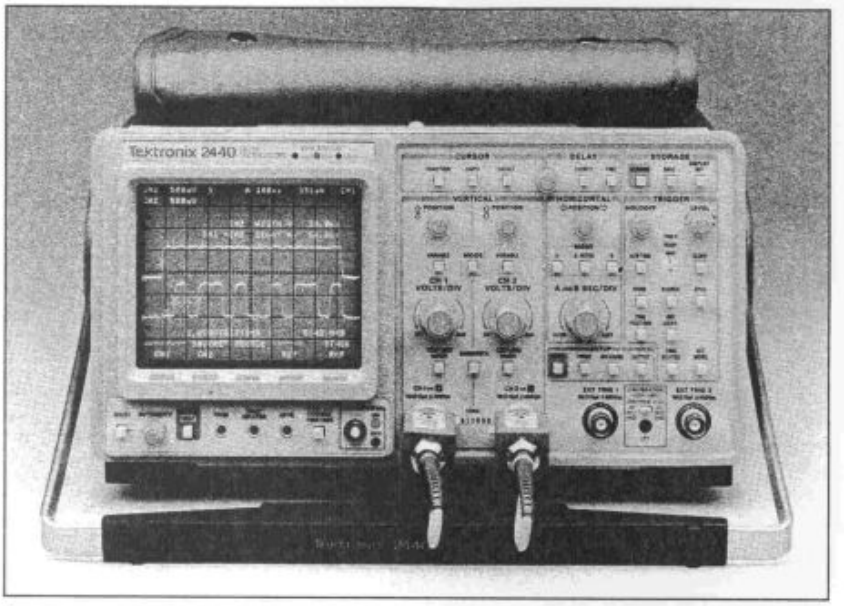
2400 SERIES PORTABLE DIGITAL STORAGE OSCILLOSCOPES



2440

NEW 2440
NEW 2432A
2430A

GPIB IEEE-488 The 2400 Series of digital scopes complies with IEEE Standard 488.1-1987, RS-232C, and Tektronix *Standard Codes and Formats.*

TYPICAL APPLICATIONS

- **Analog and Digital Design**
- **Applied Research**
- **Manufacturing Test**
- **Telecommunications**

BENEFITS

- **Better Repeatability from Built-in Automation**
- **Faster Results from Automated Measurements**
- **Less Drudgery from Push-Button Selections**
- **Better Accuracy from Reduced Operator Error**

FEATURES

- **500 MS/s Digitizing (250 MS/s for the 2432A and 100 MS/s for the 2430A)**
- **300 MHz Bandwidth (150 MHz for the 2430A)**
- **2 ns Glitch Capture**
- **Autoprobe Function with P6137 Probe (2440 and 2432A)**
- **300 MHz X-Y Bandwidth (150 MHz for 2430A) at Probe Tip**
- **Automatic Measurements**
- **Extensive Triggering Capabilities**
- **Printer/Plotter Output**
- **On-Screen HELP Text Describing Every Front-Panel Control**

Versatile Scopes

Tektronix adds timesaving innovations to high standards of technical performance. the results are powerful and versatile scopes that speed measurements, simplify setups and automate test procedures—all from the front panel. Their portable, compact design easily serves benchtop as well as rack needs.

Fully Programmable, Proven Scopes

With the 2440's 500 MS/s digitizing rate—on two channels simultaneously—you can digitize, view and store wide bandwidth, complex signals. You have 8-bit vertical resolution, 1K record length per channel and a 0.0015% crystal-controlled time base for accurate voltage and time measurements.

No other portables let you:

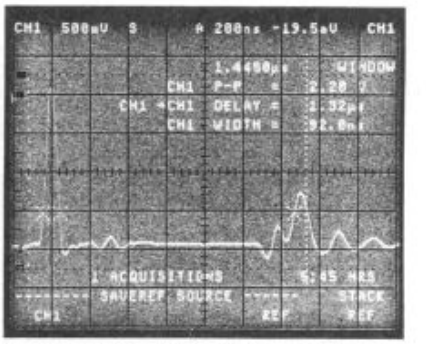
- Capture glitches as narrow as 2 ns.
- Automatically catch intermittent failures in babysitting applications, using the patented auto pass/fail testing feature.
- See waveform changes virtually *as they happen* thanks to Tektronix' fast update rate.

Unmatched Ease of Use

The 2440, 2432A, and 2430A operate like analog scopes and save time with new automated capabilities. You will immediately recognize the familiar grouping of front panel controls. You will appreciate the simple, single-level menus for standard functions.

