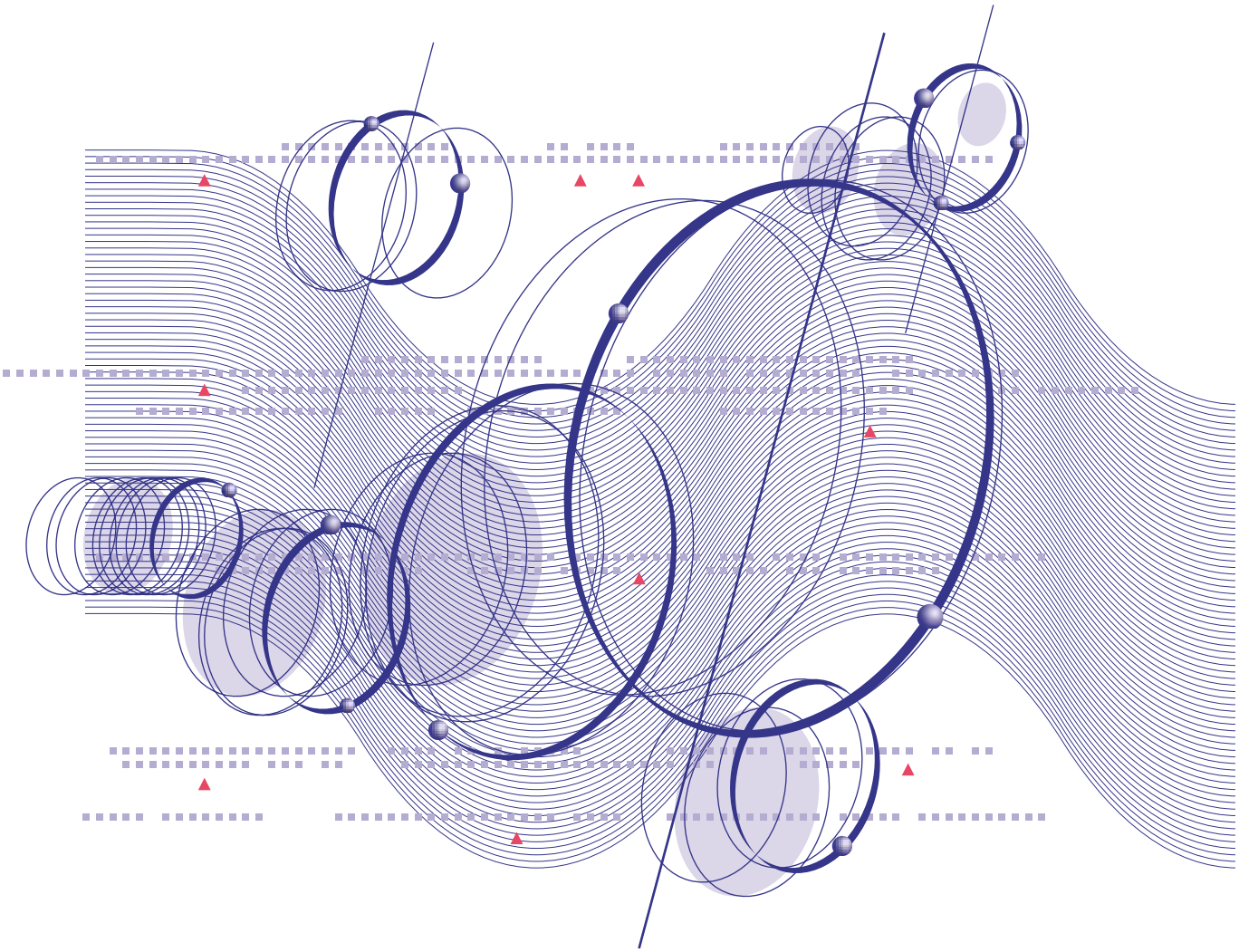
Discover What's Possible®

Anritsu

ELECTRONIC MEASURING INSTRUMENTS



Digital, SONET/SDH, IP and Optics Test
Product Catalog 2005

Contents

Digital, SONET/SDH, IP and Optics Test

OUTLINE OF ANRITSU CORPORATION

Anritsu Corporation's predecessor, Anritsu Electric Co. Ltd., was created by the 1931 merger of Kyoritsu Denki, which grew out of Sekisansha Co., founded in 1895 as a manufacturer of wire communication equipment, and Annaka Denki Seisakusho, established in 1900 as a pioneer in wireless communication equipment. The company name was changed to Anritsu Corporation in 1985 to reflect the firm's status as an international enterprise.
With a history in wire and wireless communications equipment, Anritsu has contributed to the enhancement of society through its numerous products, which include equipment for "original and high-level" communication equipment, instrumentation and control equipment, information terminals, and manufacturing equipment. In particular, Anritsu has grown to be recognized as a world leader in measurement systems for wireless communications as well as optical and super high-speed digital communications. Customers in well over 100 countries use Anritsu products in a diverse range of industrial areas.
To ensure that Anritsu products are of the highest quality, the Anritsu Group is establishing a quality system conforming to international standards, and has become registered as an ISO9001 quality assurance corporation by JQA.

Meanwhile, Anritsu head office and Tohoku Anritsu Corporation have earned ISO14001 environmental management certification, demonstrating our dedication to preserving the natural environment.
It is now apparent that the focus of Anritsu's attention, the mobile and Internet areas, are about to evolve even further. In addition to broadband and IP, the entrance of digital broadcasting and intelligent home appliances, mean the arrival of an ubiquitous network society where people are able to communicate anytime, anywhere, with everything as seamless connection between networks developed.
In order to be both the best partner for our customers and to continue to evolve, Anritsu is putting the "original and high-level" technology and intelligence coming from our 100-year history toward this ubiquitous network society. We have transformed ourselves into an "Intelligent Solution Creator." By providing electronic, information communication and measurement solutions that directly contribute to the success of our customers' businesses, Anritsu is supporting the evolution of a ubiquitous network society.

Established ..... March 17, 1931
Paid-up capital ¥14,043,000,000
Employees ..... 3,568 (worldwide)

Head Office
1800 Onna, Atsugi-shi, Kanagawa, 243-8555, Japan
Phone: +81-46-223-1111
Fax: +81-46-296-1264

See page 6 for sales network.

Head Office

ANRITSU COMPANY
490 Jarvis Drive, Morgan Hill, CA 95037-2809, U.S.A.
Phone: +1-408-778-2000
Fax: +1-408-776-1744

ANRITSU COMPANY, U.S.

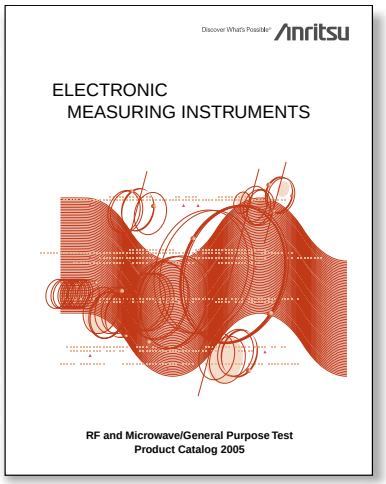
ANRITSU LTD.
200 Capability Green, Luton, Bedfordshire, LU1 3LU, United Kingdom
Phone: +44-1582-433200
Fax: +44-1582-731303

ANRITSU LTD.

For the latest product updates visit *www.anritsu.com*

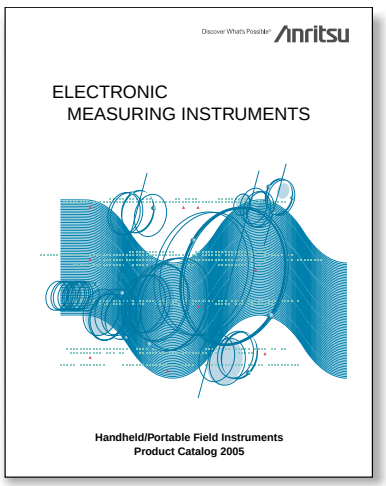
Keep up to date on the latest product specifications, literature and Anritsu news on *www.anritsu.com*. Access Anritsu's regional websites to see local events, training and upcoming conferences.

Below is a list of other Anritsu Electronic Measuring Instruments Catalogs you can order by filling out the inserted Business Reply Card or visiting *www.us.anritsu.com/emicatalog*



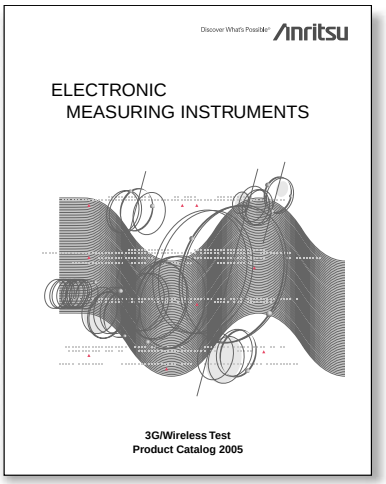
RF and Microwave/General Purpose Test

- Automatic Calibrators
- Frequency Counters
- Vector Network Analyzers
- PIM-S System
- Power Amplifier Test System
- Power Meters
- Scalar Network Analyzers
- Signal Analyzers
- Synthesized Level Generators
- Signal Generators
- Spectrum Analyzers
- Tower Mounted Amplifier Test System
- Vector Network Analyzers



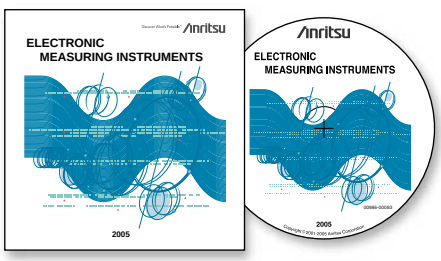
Handheld/Portable Field Instruments

- Access Master OTDR for FTTx test
- WCDMA Area Tester
- Cell Master Base Station Analyzer
- Handheld Spectrum Analyzers
- Network Data Analyzer
- Wideband Peak Power Meter
- Optical time domain Reflectometer
- Optical Loss Test Set
- OTDR, Optical Handy Power Meter
- Power Meters
- Site Master Cable and Antenna Analyzers



3G/Wireless Test

- WCDMA TRX/Performance Test System
- Digital Modulation Signal Generator
- WCDMA Signaling Tester
- Signaling Tester
- WCDMA Rapid Test Designer (RTD)
- WCDMA Protocol Test System (PTS)
- WCDMA Virtual Signaling Tester (VST)
- Digital Mobile Radio Transmitter Tester
- WLAN Test Set
- Radio Communication Analyzer
- Bluetooth™ Test Set
- Bluetooth™ Prequalification Test System (PQTS)
- WCDMA Area Tester
- Spectrum Analyzer
- Bit Error Rate Tester
- Signature™ High Performance Signal Analyzer
- 3GPP Protocol Analyzer



2005 Anritsu EMI Catalog CD ROM

Visit *www.us.anritsu.com/emicatalog* to download the full version of the 2005 Electronic Measuring Instruments Catalog in PDF format, or to order the catalog on CD ROM.

Order by model number
When ordering, please specify the model number and name of the instrument desired, for example, “MP1570A SONET/SDH/PDH/ATM Analyzer.” To ensure accuracy, please include all necessary specifications and provide specific instructions in your order; include special options, features, nonstandard power line voltage, etc. To expedite your order we suggest that you contact us directly.

Shipment
Generally, instruments will be shipped within two months of receipt of your order. In the case of “Custom-made products” mentioned in the footnotes, shipment may take from 4 to 7 months. Every endeavor will be made to maintain delivery dates, but no liability is accepted for loss, damage, or delay of instruments, for reasons which are out of our control.

Terms
Unless previous terms have been arranged, we will use one of the following:
- Full payment in advance of shipment
- Sight draft against an irrevocable confirmed letter of credit

Quotations and pro forma invoices
FOB, CIF, C&F, etc., quotations, and pro forma invoices are available upon request. The instrument price includes a packing charge.

Inspection surcharge
An inspection surcharge is applied to all orders requiring inspection by government agencies or individually appointed inspectors at our factory.

Special products made-to-order
Requests for remodeling standard products for special use will be accepted, but only after detailed discussions.

Returning instrument for repairs
When returning an instrument to Anritsu for repairs, the following suggestions will help us return it back to you in the shortest possible time:
- Send complete instructions about what you would like done to the instrument.
- If possible, include the “symptoms” or “defects.”
- Indicate the return address along with the address to be used for billing purposes.

Extended warranty service
Extended Warranty Services, Option ES, provide extension of the normal product warranty and may be purchased for many Anritsu products. These services may include repair and/or routine calibration and may be available for delivery on-site or on a return to Anritsu Service Center basis. Consult your local Anritsu Sales Office or Sales Representative for price and availability.

WARRANTY
All other expressed warranties are disclaimed and all implied warranties for this product, including the warranties of merchantability and fitness for a particular purpose, are limited in duration to a period of one year from the date of delivery. In no event shall all Anritsu group be liable to the customer for any damages, including lost profits, or other incidental or consequential damages arising out of the use or inability to use this product.

• **Argentina**

MULTIRADIO S.A.
Av. Cordoba, 4860 Buenos Aires
C1414BAT, Argentina
TEL: +5411-4779-5555
FAX: +5411-4779-5510

• **Australia**

ANRITSU PTY LTD
Unit 3/170 Forster Road
Mount. Waverley, Vic., 3149
Australia
TEL: +61-3-9558-8177
FAX: +61-3-9558-8255

• **Austria**

WIEN-SCHALL GmbH
Krichbaumgasse 25
A-1120 Vienna, Austria
TEL: +43-1-81155140
FAX: +43-1-81155180

ELSINCO GmbH
(HEADQUARTERS)
Breitenfurter Strasse 13
A-1120 Vienna, Austria
TEL: +43 (0)1 815 04 00
FAX: +43 (0)1 815 07 00

• **Bahrain**

BASMATECH
P. O. Box 5701, Manama, Bahrain
TEL: +973-273729
FAX: +973-725404

• **Belgium**

ANRITSU GmbH
Grafenberger Allee 54-56, 40237
Düsseldorf, Germany
TEL: +49-211-96855-0
FAX: +49-211-96855-55

• **Brazil**

ANRITSU ELETRÔNICA LTDA.
Praça Amadeu Amaral 27, 1 Andar
Bela Vista CEP 01327-010
São Paulo - SP, Brazil
TEL: +55-11-3283-2511
FAX: +55-11-3288-6940

ANRITSU ELETRÔNICA LTDA.
Rua Voluntarios da Patria, 45 13 Andar
Botafago CEP 22270-000, Rio de Janeiro, RJ
TEL: +55-21-2527-6922
FAX: +55-21-2537-1456

• **Bulgaria**

ELCO STAR COM
49, Zlatovrah
BG-1164 Sofia, Bulgaria
TEL: +359-2-962-8545
FAX: +359-2-962-8546

• **Canada**

ANRITSU ELECTRONICS LTD
700 Silver Seven Road, Suite 120, Kanata
ON K2V 1C3, Canada
TEL: +1-613-591-2003
FAX: +1-613-591-1006

ANRITSU ELECTRONICS LTD
(TORONTO OFFICE)
2810 Matheson Blvd. E, 2nd Fl.
Mississauga, ON L4W 4X7, Canada
TEL: +1-877-267-4878
TEL: +1-905-890-7799
FAX: +1-905-625-5864

ANRITSU ELECTRONICS LTD
(VANCOUVER OFFICE)
300-1055 W Hastings St.
Vancouver, BC V6E 2E9 Canada
TEL: +1-877-267-4878
TEL: +1-604-682-5933
FAX: +1-604-682-5934

• **Chile**

SISTEMAS DE INSTRUMENTACION LTDA.
Concha y Toro 65, Stgo Centro
Santiago, Chile 51880
TEL: +56-2-6960031
FAX: +56-2-6969665

• **China**

ANRITSU COMPANY LTD
(HONG KONG OFFICE)
Suite 923, 9/F, Chinachem Golden
Plaza, 77 Mody Road, Tsimshatsui East,
Kowloon, Hong Kong
TEL: +852-2301 4980
FAX: +852-2301 3545

ANRITSU COMPANY LTD
(BEIJING OFFICE)
Room 1515, Beijing Fortune Building
No.5, North Road, the East 3rd Ring Road
Chao Yang District, 100004
TEL: 010-6590 9230
FAX: 010-6590 9235

ANRITSU COMPANY LTD
(XI' AN OFFICE)
N0.1102, Zhi Cheng Building, No.2
Gao Xin I Road, Hign-Tech Development
Zone, Xi' an 710075
TEL: 029-8377 406/9
FAX: 029-8377 410

ANRITSU COMPANY LTD
(WUHAN OFFICE)
A1803, Zhong Shang Plaza, No.7
Zhongnan Road, Wuchang, Wuhan 430071
TEL: 027-8771 3355
FAX: 027-8732 2773

ANRITSU COMPANY LTD
(SHENYANG OFFICE)
2-185, City Plaza, No.206, Nanjing
North Street, He Ping District
Shenyang 110001
TEL: 024-2334 1178/89
FAX: 024-2334 2838

ANRITSU COMPANY LTD
(SHANGHAI OFFICES)
A1807-1810 City Center, Zun YiRoad
Shanghai 200051
TEL: 021-6237-0898
FAX: 021-6237-0899

ANRITSU ELECTRONICS CO. LTD
2F, Rm.B, 52 Section Factory Bldg.
No. 516 Fu Te Rd. (N), Shanghai Pudong
Weigaoqiao Free Trade Zone
Shanghai 200131, P.R. of China
TEL: (021) 5868-0228
FAX: (021) 5868-0588

ANRITSU COMPANY LTD
(GUANGZHOU OFFICE)
Room 3008-9, Dongshan Plaza
No.69 Xian Lie Central Road
Guangzhou 510095
TEL: 020-8732 2231/2
FAX: 020-8732 2230

ANRITSU COMPANY LTD
(CHENGDU OFFICE)
26E New Times Square,
No.42, Wen Wu Road, Xinhua Street
Chengdu 610017
TEL: 028-8651 0011/22/33
FAX: 028-8651 0055

ANRITSU COMPANY LTD
(CHONG QING OFFICE)
U9,No.3, Marriott Hotel, Office Tower
No.77, Youth Road, Central District
Chongqing 400010
TEL: 023-6383 0218
FAX: 023-6383 0238

ANRITSU COMPANY LTD
(SHENZHEN OFFICE)
Room 1505, Building A, World Trade Plaza
Fuhong Road, Shenzhen 518033
TEL: 0755-8366 2847/2851/2852
FAX: 0755-8366 2849

• **Costa Rica**

SONIVISION, S.A.
P.O. Box 620-1000, San Jose, Costa Rica
TEL: +506-231-5685
FAX: +506-231-6531

• **Croatia**

ELSINCO REPRESENTATION OFFICE ZAGREB
Savska 66 HR-10000 Zagreb, Croatia
TEL: +385 (0)1-631 2477
FAX: +385 (0)1-631 2488

• **Cyprus**

CHRIS RADIOVISION LTD
23 Crete Street, T.T. 1061
P. O. Box 21989, 1515 Nicosia, Cyprus
TEL: +357-22766121
FAX: +357-22765177

• **Czech Republic**

ELSINCO CZ S.R.O.
Novodvorská 994, CZ-142 21 Praha 4
Czech Republic
TEL: +420-241 001 251
FAX: +420-241 001 259

ELSINCO CZ S.R.O.
(BRNO BRANCH OFFICE)
Strmá 19, Czech Republic, CZ-616 00 Brno
TEL: +420-541 427 211
FAX: +420-541 427 219

• **Denmark**

ANRITSU AB DANMARK
Korskildelund 6
DK - 2670 Greve, Denmark
TEL: +45-36915035
FAX: +45-43909371

• **Ecuador**

EQUITRONICS S.A.
Belgica N32 H y Av. de Los Shyris
Edificio Ivsemon Park, Suite 4B
Quito, Ecuador
TEL: +593-2-2255-396
FAX: +593-2-2255-396

• **Egypt**

GIZA SYSTEMS ENGINEERING S.A.E.
17 Tiba Street, Mohandisseen, Giza, Egypt
TEL: +202-7608801
FAX: +202-3385775/3385799

• **Finland**

ANRITSU AB
Teknobulevardi 3-5, FI-01530
Vantaa, Finland
TEL: +358-9-435-522-0
FAX: +358-9-435-522-50

• **France**

ANRITSU S.A.
9, Avenue du Québec Z.A. de Courtaboeuf
91951 Les Ulis Cedex, France
TEL: +33-1-60-92-15-50
FAX: +33-1-64-46-10-65

• **Germany**

ANRITSU GmbH
Grafenberger Allee 54-56
D-40237 Dusseldorf, Germany
TEL: +49-211-96855-0
FAX: +49-211-96855-55

• **Greece**

KOSTAS KARAYANNIS SA
76, Lavriou str.
Nea Ionia GR 142 35
Athens, Greece
TEL: +30-210-2770800
FAX: +30-210-2719800

• **Guatemala**

IMPELSA
4a Calle 1-15 Zona 10
Guatemala, CP 01010
TEL: +502-362-5135
FAX: +502-362-6260

• **Hungary**

ELSINCO BUDAPEST K.F.T.
Pannónia utca 8. IV/I., H-1136 Budapest
Hungary
TEL: +36 (0)1 339 00 00
FAX: +36 (0)1 339 44 44

• **India**

M/S MERRA AGENCIES PVT. LTD
23 Community Centre, Zamroodpur
Kailash Colony Extension,
New Delhi - 110 048, India
TEL: +91-11-26442700
FAX: +91-11-26442500
(For Handheld Products only)

• **Indonesia**

PT. SUBUR SAKTI PUTERA
Jalan Tanah Abang III No. 15
Jakarta 10044 Indonesia
TEL: +62-21-352-4821
FAX: +62-21-352 4831

• **Ireland**

PEMA LTD
Ardee Enterprise Centre
Ardee, Co. Louth.
Ireland
TEL: +353 (0) 41-685-7870
FAX: +353 (0) 41-685-7875

• **Israel**

TECH-CENT LTD
P. O. Box 43259 (Mailing Address)
12 Raul Valenberg St. (Street Address)
Tel-Aviv, 61430
Israel
TEL: +972-03 6478563
FAX: +972-03 6478334

• **Italy**

ANRITSU S.P.A.
Via Elio Vittorini
129, 00144 Roma EUR, Italy
TEL: +39-06-509-9711
FAX: +39-06-502-2425

ANRITSU S.P.A.
(MILANO OFFICE)
C.D. Colleoni, Via Paracelso, 4 20041
AGRATE B.ZA (MI), Italy
TEL: +39-039- 657021
FAX: +39-039-6056396

• **Japan**

ANRITSU CORPORATION
1800 Onna, Atsugi-shi, Kanagawa
243-8555, Japan
TEL: +81-46-223-1111
FAX: +81-46-296-1264

• **Korea**

ANRITSU CORPORATION LTD
8F Hyunjuk-Bldg, 832-41,
Yeoksam-Dong, Kangnam-Ku
Seoul, 135-080, Korea
TEL: +82-2-553-6603
FAX: +82-2-553-6604, 6605

• **Kuwait**

TAREQ COMPANY
P.O. Box 20506 Safat, 13066 Safat, Kuwait
TEL: +965-243-6100
FAX: +965-243-7700

• **Luxembourg**

ANRITSU GmbH
Grafenberger Allee 54-56
D-40237 Dusseldorf
TEL: +49-211-96855-0
FAX: +49-211-96855-55

• **Malaysia**

O'CONNOR'S ENGINEERING SDN BHD
Bangunan O'Connor, Lot 13 Jalan 223
46100 Petaling Jaya, Selangor D.E
P.O. Box 8795, 46798 Kelana Jaya
Selangor Darul Ehsan, Malaysia
TEL: 603-79538400
FAX: 603-79577871

• **Mexico**

SHIKATRONICS MMWAVE S.A. DE C.V.
Luz Savinon # 9, Sexto Piso
Colonia del Valle
Mexico DF
CP 03100
TEL: +5255-9171-9500
FAX: +5255-9171-9515

• **Morroco**

SEDEL
24, 26, Bd, Resistance, Casablanca
Morroco
TEL: +212-2-302444
FAX: +212-2-449311

• **Nepal**

BR INTERNATIONAL PVT. LTD
P. O. Box 60, Tamrakar Comm. Bldg.
Bhotebahal Kathmandu, Nepal
TEL: +977-1-224-706
FAX: +977-1-227-956

• **Netherlands**

ANRITSU GmbH
Grafenberger Allee 54-56, 40237
Düsseldorf, Germany
TEL: +49-211-96855-0
FAX: +49-211-96855-55

• **New Zealand**

ELECTROTEST LTD
PO Box 300 475
Albany, Auckland
New Zealand
TEL: +64-9-448-2600
FAX: +64-9-448-2611

• **Nigeria**

TELNET NETWORK SERVICES
Plot 242 Kofo Abayomi Street
Victoria Island,
P.O. Box 53656, Ikoyi
Lagos, Nigeria
TEL: +234-1-2611729
FAX: +234-1-2619945

• **Norway**

BLOMKVIST AS
Veslefrikksvei 11
Pb 188 1371 ASKR, Norway
TEL: +47-66-901190
FAX: +47-66-901212

• **Oman**

NATIONAL PROJECTS AND TECHNOLOGY COMPANY L.L.C
P. O. Box 97, Wadi Al Kabi
Postal Code 117, Sultanate of Oman
TEL: +968-793741
FAX: +968-796158

• **Pakistan**

AETCO
Zia Chambers, 25-Mcleod road
Lahore 54000, Pakistan
TEL: +92-42-7311035
FAX: +92-42-7221456

SUPERIOR ELECTRONICS ASSOCIATED
B-98 Block H, North Nasimabad
Karachi-33, Pakistan
TEL: +92-21-613655

• **Paraguay**

DATALAB S.R.L.
Avda. Artigas No 1645 Edificio "DataLab"
Asuncion, Paraguay
TEL: +595-21-20-9126
FAX: +595-21-20-9127

• **Peru**

IATEC SAC
Av. Canaval y Moreyra 840 Ofic. 301
San Isidro, Lima 27
Peru
TEL: +51-1-226-4422

• **Philippines**

SALRITSU INTERNATIONAL TRADING CORPORATION
25/F Unit 2502, 139 Corporate Center
139 Valero St., Salcedo Village
Makati City 1227, Philippines
TEL: +632-893-8998/816-2646/812-4385
FAX: +632-815-0986

• **Poland**

ELSINCO POLSKA SP. Z.O.O.
ul Gdanska 50, PL-01-691 Warszawa
Poland
TEL: +48 (0)22-832 40 42
FAX: +48 (0)22-832 22 38

• **Portugal**

OMNILECTRO S.A.
Estrada de Alfragide, 43
2720-015 Amadora, Portugal
TEL: +351-21-4721210
FAX: +351-21-4721209

• **Puerto Rico**

CARIBBEAN DATA SYSTEM
636, San Patricio Ave. San Juan
PR00920-4507
Puerto Rico
TEL: +1-787-774-6969
FAX: +1-787-774-6973

• **Qatar**

QATAR COMMUNICATIONS LTD
P. O. Box 2481, Doha Qatar
TEL: +974-424347
FAX: +974-324777

• **Romania**

ELSINCO
Budapest KFT
Pannónia utca 8. IV/1
H-1136
Budapest
TEL: +36 (0)1 339 00 00
FAX: +36 (0)1 339 44 44

Authorized Distributor:

ROMKATEL S.R.L.
Str. Dristor Nr. 5, Bl. A20 Scara 2, Ap. 16RO-74321 Bucuresti 3
TEL: +40 21 322 74 40
FAX:+40 21 320 44 08

• **Russia & CIS Countries**

ELSINCO POLSKA SP.Z.O.O.
ul. Gdanska 50
PL-01-691 Warszawa
TEL: +48 (0)22-832-40-42
FAX: +48 (0)22-832-22-38

Authorized Distributor:

TELECOM TEST
Bld. 6, 4th Voykovsky proezd.
RU-125171 Moscow
TEL: +7 095 755 6592
FAX: +7 095 755 6593

• **Saudi Arabia**

A. RAJAB & A. SILSILAH & CO.
P. O. Box 203, Jeddah 21411
Saudi Arabia
TEL: +966-2-6610006
FAX: +966-2-6610558

ELECTRONIC EQUIPMENT MARKETING CO. (EEMCO)
No. 28, Baroudi Lane
Sulaymaniya, Riyadh 11481
Saudi Arabia
TEL: +966-1-477-1650
FAX: +966-1-478-5140
Add a New Country.

