TLS 216 Logic Scope

A new class of test instrument designed to simplify the task of debugging digital hardware.

TLS 216

FEATURES

- 2.5 pF, 1 MΩ Podlet Style FET Probes
- Display Modes: Analog, Timing Diagram and BusForm™
- <±100 ps Timing Resolution
- 16 Input Channels
- 2 GS/s Simultaneous Sampling on All Channels
- 500 MHz Real-time Bandwidth
- Logic Family Presets for TTL, ECL and CMOS
- Sophisticated Time Qualified Triggering with Four Word Recognizers
- 3-Year Warranty

BENEFITS

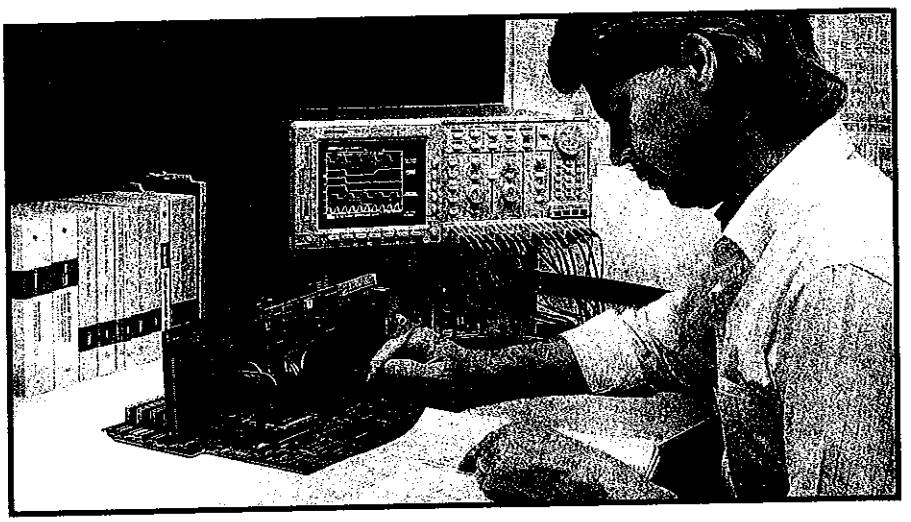
- Facilitates Hands-free Connection to SMT Devices
- Low Capacitance Probe for Non-intrusive Probing
- Powerful Triggering Reduces Time to Identify Problems
- Flexible Display Modes Simplify Recognition of Timing Faults
- High-speed Acquisitions on All Channels Facilitate Analysis of Complex System Interactions

Product(s) available through your local Tektronix representative (listed in the back of this catalog).

GPIB IEEE-488 The TLS 216 complies with IEEE Standard 488.1-1987, and with Tektronix Standard Codes and Formats.

ISO 9001 REGISTERED BY THE AUSTIN COUNCIL FOR QUALITY

Tektronix Measurement products are manufactured in ISO registered facilities.



TLS 216 Logic Scope

The TLS 216 Logic Scope is a new class of instrument designed to simplify the task of debugging digital hardware. The Logic Scope seamlessly combines in a single instrument the analog acquisition system of a high-speed digital storage oscilloscope (DSO) with the triggering and display systems of a logic analyzer. The 500 MHz bandwidth Logic Scope samples all channels simultaneously at 2 GS/s and has sophisticated time-qualified triggering, a high resolution color display, and an integrated MS-DOS compatible 3.5 inch floppy disk drive.

2.5 pF, LOW-MASS FET PROBES ENSURE NON-INTRUSIVE CONNECTION

The Logic Scope includes a set of 16 specially designed probes that have extremely low probe-tip mass (1.5 grams) and input capacitance (2.5 pF). The low probe-tip mass ensures that connections made to surface mount and fine pitch ICs will be reliable. The low input capacitance, combined with the 1 MΩ input resistance, decreases the effect of the probe on the DUT's operation, allowing very accurate measurements to be made with confidence.

These characteristics are made possible by using a "podlet-style" probe-tip design instead of the "pencil-style" design of traditional oscilloscope probes. Employing the de facto industry standard of 0.1 inch spacing between the signal and ground inputs, each 0.1 inch thick podlet can directly attach to the hundreds of readily available IC adapters and clips.

