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Find the *Tektronix 11402* at our website: *Click HERE*



The 11401 Digitizing Oscilloscope with 500 MHz System bandwidth.

11400 Series

Digitizing Oscilloscopes

GPIB IEEE-488

The 11400 Series complies with IEEE Standard 488-1978, RS-232C, and with Tektronix *Standard Codes and Formats.*

1 GHz and 500 MHz Bandwidth

Eight Channels of Display and Acquisition

Plug-In Modularity

Waveform Processing and Automatic Pulse Parameters

Multiple 10,240 Point Waveform Records

Accepts Differential, High Impedance and 50 Ω Input Amplifiers

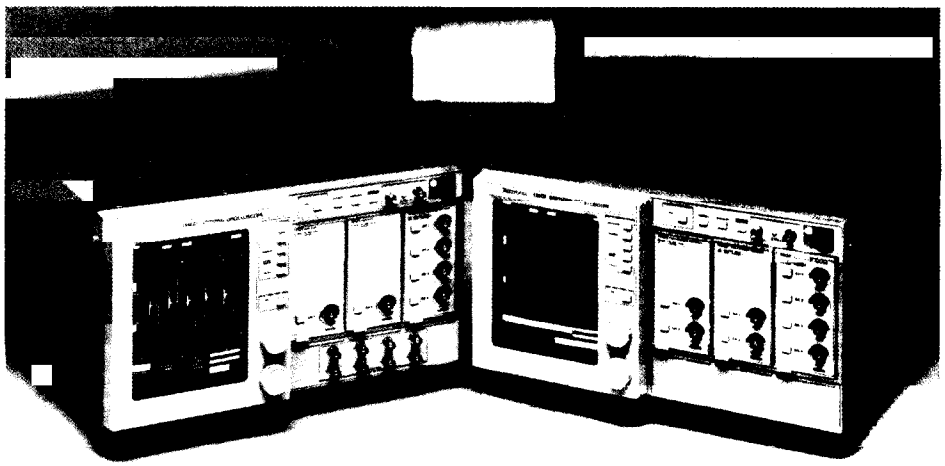
Greatly Simplified Access to Features

Fully Programmable via GPIB and RS-232C

TYPICAL APPLICATIONS

Waveform Characterization
Prototype Troubleshooting and Debugging
Measurement Against a Standard

The 11401 and 11402 are the first in a new line of digitizing oscilloscopes. These versatile scopes, with their array of new supporting plug-ins and probes, solve measurement problems equally well on a designer's bench or in a programmable



The 11401 and 11402 are the first in a new line of high bandwidth, programmable digitizing oscilloscopes. The 11401/11402 are ideal for digitizing and accurately measuring repetitive waveforms. 10–14 bit vertical resolution, 20 MS/s A/D conversion system provides a cost-effective solution to a wide range of measurement problems.

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The 11402 Digitizing Oscilloscope with 1 GHz System bandwidth.

test system. Digital designers will benefit from flexible triggering features and an eight channel display. Analog and power supply designers can apply extensive waveform processing to signals acquired through high performance differential and single ended amplifiers. 11000 Series digitizing scopes can follow your designs into production. Full programmability via either IEEE-488 or RS-232C and features like a DMA controller for fast waveform transfers make these scopes a perfect fit for systems. 11000 Series digitizing oscilloscopes set new standards in performance.

Live Display of Up to Eight Traces

The 11401/11402 each support three vertical amplifier plug-ins. This means you can acquire up to eight channels of data at 300 MHz, up to six channels of data at 600 MHz or up to three channels of data at 1 GHz. You can, of course, mix and match the plug-ins to design the system that works best for you. Eight traces can be displayed at any one time so that you can get the whole picture on one screen. The update rate is so fast that the 11401 and 11402 have the look and feel of analog scopes.