• **Serbia**

ELSINCO GmbH
Breitenfurter Str. 13
A-1120 Vienna, Austria
TEL: +43 (0)1 815 04 00
FAX: +43 (0)1 815 07 00

Authorized Distributor:

TETRA D.O.O.
V. Tomanovica 2
YU-11050 Beograd
TEL: +381 11 3470 720
FAX:+381 11 3470 700

• **Singapore**

ANRITSU PTE. LTD
10, Hoe Chiang Road #07-01/02
Keppel Towers, 089315
Singapore
TEL: +65-6282-2400
FAX: +65-6282-2533

• **Slovakia**

ELSINCO SLOVENSKO, S.R.O.
Kudlákova 4, SK-841 01 Bratislava
Slovakia
TEL: +421 (0)2 6428 41 65
FAX: +421 (0)2 6428 44 54

ELSINCO SLOVENSKO, S.R.O.
(KOSICE BRANCH OFFICE)
Juzna trieda 6 SK-040 01 Kosice
Slovakia
TEL: +421 (0) 55 622 6729
FAX: +421 (0) 55 622 6729

• **Slovenia**

ELSINCO D.O.O.
Dalmatinova 2, SI-1000
Ljubljana, Slovenia
TEL: +386 (0)1 432 62 77
FAX: +386 (0)1 231 73 97

• **South Africa**

ETECSA (PTY) LTD
12 Surrey Square Office Park, 330 Surrey Avenue, Ferndale, 2194 Randburg
South Africa
(P. O. Box 4231 Randburg, 2125 South Africa)
TEL: +27-11-787-7200
FAX: +27-11-787-0446

• **Spain**

ANRITSU LTD
European Sales Development Centre
200 Capability Green
Luton, LU1 3LU - United Kingdom
TEL: +44-1582-433 340
TEL: +44-1582-433 319
Local Support TEL: +34 91 640 4460

• **Sri Lanka**

INFOTECHS LTD
23/1 Jaya Road
Colombo 4, Sri Lanka
TEL: +94-1-583210
FAX: +94-1-584644

• **Sweden**

ANRITSU AB
Borgarfjordsgatan 13 A
164 40 KISTA
Sweden
TEL: +46(0)-8-534-707 00
FAX: +46(0)-8-534-707 30

• **Switzerland**

EXANOVIS AG
Moosstrasse 8a
3322 Schoenbuehl
Switzerland
TEL: +41-031-850-2525
FAX: +41-031-850-2520

• **Taiwan**

ANRITSU COMPANY, INC.
7F, NO. 316, Sec. 1, Neihu Road
Taipei, Taiwan R.O.C.
TEL: +886-2-8751-1816
FAX: +886-2-8751-1817

ANRITSU COMPANY, INC.
No. 21, Lane 23
Guandung Road
Hsinchu Taiwan
TEL: +886-3-563-6601
FAX: +886-3-564-5819

• **Thailand**

JASMINE TELECOM SYSTEM PUBLIC CO LTD
200 Moo 4, 9th Floor, Jasmine Intl Tower
Chaengwatana Rd., Tambon Pakkret,
Amphoe Pakkret, Nonthaburi
11120,Thailand
TEL: +(66)0-2502-3224
FAX: +(66)0-2502-3363

• **Trinidad & Tobago**

ANTEL COMMUNICATION SERVICES LTD.
24 10th Avenue Barataria
Trinidad & Tobago
TEL: (868) 674-1406
FAX: (868) 638-2409

• United Arab Emirates

UTMOST ELECTRONICS TRADING L.L.C.
(ABU DHABI BRANCH)
P. O. Box: 41175, Abu Dhabi
United Arab Emirates
TEL: +971-2-6458909
FAX: +971-2-6458907

• United Kingdom

ANRITSU LTD
200 Capability Green, Luton, Bedfordshire
LU1 3LU, United Kingdom
TEL: +44-1582-433200
FAX: +44-1582-731303

ANRITSU LTD
(LIVINGSTON OFFICE)
Unit 1, Knightsridge Industrial Estate
Turnbull Way, Knightsridge
Livingston EH54 8RB, United Kingdom
TEL: +44-1506-436111
FAX: +44-1506-436112

• United States

ANRITSU COMPANY
(CORPORATE OFFICES)
490 Jarvis Drive
Morgan Hill, CA 95037-2809, U.S.A.
Toll Free: 1-800-ANRITSU (267-4878)
TEL: +1-408-778-2000
FAX: +1-408-776-1744

ANRITSU COMPANY
1155 East Collins Blvd.
Richardson, TX 75081, U.S.A.
Toll Free: 1-800-ANRITSU (267-4878)
TEL: +1-972-644-1777
FAX: +1-972-671-1877

ANRITSU COMPANY
(SALES AND SERVICE, NJ OFFICE)
10 New Maple Avenue, Unit 305
P. O. Box 836,
Pine Brook, NJ 07058-0836, U.S.A.
Toll Free: 1-800-ANRITSU (267-4878)
TEL: +1-973-227-8999
FAX: +1-973-575-0092

• Uruguay

CABONORTE S.A.
Santa Lucia 5890
CP 11700
Montevideo Uruguay
TEL: +598 2 3095356
FAX: +598 2 3095776

• Venezuela

RADIOCOMUNICACIONES CRUZ C.A.
Calle la Colina, quinta Elison
Colina de los Caobos
Caracas 1050, Venezuela
TEL: +58-212-7932322
FAX: +58-212-7933429

• Vietnam

SYSTEM & TECHNOLOGIES VIETNAM LTD
Unit # B236, Binh Minh Hotel
27 Ly Thai To St.
Hanoi, Vietnam
TEL: +84-4-8-264-728
FAX: +84-4-9-344-111

Supports Next Generation Network Measurement from OTN to 10 GbE

MP1590B Network Performance Tester

The MP1590B Network Performance Tester is a measuring instrument capable of measuring IP networks using the Ethernet plug-in modules of the Anritsu IP tester MD1230 Family, as well as traditional functions including testing of PDH, DSn, SDH/SONET, and OTN equipment and jitter measurement, with only one box. A new EoS unit supports EoS measurement, virtual concatenation, and LCAS measurement to enable testing of next-generation SDH/SONET equipment. The traditional MP1590A plug-in units can also be used without changes.
The MP1590B can perform some simultaneous applications such as SDH/SONET, OTN, EoS, jitter and Ethernet measurement using a combination of plug-in units.

(For further information see page 14)

IP Testing Instruments Changing in Response to Applications for Core, Metropolitan-area, and Access Networks

MD1230 Family

MD1230B Data Quality Analyzer, MD1231A/A1 IP Network Analyzer, MT7407A Multislot Chassis

Anritsu's MD1230 Family can measure network quality.
Evaluating the network quality of service (QoS) based on various indexes has importance in terms of assuring the accurate transmission of video, voice, and mission-critical data.
The MD1230 Family puts all the functions required to measure network quality in one unit. The functions include the multi-flow counter, useful to measure the performance of VLAN, packet jitter checking by the measurement of the intervals of arriving packets, and packet transmission at the wire rate.
With its integrated operation, the MD1230 Family provides highly efficient measurements and cost reduction.

(For further information see page 25)

All-New Field Measuring Instrument for FTTx

MT9080 Series ACCESS Master™

1.31/1.55/1.65 µm (SM)

The functions and performance required for field measuring instruments are changing according to network trends.
Access providers are now starting broadband optical access services such as FTTB, including Gigabit Ethernet for enterprises, FTTC, and FTTP for general homes.
The MT9080 Series ACCESS Master is a compact and high-cost-performance OTDR for installation and maintenance of FTTx optical fibers.

(For further information see page 49)

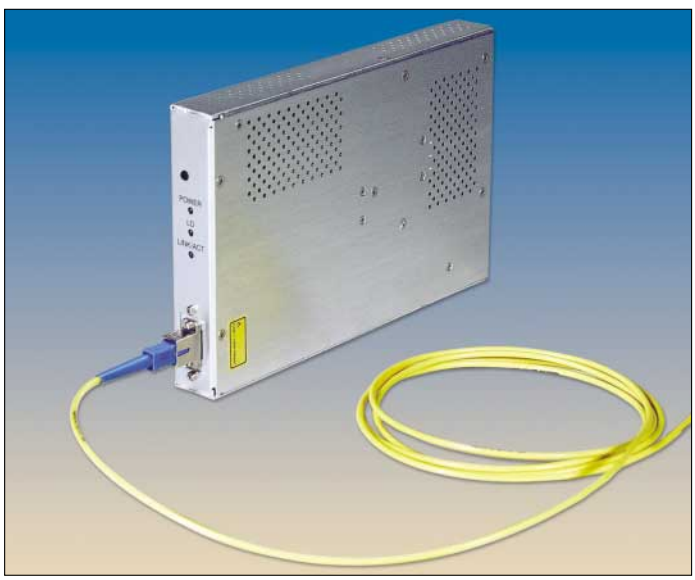
Compact and High Performance OTDR Module for Optical Fiber Monitor Systems

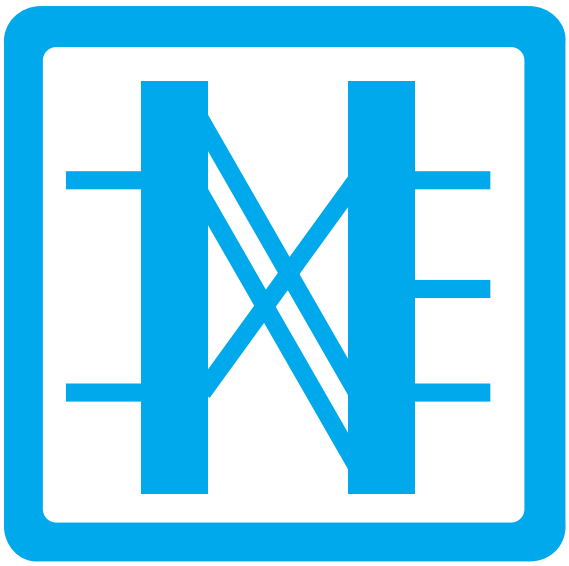
MW9077A/A1 OTDR Module

1.31 µm (SM)/1.55 µm (SM)

The MW9077A/A1 OTDR module is a suitable OTDR module for an optical fiber monitor system. In recent years, monitoring of optical fibers is applicable to many fields, not only in maintenance of optical-communications network systems, but also security sensor, flood sensor, and prevention of disasters, etc. The MW9077A/A1 OTDR module offers a compact and high performance OTDR solution in such an optical fiber application system.

(For further information see page 54)





SONET/SDH & INTERNET PROTOCOL TESTERS

NETWORK PERFORMANCE TESTER
MP1590B

CE

Supports Next Generation Network Measurement from OTN to 10 GbE

NEW

The MP1590B Network Performance Tester is a measuring instrument capable of measuring IP networks using the Ethernet plug-in modules of the Anritsu IP tester MD1230 Family, as well as traditional functions including testing of PDH, DSn, SDH/SONET, and OTN equipment and jitter measurement, with only one box. A new EoS unit supports EoS measurement, virtual concatenation, and LCAS measurement to enable testing of next-generation SDH/SONET equipment. The traditional MP1590A plug-in units can also be used without changes.
The MP1590B can perform some simultaneous applications - such as SDH/SONET, OTN, EoS, jitter and Ethernet measurement - using a combination of plug-in units.

• Encapsulation test
The EoS unit MU150101A supports the GFP-F, LEX, LAPS (X.86), PPP, CiscoHDLC, and MAPOS encapsulation methods. With more than 120 types of real-time counter functions and a 256 MB frame capture analysis function, it is possible to verify detailed information of EoS frames like GFP-F frames.
Since both this unit and Ethernet modules can work at the same time, the EoS Layer and Ethernet Layer can be measured simultaneously to evaluate the EoS encapsulation function with one box.

• Virtual concatenation
In addition to traditional concatenation mapping, the MP1590B supports virtual concatenation and arbitrary concatenation.

Virtual concatenation member size

SONET	STS3cSPE-Xv (X = 1 to 16) STS1SPE-Xv (X = 1 to 48): High order VT2SPE-Xv (X = 1 to 63) VT1.5-Xv (X = 1 to 64)
SDH	VC-4-Xv (X = 1 to 16) VC-3-Xv (X = 1 to 48): High order VC-12-Xv (X = 1 to 63) VC-11-Xv (X = 1 to 64)

• LCAS measurement
The EoS unit also supports LCAS measurement.
The LCAS monitoring function can monitor all members and all MSTs (Member Statuses) in a VCAT group simultaneously.
The LCAS capture function can capture up to 64 LCAS sequences for easy analysis of the LCAS protocol. The LCAS generation function can generate up to 64 LCAS sequences to test the LCAS function using several sequence patterns.

• Ethernet/IP measurement
Since the 10M/100M, Gigabit, and 10 Gigabit Ethernet modules for the Anritsu IP tester MD1230 Family can be used without changes, the MP1590B can be used as a full-scale IP tester with these Ethernet modules.
Also, because the MP1590B unit and Ethernet modules can be used simultaneously, comprehensive measurements for several layers including SDH/SONET, OTN, Ethernet, IP, and TCP/UDP can be performed.

• Supports PDH/DSn/SDH/SONET/OTN (1.5 Mbit/s to 10.7 Gbit/s) interfaces with only one unit
The MP1590B supports the following electrical interfaces and optical interfaces.

Electrical interfaces:
PDH (2.048, 8.448, 34.368, 139.264 Mbit/s), DSn (1.544, 44.736 Mbit/s), STM-0/1/64, STS-1/3/192
Optical interfaces:
STM-0/1/4/16/64, STS-1/3/12/48/192 OTU-1, OTU-2

Because a plug-in system is employed, units can be used in various combinations as needed.

• ITU-T G.709 OTN measurement
The MP1590B supports setting/monitoring of all overheads for OTU-1 (2.66 Gbit/s) and OTU-2 (10.71 Gbit/s) conforming to ITU-T G.709. It also supports multi-frame OH. Functions of OTN equipment can be tested by using error/alarm generation/ detection functions. In particular, the random error insertion function on the MP1590B enables evaluation of the FEC function on OTN equipment. The built-in optical output power adjustable function allows one MP1590B to test the error correction ratio of OTN equipment based on its input power specification.

• SDH/SONET functions
Switchover between SDH and SONET can be controlled on the screen. Transmission/reception with a Tandem Connection pattern (ITU-T Rec. G.707) is possible, and functions for setting and monitoring the section overhead (SOH/TOH) and path overhead (POH) have been implemented. Moreover, various error/alarm generation functions enable stress testing of SDH/SONET equipment.

• Jitter generation/measurement
Installing a jitter unit enables SDH/SONET (52 to 9953 Mbit/s), OTU-1 (2.66 Gbit/s), OTU-2 (10.71 Gbit/s) generation/measurement. Jitter tolerance and jitter transfer characteristic measurements conforming to ITU-T Rec. G.783, G.825, G.8251 and Telcordia GR-253 can be performed. The measured results are displayed in numeric values and graphs, allowing user evaluation and simplifying pass/fail judgment. It also supports 10.3 GHz clock jitter generation/measurement.

SONET/SDH/PDH/ATM ANALYZER
MP1570A
1.5 Mbit/s to 10 Gbit/s

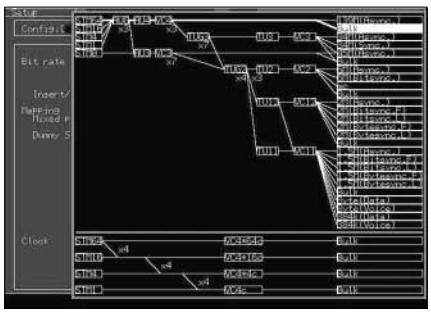
CE GPIB OPTION

Comprehensive Testing of Core Networks from One Compact Portable Analyzer

The MP1570A analyzer is designed for the development, manufacturing, construction, maintenance, and inspection of SDH, SONET, PDH, and ATM equipment and networks.
A variety of plug-in units and options are available that offer the flexibility to the users to configure various analysis systems for different applications.
The MP1570A is scalable from 1.5 Mbit/s to 10 Gbit/s, and has six slots to install the plug-in units required for SDH, SONET and PDH tests at bit different rates. Installing the appropriate combinations of plug-in units can also perform ATM, jitter and wander tests that conform to ITU-T O.171/O.172.
The MP1570A conforms to the ITU-T recommendations and Bellcore standards, and supports concatenation mapping, tandem connection, APS measurement, CID measurement and POS measurement. The user can measure 1.5 Mbit/s to 10 Gbit/s signals using a single MP1570A; previously, this required several measuring instruments.
The MP1570A has a built-in printer and a 3.5-inch floppy disk drive as standard output devices to print measurement results, and to save and read measurement data to and from the floppy disk (FD), which can also be read on an external PC. The user can also save screen data to the FD. The MP1570A has a "HELP" key function that explains operations, functions and connections.

SDH, SONET and PDH measurement

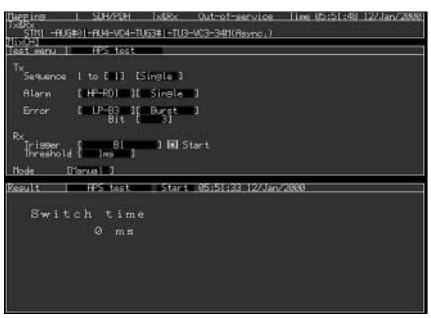
• Measurement at bit rates from 1.5 Mbit/s to 10 Gbit/s
A mapping route to a bit rate of up to 10 Gbit/s can be set.
The MP1570A mainly supports SDH, SONET, and Japanese mapping, European PDH and North American DSn for digital communications. For concatenation mapping, a route can be set from STM-1c/STS-3c up to STM-64c/STS-192c. Furthermore, the MP1570A supports a combination of channels. For example, 64 channels of VC4c/STS3c, 16 channels of VC4-4c/STS-12c, and four channels of VC4-16c/STS-48c (See Figure 1 or Figure 2 in page 151 and 152).



Mapping

• Overhead setting and testing
The user can modify and capture the overhead, and test the overhead portion with overhead change, pointer 64 frames, overhead add/drop and overhead bit errors.

• APS function
The user can test the automatic protection switch (APS) by measuring the equipment switching time accurately in milliseconds. The MP1570A also conforms to ITU-T Rec. G.783 and G.841.



APS test sub-screen

• Mixed payload
At mapping measurement in TUG-3 and AU3, the user can set different mapping for three additional channels other than the target measurement channel.

• Tandem connection
The N1/Z5 and N2/Z6 bytes can be set and measured.

• Various analysis functions
The internal optical power meter and frequency counter allows the user to measure optical power and frequency during error and alarm measurement without changing the connections of the signal cables. The MP1570A can capture any SOH/TOH or POH (1 byte), K1/ K2 byte, or H1/H2 byte in 1023 frames to analyze errors and alarms, and check APS operation.
Measured errors and alarms can be displayed as a graph with a time scale in 1 second, 1 minute, 15 minutes, or 60 minutes.

• Pointer value monitoring
Changes in pointer value can be displayed as a graph with values updated in real time.

• MUX/DEMUX function (option)
When the MUX/DEMUX option is added, the multiplexing structure including the frame alignment signal can be generated, and multiplexer/demultiplexer measurement can be performed.

• Non frame pattern/CID pattern
Frames can be set on/off at all bit rates. CID pattern can generate or analysis at SONET/SDH measurements.

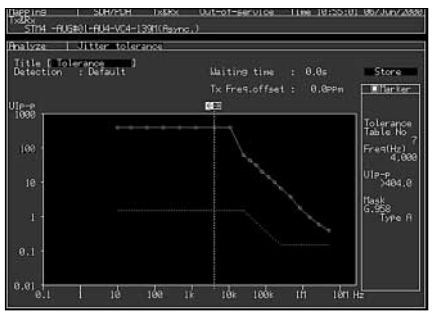
• Through modes
One of the three through modes can be selected: (1) Transparent, (2) Overhead/Overwrite, and (3) Payload/Overwrite. The external DS1/DS3/PDH signal can be added/dropped to/from payload by payload overwrite.

• Enhanced error/alarm simulation
The MP1570A can generate normal and abnormal frames alternately to test the frame synchronization function of terminal equipment. (This is an SDH/SONET FAS error addition function.)

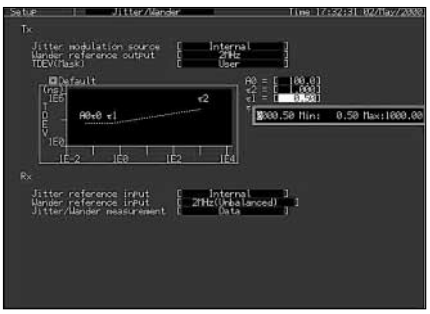
• Easily operated pointer sequence test (combined jitter measurement)
Able to generate the justification pattern conforming to ITU-T G.783 from the transmission equipment side, and simultaneously make the tributary signal offset variable. This makes the combined jitter test possible.

Jitter, wander measurements

The jitter/wander measurement conforming to ITU-T O.171/O.172 exceeds these standards in performance evaluation. Automatic measurements, such as jitter tolerance, jitter transfer, and jitter vs. frequency offset are performed in a short time. Various automatic measurements can be achieved with just one unit.



• Various wander generation functions (option)
Various wander generations for evaluation are available: such as TDEV wander tolerance measurement and TDEV wander transfer characteristics measurement that were regulated by ITU-T, ANSI, Bellcore, and ETSI.

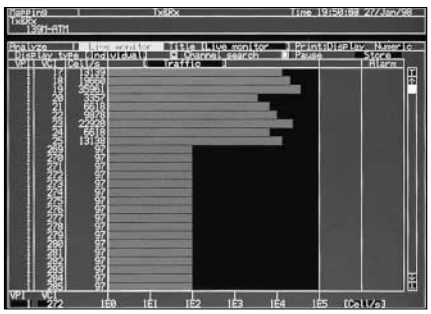


• Wander measurement (option)
Subdivides the bandwidth of the wander measurement into three ranges, and can analyze the wander factor caused by temperature change, pointer, etc. It can also perform measurements conforming to ITU-T O.172.

• Through jitter function (only SONET/SDH)
Able to generate the jitter by through, while monitoring the input jitter quality.

ATM

• Supports ATM from 1.5M to 622M rates
TC layer mappings of 622M, 156M, 52M, 139M, 45M, 34M, 2M and 1.5M are supported along with ATM mappings of O.191, AAL1, AAL2, AAL3/4, and AAL5, which makes the MP1570A ideal for various combinations of layers. The VPI/VCI for 1023 channels can be detected automatically, and the presence/absence of alarms, cell count, and non-conforming cell count can be displayed graphically, for easy comparison of line channel traffic.



• 1- and 2-point CDV in conformance with I.356
When measuring delay in cell traffic, either 1-point CDV or 2-point CDV conforming to ITU-T Rec. I.356 can be selected according to the conditions.

• Simultaneous display of error cells, inserted error cells and lost cells
The error/alarm generation conditions can be displayed both numerically and graphically to give a visual impression of the traffic conditions.

• Traffic monitoring
The constantly changing traffic can be displayed as a graph for the selected-one-channel VPI/VCI.

IP-over-SONET/SDH, IP-over-ATM (option)

Programs IP/PPP at will transmits it, picks PPP packet from capture memory (option), displays it and supports high-speed POS router evaluation. Programs IP in the AAL5 payload at will transmits it, picks the IP packet from the cell capture memory, and displays it. And evaluate router ATM function.

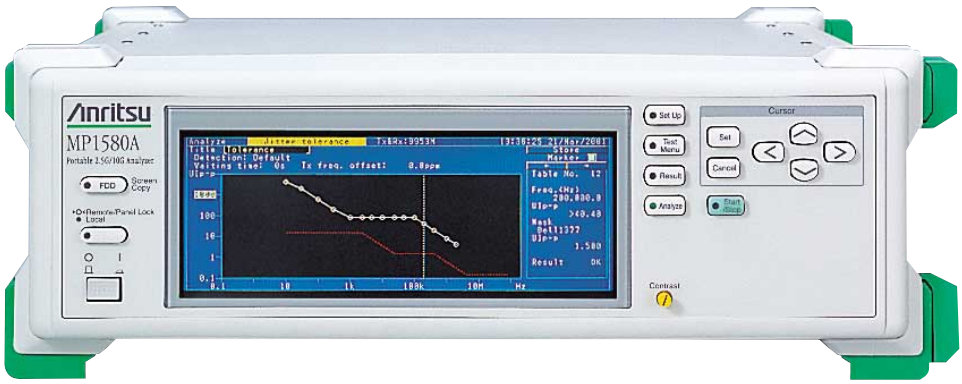
• IP/PPP header setting
Able to set the value of each header optionally when selecting IPv4 or IPv6. Calculates FCS or header checksum automatically.

• PPP packet transmission and real time count
Transmits the three types of packets (can be set separately) by optional sequence (the idle length between each packet can be set simultaneously.). Displays the number of Tx packets and Rx PPP packets at real time.

• PPP packet capture and display
Samples PPP packet from the capture memory, and displays IP header. Detects FCS error and displays it in red.

PORTABLE 2.5G/10G ANALYZER
MP1580A

For 2.5G/10G Jitter/Wander Measurements



The MP1580A is a unique and powerful solution for analyzing jitter at the standard OC-48/192 or STM-16/64 bit rates. It can measure jitter of 2.5G/10G electrical interfaces (clock signal) with a simple operation. In addition, when used in combination with the MP1570A SONET/SDH/PDH/ATM Analyzer, evaluation of jitter characteristics in digital transmission lines, systems and devices, such as jitter tolerance, jitter transfer, jitter generation, etc., can be performed easily.

Functions

- **Complies with the latest ITU-T O.172 and Telcordia GR-253 standards**

The MP1580A conforms to both the OC-192/STM-64 jitter measurement standards and supports required jitter modulation amplitude of 4000 UIp-p and 80 MHz jitter bandwidth.

