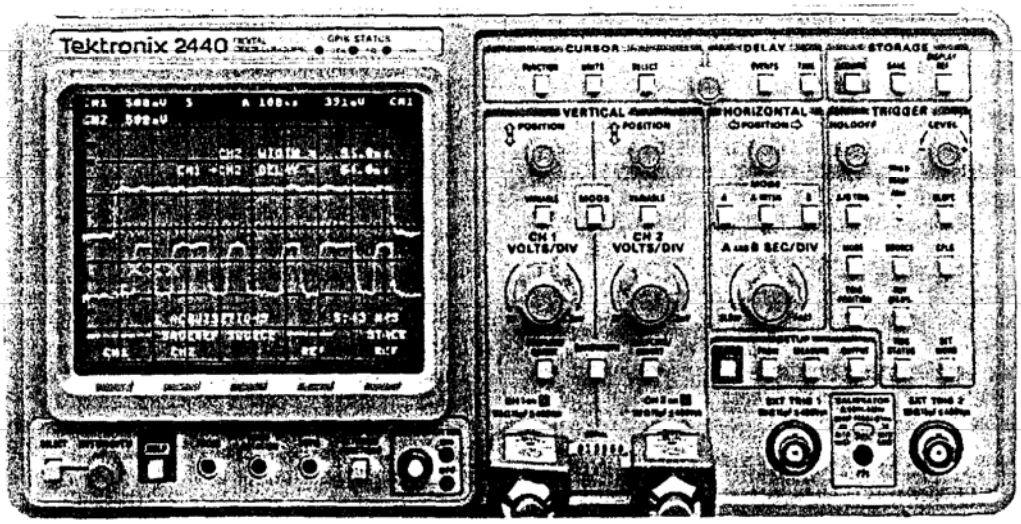
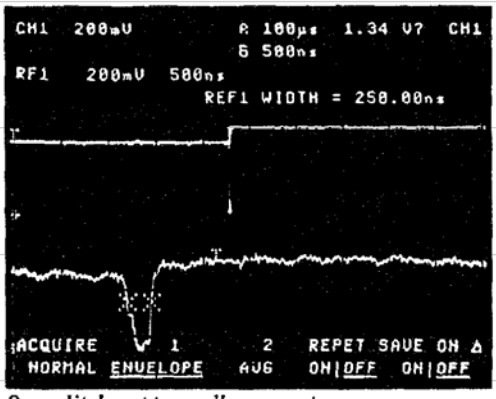
100 TO 500 MS/s DIGITIZING OSCILLOSCOPES

2440/2432A
2430A/2439/2431L



COMPACT DIGITIZING OSCILLOSCOPES

The 2400 Series Digitizing Oscilloscopes combine high bandwidth and sampling rates with powerful automation features and waveform processing capabilities. Measurement accuracy is enhanced by 8-bit vertical resolution (11 bits with averaging), user-selectable Auto Setup and Measurement methods, selectable interpolation, and high-fidelity signal acquisition.



2 ns glitch capture allows you to see narrow events, for troublesome design problems.

Advanced triggering is provided so you are sure to display a stable waveform, even in the presence of noise. The 2440, 2432A, and 2430A all capture glitches as narrow as 2 ns – a tremendous aid in troubleshooting. Fast update rate (due to Tek's proprietary Waveform Processor) insures near-real-time display response to changes in your signal and increases the probability that infrequent events will be captured and displayed.

FEATURES TO SPEED MEASUREMENTS, SIMPLIFY SETUPS, & AUTOMATE TESTING

Auto Setup – At the push of a button, the scope displays automatically scaled and triggered signals. The P6137 autoprobe supplied with the 2440 and 2432A extends this capability to its probe-tip button.

Auto Measure – 21 waveform measurements are available for crt readout and over the GPIB. Up to 4 may be selected for live (3 Hz) update, along with measurement aids and user-definable algorithms.

Auto Pass/Fail Testing – Use this special feature to compare incoming signals against reference waveforms. If the signal is out of limits, the scope time stamps it, alerts the operator or controller, or sends the offending waveform to a printer/plotter. References can be previously-acquired waveforms or templates transferred from a computer.

Auto Sequence – Routines built from the front panel (without writing code!) can include steps to make measurements, compare live waveforms against references, and send data to a printer or plotter automatically. Eliminates or decreases the need for a computer/controller for many repetitive tests. Stores typically 50 to 200 setups and actions in up to 40 named sequences.