High Vertical and Horizontal Resolution

The 11401 and 11402 uniquely combine wide bandwidth with 10 ps horizontal resolution and 10 bit vertical resolution (vertical resolution can be increased to 14 bits when signals are averaged). Other vendors have made a tradeoff; bandwidth for vertical resolution or vertical resolution for bandwidth. The 11401/11402 give you both for making demanding voltage and timing measurements in one box. In addition, the 11401/11402's trigger-to-trigger measurement feature delivers 200 ps resolution on single shot time A→B measurements and can even provide 10 ps resolution with averaging. Trigger-to-trigger measurements of this nature are only available on the 11401/11402 and a few expensive standalone counter timers. Also, window records can be used to increase horizontal resolution on specific segments of main records providing a clear picture of signal details.

Multiple Long Record Lengths

The 11401/11402 can acquire multiple records of up to 10,240 points each. No other scope can capture as much data at once on repetitive waveforms. The mainframes can contain up to 102,400 points of waveform memory with Option 2D. Long records and large storage capacity combine to let users gather data over relatively long periods of time with high resolution and improve measurement accuracy. One doesn't need a computer to log waveform data. Waveforms can be stored on-board the scope for later analysis.

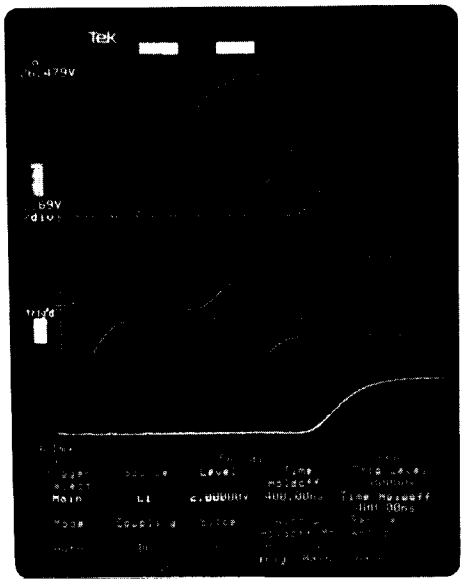
Versatility for a Wide Range of Applications

Five new plug-ins and three new probes bring outstanding versatility to the 11401/11402. The measurement system and waveform processing functions lead to quick solutions to a wide variety of voltage, time, area and energy problems. The 1 GHz 11402 can process and measure signals from high bandwidth 50 Ω amplifiers, high impedance amplifiers and differential amplifiers. 1 mV sensitivity and 500 V maximum input voltage let users capture small signals from transducers or monitor ac power lines. Fast overdrive recovery and up to 2000 divisions of dynamic range give these scopes the power to look at even the smallest detail on difficult to capture waveforms.

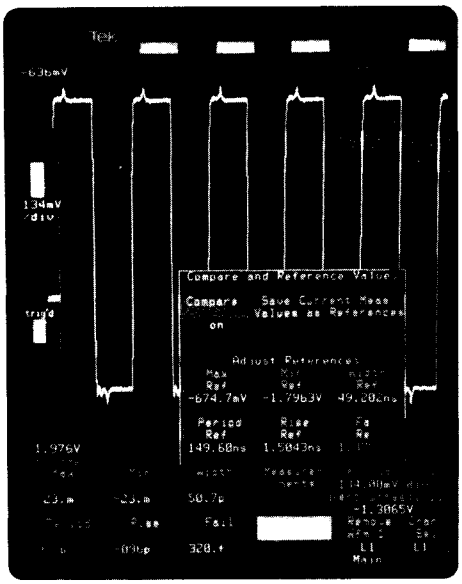
Unparalleled Ease of Use

The 11401 and 11402 use simple parallel menus and touch screen to give easy access to their measurement and display features. All but a few of the buttons and knobs have been eliminated in favor of a system that only presents selections when they are valid and/or useful. An autoset function sets up the scope for you based upon the signal characteristics of the selected trace. This can be activated from