- **Supports 10 GHz wander measurement according to the latest ITU-T G.813 standard (option)**

The MP1580A can generate and measure various types of wander. It can generate wander in the frequency range of 10 µHz to 10 Hz at 400,000 UIp-p max. In addition, MTIE/TDEV can be measured in real-time using an external PC and optional application software (MX150002B).

- **Single cabinet support for both 2.5G and 10G jitter/wander measurements**

Just one MP1580A is required for 2.5G and 10G jitter generation and analysis. When combined with the MP1570A and MU150000A, jitter can be added to SONET/SDH signals and measured.

Application

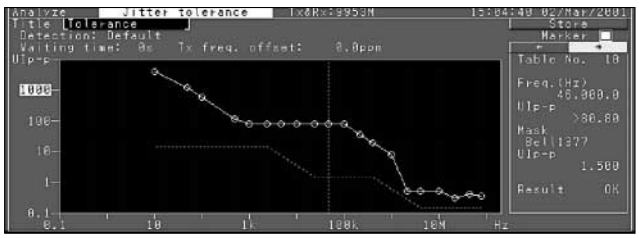
- **Output jitter measurement**

The MP1580A can easily measure the jitter clock signal (electrical interface only) by just inputting the output clock of DUT directly.

Optical signals can be measured easily by combining the MP1580A with the MP1570A, MU150000A, MU150001A and MU150017A/B.

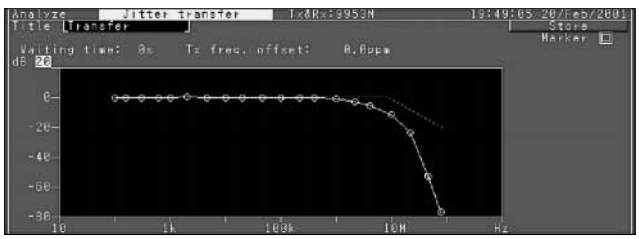
- **Jitter tolerance measurement**

When the MP1580A is used with the MP1570A (send/receive jittered clock), jitter tolerance tests can be performed on OC-192/STM-64 and OC-48/STM-16 signals of electrical and optical interfaces.



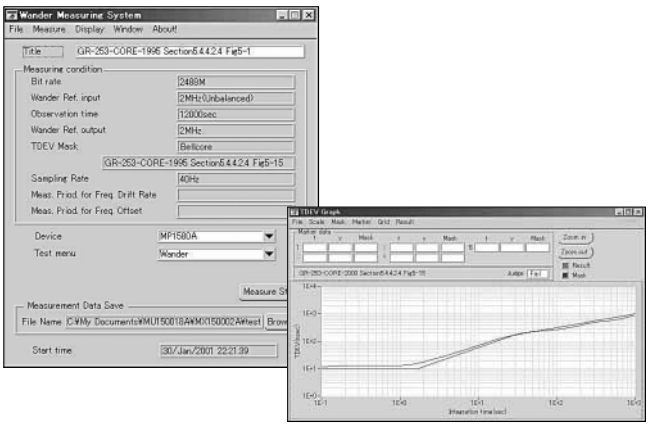
- **Jitter transfer measurement**

When the MP1580A is used with the MP1570A (send/receive jittered clock), jitter transfer tests can be performed on OC-192/STM-64 and OC-48/STM-16 signals of electrical and optical interfaces.



• Wander generation and measurement

The MP1580A can generate and measure wander conforming to ITU-T O.172 and also generation of TDEV conforming to ITU-T G.813. It also can measure TIE (Time Interval Error) by itself and measure MTIE and TDEV by connection of an external PC in which MX150002B is installed.



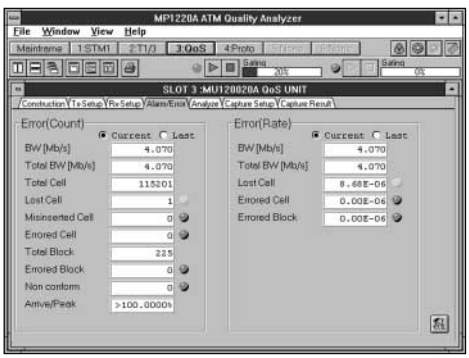
ATM QUALITY ANALYZER
MP1220A
1.5 Mbps (T1) to 622 Mbps (STM-4c/OC-12c)

For Construction and Maintenance of ATM Networks

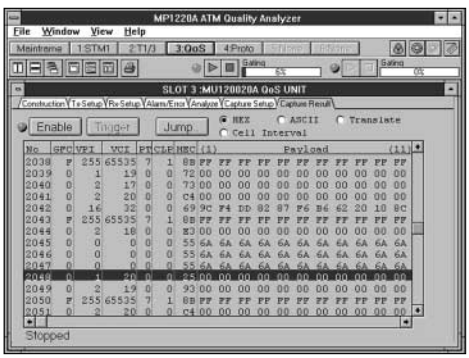
The MP1220A is a portable measuring instrument for ATM networks that can measure the PDH/SDH physical layer, the ATM layer, and the AAL. It is the perfect instrument for troubleshooting ATM networks during construction and maintenance and has a wide range of convenient applications in manufacturing inspection of ATM devices.

Features

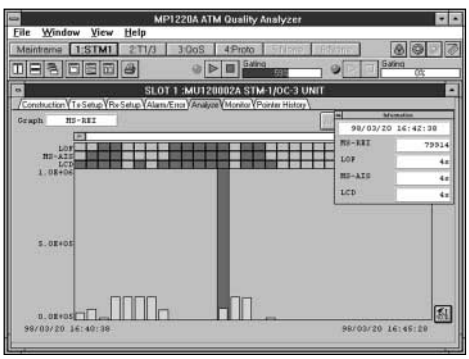
- Supports various interfaces from 1.5 Mbps (T1) to 622 Mbps (STM-4c/OC-12c) SONET and SDH
- Simultaneous measurement and real-time analysis up to the ATM-CPCS layer of two channels(up/down stream)
- Automated traffic monitoring of 1,023 network channels for bandwidth utilization
- Uses formatted payload data conforming to ITU-O.191 recommendations for cell delay performance measurements
- Small, lightweight, rack mount or portable
- Supports a variety of remote control testing configurations
- Online manuals and online help



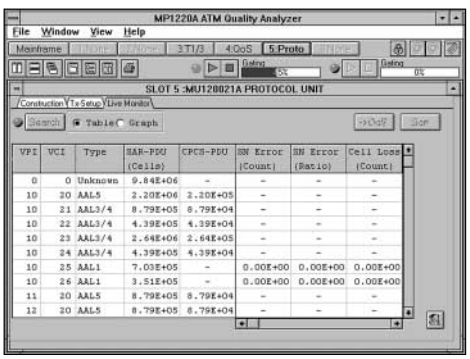
Measurement items for test cells



Cell capture display (hexadecimal)



Graphical display of alarm/error history



Automatic evaluation and measurement of AAL type for 1023 channels

NETWORK DATA ANALYZER
MD6430A
50 bit/s to 10 Mbit/s

CE GPIB OPTION

One Instrument for Installation and Maintenance

The MD6430A Network Data Analyzer can measure errors on 13 different interfaces for leased lines (64 kbit/s to 6.3 Mbit/s), ISDN (BRI, PRI), and V/X series interfaces, making it suitable for installation and maintenance of a variety of networks.
Measurements include bit errors, alarms, delay time, frequency, digital level measurements, user pattern send/trace, etc., all of which can be displayed on the large color LCD.
Error performance (ITU-T G.821, G.826, M.2100) is available with various pseudorandom patterns and user patterns up to 1024 characters. Frame Relay measurement function, ISDN signaling function (optional), and a simultaneous two-channel monitoring function are also provided. Single button “quick” function and touch-screen ensure easy operation. This unit offers the user sophisticated functions required for installation and maintenance in a small compact unit.

Features
- One unit supports installation and maintenance of leased lines, ISDN, and frame relay
- Single button quick test operation
- Lightweight, with a battery-operated function

Applications
• Many applications ranging from low-speed modems to high-speed digital lines
The MD6430A can evaluate the quality of lines ranging from low-speed modems to high-speed digital lines spanning 50 bit/s to 10 Mbit/s.

• Support for various interfaces
The MD6430A supports G.703 64k, I.430/I-430a 192k, G.703/G.704/I.431 1.5M, 2M, 2M CMI, 6.3M, V.24/V.28, V.35, V.36, RS-449, X.20, X.21, TTL/CMOS interfaces in a number of optional units designed to meet customer needs.

Units	Interfaces	Uses
MU643000A	G.703 64k, I.430/I430-a 192k, G.703/G.704/I.431 1.5M, G.703/G.704/I.431 2.0M, 2M CMI, G.703/G.704 6M	Europe and Japan
MU643000B	G.703 64k, I.430/I430-a 192k, G.703/G.704/I.431 1.5M, 2M CMI, G.703/G.704 6M	Japan
MU643000C	G.703 64k, I.430/I430-a 192k, G.703/G.704/I.431 2.0M	Europe

Note: All interface units support V.24/V.28, V.35, V.36, RS-449, X.20, X.21, and TTL/CMOS.

• Wide variety of measurement functions
Various measurements, such as error, alarm, clock slip, delay, frequency, and digital level can be performed. Also, can send user patterns with tracing functions.

• Frame relay measurements
Frame relay network connections (conforming to PVC and ITU-T Q.933 Annex A) can be tested by the MD6430A. The user can also monitor the congestion status such as FECN, BECN, and CLLM.

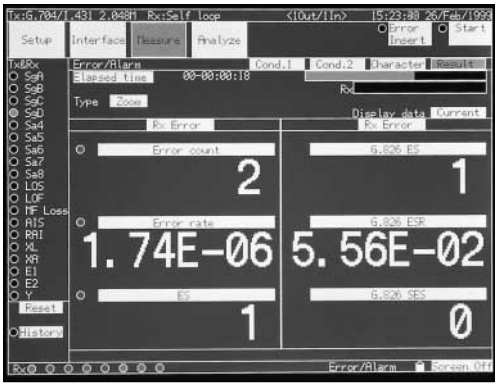
• Optional ISDN signaling functions (BRI, PRI)
The unit can be connected to ISDN networks so that both voice communication and error measurement can be performed.

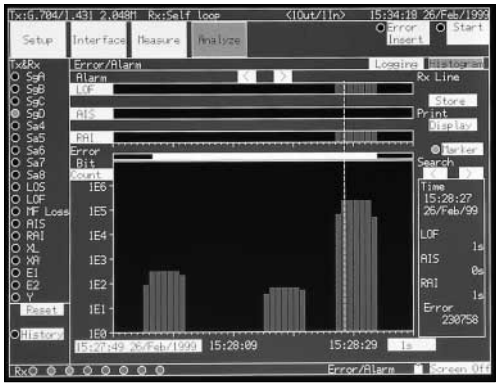
• Error data analysis and storage functions
Error data can be collected in log or histogram format. This data can also be stored in internal memory or on a floppy disk for later analysis.

• Touch-screen
The touch-screen, large color LCD, and pop-up menus provide a much better GUI operating environment.

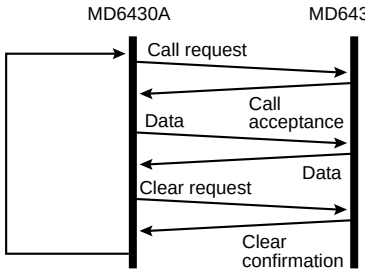
• Battery operation
When a commercial power supply is not available, the optional battery pack provides operation for up to 3 hours, and 5 hours in power save operation.

• Full range of error measurement screens
Various measurement items can be displayed simultaneously for error count, error rate, block error count, clock slip count, character error count, error performance (G.821, G.826, M.2100), HDLC error (bad frame, abort frame), and various types of alarms. The user can select the desired items and can display them using the zoom function.

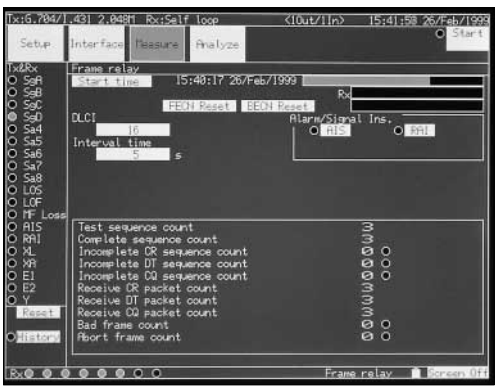




• Supports frame relay measurements
Specific DLCI connections can be checked. PVC status checking procedures are supported.

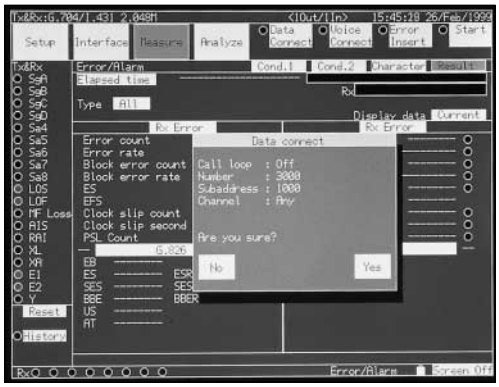


Frame relay measurement sequence



• Substantial analysis functions
Error status and alarm condition can be logged and displayed as histograms. The received data can also be captured.

• Supports ISDN networks (BRI, PRI)
The unit can be connected to the ISDN public telephone network. Return testing using one unit can be done by using the call loop function as below.



• Voice channel function
The CODEC function permits voice communications over a specified channel. Simultaneous voice communications and measurements are possible.

• Easy operation
The touch-screen and pop-up menus are quick and user-friendly, making operation easy for all levels of expertise.

DATA TRANSMISSION ANALYZER
MD6420A
50 bit/s to 10 Mbit/s

GPIB
OPTION

For Evaluating the Quality of Digital Data Networks

Bit error rate measurement is the most critical parameter in evaluating the quality of digital transmission modes. However, conventional methods, which measure only average bit error rates, are inadequate. In the MD6420A, various types of extension and remote control units are provided as options, as well as units which allow the use of various types of interfaces.
The measuring conditions can be stored in memory and recalled prior to measurement with the touch of a single key. In addition, the analyzer is portable so that it can be used on site for maintenance operations.

Features

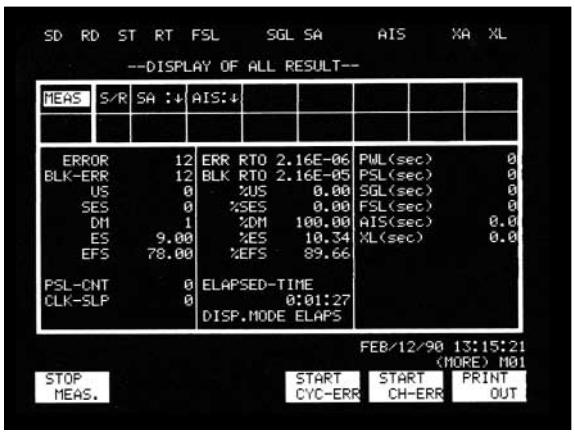
• Can measure a variety of devices from low-speed modems to high-speed digital lines
Can be configured to a variety of communications protocols via ITU-T V, X, G, and I series by using plug-in units. Can perform high-quality evaluations of data communications systems that have bit rates from 50 bit/s to 10 Mbit/s.

• Simultaneous error measurement of various error parameters
The error count (bit error, parity error, and CRC error, etc.) error rate, block error count, block error rate, US, %US, SES, %SES, DM, %DM, ES, %ES, EFS, %EFS, AT, %AT, BBER, clock slip, and synchronization loss can be measured, Alarm states such as AIS can be continuously monitored*.
* Conforms to ITU-T G.821

• Data will not be lost if a power failure occurs during measurement
If an AC power failure occurs during error rate measurements, all data obtained prior to the failure is recalled from memory and the measurement is automatically continued when the power is resupplied. When the power returns, the time at which power failure occurred is displayed on the EL display.

Example of display screen

• Overall display of error measurements
Up to 22 measurement items can be monitored simultaneously. If a power failure occurs during measurements then measurements will be continued from the time at which the power is resupplied. The failure time (PWL) will be displayed when power is resupplied.



Combinations of interface and extension units

The MD6420A can be combined with many plug-in units to perform a variety of measurement.

Interface units \ Extension units	MD0627A Analog
MD0621A V.24/V.28 (RS232C)	√
MD0621B V.35	√
MD0621C V.36 (RS-449)	√
MD0621D X.20 (RS-423)/X.21 (RS-422)	√
MD0622B G.703/G.704 1.544 Mb/s Bipolar	√*
MD0622D G.703/G.704 6.312 Mb/s Bipolar	√*
MD0622E G.703 64 kb/s	√*
MD0625B I.431 1.544 Mb/s	√*
MD0626A TTL	√*

* Except DC voltage measurement

Interface units

• V/X series

MD0621A	V.24/V.28 (RS232C)
MD0621B	V.35
MD0621C	V.36 (RS-449)
MD0621D	X.20 (RS-423)/X.21 (RS-422)

• G.703

MD0622B	G.703/G.704 1.544 Mb/s Bipolar
MD0622D	G.703/G.704 6.312 Mb/s Bipolar
MD0622E	G.703 64 kb/s

• I.431

MD0625B	I.431 1.544Mb/s

• TTL

MD0626A	TTL

Extension units

• Analog

MD0627A	Analog

Remote control units

MD0620A	GPIB
MD0620B	RS232C

MD1230 FAMILY

MD1230B DATA QUALITY ANALYZER
MD1231A/A1 IP NETWORK ANALYZER
MT7407A MULTISLOT CHASSIS

CE GPIB OPTION

IP testing instruments changing in response to applications for core, metropolitan-area, and access networks NEW

Anritsu's MD1230 Family can measure network quality.
Evaluating the network quality of service (QoS) based on various indexes has importance in terms of assuring the accurate transmission of video, voice, and mission-critical data.
The MD1230 Family puts together all the functions required to measure network quality into one unit. The functions include the multi-flow counter useful to measure the performance of VLAN, packet jitter checking by the measurement of the intervals of arriving packets, and packet transmission at the wire rate.
With its integrated operation, the MD1230 Family provides highly efficient measurements and cost reduction.

• Simple automatic measurement of network performance
The MD1230 Family provides testing that conforms to the RFC 2544 standard test. After setting up test conditions in advance, five performance parameters, (throughput, latency, frame loss rate, back-to-back frames, and system recovery) can be measured automatically with a single start button.

Throughput test
The MD1230 Family has a standard function to conduct a throughput test in conformity with RFC 2544. It can also conduct the throughput test for many-to-one, one-to-many, and many-to-many connections.

Latency measurement
The MD1230 Family has a standard function to perform latency measurement in conformity with RFC 2544. It can also conduct the latency measurement on broadcast frames in conformity with RFC 2889.

Option 10: RFC 2889 Benchmarking Test
RFC 2889 benchmark test is a specialty benchmark test for LAN Switches. It describes 10 types test such a meshed throughput test, forwarding rates test, address catching capacity test and errored frames filtering test. The MD1230 Family can conduct those tests in conformity with RFC 2889.

• Real-time detection of frame loss

Option 11: Packet BER Test
The MD1230 Family provides a test frame that allows the user to detect frame loss in real time. In addition, the BER Test in packet level allows the user to detect single-bit errors.

• Protocol emulation
The MD1230 Family supports emulation of various protocols. The emulation function can create pseudo routers and hosts, which can be useful for router testing.

IPv6
Option 12: IPv6 Expansion

Multicast Protocol
Option 14: IGAP Protocol
Option 21: PIM-SMv2 Protocol
Option 22: MLDA Protocol

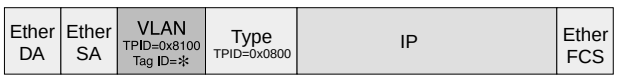
Routing protocol
Option 07: OSPF Protocol
Option 18: OSPFv3 Protocol
Option 19: BGP4+ Protocol

MPLS
Option 08: LDP/CR-LDP Protocol
Option 09: RSVP-TE Protocol

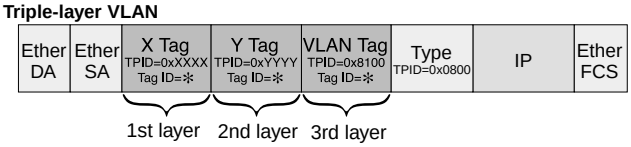
• Traffic counting functions

Multi-layer VLAN
The MU120121A and MU120122A support a multi-layer VLAN. Since the user can set the TPID (tag protocol identifer), the traffic count function can be tailored to support the vendor's original specification conforming to the VLAN specification[1].

Single-layer VLAN



Triple-layer VLAN



[1] A 4-byte tag can be identified only when it contains 2 bytes of TPID.

Multi-flow counter
The MU120121A and MU120122A can count frames in each flow separately by using the value in a specific field.[1]
For example, frames can be counted separately according to the VLAN ID or Flow ID given to transmission test frames.
There are a total of 4,096 kinds of VLAN IDs. The multi-flow counter can count frames classified in up to 65,536 kinds by VLAN ID. The multi-flow counter can also perform real-time measurement of 32 kinds of selected frames.

[1] Multiflow Counter function is available only on Port 1 and Port 2 of MU120121A/MU120122A modules.

1 ms traffic counter (Option 20: Application traffic monitor)
The volume of traffic can be measured at a high resolution of 1 ms. Even when the total traffic measured every second results in 10 Mbit/s, the total traffic measured every millisecond (ms) may exceed 20 Mbit/s, beyond relaying equipment, due to the momentary convergence of frames. Such traffic characterized by bursts can cause missing frames in video delivery services and sound deterioration in voice communications.

- **Frame capturing**

The capture function can analyze a protocol sequence to understand frames of a stream or to find an abnormal sequence in a stream. The trigger function by the sequence error[1] can evaluate a switching time because the MD1230 Family can capture frames which is exist before and after the lost frame or the overlapping frame.

- **Protocol analysis**

The MD1230 Family has standard functions to analyze Ethernet, IP, and TCP/UDP.

Ethereal converter
Ethereal® is Open Source Software used to analyze various protocols. The MD1230 family can convert it to decode captured frames[1].

Option 04: Decoding function

MX123002A expert analysis function
The use of optional Sniffer® Technologies allows the user to analyze about 400 types of protocols, including HTTP, FTP, SNMP, SIP, and RTP. The MX123002A Expert Analysis Module can detect the parts where faults or other problems may occur, and display guidance messages.

[1] Ethereal must be installed by the customer.

- **Highly flexible frame transmission function**

It is important to customize frames easily because a network device evaluation requires many frames to test various situations. Using a model of protocols, the MD1230 Family makes this easy. The MD1230 Family can also use captured frame and text files, including protocols which do not exist in the models.

Step 1
First, select a model. The following models are available for selection:
Standard:
None, ARP, IPv4, IGMP/IPv4, ICMP/IPv4, TCP/IPv4, UDP/IPv4, RIP/UDP/IPv4, DHCP/UDP/IPv4, IPv6, IPv6 Extension Header, IPX, IS-IS, MAC Control Frame (Pause Frame)

To use EoMPLS or a protocol excluded from selectable models, load a commented text or CSV file.

```
; Ether Header
00 00 91 00 32 01     ; SA
00 00 91 00 32 02     ; DA
08 00       ; Type
; IP Heaser
45 00 00 2E 00 00 40 00
40          ; TTL
00          ; Protocol
26 CE       ; Header Checksum
0A 00 00 01           ; SA
0A 00 00 02           ; DA
.....
```

Step 2
Set up each protocol based on the model selected in Step 1. For example, when TCP/IP is selected, IP and TCP tabs appear in addition to the Ethernet tab on the setup screen, allowing values in the setting fields to be changed for the respective protocols.

Step 3
After setting the header, create the data part. Selectable values are All 0, All 1, Increment, and Random. When Test Frame is selected, latency, bit error[2] and sequence error measurement[2] can be done. A flow IDs can be set when Test Frame is selected. With this setting, frames can be counted separately in each of up to 65,536 flows by the multi-flow counter function of the MU120121A/120122A.

[2] Requires Option 11 Packet BER Test in the MD1230 Family receiver side.

Step 4
The frame format was specified by the setting operation in Step 3 and before. Next, specify how to send frames. A burst means a set of frames; a stream means a set of bursts.
For example, when “3 Frame per Burst” and “2 Burst per Stream” are specified, a set of three frames will be sent twice in one stream.
The gaps between frames, between bursts, and between streams can be specified as IFG, IBG, and ISG, respectively.

Step 5
After setting the number of frames in the stream and gaps, specify the relationship of the stream to other streams. Simple sequences of streams can be created by using Next Stream and Jump to Stream commands.

Module Table

Model	Name	MD1230B	MD1230A	MD1231A	MD1231A1	MT7407A[1]	Power consumption
MU120101A	10M/100M Ethernet Module	√	√	√	√	√	4.5
MU120102A	Gigabit Ethernet Module	√	√	√	√	√	3.5
MU120103A	2.5G (1.31) Module	√	√		√	√	5.0
MU120103B	2.5G (1.31) Module	√	√		√	√	8.0
MU120104A	2.5G (1.55) Module	√	√		√	√	5.0
MU120104B	2.5G (1.55) Module	√	√		√	√	8.0
MU120105A	10G (1.31) Module	√	√		√	√	10.0
MU120106A	10G (1.55) Module	√	√		√	√	10.0
MU120111A	10/100M Ethernet Module	√	√	√	√	√	5.5
MU120112A	Gigabit Ethernet Module	√	√	√	√	√	5.5
MU120118A	10 Gigabit Ethernet Module	√	√		√	√	17.0
MU120118B	10 Gigabit Ethernet Module	√	√		√	√	19.0
MU120119A	OC-3/12 STM-1/4 Module (1310 nm)	√	√	√	√	√	3.5
MU120120A	OC-3/STM-1 Module (1310 nm)	√	√	√	√	√	3.5
MU120121A	10/100/1000M Ethernet Module	√	√[2]				19.0
MU120122A	Gigabit Ethernet Module	√	√[2]				19.0
MU740701A	IP Tester Control Module					√	2.0

[1] The total current consumption by the modules mounted in one MU740702A must be 65A or less.
[2] The MD1230A-47 can accommodate slot 1, 3, 5. The total current consumption by the modules mounted in one MD1230A must be 60A or less.