SAVE TIME AND REDUCE COST IN SYSTEMS OF ALL SIZES

In large systems, 2400 Series Digitizing Oscilloscopes cut controller time and bus traffic to increase throughput. Averaging, smoothing, measuring, and pass/fail testing can all be done by the scope upon a simple command by the controller.

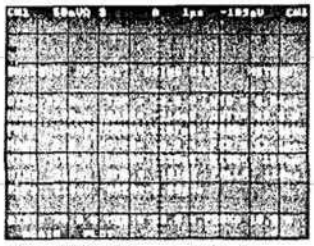
Compatible sotware is described in "Test and Measurement Software," pages 257-270.

The 2400 Series Digitizing Scopes Offer a Well-Balanced Combination of Performance, Automation, and Convenience Features.

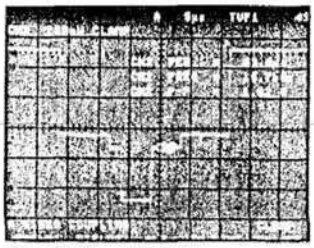
- *500 MS/s Digitizing 2440 and 2439. (250 MS/s: 2432A and 2431L, 100 MS/s: 2430A)*
- *300 MHz Bandwidth (150 MHz: 2430A)*
- *2 ns Glitch Capture (except 2439 and 2431L)*
- *8-Bit Vertical Resolution (Single-shot and Repetitive)*
- *0.0015% Crystal-Controlled Time Base*
- *Simultaneous Two-Channel Sampling*
- *Auto Pass/Fail Testing*
- *Fast, Reliable Automatic Measurements*
- *Fast Update Rate*
- *Extensive Triggering Capabilities*
- *Direct Printer/Plotter Output*
- *Disk Storage Available with 2402A TekMate*
- *On-Screen "HELP" for All Functions*
- *MATE/CIIL Versions Available – 2440M, 2432M, 2430M*

2440/2432A 2430A/2439/2431L

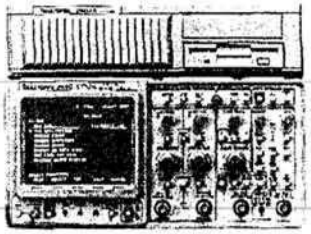
100 TO 500 MS/s DIGITIZING OSCILLOSCOPES



SNAPSHOT capability freezes all 20 automatic single-channel measurements, or up to four measurements can be selected for continuous update with waveform displays.



The Option 05 Video Measurement System allows selection of individual lines and fields. Here, Line 49 from Field 1 is selected.



The 2402A TekMate enhances 2400 Series digitizing scopes with extended capabilities:

- *Waveform Storage to PC compatible 3.5" floppy.*
- *Automatic Data Logging*
- *FFT – Waveform Processing*
- *Advanced Hardcopy features*

STAND-ALONE OPERATION IN LOW-VOLUME OR SHORT-RUN TESTS

The 2402A TekMate™ Instrument Extension extends the capabilities of the 2440, 2439, 2432A, 2430A and 2431L. During execution, TekMate displays instructions on the scope's screen, sets scope controls, makes measurements and pass/fail decisions, and stores over 300 waveforms. 2402A TekMate functions, specifications, and ordering information are located on pages 92-93.

TEK SECURE MEMORY ERASE

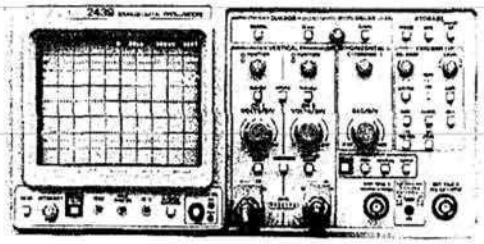
2400 Series Digitizing Oscilloscopes can be instantly declassified for removal from secure areas. Invoking the TekSecure™ feature completely erases waveform, front-panel, and sequence memories, restarts the instrument with factory settings, then gives positive indication that erasure has been accomplished.

SOFTWARE FOR 2400-SERIES DIGITIZING OSCILLOSCOPES

Powerful, off-the-shelf software packages that run on the IBM PC, XT, AT or compatibles.

The **2410 Digital Interface Test System** is a fully integrated hardware and software package. It quickly and accurately tests digital carriers to ANSI or CCITT specifications. Its features, specifications, and ordering information are located with Telecom/Datacom Testers on page 355. **WaveWriter**, specific to 2400 Series Digitizing Scopes, is described on page 262. Other **Test and Measurement Software** is located on pages 257-270.