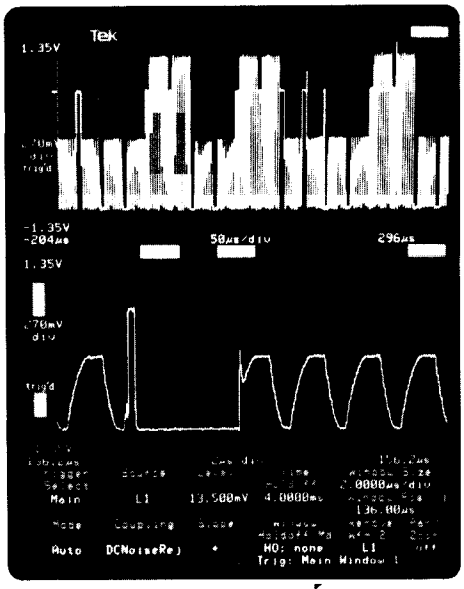
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The 11401 and 11402 can display up to eight traces from a variety of sources. Display eight channels of live waveforms for timing analysis on digital systems. Or display combinations of live and stored waveforms.



Multiple waveform parameter measurements can be performed and are updated continuously. A compare and reference measurement mode allows measurement results to be compared to a standard, and the difference of two results to be displayed.



Two built-in time bases provide the functionality of delaying and delayed sweeps in analog scopes. The main time base defines the overall acquisition interval and the window time base allows high resolution acquisition of small portions of complex waveforms.

the probe tip, allowing for hands off operation of the scope. Autoset frees the operator to concentrate on the measurement problem and the probe connection. The most commonly used functions are no deeper than a second menu level. Icons let you assign the knobs to waveform size and position no matter what operating mode you are in. Pop-up menus present choices and fold down when those selections are made. One button hard copy generation is made possible by the use of a standard Centronix port and software drivers compatible with Tektronix 4644 and low cost Epson dot matrix printers. Overall, the operation of the 11401/11402 is intuitive. The instrument can be used easily even if it is not used every day. Acquisition, measurement and documentation is as simple as six touches: Autoset, measure, measurements, rise, exit, hardcopy. It doesn't get any simpler.

Plug-In Modularity

The 11401 and 11402 are compatible with five different vertical amplifiers. Each will accept three of these amplifiers in its plug-in compartments. You can configure a scope to meet your particular needs, for example:

- **Timing Measurements on High Speed Logic**
  Use three 11A71s in the 11402 for three 1 GHz bandwidth channels.
- **Characterization of Waveforms in a Lab**
  Select an 11A52 for two high bandwidth 50 Ω channels, an 11A33 for high bandwidth differential measurements, and an 11A34 for four high impedance channels.
- **Prototype Troubleshooting and Debugging**
  Use two each, four channel amplifiers and a two channel high bandwidth amplifier. This configuration gives you eight channels of acquisition for timing analysis and two high bandwidth channels for exacting pulse response measurements.
- **Power Supply Evaluation**
  Use three differential amplifiers to determine efficiency and stability and to measure noise and ripple.
- **Medical or Mechanical Measurements**
  Use two each, four channel plug-ins for eight channels of data acquisition and a differential amplifier for digitizing small signals from transducers.

The Most Accurate Instruments of Their Kind

The 11401 and 11402 are the most accurate high bandwidth scopes on the market. They combine the timing accuracy inherent in digital time bases with 1% vertical accuracy. The Enhanced Accuracy feature prompts the user to start self-calibration routines whenever temperature or configuration changes warrant it. You can even assign the 11401/11402 to start a self-calibration automatically. Time base accuracy is 100 ps +.002% of the time interval. The 11401 and 11402's accurate, automatic measurements can replace dedicated counter/timers and ac voltmeters. Devices and subassemblies can be tested to tighter tolerances, improving end product performance and quality.

On-Site Serviceability

These scopes are card modular, they have extensive self-test and diagnostic routines and they have reliability built-in. On-site *Warranty-Plus* service options help you keep the instruments up and running when down time might otherwise halt your production line. Tektronix service technicians can be at your facility repairing these products within eight working hours if you are within 75 miles of designated U.S. service centers.

