

Multiprocessor architecture

The TDS 500A, 600A, and 700A use three microprocessors, including a Tek TriStar™ digital signal processor and a powerful proprietary display processor, to provide the power for waveform math, high-speed averaging, automatic limit testing, live measurements, and variable persistence display.

Easy-to-learn and easy-to-use

Extensive user interface design has made the TDS family of products truly intuitive. All family members share a familiar front panel layout with dedicated vertical, horizontal and trigger controls. A graphical user interface with icons helps facilitate understanding and use of TDS advanced capabilities. The TDS 524A, 644A, and 744A's color monitor enables the user to rapidly distinguish multiple waveforms and measurements. On-line help provides a convenient built-in reference manual.

Sophisticated documentation

The TDS 500A, 600A, and 700A provide several ways to easily document waveform data. Save screen displays in a number of standard desktop publishing formats to the internal 3.5" DOS

format floppy disk drive. Then transfer the floppy to a PC for import into word processing applications. Make hardcopies directly to monochrome or color printers connected to either the GPIB, RS-232, or Centronics ports. Waveforms saved to disk can even be translated to raw data in spreadsheet or ASCII format with the available CNVRTWFM utility software.

Complementary probing solution

To complement its high performance acquisition, the TDS 600A has P6205 active probes as a standard accessory. These 750 MHz probes have low loading with 2 pF capacitance and 1 MΩ resistance. The TEKPROBE™ interface provides probe power and automatic scaling. P6139A full 500 MHz passive probes are standard with the TDS 500A and 700A.

Unique and advanced performance features include:

Limit testing. Compares incoming or math waveforms against a template "on-the-fly," stopping acquisition, saving to floppy disk, or automatically printing the waveform whenever it violates the template. Create templates on-board by specifying

waveform tolerances or downloading over the GPIB or floppy disk. Save them in non-volatile waveform memories or on floppy disk.

Color-graded variable persistence.

TDS 524A, 644A, and 744A provide historical information by color grading samples as they are acquired over time. The TDS 744A uses color grading with InstaVu™ acquisition mode to show relatively how often random glitches occur.

Twenty five automatic measurements.

Eliminate the need for division counting and manual cursor setup measurements. Icons in the measurement menu clearly illustrate what each measurement does. In addition, measurement "gating" allows the user to select a specific part of a waveform for measurement. Live measurements make it easy to see the effects of changing circuit conditions.

Advanced signal processing.

Waveform analysis with live FFT analysis, waveform integration, and differentiation are easily accomplished with the TDS 500A, 600A, and 700A.

TDS 500A Series TDS 600A Series TDS 700A Series Electrical Characteristics

	TDS 520A/524A/620A	TDS 540A/640A/644A/744A
Channels	2 + 2 auxiliary	4
Samplers	2	4
Bandwidth ¹	500 MHz ²	500 MHz ²
Sensitivity		
CH 1, CH 2	1 mV to 10 V/div	1 mV to 10 V/div
CH 3, CH 4	NA	1 mV to 10 V/div
AUX 1, AUX 2 (TDS 520A)	100 mV, 1.0 V, 10 V/div	NA
AUX 1, AUX 2 (TDS 620A)	1 mV to 10 V/div	NA
Position Range	± 5 Divisions	± 5 Divisions
Offset		
CH 1, CH 2	± 1 V from 1 to 99.5 mV/div	± 1 V from 1 to 99.5 mV/div
AUX 1, AUX 2 (TDS 620A)	± 10 V from 100 mV to 995 mV/div ± 100 V from 1 to 10 V/div	± 10 V from 100 mV to 995 mV/div ± 100 V from 1 to 10 V/div
CH 3, CH 4	NA	Same as CH 1, CH 2
AUX 1, AUX 2 (TDS 520A/524A)	100 mV/div ± 5 V 1 V/div ± 5.0 V 10 V/div ± 50 V	NA

Maximum Sample Rate

	TDS 520A/524A	TDS 540A	TDS 620A	TDS 640A/644A	TDS 744A
Any One Channel	500 MS/s	1 GS/s	2 GS/s	2 GS/s	2 GS/s
Any Two Channels	250 MS/s	500 MS/s	2 GS/s	2 GS/s	1 GS/s
Four Channels	NA	250 MS/s	NA	2 GS/s	500 MS/s

¹ Reduce the upper bandwidth frequencies by 2.5 MHz for each °C above 30°C.