NEW 2439 AND 2431L



LOW-COST SOLUTION TO HIGH-PERFORMANCE REQUIREMENTS

The 2439 and 2431L, with 300 MHz, 500 MS/s and 250 MS/s respectively, built in automation features answer the need for lower costs and faster measurements. These products offer entry-level performance to the 2400 Series Digitizing Oscilloscope family.

Software written for the 2439 and 2431L is fully compatible with other, higher performance 2400 Series Digitizing Oscilloscopes: 2440, 2432A, and 2430A.

MATE/CIIL CAPABILITY

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

2400 Series Digitizing Oscilloscopes Performance

	Sampling Rate	Bandwidth (Repetitive)	Bandwidth (Single-Shot)	Vertical*1 Resolution	Glitch Capture	Time Bases
2440/2440M	500 MS/s	300 MHz	200 MHz	8 bits	2 ns	Main, Dly
2439	500 MS/s	300 MHz	100 MHz	8 bits	No	Main*2
2432A/2432M	250 MS/s	300 MHz	100 MHz	8 bits	2 ns	Main, Dly
2431L	250 MS/s	300 MHz	100 MHz	8 bits	No	Main
2430A/2430M	100 MS/s	150 MHz	40 MHz	8 bits	2 ns	Main, Dly

**1 Digitizer resolution for single-shot acquisition. Averaging of repetitive signals increases resolution to as much as 11 bits.*

**2 Delay Time base, available on GPIB bus.*

2400 Series Digitizing Oscilloscopes Features

	Auto Setup	Auto Measure	Auto Pass/Fail	Auto Sequencing	Auto Probe
2439	View Only	Live and Snapshot	Yes	200 steps (typical)	No
2440/2440M	View, Period, Pulse, Edge	Live and Snapshot	Yes	200 steps (typical)	Yes
2432A/2432M	View, Period, Pulse, Edge	Live and Snapshot	Yes	200 steps (typical)	Yes
2431L	View only	Live only	Yes	50 steps (typical)	No
2430A/2430M	View, Period, Pulse, Edge	Live and Snapshot	Yes	200 steps (typical)	No*1

**1 AutoProbe facilities available with P6137 probe.*

QUICKSTART OPERATOR'S TRAINING PACKAGE

COMPLETE WITH VIDEOTAPE, WORKBOOK, AND CIRCUIT BOARD

Proceed at your own pace through sections designed for users of various experience levels. The workbook offers an introduction to digitizing scope measurements, intermediate and advanced excercises, and procedures for calibration and diagnostics.

The QuickStart videotape previews measurement excercises and explains key points of the Workbook. All necessary signals are available on the QuickStart Circuit Board.

QuickStart is a complete and portable training package. It can serve several users for thorough self-study or as a quick, easy reference. QuickStart can be ordered as an option to your new scope or separately. See Ordering Information, page 91.

CHARACTERISTICS

2400-SERIES DIGITIZING OSCILLOSCOPES

Characteristics are common to the 2440, (2440M), 2439, 2432A (2432M), 2431L and 2430A (2430M) except where indicated. For complete specifications, refer to product data sheets available from your local Tektronix sales office or the Tek National Marketing Center – toll-free:1-800-426-2200, Ext. 99.

VERTICAL SYSTEM

Channels – two, simultaneous acquisition.

Bandwidth Limit – selectable 20 MHz or 100 MHz (2440 and 2439), 20 MHz or 50 MHz (2432A, 2431L, 2430A).

Vertical Sensitivity – 2 mV/div (200 µV/div with expansion or averaging) to 5 V/div, continuously variable between ranges.

Vertical Accuracy – ±2% + 1 digitizing level (25 digitizing levels per crt division), includes amplifier accuracies and A/D converter resolution.

AC-Coupled Lower –3dB Point – 10 Hz or less.

Frequency Response *(–3 dB Repetitive Bandwidth)*

Instrument	–15°C to + 30°C	+ 30°C to + 55°C
2440, 2439, 2432A, 2431L	300 MHz	reduce bandwidth by 2.5 MHz for each °C above + 30°C
2430A	dc to 150 MHz	

Measured with standard accessory probe or internal 50 Ω termination.

Input Coupling and Max Voltage – (1 MΩ) ac, dc, GND; Max input voltage: 400 V (dc + peak ac) (50 Ω); Max input voltage: 5 V rms.

Input R and C – 1 MΩ and 15 pF or 50 Ω (nominal).

Vertical Position Range – ±10 div (nominal).

**Not available on 2439 and 2431L.*

HORIZONTAL SYSTEM

Display Modes – A, A INTENsified, B (A only for 2439 and 2431L).

