30 dB, 5 MHz to 2 GHz.



Input Port Return Loss – R3961B: ≥17 dB, 300 kHz to 1.3 GHz. ≥12 dB, 1.3 GHz to 3 GHz. ≥10 dB, 3 GHz to 3.6 GHz. R3961BN: ≥17 dB, 300 kHz to 1.3 GHz, ≥12 dB, 1.3 GHz to 2 GHz.

Test Port Return Loss – R3961B: ≥20 dB, 300 kHz to 1.3 GHz. ≥16 dB, 1.3 GHz to 3 GHz. ≥14 dB, 3 GHz to 3.6 GHz. R3961BN: ≥17 dB.

RF Destructive Level – +27 dBm max.

Test Ports 1 and 2 Isolation – 90 dB or more.

Coaxial Switch Reproducibility – ±0.03 dB (at the tenth changeover).

FREQUENCY CHARACTERISTICS

Transmission Amplitude – R3961B: 1.5 dB p-p typical. R3961BN: 3 dB p-p typical.

Transmission Phase – R3961B: 10° p-p typical. R3961BN: 20° p-p typical.

Reflection Amplitude – R3961B: 1.5 dB p-p typical. R3961BN: 3 dB p-p typical.

Reflection Phase – R3961B: 10° p-p typical. R3961BN: 3° p-p typical.

Insertion Loss –
RF IN to PORT 1, 2: R3961B: 6 dB typical. R3961BN: 12 dB typical.
RF IN to OUTPUT R: R3961B: 21 dB typical. R3961BN: 21 dB typical.
RF IN to OUTPUT A and B: R3961B: 22 dB typical. R3961BN: 34 dB typical.

PHYSICAL CHARACTERISTICS

Dimensions (approx.)	mm	in.
Height	132	5.2
Width	424	16.7
Depth	450	17.7
Weight	**kg**	**lb.**
	8	17.6

ORDERING INFORMATION

R3762AH
Network Analyzer **$21,000**
Includes: Power Cord, NP-to-NP Input Cable, Limit Line Editor on Floppy Disk, Instruction Manual.
Opt. 40 – 198 to 250 V AC Operation ..... **NC**
Keyboard – Order TR45103 ..... **$1,300**

R3961B
50 Ω S-Parameter Test Set **$8,000**
Includes: R3762AH Interconnect Cable.

R3961BN
75 Ω S-Parameter Test Set **$8,000**
Includes: R3762AH Interconnect Cable.

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection
R3762AH ..... **+$590**
R3961B, R3961BN ..... **+$260**
Opt. C5 – Adds five years of Calibration Services
R3762AH ..... **+$1,225**
R3961B, R3961BN ..... **+$725**

CALIBRATION KITS – See page 260.

RACKMOUNT KITS
R3762AH – Without Handle. Order A02722 ..... **$132**
R3762AH – With Handle. Order A02712 ..... **$375**
R3961B – Without Handle. Order A02718 ..... **$124**
R3961B – With Handle. Order A02708 ..... **$330**

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The R3762AH, R3961B, R3961BN comply with IEEE Standard 488.1-1987.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

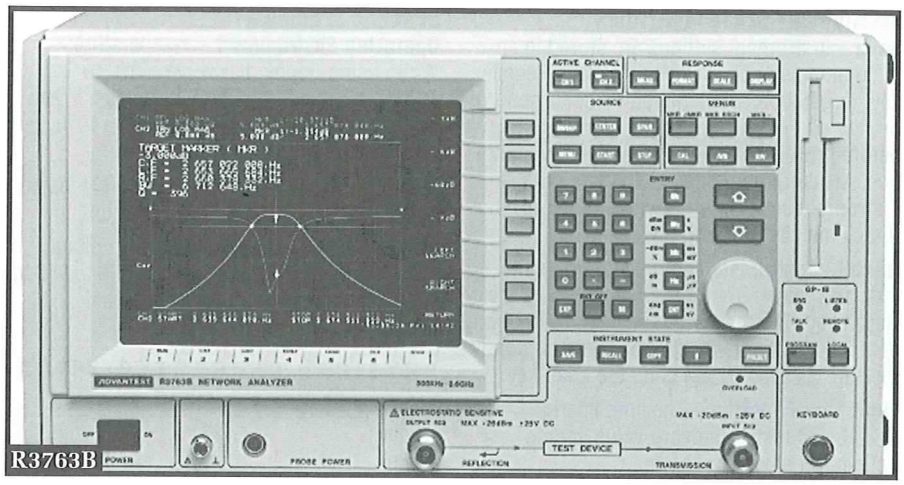
R3763B

Network Analyzers

High-throughput network analyzer with built-in controller and internal test set.

R3763B NETWORK ANALYZER

- Significantly Greater Space and Operation Efficiency
- Built-in Bridge
- Reflection Characteristic Measurement with High Repeatability
- Built-in Parallel I/O Functions
- Built-in BASIC Controller Functions
- Built-in Floppy Disk Drive



R3763B Network Analyzer

The R3763B Network Analyzer measures the transmission and reflection characteristics of RF/quasi-microwave electronic parts at a speed of 0.5 ms/point. Because it incorporates a bridge, the system can significantly enhance space and operation efficiency. For measurement and analytical functions, the system is provided with an innovative user sweep function, a limit line display function, a beep function, and a tracking search function in the partial analysis mode. These functions enable the system to be the best for use in production and inspection. The built-in BASIC controller contained in the system function uses its own editor to create the measurement, analysis, and data processing programs for automatic measurement and processing. This enables fast ATE configuration as well as measurement with turn-key operation, without the need to use an external computer.

SPACE AND OPERATION EFFICIENCY

It has been difficult to fully automate the testing and inspection of RF/quasi-microwave electronic parts. Because of the high frequencies of these devices, setup reproducibility is difficult to achieve even with special jigs. As a result, testing and inspection are often manual processes. In addition, testing for transmission and reflection characteristics has required a separate power splitter as well as a SWR bridge and cabling to connect these parts. This configuration makes the work area more complicated and degrades the operational efficiency. Because these units are incorporated into the R3763B, the workplace remains clear and uncluttered, thereby improving efficiency. The BASIC controller contained in the system allows for easy manipulation of complicated measurements through a turn-key operation.

HIGH-THROUGHPUT MEASUREMENT

The R3763B provides a number of functions which enhance the measurement throughput, including the following features:

- Fast measurement at 0.5 ms/point by the high-speed settling signal source and a fast vector operation
- High throughput for automatic measurements implemented by the BASIC controller using built-in functions
- Increased measurement speed through the user sweep function
- SAVE/RECALL functions to store up to ten system states

APPLICATIONS

- **Crystal Filters**
- **SAW Devices**
- **Amplifiers**
- **Antennas**
- **High Frequency Packages**

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The R3763B complies with IEEE Standard 488.1-1987.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

DIGITAL PROCESSING FOR HIGHLY ACCURATE MEASUREMENTS

Digital processing is used in all stages of the receiver after the IF (Intermediate Frequency) stage. Using this function in conjunction with the calibration function will provide highly accurate measurements with:

- Amplitude characteristic measurement accuracy of ±0.5 dB/0.01 dB resolution
- Phase characteristic measurement accuracy of ±0.3°/0.01° resolution

TURN-KEY OPERATION THROUGH THE BASIC CONTROLLER FUNCTIONS

You can automate the processes from data processing to analysis by creating a sequential program through the BASIC controller functions built into the system. Executing the program allows automation of your measurement processes.

LIMIT LINE FUNCTION USEFUL FOR ADJUSTMENT AND JUDGMENT

The limit line display can specify the upper and lower limits at a specific frequency and the upper and lower limits in a line (continuous frequency area). In addition, it can mix these limits and specify up to 30 segments. Also, it can specify a point in the basic data at which a pass or fail is decided, and set the limit values of ±X dB for up to 30 segments. The pass or fail result may be output through the GPIB. The limit line may be used to indicate a display circle as the pass/fail decision function on the polar coordinate display.

MARKER TRACKING FUNCTION BEST SUITED FOR ADJUSTMENT AND TEMPERATURE/TIME VARIANCE CHARACTERISTICS MEASUREMENTS

The resonant frequency of the inductive resonator (TEM mode) is adjusted in real time by trimming in the order of a few tens of microns. Using the marker tracking function provides continuous real-time measurements of the maximum value for transmission characteristics, the 3 dB bandwidth, and the minimum value for the reflection characteristics of each sweep.

FILTER ANALYSIS FUNCTION USEFUL FOR MEASURING FILTER CHARACTERISTICS

A special function called the Filter Analysis mode provides automatic filter measurements. By using only one key, this versatile function can calculate and display the center frequency, 3 dB bandwidth, left/right frequencies, Q, and SF (Shape Factor) value of the filter to be measured.

MULTI-MARKER (TEN MARKERS) FUNCTION FOR THE BEST ADJUSTMENT

The R3763B can specify ten multi-markers for each channel. In addition, the delta from the active marker related to the specified marker (the frequency or level difference) can be determined by just pressing one key.

USER SWEEP FUNCTION TO ENHANCE THROUGHPUT

The measuring speed depends upon the number of frequency points required by the device to be measured. As the number of points decrease, the measurement throughput increases. Partial measurement may be sufficient for some devices to be measured. With the R3763B, you can set the number of points from 3 to 1201 and use the user sweep function to divide the frequency band needed for the measurements into as many as 15 segments for a data sweep. In particular, the user sweep function specifies only those parts required by the measurement. With the user sweep function, a single action is sufficient to carry out a high-resolution measurement which otherwise would require separate measurements in two or three different frequency bands.

Characteristics

MEASUREMENT FUNCTIONS

Display Channels – Two channels.

Display Parameters – REFL (reflection, S_{11}), TRANS (transmission, S_{21}). Includes conversion of impedance and admittance. Characteristic impedance (Z_o) can be input.

Format – Orthogonal Display: Log/linear amplitude, phase, group delay, real and imaginary parts of complex parameters. IZI, R, X (at impedance conversion measurement). IYI, G, B (admittance conversion measurement). Phase extension display function. Smith Chart: Marker readout for log/linear amplitude, phase, real + imaginary parts, R+jX, G+jB. Polar Coordinate Display: Marker readout for log/linear amplitude, phase, real + imaginary parts.

SIGNAL SOURCE CHARACTERISTICS

Measurement Function – Range: 300 kHz to 3.6 GHz (TRANS), 20 MHz to 2.0 GHz (REFL). Resolution: 1 Hz. Accuracy: ±10 ppm (25°C ± 5°C).

Output Level – Range: +5 dBm to –18 dBm. Accuracy: ±0.5 dB (–14 dBm, 50 MHz, 25°C ± 5°C). Output Level Linearity: –14 dBm (reference). ±0.7 dB (–14 dBm to +5 dBm). ±1.0 dB (–18 dBm to –14 dBm). Flatness: 2.0 dB p-p (–14 dBm, 25°C ± 5°C). Output Impedance: 50 Ω.

Output Form – Output: Single. Connector: 50 Ω, N type, female.

Signal Purity – Harmonic Distortion: –20 dBc (at max. output, 25°C ± 5°C). Non-harmonic Spurious: Value related to mixer ≤–25 dBc (at max. output, 25°C ± 5°C).
Phase Noise: 10 kHz offset, 1 Hz bandwidth. 300 kHz ≤f <3 MHz: –75 dBc. 3 MHz ≤f <40 MHz: –85 dBc. f ≥40 MHz: –85 dBc + 20 log (f/40 MHz).

Network Analyzers

SWEEP FUNCTIONS

Sweep Parameters – Frequency and signal level.

Max. Sweep Range – Frequency: 300 kHz to 3.6 GHz. Signal Level: –18 dBm to + 5 dBm.

Range Setting – Start/stop or center/span.

Sweep Time – 0.5 ms/point min. Sweep time depends upon measurement format, type of error correction, sweep width per point, number of measurement points, and IF bandwidth for measurement.

Number of Measurement Points – 3, 6, 11, 21, 51, 101, 201, 301, 601, 1201 (max. number of display points is 601).

Sweep Mode – Dual Sweep: Two channels swept in the same frequency range. Alternate Sweep: Two channels can be swept using two different types of sweep in different frequency ranges.

RECEIVE/TRANSMISSION CHARACTERISTICS

Input Characteristics – Frequency Range: 300 kHz to 3.6 GHz. Resolution Bandwidth: 10 Hz to 1 kHz (variable in 1-3-10 sequence). Dynamic Range: 100 dB.
Noise Level: –90 dBm (in 1 kHz bandwidth). –100 dBm (in 10 Hz bandwidth ≥20 MHz).
Max. Input Level: 0 dBm.
Max. Breakdown Level: +20 dB, ±25 V DC.
Return Loss: 20 dB or more (25°C ± 5°C).
Input Crosstalk: –100 dB (20 MHz ± 1 GHz). –90 dB (300 kHz ± 3.6 GHz).

Amplitude Characteristics – Measurement Range: 0 ± 100 dB (amplitude ratio). Amplitude Resolution: 0.001 dB. Dynamic Accuracy: 0 to –10 dBm ± 0.30 dB, f ≤1.3 GHz. 0 to –10 dBm ± 0.5 dB, f >1.3 GHz. –10 to –60 dBm ± 0.05 dB. –60 to –70 dBm ± 0.15 dB. –70 to –80 dBm ± 0.40 dB. –80 to –90 dBm ± 1.00 dB.

Phase Measurement – Measurement Range: ±180° (Measurement range exceeding ±180° are enabled by using the display extension function). Phase Resolution: 0.01°. Dynamic Accuracy (at f ≥19 MHz): 0 to –10 dBm ±5.0°. –10 to –50 dBm ±0.3°. –50 to –60 dBm ±0.4°. –60 to –70 dBm ±1.5°. –70 to –80 dBm ±4.0°. –80 to –90 dBm ±8.0°.

GROUP DELAY TIME CHARACTERISTICS

Linear/Logarithmic Frequency Sweeps and Over Sweeps All Frequencies – Range: Derived from the following equation:

$$t = \frac{\Delta\phi}{360 \times \Delta f}$$

where: $\Delta\phi$ = Phase
Δf = Aperture frequency (Hz)

Measurement Range – 1 ps to 250 ps.
Aperture Frequency – Corresponds to f; can be set to any value up to 100% of frequency span.

$$\text{Accuracy} = \frac{\text{Phase accuracy}}{360 \times \text{aperture frequency (Hz)}}$$

RECEIVE/REFLECTION CHARACTERISTICS

Input Characteristics – Frequency Range: 20 MHz to 2.0 GHz. Resolution Bandwidth: 1 Hz to 1 kHz. Max. Input Level: +6 dBm. Max. Breakdown Level: +26 dBm, 0 V DC. Directivity: 35 dB or more (20 MHz to 2.0 GHz, 25°C ± 5°C). Test Port Source Match: 16 dB or more (20 MHz to 2.0 GHz, 25°C ±5°C).

Amplitude Characteristics – Measurement Range: 0 ± 100 dB (amplitude ratio). Amplitude Resolution: 0.001 dB. Amplitude Tracking: ±0.5 dB (–14 dBm, 20 MHz to 3.6 GHz, 25°C ± 5°C).

Phase Characteristics – Measurement Range: ±180° (Measurements exceeding ±180° can be displayed continuously by using the display extension function). Phase Resolution: 0.01°. Phase Tracking: ±5° (–14 dBm, 20 MHz to 3.6 GHz< 25°C ±5°C).

GROUP DELAY TIME CHARACTERISTICS

Linear/Logarithmic Frequency Sweeps And Sweeps Over All Frequencies – Range: Derived from the following equation:

$$t = \frac{\Delta\phi}{360 \times \Delta f}$$

where: $\Delta\phi$ = Phase
Δf = Aperture frequency (Hz)

Measurement Range – 1 ps to 250 ps.
Group Delay Time Resolution: 1 ps.
Aperture Frequency: Corresponds to Δf and can be set to any value to 100% of frequency span.

MARKER FUNCTION

Multiple Markers – Up to ten independent markers can be set for each channel.

Fixed Marker – Normal markers overlap the measurement waveform, but fixed marker values can be specified outside the measurement display area and can be measured for delta values against the reference marker.

Correction Marker – Two modes are available for reading marker points: one displays data at the measured frequency point without further processing, and the other displays the value between measurement points by interpolation.

Marker Coupling – Coupled or independent markers may be set for each channel.

Analysis of Any Freely Specified Section – Marker search and ripple measurement can be performed in a section specified with the marker.

MKR Search – MAX search, MIN search, and NEXT MAX search.

Marker Tracking – Marker search activation tracking function can be performed for each sweep.

Target Search – Bandwidth, center frequency, and Q at the X dB down point can be calculated. The frequency of phase 0° and the frequency width at ±X° can be searched for.

AUTO ZOOM – MAX search and MKR→CENTER automatically set the value to the SPAN specified by AUTO ZOOM SPAN.

ERROR CORRECTION FUNCTIONS

Normalize – Corrects for frequency response errors (both amplitude and phase) during transmission measurement.

1-port Calibration – Corrects for errors due to bridge directivity, frequency response, and source match during reflection measurements. Short, open, and load are required for error correction.

Data Averaging – Data (vector values) are averaged for every sweep. The average factor can be set to any value between 2 and 126.

Auto Offset Compensation – Electrical Length Compensation: Equivalent electrical length or delay time are added to the measured phase and group delay time. Range: 3 x 108 m to +3 x 108 m or +1 sec to –1 sec.

INSTRUMENT STATE FUNCTIONS

Save – The instrument settings are stored in an internal register by pressing the Save Register key. In addition, when the power is turned on, the unit is set to the state immediately before power-off by the Power Off Save function. Measurement data, calibration data, and instrument settings are saved on built-in floppy disk by pressing the Store key.

Recall – The instrument settings stored in the internal register are recalled by pressing the Recall key. The measurement data, calibration data, and instrument settings saved on built-in floppy disk are recalled by pressing the Load key.

Limit Line Function – The limit line for GO/NO-GO tests (standard value line) is defined on the CRT screen.

PROGRAMMING FUNCTIONS

BASIC Controller Function – The standard controller function in the analyzer controls the analyzer itself and other instruments with the GPIB interface. This control is executed by programs created on the analyzer.

Built-in Functions – The built-in functions contained in the analyzer provide fast analysis of measurement data.

Floppy Disk Drive (FDD) Function – Disk Capacity: 750 kB (formatted). Media Type: 3.5 in. double-sided, double-density.

CONNECTIONS TO EXTERNAL EQUIPMENT

Copy – Produces hard copies of graphs and printouts of data lists displayed on the CRT by using the GPIB-compatible plotter and printer, without the need for an external controller.

Video Plotter Output Signal – Separate signal (8-Pin DIN socket) and Composite signal (BNC connector).

GPIB Data Output and Remote Control – Conforms to IEEE 488.

Parallel I/O – TTL level (38 pins), 8-Bit output (2 ports) and 4-Bit I/O (2 ports).

EIA-232-D – Serial output conforms with EIA-232-D.

External Trigger – TTL level, LOW enable. Connector, BNC female.

External Reference Frequency Input – Frequency: 1, 2, 5, 10 MHz. Connector: BNC female.

DISPLAY

CRT Format – Single channel, 2-CH overlay, 2-CH separation, and enlarged scale.

Display Data – Data being measured is displayed, or both the data being measured and the data in memory are displayed simultaneously.

Reference Line Position – Between the top (100%) and bottom (0%) of the vertical axis scale.

Time Display – The calendar date (year/month/day) and time of day (hour/minute/second) can be set and displayed.

Label – Up to 45 characters can be entered.

GENERAL SPECIFICATIONS

Operating Environment – Temperature (when FDD is used): +5°C to +40°C, relative humidity 85% or less.

Safety – This product has been tested by Advantest to IEC 348 specifications.

Power Requirements – Operating Voltage: Standard: 90 to 132 V. Option 40: 195 to 250 V. Power Consumption: 280 V A or less. Frequency: 48 Hz to 86 Hz.

PHYSICAL CHARACTERISTICS

Dimensions (approx.)	mm	in.
Height	221	8.7
Width	424	16.7
Depth	450	17.7
Weight	**kg**	**lb.**
	25	55.1

ORDERING INFORMATION

R3763B
Network Analyzer **$28,500**
Includes: Power Cord, Limit Line Editor on Floppy Disk, Instruction Manual.
Opt. 40 – 195 to 250 V Operation ..... **NC**

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection ..... **+$590**
Opt. C5 – Adds five years of Calibration Services ..... **+$1,225**

RECOMMENDED ACCESSORIES
Keyboard – Order TR45103 ..... **$1,300**

CALIBRATION KITS
Type N, 50 Ω – Order 9617B3 ..... **$2,300**
3.5 mm, 50 Ω – Order 9617H4 ..... **$3,000**
BNC, 50 Ω – Order 9617K3 ..... **$2,100**
Type N 75 Ω – Order 9617R3 ..... **$3,500**
BNC, 75 Ω – Order 9617S3 ..... **$3,100**

RACKMOUNT KITS
Without Handle – Order A2722 ..... **$132**
With Handle – Order A02712 ..... **$375**

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The R3763B complies with IEEE Standard 488.1-1987.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

Communications Test Sets

Communications Test Sets Offered

R2465A/B, R2471A/B

One of the fastest growing segments of RF testing is communications related tests. This covers a broad spectrum of applications including PCN (Personal Communications Network), GSM (Global System for Mobile communications), and more. Our analyzers provide in-depth transmitter evaluation for standards such as NADC, PDC, and PHP.

SIGNALING

In addition to the conventional RF and AF measuring facilities, many units also include special signaling capabilities. Testers with signaling simulate the base station and perform all signaling measurements to PTT regulations in addition to all conventional radio measurements. For large cellular-radio networks, they also provide base-station testing including signaling.

Integration of a signaling unit into the radio tester ensures fast data exchange between the control units, thus creating the prerequisites for real-time measurements under practical conditions.

CONTENTS

COMMUNICATIONS TEST SETS

R2465A/B, R2471A/B 270
CMS50 272
CMS52 272
CMS54 275
CMS57 275
CMD55 279
CMTA 281
CRTP24 284

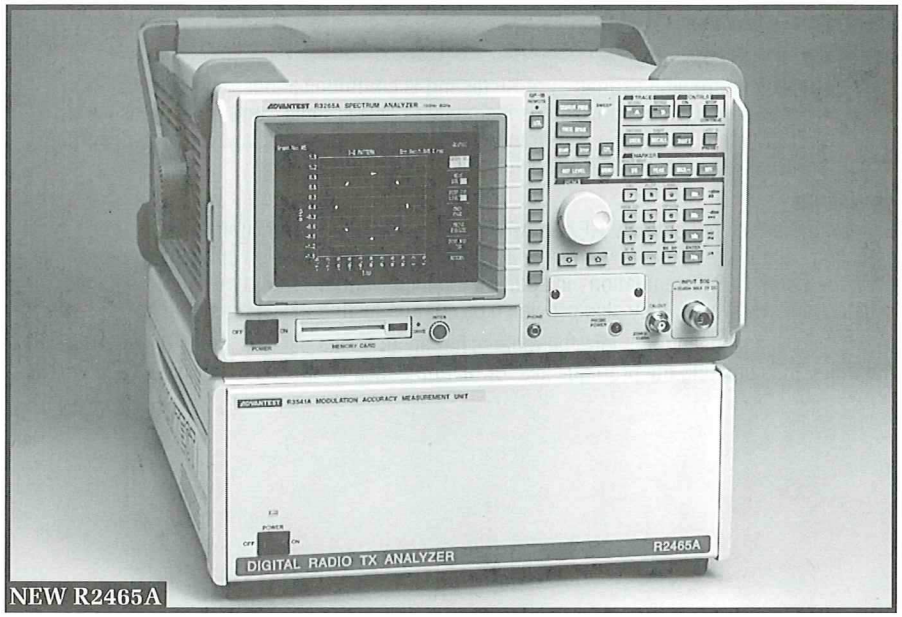
R2465A/B
R2471A/B

Communications Test Sets

A wide range of spectrum and time analysis in a single unit – conventional spectrum analysis, time-domain analysis, time-gated spectrum analysis, and modulation analysis.

New R2465A/B, R2471A/B

- Spectrum Analysis Measurements
  - –Frequency Accuracy
  - –RF Output Power
  - –Harmonic and Spurious Signal Levels
- Time-domain and Time-gated Spectrum Analysis Measurements
  - –Burst Rise and Fall Time
  - –Average Burst Power
  - –Adjacent Channel Power
- Dual Display – Simultaneous Frequency and Time Domain
- Memory Card Interface



R2465A/B, R2471A/B Digital Radio Transmitter Analyzers

The R2465A consists of the 100 Hz to 8 GHz R3265A Spectrum Analyzer coupled with the R3541C Option 70 Modulation Accuracy Measurement Unit. The R2465B consists of the 100 Hz to 8 GHz R3365A Spectrum Analyzer with built-in tracking generator coupled with the R3541C Option 70 Modulation Accuracy Measurement Unit. The R2471A consists of the 100 Hz to 26.5 GHz R3271A Spectrum Analyzer and the R3541C Option 70 Modulation Accuracy Measurement Unit. The R2471B consists of the 100 Hz to 26.5 GHz R3371A Spectrum Analyzer with tracking generator and the R3541C Option 70 Modulation Accuracy Measurement Unit. The resultant system is capable of a variety of measurements – conventional spectrum analysis, time-domain analysis, time-gated spectrum analysis, and modulation analysis.

These transmitter analyzers are designed to evaluate the digital transmitter characteristics of North American Dual-mode Cellular (NADC) phones. The systems provide simultaneous displays of frequency domain and time domain information in order to simplify analysis. To enable precision modulation measurements, the DSP-based R3541C Option 70 Modulation Accuracy Measurement Unit down converts, digitizes, and digitally demodulates $\pi/4$ DQPSK signals. Tests are performed with the high speed necessary for production line testing, and the detail and accuracy needed for the development environment.

COMPREHENSIVE TEST FUNCTIONALITY

The R2465A/B and R2471A/B systems perform a wide range of spectrum analysis measurements. The R2465A/B analyzers can measure frequency accuracy from 100 Hz to 8 GHz in one sweep; 100 Hz to 26.5 GHz for the R2471A/B.

The spectrum analyzer's time domain function allows monitoring of transmitter power and time response, meeting critical TDMA system requirements. Combined with a fast sweep function (5 µs/div in zero span), the burst signal analysis function can be used to monitor the transmission power in any single time slot of the TDMA signal. Burst signal power is measured by separating it into "on" and "off" power periods. Use time domain measurement to measure the average power of the selected zone with the marker.

APPLICATIONS

- **Mobile Radio**
  - **NADC**
  - **PHP**
  - **PDC**

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

Communications Test Sets

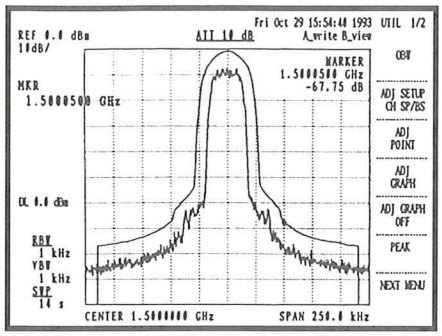


Figure 1. The channel separation and bandwidth parameters of the adjacent channel leakage power measurement can be freely set.

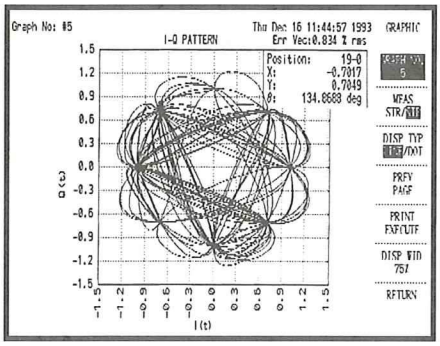


Figure 2. I-Q display.

The R2465A/B, R2471A/B analyzers can measure adjacent-channel leakage power of digital radio equipment transmitter characteristics from the measured spectrum data through a simple operation. Two types of leakage power measurements are provided. Adjacent Point measures the leakage power of the upper and lower channels, while Adjacent Graph measures the leakage power of all channels in the bandwidth specified, as shown in Figure 1.

The R2465A/B, R2471A/B can perform time-gated measurements. By setting the instrument to dual-screen mode with both a frequency display and a time display, the gate width can be adjusted so the frequency is only displayed during the gate.

DSP-POWER FOR ANALYSIS

The DSP-based R3541C Option 70 Modulation Accuracy Measurement Unit down converts, digitizes and digitally demodulates π/4 DQPSK signals, and displays the information. Combined with the R2465A/B or R2471A/B, the resultant system can measure the error vector, magnitude, and phase. In addition, an FFT (Fast Fourier Transform) of each of these measurements allows further analysis.

Eye pattern displays plot I (In-phase) and Q (Quadrature) against time. A key feature of these diagrams is that the greater the error vector, the more the eye closes. I versus Q (See Figure 2) and constellation diagrams are useful for measuring modulation quality. The key feature of this graph is that if the value of the error vector is small, the intersecting point is centered on each symbol point.

APPLICATION-DRIVEN SOLUTIONS

The R2465A/B, R2471A/B provide extensive transmitter characterization capabilities, ideally suited for the product development environment. The user can evaluate virtually every relevant transmitter RF measurement parameter, whether in the time or frequency domains.

These analyzers are equally useful in production environments, having sophisticated firmware measurement routines to facilitate operations. Software can be loaded via the spectrum analyzer's memory card interface, and the instruments can perform automatic measurements to meet the requirements of IS-55. Their GPIB interface enables them to function within a larger ATE system under computer control. Line-limit evaluation with pass/fail results can also be performed, making the analyzers useful in high-speed production testing.

Characteristics

Frequency Range –
When used with R3265A or R3365A – For PDC and NADC: 450 kHz to 8 GHz. For PHP: 10 MHz to 8 GHz.
When used with R3271A or R3371A – For PDC and NADC: 450 kHz to 26.5 GHz. For PHP: 10 MHz to 26.5 GHz.

Modulation System – For PDC and NADC: π/4 DQPSK. For PHP: π/4 DQPSK.

Measurement Input Level – –30 to +30 dBm Modulation (R3265A/R3365A or R3271A/R3371A input).

Modulation Accuracy (RMS) –
Measurement Range: 0 to 30%.
Measurement accuracy – For PDC and NADC: <0.5%±2% of measured value (RBW 3 MHz). For PHP: <1%±2% of measured value (RBW 3 MHz).

Frequency Error –
Measurement Range – For PDC and NADC: ±1.4 kHz. For PHP: ±13 kHz.
Accuracy: Accuracy of reference frequency source ±5 Hz.

Carrier Leakage –
Measurement Range: For PDC and PHP, –15 dB or lower. For NADC, –20 dB or lower.
Accuracy: ±0.5 dB (down to –35 dB).

Other Measurement Functions – Phase error (RMS). Amplitude error (RMS). Burst amplitude droop. 10-burst measurement (NADC only). Averaging function (displays average, maximum, minimum, and standard deviation of up to 50 measurements). Root Nyquist Filter: 0.5 ON/OFF.

NOTE: For complete specification information on the Advantest R3265A, R3365A, R3271A, or R3371A portable spectrum analyzers, *see pages 202 to 205.*

ORDERING INFORMATION

R2465A
Digital Radio Transmitter Analyzer **$57,000**
Includes: Power Cord, Front Cover, Instruction Manual.

R2465B
Digital Radio Transmitter Analyzer
with Tracking Generator **$66,500**
Includes: Power Cord, Front Cover, Instruction Manual.

R2471A
Digital Radio Transmitter Analyzer **$63,000**
Includes: Power Cord, Front Cover, Instruction Manual.

R2471B
Digital Radio Transmitter Analyzer
with Tracking Generator **$72,500**
Includes: Power Cord, Front Cover, Instruction Manual.

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty
Repair Protection ..... **+$1,130**

RECOMMENDED ACCESSORIES
Automatic Measurement Software for Digital Mobile Communication:
PDC Software (for Mobile Station) – Order PR326501-IC *1
PDC Software (for Base Station) – Order PR326511-IC *1
PDC Software (for Both Mobile and Base Station) –
Order PR326541-IC *1
NADC Software (for Mobile Station) – Order PR326502-IC *1
PDC/NADC Software (for Mobile Station) –
Order PR326521-IC *1
PHP Software (for Mobile Station) – Order PR326504-IC *1
GSM Software (for Mobile Station) – *1
GSM Software (for Base Station) – *1

1 Contact your Tektronix representative for price information.

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

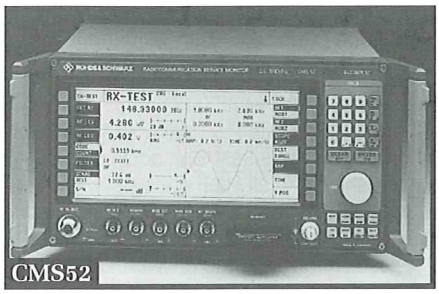
CMS50
CMS52

Communications Test Sets

The ideal radio tester for service, maintenance, and test departments.

CMS50/CMS52

- Compact, Versatile and Full-featured Radio-telephone Tester
- Low Weight and Small Size for Stationary, Portable, and Mobile Use
- High-contrast Backlit LCD Screen with Large Characters and Simultaneous Indication of All Settings and Results
- Numerous Additional Features Such as Spectrum Monitor, Oscilloscope, Continuously Tunable Distortion Meter, and Adjustable AF Filters
- Learn Mode for Easy Programming
- Signaling Unit for Cellular Radio, e.g. E-AMPS, Trunked Radio, Paging Systems, and ZVEI Digital
- High-sensitivity Second IF Input for Off-air Measurements; Can Be Used Independently for Testing Modules, Including Frequency Converting DUTs
- Full-duplex Operation Without Compromise on Measurements
- Remote Control via IEC/IEEE Bus
- Automatic Self-adjustment Functions and Comprehensive Self-test
- Built-in Automatic Test Routines for Recurring Test Sequences



CMS52

CMS50/CMS52 Radiocommunication Service Monitor

The CMS52 Radiocommunication Service Monitor is the ideal radio tester for service, maintenance, and test departments. With its full-featured configuration plus additional test facilities, it not only satisfies all requirements of radio measurements, but is also able to perform tests in related fields. The lightweight and compact instrument is particularly suitable for mobile use. With its extensive test facilities, it is also a valuable aid in development laboratories.

The CMS50 Radiocommunication Service Monitor is a budget-priced version of the CMS52 providing much of the same measurement capabilities. Differences are in the basic configuration, variety of options, and data tolerances (see following information).

OVERVIEW OF OPERATION

The CMS has a large, high-resolution LCD screen with backlighting and graphics capability. It is operated via softkeys at both sides of the display. A straight forward menu structure allows fast, direct access to the test facilities provided by the CMS50/52. Numbers and units can be entered directly via the keyboard; settings can be varied by means of the spinwheel with variable step size.

In the learn mode, the CMS stores all manual settings and measurements and produces a ready-to-start automatic test routine. The user doesn't need to have any programming knowledge or learn equipment-specific command sets. Tolerances, comments, and conditions (e.g., loops, jumps, queries, and control commands) can be easily inserted into these test routines. Generated programs and test results can be saved on a memory card. Programs and test results can be output to an optional printer.

Characteristics

TIMEBASE

Timebase/Standard –

Temperature Effect (0° to +35°C): ≤1 x 10^{-6}.
Aging: ≤1 x 10^{-7}/day; ≤1 x 10^{-6}/month ≤2 x 10^{-6}/year.

RECEIVER MEASUREMENTS

Signal Generator –

Frequency Range: 0.4 MHz to 1 GHz.
Frequency Resolution: CMS52, 10 Hz; CMS50, 50 Hz.
Frequency Error: Same as timebase.
Level – FM: φM, CW: ≤–134 to 0 dBm.
AM: –134 to –3 dBm.
Level Resolution: 0.1 dB.
Fine Variation of Level – FM: φM, CW: 0 to –19.9 dB, non-interrupting. AM: 0 to –4.9 dB, non-interrupting.
Level Error (level ≤–3 dBm, f > 1 MHz): ≤2 dB.
Harmonics: CMS52, ≤–25 dBc; CMS50, ≤–20 dBc.
Non-harmonics: ≤–50 dBc (≤5 kHz from carrier, level –3 dBm).
Residual AM (CCITT, RMS): CMS52, ≤0.03%; CMS50, ≤0.1%.
Residual FM (CMS52) (CCITT, RMS) – 400 kHz to 250 MHz, 500 MHz to 1 GHz: ≤10 Hz. 250 to 500 MHz: ≤5 Hz.
Residual FM (CMS50) (CCITT, RMS): ≤10 Hz.
Phase Noise (CMS52): ≤–110 dBc/Hz (20 KHz from Carrier).

Modulation –

Frequency range: CMS52, 0.4 MHz to 1 GHz; CMS50, 2 to 500 MHz.
AM Modulation Depth: 0 to 99%.
Resolution: 0.5%.
Modulation Frequency Range (CMS52): f <8 MHz, DC to 10 kHz; f ≥8 MHz: , DC to 20 kHz. (CMS50): 15 Hz to 10 kHz. f<8 MHz.
Modulation Distortion (m <0.8, f_{AF} = 1 kHz): ≤2%.
Modulation Error (m <0.8, f_{AF} = 300 Hz to 3 kHz): ≤5% + resolution + residual AM.

FM Deviation: CMS52, 0 to 100 kHz; CMS50, 50 Hz to 50 kHz.
Resolution: Δf <100 Hz, 1 Hz; Δf ≥100 Hz, 1%.
Modulation Frequency Range: 20 Hz to 20 kHz; suitable for POCSAG.
Modulation Distortion (f_{AF} = 1 kHz, Δf <1 kHz): ≤1%.
Modulation Error: ≤5% + resolution + residual FM.

APPLICATIONS

- **Radiocom Tests**
- **Portable and Handheld Mobile**
- **Phone Test**

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

φM Deviation (internal): 0 to 10 rad.
Resolution: Δφ <0.1 rad, 1 mrad; Δφ ≥0.1 rad, 1%.
Modulation Frequency Range: 100 Hz to 6 kHz.
Modulation Distortion (f_{AF}=1 kHz, Δφ ≤1 rad): ≤1%.
Modulation Error: ≤5% + resolution + residual φM.

Modulation Modes: Internal (single tone/two-tone), external, internal + external.

AF Voltmeter –
Frequency Range: 50 Hz to 20 kHz.
Measurement Range: 0.1 mV to 30 V.
Resolution – V <10 mV: 100 µV. V ≥10 mV: 1%.
Error: <5% + resolution.
Input Impedance: Approximately 1 MΩ.

Distortion Meter, SINAD Meter, AF Frequency Counter – See transmitter and receiver measurements.

TRANSMITTER MEASUREMENTS

RF Power Meter –
Frequency Range: CMS52, 1.5 MHz to 1 GHz; CMS50, 2 MHz to 1 GHz.
Measurement Range: 5 mW to 50 W.
Resolution – P <100 mW: 1 mW.
P≥100 mW: 1%.
Error (P >20 mW, AM = 0%): ≤0.4 dB + resolution.

RF Frequency Counter –
Frequency Range: 0.5 MHz to 1 GHz.
Input Level Range: 5 mW to 50 W.
Resolution: 10 Hz, 1 Hz.
Error: Same as timebase + resolution.

Frequency Deviation Meter –
Operating Modes: +PK, –PK, ±PK/2, PK HOLD, RMS, RMS $\sqrt{2}$.
Input Level Range: 5 mW to 50 W.
RF Frequency Range: 1.5 MHz to 1 GHz.
Deviation Measurement Range: CMS52, 0 Hz to 100 kHz; CMS50, 0 Hz to 50 kHz.
AF Frequency Range: CMS52, 20 Hz to 20 kHz; CMS50, 20 Hz to 15 kHz.
Resolution – Δf <1 kHz: 1 Hz. Δf ≥1 kHz: 1%.
Residual FM (CCITT, RMS): ≤10 Hz.
Error: ≤5% + resolution + residual FM.

Phase Deviation Meter –
Operating Modes: +PK, –PK, ±PK/2, RMS, RMS $\sqrt{2}$.
Input Level Range: 5 mW to 50 W.
RF Frequency Range: 1.5 MHz to 1 GHz.
Measurement Range: 0.001 to 5 rad.
AF Frequency Range: 300 Hz to 6 kHz.
Resolution – Δφ ≤0.1 rad: 0.001 rad.
Δφ >0.1 rad: 1%.
Error: Same as frequency deviation meter + 2% frequency response.

AM Depth Meter –
Operating Modes: +PK, –PK, ±PK/2, RMS, RMS $\sqrt{2}$.
Input Level Range: 20 mW to 50 W.
RF Frequency Range: 1.5 MHz to 1 GHz.
Modulation Depth Measurement Range: 0.01% to 99%.
AF Frequency Range: CMS52, 50 Hz to 20 kHz; CMS50, 50 Hz to 10 kHz.
Resolution – m<0.1: 0.01%. m ≥0.1, 0.1%.
Residual AM (CCITT, RMS): ≤0.03%.
Error (m ≤0.8, f_{AF} = 0.3 to 3 kHz): ≤7% + resolution + residual AM.
Distortion Meter, SINAD Meter, AF Frequency Counter: See transmitter and receiver measurements.

RF Spectrum Monitor –
Frequency Range: 1 MHz to 1 GHz.
Reference Level: +47 to –47 dBm. (Input 1)
Display Dynamic Range: >60 dB (≥7 dBm reference level at input 1).
Span: 0 (zero span) to 50 MHz.
Filters (3-dB bandwidth): 150 Hz, 6 kHz, 16 kHz, 50 kHz, 300 kHz, 1/3 MHz (coupled to span).
Error: ≤3 dB + resolution.

Tracking Generator (Option 04 or 24 required) **–**
Frequency Range: 400 KHz to 1 GHz.
Reference Level: –27 to –67 dBm.
Display Dynamic Range – f = 1 to 500 MHz: 50 dB. f = 500 MHz to 1 GHz: 45 dB.
Span: 0 (zerospan) to full span.
Filters (3-dB bandwidth): 150 Hz, 6 kHz, 16 kHz, 50 kHz, 300 KHz, 1/3 MHz (Coupled to span).
Error: <3 dB (<0.5 dB with relative measurement). Resolution 0.4 dB.
Output Level: 0 to –128 dBm.
Frequency Offset: 0 to ±999 MHz (depending on span and center frequency).

TRANSMITTER MEASUREMENTS AT 2ND RF INPUT

Second RF Input – Measurement of RF frequency, modulation (AM, FM , φM), modulation frequency and spectrum (level) of small RF signals (e.g., in off-air or module measurements, for low input levels).

RF Frequency Counter – 30 µV (selective frequency counter with presetting).

Modulation Meter –
IF narrow: 5 µV.
IF narrow, selective measurement: 1 µV.

Selective Level Measurement –
Without Weighting Filter: –75 to –35 dBm.
With 2 kHz Resonance Filter: –100 to –35 dBm.

TRANSMITTER AND RECEIVER MEASUREMENTS

Modulation Generator I and II –
Frequency Range: CMS52, 20 Hz to 30 kHz; CMS50, 20 Hz to 20 kHz.
Frequency Resolution: 0.1 Hz.
Frequency Error: Same as timebase + 1/2 x resolution.
Output Level Range: 10 µV to 5 V.
Resolution – V <1 mV: 10 µV. V ≥1 mV: 1%.
Error V >1 mV: ≤5%.
Output Impedance: ≤4 Ω.
Maximum Output Current (peak): 20 mA.
Distortion: ≤0.5%.

Distortion Meter –
Frequency: CMS52, 100 Hz to 5 kHz in 10-Hz steps; CMS50, 100 Hz to 3 kHz in 10-Hz steps.
Input Level Range: 100 mV to 30 V.
Measurement Range: 0.1 to 50%.
Resolution: 0.1%.
Inherent Distortion: ≤0.5%.
Measurement Bandwidth Weighting: 12 kHz.
Error: ≤5% + inherent distortion.

SINAD Meter –
Frequency: CMS52, 100 Hz to 5 kHz ±10 Hz; CMS50, 1 kHz ±10 Hz.
Measurement Range: 1 to 46 dB.
Input Level Range: 100 mV to 30 V.
Resolution: 0.1 dB.
Weighting Bandwidth: 12 kHz.
Error: ≤1 dB + inherent distortion.

AF Frequency Counter –
Operating Modes: Demodulation, AF, beat (frequency offset), external.
Frequency Range: CMS52, 20 Hz to 500 kHz, CMS50, 20 Hz to 20 kHz (superimposed RF).
Input Level Range (f <20 kHz): 10 mV to 30 V.
Resolution 1 Hz/0.1 Hz.
Error: Same as timebase + resolution.

Oscilloscope –
Bandwidth – DC: DC to 20 kHz; AC: 10 Hz to 20 kHz.
Horizontal Deflection: 20 to 0.1 ms/div.
Vertical Deflection: Scaled in kHz (FM), rad (φM), % (AM), mV/V (AF).
Input Level Range: 0 to 40 V peak.
Input Impedance: Approximately 1 MΩ.

CMS50
CMS52

Communications Test Sets

AF Filters –
Highpass f_{cutoff} = 300 Hz (attenuation at 200 Hz, typical 40 dB).
Lowpass f_{cutoff} = 3.4 kHz (attenuation at 10 kHz, typical 40 dB).
Bandpass (broadband): Highpass + lowpass.
Bandpass (narrowband): CMS52, 50 Hz to 5 kHz in 10-Hz steps; attenuation typical 40 dB for 0.8xf and 1.2xf. CMS50, 50 Hz to 3 kHz in 10-Hz steps, attenuation typical 40 dB for 0.8xf and 1.2xf.
Notch Filter: CMS52, 100 Hz to 5 kHz in 10-Hz steps, +40 dB; CMS50, 100 Hz to 3 kHz in 10-Hz steps, typ. 40 dB.
CCITT Filter: See Opt. 03 or 06.

Selective Call Encoder/Decoder – Tone Sequences: ZVE11, 2/CCIR/EIA/EEA/EURO/NATEL/CCITT/VDEW/DTMF/VDEW direct dialing/user-defined sequences.

Audio Monitor (loudspeaker) – Demodulated signal, AF signal, beat (frequency offset).

OTHER CHARACTERISTICS

IEC/IEEE Bus (CMS52 only) – Interface to IEC 625-1 (IEEE 488) with listener/talker function.

POWER REQUIREMENTS

AC –
Line Voltage: 100, 120, 220, 240 V AC ±10%.
Line Frequency: 47 to 420 Hz.

DC – 11 to 32 V.

Power Consumption – 50 W.

ENVIRONMENTAL CHARACTERISTICS

RFI Suppression – To VDE 0871/0875 and postal regulations 1046/84.

Operating Temperature Range – 0 to +50°C.

Storage Temperature Range – –40 to +70°C.

Shock, Vibration, and Humidity Testing – To MIL-T-28800, type III, class 3, style C.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	175	6.9
Width	320	12.6
Depth	375	14.8
Weight	**kg**	**lb.**
Net	13	28.7

ORDERING INFORMATION

CMS50 (IEC/IEEE is an option)
Radiocommunication Service Monitor *1
Includes: Power Cable, Spare Fuses, Manual.

CMS52
Radiocommunication Service Monitor *1
Includes: Power Cable, Spare Fuses, Manual.

Opt. 01/CMS-B1 – OCXO Reference Oscillator for high long-term stability. Temperature effect 0 to 50°, ≤1 x 10^{-7}; aging, ≤5 x 10^{-9}/day after 30 days of operation ≤2 x 10^{-7}/year **$695**

Opt. 02/CMS-B2 – OCXO Reference Oscillator for more exacting requirements on long-term stability. Specifications same as Opt. 01 except for aging: ≤1 x 10^{-7}/year **$1,290**

Opt. 03/CMS-B5 – Control Interface **$895**

Opt. 04/CMS-B9 (CMS52 only) – Duplex Modulation Meter for measurements on duplex radios, cellular radio phones, relay stations, and frequency-converting modules (two-part measurements, also, on frequency-converting DUTs). Including Adjacent Channel Power (ACP) meter. Dynamic range, ≥70 dB with 25 kHz Channel Spacing **$1,420**

Opt. 05/CMS-B13 (CMS52 only) – Signaling Unit for Cellular Radio. (also requires Opt. 04 or 24) Same as Opt. 20 with the addition of C-Net **$2,550**
Note: Opt. 20 may be used as an alternative to Opt. 05

Opt. 06/CMS-B20 – U/I DC Meter, CCITT Filter, DTMF Decoder **$1,170**

Opt. 07/CMS-B21 (CMS52 only) – Programmable Universal Modem for FFSK Signals (instead of Opt. 05). For modulation and demodulation of data. Bit rate, 10 to 2400 Hz **$2,960**

Opt. 08/CMS-B22 – 10-MHz Reference Frequency Input/Output for external synchronization of measuring systems. Output, TTL levels; Z_{out}, 50 Ω; f, 10 MHz. Input, level >1.5 V p-p; Z_{in}, 50 Ω; f, 10 MHz ±500 Hz **$120**

Opt. 09/CMS-B25 (CMS52 only) – NMT Base Station Test Software for Opt. 05 in conjunction with Opt. 18 ..... **+$990**

Opt. 10/CMS-B26 (for Opt. 05 or 20) **–** POCSAG, ZVEI/VDEW Digital Signaling Software for testing of POCSAG radio-paging receivers and ZVEI/VDEW mobile and base stations ..... **+$795**

Opt. 11/CMS-B28 (for Opt. 05 or 20) **–** MPT 1327/1343 Software Signaling for testing of trunked radio networks **$795**

Opt. 13/CMS-B30 – RS-232-C Interface for remote control of DUTs **$535**

Opt. 14/CMS-B31 – Additional RF Input/Output for two-signal measurements and connection of further measuring instruments; bidirectional RF connector for additional measuring instruments. Maximum input power, 20 mW; Attenuation RF_{IN} to RF_{OUT}, 32 dB **$340**

Opt. 15/CMS-B32 – 100-W RF Power Meter for measurement of high RF input power. Measurement range, 10 mW to 100 W; **$525**

Opt. 16/CMS-B33 (for Opt. 03 or 22) **–** 300-Hz Lowpass Filter for fast frequency and deviation measurement of unknown modulated subaudio tones. Attenuation approximately 50 dB at frequencies above 300 Hz **$195**

Opt. 17/CMS-B34 – 13 dBm Output **$1,140**

Opt. 18/CMS-B39 – 600 Ω AF Transformer **$1,560**

Opt. 19/ZZA-99 – 19 inch Adapter *1

Opt. 20/CMS-B53 – Signaling Unit for Cellular Radio. (also requires Opt. 04 or 24) NMT 450 (SIS), NMT 900 (SIS), E-AMPS, E-TACS, J-TACS, TACS Issue 4, R 2000 ..... **$1,975**
Note: Opt. 05 may be used as an alternative to Opt. 20.

Opt. 21/CMS-B54 (CMS50) – IEC/IEEE Bus Interface **$250**

Opt. 22/CMS-B55 – Centronics Interface **$475**

Opt. 23/CM-Z30 – ERMES Coder with Software **$5,150**

Opt. 24/CMS-B27 – Same as Opt. 04, but without Adjacent Channel Power (ACP) meter **$1,100**

SERVICE ASSURANCE OPTIONS

Opt. R2 – Adds two years of post-warranty Repair Protection ..... **+$400**

ADDITIONAL ACCESSORIES

See Page 446 for complete selection information.

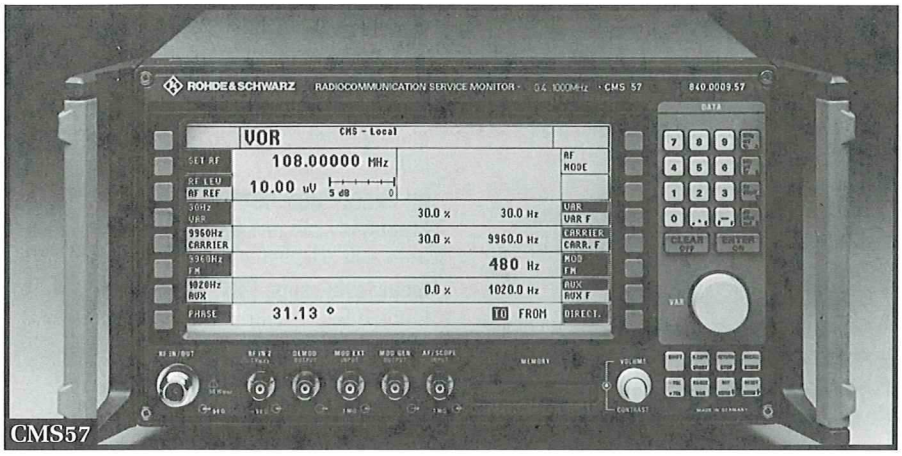
**1 Contact your Tektronix representative for price information.*

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Communications Test Sets



CMS57

CMS54/57 Radiocommunication Service Monitors

The CMS54 is the big brother of the CMS52. The CMS57 is the Avionics specialist. The CMS54 and CMS57 Radiocommunication Service Monitors can be used for all transmitter and receiver measurements on transceivers with AM, FM, or φM modulation.

The CMS54 is suitable for SSB transceiver testing as well as for measurements on mobile units for cellular and trunked radio networks. This lightweight and compact instrument is particularly suitable for mobile use. With its extensive test facilities, it is also a valuable tool for development laboratories.

The CMS57 includes a built-in VOR/ILS signal generator to generate all test signals for VOR, ILS, and MB tests. This combination of conventional radio-telephone and radio-navigation measurement allows a full range of avionics measurements to be performed by a single instrument.

LARGE, EASY-TO-READ DISPLAY

The CMS54/57 has a large, high-resolution LCD screen with back lighting and graphics capability. Functions are selected via softkeys at both sides of the display. A straightforward menu structure allows fast, direct access to the test facilities provided by the CMS54/57. Numbers and units can be entered directly via the keyboard; settings can be varied by means of the spinwheel with variable step size.

CMS54

- Compact, Versatile, Full-featured Radio-telephone Tester
- Low Weight and Small Size for Stationary, Portable, and Mobile Use
- High-contrast Backlit LCD Screen with Large Characters and Simultaneous Indication of All Settings and Results
- Numerous Additional Features Such as Full-span Spectrum Monitor, Oscilloscope, Transient Frequency/Power Measurements, Harmonic Measurement, Continuously Tunable Distortion Meter, and Adjustable AF Filter
- Learn Mode for Easy Programming
- Signaling Unit for Cellular Radio, e.g. E-AMPS, Trunked Radio, Paging Systems, and ZVEI Digital
- High-sensitivity Second IF Input for Off-air Measurements; Can Be Used Independently for Testing Modules, Including Frequency Converting DUTs
- Remote Control via IEC/IEEE Bus
- Automatic Self-adjustment Functions and Comprehensive Self-test

CMS57

- All Features of CMS52
- Built-in VOR/ILS Generator

The ideal radio tester for R&D, maintenance, and test departments.

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

APPLICATIONS

- **High-end Radiocommunications Test**
- **RF Module R&D**
- **Portable and Handheld Mobile Phone Test**
- **VOR (VHF Omnidirectional Range)**
- **ILS (Instrument Landing System)**
- **MB (Marker Beacon)**
- **Autopilot**

CMS54
CMS57

Communications Test Sets

Characteristics (CMS54)

All characteristics of the CMS52 are fully applicable.

RF SPECTRUM MONITOR
Frequency Range – 1 to 1000 MHz

Span – 0 (zero span) to 50 MHz; full span for frequency range 10 to 10000 MHz

Reference Level – +47 to -47 dBm (input 1)

Sensitivity – <-110 dBm (for resolution filter; ±6 kHz and reference level ≤37 dBm at input 2 f ≥10 MHz)

Inherent Spurious Responses – <-50 dBc (for reference level >10 dBm and f >50 MHz)

Display Dynamic Range – >65 dB (for reference level >-7 dBm at input 1)

Scaling – 2/5/10 dB/div

Display Range – ≤80 dB

Resolution Filter (3 dB bandwidth) – 150 Hz (for modulation analysis), 6/16/50/300 kHz/1/3 MHz (for full span), coupled to span

Error – <3 dB + resolution

Resolution – 0.4 dB

TRANSIENT RECORDER
Measurement of power and frequency as a function of time with graphical display and selectable zoom

Time scale – 50 us/div to 1 s/div, max. recording time 40 s

Frequency transients –
RF measurement range: 1 to 1000 MHz
FM deviation measurement range: 0 to ±100 kHz
Scaling: 0.5 to 50 kHz/div
Triggering: internal, automatic (frequency changes >8 kHz)

Power transients –
RF measurement range: 1 to 1000 MHz
Display dynamic range: 60 dB (for 47 dBm at input 1)
Scaling: 2/5/10/20 dB/div
Triggering: internal, automatic (power 10%)

HARMONIC MEASUREMENTS
Display of 1st to 4th harmonic

Max. harmonic frequency – 1000 MHz

Dynamic range – >60 dB; >90 dB in frequency range 26.965 to 27.405 MHz (CB radio)

RF FREQUENCY COUNTER
Frequency range – 0.5 to 1000 MHz (usable from 100 kHz, IF narrow)

Input level range (CW, FM) –
Input 1: 0 to +47 dBm;
Input 2: -40 to +7 dBm

TRANSMITTER MEASUREMENT, 2ND RF INPUT
Additional internal switch-selectable 0/24 dB attenuator pad for measurements with higher levels at Input 2

SIGNAL GENERATOR
Frequency range – 0.4 to 1000 MHz (usable from 100 kHz)

CHARACTERISTICS (CMS57)

All characteristics of the CMS52 are fully applicable.

VOR/ILS generator

VOR	Range	Resolution	Error
Phase RF output	0 to 360°	0.01°	typ. 0.05°
AF output	0 to 360°	0.01°	≤0.04°
9960-Hz carrier			
Modulation frequency	7.9 to 12 kHz		
Amplitude modulation			
–128 to –9 dBm	0 to 100%	0.1% AM	typ. <2% for 30% AM
-85 to -45 dBm	0 to 100%	0.1% AM	<2% for 30% AM
FM deviation	384 to 576 Hz	1 Hz	≤1 Hz
30-Hz VAR			
Modulation Frequency	24 to 36 Hz		
Amplitude modulation			
-128 to -9 dBm	0 to 100%	0.1% AM	typ. <2% for 30% AM
-85 to -45 dBm	0 to 100%	0.1% AM	<2% for 30% AM
1020-Hz AUX			
Modulation frequency	50 Hz to 20 kHz		
Amplitude modulation	0 to 100%	0.1% AM	≤3%, for 1020 Hz and 10 to 20% AM
ILS			
90-Hz and 150-Hz phase	0 to 108°, referred to 150 Hz	0.01°	≤1°
90-Hz tone			
Modulation frequency	72 to 108 Hz		
150-Hz tone			
Modulation frequency	120 to 180 Hz		
1020-Hz tone (AUX)			
Modulation frequency	50 Hz to 20 kHz		
Amplitude modulation	0 to 100%	0.1% AM	≤3%, for 1020 Hz and 10 to 20% AM
ILS Localizer			
Amplitude modulation			
-128 to -9 dBm	0 to 50%	0.01% AM	typ. <2% for 20% AM
-85 to -45 dBm	0 to 50%	0.1% AM	<2% for 20% AM
DDM1) RF output	±0 to 0.4 DDM for 20% AM	0.001 DDM	
On-course error, -128 to -9 dBm			<0.0004 DDM
Off-course error, -128 to -9 dBm			<2% + 0.0004 DDM for IDDMI ≤0.2
DDM AF output	*0 to 0.4 DDM for 20% AM	0.001 DDM	≤3% + 0.0002 DDM for IDDMI ≤0.4, AF level 0.5 to 5 V
ILS Glideslope			
Amplitude modulation			
-128 to -9 dBm	0 to 50%	0.1% AM	typ. <2% for 40% AM
-85 to -45 dBm	0 to 50%	0.1% AM	<2% for 40% AM
DDM RF output	±0 to 0.8 DDM for 40% AM	0.001 DDM	≤3% + 0.002 DDM for IDDMI ≤0.4, AF level 0.5 to 5V
Marker beacon (MD)			
Modulation frequency	400, 1300, 3000 Hz		
Amplitude modulation	0 to 100%	0.1% AM	≤5% for 95% AM
1020-Hz tone (AUX)			
Modulation frequency	50 Hz to 20 kHz		
Amplitude modulation	0 to 100%	0.1% AM	≤5% + resolution + residual AM

**1 Difference in Depth of Modulation; describes the modulation depth difference between the 90-Hz and the 150-Hz tone; IDDMI=I (90-MHz modulation in % – 150-Hz modulation in %) 1/100%.*

CMS54 / CMS57 Communications Test Sets

OTHER

IEC/IEEE Bus – Interface to IEC 625-1 (IEEE 488) with listener/talker function.

POWER REQUIREMENTS

AC –
Line Voltage: 100, 120, 220, 240 V AC ±10%.
Line Frequency: 47 to 420 Hz.

DC – 11 to 32 V.

Power Consumption – 50 W.

ENVIRONMENTAL CHARACTERISTICS

RFI Suppression – To VDE 0871/0875 and postal regulations 1046/84.

Operating Temperature Range – 0 to +50°C.

Storage Temperature Range – –40 to +70°C.

Shock, Vibration, and Humidity Testing – To MIL-T-28800, Type III, Class 3, style C.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	175	6.9
Width	320	12.6
Depth	375	14.8
Weight	**kg**	**lb.**
Net	13	28.7

ORDERING INFORMATION

CMS54 (INCLUDES OPT. 04)
Radiocommunication Service Monitor *1

CMS57
Radiocommunication Service Monitor *1
Includes: Power Cable, Spare Fuses, Manual.

Opt. 01/CMS-B1 – OCXO Reference Oscillator for high long-term stability. Temperature, ≤1 x 10^{-7}; aging, ≤5 x 10^{-9}/day after 30 days with ≤2 x 10^{-7}/year **$695**

Opt. 02/CMS-B2 – OCXO Reference Oscillator for more exacting requirements on long-term stability. Specifications same as Opt. 01 except for aging: ≤1 x 10^{-7}/year **$1,290**

Opt. 03/CMS-B5 – Control Interface **$895**

Opt. 04/CMS-B9 (CMS57) – Duplex Modulation Meter for measurements on duplex radios, cellular radio phones, relay stations, and frequency-converting modules (two-part measurements, also, on frequency-converting DUTs). Including Adjacent Channel Power (ACP) meter. Dynamic range, ≥70 dB with 25 kHz Channel Spacing **$1,420**

Opt. 05/CMS-B13 – Signaling Unit for Cellular Radio. (also requires Opt. 04 or 24) Same as Opt. 20 with the addition of C-Net **$2,550**
Note: Opt. 20 may be used as an alternative to Opt. 05

Opt. 06/CMS-B20 – U/I DC Meter, CCITT Filter, DTMF Decoder **$1,170**

Opt. 07/CMS-B21 – Programmable Universal Modem for FFSK Signals (instead of Opt. 05). For modulation and demodulation of data. Bit rate, 10 to 2400 Hz **$2,960**

Opt. 08/CMS-B22 – 10-MHz Reference Frequency Input/Output for external synchronization of measuring systems. Output, TTL levels; Z_{out}, 50 Ω; f, 10 MHz. Input, level >1.5 V p-p; Z_{in}, 50 Ω; f, 10 MHz ±500 Hz **$120**

Opt. 09/CMS-B25 – NMT Base Station Test Software for Opt. 05 in conjunction with Opt. 18 ..... **+$990**

Opt. 10/CMS-B26 (for Opt. 05 or 20) – POCSAG, ZVEI/VDEW Digital Signaling Software for testing of POCSAG radio-paging receivers and ZVEI/VDEW mobile and base stations ..... **+$795**

Opt. 11/CMS-B28 (for Opt. 05 or 20) – MPT 1327/1343 Signaling for testing of trunked radio networks **$795**

Opt. 13/CMS-B30 – RS-232-C Interface for remote control of DUTs **$535**

Opt. 14/CMS-B31 – Additional RF Input/Output for two-signal measurements and connection of further measuring instruments; bidirectional RF connector for additional measuring instruments. Maximum input power, 20 mW; Attenuation RF_{IN} to RF_{OUT}, 32 dB **$340**

Opt. 15/CMS-B32 – 100-W RF Power Meter for measurement of high RF input power. Measurement range, 10 mW to 100 W; **$525**

Opt. 16/CMS-B33 (for Opt. 05 or 20) – 300-Hz Lowpass Filter for fast frequency and deviation measurement of unknown modulated subaudio tones. Attenuation approximately 50 dB at frequencies above 300 Hz **$195**

Opt. 17/CMS-B34 – 13 dBm Output **$1,140**

Opt. 18/CMS-B39 – 600 Ω AF Transformer **$1,560**

Opt. 19/ZZA-99 – 19 inch Adapter *1

Opt. 20/CMS-B53 – Signaling Unit for Cellular Radio. (also requires Opt. 04 or 24) NMT 450 (SIS), NMT 900 (SIS), E-AMPS, E-TACS, J-TACS, TACS Issue 4, R 2000 ..... **$1,975**
Note: Opt. 05 may be used as an alternative to Opt. 20.

Opt. 22/CMS-B55 – Centronics Interface **$475**

Opt. 23/CM-Z30 – ERMES Coder with Software **$5,150**

Opt. 24/CMS-B27 (CMS57) – Same as Opt. 04, but without Adjacent Channel Power (ACP) meter **$1,100**

Opt. 25/CMS-B38 (CMS57 only) – Autopilot Generator for ILS Operation *1

SERVICE ASSURANCE OPTIONS

Opt. R2 – Adds two years of post-warranty Repair Protection
CMS54 ..... **+$400**
CMS57 ..... **+$590**

ADDITIONAL ACCESSORIES

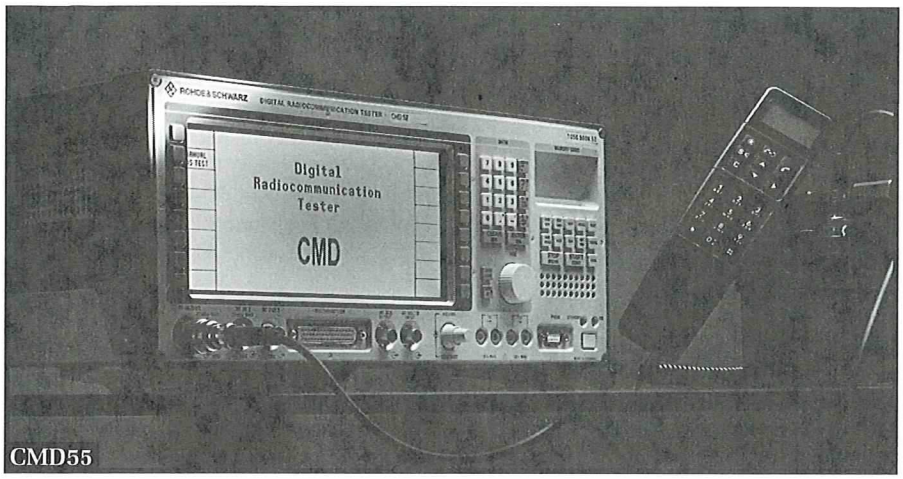
See page 446 for complete selection information.

*1 *Contact your Tektronix representative for price information.*

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).



CMD55

CMD55 Digital Radiocommunications Tester

The CMD55 Digital Radiocommunications Tester is a compact unit for testing GSM (Global System for Mobile communications), PCN (DCS 1800), and PCS (DCS 1900) mobiles. It combines small dimensions with high measurement accuracy and speed.

The range or capabilities offered by the CMD55 includes all signaling, generator, and measurement functions required for verifying the correct operation of the device-under-test. GO/NO-GO tests and accurate analysis using optional extensions makes the CMD55 equally well suited for service and production.

SIMPLE OPERATION

Operation of the CMD55 is extremely user-friendly and requires no detailed GSM knowledge in order to make accurate measurements. The high-contrast, backlit LCD provides a clear display of measurement results. Softkeys along both sides of the display allows convenient call-up of test routines under menu control. Selected parameters and measured values are displayed in easy-to-read form.

Various specific parameters are preset and permit direct testing without any operator control. The operator can modify all parameters individually in the configuration menus for customized testing.

TEST CAPABILITIES

For testing mobile phones, the CMD55 simulates a GSM, PCN, and PCS (with Option 10) base station. Using its two RF synthesizers, it delivers a continuous BCCH signal in addition to the TCH.

Characteristics

Timebase TCXO (standard) –
Nominal Frequency: 10 MHz.
Frequency Drift (0 to 35°C): ≤1.5 x 10^{-6}.
Aging (at 35°C): ≤0.5 x 10^{-6}/year.

Timebase OCXO (with Option 01) –
Nominal Frequency: 10 MHz.
Frequency Drift (0 to 50°C): ≤1 x 10^{-7}.
Aging: ≤5 x 10^{-9}/day (after 30 days of operation/); ≤2 x 10^{-7}/year.
Warmup Time (at 25°C): Approximately 5 minutes.

RF Generator –
Frequency Range: GSM/DCS 1800/DCS 1900 bands.
Frequency Error: Same as timebase.
Resolution: Same as channel spacing in the GSM Band and DCS Band.
Frequency Setting Time: ≤3 ms for phase error <2°.
Output Level – RF IN/OUT socket: –5 to –120 dBm. RF OUT 2: +1 to –77 dBm.
Resolution: 0.1 dB.
Level Error – RF IN/OUT socket: ≤1.5 dB (≤1 dB at –104 dBm). RF OUT 2 socket: ≤2 dB.
Harmonics RF IN/OUT: ≤–30 dBc.
Modulation: GMSK, B x T = 0.3.
Phase Error: ≤4° RMS, ≤10° peak.

Peak Power Meter – RF IN/OUT socket.
Frequency Range: GSM/DCS 1800/DCS 1900 bands.
Measurement Range: 10 to 47 dBm.
Resolution: 0.1 dB.
Error in GSM Band 890.2 to 914.8 MHz: ≤0.5 dB + resolution (P >13 dBm).
VSWR: 1.3.

CMD55

- Low Weight and Small Size for Stationary, Portable, and Mobile Use
- High-contrast Backlit LCD Screen with Large Characters and Simultaneous Indication of All Settings and Results
- Softkey Menu Control for Operator Convenience
- Remote Control via IEC/IEEE Bus (with Option 7)

TEST FUNCTIONS (BASIC UNIT)

- Mobile Synchronization
- Location Update
- Incoming Call Setup
- Outgoing Call Setup
- Mobile Power Level Control
- Channel Charge
- Peak Power Measurement
- SACCH Measurement (e.g., RxLev, RxQual, Power Level)
- Echo Test
- Call Clearing by Mobile
- Call Clearing by CMD55

Compact, versatile, full-featured radio-telephone tester.

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

APPLICATIONS

- **GSM (Global System for Mobile Communications) Testing**
- **DCS-1800**
- **DCS-1900**

Communications Test Sets

DC Voltmeter –
Measurement Range: 0 to ±30 V.
Resolution: 10 mV. Error: ≤2% + resolution.

DC Ammeter –
Modes: Current averaging with GSM-adapted time constant, current peak measurement (positive and negative).
Measurement Range: 0 to ±10 A.
Common-mode Rejection: ±30 V.
Resistance: 50 MΩ.
Resolution for Current Averaging: 1 mA/10 mA.
Resolution for Peak Measurement: 10 mA.
Residual Indication (no current at input): ≤10 mA.
Error: ≤2% + residual + resolution.

Phase and Frequency Error Measurement (with Option 03) –
Frequency Range: GSM/DCS 1800/DCS 1900 bands.
Level Range – RF IN/OUT socket: 0 to 47 dBm.
RF IN 2 socket: –60 to 0 dBm.
Phase Error: ≤1.5° RMS, ≤5° peak.
Reference for Frequency Measurement: Timebase.

Burst Power Measurement (with Option 03) –
Reference level for full dynamic range –
At RF IN/OUT Socket: 10 to 47 dBm. At RF IN 2 socket: –37 to 0 dBm.
Absolute measurement error of peak power: ≤1 dB.

Reference Frequency Inputs/Outputs (with Option 02) –
Synchronization input –
Frequency (selectable): GSM bit clock (270.8 kHz), 2, 4, 16 times GSM bit clock, 1 to 13 MHz in 1 MHz steps, 2.048, 26, 39, 52 MHz. Impedance: Approximately 100 Ω.
Level: 0 dBm to TTL.

Synchronization output 1 –
Frequency: 10 MHz with internal reference or frequency at synchronization input with external reference.
Level: TTL, R_{out} = 50 Ω.

Synchronization output 2 –
Frequency (selectable): GSM bit clock (270.8 kHz), 2, 4, 16 times GSM bit clock, 1, 2, 4, or 13 MHz. Level: TTL, R_{out} = 50 Ω.

IEC/IEEE-Bus Interface (with Option 07) –
Interface to IEC 625-1 (IEEE 488), SCPI-compatible instruction set. Option 04 required.

POWER REQUIREMENTS

Line Voltage – 100 to 120 V AC ±10%, 200 to 240 V AC ±10%.

Line Frequency – 50 to 400 Hz ±5%.

Power Consumption (with options) –
Approximately 85 W.

ENVIRONMENTAL CHARACTERISTICS

Operating Temperature Range – 0 to 45°C to DIN IEC 68-2-1/2.

Storage Temperature Range – –40 to +60°C.

Electromagnetic Compatibility –
Corresponds to requirements of European EMC guidelines (89/336/EEC).

Mechanical Resistance – Sine Vibration: DIN EIC 68-2-6, 5 to 55 Hz, amplitude 0.15 mm, two cycles. Random Vibration: DIN 40046, part 24, 10 to 300 Hz, 10 m/s^2, 5 minutes/axis. Shock: To MIL-STD 810 D, 400 m/s^2, shock spectrum in 6 main axes.

Electrical Safety – VDE 0411, Class 1.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	192	7.6
Width	435	17.1
Depth	363	14.3
Weight	**kg**	**lb.**
(without options)	Approx. 13.5	Approx. 29.8

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

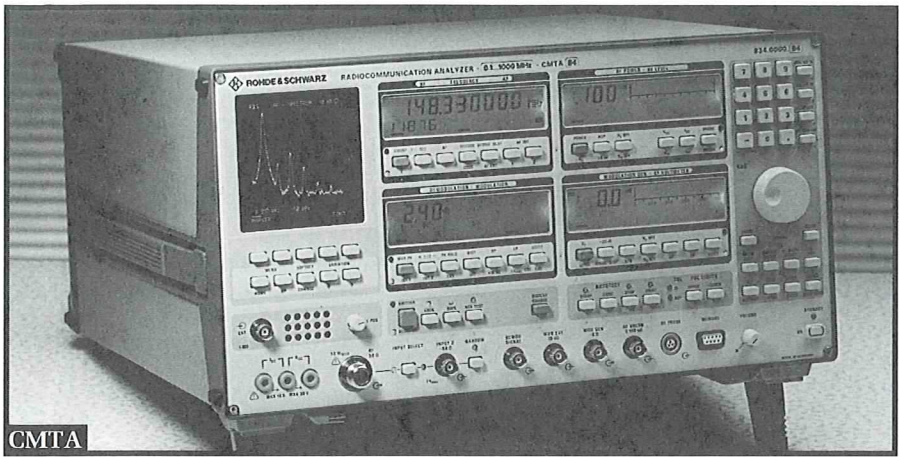
ORDERING INFORMATION

CMD55
Digital Radiocommunication Tester *1
Includes: Power Cord, Spare Fuses, Operating Manual.
Opt. 01/CMD-B1 – OCXO Reference Oscillator *1
Opt. 02/CMD-B3 – Reference Frequency Inputs/Outputs *1
Opt. 03/CMD-B4 – Fast Power Ramp, Phase/Frequency Error, and BER Measurement *1
Opt. 04/CMD-B6 – Bit Interference and TDMA Synchronization. *1
Opt. 05/CMD-B41 – Audio Measurements (Opt. 03 required) *1
Opt. 06/CMD-B42 – High Dynamic Burst Analysis (Opt. 03 required) *1
Opt. 07/CMD-B61 – IEC/IEEE Bus Interface (Opt. 04 required) *1
Opt. 08/CMD-B62 – Memory Card Interface (Opt. 04 required) *1
Opt. 10/CMD-B19 – DCS 1900 Band *1

RECOMMENDED ACCESSORIES
CRT-Z2 – GSM Test SIM *1

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection ..... **+$1,130**

*1 *Contact your Tektronix representative for price information.*



CMTA

CMTA Radiocommunication Analyzer

The CMTA Radiocommunication Analyzer provides complete test capability for radio measurements and related fields. It can perform measurements on AM, FM, φM, and SSB transceivers in mobile and base station radio networks, including cellular radio. A variety of options protects your purchase from obsolescence by allowing you to add additional capability as the need arises. The variety of measurement capabilities provided by the CMTA and its exceptional test depth make it the ideal instrument for development, quality assurance, and acceptance testing.

The CMTA functions as a full-featured electronic minilab. It provides generator, measurement, and control functions along with numerous built-in RF and AF measuring facilities. This allows it to replace the variety of individual instruments and associated cabling normally required for testing.

EASY OPERATION, EVEN FOR BEGINNERS

The logically organized front panel guarantees error-free, self-explanatory operation with fast access to all measuring capabilities. Even the execution of complex routines remains transparent to the user. Test parameters and results are updated continually and the alphanumeric display provides information on the individual steps of a sequence. Keypad polling and results displays operate in a multi-tasking mode to ensure extremely fast tester response.

RESULTS DISPLAYS

Four large, illuminated LCDs simultaneously indicate all results and parameters. Additional quasi-analog displays with clear scaling, selectable range hold, and resolution of 1% facilitate adjustments. Time constants can be selected to match the displays to various requirements. The full-scale values of the quasi-analog displays are optimally matched to the particular measurement and can also be preset for special adjustments.

TESTER SAVES USER A LOT OF WORK

Switchover between transmitter and receiver tests can be triggered either manually or automatically by the transmitter power of the transceiver. Parts of transmitter and receiver tests can be combined as desired with each individual measuring facility being directly addressable.

Auto-run control and printer interface allow automatic runs for complete transceiver testing to be generated, stored, and printed.

INTEGRATE INTO AUTOMATIC TEST SYSTEMS

The IEC/IEEE bus is the key to expanding the CMTA into a fully automatic, computer-controlled universal radio test system. Simple IEC/IEEE bus commands as well as the use of internal, automatic test routines ensure fast generation of test runs. Basic software packages make program generation extremely simple without need for programming knowledge. Individual routines can be called up to run related tests. Eight integrated relays are provided for transceiver settings and for controlling additional devices.

CMTA

- OCXO Reference Oscillator with High Immunity to Temperature Effects and Low Aging
- Programmable Highpass and Lowpass Filters
- Programmable Notch and Resonance Filters
- Distortion and SINAD Meter with Variable Test Frequency
- Additional RF Attenuator for Signal-to-be-Measured, Yielding Maximum Dynamic Range
- Synthesizer-Accurate RF and SSB Analyzer
- Synthesizer-Accurate AF Analyzer
- Storage Oscilloscope with Universal Trigger Facilities
- IEC/IEEE Bus Interface, Relay Matrix
- Two Independent AF Synthesizers
- V/I DC Meter
- DTMF Coder and Decoder
- Transient Recorder
- DC Current/Voltage Measurement
- RF Spectrum Monitor
- Cellular-radio-simulator e.g. AMPS, TACS, Radiocom 2000

The ultimate in radio measurement, plus novel measuring facilities and in-depth testing.

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

APPLICATIONS

- **AM, FM, φM, and SSB Transceiver Testing**
- **Mobile and Base Station Radio Networks**
- **Cellular Radio**
- **Research and Development**
- **Quality Assurance**
- **Acceptance Testing**

CMTA

Communications Test Sets

Characteristics

REFERENCE
Oscillator – OCXO: Reference Oscillator.
Aging: <1 x 10^{-9}/day (<1 x 10^{-6}/month) after 30 days of operation; typically <2 x 10^{-7}/year.
Temperature Effect: <2 x 10^{-9}/°C.
Warm-up Time: None because of standby-mode heating. (60 min.)

RECEIVER MEASUREMENTS
Signal Generator –
Frequency Range: 100 kHz to 1 GHz.
Resolution: 1 Hz.
Frequency Error: <0.5 x Resolution + Reference.

Level –
CW, FM, φM: –137 to +13 dBm.
AM: –137 to + 7 dBm.
Over range without specification: Adjustable to +16 dBm.
Resolution: 0.1 dB.
Fine Variation: 0 to –19.9 dB, non-interrupting.
Level Error for P ≥–127 dBm: ≤±1.5 dB.

Spectral Purity –
Harmonics: <–30 dBc.
Non-harmonics: <–70 to –80 dBc, frequency-dependent.
Spurious AM, RMS at 0.03 to 20 kHz: <0.02%, CCITT-weighted.

MODULATION
Modes – AM, FM, φM, internal/external, AC or DC, multiple modulation, multitone modulation.

Amplitude Modulation –
Modulation Depth: 0 to 99%.
Modulation Frequency Range: DC to 50 kHz.
Resolution: 0.5%.
Modulation Distortion (for 30% AM): <1%.
Error (m <0.8): <5% of setting + spurious AM.

Frequency Modulation –
Maximum Deviation: 50 to 800 kHz, frequency-dependent.
Resolution – Δf <1 kHz: 10 Hz. Δf >1 kHz: ≤1%.
Modulation frequency range – FM DC: DC to 100 kHz. FM AC: 10 Hz to 100 kHz.
Modulation Distortion: <1%.
Error: <5% of setting + residual FM of signal generator.

Phase Modulation –
Phase Deviation: 0 to 80 rad.
Modulation Frequency Range: 300 Hz to 6 kHz.
Error: Same as FM + 2% frequency response.

AF Voltmeter –
Frequency Range: 50 Hz to 20 kHz.
Weighting: RMS, +pk, –pk.
Weighting Filters: See transmitter and receiver measurements.
Measurement Range: 35 V.
Resolution – V <10 mV: 100 µV. V ≥10 mV: 1%.
Error: ≤±3% of reading + resolution.
Input Impedance: ≥100 kΩ.

AF Frequency Counter –
Frequency Range: 20 Hz to 500 kHz.
Resolution: 0.1 Hz/1 kHz, selectable.
Error: Same as reference + resolution.

S/N Meter –
Resolution: 0.1 dB.
Error: <0.5 dB + error due to residual FM/AM of signal generator.

TRANSMITTER MEASUREMENTS
Power Meter –
Frequency Range: 1.5 MHz to 1 GHz.
Measurement Range: 5 mW to 50 W, usable up to 75 W.
Resolution – Display in dBm: 0.1 dBm.
Display in Watt: (P <10 mW), 0.1 mW; (P ≥10 mW), 1%. Error: Typically 0.4 dB + resolution.

RF Frequency Counter –
Frequency Measurement Range: 1 MHz to 1 GHz.
Resolution: 1 Hz/10 Hz, selectable.
Error: Reference + resolution.

Modulation Meter – Specification for duplex off mode.
Operating Modes: +PK, –PK, PK/2, PK HOLD, MAX PK, or RMS.

AM Meter –
Frequency Range: 1.5 MHz to 1 GHz.
Measurement Range: 0.01% to 99%.
Resolution – m <10%: 0.01% AM. m ≥10%: 0.1% AM.
Demodulation Frequency Range: 50 Hz to 20 kHz.
Residual AM: <0.03% to CCITT.
Error (m <0.8): <5% of reading + residual AM.
Weighting Filters: See transmitter and receiver measurements; 300 Hz highpass filter (can be switched into modulation path).

Frequency Deviation Meter –
Operating Modes: Same as AM meter.
Frequency Range: 4 MHz to 1 GHz.
Deviation Range: 100 kHz.
Demodulation Frequency Range – Display: 20 Hz to 20 kHz. Resolution: Δf <1 kHz: 1 Hz; Δf ≥1 kHz: 1% of reading.
Output for demodulation signal: DC to 20 kHz.
Residual FM – f_c <500 MHz: ≤3 Hz to CCITT, f_c ≥500 MHz: ≤5 Hz to CCITT.
Error: 3% + error due to residual FM + resolution.
Weighting Filters: 750 µs de-emphasis; see transmitter and receiver measurements for more weighting filters.

TRANSMITTER AND RECEIVER MEASUREMENTS
CCITT Filter – According to CCITT specifications.

Programmable Notch Filter –
Programmable Notch Frequencies: 100 Hz ≤f_{notch} ≤5 kHz.
Error in Passband: ≤0.5 dB.
Maximum Attenuation (input voltage >100 mV): ≥60 dB.

Programmable Highpass Filter –
Programmable Passband Cutoff Frequencies (0.5 dB): 107 Hz to 10.6 kHz, in 60 steps.
Upper Cutoff Frequency: 21 kHz or approximately 10 times the passband cutoff frequency.
Error in Passband: ≤0.5 dB.
Inherent Distortion: <0.3%.
Maximum Attenuation (input voltages >100 mV): ≥50 dB.

Programmable Lowpass Filter –
Programmable Passband Cutoff Frequencies (0.5 dB): 235 Hz to 21 kHz, in 60 steps.
Error in Passband: <0.5 dB.
Inherent Distortion: <0.3%.
Maximum Attenuation (input voltages >100 mV): ≥50 dB.

Programmable Bandpass Filter –
Combination of highpass and lowpass filters.

Distortion Measurement –
Test Frequency Range: 100 Hz to 5 kHz.
Measurement Range: up to 50%.
Resolution: 0.1%.
Inherent distortion: ≤0.3%.
Error: <5% of reading + inherent distortion.

SINAD Measurement –
Frequency Range: 100 Hz to 5 kHz.
Measurement Range: 1 to 50 dB.
Resolution: 0.1 dB.
Error: ≤0.5 dB.

Modulation Generators –
Operating Modes: Single-tone modulation, dual-tone modulation (optional).
Frequency Range: 20 Hz to 25 kHz, usable up to 30 kHz.
Resolution (f <1/3/6/10/20 kHz): 0.1/0.2/1/2.5/10 Hz.
Frequency Error: <0.5 x resolution.
Fixed Frequencies: 8, presettable.
Output Voltage: 10 µV to 5 V.
Error: (V_0 >1 mV): ≤3%.

Selective Call Coder/Decoder –
Standard Tone Sequences: ZVEI1, ZVEI2 /CCIR/EIA/EEA/EURO/VDEW/CCITT, NATEL, and user-specified sequences.
Digits: 0 to 9, A to F.
Call Length: 1 to 25 tones.
Automatic Repeat: Selectable.
Encoder – Frequency Offset: Can be set to ±10%. Tone/Pause Duration: Standard or programmable.
Decoder: Tolerances standard or programmable with out-of-tolerance display.

DTMF Decoder – With Option 05.
Standard: DTMF.
Display: Tones 0 to 9, A to D, *, #.
Call Length: 25 digits.

Communications Test Sets

Dual-Tone Encoder – With Option 12, to DTMF and user-specific sequences.
Digits: 0 to 9, A to D, *, #.
Call Length: 25 dual tones.
Tone/Pause Duration: To standard or programmable.

DC Measurement – With Option CMT-Z6.
Voltage Measurement: 0 to ±30 V. Error: <3%.
Current Measurement: 0 to ±10A, for a short time 15 A.
Error: <3%.

AF Spectrum Analyzer –
Displayable Signals: AF voltmeter input, demodulated signals, beat signals, external signals. Input Impedance: 1 MΩ.
Frequency Range: To 20 kHz (crystal accurate).
Level Range (reference level) – AF: 1.6 mV to 35 V (RMS). Demodulated FM: 50 Hz to 100 kHz (peak). Demodulated AM: 0.1 to 100% (peak). Demodulated φM: 0.1 to 25 rad (peak).
External Signals: 5 mV to 14 V (RMS).
Dynamic Range (V_{in} >10 mV): 66 dB.
Scale: Log 10 dB/div, log 2 dB/div, or linear.
Level Error (f >50 Hz): ±2 dB to 60 dB below reference level.
Automatic Test Filter Selection: 3 test filters as a function of span.

SSB Spectrum Analyzer (CMTA54/84) –
SSB Receiver Test: AF analysis via AF input.
SSB Transmitter Test: AF analysis after internal RF IF conversion. RF Frequency: 400 kHz to 1 GHz. Level Range (Reference Level): RF input/output: –24 to +47 dBm; 2nd input: –64 to +17 dBm. Dynamic Range: 66 dB typ.
Level Error: 3 dB typical.

RF Spectrum Monitor (CMTA54/84) –
Frequency Range: 400 kHz to 1 GHz.
Level range (reference level) – RF Input/Output: –24 to +47 dBm. 2nd Input: –64 to +17 dBm.
Dynamic Range for Input Level: >60 dB.
Scale: Log 10 dB/div, log 2 dB/div, or linear.
Level Error: <3 dB.
Automatic Test Filter Selection: 4 test filters as a function of span.

Oscilloscope –
CMTA: digital storage oscilloscope.

Displayable Signals: External signal, AF, demodulated signals (AM, FM, φM) beats (AC coupling).
External Input Impedance: Approximately 1 MΩ.
Coupling: AC/DC.
Amplitude: 1/2/5 steps.
External: 2 mV/div to 5 V/div.
AF Voltmeter: 1 mV/div to 20 V/div.
Demodulated AM: 0.1%/div to 40%/div.
Demodulated FM: 20 Hz/div to 40 kHz/div.
Demodulated φM: 0.01 rad/div to 25 rad/div.
Timebase: Crystal accurate.
Divisions: 1/2/5; 0.05 to 50 ms/div.
Bandwidth: DC to 20 kHz (usable to 100 kHz).
Trigger Slope: + or –.
Trigger Level: Full screen height, in 60 steps.
Main Operating Modes: Scope or single-shot.
Scope Mode: Repeat mode with automatic free-running.
Single-shot mode – Recording Time: 3.2 ms to 3.2 s. Screen Display: 1/8 of the recording (15 overlapping ranges).
Trigger Sources: Signal or EXT connector.

POWER REQUIREMENTS

Line Voltage – 88 to 132 V AC, 194 to 264 V AC.

Line Frequency – 47 to 420 Hz.

Power Consumption – 200 V A.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	220	8.7
Width	420	16.5
Depth	460	18.1
Weight	**kg**	**lb.**
Net	26	57.3

ORDERING INFORMATION

CMTA54
Radiocommunication Tester **$38,020**
Includes: Power Cord, Manual.

CMTA84 (INCLUDES OPT. 22)
Radiocommunication Tester **$45,050**
Includes: Power Cord, Manual.

Opt. 03/CM–B8 – RF Millivoltmeter. For determination of extremely small levels down to the microvolt range; frequency range, measurement range, and frequency response are independent of the measuring head used. Frequency range, 10 kHz to 1 GHz; Measurement range, 1 mV to 10 V, 10 mV to 100 V; Readout units, mV, V, W, dBm, or dBμV; Resolution (V >100 mV), 1%; 0.1 dBm Error (+20 to +25°C): <5% + frequency response error ..... **+$795**

Opt. 06/CM–B14 (CMTA84 only) – Signaling for testing trunked radio. Allows free programming of signaling sequences via external computer and predefined signaling ..... **+$1,600**

Opt. 07/CM–B15 (CMTA84 only) – POCSAG, ZVEI/VDEW (digital Signaling). POCSAG signaling with direct carrier shift keying (NRZ) and FFSK, ZVEI/VDEW digital signaling. Use in conjunction with Opt. 06 ..... **+$870**

Opt. 20/CMTA–B13 (CMTA54) – Cellular Radio Simulator. Simulation of base station for AMPS, TACS, Radiocom 2000, NMT 450/900, and C-Net ..... **+$5,740**

Opt. 21/CMTA–B5 – Autorun Control/Printer Interface ..... **+$710**

Opt. 22/CMTA–B9 (CMTA54) – Duplex Modulation Meter independent of basic unit. Same as specifications for AM Meter, FM Meter, and φM Meter ..... **+$2,450**

Opt. 31/CM–U20 – Power Measurement of RF Burst Modification Kit CM-U20 enables GSM Power Burst Measurements and TDMA applications in general ..... **+$1,970**

ADDITIONAL ACCESSORIES
See Page 446 for complete selection information.

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection ..... **+$2,130**

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

CRTP24

Communications Test Sets

Extremely powerful test set, providing all simulation and analysis capabilities, from measurement of GSM/DCS 1800/DCS 1900-specific signals, to detailed checking for hidden errors in signaling.

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

CRTP

- Automatic Measurements and Logging Using Supplied Test Procedures
- Automatic Test Routines Ensure Reliable Evaluation of Base/Mobile Stations
- Extensive Troubleshooting Features for Easy Fault-finding on Defective Mobile Phones and Base Stations
- Simulation of Base/Mobile Station with Call Setup, Data Transfer, and All Signaling Procedures Between CRTP and the Station Under Test
- Logging of All Signaling Activities in OSI Layers 1, 2, and 3 for Protocol Analysis; Mnemonic Display of Message Content for Protocol Troubleshooting
- Checks the Error-correction Facilities of the Base/Mobile Station by Implanting Errors in the Data Stream
- Measurements on the Transmitter:
  - Power Ramp and Phase Trajectory
  - Burst Delay
  - Frequency Error
- Measurements on the Receiver:
  - Bit Error Rate in Real Time
  - Receiver Sensitivity
- Tests on Speech Coder and Decoder
- IEC/IEEE-bus Interface



The CRTP Radiocommunication Test Set provides signal generation, signal measurement, and user-friendly software.

SIGNAL GENERATION

The analog unit provides two independent RF generator channels. Using these two channels, the test set can simultaneously simulate and test a control channel (BCCH + FCCH + SCH + CCCH) and a traffic channel (TCH + CACCH). For measuring the receiver sensitivity, a fading simulator can be connected into each of the output circuits.

Transmission with or without frequency hopping is possible on all channels. The two signals are GMSK-modulated and are timed as bursts to occupy exactly one or all of the eight GSM/PCN timeslots. The timing of the bursts can be adjusted and the amplitude can be varied dynamically over a 40-dB range.

SIGNAL MEASUREMENT

A receive channel is allocated to each of the generator channels. It is offset by a duplex spacing of 45 or 95 MHz relative the generator channel, even under hopping conditions.

The digital signal is recovered by a precise GMSK demodulator. In addition, the signal in each of the receive channels is sampled. The phase and amplitude samples are stored and used for computing the signal parameters such as burst delay, phase trajectory, and power ramping.

A separate input and output are provided for testing the transmitter and receiver unit of a base station.

USER-FRIENDLY SOFTWARE SAVES TIME

For development and quality control tasks, full flexibility is given by the possibility of varying procedures, signaling parameters, and results display. For production-testing, overview measurements, and service tasks, complete test routines supplied with the equipment ensure reliable test results and ease of operation.

A menu-driven editor in line with coding rules 4.08 allows convenient entry of messages and system information simply by filling out tables.

A comfortable, window-oriented user interface simplifies the generation of test routines. Test programs are written in Borland Turbo C++. The use of such a popular standard language eliminates the long training periods needed for special test languages and offers the user high flexibility.

The complete software, including message library, control programs, and test results, is stored on a hard disk. The built-in floppy drive permits backup to be made and loading of stored data.

The digital unit may further be used as an IEC/IEEE controller, allowing extension of the test set by including external instruments. The test sets contain both the IEC/IEEE-bus interface and the necessary software drivers.

STANDARD MEASUREMENTS

The CRTP is supplied with an extensive test software package. These test programs are available in source code and can also be used as starter programs for generating user-specific programs by modifying programs or writing new ones.

The test routines fully comply with specifications:

- Receiver BFI
- Receiver sensitivity in speech channel (TCH/FS) and in user-data and control channels

APPLICATIONS

- **Test of All Signaling Functions and Validation of Data Transmission Protocols and Timing**
- **Measurements on Modulated RF Signals and Receiver Testing**
- **Simple Generation of Customized Test Procedures**
- **Complete Testing for Conformance with Recommendations 11.10/11.20 and DCS1800 Recommendations and DCS 1900 (PCS) Recommendations with Respect to**
  -Channel Coding (OSI Layer 1)
  -Data Link Protocols (OSI Layer 2)
  -Network Signaling (OSI Layer 3)
  -All Specific In-channel RF Parameters
- **Simulation of Measurements on Base and Mobile Stations, All by One Test Set**

- Usable receiver input level range
- Layer 2 signaling of base/mobile station
- Call setup (MS originated and terminated call)
- Absolute delay and timing advance
- Reception time tracing speed
- Intra-cell power change
- TX power control
- Phase and frequency error
- Power ramp of burst

In addition to this software supplied with the equipment, further programs are available allowing testing and measurements exactly in line with specifications for type-approval testing.

SIGNALING
The CRTP accurately simulates the functions of an ideal base or mobile station. For trouble-shooting on the station under test, the signaling parameters can also be varied.

All layer 1 channel coding as well as layer 2 signaling is automatically performed in real time. The layer 3 signaling sequence is defined by special test programs.

PROTOCOL ANALYSIS
Every transmitted or received layer 2 or layer 3 message, or even the bits of a burst, can be marked with a frame number and recorded in the log memory. Depending upon whether everything is logged or just selected logical channels, the log can cover a time interval between ten seconds and 15 minutes. The logged messages are displayed in mnemonic form on the screen, using the same basic mask as the message editor.

BURST ANALYSIS
After data have been logged, power ramping as well as phase and frequency errors are calculated and displayed as a whole. Detailed analysis is supported by the zoom function.

To check the timing-advance measurement function of a mobile station, the CRTP measures the arrival time of the burst and monitors the response of the mobile station to timing advance commands in the generator channels.

To check the delay measurement function of a base station, sending of the burst can be delayed and the response of the station-under-test monitored.

To permit synchronization of external measuring instruments, a spectrum analyzer for example, the CRTP has a trigger output for automatically starting measurement at the beginning of a burst.

TESTING RECEIVER SENSITIVITY
In the loop-back mode, bit error rates (BER) can be measured in real time to test the receiver sensitivity of a mobile station.

The same test can be made on base stations by applying a signal modulated with a CCITT test pattern to the receiver input.

The received data can then be analyzed at the Abis interface using a suitable instrument.

SPEECH CODER/DECODER TESTS
These tests are supported by the built-in speech coder function and the Digital Audio Interface (DAI) of the mobile station as defined in Recommendation 11.10.III.6.4.

A serial EMMI is provided for remote control of the mobile station.

MONITORING FUNCTION
This function, implemented in the CRTP24, allows passive analysis of the data traffic between base station and mobile station. Synchronization to the BCCH allows either the downlink or uplink data transfer to be recorded in static or frequency hopping mode.

AF MEASUREMENTS
Option 01 allows a wide range of audio measurements. The AF generator provides single or double tones. The following measurement functions are implemented:

- AF voltmeter with RMS or peak weighting
- Continuously tunable distortion and SINAD meter
- AF frequency counter
- DC ammeter/voltmeter

Characteristics

ANALOG UNIT
Signal Generator –
Frequency range: GSM/DCS 1800/DCS 1900.
Hop Size: Any frequency step within GSM/DCS 1800/DCS 1900 band.
Frequency Fine Tuning: 0 to 60 kHz with about 2 Hz resolution.
Frequency Setting Time: <577 µs (to within <4° of final phase).
Spurious Phase Modulation:<1° RMS, <4° peak.
Frequency Aging: <2 x 10^{-9}/day (after 30 days of operation).
Frequency Drift: <2 x 10^{-9}/° C.
Maximum Output Level: 13 dBm.
Static Attenuation Setting: 0 to 135 dB.
Resolution: 5 dB.
Dynamic Attenuation Setting: 0 to 35 dB (electronic).
Level Error: <1.5 dB from –127 to +13 dBm (with dynamic attenuation at 0 dB).
Modulation: GMSK transmission rate 270,833 bits/s in compliance with GSM 05.04-DCS.
Burst Delay: –4.6 to +4.6 ms variable in steps of 0.46 µs.

Analyzer –
Frequency range: GSM/DCS 1800/DCS 1900.
Reference Level for Maximum Dynamic Range:
$RF_{IN/OUT}$: +9 to +36 dBm.
RF_{IN2}: –21 to +6 dBm.
Level Error: <2 dB.
Sampler: Two 12-Bit A/D converters for I and Q signals, sampling rate 1.083 MHz (4 samples per bit).

Synchronization – 10-MHz output, 10-MHz input/output, 52-MHz output, slotsync output.

Inputs/outputs –
RF IN/OUT1 and RF IN2: N-type connectors, 50 Ω.
Fading Simulator: Two type N connectors, 50 Ω.
Output Level: 8 to 13 dBm.
Speech Coder Input: 20 mV to 2 V input level for maximum dynamic range, R_{IN} = 100 KΩ.
Speech Decoder Output: 2 V output level for maximum dynamic range, R_{OUT} = <3 V.
Audio Monitor: Built-in loudspeaker, headphones connector, volume control.
Modes: Voltmeter, AF generator, speech decoder, speech coder.

CRTP24 Communications Test Sets

DIGITAL UNIT

Processor – 80386 microprocessor.

RAM – 8 MB.

Hard Disk – 20 MB.

Floppy Disk Drive – 3.5 in., 1.44 MB.

Graphics – VGA.

Interfaces – RS-232-C, Centronics, keyboard connector on front and rear, CODEC input/output, control interface, DAI/EMMI.

Layer 1 Functions –
Channels Supported: FCCH + SCH + BCCH + CCCH + SDCCH/4 + SACCH/C4; TCH + FACCH + SACCH (TCH is TCH/FS or TCH/F9.6, TCH/F4.8, TCH/F2.4, TCH/H4.8, TCH/H2.4).
Ciphering and Frequency Hopping: With or without on all channels.

Layer 2 Functions –
Signaling: All logical channels for SAPI= 0 and 3.

Layer 3 Functions – Defined by user program.
Programming Language: Borland C.
Program Examples: Included for main test cases.

Presentation of Results –
GSM/DCS 1800/DCS 1900 Specific Measurements: Graphical or numerical.
Messages and Signaling (Content of Log Memory): Alphanumeric in mnemonic form.

AF MEASUREMENT UNIT (WITH OPT. 01)

AF Generator –
Signal Source: Single or dual tone.
Frequency Range: 20 Hz to 20 kHz.
Output Level (RMS): 10 µV to 5 V.
Output Impedance: <3 Ω.

AF Voltmeter –
Operating Modes: RMS, +Peak, –Peak.
Frequency Range: 50 Hz to 20 kHz.
Level Range (RMS): 0.1 mV to 30 V.
Weighting Filters: CCITT Filter, complying with CCITT 0.41.

Distortion Meter –
Frequency Range: 100 Hz to 5 kHz.
Measurement Range: 0 to 50%.

AF Frequency Counter –
Frequency Range: 20 Hz to 500 kHz.
Resolution: 0.1 Hz/1 Hz.
Input Level (up to 20 kHz): 10 mV to 30 V.

DC Measurements –
Voltage: 0 to ±30 V.
Current: 0 to ±10 A.

SYNCHRONIZATION UNIT WITH CMDA-Z1

RF Synchronization –
52 MHz Input Signal (level >0 dBm): 26 or 13 MHz Output Signal.
52, 39, 26 or 13 MHz Input Signal (level >0dBm): 10 MHz output signal connected to 10 MHz reference Input of Analog Unit.

POWER REQUIREMENTS

Line Voltage – 110/230 V AC ±10%.

Line Frequency – 47 to 63 Hz.

Power Consumption – 500 V A maximum.

Safety – Class 1 (according to IEC/IEEE 348 and VDE 0411).

ENVIRONMENTAL CHARACTERISTICS

Temperature –
Operating: 0 to +45°C.
Storage: –40°C to +70°C.
Environmental Conditions: To IEC/IEEE, Class 1 (no condensation).

PHYSICAL CHARACTERISTICS

Analog Unit Dimensions	mm	in.
Height	236	9.3
Width	435	17.1
Depth	570	22.4
Weight	**kg**	**lb.**
Net	27	61.7

Digital Unit Dimensions	mm	in.
Height	192	7.6
Width	435	17.1
Depth	570	22.4
Weight	**kg**	**lb.**
Net	18	39.7

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

ORDERING INFORMATION

CRTP24
Radiocommunication Test Set *1
Includes: Analog Unit, Digital Unit, Keyboard, Monitor, BASIC Software, Borland C Compiler, and Software Package.

RECOMMENDED ACCESSORIES

Ciphering Software *1
Opt. 01/CRTP-B1 – AF Measurement Unit **$3,500**
Opt. 02/CRTS-B2 – 200 MB Hard Disk *1
Opt. 03/PS-B4 – Second IEC/IEEE-Bus Interface *1
Opt. 04/CMDA-Z1 – Synchronization Unit *1
Opt. 05 – L2 11.10 Chapter II.5.2; L3 Part 1, Chapter II.5.3 ..... *1
Opt. 06 – Chapter II.5.3.8, Limit-switched Call Control *1
Opt. 07 – L3, MS Signalling 11.10 Chapter II.5.3 ..... *1
Opt. 08 – 5 ITA Audio Tests for mobile stations (Option 01 required) 5 ITA Audio Tests for mobile stations (Option 01 required) *1
Opt. 09 – Support of Non-transparent Data Services (NTD) for Baud Rates 2400, 4800, 9600 ..... *1
Opt. 10 – Support of Short Message Services (SMS) and Transparent Data Services (TDS) for Baud Rates 2400, 4800, 9600 ..... *1
Opt. 11 – Support of Supplementary Services (SS) *1

*1 *Contact your Tektronix representative for price information.*

Signal Sources

Introduction

A stimulus is an essential element in testing the wide range of components and assemblies that form a communications or navigation/guidance system and the various transmission line components, up to and including the antenna.

Stimulus of communications and navigation/guidance systems in use today and planned for the future require signal generators with precise frequency setting, stability, low phase noise, diversified forms of both analog and digital modulation, and frequency hopping capability.

The following signal generators have the necessary characteristics at affordable prices.

SIGNAL SOURCES OFFERED

ADS Arbitrary Waveform Generator
Two independent programmable synthesis channels for virtually unlimited flexibility.

SME 02/03 Signal Generator
5 kHz to 3 GHz with all common digital modulation modes.

SMHU58 Signal Generator
100 kHz to 4.32 GHz with high signal purity and frequency agility. For all types of digital and analog modulations.

SMP 02/22 Signal Generator
10 MHz to 20 GHz with high signal purity and output power for microwave system testing.

SMT 02/03 Signal Generator
5 kHz to 3 GHz multifunction RF generator for receiver and EMS measurements.

SMY 01/02 Signal Generator
9 kHz to 2.05 GHz generator – versatility and low cost can go hand in hand.

Specifications for these signal generators are described in detail on the following pages.

IQSIM-K Software
Software tool for creating all types of digital modulations.

CONTENTS

TDS SERIES OSCILLOSCOPES
ADS....288
SME02....291
SME03....291
SMHU58....293
SMP....296
SMT....298
SMY....299
IQSIM-K....302

Signal Sources

Signal source with virtually unlimited flexibility.

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

ADS

- Two Independently Programmable Synthesis Channels
- 12-Bit Amplitude Resolution
- 64 K-point Waveform Memory per Channel
- 33-MHz Read Clock
- Output Voltage of 0.1 mV to 10 V p-p into 50 Ω
- –5 V to + 5 V DC Offset
- Sine Synthesis with High Spectral Purity (0.1 Hz to 5 MHz)
- Triangle Wave Generation with High Linearity (0.1 Hz to 100 kHz)
- User-programmable Waveforms Comprising 2 to 65536 Points
- ARB Sequence Mode for Generating Signals with Extremely Long Periods
- User-programmable Frequency Sweep Covering a Maximum of 8191 Arbitrary Frequencies
- Non-volatile Memory for Storing 20 Instrument Setups as Well as up to 99 ARB Signals, ARB Sequences, and ARB Sweeps
- Memory Card
- Digital Output
- IEC/IEEE Bus (SCPI)



Precise Signal Simulation

The signals required for effective tests on highly sophisticated electronics – from ICs to complete systems – often cannot be produced by conventional function generators, or if they can, they only approximate the real-world signal. The synthesis capabilities of the ADS provide the means of generating exact replicas of those signals which are encountered under real conditions. This means that products can be tested under conditions that are as close to real-world as possible. So, problems which might otherwise be missed can be ironed out.

The ADS has a second independent channel. Consequently, it is ideal for developing and testing modern communication equipment which requires two precise signals for driving I/Q modulators. For digital modulation, the ADS is the ideal signal source as it has a high clock frequency, high amplitude resolution, and precise channel synchronization. Application software such as IQSIM provides flexible digital filtering, making the provision of hardware filters unnecessary.

WAVEFORM EDITOR

The waveform editor is a highly convenient tool for handling synthesis and modifying any waveform or application-specific sweep. Previously, this could only be done using external computers with the appropriate software. The complete waveform library stored by the user in internal memory can be accessed and is available for editing.

ARB SOFTWARE

To define new waveforms, an effective software tool, the Arbitrary Waveform Designer AWD-K1, complements the internal ARB editor. It operates in conjunction with an IBM PC-compatible controller and supports the graphical creation of waveforms on the screen, the generation of waveforms by entering mathematical formulas, or by signal transfer from a digital storage oscilloscope. Stored signals can also be modified in a variety of ways using this software.

APPLICATIONS

- **Digital Modulation**
- **Communications**
- **Navigation**
- **Automatic Test Equipment**
- **Component Testing**
- **Audio and Acoustics Measurements**
- **Materials Testing**
- **Ultrasound Measurements**
- **Filter Design**
- **Video Applications**
- **Control Engineering**
- **Sensors**
- **Automotive Engineering**

SEQUENCE MODE
In this mode, ARB signals can be joined to give a single continuous programmed sequence. By assigning a repetition rate to any element in the sequence, it is possible to create sequences that use a fraction of the memory capacity required for conventional ARB synthesis. Each element in the sequence can be assigned an individual read-clock frequency; in this way, "stretched" ARB signals can be included in the sequence. The sequence editor is used for programming and modifying ARB sequences.

DRIVING I/Q MODULATORS
The ADS is a high-precision signal source which is ideal for driving I/Q modulators. It is particularly well suited for driving the I/Q modulator in the SMHU58 Signal Generator (see page 293). The advantage of the ADS over modulation-specific coders is that all modulation parameters – especially filter parameters – can be varied via software.

VHF STEREO SIGNALS
Precise signal synthesis enables the generation of complex stereo multiplex signals. Stereo multiplex signals can be calculated very easily using the optional AWD-K1 Application software and transferred to the ADS via the IEC/IEEE bus.

VIDEO TEST PATTERNS
The ADS offers the means to generate virtually any type of video signal. All parameters such as line-repetitive, field-repetitive, and color subcarrier frequency can be freely selected. ADS thus allows measurements to be made on video systems that deviate from existing standards or testing of new systems during the development phase.

Characteristics

SIGNAL OUTPUT
Output Impedance – 50 Ω.

Output Voltage (AC) –
Range V_{p-p}: 0 to 20 V (EMF, I_{max} = ±100 mA); 0 to 10 V (into 50Ω).
Resolution: 3 1/2 digits, 0.1 mV minimum.
Error at 1 kHz, V_{p-p} > 10 mV: <±0.2 dB (±0.1 dB typical)/50Ω.
Non-interrupting Level Setting Range: >40 dB typical.

DC Offset –
Setting Range: –5 to +5 V (into 50Ω).
Resolution: 3 digits, 10 mV minimum.
Error: <±0.2 dB + residual offset.
Residual offset <±20 mV ±1% of level setting.

WAVEFORMS
Standard Waveforms – Sine, triangular.

User-definable Waveforms – Single ARB curves or composite ARB curves.

Sine –
Frequency Range: 0.1 Hz to 5 MHz.
Frequency Resolution: 1 Hz.
Frequency Error (after 20 minute warm-up): $<4 \times 10^{-5}$ + aging error.
Frequency Error Due to Aging: $<1 \times 10^{-5}$ per year.
Frequency Response Flatness: <0.5 dB.
THD: <–60 dB (–70 dB typical).
Harmonic and Non-harmonic Spurious Signals (100 kHz to 2 MHz, offset 0 V): <–60 dB.

Triangular –
Frequency Range: 0.1 Hz to 500 kHz.
Frequency Resolution: 1 Hz.

Phase Setting –
Setting Range CH 1/CH 2: –180° to +180°.
Resolution: 0.02° minimum.

Trigger Operating Modes – Frequency shift keying (FSK), phase shift keying (PSK), pulse modulation (PM), reset, hold, hold/reset.

Sweep Modes – Digital, user-programmable frequency and phase sweeps, triggered internally, triggered externally, triggered manually.
Frequency Range: 1 Hz to 5 MHz with user-selectable step width, 1 Hz minimum.
Phase Range: –180° to +180° with user-selectable step width, 0.02° minimum.
Step Time: Internal is 1 µs to 2,000 s.
External is 100 ns minimum.
Sweep Marker: User-selectable within sweep limits.

User-programmable Waveforms –
Curve Length: 2 to 65,536 points, composite ARB sequences.
Amplitude Resolution: 12-Bits.
Rise/fall Time: <9 ns (10/90%).
Settling Time: <30 ns (1%) typical.
Overshoots: <5% (filter off).

Clock Source (CLK) –
Internal: Output impedance is 50Ω. Signal is HCT/TTL compatible. Read frequency is 400 points/s to 25 Mpoints/s. Resolution is 40 ns minimum. Frequency error (after 20 minute warm-up) is $<4 \times 10^{-5}$ + aging error.
Frequency error due to aging is $<1 \times 10^{-5}$ per year.
External: Input impedance is 50Ω/600Ω, selectable. Input signal is ±0.5 to ±5 V.
Frequency range is DC to 33 MHz.

Filters –
Modified Bessel Filters (3rd order): 10 kHz, 100 kHz, 1 MHz, 2.5 MHz.
Modified Chebishev Filters (7th order): 500 kHz, 5 MHz.

ARB SEQUENCES
Sequence Length – 2 to 8191 ARB curves.

Repetition Rate for Single ARB Curves – 1 to 65,535, programmable for each curve.

Expansion Factor – (1 to 65,535) x clock period, programmable for each curve.

TRIGGER
Trigger Source – Internal, external, manual.

Internal Trigger Generator –
Output Impedance: 50Ω.
Signal: HCT/TTL compatible.
Trigger Period: 1 µs to 2,000 s.
On/off Ratio: Adjustable, 1:6500 to 6500:1.
Resolution, ON/OFF time: 500 ns minimum.

External Trigger –
Input Impedance: 50Ω/600Ω, selectable.
Trigger Threshold: 0.2 V/2.0 V, selectable.
Trigger Edge: Rising or falling edge can be selected.
Trigger State: Switchable to active low or active high.
Frequency: DC to 25 MHz.
Manual Trigger – With MAN key.

MEMORY
Internal Memory –
Size: 320 kB, non-volatile.
Storage Capacity: 20 complete front-panel setups plus combination of 100 ARB curves maximum, 100 ARB sequences maximum, and 100 sweeps maximum.

Memory Card – Size: 128 kB.

Signal Sources

INPUTS/OUTPUTS
Front Panel –
OUTPUT 1: CH 1 signal output, 50 Ω impedance, over-voltage protection to ±40 V DC.
OUTPUT 2: CH 2 signal output, 50 Ω impedance, over-voltage protection to ±40 V DC.
MARK 1: Marker output for CH 1, BNC connector, 50 Ω impedance, HCT/TTL compatible.
MARK 2: Marker output for CH 2, BNC connector, 50 Ω impedance, HCT/TTL compatible.
CLK 1: Clock input/output for CH 1, BNC connector (see Clock specifications).
CLK 2: Clock input/output for CH 2, BNC connector (see Clock specifications).
TRIGGER 1: Trigger input/output for CH 1, BNC connector (see Trigger specifications).
TRIGGER 2: Trigger input/output for CH 2, BNC connector (see Trigger specifications).

Rear Panel –
DIGITAL OUTPUT 1: Digital waveform output for CH 1, 25-contact connector, 12-Bit + CLK, HCT/TTL compatible.
DIGITAL OUTPUT 2: Digital waveform output for CH 2, 25-contact connector, 12-Bit + CLK, HCT/TTL compatible.
Z-MARKER 1: Z-marker output for CH 1, BNC connector, output voltage ±15 V nominal, 1 kΩ impedance.
Z-MARKER 2: Z-marker output for CH 2, BNC connector, output voltage ±15 V nominal, 1 kΩ impedance.
LEV CTRL 1: Input for CH 1 external level control signal, BNC connector, 50 Ω impedance.
LEV CTRL 2: Input for CH 2 external level control signal, BNC connector, 50 Ω impedance.

REMOTE CONTROL
Remote-controllable Functions – All functions that can be set manually from the front panel except EDIT, power on/off, and variation knob.

IEC Bus (IEEE 488) –
Connector: 24-contact.
IEC-bus Address: 00 to 30, set from front keypad.
Interface Functions: Listener and talker, SH1, AH1, T6, L4, SR1, PP1, DC1, DT0, C0.

RS-232-C –
Baud Rate: 1200, 2400, 4800, 9600, 19200, selectable.
Parity: Odd or even.

POWER REQUIREMENTS
Line Voltage – 100/230 V AC, –10/+15%; 120/220 V AC, –15/+10%.
Line Frequency – 47 to 420 Hz.
Power Consumption – 150 VA maximum.
Safety – Class I to VDE 0411 (IEC 348).

ENVIRONMENTAL CHARACTERISTICS
Operating Temperature – 0 to +55°C.
Storage Temperature – –40 to +70°C.
Mechanical Stress – Shock tested to DIN 40046, part 7 (30 G, 11 ms) and vibration-tested to DIN 40046, part 8 (5 to 55 Hz, 2 g), meets IEEE Publ. 68-2-27 and 68-2-6.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	192	7.56
Width	435	17.1
Depth	350	13.8
Weight	**kg**	**lb.**
Net	14	30.9

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

ORDERING INFORMATION

ADS
Dual Arbitrary Waveform Generator **$14,640**
Includes: Power Cord, Protective Cover, Manual.

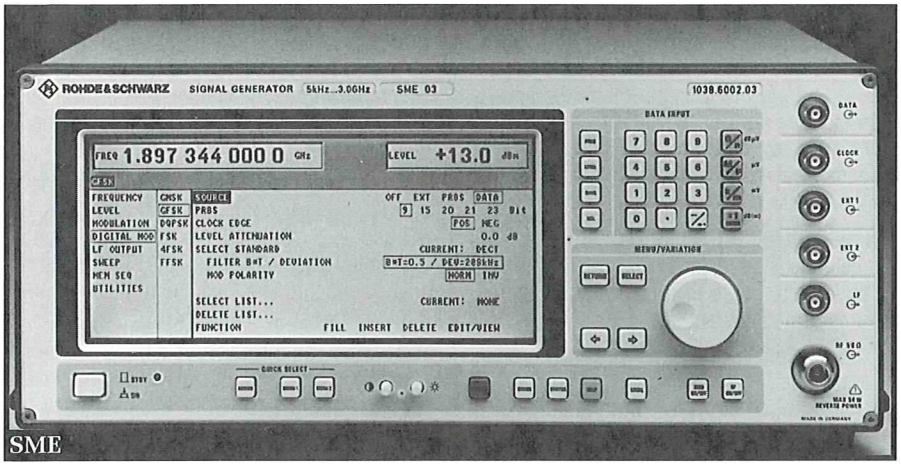
Opt. 1/ADS–B1 – Clock Generator. Read frequency, 200 points/s to 33,334 Mpoints/s; Resolution, 0.01% (10 ps minimum); Input/output frequency, 5 or 10 MHz selectable; Aging, <1 x 10^{-5}/month; Temperature effect, ≤5 x 10^{-6}/°C; Output level, >0.2 V into 50 Ω; Input level, 0.2 V to 2 V into 50 Ω or HCT/TTL ..... **+$1,135**

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**
Opt. A2 – United Kingdom 240 V, 50 Hz ..... **NC**
Opt. A3 – Australian 240 V, 50 Hz ..... **NC**
Opt. A4 – North American 240 V, 60 Hz ..... **NC**
Opt. A5 – Switzerland 220 V, 50 Hz ..... **NC**
See Customer Information Section for additional description.

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection ..... **+$400**
Opt. C5 – Adds five years of Calibration Services ..... **+$1,050**

RECOMMENDED ACCESSORIES
Memory Card – Order CMS-Z2 ..... **$315**
ARB Application Software – Order AWD-K1 ..... **$2,330**
Service Kit – Order ADS-Z2 ..... **$620**
See page 446 for complete selection information.

Signal Sources



SME Signal Generator

The SME Signal Generator supplies the complex signals required for the development and testing of digital mobile radio receivers. It is capable of generating all signals used in the main digital radio networks in line with relevant standards regarding the type of modulation, data format, TDMA structure, and frequency hop patterns. The SME is useful as well in the analog signal world of conventional signal generators.

The SME has a frequency range from 5 kHz to 1.5 GHz (SME02) or 5 kHz to 3 GHz (SME03). They can be tailored to your requirements by means of a wide variety of options with emphasis either on digital modulation, analog applications, or expansion into a universal signal generator.

DIGITAL MODULATION

With the optional DM Coder, Option 11, the SME provides a variety of network-specific digital modulation modes:

Modulation	Network
GMSK	GSM, DCS 1800 (PCN), CDPD, DSRR, MC9, MOBILTEX
π/4-DQPSK	NADC, PDC, TFTS, TETRA, APCO25
GFSK	DECT, CT2, CT3
4FSK	ERMES, APCO25 FLEX, MODACOM
FSK, FFSK	POCSAG, FLEX, Cityraf

The SME has been designed to allow for the integration of future types of modulation or networks.

Frequency and phase changes are produced by DDS (direct digital synthesis). The frequency and phase response are therefore synthesizer-accurate. There is no drift at the carrier frequency.

See page 294 for characteristics.

SME

- Frequency Range 5 kHz to 1.5 GHz (5 kHz to 3 GHz, SME03)
- All Common Digital Modulation Modes Provided in One Unit: GMSK, π/4-DQPSK, GFSK, FSK, 4FSK, FFSK
- All Modulation Modes Usable Over the Entire Frequency Range
- No External Modulation or Data Sources Required
- Internal Control of Frequency and Level Hopping Synchronous with the Data Signal
- Freely Programmable Data Sequences and Trigger Conditions
- Frequency Setting Time <0.5 ms for Frequency-agile Systems
- Broadband, Linear AM DC for Generation of Level Bursts with Predefined Shape
- Extremely High Spectral Purity for Out-of-channel Measurements
- Very High Level Accuracy; Resetting Error of Attenuator 0.01 dB
- RF, AF, and Level Sweep
- Programmable Measurement Sequence for up to 50 Complete Instrument Settings
- Ultra-low RF Leakage for Measurements on Highly Sensitive Paging Receivers
- Easy-to-operate Menu Concept

Simulation of all types of modulation of mobile radio for digital communication.

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

APPLICATIONS

- **Digital Radio Receivers**
- **Digital Radio Networks**
- **Analog Signal Generation**

Signal Sources

The modulation spectrum stands out for its high spectral purity. Sidebands are well below permissible levels at the frequency spacing relevant for adjacent-channel measurements. Filters other than the standard ones may be used for varying the modulation spectrum (for GMS network: filters with BxT = 0.2, 0.3, 0.5). With GFSK modulation for DECT, non-standard deviations may be set to allow in-depth receiver tests.

The data signals for modulation are applied externally or supplied by the internal data generator. Bit rates are selectable with FSK; they are network-specific for other types of modulation.

Data Generator: The data generator supplies freely programmable data signals and Pseudo Random Bit Sequence (PRBS) signals in line with CCITT. For PRBS signals, five sequence lengths between $2^9 - 1$ and $2^{23} - 1$ are selectable. Up to ten different data signals can be stored.

Level and Frequency Hopping Synchronous with Data Signal: In addition to the data signal, the data generator supplies a burst and level switch signal. The burst and level switch signals are programmed bit-parallel with the data signal via list entries. The burst signal serves for controlling fast level changes (>80 dB) or frequency changes (<0.5 ms).

The internal level switch signal can be replaced by an external logic signal. The signal switches the level in selectable steps with a rise/fall time <10 µs and enables level variations of up to 20 dB (over range up to 40 dB).

ANALOG MODULATION

Amplitude Modulation: The modulation frequency range is DC to 100 kHz. Particularly noteworthy is the extremely low incidental phase modulation with AM, which plays an important role in AM sensitivity tests on FM receivers.

Frequency Modulation (with Option 05): The modulation frequency range is DC to 2 MHz. The maximum selectable deviation for modulation frequencies above 500 kHz linearly decreases to 25% at 2 MHz. In the FM DC mode, there is virtually no drift. This characteristic allows the digital signaling of receivers by means of analog frequency modulation.

Phase Modulation (with Option 05): Phase modulation ranges from DC to 100 kHz. This wide span allows, for instance, tests on phase-sensitive circuits or the generation of PSK modulation with freely selectable phase deviation.

Pulse Modulation (with Option 03 for SME02 or Option 08 for SME03): The pulse modulation capability featuring an on/off ratio better than 80 dB and a rise/fall time shorter than 10 ns makes the SME an ideal choice for radar applications. The optional pulse generator allows pulsed signals to be produced without an external source.

ANALOG MODULATION SOURCES

Three optional modulation sources are available in addition to the fixed-frequency LF generator source provided standard:

LF Generator (Option 02): The LF generator is a synthesizer up to 500 kHz. In addition to sinewave, squarewave, and triangular signals, it also supplies a noise signal. If two LF generators are installed in the unit, multitone signals can be generated.

Multifunction Generator (Option 06): This generator operates in a range up to 1 MHz. It produces the same signals as the optional LF generator and, in addition, stereo multiplex and VOR/ILS modulation signals.

Pulse Generator (Option 04): The pulse generator generates single and double pulses required for radar receiver testing. It can only be used in conjunction with the pulse modulator module, into which it is integrated.

SIMULTANEOUS MODULATION

Simultaneous modulation is required for simulating the complex signals used in modern communications and radar systems. The SME is capable of simultaneous DM, AM, FM (φM) and pulse modulation.

With AM and FM, multitone modulation can be affected either by means of the internal and an external modulation signal or, if two LF generators are provided, by means of two internal signals.

Convenient Sweeping in List Mode: Operation is extremely easy thanks to a well thought-out operating concept featuring a large LCD display and menu guidance. All parameters and conditions selectable for a specific function are logically arranged in a single display. Looking up functions in a manual is a thing of the past.

In the list mode, frequency and level settings are made by means of values stored in lists which may contain up to 4096 pairs of frequency and level. This mode allows the frequency response of cable connections, amplifiers, TEM cells, etc., to be compensated in the signal generator, a particularly useful feature in EMC measurements.

The list mode may be executed either automatically with presettable dwell time, in single-step operation, or by means of external triggering (for frequency hopping applications).

Memory Sequence for Automatic Sequence Control: Up to 50 instrument settings can be stored in a non-volatile memory. After programming the sequence of measurements and the step time in a list, the sequence can be started.

External Triggering: In addition to automatic control, the list mode, memory sequence, RF, AF, and level sweep functions may also be triggered by an external signal. This facility enables synchronous operation with other units.

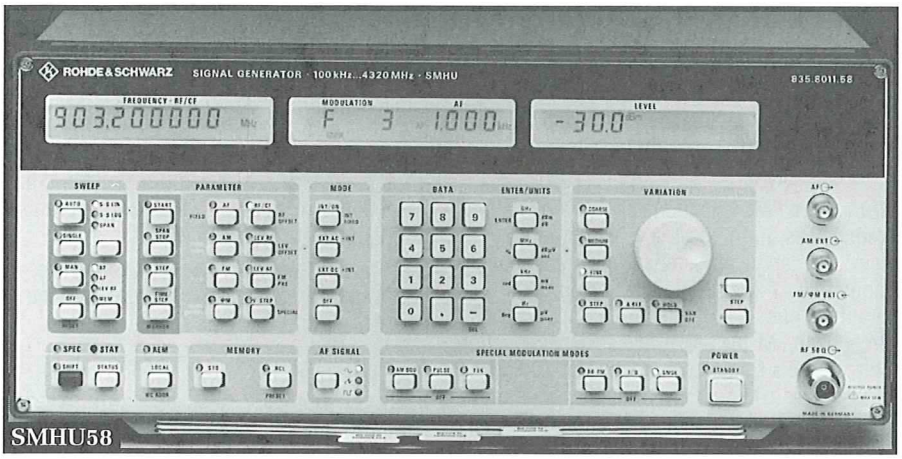
Compensation of External Frequency Response: The frequency response of external cables can be compensated by entering level correction values for up to 100 frequency points. The correction values for the frequencies between these points are determined by means of interpolation. The frequency response correction will be active in any operating mode as well as during sweeps.

CALIBRATION

Calibration of the unit is required every three years. Calibration values are loaded via the RS-232-C or the IEC/IEEE-bus interface to ensure frequency and level accuracy to specifications. The unit doesn't need to be opened nor are there any mechanical adjustments to be made.

SELF-DIAGNOSTICS

For maintenance and calibration, precise data on the instrument status are needed. Using the built-in test equipment, the SME02/03 provides data without any extra equipment required. The signal generator status is continuously monitored. The SME signals malfunctions and deviations from nominal values by means of a message on the display screen.



SMHU58

SMHU58 Signal Generator

The SMHU58 signal Generator can generate complex test signals for modern communications and radar systems. Its high versatility is based upon the great variety of modulation capabilities in conjunction with high spectral purity and frequency hopping.

The I/Q and the broadband AM/FM modulators make all digital and analog modulation modes for directional radio and satellite communications possible. Modern radio networks use digital modulation methods, for which the SMHU58 is ideally suited due to the high accuracy of its I/Q modulator.

For modulation using serial data signals, coders can be integrated for the necessary signal processing and filtering to relevant standards. The optional GMSK coder produces filtered analog signals from a serial data stream for driving the I/Q modulator. The accuracy of the resulting phase modulation meets all requirements placed on a reference signal for NADC, DECT, PDC, and GSM testing.

Broadband FM can be used for fast FSK, analog sweeping, video modulation, and for generating chirp signals.

MODULATION

Internal and external, or both internal modulation sources, can be combined for two-tone modulation.

Frequency Modulation: The maximum deviation depends upon the carrier frequency. Starting from a maximum deviation of 3.2 GHz in the frequency range 2.16 to 4.320 GHz, the maximum deviation decreases with the carrier frequency.

By selecting a special function, deviations of up to 800 kHz can be set even below 125 MHz. The FM modulation frequency range covers DC to 1 MHz. In FM DC mode, a high carrier-frequency accuracy is ensured. The frequency offset occurring with FM DC selected is extremely small.

Amplitude Modulation: The whole of the modulation frequency range can be used down to carrier frequencies of less than 100 kHz. The minimal phase shift at 30 Hz (AM DC) and a flat frequency response provide the precision amplitude modulation required for testing VOR/ILS navigation receivers.

Pulse Modulation: Rise/fall times of 20 ns (<10 ns typical for frequencies >200 MHz) and an on/off ratio of 80 dB open up a wide range of possibilities for testing telemetry, radio link, radar, and satellite communications systems.

I/Q Modulator: The I/Q modulator is adjusted for minimum amplitude and phase error in an automatic calibration routine. The settings can also be varied to simulate a non-ideal behavior of the modulator. With the aid of selectable defined modulation distortion, effects on bit error rates can be determined and demodulator maladjustments corrected.

Coder Options: The serial data signal may be derived from an external source or from a PRBS generator in the coder. By digital processing in the coder, the data signal is shaped as required for the prescribed filter function and split into I and Q signals. In addition to the standard filter functions provided, special filter functions for various bandwidths are programmed in the coder. They are used for specific variations of the

APPLICATIONS

- **Mobile Radio – GSM, DECT, PDC, NADC, and PHP**
- **Radar Systems**
- **Directional Radio**
- **Satellite Communications Simulation**

SMHU58

- I/Q Modulator for Any Phase and Amplitude Modulation (PSK, QAM, ASK, etc.), Modulation Bandwidth DC to 200 MHz
- Second, Coherent Carrier for Simple I/Q Demodulation
- Broadband Amplitude Modulation for TV Applications
- Broadband Frequency Modulation for Satellite Communications, Radar, and Video Applications
- Optional Coders for Generating Modulating Signals for Digital Radio Networks to Relevant Standards
- Frequency Hopping – 4800 Stored Frequency and Level Settings
- Parallel Bus Interface for External Addressing of Memories
- Setting Time <1 ms for Frequency-agile Systems
- High Spectral Purity for Out-of-channel Measurements and LO Applications
- High Output Power (+19 dBm)
- High Carrier Frequency Accuracy and Drift-free FM DC for FSK and VCO Modes
- Fast AM DC for Generating Level Bursts
- RF, AF, Level, and Memory Sweeps for Automatic Test Runs

RF signal generation with I/Q modulator and coder options for generating modulation signals for digital radio networks.

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Signal Sources

modulation spectrum to enable investigations of non-standard signals. The extremely high modulation accuracy meets all the requirements placed on a reference signal for use in receiver testing. Separate coders are required for GSM, DECT and NADC/PDC networks, since type of modulation, clock frequency, and baseband filtering are different in each network. The SMHU58 can accommodate one coder module. The plug-in coder modules can easily be interchanged.

Broadband AM: The I/Q modulator is also used for broadband amplitude modulation within a modulation bandwidth of 50 MHz. There are no limiting effects up to a level of +7 dBm. Modulation range, linearity, and bandwidth make the SMHU58 an ideal instrument for TV applications.

Broadband FM: This mode allows modulation frequencies up to 20 MHz. The frequency deviation can be adjusted in fine steps in the range from 1 kHz to 50 MHz. Through the simultaneous use of pulse modulation and Broadband-FM, the SMHU58 can generate radar chirps with a frequency variation of 100 MHz in less than 100 ns. Further applications are in the field of video measurements and in satellite reception.

Frequency Modulation: FM applications range from high-quality stereo modulation to fast FSK.

The maximum deviation usually decreases with the carrier frequency. This is different when FM is simultaneously used with I/Q or Broadband-AM. The maximum deviation then has a constant value of 3.2 MHz in the range between 5 MHz and 1.95 GHz.

High carrier frequency accuracy is ensured in FM DC mode. When FM DC is selected, the frequency offset remains smaller than $10^{-7} \times f_c$ (f_c = carrier frequency) and smaller than 400 Hz for I/Q modulation and Broadband-AM. There is practically no drift. This is particularly useful for receivers with digital signaling.

CHARACTERISTICS

	SME02	SME03	SMHU58
FREQUENCY			
Range	5 kHz to 1.5 GHz	5 kHz to 3 GHz	100 kHz to 4.32 GHz (usable to 1 kHz)
Resolution	0.1 Hz	0.1 Hz	0.1 Hz
Accuracy @ 1 GHz	1000 Hz based on reference aging rate per year	1000 Hz based on reference aging rate per year	100 Hz based on reference aging rate per year
Stability	±1 x 10^{-6}/year ±1 x 10^{-9}/day with Opt. 01	±1 x 10^{-6}/year ±1 x 10^{-9}/day with Opt. 01	±1 x 10^{-7}/year ±1 x 10^{-9}/year
Setting Time	<10 ms after IEEE bus delimiter	<10 ms after IEEE bus delimiter	<10 ms after IEEE bus delimiter, <1 ms fast mode
OUTPUT LEVEL			
Range	+16 to –144 dBm	+16 to –144 dBm	+19 to –140 dBm
Resolution	0.1 dB	0.1 dB	0.1 dB
Accuracy	±1 dB	±1.5 dB	±1.5 dB ±2.5 dB, ≥2.16 GHz
SPECTRAL PURITY			
Harmonics	≤–30 dBc	≤–30 dBc	≤–30 dBc
Spurious	≤–80 dBc, <–66 dBc for digital modulation	≤–74 dBc, <–60 dBc for digital modulation	–100 dBc ≤1 GHz, –94 dBc ≥1 GHz, –88 dBc ≥2.16 GHz
Residual FM (0.3 to 3 kHz BW)	1 Hz	1 Hz	≤1 Hz below 1 GHz ≤2 Hz below 2.16 GHz ≤4 Hz above 2.16 GHz
SSB Phase Noise	–130 dBc/Hz @ 10 kHz offset and 1 GHz CF	–130 dBc/Hz @ 10 kHz offset and 1 GHz CF	–130 dBc/Hz @ 10 kHz offset and 1 GHz CF
MODULATION			
AM Rate	0.4/1/3/15 kHz internal, DC to 100 kHz external	0.4/1/3/15 kHz internal, DC to 100 kHz external	1 Hz to 50 kHz internal, DC to 50 kHz external
AM Depth	0 to 100%	0 to 100%	0 to 100%
FM Rate	0.4/1/3/15 kHz internal, DC to 500 kHz external	0.4/1/3/15 kHz internal, DC to 500 kHz external	10 Hz to 100 kHz internal/external
FM Max Deviation	±125 kHz @130 MHz ±500 kHz @750 MHz ±1 MHz @ 1.5 GHz	±125 kHz @130 MHz ±500 kHz @750 MHz ±2 MHz @ 3 GHz	±100 kHz @125 MHz ±800 kHz @1 GHz ±3.2 MHz @ 4.3 GHz
Phase Modulation	YES with Opt. 05	YES with Opt. 05	YES
Phase Rate	0.4/1/3/15 kHz internal, DC to 100 kHz external	0.4/1/3/15 kHz internal, DC to 100 kHz external	10 Hz to 100 kHz internal/external
Phase Deviation (maximum)	10 radians	10 radians <1 GHz, 20 radians 1 to 3 GHz	320 radians
Pulse Modulation	YES with Opt. 03	YES with Opt. 08	YES, External
Pulse Width	20 ns to 1 s	20 ns to 1 s	–
Pulse Rate	100 ns to 85 s	100 ns to 85 s	–

Signal Sources

MODULATION (CONT.)	SME02	SME03	SMHU58
Pulse Delay	20 ns to 1 s	20 ns to 1 s	–
On/Off Ratio	>80 dB	>80 dB	>80 dB
Rise/Fall Time	<10 ns	<10 ns	<20 ns
Simultaneous Modulation	YES	YES	YES
Internal Modulation Generator	0.4/1/3/15 kHz	0.4/1/3/15 kHz	1 Hz to 100 kHz sine, 1 Hz to 2 kHz square or sawtooth
Digital Modulation	YES with Opt. 11	YES with Opt. 11	YES
FSK	YES	YES	YES
4FSK	YES	YES	YES with ADS and IQSM Software
FFSK	YES	YES	YES with ADS and IQSM Software
GFSK	YES	YES	YES with ADS and IQSM Software
GMSK	YES	YES	YES with ADS and IQSM Software
π/4-DQPSK	YES	YES	YES with ADS and IQSM Software
SWEEP			
Functions	Digital, in discrete steps, linear or log	Digital, in discrete steps, linear or log	Digital, in discrete steps, linear or log
Modes	Automatic, manual, single-shot, and external triggered,	Automatic, manual, single-shot, and external triggered,	Automatic, manual, single-shot, and external triggered,
Start/Stop	YES	YES	YES
Center Frequency/Delta Frequency	YES with Opt. 05 and 06	YES with Opt. 05 and 06	YES
Markers	3	3	User-selectable
OTHER FEATURES			
IEEE-488 Interface	YES	YES	YES
Self-diagnostics	YES	YES	YES
Overload Protection	50 W Max RF, 35 V Max DC	50 W Max RF, 35 V Max DC	30 W Max RF, 35 V Max DC
POWER REQUIREMENTS			
Line Voltage	90 to 132 V, 180 to 265 V	90 to 132 V, 180 to 265 V	100/120/220/240 V
Line Frequency	47 to 440 Hz	47 to 440 Hz	47 to 63 Hz
ENVIRONMENTAL			
Operating Temperature	0 to 50°C	0 to 50°C	0 to 50°C
Mechanical Stress	MIL-STD 810 D	MIL-STD 810 D	DIN 40046 (8)
Electromagnetic Compatibility	MIL-STD 461 B, RE02, CE03, CS01, CS02	MIL-STD 461 B, RE02, CE03, CS01, CS02	MIL-STD 461 B, CE03, RE02
PHYSICAL			
Dimensions	**mm / in.**	**mm / in.**	**mm / in.**
Height	192 / 7.89x	192 / 7.89	192 / 7.89
Width	435 / 17.8	435 / 17.8	435 / 17.8
Depth	460 / 18.9	460 / 18.9	460 / 18.9
Weight	**kg / lbs.**	**kg / lbs.**	**kg / lbs.**
Net	25 / 55	25 / 55	26 / 57.2

ORDERING INFORMATION

SME02
Signal Generator **$17,675**

SME03
Signal Generator **$23,190**
Opt. 01/SM-B1 – Reference Oscillator OCXO ..... **+$1,095**
Opt. 02/SM-B2 – LF Generator ..... **+$850**
Opt. 03/SM-B3 (SME02) – Pulse Modulator ..... **+$2,185**
Opt. 04/SM-B4 (Opt. 03 or Opt. 08) – Pulse Generator ..... **+$1,030**
Opt. 05/SM-B5 – FM/φM Modulator ..... **+$1,700**
Opt. 06/SM-B6 – Multifunction Generator ..... **+$2,360**
Opt. 08/SM-B8 (SME03) – Pulse Modulator ..... **+$2,300**
Opt. 11/SME-B11 – DM Coder ..... **+$1,455**
Opt. 12/SME-B12 – Memory Expansion ..... **+$885**
Opt. 19/SME-B19 – Rear Connectors for RF and AF ..... **+$185**

SMHU58
Signal Generator **$42,900**
Opt. 01/SMHU-B2 – GMSK Coder for GSM, PCN Networks ... **+$2,340**
Opt. 02/SMHU-B3 – GFSK Coder for DECT Networks ..... **+$2,340**
Opt. 03/SMHU-B4 – π/4 DQPSK Coder for PHP, NADC, PDC Networks ..... **+$2,340**
Opt. 04/SMHU-B5 – π/4 DQPSK Coder for PHP Networks **+$2,340**
Opt. 10/SMGU-Z9 – Rear-panel Connectors ..... **+$240**

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection
SME02, SME03 ..... **+$590**
SMHU58 ..... **+$1,130**
Opt. C5 – Adds five years of Calibration Services
SME02, SME03 ..... **+$1,225**

RECOMMENDED ACCESSORIES
Rear-panel Connectors for RF and AF – Order SMGU-Z9 ..... **$240**
19 in. Rack Adapter – Order ZZA-94 ..... **$145**
Service Kit – Order SMGU-Z2 ..... **$1,815**

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

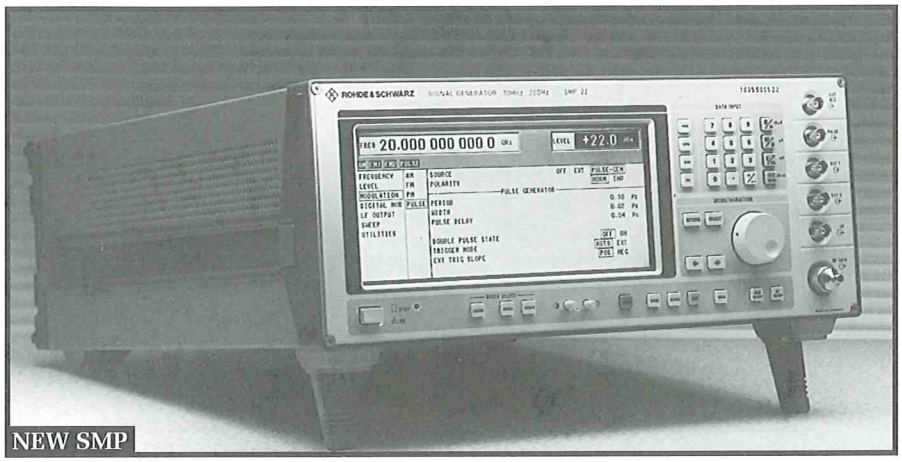
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Signal Sources

Excellent RF quality for a wide range of applications.

SMP

- Frequency Range 2 to 20 GHz (10 MHz to 20 GHz with Opt. 11)
- Maximum Output Level +10 dBm (SMP02), +20 dBm (SMP22)
- Harmonics <–50 dBc for f >2.2 GHz (SMP02, <–25 dBc for f >2.2 GHz (SMP22)
- SSB Phase Noise <–92 dB at 10 GHz (10 kHz offset)
- AM, FM, φM, and Pulse Modulation
- Ultra-low RF Leakage
- Second RF Output
- Large LCD Display
- Menu-guided Operation with All Menu Levels Shown at a Glance
- Two Menu Memories to Speed up Operation
- Non-volatile Storage for up to 50 Complete Instrument Setups
- Remote Control Interface IEC625/IEEE 488



SMP Signal Generator

The SMP Signal Generator is a high-frequency microwave signal source providing high output power with accurate level setting, high spectral purity, and excellent pulse modulation. The SMP can supply signals for radar and communications receiver tests. A wide range of extensions ensures universal use in research, production, EMC measurements, and material testing.

UNAMBIGUOUS RESULTS DUE TO HIGH SPECTRAL PURITY

The frequency range from 2 to 20 GHz is directly generated by YIG oscillators so that there are no subharmonics which may cause measurement errors. Non-harmonics of <–60 dBc and a specified SSB phase noise of >92 dBc/Hz at 10 GHz allow the user to concentrate on the device-under-test without wasting time in tracking down spurious signals of an inadequate signal source.

STABLE OUTPUT FREQUENCY

The built-in crystal reference ensures an accurate and low-drift output frequency. The SMP can also be fitted with an oven-controlled crystal oscillator (with OCXO, Option 01) to meet the most exacting requirements.

HIGH OUTPUT LEVEL ELIMINATES THE NEED FOR ADD-ON UNITS

A large number of microwave measurements requires mainly one thing: a high output level, which until now has only been possible with expensive add-on amplifiers. The SMP22 features a guaranteed level of 20 dBm (without attenuator) and thus sufficient reserves for compensating the attenuation of long cables as well as the losses of power splitters and directional couplers.

The SMP22 is therefore ideal for the many applications that require a high output level.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	192	7.89
Width	435	17.8
Depth	570	23.42
Weight	**kg**	**lbs.**
Net	27	59.4

CHARACTERISTICS

	SMP02	SMP22
FREQUENCY		
Range	2 to 20 GHz (10 MHz to 20 GHz with Opt. 11)	2 to 20 GHz (10 MHz to 20 GHz with Opt. 11)
Resolution	0.1 Hz	0.1 Hz
Accuracy @ 1 GHz	1000 Hz based on reference aging rate per year	1000 Hz based on reference aging rate per year

APPLICATIONS

- **Radar and Communications Receiver Testing**
- **Research and Development**
- **EMI Testing**

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Signal Sources

	SMP02	SMP22
FREQUENCY (CONT.)		
Stability	±1 x 10^{-6}/year, ±1 x 10^{-9}/day, with Opt. 01	±1 x 10^{-6}/year, ±1 x 10^{-9}/day, with Opt. 01
Setting Time	<11 ms +10 ms/GHz after IEEE bus delimeter	<11 ms +10 ms/GHz after IEEE bus delimeter
OUTPUT LEVEL		
Range	–20 to +10 dB. to –130 dBm with Opt. 15	–20 to +20 dBm to –130 dBm with Opt. 15
Resolution	0.1 dB	0.1 dB
Accuracy	±0.6 to ±1.5 dB level dependent	±0.6 to ±1.5 dB level dependent
SPECTRAL PURITY		
Harmonics	≤–30 dB, –50 dBc typical above 1.8 GHz	≤–25 dBc
Spurious	≤–60 dBc above 2 GHz, typically –60 dBc below 2 GHz	≤–60 dBc above 2 GHz, typically –60 dBc below 2 GHz
Residual FM (0.3 to 3 kHz BW)	≤5 Hz below 10 GHz, ≤10 Hz above 10 GHz	≤5 Hz below 10 GHz ≤10 Hz above 10 GHz
SSB Phase Noise	–92 dBc/Hz @ 10 kHz offset and 1 GHz CF	–92 dBc/Hz @ 10 kHz offset and 1 GHz CF
MODULATION		
AM Rate	DC to 100 kHz	DC to 100 kHz
AM Depth	0 to 90%	0 to 90%
FM Rate	DC to 1 MHz	DC to 1 MHz
FM Max Deviation	10 MHz	10 MHz
Phase Modulation	YES with Opt. 02 and 05	YES with Opt. 02 and 05
Phase Rate	0.4/1/3/15 kHz internal, DC to 100 kHz external	0.4/1/3/15 kHz internal, DC to 100 kHz external
Phase Deviation (maximum)	10 radians	10 radians
Pulse Modulation	YES with Opt. 14	YES with Opt. 14
Pulse Width	20 ns to 1 s	20 ns to 1 s
Pulse Rate	100 ns to 85 s, 0 to 10 MHz	100 ns to 85 s, 0 to 10 MHz
Pulse Delay	20 ns to 1 s	20 ns to 1 s
On/Off Ratio	>80 dB	>80 dB
Rise/Fall Time	<10 ns	<10 ns
Simultaneous Modulation	YES	YES
Internal Modulation Generator	0.4/1/3/15 kHz	0.4/1/3/15 kHz
Digital Modulation	YES, external	YES, external
FSK	YES, external	YES, external
SWEEP		
Functions	Digital, in discrete steps, linear or log	Digital, in discrete steps, linear or log
Modes	Automatic, manual, single-shot and external triggered	Automatic, manual, single-shot and external triggered
Start/Stop	YES	YES
Center Frequency/Delta Frequency	YES	YES
Markers	3	3
OTHER FEATURES		
IEEE-488 Interface	YES	YES
POWER REQUIREMENTS		
Line Voltage	90 to 132 V, 180 to 265 V	90 to 132 V, 180 to 265 V
Line Frequency	47 to 440 Hz	47 to 440 Hz
ENVIRONMENTAL		
Operating Temperature	0 to 55°C	0 to 50°C
Mechanical Stress	MIL-STD 810 D	MIL-STD 810 D
Electromagnetic Compatibility	MIL-STD 461 B, RE02, CE03, CS01, CS02	MIL-STD 461 B, RE02, CE03, CSO1, CS02

ORDERING INFORMATION

SMP02
Signal Generator **$27,295**

SMP22
Signal Generator **$35,175**
Includes: Power Cable, Operating Manual, 3.5 mm Female Adapter.

Opt. 01/SM–B1 – OCXO Reference Oscillator ..... **+$1,120**
Opt. 02/SM–B2 – LF Generator ..... **+$870**
Opt. 05/SM–B5 – FM/φM Modulator ..... **+$1,740**
Opt. 11/SMP–B11 – Frequen ‹tension ..... **+$3,225**
Opt. 12*[1]/SMP–B12 – Pulse . ˈulator, 2 to 40 GHz ..... **+$3,350**
Opt. 13*[1]/SMP–B13 – Pulse Modulator, 0.01 to 20 GHz..... **+$990**
Opt. 14/SMP–B14 – Pulse Generator ..... **+$805**
Opt. 15/SMP–B15 – RF Attenuator, 20 GHz ..... **+$2,420**
Opt. 18/SMP–B18 – Auxiliary Interface ..... **+$550**

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection..... **+$590**
Opt. C5 – Adds five years of Calibration Services ..... **+$1,225**

ADDITIONAL ACCESSORIES
See page 446 for complete selection information.

[1] Option 12 and Option 13 can not be installed at the same time.

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

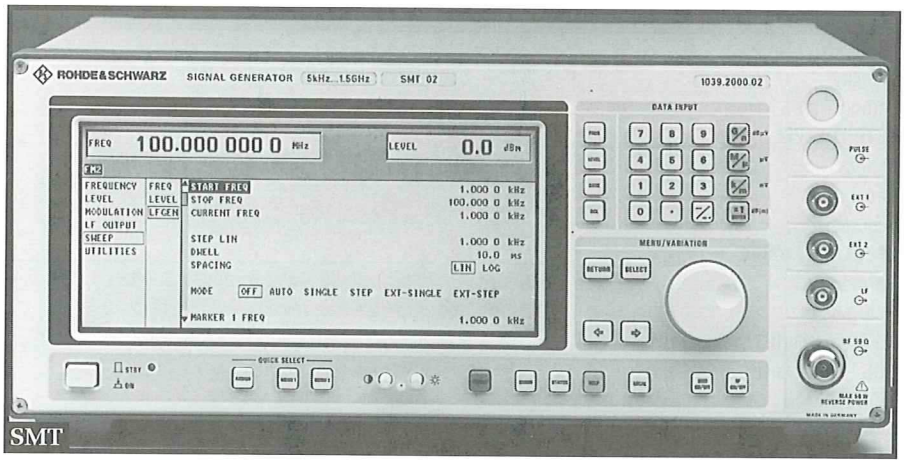
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Signal Sources

The ideal signal source for EMS, stereo multiplex, VOR, ILS.

SMT

- Frequency Range 5 kHz to 1.5 GHz (5 kHz to 3 GHz, SMY03)
- Broadband FM Modulation from DC to 8 MHz with Deviation Up to 20 MHz
- Amplitude Modulation
- Phase Modulation (φM) from DC to 2 MHz
- Convenient RF, LF, and Level Sweeps
- Memory Sequence Function for Automatic Measurements
- Programmable Level Correction for Compensation of External Frequency Response
- Optional LF Generator (Opt. 02)
- Optional Pulse Modulator (Opt. 03 or 08)
- Optional Pulse Generator (Opt. 04)
- Optional Multifunction Generator (Opt. 06)
- Large, Backlit LCD Display
- All Submenus and Current Instrument Status Clearly Displayed
- Remote Control Interface IEC625/IEEE 488



SMT Signal Generator

The SMT Signal Generator covers the complete range of conventional analog receiver measurements up to 3 GHz. It provides exceptionally high signal quality, outstanding level accuracy, a wide variety of modulation and signal generation modes, a customizable configuration, and ease of operation.

THE IDEAL EMS SIGNAL SOURCE

With a specified lower frequency limit of 5 kHz (under-range down to 1 kHz), the SMT fully covers the frequency range for EMS measurements stipulated by IEC 801. The digital, step-by-step sweep function, with preselectable start and stop frequency, span, step width, and step time, enables the convenient testing of wide frequency ranges. During the frequency sweeps, no level overshoots will occur. The sweep function can also be used for the RF level and AF frequency.

The frequency response of cables, amplifiers, TEM cells, etc., can be compensated in the signal generator by means of a level-correction function. Complicated external level controls or test routines are not required.

EXCELLENT RF CHARACTERISTICS AT A REASONABLE PRICE

For high-frequency measurements on AM, FM, and SSB receivers, the signal source must be superior to the device-under-test. The low residual FM and SSB phase noise of the SMT make it suitable for in-channel and blocking measurements, even on high-end receivers. The small level error of <1 dB throughout the frequency range allows high-precision sensitivity measurements.

MINIMUM RF EMISSIONS – FOR SENSITIVE DUTS

Measurements on highly sensitive receivers such as pagers not only require high signal quality, but also extremely high RF shielding of the signal source. Elaborate shielding measures keep RF emissions of the SMT to a minimum.

MEMORY SEQUENCE FUNCTION FOR AUTOMATIC MEASUREMENTS

For frequently repeated measurement series, the memory sequence function allows a sequence of measurements to be run without an external controller. Up to 50 instrument settings can be stored in non-volatile memory.

See page 300 for characteristics.

APPLICATIONS

- **Radar Applications (with Opt. 03 or Opt. 08)**
- **VOR/ILS Receiver Tests (with Opt. 06)**
- **FM Broadcast Transmitter and Receiver Test and Design (with Opt. 06)**

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).



SMY Signal Generator

The SMY Signal Generator is a cost-effective instrument for testing AM, FM, and φM receivers and for component measurements. The SMY comes in two models: SMY01 for 9 kHz to 1.04 GHz and SMY02 for 9 kHz to 2.08 GHz.

The SMY Signal Generator is designed with a comprehensive set of basic signal generator capabilities. As a result, it is an economical solution for universal use in the lab, production, and servicing environments.

THE IDEAL GENERATOR FOR RECEIVER MEASUREMENTS...

- Level range –140 dBm to +13 dBm (19 dBm over range) sufficient even for receivers of highest sensitivity
- High level accuracy and low RF leakage allowing accurate and undergraded sensitivity measurements
- FM-DC with high accuracy of carrier frequency for testing pagers and receivers fitted with digital squelches
- Low SSB phase noise and high spurious rejection for all in-channel and blocking measurements
- Low residual FM affording ample margin for S/N measurements
- Modulation generator 1 Hz to 500 kHz for modulation frequency response measurements
- Stereo channel separation of 50 dB and low harmonic distortion for testing FM stereo receivers
- Non-interrupting level setting over a range of 20 dB for reproduceable measurement of squelch hysteresis

... PLUS THE PERFORMANCE FOR GENERAL-PURPOSE APPLICATIONS

- Frequency resolution 1 Hz, also suitable for extremely narrowband tests
- FM-DC deviation up to 20 MHz for VCO simulation
- FM bandwidth 2 MHz for fast FSK and telemetry applications
- High output level up to 19 dBm for component and overdrive testing
- AF synthesizer 1 Hz to 500 kHz, separate use as AF signal source possible for external applications (e.g., recording of AF frequency response).
- Remote-control interface IEC625/IEEE 488 for use in automatic test systems
- Sequence function and SEQ input for semi-automatic use

See page 300 for characteristics.

SMY

- Frequency Range 9 kHz to 1.04 GHz (2.08 GHz, SMY02)
- Frequency Resolution 1 Hz
- Level Range –140 to +13 dBm, over range up to 19 dBm
- Level Accuracy Better than 1 dB
- SSB Phase Noise <–114 dB at 1 GHz, Δf = 20 kHz
- AM, FM, φM, and Pulse Modulation
- Modulation Generator 1 Hz to 500 kHz
- RF Overload Protection 30 W (SMY01) or 50 W (SMY02)
- Low RF Leakage (<0.1 µV)
- Non-volatile Storage for up to 50 Complete Front-panel Setups
- Remote Control Interface IEC625/IEEE 488
- Calibration at 3-Year Interval

An economical generator with the power you need.

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

APPLICATIONS

- **Communications Receiver Testing**
- **General Component Measurements**
- **EMI**

SMT
SMY

Signal Sources

CHARACTERISTICS

	SMT02	SMT03	SMY01	SMY02
FREQUENCY				
Range	50 kHz to 1.5 GHz	50 kHz to 3 GHz	9 kHz to 1.04 GHz	9 kHz to 2.08 GHz
Resolution	0.1 Hz	0.1 Hz	1 Hz	1 Hz
Accuracy @ 1 GHz	1000 Hz based on reference aging rate per year	1000 Hz based on reference aging rate per year	1000 Hz based on reference aging rate per year	1000 Hz based on reference aging rate per year
Stability	1×10^{-6}/year 1×10^{-9}/day with Opt. 01	$\pm 1 \times 10^{-6}$/year $\pm 1 \times 10^{-9}$/day with Opt. 01	$\pm 1 \times 10^{-6}$/year $\pm 1 \times 10^{-9}$/day with Opt. 01	$\pm 1 \times 10^{-6}$/year $\pm 1 \times 10^{-9}$/day with Opt. 01
Setting Time	<25 ms after IEEE delimiter	<25 ms after IEEE delimiter	<60 ms after IEEE delimiter	<60 ms after IEEE delimiter
OUTPUT LEVEL				
Range	+16 to –144 dBm	+16 to –144 dBm	+19 to –140 dBm	+19 to –140 dBm
Resolution	0.1 dB	0.1 dB	0.1 dB	0.1 dB
Accuracy	±1 dB	±1 dB to 1.5 GHz ±1.5 dB, ≥1.5 GHz	±1 dB	±1 dB to 1.04 GHz ±1.5 dB 1.04 to 2.08 GHz
SPECTRAL PURITY				
Harmonics	≤–30 dBc	≤–30 dBc for levels ≤–10 dBm	≤–30 dBc for levels <10 dBm	≤–30 dBc for levels <10 dBm
Spurious	≤–80 dBc	≤–80 dBc to 1.5 GHz ≤–74, ≥1.5 GHz	≤–70 dBc	≤–70 dBc to 1.04 GHz ≤–64 1.04 to 2.08 GHz
Residual FM (0.3 to 3 kHz BW)	<8 Hz @ 1.5 GHz	<8 Hz to 1.5 GHz, <16 Hz 1.5 to 3 GHz	10 Hz	10 Hz
SSB Phase Noise	–116 dBc/Hz @ 10 kHz offset and 1 GHz CF	–116 dBc/Hz @ 10 kHz offset and 1 GHz CF	–114 dBc/Hz @ 10 kHz offset and 1 GHz CF	–114 dBc/Hz @ 10 kHz offset and 1 GHz CF
MODULATION				
AM Rate	DC to 100 kHz	DC to 100 kHz	1 Hz to 500 kHz	DC to 50 kHz
AM Depth	0 to 100%	0 to 100%	0 to 100%	0 to 100%
FM Rate	DC to 100 kHz or DC to 8 MHz 25%	DC to 100 kHz or DC to 8 MHz 25%	DC to 2 MHz	DC to 2 MHz
FM Max Deviation	±10 MHz	±20 MHz	±10 MHz	±20 MHz
Phase Modulation	YES, dual channel, 100 kHz and 2 MHz BW	YES, dual channel, 100 kHz and 2 MHz BW	YES	YES
Phase Rate	0.4/1/3/15 kHz internal, DC to 2 MHz external	0.4/1/3/15 kHz internal, DC to 2 MHz external	1 Hz to 500 kHz	1 Hz to 500 kHz
Phase Deviation (maximum)	10 radians @ 100 kHz, 200 radians @ 2 MHz	10 radians @ 100 kHz, 200 radians @ 2 MHz	200 radians	200 radians
Pulse Modulation	YES with Opt. 14	YES, with Opt. 14	YES, external	YES, external
Pulse Width	20 ns to 1 s	20 ns to 1 s	–	–
Pulse Rate	100 ns to 85 s 0 to 10 MHz	100 ns to 85 s 0 to 10 MHz	–	–
Pulse Delay	20 ns to 1 s	20 ns to 1 s	2.5 µs	2.5 µs
On/Off Ratio	>80 dB	>80 dB	>80 dB	>80 dB
Rise/Fall Time	<10 ns	10 ns	4 µs	4 µs
Simultaneous Modulation	YES	YES	YES	YES
Internal Modulation Generator	0.4/1/3/15 kHz	0.4/1/3/15 kHz	1 Hz to 500 kHz	1 Hz to 500 kHz
VOR Modulation Signal	YES, with Opt. 06	YES, with Opt. 06	NO	NO
ILS Modulation Signal	YES, with Opt. 06	YES, with Opt. 06	NO	NO
Stereo Multiplex Signal	YES, with Opt. 06	YES, with Opt. 06	NO	NO
Digital Modulation	NO	NO	YES, external	YES, external
FSK	NO	NO	YES, external	YES, external
4FSK	NO	NO	YES, external	YES, external
FFSK	NO	NO	YES, external	YES, external
GFSK	NO	NO	YES, external	YES

Characteristics (Continued)

	SMT02	SMT03	SMY01	SMY02
SWEEP				
Functions	Digital, in discrete steps, linear or log	Digital, in discrete steps, linear or log	Digital, in discrete steps, linear or log	Digital, in discrete steps, linear or log
Modes	Automatic, manual, single-shot and external triggered.	Automatic, manual, single-shot and external triggered.	Automatic, manual, single-shot and external triggered.	Automatic, manual, single-shot and external triggered.
Start/Stop	YES	YES	NO	NO
Center Frequency, Delta Frequency	YES	YES	NO	NO
Markers	3	3	NO	NO
OTHER FEATURES				
IEEE-488 Interface	YES	YES	YES	YES
Self-diagnostics	NO	NO	NO	NO
Overload Protection	50 W max RF, 35 V max DC	50 W max RF, 35 V max DC	30 W max RF, 35 V max DC	50 W max RF, 35 V max DC
POWER REQUIREMENTS				
Line Voltage	90 to 132 V, 180 to 265 V	90 to 132 V, 180 to 265 V	100 V/230 V,	100 V/230 V,
Line Frequency	47 to 440 Hz	47 to 440 Hz	47 to 440 Hz	47 to 440 Hz
ENVIRONMENTAL				
Operating Temperature	0 to 50°C	0 to 55°C	0 to 55°C	0 to 55°C
Mechanical Stress	MIL-STD 810 D	MIL-T-28800D	MIL-T-28800D Class 5	MIL-STD 28800 D Class 5
Electromagnetic Compatibility	MIL-STD 461 B, RE02, CE03, CS01, CS02	MIL-STD 461 B, RE02, CE03, CS01, CS02	EN 50081-1 EN 50082-1 compliance	EN 50081-1 EN 50082-1 compliance
PHYSICAL				
Dimensions	**mm in.**	**mm in.**	**mm in.**	**mm in.**
Height	192 7.89	192 7.6	147 5.79	147 5.79
Width	435 17.8	435 17.8	435 17.12	435 17.12
Depth	480 18.9	365 14.38	350 13.8	460 18.1
Weight	**kg lb.**	**kg lb.**	**kg lb.**	**kg lb.**
Net	25 55	20 44	11 24	12 26

ORDERING INFORMATION

SMT02
Signal Generator (5 kHz to 1.5 GHz) **$10,085**

SMT03
Signal Generator (5 kHz to 3.0 GHz) **$13,290**
Includes: Power Cord, Operating Manual.

Opt. 01/SM-B1 – OCXO Reference Oscillator ..... **+$1,095**
Opt. 02/SM-B2 – LF Generator ..... **+$850**
Opt. 03/SM-B3 – Pulse Modulator for SME02 and SMT02 .... **+$2,185**
Opt. 04/SM-B4 – Pulse Generator ..... **+$1,030**
Opt. 06/SM-B6 – Multifunction Generator ..... **+$2,360**
Opt. 08/SM-B8 – Pulse Modulator for SME03 and SMT03 .... **+$2,300**
Opt. 20/SMT-B19 – Rear-panel Connectors for RF and AF (only for SMT) ..... **+$185**

SMY01
Signal Generator **$6,335**
Includes: Power Cord, Operating Manual.

SMY02
Signal Generator **$7,625**
Includes: Power Cord, Operating Manual.

Opt. 01/SMY-B1– OCXO Reference Oscillator ..... **+$970**

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection
SMT ..... **+$400**
SMY02 ..... **+$260**

Opt. C5 – Adds five years of Calibration Services
SMT ..... **+$1,050**
SMY02 ..... **+$725**

ADDITIONAL ACCESSORIES
See page 446 for complete selection information.

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

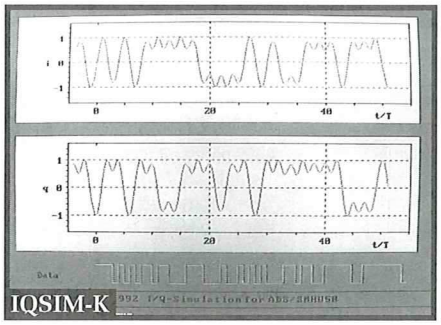
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Signal Sources

Mathematical simulation of all types of digital modulation.

IQSIM-K

- Digital Modulation
- Superpositioning/ Simulation of Interference Sources
- Power Ramping
- Data Transfer to Arbitrary Waveform Generator



IQSIM-K Software

In radiocommunication, existing analog methods are more and more being replaced by digital methods. The GSM network in Europe is just one of the many examples for the spread of the digital technique. A precondition for this type of technique is the digital modulation of signals.

IQSIM software for simulating I/Q signals allows the mathematical simulation of all digital modulations presently known, including CDMA. The simulated signals to be modulated are transferred to an arbitrary waveform generator whose output signals feed a signal generator with a built-in I/Q modulator.

Characteristics

System Features –
User Interface: Automatic adaptation to the graphic mode used, menus following SAA standard, context-sensitive help system, interactive dialog boxes, access to DOS.
Types of Modulation – 2PSK, 4PSK, 0-4PSK, 8PSK. 16QAM, 64 QAM, 256QAM. CFSK (m = 0.1 to 10). GFTM (b = 0 to 1). 4FSK (m = 0.1 to 20).

Filter Functions –
Digital Filters: No filter, Sinx/x filter, $\sqrt{\text{cosine}}$ filter, Roll-off factor r = 0.1 to 1, Cosine filter, roll-off factor r = 0 to 1, Gauss filter, bandwidth time product B x T = 0.1 to 1, User-specific FIR filters.
Window Function: Rectangular, Hanning window, Kaiser window. Parameter β = 0.1 to 20.
Pulse Length: 1 to 16-Bits/symbol.
Oversampling Factors: 4 to 32 in steps of 2.
Bit rate:

$$0 \text{ to } \frac{25 \text{ Mbit/s}}{(\text{oversampling factor})} \text{ x bit/symbol}$$

Coding – None, Gray coding, GSM coding (Groupe Spéciale Mobile), NADC-PDC coding (North American Digital Cellular, Pacific Digital Cellular), TFTS coding (Terrestrial Flight Telephone System).

Data Sources –
Pseudo-random Bit Sequences, Data Length: 127/511/2047/32767-Bits.
User-defined Data: Editor function, chaining, filling, saving.
Maximum Length: (16384/oversampling factor) x bit/symbol.

Simulation of Interference Sources –
Linear distortion effects – Carrier Leakage in I/Q: ±10%. IQ imbalance in I/Q: ±20%. Quadrature Offset: ±10%.

Nonlinear Distortion Effects – AM/AM Conversion (k2), (k3): ±10%. AM/PM conversion (k1), (k2): ±10%.

Noise – Energy per Bit Related to Noise (energy Eb/noise): –36 to –3 dB. Normalized Noise Bandwidth: B x T_s = 0/0.5/1/2/4.

Co-channel interference – Simulation of interference source.

Amplitude shape/power ramping – Amplitude Control of the RF Signal: 0 to –60 dB.

Graphic Simulation –
Graphics: I(t), Q(t), r(t), φ(t), r(t), f(t), vector diagram, eye diagram , (r = amplitude function, φ = angle function, f = frequency function).
Scaling: User-selectable.

Transfer Interface – Setting Functions: IEC/IEEE-bus address of generator, choice of generator AMS or ADS, I/Q format or FM/AM format quantization maximum 12-Bit, interpolation between r = first and last bit.

REQUIRED HARDWARE
Controller –
Type: PSA controller family or AT-compatible.
Operating system: MS-DOS 3.00 and higher.
Main Memory: 350 KB RAM minimum.
Monitor and Graphics Adapter: Hercules graphic card and monochrome monitor, EGA/VGA with monochrome or color monitor.
IEC-bus Card (IEEE 488.1): Rohde & Schwarz IEC/IEEE-bus driver (PS-K2) or National Instruments GPIB-PC software.
Mouse: Rohde & Schwarz PS-B11, serial Microsoft mouse, or compatibles.

Generator –
SMHU58 Signal Generator: Signal generator with I/Q modulator 1 kHz to 4.32 GHz.
ADS Generator: 2-CH programmable ARB generator.

Extra – Clock Generator ADS-B1.

ORDERING INFORMATION

IQSIM-K
I/Q Simulation Software *1
Includes: Manual.

**1 Contact your Tektronix representative for price information.*

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

RF Meters

Electronic Voltmeters – An Introduction

RMS/PEAK VOLTMETERS

RMS/peak voltmeters feature a broadband amplifier which boosts the test signal, virtually without any noise, to the appropriate level for the built-in rectifiers. A high-impedance input circuit allows low-load measurements on the device under test.

The built-in amplifier, as well as the rectifier circuits, have a bandwidth extending from DC to over 30 MHz. In contrast to the thermal methods usually employed, an RMS-responding rectifier circuit allows high measurement speed without any reduction in bandwidth and accuracy.

DIGITAL VOLTMETERS AND MULTIMETERS

Digital voltmeters offer advantages over meters with analog readout. With brief, unstable voltages, the purely digital indication may, however, be ambiguous and difficult to read. The combination of a digital display with an analog trend indication in a single unit offers optimum operating convenience in such cases.

RF MILLIVOLTMETERS

A diode rectifier in the probe changes the unknown RF signal into a DC voltage. This DC voltage is processed in the basic unit and indicated on the display. The non-linear rectifier characteristic is linearized by a control loop or by a calculated correction value.

Using the square weighting of a diode rectifier, RF millivoltmeters measure the RMS value of small voltages up to about 30 mV (or higher with a divider) and the peak or the peak-to-peak value (if a full-wave rectifier is used) of voltages above 1 V. Due to linearization, the meter reads the RMS value of a sine wave in the entire measurement range.

A probe incorporating a capacitively coupled diode is used for measurements on non-coaxial circuits. It features high input impedance and very low input capacitance.

Measurements in coaxial circuits are carried out with the aid of coaxial RF insertion units. They incorporate a diode inserted into the inner conductor or connected via a piston attenuator and permit broadband voltage measurements to be made up to 2 GHz with low SWR. Power sensors can be connected to RF millivoltmeters so that they can also be used as RF power meters.

RF POWER MEASUREMENT

There are two general types of RF power meters:

- Terminating power meters absorb the test signal and indicate the power picked up
- Directional power meters separately measure the forward and reflected power in an RF line, with practically no loss.

TERMINATING POWER METERS

Terminating power meters are often referred to simply as power meters. They typically have a resistive input impedance of 50 or 75 Ω. Depending upon the principle of operation – either the heat produced is measured or the RF power at the termination is measured with the aid of a diode rectifier. Conventional power meters with diode probes have a limited dynamic range since departures from linearity of the diode at as low as 10 µW cause considerable measurement errors. This range can be extended by microprocessor-controlled correction of the rectifier characteristics.

DIRECTIONAL POWER METERS

Directional power meters are inserted into an RF line and measure the forward and reflected power separately based upon a directional coupler. Directional power meters can thus be used for simultaneously checking the transmitter output power and the antenna or load matching. Minimum insertion loss is required for the measurement of higher power levels. The measuring instrument can thus remain connected to the transmitter output line for continuous monitoring. Special power sensors with peak weighting are available for measuring pulsed signals (e.g., in GSM mobile radio).

MEASUREMENT ACCURACY

The most important characteristics of a voltmeter or power meter are high measurement accuracy and short measurement times. This requires the use of microprocessors and computed correction of factors such as frequency response, temperature effect, and linearity. This relieves the user of error-prone and time-consuming tasks such as recalibration of sensors before measurement or reading, entering, and calculating correction factors.

STORED CALIBRATION DATA FOR EASE OF USE

The sensors offered for use with the URV and NRV meters are individually calibrated and their calibration data stored in memory. All relevant data required to produce accurate results is stored in calibration-data memory and is available to the meter when plugged in – even sensor-specific data such as serial number, sensor type, and calibration date are known to the meter in addition to the permissible measurement and frequency ranges. Only the frequency of the measurement is required and the meter automatically scans the data memory for the relevant calibration factors and interpolates, if necessary.

CONTENTS

URV 5 304
URV 35 304
NRVD 306
NRVS 308
URE 2 310
URE 3 310
Measuring Heads and Sensors 313

URV 5
URV 35

RF Meters

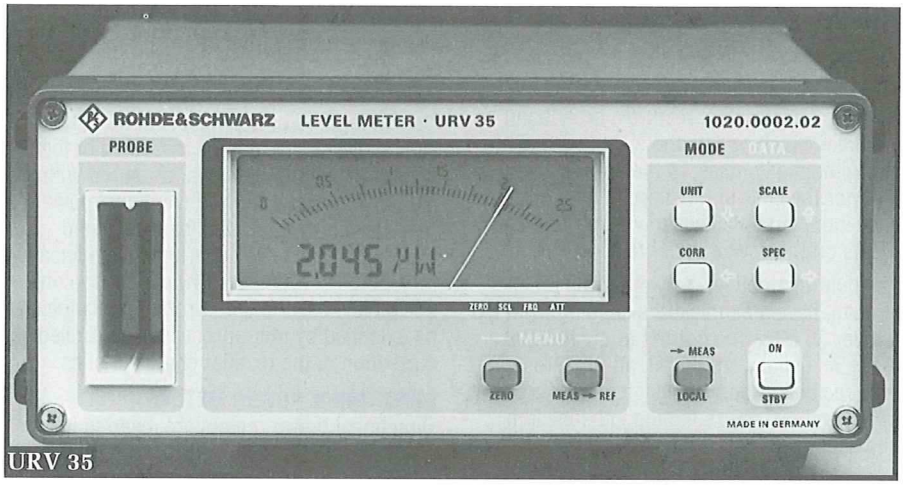
Voltage, level, power measurement with trend indication.

URV 5

- DC, 9 kHz to 2 GHz Frequency Range (26.5 GHz with NRV-Z Sensors)
- 200 µV to 1000 V Measurement Range
- Two Test Inputs
- Microprocessor Error Correction for Unexcelled Accuracy
- Wide Dynamic Range
- Readout in Standard Units with Selectable Reference Impedance
- Relative Measurements
- Individual, Frequency-dependent Calibration Factors Taken into Account
- Optional DC Output

URV 35

- DC to 26.5 GHz Frequency Range
- Compact, Handy, and Mobile
- Voltmeter and Power Meter in One Unit
- Combined Analog and Digital Display
- Menu-guided Operation
- DC Frequency Input for Tracking Frequency-response Correction
- Analog Output of YT Recorder
- Remote Control Interface
- Battery or AC Supply Operation
- Wide Choice of Probes and Sensors
- Rugged Design



URV 35

URV 5 RF Millivoltmeter

The URV 5 RF Millivoltmeter is a broadband voltage, level, and power meter with high accuracy and sensitivity. It is suitable for both manual operation and use in systems. A great variety of probes, sensors, and accessories allows the URV 5 to be used for all kinds of measurements.

The values measured in the two channels can be displayed separately, set off against one another, or referred to any reference. For relative measurements, the difference, difference in percent, logarithmic difference, or ratio is indicated (ΔV, ΔW, Δ%, ΔdB, X/REF).

The URV 5 has a fast trend indication which follows the variations of the measured value.

URV 35 Level Meter

The URV 35 Level Meter is a precise voltage and power meter for a large variety of applications. It can be used in service and production as well as for precision measurement in the RF and microwave lab.

The large variety of probes and sensors available opens up a wide level and frequency range. Excellent RF shielding provides precise measurements, even in the near field of antennas.

An intelligent operating concept in conjunction with an auto-range facility reduces the user's work to read the results in standard units, either as absolute or relative values. The appropriate scale is shown on the LCD display for convenient reading of the results.

Filtering, which is dependent upon the level and resolution, as well as the choice between 4 1/2- and 3 1/2-digit readout optimizes the display of results. Each probe and sensor is calibrated individually. All relevant data of the probes are automatically evaluated in the URV 35.

Characteristics (URV 5)

Probes and Sensors – Compatible with all URV 5 probes and NRV sensors except NRV-Z51, NRV-Z52, NRV-Z53, NRV-Z54 and NRV-Z31.

Test Channels – 2 (A and B).
Dynamic Range: >94 dB.
Absolute Measurement: A, B.
Relative Measurement: A/REF_A, B/REF_B, A/B, B/A.
Absolute Readout: V, W, dBm, dBV.
Relative Readout: ΔV, ΔW, Δ%, ΔdB, X/REF.
Resolution: 0.01% or dB.
Error Limits (18 to 28°C): ±0.15% of rdg per channel.
Filter: For reducing display noise in six steps (F0 to F5).
Zero Adjustment: Via keyboard or remote control.
Measurement Rate (manual): Approximately 1 measurement/second with filter F0, up to 30 measurements/second with filter F5.
Measurement Time (IEC/IEEE bus): Approximately 0.05 second with filter F5, up to 20 seconds with filter F0.

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

APPLICATIONS

- **Service**
- **Production**
- **Precision Measurements in RF and Microwave Labs**

PEP Measurement –
Pulse Width: Approximately 200 µs to CW.
Minimum Pulse Repetition Frequency:

Filter	F0	F1	F2	F3	F4	F5
f_{min}/Hz	0.05	0.25	1	5	25	100

Remote Control –
Interface: IEC625-1 (IEEE 488) for control of all device functions.
Interface Functions: SH1, AH1, T5, L4, SR1, RL1, DC1, DT1, PP1.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	110	4.3
Width	241	9.5
Depth	340	13.4
Weight	**kg**	**lb.**
Net	4.4	9.7

Characteristics (URV 35)

Probes and Sensors – Compatible with all URV 5-Z probes and NRV-Z sensors.

Frequency Range – DC to 26.5 GHz.

Display – Backlit LCD for display of measured value, units, and meter scale; additional moving-coil meter with short response time.

Absolute Readout: dBm, dBµV, V, or W.

Relative Readout: dB referred to stored reference value.

Resolution of digital display –
4 1/2 Digits: 19,999 steps, 0.001 dB.
3 1/2 Digits: 1,999 steps, 0.01 dB.

Analog Display: Steps of 1/2.5/5 with readout in V, W, or dB; steps of 5 (10) dB with readout in dBm and windows of 10 (20) dB, manually or automatically selected; free scaling by entry of left-hand and right-hand scale limits.

Display Filtering: Level-dependent digital averaging filter –
4 1/2-digit Resolution: Averaging over 16 to 256 Readings.
3 1/2-digit Resolution: Averaging over 1 to 32 readings.

Error Limits (18 to 28°C) –
Digital Display: ±0.02 dB ±1 digit.
Moving-coil Meter: 1.5% of full scale.

Zero Adjustment – Via interface or manually, approximately 4 s.

HOLD Function – Displayed measurement result retained upon keystroke.

Measurement Rate – Five readouts per second in manual mode.

Frequency-response Correction – Specific calibration data of probe taken into account; frequency entry via keypad, interface, or equivalent DC voltage at rear panel input.

Attenuation Correction – Attenuation or gain connected ahead taken into account; input of attenuation value via serial interface or keypad, range ±199.99 dB.

Reference Value Entry – Measured value on keystroke or value entered via interface or keypad.

Reference Impedance – 50 Ω/75 Ω, automatic/selectable.

Input/Output –
DC Frequency Input –
Connector: BNC female.
Input Impedance: 9 MΩ.
Input Voltage Range: ±12 V, freely selectable, linear, scaling.
Maximum Input Voltage: 50 V.

DC Voltage Output –
Connector: BNC female.
Source Impedance: 1 kΩ.
Output Voltage (EMF): Proportional to pointer deflection.
Left-hand Scale Limit: Corresponding to 0 V.
Right-hand Scale Limit: Corresponding to 0 V.
Settling Time: 250 ms.
Error: ≤5 mV.
Ripple: 5 mV p-p typical.

Optional DC Output (URV 5 with Option 01) –
Output Voltage Range (EMF): –1.999 to +1.999 V into Z_{out} = 1 kΩ.
Resolution: 1 mV (10 digits).
Error: ±2 mV.

Remote Control – All device functions controlled via serial interface (V.24, RS-232-C).

POWER REQUIREMENTS
Battery Operation (URV 35 Model 02) –
Battery Type: 5 LR20 (1.5 V).
Operating Time: Approximately 125 hours.
Charge Time (with UZ-35 Charger): Approximately 24 hours.

AC Operation (URV 5 and URV 35 Model 03) –
Line Voltage: 100/120/220/240 V AC ±10%.
Line Frequency: 47 to 63 Hz, 400 Hz.
Power Consumption: 30 VA.

ENVIRONMENTAL CHARACTERISTICS (URV 5 AND URV 35)
Temperature Range –
Operating: 0 to +50°C (Class I to IEC 359, no condensation).
Storage: –40 to +70°C.

Humidity – 80% maximum (without condensation).

Mechanical Strength – To IEC 359, Class I.

RFI Suppression – VDE 0871, DBP approval number to regulations 527/1979.

EMC – To IEC 801.3, severity level 3; MIL-STD-461 B RS 03 and CS 02.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	103	4.1
Width	219	6.6
Depth	240	9.4
Weight	**kg**	**lb.**
Model 02		
With batteries	3.1	6.8
Without batteries	2.3	5.1
Model 03	2.4	5.3

ORDERING INFORMATION

URV 5
RF Millivoltmeter **$4,600**
Includes: Power Cord, Manual.
Opt. 01 – DC Output ..... **+$445**

URV 35 MODEL 02
RF Millivoltmeter (Battery Operated) **$2,230**

URV 35 MODEL 03
RF Millivoltmeter (AC Supply) **$2,290**
Includes: Power Cord, Manual.

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection
URV 5 ..... **+$160**
URV 35 ..... **+$100**

Opt. C5 – Adds five years of Calibration Services
URV 5 ..... **+$475**
URV 35 ..... **+$325**

RECOMMENDED ACCESSORIES
Battery Chargers – Order UZ-35 ..... *1
Service Kit – Order URV 35-Z1 ..... *1
Transit Case – Order UZ-22 ..... *1
Carrying Strap – Order ZZT-96 ..... **$65**
Rack Adapter – Order ZZA-97 ..... **$260**
Plastic Hood *1

Probes and sensors see page 313.

*1 *Contact your Tektronix representative for price information.*

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

NRVD

RF Meters

Accurate, general-purpose, dual-channel, easy-to-use power, level, and voltage measurements.

NRVD

- DC to 26.5 GHz Frequency Range
- Two Independent Channels for Simultaneous Measurement
- Power, Level, and Voltage Measurements
- LCD Display with Variable Backlighting, Separate Digital Readout for Each Channel, Bar Graph Indicator
- Intelligent Measuring Heads – Just Plug Them in and Measure
- Autoranging
- Entry of Reference Values for Level and Attenuation
- Menu-guided Operation via Softkeys
- Storage of 20 Complete Instrument Setups
- Rear Connectors for Rack Mounting
- Built-in Test Generator for Checking Sensors
- Remote Control of All Functions via IEC/IEEE bus



NRVD Dual-channel Power Meter

The NRVD Dual-channel Power Meter functions like two independent measuring instruments housed in one cabinet to perform measurements simultaneously and exchange data with one another.The two channels can be separately set so that two completely different measurements can be carried out at the same time. The two measured values can also be related to each other for direct indication of reflection coefficient, SWR and return loss, for instance, when an SWR bridge is connected to the meter.