SOPHISTICATED TRIGGERING TO IDENTIFY COMPLEX DIGITAL PROBLEMS

In addition to edge trigger, most digital signals can be easily captured using pulse, glitch and pattern triggers. The Logic Scope provides two new trigger resources that allow the instrument to directly trigger on common digital circuit behavior. The industry's first time-interval or sequence trigger type monitors the time between two events, allowing the instrument to easily trigger on setup time violations, hold-time violations, or unexpected propagation delay. The powerful "Time-out" trigger type can be used to capture incomplete handshake sequences or to trigger the instrument when the DUT "hangs."

All of these trigger types let developers identify channel-to-channel relationships, including 16-bit patterns and time-related/time-qualified system faults. The Logic Scope's external trigger-input can be used as a "Trigger Arm" to enhance cross-triggering between two instruments, simplifying the task of using a Logic Scope with other test equipment.

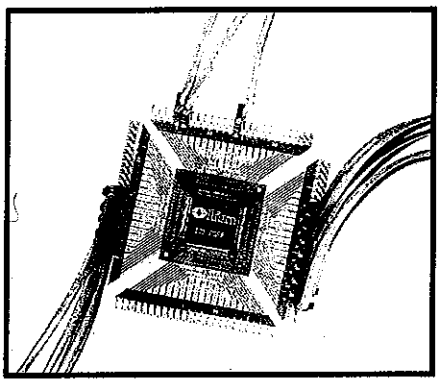
APPLICATIONS

- **Hardware Performance Verification**
- **Multi-channel Data Acquisition**
- **Mixed Signal Analysis**
- **A/D and D/A Analysis**
- **Hardware Timing Analysis**

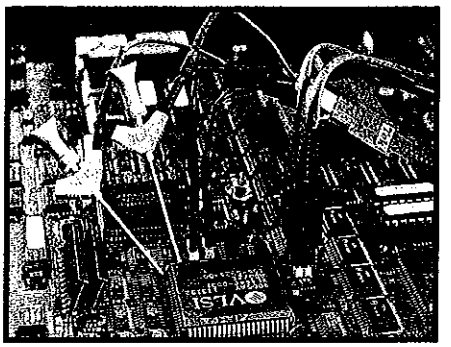
Logic Scope

Connect to the Design

- Low Mass Podlet Probes
- Low Capacitance, 2.5 pF
- 20 mil and 25 mil FlexLead™ Adapters
- Handheld Adapter and Probing Accessories
- 50 Ω Coax Adapter



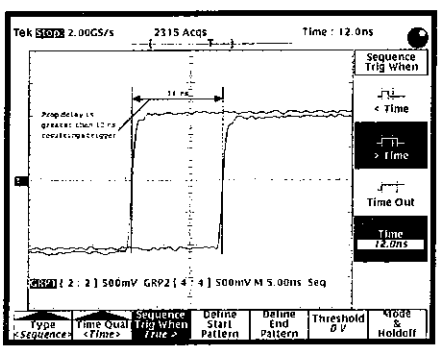
FlexLead™ Adapter offers connection to SMT devices of 20 and 25 mil spacing.



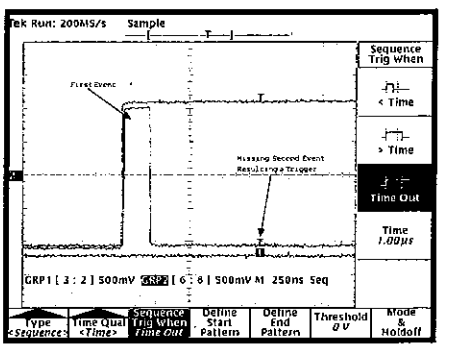
The array of probing accessories provides flexible connections to DUT. The podlet-style low-mass probe head simplifies hands-free probing.

Set up and Identify the Problem

- Powerful Triggering System: Edge, State, Pattern, Pulse, Sequence, Time-out, and Time-qualified
- NuColor™ Display
- Graphical User Interface



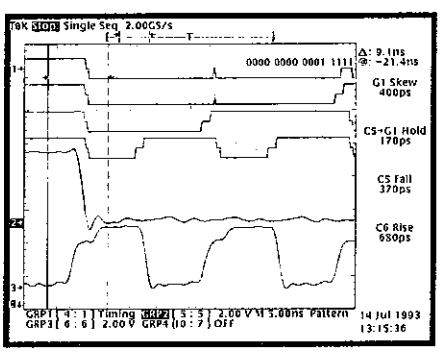
The triggering system of Logic Scope can trigger on setup time, hold time, or propagation delay violations.