² TDS 500A: 1 mV/div: 250 MHz, 2 mV/div: 350 MHz.

TDS 600A: 1 mV/div: 200 MHz, 2 mV/div: 300 MHz.

TDS 744A: 1 mV/div: 450 MHz.

Maximum Record Length

	TDS 520A/524A	TDS 540A	TDS 600A	TDS 744A
Any 1 channel	15K pts (50K opt.)	50K	2K	50K (500K opt.)
Any 2 channels	15K pts (50K opt.)	50K	2K	50K (250K opt.)
Any 4 channels	N/A	50K	2K	50K (130K opt.)

Time Base System

Time Bases — Main, Delayed.
Time Base Range — 500 ps to 10 s/div.
Time Base Accuracy (over any interval ≥ 1 ms) —
 TDS 500A — ± 25 ppm.
 TDS 600A — ± 100 ppm.
 TDS 700A — ± 25 ppm.
Pre-Trigger Position —
 TDS 500A — 0% to 100% of any record.
 TDS 600A — 20% to 80% of any record.
 TDS 700A — 0% to 100% of any record.
Delay Between Channels (any 2 channels with equal V/div and coupling) —
 TDS 500A — ≤ 250 ps.
 TDS 600A — ≤ 250 ps.
 TDS 700A — ≤ 50 ps.

Vertical System

DC Gain Accuracy — TDS 500A $\pm 1.0\%$;
 TDS 600A $\pm 1.5\%$; TDS700A $\pm 1.0\%$.

Vertical Resolution — 8 bits (256 levels over 10.24 vertical divisions). >13 bits with HiRes on TDS 700A; >12 bits with HiRes on TDS 500A; >11 bits with averaging.

Analog Bandwidth Selections —
 TDS 500A/600A: 20 MHz, 100 MHz, and full (Except Aux 1 and Aux 2 on TDS 520A/524A are full BW only);
 TDS 744A; 20 MHz, 250 MHz and full.

Step Response Setting — $\leq 0.5\%$ error within 20 ns of a ≤ 2 V step.

Effective Bits — TDS 700A: 6.8 Bits (500 MHz at 2 GS/s) HiRes: 9.3 Bits (1 MHz at 25 MS/s). TDS 500A: 6.0 Bits (500 MHz at 1 GS/s). HiRes: TDS 600A: 9.0 Bits (500 MHz at 2 GS/s).

Input Coupling — AC, DC or GND.

Input Impedance Selections — 1 M Ω in parallel with 10 pF, or 50 Ω (AC and DC coupling).

Maximum Input Voltage — ± 400 V (DC+ peak AC). Derate at 20 dB/decade above 1 MHz. 1 M Ω or GND coupled.

Channel Isolation — $\geq 100:1$ at 100 MHz and $\geq 30:1$ at bandwidth for any two channels having equal Volts/div settings.

AC Coupled Low Frequency Limit —
 ≤ 10 Hz when AC 1 M Ω coupled.
 ≤ 200 kHz when AC 50 Ω coupled.

Acquisition Modes

InstaVu™ (TDS 700A only) — Instantaneous capture of random glitches and changing signals. Captures over 400,000 waveforms per second. Uses color grading to show relative occurrence of events.

Peak Detect (TDS 500A/700A only) — High frequency and random glitch capture. Captures glitches of 1 ns (4 ns for TDS 500A) using acquisition hardware at all real-time sampling rates.

Sample — Sample data only.

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

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

HiRes (TDS 500A/700A only) — Vertical resolution improvement and noise reduction on low-frequency signals, e.g. 13 bits at 50 μ s/div and slower (12 bits for TDS 500A).