READOUT OF RESULTS

Measurement results are displayed with selectable resolution on a large 5-digit LCD display with adjustable backlighting. The values measured in the two channels, or one measured value plus an additional item of information (e.g., the correction frequency) are displayed simultaneously.

All standard units of measurements or relative modes can be selected. Relative measurements are either referred to a stored reference value or to the value measured in the second channel. A high-resolution bar graph indicator with selectable scaling or autoscaling permits quasi-analog display of measured values with any unit or resolution.

If pulse-modulated signals are measured, the NRVD calculates the pulse peak power from the measured average value and the entered pulse duty factor; the result is directly displayed. Additionally, the modulation depth of an amplitude-modulated signal can be determined from the power variation. After entering the SWR of the source, the measured value, together with its uncertainty, can be displayed.

MEASUREMENT RATE

The attainable measurement rate depends upon the type of measuring head used as well as on the setting of the averaging filter, which must be matched to the measurement conditions. Taking into account the connected measuring head, the NRVD automatically selects the appropriate measurement rate by determining the optimum averaging time required for a steady readout as a function of level and selected resolution. This automatic selection may be disabled and an averaging time of between 4 ms and 25 s may be set manually to measure faster than in automatic operation or to further reduce the noise.

POWER SENSORS

The range of probes and sensors includes thermocouple power sensors as well as highly sensitive diode power sensors, probes, and insertion units. This allows the NRVD to cover a frequency range from DC to 26.5 GHz and a power span from 400 pW up to the kW range.

TEST GENERATOR

A test generator is included to check measuring heads and sensors for proper functioning. It generates a low-distortion, highly accurate 50-MHz signal of 1 mW power (0 dBm).

INPUT/OUTPUT WITH OPTION 01

Option 01 provides a number of inputs and outputs to extend the range of the NRVD.

Characteristics

Measurement Functions – Unmodulated and modulated power (average power, AM, pulse power), reflection, and DC voltage (depending upon measuring head).

Frequency Range – DC to 26.5 GHz (depending upon measuring head).

Level Range – 400 pW to 0.5 W (depending upon measuring head).

Measuring Heads – All NRV-Z and URV 5-Z voltage and power measuring heads.

Display – LCD with adjustable backlighting for figures, units, user prompting, and analog display.

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

APPLICATIONS

- **Laboratory Test**
- **Production Test**
- **R & D**

Readout –
Absolute: W, dBm, V, dBV, dBµV.
Relative: dB, difference, %, ratio, referred to a stored reference value or to the second measurement channel; SWR, reflection coefficient, return loss in dB, modulation depth with AM; single-channel display; numeric readout of one channel and display of correction frequency or measurement error (not with all measuring heads) or dual-channel display, single-channel display, automatic, or with selectable scale.

Resolution of Digital Display – 5 digits maximum, resolution adjustable in 3 modes.
HIGH: 12,000 steps or 0.001 dB.
MEDIUM: 1,200 steps or 0.01 dB.
LOW: 120 steps or 0.1 dB.

Display Filtering – Averaging over 1 to 512 readings for reducing the display noise; manual or automatic setting depending upon measurement range and resolution (see Table 1).

Display Noise – See measuring head specifications.

Measurement Rate – See Table 2.

Error Limits of Power Readout in W (without error of measuring head) –
18 to 28°C: 0.3% + 1 digit.
10 to 40°C: 0.8% + 1 digit.
0 to 50°C: 1.3% + 1 digit.

Zero Adjustment – Manual or via IEC/IEEE bus, duration approximately 4 s.

Frequency Response Correction – Stored frequency response of measuring head taken into account by numerical entry of test frequency (manually or via IEC/IEEE bus) or by applying a frequency-proportional DC voltage.

Attenuation Compensation – Attenuation or gain connected ahead taken into account; entry of attenuation value (±200 dB) via keyboard or IEC/IEEE bus.

Reference Value – One reference value per channel for relative measurements; numeric entry via keyboard or IEC/IEEE bus, or use stored measured value or current value of second channel.

Reference Impedance – For conversion between voltage and power, automatic readout of reference impedance from data stored in the measuring head or numeric entry via keyboard or IEC/IEEE bus (for RF probe).

TABLE 1 – Automatic filter setting depending upon measurement rate.

Resolution	Filter Number						
HIGH 0.001 dB	11	9	7	7	7	7	7
MEDIUM 0.01 dB	9	7	3	3	3	3	3
LOW 0.1 dB	7	3	0	0	0	0	0
Sensors							
NRV-Z1, -Z3, -Z5, -Z6, -Z7	10 nW	100 nW	1 µW	10 µW	100 µW	1 mW	20 mW
NRV-Z2, -Z5, -Z8	1 µW	10 µW	100 µW	1 mW	10 mW	100 mW	500 mW
NRV-Z51, -Z52	10 µW	100 µW	1 mW	10 mW	100 mW	–	–
URV 5-Z2, -Z7	–	1 mV	10 mV	100 mV	1 V	10 V	–
URV 5-Z4	–	10 mV	100 mV	1 V	10 V	100 V	–

TABLE 2 – Measurement time in seconds (from trigger to output of first byte) depending upon filter setting.

Filter Number	0	1	2	3	4	5	6	7	8	9	10	11	12
NRV-Z1 to -Z8	0.045	0.05	0.06	0.08	0.15	0.27	0.49	0.95	1.85	3.6	7.2	14.5	28.5
NRV-Z51 to -Z52	0.115	0.12	0.13	0.15	0.21	0.32	0.52	0.92	1.75	3.4	6.6	13	26
URV 5-Z2, -Z4, -Z7	0.065	0.07	0.08	0.10	0.20	0.38	0.72	1.45	2.8	5.5	11	22	44

Remote Control – Control of all instrument functions via IEC 625/IEEE interface. Interface functions: SH1, AH1, T6, L4, SR1, RL1, DC1, DT1, PP0, PPI.

Test Generator –
Output power: 1.00 mW.
Frequency: 50 MHz.
Power Measurement Error: ≤0.7%.
SWR: ≤1.03.
RF Connector: N female.

DC Control Input for Frequency Response Correction –
Connector: BNC female.
Input Level: ±12 V, linear with selectable scale.
Input Impedance: 9 MΩ.
Maximum Input Voltage: 50 V.

I/O with Option 01 –
Output: Two analog outputs for simultaneous output of measurement results of both channels.
Output Impedance: 1 kΩ.
Voltage Range: 0 to 3 V.
Resolution: 1 mV. Error: ≤5 mV.

Input: DC input for analog frequency response correction.
Voltage Range: ±12 V.
Input Impedance: 1 MΩ.
Trigger Input: TTL, active low.
Ready Output: TTL, active high.

POWER REQUIREMENTS

Line Voltage – 110/120 V ±10%; 220 V ±10%, 230 V –6/+15%.

Line Frequency – 47 to 63 Hz .

Power Consumption – 25 VA.

ENVIRONMENTAL CHARACTERISTICS

Temperature Range –
Operating: 0 to +50°C, to IEC 359, Class 1.
Storage: –40 to +70°C.

RFI Suppression – DBP approval number to regulations 527/1979, VDE 0871.

EMC – IEC 801-3, severity level 3; MIL-STD-461-B; RS 03 and CS 02.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	147	5.8
Width	219	8.6
Depth	350	13.8
Weight	**kg**	**lb.**
Net	4.5	9.9

ORDERING INFORMATION

NRVD
Dual-channel Power Meter **$4,590**
Includes: Power Cable, Manual.
Opt. 01 – I/O Option ..... **+$545**

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection ..... **+$260**
Opt. C5 – Adds five years of Calibration Services ..... **+$725**

RECOMMENDED ACCESSORIES
Rack Adapter – Order ZZA-98 ..... **$290**
Accessory Bag – Order ZZT-92 ..... **$130**
Carrying Straps – Order ZZT-96 ..... **$65**
Transit Case – Order ZZK-983 ..... **$440**
Service Kit – Order NRVD-S1 ..... *1
[1] Contact your Tektronix representative for price information.

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

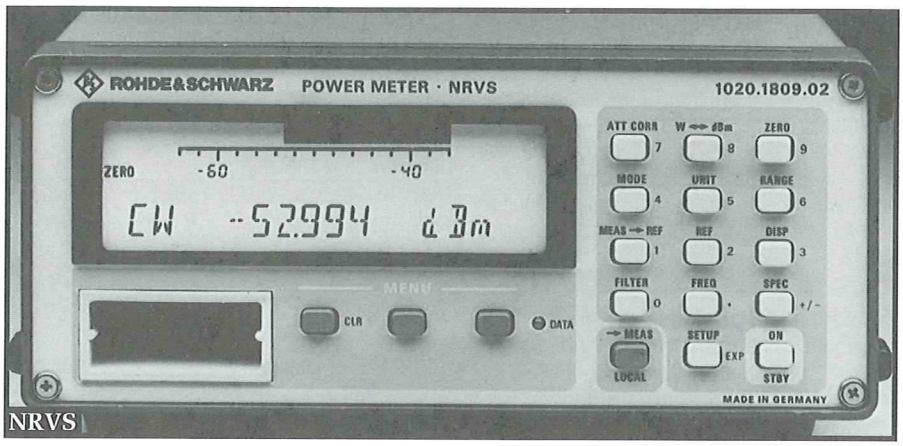
Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

RF Meters

Accurate, general-purpose, easy-to-use power, level, and voltage measurements.

NRVS

- DC to 26.5 GHz Frequency Range
- Power, Level, and Voltage Measurements
- Intelligent Measuring Heads – Just Plug Them in and Measure
- DC Frequency Input for Tracking Frequency-response Correction
- Analog Output
- Menu-guided Operation with Softkeys
- Storage of 20 Complete Instrument Setups
- 13 Digital Filters for Noise Suppression, Automatic or Manual Filter Selection
- Remote Control of All Functions via IEC/IEEE Bus



NRVS

NRVS Power Meter

The NRVS Power Meter is the ideal instrument for any kind of power measurement in laboratory and system applications. Intelligent probes with calibration data memory and thermocouple sensors make adjustments by the user unnecessary. The NRVS provides high-precision measurements free of operator errors.

READOUT OF RESULTS

Measurement results, units, and various items of information are displayed on a large 4 1/2-digit LCD display in three steps of resolution. All standard units of measurement or relative modes can be selected. A high resolution bar graph indicator with selectable scaling or auto-scaling permits quasi-analog display of measured values with any unit of resolution.

If pulse-modulated signals are measured, the NRVS calculates the pulse peak power from the measured average value and the entered pulse duty factor; the result is directly displayed.

MEASUREMENT RATE

The attainable measurement rate depends upon the type of measuring head used as well as the setting of the averaging filter, which must be matched to the measurement conditions. Taking into account the connected measuring head, the NRVS automatically selects the appropriate measurement rate by determining the optimum averaging time required for a steady readout as a function of level and selected resolution. This automatic selection may be disabled and an averaging time of between 4 ms and 25 s may be set manually to measure faster than in automatic operation or to further reduce the noise.

POWER SENSORS

The range of probes and sensors includes thermocouple power sensors as well as highly sensitive diode power sensors, probes, and insertion units. This allows the NRVS to cover a frequency range from DC to 26.5 GHz and a power span from 400 pW up to the kW range.

Characteristics

Measurement Functions – Average power, pulse power, DC voltage (depending upon measuring head).

Frequency Range – DC to 26.5 GHz (depending upon measuring head).

Level Range – 400 pW to 0.5 W (depending upon measuring head).

Measuring Heads – All NRV-Z and URV 5-Z voltage and power measuring heads.

Display – LCD for figures, units, user prompting, and analog display.

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

APPLICATIONS

- **Laboratory**
- **Production**

Readout –
Absolute: W, dBm, V, dBµV.
Relative: dB, %W, or %V referred to a stored reference value, numeric readout with or without display of correction frequency.

Analog Display – Automatic or with selectable scale.

Resolution of Digital Display – 4 1/2 digits maximum, resolution adjustable in 3 modes.
HIGH: 12,000 steps or 0.001 dB.
MEDIUM: 1,200 steps or 0.01 dB.
LOW: 120 steps or 0.1 dB.

Averaging Filter – Over 1 to 512 readings for reducing the display noise; manual or automatic setting depending upon measurement range and resolution (see Table 1).

Display Noise – See measuring head specifications.

Measurement Rate – See Table 2.

Error Limits of Power Readout in W (without error of measuring head) –
18 to 28°C: 0.4% + 1 digit.
10 to 40°C: 0.9% + 1 digit.
0 to 50°C: 1.4% + 1 digit.

Zero Adjustment – Manual or via IEC/IEEE bus, duration approximately 4 s.

Frequency Response Correction – Stored frequency response of measuring head taken into account by numerical entry of test frequency (manually or via IEC/IEEE bus) or by applying a frequency-proportional DC voltage.

Attenuation Compensation – Attenuation or gain connected ahead taken into account; entry of attenuation value (±200 dB) via keyboard or IEC/IEEE bus.

Reference Value – Numeric entry via keyboard or IEC/IEEE bus, or use stored measured value.

Reference Impedance – For conversion between voltage and power, automatic readout of reference impedance from data stored in the measuring head or numeric entry via keyboard or IEC/IEEE bus (for RF probe).

TABLE 1 – Automatic filter setting depending upon measurement rate.

Resolution	Filter Number						
HIGH 0.001 dB	11	9	7	7	7	7	7
MEDIUM 0.01 dB	9	8	3	3	3	3	3
LOW 0.1 dB	7	3	0	0	0	0	0
Sensors							
NRV-Z1, -Z3, -Z4, -Z6, -Z7	10 nW	100 nW	1 µW	10 µW	100 µW	1 mW	20 mW
NRV-Z2, -Z5, -Z8	1 µW	10 µW	100 µW	1 mW	10 mW	100 mW	500 mW
NRV-Z51, -Z52	10 µW	100 µW	1 mW	10 mW	100 mW	–	–
URV 5-Z2, -Z7	–	1 mV	10 mV	100 mV	1 V	10 V	–
URV 5-Z4	–	10 mV	100 mV	1 V	10 V	100 V	–

TABLE 2 – Measurement time in seconds (from trigger to output of first byte) depending upon filter setting.

Filter Number	0	1	2	3	4	5	6	7	8	9	10	11	12
NRV-Z1 to -Z8	0.045	0.05	0.06	0.08	0.15	0.27	0.49	0.95	1.85	3.6	7.2	14.5	28.5
NRV-Z51 to -Z52	0.115	0.12	0.13	0.15	0.21	0.32	0.52	0.92	1.75	3.4	6.6	13	26
URV 5-Z2, -Z4, -Z7	0.065	0.07	0.08	0.10	0.20	0.38	0.72	1.45	2.8	5.5	11	22	44

Remote Control – Control of all instrument functions via IEC 625/IEEE interface. Interface functions: SH1, AH1, T6, L4, SR1, RL1, DC1, DT1, PP0.

DC Control Input for Frequency Response Correction –
Connector: BNC female.
Input Level: ±12 V, linear with selectable scale.
Input Impedance: 9 MΩ.
Maximum Input Voltage: 50 V.

DC Output –
Connector: BNC female.
Source Impedance: 1 kΩ.
Output Voltage (EMF): Proportional to deflection of analog display.
Full Scale Value: Left 0 V, Right +3 V.
Additional Settling Time: 250 ms.

POWER REQUIREMENTS

Line Voltage – 115 V +15/–22% (–15%); 230 V +15/–22% (–15%).

Line Frequency – 47 to 63 (440) Hz .

Power Consumption – 13 VA.

Safety – Class 1 to VDE 0411 and IEC 348, transformer with thermal overload protection.

ENVIRONMENTAL CHARACTERISTICS

Temperature Range –
Operating: 0 to +50°C, for use in class 1 to IEC 359.
Storage: –40 to +70°C.

Humidity – To 80% (without dewing).

Mechanical Stability – IEC 359 class 1.

RFI Suppression – DBP approval number to regulations 527/1979, VDE 0871.

EMC – IEC 801-3, severity level 3; MIL-STD-461-B; RS 03 and CS 02.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	103	4.1
Width	219	8.6
Depth	350	13.8
Weight	**kg**	**lb.**
Net	3.2	7.1

ORDERING INFORMATION

NRVS
Power Meter **$2,330**
Includes: Power Cord, Manual.

RECOMMENDED ACCESSORIES
Rack Adapter – Order ZZA-97 ..... **$260**
Accessory Bag – Order ZZT-92 ..... **$130**
Carrying Straps – Order ZZT-96 ..... **$65**
Transit Case – Order ZZK-973 ..... **$425**
Service Kit – Order NRVS-1 ..... *1
*1 *Contact your Tektronix representative for price information.*

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

URE 2
URE 3

RF Meters

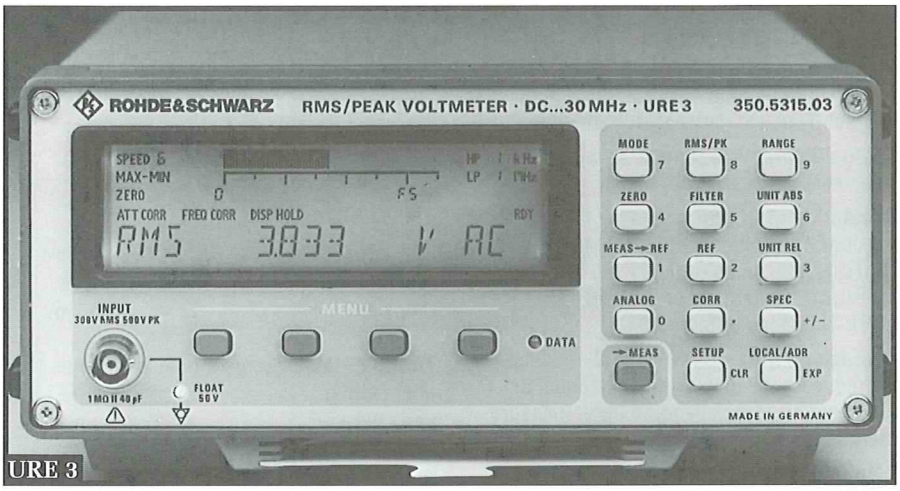
RF Voltmeters for all applications from vibration through high-density TV.

URE 2/URE 3

- True RMS Weighting for AC and AC + DC
- More Than 30 Measurements/ Second
- Digital and Scalable Analog Displays
- Very High Measurement Accuracy
- Highpass and Lowpass Filters
- Relative Measurements, Maxima/minima
- Convenient Menu-guided Operation
- Commercial Probes Can Be Used; Probe Division Factor Taken into Account in Displayed Result

URE 3 ONLY

- Peak-value Measurement (Positive, Negative, Peak-to-Peak) Without Tilt and Overshoot
- Fast RMS Measurement Even for Very Low-frequency Signals
- Frequency Measurements to 30 MHz
- Unmatched Measurement Accuracy Through Automatic Frequency Response Error Correction
- In/Out Option with Dual-channel Analog Output, Ready Output, Trigger Input, TTL Frequency-counter Input



URE 3

URE 2/URE 3 RMS Voltmeter

The URE 2 RMS Voltmeter is a broadband RMS voltmeter unrivaled for accuracy and speed. A patented rectifier circuit allows signals with a crest factor up to 7 and bandwidth of 25 MHz to be measured.

The URE 3 RMS/Peak Voltmeter further enhances the range of applications due to its greater bandwidth, built-in frequency counter, additional peak-responding rectifier, and extremely high accuracy.

ACCURATE MEASUREMENTS

The patented rectifier circuit with microprocessor-controlled autocalibration provides unparalleled measurement capability. In order to further enhance accuracy, correction factors for each measurement range are determined during initial test of each instrument and stored in non-volatile memory.

A zero function allows spurious voltages and inherent noise to be compensated for, thus increasing the measurement accuracy, particularly at low levels.

The measured frequency value is used by the URE 3 for an internal frequency-response error correction. This method increases the accuracy, mainly at higher frequencies. Measurement of signals without distortion is ensured by:

- High input impedance
- Low input capacitance
- Highpass and lowpass filters that can be switched in to suppress hum or high-frequency spurious voltages

MEASUREMENT SPEED

Measurement speed is an important criterion for a voltmeter's usability in system applications. With more than 30 measurements/ second in the fastest mode, the URE satisfies even the most exacting requirements.

DISPLAY OF RESULTS

The measured value is read out in 4 1/2 digits (URE 3, 5-digits for frequency measurements) with unit additional information on a large LCD. Readout in V, W, dBV, dBµV, dBu or dBm can be referenced to any impedance value.

Relative display is possible in dB or % as a ratio of measured value, or as a difference. Reference values can be entered or measured values can be used as reference values. Minimum and maximum values, as well as tolerance limits, can be determined automatically.

A high-resolution bar graph indicator is provided on the display for quick informative measurements and precise adjustments. The selectable scale is set automatically. It can also be adjusted manually.

APPLICATIONS

- **Level Measurements in Audio Range**
- **Interference Measurements on Switch-mode Power Supplies**
- **Measurement of Extremely Fast Dialing Signals and Detection of Simultaneously Transmitted Supply Voltages in Radiotelephony**
- **Automatic Quality Control of Audio and Videotapes**
- **High-frequency Measurements in Digital Magnetic Storage and Optical Data Storage**
- **Peak Weighting in Video Measurements (Sync Signals)**
- **Secondary Calibration Standard**

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Characteristics

Measurement Functions –
URE 2: DC, AC, AC + DC voltages.
URE 3: RMS value, peak value, DC voltage, frequency.

Frequency Range –
URE 2: DC, 10 Hz to 25 MHz.
URE 3: DC, 20 mHz to 30 MHz; PEAK, 20 mHz to 10 MHz.

Voltage Measurement Range –
DC: 0 to ±300 V.
AC, AC + DC: 50 µV to 300 V.

Range Selection – AUTO, HOLD, FIX.

Input –
Connector – URE 2: BNC female, floating.
URE 3: BNC female, either floating or grounded, switch-selectable.
Input impedance: 1 MΩ, 40 pF.
Maximum input voltage: 300 V_{RMS}, 500 V_{pk} (1 x 10^8 V x Hz maximum).

Display –
URE 2: LCD, 4 1/2-digit readout, digital and analog in V, W, dBV, dBm, dBµV, or dBu; difference, deviation in % or dB, and ratio to a reference value.

URE 3: Illuminated LCD, 4 1/2-digit level display, 5-digit frequency display, digital and analog in V, W, dBV, dBm, dBµV, dBu or Hz; difference, deviation in % or dB, and ratio to a reference value.

I/O Option (Option 01, URE 3 only) –
Two simultaneous analog outputs (level and frequency).
Voltage Range: 0 to 3 V (EMF, Z_{out} = 1 kΩ, resolution 1 mV, error ≤ 3 mV.
Frequency Input: TTL, 0.1 Hz to 30 MHz.
Trigger Input: TTL, active low.
Ready Output: TTL, active high.

Remote Control – Functions to IEC-625-2.

AC VOLTAGE MEASUREMENT (URE 2 ONLY)

Voltage Measurement Range –
50 µV to 300 V.

Ranges and Resolution – 1 mV to 300 V, 10 dB steps.
Maximum Reading: 3,800 or 12,000 counts.
Maximum Resolution: 1 µV.

Selectable Lowpass Filters – 20 kHz, 100 kHz Butterworth (3 dB cutoff frequency, 40 dB/decade).

Selectable Highpass Filters – 10 Hz, 100 Hz, 1 kHz (lower measurement limit, AC component in AC + DC).

Measurement Speed and Lower Frequency Limit –

Measurement Speed	Time of Triggered Measurement	Readout Rate	Minimum Test Frequency
Speed 4	1.3 s	10/s	10 Hz
Speed 5	250 ms	10/s	100 Hz
Speed 6	32 ms	20/s	1 kHz

Maximum Crest Factor (S) – Seven for nominal range.

Weighting Error (for spectral components up to 25 MHz) –
Crest Factor <3: Included in basic error.
Crest Factor <5: 1%. Crest factor <7: 3%.

Temperature Effect –

% of rdg/°C	Frequency (MHz)	Frequency (MHz) for Vin <3 mV
≤0.1	<10	<10
≤0.15	<20	<12
≤0.3	<25	<15
≤0.8	–	<20

RMS MEASUREMENT (URE 3 ONLY)

Voltage Measurement Range –
50 µV to 300 V.

Ranges – 1 mV to 300 V, 10 dB steps.
Maximum Reading: 3,800 to 12,000 counts.
Maximum Resolution: 1 µV.

Frequency Range –
AC Coupling: 0.02 Hz to 30 MHz.
AC + DC: DC to 30 MHz.

Selectable Lowpass Filters – 20 kHz, 100 kHz Butterworth (3 dB cutoff frequency, 40 dB/decade), 1 MHz Bessel.

Selectable Highpass Filters – 10 Hz, 100 Hz, 1 kHz (lower measurement limit, AC component in AC + DC).

Measurement Speed and Lower Frequency Limit (AC component in AC + DC) –
Speed 0, 1: Selectable time 10 ms to 60 s.
Speed 2, 3: Fixed time 10 s, 1 s.
Speed 1, 2, and 3: Automatic synchronization to whole number of signal periods; due to synchronization, measurement takes 2 or 3 times the time selected.

Measurement Speed	Time of Triggered Measurement	Readout Rate	Minimum Test Frequency
Speed 4	1.3 s	10/s	10 Hz
Speed 5	250 ms	10/s	100 Hz
Speed 6	32 ms	20/s	1 kHz

Maximum Crest Factor –
Seven for nominal range.

Weighting Error (for spectral components up to 30 MHz) –
Crest Factor <3: Included in basic error.
Crest Factor <5: 1%.
Crest Factor <7: 3%.

Temperature Effect –

% of rdg/°C	Frequency (MHz)	Frequency (MHz) for Vin <3 mV
≤0.1	<10	<10
≤0.15	<20	<12
≤0.3	<25	<15
≤0.8	<30	<20

URE 2
URE 3

RF Meters

PEAK MEASUREMENT (URE 3 ONLY)

Voltage Measurement Range – 0.1 mV to 500 V.

Ranges – 3 mV to 1000 V, 10 dB steps. Maximum Reading: 1,200 to 3,800 counts. Maximum Resolution: 1 µV.

Frequency Range – AC Coupling: 10 Hz to 10 MHz. AC + DC: DC to 10 MHz.

Selectable Lowpass Filters – 20 kHz, 100 kHz Butterworth (3 dB cutoff frequency, 40 dB/decade), 1 MHz Bessel.

Selectable Highpass Filters – 10 Hz, 100 Hz, 1 kHz (lower measurement limit, AC component in AC + DC).

Measurement Speed and Lower Frequency Limit for AC Coupling –

Measurement Speed	Time of Triggered Measurement	Readout Rate	Minimum Test Frequency
Speed 1 to 3	Depends on measurement time		10 Hz
Speed 4	1.3 s	5/s	10 Hz
Speed 5	315 ms	10/s	100 Hz
Speed 6	65 ms	20/s	1 kHz

Measurement Speed and Lower Frequency Limit for DC Coupling –

Measurement Speed	Time of Triggered Measurement	Readout Rate	Minimum Test Frequency
Speed 1 to 3	Depends on measurement time*1		0.02 Hz
Speed 4	215 ms	5/s	10 Hz
Speed 5	95 ms	10/s	100 Hz
Speed 6	65 ms	20/s	1 kHz

**1 Measurement time for speed 1 to 3 similar to RMS, but without synchronization.*

Temperature Effect – 0.1% of reading/°C.

FREQUENCY MEASUREMENT (URE 3 ONLY)

Frequency Range – 0.02 Hz to 30 MHz.

Display – 5 digits, maximum resolution 0.1 MHz.

Measurement Speed and Lower Frequency Limit –

Measurement Speed	Time of Triggered Measurement with feeding on Front	Rear	Readout Rate	Minimum Test Frequency
Speed 1 to 3	Depends on measurement time			0.02 Hz
Speed 4	2.4 s	1.4 s	2s	10 Hz
Speed 5	430 ms	330 ms	5/s	100 Hz
Speed 6	80 ms	75 ms	30/s	1 kHz

Error Limits – ±(0.005% + 1 digit) plus 100 µs/0.75 x measurement time for RMS measurement, f <10 Hz (HP off).

Sensitivity – >10 dB below nominal range.

DC VOLTAGE MEASUREMENT

Voltage Measurement Range – 0 to ±300 V.

Ranges – 10 mV to 1000 V, 20 dB steps. Maximum Reading: 12,000 counts. Maximum Resolution: 1 µV.

Measurement Speed and Lower Frequency Limit –

Measurement Speed	Time of Triggered Measurement	Readout Rate
Speed 4	1.3 s	10/s
Speed 5	250 ms	10/s
Speed 6	32 ms	20/s

Error Limits – ±(0.1% of reading + 10 counts).

Temperature Effect – <(0.01% of reading + 1 count)/°C).

POWER REQUIREMENTS

Line Voltage – 100/120/220/240 V ±10%.

Line Frequency – 47 to 440 Hz.

Power Consumption – 25 VA.

Safety – Class 1 to VDE 0411 and IEC 348.

ENVIRONMENTAL CHARACTERISTICS

Temperature Range – Operating: 0 to +50°C, for use in class 1 to IEC 359. Storage: –40 to +70°C.

Humidity – 20 to 80% (no dewing).

Mechanical Resistance – To IEC 359 class 1.

RFI Suppression – DBP approval number to regulations 1046/1984.

EMC– To VDE 0843 part 1 to 4, IEC 801 part 1 to r severity 4, NAMUR recommendations part 1.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	103	4.1
Width	219	8.6
Depth	350	13.8
Weight	**kg**	**lb.**
Net	4.5	9.9

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

ORDERING INFORMATION

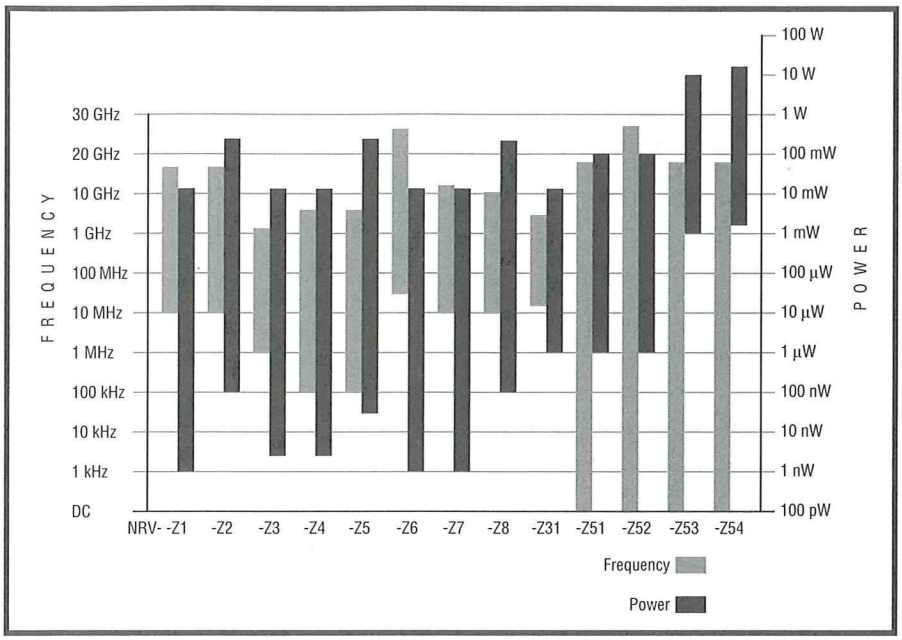
URE 2
RMS Voltmeter **$2,990**

URE 3
RMS/Peak Voltmeter **$3,990**
Includes: Power Cord, Manual.
Opt. 01 (URE 3 only) – In/ Out Option ..... **+$565**

RECOMMENDED ACCESSORIES
Carrying Strap Set – Order ZZT-96 ..... **$65**
Transport Case – Order ZZK-973 ..... **$425**
19 in. Rack Adapter – Order ZZA-97 ..... **$260**

RF Meters

Power Sensors, Probes, RF Insertion Units



Voltage probes for URV/NRV family.

- Thermocouple sensors
- Diode sensors
- Diode sensors with an integral 20-dB attenuator
- Peak power sensors
- RF probes
- RF insertion units

The right sensor for every application.

A Full Range of Probes, Insertion Units, and Power Sensors

These probes, insertion units, and power sensors extend the measurement range and offer added measurement capability for the URV 5 RF Millivoltmeter, URV 35 Level Meter, NRVD Dual-Channel Power Meter, and NRVS Power Meter.

THE RIGHT SENSOR FOR EVERY APPLICATION

Power sensors absorb the power applied and provide an equivalent DC voltage at their output. To cover the complete power range from less than 1 nW to more than 100 mW, two different types of power sensors are required: thermocouple sensors based on the Seebeck effect, and semiconductor detectors using zero-bias Schottky diodes. Both types of transducers are available for the entire frequency spectrum.

THERMOCOUPLE SENSORS

Thermocouple sensors open up a wide power range from 1 µW to 100 mW. Regardless of the waveform, they always indicate the RMS power over the full range, giving precise results, even for modulated or complex signals.

DIODE SENSORS

Diode sensors feature a higher sensitivity. They are able to measure power to as low as 100 pW. Since they measure true RMS power down to 10 µW, they can even be used for signals with harmonic contents, noisy, or modulated signals.

DIODE SENSORS WITH AN INTEGRAL 20-DB ATTENUATOR

Diode sensors with an integral 20-dB attenuator fill the gap between pure diode sensors and thermocouples. They provide true RMS measurements in a range up to 1 mW and satisfy the most exacting requirements on measurement speed, even for levels between ten and 100 µW where the use of thermocouple sensors is limited.

PEAK POWER SENSORS

Peak power sensors contain rectifiers for measuring the peak modulation. They enable direct measurement of the TV sync pulse peak power, the power of TDMA signals, as well as of other pulsed signals with a pulse width from 2 µs. In the frequency range from 1 µW to 20 mW, these sensors are a value-for-money alternative to special peak power meters.

RF PROBES

RF probes are indispensable for measurements on non-coaxial circuits and components. Small input capacitance and low loss enable low-load measurements directly in the circuit. Dividers increase the voltage measurement range and minimize the loading of the device under test.

RF INSERTION UNITS

RF insertion units are used for voltage measurements in coaxial circuits. They incorporate a diode inserted in the inner conductor or connected via a piston attenuator and permit broadband measurements to be made up to 2 GHz with low reflection coefficient. Given matched conditions, these insertion units can also be used for practically no-loss measurements of RF power.

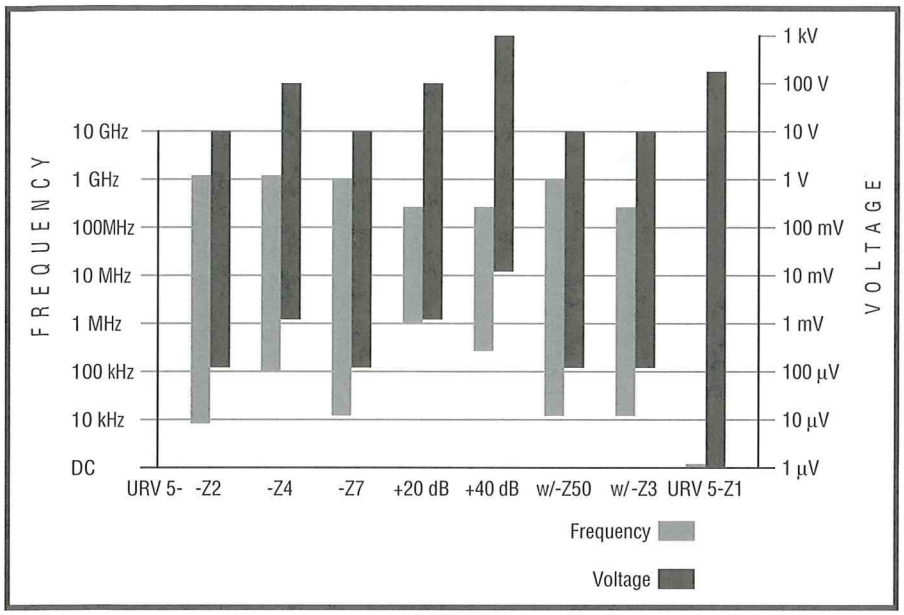
ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

RF Meters

Power Sensors, Probes, RF Insertion Units



Power Sensors for the URV/NRV family

ORDERING INFORMATION

PROBES

DC Probe – Low-capacitance DC voltage measurements in RF circuits with minimum loading. 0 to 400 V, 9 MΩ, 3 pF. Order URV 5-Z1 ..... **$325**

RF Probe – For voltage measurements in non-coaxial RF circuits with low capacitive and resistive load. 200 µV to 10 V, 20 kHz to 1 GHz. Order URV 5-Z7 ..... **$1,060**

RF Probe with 20 dB and 40 dB Plug-on Divider – Increases the voltage measuring range of the RF probe. The high Q factor of the capacitive divider makes the resistive loading negligible. 2 mV to 100 V, 1 to 500 MHz. Order URV-Z6..... **$320**

RF Probe with 50 Ω Adapter – Built-in termination for power or level measurements on DUTs with 50 Ω source impedance. 200 µV to 10 V, 20 kHz to 1 GHz. Order URV-Z50 ..... *1

RF Probe with 75 Ω Adapter – Built-in termination for power or level measurements in 75 Ω systems such as antenna or video assemblies. Order URV-Z3..... **$475**

RF INSERTION UNITS

10-V Insertion Unit, 50 Ω – Low-load RF voltage measurements and low-loss power measurements in well-matched 50 Ω RF lines. 200 µV to 10 V, 9 kHz to 2 GHz. Order URV 5-Z2..... **$1,020**

100 V Insertion Unit, 50 Ω – Virtually no-load RF voltage measurements on 50 Ω coaxial lines, even at high voltages. Due to minimum insertion loss and reflection coefficient, this unit leaves the RF line practically unaffected. 2 mV to 100 V, 100 kHz to 2 GHz. Order URV 5-Z44..... **$1,080**

100 V Insertion Unit, 75 Ω – Virtually no-load RF voltage measurements on 75 Ω coaxial lines, even at high voltages. Due to minimum insertion loss and reflection coefficient, this unit leaves the RF line practically unaffected. 2 mV to 100 V, 100 kHz to 2 GHz. Order URV 5-Z47 ..... **$1,100**

POWER SENSORS

Diode Power Sensor, 50 Ω – Power measurements of highest sensitivity up to 18 GHz in 50 Ω systems. 10 MHz to 18 GHz, 1 nW to 20 mW. Order NRV-Z1..... *1

Diode Power Sensor, 50 Ω – Power measurements with minimum mismatch, for high power ratings in 50 Ω systems. 100 nW to 500 mW, 10 MHz to 18 GHz. Order NRV-Z2..... *1

Diode Power Sensor, 75 Ω – Power measurements in 75 Ω systems. 400 pW to 13 mW, 1 MHz to 2.5 GHz, 400 pW to 13 mW. Order NRV-Z3 ..... *1

Diode Power Sensor, 50 Ω – Power measurements of highest sensitivity with extremely large dynamic range. 500 pW to 20 mW, 100 kHz to 6 GHz. Order NRV-Z4 ..... *1

Diode Power Sensor, 50 Ω – Power measurements at higher power ratings and minimum mismatch. 50 nW to 500 mW, 100 kHz to 6 GHz. Order NRV-Z5..... *1

Diode Power Sensor, 50 Ω – Power measurements up to 26.5 GHz with high sensitivity and large dynamic range, PC 3.5 connector. 1 nW to 20 mW, 50 MHz to 26.5 GHz. Order NRV-Z6 ..... **$1,590**

Diode Power Sensor, 50 Ω – Power measurement up to 13 GHz. 1 nW to 20 mW, 10 MHz to 13 GHz. Order NRV-Z7.... **$795**

Diode Power Sensor, 50 Ω – Power measurement up to 13 GHz. 100 nW to 500 mW, 10 MHz to 13 GHz. Order NRV-Z8 ..... **$1,170**

Peak Power Sensor, 50 Ω – Measurement of maximum envelope power of modulated RF; three models, also for TDMA. 1 µW to 20 mW, 30 MHz to 6 GHz. Order NRV-Z31 ..... *1

Thermocouple Power Sensor, 50 Ω – High-precision power measurement, even with non-sinusoidal signals. N connector. 1 µW to 100 mW, DC to 18 GHz. Order NRV-Z51 ..... **$1,230**

Thermocouple Power Sensor, 50 Ω – High-precision power measurement, even with non-sinusoidal signals up to 26.5 GHz. PC 3.5 connector. 1 µW to 100 mW, DC to 26.5 GHz. Order NRV-Z52 ..... **$1,480**

Thermocouple Power Sensor, 50 Ω – High-precision measurement at high power. 100 µW to 10 W, DC to 18 GHz. Order NRV-Z53..... *1

Thermocouple Power Sensor, 50 Ω – High-precision measurement at high power up to 30 W. 300 µW to 30 W, DC to 18 GHz. Order NRV-Z54..... *1

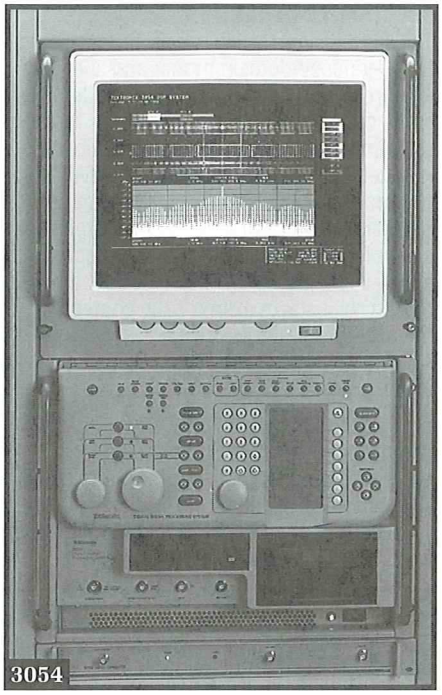
**1 Contact your Tektronix representative for price information.*

ROHDE&SCHWARZ

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Rohde & Schwarz' quality system complies with the DIN ISO 9001 standard and has been certified by DQS (German Association for the Certification of Quality Systems).

Fourier Analyzers



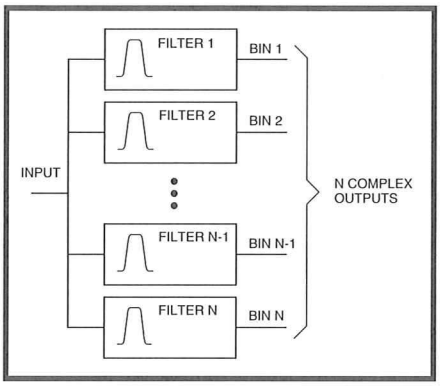
A New Way to Look at Spectrums

When the time dimension is added to spectrum analysis, the result is a time-frequency analysis of your signal.

While time-frequency analysis is not new, its practical application to a wide range of challenging modern applications has only recently become practical. Using a parallel bank of digitally implemented filters, time-frequency analysis can now cover broad ranges of frequency span, time duration, and time-frequency resolution. This brings important new capability to applications that extend from getting new insights into dynamic signal activity to comprehensively testing high purity oscillators to capture and analyze a momentary loss of phase lock.

THE KEY: A BANK-OF-FILTERS APPROACH

The key to implementing practical time-frequency analysis is the bank-of-filters approach to spectrum analysis used in the 3054 DSP Systems. The input signal is digitized and passed through a multi-stage digital down converter which provides span selection and center frequency tuning for the filter bank. This tuning enables any frequency within the instrument's input bandwidth to be analyzed by use of the filter bank.



The filter bank consists of a number of parallel resolution filters that are equally spaced in frequency and have slightly overlapping pass bands. The bandwidth of the resolution filters is the frequency resolution of the filter bank.

FILTER BANK

The output of each filter is complex, i.e., it consists of both real and imaginary components of digital data, which are converted to power and phase in real time. The digital output from each filter is carried in a hardware register called a "frequency bin" or just a "bin", for short. By convention, a bin is said to have a width equal to the frequency span of the filter bank divided by the number of bins that cover that span. The standard filter used in the 3054 has a 0.05 dB pass band that is equal to the bin width.

3054 FEATURES

- DC to 10 MHz Real-time Input BW
- Continuous Real-time Output in Spans to 2 MHz
- Frame Update Intervals to 12.5 µs
- Tune to RF and Microwave Frequencies with Receivers and Down Converters
- Flexible Triggering Capabilities
- Spectral Event Detection
- Spectral Frame Processing

BENEFITS

- Spectral Transient Analysis with High Resolution in Both Frequency and Time
- Spectrograms Covering Hours of Signal Time
- Spectral Limit Testing in Real Time
- Post-process Full-integrity Spectral Output Data
- Export Spectral Data at Real-time Rates

Wideband, continuous, real-time spectral analysis.

Measure spectral power over frequency and time with near-optimum resolution in both frequency and time.

Real-time output over wide frequency spans.

For more information, contact your local sales office (listed on the inside back cover).

GPIB IEEE-488 The 3054 complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

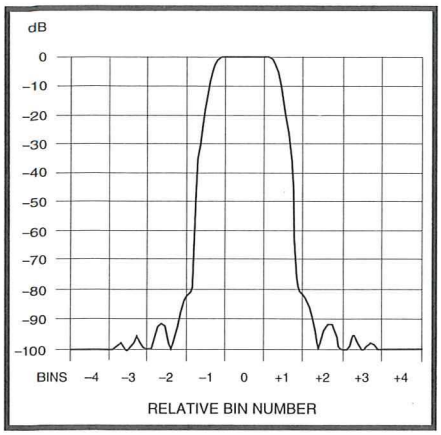
ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

APPLICATIONS

- **Signal Analysis and Measurement**
- **Digital Communications**
- **Communication Testing**
- **Doppler Radar Measurements**
- **Fast Automated Testing**
- **Regulatory Testing**
- **Multi-path Signal Analysis**

Fourier Analyzers



The shape of the resolution-filter and its output data rate are key to several of the 3054 performance characteristics: frequency flatness, amplitude accuracy, spectral resolution, dynamic range, sensitivity, and the suitability of the filter bank's spectral data for post-processing.

An ensemble of simultaneous outputs from the filters in the bank represents a spectral frame. To show the signal spectrum, this frame data is plotted on a digital color monitor.

The filters in the bank are reconfigurable, which permits tailoring them to specific needs.

ADDING THE TIME DIMENSION

The succession of spectral frames adds the time dimension to spectrum analysis. Time resolution is determined jointly by the time interval between successive frames and the charge time of the resolution filters. The spectral frame interval is equal to the reciprocal rate at which data samples are output from each filter, and the charge time is inversely proportional to the filter bandwidth. The term "real-time output" means that the complex sample rate is equal to at least twice the bandwidth of the filters.

The 3054 provides continuous real-time analysis, even at the widest spans. When the spectral output is taken from the Real-time Interface (RTI), the RTI streams out data continuously at the full rate (see more about the RTI on this page). In many cases, however, there is need to buffer high-speed signal data in a memory to accommodate slower digital processing and storage equipment downstream. When such a memory is full and has to be emptied, the result is breaks in the real-time analysis. The real-time data is in blocks, and we have "block real-time" analysis.

The 3054, in block real-time operation, fills the local Frame Capture Memory with sequential frames. Then the memory stops receiving new data until its contents are processed for display, transferred to disk storage, or post-processed and the memory is released again to fill with new data.

BLOCK MODE, SPECTRAL FRAME PROCESSING, AND OVERVIEW DISPLAY

The 3054 has a mode of operation called the Block Mode. In this mode, a block of sequential spectral frames is captured in memory and held for post-processing, for transfer to the color monitor, or for transfer to disk storage. Normally the Block Mode is used for block real-time analysis, but when combined with the spectral frame processing modes Peak or Average, the Block Mode can extend the duration of signal observation in the 3054 to hours.

In doing spectral frame processing, a number of sequential frames are processed to produce a resultant frame. In Peak Mode, for example, each resultant frame contains the maximum bin values over "R" frames, where R is the number of sequential frames processed. The values of R range from 1 to 32,768. The block size is selectable when the Block Mode is also invoked, and each resultant peak frame is held in the frame memory until the block is full.

The 3054 has a frame memory that holds a number of frames, depending on how many bins are selected to cover the span. For 801 bins, the memory holds 4094 frames; for 51 bins, the memory holds 65,534 frames.

A frame-memory overview spectrogram display can be selected when the instrument is paused. Frames or trends of interest can be located in this display, and then viewed in full detail in the normal spectrogram display mode. In the normal display, the spectrogram can be scrolled up and down (forward and backward in time) by use of signal markers and page up and page down keys.

SPECTRAL LIMIT TESTING

The spectral limit testing capability is equivalent to a frequency-domain trigger and allows capture of spectrums that meet pre-defined limits criteria. Every spectral frame is tested at real-time rates. Detection of a limit violation is called a spectral event detection. With spectral event detection, the 3054 can be programmed to take a variety of actions. For example, a user may trigger on a spectral event, capture a block of sequential frames, then scroll back to examine the contents of the block frame-by-frame.

REAL-TIME OUTPUT

The Real-time Interface (RTI) provides real-time application capabilities. Spectral frame data from this port can be routed directly to other DSP equipment for further processing. Also provided by the RTI is an analog drive for a high-speed oscillographic recorder or an X, Y, Z monitor.

SYSTEM ARCHITECTURE AND SOFTWARE

The system architecture is based upon the VMEbus. Cards comprising the main part of the instrument are "pipelined" to a stage that interfaces with the standard VMEbus. The instrument operates under the SYSTEM V/68™ version of UNIX™. Instrument controls and functions are implemented in C language and card-modular firmware. Programmers have access to selected UNIX and C libraries via an RS-232 port for the development of application programs. Individual spectra, blocks of spectra, instrument setups, and keystroke macros can be stored on disk for later recall for display or off-line processing. Stored programs can be executed from the keyboard.

SYSTEM V/68 is a trademark of Motorola. UNIX is a trademark of AT&T.

KEYBOARD AND DISPLAY

The integral keyboard allows quick access to system parameters. Knobs provide easy operation and basic spectrum analyzer control. In addition, a liquid-crystal display presents menus for more extensive functions and prompts the entry of parameters.

The 3054 features a high resolution, 16-inch color monitor that displays amplitude-versus-frequency, spectrogram (amplitude versus frequency and time), phase-versus-frequency, waterfall, and related data. A single display can occupy the full screen for easy viewing of very small variations in the signals, or two displays can be presented on a split screen for convenient comparison.

3054 Characteristics

The following characteristics and features apply to the 3054 DSP System after a 30-minute warm-up period, unless otherwise noted. The characteristics provided below apply to instrument operation with the Standard Filter Shape. The terms Bin Width, Resolution Bandwidth, and Shape are used interchangeably for the Standard Filter Shape.

FREQUENCY RELATED

Range – DC to 100 Hz.

Span – Standard: 1 kHz to 10 MHz in a 1, 2, 5 sequence.

RESOLUTION PASSBAND (Standard Filter 0.05 dB Bandwidth) –

Displayed Bins	Number of Filters	Passband
801	1024	Span÷800
401	512	Span÷400
201	256	Span÷200
101	128	Span÷100
51	64	Span÷50
25	32	Span÷25

Bin Width – For the Standard Filter shape, bin width is the same as passband.

Center Frequency Tuning Increments – In the 10 MHz span, the center frequency is fixed at 5 MHz. For spans narrower than 10 MHz, tuning is finer than one bin width.

Center Frequency (CF) Accuracy – ±CF reading x 10^{-7}.

Marker Readout (Frequency) Accuracy – ±(0.5 x bin width + CF Accuracy).

Signal Resolution with Standard Filter – ≤3 bin widths (also holds for one signal at Reference Level and the other at ≤70 dBc).

10 MHz Frequency Standard Drift – ≤1x10^{-9} per day and ≤1x10^{-7} per year.

AMPLITUDE RELATED

Reference Level Range – +33 to –140 dBm.

Accuracy – ±0.2 dB at 12.5 kHz; ±0.53 dB at all frequencies, with error correction.

Post Filter Gain Range – 0 dB to 48 dB in 1 dB steps.

Flatness Across Span – ±0.85 dB normalized to 12.5 kHz; ±0.33 dB, with error correction. ±1.0 dB when Max Input is set below –32 dBm.

Resolution Filter Shape – From bin center, 0.05 dB over ±0.50 bin, –3 dB points at ±0.75 bin, and –80 dB points at ±1.25 bins.

Marker Resolution – 0.03 dB at reference level.

Display Dynamic Range – 84 dB.

Sensitivity – –150 dBm/Hz (7 nV/$\sqrt{\text{Hz}}$) at 2 MHz; 1/f noise corner at 100 kHz.

Aliased Products – ≤–70 dB for signal amplitude equal to Max Input.

A/D Converter – 25.6 MS/s, 10-Bits.

Max Input Range – +33 to –57 dBm. (Note: signals above Max Input level are clipped by the A/D converter.)

Harmonic Distortion (2nd and 3rd order with signal 6 dB below Max Input) – 65 dBc, DC to 1 MHz; 58 dBc, 1 MHz to 10 MHz.

IM Distortion (2nd and 3rd order with two signals 6 dB below Max Input) – 65 dBc, DC to 1 MHz; 60 dBc, 1 MHz to 10 MHz.

Residual Responses – For 600 Hz and above, –70 dB below Max Input or –115 dBm, whichever is greater. Residuals below 600 Hz are ≤–100 dBm.

Zero-frequency Spur – 4 dB below Max Input, DC coupled.

Phase Noise – –80 dBc in 1 kHz span with 2.5 Hz offset.

FRAME UPDATE INTERVAL

Spectral frame update interval depends on filter bank length and selected span. The following table is a summary listing of the shortest and longest update intervals for different filter lengths:

Number of Displayed Bins	Number of Filters	Span	Update (Standard)	Interval (Turbo)
801	1024	10 MHz to 500 kHz	200 µs	200 µs
		100 kHz	1 ms	203.13 µs
		10 kHz	5 ms	234.38 µs
		1 kHz	25 ms	781.25 µs
		100 Hz	250 ms	7.8125 ms
401	512	10 MHz to 500 kHz	200 µs	200 µs
		100 kHz	1 ms	203.13 µs
		10 kHz	5 ms	234.38 µs
		1 kHz	25 ms	781.25 µs
		100 Hz	250 ms	7.8125 ms
201	256	10 MHz to 500 kHz	200 µs	200 µs
		100 kHz	1 ms	54.69 µs
		10 kHz	1.25 ms	78.13 µs
		1 kHz	6.25 ms	781.25 µs
		100 Hz	62.5 ms	7.81 ms
101	128	10 MHz to 500 kHz	50 µs	50 µs
		100 kHz	250 ms	54.69 µs
		10 kHz	1.25 ms	78.13 µs
		1 kHz	6.25 ms	781.25 µs
		100 Hz	62.5 ms	7.81 ms
51	64	10 MHz to 500 kHz	12.5 µs	12.5 µs
		100 kHz	62.5 ms	15.63 µs
		10 kHz	312.5 ms	78.13 µs
		1 kHz	1.56 ms	781.25 µs
		100 Hz	15.63 ms	7.81 ms
25	32	10 MHz to 500 kHz	212.5 µs	12.5 µs
		100 kHz	62.5 ms	15.63 µs
		10 kHz	312.5 ms	78.13 µs
		1 kHz	1.56 ms	781.25 µs
		100 Hz	15.63 ms	7.81 ms

NOTE: Update Intervals are based on real-time input processing for the 10 MHz and 5 MHz spans and real-time input/output processing on all other spans. When the Spectral Frame Update Interval divided by Resolution Passband results in a value of 2 or greater, the spectral output has a real-time sample rate.

Fourier Analyzers

PHASE RELATED
Display Range – +180° to –180° (modulo 360°).

Resolution – 0.01°.

TIME RELATED
Input Sampling Rate – 25.6 MS/s.

TIME RELATED
Frame Capture Memory –

Number of Displayed Bins	Spectral Frame Capacity
801	4,094
401	4,094
201	16,382
101	16,382
51	65,534
25	65,534

Marker Resolution – Within one frame update interval.

SPECTRAL FRAME PROCESSING
Spectral frame processing is done repetitively using full-rate spectral frames. The processing is done within each bin over a number (R) of frames. Resultant frames, also called processed frames, are forwarded for display and measurement by the user.

Spectral Frame Processing Modes – Average, Peak, Min/Max, Rth, and Weighted Filter.

Block Mode – All of the spectral frame processing can be applied to the Block Mode in order to increase the time represented by each displayed spectral frame and the duration of the block.

Spectral Event Detection – Detects events that cause any bin value to exceed or fall below user-defined limits; log display mode only and limits must be specified in dB.

INPUT TRIGGERING AND ACQUISITION START/STOP
Sources – Internal, External, Line, Free Run.

Continuous Mode – One spectral frame output from the filter bank per trigger event.

Single Frame – One spectral frame output from the filter bank per trigger event.

Start – After initial trigger, indefinite number of spectral frames are output from the filter bank.

Positioning – Trigger sample can be time positioned anywhere in the acquisition window for the first spectral frame.

Start/Stop – External control line provides on/off switching of spectral frame output from the filter bank; requires a control signal input to the Trigger Connector.

INTERNAL FREQUENCY REFERENCE I/O
Output – The internal 10 MHz Standard frequency is available for external reference. Output at TTL levels.

External Input – 100 kHz ±20 Hz; 1 MHz ±200 Hz; 5 MHz ±1 kHz; 10 MHz ±2 kHz. Input at TTL levels.

DISPLAY MODES
Log Display Mode – 1, 2, 5, and 10 dB/div; 1 to 15 dB/div selectable in 1 dB steps.

Linear Display Mode – Reference level/10.

FRONT CONNECTORS
Analog Signal Input – Connector: BNC.
Impedance: Selectable, 50 Ω or 1 MΩ.
Coupling: Selectable, AC or DC.
Maximum Rated Input (50 Ω): 5 V RMS. (+27 dBm) continuous; 50 V RMS for 10 ms.
Maximum Rated Input (1 MΩ): 500 V DC, 17 V RMS (+25 dBV).

Triggers – Time-domain triggering on the input signal.
External: ±5 V range.
Start/Stop: responds to TTL levels.
Gate: responds to TTL levels.
Connectors: BNC.

REF I/O – BNC connector. This is an output unless an input signal is selected.

REAR CONNECTORS
RS-232 Ports – Three.

AUX Digital I/O –
Clock: 25.6 MHz.
Data In: Accepts 12-Bit digital signal for application to the Digital Down Converter.
Data Out: Provides 10-Bit digital signal from the Analog to Digital Converter.

Time Domain Digital I/O – Clock: 25.6 MHz.
Data In: For input to the Parallel Filter Bank.
Data Out: Data from the Digital Down Converter.

GPIB Port – Complies with Tektronix Protocol and IEEE Std. 488.2 talker, listener, and controller functions. Includes GPIB interface cable.

Real-time Interface –
Real-time Data: Two parallel RS-422 connectors with push-pull TTL levels. 5.12 MHz maximum clock rate. 16-Bit, complex component of spectral data on each connector with event detection included on one of the lines.
Event Detect Output: TTL levels.
Analog Display Output: X, Y, and Z outputs to drive a monitor, an oscilloscope, or an oscillographic recorder.

Parallel Printer Port – Driver software provides compatibility with Tektronix 469xDX-Series color printers. Also ASCII output device compatible with Centronics printers.

RGB Interface – BNC connectors (R, G, B) for output to an RGB monitor. Compatible with Tektronix RGB-Series color printers.

SCSI Port – Complies with Small Computer System Interface, ANSI X3T9.2 standard.

Ethernet Port – Option 18. Ethernet/LAN enables remote control and data access of the system via an Ethernet network. (NOTE: Also available as a retrofit kit.)

MONITOR
Type – Bitmapped, raster scan.

Display Size – 16-in. diagonal.

Color – RGB, 256 concurrent colors.

Resolution – 1024 pixels horizontal, 768 lines vertical.

Scan Rate – 48 kHz horizontal, 60 Hz non-interlaced vertical.

Synchronization – Green.

Electrical Levels – RS-343 standard.

Input Connectors – Three BNC connectors.

Controls – Brightness, contrast, focus, and power.

ENVIRONMENTAL

Temperature –
Instrument and Monitor Units: 5° to 40°C operating, –40° to +60°C nonoperating. Keyboard Unit: 0° to 50°C operating, –20° to +60°C nonoperating.

Humidity (noncondensing) –
Instrument Unit: 5% to 95% (±5%) over a temperature range of 10° to 30°C, operating and nonoperating.
Monitor Unit: 20% to 80% operating, 5% to 95% nonoperating. Keyboard Unit: 90% operating, 95% nonoperating.

Altitude – Instrument and Monitor Units: 10,000 ft. operating, 15,000 ft. nonoperating. Keyboard Unit: 20,000 ft. operating, 40,000 ft. nonoperating.

Vibration – Instrument Unit (except disks): 2 G over 5 to 55 Hz operating and nonoperating. Monitor Unit: 0.83 G over 5 to 50 Hz nonoperating. Keyboard Unit: 2 G operating and nonoperating.

Shock – Instrument Unit: Operating, 5 G with disks or 10 G without disks; 10 G nonoperating. Monitor Unit: 5 G operating, 30 G nonoperating. Keyboard Unit: 50 G operating and nonoperating.

SAFETY

CAN/CSA – C22.2 No. 231.

ANSI/ISA – S82.02 IEC 348 (2nd edition), UL 1244 (2nd edition).

POWER REQUIREMENTS

Line Voltage – 90 to 132 V AC or 180 to 230 V AC.

Line Frequency – 47 to 63 Hz.

Input Power – Instrument Unit (keyboard connected): 1000 W maximum operating power; 12 A maximum operating current. Monitor Unit: 150 W maximum operating power; 2.4 A maximum operating current.

PHYSICAL CHARACTERISTICS

Instrument Unit	mm	in.
Width:	450.9	17.75
Height:	355.6	14.0
Depth:	635	25.0
Weight	**kg**	**lb.**
Net	55.34	122

Keyboard Unit	mm	in.
Width:	426.7	16.8
Height:	98.1	7.8
Depth:	25.4	1.0
Weight	**kg**	**lb.**
Net	0.91	2.0

Monitor Unit	mm	in.
Width:	450.9	17.75
Height:	400.0	15.75
Depth:	482.6	19.0
Weight	**kg**	**lb.**
Net	35.4	78.0

WARRANTY

On-site 90 days parts and labor. The standard system includes Option W1, which supplements the 90-day warranty with an additional nine months of warranty-like comprehensive support. This support includes remedial hardware service, software subscription service, and access to the DSP Hot Line for technical assistance on service matters.

NOTE: This is only an overview of the 3054. For complete specifications, ask your local Tektronix sales representative for a copy of the 3054 Data Sheet.

S2MG100 Frequency Enhancement Software

- Fine Frequency Resolution of Carrier
- Enhanced Marker Readouts
- Post-processing of Single or Multiple Frames

S2MG100 Frequency Enhancement Software operates with the 3054 DSP System to provide enhanced frequency resolution. It post-processes data to gain typically a 10-times higher precision over the system's normal capability to measure separated tonal-signal frequencies. A 3-bin measurement method is used to enhance frequency resolution. This software consists of five programs, each one executable from the front panel of the instrument.

ORDERING INFORMATION

3054
Digital Signal Processing System with GPIB Interface, Enhanced Frequency Response, Real-time Interface and Color Printer Interface. **$147,750**
Includes: Operator's Manual, Programmer's Manual, Assembly Level Service Manual, One Blank 160 MB Tape Cartridge.

Opt. 15 – 170 MB Removable System Hard Disk ..... **+$1,100**
Opt. 16 – 400 MB System Hard Disk ..... **+$2,260**
Opt. 18 – Ethernet/LAN (cannot order with Opt. 20) ..... **+$5,950**
Opt. 20 – 8 MB CPU ..... **+$2,050**
Opt. 22 – Add 200 MB User Hard Disk ..... **+$3,250**
Opt. 30 – Add 200 MB Removable User Hard Disk ..... **+$4,450**

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V/16 A, 50 Hz ..... **NC**
Opt. A2 – UK 240 V/13 A, 50 Hz ..... **NC**
Opt. A3 – Australian 240 V/10 A, 50 Hz ..... **NC**

SERVICE ASSURANCE OPTIONS
Opt. Q0 – Installation ..... **+$350**
Opt. 1N – Delete 9-month Supplement ..... **–$6,415**
Opt. W1 – One Year Warranty-Plus ..... **+$6,415**
Opt. W2 – Two Years of Comprehensive Support ..... **+$8,550**
Opt. W3 – Three Years of Comprehensive Support ..... **+$17,110**

S2MG100
Frequency Enhancement Software **$5,000**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 3054 complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

Down Converters

Intermediate frequency down converters enable real-time analysis of IF signals with the 3054 DSP System.

RF160

- RF160 Accepts 160, 110, or 25 MHz Wide-band IF Signals from Tektronix RF Spectrum Analyzers and Popular Receivers
- Down Converts IF Signals for Modulation Analysis on Tektronix 3054 DSP System
- Effective Component in Complex Processing Systems



Real-time Spectrum Analysis at RF and Microwave Frequencies

These down converters combine the signal analysis capabilities of the Tektronix 3054 DSP System with popular receivers and Tektronix Spectrum Analyzers. Housed in a rugged rackmountable module, the Down Converters are designed to mount below the 3054 DSP System.

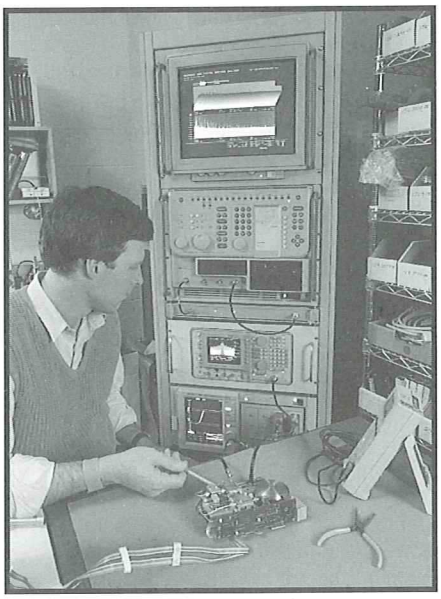
Down Converters take the Intermediate Frequency (IF) output from a receiver or Tektronix Spectrum Analyzer and mix the signal to the analysis range of the companion 3054 DSP System. Full capabilities of the 3054 DSP System may be used to analyze the signal (spans limited to 5 MHz and narrower with RF160 and RF162). A microwave signal ranging up to 40 GHz in coax, or 325 GHz using waveguide mixers (Tektronix Spectrum Analyzers only), may be fully examined.

RF160

The RF160 works directly with the IF output from spectrum analyzers and receivers. The RF160 operates at IF frequencies of 160 and 110 MHz; 25 MHz with Option 25.

MICROWAVE APPLICATIONS

A typical application makes use of the 2784 Option 04 Spectrum Analyzer, RF160 Down Converter, and a 3054 DSP System to analyze a microwave signal with a 38 GHz carrier. By tuning the 2784 to the carrier frequency and applying its wideband IF output, the RF 160 down converts the carrier to the analysis range of the 3054. The 3054 may then be employed to compare the incoming signals against spectral event detection masks, alerting the user to the presence, absence, or changing amplitude of the signal.



The measurement system shown here measures a microwave carrier signal. The signal is applied to a Tektronix 2784 Option 04 Spectrum Analyzer. The IF output of the analyzer is down converted by the RF160, effectively extending the analysis range of the 3054.

APPLICATIONS

- **RF and Microwave Signal Monitoring and Analysis**
- **Manufacturing ATE**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Characteristics

INPUT SIGNALS

Acceptable IF Frequencies – Standard is 160 MHz, 110 MHz; Option 25 is 25 MHz.

SIGNAL INPUT (50 Ω Rear Panel Connector)

Optimum Input Power – –30 dBm.

Maximum Input Level Without Damage – +20 dBm.

FREQUENCY RELATED

Flatness – 1 dB p-p across the 5 MHz to 10 MHz output range. Excludes host analyzer flatness.

AMPLITUDE RELATED

Third Order Intermodulation Distortion – –70 dBc for two input signals at –36 dBm. Specifications exclude host analyzer distortion.

Harmonic Distortion – –70 dBc for a single tone at nominal input power.

Other Single Tone Spurious Responses – –80 dBc below any single input signal within the nominal input frequency range.

Residual Responses (5 MHz to 10 MHz with No Input Signal) – –110 dBm at the output.

Noise Figure – Standard: 15 dB. Option 25: 9 dB.

REFERENCE INPUT

Rear Panel Connectors – Two BNC 50 Ω inputs direct coupled to each other and AC coupled to the RF160 circuitry. Reference applied to one connector at a time only. Required input power is –10 to +20 dBm, or TTL. Required frequency accuracy is 10 MHz ±2 PPM.

OUTPUT SIGNALS

7.5 MHz IF Output – 50 Ω BNC connector located on the front panel. Nominal output power is –20 dBm.

Maximum Reverse Power Without Damage – +22 dBm.

POWER REQUIREMENTS

Line Frequency – 60 Hz.

Line Voltage – 90 to 132 V AC; 180 to 264 V AC.

Input Power – Operating power is 16 W (25 W maximum). Operating current is typically 0.25 A, 0.42 A maximum.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	425.5	16.75
Height	44.5	1.75
Depth	527	20.75
Weight	**kg**	**lb.**
Net	4.2	9.25

WARRANTY

One year parts and labor.

MAINTENANCE

Calibration Period – 1 year.

Service Support – Component Level Repair at Tektronix designated service centers.

ORDERING INFORMATION

RF160

Down Converter (Standard 160, 110 MHz IF Input) **$10,950**

Includes: Instruction and Service Manual.

Opt. 25 – 25 MHz IF Input Exclusively ..... **NC**

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V/16 A, 50 Hz ..... **NC**

Opt. A2 – UK 240 V/13 A, 50 Hz ..... **NC**

Opt. A3 – Australian 240 V/10 A, 50 Hz ..... **NC**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Telecommunications

CONTENTS

General Information 322
Optical Time Domain Reflectometers 324, 328
Trace Analysis Package 326
Handheld Optical Fault Finder 327
Handheld Optical Power Meter 330, 369
Metallic Cable Testers 333
Telephone Cable Tester 334
Subscriber Loop Portable Test Set 338
SDH /SONET Test Sets 340
SDH/SONET Analyzer 342
VXI Programmable Optical Attenuator 344
Communications Signal Analyzer 346
Optical to Electrical Converters 354, 360
SDH/SONET Reference Receivers 356
Optical Converters/Power Meters 358
Optical Impulse Generators 362
Optical Attenuators 363
Bit Error Rate Tester 364
Optical Receiver Plug-in 366
Optical Spectrum Analyzers 367, 371
Optical Power Meter 373
Optical Wavelength Meter 376
Pulse Pattern Generator 377
Error Detectors 378

ACCESSORIES

Probes 446
SMD Adapters 474
Probe and Instrument Accessories 520
Plotter/Printer 524
Cameras 526
Instrumentation Carts 528

Tektronix Understands Your Needs

Until recently, telecommunications consisted largely of voice traffic traveling over dedicated and public lines at rates in megabits per second – satisfactory, but relatively slow compared to speeds possible today. Today, a range of technological changes has revolutionized the industry. Digital technology and gigabit transmission have expanded your service options – and your traffic load. And while telecommunications is an increasingly important strategic asset, most professionals in the industry are being asked to provide more service on tighter budgets.

Tektronix provides advanced test and measurement tools to network operators as well as designers and manufacturers of high-speed network transmission equipment.

If you're a network operator, Tektronix understands your need to reduce maintenance costs through lower cost equipment that's so easy to use it will lower your training and overall personnel costs, too. At the same time, the increasing amount of business-critical traffic on most networks means you need tools to help increase network uptime and integrity.

If you're a designer, manufacturer or evaluator of telecommunications equipment, Tektronix is aware of your need to boost your competitiveness, too. We're ready to help with equipment that can shorten your design cycle test times and contribute to efficient manufacturing test procedures.

The Customers We Serve

With over 40 years of leadership in test and measurement, Tektronix has unmatched expertise in telecommunications, video and high-speed networking that uniquely position us to meet your new, evolving requirements for test equipment. Our telecommunications products bring this expertise together to offer powerful, state-of-the-art technology and features to meet your budget and application needs.

For network operators, we provide innovative physical layer and transmission test equipment so you can install metallic, fiber and wireless networks with maximum efficiency, while reducing maintenance costs and improving network uptime. Our range of customers include local exchange telephone companies, independents and Co-ops, interexchange carriers, cellular service providers, and local- and wide-area network providers.

If you're an equipment supplier, we can help too. Tektronix offers a line of products to help design, manufacture and test equipment for high-speed telecommunications transmission, data communications, opto-electronic components and sub-assemblies and microwave transmission. As standards proliferate, Tektronix is ready to help with equipment to test compliance with the growing range of specifications, including FDDI, SDH/SONET, fiber channel and HPPI.

Telecommunications

Products and Technologies

Tektronix offers a broad range of products that are grouped into eight categories:

- Optical time domain reflectometers (OTDRs) and optical fault finders measure and display the condition of fiber optic cable media. They locate faults over long distances and offer distance resolution down to the order of centimeters. These instruments are used in data communications networks, telephony networks, and cable television distribution system installation and maintenance.
- Metallic time domain reflectometers (TDRs) measure and display the condition of metallic cable media. They locate and characterize cable breaks and faults quickly and accurately. These testers are used in local area networks, as well as telephone networks and cable television networks.
- A handheld digital interface and protocol test set for Integrated Services Digital Network (ISDN)-compliant equipment is used by crafts-level telephony service personnel. The small, battery-powered unit is optimized for field use and is continually enhanced to meet customers' changing needs.
- SDH and SONET analyzers, either in a VXI configuration or as a standalone portable instrument, provide a broadband test platform that combines bit error rate testing, overhead testing and payload analysis.
- High-performance oscilloscopes acquire, display and measure repetitive telecommunications electrical and optical waveforms. They are optimized for eye pattern analysis and optical transmitter evaluation.
- Opto-electronic products include optical-to-electronic converters, optical attenuators, optical impulse generators and SDH/SONET optical reference receivers. These modular products are used with Tektronix high-performance oscilloscopes for a variety of complex fiber optic tests and measurements.
- Bit error rate testers provide digital stimulus generation and error response measurements up to 12 gigabits. They are used for design and evaluation of components and product sub-assemblies.
- Optical spectrum analyzers measure wavelength and spectral width of fiber optic sources. They are used to assure compliance of communications standards in the design of high-speed network transmission equipment.

Tektronix Support for Telecommunications

In addition to industry-leading products for telecommunications, Tektronix offers industry-leading support. Application guides and complete training support is available from the Tektronix worldwide sales and support organization. And all products are covered by our one- to three-year warranties. Any questions? Just call our free technical support line, 1-800-426-2200.

At Tektronix, we're committed to our telecommunications products customers. Whether you design, manufacture, install or maintain telecommunications equipment, we understand your needs and we'll always provide the best support tools available.

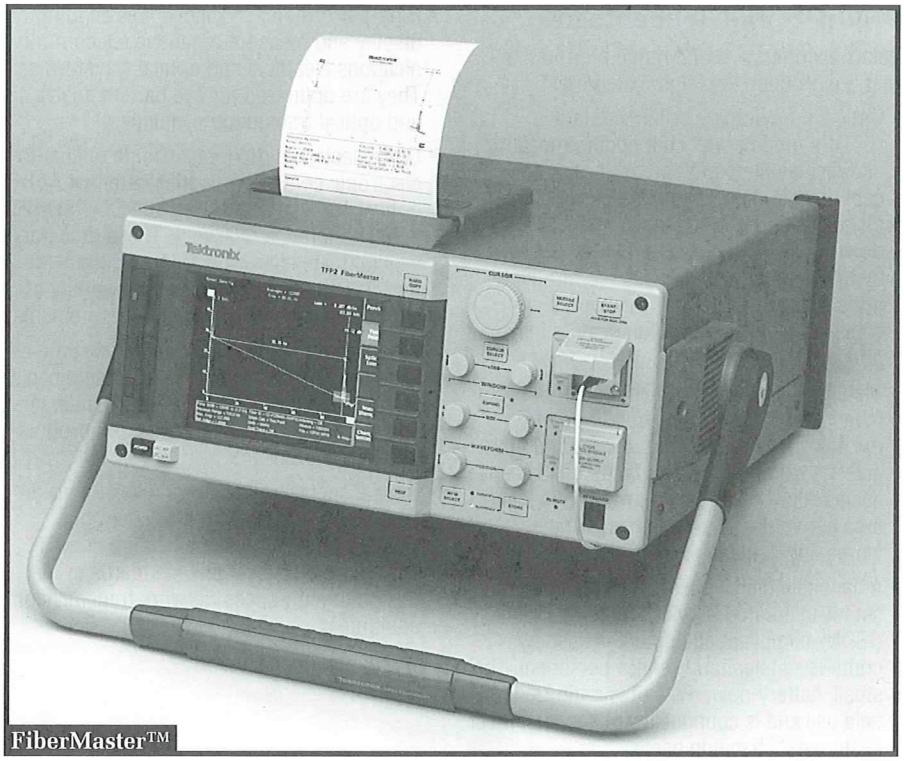
FiberMaster™

Optical Time Domain Reflectometer

Faster, easier, more efficient solution to Fiber Optic Network testing equipment.

FiberMaster™

- High-speed Processing
- User-friendly
- High-resolution Color Display System
- Custom Configurable Design
- Dual Optical Plug-in Capacity Mainframe
- High-resolution and Long-range Performance
- Expandable Overview/Window Design
- Dual Trace Display Capability
- Automatic or Manual Mark Events
- Event Tables
- Pop-up Menus
- Automatic/Manual Masking
- Cleanable/ Interchangeable Optical Connector Adapter
- High-resolution Internal Printer (Optional)
- Link and Event Return Loss Capability
- MS-DOS File Compatible
- Floppy Disk Drive and/or Internal RAM
- AT Compatible Keyboard Interface
- GPIB and RS-232C Interfaces
- PC Trace Analysis Software, FMTAP
- Remote Operation
- Language Options



FiberMaster™

FiberMaster™

Unlike any other OTDR on the market, the TFP2 FiberMaster™ sets a new level of performance and flexibility, providing faster, easier, more efficient solutions to fiber optic network testing requirements.

FiberMaster™ is the only OTDR equipped to accommodate two dual-wavelength optical plug-in modules at the same time. Fully utilized, this feature gives you dual-wavelength multimode and dual-wavelength singlemode optical cable testing at the touch of a button. This allows testing of virtually any communications network, Telco, CATV or LAN without switching modules.

FiberMaster™ is driven by a high-speed 32-Bit processor that delivers clear, concise, accurate waveforms in a fraction of the averaging time taken by other OTDR systems which are based on traditional PC technology.

Characteristics

CRT DISPLAY

Size – 16.5 cm (6.5 in.) diagonal.

Resolution – 640 x 480 pixels.

Type (color) – CRT with Liquid Crystal Color Shutter.

Cursors – Selectable, dual independent.

Module Capacity – Maximum 2 plug-ins with 4 wavelengths.

HARDCOPY OUTPUT

Internal Printer – High-speed/resolution dot matrix, thermal.

Resolution – 150 dots/in. vertical and horizontal (1.1 ratio to CRT Display).

Print Dimensions – 10.2 cm x 12.7 cm (4 in. x 5 in.).

GPIB to External – HPGL Plotter and HP ThinkJet.

RS-232C to External – HPGL Plotter, HP ThinkJet, Epson, Postscript.

Defaults – Factory and User Selectable.

To order, contact your local sales office (listed on the inside back cover) or call the National Marketing Center at 1-800-833-9200.

GPIB IEEE-488 The FiberMaster™ complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Optical Time Domain Reflectometer

FiberMaster™

NON-VOLATILE MEMORY
Mass Storage – MS-DOS Compatible.

Internal Floppy Disk Drive – Size: 8.9 cm (3.5 in.); 1.44 MB or 720 KB.

Internal RAM – Capacity: 1 MB, non-volatile.

Keyboard Interface – AT compatible, 6-Pin modular.

DISPLAY RANGE
Vertical System – Vertical Display Range (one way): 1.0 dB to 50 dB. Loss Readout Resolution Range: 0.001 dB to 0.01 dB.

Mainframe Horizontal System – Distance Display Range: 1 m to 200 km. Distance Measurement Cursor Resolution 850 nm MM: 5 cm normal density; 1 cm high density. 1300 nm MM, 1310 nm SM, 1550 nm SM: 20 cm normal density, 10 cm high density.

Index of Refraction Range – 1.4000 to 1.6000.

Distance Measurement Accuracy – ±0.001%, ± min. cursor resolution, ± uncertainty in fiber cal. factor.

Number of Stored Waveform Points – 16 K max. (Normal), 32 K max. (High Density).

PHYSICAL
Weight – 15 kg (33 lb.). Includes mainframe optics module, internal printer, disk drive.

Dimensions (including front cover, handle and feet) – Length: 60.7 cm (23.9 in.); Width: 45.2 cm (17.8 in.): Height: 19.8 cm (7.8 in.).

Power Requirements – AC Operation: 90-130 VAC, 47-440 Hz, 180-253 VAC, 47-73 Hz. Optional 10-32 VDC.

Laser Product Safety Classification – Class I.

ORDERING INFORMATION

FiberMaster™ with Color Display
Order TFP2 ..... **$12,600**
FiberMaster™ with MonoChrome Display
Order TFP2M **$10,800**
Includes: Operator's Manual (070-7906-05); Soft Carrying Case (016-1037-01); Front Panel Cover(200-3566-00); Power Cord (161-0104-00).

OPTICS PLUG-IN OPTIONS – MULTIMODE
Opt. 01 – 850 nm MM ..... **+$7,000**
Opt. 02 – 1300 nm MM ..... **+$13,500**
Opt. 03 – 850 nm/1300 nm MM ..... **+$16,000**

OPTICS PLUG-IN OPTIONS – SINGLEMODE
Opt. 04 – 1310 nm SM ..... **+$15,000**
Opt. 05 – 1550 nm SM ..... **+$17,500**
Opt. 06 – 1310 nm/1550 nm SM ..... **+$23,000**
Opt. 07 – 1310 nm SM Long Range ..... **+$13,800**
Opt. 08 – 1310/1550 nm SM Long Range ..... **+$20,000**
Opt. 09 – 1550 nm SM Long Range ..... **+$17,000**
For Options 01–09 select one connector per option at no charge.

CONNECTOR OPTIONS – MULTIMODE
Opt. 20 – Biconic (119-4515-00) ..... **NC**
Opt. 21 – FCPC (119-4516-00) ..... **NC**
Opt. 22 – D4PC (119-4514-00) ..... **NC**
Opt. 23 – SMA906 (119-4517-00) ..... **NC**
Opt. 24 – STPC (119-4513-00) ..... **NC**
Opt. 25 – Diamond 2.5 (119-4556-00) ..... **NC**
Opt. 26 – Diamond 3.5 (119-4558-00) ..... **NC**
Opt. 27 – DIN 47256 (119-4546-00) ..... **NC**
Opt. 28 – SCPC (119-4518-00) ..... **NC**
Opt. 29 – SMA 2.5 (119-4517-00) ..... **NC**

CONNECTOR OPTIONS – SINGLEMODE
Opt. 30 – Biconic (119-4515-00) ..... **NC**
Opt. 31 – FCPC (119-4516-00) ..... **NC**
Opt. 32 – D4PC (119-4514-00) ..... **NC**
Opt. 33 – SMA 905/906 (119-4557-00) ..... **NC**
Opt. 34 – STPC (119-4513-00) ..... **NC**
Opt. 35 – Diamond 2.5 (119-4556-00) ..... **NC**
Opt. 36 – Diamond 3.5 (119-4558-00) ..... **NC**
Opt. 37 – DIN 47256 (119-4546-00) ..... **NC**
Opt. 38 – SCPC (119-4518-00) ..... **NC**
Opt. 39 – SMA 2.5 (119-4517-00) ..... **NC**

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**
Opt. A2 – United Kingdom 240 V, 50 Hz ..... **NC**
Opt. A3 – Australian 240 V, 50 Hz ..... **NC**
Opt. A4 – North American 240 V, 60 Hz ..... **NC**
Opt. A5 – Switzerland 220 V, 50 Hz ..... **NC**

SERVICE ASSURANCE OPTIONS
REP4500 – Provides one year of post-warranty Repair Protection
TFP2/TFP2m ..... **+$200**
FM8500 ..... **+$200**
REP4600 – Provides one year of post-warranty Repair Protection
FM8513/FM1300 ..... **+$295**
FS1300/FS1500/FS1315 ..... **+$295**
FL1300/FL1315/1500 ..... **+$295**
CAL4500 – Provides one year of Calibration Services
TFP2/TFP2m ..... **+$210**
FM8500 ..... **+$210**
CAL4600 – Provides one year of Calibration Services
FM8513/FM1300 ..... **+$245**
FS1300/FS1500/FS1315 ..... **+$245**
FL1300/FL1315/FL1500 ..... **+$245**

ADDITIONAL ACCESSORIES
Factory Installed Options
Opt. 11 – 3.5 in. Floppy Disk Drive ..... **+$400**
Opt. 14 – Internal RAM, 1 MB ..... **+$870**
Opt. 16 – Internal High Speed Thermal Printer ..... **+$1,400**
Opt. 17 – DC Power Input (10-32 VDC) ..... **+$895**
Field Installed Options
Trace Analysis Package PC Software – Order FMTAP **$1,495**
Opt. 19 – AT Compatible Keyboard. Order 118-7637-00 and 174-2356-00 ..... **+$200**
Opt. 1R – Rackmount Kits (fits 19 in. racks) ..... **+$400**
Opt. 1T – Hard Shell Transit Case. Order 016-1036-00 ..... **+$895**

OPTICS MODULES/CONNECTOR
When ordering Optics Module connector outputs for previously purchased mainframes, use the following numbers:
FM8500 – 850 nm Multimode, 62.5 µm **$7,000**
FM1300 – 1300 nm Multimode 62.5 µm **$13,500**
FM8513 – 850 nm/1300 nm Multimode 62.5 µm **$16,000**
FS1300 – 1310 nm Singlemode **$15,000**
FS1500 – 1550 nm Singlemode **$11,500**
FS1315 – 1310 nm/1550 nm Singlemode **$23,000**
FL1300 – 1310 nm SM Long Range **$13,800**
FL1315 – 1310/1550 nm SM Long Range **$20,000**
FL1500 – 1550 nm SM Long Range **$17,000**

To order, contact your local sales office (listed on the inside back cover) or call the National Marketing Center at 1-800-833-9200.

GPIB IEEE-488 — The FiberMaster™ complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 — Tektronix Measurement products are manufactured in ISO registered facilities.

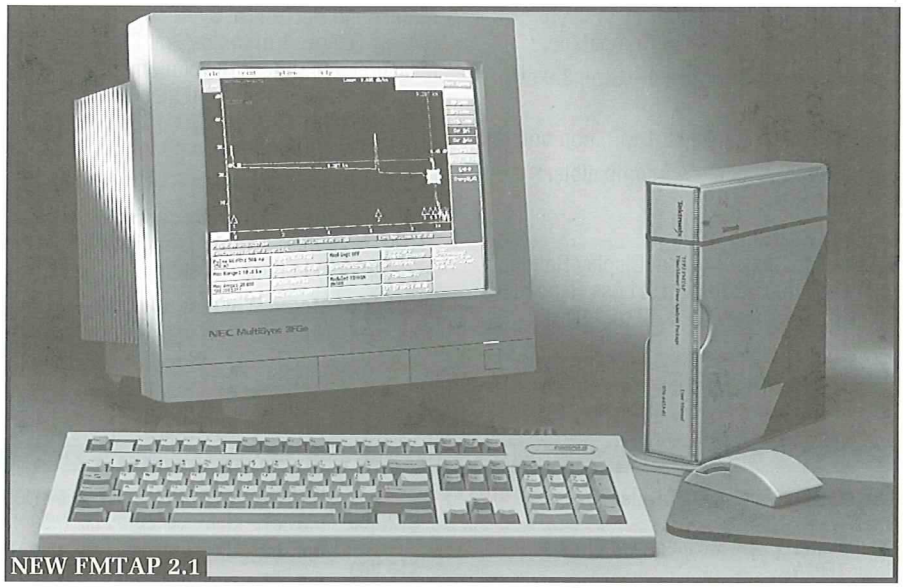
FMTAP

Trace Analysis Package 2.1

Use your IBM PC or compatible for display and analysis of waveforms.

New FMTAP

- Link Return Loss
- Event Return Loss
- High Density Data
- Automatic and Manual Event Marking
- Event Table
- Waveform Subtraction
- Waveform Averaging
- Two-way Event Averaging
- Batch Printing of Waveforms
- Screen-dump for Printing on a Variety of Printers, or for Importing into a Word Processor Document
- Export of Waveform Data for Use with Spreadsheet or Word Processor
- Data Base Searches with Selectable Tolerances for All Event Table Measurements
- Copy Established Event Markers for Documenting Redundant Fibers



FMTAP Trace Analysis Package

Trace Analysis Software for the TFP2 FiberMaster™ OTDR, and TFS3030 FiberMini™, FMTAP, allows you to use an IBM PC or compatible to display and analyze waveforms created by a TFP2 FiberMaster™ and TFS3030 FiberMini™.

Use the FiberMaster™ or FiberMini™ to acquire the waveform data and save it on a floppy disk file. Then use the PC to manipulate the waveforms and perform many of the same kinds of measurements that are possible on the FiberMaster™ and FiberMini™.

- Preview the complete waveform
- Automatic and manual two-point and splice-loss measurements
- Display distance and loss axes, measurements and settings
- Dual-trace
- Event Marking
- Expanded view of events

By using a Microsoft compatible two- or three-button mouse you can access front measurement controls.

Extensive pull down menus are available for file management and printing functions to a number of popular printing devices. On-line help is available with a push of a button.

THE MEASUREMENT SCREEN

Once loaded into your PC, the measurement screen appears, displaying a menu bar, status bar and the waveform display area, which includes a horizontal distance scale and vertical loss scale. After you load a waveform, the distance and loss cursors and the expansion window are positioned where they were located at the time the waveform was written into mass storage on the FiberMaster™ or FiberMini™.

The waveform area of the measurement screen is color coded for easier interpretation of the data.

- Waveform data is green.
- Measurement values, such as two-point distance and loss, splice-loss and fiber-loss are shown in yellow.
- The user adjustable elements (distance and loss cursors) are displayed red.
- Cursor adjustment handles and the handles on the expansion window are magenta.

The control panel on the screen allows you to select the waveform to display, the measurement mode, expanded view, and cursor functions. You can also choose various waveform settings:

- Single- or dual-trace
- Slope calculation
- Units (Meters or Feet)
- Index of refraction
- Fiber identification, Notes, Operator

Other settings, which are not selectable but are displayed, include the pulse width, range, number of averages, and masking type.

To order, contact your local sales office (listed on the inside back cover) or call the National Marketing Center at 1-800-833-9200.

ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Trace Analysis Package 2.1

System Requirements

Processor – 80286-, 80386-, or 80486-based IBM*3 PC or PS/2*3 (or 100% compatible).

Operating System – MS-DOS*8 or PC-DOS*3 3.30 or later.

Base Memory – 640 K RAM minimum. 580 K available.

Extended or Expanded Memory – At least 1 MB required.

Graphics Adapter – Color VGA.

Monitor – Color VGA.

Floppy Disk Drive – 3.5 in., 1.44 MB or 5.25 in., 1.2 MB capacity, IBM compatible*1.

Fixed Disk Drive – 2 MB minimum.

RS-232 Serial Port – For transferring stored tests from the TFS3030 to the PC. Is not necessary to run the FMTAP Software.

Mouse – Two- or three-button Microsoft-compatible serial mouse.

Compatibility – A math coprocessor (80287 or 80387) is required and a FiberMaster™-compatible printer or an IBM graphics printer are highly recommended.

Compatible printers include:

- IBM*3 Graphics Printer
- Epson*2 MX and FX
- Epson LQ 24-Pin
- Hewlett-Packard ThinkJet*4
- Hewlett-Packard LaserJet*4
- Hewlett-Packard DeskJet*4
- Hewlett-Packard DeskJet 500C*4
- Apple LaserWriter*6 (PostScript*5)
- Tek Phaser™*7 (Color PostScript)

*Note *1: A 3.5 in. disk drive is required to read the FiberMaster™ floppy disk directly, but is not necessary to run the FMTAP software.*

**2 Epson is a registered trademark of EPSON, Shinshu Seiko Co., Ltd.*

**3IBM, IBM PS/2 and PC-DOS are registered trademarks of IBM, Inc.*

**4Hewlett-Packard ThinkJet, LaserJet and DeskJet are registered trademarks of Hewlett-Packard Company.*

**5PostScript is a registered trademark of Adobe Systems, Inc.*

**6Apple LaserWriter is a registered trademark of Apple Computer, Inc.*

**7Tek and Phaser are registered trademarks of Tektronix, Inc.*

**8MS-DOS is a registered trademark of Microsoft, Inc.*

ORDERING INFORMATION

FMTAP
FiberMaster™ Trace Analysis Package **$1,495**

Includes: Disk Pack (063-0971-01), FMTAP User's Manual (070-8433-01, FMTAP Quick Reference Card (063-0828-01), FiberMaster™ Utilities Disk Pack (063-1493-00).

To order, contact your local sales office (listed on the inside back cover) or call the National Marketing Center at 1-800-833-9200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

FiberMini™

Mini Optical Time Domain Reflectometer

Three products in one: OTDR, BreakFinder and a unique EventFinder.

FiberMini™ FEATURES

- Automatic Fiber Analysis of Entire Fiber Link
- 0.05 dB Fault Threshold
- Extended Dynamic/Measurement Range
- Single or Dual Wavelength Available:
  – 1310 nm,
  – 1550 nm or
  Both from a Single Optical Port
- True OTDR Waveform
- Internal Data Storage
- Field Changeable/Cleanable Optical Connector Adapter
- Rugged, Handheld and Easy to Use
- Interactive/Context Sensitive HELP
- Backlit High-resolution LCD Display
- Real-time Display
- RS-232 Output Port for a PC or Printer
- Powered from Internal Battery, AC, Vehicle Cigarette Lighter or CO Station Battery

MULTIMODE

- Available Early 1995



FiberMini™

The TFS3030 FiberMini™ is a portable, user-friendly, mini-optical time domain reflectometer (OTDR) that offers single or dual wavelength fiber analysis.

The FiberMini™ functions as three products in one: an OTDR, BreakFinder and a unique EventFinder.

Patented algorithms and a specialized digital signal processor combine to offer an automated EventFinder mode that accurately reports more events across greater fiber lengths than any other mini-OTDR.

TRUE OTDR CAPABILITIES

FiberMini™ features multiple automatic measurements, OTDR versatility, user-selectable measurement parameters, dual cursor function and a high-resolution display with variable zoom.

The user interface offers easy-to-use features, soft keys, windowed menus for setup and operation and context-sensitive on-screen help. These features significantly reduce training time for first-time users.

AUTOMATED EVENTFINDER MODE

Only FiberMini™ has single-button automated location of events as small as 0.05 dB. Information is displayed as either an easily understandable event table or symbolic display format. Because EventFinder dynamically selects the acquisition parameters (such as pulse width and number of averages), it gives superior performance for measurement range and two-event distance resolution, eliminating the need to acquire multiple waveforms to see splices/connectors close in and further out on the fiber.

RUGGED, FIELD-FRIENDLY FEATURES

Small and light, the FiberMini™ weighs only 9.2 lb. (4.2 kg) and measures 11.5 x 4.5 x 9.5 in. (29.2 x 11.4 x 24.1 cm). An internal eight-hour NiCad battery frees you from the need for an AC power source. It can also operate from a 10 V to 60 V DC power source. Its case is dust-, shock- and water-resistant.

The FiberMini™ features a backlit 640 x 400 high-resolution, high-contrast LCD display. New technology allows the optical connector to be easily cleaned and changed in the field without tools, eliminating the time, expense and trouble of carrying multiple optical jumper cables.

Tektronix offers the FiberMini™ in four distinct configurations to meet your price and performance needs:

- A low-cost 1310 nm version (Opt. 01)
- A high-performance 1310 nm version (Opt. 03)
- A high-performance 1550 nm version (Opt. 05)
- A high-performance dual-wavelength 1310 nm and 1550 nm version (Opt. 06)

All versions have an RS-232 port allowing data output to a PC, portable or desktop printer.

Waveforms, as well as EventFinder and BreakFinder results, can easily be stored in the internal memory and uploaded to a PC over the RS-232 interface and/or recalled to the display. Additional Waveform analysis and documentation can be performed on a PC with the optional FMTAP Trace Analysis Software.

The FiberMini™ is the best possible choice for users adopting the Bellcore Mini-OTDR TR (TR-NWT-001138).

The FiberMini™ is well suited for users in the telecommunications and CATV industries. Its low price will allow users to deploy mini-OTDRs more broadly throughout their systems.

To order, contact your local sales office (listed on the inside back cover) or call the National Marketing Center at 1-800-833-9200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Mini Optical Time Domain Reflectometer

FiberMini™

Characteristics

1310 nm optical output – 1310 ±25 nm*1.
1550 nm optical output – 1545 ±25 nm*1.
Dynamic Range*2/Measurement Range*3 –

	–15°C to 45°C Minimum Spec.		Room Temp. Typical
	Dynamic Range*2	Measmt. Range*3	Measmt. Range*3
1310 nm (Opt. 01)	23 dB	18 dB	20 dB
1310 nm (Opt. 03)	26 dB	21 dB	23 dB
1550 nm (Opt. 05)	24 dB	19 dB	21 dB
1310/1550 nm (Opt. 06)	26/24 dB	21/19 dB	23/21 dB

Dead Zone –	Event	Loss
5 m Pulse	15 m	50 m
Reflection	≤–35 dB	return loss

Loss Threshold – 0.05 dB (minimum).

Loss Resolution – 0.001 dB.

Readout Resolution (Waveform Mode) – 0.1 m (High Density Acquisition).

OTDR Distance Range Setting – 2 km to 140 km.

Distance Resolution (EventFinder) – 1 m for any range.

Measurement Time (Auto Measurement Mode) – Approximately 3 min. (20 dB accumulated loss).

Power Options – AC (100 to 240 V; 50 to 60 Hz); 10 to 60 V DC; Battery (8 hours typ).

ENVIRONMENTAL

Operating Temperature Range – –15°C to 45°C.

Storage Temperature Range – –20°C to 60°C.

Relative Humidity – 5% to 95%, ±5% non-condensing.

Weight – 9.2 lb. (4.2 kg).

Dimensions – 11.5 x 4.5 x 9.5 in. (29.2 x 11.4 x 24.1 cm).

Field Usage – Tested to Bellcore Mini-OTDR TR Environmental Specifications (i.e., 30-inch drop, dust, rain-proof, etc.).

OPERATING CHARACTERISTICS

Measurements Reported:

- All losses greater than user-selected threshold
- Loss tolerance for each reported event
- Distance to/from front panel as well as surrounding events
- Distance tolerance for each reported event
- Grouped events
- Echo identification
- Return loss for each reported event
- Loss/km for previous fiber segment
- Total link loss to each event
- Distance, loss and loss/km between two cursors in waveform mode

Display – High resolution (640 x 400), high contrast black on fluorescent white, backlit LCD.

Selectable Pulse Widths (Waveform Mode) – 5 m, 20 m, 100 m, 500 m, 1 km, 2 km.

Memory Capacity – 200 traces typical.

**1 Performance accurate at room temperature (25°C).*

**2 Dynamic Range is defined as the distance (in dB) from the backscatter level at the front panel to an imaginary line which lies above 98% of the displayed noise (2.3 sigma).*

**3 Measurement Range is defined (per Bellcore TR-NWT-001138) as follows: Operating at 1310 nm, find a 0.5 dB loss with a ±0.1 dB tolerance, within three minutes, meeting the TR's single event distance accuracy and multiple event distance resolution.*

ORDERING INFORMATION

FiberMini™
Base Unit. Order TFS3030 ..... **$5,750**
Includes: Operator Manual (070-8724-01), Reference Card (063-1462-01, NiCad Battery Pack (146-0095-00, Power/Charger Adapter (119-4545-00), Power Cord for Charger/Adapter (161-0228-00, Soft Carrying Case (016-1215-00).

OUTPUT PORT OPTIONS (CHOOSE ONE)
Opt. 01 – Single Wavelength 1310 nm ..... **+$2,500**
Opt. 03 – Single Wavelength 1310 nm ER ..... **+$5,150**
Opt. 05 – Single Wavelength 1550 nm ..... **+$7,900**
Opt. 06 – Dual Wavelength 1310/1550 nm ..... **+$10,700**
Opt. TS – 1310 nm, FMTAP, FSTIP ..... **+$3,000**
Opt. TD – 1310/1550 nm, FMTAP, FSTIP ..... **+$11,200**

CONNECTOR OPTIONS (CHOOSE ONE)*1
Opt. 20 – Biconic (119-4515-00) ..... **+$160**
Opt. 21 – FCPC (119-4516-00) ..... **+$160**
Opt. 22 – D4PC (119-4514-00) ..... **+$160**
Opt. 23 – SMA 2.5 (119-4517-00) ..... **+$160**
Opt. 24 – STPC (119-4513-00) ..... **+$160**
Opt. 25 – DINPC 47256 (119-4546-00) ..... **+$160**
Opt. 26 – Diamond 3.5 (119-4558-00) ..... **+$160**
Opt. 27 – Diamond 2.5 (119-4556-00) ..... **+$160**
Opt. 28 – SCPC (119-4518-00) ..... **+$160**
**1 Additional Connectors may be ordered by 9-digit part number.*

SERVICE ASSURANCE OPTIONS
REP4500 – Provides one year of post-warranty Repair Protection ..... **+$200**
CAL4500 – Provides one year of Calibration Services ..... **+$210**

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Euro 220 V Order 161-0066-09 ..... **NC**
Opt. A2 – UK 240 V Order 161-0066-10 ..... **NC**
Opt. A3 – Australian 240 V Order 161-0066-11 ..... **NC**
Opt. A4 – Switzerland 220 V Order 161-0154-00 ..... **NC**
Opt. A6 – Japanese 110 V Order 161-0154-00 ..... **+$200**

OPTIONAL ACCESSORIES
Hard Travel Case – Order 016-1210-00 ..... **$260**
FSTIP Test Interface Package, PC Software – **$95**
FMTAP PC Software – **$1,495**
Seiko DPU411 Cable, 9-Pin male to 25-Pin male – Order 174-2562-00 ..... **$60**
PC/AT Cable, 9-Pin male to 9-Pin female – Order 174-2561-00 ..... **$60**
Seiko DPU411 Printer – Order 119-4594-00 ..... **$470**

To order, contact your local sales office (listed on the inside back cover) or call the National Marketing Center at 1-800-833-9200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

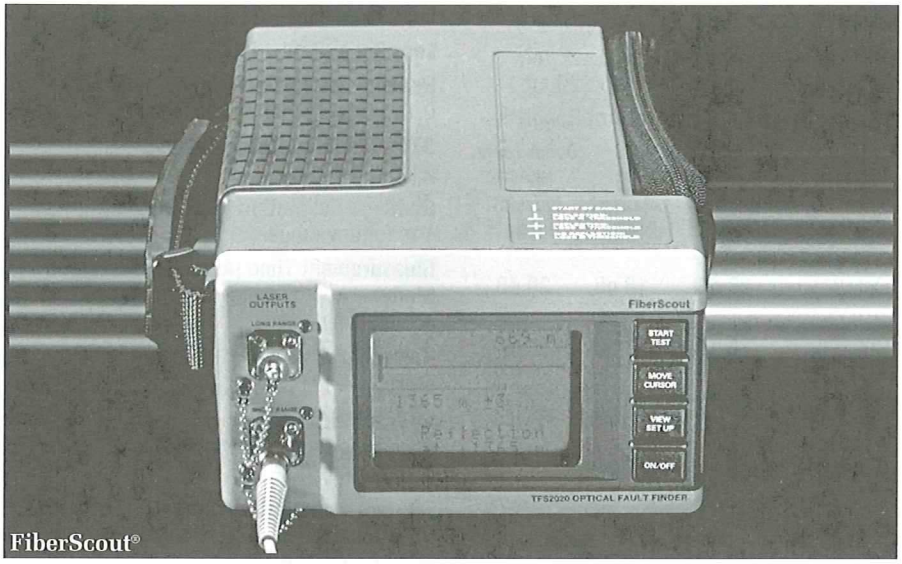
FiberScout®

Handheld Optical Fault Finder

Priced for widespread use in cable restoration environment.

FiberScout®

- Simple Symbolic Display
  - Graphics
  - Event Descriptions
- Fast Restoration Capability
- Small, Lightweight, Easy to Handle
- Easy One-button Operation
- Low Cost – High Performance
- Long Range
- Universal Short Range
- Multimode Short Range
- Dual Port Capability
- High Distance Accuracy
- User-selectable Fault Thresholds
- Internal Battery Operation
- Internal Test Result Storage
- RS-232C Output Port: PC Interface, Seiko DPU-201G Printer, Seiko DPU-411 Printer
- PC Interface Software
- Rackmount Available



FiberScout®

Weighing just five pounds (2.3 kg), the battery-operated Tektronix TFS2020 FiberScout® reports the status of the fiber through four easy-to-understand symbols.

Designed to locate events and faults in optical cable, the FiberScout® is priced for widespread use in the cable restoration environment.

CHARACTERISTICS

OPERATING PERFORMANCE*1

	Multimode Short Range	Universal Short Range	Long Range
Operating Distance Range*2	≥3.0 km @ 3.5 dB/km	≥3.0 km @ 2.5 dB/km	≥40.0 km @ 0.4 dB/km
Fault Detection Range (one way)	≥10.5 dB @ 62.5 µm	≥7.5 dB	≥16 dB*3
Distance Measurement Accuracy*4			
To Reflective Event	±2 meters	±2 meters	±5 meters
To Non-reflective Event	±2 meters	±2 meters	±5 to 20 meters*5
Distance Readout Resolution	1 meter or 1 foot	1 meter or 1 foot	1 meter or 1 foot
Two Event Resolution*6			
Distance to Detect 2nd Reflection	≤10 meters	≤10 meters	≤40 meters
Loss Measurement Repeatability	±0.2 dB	NA	±0.3 dB
Loss Readout Resolution	±0.1 dB	NA	±0.1 dB
Fault Threshold Selections	1, 2, 3, or 4 dB	NA*7	1, 2, 3, or 4 dB
Optical Output			
Wavelength	835 nm ±35 nm	835 nm ±35 nm	1300 nm ±25 nm
Output Core Size	50 or 62.5 microns	8 to 10 microns	8 to 10 microns
Display	Backlit LCD, Graphics and Text		
Laser Safety	Complies with Class I, 21 CFR 1040.10/1040.11		
Power	Internal Rechargeable NiCad Battery Pack. Typical Operation life between charges: 6 hours. Typical shelf life between charges: 6 months. External AC/DC External Power/Charger Adapter.		

**1 In some cases, varying test conditions may affect measurement performance.*

**2 With no events present.*

**3 At the 4 dB fault threshold setting.*

**4 Actual distance accuracy includes: timebase accuracy (±0.005%) quantization error in the Index of Refraction setting.*

**5 With extended averaging invoked.*

**6 The FiberScout® automatically uses the optimal pulse width to separate the loss measurements between two adjacent events.*

**7 For singlemode fiber, the FiberScout® will report any loss ≥1 dB. For multimode fiber, the FiberScout® will report any significant fault.*

To order, contact your local sales office (listed on the inside back cover) or call the National Marketing Center at 1-800-833-9200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Handheld Optical Fault Finder

FiberScout®

No waveform interpretation is necessary – making the FiberScout® so simple to use, it allows fault finding by virtually any user, regardless of the person's level of training.

The FiberScout® gives you faster restoration capability and greater service staff effectiveness, since it can be deployed in far greater numbers than the more complex, more expensive OTDRs.

Documentation is fast and simple when using either of the lightweight, portable Seiko thermal printers. FiberScout® comes standard with non-volatile memory for internal storage of test results which can later be transferred to a PC.

For advanced documentation and storage needs, we also offer the FSTIP test interface package. Files are saved to the PC in ASCII form, which allows easy analysis of the representative trace and annotations of the results through virtually any word processor.

ORDERING INFORMATION

FiberScout®
Handheld Optical Fault Finder. Order TFS2020 ..... **$25.00**
Includes: Battery Pack (146-1000-01); 110 V AC/DC, Power Supply – USA/Canada (119-2731-00); Travel Case (016-1024-00); Accessory Pouch (016-0993-00); Operator Manual and Supplement (070-7167-04); Reference Label (062-9360-01).

With each FiberScout® ordered, select one of the option groups listed below:

Opt. 01 – Equip with Long Range and Universal Short Range Ports ..... **+$8,340**
Opt. 02 – Equip with Long Range Port ..... **+$5,075**
Opt. 03 – Equip with Universal Short Range Port ..... **+$5,280**
Opt. 09 – Equip with Multimode (62.5 µm) Short Range Port ..... **+$5,485**
Opt. MC – Equip with Multimode (50 µm) Short Range Port ..... **+$5,995**
Opt. MM – Equip with Long Range and Multimode (62.5 µm) Short Range Ports ..... **+$8,645**
Opt. MN – Equip with Long Range and Multimode (50 µm) Short Range Ports ..... **+$9,155**

With each FiberScout® ordered, select one of the connector options:

CONNECTOR OPTIONS – LONG RANGE
Opt. 20 – Biconic ..... **NC**
Opt. 21 – FC ..... **NC**
Opt. 22 – D4 ..... **NC**
Opt. 24 – ST ..... **NC**
Opt. 25 – DIN ..... **NC**
Opt. 28 – SC ..... **NC**

CONNECTOR OPTIONS – UNIVERSAL SHORT RANGE
Opt. 30 – Biconic ..... **NC**
Opt. 31 – FC ..... **NC**
Opt. 32 – D4 ..... **NC**
Opt. 34 – ST ..... **NC**
Opt. 35 – DIN ..... **NC**
Opt. 38 – SC ..... **NC**

CONNECTOR OPTIONS – MULTIMODE SHORT RANGE
Opt. 40 – Biconic ..... **NC**
Opt. 41 – FC ..... **NC**
Opt. 42 – D4 ..... **NC**
Opt. 44 – ST ..... **NC**
Opt. 45 – DIN ..... **NC**
Opt. 46 – SMA 905/906 ..... **NC**
Opt. 48 – SC ..... **NC**

AC/DC POWER SUPPLY OPTIONS
The FiberScout® is equipped for use in the U.S.A. and Canada. If use is for other than in the U.S.A. or Canada, order one of the following options:
Opt. 1C – 220 V AC/DC Power Supply (Europe) ..... **NC**
Opt. 2C – 240 V AC/DC Power Supply (UK) ..... **NC**

SERVICE ASSURANCE OPTIONS
REP4400 – Provides one year of post-warranty Repair Protection ..... **+$130**
CAL4400 – Provides one year of Calibration Services ..... **+$145**

Note: Units are not modular or customer modifiable. Any change in capability from originally ordered configuration, if available, must be performed by the factory or authorized Tektronix service center. Additional charges will apply.

To order, contact your local sales office (listed on the inside back cover) or call the National Marketing Center at 1-800-833-9200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

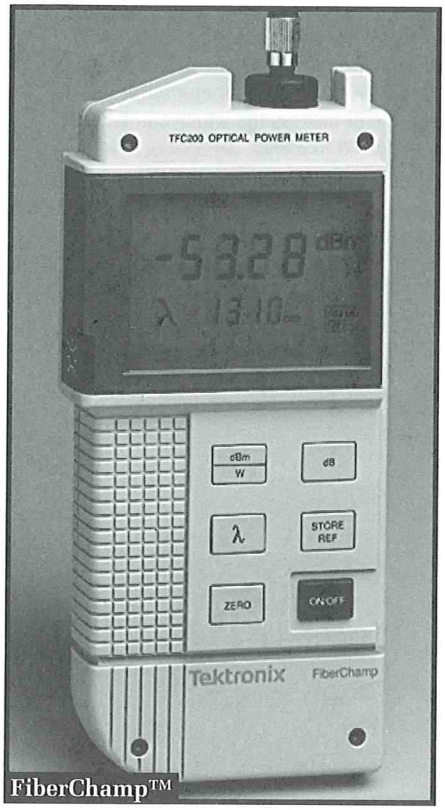
FiberChamp™

Optical Power Meter

FiberChamp™ – Accurate optical power and loss measurements in a single, rugged handheld unit.

FiberChamp™

- 3% Accuracy
- Selectable dB Threshold Audio Indicator
- Readouts in dBm, dB and Watts
- Multiple Calibrated Wavelengths: 780, 820, 850, 1060, 1300, 1310 and 1550
- Non-volatile Storage of Reference Power Level for Each Wavelength
- Averaging
- Analog Output Port
- Easy-to-use, Intuitive User Interface
- Large, Backlit LCD Display Is Easy to Read in Direct Sunlight or Total Darkness
- Battery or AC/DC Operation
- Wide Selection of Connector Adapters
- Interfaces to Multimode and Singlemode Fiber



FiberChamp™

FiberChamp™ Characteristics

These specifications apply for use with all singlemode and multimode fibers up to 200 µm, 0.3 NA core with all connector options.

Spectral Range – 750 nm to 1700 nm.

Calibrated Wavelengths – 780, 820, 850, 1060, 1300, 1310, 1550 nm.

Dynamic Range – +10 dBm to –70 dBm.

Accuracy – ±3% (±0.1 dB). Note: At –20 dBm at 20°C at calibrated wavelengths.

Readout Resolution – 4 digits, 0.01 dBm.

Display – Backlit LCD 6.98 x 5.08 cm (2.78 x 2.00 in.).

ENVIRONMENTAL

Temperature – Operating: –5°C to +45°C; Storage: –30°C to +75°C.

Humidity – 5 to 95% Relative Humidity, non-condensing.

Altitude – Operating: 4,500 meters (15,000 ft.); Storage: 15,000 meters (50,000 ft.).

POWER REQUIREMENTS

Internal – 9 V Alkaline (non-rechargeable) or 7.2 V, 6 cell NiCad (rechargeable).

Battery Life – Alkaline 28 hours, NiCad 8 hours.

External – 12-20 VDC (AC/DC converter) at 100 mA minimum.

PHYSICAL

Dimensions – Length: 3.74 in. (9.5 cm); Width: 1.3 in. (3.3 cm); Height: 7.91 in. (20.1 cm).

Weight – 1 lb. (0.45 kg).

APPLICATIONS/REPRESENTATIVE USERS

- **Absolute Power Measurements**
- **Link Loss**
- **Threshold Testing**
- **Monitoring Power Levels**
- **Telco**
- **CATV**
- **LAN**
- **R&D**

ORDERING INFORMATION

FiberChamp™
Optical Power Meter. Order TFC200.....**$1,305**
Includes: Operator Manual (070-7913-00); User Guide (063-0809-00); Carrying Case (016-1078-00); Alkaline Battery (146-0094-00).

Connector Adapters, Rechargeable Power options, and additional accessories are available.

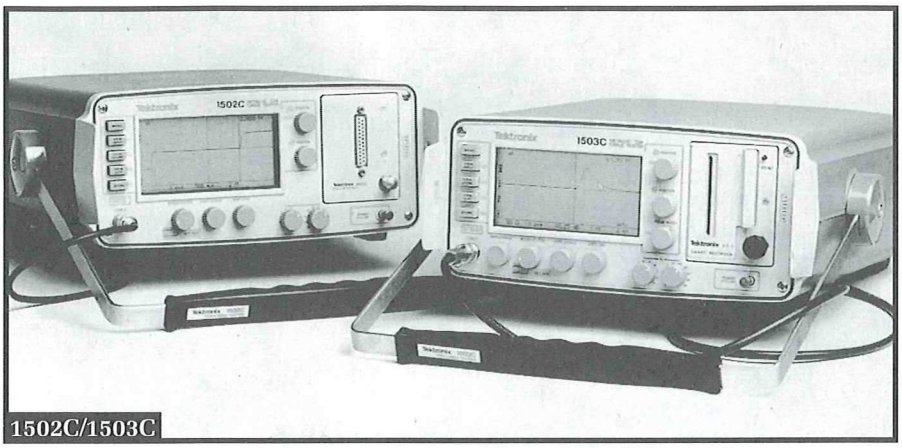
To order, contact your local sales office (listed on the inside back cover) or call the National Marketing Center at 1-800-833-9200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

Metallic Cable Testers

1503C / 1503B

1502C / 1502B



The 1502C/1503C MTDR Cable Testers combine portability and ease of use with the ability to test most dual conductor metallic cable under virtually any condition.

1503B/1503C
GENERAL PURPOSE CABLE TESTERS
These products generate a 1/2 sine pulse, with selectable pulse widths of 2, 10, 100, or 1000 ns. The high-resolution 2 ns pulse permits the identification of multiple faults as close together as one foot. The 1000 ns pulse gives the 1503C a range of 5,000 to 50,000 feet (depending on cable type and condition).

For most TDR applications, where determining distance to an impedance change is the key measurement, the 1503C/1503B are the best choices.

1502C/1502B ULTRA-HIGH-RESOLUTION TDRS
The 1502C and 1502B generate a 200 ps rise time step pulse and have an output impedance of 50 Ω. The fast rise time permits the identification of multiple faults as close together as 0.6 inches.

Sample Applications

LOCAL AREA NETWORKS
Cable and connector problems can be the biggest headache for the LAN installer. The 1503C's high-resolution 2 ns pulse will precisely identify problems in seconds. The calibrated vertical scale can help identify marginal components before they cause problems, and a return call.

ON-BOARD SYSTEMS
The ultra-high resolution of the 1502C or 1502B are perfectly adapted for testing critical wiring on board aircraft and ships.

MANUFACTURING QUALITY CONTROL
Manufacturers of circuit boards or precision cabling can quickly and accurately determine or verify the impedance characteristics of their products in a matter of seconds with the 1502C or 1502B.

1502C/1503C
1502B/1503B

- Direct Distance Readout – Accurate to Better Than 1%
- Intermittent Fault Monitor Mode
- High-Resolution LCD Display With Zoom
- Menu-driven Setup
- Help Mode
- Rugged Portability
- Calibrated Vertical Scale
- Optional Serial Interface
- Optional Internal Printer
- Noise Filtering

Custom configure to meet your needs.

ORDERING INFORMATION

1503C – Metallic TDR **$5,050**
1503B – Metallic TDR **$6,050**
1502C – Metallic TDR **$7,100**
1502B – Metallic TDR **$8,100**
Includes: AC Power Cord; 50 Ω BNC Terminator; Precision 50 Ω Cable (1502); 93 Ω Cable (1503); BNC-Cliplead (1503); Female-to-female BNC Connector; Spare Fuse; Operator's Manual; Accessory Pouch; Option Port Cover; Calculator Slide Rule.

Opt. 03 – Battery Pack ..... **+$250**
1500C Series products meet environmental requirements of MIL-STD-28800C for Type III, Class 3, Style C, and utilize a high-performance internal gel-cell battery. 1500B Series products meet environmental requirements for Style A, and utilize a removable NiCad battery pack.

Opt. 04 – YT1 Chart Recorder ..... **+$950**
Records all information displayed on LCD, including waveform and settings for a permanent record.

Opt. 06 – (1503 only) Live Ethernet testing capability ..... **+$350**
Opt. 08 – Token Ring TDR Adapter (1503 only) ..... **+$150**
Opt. 09 – USOC Adapter (1503 only) ..... **+$150**
Opt. 10 – Token Ring Interface (1503 only) ..... **+$150**
SP232 Serial Interface Module ..... **+$350**
Provides a serial link to a host PC for remote control, waveform storage, and automated fault finding. Includes host software for IBM-compatible PCs.

SERVICE ASSURANCE OPTIONS
REP4400 – Provides one year of post-warranty Repair Protection ..... **+$130**
CAL4400 – Provides one year of Calibration Services ..... **+$145**
A wide range of other options and connectors is available.

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**
Opt. A2 – United Kingdom 240 V, 50 Hz ..... **NC**
Opt. A3 – Australian 240 V, 50 Hz ..... **NC**
Opt. A4 – North American 240 V, 60 Hz ..... **NC**
Opt. A5 – Switzerland 220 V, 50 Hz ..... **NC**
See Customer Information Section for additional description.

To order, contact your local sales office (listed on the inside back cover) or call the National Marketing Center at 1-800-833-9200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

TelScout™

TDR for Telephony Cable Tester

Spend less time operating the TDR and more time repairing the faults.

TS100

- One-step Setup
- Automatic Instrument Control Mode
- Manual Instrument Control Mode
- 15 km Fault Location Capability
- Rugged (survives 2 m drop) and Splash-proof
- Powered from AC Mains or Battery
- 10 x 12 x 3.5 in., 6.4 lb.
- Single Button Zoom
- Pair Comparison Mode
- Crosstalk Mode
- Measures Distance to Fault in Feet, Meters, or Time
- Configurable for any Cable Type and Vp (0.300 to 1.000)
- Internal Memory for 20 Waveforms and Notes
- Serial Printer Output for Stored or Displayed Waveforms
- Accurate (±3 ft. at 10,000 ft.)
- Short-pulse Option
- Intermittent Fault Location



TelScout™ TDR

If your job is to find faults on telephone twisted pair cable, the Tektronix TS100 TelScout™ is built for you. Designed specifically for twisted pair telephony applications, TelScout™ applies the newest technology to provide both ease of use and performance that cannot be found in any other TDR. With the TS100, you'll spend less time operating the TDR, and more time repairing faults.

Simply select the cable type to be tested and TelScout™ does the rest. Impedance, Vp, gain, pulse width and vertical position are automatically selected and adjusted as you scan the cable. Just move the cursor to the fault to pinpoint its location.

On the performance side, TelScout™ employs optimized pulsing and sampling, coupled with advanced filtering and signal processing techniques, to insure the maximum measurement range. That way, you'll always have a clean waveform for easier fault interpretation.

Best of all, you get all this performance in the industry's most rugged TDR package. Come snow, rain, heat and humidity, TelScout™ keeps working, because you have to.

TelScout™ MEASUREMENT MODES

The TS100 has connectors for two pairs, the test pair and the reference pair. There are four basic modes of operation:

1. **Test pair only.** Conventional TDR operation with one displayed waveform for the test pair.
2. **Test pair and reference pair.** This mode is used to visually compare the test and reference pairs. Pulsing occurs on both pairs and two waveforms are displayed. A stored waveform can also be selected for comparison.
3. **Test pair – reference pair.** Similar to the mode described above, pulsing occurs on both test pair and the reference pair (a single displayed waveform) to simplify the comparison. A stored waveform can also be selected for comparison.
4. **Crosstalk test.** A single waveform mode in which TelScout™ pulses on the test pair and samples on the reference pair for returning signal. This mode is typically used to determine the distance to the point where a split pair is occurring.

To order, contact your local sales office (listed on the inside back cover) or call the National Marketing Center at 1-800-833-9200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

TDR Telephone Cable Tester

TelScout™

Characteristics

Test Signal (Std. Opt.) – 1/2 Sine, balanced.

Amplitude (Std. Opt.) – 20 V into 100 Ω.

Output Impedance (Std. Opt.) – 100 Ω.

Pulse Widths (Std. Opt.) – 20 to 3000 ns; 5 ns optional.

Test Signal (Opt. 01) – 1/2 Sine.

Amplitude (Opt. 01) – 5 ns + 5 V into 100 Ω, 20 ns to 3000 ns ±4 V into 100 Ω.

Output Impedance (Opt. 01) – 100 Ω.

Pulse Widths (Opt. 01) – 5 ns to to 3000 ns.

Input Protection – ±400 V, DC + peak AC, to a maximum of 440 Hz.

Maximum Range – 15,000 m/45,000 ft., depending on cable type and condition.

Display Resolution – 0.33% of selected range, 4.5 cm/0.15 ft. minimum, on 640 x 200 high resolution LCD.

Display Ranges – Eleven display ranges plus single button expand window. (Ranges are user definable in manual mode.)

Filter – High pass, cutoff frequency 150 kHz, user selectable.

Amplifier – A 5 mV reflection produces a full-screen vertical deflection.

Gain – 0 to 63 dB.

Waveform Storage – Up to 20 waveforms with notes.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	300	12
Height	250	10
Depth	90	3.5
Weight ≈	**kg**	**lb.**
Net	3	6.4

Horizontal Accuracy – 0 to 5000 m = ±1 m, 5000 to 15,000 m = ±2 m ±uncertainty in Vp. 0 to 2000 ft. = ±2 ft., 2000 to 10,000 ft. = ±3 ft., 10,000 to 20,000 ft. = ±4 ft., ±uncertainty in Vp.

Mains Operation – 110 V, 220 V, or 240 V, with appropriate AC to DC adapter.

Battery Operation – 8 hours, continuous.

Battery Saver – 5 to 30 minutes or disabled, selectable.

Printer Interface – Serial 9-Pin D-type connector.

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature – –15° to +60°C.

Nonoperating Temperature – –20° to +65°C.

Humidity – 95% RH, non-condensing.

Shock – Survives drop of two meters to concrete in standard soft case.

EMI Emissions – FCC part 15, subpart J, class A; VFG243 and EN55022.

ORDERING INFORMATION

TelScout™
Basic Configuration. Order TS100 ..... **$3,265**
Includes: Test Leads (two sets), Soft Carrying Case with Shoulder Strap, U.S. AC Adapter/Charger, 120 VAC, 60 Hz, 9 V @ 1A, Cigarette Lighter Charger Cable, User Manual, Quick Reference Card. The rechargeable internal battery is a standard feature.

Opt. 01 – Adds 5 ns Pulse Width **$135**

Opt. 1C – Universal Euro Adapter/Charger, 220 VAC, 6A, 50 Hz (119-4240-00) ..... **NC**

Opt. 2C – United Kingdom Adapter/Charger, 240 VAC, 5A, 50 Hz (119-4239-00) ..... **NC**

Opt. 3C – Australian Adapter/Charger, 240 VAC, 5A, 50 Hz (119-4238-00) ..... **NC**

Opt. 6C – Japanese Adapter/Charger, 110 V, 1A, 60 Hz (119-4241-00) ..... **NC**

SERVICE ASSURANCE OPTIONS

REP4300 – Provides one year of post-warranty Repair Protection ..... **+$80**

CAL4300 – Provides one year of Calibration Services ..... **+$95**

OPTIONAL ACCESSORIES

Cigarette Lighter Charger Cable – Order 174-1734-00 ..... **$19.75**

General Printer Cable – Order 012-1313-00 ..... **$45.00**

Seiko DPU-411 Printer Cable – Order 012-1462-00 ..... **$45.00**

Printer, Seiko DPU-411 – Order 119-4594-00 ..... **$470**

Thermal Paper for Seiko Printer – Order 006-7840-00 ..... **$3.50**

AC Adapter/Charger, 220 VAC for Seiko Printer – Order 119-4648-00 ..... **$75.00**

To order, contact your local sales office (listed on the inside back cover) or call the National Marketing Center at 1-800-833-9200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

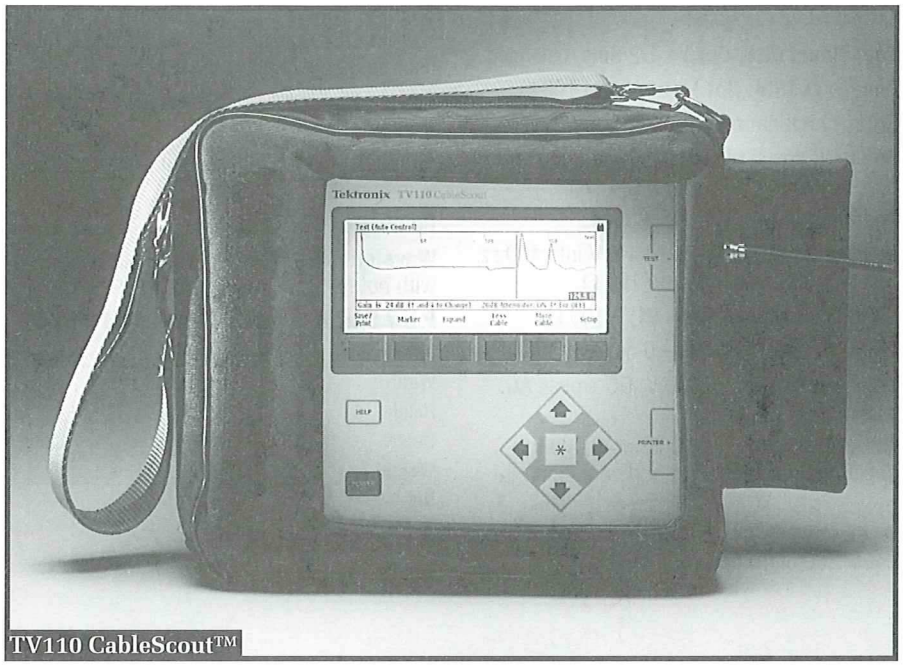
CableScout™

TDR Cable Tester for CATV

Performance Plus Ease of Use. Field rugged and reliable.

TV110 CableScout™

- One-step Setup and Acquisition
- Exclusive One Button Zoom/Overview Function
- Fully Automatic and Manual Control Modes
- Context Sensitive Help (Help Screens Available for All Functions)
- Internal Memory for 20 Waveforms with Notes
- Large, High-resolution Display (2.5 in. x 6 in.)
- Intermittent Fault Location
- Noise Reducing Digital Trace Smoothing
- Marker Function Measures Relative Distance Between Any Two Points
- Serial RS-232 Printer Output
- Rain, Dust, and Shock Proof Packaging (2 meter (6 ft.) Drop Tested)



TV110 CableScout™

CableScout™ TDR

If your job is to find faults on coaxial cable, the new Tektronix TV110 CableScout™ is built for you. Designed specifically for CATV and other coaxial cable applications, CableScout™ applies the newest technology to provide both ease of use and coaxial cable testing performance that cannot be found in any other TDR.

With the TV110, you'll spend less time operating the TDR, and more time repairing faults. Simply select the cable type to be tested and CableScout™ does the rest. Pulse width, Vp, gain, and vertical position are automatically selected and adjusted as you scan the cable. Finding the fault couldn't be faster; just move the cursor to the fault and use the one button zoom function to pinpoint its location. Identifying the fault is easy, just activate the dual trace display to compare your waveform to the stored sample CATV waveforms. Then use the TV110's standard waveform memory to store and document your results.

On the performance side, CableScout™ employs optimized pulsing and sampling, coupled with advanced filtering and signal processing techniques. That way, you'll always have a clean waveform for easier event identification.

Best of all, you get all this performance and ease of use in the industry's most rugged TDR package. Come snow, rain, heat and humidity, CableScout™ keeps working, because you have to.

APPLICATIONS

The TV100 CableScout™ is designed specifically for CATV/Coaxial Cable Applications.

- **Dedicated 75 Ω F Connector**
- **Pulsewidths Optimized for CATV/Coaxial Cable Runs**
- **Return Loss Measurement**
- **Sample Waveforms, Cable Types and Vps Stored in Memory**

To order, contact your local sales office (listed on the inside back cover) or call the National Marketing Center at 1-800-833-9200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

TDR Cable Tester for CATV

CableScout™

Characteristics

Test Signal – 1/2 Sine.

Amplitude – 15 V into 75 Ω.

Output Impedance – 75 Ω.

Pulse Widths – 6 and 12 ns.

Input Protection – ±400 V, DC and ±400 V, peak AC, to 440 Hz.

Maximum Range – 1,830 m (6,000 ft.) depending on cable type and condition.

Display Resolution – 0.33% of selected range, 4.5 cm (0.15 ft.) minimum, on 640 x 200 pixel high resolution reflective liquid crystal display 6.35 x 15.24 cm (2.5 x 6 in.).

Display Ranges – Eight display ranges plus single button expand window.

Filter – High pass, cutoff frequency 150 kHz, user selectable.

Amplifier – A 5mV reflection produces a fullscreen vertical deflection.

Gain – 0 to 63 dB.

Waveform Storage – Up to 20 waveforms with notes.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	300	12
Height	250	10
Depth	90	3.5
Weight	**kg**	**lb.**
	3	6.4

Horizontal Accuracy – 0 to 600 m = ±0.6 m, ±uncertainty in Vp. 601 m to 1,830 m = ±1 m, ±uncertainty in Vp. 0 to 2,000 ft. = ±2 ft., ±uncertainty in Vp. 2,001 ft. to 6,000 ft. = ±3 ft., ±uncertainty in Vp. Horizontal measurements in feet, meters, or time.

Mains Operation – 110 V, 220 V, or 240 V, with appropriate AC to DC adapter.

Battery Operation – 8 hours, continuous operation (4.6 A hours).

Battery Saver – 5 to 30 minutes or disabled, selectable.

Printer Interface – Serial 9-Pin D-type connector.

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature – –15°C to +60°C (5°F to 140°F).

Nonoperating Temperature – –20°C to +65°C (–5°F to 150°F).

Humidity – 95% RH, non-condensing.

Shock – Survives drop of two meters (6 ft.) to concrete in standard soft case.

EMI Emissions – FCC part 15, subpart J, class A; VFG243 and EN55022.

ORDERING INFORMATION

TV110 CableScout™
TDR Cable Tester for CATV **$2,950**
Includes: BNC to Alligator Clips (F to BNC, and F to F Barrel Adapters), Coaxial Jumper Cable, Soft Carrying Case with Shoulder Strap, U.S. AC Adapter/Charger (120 VAC, 60 Hz, 9 V @ 1A), User's Manual, Quick Reference Card, Rechargeable Internal Lead Acid Battery, Standard 1 Year Warranty.

Opt. 1C – Changes U.S. AC Adapter/Charger to 119-4240-00 Universal Euro Adapter/Charger, 220 VAC, 6 A, 50 Hz ..... **NC**

Opt. 2C – Changes U.S. AC Adapter/Charger to 119-4239-00 United Kingdom Adapter/Charger, 240 VAC, 5 A, 50 Hz ..... **NC**

Opt. 3C – Changes U.S. AC Adapter/Charger to 119-4238-00 Australian Adapter/Charger, 240 VAC, 6 A, 50 Hz ..... **NC**

Opt. 6C – Japanese Adapter/Charger, 110 V, 1 A, 60 Hz (119-4241-00) ..... **NC**

SERVICE ASSURANCE OPTIONS

REP4300 – Provides one year of post-warranty Repair Protection ..... **+$80**

CAL4300 – Provides one year of Calibration Services ..... **+$95**

OPTIONAL ACCESSORIES

Cigarette Lighter Charger Cable – Order 174-1734-00 ..... **$19.75**

General Printer Cable – Order 012-1313-00 ..... **$45.00**

Seiko DPU-411 Printer Cable – Order 012-1462-00 ..... **$45.00**

Printer, Seiko DPU-411 – Order 119-4594-00 ..... **$470**

Thermal Paper for Seiko Printer – Order 006-7840-00 ..... **$3.50**

AC Adapter/Charger, 220 VAC for Seiko Printer – Order 119-4648-00 ..... **$75.00**

To order, contact your local sales office (listed on the inside back cover) or call the National Marketing Center at 1-800-833-9200.

ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

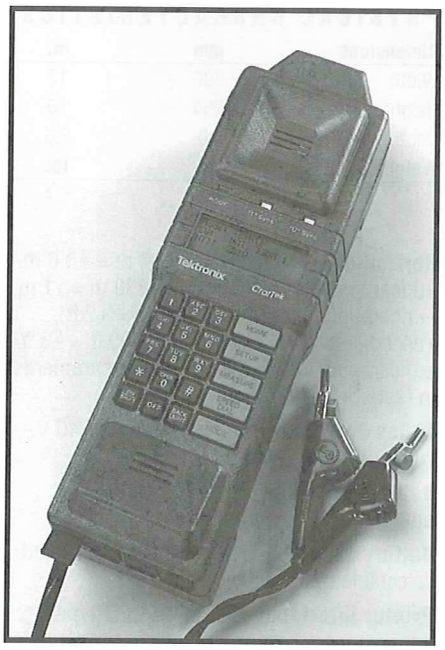
CrafTek™

Subscriber Loop Portable Test Set

Rugged, hand-held test set designed to support multiple loop technologies from multiple vendors.

CrafTek™

- Craft Tool for Subscriber Loop Installation and Maintenance:
  - –POTS/CLASS
  - –ISDN Basic Rate
  - –EBS (P-Phone)
- Highly Flexible Architecture for Easy Upgrading
- Rugged, Lightweight, Battery Operation
- ISDN Service Verification
  - – EOC and Cause Messages
  - – NEBE/FEBE Block Errors
  - – Info, LAP-D, and Call States
  - – Local Power
  - – Sealing Current
- EBS P-Phone Verification
  - – Call Appearance and Feature Verification
  - – DC Voltage
  - – Signaling Channel



CrafTek™ Subscriber Loop Portable Test Set.

CrafTek™ Subscriber Loop Portable Test Set

The CrafTek™ Subscriber Loop Test Set is designed to meet the changing needs of the telephone craftsperson, with flexibility to handle rapidly evolving and increasingly sophisticated digital technologies. The platform is built to support multiple loop technologies from multiple vendors, allowing each unit to be custom-configured.

As ISDN standards evolve, such as ANSI 2B1Q, you can easily upgrade the CrafTek™ by simply snapping in up to three interface modules. When switch generics are released (for example, National ISDN-1), upgrading CrafTek's software is just as easy. The software EPROM is mounted in a simple module that the craftsperson plugs into a keyed module socket.

The CrafTek's ruggedness, portability and multiple power options assure use in any environment, minimizing customer down-time. Extensive ease of use features, like self-prompting plain-English menu displays, speed dialing, and stored settings assure users are productive from the start.

THE CrafTek™: PUT IT TO WORK

Each CrafTek™ comes equipped for POTS service, with all the features of the analog craft test set you're used to using. In addition, CLASS service such as Calling Party ID can be captured and decoded.

In the ISDN environment, this portable hand-held set becomes the fundamental Basic Rate Service installation and maintenance tool.

For EBS P-Phone, the CrafTek™ goes much beyond a simple butt-in, allowing service verification and trouble-shooting of EBS lines. A variety of operating modes and measurements are ideally suited to craft needs.

THE INTEGRATED CRAFT SOLUTION

During installation, the CrafTek™ allows you to turn up services even before customer premises equipment is delivered. Once the system is up and running, the CrafTek™ becomes the first line of defense, allowing location and repair of service problems on the first call. There's no longer the need to escalate the problem or to rely on expensive protocol analyzers or on multiple test equipment.

Continued on next page.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Subscriber Loop Portable Test Set

CrafTek™

Characteristics

CrafTek™ PLATFORM
Display – Supertwist Liquid Crystal (LCD), Backlit.

User Interface – Easy-to-use menus with extensive user prompts and error messages via 4-line x 20 character LCD.

Power Supply – Rechargeable NiCad battery pack. Alkaline "C" cells, or 120 VAC with adapter. "Low Battery" and "Charging" indicators via LCD. Automatic shut-off.

Interface Ports – Four RJ45-type jacks (LINE, S/T(NT1), S/T(TE), AUXiliary).

Speed Dial – Storage for ten numbers (up to 22 digits per number) plus last number redial.

PHYSICAL ENVIRONMENT
Weather, moisture, dust and shock resistant. Designed for rugged field use.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	84	3.30
Length	273	10.75
Depth	83	3.25
Weight ≈	**kg**	**lb.**
Net	1.5	3.35

Safety – UL 1244, CSA C22.2 No. 231-M89.

POTS
Dial Modes – DTMF, Pulse.

Functions – Meets monitor mode, talk mode, and acoustic response requirements as specified in Bellcore TR-TSY-000344.

Measurements – Polarity.

CLASS^{SM}*1 – Support of "Customized Local Access Signaling Services" (Calling Line ID, with Calling Name).

**1CLASS^{SM} is a service mark of Bellcore.*

ISDN TE
TE Compatibility – AT&T Type C and Type D terminal equipment; Northern Telecom terminal equipment; and National ISDN equipment.

Software Generics – Currently compatible with AT&T software generics up to and including 5E8, Northern Telecom DMS-100 up to and including BCS-35; National ISDN-1.

TE Functions – Provides basic voice and circuit-switched data services plus redirect. Supports B-Channel loopbacks using BRITL (Basic Rate Interface Test Line). Supports D-Channel X.25 Packet Data calling testing.

S/T Interface – Complies with T1.605-1991 ISDN Basic Rate Interface Specifications.

"T" Terminations – User selectable: Bridged, 100 Ω.

"T" Pad Attenuation – Range: 0 to 15 dB; Resolution: 1 dB.

"T" Synchronization – LED: Red = No Sync; Orange = Sync, not Activated; Green = Sync and Activated.

Hook LED – Red=Awaiting Dial Tone; Orange=Negative Acknowledgment; Green=Dial Tone/Active Call.

ISDN NT1
AMI Interface (Opt. 1B) – Meets specifications defined in AT&T Technical Reference 801-802-100 for AMI Loop Interface.

2B1Q Interface (Opt. 2B) – Meets specifications defined in ANSI T1.601-1988 (1991 Draft Revision) Standard. Complies with all 15 defined ANSI "U" loops. Supports Quiet and Insertion Loss Modes (AC/DC Triggers).

S/T Terminations – User selectable: Bridged, 100 Ω, 50 Ω.

"U" Pad Attenuation – Range: 0 to 42 dB; Resolution: 1 dB.

"U" Synchronization – LED: Red = No Sync; Orange = Sync, not Transparent; Green = Sync and Transparent.

ISDN MEASUREMENTS AND INDICATORS
Near End Block Errors (NEBE) – Total errors, errored seconds, selectable elapsed time.

Far End Block Errors (FEBE) – Total errors, errored seconds, selectable elapsed time.

Sealing Current –
Presence with polarity indication.

2B1Q Battery –
Presence with polarity indication.

Local Power –
Presence with polarity indication.

S/T Power Sources 1, 2 and 3 –
Presence with polarity indication.

TE Receive Level – Range: –9 dB to +3 dB; Resolution: 0.5 dB.

Indicators via LCD – INFO ("F" and "G") States, LAPD and CALL States, B-Channel Assignment, TEI Number, ANI Number, CAUSE messages, and NT1 EOC messages.

BER Testing – Provides BER testing on either B-Channel, (56 kbps, 64 kbps).

EBS (P-PHONE)
P-Phone Interface (Opt. 3B) – Provides support for Northern Telecom "Electronic Business Service," including phone emulation for primary set, add-on sets, and Monitor mode (allows passive monitoring of voice and signaling channels); 2x16 message display.

P-Phone Measurements – DC Voltage and Polarity; Peak signal level of 8 kHz signaling channel; Signaling Message elements (Hex and decoded displays, with buffer).

ANALOG TERMINAL ADAPTER
ATA Interface (Opt. 1A) – Provides analog terminal adapter to connect analog devices (e.g. Craft Access) to ISDN or EBS lines.

RS-232 SERIAL PORT
RS-232 Interface (Opt. 2A) – Provides an RS-232 interface for data logging to a printer or PC (ISDN signaling, measurements, EBS signaling, CLASS messages); and D-channel data sourcing.

ORDERING INFORMATION

CrafTek™ Subscriber Loop Portable Test Set
Order CT-100 ..... **$1,495**
Includes: User Manual (070-7895-05); Reference Card (070-7921-05); Rechargeable Battery Pack (016-1072-00); AC Adapter/Charger (119-2731-00); RJ11 to RJ11 Cord (012-1363-00); RJ45 to RJ45 Cords (012-1364-00); RJ11 to Bed-of-Nails Clips (012-1365-01); Portable RS-232 Printer (119-4594-00); CLEI Number: TETQ3006AA.

Opt. 1A – ATA Interface ..... **+$195**
Opt. 1B – AT&T AMI "U" Interface ..... **+$495**
Opt. 2A – RS-232 Interface ..... **+$495**
Opt. 2B – ANSI 2B1Q "U" Interface ..... **+$895**
Opt. 3B – EBS (P-Phone) Interface ..... **+$495**
Opt. 38 – Soft-padded Carrying Case (016-1073-00) ..... **+$60**
Opt. 46 – RJ45 to Bed-of-Nails Clips (012-1366-01) ..... **+$50**

WARRANTY
One year warranty.

UPGRADES
For ordering information to upgrade existing CrafTek™ test sets with new interface options or the latest operating firmware, please contact your local Tektronix representative or call the TeleBusiness Center at 1-800-426-2200.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

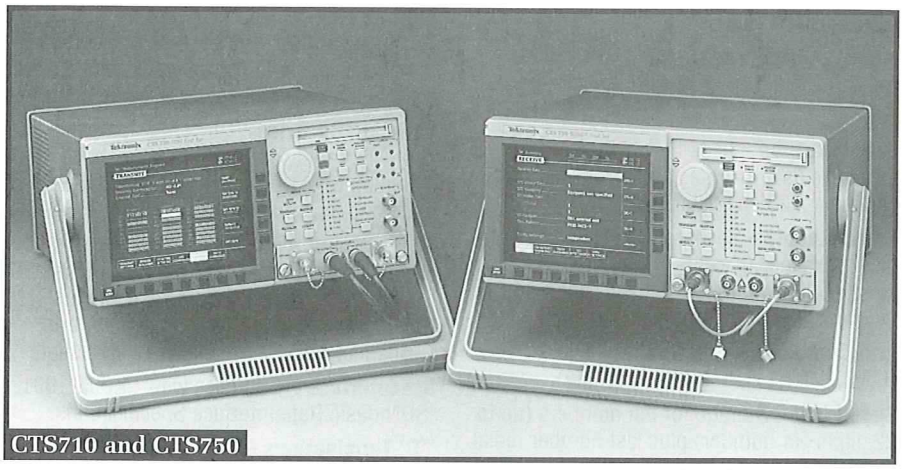
CTS 710
CTS 750

SDH and SONET Test Sets

The CTS 700 Series of Communications Test Sets provides SDH and SONET testing that combines bit error rate test capabilities with overhead testing and payload analysis.

FEATURES

- 52 Mbit/s, 155 Mbit/s, and 622 Mbit/s Transmit and Receive
- Bit Error Rate Testing Including BIP Error Monitoring and Analysis
- Payload Mapping and Demapping
- Tributary Add, Drop and Test
  – DS1 and
  – DS3
  2 MB, 34 MB and 140 MB (Optional)
- Pointer Generation and Analysis
- Alarms Generation and Analysis
- DCC and User Channel Access
- APS/MSP Testing
- Simple User Interface
- Automatic Setup
- Pass/Fail Testing
- Rugged Modular Design, Customer Configurable
- Disk Drive
- IEEE 488.2 and RS-232C



CTS710 and CTS750

CTS 700 Series

The ITU-T and ANSI standards for SDH/SONET specify requirements for the network element (ADM, multiplexers, terminals, etc.) interfaces. Installation, commissioning, maintenance and repair of the SDH/SONET network involves the challenge of testing to ITU-T and ANSI standards. The CTS 700 Series is ready for the challenge to assist with these and other testing needs. In one configurable, expandable and upgradable instrument you will find everything required to do your testing.

CONFIGURABLE

The CTS 700 Series is a rugged portable test set designed not only for your current tasks but through its unique architecture, it will grow with you as SDH and SONET grows. When you require additional capabilities like optical interfaces, jitter analysis, ATM testing, etc., you still keep it from becoming obsolete. Its upgradability is important due to evolving nature of the standards, test requirements and equipment capabilities.

The CTS 700 Series is part of a new generation of test sets combining various different functions in one instrument with the power to go beyond basic testing. The modular nature of the test set allows you to configure the instrument to your needs, without the cost of unwanted built-in capabilities. Starting with a low cost platform which addresses your basic SDH or SONET testing needs, you can expand its capabilities as desired with a growing number of options.

EASY TO USE

The CTS 700 Series incorporates a number of new productivity features:

- AutoScan – Graphically presents the incoming signal structure and allows easy instrument set-up
- Pass/Fail Testing – Automates following a written test procedure
- TroubleScan – Highlights error, alarms, and defects
- Graphical Displays – For historical trend analysis
- Online Help – For quick assistance with operation
- Disk Drive – For easy storage of instrument setups, Pass/Fail Test and results

These instruments employ innovative hardware technology which reprograms itself depending on the operational mode. Future demands regarding access and control of particular bytes are easily reprogrammed. Upgrades are distributed on disks.

APPLICATIONS

- **Network Integrity Testing**
- **In-service Performance Monitoring**
- **Overhead Testing**
- **Tributary Mapping and Demapping**
- **Tributary Testing**
- **Stimulus and Response Testing**
- **Stress Testing**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The CTS 700 Series complies with IEEE Standard 488.2, and RS-232C.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

SDH and SONET Test Sets

CTS 710
CTS 750

CTS 710 SONET Test Set

TRANSMIT AND RECEIVE RATES
- STS-1, STS-3 (electrical)
- OC-1, OC-3, OC-12 (optical)
- DS1, DS3 (Opt. 22)
- Compliance to ANSI T1-105

GENERATION AND ANALYSIS
- Testing of Bit Error Rates including B1, B2, B3, VT BIP, Line FEBE, Path FEBE and Payload
- Complete alarm monitoring and generation
- Measurements 1 sec to 99 days
- Histories up to 72 hours with 1 minute resolution
- Measurements with ANSI T1M1.3 analysis

OVERHEAD MANAGEMENT
Transport Overhead, Path Overhead and VT Overhead
- Set and View Byte Value: All
- Set and View Byte Trace Message: J1
- Add/Drop: DCC's, F1, F2

CTS 750 SDH Test Set

TRANSMIT AND RECEIVE RATES
- STM-1E (electrical)
- STM-1, STM-4 (optical)
- 2 Mbit/s, 34 Mbit/s, 140 Mbit/s (Opt. 36)
- Compliance to ITU-T G.707, G.708, G.709

GENERATION AND ANALYSIS
- Testing of Bit Error Rates including B1, B2, B3, TU BIP, MS FEBE, Path FEBE and Payload
- Complete alarm monitoring and generation
- Measurements 1 sec to 99 days
- Histories up to 72 hours
- Measurements with ITU-T analysis according to G.826, G.821, M.2100

OVERHEAD MANAGEMENT
Section Overhead, Path Overhead and TU Overhead
- Set and View Byte Value: All
- Set and View Byte Trace Message : J1
- Add/Drop: DCC's, F1, F2

CTS 710/CTS 750

OTHER
- APS/MPS Control
- Pointer movement control
- Timing offset up to ±100 ppm
- DS1 and DS3 T-Carrier testing (Opt. 22)
- 2 Mbit/s, 34 Mbit/s, 140 Mbit/s (Opt. 36) PDH testing
- Disk storage: 200 instrument setups, or 400 hours of results including histories, or 200 Pass/Fail tests on each disk (DOS compatible)

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	164	6.4
Width	491	14.25
Depth	1362	19.25
Weight	**kg**	**lb.**
Net	10	22.5

ORDERING INFORMATION

CTS 710
SONET Test Set **$15,900**
Includes: User Manual, Reference Manual, Performance Verification, Front Cover, Accessory Pouch, 75 Ω Cable, Power Cord.

CTS 750
SDH Test Set **$15,900**
Includes: User Manual, Reference Manual, Performance Verification, Front Cover, Accessory Pouch, 75 Ω Cable, Power Cord.

OPTIONS FOR CTS 710 AND CTS 750
Opt. 03 – Optical Interface 52 Mbit/s,155 Mbit/s, 1310 nm Includes: Two Optical Connector Kits 020-1885-00 for FC-PC, ST, DIN, SC ..... **+$7,500**
Opt. 04 – Optical Interface 52 Mbit/s, 55 Mbit/s, 622 Mbit/s, 1310 nm. Includes: Two Optical Connector Kits 020-1885-00 for FC-PC, ST, DIN, SC ..... **+$16,900**

OPTIONS FOR CTS 710 ONLY
Opt. 22 – DS1 and DS3 Add/Drop, Testing *1

OPTIONS FOR CTS 750 ONLY
Opt. 36 – 2 Mbit/s, 34 Mbit/s and 140 Mbit/s Add/Drop, Testing *1

SERVICE ASSURANCE OPTIONS *1

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**
Opt. A2 – United Kingdom 240 V, 50 Hz ..... **NC**
Opt. A3 – Australian 240 V, 50 Hz ..... **NC**
Opt. A4 – North American 240 V, 60 Hz ..... **NC**
Opt. A5 – Switzerland 220 V, 50 Hz ..... **NC**

FIELD UPGRADE KITS
CTS7F01 – Electrical Interface 52 Mbit/s, 155 Mbit/s, 75 Ω BNC *1
CTS7F03 – Optical Interface 52 Mbit/s, 155 Mbit/s, 1310 nm *1
CTS7F04 – Optical Interface 52 Mbit/s, 55 Mbit/s, 622 Mbit/s, 1310 nm *1
CTS7F22 – DS1 and DS3 Add/Drop, Testing *1
CTS7F36 – 2 Mbit/s, 34 Mbit/s and 140 Mbit/s Add/Drop, Testing *1

ACCESSORIES
Rackmount – Order 016-0819-1x *1
Optical Connector Kit – Includes: FC-PC, ST, DIN, SC. Order 020-1885-00 ..... *1
Battery Powered Printer – Order 119-4594-00 ..... **$470**
Hard Transit Case – Order 016-1157-00 ..... **$625**
Soft Carrying Bag – Order 016-1158-00 ..... **$140**

CART
Order K212 ..... **$420**

*1 *Contact your Tektronix representative for price information.*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

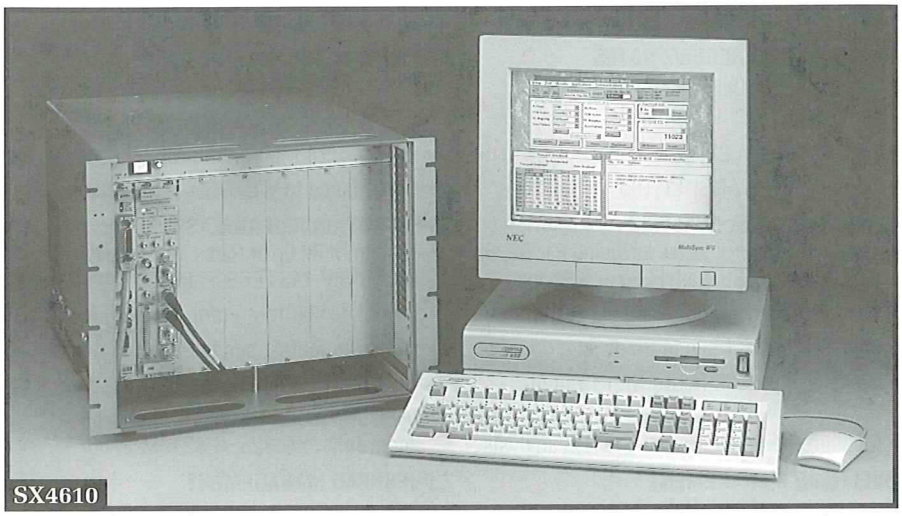
SX4610
VX4610

SDH/SONET Analyzer

The SX4610 SDH/ SONET Analyzer is a Broadband Test Platform that combines bit error rate testing, overhead testing and payload analysis for SDH and SONET test applications.

FEATURES

- 52, 155 and 622 Mbit/s Transmit and Receive
- Bit Error Rate Testing
- BIP Error Testing and Analysis
- VT/TU/SPE/AU Payload Mapping and Demapping with Optional Tributary Test Modules
- Pass/Fail Testing
- Graphical User Interface Simplifies Test Development
- Easy to Integrate
- C-Size, Message Based Control
- IEEE 488.2 with SCPI Compatible Commands



SX4610 SDH/SONET Analyzer

The new SX4610 is a VXI based SDH/SONET Analyzer that meets the testing needs for the development and production test of both SDH and SONET Network Elements, including Add-drop multiplexers, Digital Cross-connects, and Line-terminal multiplexers. The SX4610 is comprehensive enough to meet your current testing requirements, yet leaves room for your future broadband test needs.

COMPREHENSIVE TESTING

At the heart of the SX4610 SDH/SONET Analyzer, is the VX4610 SDH/SONET Generator/ Receiver module that provides comprehensive testing at 52, 155 and 622 Mbit/s including:

- Testing of Bit Error Rates for B1, B2, B3, payload errors
- Complete alarm monitoring and generation
- Control to read and write all Section/Transport and Path Overhead bytes
- Payload mapping and demapping simulation and verification
- APS/MSP testing
- DCC and User channel access
- Measurement analysis according to ITU-T Rec. G.821 and ANSI T1M1.3

For rigorous stress testing, design verification, and standards compliance, the SX4610 offers the following advanced capabilities:

- User defined payload generation and capture
- Frequency offset up to ±100 ppm with 0.1 ppm resolution
- Extended triggering with trigger position control

QUICK TEST PROGRAM DEVELOPMENT

The SX4610 comes with an easy to use Windows-based Graphical User Interface preloaded on the PC controller. This interface allows users to quickly learn and operate the analyzer. The User Interface also provides three ways to dramatically simplify test program development.

First, the User Interface can be used to create pass/fail tests. Once saved to memory, multiple tests can be stored on the VX4610 module. These pass/fail tests can then be executed with just a few lines of code. This technique allows users to generate new tests with the SX4610 and run these tests from almost any controller or operating system without having to learn a new command language.

Secondly, the User Interface contains a Command Builder and Command Monitor, which can be used to quickly generate and evaluate commands and command test sequences. These commands can then be "cut and pasted" into virtually any software development environment.

Finally, test program development is simplified by having all of the core test functionality – Generator, Receiver and Measurement Analysis – in a single message based module. This integration removes any synchronization and external cabling problems.

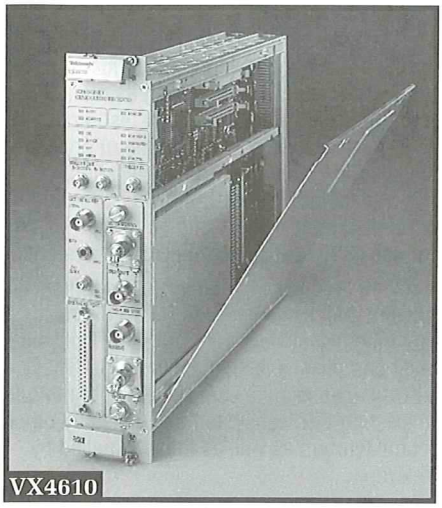
APPLICATIONS

- **Production Test**
- **Design Verification and Debug**
- **Standards Compliance Evaluation**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

SDH/SONET Analyzer

SX4610
VX4610



SDH/SONET Generator/Receiver Module.

EASY TO INTEGRATE AND UPDATE
The SX4610 has an open systems architecture that is flexible to integrate and upgrade. The SX4610 Analyzer is not computer platform dependent, and can be used in conjunction with virtually any existing software environment.

VX4610 SDH/SONET Generator/Receiver Module

The VX4610 SDH/SONET Generator/Receiver Module is a single C-sized, 2-wide message based instrument and can be ordered as a separate module for integration into existing VXI test systems. This module includes complete SDH/SONET frame generation/analysis. The VX4610 module comes standard with a 52 and 155 Mbit/s electrical interface plug-in. Optional optical/electrical interface plug-ins and add-on tributary modules can be added for specific test applications.

Configuration

The base SX4610 configuration includes:

- VX4610 SDH/SONET Generator/Receiver (with 52 and 155 Mbit/s electrical plug-in)
- 486 MS-DOS PC controller with Super VGA monitor, Windows software, GPIB card and GPIB cable
- 13-slot VXI mainframe with Slot 0 controller
- User Interface Software package

Options can add the following capabilities:

- Optical Transmit/Receive for 52, 155 and 622 Mbit/s
- Mapping/Demapping for DS1/DS3, including complete VT control/analysis and tributary testing
- Mapping/Demapping for 2 Mbit/s, 34 Mbit/s and 139 Mbit/s, including complete TU control/analysis, and tributary testing

Additional Broadband Test Products

The SX4610 is the basis for a broadband test platform. Additional modules, both from Tektronix (see VXI Section) and other vendors, can augment the test capabilities. In the future, additional modules will become available to extend the broadband testing to areas such as ATM testing and jitter generation/analysis. The architecture of the SDH/SONET analyzer is designed to offer additional functionality (new measurement capabilities and measurements such as pointer sequencing).

SPECIFICATIONS

Frame formats: STS-1, STS-3, STS-3c, STS-12 to ANSI T1.105 and TR-TSY-0000253; STM-1, STM-4 to ITU-T Rec. G.707-709.

Mappings (Optional): 2 Mbit/s into TU-12, 34 Mbit/s into TU-3, 1.544 Mbit/s into VT1.5, 44.736 Mbit/s into STS-1 SPE, 139 Mbit/s into AU-4.

TEST INTERFACES

Optical: 52, 155, 622 Mbit/s (1310 nm).

Coded Electrical: 52 Mbit/s (B3ZS) and 155 Mbit/s (CMI).

ECL Electrical Interface: Complementary Clock and Data for both Transmit and Receive. Supports standard ECL as well as PECL (Vt= +3.2 V) from 52 Mbit/s to 622 Mbit/s.

Measurements: Error Totals, Error Rate and Error Seconds on B1, B2, B3, line FEBE, Path FEBE, VT/TU BIP, VT/TU FEBE, payload.

Error Analysis: According to G.821 and T1M1.3

Pointer Control: Single, Burst, Settable pointer value with and without New Data Flag, illegal pointer, and T1X1.6/G.783 pointer sequences.

Triggering and Frame Capture: Triggered capture of 64 sequential section overheads, extensive Transmit and Receive section trigger outputs for stimulus and response testing, Triggered capture of 54 sequential STM-1/STS-3c, and Programmable trigger position.

ORDERING INFORMATION

SX4610
SDH/SONET Analyzer **$55,000**
Includes: MS-DOS 486 PC Controller with Super VGA Monitor, GPIB Card with GPIB Cables, 13-slot VXI Mainframe with Slot 0 Controller and Manuals, VX4610 SDH/SONET Generator/Receiver (52 and 155 Mbit/s Electrical Plug-in), VX4610 User Manual, Graphical User Interface Software Package, and SX4610 Analyzer User Manual.

VX4610
SDH/SONET Generator/Receiver Module **$40,000**
Includes: 52 and 155 Mbit/s Electrical Plug-in, VX4610 User Manual, Graphical User Interface Software Package, and Instruction Manual.

Options common to the SX4610 Analyzer and the VX4610 Generator/Receiver Module:

Opt. 02 – ECL Electrical Interface (52 to 622 Mbit/s) *1
Opt. 03 – 52/155 Mbit/s Electrical and 155 Mbit/s Optical Plug-in ..... **+$7,500**
Opt. 04 – 52/155 Mbit/s Electrical and 52/155/622 Mbit/s Optical Plug-in ..... **+$16,900**

For Add/Drop and Tributary testing, order the following option modules:

Opt. 22 – DS1/DS3 (1.5/45 Mbit/s) *1
Opt. 36 – E1, E3, E4 (2, 34, 139 Mbit/s) *1

Options for the SX4610 Analyzer only :

Opt. 1C – Delete PC Controller *1

INTERNATIONAL POWER PLUG OPTIONS (MAINFRAME)

Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**
Opt. A2 – United Kingdom 240 V, 50 Hz ..... **NC**
Opt. A3 – Australian 240 V, 50 Hz ..... **NC**
Opt. A4 – North American 240 V, 60 Hz ..... **NC**
Opt. A5 – Switzerland 220 V, 50 Hz ..... **NC**

See General Customer Information Section for additional description.

**1 For price and order information call your local Tektronix representative.*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

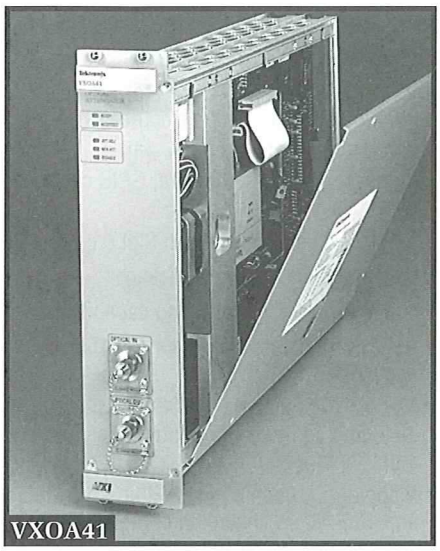
VXOA41

VXI Programmable Optical Attenuator

The VX0A41 is a computer controlled optical attenuation plug-in module for use in VXI-based automated test systems.

FEATURES

- Singlemode and Multimode Input/Outputs
- Four User Changeable Optical Fiber Connector Type
- Compact Physical Size
- Message Based Control
- "C" Sized Card Configuration



VXOA41 Optical Attenuator

The Tektronix VXOA41 optical attenuator is a high-performance instrument used to control the level of optical power propagating through an optical fiber. This product is a plug-in C-sized instrument module for use in a VXIbus System. It provides computer controlled optical attenuation from 0 to 60 dB in 0.01 dB steps.

VXOA41 Attenuators accept and deliver optical input and output signals on connectorized optical fiber cables. The standard version VXOA41 provides for singlemode fiber input and output. Options 01, 02, & 03 provide for the input and output of the three most commonly used multimode fiber sizes (50 µm, 62.5 µm, and 100 µm fiber core diameters).

Technical specifications for the VXOA41 are essentially the same as the Tektronix OA5000 Series GPIB Programmable Optical Attenuators with only minor exceptions.

KEY APPLICATIONS

The VXOA41 products are intended for use in production testing of high-speed fiber optic transmission equipment during its manufacture. Optical receiver sensitivity testing (bit error rate measured as a function of optical signal level) is an important application for this attenuator. The VXOA41 is a computer controlled optical attenuation plug-in module for use in VXI based automated test systems.

VXOA41 products provide one basic functional building block in an all-VXI Tektronix manufacturing test system for SDH/SONET physical layer compliance testing applications. The VXOA41 can also be used as a retrofit module in existing VXI test systems supplied by other manufacturers as well as those supplied by Tektronix.

TYPICAL CONFIGURATIONS

The VXOA41 is a double-wide VXIbus module. The instrument may therefore be configured with numerous other modules in a VXIbus mainframe, thereby taking advantage of the backplane triggers available. The VXOA41 is often used in conjunction with an optical power meter module and/or a stable optical source. The VXOA41 also may be used in a VXI-based SDH/SONET test system for qualifying SONET transmitters and receivers over their specified dynamic operating range (optical power range). Control of the instrument is accomplished through VXI Message based Communications and with an IEEE 488.2 compliant command set.

FRONT-PANEL INDICATORS

The VXOA41 has five LED indicators on the front panel. Two of these are the standard Tektronix VXIbus indicators: READY and ACCESSED. The other three indicators are specific to the VXOA41: ATT ADJ, MIN ATT, and DISABLE. The user adjusts the various states and settings of the instrument through the command set.

FRONT-PANEL OPTICAL CONNECTORS

The VXOA41 is provided with FC fiber optic connectors installed on the front panel. Users wishing to convert these bulkhead connectors to another type (ST, SC, or DIN-47256) will need to order one Universal Fiber Optic Connector Adapter Kit (020-1885-00) per bulkhead connector that is to be changed. Users who wish to convert both input and output connectors will need to order two Universal Fiber Optic Connector Adapter Kits.

APPLICATIONS

- **Bit Error Testing**
- **Receiver Performance Evaluation**
- **Fiber Optic Link and System R&D**
- **OTDR Fiber Attenuation Calibration**
- **Calibration of Optical Power Meter Linearity**
- **General Control of Fiber Based Optical Power**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

VXI Programmable Optical Attenuator

MAINTENANCE
The only routine maintenance required of the user is the cleaning of the optical input and output optical connectors. There is no rigid schedule for the frequency of this maintenance. It depends largely on the cleanliness and frequency of fiber connections and disconnections made to the instrument. It is suggested that any noticeable increase in insertion loss to the instrument is indicative of possible fiber optic connectors which require cleaning.

BITE
Built-In-Test Equipment (BITE) is provided by several self-tests that are automatically performed on power-up and may also be invoked on command. Circuitry tested includes the CPU and all memory. The VXOA41 supports the IEEE 488.2 defined *TST? and *CAL? commands. Front panel LEDs provide visual BITE for instrument readiness, system controller access, attenuation adjustment, minimum attenuation condition, and shutter status. Instrument parameters and conditions may be read at any time by the system controller.

EQUIPMENT REQUIRED
The VXOA41 is not a standalone instrument and must be used with a Tektronix C-size Mainframe and VXI Slot 0 controller and/or Resource Manager. Additionally a software utility is needed that is capable of sending and receiving VXI message-based commands and queries to and from a VXI device.

Characteristics

OPTICAL

Wavelength Range – 600 nm – 1700 nm (usable wavelengths are > 1100 nm for singlemode).

Input/Output Fiber Type –
Singlemode (standard).
50/125 µm diameter (Option 01).
62.5/125 µm diameter (Option 02).
100/140 µm diameter (Option 03).

Insertion Loss – 2 dB from 1100 – 1600 nm; SM & MM. 4 dB from 700 – 1100 nm; MM only.

Attenuation Range – 60 dB from 700 nm – 1350 nm. 50 dB from 1350 nm – 1600 nm. >100 dB with shutter closed (for standard, Opt. 01, and Opt. 02 versions).
> 90dB with shutter closed (for Opt. 03).

Accuracy – MM Unit: ±0.15 dB (±0.05 dB typ.) at 850 ±20 nm, 1300 ±20 nm, and 1550 ±20 nm.
SM Unit: ±0.15 dB at 1300 ±20 nm, 1550 ±20 nm.
SM Unit: ±0.25 dB at other wavelengths.

Linearity – MM Units: ±0.05 dB, 600 nm – 1700 nm.
SM Units: ±0.05 dB, 1100 nm – 1700 nm.

Repeatability – ±0.05 dB.

Mode Dependent Loss –
Relative Attenuation: ±0.05 dB.
Insertion Loss: 0.25 dB (Option 01); 0.35 dB (Opt. 02 & 03).

Temperature Dependence – ±0.005 dB/°C/db ATT setting; ±0.02 dB/°C (insertion loss). (0 – 50°C relative to 25°C).

Input Return Loss – SM Unit: <–45 dB, MM Unit: <–25 dB.

Polarization Dependence – <±0.2 dB diff. in throughput attenuation.

Maximum Optical Input – 100 mW (+20 dBm) continuous.

ENVIRONMENTAL

Temperature – Operating, 0°C – 50°C. Nonoperating, –55°C – 60°C.

Altitude – Operating, 4.6 km (15,000 ft.). Nonoperating, 15 km (50,000 ft.).

Humidity – Operating, 90% RH, 0°C – 50°C. Nonoperating, 90% RH, 60°C.

Shock – 60 g's (Ω sine) 11 ms duration, 3 shocks in each direction along 3 major axes, 18 total shocks.

Bench Handling – 12 drops from 45° and/or 4 inches.

Transportation Handling – Nonoperating, drops of 36 inches on all edges, faces, corners.

Emissions, EMI (conducted & radiated) – FCC Rules and Regulations, Part 15, Subpart J, Class A; VFG 243; CISPR 22.

Susceptibility, EMI – Radiated: IEC 801-3 (3 V/m). Conducted: MIL-461B (1980) CS01, CS02, and CS06).

Susceptibility, ESD – 6 kV maximum ESD discharge applied to operating instrument.

PHYSICAL CHARACTERISTICS

Double-wide, C-size module

Dimensions, Overall	mm	in.
Width	60.66	2.388
Height	366.70	14.437
Depth	345.03	13.584
Weight	**kg**	**lb.**
Net	2.4	5.25

POWER REQUIREMENTS*
+24V – 0.32 A
+12V – 0.00 A
+5V – 2.30 A
–2 V – 0.68 A
–5.2 V – 0.05 A
–12 V – 0.00 A
–12 V – 0.04 A

Power Dissipated – 22 Watts

Required Cooling –
1.5 liters/sec at 0.04 mm H_2O

** Maximum peak current in amps.*

ORDERING INFORMATION

VXOA41 – VXI Programmable Optical Attenuator.....**$7,905**
Includes: VXI Optical Attenuation C-sized Plug-in Module with Female FC (installed) Input and Output Optical Bulkhead Connectors; User Manual (070-8777-00); Single Mode Fiber Input and Output.
Opt. 01 – Substitute 50/125 µm Fiber Input and Output .....**–$255**
Opt. 02 – Substitute 62.5/125 µm Fiber Input and Output ...**–$255**
Opt. 03 – Substitute 100/140 µm Fiber Input and Output ....**–$255**

OPTIONAL ACCESSORIES
Universal Fiber Optic Connector Adapter Kit – Universal Fiber Optic Connector Adapter Kits (020-1885-00) provide the field installable parts necessary to convert VXOA41 front-panel optical bulkhead (female) connectors to ST™, SC, and DIN-47256 input and output optical connectors (FC connectors come installed on instrument). One kit is needed for each of two instrument connectors **$450**
Fiber Optic Cables – Refer to page 355 for complete list.

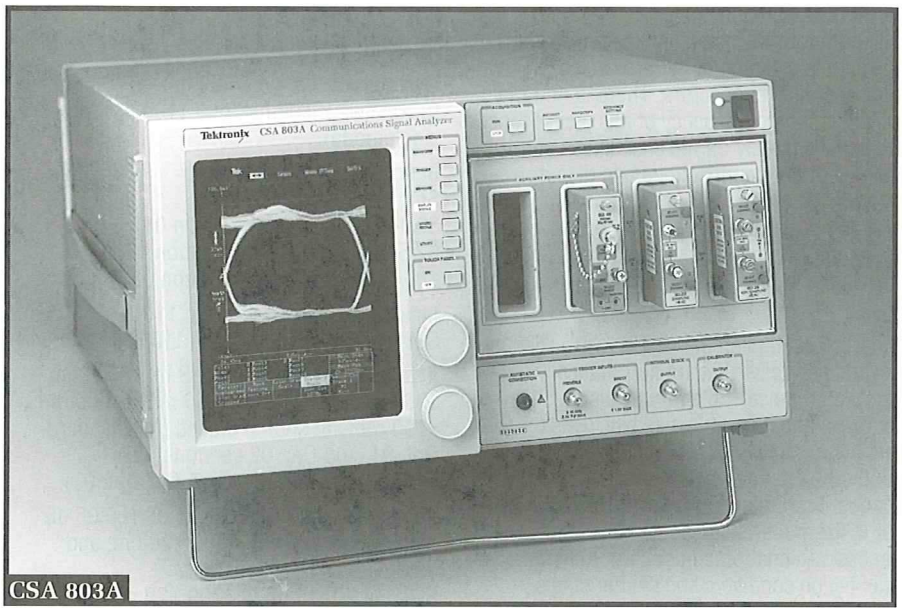
Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Communications Signal Analyzer

Specifically designed for communications applications, the CSA 803A Communications Signal Analyzer is the ideal tool for design, development, and production testing of telecommunications and data communications components, terminals, and systems.

CSA 803A

- DC to 50 GHz Bandwidth
- Automatic Statistical Analysis
- 38 Industry Standard Masks (ITU-T & ANSI)
- High Resolution and Repeatability
- 7 ps Rise Time (SD32)
- Modularity Through Sampling Heads
- Triggering to 10 GHz (Prescaler)
- TDR for Precision Impedance Analysis
- FFT for Spectral Analysis
- Extinction Ratio Measured Automatically
- Built-in Automatic Eye Pattern and Pulse Template Testing



CSA 803A

CSA 803A

The CSA 803A communications signal analyzer offers the highest bandwidth and time resolution of the 11000 Series. In addition to the easy-to-use, touch-screen user interface and powerful automatic measurement system common to all 11000 Series instruments, the CSA 803A adds single-ended and differential TDR and TDT, timing resolution to 0.01 ps, and up to 50 GHz bandwidth (depending on the sampling head used). This unmatched performance and feature set makes the unit ideal for semiconductor device testing. TDR characterization of circuit boards, IC packages, cables and high-speed digital communication measurements.

The CSA 803A accepts up to two, dual-channel SD Series sampling heads and has built-in trigger capability of up to 10 GHz through the prescaler.

RESOLUTION AND REPEATABILITY
The state-of-the-art digital time base in the CSA 803A provides unmatched timing resolution, with sample intervals to 10 femtoseconds (0.01 ps) and measurement repeatability to1 ps. In addition, the vertical system provides 8 bits of vertical resolution at all deflection factors (80 µV LSB at 2 mV/div). Powerful on-board waveform processing allows expansion with averaging to sensitivities in the 100 µV/div range and beyond.

NON-VOLATILE STORAGE
Waveforms, settings and user defined masks are preserved in battery backed-up memory for added convenience.

FAST FOURIER TRANSFORM (FFT)
FFT allows for analysis of both spectral magnitude and phase of acquired waveforms.

FASTEST ACQUISITION
The CSA 803A, with its multiprocessor-based architecture and high-speed analog, error-sample feedback-loop technology, has the highest sample rate of any sampling oscilloscope. The 200 kHz sampling rate gives the CSA 803A a "real-time" feel for waveform controls and allows high-speed data capture for histograms and automated measurements.

MODULARITY MAKES ROOM FOR GROWTH
In the Tektronix tradition, the CSA 803A can be tailored through modular plug-in sampling heads for a variety of applications. Modularity also offers a path for growth and expansion as new sampling heads become available. For example, for applications requiring superior noise performance, the SD-22 Sampling Head offers two channels of acquisition at 12.5 GHz with 450 µV (typical) of noise. High bandwidth acquisition and TDR are available in the SD-24 sampling head, which offers two channels with 20 GHz bandwidth and two polarity-selectable TDR step generators. The complete SD Series of sampling heads is listed on page 106.

APPLICATIONS

- **Optical Standards Compliance Testing**
- **Electrical Standards Compliance Testing**
- **Timing Analysis**
- **Pass/Fail Mask Measurements for Telecom (SDH/ SONET) and Datacomm (FDDI/ Fiberchannel)**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The CSA 803A complies with IEEE Standard 488.1-1987, RS-232C and Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Communications Signal Analyzer

STATISTICAL MEASUREMENTS

A built-in statistical database allows the instruments to accumulate three-dimensional waveform data-time, voltage, and sample density. The database is a 512 x 256 x 16-Bit data array which accumulates waveform data by counting the number of times each pixel in the display is activated. This information is then displayed in a color-graded format that gives you an instant qualitative view of the acquired waveform. The power of the statistical database is the measurement capabilities – time and voltage histograms and automatic statistical measurements.

COMMUNICATION APPLICATIONS USING THE STATISTICAL DATABASE

Time and voltage histograms are powerful statistical tools for measuring noise and jitter in communication signals. The histograms include useful information such as mean, RMS deviation, and pk-pk displayed and continuously updated at a user selectable rate. High sample rates make it possible to analyze data concurrent with acquisition rather than in a batch mode later on. The statistical database allows you to change histogram parameters without reacquiring data.

For the first time you can make jitter and noise measurements with one simple selection from an on-screen menu. Controls are provided for adjusting left and right limits, selecting RMS or pk-pk and absolute or relative measurements. For eye diagram measurements you can choose either the eye crossing or the mesial level for jitter measurement location. Either top line or base line can be selected for noise measurements. The CSA does the rest, and displays the jitter and noise measurements in the status menu at the bottom of the screen.

MASK TESTING

For Compliance test to ITU-T and ANSI standards, 38 predefined telecom masks are available by adding Option 1T. The CSA 803A settings are all automatically determined by pressing AUTOSET while the desired mask is displayed. See table for a complete listing of masks.

In addition, you can define and edit up to 10 masks simultaneously. These masks (polygons) may each have up to 50 vertices. The CSA 803A then counts the individual and total samples that fall in each of the defined masks. Once defined the masks can be stored for future use.

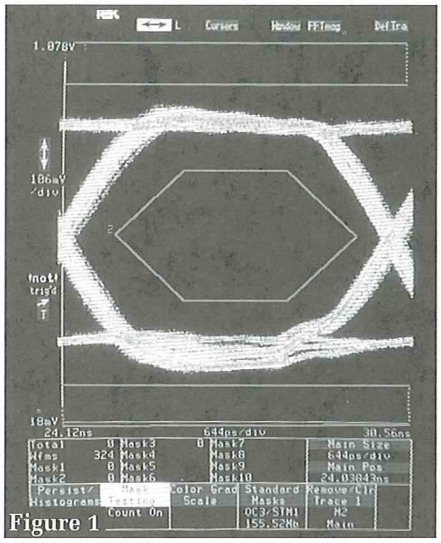


Figure 1

Figure 1: Predefined masks (Option 1T) allow for complete compliance testing without the need for an external computer. See table for a complete mask listing.

Predefined Standard ITU-T and ANSI Eye Pattern and Pulse Masks (Option 1T)

ITU-T SDH and ANSI SONET Optical Standards

OC-1 51.84 Mbits/s	OC-3/STM-1 155.52 Mbits/s	OC-9 466.56 Mbits/s
OC-12/STM-4 622.08 Mbits/s	OC-18 933.12 Mbits/s	OC-24 1.2442 Gbits/s
OC-36 1.8662 Gbits	OC-48/STM-16 2.4883 Gbits/s	

ANSI T1.102 Electrical Standards

DS1 1.544 Mbits/s	DS1 (old) 1.544 Mbits/s	DS1C 3.152 Mbits/s
DS2 6.312 Mbits/s	DS3 44.736 Mbits/s	DS4NA 139.26 Mbits/s
DS4XNA 139.26 Mbits/s	STS1 51.84 Mbits/s	STS3 155.52 Mbits/s
STSX3 155.52 Mbits/s		

ITU-T G.703 Electrical Standards

Single Pulse 64 kbits/s	Double Pulse 64 kbits/s	Data Pulse 64 kbits/s
Timing Pulse 64 kbits/s	Pulse 1.544 Mbits/s	Sym. Pair 2.048 Mbits/s
Coax Pair 2.048 Mbits/s	Sym. Pair 6.312 Mbits/s	Coax Pair 6.312 Mbits/s
Pulse 8.448 Mbits/s	Coax Pair 32.064 Mbits/s	Pulse 34.368 Mbits/s
Coax Pair 44.736 Mbits/s	Pulse 97.728 Mbits/s	Zero Pulse 139.26 Mbits/s
One Pulse 139.26 Mbits/s	STM1 155.52 Mbits/s	CEPT 565 Mbits/s

Other Masks

FDDI 125 Mbits/s	User Programmable (default is OC-192/STM-64)

AUTOMATED MEASUREMENTS MAKE IT EASY

The CSA 803A offers a comprehensive, accurate, and automatic measurement system. Up to six measurements can be displayed on screen at any time, all updated continuously. Any number of measurements may be made over the GPIB or RS-232C interfaces.

For the first time in the industry, you now can make automatic jitter and noise measurements using the statistical measurement mode. Statistical measurements allow automatic pulse parameter measurements on random signals such as eye diagrams and allow you to make stable and accurate measurements even in the presence of jitter and noise.

All measurement parameters are user-controllable and measurement levels may be set in relative (i.e., percentage) or absolute terms. Measurements are also fully annotated so there is no question about which part of the waveform is used for making the measurements.

Measurements include: extinction ratio, amplitude measurements, such as mean, RMS, p-p, and overshoot; timing measurements, such as width, propagation delay, and phase; and energy measurements, that provide direct area or energy results! Measurement statistics are also available to evaluate the stability of any measurement result.

ON-BOARD WAVEFORM PROCESSING

The extensive on-board waveform processing capability of the CSA 803A not only provides smooth "real-time" update rate and control response, it also allows complex waveform calculations to be performed and displayed in the same continuously updated fashion. Calculated waveforms can be as simple as addition of two channels, or more complex, from basic operators (+, –, x, ÷), to specialized math functions such as square root, differentiate, log, envelope, and filter. Calculations can include acquired waveforms, stored waveforms, and constants.

All measurement functions, except hardware measurements, are allowed on calculated traces. In addition, the instrument can be set to stop acquisition after certain conditions, such as when a specified number of averages have been completed.

WINDOWING SHOWS THE DETAILS

The CSA 803A offers another first for sampling oscilloscopes – windows. Similar to the delayed sweep on conventional oscilloscopes, windows allow viewing a long interval on one trace while examining the details of a section of the waveform on a second trace.

Continued on next page.

CSA 803A

Communications Signal Analyzer

Up to seven windows can be created on a single main trace, each with independent positions. The instrument can even be programmed to automatically locate a window on a specified transition within the main waveform. Like the other oscilloscopes in the 11000 Series, windows in the CSA 803A are actually re-acquired with a higher resolution than the main waveform – not just digitally expanded from the main trace, as in some lower performance instruments.

Characteristics

VERTICAL SYSTEM

Rise Time/Bandwidth – Determined by the sampling head used.*1

Vertical Resolution – 8-Bits full screen (80 µV LSB at 2 mV/div deflection factor).

Amplifier Gain Accuracy – ±1% of all settings.

Deflection Factors – 2 to 255 mV/div in 1 mV/div increments.

Offset Range – ±2 V.

HORIZONTAL SYSTEM

Main and Window Time Base – 1 ps/div to 5 ms/div, settable in 1-2-5 sequence or in 1 ps increments.

TIME BASE ACCURACY *2

Time interval	Accuracy
≥ 10 ns	0.01% x time interval + 8 ps
1 ns	10 ps
100 ps	5 ps
10 ps	2 ps

Record Length – 512, 1024, 2048, 4096, and 5120 points.

Windows – Any number of window records may be placed on any number of main records, up to a maximum of 8 displayed traces. All window records have the same duration, but may be independently positioned on any main record. The window may be set to automatically track a moving edge on the main record.

Maximum Sample Rate – 200 kHz.

TRIGGER SYSTEM

Trigger Bandwidth – 3.0 GHz (direct), 2 to 10 GHz (Prescaled).