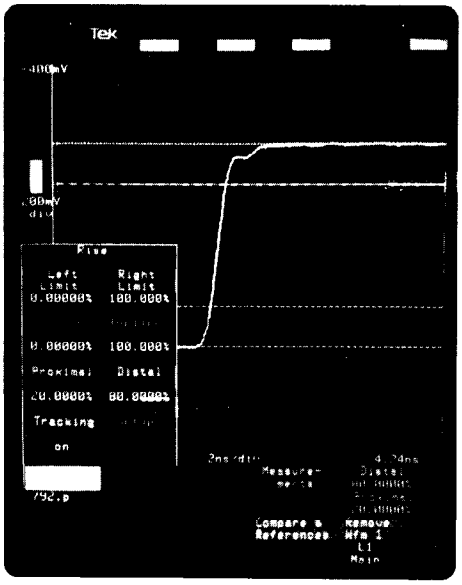
All New Probe Interface

We've set a new standard for probe interfacing. Signal and probe power connections are all made at the amplifier input eliminating extra probe power lines. We can support as many active probes as you have channels. A smart serial interface between the probe and the scope lets you stop worrying about the proper termination impedance; it is set automatically. You can autoset the scope or sequence through a series of front panel set-ups all from the probe ID button. This leaves your hands free to probe your circuit. A full complement of active and passive probes with this new interface is ready to assist in the solution to your measurement problems.

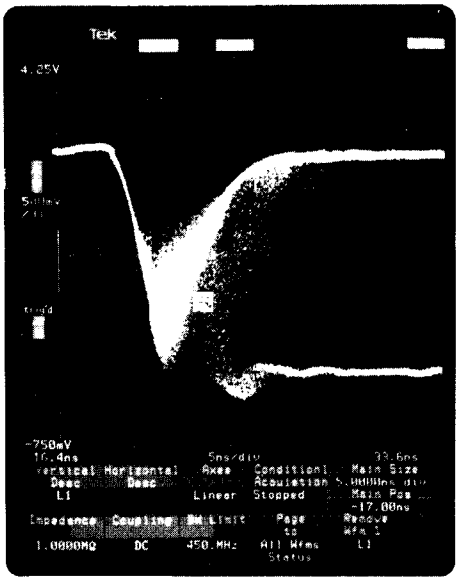
Choose Your Computer Interface

The 11401 and 11402 have both IEEE-488 and RS-232C interfaces as standard features for data transfer and instrument control. The RS-232C port lets you control the instrument with a PC, upload or download waveforms from a workstation or main

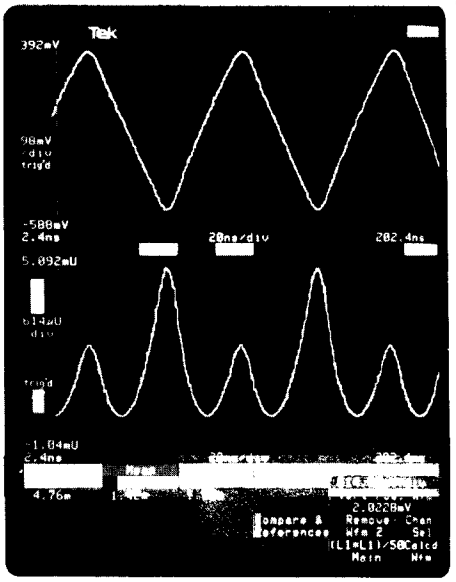
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High bandwidth allows capture and measurement of fast rise times. Measurements can be customized and annotated to clearly show where and how the measurement is being made.



A high resolution display with Point Accumulate Mode along with powerful triggering makes it much easier to capture and display common digital fault conditions like metastable states, glitches and race conditions.



Powerful waveform processing functions let users define traces such as the power waveform shown above. The top waveform is a voltage waveform and the bottom waveform is a power waveform created by squaring the voltage waveform and dividing it by a load resistance.

frame, or run diagnostics over a modem. GPIB and RS-232C menus let you match interface parameters with a controller, modem or host. If speed is a consideration the parallel interface provided by the IEEE-488 port should be used. A DMA option can be added to speed up GPIB data transfers even further. Whichever bus is chosen, the instruments respond to a logical set of Tektronix *Standard Codes and Formats* commands that make it easy to write your test procedures.