2400 Series with MATE/CIIL Capabilities

The 2440M, 2432M, and 2430M Digital Oscilloscopes offer Control Intermediate Interface Language (CIIL) capability that is essential for operation in Modular Automatic Test Equipment (MATE) used in testing military avionics and weapons systems.



Tektronix 2400 Series Digital Oscilloscopes easily capture single-event pulses—as in nondestructive, ultrasound testing—and store them in scope memory. Here the scope measures the time from a reflected pulse using the automatic delay measurement feature.

Contact your local Sales representative for more detailed information.

2400 SERIES DIGITAL OSCILLOSCOPES

	Sampling Rate	Bandwidth	Glitch Capture	Automation Time Savers	Auto Probe	Warranty
2440*1	500 MS/s	300 MHz	2 ns	Yes	Yes	3 years*2
2432A*1	250 MS/s	300 MHz	2 ns	Yes	Yes	3 years *2
2430A*1	100 MS/s	150 MHz	2 ns	Yes	No	3 years *2

*1 *2440M, 2432M and 2430M also.*
*2 *Five years optional.*

CHARACTERISTICS

AUTOMATION FEATURES

Auto Sequencing
Saves and recalls typically 50 to 200 front-panel setups, user prompts, test procedures and associated control and I/O actions in up to 40 named test sequences.

Auto Setup
Automatically configures controls to display the selected channel in the selected mode. In View and Measurement mode, auto setup is user-selectable on: Period, Pulse, or Edge.

Pressing the button on the autoprobe selects the auto setup function on the 2440 and 2432A.

In the View mode, the auto setup capability displays one channel with ground at screen center. Displays two channels with ground ±2 divisions. Horizontally scales for three to six cycles.

Auto Pass/Fail Testing
This unique Save on Delta feature compares incoming waveforms to a user-definable waveform envelope and saves the waveforms that are outside reference limits. For easy examination, saved events (events that caused a Save on Delta trigger) are horizontally positioned at center screen.

Auto Measure
Provides two operating modes:

- Simultaneously measures up to four parameters on one or more displayed waveforms. Parameter readouts are updated at 3 Hz intervals.
- Displays a Snapshot of 20 waveform parameters on a single waveform target.

Waveform parameters measured—Frequency, period, width, rise time, fall time, propagation delay, duty cycle overshoot, RMS, area, minimum, maximum, mid, peak-to-peak, mean, base, top, proximal, mesial, and distal.
Thresholds—Settable in percentage or voltage.
Determining 0% and 100% levels—Three methods available.
Threshold crossing locations indication—Visual.
Windowing capability—Measurement windows defined by cursors.
Indications—Extensive warning and error-condition indication capabilities.

VERTICAL SYSTEM

Channels—Two, with simultaneous acquisition.
Bandwidth Limit—20 MHz or 100 MHz (50 MHz for 2432A and 2430A), selectable; reduces −3 dB point between 13-24 and 90-110 MHz.
Vertical Accuracy—±2% +1 digitizing level (25 digitizing levels per CRT division).

Bandwidth*1 Versus Temperature—

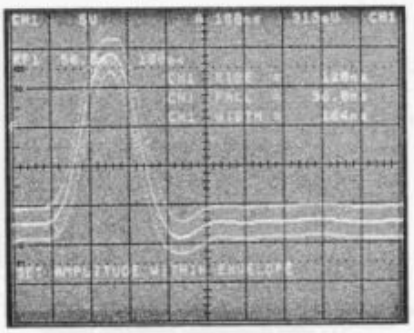
	−15 to +30°C	30 to 55°C
2440	<10 Hz to 300 MHz for ac coupling	Reduce upper BW limit 2.5 MHz for each °C, above 30°C*2
2432A	DC to 300 MHz for dc coupling	
2430A	<10 Hz to 150 MHz for ac; dc to 150 MHz for dc input coupling	

*1 *Measured at −3 dB in Normal, Average, or Envelope with Repet mode on.*
*2 *Measured with standard accessory probe or internal 50 Ω termination.*

Deflection Factor—2 mV/div to 5 v/div in 1-2-5 sequence, continuously variable between ranges.
Vertical Position Range—±10 div (+0.4 div, −0.7 div).
Auto Scale Factor—On-screen readout indicates probe tip deflection factors for 1X, 10X, 100X and 1000X probes.
Delay Matching—CH1 to CH2 ±150 ps for 2440, 2432A; ±250 ps for 2430A. Delay between CH1 to CH2 is nulled in progagation delay measurement readout (for 2432A and 2440).
Maximum Input Voltage—For 1 MΩ input with DC, AC, and GND coupled selections: 400 V (dc +peak ac), 800 V p-p ac at 10 kHz or less.