Selection guide

• Ethernet modules

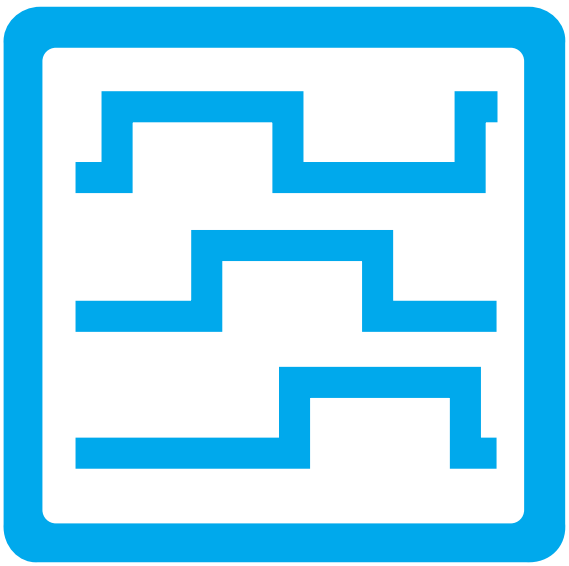
Model	MU120101A	MU120111A	MU120121A	MU120102A	MU120112A	MU120122A	MU120118B
Interface	10/100M		10/100/1000M	GbE			10 GbE
Ports (Connector)	8 (RJ-45)	8 (RJ-45)	4 (RJ-45)	2 (GBIC[1])	2 (GBIC)	2 (RJ-45) 2 (SFP)	2 (XENPAK)
Clock Variation			√			√	√[2]
Auto MDI/MDI-X Detection			√			√	
Frame Generation							
Stream Generation (TxStream)	√	√	√	√	√	√	√
Multi Layer VLAN			√			√	
MAC Address Increment	√	√	√	√	√	√	√
IP Address Increment	√	√	√	√	√	√	√
TCP/UDP Port Number Increment		√	√	√	√	√	√
Spanning Tree / Link Aggregation Frame (opt23)		√	√		√	√	√
Test Frame Addition	√[3]	√	√	√	√	√	√
Hardware Random Pattern			√			√	
Measurement							
Counter	√	√	√	√	√	√	√
Multi Flow Counter			√		√		
Capture	√	√	√	√	√	√	√
Decode	√	√	√	√	√	√	√
Latency	√	√	√	√	√	√	√
Ping	√	√	√	√	√	√	√
Ping6 (opt12)		√	√		√	√	√
Arrival Time Variation	√	√	√	√	√	√	√
Through Mode	√	√	√	√	√	√	√
Monitor Mode	√	√	√	√	√	√	√
Address Swap Mode		√	√		√	√	
Unframe BER Test		√	√	√	√	√	√[4]
Packet BER Test (opt11)		√	√	√	√	√	√
Autonegotiation Analysis (opt15)[5]					√	√	
Application Traffic Monitor (opt20)[6]					√		
Link Fault Signaling (opt16)[7]							√
XENPAK Test (opt13)[7]							√
Optical Power Meter							
Automatic Test							
RFC2544	√	√	√	√	√	√	√
RFC2889 (opt10)		√	√	√	√	√	
Protocol Emulation							
ARP	√	√	√	√	√	√	√
ICMP	√	√	√	√	√	√	√
OSPF (opt07)		√	√		√	√	√
BGP-4	√[8]	√	√	√[8]	√	√	√
ICMPv6 (opt12)		√	√		√	√	√
OSPFv3 (opt18)[9]		√	√		√	√	√
BGP4+ (opt19)[9]		√	√		√	√	√
IGMP	√	√	√	√	√	√	√
IGAP (opt14)		√	√		√	√	√
MLD (opt12)		√	√		√	√	√
MLDA (opt22)[9]		√	√		√	√	√
PIM-SMv2 (opt21)[10]		√	√		√	√	√
MPLS (LDP/CR-LDP) (opt08)		√	√		√	√	√
MPLS (RSVP-TE) (opt09)		√	√		√	√	√

1 1000BASE-T GBIC is not supported.
2 Option 13 provides its clock only to XAUI interface of the XENPAK module.
3 Packet BER Test is disabled when a test frame is sent to another module.
4 Option 13 XENPAK Test is required.
5 This function is implemented by using GBIC on the SX/LX/LH/ZX and SFP on the SX/LX/LE/LR.
6 This function cannot be used on the MT7407A. (Use the MD1230A/B or MD1231A/A1.)
7 This function cannot be used on the MD1231A. (Use the MD1231A1, MD1230A/B, or MT7407A.).
8 Only up to eight virtual routers can be emulated.
9 Option 12 IPv6 Expansion is required.
10 Option 12 IPv6 Expansion is required when IPv6 addresses are to be used. This option supports only IPv4 addresses.

• **POS/EoS modules**

Model	MU120120A	MU120119A	MU120103A	MU120104A	MU120105A	MU120106A	MU120103B	MU120104B
Interface	STM-1 OC-3	STM-1/4 OC-3/12	STM-16 OC-48	STM-16 OC-48	STM-64 OC-192	STM-64 OC-192	STM-16 OC-48	STM-16 OC-48
Bit Rate	155.52 M	155.52 M 622.08 M	2,488.32 M	2,488.32 M	9,953.28 M	9,953.28 M	2,488.32 M	2,488.32 M
Wavelength	1,310 nm	1,310 nm	1,310 nm	1,550 nm	1,310 nm	1,550 nm	1,310 nm	1,550 nm
Input Sensitivity (dBm)	–28 to –8	–28 to –8	–18 to 0	–28 to –9	–12 to 0	–14 to –3	–18 to 0	–18 to 0
Output Level (dBm)	–15 to –8	–15 to –8	–5 to 0	–2 to +3	–4 to 0	–1 to +2	–5 to 0	–5 to 0
Ports (Connector)	2 (SC)	2 (SC)	1 (SC)	1 (SC)	1 (SC)	1 (SC)	1 (SC)	1 (SC)
Mapping								
POS	√	√	√	√	√	√	√	√
EoS							√[1]	√[2]
VCAT							√[3]	√[4]
Frame Generation								
Stream Generation (TxStream)	√	√	√	√	√	√	√	√
Multi Layer VLAN								
MAC Address Increment							√	√
IP Address Increment	√	√	√	√	√	√	√	√
TCP/UDP Port Number Increment	√	√	√	√	√	√	√	√
Spanning Tree/Link Aggregation Frame (opt23)								
Test Frame Addition	√	√	√	√	√	√	√	√
Hardware Random Pattern								
Measurement								
Counter	√	√	√	√	√	√	√	√
Multi Flow Counter								
Capture	√	√	√	√	√	√	√	√
Decode	√	√	√	√	√	√	√	√
Latency	√	√	√	√	√	√	√	√
Ping	√	√	√	√	√	√	√	√
Ping6 (opt12)								
Arrival Time Variation	√	√	√	√	√	√	√	√
Through Mode	√	√	√	√	√	√	√	√
Monitor Mode	√	√	√	√	√	√	√	√
Address Swap Mode								
Unframe BER Test	√	√	√	√	√	√	√	√
Packet BER Test (opt11)	√	√	√	√	√	√	√	√
Autonegotiation Analysis (opt15)								
Application Traffic Monitor (opt20)								
Link Fault Signaling (opt16)								
XENPAK Test (opt13)								
Optical Power Meter	√[5]	√[6]	√	√	√	√	√	√
Automatic Test								
RFC2544	√	√	√	√	√	√	√	√
RFC2889 (opt10)								
Protocol Emulation								
ARP							√	√
ICMP	√	√	√	√	√	√	√	√
OSPF (opt07)								
BGP-4	√[7]	√[7]	√[7]	√[7]	√[7]	√[7]	√[7]	√[7]
ICMPv6 (opt12)								
OSPFv3 (opt18)								
BGP4+(opt19)								
IGMP	√	√	√	√	√	√	√	√
IGAP (opt14)								
MLD (opt12)								
MLDA (opt22)								
PIM-SMv2 (opt21)								
MPLS (LDP/CR-LDP) (opt08)								
MPLS (RSVP-TE) (opt09)								

[1] The module option (MU120103B-01 EOS Mapping) is required.
[2] The module option (MU120104B-01 EOS Mapping) is required.
[3] The module option (MU120103B-02 Virtual Concatenation) is required.
[4] The module option (MU120104B-02 Virtual Concatenation) is required.
[5] The module option (MU120120A-01 Optical Power Meter) is required.
[6] The module option (MU120119A-01 Optical Power Meter) is required.
[7] Only up to eight virtual routers can be emulated.



BIT ERROR RATE TESTERS

43.5 Gbit/s BERT SYSTEM
ME7760A/B
25 to 43.5 Gbit/s

GPIB ME7760B

Measurement Solution for 40 Gbit/s SONET/SDH System and Modules

The ME7760A/B is bit error rate measurement system that measures the bit error rate of transmission signals from 25 to 43.5 Gbit/s. This system is composed of a pulse pattern generator, multiplexer, demultiplexer, error detector and synthesizer.
The ME7760A/B is used in the electrical or optical market to perform component evaluations on communication equipment.
MX177601A SDH/SONET Pattern Editor Software is provided and can be used to edit a SDH/SONET frame.

Features

• High quality waveform
A re-timing circuit using a D-type Flip-Flop produces a high quality waveform (small jitter and low wave distortion) and high output amplitude (2 Vp-p).

• Measurement with pure PRBS
The MP1775A Pulse Pattern Generator can generate PRBS on 43.5 Gbit/s (selectable pattern length = $2^n - 1$: n= 7, 9, 11, 15, 20, 23, 31). The phase of each channel is shifted by 1/4 cycle and the multiplexed signal can be treated as pure PRBS.

• Wide operation frequency
The ME7760A has the capability to treat FEC signals uo to 40 Gbit/s. A four channel pulse pattern generator (MP1775A) and the four channel error detector (MP1776A) can support 100 Mbit/s to 12.5 Gbit/s signals.
The multiplexer (MP1801A/1803A) and the de-multiplexer (MP1802A/1804A) can support 25 to 43.5 Gbit/s signals.

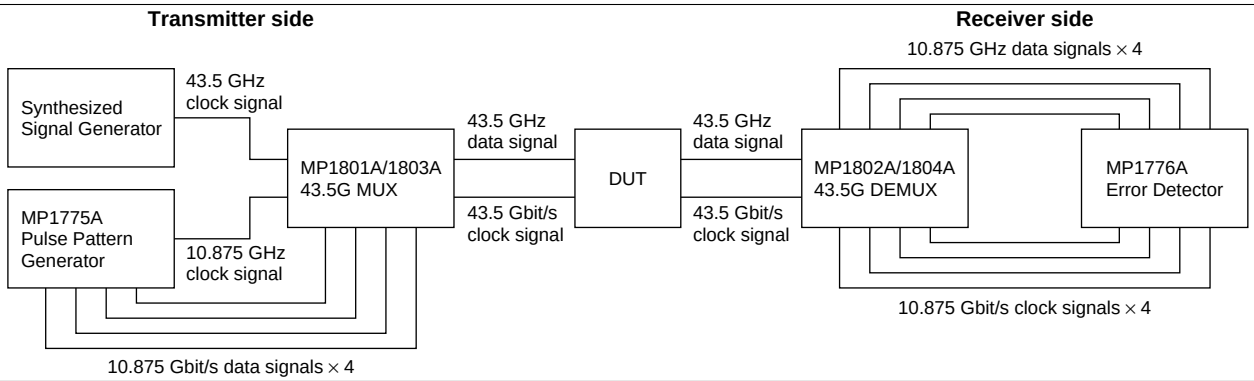
• 32 Mbits pattern memory for OC-768/STM-256
Both the MP1775A and the MP1776A have 32 Mbits pattern memory and are suitable for 40 Gbit/s SDH/SONET frames (OC-768/STM-256). Its pattern can be edited using the MX177601A SDH/ SONET Pattern Editor via GPIB interface.

• High flexibility
The MP1775A Pulse Pattern Generator and the MP1776A Error Detector can be used as single measurement systems and provide high flexibility in many combinations.

Selection guide

	ME7760A	ME7760B
MP1801A	√	
MP1802A	√	
MP1803A*		√
MP1804A*		√
MP1775A	√	√
MP1776A	√	√

* Custom-made product



System configurations

PULSE PATTERN GENERATOR
MP1775A

100 MHz to 12.5 GHz (4 channels)

CE GPIB

Supports Measurement for up to 50 Gbit/s System (Installed with 4 Channels)

The MP1775A Pulse Pattern Generator has four channels of data output lines and each channel has the capability to generate a maximum 12.5 Gbit/s signal. It is available to create PRBS (maximum pattern length is $2^n - 1$, n = 7, 9, 11, 15, 20, 23, 31) and 32 Mbits programmable pattern (user defined pattern). Combined with the MP1801A/MP1803A 43.5G Multiplexer, the MP1775A makes it possible to generate a 43.5 Gbit/s pure PRBS or programmable pattern suitable for OC-768/STM-256.

Features

- Error measurement of OC-768c/STM-256c SDH/SONET frame using 8 Mbits/channel PRGM pattern and application software (MX177601A)
- Parallel output of 12.5 Gbit/s x 4-channels
- Independent level adjustment for each of the 4-channels
- Reduce waveform distortion using back-termination
- Cross-Point adjustment capability on the front panel

PULSE PATTERN GENERATOR
MP1763C
50 Mbit/s to 12.5 Gbit/s

CE GPIB

For R&D of High-Speed Logic, ICs, Optical Modules and Devices

The MP1763C is used in combination with the MP1764C/1764D Error Detector. The amplitude of the clock and data signals can be varied from 0.25 to 2 Vp-p while the offset can be adjusted to within ±2 V so that the amplitude and the offset margin can be measured. The clock has a variable delay function so that time-dependent characteristics or phase margins of the input clock and data can be measured. An M series pseudorandom pattern representative of actual conditions or a programmable pattern can be selected as cell data.
In addition, a 3.5 inch floppy disk drive is built in for storing preset data, enabling rapid measurements to be performed by simply pressing a key. A GPIB function is provided, enabling automatic or remote measurement via an external controller.
The MP1763C is a pulse pattern generator ideal for research and development of high-speed logic, ICs, and digital systems.

MX176400A Q and Eye Analysis Software controls MP1763C and MP1764C from the PC to measure Q factor, eye margin, and eye diagram. MX176401A SDH/SONET Pattern Editor controls the MP1763C and MP1764C/1764D to generate frame pattern conforming to SDH/SONET standards.

Features
- High quality waveform
- Low FM/PM-noise clock generator
- 8 Mbit programmable pattern corresponding to six frames of STM-64/STS-192
- Generates PRBS patterns with bit length from $2^7 - 1$ to $2^{31} - 1$ bits
- Complementary outputs of both data and clock
- The MP1763C-08 option generates a maximum of 3.125 Gbit/s 4 pairs of differential data and 1 pair of differential clock.

ERROR DETECTOR

MP1764C/MP1764D

50 Mbit/s to 12.5 Gbit/s

CE GPIB

For R&D of High-Speed Logic, ICs, Optical Modules and Devices

The MP1764C/1764D are used in combination with the MP1763C Pulse Pattern Generator to detect errors used to evaluate conformity with ITU-T standards. In addition, complicated searching for input thresholds or phase adjustments is simplified with the touch of a single key. These functions are ideally suited for the research and development of ultrahigh-speed logic ICs and digital communication systems.
MX176400A Q and Eye Analysis Software controls MP1764C/1764D and MP1763C from the PC to measure Q factor, eye margin, and eye diagram. MX176401A SDH/SONET Pattern Editor controls the MP1763C and MP1764C/1764D to generate frame pattern conforming to SDH/SONET standards.
The picture above shows the MP1764D which provides differential input and CDR.

Features

- Auto-search function for setting optimum values of input threshold and phase setting by a “one-touch” operation
- Synchronization of 8 Mbits pattern is easily made within a short period of time (when in frame mode)
- Errors are detected in intervals as short as 0.1 sec.
- The MP1764C-02 option allows to perform differential data input.
- The MP1764C-03 option adds the function of CDR (Clock Data Recovery).
- The MP1764D is the model name for the MP1764C on which the MP1764C-02 and MP1764C-03 options are initially installed.

ERROR DETECTOR
MP1776A
100 MHz to 12.5 GHz

Supports Measurement for up to 50 Gbit/s System (Installed with 4 Channels)

MP1776A is an error detector housing four error detectors that can measure error up to 12.5 Gbit/s. It has a four-channel independent measurement mode, two-channel or four-channel combined measurement mode and can be used for development, manufacturing and maintenance of transmission systems and modules from 12.5 Gbit/s to a maximum of 50 Gbit/s.

Features
- Maximum 4-channels in one box
- Independent measurement of 4-channels
- PRBS patterns from $2^7 - 1$ to $2^{31} - 1$
- Maximum 32 Mbit programmable pattern at 4-channels combined mode (corresponding six frames of STM-256/ STS-768)
- Burst data BER measurement for optical circulating loop test
- Good operability by GUI
- Display 4-channel measurement results on screen

43.5G MUX/43.5G DEMUX

MP1803A/MP1804A

25 to 43.5 Gbit/s

For R&D and Manufacturing of 40 Gbit/s Devices and Transmission systems

MP1803A

MP1804A

Custom-made product

The MP1803A 43.5G MUX can multiplex a maximum of four data signal inputs (each transmission speed is maximum 10.875 Gbit/s) and generate a 43.5 Gbit/s multiplexed signal. It can also generate a 1/4 clock signal.
The MP1804A 43.5G DEMUX can de-multiplex the 43.5 Gbit/s data input into four signals. Its four output signal lines are brought to the four channel error detector (MP1776A) and is used to evaluate 43.5 Gbit/s high-speed data signal.

Features

- Adopting high resolution variable delay unit (Resolution: 0.1 ps)
- High resolution threshold voltage setting suitable for the Q factor analysis (Resolution: 0.001V)
- Digital display
- For various applications with the remote control

DIGITAL DATA ANALYZER
MP1632C
50 MHz to 3.2 GHz

GPIB OPTION

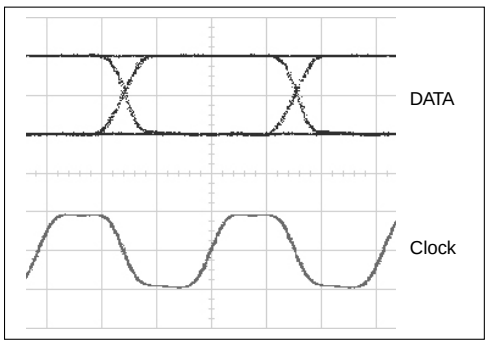
For Development, Manufacturing and Inspection of Transmission Systems, Optical Modules and Logic Devices

Core networks and computer networks are increasing rapidly as the volume of data transmitted in this multimedia data is growing. In addition to the STM-16/OC-48 (2.488 Gbit/s), Fibre channel, Giga-bit Ethernet, etc. are being commercialized. Compact and high performance digital data analyzers are required for inspecting products like digital transmission systems, optical modules, and logic devices.
The MP1632C provides a compact solution that incorporates former measuring equipment (Pulse Pattern Generator and Error Detector) into one case.
MX163201A TEXT to MP1632A/C Pattern Conversion Software, MX163202A MP165X to MP1632A/C Pattern Conversion Software, MX163205A Q and Eye Analysis Software, and MX163206A SDH/SONET Pattern Editor are available as application software.

Features
- 3.2 Gbit/s PPG and ED in one case
- Eye diagram measurement and burst signal measurement supported

Performance and functions
• Easy operation
The MP1632C has a large, color LCD with touch screen. Customized screens enable one-key and one-parameter operation.

• High-quality pulse pattern generator
Programmable patterns of 8 Mbit max, PRBS patterns [(2^7 – 1) to (2^{31} – 1) with variable mark ratio], and zero substitution patterns can be generated. Variable cross-point of data output waveform is also supported.

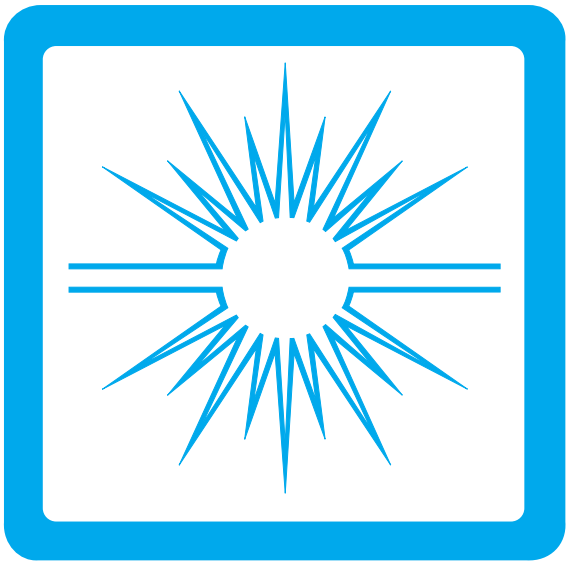


H: 100 ps/div, V: 1 V/div
MU163220C output waveform (3.2 GHz)

• Error detector with many functions
High input sensitivity (25 mVp-p*) and wide phase margin (250 ps*) performance is provided. The autosearch function enables PRBS pattern search with usual phase and threshold search. Insertion error and omission error can be measured simultaneously.
*Typical values at 3 Gbit/s, PRBS 2^{23} – 1

• Internal synthesizer with high signal purity (Option)
Highly pure signals, SSB phase noise characteristics of –85 dBc/Hz or less (10 kHz offset), is generated.

• Support of various applications
The MP1632C supports testing of SDH/SONET (STM-0, 1, 4, 16/OC-1, 3, 12, 48) devices and modules, research and development on WDM components, Fibre channels, Giga-bit Ethernet, evaluation of E/O and O/E module, GaAs IC, and high-speed ASIC/FPGAs.



OPTICAL MEASURING INSTRUMENTS

OPTICAL POWER METER
ML9001A
0.38 to 1.8 µm

CE GPIB

A Variety of Optical Sensors such as Si, Ge and InGaAs

The ML9001A is a single-channel digital-display optical power meter. It ensures accuracy and linearity over a wide wavelength range and greatly improves measurement reliability. It also has improved basic performance. For example, measurements can be made over the wide level range from –100 to +20 dBm because internal reflection in the power sensors has been suppressed. The ML9001A also has many new functions that make it easier to use than other power meters. It can be used for all optical power measurements such as optical fiber loss, and for optical device performance evaluation.

Features

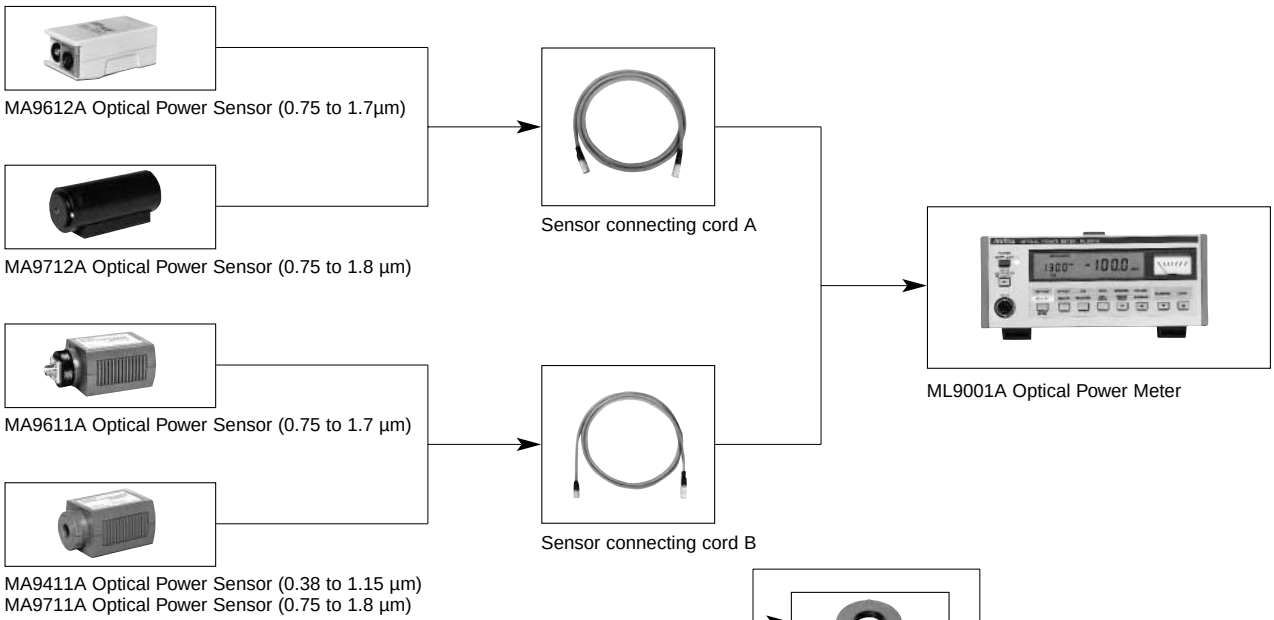
• Enables high-accuracy measurement
The ML9001A accurately and automatically calibrates all the power sensors within the specified wavelength range and ensures a ±5% accuracy at –23 dBm. It also has a ±0.15 dB linearity (–23 dBm reference value). The ML9001A extends the guaranteed accuracy range of the measured values and enables high-accuracy measurement.

• One power sensor for repeater maintenance and long-distance fiber loss measurement
The MA9612A Optical Power Sensor has ultra-high sensitivity. Its measurement level range is –100 to ±3 dBm in the 1.3 µm band and it can sense either continuous light or modulated light. A single MA9612A can measure the near-end and far-end outputs of a repeater as well as measure long-distance fiber losses.

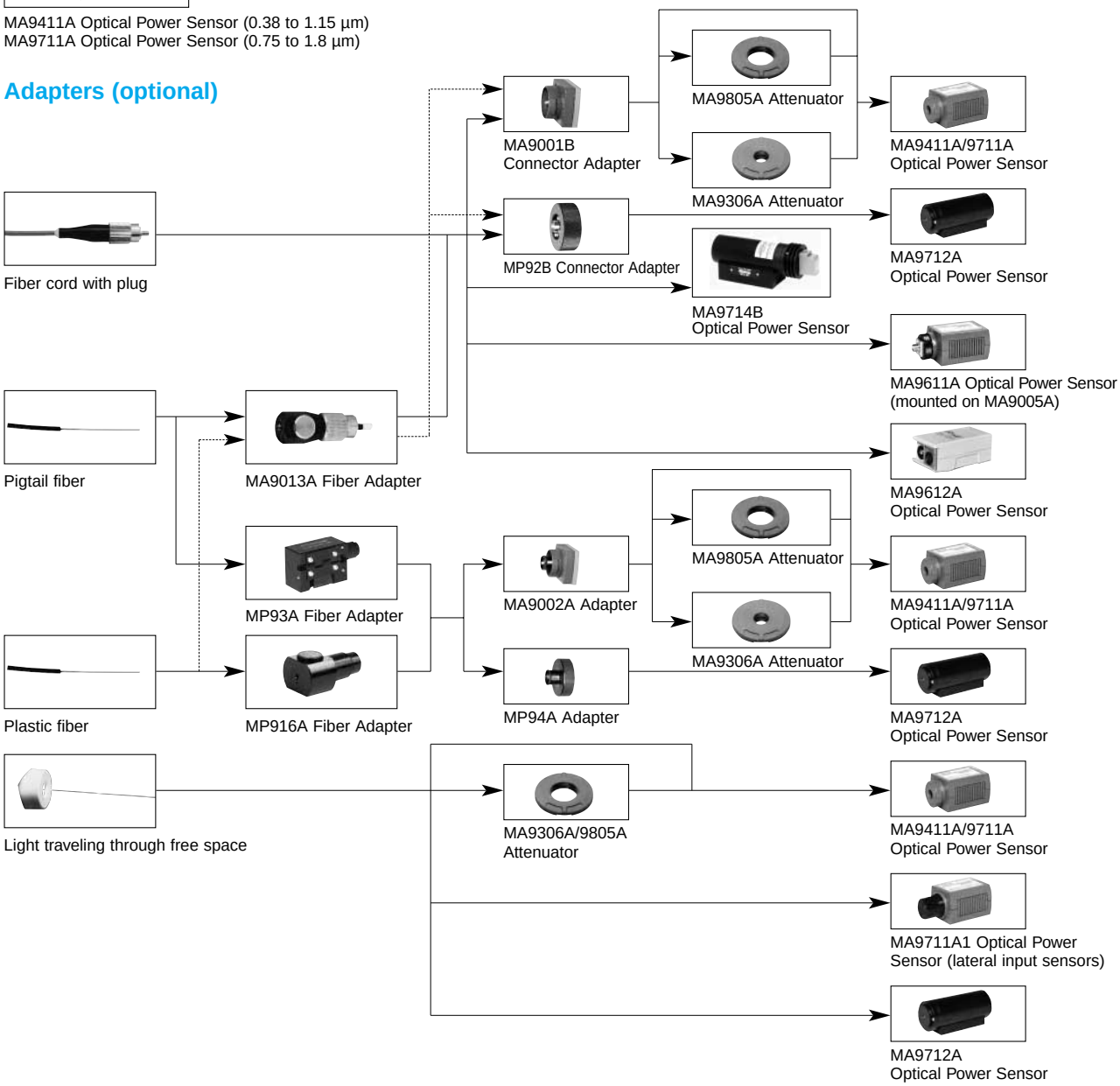
• Interchangeable optical connectors
The optical connectors of all the power sensors accept adapters. This system allows the optical connectors to be interchanged so the ML9001A can be quickly used with various optical connectors. Since the internal coating of the optical power sensors suppress reflected light, measurement errors are reduced in beam measurement (with or without an optical fiber).