Time Base Accuracy – 0.0015%.

Maximum Time Base Resolution – 40 ps (2440, 2439, 2432A, 2431L), 100 ps (2430A).

A and B (Delayed) Sweep Time Base Range*– 2 ns/div to 5 s/div (2440, 2432A, 2431L); 5 ns/div to 5 s/div (2430A).

External Clock Frequency – 1 MHz to 100 MHz.

Delay by Events* – Delays A or B sweep by user-selected number of B trigger events after the normal A trigger occurs, max number of events: 65,536.

Acquisition System

Single-Shot Bandwidth – 200 MHz (2440, 2439), 100 MHz (2432A, 2431L), 40 MHz (2430A) using internal Modified (sine x)/x interpolator with REPET mode OFF.

Maximum Sample Rate – 500 MS/s (2440, 2439), 250 MS/s (2432A, 2431L), 100 MS/s (2430A) on both channels simultaneously.

Update Rate – 30 Hz typical (100 Hz max with 50 kHz trigger, one channel selected, 100 µs/div).

Vertical Resolution – 8 bits or 0.39% (256 levels over 10.24 vertical divisions), 11 bits or 0.049% (2048 levels) with 64 or more averages.

Record Length – 1024 points per channel (all modes).

Acquisition Modes – Normal (real-time sampling), Envelope (displays min and max waveform values over one or more sweeps), Average (effectively increases vertical resolution and sensitivity).

Glitch Capture* – pulses 2 ns and wider are captured at > 50% amplitude with > 85% confidence (5 s/div to 5 ns/div, REPET mode OFF for 2430A; 5 s/div to 500 ns/div for 2440, 2432A).

MEMORY

Retention Time – > 3 years for calibration, setups, and sequences.

TRIGGERING

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

B Mode* – Triggerable After Delay, Runs After Delay.

A and B Source – Vertical, CH 1, CH 2, 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, (Video, 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 –
CH 1 and CH 2 Source: ±18 div x V/div.
Ext 1 and Ext 2 Source Gain +1: ±0.9 V.

QuickStart Operator's Training Package

- *Basic Training for First-Time Users*
- *Advanced Techniques for Experienced Operators*
- *Refresher for Occasional Users*

OTHER SIGNAL OUTPUTS

CH 2 Signal Out, A Trigger, Record Trigger, Word Recognizer Trigger – (signal outputs not available on 2439 and 2431L).

POWER REQUIREMENTS

Line Voltage Ranges – 115 V: 90 V to 132 VAC; 230 V: 180 V to 250 VAC.

Line Frequency – 48 Hz to 440 Hz.

Maximum Power Consumption – Typical:160 W (250 VA) for standard instrument, Maximum: 200 W (300 VA) for fully-optioned instrument.

AUTOMATIC MEASUREMENTS

21 Parameters – frequency, period, width, risetime, falltime, prop delay, duty cycle, overshoot, undershoot, RMS, area, minimum, maximum, mid, peak-to-peak, mean, base, top, proximal, mesial, and distal.

Thresholds – settable in percentage or volts. Methods to determine 0%, 100% – Min/Max, Histogram, Cursors.

Windows – measurement windows defined by time cursors.

Indicators – extensive warning and error-flagging capabilities.

Cursors – Volts, Time, Volts at Time, 1/Time, Slope GPIB PROGRAMMABILITY.

Compatibility – full talk/listen modes, control of all front panel settings, transmit/receive waveform data.

Data Transfer Rate – 30-40 waveforms/s typical.

Debug Mode – permits user to monitor bus traffic.

ENVIRONMENTAL AND SAFETY

SPECIFICATIONS FOR 2400 SERIES ANALOG AND DIGITIZING OSCILLOSCOPES

For complete Environmental and Safety specifications, refer to product data sheets available from your local Tektronix Sales Office or the Tek National Marketing Center – Toll free: 1-800-426-2200, Ext. 99.

Environmental Requirements –

- Meets requirements of MIL-T-28800D for Type III, Class 3, Style C equipment.
- Meets humidity and temperature requirements defined in paragraphs 3.7.2.2, 3.7.2.3, and 3.7.2.4.

Electromagnetic Interference (EMI) –

- Meets MIL-T-28800D.
- Meets MIL-STD-461C, Part 4 (CE-03 and CS-02), Part 5 (CS-06) 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.

Electrostatic Discharge Susceptibility – Meets Tektronix Standard 062-2862-00.