Trigger Holdoff – Adjustable from 5 µs to 2.5 s

Trigger Sensitivity*3 – Direct: DC Coupled, 100 mV p-p, DC –3.0 GHz; Prescaled: AC Coupled, 600 mV p-p, AC Coupled: Attenuates signals below 30 kHz.

Delay Jitter (Ext. Trigger)– 2.0 ps (1.3 ps typical) +5 ppm of selected delay (RMS).

Internal Clock – 100 kHz (drives TDR, Internal Clock Output, and Calibrator).

Trigger Input Range – ±1.5 V (direct), ±2.5 V (Prescaled).

MEASUREMENT SYSTEM

Waveform Processing Functions – Add, subtract, multiply, divide, absolute, average, differentiate, envelope, exponent, integrate, natural log, log, signum, square root, smoothing, and filter.

Measurement Set – Max, min, mid, p-p, mean, RMS, amplitude, extinction ratio, overshoot, undershoot, noise*4, rise, fall, frequency, period, prop delay, cross, width, phase, duty cycle, jitter*4, area +, area –, and energy. Measurements are constantly updated; mean and standard deviation available on all measurements.

Measurement Parameters – Proximal, mesial, distal,and start/stop levels: May be set to relative or absolute values.

Cursors – Paired or split dots, vertical bars, and horizontal bars.

POWER REQUIREMENTS

Line-Voltage Ranges – 90 to 132 V RMS, 180 to 250 V RMS.

Line Frequency – 48 to 440 Hz.

Maximum Power Consumption – 214 W.

ENVIRONMENTAL AND SAFETY

Operating Temperature – 0°C to 50°C.

Nonoperating Temperature – –40°C to +75°C.

Altitude, Vibration, Shock, Bench Handling – Operating and Nonoperating: meets MIL-T-28800C, Type III, Class 5.

Safety – Listed UL 1244, CSA Bulletin 556B.

Electromagnetic Compatibility – Meets the following requirements of MIL-STD-461C: CE-03 Pt 4 Curve 1, CS-01 Pt 7, CS-02 Pt 4, CS-06 Pt 5, RE-02, Pt 7, RS-01 Pt 4, RS-02 Pt 5, RS-03 Pt 7, (limited to 1 GHz). Meets FCC Part 15, subpart J, Class A.

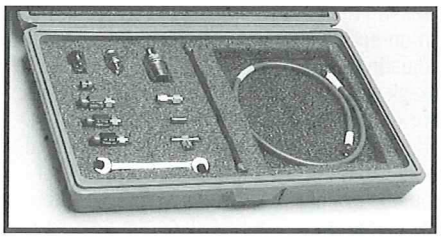
For Germany: Meets VDE 0871/6.78 Class B.

Humidity – To 95% RH at up to 50°C.

PHYSICAL CHARACTERISTICS

	Benchtop		Rackmount	
Dimensions	**mm**	**in.**	**mm**	**in.**
Width	448	17.6	483	19.0
Height	238	9.4	222	8.8
Depth	599	23.6	550	21.6
Weight ≈	**kg**	**lb.**	**kg**	**lb.**
Net	21.8	48	22.7	50
Shipping	31.3	69	32.3	71

**1 See Sampling Head Characteristics on page 106. The CSA 803A mainframe has no acquisition bandwidth limits.*
**2 Interpolate linearly between cardinal points.*
**3 CSA 803A has external trigger only; requires >23 ns pretrigger or use of DL-11 Delay Lines to view trigger point.*
**4 Available only in statistical measurement mode.*



Accessory

AK02

- Provides adaptability to most signal sources for 50 Ω termination
- Includes 50 Ω attenuators, 50 Ω cables, gender adapters

For complete selection information on all Accessory products, see page 446.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The CSA 803A complies with IEEE Standard 488.1-1987, RS-232C and Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

CSA 803A
Communications Signal Analyzer.....**$25,150.00**
Includes: Tutorial Manual (070-7718-00), User Reference (070-7719-00), Command Reference (070-7720-01), Programmer Reference (070-7738-01), Service Reference (070-7721-00), 12-inch SMA-SMA Cable, 2 ea. 8.5 in. SMA-SMA Cable, 1 Wrist Strap, Power Cord, U.S., Power Cord, U.S., 120 V (161-0066-00).

Opt. 1T – Predefined Telecom Masks .....**NC**
Opt. 1R – Rackmount.....**+$250.00**
Opt. 10 – Deletes the 10 GHz prescaler trigger capability. This does not affect the 3.0 GHz trigger.....**–$1,000.00**

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz .....**NC**
Opt. A2 – United Kingdom 240 V, 50 Hz.....**NC**
Opt. A3 – Australian 240 V, 50 Hz .....**NC**
Opt. A4 – North American 240 V, 60 Hz .....**NC**
Opt. A5 – Switzerland 220 V, 50 Hz.....**NC**
See General Customer Information Section for additional description.

Communications Signal Analyzer

ORDERING INFORMATION

SOFTWARE
See Software Section for selection guide and complete description of software available.

SD-14
High Impedance Probe Sampler 3 GHz **$4,500**
Includes: Installation/User Manual (070-8286-00); Service Manual (070-8285-00); 4-post ECB Mount Ground Socket; Edge Tab Ground Socket; 10 ea. Wire-Form Ground, .050 Spacing; 10 ea. Wire-Form Ground, .040 Spacing; Plastic Accessories Case.

SD-20
Loopthrough Sampling Head 20 GHz **$4,400**
Includes: Installation/User Reference (070-7531-00), Service Reference (070-7528-00), Precision 3.5 mm Termination (011-0155-00), 2 SMA Short-circuit Terminations (015-1020-00).

SD-24
Dual TDR/Sampling Head 20 GHz **$5,250**
Includes: Installation/User Reference (070-7052-00), Service Reference (070-7053-00), 2 SMA Short-circuit Terminations (015-1020-00).

SD-26
Dual Sampling Head 20 GHz **$3,780**
Includes: Installation/User Reference (070-7226-01), Service Reference (070-7227-01), 2 SMA Short-circuit Terminations (015-1020-00).

SD-22
Low-Noise Sampling Head 12.5 GHz **$3,780**
Includes: Installation/User Reference (070-7226-01), Service Reference (070-7227-01), 2 SMA Short-circuit Terminations (015-1020-00).

SD-30
Sampling Head 40 GHz **$9,450**
Includes: Installation/User Reference (070-7904-00), Service Reference (070-7905-00), 2 SMA Short-circuit Terminations (015-1020-00).

SD-32
Sampling Head 50 GHz **$12,500**
Includes: Installation/User Reference (070-8268-00), Service Reference (070-8269-00), 1 SMA Short-circuit Termination (015-1020-00).

SD-42
Optical-to-Electrical Converter 6.4 GHz **$3,995**

SD-46
Optical-to-Electrical Converter 20 GHz **$6,995**

RECOMMENDED ACCESSORIES
See page 446 for complete selection information.

PROBES

LOW-Z-PROBES (50 Ω INPUT)
10X, DC – 9.0 GHz. Order P6150 ..... **$995**

ACTIVE PROBES (Requires 1103 Power Supply) –
10X. DC – 1 GHz, ≥10 MΩ Input Impedance, 1.9 pF.
Order P6204 ..... **$1,595**
10X. DC – 4 GHz, ≥100 kΩ Input Impedance, 0.4 pF.
Order P6217 ..... **$3,595**

CART
Order K465 ..... **$835.00**

CAMERAS/PLOTTERS
Camera – Order C-9 with Opt. 1A and Opt. 11 ..... **$955**
Plotter – Order HC 100 ..... **$1,250**

CALIBRATION STEP GENERATOR
U.S. – Order 067-1338-00 ..... **$8,140**
Universal European – (240 V, 50 Hz).
Order 067-1338-01 ..... **$8,140**
UK – (240 V, 50 Hz). Order 067-1338-02 ..... **$8,140**
Australia – (240 V, 50 Hz). Order 067-1338-03 ..... **$8,140**
Switzerland – (240 V, 50 Hz). Order 067-1338-05 ..... **$8,140**
Japan – (100 V, 50-60 Hz). Order 067-1338-06 ..... **$8,140**

ADDITIONAL ACCESSORIES
Power Strip – Four Outlet, 6 ft., Noise/Surge Suppression*[1]
SMA Accessory Kit – Order 020-1693-00 ..... **$2,605**
Includes: 2 ea. 2X and 5X Attenuators; 2 ea. SMA Terminations, Male Short Circuit, Female Short Circuit, Male 50 Ω, Female 50 Ω, 2 ea. 50 Ω Signal Cables (2 ns), 2 ea. 500 ps Semi-rigid Cable, 2 ea. Male-to-Male adapters, 2 ea. SMA Male-to-BNC Female, 2 ea. Female-to-Female, 1 ea. 50 Ω Power Divider, 1 ea. Combination Wrench (.312, 6 point).
3.5 mm Accessory Kit – Order 020-1692-00 ..... **$8,365**
Includes: 1 ea. 50 Ω Reference Air Line, 1 ea. Male-to-Male Adapter, 1 ea. Female-to-Female Adapter, 1 ea. 26.5 GHz 50 Ω Terminator (Male), 1 ea. 26.5 GHz 50 Ω Terminator (Female), 1 ea. 26.5 GHz Short Circuit (Male), 1 ea. 26.5 GHz Short Circuit (Female), 2 ea. 50 Ω Terminators (6 dB 26.5 GHz, 2.9 mm), 2 ea. 50 Ω Terminators (20 dB 26.5 GHz, 2.9 mm), 1 ea. Power Divider (26.5 GHz, 2.9 mm), 2 ea. Signal Blews (2 ns, Male-to-Male), 2 ea. Signal Cables (500 ps, Male-to-Male, 2.9 mm Semi-rigid), 1 ea. Torque Wrench, 1 each Combination Wrench (0.312, 6 point), 1 ea. Combination Wrench (0.281, 6 point).
2X Attenuator –
SMA Male-to-Female. Order 015-1001-00 ..... **$225**
5X Attenuator –
SMA Male-to-Female. Order 015-1002-00 ..... **$210**
75 Ω to 50 Ω Min. Loss Attenuator –
BNC, AC coupled. Order 011-0112-00 ..... **$110**
Power Divider – Order 015-1014-00 ..... **$315**
Blank Sampling Head – Order 200-3395-00 ..... **$1.15**
ECL Terminator – Provides the bias and termination for ECL device outputs. At 10 GHz bandwidth and 1% precision attenuation, accurate AC and DC measurements are ensured. Attenuation: 10X ±1.0% @ DC, 20 dB ±3 dB, DC to 10 GHz. Aberrations: ±3% max with 100 ps rise time. Order 015-0558-00 ..... **$1,285**
DC Block (Coupling Capacitor) –
SMA: Order 015-1013-00 ..... **$390**
BNC: Order 015-0221-00 ..... **$160**
Slip-On Connector – Order 015-0553-00 ..... **$46**
Connector Savers – SMA: Order 015-0549-00 ..... **$185**
APC: Order 015-0552-00 ..... **$280**

CABLES AND EXTENDERS
Sampling Head Extender Cables –
(1 m). Order 012-1220-00 ..... **$850**
(2 m). Order 012-1221-00 ..... **$935**
Acquisition Extender – Order 067-1324-00 ..... **$160**
Card Cage Extender – Order 067-1267-00 ..... **$1,430**

*[1] *Contact your Tektronix representative for price information.*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 — The CSA 803A complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 — ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

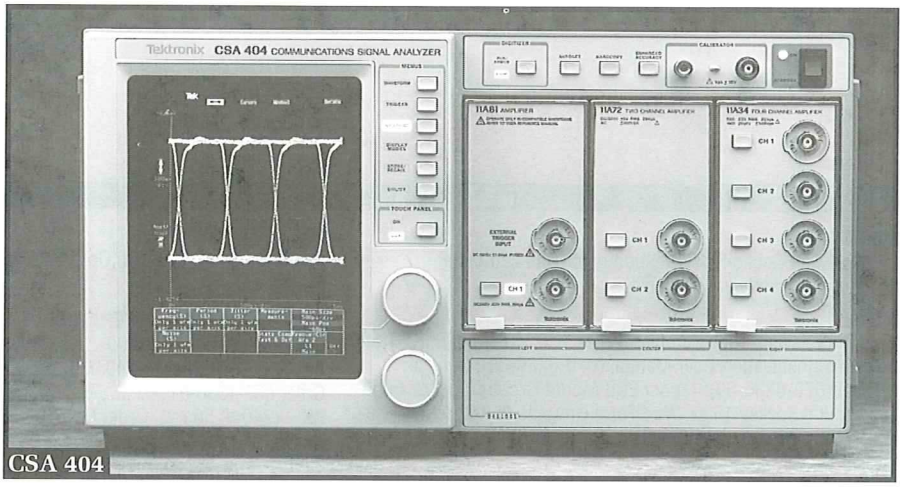
Tektronix Measurement products are manufactured in ISO registered facilities.

Communications Signal Analyzer

Specifically designed for communications applications, the CSA 404 Communications Signal Analyzer is the ideal tool for design, development, and production testing of telecommunications and data communications components, terminals, and systems.

CSA 404

- 200 ps Single Shot Time Interval Resolution (Main-to-Window Trigger Measurement)
- Choice of Bandwidths Through Modularity
- CSA 404: DC to 150, 300, 400, 600
- Trigger up to 1 GHz, Trigger to 2 GHz with the 11A81 Amplifier with up to 2 GHz Trigger Bandwidth
- Fully Automatic Extinction Ratio, Jitter and Noise Measurements
- Infinite, Variable Persistence, and Color Graded Display Modes



CSA 404

The CSA 404 Communications Signal Analyzer is equipped with a comprehensive, communications-focused measurement set, on-board statistical database, variable persistence and color graded displays, histograms, mask testing, constellation diagrams, and optical waveform measurement capabilities. A large selection of modular plug-ins and sampling heads lets you easily reconfigure your communications test and measurement system for your particular needs.

MULTIPROCESSOR CONTROL PLATFORMS

A multiprocessor control platform allows functions previously managed by external computers and controllers to be performed within the analyzer itself. This sophisticated platform lets you generate measurement results – not just raw data – with time and voltage histograms, mask testing, and statistical pulse parameter measurements. It virtually eliminates the need for external computers and specialized software. And it provides a communications-focused measurement set that includes jitter, noise, duty cycle, overshoot, undershoot, extinction ration and amplitude measurements.

In addition, mask testing of SDH/SONET and FDDI compliant signals broadens your analysis capabilities. A full color display helps you discriminate waveform details, while variable persistence mode gives you the real-time feel of analog. A color-graded display mode adds a third dimension – sample density – to your signal acquisitions and analysis. And color hardcopy capabilities allow you to accurately document your measurement results.

MODULARITY ALLOWS CUSTOMIZATION

The 11A81 provides up to 3 GHz with a 2 GHz trigger bandwidth. Use the 11A16 for direct acquisition of current waveforms to compute and analyze power. With the 11A33, 150 MHz with true differential input is achieved.

High bandwidth probes are also available for constructing a total acquisition and measurement solution. The P6204 active probe offers 1 GHz bandwidth, while the P6150 and P6156 passive probes offer 9.0 and 3.5 GHz respectively. The P6204 and P6156 are equipped with Identify and Readout capabilities and provide key information, such as attenuation, input impedance and offset scale factor.

STATISTICAL DATABASE

A built-in statistical database gives the CSA 404 the ability to accumulate three-dimensional waveform data – time, voltage, and now *sample density*. The database is a 512 x 256 x 16-Bit data array which accumulates waveform data by counting the number of times each pixel in the display is activated (Figure 1). This information is then displayed in a color-graded format that gives you a qualitative view of the acquired waveform data. You can view data distribution in eye and constellation diagrams at a glance.

The instrument provides a menu showing the sample density assigned to each color, giving you the ability to generate time and voltage histograms for any portion of the acquired waveform.

The power of this statistical database is the measurement capabilities – time and voltage measurements.

APPLICATIONS

- **Optical Standards Compliance Testing**
- **Electrical Standards Compliance Testing**
- **Timing Analysis**
- **Pass/Fail Mask Measurements for Telecom (SDH/SONET) and Datacomm (FDDI/Fiberchannel)**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The CSA 404 complies with IEEE Standard 488.1-1987, RS-232C and Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Communications Signal Analyzer

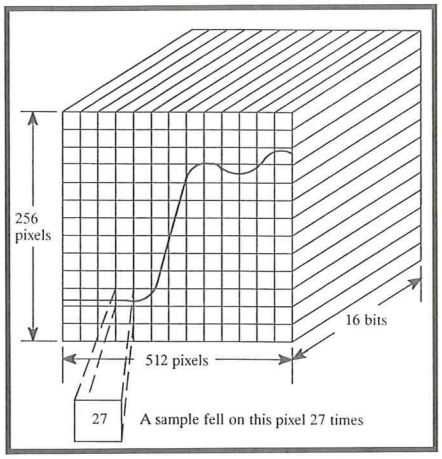


Figure 1: The unique 512 x 256 x 16-Bit data array counts and records the number of times each pixel in the display is activated.

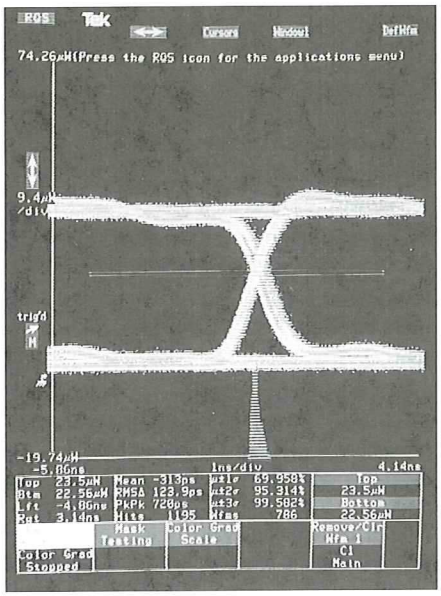


Figure 2: Histograms let you make extremely accurate jitter and noise measurements with one Data Acquisition.

HISTOGRAMS

Time and voltage histograms are powerful statistical tools for measuring noise and jitter in communication signals. The histograms include useful information such as mean, RMS deviation, and peak to peak, and are displayed and continuously updated at a user-selectable rate (Figure 2). High sample rates make it possible to analyze data concurrent with acquisition, rather than in a batch mode later on. The statistical data base allows you to change histogram parameters without reacquiring data.

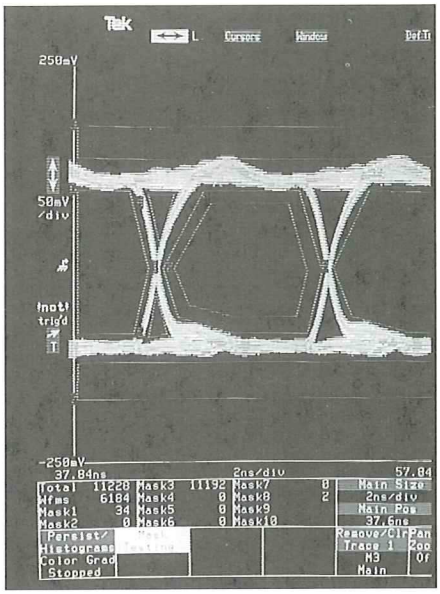


Figure 3: You can perform tolerance testing with the unique mask testing capabilities of the Communications Signal Analyzers.

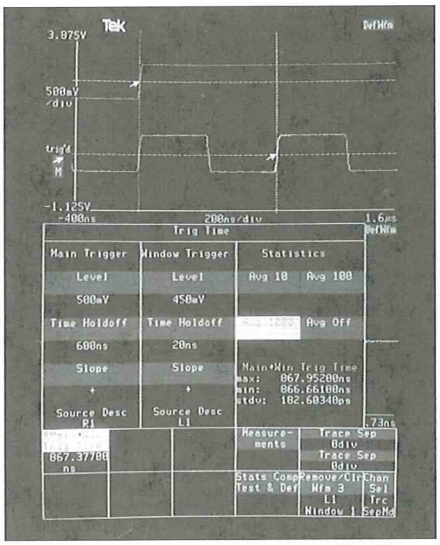


Figure 4: The CSA 404 is equipped with precision Time Interval Hardware for Counter/Timer-like measurements. Time Interval measurement resolution of 200 ps single shot and 10 ps averaged provide a higher level of utility than measurements performed by waveform digitizing.

AUTOMATIC JITTER AND NOISE MEASUREMENTS

For the first time, you can make jitter and noise measurements with one simple selection from an on-screen menu. Controls are provided, with default settings, for adjusting left and right limits, selecting RMS or pk-pk, tracking on/off, and absolute or relative positions.

For eye diagrams, you can select either the eye crossing or the mesial level for the jitter measurement location. Either top line or base line can be selected for the noise measurements. The CSA does the rest, and displays the jitter and noise measurements in the status menu at the bottom of the screen.

AUTOMATIC PULSE PARAMETER MEASUREMENTS

Until now, automatic timing measurements such as "clock to data" phase measurements were not possible on random data such as eye diagrams. With the Tektronix-proprietary statistical measurement mode you can make all automatic pulse parameter measurements directly on random data.

In addition, you can make automatic extinction ratio and amplitude measurements for laser diodes, optical receiver components, and other optical devices. The CSA 404 offers 24 automatic measurements. Each will display up to six selected measurements simultaneously. All measurement results are updated continuously, as are the mean and standard deviation statistics for each measurement.

MEASUREMENT STATISTICS

Measurement statistics – including mean, minimum value, maximum value, and standard deviation – can be automatically generated and displayed for all measurements. In the CSA 404, you can display the statistical results of up to six measurements simultaneously in the statistic pop-up menu, accessible through the measurements menu. This powerful feature gives you a clear picture of circuit operation over time, simplifies performance characterization, and provides for statistical quality control.

PASS/FAIL TESTING

Boundary conditions can be defined for all pulse parametric measurements. After running a test, two summary modes are available. Go or No-go gives a quick green/red status indication. For a more complete characterization, the Statistical mode gives a summary of all measurement types.

VARIABLE PERSISTENCE AND COLOR GRADED DISPLAYS

You can view up to eight waveforms at once in any of the four available persistence modes – normal, infinite, variable and color-graded. Variable persistence lets you examine signal aberrations over a specified period of time from 200 ms to 20 seconds, and gives you the feel of real-time analog. The unique use of color-graded persistence clearly exhibits the sample density on all parts of the waveform.

Continued on next page.

Communications Signal Analyzer

MASK TESTING
For tolerance testing in design or on the manufacturing floor, you can define and edit up to 10 masks simultaneously. These masks (polygons) may each have up to 50 vertices (Figure 3). The CSA 404 then counts the individual and total samples that fall in each of the defined masks. You can store defined masks for future use.

OPTICAL WAVEFORM ACQUISITION AND ANALYSIS
The P6700 Series of Optical-to-Electrical Converters transform your CSA 404 into a powerful tool for characterizing, calibrating or troubleshooting electro-optic devices such as diode lasers, LEDs, electro-optic modulators, and optical waveguides. Network designers can use these converters to develop fiber optic control networks, LANs, and optical disk storage systems.

When any of the P6700 Series converters are connected to the CSA 404, scale factors are automatically changed to mW, µW or nW in order to show optical average or pulse power levels of the incoming signals, eliminating the need for tedious calculations.

With the OIG 501/OIG 502 Optical Impulse Generators and the OCP 5002/OCP 5502 Optical-to-Electrical Converter/Power Meter complete optical test and measurement systems can be constructed. These high-performance tools make complete optical system component measurements effortless for even the novice.

The CSA 404 offers the performance you need to work with the emerging SDH/SONET and FDDI standards, and the modularity you need to adapt your system as new standards are introduced.

Characteristics

VERTICAL SYSTEM
WITH ENHANCED ACCURACY
ΔVDC Accuracy – ≤1% for an 8-division signal.

Absolute DC Accuracy – ≤0.6% when using full scale of the plug-in offset range.

ENHANCED ACCURACY automatically expires when the instrument temperature changes by approximately ±5°C from the temperature of the last calibration. Even if the ENHANCED ACCURACY is not renewed, the accuracy typically remains ≤2%.

11000 Series Probes can be included in calibration. The instrument will prompt you to connect the probes to the CALIBRATOR.

Vertical Resolution – 10-Bits (1024 levels). Resolution can be increased to 14-Bits (16384 levels) with signal averaging.

Equivalent-Time Bandwidth – 3 GHz max determined by plug-in. See **page XXX**.

HORIZONTAL SYSTEM
Time Bases – Two independent, built-in time bases.

Record Duration – 5.11 ns to 1024 s.

Time Base Accuracy – 100 ps +0.002% of measurement interval.

Record Length – 512, 1024, 2048, 4096, 5120, 8192, and 10240 points.

Sampling Rate – 20 MS/s max.

Main Record Positioning – The main record is positioned with respect to the main trigger point. Pretrigger: One record duration. Posttrigger: One record duration. Resolution: One main record point.

Windows – The main record plus two window records can be acquired and displayed. The window records can be of a different length (duration) and can have a shorter time/div than the main record. If two window records are used, they have the same duration and time/div settings, but can be positioned independently.

Window Record Positioning – The window records are positioned relative to a window trigger point which can be delayed by either time or events relative to the main record's trigger point.

Main-to-Window Trigger Time Measurements –
The time between the Main record trigger and the Window trigger can be measured precisely, even if each trigger only occurs once. Repetitive events allow this measurement to be averaged for better resolution and accuracy. Single Trigger Resolution: 200 ps Repetitive Resolution: 10 ps with averaging Accuracy: 250 ps +0.002% of measured interval.

TRIGGERING SYSTEM
Range – ±Full Scale.

Main Trigger, Coupling and Sensitivity: Jitter (Typical) – 10 ps RMS; 70 ps peak-to-peak.

DC Coupled – 0.5 div from DC to 50 MHz; 1.5 div from 50 MHz to 3 GHz.*1

Noise Reject Coupled – 1.2 div or less from DC to 50 MHz; 3 div from 50 MHz to 3 GHz.*1

AC Coupled – 0.5 div from 60 Hz to 50 MHz; 1.5 div from 50 MHz to 1 GHz.*1 Attenuates signals below 60 Hz.

HF Reject Coupled –
0.65 div from DC to 30 kHz.

LF Reject Coupled – 0.65 div from 80 kHz to 50 MHz; 1.5 div from 50 MHz to 1 GHz.*1

Window Trigger, Coupling and Sensitivity:
DC Coupled – 0.5 div from DC to 50 MHz; 1.5 div from 50 MHz to 500 MHz.*1

Noise Reject Coupled – 1.2 div or less from DC to 50 MHz; 3 div from 50 MHz to 500 MHz.*1

AC Coupled – 0.5 div from 60 Hz to 50 MHz; 1.5 div from 50 MHz to 500 MHz.*1 Attenuates signals below 60 Hz.

HF Reject Coupled –
0.65 div from DC to 30 kHz.

LF Reject Coupled – 0.65 div from 80 kHz to 50 MHz; 1.5 div from 50 MHz to 500 MHz.*1

Holdoff Range:
Main Record – Min: 490 ns; max: 10x.

Window Triggering – By time or event.

MEASUREMENT SYSTEM
Waveform Processing Functions:
Waveform Functions – Differentiate, integrate, interpolate, smooth, average, envelope, square root, signum, logarithm, natural log, absolute value, and exponential.

Arithmetic Operators – Add, subtract, multiply, divide.

Measurement Set:
Amplitude – Min, max, mid, mean, gain, p-p, undershoot, overshoot, amplitude, noise, extinction ratio, and RMS.

Timing – Rise, fall, width, delay, main-to-window trigger time, phase, period, duty cycle, skew, jitter, propagation delay, cross, and frequency.

Area and Energy – Area +, area –, and energy.

Measurement Statistics – Min, max, mean, and standard deviation of all active measurements.

Cursors – Dual dots in split or paired mode, horizontal and vertical bars, measurement zone delimiters.

*1 *At minimum holdoff setting.*

Communications Signal Analyzer

INPUTS/OUTPUTS
Centronics, GPIB, and RS-232C ports standard. Fully GPIB and RS-232C programmable.

Hardcopy Drivers – Support for 9-Pin and 24-Pin Epson-graphics compatible printers; Tektronix HC100 and HPGL-compatible plotters; Tektronix 4693, 4696, 4697 color printers; HP LaserJet and ThinkJet printers; Bitmap transfer to computers. Draft, high resolution, and reduced modes.

CRT AND DISPLAY FEATURES
CRT – Magnetic deflection, vertical raster-scan orientation. 7.5 in. diagonal color CRT.

Colors – Eight-color set; selectable from a palette of 262, 144 colors.

Video Resolution – 552 horizontal by 704 vertical displayed pixels.

ENVIRONMENTAL AND SAFETY
Temperature – Operating: 0 to +50°C. Nonoperating: –40 to +75°C.

Humidity – Operating and Nonoperating: Up to 95% relative humidity, up to +50°C.

Altitude – Operating and Nonoperating: meets MIL-T-28800C, Type Class 5.

Electromagnetic Compatibility – Referenced to MIL-STD-461B. Meets FCC part 15, subpart J, class A. Meets VDE 0871/6.78 for Class "B."

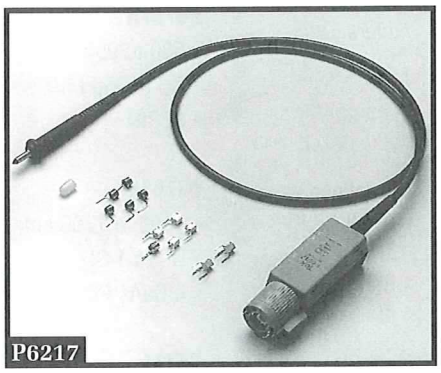
Shock – Nonoperating: meets MIL-T-28800C, Section 4.5.5.4.1, Type Class 5.

Bench Handling – Operating: meets MIL-T-28800C, Section 4.5.5.4.3., Type Class 5. Electromagnetic Compatibility – Meets the following requirements of MIL-STD-461B – CE-03, Part 4, Curve 1; CS-01, Part 7; CS-01, Part 4; CS-06, Part 5; RE-02, Part 7; RS-01, Part 4; RS-02, Part 5; RS-03, Part 7 (limited to 1 GHz). Meets FCC part 15, subpart J, class A. Meets VDE 0871/6.78 for Class B.

Safety – Listed UL 1244; Certified CSA C22.2, No. 231-M89.

PHYSICAL CHARACTERISTICS

	Benchtop		Rackmount	
Dimensions	**mm**	**in.**	**mm**	**in.**
Width	448	17.6	483	19.0
Height	238	9.4	222	8.8
Depth	599	23.6	550	21.6
Weight ≈	**kg**	**lb.**	**kg**	**lb.**
Net	20.0	44	22.0	46.0
Shipping	24.0	44	25.0	54.0



Accessory

Maximize Your Signal Acquisition Performance

P6217 FET PROBE
- Wide Bandwidth (DC to >4 GHz)
- Minimal DUT Loading <0.4 pF capacitive/>100 kΩ resistive
- Requires no additional cables or power supplies.
- Smaller size than traditional active FET Probes

For complete selection information on all Accessory products, see page 446.

ORDERING INFORMATION

CSA 404
Communications Signal Analyzer.....**$22,000**
Includes: Tutorial Manual (070-8185-00), User Reference (070-8186-00), Programmer Reference (070-8187-00), Quick Reference (070-8188-00), Service Reference (070-8189-00), Power Cord, U.S., 120 V (161-0066-00).

SOFTWARE
See Software Section for selection guide and complete description of utility software available for the CSA 404.

INSTRUMENT OPTIONS
Opt. 1C – Cable Feedthrough Connectors. .....**+$200**
Opt. 1R – Rackmount.....**+$250**
Opt. 2D – Memory expansion adds 768 KB of non-volatile memory for storage of waveforms and settings.....**+$1,500**
Opt. 4D – DMA Controller increases transfer speed over GPIB.....**+$400**

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro, 220 V, 50 Hz .....**NC**
Opt. A2 – United Kingdom, 240 V, 50 Hz.....**NC**
Opt. A3 – Australian, 240 V, 50 Hz .....**NC**
Opt. A4 – North American, 240 V, 60 Hz .....**NC**
Opt. A5 – Switzerland, 220 V, 50 Hz.....**NC**
See General Customer Information Section for additional description.

SERVICE ASSURANCE OPTIONS[*1]

OPTICAL-TO-ELECTRIC CONVERTERS
See page 354 for complete information.
DC to 1 GHz, 1100 nm to 1700 nm –
Specify Opt. 01-05 listed on page 355. Order P6703A.....**$3,605**
DC to 700 GHz, 450 nm to 1050 nm –
Specify Opt. 01-05 listed on page 355. Order P6701A.....**$2,625**
DC to 300 GHz, 1000 nm to 1700 nm, High gain –
Specify Opt. 01-05 listed on page 355. Order P6713 .....**$2,500**
DC to 250 GHz, 450 nm to 1050 nm, High gain –
Specify Opt. 01-05 listed on page 355. Order P6711 .....**$2,100**

RECOMMENDED ACCESSORIES
See page 446 for complete selection information.
Probes – See page 450.
Power Strip – Four Outlet, 6 ft., Noise/Surge Suppression[*1]
Cables – RS-232C, 10 ft. Order 012-0911-00.....**$100**
Centronics, 10 ft. Order 012-1233.....**$100**
GPIB Cable .....[*1]
Blank Panels – Plug-in. Order 016-0829-00.....**$195**

CART
Instrument Cart with Tilt Tray, Wire Basket, Four Heavy Duty Safety Straps. Order K465 .....**$835**

CAMERAS/PLOTTERS
Camera – Order C-9 with Opt. 11 and Opt. 1A **$955**
Plotter – Order HC100.....**$1,250**

*[*1] Contact your local Tektronix representative for price and ordering information.*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 — The CSA 404 complies with IEEE Standard 488.1-1987, RS-232C and with Tektronix Standard Codes and Formats.

ISO 9001 — Tektronix Measurement products are manufactured in ISO registered facilities.

P6701A
P6703A
P6711
P6713
P6721
P6751

Optical-to-Electrical Converters

The P6700 Series products provide calibrated optical-to-electrical conversion in a compact and convenient package for use at commonly used optical communications wavelengths and modulation bandwidths.

P6701A
- 500 to 950 nm
- DC to 850 MHz
- Si PIN

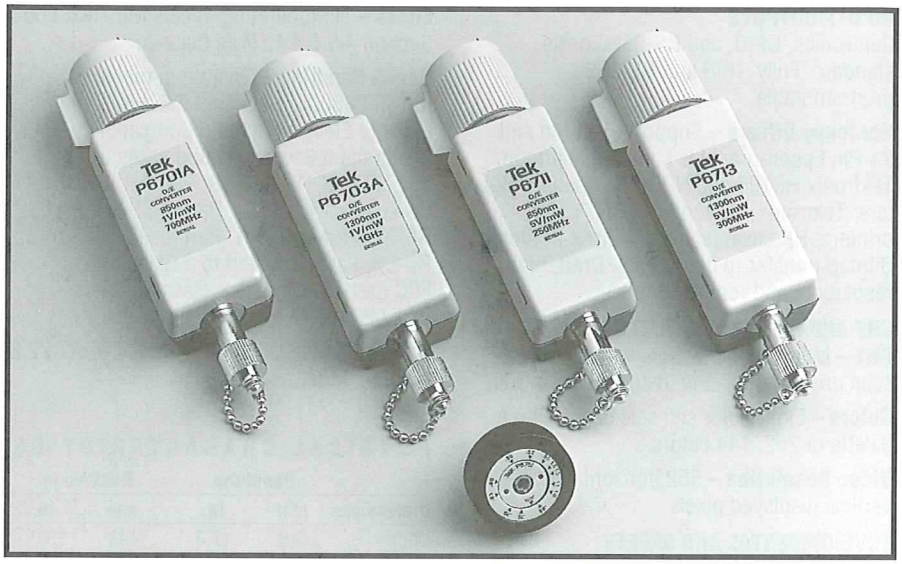
P6703A
- 1100 to 1700 nm
- DC to 1 GHz
- InGaAs PIN

P6711
- 500 to 950 nm
- DC to 250 MHz
- High Gain
- Si PIN

P6713
- 1100 to 1700 nm
- DC to 300 MHz
- High Gain
- InGaAs PIN

P6721
- 400 to 1000 nm
- DC to 50 MHz
- Large Area Detector (3 mm)
- Si PIN

P6751 SPATIAL INPUT HEAD
- 500 to 1500 nm
- Tunable
- Collimated Beam Input
- Multimode Fiber Output



P6701A, P6703A, P6711, P6713 and Optical-to-Electrical Converters and P6751 Spatial Input Head.

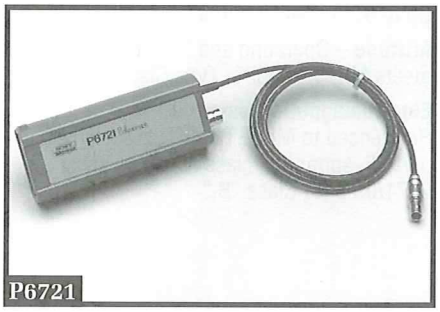
Product Description

The Tektronix P6701A/P6703A/P6711/P6713 are optical probes that allow the user to receive optical signals and convert them to electrical signals for convenient analysis on Tektronix oscilloscopes equipped with the TEKPROBE™ Interface or any other oscilloscope when used in conjunction with the Tektronix 1103 TEKPROBE™ Interface Power Supply.

Use of the 11000 Series oscilloscope's TEKPROBE™ Interface allows the oscilloscope to supply power to the P6700 Series probes, automatically determine and display the proper scale factor (in microwatts of optical power) and set the input termination to the required 50 Ω.

The P6700 Series provides a calibrated means of analog analysis of optical signals in the wavelength range 450 to 1050 nm (P6701A/P6711) and 1100 to 1700 nm (P6703A/P6713). Thus the functions of an optical power meter and the high-speed analog waveform analysis capability of an oscilloscope are combined in one instrument. The user has the capability of acquiring, displaying and analyzing mixed analog and digital, optical and electrical signals simultaneously.

The P6701A and P6703A have an added DC stable circuit from decreased offset drift (≤1 µW). This improves the performance for extinction ratio measurements and absolute optical power levels. The P6711 and P6713 have increased gain and lower noise, and thus have improved the sensitivity of the converters and are excellent choices for LED measurements.



The P6721 is a high gain optical-to-electrical converter for use with plastic fiber and larger diameter glass fiber. For the laser disk service, automotive optical communication and others, the P6721 is a link to waveform test and measurement tools. The P6721 uses Tektronix probe power or the 1101A Power Supply.

The P6751 Spatial Input Head is a tunable lens system for sampling optical energy from any collimated source and delivering it via a fiber optic cable to the P6700 Series Optical-to-Electrical Converter. The P6751 is easily mounted using standard optical bench fixtures. This spatial input head can be adjusted (500 to 1500 nm) by the user to optimize the amount of optical energy delivered to the P6700 Series. The P6751 has a standard SMA fiber optic cable connector. The P6751 is intended for use with 100/140 µm diameter multimode fiber.

Also available are a series of fiber optic jumper cables for interfacing the P6700 Series and P6751 with other industry standard optical fiber connectors.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Optical-to-Electrical Converters

P6701A | **P6713**
P6703A | **P6721**
P6711 | **P6751**

TYPICAL APPLICATIONS
Applications range from measuring the transient optical properties of lasers, LEDs, electro-optic modulators, flashlamps, etc., to the development, manufacturing, and maintenance of fiber optic control networks, local area networks (LANs), fiber based systems based on the FDDI and SONET standard, optical disk devices, and high-speed fiber optic communications systems.

As an example, eight probes of the P6700 Series type coupled with two 11A34 Amplifier Plug-ins and an 11000 Series oscilloscope can be configured as an 8-channel optical oscilloscope.

Characteristics

	P6701A	P6703A	P6711	P6713	P6721
Wavelength Response	500 to 950 nm	1100 to 1700 nm	500 to 950 nm	1100 to 1700 nm	400 to 1000 nm
Bandwidth	DC to 850 MHz	DC to 1 GHz	DC to 250 MHz	DC to 300 MHz	DC to 50 MHz
Rise time	≤700 ps	≤500 ps	≤2 ns	≤1.6 ns	≤10 ns
Conversion Gain	1 V/mW at 850 nm	1 V/mW at 1300 nm	5 V/mW at 850 nm	5 V/mW at 1300 nm	10 V/mW at 660 nm
Max Input Optical Power	1 mW	1 mW	200 µW	200 µW	0.3 mW
Noise Equivalent Power	≤1 µW(RMS)	≤1 µW(RMS)	≤250 nW(RMS)	≤200 nW (RMS)	≤200 nW(RMS)
Max. Input Fiber Core Diameter	200 µm	100 µm	200 µm	100 µm	1000 µm

Note: For further technical information on these above products request the following product literature:

- *For P6701A, P6711, P6703A, P6713 – #3TW-7914 (Data Sheet).*
- *For P6721 – #3TW-8309-0 (Data Sheet).*
- *For P6751 – #3TW-7304-1 (Data Sheet/Application Note).*

ORDERING INFORMATION

P6701A
Optical-to-Electrical Converter ..... **NC**
Includes: Option Specified Fiber Optic Input Connector, Carrying Case (016-0156-03), and Instruction Manual (070-8237-00).
Opt. 01 – FC input connector ..... **+$2,678**
Opt. 02 – ST*[1] input connector ..... **+$2,678**
Opt. 03 – DIN 47256 input connector ..... **+$2,678**
Opt. 04 – SMA Input connector ..... **+$2,678**
Opt. 05 – SC Input connector ..... **+$2,678**

P6703A
Optical-to-Electrical Converter ..... **NC**
Includes: Option Specified Fiber Optic Input Connector, Carrying Case (016-0156-03), and Instruction Manual (070-8237-00).
Opt. 01 – FC input connector ..... **+$3,677**
Opt. 02 – ST*[1] input connector ..... **+$3,677**
Opt. 03 – DIN 47256 connector ..... **+$3,677**
Opt. 04 – SMA input connector ..... **+$3,677**
Opt. 05 – SC input connector ..... **+$3,677**

P6711
Optical-to-Electrical Converter ..... **NC**
Includes: Option Specified Fiber Optic Input Connector, Carrying Case (016-0156-03), and Instruction Manual (070-8237-00).
Opt. 01 – FC input connector ..... **+$2,142**
Opt. 02 – ST*[1] input connector ..... **+$2,142**
Opt. 03 – DIN 47256 connector ..... **+$2,142**
Opt. 04 – SMA input connector ..... **+$2,142**
Opt. 05 – SC input connector ..... **+$2,142**

P6713
Optical-to-Electrical Converter ..... **NC**
Includes: Option Specified Fiber Optic Input Connector, Carrying Case (016-0156-03), and Instruction Manual (070-8237-00).
Opt. 01 – FC input connector ..... **+$2,550**
Opt. 02 – ST*[1] input connector ..... **+$2,550**
Opt. 03 – DIN 47256 connector ..... **+$2,550**
Opt. 04 – SMA input connector ..... **+$2,550**
Opt. 05 – SC input connector ..... **+$2,550**

P6721
Optical-to-Electrical Converter **$1,523**
Includes: Standard TOSLINK Fiber Optic Input Connector, and Instruction Manual (070-7842-00).

P6751
Spatial Input Head **$467**
Includes: Adjustment Tool and Instruction Sheet.

OPTIONAL ACCESSORIES
TEKPROBE™ Power Supply – Order 1103 ..... **$655**

Fiber Optic Cables – Single Mode and Multimode

The following fiber optic cable assemblies are intended to provide high quality interconnections between fiber optic test equipment having the same or different optical connector types. Each cable assembly consists of a single jacketed fiber connectorized on both ends with male connectors. Cables with different type connectors on each end are for interconnecting two instruments having dissimilar female connectors. The type of connector installed on each end of the fibers are indicated below.

Single Mode

Fiber Optic Cables – 2 meter length, 8/125 µm core/cladding diameter, including in-Line connector adapter.
FC/PC to diamond 3.5 connectors. Order 174-1385-00 ..... **$617**
FC/PC to ST*[1] connectors. Order 174-1386-00 ..... **$785**
FC/PC to FC/PC connectors. Order 174-1387-00 ..... **$449**
FC/PC to biconic connectors. Order 174-1388-00 ..... **$561**
FC/PC to diamond 2.5 connectors. Order 174-1497-00 ..... **$592**

Multimode

Fiber Optic Cables – 2 meter length, 62.5/125 µm core/cladding diameter.
FC/PC to FC/PC connectors. Order 174-2322-00 ..... **$225**
FC/PC to biconic connectors. Order 174-2323-00 ..... **$315**
FC/PC to SMA connectors. Order 174-2324-00 ..... **$225**

Fiber Optic Cables – 2 meter length, 100/140 µm core/cladding diameter.
SMA to ST*[1] connectors. Order 174-0876-00 ..... **$410**
SMA to diamond 3.5 connectors. Order 174-0877-00 ..... **$450**
SMA to FC connectors. Order 174-0878-00 ..... **$475**
SMA to SMA connectors. Order 174-0879-00 ..... **$475**
SMA to biconic connectors. Order 174-0880-00 ..... **$335**
SMA to diamond 2.5 connectors. Order 174-1303-00 ..... **$360**

**1 ST is a registered trademark of AT&T*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

ORS52 ORS156 ORS622 ORS2488

SDH/SONET Reference Receivers

The ORS Series of SDH/SONET Reference Receivers provides calibrated testing to ensure optical transmitter compliance with SDH/SONET OC-1, OC-3/STM-1, OC-12/STM-4, and OC-48/STM-16 frequency-response specifications.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The SDH/SONET Reference Receivers comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORS52/ORS156/ ORS622/ORS2488

- Strict ITU-T G.957 Compliance
- Data Rates Through 2.488 Gbits/s
- Bessel-Thompson Frequency Response
- Accurate Extinction Ratio Measurements
- Low Distortion Eye Pattern and Pulse Measurements
- DC Coupled and Stabilized Amplification
- Convenient and Flexible Configurations
- Measures Average Optical Power
- Easy to Use
- Fully GPIB Controllable



ORS622 with Options 31 and 41

Verifying SDH/SONET System Performance

The Synchronous Data Hierarchy (SDH) and the Synchronous Optical NETwork (SONET) standards are crucial to the next generation of high-speed digital telecommunications systems. The Tektronix ORS Series of optical reference receivers fills a crucial test system gap for verifying SDH/SONET optical system performance.

These are true optical receivers, not just filters. The result is a precision optical reference receiver that can be relied upon to faithfully represent transmitted signals at specific SDH/SONET bit rates for the purpose of waveform or eye pattern analysis. Without an optical reference receiver of this completeness and precision, optical transmitter signal evaluation can become fraught with uncertainties caused by unrelated optical transmitter noise.

In addition to defining optical system signal hierarchy and signal characteristics, SDH/SONET also defines test methodologies and specifications for verifying equipment and system performance. Prominent in this is the use of an SDH/SONET optical reference receiver and an oscilloscope for display and comparison of the data eye pattern to specified masks.



ORS156 with Option 1x/2x

ORS SERIES SPECIFICATIONS

SDH/SONET recommendations define the nominal transfer function for an optical reference receiver as being a fourth-order Bessel-Thompson response. The following table lists the corresponding attenuation at various frequencies, f. In this table f_0 is the receiver's bit rate and f_r is the 3 dB cutoff, which is defined as $f_r=0.75f_0$.

Allowable deviation from the nominal attenuation in the table is very tightly specified in the SDH/SONET recommendations. The actual allowable deviation values depend on f/f_r and the bit rate. These values run as low as ±0.3 dB.

NOMINAL PERFORMANCE VALUES FOR AN SDH/SONET OPTICAL REFERENCE RECEIVER
(O/E Converter and Filter Together)

f/f_0	f/f_r	Attenuation (dB)
0.15	0.2	0.1
0.3	0.4	0.4
0.45	0.6	1.0
0.6	0.8	1.9
0.75	1.0	3.0
0.9	1.2	4.5
1.0	1.33	5.7
1.05	1.4	6.4
1.2	1.6	8.5
1.35	1.8	10.9
1.5	2.0	13.4
2.0	2.67	21.5

Each Tektronix ORS Series SDH/SONET Reference Receiver undergoes extensive frequency-response testing. All verification tests are documented. The verification document is supplied as part of the ORS Series SDH/SONET Reference Receiver. This document contains the serial number of the receiver as well as the measured verification data for that receiver.

Receiver selection is based, first of all, on the SDH/SONET bit rate of interest. For greatest flexibility, a receiver based on the OCP5502 O/E converter is recommended even for OC-1 applications. The broad bandwidth of the OCP5502 allows later addition of filters to cover higher bit rates as needed without having to purchase an additional O/E converter. For OC-1 applications requiring economy and high sensitivity, but not requiring flexibility for higher bit rates, a receiver based on the P6713 O/E Converter is recommended. Where economy or coverage of more than one bit rate is the greatest concern, receivers based on the P6703A O/E converter are the appropriate choice for testing OC-1 and OC-3/STM-1-Bit rates.

The ORS Series SDH/SONET Reference Receivers are TEKPROBE™ compatible. When used with Tektronix oscilloscopes having the TEKPROBE™ interface, screen displays will show the proper scale factor for the optical signal (microwatts of optical power). This allows direct measurement and display of results without having to manually apply conversion factors. For oscilloscopes or other instruments not having this TEKPROBE™ interface, a Tektronix 1103 Power Supply can be ordered separately for ORS Series Reference Receivers using P6703A or P6713 O/E Converters. ORS Series Reference Receivers using the OCP5502 O/E Converter and the ORS2488 are compatible with (but do not require) the TEKPROBE™ Interface for their operation.

SDH/SONET Reference Receivers

ORS622 ORS2488 | **ORS52 ORS156**

SELECTION TABLES

Receiver	Option	Configuration	Optical Connectors	Key Benefits
OC-1 (51.84 Mbits/s)				
ORS52		OCP5502/FS52 and OC-1 calibration	FC, ST, DIN 47256, and SC	Greatest flexibility. Can add filters for OC-3 and OC-12. Built-in power meter. GPIB.
	1P	Delete OCP5502 power supply resulting in TM5000 compatible plug-in instrument	same	Provides compatibility with bench or rackmountable TM5000 Series Modular Instrument Mainframes.
	1x*1	P6703A/FS52 and OC-1 calibration	*1	Greatest value.Can add filter for OC-3.
	2x*1	P6713/FS52 and OC-1 calibration	*1	Highest sensitivity.
OC-3/STM-1 (155.52 Mbits/s)				
ORS156		OCP5502/FS156 and OC-3 calibration	FC,ST, DIN 47256, and SC	Greatest flexibility. Can add filters for OC-1 and OC-12. Built-in power meter. GPIB.
	1P	Delete OCP5502 power supply resulting in TM5000 compatible plug-in instrument	same	Provides compatibility with bench or rackmountable TM5000 Series Modular Instrument Mainframes.
	1x*1	P6703A/FS156 and OC-3 calibration	*1	Greatest value. Can add filter for OC-1.
	31	Add FS52 and OC-1 calibration		
OC-12/STM-4 (622.08 Mbits/s)				
ORS622		OCP5502/FS622 and OC-12 calibration	FC, ST, DIN 47256, and SC	Greatest flexibility. Built-in power meter. GPIB. Multiple bit rate options.
	1P	Delete OCP5502 power supply resulting in TM5000 compatible plug-in instrument	same	Provides compatibility with bench or rackmountable TM5000 Series Modular Instrument Mainframes.
	31	Add FS52 and OC-1 calibration		
	41	Add FS156 and OC-3 calibration		
OC-48/STM-16 (2.488 Gbits/s)				
ORS2488		ORS2488 (includes power supply) and OC-48 calibration	FC, ST, DIN 47256, and SC	Specific to OC-48/STM-16 data rate. Built-in power meter. GPIB.
	1P	Delete OE converter power supply resulting in TM5000 compatible plug-in instrument	same	Provides compatibility with bench or rackmountable TM5000 Series Modular Instrument Mainframes.

*[*1]x=1 (FC Optical Input Connector). x=2 (ST Optical Input Connector). x=3 (DIN 47256 Optical Input Connector). x=4 (SMA Optical Input Connector). x=5 (SC Optical Input Connector). Note: [(a)]For further technical information on ORS Series products request Data Sheet #3TW-8530-1. [(b)]For information on SDH/SONET Reference Receiver calibration services available for new or previously purchased O/E Converters, contact your local Tektronix sales office.*

ORDERING INFORMATION

ORS52
SDH/SONET Receiver.....**$11,295**
Includes: OCP5502, FS52 Filter, Calibration Document (062-1266-00), Instruction Manuals (070-8562-00).

Opt. 1P – Delete OCP5502 Power Supply .....**–$495**
Opt. 11 – Delete OCP5502/Add P6703A Opt. 01 – FC Optical Input Connector .....**–$6,300**
Opt. 12 – Delete OCP5502/Add P6703A Opt. 02 – ST Optical Input Connector .....**–$6,300**
Opt. 13 – Delete OCP5502/Add P6703A Opt. 03 – DIN 47256 Optical Input Connector .....**–$6,300**
Opt. 14 – Delete OCP5502/Add P6703A Opt. 04 – SMA Optical Input Connector.....**–$6,300**
Opt. 15 – Delete OCP5502/Add P6703A Opt. 05 – SC Optical Input Connector.....**–$6,300**
Opt. 21 – Delete OCP5502/Add P6713A Opt. 01 – FC Optical Input Connector .....**–$7,300**
Opt. 22 – Delete OCP5502/Add P6713A Opt. 02 – ST Optical Input Connector.....**–$7,300**
Opt. 23 – Delete OCP5502/Add P6713A Opt. 03 – DIN 47256 Optical Input Connector .....**–$7,300**
Opt. 24 – Delete OCP5502/Add P6713A Opt. 04 – SMA Optical Input Connector.....**–$7,300**
Opt. 25 – Delete OCP5502/Add P6713A Opt. 05 – SC Optical Input Connector.....**–$7,300**

ORS156
SDH/SONET Receiver.....**$11,395**
Includes: OCP5502, FS156 Filter, Calibration Document (063-1266-00), Instruction Manuals (070-8562-00).

Opt. 1P – Delete OCP5502 Power Supply .....**–$495**
Opt. 11 – Delete OCP5502/Add P6703A Opt. 01 – FC Optical Input Connector .....**–$6,300**
Opt. 12 – Delete OCP5502/Add P6703A Opt. 02 – ST Optical Input Connector .....**–$6,300**
Opt. 13 – Delete OCP5502/Add P6703A Opt. 03 – DIN 47256 Optical Input Connector .....**–$6,300**
Opt. 14 – Delete OCP5502/Add P6703A Opt. 04 – SMA Optical Input Connector.....**–$6,300**
Opt. 15 – Delete OCP5502/Add P6703A Opt. 05 – SC Optical Input Connector.....**–$6,300**
Opt. 31 – Add FS52 Filter and OC-1 Calibration .....**+$1,500**

ORS622
SDH/SONET Receiver.....**$11,495**
Includes: OCP5502, FS622 Filter, Calibration Document (063-1266-00), Instruction Manuals (070-8562-00).

Opt. 1P – Delete OCP5502 Power Supply .....**–$495**
Opt. 31 – Add FS52 Filter and OC-1 Calibration .....**+$1,500**
Opt. 41 – Add FS156 Filter and OC-3/STM-1 Calibration ..**+$1,600**

ORS2488
SDH/SONET Receiver.....**$17,950**
Includes: Calibration Document (063-1266-0), Instruction Manual (070-8731-00).

Opt. 1P – Delete ORS2488 Power Supply .....**–$495**

ADDITIONAL ACCESSORIES
Fiber Optic Cables – Refer to page 322 for complete list.
TEKPROBE™ Interface Cable – Order 012-1372-00 .....**$375**
TEKPROBE™ Power Supply – Order 1103*1.....**$655**

*[*1] For use with oscilloscopes or other signal analysis instruments not having Tektronix TEKPROBE™ Interface compatibility, the ORS52 and ORS156 Reference Receivers using the P6703A or P6713 O/E Converters require a Tektronix 1103 Power Supply to be ordered separately.*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

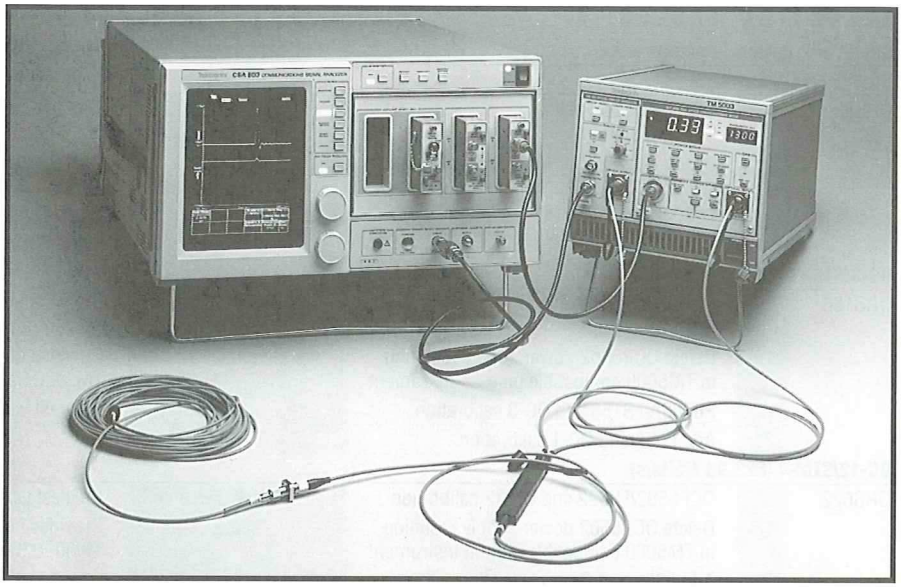
OCP 5002
OCP 5502

Optical-to-Electrical Converters/Power Meters

The OCP 5000 Series products provide general purpose optical-to-electrical conversion and simultaneous measurement and display of average optical power over a wide signal bandwidth.

OCP 5002/OCP 5502

- DC to 2 GHz Optical-to-Electrical Conversion
- Extremely Low Drift
- Low Equivalent Input Noise
- High Optical Return Loss
- Average Reading Optical Power Meter
- GPIB IEEE 488.2 Controllable
- TEKPROBE™ Interface Compatible
- Multiple Optical Connector Types Accommodated
  –FC/PC
  –DIN 47256
  –ST*1
  –SC



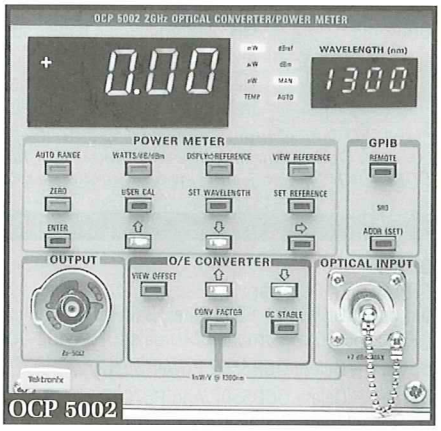
High Resolution Optical Reflection Measurement using OIG 502, OCP 5002 and the CSA 803A.

OCP 5002/OCP 5502

The OCP 5000 Series instruments are optical-to-electrical converters with an average reading optical power meter integrated into their design. This combination eliminates the need to use two separate instruments to make parametric measurements on optical signals.

The OCP 5002 occupies two slots in a Tektronix TM 5000 Series Modular Instrument Mainframe. The OCP 5502 is a functionally equivalent instrument, packaged as a stand-alone, monolithic unit. The OCP 5000 Series instruments can be operated from the front-panel keypad or from a GPIB controller. The GPIB interface meets the IEEE 488.2 standard. The front-panel controls are all matched over the bus and all readings can be communicated over the GPIB interface.

The power meter displays average optical power input in W, dBm and dB. You can set the calibration level to a user defined wavelength (within the 1100 to 1650 nm range) with a simple button push or GPIB command. This feature allows you to use the OCP 5000 Series instruments to design tests and applications that meet your specifications.



In addition to operating with any Tektronix oscilloscope, OCP 5000 Series instruments offer additional functionality when connected with instruments that have a TEKPROBE™ interface. With the optional TEKPROBE™ cable, users can read the optical power units directly on the oscilloscope screen.

**1 ST is a registered trademark of AT&T.*

APPLICATIONS

- **Accurate Extinction Ratio Measurements**
- **Optical Eye Pattern Analysis**
- **LED and Laser Transmitter Characterization**
- **FDDI and SONET Waveform Standards Verification**
- **High Sensitivity Optical Reflection Measurements**
- **High Resolution Optical Reflectometry**
- **Optical Digital Communication Measurements**
- **Optical Component Characterization**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The OCP 5002/ OCP 5502 comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Optical-to-Electrical Converters/Power Meters

OCP 5002
OCP 5502

The Tektronix OCP 5000 Series instruments in the standard configuration are shipped with the "FC" Style optical connector on the input. They are also shipped with field installable front-panel connectors to change the input to either "ST*1," "SC," or "DIN 47256" style connectors. Changing the input connectors is simple and the manual includes clear instructions on how to make this change whenever needed.

OPTICAL REFLECTION TESTS

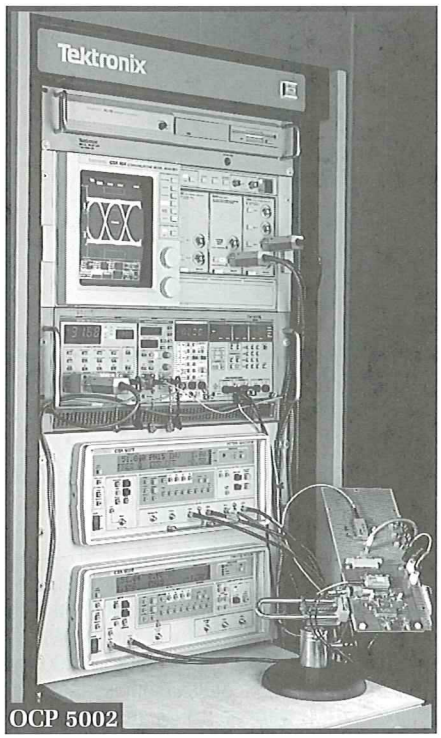
Optical reflections in fiber optic systems can seriously degrade transmission performance, especially in high-speed communications links using laser sources. Characterization of the reflective performance of optical connectors and components can be crucial to ensuring signal integrity in fiber optic communications equipment.

The OCP 5000 Series instruments can be used with the Tektronix CSA 803A, CSA 404 Communication Signal Analyzers or other 11000 Series oscilloscopes and the OIG 502 Optical Impulse Generator to evaluate optical reflections. The return loss of optical reflections can be measured to levels ≤50 dB. Depending on the specific instrument configuration used, multiple reflection events in optical fiber can be spatially resolved to the centimeter range. Single reflection events in optical fiber can be measured down to submillimeter accuracy levels.

OPTICAL DIGITAL COMMUNICATION TESTS

The OCP 5000 Series instruments, with their 2 GHz bandwidth, are excellent optical-to-electrical converters for use in FDDI and SONET compliance testing. When combined with other Tektronix instruments, the OCP 5000 instruments can be used for mask test verification to the FDDI and SONET waveform standards.

The OCP 5000 Series instruments, when coupled with the Tektronix CSA 803A or CSA 404 Communication Signal Analyzers, can perform on-board optical eye pattern analysis even at the low signal levels characteristic of LED transmitters.



Tektronix Physical Layer Standards Compliance Test System for testing to high-speed digital communications standards such as FDDI and SDH/SONET. OCP 5002 shown in TM5006 Modular Instrument Mainframe.

When the OCP 5000 Series instruments are coupled with the CSA 404 or other Tektronix 11000 Series oscilloscopes equipped with the TEKPROBE™ interface, users can evaluate complex time-domain optical signals to determine the physical layer performance of a fiber optic communication network. Accurate extinction ratio measurements are made possible by the low (<0.5 µW) DC drift of the optical-to-electrical converter when the instrument is in the DC Stable Mode.

The OCP 5000 Series instruments are used as one of the base optical-to-electrical converters in the Tektronix ORS Series SDH/SONET Reference Receivers. For further information on these Reference Receivers consult the separate entry on these products appearing in this catalog.

OPTICAL COMPONENT CHARACTERIZATION

The combination of an average reading optical power meter and a 2 GHz optical-to-electrical converter in one instrument provides unique benefits when either manual or program control modes are being used. This combination allows users to fulfill most of their optical component characterization requirements with a single instrument. It also allows different tests and multiple test steps to be run without disconnecting and reconnecting optical fiber connectors. This reduces both testing time and cost as well as increases measurement reliability and repeatability.

The OCP 5000 Series instruments meet or exceed performance specifications for characterizing many of the latest fiber optic components, such as lasers and LEDs.

**1ST is a registered trademark of AT&T.*

CHARACTERISTICS

Optical Converter	OCP 5002/OCP 5502
Wavelength Response	1100-1650 nm
Bandwidth	DC-2 GHz*2
Rise Time	260 ps
Conversion Gain	1 V/mW ±8% at 1300 nm
Calibrated Offset	0-1 mW ±1%
Maximum Input Optical Power	2 mW offset at 1 mW 1 mW (no offset)
Noise Equivalent Power	≤1 µW RMS
Optical Power Meter	
Dynamic Range	+7 dBm to –80 dBm
Accuracy*3	≤5% at 1300 nm

**2 –3 dB Optical/–6 dB Electrical.*
**3 With FC/PC connectors.*

Note: For further technical information on the OCP 5000 Series products request Data Sheet #3TW-7671-1.

ORDERING INFORMATION

OCP 5002
2 GHz Optical Converter/Power Meter **$9,500**
Includes: Instruction Manual (070-7817-00), Universal Optical Input/Output Connector Kit (020-1885-00).

OCP 5502
2 GHz Optical Converter/Power Meter **$9,995**
Includes: Instruction Manual (070-7817-00), Universal Optical Input/Output Connector Kit (020-1885-00).

Opt. 1P – Delete OCP5502 Power Supply ..... **–$495**

OPTIONAL ACCESSORIES

Fiber Optic Cables – Refer to page 355 for complete list.

TEKPROBE™ Interface Cable – Order 012-1372-00 ..... **$375**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

SA-42 SA-46 SD-42 SD-46

Optical-to-Electrical Converters

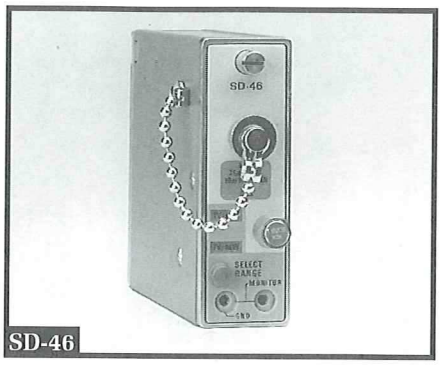
The SD and SA Series products are general purpose optical-to-electrical converters for use with oscilloscopes and spectrum analyzers.

SD-42
- 55 ps Optical Impulse Response
- DC – 6.4 GHz Optical Bandwidth
- 1000 nm – 1700 nm Spectral Response
- Mean Optical Power Monitor Function

SD-46
- 22 ps Optical Impulse Response
- DC –20 GHz Optical Bandwidth
- 1200 nm – 1650 nm Spectral Response
- Mean Optical Power Monitor Function

SA-42
- 50 ps Optical Impulse Response
- DC –7 GHz (–3 dB), to 15 GHz (–25 dB)
- 1000 nm – 1700 nm Spectral Response
- Ultra Low Noise

SA-46
- 22 ps Optical Impulse Response
- DC –20 GHz Optical Bandwidth
- 1100 nm to 1650 nm Spectral Response



Optical-to-Electrical Converter Plug-in Head.



Optical-to-Electrical Converter Module.

SD-42

The SD-42 is an optical-to-electrical converter for use with the Tektronix CSA 800 or 11800 Series sampling oscilloscopes equipped with an SD-22, SD-24, or SD-26 Sampling Head. The optical-to-electrical conversion is linear up to 25 mW peak input with a calibrated deflection factor from 50 µW/div to 5 mW/div for optical wavelengths at 1300 nm. This unit has a 55 ps optical impulse response (max. FWHM) with the SD-24 and SD-26 Sampling Heads and 60 ps optical impulse response (max. FWHM) with the SD-22 Sampling Head.

SD-46

The SD-46 is an optical-to-electrical converter plug-in head for use with the Tektronix CSA 800 or 11800 Series sampling oscilloscopes equipped with an SD-22, SD-24, or SD-26 Sampling Head. The optical-to-electrical conversion is linear up to 25 mW peak input with a calibrated deflection factor from 60 µW/div to 6 mW/div for optical wavelengths at 1300 nm. This unit has a 28.5 ps optical impulse response (max. FWHM) with the SD-24 and SD-26 Sampling Heads.

The SD-42 and the SD-46 Optical-to-Electrical Converters can be plugged into the sampling unit or attached by a sampling head extender for remote use. The head extenders come in either 1 meter (012-1220-00) or 2 meter (012-1221-00) options. Refer to next page for SD-42 and SD-46 head extenders.

Optical signal input on the SD-42, SD-46, SA-42, and SA-46 are through a standard FC fiber optic connector. Other connector types can be accommodated by using fiber optic jumper cables offered by Tektronix. The SD-42 and the SD-46 also have a mean power meter function with selectable 1 V/nW and 1 V/µW ranges.

STANDALONE CONVERTER MODULES

The SA-46 and SA-42 are standalone, wide-bandwidth optical-to-electrical converters packaged as small (palm-sized) compact modules that are easy to use.

The SA-42 and SA-46 Optical-to-Electrical Converters can be used with Tektronix oscilloscopes and spectrum analyzers, as well as other manufacturers' instruments. These wide-bandwidth optical converters support the analysis of the frequency and time domain characteristics of lightwave modulation in optical fiber based equipment and communications systems.

The SA-42 and SA-46 have an internal battery power source that can be recharged via the battery charger. The SA-42 and SA-46 units have integral battery test indicators to monitor battery status. The units have an FC optical fiber Input Connector and a female "K" electrical output connector.

TYPICAL APPLICATIONS

Characterization of opto-electronic devices such as laser diodes, light emitting diodes, optical waveguides, optical detectors and electro-optic modulators is becoming more important as applications for fiber optics in telecommunications and data communications expand. The SD-42 and the SA-42 Optical-to-Electrical Converters offer DC to 7 GHz bandwidth performance for wavelengths from 1000 nm to 1700 nm. The SD-42 and SD-46 Optical-to-Electrical Converters give fiber optic equipment developers and researchers optical waveform measurement capability from DC to 20 GHz in the 1200 nm to 1650 nm wavelength range. Measurements such as rise time, aberration, optical power vs. drive current and voltage, modulation bandwidth, and sensitivity can now be made at high bandwidth, accurately and easily.

The SA-42 or SA-46, combined with a Tektronix oscilloscope or spectrum analyzer, provides convenient optical waveform analysis capabilities. This is useful in the development and characterization of opto-electronic components and modules found in fiber optic transmission networks and fiber optic sensor systems.

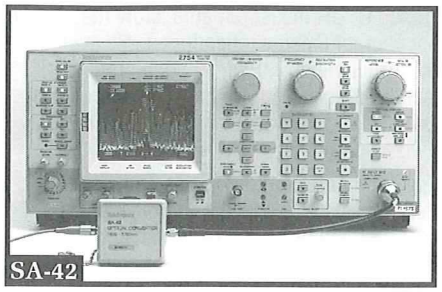
Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Optical-to-Electrical Converters

SA-42 SA-46 SD-42 SD-46



SA-42 Optical-to-Electrical Converter with Tektronix 2754 Spectrum Analyzer.

CHARACTERISTICS

PULSE CHARACTERISTICS

	SD-42	SD-46	SA-42	SA-46
Impulse Response	55 ps Max. (FWHM)	22 ps(FWHM)*1	50 ps Max (FWHM)	22 ps Max (FWHM)
Bandwidth	DC –6.4 GHz Optical	DC –20.0 GHz Optical	DC –7.0 GHz Optical	DC –20.0 GHz Optical
Spectral Response	1000 to 1700 nm	1200 to 1650 nm	1000 to 1700 nm	1100 to 1650 nm
Noise Equivalent Power	<23 pW/$\sqrt{Hz}$ *2 ≤33 µW*3 ≤10 µW*4	32 pW/$\sqrt{Hz}$ *2 ≤45 µW*3 ≤16 µW*4	23 pW/$\sqrt{Hz}$ *2	32 pW/$\sqrt{Hz}$ *2 ≤45 µW*3 ≤16 µW*4
Linear Response Range	≤25 mW Peak Power ≤5 mW Average Power	≤25 mW Peak Power ≤5 mW Average Power	≤25 mW Peak Power ≤5 mW Average Power	≤25 mW Peak Power ≤5 mW Average Power
Aberrations	≤15% p-p*5	≤10% p-p*5	≤15% p-p*5	≤10% p-p*5
Conversion Gain	40 mV/mW	29 mV/mW	40 mV/mW	29 mV/mW
Conversion Factor	25 µW/mV	35 µW/mV	25 µW/mV	35 µW/mV

MEAN OPTICAL POWER MONITOR

Dynamic Range	5 nW to 5 mW (60 dB)	5 nW to 5 mW (60 dB)	NA	NA
Sensitivity Range 1 Sensitivity Range 2	1 V/mW ±10% 1 V/µW ±10%	1 V/mW ±10% 1 V/µW ±10%	NA	NA

ENVIRONMENTAL

Operating Temperature Range	0°C to 50°C	0°C to 50°C	0°C to 50°C	0°C to 50°C

**1 Calculated (.44/Optical Bandwidth).*

**2 Root Hertz into 50 Ω.*

**3 System specification with SD-24/SD-26.*

**4 System specification with SD-22.*

**5 Within the first 400ps following a pulse input.*

ORDERING INFORMATION

SD-42
Optical-to-Electrical Converter **$3,995**
Includes: Red, 2 mm to Banana Lead, 1 m length (012-1286-00), Black, 2 mm to Banana Lead, 1 m length (012-1287-00), 50 Ω Semi-rigid Cable Link (174-1635-00), Instruction Manual (070-8671-00).

SD-46
Optical-to-Electrical Converter **$6,995**
Includes: Red, 2 mm to Banana Lead, 1 m length (012-1286-00), Black, 2 mm to Banana Lead, 1 m length (012-1287-00), 50 Ω Semi-rigid Cable Link (174-1635-00), Instruction Manual (070-8671-00).

SA-42
Optical-to-Electrical Converter **$3,995**
Includes: Instruction Manual (070-7733-00), Power Supply and Charger Unit (119-3716-00), DC Power Cable (174-1966-00), and Power Cable (161-0104-00).

SA-46
Optical-to-Electrical Converter **$6,995**
Includes: Instruction Manual (070-8047-00), Power Supply and Charger Unit (119-3716-00), DC Power Cable (174-1966-00), and Power Cable (161-0104-00).

INTERNATIONAL POWER PLUG OPTIONS (SA-42 AND SA-46 ONLY)
Opt. A1 – Universal Euro 220 V, 50 Hz. (161-0104-06).....**NC**
Opt. A2 – United Kingdom 240 V, 50 Hz. (161-0104-07) .....**NC**
Opt. A3 – Australian 240 V, 50 Hz. (161-0104-05) .....**NC**
Opt. A4 – North American 240 V, 60 Hz. (161-0104-08) .....**NC**
Opt. A5 – Switzerland 220 V, 50 Hz. (161-0167-00).....**NC**

OPTIONAL ACCESSORIES
Fiber Optic Cables – Refer to page 355 for complete list.

OTHER ACCESSORIES
Sampling Head Extender Cables –
(1 m). Order 012-1220-00 (SD-42 and SD-46) **$850**
(2 m). Order 012-1221-00 (SD-42 and SD-46) **$935**
10 kHz to 21 GHz DC Block –
("N" Type). Order 015-0509-00.....**$490**
(K to "N" Type Adapter). Order 015-0369-00 .....**$65**
See General Customer Information Section for additional description.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

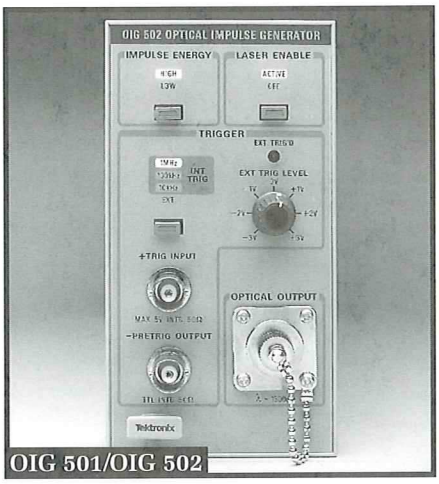
OIG 501
OIG 502

Optical Impulse Generators

The OIG Series products generate extremely narrow laser impulses for use in general purpose optical reflection measurements and opto-electronic device characterization.

OIG 501/OIG 502

- Optical Wavelength
  –OIG 501-850 nm
  –OIG 502-1300 nm
- Near Gaussian Pulse Shape (Low Energy Mode)
- Easy to Use Front-Panel Controls
- Compact/Small Size
- Selectable Pulse Repetition Rates
- Multiple Optical Connector Types Accommodated
  –FC/PC
  –DIN 47256
  –ST*1
  –SC
- Millimeter Resolution Optical Time Domain Reflectometry
- Optical Reflection Measurement
- Optical Component Characterization



OIG 501/OIG 502

OIG 501/OIG 502

The OIG 501/OIG 502 Optical Impulse Generators are laser impulse sources that operate at 850 and 1300 nm respectively. The OIG 500 Series sources produce very narrow and stable optical pulses at various user selectable repetition rates.

The user may select either internal or external triggering. The trigger level can be adjusted from ±3 V. The internal triggering repetition rates are 10 kHz, 100 kHz or 1 MHz. These rates are selectable with front-panel switches.

The output is stabilized to provide repeatable output signal levels. These units are compatible with either the Tektronix TM 500 or TM 5000 Series Modular Instrument Mainframes.

The OIG 501/OIG 502 have two user-selectable output pulse modes: high impulse energy or low impulse energy. The OIG 501/OIG 502 have a 60 ns pre-trigger for easy viewing of the impulses on a variety of oscilloscopes.

Highly stable measurements are made possible by a trigger jitter of ≤5 ps (RMS) and an impulse amplitude variation of <±10% at impulse repetition rates between 10 kHz and 1.0 MHz.

MILLIMETER RESOLUTION OPTICAL TIME DOMAIN REFLECTOMETRY

When combined with other Tektronix instruments such as an optical-to-electrical converter (OCP5000, P6700 or SD/SA-40 Series products) and a high-performance oscilloscope (CSA 404, CSA 803A, 11400, or 11800 Series products) the OIG 500 Series Optical Impulse Generators can be used to perform extremely high resolution optical time domain reflectometry (OTDR).

These OTDR measurements allow the precise location of Fresnel reflecting single events to <0.1 millimeter. Multiple Fresnel reflectors can be precisely located and measured even when they are spaced as close together as two centimeters.

For more information on this application request Tektronix Application Note #3TW-8058-1 ("High Resolution Optical Reflection Testing with the Tektronix OIG 500 Series Optical Impulse Generators").

OPTICAL REFLECTION MEASUREMENTS

Optical reflections in fiber optic systems can seriously degrade transmission performance, especially in highs-peed communications links using laser sources. Characterization of reflective performance of optical connectors and components can be crucial to ensuring signal integrity in these systems. Multiple reflections can occur throughout the optical pathway. It is useful for designers to identify and isolate the specific sources of these reflections.

The OIG 500 Series instruments can be used with the Tektronix CSA 803A, CSA 404 Communication Signal Analyzers or other 11000 Series oscilloscopes to evaluate optical reflections. The return loss of optical reflections can be measured to 50 dB levels.

OPTICAL COMPONENT CHARACTERIZATION

With the OIG 500 Series and the CSA 803A or CSA 404, the user can easily characterize optical devices in terms of their frequency response, rise time, and aberration levels.

**1 ST is a registered trademark of AT&T.*

CHARACTERISTICS

	OIG 501	OIG 502
Wavelength	850 nm*1	1300 nm*2
Impulse Width		
Low Energy	≤35 ps	≤35 ps
High Energy	≤300 ps	≤300 ps
Max Output Optical Power		
Low Energy	≥15 mW	≥5 mW
High Energy	≥30 mW	≥15 mW
Impulse Amplitude Variation	10% from 10 kHz to 1.0 MHz	
External Trigger	DC to 1.0 MHz	DC to 1.0 MHz
Internal Trigger	10 kHz 100 kHz 1.0 MHz	10 kHz 100 kHz 1.0 MHz

**1 ±50 nm* **2 ±20 nm*

Note: For further technical information request Product Data Sheet #3TW-7797-1.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

OIG 501
Optical Impulse Generator.....**$9,435**

OIG 502
Optical Impulse Generator.....**$9,945**

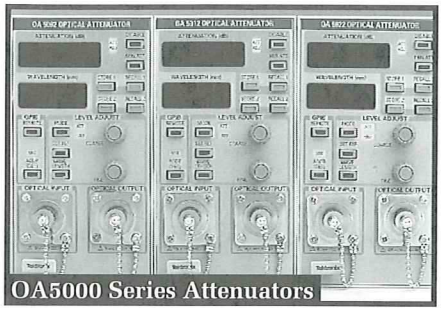
Both Include: Instruction Manual (070-7818-01), Universal Optical Input/Output Connector Kit (020-1885-00).

OPTIONAL ACCESSORIES

Fiber Optic Cables – Refer to page 355 for complete list.

Optical Attenuators

OA5002 OA5022 OA5012 OA5032


OA5000 Series Attenuators

A Vital Link in Optical Systems Analysis

Tektronix Programmable Optical Attenuators provide a convenient, accurate and cost-effective means of controlling optical power levels in fiber optic media.

The OA5000 Series instruments provide variable attenuation of single and multimode fiber optic signals commonly used in communications equipment. Attenuation levels can be varied manually, using the front-panel controls or automatically via programmable computer control. These instruments are packaged as compact single-wide plug-in units compatible with Tektronix TM 5000 Series Modular Instrument Mainframes. Six units will fit side by side in a TM5006 Mainframe taking up approximately seven inches of vertical space in a standard 19-inch wide equipment rack.

TYPICAL APPLICATIONS

Communication standards using optical components typically require that the receiver operate over a given optical power range. This specification is tested by monitoring the bit error rate (BER) as a function of optical power. The CSA 907 BER Test Set and OA5000 Series Optical Attenuators meet the requirements for performing this test.

FDDI/LAN DESIGN

Using the OA5000 Series Optical Attenuators with the CSA 907 BER Tester and the CSA 404 Communications Signal Analyzer, network equipment designers can characterize, with repeatable results, the system performance over the specified optical power range.

Signal levels may range from –14 dBm to –24 dBm for FDDI systems. The OA5022 Optical Attenuators provide the signal level variation and input fiber size required for FDDI compliance testing.

SDH/SONET COMPLIANCE TESTING

SDH/SONET compliant signal levels may be as high as +2 dBm to as low as –34 dBm. To verify the performance of SONET equipment over these signal levels, it is necessary to have calibrated attenuators with at least this much range. The OA5002 is the attenuator of choice for SDH/SONET testing.

MANUFACTURING AND OTHER AUTOMATED TEST APPLICATIONS

Because the OA5000 Series Optical Attenuators are GPIB Programmable, these units can be operated in a completely automated environment. With the step size of 0.01 dB and a calibrated attenuation range of 0 to 60 dB (continuous), measuring parameters such as receiver linearity is quickly and reliably accomplished. Also, with their storable attenuation levels, the OA5000 Series Optical Attenuators are very useful for repeat measurements in manufacturing environments.

**1 ST is a registered trademark of AT&T.*

CHARACTERISTICS

Wavelength Range		750 to 1600 nm
Input	OA5002	Single Mode fiber
	OA5012	50 µm Multimode fiber
	OA5022	62.5 µm Multimode fiber
	OA5032	100 µm Multimode fiber
Insertion Loss		≤2.0 dB
Return Loss		≤–45 dB*1 ≤–25 dB*2
Attenuation Range		≥60 dB*3 ≥50 dB*4
Disable		≥100 dB*5 ≥90 dB*5
Accuracy		±0.15 dB (±0.05 dB typ.)
Repeatability		±0.05 dB
Linearity		±0.05 dB

**1 OA5002*
**2 OA5012/OA5022/OA5032*
**3 750-1350 nm*
**4 1350-1600 nm*
**5 OA5032*

Note: [a]For further technical information request Product Data Sheet #3TW-8032-1. [b]For information on OA5000 Series compatibility with other fiber sizes, contact your local Tektronix sales office.

FEATURES

- 750 nm to 1600 nm Calibrated Spectral Response in One Unit
- Multiple Optical Connector Types Accommodated
  –FC/PC
  –DIN 47256
  –ST*1
  –SC
- GPIB, IEEE 488.2 Controllable
- Models for Single and Multimode Fiber
- Can Be Mounted Six Abreast in Standard Rackmount
- Evaluate Receiver Sensitivity as a Function of Optical Power
- General Development of Fiber Optic Equipment
- SDH/SONET and FDDI Standards Testing
- OTDR Attenuation Measurement Calibration
- Optical Power Meter Linearity Calibration
- Manufacturing Test of Fiber Optic Equipment

The OA5000 Series products provide calibrated levels of optical path attenuation for use in general purpose fiber optic measurements and optical receiver characterization.

ORDERING INFORMATION

OA5002
Optical Attenuator **$7,395**
Includes: Single Mode Input and Output; Universal Optical Input and Output Connector Kit (020-1885-00); and Instruction Manual (070-7612-00).

OA5012
Optical Attenuator **$7,135**
Includes: 50 Micron Multimode Input and Output; Universal Optical Input and Output Connector Kit (020-1885-00); and Instruction Manual (070-7612-00).

OA5022
Optical Attenuator **$7,135**
Includes: 62.5 Micron Multimode Input and Output; Universal Optical Input and Output Connector Kit (020-1885-00); and Instruction Manual (070-7612-00).

OA5032
Optical Attenuator **$7,135**
Includes: 100 Micron Multimode Input and Output; Universal Optical Input and Output Connector Kit (020-1885-00); and Instruction Manual (070-7612-00).

OPTIONAL ACCESSORIES
Fiber Optic Cables – Refer to page 355 for complete list.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The OA5002/OA5012/OA5022 comply with IEEE Standard 488.2, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

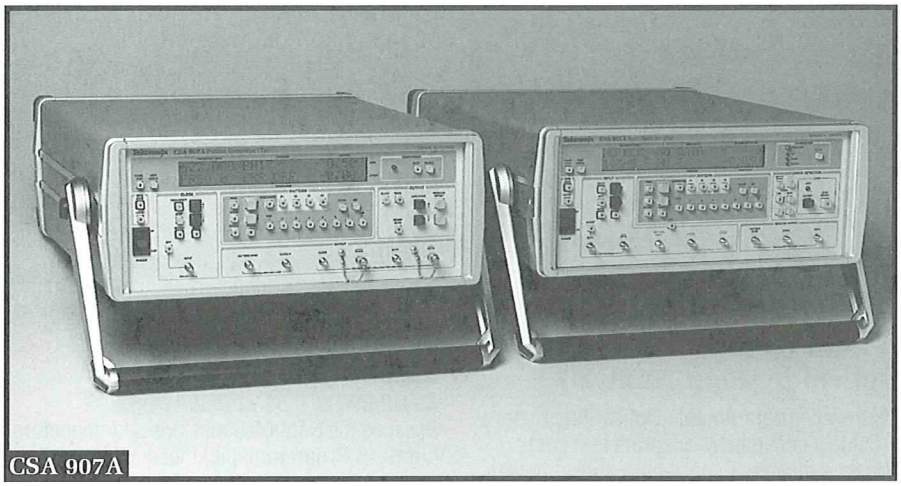
CSA 907A

Bit Error Rate Tester

The CSA907A Bit Error Rate Tester is a stimulus-response system with high speed serial pattern generator and companion error detection.

CSA 907A

- SDH/SONET and FDDI Pattern Generation
- 150 kHz to 700 MHz Internal PLL Clock Source
- PRBS Patterns: $2^{(7,15,17,20,23)} - 1$
- Standard 128 kbit Programmable Word Memory
- PC Based Frame Editing Software for Added Versatility
- Error Injection: Single Errors, Selectable Error Rate, or Gated Errors
- Differential and Single Ended Inputs
- External Reference Data Input for User Generated Patterns
- Automatic Data/Clock Setup
- Versatile Bit Error Rate Measurements and Analysis
- Centronics, RS-232 and GPIB (IEEE 488.2) Remote Interfaces
- ECL, PECL and Programmable Voltage Levels


CSA 907A

CSA 907A

The CSA 907A Bit Error Rate Tester is a stimulus-response system that features a high-speed serial pattern generator, the CSA 907A Tx, and a companion error detector, the CSA 907A Rx. Each unit is portable, and can be used in a lab, production testing, or field environment. The CSA 907A Bit Error Rate Tester can be used to evaluate transmission quality of high-speed modules and systems for a variety of testing applications including SDH/SONET, FDDI, and satellite communications.

Along with the CSA 803A Communications Signal Analyzer, and a full line of optical test products, a complete SDH/SONET/FDDI Standards Test System is formed to verify compliance to physical layer standards for bit error rate, noise, jitter, and mask templates.

DATA PATTERN GENERATION

Pseudo Random Bit Sequence patterns (PRBS) simulate real data and are important in order to make statistical measurements such as error rate, jitter and noise on communication devices, modules and systems. The CSA 907A Tx has the ability to generate five PRBS patterns that include $2^{(7,15,17,20,23)} - 1$. In addition, single errors, a programmed error rate, or burst errors can be transmitted in the data stream for continuity checks and system stress evaluation. In addition to the PRBS patterns, the CSA 907A features eight 128 k programmable words.

FDDI/SDH/SONET PATTERN GENERATION

For long word lengths, the FrameWriter™ software package, together with a 128 k memory, provide the tools to make application-specific or user-defined patterns. Applications include the ability to send 20 contiguous STS-1 patterns, up to six contiguous STM-1/STS-3c patterns, or a single STM-4/STS-12c pattern. To insure test repeatability, 10 fixed ROM based patterns are included:

- FDDI: 4B/5B NRZ pattern, 4B/5B NRZ-I pattern
- SDH: STM-1 pattern, STM-1 scrambled pattern
- SONET: STS-1 pattern, STS-1 scrambled pattern, 4 STS-1 patterns, 4 STS-1 scrambled patterns, STS-3 pattern, STS-3 scrambled pattern

DATA PATTERN EDITING SOFTWARE

A menu driven IBM-PC compatible software package, FrameWriter™, is provided with the CSA 907A. FDDI and SDH/SONET patterns are easily created and edited on a computer or controller external to the CSA 907A, and then downloaded to the CSA 907A through the GPIB interface. These signal frames can then be quickly and reliably recalled with a single front-panel button on the CSA 907A or recalled automatically under program control.

VERSATILE CLOCKING SOURCES

The CSA 907A has an internal PLL clock source that transmits patterns at speeds of 150 kHz to 700 MHz, thereby eliminating the need for an external clock synthesizer. The clock source has a resolution of 1 kHz and 10 ppm stability. This extra resolution is especially important in:

- SDH/SONET applications where frequencies are allocated in increments of 10 kHz
- Testing a clock recovery circuit where the user wants to sweep across the bandpass of the PLL to check lock-in and hold ranges

Continued on next page.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The CSA907A complies with IEEE Standard 488.2-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Bit Error Rate Tester

CSA 907A

Ten commonly used frequencies can be stored and later recalled for repeatability and standards compliance testing. For applications where the test is to be performed using a known reference clock, the CSA 907A Tx has the ability to accept an external clock input. The external clock input can be used to inject jitter in conjunction with an external signal generator.

The CSA 907A Tx external clock input is conditioned to accept a clock burst, and output a pattern with periods of no data (burst mode). The CSA 907A Rx can recognize the pattern with periods of no data without losing synchronization. The burst mode simulates communication and telemetry systems that often send data in "bursts" with variable times of inactivity between bursts.

AUTO SET AND SYNC

The CSA 907A "auto-set" synchronization feature allows effortless system setup and operation. The "auto-set and sync" feature simplifies adjusting multiple input parameters by providing automatic clock/data threshold level, clock to data phase adjustment, appropriate data pattern selection (and polarity), and bit synchronization to data patterns. These powerful automatic synchronization features allow the user to immediately perform a wide range of tests on systems and components.

VERSATILE MEASUREMENT AND ANALYSIS

The CSA 907A allows a wide range of concurrent Bit Error Rate measurements and analysis for fully characterizing and testing communication devices, subsystems, and links. In addition to total errors and error rate, the Error Detector measures errors in a programmable time, bit length, or sliding window. Report printouts are available both at end-of-test, and when exceeding a user defined error threshold.

EXTERNAL REFERENCE DATA

The external data reference mode in the CSA 907A allows the user to measure and analyze transmission errors for virtually any user generated data pattern. It is useful when evaluating the performance of a component or system against a user supplied reference data. Delay compensation up to 4 ns, data threshold adjust, and input termination voltage selection are also possible with the external reference data input.

OPERATIONAL SUPPORT

For test repeatability and programmed control, the CSA 907A supports both RS-232 and IEEE 488.2 GPIB (with Tektronix Standard Codes and Formats) remote interfaces. The battery backed-up non-volatile RAM memory provides storage of eight 128 kbit word patterns, ten clock frequencies, error measurements and unit setup for loss of power conditions. The Error Detector provides monitor outputs for viewing eye diagrams on the CSA 803A and CSA 404 Communication Signal Analyzers. The rear panel has specialized inputs and outputs for customized data generation and BER measurements.

Characteristics

CSA 907A TX PATTERN GENERATOR

Frequency Range: – 150 kHz to 700 MHz (Mbit/s) with internal or external clock.

Resolution – 1 kHz with 10 ppm stability.

Frequency Memory – 10 frequencies.

External Clock Input – Selectable termination: (50 Ω to GND, or 50 Ω to –2 V) DC coupled, 1.4 V p-p.

Data Output Formats – NRZ, Normal and complement; PRBS patterns and programmable WORD.

PRBS Patterns – $2^{(7,15,17,20,23)}$-1.

Maximum WORD Length – 128 kbits.

WORD Memories – 8 x 128 kbits.

Data and Clock Outputs – 50 Ω true and complement (differential); Amplitude: 500 mV p-p to 2 V p-p into 50 Ω; Baseline Offset: –2.0 V to +1.8 V (50 Ω to GND), –3.0 V to +0.8 V (50 Ω to –2 V), –0.5 V to 3.3 V (50 Ω to +3 V); Rise/Fall Times: 200 ps, typical at 1 V p-p.

Internal Error Injection – 1 x $10^{-3, 4, 5, 6 \text{ or } 7}$ rate.

External Error Injection – 1 error injected for each rising edge, ECL.

Auxiliary Outputs – Clock/4 and pattern sync; 500 mV p-p into 50 Ω centered to GND.

CSA 907A RX ERROR DETECTOR

Frequency Range – Clock Input: 150 kHz to 700 MHz; Data Input: 150 kbits to 700 Mbit/s.

Error Measurements and Analysis – Measurements: BER, total errors; Sliding BER Window: *Time* - 1 second to 24 hours, *Bits* - 1 x 108 to 1 x 1016; Error Analysis: Error Seconds, Error Free Seconds, Severely Error Seconds, Degraded Minutes, Unavailable Seconds, Loss Of Signal, Threshold Error Seconds.

Clock, Data and Data Reference Inputs – NRZ, RZ, Normal and complement (data only); Input Threshold: –2 V to + 4 V (50 Ω to GND), –3 V to + 3 V (50 Ω to –2 V), –1.5 V to + 4.5 V (50 Ω to + 3 V); Input Amplitude: 0.5 to 6.0 V p-p; Impedance: 50 Ω, selectable terminations (GND, –2 V, +3 V, or floating); Delay Range: 0 to 4 ns, variable.

Monitor Outputs – Pattern sync, clock, data, and error; DC coupled, 500 mV p-p centered on GND.

CSA 907A TX/CSA 907A RX GENERAL SPECIFICATIONS

Front-Panel Connectors – SMA female.

Power Requirements – 90 to 132 VAC, or 180 to 264 VAC, 47 to 63 Hz, 100 VA max.

Operating Temperature – 0 to 50°C.

EMI – Complies with FCC A and VDE B specifications.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width	366	14.4
Height	152	6
Depth	340	13.4
Weight ≈	**kg**	**lb.**
Net	10.9	24

ORDERING INFORMATION

CSA 907A
Bit Error Rate Tester.....**$47,450**
Includes: Pattern Generator, Error Detector, CSA 907A User Manual (P/N 070-8685-00), CSA 907A Programmer Manual (P/N 070-8686-00), FrameWriter™ IBM-PC Compatible Software Frame Editing Package.

INSTRUMENT OPTIONS
Opt. 1M – Rackmount for One Unit.....**+$295**
Opt. 2M – Rackmount for Both Units.....**+$590**
Opt 2A – 75 Ω Terminations on Both Units.....**+$1,990**
Opt 2R – 75 Ω Terminations on Error Detector.....**+$995**
Opt. 2T – 75 Ω Terminations on Pattern Generator.....**+$995**
Opt. 4T – Delete CSA 907A Error Detector.....**–$13,000**
Opt. 4R – Delete CSA 907A Pattern Detector.....**–$15,000**

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1-A5 – Available. See General Customer Information Section for additional description.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The CSA 907A complies with IEEE Standard 488.2-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Q32605

Optical Receiver Plug-in for RF Spectrum Analyzer

This plug-in is used with an Advantest microwave Spectrum Analyzer to characterize high bandwidth analog optical sources operating in the 1200 nm to 1600 nm wavelength band.

- Plug-in for Advantest RF Spectrum Analyzers
- Compatible with R3265A and R3271A Analyzers
- Direct on-screen readout of measurements
- High optical input sensitivity
- Wide frequency range to 2.4 GHz
- Excellent frequency response flatness
- High input return loss

ADVANTEST Q32605

This plug-in combined with an Advantest RF Spectrum Analyzer is used to measure and display certain specific noise and modulation characteristics of optical sources and optical fiber amplifiers. These sources are operating in the 1200 nm to 1600 nm optical wavelength range and operating in continuous wave or with analog modulation in the 6 MHz – 2.4 GHz band. Such sources are used in telecommunications and cable TV transmission.

The Q32605 allows an Advantest R3265A or R3271A RF Spectrum Analyzer to directly measure the percent of modulation, average optical power, carrier-to-noise (C/N) ratio, and relative intensity noise (RIN) of single mode optical sources such as distributed feedback (DFB) lasers. All of these measurements are used to characterize fiber optic sources used in analog cable TV transmission.

Additionally, average optical power and RIN measurements are important in the characterization of lasers and fiber amplifiers used in digital telecommunications. These type measurements are made in design engineering, manufacturing, standards compliance test, and service applications using the above optical sources.

GENERAL

The Q32605 is a palm-sized plug-in module fitting into a front-panel slot in the Advantest R3265A or R3271A RF Spectrum Analyzer. This plug-in is a special purpose optical-to-electrical (O/E) converter whose electrical outputs are both AC and DC coupled into the spectrum analyzer. No modification to the analyzer is necessary to use this plug-in. Use of this plug-in with earlier Advantest R3265/3271 Spectrum Analyzers may require factory modification of the analyzer. Contact Tektronix for further information.

KEY PRODUCT FEATURES AND BENEFITS

The Advantest R3265A or R3271A RF Spectrum Analyzers have special built-in firmware that allows the operator to directly and easily make the above measurements by utilizing simple menu selections provided on the instrument front-panel display. Unlike alternative measurement methods, no time-consuming external equipment connection, reconfiguration or off-line manual computations are required by the operator to acquire the measurement data and display the results.

CHARACTERISTICS

Optical input wavelength range – 1200 nm to 1600 nm.

Maximum input optical power – Average light: +10 dBm. Modulated light: –7 dBm.

Modulated optical power measurements – Frequency range: 6 MHz to 2.4 GHz. Flatness: ±1.8 dBm, optical.*1 Optical input sensitivity: –57 dBm, optical,*2 –160 dB/Hz *3.

Average optical power measurements – Accuracy: ±0.25 dB. Measurement range: –20 dBm to +10 dBm.

Measurement function – RIN measurement: Directly read on Spectrum Analyzer screen. % modulation measurement: Directly read on Spectrum Analyzer screen.

Input/output – Optical input: FC/PC type connector, single mode fiber.*4 RF output: SMA type electrical connector.

Input return loss – ≤ 45 dB.

Operating environment – 0 to 40°C, ≤ 85% relative humidity.

Storage environment – –20 to +60°C, ≤ 90 % relative humidity.

**1 130 MHz as the standard*
**2 Noise level converted to light input. For the RF spectrum analyzer: RBW = 1 Hz, VBW = 30 Hz, Att = 0 dB.*
**3 Noise level converted to RIN. Average optical power: +8dBm*
**4 When a low reflection PC optical connector is used.*

APPLICATIONS

- **Characterization of cable TV optical assemblies:**
  - **Laser diode transmitters**
  - **Erbium doped fiber amplifiers (EDFA)**
- **Direct measurement of cable TV analog parameters:**
  - **Relative intensity noise (RIN)**
  - **Carrier-to-noise ratio (C/N)**
  - **Percent modulation**

ORDERING INFORMATION

Q32605
Advantest Optical Receiver Plug-in *1
Includes: Instruction Manual
**1 Contact your local Tektronix sales office*

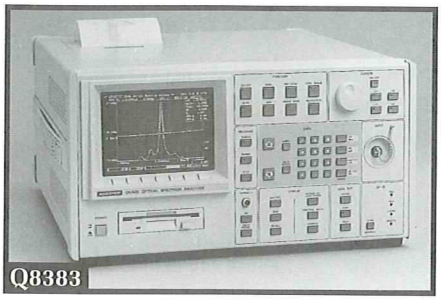
ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

Optical Spectrum Analyzers

Q8383
Q8381A
Q8344A



Advantest Q8383

The Q8383 is an outstanding general purpose optical spectrum analyzer for use in the spectrum analysis of laser diodes (LDs), for measuring the wavelength characteristics of other optical components, and characterizing erbium doped fiber amplifiers (EDFA). The wide dynamic range of 65 dB has been achieved with a design employing a Czerny-Turner type double-pass monochromator which uses Advantest's unique optical technology. These innovations facilitate side mode suppression ratio (SMSR) measurements on DFB laser diodes and light level measurements of amplified spontaneous emissions (ASE) on fiber amplifiers.

For measurement of pulse modulated light, the Q8383 provides a pulse light mode and synchronous input terminal. This pulse mode measures the peak level within a specified gate time, while the synchronous input terminal measures the light pulse by controlling measurement timing from an external input signal. This spectrum analyzer is ideal for measurements when circulating loop tests are performed in long haul transmission experiments.

During optical tests on optical amplifier characteristics, gain and noise figure (NF) measurement accuracy are greatly affected by the characteristic performance of the spectrum analyzer. Critical characteristics include the dynamic range, polarization dependence, level accuracy, linearity, and wavelength resolution setting accuracy. The Q8383 provides a curve-fitting function ensuring that EDFA ASE level, gain, and NF measurements can be made easily with high accuracy using the optical amplifier NF measurement function.

The Q8383's unique measurement method offers an extremely low polarization dependence which is within ±0.05 dB at any wavelength. Additionally the wavelength sensitivity compensation is performed for each and every unit. This results in a very low polarization dependency.

Advantest Q8381A

The Q8381A is a general purpose optical spectrum analyzer utilizing a single-pass monochromator design. Like the Q8383 it provides a high sensitivity measurement at a fast sweep speed. The Q8381A also provides a pulse measurement mode and an optical power measurement with trend display capability. The Q8381A provides a lower dynamic range but wider optical wavelength range and lower price than the Q8383. Like the Q8383, the Q8381A has a battery backed-up internal memory and an MS-DOS compatible floppy disk drive for measurement and set-up data storage and retrieval. Although low by competitive standards, the polarization dependence of the Q8381A is not as low as that of the Q8383.

Advantest Q8344A

The Q8344A makes use of a Fourier spectrum analysis approach based on a Michelson interferometer. Because of this, the Q8344A can measure optical coherence that cannot be obtained directly using diffraction type optical spectrum analyzers which use monochromators to make their measurements.

The features of this analyzer make it very effective for the evaluation of laser diodes used in optical data storage equipment, fiber optic gyroscopes, and related applications. The Q8344A has a built-in He-Ne laser that functions as the wavelength reference and ensures the wavelength measurement accuracy is maintained within ±0.1 nm (at 1.3 µm). Because of this internal reference source, no calibration is needed thereby allowing this analyzer to provide long-term repeatable measurements.

This instrument is exceptionally well suited to the measurement of coherence length of LD and LED optical sources operated in continuous wave mode. Unlike the Q8383 and Q8381A, the Q8344A is not suitable for spectral analysis of modulated light sources.

FEATURES

Q8383

- Double-pass Diffraction Type Measurements
- Wide Dynamic Range
- High Accuracy
- Low Polarization Dependence
- Excellent Linearity
- High Accuracy Wavelength Setting Resolution
- Optical Amplifier Noise Figure Measurement Function
- Accurate Pulse Measurements

Q8381A

- Single-pass Diffraction Type Measurements
- Wide Wavelength Range
- High Sensitivity
- Low Polarization Dependence
- Power Monitoring with Trend Display
- Versatile Memory Functions

Q8344A

- Michelson Interferometer Type Measurements
- Direct Coherence Length Measurements
- Fast Scanning

These instruments analyze and display the optical spectral content of lightwave emissions from lasers and light emitting diodes operating in the 350 nm to 1750 nm wavelength band.

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The Q8383, Q8381A, Q8344A comply with IEEE Standard 488.1-1987.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

APPLICATIONS

- **Optical Fiber Amplifier Measurements**
- **Communications Laser and LED Transmitter Characterization**
- **Manufacturing Test of Optical Sources**
- **Optical Source Standards Compliance**

Q8383
Q8381A
Q8344A

Optical Spectrum Analyzers

CHARACTERISTICS

	Characteristic	Q8383	Q8381A	Q8344A
Wavelength	Measurement range	550 nm to 1750 nm	350 nm to 1750 nm	350 nm to 1750 nm
	Resolution settings	0.1, 0.2, 0.5, 1.0, 2.0, 5.0 nm	0.1, 0.2, 0.5, 1.0, 2.0, 5.0 nm	0.05 to 0.1 nm max resol. (at 0.85 & 1.31 µm)
	Accuracy	±0.5 nm	±0.5 nm	±0.1 nm
	Repetitive reproducibility	≤ 0.1 nm	≤ 0.1 nm	
Level	Measurement range (input sensitivity)	–85 to +10 dBm (1.2 to 1.65 µm) –55 to +10 dBm (0.55 to 1.75 µm)	–85 to +10 dBm (1.1-1.6 µm) –75 to +10 dBm (0.7-1.6 µm) –70 to +10 dBm (0.4-1.65 µm) –60 to +10 dBm (0.35-1.75 µm)	–70 to +10 dBm (0.7-1.6 µm) –60 to +10 dBm (0.45-1.7 µm) –45 to +10 dBm (0.35-1.75 µm)
	Polarization dependence	within ±0.05 dB	≤ 0.05 dB pk-pk	–
	Accuracy	within ±0.4 dB	≤ ±1.5 dB, (at 0.633, 1.31, & 1.55 µm)	≤ ±2.0 dB, (at 0.85 or 1.31 µm)
	Linearity	±0.05 dB (1.2 to 1.65 µm, –50 to +10 dBm)	±0.05 dB at ≤20 dB, ±1.0 dB at ≤40 dB	±0.05 dB at ≤10 dB, ±1.0 dB at ≤25 dB
	Scale	0.2, 0.5, 1.0, 2.0, 5.0, 10.0 dB/div and linear	0.2, 0.5, 1.0, 2.0, 5.0, 10.0 dB/div and linear	0.2, 0.5, 1.0, 2.0, 5.0, 10.0 dB/div and linear
	Dynamic range	≥ 55 dB (±0.5 nm from peak) ≥ 65 dB (±1.0 nm from peak)	≥ 40 dB (±1.0 nm from peak) ≥ 50 dB (±5 nm from peak)	–
Sweep	Measurement time	≤ 0.8 sec (≤ 200 nm span)	≤ 0.8 sec (≤ 200 nm span) ≤ 1.5 sec (≤ 500 nm span)	≤ 1.5 sec (SNGL mode, 1 avg.)
Pulse light measurement	Peak hold mode	≥ 10 ns pulse width, (≥ 30 µs recommended) ≥ 0.1 Hz pulse rep. rate Gate time: 1 ms to 10 sec	≥ 30 µs pulse width Gate time: 1 ms to 10 sec	N/A
	Synchronous (gated) measurement input	Sync. sig. input level: 3.5 V high, 1.5 V low, pos. logic Min optical pulse width: ≥10 ns (30 µs recommended) Optical pulse rep. rate: DC to 100 MHz	Sync. sig. input level: 3.5 V high, 1.5 V low, pos. logic Min optical pulse width: ≥10 ns (30 µs recommended)	N/A
Processing functions	Data storage	Battery backed-up RAM, MS-DOS format floppy disk	Battery backed-up RAM, MS-DOS format floppy disk	Battery backed-up RAM
	Calculation, analysis, & display	Optical amp NF function Power monitor & trend Measurement cursors Dual screen & superimpose display Split display 3-D display function Averaging	Auto optimum settings Auto peak search Measurement cursors Power monitor & trend Luminosity compensation 3-D display function Superimpose & split displays, Averaging	Coherence analysis Auto optimum settings Auto peak search Measurement cursors 3-D display function Averaging
Input/Output	Optical input	FC type connector	FC type connector	FC type connector
	Data output	GPIB IEEE 488 control Internal printer Direct plotter output	GPIB IEEE 488 control Internal printer Direct plotter output	GPIB IEEE488 control Internal printer option Direct plotter output
General	Operating environment	–10 to +40° C, ≤ 85% RH (noncondensing)	–10 to +40° C, ≤ 85% RH (noncondensing)	–10 to +40° C, ≤ 85% RH (noncondensing)
	Power supply	90 to 250 VAC, 48 to 66 Hz, ≤ 180 VA	90 to 250 VAC, 48 to 66 Hz, ≤ 180 VA	90 to 132 V AC , (198 to 250 V AC optional), 48 to 66 Hz, ≤ 180 VA
	Dimensions	424 (W) x 221 (H) x 450 (D) mm	424 (W) x 221 (H) x 450 (D) mm	424 (W) x 221 (H) x 500 (D) mm
	Weight	≤ 28 kg	≤ 29 kg	≤ 27 kg

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The Q8383, Q8381A, Q8344A comply with IEEE Standard 488.1-1987.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

ORDERING INFORMATION

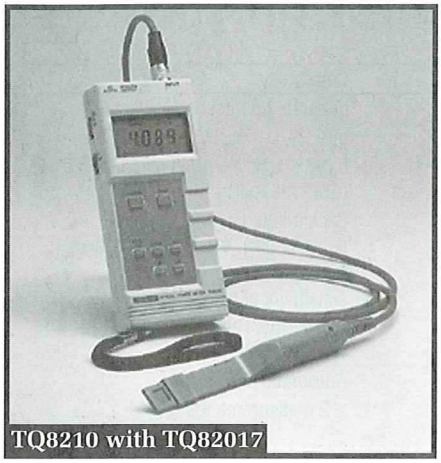
Q8383
Advantest Optical Spectrum Analyzer.....**$43,900**
Includes: Instruction Manual, Power Cable (AO1402).

Q8381A
Advantest Optical Spectrum Analyzer.....**$35,000**
Includes: Instruction Manual, Power Cable (AO1402), Printer Paper (AO9075), and 3.5 Floppy Disk.

Q8344A
Advantest Optical Spectrum Analyzer.....**$33,800**
Includes: Instruction Manual, Power Cable (AO1402)
Opt. 01 – Built-in Printer (with paper).....**+$1,950**
Opt. 10 – 200 µm Fiber Input.....**+$950**
Opt. 40 – 198 to 250 V AC Power.....*1
AO9075 – Thermal printer paper for built-in printer (5 roll box).....**$53**

*1 *Contact your local Tektronix representative for price information.*

Handheld Optical Power Meter


TQ8210 with TQ82017

The Advantest TQ8210 is a general purpose battery or AC powered portable optical power meter. It is a compact and easy to use handheld unit weighing less than 400 g. The TQ8210 can be operated continuously on its internal battery supply for up to 13 hours before recharge. Optical power measurements can be made over –60 dBm to +17 dBm levels and in the 400 nm to 1650 nm wavelength range using one of the available power sensors specified below.

KEY FEATURES

Depending upon the measurement requirements and the physical configuration needed, one of several power sensor units can be selected to work with the TQ8210 mainframe. Optical power sensors using silicon photo diodes are available for use at shorter wavelengths. At longer wavelengths, sensors based on germanium (Ge) or indium-gallium-arsenide (InGaAs) are available and recommended. The TQ8210 automatically applies a wavelength sensitivity compensation factor to the optical power measurement for any of the available power sensors attached.

To allow maximum flexibility in making measurements in tight spaces or awkward positions, the power sensors are connected to the mainframe using a flexible electrical cable which is detachable from the handheld unit. The mechanical design of some power sensors also allow them to be used with both free-space optical beams as well as bare or connectorized optical fibers. A wide range of fiber connector types are accommodated by selecting the appropriate connector adapter for the sensor being used.

The TQ8210 has several built-in functions that contribute to its measurement capability and ease of use. Automatic measurement range selection and max.-value hold is available with a button push. Also, measurement smoothing using a variable length moving average can be invoked using one button.

Power measurements can be conveniently displayed on a linear power scale (milliwatts, microwatts, nanowatts) or on a logarithmic absolute (dBm) or relative (dBr) scale. Sensor measurement offset is automatically detected and compensated.

TQ8210 FEATURES

- Automatic wavelength sensitivity compensation
- Multiple sensors available
- Battery and AC line powered
- High sensitivity
- Wide dynamic range
- Measurement smoothing
- Max-hold function
- Backlit liquid crystal display
- Analog output
- Easy to use

The TQ8210 is a general purpose handheld instrument providing portable optical power measurement in the 400 nm to 1650 nm wavelength band.

TQ8210 OPTICAL POWER SENSOR SPECIFICATIONS:

Characteristic	TQ82014/TQ82017	TQ82015	TQ82018A
Wavelength range	400 to 1100 nm	800 to 1600 nm	800 to 1650 nm
Power range*1	–60 to +17 dBm (1 nW to 50 mW)	–40 to +10 dBm (100 nW to 10 mW)	–60 to 0 dBm (1 nW to 1 mW)
Photo sensor type	Silicon photo diode	Germanium photo diode	InGaAs PIN photo diode
Optical input form*2	Beam or fiber	Beam or fiber	Fiber only
Size of photo sensor's active area	TQ82014: 8 mm dia.*3 TQ82017: 10 mm x 10 mm*4	5 mm dia.	—
Measurement ranges	8 ranges in 10 dB steps	5 ranges in 10 dB steps	6 ranges in 10 dB steps
Measurement accuracy	±5.0% (at 850 nm)	±5.0% (at 1300 nm)	±5.0% (at 1300 nm)
Connection to TQ8210 Mainframe	sensor attached cable	sensor attached cable	A01905 sensor cable

*1 *At reference wavelength shown under Measurement Accuracy.*

*2 *Refer to connector-to-adapter correspondence table on next page for required adapters.*

*3 *The TQ82014 has a 38 mm (dia.) x 40 mm (length) cylindrical sensor housing with attached cord.*

*4 *The TQ82017 has a wand-shaped sensor housing (3.2 mm thick x 18 mm wide tip) with attached cord.*

APPLICATIONS

- **General optical power measurements**
- **Fiber optic manufacturing test**
- **Optical communications equipment R&D**
- **Optical data storage testing**
- **Optical equipment calibration and repair**

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

TQ8210

Handheld Optical Power Meter

SELECTION GUIDE

Optional Accessory	Used With Q8221	Used With TQ8210	Description	Price
A01905		√	Sensor cable	$150
A08012	√	√	Connector adapter, FC	$168
A08013	√	√	Connector adapter, D4	$252
A08014		√	Connector adapter, OF2	$400
A08017		√	AC Power adapter (90 to 110 V AC)	$20
A08019		√	AC Power adapter (200 to 245 V AC)	$20
A08020	√	√	Bare fiber adapter, V groove (requires A08021)	$420
A08021	√	√	Adapter cap (required by A08020)	$116
A08024		√	Bare fiber adapter, FC type	$473
A08025		√	Connector adapter, AT&T Biconical	$400
A08026		√	Connector adapter, Diamond 2.5	$400
A08027		√	Connector adapter, Diamond 3.5	$400
A08028	√	√	Connector adapter, Amphenol SMA	$400
A08029		√	Connector adapter, Siemens	$400
A08030		√	Connector adapter, Sumitomo Mini-BNC	$400
A08031		√	Connector adapter, MBO	$400
A08032		√	Connector adapter, HFBR-4000	$400
A08081		√	Connector adapter, FC/PC (required by Q82018A)	$250
A08082		√	Connector adapter, SC (required by Q82018A)	$300
A08083		√	Connector adapter, ST (required by Q82018A)	$300
A08084		√	Connector adapter, DIN (required by Q82018A)	$300
A08087		√	Connector adapter, D4 (required by Q82018A)	$300
A08090	√	√	Connector adapter, SC	$420
A08095		√	Connector adapter, SMA 2.5	$400
A08096	√	√	Connector adapter, ST	$420
A08161	√		Connector adapter, FC (used with Q82208)	*1
A08162	√		Connector adapter, SC (used with Q82208)	*1
A08163	√		Connector adapter, ST (used with Q82208)	*1
A08186	√		Connector adapter, low return loss	*1
A08187	√		Connector adapter, FC (used with Q82215 and Q82216)	*1

*1 *Contact your Tektronix representative for price information.*

TQ8210 MAINFRAME SPECIFICATIONS:

Basic Capabilities

Characteristic	Capability
Wavelength & power ranges	depends upon sensor selected
Sensor plug-in channels	one
Resolution	0.005% to 0.1% (Watt readout), 0.01dB (dBm readout)
Display	Backlit liquid crystal, 4 digits (wavelength), 4-1/2 digits (power)
Sensor wavelength compensation	Automatic for sensor sensitivity at set wavelengths
Units display	Watts (mW, µW, nW), dBm, dBr, Wavelength (nm)
Range switching	Automatic or manual
Measurement rate	≥ 2 measurements/sec
Processing	
Averaging	Digital smoothing by 2 to 20 sample moving average
Measurement functions	Maximum value hold (Watt meas.), Relative value measurement (dBr)
Offset & zero	Automatic sensor offset zero compensation
Input/output	
Optical input	Input style & connector type determined by sensor & adapter, sensor attached with electrical cable to mainframe
Data output	Analog output voltage (0 to 2 V) proportional to input optical power, output impedance ≤ 10Ω
General	
Operating environment	0 to +40°C, ≤ 85% RH (non condensing)
Power supply	Internal NiCd battery (operating life >10 hrs with LCD backlight on, >13 hrs with backlight off), 100 V AC (using AC adapter, which also charges the NiCd battery)
Dimensions	80 (W) x 180 (L) x 35 (H) mm, approximate
Weight	≤ 400 g

CONNECTOR-TO-ADAPTER CORRESPONDENCE

Connector Type	TQ82014	TQ82015	TQ82018A
FC/PC	A08012	A08012	A08081*1
SC	A08090	A08090	A08082
ST	A08096	A08096	A08083
Biconical	A08025	A08025	—
D4	A08013	A08013	A08087
DIN	A08029	A08029	A08084
SMA 2.5	A08095	A08095	—
SMA 3.175	A08028	A08028	—

*1 *Standard accessory.*

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

ORDERING INFORMATION

TQ8210
Handheld optical power meter mainframe,
Includes: Instruction Manual, AC power adapter $650

TQ82014
Power sensor, 0.4 µm to 1.1 µm $431

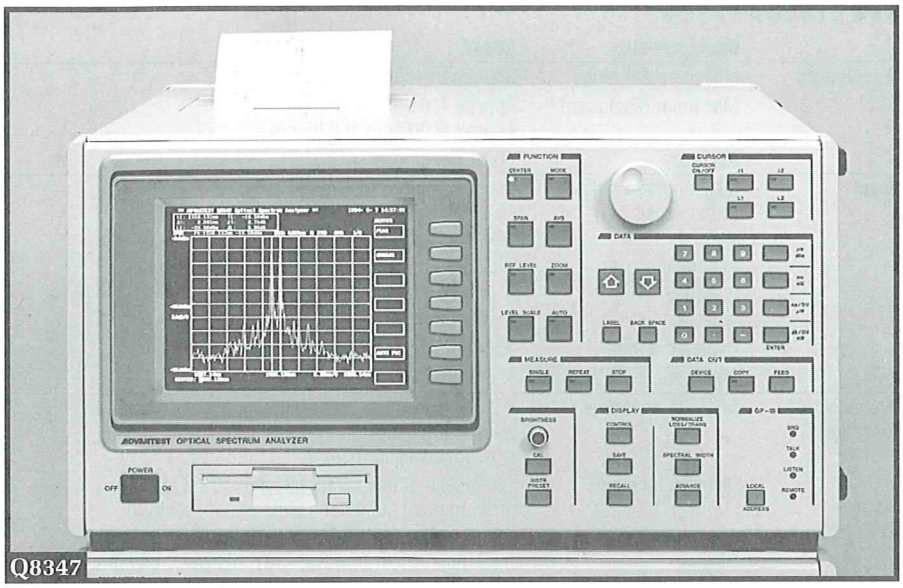
TQ82015
Power sensor, 0.8 µm to 1.6 µm (Ge) $840

TQ82017
Power sensor, 0.4 µm to 1.1 µm, thin wand $357

TQ82018A
Power sensor, 0.8 µm to 1.65 µm (InGaAs) *1

*1 *Contact your Tektronix representative for price information.*

High Resolution Optical Spectrum Analyzer



Advantest Q8347

The Q8347 makes use of a Fourier spectrum analysis approach based on a Michelson interferometer. Because of this the Q8347 can measure optical coherence that cannot be obtained directly using diffraction type optical spectrum analyzers which use monochromators to make their measurements. The Q8347 provides a high wavelength resolution measurement capability in the 350 nm to 1750 nm wavelength band. This instrument achieves a wavelength resolution that is ten times that of conventional optical spectrum analyzers.

With its high wavelength resolution and enhanced accuracy, the Q8347 is an advanced and powerful optical spectrum analysis tool providing the unique measurement capabilities needed in the design, development, and manufacture of wavelength division multiplexed (WDM) communication equipment, as well as related assemblies and components utilizing very closely spaced optical carriers.

The Q8347 also provides unique measurement capabilities when characterizing narrow band passive optical filters and wavelength selective couplers. Also, because of its short wavelength capabilities, the Q8347 is useful in the optical coherence length analysis required for research on shorter wavelength laser diodes.

These features make this analyzer very effective for the evaluation of laser diodes used in optical data storage equipment, fiber optic gyroscopes, and related applications, as well as high speed communications equipment. This instrument is exceptionally well suited to the measurement of coherence length of laser diode and LED optical sources.

A standard rackmount set is available for both the Display Unit and Optical Unit making up the Q8347. Contact your local Tektronix Sales office for further information.

Q8347

- Michelson Interferometer Type Measurements
- High Wavelength Resolution
  – 0.01 nm at 1.55 µm
  – 0.001 nm at 0.5 µm
- Enhanced Wavelength Accuracy
- Direct Coherence Length Analysis
- Wide Wavelength Range
- High Accuracy Wavelength Setting Resolution
- Color LCD Display
- Friendly User Interface

This instrument analyzes and displays the high resolution optical spectral content of light-wave emissions from lasers and light emitting diodes operating in the 350 nm to 1750 nm wavelength band.

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The Q8347 complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

APPLICATIONS

- **WDM Transmission Analysis**
- **Analysis of Source Coherence Length**
- **Characterization of Narrow-band Optical Filters**
- **Communications Laser and LED Transmitter Characterization**
- **Manufacturing Test of Optical Sources and Components**
- **Optical Transmission Standards Compliance**
- **Short Wavelength Laser Characterization**

Q8347

High Resolution Optical Spectrum Analyzer

SPECIFICATIONS

	Characteristic	Q8347
Wavelength	Measurement range	350 nm to 1750 nm
	Maximum resolution*1	Approx. 0.01 nm at 1.55 µm Approx. 0.003 nm at 0.85 nm
	Accuracy	±0.01 nm or less
Level	Measurement range (input sensitivity)*2	–65 to +10 dBm (0.7 to 1.6 µm) –52 to +10 dBm (0.45 to 1.7 µm) –42 to +10 dBm (0.35 to 1.75 µm)
	Accuracy	≤ ±2.0 dB (at 0.85 µm, 1.31 µm, and 1.55 µm)
	Linearity	≤ ±1.0 dB/25dB ≤ ±0.5 dB/10dB
	Dynamic Range	≥30 dB (±0.5 nm from peak wavelength)
	Polarization Dependence	≤ ±0.8 dB
Processing functions	Measurement time	≤ 2.5 sec (high res. mode, 0.95 µm to 1.75 µm wavelength band)*3 ≤ 1 sec (normal mode)*3
	Memory function	16 screens of measured data and 10 screens of measurement conditions (with battery backup) 3.5 in. floppy disk (720 KB/1.2 MB, MS-DOS format)
	Display	Dual trace, super-impose, "3-D" display, trend monitor
	Monitor functions	Average optical power and wavelength monitoring and display
	Computing/Analysis	Spectral width calculation, coherence length analysis (±165 mm), normalize function, auto peak search
Input/output	Optical input	FC type connector (50/125 internal fiber)
	Data output	GPIB IEEE 488 control interface. Built-in printer (≤8 sec print time) Direct plotter output*4
General	Operating environment	+10 to +40°C, ≤ 85% relative humidity (non-condensing)
	Power supply	100 to 120/240 VAC, 48 to 66 Hz
	Dimensions	Approx. 424 (W) x 221 (H) x 500 (D) mm (main unit) Approx. 424 (W) x 132 (H) x 500 (D) mm (optical unit)

**1 Performance in high resolution mode.*

**2 The minimum level is measured over a 50 nm span with 16 averages.*

**3 On SINGLE measurement, one average is performed. Measuring time is from triggering to completion of display.*

**4 Compatible plotters: Advantest R9833, HP 7475A, HP7440A, and HP7470A.*

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The Q8347 complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

ORDERING INFORMATION

Q8347
Advantest High Resolution Optical Spectrum Analyzer *1
Includes: Instruction Manual, Power Cable (A01402).

A09075
Thermal Printer Paper for Built-in Advantest Printer (5-roll Box).....**$53**

**1 Contact your Tektronix representative for price information.*

Optical Power Multimeter



Application Description

This bench-top instrument and its related family of plug-ins are intended for use by engineers and skilled technicians in the design, evaluation, manufacture, or service of fiber optic equipment and systems. This class of product is one of the most widely applicable fiber optic test and measurement instruments used in engineering, manufacturing, and service organizations. Typical applications include such things as:

- General purpose measurement of optical power in fibers and free-space beams
- Loss measurements in optical fiber and related components
- Characterization of laser and LED source output power and stability
- Fiber amplifier testing and characterization
- Calibration and repair of other optical instruments including power meters

Product Description – General

The Q8221 is a compact lab instrument providing both precision optical power measurement and stable light source capabilities. It is a small bench-top unit weighing less than 3.9 kg (with plug-ins). The Q8221 mainframe accepts two small plug-ins that can be either power sensors (detectors) or optical sources. Five types of optical sensors and nine types of light sources are available.

KEY PRODUCT FEATURES AND BENEFITS

The Q8221 mainframe allows measurement of optical power on two channels simultaneously. These measurements can be ratioed, multiplied by a constant, or offset, thus allowing a wide variety of applications. The mainframe's on-board processor also provides automatic wavelength compensation for the power sensor being used. This processor also allows measurement averaging, identification of maximum values, storage of up to 400 data points and five front-panel set-ups for each of the two channels. Also the mainframe provides direct output of digital stored data to an external plotter, real-time analog voltage output proportional to measured optical power, and full instrument operation via a GPIB controller.

Both single and multimode LED and laser sources are available and can be used in either or both plug-in slots. These stable sources operate at 850 nm, 1310 nm, and 1550 nm wavelengths. Source output power levels cover a wide range from 0 dBm to –53 dBm depending upon the source's wavelength, type (laser or LED), and spectral width. For further technical information refer to the Q8221 Product Data Sheet (Tektronix Literature # 2HA-10187-0).

Characteristics

BASIC CAPABILITIES

Wavelength and Power Ranges – Depends upon plug-in.

Sensor Plug-in Channels – Two independent measurement channels (A & B).

Resolution – 0.001 dB (dBm readout), 0.0001 dB (GPIB).

Display – Five and one half digits (7 segment FL device) with brightness adjustment, 11 segment measurement level bar-type meter.

Sensor Wavelength – If wavelength is entered, an internal wavelength compensation constant for the sensor is automatically applied.

Units Display – Watts (mW, µW, nW, pW), dBm, dB.

Range Switching – Automatic, manual, or remote.

Measurement Rate – Approx. 50 meas./sec (with integrate time of 7 msec), Approx. 9 meas./sec (with integrate time of 100 msec), 1 channel opertation.

- Two Independent Plug-in Channels
- Optical Sensor and Source Plug-ins
- Simultaneous Channel Measurements
- Dual Channel Displays
- High Power Input
- High Sensitivity and High Accuracy
- High Speed Measurements
- Low Polarization Dependence
- On-board Recorded Data Memory
- GPIB Controllable

The Q8221 is a compact modular lab instrument providing both precision optical power measurement in the 400 nm to 1750 nm wavelength band as well as stable light source capabilities.

APPLICATIONS

- **General Optical Power Measurements**
- **Fiber Optic Manufacturing Test**
- **Optical Communications Equipment R&D**
- **Insertion Loss Measurements**
- **Optical Equipment Calibration and Repair**

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The Q8221 complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

Q8221 Optical Power Multimeter

PROCESSING

Averaging – Can be set to any value from 2 to 256 (moving average).

Calculations – A/B, B/A, CF (in Watts mode; multiplication of measurement and constant value, in dBm mode offset can be added).

Other Measurement Functions – Maximum value hold, Settable measurement integration time (100 msec, 20 msec, or 7 msec), Relative value measurement (dBr, with 0.001 dB max. resolution), Modes for CW or chopped light inputs.

Record Function – Memory storage of 400 data points for each of A and B channels (external data retrieval possible via GPIB interface).

Memory Function – Up to five instrument settings storable and readable for each of A and B channels.

INPUT/OUTPUT

Optical Input – Connector type determined by sensor head or plug-in.

Data Output – GPIB/IEEE 488 control, 0 to 2 V analog output (each range) proportional to input optical power, Direct output to external plotter.

GENERAL

Operating Environment – 0 to +40°C, ≤ 85% RH (noncondensing).

Power Supply – 100 to 230 VAC, 48 to 66 Hz.

Dimensions – 212 (W) x 88 (H) x 360 (D) mm, approximate.

Weight – Approximately 3.9 kg (including plug-in).

OPTICAL POWER SENSOR PLUG-IN SPECIFICATIONS

Characteristic	Q82214	Q82215	Q82216	Q82226	Q82208
Application type	Short wavelength, general purpose	Long wavelength, general purpose	Long wavelength, wide area, medium sensitivity	Long wavelength, high power	Long wavelength, high sensitivity
Wavelength range (nm)	400 to 1100	800 to 1750	800 to 1750	800 to 1750	800 to 1700
Power range (dBm)	–80 to +17	–60 to +10	–77 to +10	–57 to +27	–94 to +10
Photosensor type	Silicon	Germanium	Germanium (cooled)	Germanium (cooled)	InGaAs (cooled)
Optical input form*1	Beam or fiber	Beam or fiber	Beam or fiber	Fiber only	Fiber only
Measurement Accuracy					
At calibration wavelength	±3.0%, 780 nm 1 mW, 0 to 40°C	±3.0%, 1300 nm 1 mW, 0 to 40°C	±2.5%, 1300 nm 1 mW, 0 to 40°C	±3.0%, 1300 nm 1 mW, 0 to 40°C	±2.5%, 1300 nm 1 mW, 0 to 40°C
Over wide wavelength range	±5.0%, 480 – 900 nm 1 mW, 23 ±3°C	±5.0%, 950 – 1600 nm 1 mW, 23 ±3°C	±4.5%, 950 – 1600 nm 1 mW, 0 to 40°C	±7.0%, 950–1600 nm 1 mW, 0 to 40°C	±4.5%, 1000–1650 nm 1 mW, 0 to 40°C
Linearity					
Over range 1	±0.5% ±10 pW, –54 to +17 dBm, 23 ±3°C	±0.5% ±1 nW, –37 to +10 dBm, 23 ±3°C	±0.5% ±20 pW, –47 to +10 dBm, 23 ±3°C	±0.5% ±2 nW, –27 to +27 dBm, 23 ±3°C	±0.5% ±0.4 pW, –72 to +10 dBm, 0 to 40°C
Over range 2	±1.0% ±10 pW, –57 to +17 dBm, 23 ±3°C	±1.0% ±1 nW, –40 to +10 dBm, 23 ±3°C	±1.0% ±20 pW, –50 to +10 dBm, 23 ±3°C	±1.0% ±2 nW, –30 to +27 dBm, 23 ±3°C	±1.0% ±0.4 pW, –75 to +10 dBm, 0 to 40°C
Noise level (one second average)	–80 dBm	–60 dBm	–77 dBm	–57 dBm	–94 dBm
Polarization dependence	–	0.03 dB p-p (typ)	0.03 dB p-p (typ)	0.06 dB p-p (typ)	≤0.02 dB p-p
Return loss	≥45 dB (with angled polished connectors), ≥30 dB (with A08186 adapter, depending upon specifications of fiber used), ≥14 dB (with flat polished connectors)				
Connection to Q8221 Mainframe	Q82202 interface plug-in required				Q82202 not required
Dimensions and mass	Approx. 60 mm (W) x 43 mm (H) x 110 mm (L), ≤270 g				Plugs into Q8221

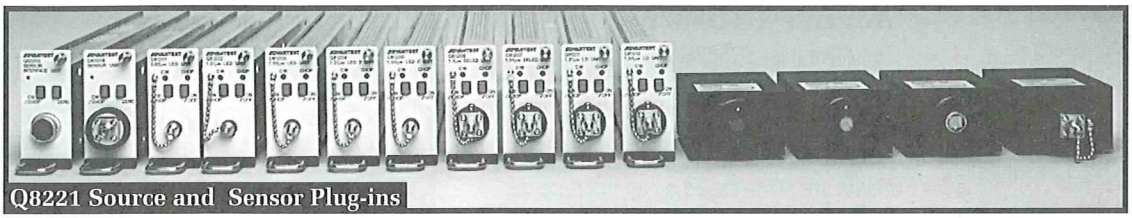
*1 *Refer to connector-to-adaptor correspondence table following.*

CONNECTOR-TO-ADAPTER CORRESPONDENCE

Connector Type	Q82214	Q82215	Q82216	Q82226	Q82208
FC	A08012	A08012	A08012	dedicated to FC connector	A08161*1
SC	A08090	A08090	A08090	–	A08162
ST	A08096	A08096	A08096	–	A08163
D4	A08013	A08013	A08013	–	–
SMA	A08028	A08028	A08028	–	–
MT adaptor	–	A08187 (mating to 12-Pin SMF)	A08187 (mating to 12-Pin SMF)	–	–
Low return loss adaptor	A08186	A08186	A08186	A08186*1	A08186

*1 *Standard accessory.*

Optical Power Multimeter



Q8221 Source and Sensor Plug-ins

OPTICAL SOURCE PLUG-IN SPECIFICATIONS

Characteristic*5	Q81201	Q81202	Q81203	Q81204	Q81205	Q81206	Q81207	Q81211*4	Q81212*4
Photoemitting element type	LED	LED	LED	LED	LED	Edge Emitting LED	Edge Emitting LED	Laser diode (FP)	Laser diode (FP)
Wavelength (nm)	850 ±25	1310 ±40	1550 ±30	1310 ±10	1550 ±10	1300 ±30	1550 ±30	1310 ±10	1550 ±20
Spectral width (at half max. power)	≤55 nm	≤160 nm	≤210 nm	20 ±5 nm	20 ±5 nm	≤100 nm	≤140 nm	≤5 nm	≤10 nm
Output power	–15 ±1 dBm*1	–20 ±1 dBm*1	–43 ±1 dBm*2	–35 ±1 dBm*1	≤–53 ±1dBm*2	–14 ±1 dBm*2	–17 ±1 dBm*2	0 ±1 dBm*2	0 ±1 dBm*2
Output power attenuation (variable)	–	–	–	–	–	–	–	0 to –6 dB (0.1 dB steps)	0 to –6 dB (0.1 dB steps)
Temperature Stability 23±2°C/1 hr 0 to 40°C/8 hrs	≤ ±0.02 dB ≤ ±0.2 dB	≤ ±0.02 dB ≤ ±0.2 dB	≤ ±0.04 dB ≤ ±0.2 dB	≤ ±0.02 dB ≤ ±0.2 dB	≤ ±0.04 dB ≤ ±0.2 dB	≤ ±0.02 dB*3 ≤ ±0.4 dB	≤ ±0.04 dB*3 ≤ ±0.4 dB	≤ ±0.01 dB*3 ≤ ±1 dB	≤ ±0.01 dB*3 ≤ ±1 dB

*1 *At the emitting end of 2 m fiber (Graded index, 50/125 fiber type).*

*2 *At the emitting end of 2 m fiber (Single mode, 10/125 fiber type).*

*3 *Stability between 0 to 40°C ±2°C/1 hr.*

*4 *Stability ≤ ±0.05 dB, within 0 to 40°C ±2°C/1 hr.*

*5 *Output waveform: CW or chopped light (270 Hz, 2 kHz, 4 kHz), FC type output connector, Preheating time of 60 minutes after power on.*

ORDERING INFORMATION

Q8221
Mainframe, Optical Power Multimeter **$1,900**
Includes: AC Power Cable and Instruction Manual.

Q82202
Interface Plug-in **$950**

Q82208
Power Sensor, High Sensitivity **$4,550**

Q82214
Power Sensor, Short Wavelength, Gen'l Purpose **$750**

Q82215
Power Sensor, Long Wavelength, Gen'l Purpose **$1,150**

Q82216
Power Sensor, Large Area and Hi-sensitivity **$3,550**

Q82226
Power Sensor, High Power **$3,250**

Q81201
LED Source, 850 nm **$1,050**

Q81202
LED Source, 1310 nm **$1,700**

Q81203
LED Source, 1550 nm **$2,700**

Q81204
LED Source, 1310 nm **$2,500**

Q81205
LED Source, 1550 nm **$3,350**

Q81206
EELED Source, 1300 nm **$4,750**

Q81207
EELED Source, 1550 nm **$5,250**

Q81211
Laser Source, 1310 nm **$4,750**

Q81212
Laser Source, 1550 nm **$7,150**

Depending upon the application and plug-in modules selected, one or more of the following fiber interconnection adapters may be needed:

A08012 – Connector Adapter, FC **$168**
A08013 – Connector Adapter, D4 ..... **$252**
A08020 – Bare Fiber Adapter (Requires A08021) **$420**
A08021 – Adapter Cap (Required by A08020) **$116**
A08028 – Connector Adapter, SMA *1
A08090 – Connector Adapter, SC **$420**
A08096 – Connector Adapter, ST **$420**
A08161 – Connector Adapter, FC (Used with Q82208) **$90**
A08162 – Connector Adapter, SC (Used with Q82208) **$110**
A08163 – Connector Adapter, ST (Used with Q82208) **$110**
A08186 – Connector Adapter, Low Return Loss **$400**
A08187 – Connector Adapter, FC (Used with Q82215 and Q82216) **$400**

RACK MOUNT KITS
A02463 – Rack Mount Set (EIA, single) **$120**
A02464 – Rack Mount Set (EIA, twin) **$150**
A02263 – Rack Mount Set (JIS, single) **$120**
A02264 – Rack Mount Set (JIS, twin) **$150**

*1 *Contact local Tektronix sales office.*

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The Q8221 complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

TQ8325

Optical Wavelength Meter

This instrument makes high accuracy, high precision, measurements of the central emitted wavelength of lightwave emissions from lasers and light emitting diodes operating in the 600 nm to 1600 nm wavelength band.

FEATURES

- Michelson Interferometer Design
- High Accuracy
- High Resolution
- High Speed
- Frequency & Deviation Displays
- Built-In He-Ne Laser Standard
- Input Level Meter
- Analog Output
- GPIB Controllable
- Calibration of Optical Spectrum Analyzers
- Communications Laser & LED Transmitter Characterization
- Calibration of Tunable Lasers
- Testing of Wavelength vrs Drive Current or Temperature
- Laser & LED Parts Screening

Advantest TQ8325

The Advantest TQ8325 is a digital optical wavelength meter capable of making high accuracy, high resolution measurements of the central emitted wavelength of optical sources such as lasers and LEDs. Measurements are made based on an interference method using a single-pass Michelson interferometer working with an internal He-Ne laser wavelength standard.

This basic design allows a very high level of accuracy and resolution to be achieved and maintained over long periods of time without calibration. Wavelength measurement accuracies of 5 ppm and a resolution of 0.001 nm are achieved. Also the TQ8325 takes measurements at a rate of five per second thereby enabling the reliable measurement of changes in wavelength with changing temperature.

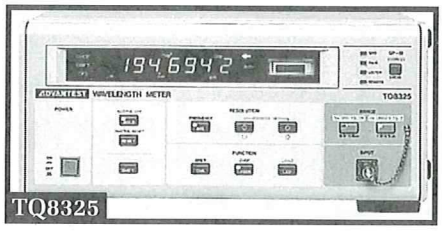
A switch selection enables measurements over the 0.6 to 1.0 µm or 1.0 to 1.6 µm wavelength bands. The TQ8325 can also measure the wavelength of modulated light sources for modulation rates of 3 MHz and above. An auto-resolution function automatically optimizes the resolution depending upon the spectral half-width of the source being measured.

A simple switch operation determines whether measurements of wavelength or frequency are displayed. This feature is very useful when the frequency of a given light source must be read directly. The TQ8325 can also display the changing frequency deviation of a measured source from a reference frequency determined by pressing the deviation display key. This feature enables the continual wavelength changes (from temperature fluctuations) of a light source to be measured and displayed with high accuracy and resolution.

APPLICATIONS

The TQ8325 has the high precision necessary for it to be used a wavelength standard in the calibration of laboratory monochromators. The TQ8325 also can be used to tune dye lasers and monitor the wavelength output of tunable laser sources as these units are manufactured or used.

The TQ8325 can also be used in the automated measurement of the wavelength-temperature or wavelength-drive current characteristics of laser diodes. The TQ8325 can also be used to measure wavelength fluctuation of lasers and LEDs while those devices are under modulation. The screening of laser diodes and LEDs in the manufacturing environment is also a job for which the TQ8325 is well suited.



Characteristics

WAVELENGTH

Measurement Range – 600 nm to 1000 nm (short wavelength band). 1000 nm to 1600 nm (long wavelength band).

Display Resolution – 1 nm, 0.1 nm, 0.01 nm, 0.001 nm (10 digits). 100 GHz, 10 GHz, 100 MHz.

Accuracy – ±Full width (nm) at half maximum x 0.05 ± 5 ppm ± 1 count (at 25°C ± 10°C).

Stability – ± 1 count (in AVG mode)l.

LEVEL

Measurement Range (Input Sensitivity) –
–23 to +3 dBm (0.6 to 1.0 µm).
–20 to +3 dBm (1.0 to 1.4 µm).
–15 to +3 dBm (1.4 to 1.6 µm).

SAMPLING

Sample Period – 200 ms (5 samples/sec rate).

NON CW INPUTS

CHOP mode – Chopping frequency must be 1 to 500 Hz.

Modulated Input – Modulation must be ≥ 3 MHz.

PROCESSING

Averaging – Moving average of 10 measurements is displayed (AVG mode).

Deviation Display – Deviation is displayed in reference to the standard determined by pressing the deviation display key.

INPUT/OUTPUT

Optical Input – FC type connector.

Data Output – GPIB and Analog output.

GENERAL

Operating Environment – –10 to +40°C, ≤ 85% RH (non-condensing).

Power Supply – 90 to 132 VAC (standard), 180 to 250 VAC (optional). 50 to 60 Hz, ≤ 52 VA.

PHYSICAL CHARACTERISTICS

Dimensions – Width: 300 mm. Height: 132 mm. Depth: 450 mm.

Weight – 12 kg.

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The TQ8325 complies with IEEE Standard 488.1-1987.

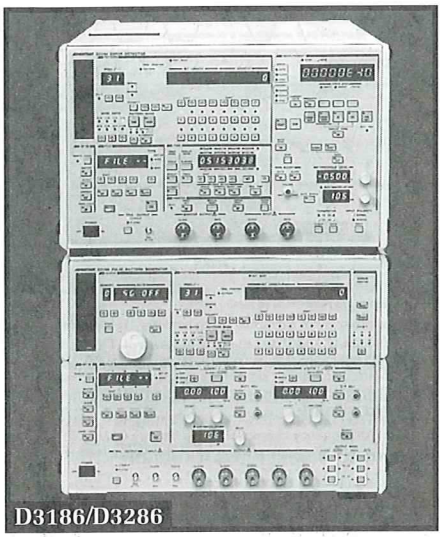
Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

ORDERING INFORMATION

TQ8325
Advantest Optical Wavelength Meter.....**$18,000**
Includes: Instruction Manual, Power Cable (A01402)

Opt. 4D – 180 to 250 VAC power.....**NC**

Pulse Pattern Generator Error Detector


D3186/D3286

D3186 and D3286

The D3186 is a high performance pulse pattern generator and the D3286 is a high performance error detector. They are well suited for evaluating and analyzing digital transmission equipment for Bit Error Rate, high speed logic devices, optical transmission components and receiver clock recovery performance.

MIXED PRBS AND WORD (OPTIONAL)
Simulate real SONET/SDH traffic with a fixed overhead (Word portion) mixed with random data (PRBS portion) in one pattern.

ERROR LOCATION AND ISOLATION (OPTIONAL)
Single bit errors can be located to reveal pattern dependences. Error detection can also be isolated to a specific bit or contiguous bits within the data stream while ignoring the rest.

ERROR MEASUREMENTS
Measurement selections include Error Rate, Error Count, Error Interval, Error Free Interval, Threshold EI/EFI, Error Performance (CCITT G.821) and Frequency (of clock).

Common Characteristics

Pattern – PRBS: 2^n-1 (where n=7, 9, 10, 11, 15, 23, and 31).

Mark Space Ratio – 0/8, 1/8, 1/4, 1/2, 8/8, 7/8, 3/4, and 1/2 (bar).

Programmable Word Pattern – Variable Bit Length: 1 to 8,388,608-Bits.

Characteristics

D3186

Operating Range – 150 Mbit/s to 12 Gbit/s.

Data Output – Rise and Fall time (20% to 80%): ≤25 ps; Jitter: 3 ps rms; Encoding: NRZ; Polarity: Normal and Invert; Amplitude: 0.5 Vpp to 2 Vpp, ECL term: 0.6 Vpp to 1 Vpp; Offset: ±2 V, ECL term: –1.0 V to –0.6 V; Impedance: 50 Ω.

Clock Output – Rise and Fall time (20% to 80%): 50 ps; Variable Delay: ±400 ps; Amplitude: 0.5 Vpp to 2 Vpp, ECL term: 0.6 Vpp to 1 Vpp; Offset: ±2 V, ECL term: –1.0 V to –0.6 V; Impedance: 50 Ω.

Error Insertion Rate – 10^{-N} (N=4, 5, 6, 7, 8 and 9) or Single.

D3286

Operating Range – 150 Mbit/s to 12 Gbit/s.

Data Input – Encoding: NRZ; Polarity: Normal and Invert; Sensitivity: 50 mV ≤6 Gbit/s, 100 mV @12 Gbit/s; Amplitude: 0.2 Vpp to 2 Vpp; Termination Voltage: 0 V or –2 V(ECL); Threshold Level: ±2 V, ECL term: –1.85 V to 0.75 V; Impedance: 50 Ω.

Clock Input – Amplitude: 0.5 Vpp to 2 Vpp; Termination Voltage: 0 V or –2 V(ECL); Variable Delay: ±400 ps; Impedance: 50 Ω.

PHYSICAL CHARACTERISTICS

	D3186		D3286	
Dimensions	**mm**	**in**	**mm**	**in**
Height	310	12.2	266	10.5
Width	424	16.7	424	16.7
Depth	525	20.7	525	20.7
	kg	**lb.**	**kg**	**lb.**
Mass/Weight	34	75	34	75

Power Consumption – 600 VA max.

Line Frequency – 48 Hz to 63 Hz.

Operating Temp – 0°C to +40°C.

Storage Temp – –20°C to +60°C.

D3186/D3286

- 150 Mbit/s to 12 Gbit/s
- 8,388,608 Bits of User Programmable Patterns
- Mixed PRBS and Word Pattern
- Pseudo Random Patterns 2^7-1 to 2^{31}-1
- Selectable Output Terminations AC, –2 V or GND
- Complimentary Clock and Data Outputs
- Disk Drive for Settings and Error Logging
- Printer for Error Logging
- GPIB Programmable

The D3186 and D3286 combine to perform Bit Error Rate analysis of high-speed electrical and optical communication components and transmission equipment.

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The D3186 and D3286 comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

ORDERING INFORMATION

D3186
Advantest Pulse Pattern Generator, 12Gbit/s *1
Includes: Instruction Manual, Power Cable (AO1402).
Opt. 10 – 150GHz to 12GHz Clock Source *1
Opt. 11 – 2GHz to 12GHz Clock Source *1
Opt. 70 – Mixed PRBS and Word Pattern *1

D3286
Advantest Error Detector, 12 Gbit/s *1
Includes: Instruction Manual, Power Cable (AO1402).
Opt. 70 – Mixed PRBS and Word Pattern *1
Opt. 71 – Error Location/Isolation *1

*1 *Contact your Tektronix representative for price information.*

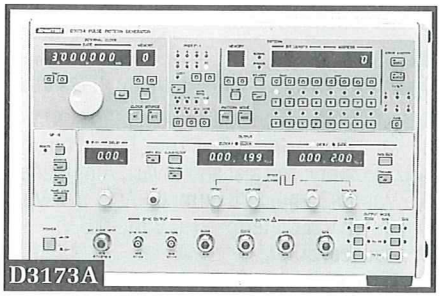
D3173A
D3273

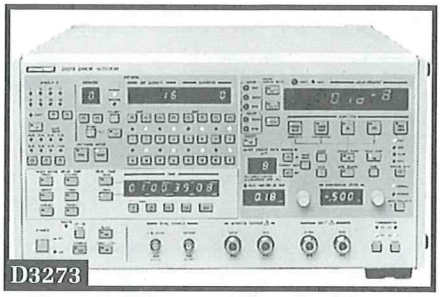
Pulse Pattern Generator Error Detector

The D3173A and D3273 combine to perform Bit Error Rate analysis of high-speed electrical and optical communication components and transmission equipment.

D3172/D3273

- 50 Mbit/s to 3 Gbit/s
- Pseudo Random Patterns 2^7–1 to 2^{23}–1
- 65,536-Bits of User Programmable Patterns
- Selectable Output Terminations AC, –2 V or GND
- Complimentary Clock and Data Outputs
- Master/Slave to Control Error Detector
- GPIB Programmable


D3173A


D3273

D3173A and D3273

The D3173A is a high performance pulse pattern generator and the D3273 is a high performance error detector. They are well suited for evaluating and analyzing digital transmission equipment for Bit Error Rate, high speed logic devices, optical transmission components and receiver clock recovery performance.

ERROR MEASUREMENTS
Measurement selections include Error Rate, Error Count, Error Second, Error Free Second and Frequency (of clock).

Characteristics

Pattern – PRBS: 2^n–1 (where n=7, 9, 10, 11, 15, 17, 20, and 23).

Mark Space Ratio – 0/8, 1/8, 1/4, 1/2, 8/8, 7/8, 3/4, and 1/2(bar).

Programmable Word Pattern – Variable Bit Length: 1 to 65,536-Bits.

D3173A
Operating Range – 50 Mbit/s to 3 Gbit/s.

Data Output – Rise and Fall time (20% to 80%): ≤70 ps; Jitter: ≤40 ps; Encoding: NRZ; Polarity: Normal and Invert; Amplitude: 0.5 Vpp to 2 Vpp; Offset: ±2 V; Impedance: 50 Ω.

Clock Output – Rise and Fall time (20% to 80%): 50 ps; Variable Delay: ±1 ns; Amplitude: 0.5 Vpp to 2 Vpp, ECL term: 0.6 Vpp to 1 Vpp; Offset: ±2 V, ECL term: –1.0 V to 0.6 V; Impedance: 50 Ω.

External Clock Input (timing source) – Amplitude: 0.7 Vpp to 1.5 Vpp (0.9 dBm to 7.5 dBm); Waveshape: Sinewave; Impedance: 50 Ω.

Error Insertion Rate – 10^{-N} (N= 4, 5, 6, 7, 8 and 9) or Single.

D3273
Operating Range – 50 Mbit/s to 3 Gbit/s.

Frequency Measurement Range – 50MHz to 3GHz.

Error Rate Measurement Range – 10^{-14} to 9.9999 10^{-1}.

Error Count Measurement – Count Capacity: 9.9999 10^{18} seconds; Error Display: Integer Count: 0 to 9999999, Exponential Count: 0 to 10^{16}.

Error Seconds Measurement – Count Capacity: 4.2949 10^9 seconds; Display: % (percent): 0.0000% to 100.0000%; Seconds: 0 to 10^6 seconds.

Error Free Seconds Measurement – Count Capacity: 4.2949 10^9 seconds; Display: % (percent): 0.0000% to 100.0000%; Seconds: 0 to 10^6 seconds.

Data Input – Encoding: NRZ; Polarity: Normal and Invert; Amplitude: 0.2 Vpp to 2 Vpp; Termination Voltage: 0 V or –2 V (ECL); Threshold Level: ±2 V, ECL term: –1.85 V to –0.75 V; Impedance: 50 Ω.

Clock Input – Amplitude (AC coupled): 0.5 Vpp to 2 Vpp; Variable Delay: ±400 ps; Impedance: 50 Ω.

PHYSICAL CHARACTERISTICS

	D3173A		D3273	
Dimensions	**mm**	**in.**	**mm**	**in.**
Height	260	10.5	221	8.7
Width	424	16.7	424	16.7
Depth	525	20.7	525	20.7
	kg	**lb.**	**kg**	**lb.**
Mass/Weight	37	81	28	62

Power Consumption – 600 VA max.
Line Frequency – 48 Hz to 63 Hz.
Operating Temp – 0°C to +40°C.
Storage Temp – –20°C to +60°C.

ADVANTEST

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488

The D3173A and D3273 comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

Advantest's quality system complies with the DIN ISO 9002 standard and has been certified by TUV Product Service GMBH.

ORDERING INFORMATION

D3173A
Advantest Pulse Pattern Generator, 3 Gbit/s *1
Includes: Instruction Manual, Power Cable (AO1402).
Opt. 40 – 180 to 250 VAC Power *1

D3273
Advantest Error Detector, 3 Gbit/s *1
Includes: Instruction Manual, Power Cable (AO1402).
Opt. 40 – 180 to 250 VAC Power *1

*1 *Contact your Tektronix representative for price information.*

VXI Introduction

The Five S's of Selection

Judge your VXI Vendor not just on today's needs, but also those needs created one, two, or three years after your initial purchase.

SOURCE
Depth of product line both in hardware and software is critical to your long term success. Over 30 new products have been added to the VXI Product line since 1994 – a strong indicator of Tektronix' commitment to VXI.

SYSTEM ARCHITECTURE
Any vendor can force you to his non-standard architecture – note Tektronix' open architecture offers the best solution. Now with VXI*plug&play*, customers are assured that their investments in instrumentation, software, and systems will be open. VXI*plug&play* is your economic advantage in VXI.

SUPPORT
Not only before, but after the sale! Tektronix' support center is the best. Also, with bulletin board services to the latest VXI*plug&play* and other instrument driver software, assistance is just a phone call away.

SERVICE
Worldwide, of course.

SYSTEM INTEGRATION SERVICE
Your VXI vendor must be able to pitch in when you need it – without constraints or big prices. Tektronix introduces "Receiver Ready" and "Fixture Ready" Services this year for customers and Tektronix integration partners. Combining these low priced services, system components, and VXI*plug&play* software provides you with a complete solution that can be "programming ready."



CONTENTS

Introduction 379
System Integration Services 382
System Software 383
Controllers/Interfaces 385
Mainframes 386
Measurement 388
Sources 389
Switching/Scanning 390
Digital and Boundary Scan 392
Avionics 393
Digitizers 394
Standard Product Summary 395

VXI Introduction

As a founding member, Tektronix' backing of the VXIplug&play architecture and alliance is a statement of commitment to openness – your best guarantee that your investment truly has the backing of many instrument and software vendors.

- VXI*plug&play*
- Broad Range of Instrument Choices
- Open Architecture Supports Multi-vendor System Configurations

VXI: An Instrument Standard

VXI ("VME Extensions for Instrumentation") is a recognized standard for card-modular automated electronic instrumentation. It has become the preferred architecture in applications that demand uncompromised throughput and performance in a compact package. Whether testing circuit boards in the factory, avionics subsystems on the flightline, or system-level end-user products, a VXI solution offers high reliability, ease of use, and cost-effectiveness.

TOWARD OPEN SYSTEMS IN VXI

When configuring a system, the test problem, not the constraints of a particular vendor's VXI product line, must dictate the choice of instruments.

Recognizing that no single manufacturer can fulfill every possible test requirement, Tektronix has chosen to pursue an Open Systems approach. During 1994, this open approach was enhanced by multiple vendors in the VXI*plug&play* Alliance. Tektronix is committed to providing customers a broad range of instrument choices and an open architecture that supports multi-vendor system configurations.

What Is VXI*plug&play*?*[1]

The VXI*plug&play* Systems Alliance is an organization whose members share a common commitment to end-user success with open, multivendor VXI systems. The alliance will accomplish major improvements in ease of use by endorsing and implementing common standards and practices in both hardware and software, beyond the scope of the VXIbus Specifications. The Alliance will use both formal and de facto standards to define complete system frameworks. These standard frameworks give end-users true "plug and play" interoperability at both the hardware and system software level.

VXI*plug&play* HARDWARE

The goal of the VXI*plug&play* Systems Alliance is to improve ease of use and maintain VXI as a true, open-architecture at the system level. As such, all VXI hardware that is compatible with VXIbus Specifications is applicable to VXI*plug&play* frameworks, and vendors do not need to be members of the organization for their products to be compatible. Areas that will enhance hardware "plug and play" compatibility beyond the scope of the VXIbus specifications include consistent approaches for connectors; UUT interfacing and fixturing; instrument protocols for shared-memory communication, consistency in the use of optional VXI features such as backplate triggers, interrupts, sumbus, and local bus; and common documentation approaches. In addition, a consistent approach for calibration will be developed to deliver major benefits to both vendors and end-users.

VXI*plug&play* SYSTEM SOFTWARE

The alliance will achieve "*plug&play*" interoperability for system software by working together to identify and promote standardized system software frameworks. Some elements of a system software framework include operating system, programming language, I/O drivers, instrument drivers, and higher-level application software tools. The alliance recognizes that many shared architectural elements already exist in the market today, representing both an opportunity and a mutual responsibility.

Tektronix' strict compliance with the VXI Specification support for a diversity of workstation, PC and software platforms, and its commitment to supporting open software standards and packages for programming environments, ensures compatibility with hundreds of VXI products.

PERFORMANCE WHERE YOU NEED IT

Tektronix VXI instruments take full advantage of the company's proven expertise in analog and digital signal acquisition, advanced semiconductor processes, and data display. Many Tektronix VXI instruments apply new technologies developed at Tek Labs, the company's renowned research arm.

In addition, certain Tektronix VXI instruments are equipped with architectural enhancements like Fast Data Channel (a unique shared memory protocol) and local pass/fail processing. These supplement the standard VXI capabilities and provide improved throughput without sacrificing compatibility with other VXI products.

Products Summary/Order Information is on page 395.

[1] Reprinted from the Alliance Charter.

For product detail, request a VXI Catalog by completing the business reply card in the back of this catalog.

VXI Introduction

Your VXI Source

Tektronix is committed to VXI. This commitment means that we provide a broad line of all the components you will need to integrate your own system. And not only are the specs of each of these components carefully developed, they are also strongly influenced by our own system engineering efforts – in other words, Tektronix has invested not just in "knowing" the components. Tektronix knows systems as well.

MORE INSTRUMENTS TO CHOOSE FROM

The Tektronix Architecture includes over 100 VXI components including modular instruments, mainframes and controllers. You'll find a broad selection of GPIB instruments as well, giving you what you need to create a high performance solution for almost all applications. You can also include instruments from other manufacturers in your systems. We're working throughout the industry to maintain open standards, ensuring cross-compatibility and ease of integration.

OPEN YOUR OPTIONS

This open measurement environment is an approach to doing business, not a product or a specific group of instruments.

It means that Tektronix goes the extra step to make sure that we are easy to do business with. We have also established strategic partnerships with industry leaders to make sure that you can tap into their products and expertise. As well, Tektronix is deeply involved with industry standards efforts to help make the world of Test and Measurement a truly open environment. It includes a universe of industry standard components from various manufacturers, so the range of options available to you is in fact much, much greater.

WORLDWIDE SUPPORT NETWORK

Tektronix offers you the resources of a global service-and-support network. Tektronix and its third-party partners can provide the support you need for a successful completion of your systems project. We can help you assess your requirements and planning strategy and help integrate your system. Tektronix service includes calibration and servicing of third-party products, with response time ranging from three-day depot turnaround to four hour on-site service.

SCS-9000 SYSTEM INTEGRATION SERVICES

- Receiver and Fixture Ready
- Standard Core Systems

MAINFRAMES

- VX1410 Intelliframe™, Intelligent, VXI*plug&play* Compliant, 13-Slot
- VX1401 Low Cost 13-Slot
- VX1406 Portable 6-Slot

COMPUTERS/CONTROLLERS

- NI-599/566 100/66 MHz Embedded
- NI-MXI Kits
- NI-GPIB Kits

MEASUREMENT

- 4.5/6.5 Digit DMMs
- 10 MHz/100 MHz/2.5 GHz Counters

DIGITIZERS

- 500 MHz/1 GHz High Performance
- 16x200 KHz & 10 MHz High Throughput
- 200/400 KHz Analogic

SOURCES

- 25/250 MHz ARBs
- D/A Modules
- Relay/High Voltage Driver
- Dual Programmable Resistance

SWITCHING/SCANNING

- 32/64 Channel I/O Module
- Medium and High-density Matrixes
- Medium and High-density Switches
- 1 GHz Switching

DIGITAL

- Boundary Scan
- Memory Backed Digital I/O
- Basic Functional Test

AVIONICS

- 1553/429 Interfaces
- 629 with Error Insertion

TELECOM

- SDH/Sonet Generator/Receiver
- Optical Attenuator

For product detail, request a VXI Catalog by completing the business reply card in the back of this catalog.

System Integration Services

Open Systems Architecture

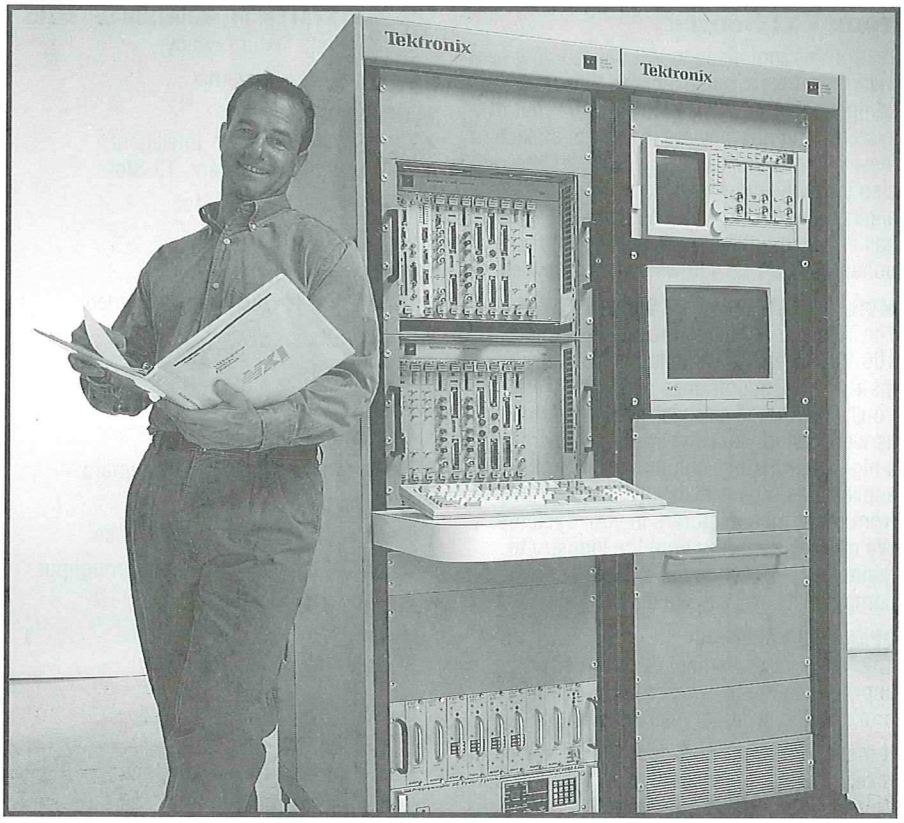
Open Systems Architecture gives you the means to create an uncompromised system for your most challenging test problems.

UNLIMITED FLEXIBILITY IN SYSTEM COMPONENTS

The Tektronix VXI Architecture helps you choose the ideal test-and-measurement components for your needs. It allows you to choose products from a wide range of manufacturers of test-and-measurement technology, with confidence that all the components will work together. You can use the ideal computer hardware, the best software package, and the specific instruments that best suit your application.

MORE WAYS TO INTEGRATE SYSTEMS

Whether you have full system integration capabilities within your company or contract to other suppliers, the open measurement environment gives you a convenient, cost effective means to integrate systems. This is a low-cost service that provides "Receiver" and "Fixture" Ready Services for test engineers or system integrators worldwide.



MULTIPLE CHOICES IN HARDWARE AND SOFTWARE

The open measurement environment makes it easy to combine Tektronix instruments with the optimum hardware platform for cost-effective performance. You can use PCs or embedded VXI controllers. And you can take many approaches to software design: coding in C, BASIC, ATLAS, or using interactive, graphical development environments like LabVIEW® and LabWindows®.

Component compatibility and connectivity is simplified by the wide variety of hardware and software VXI*plug&play* drivers available for various computer platforms, software packages, and instruments from Tektronix and other manufacturers.

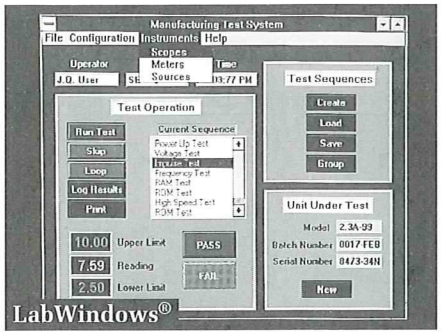
New for 1995 are Tek's SCS-9000 "Receiver Ready" and "Fixture Ready" System Integration Services. With this service, you fill in a simple workbook (with the help of our automated Mainframe Configuration spreadsheet-on-diskette) and configure a one or two bay, one to four mainframe system of five or seven feet in height. Further, you simply use "check boxes" to choose receiver ready-wired UUT power supplies, controller types, software, and other options to the rack. Using this approach, Tektronix has been able to forge new tools that make VXI system purchases flow quickly and easily–whether you are a system integrator, Synergy Partner, test engineer, or third party applications development house. Not only is this service a breakthrough, it is dramatically lower in price… as much as one fourth the cost of integration hardware and services costs in the industry today.

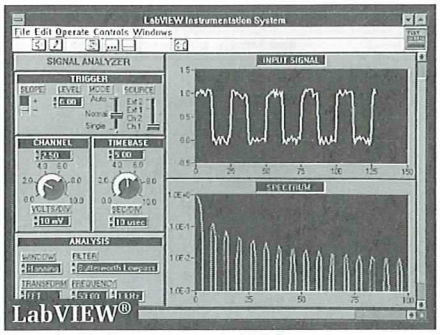
Prices for the SCS-9000 systems services are based on the total price of the Core VXI system hardware and software you configure plus ten percent. In most cases, using funnel cards to interface with receivers, this ten percent charge will never be exceeded. If you do have system requirements that go beyond SCS-9000 scope, Tektronix can respond to these separately at reasonable charges.

For product detail, request a VXI Catalog by completing the business reply card in the back of this catalog.

System Software

LabWindows®/CVI for Windows and Solaris





LabWindows®/CVI for Windows and Solaris

LabWindows®/CVI is a multiplatform data acquisition and instrument control development system for C programmers. Whether you are a casual developer or an experienced C programmer, you can reduce your system development time and improve the functionality of your system with LabWindows®/CVI. The tools in LabWindows®/CVI simplify time consuming tasks of creating and controlling custom graphical user interfaces (GUIs), controlling test and measurement instruments, and developing and maintaining test programs.

TEST PROGRAM DEVELOPMENT IN LabWindows®/CVI

LabWindows®/CVI has a complete set of standard C development tools integrated in an interactive programming environment. The standard tools include a compiler, linker, variable display, and numerous debugging utilities. The built-in C compiler automatically catches any syntax errors in your code. During program execution, you can insert breakpoints, view variables, and single-step through your source code. The LabWindows®/CVI environment even protects you from memory violations and runtime errors.

LabWindows®/CVI saves development time by automatically generating code for your instrument control, data acquisition, data analysis, and data presentation operations. All of the functions in the LabWindows®/CVI libraries have graphical function panels that generate code for your programs. Using a function panel, you simply set the values of each parameter to build the function call interactively. You can execute the function by itself, and then paste the function call into your program automatically. You save time bypassing the tedious process of typing and editing function calls in your program.

CREATING A GRAPHICAL USER INTERFACE

LabWindows®/CVI has easy-to-use tools for creating sophisticated graphical user interfaces. In the User Interface Editor, you can select from push buttons, pull-down menus, knobs, graphs, strip charts, or your own graphics images to design a GUI for your project. Your entire user interface is created interactively, without a single line of code. To control the user interface, you select functions from the User Interface Library to hide and display panels, get user events, and set and retrieve values on the controls of your panel. The User Interface Library makes creating and operator interface easy – you do not need to be a programming expert to create your own custom GUI.

BUILT-IN LIBRARIES FOR TEST AND MEASUREMENT

When developing your programs with LabWindows®/CVI, you will have access to functions for all of your test and measurement operations:

- **GPIB –** The GPIB Library contains functions for complete programmatic control of IEEE 488 instruments. With the GPIB 488.2 Library, you can use any of the National Instruments IEEE 488.2 Controller boards and the standard NI-488.2 device driver.
- **VXI –** As part of the VXI Development System, the VXI Library has functions to control VXI instruments from either embedded VXI controllers or external computers equipped with a MXI interface. The library has functions for programming both message-based and register-based devices.
- **RS-232 –** The RS-232 Library has functions for performing serial communication using multiple RS-232 ports under interrupt control.
- **Instrument Library –** The Instrument Library with over 300 instrument drivers for GPIB, RS-232, and VXI devices, are available for LabWindows®. You can interactively operate your instruments with the LabWindows®/CVI function panels and automatically generate instrument control code for your application program. A list of supported Tektronix instruments is shown on the next page.

LabWindows®/CVI

- Interactive C Program Development
- Automatic Code Generation
- Acquisition, Control, and Analysis Libraries
- GUI Development Tools
- Instrument Driver Library

LabVIEW®

- Graphical Programming for Instrumentation
- Modular Program Development
- Acquisition, Control, and Analysis Libraries
- Test Executive
- Instrument Driver Library

Reduce system development time and improve functionality.

Innovative programming without sacrificing performance.

For product detail, request a VXI Catalog by completing the business reply card in the back of this catalog.

System Software
Selection Guide

SELECTION GUIDE

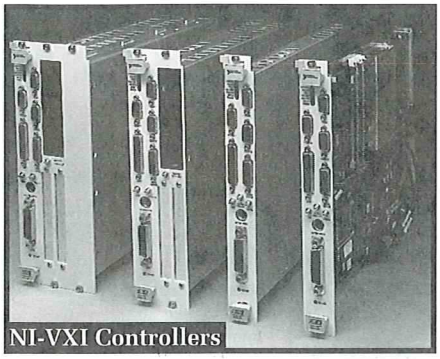
Tektronix Instruments

Model	Description	LabVIEW®	LabWindows®
222	Handheld Digitizing Oscilloscope	√	√
11300	Digitizing Oscilloscope	–	√
11400	Digitizing Oscilloscope	√	√
11800	Digitizing Oscilloscope	√	–
2220	Digitizing Oscilloscope	–	√
2221	Digitizing Oscilloscope	–	√
2224	Digitizing Oscilloscope	–	√
2230	Digitizing Oscilloscope	√	√
2232	Digitizing Oscilloscope	–	√
2252	Oscilloscope	√	√
2430	Digitizing Oscilloscope	√	√
2432	Digitizing Oscilloscope	√	√
2440	Digitizing Oscilloscope	√	√
2465A	Analog Oscilloscope	√	–
390AD	Digitizer	√	–
7612D	Digitizer	√	–
7D20	Digitizer	√	–
7854	Digitizer	–	√
7912	Digitizer	–	√
AA 5001	Distortion Analyzer	√	√
AFG 5101	Prob. Arb./Func. Gen.	√	√
AFG 5501	Prob. Arb./Func. Gen.	√	–
CG 5001	Calibration Generator	√	–
CG 551AP	Calibration Generator	√	–
CSA 803	Comm. Signal Analyzer	√	–
DC 5004	Counter/Timer	√	–
DC 5009	Counter/Timer	√	–
DC 5010	Counter/Timer	√	–
DM 5010	Digital Multimeter	√	–
DM 5110	Digital Multimeter	√	–
DSA 600	Digitizing Analyzer	√	√
FG 5010	Function Generator	√	√
HFS 9003	Stimulus System	√	√
MI/MX 5010	Multifunction Interface	–	√
PS 5004	Power Supply	√	√
PS 5010	Power Supply	√	√
RTD 710	Digitizer	√	√
RTD 720	Digitizer	√	–
SCD 1000	Digitizer	√	–
SCD 5000	Digitizer	√	–
SG 5010	Oscillator	√	√
SI 5010	Scanner	√	√
TDS 420	Digitizing Oscilloscope	√	√
TDS 460	Digitizing Oscilloscope	√	√
TDS 520	Digitizing Oscilloscope	√	√
TDS 540	Digitizing Oscilloscope	√	√
TDS 620	Digitizing Oscilloscope	√	√
TDS 640	Digitizing Oscilloscope	√	√
TDS 644	Digitizing Oscilloscope	√	√
TDS 820	Digitizing Oscilloscope	–	√

Tektronix VXI Instruments

Model	Description	LabVIEW®	LabWindows®	VXI *plug&play*
73A-270	Arbitrary Pulse Pattern Generator	√	√	√
73A-308	Relay and High Voltage Logic Driver	√	√	√
73A-425	Quad ARINC 429 Transmitter	√	√	√
73A-426	Quad ARINC 429 Receiver	√	√	√
73A-453	1-CH MIL-STD-1553A/B Bus Simulator	√	√	√
73A-455	2-CH MIL-STD-1553A/B Bus Simulator	√	√	√
73A-541	10 MHz Universal Digitizing Counter	√	√	√
DBS8700	8-CH, 200 kS/s A/D Conv./Dig.	√	√	√
DBS8701	8-CH, 400 kS/s A/D Conv./Dig.	√	√	√
DBS8710	16-CH, Diff. Multiplexer	√	√	√
DBS8720	32-CH, Diff. Multiplexer	√	√	√
DBS8750	2-CH, 400 kS/s Arb. Wvfm. Synthesizer	√	√	√
DBS8751	4-CH, 200 kS/s D/A Conv./Wvfm. Gen.	√	√	√
DBS8752	4-CH, 200 kS/s D/A Conv./Wvfm. Gen.	√	√	√
VX1410	IntelliFrame™, 13-Slot Mainframe.		√	√
VX4224	Universal Counter/Timer		√	√
VX4234	4.5-Digit Multimeter	√	√	√
VX4237	6.5-Digit Multimeter		√	√
VX4240	Waveform Digitizer/Analyzer	√	√	√
VX4244	16-CH, 200 kS/s Simultaneous Digitizer		√	√
VX4281	RF Power Meter		√	√
VX4286	32-CH Analog/Digital Input Module	√	√	√
VX4287	Differential 32-CH, A/D Comparator		√	√
VX4320	Six 1X4 RF Multiplexer		√	√
VX4330	120-CH, Scanner/Multiplexer		√	√
VX4332	40-CH 2-Wire Reed Relay Scanner Master	√	√	√
VX4334	24-CH 4-Wire Reed Relay Scanner Master	√	√	√
VX4342	Dual Resistance Programming Module		√	√
VX4350	64-CH, SPST/SPDT Switching Module		√	√
VX4353	32-CH SPST Relay Switch	√	√	√
VX4355	24-CH DPST Relay Switch	√	√	√
VX4356	20-CH DPDT Relay Switch	√	√	√
VX4357	32-CH SPDT Relay Switch	√	√	√
VX4363	32-CH SPST Relay Switch	√	√	√
VX4365	24-CH DPST Relay Switch	√	√	√
VX4366	20-CH DPDT Relay Switch	√	√	√
VX4367	32-CH SPDT Relay Switch	√	√	√
VX4372	48-CH 2-Wire Reed Relay Scanner Slave	√	√	√
VX4374	24-CH 4-Wire Reed Relay Scanner Slave	√	√	√
VX4380	256 Crosspoint Switch Matrix		√	√
VX4385	Matrix Switch	√	√	√
VX4386	Latching Matrix Switch	√	√	√
VX4428	Quad ARINC 429 Transmitter/Receiver	√	√	√
VX4457	MIL-STD-1553A/B Intelligent Bus Monitor		√	√
VX4469A	ARINC 629 Simulator w/Error Injection		√	√
VX4491	Serial Test Module	√	√	√
VX4730	12-CH, 16-Bit D/A Converter	√	√	√
VX4750	Function Generator	√	√	√
VX4790A	Arbitrary Waveform Generator	√	√	√
VX4792	250 MHz VXI Arbitrary Wvfm. Gen.		√	√
VX4801	40-Line Isolated Digital I/O	√	√	√
VX4802	80-Line Digital I/O	√	√	√
VX4820	Parallel Digital Test Module	√	√	√

Controllers/Interfaces


NI-VXI Controllers

The Right Choice

Certainly no single architecture will be right for all users. Let us work with you to guide you through the choices and assist you in arriving at the right choices for your situation.

Tektronix offers a suite of controllers, interface hardware and software for automated instrumentation control. Whether the test requirement calls for GPIB, VXIbus, or a combination thereof, Tektronix can provide a powerful, cost-effective controller or interface perfectly matched to your needs.

As a strong advocate of the open systems approach, Tektronix is a leader in furthering the development of standards for instrumentation systems. Tektronix evaluates all of its system controllers and interfaces for adherence to standardized interface rules. This evaluation ensures straightforward system integration and gives the system designer the latitude to use the most appropriate instrumentation and programming tools, regardless of the vendor.

EMBEDDED VS. EXTERNAL CONTROLLERS

Depending upon its instrument configuration, cost constraints, and throughput requirements, a test system might best be controlled from either an external PC-type controller or an embedded VXI controller.

Of the two alternatives, external controllers are typically the more flexible and configurable. Within this format, it is possible to achieve either minimum cost, or massive but cost-effective compute power. Embedded controllers, on the other hand, provide an optimized high-performance interface to VXI instruments and require the least physical space.

EMBEDDED CONTROLLERS

Tektronix offers the widest choice of embedded controllers of any vendor. Again demonstrating "openness" in the industry, Tektronix System architecture supports both National Instruments and RadiSys controllers. The VXI566 66 MHz 486DX2 Controller and VXI599 100 MHz 486DX4 Controller from National Instruments offer many different system configurations ranging from 4 MB RAM, 80 MB hard disk to 32 MB RAM, 1GB hard disk. These embedded controllers give you direct control of VXI registers, memory and triggers while maintaining compatibility with the scores of software packages and tools available for general market desktop PC computers. Tektronix also offers the RadiSys EPC-7 Embedded Controller with configurations ranging from 4 MB RAM, 100 MB hard disk to 16 MB RAM, 240 MB hard disk. Industry standard EPConnect® software development and run-time environments are available for the EPC-7.

EXTERNAL CONTROLLERS

Tektronix offers a range of external controllers with different price and performance levels and physical formats.

External controllers interface to instruments in one of several ways. Among the most common interfaces are GPIB and MXI. GPIB is the lowest cost method to control VXI instruments. Many customers already have a GPIB interface for their computer. MXI offers higher performance while still utilizing an external computer.

Tektronix offers PC and VXI interface cards in each of these formats. The S3FG210 GPIB PCII/IIA and S3FG220 AT-GPIB/TNT cards interface with the VXIGPIB Slot 0 Resource Manager. The interface for the MXIWIN Standard VXI-MXI AT2010 is included with the VXI module.

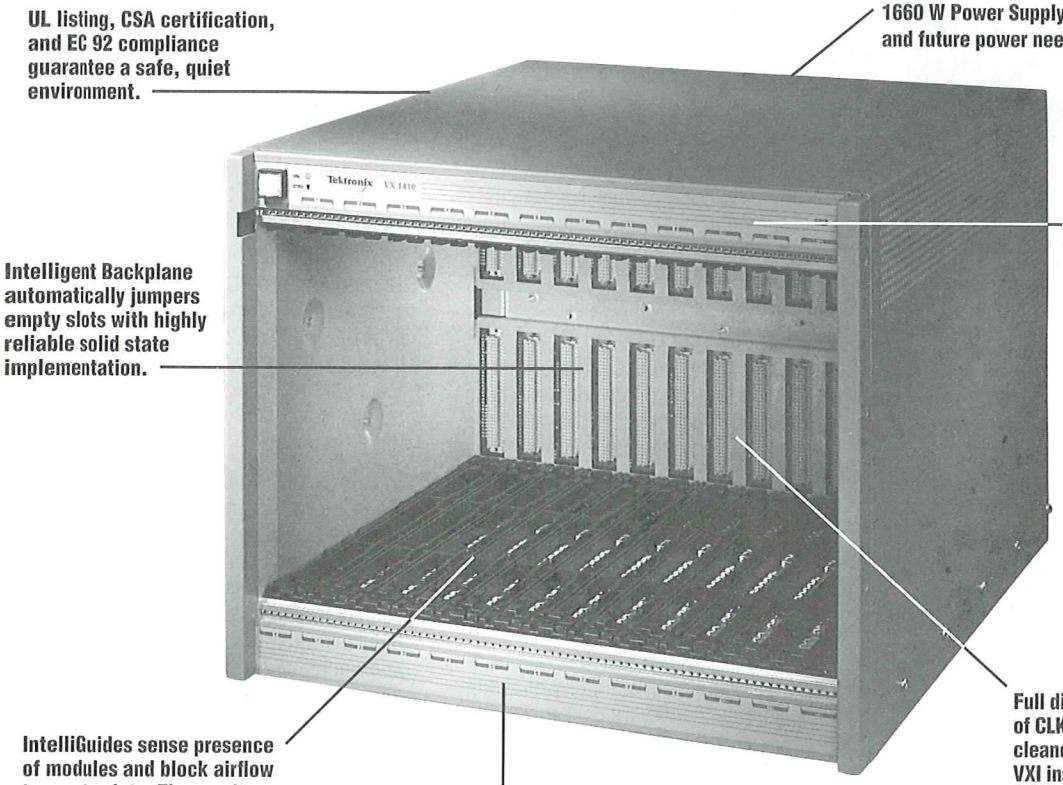
SYSTEM SOFTWARE

System software includes several kinds of software packages. Using our experienced help, you select the combination that will work best for you. Our controllers support various operating systems and related system software. Because we emphasize an open systems approach, the capabilities you need are probably already available in a standard package.

Instrument	RAM	Hard Disk	MHz	Microprocessor
VXI566	4 MB RAM	80 MB to 1 GB	66	80486DX2
VXI599	16 MB to 32 MB	240 MB to 1 GB	100	80486DX4
EPC-7	4 MB to 16 MB	100 MB to 240 MB	33 to 50	80486

For product detail, request a VXI Catalog by completing the business reply card in the back of this catalog.

Mainframes



NEW VX1410 IntelliFrame™ Mainframe

VXI Mainframes

The mainframe can be viewed as the most important VXI instrument in a system. It is responsible for the complete environment for VXI modules: power, cooling, EMI, mechanical, and backplane communication and timing. The performance of the mainframe directly impacts the performance of the modules:

- More available power allows greater flexibility for future instrument selection.
- Better mainframe cooling extends the life of the instruments.
- More EMI protection improves measurement accuracy.
- Better mechanical design makes maintenance and system integration easier.
- Superior backplane CLK10 distribution improves system timing accuracy.

Tektronix has a family of VXI mainframes to cover a broad range of applications. The VX1410 IntelliFrame™ mainframe is the latest product and represents breakthroughs in each of the areas listed above. It can be configured as a benchtop instrument or rackmounted. The IntelliFrame™ also has superior fault isolation capability.