• Reduced measurement time
The ML9001A has a much better response speed and stability than conventional optical power meters. With GPIB, it can measure at 30 ms/point so the measurement time can be reduced to less than 50% of conventional automatic measurement.

ML9001A with sensor



Adapters (optional)



OPTICAL HANDY POWER METER
ML9002A
0.38 to 1.8 µm

For Easy Optical Power Measurement

The ML9002A is a compact handy power meter with a measurement level as wide as other more expensive instruments. Optical sensors are available for different wavelengths, measurement levels, and optical input types. Each can be calibrated for three common wavelengths so absolute optical power can be read directly. Each optical sensor can either be incorporated directly in the main frame or connected using a connecting cord. The ML9002A can be used to check optical disks, optical printers and optical communications systems and can back-up on-side operations as a powerful multifunctional measuring instrument for maintenance.

Features

- **Accurate optical power measurement**

The power of a narrow beam can be accurately measured even when an adapter is changed because an anti-reflection optical sensor is used.

- **Long-distance measurement with wide measurement level range**

An unprecedented wide measurement level has been achieved in this handy optical power meter. Optical power of –70 to +3 dBm (MA9621A Optical Power Sensor) in the 1.3 µm band and –70 to +10 dBm (MA9423A Optical Power Sensor) in the 0.85 µm band can be measured.

- **Direct absolute power readings for three wavelengths**

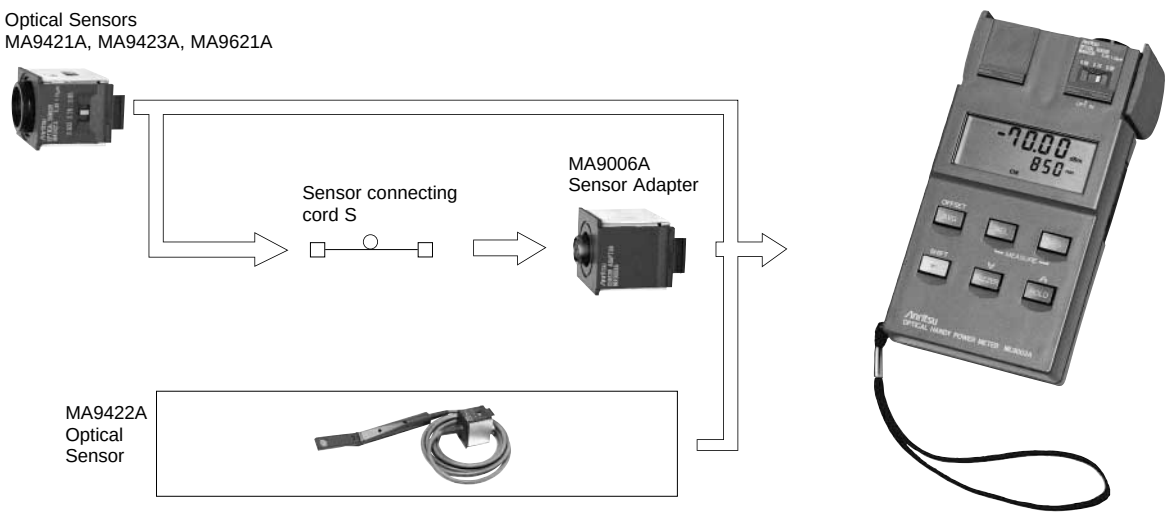
Each optical sensor is calibrated at three wavelengths (0.633/0.78/0.85 µm or 0.66/0.78/0.85 µm for short wavelengths, and 0.85/1.3/1.55 µm for long wavelengths). The absolute power is indicated automatically just by switching to the measured wavelength.

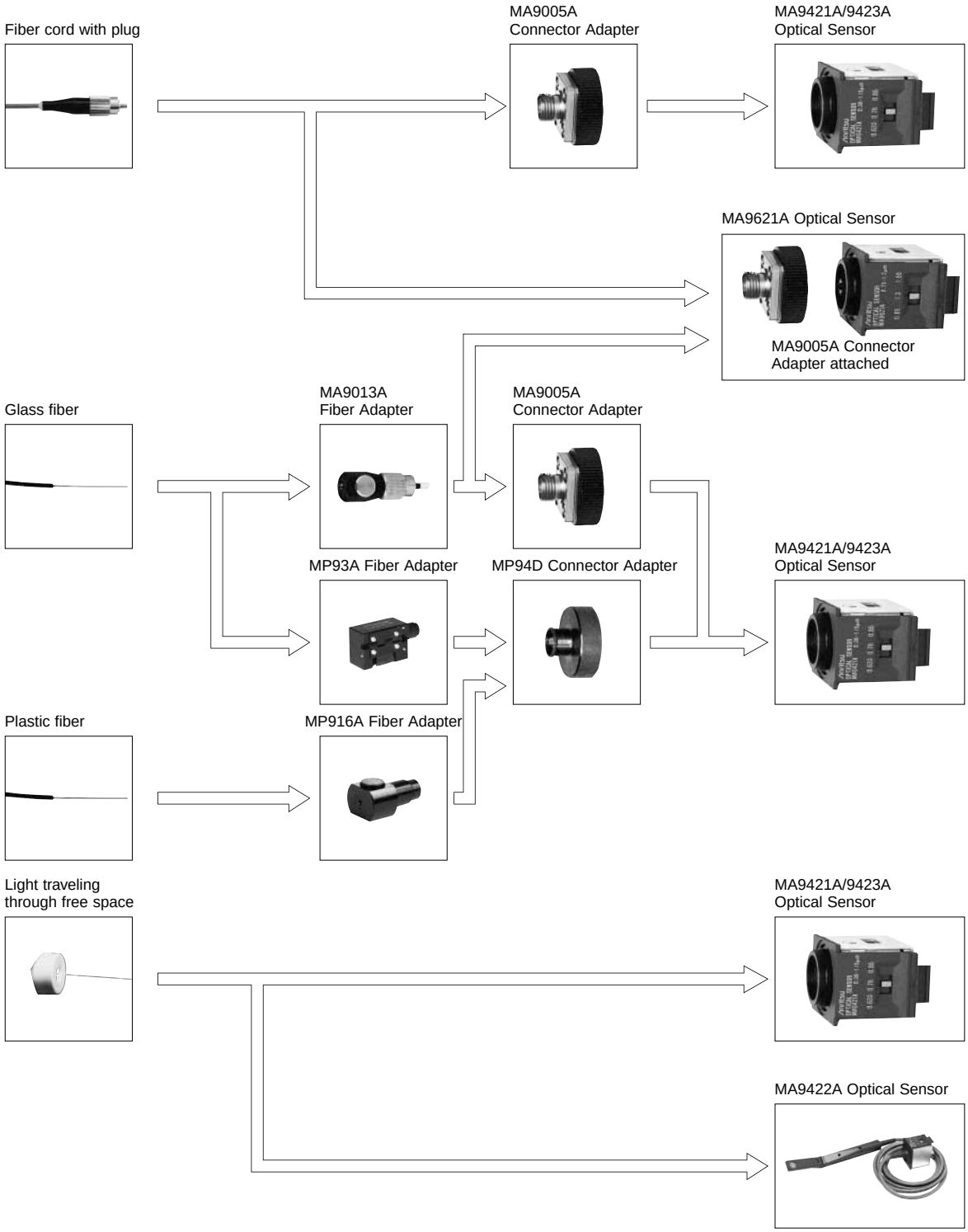
- **Flexible measurements**

Two types of connections, a plug-in system (sensor incorporated into main frame) or a cord system (sensor connected using connecting cord), are possible so that measurement capabilities are flexible.

- **Compatible with various connectors**

The ML9002A can be quickly connected to FC, ST, DIN, HMS-10/A,




Fiber cord with plug
MA9005A
Connector Adapter
MA9421A/9423A
Optical Sensor
MA9621A Optical Sensor
MA9005A Connector
Adapter attached
Glass fiber
MA9013A
Fiber Adapter
MA9005A
Connector Adapter
MP93A Fiber Adapter
MP94D Connector Adapter
MA9421A/9423A
Optical Sensor
Plastic fiber
MP916A Fiber Adapter
Light traveling
through free space
MA9421A/9423A
Optical Sensor
MA9422A Optical Sensor

OPTICAL LOSS TEST SET
MS9020D

For Measuring Optical Loss and Checking Optical Parts

The MS9020D is a handy optical measuring instrument that incorporates an LD or an LED light source and an optical power meter. It can also be used for return loss measurement. Every unit of the LD light source, LED source, the sensors and the return loss measurement unit is a plug-in type, for easy exchange and highest suitability for field use.
The MS9020D covers 0.66 µm, 0.85 µm, 1.3 µm, and 1.55 µm bands for optical loss measurement. In addition to the CW mode, it provides a modulated light mode with 270 Hz, 1 kHz, and 2 kHz modulation signals. Therefore, it is possible to measure optical loss over a wide dynamic range without stray light effect. This is the most suitable for single mode fiber measurement. For return loss, 1.3 µm band single mode fibers can be measured in the 0 to 40 dB range. As a power meter, every sensor has a wavelength calibration function of 5 nm steps at 3 wavelengths, so absolute values can be read directly.

Features

- Measures optical loss up to 67 dB
- Measures CW and modulated light
- Provides calibration function of 5 nm steps at 3 wavelengths
- Also measures optical return loss (0 to 40 dB)
- Operates in 3 modes; AC, rechargeable battery, and dry cells
- Various connectors

Applications

• Optical fiber loss measurement
When measuring optical fibers, it is convenient to provide one MS9020D each at both the near and far ends. By using switchable light source units (MS0909A), one-touch measurement of 0.85/1.3 µm and 1.3/1.55 µm can be done.
More accurate loss measurement is possible by using the modulated light function. When an LD light source is used, it is possible to measure optical loss up to 67 dB.

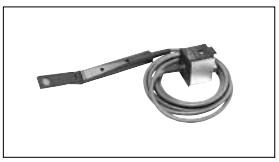
• Optical parts performance check
A light source and optical power meter are provided, and an optical parts performance check is possible at low cost.

• Optical return loss measurement
Return loss of connectors or optical devices can be measured easily using return loss measuring units.

Optical Sensor
(MA9421A/9423A/9621A/
9622A)

LED Source
(MS0901A/0902A/0906A)
LD Source
(MS0902D/0903D)

Optical sensor
(MA9422A)

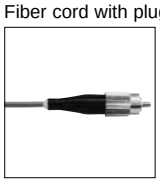


LD Source
(MS0908A/0909A)

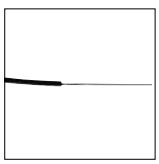
(Photograph
includes a sensor)

MS9020D

Fiber cord with plug

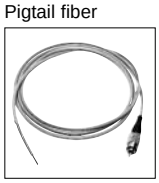


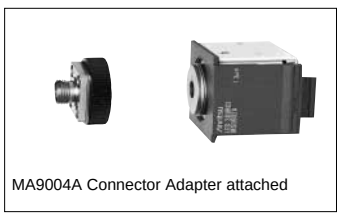
Bare fiber



MA9014A
Bare Fiber Connector

Pigtail fiber

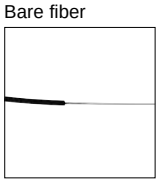




MA9004A Connector Adapter attached

LED Source (MS0901A/0902A/0906A)

Bare fiber

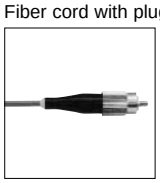


MA9013A Fiber Adapter

LD Source
(MS0902D/0903D)

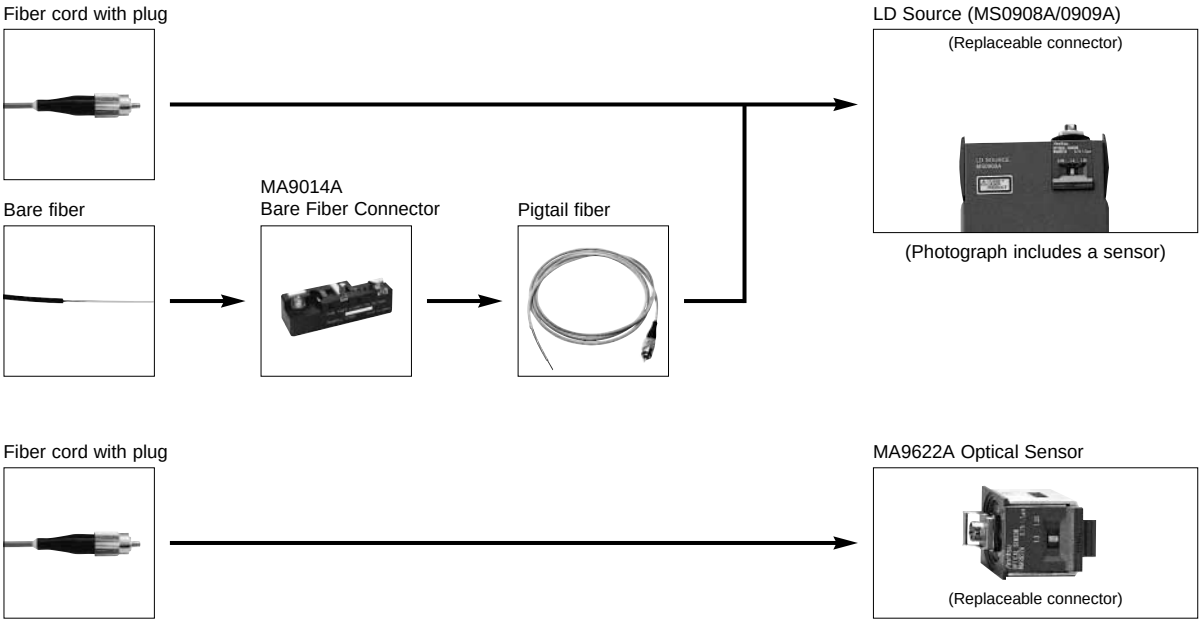
FC/SC type (integrated with connector)

Fiber cord with plug



Optical Sensor
(MA9421A/9423A/9621A)

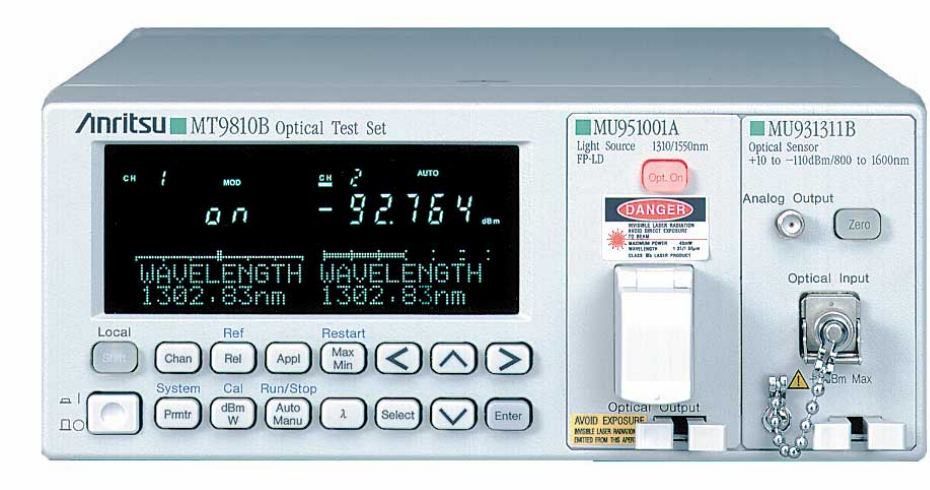
MA9005A Connector Adapter


Fiber cord with plug
LD Source (MS0908A/0909A)
(Replaceable connector)
Bare fiber
MA9014A
Bare Fiber Connector
Pigtail fiber
(Photograph includes a sensor)
Fiber cord with plug
MA9622A Optical Sensor
(Replaceable connector)

OPTICAL TEST SET
MT9810B

CE GPIB

Multipurpose Optical Measuring Instruments Supporting Reference Light Sources



Today, as we turn to photonic communications, a variety of optical communication networks, from core to access, are about to be realized. For this reason, there are a wide variety of performance requirements demanded of optical components and optical communications systems making up these rapidly developing optical communication networks.
The performance and specifications of the sought after evaluation systems vary depending on the field (development, manufacturing, inspection, maintenance) in which these are developed, supplied and implemented.
The MT9810B Optical Test Set is the most fundamental optical measurement instrument with a complete line-up of light sources (DFB-LD, FP-LD, SLD) and optical sensors (high-speed, general-purpose, high-power).
The evaluation system can be configured to fit the users needs. In addition, by combining the optical test set with peripheral devices such as the optical directional coupler and the optical channel selector, the user can construct even more diverse evaluation systems. The MT9810B is a highly accurate and reliable evaluation system that will respond with flexibility to future diverse measurement needs.

• Light source
The DFB-LD complies with ITU-T recommended wavelengths and highly stable 1.31 µm band, 1.55 µm band FP-LD's are also offered. In addition, an SLD light source with a center wavelength of 1.55 µm and an approximately 40 nm wavelength band is provided.

• Optical sensors
There are three optical sensors: high-sensitivity, general-purpose and high-power. Each has sensor head and plug-in models.

• Measurement conditions saving function
Up to 10 sets of measurement conditions can be saved for each channel, permitting the repetition of measurements.

• Clone function
When the same types of units are mounted in Channels 1 and 2, the measurement conditions for one side can be copied onto the other side.

• Measurement of max., min. and variation of optical power
By mounting an optical sensor, the maximum and minimum values of optical power and the variations in its value can be always displayed, eliminating the need for saving the measured optical power various in the memory. Light source stability and PDL (polarization dependent loss) characteristics can be evaluated in real time.

• Recording measured optical power values
By mounting an optical sensor, a maximum of 1000 power measurement values can be saved per channel. The saved measurement values can be read by remote control, permitting various analyses and processings.

• Variable optical power measurement interval
By mounting an optical sensor, the optimum measurement interval can be set according to the applications (1 ms to 99 h 59 min 59 s); for example, a long interval for a long-duration measurement, and a short interval for high-speed measurement.

• Variable optical power measurement bandwidth
By mounting an optical sensor, the bandwidth can be set according to the measured item; for example, the average pulse optical power can be measured by widening the bandwidth, and the variations in optical power at an optical switch can be measured by narrowing the bandwidth. The setting range is between 0.1 Hz to 100 kHz (MU931311A) or 10 kHz (MU931421A/931422A).

• Relative measurement
By mounting an optical sensor, 0 dB is displayed as the measured value on the display when the relative key (Rel) is pressed. It allows the difference from the reference value to be read directly in the loss measurement of an optical fiber or device.

• Reference measurement
By mounting an optical sensor, a relative value based on a reference value (reference) entered using the keys can be displayed. When the light is incident at a distant location in the loss measurement of an optical fiber, the fiber loss can be read directly by entering the reference value of incident light as a reference.

• Controlling optical channel selector
The MN96xxA Optical Channel Selector can be controlled from the MT9810B Optical Test Set by connecting the two via a dedicated cable. It facilitates the measurement if the optical test set and the optical channel selector are at a distance from each other due to the configuration of the measurement system. The cable lengths are available in the range from 1 to 10 m.

• GPIB and RS232C I/F as standard
GPIB and RS232C interfaces are provided as standard, permitting remote control of the measurements via a PC. In addition, the LabVIEW® software driver for remote control is provided as standard, enhancing the construction of a remote measurement system.
∗ LabVIEW® is registered trademark of National Instruments Corporation.

Light source units

• DFB-LD light source unit

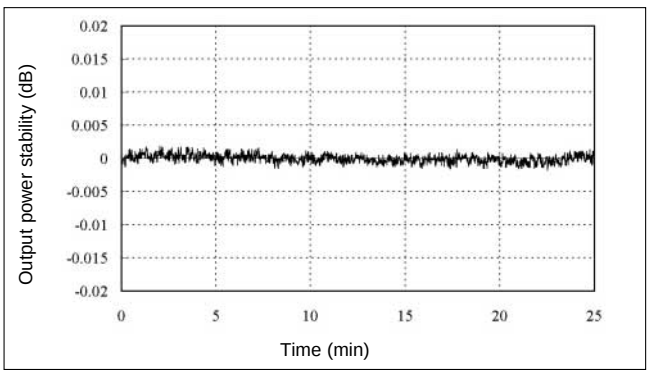
MU952500A/952600A series are 97 wavelengths supporting WDM. The unit is equipped with a high-output and high-stability DFB-LD light source.

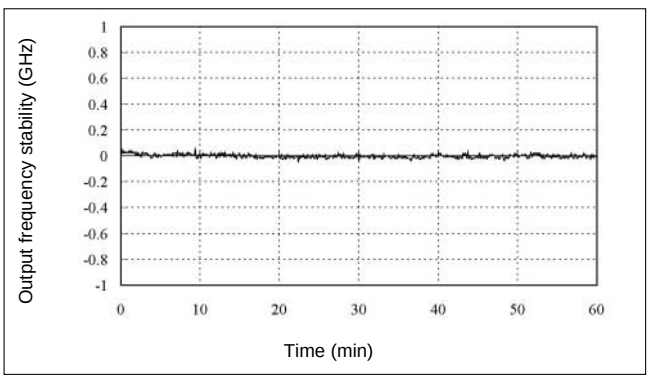
Conforms to wavelengths complying with ITU-T

The unit incorporates a DFB-LD light source that supports D-WDM and complies with ITU-T. Frequencies from 186.3 to 195.9 THz (1609.19 to 1530.33 nm) over a 100 GHz interval are available.

High-power, high-stability

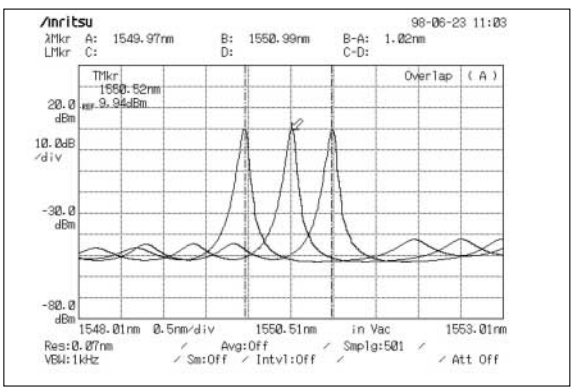
High Power of +10 dBm and high stability of better than or equal to ±0.005 dB are provided. In addition, high stability of better than or equal to ±2 GHz can be achieved for the center frequency (MU952501A/952502A/952503A/952504A/952505A).





Variable optical frequency

The center frequency of the light source can be varied in the maximum range of ±60 GHz (approx. ±0.5 nm). Moreover, the frequency can be displayed in either frequency or wavelength units. This function allows a required frequency to be set between reference grids.



• FP-LD light source units

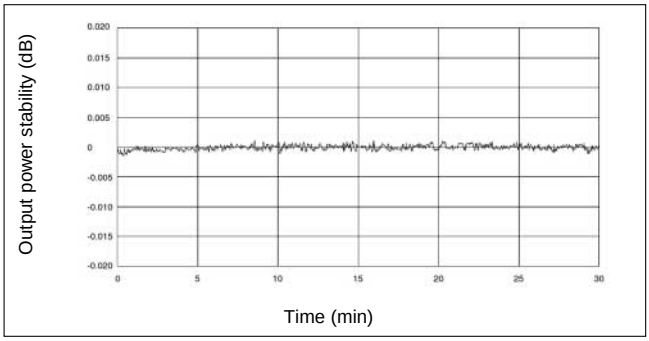
The MU951301A and MU951501A have a wavelength of 1.31 µm and 1.55 µm, respectively. The MU951001A allows the wavelength to be selected as either 1.31 or 1.55 µm.

High-power

The units are general-purpose light sources with a high output of +7 dBm, making them ideal for performing measurements over a high dynamic range.

High-stability

The units provide high output-power stability of better than or equal to ±0.002 dB. They are suitable as light sources for measurements in which high accuracy is required(MU951301A/951501A).



• SLD light source unit

This light source has a center wavelength of 1550 nm and an approximate wavelength band of 40 nm. Optical output power is –3 dBm. The output level is higher than LED light source. A measurement system of MS9710B/C Optical Spectrum Analyzer and SLD light source unit achieves more dynamic range.

On the other hand, when combined with the MN9604C/D Optical Directional Coupler, highly stable reflectance measurements can be performed because of low interference to use SLD light source.

Optical sensor units

High-sensitivity, general-purpose or high-power optical sensors are available. A remote sensor head model and a plug-in model are also provided. Furthermore, besides supporting all optical connectors, the optical input method (connection method) for optical sensors supports bare fiber connection and free-space optical input. The user can select the optical sensor that meets his use environment and purpose.

• General-purpose optical sensor (MU931421A/MU931422A/MA9332A)

MU931421A and MU931422A with measurement ranges of +10 to –80 dBm and MA9332A with a measurement range of +7 to –80 dBm, are highly accurate optical sensors that achieve a measurement accuracy of ±2% and linearity of ±0.01 dB.

MU931422A and MA9332A can be used in measuring fiber with an APC connector, GI fiber and bare fiber. MU931422A is a plug-in model and MA9332A, a sensor head model.

* When using MA9332A, MU931002A sensor adapter is necessary.

• High-power optical sensor (MA9331A/MU931431A)

High-power optical sensors MA9331A and MU931431A have maximum measurement optical inputs of +35 dBm and +33 dBm, respectively. These sensors have NPL (National Physical Laboratory) traceability in conducting calibration at +30 dBm, and are able to measure “high-power” with an even higher level of confidence than conventional high-power optical sensors. And of course all types of corresponding connectors also support fiber with an APC connector, GI fiber and bare fiber. MU931431A is a plug-in model and MA9331A, a sensor head model.

* When using MA9331A, MU931002A sensor adapter is necessary.

Optical input method of the sensor

Item	Model	Type	Various connector	Bare fiber	Space beam
General purpose	MU931421A	Unit	√[1]		
	MU931422A	Unit	√	√	
	MA9332A	Sensor head	√	√	
High power	MU931431A	Unit	√	√	
	MA9331A	Sensor head	√	√	
High sensitivity	MU931311A	Unit	√[1]		
Large diameter PD	MA9333A	Sensor head	√	√	√

[1] MU931421A/MU931311A does not correspond to MU connector, LC connector, and APC connector.