Radiation – Meets Tektronix Standard 062-1860-00.

Ambient Temperature – Operating: –15°C to + 55°C. Nonoperating: –62°C to + 85°C.

Humidity – Operating and nonoperating: stored at 95% relative humidity for five cycles (120 hours) at + 30°C to + 60°C with operational performance checks at + 30°C and + 55°C.

Altitude – Operating: to 4500 m (max operating temperature decreases above 1500 m), Nonoperating: to 15,000 m.

Shock – 50 g's.

Transit Drop – Meets MIL-T-28800D, paragraph 4.5.5.4.2.

Bench Handling – Meets MIL-STR-810E, Method 516.4, Procedure VI (MIL-T-28800D, paragraph 4.5.5.4.3) with and without cabinet installed.

Safety – Certified by CSA (CSA 556B) and UL listed (UL 1244).

ENVIRONMENTAL SPECIFICATIONS FOR RACKMOUNTED OSCILLOSCOPES

Rackmounting changes temperature, vibration, and shock capabilities. The rackmounted scope meets or exceeds the requirements of MIL-T-28800D with respect to Type III, Class 5, Style C equipment, when installed as directed. It also meets or exceeds Tektronix Standard 062-2853-00, Class 5 requirements.

Ambient Temperature – Operating: –15°C to + 55°C, measured at the instrument's air inlet. Fan exhaust should not exceed + 65°C.

Vibration – Operating: same as standard instrument, except total displacement is 0.015 inch p-p (2.3 g's at 55 Hz).

Shock – Operating and nonoperating: same as standard instrument, except shocks are 30 g's.

PHYSICAL CHARACTERISTICS

	Cabinet		Rackmount	
Dimensions	**mm**	**in.**	**mm**	**in.**
Width (with handle)	338	13.3	483	19.0
Height				
(with feet and pouch)	190	7.5		
(without feet and pouch)	160	6.3	178	7.0
Depth			419	16.5
(with front cover)	479	18.9		
(with handle extended)	563	22.2		
Weights	**kg**	**lb**	**kg**	**lb**
Net (with accessories and Pouch)	12.8	28.1		
(without accessories and Pouch)	10.9	23.9	4.0	8.8
Shipping	16.4	36.0		

ORDERING INFORMATION

2440 500 MS/s Digitizing Oscilloscope — **$12,390**
Includes: two P6137 10X auto-probes (1.5 m) with accessories, fuse (159-0014-00), snap accessory pouch (016-0692-00), front cover (200-3199-01), power cord, Operators' Manual, Users' Reference Guide, Programmers Reference Guide, GPIB Pocket Guide.

2439 500 MS/s Digitizing Oscilloscope — **$9,995**
Includes: two P6136 10 x probe (1.3 m) with accessories, fuse, power cord, Operators Manual (070-8232-00),Users' Reference Guide (070-8230-00), Programmers Reference Guide (070-8231-00), GPIB Pocket Guide (070-8229-00).

2432A 250 MS/s Digitizing Oscilloscope — **$10,900**
Includes: same as 2440.

2431L 250 MS/s Digitizing Oscilloscope — **$7,990**
Includes: same as 2439.

2430A 100 MS/s Digitizing Oscilloscope — **$6,950**
Includes: same as 2440, except 2 P6133 Opt. 25 10X (1.3 m) probes.

MATE/CIIL VERSIONS

2440M 500 MS/s MATE/CIIL Digitizing Oscilloscope — **$22,625**
Includes: same as 2440, plus MATE/CIIL Operators' Manual (070-6828-00) and 2440 Service Manual (070-6603-00).

2432M 250 MS/s MATE/CIIL Digitizing Oscilloscope — **$19,685**
Includes: same as 2440, plus MATE/CIIL Operators' Manual (070-6287-01) and 2432 Service Manual (070-7273-00).

2430M 100 MS/s MATE/CIIL Digitizing Oscilloscope — **$18,080**
Includes: same as 2430A, plus MATE/CIIL Operators' Manual (070-6042-01) and 2430A Service Manual (070-6330-01).