The VX1401 is an excellent, low cost, full size VXI mainframe that meets most application needs. It includes all rackmount hardware and a tough, Lexan front door at a very attractive price.

The VX1406 rounds out the Tektronix family of mainframes. It is a six slot VXI mainframe that is good for portable applications or engineering development.

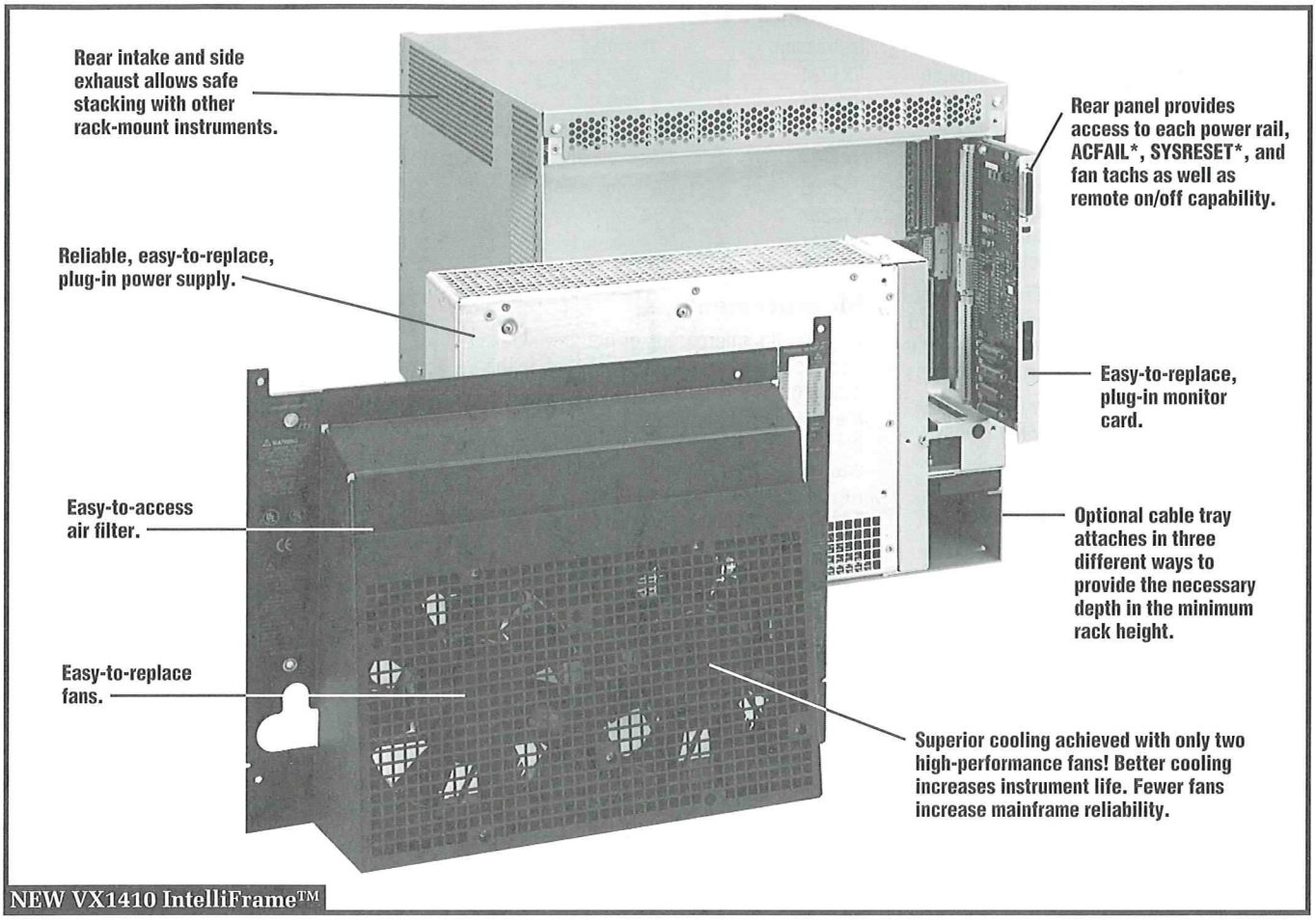
All Tektronix VXI mainframes have Options A1 through A5 for non-U.S. power cords.

VX1410 OPTIONS NOT SHOWN ABOVE:

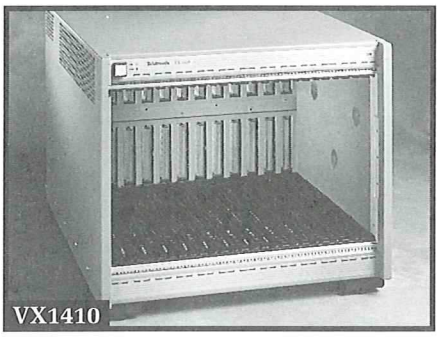
- Enhanced Monitor
  - Provides Readout of:
    Input temperature
    Exhaust temperature for each slot
    Each voltage rail
    Fan speeds
    Hours of operation timer
    Air filter cleaning timer
  - Allows user selection of interrupt (alarm) conditions
  - Communicates as a message-based instrument and RS-232
  - VXI*plug&play* software driver
  - Bright front-panel Fluorescent Display
- Rack Kit
  - VXI*plug&play*-compatible, accepts VXI*plug&play* receivers without need for expensive adapters
  - Adjustable recess accommodates cables with large bend radii
  - Lexan™ door is stronger than acrylic, providing better protection while allowing visibility of instrument front panels.
  - Top and bottom vertical cable access allows for shorter cables to instruments above and below the mainframe, improving signal fidelity.

Products summary/order information is on page 395.

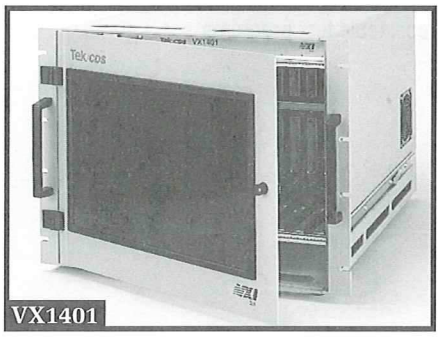
Mainframes Summary



NEW VX1410 IntelliFrame™



VX1410



VX1401



VX1406

VX1410 INTELLIFRAME™

- 13 Slots
- 1660 W Autoranging Power Supply
- Intelligent Cooling
- Easy Maintenance
- Powerful (Opt.) Enhanced Monitor
- Adjustable (Opt.) VXI*plug&play* compatible Rack Kit

VX1401 LOW COST MAINFRAME

- 13 Slots
- 692 W Power Supply
- Rack Kit and Cable Tray Included
- Vertical Cable Access
- Reliable Backplane
- Rugged

VX1406 PORTABLE MAINFRAME

- 6 Slots
- 486 W Autoranging Power Supply
- Removable Side Panel for Instrument Access
- Optional Rackmount Kit

For product detail, request a VXI Catalog by completing the business reply card in the back of this catalog.

Measurement

Solutions for wide range of user signals and demands.

VXI MEASUREMENT

- Wide Range of General Purpose Instruments, all VXI*plug&play* Compliant
- All AC, DC, I, and Related Digital Multimeter Functions
- All Frequency, Time Interval, and Other Typical Timer Counter Functions
- New DC-400 KHz Low Frequency/ Audio Spectrum Support
- High Reliability/ Excellent Repeatability of Measurements

MEASUREMENT INSTRUMENT SELECTION GUIDE

Instrument	Function	Key Specs	Key Features
VX4234	DMM	4.5 digits	Fast, fully guarded, AC & DC
VX4237	DMM	6.5 digits	High perf. 5 AC/5 DC ranges
73A-541	Timer Counter	10 MHz	General purpose, time tag
VX4224	Timer Counter	200 MHz/2.5 GHz	9 digit res. high performance
VX4286	A/D Comparator	32 CH	Single-ended input
VX4287	A/D Comparator	32 CH	Differential input
VX4281	RF Powermeter	40 GHz	–60 dBm to +13 dBm

Measurement

Whether it's microamps or hundred volt signals, your measurement subsystem is the 'workhorse' of your VXI test and measurement system. Easy programming, well-behaved and predictable operation, accuracy, and repeatable measurement are the key requirements of this kind of equipment. With Tek's many years of experience with the vast range of user signals and demands, you are assured of satisfying performance in these areas, not to mention functions and specs that are hard to beat.

WHAT, WHEN, HOW

A key aspect of Tek's designs are their highly evolved triggering, capture, and data manipulation architectures. Tek's established VXI leadership in high throughput measurement is based not only on the high speed 'smarts' of these message based designs, but also on their ability to be setup, fired, and then read in a fast manner. Software plays a key role in this too: Tek's designs have pioneered the streamlined arming and 'statusing' of these instruments. All this adds up to fast and repeatable test programs.

THE SYSTEM VIEW

You'll find that with Tek's LabVIEW® and LabWindows® drivers, now upgraded and compatible with VXI*plug&play*, the integration of instruments into test systems and test program development is simplified and streamlined. Nothing is more frustrating than installing an instrument only to find you need to call the factory for 'the latest' driver or firmware… a problem many customers have experienced with other vendors' non-compliant VXI*plug&play* equipment. With Tek, you will experience rapid system integration schedules, quick learning curves with the drivers and applications software, and – best yet – solid, predictable instrument measurements that you can write home about.

APPLICATIONS

- **General Purpose AC/DC Measurement**
- **General Purpose Time/Freq to 2.5 GHz**
- **RF Power Measurement – Wireless Applications**
- **Industrial A/D requirements, high speed/many channels**

For product detail, request a VXI Catalog by completing the business reply card in the back of this catalog.

Sources

SOURCES INSTRUMENT SELECTION GUIDE

Instrument	Function	Key Specs	Key Features
VX4342	Dual Resistance	4 decades/CH	200 value changes/s
VX4730	D/A High Output	12 CH	±16V, 400 mA
VX4750	Function Generator	25 MHz	Modulation, sweep
VX4790A	General Purpose ARB	25 MHz	±10V, with sine, sq, sawtooth
VX4792	Fast ARB	250 MHz	Versatile Software
DBS8750	Precision ARB	400 KHz	16-Bit with on board DSP
DBS8751	Precision D/A	4 CH	16-Bit, 3/6 V
DBS8752	Precision D/A	4 CH	16-Bit, 5/10 V

Sources

Like a lighthouse, a source is expected to be on the job, whatever conditions prevail – severe noise, low signal level, or dynamic loading. Tektronix mastery of signal source stability, built on the well known TM5000/500 product series foundation, continues into the VXI products, some of which are already becoming a legend in time.

New this year is the very powerful VX4792 250 MHz ARB: a breakthrough moving VXI testing capabilities well beyond those of 100 MHz units. Compatible with the AWG2020's WaveWriter™ software, this unit can open doors to testing complex low RF applications, high speed logic tests, and cable/communications testing.

STUFFING THE WAVE

Because of the large amounts of waveform data, and the many times a test program may need to configure the ARBs, it is critical that source instrument software quickly and easily load, arm, and fire the instruments. As with all of Tektronix VXI instruments, emphasis is placed at a system level, forcing designers to worry about a) making the instruments easy to program, and b) making the instruments function as fast as possible.

Front ends of Tektronix sources are clean, accurate, and predictable. Stable, wide (in output) range UUT stimulus makes UUT interfacing easy and manageable.

NOTHING IS FIXED ANYMORE

Yesterday's sources are fine, but today's UUTs demand a diverse range of modulation. Tek's sources allow and support complex and traditional modulation without losses in instrument accuracies or stability. Just as signals continue their march toward more use of coding, demands on the instrument also increase in other areas: synchronization, triggering, and paging (of waveform memory). With many years of understanding the nature of complex signals from our years in oscilloscopes, Tektronix has been able to apply technical agility in mastering these synchronization and triggering needs.

ON THE HORIZON

So when you're trying to stress that UUT with worst case signals programmed from a Tek source, you'll be able to trust those outputs – as did the mariners of old trust their lighthouses. Tektronix commitment to VXI, as witnessed with the advent of the VX4792, marches attuned to the advancement of UUT technology – again!

VXI SOURCES

- Wide Range of General Purpose Instruments, all VXI*plug&play* Compliant
- Low Noise, Stable Fixed and Programmable Outputs, From 16-Bit Precision Audio to 250 MHz Coded Formats.
- New VX4792 is Compatible with AWG2020 Bench Units and Programming Software
- Fast and Easy Programming
- High Reliability/ Excellent Stability and Accuracy

Clean, accurate and predictable.

For product detail, request a VXI Catalog by completing the business reply card in the back of this catalog.

APPLICATIONS

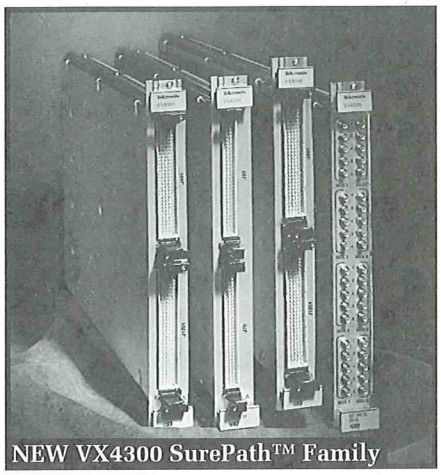
- **General purpose signal sources – audio to RF**
- **Modulated and coded signal source requirements**
- **Resistance/Impedance tests**
- **Voice, Modem, PCM, and telephony tests**

Switching/Scanning

New VXI general purpose relay switching and scanning crosspoint matrix, and RF switching for all automatic test system and manufacturing test applications.

New VXI SWITCHING

- Relay Switching in SPST, SPDT, DPST, DPDT Configurations
- Relay Scanners Offer 1 Wire, 2 Wire, and 4 Wire Configurations up to 240 Channels Per Module
- Relay Matrix with 256 and 128 Cross Points, Latching and Non-latching Configurations
- 1.3 GHz RF Multiplexer Offers Eight One x Four Muxes in a Single Slot
- Relay Drivers/Solenoid Controllers to 50 V DC and 300 mA



This VXI Interface and Slave Controller is installed on the first switch module. Additional modules are controlled from the Local Bus.

Switching

This year, Tektronix is introducing a new switching family architecture to our broad line of VXI switching products. The new SurePath™ switching family illustrates Tektronix' continued commitment to achieving greater levels of performance while driving the price of VXI below comparable GPIB rack and stack installations.

The initial introduction consists of four switching products:

- VX4320 1.3 GHz RF Mux usable to 2 GHz
- VX4330 120-CH Scanner/Mux
- VX4350 64 CH Relay Switching Module
- VX4380 256 Crosspoint Relay Matrix

LOWER COST LOCAL BUS COMMUNICATIONS
All relay modules are controlled via the Local Bus on the VXI chassis backplane by a VXI Interface and Slave Control daughter board. Only a single daughter board is required to control a full chassis of these new relay switching modules.

LOW NOISE MODE
A unique feature of the new family of switching modules is that the VXI interface and relay controller daughter board goes to a quiescent mode when not actively in use. This mode greatly lowers the risk that digital noise within your VXI system can disturb low level measurements.

IEEE-488.2/SCPI
Tektronix proves its commitment to open architecture and ease of use through the implementation of IEEE-488.2 commands and formats and SCPI programming structures. IEEE-488.2 and SCPI give the user an English language command set that self-documents the switching subsystem program.

VXI*plug&play* FRONT PANELS
Tektronix, a founding member of the VXI*plug&play* alliance, is committed to wide spread availability of VXI*plug&play* soft front panels. There are easy to use soft front panels that enable the user to control each of these modules virtually right out of the box.

BACKWARD COMPATIBLE
The SurePath™ family can be used to control the VX4372 2-wire and VX4374 4-wire scanner slave modules. The VX4372 and VX4374 are lower cost/channel density modules that allow the user to tailor the switching configuration to the needs of the UUT.

EXPANDING ARCHITECTURE
The initial introduction of four SurePath™ switching modules is just the beginning. More switching modules are on the drawing board. New Tektronix non-switching modules will also implement the local bus control design for applications that will benefit from VXI switching.

LATCHING RELAY DESIGN
Thermal EMF errors can be caused by relay contact heating as a result of leaving the relay coil energized for extended periods. Tektronix' SurePath™ family uses latching relays that are pulsed on or off. Not only do latching relays contribute to lower thermal EMF errors, but they will reduce overall chassis power consumption and, in the event of a VXI chassis AC fail signal, the user can choose to open all relays, maintain their present state or open all relays when power is reapplied. This allows the user to select the option that will most likely reduce the risk of damage to the UUT.

INTERNATIONAL REGULATORY APPROVALS
Reduce your test system design risk by selecting VXI components that have been rigorously tested and certified. Don't jeopardize your system design with susceptible or radiating modules. A unique Tektronix shield and electrical design have allowed all members of the new family of switching modules to achieve:

- IEC 1010 Certification
- UL 1244/3111 Listing
- EC92 Compliance

APPLICATIONS

- **RF MUX**
- **Scanner/MUX**
- **Relay Switch**
- **MATRIX**

For product detail, request a VXI Catalog by completing the business reply card in the back of this catalog.

Switching/Scanning

VX4320
- 1.3 GHz 3 dBpt usable to 2 GHz
- Eight groups of 1 x 4 muxes
- Each mux utilizes a tree configuration for outstanding RF characteristics
- Low Insertion Loss
- Excellent VSWR
- High Crosstalk Isolation

VX4330
Software configurable maximums:
- 120 CH 2-wire scanner multiplexer
- 1X240 1-wire
- 1X60 4-wire
- Simultaneously and multiple 1-wire, 2-wire,
- 4-wire configurations
- 10 MHz 3 dBpt
- 2 A continuous switching
- 220 V AC or DC switching

VX4350
- Low cost, high density
- 64 CH SPST or SPDT switches
- Each switch individually controlled
- 2 A continuous
- 220 V AC or DC switching

VX4380
- 256 crosspoints
- Configure a single module as 2-wire or 4-wire
- No unique modules; each VX4380 can be configured as a 16 x 16 or 8 x 32 or 4 x 65
- Create large matrices by easily joining modules in either the X or Y dimensions

VXI SWITCHING/SCANNING SELECTION GUIDE

Relay Switch	VX4350 64-CH	VX4353 32-CH	VX4355 24-CH	VX4356 20-CH	VX4357 32-CH	VX4363 32-CH	VX4365 24-CH	VX4366 20-CH	VX4367 32-CH
SPST	X	X				X			
SPDT	X		X		X		X		X
DPST			X				X		
DPDT				X				X	
Volts DC max	220	48	48	48	48	220	220	220	220
Volts AC max	260	250	250	250	250	250	250	250	250
Switching Imax	2	5	5	5	5	2	2	2	2
Max Power VDC	50	90	90	90	90	60	60	60	60
Max VA	125	1,000	1,000	1,000	1,000	125	125	125	125

Scanner	VX4330	VX4332	VX4334	VX4372	VX4374
Description	120-CH	40-CH	48-CH	24-CH	24-CH
1-wire	X				
2-wire	X	X		X	
4-wire	X		X		X
Volts DC max	220	200	200	200	200
Volts AC max	260	120	120	120	120
Switching Imax	2	0.5	0.5	0.5	0.5
Max Power VDC	60	10	10	10	10
Max VA	125	10	10	10	10

Matrix	VX4380 18X18-4X64	VX4385 8-18-4X32	VX4386 8X18-4-32
X Cross points	268	128	128
Expandable	yes	yes	yes
Latching	X		X
Volt DC max	220	110	110
Volts AC max	250	120	120
Switching Imax	2	1	1
Max Power VDC	60	30	30
Max VA	125	60	60

Relay Control	73A-308
Open Collector	X
TTL Compatible	
No. of Channels	80

RF Max	VX4320
3 dB Point	1.3 GHz
Typical	8 dB @ 2 GHz
Configuration	8 Groups of 1x4 RF Muxes

For product detail, request a VXI Catalog by completing the business reply card in the back of this catalog.

Digital and Boundary Scan

Match instrument and price to your specific application.

BSCAN

- First In the Industry with 1149.1 Support and ASSET VXI Tools. Compatible with TI's ASSET™ and Teradyne's Victory™ Products Through SVF File Format.
- Cost Effective Boundary Scan Packages for the R&D Lab or for the Production Floor.
- Serial and Parallel Tools
- Cost Effective Basic Digital Pin Instruments with Simple to Use VXI*plug&play* Driver Support

DIGITAL AND B-SCAN SELECTION GUIDE

Instrument	Function	Key Specs	Key Features
73A-270	Prog Generator	2 Fast Serial	Complex pulse trains
VX4801	Basic Pins	48TTL/CMOS	Byte-by-byte I/O programming
VX4802	Basic Pins	80TTL/CMOS	User masks
VX4820	Dynamic Pins	20 MHz	32/64 Pin groups/Pods
VX4491	Serial Test	JTAG/1149.1	2 TAPs
ASSET VXI	B-Scan Software	Supports VX4491	Automatic vector generation, interactive debugger, scan analyzer.

It May Be Where You're Headed

Inevitably, test development grinds to a slow pace when confronted with complex programmable and standard VLSI devices. While growing modestly as a testability technique over the last years, boundary scan is soon to gain rapid acceptance as a methodology both 'in the lab' and in production. Tek VX4491 and ASSET VXI software products allow you to implement your boundary scan testing philosophies or trials today – either as a 'bench' configured VX1406 mini-system, or in a full blown ATE Functional VXI system.

BURSTY AND STATIC

Digital pin requirements follow a never ending highway of need, from the necessity to test simple latched I/O, to complex processor or state machine bursts. Tek's digital products allow you to match the instrument and price to your specific application. VXI*plug&play* drivers and applications simplify the test program development. Tek's VX4820 is suited to larger testing requirements with its openness to slave additional VX4820s.

AND ONE BY ONE...

Have you ever wasted a VXI slot for a need of a single soloist pin? Tek's experience in serial avionics, automotive, and communications busses has been a basis for the design of the 73A-270, a very popular general purpose serial pattern generator. This instrument allows complex streams – of up to 1,600 events – to be programmed and burst, with additional facilities of triggering and synchronization readily available.

APPLICATIONS

- **General Purpose Digital I/O**
- **Boundary Scan R&D Development**
- **Digital Functional Test**
- **IC, LCA, ASIC, etc. Functional Testing**
- **Functional pcb module or card testing**

For product detail, request a VXI Catalog by completing the business reply card in the back of this catalog.

Avionics

Avionics

Tektronix has a long history of commitment to aerospace and avionics testing. This year, Tektronix is introducing a wide range of new products and services tailored to the avionics community. Whether you are a self-integrator of avionics ATE systems or need avionics test system integration services and expertise, Tektronix has the experience, products, and services to get you off the ground quickly and reliably.

Tektronix offers the widest range of VXI based instrumentation and communication interfaces specifically designed for avionics test and simulation. Our extensive catalog includes ARINC 429, ARINC 629, and MIL-STD-1553 VXI modules. These products are used by airlines and depot repair facilities worldwide. Tektronix card modular instruments are included in avionics ATE systems supplied by leading avionics and aircraft manufacturers worldwide.

ARINC 629

In support of Boeing's new jet liner, the B777, Tektronix is announcing the VX4469A ARINC 629 Simulator with Enhanced Error Injection. The VX4469A is our third generation ARINC 629 tester whose enhancements are a direct result of our experience and customer feedback on our earlier products. The VX4469A combines all of the functions of the proven VX4469 with new error injection capability you need to get your test system flying. The VX4469A provides you an advanced tool for ARINC 629 communication, bus traffic simulation, and bit, word and message level error injection. The VX4469A provides the maximum visibility into your LRU's ARINC 629 interface.

PRE-CONFIGURED AVIONICS SYSTEM

Through our System Integration Services program, Tektronix is now offering the ACS 100, a preconfigured system targeted at avionics test applications. The ACS 100 provides the core instrument complement required to test most avionics devices. The ACS 100 consists of an IBM compatible 486 class computer, National Instruments LabVIEW® graphical programming environment, your choice of ARINC 429. ARINC 629, MIL-STD-1553 communications, 28 VDC discrete I/O, analog measurement and signal routing, and UUT power. The ACS 100 is delivered with the instrument drivers loaded, ready for test programming.

New VXI AVIONICS TEST

- MIL-STD-1553 Bus Simulators and Bus Monitors
- ARINC 429 Receiver/ Transmitter
- ARINC 629 Multi-terminal Simulator
- Discrete I/O and Aircraft Transducer Simulation
- Avionics Test System Services

VXI avionics bus simulators and testers for avionics LRU testing of MIL-STD-1553. ARINC 429, and ARINC 629 interfaces. Full error injection and detection makes these products ideal for design, manufacturing and depot service applications. LabVIEW®, LabWindows® drivers are available.

AVIONICS PRODUCT SELECTION GUIDE

Product	Description	Software Support	Applications
ARINC 429	**Quad ARINC**	**LabVIEW®**	**Transmitter**
73A-425	Quad ARINC 429 Transmitter	LabVIEW®, LabWindows®	Low cost ARINC 429 transmitter
73A-426	Quad ARINC 429 Receiver	LabVIEW®, LabWindows®	Low cost ARINC 429 receiver
VX4428	Quad ARINC 429 Transmitter and Receiver	LabVIEW®, LabWindows®	Test and control LRUs via ARINC 429 transmitter/receiver
ARINC 629			
VX4469A	ARINC 629 Simulator with Enhanced Error Injection	LabVIEW®, LabWindows® Windows soft front panel	Up to 3 terminals with full error injection. Emulate multiple terminals in real-time
MIL-STD-1553			
73A-453	MIL-STD-1553 A/B Bus Simulator Tester	LabVIEW®, LabWindows®	Test & control LRUs via MIL-STD-1553
73A-455	Dual Channel MIL-STD-1553 A/B Bus Simulator Tester	LabVIEW®, LabWindows®	Test dual redundant MIL-STD-1553
VX4457	MIL-STD-1553 A/B Intelligent Bus Analyzer Monitor	–	LRUs, Simulate bus controller, remote terminal, or bus monitor
VX4456	MATE Compatible MIL-STD-1553 Simulator Tester	ATLAS support of TYX Corp	MIL-STD-1553 support for MATE applications
73A-156	MATE Instrument on a Card (IAC) Control Module	ATLAS support of TYX Corp	MATE complaint Slot 0 resource manager
Complementary Products			
VX4286	32-CH Analog Digital Input Module	LabVIEW®, LabWindows®	Monitor aircraft discrete outputs
VX4287	32-CH Differential Analog Digital Input Module	LabVIEW®, LabWindows®	Monitor aircraft discrete outputs in noisy environment
73A-308	Discrete Output/Relay Driver Module	LabVIEW®, LabWindows®	Control 80 discrete outputs (simulate 28 V DC discretes)
73A-270	Arbitrary Serial Pattern Generator	LabVIEW®, LabWindows®	Simulate proprietary serial data streams
73A-541	Universal Digitizing Courier Module w/ Time Tag Memory	LabVIEW®, LabWindows®	Receive complex, proprietary serial data, format for computer input

For product detail, request a VXI Catalog by completing the business reply card in the back of this catalog.

Digitizers

Reliability, accuracy and dependability.

DIGITIZERS

- Breakthrough in Price/Sample Rate!
- Breakthrough in Price/Bandwidth!
- Breakthrough in Price/Resolution!
- Breakthroughs in Record Lengths at Low and High Sample Rates!
- Industry's First VXIplug&play VXI Precision DSO
- 1, 2, 4 Channel Configurations

The Name That is a Scope

If you are acquiring signals in any part of the spectrum and need a DSO, the first name you'll hear is Tektronix. New for 1995, the TVS series redefines the dimensions of DSOs for VXI, including their virtual scope front panel operation and VXI*plug&play* easy programmability. Sacrifice neither bits of resolution, record length, nor sample rates with the TVS series, which ranges from the cost effective TVS521 to the "industry best" TVS545.

YOU'VE SEEN THEM BEFORE

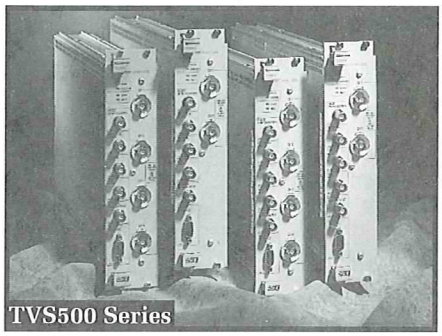
Using the known and proven foundation of the TDS series technology, The TVS series' architects designed these instruments for very high throughput. Data analysis is simple with the high level command and function set of the instruments, so you will realize faster test program development and test times – whether you're acquiring one signal or ten-thousand. Reliability, accuracy, and dependability are the synonyms for the TVS line, just like the phrases "a Tek scope" and "a scope" mean one and the same.

VXI OSCILLOSCOPES, WAVEFORM DIGITIZERS, AND ANALOG TO DIGITAL CONVERTERS (ADC)

	Bandwidth	Channels	Sample Rate	Vertical Resolution	Record length
TVS525	1 GHz	2	1 GS/s	10	16 K
		1	2 GS/s	10	32 K
TVS545	1 GHz	4	1 GS/s	10	16 K
		2	2 GS/s	10	32 K
		1	4 GS/s	10	64 K
TVS521	1 GHz	2	500 MS/s	10	8 K
		1	1 GS/s	10	16 K
TVS541	1 GHz	4	500 MS/s	10	8 K
		2	1 GS/s	10	16 K
VX4240	5 MHz	1	10 MS/s	12	256 K to 1 M
VX4244	1.5 KHz	16	200 KS/s	16	64 K
		8	200 KS/s		128 K
		4	200 KS/s		256 K
DBS8700		1	200 KS/s	16	1 K FIFO w/DMA
		8	25 KS/s		
		128 w/DBS8710*1	1.56 KS/s		
		256 w/DBS8720*2	0.78 KS/s		
DBS8701		1	400 KS/s	16	1 K FIFO w/DMA
		8	50 KS/s		
		128 w/DBS8710*1	3.125 KS/s		
		256 w/DBS8720*2	1.56 KS/s		

**1 The DBS8710 is a 16 channel, sample and hold MUX that is controlled by the DBS8700 and DBS8701.*

**2 The DBS8720 is a 32 channel MUX that is controlled by the DBS8700 and DBS8701.*



TVS500 Series Waveform Analyzers

- 4 GS/s sample rate
- 1 GHz bandwidth
- 10-Bit resolution
- 64 K record length
- High Throughput
- Extensive Signal Processing
- Message Based VXI*plug&play*

See page 126 for more information.

APPLICATIONS

- **Signal quality – Audio, Voice, Telephony**
- **Audio to very high speed signal analysis**
- **Very high volume/High test throughput**

For product detail, request a VXI Catalog by completing the business reply card in the back of this catalog.

Standard Product Summary

STANDARD PRODUCT SUMMARY

Contact your nearest Tektronix Representative for complete ordering and pricing information.

MAINFRAMES
VX1401 – Low Cost, 13-slot Mainframe

VX1406 – Portable, 6-Slot Mainframe

VX1410 – IntelliFrame™, Intelligent 13-Slot Mainframe

FIXTURING AND DUT INTERFACING
Virginia Panel –

- Pre-Wired Interconnect Adapters
- VXI Interlocking Receiver
- Vertical Hinged/Horizontal or Hinged Mounting Frame
- Interchangeable Test Adapter (ITA)

MAC Panel –

- Rotary Interface System
- Modular Interface System
- Pull-thru Interface System

SLOT 0/RESOURCE MANAGER MODULES
VXIGPIB – GPIB-VXI/C Slot 0 Resource Manager

MXIWIN – Standard VXI-MXI AT2010 without Cables

GPIB INTERFACES
S3FG210 – GPIB-PCII/IIA I/O Card for PC

S3FG220 – AT-GPIB/TNT I/O Card for PC

S3FG222 – EXM 27 AT-GPIB for EPC-7

MXI INTERFACES
VXI-AT2000 – MXI for DOS

VXI-AT2010 – MXI for Windows

VXI-AT2020 – MXI for SUN

MXIEXT – VXI-MXI Mainframe Extender

EMBEDDED CONTROLLERS
VXI566 – 66 MHz Embedded 486 VXIbus Controller

VXI599 – 100 MHz Embedded 486DX4 VXIbus Controller

VXIpc-486 Model 500 – 50 MHz Embedded 486 VXIbus Controller

VXIpc-486 Model 200 – 20 MHz Embedded 486 VXIbus Controller

EPC-7 – 33/50 MHz Embedded 486 VXIbus Controller

SOFTWARE
LVWIN – National Instruments LabVIEW® for Windows

LWDOS – National Instruments LabWindows® for MS DOS

LWCVI – National Instruments LabWindows® for Windows

MEASUREMENT
73A-541 – 10 MHz Universal Digitizing Counter

VX4224 – 200 MHz High Performance Universal Counter

VX4234 – 4.5-Digit Digital Multimeter

VX4237 – 6.5-Digit Digital Multimeter

VX4281 – RF Power Meter

VX1811A – 18 GHz RF Diode Sensor

VX1812A – 26.5 GHz RF Diode Sensor

VX1813 – Remote Calibrator for VX4281

VX1814A – 18 GHz RF True RMS Sensor

VX1815A – 40 GHz RF Diode Sensor

VX1817A – 18 GHz 5W Power Sensor

VX4286 – Single-ended, 32-CH, Analog/Digital Comparator

VX4287 – Differential 32-CH, Analog/Digital Comparator

DIGITIZERS
DBS8700 – 8-CH, 200 kS/s Multiplexed Analog to Digital Converter/Digitizer

DBS8701 – 8-CH, 400 kS/s Multiplexed Analog to Digital Converter/Digitizer

DBS8710 – 16-CH, Differential Multiplexer with Sample and Hold

DBS8720 – 32-CH, Differential Multiplexer

VX4244 – 16-CH, 200 kS/s Simultaneous Digitizer

VX4240 – 10 MS/s Waveform Digitizer/Analyzer

TVS521 – 2-CH, 500 MS/s Waveform Analyzer

TVS525 – 2-CH, 1 GS/s Waveform Analyzer

TVS541 – 4-CH, 500 MS/s Waveform Analyzer

TVS545 – 4-CH, 1 GS/s Waveform Analyzer

SOURCES
VX4342 – Dual Resistance Programming Module

VX4730 – 12-CH, 16-Bit DAC

VX4750 – 25 MHz Function Generator

DBS8750 – 2-CH, 400 kS/s Arbitrary Waveform Synthesizer

DBS8751 – (Low Output) 4-CH, 200 kS/s Digital to Analog Converter/Waveform Generator

DBS8752 – (High Output) 4-CH, 200 kS/s Digital to Analog Converter/Waveform Generator

VX4790A – 25 MS/s Arbitrary Waveform Generator

VX4792 – 250 MHz Arbitrary Waveform Generator

SWITCHING AND SCANNING
VX4320 – Six 1X4 RF Multiplexer

VX4330 – 120-CH, Scanner/Multiplexer

VX4332 – 40-CH, Two-wire Scanner Master

VX4372 – 48-CH, Two-wire Scanner Slave

VX4334 – 24-CH, Four-wire Scanner Master

VX4374 – 24-CH, Four-wire Scanner Slave

VX4350 – 64-CH, SPST/SPDT Switching Module

VX4353 – 32-CH, SPST 5A General Purpose Relay Switching

VX4355 – 24-CH, DPST/SPDT 5A General Purpose Relay Switching

VX4356 – 20-CH, DPDT 5A General Purpose Relay Switching

VX4357 – 32-CH, SPDT 5A General Purpose Relay Switching

VX4363 – 32-CH, SPST 2A Low Cost Relay Switching

VX4365 – 24-CH, DPST/SPDT 2A Low Cost Relay Switching

VX4366 – 20-CH, DPDT 2A Low Cost Relay Switching

VX4367 – 32-CH, SPDT 2A Low Cost Relay Switching

VX4380 – 256 Crosspoint Switch Matrix

VX4385 – 128 Crosspoint Relay Matrix Switch

VX4386 – 128 Crosspoint Latching Relay Matrix Switch

73A-308 – Relay and High Voltage Logic Driver

DIGITAL AND BOUNDARY SCAN
73A-270 – 2-CH, 10 MHz Arbitrary Serial Pulse/Pattern Generator

VX4491 – Serial Test Module (Boundary Scan)

S59ADGS – ASSET™ VXI boundary Scan Diagnostic System

S59AITP – ASSET™ Interconnect Test Product

S59ASFL – ASSET™ Scan Function Library

VX4801 – 48-CH, Isolated Digital I/O

VX4802 – 80-CH, Programmable Digital I/O

VX4820 – 20 MHz Digital Test Module (64 Channels)

AVIONICS
ARINC

VX4428 – ARINC 429 Quad Transmitter/Receiver

VX4469A – ARINC 629 Simulator with Enhanced Error Injection

73A-425 – Quad ARINC 429 Transmitter

73A-426 – Quad ARINC 429 Receiver

MIL-STD-1553/SYNCHRO
VX4456 – MATE Compatible 1553A/B

VX4457 – MIL-STD-1553A/B Intelligent Bus Monitor

73A-156 – MATE IAC Control Module (ICM)

73A-453 – One Channel MIL-STD-1553A/B Bus Simulator

73A-455 – Dual Channel MIL-STD-1553A/B Bus Simulator

TELECOMMUNICATIONS
SX4610 – SDH/SONET Analyzer

VX4610 – SDH/SONET Generator/Receiver

VXOA41 – VXI Programmable Optical Attenuator

ACCESSORIES
73A-451 – Wire-Wrap Module with VXIbus Interface

73A-452 – Blank Wire-Wrap

73A-850 – Extender

73A-851 – VME to VXI Adapter

For product detail, request a VXI Catalog by completing the business reply card in the back of this catalog.

Modular Instruments

Discontinued

Many of the TM 5000/TM 500 Products will be discontinued as inventories are sold. Consult your nearest Tektronix office for availability and recommended replacements for the following:

AA 501A
AM 502
DC 5009
DM 504A
DM 5110
DM 511
FG 503
FG 502
PG 508
PG 502
PG 501
PG 5110
SC 502
SC 504
SG 505
SI 5010
TVC 501

Products to Remain Active

The TM 5003 and TM 502A Mainframes to support optical instruments and current probe systems/amplifiers will continue to be available when ordered with the following:

OPTICAL INSTRUMENTS

OA5002
OA5012
OA5032
OCP5002
OCP5502
OIG 501
OIG 502
ORS156
ORS2488
ORS52
ORS622
ORS52
ORS622

CURRENT PROBE SYSTEMS/AMPLIFIERS

AM 503A
AM 503B
AM 5030
AM 503S

MAINFRAMES

TM 502A
TM 5003

Limited Supply Availability Until June 1995

Subject to prior sale, these products will be available until June 1995:

AA 5001
AWG 5105
CG 5011
DC 5010
DC 503A
FG 501A
FG 5010
FG 504
PS 5004
PS 5010
PS 503A
SG 5030
SG 5010
TG 501A
TM 5006A
TM 503B

Universal Signal Sources

Arbitrary Generators – Benchtop or VXI

CONTENTS

STANDALONE

General Information 398
AWG 2040 402
AWG 2021 404
AWG 2005 406
AFG 2020 408
HFS 9003 410
HFS 9009 410

Arbitrary Generators

Tektronix offers a wide variety of Arbitrary Waveform Generators that have the capabilities to earn the title of "Universal Signal Source." From the powerful and easy to use 2000 Series Benchtop to fast system VXI sources, Tektronix has an Arbitrary signal source to solve your application requirements.

Arbitrary waveform generators ("Arbs" for short) are used to generate "real world" signals. They can generate signals with all the glitches, drift, noise, and other anomalies that a device under test will encounter when it leaves the lab or manufacturing floor. Some examples where Arbs are being used include disk drive testing, automotive anti-lock brakes and engine control modules, fax testing, biomedical simulations and more. "What if" scenarios are easy since waveforms can be captured from a digital scope and then modified to see when a device under test fails. They also make it easy to simulate transducers that can be difficult or expensive to use.

SELECTION GUIDE

Vendor and Model	Tektronix AWG 2040	Tektronix AWG 2021	Tektronix AWG 2005
Maximum Clock Rate (Point Rate)	1 GS/s (1 ns/pt)	250 MS/s (4 ns/pt) (up to 4 ps resolution with Region shift)	20 MS/s (50 ns/pt)
Output Channels	1	1 std.; 2 total opt.	2 std.; 4 total opt.
Ampl V p-p into 50 Ω	2 V p-p	5 V p-p	10 V p-p
Vertical Resolution (bits)	8	12	12
Sine, Sqr,Tri, Ramp, DC	10 MHz Synthesized	2.5 MHz Synthesized	200 KHz Synthesized
Execution Memory	1 MB std. (4 MB Opt. 01)	256 KB/CH	64 KB/CH
Waveform Editing	Graphical, Equation. Timing, Table, Autostep Sequencing, Enhanced Math & Convolute	Graphical, Equation. Timing, Table, Autostep Sequencing, Enhanced Math	Graphical, Equation. Timing, Table, Autostep Sequencing, Enhanced Math
DSO Transfer	Direct via GPIB	Yes	Yes
Digital Output	8-Bits ECL + 2 markers (Opt. 03)	12- or 24-Bit (TTL @ 100 MHz) 12-Bit (ECL @ 250 MHz) + 2 markers (Opt. 03 or 04)	24-Bit TTL + 2 markers (Opt. 04)
Package Format	Monolithic	Monolithic	Monolithic
Where to find more info.	Page 402	Page 404	Page 406

Universal Signal Sources

Arbitrary Generators – Standalone or VXI

Arbitrary waveform generators have evolved from simple D/A converters to sophisticated signal sources with powerful creation, editing and triggering capabilities. Listed below are some common terms you will see as you look through the rest of the Universal Signal Source section of this catalog.

ARBITRARY WAVEFORM GENERATOR (AWG)
Refers to sources that convert digital information into analog waveforms by storing the waveform information in memory, clocking it into a D/A converter and amplifier. Typically, AWGs have long record length and offer extreme flexibility how the waveform is generated.

ARBITRARY FUNCTION GENERATOR (AFG)
Includes AWG capabilities plus enhanced synthesized (DDS) standard signal generation and modulation. An AFG offers higher frequency signal generation of standard signals (sine, triangle, square, ramp, DC) with better precision and resolution. Additional modulation and sweep capabilities are also built in.

DIRECT DIGITAL SYNTHESIS (DDS)
DDS is a technique to compute standard signals instead of simply storing the waveshape in memory. This technique produces enhanced resolution, accuracy and signal purity of standard sinusoidal waveshapes.

The Arb selection chart on pages 398 and 399 lists the major specifications for all the Arbitrary waveform generators available from Tektronix. To find out more about the Arb that will fit your needs, refer to the bottom of the table. It will list where to find more information.

Tektronix AFG 2020	Rohde & Schwarz ADS	Rohde & Schwarz AFGU Series, Opt. B1	Tektronix VX4792	Tektronix VX4790A	Analogic DBS 8750
250 MS/s (4 ns/pt)	Internal: 25 MS/s (40 ns/pt) External: 33 MS/s (30 ns/pt)	50 MS/s (20 ns/pt)	250 MS/s (4 ns/pt)	25 MS/s (40 ns/pt)	400 KS/s (2.5 µs/pt)
1 std.; 2 total opt.	2	1	1	1	2
10 V p-p	10 V p-p	15 V p-p	5 V p-p	±10.22 V	±10 V single-ended or ±5 V differential
12	12	8	12	12	16
DDS Synthesized 100 MHz – Sin 50 MHz – Sqr. 31.2 – Other	5 MHz – Sine 100 KHz – Tri	20 MHz (Sym 50%)	2.5 MHz Synthesized	250 kHz	20 kHz – Sine
1 KB/CH	64 KB	4 KB	256 KB	256 K (std.) up to 1 MB option	32 KB
Graphical Pre-Defined Sin, Sqr, Tri, etc., Math (+, –, *, /)	Via Front Panel or Arbitrary Waveform Designer Software	Via Front Panel or Arbitrary Waveform Designer Software	Equation, Autostep Sequencing	None	Equation
Yes	Yes with external software	Yes with external software	No	No	No
NA	12-Bits	No	NA	NA	NA
Monolithic	Monolithic	Monolithic	VXI 2 wide	VXI 1 wide	VXI 1 wide
Page 408	Page 288	*1	VXI Catalog	VXI Catalog	VXI Catalog

**1 Contact your Tektronix representative for price information.*

Universal Signal Sources

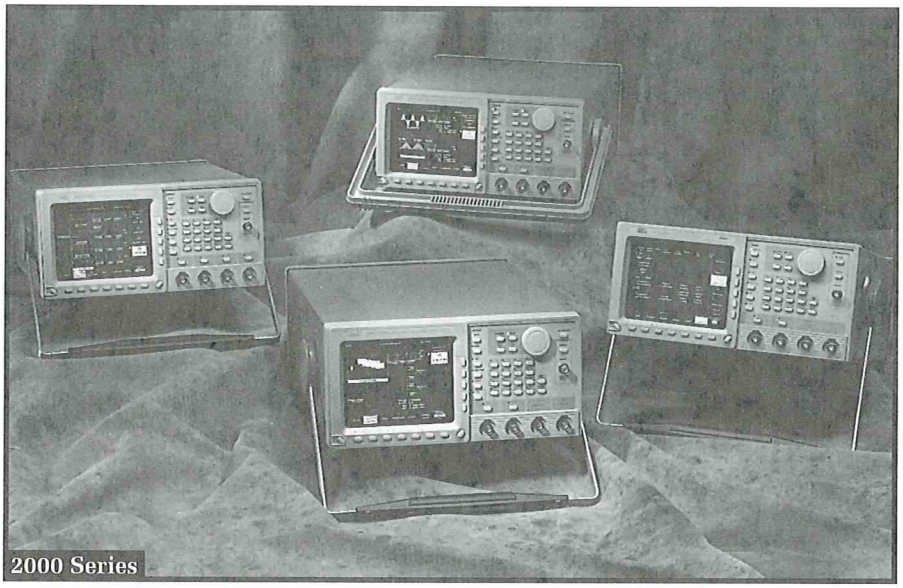
Arbitrary Generators – Standalone or VXI

Tektronix offers a broad range of arbitrary generators with feature sets which allow us to truly call them "Universal Signal Sources".

2000 SERIES APPLICATIONS

- Simulate Broadcast Telecom
  - I & Q
  - Complex Modulation
  - Broad Band
  - FSK, PSK, AM
  - Jitter Modulation
  - Mobile Communication
  - Digital Cellular
- Simulate Media
  - Disk Drive Read/Write
  - Peak Shift
  - Bit Drop Out
  - Servo Control
  - Mixed Signal ASICs
- Simulate Bio-Medical
  - Physiological Responses
  - Heart Fibrillation
  - Blood Gas Content
  - EEG and EKG
- Simulate Networks
  - Token Ring
  - Ethernet
  - ATM
  - Sonet
  - Fax and Modems
- Avionics Simulation
  - Flight Characterization Flight Data Recoders
  - Instrument Launching Navigation Systems (ILS/MLS/VOR)
- Automotive Simulation
  - Engine Control Modules
  - Ignition Systems
  - Mechanical Vibration Analysis
  - Anti Lock Braking
  - Safety Retraining Systems

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.



2000 Series Arb Overview

CREATE ANY WAVEFORM YOUR MIND CAN CONCEIVE!

Each of the 2000 Series Arbitrary Generators shares a common philosophy for industry leading performance, ease of use and flexibility. This section gives an overview of the shared capabilities of the 2000 Series Arbs.

All 2000 Series Arbs have a graphical user interface with several powerful creation and editing capabilities built in so you don't need an external computer and software. Waveforms can be created from scratch, retrieved from mass storage or transferred from a digital scope. Once the waveform is ready, you have several options that control how the waveform is output. Each 2000 Series Arb has sophisticated controls to synchronize the Arb to the outside world with several trigger and clocking modes. Composite signals can be output using waveform summing, multiply, convolution, and more.

There are a variety of different ways to create and modify waveforms. Here are some examples of these powerful capabilities:

DIRECT WAVEFORM TRANSFER

One of the truly powerful capabilities of the 2000 Series Arb is the ability to read waveforms captured on a digital oscilloscope. The digital scope (for example, a TDS Series scope) can capture a signal; for example, transducer signals, DUT output, a disk drive read head signal, or a serial communications signal. The waveform is transferred into the 2000 Series Arb with a simple button push. Once the waveform is in the Arb memory, it can be saved, modified or output with ease. Direct waveform transfer is standard on all 2000 Series Arbs. The illustration on the next page shows the three easy steps to output a signal that was captured on a digital scope.

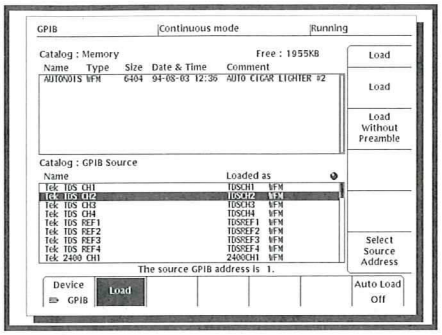
GRAPHICAL EDITOR

The graphical editor operates much like popular drawing programs. The user can create a waveform from scratch or paste pieces from other waveforms already available. Capabilities such as cut, copy, paste, invert, clip, and scale make it easy to edit waveshapes. You can zoom and pan on the waveform to view intricate details easily. Waveform math allows addition, subtraction, or multiplication from two or more waveforms to create complex composite waveforms. There's even an UNDO function if the result isn't what you want. The graphical editor is standard on all 2000 Series Arbs.

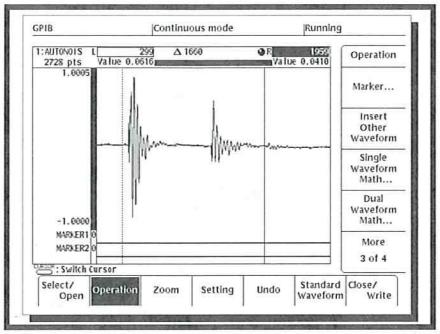
Universal Signal Sources

Arbitrary Generators – Standalone or VXI

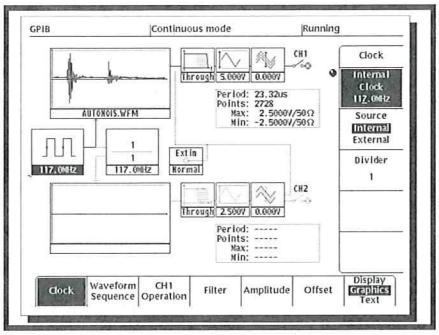
2000 SERIES



Step 1: Transfer waveform from a digital scope.



Step 2: Modify waveform using one of several built-in editors (in this example, the graphical editor).



Step 3: Output the signal with complete control over its parameters.

SEQUENCE EDITOR

Sequencing extends the effective record length of the signal to over one billion points! Sequencing seamlessly transitions from one segment to the next with no discontinuities between segments. All segments in a sequence are executed from memory. Each segment can be repeated thousands of times with thousands of segments in a sequence. Using the Auto Step and Waveform Advance modes, users can modify the output of the arbitrary generator using an external event such as manual trigger, external trigger, GPIB, or RS-232. Digital applications include serial or parallel pattern generation for digital test, building complex modulated signals such as FSK/PSK/PWM, magnetic media design/test, and filter design/test. The sequence editor is standard on the AWG 2040, AWG 2021 and AWG 2005.

FFT EDITOR

The FFT editor allows easy modification of waveform frequency and phase components. Six different FFT windows available include Rectangle, Triangle, Hanning, Hamming, Blackman, and Blackman-Harris. The filter menu allows the user to view the impact of a user-definable filter network on a waveform. The built-in limiter function provides noise-floor editing to eliminate frequency components below a user-definable magnitude level. Some examples where FFT capability is used are filter and motor control applications. The FFT editor is optional on the AWG 2040, AWG 2021 and AWG 2005.

TIMING AND TABLE EDITOR

The combination of the timing and table editor with the optional AWG pattern generator port is ideal for digital circuit testing and control of ASICs, DACs, etc. The AWGs can perform as a Pattern Generator with data rates up to their full clock speed. The table editor allows the user to edit the signals in binary, hex, or decimal. The timing editor provides a "logic analyzer" style timing diagram for easy manipulation of digital data. The timing and table editor is standard on the AWG 2040, AWG 2021 and AWG 2005.

EQUATION EDITOR

The equation editor creates waveforms based upon polynomial formulas. This gives the user excellent flexibility to create waveforms based upon standard equations and to vary them easily by changing the formula. Examples of waveforms that can be created with the equation editor include 1F read head signals, SINX/X, damped sine waves, and exponential pulses. The equation editor is standard on the AWG 2040, AWG 2021 and AWG 2005.

MODULATION EDITOR

The built-in modulation editor makes creation of FSK, PSK, AM, FM or Offset modulated signals easy. For example, to create a 4-key FSK modulated signal, simply enter the frequencies and amplitudes of each key using a straightforward entry screen. The modulation editor is standard on the AFG 2020.

SWEEP EDITOR

The sweep editor allows generating linear or logarithmic sweeps by using a simple graphical editor. You see the effects of changing the parameters as you edit them. The sweep editor is standard on the AFG 2020 and is an option on the AWG 2005.

TURN THE PAGES TO SEE MORE

Now that you understand the capabilities that make the 2000 Series Arbs the only universal signal source you need, turn to the following pages to see the specific characteristics of each member of the family.

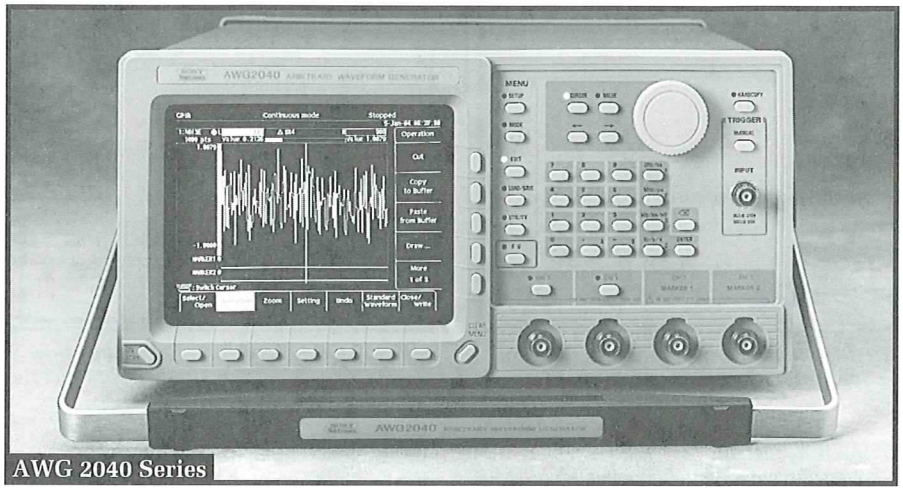
AWG 2040

1 GS/sec Arbitrary Waveform Generator

World's highest performance, easy-to-use GUI-based Arb with on-screen edit.

AWG 2040

- 1.024 GS/sec Clock Rate Provides up to 500 MHz Waveforms
- 1 MB Record Length (4 MB with Opt. 01)
- 8-Bit (1/256) Vertical Resolution
- Direct Waveform Transfers from DSO
- Optional 8-Bit Digital Pattern Generator
- Built-in 1.4 MB PC-compatible 3.5 in. Floppy Disk for Storage and Transfer
- FFT Editor (Opt. 09) Allows Editing in the Frequency Domain
- Easily Create Automatic Test Sequences with Waveform Sequencing
- Formula Entry of Parameters for Mathematically Precise Waveforms
- Fully Programmable from Front Panel, RS-232, or GPIB (IEEE 488.2)



AWG 2040 Series

AWG 2040 Series Arbitrary Waveform Generator

The AWG 2040 is the world's fastest and deepest Arb with its 1 GS/s sample rate, 1 MB memory (4 MB optional), and 8-Bit vertical resolution into one channel. The optional 8-Bit ECL pattern generator port can generate 8-Bit wide digital patterns at up to 1 GHz rate. The AWG 2040 is used where fine time resolution (down to 1 ns per point) is needed, such as disk drive development, telecommunication testing (SONET, high-speed serial), and in applications that traditionally did not need the performance of the AWG 2040. An example is automotive engine control module testing where glitches can be nanoseconds in duration.

Characteristics

STANDARD WAVESHAPES
Sine, square, triangle, ramp, pulse, arbitrary, linked sequence, and DC.

ARBITRARY WAVEFORMS
Memory – Waveform: 1 Mwords x 8-Bits (4 Mwords x 8-Bits with Option 01).
Marker: 1 Mwords x 2-Bits (4 Mwords x 2-Bits with Option 01).
Data Points of Waveform: 32 to 1 M (4 M with Option 01) in multiples of 32.

CLOCK GENERATOR
Frequency Range – 1.000000 kHz to 1.024000 GHz.

Resolution – 7 digits.

Stability – 1 ppm/year (+15°C to ±25°C).

OPERATING MODES
Continuous – Output waveform/sequence continuous at programmed waveshape, frequency, amplitude, and offset.

Triggered – Output quiescent until triggered by an external, GPIB, or manual trigger; generates a waveform/sequence only one time.

Burst – Output quiescent until triggered by an external, GPIB, or manual trigger; then generates a waveform/sequence up to 65,536 times.

Gated – Same as continuous mode except period is executed only for the duration of the gated signal until the sequence started is completed.

Waveform Advance – Output quiescent until triggered by an external, GPIB, or manual trigger, then generates the waveform/sequence in the Sequence file. When the scan count reaches value, output stops and waits for next trigger.

Auto Step – Continuously outputs the waveform/sequence in the Auto Step file; the next Auto Step Trigger (rear panel) advances the waveform/sequence.

Slave – Receives clock from a master arbitrary waveform generator for parallel operation.

MAIN OUTPUT
Digital-to-Analog Converter Resolution – 8-Bits.

Output Impedance – 50 Ω.

Output Voltage – –2.0 V to +2.0 V into 50 Ω.

Amplitude – Range: 20 mV to 2 V into 50 Ω. Resolution: 1 mV.

Offset – Range: –1.000 V to 1.000 V into 50 Ω. Resolution: 1 mV. Accuracy (20 mV Amplitude, 7F waveform data): ±(1% of offset + 5 mV).

APPLICATIONS

- **Broadcast Telecom Test**
- **Network Test**
- **Computer Peripherals**
- **Electronic Warfare Simulation**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

1 GS/sec Arbitrary Waveform Generator

Rise Time – Amplitude >1.0 V, ≤2.5 ns; Amplitude ≤1.0 V, ≤1.5 ns.

Fall Time – Amplitude >1.0 V, ≤2.5 ns; Amplitude ≤1.0 V, ≤1.7 ns.

Aberrations (at 500 MHz BW) – Amplitude >1.0 V, within ±10%; Amplitude ≤1.0 V, within ±7%.

Flatness – Within ±3% after 50 ns from rise/fall edges.

Sinewave Characteristics (1 GHz clock, 32 waveform points, 31.25 MHz frequency, 1.0 V amplitude, no offset, no filter) – Harmonics: ≤45 dBc, DC to 400 MHz. Noise: ≤50 dBc, DC to 400 MHz. Phase Noise: –90 dBc/Hz at 10 kHz offset.

FILTERS

Type – Bessel low pass.

Risetime – 10 MHz: 35 ns, 20 MHz: 17 ns. 50 MHz: 7.0 ns. 100 MHz: 3.5 ns.

Delay from Marker – 10 MHz: 42 ns. 20 MHz: 22 ns. 50 MHz: 12 ns. 100 MHz: 7.0 ns. Through: 2.5 ns.

AUXILIARY OUTPUTS

Marker – Number of Markers: 2. Level: Hi/Lo, –2.0 V to 2.0 V into 50 Ω, –4.0 V to 4.0 V into 1 MΩ; Resolution, 0.1 V Accuracy: within ±0.1 V. Rise/Fall Time: <1 ns (at 1 V p-p). Connector: BNC.

Busy – Level: Positive TTL pulse (0 V to 5.0 V into 1 MΩ). Delay: <60 ns from Ext. Trig; <150 ns from CH 1. Output Resistance: 51 Ω. Connector: SMB.

Sync – Level: Positive TTL pulse (0 V to 5.0 V into 1 MΩ). Delay: <60 ns from Ext. Trig. Duration: 100 ns. Output Resistance: 51 Ω. Connector: SMB.

Master Clock – Level: ECL compatible (–1.620 to –0.810 into 50 Ω). Connector: SMB.

8-Bit ECL Digital Out (Option 03) – Output Signals: D0 to D7, Clock. Level: Differential ECL compatible (–1.81 V to –0.810 V into 50 Ω). Skew Between Data: ±250 ps. Delay: Data to Marker: 2.0 ns; Clock to Data: 2.5 ns. Connector: SMB.

AUXILIARY INPUTS

Trigger – Threshold: Level, –5 V to +5 V; Resolution: 0.1 V; Accuracy: –(5% x Level + 0.1 V). Pulse Width: 10 ns minimum (0.2 V amplitude). Sensitivity: 0.2 V minimum (1 MHz square wave). Maximum Input: ±10 V p-p when 1 kΩ selected; ±5 V when 50 Ω selected. Impedance: 1 kΩ or 50 Ω. Trigger Holdoff: 500 ns maximum.

Stop Trig – Threshold Level: TTL Level. Pulse Width: 100 ns minimum. Maximum Input Volts: +5 V to 0 V. Delay: 100 ms maximum. Impedance: 10 kΩ. Connector: SMB.

Auto Step Trig – Threshold Level: TTL Level. Pulse Width: 100 ns minimum. Maximum Input Volts: +5 V to 0 V. Delay: 100 ms maximum. Impedance: 10 kΩ. Connector: SMB.

External Clock – Sensitivity: 400 mV p-p (–4.0 dBm). Maximum Input Volts: 1.0 V p-p (+4.0 dBm) DC ±20 V. Frequency: 10 MHz to 1.0 GHz. Delay External Clock to Marker: 13 ns.

Slave Clock – Threshold: ECL compatible (100 K). Maximum Input Volts: –2.0 V to 0.0 V. Frequency: DC to 1.0 GHz. Delay External Clock to Marker: 13 ns.

FUNCTION GENERATOR

Waveform Shape (predefined 100-point waveforms) – Sine, Triangle, Square, Ramp, Pulse (1 MHz filter is inserted when Sine is selected). Frequency: 1.000000 Hz to 10.00000 MHz. Accuracy: 1 ppm. Amplitude: 20 mV to 2 V into 50 Ω. Offset: –1.000 V to 1.000 V into 50 Ω. Polarity: Normal, Invert. Duty Cycle: 0% to 100%, Pulse only. Sine Flatness: Within –1 dB referenced to 100 kHz.

PROGRAMMABLE INTERFACE

GPIB – IEEE 488.2-1987 compatible.

RS-232 – 9-Pin D connector.

ENVIRONMENTAL

Temperature – Operating: +10°C to +40°C. Nonoperating: –20°C to +60°C.

Humidity – Operating: 20% to 80% (no condensation). Nonoperating: 5% to 90% (no condensation).

Altitude – Operating: To 4.5 km (15,000 ft.). Maximum operating temperature decreases 1°C for each 300 m above 1.5 km. Nonoperating: To 15 km (50,000 ft.).

Vibration – Operating: 0.33 mm p-p, 10 Hz to 55 Hz for 15 minutes.

Shock – Nonoperating: 30 g (1/2 sine) 11 ms duration.

Bench Handling – Operating: Drop from 10 cm (4 in.) tilt or 45°, whichever is less.

EMC – Emissions: Within limits of FCC CFR 47, Part 15, Subpart B, Class A; VFG 243; EN55022, B;EN6055-2. Immunity: Within limits of IEC 801-3, IEC 801-2, IEC 801-4.

Electrical Discharge – Operating Max Test Voltage: 15 kV (150 pF through 150 Ω).

Safety – Designed to meet UL 1244 and CSA 22.2 No. 231.EEC certified.

POWER

Source Power – Voltage Ranges: 90 to 127 V AC or 90 to 250 V AC. Line Frequency: 90 to 127 V, 48 to 440 Hz; 90 to 250 V, 48 to 63 Hz.

Maximum Current – 4 A at 50 Hz, 90 V.

Maximum Power Dissipation – 300 W.

Fuse Rating – UL 198.6 (3 AG): 6 AFAST, 250 V. IEC 127:5 A (T), 250 V.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height (with feet)	164	6.4
Width (with handle)	362	14.3
Length (with front cover)	491	19.25
Length (with handle extended)	576	22.2
Weight	**kg**	**lb.**
Net	10.7	23.6

ORDERING INFORMATION

AWG 2040
1 GS/s Arbitrary Waveform Generator **$19,995**
Includes: User/Programmer's Manual, GPIB Programming Examples Disk, Sample Waveform Library Disk, Power Cable.

Opt. 01 – Increase Memory to 4 Mwords (Overseas Only) ..... **+$4,495**
Opt. 03 – IGBPS, ECL Level Digital Output ..... **+$1,695**
Opt. 09 – Add FFT Editor. Allows Editing Waveforms in the Frequency Domain ..... **+$2,395**
Opt. 1R – Rackmount. Floppy Drive Access Moved to Front ..... **+$595**
Opt. 1S – Adds WaveWriter S/W ..... **+$695**
Opt. B1 – Service Manual ..... **+$150**

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection ..... **+$590**
Opt. C5 – Adds five years of Calibration Services ..... **+$1,225**

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Opt. A5 ..... **NC**

ACCESSORIES
Accessory Pouch – Order 016-1159-00 ..... **$50**
Front Cover – Order 200-3232-00 ..... **$10**
RS-232-C Cable – 9-Pin to 25-Pin. Order 174-1453-00 ..... **$55**
Service Manual – Order 070-8963-00 ..... **$150**
Rackmount Kit – Order 016-1189-00.. ..... **$2,000**
GPIB Cable – Order 012-0991-00 ..... **$195**
SMB to BNC Cable – Order 012-1459-00 ..... **$40**
SMB to BNC Adapter – Order 015-0554-00. ..... **$47**
SMB Cable – Order 012-1342-00 ..... **$60**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 — All 2000 Series Arbs comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

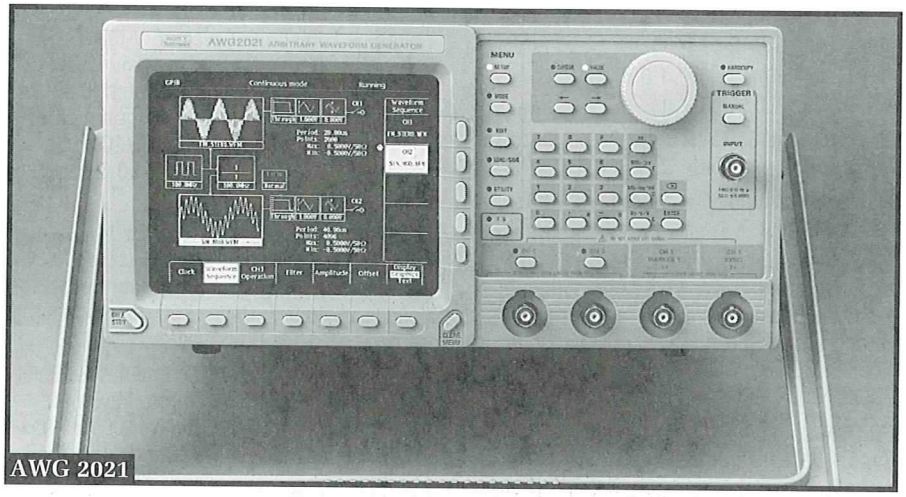
AWG 2021

250 MS/sec Arbitrary Waveform Generator

Best in class mid-range performance with new dual digital output capability for mixed signal test.

AWG 2021

- 250 MS/s Clock Rate Provides up to 125 MHz Waveforms
- 256 K (262,144 Points) record length
- 12-Bit (1/4096) Vertical Resolution
- Direct Waveform Transfers from DSO
- Optional 12-Bit 250 MHz (ECL) or 12/24-Bit 100 MHz (TTL) Digital Pattern Generator
- Built-in 1.4 MB PC-compatible 3.5 in. Floppy Disk for Storage and Transfer
- FFT Editor (Opt. 09) Allows Editing in the Frequency Domain
- Easily Create Automatic Test Sequences with Waveform Sequencing
- Formula Entry of Parameters for Mathematically Precise Waveforms
- Fully Programmable from Front Panel, RS-232, or GPIB (IEEE 488.2)



AWG 2021 Arbitrary Generator

The AWG 2021 is an excellent mid-range Arb with 250 MS/s clock, 256 K memory per channel, up to two channels and an optional 12-Bit ECL or 12/24-Bit TTL digital word generator option. The AWG 2021 is an improved version of the original AWG 2020 with additional firmware and hardware enhancements, including Convolution, I&Q generation, shift capability (useful for jitter susceptibility testing), faster external trigger (<5µS), increased marker amplitude, and TTL level digital word generation for easier interfacing to the device under test.

Characteristics

STANDARD WAVESHAPES
Sine, square, triangle, ramp, pulse, arbitrary, linked sequence, and DC.

ARBITRARY WAVEFORMS
Memory – Waveform: 256 Kwords x 12-Bits. Marker: 256 Kwords x 2-Bits. Data Points of Waveform: 64 to 256 K in multiples of 8.

Sequencer Memory – 8 K individual waveforms.

Scan Counter – 1 to 64 K repeats.

Burst Counter – 1 to 64 K cycles.

CLOCK GENERATOR
Frequency Range – 10 Hz to 250 MHz.

Resolution – 4 digit.

Accuracy – +10°C to +40°C: 0.01%. +15°C to +30°C: 0.005%.

Skew between CH 1 and CH 2 (Option 02 only) – Within 4 ns.

OPERATING MODES
Continuous – Output continuous at programmed waveshape, frequency, amplitude, and offset.

Triggered – Output quiescent until triggered by an external, GPIB, or manual trigger; then generates a sequence only one time.

Gated – Same as triggered mode except period is executed only for the duration of the gated signal until the sequence started is completed.

Burst – Output quiescent until triggered by an external, GPIB, or manual trigger; then generates "n" sequences or cycles.

Waveform Advance – Continuously generates the waveform in a predefined sequence; the next trigger advances to the next waveform in sequence.

Autostep – Generates the predefined waveform once in the Autostep File; the next trigger advances the waveform.

MAIN OUTPUT
Amplitude (excluding ADD and Multiply operation) – Digital-to-Analog Resolution: 1/4096 (12-Bits). Range: 0.05 V to 5 V p-p into 50 Ω. DC Accuracy: 0.05 V to 0.5 V, ±(0.5% of amplitude +5 mV); 0.501 V to 5 V, ±(1% of amplitude +25 mV).

Offset – Range: –2.5 V to +2.5 V into 50 Ω, (–100 mA to +100 mA). Resolution: 0.2 mA. Accuracy: ±(1% of offset +0.2 mA).

APPLICATIONS

- **Broadcast Telecom**
- **Network Test**
- **Computer Peripherals**
- **Automotive**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 All 2000 Series Arbs comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

250 MS/sec Arbitrary Waveform Generator

Pulse Response – +15°C to +30°C: Flatness, within 3% after 20 ns from rise/fall edges; Aberrations, within 7% +10 mV. +10°C to +40°C: Rise/Fall Time, <4.2 ns; Flatness, within 5% after 20 ns from rise/fall edges; Aberrations, within 9% +10 mV.

Impedance – Typically 50 Ω.

Sinewave (amplitude 1 V, 100 kHz reference) – Flatness: Within 4%. THD: 1.0 V, ≤50 dBc, 0.5 V, ≤66 dBc; Spurious: ≤66 dBc.

CHANNEL SUMMING (Option 02 only)

AM (Multiply) – Output: Within 5%. Frequency Response: DC to 30 MHz.

External AM – Sensitivity: 2 V p-p (±5%) signal produces 100% modulation. Frequency Response: CH 1, DC to 30 MHz; Ext. Signal, DC to 4 MHz.

Add – Output: Within 5%. Frequency Response: DC to 30 MHz.

FILTERS

3 dB cutoff frequency – 1 MHz: Within 20%. 5 MHz: Within 20%. 20 MHz: Within 20%. 50 MHz: Within 20%.

Delay – 1 MHz: Typically 390 ns. 5 MHz: Typically 78 ns. 20 MHz: Typically 18 ns. 50 MHz: Typically 11 ns.

AUXILIARY OUTPUTS

Markers 1 and 2 – Amplitude: 1 V ±0.3 V into 50 Ω. Impedance: 50 Ω. Marker to Signal Delay: Within 15 ns.

Sync – Amplitude: 1 V ±0.3 V into 50 Ω. Impedance: 50 Ω. Sync to Signal Delay: Within 15 ns.

Clock – Amplitude: 1 V ±0.3 V into 50 Ω. Impedance: 50 Ω.

Digital Data Out (Option 03) – Level: Differential ECL compatible. Output Signals: Data (D0 to D11). Skew Between Data: Within 1 ns. Clock to Data Delay: Within 3 ns. Connector: 68-Pin mini-D sub.

AUXILIARY INPUTS

Trigger – Threshold Level: –5 V to +5 V. Resolution: 0.1 V. Accuracy: ±(5% x Level + 0.1 V). Pulse Width: 15 ns minimum. Input Swing: 0.2 V minimum. Maximum Input Volts: 10 V p-p when 1 MΩ selected; 5 V RMS when 50 Ω selected. Impedance: 1 MΩ with 30 pF max. Trigger to Output Signal Delay: External Clock, 100 ns maximum +1 clock.

Trigger Holdoff – 5µs maximum.

AM (Option 02 only) – Range: 2 V p-p (–1 V to +1 V) for 100% modulation. Maximum Input: ±5 V p-p, 10 kΩ impedance.

System Clock – Threshold Level: 0.3 V ±0.1 V. Input Swing: 0.8 V minimum. Pulse Width: 2 ns minimum. Maximum Input Voltage: ±2 V p-p. Impedance: 50 Ω. Frequency Range: Up to 250 MHz phase coherent.

PROGRAMMABLE INTERFACE

GPIB – IEEE 488.2-1987 compatible.

RS-232 – 9-Pin D connector.

ENVIRONMENTAL

Temperature – Operating: +10°C to +40°C. Nonoperating: –20°C to +60°C.

Temperature Change – Operating: +15°C per hour (no condensation). Nonoperating: +30°C per hour (no condensation).

Humidity – Operating: 20% to 80% (no condensation). Nonoperating: 5% to 90% (no condensation).

Altitude – Operating: To 4.5 km (15,000 ft.). Maximum operating temperature decreases 1°C for each 300 m above 1.5 km. Nonoperating: To 15 km (50,000 ft.).

Vibration – Operating: 0.33 mm p-p, 10 Hz to 55 Hz for 15 minutes.

Shock – Nonoperating: 30 g (1/2 sine) 11 ms duration.

Bench Handling – Operating: Drop from 10 cm (4 in.) tilt or 45°, whichever is less.

EMC – Emissions: Within limits of FCC CFR 47, Part 15, Subpart B, Class A; VFG 243; EN55022, B;EN6055-2. Immunity: Within limits of IEC 801-3, IEC 801-2, IEC 801-4.

Electrical Discharge – Operating max test voltage: 15 kV (150 pF through 150 Ω).

Safety – Designed to meet UL 1244 and CSA 22.2 No. 231.EEC certified.

POWER

Source Power – Voltage Ranges: 90 to 127 V AC or 90 to 250 V AC. Line Frequency: 90 to 127 V, 48 to 440 Hz; 90 to 250 V, 48 to 63 Hz.

Maximum Current – 4 A at 50 Hz, 90 V.

Maximum Power Dissipation – 300 W.

Fuse Rating – UL 198.6 (3AG): 6 AFAST, 250 V. IEC 127:5 A (T), 250 V.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height (with feet)	164	6.4
Width (with handle)	362	14.3
Length (with front cover)	491	19.25
Length (with handle extended)	576	22.2
Weight	**kg**	**lb.**
Net	10.7	23.6

ORDERING INFORMATION

AWG 2021

250 MS/s Arbitrary Waveform Generator **$11,495**
Includes: User/Programmer's Manual, GPIB Programming Examples Disk, Sample Waveform Library Disk, Power Cable.

Opt. 02 – Independent, 256 K Second Channel ..... **+$4,395**

Opt. 03*1 – 12-Bit, ECL Level Digital Out ..... **+$1,695**

Opt. 04*1 *2 – 12/24-Bit, TTL Level Digital Out ..... **+$1,695**

Opt. 09*1 – Add FFT Editor. Allows editing waveforms in the frequency domain ..... **+$2,395**

Opt. 1R – Rackmount ..... **+$595**

SERVICE ASSURANCE OPTIONS

Opt. R2 – Adds two years of post-warranty Repair Protection ..... **+$400**

Opt. C5 – Adds five years of Calibration Services ..... **+$1,050**

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**

Opt. A2 – United Kingdom 240 V, 50 Hz ..... **NC**

Opt. A3 – Australian 240 V, 50 Hz ..... **NC**

Opt. A4 – North American 240 V, 60 Hz ..... **NC**

Opt. A5 – Switzerland 220 V, 50 Hz ..... **NC**

ACCESSORIES

Accessory Pouch – Order 016-1159-00 ..... **$50**

Front Cover – Order 200-3232-00 ..... **$10**

RS-232-C Cable – 9-Pin to 25-Pin. Order 174-1453-00. ..... **$55**

Rackmount Kit – Order 016-1189-00.. ..... **$2,000**

GPIB Cable – Order 012-0991-00. ..... **$195**

**1 Options 03, 04, & 09 are mutually exclusive.*

**2 12-Bits with single channel, 24-Bits with dual channel (Opt. 02).*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 — All 2000 Series Arbs comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

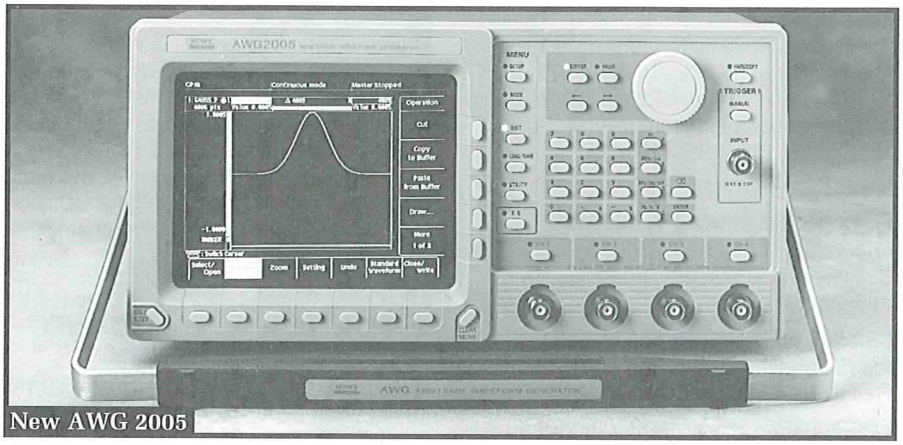
AWG 2005

20 MS/sec Arbitrary Waveform Generator

The best value in an easy-to-use, GUI-based Arb with on-screen editing.

NEW AWG 2005

- 20 MS/s Clock Rate Provides up to 200 kHz Waveforms
- Up to Four 64 KGB Record Length
- 12-Bit (1/4096) Vertical Resolution
- Direct Waveform Transfers from DSO
- 24-Bit Channel, TTL Digital Data Pattern Generator (Opt. 04)
- Optional Sweep Generation (Opt. 05)
- Built-in 1.4 MB PC-compatible 3.5 in. Floppy Disk for Storage and Transfer
- FFT Editor (Opt. 09) Allows Editing in the Frequency Domain
- Easily Create Automatic Test Sequences with Waveform Sequencing
- Formula Entry of Parameters for Mathematically Precise Waveforms
- Fully Programmable from Front Panel, RS-232, or GPIB (IEEE 488.2)


New AWG 2005

AWG 2005 Arbitrary Waveform Generator

The AWG 2005 offers the performance needed for physical simulations with a 20 MS/s clock, 64 K memory per channel, up to four channels and an optional 24-Bit digital word generator. It is being used in applications where signals are in the kHz range, such as automotive, vibration, and Bio-Medical.

Characteristics

STANDARD WAVESHAPES
Sine, square, triangle, ramp, noise, arbitrary, linked sequence, and DC.

ARBITRARY WAVEFORMS
Memory – Waveform: 64 K x 12-Bits for each channel. Marker: 64 K x 1-Bit for each channel. Data Points of Waveform: 16 to 64 K in multiples of 16. Sequence Memory: 32 K x 16-Bits.

Scan Counter – Waveform: 1 to 64 K repeats. Sequence: 1 to 64 K repeats.

Catalog Memory – 2 MB.

CLOCK GENERATOR
Frequency Range – 0.01 Hz to 20 MHz.

Resolution – Standard: 4 digits. With Option 05: 7 digits.

Accuracy – Standard: +15°C to +30°C: 0.005%. +10°C to +40°C: 0.01%. With Option 05: +15°C to +30°C: 0.0005%. +10°C to +40°C: 0.001%.

OPERATING MODES
Continuous – Output waveform/sequence continuous at programmed waveshape, frequency, amplitude, and offset.

Triggered – Output quiescent until triggered by an external, GPIB, or manual trigger; generates a waveform/sequence only one time.

Gated – Same as continuous mode except period is executed only for the duration of the gated signal until the sequence started is completed.

Seq/Wfm Advance – Continuous: Continuously outputs the waveform/sequence in the Sequence file. The next trigger advances to the next waveform/sequence. Step: Output quiescent until triggered; then execute the next waveform/sequence in the Sequence file. When the scan count reaches its value, output stops and waits for next trigger.

Auto Step – Continuous: Continuously outputs the waveform/sequence in the Auto Step file; the output parameters (Amplitude, Offset) are saved in the file. Step: Output quiescent until triggered; then get the waveform/sequence in the Auto Step file.

Master – Provides Clock and Trigger to a slave arbitrary waveform generator for parallel operation.

Slave – Receives Clock and Trigger from a master arbitrary waveform generator for parallel operation.

MAIN OUTPUT
Digital-to-Analog Converter Resolution – 12-Bits

Output Impedance – 50 Ω.

Amplitude (1 MHz clock, 000 and FFF waveform data, norm, no filter, no offset, excluding and ADD operation) –
Range: 0.05 V to 10 V p-p into 50 Ω. Resolution: 1 mV (4 digits). DC Accuracy: 0.050 V to 0.999 V, ±(0.5% of amplitude + 5 mV); 1.000 V to 10.000 V, ±(1% of amplitude + 50 mV).

APPLICATIONS

- **Transducer Simulation**
- **Motor Control**
- **Automotive**
- **Industrial**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488

All 2000 Series Arbs comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

20 MS/sec Arbitrary Waveform Generator

Offset – Range: –5.0 V to +5.0 V into 50 Ω (–200 mA to +200 mA). Resolution: 5 mV (4 digits). Accuracy (1 MHz clock, 7FF waveform data, norm, no filter, amplitude range 0.05 V): –±(1% of offset + 10 mV).

Pulse Response (20 MHz clock, 000 and FFF waveform data, norm, no filter, amplitude 5 V, no offset) – Rise/Fall Time: <35 ns. Flatness: Within ±3% after 150 ns from rise/fall edges. Aberrations: Within ±7%.

Cross Talk Between Channels – 512-point sine, 20 MHz clock, norm, no filter, amplitude offset. <70 dBc.

Noise Floor – 20 MHz clock, 7FFF waveform data, norm, no filter, no offset. 0.5 V: ≤110 dBm/Hz at 1 MHz. 5.0 V: ≤95 dBm/Hz at 1 MHz.

Sinewave Characteristics – Function Generator mode, 100 Hz to 200 kHz, no offset. Flatness (1 V amplitude, 1 kHz reference): Within –4%. T.H.D. (Including up to 4th harmonics): ≤55 dBc at 5.0 V.

AUXILIARY OUTPUTS

Marker – Amplitude: >2 V into 50 Ω. Impedance: 50 Ω. Marker to Signal Delay: 35 ns.

Clock – Amplitude: >2 V into 50 Ω. Impedance: 50 Ω.

Control Sig. – Amplitude: >2 V into 50 Ω. Impedance: 50 Ω.

Sweep (Option 05) – Waveshape: Same waveshape as selected sweep. Amplitude: 0 to 5 V (amplitude is dependent upon start and stop frequencies with a 5 V maximum limit). Impedance: 600 Ω.

24-Bit TTL Digital Out (Option 04) – Output Signals (CH 1 and CH 2): D0 to D11, Clock. Level: TTL. Amplitude: >2 V into 50 Ω. Skew Between Data: Within ±10 ns. Clock to Data Delay: Within ±10 ns. Impedance: 50 Ω.

AUXILIARY INPUTS

Trigger – Threshold Level: –5 V to +5 V. Resolution: 0.1 V. Accuracy: ±(5% of Level + 0.1 V). Minimum Pulse Width: 150 ns. Minimum Input Swing: 0.2 V p-p. Maximum Input Volts: ±10 V (DC + peak AC). Impedance: 10 kΩ. Trigger to Signal Delay: Internal Clock, 400 ns (excluding clock sweep mode);

AM (512-point sine, 20 MHz clock, AM, no filter, 5 V amplitude, no offset) – Range: 2 V p-p (–1 V to +1 V) for 100% modulation. Amplitude Accuracy: Within 5%. Maximum Input Volts: –5 V (DC + peak AC). Impedance: 10 kΩ.

ADD (512-point sine, 20 MHz clock, ADD, no filter, 5 V amplitude, no offset) – Range: 10 V p-p (–5 V to +5 V). Amplitude Accuracy: Amplitude specification plus 5%. Maximum Input Volts: –5 V (DC + peak AC). Impedance: 50 Ω.

Control Sig. – Threshold Level: TTL level (0.8 V to 2.0 V). Minimum Pulse Width: 40 ns. Maximum Input Volts: 5 V to 0 V. Impedance: 10 kΩ.

Clock – Threshold Level: TTL level (0.8 V to 2.0 V). Minimum Pulse Width: 20 ns. Maximum Input Volts: 5 V to 0 V. Impedance: External Clock, 330 Ω; Slave Mode, 10 kΩ. Frequency Range: 1 Hz to 20 MHz.

Sweep (Option 05 only) – Type: Linear, log, arbitrary. Mode: Continuous, triggered, gated. Update Rate: 1 s to 65.535 ms Points per Sweep: 8 K maximum.

FUNCTION GENERATOR

Waveform Shape – (Predefined 100 pt. waveforms). Sine, Triangle, Square, Ramp, Pulse (1 MHz filter is inserted when Sine is selected.)

Frequency – 1.000 Hz to 200 kHz.

Duty Cycle – 0% to 100%, Pulse only.

PROGRAMMABLE INTERFACE

GPIB – IEEE 488.2-1987 compatible.

RS-232 – 9-Pin D connector.

ENVIRONMENTAL

Temperature – Operating: +10°C to +40°C. Nonoperating: –20°C to +60°C.

Humidity – Operating: 20% to 80% (no condensation). Nonoperating: 5% to 90% (no condensation).

Altitude – Operating: To 4.5 km (15,000 ft.). Maximum operating temperature decreases 1°C for each 300 m above 1.5 km. Nonoperating: To 15 km (50,000 ft.).

Vibration – Operating: 0.33 mm p-p, 10 Hz to 55 Hz for 15 minutes.

Shock – Nonoperating: 30 g (1/2 sine) 11 ms duration.

EMC – Emissions: Within limits of FCC CFR 47, Part 15, Subpart B, Class A; VFG 243; EN55022, B;EN6055-2. Immunity: Within limits of IEC 801-3, IEC 801-2, IEC 801-4.

Electrical Discharge – Operating max test voltage: 15 kV (150 pF through 150 Ω).

Safety – Designed to meet UL 1244 and CSA 22.2 No. 231.EEC certified.

POWER

Source Power – Voltage Ranges: 90 to 127 V AC or 90 to 250 V AC. Line Frequency: 90 to 127 V, 48 to 440 Hz; 90 to 250 V, 48 to 63 Hz.

Maximum Current – 4 A at 50 Hz, 90 V.

Maximum Power Dissipation – 300 W.

Fuse Rating – UL 198.6 (3AG): 6 AFAST, 250 V. IEC 127:5 A (T), 250 V.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height (with feet)	164	6.4
Width (with handle)	362	14.3
Length (with front cover)	491	19.25
Length (with handle extended)	576	22.2
Weight	**kg**	**lb.**
	10.7	23.6

ORDERING INFORMATION

AWG 2005
Programmable Arbitrary Waveform Generator **$8,495**
Includes: User/Programmer's Manual, GPIB Programming Examples Disk, Sample Waveform Library Disk, Power Cable.

Opt. 02 – Add Two Channels (Four Total) ..... **+$4,495**
Opt. 04 – 12-Bit, TTL Level Digital Out ..... **+$1,695**
Opt. 05 – Add Clock Sweep ..... **+$1,495**
Opt. 09 – Add FFT Editor.
Allows editing waveforms in the frequency domain ..... **+$2,395**
Opt. 1R – Rackmount. Floppy Drive Access Moved to Front .... **+$595**
Opt. 1S – Service Manual ..... **+$150**
Opt. B1 – Adds WaveWriter S/W ..... **+$695**

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection ..... **+$400**
Opt. C5 – Adds five years of Calibration Services ..... **+$1,050**

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Opt. A5 ..... **NC**

ACCESSORIES
Accessory Pouch – Order 016-1159-00 ..... **$50**
Front Cover – Order 200-3232-00 ..... **$10**
RS-232-C Cable – 9-Pin to 25-Pin. Order 174-1453-00. ..... **$55**
Rackmount Kit – Order 016-1189-00.. ..... **$2,000**
GPIB Cable – Order 012-0991-00. ..... **$195**
50 Ω BNC Cable – Order 012-1342-00 ..... **$60**
12-Bit Word Generator Cable (Opt. 04) – Order 174-3192-00 ..... *1
SMA to BNC Adapter – Order 015-0544-00 ..... *1
50 Ω Termination – Order 011-0049-01 ..... **$38**

**1 Contact your Tektronix representative for price information.*

Product available through an Authorized Tektronix Distributor (see pages 592-595).

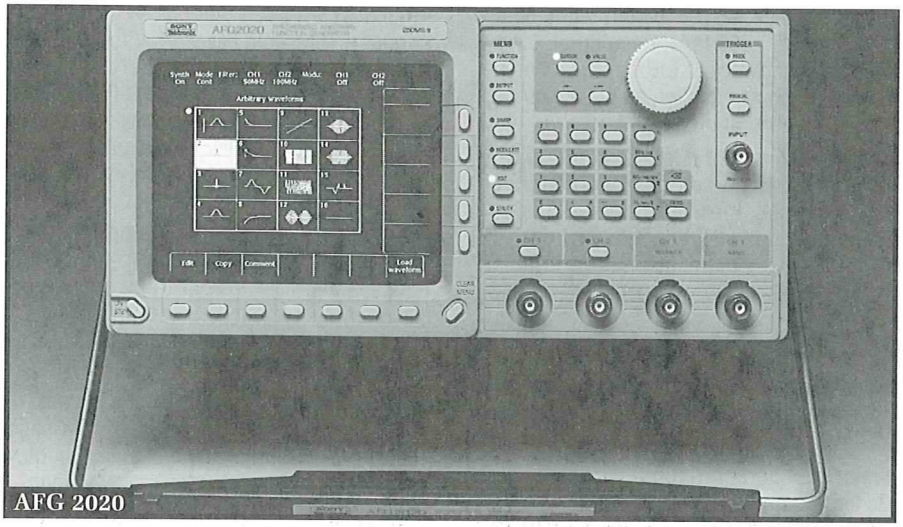
GPIB IEEE-488 All 2000 Series Arbs comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

Arbitrary Function Generator

An agile and precise function generation with arbitrary generation capability.

AFG 2020

- 250 MS/s, 4.0 ns, 1 ppm Clock
- DDS Synthesized Function Generation
- Sixteen Separate Arbitrary Waveforms with 1 K (1024 Points) Record Length
- Direct Waveform Transfers from DSO
- 100 MHz Sinewave
- 50 MHz Square Wave
- 31.2 MHz Triangle, Ramp, and Pulse
- AM/FM/PSK/FSK Amplitude and Offset Modulation
- Linear/Log Sweep
- Optional Second Channel (Opt. 02)


AFG 2020

AFG 2020 Arbitrary Generator

The AFG 2020 (Arbitrary Function Generator) differs from the AWGs because it is an excellent function generator first with some arbitrary capabilities built in. It uses DDS (direct digital synthesis) to create extremely pure standard sine, square, ramp and triangle signals at higher frequencies, resolution and stability. The AFG 2020 has PSK, FSK, AM, FM and Offset modulation and sweep built in. The AFG 2020 is targeted at Telecom users or users who need an excellent function generator first and an arbitrary waveform generator second.

Characteristics

STANDARD WAVESHAPES
Sine, square, triangle, ramp, pulse, and arbitrary.

FREQUENCY/PHASE (SYNTHESIZER ON)
Clock – 250 MHz, 4.0 ns, 1 ppm.

Frequency – 10 digits.

Range – Sine, 0.5 Hz to 100.00 MHz. Square, 0.500 Hz to 50.00 MHz; Other, 0.500 Hz to 31.2 MHz.

Resolution – 0.5 Hz. Accuracy: ±(Reference Oscillator Accuracy + 0.12 Hz).

Period – 10 digits, 2.0 sec to 4.0 ns.

Phase – 4 digits.

Range – ±360°. Resolution: 0.1°.

AMPLITUDE/OFFSET
Amplitude – 4 digits.

Resolution – 0.4 V p-p, 1 mV p-p; 2 V p-p, 2 mV p-p; 10 V p-p, 10 mV p-p.

Max. Amplitude – 10 V p-p into 50 Ω; 20 V p-p open circuit.

DC Accuracy – Range: 0.4 V p-p, ±(1.0% of setting +1 mV p-p); 2.0 V p-p, ±(1.0% of setting +5 mV p-p); 10 V p-p, ±(2.5% of setting +50 mV p-p).

Resolution – 0.4 V p-p, 1 mV; 2 V p-p, 2 mV; 10 V p-p, 10 mV.
Max. Offset: ±5 V into 50 Ω; ±10 V open circuit. Accuracy: 0.4 V p-p, ±(1.0% of setting +1 mV), 2.0 V p-p, ±(1.0% of setting +5 mV); 10 V p-p, ±(2.5% of setting +50 mV).

Noise Floor – Range: 0.4 V p-p, –128 dBm/Hz at 10 MHz; 2.0 V p-p, –114 dBm/Hz; 10 V p-p, –100 dBm/Hz.

SSB Phase Noise – Synthesizer On: –90 dBc/Hz. Synthesizer Off: –80 dBc/Hz.

Harmonics – See Data Sheet.

SQUARE
Accuracy – DC accuracy ±2% + Flatness.

Rise/Fall Time – With 50 MHz LPF: Within 9.0 ns. With Full Pass: Within 4.0 ns.

Aberrations – With 50 MHz LPF: 0.4 V p-p and 2 V p-p, within 5% + 2 mV p-p; 10 V p-p, within 7% + 10 mV p-p. With Full Pass: 0.4 V p-p and 2 V p-p, within 7% + 2 mV p-p; 10 V p-p, within 12% + 10 mV p-p.

TRIANGLE
Amplitude – Flatness with 50 MHz LPF: ≤100 kHz, ±2.0%; ≤2.5 MHz, –7.0%; ≤15.6 MHz, –20%; ≤31.2 MHz, –40%.

RAMP
Timing – Rise/Fall: 4 digits, 0% to 100% of period.

APPLICATIONS

- **Broadcast Telecom**
- **Complex Modulation Simulation**
- **Standard Signal Generation (e.g., Sine)**
- **Frequency Response Stimulus**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 All 2000 Series Arbs comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

Arbitrary Function Generator

Amplitude – Flatness with 50 MHz LPF: ≤100 kHz , ±2.0%; ≤2.5 MHz, –8.0%; ≤15.6 MHz, –25%; ≤31.2 MHz, –45%.

PULSE

Pulse Width – 20% to 50.0% of period.

Transition – 0% to 35.0% of pulse width.

Amplitude – Flatness with 50 MHz LPF: ≤100 kHz , ±2.0%; ≤2.5 MHz, –5.0%; ≤15.6 MHz, –5.0%; ≤31.2 MHz, –20%.

ARBITRARY

Maximum Points – Any periodic waveform described with 12-Bits and 1024 points.

Number of Waveforms – 16.

SWEEP

Type – Linear, log.

Frequency – 5 digits. Start, stop: Sine, 1.0 Hz to 100 MHz; Others, 1.0 Hz to 2.5 MHz.

Step (Linear) – Within 2.5 MHz, 5 digits.

Dwell Time – 4 digits. Sweep: 0.5 µs to 100 sec. Return: 0.5 µs to 100 sec.

Marker – Number: 3. Frequency: Between Start and Stop. Time: 0.5 µs to 100 sec.

Maximum Period – 2048 seconds ≤Sweep + Return Time.

MODULATION

Amplitude Modulation (Internal and External) – Amplitude: 4 digits, –10.00 V p-p to +10.00 V p-p. External CH 2 Amplitude: 1 V p-p. Depth: 3 digits, 0 to 100%. Double Sideband Suppressed Carrier: ON/OFF. Modulation Rate: Period, 10 µs to 1 sec every 0.2 µs. Accuracy: ±0.1%. Rise Time: Within 2 µs. AM Noise: Within 1% of range.

Offset Modulation (Internal) – High, Low: 4 digits, –5.000 V p-p to +5.000 V p-p. Modulation Rate: Period, 10 µs to 1 sec every 0.2 µs; accuracy, ±0.1%. Rise Time: Within 2 µs. Modulation Noise: Within 1% of range.

Frequency Modulation (Internal) – Center Frequency: 9 digits. Deviation: 6 digits. Modulation Rate: Period, 10 µs to 1 sec every 0.2 µs; accuracy, ±0.1%.

Frequency Shift Keying (FSK) (Internal) – Key: Number of Keys, 2 to 256: Frequency, within 100 MHz (sine); Amplitude, within 10 V p-p; Offset, within ±5 V. Data: Number of Data, 2 to 2,048. Frequency Transition Time: 4 ns. Data Rate: 1 to 2,500,000; Period, 1 sec to 0.4 µs, every 0.1 µs.

Phase Shift Keying (PSK) (Internal) – Key: Number of Keys, 2 to 256: Phase, within ±360.0°; Amplitude, within 10 V p-p; Offset, within ±5 V. Data: Number of Data, 2 to 2,048. Phase Transition Time: 800 ns (200 clocks). Data Rate: 1 to 50,000; Period, 1 sec to 20 µs, every 0.1 µs.

MAIN OUTPUT

Filters – 100 MHz Brick Wall: Within 1 dB to 100 MHz; less than –40 dB, 125 MHz to 1 GHz. 50 MHz Linear Phase: –3 dB ±0.5 dB at 50 MHz.

Output Impedance – 50 Ω.

AUXILIARY OUTPUTS

Sync Output – Positive TTL level. Min. Pulse Width: 400 ns. Output Impedance: 51 Ω nominal.

Marker Output – Positive TTL level. Min. Pulse Width, 100 ns. Output Impedance: 51 Ω nominal.

10 MHz Output – TTL level square wave. Duty Cycle: 50% to 75%. Output Impedance: 51 Ω nominal.

AUXILIARY INPUTS

Trigger/Gate In – Sensitivity: 200 mV p-p min. Bandwidth: DC to 10 MHz. Amplitude: 30 ns, 200 mV p-p amplitude. Input Impedance: 1 kΩ ±5%. Max. Input Voltage: ≤10 V DC + peak AC. Range: ±9.90 V. Resolution: 0.1 V. Accuracy: ±10% ±100 mV.

AM Input – Input Impedance: 10 kΩ ±5%. Max. Input Voltage: 10 V DC + peak AC.

REF IN – TTL compatible. Range: 10 MHz ±10 kHz. Input Impedance: 10 kΩ ±5%. Max.

OPERATING MODES

Continuous – Generates the waveform continuously.

Triggered Continuous – Output quiescent until triggered by an external, GPIB, or manual trigger; then generates a sequence after pre-defined delay and stops by STOP command or GPIB command.

Gated – Same as triggered mode except period is executed after the pre-defined delay for the duration of the gated signal. The last sequence started is completed.

Time Burst – Output quiescent until triggered by an external, GPIB, or manual trigger; then generates "n" sequences or cycles.

PROGRAMMABLE INTERFACE

GPIB – IEEE-488.2-1987 compatible.

ENVIRONMENTAL

Temperature – Operating: +10°C to +40°C. Nonoperating: –20°C to +60°C.

Humidity – Operating: 20% to 80% (no condensation). Nonoperating: 5% to 90% (no condensation).

Altitude – Operating: To 4.5 km (15,000 ft.). Maximum operating temperature decreases 1°C for each 300 m above 1.5 km. Nonoperating: To 15 km (50,000 ft.).

Vibration – Operating: 0.33 mm p-p, 10 Hz to 55 Hz for 15 minutes.

Shock – Nonoperating: 30 g (1/2 sine) 11 ms duration.

EMC – Emissions: Within limits of FCC CFR 47, Part 15, Subpart B, Class A; VFG 243; EN55022, B;EN6055-2. Immunity: Within limits of IEC 801-3, IEC 801-2, IEC 801-4.

Electrical Discharge – Operating max test voltage: 15 kV (150 pF through 150 Ω).

Safety – Designed to meet UL 1244 and CSA 22.2 No. 231.EEC certified.

POWER

Source Power – Voltage Ranges: 90 to 127 V AC or 90 to 250 V AC. Line Frequency: 90 to 127 V, 48 to 440 Hz; 90 to 250 V, 48 to 63 Hz.

Maximum Current – 4 A at 50 Hz, 90 V.

Maximum Power Dissipation – 300 W.

Fuse Rating – UL 198.6 (3AG): 6 AFAST, 250 V. IEC 127:5 A (T), 250 V.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height (with feet)	164	6.4
Width (with handle)	362	14.3
Length (with front cover)	491	19.25
Length (with handle extended)	576	22.2
Weight	**kg**	**lb.**
	10.7	23.6

ORDERING INFORMATION

AFG 2020
Programmable Arbitrary Function Generator **$6,995**
Includes: User/Programmer's Manual, GPIB Programming Examples Disk, Power Cable.
Opt. 02 – Add Second Channel. ..... **+$3,295**
Opt. 1R – Rackmount. ..... **+$495**
Opt. 1B – Service Manual ..... **+$150**
Opt. 1S – Adds WaveWriter S/W ..... **+$695**
Opts. A1 - A5 – International Plug Options ..... **NC**

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection ..... **+$400**
Opt. C5 – Adds five years of Calibration Services ..... **+$1,050**

ACCESSORIES
Accessory Pouch – Order 016-1159-00 ..... **$50**
Front Cover – Order 200-3232-00 ..... **$10**
GPIB Cable – Order 012-0991-00. ..... **$195**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488

All 2000 Series Arbs comply with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

HFS 9003
HFS 9009
HFS 9DG1
HFS 9DG2

Programmable Stimulus System

Signal Sources – Standalone

All the stimulus you need in a single instrument.

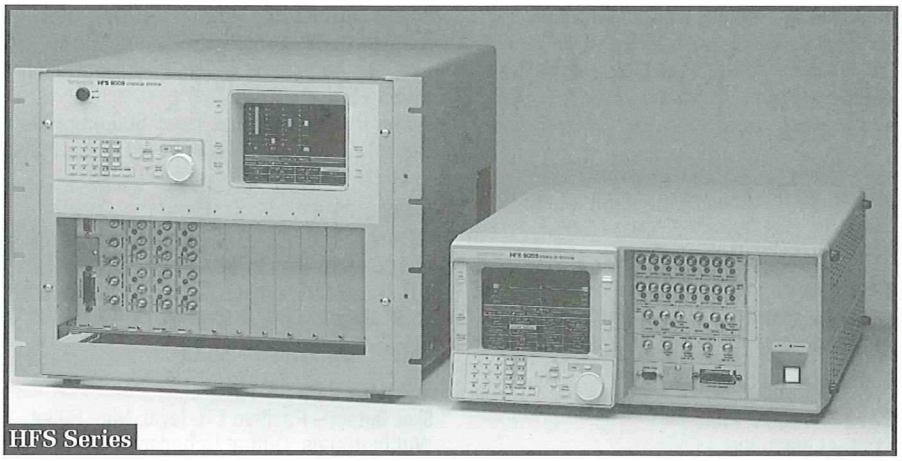
The Tektronix HFS 9000 Stimulus System combines the capabilities of a complete data generator, pulse generator, DC level source and switch matrix in a single instrument – it's the industry's first Data Time Generator.

HFS 9000 SERIES FEATURES

- Complete Stimulus Setup In Just Minutes
- Specify Data and Timing On Every Pin
- Up to 630 MHz Repetition Rate
- Fully Digital Implementation
- Multi-Channel Architecture – Up to 640 or More Phase-Locked Channels
- Independent Edge Placement
- Channel Deskew
- Precision Channel-to-Channel Timing Alignment
- 1 ps Timing Resolution
- GPIB (IEEE 488) Programmable
- Modular Construction

BENEFITS

- Upgrade Capability
- Maximum Control and Flexibility


HFS Series

HFS 9000 STIMULUS SYSTEM

When product designs were simple, and time-to-market not so critical, designers could afford the days, or even weeks, necessary to assemble, program, debug and characterize the various elements of a stimulus system and its fixturing. As product design complexity and market pressures have increased, however, designers of high-speed, high-performance circuits simply cannot afford this expenditure in time.

Now there's a solution. With Tektronix HFS 9000 Stimulus Systems we've taken the features of a high-performance pulse generator, made them better, and added complete data generation capabilities as well. We've eliminated the need for a switch matrix since we have data and timing on every pin. And the need for a separate power supply is gone as the HFS 9000 has the ability to produce the DC levels needed to drive logic lines directly. Finally, all these capabilities are present on every pin simultaneously, so you get extremely flexible formatting. Now you can set up a complete stimulus system in minutes rather than hours or days, and test products more thoroughly throughout the development cycle.

DIGITAL ARCHITECTURE

The HFS 9000 Series products were designed as completely programmable digital instruments rather than being based on traditional monostable analog architecture. This allows more capability and flexibility in pulse edge placement without the restrictions that analog instruments commonly impose. Now you can adjust both Delay and Width from 0 to 20 µs over all frequencies.

MODULAR DESIGN

You can build a stimulus system with from four to 36 channels in one mainframe, and 640 or more channels across multiple phase-locked mainframes. Choose from the HFS 9003 mainframe with three-slot, 12-Channel capability, or the HFS 9009 mainframe with nine-slot, 36-Channel capability. Both systems can include the 4-Channel HFS 9DG1 and HFS 9DG2 Data Time Generator cards in any combination.

All channels are slaved to a common clock, resulting in highly accurate channel-to-channel edge placement. This makes the HFS 9000 ideal for precise characterization and evaluation of synchronous devices having multiple, and possibly interactive, inputs.

APPLICATIONS

- **Characterize CMOS, ECL, ACL, BiCMOS, and GaAs Devices**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The HFS 9000 Series complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

Programmable Stimulus System

Signal Sources – Standalone

HFS 9003
HFS 9009
HFS 9DG1
HFS 9DG2

FULL CHANNEL DESKEW CAPABILITY

All HFS 9000 channels have independent, wide deskew ranges to allow precise pulse alignment and timing at the device under test (DUT). Deskew compensates for the timing differences caused by cabling and fixturing so your analysis can be focused on the relative timing at the DUT.

1 PS TIMING RESOLUTION

No other system lets you generate whatever combination of signals is required, with data and timing on every pin with 1 ps resolution. Now you can create data buses, clocks, strobes, gated clocks, logic level sources, pseudorandom bits and other stimuli with unequaled accuracy. You can perform setup and hold time margin tests by providing the clock, data, set and reset signals to the DUT. And you can hold inactive signals at programmable high or low logic levels, eliminating the need for external DC voltage sources and microwave switches.

630 MHZ REPETITION RATE

Accurate and repeatable AC measurements of prop delay, setup and hold time, and maximum operating frequency (fmax) require fast rep rates and edge speeds. With repetition rates up to 630 MHz, the HFS 9000 is ideal for characterizing the most advanced logic families. And, it can be used for testing component compliance with the SONET telecommunications standard. Transition times as fast as 250 ps (20%- 80%) enable repeatable and accurate testing of the highest-speed ECL and GaAs digital devices. Variable transition time control from 800 ps to 6 ns is also available with the appropriate output levels for testing advanced CMOS, BiCMOS and TTL logic families.

EASY EDITING OF SETUPS AND VECTORS

Edit setups and vectors easily with BitWrite™ Software. With this Microsoft® Windows® based package you can build a complete test setup, including timing parameters,voltage levels, channel assignment and test vectors on your PC. Ideal for remote test development. Individual setups and test vectors can be uploaded and stored when the HFS 9000 has multiple users.

FULLY PROGRAMMABLE

Programmability is important in developing automated, repeatable tests in R&D, incoming inspection, and production of high-speed components. Therefore, the HFS 9000 offers full implementation of the new IEEE 488.2 standard and utilizes Tektronix Codes and Formats. GPIB/RS-232 ports provide for remote, fully programmable control. Coupled with a high-speed acquisition system, such as the 11801B Digital Sampling Oscilloscope, or the most advanced logic analysis system on the market – the Tektronix DAS 9200 Digital Analysis System – a fully automated test system can be developed with unequaled accuracy and repeatability.

PHASE LOCK MODE

Phase lock-in allows the internal time base to be phase-locked to an external frequency source. This "supercharger" capability can be used to augment the speed performance of automated component test systems by creating synchronized signals as fast as 630 MHz.

CONFIGURATION OPTIONS

Card-modular design lets you adapt to any logic family from within the same mainframe. Choose the HFS 9DG1 Data Time Generator card for 630 MHz bandwidth and <250 ps fixed rise time. The 9DG1 provides four channels of stimulus. This card is ideal for ECL and GaAs device characterization.

Or, choose the HFS 9DG2 Data Time Generator card for up to 315 MHz bandwidth and variable transition times from 800 ps to 6 ns. The 9DG2 provides four channels of stimulus. This card is ideal for simulating TTL, CMOS and BiCMOS logic signals.

Combine these cards in any combination for testing a broad range of components or systems with mixed logic families.

APPLICATIONS

From verifying critical parameters to full characterization, from developing manufacturing test vectors on the bench to phase-locked at-speed testing in conjunction with production test systems, the HFS 9000 Data Time Generator simplifies the process while adding unmatched capabilities. You can, for example, create complex stimulus that are impossible with other systems. Download test vectors and timing parameters to the HFS 9000 to set up worst-case conditions and to stimulate each pin in isolation. Vary voltage levels, pulse widths and timing relationships independently for each channel. Mix high-speed and variable transition time modules to fit your logic family. And obtain channel counts unavailable in any other discrete instrument.

The Data Time Generator also provides a new dimension of assistance in characterizing pattern sensitivity. It provides the data stream while also creating the varying signal levels, timing relationships or signal characteristics required to detect pattern sensitivity across worst-case operating conditions.

Capabilities like these allow you to perform full characterizations on the first run, lowering your development costs and reducing your time to market.

Characteristics

Level Resolution – 0.01 V.

HIGH Level Accuracy – ±2% of level ±50 mV.

LOW Level Accuracy – ±2% of HIGH level ±2% of amplitude ±50 mV.

Output Aberrations (200ps after 50% pt.) –
Overshoot: +15% +20 mV.
Undershoot: –10% –20 mV.

TIME BASE PERFORMANCE

Frequency Range – 50 kHz to 630 MHz.

Frequency Resolution – ≤0.1% of programmed value.

Frequency Accuracy – ±1% of programmed value.

RMS Jitter – 15 ps ±0.05% of interval.

PHASE LOCK IN Frequency Range – 6 MHz to 630 MHz.

PHASE LOCK IN Amplitude Range – 0.8 V to 1.0 V p-p.

Output Frequency Range – any 2^n multiple or submultiple of PHASE LOCK IN frequency. Must remain inside the allowed frequency range for installed cards.

FRAME SYNC IN – Initiates a burst when using PHASE LOCK IN external frequency reference.

Continued on next page.

HFS 9003
HFS 9009
HFS 9DG1
HFS 9DG2

Programmable Stimulus System

Signal Sources – Standalone

OUTPUT PERFORMANCE

	HFS 9DG1	HFS 9DG2
Outputs	4 differential	4 single-ended
Maximum HIGH level	+5.00 V	+5.50 V
Minimum LOW level	–2.50 V	–2.00 V
Max p-p amplitude	3.00 V	5.50 V
Min p-p amplitude	0.01 V (10 mV)	0.01 V (10 mV)
Output transition time (20% to 80%)	<250 p (≤1 V p-p)	variable 800 ps to 6 ns

OUTPUT EDGE PLACEMENT PERFORMANCE

Channel Deskew Range – Minus 60 ns to 2.0 µs.

Channel Deskew Resolution – 1 ps.

DELAY Adjust Range – Zero to 20 µs.

DELAY Adjust Resolution – 1 ps.

DELAY Accuracy – 1% ±50 ps.

WIDTH Adjust Range – 0 to 65,536 times one period.

WIDTH Adjust Resolution – 1 ps.

WIDTH Accuracy – HFS 9DG1: 1% of width ±50 ps; HFS 9DG2: 1% of width +50 ps –250 ps.

TRIGGER INPUT PERFORMANCE

Input Resistance – 50 Ω.

Input Voltage Range – ±5 V maximum.

Programmable Threshold Range – –4.70 V to +4.70 V.

Programmable Threshold Resolution – 100 mV.

Programmable Threshold Accuracy – ±100 mV ±5% of level.

Minimum Input Pulse Width – 1 ns.

Input Rise/Fall Time Requirement – ≤10 ns

Sensitivity – ≤500 mV.

POWER REQUIREMENTS

Line Voltage Ranges – 90 V AC to 130 V AC RMS, and 180 V AC to 250 V AC RMS; range switched automatically for HFS 9003 (factory configured for HFS 9009).

Line Frequency – 48 Hz to 63 Hz.

Power Consumption –

	HFS 9003	HFS 9009
Maximum	540 W	900 W
Typical	400 W	750 W

ENVIRONMENTAL

Temperature – Operating: 0° to +50°C (HFS 9003) 0° to +40°C (HFS 9009) Nonoperating: –40° to +75°C.

Humidity – –10°C to +30°C up to 95% relative humidity. 30°C to 40°C up to 75% relative humidity.

Altitude, Shock Nonoperating, Bench Handling – Meets MIL-T-28800C, Type III, Class 5.

PHYSICAL CHARACTERISTICS

HFS 9003	Cabinet		Rackmount	
Dimensions	**mm**	**in.**	**mm**	**in**
Width	414	16.3	483	19.0
Height	178	7.0	178	7.0
Depth	629	24.75	629	24.75
Weight*1	**kg**	**lb.**	**kg**	**lb.**
Net	20.5	45.0	23.2	51.0
Shipping	27.3	60.0	30.0	66.0

[1] maximum configuration

HFS 9009	Cabinet	
Dimensions	**mm**	**in.**
Width	426	16.75
Height	356	14.0
Depth	610	24.0
Weight	**kg**	**lb.**
Net	36.8	81.0
Shipping	45.5	100.0

HFS 9DG1, HFS 9DG2	Cabinet	
Dimensions	**mm**	**in.**
Width	51	2.0
Height	267	10.5
Depth	356	14.0
Weight	**kg**	**lb.**
Shipping	1.36	3.0

ORDERING INFORMATION

HFS 9003
3-slot Mainframe.....**$13,295**
Includes: User Reference Manual; Service Reference Manual; Power Cord; RS-232 Pigtail; SMA–BNC Adapter; Zip-Lock Pouch; Two Replacement Fuses; and One 50 Ω SMA Coaxial Cable.
Opt. 01 – BitWrite™ software.....**+$995**
Opt. 1R – Rackmount.....**+$295**

HFS 9009
9-slot Mainframe.....**$20,995**
Includes: User Reference Manual; Service Reference Manual; Power Cord; RS-232 Pigtail; SMA–BNC Adapter; Zip-Lock Pouch; Two Replacement Fuses; and One 50 Ω SMA Coaxial Cable.
Opt. 01 – BitWrite™ Software.....**+$995**

ACCESSORIES
See page 446 for Cables, Adapters, and Terminators.

HFS 9DG1
Four differential data time outputs per card with <250 ps transition time, 630 MHz.....**$11,500**
Includes: Installation Instructions and Two Clock Cables.

HFS 9DG2
Four single-ended data time outputs per card with 800 ps to 6 ns variable transition time.....**$8,300**
Includes: Installation Instructions and Two Clock Cables.
S85HFS1 – BitWrite™ Software.....**$995**

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro: 220 V, 50 Hz.....**NC**
Opt. A2 – United Kingdom: 240 V, 50 Hz.....**NC**
Opt. A3 – Australian: 240 V, 50 Hz.....**NC**
Opt. A4 – North American: 240 V, 60 Hz.....**NC**
Opt. A5 – Switzerland: 220 V, 50 Hz.....**NC**

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection.....**+$400**
Opt. C5 – Adds five years of Calibration Services.....**+$1,050**
See Customer Information Section for additional description.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 — The HFS 9000 Series complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 — ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Basic Bench Test Instruments

Tektronix has a complete line of low-cost, bench test instruments for both basic and advanced test benches: triple output power supplies, digital and programmable multimeters, function generators, multifunction counters.

Instrument and operator safety are all-important. Tektronix TM250 and TM2500 Series instruments comply with independent safety certification standards established by UL, CSA, or ETL.

The TM Series instruments are covered by a one year warranty.

Power Supplies

The CPS250 power supply is a versatile instrument with one fixed and two variable outputs. Two switchable analog meters and switchable outputs operating independently, in series, or in parallel, make this power supply ideal for lab and field work. If your needs require programmability, look at our new PG2500 Series power supplies.

Digital Multimeters

Tektronix digital multimeters measure AC and DC voltage, current and resistance. The New DM2510 and DM2510G Digital Programmable Multimeters provide exceptional accuracy and speed, especially in repetitive testing situations. The DM2510G has a GPIB interface for computerized remote operation and data capture.

Function Generators

Tektronix TM250 Series Function Generators produce TTL signals and square sine, and triangle waves for testing amplifiers, filters, and digital circuits. The frequency range of these Tektronix instruments runs from 0.1 Hz to 11 MHz. Sweep functions can be controlled internally or by an external signal.

The CFG280 includes a 1 Hz to 100 MHz integral counter.

Multifunction Counters

Tektronix benchtop counters accurately measure the frequency of sine, square and triangle waves. The counters span the frequency range from 1 Hz to 1.3 GHz, and several counters also provide period, totalize, frequency ratio, and time interval measurements.

The CDC250 and CMC251 have a temperature-compensated time base to ensure accurate performance in changing ambient conditions. Service technicians will find these two meters useful as standards for calibrating other equipment.

TM250 Basic Bench Set

Whether you are setting up a lab or a production line, or replacing a mismatched collection of old instruments, you will find this set a cost-effective way to get the measurement power you need to do the job right. The TM250 Basic Bench Set is unbeatable in a classroom when used with the excellent instructional materials available from Tektronix.

The set includes the CFG250, CDM250 and CPS250. You will want to add your choice of optional counters or a basic oscilloscope for more complete test and measurement capability.

CONTENTS

OSCILLOSCOPES
200 Series....114
2200 Series....116
Laptop Digital Oscilloscope....420

TekTools/TekBench
Digital Multimeters....414, 422
TekMeter™....416
Counters....424
Function Generators....426
Power Supplies....428
ACCESSORIES....418, 420, 446

DMM155
DMM156
DMM157
DMM250
DMM251
DMM252
DMM254
DMM353

Handheld Digital Multimeters

Rugged handheld multimeters for field/plant maintenance, trouble shooting, classroom labs.

DMM155
- 2,000 Counts Display
- 0.7% Basic Accuracy
- Current Measurement

DMM156
- 2,000 Counts Display
- 0.5% Basic Accuracy
- Capacitance Measurement

DMM157
- 2,000 Counts Display
- 0.5% Basic Accuracy
- Current and Capacitance Measurement

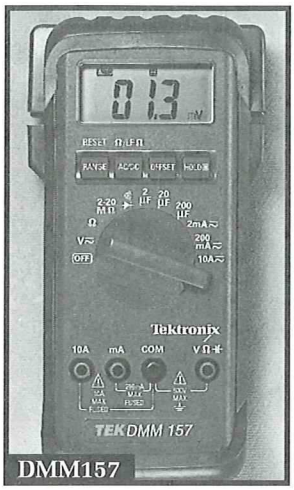
DMM250
- 2,000 Counts Display
- 0.5% Basic Accuracy

DMM251
- 4,000 Count Autoranging
- 0.3% Basic Accuracy
- Frequency Measurement
- Capacitance Test

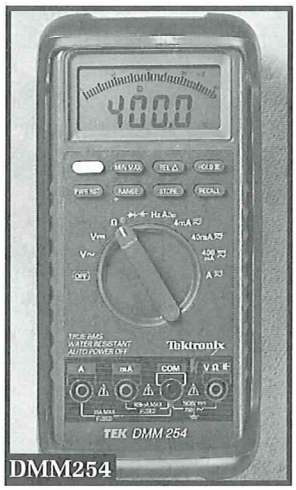
DMM252
- 4,000 Count Autoranging
- 0.1% Basic Accuracy
- Frequency Measurement
- Capacitance Test

DMM254
- True RMS Measurement
- 4,000 Count Autoranging
- 0.1% Basic Accuracy
- Frequency Measurement
- Capacitance Test

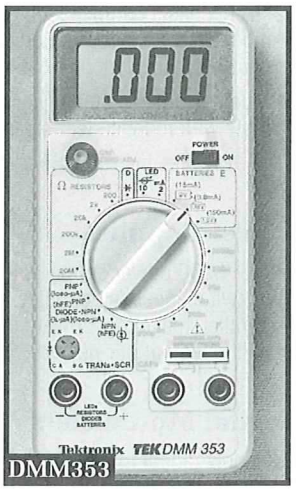
DMM353
- 0.5% Basic Accuracy
- Capacitance Measurement
- Resistance Measurement
- SCR Go/No-Go Test



DMM157



DMM254



DMM353

DMM155
The DMM155 is designed for indoor/outdoor service of electrical equipment. It has functions to satisfy the needs of most hobbyists.

DMM156
The DMM156 is the multimeter for hobbyists and technicians testing voltage, capacitance, resistance, and diodes, but who don't need current measurement capability.

DMM157
The DMM157 is ideal for the service technician or student needing a rugged, multifunction product with good accuracy at a reasonable price.

DMM250
The DMM250 is designed for field service, laboratory work, and for the electronics hobbyist.

DMM251
The DMM251 is an extended function DMM for users with moderate accuracy requirements. Safety features give a high level of operator protection.

DMM252
The DMM252 has the same safety features and measurement functions as the DMM251 but is a more accurate instrument.

DMM254
The DMM254 is for the professional who needs full function capabilities with exceptional accuracy. It provides precise true RMS measurement of all AC signals.

DMM353
The DMM353 Component Checker is an indispensable tool for the electronic service technician. With several ranges for versatility, it tests transistors, diodes, LEDs, capacitors, and batteries.

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Handheld Digital Multimeters

DMM155 DMM251
DMM156 DMM252
DMM157 DMM353
DMM250 DMM254

KEY SPECIFICATIONS

	DMM155	DMM156	DMM157	DMM250	DMM251	DMM252	DMM254	DMM353
Basic DC Volts Accuracy	0.7%	0.5%	0.5%	0.5%	0.3%	0.1% (except 400 mV range)	0.1% (except 400 mV range)	(0.5% R & C)
AC Voltage Ranges	2 V to 600 V	2 V to 600 V	2 V to 600 V	2 V to 750 V	400 mV to 750 V	400 mV to 750 V	400 mV to 750 V	–
DC Voltage Ranges	200 mV to 600 V	200 mV to 600 V	200 mV to 600 V	200 mV to 1000 V	400 mV to 1000 V	400 mV to 1000 V	400 mV to 1000 V	–
True RMS AC	–	–	–	–	–	–	Yes	–
AC Current Ranges	2 mA to 10 A	–	2 mA to 10 A	200 µA to 10 A	4 mA to 10 A	4 mA to 10 A	4 mA to 10 A	–
DC Current Ranges	2 mA to 10 A	–	2 mA to 10 A	200 µA to 10 A	4 mA to 10 A	4 mA to 10 A	4 mA to 10 A	–
Resistance Ranges	200 Ω to 20 MΩ	200 Ω to 20 MΩ	200 Ω to 20 MΩ	200 Ω to 20 MΩ	400 Ω to 40 MΩ	400 Ω to 40 MΩ	400 Ω to 40 MΩ	200 Ω to 20 MΩ
Capacitance Ranges	–	2 µF to 200 µF	2 µF to 200 µF	–	4 nF to 40 µF	4 nF to 40 µF	4 nF to 40 µF	200 pF to 20 mF
Frequency Ranges	–	–	–	–	100 Hz to 1 MHz	100 Hz to 1 MHz	100 Hz to 1 MHz	–
Features								
Analog Display	–	–	–	Yes	Yes	Yes	Yes	–
Auto Power Off	Yes	Yes	Yes	Yes	Yes	Yes	Yes	–
Autoranging	Yes	Yes	Yes	Yes	Yes	Yes	Yes	–
Compare Mode	–	–	–	Yes	Yes	Yes	Yes	–
Continuity Check/Beeper	Yes	Yes	Yes	Yes	Yes	Yes	Yes	–
Data Hold	Yes	Yes	Yes	Yes	Yes	Yes	Yes	–
Digital Display	2,000 Count LCD	2,000 Count LCD	2,000 Count LCD	2,000 Count LCD	4,000 Count LCD	4,000 Count LCD	4,000 Count LCD	2,000 Count LCD
Diode Test	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LED Test	–	–	–	–	–	–	–	Yes
Low Battery Indicator	Yes	Yes	Yes	Yes	Yes	Yes	Yes	–
Memory Offset	Yes	Yes	Yes	Yes	Yes	Yes	Yes	–
Overrange Indication	Yes	Yes	Yes	Yes	Yes	Yes	Yes	–
Safety Certification	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NA
SCR Test	–	–	–	–	–	–	–	Yes
Transistor Leakage ICEO Test	–	–	–	–	–	–	–	Yes
Transistor hFE Test (PNP or NPN)	–	–	–	–	–	–	–	Yes
Water-Resistant Case	–	–	–	Yes	Yes	Yes	Yes	–

ORDERING INFORMATION

DMM353
Component Checker

DMM250
Handheld Digital Multimeter
Both Include: Right-angle Test Leads, Spare Fuse, 9 Volt Battery, Operator's Manual.

AVAILABLE ACCESSORIES (DMM250 AND DMM353)
Holster – Order 118-8733-00
Soft Carrying Case – (DMM353) Order 118-8338-00

DMM251/DMM252
Handheld Digital Multimeter
Both Include: Test Leads, Two AAA batteries, User Manual, Holster

DMM254/DMM155/DMM156/DMM157
Handheld Digital Multimeter
All Include: Test Leads, 9 V Battery, User Manual, Holster

AVAILABLE ACCESSORIES (DMM251, DMM252, and DMM254)
Soft Carrying Case – Fits with holster removed. Order 118-8338-00

SERVICE ASSURANCE OPTIONS
These products covered by the following service assurance options
REP4100 – Provides One Year of Post-Warranty Repair Protection
CAL4100 – Provides One Year of Calibration Services

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

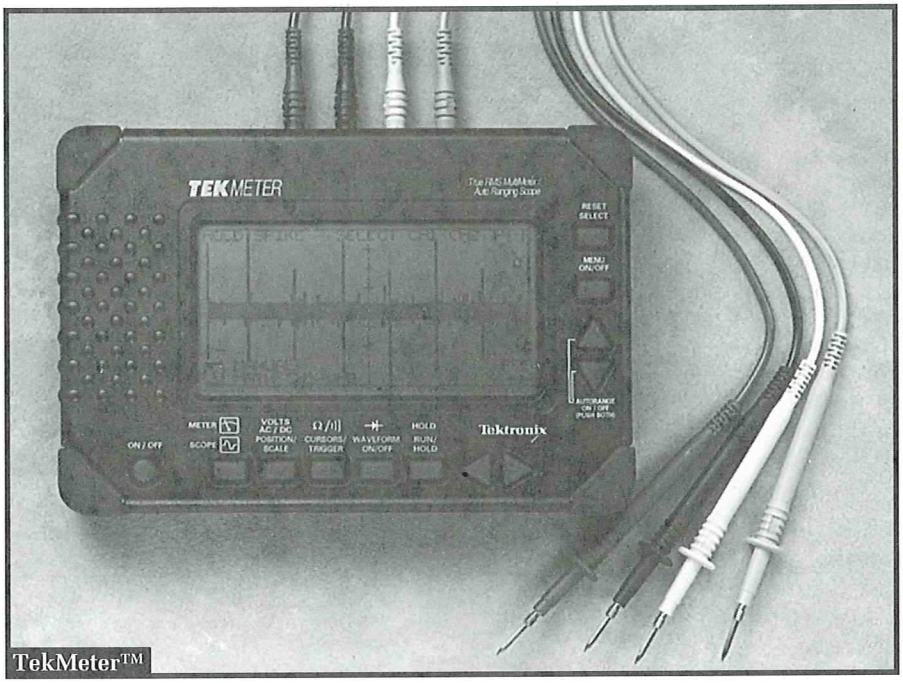
THM 550
THM 560
THM 565

TekMeter™

Integrated digital multimeter and auto-ranging scope in a rugged two-pound package.

THM SERIES
TekMeter™

- True RMS Multimeter
- Autoranging Oscilloscope
- ΔV, ΔT, and 1/ΔT Cursors
- Automatic Measurements
- LCD Display (Backlit on THM 565)
- UL and CSA Certified to 600 V AC RMS or 850 V DC
- 6 kV Surge Protected
- Powered by Six Standard AA Batteries, Optional Replaceable NiCd Pack or AC adapter
- Weighs Only 2.2 lbs. (990 grams)
- Works with Standard DMM Probes and Accessories



TekMeter™

THM Series TekMeter™

The TekMeter™ Series combines the power of a true RMS digital multimeter and a 25 MS/s autoranging digital storage oscilloscope in one compact, simple-to-use, rugged, battery-powered unit. Designed for a wide variety of industrial applications, the TekMeter™ measures and displays signals from a few millivolts to several hundreds of volts. Its unique, auto-ranging scope tracks the signal and adjusts the instrument automatically. There's no need to be an expert scope user to get immediate results.

The simple interface allows access to numerous powerful and time-saving features such as automatic measurements, capturing and time stamping AC-line faults, calculation of transformer harmonic derating factor (THDF), stable triggering on complex AC-motor drive signals, measuring true power, plus several other DMM and scope functions.

A UNIQUE MULTI-FUNCTION DISPLAY

Unlike a traditional DMM, the TekMeter's large display tells you everything you need to know about what you're measuring. In addition to the numerical and analog bar readout you're used to seeing on a DMM, the display shows Max, Min, Max-Min, Hold, and ΔHold all at once. You get more information about the signal, all on a single display.

Switch to the scope mode and TekMeter™ provides a waveform display similar to a traditional oscilloscope. The scope-mode display is autoranging, so it automatically scales and tracks as the signal changes, giving you hands-free operation. You can concentrate on the measurement, not the instrument, making measurements easier and faster.

LOTS OF POWER IN A SMALL PACKAGE

Even though the TekMeter™ easily fits in your hand, it packs more power and features than instruments many times its size. Its simple interface allows quick access to a host of features such as cursors, automatic measurements, true power measurements, Power Factor, Transformer Harmonic Derating Factor (THDF), and spike detect – all of which will help you get to the source of your problem more quickly. TekMeter™ can do anything you're doing now, and more. You get measurable results that get the job done.

APPLICATIONS

- **Test Power Quality**
- **Verify Logic Circuitry**
- **Test Motor Drives**
- **Examine Video Signals**

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

TekMeter™

THM 550
THM 560
THM 565

KEY SPECIFICATIONS

	THM 550	THM 560	THM 565
DIGITAL MULTIMETER			
Resolution	True RMS, 4,000 counts, 3 3/4 digits	True RMS, 4,000 counts, 3 3/4 digits	True RMS, 4,000 counts, 3 3/4 digits
DC Voltage Ranges	400 mV to 850 V	400 mV to 850 V	400 mV to 850 V
DC Accuracy	±(0.5% of reading + 5 counts)	±(0.5% of reading + 5 counts)	±(0.5% of reading + 5 counts)
AC Voltage Ranges	400 mV to 600 V, true RMS, crest factor of 3	400 mV to 600 V, true RMS, crest factor of 3	400 mV to 600 V, true RMS, crest factor of 3
AC Bandwidth	1 Hz to 5 kHz	1 Hz to 5 kHz	1 Hz to 5 kHz
AC Accuracy	±(2% of reading + 5 counts) @50 to 60 Hz	±(2% of reading + 5 counts) @50 to 60 Hz	±(2% of reading + 5 counts) @50 to 60 Hz
	±(2% of reading + 5 counts) @500 Hz	±(2% of reading + 5 counts) @500 Hz	±(2% of reading + 5 counts) @500 Hz
Resistance Ranges	400 Ω to 40 MΩ	400 Ω to 40 MΩ	400 Ω to 40 MΩ
Resistance Accuracy	±(0.5% of reading + 2 counts) all ranges except 40 MΩ which is ±(2% of reading + 5 counts)	±(0.5% of reading + 2 counts) all ranges except 40 MΩ which is ±(2% of reading + 5 counts)	±(0.5% of reading + 2 counts) all ranges except 40 MΩ which is ±(2% of reading + 5 counts)
DMM Measurements	Max, Min, Max-Min, Hold, ΔHold	Max, Min, Max-Min, Hold, ΔHold	Max, Min, Max-Min, Hold, ΔHold
Other DMM Features	Diode Tester, Continuity Tester, Current (with optional current probe)	Diode Tester, Continuity Tester, Current (with optional current probe)	Diode Tester, Continuity Tester, Current (with optional current probe)
AUTORANGING OSCILLOSCOPE			
Bandwidth	5 MHz	5 MHz	5 MHz
Sample Rate	25 MS/s	25 MS/s	25 MS/s
Channels/Digitizers	1	2	2
Vertical Sensitivity	5 mV to 500 V/div	5 mV to 500 V/div	5 mV to 500 V/div
Resolution	8-Bits	8-Bits	8-Bits
Horizontal Time/Division Range	200 ns/div to 60 s/div	200 ns/div to 60 s/div	200 ns/div to 60 s/div
Record Lengths	256 points	256 points	256 points
Acquisition Modes	Sample, Spike Detect, Smooth, Roll, Dynamic Display DSP	Sample, Spike Detect, Smooth, Roll, Dynamic Display DSP	Sample, Spike Detect, Smooth, Roll, Dynamic Display DSP
Automatic Measurements	Cursors (ΔV, ΔT, 1/ΔT), Frequency, Period, Max, Min, P-P	Cursors (ΔV, ΔT, 1/ΔT), Frequency, Period, Max, Min, P-P	Cursors (ΔV, ΔT, 1/ΔT), Frequency, Period, Max, Min, P-P
Advanced Measurements	N/A	CH 1 + CH 2, CH 1 – CH 2, Current, Power, AC Line Test, THDF	CH 1 + CH 2, CH 1 – CH 2, Current, Power, AC Line Test, THDF, Motor Test
Memories	4 waveforms, 4 setups, 1 screen	4 waveforms, 4 setups, 1 screen	8 waveforms, 8 setups, 8 screens

ORDERING INFORMATION

THM 550/THM 560/THM 565
TekMeter™
Includes: Test Leads, User Manual, Quick Reference Guide.

AVAILABLE ACCESSORIES

TXMDXPB
Deluxe Probe Set

THM5SCA
Soft Case with Neck Strap

THM5HCA
Transport Case

THM5CHG
NiCd Battery Charger

THM5BAT
NiCd Battery Pack

THM5AC
AC Power Adapter

THMCOM1
AC Adapter, DC Cigarette Lighter Adapter, RS-232 Interface, Cable, DocuWave Software, and Flip-Out stand

A605
500 A AC Current Probe

A621
2,000 A AC Current Probe

A622
100 A AC/DC Current Probe

SERVICE ASSURANCE OPTIONS
These products covered by the following service assurance options:

REP4100 – Provides One Year of Post-Warranty Repair Protection

CAL4100 – Provides One Year of Calibration Services

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

TekMeter™ 200 Series

Current Probes DMMs

TekTools Accessories

For Handheld Digital Multimeters, TekMeter™, 200 Series Oscilloscopes

Accessories to make your Handheld Digital Multimeter, TekMeter™, or 200 Series Handheld Digitizing Oscilloscope easier to use and more effective.

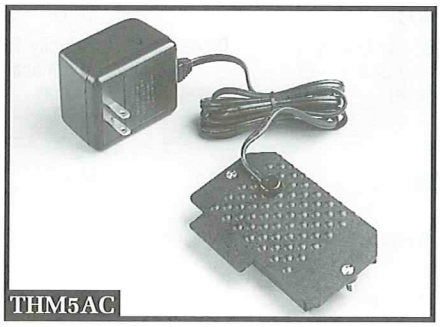
- Rechargeable NiCd Battery Pack
- Quick Charge Battery Charger
- AC Power Adapter
- Transport Case
- Soft Case
- Communications Pack
- Deluxe Probe Set
- Parallel Printer Interface
- Portable Battery Kit
- Remote Control Software
- 1X/10X High Voltage Probe
- Current Probes
  - 150A AC
  - 500A AC
  - 500A AC/DC
  - 2000A AC
- Current Probes/BNC
  - 1000A AC
  - 100A AC

RECHARGEABLE NICD BATTERY PACK

The Rechargeable NiCd Battery Pack is specially designed for the TekMeter. With 750 milliamp hours of capacity, the TekMeter™ Battery Pack has 50% more energy than regular NiCd batteries. Matched cells ensure that the battery pack delivers full power. Buy two battery packs and keep one ready to go with the THM5CHG charger.

QUICK CHARGE BATTERY CHARGER

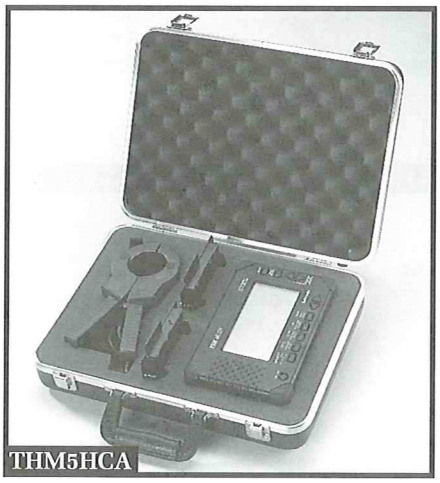
Never be without power! Charge your TekMeter™ THM5BAT NiCd Battery Pack in one hour or less. The smart charger senses when the battery pack is fully charged and shifts into trickle charge mode to keep it fully charged, maximizing the life of your battery pack. A wall-mount transformer and a cigarette lighter adapter are included.



THM5AC

AC POWER ADAPTER

The AC Power Adapter allows continuous operation of the TekMeter™ from an AC power source. The specially designed wall-mount transformer supplies power directly to the TekMeter™ battery compartment while maintaining the 600 V/floatability specification.



THM5HCA

PROTECTIVE TRANSPORT CASE

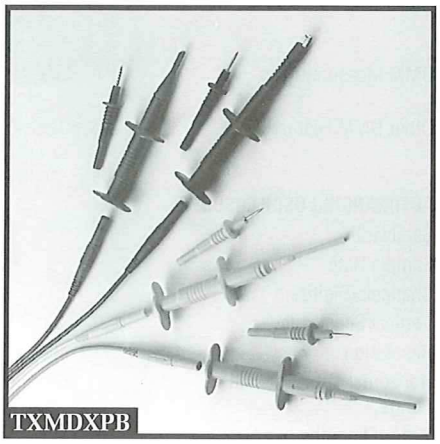
The Hard-sided Transport Case provides heavy duty protection for transport of your TekMeter™ and all its accessories.

SOFT CASE

The Soft Case has an adjustable neck strap which frees you to make measurements that require both hands. A thumbscrew holds your TekMeter™ securely in the padded case, so even if tipped upside down it won't fall out. The Soft Case is also a carrying case with handle. There's space inside for probes, probe attachments, and a pocket for notes or reference guides.

COMMUNICATIONS PACK

The Communications Pack provides an AC adapter, DC cigarette lighter adapter, RS-232 interface, RS-232 cable, DocuWave software, and a flip-out stand.



TXMDXPB

DELUXE PROBE SET

The Deluxe Probe Set consists of four high-temperature, silicone-insulated probe leads with matching attachments. Each set includes a very sharp test point useful for piercing conformal coatings or corrosion that might interfere with accurate readings. The set also includes two mini-plunger clamps for hands-free operation, one red hook-style test clip, and one black wide-jaw alligator test clip for secure attachment to ground.

PARALLEL PRINTER INTERFACE

The Parallel Printer Interface allows the 200 Series Handheld Digitizing Oscilloscope to connect directly to an Epson-compatible printer. Just push a button and this battery-powered (9 V) unit instantly acquires and prints the displayed waveform. The interface automatically disconnects when not in use.

PORTABLE BATTERY KIT

The BAT200 Battery Kit provides extended measurement time for remote or on-site measurements with a 200 Series Handheld Digitizing Oscilloscope. Includes an extra battery, charger, cigarette lighter adapter, clamp-on hood, and two accessory pouches.

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

TekTools Accessories

For Handheld Digital Multimeters, TekMeter™, 200 Series Oscilloscopes

CURRENT PROBE SELECTION CHART

	COMPATIBILITY						APPLICATION	
	Current Range	Frequency Range	Handheld DMMs	TekMeter™	200 Series DSOs	TekBench™	Typical Application	Reasons To Choose
A603	≥2 A to 150 A	45 Hz to 1 kHz	Yes	–	–	–	General	Basic Measurements
A605	≥4 A to 500 A	48 Hz to 1 kHz	Yes	Yes	–	–	Plant Maintenance	Basic High Current
A610	≥2 A to 500 A	DC to 440 Hz	Yes	–	–	–	Equipment, Installation HVAC	Line Power, 3-Phase Power
A620	100 mA to 1,200 A	1 Hz to 50 kHz	–	–	Yes	–	Industrial Service Automotive Service	Versatility, Safety
A621	100 mA to 2,000 A	5 Hz to 50 kHz	Yes	Yes	–	Yes	Industrial Service	Versatility
A622	50 mA to 100 A	DC to 100 kHz	Yes	Yes	–	Yes	Equipment Maintenance	Full Spectrum

REMOTE CONTROL SOFTWARE
The CAT200 Virtual Instrument Software recreates the front panel of a 200 Series Handheld Digitizing Oscilloscope on an IBM PC- or PS/2-compatible computer monitor. You can remotely control the front panel of the 200 Series using either the keyboard or a mouse. Connect the scope via a 2400-baud modem and you can control scope operation and collect waveform data from across the room or across the country.

1X PROBE
The P400 1X Probe plugs directly into the 200 Series Handheld Digitizing Oscilloscopes. The P400 is UL listed and was specifically designed for making safe power measurements using the completely isolated floating input channels of the 200 Series.

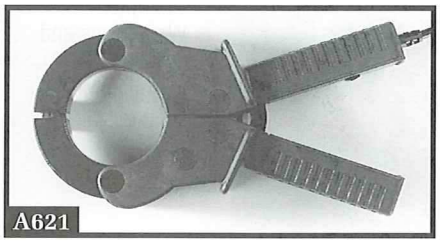
10X HIGH VOLTAGE PROBE
The P850 10X High Voltage Probe plugs directly into the 200 Series Handheld Digitizing Oscilloscopes. The P850 is UL listed and was specifically designed for making safe power measurements using the completely isolated floating input channels of the 200 Series.

150 AMP AC CURRENT PROBE
This "clothes-pin" style clamp-on probe is a current transformer for digital multimeters having a mA input. The A603 can measure RMS AC currents ≥2 Amps and peak currents up to 150 Amps over a frequency range of 45 Hz to 1 kHz. It provides a 1 mA output for each Amp measured.

500 AMP AC CURRENT PROBE
This "busbar" style clamp-on probe is a current/voltage transformer for digital multimeters and TekMeter. The A605 can measure RMS AC currents ≥4 Amps and peak currents up to 500 Amps over a frequency range of 48 Hz to 1 kHz. It provides a 1 mV output for each Amp measured.

500 AMP AC/DC CURRENT PROBE
This "busbar" style clamp-on probe uses a Hall Effect current sensor to provide a voltage output to digital multimeters. The A610 can measure RMS AC currents ≥2 Amps and peak currents up to 500 Amps over a frequency range of DC to 440 Hz. It provides a 1 mV output for each Amp measured.

1200 AMP AC CURRENT PROBE
This industrial style clamp-on probe is a current transformer for the 200 Series Handheld Digitizing Oscilloscopes. The A620 can measure RMS AC currents from 100 milliamps to 1200 Amps peak over a frequency range of 1 Hz to 50 kHz. It provides a 1 mV, 10 mV, or 100 mV output for each Amp measured. The A620 provides safe, easy, floating current measurements with no danger to you or your equipment.


A621

2000 AMP AC CURRENT PROBE/BNC
This industrial style clamp-on probe has a BNC connector and a shrouded banana plug adapter so it can be used on digital multimeters, TekMeter™, and scopes. The A621 can measure AC currents from 100 milliamps to 2000 Amps peak over a frequency range of 5 Hz to 50 kHz. It provides a 1 mV, 10 mV, or 100 mV output for each Amp measured.

100 AMP AC CURRENT PROBE/BNC
This "long nose" style clamp-on probe uses a Hall Effect current sensor to provide a voltage output to oscilloscopes. It has a BNC connector and a shrouded banana plug adapter so it can also be used on digital multimeters and TekMeter. The A622 can measure AC/DC currents from 50 mA to 100 Amps peak over a frequency range of DC to 100 kHz. It provides 10 mV or 100 mV output for each Amp measured.

ORDERING INFORMATION

THM5BAT – Rechargeable NiCd Battery Pack
THM5CHG – Quick Charge Battery Charger
THM5AC – AC Power Adapter
THM5HCA – Protective Transport Case
THM5SCA – Soft Case
THMCOM1 – Communications Pack
THMDXPB – Deluxe Probe Set
WP200 – Parallel Printer Interface
BAT200 – Portable Battery Kit
CAT200 – Remote Control Software
P400 – 1X High Voltage Probe
P850 – 10X High Voltage Probe
A603 – 150 A AC Current Probe
A605 – 500 A AC Current Probe
A610 – 500 A AC/DC Current Probe
A620 – 1200 A AC Current Probe
A621 – 2000 A AC Current Probe/BNC
A622 – 100 A AC Current Probe/BNC

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

TWD 120

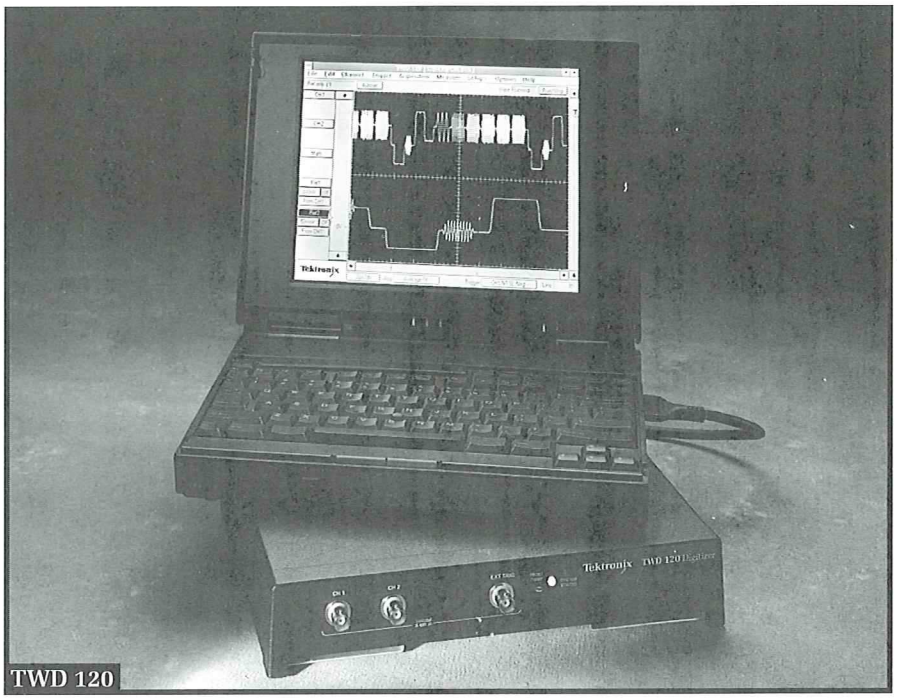
Laptop Digital Oscilloscope

Field Service

Tremendous value to standard test routines with substantial cost savings.

TWD 120

- 100 MHz Bandwidth
- 100 MS/s Sample Rate Each Channel
- Microsoft® Windows™ Environment Running SOAR™ Personality Software
- 21 Automatic Measurements
- Store and Recall Unlimited Waveforms and Setups
- Lightweight and Portable



TWD 120

TWD 120 Waveform Digitizer

The TWD 120 is a 2-channel waveform digitizer that works together with IBM compatible PCs (under Windows) to make a 2-channel 100 MHz Digital Storage Oscilloscope. All displays and control functions are performed by a user-supplied PC. Its lightweight and portability enhances service engineers' or technicians' effectiveness. The TWD 120 saves the bulky and expensive hardware of stand-alone oscilloscopes by exploiting the interface of the service engineer's notebook PC. As well, the fax modem, data storage, integrated applications, printing capabilities, and programmability of PCs add tremendous value to the standard test routines with substantial cost savings.

APPLICATIONS:
The TWD 120 was designed for equipment calibration, troubleshooting and maintenance applications. For example, it is ideally suited for medical equipment service.

The stored instrument set-ups, saved waveforms and fax/modem capability of the TWD 120 greatly facilitates servicing in remote locations. Factory personnel can communicate with remote service technicians and provide repair guidance when looking at equipment waveforms.

The TWD 120 is only available for quantity purchases. See your Tektronix sales representative for more information.

Characteristics

SIGNAL ACQUISITION SYSTEM

Bandwidth – 100 MHz

Sample Rate – 100 MS/s each channel

Channels – 2 identical channels

Vertical Sensitivity – 2 Ch @ 2mV/div to 10 V/div

Calibrated Offset Ranges –

Volts/div Setting	Offset Range
2 mV – 50.0 mV/div	±1 V
100 mV – 500 mV/div	±10 V
1V – 10 V/div	± 100 V

DC Gain Accuracy – ±2%

Vertical Resolution – 8 bits (256 levels over 10.24 vertical divisions)

Autoset – Basic (with Undo)

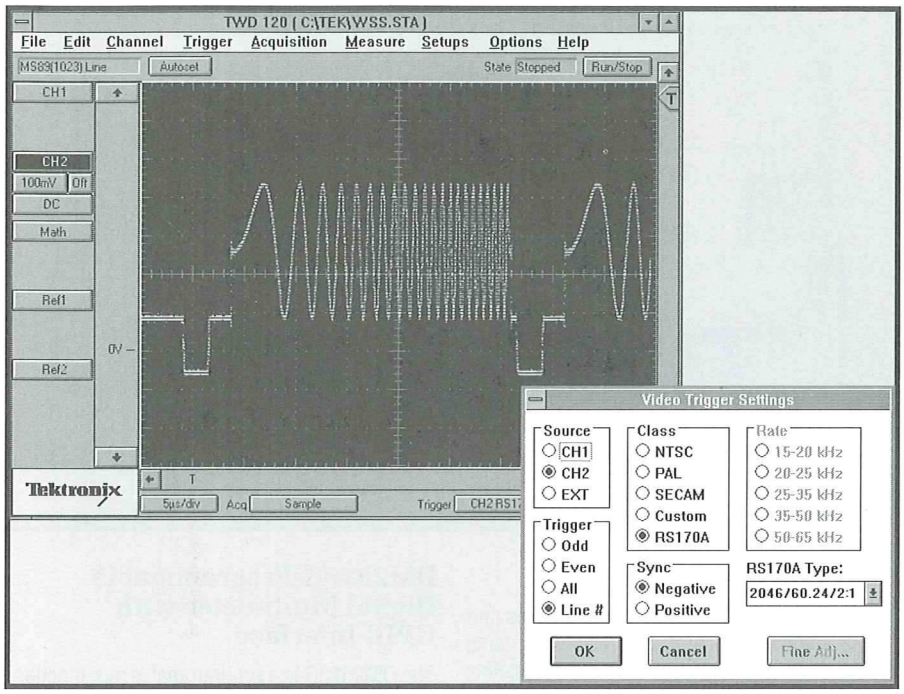
- **Equipment Calibration**
- **Equipment Troubleshooting and Maintenance**

Product(s) available through your local Tektronix representative (listed in the back of this catalog).

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Laptop Digital Oscilloscope
Field Service



Highlight: Use in Medical Service Applications
For servicing medical imaging equipment such as X-Ray, CT, and MRI machines the TWD 120 with its extensive video trigger capability and dot accumulate display is ideal for displaying complex video waveforms such as the phantoms that represent the different densities of human tissue. Simply select either the RS170A standard for your signal type or Custom class and the line rate of your signal.

ACQUISITION MODES
Sample, Average, Envelope, Peak Detect, Hi Res

TIME BASE SYSTEM (MAIN AND DELAYED)
Time/Division Range – 5 ns to 10 s/div

Record Length – Selectable: 500, 1000, 2500, & 5000 points

Horizontal Accuracy – ± (150 ppm + 1 pixel + 650 ps)

Slowest Sweep Speed – 10 s/div

TRIGGERING SYSTEM (MAIN ONLY)
Trigger Types – Edge, Video Lines (w/line count), Video Fields

Trigger Modes – Auto and Normal

Video-type Trigger Formats and Field Rates – Triggers from composite video,either polarity, odd and/or even fields, any line up to 2600, on 525 to 1023 line, 50 Hz to 60 Hz, with line rate up to 65 kHz, interlaced or non-interlaced system–such as NTSC, PAL, SECAM, or Custom.

AUTOMATIC MEASUREMENTS

Period	Freq.	Peak-to-Peak	Amplitude
High	Low	+Duty Cycle	–Duty Cycle
+Width	–Width	+Overshoot	–Overshoot
Max.	Min.	Mean	Cycle Mean
Rise	Fall	RMS	Cycle RMS
Burst Width			

CURSORS
Types – Horizontal Bars, Vertical Bars, Volts@Time

PC REQUIREMENTS
386/25 MHz microprocessor or faster, 640 x 480 VGA monitor, SCSI interface card with WINASPI.DLL compatible driver, 4Mb RAM, 1.4 Mb, 3.5 inch floppy drive, 5 Mb free hard disk space, MS–DOS version 5.0 or later, MS–Windows version 3.1 or later.

ORDERING INFORMATION

TWD 120
Two Channel Waveform Digitizer
Includes: TWD 120 Two Channel Peripheral Digitizer, 2 Passive 10X Voltage Probes (P6109B); Instruction Manual (070-8821-00), Reference (070-8868-00), AC Adapter (119-4749-00), Power Cord (161-0066-00), TWD 120 Application Software (SOAR™), Includes TWD 120 Viewer and TWD 120 Init Utilities (063-2018-00), XYZs of Using Analog and Digital Oscilloscopes (070-8690-00)

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz (161-0066-09)

Opt. A2 – United Kingdom 240 V, 50 Hz (161-0066-10)

Opt. A3 – Australian 240 V, 50 Hz (161-0066-11)

Opt. A4 – North American 240 V, 60 Hz (161-0066-12)

Opt. A5 – Switzerland 220 V, 50 Hz
See General Customer Information Section for additional description.

RECOMMENDED ACCESSORIES
Adjustments Disk – Order 063-2036-00

SCSI-2 Terminator, Male – Order 011-0165-00

SCSI-2 Male Cable – 24 inch Order 012-1460-00

RS-232 Female Null-modem – 9-Pin to 9-Pin cable, 76 inch. Order 012-1379-00

RS-232 Female Null-modem – 9-Pin to 25-Pin cable, 76 inch. Order 012-1380-00

Product(s) available through your local Tektronix representative (listed in the back of this catalog).

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

CDM250
DM2510
DM2510G

Digital Multimeters

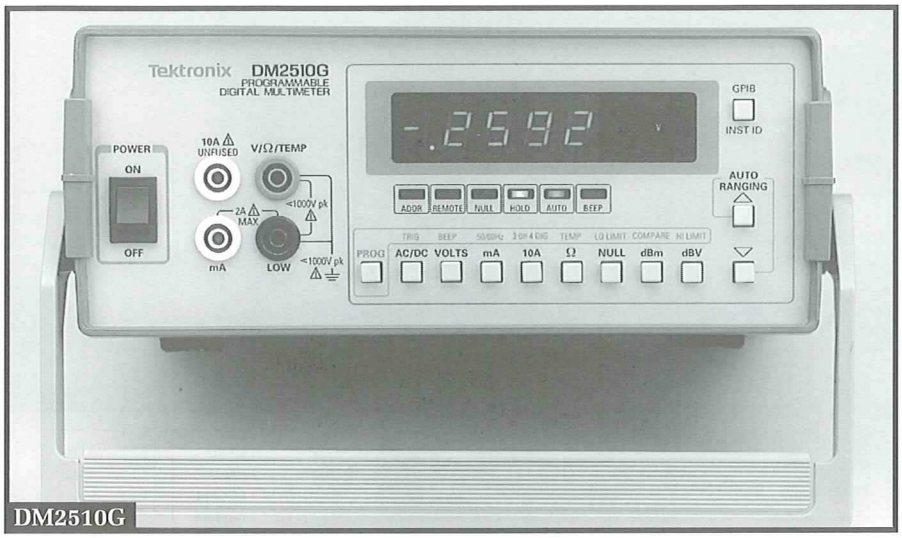
Digital Multimeters for all your testing needs.

CDM250

- AC/DC Volts (500 V Range)
- Resistance (20 MΩ Range)
- Current (10 A Range)
- Overload Protection

DM2510/ DM2510G

- Programmable
- GPIB (DM2510G)
- 1000 V DC
- 500 V AC RMS
- dB Function (AC Voltage)
- 10 A DC/AC Current
- 20 MΩ Resistance
- Temperature
- Autoranging (Except Temperature)
- Null Function
- Hold Mode
- Trigger Function
- Compare Mode (High to Low Limits)
- Fast and Normal Modes



DM2510G

CDM250

The CDM250 Digital Multimeter measures and displays voltage, current, and resistance using a 3-1/2 digit LED display. Sine wave alternating voltages and currents are displayed in RMS values. The CDM250 is safe and easy to use in the classroom and on the job. This meter has overload protection and is UL listed and CSA certified. Test leads are included.

DM2510 Programmable Digital Multimeter

The DM2510 is a programmable, six-function, autoranging digital multimeter. You can use it to measure DC and AC voltage and current, plus resistance and temperature. It has a NULL function to make measurements with an offset value, plus a HOLD mode and a TRIGGER function. COMPARE mode compares a measurement with user-selected high and low limits; a beeper can be set to sound when the measurement is beyond the specified limits.

DM2510G Programmable Digital Multimeter with GPIB Interface

The DM2510G is a programmable, six-function, autoranging digital multimeter with a GPIB interface for computerized programming or remote operation and data capture.

The DM2510 and DM2510G Programmable Digital Multimeters are the first in a new series of programmable instruments which offer exceptional accuracy and speed, especially in repetitive testing situations. Other features of the DM2510G are the same as the DM2510.

APPLICATIONS

- **Training**
- **Manufacturing Production Test**
- **Field Repair**
- **Bench Calibration and Repair**
- **Product Design**

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Digital Multimeters

CDM250
DM2510
DM2510G

KEY SPECIFICATIONS

	CDM250	DM2510/DM2510G
DC Volts		
Ranges	200 mV, 2 V, 20 V, 200 V, 500 V	200 mV, 2 V, 20 V, 200 V, 1000 V
Basic Accuracy	±(0.5% of reading + 1 count)	±(0.03% of reading + 0.015% of full scale)
Max. Input Voltage	500 V DC (DC + peak AC)	1000 V DC
AC Volts		
Ranges	200 mV, 2 V, 20 V, 200 V, 500 V	200 mV, 2 V, 20 V, 200 V, 500 V (RMS)
Basic Accuracy	±(1.0% of reading + 4 counts)	±(0.6% of reading + 0.05% of full scale)
Max. Input Voltage	350 V AC RMS; 500 V (DC + peak AC)	Front panel, V/Ω/Temp to LOW: 500 V RMS or 600 V DC; Front panel, V/Ω/Temp to GND and LOW to GND: 1000 V pk
dB (True RMS AC Volts)		
Basic Accuracy	–	± 0.3 dB
DC Current		
Ranges	200 µA, 2 mA, 20 mA, 200 mA, 2 A, 10 A	200 µA, 2 mA, 20 mA, 200 mA, 2 A, 10 A
Basic Accuracy	±(1.0% of reading +1 count)	±(0.06% of reading + 0.01% of full scale)
Max. Input Current	2 A fused, 10 A unfused	2 A any range, mA to LOW 10 A unfused, A to LOW
Max. Floating Voltage	–	10 A, mA or LOW to GND: 1000 V pk
AC Current		
Ranges	200 µA, 2 mA, 20 mA, 200 mA, 2 A, 10 A	200 µA, 2 mA, 20 mA, 200 mA, 2 A, 10 A
Basic Accuracy	±(1.5% of reading + 4 counts)	±(0.8% of reading + 0.05% of full scale)
Max. Input Voltage	650 V pk, A to COM	650 V pk, mA to LOW
Resistance		
Ranges	200 Ω , 2 kΩ, 20 kΩ, 200 kΩ, 2 MΩ, 20 MΩ	200 Ω , 2 kΩ, 20 kΩ, 200 kΩ, 2 MΩ, 20 MΩ
Basic Accuracy	±(0.75% of reading + 1 count)	±(0.05% of reading + 0.02% of full scale)
Max. Input Voltage	500 V (DC + peak AC)	300 V pk (all ranges)
Temperature Measurement	–	–62°C to 240°C
Programmable	–	Yes
GPIB Interface	–	DM2510G only, on rear panel
Warranty	One Year	One Year
Safety Certification	UL Listed, CSA Certified	ETL, CSA Certified

ORDERING INFORMATION

CDM250
Digital Multimeter
Includes: Test Leads, Operator's Manual, US Power Cord, One Year Warranty.

DM2510
Programmable Digital Multimeter
Includes: Test Leads, Operator's Manual, US Power Cord, One Year Warranty.

DM2510G
Programmable Digital Multimeter with GPIB Interface
Includes: Test Leads, Operator's Manual, US Power Cord, One Year Warranty.

SERVICE ASSURANCE OPTIONS
These products covered by the following service assurance options:

CDM250
REP4100 – Provides One Year of Post-Warranty Repair Protection
CAL4100 – Provides One Year of Calibration Services

DM2510/DM2510G
REP4200 – Provides One Year of Post-Warranty Repair Protection
CAL4200 – Provides One Year of Calibration Services

AVAILABLE ACCESSORIES
Temperature Probe – For DM2510/G. Order P6602
GPIB Interface Cable – Order 012-0991-01

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

CFC250 CDC250 CMC250 CMC251 Counters

Multifunction Counter for use in high frequency systems.

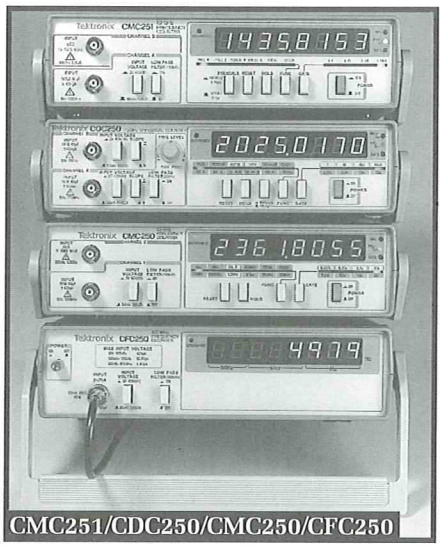
Universal Counter with temperature compensated time base to ensure performance in changing ambient temperature.

CMC251
- 1 Hz to 100 MHz (CH 1)
  80 MHz to 1.3 GHz (CH 2)
- ±1 ppm Time Base
- Period Average, Period, Frequency, Totalize, Self Test
- Display Hold
- Remote Start/Stop

CDC250
- 1 Hz to 175 MHz
- Frequency Ratio
- Time Interval
- ±1 ppm Time Base
- Period Average, Period, Frequency, Totalize, Self Test

CMC250
- 5 Hz to 100 MHz (CH 1)
  80 MHz to 1.3 GHz (CH 2)
- ±10 ppm Time Base
- Period Average, Period, Frequency, Totalize, Self Test
- Display Hold
- Remote Start/Stop

CFC250
- 5 Hz to 100 MHz
- Switchable Input Sensitivity
- 1 Hz Resolution


CMC251/CDC250/CMC250/CFC250

CMC251

The CMC251 1.3 GHz Multifunction Counter measures the frequency of sine, square, and triangle waves from 1 Hz to 1.3 GHz. The CMC251 also provides period, totalize, and pulse width measurements. The counter has two input channels. Channel A is a standard 1 MΩ input for frequency measurements up to 100 MHz. Channel B is a 50 Ω terminated input for use in high-frequency systems. This counter is of interest to radio amateurs because of its ability to measure high-frequency systems. The temperature-compensated, crystal-controlled time base is stable to ±1 part per million per year.

CDC250

The CDC250 175 MHz Universal Counter measures frequency of sine, square, and triangle waves from 1 Hz to 175 MHz at input levels from 20 mV to 42 V peak. The CDC250 also provides period measurements, frequency ratio, time interval, and totalize measurement functions. The CDC250 has a ±1 ppm/year, temperature-compensated time base to ensure consistent accuracy. Service technicians will find the CDC250 useful as a standard for calibrating other equipment.

CMC250

The CMC250 1.3 GHz Multifunction Counter measures the frequency of sine, square, and triangle waves from 5 Hz to 1.3 GHz. The CMC250 also provides period measurements and totalize functions. Channel A is a standard 1 MΩ input for frequency measurements up to 100 MHz. Channel B is a special 50 Ω terminated input, prescaled to 1.3 GHz for easy RF measurements. The time base stability is ±10 ppm/yr.

CFC250

The CFC250 100 MHz Frequency Counter measures the frequency of sine, square, and triangle waves from 5 Hz to 100 MHz at input levels from 30 mV to 42 V peak. Students will enjoy the simplicity of using the CFC250. Applications include adjustment, testing, and repair of electronic items, such as audio equipment, radios, televisions, computer clocks, and musical instruments.

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

CFC250
100 MHz Frequency Counter
Includes: Operator's Manual, US Power Cord, One Year Warranty.

CDC250
175 MHz Universal Counter
Includes: Operator's Manual, US Power Cord, One Year Warranty.

CMC250
1.3 GHz Frequency Counter
Includes: Operator's Manual, US Power Cord, One Year Warranty.

CMC251
1.3 GHz Frequency Counter with High Stability Time Base
Includes: Operator's Manual, US Power Cord, One Year Warranty.

AVAILABLE ACCESSORIES
10X Probe, 250 MHz. Order P6130

SERVICE ASSURANCE OPTIONS
These products covered by the following service assurance options:
REP4100 – Provides One Year of Post-Warranty Repair Protection
CAL4100 – Provides One Year of Calibration Services

KEY SPECIFICATIONS

	CMC251	CDC250	CMC250	CFC250
Channel A				
Frequency Range	1 Hz to 100 MHz	1 Hz to 175 MHz	1 Hz to 100 MHz	5 Hz to 100 MHz
Sensitivity	20 mV RMS, 1 Hz to 30 MHz; 50 mV RMS, 30 MHz to 100 MHz	kHz/ms mode: 20 mV RMS, 5 Hz to 10 MHz; MHz/µs mode: 50 mV RMS, 5 MHz to 125 MHz; 100 mV RMS, 125 MHz to 150 MHz; 150 mV RMS, 150 MHz to 175 MHz	20 mV RMS, 5 Hz to 30 MHz; 50 mV RMS, 30 MHz to 100 MHz	30 mV RMS, 5 Hz to 30 MHz; 50 mV RMS, 30 MHz to 70 MHz 80 mV RMS, 70 MHz to 100 MHz
Attenuation	3 V to 42 V (HI); 50 mV to 5 V (LO)	3 V to 42 V (HI); 50 mV to 5 V (LO)	3 V to 42 V (HI); 50 mV to 5 V (LO)	3 V to 42 V (HI); 50 mV to 5 V (LO)
Max Input Voltage	1 Hz to 5 MHz: 42 V pk; 5 MHz to 100 MHz: 4.9 V pk	1 Hz to 5 MHz: 42 V pk; 5 MHz to 175 MHz: 4.9 V pk	5 Hz to 5 MHz: 42 V pk; 5 MHz to 100 MHz: 4.9 V pk	5 Hz to 100 kHz: 42 V pk; 100 kHz to 10 MHz: 13.8 V pk; 10 MHz to 100 MHz: 5.4 V pk
Low Pass Filter	–3 dB at 100 kHz	–3 dB at 10 kHz	–3 dB at 100 kHz	100 kHz
Impedance	1.0 MΩ, paralleled by 40 pF	1.0 MΩ, paralleled by 40 pF	1.0 MΩ, paralleled by 40 pF	1.0 MΩ, paralleled by 40 pF
Channel B				
Frequency Range	80 MHz to 1.3 GHz	1 Hz to 2 MHz	80 MHz to 1.3 GHz	–
Sensitivity	5 mV RMS, 80 MHz to 600 MHz; 15 mV RMS, 600 MHz to 900 MHz; 35 mV RMS, 900 MHz to 1.3 GHz	30 mV RMS, 5 Hz to 2 MHz	10 mV RMS, 80 MHz to 600 MHz; 25 mV RMS, 600 MHz to 900 MHz; 50 mV RMS, 900 MHz to 1.3 GHz	–
Impedance	50 Ω	1.0 MΩ, paralleled by 40 pF	50 Ω	–
Max Input Voltage	1 V RMS	42 V pk	1 V RMS	–
Period				
Range	Direct: 0.4 µs to 1.0 s; Prescale: 0.04 µs to 1.0 s	0.5 µs to 0.2 s	0.4 µs to 0.2 s	–
Resolution	Direct: 100 ps to 100 ns; Prescale: 10 ps to 10 ns	100 ps to 100 ns	100 ps to 100 ns	–
Min Pulse Width	Direct: 0.2 µs; Prescale: 20 ns	250 ns	250 ns	–
Frequency Range	Direct: 1 Hz to 2.5 MHz; Prescale: 1 Hz to 25 MHz	1 Hz to 2 MHz	5 Hz to 2.5 MHz	–
Events Averaged (N)	1, 10, 100, 1000, 10,000 cycles	1, 10, 100, 1000 cycles	1, 10, 100, 1000 cycles	–
Totalize Range	0 to 99,999,999	0 to 99,999,999	0 to 99,999,999	–
Pulse Width				
Range	0.25 µs to 0.5 s	–	–	–
Period Range	100 ps to 100 ns	–	–	–
Events Averaged (N)	1, 10, 100, or 1000 cycles	–	–	–
Time Base Stability				
Temperature	<1 ppm from 0° to 40°C	<1 ppm from 0° to 40°C	<10 ppm from 0° to 40°C	<10 ppm from 0° to 40°C
10% Line Voltage Change	<0.4 ppm	<0.4 ppm	<1.0 ppm	<1.0 ppm
Accuracy				
Frequency	±(time base error + 1 count)	±(time base error + 1 count)	±(time base error + 1 count)	±(time base error + 1 count)
Period	±(time base error + 1 count + trigger error)	±(time base error + 1 count + trigger error)	±(time base error + 1 count + trigger error)	–
Pulse Width	±(time base error + 1 count + trigger error + 10 ns)	–	–	–
Plus				
Selectable Slope	No	Yes	No	No
Ratio CH A: CH B	No	Yes	No	No
Display Hold	Yes	Yes	Yes	No
Remote Start/Stop	Yes	Yes	Yes	No
Time Interval CH A: CH B	No	Yes	No	No
Safety Certification	ETL, CSA	UL , CSA	UL , CSA	UL , CSA

CFG253
CFG280
CFG250

Function Generators

Function generators with flexible output waveshape selections.

CFG250

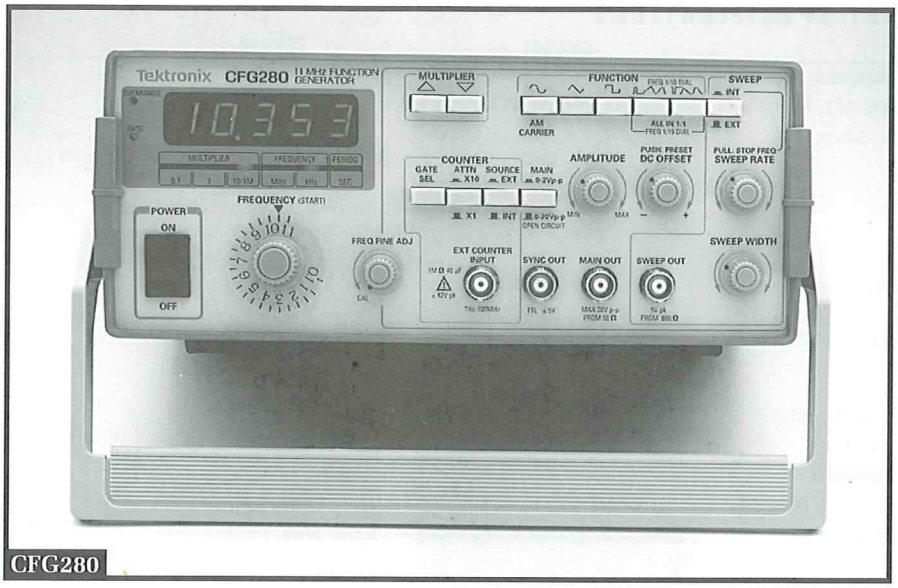
- 0.2 Hz to 2 MHz
- Square, Triangle, and Sine Waves; TTL Output
- 20 dB Attenuator
- Internal or External Frequency Sweep
- Variable Duty Cycle
- Variable Symmetry (20 to 80%)

CFG253

- 0.03 Hz to 3 MHz
- Square, Triangle, and Sine Waves; TTL Output
- 20 dB Attenuator
- Internal or External Frequency Sweep
- Variable Duty Cycle
- Variable Symmetry (20 to 80%)

CFG280

- 0.1 Hz to 11 MHz (Calibrated)
- 0.01 Hz to 11 MHz (Uncalibrated)
- 1 Hz to 100 MHz Counter
- Square, Triangle, and Sine Waves; TTL Output
- 20 dB Attenuator
- External Gate Input
- VCF (FM) Input
- AM 0 to 100% Input for External Sine Wave
- Internal or External Frequency Sweep



CFG280

CFG250 and CFG253

Function Generators produce sine, square, and triangle waves, and TTL signals for testing amplifiers, filters, and digital circuits. Sweep function can be controlled internally or with an external signal. Duty cycle, DC offset, sweep rate, sweep width, and amplitude are all operator controlled. The CFG253, at 0.03 Hz to 3 MHz, has a wider output bandwidth than the CFG250, at 0.2 Hz to 2 MHz.

CFG280 11 MHz Function Generator with Counter

The CFG280 combines an 11 MHz Function Generator with a 1 Hz to 100 MHz Frequency Counter. The onboard counter allows the operator to set the frequency output of the function generator precisely. This versatile instrument conserves both bench space and budget.

APPLICATIONS

- **Training**
- **Manufacturing Production Test**
- **Field Repair**
- **Bench Calibration and Repair**
- **Product Design**

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Function Generators

CFG253
CFG280
CFG250

KEY SPECIFICATIONS

	CFG253	CFG250	CFG280
Waveform Outputs	Square wave, sine wave, triangle wave, TTL pulse, sweep functions for all outputs	Square wave, sine wave, triangle wave, TTL pulse, sweep functions for all outputs	Square wave, sine wave, triangle wave, TTL pulse, sweep functions for all outputs
Ranges	1.0 Hz to 1.0 MHz in 7 ranges	1.0 Hz to 1.0 MHz in 7 ranges	0.1 Hz (calibrated) to 11 MHz in 8 ranges
Frequency Multiplier	Variable from 0.3 to 3.0 times the selected frequency range	Variable from 0.2 to 2.0 times the selected frequency range	Variable from 0.1 to 1 (uncalibrated) 1 to 11 (calibrated)
Dial Accuracy	±5% of full scale	±5% of full scale	±5% of full scale from 0.1 Hz to 10 MHz
Sine Wave Distortion	<1% (10 Hz to 100 kHz)	<1% (10 Hz to 100 kHz)	<1% (10 Hz to 100 kHz) –30 dB at all other frequencies
Triangle Wave Linearity	20 Hz to 200 kHz: ≥99%; 200 kHz to 3 MHz: ≥97%	20 Hz to 200 kHz: ≥99%; 200 kHz to 2 MHz: ≥97%	0.1 Hz to 110 kHz: ≥99%; 110 kHz to 1 MHz: ≥97%; 1 MHz to 11 MHz: ≥95%
Square Wave Response	≤100 ns rise/fall time, maximum output into 50 Ω load	≤100 ns rise/fall time, maximum output into 50 Ω load	≤25 ns rise/fall time, maximum output into 50 Ω load
Main Output Amplitude	0 to 20 V p-p	0 to 20 V p-p	0 to 20 V p-p
Attenuator	20 dB	20 dB	20 dB
SYNC/TTL Output	TTL output level, rise <25 ns (20 TTL load) ≥3 V pk	TTL output level, rise <25 ns (20 TTL load) ≥3 V pk	<25 ns rise/fall time, maximum output into 50 Ω load
Main Output Impedance	50 Ω ± 10%	50 Ω ±10%	50 Ω ±10%
DC Offset (continuously variable)	±10 V minimum open circuit ; ±5 V minimum into 50 Ω load	±10 V minimum open circuit; ±5 V minimum into 50 Ω load	±10 V minimum open circuit; ±5 V minimum into 50 Ω load
Symmetry/Duty Cycle	5 to 1 minimum symmetry change	5 to 1 minimum symmetry change	95/5 fixed (pulse and ramp)
Internal Variable Sweep Rate	0.5 Hz to 50 Hz	0.5 Hz to 50 Hz	0.5 Hz to 50 Hz
External Voltage-controlled Variable Sweep Range (10 kΩ Input)	100:1 minimum for 0 to +10 V DC input with frequency control set at maximum	100:1 minimum for 0 to +10 V DC input with frequency control set at maximum	100:1 minimum for 0 to ±10 V DC input with frequency control set at 0.1 or 11
VCF (FM) Input	–	–	±10 V input shifts frequency ≥100:1 up or down with dial set at 0.1 or 11 respectively
AM	–	–	0 to 100%, DBSC, external sine wave only
Warranty	One year	One year	One year
Safety	UL, CSA	UL, CSA	ETL, CSA
CFG280 Counter Specifications			
Frequency Range (AC coupled)	–	–	1 Hz to 100 MHz
Sensitivity	–	–	30 mV RMS from 1 Hz to 50 MHz; 50 mV RMS from 50 MHz to 100 MHz:
Period Range/Resolution	–	–	1 ms to 60 s / 1 ms
Crystal Frequency	–	–	10 MHz
Time Base Stability	–	–	±0.001% (±10 ppm) from 0° to 40°C
Frequency Accuracy	–	–	±(time base error + 1 count)
Period Accuracy	–	–	±(time base error + 1 count + trigger error)

ORDERING INFORMATION

CFG250
2 MHz Function Generator
Includes: Operator's Manual, US Power Cord, One Year Warranty.

CFG253
3 MHz Function Generator
Includes: Operator's Manual, US Power Cord, One Year Warranty.

CFG280
11 MHz Function Generator with 100 MHz Counter
Includes: Operator's Manual, US Power Cord, One Year Warranty.

SERVICE ASSURANCE OPTIONS
These products covered by the following service assurance options:
REP4100 – Provides One Year of Post-Warranty Repair Protection
CAL4100 – Provides One Year of Calibration Services

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

CPS250
PS280
PS281
PS282
PS283

Power Supplies

Versatile bench or portable power supplies for most basic test and lab bench requirements.

CPS250

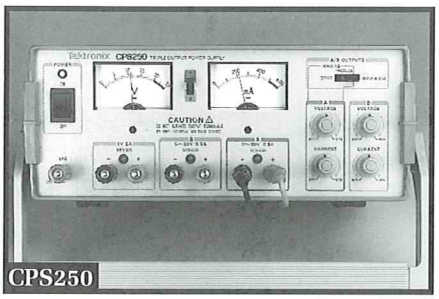
- Triple Output Power Supply
- Two Variable 0 to 20 V, 0.5 A Supplies
- Fixed 5 V, 2 A Supply
- Variable Current Limiting
- Overload Indicators

PS 280/283

- One Fixed 5 V, 3 A Supply
- Two Variable Outputs, 0 to 30 V, 2 A (PS280), 1 A (PS283)
- Variable Current Limiting
- Selectable Independent Tracking Mode
- Dual Tracking, Variable 0 to 30 V, 2.0 A (PS280); 0 to 30 V, 1.0 A (PS283)

PS281/282

- 90 W, Single Output, 3-1/2 digit Display
- 0 to 30 V, 0 to 3 A (PS281)
- 0 to 18 V, 0 to 5 A (PS282)
- Variable Current Limiting
- Overload and Over-voltage Protection


CPS250



CPS250

The CPS250 Triple Output Power Supply is a versatile instrument with two variable and one fixed output. Its attractive, compact design with tilt-bail handle takes up less bench space than most other power supplies. It meets most basic test and lab bench requirements.

PS280/PS283 Power Supplies

The Tektronix PS280 and PS283 Laboratory DC Power Supplies are multifunction benchtop or portable instruments. These regulated power supplies provide fixed 5 V output for powering logic circuits and two variable outputs for a wide variety of test and experimental uses.

The PS280 and PS283 contain two identical, independently adjustable DC power supplies that can vary from 0 to 30 V, and 0 to 2 A in the PS280 or 0 to 1 A in the PS283. Front-panel switches select one of three modes of operation: independent, series, or parallel.

PS281/282 DC Power Supplies

The Tektronix PS281/282 DC Power Supplies meet the requirements of laboratory, classroom and production environments. Output is continuously variable up to the rated voltage/current by means of coarse and fine potentiometers. The PS281 is rated at 30 V/3 A; the PS282 at 18 V/5 A max.

The PS281 and PS282 are designed to be connected in series to increase voltage output or in parallel for a higher current output. Serial and parallel tracking can be achieved by connecting a rear panel jumper between two or more units.

The compact case and multiple operating modes of the PS281 and PS282 offer convenience and flexibility for a space-limited engineering bench.

APPLICATIONS

- **Training**
- **Manufacturing Production Test**
- **Field Repair**
- **Bench Calibration and Repair**
- **Product Design**

KEY SPECIFICATIONS

	PS281	PS282
Output Voltage	0 to 30 V DC	0 to 18 V DC
Output Current	0 to 3.0 A	0 to 5.0 A
Line Regulation	≤0.01% + 3 mV	≤0.01% + 3 mV
Load Regulation	≤0.01% + 3 mV	≤0.01% + 3 mV (≤3 A) ≤0.01% + 5 mV (>3 A)
Ripple / Noise	≤0.5 mV RMS, 5 Hz to 1 MHz	≤0.5 mV RMS, 5 Hz to 1 MHz (≤3 A) ≤1.0 mV RMS, 5 Hz to 1 MHz (>3 A)
Tracking Error	<±500 mV	<± 500 mV
Displays		
Readout	One 3-1/2 digit LED	One 3-1/2 digit LED
Accuracy	±(0.5% of reading + 2 digits)	±(0.5% of reading + 2 digits)
Overload Indicator	Yes	Yes
Insulation		
Chassis to Terminal	≥20 MΩ at 500 V DC	≥20 MΩ at 500 V DC
Chassis to Power Cord	≥30 MΩ at 500 V DC	≥30 MΩ at 500 V DC
Safety Certification	ETL, T-MARK, CSA	ETL, T-MARK, CSA

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Power Supplies

CPS250 PS280 PS281 PS282 PS283

KEY SPECIFICATIONS

	CPS250	PS280	PS283
Output Voltage			
Two Variable	0 to 20 V DC	0 to 30 V DC	0 to 30 V DC
One Fixed	5.0 V	5.0 V	5.0 V
Output Current			
Two Variable	0 to 0.5 A (CC)*1	0 to 2.0 A (CC)*1	0 to 1.0 A (CC)*1
One Fixed (foldback limited)	2.0 A max	3.0 A max	3.0 A max
Line Regulation			
Two Variable	0.01% + 3 mV (CV); 0.2% + 3 mA (CC)	0.01% + 3 mV (CV); 0.2% + 3 mA (CC)	0.01% + 5 mV (CV); 0.2% + 3 mA (CC)
One Fixed	≤10 mV)(CV)	≤5 mV (CV)	≤5 mV (CV)
Load Regulation			
Two Variable	0.01% + 3 mV (CV); 0.2% + 6 mA (CC)	≤0.01% + 5 mV, current > 3 A (CV); ≤300 mV, 0 to 60 V single series tracking supply (CV); 0.2% + 3 mA (CC)	≤0.01% + 3 mV (CV) ≤300 mV, 0 to 60 V single series tracking supply (CV); 0.2% + 3 mA (CC)
One Fixed	0.1% + 5 mV (CV)	≤10 mV (CV)	≤10 mV (CV)
Ripple/Noise			
Two Variable	2 mV RMS, 5 Hz to 1 MHz (CV); 3 mA RMS, 5 Hz to 1 MHz (CC)	≤1 mV RMS, 5 Hz to 1 MHz (CV); ≤3 mA (CC)	≤1 mV RMS, 5 Hz to 1 MHz (CV); ≤3 mA (CC)
One Fixed	2 mV RMS	≤2 mV RMS	≤2 mV RMS
Output in Independent Mode			
	Two variable 0 to 20 V (CV); 0.5 A (CC)	Two variable 0 to 30 V (CV); 2.0 A (CC)	Two variable 0 to 30 V (CV); 1.0 A (CC)
Output in Parallel Mode	One 0 to 20 V, 1.0 A max	One 0 to 30 V, 4.0 A max	One 0 to 30 V, 2.0 A max
Tracking Error	±0.2% ± 20 mV	≤0.5% + 10 mV	≤0.5% + 10 mV
Series Mode	One 0–40 V, 0.5 A max or one ±20 V, 0.5 A	One 0 ±30 V, 2.0 A max or one 60 V, 2 A	One 0 ±30 V, 1.0 A max or one 60 V, 1 A
Tracking Error	±0.2% ±20 mV	±0.5% + 10 mV	±0.5% + 10 mV
Displays	Two analog meters (switchable)	Two 3-1/2 digit LED (switchable)	Two 3-1/2 digit LED (switchable)
Voltage Indicator	0 to 25 V DC ± 2.5% of full scale	0 to 30 V DC ± (0.5% of rdg + 2 digits)	0 to 30 V DC ± (0.5% of rdg + 2 digits)
Current Indicator	0 to 800 mA ± 2.5% of full scale	0 to 2 A DC ± (0.5% of rdg + 2 digits)	0 to 2 A DC ± (0.5% of rdg + 2 digits)
Overload Indicator	Yes	Yes	Yes
Insulation			
Chassis to Terminal	>50 MΩ at 500 V DC	≥20 MΩ at 500 V DC	≥20 MΩ at 500 V DC
Chassis to Power Cord	>50 MΩ at 500 V DC	≥30 MΩ at 500 V DC	≥30 MΩ at 500 V DC
Safety Certification	UL, CSA, T-MARK	ETL, CSA, T-MARK	ETL, CSA, T-MARK

(CC): When operated in Constant Current mode.
(CV): When operated in Constant Voltage mode.