FastFrame™ (TDS 500A/700A only) — Acquisition memory size segmentable with trigger rate up to 50,000 per second from 50 to 5,000 points per frame (independent of the number of channels).

Single Sequence — Use Run/Stop button to capture a single triggered acquisition at a time which may be automatically saved to NVRAM with AutoSave.

Trigger Types

EDGE (main and delayed) —

Conventional level driven trigger. Positive or negative slope on any channel or rear panel auxiliary input (Except TDS 520A/524A). Coupling Selections: DC, AC, noise reject, HF reject, LF reject.

PULSE (main) —

 **WIDTH**


Trigger on width of positive or negative pulse either within or not within selectable time limits. Time limits settable from 1 ns to 1 s (2 ns to 1 s with TDS 500A/600A).

 **GLITCH**

Trigger on or reject glitches of positive, negative or either polarity. Minimum glitch width threshold is 1.0 ns (2.0 ns for TDS 500A/600A), with 200 ps resolution.

 **RUNT**

Trigger on a pulse that crosses one threshold but fails to cross a second threshold before crossing the first again.

 **SLEW RATE**

(TDS 700A only) Trigger on pulse edge rates that are either faster or slower than a set rate. Edges can be rising, falling, or either.

Trigger Types (Continued)

LOGIC (main) —



PATTERN Specifies a logical combination (AND, OR, NAND, NOR) of the four input channels (Hi, Lo, Don't Care). Trigger when pattern stays True or False for user specified time.



STATE Any logical pattern of channels 1, 2 and 3 (AUX1 on TDS 520A/524A/620A) plus clock edge on channel 4 (AUX2 on TDS 520A/524A/620A). Triggerable on positive or negative clock edge.



SETUP & HOLD (TDS 700A only) Trigger on violations of both setup time and hold time between clock and data which are on separate input channels.

Video (Optional) NTSC, PAL, HDTV, FlexFormat™ —

Trigger on a particular line of individual, odd/even, or all fields. Trigger on a specific pixel of a line by using video trigger with delay by events. Choose horizontal sync polarity. Choose from popular HDTV formats (1125/60, 1050/60, 1250/50, 787.5/60) or use FlexFormat™ for other HDTV-type formats by defining frame rep rate, number of lines and fields, and sync timing structure.

Triggering System

Triggers — Main, Delayed.

Main Trigger Modes — Auto, Normal, Single.

Delayed Trigger — Delayed by time, events, or events and time.

Time Delay Range — 16 ns to 250 s.

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

External Rear Input — (except TDS 520A/524A) $\geq 1.5 \text{ k}\Omega$; Max input voltage is $\pm 20 \text{ V}$ (DC + AC peak).

Display

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 (TDS 744A/644A/524A only) — With variable persistence selected, historical timing information is represented by temperature or spectral color scheme providing "z-axis" information about rapidly changing waveforms.

Gray Scaling — With variable persistence selected, waveform points time-decay through 16 levels of intensity.

Display (Continued)

Waveform Capture Rate — For 500 point waveforms with infinite persistence mode selected: 150/sec (TDS 700A/500A); 100/sec (TDS 600A) typically. With InstaVu on TDS 700A: $> 400,000/\text{sec}$.

Graticules — Full, grid, cross hair, frame. NTSC and PAL with video trigger option.

Format — YT and XY.

Fit to Screen — Entire acquisition memory displayed on screen.

Zoom

The zoom feature allows waveforms to be expanded or compressed in both vertical and horizontal axes. Allows precise comparison and study of fine waveform detail without affecting ongoing acquisitions. When used with HiRes or Average acquisition modes, Zoom provides an effective vertical dynamic range of 1000 divisions or 100 screens.

Dual Window Zoom (TDS 700A only) — Dual graticules simultaneously show selected and zoomed waveforms. Up to two zoom boxes show areas on the selected trace that are being magnified, and the two magnified areas can be overlapped for quick comparison. Color of zoomed trace matches selected trace.