INSTRUMENT OPTIONS

Opt. 03 – Word Recognizer Probe Pod (P6407) (Not available for 2431L or 2439)	+$495
Opt. 05 – Video Waveform Trigger System	+$1,295
Opt. 11 – Probe Power (not available for 2431L, 2439)	+$225
Opt. 22 – Two Additional Matching Probes	+$350
Opt. 29 – 2402A TekMate (Not available for 'M' Versions)	+$3,195
Opt. 46 – Commercial Version of ARMY OS-291/G (National Stock Number 6625-01-258-0022)	*1
Opt. 2C – FeedThrough Cable Kit (Included with Opt. 1R for 'M' Versions)	+$225
Opt. 2F – QuickStart Training Package (U.S. power) (2440/2430A/2432A only)	+$205
Opt. 3F – QuickStart Training Package (Euro power) (2440/2430A/2432A only)	+$205
Opt. 1P – HC100 Color Plotter (U.S. power 110V) (Includes GPIB cable) (Not available for 'M' Versions)	+$1,020
Opt. 2P – HC100 Color Plotter (Euro power 220V) (Includes GPIB cable) (Not available for 'M' Versions)	+$1,020
Opt. 1R – Rackmount	+$330
Opt. 1T – Transit Case (telescoping handle, retractable wheels) (2440/2430A/2432A only)	+$465
Opt. 4F – French HELP Text (2440/2430A/2432A only)	NC
Opt. 4G – German HELP Text (2440/2430A/2432A only)	NC
Opt. 4H – Italian HELP Text (2440/2430A/2432A only)	NC
Opt. 4S – Spanish HELP Text (2440/2430A/2432A only)	NC
Opt. B1 – Service Manual (Not required for 'M' Versions) (2440/2432A/2431L/2430A)	+$55
(2439)	+$75

SOFTWARE FOR 2400 SERIES DIGITIZING OSCILLOSCOPES

For additional software packages, see the "Test and Measurement Software" section, pages 257-270.

Wave Writer –	
S37T100 or	$285
S37T100 Opt. 28 (U.S. only)	$470

INTERNATIONAL POWER PLUG OPTIONS

Opt. A1 – Universal Euro 220 V, 50 Hz	NC
Opt. A2 – UK 240 V, 50 Hz	NC
Opt. A3 – Australian 240 V, 50 Hz	NC
Opt. A4 – North American 240 V, 50 Hz	NC
Opt. A5 – Switzerland 220 V, 50 Hz	NC

WARRANTY

Three years covering parts and labor, includes crt, excludes probes. Coverage can be extended to five years through the optional *Warranty-Plus* service plans.

WARRANTY-PLUS SERVICE PLANS

Opt. M2 – Remedial Coverage in years 4 and 5.	
2440	+$380
2440M	+$415
2432A/2439	+$380
2431L	+$340
2432M	+$415
2430A	+$325
2430M	+$385
Opt. M3 – 4 calibrations (in years 2 through 5), Remedial Coverage for years 4 and 5.	
2440	+$826
2440M	+$864
2432A/2431L	+$768
2439	*1
2432M	+$779
2430A/2430M	+$903
Opt. M4 – 5 calibrations (in years 1 through 3).	
2440	+$523
2440M	+$523
2432A/2431L	+$501
2439	*1
2432M	+$501
2430A/2430M	+$608
Opt. M5 – 9 calibrations (in years 1 through 5), Remedial Coverage for years 4 and 5.	
2440	+$1,316
2440M	+$1,354
2432A/2431L	+$1,235
2439	*1
2432M	+$1,246
2430A/2430M	+$1,472
Opt. M7 – 2 calibrations (in years 2 and 3).	
2440	+$223
2440M	+$223
2432A	+$214
2431L/2439	*1
2432M	+$214
2430A/2430M	+$259
Opt. M8 – 4 calibrations (in years 2 through 5).	
2440	+$435
2440M	+$495
2432A/2431L	+$435
2439	*1
2432M/2430M	+$495
2430A	+$435

*1 *Contact your local sales representative.*

MANUALS

	2440/2440M	Price	2439	Price	2432A/2432M	Price	2431L	Price	2430A/2430M	Price
Operators' Manual	070-6599-00	$55	070-8232-00	$55	070-7272-00	$48	070-7701-00	$48	070-6286-02	$55
Programmers' Reference	070-6601-00	$21	070-8231-00	$21	070-7271-00	$21	070-7700-00	$21	070-6338-01	$24
GPIB Pocket Guide	070-6602-00	$6.75	070-8229-00	$6.75	070-7270-00	$6.75	070-7699-00	$6.75	070-6604-01	$6.75
Users' Reference Guide	070-6600-00	$6.75	070-8230-00	$6.75	070-7269-00	$6.75	070-7698-00	$6.75	070-6339-02	$6.75
Service Manual	070-6603-00	$125	070-8233-00	$125	070-7273-00	$110	070-7702-00	$100	070-6330-01	$100