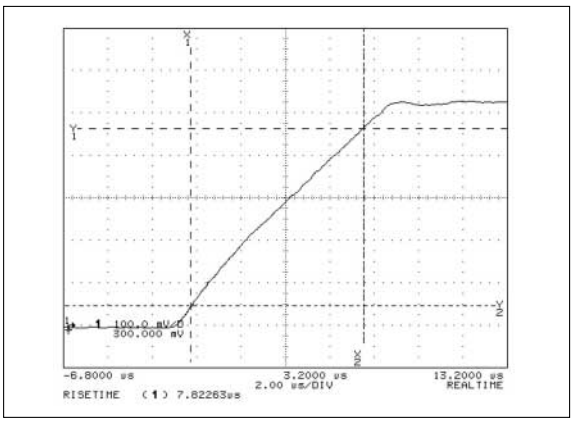
• High-sensitivity optical sensor (MU931311A)
The MU931311A has an optical power range of +10 to –110 dBm and measures high-level to extremely low-level light. It achieves measurement uncertainty of ±2% and linearity of ±0.01 dB. Optical power can be measured with a high degree of accuracy. And of course, this optical sensor is compatible with all connectors.

• Large diameter PD sensor (MA9333A)
This is a sensor head-model optical sensor that has low noise characteristics, and uses an internal photo acceptance unit with a ±5 mm-InGaAs-PD. In addition to SM, GI and POF (plastic fiber), a collimated spatial beam can also be measured directly. This optical sensor also supports bare fiber.
* When using MA9333A, MU931002A Sensor Adapter is necessary.

• MA9901A/B Fiber Adapter
Setting can be accomplished without touching the cut fiber edge by using the clamping method, which catches and then fixes the fiber at both ends. Fiber can also be easily attached and removed by pinching the clamp, making this adapter perfect for extended work.

High-resolution optical power measurement
The MT9810B has a panel of high resolution of 1/1000 dB. In addition, the optical power can be measured at a high resolution of 1/10000 dB via GPIB or RS232C interface.

High-speed analog output
The MU931311A Optical Sensor can send a signal to an analog output terminal with a response speed of approx. 10 µs (The response speed of other optical sensors is approx. 100 µs).



MULTI CHANNEL BOX
MT9812B

CE GPIB

For Adding Light Sources and Optical Sensors for Maximum of 9 Channels

The MT9812B is a mainframe supporting devices such as DFB-LD multiple light sources and multi-channel device evaluation systems. A maximum of 9 MT9810B compatible light sources (DFB-LD, FP-LD, SLD) and optical sensor units can be inserted. In addition to being able to set and verify setting conditions for each unit on the front panel, a remotely controlled measurement system can be supported as GPIB and RS232C interfaces are standard equipment.

Comparison of the features of MT9810B and MT9812B

	Functions	MT9810B	MT9812B
Main frame	Number of channels	2	9
	Remote functions	√	√
	Date/time setting	√	
	Optical channel selector control	√	
	Laser safety protection mechanism	√	√
Optical sensor	Measuring power display	√	√
	Measuring range	√	Can be set remotely
	BW/interval	√	Can be set remotely
	Averaging	√	Can be set remotely
	Optical modulation mode	√	Can be set remotely
	Max/min value memory	√	
	Measurement condition/measuring value saving	√	
	Relative measurement	√	
	Reference measurement	√	
	Calibration measurement	√	
	Wavelength calibration	√	√
	Unit*	√	√
	Sensor head*	√	
DFB-LD	Attenuation	√	√
	Variable wavelength	√	√
	Modulation frequency	√	Can be set remotely
FP-LD	Attenuation	√	√
	Modulation frequency	√	Can be set remotely
	Changed wavelength (2 wavelength unit)	√	√
SLD	Modulation frequency	√	Can be set remotely

* Unit: MU931311A, MU931421A, MU931422A, MU931431A
Sensor head: MA9331A, MA9332A, MA9333A

ACCESS MASTER™
MT9080 Series
1.31/1.55/1.65 µm (SM)

All-New Field Measuring Instrument Integrating Functions Required for FTTx Optical Fiber Installation and Maintenance in One Unit

NEW

- SM 1310 nm/1550 nm/1650 nm OTDR for optical fiber installation and maintenance
- Functions and performance supporting FTTx (FTTB, FTTC, FTTH, PON)
- Short dead zone of 1m (event)
- Light source and optical power meter function provided as standard
- Effective performance and functions for installation and maintenance of optical fibers

User-friendly operation and all-in-one

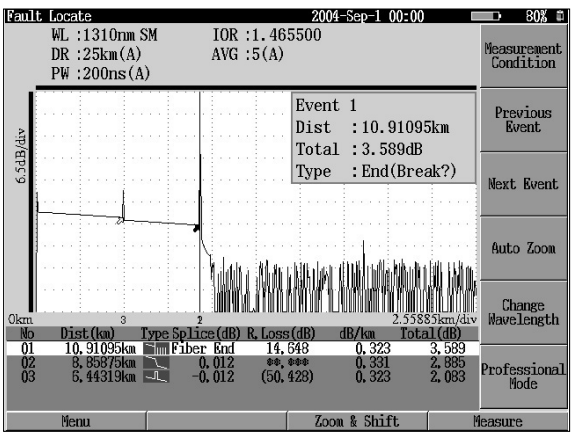
• Simple operation from the top menu

The top menu shown below appears when the MT9080 Series ACCESS Master is activated. You can return to this screen any time by pressing the top menu button (panel key) even if the measurement window is displayed in the selection area. Necessary test items for the user can therefore be executed smoothly.

• Easily identifies failure location with enhanced maintenance function

If a failure occurs, the failure location should be identified immediately and recovery should be made as soon as possible. The MT9080 Series ACCESS Master offers a fault failure locate mode for identifying the failure location easily.

A pulse test is automatically started by pressing the measurement button, and the failure location is displayed enlarged on the screen.



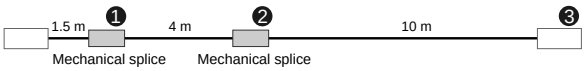
• Provides light source and optical power meter functions as standard, as well as optionally available visible light source

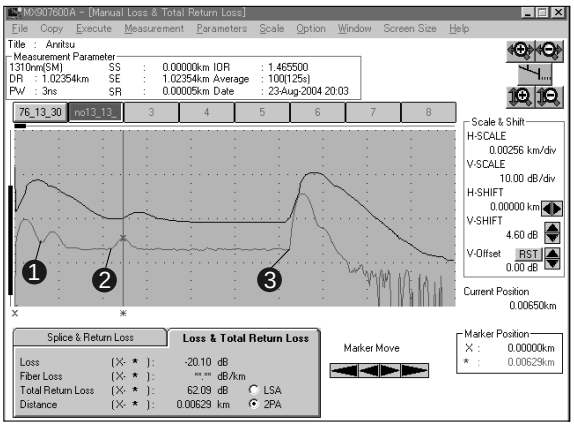
The concept of the MT9080 Series ACCESS Master is to support the functions required for optical fiber installation and maintenance as standard. The MT9080 Series ACCESS Master comes equipped with a light source for fiber identification and an optical power meter function as standard. Together with the optional visible light source, optical fiber installation and maintenance are supported with only one MT9080 Series unit.

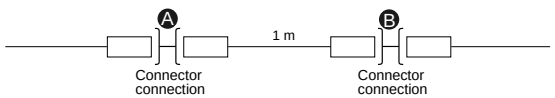
Short dead zone

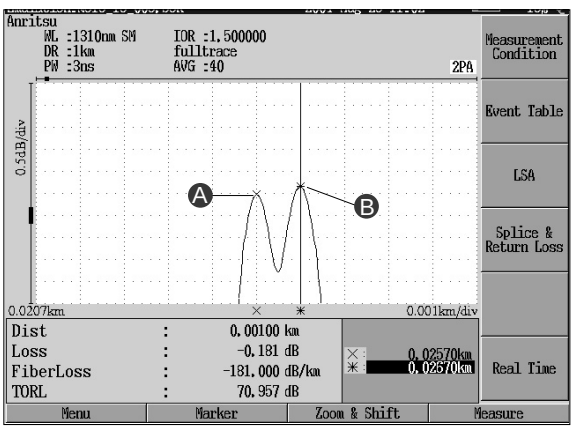
• Short dead zone of 1m (event)
Effective for FTTx

The MT9080 Series ACCESS Master has achieved an event dead zone of 1m and a high sampling resolution of 5 cm, so the connection status in a building and the failure location, which were hard to analyze, can be analyzed and identified.
This OTDR is small but has a high performance.









Compact, lightweight, and convenient functions

• Compactness, lightweight (2.2 kg), and non-HDD

One of the requirements for field measuring instruments is that they can be carried into any field location such as the top of a telephone pole or in a manhole; in other words, they must be able to be used in any measurement location. The MT9080 Series ACCESS Master is smaller and lighter than the traditional MW9076 Series. The user can concentrate on measurements without worrying about the location. Further, the MT9080 Series ACCESS Master is a non-hard-disk measuring instrument, so the system is not started from the hard disk. Stable operation is thus ensured regardless of shock and vibration. Since this compact unit can be brought into any field location, the MT9080 Series ACCESS Master can accommodate sudden problems and support installation and maintenance of optical fibers to the customer's satisfaction. The MT9080 Series ACCESS Master is handy and convenient in the field.

• Dynamic range supporting FTTx

The MT9080 Series ACCESS Master realizes a dynamic range performance for installation and maintenance of optical fibers up to approximately 50 km.

• High-speed start-up of 15 or less seconds

The MT9080 Series ACCESS Master displays the top menu within 15 seconds of power on, making it ready to go to work without a wait.

• Telcordia format (SR-4731) supported

The Telcordia format (SR-4731), the common format for OTDRs, is supported.

• More than 1,000 waveforms can be recorded in the internal memory; more than 30,000 waveforms can be recorded with additional USB memory[1]

The MT9080 Series ACCESS Master can record files of more than 1,000 waveforms in the internal memory. If a USB memory module is inserted into the USB port, files of more than 30,000 waveforms[1] can be recorded.

[1] When a 512 MB USB memory module is used.

• Communication light check

If the fiber being tested contains communication light, the OTDR cannot perform measurements successfully. Also, the pulse light from the OTDR may damage the receiver of a system such as WDM or PON that performs transmission and reception through one fiber.
The MT9080 Series ACCESS Master executes a communication light check before emitting a pulse, and displays the check result on the screen. This function is provided to ensure normal measurement and protect the communication system.

• Waveform comparison function

Measurement data is compared with the saved data by reading it. If measurement data is compared with the data provided when the optical fiber was installed, this function can be used to check aging and identify the failure location in the event of a failure.

• Warning level setting function

Events of loss and reflection at or above the set level are highlighted in the event table. At a glance, whether the line is acceptable can be identified when connection loss at each point is evaluated in installation or maintenance of the optical fiber.

• Emulation software MX907600A

This PC software is used to analyze and edit the recorded data on a Windows-based PC. A report can also be created.

OPTICAL TIME DOMAIN REFLECTOMETER
MW9076 Series
1.31/1.45/1.55/1.625 µm (SM), 0.85/1.3 µm (GI)

CE

Simple Measurement of Chromatic Dispersion

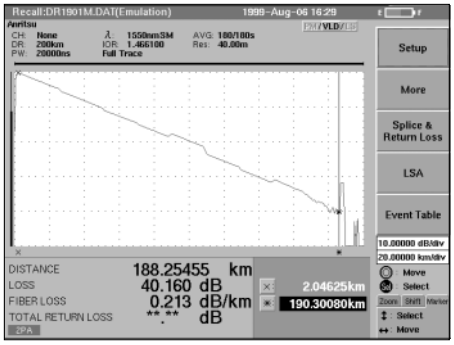
Features
- 45 dB high dynamic range
- 8m short dead zone
- Simple measurement of chromatic dispersion from one end of optical fiber
- Measurement in 10s (Full-Auto mode), 0.15s real-time sweep
- 5 cm high resolution, 50,000 sampling points
- 8.4 inch TFT-LCD color display

Model		MW9076B1	MW9076B	MW9076C	MW9076D1	MW9076J	MW9076K
Optical fiber		SM	SM	SM	SM	GI	GI
Wavelength		1.31/1.55 µm ± 25 nm	1.31/1.55 µm ± 25 nm	1.31/1.55/ 1.625 µm ± 25 nm	1.31/1.45/1.55/ 1.625 µm ± 3 nm	0.85 µm ± 30 nm	0.85/1.3 µm ± 30 nm
Dynamic range		40.5/38.5 dB (typical value)	45/43 dB (typical value)	41.5/39.5/37 dB	34.5/33.5/32.5/30.0 dB	21 dB	21/25 dB
Dead zone (Fresnel/ back-scattered)		1.6/8 m	1.6/8 m	1.6/8 m	3/25 m	2/7 m	2/7 m
Chromatic dispersion					√		
Light source function			√	√			
Options	Visible LD	√	√	√	√	√	√
	Optical power meter	√	√	√			
	High power optical power meter	√	√	√			
	Optical channel selector	√	√	√			
Features		• High cost performance • Short dead zone • Low cost	• Highest class model • Wide dynamic range • Short dead zone	• Three wavelengths • L-band measurement	• Chromatic dispersion measurement • Four wavelengths • Wavelength accuracy: ±3 nm	• For GI fiber • Short dead zone	• For GI fiber • Dual wavelengths • Short dead zone

Performance and functions

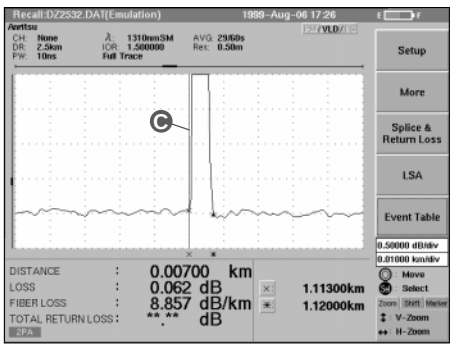
• High dynamic range

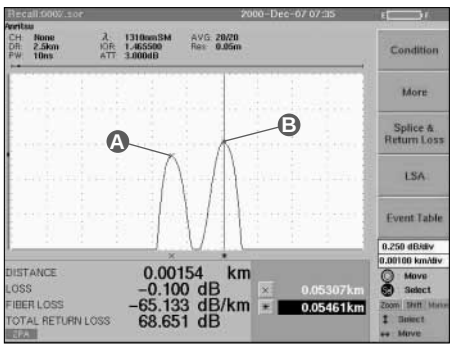
When using a wavelength of 1.55 µm, a point about 190 km distant can be measured.



• Short dead zone

Clearly measure up to near end by 8m dead zone (back-scatter, SM unit)





• Chromatic dispersion measurement

The MW9076D1 has a built-in function for measuring chromatic dispersion even outdoors. The chromatic dispersion can be measured automatically over a wide range from 1300 to 1660 nm from one end of the fiber. The dispersion reproducibility is ±0.05 ps/(nm · km)* and the dynamic range is 30 dB. The MW9076D1 can be operated from an external PC using remote commands to measure the chromatic dispersion. For detail of the chromatic dispersion measurement, refer to the document of "product introduction MW9076 series Optical Time Domain Reflectometer".

* Measured with 25 km of 1.3 µm zero-dispersion fiber (ITU-T G.652) at 1550 nm.

• Fresnel reflection

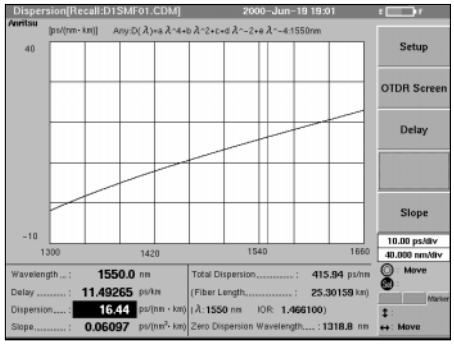
The far-end Fresnel reflection can be measured for four wavelengths (1310/1450/1550/1625 nm).

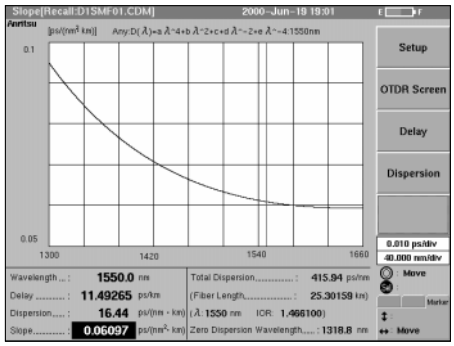
• Group delay characteristics

The fitting formula supports cubic or quintic Sellmeier, and polynomials can be applied to various types of fibers.

• Chromatic dispersion characteristics

The zero and total dispersion can be displayed along with the delay, dispersion and dispersion slope at 0.1 nm steps.





• High-speed measurement

It takes only 10 seconds to measure and display the waveform and connection loss on one screen. Just one press of the Start key is all that is needed to make measurement.

• Full automatic mode

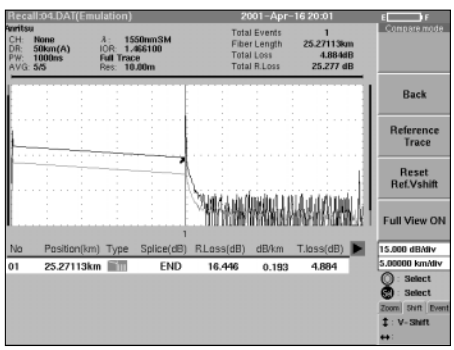
Measurement results are displayed by simply pressing the Start key. All complicated settings of distance range, pulse width, attenuator, and maker can be automatically executed. Measurement speed in this mode was significantly increased. When the wavelengths are set to ALL, wavelengths are automatically changed.

• Repeated measurement

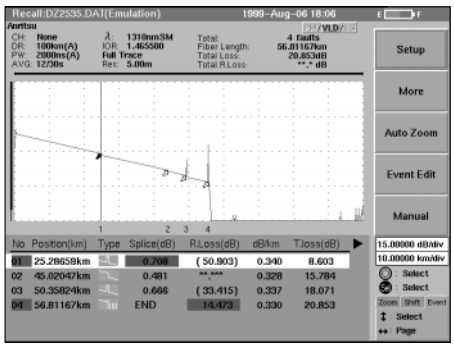
A series of operations, such as measurement, wavelength switching, data saving, optical channel switching, and next optical fiber measurement, can be executed automatically under preset measurement conditions. This mode is ideal for measuring a multi-core optical fiber.

• Waveform comparison function

Measured and saved data can be compared on the same screen. In addition, differences can be displayed as a waveform for simple observation of distance and level differences. This is useful for checking aging changes or comparing several fibers.



• Warning level setup function
In automatic measurement mode, an event warning value can also be set in addition to a detection threshold value. For example, the threshold value can be set to the acceptance level, and warning value to a pass/rejection decision level. In this case, all events will be detected, and those exceeding the warning value are displayed in another color, therefore, enabling the operator to easily identify possible “borderline” events.

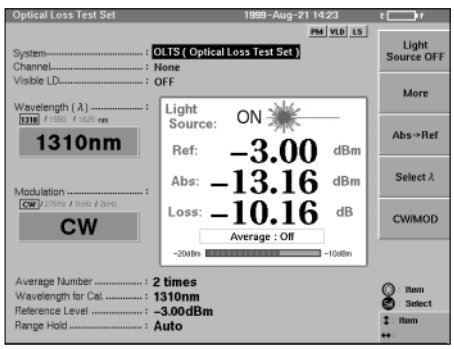


• Communication light check function
When measuring a fiber in service, there is a possibility of mis-measurement by an OTDR. To guard against the risk of mis-measurement, this check function checks for the presence of light other than the OTDR optical measurement pulse.

• Optical channel selector control function
In addition to using the built-in optical channel selector, external MN9662A/9664A Optical Channel Selector can be controlled via the RS232C interface from an OTDR. By using these selectors, an optical fibercable consisting of up to 32 cores can be measured automatically.

• Visible LD
A 635 nm visible LD option is available for the detection of breaks and loss points along the fiber to be measured.

• Light source, power meter
Optical fiber loss can be measured using the optical power meter function and light source function. Two types of optical power meters are supported: One is measurement range of –70 to +3 dBm (MW9076B/B1/C-02 option), the other is measurement range of –50 to +23 dBm (MW9076B/B1/C-03 option).



∗ Light source function is mounted on MW9076B/C as standard. Power meter function is optional to MW9076B/B1/C.

• VGA output terminal
The VGA connector outputs the screen interface to a CRT monitor, which is very useful for production-line applications.

• Large internal memory
About 18 MB internal memory is provided as standard. The following table shows the number of waveforms which can be saved in each media.

Media	GR196	Analysis
FDD (1.4 MB)	123	67
PC-ATA card (256 MB)	16000	10600
Hard disk (1 GB)*	32700	32700

Number of data points: 5,000
* The hard disk is for the PC card slot (IBM Microdrive DSCM-11000 + PC card adapter)

MX907600A OTDR Emulation Software

• Emulation function
Measured waveform data can be analyzed using a PC.

• Data transmission function
Data files recorded by the MW9076 series can be transferred to a PC via the RS232C port.

• Both-end measurement function
A new waveform can be composed by averaging data measured at both ends of an optical fiber.

OTDR MODULE
MW9077A/A1
1.31 µm (SM)/1.55 µm (SM)

CE

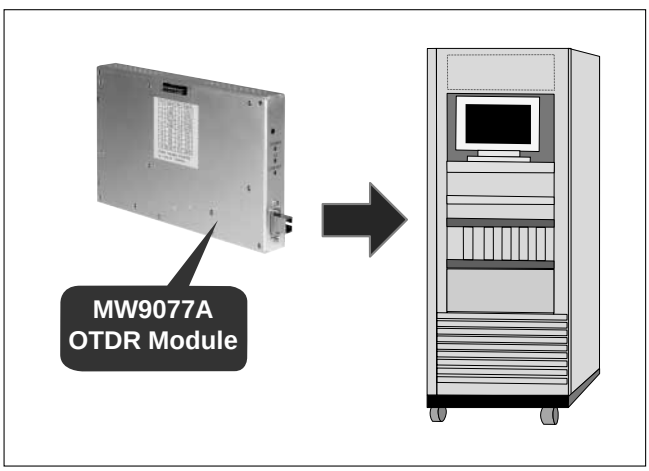
For Optical Fiber Monitor System, Compact and High Performance OTDR Module

NEW

The MW9077A/A1 OTDR module is a suitable OTDR module for an optical fiber monitor system. In recent years, monitoring of optical fibers has become applicable to many fields, not only the maintenance of optical-communications network systems, but also security sensor, flood sensor and prevention of disasters, etc. The MW9077A/A1 OTDR module offers a compact and high performance OTDR solution in such an optical fiber application system.

Features
- A5 size compact for optical fiber monitor system
- Extensive operating temperature range of –5˚ to +55˚C
- High performance inherited from MW9076 Series
- OTDR quick data transmission by Ethernet interface and RS232C

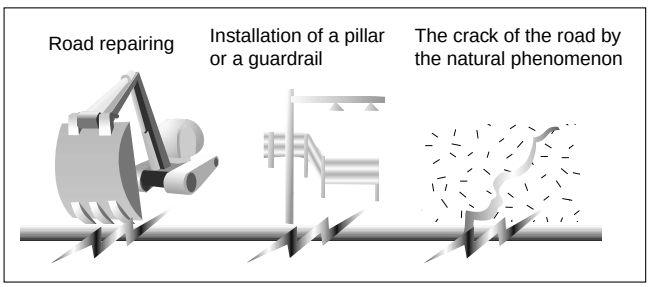
• A5 size compact for optical fiber monitor system
When designing a monitor system, the space factor is important. To satisfy the system requirement in the limited space, a system designer investigates a system configuration from various angles, such as functions, abilities, and module size. Therefore, it is effective to use a compact module for the achievement of system requirements. Furthermore, using a compact module will miniaturize the whole monitor system, and lead to a system-wide cost cut as a result. The MW9077A/A1 OTDR module is a compact module less than A5 size (200 x 130 x 25 mm). Even for strict system conditions, there will still be sufficient space to install the module.



• Extensive operating temperature range of –5˚ to +55˚C
The operation temperature of a system is influenced by various environmental conditions, such as the installation place, and the objects being monitored. Moreover, the heat which the system itself generates influences the operation temperature. Even with operation temperature changes, it is necessary that each module in the configured system be maintained. The performance and monitor system must maintain its reliability. The MW9077A/A1 OTDR module has a standardized dynamic range from –5˚ to +55˚C. When the surrounding temperature conditions are severe, the MW9077A/A1 OTDR module always works at stabilized performance.

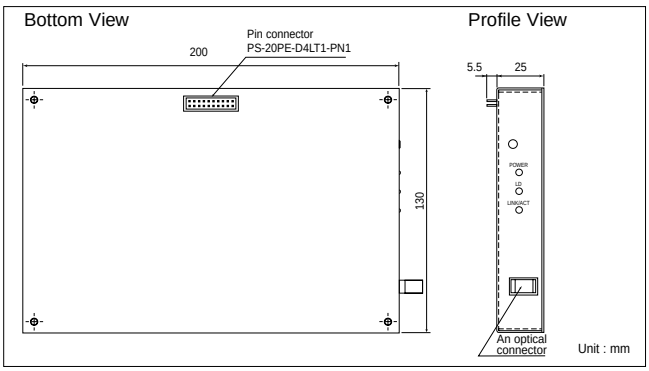
• High performance inherited from MW9076 series OTDR
The MW9077A/A1 OTDR module inherits the technology of the MW9076 series Mini-OTDR. The event dead zone is 5m and the back-scattered dead zone is 20m. The dynamic ranges are 41 dB (1310 nm) and 40 dB (1550 nm). The sampling resolution is a minimum of 5 cm. The MW9077A/A1 is compact, it has a high performance to use the optical fiber monitor.

• Quick data transmission by Ethernet interface and RS232C
The situation of the optical fiber monitoring is various. For example, in the case of measuring long-term change of optical fiber, the system checks optical fiber once in several hours by OTDR. In other cases of fiber monitoring, when the communication network happens to be troubled, the system check optical fiber immediately to find a fiber break point by OTDR. On the other hand, the monitoring of the optical fiber is always carried out to detect change of an optical fiber loss quickly. The MW9077A/A1 OTDR module can carry out trace sweep at intervals of about 1 second or less as well as getting smooth trace by averaging. The MW9077A/A1 OTDR module has 10 Base Ethernet interface. It can transmit the waveform data to a control device at high speed. The MW9077A/A1 can carry out the monitor of an optical fiber without stress.