ORDERING INFORMATION

CPS250
Triple Output Power Supply
Includes: Operator's Manual, three pairs of test leads, US Power Cord, One Year Warranty.

PS280
Triple Output 0 to 30 V/2 A Power Supply
Includes: Operator's Manual, 3 pairs of test leads, US power cord, one year warranty.

PS281
Single Output 30 V/3 A Power Supply
Includes: Instruction Manual, One pair of Test Leads, US Power Cord, One Year Warranty.

PS282
Single Output 18 V/5 A Power Supply
Includes: Operator's Manual, Three Pairs of Test Leads, US Power Cord, One Year Warranty.

PS283
Triple Output 0 to 30 V/1 A Power Supply
Includes: Operator's Manual, Three Pairs of Test Leads, US Power Cord, One Year Warranty.

SERVICE ASSURANCE OPTIONS
These products covered by the following service assurance options:
REP4100 – Provides One Year of Post-Warranty Repair Protection
CAL4100 – Provides One Year of Calibration Services

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

Programmable Benchtop Power Supplies

PS2510
PS2510G
PS2511
PS2511G

PS2520
PS2520G
PS2521
PS2521G

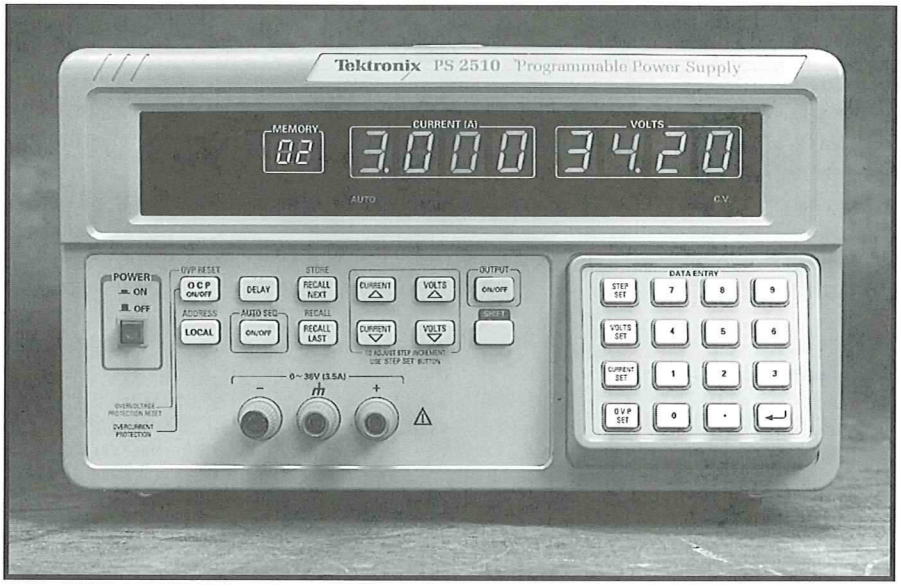
Benchtop power supplies to meet your needs – available as both manual and programmable models.

PS2510/PS2510G
- Single Output
- 0 to 36 V, 0 to 3.5 A
- Digital LED Output Indicator
- SCPI Compatible (PS2510G)

PS2511/PS2511G
- Single Output
- 0 to 20 V, 0 to 7 A
- Digital LED Output Indicator
- SCPI Compatible (PS2511G)

PS2520/PS2520G
- Triple Output
- One 0 to 6 V, 0 to 3 A
- Two 0 to 36 V, 0 to 1.5 A
- Digital LED Output Indicator
- SCPI Compatible (PS2520G)

PS2521/PS2521G
- Triple Output
- One 0 to 6 V, 0 to 5 A
- Two 0 to 20 V, 0 to 2.5 A
- Digital LED Output Indicator
- SCPI Compatible (PS2521G)



PS2510/PS2510G/ PS2511/PS2511G

The single output PS2510/PS2510G and PS2511/PS2511G Power Supplies are especially suited to low-cost computer controlled systems. The PS2510/PS2510G provide a maximum of 36 V and 3.5 A. The PS2511/PS2511G are rated up to 20 V and 7.0 A.

The PS2510G and PS2511G are GPIB programmable. The GPIB command sets are SCPI compatible.

Each power supply features 100 memories to store voltage and current limits for instant recall via the front panel or GPIB.

PS2520/PS2520G/ PS2521/PS2521G

The triple output PS2520/PS2520G and PS2521/PS2521G Power Supplies are versatile supplies suitable for many applications. The PS2520/PS2520G has a single supply providing a maximum of 6 V and 3 A and two supplies providing a maximum of 36 V and 1.5 A. The PS2521/PS2521G has a single supply providing a maximum of 6 V and 5.0 A and two supplies providing a maximum of 20 V and 2.5 A.

The supplies can be operated in one of three modes: independent, series, or parallel. In the independent mode, the output voltage and current of each supply are controlled independently. In the two tracking modes, the variable outputs are connected either in series or in parallel; the controls of the master power supply adjust the voltage or current of both power supplies.

The PS2520G and PS2521G are GPIB programmable. The GPIB command sets are SCPI compatible.

Each power supply features 100 memories to store voltage and current limits for instant recall via the front panel or GPIB.

APPLICATIONS

- **Training**
- **Manufacturing Production Test**
- **Field Repair**
- **Bench Calibration and Repair**
- **Product Design**

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Programmable Benchtop Power Supplies

PS2510 **PS2520**
PS2510G **PS2520G**
PS2511 **PS2521**
PS2511G **PS2521G**

KEY SPECIFICATIONS

	PS2510/PS2510G	PS2511/PS2511G	*Available February 1995* PS2520/PS2520G	*Available February 1995* PS2521/PS2521G
Number of Outputs	1	1	3	3
Output Voltage	0 to 36 V	0 to 20 V	0 to 6 V, 0 to 36 V (two)	0 to 6 V, 0 to 20 V (two)
Output Current	0 to 3.5 A	0 to 7 A	0 to 3 A (6 V), 0 to 1.5 A (36 V)	0 to 5 A (6 V) 0 to 2.5 A (20 V)
Voltage Accuracy	0.025% + 25 mV	0.025% + 25 mV	0.05% 5 mV + 25 mV	0.05% 5 mV + 25 mV
Current Accuracy	0.2% + 10 mA	0.2% + 10 mA	0.2% + 10 mA	0.2% + 10 mA
Programmable Voltage Resolution	10 mV	10 mV	10 mV	10 mV
Programmable Current Resolution	1 mA	1 mA (2 mA >3.5 A)	1 mA	1 mA
Display	Digital, LED	Digital, LED	Digital LED	Digital, LED
Auto-series/Parallel Operation	N/A	N/A	Yes	Yes
Auto-master/Slave Tracking	N/A	N/A	Yes	Yes
Internal Memory	Yes, 100	Yes, 100	Yes, 100	Yes, 100
GPIB (SCPI)	Yes, PS2510G	Yes, PS2511G	Yes, PS2520G	Yes, PS2521G
Constant Voltage Mode	Yes	Yes	Yes	Yes
Constant Current Mode	Yes	Yes	Yes	Yes
Variable Current Limit	Yes	Yes	Yes	Yes
Over-voltage Protection	Yes	Yes	Yes	Yes
Over-current Protection	Yes	Yes	Yes	Yes
Dual 4-Digit Panel Meter	Yes	Yes	Yes	Yes
Safety Certifications	ETL, CSA	ETL, CSA	ETL, CSA	ETL, CSA

ORDERING INFORMATION

PS2510
Single Output Programmable Power Supply

PS2510G
Single Output Programmable Power Supply

PS2511
Single Output Programmable Power Supply

PS2511G
Single Output Programmable Power Supply

PS2520
(Available 2/95) Triple Output Power Supply

PS2520G
(Available 2/95) Triple Output Programmable Power Supply

PS2521
(Available 2/95) Triple Output Programmable Power Supply

PS2521G
(Available 2/95) Triple Output Programmable Power Supply

All Include: User Manual, US Power Cord, 1 Pair Black/Red Test Leads.

AVAILABLE ACCESSORIES

Programmer's Manual – Included with PS2510G, PS2511G, PS2520G, PS2521G. Order 070-8069-00

SERVICE ASSURANCE OPTIONS

These products covered by the following service assurance options:

REP4100 – Provides One Year of Post-Warranty Repair Protection

CAL4100 – Provides One Year of Calibration Services

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

J17
J18

TekLumaColor™ Photometers

The J17 builds on over 20 years of Tektronix experience in light measurement.

The J17 is smaller and has built-in features typical of products costing much more.

New J18

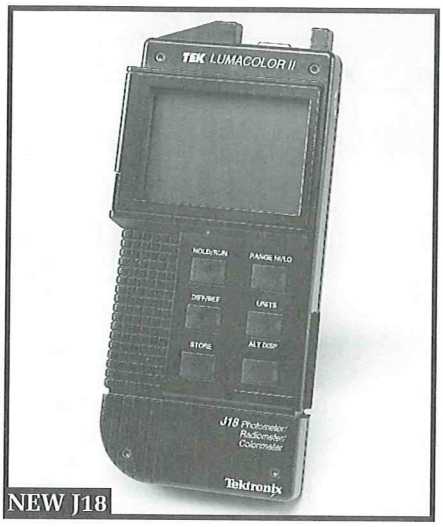
- Real-time Color Measurements
- Ten Memories for storing Reference Colors (with J1810)
- RGB Bar Graph
- D6500 Kelvin Calibration
- Color Temperature Measurement
- Full Control of Measurements Plus Output of Results (RS-232)
- Analog Output

J17

- Auto-ranging
- Auto Zero
- RS-232 Interface (Output Only)
- Wide Dynamic Range

COMMON FEATURES

- Interchangeable Pre-calibrated Heads
- Accurate Spectral and Cosine Corrections
- Metric/English Conversions
- Large LCD with Backlight
- Rugged
- Handheld
- Adaptable to Many Light Measurement Needs



J17/J18 Photometers

The Tektronix J17 and J18 are handheld digital Photometers/Radiometers/Colorimeters for the laboratory, field, or production area. A J17/J18 System consists of a J17/J18 handheld meter and one of nine interchangeable heads. At the heart of the J17/J18 is a microprocessor capable of performing several functions: Metric-to-US conversion, auto-range, auto-zero, hold, and conversion between color coordinate systems. The J17/J18 can be used with a PC for automated testing and data recording. The J17/J18 are powered by a 9-volt battery.

PLUG-IN HEADS PROVIDE MEASUREMENT FLEXIBILITY

Pre-calibrated plug-in heads measure illuminance, irradiance, luminance, radiance, light emitting diode (LED) output, and color using CIE coordinates (u' v' or xy). All heads use silicon photodiodes and spectrally-corrected, multi-element, glass filters for long-term stability and accuracy. Connection of a head to the J17/J18 automatically selects the correct measurement units. The backlit liquid crystal display can be read easily in dark locations.

J1803 8° LUMINANCE HEAD

- Video and Projection Screens
- Surface Reflectance

The J1803 measures luminance, in candelas/m^2 (nits) or footlamberts, where light scattered or emitted by a surface must be measured. Spectral response is closely matched to the CIE photopic curve, ensuring accurate results even when measuring spectrally different light sources.

The 8° acceptance angle is determined by internal field-stop apertures.

J1805 HEAD FOR LEDS

- Output of Red, Yellow, Green, and Blue LEDs

The J1805 measures luminous intensity in candelas or millicandelas.

Inserts are supplied to fit common sizes of LEDs. These inserts can be modified by the user for other LED sizes or similar light sources.

J1806 8° RADIANCE/RADIANT INTENSITY HEAD

- Display Color Balance

The J1806 is useful for quickly verifying or resetting color balance once initial color characterization has been done using the J1820 or J1810.

J1811 ILLUMINANCE HEAD

- Highway Illumination
- Luminaires and Lamps
- Workstation Illumination

The J1811 is an illuminance head with readout in footcandles or lumens/m^2 (lux). A multi-element glass filter and silicon photo-diode ensure a close match to the CIE photopic curve for accurate measurement of spectrally differing light sources.

J1812 IRRADIANCE HEAD

- Laser Experiments
- Infrared LED Testing

The J1812 measures irradiance in milliwatts/m^2 or output power in milliwatts. The spectral response is flat ±8% from 450 to 950 nanometers. The response is typically down 50% at 400 and 1030 nm.

J1810/J1820 CHROMATICITY HEAD

- Color Monitor Chromaticity and White Balance
- Color Temperature

The J1810/J1820 measure color coordinates in the 1931 CIE and 1976 CIE-UCS chromaticity systems. Color coordinates are automatically computed and displayed in either x and y or u' and v' units. Luminance in candela/m^2 or footlamberts may also be measured. The J1820 works with the J17; the J1810 provides similar performance plus real-time color measurements, correlated color temperature measurement and programmable control of the J18.

J1823 1° LUMINANCE HEAD

- Roadway Lighting
- Contrast Measurements
- Signs and Displays
- Glare Measurements

The J1823 heads can be used as telephotometers for measurements such as glare from roadways or reflectance from signs. By adding commercially available 55 mm diameter photographic close-up lenses, areas down to 0.040" diameter can be measured, while the 1/3° version, J1823 Option 01, can measure areas as small as 0.015". The focusing range is from infinity to 18", closer with the close-up lenses. These heads are particularly useful for flat panel and CRT measurements of single pixels.

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

TekLumaColor™ Photometers

CHARACTERISTICS

	J1803	J1805	J1806	J1823/J1823 Opt. 01
Measurement	Luminance	Luminance Intensity	Radiant Intensity	Luminance
Applications	Displays, Television, Medical	LEDs	Displays, Television	Displays, Television, Lighting
Ranges with J17	0.03 to 1,500,000 candelas/m^2 (Nit) 0.01 to 500,000 footlamberts	0.01 mcandelas to 100 candelas	0.001 to 1,000 W/m^2/sr	0.3 to 30,000 or 3 to 30,000 candelas/m^2 (Nit) 0.1 to 10,000 or 1 to 10,000 footlamberts
Ranges with J18	0.3 to 300,000 candelas/m^2 (Nit) 0.1 to 100,000 footlamberts	0.01 mcandelas to 10 candelas	0.001 to 200 W/m^2/sr	3 to 30,000 or 30 to 30,000 candelas/m^2 (Nit) 1 to 10,000 or 10 to 10,000 footlamberts
Spectral Response	CIE Photopic	CIE Photopic	Flat	CIE Photopic
Spectral Accuracy	f_1' =< 3% (DIN Class A)	f_1' = <3% (DIN Class A)	±8% 450 to 750 nm	f_1' = <5% (DIN Class B)
Accuracy	5% ± 2 digits	5% ± 2 digits	5% ± 2 digits	5% ± 2 digits
Acceptance Angle	8°	8°	8°	1°; Opt. 01 1/3°
Other Features	Suction cup	LED adaptors	Suction cup	Optical sighting
Cable Length	3.5 ft	3.5 ft	3.5 ft	6 ft

	J1810	J1811	J1812	J1820
Measurement	Chromaticity, Luminance	Illuminance	Irradiance	Chromaticity, Luminance
Applications	Displays, Television	Highway lighting, Office lighting, Transportation	Lasers, IR LEDs, Research	Displays, Television
Ranges with J17	Usable with J18 only	0.01 to 50,000 lux (lm/m^2) 0.001 to 5,000 footcandles	0.01 to 20,000 mW/m^2 1 nW to 2 mW	0.001 to 0.999 x,y and u',v' 0.3 to 300,000 candelas/m^2 (Nit) 0.1 to 100,000 footlamberts
Ranges with J18	0.001 to 0.999 x,y and u',v' 0.3 to 1,000 candelas/m^2 (Nit) 0.1 to 300 footlamberts	0.01 to 5,000 lux (lm/m^2) 0.001 to 500 footcandles	0.001 to 2,000 mW/m^2 0.1 nW to 0.2 mW	Usable with J17 only
Spectral Response	CIE Tristimulus	CIE Photopic	Flat	CIE Tristimulus
Spectral Accuracy	f_1' = <3% (DIN Class A)	f_1' = <3% (DIN Class A)	±8% 450 to 950 nm	f_1' = <3% (DIN Class A)
Accuracy	0.009 at D6500	5% ± 2 digits	5% ± 2 digits	0.018 at Illum A
Acceptance Angle	16°	180° (Cosine)	96° (Approx.)	16°
Other Features	Suction cup	Level and cover	Cover	Suction cup
Cable Length	3.5 ft	6 ft	6 ft	3.5 ft

ORDERING INFORMATION

J17
TekLumaColor™ Photometer

J18
TekLumaColor™ Photometer

Both Include: Battery, Operator's Manual. J17 and J18 require one or more of the following heads:

J1803
Luminance Head
Includes: Operator's Manual, Spectral Curve, Suction Cup, Retainer/Filter Holder, Light Occluder

J1805
LED Head
Includes: Operator's Manual, Spectral Curve, Two LED inserts, Rubber Retainer

J1806
Radiance/Radiant Intensity Head
Includes: Operator's Manual, Spectral Curve, Suction Cup

J1811
Illuminance Head (cosine corrected).
Includes: Operator's Manual, Spectral Curve

J1812
Irradiance Head
Includes: Operator's Manual, Spectral Curve

J1810
Color Head (J18 only)
Includes: Operator's Manual, Spectral Curve, Suction Cup

J1820
Color Head (J17 only)
Includes: Operator's Manual, Spectral Curve

J1823
1° Luminance Head
Includes: Operator's Manual, Spectral Curve

J1823, Option 1
1/3° Luminance Head
Includes: Operator's Manual, Spectral Curve, Suction Cup

AVAILABLE ACCESSORIES
RS-232 Cable – Order 012-1411-00
120 V AC Supply – Order 119-5032-00
220 V AC Supply – Order 119-3297-00

Product(s) available through an Authorized Tektronix Distributor. See pages 590-595.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Measurement
Education

Tektronix has a long history of commitment to partnership with education. To further assist you in reaching your educational goals, Tektronix now offers qualifying institutions the finest test and measurement equipment at substantial discounts.

We are giving eligible non-profit organizations discounts on most Tektronix test and measurement equipment and software.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

LEARNING MATERIALS

Tektronix Learning Materials Are:

- Written by Educators and Instructional Designers
- Professionally Produced
- Comprehensive, Covering Both Operations and Concepts
- Designed for Beginning Through Advanced Students
- Available in Videotapes, Workbooks, Instructors Guides, QuickStart, and Self-study Packages

A Partnership Dedicated to Educational Excellence

As an educator, you play a key role in shaping the future of business and technology: you're committed to helping emerging technicians, scientists, and engineers learn skills they'll apply for years to come.

Tektronix products have long been the products of choice for educational institutions around the world because they:

- Are easy to learn and use
- Meet stringent testing standards
- Are rugged, student-proof and safe
- Are the same high-quality instruments used in industry
- Provide a smooth transition from school to career

THE LONG TERM CHOICE

Tektronix' commitment to education does not end with the purchase of equipment. Our long-term commitment to education is demonstrated by the availability of:

- Courseware and instructional materials
- Rugged and safe equipment
- Operator and technician training
- Extended warranties

A BROAD RANGE OF PRODUCTS

Tektronix offers the best selection of test and measurement equipment in the industry. Whether you're buying for a vocational center, community college or major university, you'll find we have everything you need.

The Tektronix measurement products include:

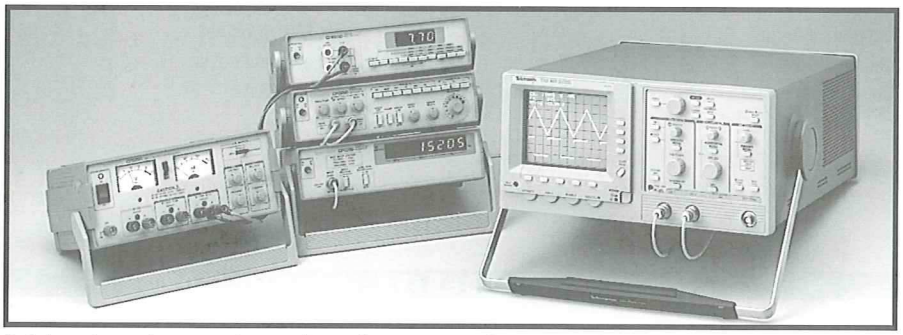
- Analog and Digital Oscilloscopes
- Logic Analyzers, Spectrum Analyzers
- Function Generators, Power Supplies, Counters
- Automatic stimulus and measurements tools
- Modular instruments for custom systems
- A full line of accessories

From basic to advanced laboratory and bench instrumentation, our products will meet your needs in:

- Electronics
- Mechanical Engineering
- Physics
- Semi- and fully-automated test

And in every Tektronix product you'll find the familiar, easy operation that's become a de facto standard the world over. Which is perhaps the main reason why people in so many different environments prefer Tektronix equipment.

Because whether your students are preparing to seek their fortune, or applying what they've learned to make it, there's no substitute for the confidence that comes from using the best: Tektronix.



Lab bench stations can be configured to your needs. Our stackable triple-output power supply, digital multimeter, 100 MHz frequency counter and 2 MHz function generator (see pages 416-431) join a 100 MHz dual-trace TAS 465 Oscilloscope (pages 118-119) as a popular setup for basic lab stations.

BUDGET SOLUTIONS

At Tektronix we understand the dilemma that many educators face – you have a need for industry-proven, up-to-date equipment, but your budgets don't always allow for funding. Therefore, we offer a line of low-cost basic electronics equipment that meets the needs of both education and industry. You'll also be pleased to know that Tektronix offers special pricing for educational institutions.

We are working to meet your educational objectives – providing technologically advanced products, budget alternatives, and superior quality and service.

RUGGED AND SAFE

In both design and test, we ensure that our products meet stringent standards for EMI, humidity, temperature, electrostatic shock, and vibration. Tektronix products are also third-party certified by UL and CSA. Not only do these certifications protect you and your students, they help you comply with many state and local regulations.

Measurement
Education

Courseware and Training

For many instructors, the time spent preparing to teach far outweighs the time spent teaching. That's why we offer comprehensive and self-contained courseware. This courseware is designed to complement and supplement the broad range of Tektronix' test and measurement products and your classroom curriculum.

SELF-STUDY PACKAGES

Realizing the need for individuals to learn at their own pace, Tektronix has developed an extensive line of self-study packages. The engineer as well as the student can sharpen their skills in instrument usage and application in less time than learning by trial and error.

In less than an hour, the student can learn the unique time-saving features of the equipment and put these to use immediately. The result is increased productivity.

To conserve valuable lab time, Tektronix has created these aids so that students can come prepared to apply their understanding of the equipment to the challenges of the curriculum.

Each self-study course includes a detailed video instruction tape and a workbook. Materials cover instrument operations as well as concepts and applications, from basic through advanced test and measurement techniques. Discussions include:

- Basic Instrument Concepts
- Major Product Features and Operation
- Applications
- Probe Compensation and Usage
- Measurement Techniques
- Controller Integration
- Communication Interfaces
- Display and Output Concepts

QUICKSTART PACKAGES

These specially designed packages provide detailed hands-on instruction and application examples. Each package provides step-by-step workbooks and specially designed signal generation boards to help the user get up and running in no time at all. These packages are designed for self-paced use or integrated into the classroom curriculum.



Tektronix' extensive selection of learning materials can save you countless hours in the preparation and presentation process so that you can concentrate on what you do best – educating our next generation of engineers and technicians.

VIDEOTAPE AND LITERATURE

Tektronix offers educators one of the most extensive libraries of videotaped presentations on theory and application in the industry. And for classroom and lab work, Tektronix' primers and workbooks take students from the most basic level of skills through the highest levels of sophistication they'll need for a successful career.

SERVICE AND SUPPORT ALSO KEY

Tektronix' highly trained account managers, application engineers and distributors stand ready to offer you both curriculum and technical support. Our curriculum support materials and workshops will help you keep up-to-date. Also, we offer standard warranties as well as a variety of service programs to keep your Tektronix equipment calibrated and in the best working condition.

To complement the warranty programs, Tektronix has service centers conveniently located around the U.S. and throughout the world. You will want to take advantage of our service network because we can provide the expertise needed to calibrate and maintain your instruments at their highest level of performance.



"We are pleased to say that in our Industrial Electronics training program we are still successfully using Tektronix test equipment that was purchased 16 years ago. The wearability and quality of the equipment is noteworthy because we utilize the equipment on a daily basis in the instruction and training of our students. We spend little time on repairs and are very satisfied with the technical support and service offered through Tektronix."

Gene Prigmore
Industrial Electronics Instructor
Moore-Norman Vo-Tech Center
Norman, Oklahoma

Measurement
Education

ORDERING INFORMATION

VIDEOTAPE SELECTION GUIDE
Note: "XX" is to be replaced by one of the following:
NTSC format (used in USA)
00 = 3/4 in., **01** = BETA I, **02** = BETA II,
03 = BETA III, **04** = VHS/NTSC

PAL format
06 = VHS/PAL, **08** = Workbooks

SECAM format
07 = VHS/SECAM

SELF-STUDY PACKAGES
Each self-study course includes a detailed video instruction tape and a workbook. Additional workbooks are available at four/$100.

Fundamentals of Analog Scopes 068-0270-XX **$115**
Fundamentals of Probes 068-0269-XX **$115**
Fundamentals of Digital Scopes 068-0268-XX.....**$115**
Fundamentals of GPIB 068-0260-XX.....**$115**
Fundamentals of RS232 068-0259-XX **$115**
Using the PC as a Controller 068-0301-XX.....**$145**
Fundamentals of Logic Analyzers 068-0291-XX.....**$115**
Operating the 2201 068-0290-XX.....**$60**
Operating the 2205 068-0289-XX.....**$60**
Operating the 2210 068-0274-XX.....**$125**
Operating the 2211 068-0311-XX.....**$125**
Operating the 2213A/2215A 068-0278-XX **$115**
Operating the 2220 068-0273-XX.....**$125**
Operating the 2221 068-0272-XX.....**$115**
Operating the 2224 068-0310-XX.....**$125**
Operating the 2225 068-0279-XX.....**$115**
Operating the 2230 068-0271-XX.....**$125**
Operating the 2232 068-0312-XX.....**$125**
Operating the 2235 068-0277-XX.....**$115**
Operating the 2236 068-0276-XX.....**$115**
Operating the 2245A 068-0325-XX **$125**
Operating the 2246A 068-0326-XX **$125**
Operating the 2247A 068-0327-XX **$125**
Operating the 2430A 068-0267-XX **$145**
Operating the 2432 068-0266-XX.....**$145**
Operating the 2432A 068-0305-XX **$145**
Operating the 2440 068-0265-XX.....**$145**
Operating the 2445A/2465A 068-0262-XX **$145**
Operating the 2445B/2465B/2467B 068-0261-XX.....**$145**
Operating the 11301A/11302A 068-0264-XX **$145**
11301/11302 Waveform Measurement 068-0304-XX.....**$145**
11401/11402 Waveform Measurement 068-0302-XX.....**$145**
11401/11402 Adv. Waveform Measurement 068-0303-XX...**$145**
Operating the 1230 068-0288-XX.....**$115**

QUICKSTART PACKAGES
Each package is designed to give step-by-step instruction using workbooks and specially designed signal generation boards.

TDS500/600 QuickStart Package
020-2024-00 (U.S.), 020-2025-00 (European).....**$255**
2240 Series QuickStart Package*1
020-1864-04 (VHS/NTSC), 020-1864-06 (VHS/PAL).....**$240**
GPX QuickStart Package
020-2093-00 .....**$90**
2211 DSO QuickStart Package*1
020-1811-04 (VHS/NTSC), 020-1811-06 (VHS/PAL).....**$295**
2400 Series Digital Oscilloscopes QuickStart Package*1
020-1679-00 U.S. power (VHS/NTSC), 020-1681-00 European power (VHS/PAL) **$315**
11402/11403 QuickStart Package
020-1767-01 (U.S.), 020-1768-01 (European).....**$270**
DSA 600 QuickStart Package
020-1769-00 (U.S.), 020-1770-00 (European).....**$270**
2252/2247A/2245A QuickStart Package*1
020-1864-04 (VHS/NTSC), 020-1864-06 (VHS/PAL).....**$240**
2232/2224/2221A QuickStart Package*1
020-1812-04 (VHS/NTSC), 020-1812-06 (VHS/PAL).....**$280**

VIDEOTAPES
Oscillo-what? What Is an Oscilloscope? Discusses the display, vertical, horizontal and trigger sections and introduces digitizing oscilloscopes. 068-0218-XX.....**$60**
Oscilloscope Primer Practical Scope How to use a scope, acquire a trace, select suitable vertical and horizontal scale factors, and how to use the special features on the Tektronix 2225 oscilloscope. 068-0227-XX.....**$60**
The Vital Link – Probe and Signal Concepts 068-0229-XX. See page 448 for full description.....**$75**
Fundamentals of Oscilloscopes: A Functional Overview For people with prior electronics knowledge and some exposure to oscilloscopes. Explains functional characteristics of a typical analog oscilloscope. 068-0217-XX.....**$60**
Fundamentals of Oscilloscopes: Digital Storage Concepts Describes and illustrates functional concepts of typical digital storage oscilloscope. 068-0240-XX.....**$60**
222 Family Operation Overview of oscilloscope operation and a detailed front panel tour of the 222 Family. 068-0344-XX.....**$60**
Understanding Spectrum Analyzers Highlights differences between time and frequency domain displays. Examines real time and swept super heterodyne spectrum analyzers. Demonstrates basic controls and functions. 068-0350-XX. **$60**
Soldering FlexLead™ Adapters 068-0320-04 (VHS/NTSC), 068-0320-06 (VHS/PAL), 068-0320-07 (VHS/SECAM).....**N/C**
Networking 101 – Ethernet Networking Made Simple Describes Ethernet from its hardware perspective. Demonstrates how Ethernet works. Illustrates common Ethernet building blocks. 068-0345-XX.....**$90**
Networking 102 – TCP/IP Explains Basics of TCP/IP addressing the three classes of networks, use of netmasks to create subnets, how TCP/IP/Ethernet addressing work together to move data across networks, use of a default gateway to move data between networks. 068-0347-XX. **$90**
Networking 103 – Token-Ring Discusses Token-Ring Computer networks. Explores the similarities and differences with Ethernet. Explains source routing, MAU's, Cabling and LAN speed. Third in a series of Networking videotapes. 068-0348-XX. **$90**

LITERATURE
Lab Bench Equipment Orientation Instructor guide and workbooks for CFC250, CFG250, CDM250 and CPS250. (50 workbooks, 1 guide) 062-9511-01.....**$50**
Oscilloscope XYZs Primer Covers horizontal, vertical and trigger functions, controls, use of probes, terminology, and theory of waveforms and measurement techniques (50 primers) 062-9323-01. .....**$120**
ABCs of Probes 062-9471-00 (50 primers) **$120**

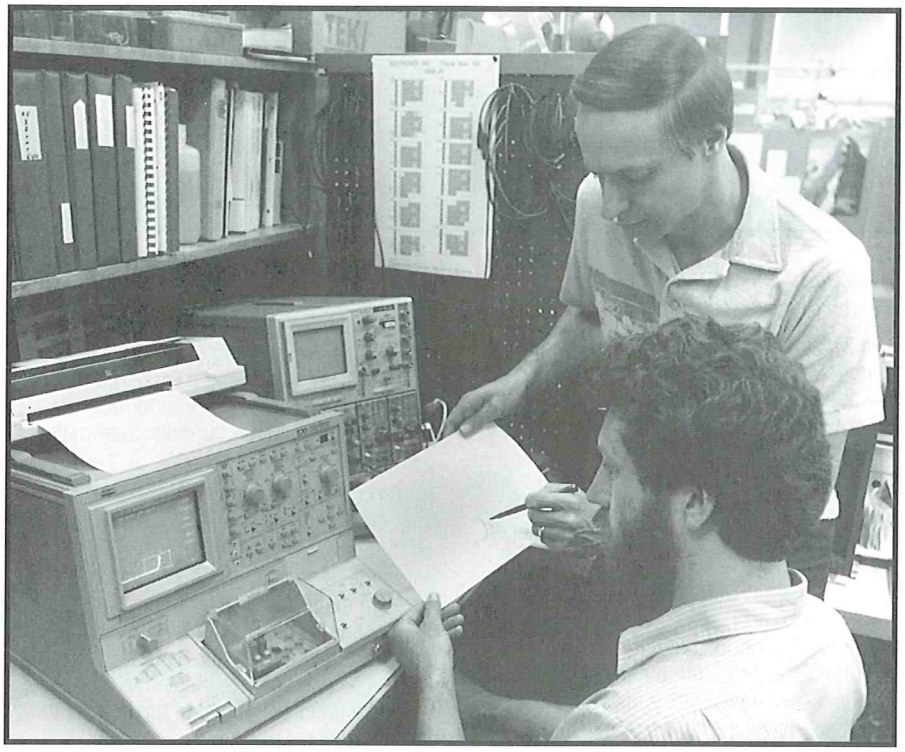
**1 Videotape included where noted.*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Semiconductor DC Characterization

Characterization and Test Solutions for Semiconductor Design, Manufacture and Quality Assurance

- The 372 Semiconductor Workbench features 25 fA, 25 uV resolution for precise low current measurements.
- The 370A provides a broad measurement range with up to 20 A capability.
- The 3000 W 371A has all the power you will need for high power semiconductors.
- The low cost 571 is versatile and ideally suited for educational use.



CONTENTS

372 Semiconductor Workbench 438
370A Curve Tracer 440
371A High Power Curve Tracer.....442
571 Curve Tracer 443
Device Adapters 444

ACCESSORIES

Probes 446
SMD Adapters.....474
Probe and Instrument Accessories 520
Plotter/Printer 524
Cameras.....526
Instrumentation Carts 528

Semiconductor Workbench™

Advanced features provide fast access to even the most complex measurements.

372 BENEFITS/FEATURES

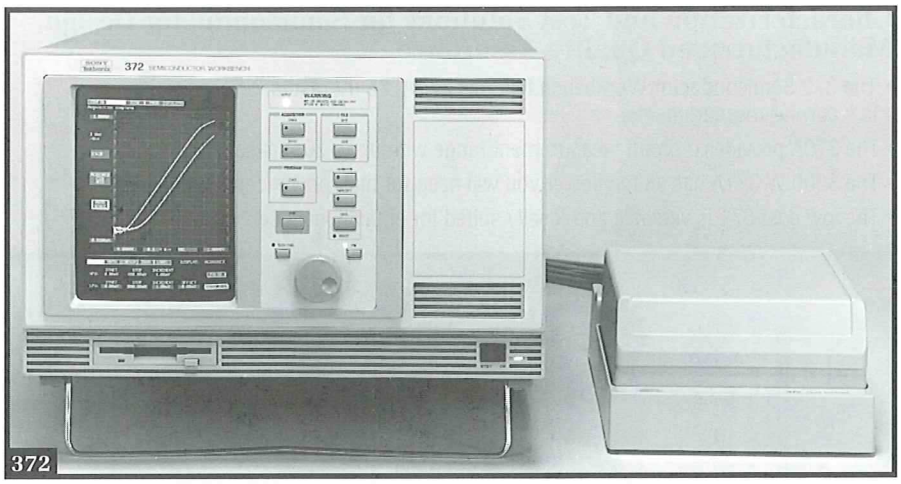
- Range: up to 200 V, 400 mA
- Resolution: to 25 fA, 25 µV
- Kelvin sense
- Flexible waveform math
- Automatic pass/fail testing
- Intuitive User Interface
- MS-DOS compatible disk
- Stand-alone programming
- Hardcopy output

APPLICATIONS

- IC Testing
  - Research
  - Design
  - Manufacturing
  - Quality Assurance

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 372 complies with IEEE Standard 488.2 and Tektronix Standard Codes and Formats.



372 Semiconductor Workbench™

The 372 offers a different approach to semiconductor characterization, combining the resolution and advanced features found in parameter analyzers with a curve tracer's interactive user interface and sourcing capability. Plus, it provides features, such as automatic pass/fail testing and built-in setups, that greatly reduce the cost and time needed for DC characterization.

The 372 provides the measurement capabilities and advanced analysis required for IC research, design, manufacturing and quality assurance testing. With two high-precision stimulus-response units you can make highly accurate, Kelvin sense, current measurements with 25 fA resolution and source up to 400 mA or 200 V with a maximum output of 10 watts. Powerful analysis features such as waveform math and flexible display parameters allow you to see your results in the form you want. These capabilities make the 372 useful for a wide range of device technologies including CMOS, bipolar, GaAs and BiCMOS.

HIGH PRECISION STIMULUS/RESPONSE

The keys to the 372's performance are its high precision stimulus-response units – a high power unit capable of sourcing 400 mA and 200 V and a low power unit capable of sourcing a maximum 100 mA and 100 V . Both units have Kelvin sense capability. These two units and an active ground unit capable of sinking up to 700 mA at 0 V ±1 mV can be flexibly interchanged among device terminals via an internal switching matrix.

POWERFUL ANALYSIS

In addition to a high precision stimulus-response system, the 372 has powerful tools for device analysis. The 372's waveform math function lets you display a mathematical function of the data on the y-axis. So whether you want to display log I_C and log I_B versus V_{BE} or the square root of I_D versus V_{GS}, the 372 lets you see what you want to see. The 372 also lets you plot current or voltage versus time for tracking down critical device drift problems. And, the 372 has 4 different cursor types which allow you to measure I, V points, slopes, gain, or make automatic pass/fail decisions.

INTERACTIVE CONTROL

The 372's interactive interface allows you to configure a test and view the data on the same menu screen, giving you instant feedback. In many cases you can change set up parameters by simply touching the parameter on screen and turning the general purpose knob – no paging through menus. This level of interaction lets you get to the bottom of tough problems quickly.

APPLICATIONS

QA/Incoming Inspection: Whether you need a fully automated solution, a manual solution, or something in between, the 372 is ideal for QA and incoming inspection applications. The 372's program mode will let you fully automate many test sequences, eliminating the need for an external controller. Pass/no-pass cursors make pass/fail decisions on your acquired data, saving time and eliminating the need for external data analysis. The 372 is also programmable over GPIB and for those who want to step through each test manually, setups may be recalled from MS-DOS formatted diskettes to speed the configuration process.

Process Monitoring: With its highly accurate stimulus/response units and its automation features, the 372 is an excellent tool for process monitoring. Whether your technology is bipolar or MOS the 372 has the ranges and resolutions necessary for typical wafer level measurements. For stand-alone monitoring applications measurements may be automated under the 372's program mode, or by recalling setups from disk.

Semiconductor Workbench™

Device Research/Troubleshooting:
An interactive user interface for zeroing in quickly on device characteristics, highly accurate measurements of up to 4000 points, and a flexible display to see the data in a useful form are all powerful tools for device research and troubleshooting applications.

Source Characteristics

The 372's two stimulus/response units, the high power unit (HPU) and the low power unit (LPU), both have the same resolution and accuracy. The HPU simply extends the maximum ranges of the LPU from 100 mA and 100 V to 400 mA and 200 V. Range resolution and accuracy for the HPU is specified as follows:

HPU VOLTAGE RANGE, RESOLUTION AND ACCURACY

V Range	Resolution	Stimulus Accuracy	Response Accuracy	Max Current
0.1 V	25 µV	±(0.1% + 500 µV)	±(0.1% + 500 µV)	400 mA
1 V	250 µV	±(0.1% + 500 µV)	±(0.1% + 500 µV)	400 mA
10 V	2.5 mV	±(0.1% + 5 mV)	±(0.1% + 5 mV)	400 mA
100 V	25 mV	±(0.1% + 50 mV)	±(0.1% + 50 mV)	100 mA (V > 10 V) 400 mA (V ≤ 10 V)
200 V	50 mV	±(0.1% + 100 mV)	±(0.1% + 100 mV)	40 mA (V > 100 V) 100 mA (10 V ≤ V < 100 V) 400 mA (V ≤ 10 V)

HPU CURRENT RANGE, RESOLUTION, AND ACCURACY

Range	Resolution	Stimulus Accuracy	Response Accuracy	Max V
100 pA	25 fA	±0.6% ± 6 pA + 100 fAxV_0*	±0.6% ± 5 pA + 100 fAxV	200 V
1 nA	250 fA	±0.6% ± 7 pA + 100 fAxV_0	±0.6% ± 6 pA + 100 fAxV	200 V
10 nA	2.5 pA	±0.5% ± 23 pA + 100 fAxV_0	±0.5% ± 20 pA + 100 fAxV	200 V
100 nA	25 pA	±0.5% ± 180 pA + 100 fAxV_0	±0.5% ± 150 pA + 100 fAxV	200 V
1 µA	250 pA	±0.1% ± 1.8 nA + 100 fAxV_0	±0.1% ± 1.5 nA + 100 fAxV	200 V
10 µA	2.5 nA	±0.1% ± 18 nA	±0.1% ± 15 nA	200 V
100 µA	25 nA	±0.1% ± 180 nA	±0.1% ± 150 nA	200 V
1 mA	250 nA	±0.1% ± 1.8 µA	±0.1% ± 1.5 µA	200 V
10 mA	2.5 µA	±0.1% ± 18 µA	±0.1% ± 15 µA	200 V
100 mA	25 µA	±0.1% ± 180 µA	±0.1% ± 150 µA	100 V (I > 40 mA) 200 V (I ≤ 40 mA)
400 mA	100 µA	±0.1% ± 720 µA	±0.1% ± 600 µA	10 V (I > 100 mA) 100 V (100 mA ≥ I > 40 mA) 200 V (I ≤ 40 mA)

V_0 = (HPU voltage ÷ 1 V)

Source and measurement accuracies are specified at 23°C ±5°C after instrument has been allowed to warm up for at least 40 minutes with AUTOCAL set to ON.

ORDERING INFORMATION

372
Semiconductor Workbench™ **$34,275**
Includes: Operator's Manual; 3.5 in., 2HD Floppy Disk; Power Cord; Fast Blow 250 V, 1 A Fuse; Test Fixture and Cable; six 1.5 meter Triaxial Cables; Set of Miniature Banana Connection Leads; Carrying Case; A1101, A1102, A1103 and A1104 Adapters.

Opt. 20 – 3 meter cable set ..... **+$2,200**

ADDITIONAL ACCESSORIES
CART – Order K475 ..... **$940**
CAMERA – Order C-9 Opt. 11 ..... **$695**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 372 complies with IEEE Standard 488.2 and Tektronix Standard Codes and Formats.

Curve Tracer

Wide measurement range and productivity enhancement features allow the 370A to address a broad range of semiconductor devices.

370A FEATURES

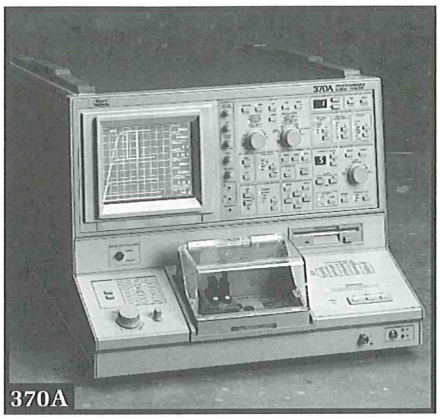
- 3.5 inch MS-DOS Compatible Disk Storage
- Non-Volatile Storage via GPIB Interface
- Waveform Comparison
- Dot Cursor
- Envelope Display
- Digital Storage Display and Non-Storage Mode
- Waveform Averaging

BENEFITS

- Versatile Power Range
- Programmable
- Save/Recall Setups from Disk
- Kelvin Sense Measurements

APPLICATIONS

- Semiconductor Device Testing
  - R&D
  - Manufacturing
  - Incoming Inspection
  - Quality Control
  - Engineering
  - Component Matching
  - Failure Analysis



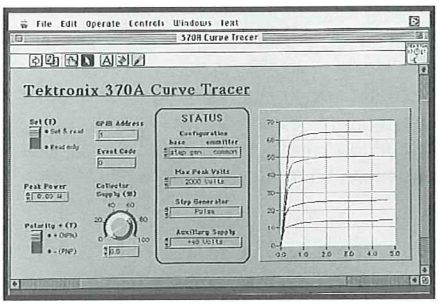
370A Programmable Curve Tracer

The 370A Programmable Curve Tracer provides DC parameter characterization of transistors, thyristors, diodes, SCRs, MOSFETs, optoelectronic components, solar cells, solid state displays and other semiconductor devices. With the 370A you can perform automated device characterizations for: Manufacturing processes, incoming inspection, semiconductor R & D, quality control, component engineering, component matching and failure analysis.

INTERACTIVE, PROGRAMMABLE CONTROL

Interactive control of all measurements allows you to refine characterizations for unique devices during research or design. After completing the characterization definition, interactive settings can be stored in the curve tracer's memory, disk or an external controller.

The 370A's non-volatile memory provides automatic test sequencing. Or, you may perform external controller test sequencing from an IBM compatible PC via the GPIB interface. With either method, the 370A front panel settings can be recalled and measurements made, storing the results for later review or comparison.



TEST FIXTURING

The test fixture is a standard accessory that provides safe device enclosure to assure operator protection during measurements. The test fixture accommodates standard A1001 through A1005 adapters with Kelvin sensing, 3-Pin adapters without Kelvin sensing and the A1023 and A1024 surface mount adapters.

HARDCOPY

Plotter output data is sent directly from the 370A without the need for an external controller. Plotting can continue while the 370A performs the next tasks.

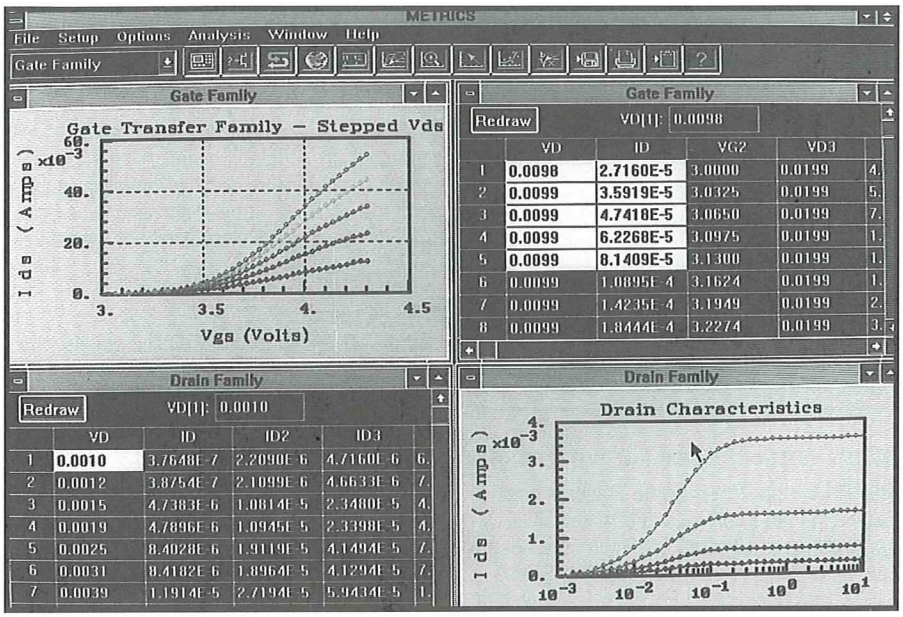
ACQUISITION

In storage mode, information is displayed in one of three ways: normal, envelope or average.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 370A complies with IEEE Standard 488.1 and Tektronix Standard Codes and Formats.

Curve Tracer



Source Characteristics

COLLECTOR SUPPLY

Modes – AC, ±DC, ±Leakage, ±Rectified Sine.

Range	Max Peak Current (±)	Peak Current Pulsed (±)*
16 V	10 A	20 A
80 V	2 A	4 A
400 V	.4 A	.8 A
2000 V	.05 A	.1 A

**Collector supply is not pulsed; assumes a pulsed step generator supply.*

STEP GENERATOR

Modes – Stair step: DC, 80 µsec pulse, 300 µsec pulse.

Step Range – Current: 50 nA to 200 mA in 1-2-5 sequence. Voltage: 50 mV to 2 V in 1-2-5 sequence.

Offset – Up to ±10X step amplitude.

No. of steps – 0 to 10.

Measurement Characteristics

Collector Current – Measurement range: 100 nA/div (1 nA resolution) to 2 A/div. Accuracy: 1.5% of cursor readout +0.05 div of setting (with dot cursor).

Emitter Current – Measurement range: 1 nA/div (10 pA resolution) to 2 mA/div. Accuracy: 1.5% of cursor readout + 0.05 div of setting + 1 nA.

Software

METRICS™ BY ALLIANCE TECHNOLOGIES

METRICS™ Software gives you the ability to control the 370A as well as to collect, analyze, and display the data using a PC. METRICS™ features are easy to use and require no programming. You graphically construct test setups through intuitive mouse-driven editing. Using Dynamic Data Exchange, the data can be easily transferred in real-time to other Windows™ based applications.

LabVIEW™ BY NATIONAL INSTRUMENTS

LabVIEW™ is a graphical programming system for data acquisition and control, data analysis, and data presentation. LabVIEW™ offers an innovative programming methodology in which you graphically assemble software modules called virtual instruments (VIs). LabVIEW™ gives you an alternative to cumbersome text-based programming.

ORDERING INFORMATION

370A

Curve Tracer.....**$23,900**

Includes: Blank Adapter A1001; In-line Transistor A1002, Axial Diode Lead Adapter A1005; 4 and 6 Lead Transistor/FET Adapter A1007; Floppy Diskette (119-3446-00); Protective Cover (337-3344- 00); Spare Fuses 125V/4A (159-0259-00); Slow Blow 250V/2A Fuse (159-0160-00); Power Cord (161-0066- 00); Operator's Manual (070-7779-00).

Opt. 1R – Rack Mounting.....**+$550**

ADDITIONAL ACCESSORIES

Service Manual – Order 070-7780-00.....**$135**

Calibration Fixture – Order 067-0187-00.....**$645**

Rackmount Kit – Order 016-0930-00.....**$1,045**

Socket Adapters – See adapters on page 444

SOFTWARE

METRICS™ Software – Core Program. Order 063-1649-00.....**$1,995**

METRICS™ Software – Tektronix Drivers. Order 063-1650-00.....**$695**

LabVIEW™ – National Instruments LabVIEW™ for Windows*[1]

CART – Order K475.....**$940**

CAMERA – Order C-9 Opt. 1A and Opt. 07.....**$925**

PLOTTER – HC100 with Opt. 01.....**$1,380**

[1] Contact your local Tektronix representative for price information.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 370A complies with IEEE Standard 488.1 and Tektronix Standard Codes and Formats.

Curve Tracer

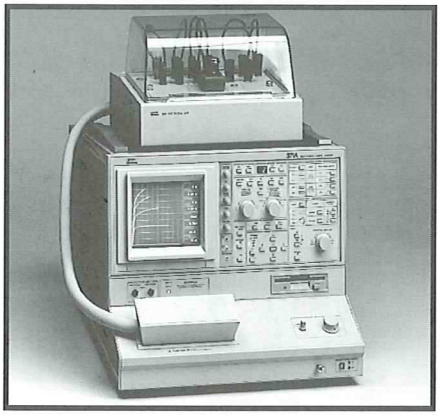
For characterization and test of power semiconductors.

371A BENEFITS/FEATURES

- Test High Power Devices:
  - Up to 3,000 Volts
  - Up to 400 Amps
  - Up to 3,000 Watts
- 3.5 inch MS-DOS Compatible Disk Storage
- Waveform Comparison
- Cursor Measurements
- Readout of Control Settings and Cursor Values
- Programmable
- Save/Recall Setups from Disk
- Kelvin Sense Measurements

APPLICATIONS

- Automated DC Parameter Characterization of High Power Semiconductors



371A High Power Curve Tracer

The 371A High Power Curve Tracer is specifically designed to provide automated DC parameter characterization of high power semiconductor devices such as thyristors, STRs, IGBTs, and power MOSFETs. The high voltage collector mode permits testing the Off-Characteristics of a device up to 3000 Volts. The pulsed high current collector mode provides output current pulses greater than 400 amps peak for testing On-Characteristics. It also permits high power testing up to 3,000 watts.

COMPLETE PROGRAMMABILITY

The 371A provides remote setup, computerized control and software analysis with external programming over the IEEE-488 GPIB.

COMPREHENSIVE STORAGE CAPABILITIES

For enhanced productivity the 371A can save up to 64 setups and 64 displays on a 3.5 in. floppy and 16 of each in internal memory. With stored setups you can easily cycle through a series of tests, either manually or automatically through GPIB program control. To help identify data, up to 24 characters of text may be used to label or annotate a curve.

AUTOMATED CURSOR MEASUREMENTS

The 371A provides three cursor measurement modes. The Dot cursor provides direct screen readout of voltage, current, gm or DC beta at any point. The Window cursor can be positioned between two curves to measure small signal beta or gm, and can also be used for visual go/no-go tests. The Function Line cursor provides screen readout of a slope or intercept value.

SWEEP MEASUREMENT MODE

In the Sweep Measurement Mode the 371A will automatically construct a family of curves while stimulating the device with low duty-cycle pulses. With this capability, power curves can be displayed without excessive heating of the device.

Characteristics

COLLECTOR SUPPLY

Modes – High Current: 250 µsec pulses with max. peak of 30 volts. High Voltage: Full rectified sine with max. peak of 300 volts (positive and negative polarities for both modes).

Range	Peak Current	Peak Power
30 V	400 A	3 kW
30 V	40 A	300 W
300 V	40 mA ±20%	30 W
300 V	4 mA ±20%	3 W
3 kV	4 mA 0 ±20%	300 mW
3 kV	4 mA ±20%	30 mW

Measurement Characteristics

COLLECTOR CURRENT

Maximum Power Setting	Vertical Range (in 1-2-5 increments)
3 kW	1 A/div to 50 A/div
300 W	500 mA/div to 5 A/div
30 W	100 µA/div to 5 mA/div
3 W, 300 mW	10 µA/div to 500 µA/div
30 mW	1 µA/div to 50 µA/div

Accuracy: within 0.1 vertical division.

Test Fixture – Designed to allow easy connection to a variety of devices. It has a safety enclosure to assure operator protection. Special patch cords are provided for connecting large devices.

STEP GENERATOR

Modes – Current (stair step): DC, 500 µsec ±10% of pulse.Voltage (stair step): DC.

Step Range – Current: 1 mA/step to 2 A/step pulsed (hi current mode). 1 µA/step to 2 mA/step DC (hi voltage mode). Voltage: 200 mV/step to 5 V/step. Offset: ±10X step amplitude (5X in 5 V/step and 2 V/step settings).

ORDERING INFORMATION

371A

High Power Curve Tracer **$27,500**

Includes: In-line transistor A1002; TO3/TO66 adapter A1003; power cord (070-6839-00); operator's manual (070-8043-00); and pocket reference guide (070-6841-00).

ADDITIONAL ACCESSORIES

Field Wiring Cable – Order 198-5628-00 ..... **$365**

Service Manual – Order 070-6840-00 ..... **$105**

Calibration Fixture – Order 067-1345-00 ..... **$3,995**

Rackmount Kit – Order 016-0930-00 ..... **$1,200**

Socket Adapters – See adapters section on page 444.

SOFTWARE

METRICS™ Software – Core Program.
Order 063-1649-00 ..... **$1,995**

METRICS™ Software – Tektronix Drivers.
Order 063-1650-00 ..... **$695**

LabVIEW™ – National Instruments LabVIEW™ for Windows *1

CART – Order K475 ..... **$895**

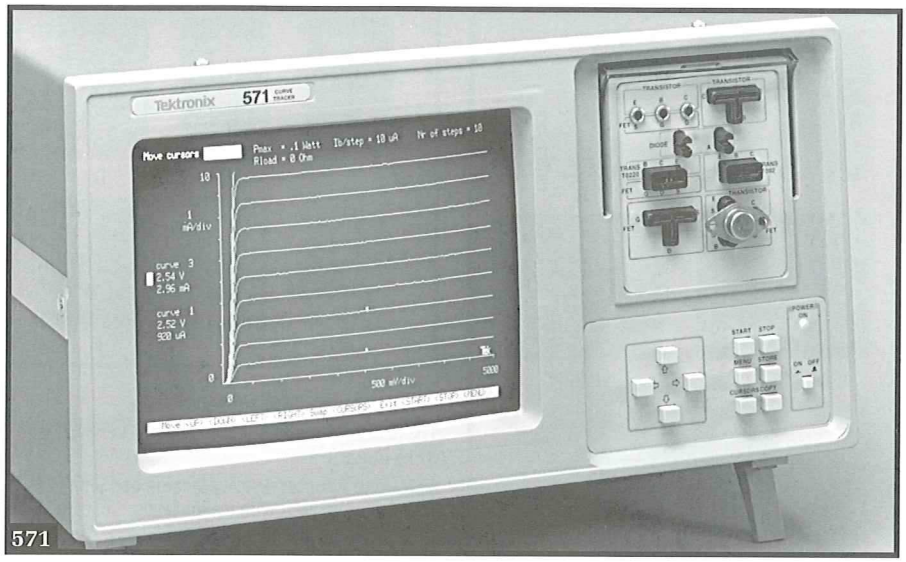
PLOTTER – HC100 with Opt. 01 ..... **$1,380**

*1 *Contact your local Tektronix representative for price information.*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

GPIB IEEE-488 The 371A complies with IEEE Standard 488.1 and Tektronix Standard Codes and Formats.

Curve Tracer



571 Curve Tracer

The 571 Curve Tracer is designed to accurately display the characteristics of two and three terminal semiconductor devices at a very affordable price. This easy-to-operate curve tracer is ideally suited for testing diodes, transistors, and thyristors.

Characteristic curves are digitized and displayed on a large video display CRT.

The 571 Curve Tracer is extremely versatile, yet remarkably easy to operate. Two main display screens are provided. The first screen is a menu page for selecting the device type and all relevant parameters. Parameters are selected and modified by a simple front-panel keypad entry.

The second screen displays the measured data – a family (set) of curves. The collector voltage and current parameters can be easily changed without switching back to the menu screen. An operator prompt line is provided at the bottom of each screen to indicate which push-buttons are active.

Up to 12 parameter setups (12 completed tests) can be stored in non-volatile EEROM memory to speed up testing of frequently used devices. One set of characteristic curves can be stored in RAM memory for comparison of one device to another (reference device).

A complete set of device adapter sockets are an integral part of the front-panel, preventing possible misplacement.

Characteristics

Collector Supply – 0.5 to 100 volts in 8 ranges, max 2 A @ 50 V, 1 A @ 100 V.

Selectable Load Resistor – 0.3, 10, 100 Ω and 1, 10 kΩ.

Base Drive – Max 10 steps, 0.5 µA/step to 20 mA/step both source and sink in 15 ranges.

Gate Drive – 0.1 V/step to 1 V/step positive and negative in 4 ranges.

I_C Measurement – 5 µA to 200 mA/div. in 15 ranges.

Cursors – Two cursors can be moved along the displayed curves. The X and Y position of the cursor will be displayed on the screen. Basic accuracy is 2% of full scale, all mentioned ranges are in 1-2-5 sequence.

Printer Out – Centronics® parallel interface. Output format for Epson® or IBM® compatible.

571 FEATURES

- Easy to Operate
- Menu Driven
- Non-Volatile EEROM Store 12 Test Setups
- Accurate Cursor Measurements
- Hard Copy Output to Printer
- Built-in Safety Features
- Built-in Test Sockets

BENEFITS

- Moderate Power
- Versatile Built-In Adapter Sockets

APPLICATIONS

- Diode Testing
- Transistor Test
- Thyristors Test

Ideal for Educational Laboratories!

ORDERING INFORMATION

571
Curve Tracer **$3,950**
Includes: Operator's Manual, Power Cord

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**
Opt. A2 – United Kingdom 240 V, 50 Hz ..... **NC**
Opt. A3 – Australian 240 V, 50 Hz ..... **NC**
Opt. A4 – North American 240 V, 60 Hz ..... **NC**
Opt. A5 – Switzerland 220 V, 50 Hz ..... **NC**
See General Customer Information Section for additional description.

ADDITIONAL ACCESSORIES
Printer Cable – 9 ft. Male to Male Centronics. Order 012-1284-00 ..... **$35**
Printer Cable – Shielded. Order 012-1233-00 ..... **$180**
CART – Order K475 ..... **$940**
CAMERA – Order C-9 Opt. 1A and Opt. 07 ..... **$925**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

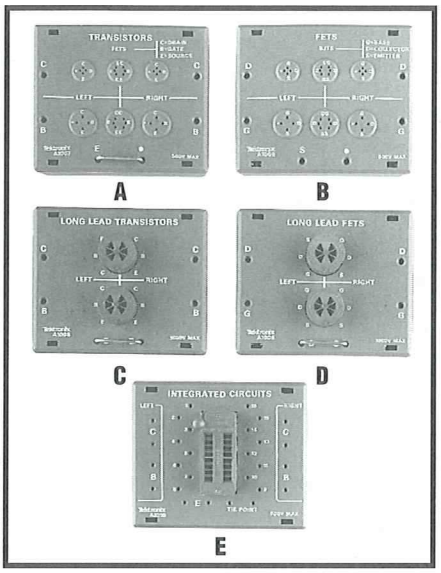
ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

Semiconductor Testers
Device Adapters

Adapters for 370A and 371A Curve Tracers and SMT Devices.

ADAPTERS

- Dual Width Adapters
- Kelvin Sensing Adapters
- SMT Device Adapters



DUAL WIDTH ADAPTERS
Adapters A1006 through A1010 fit the side-by-side terminals on test fixtures of the 370A Curve Tracer. These adapters allow either 1 or 2 devices mounted in the adapter which is useful for alternating comparisons of two devices.

A. Transistor Adapters for Bipolar Transistors and some MOSFETs – Order A1007 ..... **$350**

B. FET Adapter for most FETs – Order A1009 ..... **$345**

C. Long Lead Transistor Adapter for Transistors with Untrimmed Leads – Order A1006 ..... **$325**

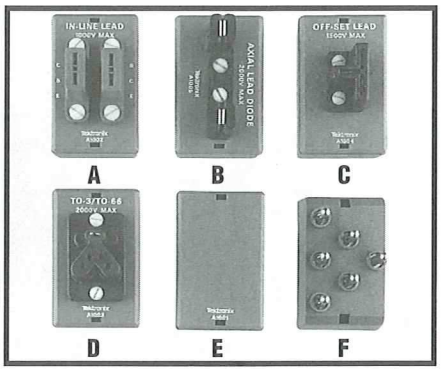
D. Long Lead FET Adapter for FETs with Untrimmed Leads – Order A1008 ..... **$350**

E. Integrated Circuit Adapter for Multi-Pin Dual-in-Line Device Packages – The pins are connected to the collector, base or emitter terminals with patch cords. A tie point is also provided for an external power supply or signal source connection to the IC pins. Includes one each lead for connecting auxiliary supply to the tie points (196-3067-00); six each 4-inch test leads (012-0310-00). Order A1010 ..... **$495**

SMT DEVICE ADAPTERS

SOT-23 Adapter for Surface Mount Devices – Order A1023 ..... **$300**

TO 252/SMT DPack Adapter for Surface Mount Devices – Order A1024 ..... **$300**



KELVIN SENSING ADAPTERS
These adapters fit the test fixtures of the 370A and 371A Curve Tracer.

A. In-Line Adapter – Accepts large and small TO-220 transistors with in-line leads. Spacing between leads is 0.06 inch to 0.18 inch. The adapter is wired for both B-C-E and C-B-E lead configurations. Order A1002 ..... **$205**

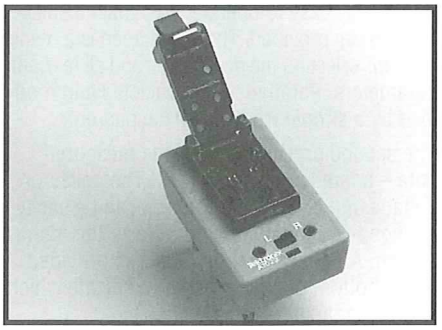
B. Axial Lead Diode Adapter – Order A1005 ..... **$205**

C. Offset Lead Adapter for Power Transistor – Order A1004 ..... **$205**

D. TO-3/TO-66 Adapter for Power Transistors – Order A1003 ..... **$205**

E. Blank Adapter for Mounting Custom Sockets – Order A1001 ..... **$110**

F. Example Showing Adapter Bottom 6th Pin for Base/Gate Kelvin Sensing



A1023 SOT-23 Adapter.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Accessories

CONTENTS

ACCESSORIES INTRODUCTION
Probing Tutorial 447

PROBES
Oscilloscope to Probe Cross Reference 450
Probe Specification Chart 452
Obsolete Probes/Replacements 454
FET Voltage Probe Tutorial 456
FET Voltage (Active) Probes 458
50 Ω Divider Probes (Zo) 466
Passive Voltage Probes 467
SMD Probes/Adapters 474
SMD Interconnect Solutions 476
Probing Stations/Articulated Arms 480

PROBE REPLACEMENT PARTS & ADAPTERS
Replacement Parts 482
SMD Probes Parts 484
P6150/4 mm 485
2.5 mm (Subminiature) 486
3.5 mm (Compact) 488
5 mm (Miniature) 490
Monolithic 492
P5100/SMD Active 494

POWER MEASUREMENT PROBES
High Voltage Probes 496
Differential Probes 498
Voltage Isolators 505
Current Probes 511

OTHER PROBING COMPONENTS
Specialty Probes (Temp, RF, Environmental) 518
Digital Word Trigger Probes 519

PROBE & INSTRUMENT ACCESSORIES
Probe Packs, Cables, Test Leads 520
Adapters/Connectors 521
Attenuators/Terminators 522

DOCUMENTATION DEVICES
Plotter (Four Color) 524
Printer (Bubble Jet) 524
Recommended Film Based Camera Adapters 527
Film-Based Cameras 526

INSTRUMENTATION CARTS 528

OTHER INSTRUMENTATION ACCESSORIES
Travel Kits 532
Viewing Hoods 534
Rackmount Kits 535
Light Filters 536

With Tektronix, the Difference Is Measurable

Whether you're using a scope from our revolutionary New TDS 600/700, TDS 400/500, TAS or 11000 Series, our portable 2400 or 2200 Series, or our TLS Series, you've invested in the finest line of measurement instruments available. That's why it doesn't pay to compromise performance with accessories you can't be sure of.

A dependable probe is essential to completing your test system – because even the most advanced scope can only be as precise as the data that goes into it. Off-the-shelf general-purpose probes are frequently unreliable, and are not expressly designed for your scope. They can cost you in ways you never bargained for: greatly impaired measurement results, embarrassing errors, and expensive delays.

PLUG IN PEACE OF MIND

Only genuine Tektronix probes measure up to your Tektronix scope, with designed-in compatibility and identical standards for quality – for performance you can always depend on.

Of course, choosing the *right kind* of probe is equally important, which is why we offer the world's largest and most respected line – passive and active voltage probes, current probes, high voltage probes, opto-electrical converters, specialty probes, and SMD probes designed for dense circuitry. All are built with the kind of ruggedness, reliability and long life that add up to the best probe value on the market. And they're complimented by an amazingly wide array of probe accessories for virtually every need.

DOCUMENTATION

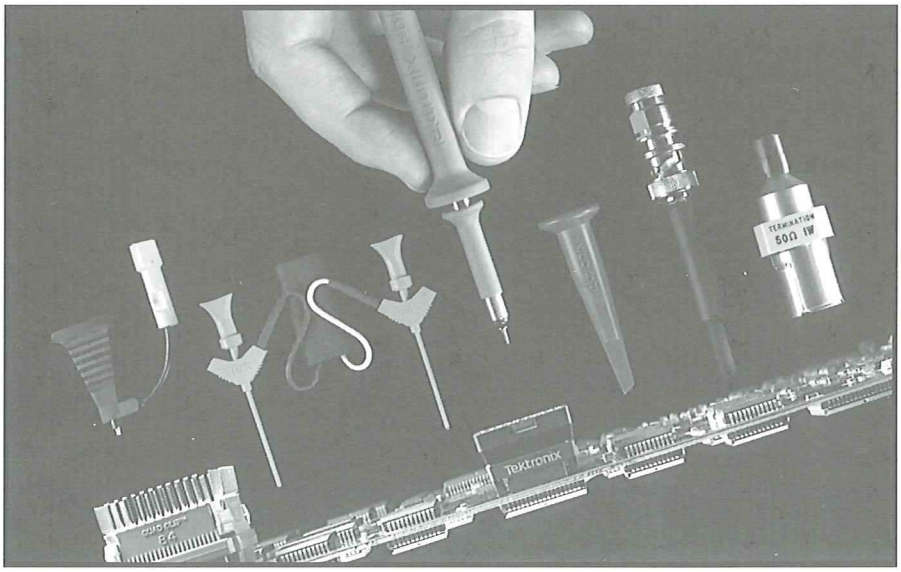
We also provide a complete family of products for documenting your measurement results, a step that's become almost as essential as testing itself. As with our probes, only Tektronix digitizing systems, film-based cameras, printers, and plotters are precision-matched to your instrument and applications. They're exceptional values, too, as are TEK SCOPE-MOBILE® carts and workstations which free up bench space and make equipment easy to share and move around.

SUPPORT IN EVERY SENSE OF THE WORD

Tektronix products come with all the back-up you could ever need – generous warranties, optional extended service plans, and parts and service that are always readily available. Plus the convenience of Tektronix' worldwide field office network for in-person product demos, service, and other assistance.

Even more than that, expert personal guidance is as close as your phone, anytime you need help in choosing and using Tektronix products. And we're always ready to assist you with the widest choice of training materials in the industry.

An extra measure of performance, compatibility, quality, and support – added value that increases your productivity without raising your costs. That's the competitive advantage you get with every Tektronix product.



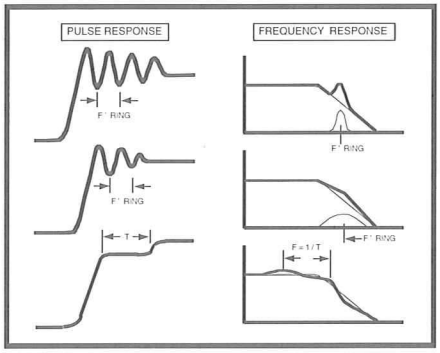
Probe Tutorial

Tektronix Instrument Probes

A probe can be any conductor used to establish a connection between the circuit under test and the measuring instrument. This conductor could be a piece of bare wire, a multimeter lead, or a piece of unterminated coaxial cable.

However, these "simple probes" do not fulfill the essential purpose of a probe; that is "to extract minimal energy from the circuit under test and transfer it to a measuring instrument with maximum fidelity." The bare wire can load the input amplifier with its high capacitance and inductance or even cause a short circuit; multimeter leads are unshielded and are often susceptible to stray pickup, and the unterminated coax will severely capacitively load the circuit under test (100 pF per meter typically). Also, the unterminated coax is usually resonant at certain frequencies and does not allow faithful transfer of the signal to the test instrument due to reflections.

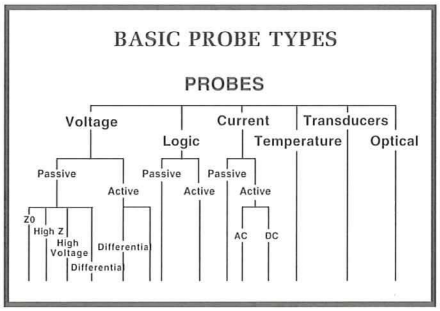
Tektronix has been designing and manufacturing instrument probes for more than 40 years, placing a constant effort on minimizing the reflections and other effects associated with unterminated coaxial probe cables and to reduce the effect of coaxial probe cables' capacitance in today's high-speed probing products.



This brief tutorial will quickly review the basic probe types and look at some of the more common issues around probe selection.

Types of Probes

Tektronix probe products include: General Purpose Passive Voltage Probes; Active (FET) Voltage Probes; SMD Passive Voltage Probes; Active and Passive Current Probes; High Voltage Passive Probes; 50 Ω Divider Passive Voltage Probes (Zo, low impedance/high frequency); and Differential Voltage Probes, to name a few.



GENERAL PURPOSE PASSIVE (Page 467)

Attenuating Passive Voltage Probes are the most commonly used probes today. They provide a convenient and extremely rugged, yet inexpensive, way to acquire signals from your device under test. They maintain the accuracy of the oscilloscope to which they are connected over a wide dynamic range (±400 V). The 10X passive voltage probe presents a high impedance to the circuit under test at low frequencies (approximately 5 MHz and lower). Their main disadvantage is a decreasing impedance level with increasing frequency (i.e., high input capacitance).

ACTIVE FET PROBES (Page 456)

FET probes include active components (field effect transistors or other active devices) rather than passive components. The FET input results in a higher input impedance without loss of signal, i.e., low input capacitance (typically <2 pF to <0.4 pF), and high input resistance values (typically >100 kΩ). Some FET probes include an offset control that allows a substantial increase in the active probe's linear dynamic range. Since FET probes have a 50 Ω output impedance, they can drive a 50 Ω cable. This capability allows the distance from the probe tip to the instrument to be increased within the practical limits of the probe amplifier system and the limitations of the coaxial cable.

HIGH VOLTAGE PASSIVE (Page 496)

Several high voltage probes are available from Tektronix that provide 100X or 1000X compensated dividers. Because of the larger attenuation factors required for high voltage applications, a reduction in the input capacitance of approximately 3 pF is achieved.

CURRENT PROBES (Page 510)

Current probes provide a method to measure the current flowing in a circuit. Two types of current probes are available, the traditional AC only probes and the "Hall effect" type. AC only current probes use a transformer to convert current flux into AC signals and have a frequency response from a few hundred Hz to GHz. Hall effect current probes use semiconductors to provide a frequency response from DC to 50 MHz. Because of its "non-invasive" nature, a current probe imposes less loading than other probes.

50 Ω DIVIDER PROBES (Z0) (Page 466)

50 Ω Divider Probes provide the lowest input capacitance (typically <1 pF for high frequency signals) and are used with high frequency, 50 Ω input scopes. 50 Ω Divider Probes provide the most consistent probe loading because they exhibit a frequency response that is essentially flat throughout their designed frequency range.

Probe Tutorial

DIFFERENTIAL PROBES (Page 508)
Tektronix oscilloscope plug-ins are available with high common rejection ratio (10,000:1, 11A33). The normal 10X probe has a typical accuracy of ±1% and gives a differential measurement accuracy of two parts per 100. Using this 10X probe, the common mode rejection ratio of a scope and probe combination would be no better than 50:1. A matched pair (P6135A) of differential probes allows the user to adjust the probe's attenuation for compatibility with the variety of Tektronix plug-ins. This attenuation adjustment includes probe compensation so the probes match at high frequency as well as low frequencies.

PROBE SELECTION CRITERIA
Proper probe selection will extend and enhance an instrument's performance, while imprudent probe selection often reduces your system's performance. Thoughtful consideration of probe characteristics will help ensure that the performance of your instrument meets your application's requirements. While the major considerations for an appropriate probe are its loading and signal fidelity transfer, physical parameters such as probe size, cable length and device under test interconnect adapters are potentially more important to the success of your measurement.

For a complete understanding and description of signal acquisition probing techniques, issues and applications, the following information is available by contacting your local Tektronix representative.

"ABC's of Probes" –
• Literature # 60W-6053-4 (Free)

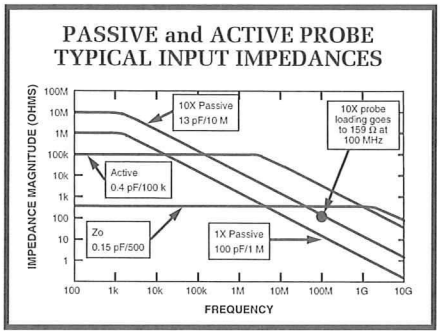
"Probing High Frequency Digital Circuitry" –
• Literature # 60W-8412-0 (Free)

"Active Probes: Their Unique Characteristics and Applications" –
• Literature # 60W-6883 (Free)

"The Effect of Probe Input Capacitance on Measurement Accuracy" –
• Literature # 60W-8910-0 (Free)

"Probe and Signal Concepts" –
• Video Tape and Workbook.
Order 068-0229-XX specify tape format:
-01 Beta
-02 Beta II
-03 Beta III
-04 VHS NTSC
-06 VHS PAL
-07 VHS SECAM

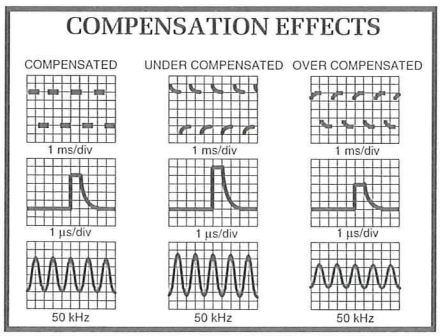
CRITERIA
Bandwidth/Rise Time
The bandwidth of a probe can be defined as the maximum –3 dB frequency a user can expect with a scope/probe system. In most probes, the bandwidth/rise time product is close to 0.35. In many cases the bandwidth is verified by pulse rise time to ensure minimum aberrations. To accurately define these parameters, the source impedance is specified as a terminated 50 Ω system (i.e., 25 Ω).



Probe Loading
Input resistance and capacitance is used to describe the loading effect of a probe. At low frequencies (<1 MHz) the probe input resistance is the key factor for probe loading of the circuit under test. At higher frequencies the probe input capacitance is now the significant factor. The chart above shows various probes and changes in their impedance as frequency changes.

Aberrations
A high frequency probe that is specified without limiting aberrations can provide very misleading measurements. Existing aberrations can indicate a severely distorted bandwidth/roll-off characteristic.

Compensation Range
The range of a scope's input capacitance over which a specific probe will compensate to provide a flat frequency/attenuation ratio.

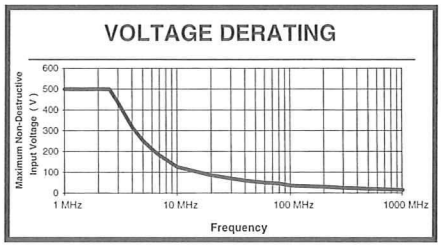


Tip – Always remember to check/adjust the compensation of your probe when you move it between channels or to another scope.

Attenuator Ratio
When correctly terminated, a probe should have a constant attenuation ratio. The attenuation ratio is the ratio of the output signal to the input signal. The attenuation should remain constant throughout a wide band of frequencies, decreasing by 3 dB as the frequency increases to the rated bandwidth.

Maximum Voltage
The maximum voltage (DC + peak AC) should be specified to ensure a usable, upper voltage range. At Tektronix, probes are tested in accordance with standard safety procedures.

Voltage Derating with Frequency
This specification is applicable for all high frequency probes. Either the termination elements or the resistive center conductor in the probe cable limits the maximum voltage that may be applied to a probe at a specific frequency. This derating applies at frequencies above 100 kHz.



Probe Length
Keep probe cable lengths as short as possible because extra length decreases the bandwidth and increases the loading capacitance of the probe. Longer probe cables also have greater propagation delays (typically 4 ns/meter in passive probes).

Probe Tip Accessories
A wide variety of adapters is available to mechanically connect the probe to the circuit under test (see page 482 for complete selection information). Since the probe tip conducts very little current, many materials that are normally considered to be good conductors have high resistance at lower current levels. Tektronix probe tips use an alloy coating to minimize current conduction problems.

Probe Coding
Probe coding provides the user with an indication of the actual probe tip sensitivity. This coding eliminates the need to divide by the attenuation ratio or remember which probe is being used. Most passive probes today provide readout capability that allows you to read your measurements directly from the oscilloscope screen.

Probe Tutorial

Maximum Current (CW)
The maximum sine wave current that can be measured with a specified current probe without distortion.

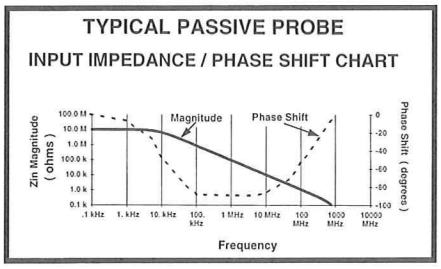
Maximum Current (PULSE)
The maximum pulse current that can be measured with a specified current probe without distortion limited by Amp-Second (A-S) product.

Amp-Second Product
The maximum integral of the Current Pulse Waveform that may be measured without distortion. (See page 511 for more detail.)

Maximum DC Current
At levels lower than the RMS current specification, a DC level will saturate AC only current probes causing distortion and insertion impedance changes. The impedance reflected into the circuit being measured is normally in the form of resistance and inductance.

PROBING CONSIDERATIONS AND RULES OF THUMB

A prime consideration in selecting the proper probe is the circuit loading effect of the oscilloscope/probe combination. The probe with the highest input impedance (lowest input capacitance and highest input resistance) will provide the least circuit loading. As circuit frequency increases and/or rise time decreases, the capacitive loading becomes most important. At DC and low frequencies the resistive loading is the most important.



Capacitive loading of voltage probes is the most important consideration when measuring fast rise-time pulses. The time required to charge the input capacitance of the probe from the 10 to 90 % level is:

$$t_r = 2.2 \times R_{source} \times C_{probe}$$

Probe only rise time is the rise time of the probe driven from a terminated 50 Ω source. From this formula the rise time of the probe/oscilloscope system may be calculated for non passive probes that terminate in 50 Ω.

$$t_{r2\ system} = t_{r2\ probe} + t_{r2\ scope}$$

Bandwidth (3 dB down) of the probe/oscilloscope system may be calculated, knowing the system rise time and using the formula

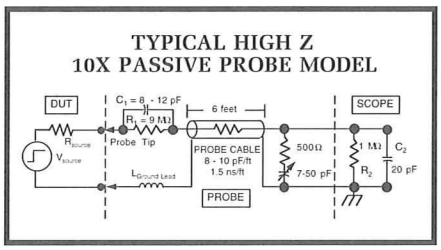
$$BW \approx 0.35 / t_{rise}$$

As you can see, these formulas are all dependent upon the input capacitance of the probe/oscilloscope system. **Since input capacitance plays such an important role, carefully consider the value of the probe's input capacitance when selecting your probe.**

Probe attenuation ratio is also an important consideration. The oscilloscope must have enough gain to allow viewing of the attenuated signal when using probes with larger attenuation ratios.

When an attenuating probe is used with an oscilloscope, the input resistance and input capacitance of the oscilloscope are represented by R_2C_2, and the probe resistance and capacitance are represented by R_1 C_1 (see the figure below).

R2C2 = R1C1 = Optimum Signal Transfer



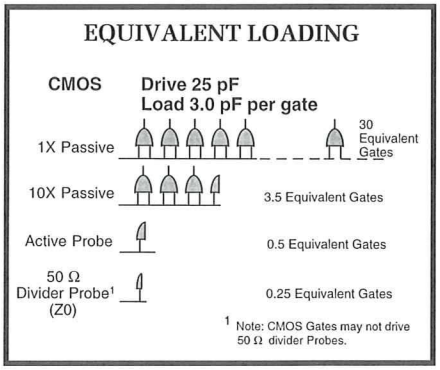
When the probe is first connected to the oscilloscope, compensate it by applying a low frequency square wave (1 to 10 kHz normally) to achieve the equalization of time constants. Improper compensation will result in either overshoot, roll-off or incorrect signal amplitudes (see Compensation Effects figure page 448).

The charts on pages 450 to 455 give you information on specifications, oscilloscope compatibility and obsolete probe replacements to help you select the right probe for your application.

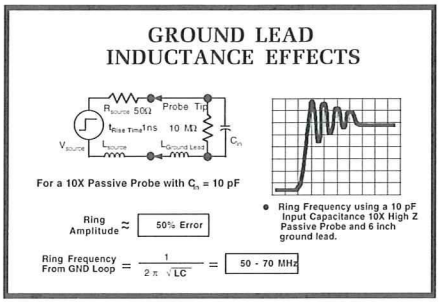
CONSIDER THE FOLLOWING FACTORS IN MAKING YOUR PROBE SELECTION:

- **Match Probe to Scope Input Resistance and Input Capacitance –** Be sure the desired probe will match the input resistance and capacitance of the oscilloscope being used. Fifty ohm (50 Ω) scope inputs will require 50 Ω probes. One Megaohm (1 MΩ) scope inputs will require 1 MΩ probes. Also check for connector interface compatibility or choose the appropriate adapter required.
- **Match to Scope Bandwidth and Rise Times –** Select a probe with adequate rise time and bandwidth for the oscilloscope and application.
- **Probe Loading Effects –** Minimize probe loading effects by selecting low-impedance test points. Although the input impedance of a probe is made as high as possible, it still will always have some finite effect on the circuit under test. Usually cathodes, emitters and sources are preferred over plates, collectors or drains. Inputs to high-impedance dividers should be used rather than the midpoints.

  Be aware of the fact that the input impedance of a probe varies inversely with frequency. Example: A probe having a bandwidth of 50 MHz and an input resistance of 10 MΩ at DC would have an input resistance of approximately 1.5 kΩ at 50 MHz. Choose the probe with the lowest possible input capacitance and highest input resistance for best overall signal fidelity.



- **Time Delay Effects –** Time delay differences must be considered particularly in phase and time coincidence measurements and in differential measurement applications. Always use two probes of the same model and cable length when making skew or time difference measurements.
- **Grounding Effects –** Grounding practices should always be kept in mind, particularly in high-impedance probe applications. Using as short a ground path as possible (preferably a coaxial adapter or short ground connector) will minimize the effect of series inductance to the probe input.



Oscilloscopes to Probes
Cross Reference

Tektronix Scopes to Tektronix Probes.

Bolded probes are those normally shipped with the scope.

For non-bolded probes, the scope bandwidth may be limited by the probe shown.

Use scope's bandwidth and probe specification chart to determine overall probe/scope bandwidth.

RECOMMENDED PROBES

	Passive 1X*6	Passive 10X*6	Passive 1X/10X*6	SMD 10X*6	50 Ω Divider	High Volt. 100X*6	High Volt. 1000X*6	Active
TDS 300/400/500(A)/600(A)/700A/800 and TLS 200 Series								
TDS 310/320	P6101B	**P6109B**	P6129B	P6561AS	–	P5100	P6015A	–
TDS 350	P6101B	**P6111B**	P6129B	P6561AS	–	P5100	P6105A	–
TDS 410	P6101B	**P6138**	P6129B	P6562AS	–	P5100	P6015A	P6205
TDS 420	P6101B	**P6138**	P6129B	P6562AS	P6156*2	P5100	P6015A	P6205
TDS 460	P6101B	**P6138**	P6129B	P6562AS	P6156*2	P5100	P6015A	P6205
TDS 520/A	P6101B	**P6139A**		P6563AS	P6156*2	P5100	P6015A	P6205/P6204
TDS 524/A	P6101B	**P6139A**		P6563AS	P6156*2	P5100	P6015A	P6205/P6204
TDS 540/A	P6101B	**P6139A**		P6563AS	P6156*2	P5100	P6015A	P6205/P6204
TDS 544/A	P6101B	**P6139A**		P6563AS	P6156*2	P5100	P6015A	P6205/P6204
TDS 620/A	P6101B	P6139A		P6563AS	P6156*2	P5100	P6015A	**P6205**/P6245
TDS 640/A	P6101B	P6139A		P6563AS	P6156*2	P5100	P6015A	**P6205**/P6245
TDS 644/A	P6101B	P6139A		P6563AS	P6156*2	P5100	P6015A	**P6205**/P6245
TDS 684A	P6101B	**P6139A**		P6563AS	P6156*2	P5100	P6015A	P6245
TDS 744A	P6101B	**P6139A**		P6563AS	P6156*2	P5100	P6015A	P6205/P6245
TDS 784A	P6101B	**P6139A**		P6563AS	P6156*2	P5100	P6015A	P6205/P6245
TDS 820	–	–	–	–	P6150	–	–	**P6207**
TLS 216	–	–	–	–	–	–	–	**P6240**
TAS 400/200 Series								
TAS 465	P6101B	**P6109B**	P6129B	P6561AS		P5100	P6015A	–
TAS 475	P6101B	**P6109B**	P6129B	P6561AS		P5100	P6015A	–
TAS 485	P6101B	**P6111B**	P6129B	P6561AS		P5100	P6015A	–
TAS 220	P6101B	P6103B	P6119B	–		P5100	P6015A	–
TAS 250	P6101B	P6103B	P6119B	–		P5100	P6015A	–
11000 Series								
11A32	P6101B	P6134C	P6063B	P6562AS	–	P5100	P6015A	P6204/P6205
11A33	P6101B	P6135A*4		P6562AS	–		–	
11A34/V	P6101B	P6134C	P6063B	P6562AS	–	P5100	–	P6204*7/P6205*7
11A52	–	–	–	–	P6156*2	–	–	P6204/P6205
11A72	–	–	–	–	P6156*2	–	–	P6204/P6217
11A81	–	–	–	–	P6156*2	–	–	P6204/P6217
SD20/22/24/ 26/30/32	–	–	–	–	P6150	–	–	P6217*5
2400 Series								
2430/A/M	P6101B	**P6133 Opt. 25**	P6063B	P6562AS	P6156*2	P5100	P6015A	P6202A*1
2431L	P6101B	**P6136 Opt. 25**	P6063B	P6562AS	P6156*2	P5100	P6015A	P6201*1
2432/A/M	P6101B	**P6137**	P6063B	P6562AS	P6156*2	P5100	P6015A	P6201*1
2439	P6101B	**P6136 Opt. 25**	P6063B	P6562AS	P6156*2	P5100	P6015A	P6202A*1
2440/M	P6101B	**P6137**	P6063B	P6562AS	P6156*2	P5100	P6015A	P6201*1
2445	P6101B	**P6131**	P6063B	P6562AS	P6156*2	P5100	P6015A	P6202A*1
2445A	P6101B	**P6133 Opt. 25**	P6063B	P6562AS	P6156*2	P5100	P6015A	P6202A*1
2445B	P6101B	**P6137** **P6133 Opt. 25***3	P6063B	P6562AS	P6156*2	P5100	P6015A	P6202A*1
2455A/B	P6101B	**P6136 Opt. 25**	P6063B	P6562AS	P6156*2	P5100	P6015A	P6202A*1
2465	P6101B	**P6131**	P6063B	P6562AS	P6156*2	P5100	P6015A	P6201*1
2465A	P6101B	**P6136 Opt. 25**	P6063B	P6562AS	P6156*2	P5100	P6015A	P6201*1
2465B	P6101B	**P6137**	P6063B	P6562AS	P6156*2	P5100	P6015A	P6201*1
2467	P6101B	**P6136 Opt. 25**	P6063B	P6562AS	P6156*2	P5100	P6015A	P6201*1
2467B/HD	P6101B	**P6137**	P6063B	P6562AS	P6156*2	P5100	P6015A	P6201*1
Digitizers								
RTD710A/TD1301	P6101B	P6109B	P6129B	–		P5100	P6015A	P6205/P6245*5
RTD720A	–	–	–		P6156*2	–	–	P6204/P6245*5
SCD1000	–			–	P6156*2	–	–	P6217/P6245*5
SCD5000	–	–	–		P6156*2	–	–	P6217/P6245*5

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Oscilloscopes to Probes

Cross Reference

RECOMMENDED PROBES

	Passive 1X*6	Passive 10X*6	Passive 1X/10X*6	Low-Z	High Volt. 100X*6	High Volt. 1000X*6	Active FET
2200 Series							
2201/2205	P6101B	**P6103B**	P6119B	–	P5100	P6015A	–
2210	P6101B	**P6103B**	P6119B	–	P5100	P6015A	–
2211/2212	P6101B	**P6109B**	P6129B	–	P5100	P6015A	–
2213/A	P6101B	**P6122**	P6119B	–	P5100	P6015A	–
2214	P6101B	**P6103B**	P6119B	–	P5100	P6015A	–
2215/A	P6101B	**P6122**	P6119B	–	P5100	P6015A	–
2216	P6101B	**P6109B**	P6129B	–	P5100	P6015A	–
2220	P6101B	**P6109B**	P6129B	–	P5100	P6015A	–
2221/A/2224	P6101B	**P6109B**	P6129B	–	P5100	P6015A	–
2225	P6101B	**P6103B**	P6119B	–	P5100	P6015A	–
2230/2232	P6101B	**P6109B**	P6129B	–	P5100	P6015A	–
2235/A	P6101B	**P6109B**	P6119B	–	P5100	P6015A	–
2235L	P6101B	**P6122**	P6119B	–	P5100	P6015A	–
2236/A	P6101B	**P6109B**	P6129B	–	P5100	P6015A	–
2245/A	P6101B	**P6109B**	P6129B	–	P5100	P6015A	P6205*5*8
2246/A	P6101B	**P6109B**	P6129B	–	P5100	P6015A	P6205*5*8
2247/A/2252	P6101B	**P6109B**	P6129B	–	P5100	P6015A	P6205*5
200 Series							
222A	**P400**	P850	–	–	–	–	–
222PS	**P400**	P850	–	–	–	–	–
224	**P400**	P850	–	–	–	–	–

**1 The P6201 and P6202A active probes require probe power, which is normally supplied by the scope (either standard or optional to the scope). If probe power is unavailable, an 1101A power supply can be used to supply probe power.*

**2 The P6156 is standard with 10X attenuation. Other attenuations are available. Order Option 25 for 10X plus 100X and see ordering information on page 466 for separate 1X and 20X attenuator tips.*

**3 2445B shipped with P6133 Option 25 probe until BW changed to 200 MHz, then shipped with P6137.*

**4 Differential Pair.*

**5 Requires 1103 TEKPROBE™ Power Supply. For SCD1000 order SCD1000 Option 1E.*

**6 1 MΩ input required.*

**7 11A34 only.*

**8 P6205 plus 1103 power supply may also be used.*

VOLTAGE PROBE/PAGE INDEX

Probe	Page	Probe	Page	Probe	Page	Probe	Page	Probe	Page	Probe	Page
ADA400A	501	P6053	454	P6103B	468	P6122	470	P6136	472	P6205	460
P400	420	P6053B	454	P6105A	470	P6125	454	P6137	472	P6206	454
P5100	496	P6053C	454	P6106A	470	P6127	454	P6138	472	P6207	462
P5135	503	P6055	454	P6107A	454	P6129	454	P6139A	472	P6217	460
P5200	502	P6056	454	P6108A	454	P6129B	468	P6148A	454	P6230	454
P6006	454	P6057	454	P6109	454	P6130	454	P6149A	454	P6231	460
P6007	496	P6062B	470	P6109B	468	P6131	472	P6150	466	P6245	458
P6008	518	P6063B	470	P6111B	468	P6133	472	P6156	466	P6561A/AS	474
P6009	496	P6101A	454	P6115	454	P6134	454	P6201	464	P6562	454
P6015	454	P6101B	468	P6119	454	P6134C	472	P6202A	464	P6562A/AS	474
P6015A	496	P6102A	454	P6119B	468	P6135	454	P6203	454	P6563A/AS	474
P6046	500	P6103	454	P6121	454	P6135A	504	P6204	460	P850	420

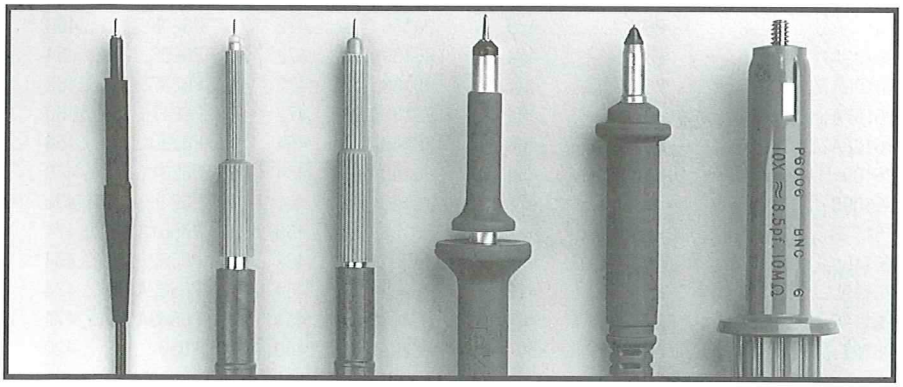
Probes
Specifications

PASSIVE PROBES

Type	Cable Length	Attenuation	Bandwidth at –3dB	System Input Resistance	Typical Input C	Max Voltage DC + pk AC	Compensation Range	Read Out	ID/Gnd Ref.	Tip/Head Style	Page
1X Passive Probe											
P6101B	2 m	1	15 MHz	1 MΩ	100 pF	420 V	NA	–	–	5 mm (Min)	468
10X Passive Probes											
P6103B	2 m	10	60 MHz	10 MΩ	13 pF	420 V	15 to 35 pF			5 mm (Min)	468
P6105A	2 m	10	100 MHz	10 MΩ	11 pF	500 V	15 to 35 pF	√	√	5 mm (Min)	470
Opt. 01	1 m	10	100 MHz	10 MΩ	9 pF	500 V	15 to 35 pF			5 mm (Min)	
Opt. 03	3 m	10	90 MHz	10 MΩ	13 pF	500 V	15 to 30 pF			5 mm (Min)	
P6106A	2 m	10	250 MHz	10 MΩ	11 pF	500 V	15 to 35 pF	√	√	5 mm (Min)	470
Opt. 01	1 m	10	250 MHz	10 MΩ	9 pF	500 V	15 to 35 pF			5 mm (Min)	
Opt. 03	3 m	10	150 MHz	10 MΩ	13 pF	500 V	15 to 30 pF			5 mm (Min)	
P6109B	2 m	10	100 MHz	10 MΩ	13 pF	420 V	15 to 35 pF	√	–	5 mm (Min)	468
P6111B	2 m	10	200 MHz	10 MΩ	14 pF	420 V	15 to 35 pF	√	–	5 mm (Min)	468
P6122	1.5 m	10	100 MHz	10 MΩ	11 pF	500 V	15 to 35 pF		–	5 mm (Min)	470
P6130	2 m	10	250 MHz	10 MΩ	13.2 pF	500 V	15 to 35 pF	√		2.5 mm (Sub)	454
Opt. 01	1.5 m	10	250 MHz	10 MΩ	12.7 pF	500 V	15 to 35 pF		–	2.5 mm (Sub)	
Opt. 03	3 m	10	150 MHz	10 MΩ	14.5 pF	500 V	15 to 30 pF			2.5 mm (Sub)	
P6131	1.3 m	10	300 MHz	10 MΩ	10.8 pF	500 V	14 to 18 pF	√		2.5 mm (Sub)	472
Opt. 02	2 m	10	250 MHz	10 MΩ	13.5 pF	500 V	14 to 18 pF		–	2.5 mm (Sub)	
Opt. 03	3 m	10	150 MHz	10 MΩ	14.5 pF	500 V	14 to 18 pF			2.5 mm (Sub)	
P6133	2 m	10	150 MHz	10 MΩ	12.7 pF	500 V	10 to 25 pF	√		2.5 mm (Sub)	472
Opt. 01	1.3 m	10	150 MHz	10 MΩ	11.4 pF	500 V	10 to 25 pF			2.5 mm (Sub)	
Opt. 03	3 m	10	120 MHz	10 MΩ	14.5 pF	500 V	10 to 25 pF		–	2.5 mm (Sub)	
Opt. 25	1.3 m	10	150 MHz	10 MΩ	10.8 pF	500 V	10 to 25 pF			3.5 mm (Comp.)	
P6134C	1.5 m	10	400 MHz	10 MΩ	11.3 pF	500 V	12 to 18 pF	√	√	2.5 mm (Sub)	472
P6136	1.3 m	10	350 MHz	10 MΩ	10.8 pF	500 V	12 to 18 pF	√		2.5 mm (Sub)	472
Opt. 25	1.3 m	10	350 MHz	10 MΩ	10.8 pF	500 V	12 to 18 pF		–	3.5 mm (Comp.)	
P6137	1.5 m	10	400 MHz	10 MΩ	10.8 pF	500 V	12 to 18 pF	√	√	3.5 mm (Comp.)	472
P6138	1.3 m	10	350 MHz	10 MΩ	10 pF	500 V	12 to 18 pF	√	–	3.5 mm (Comp.)	472
P6139A	1.3 m	10	500 MHz	10 MΩ	8 pF	500 V	8 to 12 pF	√	–	3.5 mm (Comp.)	472
P6561AS	1.3 m	10	200 MHz	10 MΩ	<11 pF	42 V	15 to 35 pF	√	–	SMD	474
P6562AS	1.3 m	10	350 MHz	10 MΩ	<11 pF	42 V	12 to 35 pF	√	–	SMD	474
P6563AS	1.3 m	20	500 MHz	9.5 MΩ	<5 pF	42 V	7 to 30 pF	√	–	SMD	474

m = meters V = volts MHz = Megahertz MΩ = Megaohms pF = picofarads mm = millimeters

TIP/HEAD STYLES



Tip/Head Style: *SMD* *2.5 mm Subminiature* *3.5 mm Compact* *5 mm Miniature* *4 mm* *6/32 Thread Monolithic*

Probes
Specifications

PASSIVE PROBES

Type	Cable Length	Attenuation	Bandwidth at –3dB	System Input Resistance	Typical Input C	Max Voltage DC + pk AC	Compensation Range	Read Out	ID/Gnd Ref.	Tip/Head Style	Page
1X/10X Switchable											
P6062B	2 m	1/10	6.5/100 MHz	1/10 MΩ	105/14 pF	500 V	15 to 47 pF	√	√	5 mm (min.)	470
Opt. 01	1.5 m	1/10	8/100 MHz	1/10 MΩ	100/13 pF	500 V	15 to 47 pF			5 mm (min.)	
Opt. 03	3 m	1/10	4.5/100 MHz	1/10 MΩ	135/17 pF	500 V	15 to 47 pF			5 mm (min.)	
P6063B	2 m	1/10	6/200 MHz	1/10 MΩ	105/14 pF	500 V	15 to 24 pF	√	√	5 mm (min.)	470
Opt. 01	1.5 m	1/10	12/200 MHz	1/10 MΩ	80/11 pF	500 V	15 to 24 pF			5 mm (min.)	
P6119B	2 m	1/10	10/100 MHz	1/10 MΩ	100/18 pF	420 V	15 to 35 pF	–	–	5 mm (min.)	468
P6129B	2 m	1/10	10/100 MHz	1/10 MΩ	100/18 pF	420 V	15 to 35 pF	√	–	5 mm (min.)	468
100X/1000X High Voltage											
P6007	2.2 m	100	20 MHz	10 MΩ	2.2 pF	1,500 V	8 to 55 pF			Mono.	496
Opt. 01	1.2 m	100	25 MHz	10 MΩ	2.0 pF	1,500 V	8 to 55 pF	–	–	Mono.	
Opt. 03	3.4 m	100	15 MHz	10 MΩ	2.4 pF	1,500 V	8 to 55 pF			Mono.	
Opt. 04	4.5 m	100	13 MHz	10 MΩ	2.6 pF	1,500 V	8 to 55 pF			Mono.	
P6009	3.4 m	100	120 MHz	10 MΩ	2.5 pF	1,500 V	8 to 55 pF	√	–	Mono	496
P5100	3.1 m	100	250 MHz	10 MΩ	2.75 pF	2,500 V	7 to 30 pF	√	–	Mono	496
P6015A	3.8 m	1000	75 MHz	100 MΩ	3.0 pF	40,000 V	7 to 49 pF			HVP	496
Opt. 1R	3.8 m	1000	75 MHz	100 MΩ	3.0 pF	40,000 V	7 to 49 pF	√	–	HVP	
Opt. 25	9.4 m	1000	25 MHz	100 MΩ	3.0 pF	40,000 V	7 to 49 pF			HVP	
Opt. 2R	9.4 m	1000	25 MHz	100 MΩ	3.0 pF	40,000 V	7 to 49 pF	√		HVP	

ACTIVE PROBES

Type	Length	Attenuation	Bandwidth at –3dB	System Input Resistance	Typical Input C	Max Voltage DC + pk AC	Linear Range	DC Offset Range	ID/Gnd Ref.	Tip/Head Style	Page
P6201	1.8 m	1	900 MHz	100 kΩ	3.0 pF	±100 V	±0.6 V	±5.6 V		Mono	464
		10	900 MHz	1 MΩ	1.5 pF	±200 V	±6.0 V	±56 V	–	Mono	
		100	900 MHz	1 MΩ	1.5 pF	±200 V	±60 V	±200 V		Mono	
P6202A	2.0 m	10	500 MHz	10 MΩ	2.0 pF	±200 V	+6.0 V	±55 V	–	Mono	464
		100	500 MHz	10 MΩ	2.0 pF	±200 V	±60 V	±200 V		Mono	
P6204	1.5 m	10	1000 MHz	10 MΩ	1.9 pF	±40 V	±10 V	±15 V	√	5 mm (min.)	460
P6205	1.5 m	10	750 MHz	1 MΩ	2.0 pF	±40 V	±10 V	N/A	–	5 mm (min.)	460
P6207	1.6 m	10	4000 MHz	100 kΩ	0.4 pF	±40 V	±4.0 V	±5 V	–	4 mm	462
P6217	1.5 m	10	4000 MHz	100 kΩ	0.4 pF	±40 V	±4.0 V	±5 V	–	4 mm	460
P6231	1.5 m	10	1500 MHz	450 Ω	1.6 pF	±30 V	±5.0 V	±5 V	√	2.5 mm (sub.)	460
P6245	1.3 m	10	1500 MHz	1 MΩ	1.0 pF	±40 V	±8.0 V	±10 V	–	SMD	458

50Ω DIVIDER PROBES

Type	Length	Attenuation	Bandwidth at –3dB	System Input Resistance	Typical Input C	Max Voltage DC + pk AC	Instrument Input	Read Out	ID/Gnd Ref.	Tip/Head Style	Page
P6150	1 m	10	9 GHz	500 Ω	<0.15 pF	12.5 V RMS	50 Ω	–	–	Comp.	466
		1	≥3 GHz	50 Ω	N/A	*1	50 Ω				
P6156	1.5 m	10	≥3.5 GHz	500 Ω	≤1 pF	15 V RMS	50/1 MΩ	√	√	3.5 mm (Comp.)	466
Opt. 25		100	≥3.0 GHz	5000 Ω	≤1.1 pF	50 V RMS	50/1 MΩ				
		20	≥3.5 GHz	1000 Ω	≤1 pF	22 V RMS	50/1 MΩ				
		1	≥1.5 GHz	50 Ω	N/A	*2	50/1 MΩ				

DIFFERENTIAL PROBES/SIGNAL CONDITIONERS

Type	
ADA400A	For Specifications see page 501
P5200	For Specifications see page 502
P6046	For Specifications see page 500
P6135A	For Specifications see page 504
P5135	For Specifications see page 503

m = meters V = volts MHz = Megahertz MΩ = Megaohms pF = picofarads mm = millimeters

*1 *Limited by scope input or 42 V RMS.*
*2 *Limited by scope input or 50 V RMS.*

Obsolete Probes
Replacement Guide

PASSIVE PROBES

Obsolete Probe	Characteristics: Attn	B/W MHz	Comp. Range	R/O	ID	Direct Replacement	Suggested Replacement	Changes in Characteristics: Attn	B/W MHz	Comp. Range	R/O	ID	Other
P6006	10	35	15 to 55	N	N	–	**P6062B**	1/10	7/100	15 to 47	Y	–	Body Size
P6015	1000	75	12 to 47	N	N	**P6015A**	–	–	–	7 to 49	–	–	–
P6048	10	100	15 to 20	N	N	–	**P6202A/1101A**	10	500	50 Ω	Y	N	Active
P6053/B/C	10	200	15 to 35	Y	Y	–	**P6106A**	10	250	15 to 35	Y	N	Accessories
P6055	10	150	17 to 23	Y	Y	–	**P6135A**	10	150	10 to 47	Y	Y	Accessories
P6056	10	3500	50 Ω	Y	Y	–	**P6156**	10	3500	50 Ω	Y	Y	Accessories
P6057	100	1400	50 Ω	Y	N	–	**P6156 Opt 25**	100	3000	50 Ω	Y	Y	Accessories
P6101A	1	15	Any	N	N	**P6101B**	–	–	–	–	–	–	–
P6102A	10	60	36 to 55	Y	N	–	**P6062B**	1/10	7/100	15 to 47	Y	N	Accessories
P6103	10	50	15 to 35	N	N	**P6103B**	–		60	–	–	–	–
P6107A	10	100	20 to 51	Y	N	–	**P6062B**	1/10	7/100	15 to 47	Y	N	Not Rt Angle
P6108A	10	100	15 to 35	N	N	–	**P6109B**	–	–	–	Y	–	Body Size
P6109	10	150	15 to 35	Y	N	**P6109B**	–	–	100	–	–	–	–
P6115	1	5	Any	N	N	–	**P6101B**	1	15	Any	N	N	–
P6119	1/10	8/100	15 to 35	N	N	**P6119B**	–	–	10/100	–	–	–	–
P6121	10	100	20 to 26	N	N	–	**P6109B**	10	100	15 to 35	Y	N	–
P6125	5	200	15 to 33	N	N	–	**P6063B**	1/10	6/200	15 to 24	Y	N	–
P6127	1/10	8/300	12 to 18	Y	N	–	**P6063B**	1/10	6/200	15 to 24	Y	N	–
P6129	1/10	8/100	15 to 35	Y	N	**P6129B**	–	–	10/100	–	–	–	–
P6130	10	250	15 to 35	Y	N	–	**P6106A**	10	250	15-35	Y	N	Body Size
P6134	10	300	12 to 18	Y	Y	–	**P6134C**	–	–	–	–	–	Body Size
P6135	10	150	13 to 16	Y	Y	–	**P6135A**	–	–	–	–	–	Body Size
P6148A	10	50	20 to 51	Y	N	–	**P6062B**	1/10	7/100	15 to 47	Y	N	Not Rt Angle
P6149A	10	50	20 to 51	N	N	–	**P6062B**	1/10	7/100	15 to 47	Y	N	Not Rt Angle
P6562	10	350	15 to 30	Y	N	**P6562AS**	–	–	–	12 to 35	–	–	Accessories

ACTIVE PROBES

Obsolete Probe	Characteristics: Attn	B/W MHz	Linear Range	DC Offset	Max Vin	Cin pF	Rin	Suggested Replacement	Changes in Characteristics: Attn	B/W MHz	Linear Range	DC Offset	Max Vin	Cin pF	Rin
P6203	10	1000	±10 V	±10 V	40	2	10 k	P6204 w/1103 or	10	1000	±10 V	±10 V	40	1.9	10 M
								P6205 w/1103	10	750	±10 V	N/A	40	2	1 M
P6206	10	1000	±10 V	N/A	40	2	1 M	P6204 w/1103 or	10	1000	±10 V	±10 V	40	1.9	10 M
								P6205 w/1103	10	750	±10 V	N/A	40	2	1 M
P6230	10	1500	±5 V	±5 V	30	1.3	450	P6231 w/1103	10	1500	±5 V	±5 V	30	1.6	450

VOLTAGE PROBE/PAGE INDEX

Probe	Page	Probe	Page	Probe	Page	Probe	Page	Probe	Page	Probe	Page
ADA 400A	501	P6053B	454	P6105A	470	P6125	454	P6137	472	P6206	454
P400	420	P6053C	454	P6106A	470	P6127	454	P6138	472	P6207	462
P5100	496	P6055	454	P6107A	454	P6129	454	P6139A	472	P6217	460
P5135	503	P6056	454	P6108A	454	P6129B	468	P6148A	454	P6230	454
P5200	502	P6057	454	P6109	454	P6130	454	P6149A	454	P6231	460
P6006	454	P6062B	470	P6109B	468	P6131	472	P6150	466	P6245	458
P6007	496	P6063B	470	P6111B	468	P6133	472	P6156	466	P6561A/AS	474
P6008	518	P6101A	454	P6115	454	P6134	454	P6201	464	P6562	454
P6009	496	P6101B	468	P6119	454	P6134C	472	P6202A	464	P6562A/AS	474
P6015	454	P6102A	454	P6119B	468	P6135	454	P6203	454	P6563A/AS	474
P6015A	496	P6103	454	P6121	454	P6135A	504	P6204	460	P850	420
P6046	500	P6103B	468	P6122	470	P6136	472	P6205	460		
P6053	454										

Obsolete Scopes
Probe Replacement Guide

SUGGESTED REPLACEMENTS

Obsolete Scope	Passive 10X	Passive 1X/10X	SMD 10X	Low-Z	High Volt. 100X	High Volt. 1000X	Active
11000 Series							
11201/A	P6134C	P6063B	P6562AS	–	P5100	P6015A	P6204/P6205
11A72	–	–	–	P6156 Opt. 25	–	–	P6204/P6217
7000 Series							
7A13	P6135A*3	–	–	–	P5100	P6015A	–
7A15A/7A18/A	P6105A	P6129B	P6561AS	–	P5100	P6015A	P6202A*1/P6205*2
7A16A	P6106A	P6063B	P6561AS	–	P5100	P6015A	P6202A*1/P6205*2
7A19/7A24	–	–	–	P6156 Opt. 25	–	–	P6201*1/P6217*2
7A22	P6135A*3	–	–	–	–	–	–
7A26	P6106A	P6063B	P6561AS	–	P5100	P6015A–	P6202A*1/P6205*2
7A29/P	–	–	–	P6156 Opt. 25	–	–	P6201*1/P6217*2
7A42	P6131	P6063B	P6561AS	P6156 Opt. 25	P5100	–	P6202A*1/P6205*2
7D15	P6106A	P6063B	P6561AS	–	–	–	–
7D20	P6106A	P6129B	P6561AS	–	–	P6015A	–
5000 Series							
5A14N	P6006/P6102A	P6062B	P6561AS	–	P6007	P6015A	–
5A15N/5A18N	P6006/P6102A	P6062B	P6561AS	–	P6007	–	–
5A21N/5A22N	P6135A*3	–	–	–	–	–	–
5A26	P6135A*3	–	–	–	–	–	–
5A38N	P6105A	P6129B	P6561AS	–	P6009	–	–
5A45/5A48/5D10	P6105A	P6129B	P6561AS	–	P6009	P6015A	–
2400 Series							
2430/A/M	P6133 Opt. 25	P6063B	P6562AS	P6156 Opt. 25	P5100	P6015A	P6202A*1
2300 Series							
2335/2336	P6109B	P6119B	–	–	P5100	P6015A	–
2336YA	P6109B	P6119B	–	–	P5100	P6015A	–
2337	P6109B	P6119B	–	–	P5100	P6015A	–
400 Series							
434/455	P6105A	P6129B	P6561AS	–	P5100	P6015A	P6202A*1
464	P6105A	P6062B	P6561AS	–	P5100	P6015A	P6202A*1
464/M	P6105A	P6129B	P6561AS	–	P5100	P6015A	P6202A*1
465/B	P6105A	P6129B	P6561AS	–	P5100	P6015A	P6202A*1
465/M	P6105A	P6129B	P6561AS	–	P5100	P6015A	P6201*1
466	P6105A	P6062B	P6561AS	–	P5100	P6015A	P6202A*1
468	P6105A	P6129B	P6561AS	–	P5100	P6015A	P6202A*1
475/A	P6106A	P6063B	P6561AS	P6156 Opt. 25	P5100	P6015A	P6201*1
485	P6106A	P6063B	P6561AS	P6156 Opt. 25	P5100	P6015A	P6201*1
300 Series							
305/314/335	–	P6062B	–	–	–	–	–
336/A	–	P6062B	–	–	–	–	–
390AD	P6105A	P6129B	–	–	P5100	P6015A	–
TAS 400 Series							
TAS 455	P6109B	P6129B	P6561AS	–	P5100	P6015A	–
TDS 500 Series							
TDS 544A	P6139A	–	P6563AS	P6156 Opt. 25	P5100	P6015A	P6205/P6245
TM 500/5000 Series							
AM 502	P6135A*4	–	–	–	–	–	–
DC 503A/504A/5004	P6106A	–	–	–	–	–	–
DC 509/5009/510/5010	P6106A	–	–	–	–	–	–
DC 505/A	P6122	–	–	–	–	–	–
DC 508/A	P6106A	–	–	–	–	–	–
SC 501/2/3	–	P6062B	–	–	P6007	P6015A	–
SC 504	P6105A	P6129B	–	–	P6009	P6015A	–
SI5010	–	–	–	P6156*2	–	–	P6202A*1*8

**1 Requires Scope Power or 1101A Power Supply.*

**2 Requires Scope Power or 1103 Power Supply.*

**3 Differential Pair.*

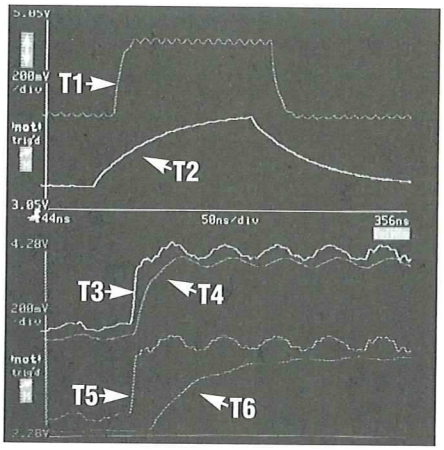
Active Probes

Choosing an Active Probe

Active performance with passive simplicity.

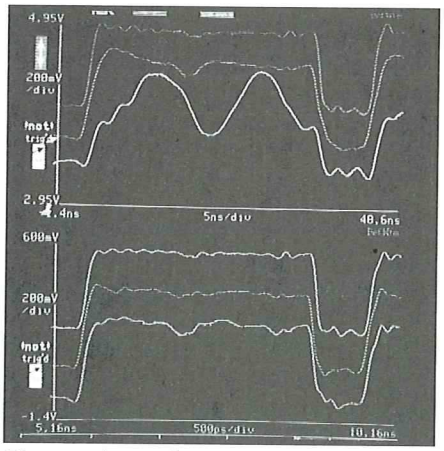
DESIGNED FOR:

- Digital Design and Debug of Logic Families Such As:
  - –ECL
  - –GaAs
  - –MOS
    - CMOS
    - FastCMOS
    - BiCMOS
  - –TTL
- Component Characterization/ Measurement of High-Speed Analog Circuitry Relative to:
  - –Amplitude Levels
  - –Aberrations
  - –Propagation Delay and Timing
  - –Bandwidths and Rise Times



The waveforms above show impedance test points of 50 Ω and 1 kΩ as probed with:

- *A 1X Passive probe [trace T1 (50 Ω), trace T2 (1 kΩ)]*
- *A 10X Active FET probe [trace T3 (50 Ω), trace T4 (1 kΩ)] and*
- *A 10X Passive probe [trace T5 (50 Ω), trace T6 (1 kΩ)]*



The waveforms above show the effects of ground lead inductance. The top three traces show how the displayed waveform changes as the passive probe's ground lead length is increased from 1/2 in. (top trace) to 6 in. to 12 in. (bottom trace). The bottom three traces show how an Active probe's waveform remains relatively unchanged, regardless of ground lead length, using the same ground lead sequence as the passive probe in the top three traces.

Today active probes achieve higher performance than their predecessors and their high impedance passive counterparts. They provide:

Easy Use:

- **Integral Probe Power** from compatible instrumentation.
- **Scope AutoCal*[1]** which compensates for probe offsets and drift.
- **Readout Encoding** accounts for probe attenuation factor and reduces measurement reading errors.
- **Auto Termination** eliminates the need to manually terminate the system (TEKPROBE™ models).
- **Wide Linear Dynamic Range** allows access to today's logic voltage levels.
- **Variable DC Offset** allows correction for DC levels, to bring the signal into the probe's linear dynamic range. Probe Offset is controlled by a compatible instrument, externally by the probe itself or, for the P6205 model, there is no probe offset control to deal with.

Truer Signal Reproduction and Fidelity

- **Ultra-low Input Capacitances and High Input Resistances** allow making measurements at unknown impedance test points by maintaining higher probe input impedance across a wider bandpass and reduce ground lead loop effects allowing the use of longer ground leads than a standard passive probe.
- **DC up to 4 GHz Bandwidths** allow improved AC and DC signal characterization and testing.

Service, Durability and Reliability

- **1 Year Warranty**
- **Gold-Plated Replaceable Probe Tips** (Replaceable except P6207/P6217) improve electrical connections, reliability and lower maintenance costs.

[1] 11000 Series only.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Active Probes
Choosing an Active Probe

CHOOSING AN ACTIVE PROBE

WHERE or WHEN YOU HAVE	WHAT YOU NEED	WHY
Source impedance test points; >100 Ω and/or low power circuits	Any active probe with greater than 100 kΩ and <2 pF; depends on the instrumentation interface, the frequency range and the sensitivity required.	Active probes maintain a higher input impedance throughout their frequency range. The low input C and high input R combination allows the acquisition of the fastest rise times (input C influenced) and accurate amplitude measurements and provides less signal drain than a conventional passive probe.
Small signal circuit analysis	P6201 with its 1X sensitivity or P6217, P6245, P6204 and P6205 with 11 K high resolution mode.	Unity gain (1X) allows full sensitivity without bandwidth loss and maintains signal amplitude of small signals.
Characterization of circuits >350 MHz	The use of active probes or 50 Ω divider probes is recommended, depends upon the frequency and measurement response required.	Low input C, 50 Ω divider probes provide excellent rise time and propagation delay measurements. However, active probes provide better overall circuit analysis capabilities (amplitudes, rise times, propagation delay, aberrations,etc.).
Tuned Circuits: Oscillators, tank circuits, etc.	P6217, P6207, P6245, P6201, P6204 dependent upon the frequency and measurement response required.	Low input C and high input R minimize circuit disturbance by reducing any additional impedance to the circuit.
General purpose circuit characterization and trouble-shooting where the circuit under test impedance is unknown or not easily calculated, and/or access to circuit ground is several inches away.	The P6205 and P6245 active probes provide low input C, high input R, durability and a budget price.	Low input C and the high input R provide truer signal fidelity for unknown or uncalculated impedance points. Lower input C's also provide a higher ring frequency than passive probes, allowing the use of longer grounds.

Probe Type	Cable Length in meters	Atten-uation	Band-width at –3dB in MHz	Input C in ≤pF	Input R in Ω	Linear Dynamic Range in Volts	DC Offset Range in Volts	Maximum Voltage in Volts (DC + pk AC)	Interface/ Readout/ Identify*2	Recommended Instrument
P6201	1.8	1X 10X 100X	900 900 900	3 1.5 1.5	100 k 1 M 1 M	±0.6 ±6.0 ±60	±5.6 ±56 ±200	±100 ±200 ±200	BNC/Y/N BNC/Y/N BNC/Y/N	400/2400/ 7000 Series*3
P6202A	2	10X 100X*1	500 500	2 2	10 M 10 M	±6.0 ±60	±55 ±200	±200 ±200	BNC/Y/N BNC/N/N	400/2400/ 7000 Series *3
P6204	1.5	10X	1000	1.9	10 M	±10	±15	±40	TPB/Y/Y	11000*4 TDS 400*5/ 500 (A)/600(A)/ 700A
P6205	1.5	10X	750	2	1 M	±10	NA	±40	TPB/Y/N	11000*4 TDS 400*5/ 500 (A)/600(A)/ 700A
P6217	1.5	10X	4000	0.4 (typical)	100 k	±4.0	±5.0	±40	TPB/Y/N	11000*4 TDS 400*5/ 500 (A)/600(A)/ 700A
P6231	1.5	10X	1500	1.6	450	±5.0	±5.0	±30	TPB/Y/Y	11000 *4
P6207	1.6	10X	4000	0.4 (typical)	100 k	±4.0	±5.0	±40	TPS/Y/N	TDS 820
P6245	1.3	10X	1500	≤1	1M	±8.0	±10.0	±40	TPBN/N	11000*4 TDS 400*5/ 500 (A)/600(A)/ 700A

**1 Optional Accessory. Order 010-0384-00.*
**2 Interface/Readout/Identify-AutoProbe Code: (TPB=TEKPROBE™ BNC)/(TPS=TEKPROBE™ SMA)/(BNC=Conventional BNC)/(Y=Yes)/(N=No).*
**3 Requires Probe Power connector on the scope or recommended power supply.*
**4 11000 Series = 11A32/11A34/11A52/11A71/11A81 in a compatible mainframe, i.e., DSA600/CSA400/11400, etc.*
**5 P6204 and P6217 DC Offset Functions are not incorporated into the TDS400.*

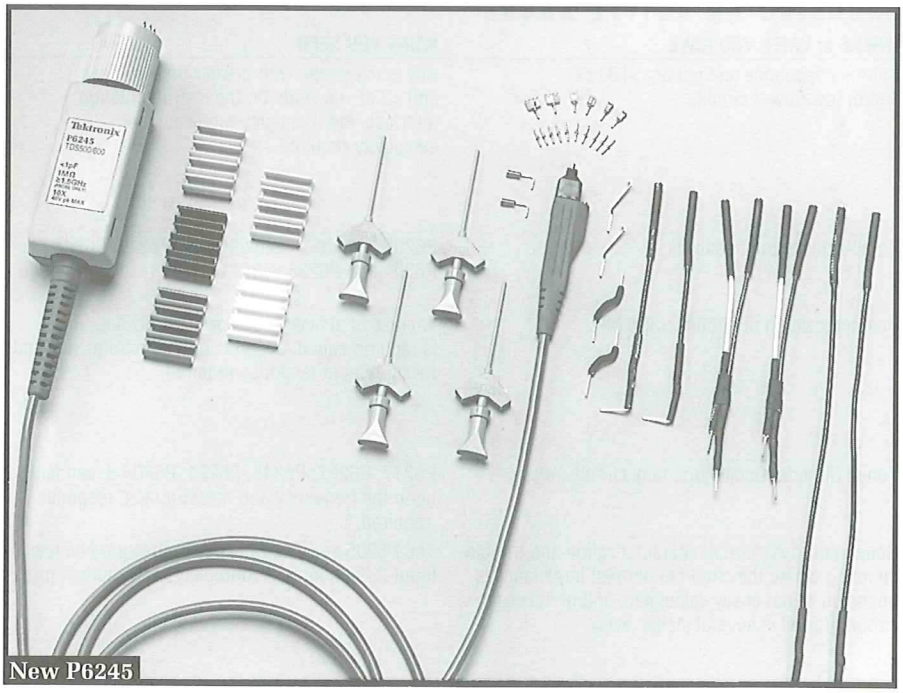
Active FET Probe for SMD's

For TEKPROBE™ BNC Interfaces

An "Off the shelf", Low Mass/Low Loading Signal Acquisition solution for Digital Systems Designers.

New P6245

- ≤1 pF Input Capacitance
- ≥1.5 GHz Bandwidth
- 1 MΩ Input Resistance
- Direct Access to SMD's as Small as 0.5 mm Pitch
- Measures CMOS, BiCMOS, ECL, GaAs and TTL logic
- Low Mass Probe Head/Cable
- No Additional Power Supplies or Cables Are Required with TekProbe™ BNC Interface



New P6245 Active FET Probe

The P6245 Active FET probe provides the electrical and mechanical performance required for today's digital systems designs. The P6245 achieves high speed signal acquisition by solving three traditional problems:

- Lower DUT loading (≤1 pF/1 MΩ Probe loading)
- Direct and easy access to SMDs (Small compact probe head and versatile attachment accessories allow direct connection to the DUT).
- Access DUT signals at scope bandwidth (P6245 Active FET Probe provides scope bandwidth at the probe tip for the TDS 684A.)

SCOPE COMPATIBILITY

TDS 700 Series	TDS 784A, TDS 744A
TDS 600 Series	TDS 684A, TDS 644A, TDS 640A, TDS 620A
TDS 500 Series	TDS 544A, TDS 540A, TDS 524A, TDS 520A,
11000 Series with TEKPROBE™ Interface	11A32, 11A33, 11A34, 11A52, 11A71, 11A72, 11A81

APPLICATIONS

- **High-speed Digital Systems Design**
- **Component Design/Characterization**
- **Educational Research**
- **Manufacturing Engineering and Test**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Active FET Probe for SMD's

For TEKPROBE™ BNC Interfaces

P6245

Characteristics

Bandwidth – Probe Only: 1.5 GHz (calculated from rise time).
With TDS 684A, System: DC to ≥1 GHz.

Rise Time – Probe Only: ≤267 ps.

Attenuation – Probe Only: 10X ±2 % at DC.

Propagation Delay – Probe Only: 5.3 ns, ±200 ps.

Output Load Requirement – 50 Ω ± 0.5 Ω.

DC Offset Range – ±10 V.

Output Offset (Zero) – Probe Only: ±5 mV. System on screen display with TEKPROBE™ interface: ±50 mV.

Electrostatic Immunity – PER IEC 801-2. >8 kV (from a 330 Ω/150 pF source).

Typical Characteristics

Input C – System: ≤1 pF.

Input R – System: 1 MΩ at DC.

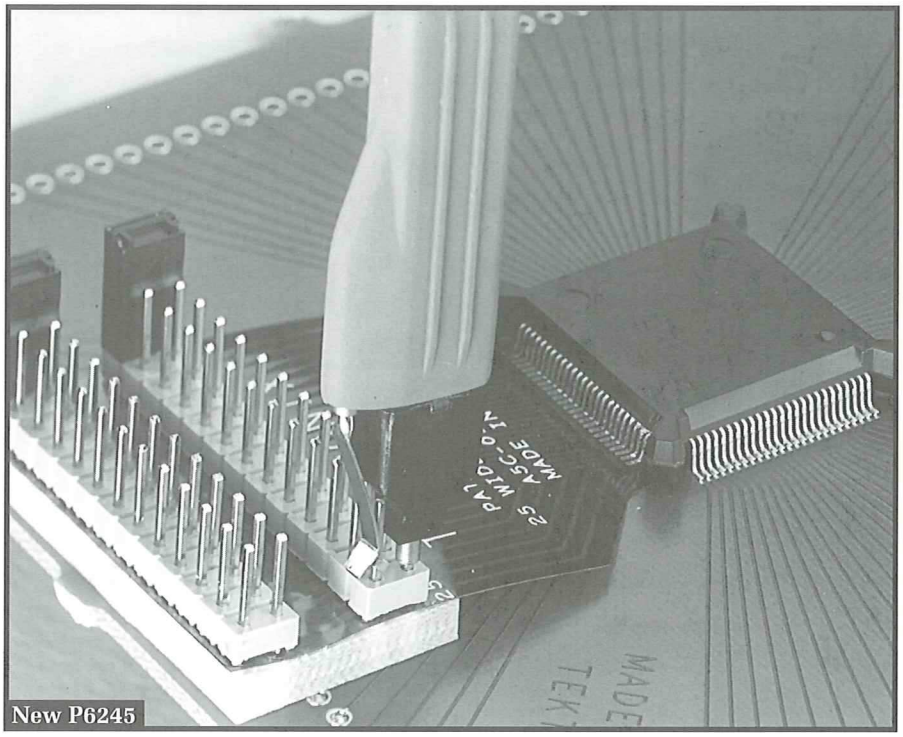
DC Thermal Drift – Probe Only: ≤100 µV/°C System on screen display with TEKPROBE™ interface: ≤1 mV/°C.

Linearity Error – ±4% at DC.

Input Linear Dynamic Range ($V_{\text{dynamic limit}}$) – ±8 V; at ±4 % error.

Maximum Non-destructive Input Voltage – ±40 V (DC + pk AC).

Power Supply Requirements –
+5 V ±3% @ 100 mA;
–5 V ±3% @ 100 mA.



PHYSICAL CHARACTERISTICS

Dimensions	mm	ft.
Length	1.3	~4.26
Weight	**kg**	**lb.**
(includes accessories)	2.2	1

ORDERING INFORMATION

P6245
Active FET Probe **$1,395**
Includes: Two each: 50 mil, 25 mil (0.65 mm), and 0.5 mm SureFoot™ Adapters; 10 each Solderable Probe Tips; 2 each 1 in., 3 in., and 6 in. Ground Leads; 2 each Y Lead Adapters; 4 each SMT KlipChip™; 2 each of 5 colors, Cable Markers; 2 each Spring Adapter: Right Angle; and Instruction Manual.

RECOMMENDED ACCESSORIES
See pages 476-494 for complete selection information.

Power Supply – TEKPROBE™ Power Supply
Order 1103 ..... **$655**
See page 461 for complete selection information.

SMD PROBING ADAPTERS

SureFoot™ Adapters –
See page 478 for complete selection information.
50 mil pitch. Order SF501 ..... **$39**
25 mil and 0.65 mm pitch. Order SF502 ..... **$39**
0.5 mm pitch. Order SF503 ..... **$39**

FlexLead™ Adapters –
JEDEC Packages (25 mil pitch)*1
EIAJ Packages (0.65 mm pitch)*1
EIAJ Packages (0.5 mm pitch)*1
1 See page 484 for complete FlexLead Adapters information.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

P6217
P6205
1103

P6204
P6231

Active FET Probes

For TEKPROBE™ BNC Interfaces

Easy to Use, Active Performance, Passive Simplicity.

P6217/P6205/ P6204/P6231

- Ultra Low Input Capacitance
- High Input Resistance
- True Signal Fidelity up to 4 GHz
- Variable DC Offset
- Integral Probe Power TEKPROBE™ BNC

P6217

- DC to 4 GHz
- ≤0.40 pF Input C
- 100 kΩ Input R
- DC Offset
- Small Size

P6205

- DC to 750 MHz
- 2 pF Input C
- 1 MΩ Input R
- Low Price

P6204

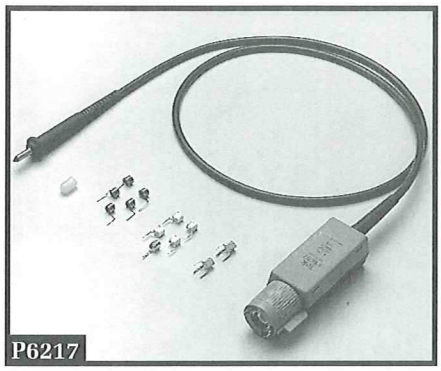
- DC to 1 GHz
- 1.9 pF Input C
- 10 MΩ Input R
- DC Offset
- Identify Button

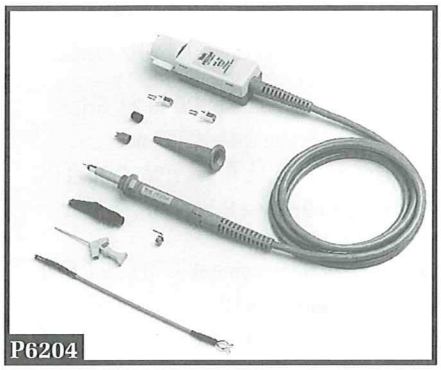
P6231

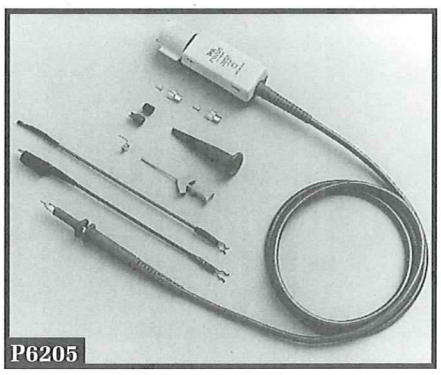
- DC to 1.5 GHz
- 1.6 pF Input C
- 450 Ω Input R
- Bias/Offset (Tip Nulling)
- Small Size

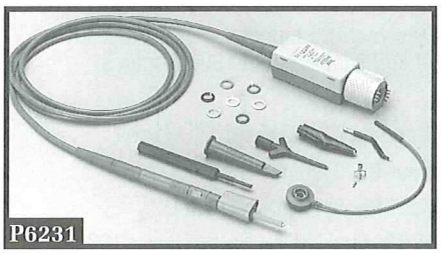
1103

- Powers up to Two Probes
- For Use with:
  - 11000 Series Probes on Non-TEKPROBE™ Interfaced Scopes
  - P6203, P6204, P6205, P6217, P6231, P6245
- Overload Protected









The P6204, P6205, P6217 and P6231 Probes are Tektronix' line of Low Circuit Loading Signal Acquisition probes for CSA (Communications Signal Analyzers), DSA (Digitizing Signal Analyzers), 11000 Series and the TDS Family of Oscilloscopes.

The P6204, P6205 and P6217 are designed with FET devices for their inputs, which allows very high input resistance values and low input capacitances.

The P6231 is a specialty active probe that provides a higher impedance level to DC through a Bias/Offset capability which provides an adjustable tip nulling voltage.

The P6217 provides the widest bandwidth and lowest input capacitance at 100 KΩ available for a handheld active voltage probe.

The P6204 provides wide bandwidth, with low input capacitance and the highest input resistance available. At the same time the P6204 is the only active FET probe available which provides remote control capabilities.

The P6205 provides low input capacitance and high input resistance performance at a budget price.

All three Active FET probes provide a wide linear dynamic input range for accessing most digital device families using today's logic voltage levels.

Power for the P6204, P6205, P6217 and P6231s is supplied by the CSA, DSA, TDS and 11000 Series mainframes through the TEKPROBE™ BNC Interface, eliminating the need for extra cabling and/or external power supplies*1.

A variable DC Offset function, which is controlled through the mainframe (CSA, DSA and 11000 series) to bring signals (those within the offset control range) into the dynamic range of the probe, is available for the P6204 and P6217 probes.

The P6231 Bias/Offset probe acts as a standard 500 Ω passive divider voltage with the additional capability of having an adjustable tip nulling voltage. This feature reduces the DC-Loading effects of the probe when it is used to measure signals whose mid-voltage value is not at zero volts, or in circuits where the termination impedance is not returned to ground level. The Input Bias/Offset Voltage may be adjusted so that the voltage at the probe input resistor is equal to the test signal potential: thus no DC current flows through the probe's input resistor.



P6205/1103 available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Active FET Probes

For TEKPROBE™ BNC Interfaces

P6217 P6204 P6205 P6231 1103

Probe information such as type, serial number, attenuation factor, offset scale factor, input resistance, and termination resistance required is communicated through the TEKPROBE™ Interface between the Active Probe and the CSA, DSA and 11000 Series mainframes. This information is used by these oscilloscope mainframes during the scope initialization sequence and measurement analysis.

Remote Control of several 11000 Series Programmable Functions/Actions is possible using the "Identify Button" on the P6204 and P6231 probe head. These functions include: Autoset, recall the next in a series of stored setups, invoke Automatic-Measurement, issue an SRQ (service action request), or activate the trace identification function.

These Active Probes may also be used with 50 Ω or 1 MΩ oscilloscope systems, with conventional BNC interfaces, via the Tektronix 1103 TEKPROBE™ Power Supply. The 1103 has dual TEKPROBE™ inputs, dual BNC signal outputs, and dual voltage offset on/off switches and potentiometers.

BENEFIT HIGHLIGHTS

- **Low Input C, High Input R –** Minimizes circuit under test loading.
- **Probe Power Directly from CSA, DSA,TDS or 11000 Series TEKPROBE™ SMA Interfaces –** Means no additional cables or power supplies required.*1
- **Variable DC Offset (Except P6205/P6231) –** Allows correction for DC levels to bring the signal into the probe's dynamic measurement range.
- **Readout Coding for 10X Attenuation –** Reduces confusion and errors in measurement readings.
- **Gold Plated Replaceable Probe Tips (Except P6217) –** Improved electrical connections and lower maintenance costs.
- **Miniature Size Accessories (Except P6217/P6231) –** Provides wide range of circuit attachments.
- **UL Listed –** Third party certification for safe operation.

DESIGNED FOR:

- Digital Design and Debug of Logic Families such as:
  - ECL
  - GaAs
  - MOS
    - CMOS
    - FastCMOS
    - BiCMOS
  - TTL
- Component Characterization/ Measurement of High-Speed Analog Circuitry Relative to:
  - Amplitude Levels
  - Aberrations
  - Propagation Delay and Timing
  - Bandwidths and Rise Times

**1 To use these TEKPROBE™ BNC Interface Probes on the 11800 or CSA800 Series requires a 1103 TEKPROBE™ Power Supply, an SMA Male to BNC Female adapter, and a 50 Ω BNC cable.*

CHARACTERISTICS

Probe Type	Nominal Cable Length in meters	Attenuation	Bandwidth at –3dB in MHz	Input C in pF	Input R in Ω	Linear Dynamic Range in Volts	DC Offset Range in Volts	Max. Voltage in Volts (DC + pk AC)	Interface/ Readout/ Identify*1	Recommended Instrument
P6204	1.5	10X	1000	1.9	10 M	±10	±15	±40	TPB/Y/Y	11000 *2
P6205	1.5	10X	750	2	1 M	±10	NA	±40	TPB/Y/N	11000 *2/TDS400 *3
P6217	1.5	10X	4000	0.40 Typical	100 k	±4.0	±5.0	±40	TPB/Y/N	TDS 500(A)/ TDS 600(A)/TDS 700
P6231	1.5	10X	1500	1.6	450	±5.0	±5.0	±30	TPB/Y/Y	11000 *2

**1 Interface/Readout/Identify Code: (TPB=TEKPROBE™ BNC)/(TPS=TEKPROBE™ SMA)/(BNC=CONVENTIONAL BNC)/(Y=Yes)/(N=No).*
**2 11000 SERIES = 11A32/11A34/11A52/11A71/11A72/11A81.*
**3 P6204, P6217, and P6245 DC Offset functions are not incorporated into the TDS400 Family.*

ORDERING INFORMATION

P6204
10X, 1 GHz Active FET Probe **$1,595**
Includes: Retractable Hook Tip (013-0107-07); 6 in. Ground Lead with Alligator (196-3120-00); 6 in. Ground Lead with Square Pin Receptacle (196-3198-00); Ground Contact, Spring (214-4125-00) SMT KlipChip™ (206-0364-00); Insulating Ground Cover (166-0404-01); IC Test Tip; 2 Probe Tip to Circuit Board Adapters; Carrying Case; Instruction Manual (070-6949-00).

P6205
10X, 750 MHz Active FET Probe **$595**
Includes: Same as P6204 except Instruction Manual (070-8202-00).

P6217
4 GHz Active FET Probe..... **$3,595**
Includes: 4-post ECB Mount Ground Socket (131-5308-00); Edge Tab Ground Socket (131-5309-00); 2 each of 5 Lengths Wire-form Ground (131-5482-00); 1 Electrostatic Protection Cap (200-3961-00); 1 Adjustable Anti-static Wrist Strap (006-3415-04); Storage Cabinet; Instruction Manual (070-8553-00).

P6231
10X, 1.5 GHz Bias/Offset Probe **$799**
Includes: Retractable Probe Tip (013-0208-02); Probe Tip-to-Circuit Board Connector (131-2766-03); 6 in. Ground Lead with Alligator (196-3305-00); 6 in. Ground Lead with Square Pin Receptacle (196-3113-02); 2 in. Ground Lead (195-4240-00); SMT KlipChip™ (206-0364-00); Probe Adjustment Tool (003-1433-00); Probe Holder (352-0351-00); Cable Markers, 2 each of 4 Colors; Carrying Case; Instruction Manual (070-6027-00).

RECOMMENDED ACCESSORIES
See page 476-494 for complete selection information.

Probe Tip Adapter – For P6207, P6217 and SD-14 Active Probes. Instruction Sheet Plus SMA Male 50 Ω Termination provided.
Order 013-0271-01 ..... **$560**

1103
TEKPROBE™ Power Supply..... **$655**
For P6203, P6204, P6205. P6217, P6245 and P6231. Powers 2 Probes.

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Opt. A5 – Available.
See the General Customer Information Section for description.

ADDITIONAL ACCESSORIES (FOR 1103)
36 In. Precision 50 Ω BNC cable – Order 012-0482-00..... **$38**
50 Ω Feedthrough Termination – Order 011-0049-01 ..... **$40**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

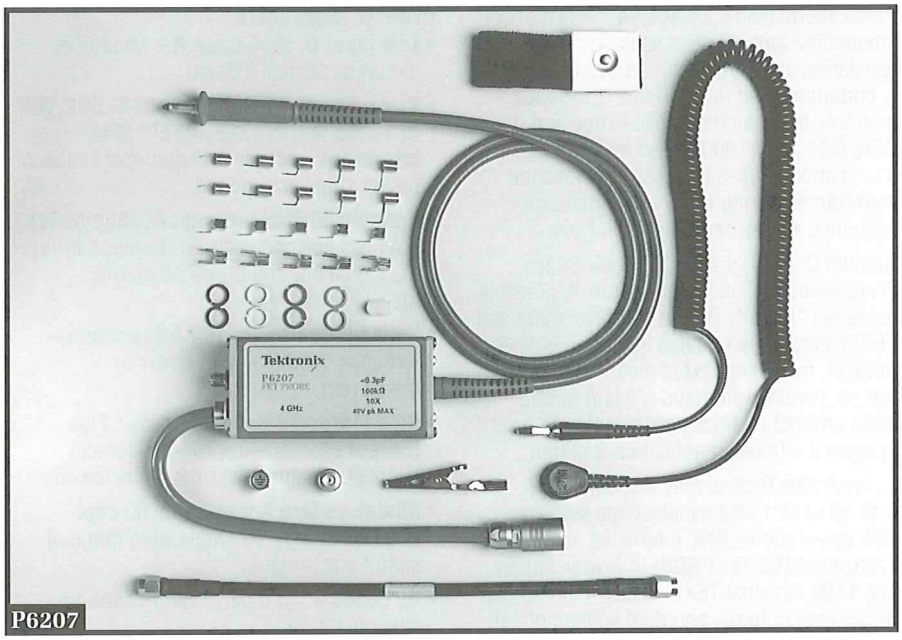
Active FET Probe

For TEKPROBE™ SMA Interfaces

High Performance Active Probes for the TDS 820 Series Oscilloscopes.

P6207

- True Signal Fidelity – DC up to 4 GHz
- Ultra-low Input Capacitance – 0.4 pF Provides Lower Circuit Loading and the Use of Longer Ground Leads
- 100 kΩ Input Resistance – Maintains Circuit Biasing Levels
- Easy to Use – Active Performance with Passive Simplicity
- Variable DC Offset ±5 V
- Integral Probe Power TEKPROBE™ SMA
- Small Geometry Accessibility



P6207 Active FET Probe

The P6207 Active (FET) Probe is a Low Circuit Loading Signal Acquisition probe for TDS820 Oscilloscopes.

The P6207 provides the widest bandwidth and lowest input capacitance at 100 kΩ available for a handheld active voltage probe.

The P6207 provides a wide linear dynamic input range for accessing most digital device families using today's logic voltage levels.

The reduced input capacitance for this active FET probe reduces the AC current flow and reduces the sensitivity to the ground loop, thereby easing ground lead length requirements.

The P6207 provides a variable DC Offset function which is controlled through the TDS800 Series mainframe to bring signals (those within the offset control range) into the dynamic range of the probe.

Probe information such as type, serial number, attenuation factor; offset scale factor, input resistance, and termination resistance required is communicated through the TEKPROBE™ SMA Interface between the Active Probe and the TDS 820 Series mainframe. This information is used by the oscilloscope mainframe during the scope initialization sequence and measurement analysis.

Power for the P6207 is supplied by the TDS 820 Series mainframes through the TEKPROBE™ SMA Interface, eliminating the need for extra cabling and/or external power supplies.

BENEFIT HIGHLIGHTS

- **Low Input C, High Input R** – Minimizes circuit under test loading.
- **Probe Power Directly from TDS820 Series TEKPROBE™ SMA Interfaces** – Means no additional cables or power supplies required.
- **Variable DC Offset** – Allows correction for DC levels to bring the signal into the probe's dynamic measurement range.
- **Readout Coding for 10X Attenuation** – Reduces confusion and errors in measurement readings.
- **Gold Plated Probe Tips** – Improved electrical connections.
- **UL Listed** – Third party certification for safe operation.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

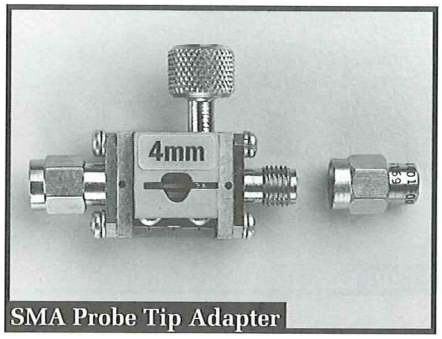
Tektronix Measurement products are manufactured in ISO registered facilities.

Active FET Probe
For TEKPROBE™ SMA Interfaces

PROBE TIP ADAPTER

The Probe Tip Adapter is a high-performance 50 Ω "T" type pickoff for use with high impedance Tektronix P6207 or P6217 Active FET probes, the Tektronix SD-14 Sampling Head and other probes compatible with the 4 mm probe tip system. The in-line portion of the "T" is fitted with SMA-compatible 2.92 mm connector, one end male and one end female. The signal pickoff point is a receptacle for the Probe Tip. An SMA male 50 Ω termination is included.

When used with the P6207 or P6217, the Probe Tip Adapter allows signal pickoff from a 50 Ω system with a minimum of disturbance of the system characteristics. This provides a convenient means of obtaining a signal for the P6207 or P6217 from a closed coaxial 50 Ω system.



SMA Probe Tip Adapter

DESIGNED FOR:

- Digital Design and Debug of Logic Families such as:
  - ECL
  - GaAs
  - MOS
    - CMOS
    - FastCMOS
    - BiCMOS
  - TTL
- Component Characterization/ Measurement of High-speed Analog Circuitry Relative to:
  - Amplitude Levels
  - Aberrations
  - Propagation Delay and Timing
  - Bandwidths and Rise Times

CHARACTERISTICS

Probe Type	Nominal Cable Length in meters	Attenuation	Bandwidth at –3dB in MHz	Input C in pF	Input R in Ω	Linear Dynamic Range in Volts	DC Offset Range in Volts	Maximum Voltage in Volts (DC + pk AC)	Interface/ Readout/ Identify*[1]	Recommended Instrument
P6207	1.6	10X	4000	0.4 Typical	100 k	±4.0	±5.0	±40	TPS/Y/N	TDS820

*[1] *Interface/Readout/Identify-autoProbe Code: (TPB=TEKPROBE™ BNC)/(TPS=TEKPROBE™ SMA)/(BNC=Conventional BNC)/(Y=Yes)/(N=No).*

ORDERING INFORMATION

P6207
4 GHz Active FET Probe, SMA **$3,595**
Includes: 1 RF Cable Assembly, 8.5 in. (174-1120-00); 4-post ECB Mount Ground Socket (131-5308-00); Edge Tab Ground Socket (131-5309-00); 2 each of 5 Lengths Wire-form Ground (131-5482-00); 1 Electrostatic Protection Cap (200-3961-00); 1 SMA Shorting Connector (015-1021-00); 1 Adjustable Antistatic Wrist Strap (006-3415-04); Storage Cabinet; Instruction Manual (070-7909-00).

RECOMMENDED ACCESSORIES
See page 476-494 for complete selection information.

Probe Tip Adapter – For P6207, P6217, SD-14. Active Probes. Instruction Sheet plus SMA Male 50 Ω Termination Provided (015-1022-00). Order 013-0271-01 ..... **$560**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

P6201
P6202A
1101A

Active FET Probes
For 50 Ω and 1 MΩ Interfaces

Large and Small Signal Measurements while Maintaining Low Capacitive Loading.

P6201/ P6202A

- True Signal Fidelity, DC up to 900 MHz
- Low Input Capacitance, <1.5 pF
- High Input Resistance 10 MΩ
- Variable DC Offset, Up to ±200 V
- Selectable 50 Ω, Termination for Use with 50 Ω or 1 MΩ Inputs

P6201

- DC to 900 MHz
- 1.5 pF Input C*1
- 1 MΩ Input R*1
- Unity Gain
- 1X/10X/100X
- DC Offset
- AC-DC Coupling

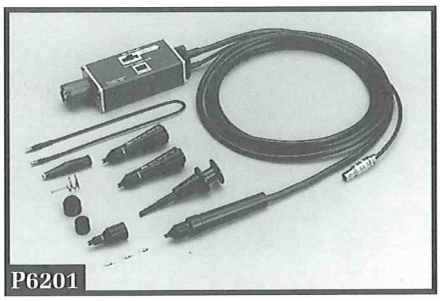
P6202A

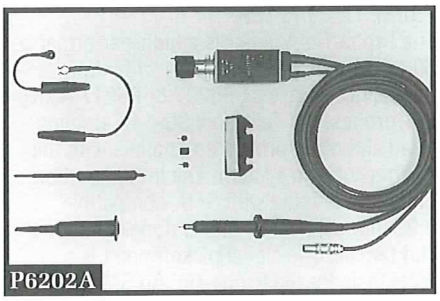
- DC to 500 MHz
- 2 pF Input C
- 10 M Ω Input R
- 10X/Optional 100X
- DC Offset
- AC-DC Coupling

1101A

- Powers up to Two Probes
- For Probe Use with Oscilloscopes that Do Not Have Probe Power
- Compatible with the P6201, P6202A, and P6230
- Overload Protected

**1 See Specifications.*


P6201


P6202A

P6201/P6202A

The P6201 and P6202A are Tektronix' line of Low Circuit Loading Active Signal Acquisition probes for 400 Series, 2400 Series, and 7000 Series Families of Oscilloscopes.

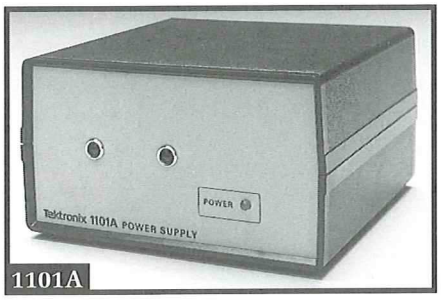
The P6201 and P6202A with Active FET devices in their inputs provide very high input impedances.

Both the P6201 and P6202A probes provide a wide linear dynamic input range for accessing most digital device families using today's logic voltage levels.

The P6201 provides unity gain (1X) and is the best general purpose FET probe within its voltage range. Plug-on attenuator heads provide wider dynamic ranges (10X and 100X), while maintaining the oscilloscope readout factor.

Wider dynamic input range for the P6202A is achieved by an optional 10X attenuator head which provides 100X attenuation.

Both the P6201 and P6202A probes provide a variable DC Offset function which is controlled via the offset controls on the probe's compensation box to bring signals (those within the offset control range) into the dynamic range of the probe.



1101A

AC or DC coupling selection is available on the P6201 and P6202A FET Probes. When AC coupled, the DC voltage component is blocked allowing viewing of super-imposed signals.

A self-contained selectable 50 Ω termination switch allows the P6201 or P6202A to be terminated into a 50 Ω or 1 MΩ oscilloscope inputs.

Power for the P6201 and P6202A is supplied by the 400 Series, 2400 Series, and 7000 Series mainframes through the optional Probe Power Jack, or the 1101A Power Supply.

The P6201 or P6202A may also be used with other 50 Ω and 1 MΩ input real-time oscilloscopes, sampling systems, spectrum analyzers and counters via the 1101A and appropriate interface adapters (SMA to BNC, GR to BNC, etc.).

The 1101A power supply provides external power to probes when the oscilloscope used does not have the capability to supply probe power.

The 1101A has two power receptacles that will power up to two independent probes, such as the P6201, P6202A, and P6230.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

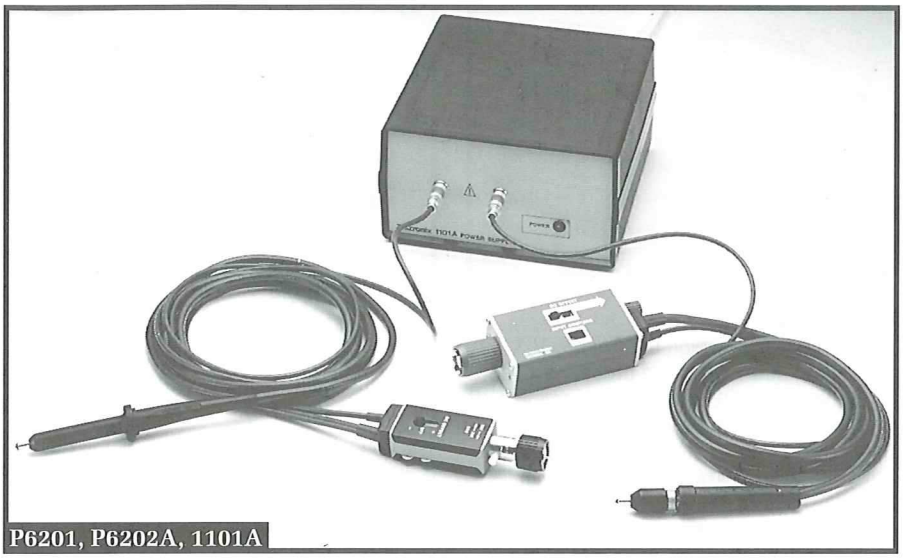
ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Active FET Probes

For 50 Ω and 1 MΩ Interfaces

P6201
P6202A
1101A


P6201, P6202A, 1101A

DESIGNED FOR:

- Digital Design and Debug of Logic Families such as:
  - ECL
  - GaAs
  - MOS
    - CMOS
    - FastCMOS
    - BiCMOS
  - TTL
- Component Characterization/ Measurement of High-speed Analog Circuitry Relative to:
  - Amplitude Levels
  - Aberrations
  - Propagation Delay and Timing
  - Bandwidths and Rise Times

CHARACTERISTICS

Probe Type	Nominal Cable Length in meters	Attenuation	Bandwidth at –3dB in MHz	Input C in pF	Input R in Ω	Linear Dynamic Range in Volts	DC Offset Range in Volts	Maximum Voltage in Volts (DC + pk AC)	Interface/ Readout/ Identify*1	Recommended Instrument
P6201	1.8	1X	900	3	100 k	±0.6	±5.6	±100	BNC/Y/N	400 / 2400 / 7000 Series *2
		10X	900	1.5	1 M	±6.0	±56	±200	BNC/Y/N	
		100X	900	1.5	1 M	±60.0	±200	±200	BNC/Y/N	
P6202A	2	10X	500	2	10 M	±6.0	±55	±200	BNC/Y/N	400 / 2400 / 7000 Series *2
		100X*3	500	2	10 M	±60.0	±200	±200	BNC/Y/N	

*1 *Interface/Readout/Identify-autoProbe Code: (TPB=TEKPROBE™ BNC) / (TPS=TEKPROBE™ SMA) / (BNC=Conventional BNC) / (Y=Yes) / (N=No).*

*2 *Requires Probe Power connector on mainframe or 1101A Power Supply.*

*3 *Optional Accessory. Order 010-0384-00.*

ORDERING INFORMATION

P6201
1X, 900 MHz FET Probe **$1,595**
Includes: Retractable Probe Tip (013-0135-00); 10X Attenuator Head (010-0376-00); 100X Attenuator Head (010-0377-00); 3 Probe Tips (206-0200-00); Miniature Probe Tip Adapter (103-0164-00); 12 in. Ground Lead (175-0848-02); Ground Contact (131-1302-00); Alligator Clip (344-0046-00); Electrical Insulating Sleeve (166-0557-00); Ground Contact Insulator (342-0180-00); Probe Holder (352-0351-00); Carrying Case; Instruction Manual (070-1306-01).

P6202A
10X, 500 MHz FET Probe **$1,115**
Includes: Retractable Probe Tip (013-0097-01); 2 Alligator Clips (344-0046-00); Probe Holder (352-0351-00); 3 in. Ground Lead (175-0849-00); Probe Adjustment Tool (003-0675-01); 6 in. Ground Lead (175-1017-00); 2 Replaceable Probe Tips (206-0230-01); Electrical Insulating Sleeve (166-0404-01); Carrying Case; Instruction Manual (070-3642-00).

ADDITIONAL ACCESSORIES
Also see pages 476-494 for complete selection information.

10X Attenuator – (P6202A only) For a total of 100X attenuation. Order 010-0384-00 ..... **$140**

1101A Power Supply –
For P6201, P6202A Powers 2 Probes **$695**

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro, 220 V 50 Hz ..... **NC**
Opt. A2 – United Kingdom, 240 V 50 Hz ..... **NC**
Opt. A3 – Australian, 240 V 50 Hz ..... **NC**
Opt. A4 – North American, 240 V 60 Hz ..... **NC**
Opt. A5 – Switzerland, 220 V 50 Hz ..... **NC**

See General Customer Information Section for additional description.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

P6150
P6156

50Ω Divider (Zo)
Low Impedance Zo
TDR Passive Probes

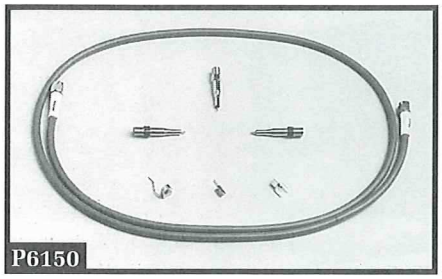
50 Ω divider probes for high speed edge measurements and propagation delays.

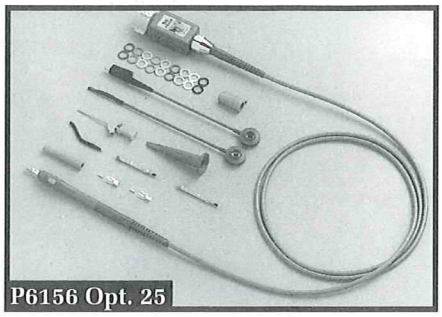
P6150
- 9 GHz

P6156
- 3.5 GHz

TYPICAL APPLICATIONS
- High Speed Device Characterization in Microwave Communication, Signal Processing, and Logic Applications
- Propagation Delays for ECL, GaAs and Other Logic Circuitry and Devices
- Circuit Board Impedance Testing (TDR)
- High Speed Sampling Systems

FEATURES/BENEFITS
- Low Capacitive Loading to Extremely High Frequencies
- Interchangeable Attenuator Tip Assemblies, 1X and 10X (20X and 100X P6156 Only)


P6150


P6156 Opt. 25

P6150 DC TO 9 GHz
The P6150 is a very high bandwidth, 10X attenuation, low impedance probe designed for use with the SD2X family of Sampling/TDR plug-ins. The probe consists of interchangeable, screw-in attenuator tip assemblies (1X and 10X) and an SMA-to-SMA probe cable. An assortment of circuit and grounding attachments is included to optimize attachment to the device under test while maintaining high signal integrity.

P6156 DC TO 3.5 GHz
The P6156 is a 3.5 GHz, low impedance Zo probe (50 Ω divider) which comes standard with a 10X (500 Ω) attenuator tip. The 100X attenuation value is available as an option, and the 1X and 20X attenuators may be purchased as replaceable sub-assemblies. Although designed for the 11A52, 11A72, and 11A82, the P6156 probe may be used with 11000-Series plug-ins, the 11800-Series SD2X Sampling/TDR plug-ins, 7000-Series plug-ins and Sampling/TDR units, 2400-Series, or other 50 Ω/1 MΩ input channel amplifiers and oscilloscopes (with the proper adapters).

The 50 Ω Termination required by the P6156 is automatically sensed by 1100-Series mainframes and plug-ins.The P6156 may be directly connected to a 50 Ω input, but requires a 50 Ω termination when used with 1 MΩ amplifiers. Check the instruction sheet for proper usage. This probe gives you a handy identify button for accessing many of the functions of your 11000 or DSA600 Series scopes from the probe. The compact tip size is perfect for accessing small geometry circuits. The attenuator tips are color-coded to a switch on the compensation box of the P6156 to help in properly setting the readout scale factor.

Note: The P6156 attenuator tip must be changed and the compensation box readout switch changed to provide the various 1X, 10X, 20X, and 100X attenuation values. Tip colors match switch setting colors.

CHARACTERISTICS

Probe Type	Nominal Length	Attenuation	Bandwidth	Rise Time	Loading Input R/C	Max V In	Propagation Delay
P6150	1 m	10X ±2% 1X ±2%	9 GHz ≥3 GHz	<38.8 ps ≤170 ps	500 Ω/<0.15 pF 50 Ω/N/A	12.5 V RMS *1	4.40 ns ±0.1 ns 4.40 ns ±0.1 ns
P6156	1.5 m	10X ±3%	≥3.5 GHz	<100 ps	500 Ω/≤1 pF	15 V RMS	7.75 ns ±0.07 ns
		100X ±3%	≥3.0 GHz	≤120 ps	5000 Ω/≤1.1 pF	50 V RMS	7.75 ns ±0.07 ns
		20X ±3%	≥3.5 GHz	<100 ps	1000 Ω/≤1 pF	22 V RMS	7.75 ns ±0.07 ns
		1X ±5%	≥1.5 GHz	<300 ps	50 Ω/N/A	*2	7.75 ns ±0.07 ns

Interface/Readout/Identify: Interface: B=BNC; S=SMA
Readout/Identify: Y=Yes; N=No

**1 Limited by scope input or 42 V RMS.*
**2 Limited by scope input or 50 V RMS.*

ORDERING INFORMATION

P6150
10X, 9 GHz, 1.0 m, Low Impedance Probe **$995**
Includes: One 1X Attenuator Head (206-0398-00); Two 10X Attenuator Heads (206-0399-02); 1.0 m Cable Assembly (174-1341-00); Instruction Sheet (070-7173-00); and 1 Accessory Kit consisting of: 20 each Ground Clip, 3 each Adjustable Ground Lead, 10 each Electrical Contact, and 2 each Probe to Circuit Board Ground Connectors (020-1708-00).

ADDITIONAL ACCESSORIES
Also see pages 476-494 for complete selection information.

SMA Male to BNC Female – Order 015-0554-00 ..... **$47**
SMA Female to BNC Male – Order 015-0572-00 ..... **$28**
SMA to Probe Tip – (For P6156 only) Order 013-0237-00 ..... **$365**

P6156
3.5 GHz (10X), 1.5 m Low Impedance Probe **$275**
Includes: 10X Attenuator Head (206-0380-00), 6 in. Ground Lead with Alligator Clip (196-3305-00) Retractable Hook Tip (013-0107-07); 2 Circuit Board Connectors; 2 in. Ground Lead (195-4240-00); 6 in. Ground Lead (196-3113-02); Ground Collar (343-1003-01); SMT KlipChip™ (206-0364-00); 2 each Cable Markers, various colors: gray, white, green, red; Probe Tip Holder (352-0670-00); Instruction Sheet (070-6430-00).
Opt. 25 – Adds 100X Attenuator ..... **+$85**

Probe Tips – For P6156 only
(1X) Order 206-0379-00 ..... **$79**
(10X) Order 206-0380-00 ..... **$79**
(20X) Order 206-0381-00 ..... **$79**
(100X) Order 206-0382-00 ..... **$85**

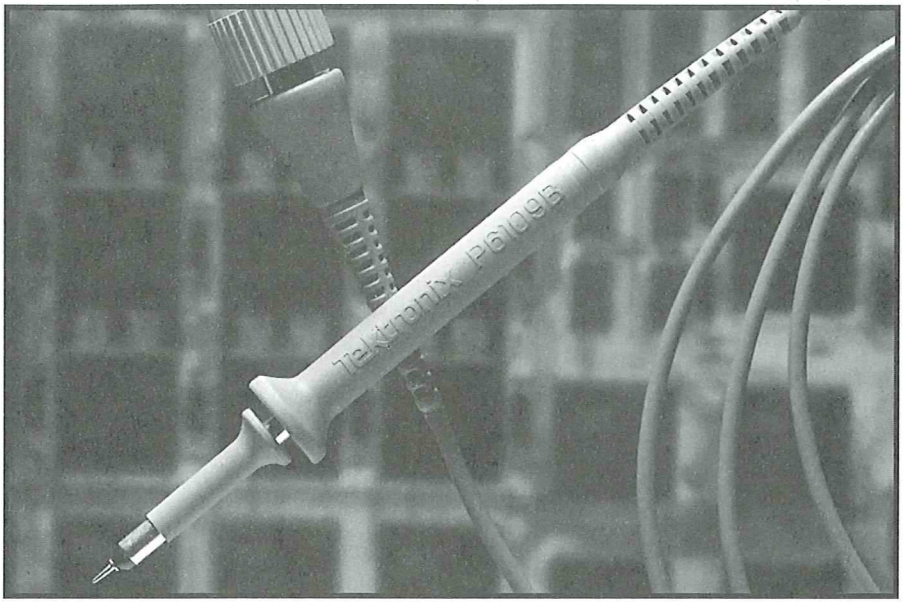
P6156 available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Passive Voltage Probes



PASSIVE VOLTAGE PROBES

- Every Scope Needs at Least a Pair of General Purpose Probes.

General purpose probes for Tektronix Oscilloscopes, Portables, the Classics, TDS, and TAS.

Tips on Selecting Probes

Nearly all general purpose and laboratory oscilloscopes use probes to make a direct, flexible and convenient connection to a device-under-test (DUT). Of all the different types of measurements, voltage measurements top the list by a wide margin. The ideal probe/oscilloscope combination should acquire the signal and truly represent it on the display without changing the signal source.

What to Consider When Selecting Probes

YOUR SCOPE'S...

- **Bandwidth?** Select a probe with equal or better bandwidth.
- **Input capacitance?** Select a probe with a compensation range covering the scope's nominal input capacitance.
- **Readout feature support?** Select a probe that provides automatic coding for scale factor.
- **Input loading?** Standard passive probes support 1 MΩ inputs. 50 Ω probes are also available in passive and active (FET) styles.

YOUR APPLICATION...

- **Engineering and design** – High frequency, specialty, absolute measurements
- **Service** – Mixture of high and low frequency, specialty and general purpose, absolute and relative measurements
- **Manufacturing** – Low frequency, general purpose, relative measurements

YOUR MEASUREMENTS . . .

- **How will probe loading affect your measurements?** High resistance probes (10 MΩ) give minimum amplitude error; however, any significant tip capacitance will degrade the leading edge.
- **What is the waveform risetime?** Passive probes work in conjunction with the scope's input circuitry to provide a system bandwidth.
- **What is the peak voltage?** Passive probes typically have 420 V peaks. High voltage probes can handle 1.5 kV to 40 kV.
- **What is the waveform amplitude?** Maximum input voltage for a passive probe is stated as DC pulse peak AC. This is also the maximum safe input before electrical damage occurs.

YOUR MECHANICAL REQUIREMENTS...

- **Probe size?** Small probes are easier to handle and attach to test points. Larger probes are more durable.
- **Tip type?** Probe tip durability is affected by materials and design. Tektronix' most durable configuration for passive voltage probes is the miniature type which is supported by a wide variety of tip accessories for test point connection. The compact probe configuration offers improved electrical performance. Subminiature probe types are useful for probing high density circuitry where several probes have to attached in close proximity.
- **Environmental conditions?** Probes are expected to be exposed to harsh conditions in the field, but often overlooked are the rigors of daily use and abuse that general purpose probes are most likely to experience.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

P6101B P6111B
P6103B P6119B
P6109B P6129B

Passive Voltage Probes

B-Series 1 MΩ Inputs

Guaranteed compatibility and performance with Tektronix portable oscilloscopes.

P6101B
- 1X, 15 MHz

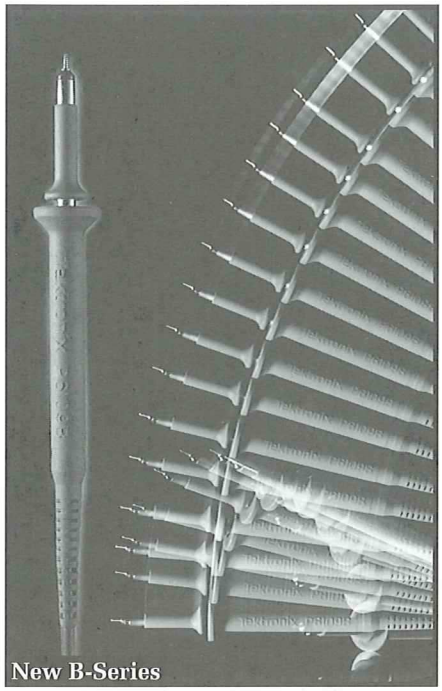
P6103B
- 10X, 60 MHz

P6109B
- 10X, 100 MHz
- Readout

P6111B
- 10X, 200 MHz
- Readout

P6119B
- 1X/10X,
- 10 MHz/100 MHz

P6129B
- 1X/10X,
- 10 MHz/100 MHz
- Readout



B-Series Family Photo

B-Series Passive Voltage Probes

- Single piece, molded rubber body
- Lightweight ergonomic design
- 10 times improvement in durability
- HYBRID/SMT circuitry on multi-layer circuit board for improved performance and reliability
- New stronger replaceable probe tip
- UL safety certification
- 1 year unconditional guarantee
- Miniature probe tip compatible with a wide range of Tektronix accessories and adapters

Passive voltage probes are the most commonly used oscilloscope probe. Other specialty probes expand the range and functionality of an oscilloscope as a measurement system, but a general purpose, passive voltage probe is the working end of the oscilloscope, a tool used and abused every day without concern by engineers and technicians. The probe's utility is often taken for granted…that is until it doesn't work. And then it's a scramble just to complete the simplest task.

Two years of customer research, design innovation, and an exhaustive test program resulted in a most remarkable family of oscilloscope probes. The B-Series of passive voltage probes is specifically designed for Tektronix' analog and digital portable oscilloscopes. The 1X, 10X and 1X/10X switchable probes combine the same high quality electrical performance that customers expect from Tektronix with a new rugged mechanical design.

A B-Series probe is encased in a resilient, molded rubber body and is virtually indestructible. It is lighter weight, more comfortable to hold, and more reliable than modular probe styles. The probe's replaceable tip is designed to withstand up to 20 pounds of force. Patented integral strain relief allows complete freedom of movement while providing superior cable flex. Each probe has received UL safety certification and meets MIL-T-28800, Class 3, environment specifications – something portable scope users will appreciate.

PROBE/SCOPE COMPATIBILITY

Probe	Scope/Product
P6101B	All Scopes
P6103B	2201, 2205, 2212, 2214, 2225, TAS 220, TAS 250
P6109B	2211, 2221, 2224, 2230, 2232, 2235A, 2236A, 2245A, 2246A, 2247A, 2252, TAS 455, TAS 465, TAS 475, TDS 310, TDS 320
P6111B	TAS 485, TDS 350
P6119B	2201, 2205, 2212, 2214, 2225, TAS 220, TAS 250
P6129B	2211, 2221, 2224, 2230, 2232, 2235, 2236A, 2245A, 2246A, 2247A, 2225, TAS 455, TAS 465, TAS 475, TDS 310, TDS 320, TDS 350

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

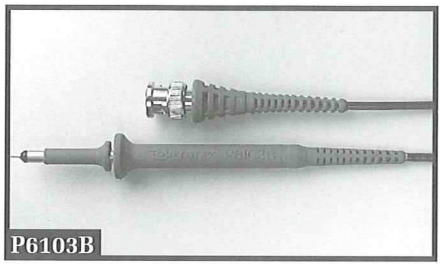
Passive Voltage Probes

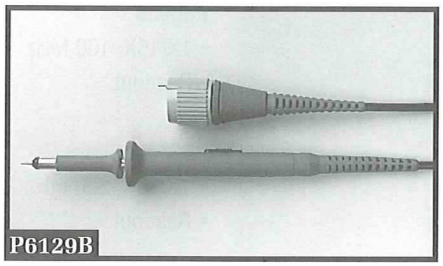
B-Series 1 MΩ Inputs

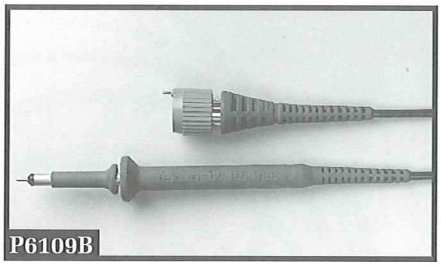
P6101B **P6111B**
P6103B **P6119B**
P6109B **P6129B**

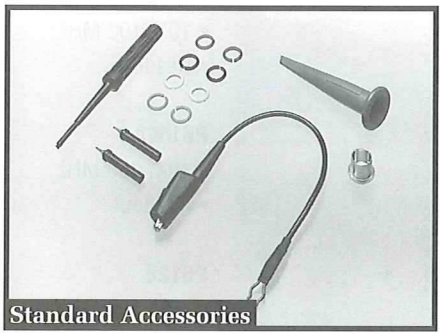
The P6101B, P6103B, P6109B, P6111B, P6119B and P6129B probes are designed to complement Tektronix' family of portable DSO and ART instruments. The core of each probe's performance is supplied by a Tektronix HYBRID/SMT device. Tektronix' instrumentation experience provides an extra margin of quality and reliability to the B-Series that is not commonly available to probe manufacturers. B-Series probes have been designed and tested to support the overall system performance and measurement quality that Tektronix oscilloscopes guarantee.

Through the introduction of the B-Series, Tektronix has set a new standard for passive voltage probe styling, performance and durability.


P6103B


P6129B


P6109B


Standard Accessories

CHARACTERISTICS

Type	Attenuation	Bandwidth Megahertz (MHz)	Comp. Range Picofarads (pF)	System Input Resistance Megaohms (MΩ)	Typical Input C Picofarads (pF)	Maximum Voltage DC + pk AC (Volts)	Readout
P6101B	1X	15	NA	1	100	420	
P6103B	10X	60	15 to 35	10	13	420	
P6109B	10X	100	15 to 35	10	13	420	√
P6111B	10X	200	15 to 35	10	14	420	√
P6119B	1X/10X	10/100	15 to 35	1/10	100/18	420	
P6129B	1X/10X	10/100	15 to 35	1/10	100/18	420	√

Note: All probe cables are 2 meters.

ORDERING INFORMATION

P6101B
1X, 15 MHz Passive Voltage Probe.....**$60**
Includes: 4 Pairs of Colored Cable Markers; Retractable Hook Tip; 6 in. Ground Lead; 2 Replacement Probe Tips; BNC to Probe Tip Adapter; Adjustment Tool; Storage Pouch; Instruction Manual (070-7819-03).

P6103B
10X, 60 MHz Passive Voltage Probe.....**$65**
Includes: 4 Pairs of Colored Cable Markers; Retractable Hook Tip; 6 in. Ground Lead; 2 Replacement Probe Tips; BNC to Probe Tip Adapter; Adjustment Tool; Storage Pouch; Instruction Manual (070-7847-02).

P6109B
10X, 100 MHz Passive Voltage Probe with Readout.....**$85**
Includes: 4 Pairs of Colored Cable Markers; Retractable Hook Tip; 6 in. Ground Lead; 2 Replacement Probe Tips; BNC to Probe Tip Adapter; Adjustment Tool; Storage Pouch; Instruction Manual (070-7849-02).

P6111B
10X, 200 MHz Passive Voltage Probe **$135**
Includes: 4 Pairs of Colored Cable Markers; Retractable Hook Tip; 6 in. Ground Lead; 2 Replacement Probe Tips; BNC to Probe Tip Adapter; Adjustment Tool; Storage Pouch; Instruction Manual (070-8543-01).

P6119B
1X/10X, 10/100 MHz Passive Voltage Probe **$90**
Includes: 4 Pairs of Colored Cable Markers; Retractable Hook Tip; 6 in. Ground Lead; 2 Replacement Probe Tips; BNC to Probe Tip Adapter; Adjustment Tool; Storage Pouch; Instruction Manual (070-8547-02).

P6129B
1X/10X, 10/100 MHz Passive Voltage Probe with Readout.....**$105**
Includes: 4 Pairs of Colored Cable Markers; Retractable Hook Tip; 6 in. Ground Lead; 2 Replacement Probe Tips; BNC to Probe Tip Adapter; Adjustment Tool; Storage Pouch; Instruction Manual (070-8000-02).

RECOMMENDED ACCESSORIES
See page 476-494 for complete selection information.

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

P6062B
P6063B
P6105A
P6106A
P6122

Passive Voltage Probes

For the Classic Oscilloscopes

For the Classic oscilloscopes.

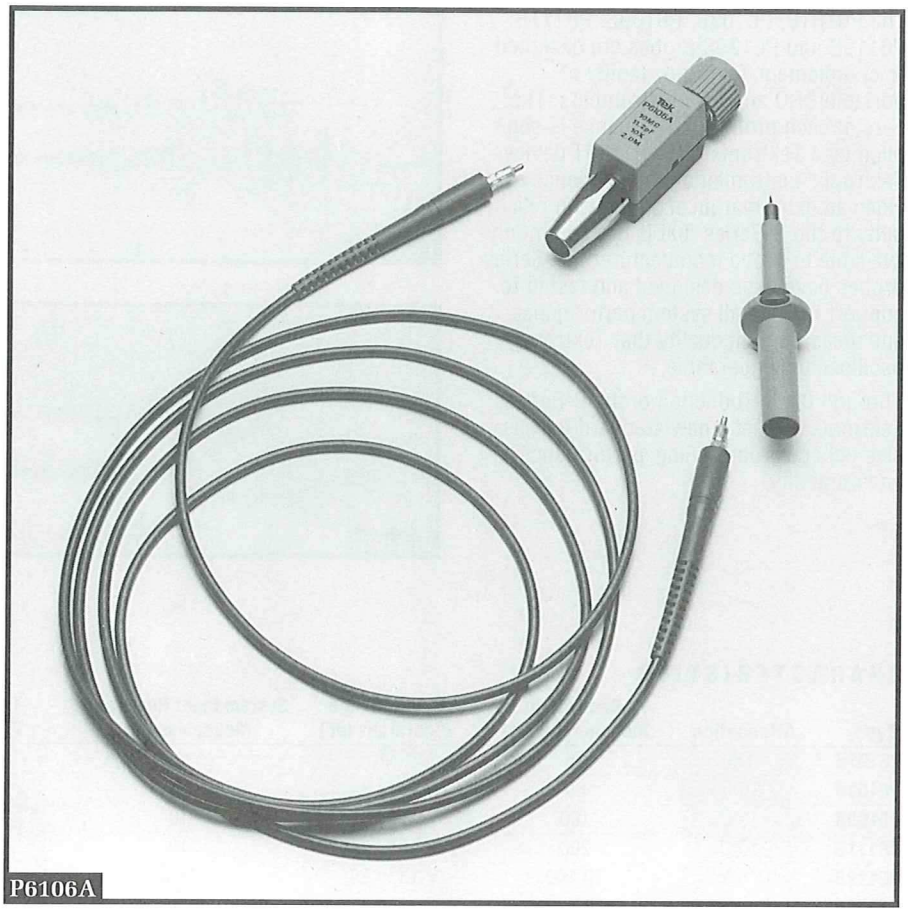
P6062B
- 1X/10X, 100 MHz
- Readout

P6063B
- 1X/10X, 200 MHz
- Readout

P6105A
- 10X, 100 MHz
- Readout

P6106A
- 10X, 250 MHz
- Readout

P6122
- 10X, 100 MHz



P6106A

Modular Probes

During our first 40 years, Tektronix introduced many innovative oscilloscopes which established the standards for form and function that are still followed today. Technological gains have allowed performance improvements over time, but the basic look and feel established by Tektronix remains. Because of this, Tektronix scopes ten and even 20 years old are still being used. We call these the Classics. Some of these older instruments have special probe requirements. The passive voltage probes found on these pages are for oscilloscopes introduced prior to 1986.

Tektronix modular probes are designed to save you money in repair and maintenance over the life of the probe. The three modules, probe head, cable and connector quickly snap or screw together, eliminating the need for soldering. Spare modules can be ordered and stocked, reducing down-time and eliminating the need to send a probe in for repairs. Modularity, rugged construction and highly reliable hybrid circuitry make these Tektronix probes a cost effective probing solution.

Tektronix modular passive probes are used to acquire high fidelity signals from low source impedance circuits. Each probe, except the P6122, will automatically scale the readings on oscilloscopes equipped with the readout feature. Additionally, these same probes provide a ground reference button on the probe head for quick trace identification.