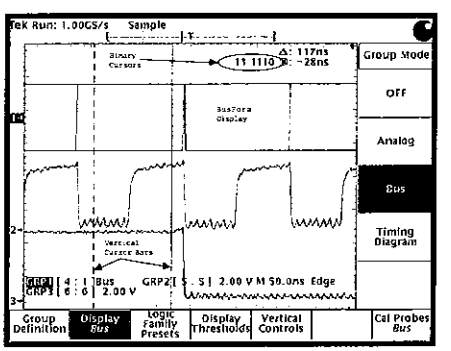
The time-out trigger simplifies detection of incomplete or missing system events.

Capture and Visualize the Cause

- 2 GS/s Sample Rate on All Channels
- 500 MHz Bandwidth
- 8-bit Vertical Resolution
- ±100 ps Timing Accuracy
- Multiple Display Formats: Analog, Timing, and BusForm™
- Binary Cursor Readouts



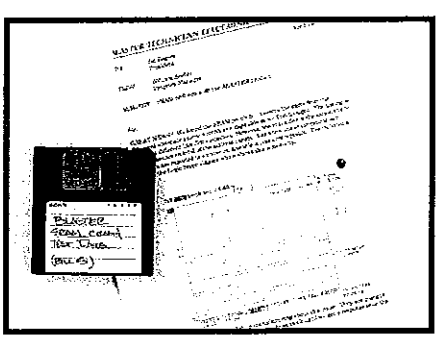
The dual-threshold Timing Diagram provides visual information at each transition.



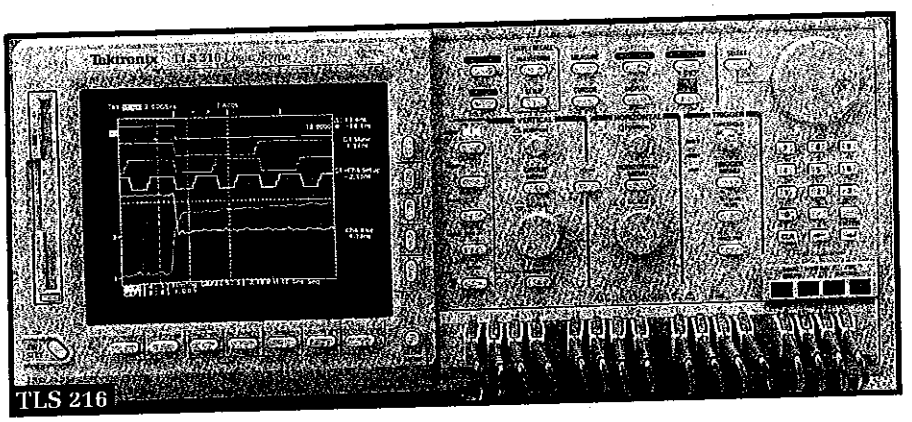
Binary cursors show the logic values of each waveform at the vertical cursor.

Analyze and Solve the Problem

- 28 Automatic Measurements including Setup Time, Hold Time, and Skew
- Desktop Documentation Formats: PCX, BMP, TIFF, EPS, etc.