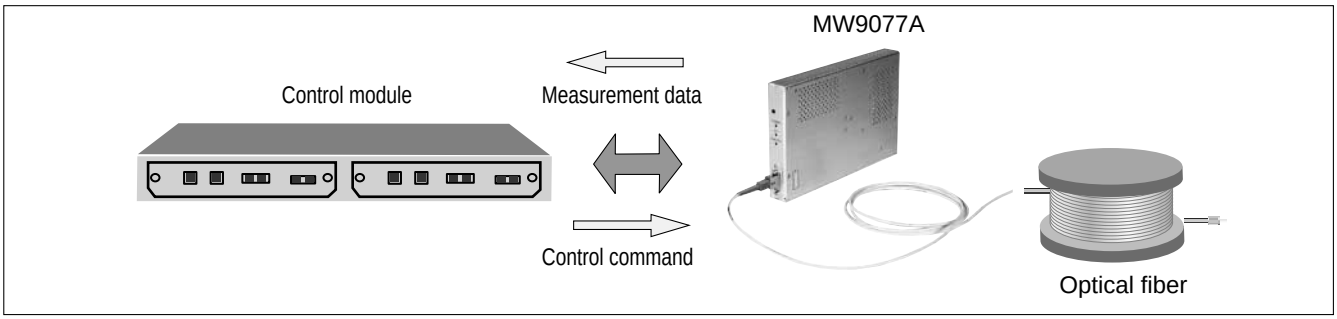


• Fine operation from a control device

The MW9077A/A1 OTDR module has two types of interfaces, 10 Base Ethernet interface and RS232C. From the control device, the MW9077A/A1 OTDR module is controlled by some useful control commands, such as the measurement conditions setup commands and data transmission command to the control device. The setup is possible for each system.



Appearance of MW9077A



OPTICAL SPECTRUM ANALYZER
MS9710C
600 to 1750 nm

CE GPIB

High Performance for DWDM Optical Communications

The MS9710C is a diffraction-grating spectrum analyzer for analyzing optical spectra in the 600 to 1750 nm wavelength band. In addition to uses such as measurement of LD and LED spectra, it has functions for measuring the transmission characteristics of passive elements such as optical isolators, as well as NF/Gain of optical fiber amplifier systems.
In addition to its basic features, the superior stability and reliability of the diffraction grating (patent pending) offer the severe level and wavelength specifications particularly in the WDM band.
This analyzer has the dynamic range, reception sensitivity, and sweep speed requested by users, backed by Anritsu's high-level technology. The high sensitivity meets the exacting demands placed on today's measuring instruments. In particular, the excellent wavelength and level specifications fully meet the dense WDM requirements (1520 to 1620 nm).
The MS9710C Optical Spectrum Analyzer is the successor to the popular MS9710B but with improved functions and higher performance. The specifications have been upgraded for the important 1.55 µm band for WDM communications and have also been optimised to include the new requirements for L-band (1570 to 1620 nm) use. In addition to the high reliability and excellent basic performance, this analyzer has a full range of application functions to support accurate measurement in the fastest possible time.

Features

- Wavelength accuracy of ±20 pm (C-band) and ±50 pm (L-band)
- Dynamic range of 42 dB (0.2 nm from peak wavelength), 70 dB (1 nm from peak wavelength)
- WDM measurement of wavelength, level, and SNR for up to 128 channels

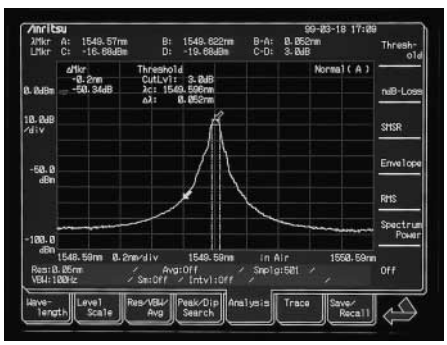
Performance and applications

• 70 dB dynamic range
The dynamic range at 0.2 nm from the peak wavelength is better than 42 dB and is a high 58 dB min. at 0.4 nm from the peak, permitting high-accuracy measurement of DWDM systems with a 50 GHz (0.4 nm) channel spacing. The analyzer demonstrates its excellence in SNR measurement of WDM light sources, as well as in evaluation of narrow-band optical band pass filters.

Distance from peak wavelength	0.2 nm	0.4 nm	1 nm
Normal dynamic range mode	42 dB (45 dB typical)	58 dB	62 dB
High dynamic range mode	42 dB (45 dB typical)	60 dB	70 dB

High-dynamic range measurement example with DFB-LD spectrum passed via narrow-band Band-Pass Filter (BPF).

DFB-LD — Narrow-band BPF — MS9710C



• Relying on WDM transmission
As a result of the need for increased transmission capacity, R&D into large-capacity transmission techniques is becoming more active, and Wavelength Division Multiplexing (WDM) is now in use. This WDM transmission technology requires quantitative measurement of the signal quality and wavelength transmission characteristics of each channel.
Measuring instruments for this purpose require highly-accurate wavelength and level measurements. Furthermore, accurate measurement of fiber-amplifier NF requires extremely good polarization dependant loss characteristics and level linearity specifications.
The MS9710C design achieves excellent wavelength and level specifications for this purpose in the 1520 to 1620 nm wavelength band and also in the extended band (L-band) to 1620 nm. In particular, the wavelength accuracy can be calibrated automatically using an optional internal reference wavelength light source; the post-calibration accuracy is better than ±20 pm.

Specifications for WDM application

Mainframe, option	MS9710C	With Option 15[2]
Wavelength accuracy[1]	±20 pm (1530 to 1570 nm) ±50 pm (1520 to 1600 nm)	±20 pm (1520 to 1620 nm)
Wavelength resolution	50 pm (FWHM of internal optical BPF)	
Resolution accuracy	≤±3% (1530 to 1570 nm, resolution: 0.2 nm)	≤±3% (1520 to 1620 nm, resolution: 0.2 nm)
Level flatness to wavelength	±0.1 dB (1530 to 1570 nm) ±0.3 dB (1520 to 1620 nm)	±0.1 dB (1520 to 1620 nm)
	Resolution: 0.5 nm, ATT: off	
Polarization dependency	±0.05 dB (1550/1600 nm)	
Level linearity	±0.05 dB (1550 nm)	±0.05 dB (1550/1600 nm)
	–50 to 0 dBm (ATT: off), –30 to +20 dBm (ATT: on)	

[1] After calibration with optical reference wavelength light source
[2] L-band enhancement

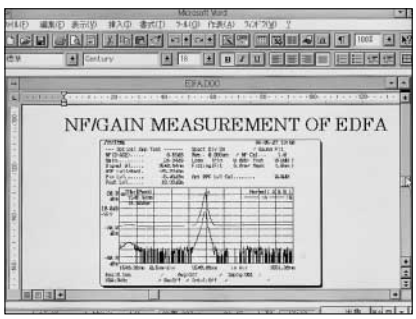
Full function lineup

In addition to its excellent basic functions, the MS9710C comes with a full lineup of other useful functions summarized in the following table.

Device analysis	For analyzing and evaluating waveforms of optical devices (DFB-LDs, FP-LDs, LEDs)
Waveform analysis	For waveform analysis by RMS and threshold methods; SMSR, half-width evaluation, WDM waveform analysis
Application measurement	EDFA NF and gain measurement, polarization mode dispersion measurement
Modulation, pulsed light measurement	Max. frequency range (VBW) = 1 MHz
Markers	Multimarkers: Marker function for max. 300 points Zone markers: For waveform analysis within zone Peak/dip search: Searches for a peak or dip
Power monitor	Also functions an optical power meter
Vacuum wavelength display	Converts displayed wavelength to value in vacuum
External interfaces	GPIB, RS232C, VGA monitor output

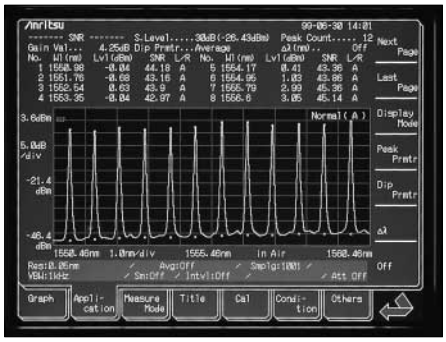
• 3.5 inch internal FDD

In addition to saving and recalling measurement data, etc., waveforms saved to floppy disk can be easily and directly read by a personal computer.
The PC screen shown on the right is displaying an image of the MS9710C screen saved to floppy disk. Screen images can be saved to FD media and output as Windows® bitmap-format files. In addition, since the data can be output in text-file format, it can be manipulated easily using spreadsheet software.

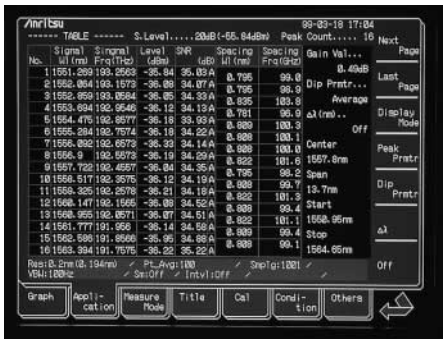


• Spectrum analysis for WDM communication systems

The wavelength, level, and SNR of up to 300 WDM channels can be analyzed.
A new noise level left/right average function (shown below) has been added to SNR measurement. In addition, the noise level is normalized to a per nm figure. Accurate SNR measurement can be achieved due to the high-resolution accuracy of the MS9710C.

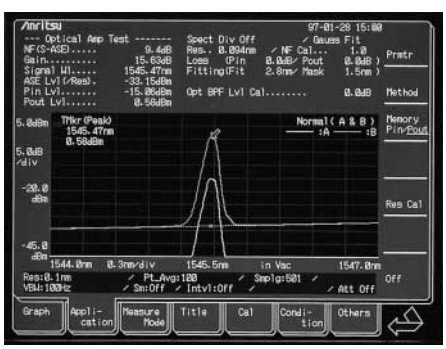


The measurement results described above can be switched to a table display that can be saved and recalled in text format. Both the wavelength and frequency are shown in the table.



• NF measurement of fiber amplifier (EDFA)

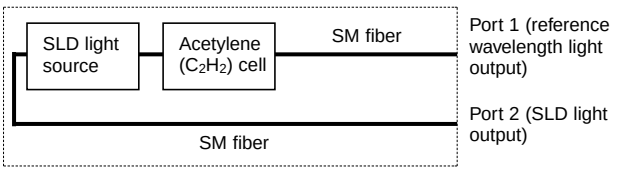
NF measurement by the optical method using an optical spectrum analyzer measures the light input to and output from the EDFA. NF is determined by the beat noise between the optical signal and the Amplified Spontaneous Emission (ASE) from the EDFA as well as by the beat noise between the ASE.
Since the MS9710C measures the ASE level with very high accuracy, three methods can be used to measure NF: 1. Pulse measurement (JIS: under discussion), 2. Level calibration using fitting, and 3. Polarization nulling. Moreover, measurement can be performed with the required dynamic range, level linearity, and polarization dependency.



• Convenient light source option, including reference wavelength light source for better accuracy

Any one of the Wavelength reference & SLD light source (Option 13), SLD light source (Option 14), Wavelength reference light source (Option 05), and White light source (Option 02) can be installed in the MS9710C.

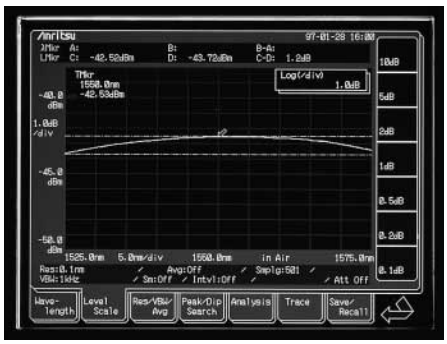
The block diagram of the SLD light source & Reference wavelength light source option is shown below. This option has two separate output ports: Port 1 for wavelength calibration, and the Port 2 for measuring transmission characteristics. When the MS9710C is calibrated automatically by inputting the reference wavelength light source, post-calibration wavelength accuracy in the 1520 to 1620 nm range is better than ±20 pm (Option 15). This is very useful in precision absolute measurement of the wavelengths of light sources used in WDM systems.



Block diagram of SLD light source & Reference wavelength light

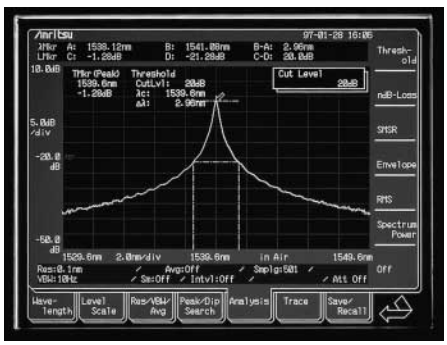
The following diagram shows the spectrum of the SLD light source output from Port 2.

When this light source is used instead of the earlier white light source for measurement of the wavelength transmission characteristics of optical receiver elements, it is possible to achieve a 20 dB wider dynamic range.



Spectrum of SLD light

The following figure is a measurement example of the transmission characteristics of an optical band pass filter using the SLD light source.



Measurement of optical bandpass filter

If this dynamic range is not required, a lower-cost white light source can be installed instead.

OPTICAL SPECTRUM ANALYZER
MS9710B
600 to 1750 nm

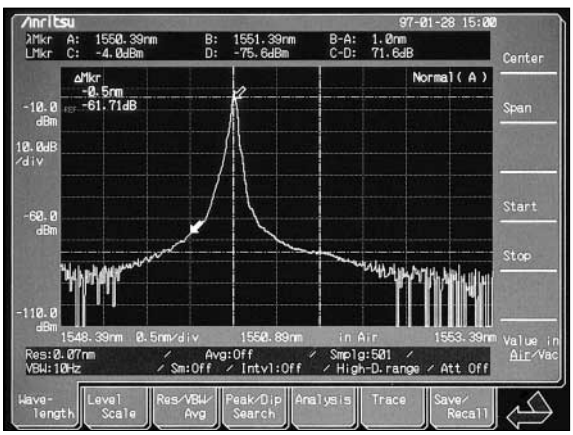
CE GPIB

For Evaluating LED/LD Spectra and Transmission Characteristics of Passive Elements

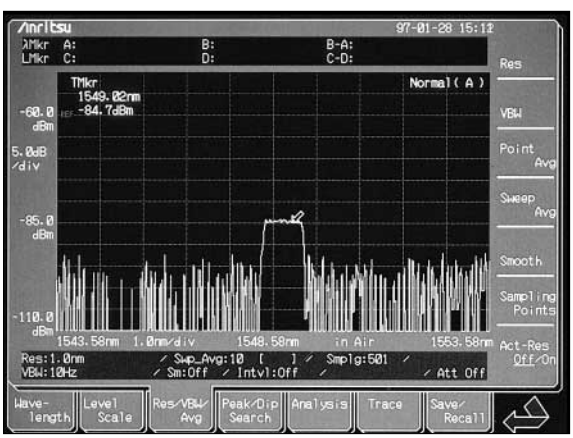
The MS9710B is a diffraction-grating spectrum analyzer for analyzing optical spectra in the 600 to 1750 nm wavelength band. In addition to uses such as measurement of LD and LED spectra, it has functions for measuring the transmission characteristics of passive elements such as optical isolators, as well as the NF/Gain of optical fiber systems.
In addition to its basic features, the superior stability and reliability of the diffraction grating (patent pending) easily pass the severe specifications required for precise measurement of WDM communications methods, particularly in the 1.55 µm band. This analyzer has the dynamic range, reception sensitivity, and sweep speed requested by users, backed by Anritsu's high-level technology. The high sensitivity meets the exacting demands placed on today's measuring instruments. In particular, the excellent wavelength and level specifications fully meet the dense WDM requirements in the 1.55 µm band.
In addition to having a much wider dynamic range, its compact portability (approx. 50% lighter) eliminates the large cumbersome image of earlier analyzers by perfectly combining portability with high performance. In addition to the high reliability and excellent basic performance, this analyzer has a full range of application functions to support accurate measurement in the fastest possible time.

Features
- 70 dB dynamic range
- –90 dBm guaranteed optical reception sensitivity
- Internal 3.5 inch FDD (Windows®)
- Tracking with tunable laser source
- Optical pulse measurement
- Full range of WDM application functions

Performance and functions
• 70 dB dynamic range
The measurement dynamic range of the MS9710B in the normal measurement mode at a wavelength 1 nm from the peak wavelength is 62 dB. In the high dynamic range measurement mode, better than 70 dB can be achieved. The analyzer demonstrates its excellence in SMSR measurement of DFB-LDs, as well as in evaluation of narrowband optical band pass filters. (See top screen in adjoining column.)



• –90 dBm guaranteed optical reception sensitivity
The MS9710B has achieved an improved S/N over a wide range by taking thorough countermeasures to noise and stray light. The RMS noise level at wavelengths from 1250 to 1600 nm is –90 dBm max. The screen display below is the waveform obtained when measuring a 1.55 µm DFB-LD optical source of –85 dBm; only 25 seconds are required for the measurement. In addition, the S/N can be improved using sweep averaging.



• Full function lineup

In addition to its excellent basic functions, the MS9710B comes with a full lineup of other useful functions summarized in the following table.

Device analysis	For analyzing and evaluating waveforms of optical elements (DFB-LDs, FP-LDs, LEDs)
Waveform analysis	For waveform analysis by RMS and threshold methods; SMSR, half-width evaluation, WDM waveform analysis
Application measurement	EDFA NF and gain measurement, PMD measurement (See applications.)
Modulation, pulsed light measurement	Max. frequency range (VBW) = 1 MHz
Markers	Multimarkers: Marker function for max. 128 points (See applications.) Zone markers: For waveform analysis in zone Peak/dip search: Searches for a peak or dip
Power monitor	Also functions as optical power meter
Vacuum wavelength display	Converts displayed wavelength to value in vacuum
External interfaces	GPIB, RS232C

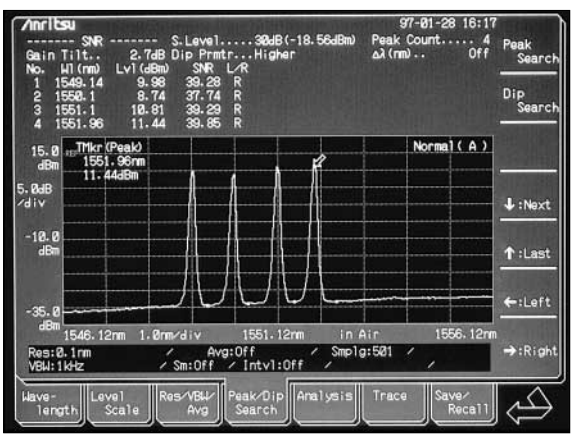
• Relying on 1.55 µm transmission band

As a result of the need for increased transmission capacity, R&D into large-capacity transmission techniques is becoming more active and wavelength division multiplexing (WDM) is ready to use. This WDM transmission technology requires quantitative measurement of the wavelength transmission characteristics between each channel.
Measuring instruments for this purpose require more accurate wavelength and level measurement. Furthermore, accurate measurement of fiber-amplifier NF requires extremely good polarized light dependency and level linearity specifications. The MS9710B design has achieved excellent wavelength and level specifications for this purpose in the 1.53 to 1.57 µm wavelength band. In particular, the wavelength accuracy can be calibrated automatically using an optional internal reference wavelength light source — the post-calibration accuracy is better than ±0.05 nm. Evaluation of WDM systems requires measurement without repeated calibration at each measurement and the MS9710B achieves high-accuracy measurement with high repeatability.

Applications

• Spectrum analysis for WDM communication system

The wavelength characteristics for the gain, and signal to noise ratio (SNR) between each channel are difficult problems in WDM transmission technology. In evaluation, it is very important to measure this quantitatively. The MS9710B permits extremely quick and simple waveform analysis of up to 300 spectra. The waveform and level (SNR) of each peak exceeding the set threshold is displayed. The screen display below shows an example of the tilt gain.

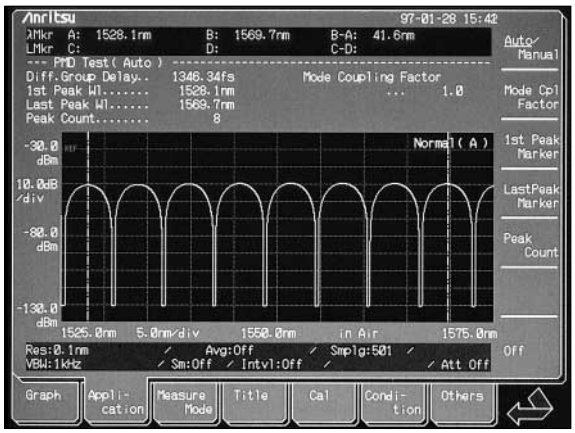


• Polarization mode dispersion

An important factor determining the upper limit of the transmission bit rate is the polarization mode dispersion (PMD). PMD is measured in the time and wavelength domains (see below). The MS9710B can be used as a fixed analyzer to perform simple and automated measurement in the wavelength domain and immediately computes the PMD by data processing from the measured waveform. The wavelength difference ($\lambda_2 - \lambda_1$) between the peak wavelength (λ_1) and the wavelength at the Nth peak (λ_2) are read directly, and the PMD is calculated from the following equation:

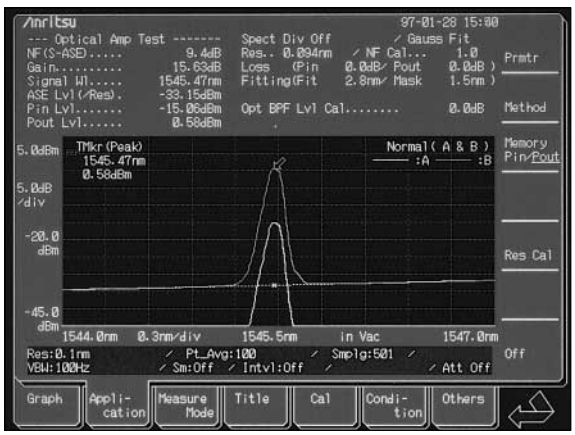
$$PMD = K \frac{N-1}{C} \times \frac{\lambda_1 \cdot \lambda_2}{\Delta\lambda}$$

where: K is the mode coupling factor and C is the speed of light (m/s).



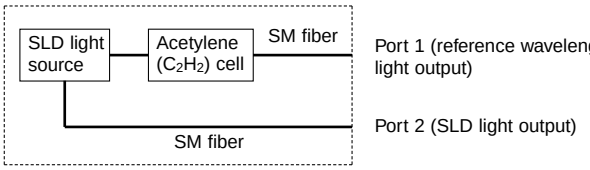
• NF measurement of fiber amplifier (EDFA)

NF measurement by the optical method using an optical spectrum analyzer measures the light input and output to and from the EDFA. NF is determined by the beat noise between the optical signal and the amplified spontaneous emission (ASE) as well as by the beat noise between the ASE (see below).
Since the MS9710B measures the ASE level with very high accuracy, three methods can be used to measure NF: 1. Pulse measurement (JIS Method: under discussing), 2. Level calibration using fitting, and 3. Polarized light nulling. Moreover, measurement can be performed with the required dynamic range, level linearity, and polarization dependency.



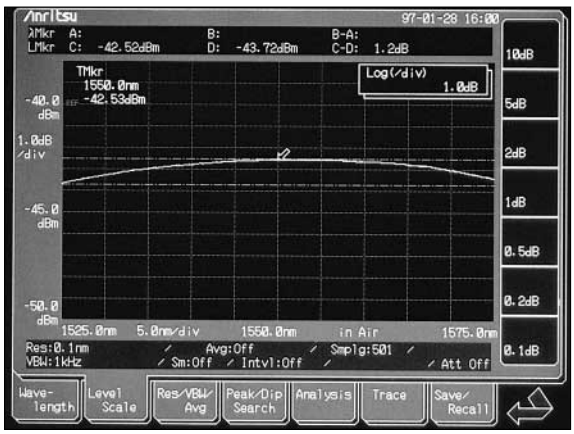
• Convenient light source option (reference wavelength or white light) for better accuracy

The Wavelength reference & SLD light source (Option 13), SLD light source (Option 14), Wavelength reference light source (Option 05), and White light source (Option 02) can each be installed in the MS9710B. The block diagram of the SLD light source and reference wavelength light source option is shown below. This option has two separate output ports: Port 1 for wavelength calibration and Port 2 for measuring transmission characteristics. When the MS9710B is calibrated automatically by inputting the reference light for the wavelength, post-calibration wavelength accuracy in the 1.52 to 1.57 µm range is better than ±0.05 nm. This is very useful in precision absolute measurement of the wavelengths of light sources used in WDM systems.



Block diagram of SLD light source & reference wavelength light

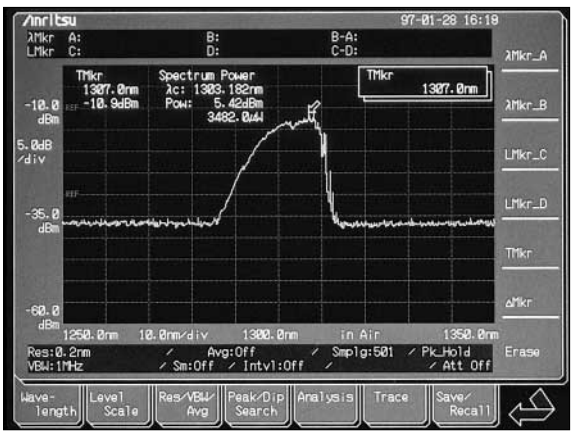
The following diagram shows the spectrum of the SLD light output from Port 2. When this light source is used instead of the earlier white light source for measurement of the wavelength transmission characteristics of optical receiver elements, it is possible to achieve a 20 dB wider dynamic range.



Spectrum of SLD light source

• Measurement of modulated and pulsed light

The synchronization signal for the measured modulated/pulsed light is input to the external input trigger on the rear panel. With this analyzer, the data can be held by this sync signal. As a result, the spectrum of the modulated or pulsed light can be measured accurately without data loss. In addition, an optical source that does not have a sync signal can be measured in the same manner by setting an appropriate gate time. The waveform in the diagram on the right shows measurement of an optical pulse (OTDR's light source) with a pulse width of 1 µs and a duty cycle of 1%. However, for accurate spectrum measurement, the VBW must be set to a wider bandwidth than the modulation frequency of the measured light (see below). The maximum settable VBW in the MS9710B is 1 MHz. (Refer to the specifications page for the relationship between VBW, received light sensitivity and sweep time.)



OPTICAL SPECTRUM ANALYZER
MS9780A
600 to 1750 nm

GPIB

For Fibers with Core Diameters of 10, 50, and 62.5 µm

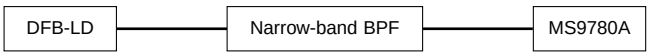
The MS9780A is a diffraction-grating spectrum analyzer for analyzing optical spectra in the 600 to 1750 nm wavelength band. Its input section has been redesigned to support fibers with core diameters of 50/62.5 µm; the input section of the MS9780A can be used to measure the spectra of LDs and LEDs, etc. In addition to uses such as measurement of LD and LED spectra, it has functions for measuring the transmission characteristics of passive elements such as optical isolators, as well as the NF/Gain of optical fiber amplifier systems. In addition to its basic features, the superior stability and reliability of the diffraction-grating (patent pending) capability easily passes the severe specifications required for the precise measurement of WDM communications methods, particularly in the 1.55 µm band.
This analyzer, which is backed by Anritsu's high-level technology, has the dynamic range, reception sensitivity and sweep speed requested by users. Its high sensitivity meets the exacting demands placed on today's measuring instruments. In particular, the excellent wavelength and level specifications fully meet the dense WDM requirements in the 1.55 µm band. In addition to the high reliability and excellent basic performance, this analyzer has a full range of application functions to support accurate measurement in the fastest possible time.