Accurate, Automatic Measurements

The only reason oscilloscopes exist is for making measurements. The 11401 and 11402 perform waveform processing functions, pulse parameter analysis, cursor functions and trigger-to-trigger measurements that combine to cover a full range of measurement needs. A special annotation mode shows where measurements are being made on the trace so users can feel confident that they are on target. Dot cursors can be split between two waveforms to make propagation delay measurements or compare voltages. Measurement zones can be set to limit the automatic measurement to a portion of a displayed trace. Users can set proximal, distal and mesial levels to customize timing measurements. Up to six measurement results can be displayed and continuously updated as the data changes. This lets users make adjustments and see the results quicker than ever before. A direct hard copy output is provided that includes time and date of the measurement for archiving.

A Measureable Advance in Oscilloscope Technology

Higher bandwidths, better resolution, more accuracy, more versatility, hardware and software modular, easier to use and service, the 11000 Series sets new standards in digitizing oscilloscopes.

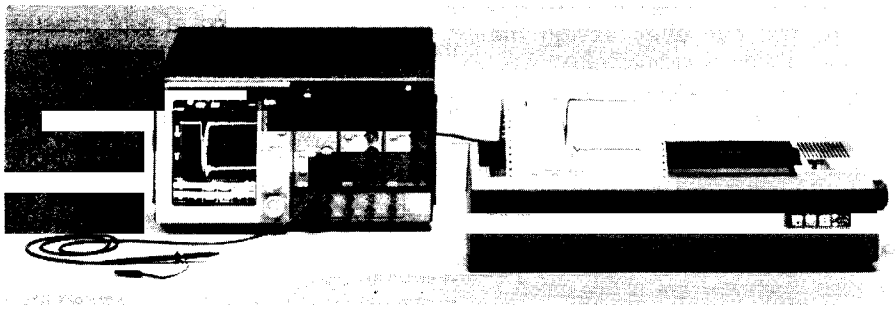
CHARACTERISTICS

VERTICAL SYSTEM

Accuracy With Enhanced Accuracy — Depends on plug-in unit.

Equivalent Time Bandwidth — Depends on plug-in used. See matrix on page 199.

Vertical Resolution — 10 bits (1024 levels.) Resolution can be increased to 14 bits (16384 levels) using signal averaging.



Direct hard copy output to dot matrix printers is provided through a standard Centronics port. Hard copies are time and date stamped for archiving.

HORIZONTAL SYSTEM

Time Bases — Two identical built-in time bases.

Record Duration — 5.12 ns to 1024 s in 1-2-5 sequence.

Time Base Accuracy — 100 ps +0.002% of measurement interval.

Record Length — 512 points to 10,240 points.

Sampling Rate — 20 MS/s maximum.

Main Record Positioning — Position of the main record with respect to the trigger point of the main record. Pretrigger: 1 record duration. Posttrigger: 1 record duration. Resolution: 1 main record point.

Windows — In addition to the main record, either one or two window records may be acquired and displayed. The window records may be of a different length (duration) and may have a smaller time/div than the main record. If two window records are used, they have the same duration and time/div settings and can be positioned independently.

Window Record Positioning — The window records are positioned relative to a window trigger point which may be positioned relative to the main record's trigger point delayed by either time or events.

Precision Time Measurement — The time between the beginning of the MAIN record trigger and the WINDOW trigger can be measured precisely, even if each trigger only occurs once. Repetitive events allow this measurement to be averaged for better resolution and accuracy. Single Trigger Resolution: 200 ps. Repetitive Resolution: 10 ps, after 100 averages. Accuracy: 100 ps +0.002% of record duration.

TRIGGERING SYSTEM

Range — ±Full screen.