TLS 216 Logic Scope



MULTIPLE DISPLAY FORMATS SIMPLIFY PROBLEM IDENTIFICATION

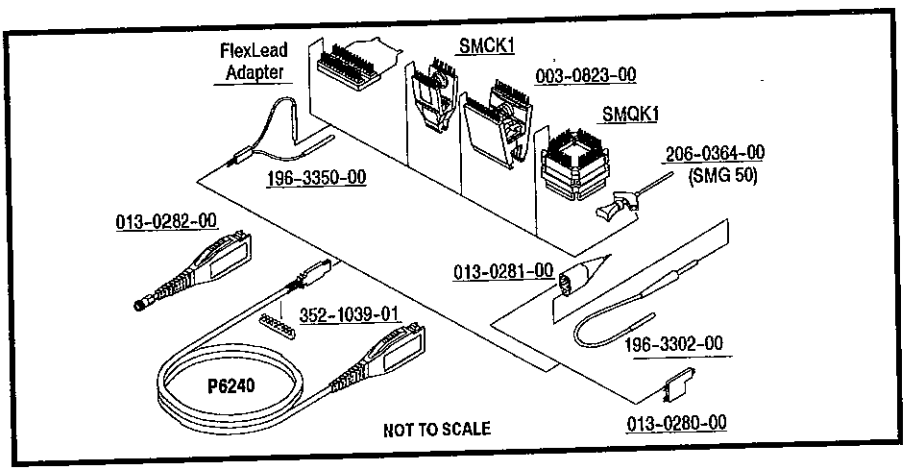
The Logic Scope integrates the analog acquisition system of a modern DSO with the display flexibility of a logic analyzer. The Logic Scope offers three display formats to simplify the process of identifying logic timing anomalies or violations. Acquired data can be displayed as either 8-bit analog waveforms, like a traditional DSO, or as dual threshold timing diagrams or BusForm™, similar to a logic analyzer. The operator can easily change the display format without having to reacquire data, a feature that is critical when debugging elusive, infrequent problems. Dual threshold timing diagrams and BusForm™ show the transition time of a signal, which eases identification of such problems as ground bounce, signal contention or noise margin violations.

Characteristics

SIGNAL ACQUISITION SYSTEM

Sample Rate	2 GS/s
Bandwidth	500 MHz
Channels	16
Samplers	16
Sensitivity	50 mV to 10 V/div*1
Position Range	±5 Div
Offset	±1 V from 1 to 99.5 mV/div

*1 *Magnification used above 2 V/div range.*



P6240 PROBE ACCESSORIES

The TLS 216 is shipped with 16 P6240 FET probes and associated accessories. The figure above shows the P6240 and how it may be used with each of the included accessories. The FlexLead™ Adapter provides convenient probing of 25 mil, 0.65 mm and 0.5 mm pitch devices (see page 376 for a total package listing).

The SMQK1/SMCK1 adapters and SMG50 are available in kits for 50 mil pitch devices (see page 370). The Coax Adapter (PN: 013-0282-00) converts a standard input to a 50 Ω SMA connection. The adapter also scales the signal so that on-screen readings are correct. The coax adapter has a maximum input of 5 V RMS. The remaining accessories provide device under test access for handheld probing situations.

VERTICAL SYSTEM

DC Gain Accuracy – ±1.5% after probe calibration.

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

Analog Bandwidth Selection – 20 MHz and full.

Input Coupling – DC.

Input Impedance – 50 Ω with coax adapter, 1 MΩ with probe.

Maximum Input Voltage – Max non-destructive input ±25 V (DC + Peak AC).

Dynamic Range – +15 V to –12 V with probe.

TIME BASE SYSTEM

Time Bases	Main, Delayed
Time/Division Range	500 ps to 5 s/div
Time Base Accuracy	0.01% over any interval ≥1 ms
Record Length	500 to 2,000 pts
Pre-trigger Position	20% to 80% of record

ACQUISITION MODES

Sample – Sample data only.

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

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

DISPLAY

Mixed-mode Data Display – Logic Scope offers Analog, Timing, and BusForm™ display formats that simplify recognition of digital timing faults and signal anomalies. BusForm™ display compresses many input signals into the least amount of display area. The acquired data can be displayed in any of the three display modes without re-acquiring.

Waveform Style – Dots, vectors, variable persistence selectable from 250 ms to 10 s, infinite persistence, and intensified samples.

Color – Standard palettes and user definable colors for waveforms, text, graticules, and cursors. Measurement text and cursor colors matched to waveform. Waveform collision areas highlighted with different color. Statistical waveform distribution shown with color grading through variable persistence.

Color Grading – With variable persistence selected, historical timing information is represented by temperature or spectral color scheme providing "z-axis" information about rapidly changing waveforms.

Graticules – Full, grid, cross hair, frame.

Format – YT.

Fit to Screen – Entire acquisition memory displayed on screen.