PROBE/SCOPE COMPATIBILITY

Probe	Scope/Product
P6062B	300 Series, 400 Series, 5000 Series, TM500 Series, TM5000 Series, 7D20
P6063B	400 Series, 7A13, 7A15A, 7A26
P6105A	434, 455, 464, 464M, 465, 466, 468, 475, 485, 7A16, SC504
P6106A	475, 485, DC503A, DC5009, DC5010
P6122	2201, 2205, 2212, 2214, 2225

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Passive Voltage Probes

For the Classic Oscilloscopes

P6062B **P6105A**
P6063B **P6106A**
P6122

PROBE SPECIFICATIONS CHART

Type	Cable Length meters (m)	Attenuation	Bandwidth Megahertz (MHz)	Comp. Range Picofarads (pF)	System Input Resistance Megaohms (MΩ)	Typical Input C Picofarads (pF)	Ground Reference	Readout
P6062B	2	1X/10X	6.5/100	15 to 47	1/10	14/105	√	√
Opt. 01	1.5	–	8/100	–	–	13/100	–	–
Opt. 03	3	–	4.5/100	–	–	17/135	–	–
P6063B	2	1X/10X	6/200	15 to 24	1/10	14/105	√	√
Opt. 01	1.5	–	12/200	–	–	11/80	–	–
P6105A	2	10X	100	15 to 35	10	11	√	√
Opt. 01	1	–	100	–	–	9	–	–
Opt. 03	3	–	90	–	–	13	–	–
P6106A	2	10X	250	15 to 35	10	11	√	√
Opt. 01	1	–	250	–	–	9	–	–
Opt. 03	3	–	150	–	–	13	–	–
P6122	1.5	10X	100	15 to 35	10	11	–	–

Note: Maximum voltage DC + peak AC ≤500.

ORDERING INFORMATION

P6062B
1X/10X, 100 MHz Switchable Probe with Ground Reference and Readout Functions **$270**
Includes: Retractable Hook Tip; Probe Tip Ground Cover; 5 in. Ground Lead, 12 in. Ground Lead; Hook Tip; Two Replaceable Tips; Probe Holder; Alligator Clip; Instruction Sheet (062-2927-00).

P6063B
1X/10X, 200 MHz Switchable Probe with Ground Reference and Readout Functions **$350**
Includes: Same as P6062B; Instruction Sheet (062-2928-01).

P6105A
1X, 100 MHz Modular Probe **$175**
Includes: Retractable Hook Tip; Probe Tip Ground Cover; 5 in. Ground Lead, 12 in. Ground Lead; Alligator Clip; 4 Pairs of Colored Cable Markers; Adjustment Tool; Instruction Sheet (070-5516-01).

P6106A
10X, 250 MHz Modular Probe **$210**
Includes: Same as P6105A except 3 in. Ground Lead instead of 12 in. Ground Lead; Instruction Sheet (070-5517-01).

P6122
10X, 100 MHz Modular Probe **$120**
Includes: Same as P6105A; Instruction Sheet (070-5512-00).

OPTIONAL CABLE LENGTHS
(P6105A, P6106A)
Opt. 01 – 1 Meter Cable ..... **+$40**
Opt. 03 – 3 Meter Cable ..... **+$45**

RECOMMENDED ACCESSORIES
See page 476-494 for complete selection information.

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

P6131
P6133
P6134C
P6136
P6137
P6138
P6139A

Passive Voltage Probes

TDS Series and 2400 Series Oscilloscopes

Probes for TDS Series and 2400 Series Oscilloscopes.

P6131
- 10X, 300 MHz
- 2.5 mm Subminiature Probe Tip

P6133
- 10X, 150 MHz
- 2.5 mm Subminiature Probe Tip
- 3.5 mm Compact Probe Tip Optional

P6134C
- 10X, 400 MHz
- 3.5 mm Compact Probe Tip

P6136
- 10X, 350 MHz
- 2.5 mm Subminiature Probe Tip
- 3.5 mm Compact Probe Tip Optional

P6137
- 10X, 400 MHz
- 3.5 mm Compact Probe Tip

P6138
- 10X, 350 MHz
- 3.5 mm Compact Probe Tip

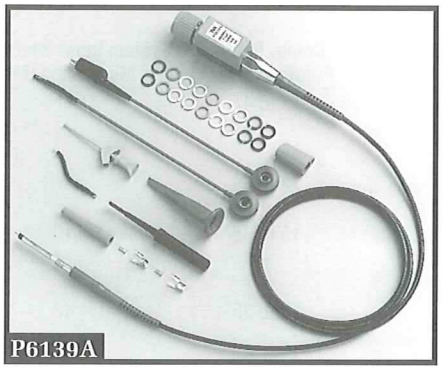
P6139A
- 10X, 350 MHz
- 3.5 mm Compact Probe Tip

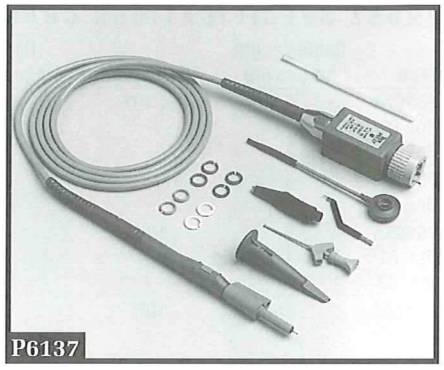
P6131, P6133, P6136, P6137, P6138 are available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.





Modular Subminiature Probes

- Small geometry tips – Easier circuit access
- Readout for 10X attenuation factor – Reduces confusion and errors in measurement readings
- Flexible lightweight cable – Easier to use and reduces mechanical stress to device under test
- HYBRID/SMT Circuitry – Provides improved performance and reliability
- Modularity – Provides lower cost of ownership
- Compact size accessories – Provides compatibility with existing adapters
- UL safety certification

The P613X family of oscilloscope probes sets the standard for high performance passive voltage probes. Continued growth of the family paces Tektronix' new series of high performance bench top oscilloscopes, the TDS 500A Series and high performance portable oscilloscopes, and the TDS 400 Series (with the introduction of the P6139A and P6138).

PROBE/SCOPE COMPATIBILITY

Probe	Scope/Product
P6131	2400 Series (2445,2465)
P6133	2400 Series (2430/A/M, 2445A, 2445B)
P6134C	11000 Series (11A32, 11A34)
P6136	2400 Series (2431L, 2439, 2455 A/B, 2465A, 2467)
P6137	2400 Series (2432/A/M, 2440/M, 2445B, 2465B, 2467B/HD)
P6138	TDS 400 Series
P6139A	TDS 500/A, 600/A, and 700A Series

Both probes feature modular construction, HYBRID/SMT circuitry, a smaller probe head/cable assembly than traditional passive probes, 10X attenuation readout encoding, and a full complement of attachment accessories. Smaller probe tips and lightweight cable assemblies allow easy negotiation of dense circuitry or tight spaces.

The compact probe head/tip assembly is compatible with the full line of compact accessories. When the Subminiature/ Compact- to-Miniature probe tip adapter (013-0202-02) is installed over the probe head/tip, the P6138 and P6139A probes are fully compatible with all miniature tip accessories.

The P6139A probe has been specifically designed for the TDS 500A/600A Series of oscilloscopes to provide 500 MHz bandwidth at the probe tip, while presenting an 8 pF/10 MΩ input impedance to the circuit under test. Similarly, the P6138's design meets the TDS 400 Series 350 MHz signal path requirements, helping to ensure the highest accuracy ever in a general purpose oscilloscope.

Passive Voltage Probes

TDS Series and 2400 Series Oscilloscopes

P6131
P6133
P6134C
P6136
P6137
P6138
P6139A

Characteristics

Type	Cable Length meters (m)	Bandwidth Megahertz (MHz)	Attenuation	Comp. Range Picofarads (pF)	Input C Picofarads (pF)	System Input Resistance Megaohms (MΩ)	Readout	ID/ Ground Ref.
P6131	1.3	300	10X	14 to 18	10.8	10	√	–
Opt. 02	2	250	–	–	13.5	–	–	–
Opt. 03	3	150	–	–	14.5	–	–	–
P6133	2	150	10X	10 to 25	12.7	10	√	–
Opt. 01	1.3	150	–	–	11.4	–	–	–
Opt. 03	3	120	–	–	14.5	–	–	–
Opt. 25	1.3	150	–	–	10.8	–	–	–
P6134C	1.5	400	10X	12 to 18	11.3	10	√	√
P6136	1.3	350	10X	12 to 18	10.8	10	–	–
Opt. 25	1.3	350	–	–	10.8	–	–	–
P6137	1.5	400	10X	12 to 18	10.8	10	√	√
P6138	1.3	350	10X	12 to 18	10.0	10	√	√
P6139A	1.3	500	10X	8 to 12	8.0	10	√	√

Note: Maximum voltage DC + peak AC ≤ 500;
Option 25 substitutes Compact for Subminiature Tip.

ORDERING INFORMATION

P6131
10X, 300 MHz Modular Subminiature Probe **$195**
Includes: Retractable Hook Tip; Adjustment Tool; Circuit Board Connector; 8 in. Alligator Ground Lead; 6 in. Microhook Ground Lead; 2 in. Ground Lead; Probe Holder; 4 Pairs of Colored Cable Markers.
Opt. 02 – 2 Meter Cable .....**+$45**
Opt. 03 – 3 Meter Cable .....**+$50**

P6133
10X, 150 MHz Modular Subminiature Probe **$175**
Includes: Same as P6130 except Instruction Sheet (070-5795-01).
Opt. 01 – 1.3 Meter Cable .....**+$45**
Opt. 03 – 3 Meter Cable .....**+$50**
Opt. 25 – 1.3 Meter Cable and Compact Tip.....**+$40**
Includes: Same as P6137 except Instruction Sheet (070-5795-01).

P6134C
10X, 400 MHz Modular Compact Probe **$250**
Includes: Adjustment Tool; Retractable Hook Tip; Two Probe Tip to Circuit Board Adapters; 2 in. Ground Lead; 6 in. Ground Lead; Miniature Alligator Clip; SMT KlipChip™; 4 Pairs of Colored Cable Markers; Instruction Sheet (070-7676-00).

P6136
10X, 350 MHz Modular Subminiature Probe **$210**
Includes: Same as P6130 except Instruction Sheet (070-6025-01).
Opt. 25 – 1.3 Meter Cable and Compact Tip.....**+$40**
Includes: Same as P6137 except Instruction Sheet (070-6025-01).

P6137
10X, 400 MHz Modular Compact Probe **$220**
Includes: Adjustment Tool; Retractable Hook Tip; Two Circuit Board Connectors; 2 in. Ground Lead; 6 in. Ground Lead with 0.025 in. Square Pin Receptacle; 6 in. Ground Lead with Alligator Clip; SMT KlipChip™; Low Inductance Lead Ground Collar; 4 Pairs of Colored Cable Markers; Instruction Sheet (070-6432-00).

P6138
10X, 350 MHz Modular Compact Probe **$190**
Includes: Adjustment Tool; Retractable Hook Tip; Two Circuit Board Connectors; 2 in. Ground Lead; 6 in. Ground Lead with 0.025 in. Square Pin Receptacle; 6 in. Ground Lead with Alligator Clip; SMT KlipChip™; Low Inductance Lead Ground Collar; 2 in. Low Inductance Ground Lead; Two Probe Tip to Circuit Board Adapters; 4 Pairs of Colored Cable Markers; Accessory Pouch; Instruction Sheet (063-0835-00).

P6139A
10X, 500 MHz Modular Compact Probe **$280**
Includes: Same as P6138 except Instruction Sheet (063-0870-00).

OPTIONAL ACCESSORIES
Conversion Kit – Subminiature Tip to Compact Tip.
P6130. Order 040-1252-02 .....**$70**
P6131. Order 040-1251-02 .....**$70**
P6133. Opt. 01. Order 040-1250-02.....**$70**
P6136. Order 040-1253-02 .....**$75**

RECOMMENDED ACCESSORIES
See page 476-494 for complete selection information.

P6131, P6133, P6136, P6137, P6138 are available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

P6561AS
P6562AS
P6563AS
P6245

Small Geometry Probes for Surface Mount Devices

Created to fit the work style of circuit designers.

Scaled for surface mounted IC packages.

Low-mass probe body only 1.5 inches long and 100 mils wide.

Solutions for the most popular EIAJ and JEDEC surface mount packages.

Provided in sets matched to the oscilloscope's performance and channel count.

P6561 available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

SMD PACKAGE SUPPORT
- 50 mil SO/SOIC
- 50 mil QUAD
- 25 mil JEDEC
- 0.5 mm EIAJ
- 0.65 mm EIAJ

CIRCUIT COMPATIBILITY
- CMOS
- BiCMOS
- FastCMOS
- TTL
- ECL

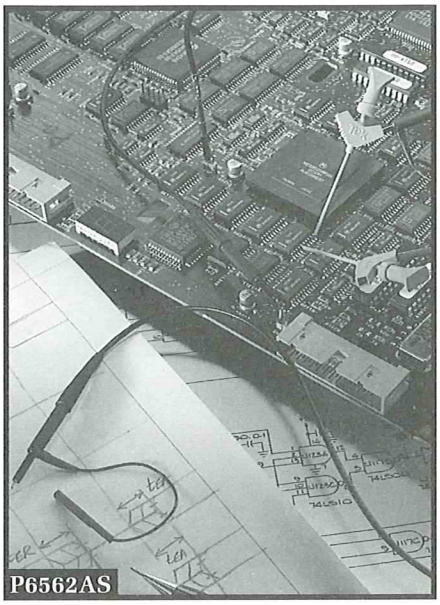
SCOPE COMPATIBILITY
- TDS Series
- TAS Series
- 2400 Series
- 11000 Series

P6561AS
- 10X – 200 MHz
- <11 pF Loading
- Readout

P6562AS
- 10X – 350 MHz
- <11 pF Loading
- Readout

P6563AS
- 20X – 500 MHz
- <5 pF Loading
- Readout

New P6245
- 10X – 1.5 GHz
- ≤1 pF Loading
- DC Offset
- For 11000, TDS 500A, TDS 600A and TDS 700A Series
- See page 458 for complete information


P6562AS


SMD Standard Accessories

The P6561AS, P6562AS, and P6563AS are scaled for surface mounted IC packages.

Their low-mass probe body is only 1.5 inches long and 100 mils wide.

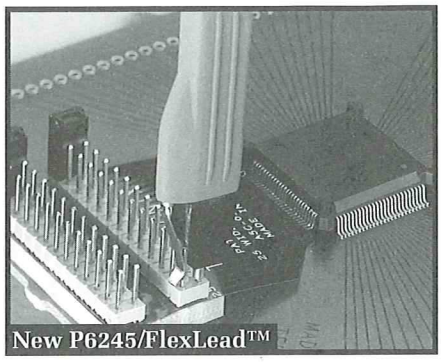
Bundled in sets to match the oscilloscope's performance and channel count, these probes provide solutions for the most popular EIAJ and JEDEC surface mount packages.

SURFACE MOUNT DEVICE PROBING

While instrumentation improvements have provided a steady stream of digital troubleshooting tools, the physical challenges associated with probing small geometry ICs have gone unaddressed until now. SMD probes from Tektronix provide circuit designers the first complete, off-the-shelf solution for probing small geometry IC packages.

UNIQUE UTILITY

The basic contact of the SMD probe family is a 25 mil socket that accepts square or round pins. A variety of tip adapters permit convenient, non-destructive, temporary connection to the most popular EIAJ and JEDEC surface mount packages.


New P6245/FlexLead™

EXCEPTIONAL PERFORMANCE

Each SMD probe is designed to minimize capacitive loading on TTL, ECL, CMOS, FastCMOS, and BiCMOS circuits. The probe and oscilloscope form a measurement system optimized for circuit designers by providing fast transient responsive, high system bandwidth, and low capacitive circuit loading.

EQUIVALENT PROBE LOADING IN A CMOS CIRCUIT

Below is a sample conversion of the SMD probe family's capacitive circuit loading to an equivalent number of typical CMOS gates. Being aware of the potential effect of probe loading on the circuit under test can eliminate chasing false indicators, reduce test times, and lead to more accurate and repeatable measurements.

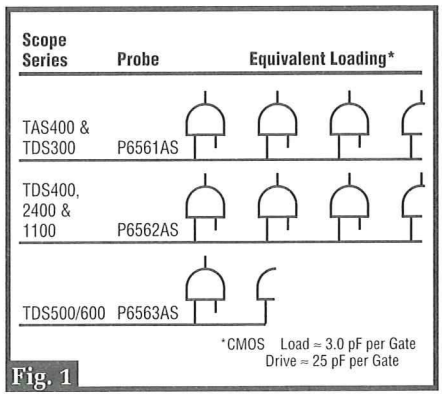


Fig. 1

Figure 1 presents a sample conversion of the SMD probe family's capacitive circuit loading to an equivalent number of typical CMOS gates. Being aware of the potential effects of probe loading on the circuit under test can eliminate chasing false indicators, reduce test times, and lead to more accurate and repeatable measurements.

Small Geometry Probes for Surface Mount Devices

P6561AS
P6562AS
P6563AS
P6245

PROBE TO OSCILLOSCOPE SELECTION CHART

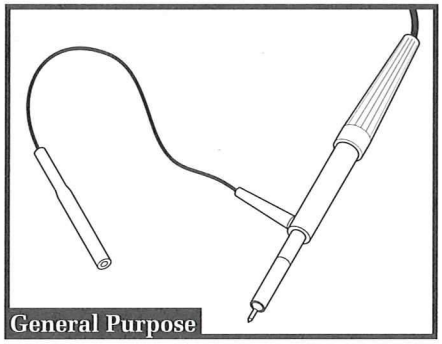
Scope Type	P6561AS	P6562AS	P6563AS
Digitizing	TDS310	2430A	TDS544A
	TDS320	TDS420	TDS520A
	TDS350	TDS460A	TDS524A
	–	2430M	TDS540A
	–	2440	TDS620A
	–	2440M	TDS640A
			TDS644A
	–	–	TDS684A
	–	–	TDS744A
	–	–	TDS784A
Analog	TAS465	2445B	–
	TAS475	2465B	–
	TAS485	2467B/BHD	–
Plug-Ins	–	11A32	–
	–	11A34/V	–

SMD PROBE CHARACTERISTICS

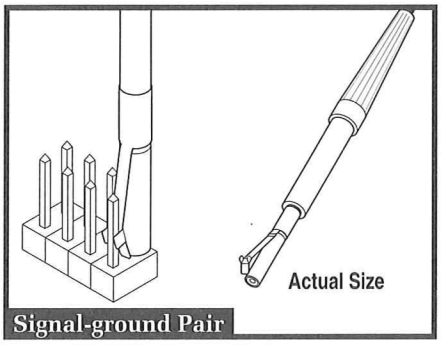
Probe Set (Replacement Probe)	P6561AS (P6561A)	P6562AS (P6562A)	P6563AS (P6563A)
Probes per Set	2	4	4
Oscilloscope Series	TDS300 TAS400	TDS400 2400 & 11000	TDS500/A TDS600/700A
Bandwidth (–3dB)	200 MHz	350 MHz	500 MHz
Rise Time (typical)	<1.85 ns	<1.1 ns	<800 ps
Uniform Signal Delay	±150 ps	±125 ps	±100 ps
Attenuation	10X	10X	20X
Device Loading Capacitance (typical)	<11 pF	<11 pF	<5 pF
Device Loading Resistance	10 MΩ	10 MΩ	9.5 MΩ
Maximum Non-destructive Input Voltage	42 V (DC + peak AC)	42 V (DC + peak AC)	42 V (DC + peak AC)
Compensation Range	15 pF – 35 pF	12 pF – 35 pF	7 pF – 30 pF

For improved signal fidelity and probing convenience, a short ground blade is included. To use it, form a ground plane of copper clad on top of the IC to be probed. Attach short jumper wires from the device ground to the copper clad. Then, with the SureFoot™ probe tip installed, probe the device and display a cleaner signal on the scope.

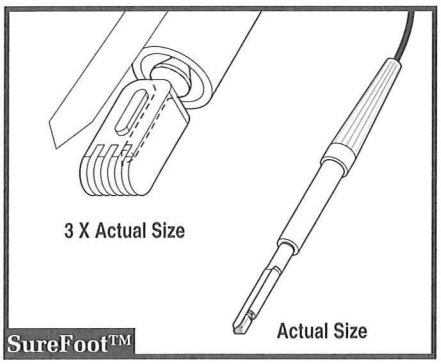
Probing Tip



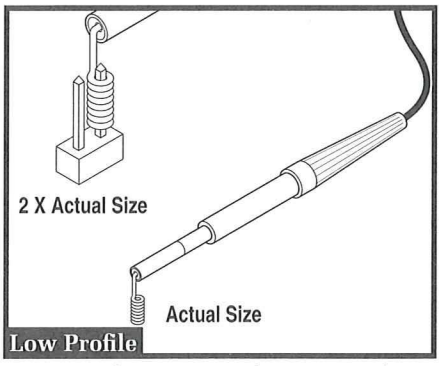
General purpose handheld probing.



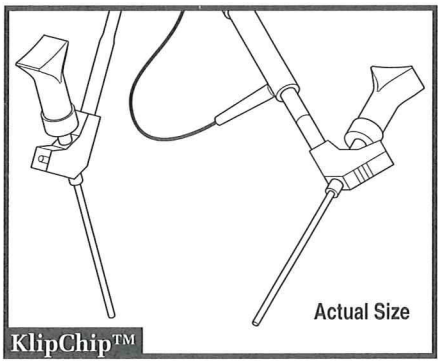
Signal-ground Pair – 25 mil square-pin headers on 100 mil centers.



PQFP and Quad Packages – JEDEC 25 mil center lead spacing. EIAJ 0.5 and 0.65 mm center lead spacing.



Circuit Boards in System Enclosures – 25 mil square-pin headers on 100 mil centers.



SOIC/SOP Small Outline Packages – 50 mil centers lead spacing.

ORDERING INFORMATION

P6561AS
200 MHz, 10X, SMD Probe.....**$375**
Includes: 2 ea. P6561A Probe, Probe Tips, SureFoot™ Tip Guides, 4 in. Ground Leads, Signal-ground Adapters, Blade-ground Adapters, and 1 ea. Adjustment Tool and Instruction Sheet.

P6562AS
350 MHz, 10X, SMD Probe.....**$775**
Includes: 4 ea. P6562A Probe, Probe Tips, SureFoot™ Tip Guides, and 1 ea. 4 in. Ground Lead, Signal-ground Adapter, Blade-ground Adapter, Adjustment Tool and Instruction Sheet.

P6563AS
500 MHz, 20X, SMD Probe.....**$825**
Includes: 4 ea. P6563A Probes, Probe Tips, SureFoot™ Tip Guides, 4 in. Ground Leads, Signal-ground Adapters, Blade-ground Adapters, and 1 ea. Adjustment Tool and Instruction Sheet.

P6245
Active FET Probe.....**$1,395**

RECOMMENDED ACCESSORIES
See pages 476-494 for complete selection and ordering information.

P6561 available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

FlexLead™ SERIES

PJ (JEDEC)
PE (EIAJ)

FlexLead™ Adapters

Fine Pitch Surface Mounted Devices

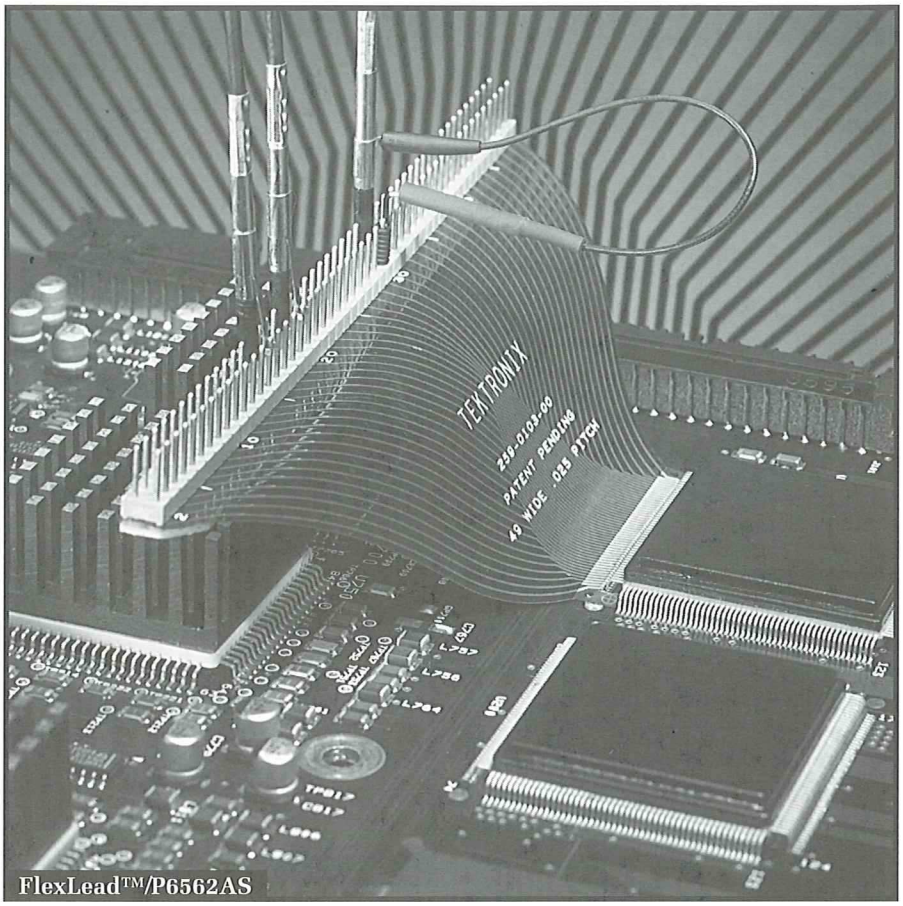
Low Cost.

Adapts to the most popular EIAJ and JEDEC QFP Gull-wing surface mount packages.

Universal 25 mil square-pin interface compatible with any oscilloscope or logic analyzer probe/podlet.

FlexLead™ FAMILY
25 mil JEDEC
0.65 mm EIAJ
0.5 mm EIAJ

- Convenient Probing of 25 mil Pitch and Smaller Packages
- Minimum Circuit Loading
- Adapts to Many of the Most Common JEDEC and EIAJ Packages
- Compatible with any Oscilloscope or Logic Analyzer Probe or Podlet
- 100 mil Interface for Easy Probe Connection



FlexLead™/P6562AS

Surface and Device Probing

As the pitch and lead spacing on surface mount packages gets smaller, connecting a probe to these packages becomes increasingly difficult. At a pitch of 25 mils or smaller the leads will no longer mechanically support a probe without potentially damaging the package. At this fine pitch it also becomes difficult to hand hold a probe without shorting to adjacent leads or causing mechanical damage to the package. The Tektronix FlexLead™ Adapters make it possible to conveniently connect to fine pitch Gull-wing Leaded QFP (Quad Flat Pack) packages while reducing the risk of both mechanical and electrical damage to the part.

FlexLead™ ADAPTERS
The FlexLead™ Adapter have a standard 100 mil. interface on one end to which any oscilloscope probe or logic analyzer podlet will directly connect, both signal and ground leads. The opposite end of the adapter has a row of solder pads, matching the leads of the package, that are soldered to the package leads. After the necessary probing is complete the adapters are intended to be unsoldered and discarded. The are intended to be used only once and are priced low enough to make this practical.

AVAILABLE FlexLead™ ADAPTERS
There are thirty-two FlexLead™ Adapters available to adapt to the larger volume Gull-wing surface mount packages, both JEDEC and EIAJ standards. Additional FlexLead™ Adapters will be offered as demand dictates.

Characteristics

Series Resistance – Less than 100 MΩ (typical).

Inductance – Less than 100 nH (typical).

Capacitance – Less than 2 pF (typical).

Maximum Voltage – 42 V.

Maximum Current – 750 mA.

Videotape and Flux Applicator

We have done two things to help in overcoming customers' concerns about soldering the FlexLead™ Adapters to fine pitch packages. First, the customers can order a free videotape of soldering instructions. Second, we are adding easy-to-use flux applicators to each package of FlexLead™ Adapters. The part numbers for the videotapes are: NTSC 068-0320-04, PAL 068-0320-06, SECAM 068-0320-07.

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

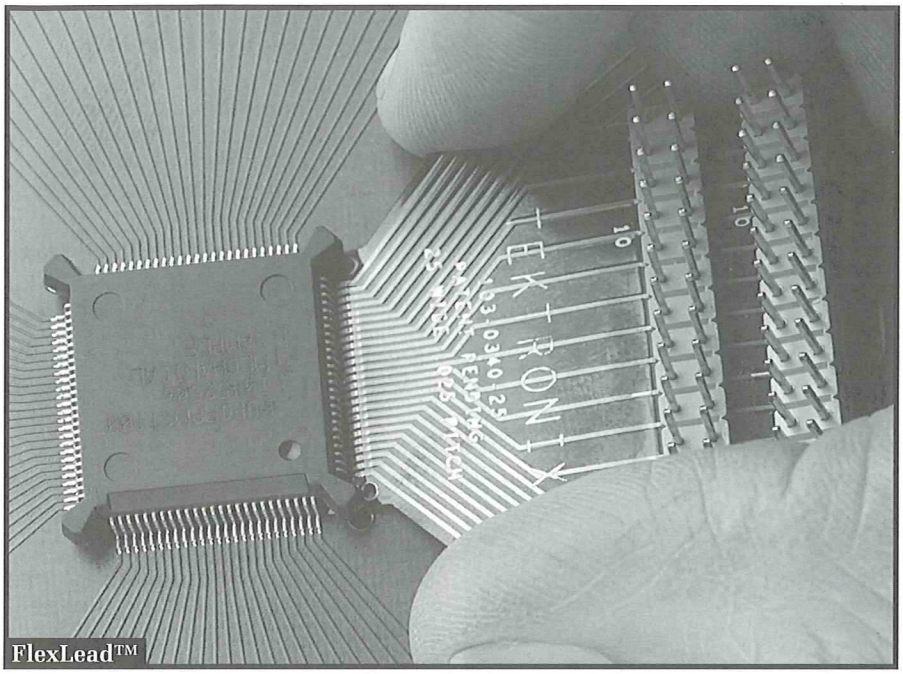
Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

FlexLead™ Adapters

Fine Pitch Surface Mounted Devices

PJ (JEDEC)
PE (EIAJ)

FlexLead™ SERIES



ORDERING INFORMATION

Package Type	Includes	Nomenclature	Price
JEDEC, 25 mil, 64 leads (16X16)	Eight 64 lead adapters	PJ25X16	**$130**
JEDEC, 25 mil, 68 leads (17X17)	Eight 17 lead adapters	PJ25X17	**$135**
JEDEC, 25 mil, 80 leads (20X20)	Eight 20 lead adapters	PJ25X20	**$145**
JEDEC, 25 mil, 84 leads (21X21)	Eight 21 lead adapters	PJ25X21	**$150**
JEDEC, 25 mil, 96 leads (24X24)	Eight 24 lead adapters	PJ25X24	**$155**
JEDEC, 25 mil, 80 leads (16X24)	Four 16 lead and 24 lead adapters	PJ21624	**$145**
JEDEC, 25 mil, 100 leads (25X25)	Eight 25 lead adapters	PJ25X25	**$160**
JEDEC, 25 mil, 120 leads (30X30)	Eight 30 lead adapters	PJ25X30	**$165**
JEDEC, 25 mil, 100 leads (20X30)	Four 20 lead and 30 lead adapters	PJ22030	**$155**
JEDEC, 25 mil, 132 leads (33X33)	Eight 33 lead adapters	PJ25X33	**$175**
JEDEC, 25 mil, 164 leads (41X41)	Eight 41 lead adapters	PJ25X41	**$190**
JEDEC, 25 mil, 196 leads (49X49)	Eight 49 lead adapters	PJ25X49	**$210**
JEDEC, 25 mil, 208 leads (52X52)	Eight 52 lead adapters	PJ25X52	**$220**
JEDEC, 25 mil, 240 leads (60X60)	Eight 60 lead adapters	PJ25X60	**$240**
EIAJ, 0.5 mm, 80 leads (20X20)	Eight 20 lead adapters	PE50X20	**$160**
EIAJ, 0.5 mm, 100 leads (25X25)	Eight 25 lead adapters	PE50X25	**$175**
EIAJ, 0.5 mm, 104 leads (26X26)	Eight 26 lead adapters	PE50X26	**$180**
EIAJ, 0.5 mm, 144 leads (36X36)	Eight 36 lead adapters	PE50X36	**$190**
EIAJ, 0.5 mm, 152 leads (38X38)	Eight 38 lead adapters	PE50X38	**$200**
EIAJ, 0.5 mm, 128 leads (26X38)	Four 26 lead and 38 lead adapters	PE22638	**$190**
EIAJ, 0.5 mm, 160 leads (40X40)	Eight 40 lead adapters	PE50X40	**$210**
EIAJ, 0.5 mm, 208 leads (52X52)	Eight 52 lead adapters	PE50X52	**$250**
EIAJ, 0.5 mm, 240 leads (60X60)	Eight 60 lead adapters	PE50X60	**$255**
EIAJ, 0.5 mm, 256 leads (64X64)	Eight 64 lead adapters	PE50X64	**$270**
EIAJ, 0.5 mm, 300 leads (75X75)	Eight 75 lead adapters	PE50X75	**$315**
EIAJ, 0.5 mm, 304 leads (76X76)	Eight 76 lead adapters	PE50X76	**$325**
EIAJ, 0.65 mm, 80 leads (20X20)	Eight 20 lead adapters	PE65X20	**$130**
EIAJ, 0.65 mm, 112 leads (28X28)	Eight 28 lead adapters	PE65X28	**$160**
EIAJ, 0.65 mm, 144 leads (36X36)	Eight 36 lead adapters	PE65X36	**$180**
EIAJ, 0.65 mm, 160 leads (40X40)	Eight 40 lead adapters	PE65X40	**$185**
EIAJ, 0.65 mm, 184 leads (46X46)	Eight 46 lead adapters	PE65X46	**$195**
EIAJ, 0.65 mm, 208 leads (52X52)	Eight 52 lead adapters	PE65X52	**$200**

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

SMG50
SMCK1
SMQK1

SureFoot™
PQFP100
PQFP132

Surface Mount Device Interconnects

Now safely attach to a variety of fine pitch surface mount devices.

APPLICATIONS

- Research and Design
- Manufacturing Test of SMD Circuitry
- Servicing of SMD Circuitry
- Prototype Debug and Design

SureFoot™

- Hand Probe Fine Pitch SMD Packages
  - 25 mil JEDEC
  - 0.65 mm EIAJ
  - 0.5 mm EIAJ
- For P656XAS and P6245

SMG50/ SMT KlipChip™ KITS

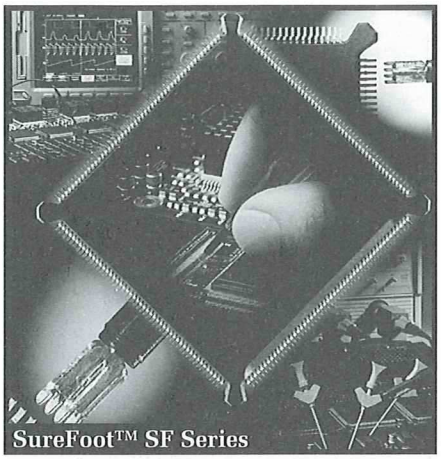
- Access to 0.050 in. Centers PLCC, SOIC, and Other Packages

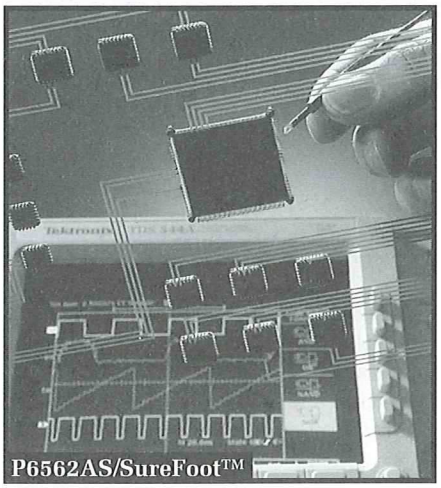
PQFP100/132 PQFP ADAPTER CLIPS

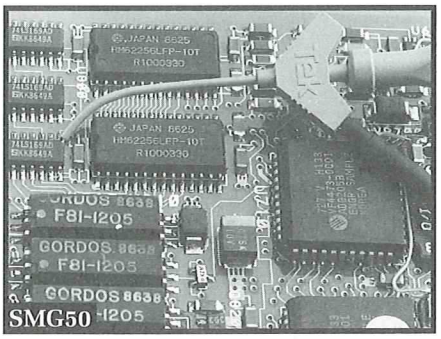
- 386SX Attachment with PQFP100
- 68020/68030 Attachment with PQFP132
- 350 MHz Bandwidth
- Small Low-profile Design Fits in Tight Spaces

SMCK1/SMQK1 SOIC/PLCC ADAPTER KITS

- Assortment of SOIC or PLCC Clips
- Leads and SMT KlipChip™ Included
- Signal Insertion and Temporary Lead Jumpers Without Soldering


SureFoot™ SF Series


P6562AS/SureFoot™


SMG50

SMT KlipChip™ used on SOIC package.

Surface Mount Device Probing and Interconnects

The increasing use of surface mount technology (SMT) brings many benefits to electronic circuit board (ECB) design and manufacture. Among these are increased circuit density, increased product reliability, and lower assembly costs.

Troubleshooting and device interconnection, however, have become more difficult due to decreased device size, tighter lead spacing and increased ECB densities. Tektronix' offering of the following SMT probing and inter-connect devices meets these demanding requirements.

SureFoot™

PROBING 25 Mil JEDEC, 0.65 AND 0.5 mm EIAJ PACKAGES

SureFoot™ (patent pending) is an integral probe tip and miniature guide that enables fault-free "hands-on" probing of fine-pitch SMD packages. Guided by the IC's leads, SureFoot's miniature plastic tines align the probe before electrical contact is made. The tines also form a shield between IC leads, preventing the probe tip from shortening adjacent pins.

SureFoot™ conforms to EIAJ (Electronic Industry Association of Japan) or JEDEC (Joint Electron Device Engineering Council) packaging standards, assuring quick and reliable probe contact with fine-pitch IC leads.

Several color coded versions of SureFoot™ are available addressing the most common SMD packages with leads spaced on 0.65 mm (EIAJ) and 25 mil (JEDEC) centers. A crystal orange version fits the tighter 0.5 mm lead spacing of several EIAJ packages.

STYLE FOR TEKTRONIX SMD PROBES

Tektronix probes have replaceable probe tips. The basic contact of the new SMD probe family is a 25 mil socket that accepts square or round pins. SureFoot™ probe tips are available in styles to match each of these high-performance probe families.

SureFoot™ SELECTION CHART

Package Lead Spacing	Package Standard	Color Code	SureFoot™ Compatibility: Active SMD Probes P6245	SureFoot™ Compatibility: SMD Probes P6561AS/2AS/3AS
50 mil	JEDEC	Yellow	SF501	SF501
25 mil	JEDEC	Blue	SF502	SF502
0.65 mm	EIAJ	Blue	SF502	SF502
0.5 mm	EIAJ	Red	SF503	SF503

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Surface Mount Device Interconnects

SMG50	SureFoot™
SMCK1	PQFP100
SMQK1	PQFP132

SMT KlipChip™

The SMT KlipChip™ is an interface device for attachment of logic and analog probes to today's SMDs, DIPs, and discrete components. The SMT KlipChip™ is capable of attaching to components with maximum lead diameters of 0.095 inches and stackable on lead centers of 0.050 inches. Dual sided 0.025 inch lead contacts allow this grabber to be used in multiple signal insertion/acquisition.

PLCC Quad Clips

For easy connection to Plastic Leaded Chip Carriers (PLCC) with "J" leads on .050 inch centers. Gold plated contacts maintain low contact resistance. .025 inch square pins provide contact for probes, flying leads, etc.

SOIC Clips

Simplify connection to Small Outline Integrated Circuits (SOIC). The spring design provides a strong and accurate fit. Compatible with gull-wing or "J" leads on .050 inch centers. Gold plated contacts for low contact resistances; .025 inch upper square pins provide access for probe or flying lead connection.

PQFP100/132

The PQFP100 and PQFP132 provide easy probe access to soldered-in 100 or 132-Pin Plastic Quad Flat Pack (PQFP) JEDEC standard devices. The molded bottom of the clip fits snugly to the PQFP device, allowing single or multiple probe interconnects without risk of detachment.

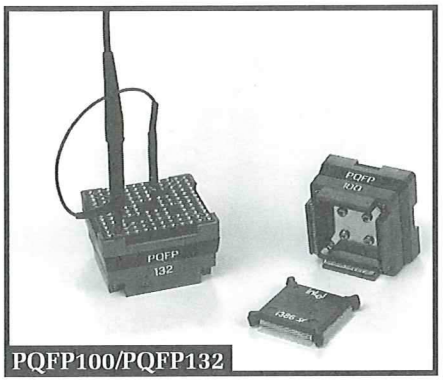

SMQK1/PLCC Kit

The top of the clip is a pin grid array socket which provides simple attachment for various probing options such as:

- P656XAS SMD Probe Family, P6245 Active SMD, and P6139A or P613X Family
- Conventional Probes using included Signal/Ground Pins
- Matching PGA Adapter
- Available Male PGA Adapter for Square-pin Connections

The compact, low-profile design makes it possible to probe devices on densely populated ECBs or where access space is limited.

Loading and crosstalk are minimized and bandwidth is greater than 350 MHz for high measurement precision.



PQFP100/PQFP132


SMCK1/SOIC Kit

ORDERING INFORMATION

SMG50
SMT KlipChip™ **$99**
Includes: 20 SMT KlipChip™.

SMCK1
SOIC Engineering Kit **$99**
Includes: 1 each of 8, 14, 16, 20, 24-Pin SOIC Clips plus 4 SMT KlipChip™ Adapter; 8 Electrical Leads with (0.025 in.) Square-pin Connectors.

SMQK1
PLCC Engineering Kit **$270**
Includes: 1 each of 20, 28, 44, 52, 68, 84-Pin PLCC Clips plus 4 SMT KlipChip™ Adapter; 8 Electrical Leads with (0.025 in.) Square-pin Connectors.

PQFP100
Converter Clip **$275**
Includes: Convenient Storage Case; 5 each Signal/Ground Adapter Pins (131-5336-01); Instruction Sheet (070-8171-00).

PQFP132
Converter Clip **$315**
Includes: Convenient Storage Case; 5 each Signal/Ground Adapter Pins (131-5336-01); Instruction Sheet (070-8171-00).

PQFP100/PQFP132 RECOMMENDED ACCESSORIES

Adapter Shim for PQFP132 Pin Packages –
Order 361-1599-00 ..... **$1.65**

Signal/Ground Adapter Pins – Pkg. of 25.
Order 131-5336-01 ..... **$9.75**

PQFP100 Pin Male PGA Adapter to 0.030 in. Round Pin –
Order 103-0278-00 ..... **$25**

PQFP132 Pin Male PGA Adapter to 0.030 in. Round Pin –
Order 103-0324-00 ..... **$42**

SF501 (50 mil)
SureFoot™ for P6561AS, P6562AS, P6563AS, P6245 SMD Probes **$39**
Includes: 12 Yellow 50 mil (25 mil-pin) SureFoot™ Tip Guides.

SF502 (25 mil/0.65 mm Pitch)
SureFoot™ for P6561AS, P6562AS, P6563AS, P6245 SMD Probes **$39**
Includes: 12 Blue 25 mil/0.65 mm (25 mil-pin) SureFoot™ Tip Guides.

SF503 (0.5 mm Pitch)
SureFoot™ for P6561AS, P6562AS, P6563AS, P6245 SMD Probes **$39**
Includes: 12 Red 0.5 mm (25 mil-pin) SureFoot™ Tip Guides.

Electrical Leads –
Package of 10 each with 0.025 in. Square Pin Receptacles.
4 in. length Order 198-5817-00 ..... **$17.50**
6 in. length Order 198-5818.00 ..... **$17.75**
8 in. length Order 198-5819-00 ..... **$17.75**

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

PPMS100
PPMS200
PPM201B
PPM201C
PPM203B
PPM203C
119-4839-00

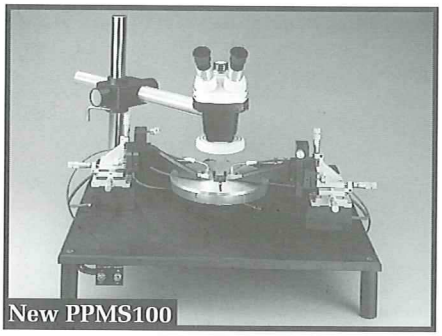
Probing Stations and Articulated Arms

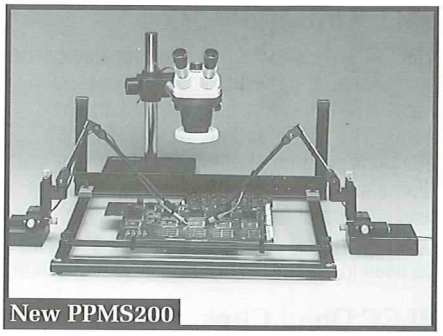
for Mechanically Assisted Probing

Probing Stations and Articulated Arms for high resolution, accurate mechanically assisted, hands-free probing.

Conveniently position conventional oscilloscope probes or microwave probes on SMT packages and Interconnects, MCMs, Hybrids, and ICs.

- **New PPMS100**
  - High-resolution Probing Station
- **New PPMS200**
  - Fine-pitch Probing System
- **New PPM201B**
  - 1 Axis Articulated Arm with Hi-mass Base
- **New PPM201C**
  - 1 Axis Articulated Arm with Chassis Clamp
- **New PPM203B**
  - 3 Axis Articulated Arm with Hi-mass Base
- **New PPM203C**
  - 3 Axis Articulated Arm with Chassis Clamp
- **New 119-4839-00**
  - Microscope Assembly


New PPMS100


New PPMS200

Probing Fine Pitch Devices

Probing today's designs with their delicate fine pitch devices is safer and more convenient with the new Tektronix PPMS Series of probing stations and articulating arms. The PPMS Series allows designers to guide microwave and standard handheld probes onto the small geometries of fine-pitch interconnects, SMD packages, MCMs (multi-chip-modules), hybrids, and ICs.

The PPMS probing stations and articulating arms provide high accuracy and resolution mechanically assisted probe positioning, helping designers meet the physical demands of probing the constantly shrinking geometry of devices.

The PPMS family includes the PPMS100 High Resolution Probing Station, the PPMS200 Fine Pitch Probing System; four Articulated Arms (PPM201B and 201C single axis arms and the PPM203B and PPM203C three axis arms); plus the 119-4839-00 Microscope Assembly.

PPMS100
The PPMS100 is a complete probing station intended for those applications requiring high resolution: positioning microwave probes as an optional accessory to the Tektronix IPA 310 Interconnect Parameter Analyzer. The IPA 310 is a TDR (Time Domain Reflectometry) oscilloscope designed to characterize and extract modeling parameters from packages, interconnects, MCMs and ICs.

THE PPMS200
The PPMS200 is a more general purpose probing system designed to position conventional oscilloscope probes. It is an accessory to the TDS Series of oscilloscopes and other models of oscilloscopes. It is designed to be used for probing PC Boards, Hybrids and MCMs that employ fine pitch devices and interconnects.

PPM201B AND PPM203B
The PPM201B and PPM203B incorporate a weighted base that makes them well suited to probing fine pitches in benchtop applications. The PPM201B is a single axis arm while the PPM203B is a three axis arm. They are general purpose, benchtop probing aides designed to be used when probing PC Boards, Hybrids and MCMs that employ fine pitch devices and interconnects.

PPM201C AND PPM203C
The PPM201C and PPM203C have a clamp that permits the probing of fine pitch devices while the arm is clamped to a variety of different chassis types. The PPM201C is a single axis arm while the PPM203C is a three axis arm. They are general purpose, chassis mounted probing aides designed to be used for probing PC Boards, Hybrids and MCMs that employ fine pitch devices and interconnects.

119-4839-00 MICROSCOPE ASSEMBLY
The 119-4839-00 binocular microscope is intended as a companion to the PPM201B, PPM203B, PPM201C, and PPM203C when assistance to vision is required. It incorporates a weighted base and convenient boom mount for ease of benchtop use.

Characteristics

PPMS100
Platform – Dimensions: 23.5 in. by 23.5 in. Material: Aluminum. Surface: Black matte. BNC Connectors: 5 female-to-female connections. Vacuum Distribution: 1 switched vacuum connection, 5 manifold connections. Microscope Mounting: 3 E-arm mounting positions.

Substrate Holder – Holder Diameter: 8 in. (20 cm). Holder Surface Flatness: ±0.0005 in. maximum (±0.013 mm). Holder Material: Stainless steel. Holder φ Adjust: 360°. Hold Down Method: Vacuum.

APPLICATIONS

- **Research & Design**
- **Prototype Debug**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

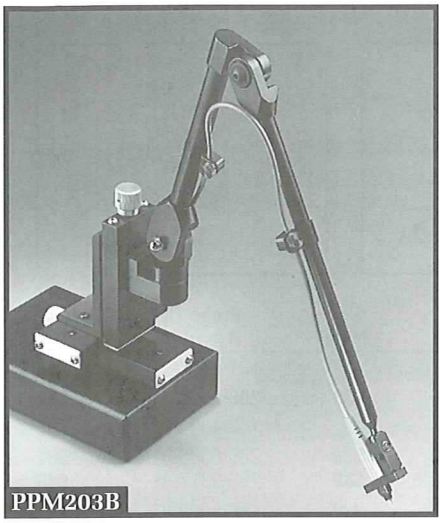
ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Probing Stations and Articulated Arms

for Mechanically Assisted Probing

PPM203B
PPM203C
119-4839-00
PPMS100
PPMS200
PPM201B
PPM201C


PPM203B

Manipulator – X,Y and Z axis travel (min.): 0.5 in. (1.27 cm). Theta Adjust (min.): 4°. Planarity Adjust (min.): 4°. Axis Control: Micrometer adjust at 40 threads per inch. Probe Mount: Accepts standard Tektronix TMP or other microwave probes with two hole configuration. Attachment Method: Vacuum hold down with manual release button.

Microscope – Type: Binocular. Magnification range: 0.8X to 4X. Eyepieces: 10X. Objective: 1/3X. Illuminator: 120 VAC fluorescent ring. UL/CSA certified.

Vacuum Pump – Power Requirement: 120 V AC, 50-60 Hz.

PPMS200

Articulated Arm and Manipulator – Number of Manipulator Axis: 3(X,Y and Z). Manipulator Travel: 1 in. min. in all axes. Manipulator Lead Screw Pitch: 10 threads per inch. Probe Mounting: Accepts most Tektronix probes including SMD, 2.5 mm, 3.5 mm, 4 mm, 5 mm and P6245 probe styles. Attachment Method: Manually positioned with weighted base. Articulated Arm Reach: X,Y: 14 in., Theta: 180°.

Circuit Board Holder – Circuit Board Size, Max.: 12 by 18 inches. Circuit Board Thickness: 0.085 Max.

Microscope – Type: Binocular. Magnification range: 0.8X to 4X. Eyepieces: 10X. Objective: 1/3X. Illuminator: 120 V AC fluorescent ring. UL/CSA certified.

PPM201B/C, PPM203B/C

Number of Manipulator Axes – PPM201B/C, 1 Axis (Z). PPM203B/C, 3 Axis (X,Y and Z)

Manipulator Travel – PPM201B/C and PPMS203B/C, 1 in. min.

Manipulator Lead Screw Pitch – PPM201B/C and PPM203B/C, 10 threads per inch.

Probe Mounting – Accepts most Tektronix probes including SMD, 2.5 mm, 3.5 mm, 4 mm, 5 mm and P6245 probe styles.

Attachment Method to Work Surface – PPM201B and PPM203B, manually positioned with weighted base. PPM201C and PPM203C, manually positioned with chassis clamp.

Articulated Arm Reach – X,Y: 14 in., Theta: 180°.

119-4839-00 MICROSCOPE ASSEMBLY:

Type – Binocular.

Magnification range – 0.8X to 4X.

Eyepieces – 10X.

Objective – 1/3X.

Illuminator – 120 V AC fluorescent ring. UL/CSA certified.

ORDERING INFORMATION

PPMS100
Probing Station, High Resolution **$15,995**
Includes: Platform, Substrate Holder, 1 each Right Hand Precision Manipulators, 1 each Left Hand Precision Manipulator, Vacuum Chuck, Microscope and Vacuum Pump.

A set of six probe adapters, one each for each of the families of Tektronix probes, is supplied with each of the Articulated Arms.

PPMS200
Probing System, Fine Pitch **$5,995**
Includes: Microscope; 2 each Articulated Arms, Circuit Board Holder; set of five probe adapters for each arm to attach various probe styles.

PPM201B
Articulated Arm, 1 Axis with Hi-mass Base **$795**
Includes: Articulated Arm; Hi-mass Base; 6 probe adapters to attach various probe styles.

PPM201C
Articulated Arm, 1 Axis with Chassis Clamp **$795**
Includes: Articulated Arm; Hi-mass Base; 6 probe adapters to attach various probe styles.

PPM203B
Articulated Arm, 3 Axis with Hi-mass Base **$1,295**
Includes: Articulated Arm; Hi-mass Base; 6 probe adapters to attach various probe styles.

PPM203C
Articulated Arm, 3 Axis with Chassis Clamp **$1,295**
Includes: Articulated Arm; Hi-mass Base; 6 probe adapters to attach various probe styles.

Microscope Assembly – Stereo zoom microscope and swivel boom stand. Order 119-4839-00 ..... **$2,995**

Additional Precision Manipulators for the PPMS100 can be ordered by the following part numbers. One each left and one each right come with the PPMS100 standard.

Precision Manipulator – Left. Order 119-4831-00 ..... **$3,995**

Precision Manipulator – Right. Order 119-4832-00 ..... **$3,995**

Probe Adapters – Additional probe adapters can be ordered by the following part numbers:
SMD Probes. Order 407-4365-00 ..... **$35.00**
P6245. Order 407-4368-00 ..... **$35.00**
4 mm, Active Probes. Order 407-4370-00 ..... **$35.00**
2.5 mm, Subminiature Probes. Order 407-4366-00 ..... **$35.00**
3.5 mm, Compact Probes. Order 407-4367-00 ..... **$35.00**
5 mm, Miniature Probes. Order 407-4369-00 ..... **$35.00**

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**
Opt. A2 – United Kingdom 240 V, 50 Hz ..... **NC**
Opt. A3 – Australian 240 V, 50 Hz ..... **NC**
Opt. A4 – North American 240 V, 60 Hz ..... **NC**
Opt. A5 – Switzerland 220 V, 50 Hz ..... **NC**

See Customer Information Section for additional description.

CIRCUIT BOARD HOLDER
Bench Top 12" X 18". Order 119-4845-00 ..... **$649**

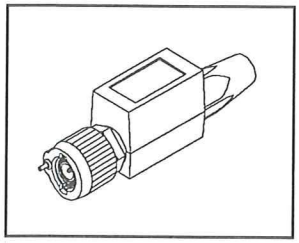
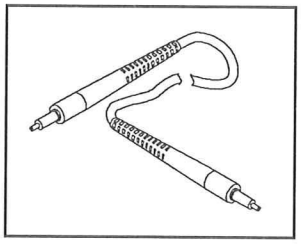
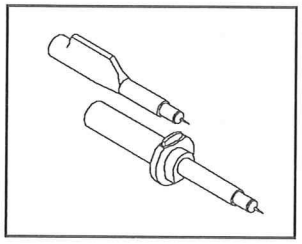
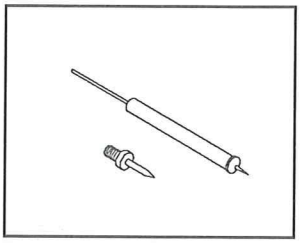
Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Replacement Parts

PASSIVE AND ACTIVE PROBE GENERAL REPLACEMENT PARTS

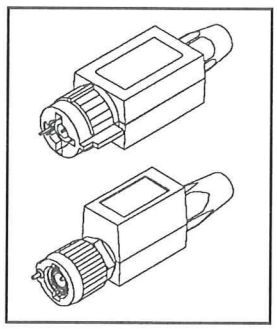





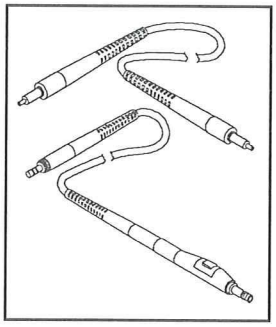
Probe	Length (m)	Connector/ Comp. Box	Price	Probe Cable	Price	Probe Head	Price	Probe Tip/ Hybrid Tip	Price
P6101B	2	N/A		N/A		N/A		131-4997-01*3	$6.25
P6102A	2	206-0352-00	$60	174-0976-00	$27	206-0302-00	$33	206-0338-01*3	$51
P6103B	2	N/A		N/A		N/A		131-4997-01*3	$6.25
P6105A	1	206-0331-00	$89	174-0975-00	$23	206-0328-00	$30	206-0336-01*3	$51
	2	206-0334-00	$100	174-0976-00	$27	206-0301-00	$30	206-0337-01*3	$45
	3	206-0320-02	$80	174-0977-00	$29	206-0302-00	$33	206-0338-01*3	$51
P6106A	1	206-0313-01	$110	174-0975-00	$23	206-0328-00	$29	206-0336-01*3	$51
	2	206-0319-01	$110	174-0976-00	$27	206-0301-00	$30	206-0337-01*3	$45
	3	206-0320-01	$105	174-0977-00	$29	206-0302-00	$33	206-0338-01*3	$51
P6107A	2	206-0247-02	$100	174-0976-00	$27	206-0217-02	$35	206-0339-03*3	$40
P6108A	1	206-0332-01	$65	174-0975-00	$23	206-0303-00	$34	206-0336-01*3	$51
	2	206-0318-02	$65	174-0976-00	$27	206-0304-00	$35	206-0337-01*3	$45
	3	206-0333-00	$65	174-0977-00	$29	206-0305-00	$25	206-0338-01*3	$51
P6109B	2	N/A		N/A		N/A		131-4997-01*3	$6.25
P6111B	2	N/A		N/A		N/A		131-4997-01*3	$6.25
P6119B	2	N/A		N/A		N/A		131-4997-01*3	$6.25
P6121	1.5	206-0311-00	$95	174-0967-00	$23	206-0323-00	$36	206-0341-01*3	$65
P6122	1.5	206-0312-00	$74	174-0967-00	$23	206-0324-00	$29	206-0342-01*3	$51
	2	206-0318-00	$70	174-0968-00	$26	206-0325-00	$27	206-0343-01*3	$36
	3	206-0318-01	$75	174-0969-00	$27	206-0326-00	$32	206-0344-01*3	$44
P6129B	2	N/A		N/A		N/A		131-4997-01*3	$6.25
P6148A	2	206-0255-02	$110	174-0976-00	$27	206-0217-02	$35	206-0339-03*3	$40
P6149A	2	206-0255-02	$110	174-0976-00	$27	206-0217-02	$35	206-0339-03*3	$40
P6202A	2	N/A		N/A		N/A		206-0230-03*2	$38
P6203	1.5	N/A		N/A		206-0391-00	$190	131-4280-00*4	$2.25
P6204	1.5	N/A		N/A		206-0390-00	$715	131-4280-00*4	$2.25
P6205	1.5	N/A		N/A		N/A		131-4280-00*4	$2.25
P6206	1.7	N/A		N/A		N/A		131-4280-00*4	$2.25
P6420	1	N/A		174-0975-00	$23	206-0236-01	$75	206-0230-03*2	$38
	2	N/A		174-0976-00	$27	206-0236-01	$75	206-0230-03*2	$38
	3	N/A		174-0977-00	$29	206-0236-01	$75	206-0230-03*2	$38
P6561A	1.3	N/A		206-0417-10	$80	206-0417-10	$80	131-5638-10*2	$10
P6562A	1.3	N/A		206-0417-10	$80	206-0417-10	$80	131-5638-10*2	$10
P6563A	1.3	N/A		206-0459-00	$85	206-0459-00	$85	131-5638-10*2	$10
P450		N/A		N/A		206-0426-00	$42	N/A	
P850		N/A		N/A		206-0427-00	$65	N/A	

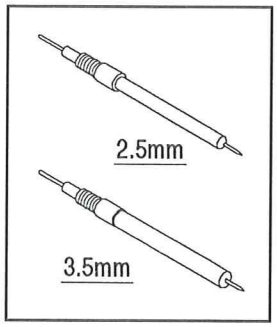
**1 Not pictured above.*
**2 Probe tips in package of ten.*
**3 Probe hybrid tip assemblies in packages of five.*
**4 Probe hybrid tip assembly in quantities of one.*
**5 Consists of a matched pair.*
**6 Scope Input Capacitance Range.*

Replacement Parts

PASSIVE AND ACTIVE PROBE GENERAL REPLACEMENT PARTS







Probe	Length (m)	Connector/ Comp. Box	Price	Probe Cable	Price	Probe Tip/ Hybrid Tip	Probe Tip/ Hybrid Tip Color	Price
P6053C	6	206-0421-00	**$115**	174-2132-01	**$75**	206-0422-01	tip – gray / tail – red	**$16.25**
Opt. 01	3.5	N/A		174-2133-01	**$42**	206-0392-00	tip – gray / tail – blue	**$23**
Opt. 03	9	N/A		174-2134-01	**$75**	206-0422-02	tip – blue / tail – red	**$21**
P6130	1.5	206-0313-00	**$95**	174-0970-00	**$32**	206-0270-10*4	tip – brown / tail – yellow	**$23**
	2	206-0319-00	**$100**	174-0971-00	**$33**	206-0270-12*4	tip – brown / tail – blue	**$22**
	3	206-0320-00	**$100**	174-0972-00	**$38**	206-0270-11*4	tip – brown / tail – red	**$20**
P6131	1.3	206-0314-00	**$115**	174-0973-00	**$28**	206-0265-10*4	tip – clear / tail – blue	**$21**
	2	206-0321-00	**$130**	174-0971-00	**$35**	206-0265-12*4	tip – clear / tail – yellow	**$21**
	3	206-0322-00	**$115**	174-0972-00	**$40**	206-0265-11*4	tip – clear / tail – red	**$21**
P6133	2	206-0350-00	**$80**	174-0971-00	**$24**	206-0265-12*4	tip – clear / tail – yellow	**$21**
Opt. 01	1.3	206-0349-00	**$89**	174-0973-00	**$35**	206-0265-13*4	tip – clear / tail – clear	**$21**
Opt. 03	3	206-0351-00	**$95**	174-0972-00	**$40**	206-0265-11*4	tip – clear / tail – red	**$21**
Opt. 25	1.3	206-0349-00	**$89**	174-0973-00	**$29**	206-0393-00*4	tip – clear / tail – natural	**$23**
P6134C	1.5	206-0420-00	**$120**	174-1081-04	**$70**	206-0418-00*4	tip – black / tail – red	**$23**
P6135A (13-17pF)*6	1.5	N/A		N/A		206-0416-00*5	tip – red / tail – natural	**$33**
(18-22pF)*6		N/A		N/A		206-0419-00*5	tip – black / tail – yellow	**$33**
(45-49pF)*6		N/A		N/A		206-0415-00*5	tip – blue / tail – natural	**$33**
P6136	1.3	206-0359-00	**$115**	174-0978-00	**$33**	206-0265-10*4	tip – clear / tail – blue	**$21**
Opt. 25	1.3	206-0359-00	**$115**	174-0978-00	**$33**	206-0392-00*4	tip – gray / tail – blue	**$23**
P6137	1.5	206-0389-01	**$150**	174-1081-04	**$70**	206-0378-00*4	tip – black / tail – natural	**$21**
P6138	1.3	206-0439-00	**$120**	174-0978-00	**$33**	206-0392-00*4	tip – gray / tail – blue	**$23**
P6139A	1.3	206-0440-00	**$170**	174-0978-00	**$33**	206-0441-00*4	tip – blue / tail – yellow	**$23**
P6150*1 (10X)	1	N/A		174-1341-00	**$305**	206-0399-03*4	N/A	**$485**
(1X)		N/A				206-0398-00*4	N/A	**$240**
P6156 (10X)	1.5	N/A		174-1127-00	**$85**	206-0380-00*4	tip – blue / tail – black	**$79**
Opt. 25 adds 100X tip		N/A		N/A		206-0382-00*4	tip – red / tail – black	**$85**
20X tip		N/A		N/A		206-0381-00*4	tip – gray / tail – black	**$79**
1X tip		N/A		N/A		206-0379-00*4	tip – black / tail – black	**$79**
P6230	1.6	N/A		N/A		206-0279-10*4	tip – yellow / tail – blue	**$23**
P6231	1.5	N/A		N/A		206-0279-10*4	tip – yellow / tail – blue	**$23**

**1 Not pictured above.*

**2 Probe tips in package of ten.*

**3 Probe hybrid tip assemblies in packages of five.*

**4 Probe hybrid tip assembly in quantities of one.*

**5 Consists of a matched pair.*

**6 Scope Input Capacitance Range.*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

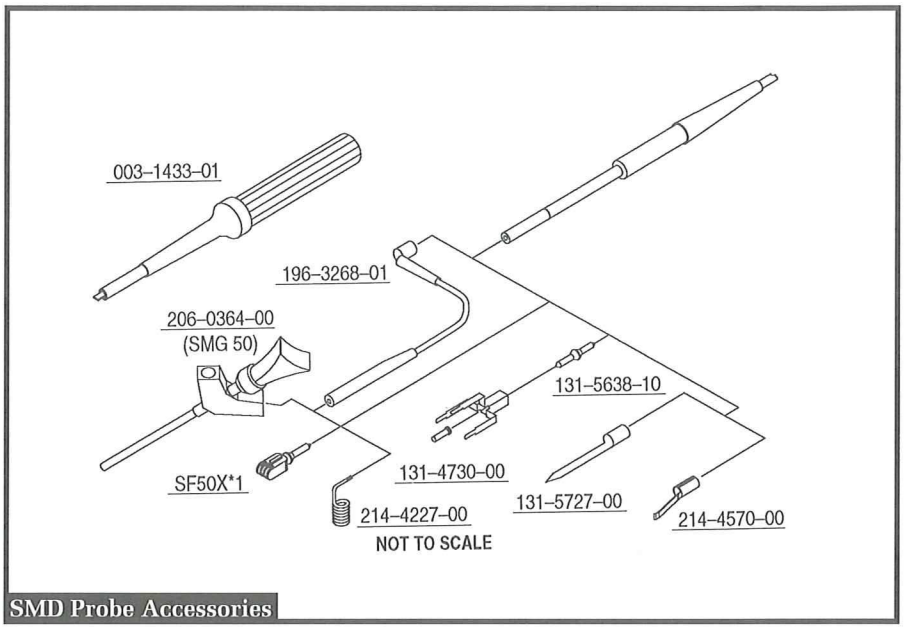
Probe Accessories
SMD (P656XAS) and P6240

ORDERING INFORMATION – SELECTION GUIDE

P6561AS/P6562AS/P6563AS

Part Number	Description	Price
003-1433-00	Adjustment Tool for P610x/A/B, P612x, P613x, and P656x/AS Families	$1.25
003-1433-01	Adjustment Tool pkg. of 5 for P610x/A/B, P612x, P613x, and P656x/AS Families	$6.50
131-5727-00	Low Inductance Ground Lead	*1
131-4730-00	SMT Probe Tip Circuit Board Test Points, pkg. of 5	$15.75
131-5638-10	Receptacle Tip for P656(X)AS, pkg. of 10	$10
196-3268-01	Ground Lead with 0.025 in. Receptacle, pkg. of 5	$45
206-0364-00	SMT KlipChip™, 1 each	$5.50
214-4227-00	Right Angle Square-pin Adapter	$6.25
214-4570-00	100 mil Square-pin Ground Adapter	$1.50
FlexLead™	(See FlexLead™ section below)	
SMG50	SMT KlipChip™, 20 each	$99
SF501	SureFoot™ Probe Tip Adapter, pkg. of 12, Yellow, 50 mil Pitch	$39
SF502	SureFoot™ Probe Tip Adapter, pkg. of 12, Blue, 25 mil/0.65 mm Pitch	$39
SF503	SureFoot™ Probe Tip Adapter, pkg. of 12, Red, 0.5 mm Pitch	$39

**1 See SF501/SF502/SF503 above or page 478 for complete selection information.*

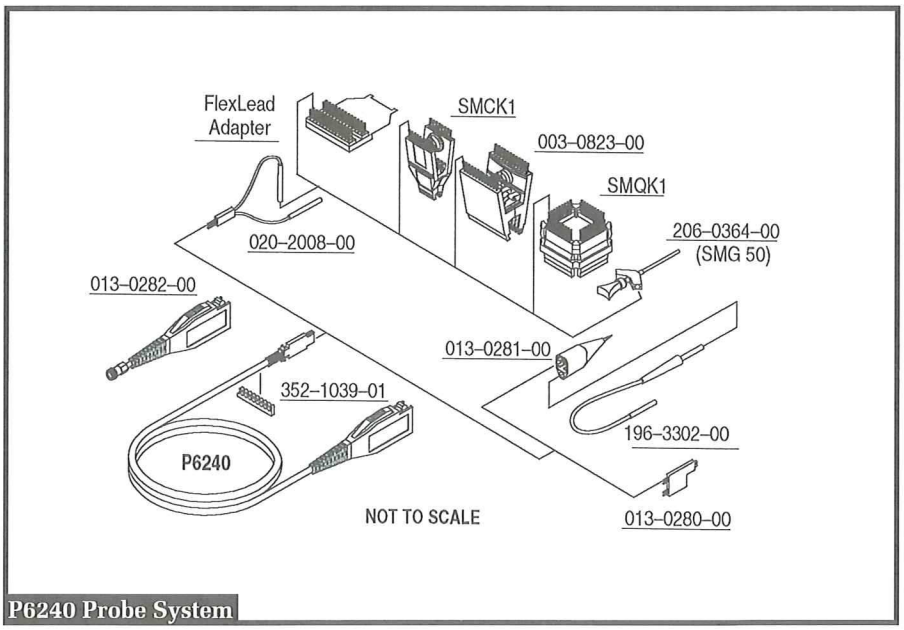


SMD Probe Accessories

Accessories for P6561AS/P6562AS/P6563AS.

P6240 PROBE SYSTEM FOR TLS216

Part Number	Description	Price
003-0823-00	24-Pin DIP, Clothes-pin Style	$42
013-0280-00	One to Two Adapter	$15
013-0281-00	Handheld Probe Tip Adapter w/ Tips	$20
013-0282-00	50 to 75 Ω Converter	$125
196-3302-00	6 in. Ground Lead	$16.50
020-2008-00	Y Lead Adapter, pkg. of 10	$135
206-0364-00	SMT KlipChip™, 1 each	$5.50
352-1039-01	Probe Cable Loom, pkg. of 6	$15.75



P6240 Probe System

SMG50	SMT KlipChip™, 20 each	$99
SMCK1	SOIC Engineering Kit (See page 478 for included items.)	$99
SMQK1	PLCC Engineering Kit (See page 478 for included items.)	$270
FlexLead™ Adapter	PJ (JEDEC) and PE (EIAJ) series. Includes Instruction Sheet, 8 each Adapters. (See page 476 for complete selection and ordering information.)	*1

**1 Contact your local Tektronix representative for price information.*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

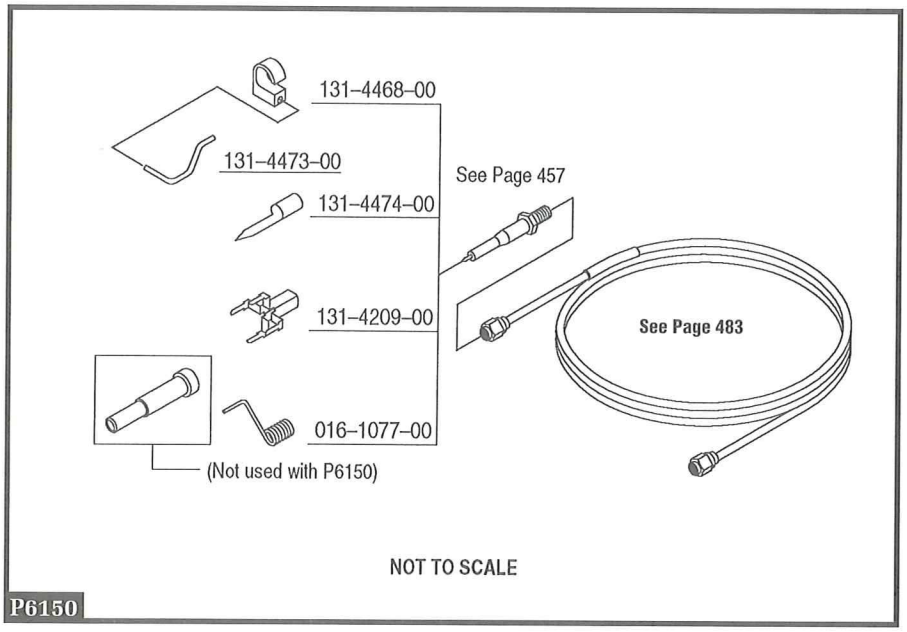
Probe Accessories

P6150 and 4mm

ORDERING INFORMATION – SELECTION GUIDE

P6150

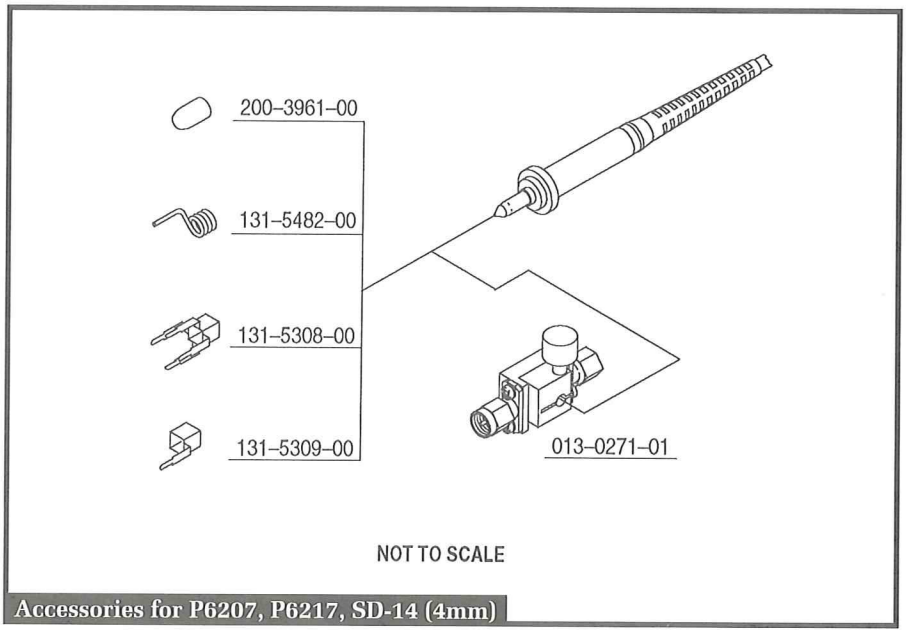
Part Number	Description	Price
016-1077-00	Spring Ground Contact, 2 each of 5 Lengths	**$16.75**
131-4209-00	Probe Tip to CKT BD Adapter	**$.40**
131-4468-00	Ground Collar	**$12.00**
131-4473-00	1/4 in. Ground Lead	**$1.60**
131-4474-00	1 Leg Ground Contact	**$1.55**



P6150

P6207, P6217, SD-14

Part Number	Description	Price
013-0271-01	SMA Adapter to SD-14	**$560.00**
131-5308-00	4 Leg Ground Contact	**$1.55**
131-5309-00	1 Leg Ground Contact	**$1.55**
131-5482-00	Spring Ground Contact 2 each of 5 Lengths	**$19.25**
200-3961-00	ESD Protective Probe Tip Cover	**$1.55**



Accessories for P6207, P6217, SD-14 (4mm)

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

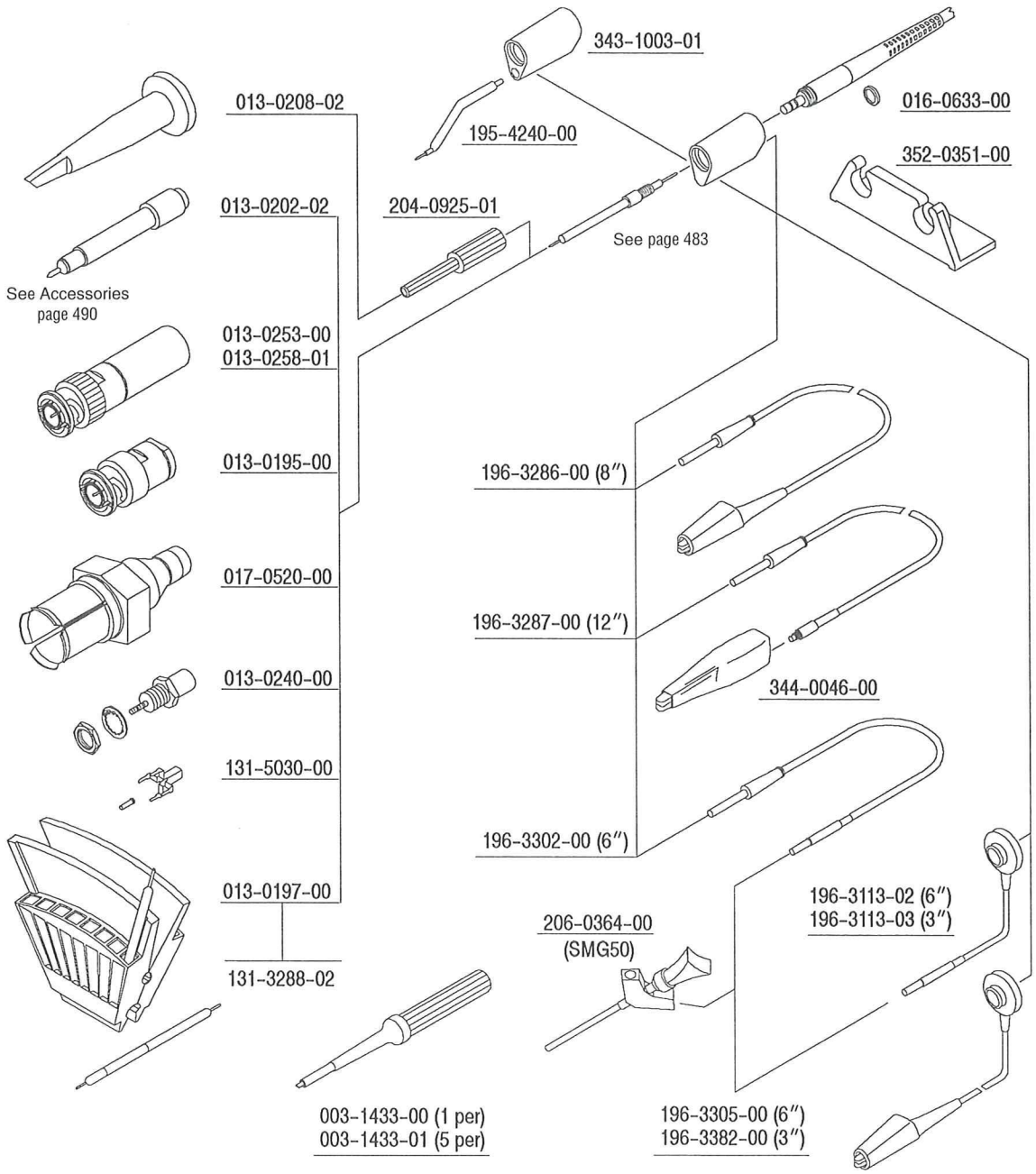
ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Probe Accessories

2.5mm (Subminiature) Probe System

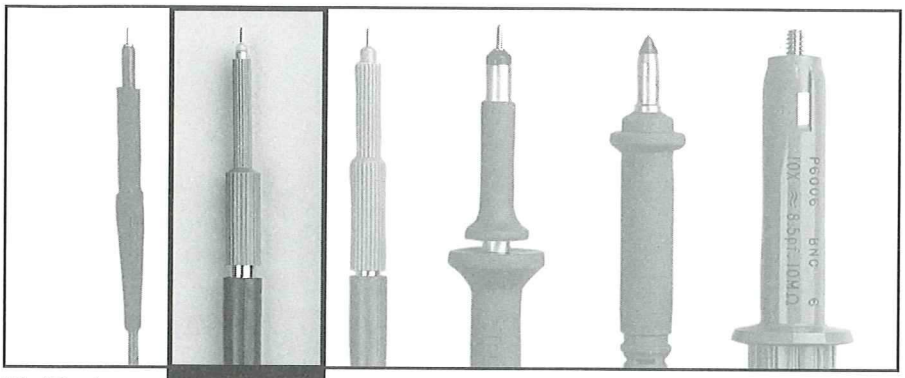


NOT TO SCALE

Probe Accessories for P6130, P6131, P6133, P6134, P6135, P6136, P6230, P6231.

Probe Accessories

2.5mm (Subminiature) Probe System



Tip/Head Style: *SMD* | ***2.5 mm Subminiature*** | *3.5 mm Compact* | *5 mm Miniature* | *4 mm* | *6/32 Thread Monolithic*

ORDERING INFORMATION – SELECTION GUIDE

Part Number	Description	Price
003-1433-00	Adjustment Tool for P601X/A, P612X, and P613X Family	**$1.25**
003-1433-01	Package of 5 each of 003-1433-00, Above	**$6.50**
013-0195-00	Subminiature Probe Tip to BNC Adapter	**$14.75**
013-0197-00	KLIP-KIT (includes two 16-Pin DIP Clips and four signal/ground pins)*1	**$79.00**
013-0202-02	Subminiature/Compact-to-Miniature Probe to Adapter (allows use of miniature probe tip accessories). See page 490	**$7.50**
013-0208-02	Retractable Hook Tip for Subminiature Tip Probes	**$6.50**
013-0240-00	Subminiature Probe Tip Chassis Mount Test Jack	**$7.50**
013-0253-00	Subminiature Probe Tip to BNC Adapter Thread Locking (non-terminated)	**$30.00**
013-0258-01	P6562 Subminiature Probe Tip to BNC Adapter, Thread Locking, 50 Ω Terminated	**$105.00**
016-0633-00	Cable Marker Set for all Modular Cables (P610X/A/B, P612X, P613X/A, P62X, (except P6201, P6202A))	**$5.50**
017-0520-00	Subminiature Probe Tip to GR 50 Ω Termination Adapter	**$95.00**
131-3288-02	Signal/Ground Pins for KLIP-KIT (013-0197-00), (includes eight pins)	**$85.00**
131-5030-00	Subminiature Probe Tip Circuit Board Test Points (Pkg. 25)	**$63.00**
195-4240-00	Low Impedance Ground Contact	**$3.50**
196-3113-02	6 in. Slip-on Ground Lead	**$12.50**
196-3113-03	3 in. Slip-on Ground Lead	**$9.75**
196-3286-00	8 in. Alligator Ground Lead	**$9.75**
196-3287-00	12 in. Slip-on Ground Lead	**$12.50**
196-3302-00	6 in. Alligator Ground Lead (not compatible with P6137, P6134/C, P6053C or P6156)	**$16.50**
196-3305-00	6 in. Alligator Ground Lead	**$15.75**
196-3382-00	3 in. Alligator Ground Lead	**$17.75**
204-0925-01	Subminiature Probe Tip Attenuator Tip Cover	**$1.25**
206-0364-00	SMT KlipChip™ Adapter	**$5.50**
343-1003-01	Ground Collar	**$3.50**
344-0046-00	#6-32 Thread Alligator Ground Clip	**$3.50**
352-0351-00	Probe Holder, Self-adhesive Back, Black	**$2.10**

SMD ATTACHMENT TOOLS

SMG50	SMT KlipChip™ Adapter, package of 2D	**$99.00**

See pages 476-481 for complete selection of SMD Tools.

1 Subminiature (2.5 mm) Probes can be used in place of the Signal/Ground pins.

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

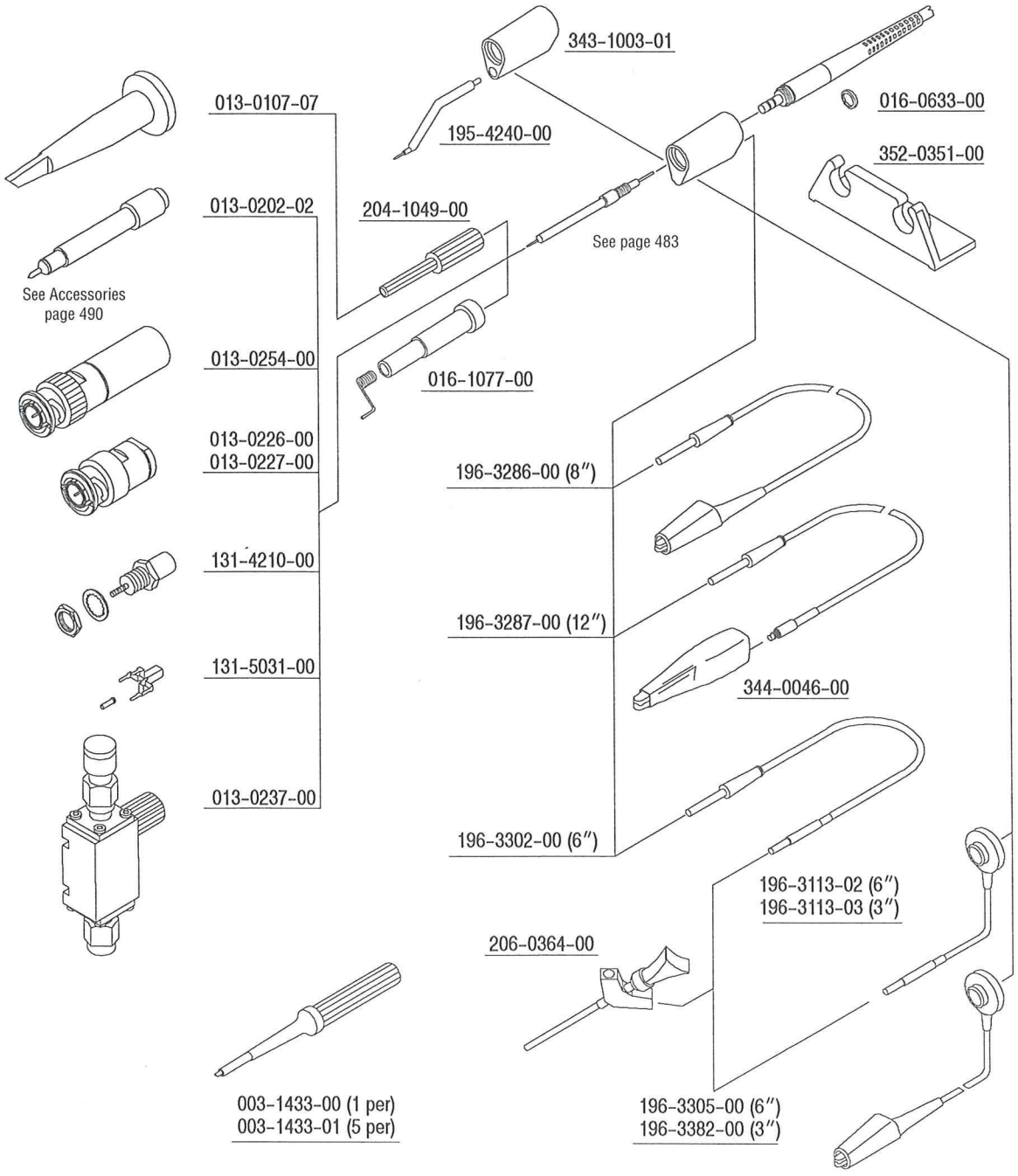
ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Probe Accessories

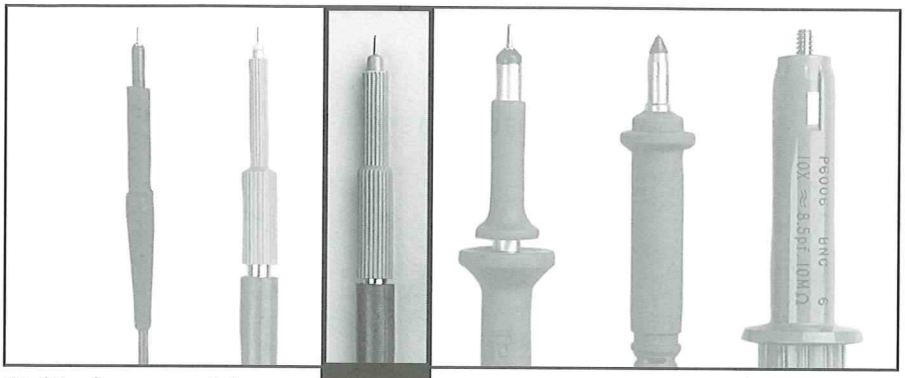
3.5mm (Compact) Probe System



Probe Accessories for P6053C, P6133 Opt. 25, P6134C, P6135A, P6136 Opt. 25, P6137, P6138, P6139A, P6156.

Probe Accessories

3.5mm (Compact) Probe System



Tip/Head Style: *SMD* | *2.5 mm Subminiature* | ***3.5 mm Compact*** | *5 mm Miniature* | *4 mm* | *6/32 Thread Monolithic*

ORDERING INFORMATION – SELECTION GUIDE

Part Number	Description	Price
003-1433-00	Adjustment Tool for P601X/A, P612X, and P613X Family	**$1.25**
003-1433-01	Package of 5 each of 003-1433-00, Above	**$6.50**
013-0107-07	Retractable Hook Tip for Compact Tip Probes	**$5.75**
013-0202-02	Subminiature/Compact-to-Miniature Probe to Adapter (allows use of miniature probe tip accessories). See page 490	**$7.25**
013-0226-00	Compact Probe Tip to BNC Adapter (non-terminated)	**$15.75**
013-0227-00	50 Ω Compact Probe Tip to BNC Termination Adapter	**$84.00**
013-0237-00	Compact Probe Tip to SMA Adapter (50 Ω)	**$365.00**
013-0254-00	Compact Probe Tip to BNC Adapter Thread Locking (non-terminated)	**$30.00**
016-0633-00	Cable Marker Set For All Modular Cables (P610X/A/B, P612X, P613X/A, P623X, P62XX)(except P6201, P6202A)	**$5.50**
016-1077-00	Ground Tip Contact for Compact Tip Probes. 2 ea. Five Different Probe Tip to Ground Contact Spacings.	**$16.75**
131-4210-00	Compact Probe Tip Chassis Mount Test Jack	**$7.50**
131-5031-00	Compact Probe Tip Circuit Board Test Points (Pkg. 25)	**$63.00**
195-4240-00	Low Impedance Ground Contact	**$3.50**
196-3113-02	6 in. Slip-on Ground Lead	**$12.50**
196-3113-03	3 in. Slip-on Ground Lead	**$9.75**
196-3286-00	8 in. Alligator Ground Lead	**$9.75**
196-3287-00	12 in. Slip-on Ground Lead	**$12.50**
196-3302-00	6 in. Alligator Ground Lead (not compatible with P6137 P6134C, P6053C or P6156).	**$15.75**
196-3305-00	6 in. Alligator Ground Lead	**$17.75**
196-3382-00	3 in. Alligator Ground Lead	**$17.75**
204-1049-00	Compact Probe Tip Attenuator Tip Cover.	**$1.50**
206-0364-00	SMT KlipChip™ Adapter	**$5.50**
343-1003-01	Ground Collar	**$3.50**
344-0046-00	#6-32 Thread Alligator Ground Clip	**$3.50**
352-0351-00	Probe Holder, Self-adhesive Back, Black	**$2.10**

SMD ATTACHMENT TOOLS

SMG50	SMT KlipChip™ Adapter, pkg. of 20	**$99.00**

See pages 476-481 for complete selection of SMD Tools.

**1 Contact your local Tektronix representative for price and ordering information.*

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

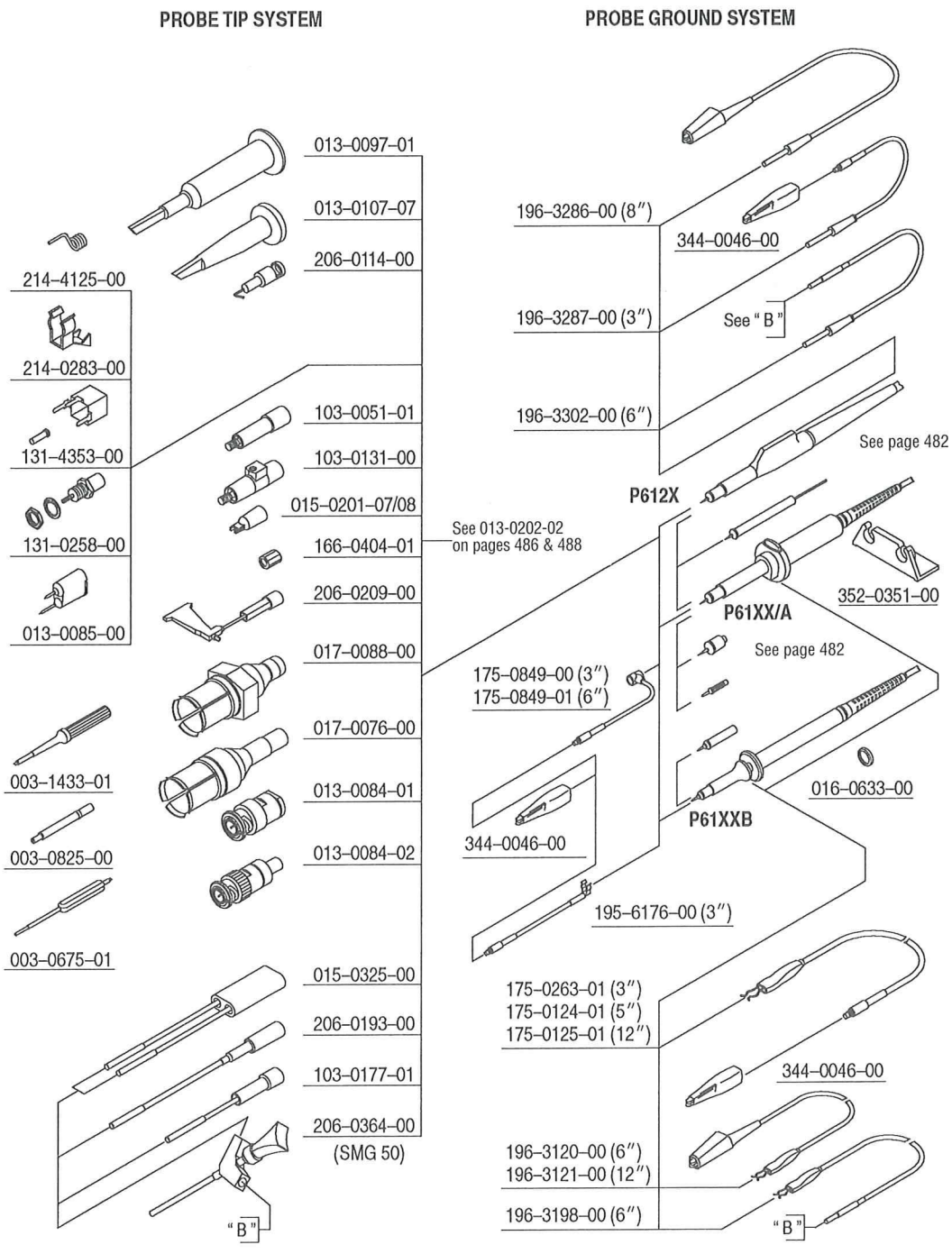
ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Probe Accessories

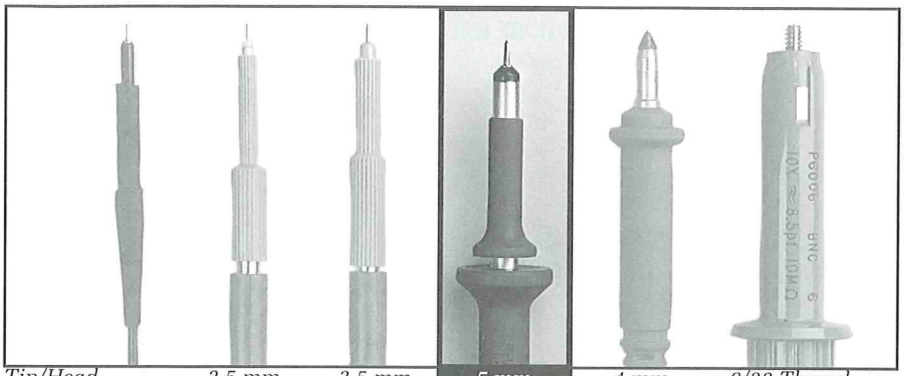
5mm (Miniature) Probe System



Probe Accessories for P6048, P6053, P6053B, P6055, P6056, P6057, P6062B, P6063B, P61XX/A Family, P612X Family, P61XXB Family, P6202A with Adapter, P6203, P6204, P6205, and P6206.

Probe Accessories

5mm (Miniature) Probe System



Tip/Head Style:	SMD	2.5 mm Subminiature	3.5 mm Compact	**5 mm Miniature**	4 mm	6/32 Thread Monolithic

ORDERING INFORMATION – SELECTION GUIDE

MINIATURE PROBE ACCESSORIES

Part Number	Description	Price
003-0675-01	Adjustment Tool P6202A	**$3.00**
003-0825-00	Tip Extractor for Miniature Probes (except for P610X "A" Version and P612X Family Probes)	**$7.50**
003-1433-00	Adjustment Tool for P601XA, P612X, and P613X Family	**$1.25**
003-1433-01	Package of 5 each of 003-1433-00, Above	**$6.50**
013-0084-01	Miniature Probe Tip to BNC Adapter (non-terminated)	**$16.75**
013-0084-02	Miniature Probe Tip to BNC Adapter for All except P6202A, P6420, and P6201 Adapter	**$16.75**
013-0085-00	Bayonet Ground Assembly	**$15.75**
013-0097-01	Retractable Hook Tip for P6202A and P6420	**$17.75**
013-0107-07	Retractable Hook Tip (for all except P6202A and P6420)	**$5.75**
015-0201-07	IC Test Ground Cover, Gray (100 mil spacing) Package of 10	**$8.75**
015-0201-08	IC Test Ground Cover, Gray (100 mil spacing) Package of 100	**$26.00**
015-0325-00	Dual Lead Adapter	**$23.00**
016-0633-00	Cable Marker Set for all Modular Cables (P610X/A/B, P612X, P613X/A, P623X, P62XX)(except P6201, P6202A)	**$5.50**
017-0076-00	Miniature Probe Tip to GR Adapter	**$115.00**
017-0088-00	Miniature Probe Tip GR 50 Ω Termination Adapter	**$105.00**
103-0051-01	Screw Tip (#6-32)	**$6.50**
103-0131-00	Screw Tip with Ground Connection (#6-32)	**$28.00**
103-0177-01	Flexible Tip	**$11.50**
131-0258-00	Chassis Mount Test Jack	**$3.50**
131-4353-00	Circuit Board Test Point, Package of 25	**$63.00**
166-0404-01	Insulating Ground Cover	**$1.85**
175-0124-01	5 in. Clip-on Ground Lead	**$3.50**
175-0125-01	12 in. Clip-on Ground Lead	**$3.50**
175-0263-01	3 in. Clip-on Ground Lead	**$3.50**
175-0849-00	3 in. Probe Tip Cap Lead for All Miniature Size Probe Tips	**$9.75**
175-0849-01	6 in. Probe Tip Cap Lead for All Miniature Size Probe Tips	**$13.50**
195-6176-00	3 in. Probe Tip Clip-on Lead for All Miniature Size Probe Tips	**$8.75**
196-3120-00	6 in. Clip-on Ground Lead	**$3.50**
196-3121-00	12 in. Clip-on Ground Lead	**$5.50**
196-3198-00	6 in. Clip-on Ground Lead (with 0.025 in. pin receptacle)	**$5.25**
196-3286-00	8 in. Ground Lead	**$9.25**
196-3287-00	#6-32 Thread Ground Lead	**$12.00**
196-3302-00	6 in. Slip-on Ground Lead (with 0.025 in. pin receptacle)	**$16.50**
206-0114-00	Hook Tip	**$5.50**
206-0193-00	Flex Tip for 0.025 in. Square Pin	**$22.00**
206-0209-00	Pin Tip (accepts 0.025 in. IBM SLT pin)	**$7.25**
214-0283-00	Electrical Ground Contact	**$2.45**
214-4125-00	Electrical contact ground	**$2.25**
344-0046-00	#6-32 Thread Alligator Ground Clip	**$3.50**
352-0351-00	Probe Holder, Self-adhesive Back, Black	**$2.25**

SMD ATTACHMENT TOOLS

206-0364-00	SMT KlipChip™ (used with 0.025 pin receptacles)	**$5.50**
SMG 50	Package of 20 each SMT KlipChip™ Adapters	**$99.00**

See pages 476-481 for complete selection of SMD Tools.

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

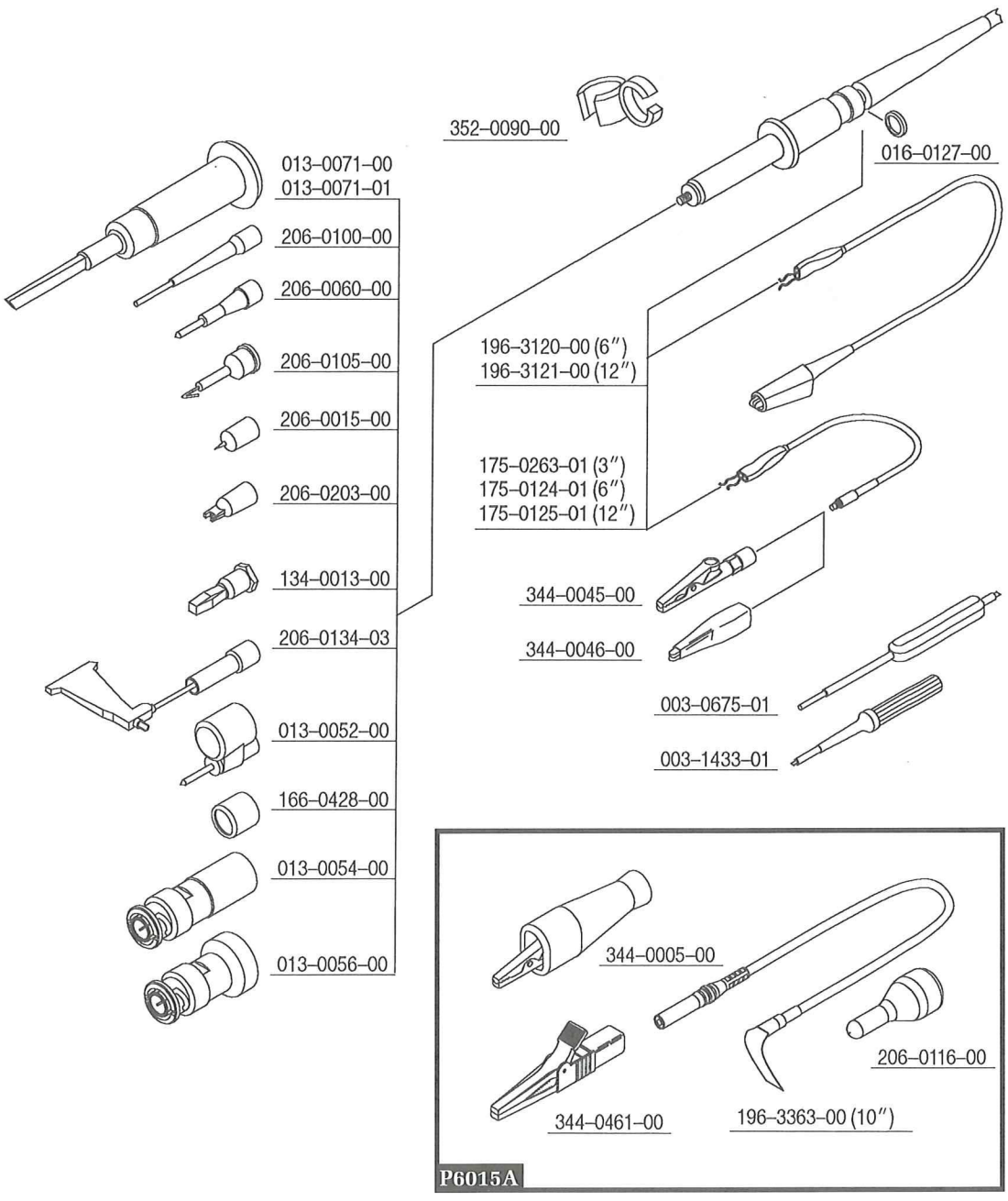
ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Probe Accessories

6/32 Thread (Monolithic), P6015A and P6201

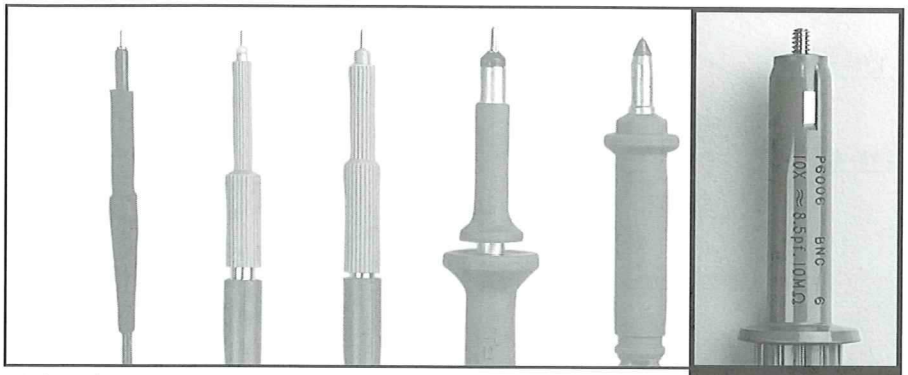


NOT TO SCALE

Accessories for P6006, P6007, P6008, P6009, P6028, P6060.

Probe Accessories

6/32 Thread (Monolithic), P6015A and P6201

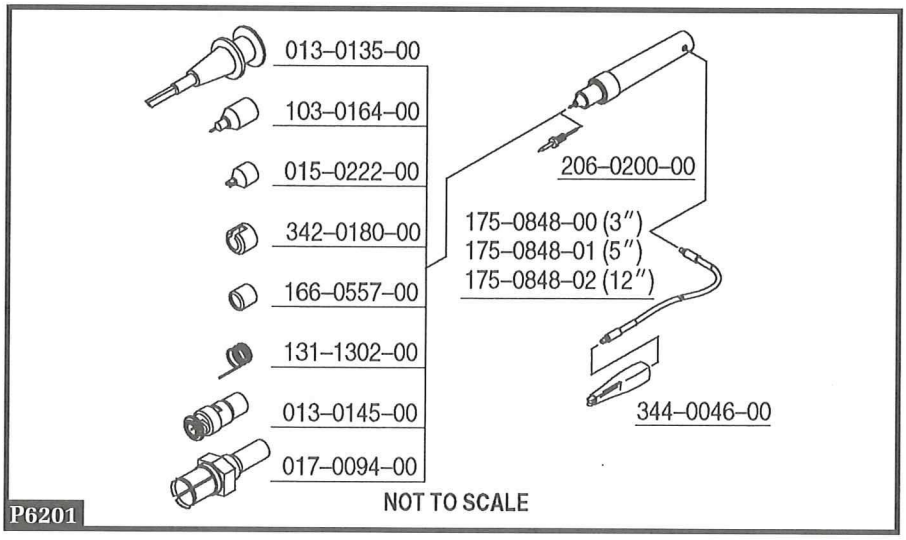


Tip/Head Style:	SMD	2.5 mm Subminiature	3.5 mm Compact	5 mm Miniature	4 mm	6/32 Thread Monolithic

ORDERING INFORMATION – SELECTION GUIDE

MONOLITHIC PROBE ACCESSORIES
(For probes with #6-32 Screw Tips)

Part Number	Description	Price
003-0675-01	Adjust Tool	$2.25
003-1433-00	Adjust Tool for P600X Family	$1.25
003-1433-01	Adjust Tool for P600X Family Pkg. of 5	$6.50
013-0052-00	Bayonet Ground Assembly	$17.75
013-0054-00	Probe Screw Tip to BNC Adapter	$28.00
013-0056-00	Probe Screw Tip to BNC Adapter for P6028	$30.00
013-0071-00	Retractable Hook Tip	$7.50
013-0071-01	Retractable Hook for P6008 Environmental Probe.	$6.50
134-0013-00	Banana Tip (#6-32)..	$1.25
166-0428-00	Insulating Ground Cover for P6009	$1.40
175-0124-01	5 in. Ground Lead	$3.50
175-0125-01	12 in. Ground Lead	$3.50
175-0263-01	3 in. Ground Lead	$3.50
196-3120-00	6 in. Clip-on Ground Lead	$3.50
196-3121-00	12 in. Clip-on Ground Lead	$5.50
196-3363-00	10 in. Clip-on Ground Lead for P6015A	$24.00
206-0015-00	Straight Tip (0.055 in. dia).	$2.25
206-0060-00	Spring Tip (0.08 in. dia).	$7.50
206-0100-00	Calibration Tip (0.063 in. dia)	$14.50
206-0105-00	Hook Tip	$2.25
206-0116-00	Banana Tip (P6015 only) #10-32	$4.05
206-0134-03	Pin Tip (accepts 0.025 in. IBM SLT pin)	$9.75
206-0203-00	IC Test Tip	$2.25
344-0045-00	Alligator Clip	$1.55
344-0046-00	Miniature Alligator Clip with Boot	$3.50
344-0461-00	Crocodile Clip, 4 mm Socket	$12.25
352-0090-00	P600X Probe Holder	$.70



P6201 PROBE

Part Number	Description	Price
013-0135-00	Retractable Hook Tip	$9.75
013-0145-00	Probe Tip to BNC Adapter.	$43.00
015-0222-00	IC Test Ground Cover	$1.05
017-0094-00	Probe Tip to GR 50 Ω Termination Adapter	$160.00
103-0164-00	Probe Tip to Miniature Probe Tip Adapter (See page 490 for compatible accessories)	$19.00
131-1302-00	Ground Contact	$1.25
166-0557-00	Insulating Ground Cover	$1.25
175-0848-00	3 in. Ground Lead	$3.50
175-0848-01	5 in. Ground Lead	$3.50
175-0848-02	12 in. Ground Lead	$3.50
206-0200-00	Replaceable Probe Tip	$2.25
342-0180-00	Ground Contact Insulator	$2.55
344-0046-00	#6-32 Thread Alligator Ground Clip	$3.50

CABLE MARKER SETS

016-0127-00	For 3/16 in. dia. Cable	$35.00

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

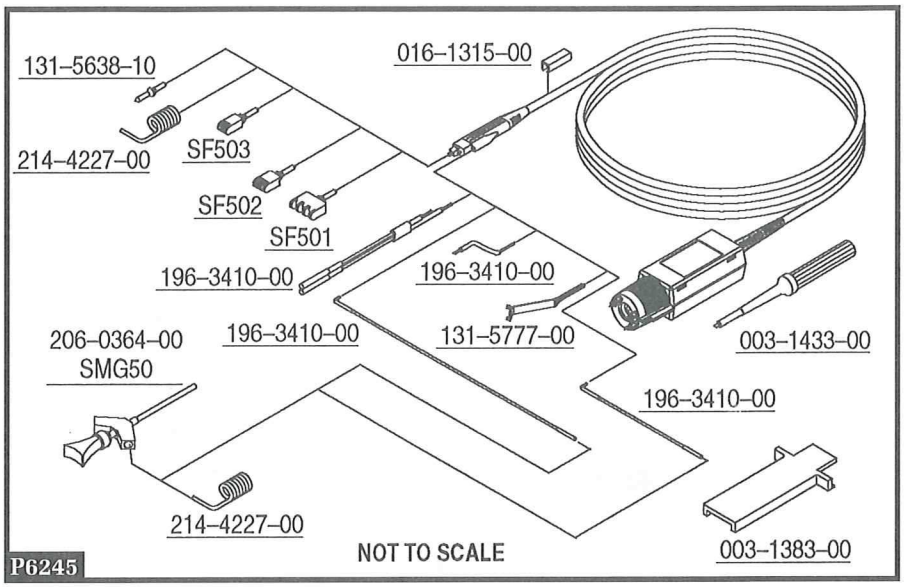
Tektronix Measurement products are manufactured in ISO registered facilities.

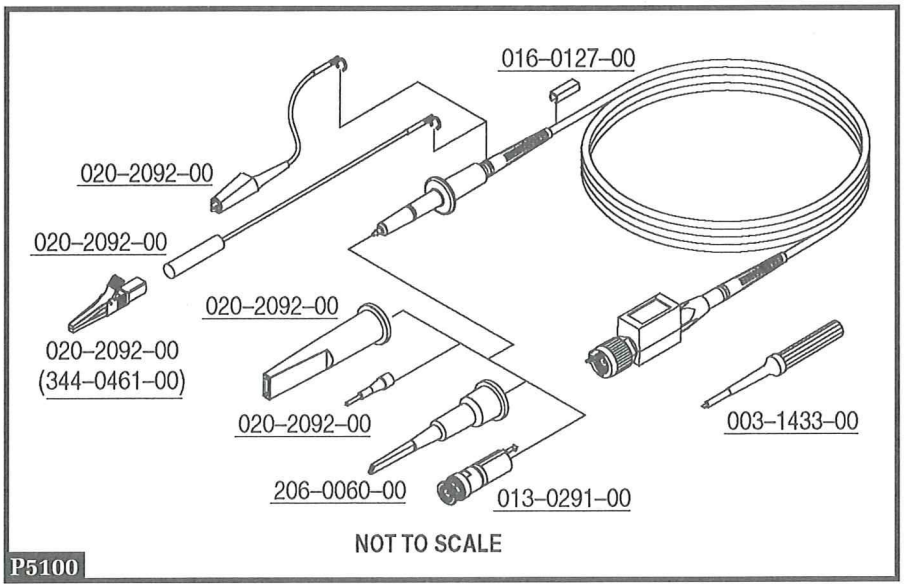
P6245
P5100

Probe Accessories

P6245

Part Number	Description	Price
003-1383-00	Compensation Box Cover Removal Tool	**$3.45**
003-1433-01	Package of 5 each of 003-1433-00, Above	**$6.50**
016-1315-00	2 each – 5 Colors of Cable Markers	**$5.00**
131-5638-10	10 each - Solderable Probe Tips	**$10.00**
131-5777-00	100 mil Square-Pin Ground Adapter	**$2.00**
196-3410-00	Ground lead set includes: 2 each – 1 in, 3 in, 6 in Ground Leads w/Square Pin Recepticle 2 each – Y Lead Adapters	**$40.00**
206-0364-00	SMT KlipChip™, 1 each	**$5.50**
214-4227-00	Right Angle Square-Pin Adapter	**$6.25**
SF501	SureFoot™ Probe Tip Adapter, pkg. of 12, yellow, 50 mil pitch	**$39.00**
SF502	SureFoot™ Probe Tip Adapter, pkg. of 12, Blue, 25 mil/ 0.65 mm Pitch	**$39.00**
SF503	SureFoot™ Probe Tip Adapter, pkg. of 12, red, 0.5 mm pitch	**$39.00**
SMG50	SMT KlipChip™, 20 each	**$99.00**





P5100

Part Number	Description	Price
020-2092-00	P5100 Accessory Kit Includes: Regular Retractable Hook Tip, Large Retractable Hook Tip, 6 in Ground Lead w/Alligator Clip, 18 in Gound Lead w/4 mm Shielded Banana Plug, Large Crocodile Clip	**$25.00**

Part Number	Description	Price
003-1433-01	Package of 5 each of 003-1433-00, Above	**$6.50**
013-0291-00	P5100 Probe Tip to BNC Adapter	**$29.00**
016-0127-00	Cable Marker Set	**$35.00**
206-0060-00	Spring Tip (0.08 in. dia.)	**$7.50**
344-0461-00	Large Crocodile Clip	**$12.25**

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

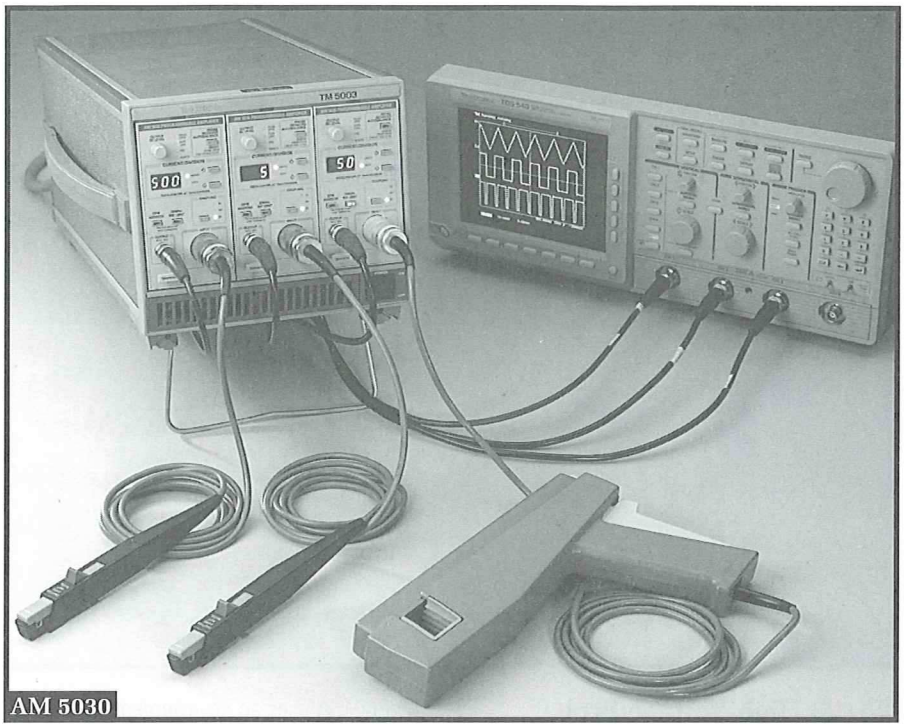
Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Power Measurements



AM 5030 Programmable Current Probe Amplifier with A6302 and A6303 Current Probes.

Power Measurements

Oscilloscopes measure voltages, presented at their inputs, to provide amplitude versus time displays and offer a wide range of analysis capabilities. These voltage signals are typically referenced to ground and less than 500 V. While providing valuable information about what is occurring in your device, it is clear that knowledge of currents, high voltages, and floating voltages may all be required to completely understand what is happening with your application.

In the following sections we describe a selection of probes and devices which enable you to safely and accurately capture current, high voltage, and floating signals – all converted to voltage inputs acceptable to your oscilloscope or other measurement instrument.

While current and differential voltage measurements are important to most electrical and electronic applications, higher current and voltage and isolated floating measurements are especially critical in power conversion applications. These applications include devices characterized by high currents and differential voltages which change rapidly as the devices switch on and off. In these applications, safety as well as accuracy is of critical importance. The special needs of these applications are addressed by the group of products we refer to as power measurement products.

In the following pages we describe each category of measurement products: Current probes, high voltage probes, monolithic isolators, fiber optic isolation systems, and differential probes.

In each section we describe product features and applications and provide information to enable you to select the right device which will allow you to safely and accurately make your measurement. We will also provide information about literature which provides valuable information on how to make measurements specific to your application.

POWER MEASUREMENTS

- High Voltage
- Isolation
- Differential
- Current

Tektronix has what you need to design and test power applications, such as Power Supplies, Motor Drives, Avionics, Electric Vehicles, Electronic Ballasts, Uninterruptible Power Supplies, DC to DC Converters, Inverters, Welders, Discharge Devices.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001

Tektronix Measurement products are manufactured in ISO registered facilities.

High Voltage Probes

P5100
P6015A
P400
P850

P6015A

Measurements for auto ignition, transformers, circuit breakers, surge protectors, lightning strike evaluation, avionics: radar, magnetrons, traveling wave tubes, electric ground transportation vehicles, semiconductor production equipment.

P400/P850

Safe floating power measurements for industrial service with 22X Handheld Oscilloscopes.

P5100

Measurements up to 2.5 kV for motor drives, power supplies, and other switch-mode control devices.

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

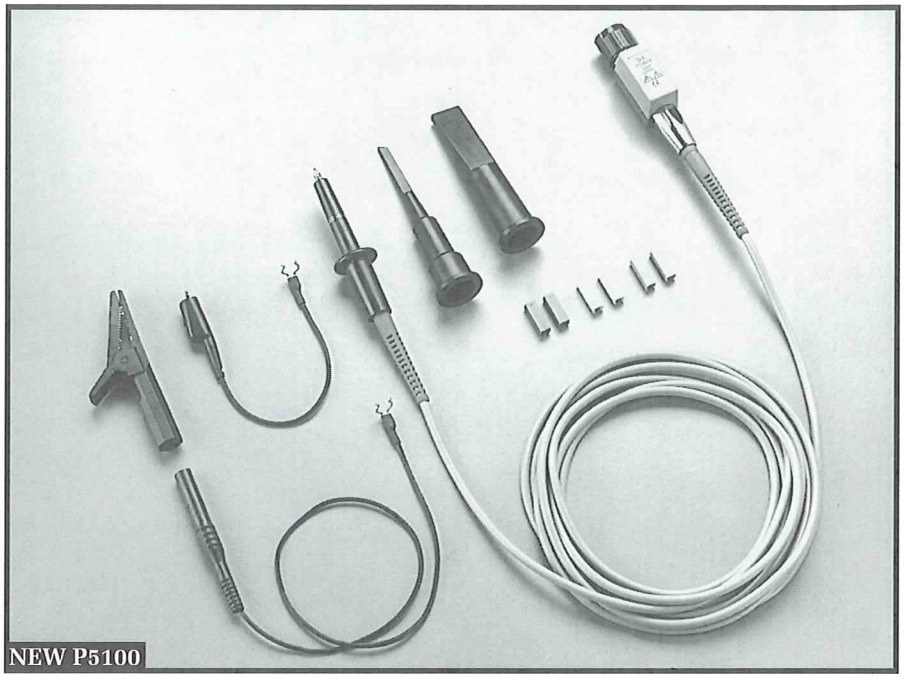
Tektronix Measurement products are manufactured in ISO registered facilities.

New P5100
- DC to 250 MHz
- 2500 VDC + Peak AC
- 100X with Readout
- UL Listed 1244
- IEC 1010 Certified
- 7-30 pF Compensation Range

P6015A
- High Voltage – 20 kV DC/40 kV Peak (100 ms Pulse Width)
- High Bandwidth – 75 MHz
- Silicone Dielectric
- Optional 1,000X Coding
- Wide Compensation Range (7-49 pF)
- Heavy Duty Versatile Ground Lead and Clip

P400
- 1X
- DC to 20 MHz
- UL Listed 1244

P850
- 10X
- DC to 60 MHz
- UL Listed 1244


NEW P5100

P5100 High Voltage Probe

The P5100 is a low-input capacitance High Voltage (2.5 kV) Probe designed for higher frequency applications. The probe can be compensated to match plug-ins and oscilloscopes with nominal input capacitances of 7-30 pF. A variety of screw-on accessories provide easy connection to the device under test.

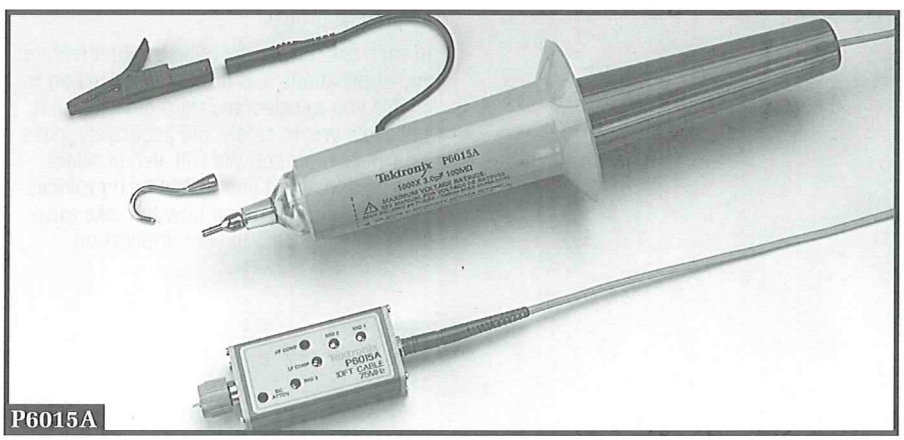
For additional information on P5100 request Data Sheet 56W-10262-0.

P6015A High Voltage Probe

For heavy duty high-performance measurements of voltages over 2.5 kV, the P6015A is the industry standard. You can measure DC voltages up to 20 kV and pulses up to 40 kV. The 75 MHz bandwidth enables you to capture fast, high-voltage signals.

The P6015A uses an environmentally safe silicone compound for a dielectric and never needs refilling. Other features include: a 7-49 pF compensation range, small compensation boxes which fit on adjacent amplifier inputs, and a readout option for use with Tektronix digital scopes. With the readout option, displayed voltage amplitude values will be the actual signal value rather than understated by a factor of 1,000. Using the readout version with other than Tektronix digital scopes may result in an erroneous readout display.

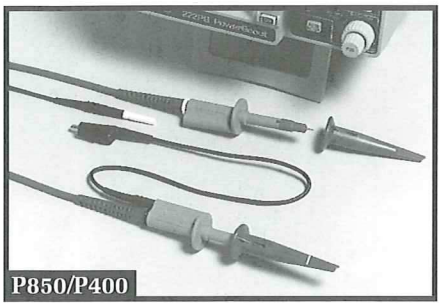
For additional information on the P6015A, request P6015A Data Sheet 51W-8217-1.



P6015A

High Voltage Probes

P5100
P6015A
P400
P850



P850 and P400 with 222PS.

P400 and P850 Voltage Probes

The P400 and P850 are used with the 222A, 222PS, and 224 handheld oscilloscopes. These oscilloscopes feature two completely isolated floating input channels. The P400 and P850 are UL listed and were specifically designed for making safe power measurements. The P400 is 1X attenuation and the P850 is 10X attenuation. These probes directly plug into the 22X oscilloscopes. Since the performance of the probes depends on which of the 22X oscilloscopes they are being used with, refer to the characteristics table for specific scope/probe specifications.

CHARACTERISTICS

P6015A/P5100/P6007/P6009

Probe	Nominal Length	Attenuation	Bandwidth	Rise Time	Loading	Max Input V	In pF DC or RMS	Readout
P6015A	10 ft.	1000X	75 MHz	4.0 ns	100 MΩ/3 pF	20 kV	7 to 49	No
P6015A Opt. 1R	10 ft.	1000X	75 MHz	4.0 ns	100 MΩ/3 pF	20 kV	7 to 49	Yes
P6015A Opt. 25	25 ft.	1000X	25 MHz	14 ns	100 MΩ/4 pF	20 kV	7-49	No
P6015A Opt. 2R	25 ft.	1000X	25 MHz	14 ns	100 MΩ/4 pF	20 kV	7-49	Yes
P5100	10 ft.	100x	250 MHz	1.75 ns	10 MΩ/2.75 pF	2.5 kV	7 to 30	Yes
P6007 Opt. 01	3.5 ft.	100X	25 MHz	14 ns	10 MΩ/2 pF	1.5 kV	8 to 55	No
P6007	6 ft.	100X	25 MHz	14 ns	10 MΩ/2.2 pF	1.5 kV	8 to 55	No
P6007 Opt. 03	9 ft.	100X	25 MHz	14 ns	10 MΩ/2.4 pF	1.5 kV	8 to 55	No
P6007 Opt. 04	12 ft.	100X	25 MHz	14 ns	10 MΩ/2.6 pF	1.5 kV	8 to 55	No
P6009	9 ft.	100X	120 MHz	2.9 ns	10 MΩ/2.5 pF	1.5 kV	8 to 47	Yes

P850/P400

	Nominal Length	Attenuation	Loading	Bandwidth			Max Input V		
				222A	222PS	224	222A	222PS	224
P400	3.5 ft.	1X	1 MΩ/30 pF	10 MHz	10 MHz	20 MHz	400 V	850 V	850 V
P850*[1]	3.5 ft.	10X	10 MΩ/4.5 pF	10 MHz	10 MHz	60 MHz	400 V	850 V	850 V

[1] The P850 is rated for 6 kV peak surge (≤250 µS) when used with the 222PS and 224, but not for the 222A.

ORDERING INFORMATION

P5100
100X, 10 ft. High Voltage Probe **$199**
Includes: Two each three colors Cable Markers, One each Crocodile Clip, One each Adjustment Tool, One each Hooktip (Small), One each Hooktip (large), One each 18 inch Ground Lead, One each six inch Ground Lead, Instruction Manual (070-8151-00).

P6015A
1,000X, 10 ft. High Voltage Probe **$985**
Includes: Hook Probe Tip (206-0463-00); Banana Plug Tip (134-0016-00); Crocodile Clip – plugs onto Ground Lead (344-0461-00); Ground Lead (196-3363-00); Carrying Case (016-1147-00); Instruction Manual (070-8223-02).

Opt. 1R – 10 ft. with Readout. ..... **+$55**
Opt. 25 – 25 ft. without Readout. ..... **+$125**
Opt. 2R – 25 ft. with Readout. ..... **+$170**

P850
10X, 3.5 ft. Voltage Probe **$115**
Includes: Ground Lead (196-3337-00); Accessory Kit (020-1908-00); Data Sheet (063-0634-00).

P400
1X, 3.5 ft. Voltage Probe **$105**
Includes: Ground Lead (196-3337-00); Accessory Kit (020-1908-00); Data Sheet (063-0634-00).

P6007
100X, 5 ft. High Voltage Probe **$195**
Includes: Retractable Hook Tip (013-0071-00); Banana Tip (134-0013-00); 5 in. Ground Lead (175-0124-01); 12 in. Ground Lead (175-0125-01); .005 in. Diameter Straight Tip (206-0015-00); .080 in. Diameter Spring Tip (206-0060-00); Hook Tip (206-0105-00); 2 Miniature Alligator Clips (344-0046-00); Probe Holder (352-0090-00); Instruction Manual (070-0388-01).

Opt. 01 – 3.5 ft. Cable ..... **+$30**
Opt. 03 – 9 ft. Cable ..... **+$35**
Opt. 04 – 12 ft. Cable ..... **+$55**

P6009
100X, 9 ft. High Voltage Probe with Readout **$299**
Includes: Same as the P5100 plus Bayonet Ground Assembly (013-0052-00); 3 in. Ground Lead (175-0263-01); Instruction Manual (070-0401-01).

RECOMMENDED ACCESSORIES
See page 476-494 for complete selection information.

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Floating Measurements

Safe and accurate high-performance measurement solutions for floating voltages: Isolation Amplifiers, Differential Measurement Systems, and Isolated Input Oscilloscopes.

P6046
- Active Differential Probe
- 100 MHz

New ADA400A
- Active Differential Preamplifier
- 10 mV/div Sensitivity

New P5200

Active Differential Probe
- 1300 V differential

New P5135
- High Voltage Differential Probe Pair
- 2,500 V

P6135A
- Differential Probe Pair
- High CMRR with All Tektronix Differential Amplifiers

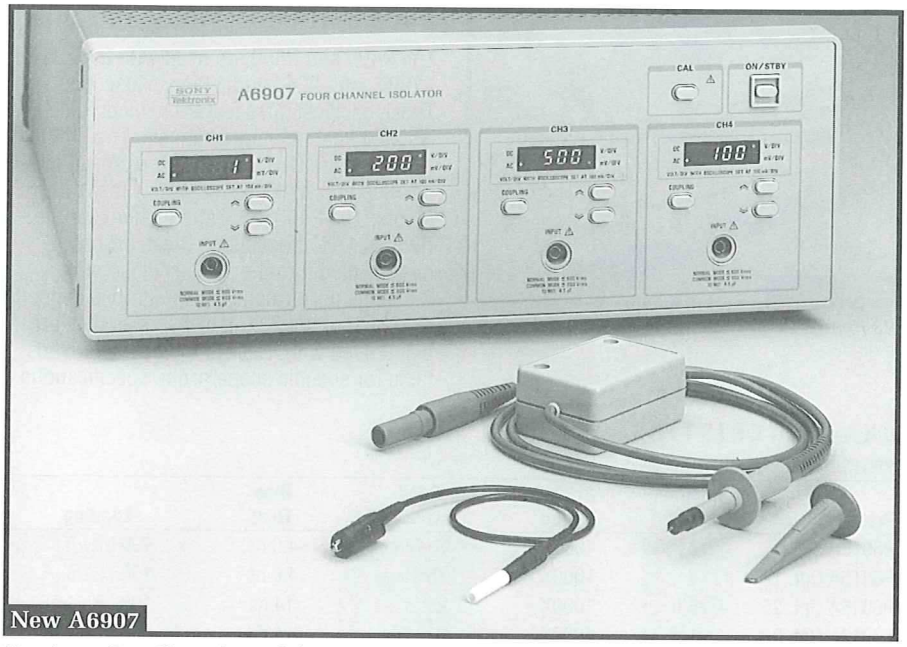
New A6907
- Monolithic Voltage Isolator
- 4 Channel

New A6909
- Monolithic Voltage Isolator
- 2 Channel

A6905S
- Fiber Optic Isolation System
- Up to 100 m Separation

A6906S
- Fiber Optic Isolation System
- High Performance Measurements

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.



New A6907 Four Channel Monolithic Isolator.

Floating Measurements

Differential probes and isolators enable safe oscilloscope measurements of floating voltages or signals that are not referenced to ground. They are particularly useful for measuring signals in line-connected power electronics circuits such as switching supplies, motor drives, ballasts and uninterruptible power sources. Fiber optic isolators offer the additional benefit of physically separating the scope from the probe by up to 200 meters while maintaining up to 100 MHz of signal bandwidth.

Oscilloscope users often have to make measurements where neither point of the measurement is at ground (earth potential). Signal "common" may be elevated to hundreds of volts from ground. In addition, many of these measurements require the rejection of high common mode signals in order to evaluate low level signals riding on them. Extraneous ground currents can also add hum to the display. Too often, these problems force users into using dangerous measurement techniques.

For safe and accurate operation, an oscilloscope must be referenced to ground. "Floating" a scope by defeating the scope's protective grounding system not only presents a danger to the operator because of high voltage shock hazard on the entire scope, but also stresses the scope's power transformer insulation. Measurement accuracy is also degraded since the capitance of the scope chassis is now connected to your circuit. Common ways of defeating the scope ground are: non-monitored isolation transformers, double insulated mains, isolating circuits and the traditional cutting off the ground prong or using a 3-to-2 wire adapter. All of these are dangerous!

Fortunately, there are several solutions available which are not only safe but much more accurate than the dangerous procedures. These fall into three general categories: isolation amplifiers, differential measurement systems, and isolated input oscilloscopes.

Floating Measurements

ISOLATION AMPLIFIERS

An isolation amplifier is connected between the circuit and the oscilloscope, with the signal coupled across an isolation barrier. The A6905S and A6906S Fiber Optic Systems provide both isolation and physical separation for signals up to 850 V by using fiber optic cable as the isolation medium. This also enables up to 200 meters of physical separation between the probe and the measurement instrument. The monolithic four and two channel A6907/A6909 use electro-optical/transformer isolation and are also rated for up to 850 V.

DIFFERENTIAL MEASUREMENT SYSTEMS

Differential measurement systems compare the voltage levels at two different points in the circuit and provide the difference as an output. They will typically have better CMRR performance at higher frequencies than voltage isolators. The P6046, P5200, and ADA 400A are standalone systems which enable differential measurements to be displayed by Tektronix TDS and most other oscilloscopes. The P6046 is well suited for fast, lower amplitude signals, while the P5200 can handle slower signals with higher voltage amplitudes. The ADA 400A Differential Preamplifier provides the capability to display low frequency, very low amplitude differential signals even in high noise environments.

Passive differential probe pairs maximize the performance of differential amplifiers/comparators such as the 11A33. The P6135A supports all Tektronix differential amplifiers for input voltages up to 500 V. The 100X P5135 supports Tektronix 11A33 and 7A13 differential amplifiers for input voltages up to 2.5 kV.

ISOLATED INPUT OSCILLOSCOPES

The 222PS/224 handheld oscilloscopes feature dual input channels, individually isolated from the scope's chassis as well as from each other. With the 850 V rated P400 and P850 probes, floating measurements can be made safely and accurately.

For more information, request Floating Oscilloscope Measurements… And Operator Protection, 60W-8535-0.

COMMON MODE REJECTION RATIO

Differential measurements, simply stated, show you the difference in levels between two test points. Specifically, a floating measurement is a differential measurement which is not referenced to ground. To accurately make this measurement, the measurement system must reject the signal which is common to both test points and display the amplified voltage difference.

WHAT IS CMRR?

CMRR stands for Common Mode Rejection Ratio. CMRR serves as a figure of merit for a differential amplifier defined by:
$CMRR = |A_d/A_c|$, where:

- A_d is the voltage gain for the difference signal
- A_c is the voltage gain for the common-mode signal

Ideally, A_d should be large, while A_c should equal zero. Since a perfect differential amplifier has a CMRR equal to ∞, the higher the CMRR for the differential measurement system, the closer it is to the ideal. For example, with a system CMRR of 10,000:1, a common-mode input of 5 V will result in an output of 0.5 mV. (5 V / 0.5 mV) = 10,000:1 CMRR. CMRR is also expressed in dB with the relationship of: CMRR dB = 20 log CMRR. Hence, a CMRR of 10,000:1 would be 80 dB.

WHY CMRR IS IMPORTANT

CMRR defines the ability of a measurement system to accurately resolve difference measurements in the presence of common-mode signals. With a CMRR of 10,000:1 (80 dB), if our common-mode signal is 50 V, we will be able to distinguish voltage differences > 5 mV. With a CMRR of 100:1(40 dB), however, we would only be able to resolve differences >500 mV.

CMRR is degraded by an increase in signal frequency, differences in source impedance, inappropriate ground connections and mismatch in probes and scope input amplifiers. Since common mode signals in switching circuits contain significant high frequency components, CMRR at higher frequencies is critical for making accurate measurements.

Differential Probes

Measure two voltage points in a circuit and provide, as an output, the difference between two voltages.

Avoid ground loop errors in mixed signal circuits.

Test twisted pair data links.

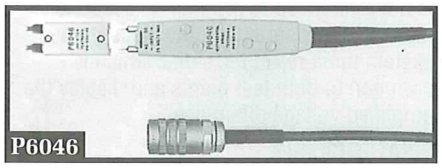
P6046

- Active Differential System
- DC to 100 MHz
- 1X/10X Differential
- Typically 10,000:1 CMRR Derating to 1,000:1 at 50 MHz
- ±250 V Maximum Voltage with 10X Attenuator

Differential Measurements

Differential measurement systems enable you to simultaneously measure two voltage points in a circuit and provide as an output the difference between the two voltages.

Tektronix offers two types of differential measurement probes: the active differential probe system and the passive matched pair of probes. The P6046 and P5200 are active differential amplifiers in probe form which connect to one channel of a standard scope amplifier. The P6135A and P5135 are passive probe pairs designed to enhance the performance of a differential amplifier.

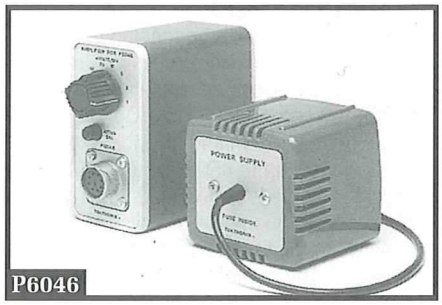


P6046 with 10X Attenuator

P6046 ACTIVE DIFFERENTIAL PROBE SYSTEM
The P6046 is a self-contained active differential system consisting of a Differential Probe, Amplifier and Power Supply. Active FET amplifiers at the dual-inputs reduce circuit loading. Combined with the differential processing occurring in the probe head, the P6046 provides superior common mode rejection ratios (CMRR) at high frequencies typically 10,000:1 out to 50 kHz, derating to 5,000:1 at 1 MHz.

Since the P6046 is self-contained, it provides a differential output into a single channel of any oscilloscope. System controls enable you to select AC or DC coupling, adjust the DC balance and select mV/div from 1 to 200 mV (10 mV to 2 V with attenuator head) in standard 1, 2, 5 steps.

A slip-on 10X attenuator is also included which increases the maximum input voltage from ±25 V to ±250 V and the common mode dynamic range from ±5 V to ±50 V.



P6046 Amplifier with Power Supply

Characteristics

CMRR – With deflection factors of 1 to 20 mV/div: at least 10,000:1 at 50 kHz, 5,000:1 at 1 MHz, and 1,000:1 at 50 MHz (DC coupled).

Common Mode Linear Dynamic Range – ±5 V, ±50 V with 10X attenuator.

Bandwidth – DC to 100 MHz (–3 dB).

Rise Time – 3.5 ns or less.

Deflection Factor Range – 1 to 200 mV/div in eight calibrated steps, 1-2-5 sequence, accurate within 3% (with an oscilloscope deflection factor of 10 mV/div). Input RC 1 MΩ paralleled by 10 pF or less.

Input Coupling – AC or DC, selected by a switch on the probe. Low frequency response AC-coupled is –3 dB at 20 Hz, 2 Hz with 10X attenuator.

Displayed Noise – Typically 450 mV or less (tangentially measured).

Maximum Input Voltage – ±25 V (DC + peak AC), ±250 V with 10X attenuation, derated with frequency. The P6046 circuitry can be damaged by electrostatic discharge. Please refer to the manual for use.

Output Impedance – 50 Ω through a BNC-connector. 50 Ω termination supplied with amplifier for use with 1 MΩ systems.

Probe Cable – 6 ft. long, terminated with special nine-pin connector.

APPLICATIONS

- **Power Supplies**
- **Disk Drives**
- **Electronic Ballast**
- **Intelligent Motion**
- **Single and Three Phase Adjustable Speed Drives**

ORDERING INFORMATION

P6046
1X, 6 ft. FET Differential Probe with Amplifier and Power Supply.....**$2,395**
Includes: 50 Ω Termination (011-0049-01); Amp and Power Supply (015-0106-00); 50 Ω Coaxial Cable (012-0076-00); Hanger Assembly (014- 0029-00); Carrying Case (016-0111 01); Dual Attenuator Head (010-0419-00); Swivel Probe Tip; Spring Ground Contact; Connector Test Point Jack; Instruction Manual (070-7129-01).

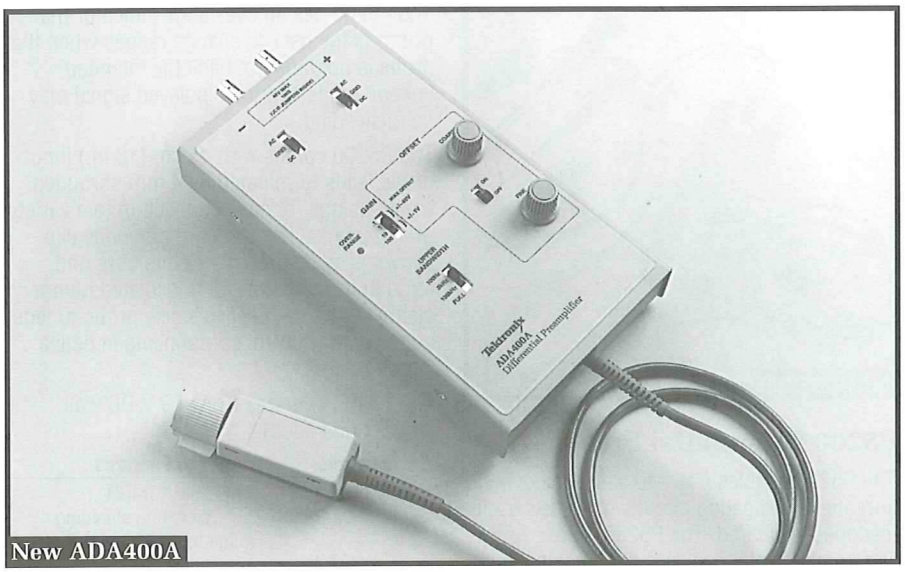
Opt. A6 – Japan, 100 V, 50 Hz.....**NC**
Power Supply with Amplifier – Order 015-0106-00.....**$1,515**

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection.....**+$100**
Opt. C5 – Adds five years of Calibration Services.....**+$325**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

Differential Preamplifier



New ADA400A

New ADA400A

- Active Differential Preamplifier
- 10 µV/div Sensitivity
- Typically 100 dB CMRR DC to 10 kHz
- Integral Probe Power with TEKPROBE™ BNC

The ADA400A extends the capabilities of the TDS family of scopes to include high gain differential measurements of µV signals.

ADA400A

The ADA400A Differential Preamplifier allows direct oscilloscope measurements of very low amplitude voltages and signals which are not ground referenced. The high impedance of both inputs eliminates the need to add additional ground points in the DUT, thereby avoiding circulating currents which disturb the measurement or the circuit.

The high gain and extremely high common mode rejection provides usable measurements of voltages as low as 5 µV, even in high noise environments. Selectable bandwidth limiting reduces normal mode noise from digital logic, switch mode power supplies, and line frequency sources. Adjustable differential offset allows the user to null out transducer bridge bias and galvanic potentials from the test setup. An "infinite impedance" mode can be selected in the two highest gain ranges allowing accurate measurements of signals with high source impedance. Special circuitry greatly reduces annoying DC drift common in older differential preamplifiers.

The ADA400A is powered directly from TDS 400, TDS 500A, TDS 600A, and TDS 700A Series oscilloscopes. It can also be used with other oscilloscopes when powered by a 1103 Probe Power Supply.

Characteristics

Gain – X100, X10, X1, X0.1.

CMRR – ≥100,000:1 DC - 10 kHz.

Gain	CM Range	Input Range	MAX Offset
100	10 V	0.1 V	1.0 V
10	10 V	1 V	1.0 V
1	40 V	10 V	40 V
0.1	40 V	40 V	40 V

Bandwidth Limits – 100Hz, 3 kHz, 100 kHz, Full (≥1 MHz).

Input Impedance – 1 MΩ || ~ 50 pF (∞Ω Selectable in 100X and 10X gains).

Noise – Typically ≤30 µV Displayed @ 100X Gain (Referred to Input).

APPLICATIONS

- **Biomedical Research**
- **Medical Equipment**
- **Mechanical Analysis**
- **Audio Design**

ORDERING INFORMATION

ADA400A
Differential Preamplifier *1
Includes: 070-9164-00 Instruction Manual, 159-0024-00 Spare Input Fuses (2).

RECOMMENDED ACCESSORIES
P6101B 1X Passive Probe (2 recommended).....**$60**

**1 Contact your Tektronix representative for price information.*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

Differential Probes

The P5200 is an active differential probe that allows safe and accurate measurement of elevated floating voltages with any oscilloscope.

New P5200

- 1300 V Differential
- ±1 kV to Ground (Each Channel)
- 50X/500X Attenuation
- 25 MHz
- No More Floating Your Scope
- Excellent Signal Fidelity
- Easy Connection to ICs and Bus Bars
- Safe for User and DUT
- UL Certified 1244
- IEC 1010 Certified



P5200 Differential Probe

The P5200 enables users to safely make measurements of floating circuits with their oscilloscopes grounded. The P5200 Active Differential Probe converts floating signals to low voltage ground referenced signals that can be displayed safely and easily on any ground referenced oscilloscope.

The P5200 safely measures up to 1,300 V differential and is ideally suited for measuring the fast dV/dt in switching power devices, such as IGBTs, power MOSFETs, thyristors, GTOs, and bipolar transistors. The fast speed and excellent CMRR enable the user to clearly and accurately measure the high speed transitions of the switching waveform.

The P5200 is simple to use and protects the user from shorting any circuits or test equipment to ground. A true differential amplifier, both input leads are high impedance and have low parasitic capacitance to ground, eliminating the possibility of damaging the device under test. This is well-suited for education and service/repair when circuit diagrams may not always be available and there is a danger of connecting the oscilloscope ground to high voltage test points.

The P5200 has an overrange indicator that prompts the user to change ranges when the probe is operating outside the intended voltage range and the displayed signal may be misleading.

The P5200 comes with 45 cm (18 in.) input probe leads terminated by 4 mm shrouded banana plugs for easy connection to a variety of test points. The standard crocodile clip allows easy connection to bus bars and large bolts, while the long insulated plunger clamp allows the user to safely probe IC legs and discrete control components in dense circuit boards.

The P5200 operates from a 9 V DC wall adapter (included).

Benefits	Features
Fidelity	CMRR slew rate shielding made for noisy environments
Easy connection to DUT	4 mm shrouded banana at probe tip 7 in. needle plungers crocodile clip
Safety	UL/IEC Certification won't damage DUT if dropped shrouded banana prevents accidental shorts

Characteristics

Maximum Floating Voltage – ±1,000 V.
Maximum Differential Voltage – 1,300 V.
Bandwidth – 25 MHz.
CMRR (1 MHz) – –60 dB.
Input R – 4 MΩ each input.
Input C – 10 pF each input.
Certification – UL 1244/IEC1010.
Power – AC Transformer.

APPLICATIONS

- **Floating Measurements**
- **Switching Power Supply Design**
- **TV/VCR Service and Repair**
- **Motor Drive Design**

ORDERING INFORMATION

P5200
Active Differential Probe $399
Includes: 2 Crocodile Clips, 2 Plunger Clips, 9 V DC Power Supply, Manual (070-9018-00).

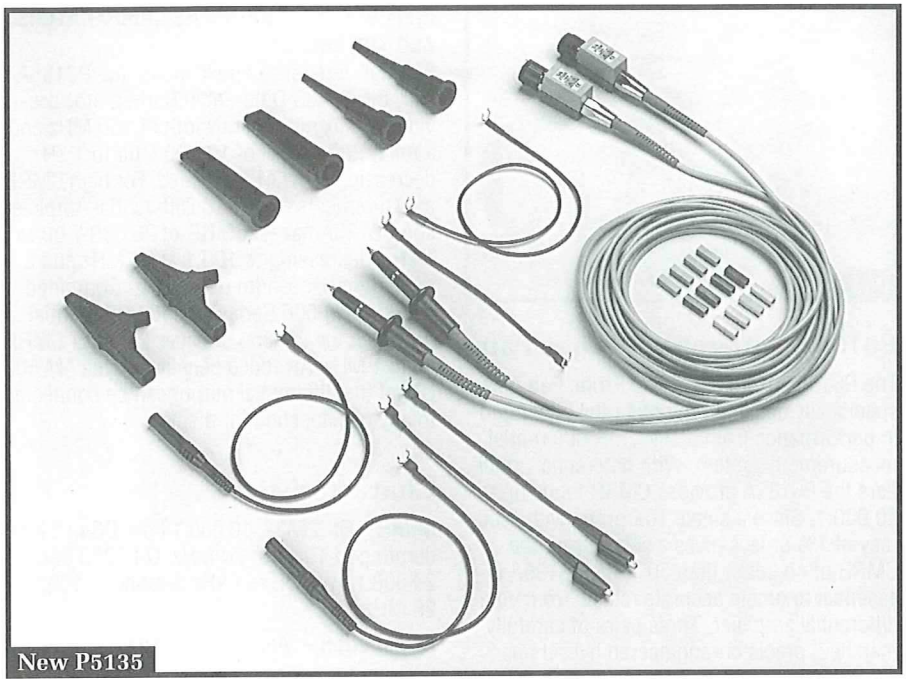
INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz ..... NC
Opt. A2 – United Kingdom 240 V, 50 Hz ..... NC
Opt. A3 – Australian 240 V, 50 Hz ..... NC
Opt. A5 – Switzerland 220 V, 50 Hz ..... NC
Opt. A6 – Japan 100 V, 50 Hz ..... NC
See Customer Information Section for additional description.

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

Differential Probe



New P5135

- 2,500 V Maximum Input Voltage
- 150 MHz Bandwidth
- Stable Adjustments for Accurate and Reliable Measurements
- Easy Connections to Test Points ≤1/4 in. in Diameter
- Readout for Correct Scale Factor
- Rugged Probe Head
- UL1244 and IEC 1010 Safety Certified

The P5135 expands the use of differential amplifiers for making floating measurements of high voltage, high frequency signals common in fast, heavy duty switch-mode control devices.

P5135 High Voltage Differential Probe Pair

The P5135 100X Differential Probe Pair is specifically designed to make high voltage differential measurements with Tektronix differential measurement systems. With differential amplifiers the P5135 provides CMRR ratios up to 20,000:1. The P5135 is essential to obtain accurate high voltage measurement results from your differential amplifier. Carefully matched, precision-engineered hybrid tips enable the P5135 to be specifically matched with Tektronix 11A33 and 7A13 differential amplifiers/comparators. The P5135 also provides excellent performance when used with plug-in amplifiers or oscilloscopes having input impedances of 1 MΩ/7-30 pF.

Benefits	Features
Easy/Convenient to Use	accessories allow easy connection to DUT stable adjustments readout standards
Safe	IEC 1010 certified accessories screw on, won't fall off
Performance	high voltage high bandwidth

Characteristics

BW – 150 MHz.
Maximum Voltage – 2.5 kV.
Attenuation – 100X.
Risetime – ≤1.7 ns.
Input C – ≤2.75 pF.
Input R – 10 MΩ.
Comp. Range – 7-30 pF.
Length – 10 ft.

APPLICATIONS

- **Power Supply Design**
- **Motor Drive Design**
- **Consumer Electronics Service and Repair**
- **Electric Vehicles**
- **General Purpose**
- **Power Semiconductors**

ORDERING INFORMATION

P5135
Pair of 100X, 150 MHz Differential Probes.....*1
Includes: 2 Crocodile Clips, 2 Plunger Clips, 9 V DC Power Supply, Manual (070-9018-00).

RECOMMENDED ACCESSORIES
See page 494 for complete selection information.

[1] Contact your Tektronix representative for price information.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

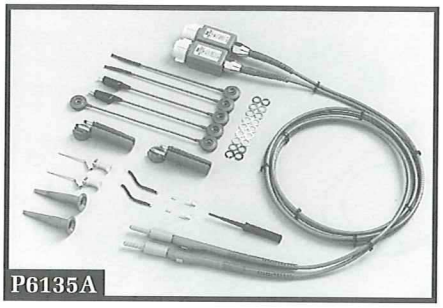
ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

Differential Probes

Specifically designed to obtain the maximum in performance from a Tektronix differential measurement system for signals up to 500 volts maximum.

P6135A

- Attenuation Adjustable to 10X
- 10,000: 1 CMRR on 11A33 Differential Comparator; 20,000: 1 on 7A13 Differential Amplifier
- ±500 V Maximum Common Mode Voltage
- Matched Pair



P6135A Differential Probe Pair

The P6135A 10X Differential Probe Pair is specifically designed to obtain the maximum in performance from a Tektronix differential measurement system. With differential amplifiers the P6135A provides CMRR ratios up to 20,000:1. Since a single 10X probe with accuracy of 1% or less gives a scope-to-probe CMRR of no better than 50:1, the P6135A is essential to obtain accurate results from your differential amplifier. Three pairs of carefully matched, precision-engineered hybrid tips enable the P6135A to be specifically matched with all Tektronix 11000, 7000 and 5000 Series differential amplifiers and comparators. It also provides excellent performance when used with plug-in amplifiers or oscilloscopes having input impedances of 1 MΩ/13-15 pF, 1 MΩ/18-22 pF and 1 MΩ/45-49 pF.

DIFFERENTIAL PROBE PAIRS

Differential probe pairs such as the P6135A are very carefully matched to minimize differences in capacitance and resistance (to minimize differences in impedance) and length (to minimize signal delay differences). Additionally, the attenuation adjusts to compensate for any remaining differences in the probes as well as differences in the attenuation of the plug-in or scope amplifier.

DIFFERENTIAL AMPLIFIERS/COMPARATORS AND THE P6135A

For high frequency applications, the P6135A with the 11A33 Differential Comparator provides a maximum bandwidth of 150 MHz and a minimum CMRR of 10,000:1 up to 1 kHz, decreasing to 100:1 at 20 MHz. For high CMRR measurements, the 7A13 Differential Amplifier and P6135A have a CMRR of 20,000:1 up to 1 kHz, decreasing to 100:1 at 20 MHz and a maximum bandwidth of 90 MHz. Combined with the TM 500 Series AM 502 Differential Amplifier, the P6135A provides 20,000:1 CMRR up to 1 MHz. An added benefit with the AM 502 is that the differential output can be connected to any oscilloscope for display.

Characteristics

CMRR – On 11A33: 10,000:1 from DC to 1 kHz, derating to 100:1 at 20 MHz. On 7000 Series: 20,000:1 from DC to 1 kHz derating to 100:1 at 20 MHz.

Attenuation – Adjustable to 10X.

Input Resistance – 1 MΩ.

Input Capitance – 10.5 pF on instrument with 15 pF input capitance; 11.0 pF when used with instrument that has 20 pF input capitance; 13.7 pF when used with instrument that has 47 pF input capitance.

Maximum Useful Bandwidth – On 11A33: DC to 150 MHz; On 7A13: DC >90 MHz.

Typical Probe Rise Time – On 11A33: <2.33 ns; On 7A13: <3.89 ns.

Maximum Common Mode Voltage – 500 V (DC + pk AC) from DC to 1.3 MHz, derated to 50 V (DC + pk AC) at 100 MHz.

For more information about the P6135A and differential measurements, request Data Sheet 63W-8103.

Safety – UL Listed 1244.

APPLICATIONS

- **Power Supplies**
- **Disk Drives**
- **Electronic Ballast**
- **Intelligent Motion**
- **Adjustable Speed Drives**

ORDERING INFORMATION

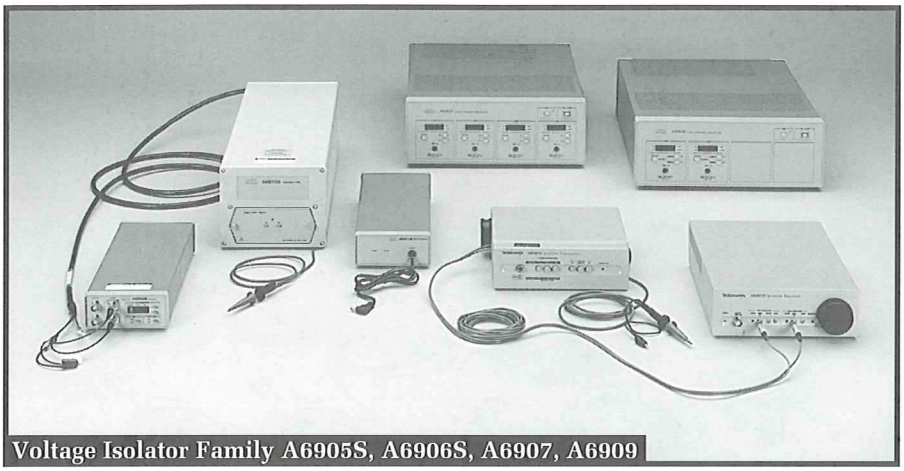
P6135A
Pair of 10X, 150 MHz Differential Probes **$795**
Includes: Adjustment Tool (003-1433-00); Two Retractable Hook Tips (013-0107-07); Two Circuit Board Connectors; 6 in. Dual-ring Ground Lead (196-3295-00); Accessory Pouch (016-0708-00); Two 6 in. Ground Leads (196-3113-02); Two 6 in. Ground Leads with Alligator Clips (196-3305-00); Two SMT KlipChip™ (206-0364-00); Two Low Inductance GND Collars (343-1003-01); Two Probe Tip Holders (352-0670-00); 2 in. Ground Leads (195-4240-00); Cable Marker Rings; Instruction Manual (070-7675-00).

RECOMMENDED ACCESSORIES
See page 490 for complete selection information.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

Voltage Isolators



Voltage Isolator Family A6905S, A6906S, A6907, A6909

Voltage Isolators

Tektronix offers the most complete line of isolation products to satisfy your high performance floating measurement requirements. The isolation product family includes four isolation instruments which provide a wide range of accurate and safe solutions to your measurement problems.

As discussed in the Floating Measurements overview, we define floating measurements as measurements in which neither reference point is ground. We provide four isolators for making floating measurements – one of which will be the most appropriate to your specific situation. All the isolators are third party safety certified.

MONOLITHIC VOLTAGE ISOLATORS

Monolithic voltage isolators provide multiple channels in a convenient portable package. These units are designed to be used next to the measurement instrument where physical separation is not a requirement. Because multiple channels are contained within a single unit, the cost per channel is lower and the circuit/instrument connections are simplified. Our monolithic four and two channel voltage isolators, the A6907/A6909, are an economical solution for isolation of power devices with switching speeds consistent with their dV/dt and slew rate characteristics.

FIBER OPTIC ISOLATION SYSTEMS

The A6905S and A6906S Fiber Optic Isolation Systems not only provide exceptional isolation performance but the flexibility of physical separation as well. These systems consist of a specially designed floating probe connected to a battery powered transmitter unit. The transmitter converts the electrical signal to light which is transmitted via a fiber optic cable to the receiver unit. The receiver unit converts the light back to an electrical signal which is input into the measurement instrument via a 50 Ω BNC cable. The fiber optic cable not only provides total isolation, but has the advantages of EMI immunity, light weight and flexibility which has made it the standard for state of the art signal transmission.

New A6907

- Monolithic
- 4 Channels
- GPIB
- Mid Range Performance

New A6909

- Monolithic
- 2 Channel
- GPIB Optional
- Mid Range Performance

A6905S

- Fiber Optic Separation up to 100 m
- Single Channel
- Battery Powered Transmitter

A6906S

- Fiber Optic Separation up to 200 m
- Single Channel
- GPIB
- Battery Powered Transmitter
- High Performance

Voltage Isolators enable safe and accurate floating measurements of switch mode devices with a grounded oscilloscope.

Monolithic Isolators provide multiple channels in a single instrument. Fiber Optic systems provide physical separation as well as isolation.

ISOLATOR CHARACTERISTICS SUMMARY

	A6907	A6909	A6905S	A6906S
Bandwidth (-3 dB)	60 MHz	60 MHz	15 MHz	100 MHz
Maximum Voltage	±850 V	±850 V	±850 V	±850 V
Common to GND Slew Rate	20,000 V/µs	20,000 V/µs	10,000 V/µs	100,000 V/µs
Separation Distance	1.5 m	1.5 m	3 m, 15 m, 50 m, 100 m	3 m, 10 m, 20 m, 100 m, 200 m
CMRR*1 @ 60 Hz	105 dB	105 dB	100 dB	120 dB
@ 1 MHz	60 dB	60 dB	50 dB	60 dB
@ 10 MHz	50 dB	50 dB	30 dB	40 dB
Channels	4 (Monolithic)	2 (Monolithic)	1	1
Isolation Method	Optical/ transformer	Optical/ transformer	Fiber Optic	Fiber Optic
GPIB	IEEE 488.1	Option 10	N/A	IEEE 488.1
Recommended Environment	Ambient	Ambient	Controlled	Ambient
Battery Operating Time	N/A	N/A	10 hours	12 hours

*1 *With Probe.*

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

A6909
A6907

Isolation Systems

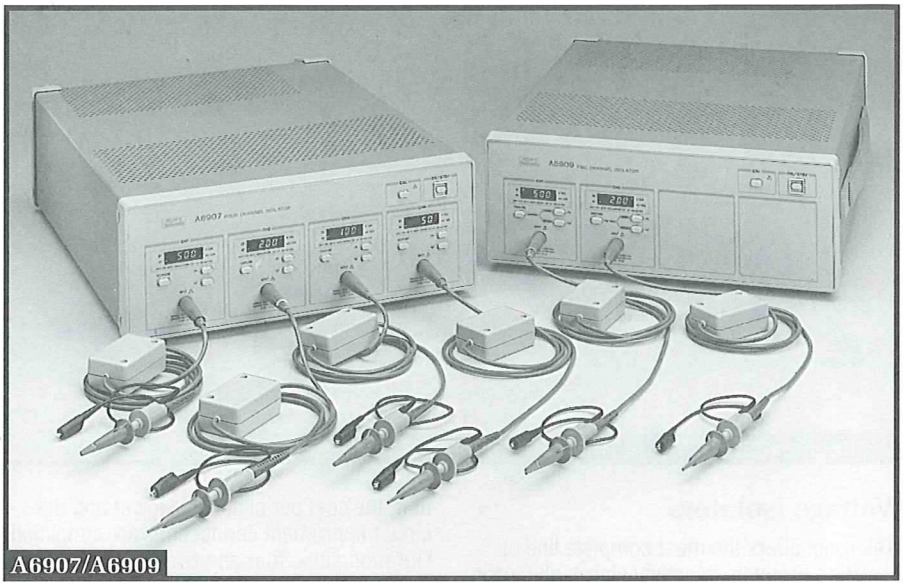
Monolithic voltage isolators for safe, high performance floating measurements.

New A6907

- For Floating Signals to ±850 V
- 60 MHz
- Monolithic
- 4 Channels
- CMRR: 60dB @ 1 MHz
- GPIB

New A6909

- For Floating Signals to ±850 V
- 60 MHz
- Monolithic
- 2 Channels
- CMRR: 60dB @ 1 MHz
- GPIB Optional


A6907/A6909

A6907/A6909 Voltage Isolators

The new A6907/A6909 monolithic voltage isolators are essential tools for power conversion design. Accurate floating measurements are required to design and verify high-performance switch mode circuits. The A6907 and A6909 offer safety, performance, multiple isolated channels (A6907-four/A6909-two), direct connection to the measurement instrument and simplified controls in a single box. The A6907/A6909 offer high performance and safety for the lowest cost per channel.

The A6907/A6909 Isolators feature a bandwidth of 60 MHz, slew rate of 20,000 V/µs and CMRR of 60 dB (1,000:1) at 1 MHz and GPIB control (standard on the A6907; available as Option 10 for the A6909) in a package the size of a Tektronix TDS oscilloscope. The ±850 V probes plug directly into the isolator and are specifically designed for safe connection to floating circuits and enhanced CMRR.

These microprocessor controlled instruments feature push button self-calibration of offset and gain for increased accuracy and a very high degree of isolation between individual channels. Each channel can be individually set for coupling and attenuation.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

APPLICATIONS

- **Motor Drives**
- **Power Supplies**
- **Electronic Ballast**
- **UPS Systems**
- **Switch Mode Control**
- **Power Semi-Conductors**

Isolation Systems

Characteristics

ELECTRICAL

Attenuation Settings – 2,000X to 1X (100 mV/div to 200 V/div with oscilloscope set to 100 mV/div) in 1-2-5 steps.

Full Range Measurements – ±2 mV to ±850 V.

Frequency Response Bandwidth – 60 MHz (-3 dB).

Transient Response – Rise Time:
<7.0 ns 100 mV/div and 200 mV/div.
<5.8 ns 500 mV/div to 200 V/div.

Maximum Working Voltage – 600 V RMS, 850 V (DC + peak AC).

Input Impedance –
Resistance: 10 MΩ.
Capacitance: 4.5 pF, ±0.5 pF.

Output Impedance – 50 Ω.

Output Drive – ±500 mV into 50 Ω load.

Maximum Common to Ground Slew Rate – 20,000 V/µs.

Offset Accuracy – ±20 mV.

Delay – ≈30 ns with 1.5 probe cable.

CMRR –
60 Hz: >105 dB (100 mV/div),
>100 dB (1 V/div).
1 MHz: >60 dB (100 mV/div),
>45 dB (1 V/div).
10 MHz:>50 dB (100 mV/div),
>40 dB (1 V/div)

POWER REQUIREMENTS

Line Voltage Ranges – 90-250 V AC.

Line Frequency Range – 47-66 Hz.

Maximum Power Consumption – A6907: 48 W. A6909: 28 W.

ORDERING INFORMATION

A6907
60 MHz Monolithic 4-CH Isolator
(850 V Maximum) **$6,400**
Includes: Four 850 V Floating Probes (010-0576-00); 43 in. 50 Ω Cable Set (4) (012-1452-00); A6907/A6909 Instruction Manual (070-9094-00)

A6909
60 MHz Monolithic 2-CH Isolator
(850 V Maximum) **$3,400**
Includes: Two 850 V Floating Probes (010-0576-00); 43 in. 50 Ω Cable Set (2) (012-0057-01); A6907/A6909 Instruction Manual (070-9094-00)

Opt. 10 – Add GPIB ..... **+$250**

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz ..... **NC**
Opt. A2 – United Kingdom 240 V, 50 Hz ..... **NC**
Opt. A3 – Australian 240 V, 50 Hz ..... **NC**
Opt. A5 – Switzerland 220 V, 50 Hz ..... **NC**

See Customer Information Section for additional description.

SERVICE ASSURANCE OPTIONS

Opt. R2 – Adds two years of post-warranty Repair Protection
A6907 ..... **+$260**
A6909 ..... **+$160**

Opt. C5 – Adds five years of Calibration Services
A6907 ..... **+$725**
A6909 ..... **+$475**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

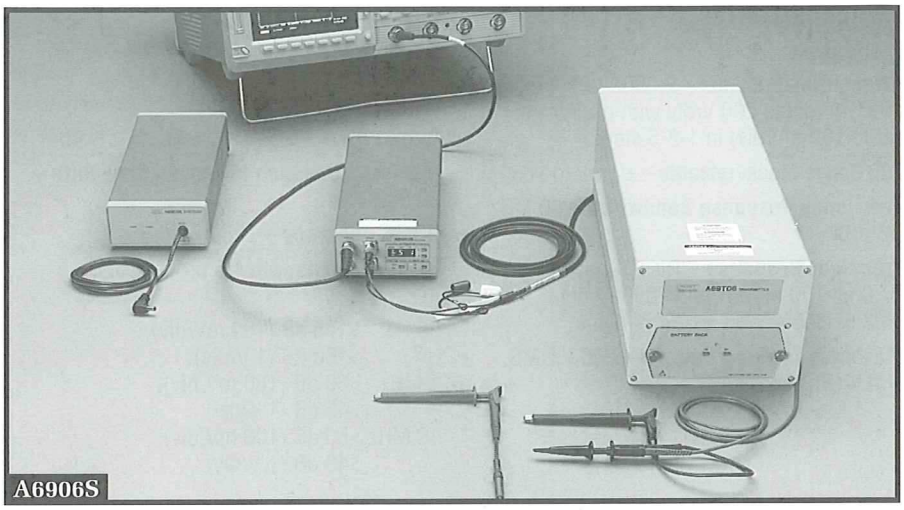
Tektronix Measurement products are manufactured in ISO registered facilities.

Isolation Systems

Provides safe floating measurements for the highest performance switch-mode power electronic circuits with slew rates up to 100,000 V/µsec.

A6906S

- 850 V of Isolation
- DC to 100 MHz
- CMRR: 40 dB @ 10 MHz
- Up to 200m of Probe-to-scope Fiber Optic Separation
- Selectable 20X to 5000X Attenuation
- GPIB Controllable
- 50 Ω and 75 Ω Output



A6906S

The A6906S is the highest performance Isolation System available. This is what you need to make floating measurements on state-of-the-art power control devices such as IGBTs used on fast motor drives and switching power supplies. The bandwidth is 100 MHz and an extraordinary 200 meters of fiber optic cable is available. All system parameters, including attenuation, can be controlled via a General Purpose Interface Bus. System CMRR with the probe is 60 dB (1,000:1) out to 1 MHz and 40 dB (100:1) at 10 MHz. This premium product will exceed your expectations for quality, performance and reliability.

The A6906S consists of a floating probe, battery powered transmitter unit, connecting fiber optic cable, receiver unit, and battery charger.

Order A6906S Fiber Optic Isolation System Data Sheet 51W-9086-0 for more information.

Characteristics

ELECTRICAL

Attenuation Settings – 5,000X to 20X in 1-2-5 steps.

Full Range Measurements– ±25 mV to ±850 V.

Frequency Response Bandwidth – 100 MHz (-3 dB).

Transient Response – Rise Time <3.5 ns.

Maximum Working Voltage – 600 V RMS, 850 V (DC + peak AC).

Input Impedance – Resistance: 10 MΩ ±2%. Capacitance: 2.9 pF.

Output Impedance – 50 Ω and 75 Ω ±5% at DC.

Output Drive – ±1V into 50 Ω load.

Max Common to Ground Slew Rate – 100 kV/µs.

Zero Drift with Temperature – 40 mV (10 to 40° C). 80 mV (0 to 50° C)

Delay – ≈ 50 ns for 3 meter fiber optic cable. Add ≈ 5 ns per meter for longer cables.

Common Mode Rejection Ratio –
60 Hz: >120 dB
1 MHz: >60 dB
10 MHz: >40 dB

POWER REQUIREMENTS

Line Voltage Ranges – 90-250 V AC.

Line Frequency Range – 47-66 Hz.

Maximum Power Consumption – 10 W.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ORDERING INFORMATION

A6906S
100 MHz Fiber Optic Isolation System (850 V Max).....**$6,750**
Includes: One 850 V Floating Probe (010-0568-00); Industrial Lead Set (012-1392-00); 50 Ω Terminator (011-0049-01); 43 in. 50 Ω cable (012-0057-01); Optical Fiber Cleaner (016-1218-00);1 Rechargeable Battery Pack (650-3022-00); A6906S Instruction Manual (070-8900-00).

Opt. 01 – Substitute 20 Meter Fiber Optic Cable .....**+$200**
Opt. 02 – Substitute 100 Meter Fiber Optic Cable .....**+$1,200**
Opt. 03 – Substitute 200 Meter Fiber Optic Cable .....**+$2,500**
Opt. 04 – Substitute 10 Meter Fiber Optic Cable .....**+$85**

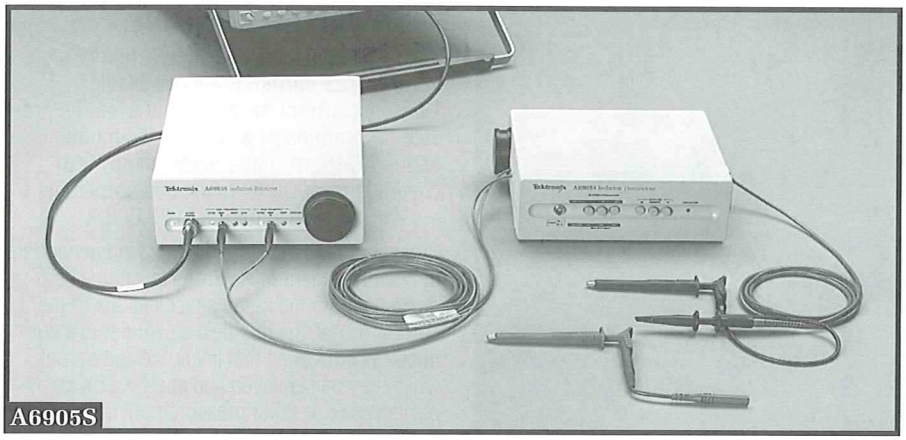
GPIB Cable – Order 012-0991-00 .....**$195**
75 Ω BNC Cable – Order 012-0074-00 .....**$36**
75 Ω Termination – Order 011-0055-01.....**$50**
Index Matching Oil – Order 252-0408-00.....**$80**
Optical Fiber Cleaner Set – Order 016-1208-00 .....**$290**

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Opt. A5 .....**NC**

See page 583 for complete selection information.

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection....**+$260**
Opt. C5 – Adds five years of Calibration Services.....**+$725**

Isolation Systems



A6905S

- 850 V of Isolation
- DC to 15 MHz
- Up to 100m of Probe-to-scope Fiber Optic Separation
- Selectable 10X, 100X, or 1000X Attenuation
- CMRR: 50 dB @ 1 MHz

Provides safe floating measurements for most line-operated power electronics devices including switch mode circuits with common-mode slew rates up to 10,000 V/µsec.

A6905S

The A6905S is the mid-line power measurements work horse where physical separation is desired. It is especially appropriate for making floating measurements on mid-range switching power control devices such as motor drives, electronic ballasts and power supplies.

This single channel system is rated for up to 850 V of isolation capability, with a 15 MHz bandwidth and 10X, 100X and 1,000X attenuation settings. The three meter fiber optic cable is standard. 15 m, 50 m and 100 m lengths are also available, providing the capability to make high impedance measurements at extended distances from the signal connection point with no signal loss. The A6905S can handle signals characterized by common to ground slew rates of ≤10,000 V/µs.

The A6905S consists of a floating probe, a battery powered transmitter unit, connecting fiber optic cable and receiver unit which also serves as a battery charger. Two batteries are included so one can be charging while the other is powering the transmitter.

For more information on the A6905S order A6905S Fiber Optic Isolation System Data Sheet 51W-8987-0.

For information about using the A6905S with a TDS oscilloscope and AM503S Current Measurement System, order Simplifying Power Measurements with TDS Oscilloscopes, Application Note 3GW-1091-0.

Characteristics

ELECTRICAL

Attenuation Settings – 10X, 100X, 1000X.

Full Range Measurements – ±10 V, ±100 V, ±850 V.

Frequency Response Bandwidth – 15 MHz (-3 dB).

Transient Response – Rise time <25 ns.

Maximum Working Voltage – 600 V RMS, 850 V (DC + peak AC).

Input Impedance at Probe Tip –
Resistance: 10 MΩ ±2%/
Capacitance: 2.9 pF.

Output Impedance – 50 Ω ±3%.

Output Drive – ±1V into 50 Ω load; ±2 V into 1 MΩ load.

Max Common to Ground Slew Rate – ≤10 kV/µS.

Tangential Noise – ≤1.5 mV.

DC Drift with Temperature – <2.5 mV/° C @ receiver output.

Delay – ≈ 80 ns for 3 meter Fiber Optic Cable. Add ≈ 5 ns per meter for longer cables.

Common Mode Rejection Ratio –

DC to 10 kHz:	> 100 dB
10 kHz to 100 kHz:	> 90 dB
100 kHz to 1 MHz:	> 50 dB
1 MHz to 10 MHz:	> 30 dB

POWER REQUIREMENTS

Line Voltage Ranges – 100 - 132 V, 200 - 242 V.

Line Frequency Range – 45 - 65 Hz.

Maximum Power Consumption – 15 W.

ORDERING INFORMATION

A6905S
15 MHz Fiber Optic Isolation System (850 V Max).....**$2,695**
Includes: One 850 V Floating Probe (010-0565-00), Industrial Lead Set (012-1392-00); 50 Ω Terminator (011-0049-01); 43 in. 50 Ω Cable (012-0057-01); 2 Rechargeable Battery Packs (118-9020-00); A6905S Instruction Manual (070-8773-00).

Opt. 01 – Substitute 15 M Fiber Optic Cable .....**+$185**

Opt. 02 – Substitute 100 M Fiber Optic Cable .....**+$655**

50 M Fiber Optic Cable – Order 174-3096-00.....**$715**

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz .....**NC**

Opt. A2 – UK 240 V, 50 Hz.....**NC**

SERVICE ASSURANCE OPTIONS

Opt. R2 – Adds two years of post-warranty Repair Protection .....**+$160**

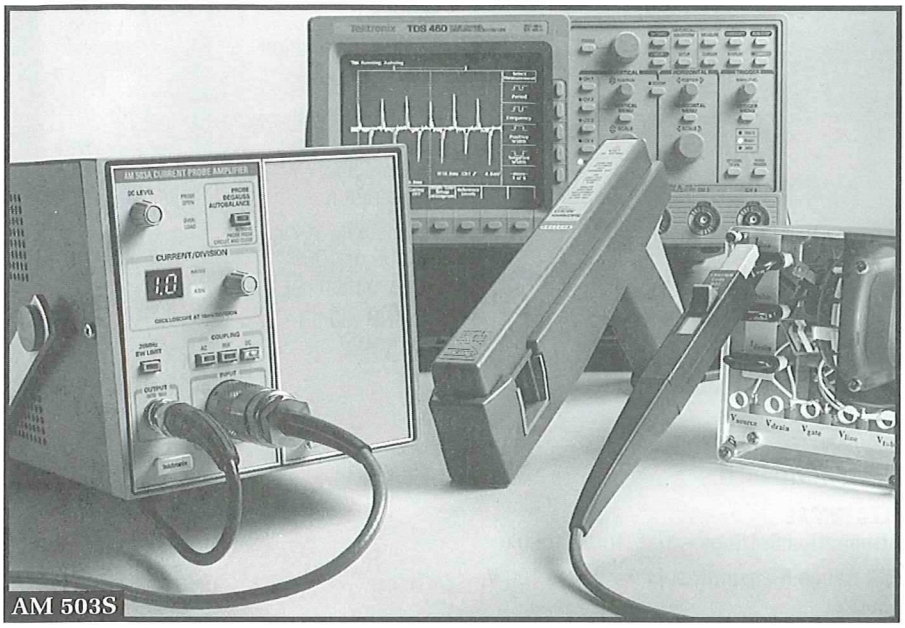
Opt. C5 – Adds five years of Calibration Services.....**+$475**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Current Measurements



AM 503S current probe system with both A6303 and A6302 current probes. The A6302 is measuring the fluorescent ballast line current which is displayed on a TDS 460 Digitizing Oscilloscope. For information about ballast testing request application note 51W-8614-0.

Current Measurements

Tektronix offers the widest selection of high performance current probes available. Tektronix current measurement systems provide programmable and manual simultaneous AC/DC measurements, bandwidth coverage from DC to 1 GHz and amplitude measurements from mAs to 20,000 A.

Current probes measure the flux field generated by the movement of electrons through a conductor. Within the range specifications of the current probe, the flux field surrounding a conductor is converted to a linear voltage output which can be displayed and analyzed on an oscilloscope or other measurement instrument.

Tektronix provides current probes for AC only and AC/DC current measurements. The AC only probes are available in solid and split core configurations.

CURRENT PROBE SELECTION GUIDE

Type AM 503B or AM 5030 Amplifiers with:	Bandwidth Hz to MHz	Peak Pulse	Max AC p-p	Derate Below	Derate Above	Max DC	Amp*S Product	Current/Div Display Range	Rise Time	Insertion Impedance @ 1 MHz	Max Barewire Voltage	Max Conductor Diameter	Cable Length
A6302	DC to 50	50 A	40 A	N/A	20 kHz	20 A	$100x10^{-6}$	1 mA to 5 A*1	≤7.0 ns	0.1 Ω	500 V	0.15 in.	2 m
A6302 w/ CT-4	0.5 to 20	20 kA*2	2 kA*3	50 Hz	1.2 kHz	20 A	0.1	20 mA to 5 kA*1	≤17.5 ns	30 MΩ	3 kV	1.5 in.	2 m
A6302XL	DC to 17	50 A	40 A	N/A	20 kHz	20 A	$100x10^{-6}$	1 mA to 5 A*1	≤20 ns	0.1 Ω	500 V	0.15 in.	8 m
A6302XL w/ CT-4	0.5 to 13	20 kA	2 kA*3	50 Hz	1.2 kHz	20 A	0.1	20 mA to 5 kA*1	≤20 ns	30 MΩ	3 kV	1.5 in.	2 m
A6303	DC to 15	500 A	200 A	N/A	20 kHz	100 A	$10,000x10^{-6}$	5 mA to 50 A*1	≤23 ns	0.02 Ω	700 V	0.83 in.	2 m
A6303XL	DC to 10	500 A	200 A	N/A	1.8 kHz	100 A	$10,000x10^{-6}$	5 mA to 50 A*1	≤35 ns	500 MΩ	700 V	0.83 in.	8 m
A6304XL	DC to 2	700 A	700 A	N/A	1.8 kHz	500 A	0.4	500 mA to 200 A*1	≤175 ns	500 MΩ	700 V	0.83 in.	8 m/1.5 m

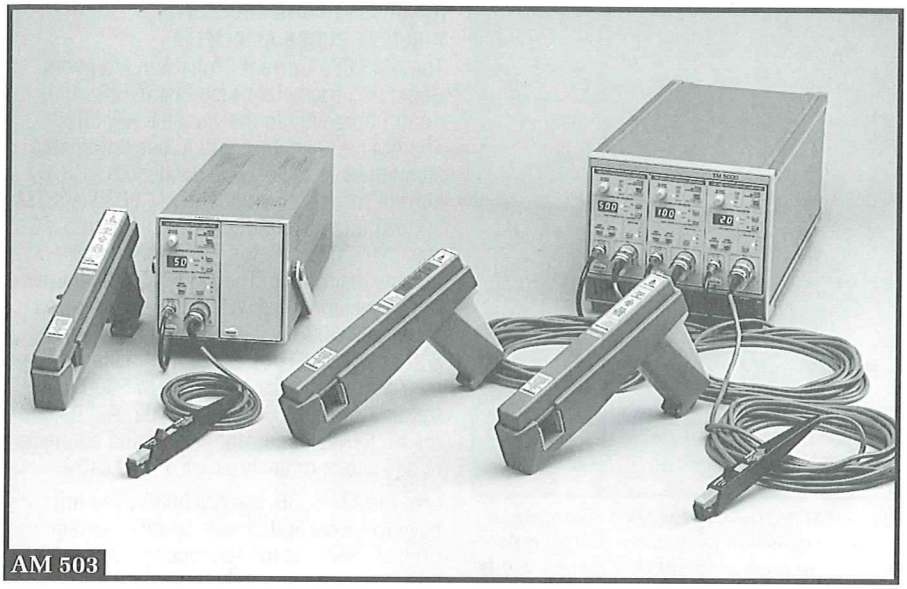
	Bandwidth Hz to MHz	Peak Pulse	Max AC p-p	Derate Below	Derate Above	Max DC	Amp*S Product	Current/Div Display Range	Rise Time	Insertion Impedance @ 1 MHz	Max Barewire Voltage	Max Conductor Diameter	Cable Length
P6021	120 to 60	250 A	15 A	300 Hz	5 MHz	0.5 A	$500x10^{-6}$	20 mA or 100 mA*1	≤5.8 ns	0.03 Ω	600 V	0.15 in.	2.75/1.5 m
P6021 w/ CT-4	120 to 20	20 kA*2	2 kA*3	300 Hz	1.2 MHz	20 A	0.5	400 mA or 100 A*1	≤17.5 ns	30 MΩ	3 kV	1.5 in.	2.75/1.5 m
P6022	935 to 120	100 A	6 A	3 kHz	10 MHz	0.2 A	$9x10^{-6}$	10 mA or 100 mA*1	≤2.2 ns	0.03 Ω	600 V	0.10 in.	2.75 m
CT-1	25K to 1000	12 A	1.4 A	25K to 1000		0.3 A	$1x10^{-6}$	2 mA(5 mV/mA)	≤0.35 ns	1 Ω	1000 V	0.070 in.	1.07 m
CT-2	1.2K to 200	36 A	7 A	1.2K to 200		0.3 A	$50x10^{-6}$	10 mA(1mV/mA)	≤0.5 ns	0.04 Ω	1000 V	0.052 in.	1.07 m

**1 Scope set at 10 mV/Div.*

**2 Based on voltage breakdown.*

**3 Based on thermal heating limits in CT-4.*

Current Measurements



The AM 503 Current Measurement Family: AM 503B and AM 5030 current probe amplifiers with A6303, A6302, A6304XL, A6303XL and A6302XL AC/DC current probes.