Measurement System

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	

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

Thresholds — Settable in percentage or voltage.

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. NTSC IRE and Line Number with video trigger option.

Measurement System (Continued)

Time Measurements Accuracy — (Single Shot Typical) TDS 744A: <80 ps @ 2 GS/s. TDS 600A: <110 ps @ 2 GS/s. TDS 540A: <160 ps @ 1 GS/s. TDS 520A/524A: <305 ps @ 500 MS/s.

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

Waveform Processing

Waveform Functions — Interpolate-selectable sin(x)/x or linear, Average, Envelope.

Advanced Waveform Functions (Standard on TDS 524A/644A/744A) — FFT, Integration, Differentiation.

Arithmetic Operators — Add, Subtract, Multiply, Divide, Invert.

Autosetup — Single button, automatic setup on selected input signal for vertical, horizontal and trigger systems.

Waveform Limit Testing — Compares incoming or math waveform to a reference waveform's upper and lower limits.

Computer Interface

GPIB (IEEE-488.2) Programmability — Full talk/listen modes. Control of all modes, settings, and measurements.

Hardcopy

Printer — HPThinkjet, Epson, Interleaf, Deskjet, Laserjet, PostScript, TIFF, PCX, BMP (Microsoft Windows), DPU 411/412, RLE.

Plotter — HPGL.

Data (TDS 700A only) — MathCad, Spreadsheet formats.

Interface — GPIB standard.

Hardcopy Interface (Standard on TDS 524A/544A/644A) — Centronics and RS-232.

Storage

Waveforms — TDS 500A: 4 full 50 K point records. TDS 600A: 4 full 2,000 point waveforms. TDS 744A: 4 full 50 K (with Option 1M: 2 full 130 K pt., 1 full 250 K pt., or 1 compressed 500 K pt. waveform).

Setups — 10 front panel setups.

Floppy Drive (Standard on TDS 524A/644A/744A) — Store reference waveforms, setups, and image files on 3.5" 1.44 MByte or 720 KByte DOS format floppy disk.

CRT

Type (TDS 520A/540A/620A/640A) — 7 in. diagonal, magnetic deflection. Horizontal raster-scan. P4 White phosphor.

Type (TDS 524A/644A/744A) — 7 in. diagonal, NuColor™ liquid crystal full color shutter display. 256 color levels.

Resolution — 640 horizontal by 480 vertical displayed pixels (VGA).

Power Requirements

Line Voltage Range — 90 to 250 V RMS.

Line Frequency — 45 to 440 Hz.

Power Consumption — 300 Watts max.

Environmental and Safety

Temperature

Operating — +4°C to +50°C (floppy not used). +10°C to +50°C (floppy in use).
Nonoperating — -22°C to +60°C.

Humidity

Operating (floppy not used) — To 80% RH at ≤ 32°C.
Derates to 30% RH at +45°C.

Operating (floppy in use) — To 80% RH at ≤ 32°C.
Derates to 30% RH at +45°C.

Nonoperating — To 90% RH at ≤ 40°C.
Derates to 30% RH at +60°C.

Altitude

Operating — 15,000 ft.
Nonoperating — 40,000 ft.

Electromagnetic Compatibility — Meets or exceeds Vfg. 243/1991 amended per Vfg. 46/1992; FCC 47 CFR, Part 15, Subpart B, Class A; EN 50081-1; and EN 50082-1.

Safety — Listed UL 1244; CSA - C22 No. 23; Tektronix self-certification to comply with IEC 348 recommendations.