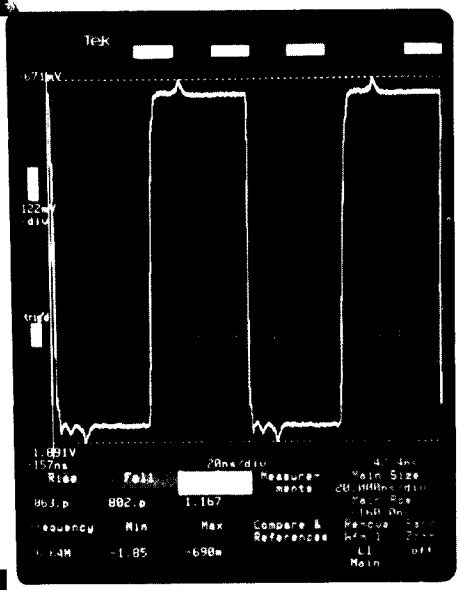
Level Accuracy — Within 1% of full screen (10 LSBs).

Coupling and Sensitivity —

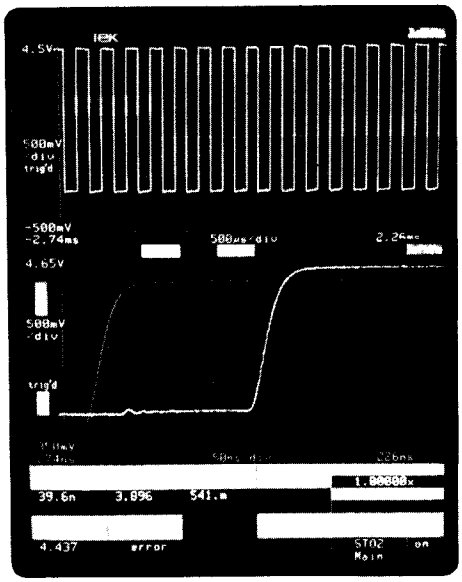
Dc Coupled: 0.35 div from dc to 50 MHz, increasing to 1 div at 500 MHz.

Noise Reject Coupled: 1.2 div or less from dc to 50 MHz, increasing to 3 div at 500 MHz.

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The 11401 and 11402 offer a unique combination of accurate timing and accurate amplitude measurements in one instrument.



Single or dual 10 x 10 division axes may be brought up for waveform display. Each axis represents a full 10 bit digitizing window.



The 11401 and 11402 are easily integrated into automated test systems. Options for rack conversion, rear to front signal routing and DMA transfer of waveform data and measurement results makes the 11401/11402 ideal for systems applications.

Ac Coupled: 0.35 div from 60 Hz to 50 MHz increasing to 1 div at 500 MHz. Attenuates signals below 50 Hz.

HF **Reject Coupled:** 0.5 div from dc to 30 kHz.

LF **Reject Coupled:** 0.5 div from 80 kHz to 50 MHz, increasing to 1 div at 500 MHz.

Holdoff Range — 500 ns to 10 s.

MEASUREMENT SYSTEM

Waveform Processing Functions — Waveform Functions: Differentiate, integrate, interpolate, smooth, average, and envelope. **Arithmetic Operators:** Plus, minus, multiply, divide, square root, logn, absolute value, signum, exp.

Measurement Set — Amplitude Measurements: Min, max, mid mean, peak-peak, RMS. **Timing Measurements:** Rise, fall, width, delay1, main→window, period, frequency. **Area and Energy:** Area +, Area −, energy. **Cursors:** Single or dual dots, split or paired mode, horizontal and vertical bars, measurement zone delimiters.

CRT AND DISPLAY FEATURES

Standard CRT — 9 inch diagonal, monochrome, magnetic deflection. Vertical raster scan orientation.

Standard Phosphor — GH (P31).

Video **Resolution** — 552 horizontal by 704 vertical displayed pixels.

POWER REQUIREMENTS

Line **Voltage Ranges** — 90 V RMS to 132 V RMS. 180 V RMS to 250 V RMS.

Line **Frequency** — 48 Hz to 440 Hz.

Maximum Power Consumption — 320 W.