For 50 Ω input: 5 V RMS; 0.5 W for any 1 s interval for instantaneous voltages from 5 to 50 V.

Input R and C—
For 1 MΩ input, ±0.5% paralleled by 15 pF ±2 pF.
For 50 Ω input, ±1%.



Perform high-speed testing of disk-drive test applications. Using a reference memory template waveform, compare live read pulses for full automatic testing.

HORIZONTAL SYSTEM

Display Modes—A, A Intensified, and B.
A and B Delayed Sweep Range—
For 2440 and 2432A: 2 ns/div to 5 s/div in 1-2-5 sequence.
For 2430A: 5 ns/div to 5 s/div in 1-2-5 sequence.
External Clock Repetition Rate—
1 MHz min, 100 MHz max.
Delay by Events—Delays the A or B sweep by a user-selected number of B trigger events after the normal A trigger occurs. (Maximum events: 65,536.)

ACQUISITION SYSTEM

Maximum Single-Event Useful Storage Bandwidth—200 MHz (2440), 100 MHz (2432A), 40 MHz (2430A) using internal Modified (Sine X)/X Interpolator (Repet mode off).
Maximum Sample Rate—500 MS/s (2440); 250 MS/s (2432A), and 100 MS/s (2430A) on two channels simultaneously.
Vertical Resolution—8 bits (256 levels over 10.24 vertical div).
Record Length—1024 points per channel.
Dynamic Range (2440 and 2432A only)—

Sweep Speed	Digitizing Levels
100 µs or slower	0 to 255 (−128 to +127)
50 µs to 500 ns	4 to 251 (−124 to +123
200 ns	7 to 248 (−121 to +120
100 ns*1	15 to 240 (−113 to +112)
50 ns to 2 ns*2, Repetitive mode off	15 to 240 (−113 to +112)
50 ns to 2 ns*2, Repetitive mode on	7 to 248 (−121 to +120)

*1 *Applies to 2440 only.*
*2 *100 ns 2432A.*

Normal Acquisition Mode Sweep Speeds—

Model	Real Time Sampling	Equivalent Time Sampling	Interpolated Real Time Sampling
2440 2440M	5 s/div to 100 ns/div	50 ns/div to 2 ns/div	50 ns/div to 2 ns/div
2432A 2432M	5 s/div to 200 ns/div	100 ns/div to 2 ns/div	100 ns/div to 2 ns/div
2430A 2430M	5 s/div to 500 ns/div	200 ns/div to 5 ns/div	200 ns/div to 5 ns/div

Acquisition Modes

Normal Mode—Normal, real-time sampling of input signals.

Envelope Mode—Uses internal analog peak detectors to record and display minimum and maximum waveform values over one or more sweeps. Number of waveforms recorded before reset is user-selectable in binary sequence from 1 to 256 or continuous.

Envelope Mode Pulse Response (Glitch Capture)—The following pulse capture capabilities apply for sweep speeds from 5 s/div to 500 ns/div.

Pulse Duration	% of Amplitude Capture	Confidence Level
2 ns	>50%	>85%
4 ns	>50%	100%
8 ns	>80%	100%

Envelope Mode Software Function—Operates at sweep speeds from 2 to 50 ns/div (2440); 2 to 100 ns/div (2432A); from 5 to 200 ns/div for the 2430A (repetitive mode on).

Average Mode—Averages continuously for a number of acquisitions from 2 to 256 in binary sequence. Averaging of 128 or 256 acquisitions effectively increases vertical resolution to 11 bits and vertical sensitivity to 200 μV/div (for signals containing sufficient noise component).

MEMORY

Nonvolatile Memory—Memory containing calibration data, readout data, an initial front-panel setting, power-down front-panel setup and action storage. Nonvolatile memory retention time: ≥3 years; lithium battery back-up.

DISPLAY

Display Modes—CH1, CH2, Invert, Add, Multiply, X-Y (CH1 vs CH2, Ref1 vs Ref2) reference displays 1 through 4.

Waveform Expansion—10X vertical expansion of SAVEd waveforms, in 1-2-5 sequence. 100X horizontal expansion of SAVEd waveforms, in 1-2-5 sequence. (Expanded waveforms can be positioned vertically and horizontally to examine any area of interest.)

Display Update Rate—With 50 kHz trigger, and one channel selected and 100 μs/div sweep speed, fastest update rate possible: 100 Hz. Average: 60 Hz (typical performance).