AC AND DC CURRENT MEASUREMENTS

AC currents induce voltage in a transformer resulting from the build-up and collapse of flux fields as the current changes direction. AC current probes are passive in that they do not require external power. A steady state DC current, however, will not induce a current in a transformer. By taking advantage of the Hall Effect, a current biased semiconductor device will produce a voltage output in response to a DC generated flux field. Consequently, a DC current probe is an active device in that it requires external power.

Each type of current sensing device will roll-off, or produce a non-linear output at a certain point. A given AC probe will roll-off at a certain maximum current amplitude and frequency as well as at a minimum amplitude and low-end frequency. DC current probes will be linear from DC to a maximum frequency and will have a minimum and maximum sensitivity level as well. Since we often encounter signals which contain both AC and DC components, it is important to be able to measure both simultaneously with a single probe. Additionally, signals which may look like AC, such as a square wave switching on and off, but never fall below zero Amps, actually have a significant DC component and cannot be accurately captured with a transformer only AC probe. The unique Tektronix solution is to combine both a Hall Effect device and a transformer to provide broadband current measurement capabilities within one system.

SPLIT VERSUS SOLID CORE

To accurately measure the flux field, we need to completely surround the conductor with the probe core. Tektronix offers two mechanical probe configurations: split core and solid core. Split core probes offer convenience. Precisely engineered and manufactured, the split core probes can be clipped onto a conductor without having to break the connection.

Solid core current transformers (CT) offer small size and very high frequency response for measuring very fast, low amplitude current pulses and AC signals. They are designed to be permanently or semi-permanently installed and have cables which are easily connected and disconnected to the CT.

In this Current Probe section we will describe the features and characteristics of each of the Tektronix Current probes, as well as mention some of the primary applications of each.

AMP*SECOND PRODUCT

As mentioned in the current probe introduction, transformer core materials saturate and become nonlinear when they are subjected to too much current. "Too much current" is a function of both the amplitude of the current and the time it is applied. The product of the *average amplitude* times the *pulse width* is called the amp*second product. Each probe has an amp*second product specification (see the Current Probe Selection Guide). If the signal does not exceed this specification, the voltage output will be linear and the measurement accurate.

A special feature of the AM 503S Current Probe Systems utilizes the phenomenon that opposing currents are subtractive. The AM 503S senses the current level in the conductor under test and feeds an equal but opposite current through the probe. This "bucking current" nulls out the current in the transformer and eliminates any core saturation. The bucking current limit is 20 A in the A6302/XL, 100 A in the A6303/XL and 500 A in the A6304XL. Up to these amplitudes you need not be concerned about the amp*second product.

AM 5030
AM 503S
AM 503B

Current Measurement Systems

State of the art simultaneous broadband AC/DC current measurements. Ideal for measuring currents in switching power supplies, motor controllers, disk drives.

AM 5030 automates evaluation, characterization or test system measurements. Ideal for multiple input, repetitive measurements.

AM503S available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

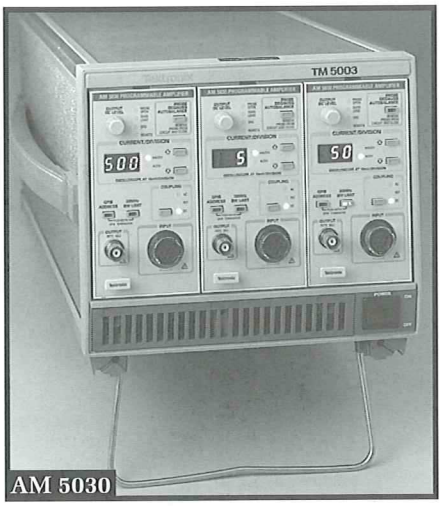
ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

AM 5030
- GPIB Programmable Current Probe Amplifier
- Plugs into TM 5000 Power Modules
- Operated with External Controller or Manually from Front Panel

AM 503S
- AC/DC Measurements
- With A6302 Probe:
  - DC to 50 MHz
  - 20 A Continuous/ 50 A Peak
  - Split Core
  - Clips on to Conductors up to 0.15 in. Diameter
- With A6303 Probe:
  - DC to 15 MHz
  - 100 A Continuous/ 500 A Peak
  - Split Core
  - Clips on to Conductors up to 0.83 in. Diameter
- With A6304XL
  - DC to 2 MHz
  - 500 A Continuous 700 A Peak
  - Clips on to Conductors up to 0.83 in. Diameter

New AM 503B
- Manual Current Probe Amplifier
- Push Button Auto Balance/Degauss
- Bright LED Current/ Division Display
- Microprocessor Controlled
- Eliminates Need to Calibrate Amplifier with Specific Probes
- Plugs into TM 500 or TM 5000 Power Modules



Three AM 5030s in a TM 5003 mainframe. Six AM 5030s will plug into a TM 5006A. All current measurement parameters can be set using a GPIB controller.

AM 503 Current Measurement Family

The AM 503 Current Measurement system family is the most sophisticated current measurement solution available. The split core probes incorporate both a transformer for AC and a Hall Effect Device for DC measurements to provide broadband current measurements from DC to 50 MHz. The AM 5030 Programmable Current Probe Amplifier automates time consuming manual measurements via a GPIB command set. The industry standard AM 503S Current Probe System provides a complete current measurement system in a single package.

The new XL Series of probes feature eight meter cables for convenient access to test points. The A6304XL enables measurements of 500 A at DC, 700 A Peak.

For more information about the AM 503 Current Measurement Family order Data Sheet 51W-7955-2.

AM 5030 PROGRAMMABLE CURRENT PROBE AMPLIFIER

The AM 5030 Current Probe Amplifier with General Purpose Interface Bus (GPIB) adds programmability to the versatile AM 503B. The AM 5030 enables you to use automated techniques to make wide bandwidth AC/DC current measurements. The AM 5030 is a TM 5000 single-wide module that plugs into a 3-slot TM 5003 or 6-slot TM 5006A power module mainframe. The TM 5000 mainframes can be rackmounted. While the non-programmable AM 503B will operate in either a TM 500 or TM 5000 power module mainframe, the AM 5030 works only in a TM 5000 mainframe. The AM 5030 uses A6302, A6303 and the XL Series of current probes and connects to any scope or analyzer via a BNC cable.

Like the AM 503B, the AM 5030 does not have to be calibrated with specific current probes. This is a tremendous operational improvement over the older AM 503. The AM 5030 and AM 503B also provide several improvements over the AM 503A including a faster Degauss/self-calibration cycle and more responsive, reliable front-panel controls.

The AM 5030 uses the IEEE 488.1 bus standard. Using a simple command set, you can configure and confirm the settings of the amplifier or read the instrument's serial number. You can determine whether the current probe is open or closed, use bus commands to initiate a self-test or force a probe Degauss and DC balance operation. The AM 5030 bus address is set through the front panel and the address is retained when power is removed. The AM 5030 does not require an external controller to operate. It can be completely controlled using the front panel. However, when used with a controller, the front panel can be disabled to prevent manual operator adjustments.

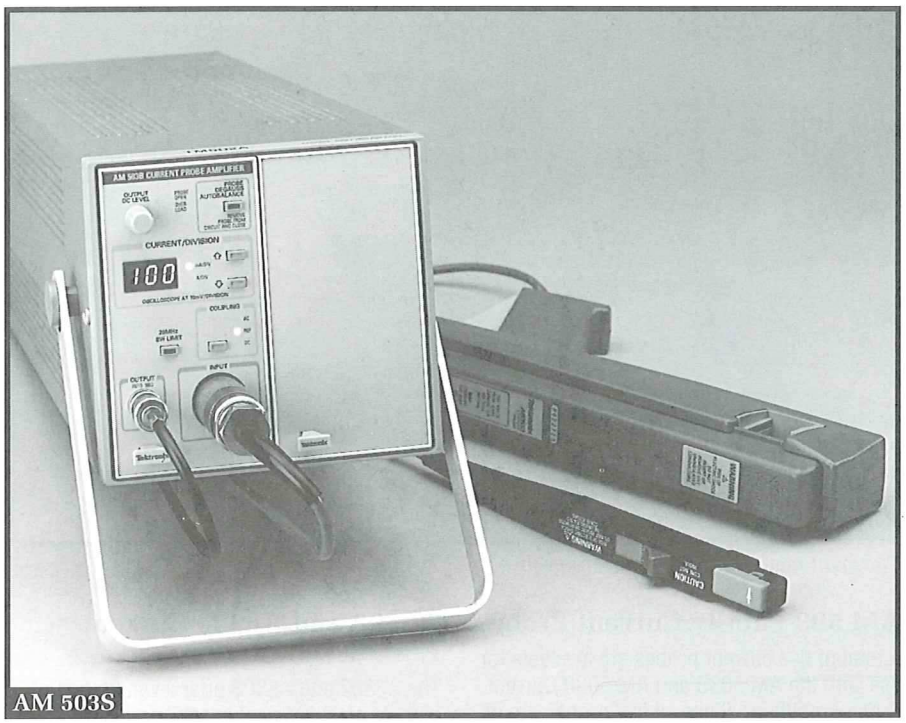
For more information about the AM 5030, request the AM 5030 Programmable Current Probe Amplifier Data Sheet 51W-8941-0.

APPLICATIONS

- **Switching Power Supplies**
- **Disk Drives**
- **Electronic Ballasts**
- **Motor Drives**
- **Inverters**
- **All Mixed AC/DC Current Signals**

Current Measurement Systems

AM 503S
AM 503B
AM 5030



AM 503S

AM 503S with A6302 and A6303 probes.

AM 503S CURRENT PROBE SYSTEM

The AM 503S Current Probe System is the most versatile current measurement system available. Since the probes incorporate both a transformer and a Hall Effect device, broadband AC/DC current can be measured simultaneously. Depending on the probe used, current from DC to 50 MHz and up to 700 A can be measured by clipping the split-core probes around the conductor. The AM 503S is truly a system, consisting of an AM 503B Current Probe Amplifier, a TM 502A two-wide Power Module, an A6302 Current Probe and a handy plug-in tool box. Options enable you to add or substitute an A6303 Current Probe. Any of the three eight meter XL Current Probes can also be added.

Order AM 503S Current Measurement System Data Sheet 51W-10226-0 for more information.

NEW AM 503B CURRENT PROBE AMPLIFIER

The AM 503B Current Probe Amplifier is the heart of the AM 503S System. The AM 503B amplifies and sums the voltage outputs from the transformer and Hall Effect device and outputs it to the measurement instrument. It also provides the Hall Effect Device bias voltage and a reverse "bucking" current which resists saturation of the A6302/A6303 Current Probe core.

The AM 503B Current Probe Amplifier replaces the AM 503A. All functions are microprocessor controlled, providing a significant improvement in ease of use and functionality. The AM 503B uses bright, easy-to-read LEDs to display current/Division settings which are controlled with up/down push-buttons. A single push-button provides both Degauss and auto-balance functions. An additional significant improvement with the AM 503B is that individual A6302/A6303 probes no longer need to be calibrated with a specific amplifier but can be interchanged between AM 503Bs and AM 5030s. The AM 503B and the AM 5030 both support the new XL Series of current probes. The AM 503 and the AM 503A do *not* support the XL Series.

The AM 503B operates in any TM 500/TM 5000 power module. The 50 Ω output of the AM 503B can be displayed on any oscilloscope or measurement instrument that has a sensitivity setting of 10 mV/Div. A 50 Ω output cable and termination is included with the AM 503B. The scope or measurement instrument requires at least a 200 MHz bandwidth to display the full bandwidth of the A6302 and 60 MHz for the A6303. You can select either AC only mode or a DC mode which allows you to display a combined AC/DC current signal.

ORDERING INFORMATION

AM 5030
Programmable Current Probe Amplifier **$1,995**
Includes: 50 Ω BNC Cable (012-0057-01); 50 Ω BNC Termination (011-0049-01); Instruction Manual (070-8766-01); Reference Card (070-8770-01). The AM 5030 requires an A6302, A6303 or XL Series Current Probe and a TM 5003 or TM 5006A Power Module Mainframe. See page 514.

AM 503B
Current Probe Amplifier **$1,745**
Includes: Same as AM 5030. The AM 503B requires one of the TM 500/5000 Series Power Modules, and an A6302, A6303 or XL Series Current Probe. See page 514.

AM 503S
Current Probe System **$2,745**
Includes: AM 503B Current Probe Amplifier; TM 502A Power Module; A6302 Current Probe; Plug-in Tool Box (016-0362-02); Instruction Manual (070-8766-01).

Opt. 01 – Adds A6303 Current Probe ..... **+$1,395**
Opt. 03 – Substitutes A6303 Current Probe ..... **+$650**

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz. ..... **NC**
Opt. A2 – UK 240 V, 50 Hz. ..... **NC**
Opt. A3 – Australian 240 V, 50 Hz. ..... **NC**
Opt. A4 – North American 240 V, 60 Hz. ..... **NC**
Opt. A5 – Switzerland 220 V, 50 Hz. ..... **NC**
See Customer Information Section for additional description.

SERVICE ASSURANCE OPTIONS
Opt. R2 – Adds two years of post-warranty Repair Protection
AM 5030 ..... **+$100**
AM 503B ..... **+$100**
AM 503S ..... **+$160**

Opt. C5 – Adds five years of Calibration Services
AM 5030 ..... **+$325**
AM 503B ..... **+$325**
AM 503S ..... **+$475**

AM503S available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

A6302
A6302XL
A6303

A6303XL
A6304XL

Current Measurement Systems

A630X Series AC/DC Current Probes. High performance broadband current measurements for all applications. Convenient split-core design for easy attachment to conductors.

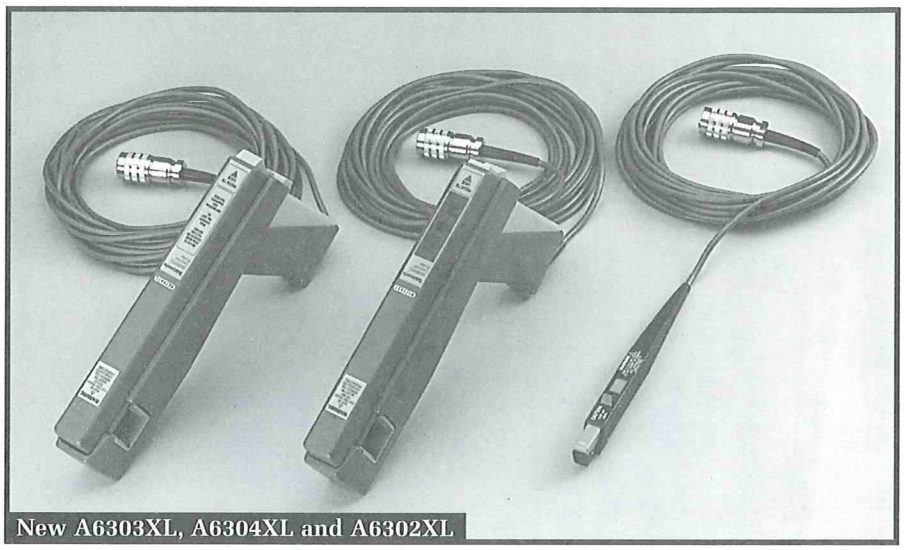
A6302
- 20 Amps Continuous/ 50 Amps Peak
- DC to 50 MHz
- 2 Meter Cable
- Up to 0.15 Conductor Size

A6303
- 20 Amps Continuous/ 500 Amps Peak
- DC to 15 MHz
- 2 Meter Cable
- Up to 0.83 Conductor Diameter

New A6302XL
- 8 Meter Cable
- 20 Amps
- 17 MHz

New A6303XL
- 8 Meter Cable
- 100 Amps
- 10 MHz

New A6304XL
- 8 Meter Cable
- 500 Amps
- 2 MHz



The eight meter XL Series Current Probes.

AM 503 Family Current Probes

A total of five current probes are available for use with the AM 503B and AM 5030 Current Probe Amplifiers. Since all five probes are of the split-core mechanical design, they easily clip on and off of a conductor. All the probes provide simultaneous DC and AC current measurements with a wide range of current amplitude and bandwidth capabilities.

The AM 503 Current Probes convert the DC and AC flux field of a conductor to a voltage signal which is sent to an AM 503B or AM 5030 Amplifier. The probes include both a Hall Effect Device which senses the DC current and a ferrite transformer which senses the AC current. The probes also utilize a bucking current from the Amplifier which eliminates core saturation. The bucking current for the A6302/XL is 20 A, 100 A for the A6303/XL and 500 A for the A6304XL.

A6302 and A6303 Current Probes

The A6302 and A6303 offer a wide range of current measurement capability for the lab and bench environment. The A6302 covers frequencies from DC to 50 MHz. It clips onto conductors up to 3.81 mm (0.15 in.) and measures continuous currents up to 20 A and peak currents up to 50 A as long as they do not exceed the amp*second product of 100 A*µs. The larger A6303 measures higher amplitude, lower frequency currents. It clips onto conductors up to 21.1 mm (0.83 in.) in diameter. Its frequency range is DC to 15 MHz. It will measure continuous currents up to 100 A and peak currents up to 500 A as long as the Amp*second product of 10,000 A*µs is not exceeded.

The A6302 and A6303 are also compatible with the 11A16 2-CH Current Probe Amplifier for the 11000 and DSA Series oscilloscopes. With the 11A16, the A6302 is rated for 10.5 A, 52.5 A for the A6303.

APPLICATIONS

- **Motor Drives**
- **Inverters**
- **Power Supplies**
- **Satellite Systems**
- **Transportation Systems**
- **Avionics**

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

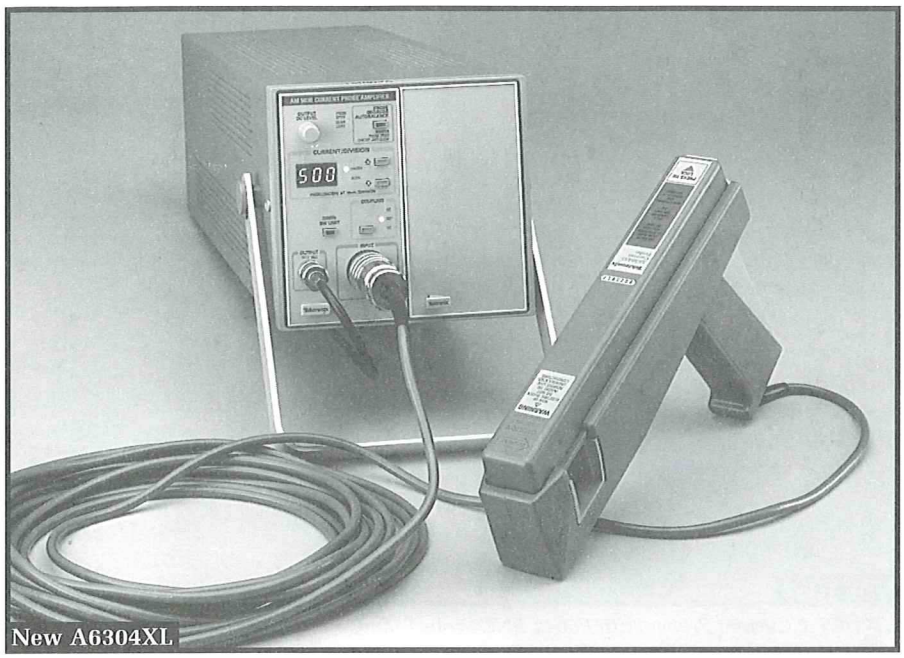
ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Current Measurement Systems

A6303XL
A6304XL

A6302
A6302XL
A6303



A 500 A A6304XL with AM 503B in TM 502A Power Module

XL Series Current Probes

The three new XL current probes add both convenience and expanded current measurement capability. The XL probes are designed to operate with the AM 503B and AM 5030 Current Probe Amplifiers. They are incompatible with the older AM 503 and AM 503A amplifiers. The XL (for extra long) probes have eight meter cables which allow you to reach test points on large devices such as heavy duty motors or automobiles. Additionally, connecting to test points on transportation platforms such as trains, ships, or aircraft will be much easier with the XL probes.

The A6302XL and A6303XL are modified versions of the A6302 and A6303 probes. The A6302XL can measure 20 A continuous (50 A peak) signals from DC to 17 MHz. The A6303XL can measure 100 A continuous (500 A peak) signals from DC to 10 MHz.

The newest member of the AM 503 family, the A6304XL, provides a significant increase in current measurement capability. Rated for 500 A continuous (700 A peak), the A6304XL is the same size as the A6303/XL. The A6304XL has a bandwidth of DC to 2 MHz and is especially well suited for measurements on high-performance inverters, motor drives, and other high current switch-mode control devices. The eight meter cable makes it very easy to access test points on devices physically separated from your measurement instrument.

ORDERING INFORMATION

A6302
2 m 20 A Current Probe.....**$795**
Includes: 5 in. (130 mm) Ground Lead (175-0124-01); 3 in. (75 mm) Ground Lead (175-0263-01); 2 Miniature Alligator Clips (344-0046-00); A6302 and A6302XL Instructions (070-3905-02)

A6303
2 m 100 A Current Probe **$1,435**
Includes: Carrying Case (016-0622-02); A6303 and A6303XL Instructions (070-3906-02).

A6302/A6303 probes must be used with an AM 503, AM 503A, AM 503B or AM 5030 Current Probe Amplifier.

A6302XL
8 m 20 A Current Probe.....**$945**
Includes: Same as A6302 Current Probe.

A6303XL
8 m 100 A Current Probe **$1,595**
Includes: Same as A6303 Current Probe.

A6304XL
8 m 500 A Current Probe **$1,950**
Includes: Carrying Case (016-0622-02); A6304XL Instructions (070-8939-00)

Note: XL Probes only work with AM 503B or AM 5030 Current Probe Amplifiers.

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

CT-1
CT-2
CT-4

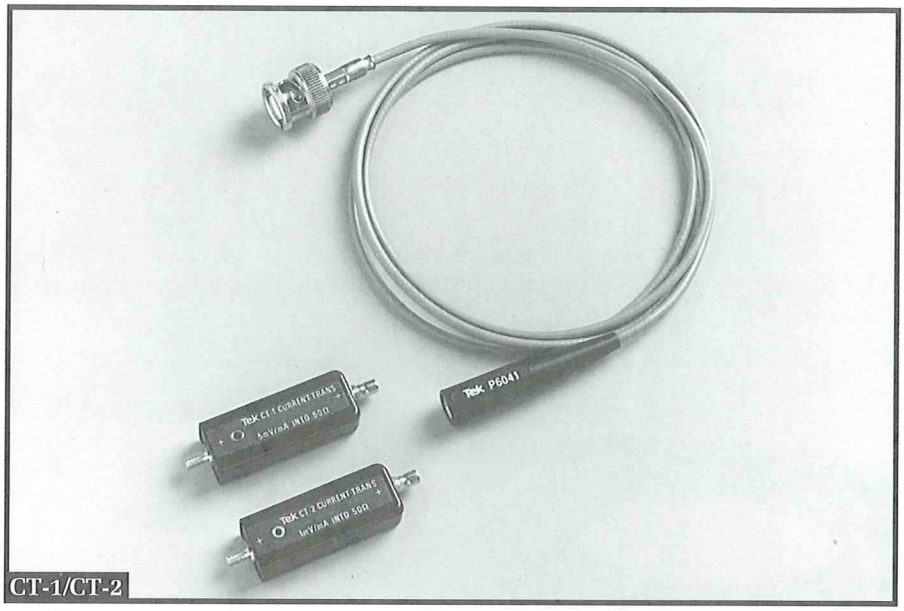
AC Current Probes

CT-1 and CT-2 Solid Core AC Current Transformers for fast, low amplitude current measurement. The CT-4 enables 20,000 A AC current measurements for automotive, avionics and industrial power applications.

CT-1
- 25 kHz to 1 GHz
- 12 A Maximum Pulse Current
- 450 mA Maximum CW Current
- For 50 Ω Input
- AC Only
- Solid Core
- ESD Testing

CT-2
- 1.2 kHz to 200 MHz
- 36 A Maximum Pulse Current
- 2.5 A Maximum CW Current
- For 50 Ω Input
- AC Only
- Solid Core
- Disk Drive Read/Write Signals

CT-4
- Pulsed Currents to 20,000 A
- Continuous Currents up to 2000 A p-p
- Accepts 1.5 Inch Diameter Conductors
- Measurements on Bare Conductors to 3000 V
- Nullifies DC Effects to 300 A with DC Bucking Coil
- AC
- Split Core
- Use with A6302/XL or P6021

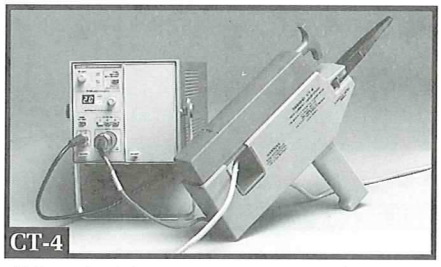


CT-1/CT-2 Current Probes with P6041 BNC Probe Cable.

CT-1/CT-2 Current Probes

The CT-1 and CT-2 Current Probes are designed for permanent or semi-permanent in-circuit installation. Each probe consists of a current transformer and an interconnecting cable. The current transformers have a small hole through which a current carrying conductor is passed during circuit assembly.

The P6041 Probe Cable provides the connection between the CT-1 and CT-2 Current Transformers and a BNC oscilloscope input. A 50 Ω termination is required to terminate the cable when connected to a high impedance (1 MΩ) oscilloscope input. One probe cable can be used to monitor several current transformers that have been wired into a circuit.



AM 503S with CT-4 Current Transformer.

CT-4 Current Probe

The CT-4 is a robust clip-on high current transformer that extends the measurement capability of the P6021 and A6302/XL clip-on current probes. Maximum low frequency performance down to 0.5 Hz is obtained using the AM 503S. Current amplitudes to 20,000 A may be measured using the A6302 or P6021 (with passive termination) provided the amp*second ratings are not exceeded.

The CT-4 may be used with the P6021 and 134 for measurements at normal line frequency and above. (The P6022 and A6303 are not compatible with the CT-4.)

The CT-4 has receptacles for current probes in either 20:1 or 1000:1 step-down ratios.

The 1.5 inch square split-core opening makes it possible to clip onto large conductors without breaking the circuit under test. Insulated core and shield assemblies allow measurements on bare wires to 3000 V, and to 14 kV with the included high voltage bushing. A DC bucking coil assembly allows up to 300 A of steady state DC to be nullified (derates to 1 MHz B/W). This is very useful for measuring AC signals on top of a constant DC voltage level.

ORDERING INFORMATION

CT-1
Current Probe, Current Transformer and Probe Cable (42 in.). **$295**
Includes: Instruction Manual (070-7957-00).
Opt. 09 – Current Transformer only. ..... **–$100**

CT-2
Current Probe, Current Transformer and Probe Cable **$270**
Includes: Instruction Manual (070-7957-00).

Opt. 09 – Current Transformer only ..... **–$100**
P6041 – Probe Cable (42 in.) only **$100**

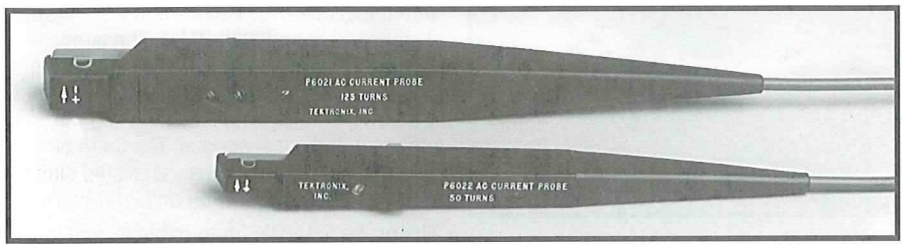
CT-4
Current Probe with DC Bucking Coil **$1,695**
Includes: Carrying Case (016-0191-04); 12 in. wide, 4 ft. long High Voltage Bushing (015-0194-00); DC Bucking Coil (015-0190-00); Instruction Manual (070-6478-00).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

AC Current Probes



P6021 and 6022 AC Current Probes.

P6021 Current Probe

The P6021 and P6022 Current Probes provide versatile AC current measurements. Both probes provide accurate current measurements over a wide range of frequencies. The P6021 and P6022 allow current measurements without breaking the circuit by clipping onto the current carrying conductor. Shielded probe heads are not grounded when the slides are in their open positions, eliminating accidental grounding of the circuit under test.

For general purpose applications, the P6021 provides wide-band performance with excellent low-frequency characteristics. Bandwidth is 120 Hz to 60 MHz. The passive termination is switchable from 2 mA/mV to 10 mA/mV.

P6022 Current Probe

With a head size of 0.47 inches x 0.25 inches (10 mm x 6 mm, about half the size of the P6021) and a bandwidth of 935 Hz to 120 MHz, the P6022 is ideal for measuring currents in compact high-performance circuits. Passive termination output is switchable between 1 mA/mV or 10 mA/mV.

P6021

- 120 Hz to 60 MHz
- 15 A Peak
- For 1 MΩ Inputs
- Shielded Probe Heads
- AC Only
- Split Core

P6022

- 935 Hz to 120 MHz
- 6 A Peak
- For 1 MΩ Inputs
- Shielded Probe Heads
- AC Only
- Split Core

Versatile clip-on probes for general purpose high-performance AC current measurements.

ORDERING INFORMATION

P6021
5 ft. Current Probe with Termination **$575**
Includes: 5 in. (130 mm) Ground Lead (175-0124-01); 3 in. (75 mm) Ground Lead (175-0263-01); Two Miniature Alligator Clips (344-0046-00); Instruction Manual (070-0947-02).

P6022
5 ft. Current Probe with Termination **$610**
Includes: Same as the P6021; Instruction Manual (070-0948-01).
Opt. 03 – 9 ft. with Termination, P6021 and P6022 ..... **+$50**
Passive Termination –
(P6021) – Order 011-0105-00 ..... **$195**
(P6022) – Order 011-0106-00 ..... **$245**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

P6008
P6602
P6420

Specialty Probes

The P6008 provides voltage measurements in extreme environments.

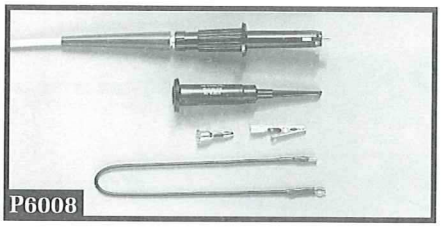
The P6420 is ideal for transmitter or receiver design, RF power measurement and RF demodulation testing.

The P6602 provides circuit board thermal analysis, heat sink evaluation, and hot spot detection.

P6008
- –50°C to +150°C Temperature Range
- 100 MHz, Environmental

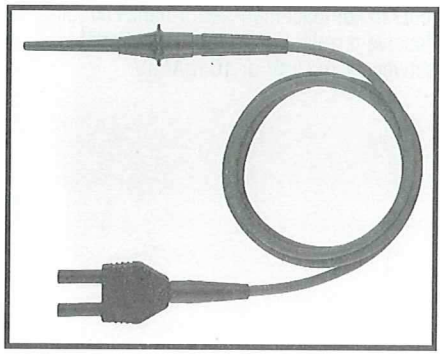
P6420
- RF Probe
- 10 kHz to 1 GHz Bandwidth
- Voltage Range 0.5 to 25 V RMS (70.7 V p-p)
- For DMM or Oscilloscope
- UL Listed 1244

P6602
- Temperature Measurements from –62°C to +240°C
- Use with TM500/5000 and Tektronix Oscilloscope DMMs
- UL Listed 1244



P6008 Environmental Probe

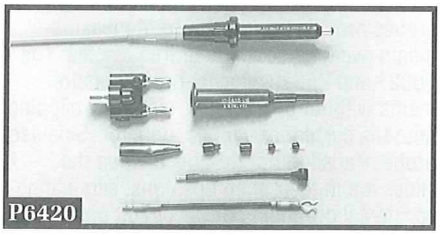
The P6008 Environmental Probe operates over –50°C to +150°C for the probe body and cable; the compensation box operates from –15°C to +55°C. The P6008 is compatible with the #6-32 screw-tip accessories.



P6602 Temperature Probe for DMM Input

The P6602 is a temperature-measuring device designed to operate with the DM504A, DM5110 and DM511 Digital Multimeters, or with the 2236A oscilloscope and the 2445B, 2455B, and 2465B with DMM. The temperature-sensing element consists of a thin-film platinum resistor on the tip of the probe. Measurements are made by touching the probe tip to the test surface. The thermal signal is transmitted to the associated digital multimeter through a two-conductor cable.

The probe is totally immersible except in liquids that are incompatible with Polyetherether-ketone (PEEK) compounds. The sensor, tip, and cable are limited to a maximum of 240°C.



P6420 RF Probe

The P6420 radio frequency (RF) probe measures high frequency AC voltage from 10 kHz to 1 GHz. It provides a DC output voltage proportional to the RMS value of a sine-wave input. It can be used with a DMM or with an oscilloscope for RF envelope analysis.

CHARACTERISTICS

Probe Type	Nominal Length	Attenuation	Bandwidth	Rise Time	Loading Input R/C	Max V (DC + pk AC)	Instrument Input R/C
P6008	6 ft.	10X	100 MHz	3.5 ns	10 MΩ/7.5 pF	600 V	1 MΩ/12-47 pF
P6420	2 m	N/A	10 kHz to 1 GHz	N/A	10 MΩ/3.7 pF	42.2 V	10 MΩ DMM

ORDERING INFORMATION

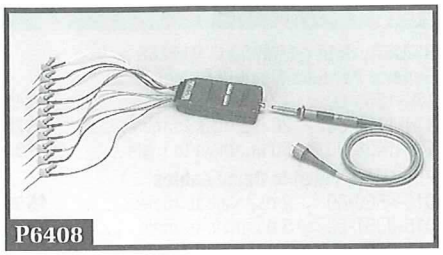
P6008
100 MHz Environmental Probe.....**$410**
Includes: Retractable Hook Tip (013-0071-01); Banana Tip (134-0013-00); 12 in. Ground Lead (175-0125-01); Alligator Clip (344-0045-00); Probe Holder (352-0090-00); Instruction Sheet.

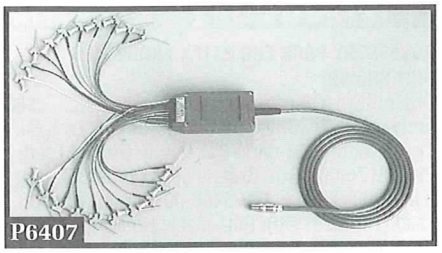
P6602
1.5 m Temperature Probe.....**$365**
Includes: Instruction Manual.

P6420
2 m RF DMM Probe.....**$215**
Includes: Retractable Probe Tip (013-0097-01); Two Alligator Clips (344-0046-00); Two Replaceable Probe Tips; Insulating Ground Cover (166-0404-01); 3 in. Ground Lead (175-0849-00); 6 in. Ground Lead (175-1017-00); Probe Holder (352-0351-00); BNC Female to Dual Banana Adapter (103-0090-00); Data Sheet.

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Word Recognizer Trigger Probes





P6407/P6408

The P6407 and P6408 are 16-Bit word recognizer trigger probes for use with analog and digital storage oscilloscopes. They allow the oscilloscope to trigger on user-defined logic states (rather than on analog levels), thus extending the utility of the oscilloscope into digital troubleshooting and debug applications.

The P6407 is available as an option to 2400-Series oscilloscopes and may be field-added to 2400-Series digital storage oscilloscopes. The trigger word is programmed from the oscilloscope's front panel.

The P6408 may also be used with oscilloscopes with 15 to 35 pF inputs, when used with the P6109B probe or other probes which have a miniature size probe tip. The P6408 trigger word is manually programmed via miniature DIP switches on the probe pod. The P6408 derives its operating power from the device under test +5 V bus.

The P6408 can be used with the TVC 501 to detect interrupt response faults, monitor subroutine timing, or verify PWM digital generation in embedded processor applications. Refer to the TVC 501 Applications Brochure (60W-7869) for further information.

P6407/P6408

- For TTL and TTL-Compatible Logic
- 17-Bits (16 Data Bits Plus Qualifier)
- Synchronous and Asynchronous Operation
- Easy to Use
- Simplifies Digital Troubleshooting and Debug
- P6407 – Use with 2400-Series Oscilloscopes
- P6408 – Use with any Oscilloscope

Oscilloscope triggering on user-defined logic states.

CHARACTERISTICS

	P6407	P6408
Input Channels – Data (Clock/Qualifier)/Power (Ground)	16 (2)/1 (2)	16 (1)/1 (2)
Input Logic Level – HI (ONE)/LO (ZERO)	≥ 2.0 V / ≤ 0.6 V	≥ 2.0 V / ≤ 0.7 V
Input Loading Current – HI (ONE) – LO (Zero)	20 mA max @ 2.5 V –600 mA max @ 0.5 V	20 mA max @ 2.7 V –600 mA max @ 0.5 V
Maximum Input Voltage Swing	–0.5 V to ≤ 5.5 V	0 V to ≤ V cc
Maximum Non-destructive Input Voltage	–0.7 V to 5.5 V	–1 V (LO) to +15 V (HI)
Word Recognizer Output Level – HI (ONE)/LO (ZERO)	≥ 2.0 V/≤ 0.5 V	≥ 200 mV/≤ 70 mV
Asynchronous Mode		
Maximum Trigger Frequency	10 MHz	20 MHz
Minimum Coincidence Between Data Inputs Resulting in a Trigger	85 ns	40 ns
Maximum Coincidence Between any Two Data Inputs Without Producing a Trigger	20 ns	40 ns
Delay of Input Word Coincidence to Word Out	≤140 ns	20 ns
Synchronous Mode		
Data Setup Time	25 ns	
Data Hold Time	0 ns	
Minimum Clock Pulse Width High / Low	20 ns / 20 ns	
Minimum Clock Period	50 ns	
Delay of Selected Clock Edge to Word Out	≤ 55 ns	
Power Requirements	Provided by Host 2400 Series Instrument	+5 V ±0.25 V 100 mA max
Recommended Instrument	2400 Series with Word Recognizer Option	Any instrumentation with 8 to 35 pF inputs.

ORDERING INFORMATION

P6407
Word Recognizer/Trigger Probe **$799**
Includes: Two (10 wide) Lead Headers (012-0747-01); Pkg. of 20 SMT KlipChip™ Adapters (SMG50); Instruction Sheet (070-5582-01).

P6408
Word Recognizer/Trigger Probe **$555**
Includes: Two (10 wide) Lead Headers (012-0747-01); Pkg. of 20 SMT KlipChip™ Adapters (SMG50); P6109B Probe (complete package); Instruction Sheet (070-6938-00).

ADDITIONAL ACCESSORY
Probe Power Cable – Order 174-1342-00 ..... **$68**
Used with 1101A Power Supply.

P6408 available through an Authorized Tektronix Distributor (see pages 590-595).

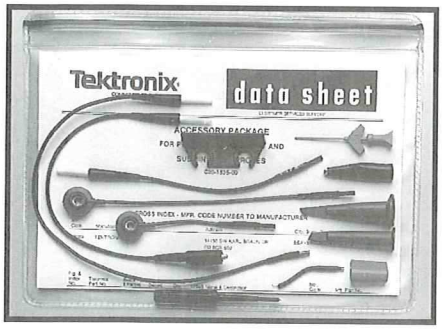
Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Probe Accessories Packs, Test Leads, Cables

ORDERING INFORMATION – SELECTION GUIDE



ACCESSORY PACK/MINIATURE PROBE TIPS
Order 020-1724-00 ..... **$45**
Includes: Screwdriver (003-1433-00); Retractable Hook Tip (013-0107-07); Ground Cover (166-0404-01); 6 in. Ground Lead (196-3198-00); 5 in. Ground Lead (175-0124-01); 12 in. Ground Lead (175-0125-01); 3 in. Ground Lead (175-0263-01); SMT KlipChip™ (206-0364-00); Alligator Clip for #6-32 Thread (344-0046-00); IC Test Tip; 3.5 in. Ground Lead (195-6176-00); Spring Ground (214-4125-00).



ACCESSORY PACK/P613X COMPACT AND SUBMINIATURE
Order 020-1835-00 ..... **$100**
Includes: Screwdriver (003-1433-00); Retractable Hook Tip (013-0107-07); Retractable Hook Tip (013-0208-02); 2 in. Ground Lead (195-4240-00); 3 in. Ground Lead (196-3113-03); 6 in. Ground Lead (196-3113-02); 12 in. #6-32 Stud Ground Lead (196-3287-00); 8 in. Ground Lead (196-3286-00); SMT KlipChip™ (206-0364-00); Ground Collar (343-1003-01); Alligator Clip #6-32 Thread (344-0046-00); 6 in. Ground Lead with 0.025 in. Receptacle (196-3302-00); 6 in. Ground Lead w/Alligator (196-3305-00).

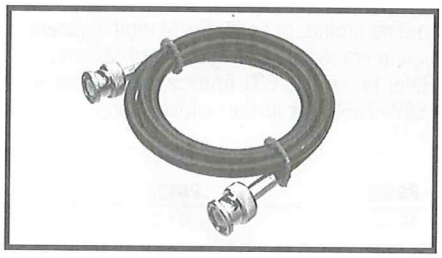
Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ACCESSORY PACK FOR P612X PROBE TIPS (NOT SHOWN)
Order 020-1836-00 ..... **$63**
Includes: Screwdriver (003-1433-00); IC Test Tip; Tip Insulator (166-0404-01); 3.5 in. Ground Lead (195-6176-00); 6 in. Ground Lead (196-3302-00); 8 in. Ground Lead (196-3286-00); 12 in. Ground Lead (196-3287-00); Retractable Hook Tip (013-0107-07); Alligator Clip #6-32 Connector (344-0046-00); SMT KlipChip™ (206-0364-00); Spring Ground (214-4125-00).

Test Leads

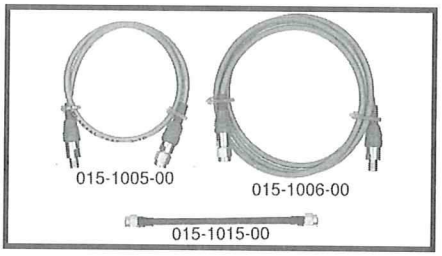
ALM01
UL listed red and black test lead set with miniature size probe tips. Incorporates shrouded banana plugs and includes two retractable hook tips **$25**



Cables

COAXIAL BNC CABLES

50 Ω		
012-0057-01	42 in., male to male	**$33**
012-0076-00	18 in., male to male	**$36**
012-0104-00	18 in., male to female	**$35**
012-0208-00	10 in., male to male	**$28**
012-0482-00	36 in., precision (1%) male to male	**$38**
012-1341-00	36 in., male to male	**$55**
012-1342-00	24 in., male to male	**$60**
75 Ω		
012-0074-00	42 in., male to male	**$36**
012-1337-00	60 in., male to male	**$55**
012-1338-00	36 in., male to male	**$55**
012-1339-00	24 in., male to male	**$55**
067-1232-00	75 Ω/50 Ω BNC Output, 50 Ω BNC Input	**$350**



COAXIAL SMA (3MM) 50 Ω CABLES

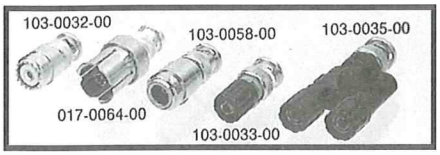
General Purpose Flexible Cables		
174-1364-00	12 in., male to male	**$42**
174-1427-00	20 in., male to male	**$70**
174-1428-00	60 in., male to male	**$85**
Precision, Flexible Delay Cables		
015-0560-00	2 ns, male to male	**$565**
015-0561-00	5 ns, male to male	**$675**
015-0562-00	1 ns, male to male	**$515**
015-1005-00	2 ns, male to female	**$345**
015-1006-00	5 ns, male to female	**$325**
015-1019-00	1 ns, male to female	**$335**
Semi-rigid Delay Cables		
015-1015-00	500 ps, 4.5, male to male	**$40**
015-1017-00	750 ps, male to male	**$68**
BNC to Banana Plug-Jack, 18 in.		
012-0090-00	Black	**$11.25**
012-0091-00	Red	**$10.75**
Banana Plug-Jack to Banana Plug-Jack, 18 in.		
012-0031-00	Red	**$13.75**
012-0039-00	Black	**$13.75**
Pin-Jack to Pin-Jack, 0.08 in. Dia-pin		
012-0179-00	Red, 8 in.	**$6.50**
012-0180-00	Red, 18 in.	**$5.50**
012-0181-00	Black, 8 in.	**$6.50**
012-0182-00	Black, 18 in.	**$7.50**

INTERFACE CABLES (Not Shown)

GPIB		
012-0991-00	2m, double-shielded	**$195**
012-0991-01	1m, double-shielded	**$195**
012-0991-02	4m, double-shielded	**$315**
012-1282-00	0.5 m GPIB	**$170**
Centronics		
012-1233-00	3 m, 4693 to Terminal	**$180**
012-1214-00	8 ft. Male Centronics to PC 25-Pin D	**$55**
012-1284-00	9 ft. male to male	**$38**
RS-232-C		
012-0911-00	10 ft. DB25 male – DB25 female, straight through	**$100**
012-1285-00	9 ft. DB25 male – DB25 female, null modem	**$50**
012-1298-00	9 ft. DB25 male – DB9 female, null modem	**$45**
131-4923-00	DB25 male – DB25 male gender changer	**$18**
174-1453-00	For 222/224	**$55**
012-1241-00	RS-232-C, 9-Pin female to 25-Pin male	**$85**
012-1379-00	RS-232-C, 9-Pin female to 9-Pin male	**$80**
012-1380-00	RS-232-C, 9-Pin female to 25-Pin male	**$75**
012-1398-00	9 in. RS-232-C to plotter/printer	**$37**

Adapters, Connectors and Adapter Kits

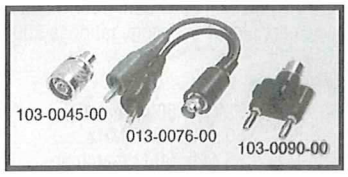
ORDERING INFORMATION – SELECTION GUIDE



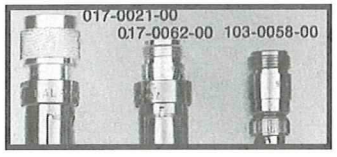
Adapters

BNC ADAPTERS

103-0032-00	BNC male to UHF female	**$10.25**
017-0064-00	BNC male to GR	**$165**
103-0058-00	BNC male to N female	**$19.75**
103-0033-00	BNC male to binding post	**$22**



103-0035-00	BNC male to dual binding post	**$23**
103-0045-00	BNC female to N male	**$23**
013-0076-00	BNC female to Clip Leads	**$63**
013-0076-01	BNC female to EZ ball (not shown)	**$32**



103-0090-00	BNC female to dual banana	**$16.50**
131-4199-00	75 Ω BNC to 50 Ω Type N, Min Loss	**$75**
011-0112-00	75 Ω to 50 Ω min loss with block	**$110**

N STYLE ADAPTERS

015-0509-00	N male to N female	**$490**
017-0062-00	N female to GR	**$145**
103-0058-00	N female to BNC male	**$19.75**
103-0045-00	N male to BNC female	**$23**

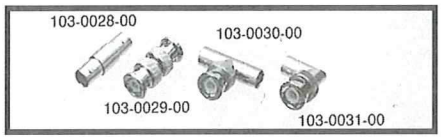
3.5 MM ADAPTERS (NOT SHOWN)

015-0551-00	Male to male	**$400**
015-0550-00	Female to female	*1
015-0552-00	Male to female connector saver*1	**$280**
015-0563-00	3.5 mm, 50 Ω, 2 ns, male to male	*1

SMA ADAPTERS (NOT SHOWN)

015-0369-00	SMA male to N	**$65**
015-0572-00	SMA female to BNC male	**$28**
015-0554-00	SMA male to BNC female	**$47**
015-1009-00	SMA male to N female	**$70**
015-0553-00	Threaded female to male slip-on connector	**$46**
015-0549-00	Male to female connector saver*1	**$185**
020-1693-00	SMA Kit	**$2,605**

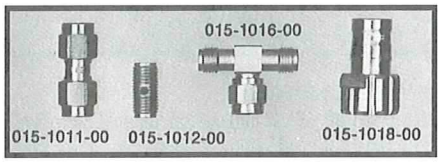
*1 *Used permanently installed on instrument to prolong life of instrument connector.*



Connectors

BNC CONNECTORS

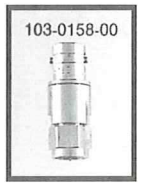
103-0028-00	BNC female to BNC female	**$13.75**
103-0029-00	BNC male to BNC male	**$15.75**
103-0030-00	BNC "T"	**$15.75**
103-0031-00	BNC elbow male to female	**$14.75**



SMA CONNECTORS

015-1011-00	SMA male to male	**$33**
015-1012-00	SMA female to female	**$12**
015-1016-00	SMA "T"	**$50**
015-1018-00	SMA male to BNC female	**$14**





MISC. CONNECTORS

013-0126-00	"F" Female to BNC male	**$26**
103-0158-00	"F" Male to BNC female	**$15.50**

*1 *Contact your Tektronix representative for price information.*

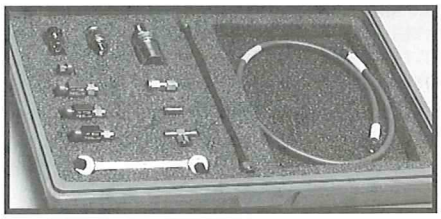


Adapter Kits

BNC ADAPTER KIT

AK01 BNC Adapter Kit.....**$440**

Includes: 50 Ω Feed-through Termination (011-0049-01); 50 Ω 10X Attenuator (011-0059-02); 50 Ω, 5X Attenuator (011-0060-02); 50 Ω, 6 dB Attenuator (011-0069-02); 42 in. 50 Ω Coax Cable (2 each) (012-0057-01); GR to BNC Female Adapter (017-0063-00); BNC Female to BNC Female Adapter (103-0028-00); BNC "T" (103-0030-00); BNC Elbow Male to Female (103-0031-00); BNC Female to Dual Banana (103-0090-00); BNC Male to BNC Male (103-0029-00).



SMA ADAPTER KIT

AK02 SMA Adapter Kit.....**$1,080**

Includes: 4.5 in. Semi-rigid Cable w/Male Connectors (015-0015-00); 1 m Flexible 50 Ω Cable w/Male Connectors (174-1341-00); 2X Attenuator (015-1001-00); 5X Attenuator (015-1002-00); 10X Attenuator (015-1003-00); GR to SMA Female Adapter (015-1008-00); SMA Male to SMA Male Adapter (015-1011-00); SMA Female to SMA Female Adapter (015-1012-00); SMA "T" (015-1016-00); SMA Male to BNC Female (015-1018-00); 50 Ω Termination (015-1022-00); SMA Female to BNC Male Adapter (015-0572-00).

Combination Wrench

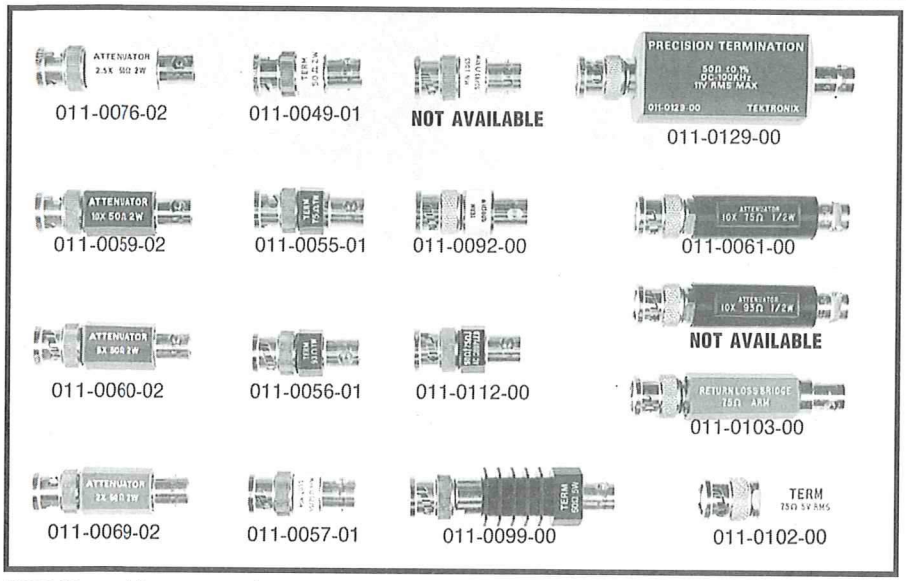
003-0245-00	0.281, 6 point	**$10.75**
033-0247-00	0.312, 6 point	**$13**

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

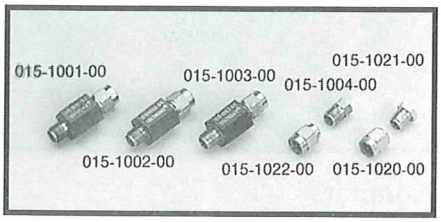
Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Attenuators

ORDERING INFORMATION – SELECTION GUIDE



BNC (See table next page)



SMA (See table next page)

50 Ω COUPLING CAPACITORS/DC BLOCK

Coupling Capacitor SMA (015-1013-00).....**$390**

The coupling capacitor is a short length of coaxial line with a disk capacitor (5000 pF SMA) in series with the inner conductor. High frequencies are transmitted with small reflection, but DC and low frequencies are blocked. Voltage rating is 200 V (015-1013-00).

TRANSFORMERS

120-1883-00 75 Ω to 50 Ω matching, 50 kHz to 300 MHz.....**$250**

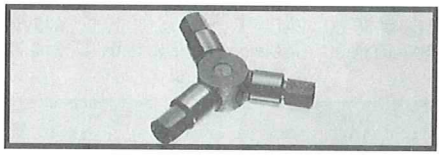
120-1884-00 75 Ω to 50 Ω matching, 50 MHz to 1 GHz.....**$250**

3.5 MM TERMINATIONS (NOT SHOWN)

011-0150-00 Female short-circuit.....**$385**
011-0148-00 Male 50 Ω.....**$1,935**
011-0151-00 Male short-circuit.....**$330**

ATTENUATORS (NOT SHOWN)

011-0118-00 75 Ω to 50 Ω matching, dBm to dBV.....**$140**



50 Ω POWER DIVIDER

015-0565-00 SMA female connector.....**$445**
015-1014-00 SMA male connector.....**$315**
017-0082-00 GR connectors.....**$1,300**

Designed for use in broad-band 50 Ω systems where the mismatch introduced by ordinary "Tee" connectors is undesirable. Load isolation is nominally 6 dB while the voltage attenuation ratio is nominally 2X (input to either load arm, other load arm terminated in a standard 50 Ω termination). Maximum VSWR on the 015-1014-00 is 1.50 from DC to 12.00 GHz and 1.90 from 12.01 to 18.00 GHz.

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Attenuators/Terminations

ATTENUATORS/TERMINATIONS SELECTION GUIDE

BNC 50, 75, and 93 Ω (See photo next page)

	Type	Impedance (Ω)	Z-Tol. (Ω)	Atten.	Atten. (dB)	Tol. (dB)	Freq. (DC to) (Watts)	Avg. Power (Watts)	Peak Power	Max. VSWR	Price
011-0049-01	Feed-through termination	50	±1	NA	NA	NA	1 GHz	2	300	1.2-DC to 1 GHz	$40
011-0059-02	Attenuator	50	±1	10X	20	±0.4 to 1 GHz ±0.6 1-2 GHz	2 GHz	2	500	1.1-DC to 1 GHz 1.2-1 to 2 GHz	$75
011-0060-02	Attenuator	50	±1	5X	14	±0.4 to 1 GHz ±0.6 1-2 GHz	2 GHz	2	500	1.1-DC to 1 GHz 1.2-1 to 2 GHz	$63
011-0069-02	Attenuator	50	±1	2X	6	±0.3 to 1 GHz ±0.5 1-2 GHz	2 GHz	2	500	1.1-DC to 1 GHz 1.2-1 to 2 GHz	$75
011-0076-02	Attenuator	50	±1	2.5X	8	±0.3 to 1 GHz ±0.5 1-2 GHz	2 GHz	2	500	1.1-DC to 1 GHz 1.2-1 to 2 GHz	$65
011-0099-00	Feed-through termination	50	±0.5	NA	NA	NA	200 MHz	5	–	1.1-DC to 100 MHz 1.2-100 to 200 MHz	$79
011-0055-01	Feed-through termination	75	±1	NA	NA	NA	100 MHz	1	300	1.1-DC to 100 MHz	$50
011-0056-01	Feed-through termination	93	±1	NA	NA	NA	100 MHz	1	300	1.1-DC to 100 MHz	$48
011-0057-01	Min. loss attenuator	50-75	–	2.3X	7.2	±0.5	100 MHz	0.5	–	1.1-DC to 100 MHz	$55
011-0061-00	Attenuator	75	–	10X	20	–	–	0.5	–	–	$63
011-0092-00	Feed-through termination	600	±6	NA	NA	NA	1 MHz	1	–	–	$46
011-0112-00	Min. loss attenuator	75-50	–	–	–	–	–	2	–	(AC coupled)	$110
011-0129-00	Feed-through termination	50	±0.05	NA	NA	NA	100 kHz	–	–	–	$210
011-0102-00	Coax termination	75	±0.5	NA	NA	NA	–	0.5	–	–	$36
011-0103-00*[1]	Return loss bridge	75	±0.5	NA	NA	NA	–	–	–	–	$35

*[1] *011-0103-00 red color body; 011-0103-01 green color body; 011-0103-02 white color body.*

SMA (3mm) 50 Ω (see photo on next page)

	Type	Impedance (Ω)	Z-Tol. (Ω)	Atten.	Atten. (dB)	Tol. (dB)	Freq. (DC to) (Watts)	Avg. Power (Watts)	Peak Power	Max. VSWR	Price
015-1001-00	Attenuator	50	±1.0	2X	6	±0.3	18 GHz	1	500	1.15-DC to 4 GHz 1.25-4 to 12.4 GHz 1.35-12.4 to 18 GHz	$225
015-1002-00	Attenuator	50	±10	5X	14	±0.5	18 GHz	1	500	1.15-DC to 4 GHz 1.20-4 to 8 GHz 1.25-8 to 12.4 GHz 1.35-12.4 to 18 GHz	$210
015-1003-00	Attenuator	50	±1.0	10X	20	±0.5	18 GHz	2	500	1.15-DC to 4 GHz 1.20-4 to 8 GHz 1.25-8 to 12.4 GHz 1.35-12.4 to 18 GHz	$235
015-1004-00	Termination (female)	50	±0.5	NA	NA	NA	18 GHz	0.5	200	1.05-DC to 4 GHz 1.10-4 to 12.4 GHz 1.15-12.4 to 18 GHz	$89
015-1020-00	Short-circuit termination (male)	0	–	NA	NA	NA	18 GHz	NA	NA	–	$31
015-1021-00	Short-circuit termination (female)	0	–	NA	NA	NA	18 GHz	NA	NA	–	$36
015-1022-00	Termination (male)	50	±0.5	NA	NA	NA	18 GHz	0.5	100	–	$50

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

HC100
HC220

Four Color Plotter/ Low Cost Bubble Jet Printer

Color or laser quality hard copy at the touch of a button!

PRODUCT COMPATIBILITY

- TDS Series
- 11000 Series
- Most PC Systems

HC100

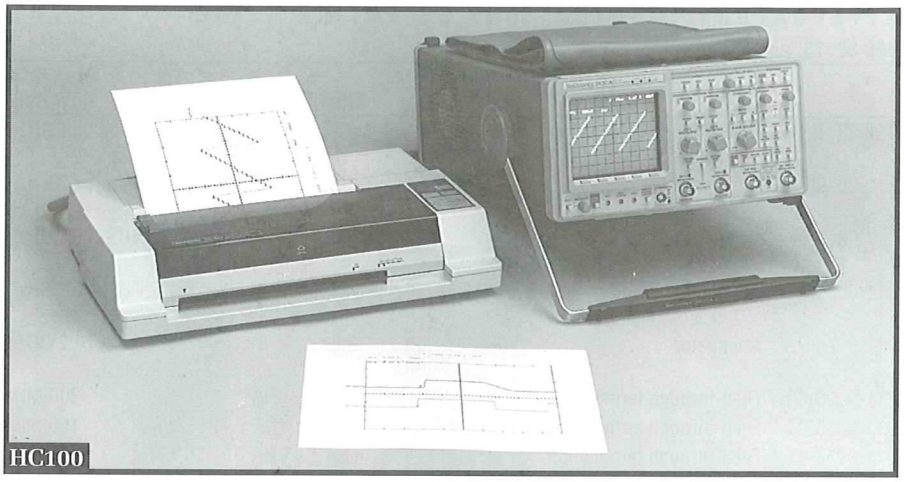
- Direct Plots from Most Tektronix Digitally-Based Instruments Without Using a Controller
- Standard Interfaces:
  - Centronics Parallel
  - GPIB
- Optional Interface:
  - RS-232-C Serial
- A4 and US Letter Sizes
- Four Plotting Modes, Including HPGL

HC 220

- Direct Plots in About 90 Seconds
- Compact Size
- Inexpensive
- Accurate and Fast
- Laser Quality Printouts

HC220 available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.



Direct Waveform Plotting

The Tektronix HC100 Color Plotter is a low-cost, four-color plotter designed to make waveform plots directly from a variety of Tektronix digitizing instruments without requiring an external controller. Under program control from the attached instrument's front panel or keyboard, the HC100 provides plots of digitally stored waveforms and printouts of instrument setup information.

FUNCTIONS

Drawing Modes: Plotter (HP-GL, Epson HI 80, Graphtec commands sets), printer (Epson RX-80 compatible), self-tests (HP-GL and standard plotter). The HC100 is shipped in the HP-GL mode.

Plotter operation is supported by HP-GL (Hewlett-Packard Graphics Language). Tektronix codes and formats are also supported on the GPIB interface.

Other modes in the HC100 include Graphtec emulation and Epson RX-80 printer mode.

Printer operation is Epson RX-80 compatible and is supported by a full ASCII 96-character set. International character sets for 11 countries can be selected as well. HC100 handles printer functions to format and print text, but it does not support dot graphics.

Both graphics and text can be plotted in color. There are three types of pens used: fiber-tip pens with water-based ink for paper, fiber-tip pens with oil-based ink for overhead projection film, and ball-point pens with water-based ink for paper. Ball-point pens produce a finer line than a fiber pen. Additional or replacement pens are available through Tektronix.

The HC100 pen cartridge holds four pens. The pens can be different colors, ink types, or point styles. The pen cartridge is easily changed, allowing you to quickly change colors or pen types.

The HC100 cannot be used in a multi-controller environment, such as with a GPIB instrument and GPIB controller, unless attached to the controller (IBM PC or equivalent). Multiple GPIB controllers on one bus do not conform to IEEE 488 standards.

HC100 Characteristics

Effective Drawing Size – 267 mm (X-axis) x 192 mm (Y-axis).

Maximum Drawing Speed – 230 mm/s (along pen axis).

Maximum Resolution – 0.1 mm.

Pen Response Speed – 15 times/s.

Number of Pens – 4 (changed automatically).

Pen Types – Fiber pens: aqueous ink or oil-based ink; Ball-point pens: aqueous ink.

Pen Colors – Set of black, blue, red, and green.

Paper Sizes – ISO A4: 297 mm x 210 mm; B5: 257 mm x 182 mm; US letter size: 279 mm x 216 mm.

Paper Types – Ordinary paper; OHJ film.

RS-232C BOARD SPECS

Asynchronous – Bit Rate: 75 BPS to 19,200 BPS. Note: HC100 Option 03 is set at 9,600 baud. Buffer: 32 K.

APPLICATIONS

- **Business Reports**
- **Presentations**
- **Archives**
- **Documentation**

Four Color Plotter/ Low Cost Bubble Jet Printer

HC100 Characteristics Cont.

POWER REQUIREMENTS

Line Voltage – Standard: 117 V AC ±10%; Options A1-A5: 220 V/240 V AC ±10%.

Line Frequency – 49.5 Hz to 60.5 Hz.

Power Consumption – 30 W.

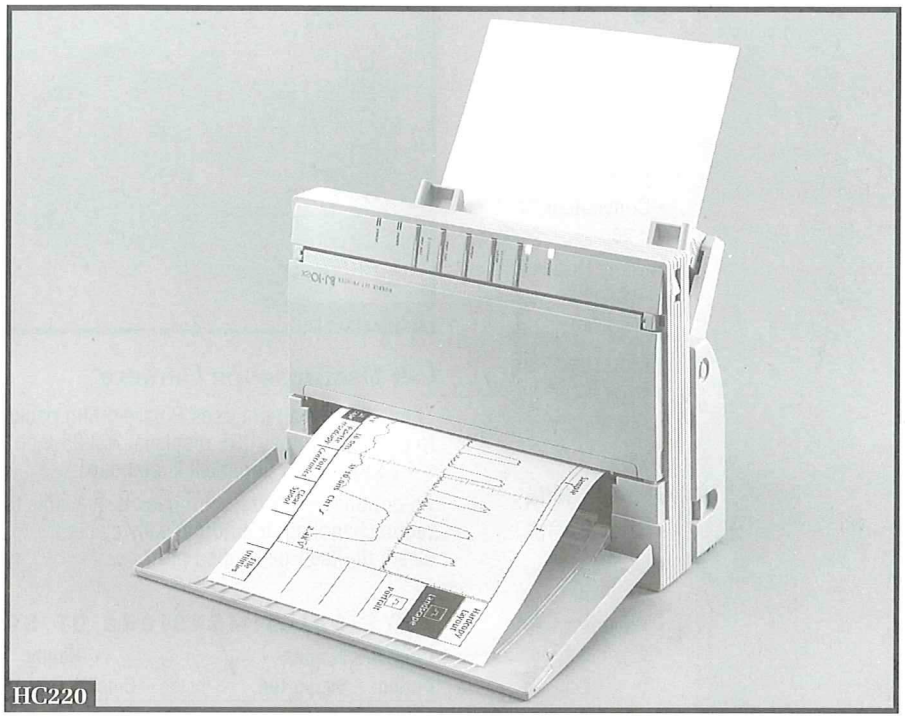
PHYSICAL CHARACTERISTICS

Outside Dimensions	in.	mm
Width	16.5	415
Height	3.2	81
Depth	10.8	272
Weight	**lb.**	**kg**
	13.2	6

Laser Quality Printer

The HC220 bubble jet printer offers high quality printing in a small package at an economical price. We are proud to offer this Tektronix compatible Canon printer to satisfy your documentation needs.

Because it is an ink-jet printer, the HC220 has darker, denser, more consistent printing than most other printers. At 360 dots per inch (DPI), it is considered a laser quality printer. In addition, the printer uses plain paper, not the hard to manage and expensive continuous feed paper. No time consuming tractor feed edges to tear off or fuzzy ends. The more traditional dot-matrix printers make a lot of noise, while the whisper quiet HC220 (less than 45 dBA acoustic noise level) doesn't require bulky and ineffective noise suppression boxes. Finally, the versatile HC220 is compatible with your customer's PCs or other Centronics port instruments.


HC220

The HC220 comes standard with a 110 V transformer/power cord, detailed instruction manual and an initial ink cartridge. Replacement cartridges are available at most computer or office supply stores. The optional automatic paper feeder is highly recommended for customers who print frequently. A one year manufacturer's warranty applies to the HC220.

ORDERING INFORMATION

HC100

Color Plotter.....**$1,250**

Includes: 1 Package of each Pen Set: Fiber Tip/Water-based (016-0879-00); Fiber Tip/Oil-based (016-0878-00); Ball-point (016-0877-00); Operator's Manual (070-6441-01); One Pen Cartridge (016-0876-00)

Opt. 01 – 1M GPIB Cable. Order 012-0991-01.....**+$130**

Opt. 02 – DB-25 M to Centronics M Cable for PCs. Order 012-1214-00 (Both Opt. 01 and 02 may be ordered).....**+$60.00**

Opt. 03 – Deletes GPIB I/F Board, and adds RS-232C I/F Board; Includes DB-9 to DB-25. RS-232 Cable. Order 012-1298-00.....**NC**

Opt. 04 – Parallel Cable for Use with Oscilloscopes (012-1284-00).....**+$40.00**

Opt. 05 – Serial Cable for Use with Oscilloscopes (012-1285-00).....**+$45.00**

For a 220 V/240 V, 50 Hz version order one of following options:

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz.....**NC**

Opt. A2 – United Kingdom 240 V, 50 Hz.....**NC**

Opt. A3 – Australian 240 V, 50 Hz.....**NC**

Opt. A4 – North American 240 V, 60 Hz.....**NC**

Opt. A5 – Switzerland 220 V, 50 Hz.....**NC**

See General Customer Information Section for additional description.

ADDITIONAL ACCESSORIES FOR HC100

Extra Pen Cartridge – Order 016-0876-00.....**$26**

Pens – Four colors (black, red, green, blue) in each package:
Fiber-tip, aqueous ink. Order 016-0879-00.....**$14.75**
Fiber-tip/oil-based ink. Order 016-0878-00.....**$14.75**
Ball-point/aqueous ink. Order 016-0877-00.....**$14.75**

Interface Board Kits – Has all the parts necessary to install the board in the HC100. It includes the interface board, mounting hardware, and installation instructions.
GPIB Interface Board Kit. Order 021-0457-00.....**$340**
RS-232-C Interface Board Kit. Order 021-0458-01.....**$450**

Cable – Data Cable. 10 ft., Male to Male with 9-Pin DB Connectors. Order 174-0537-01.....**$22**

HC220

Bubble Jet Printer.....**$445**

ADDITIONAL ACCESSORIES

36-Pin Male to Male Centronics 9 ft. Cable – Order 012-1284-00.....**$36**

DB-25 Male to 36-Pin Male Centronics 9 ft. Cable – Order 012-1214-00.....**$55**

HC220 available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Film Based Camera

C-9 Oscilloscope Camera

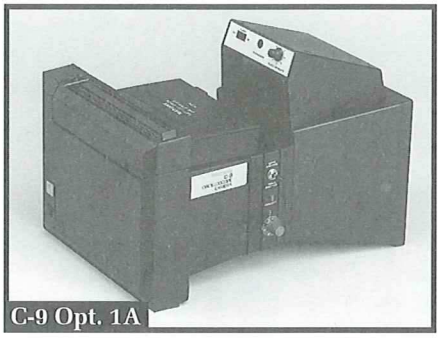
Photographic documentation for most Tektronix oscilloscopes.

C-9

- Instant Documentation
- Small, Easily Shared
- Legal Proof
- Convenient Print Size
- Many Hoods Available
- Flash Available
- Motorized Film Back Available
- One Year Warranty

APPLICATIONS

- Clean Rooms
- Scope Data Archival
- Patient Areas


C-9 Opt. 1A

C-9 Oscilloscope Camera

The C-9 CRT camera uses Polaroid film packs to document most CRT displays. A 3.25 inch x 4.25 inch pack film back is standard.

An optional motorized film back is available to reduce handling. It automatically ejects a clean, dry, self-developed print.

An optional pistol grip is available for use when only one hand is free. A flash unit is also available for scopes without graticule lighting. The variable xenon flash makes the CRT phosphor glow, which evenly backlights the graticule.

Characteristics

Aperture – Fixed at f/11.

Lens – Fixed-focus, three element.

Magnification – .55 or .73.

Geometric Distortion – Less than 0.5%.

Relative Light-gathering Ability – .035.

Shutter – Electronic; timed mode from 0.1 to 5 seconds and manual exposure.

Power – Eight AA alkaline batteries (not included).

Resolving Power – At least 6 lines/mm at center, 3 lines/mm at the corners.

Safety – UL Listed 1244.

PHYSICAL DIMENSIONS OF SCOPE HOODS

C-9 Hood Option	Scopes Supported	Height				Width				Mag. Ratio
		Inside (cm)	Outside (cm)	Inside (in.)	Outside (in.)	Inside (cm)	Outside (cm)	Inside (in.)	Outside (in.)	
C9-04	TDS400	10.40	10.60	4.09	4.17	13.80	14.00	5.43	5.51	0.71
C9-05	TDS5/6/800	10.80	11.20	4.25	4.41	14.10	14.50	5.55	5.71	0.71
C9-06	TAS400	*1	*1	5.28	5.61	*1	*1	6.38	6.64	*1
C9-07	7 K	13.03	13.67	5.13	5.38	14.22	14.86	5.60	5.85	0.70
C9-11	11 K, CSA, DSA	12.29	12.80	4.84	5.04	15.75	16.26	6.20	6.40	0.73
C9-20	Portable	10.49	11.18	4.13	4.40	11.94	12.67	4.70	4.99	0.51

*1 *Contact your local Tektronix representative for price and ordering information.*

RECOMMENDED POLAROID FILM PACKS

Back Type	Film Type	ISO Speed	Color	Wide Gray Scale	Contrast	Special	Prints	Order #	Price
AutoFilm™ *2	337	3200		√	Medium	Clean room	200	006-7350-00	**$285**
							60	006-7349-00	**$75**
Manual	612	20,000			High	Panachromatic	24	006-6822-00	**$63**
Manual	667	3000			Medium	Coaterless	500	006-6825-00	**$535**
							60	006-6824-00	**$74**
Manual	669	80	√	√	Medium	Extended dynamic range	48	006-6826-00	**$95**

*2 *AutoFilm™ is a trademark of the Polaroid Corporation.*

ORDERING INFORMATION

C-9

Camera **$620**

Includes: Camera Body without Hood (a Hood is Required), Instruction Manual. Order 070-8105-01

Opt. 1A – AutoFilm™ Motorized Film Back ..... **+$260**

Opt. 1F – Graticule Flash Unit for Use with Opt. 07 and/or Opt. 20 ..... **+$135**

Opt. 1P – Pistol Grip Handle with Trigger ..... **+$80**

Opt. 04 – TDS400 Series Scope Hood ..... **+$65**

Opt. 05 – TDS500/600/800 Series Scope Hood ..... **+$65**

Opt. 06 – TAS400 Series Hood ..... **+$45**

Opt. 07 – 7 K Series Scope Hood ..... **+$45**

Opt. 11 – 11 K, CSA, DSA Series Scope Hood ..... **+$75**

Opt. 20 – Portables (2000) Series Scope Hood ..... **+$45**

ADDITIONAL ACCESSORIES

Graticule Flash – Use with 7000 Series and 2000 Series Scope Hoods. Order 016-0642-02 ..... **$270**

Pistol Grip – Pistol Grip Hand with Trigger. Order 122-0186-01 ..... **$90**

Scope Hoods –

TAS400. Order 016-1181-00 ..... **$46**

TDS400 Series. Order 016-1154-00 ..... **$75**

TDS500, TDS600, TDS800 Series. Order 016-1145-00 ..... **$70**

7000 Series. Order 016-0357-03 ..... **$48**

11000, CSA, DSA Series. Order 016-1099-01 ..... **$85**

2000 Series. Order 016-0359-03 ..... **$48**

C-9 available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Recommended Camera Adapters

RECOMMENDED CAMERA ADAPTERS

Instruments	C-9 Hood	Price	C-30BP Bezel Adapter	Price
300 Series*1	None Available		Opt. 01 016-0327-01	$270
308*1	Not Recommended		Not Recommended	
370, 371	Opt. 07, 016-0357-03	$48	Not Recommended	
400 Series*1	Opt. 20 016-0359-03	$48	Opt. 01 016-0269-03	$170
400 Series with 0.8 cm graticule: 422, 453, 454, 485, 491*1	None Available		016-0306-01	$155
All 49X Series Except 491	Opt. 07, 016-0357-03	$48	016-0248-01	$170
500 Series Round*1	None Available		None Available	
500 Series Rectangular*1	None Available		None Available	
500 Series TV Vectorscopes*1	None Available		None Available	
528A*1	Opt. 07, 016-0357-03	$48	016-0248-01	$170
529, 576	None Available		None Available	
600 Series	Opt. 07 016-0357-03	$48	Opt. 01, 016-0248-01 (NR for 10 x 12 cm size)	$170
1240	Not Recommended		Not Recommended	
1400 Series (not 1480C)	Opt. 07, 016-0357-03	$48	016-0248-01	$170
1500 Series	None Available		Opt. 01, 016-0327-01	$270
1700 Series	Opt. 20 016-0359-03	$48	Opt. 01, 016-0269-03 (NOT 1740 or 1750 Series)	$170
2200 Series	Opt. 20*2 016-0359-03	$48	Opt. 01 016-0269-03	$170
2300 Series	Opt. 1P, 20*2 016-0359-03	$48	None Available	
2400 Series	Opt. 20 016-0359-03	$48	Opt. 01 016-0269-03	$170
271X Series	Opt. 20 016-0359-03	$48	Opt. 01 016-0269-03	$170
275X Series	Opt. 07, 016-0357-03	$48	016-0248-01	$170
5000 Series*1	Opt. 07, 016-0357-03	$48	Not Recommended	
5030, 5031*1	None Available		None Available	
5400 Storage 5403/D41, 5441, D41	Opt. 07 016-0357-03	$48	016-0248-01	$170
7000 Series*1	Opt. 07, 016-0357-03	$48	Opt. 01 016-0248-01	$170
7000 Large-screen 7403, 7603, 7603N	Opt. 07 016-0357-03	$48	Not Recommended	
11300 Series	Opt. 07, 016-0357-03	$48	Not Recommended	
11400 Series	Opt. 11, 016-1099-01	$85	Not Recommended	
CSA Series	Opt. 11, 016-1099-01	$85	Not Recommended	
DSA600 Series	Opt. 11, 016-1099-01	$85	Not Recommended	
OF100, OF200 TDR	Opt. 07, 016-0357-03	$48	Not Recommended	
R7103	Opt. 07, 016-0357-03	$48	016-0248-01	$170
T900 Series*1	Not Recommended		None Available	
T922R	Opt. 07, 016-0357-03	$48	016-0248-01	$170
TAS400	Opt. 06, 016-1181-00	$46		
TDS300, TDS400	Opt. 04, 016-1154-00	$75		
TDS500, TDS600, TDS800	Opt. 1P, 05, 016-1145-00	$70		
TLS216	Opt. 1P, 05, 016-1145-00	$70		
TM500 SC502, SC503, SC504	None Available		Opt. 01 016-0327-01	$270
WFM300	Opt. 20, 016-0359-03	$48	None Available	

*1 *See next entry.*

*2 *Opt. 1F recommended for scopes with no graticule lighting. The first and last small graticules may be cut off the picture image on some oscilloscopes.*

Instrument Carts/Workstations

CONTENTS

K420 Bench-Height Cart 529
K465 Storage Tower 529
K415 Transport Cart 530
K475 Workstation Tower 530
K212 Portable Instrument Cart 531
Test Station.....531

Instrument Carts/Workstations

Tektronix can free up your valuable work space, make sharing and moving equipment easy, and get you closer to the device under test.

Our ergonomically designed instrument carts and workstations bring a higher level of functionality to the end user, while safeguarding your instrument investment.

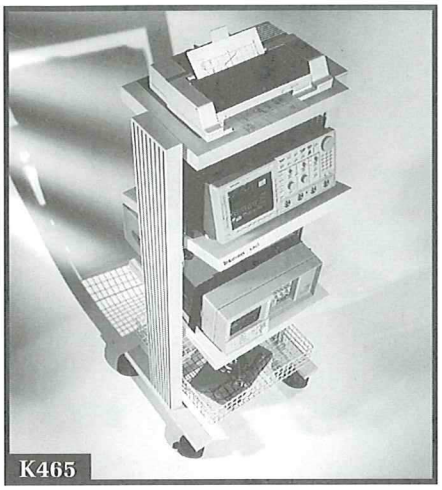
All new instrument carts and workstations can be customized to meet your specific requirements. The carts are shipped ready to assemble, allowing maximum configuration flexibility. The shelf height of the carts can be quickly and easily adjusted.

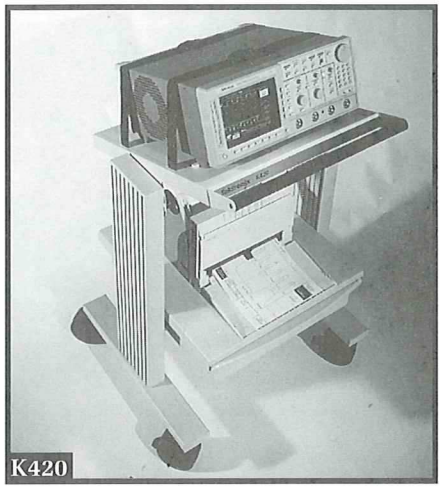
INSTRUMENT COMPATIBILITY CHART

	K212	K415	K420	K465	K475	TEST STATION
Oscilloscopes/Digitizers						
11000 Series CSA 803A 404		•		√	•	
DSA 600 Series					√	•
2200/2400 Series	√	•	•			
305/314/336	√	•				
5000/7000 Cabinet			√			
5000/7000 Rackmount		•	√	•	•	
TDS 300/400 Series	√		•	•		
TDS 500,600,700,800 Series		•	√	•	•	
TAS Series	√	•				
2500/2600		•	√	•		
TLS 216		•	√	•		
Television/Spectrum Analyzers						
1480 Series Cabinet	√		•			
1480 Rackmount		√	•		•	
17XX Cabinet	√					
17XX Rackmount		•		•		
1910		√	•		•	
2710 Series	√					
2750 Series		•		•	•	
2780 2790 Series	√		•			
490 Series	√	•				
Logic Analyzers						
1230		√	•	•		
DAS 9200		•		•	√	•
LV500				•	√	•
Prism 3000		•	•	•	√	•
Curve Tracers						
370A/371, 372					√	•
577		•				

√ – *Recommended*
• – *Compatible*

Instrument Carts/Workstations





Rack-width Portability

The K465 Instrument Tower is specifically designed for Tektronix larger oscilloscopes like the 11K Series and the CSA Series. These sturdy carts provide stable and safe instrument mobility with large smooth-rolling four-inch dual durometer twin wheel casters. The tiltable shelf has infinite positive locking positions between horizontal and 26 degrees. The three-quarter shelf is intended to hold a printer or other small device.

Characteristics

Shelf Tilt – 0° to 26°

Shelf Loading – Top Shelf: 35 lb. (16 kg). Middle Shelves: 82 lb. (37 kg). Basket 50 lb. (23 kg).

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width		
Overall Cart	635	25
Tilt Shelf	502	19.75
All Other Shelves and Basket	508	20
Height		
Overall Cart	1415	55.7
Depth		
Overall Cart	533.4	21
Top Shelf	419	16.5
Middle and Bottom Shelves	533.4	21
Weight	**kg**	**lb.**
Net	35	78

Durable Work Bench

These sturdy, portable carts are specifically designed for the Tektronix TDS Series Oscilloscopes used in digital design, telecommunications service and installation, and manufacturing environments. The tiltable shelf is rack-width to accommodate your instruments. The cart handle can serve double duty as a probe drape.

In addition, the spacious accessories drawer provides convenient storage for power cords, probes, manuals, and small parts.

Characteristics

Shelf Tilt – 0° to 26°.

Shelf Loading – 82 lb. (37 kg) per shelf.

Drawer Dimensions – 18 in. x 19.5 in. x 4 in. (645 x 495 x 102 mm).

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width		
Overall Cart	635	25
Top Shelf	502	19.75
Bottom Shelf	508	20
Height		
Overall Cart	780	30.7
Depth		
Overall Cart	620	24.4
Top Shelf	533	21
Bottom Shelf	533	21
Weight	**kg**	**lb.**
Net	26	57

K465

- Three Rack-width Shelves
- Designed for Use with 11K Series and CSA Series Oscilloscopes
- Tiltable Shelf with Positive Locking
- Three-quarter Shelf for Printer
- Wire Accessories Basket
- Tough Steel and Aluminum Construction Means a Secure Platform For All Your Instruments
- Shipped Ready to Assemble to Give Maximum Configurability

K420

- Stable/Mobile Platform
- Tiltable Shelf for Optimum Viewing
- Work-bench Height
- Heavy-duty Nylon Instrument Straps
- Surge and Noise Suppression
- Surge-protected Four Outlet Power Strip Accessory
- Shipped Ready to Assemble

Ergonomic design brings higher level of functionality.

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ORDERING INFORMATION

K420
Work Bench Cart **$730**
Includes: Probe Holders, Two Heavy Duty Nylon Instrument Straps, Instrument Manual, Retainer Bar, Hex Wrench, Level.

K465
Instrument Tower **$835**
Includes: Two Probe Holders, Four Nylon Instrument Straps, Instrument Manual, Level, Hex Wrench, Retainer Bar.

RECOMMENDED ACCESSORIES
U.S. Power Strip – Four Outlet, 6 ft., Noise/Surge Suppression.
Order 131-5342-01 ..... **$48**

K415
K475

Instrument Carts/Workstations

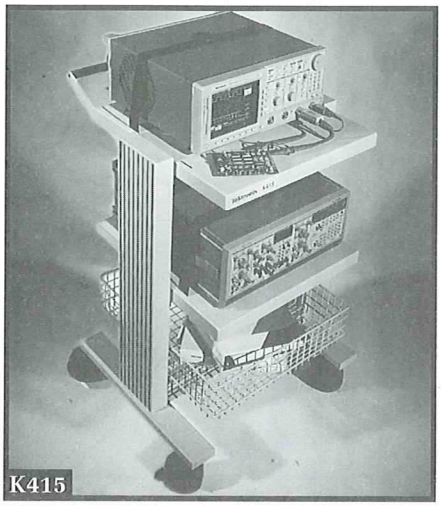
Stable and mobile rackmount capability.

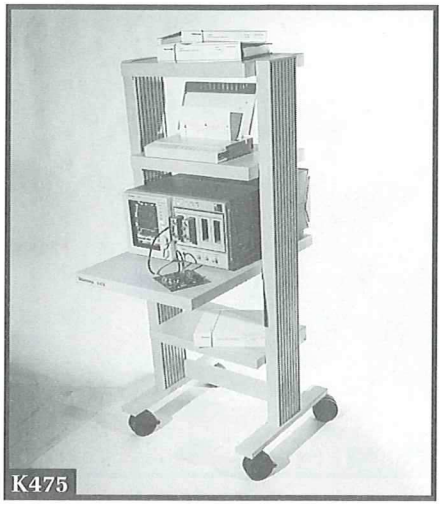
K415

- Constructed of Extruded Aircraft Aluminum
- Tactile Fit and Hold Soft Form Handle
- Stable/sturdy Platform
- Easy Assembly
- Accessories Basket Holds Up to 50 lb.
- Height Adjustable Shelves

K475

- Rugged Workstation Tower Offering Sturdy, Mobile Instrument Platform
- Oversized Shelf for Larger Oscilloscopes or Fixed Keyboard Platform
- 4 Instrument Restraining Straps
- Steel and Aluminum Design Ensures Solid Support
- Shipped Ready to Assemble to Give Maximum Configurability





Unmatched Value in Portability

The K415 Transport Cart, one of two mid-height carts, is constructed of nearly indestructible high-strength aluminum. These sturdy carts are ideal general purpose utility cart for holding Tektronix portable oscilloscopes, 1230 Logic Analyzers, and other general-purpose service instrumentation like the Tektronix TM5000 and 7000 Series. The K415 consists of two rack width shelves, plus a wire basket for storage.

Characteristics

Shelf Loading – 75 lb. per shelf

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width		
Overall Cart	635	25
Top Shelf	508	20
Bottom Shelf	508	20
Height		
Overall Cart	907	35.7
Depth		
Overall Cart	533	21
Shelves	533	21
Weight	**kg**	**lb.**
Net	30	65

Portability For Larger Oscilloscopes

The rugged K475 Workstation Tower is designed for rackmount applications required in digital design, research and development and manufacturing environments. This cart holds Tektronix larger oscilloscopes, like the DSA Series, providing stable transportation. It includes an extra long shelf (26.6 inches) with ample work space in front of the scope and three three-quarter shelves with loading capacity of 75 lb. per shelf.

Characteristics

Shelf Loading – Top Shelf 35 lb (16 kg.) All other shelves 82 lb. (37 kg.).

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width		
Overall Cart	635	25
All Shelves	508	20
Height		
Overall Cart	1418	55.7
Depth		
Overall Cart	676	26.6
Middle Shelf	676	26.6
All Other Shelves	370	16.5
Weight	**kg**	**lb.**
Net	38	83

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ORDERING INFORMATION

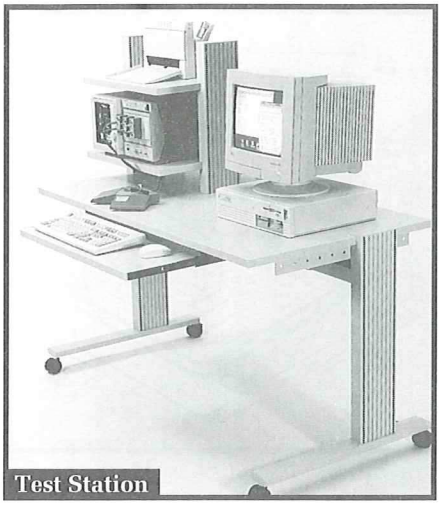
K415
Transport Cart **$710**
Includes: Two Probe Holders, Two Heavy Duty Nylon Safety Straps, Hex Wrench, Instruction Manual, Level.

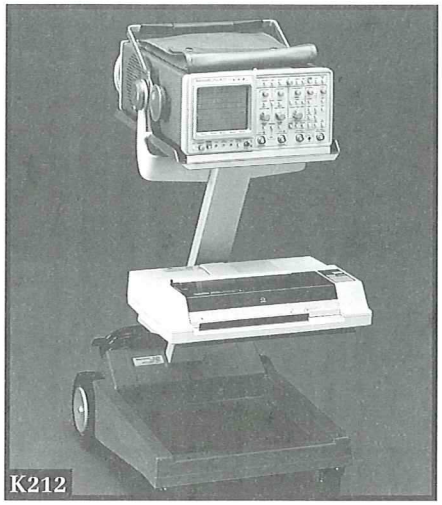
K475
Workstation Tower **$940**
Includes: Two Probe Holders, Four Nylon Instrument Straps, Hex Wrench, Level, Instrument Manual.

RECOMMENDED ACCESSORIES
U.S. Power Strip – Four Outlet, 6 ft., Noise/Surge Suppression. Order 131-5342-01. ..... **$48**

Instrument Carts/Workstations

TEST STATION K212


Test Station


K212

System Mobility and Work Space Functionality

The Test Station is inspired by the Tektronix IPA 310 Interconnect Parameter Analyzer System. It is perfect for use with systems requiring multiple pieces of equipment. It can be used as a standalone work space with enough room for a scope and accessories, as well as an additional work area. The Test Station consists of the main desk top, two shelves, a slide out keyboard, manual holders and power cord channel. Both the shelves and base are height adjustable.

Characteristics

Shelf Loading – 75 lb. per shelf; 100 lb. on main desktop.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width		
Overall Cart	1442	56
Shelf	559	22
Height		
Overall Cart	1295	51
Depth		
Overall Cart	762	30
Shelf	533	21
Weight	**kg**	**lb.**
Net	*1	*1

*1 *Contact your local Tektronix representative.*

Low Cost Portability

The K212 column and trays are made from high strength aluminum; the base is thermoset polyester.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Width		
Overall Cart	435	17.0
Shelf	407	16.0
Height		
Overall Cart	840	33.0
Depth		
Overall Cart	550	21.6
Shelf	352	14.0
Weight	**kg**	**lb.**
Net	9	20

TEST STATION

- Organize System Hardware
- Provides Additional Work Area
- Slide Out Keyboard
- Height Adjustability
- Practical and Sturdy
- Shipped Ready to Assemble

K212

- For All Portable Instruments
- Sturdy and Mobile Platform
- Enhances Sharing and Work Space
- Tiltable Top Tray
- Locking Front Casters
- Four Outlet Power Strip Option

Efficient system management and work space use.

ORDERING INFORMATION

TEST STATION
Order 016-1239-00 ..... **$1,195**
Includes: Slide Out Keyboard Tray, Cable Management Channel, Manual Holders.

K212
Portable Instrument Cart **$420**
Includes: Two 1 in. x 5 ft. Securing Straps, Retaining Bar, Instruction Sheet, and Probe Holders.

Opt. 10 – Add Four Outlet Power Strip ..... **+$75**
Opt. 12 – Add Second Tray ..... **+$95**
Opt. 22 – Combines Opt. 10/12 ..... **+$160**

RECOMMENDED ACCESSORIES
U.S. Power Strip – Four Outlet, 6 ft., Noise/Surge Suppression. Order 131-5342-01. ..... **$48**

Product(s) available through an Authorized Tektronix Distributor (see pages 590-595).

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Additional Accessories

Instrument Travel

Avoid Scope Damage and Improve Portability

Special Protection for Transporting and Shipping Portable Instruments

TRAVEL LINE PACKAGE

- Impact-resistant Packaging
- Pouch and Cover
- Carrying Strap
- Rubber Shock-absorbing Bumpers

PORTABLE INSTRUMENT TRANSIT/CARRYING CASES

- High Strength
- Foam Padding
- Custom Fit

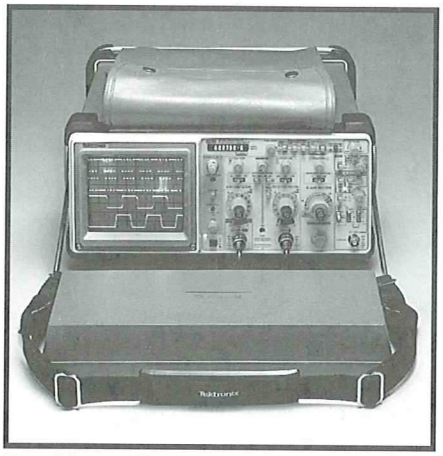
PORTABLE INSTRUMENT PROTECTIVE COVERS

- Custom Fit
- Waterproof Vinyl for Complete Enclosure of High-impact Plastic for Front Panel Enclosure

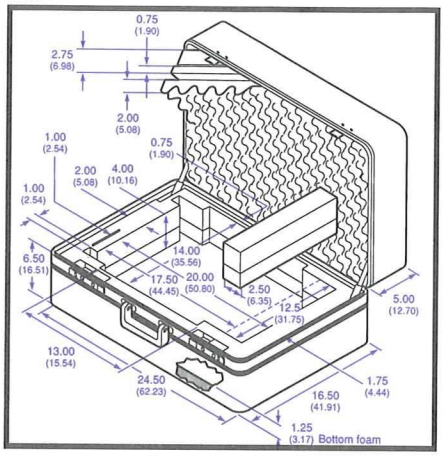
FRONT COVERS

- Snap-on Front Cover
- High-impact Plastic

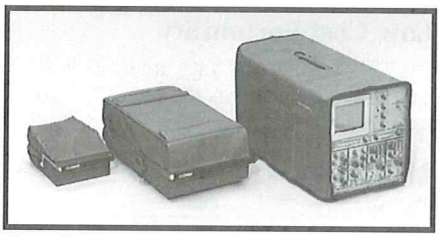
Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.



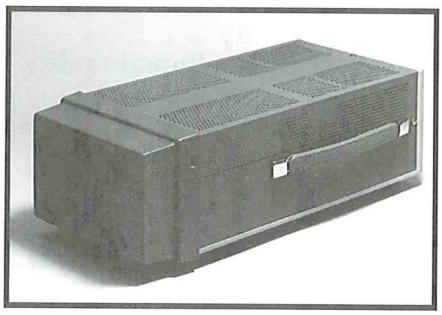
Portable Oscilloscope



016-0792-01 (Shown)



Complete Covers



Front Covers Only

Travel Line Package

Now give your 2200 Series instrument the added protection often necessary when used in rough environments. The Travel Line package provides protection from impacts along the front and rear of the instrument. The rear bumper is designed to provide a wider base to set the instrument on and reduces the potential of tip over when standing vertically. Plus it has a handy cord wrap.

The high-quality rubber moldings offer long life and are resistant to cracking and becoming brittle with age. The rubber composition provides excellent desk bench and inclined plane grab, so there is no worry about instrument slippage.

A front-panel protective cover and an accessory pouch for carrying probes and documentation are also included, plus a convenient carrying strap for hands-free operation and transport.

The Travel Line Package can be ordered at the time of purchase or as a field retrofit kit (available on 2235A, 2236A, 2221, 2224, and 2232).

Portable Instrument Transit/Carrying Cases

Rugged transit cases molded of high strength glass-epoxy protect your instruments from hostile environments, shock, vibration, moisture, and impact. Recommended for shipping or transporting your instruments.

Adjustments can be made to the internal padding of the 016-0792-01 to accommodate a wide variety of portable instruments and accessories.

Portable Instrument Protective Covers

The covers provide protection for the instrument during transport or storage. Made of waterproof vinyl, the covers are available for both laboratory and portable instruments. The covers for 5000/7000 Series have clear vinyl frontal areas.

Front Covers

Front covers are available for most portable oscilloscopes, spectrum analyzers, and TM 500/5000 mainframes.

Additional Accessories
Instrument Travel

ORDERING INFORMATION – SELECTION GUIDE

TRAVEL LINE PACKAGE
Order Opt. 33 for specific instrument.

2235A, 2236A –
Includes: Rubber Molding, Accessory Pouch, Front-panel Cover, Carrying Strap...**$295.00**

2221, 2224, 2232 –
Includes: Rubber Molding, Carrying Strap...**$295.00**

TRAVEL LINE PACKAGE CONVERSION KIT
2235A – Order 040-1188-03.....**$515.00**
Includes: Replacement cabinet and rear cover with the rubber moldings installed.

2236A, 2221, 2224, 2232 –
Order 040-1187-03.....**$300.00**
Includes: Replacement cabinet and rear cover with the rubber moldings installed.

PORTABLE INSTRUMENT TRANSIT/CARRYING CASES

Hard Sided Case
271X Family. Order 016-0792-02.....**$520.00**
2400 Series, 2200 Series. Order 016-0792-01.....**$455.00**
278X, 279X Family, OF150, OF235 Order 016-0658-00.....**$1,180.00**
TM 504. Order 016-0608-00.....**$965.00**
TM 515. Order 016-0643-00.....**$1,015.00**

Soft Sided Case
271X Family. Order 016-1158-00.....**$140.00**
278X, 279X Family, OF150, OF235 Order 016-0659-00.....**$190.00**

Carrying Strap
2200/2300 Series, 271X Family Order 346-0199-00.....**$30.00**

Accessory Pouch
271X Family. Order 016-0677-02.....**$50.00**

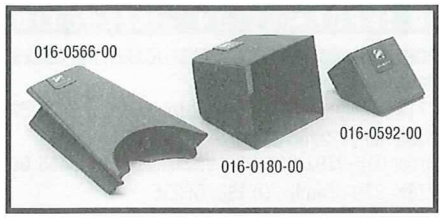
PORTABLE INSTRUMENT PROTECTIVE COVERS
7300/7400/7600 Series. Order 016-0192-01.....**$35.00**
5000 Series. Order 016-0544-00.....**$22.00**
2400 Series. Order 016-0720-00.....**$41.00**
2200 Series. Order 016-0848-00.....**$28.00**
200 Series. Order 016-0512-00.....**$36.00**
434/464/466. Order 016-0365-00.....**$45.00**
314/335. Order 016-0612-00.....**$195.00**
TM 504. Order 016-0621-00.....**$55.00**
TM 503. Order 016-0620-00.....**$42.00**

FRONT COVERS
2400 Series. Order 200-3199-01.....**$15.50**
2245A, 2246A, 2247A. Order 200-3232-01.....**$10.50**
2235A, 2236A/271X Family. Order 200-2520-00.....**$18.00**
2201, 2205, 2211, 2225. Order 200-3397-00.....**$34.00**
TM 506. Order 200-1728-00.....**$35.00**
TM 504. Order 200-1727-00.....**$29.00**
TM 503A. Order 200-3554-00.....**$38.00**
1700 Series. Order 200-3897-01.....**$18.00**

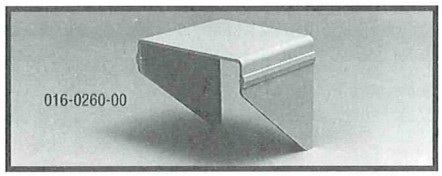
Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Additional Accessories
Viewing Hoods, Storage Compartments

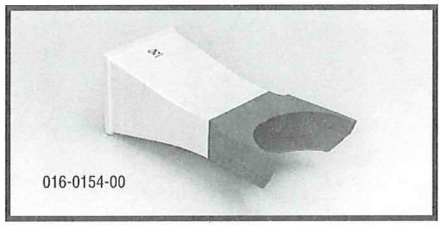
- Viewing Hoods
- Blank Plug-in Chassis
- Blank Panel
- Plug-in Storage Compartment



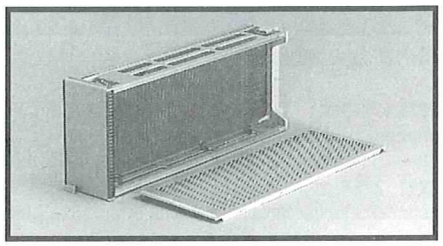
The viewing accessories normally mount on the instrument graticule cover. Some may fit camera-mounted bezels. If you intend using a camera on your instrument, check with your Tektronix Sales Engineer for bezel-viewer compatibility.



Folding Viewing Hoods



Non-collapsible Viewing Hoods



BLANK PLUG-IN CHASSIS
Available for all Tektronix mainframes. The 11000 Series provides a blank plug-in only. The 7000 Series includes a bare printed circuit board.

BLANK PANEL
When operating the 5000/7000 Series mainframes or the TM500/TM 5000 Series mainframes with less than a full complement of plug-ins, the blank panel may be used to cover an unused compartment. The panel for the 7000 Series is also good for EMC Shielding.

PLUG-IN STORAGE COMPARTMENT
The plug-in storage compartment provides storage space for probes, cables, "tees", accessories, and small tools. Inside dimensions: 250 mm long x 51 mm wide x 106 mm high (9 7/8 x 2 x 4 1/4 inches).

ORDERING INFORMATION

FOLDING BINOCULAR
For 2200 series, 2445A/B, 2465A/B, 2467B, 271X Family, 434, 455, 464, 466,465B, 475, 475A. Order 016-0566-00 ..... **$30**

COLLAPSIBLE
To reduce reflections and glare under high ambient light. Blue vinyl, folds flat for storage. For 2200 Series, 2445A/B, 2455A, 2465A/B, 2467B, 271X Family, 432, 434, 455, 465/B, 475, 464, 466 (Polarized). Order 016-0180-00 ..... **$100**

For 2200 Series, 2445A/B, 2465A/B, 2467B, 271X Family, 464, 466, 455, 465, 465B, 475 (Non-polarized). Order 016-0592-00 ..... **$20**

FOLDING
For 576. Order 016-0259-00 ..... **$38**

For 577, 5000, 7000, 11000 Series. Order 016-0260-00..... **$85**

NON-COLLAPSIBLE
For Older Tektronix 5-in. Oscilloscopes. Order 016-0001-01 .. **$360**

MOLDED
Gray Polystyrene with Polyurethane Eyepiece. For 5000 and 7000 Series, 528, 577. Order 016-0154-00..... **$130**

For 576. Order 016-0153-00 ..... **$100**

BLANK PLUG-IN CHASSIS
11000 Series. Order 016-0829-00..... **$195**

7000 Series. Order 040-0553-04..... **$310**

5000 Series. Order 040-0818-04..... **$190**

TM 500 Series. Order 040-0652-06..... **$165**

BLANK PANEL
7000 Series. Order 016-0155-00..... **$145**

5000 Series. Order 016-0452-01..... **$110**

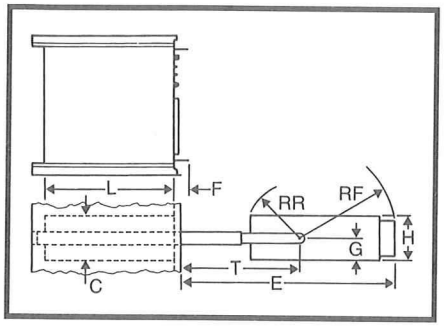
TM 500/TM 5000 Series. Order 016-0195-05 ..... **$60**

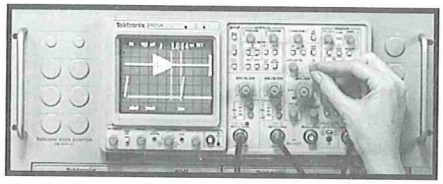
PLUG-IN STORAGE COMPARTMENT
Plug-in Storage Comp. Order 016-0362-02..... **$100**

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

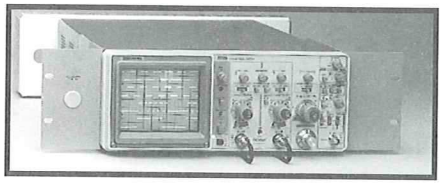
Additional Accessories

Rackmount Kits





Typical 2400 Series Rackmount



Typical 2200 Series Rackmount

Dimensions – Exclusive of Plug-in Units and Probes.

Symbol	Definition
H	Height of front panel
L	Rack front to rearmost permanent fixture excluding cables
F	Back of front panel to foremost protrusion
E	Maximum forward clearance with instrument out and horizontal
D Min	Minimum mounting depth from front mounting rail to rear mounting rail
D Max	Maximum mounting depth from front mounting rail to rear mounting rail

RACKMOUNT KIT SELECTION GUIDE

		H		L		F		E		D Min.		D Max.	
Instrument	**Part Number**	**in.**	**cm**	**in.**	**cm.**	**in.**	**cm**	**in.**	**cm**	**in.**	**cm**	**in.**	**cm**
DSA 601, DSA 602, 1201/A, 11301/A, 11302/A, 11401, 11402/A, 11403	040-1279-02 040-1214-03	12.25	31.1	24.3	61.7	2.4	6.1	31.7	80.5	14.63	37.2	27.75	70.49
11801, 11802, CSA 803A, SM11	040-1214-03	8.75	22.3	21.6	55.0	–	–	–	–	14.63	37.2	27.75	70.49
7704A, 7104, 7934, 7854, 7904A	040-0611-01	15.75	40.0	21.63	54.9	1.25	3.18	30.48	77.4	–	–	–	–
7704A, 7104, 7934, 7854, 7904A	040-0560-00*1	22.0	55.9	21.9	55.6	1.98	5.0	–	–	–	–	–	–
7000 Series Plug-in Storage Cabinet	437-0126-03	5.25	13.3	–	–	–	–	–	–	–	–	–	–
5100, 5400 Series	040-0583-03	5.25	13.3	19.0	48.3	1.1	2.8	24.6	62.5	–	–	–	–
279X Family	016-0844-02	8.75	22.3	17.8	45.2	–	–	–	–	–	–	–	–
278X Family	016-1019-01	8.75	22.3	17.8	45.2	–	–	–	–	–	–	–	–
271X Family	016-0901-00	5.25	13.3	16.3	41.4	1.84	4.67	–	–	–	–	–	–
271X Family	016-0897-00*1	7.0	17.8	18.4	46.7	4.67	11.9	–	–	–	–	–	–
2400 Series (with DV or DMM Opt.)	016-0805-00	8.75	22.3	18.3	46.5	1.8	4.5	24.8	62.9	12.8	32.5	26.8	68.1
2400 Series (w/o DV or DMM Opt.)	016-0825-01	7.0	17.8	18.3	46.5	1.8	4.5	24.8	62.9	12.8	32.5	26.8	68.1
2402 TekMate™	016-0971-00	3.5	8.9	18.0	45.7	1.8	4.5	24.5	62.2	11.0	27.9	23.0	58.4
2245A, 2246A, 2247A	2240FIR	7.0	17.8	18.3	46.5	2.2	5.6	24.8	62.9	12.8	32.5	24.5	62.2
2335	016-0468-00	5.25	13.3	16.3	41.4	1.8	4.5	–	–	7.5	19.1	24.5	62.2
2236, 2236A	016-0015-03	5.25	13.3	16.3	41.4	1.8	4.5	–	–	7.5	19.1	24.5	62.2
2235 Opt. 01	016-0833-02	5.25	13.3	16.3	41.4	1.8	4.5	–	–	7.5	19.1	24.5	62.2
2235A	016-0883-02	5.25	13.3	16.3	41.4	1.8	4.5	–	–	7.5	19.1	24.5	62.2
2220, 2221, 2224, 2230, 2232	016-0833-02	5.25	13.3	16.3	41.4	1.8	4.5	–	–	7.5	19.1	24.5	62.2
2213A, 2215A	016-0466-00	5.25	13.3	16.3	41.4	1.8	4.5	–	–	7.5	19.1	24.5	62.2
2211	016-0819-03*2	5.25	13.3	16.3	41.4	1.8	4.5	–	–	7.5	19.1	24.5	62.2
2201, 2205, 2225, 2815	016-0819-03*2	5.25	13.3	16.3	41.4	1.8	4.5	–	–	7.5	19.1	24.5	62.2
1240, 1241	016-0789-00	8.75	22.3	17.75	45.1	1.13	2.9	–	–	–	–	–	–
1230	1230F05	8.75	22.3	17.75	45.1	1.13	2.9	–	–	–	–	–	–
490 Series	016-0844-02*1	8.75	22.3	17.75	45.1	4.7	11.9	–	–	–	–	–	–
DAS9100	016-0463-00	8.75	22.3	23.5	59.7	0.75	1.9	26.5	67.3	23.38	59.4	27.3	69.5
DAS9200	016-0845-00	10.5	26.7	23.5	59.7	0.63	1.6	26.5	67.3	23.38	59.4	27.3	69.5
91HS8, 92HS8	016-0884-00	3.5	8.9	23.5	59.7	0.75	1.9	26.5	67.3	23.38	59.4	27.3	69.5
TM5006, TM506A	040-0982-04	7.0	17.8	18.0	45.7	–	–	–	–	–	–	–	–
TM5003	040-1257-02	7.0	17.8	18.0	45.7	–	–	–	–	–	–	–	–
Two TM503s side by side	040-0616-02	5.3	13.5	16.5	41.9	1.1	2.8	24.6	62.5	–	–	–	–
TM503 with 1/2 Rackwidth Adapter	040-0617-02	5.3	13.5	16.5	41.9	1.1	2.8	24.6	62.5	–	–	–	–

**1 Cradle mount to rackmount a cabinetized instrument.*

**2 For the 2211, 2201, 2225, 2205 oscilloscopes, and the 2815 Opto-Electronics scope when ordered with a rackmount kit (Option 1R) from the factory, the front feet of the instrument are removed. This reduces instrument height by one-half inch and cannot be reversed. When a field retrofit rackmount kit is installed, the instrument feet will remain integral to the instrument.*

Additional Accessories
Light Filters

Light Filters

Mesh Filters

EMC Filters

Product(s) available through your local Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

ORDERING INFORMATION

CATHODE-RAY TUBE LIGHT FILTERS

Instrument*1	Color	Part Number	Price
200 Series	Blue	378-0691-00	$10.25
324/335	Blue	378-2016-01	$2.10
490	Amber	378-0115-01	$4.45
	Gray	378-0115-02	$8.50
	Blue	378-0115-00	$3.95
434	Blue	378-0678-01	$27.00
455/465M	Blue	337-2122-00	$13.00
465/465B	Blue	337-1674-00	$15.25
475	Clear	337-1674-01	$13.25
464/466	Smoke-grey filter	337-1674-07	$26.00
576	Blue*2	378-0616-00	$22.00
603/604	Clear (603*2)	337-1440-00	$7.00
	Green	337-1440-01	$8.75
	Amber	337-1440-02	$19.50
	Blue	337-1440-03	*3
	Gray	337-1440-04	*3
	Graticule (8 x 10 div)	331-0303-00	$18.75
605/606/607	Blue	337-1674-00	$15.25
	Graticule (Clear)	337-1674-10	$13.50
	Clear Shield	337-1674-13	$14.50
	Gray*2	337-1674-06	$7.00
608	Amber	378-0704-00	$12.00
	Graticule*2	337-2126-02	$12.75
2200 Series	Blue*2	337-2775-00	$7.25
	Clear	337-2775-01	$9.40
	Gray w/TV Graticule	035-0175-00	*3
2300 Series	Blue Implosion Shield*2	337-2760-00	$12.50
2400 Series	Blue*2	378-0199-03	$6.50
	Clear Implosion Shield*2	378-0208-00	$2.65
271X Series	Smoke Gray	337-2775-02	$14.25

CATHODE-RAY TUBE LIGHT FILTERS

Instrument*1	Color	Part Number	Price
5100 & 5400 Series (except 5441)	Clear	337-1440-00	$7.00
	Green	337-1440-01	$8.75
	Amber	337-1440-02	$19.50
	Blue	337-1440-03	*3
	Gray	337-1440-04	*3
5441	Clear*2	337-1674-01	$13.25
	Gray	337-1674-07	$26.00
7603	Blue	378-0684-00	$15.50
	Amber	378-0684-01	$10.25
	Gray	378-0684-02	$13.50
	Green	378-0684-03	$21.00
	Spectrum Analyzer Graticule	337-1439-01	$16.75
	Blue Implosion Shield*2	337-1700-01	$17.50
	Clear Implosion Shield	337-1700-04	$10.50
7613/7623/7623A/7633	Spectrum Analyzer Graticule	378-0625-07	$32.00
	Green (UV)	378-0625-08	$10.50
7844/7313	Blue*2	378-0625-00	$21.00
7700 Series/7613/7623/7100 Series/7900	Amber	378-0625-01	$11.50
	Gray	378-0625-02	$21.00
	Green	378-0625-03	$26.00
	Gray TV Graticule NTSC	378-0625-06	$15.75
	Clear Shield		
	Spectrum Analyzer Graticule	337-1159-02	$34.00

CRT MESH/EMC FILTERS

Instrument*1	Color	Part Number	Price
314/326/335	N/A	378-0063-00	$80.00
432/434	N/A	378-0682-00	$80.00
422/491/453A/454A/485	N/A	378-0648-00	$105.00
465/465B/475/464/466/434	N/A	378-0726-01	$200.00
7400/7603	N/A	378-0696-00	$140.00
7100/7500/7700/7800/7900 Series/7613/7623/A/7633	N/A	378-0603-00	$220.00

The mesh filter improves display contrast for instrument viewing under high ambient light conditions. A fine metal screen with a matte black surface is utilized to reduce light reflections. Although light transmission from the CRT is reduced to approximately 28%, the high attenuation of external reflections allows viewing low intensity displays in room light or other bright surroundings.

The mesh filter also serves as an EMC filter. Installed on the instrument, the metal frame of the filter is grounded, providing effective filtering of the EMC spectrum.

**1 For cabinet and rackmount instruments unless otherwise noted.*

**2 Standard filter supplied with instrument.*

**3 Contact your local Tektronix sales representative.*

Television Products

Building on its success in the video marketplace, Tektronix' Television Division has broken competitive strongholds in the **audio** marketplace with its introduction of the VM 700. This advanced mixed signal measurement set brings the power of digital signal processing to analog and digital audio measurement tasks. An advanced user interface relies upon proven CRT-touchscreen, hardkey and keystroke programming elements to control the internal applications and utilities. Conventional measurement capabilities include FFT-based spectral analysis featuring zoom, waterfall, and cursors, plotting analysis, audio waveform display, auto-sequences and multitone analysis, etc. The digital interface analyzer measures digital audio time-domain, frequency-domain, and data-domain parameters such as jitter, synchronization and delay, bit activity, and data errors.

Addressing **digital** implementation and expansion in video environments, Tektronix introduced several products, among them, the new WFM601i Serial Component Monitor for operational environments. It provides component displays including the Tektronix patented Lightning, and error detection and handling capability for thorough testing of digital signals. A full line of digital products including the SDA601 Handheld Analyzer, TSG601 Handheld Generator and the SPG422 Synch Generator have been designed specifically for the needs in digital video environments.

Several new introductions for **cable** customers currently provide the broadest product offering for CATV test and measurement equipment. Our most notable additions include the SLM150 SignalScout Signal Level Meter and TV110 CableScout TDR Cable Tester. Tektronix has the products, service, and education conveniently packaged to help customers maximize their time and potential. A full range of equipment is available for baseband and RF measurements, in manual or automated applications.

A comprehensive line of handheld waveform/vector/picture/audio monitors and low-cost generators has also been added to the list of new products. These application-specific products break significant price/performance barriers while maintaining Tektronix quality. Look for the world's first handheld WFM90 Series monitors on page 542.

Tektronix' biggest technological breakthrough comes with Pro*file*™, a **digital disk-based** recorder that has made disk-based video management and storage affordable and practical. It provides CD quality audio and first generation Betacam® SP quality video and better. It utilizes Intelligent Compression™ that specifies the exact video quality for various applications. So as the transition from analog to digital, and from tape to disk takes place, Tektronix continues to help facilitate the transition by augmenting current formats while incorporating new technologies.

CONTENTS

MEASUREMENT SETS

VM 700A....538
1780R/1781R....539

WAVEFORM MONITORS/VECTORSCOPES

1710B, 1711B, 1720, 1721, 1725, 1720 SCH, 1721 SCH, 1730, 1731, 1735, 1730 D, 1731 D....540
1735 HD, 1740A, 1750A, 1760 Series....541
WFM 90, WFM 91, WFM 300A WFM601, WFM601i....542
WVR 500....543

GENERATORS/INSERTERS

TSG 170D....544
TSG 273....544
TSG 422....544
SPG 422, ECO 422....544
TSG 95, TSG 100, TSG 111, TSG 120....546
TSG 130A, TSG 131A, TSG 200....547
TSG 271, TSG 170A, SDA 601, TSG 601....548
TSG 300, TSG 371....549
SPG 1000....550
PE1000....550
TSG 1001....550
TPG 20....550
TPG 625....550
VITS 100, VITS 200, VITS 201....550
1910....550

SYNCHRONIZERS

VS 210, VS 211A, 118-AS....552

AUDIO

AM700....553
AM70, ASW100F/100M....554
760A, 760D, 760N....555
ASG 100/ASG 140....555

OPERATIONAL

Pro*file*™....556

RF/CABLE

CMP500, CSS500, CMP100, CMP200....557
RFM150, SignalScout™ DS1200, TV1350....558
2714, 2721A, 2722A, 1705A....559

Television Products
Video Measurement Sets

Emmy Award-winning VM 700A automatic video measurement set.

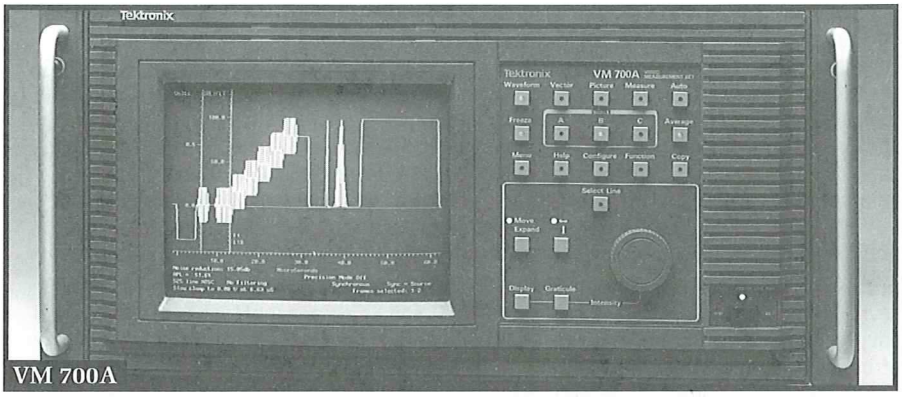
AVTIME audio to video delay measurement package.

Teletext measurements.

Camera measurements.

Component measurements.

- VM 700A
  - Opt. 20
  - Opt. 21
  - Opt. 30
  - Opt. 41
  - Opt. 42
- AVTIME
- VMBKUP
- VMT
- VMREMGR
- 1780R/1781R

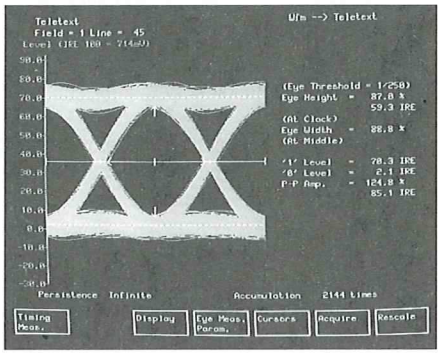


VM 700A Video Measurement Set

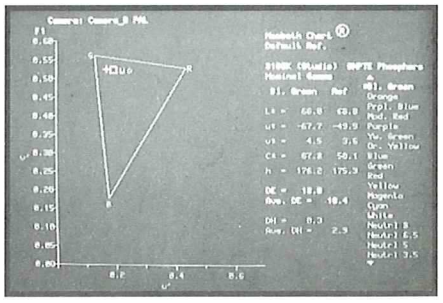
- Many capabilities in one instrument
  - Digital waveform monitor
  - Digital vectorscope
  - Group delay and frequency response
  - Noise measurement set
  - Automatic measurement set
- Auto Mode
  - Unattended monitoring of NTSC or PAL video signals from studios, STLs, earth stations, and transmitters
  - User-specified limits
- Remote control operation
- Automatic measurement of short duration audio test sequence
- Measure frequency response, distortion, phase, crosstalk, and other important audio parameters
- Measure mode provides graphic display of measurements
  - K factor
  - Noise spectrum
  - Differential gain and phase
  - Group delay with (Sin x)/x
  - Chrominance to luminance delay
  - Color bars
  - Relative-to-reference on most measurements
- Three input channels
- Averaging on most measurement modes
- Picture mode for source ID
- Hardcopy for analysis and documentation

VM 700A Option 20 Teletext Measurements

- Provides numerical results
  - Eye height
  - Start of data code
  - Eye width
  - Number of run-in bits
  - Data levels (logical "0" and logical "1" levels)
- Provides graphical displays
  - Eye height with variable persistence
  - Eye height with grading
  - Amplitude histogram
  - Teletext timing
- Multiple clock frequencies
  5.727272 MHz for System M (NTSC)
  6.9375 MHz for System B/G/I (PAL)
- Cursors for manual measurements



VM 700A Option 20



VM 700A Option 21

VM 700A Option 21 Camera Measurements

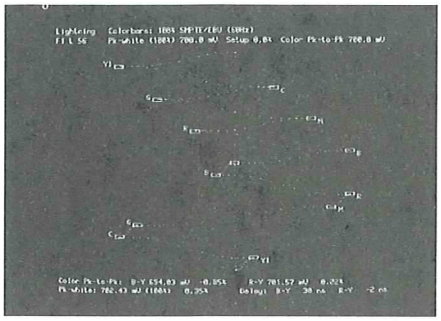
- Significantly simplifies key measurements of camera performance
- Compatible with NTSC or PAL cameras
- Automates pre-purchase evaluation and comparison of cameras
- Reduces time spent on acceptance testing, routine maintenance and operational adjustments
- Uses industry standard charts
- Camera matching simplified with relative-to-reference mode
- Ten key measurements:
  - Colorimetry
  - CDD Defects
  - Vertical Smear
  - Shading
  - Gamma
  - Detail
  - Fixed Pattern Noise
  - Geometry/Registration
  - Frequency Response
  - Frequency Response with Aliasing

TV Catalog available. Please complete and return the reply card in the back of this catalog.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Television Products
Video Measurement Sets



VM 700A Option 30
Component Measurements
- Provides numerical results for:
  - Relative timing of B-Y and R-Y
  - Relative amplitude of B-Y and R-Y
  - Peak to peak amplitude for B-Y and R-Y
  - Peak white amplitude
- Compatible with SMPTE/EBU, Sony Betacam®, and MII Formats
- Numerical results in all measurements
- Level meter displays amplitude of all three channels simultaneously
- Configurable for Y/R-Y/B-Y or GBR formats
- Full complement of component analog video measurements and displays

VM 700A Option 41
Three Stereo Audio Inputs
Option 41 adds three stereo audio inputs to the VM 700A. This provides the capability to measure the audio signals from three stereo audio sources via separate inputs. Each audio channel can be configured to follow one of the video inputs through the front panel video source selection.
- Three independent stereo audio inputs
- Same measurement capabilities as Option 40

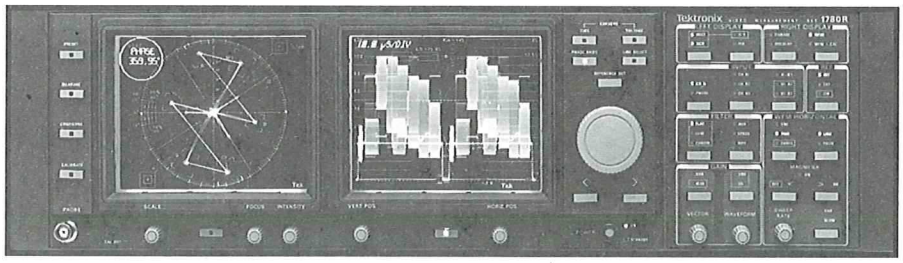
VM 700A Option 42
Audio to Video Delay Measurement
Option 42 provides the VM 700A with the capability to measure the timing difference between the audio and video portions of a program. The measurement is designed to operate with a Tektronix VITS 200 NTSC VITS Inserter or VITS 201 PAL VITS Inserter, and a Tektronix ASG 140 Audio Signal Generator.
- Measures audio to video delay of transmission paths
- Operates in both NTSC and PAL video standards
- Measures audio to video delay of up to 120 video frames
- Easy to read graphic display

VM 700A AVTIME
Audio to Video Delay Measurement Package
Complete audio to video time delay measurement package including VM 700A with Option 40 audio measurement hardware, audio to video delay measurement Option 42, a VITS 200 Series Inserter, and an ASG 140 Audio Signal Generator.

VMBKUP Backup and Remote Control Software
- Backup or restore sets of measurement configuration files, reference measurement files and function key definitions
- Perform individual file and directory operations on both the connected personal computer and VM 700A
- Use to restore backed up files to VM 700A after upgrade
- Control the VM 700A from a PC
- Use Serial Line Internet Protocol (SLIP) for data transfer over RS-232-C connection

VMT Remote Control Software
- Controls the VM 700 or VM 700A
- Pull down/pop up menus simplify operation
- Conditional testing of incoming data
- PC based functions
- Text and graphics capture
- Adapts to VM 700A and its options

VMREMGR Remote Graphics Software
- Display VM 700A graphics on a remote PC
- Perform front panel operations via mouse
- Issue remote commands
- Terminal operations



1780R/1781R Video Measurement Sets
- Full bandwidth analog processing
- Precision waveform/vector measurements
- Polar SCH presentation with calibration mode
- Four loop-through video input channels
- Component or composite waveform evaluation
- Measurement-grade time/voltage cursors
- Precision differential phase/differential gain measurements even with noisy signals
- Stereo audio phase and amplitude display
- User definable semi-automatic setups
- Available for either NTSC or PAL standards

ORDERING INFORMATION

VM 700A
Video Measurement Set **$16,500**
Opt. 01 – NTSC Measurements ..... **+$4,500**
Opt. 11 – PAL Measurements ..... **+$4,500**
Opt. 20 – Teletext Measurements ..... **+$3,000**
Opt. 21 – Camera Measurements ..... **+$4,500**
Opt. 30 – Component Measurements ..... **+$2,500**
Opt. 40 – Audio Measurements ..... **+$4,000**
Opt. 41 – Three Stereo Audio Inputs ..... **+$4,600**
Opt. 42 – Audio to Video Delay Measurement ..... **+$1,500**
Opt. 48 – GPIB Interface ..... **+$2,500**
Opt. 74 – White Phosphor CRT ..... **+$100**
Opt. 1C – Cabinet Version ..... **NC**
Opt. 1P – Printer Version (110 V only) ..... **+$625**
Opt. 1Z – Probe Adapter (067-1429-00) ..... **+$500**

AVTIME
Audio to Video Delay Measurement Package
Opt. 01 – NTSC System with an ASG 140 ..... **+$31,300**
Opt. 02 – NTSC System with an ASG 100 in place of an ASG 140. ..... **+$31,300**
Opt. 11 – PAL System with an ASG 140 ..... **+$30,800**
Opt. 12 – PAL System with an ASG 100 in place of an ASG 140 ..... **+$30,800**
VMBKUP – VM 700A Backup and Remote Control Software **$250**
VMREMGR – VM 700A Remote Graphics Software **$250**
VMT – VM 700A Remote Control Software **$195**
1780R (NTSC)/1781R (PAL) – Video Measurement Sets ... **$10,500**
1780F02 – Portable Carrying Case for 1780R/1781R **$295**
1780F05 – Rackmount Shelf **$100**

TV Catalog available. Please complete and return the reply card in the back of this catalog.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

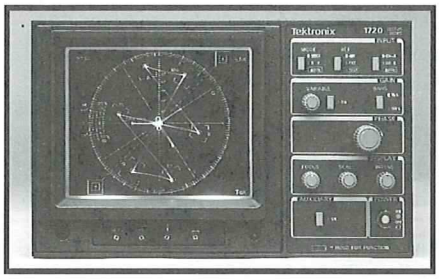
Television Products

Waveform Monitors/Vectorscopes

Waveform monitors and vectorscopes for composite, component, serial digital, dual standard, multifomat.

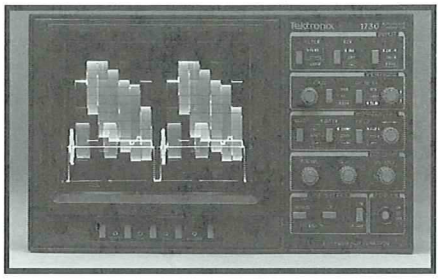
- 1710B/1711B
- 1720/1721/1725
- 1720 SCH/1721 SCH
- 1730/1731/1735
- 1730 D/1731 D
- 1735 HD
- 1740A Series
- 1750A Series
- 1760 Series

1710B/1711B
Waveform Monitors
- Easy operation/cost effective
- Burst phase indicator
- Dual filter display
- Bright CRT display
- Available in NTSC or PAL standards

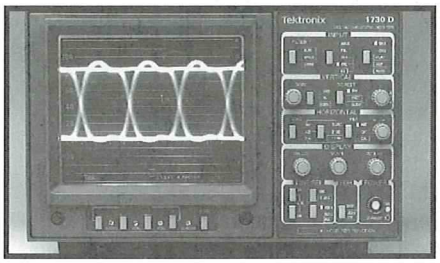


1720/1721/1725
Vectorscopes
- Performance and economy
- Simultaneous channel A and B display
- Stereo audio phase measurement
- R-Y output for differential phase measurement
- Available in NTSC, PAL or dual standard

1720 SCH/1721 SCH
Vectorscopes with Polar SCH Phase Display
- Polar display of relative and absolute SCH phase
- Full line select capabilities when used with 1730 Series Waveform Monitors
- White CRT phosphor available for neutral color display applications
- Stereo audio phase and amplitude display
- Especially useful in editing suites for matched frame editing
- Digital phase shifter
- Available in NTSC (1720 SCH) and PAL (1721 SCH) standards



1730/1731/1735
Waveform Monitors
- Performance and economy
- Complete line select
- Simultaneous channel A and B display
- Differential gain measurement
- One button front-panel recall
- Dual filter display
- VTR servo rates
- Available in NTSC, PAL or dual standard



1730 D/1731 D
Serial Digital Waveform Monitors
- Two analog composite inputs
- Two serial digital composite inputs
- One parallel digital composite input
- Passive loop-through for serial inputs
- Precision analog display of digital input
- Full time DAC output
- Serial digital bit stream EYE Pattern display
- Error Detection and Handling display mode (EDH)
- Displays D-2 servo waveforms
- Available in NTSC (1730 D) and PAL (1731 D) versions

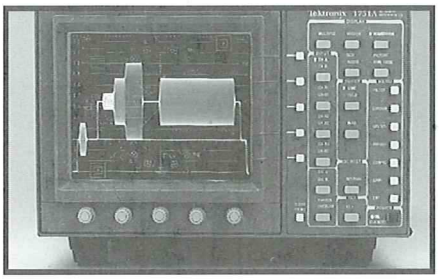
TV Catalog available. Please complete and return the reply card in the back of this catalog.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

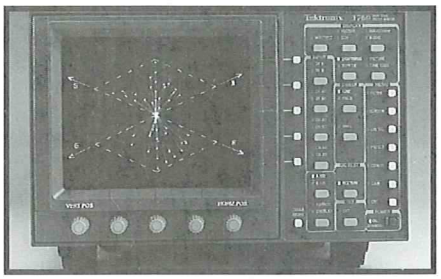
Tektronix Measurement products are manufactured in ISO registered facilities.

Television Products
Waveform Monitors/Vectorscopes

1735 HD
Multiformat Waveform Monitor
- Six video inputs
- 30 MHz video bandwidth
- Excellent performance in high magnifications
- High DC stability with front-panel ground reference
- HDTV and standard video formats
- Full line select in each format
- Subtract mode for intersignal timing



1740A/1750A Series
Analog Composite
Waveform/Vector Monitors
- Easy to use operating system
- Eight video inputs
- Waveform and vector displays
- Picture display for signal identification
- Stereo audio phase/amplitude display
- Time code waveform display
- Waveform and vector cursors
- 1750A includes Polar SCH and color framing



1760 Series
Composite/Component
Waveform/Vector Monitor
- Two composite plus two component inputs
- All composite features of the 1740A
- Component vector, Lightning and Diamond displays
- Component picture monitor output
- Optional SCH and color framing

ORDERING INFORMATION

1710B (NTSC)/1711B (PAL)
Waveform/Burst Phase Monitor **$1,795**

1720 (NTSC)/1721 (PAL)
Vectorscope **$2,395**

1725
NTSC/PAL Vectorscope **$3,400**

1720 SCH (NTSC)/1721 SCH (PAL)
Vectorscope **$3,400**

1730 (NTSC)/1731 (PAL)
Waveform Monitor **$2,395**

1735
NTSC/PAL Waveform Monitor **$2,600**

1730 D (NTSC)/1731 D (PAL)
Serial Digital Waveform Monitor **$3,495**

1735 HD
HDTV Waveform Monitor **$5,900**

1740A (NTSC)/1741A (PAL)
Waveform/Vector Monitor **$4,395**

1745A
NTSC/PAL Waveform/Vector Monitor **$4,695**

1750A (NTSC)/1751A (PAL)
Waveform/Vector/SCH Monitor **$5,900**

1755A
NTSC/PAL Waveform/Vector/SCH Monitor **$6,200**

1760 (NTSC)/1761 (PAL)
Composite/Component Waveform/Vector Monitor **$4,900**

1765
NTSC/PAL Composite/Component Waveform/Vector Monitor **$5,200**

Opt. SC – (1760/1761/1765)
Adds SCH/Color Framing Display ..... **+$1,700**

Opt. 74 – P4 White Phosphor.
Available on all half-rack 1700 Series products ..... **+$100**

ACCESSORIES
1700F00 – Plain Case **$65**
1700F02 – Portable Case **$100**
1700F05 – Dual Rack Adapter **$230**
1700F06 – Blank Panel **$60**
1700F07 – Utility Drawer **$155**
1700F10 – DC Voltage Kit **$230**

TV Catalog available. Please complete and return the reply card in the back of this catalog.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION
Tektronix Measurement products are manufactured in ISO registered facilities.

WFM 90
WFM 91
WFM 300A

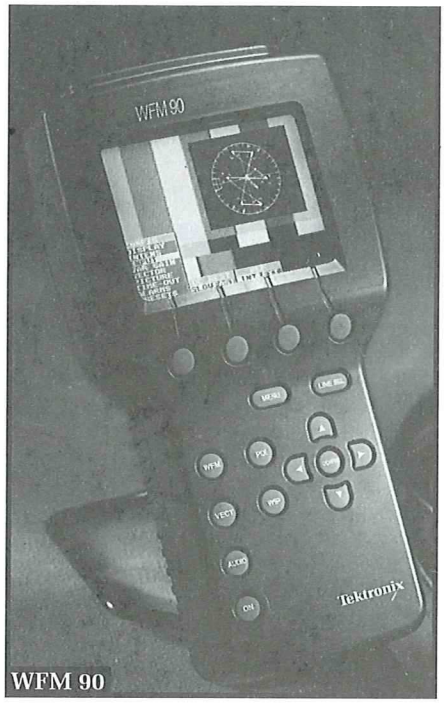
WFM601
WFM601i

Television Products

Waveform Monitors/Vectorscopes

Waveform monitors and vectorscopes for composite, component, serial digital, dual standard, multiformat.

- WFM 90
- WFM 91
- WFM 300A
- WFM601
- WFM601i



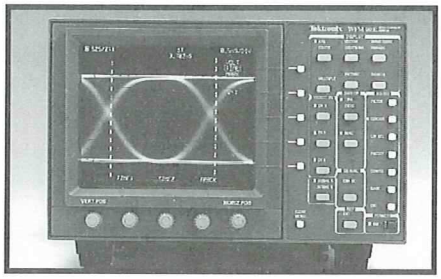
WFM 90

WFM 90 and WFM 91Handheld Waveform/Vector/Audio/Picture Monitors

- Video waveform, with 1H, 2H, 2F, and magnified displays
- Composite vector display, with x5 magnification
- Audio waveform voltage/time display
- High quality color picture display
- Waveform or vector displays cut into picture
- Output to external picture monitor
- Battery or AC operation with adapter
- Headphone output for audio identification and microphone checks
- Rugged package for field operation
- Available for NTSC (WFM 90) or PAL (WFM 91) operation

WFM 300A
Component/Composite Waveform Monitor

- Component and composite waveform display
- Lightning display for equipment setup and monitoring
- Bow tie display for system timing
- Menu selectable component format options
- Menu selected 625/50 or 525/60 configuration
- Separate GBR and composite picture monitor outputs
- Front-panel user recalls for fast operation



WFM601/WFM601i
Serial Component Monitors
WFM601 Series Features:

- Two serial digital component video inputs
- Waveform parade and overlay displays
- Component vector display
- Tektronix Diamond color gamut display
- Tektronix Lightning and bowtie displays
- Waveform time and amplitude cursors
- EDH and date error reporting
- Picture display of Y channel
- RGB picture monitor outputs
- Eight user presets

Features Unique to WFM601i Series:

- Eye Pattern of 270 MB/s data signal
- Format Checking
- ANC data identification
- Expanded data error reporting
- Active picture CRC readout

TV Catalog available. Please complete and return the reply card in the back of this catalog.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

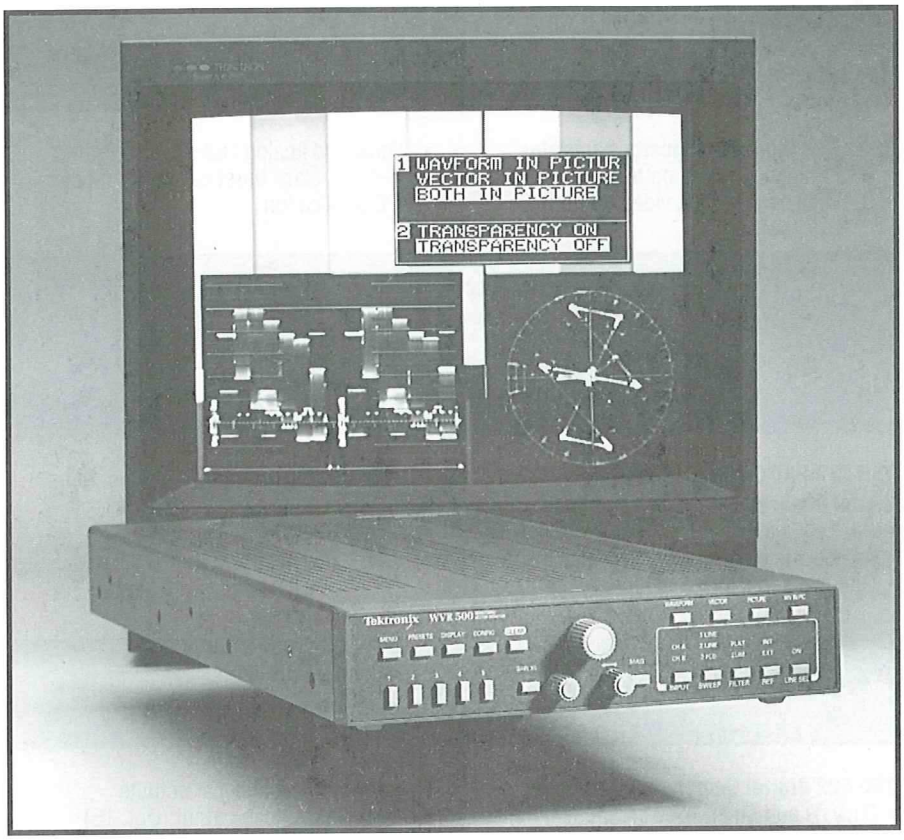
WFM 90 (NTSC)/ WFM 91 (PAL)
Handheld Waveform/Vector/Audio/Picture Monitor **$1,995**

WFM 300A
Component/Composite Monitor **$3,900**
Opt. 05 – Delete Color Shutter ..... **–$350**
Opt. 10 – NTSC/BETA CAM Transcoder ..... **NC**
Opt. 14 – NTSC/MII Transcoder ..... **NC**

WFM601
Serial Component Monitor **$4,995**

WFM601i
Serial Component Monitor **$6,495**

Television Products
Waveform/Vector Rasterizer



(Monitor not included)

Compact and economical solution for monitoring the waveform and color vector display of an NTSC or PAL television signal.

WVR 500 Waveform/Vector Rasterizer

- Rasterizes NTSC or PAL video signal for picture monitor display
- High quality display of live or test waveforms
- Full field or cut-in waveform and vector displays
- Safe title/safe action area indication
- No processing of picture, even in cut-in modes
- Line select of VITS observation
- Local or RS-232 control
- Small, single unit package
- Compatible with Tektronix mounting system
- Ideal for dual-standard applications
- Safety certified to UL, CSA, and VDE standards

TV Catalog available. Please complete and return the reply card in the back of this catalog.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

WVR 500
Waveform/Vector Rasterizer **$1,795**

TSG 170D
TSG 273
TSG 422

SPG 422
ECO 422

Television Products

Generators

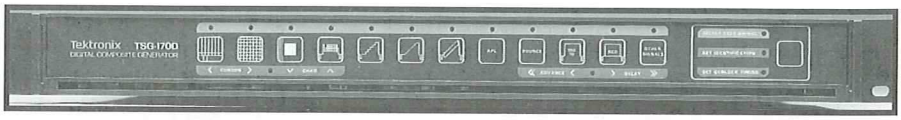
Generators, Inserters and D to A Converter.

Parallel and Serial Digital.

Digital Composite.

Digital Component.

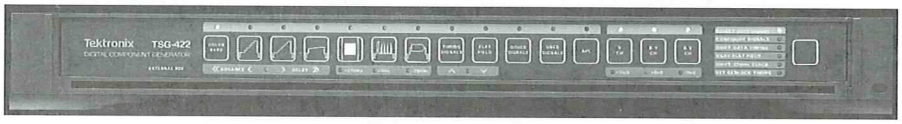
- TSG 170D
- TSG 273
- TSG 422
- ECO 422
- SPG 422



TSG 170D Digital Composite Generator
- NTSC digital and analog test signal outputs
- Optional serial digital video outputs
- Digital and analog audio tone outputs
- RS-170A black burst output for master SPG application



TSG 273 PAL Composite Digital Signal Generator
- PAL test signals
- Analog and parallel digital test signal outputs
- Optional serial digital video outputs
- Serial and parallel digital audio outputs
- PAL sync generator with genlock
- Full field character identification
- Tape leader countdown



TSG 422 Digital Component Generator
- D1 VTR and other 4:2:2 component digital equipment testing and maintenance
- Conforms to CCIR recommendation 601, SMPTE 125M, and EBU Tech. 3267-E
- 10 or 8-Bit signal generation
- Digital video test signal outputs
- Serial digital video output (Opt. 1S)
- Separate Y, B-Y, R-Y clock outputs
- 525/60 and 625/50 operation
- NTSC or PAL black burst outputs
- Sync lock to 525/60 or 625/50

TV Catalog available. Please complete and return the reply card in the back of this catalog.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Television Products

Generator/Changeover Unit/Digial Analyzer

TSG 170D
TSG 273
TSG 422

SPG 422
ECO 422



- SPG 422
- ECO 422
- TSG 170D
- TSG 273
- TSG 422

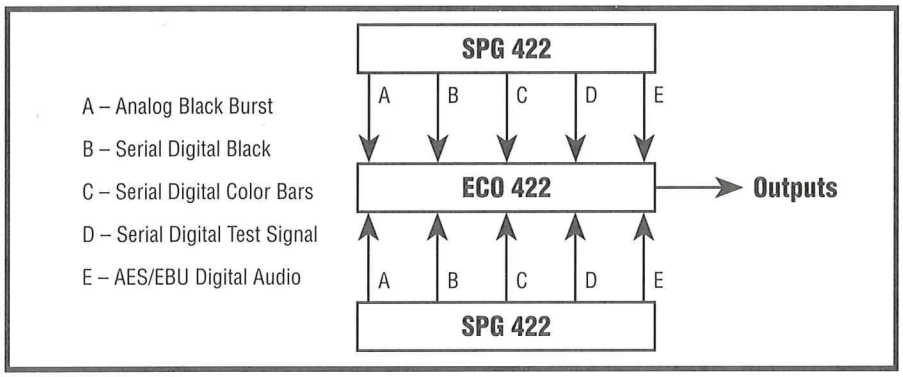
SPG 422 Component Digital Master Sync Generator

- Conforms to CCIR 601/656; EBU N14, Tech. 3267; SMPTE 259M, RP 154, RP 155, RP 165; proposed SMPTE standard for adding AES/EBU audio data to the digital video ancillary data area; proposed SMPTE standard for transmission of AES/EBU digital audio over coaxial cable; ANSI S4.40 (AES 3)
- 525/60, 625/50, or dual standard operation
- Multiple, independently timeable analog black burst outputs
- High stability internal reference with genlock to NTSC or PAL
- Full time serial digital bars and black outputs
- AES/EBU serial digital audio outputs (XLR and BNC)
- Optional serial digital video test signal output
- User presets with non-volatile storage
- RS-232 or ground closure remote control



ECO 422 Changeover Unit

- Switches analog black and serial digital video and digital audio
- Eleven user-configurable signal channels
- Amplitude detection on all channels
- Automatic or manual operation
- Fault and operating mode front-panel indicators



Component digital master sync system. The ECO 422 provides eleven user configurable signal channels, each consisting of primary and backup inputs and an output.

ORDERING INFORMATION

SPG 422
Component Digital Master Sync Generator **$3,900**

ECO 422
Changeover Unit..... **$2,500**

TSG 170D
NTSC Digital Composite Generator **$5,600**
Opt. 1V – VM 700A Signal Set ..... **NC**
Opt. 1S – Adds Serial Digital Video Outputs ..... **+$800**

TSG 273
PAL Composite Digital Signal Generator **$7,375**
Opt. 1S – Adds Serial Digital Video Outputs ..... **+$800**

TSG 422
Digital Component Generator **$5,500**
Opt. 1S – Adds Serial Digital Video Outputs ..... **+$800**

TV Catalog available. Please complete and return the reply card in the back of this catalog.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

TSG 95
TSG 100
TSG 111
TSG 120

Television Products
Generators

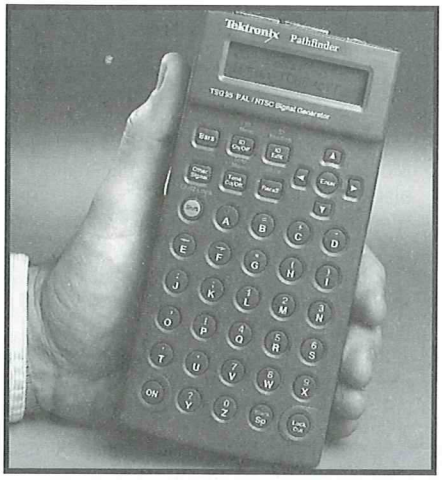
Generators.

Handheld.

YC/NTSC.

SVHS/PAL.

- TSG 95
- TSG 100
- TSG 111
- TSG 120



TSG 95 Handheld PAL/NTSC Signal Generator

PAL:
- 75% Bars
- 100% Bars
- 75% Bars over Red
- 100% Bars over Red
- Green Field
- Blue Field
- Red Field
- 100% Flat Field
- 50% Flat Field
- 0% Flat Field
- Multiburst
- 60% Reduced Line Sweep
- Bounce
- 5 Step (Grey Scale)
- Modulated 5 Step
- Convergence
- Plug
- Matrix
- Field Square Wave
- Safe Area

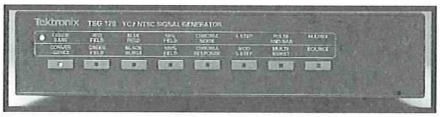
NTSC:
- SMPTE Bars
- 75% Bars
- Multiburst
- NTC7 Composite
- NTC7 Combination
- FCC Composite
- 5 Step (Grey Scale)
- Red Field
- Field Square Wave
- 50 IRE Flat Field
- 0 IRE No Burst
- Black Burst
- (Sin x)/x
- Convergence
- Matrix
- Safe Area



TSG 100 NTSC Signal Generator
- Studio and transmission test signal sets
- 8-Bit digital generation
- Conforms to RS-170A timing specifications
- 1 kHz audio tone
- H or V rate scope trigger signal
- DC power option
- Compact and lightweight



TSG 111 PAL Signal Generator
- Low cost test signal generator
- Tailored for service applications
- High accuracy (12-Bit) signal generation
- Two channels of audio tone with channel one identification
- Compact and lightweight



TSG 120 YC/NTSC Signal Generator
- Low cost test signal generator
- NTSC or PAL; Y, C and Y/C outputs
- Stereo audio outputs
- Ideal for equipment maintenance

Cable Option for TSG 120 (Option 02)
- Special signals to test cable systems to FCC requirements

TV Catalog available. Please complete and return the reply card in the back of this catalog.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

TSG 95
Handheld Generator **$895**

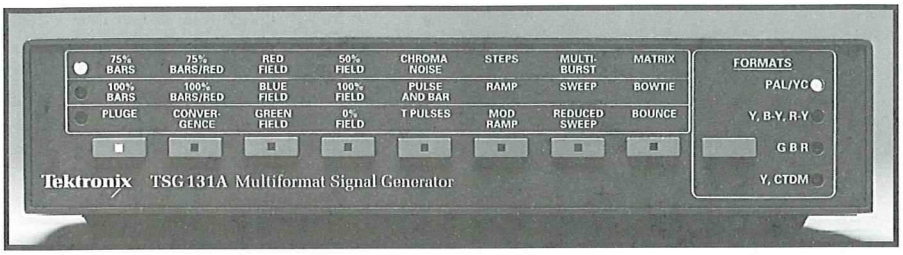
TSG 100
NTSC Test Signal Generator **$1,250**
Opt. 01 – Transmission Test Signal Set ..... **NC**

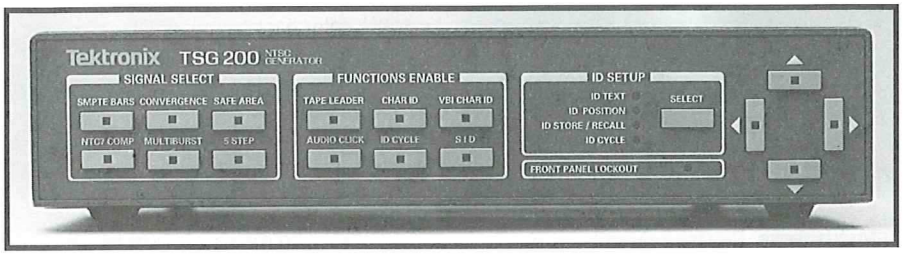
TSG 111
PAL Signal Generator **$1,575**
Opt. 10 – ±5 Hz Internal Reference ..... **+$100**

TSG 120
YC/NTSC Generator **$1,850**
Opt. 01 – Adds Black Burst Output ..... **+$300**
Opt. 02 – Cable Signal Set ..... **NC**

Television Products
Generators

TSG 130A
TSG 131A
TSG 200





- TSG130A
- TSG131A
- TSG 200

Multiformat generators.

Signal generators.

TSG130A/TSG131A Multiformat Generators
- Low cost test signal generator
- NTSC or PAL; Y,C; Y/C; Y, B-Y, R-Y; GBR and CTDM outputs
- Betacam® or MII levels
- Optional black burst output
- Stereo audio outputs
- Ideal for equipment maintenance

TSG 200 Signal Generator
- NTSC test signals
- Multiple black burst outputs
- Character identification positionable within the active field
- Tape leader countdown with visual and audio cues
- Stereo audio tone with CH 1 identification
- 12 V DC input
- Remote control
- Applications:
  - Small production system SPG
  - Bars/ID source for microwave links

ORDERING INFORMATION

TSG 130A
Multiformat Generator (NTSC) **$2,595**

Note: Only Opt. 01 and 02 may be combined.

Opt. 01 – MII Test Signals (replaces Betacam® signals) ..... **NC**

Opt. 02 – Adds a Dedicated Black Burst Output ..... **+$300**

Opt. 2J – 0 IRE Setup and Black Burst ..... **+$300**

Opt. 03 – Sony PVW Series Service ..... **+$300**
Includes: Special test signal set, black burst output, and TTL level color frame pulse output.

Opt. 04 – Panasonic MII Service ..... **+$300**
Includes: Special test signal set and TTL level comp sync and frame pulse outputs.

TSG 131A
Multiformat Generator (PAL) **$2,595**

Note: Only Opt. 01 and 02 may be combined.

Opt. 01 – MII CTCM Signals ..... **NC**

Opt. 02 – Adds a Dedicated Black Burst Output ..... **+$300**

Opt. 03 – Sony PVW Series Service ..... **+$300**
Includes: Special test signal set, black burst output, and TTL level color frame pulse output.

Opt. 04 – Panasonic MII Service ..... **+$300**
Includes: Special test signal set and TTL level comp sync and frame pulse outputs.

Opt. 10 – ±5 Hz Internal Reference ..... **+$100**

TSG 200
Signal Generator **$1,950**

TV Catalog available. Please complete and return the reply card in the back of this catalog.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

SDA 601
TSG 601
TSG 271
TSG 170A

Television Products

Digital Analyzer/Generators

Generators and inserters.

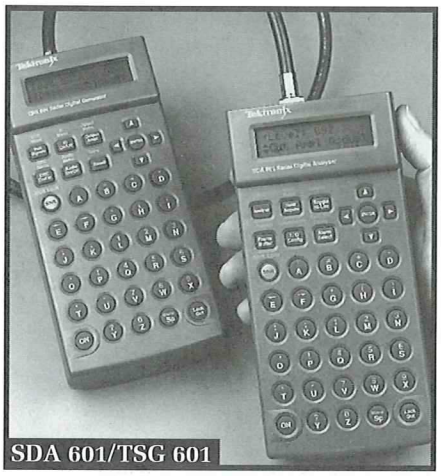
NTSC.

PAL.

Digital Genlock.

Audio Tone.

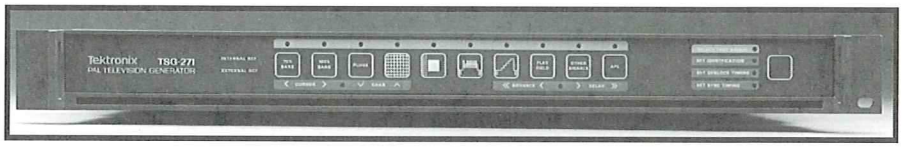
- SDA 601
- TSG 601
- TSG 271
- TSG 170A



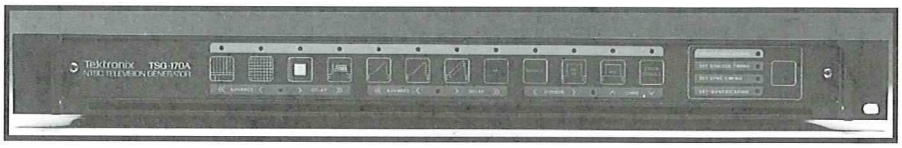
The SDA 601 provides analysis of the incoming digital television signal with the push of a button, quickly identifying data errors and indicating the presence and status of SMPTE RP165 and other ancillary (ANC) data signals.

SDA 601 Serial Digital Analyzer
Teamed with the TSG 601 Serial Component Generator, the SDA 601 Serial Digital Analyzer completes a comprehensive test set for serial component television system installation and maintenance. Each convenient, handheld instrument complements the other, and the set excels in its capability for stress testing the television system data path.

TSG 601 Handheld Serial Component Generator
- 75% color bars
- 100% color bars
- Pluge, BBC version 1
- Pluge, BBC version 2
- 5 Step staircase
- Limit ramp
- Convergence
- PLL SDI checkfield
- Equalizer SDI checkfield
- SDI checkfield matrix
- Valid (Encodes to PAL or NTSC) 5 step modulated staircase
- Valid modulated pulse and bar
- 60% line sweep with markers at 0.5, 1.0, 3.0, 4.0 and 5.0 MHz
- 500 kHz reduced amplitude bowtie
- Shallow ramp, settable levels
- Active picture markers



TSG 271 PAL Television Generator
- Precise 12-Bit digitally derived test signals
- SCH phase accuracy, guaranteed by use of a single DAC
- Conforms to EBU Statements D23 and D25
- Stable internal reference, ideal for master sync operation



TSG 170A NTSC Television Generator
- Simple, effective test signal complement
- Correctly SCH phased sync pulse generator with digital genlock
- Separate SMPTE bars with programmable ID (Opt. 01)

TV Catalog available. Please complete and return the reply card in the back of this catalog.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

SDA 601
Serial Digital Analyzer **$2,495**

TSG 601
Handheld Serial Component Generator **$2,495**

TSG 271
PAL Television Generator **$5,200**
Opt. 01 – Character ID and Audio Tone Output ..... **+$635**
Opt. 05 – PAL-D Signals ..... **NC**

TSG 170A
NTSC Television Generator **$5,250**
Opt. 01 – Adds separate SMPTE Bars Output with 12-character ID, Audio Tone Output and Tape Leader Countdown ..... **+$1,000**
Opt. 1V – VM 700A Signal Set ..... **NC**

Television Products
Generators

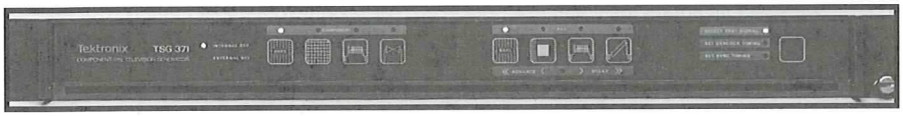


- TSG 300
- TSG 371

Generators and encoder.

Component.

TSG 300 Component Television Generator
- Multiple formats and standards
  – Y, B-Y, R-Y (Y, P_b, P_r; SMPTE/EBU)
  – GBR, Betacam®, MII
  – 525/60 and 625/50
- 10-Bit digital signal generation



TSG371 Component/Composite Television Generator
- Analog component and composite test signals
- Simultaneous and independent component and composite test signal outputs
- High stability, correctly SCH phased internal sync generator

TV Catalog available. Please complete and return the reply card in the back of this catalog.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

TSG 300
Component Television Generator **$6,500**

TSG 371
Component/PAL Television Generator **$5,050**

TVGF10 – Single Half-rack Mount (for TSG 100 only) **$100**
TVGF11A – Single Rack Mount Adapter **$75**
TVGF13 – Dual Rack Adapter **$125**
TVGF14 – Dual Half-rack Adapter **$125**

Television Products

Generators/Inserters

PE1000
SPG 1000
TSG 1001
TPG 20
TPG 625
VITS 100
VITS 200/1
1910

Generators and Inserters.

Programmable.

Multiformat.

Test Patterns.

VITS.

VIRS.

GCR.

NTC7.

FCC.

- PE1000
- SPG 1000
- TSG 1001
- TPG 20
- TPG 625
- VITS 100
- VITS 200
- VITS 201
- 1910



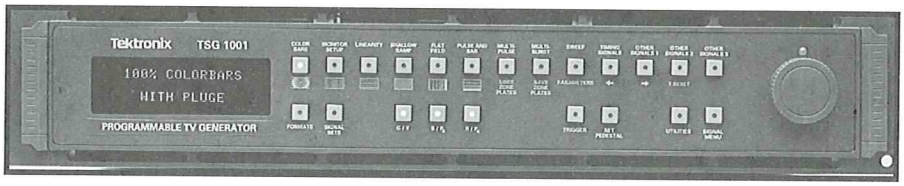
PE1000 PAL Encoder for TSG 1000 Series Generators

- High accuracy, wide bandwidth analog PAL test signals
- Y, U, V test signal library included
- Full programmability with the SDP 1000 Signal Development Package
- Adds the PAL color burst to luminance zone plate signals
- Compatible with the:
  - TSG 1001
  - TSG 1050 with a RAM board (Opt. 07)
  - TSG 1250 with a RAM board (Opt. 07)
  - TSG 1125 with a RAM board (Opt. 07) and a 72 MHz external clock signal
- Test signal, black burst, and color frame reference outputs



SPG 1000 HDTV Sync Generator

- Master sync generator for high definition television systems
- Sync locks to HDTV, NTSC, and PAL
- Supports proposed HDTV production standards
- Color bars and monitor setup test signals
- Provides genlock function for TSG 1000 Series Generators



TSG 1001 Programmable TV Generator

- Multiformat, programmable test signal generator
- Programmable zone plate generator
- SDP 1000 Signal Development Package
- PC based software program
- Waveform editing and creation
- PC to generator test signal downloads
- Internal or external clock operation
- SMPTE/EBU, Betacam®, MII, NTSC analog, NTSC composite digital, CCIR 601 component digital, and HDTV test signal libraries
- 10-Bit signal generation
- 30 MHz bandwidth
- Analog and parallel digital test signal outputs
- Battery backup for RAM signal memory
- Programmable trigger function for waveform analysis



TPG 20 Test Pattern Generator

- Multiformat test signal pattern and image generator
- Serial and parallel composite and component digital outputs
- Analog composite, Y/C, Y and Color Difference and GBR and Sync output
- 10-Bit resolution on three independent channels
- Instant switching between any two patterns
- Controllable moving patterns
- Fully genlockable
- Supports VM 700A measurement routines
- Conforms to digital standards CCIR 601, 656: EBU Tech 3267, SMPTE 125M, 244M, 259M, 267M
- Compatible with 16:9 EDTV standards
- Pattern upgrades available

TV Catalog available. Please complete and return the reply card in the back of this catalog.

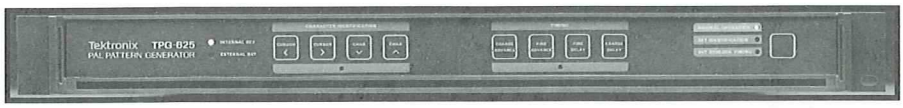
ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Television Products

Generators/Inserters

PE1000
SPG 1000
TSG 1001
TPG 20
TPG 625
VITS 100
VITS 200/1
1910

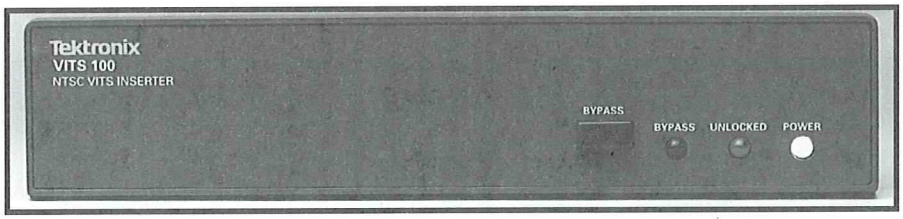


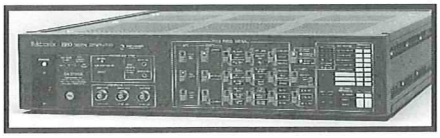
TPG 625 PAL Pattern Generator
- PAL television test pattern
- Color monitor and receiver testing
- Programmable character identification
- 10-Bit digital generation
- Digital genlock
- Black burst outputs
- Special pattern for VM 700A Video Measurement Set (Opt. 01)



VITS 201 PAL Insertion Generator
- CCIR, EBU, UK National ITS
- Operates in the presence of sound in syncs
- Four external ITS inputs
- Comp Sync output
- Source identification
- All user program settings saved in non-volatile storage
- User programs for:
  - Insertion of internal, external, and source identification signals
  - Loss of program input modes
  - Text insertion







1910 NTSC Digital Generator/Inserter
- Studio, transmitter, and transmission test signals
- 10-Bit signal generation
- RS-232-C control port
- Four external VITS inputs
- Non-volatile memory to maintain selected VITS and full field signal configuration after power interruption
- Ghost Canceller Reference (GCR) signals available

VITS 200 NTSC Generator/Inserter
- Full capability generator/inserter for use at the facility output point
- NTC7, FCC, VIRS, and GCR signals
- Four external VITS inputs
- VM 700A compatible vertical interval source identification
- Text generator for full field and vertical interval messages
- Sync and burst regeneration
- Full field test signal output
- RS-232-C and ground closure remote control
- Loss of program continuity mode (standby mode)

VITS 100 NTSC Generator/Inserter
- Low price generator/inserter
- NTC7, FCC, and VIR signals
- VM 700A recognizable vertical interval source identification
- Cable signal set (Opt. 02)
- Special features for PAL-M systems (Opt. 1M)

ORDERING INFORMATION

PE1000
PAL Encoder **$4,500**

SPG 1000
HDTV Sync Generator **$5,250**

TSG 1001
Programmable TV Generator **$16,750**

TPG 20
Test Pattern Generator **$13,950**

TPG 625
Pattern Generator **$5,775**
Opt. 01 – PAL Pattern Generator for use with VM 700A ..... **NC**

VITS 100
NTSC Generator/Inserter **$2,250**
Opt. 02 – Cable signal set ..... **NC**
Opt. 1M – Special features for PAL-M systems ..... **+$250**

VITS 200
NTSC Generator/Inserter **$4,950**

VITS 201
PAL Insertion Generator **$4,200**

1910
NTSC Digital Generator/Inserter **$7,500**
Opt. 01 – GCR signal and 0% setup test signals ..... **NC**
Opt. 03 – CBC test signals ..... **NC**

TV Catalog available. Please complete and return the reply card in the back of this catalog.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

VS 210
VS 211A
118-AS

Television Products
Synchronizers

Video andaudio synchronizers.

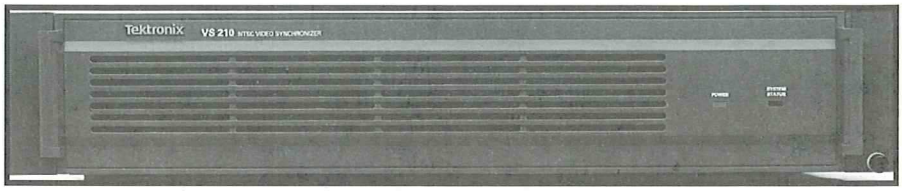
10-Bit accuracy.

NTSC.

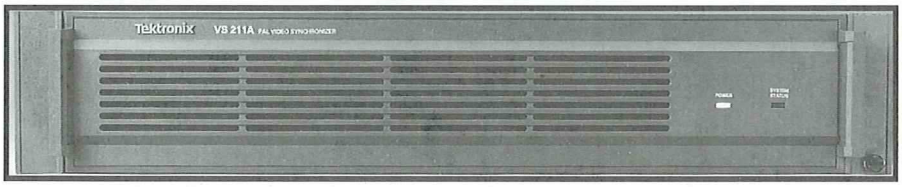
PAL

Audio.

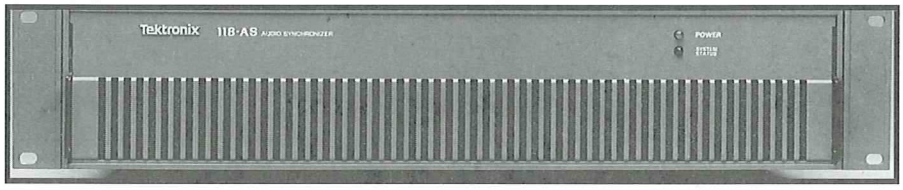
- VS 210
- VS 211A
- 118-AS



VS 210 NTSC Video Synchronizer
- 10-Bit digitizing
- 8 F_{sc} sampling
- 4 field memory
- Sync and burst insertion
- Digital processing amplifier functions
- Serial digital I/O
- Audio delay control signal output
- Remote control



VS 211A PAL Video Synchronizer
- True 10-Bit accuracy and resolution
- Tracks signal into the noise
- Eight-field memory for highest picture quality
- Adaptive clamping – minimizes streaking on noisy signals
- Digitally precise sync and burst insertion
- Outputs analog and composite digital signals simultaneously
- Composite serial digital I/O option
- Digital processing amplifier
- Passes the vertical interval
- Powerful and user-friendly remote control
- Precalibrated boards and modular design



118-AS Audio Synchronizer
- Automatic or manual control of audio to video timing
- Simple one-wire interface to VS 210, or VS 211A Video Synchronizers
- Expandable to three channels for stereo and auxiliary channel
- Compensates for 30+ fields of video delay

TV Catalog available. Please complete and return the reply card in the back of this catalog.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

VS 210
NTSC Video Synchronizer **$8,395**

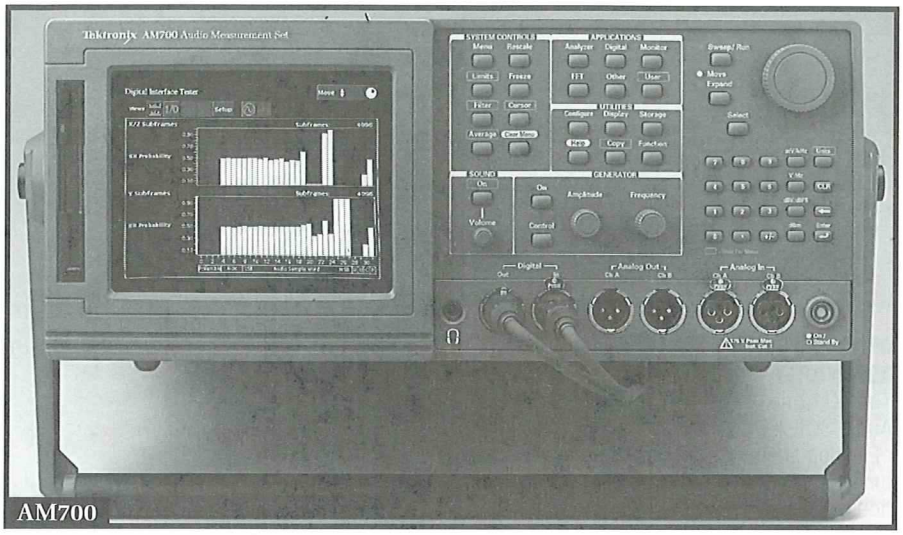
RC 210
Remote Control for VS 210 ..... **$1,050**

VS 211A
PAL Video Synchronizer **$7,995**

RC 211
Remote Control for VS 211A **$1,050**

118-AS
Audio Synchronizer **$5,775**

Television Products
Audio Measurement Set



AM700
- Programmable Audio Analyzer
- Programmable Audio Generator
- Analog Audio Inputs/Outputs
  – Balanced
  – Unbalanced
- Digital Audio Inputs/Outputs
  – AES/EBU
  – SPDIF
  – Optical
- Manual and Automatic Measurements
- GPIB Remote Control
- Benchtop or Portable Operation

Programmable.

Analog and digital or mixed signals.

Easy to use.

Portable.

Remote control.

AM700 AUDIO MEASUREMENT SET
The Tektronix AM700 Audio Measurement Set provides audio professionals operating in a mixed-signal environment a powerful tool set for design, manufacturing, quality control, installation and service applications. An intuitive user interface allows first-time users to immediately perform common tasks with accuracy and repeatability.

A totally self-contained instrument, the AM700 requires no personal computer, external display monitor or separate signal generator to stimulate and analyze audio equipment and display measurement results. This level of integration makes the AM700 a truly portable measurement system.

FFT Analyzer
Two-channel, wideband FFT analysis has never been easier. Selecting windowing schemes, weighting filters and cursors is accomplished through touch-screen menus. The zoom mode provides variable frequency resolution. The AM700 can record maximums and minimums to track signal deviation over time.

Plotting Analyzer
The AM700's plotting analyzer is exceptionally flexible. It provides plots of dependent parameters like level, phase and distortion against independent parameters like level, frequency and time. Cursors, zoom and relative-to-reference add to the functionality of this two-channel analyzer.

Multitone Analyzer
Real-time analysis of both user-defined multitones and standard multitones simplifies many analysis, adjustment and measurement operations. The AM700 multitone analyzer is compatible with multitone signals from the Tektronix ASG 100/140 Audio Signal Generators, and generates multitones compatible with the VM 700A Video Measurement Set, as well as other popular test equipment.

Monitor Mode
The "Waveform" provides oscilloscope displays of input, output, and residual signals like harmonic distortion. An internal speaker/headphone permits users to listen to these signals as well.

Digital Interface Analyzer
Measurement and analysis of the digital signal in the analog domain is critical for ensuring that the signal conforms to technical standards. Whether troubleshooting equipment interface problems or designing interface circuitry, this analyzer provides an eye pattern display, jitter, and time-domain measurements.

The AM700 can be used as a "smart" break-out box for solving equipment interface problems quickly. The Digital Data Analyzer examines bit activity and data formatting. It enables users to find and correct problems like stuck bits, incorrect polarity, or illegal formats.

Audio Generator
For every function listed above, the internal programmable generator can produce a complimentary signal in digital or analog form (as appropriate).

TV Catalog available. Please complete and return the reply card in the back of this catalog.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

AM700
Audio Measurement Set.....**$16,000**

ASW100M
ASW100F
AM70

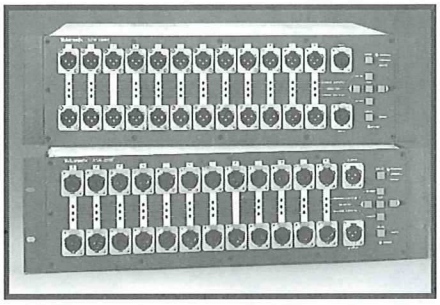
Television Products
Audio Products

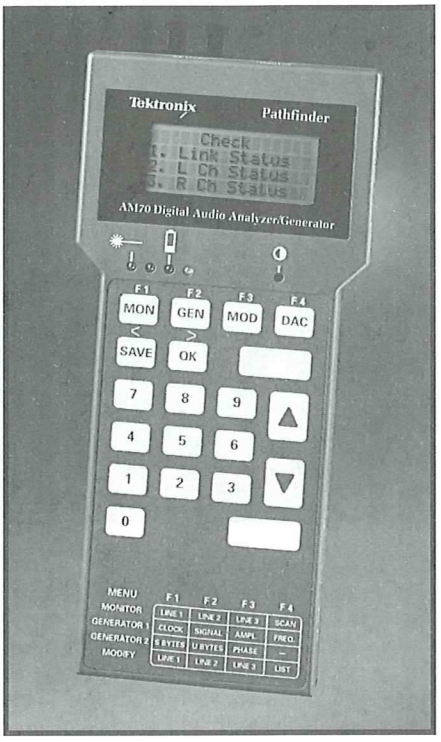
Output Switcher.

Input Switches.

Handheld Analyzer/ Generator.

- ASW100M
- ASW100F
- AM70





ASW100M OUTPUT SWITCHER
ASW100F INPUT SWITCHER

The Tektronix ASW100 Measurement Grade Audio Switchers permit the inputs and outputs of analog audio test equipment to be switched between multiple signal sources and destinations. ASW100 instruments contribute no measurable degradation to signals under test.

- Balanced signal paths
- Manual controls
- RS-232 and GPIB operation
- Cascadable
- Cable shield lifts
- Universal power supply
- Rackmount

Calibration and Testing of Audio Equipment
- Multitrack tape decks
- Mixing consoles
- Surround sound gear

Monitoring Multiple Devices Under Test
- Burn-in test chamber
- Powered life testing

Routing Ultrasonic Signals
- BTSC basebound signals
- RDS-modulated signals
- SCA-modulated signals

AM70 HANDHELD DIGITAL AUDIO ANALYZER/GENERATOR
- Balanced analog outputs
- Balanced/unbalanced digital inputs and outputs
- Optical inputs and outputs
- Internal speaker/headphone jack
- Battery powered

Installation and Troubleshooting
- Signal tracing in analog and digital domains
- Confidence monitoring of digital audio signals

Digital Compatibility Debug
- Resolving data compatibility problems
- Digital audio format conversion

TV Catalog available. Please complete and return the reply card in the back of this catalog.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

ASW100M
Output Switcher **$1,995**

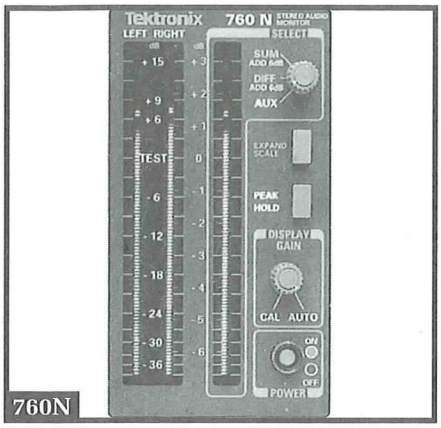
ASW100F
Input Switcher **$1,995**

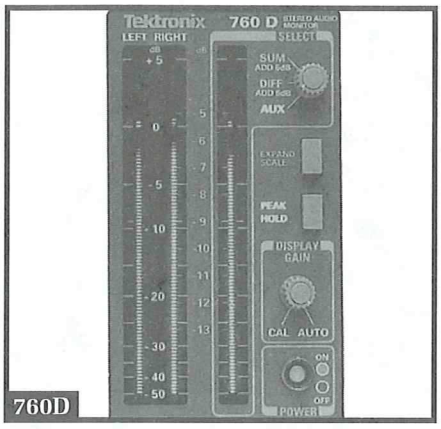
AM70
Handheld Digital Audio Analyzer/Generator **$1,995**
Opt. 01 – NiCad Battery Pack ..... **+$50**

Television Products
Audio Products

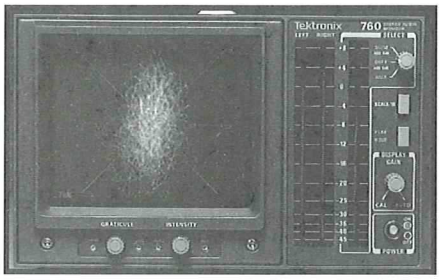
760N | **760D** | **760A**

ASG 100 | **ASG 140**





With Tektronix' 760 Series Stereo Audio Monitors, the audio engineer can analyze a pattern display of the stereo audio signal. This display, along with a high resolution bar graph, provides accurate monitoring and measurement capabilities. Used in both operation and setup, the instrument provides immediate feedback of the audio signal for creative or technical correction. With the appropriate test signals, the unit can also be used for accurate phase and amplitude measurements. Three product versions are available with various scales: 760A (standard), 760N (Nordic), or 760D (DIN) (see photos).



760 Series Stereo Audio Monitor
- Graphic CRT display of stereo audio signal
- AGC for continuously viewable pattern
- Bar graph for quick setups and accurate peak indication
- Third bar indicates mono compatibility when set to L+R
- Suitable for phase and amplitude measurements
- Optional Nordic or DIN Scale
- Scale and dynamics conform to proposed IEEE ppm standard
- EXPAND SCALE feature increases resolution at –8 dB (760A) level for accurate line-ups
- White phosphor CRT option available



ASG 100
- Dual channel for stereo applications
- Balanced inputs and outputs
- Connects in-line for easy test signal insertion
- Quick identification of insertion point with voice ID

ASG 140
- Four output channels
- 10 Ω output impedance
- Ideal for VTR maintenance

ASG 100/ASG 140 Common Features
- Short duration audio test sequence for rapid automatic checkout of audio lines
- Single button selection of line-up tone
- Manual mode allows selection of frequency and amplitude
- Quick identification of insertion point with voice ID
- RS-232 for remote control

ORDERING INFORMATION

760N
Stereo Audio Monitor **$2,500**
Opt. 74 – White Phosphor CRT (760 Series) ..... **+$100**

760D
Stereo Audio Monitor **$2,500**

760A
Stereo Audio Monitor **$2,500**

ASG 100
Audio Signal Generator **$1,800**

ASG 140
Four Channel Audio Generator **$1,800**

TV Catalog available. Please complete and return the reply card in the back of this catalog.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

NEW
Profile™

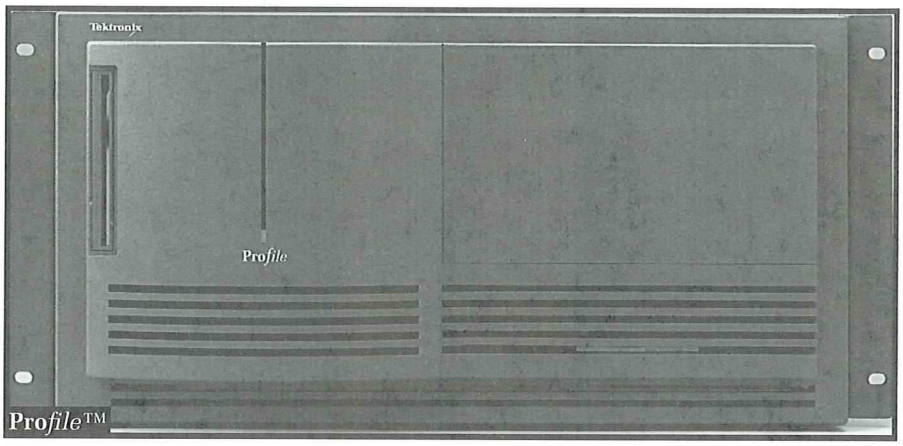
Television Products
Digital Disk-Based Recorder

Affordable disk-based video management and storage.

CD quality audio.

First generation Betacam® SP quality video.

New
- PDR 100
- PDR 101



Profile™ (PDR 100/PDR 101 Professional Disk Recorder)
- Simultaneous read and write capability across all channels
- Random access to stored information
- Analog composite and component and serial digital component and composite I/O
- Onboard compute power using i486DX2/66 processor system includes 340 MB hard disk and a 3.5 inch floppy drive
- Configurable and extendable with 17-slot EISA mother board
- Includes integral 32 x 32 CCIR 601 parallel digital video router
- Audio routed over the EISA bus
- Mix effects and keying
- Mounts on rack slides in a standard 19-inch (483 mm) rack
- Two-year warranty
- Supports 525/625 line operation
- Vertical interval recording

TV Catalog available. Please complete and return the reply card in the back of this catalog.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

PDR 100 (for 525/59.94 systems)
Professional Disk Recorder.....**$37,720**

PDR 101 (for 625/50 systems)
Professional Disk Recorder.....**$37,720**

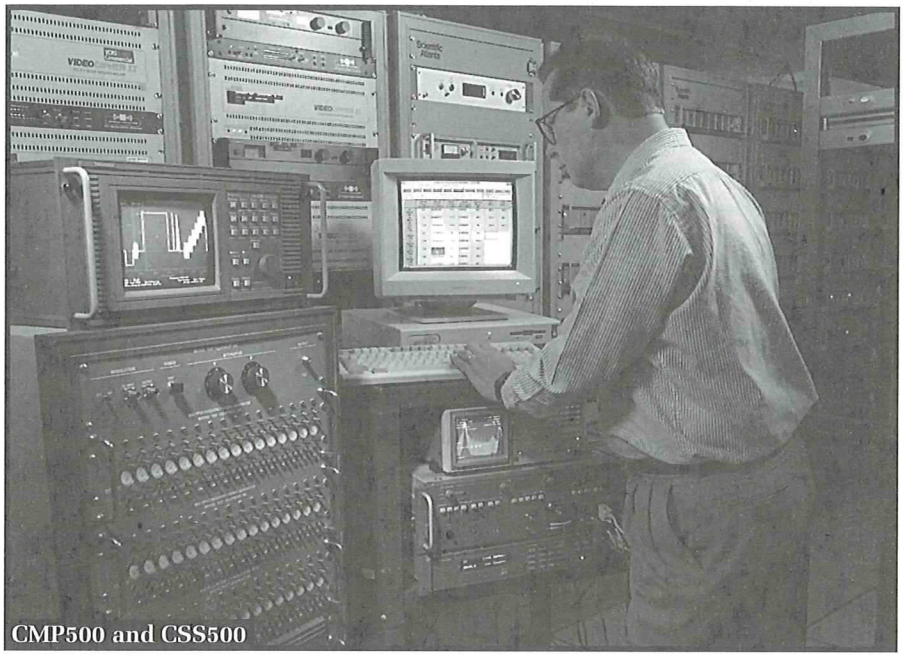
Television Products

Cable Measurement Packages

CMP500
CSS500
CMP100
CMP200

RF products.