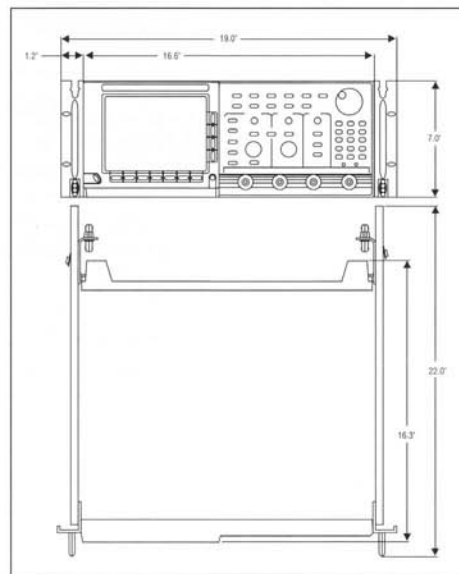
Physical Characteristics

Weight

Net — Approximately 14.1 kg (31 lb).
Shipping — Approximately 25.4 kg (56 lb).

Dimensions

Height — 193 mm (7.6 in.) with feet; 178 mm (7.0 in.) without feet.
Width — 445 mm (17.5 in.) with handle.
Depth — 434 mm (17.1 in.) with front cover installed.



Ordering Information

TDS 500A
TDS 600A
TDS 700A
 500 MHz
 Digitizing
 Oscilloscopes

Standard Accessories

	TDS 700A	TDS 600A	TDS 500A
Probes 2 Ch	N/A	2 ea P6205	2 ea P6139A
4 Ch	4 ea P6139A	4 ea P6205	4 ea P6139A
Reference	070-8999-02	070-8711-01	070-8711-01
User Manual	070-8991-02	070-8715-01	070-8710-01
Technical Reference	070-8990-03	070-8717-01	070-8712-01
Programmer Manual	070-8709-06	070-8709-06	070-8709-06
Front Cover	200-3696-01	200-3696-01	200-3696-01
U.S. Power Supply	161-0230-01	161-0230-01	161-0230-01
Accessory Pouch	016-1268-00	N/A	N/A

Instrument Options

Option 05 — Add Video Trigger; NTSC, PAL, HDTV, FlexFormat.™

Option 1F (TDS 520A/540A/620A/640A only) — Add 3.5" floppy disk drive.

Option 1K — K420 scope cart without power strip.

Option 1M — TDS 520A/524A: 50K Memory Length. TDS 744A 500K Memory Length on 1 channel.

Option 1R — Rack Mount.

Option 2D (TDS 520A/524A/620A only) — Delete 2 ea standard probes.

Option 2F (TDS 520A/540A/620A/640A only) — Extended waveform math; FFT, Integration, Differentiation.

Option 2P (TDS 524A/644A/744A only) — Tektronix Phaser 200e thermal wax transfer color printer.

Option 4D (TDS 540A/640A/644A only) — Delete 4 ea standard probes.

Option 13 (TDS 520A/540A/620A/640A only) — Add RS 232C and Centronics hardcopy interfaces.

Option 22 (TDS 520A/524A only) — Two additional P6139A Probes.

Option 23 (all except TDS 640A/644A) — Add 2 ea P6205 active probes.

Option 24 (TDS 600A only) — Add 4 ea P6139A probes.

Option 95 — NIST, MIL-STD-45662A and ISO 9000 calibration certification.

Option 96 — Calibration data.

Option R2 — Two years of post-warranty repair protection.

Option C5 — Five years of calibration service.

International Power 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.

*International power options required on instruments and selected accessories for operation outside U.S.

Probes

P6139A — 500 MHz Passive Probe.

P6205 — 750 MHz FET Probe.

P6245 — 1 GHz FET Probe.

P6563AS — 4 SMD Probes.

P6711 — 500 nm to 950 nm optical converter.

P6713 — 1100 nm to 1700 nm optical converter.

P5100 — High Voltage Probe.

AM 503S — DC/AC Current Probe System.*

ADA400A — 10 mV Differential Probe.

Recommended Accessories

070-8992-04 — TDS 700A Service Manual.

070-8718-02 — TDS 600A Service Manual.

070-8713-01 — TDS 500A Service Manual.

016-1268-00 — Accessory Pouch.

016-0909-01 — Soft-sided Carrying Case.

016-1135-00 — Transit Case.