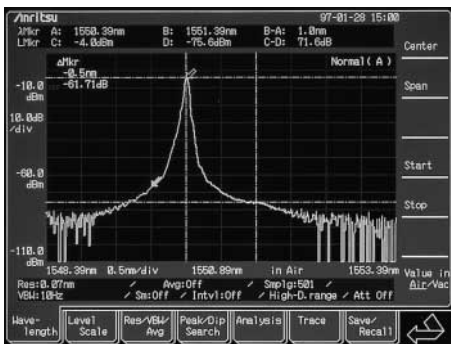
Features
- **70 dB dynamic range**
- **–90 dBm guaranteed optical reception sensitivity**
- **Optical pulse measurement**
- **Full range of WDM application functions**
- **Tracking with tunable laser source**

Applications
• 70 dB dynamic range
The measurement dynamic range of the MS9780A in the normal measurement mode at a wavelength 1 nm from the peak wavelength is 62 dB. In the high-dynamic range measurement mode, better than 70 dB can be achieved. The analyzer demonstrates its excellence in SMSR measurement of DFB-LDs, as well as in evaluation of narrow-band optical band pass filters.

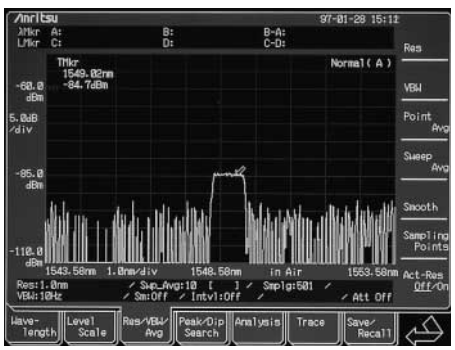
Measurement mode	Dynamic range (at SM fiber)	
	1 nm from peak	0.5 nm from peak
High dynamic range	70 dB	60 dB
Normal	62 dB	58 dB

Wide-dynamic range measurement example with DFB-LD spectrum passed via narrow-band BPF.





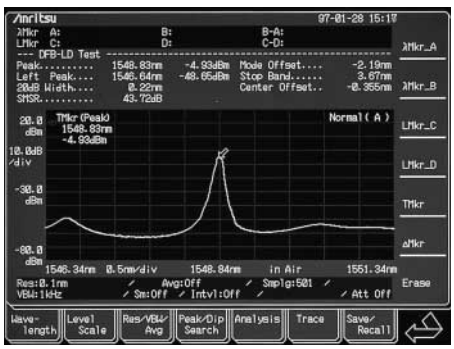
• –90 dBm guaranteed optical reception sensitivity
The MS9780A has achieved an improved S/N over a wide range by taking thorough countermeasures to noise and stray light. The RMS noise level at wavelengths from 1250 to 1600 nm is –90 dBm max. In addition, the S/N can be improved using sweep averaging. The screen display below shows the waveform after 10 averagings; the S/N is improved by more than 5 dB.



• Full function lineup

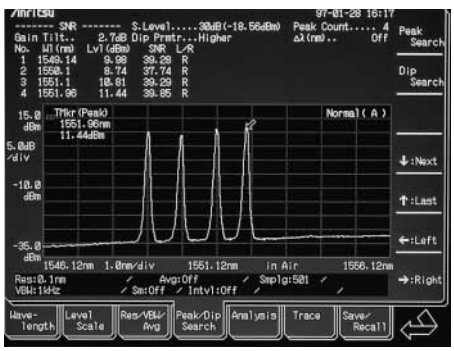
In addition to its excellent basic functions, the MS9780A comes with a full lineup of other useful functions summarized in the following table.

Device analysis	For analyzing and evaluating waveforms of optical elements (DFB-LDs, FP-LDs, LEDs)
Waveform analysis	For waveform analysis by RMS and threshold methods; SMSR, half-width evaluation, WDM waveform analysis
Application measurement	EDFA NF and gain measurement, PMD measurement (See applications.)
Modulation, pulsed light measurement	Max. frequency range (VBW) = 1 MHz (See applications.)
Markers	Multimarkers: Marker function for max. 128 points (See applications.) Zone markers: For waveform analysis in zone specified zone Peak/dip search: Searches for a peak or dip
Power monitor	Also functions as optical power meter
Vacuum wavelength	Converts displayed wavelength to value in display vacuum
External interfaces	GPIB, RS232C



• Spectrum analysis for WDM communication systems

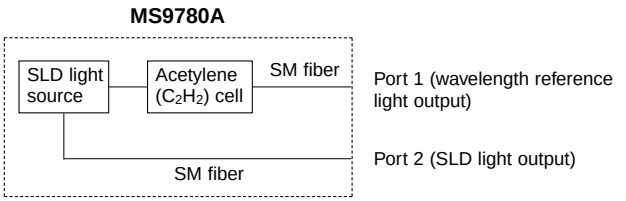
Difficult problems in WDM transmission technology are the wavelength characteristics for the gain, and signal to noise ratio (SNR) between each channel. In evaluation, it is very important to measure this quantitatively. The MS9780A permits extremely quick and simple waveform analysis of up to 128 spectra. The waveform and level (SNR) of each peak exceeding the set threshold is displayed. The screen display below shows an example of the tilt gain.



• Convenient light source option (refer wavelength light) for better accuracy

Any one of the wavelength reference & SLD light source (Option 13), SLD light source (Option 14), wavelength reference light source (Option 05), and white light source (Option 02) can be installed in the MS9780A.

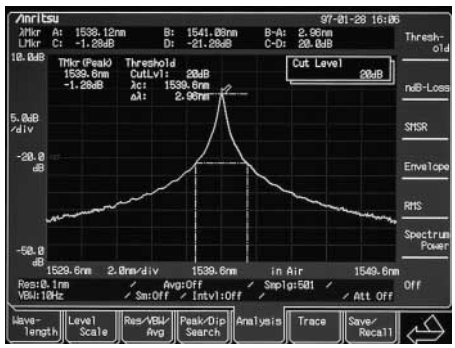
The block diagram of the wavelength reference & SLD light source option is shown below. This option has two separate output ports: Port 1 for wavelength calibration, and Port 2 for measuring transmission characteristics. When the MS9780A is calibrated automatically by inputting the reference light for the wavelength, post-calibration wavelength accuracy in the 1.52 to 1.57 µm range is better than ±0.05 nm. This is very useful in precision absolute measurement of the wavelengths of light sources used in WDM systems.



Block diagram of wavelength reference & SLD light

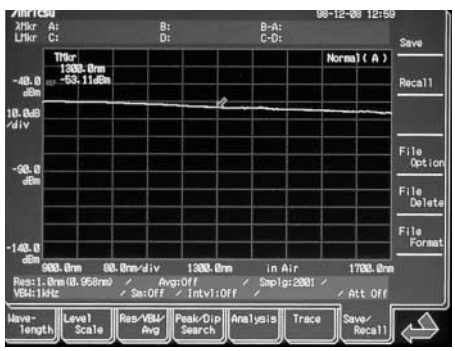
The following diagram shows the spectrum of the SLD light output from Port 2. When this light source is used instead of the earlier white light source for measurement of the wavelength transmission characteristics of optical receiver elements, it is possible to achieve a 20 dB wider dynamic range.

The following figure shows an example of measuring the transmission characteristics of optical band pass filter using the SLD light.



Measurement of optical band pass filter

If this dynamic range is not required, a lower-cost white light source can be installed instead. The following figure shows the spectrum of the white light source. When this light is used, transmission characteristics can be measured in wide range of 900 to 1750 nm.

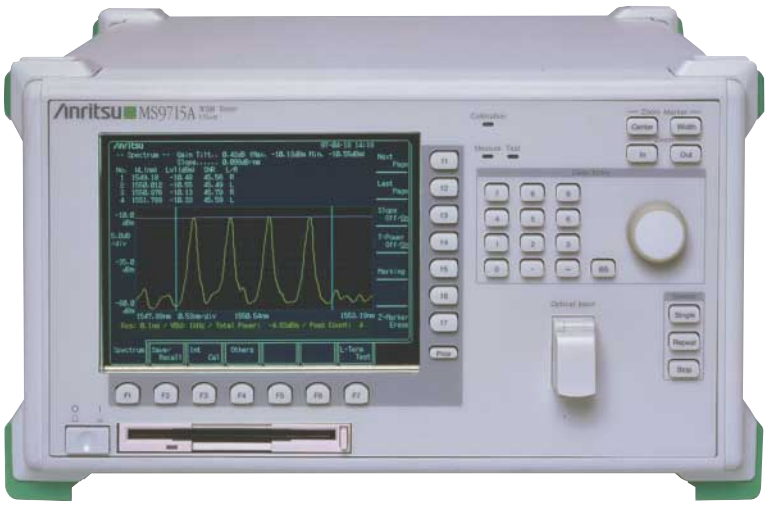


Spectrum of white light source

WDM TESTER
MS9715A
1.527 to 1.567 µm

GPIB

For Maintaining and Monitoring WDM Optical Communication Systems



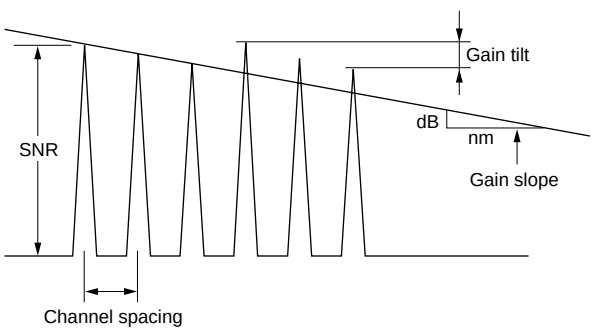
Custom-made product

Optical communications are getting into full swing. Great things are expected of WDM optical communications in answer to the recent social demand for dramatic increases in transmission volume. In WDM communications, multiple optical elements are used in an optical amplifier and various characteristics are precisely controlled to maintain system performance.
The MS9715A is a measuring instrument for use in system manufacture, construction, and maintenance. One instrument combines accurate measurement of necessary items over long periods and satisfies conditions of simplicity of use in construction and maintenance operations, lightness and compactness, and superior environmental performance with respect to vibration and shock. In addition, since the LabVIEW driver is fitted as standard, programming by remote control is simple. A windows compatible floppy disk drive is also fitted as standard.

Feature
• For WDM optical communication

Performance and functions
• Measurement items
Maximum, minimum, and average values over a long period for wavelength, level, SNR[1], channel spacing[2], gain tilt[3], gain slope[4], total power, and spectrum measurement.

[1] Signal to Noise Ratio (dB). Noise resolution level of 0.1 nm. Of the signal's 2 extremes, that with the greater level (smaller SNR) is automatically selected.



[2] Wavelength difference between spectra for individual signal (nm, GHz)

[3] Difference between maximum and minimum peak values for total signal spectrum

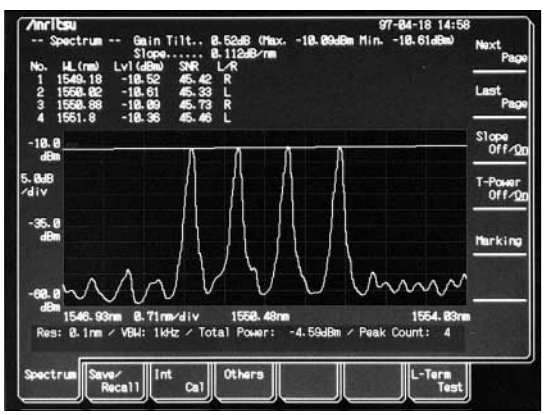
[4] Slope of least mean square regression line of total signal spectrum peaks (dB/nm)

• Superior basic functions
The MS9715A provides the high performance required for the performance testing and evaluation of WDM equipment. Wavelength measurement has ±50 pm accuracy, ±5 pm wavelength stability, and ±20 pm wavelength linearity. High performance level measurement has a dynamic range of 53 dB (0.5 nm from peak), ±0.4 dB level accuracy, ±0.02 dB level stability, and ±0.05 dB level linearity*[5].

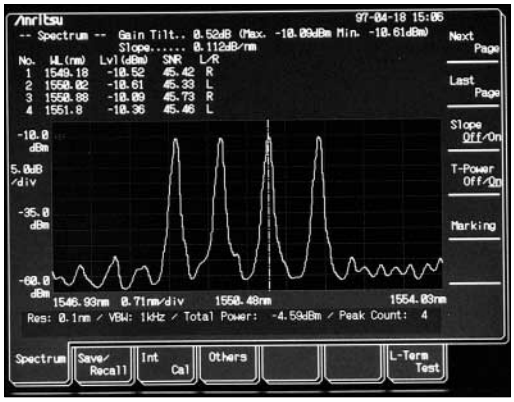
*5: 5 performances at 0.1 nm resolution

• Calculation functions
Measurement calculation functions for SNR, gain tilt, total power, gain slope, channel spacing, etc. are provided.

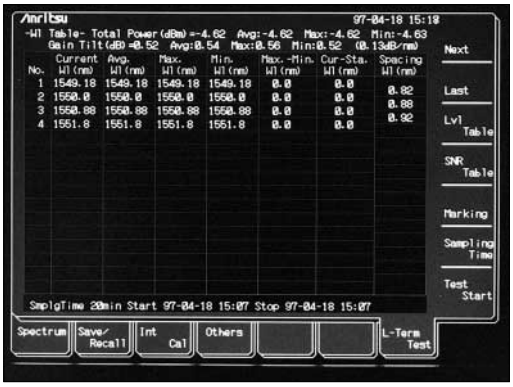
• Two measurement modes
Spectrum measurement mode and long-time measurement mode are provided. As shown on the screen below, in spectrum measurement mode, the results calculated are displayed. (The spectrum is expanded or contracted using the zoom marker.)



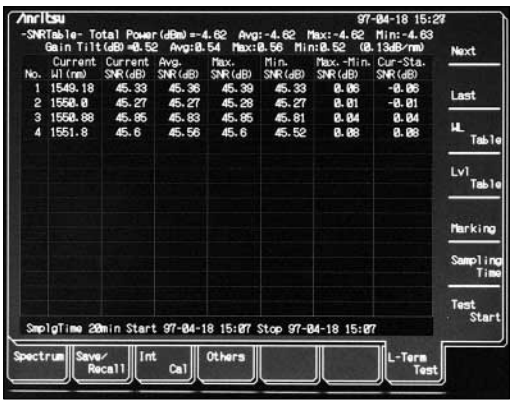
Example of gain tilt and gain slope display



Example of specific spectrum emphasis display



Wavelength table



Level table

• Ease of operation

Measured wavelength settings can be freely expanded or contracted using the zoom marker. The guide spectrum for a specific spectrum can be found at a glance while freely setting the marker. In addition, the level axis is automatically set by detection of maximum and minimum. Wavelength calibration is performed automatically using an internal standard light source.

• Long-time mode

The long-time mode displays measurement results for wavelength, level, and SNR in tables. Besides average value, maximum value, minimum value, and maximum – minimum value for the time interval set by the user (sampling period), the table displays the difference between the current value and that at start time (initial long-time measurement). The wavelength tables also display channel spacing. The complete table value display for each sampling period is treated as one set, and a maximum of 1000 sets are recorded on floppy disk. The behavior of the measured system can be analyzed over a long time period. During the long-time measurement, wavelength calibration is performed automatically using the internal wavelength standard; even if ambient conditions change during the measurement, high wavelength measurement accuracy is secured.

OPTICAL CHANNEL SELECTOR
MN9662A/9664A/9672A/9674A

1.2 to 1.65 µm

CE GPIB

For Automatic Switching of Optical Paths

The optical channel selector is a switching device used for outputting the light that is input to the common channels to any channel. The above devices are equipped with eight (for MN9662A/9672A) and sixteen (for MN9664A/9674A) channels, making them ideal for the evaluation of devices for WDM and various optical transmission devices*. They possess excellent switching repeatability of 0.003 dB (typical value) and low polarization dependent loss of 0.03 dBp-p (MN9662A/9664A). Cleanable and replaceable optical adapters (FC, SC, ST, DIN and HMS-10/A) are also available as applications.

* Please contact us for 1 x 24, 2 x 24, 1 x 32 and 2 x 32 optical channel selectors

Moreover, in addition to the control by the MT9810B Optical Test Set, GPIB and RS232C interfaces are provided as standards, allowing the above devices to be used as components of an automatic measurement system.

Features

- Low polarization-dependent Loss (0.03 dBp-p: MN9662A/9664A)
- Cleanable and replaceable optical adapters (FC, SC, ST, DIN, HMS-10/A)

OPTICAL DIRECTIONAL COUPLER

MN9604C/D

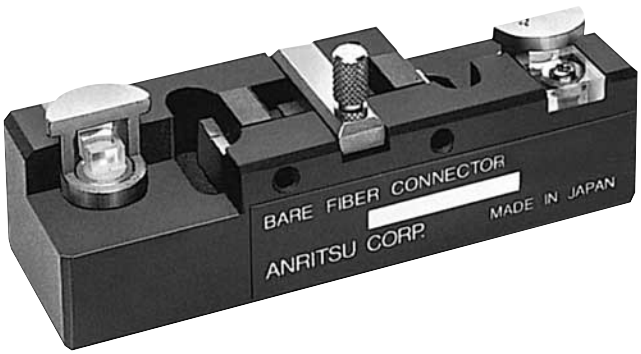
1.25 to 1.65 µm

For High-Accuracy Measurement of Optical Connector Return Loss

The MN9604C/D is used in combination with a stabilized light source and optical power meter to measure optical return loss of optical connectors at approximately 50 dB.

BARE FIBER CONNECTOR
MA9014A

Simple to Use



The MA9014A Bare Fiber Connector has a V-groove design to permit quick connections of optical fibers. During maintenance and installation, bare optical fibers with mirrored cut-end faces can be connected. The use of an optical fiber guide and glass tube ensures that the fibers are easily and reliably set.

Features
- Simple to use
- Accommodates single-mode fibers

PROGRAMMABLE OPTICAL ATTENUATOR
MN938A
0.85/1.3 µm

For Two Wavelengths of 0.85/1.3 µm

GPIB

The MN938A can set attenuation in a range of 0 to 60 dB in 0.1 dB steps. Two wavelengths can be selected. As the MN938A is provided with GPIB as standard, it can be used in a variety of automatic measuring systems for development, production, and inspection. A rotary encoder permits attenuation to be set smoothly even when used manually.

Features
- Wide attenuation range: 0 to 60 dB
- Application for two wavelengths by switch selection
- Suitable for multi-mode fibers (50/125 µm)

OPTICAL VARIABLE ATTENUATOR
MN95D
1.3 µm

Highly Stable Attenuation

The MN95D optical variable attenuator passes an optical signal from a light emitting element through an optical fiber via a lens through an attenuating filter to reduce it to an appropriate light power output. It is a reflection type using metallic film and is used in the 1.3 µm band. The MN95D can be varied continuously and in steps.

Features
- Metallic film filters assure a wide range of usable wavelengths and stable accuracy.
- Prevention of multiple reflection
- Small and lightweight
- Suitable for multi-mode fibers (50/125 µm)

OPTICAL ATTENUATOR
MN9605C
1.3/1.55 µm

Easy-to-Change Optical Connector Adapters

The MN9605C is a high-precision optical attenuator designed for use with single mode optical fibers. A combined step attenuator and continuous attenuator permit highly accurate attenuation adjustment.
The MN9605C has PC-type optical connectors, so that internally-reflected light is thoroughly suppressed. It is precisely constructed for single-mode fiber use and can be used as a highly accurate 65 dB variable attenuator.

Features
- Suitable for 1.3 and 1.55 µm wavelengths
- Minimal light reflection at input/output connectors (return loss: ≥40 dB)
- Optical connector adapters easily attached and removed

BARE FIBER CONNECTOR
MP922B

For Low-Loss Connection of GI/SM Fibers

The MP922B is a bare-fiber connect using a V-shaped groove to temporarily and quickly connect optical fiber cores. The V-groove can be observed by microscope. This permits fine control of distance between optical fiber end-surfaces, and allows low-loss single mode fiber connection.

Features
- No special technical training required
- Low-loss connection even for single mode and multi-mode fibers
- Usable for optical fibers with jacket diameters from 0.25 to 1.2 mm

FIBER ADAPTER
MA9013A

Easy-to-Use Optical FIber Insertion

With the MA9013A Fiber Adapter, bare fiber connections can be made quickly and easily. The device, engineered to allow fiber core connections without need for polishing, is especially useful for simple temporary instrument connections during on-site operations. Moreover, the high-precision ferrule facilitates low-loss single-mode and multi-mode fiber connections.

Features
- Simple to use
- Suitable for single-mode and multi-mode fibers
- Accommodates optical fibers with external diameter error
- Compatible with various optical fibers
- Easy ferrule replacement (FC connector)

PORTABLE TEST RACK
MB23A, MB24A

MB23A **MB24A**

The MB23A and MB24A can be folded so they can be transported easily and used in places with space limitations. Metal fittings to accommodate both current and new cabinet designs are included.

MB23A
- By easy operation of the lever, the table can be inclined at five different angles for optimum instrument viewing ease.
- Thanks to Anritsu's exclusive construction, just a light touch of the lever is all it takes to move the angle safely up to 45˚.

MB24A
- The table is fixed in a horizontal position.
- Since the rack can support up to 80 kg, several instruments may be stacked.

ISO9001/14000

IP Network, Wireless and Precision products contained in this catalogue are manufactured under a quality system and environment management system in conformance to the ISO international standard.

Factory name	Conformed standard	Qualification number	Qualified date	Qualification organization
Atsugi factory	ISO9001	JQA-0316	Nov. 15, 1993	Japan Quality Assurance Organization (JQA)
	ISO14001	JQA-EM0210	Aug. 28, 1998	
Tohoku Anritsu	ISO9001	JQA-0737	Dec. 28, 1994	
	ISO14001	JQA-EM0560	Oct. 22, 1999	
England factory	ISO9001	FS22679	May 24, 1999	BSI Quality Assurance
	ISO14001	EMS54120	Mar. 15, 2000	
U.S.A factory	ISO9001:2000	6495	Apr. 27, 1995	The Seal of National Quality Assurance Limited Registered to A2LA
	ISO/IEC 17025	2160.01	Mar. 18, 2004	

Quality and Reliability Assurance for Products

• Planning stage

Management resources are focused on measuring instruments related to growing fields such as mobile Internet, WDM and digital broadcasting, System solutions, precision measurement business and device businesses. New products are planned to provide solutions whenever required by users.

• Design stage

To realize a design with high-safety and high-reliability, several levels of design assessments are performed. Power consumption is reduced from the viewpoint of environment considerations, starting with evaluation of specifications, legal regulations and parts used. Evaluations are also implemented for improving the recycling ratio, and the design quality is improved.
Anritsu utilizes a design process that targets customer satisfaction.

• Evaluation stage

In addition to safety, reliability and environment considerations of test models for new products, functions and performance are verified by an operating environmental conditions test and operability, uncertainty, maintainability and flexibility of design are evaluated fully. After passing these tests, the products can be commercialized.

• Manufacturing and inspection stages

Based on our policy, “post-processing is the customer,” the product is manufactured by experienced employees according to the workmanship standards. In the adjustment and inspection stage, automatic measurement is promoted. An expert will be in charge of the adjustment if high-skilled adjustment is required.

• After sold

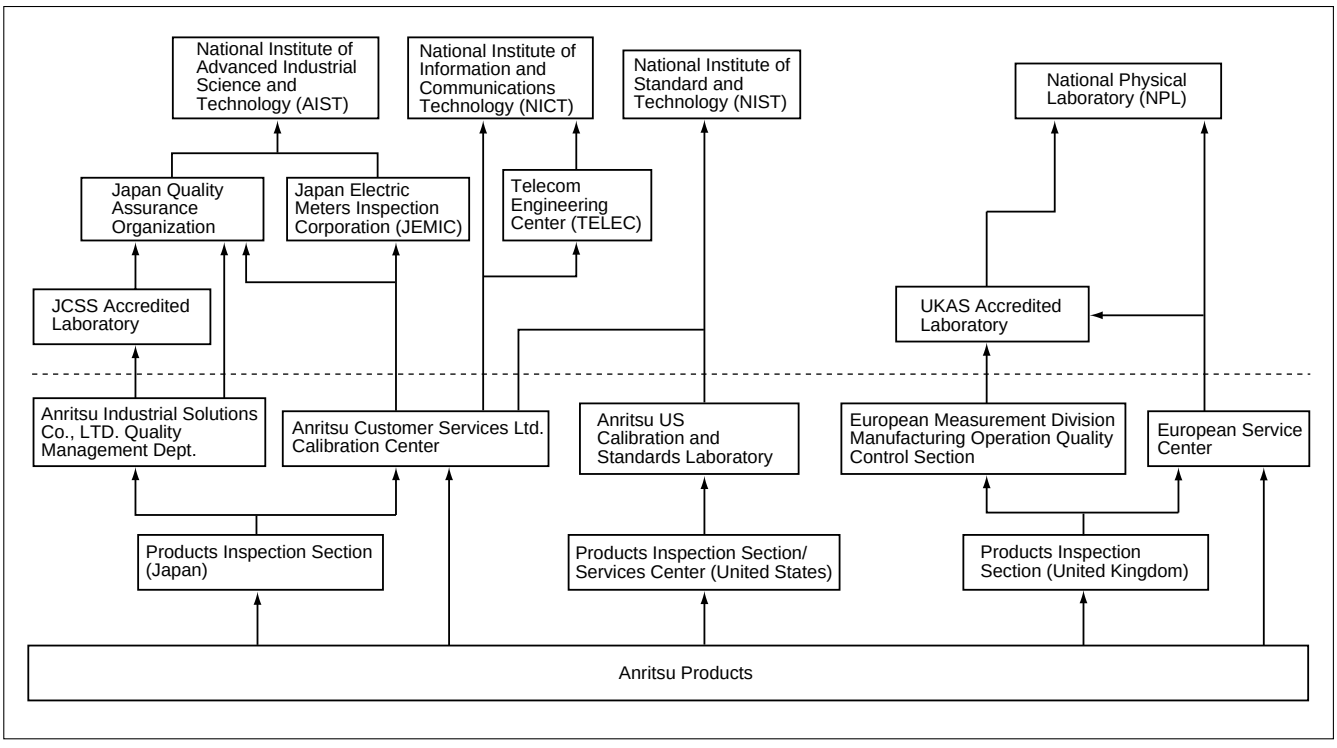
In each service department, traceability assurance by calibrations based on high-technical capabilities, as well as rapid repair and preventive maintenance are performed.

Parts standardization and improving activities for quality and reliability

For parts generally used in each measuring instrument, quality improvement and standardization are actively promoted. All field data is analyzed, arranged and completely made known to each department while required actions are taken for reliability improvement.
In addition, failure rate, MTBF observation and parts failure rate are calculated based on this information.

Traceability assurance

As defined in the International Vocabulary of Basic and General Terms in Metrology (VIM; 1993), traceability is defined as "the property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons." Anritsu's system to ensure traceability is shown below.
Measurements made by Anritsu's laboratory's are traceable to national, international, or intrinsic standards, where such standards are available.



ANRITSU CORPORATION

P/N: 11410-00355