Logic Scope

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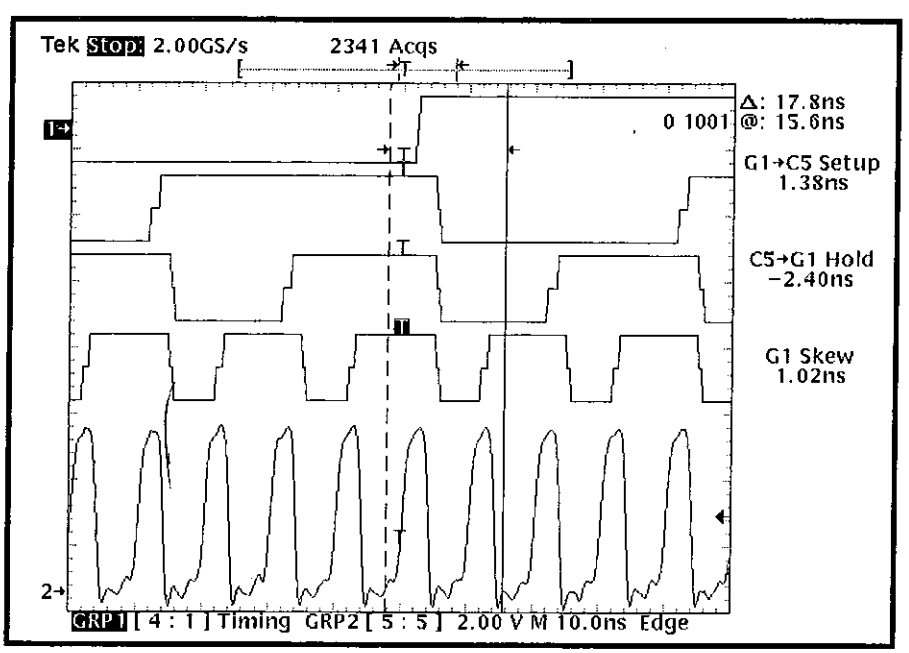
TRIGGER TYPES (MAIN AND DELAYED)

Edge	Trigger when either a rising or falling edge (positive or negative slope) is detected.
Pulse	The pulse may be positive or negative and defined by a duration.
Width (<Time, >Time)	Trigger when the duration of either a positive or negative pulse is less than or greater than the user-defined input.
Range (In Range, Out of Range)	Trigger when the duration of either a positive or negative pulse is either between the upper and lower limits or outside the limits.
Time-out	Trigger at the end of a user-defined time period if the trailing edge of either a positive or negative pulse is not detected.
Pattern	Each input may be defined as a low (logic 0), high (logic 1), or don't care (X). Inputs can be ANDed or ORed. The pattern may be positive true or positive false.
Width (<Time, >Time)	Trigger when the duration of a user-defined logical pattern is less than or greater than the user-defined input.
Range (In Range, Out of Range)	Trigger when the duration of a user-defined logical pattern is either between the upper and lower limits or outside the limits.
Time-out	Trigger at the end of a user-defined time period if the user-defined logical pattern of a specified duration does not occur.
Sequence	The sequence is defined by a set of start and end events. The start or end event can be either a pattern or an edge (positive or negative slope).
Width (<Time, >Time)	Trigger when the duration between the user-defined start and end events is less than or greater than the user-defined input.
Range (In Range, Out of Range)	Trigger when the duration between the user-defined start and end events is either between the upper and lower limits or outside the limits.
Time-out	Trigger at the end of a user-defined time period if the user-defined end event does not occur within the specified time after the start event.
State	Trigger when a user-specified logical pattern is detected and the input defined as the clock goes true or goes false. Each input may be specified as a low (logic 0), high (logic 1), or don't care (X). Inputs can be ANDed or ORed.



The Logic Scope features 28 automatic measurements, including setup time, hold time and skew measurements.

TRIGGERING SYSTEM

Triggers – Main, Delayed.

Main Trigger Modes – Auto, Normal, Single.

Delayed Trigger – Delayed by time and/or events.

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

Events Delay Range – 1 to 9,999,999 events.

AUX Trigger Input – TTL compatible; Max input voltage is –1 V to +6 V.