ENVIRONMENTAL AND SAFETY

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

Humidity — Operating and Nonoperating: Up to 95% relative humidity, up to +50°C.

Altitude, Vibration, Shock, Bench Handling — Meets MIL-T-28800C, Type III, Class 5.

Electromagnetic Compatibility — Meets MIL-T-28800C; MIL-STD-461B; FCC Part 15, Subpart J, Class B; VDE 0871/6.78 Class B; CE-01 Part 4, with exceptions; CE-03 Part 4, Curve 1; CE-03 Part 4, Curve 4, Navy, NB, BB (with exceptions); CS-01 Part 7; CS-02 Part 4 (with exceptions); CS-06 Part 5; RE-01 Part 4 (with exceptions); RE-02 Part 4; RS-01 Part 4; RS-03 Part 7 (limited to 1 GHz).

Safety — Listed UL 1244; CSA Bulletin 556B, September 1973; Tektronix self-certification to comply with IEC 348 recommendations.

PHYSICAL CHARACTERISTICS

Standard Instrument	Benchtop		Rackmount	
Dimensions	**mm**	**in**	**mm**	**in**
Width	448	17.6	483	19.0
Height	238	9.4	222	8.8
Depth	599	23.6	550	21.6
Weights≈	**kg**	**lb**	**kg**	**lb**
Net	20	41.6	27.8	—
Shipping	23.6	58.4	31.4	64.8

ORDERING INFORMATION

11401 500 MHz Programmable Digitizing Oscilloscope **$13,000**
Includes: Operator guide (070-6103-00); operator reference (070-5791-00); operator pocket reference (070-6255-00); power cord (161-0066-00).

11402 1 GHz Programmable Digitizing Oscilloscope **$15,500**
Includes: Same as 11401.

OPTIONS

Option 1C — Cable Feedthroughs. Adds eight rear-to-front feedthroughs. **+$200**

Option 1R — Rackmount. **+$250**
Includes: Hardware, tooling, and instructions for converting bench model to rackmount configuration.

Option 2D — Memory Expansion. Expands total waveform memory to 102,400 points for storage of waveform records. **+$600**

Option 4D — DMA Controller. Increases transfer speed over GPIB. Improves the overall throughput of the scope system. **+$300**

INTERNATIONAL POWER PLUG OPTIONS

Option A1 — Universal Euro 220 V, 50 Hz.
Option A2 — UK 240 V, 50 Hz.
Option A3 — Australian 240 V, 50 Hz.
Option A4 — North American 240 V, 60 Hz.
Option A5 — Switzerland 220 V, 50 Hz.

WARRANTY-PLUS SERVICE PLANS

SEE PAGE 496

Contact your local Sales Engineer for prices.
S0 — On-Site Product Installation and Set-Up.
S1 — 1 Year On-Site Service.

OPTIONAL ACCESSORIES

SERVICE MANUALS

11401/11402 —
(Volume I) Maintenance. Order 070-6100-00*[1]
(Volume II) Diagnostics and Troubleshooting. Order 070-6101-00*[1]
(Volume III) Diagrams and Parts List. Order 070-6102-00*[1]

Cables —
(GPIB) 2 m. Order 012-0991-00 **$150**
(RS-232C) 10 ft. Order 012-0911-00 **$100**
(Centronics) 10 ft for hard copy output. Order 012-0555-00 **$70**

Blank Panel — For filling empty plug-in compartments. Order 016-0829-00 **$95**

Extender Board — Order 067-1297-00.*[1]

Hard Copy Unit — Tektronix 4644 Dot Matrix Printer **$1,350**

Recommended Cameras — See page 442.
Recommended Probes — See page 215.
Recommended Cart — K217. See page 462. **$495**

[1] To order, contact your local Tektronix Sales Office.

SOFTWARE SUPPORT

For information on utility and application software, see page 359 or consult your local sales or applications engineer.

TRAINING

Tektronix Instrument Group Customer Training offers operation and application training to help you get full value out of your instrumentation investment. See page 195-196 for information or call (503) 642-8013 (collect).

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