ON-SCREEN CURSORS

Functions—Volts, Time, Volts at Time, 1/Time, Slope. Settings selectable for either data or absolute time/volts (referenced to trigger point/ground).

Units	Selectable as
Volts	Volts, %, dB
Volts at Time	Volts, %, dB
Time	Seconds, %, degrees
1/Time	Hz, %, degrees

FUNCTIONS

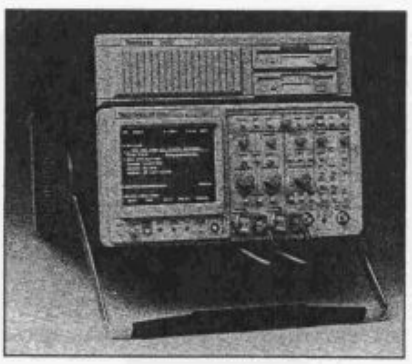
A Mode—Auto Level, Auto/Roll, Normal, and Single Sequence.

B Mode—Triggerable After Delay, Runs After Delay.

A and B Source—Vertical, CH1, CH2, Line (A only), Ext 1, Ext 2, A*B (A sweep only), Word (17-bit Word Recognizer Probe optional accessory).

A and B Coupling—AC, DC, Noise Reject, HF Reject, LF Reject, TV,f A mode only with option 05.

A and B Trigger Position—1/8 to 7/8 of acquisition record, user selectable in 1/8-1/4-1/2-3/4-7/8 sequence. User selectable in 32 sample intervals (from 1/32 to 30/32) using GPIB.



Ext 1 and Ext 2 Inputs—Resistance: 1 MΩ ±1%.
Capacitance: 15 pF ±3 pF.
Maximum Input Voltage: 400 V (dc + peak ac), 800 V p-p ac at 10 kHz or less.
Trigger Level Control Range—CH1 and CH2 Source: ±18 div ×V/div.
Ext 1 and Ext 2 Source Gain ÷1: ±0.9 V.
Ext 1 and Ext 2 Source Gain ÷5: ±4.5 V.

REAR PANEL OUTPUTS AND INPUTS

Channel 2 Output Voltage—
- 20 mV/div ±10% into 1 MΩ
- 10 mV/div ±10% into 50 Ω
- −3 dB bandwidth: dc to >50 MHz.

A Trigger, Record Trigger, Word Recognizer Output—Logic Polarity: negative-true trigger occurence indicated by HI to LO transition.
Output Voltage HI: ≤400 μA load is 2.5 V to 3.5 V 50 Ω load to ground is ≤0.45 V.
Output Voltage LO: ≤4 mA load is ≤0.5 V. 50Ω load to ground is ≥0.15 V.
Direct Hardcopy Output—Sends waveform data and parameters, cursor measurements, and instrument configuration over GPIB to an HP 7400 Series plotter, Tek HC 100 Color Pen Plotter, or HP ThinkJet™.

POWER REQUIREMENTS

Line Voltage Ranges—115 V: 90 to 132 V; 230 V: 80 to 250 V.
Line Frequency—48 to 440 Hz.
Power Consumption—Typical (standard instruments): 160 W (250 VA). Maximum (fully optioned instruments): 200 W (300 VA).

GPIB PROGRAMMABILITY

GPIB compatibility includes: Full talk-listen modes, control of all front-panel settings, transmitting and receiving waveform data.
Data Transfer Rate—36–45 KB/s (depending on sweep speed.)
Debug Mode—Helps streamline GPIB program development; permits user to monitor general bus traffic or traffic to and from scope.

ENVIRONMENTAL AND SAFETY

Environmental Requirements—
- Meets requirements of MIL-T-28800C for Type III, class 3 Style D equipment.
- Meets humidity and temperature requirements defined in paragraphs 3.9.2.2, 2.8.2.3, and 3.8.2.4.

Electromagnetic Interference (EMI)—
- Meets MIL-T-28800C.
- Meets MIL-STD-461B, Part 4 (CE-03 and CS-02), Part 5 (CS-06 and RS-02), and Part 7 (CS-01, RE-02, and RS-03—limited to 1 GHz.
- Meets VDE 0871, Category B, Part 15 of FCC rules and regulations, Subpart J, Class A.
- Meets Tektronix Standard 062-2866-00.

Ambient Temperature—−15 to +55°C, operating; −62 to +85°C, nonoperating.
Humidity—Operating and nonoperating: stored at 95% relative humidity for five cycles (120 hours), at +30 to +60°C, with operational performance checks at +30°C and +55°C.