MEASUREMENT SYSTEM

The Logic Scope provides a comprehensive suite of automatic measurements specifically designed to improve efficiency when troubleshooting digital hardware. Twenty-eight on-board measurements, including setup time, hold time, and skew, speed identification of common digital problems. Whereas traditional DSOs confine waveform measurements to establishing the relationship of a single channel to a clock, the Logic Scope simultaneously samples on all channels, so you can see the relationships between multiple channels.

Automatic Waveform Measurements –

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

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

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

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

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

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

TLS 216 Logic Scope

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

HARD COPY/DESKTOP PUBLISHING
Printer – HP ThinkJet, Epson, PostScript, DeskJet, LaserJet, DPU 411/412.

Export File Formats – EPS (Encapsulated PostScript), Interleaf, TIFF, PCX, BMP, RLE.

Plotter Support – HPGL.

I/O Ports – GPIB, Centronics, RS-232 (Talk only).

Floppy Disk Drive – 3.5 in., 1.44 MB DOS format.

VGA Output – 15-Pin analog output (Color).

STORAGE
Waveforms – 16 full 2,000 pt waveforms. 119,008 500 pt waveforms on 1.44 MB floppy disk.

Setups – 10 front-panel setups. 78,947 setups on 1.44 MB floppy disk.

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

Line Frequency – 47 to 63 Hz.

Power Consumption – 300 W max.

ENVIRONMENTAL AND SAFETY
Temperature – Operating: +4°C to +50°C. Nonoperating: –22°C to +60°C

Humidity – Operating and Nonoperating: Operating to 80% at or below 29°C, to 20% from +30°C to +50°C. Nonoperating to 90% at or below 41°C to 5% from +41°C to 50°C.

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

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

Safety – Listed UL 1244, certified CSA C 22.2 No. 231-M89.

PROBES
Active Probes – 2.5 pF, 1 MΩ FET.

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height with feet	236	9.3
without feet	193	7.6
Width with handle	445	17.5
Depth with front cover installed	432	17.0
Weight	**kg**	**lb.**
Net ≈	12.3	27
Shipping ≈	20.0	44

ORDERING INFORMATION

TLS 216
Logic Scope
Includes: 16 each P6240 2.5 pF, FET Probes.
2 each Handheld Adapters (013-0281-00).
2 each 7 in. Ground Leads (196-3302-00).
2 Packages of 10 each Y-leadsets (020-2008-00).
3 Packages of 12 each KlipChip™ (020-1386-01).
2 each 2-to-1 Podlet Adapters (013-0280-00).
1 Package of 6 Probe Cable Looms (352-0139-00).
3 Cards of Channel ID Labels (334-8632-00).
Instrument Front Cover (200-3696-00).
U.S. Power Cord (161-0230-01).
Quick Reference Guide (070-8833-00).
User Manual (070-8834-00).
Programmer Manual (070-8835-00).

Opt. 1B – Package of 16 50 Ω Coax Adapters
Opt. 1K – K420 Instrument Cart Without Power Strip
Opt. 1R – Rackmount Kit
Opt. 1S – Substitute 16 Coax Adapters for Standard Probes
Opt. 2P – Phaser™ 200e Color Printer
Opt. 24 – Four Extra P6240 Probes
Opt. 95 – Calibration Data Report
Opt. 96 – Calibration Certificate

INTERNATIONAL POWER PLUG OPTIONS
Opt. A1 – Universal Euro 220 V, 50 Hz
Opt. A2 – United Kingdom 240 V, 50 Hz
Opt. A3 – Australian 240 V, 50 Hz
Opt. A4 – North American 240 V, 60 Hz
Opt. A5 – Switzerland 220 V, 50 Hz

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

PROBES
FET Probes Only – Order P6240, 2.5 pF, 1 MΩ, 800 MHz, 20X, 1.5m

CAMERAS/PLOTTERS/PRINTERS
BW Printer – Cannon BJ-10ex BubbleJet Order HC220

CARTS
Instrument Cart – Order K420

ADDITIONAL ACCESSORIES
Service Manual – Order 070-8836-00
Soft Carrying Case – Order 016-0909-00
Hard Transit Case – Order 016-1157-00
U.S. Power Strip – Four Outlet, 6 ft., Noise/Surge Suppression. Order 131-5342-01

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ISO 9001

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