HC100 — Four Color Plotter.

Software

LVWIN — LabView for PC Windows system.

S3FT400 — WaveWriter; AWG and waveform creation.

LWDOS — Labwindows for DOS system.

LWCVI — Labwindows for CVI system.

S3FG910 — Labwindows.

Cables

012-1298-00 — RS232.

012-1250-00 — Centronics.

012-0991-01 — GPIB (1 meter).

012-0991-00 — GPIB (2 meters).

Warranty Information

Three years warranty, covering all labor and parts, including CRT, but excluding probes.

For further information, contact:

U.S.A., Africa, Asia, Australia, Central & South America, Japan
 Tektronix, Inc.
 P.O. Box 500
 Beaverton, Oregon 97077-0001
 For additional literature, or the address and phone number of the Tektronix Sales Office nearest you, contact: (800) 426-2200 (U.S.A. only)



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Tektronix

TDS 510A/500B/600B/700A Series 500 MHz Digitizing Oscilloscopes



- Sample rates to 2.5 GS/s on four channels
- Up to 400,000 Wfms/sec
- 2 and 4 input channels
- Vertical accuracy to 1%
- Pulse Width, 1 ns Glitch, Runt, Pattern and State Triggering
- Slew Rate, Setup & Hold Violation and Time Out triggers
- 1 mV/div -10 V/div sensitivity
- Waveform pass/fail testing
- Infinite and variable persistence
- 25 automatic measurements
- Record lengths to 500,000 points
- Full GPIB programmability
- 8-bit vertical resolution and up to 13 bits with HiRes
- Desktop publishing outputs
- High resolution color monitor
- HDTV Video trigger option
- Channel Deskew
- Segmentable acquisition memory
- VGA output
- Color Grading

The TDS Series offer world leading DSO performance, and set the pace for measurement capability in advanced design, manufacturing test, and R & D applications.

Delivering the greatest breadth of choice in technology, and price addressing a variety of applications and measurement needs, the TDS Series offer:

Patented InstaVu™ Acquisition - The Pinnacle in Waveform Acquisition Technology: (TDS 500B/TDS 700A Models) Ensuring the highest confidence in capture of infrequent and rare events, a blazing fast waveform capture rate from 100,000 Wfms/sec to 400,000 Wfms/sec (on the TDS 744A) make the TDS 500B/TDS 700A DSO's as fast as the fastest analog oscilloscopes (Tektronix 2467B).

Digital Real Time (DRT) - UnCompromised Single Shot Signal Capture (TDS 600B models): For super high speed applications, often requiring single shot capture performance, the TDS 600B DRT oscilloscopes delivers simultaneous 2.5 GS/s on 4 channels. Measurement accuracy of 100 picosecond

ensures timing measurement confidence when making critical measurements on high speed designs and applications.

Full Featured to meet your Budget (TDS 510A) - For general purpose analog and digital design, and manufacturing test applications that require balanced performance at an affordable price, the 500 MHz four channel TDS 510A offers a wealth of features from 500 MS/s, flexible triggering, 50K points/channel, HiRes, automatic measurements, and floppy disk storage and documentation.

Other significant advantages over comparable class instruments include:

High Fidelity Acquisition: In addition to their high sample rates, the TDS offers wide dynamic range, flat response, 8-bit vertical resolution, fast overdrive recovery, calibrated DC offset, 1 mV/division sensitivity and controllable internal self calibration. The TDS 500B and TDS 700A improve acquisition memory management with their FastFrame™ segmentable memory.

Powerful and Flexible Triggering. The TDS scopes help debug digital designs quickly with extended triggering functions, including pulse width, logic state and pattern, glitch, and runt. The TDS 500B/TDS 600B/TDS 700A also include the new Setup & Hold Violation, Timeout, and Slew Rate triggers¹. A video trigger option provides individual field and line triggering on all popular formats including HDTV².

¹ Set-up and Hold, Time-Out, and Slew Rate triggering is not available on the TDS 510A.