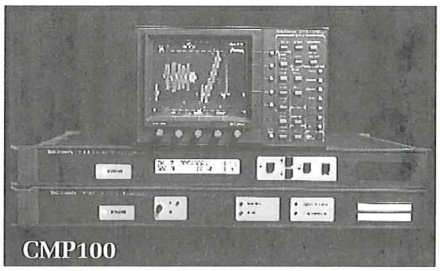
Automatic Cable TV RF measurements.


CMP500 and CSS500

- CMP500/CSS500
- CMP100
- CMP200

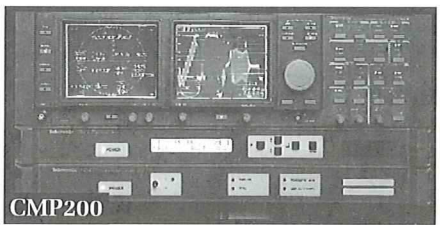
CMP500 Cable Television Measurement Package/CSS500 Cable Television System Software

- Delivers baseband video and RF measurement performance unmatched in the industry
- Performs all recommended baseband and RF measurements including the FCC requirements
- Includes easy-to-use Windows-based control software
- Automatically monitors results and displays alarm when out-of-service measurement limits are reached
- Sequences can be defined on the computer, downloaded to the 2714, which can be removed from the system to make automatic field RF measurements
- Displays the picture of the channel being measured on the computer screen when equipped with video display board
- Compatible with standard, HCR or IRC systems up to 1 GHz
- Export data to Windows-based programs such as Lotus 1-2-3 or Microsoft Excel for more detailed analysis
- Supports many different types of printers


CMP100

CMP100 Cable Measurement Package

- Low cost
- Ideal for all FCC baseband measurements
- Includes: DS1200 Demodulator System and 1740 Waveform/Vector Monitor


CMP200

CMP200 Cable Measurement Package

- Low cost
- Ideal for all FCC baseband measurements
- Measures signal-to-noise ratio and K Factor
- Includes: DS1200 Demodulator System and 1780R Video Measurement Set

TV Catalog available. Please complete and return the reply card in the back of this catalog.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

CMP500
Cable Measurement Package **$56,000**

CSS500
Cable Measurement Package Software **$2,000**

CMP100
Cable Measurement Package **$14,900**

CMP200
Cable Measurement Package **$19,900**

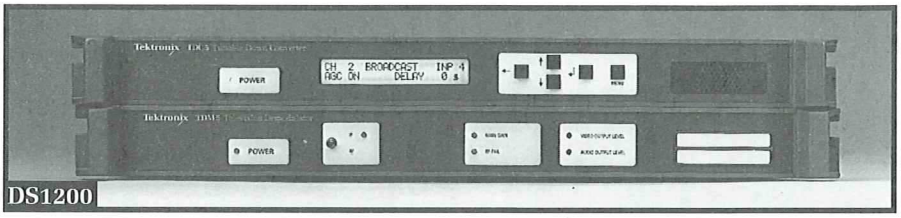
DS1200
TV1350
RFM150

Television Products
Demodulators/Signal Level Meter

RF Products.

Measurement quality television demodulator.

- DS1200
- TV1350
- RFM150



DS1200 Low Cost Television Demodulator System

- Low cost
- Measurement quality performance
- 47 MHz to 860 MHz frequency range
- Cable TV standard, HRC and VHF/UHF channel tables
- RS-232-C or RS-485 Control of TDC5 Tunable Down Converter
- Synchronous detection
- Gain control system optimizes signal-to-noise ratio and intermodulation distortion
- Zero carrier pulse for depth of modulation measurement
- Wide dynamic range
- Four RF inputs on TDC5
- Quadrature out for ICPM measurements
- Aural intercarrier out for interface to a BTSC decoder



RFM150 SignalScout™ Signal Level Meter

- 5 MHz to 1GHz frequency range
- ±1 dB accuracy over wide temperature range
- In-service hum at subscriber tap levels (0 dBmV/60 dBμV)
- In-service hum
- NICAM and dual aural carrier compatible
- Channel spectrum mode
- Multi-format compatible – NTSC, PAL, SECAM, digital carriers
- Interface port for uploading test results to a PC and downloading test sequences and configuration to SignalScout™
- Three year parts and labor warranty

TV1350 Series Television Demodulators

- Continuously tunable over all TV bands and CATV channels (HRC and IRC) to 880 MHz (channels 2-99) with synthesizer precision for HRC and IRC
- Channel selection by digital entry of channel number, manual or remote modes, plus search
- Automatic compensation for carrier offsets to ±100 kHz
- Switch selectable sound trap
- Switchable IF gain for improved S/N ratio
- Selectable envelope or synchronous detection
- Synchronous detector quadrature output for convenient adjustment of modulation balance and ICPM measurements
- Stable zero carrier reference for video level adjustments and residual carrier measurements
- Built-in loudspeaker, headphone jack, and deviation meter
- Parallel remote control standard; IEEE 488 bus interface optional
- User-friendly operation
- Available in standards M, D/K, B/G, I, and K1
- Worldwide audio standards available: dual sound, NICAM prepared, or BTSC output

TV Catalog available. Please complete and return the reply card in the back of this catalog.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

ORDERING INFORMATION

For complete ordering information for your country, please contact your local Tektronix representative.

DS1200
Demodulator System **$11,900**

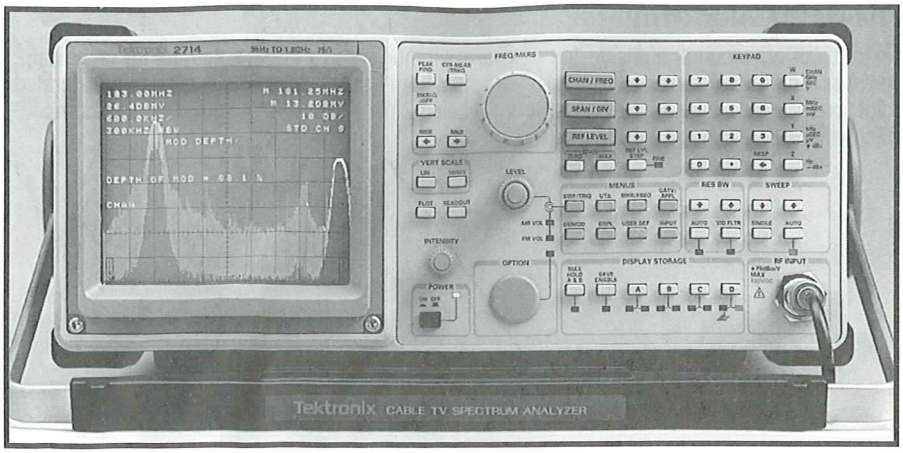
TV1350
Demodulator **$20,500**

RFM150
SignalScout™ Level Meter **$2,250**

Television Products
RF/Cable Products

2714
1705A

2721A
2722A



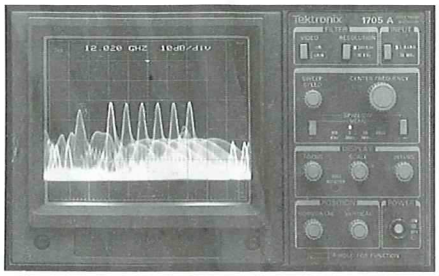
- 2714
- 2721A/2722A
- 1705A

RF products.

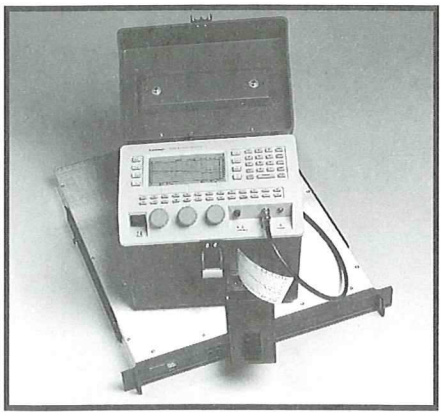
Low cost spectrum display of satellite signals.

Non-interfering cable TV system sweep.

2714 Cable TV Spectrum Analyzer
- Automatic positioning of visual and aural carriers
- Visual and aural carrier levels and frequencies for selected channels
- Survey of system visual and aural carrier levels and frequencies
- Depth of modulation
- Aural carrier deviation measurement
- Visual carrier-to-noise measurement
- Visual to carrier amplitude and frequency difference measurements
- Automatic measurement of CSO, CTB, and cross modulation



1705A Spectrum Monitor
- Full 850 MHz span for international satellites
- L-Band and 70 MHz IF inputs
- Designed for satellite news gathering
- On-screen Ku- or C-Band frequency readout
- Selectable 2 dB/div or 10 dB/div sensitivity
- Resolution bandwidth switchable to 10 kHz or 300 kHz
- Span range and video filter selection
- Portable DC power and battery available



2721A/2722A Cable TV Sweep System
- Non-interfering
- Full 5-600 MHz range
- Full Alpha Keyboard for data entry
- LCD Display visible even in bright sunlight
- Lightweight, compact receiver
- User programmable sweep frequency and telemetry frequency
- 63 archive records
- RS-232-C downloads stored waveforms to Serial Printer or PC
- PC download software included
- Three year parts and labor limited warranty
- Worldwide compatibility

ORDERING INFORMATION

2714
Cable TV Spectrum Analyzer **$12,780**

2721A
Sweep Transmitter **$7,500**

2722A
Sweep Receiver **$8,500**

Opt. 01 – Chart Recorder ..... **+$950**

1705A
Spectrum Monitor **$4,200**

TV Catalog available. Please complete and return the reply card in the back of this catalog.

ISO 9001
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Tektronix Measurement products are manufactured in ISO registered facilities.

Color Printing and Imaging

CONTENTS

Phaser™ 200e....562
Phaser™ 220e....562
Phaser™ 220i....562
Phaser™ III PXi....563
Phaser™ 300i....563
Phaser™ IIsdx....564
Phaser™ 440....564
Phaser™ 480....564
Features/Options....565
Ordering Information....566

Phaser™ Color Printers

Tektronix offers a comprehensive line of award-winning color printing solutions for technical, business, and graphic arts applications. Tektronix' high-quality standards ensure rich, saturated color; crisp output; true Adobe™ PostScript™ Level 2 page description language; and compatibility with PCs, Macs and workstations.

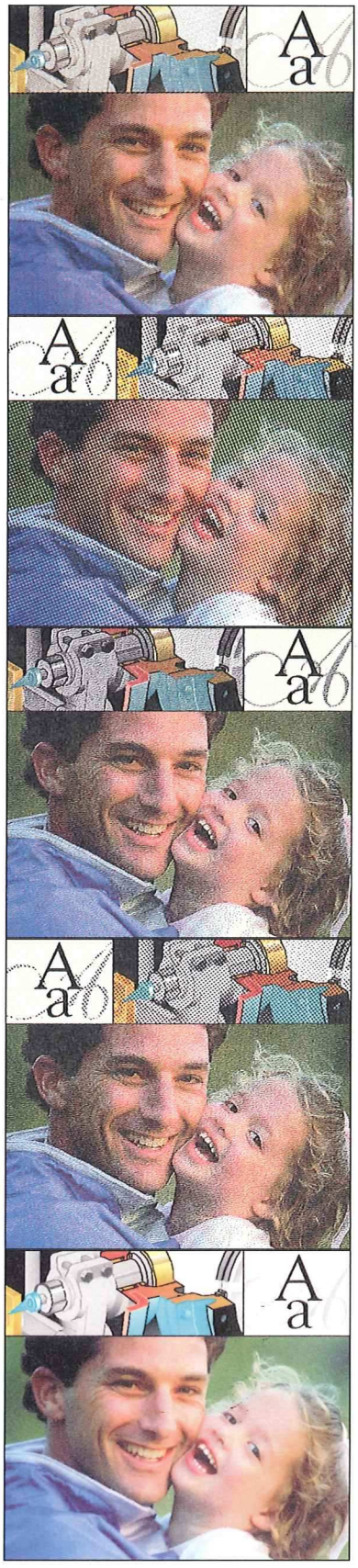
Phaser™ Workgroup Color Printers

Bringing Color to the Desktop

Since 1980, Tektronix has pioneered precision color printing and imaging solutions for the desktop. Today, we offer a wide choice of network color printers so you can choose the model that's best for your application. Each printer is built to the highest standards to ensure the best performance at a reasonable price. The quality of Tektronix Phaser™ color printers has been recognized worldwide by independent experts in the industry's leading magazines, including PC Magazine, PC Computing, BYTE, MacWorld, and MacUser – to name a few. As a co-developer with Adobe of the color PostScript for our printers, Tektronix is recognized as a world leader in color printing expertise. Tektronix Phaser™ color printers – bringing color to your desktop.

TekColor Care

You can rely on Tektronix. Every Tektronix color printer includes TekColor Care, our comprehensive support system. TekColor Care provides a one-year return-to-depot warranty, direct access to telephone technical support, and our automated fax reference library. For additional care, Tektronix' factory-trained, worldwide service organization offers RealSupport™ On-site Service. It's available in one, two, and three-year plans.



Actual size Phaser™ 220 output at 600 x 300 dpi.

Actual size Phaser™ 200e output at 300 x 300 dpi.

Actual size Phaser™ 300i phase-change output.

Actual size Phaser™ III PXi phase-change output.

Actual size dye sublimation output.

Thermal-transfer

Unsurpassed for overhead transparencies and reports.

Phase-change

Rich, vibrant color printing on any paper.

Dye Sublimation

Photorealistic color printing on paper or transparencies.

Phaser™ 220i
Phaser™ 220e
Phaser™ 200e

Phaser™ Workgroup Color Printers

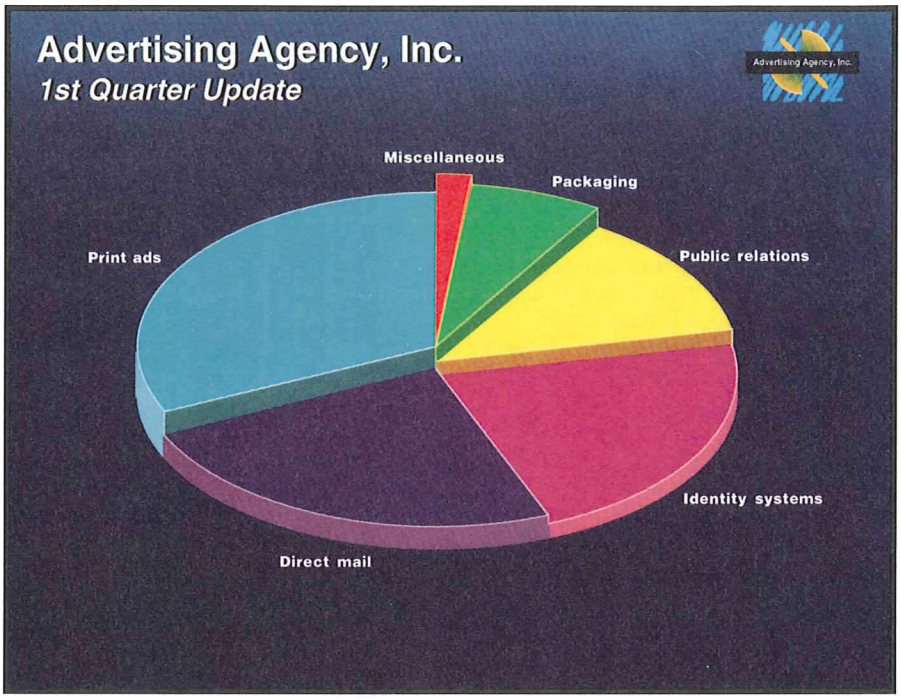
Thermal Transfer

Unsurpassed for overhead transparencies and reports.

With our exclusive TekColor™ color control technology, it's easy to print the colors you want.

New PHASER™ 220i
New PHASER™ 220e
New PHASER™ 200e

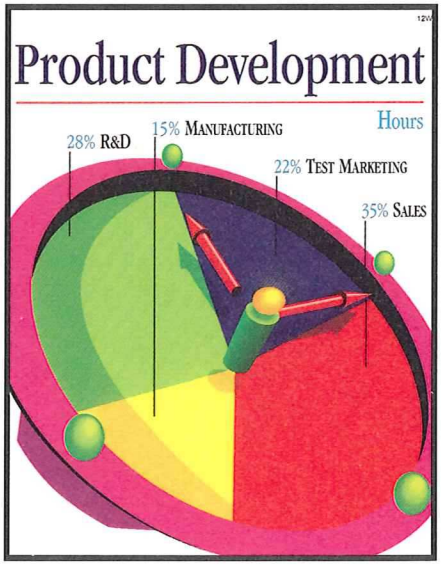
- Up to Two Pages per Minute
- Paper or Transparencies
- Common Laser Paper
- PCs, Mac, and Workstations
- High-performance RISC Processor
- Adobe PostScript™ Level 2



The Phaser™ 200 Series color printers produces high-quality color prints on paper or transparencies.

Color Printing for Business

Affordable and fast, Tektronix thermal-transfer color printers were designed for today's fast-paced business workgroups. Project your best image with boardroom-quality transparencies and handouts your clients will remember. Whether you want spot color or full-coverage, you can print at speeds of up to 30 seconds a page – on paper or transparencies – and our second input tray option allows you to switch between them without leaving your computer. The Phaser™ 220 features beautiful color output. It's the world's first 600 x 300 DPI color printer. For workgroups on a budget, the Phaser™ 200e offers 300 DPI color printing with basic networking capabilities.



Phaser™ 220i
PC Computing BEST 200 June 1994
June 1994

Phaser™ 220i
MW EDITORS' CHOICE
August 1994

TekColor


Phaser™ 220i

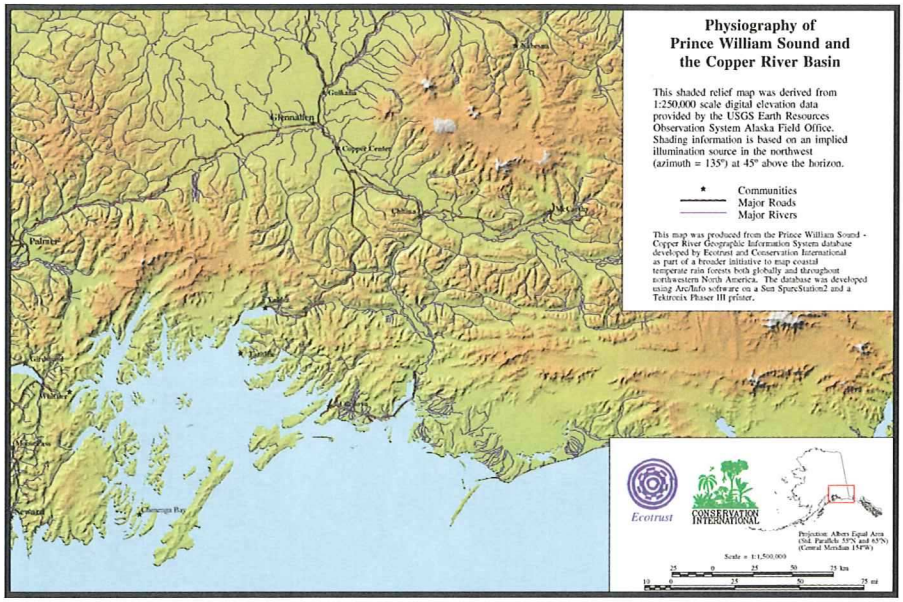

Phaser™ 220e


Phaser™ 200e

In the U.S. for more information or the location of your nearest dealer call 1-800-835-6100, Dept. M16.

HAL
Fax library of news, product information, and technical information.
(503) 682-7450

Phaser™ Workgroup Color Printers



Tektronix phase-change color printers produce beautiful prints on any size paper from postcard to tabloid-extra.

Color Printing on Any Paper

With Tektronix' phase-change color printers you can print beautiful, saturated color on any paper you'd like. And you can print on any size from postcard to double-page spreads with full bleeds. It's perfect for graphic arts and engineering workgroups that need high-quality color layouts and desktop proofs. The top-of-the-line Phaser™ 300i provides high-performance speed, precise imaging, and internal networking options. With our exclusive TekColor™ Dynamic Correction imaging technology you can simulate commercial press proofs right on your desktop. The lower-cost Phaser™ III PXi offers plain paper color printing at moderate speeds.



PHASER™ 300i
PHASER™ III PXi

- Large format
- Any Paper, Most Weights
- PANTONE®*1 Approved
- PCs, Mac, and Workstations
- High-performance 24-MHz RISC Processor
- Adobe PostScript™ Level 2

**1 Pantone, Inc.'s check-standard trademark for color reproduction and color reproduction materials.*

Phase-change

Rich, vibrant color printing on any paper.

With our exclusive TekColor™ color control technology it's easy to print the colors you want.

Phaser™ 300i

PCComputing HARDWARE 200 1994 1993 FINALIST

June 1994

Phaser™ 300i

MW EDITORS' CHOICE

August 1994

TekColor



Phaser™ 300i



Phaser™ III PXi

In the U.S. for more information or the location of your nearest dealer call 1-800-835-6100, Dept. M16.

HAL
Fax library of news, product information, and technical information.
(503) 682-7450

Phaser™ 480
Phaser™ 440
Phaser™ IIsdx

Phaser™ Workgroup Color Printers

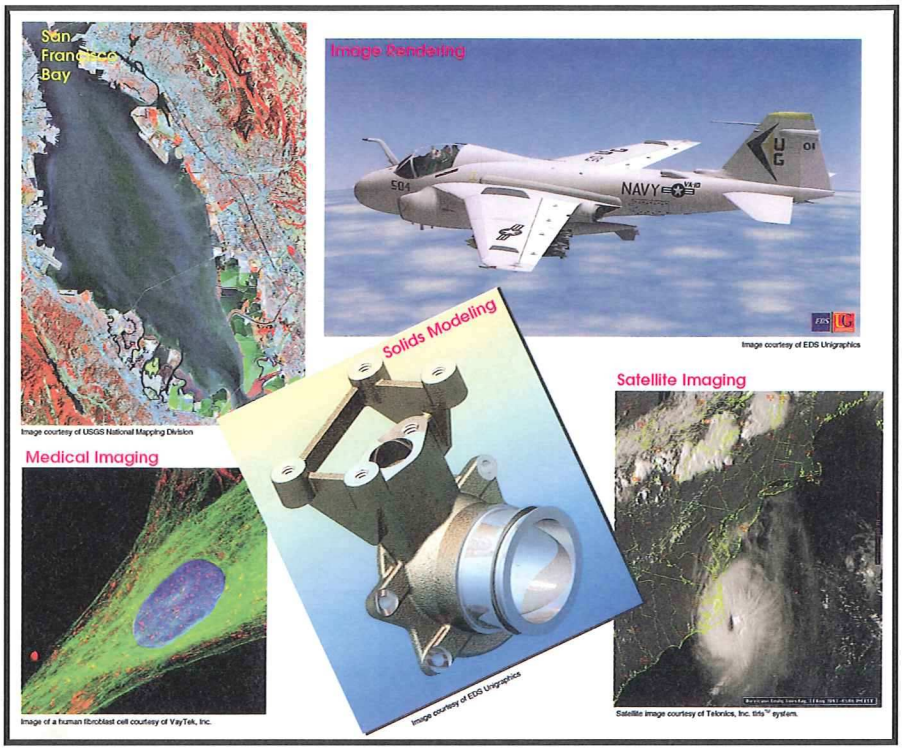
Dye Sublimation

Photorealistic color printing on paper or transparencies.

With our exclusive TekColor™ color control technology it's easy to print the colors you want.

PHASER™ 480
PHASER™ 440
PHASER™ IISDX

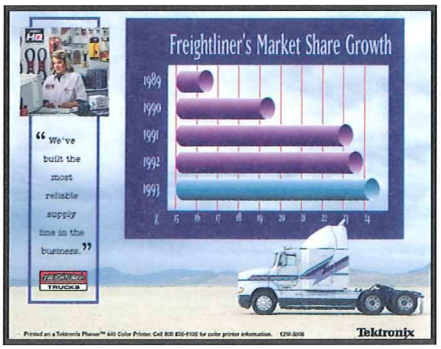
- Photo quality
- Paper or Transparencies
- Crisp Text and Fine Lines
- PCs, Mac, and Workstations
- High-performance 24-MHz RISC Processor
- Adobe PostScript™ Level 2



Tektronix offers a photorealistic color printer for every application.

Photographic-quality Color Printing

For photographic-quality color, Tektronix offers the industry's leading dye sublimation color printers. Photographic files are big, so Tektronix engineers designed each model for high-performance image processing. In fact, we build the fastest continuous-tone desktop color printers on the market. The Phaser™ 480 features large-format output big enough for two-page spreads with full-bleeds. The new Phaser™ 440 provides single page output large enough for full-bleed images. And the Phaser™ IISDX prints photorealistic color on letter and legal-sized media.



Phaser™ IIsdx
PC MAGAZINE
EDITORS' CHOICE
November 1993

Phaser™ 480
MW
EDITORS' CHOICE
July 1994

TekColor

In the U.S. for more information or the location of your nearest dealer call 1-800-835-6100, Dept. M16.

HAL
Fax library of news, product information, and technical information.
(503) 682-7450



Phaser™ 480



Phaser™ 440



Phaser™ IIsdx

Phaser™ Workgroup Color Printers

TEKTRONIX COLOR PRINTERS FEATURES AND OPTIONS

	Phaser™ 200e	Phaser™ 220e	Phaser™ 220i	Phaser™ III PXi	Phaser™ 300i	Phaser™ IISDX	Phaser™ 440	Phaser™ 480
Color Technology								
Thermal-transfer	•	•	•	–	–	–	–	–
Phase-change	–	–	–	•	•	–	–	–
Dye Sublimation	–	–	–	–	–	•	•	•
Page Size								
8.5 x 11 in. (A)	•	•	•	•	•	•	•	•
210 x 297 mm (A4)	•	•	•	•	•	•	•	•
8.5 x 14 in. (Legal)	–	–	–	•	•	•	–	–
210 x 356 mm (A4 Special)	–	–	–	•	•	•	–	–
9.6 x 13.3 in. (243 x 338 mm)	–	–	–	•	•	–	•	–
11 x 17 in. (B)	–	–	–	•	•	–	–	•
297 x 420 mm (A3)	–	–	–	•	•	–	–	•
Tabloid Extra*1	–	–	–	•	•	–	–	•
Standard RAM (MB)	4	8	10	10	10	16	16	32
Maximum RAM (MB)	8	8	14	22	22	64	64	64
24-MHz RISC Processor	–	–	•	•	•	•	•	•
16-MHz RISC Processor	•	•	–	–	–	–	–	–
Adobe™ PostScript™ Level 2	•	•	•	•	•	•	•	•
HP-GL Emulation	•	•	•	•	•	–	–	–
PCL5 (Monochrome)*2	–	•	•	–	•	–	–	–
PANTONE*3 -approved	•	•	•	•	•	•	•	•
TekColor™ Rendering								
Dynamic Correction	–	•	•	–	•	–	•	•
PS Color Adjust	•	–	–	•	–	•	–	–
Finepoint™	–	–	–	•	•	–	–	–
Photofine™	–	–	–	–	–	•	•	•
SuperCell 600™ (600 x 300 DPI)	–	•	•	–	–	–	–	–
300 dots per inch	•	•	•	•	•	•	•	•
Paper & Transparency Film								
Transparency Film	•	•	•	•	•	•	•	•
Thermal-transfer Paper	•	•	•	–	–	–	–	–
Laser Paper	•	•	•	•	•	–	–	–
Any Paper	–	–	–	•	•	–	–	–
Tektronix Dye Sub Paper	–	–	–	–	–	•	•	•
Resident Fonts	17	17	39	39	39	39	39	39
SCSI for external font disk	–	–	•	•	•	•	•	•
Network Connections								
Parallel	•	•	•	•	•	•	•	•
RS-232 Serial	•	•	•	•	•	•	•	•
AppleTalk™	•	•	•	•	•	•	•	•
Optional Ethernet								
Novell® NetWare®	–	–	•	–	•	–	•	•
EtherTalk™	–	–	•	•	•	•	•	•
TCP/IP™	•	•	•	•	•	•	•	•
Optional Second Input Tray	•	•	•	–	–	–	•	–
Standard 1-yr. Warranty	•	•	•	•	•	•	•	•
Optional RealSUPPORT™ Service								
1, 2, & 3-yr. On-site Plans	•	•	•	•	•	•	•	•
3-yr. Express Depot Plans	•	•	•	–	–	–	–	–
Mfr. Sug. Retail (U.S.)	$ 2,995	3,995	5,995	6,995	9,995	6,995	7,995	14,995

*1 *Tabloid Extra allows you to print two-page spreads with full bleeds.*

*2 *Maximum RAM required for PCL5 emulation for Phaser™ 220i and Phaser™ 300i.*

*3 *Pantone, Inc.'s check-standard trademark for color reproduction and color reproduction materials.*

The World's Best Color Printers

Since 1980, Tektronix has pioneered precision color printing and imaging solutions for the desktop. In fact, Tektronix is the world's leading manufacturer of color printers for workgroups. Phaser™ color printers are recognized around the world for the highest-quality desktop color printing. For a sample printed on the Tektronix Phaser™ color printer of your choice, contact your Authorized Tektronix Dealer. In the U.S. for more information or the location of your nearest dealer call 1-800-835-6100, Dept. M16.

Phaser™ Workgroup Color Printers

ORDERING INFORMATION

PHASER™ 220i
Thermal-transfer Color Printer. Order number 4681i **$5,995**
Includes: U.S. Letter-size Input Tray for Perforated Media; U.S. Power Cord; Media Startup Kit with Perforated Paper, Transparency Film and Sample 3-Color Transfer Roll; Installation Instructions; User Manual; Cleaning Kit; and Utilities, Drivers and Sample Images on Diskettes with Instruction Manual.

PHASER™ 220e
Thermal-transfer Color Printer. Order number 4681e **$3,995**
Includes: U.S. Letter-size Input Tray for Perforated Media; U.S. Power Cord; Media Startup Kit with Perforated Paper, Transparency Film and Sample 3-Color Transfer Roll; Installation Instructions; User Manual; Cleaning Kit; and Utilities, Drivers and Sample Images on Diskettes with Instruction Manual.

PHASER™ 200e
Thermal-transfer Color Printer. Order number 4681PXe.....**$2,995**
Includes: U.S. Letter-size Input Tray for Perforated Media; U.S. Power Cord; Media Startup Kit with Perforated Paper, Transparency Film and Sample 3-Color Transfer Roll; Installation Instructions; User Manual; Cleaning Kit; and Utilities, Drivers and Sample Images on Diskettes with Instruction Manual.

Opt. 01 – Metric Media Startup Kit. Includes metric-standard media startup kit and input tray in place of U.S. Customary-standard.....**NC**

Opt. 03 – Lower Tray Assembly letter-size input tray and assembly. This option allows you to conveniently switch between input trays from your computer. .....**+$495**

Opt. 13 – Lower Tray Assembly A4-size input tray and assembly. This option allows you to conveniently switch between input trays from your computer. .....**+$495**

Opt. 04 (220i & 200e) – Add 4 MB of RAM.....**+$395**

Opt. 1F (220e & 200e) – Add 22 fonts. Increases standard 17 fonts to total of 39 .....**+$595**

Opt. P1 (Phaser™ 220i) – Novell™, EtherTalk™ Ethernet. Internal Ethernet interface with support for Novell NetWare and EtherTalk protocols .....**+$695**

Opt. P2 (Phaser™ 220i) – TCP/IP Ethernet. Adds TCP/IP protocol support to the Ethernet interface (requires Opt. P1).....**+$295**

ACCESSORIES

CART
The Tektronix printer cart is perfectly matched to the Phaser™ 200 Series. The contemporary design features a built-in lower shelf, all-steel construction, and non-skid casters. Order 200CART.....**$295**

Plain-paper Starter Kit – Includes ColorCoat™ plain-paper transfer roll, paper tray for Letter-size media (required to print on non-perforated paper), and 500 sheets of perforated Premium laser paper.
Order 4681FSS (Letter-size).....**$195**
Order 4681FSS Opt. 01 (A4-size) **$195**

TCP/IP Ethernet – (Phaser™ 220e & 200e) External Ethernet interface for TCP/IP. Order 4511A.....**$1,495**

PHASER™ 300i
Phase-change Color Printer. Order 4699PXi **$9,995**
Includes: AMD 29000 24-MHz RISC Processor with 10 MB RAM; U.S. Letter-size Input Tray (adjustable for A- and A4-size media); ColorStix™ Solid Ink; Universal Output Tray; U.S. Power Cord; Installation Instructions; User Manual; Cleaning Kit; Utilities, Drivers and Sample Images, with Instruction Manual; Media Sampler Kit with Bond Paper, Cover Stock, and Transparency Film.

PHASER™ III PXi
Phase-change Color Printer. Order 4698PXi **$6,995**
Includes: AMD 29000 24-MHz RISC Processor with 10 MB RAM; U.S. Letter-size Input Tray (adjustable for A- and A4-size media); ColorStix™ Solid Ink; Universal Output Tray; U.S. Power Cord; Installation Instructions; User Manual; Cleaning Kit; Utilities, Drivers and Sample Images, with Instruction Manual; Media Sampler Kit with Bond Paper, Cover Stock, and Transparency Film.

Opt. 01 – Large-format Starter Kit. Includes universal input tray (adjustable for Tabloid, A3, and Tabloid Extra media) and ColorStix™ solid ink startup kit (includes 8 ColorStix each of cyan, yellow, magenta, and black).....**+$395**

Opt. 04 – Add 4 MB of RAM (Total of 14 MB). Required to print double page spreads with full bleed.....**+$395**

Opt. 08 – Add 8 MB of RAM (Total of 18 MB). Accelerates printing of complex images, provides a larger input buffer, and enhances downloading of multiple fonts .....**+$790**

Opt. 12 – Add 12 MB of RAM (Total of 22 MB). Required for TekColor Finepoint™ Level 2 rendering on Tabloid Extra-size and for PCL5 emulation (Phaser™ 300i), optimizes downloading and input buffer; and accelerates printing for applications that frequently process complex images.....**+$1,185**

Opt. P1 (Phaser™ 300i) – Novell, EtherTalk Ethernet. Includes internal Ethernet interface with support for Novell NetWare and EtherTalk protocols .....**+$695**

Opt. P2 (Phaser™ 300i) – TCP/IP Ethernet. Adds TCP/IP protocol support to the Ethernet interface (requires Opt. P1).....**+$295**

Opt. 02 (Phaser™ III PXi) – EtherTalk Ethernet. EtherTalk interface hardware .....**+$695**

ACCESSORIES

CART
Custom printer cart with drawer and adjustable shelf. Order 4698CRT.....**$695**

Phaser™ Media Laminator – Optimizes the brilliance of projected colors on overhead transparencies and adds a protective coating to all media. Order 469LAM.....**$995**

TCP/IP Ethernet – (Phaser™ III PXi) External Ethernet interface for TCP/IP. Order 4511A.....**$1,495**

Phaser™ Workgroup Color Printers

ORDERING INFORMATION

PHASER™ 480
Dye Sublimation Color Printer. Order 4688 ..... **$14,995**
Includes: Input Tray (adjustable for Tabloid, A3, and Tabloid Extra-size media); U.S. Power Cord; Media Startup Kit with Paper and a Sample Transfer Roll; Installation Instructions; User Manual; Cleaning Kit; and Utilities and Drivers on Diskette with an Instruction Manual.

Opt. 16 – Add 16 MB of RAM (Total of 48 MB). Required for 4-color printing on Tabloid size media ..... **+$1,595**

Opt. 32 – Add 32 MB of RAM (Total of 64 MB). Provides optimum input buffers and additional processor cache for faster throughput ..... **+$3,195**

Opt. P1 – Novell™, EtherTalk™ Ethernet. Includes internal Ethernet interface with support for Novell NetWare and EtherTalk protocols ..... **+$695**

Opt. P2 – TCP/IP Ethernet. Adds TCP/IP protocol support to the Ethernet interface (requires Opt. P1) ..... **+$295**

ACCESSORIES

Letter-size Input Tray – Adjustable for Letter-size and A4-size media. Order 436-0272-00 ..... **$195**

CART
Our convenient, mobile printer cart includes three shelves to easily accommodate your Phaser™ color printer, supplies, and accessories. Order 469CART **$395**

PHASER™ 440
Dye Sublimation Color Printer. Order 4685 ..... **$7,995**
Includes: Input Tray (adjustable for all media) U.S. Power Cord; Media Startup Kit with Paper and a Sample Transfer Roll; Installation Instructions; User Manual; Cleaning Kit; and Utilities and Drivers on Diskette with an Instruction Manual.

Opt. 01 – Metric Media Startup Kit. Includes metric-standard media startup kit in place of U.S. Customary-standard ..... **NC**

Opt. 16 – Add 16 MB of RAM (Total 32 MB). Required to print the maximum image area on Letter Extra-size paper and for printing with a 4-color transfer roll ..... **+$1,595**

Opt. 32 – Add 32 MB of RAM (Total 48 MB). Accelerates processing of complex images (up to twice the speed of the standard configuration) and enhances downloading of multiple fonts ..... **+$3,190**

Opt. 48 – Add 48 MB of RAM (Total of 64 MB). Increases the size of input buffers to optimize image downloading and maximizes the memory available for use in the most demanding applications ..... **+$4,785**

Opt. P1 – Novell, EtherTalk Ethernet. Includes Internal Ethernet interface with support for Novell NetWare and EtherTalk protocols ..... **+$695**

Opt. P2 – TCP/IP Ethernet. Adds TCP/IP protocol support to the Ethernet interface (requires Opt. P1) ..... **+$295**

ACCESSORIES

CART
The Tektronix printer cart is perfectly matched to the Phaser™ 440. The contemporary design features a built-in lower shelf, all-steel construction, and non-skid casters. Order 200CART **$295**

Lower Tray Assembly – Second input tray and assembly. This option allows you to conveniently switch between input trays from your computer.
Order 4685FTA (Letter) **$495**
Order 4685FTA Opt. 01 (A4) **$495**

PHASER™ IIsdx
Dye Sublimation Color Printer. Order 4684 ..... **$6,995**
Includes: Input Tray (adjustable for all media) U.S. Power Cord; Media Startup Kit with Paper and a Sample Transfer Roll; Installation Instructions; User Manual; Cleaning Kit; and Utilities and Drivers on Diskette with an Instruction Manual.

Opt.01 – Metric Media Startup Kit. Includes metric-standard media startup kit in place of U.S. Customary-standard ..... **NC**

Opt. 04 – Add 4 MB of RAM (Total 20 MB). Required to print with a 4-color transfer roll ..... **+$395**

Opt. 16 – Add 16 MB of RAM (Total 32 MB). Accelerates processing of complex images and enhances downloading of multiple fonts ..... **+$1,595**

Opt. 32 – Add 32 MB of RAM (Total 48 MB). Increases the size of input buffers for downloading complex images and provides more memory for processing scanned images... **+$3,190**

Opt. 02 – EtherTalk Ethernet. Internal Ethernet EtherTalk interface ..... **+$695**

ACCESSORIES

TCP/IP Ethernet – Support for TCP/IP Ethernet through external 4511A Network interface. Order 4511A **$1,495**

CART
Our convenient, mobile printer cart includes three shelves to easily accommodate your Phaser™ color printer, supplies, and accessories. Order 469CART **$395**

ADDITIONAL OPTIONS & ACCESSORIES FOR ALL TEKTRONIX COLOR PRINTERS

INTERNATIONAL POWER CORDS (IN PLACE OF U.S. CUSTOMARY-STANDARD)
Opt. A1 – Universal European 220 V/15 A, 50 Hz ..... **NC**
Opt. A2 – United Kingdom 240 V/12 A, 50 Hz ..... **NC**
Opt. A3 – Australian 240 V/10 A, 50 Hz ..... **NC**
Opt. A5 – Swiss 220 V/6 A, 50 Hz ..... **NC**

Ethernet Cable Adapters –
Ethernet Twisted Pair (10BaseT) Adapter. Order 011-0162-00 ..... **$95**
Ethernet Thin Net (10Base2) Adapter. Order 011-0161-00 ..... **$95**
Ethernet Thick Net (10Base5) Adapter. Order 011-0160-00 ... **$125**

Workstation Software – Provides fast screen-copy and raster image color printing.
Sun (Solaris 1.x). Order 4690F22 ..... **$995**
Sun (Solaris 2.x). Order 4690F22 Opt. 10 ..... **$995**
SGI. Order 4690F23 ..... **$995**
HP 9000. Order 4690F24 ..... **$995**
IBM RS/6000. Order 4690F25 ..... **$995**
DEC (ULTRIX). Order 4690F26 ..... **$995**
DEC Alpha (Open VMS). Order 4690F27 ..... **$995**
DEC (VMS). Order 4690F29 ..... **$995**
PhaserSym (VMS Print Symbiont). Order 4690F41 ..... **$495**

RealSUPPORT™ SERVICE OPTIONS
Opt. S0 – RealSUPPORT™ Service. Installation and setup ..... **+$350**

Extended warranty programs with complete coverage of parts and labor. Contact your local Tektronix Dealer for pricing information.
Opt. S1 – One year of on-site service
Opt. S2 – Two years of on-site service
Opt. S3 – Three years of on-site service

ISO 9001 KEMA CERT. NR. 93106
ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION

Adobe PostScript

Apple Macintosh System 7 Compatible

MICROSOFT WINDOWS COMPATIBLE

PANTONE CALIBRATED

yes It runs with NetWare

In the U.S. for more information or the location of your nearest dealer call 1-800-835-6100, Dept. M16.

HAL
Fax library of news, product information, and technical information.
(503) 682-7450

Network Displays

Graphics Terminals

Tektronix offers traditional graphics terminals and most recently, X terminals – devices that provide windowed access to multiple hosts and applications across a network.

CONTENTS

XP350 Series 570
XP200 Series 570

XP350 SERIES

XP200 SERIES

Network Displays

Broad family of affordable price/ performance terminals.

XP350 SERIES

- RISC X Terminals
- Fully Compatible with SUN, DEC and Other UNIX Computer Environments
- Displays with Workstation Resolution and Quality
- Server Is Optimized for Maximum Performance with a Broad Range of Demanding Technical and Engineering Applications for Superior User Productivity
- Worldwide Sales, Service and Support



XP2000 SERIES SELECTION GUIDE

	XP214M	XP214C	XP217C	XP200 Logic Base
Display Size	14 in. monochrome	14 in. color	17 in. color	Supports Tektronix XP100's, XP21, XP18, XP25, XP27, XP336, XP337, XP356 and SVG/VGA monitors (up to 1152 x 900 @ 72 Hz)
Resolution: Standard	1024 x 768 @ 70 Hz	1024 x 768 @ 70 Hz	1152 x 900 @ 70 Hz
User Selectable	–	–	1024 x 768 @ 72 Hz
Display Colors	black and white	256 colors	256 colors
Color Palette	–	16.7 million colors	16.7 million colors
Display Control	Analog	Digital	Digital
Refresh Rate	70 Hz	70 Hz	70 Hz or 72 Hz
Display DPI /Dot Pitch	108 dpi	108 dpi/0.28 mm	100 dpi/0.28 mm
Prices	**$1,045**	**$1,445**	**$2,445**	**$1,245**

XP350 SERIES SELECTION GUIDE

	XP350	XP354	XP356	XP358	XP338P PEX
Display Size	(Base Module Only)	19 in. greyscale	17 in. color	19 in. color	19 in. color
Resolution	–	1280 x 1024	1280 x 1024	1280 x 1024	1280 x 1024
Display Colors	–	256 shades of grey	256 colors	256 colors	256 colors
Color Palette	–	256 greys	16.7 million	16.7 million	16.7 million
Refresh Rate	–	72 Hz	72 Hz	72 Hz	72 Hz
Display DPI/ Dot Pitch	–	100 DPI	100 dpi/0.28 mm	100 dpi/0.28 mm	100 dpi/0.28 mm
Prices	**$2,245**	**$2,945**	**$3,695**	**$4,445**	*1

[1] Contact your Tektronix representative for price information.

XP350 Characteristics

Standard features – Logic unit, tilt display, 3 Ethernet interfaces (2 on XP338P), 3-button mouse, and power cord.

Warranty – One year return to depot, or 90 day on-site.

Processors – Main CPU: LSI Logic 33020 @ 33 MHz; Graphics Processor: integrated XP338P: MIPS R3000 @ 40 MHz with integral floating point and TMS34020 Graphics Processor.

SIMM Memory – 4 MB standard expandable to 68 MB; XP338P: 8 MB standard expandable to 32 MB.

LAN Ports – 3 Auto-selected Ethernet: 10Base5 AUI (Thicknet), 10Base2 (Thinnet), and 10BaseT (Twisted-pair). (Two on XP338P).

Serial Ports – Two 9-Pin RS-232 ports.

Parallel Port – Optional: One 25-Pin DSUM IBM-style port. (Not available on XP338P).

Flash Memory – Optional for X server, local clients, and fonts (2 MB and 4 MB).

Cooling – Natural convection (no fan).

Product(s) available through your local Tektronix representative (listed in the back of this catalog).

Network Displays

XP350 SERIES

XP200 SERIES


XP300 Series

XPRESSWARE SOFTWARE FEATURES

Boot Options	X Server code downloadable from host or optionally from Flash Memory
Boot Protocols	Standard: TFTP, NFS, Optional: MOP/DAP
Network Protocols	Standard: TCP/IP, TFTP, NFS, BOOTP, RARP: Optional: Serial Xpress, DECnet
Network Management	Standard: DNS, SNMP MIB IL, PING, Boot Monitor, DECnet Mirror, DECnet Trigger
Parameter Set-up	Motif-like set-up menu system and remote configuration files
Printer Support	Network printer support, local print screen, local BSD print spooler
Server	X server based on X11 Release 5; XP338P: X11R5 and PEX Protocol 5.1
Server Extensions	Shape, Input, Multibuffer, XIE imaging extension, font catching, Xidle and Xtest extensions
Local Clients	Standard: TELNET, Console, Protocol Independent Chooser, Setup, Local Client Launcher, local xlock, low memory indicator. Optional: true OSF/Motif window manager, DECnet (Cterm, LAT), Serial Xpress, true OPEN LOOK window manager, Tek340 emulator, 3270 emulator, 3287 emulator, IBM graphics, 3179G+ emulator, XIE, Image/Audio/Video player, TekXpress Window Manager
Terminal Emulation	VT340, 3270 (Models 2,3,4,5), 3179G (Models 2,3,4,5), VT220, VT100
Fonts	27 Resident, 700+ available on server tape
Font Service	TPTP, NFS, Flash, Serial Xpress, DAP
Boot/Font Tapes	For SUN, HP, DEC (Ultrix, VMS), IBM R/S6000, SGI, and other UNIX platforms
Tape Formats	CD-ROM, Cartridge Tape, TK-50, 8 MM, 4 MM
Input Options	Tablet, touchscreen, barcode reader, light pen, trackball

ORDERING INFORMATION

ALL XP TERMINALS INCLUDE:
Logic Unit, Display Monitor, Ethernet Interface, 3-button Mouse, Keyboard, Power Cord, and User Manual.

XP11 – 15 in. Monochrome Terminal **$945**
XP12 – 19 in. Monochrome Terminal **$2,445**
XP13 – 15 in. Greyscale Terminal **$1,645**
XP17 – 14 in. Color Terminal **$1,945**
XP18 – 19 in. Color Terminal **$3,745**
XP350 SERIES – Contact your local sales office for information.

KEYBOARD OPTIONS
IBM 102 Keyboard, French. Order XPFXB **$50**
IBM 102 Keyboard, Swedish/Finnish. Order XPFXC **$50**
IBM 102 Keyboard, Danish/Norwegian. Order XPFXF **$50**
IBM 102 Keyboard, German. Order XPFXG **$50**
IBM 102 Keyboard, Italian. Order XPFXI **$50**
IBM 102 Keyboard, Swiss-German. Order XPFXJ **$50**
IBM 102 Keyboard, Spanish. Order XPFXS **$50**
DEC Keyboard, North American. Order XPFV *1
DEC Keyboard, U.K. Order XPFVA **$100**
DEC Keyboard, French. Order XPFVB **$100**
DEC Keyboard, Swedish. Order XPFVC **$100**
DEC Keyboard, Finnish. Order XPFVE **$100**
DEC Keyboard, Danish/Norwegian. Order XPFVF **$100**
DEC Keyboard, German. Order XPFVG **$100**
DEC Keyboard, Italian. Order XPFVI **$100**
DEC Keyboard, Swiss-German. Order XPFVJ **$100**
DEC Keyboard, Spanish. Order XPFXS **$50**
UNIX Keyboard, North American. Order XPFUN **$150**
3270 Keyboard, North American. Order XPFYN **$150**

WARRANTY
One year return to depot or 90 day on-site.

**1 Contact your Tektronix representative for price information.*

Product(s) available through your local Tektronix representative (listed in the back of this catalog).

General Customer Information

CONTENTS

GENERAL BUSINESS INFORMATION
Sales/Service Offices....574
TeleBusiness Center....574
Distributors/Representatives....574
Federal Government Customers....574

CUSTOMER SUPPORT/SERVICE
Technical Support....575
Service Assurance....576
Comprehensive System Services....577
Service Agreements....578
Standard Price Service....579
RECONDITIONED INSTRUMENTS....580
TRAINING/SEMINARS....581

TERMS AND METHODS OF PAYMENT
Terms of Sale....582
Leasing/Rental Programs....582
Power Cords/Plugs....583

APPLICATION/TECHNICAL NOTES....584

SALES/SERVICE OFFICES LISTING
Worldwide....585
U.S....Inside Back Cover
Distributors....590
Representatives....590
Leasing Companies....590

General Business Information

Quality, support, and convenience.

- Sales and Service Offices
- Distributors
- Representatives
- TBC
- Warranty
- Federal Customers

Tektronix Sales and Service Offices

Tektronix products and technical support are available through a worldwide network of sales and service offices. Your nearest Tektronix Account Manager is available to answer your questions. To find the sales and service office nearest you, see pages 585-589 and the inside back cover.

Tektronix TeleBusiness Center (TBC)

The same quality support found in our sales and service offices is available toll free. In the U.S., call 1-800-426-2200, Monday through Friday, from 8:00 am Eastern Time to 5:00 pm Pacific Time. Expert sales engineers are available to provide technical support to help you choose the right equipment, answer questions, and assist in taking your order.

Authorized Tektronix Distributor and Manufacturers Representatives

We have Authorized Tektronix Distributors and Manufacturers Representatives for selected products and geographic areas. They will provide you with fast, convenient service and support. You may already be served by them, so ask if they carry Tektronix. We encourage you to take advantage of their support and purchase Tektronix products from them.

As you use this catalog watch for products that are available through our distributors and representatives. To find the distributor or representative nearest you, see pages 590-595. Also, we are adding new ones all the time to better serve your needs, so call 1-800-426-2200, in the U.S.

Warranty

Products offered by Tektronix are manufactured to meet the highest level of reliability and performance. Tektronix warrants these products against defects in materials and workmanship in accordance with the warranty statement provided with each product. If any product fails during the warranty period, Tektronix will provide the remedy set forth in the applicable warranty. A copy of the warranty applicable to a particular Tektronix product may also be obtained from your local Tektronix field office.

Federal Customers

FEDERAL ORDER ADMINISTRATION OFFICE

Federal Agencies should obtain price, delivery and place orders directly with Tektronix Federal Order Administration at 1-800-682-1210. Federal Agency RFQs, RFPs, IFBs, Purchase Orders and Contracts should be mailed or faxed directly to:

Tektronix, Inc.
Federal Order Administration M/S 94-532
PO Box 4600
Beaverton, OR 97076

FAX: (503) 629-5388
Phone: 1 (800) 682-1210

If you use FOI, please contact us through the phone number above, so we may establish a paperless link with you. Tektronix CAGE code is 80009.

GSA CONTRACT INFORMATION

Tektronix, Inc. has General Service Administration Multiple Award Schedule Contracts for many products listed in this catalog. These contracts are:

- Instruments and Laboratory Equipment; FSC Group 66, Class 6625, Part II, *Section H*
- Instruments and Laboratory Equipment; FSC Group 66, Class 6625, Part II, *Section J*

An authorized GSA Price List for one of the above contracts is available through your nearest Tektronix office or by calling 1-800-682-1210.

Tektronix' subsidiary, Grass Valley Group, also has GSA contracts. Contact GVG at (916) 478-4055.

LOGISTICS DATA BOOK

A special Logistics Data Book on Tektronix products is available to Federal customers. This manual contains information on Tektronix products which have been assigned a NSN or a military nomenclature, provisioned products, replacement product information, test and calibration systems, and calibration fixtures for servicing Tektronix products. Contact your nearest Tektronix sales office or call 1-800-682-1210.

GSA Price List and/or Logistics Data Book available. Call 1-800-682-1210, or contact your Tektronix representative (listed in the back of this catalog).

Customer Support

Total Solutions for Your Success

When you purchase your Tektronix product, you will find more in the box than a quality product. You'll find an array of services that provide total-solution coverage – coverage that begins with the first call to your customer service representative and continues after the sale through long-term product support. Our sales and service personnel work closely to help you make the best selections for your applications. Then we help you maximize your investment by ensuring optimum product performance. All this is accomplished through customer support programs ranging from training to product installations and a variety of maintenance plans.

It all begins by contacting a customer service representative (CSR) located in your nearest Tektronix sales and service office. Our U.S. and international office locations are listed at the back of this catalog. The CSR will give you information on products and the names of account managers assigned to serve your product interests.

SERVICE OFFERINGS

Simply tell us what you need – there is a good chance that we have already developed a service solution you will like. If not, we will gladly create a service package to complement your current goals and will partner with you to anticipate your future requirements. See page 576-579 for specific service offerings.

CUSTOMER-SITE INSTALLATIONS

Tektronix provides on-site installations for most Tektronix-configured systems. Your Tektronix specialist will set up your product to meet all operating specifications. Contact your local sales and service office for more information.

LONG TERM PRODUCT SUPPORT

Tektronix has a long-standing policy to provide service coverage after a product has been removed from the catalog. These products can be serviced subject to parts availability. Contact your local Tektronix service center for service quotes and information.

TRAINING AND ASSISTANCE

Your Tektronix product is most useful to you when you are thoroughly familiar with it. Formal training classes and self-study aides can help you get up to speed faster. Ask your Tektronix sales representative for details about customer training.



SEMINARS

To receive information about our free Tektronix product and technical seminars, contact your local sales office to be added to the seminar mail list. See page 581.

OPERATIONAL AND APPLICATIONS SERVICE TRAINING WORKSHOPS

To help you achieve optimum utilization of your equipment, Tektronix provides fast-paced courses with classroom lectures and supervised hands-on laboratory sessions. Participants receive manuals and workbooks containing detailed course notes and lab exercises. For added convenience, Tektronix also offers private workshops conducted at your company. See page 581.

MODULE EXCHANGE SERVICES

Easily exchangeable modular components facilitate rapid troubleshooting and repair of many Tektronix products. You may choose to diagnose a problem and specify the module to exchange, or a Tektronix Customer Service technician can provide assistance. Typically your module order will ship from our dock within 24 hours, and overnight delivery can be arranged for most US locations. To place an order, call Tektronix at 1-800-835-9433, Ext. 6630.

REPLACEMENT PARTS

Components of equal or improved quality can be supplied for over 5,000 Tektronix products. Replacement parts and supplies can be ordered by calling toll free between 5AM and 5PM, Pacific Time. Call Tektronix at 1-800-835-3553.

TECHNICAL SUPPORT

Tektronix provides high quality Technical Support on applications, operation, measurement specifications, hardware, and software, by expert Application Engineers. See contact information at right.

CUSTOMER SUPPORT PROGRAMS

- Service Offerings
- Warranty Coverage
- Customer-site Installations
- Training and Assistance
- Product and Technical Seminars
- Operational and Applications Workshops
- Service Training Workshops
- Module Exchange Services
- Replacement Parts
- Long-term Product Support
- Technical Support

Providing you with worldwide service and support to complement your new product purchase.

Request a copy of our Measurement Service Brochure detailing service options available to you.

Applications Support
Call 1-800-835-9433, Ext. 2400
Email Address "tm_app_supp@tek.com"
Hours: 6:00 AM - 5:00 PM Pacific Time.

Software Bulletin Board
24 hrs., 7 days a week.
2400/9600 baud,
dial 503-627-5658.

Customer support programs vary according to country. For information on programs available in your location, contact your Tektronix representative (listed in the back of this catalog).

Service Assurance

Our Unconditional Service Guarantee

"If, for any reason, our services fail to fully meet your requirements as promised, we will resolve the problem at our expense."

Request a copy of our Measurement Service Brochure detailing service options available to you.

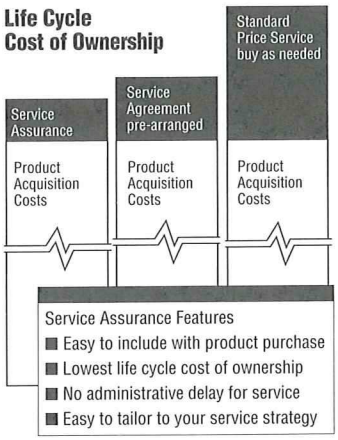
Service Assurance programs vary according to country. For information on programs available in your location, contact your Tektronix representative (listed in the back of this catalog).

SERVICE ASSURANCE

- Calibration Services
- Repair Protection
- ISO 9001 Certified

Service Assurance

You can pre-arrange reliable, convenient, long-term instrument support that suits your needs. Service Assurance expands your own instrument calibration and repair capabilities with Tektronix resources at Service Centers nationwide. Avoid authorization delays when routine calibration or unplanned repairs are needed, and eliminate unplanned support expenses, by including Service Assurance in your instrument purchase.



FLEXIBLE, EASY ALTERNATIVES

When you buy Service Assurance with your new Tektronix instrument as a Product Option, Tektronix-recommended protection begins for you automatically.

If you prefer, you may buy Service Assurance any time during your instrument's warranty period.

Purchase one or several years of **Repair Protection, Calibration Services** or both to suit your needs, and we will send you a postpaid registration card. Once registered, your Service Assurance will be honored at any Service Center nationwide with no further proof of coverage. Calibration Services begin upon registration. Repair Protection begins at the end of your product warranty.

TEKTRONIX METROLOGY EXPERTISE

Combine Service Assurance programs to meet your needs:

Repair Protection extends priority repair services for up to three years beyond your instrument's warranty period. Order up to three each, REPXXXX.

Calibration Services include adjustment or verification to assure instrument accuracy. As appropriate, we provide our Certificate of NIST Traceability and MIL-STD-45662A Compliance, as well as calibration stickers, reverse traceability record maintenance, calibration recall assurance, and scheduled recalibration notification. Along with our ISO 9001 Certification, these services will significantly help you meet your internal quality audit requirements. Order up to five years of support by requesting 5 each, CALXXXX.

TAILORED SUPPORT

Additional, customized Service Assurance plans can be arranged for large blocks of instruments, customer-site protection, telephone hotline support, extended software support, and a variety of other alternatives. Contact a Tektronix Service Account Manager for help meeting your needs, from one calibration to managing your entire metrology support function.

Comprehensive Systems Services

These services are available for many Tektronix measurement systems and combine the features of Calibration Services Repair Protection, and Customer-site Support as well as access to our Telephone Support Center and extended software support.

Customer-site Services

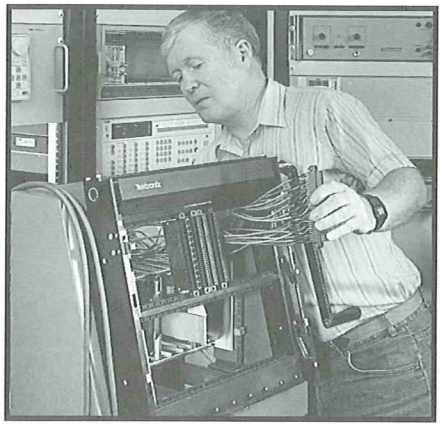
The following services are provided at your site:

SHARED SERVICE AGREEMENTS
You provide the first line of response; Tektronix provides spares support and telephone assistance. If we can't help you over the phone to have your system fully functional within 24 hours, we provide back-up support at your site from one of our systems technical support specialists.

CUSTOMER-SITE SUPPORT AGREEMENTS
You call us, we do the rest. We provide rapid response at your site by our highly-trained technical support specialists, with the right spares to get your system up and running right away. Where applicable, Tektronix also provides preventive maintenance and calibration services at your site as part of the agreement.

TOTAL-SITE HARDWARE AND SOFTWARE SUPPORT AGREEMENTS
If you have multiple qualifying systems, Total-site Support may be just what you're looking for. At a very substantial discount from our single-system pricing, we cover all the systems at your site, providing software update services, hardware maintenance and repair, as well as any required preventive maintenance. Since we know every system at your site is covered, there's no hassle with serial numbers to check coverage – we come when you call.

CUSTOMER-SITE SYSTEM ENGINEERING/APPLICATION SUPPORT
For qualifying systems, we provide system engineering support right at your site, helping you with system integration and/or helping you develop application software to maximize the utility of your Tektronix system.



Depot Services

The following services are provided at the nearest designated Tektronix Service Center:

EXCHANGE SERVICE AGREEMENTS
For a nominal fee, we provide access to our exchange system, giving you next-day receipt of replacements for your failed module when you call. We take your failed module, refurbish it to like-new condition, and place it in our exchange inventory.

REPAIR
We provide three-day turnaround (exclusive of shipping time) on your failed module when you return it to us for repair.

STANDARD PRICE CALIBRATION OR PERFORMANCE VERIFICATION
On a per-incident basis, Tektronix provides MIL-STD-45662A calibrations, or full performance verifications to manufacturer's specification, as applicable.

CALIBRATION OR PERFORMANCE VERIFICATION AGREEMENTS
Tektronix provides MIL-STD-45662A calibrations, or full performance verification to manufacturer's specification, as applicable. We also provide recall notification, and do it at a discount from our per-incident rates.

Custom Service Agreements

With all the system options we provide, we know that there are times when our standard offerings may not give you exactly what you need. We are happy to discuss your needs and tailor a custom Service Agreement to fit them exactly.

Telephone Support Hotline

Tektronix provides telephone support via nationwide 800 numbers to resolve hardware and software operability, system integration, and fault-isolation issues.

COMPREHENSIVE SYSTEMS SERVICES

- Customer-site Services
- Depot Services
- Custom Service Agreements
- Telephone Support Hotline

Our Unconditional Service Guarantee

"If, for any reason, our services fail to fully meet your requirements as promised, we will resolve the problem at our expense."

Request a copy of our Measurement Service Brochure detailing service options available to you.

Systems services vary according to country. For information on services available in your location, contact your Tektronix representative (listed in the back of this catalog) or call 1-800-426-2200.

Service Agreements

Our Unconditional Service Guarantee

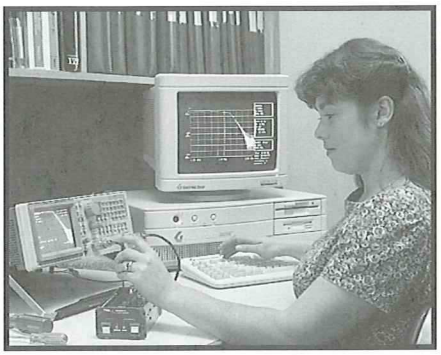
"If, for any reason, our services fail to fully meet your requirements as promised, we will resolve the problem at our expense."

Request a copy of our Measurement Service Brochure detailing service options available to you.

Service Agreements vary according to country. For information and availability of agreements in your location, contact your Tektronix representative (listed in the back of this catalog).

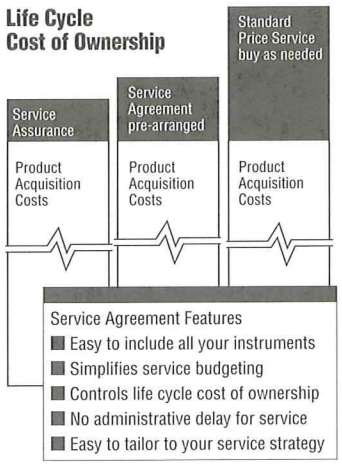
SERVICE AGREEMENTS

- Low Cost Protection
- A Variety of Offerings
- Discounts May Apply
- ISO 9001 Certified



Pre-arranged Instrument Protection

Once your product warranty or Service Assurance coverage expires, consider the cost effectiveness of purchasing a Service Agreement. Service Agreements provide a substantial cost advantage over per-incident Standard Price service costs. Multi-year coverage minimizes your paperwork and affords you tighter control over your ownership costs. Most important, Service Agreement protection helps you maximize your instrument uptime and performance.



CALIBRATION, REPAIR, AND SYSTEMS AGREEMENTS

Repair Protection, Calibration Services, or both, may be pre-arranged by a Service Agreement. Comprehensive Systems Service Agreements are available for many Tektronix test and measurement systems and feature calibration and repair protection along with access to our Telephone Support Center and extended software support.

REDUCED COST OF OWNERSHIP WITH NO SPECIAL CONDITIONS

Tektronix Service Agreements foster a disciplined approach to providing superior quality, performance and value by assuring in advance that any care your Tektronix product needs will be provided. Instruments maintained in this manner perform faithfully and experience an extended useful life, which translates into a lower cost of ownership.

ADDITIONAL COST SAVINGS

Aggressive discounts can be added together to reduce support costs below the already favorable basic agreement prices.

MULTI-YEAR DISCOUNT

Multi-year discounts are available on Service Agreements of two or more years.

QUANTITY DISCOUNT

Significant discounts may be applied to Service Agreements covering a number of instruments.

DOLLAR VOLUME DISCOUNT

If you expect to make a substantial investment in repair and calibration services during the year, you may qualify for discounted pricing based on the value of the services you have already purchased from us. Ask a Tektronix Service Account Manager for information about our Dollar Volume Discount Program.

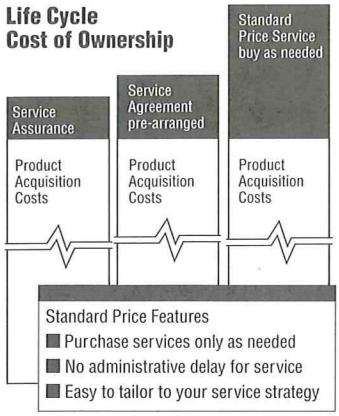
ELIGIBILITY

Products covered by a new product or service warranty, Service Assurance, or an existing Tektronix Service Agreement are automatically eligible for Tektronix Service Agreement coverage. Other products may be eligible subject to a qualifying inspection. To avoid inconvenience, we can waive inspection in many cases – ask about our inspection waiver fee.

Standard Price Service

Standard Price Service

Tektronix offers calibration and repair services for most products on a Standard Price basis. This lets you make a service decision without waiting for a quote, allowing us to go to work for you right away.

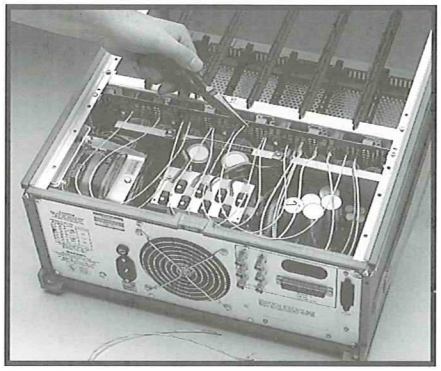


STANDARD PRICE CALIBRATION

Our calibration program is designed to ensure the continued accuracy and precision of your instruments. It provides NIST traceability and MIL–STD–45662A compliance at no additional charge, on all eligible products. This includes a Certificate of Traceable Calibration and a calibration label showing our certification date and the due date for the next calibration. The Certificate of Traceable Calibration describes your instrument's condition, the measurement standards we used, and the environmental conditions at the time of calibration. Your product is entered into our calibration records and recall system. We notify you when it is time to schedule recalibration to maintain your instrument's certification, and we maintain audit documentation of your instrument's performance in compliance with MIL–STD–45662A.

STANDARD PRICE REPAIR

Tektronix will repair your instrument as you request, installing any component modifications needed to make the repair, and then conduct a front-panel check, verifying externally accessible adjustments, to enable your instrument to be calibrated to perform within its specifications. To ensure optimum performance, we encourage you to have us calibrate your instrument when we repair it.



A FEW EXCLUSIONS KEEP OUR STANDARD PRICES LOW

Standard Prices generally cover all labor and parts. Some major, high reliability components are billed separately on the few occasions they are needed. Products that have been damaged through accident or improper use may be ineligible for Standard Price.

ADDITIONAL SERVICES ASSURE YOU OF PREMIUM VALUE AT NO EXTRA CHARGE

We treat every instrument service as an opportunity to deliver the extra care that sets Tektronix apart from other service providers. We install up-to-the-minute safety modifications in accordance with the latest Tektronix engineering change orders. We alert you to any performance problems you may want to consider correcting, and if there appears to be an application or operator error, we may phone with technical suggestions to improve your success. Finally, we verify the appearance of your instrument and correct minor cosmetic flaws before packaging it with the appropriate certifications and returning it to you.

DIMENSIONAL STANDARDS SERVICES

Calibration and repair of your dimensional tools are available at selected Tektronix Service Centers. Tektronix Dimensional Service offers superior quality, convenience, and value. Contact your local Tektronix service representative for detailed information.

TIME AND MATERIAL

Products that are obsolete or that have been damaged or abused are serviced under Time and Material charges with hourly labor rates and parts usage prices applied.

INCIDENTAL SERVICES

Other services offered are: Before and After Test Data Recording, Instrument Wash, Shuttle Services, Pick Up and Delivery, and Next Day Calibrations.

STANDARD PRICE SERVICE

Services Available:

- Product Calibration
- Product Repair
- Dimensional Tools
- Obsolete Products
- ISO 9001 Certified
- Calibration Scheduling and Recall
- Metrology Audit Records
- Instrument Upgrades
- Technical Support

Our Unconditional Service Guarantee

"If, for any reason, our services fail to fully meet your requirements as promised, we will resolve the problem at our expense."

Request a copy of our Measurement Service Brochure detailing service options available to you.

Standard Price service varies according to country. For information on services available in your location, contact your Tektronix representative (listed in the back of this catalog).

Reconditioned Products

An ideal solution for stretching the tight budget dollar.

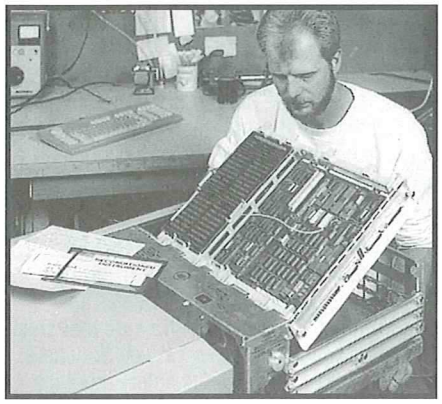
- Reduced Prices
- Quick Delivery
  – Many products are in stock and are immediately available.
- Warranty
  – Products meet Tektronix high standards for performance, quality and reliability.

Reconditioned Products

If budget restrictions are in the way of getting the Tektronix product that you would like to have – Tektronix Reconditioned Products may be an ideal solution for stretching the tight budget dollar.

THE ORIGINS

Tektronix Reconditioned Products are usually field, marketing, or training demo units. Products meet Tektronix standards for quality and performance, both technically and aesthetically.



Reconditioned Products meet Tektronix standards for quality and performance.

PERFORMANCE

Tektronix Reconditioned Products are serviced, calibrated and tested to meet the same high quality standards as new products. All essential upgrades are installed and all products are functionally equivalent to new products and meet full product specifications. All reconditioned products are provided with standard manuals and accessories.

REDUCED PRICES

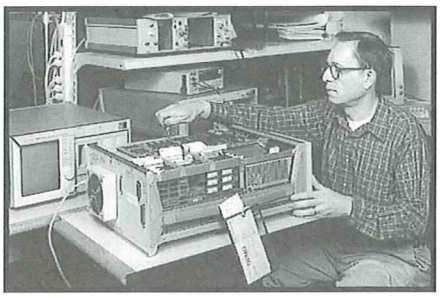
Tektronix Reconditioned Products are usually sold at reduced prices – below new product prices. All standard and contract discounts normally apply.

WARRANTY

We are confident in the reconditioning process. Accordingly, all Tektronix Reconditioned Products are warranted. Extended service options are also available on most products.

APPEARANCE

We like our products to look as good as they run. Instruments are inspected and cleaned prior to delivery.



Reconditioned Products are calibrated and tested to meet the same high standards as new products.

AVAILABILITY/DELIVERY

Reconditioned Products are offered on an "as-available" basis. Many products are in stock and are immediately available.

Your Tektronix Account Manager or local Tektronix sales office will be glad to see if there is a Reconditioned Product available and to provide you with a current price quote.

ORDERING INFORMATION

Check with your local Tektronix Sales Office to take advantage of Tektronix' Reconditioned Product bargains.

In the U.S. you may call the TeleBusiness Center Toll free line: 1-800-426-2200 (Measurement Products).

Your Tektronix Account Manager will be pleased to discuss your instrument needs.

Training and Seminars

For Users and Service Technicians

Measurement Product Service Training Classes

Professional training provides your technicians the opportunity to learn the latest maintenance techniques in the same courses used to train Tektronix technicians. We emphasize the "How to Fix" philosophy.

Our formal classroom training is intensive, with lectures and hands-on labs. Tektronix product service training instructors sharpen your skills in troubleshooting, isolating faults, and repairing Tektronix products. You learn factory-approved maintenance procedures for long product life and maximum uptime.

Customized on-site product service training is available. We have the flexibility within our programs to provide training at your location, enabling you to save costly travel expenses. By tailoring the class presentations and materials to your exact needs, you receive maximum value for your training investment.

INSTRUMENT USER AND MEASUREMENT TECHNIQUES WORKSHOPS

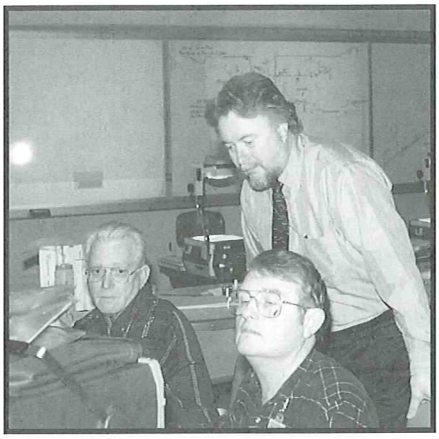
Maximize the efficient utilization of your Tektronix products by subscribing to one of the many Instrument User and Measurement Techniques Workshops offered by Tektronix Measurement Training. These workshops combine classroom lectures with plenty of hands-on labs that emphasize the "Make Measurements" philosophy.

These workshops may be conducted at your location and customized to satisfy your needs. This high quality training increases your productivity and provides you with the instrument familiarity necessary to excel in your profession. Tell us what you need and see what we can do for you. Call today 1-800-835-9433 x WR1407.

SELF-STUDY MATERIALS

Study on the job or at home. We offer self-study video/audio tapes and training packages which include exercises to help you quickly develop product familiarity and skills in fault diagnosis and repair.

Tektronix Measurement product user self-study training packages provide interactive, hands-on instruction for comprehension of product operation and applications. Measurement product service packages cover troubleshooting and repair techniques at your own bench. Our tapes are quality products that progress from basic concept packages for novice technicians to advanced concept packages for experienced



service specialists. Build your own library of relevant training tapes and materials. Training packages are the next best thing to being in class. Refer to page 436 for self-study package content and ordering information.

TRAINING DOCUMENTATION

Tektronix Measurement Training develops the complete program for your training needs. In addition to formal training, we can create for your use a complete instructor package consisting of: class outline; lesson plan; instructor guide; student workbook; lab exercises; and visual projections. Service manuals, created by the Measurement Training group, can be developed to satisfy your specific needs. Our professional technical writers develop materials which emphasize the "How to Fix" techniques used by the Tektronix service specialist.

Our training programs have been used by various branches of the Armed Services with high acclaim. Join the team of professionals using training offered by Tektronix Measurement Training.

MEASUREMENT PRODUCT AND TECHNOLOGY SEMINARS

Tektronix offers a wide variety of seminars ranging from product specific seminars to test and measurement technology seminars. Learn about the latest technology advances in the test and measurement field or about the latest product features. We want to support you in your need to stay on top of the rapid advances in technology. To receive information on seminars, call your local Tektronix sales office and have your name added to the seminar mail list.

MEASUREMENT CUSTOMER TRAINING OFFERINGS:

- Measurement Product Service Training
- Measurement User and Measurement Techniques Workshops
- Measurement Self-Study Material
  - Self-Study Packages
  - Video Tapes
  - Audio Tapes
- Measurement Training Documentation
  - Instructor/Training Guides
  - Service Manuals
- Measurement Product and Technology Seminars

Join the growing number of Tektronix-trained customers.

Training and Seminar programs vary according to country. For availability of programs available in your location, contact your Tektronix representative (listed in the back of this catalog).

ORDERING INFORMATION

To register for formal training classes or for information on other training services, contact: Tektronix, Measurement Training, Walker Road Industrial Park. Attention: Measurement Training Registrar, P.O. Box 4600, M/S 94-925, Beaverton, OR 97076. Phone: (800) 835-9433 ext. WR1407.

Formal classroom training is available at the Tektronix training facilities in Beaverton, Oregon, as well as in Atlanta, GA; Boston, MA; Chicago, IL; Dallas, TX; Denver, CO; Irvine, CA; Santa Clara, CA; and Washington, D.C. On-site classes and workshops are also available upon request.

Terms and Methods of Sale

Terms and methods of sale to meet varied purchasing objectives.

- General Terms of Sale
- Rental/Leasing Programs
- Power Sources

Purchasing terms vary according to country. For information on terms available in your location, contact your Tektronix representative (listed in the back of this catalog).

General Terms and Methods of Sale

PRICES
Prices shown in this catalog are US list prices in effect at the time of printing. Tektronix reserves the right to change prices without notice. Export pricing is available from your local Tektronix Sales Office.

PAYMENT
Net 30 from date of invoice, subject to approved credit. Other terms are available.

CREDIT CARDS
Tektronix currently accepts the following credit cards: VISA, MasterCharge, Discover, American Express.

MINIMUM ORDER
$25.

SHIPMENT
FOB Tektronix plant, Beaverton, Oregon.

ELECTRONIC DATA INTERCHANGE
Tektronix encourages the use of EDI for the communication of quotations, orders, invoices and payment. Please contact your local Tektronix Sales Office for details.

Tektronix Measurement Leasing Program

Although Tektronix will continue to offer leasing opportunities through our well established leasing company partners, Tektronix customers now have the option to lease new equipment sold by the Measurement Group directly from Tektronix. Since you can make arrangements to lease at the time product selections are made, leasing from Tektronix provides a quick and easy way to acquire instrumentation. The Tektronix leasing terms include a variety of 12-, 24-, and 36-month programs with a minimum order of $3000. In addition, our FlexLease™ program offers a very competitive monthly rate for 39 months with many attractive features. Contact your local Tektronix Account Manager, or call the Tektronix TeleBusiness Center at 1-800-426-2200.

Rental/Leasing Program

Tektronix' Authorized Rental Companies provide the widest selection of well-maintained Tektronix instruments, with flexible and attractive terms. For short term rentals, leases and lease purchase options, Tektronix' Authorized Rental Companies provide the right terms, the right instruments, the right options so you can make the right choice.

Our Authorized Rental Companies can provide you a solution when you want to try out new equipment before you purchase or when you need equipment for short-term projects or for an immediate requirement. They will provide you the best answers for managing your test equipment inventory, whether you rent it for a month or lease it for a year.

When you need Tektronix products, you will not need to look further than our list of Authorized Rental Companies. Trust your rental and leasing requirements to the very best, Tektronix and, in the U.S., call:

AT&T Capital Corporation Instrument Services	**1-800-874-7123**
Continental Resources, Inc.	**1-800-937-4688**
Electro Rent Corporation	**1-800-688-1111**
G.E. Rental/Lease	**1-800-GE-RENTS**
Genstar Rental Electronics, Inc.	**1-800-422-3300**
McGrath RentCorp	**1-800-352-2900**
McGrath RenTelco	**1-800-233-5807**
Telogy, Inc.	**1-800-TELOGY-I**

Power Sources

Power Sources

Most Tektronix instruments provide wide-range regulated supplies, or quick change line-voltage selectors for convenient selection of line-voltage operating ranges.Transformer taps in a few instruments can be changed to accommodate specific line-voltage operating ranges or can be factory wired for a specific range if specified on the purchase order.

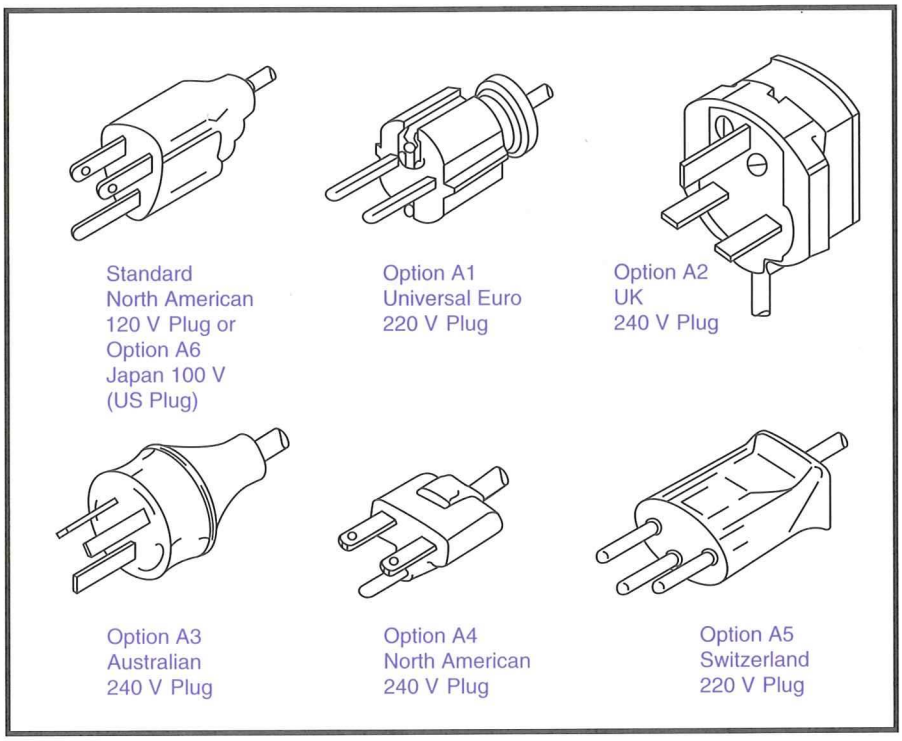
Most Tektronix instruments are designed to operate from a power source that will not apply more than 250 Volts RMS between the supply conductors or between either supply conductor and ground.

The power cord/plug options may become available on instruments not specified in this catalog. Contact your local Tektronix representative for information.

Except for some double-insulated instruments, most Tektronix instruments are equipped with either a three conductor attached power cord or a three-terminal power-cord receptacle. The third wire or terminal is connected directly to the instruments chassis to protect operating personnel.

Power-cord coding follows one of the two following schemes:

	Scheme 1	Scheme 2
Line	Black	Brown
Neutral	White	Light blue
Ground (safety earth)	Green-yellow	Green-yellow



POWER SOURCES

Many Tektronix instruments can be fitted with one of the power cord/plug options listed and wired for the voltage as indicated, if specified on the purchase order.

Standard	North American	120 V
Opt. A1	Universal Euro	220 V
Opt. A2	United Kingdom	240 V
Opt. A3	Australian	240 V
Opt. A4	North American	240 V
Opt. A5	Switzerland	220 V
Opt. A6	Japan	100 V

Application/Technical Notes

Tektronix has a full library of information to support your needs.

YOU NOW HAVE A FAST, CONVENIENT WAY TO OBTAIN APPLICATION/ TECHNICAL INFORMATION

FROM TEKTRONIX:

- New INFOFax 24 Hour Service. Perfect For Information You Need Immediately.

Application/Technical Notes Available Via FAX

Tektronix is pleased to provide 24 hour automated information service on over 100 of our fine measurement products.

Through your touch tone telephone, follow our voice-prompted selection process and immediately receive application information or specification data directly from your office or home fax machine.

This new service reflects our commitment to deliver top value to you in all our products and services.

CALL INFOfax AT: 1-800-835-7732

Products with Application/Technical Notes available through INFOfax service:	**To Receive: Call INFOfax and**
• Oscilloscopes • Digitizers • Logic Analyzers • Spectrum Analyzers • Telecommunications • Systems • Instrument Controllers/Software • Modular Instruments • Accessories	**SELECT "1" IF YOU KNOW THE DOCUMENT NUMBER FOR PRODUCT** **OR** **SELECT "2" FOR THE DOCUMENT INDEX**

TO ACCESS INFOfax:

1. Call 1-800-835-7732 (from anywhere in the US).
2. Select "1" if you know the document number you wish to receive.
3. Select "2" if you are calling to request our document index.
4. After selecting the information you would like, you will be prompted to enter the fax machine number to which you want information sent.
5. Another prompt will allow you to indicate a phone extension number to ensure delivery of information if you have a multiple users fax machine.
6. In most cases, as soon as you hang up, InfoFax will begin processing your request.

If you prefer personal service, call 1-800-426-2200. At the auto prompt press 3 and a representative will be available to assist you.

Worldwide Sales and Service Offices

For customers in areas not listed, see below for your nearest office.

Customers in Eastern Europe contact:
Rohde & Schwarz
Austria
Sonnleithnergasse 20,
A-1100 Vienna
Phone: 43(1) 6026141-0
FAX: 43(1) 6026141-14

Customers in Near- and Middle East contact:
Rohde & Schwarz
International GmbH
Mühldorfstraße 15,
D-81671 München
Phone: 49(89) 4129-0
FAX: 49(89) 4129-3115

Customers in Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Congo, Djibouti, Equatorial Guinea, Gabon, Guinea, Ivory Coast, Malagasy, Mali, Mauritius, Niger, Senegal, Togo, Zaire contact: Tektronix S.A., France

Customers in Andorra, Angola, Azores, Gibraltar contact: Tektronix Española, S.A., Spain

Customers in Central America and The Caribbean contact:
Wandel & Goltermann & Co.
America Central y El Caribe
P.O. Box 2761, 01901
Guatemala, Guatemala

Customers in unlisted locations contact:
Tektronix, Inc.
Export Sales
P.O. Box 500, M/S 78-562
Beaverton, OR 97077 USA
Phone (in U.S.):
1-800-835-9433 x1916
Phone (outside U.S.):
1 (503) 627-1916
Fax: 1 (503) 627-6905

ALGERIA

(Product Information & Service)

TEKSYSTEM
36 Place Ben Omar
KOUBA
ALGER
Phone: 213 (2) 68.05.28
Fax: Same

(Sales Office)
Tektronix, S.A.
Algeria Sales
ZA de Courtaboeuf, Av du Canada, BP 13
91941 Les Ulis Cédex
France
Phone: 33 (1) 69 86 81 81
FAX: 33 (1) 69 86 82 51
Telex: (842) 604332 TEKOR A

ARGENTINA

(Test and Measurement, Telecom, and TV)

Coasin S.A.
Buenos Aires Office
Virrey del Pino 4071
1430 Buenos Aires
Phone: 54 (1) 552-5248/ 552-3485/ 552-3185
FAX: 54 (1) 11-1427 (International)
551-9361 (Local)

Cordoba Office
25 de Mayo No. 1930
5000 Cordoba
Phone 54 (51) 3037

(Color printers only)

Techex Argentina S.A.
SuiPacha 1380, 6 Piso
Buenos Aires 1011
Phone: 54 (1) 325-5733
FAX: 54 (1) 326-7675

AUSTRALIA

Tektronix Australia Pty. Limited

Sydney
80 Waterloo Road
North Ryde, N.S.W. 2113
Phone: 61 (2) 888-7066
FAX: 61 (2) 888-0125

Adelaide/Northern Territory
128 Gilles Street
Adelaide, South Australia 5000
Phone: 61 (8) 223-2811
FAX: 61 (8) 223-7890

Brisbane/Papua New Guinea
737 Logan Road
Greenslopes Brisbane
Queensland 4120
Phone: 61 (7) 394-1155
Fax: 61 (7) 397-8679

Canberra/A.C.T.
Unit 14
Trevor Pearcy House
Fern Hill
Bruce, Australia
Capital Terr. 2617
Phone: 61 (6) 251-6111
FAX: 61 (6) 251-4509

Melbourne/Tasmania
259 Whitehorse Rd.
Balwyn, Victoria 3103
Phone: 61 (3) 836-3355
FAX: 61 (3) 836-6592

Perth

(Test and Measurement Products)

Control Dynamics
Phone: 61 (9) 275-9700
FAX: 61 (9) 275-9717

(TV Products)

TV Communications
Phone: 61 (9) 249-6688
FAX: 61 (9) 249-6858

(Color Printer Products)
Phone: (800) 811-177
FAX: 61 (2) 888-0131

(Test and Measurement/ Printer Service)
Phone: 61 (9) 370-2177
FAX: 61 (9) 370-3959

AUSTRIA

Tektronix Ges.m.b.H.
Doerenkampgasse 7
A-1100 Vienna, Austria
Phone: 43(1) 68-66-02-0
FAX: 43(1) 68-66-00
Telex: (847) 111481 TEK A

BAHRAIN

Rohde & Schwarz International GmbH
Mühldorfstraße 15,
D-81671 München
Phone: 49(89) 4129-0
FAX: 49(89) 4129-3115
Telex: 523703-20 rsd

BELGIUM

Tektronix nv/sa
Brussels Office
Bedrijfspark Keiberg
Excelsiorlaan, 3
1930 Zaventem
Phone: 32(2) 725-96-10
FAX: 32(2) 725-99-53
Telex:
(846) 26713 TEKBEL B

BOLIVIA

Coasin Bolivia S.R.L.
Ayacucho 208.5° piso
Casilla 7265
La Paz - Bolivia
Phone: 591 (2) 317545, 317237, 317173, 317531
FAX: 591 (2) 317545, 359268

BRAZIL

Tektronix Industria e Comercio Ltda

São Paulo Head Office
Av. das Naçoes Unidas, 13797 Bloco III
04794-000-São Paulo, SP
Brazil
Phone: 55 (11) 543.1911
FAX:
55 (11) 542.0696 (Sales)
55 (11) 535-5708 (Service)

Rio de Janeiro Office
RUA JURUPARI 20
TIJUCA
20520-110
Rio de Janeiro, RJ
Phone : 55(21) 567-1428
FAX: 55(21) 254-4026

(Network Display Products)
Prolan Sistemas Integrados (TDA)
Rua Agostino Togneri, 92
4690-090 São Paulo/SP
Brazil
Phone: 55-11-548-6555
Fax: 55-11-524-3923

BULGARIA

REA-Service Co.
39, Fridtjof Nansen Blvd.
BG-1000 SOFIA
Phone: 359/2/652443
FAX: 359/2/656833

CANADA

Tektronix Canada Inc.

Montreal
890 Selkirk Street
Pointe Claire,
Quebec H9R 3S3
Phone: (514) 697-5340
FAX: (514) 697-5205

Ottawa
555 March Road
Kanata, Ontario K2K 2M5
Phone: (613) 599-4511
FAX: (613) 599-4513

Toronto/Western Canada
785 Arrow Road
Weston, Ontario M9M 2L4
Phone: (416) 747-5000
FAX: (416) 747-9799

Vancouver
4175 Dawson Street
Burnaby, B.C. V5C 4B3
Phone: (800) 661-5625, (604) 291-1222
FAX: (800) 661-8994

Alberta and Saskatchewan
Phone: (800) 661-5625
FAX: (800) 661-8994

Maritimes:
Phone: (800) 267-7016
FAX: (613) 599-4513

TekDirect
Test and Measurement Telesales Order Desk
Toll Free Voice:
(800) 268-4835
Toll Free FAX:
(800) 661-8994
Local Voice:
(416) 747-5000
Local FAX:
(416) 747-9799

CARIBBEAN AND CENTRAL AMERICA

(Test and Measurement, TV, and Telecom)

Wandel and Goltermann and Co.
America Central y El Caribe
6A Calle 6-38 Zona 9
Edificio Tivoli Plaza, Of. 507
Guatemala, Guatemala
Phone: 502 (2) 318 065
FAX: 502 (2) 318 682

(Color Printer Products)

Berges et Company, Inc.
1272 NE Business
Park Place
Jensen Beach, FL 34957
USA
Phone: (407) 334-8484
Fax: (407) 334-2773

CHILE

(Test and Measurement, TV, and Telecom)

AVANTEC LTDA.
Fidel Oteiza 1921 of. 1106
Providencia
Santiago, Chile
Phone: 56 (2) 341-1021
Fax: 56 (2) 341-1020

(Color Printer Products)

Instrumentos Para La Inteligencia (IPI)
Calderon 125
Santiago, Chile
Fax: 56 (2) 235-3302

Impresión Uno
M. Barros Borgono 393
Providencia
Santiago, Chile
Phone: 56 (2) 235-1190
Fax: 56 (2) 235-3612

(Network Display Products)

Incom S.A.
Av. Pedro de Valdivia
No. 800
Santiago
Phone: 56 (2) 233-9935
Fax: 56 (2) 234-1107

Worldwide Sales and Service Offices

CHINA

(See People's Republic of China)

COLOMBIA

Selectronica, Ltda.
Carrera 71 #55-98
Mail:
Apartado Aereo 25124
Santafé de Bogota, D.C.
Phone: 57 (1) 263-1220, 295-3215
FAX: 57 (1) 263-2874

COMMONWEALTH OF INDEPENDENT STATES

Rohde & Schwarz International GmbH
Mühldorfstraße 15,
D-81671 München
Phone: 49(89) 4129-0
FAX: 49(89) 4729 3669
Telex: 523703-20 rsd

CROATIA

Distributor:
Tescom
Gunduliceva 41
CRO-41000 Zagreb
Phone: 385 (41) 417080
FAX: 385 (41) 442273

Local Service Representative:
TES
Gunduliceva 41
CRO-41000 Zagreb
Phone: 385 (41) 417080
FAX: 385 (41) 442273

CYPRUS

Chris Radiovision Ltd.
23, Crete Str.
P.O. Box 1989
Nicosia, CYPRUS
Phone: 357(2) 466121
FAX: 357(2) 365177
Telex: 605 2395 (8680)

CZECH REPUBLIC AND SLOVAK REPUBLIC

Zenit s.r.o.
Podkaslany 3
CZ-160 00 Praha 6
Phone:
42/2/341272/341280
FAX: 42/2/328841

DENMARK

Tektronix A/S
Literbuen 7
DK-2740 Skovlunde
Phone: 45 (44) 53 54 55
FAX: 45 (44) 53 07 55

ECUADOR

(Measurement, TV and Telecom Products)

Proteco Coasin Cia Ltda.
Quito Office
12 de Octubre 2449 y Orellana
Casilla 7-03-228A Quito
Phone: 593 (2) 52-6759, 52-9684
FAX: 593 (2) 56-1980

(Measurement and Telecom Products)

Guayaquil Office
Proteco Coasin Cia Ltda.
Miraflores Av. Principal 204 y Calle Segunda
Guayaquil, Ecuador
Phone: 593 (4) 201529

(TV Products)

Guayaquil Office
Electrolab Ltda.
Av. Juan Tanca Morengo #200
PO Box 09-01-1233
Guayaquil, Ecuador
Phone: 593 (4) 291456
Fax: 593 (4) 286602

EGYPT

Giza Systems Engineering Co.
2, El Mesaha Sq.
DOKKI, A.R.E.
P.O. Box 1913
CAIRO 11511
Phone: 20 (2) 3490140
FAX: 20 (2) 3609932
Telex: 93644 ALKAN UN

FINLAND

Tektronix Oy
Larin Kyöstin tie 4,
FIN-00650 Helsinki
Phone: 358 (0) 7282 400
FAX: 358 (0) 7520 033

FRANCE

Tektronix S.A.
Orsay
ZAC de Courtaboeuf
6, rue de la Terre de feu
B.P. 13 – 91941 LES ULIS Cedex
FRANCE
Phone: 33 (1) 69 86 81 81
FAX: 33 (1) 69 07 09 37
Telex: (842) 604332 TEKOR A

After Sales Service – France
ZAC de Courtaboeuf
4 Av. du Canada, B.P. 13
91941 LES ULIS Cedex 3
FRANCE
Phone: 33(1) 69 86 81 81
FAX: 33(1) 69 07 09 37

Aix-en-Provence Region Center
Immeuble Tertia 1
Zone Industrielle
13851 Aix-en-Provence Cedex 3
Phone: 33 (16) 42 24 45 03
FAX: 33 (16) 42 24 41 20
Telex: (842) 440045

Lyon Region Center
Les Jardins d'Entreprise
213 rue de Gerland, Bât. F1
69007 LYON
Phone: 33 (16) 78 58 15 38
FAX: 33 (16) 78 69 52 55
Telex:
(842) 300150 TEKLYON

Rennes Region Center
rue de la Rigourdière
35510 Cesson Sévigné
Phone: 33 (16) 99 83 40 40
FAX: 33 (16) 99 83 36 23

Strasbourg Region Center
Parc d'Activités des Tanneries
2a, Route de la Rivière
67380 Lingolsheim
Adresse postale:
BP 98
67833 Tanneries Cedex
Phone: 33 (16) 88 76 15 45
FAX: 33 (16) 88 76 09 89

Toulouse Region Center
Peri-Sud 2, Z.I. du Palays
13 Rue Villet Bat. 1
31400 Toulouse
Phone: 33 (16) 62 16 64 00
FAX: 33 (16) 61 34 84 52
Telex:
(842) 530243 TEKTOUL F

GERMANY, FEDERAL REPUBLIC OF

Tektronix GmbH

Cologne Office
Colonia Allee 11
51067 Köln
Postfach 103634
50476 KOLN
Phone: 49 (221) 9 69 69-0
FAX:
49 (221) 9 69 69-78/-362

Berlin Office
Ernst-Reuter-Platz 3-5
10587 Berlin
Tel: 49 (30) 31 59 05-0
FAX: 49 (30) 31 33-132

Deutschland Office
Grass Valley Group
Mainzer Strasse 19
65185 Wiesbaden
GERMANY
Tel: 49 (611) 360 920
FAX: 49 (611) 360 926-6
Email hub: COLO

Karlsruhe Office
Neureuter Straße 37a-b
76163 Karlsruhe
Postfach 21 13 62
Tel: 49 (721) 79 08-0
FAX: 49 (721) 79 08-300

Munich Office
Fraunhoferstrabe 9-11
85737 Ismaning
Phone: 49 (89) 96 24 05-0
FAX: 49 (89) 96 25 0550

GREECE

Mercury Ltd.
6, Loukianou Str.
GR-10675 Athens
Phone: 30(1) 3633834
FAX: 30(1) 3645885
Telex: 214887 (merc gr)

HONG KONG

Tektronix

Hong Kong, Ltd.
22nd Floor,
Dah Sing Financial Ctr
108 Gloucester Road
Wanchai, Hong Kong
Phone: (852) 598 6188
FAX: (852) 598 6260
Cable: TEKHKGLTD

HUNGARY

Rohde & Schwarz
Budapesti Iroda
Etele ut. 68
H-1115 Budapest XI
Phone: 36/1/1850835
FAX: 36/1/1850835

INDIA

Hinditron Tektronix Instruments, Ltd.

Bangalore Office
No. 5, Crescent Rd
Highgrounds
Bangalore 560 001
Phone: 91 (80) 2265470/ 2265471/ 2263474
FAX: 91 (80) 2260669

Bombay Office
17-B Mahal Estate
Mahakali Road
Andheri East
Bombay 400 093
Phone: 91 (22) 837-0013/ 837-0088
Fax: 91 (22) 837-0087

Calcutta Office
Castle House, 5th Floor,
5/1-A, Hungerford Street,
Calcutta 700 017
Phone: 91 (33) 247-9094, 247-6844, 247-2049
FAX: 91 (33) 2400194

Madras Office
15 Harrington Road
Chetpet Road
Madras 600 031
Phone: 91 (44) 8261286/ 8269480
FAX: 91 (44) 8259954

New Delhi Office
201-206 Hemkunt Tower
98, Nehru Place
New Delhi 110 019
Phone: 91 (11) 641-0380, 644-3375, 644-8954
FAX: 91 (11) 642-9118

Secunderabad Office
5th Floor, Emerald House
114 Sarojini Devi Road
Secunderabad 500 003
Phone: 91 (40) 844033, 814742, 847007
FAX: 91 (40) 841697

INDONESIA

(Test and Measurement, TV, Telecom)

Mecomb Tehnik
Bldg. #304
Cilandak Commercial Estate
Jl. Cilandak KKO
P.O. Box 7588/CCE
Jakarta 12560
Phone: 62 (21) 780-8008
FAX: 62 (21) 780-1040

(Color Printer Products)

INMAC PT
Indo Permai Citradata
Delta Bldg., Block A34-36
Jl. suryopranoto No. 1-9
Jakarta 10011
Phone:
62 (21) 374372, 377443
FAX: 62 (21) 345-9737

IRAN

Rohde & Schwarz International GmbH
Mühldorfstraße 15,
D-81671 München
Phone: 49(89) 4129-0
FAX: 49(89) 4129-3115
Telex: 523703-20 rsd

ISRAEL

Eastronics Ltd
11 Rozanis Street
Mail:
P.O. Box 39300
Tel Aviv 61392
Phone: 972 (3) 645-8777
FAX: 972 (3) 645-8666

ITALY

Tektronix S.p.A.

Milan
Via Lampedusa 13
20141 Milan
Phone: 39(2) 84441
FAX: 39(2) 8950-0665
Telex:
(843) 315217 TEKMIL I

Rome
Piazza Antonio Baldini 45
00141 Rome
Phone: 39 (6) 827-8041, 827-1039
FAX: 39 (6) 868-91546
Telex:
(843) 616018 TEKROM I

Turin
Via Cardinal M. Fossati 5
10141 Turin
Phone: 39 (11) 385-1143, 385-2163, 385-4086
FAX: 39 (11) 3352783
Telex:
(843) 212543 TEKTOR I

JAPAN

Sony/Tektronix Corporation Headquarters
9-31, Kitashinagawa 5
Shinagawa-ku
Tokyo 141
Mail: P.O. Box 5209
Tokyo Int'l, Tokyo 100-31
Phone: 81(3) 3448-4611
FAX: 81(3) 3444-0318
Telex:
(781) 2422850 STTYO J

Atsugi
Pastoral Bldg
1-8-6 Asahi-cho
Atsugi 243
Phone: 81 (462) 28-6768
FAX: 81 (462) 28-8043

Chiba
Taiso Center Bldg.
2-7-2 Shinchiba
Chiba 260
Phone: 81 (43) 242-1911
FAX: 81 (43) 242-2291

Fukuoka
Nihon Seimei
Hakataekimae Bldg.
2-1 Hakataekimae-3,
Hakata-ku
Fukuoka 812
Phone: 81 (92) 472-2626
FAX: 81 (92) 472-2627

Hiroshima
HIROSHIMA INTES
10-10 Hashimoto-cho
Naka-ku, Hiroshima 730
Phone: 81 (82) 222-7221
FAX: 81 (82) 222-7225

Worldwide Sales and Service Offices

Kyoto
Recruit Meijiseimei Bldg.
Karasumaoike
Nakagyo-ku
Kyoto 604
Phone: 81 (75) 212-2990
FAX: 81 (75) 212-2993

Matsumoto
Design Center Bldg.
Shimadate 1095-1
Matumoto 390
Phone: 81 (263) 48-2211
FAX: 81 (262) 48-2110

Nagoya
Sanko Building
21-7 Meieki 3-Chome,
Nakamura-ku
Nagoya 450
Phone: 81 (52) 581-3547
FAX: 81 (52) 563-7637

Omiya
Omiya Sawada Building
1-12-5 Sakuragicho
Omiya 331
Phone: 81 (48) 646-0711
FAX: 81 (48) 646-0859

Osaka
Osaka Ohbayashi Building
4-33 Kitahama-Higashi
Chuo-ku, Osaka 540
Phone: 81 (6) 947-0321
FAX: 81 (6) 941-3861

Sendai
Sendai NS Building
2-25 Ichibancho-1
Aoba-ku, Sendai 980
Phone: 81 (22) 267-2181
FAX: 81 (22) 262-3290

Tama
2-45-10 Fujimidai
Kunitachi, Tokyo 186
Phone: 81 (425) 73-2111
FAX: 81 (425) 73-2170

Tsuchiura
Sumitomo Seimei
Tsuchiura Bldg.
16-12 Sakuracho-1
Tsuchiura 300
Phone: 81 (298) 24-2602
FAX: 81 (298) 24-2606

Yokohama
Dai-ichi Yamashitacho
Bldg.
74-1 Yamashitacho
Naka-ku, Yokohama 231
Phone: 81 (45) 661-3511
FAX: 81 (45) 661-3519

JORDAN

Mideast Data Systems (MDS)
Ahmed Bin Ghannoum
Bldg.
Salam Street
P.O. Box 7899
Abu Dhabi
UNITED ARAB EMIRATES
Phone: 971(2) 213 000
FAX: 971(2) 213 741
Telex:
(893) 24325 MDSUAEEM

TekSignals – MDS
P.O. Box 7899
Abu Dhabi
UNITED ARAB EMIRATES
Phone: 971-2-343401
FAX: 971-2-327069
Telex: 24325 MDSUAE EM

KOREA, REPUBLIC OF

(Test and Measurement, TV, Telecom)

CSC, INC.

Seoul Office
Tektronix Korea, Ltd.
13th Floor, I1 – Song Bldg.
157-37 Samsung-Dong,
Kangnam-Gu
Seoul 135-090
KOREA
Phone: 82 (2) 528-5299
FAX: 82 (2) 528-5377
Service Center
Phone: 82 (2) 528-4664

Kumi Office
462-2, Songjeong-Dong,
Kumi City
Kyoungbuk Province,
Korea
Phone: (546) 456-0966
FAX: (546) 456-9005

Taejon Office
1009, Yusung Hyundai,
Resortel
535-6, Bongmyoung-
Dong,
Yusung-Gu,
Taejon City, Korea
Phone: (42) 822-6701
FAX: (42) 822-9488

(Color Printer Products and Network Display Products)
Myoung System, Inc.
2/F, Chungrok Bldg.
721-29, Yeoksam-Dong
Kangnam-ku
Seoul, 135-080
Phone: 82 (2) 538-9942
FAX: 82 (2) 552-9948

(Service, All Products)
Tektronix Korea, Ltd.
13F., Ilsong Bldg.
157-37 Samsung-Dong
Kangnam-Gu
Seoul 135-090, KOREA
Phone: 82 (2) 528-5299
FAX: 82(2) 528-5377

KUWAIT

Tareq Company Ltd.
P.O. Box 20506
13066, Safat, Kuwait
Phone: 965 () 243-6045
FAX: 965 () 243 7700
Telex:
(496) 22315 ZUAITER KT

LEBANON

Mideast Data Systems (MDS)
Ahmed Bin Ghannoum
Bldg.
Salam Street
P.O. Box 7899
Abu Dhabi
UNITEDARAB EMIRATES
Phone: 971(2) 213 000
FAX: 971(2) 213 741
Telex:
(893) 24325 MDSUAEEM

TekSignals – MDS
P.O. Box 7899
Abu Dhabi
UNITED ARAB EMIRATES
Phone: 971-2-343401
FAX: 971-2-327069
Telex: 24325 MDSUAEEM

MALAYSIA

TekMark Sdn. Bhd.
No.1 Jalan PJS 10/32
Bandar Sri Subang,
46000 Petaling Jaya,
Selangor Darul Ehsan,
Malaysia
Phone: 60 (3) 731-6858
FAX: 60 (3) 731-6857

Penang Office
No. 46, 1st Floor,
Jalan Tengah,
11950 Bayan Baru,
Penang, Malaysia
Phone: 60 (4) 641-4298
FAX: 60 (4) 641-4299

MALTA

Rohde & Schwarz International GmbH
Mühldorfstraße 15,
D-81671 München
Phone: 49(89) 4129-0
FAX: 49(89) 4129-3115
Telex: 523703-20 rsd

MEXICO

Tektronix S.A. de C.V.
Viena 71, 1° Piso
Col. El Carmen, Coyoacan
04100 Mexico, D.F.
Phone: 52(5) 659-4986/
659-7080
FAX: 52(5) 658-7982

(Color Printers Only)

Mexico City Office:
Crayona S.A. de C.V.
Av. Mexico No. 99-402
Col. Condesa CP 06170
Mexico D.F.

Monterrey Office:
Intertec de Mexico,
S.A. de C.V.
Avenida San Jeronimo 960
Monterrey, NL: Mexico
64640
Phone: 52 (83) 33-6622,
46-1040
Fax: 52 (83) 33-0744

MOROCCO

(All products except CGG)

Tradec-Signal
Place Khaibar
Angle Bd de la Gironde et
Rue d'Ifni
Casablanca 03
Phone: 212 (2) 24 85 43
FAX: 212 (2) 24 85 66
Telex: 25992

THE NETHERLANDS

Tektronix Europe
Planetenweg 87
2132 HL Hoofddorp
Mail: P.O. Box 406
2130 AK Hoofddorp
Phone: 31(2503) 65265
FAX: 31(2503) 23444
Telex:
(844) 74898 TEKSO NL

NEW ZEALAND

Datamatic Networks, Ltd. Wellington Office
Level 2 Siemens House
265 Wakefield Street
PO Box 11-692
Wellington, New Zealand
Phone: 64 (4) 384-7792
Fax: 64 (4) 384-7334

Auckland Office
21 William Pickering Dr.
North Harbour Industrial
Estate
Albany, Auckland
Mail: P.O. Box 33-326
Takapuna, Auckland
Phone: 64 (9) 415-6928
FAX: 64 (9) 415-6939

NORWAY

Tektronix Norge A/S
Trondheimsveien 436 B
Postboks 95 Grorudhagen
0905 OSLO 9
Phone: 47(22) 165 050
FAX: 47(22) 165 052

OMAN, SULTANATE OF

Mideast Data Systems (MDS)
Ahmed Bin Ghannoum
Bldg.
Salam Street
P.O. Box 7899
Abu Dhabi
UNITED ARAB EMIRATES
Phone: 971(2) 213 000
FAX: 971(2) 213 741
Telex:
(893) 24325 MDSUAEEM

TekSignals – MDS
P.O. Box 7899
Abu Dhabi
UNITED ARAB EMIRATES
Phone: 971-2-343401
FAX: 971-2-327069
Telex: 24325 MDSUAE EM

PAKISTAN

Pakland Corporation (Pvt) Ltd.
Zull Jalal Centre
Main Tariq Road
PECH Society
Karachi 75400
Pakistan
Phone: 92 (21) 453-4205,
455-5915, 44-4207
Fax: 92 (21) 455-5384

PEOPLE'S REPUBLIC OF CHINA

Tektronix China, Ltd. Beijing Office
Room 701
7th Floor, Office Building
New Century Hotel
6 Shoudutiyuguan
South Road
Beijing, P.R.C.
Phone: 86 (1) 834-7657,
849-2340, 849-2344
FAX: 86 (1) 834-7502
Telex:
(716) 221095 NCH CN

Tektronix Asia Southeast Hong Kong
22nd Floor,
Dah Sing Financial Ctr
108 Gloucester Road
Wanchai, Hong Kong
Phone: (852) 598 6188
FAX: (852) 598 6260
Telex:
(780) 77708 DCBIA HX
Cable: TEKHKGLTD

Shanghai Office
Room 614/616,
Shanghai Convention
Centre
500 Zhao Jian Bang Road
Shanghai P.R.C.
Phone: 86 (21) 471-0330
FAX: 86 (21) 471 0282

Asia Support Group U.S. Office
P.O. Box 500, M/S 78-565
Beaverton, Oregon 97077
U.S.A.
Phone: (503) 627-6563
FAX: (503) 627-6611
Telex: 192825
Delivery: 78-565

PERU

Importaciones y Representaciones Electronicas S.A. (IRE Ingenieros)
Jr. Pumacahua 955
Jesus Maria
Lima 11, Peru
Phone: 51 (14) 23-5099
FAX 51(14) 31-0707

Worldwide Sales and Service Offices

PHILIPPINES

Philippine Electronic Industries, Inc.
Tito Jovy Building #2,
Buencamino Street, Alabang
Muntinlupa, Metro Manila.
Phone: 63 (2) 842-5443,
63 (2) 805-7455
Fax: 63 (2) 802-3518

(Color Printers Only)

Distributed Processing Systems, Inc. (DPSI)
Don Chua Lamko Bldg.
H V dela Costa corner
Alfaro Sts
Salcedo Village, Makati,
Metro Manila
Phone: 63 (2) 818-9640,
818-9646, 818-9343
FAX: 63 (2) 817-4804
Telex: (742) 66284 DPSI PN

(TV Products Only)

Broadcast and Communication Company of Asia, Inc.
19th Floor, Strata 100 Bldg.
Emerald Ave.,
Ortigas Center
Pasig, Metro Manila
Phone: (632) 633-6822,
633-6162
FAX: (632) 633-6823

POLAND

Rohde & Schwarz
Oddział w Warszawie
ul. Stawki 2
PL-00-193 Warszawa
Phone: 48/2/6350687
FAX: 48/2/6353544

Local Service Representatives:

RSM SERVICE
ul. Tarnogajska 11/13
PL-50-950 Wroclaw
Phone: 48/71/673893
FAX: 48/71/673893
Telex: 863/712357

Tespol
ul. Tarnogajska 11/13
PL-50-950 Wroclaw
Phone: 48/71/673893
FAX: 48/71/673893

PORTUGAL

Decada Equipamentos de Electronica e Cientificos, SA
Rua Margarida Palla, 11 B
Miraflores/Alges
1495 Lisbon
Phone: 351 (1) 410-3420
FAX: 351 (1) 410-1844
Telex: (832) 15515 ESPEC P

QATAR

Mideast Data Systems (MDS)
Ahmed Bin Ghannoum Bldg.
Salam Street
P.O. Box 7899
Abu Dhabi
UNITED ARAB EMIRATES
Phone: 971(2) 213 000
FAX: 971(2) 213 741
Telex:
(893) 24325 MDSUAEEM

TekSignals – MDS
P.O. Box 7899
Abu Dhabi
UNITED ARAB EMIRATES
Phone: 971-2-343401
FAX: 971-2-327069
Telex: 24325 MDSUAE EM

ROMANIA

Tektronix Representation Office Bucharest
Str. Uranus 98
Sc 2, Et 5, Ap. 36
R-76102 Bucuresti, Sector 5
Phone: 40/1/6316878
FAX: 40/1/3122013

Local Service Representative: Vega Electronics SRL
Str. Alexandra cci Bun 14
BL T22, Ap.1
R-72238 Bucursti, Sector 2
Phone: 40/1/6556764
FAX: 40/1/6556764
Telex: 865/10076

SAUDI ARABIA

Electronic Equipment Marketing Co. (EEMCO)
P.O. Box 3750
11481 Riyadh
Phone: 966 (1) 477 1650
FAX: 966 (1) 478 5140
Telex:
(928) 401120 ZUHAIR SJ

Rohde & Schwarz International GmbH
Mühldorfstraße 15,
D-81671 München
Phone: 49(89) 4129-0
FAX: 49(89) 4129-3115
Telex: 523703-20 rsd

TekSignals – MDS
P.O. Box 7899
Abu Dhabi
UNITED ARAB EMIRATES
Phone: 971-2-343401
FAX: 971-2-327069
Telex: 24325 MDSUAE EM

SINGAPORE

Mecomb Singapore Ltd.
Sime Darby Centre
896 Dunearn Road, 04-02
Singapore 2158
Phone:
(65) 469-8833, 468-0978
FAX: (65) 467-1905

Tektronix Singapore Pte. Ltd.
21 Collyer Quay, #17-02A
Hong Kong Bank Building
Singapore 0104
Phone: (65) 227-5793
FAX: (65) 227-6397

SLOVENIA

Sales Office: Rohde & Schwarz
Repräsentanz
Langusova 8
SLO-61000 Ljubljana
Phone: 386/61/272577
FAX: 386/61/262882
Distributor: Commerce p.c.
Einspielerjeva 6
SLO-61109 Ljubljana
Phone: 38/61/329265
FAX: 38/61/329171

Local Service Representative: TMM Servis
C.V.Gorice 38
SLO-61000 Ljbljana
Phone: 38/61/264066
FAX: 38/61/264066

SOUTH AFRICA

(Measurements, TV and Telecom Products)

Protea Technology Ltd. Johannesburg Office
26 6th Street
Wynberg, Sandton 2090
Mail: Private Bag X19
Bramley 2018
Transvaal
Phone: 27 (11) 786-3647
FAX: 27 (11) 786-3789

Capetown
1st Floor, Avalon I
123 Hope Street
Gardens, 8001
Phone: 27 (21) 457 104
FAX: 27 (21) 461 0019

Durban Office
Suite No. 6, Upminster
Essex Gardens,
Nelson Road
Westville 3630
Mail: PO Box 1375
Wandsbeck 3631
Phone; 27 (31) 86-6324
FAX: 27 (31) 86-1938

(Color Printer Products)

Square One Investments (Pty) Ltd.
First Floor, Eastgate Park
8 Commerce Crescent
West
Eastgate Ext 13, Sandton
Mail: PO Box 1163
Gallo Manor 2052
Republic of South Africa
Phone: 27 (11) 444-7716
Fax: 27 (11) 444-6650

SPAIN

Tektronix Española S.A. Madrid
C/Procion, 1-3
La Florida
28023 Madrid
SPAIN
Phone: 34 (1) 372 6000
FAX: 34 (1) 372 6049
Telex: (831) 46014 TKME E

Barcelona
C/Tarragona, 141-157
08015 Barcelona
Phone: 34 (3) 425.3911
FAX: 34 (3) 424.6607

SRI LANKA

Megatech (Pvt) Ltd.
No. 85 Braybrooke Place
Colombo 2
Sri Lanka
Phone: 94 (1) 4379402/
437797
FAX: 94 (1) 448980

SWEDEN

Tektronix AB Stockholm
Adolfsbergsvägen 31
Mail: Box 20085,
S-161 02 Bromma
Phone: 46 (8) 629 6500
FAX: 46 (8) 629 6540

SWITZERLAND

Tektronix International A.G.
Gubelstrasse 11
Mail: P.O. Box 2142
CH-6300 Zug 2
Phone: 41(42) 219192
FAX: 41(42) 217784
Telex:
(847) 11481 TEKA

SYRIA

TekSignals - MDS
P.O. Box 7899
Abu Dhabi
UNITED ARAB EMIRATES
Phone: 971-2-343401
FAX: 971-2-327069
Telex: 24325 MDSUAE EM

TAIWAN

Tektronix Taiwan, Ltd Taipei
6th Floor, CDC Tower
125 Nanking East Rd, Sec 5
P.O. Box 36-659
Taipei 10572, Taiwan
Phone: 886 (2) 765-6362
FAX: 886 (2) 767-4360

Kaohsiung Office
18F., No. 12 Po-Ai 3 Road
Kaosiung
Phone: 886 (7) 345-8251
Fax: 886 (7) 345-8165

THAILAND

Dynamic Supply Engineering R.O.P.
12 Soi Ekamai 2
Ekamai (Sukhumvit 63)
Bangkok 10110
Phone: 66 (2) 392-5313
(8 Lines)
FAX: 66 (2) 381-1467

(Color Printers Only)

Comgraph Co., Ltd.
139 Setthiwan Bldg.,
4th Floor
Pan Road, Silom
Bangkok 10500
Thailand
Phone: (662) 266-6184,
266-6185
FAX: (662) 266-6188

(Color Printers Only)

The Value Systems Co., Ltd.
7th Floor, Central Chidlom
Tower
22 Soi Somkid,
Ploenchit Rd., Pathumwan
Bangkok 10330
Phone: 66 (2) 254-7088
FAX: 66 (2) 254-7087

TUNISIA

Societe El Eslek
3 Rue de la Monnaie
1001 Tunis
Phone: 216 (1) 244372
FAX: 216 (1) 342003
Telex:
(934) 13664 ESLEK TN

TURKEY

Inter Mühendislik Danismanlik Ve Ticaret A.S.
Hasircibasi
Caddesi No. 55
TR-81310 Kadiköy-Istanbul
Phone: 90 (1) 349 9400
FAX: 90 (1) 349 9430
Telex:
(821) 29245 INMD TR
Kizkulesi Sokak 36/3-4
G.O. Pasa 06700 Ankara
Phone: 90(4) 436 4422
FAX: 90(4) 436 4493
Telex: (821) 46780

UNITED ARAB EMIRATES

Mideast Data Systems (MDS)
Ahmed Bin Ghannoum Bldg.
Salam Street
P.O. Box 7899
Abu Dhabi
Phone: 971(2) 213 000
FAX: 971(2) 213 741
Telex:
(893) 24325 MDSUAE EM

TekSignals – MDS
P.O. Box 7899
Abu Dhabi
UNITED ARAB EMIRATES
Phone: 971-2-343401
FAX: 971-2-327069
Telex: 24325 MDSUAE EM

UNITED KINGDOM

Tektronix U.K. Limited
Fourth Avenue
Globe Park
Marlow, Bucks SL7 1YD
Phone: 44 (1628) 403300
FAX: 44 (1628) 403301
GVG
Phone: 44 (1628) 403699
FAX: 44 (1628) 403698
Telex:
(851) 847277, TEKMARG
(851) 847378, TEKMARG

UNITED STATES

ALABAMA

Huntsville
4970 Corporate Drive
Suite 100A
Huntsville 35805
Phone: (205) 830-9212
Fax: (205) 837-2666

ALASKA

Served by Seattle, Washington Field Office
Phone: (800) 237-9514
For Orders:
(800) 835-3553

ARIZONA

Phoenix
3015 S. 48th Street
Suite 100
Tempe 85282
Phone: (602) 438-1011
Toll Free: (800) 366-8358
Fax: (602) 437-9210
For Orders:
(800) 538-8125

CALIFORNIA (NORTH)

Santa Clara
3003 Bunker Hill Lane
Santa Clara 95054
Phone: (408) 496-0800
Fax: (408) 988-6051
For Orders:
(800) 538-8125
Mailing Address:
P.O. Box 58086
Santa Clara 95052-8086

CALIFORNIA (SOUTH)

Irvine
17052 Jamboree Rd.
Irvine 92714
Phone: (714) 660-8080
Toll Free: (800) 255-2958
Fax: (714) 474-1490
Mailing Address:
P.O. Box 19523
Irvine 92713
For Orders:
(800) 538-8125

Los Angeles
21300 Erwin Street
Woodland Hills 91367
Phone: (818) 999-1711
Toll Free: (800) 404-1170
Fax: (818) 340-9840
Mailing Address:
P.O. Box 8500
Woodland Hills 91365
For Orders:
(800) 538-8125

Worldwide Sales and Service Offices

COLORADO

Denver
61 Inverness Drive East
Suite 206
Englewood 80112
Phone: (303) 799-1000
Fax: (303) 790-4754
Toll Free: (800) 543-6097

DISTRICT OF COLUMBIA

See Maryland

FLORIDA

Orlando
151 Southhall Lane
Suite 170
Maitland 32751
Phone: (407) 660-2727
Fax: (407) 660-8585

Pensacola
1101 Gulf Breeze Pky. #211
Gulf Breeze 32561
Phone: (904) 932-4080
Fax: (904) 932-5642

GEORGIA

Atlanta
6625 The Corners Parkway
Suite 120
Norcross 30092
Phone: (404) 449-4770
Fax: (404) 449-0358

HAWAII

Honolulu
Served by the Santa Clara, California Field Office
For Orders:
(800) 538-8125

IDAHO

Served by Seattle, Washington Field Office
Phone: (800) 237-9514
For Orders:
(800) 835-3553

ILLINOIS

Chicago
5350 Keystone Court
Rolling Meadows 60008
Phone: (708) 259-7580
Fax: (708) 259-8388
Service Fax:
(708) 259-1394
Toll Free: (800) 458-7587

INDIANA

Indianapolis
Served by the Chicago, Illinois Field Office
Phone: (800) 458-7587

IOWA

Served by the Chicago, Illinois Field Office
Phone: (800) 458-7587

KENTUCKY

Served by the DC, Maryland Field Office.
Phone Toll Free:
(800) 545-2712

MARYLAND

DC
700 Professional Drive
Suite A
Gaithersburg 20879-3499
Phone: (301) 948-7151
Fax: (301) 921-9273
Mailing Address:
P.O. Box 6026
Gaithersburg 20884-6026
Service: (301) 948-6316
Service Fax:
(301) 926-4329
Toll Free Sales:
(800) 545-2712
Toll Free Service:
(800) 962-9738

MASSACHUSETTS

Boston
125 Hartwell Avenue
Lexington 02173
Phone: (617) 861-6800
Fax: (617) 863-5994
Toll Free (800) 545-8408

MICHIGAN

Detroit
39555 Orchard Hill Place
Dr., Suite 525
Novi 48375
Phone: (810) 348-9070
Fax: (810) 348-4819

MINNESOTA

St Paul
2685 Long Lake Road
Roseville 55113
Phone: (612) 635-0520
Fax: (612) 635-0716

MISSOURI

St. Louis
12400 Olive Blvd.
Suite 555
St. Louis 61341-5439
Phone: (314) 275-4474
Fax: (314) 569-1061

MONTANA

Served by Seattle, Washington Field Office
Phone: (800) 237-9514
For Orders:
(800) 835-3553

NEVADA

Served by the Santa Clara, California Field Office
For Orders:
(800) 538-8125

NEW JERSEY

Woodbridge
40 Gill Lane
Woodbridge 07095
Phone: (908) 636-8616
Fax: (908) 636-7234

NEW MEXICO

Albuquerque
6100 Uptown Blvd., NE
Suite 640
Albuquerque 87110
Phone: (505) 884-2828
Fax: (505) 888-3558

Los Alamos
127 Eastgate Drive
Suite H
Los Alamos 87544
Phone: (505) 662-6960

NEW YORK

Albany
125 Wolf Road
Suite 503-7
Albany 12205
Phone: (518) 458-7291
Fax: (518) 458-7361

Long Island
425 Broad Hollow Road,
Suite 231
Melville 11747
Phone: (516) 249-8833
Fax: (516) 249-4411

Rochester
1160 Pittsford-Victor
Road, Suite C
Pittsford 14534
Phone: (716) 383-0070
Fax: (716) 383-0022

NORTH CAROLINA

Raleigh
2950 Gateway Centre Blvd.
Morrisville 27560
Phone: (919) 481-3800
Fax: (919) 469-8823

NORTH DAKOTA

Served by the St. Paul, Minnesota Field Office
Phone: (612) 635-0520

OHIO

Cleveland
Served by the Gaithersburg, Maryland Field Office
Phone: (301) 948-7151

Dayton
3131 Newmark Drive
Suite 206
Miamisburg 45342
Phone: (513) 438-1166
Fax: (513) 438-1106

OREGON

Portland
Mailing Address:
Portland Sales
M/S 50-PTLD
P.O. Box 500
Beaverton 97077
Shipping Address:
Portland Sales
M/S 50-PTLD
Regional Distr. Ctr.
Beaverton 97077
Phone: (503) 627-7999
Fax: (503) 627-7995
Toll Free (800) 621-1966
Service:
Phone: 1-TEK-WIDE
Ext. 6630
Phone (503) 627-6630
Fax: (503) 627-6576
For Orders: (800) 835-3553

PENNSYLVANIA

Philadelphia
450 Sentry Parkway
Blue Bell 19422
Phone: (610) 825-6400
Fax: (610) 825-8839

Pittsburgh
1051 Brinton Road
Pittsburgh 15221
Phone: (412) 244-9800
Fax: (412) 244-1948

SOUTH CAROLINA

Served by the Raleigh, North Carolina Field Office
Phone: (919) 481-3800

SOUTH DAKOTA

Served by the St. Paul, Minnesota Field Office
Phone: (612) 635-0520

TENNESSEE

Served by the Huntsville, Alabama Field Office
Phone: (205) 830-9212

TEXAS

Dallas
2435 Kinwest Parkway
Suite 101, Irving 75063
Phone: (214) 401-1666
Fax: (214) 401-1646
Toll Free Sales:
(800) 852-4043
Toll Free Service:
(800) 334-0525

El Paso
1855 Trawood, Suite 101
El Paso 79935
Phone: (915) 593-8090

Houston
One West Chase Center
10770 Westheimer
Suite 170
Houston 77042
Phone: (713) 784-1800
Fax: (713) 784-4440

Kelly
1831 S. Gen. McMullen
Dr., Suite 101
San Antonio 78226
Phone: (210) 432-1341
Fax: (210) 432-1859

UTAH

Served by Seattle, Washington Field Office
Phone: (800) 237-9514
For Orders:
(800) 835-3553

VIRGINIA

Crystal City
Crystal Square 2,
Suite 406
1725 Jefferson Davis Hwy.
Arlington 22202
Phone: (703) 413-1200
Fax: (703) 413-1205

Hampton
Served by the Gaithersburg, Maryland Field Office
Phone: (301) 948-7151

WASHINGTON

Seattle
11814 115th Avenue N.E.
Kirkland 98034
Phone: (206) 821-9100
Fax: (206) 821-3607
For Orders:
(800) 835-3553

WEST VIRGINIA

Served by the Gaithersburg, Maryland Field Office
Phone: (301) 948-7151

URUGUAY

Coasin Uruguaya S.A.
Libertad 2529
Mail:
Casilla de Correos 1400
Correo Central
Montevideo
Phone: 598 (2) 49-2436
FAX: 598 (2) 49-2199

VENEZUELA

Equilab C.A.
Caracas Office

Centro Sequros La Paz,
Piso 6, Ofic. E-61
Av. Francisco de Mirada
Boleita
Caracas 1070
Phone: 58 (2) 239-3233
FAX: 58 (2) 239-5205

Maracaibo Office
Centro Comercial
Montielco
Oficina 4, Piso 5
Avda 5 de Julio con Calle 72
Maracaibo
Mail: Apartado 1949
Maracaibo 4001-A
Phone: 58 (61) 52-4578,
52-7490
FAX: 58 (61) 51-2777

YEMEN ARAB REPUBLIC

Mideast Data Systems (MSD)
Ahmed Bin Ghannoum
Bldg.
Salam Street
P.O. Box 7899
Abu Dhabi
UNITEDARAB EMIRATES
Phone: 971(2) 213 000
FAX: 971(2) 213 741
Telex:
(893) 24325 MDSUAEEM

TekSignals – MDS
P.O. Box 7899
Abu Dhabi
UNITED ARAB EMIRATES
Phone: 971-2-343401
FAX: 971-2-327069
Telex: 24325 MDSUAEEM

CORPORATE OFFICE

Tektronix, Inc.
26600 SW Parkway
P.O. Box 1000
Wilsonville, Oregon
97070-1000
(503) 682-3411
(800) TEK-WIDE

Distributors

Measurement Products

ALABAMA

Birmingham
Brownell Electro, Inc.
(205) 322-3374
Grainger
(205) 942-6741
Inotek
(205) 995-0852 or
(800) 492-6767

Huntsville
Allied Electronics
(205) 721-3500 or
(800) 433-5700
Innovative Measurement Products
(205) 883-6699
Marshall Industries, Inc.
(205) 881-9235
RS Electronics
(205) 721-9999 or
(800) 859-5859

Mobile
Allied Electronics
(205) 476-1875 or
(800) 433-5700
Brownell Electro, Inc.
(205) 479-5405

Also in this state:
Automotive Scope Applications
(404) 476-1431
Contact East, Inc.
(800) 225-5382
EMSCO
(800) 275-3033
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

ALASKA

Anchorage
Frigid North Co.
(907) 561-4633
Grainger
(907) 562-5400

Also in this state:
Allied Electronics
(800) 432-2223
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

ARIZONA

Mesa
Techni-Tool
(602) 345-2700

Phoenix
Allied Electronics
(602) 437-9080 or
(800) 433-5700
Grainger
(602) 273-9143
Jensen Tools, Inc.
(800) 426-1194
Marshall Industries, Inc.
(602) 496-0290
Zeus Electronics, Inc.
(800) 528-4512

Springdale
Carlton-Bates Co.
(800) 632-7633

Tempe
Metermaster
(800) 251-4443

Also in this state:
Contact East, Inc.
(800) 225-5382
Instrument Engineers
(619) 673-3644
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

ARKANSAS

Ft. Smith
Carlton-Bates
(501) 646-8201

Little Rock
Carlton-Bates
(800) 482-9313
Grainger
(501) 568-7800

Springdale
Carlton-Bates
(800) 632-7633

Also in this state:
Allied Electronics
(800) 433-5700
Brownell Electro, Inc.
(800) 955-0077
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

CALIFORNIA

Anaheim
Grainger
(714) 776-8514

Calabasas
Marshall Industries, Inc.
(818) 878-7000

Chatsworth
ITC Electronics
(818) 700-0940

Danville
Westcon, Inc.
(510) 736-1304

El Monte
Marshall Industries, Inc.
(800) 432-2223

Fremont
Allied Electronics
(510) 505-0220 or
(800) 433-5700

Irvine
Allied Electronics
(714) 727-3010 or
(800) 433-5700
Marshall Industries, Inc.
(714) 458-5333

Los Angeles
Allied Electronics
(800) 433-5700
ITC Electronics
(213) 388-0621
Zack Electronics
(818) 303-1183

Milpitas
Marshall Industries, Inc.
(408) 942-4700

Mountain View
Metermaster
(800) 251-4443

Newbury Park
RAG Electronics, Inc.
(800) 732-3457

Oxnard
ITC Electronics
(805) 983-4115

Palo Alto
Metermaster
(800) 251-4443

Rancho Cordova
Marshall Industries, Inc.
(916) 635-9700

Rancho Cucamonga
Allied Electronics
(909) 980-6522 or
(800) 433-5700

Rocklin
Allied Electronics
(916) 632-3104 or
(800) 433-5700

Sacramento
Zack Electronics
(916) 369-1786

San Diego
Allied Electronics
(619) 279-2550 or
(800) 433-5700
Grainger
(619) 278-5120
Instrument Engineers
(619) 673-3644
Marshall Industries, Inc.
(619) 627-4140
Metermaster
(800) 251-4443

San Francisco
Grainger
(415) 285-7200

San Jose
Allied Electronics
(408) 383-0366 or
(800) 433-5700
Grainger
(408) 286-5373
Techni-Tool, Inc.
(408) 224-5032
Zack Electronics
(408) 324-0551

South San Francisco
Allied Electronics
(415) 952-9599 or
(800) 433-5700

Torrance
ITC Electronics
(310) 370-6211
Techni-Tool, Inc.
(714) 731-7733
(310) 326-6608

Woodland Hills
Allied Electronics
(818) 594-8280 or
(800) 433-5700

Yorba Linda
Metermaster
(800) 251-4443

Also in this state:
Automotive Scope Applications
(503) 777-3272
Contact East, Inc.
(800) 225-5382
Instrument Engineers
(800) 444-6106

(Only San Diego, Imperial, Orange, LA, Riverside, & San Bernardo Counties.)
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
Platt Electric Supply
(800) 25-PLATT
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

COLORADO

Aurora
R & R Instrumentation, Inc.
(303) 364-8325 or
(800) 452-1463

Broomfield
Techni-Tool, Inc.
(602) 345-2700

Colorado Springs
Grainger
(719) 598-9500
Marshall Industries, Inc.
(719) 573-0904

Denver
Brownell Electro, Inc.
(303) 333-3541
Grainger
(303) 733-8777 or
(303) 366-6939

Englewood
Allied Electronics
(303) 790-1664 or
(800) 433-5700

Fort Collins
Grainger
(303) 223-2100

Thornton
Marshall Industries, Inc.
(303) 451-8383

Wheatridge
Zeus Electronics, Inc.
(303) 420-5100

Also in this state:
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

CONNECTICUT

Cheshire
Allied Electronics
(203) 272-7730 or
(800) 433-5700

Hartford
Grainger
(203) 525-1967

Newtown
Beta Lambda Instruments
(800) 282-5632

Wallingford
Contact East, Inc.
(800) 225-5382
Marshall Industries, Inc.
(203) 265-3822

West Hartford
Techni-Tool, Inc.
(203) 231-9193

Also in this state:
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

DELAWARE

Dover
Transcat
(800) 828-1470

Newark
Jensen Tools, Inc.
(800) 426-1194

New Castle
Grainger
(302) 322-1840

Also in this state:
Allied Electronics
(800) 433-5700
Beta Lambda Instruments
(800) 282-5632
Contact East, Inc.
(800) 225-5382
Harco Electronics, Inc.
(800) 638-7616
Kent-Moore, SPX
(800) 345-2233
Marshall Industries, Inc.
(800) 432-2223
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457
Sunshine Instruments
(800) 343-1149
Techni-Tool, Inc.
(610) 940-5467
TESSCO
(800) 472-7373

DISTRICT OF COLUMBIA

Allied Electronics
(800) 433-5700
Beta Lambda Instruments
(800) 282-5632
Contact East, Inc.
(800) 225-5382
Grainger
(202) 234-9010
Harco Electronics, Inc.
(800) 638-7616
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
Marshall Industries, Inc.
(800) 432-2223
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(301) 912-3062
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

FLORIDA

Altamonte Springs
Marshall Industries, Inc.
(407) 767-8585

Boca Raton
EMSCO
(407) 483-3672

Ft. Lauderdale
Allied Electronics
(305) 733-3144 or
(800) 433-5700
Marshall Industries, Inc.
(305) 977-4880

Ft. Pierce
Techni-Tool, Inc.
(407) 464-0461

Distributors

Jacksonville
Allied Electronics
(904) 739-5920 or
(800) 433-5700
Dow Electronics
(904) 367-0377 or
(800) 627-2960
EMSCO
(800) 275-3029
Inotek
(904) 725-5001 or
(800) 492-6767

Lakeland
Inotek
(813) 644-9493 or
(800) 492-6767

Largo
Allied Electronics
(813) 541-4660 or
(800) 433-5700

Maitland
Allied Electronics
(407) 539-0055 or
(800) 433-5700
Electronic Equipment Co., Inc.
(407) 539-0888

Miami
Electronic Equipment Co., Inc.
(800) 327-1526

Miami Lakes
Allied Electronics
(305) 558-2511 or
(800) 433-5700

Orlando
Brownell Electro, Inc.
(800) 332-3423
Dow Electronics
(407) 426-6822
EMSCO
(800) 275-3554
Grainger
(407) 843-3220

Pampano Beach
Electronic Equipment Co., Inc.
(305) 960-1200

Pembroke Pines
Electronic Equipment Co., Inc.
(305) 431-1488

St. Petersburg
Marshall Industries, Inc.
(813) 573-1399

Tampa
Dow Electronics
(800) 627-2990
Electronic Equipment Co., Inc.
(813) 988-0810
EMSCO
(800) 275-3031

Also in this state:
Automotive Scope Applications
(404) 476-1431
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(407) 464-0461
TESSCO
(800) 472-7373
Transcat
(800) 828-1470
Tycom Industries, Inc.
(404) 378-6160

GEORGIA

Albany
Dow Electronics
(800) 627-2830

Athens
Resource Electronics/Dixie
(706) 613-7755

Atlanta
Allied Electronics
(404) 612-9360 or
(800) 433-5700
Grainger
(404) 762-9202
Inotek
(404) 458-6423 or
(800) 492-6767

Decatur
Tycom Industries, Inc.
(404) 378-6160

Duluth
Allied Electronics
(800) 433-5700

Automotive Scope Applications
(404) 476-1431

Forest Park
Brownell Electro, Inc.
(800) 332-3423

Lilburn
Metermaster
(800) 251-4443

Norcross
Dow Electronics
(800) 627-2910
EMSCO
(404) 925-8366
Marshall Industries, Inc.
(404) 923-5750
RS Electronics
(404) 242-0520 or
(800) 776-5284

Savannah
Dow Electronics
(800) 627-2890

Also in this state:
Contact East, Inc.
(800) 225-5382
Electronic Equipment Co., Inc.
(800) 988-0810
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

HAWAII

Honolulu
Grainger
(808) 432-0028

Also in this state:
Allied Electronics
(800) 433-5700
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
Marshall Industries, Inc.
(800) 432-2223
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
NW Test and Measurement
(800) 320-9001
Radar Electric Co.
(206) 282-2511
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

IDAHO

Boise
Allied Electronics
(800) 433-5700
Grainger
(208) 377-2801
Radar Electric Co.
(208) 336-2227

Also in this state:
Automotive Scope Applications
(503) 777-3272
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
Marshall Industries, Inc.
(800) 432-2223
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
NW Test and Measurement
(800) 320-9001
Platt Electric Supply
(800) 25-PLATT
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(602) 345-2700
Technology Sales, Inc.
(801) 572-1588
TESSCO
(800) 472-7373
Transcat
(800) 828-1470
Westcon, Inc.
(206) 747-5055
Zeus Electronics, Inc.
(800) 528-4512

ILLINOIS

Addison
Metermaster
(800) 251-4443

Bensenville
Allied Electronics
(800) 433-5700

Champaign
Klaus Companies
(800) 221-5951

Countryside
Inotek
(708) 352-3500 or
(800) 492-6767

Elmhurst
McMaster-Carr Supply Co.
(708) 833-0300
Transcat
(708) 832-1588

Libertyville
Allied Electronics
(708) 918-0250 or
(800) 433-5700

Lincolnshire
Grainger
(708) 913-7400 x75

Loves Park
Allied Electronics
(815) 636-1010 or
(800) 433-5700

Niles
Grainger
(708) 965-7600
Joseph Electronics
(708) 297-4200

Oak Forest
Allied Electronics
(708) 535-0038 or
(800) 433-5700

Peoria
Klaus Companies
(309) 691-4840 or
(800) 475-5287
Industrial Parts

Quincy
Klaus Companies
(217) 223-7560

Schaumburg
Marshall Industries, Inc.
(708) 490-0155

Also in this state:
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
RS Electronics
(800) 325-4806
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373

INDIANA

Indianapolis
Allied Electronics
(317) 571-1880 or
(800) 433-5700
Grainger
(317) 632-8341
Great Lakes Electronics
(317) 841-1024 or
(800) 968-2009
Marshall Industries, Inc.
(317) 388-9069
RS Electronics
(317) 253-9065
(800) 488-9065

Richmond
Harris Allied
(800) 622-0022

Also in this state:
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Joseph Electronics
(800) 323-5925
Kent-Moore, SPX
(800) 345-2233
Klaus Companies
(800) 221-5951
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

IOWA

Cedar Rapids
Allied Electronics
(319) 390-5730 or
(800) 433-5700
Grainger
(319) 366-7174

W. Des Moines
Allied Electronics
(515) 223-6488 or
(800) 433-5700

Also in this state:
Contact East, Inc.
(800) 225-5382
Instrumentation Services, Inc.
(800) 959-2153
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
Klaus Companies
(800) 545-5287
Marshall Industries, Inc.
(800) 432-2223
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
Stark Electronics, Inc.
(800) 334-6154
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

KANSAS

Lenexa
Allied Electronics
(913) 599-6227 or
(800) 433-5700
Marshall Industries, Inc.
(913) 492-3121

Overland Park
RS Electronics
(913) 362-1923 or
(800) 251-0067

Wichita
Grainger
(316) 945-5101

Also in this state:
Contact East, Inc.
(800) 225-5382
Electronics Supply Co., Inc.
(816) 931-0250
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

Distributors

Measurement Products
Continued

KENTUCKY

Lexington
Marshall Industries, Inc.
(606) 276-0571

Louisville
Allied Electronics
(502) 452-2293 or
(800) 433-5700
Grainger
(502) 499-0001
Also in this state:
Auto Advisors, Inc.
(704) 329-9446
Beta Lambda Instruments
(800) 282-5632
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

LOUISIANA

Alexandria
Ralph's Industrial Electronic Supplies
(318) 443-4517 or
(800) 324-4517

Baton Rouge
Inotek
(504) 924-9046 or
(800) 492-6767
Ralph's Industrial Electronic Supplies
(318) 443-4517 or
(800) 324-4517
Transcat
(504) 272-9156 or
(800) 828-1470

Lafayette
Ralph's Industrial Electronic Supplies
(318) 443-4517 or
(800) 324-4517

Lake Charles
Ralph's Industrial Electronic Supplies
(318) 443-4517 or
(800) 324-4517

Morgan City
Ralph's Industrial Electronic Supplies
(318) 443-4517 or
(800) 324-4517

New Iberia
Ralph's Industrial Electronic Supplies
(318) 443-4517 or
(800) 324-4517

New Orleans
Grainger
(504) 733-9742

Shreveport
Carlton-Bates
(318) 636-9975

St. Rose
Allied Electronics
(504) 466-7575 or
(800) 433-5700
Also in this state:
Brownell Electro, Inc.
(800) 332-3423
Contact East, Inc.
(800) 225-5382
EnTest
(800) 955-0077
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
Marshall Industries, Inc.
(800) 432-2223
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

MAINE

Portland
Grainger
(207) 797-7693
Also in this state:
Allied Electronics
(913) 599-6227 or
(800) 433-5700
Beta Lambda Instruments
(800) 282-5632
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
Marshall Industries, Inc.
(913) 432-2223
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

MARYLAND

Aberdeen
Harco Electronics, Inc.
(410) 838-7990

Baltimore
Beta Lambda Instruments
(800) 282-5632
Harco Electronics, Inc.
(410) 575-6885

Baltimore East
Grainger
(410) 391-9000

Columbia
Allied Electronics
(410) 312-0810 or
(800) 433-5700
Marshall Industries, Inc.
(301) 470-2800 (VA) or
(410) 880-3030 (MD)

Gaithersburg
Beta Lambda Instruments
(800) 282-5632

Gambrills
Techni-Tool, Inc.
(610) 941-2400

Salisbury
Harco Electronics, Inc.
(800) 634-2589

Sparks
TESSCO
(410) 472-7000
Also in this state:
Contact East, Inc.
(800) 225-5382
Harco Electronics, Inc.
(800) 638-7616
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457
Transcat
(800) 828-1470

MASSACHUSETTS

Boston
Beta Lambda Instruments
(800) 282-5632

North Andover
Contact East, Inc.
(800) 225-5382

Northboro
Techni-Tool, Inc.
(508) 393-3399

Norwood
Allied Electronics
(617) 255-0361 or
(800) 433-5700
Grainger
(617) 935-8808

Peabody
Allied Electronics
(800) 433-5700

Wilmington
Marshall Industries, Inc.
(508) 658-0810
Also in this state:
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

MICHIGAN

Battle Creek
Great Lakes Electronics
(616) 963-6282 or
(800) 962-3144

Dearborn
Grainger
(313) 295-2750

Flint
RS Electronics
(810) 742-5000 or
(800) 726-4556

Grand Rapids
Allied Electronics
(616) 365-9960 or
(800) 433-5700
RS Electronics
(616) 241-3483 or
(800) 776-1155

Livonia
Marshall Industries, Inc.
(313) 525-5850
RS Electronics
(313) 525-1155 or
(800) 366-7750

Plymouth
Allied Electronics
(313) 416-9300 or
(800) 433-5700

Saginaw
Allied Electronics
(517) 792-2400 or
(800) 433-5700

Warren
Kent Moore - SPX
(800) 345-2233
Also in this state:
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

MINNESOTA

Minneapolis
Instrumentation Services, Inc.
(612) 544-8916 or
(800) 959-2153
Marshall Industries, Inc.
(612) 559-2211
Stark Electronics, Inc.
(612) 332-1325

Minnetonka
Allied Electronics
(612) 938-5633 or
(800) 433-5700

Plymouth
Grainger
(612) 352-0891

St. Paul
Allied Electronics
(612) 482-9904 or
(800) 433-5700

Also in this state:
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

MISSISSIPPI

Jackson
Grainger
(601) 352-0891
Also in this state:
Allied Electronics
(800) 433-5700
Brownell Electro, Inc.
(800) 332-3423
Carlton-Bates
(901) 365-3539
Contact East, Inc.
(800) 225-5382
EnTest
(800) 955-0077
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
Marshall Industries, Inc.
(800) 432-2223
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

MISSOURI

Earth City
Allied Electronics
(314) 291-7031 or
(800) 433-5700
Marshall Industries, Inc.
(314) 770-1749

Kansas City
Electronics Supply Co., Inc.
(816) 931-0250

Maryland Heights
RS Electronics
(314) 997-7709 or
(800) 325-4806

Springfield
Carlton-Bates
(417) 862-1699 or
(800) 356-9275

St. Louis
Carlton-Bates
(314) 343-6060
Grainger
(314) 231-5031

Also in this state:
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

MONTANA

Billings
Grainger
(406) 252-6311
Also in this state:
Allied Electronics
(800) 433-5700
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
Marshall Industries, Inc.
(800) 432-2223
McMaster-Carr Supply Co.
(708) 833-0300
Platt Electric Supply
(800) 25-PLATT or
(503) 641-6121
Radar Electric Co.
(208) 336-2227
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(602) 345-2700
Technology Sales, Inc.
(801) 572-1588
TESSCO
(800) 472-7373
Transcat
(800) 828-1470
Zeus Electronics, Inc.
(800) 528-4512

NEBRASKA

Lincoln
Electronics Supply Co., Inc.
(402) 467-1550
Grainger
(402) 476-9014

Omaha
Allied Electronics
(402) 697-0038 or
(800) 433-5700
Grainger
(402) 339-1800

Distributors

Also in this state:
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
Marshall Industries, Inc.
(800) 432-2223
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

NEVADA

Las Vegas
Allied Electronics
(702) 258-1087 or
(800) 433-5700
Grainger
(702) 385-6833
Kent-Moore, SPX
(800) 345-2233
Marshall Industries, Inc.
(800) 432-2223
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457
Zeus Electronics, Inc.
(800) 528-4512

Also in this state:
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
McMaster-Carr Supply Co.
(708) 833-0300
Techni-Tool, Inc.
(408) 224-5032 or
(602) 345-2700
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

NEW HAMPSHIRE

Manchester
Grainger
(603) 668-7161

Nashua
Allied Electronics
(603) 883-3006 or
(800) 433-5700

Also in this state:
Beta Lambda Instruments
(800) 282-5632
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
Marshall Industries, Inc.
(800) 432-2223
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

NEW JERSEY

Cranbury
Metermaster
(800) 251-4443

Cranford
Grainger
(908) 272-7156

Edison
Allied Electronics
(908) 572-9600 or
(800) 433-5700
Brownell Electro, Inc.
(908) 287-3355

Englishtown
Beta Lambda Instruments
(800) 282-5632

Fairfield
Marshall Industries, Inc.
(201) 882-0320

Kinnelon
Techni-Tool, Inc.
(201) 492-1292 or
(610) 940-5467

Moorestown
Allied Electronics
(609) 234-7769 or
(800) 433-5700

Mt. Laurel
Marshall Industries, Inc.
(609) 234-9100

Parsippany
Allied Electronics
(201) 428-3350 or
(800) 433-5700

Also in this state:
Contact East, Inc.
(800) 225-5382
Harco Electronics, Inc.
(800) 638-7616
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
Sunshine Instruments
(800) 343-1149
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

NEW MEXICO

Alburquerque
Grainger
(505) 345-8631
Zeus Electronics, Inc.
(505) 842-6633

Bohemia
Exphil
800-5-EXPHIL

Also in this state:
Allied Electronics
(800) 433-5700
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
Marshall Industries, Inc.
(800) 432-2223
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(602) 345-2700
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

NEW YORK

Albany
Grainger
(518) 869-1414

Amherst
Allied Electronics
(716) 831-8101 or
(800) 433-5700

Binghamton
Beta Lambda Instruments
(800) 282-5632

Bohemia
Exphil Calibration Labs, Inc.
(800) 539-7445 or
(516) 563-3520

Endicott
Marshall Industries, Inc.
(607) 785-2345

Fairport
Allied Electronics
(716) 425-3850 or
(800) 433-5700

Hauppauge
Beta Lambda Instruments
(800) 282-5632
Marshall Industries, Inc.
(516) 273-2695
RS Electronics
(516) 231-3313 or
(800) 433-8952

Lagrangeville
Allied Electronics
(914) 452-1470 or
(800) 433-5700

Mineola
Allied Electronics
(516) 248-2360 or
(800) 433-5700

New York City
Allied Electronics
(908) 572-9600

Rochester
Beta Lambda Instruments
(800) 282-5632
Marshall Industries, Inc.
(716) 235-7620
Transcat
(800) 828-1470

Syracuse
Allied Electronics
(315) 463-2955 or
(800) 433-5700

Also in this state:
Brownell Electro, Inc.
(800) 332-3423
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(201) 492-1292
TESSCO
(800) 472-7373

NORTH CAROLINA

Cary
Inotek
(919) 380-0220 or
(800) 492-6767

Charlotte
Allied Electronics
(704) 525-0300 or
(800) 433-5700
Auto Advisors, Inc.
(704) 329-9446
Brownell Electro, Inc.
(800) 332-3423
Grainger
(704) 376-0785
Inotek
(704) 527-5000 or
(800) 492-6767
Resource Electronics/Dixie
(704) 521-8682
Transcat
(800) 828-1470

Greensboro
EMSCO
(800) 275-3034
Inotek
(910) 299-2950 or
(800) 492-6767

Raleigh
Allied Electronics
(800) 433-5700
Brownell Electro, Inc.
(919) 876-6525
Marshall Industries, Inc.
(919) 878-9882
Resource Electronics/Dixie
(919) 829-0704

Winston Salem
Resource Electronics/Dixie
(800) 854-1007

Also in this state:
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Tycom Industries, Inc.
(404) 378-6160

NORTH DAKOTA

Fargo
Grainger
(701) 282-8905

Also in this state:
Allied Electronics
(800) 433-5700
Contact East, Inc.
(800) 225-5382
Instrumentation Services, Inc.
(800) 959-2153
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
Marshall Industries, Inc.
(800) 432-2223
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
Stark Electronics, Inc.
(800) 334-6154
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

OHIO

Cincinnati
Allied Electronics
(513) 771-6990 or
(800) 433-5700
Beta Lambda Instruments
(800) 282-5632

Cleveland
Allied Electronics
(216) 831-4900 or
(800) 433-5700
Grainger
(216) 398-1880
Metermaster
(800) 251-4443
RS Electronics
(216) 351-2220 or
(800) 576-4533

Columbus
Allied Electronics
(614) 785-1270 or
(800) 433-5700
Grainger
(614) 276-5231
RS Electronics
(216) 351-2220 or
(800) 576-4533

Dayton
Beta Lambda Instruments
(800) 282-5632
Marshall Industries, Inc.
(513) 898-4480

Maumee
RS Electronics
(419) 893-0721
(800) 472-3231

Solon
Marshall Industries, Inc.
(216) 248-1788

Toledo
Allied Electronics
(419) 865-2246 or
(800) 433-5700

Also in this state:
Auto Advisors, Inc.
(704) 329-9446
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

OKLAHOMA

Edmond
Marshall Industries, Inc.
(405) 340-0198

Oklahoma City
Carlton-Bates
(405) 681-4446
Grainger
(405) 943-9631
Inotek
(405) 373-3359

Tulsa
Allied Electronics
(918) 664-0844 or
(800) 433-5700
Carlton-Bates
(918) 250-1626
Inotek
(918) 627-1500 or
(800) 492-6767

Also in this state:
Contact East, Inc.
(800) 225-5382
EnTest
(800) 955-0077
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

Distributors

Measurement Products
Continued

OREGON

Beaverton
Allied Electronics
(800) 433-5700
Marshall Industries, Inc.
(503) 644-5050
NW Test and Measurement
(503) 645-9000
Platt Electric Supply
(503) 641-6121 or
(503) 643-4671 or
(800) 25-PLATT

Clackamas
Automotive Scope Applications
(503) 777-3272
Platt Electric Supply
(503) 655-3504 or
(800) 25-PLATT

East Portland
Platt Electric Supply
(503) 232-1265 or
(800) 25-PLATT

Gresham
Platt Electric Supply
(503) 667-9931 or
(800) 25-PLATT

Hillsboro
Platt Electric Supply
(503) 640-8907 or
(800) 25-PLATT

Hood River
Platt Electric Supply
(503) 386-1344 or
(800) 25-PLATT

McMinnville
Platt Electric Supply
(503) 472-5161 or
(800) 25-PLATT

North Portland
Platt Electric Supply
(503) 287-3617 or
(800) 25-PLATT

Parkrose
Platt Electric Supply
(503) 255-3436 or
(800) 25-PLATT

Portland
Grainger
(503) 283-0366
Platt Electric Supply
(503) 224-1919 or
(800) 25-PLATT
Radar Electric Co.
(503) 232-3404
Westcon, Inc.
(800) 547-4515

Salem
Platt Electric Supply
(503) 581-7012 or
(800) 25-PLATT

Tualatin
Platt Electric Supply
(503) 684-2087 or
(800) 25-PLATT

Wilsonville
Platt Electric Supply
(503) 682-1399 or
(800) 25-PLATT

Also in this state:
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(602) 345-2700
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

PENNSYLVANIA

Bridgeville
Brownell Electro, Inc.
(412) 221-0074

Camp Hill
Allied Electronics
(717) 975-3570 or
(800) 433-5700

Chadds Ford
Allied Electronics
(610) 388-8455 or
(800) 433-5700

Jenkintown
Beta Lambda Instruments
(800) 282-5632

Lancaster
Harco Electronics, Inc.
(717) 291-1861 or
(800) 345-4941

Langhorne
Techni-Tool, Inc.
(610) 941-2400

Malverne
Beta Lambda Instruments
(800) 282-5632

Norristown
Grainger
(215) 630-9070

Philadelphia
Harco Electronics, Inc.
(800) 345-4941
Sunshine Instruments
(215) 673-5600
(800) 343-1199

Pittsburgh
Allied Electronics
(412) 367-4124 or
(800) 433-5700
Grainger
(412) 788-8890
Leff Electronics, Inc.
(412) 351-5000 or
(800) 245-4200
Transcat
(800) 828-1470

Plymouth Meeting
Techni-Tool, Inc.
(610) 941-2400

Trevose
Brownell Electro, Inc.
(215) 364-1401

West Chester
Transcat
(215) 692-0912 or
(800) 828-1470

Also in this state:
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
Marshall Industries, Inc.
(800) 432-2223
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457
TESSCO
(800) 472-7373

RHODE ISLAND

East Greenwich
Beta Lambda Instruments
(800) 282-5632

Warwick
Grainger
(401) 467-9160

Also in this state:
Allied Electronics
(800) 433-5700
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
Marshall Industries, Inc.
(800) 432-2223
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(203) 231-9193
TESSCO
(800) 472-7373
Transcat
(800) 828-147

SOUTH CAROLINA

Charleston
Grainger
(803) 552-6504
Inotek
(803) 529-9400 or
(800) 492-6767

Columbia
Grainger
(803) 926-8100
Resource Electronics/Dixie
(803) 779-5332

Greenville
Allied Electronics
(803) 288-8835 or
(800) 433-5700
Grainger
(803) 288-0110
Inotek
(803) 370-1432 or
(800) 492-6767
Resource Electronics/Dixie
(803) 297-1430

Greer
EMSCO
(803) 879-4121

N. Charleston
Resource Electronics/Dixie
(803) 569-1410

Summerville
Brownell Electro, Inc.
(803) 875-5568

Also in this state:
Auto Advisors, Inc.
(704) 329-9446
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
Marshall Industries, Inc.
(800) 432-2223
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470
Tycom Industries, Inc.
(404) 378-6160

SOUTH DAKOTA

Sioux Falls
Grainger
(605) 339-9164

Also in this state:
Allied Electronics
(800) 433-5700
Contact East, Inc.
(800) 225-5382
Instrumentation Services, Inc.
(800) 959-2153
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
Marshall Industries, Inc.
(800) 432-2223
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
Stark Electronics, Inc.
(800) 334-6154
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

TENNESSEE

Gray
Resource Electronics/Dixie
(615) 477-2131

Jackson
Carlton-Bates
(901) 664-2714

Knoxville
Allied Electronics
(615) 693-3305 or
(800) 433-5700
Brownell Electro, Inc.
(800) 332-3423
Carlton-Bates Co.
(800) 226-6870
Inotek
(615) 457-1053 or
(800) 492-6767

Memphis
Allied Electronics
(901) 367-2895 or
(800) 433-5700
Brownell Electro, Inc.
(800) 332-3423
Carlton-Bates
(901) 365-3539

Nashville
Brownell Electro, Inc.
(615) 885-1302
Carlton-Bates
(615) 885-3232
Grainger
(615) 885-0332

Oak Ridge
Resource Electronics/Dixie
(615) 481-3393

Also in this state:
Auto Advisors, Inc.
(704) 329-9446
Contact East, Inc.
(800) 225-5382
EMSCO
(800) 275-2934
Innovative Measurement Products
(205) 883-6699
Inotek
(404) 458-6423 or
(800) 492-6767
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
Marshall Industries, Inc.
(800) 432-2223
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470
Tycom Industries, Inc.
(404) 378-6160

TEXAS

Austin
Allied Electronics
(512) 219-7171 or
(800) 433-5700
Carlton-Bates
(512) 837-9098
Inotek
(800) 492-6767
Marshall Industries Inc.
(512) 837-1991

Corpus Christi
Allied Electronics
(512) 857-2705 or
(800) 433-5700

Dallas
Allied Electronics
(214) 553-4370 or
(800) 433-5700
Carlton-Bates
(214) 235-7771
EnTest
(800) 955-0077
Grainger
(214) 637-2380
Inotek
(214) 243-7000 or
(800) 492-6767
Jensen Tools
(800) 426-1194

El Paso
Allied Electronics
(915) 779-6294 or
(800) 433-5700
Zeus Electronics
(800) 528-4512

Ft. Worth
Allied Electronics
(800) 443-5700
Carlton-Bates
(817) 293-5558
Inotek
(817) 877-5100
(800) 492-6767

Grand Prairie
Brownell Electro, Inc.
(800) 332-3423

Houston
Brownell Electro, Inc.
(713) 691-4347
Carlton-Bates
(713) 956-2244
EnTest
(713) 686-7306
Inotek
(713) 688-7000 or
(800) 492-6767
Marshall Industries, Inc.
(713) 467-1666
Metermaster
(800) 251-4443
Transcat
(800) 828-1470

Humble
Allied Electronics
(713) 446-8005 or
(800) 433-5700

Longview
Allied Electronics
(903) 295-1164 or
(800) 433-5700

Lubbock
Allied Electronics
(806) 785-0044 or
(800) 433-5700
Brownell Electro, Inc.
(806) 747-0211

Mesquite
Metermaster
(800) 251-4443

Richardson
Marshall Industries, Inc.
(214) 705-0600

Roanoke
Carlton-Bates
(800) 482-9313

Distributors

San Antonio
Carlton-Bates
(210) 805-8300

Seabrook
Transcat
(713) 465-4399

Texarkana
Carlton-Bates
(800) 792-6923

Also in this state:
Contact East, Inc.
(800) 225-5382
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373

UTAH

Salt Lake City
Allied Electronics
(801) 261-5244 or
(800) 433-5700
Grainger
(801) 972-1340
Marshall Industries, Inc.
(801) 973-2288
Zeus Electronics, Inc.
(801) 487-9402

Sandy
Technology Sales, Inc.
(801) 572-1588

Also in this state:
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(602) 345-2700
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

VERMONT

Burlington
Grainger
(802) 658-4988

Also in this state:
Allied Electronics
(800) 433-5700
Beta Lambda Instruments
(800) 282-5632
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
Marshall Industries, Inc.
(800) 432-2223
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

VIRGINIA

Charlottesville
Harco Electronics, Inc.
(800) 999-8420

Harrisonburg
Harco Electronics, Inc.
(703) 434-8420 or
(800) 999-8420

Richmond
Allied Electronics
(804) 553-0188 or
(800) 433-5700
Grainger
(804) 649-0731
Inotek
(804) 743-1226 or 1663 or
(800) 492-6767

Springfield
Allied Electronics
(703) 644-9515 or
(800) 433-5700

Suffolk
Techni-Tool, Inc.
(301) 912-3062 or
(804) 459-3837

Virginia Beach
Allied Electronics
(804) 363-8662 or
(800) 433-5700

Also in this state:
Auto Advisors, Inc.
(704) 329-9446
Beta Lambda Instruments
(800) 282-5632
Contact East, Inc.
(800) 225-5382
Harco Electronics, Inc.
(800) 999-8420
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
Marshall Industries, Inc.
(800) 432-2223
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

WASHINGTON

Bellevue
NW Test and Measurement
(206) 881-8857
Westcon, Inc.
(206) 747-5055

Bothell
Marshall Industries, Inc.
(206) 486-5747

Everett
Allied Electronics
(206) 353-7313 or
(800) 433-5700

Longview
Platt Electric Supply
(206) 423-4800 or
(800) 25-PLATT

Richland
Radar Electric Co.
(509) 943-8336

Seattle
Grainger
(206) 251-5030
Radar Electric Co.
(206) 282-2511

Spokane
Grainger
(509) 535-9882
Radar Electric Co.
(509) 747-3053

Tacoma
Allied Electronics
(206) 572-7745 or
(800 433-5700

Vancouver
Platt Electric Supply
(206) 699-4833 or
(800) 25-PLATT

Also in this state:
Automotive Scope Applications
(503) 777-3272
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
Platt Electric Supply
(800) 25-PLATT or
(503) 641-6121
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

WEST VIRGINIA

Charleston
Grainger
(304) 744-1383

Poca
Transcat
(800) 828-1470

Also in this state:
Auto Advisors, Inc.
(704) 329-9446
Beta Lambda Instruments
(800) 282-5632
Contact East, Inc.
(800) 225-5382
Harco Electronics, Inc.
(800) 999-8420
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457

Also in this state:
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373

WISCONSIN

Milwaukee
Dist-Tron
(414) 781-7770
Grainger
(414) 353-7400

New Berlin
Allied Electronics
(414) 796-1280 or
(800) 433-5700

Waukesha
Marshall Industries, Inc.
(800) 726-8512

Also in this state:
Contact East, Inc.
(800) 225-5382
Instrumentation Services, Inc.
(800) 959-2153
Joseph Electronics
(800) 323-5925
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
McMaster-Carr Supply Co.
(708) 833-0300
Metermaster
(800) 251-4443
RAG Electronics, Inc.
(800) 732-3457
Stark Electronics, Inc.
(800) 334-6154
Techni-Tool, Inc.
(610) 941-2400
TESSCO
(800) 472-7373
Transcat
(800) 828-1470

WYOMING

Casper
Grainger
(307) 577-5797

Also in this state:
Allied Electronics
(800) 433-5700
Contact East, Inc.
(800) 225-5382
Jensen Tools, Inc.
(800) 426-1194
Kent-Moore, SPX
(800) 345-2233
Marshall Industries, Inc.
(800) 432-2223
McMaster-Carr Supply Co.
(708) 833-0300
RAG Electronics, Inc.
(800) 732-3457
Techni-Tool, Inc.
(602) 345-2700
Technology Sales, Inc.
(801) 572-1588
TESSCO
(800) 472-7373
Transcat
(800) 828-1470
Zeus Electronics, Inc.
(800) 528-4512

Telecom Products

ALABAMA

Birmingham
Anixter (Datacom)
(205) 822-8066

Decatur
Antec (CATV)
(800) 242-1181
(404) 840-7901

ARIZONA

Phoenix
Anixter (Datacom)
(602) 968-7901

Tucson
Anixter (Datacom)
(602) 295-9844

ARKANSAS

Little Rock
Anixter (Datacom)
(501) 223-2824

CALIFORNIA

Anaheim
Anixter (Datacom)
(714) 779-0500

Bakersfield
Anixter (Datacom)
(805) 836-9191

Clayton
North Supply Company (Telco)
(510) 672-8658

Fresno
North Supply Company (Telco)
(209) 431-5136

Los Angeles
Anixter (Datacom)
(213) 625-7828

Martinez
North Supply Company (Telco)
(510) 947-0699

Pleasanton
Anixter (Datacom)
(510) 463-1223

Sacramento
Anixter (Datacom)
(916) 372-1207

San Bernadino
Anixter (Datacom)
(909) 825-7755

San Diego
Anixter (Datacom)
(619) 583-9960

San Francisco
Anixter (Datacom)
(415) 543-6070

Santa Clara
Anixter (Datacom)
(408) 435-1212

Santa Ana
Antec (CATV)
(800) 854-0443
(714) 757-1630

Torrance
Anixter (Datacom)
(310) 320-4783

Union City
Anixter (Datacom)
(510) 489-7100

COLORADO

Denver
Anixter (Datacom)
(303) 373-9200

Englewood
Antec (CATV)
(800) 841-1531
(303) 740-8949

CONNECTICUT

Branford
RJ Heffernan & Assoc (Security)
(203) 488-2235

Cheshire
Anixter (Datacom)
(203)-271-3600
E. Hartford
North Supply Company (Telco)
(203) 569-7988

Stamford
Anixter (Datacom)
(203) 325-0390

FLORIDA

Clearwater
North Supply Company (Telco)
(813) 535-0061

Dayton
Anixter (Datacom)
(513)-320-0020

Fort Lauderdale
Anixter (Datacom)
(305) 975-7722

Jacksonville
North Supply Company (Telco)
(904) 292-4902
Antec (CATV)
(800) 242-1181
Anixter (Datacom)
(904) 730-2703

Orlando
Anixter (Datacom)
(407) 240-1888
Antec (CATV)
(800) 242-1181
(404) 840-7901

Tampa
Anixter (Datacom)
(813) 626-7115

Distributors/Representatives

Telecom Products
Continued

GEORGIA

Atlanta
North Supply Company (Telco)
(404) 231-0394
Anixter (Datacom)
(404) 921-3732

Lovejoy
Antec (CATV)
(800) 242-1181
(404) 940-7901

Lilburn
North Supply Company
(Telco)
(404) 925-8727

Norcross
Antec (CATV)
(800) 242-1181
(404) 840-7901

Stone Mountain
North Supply Company (Telco)
(404) 294-7369

Watkinsville
Antec (CATV)
(800) 242-1181
(404) 840-7901

ILLINOIS

Bensenville
Antec (CATV)
(800) 544-5368
(708) 350-7788

Bloomington
Anixter (Datacom)
(309) 452-8572

Buffalo Grove
North Supply Company (Telco)
(708) 465-0203

Chicago
Anixter (Datacom)
(312) 222-0009

Evanston
Anixter (Datacom)
(708) 869-8011

Skokie
Anixter (Datacom)
Brothers, Inc. (Datacom)
(800) 221-5217
(708) 677-6000

Speedpull
Anixter (Datacom)
(708) 597-7100

INDIANA

Elwood
Antec (CATV)
(317) 552-2120

Indianapolis
Anixter (Datacom)
(317) 243-2008

IOWA

Des Moines
Anixter (Datacom)
(515) 278-1722

KANSAS

Industrial Airport
North Supply Company (Telco)
(800) 755-1975
(913) 791-7000

Kansas City
Anixter (Datacom)
(913) 492-2622

Olathe
North Supply Company (Telco)
(913) 780-1589

Overland Park
North Supply Company (Telco)
(913) 894-5199

KENTUCKY

Louisville
Anixter (Datacom)
(502) 266-8555

LOUISIANA

Baton Rouge
Anixter (Datacom)
(504) 767-0080

New Orleans
Anixter (Datacom)
(504) 888-5114

MARYLAND

Baltimore
Anixter (Datacom)
(410) 290-7722

Shrewsbury
Antec (CATV)
(508) 791-6707

Sparks
TESSCO (Cellular)
(800) 638-7666
(410)472-7352

MASSACHUSETTES

Boston
Anixter (Datacom)
(508) 682-8870

Boston (South)
Anixter (Datacom)
(617) 828-3330

Springfield
Anixter (Datacom)
(413) 731-5100

MICHIGAN

Detroit
Anixter (Datacom)
(810) 478-3900

Grand Rapids
Anixter (Datacom)
(616) 698-7800

Iron Mountain
Antec (CATV)
(800) 624-8358
(906) 774-4111

MINNESOTA

Minneapolis
Anixter (Datacom)
(612) 542-1804

St. Paul
Anixter (Datacom)
(612) 224-2112

MISSOURI

Kansas City
North Supply Company (Telco)
(816) 741-8599

Peculiar
North Supply Company (Telco)
(816) 758-6744

St. Louis
Anixter (Datacom)
(314) 423-6161

NEBRASKA

Blair
North Supply Company (Telco)
(402) 426-9364

Lincoln
Anixter (Datacom)
(402) 466-8337

Omaha
Anixter (Datacom)
(402) 330-7455

NEW HAMPSHIRE

Manchester
Anixter (Datacom)
(603) 666-4416

NEW JERSEY

Princeton
Anixter (Datacom)
(609) 987-9777

Turnersville
Antec (CATV)
(609) 228-0554

Wharton
Antec (CATV)
(800) 631-9603
(201) 328-0980

Whippany
Anixter (Datacom)
(201) 515-3100

NEW MEXICO

Albuquerque
Anixter (Datacom)
(505) 345-1661

NEW YORK

Albany
Anixter (Datacom)
(518) 464-6251

Brooklyn
Anixter (Datacom)
(718) 821-0065

Buffalo
Anixter (Datacom)
(716) 631-0733

Clifton Park
North Supply Company (Telco)
(518) 383-0275

Monroe
Antec (CATV)
(201) 328-6679

Rochester
Anixter (Datacom)
(716) 426-3440

NORTH CAROLINA

Charleston
Anixter (Datacom)
(803) 572-5526

Charolette
Anixter (Datacom)
(704) 847-5900

Elm City
North Supply Company (Telco)
(919) 236-3812

Greensboro
Anixter (Datacom)
(910) 855-9131

Raleigh
Anixter (Datacom)
(919) 941-5023

Zirconia
North Supply Company (Telco)
(704) 693-4025

OHIO

Cincinnati
Anixter (Datacom)
(513) 489-21290

Cleveland
Anixter (Datacom)
(216) 546-4400

Columbus
Anixter (Datacom)
(614) 799-2600

Delaware
North Supply Company (Telco)
(614) 363-7180

Macedonia
Antec (CATV)
(800) 544-5368
(708) 350-7788

OKLAHOMA

Tulsa
Anixter (Datacom)
(918) 664-5558
Jarvis International (Security)
(918) 437-1100

OREGON

Portland
Anixter (Datacom)
(503) 306-4199
North Supply Company (Telco)
(503) 254-8499

PENNSYLVANIA

Gettysburg
North Supply Company (Telco)
(707) 642-5288

Harrisburg
Anixter (Datacom)
(717) 232-6219

Leechburg
North Supply Company (Telco)
(412) 845-6474

Philadelphia
Anixter (Datacom)
(610) 534-3900

PUERTO RICO

Guaynabo
Anixter (Datacom)
(809) 783-6300

San Juan
Telenetworks, Inc.
(809) 766-2829

SOUTH CAROLINA

Columbia
Anixter (Datacom)
(803) 691-9444

TENNESSEE

Memphis
Anixter (Datacom)
(901) 360-8222

Nashville
North Supply Company (Telco)
(615) 662-1632
Anixter (Datacom)
(615) 331-8190

Savannah
Antec (CATV)
(901) 925-8285

TEXAS

Arlington
North Supply Company (Telco)
(817) 277-6852
Antec (CATV)
(817) 548-9695

Dallas
Anixter (Datacom)
(214) 446-7337

Houston
Anixter (Datacom)
(713) 460-9473

Irving
Antec (CATV)
(800) 231-5006
214 717-4933

UTAH

Anixter (Datacom)
(801) 973-4472

VIRGINIA

Maidens
North Supply Company (Telco)
(804) 556-3450

Richmond
Anixter (Datacom)
(804) 527-0866

WASHINGTON

Edmonds
North Supply Company (Telco)
(206) 771-2283

Federal Way
Antec (CATV)
(800) 438-9290
(206) 838-9552

Seattle
Anixter (Datacom)
(206) 251-5287

WASHINGTON DC

Anixter (Datacom)
(703) 818-0150

WEST VIRGINIA

Huntington
Anixter (Datacom)
(304) 733-0845

WISCONSIN

Appleton
Anixter (Datacom)
(414) 730-9309

Eau Claire
North Supply Company (Telco)
(715) 878-4459

Milwaukee
Anixter (Datacom)
(414) 355-0222

Representatives

ALASKA

Frigid North
(907) 561-4633

ARKANSAS

Entest
(800) 955-0077

FLORIDA

(North)
EMSCO
(407) 849-6362

HAWAII

Ward/Davis Assoc.

IDAHO

Seltech
(503) 643-9202

KANSAS

Electronics Supply Co.
(816) 931-0250

LOUISANA

Entest
(800) 955-0077

MISSISSIPPI

Entest
(800) 955-0077

MISSOURI

(West)
Electronics Supply Co.
(816) 931-0250

MONTANA

Seltech
(503) 643-9202

NEBRASKA

Electronics Supply Co.
(816) 931-0250

NEVADA

(North)
Ward/Davis Assoc.
(310) 643-6977

OKLAHOMA

Entest
(800) 955-0077

UTAH

Seltech
(503) 643-9202

WYOMING

Seltech
(503) 643-9202

IDENTIFIED MILITARY ACCOUNTS

Jack Howard Assoc., Inc.
(210) 828-5741

FOR CABLE AND TRANSMISSION TEST PRODUCTS

Call Toll Free:
1-800-833-9200

US Sales and Service Offices

ALABAMA

Huntsville
4970 Corporate Drive
Suite 100A
Huntsville 35805
Phone: (205) 830-9212
Fax: (205) 837-2666

ALASKA

Served by Seattle, Washington Field Office
Phone: (800) 237-9514
For Orders:
(800) 835-3553

ARIZONA

Phoenix
3015 S. 48th Street
Suite 100
Tempe 85282
Phone: (602) 438-1011
Toll Free: (800) 366-8358
Fax: (602) 437-9210
For Orders:
(800) 538-8125

CALIFORNIA (NORTH)

Santa Clara
3003 Bunker Hill Lane
Santa Clara 95054
Phone: (408) 496-0800
Fax: (408) 988-6051
For Orders:
(800) 538-8125
Mailing Address:
P.O. Box 58086
Santa Clara 95052-8086

CALIFORNIA (SOUTH)

Irvine
17052 Jamboree Rd.
Irvine 92714
Phone: (714) 660-8080
Toll Free: (800) 255-2958
Fax: (714) 474-1490
Mailing Address:
P.O. Box 19523
Irvine 92713
For Orders:
(800) 538-8125

Los Angeles
21300 Erwin Street
Woodland Hills 91367
Phone: (818) 999-1711
Toll Free: (800) 404-1170
Fax: (818) 340-9840
Mailing Address:
P.O. Box 8500
Woodland Hills 91365
For Orders:
(800) 538-8125

COLORADO

Denver
61 Inverness Drive East
Suite 206
Englewood 80112
Phone: (303) 799-1000
Fax: (303) 790-4754
Toll Free: (800) 543-6097

DISTRICT OF COLUMBIA

See Maryland

FLORIDA

Orlando
151 Southhall Lane
Suite 170
Maitland 32751
Phone: (407) 660-2727
Fax: (407) 660-8585

Pensacola
1101 Gulf Breeze Pky. #211
Gulf Breeze 32561
Phone: (904) 932-4080
Fax: (904) 932-5642

GEORGIA

Atlanta
6625 The Corners Parkway
Suite 120
Norcross 30092
Phone: (404) 449-4770
Fax: (404) 449-0358

HAWAII

Honolulu
Served by the Santa Clara, California Field Office
For Orders:
(800) 538-8125

IDAHO

Served by Seattle, Washington Field Office
Phone: (800) 237-9514
For Orders:
(800) 835-3553

ILLINOIS

Chicago
5350 Keystone Court
Rolling Meadows 60008
Phone: (708) 259-7580
Fax: (708) 259-8388
Service Fax:
(708) 259-1394
Toll Free: (800) 458-7587

INDIANA

Indianapolis
Served by the Chicago, Illinois Field Office
Phone: (800) 458-7587

IOWA

Served by the Chicago, Illinois Field Office
Phone: (800) 458-7587

KENTUCKY

Served by the DC, Maryland Field Office.
Phone Toll Free:
(800) 545-2712

MARYLAND

DC
700 Professional Drive
Suite A
Gaithersburg 20879-3499
Phone: (301) 948-7151
Fax: (301) 921-9273
Mailing Address:
P.O. Box 6026
Gaithersburg 20884-6026
Service: (301) 948-6316
Service Fax:
(301) 926-4329
Toll Free Sales:
(800) 545-2712
Toll Free Service:
(800) 962-9738

MASSACHUSETTS

Boston
125 Hartwell Avenue
Lexington 02173
Phone: (617) 861-6800
Fax: (617) 863-5994
Toll Free (800) 545-8408

MICHIGAN

Detroit
39555 Orchard Hill Place
Dr., Suite 525
Novi 48375
Phone: (810) 348-9070
Fax: (810) 348-4819

MINNESOTA

St Paul
2685 Long Lake Road
Roseville 55113
Phone: (612) 635-0520
Fax: (612) 635-0716

MISSOURI

St. Louis
12400 Olive Blvd.
Suite 555
St. Louis 61341-5439
Phone: (314) 275-4474
Fax: (314) 569-1061

MONTANA

Served by Seattle, Washington Field Office
Phone: (800) 237-9514
For Orders:
(800) 835-3553

NEVADA

Served by the Santa Clara, California Field Office
For Orders:
(800) 538-8125

NEW JERSEY

Woodbridge
40 Gill Lane
Woodbridge 07095
Phone: (908) 636-8616
Fax: (908) 636-7234

NEW MEXICO

Albuquerque
6100 Uptown Blvd., NE
Suite 640
Albuquerque 87110
Phone: (505) 884-2828
Fax: (505) 888-3558

Los Alamos
127 Eastgate Drive
Suite H
Los Alamos 87544
Phone: (505) 662-6960

NEW YORK

Albany
125 Wolf Road
Suite 503-7
Albany 12205
Phone: (518) 458-7291
Fax: (518) 458-7361

Long Island
425 Broad Hollow Road,
Suite 231
Melville 11747
Phone: (516) 249-8833
Fax: (516) 249-4411

Rochester
1160 Pittsford-Victor
Road, Suite C
Pittsford 14534
Phone: (716) 383-0070
Fax: (716) 383-0022

NORTH CAROLINA

Raleigh
2950 Gateway Centre Blvd.
Morrisville 27560
Phone: (919) 481-3800
Fax: (919) 469-8823

NORTH DAKOTA

Served by the St. Paul, Minnesota Field Office
Phone: (612) 635-0520

OHIO

Cleveland
Served by the Gaithersburg, Maryland Field Office
Phone: (301) 948-7151

Dayton
3131 Newmark Drive
Suite 206
Miamisburg 45342
Phone: (513) 438-1166
Fax: (513) 438-1106

OREGON

Portland
Mailing Address:
Portland Sales
M/S 50-PTLD
P.O. Box 500
Beaverton 97077
Shipping Address:
Portland Sales
M/S 50-PTLD
Regional Distr. Ctr.
Beaverton 97077
Phone: (503) 627-7999
Fax: (503) 627-7995
Toll Free (800) 621-1966
Service:
Phone: 1-TEK-WIDE
Ext. 6630
Phone (503) 627-6630
Fax: (503) 627-6576
For Orders: (800) 835-3553

PENNSYLVANIA

Philadelphia
450 Sentry Parkway
Blue Bell 19422
Phone: (610) 825-6400
Fax: (610) 825-8839

Pittsburgh
1051 Brinton Road
Pittsburgh 15221
Phone: (412) 244-9800
Fax: (412) 244-1948

SOUTH CAROLINA

Served by the Raleigh, North Carolina Field Office
Phone: (919) 481-3800

SOUTH DAKOTA

Served by the St. Paul, Minnesota Field Office
Phone: (612) 635-0520

TENNESSEE

Served by the Huntsville, Alabama Field Office
Phone: (205) 830-9212

TEXAS

Dallas
2435 Kinwest Parkway
Suite 101, Irving 75063
Phone: (214) 401-1666
Fax: (214) 401-1646
Toll Free Sales:
(800) 852-4043
Toll Free Service:
(800) 334-0525

El Paso
1855 Trawood, Suite 101
El Paso 79935
Phone: (915) 593-8090

Houston
One West Chase Center
10770 Westheimer
Suite 170
Houston 77042
Phone: (713) 784-1800
Fax: (713) 784-4440

Kelly
1831 S. Gen. McMullen
Dr., Suite 101
San Antonio 78226
Phone: (210) 432-1341
Fax: (210) 432-1859

UTAH

Served by Seattle, Washington Field Office
Phone: (800) 237-9514
For Orders:
(800) 835-3553

VIRGINIA

Crystal City
Crystal Square 2,
Suite 406
1725 Jefferson Davis Hwy.
Arlington 22202
Phone: (703) 413-1200
Fax: (703) 413-1205

Hampton
Served by the Gaithersburg, Maryland Field Office
Phone: (301) 948-7151

WASHINGTON

Seattle
11814 115th Avenue N.E.
Kirkland 98034
Phone: (206) 821-9100
Fax: (206) 821-3607
For Orders:
(800) 835-3553

WEST VIRGINIA

Served by the Gaithersburg, Maryland Field Office
Phone: (301) 948-7151

FOR FEDERAL ORDERS

Tektronix, Inc.
Federal Order Mgt.
MS/94-532
P.O. Box 4600
Beaverton, OR 97076
Phone: (800) 835-3553
Fax: (503) 629-5388

CORPORATE OFFICE

Tektronix, Inc.
26600 SW Parkway
P.O. Box 1000
Wilsonville, Oregon
97070-1000
(503) 682-3411
(800) TEK-WIDE