² HDTV not available on the TDS 510A.

Multiprocessor Architecture:

Three microprocessors, including a Tektronix Tristar™ digital signal processor deliver the processing horsepower for waveform math, FFTs, high speed averaging, automatic limit testing, live measurements, and variable persistence display.

Simple to learn, Easy to use:

Extensive user interface design has made the TDS family of products truly intuitive. All family members share a common front panel layout with dedicated vertical, horizontal and trigger controls. A graphical user interface with icons helps facilitate quick learning and use of TDS advanced capabilities. Color monitors on select models enable the user to rapidly distinguish multiple waveforms and measurements. On-line help provides a convenient built-in reference manual.

Sophisticated documentation

The TDS 510A, 500B, 600B, and 700A provide several ways to easily document waveform data. Save screen displays in a number of standard desktop publishing formats to the internal 3.5" DOS format floppy disk drive. Then transfer the floppy to a PC for import into word processing applications. Make hardcopies directly to monochrome or color printers connected to either the GPIB, RS-232, or Centronics ports. Waveforms saved to disk can even be translated to raw data in spreadsheet or ASCII

format with the available CNVRTWFM utility software.

Complementary probing solutions

To complement its high performance acquisition, the TDS 600B has P6243 active probes as a standard accessory. These 1 GHz probes have low loading with < 1pF capacitance and 1MΩ resistance. The TEKPROBE™ interface provides probe power and automatic scaling. P6139A full 500 MHz passive probes are standard with the TDS 510A, 500B and 700A.

Direct Readout Probing (TDS 510A/500B/700A)

Choose the unique TCP202 Current Probe along with P5205 High Voltage Differential Probe for accurate measurements in units of Amperes, Volts, and Watts. The TCP202 probe measures current up to 50 Amps Peak Pulse. The P5205 High Voltage Differential probe enables ± 1000 V safe floating voltage measurements and up to 1,300V differential allowing easy connections to IC's, discrete components, and bus bars. Direct readout ensures you spend time actually measuring, and not setting up and doing complex time consuming calculations.

Unique and advanced performance features include:

Channel Deskew³. Allows increased time measurement accuracy by specifying a deskew value up to

± 25 ns for each channel. This feature can be used for probe matching, to account for cabling propagation delays, or to match different types of probes.

Limit Testing. Compares incoming or math waveforms against a golden template "on-the-fly," stopping acquisition⁴, saving to floppy disk, or automatically printing the waveform whenever it violates the template.

Color-graded variable persistence. TDS 644B, 724A, 754A, and 744A provide historical information by color grading samples as they are acquired over time. The TDS 724A, TDS 754A and TDS 744A uses color grading with InstaVu™ acquisition mode to show relatively how often random glitches occur.

Twenty five automatic measurements. Eliminate the need for division counting and manual cursor setup measurements. Icons in the measurement menu clearly illustrate what each measurement does. In addition, measurement "gating" allows the user to select a specific part of a waveform for measurement. Live measurements make it easy to see the effects of changing circuit conditions.

Advanced signal processing. Waveform analysis with live FFT analysis, waveform integration, and differentiation are easily accomplished with the TDS 510A, 500B, 600B, and 700A.

³ Channel Deskew not on TDS 510A.

⁴ Limit Testing not available on TDS 510A.

**TDS 510A,
TDS 500B Series
TDS 600B Series
TDS 700A Series
Electrical
Characteristics**

	TDS 520B/620B/724A	TDS 510A/540B/644B/754A/744A
Channels	2 + 2 auxiliary	4
Samplers	2	4
Bandwidth¹	500 MHz ²	500 MHz ²
Sensitivity		
CH 1, CH 2	1 mV to 10 V/div (1 MΩ)	1 mV to 10 V/div (1 MΩ)
CH 3, CH 4	NA	1 mV to 10 V/div
AUX 1, AUX 2 (TDS 520B)	100 mV, 1.0 V, 10 V/div	NA
AUX 1, AUX 2 (TDS 620B)	1 mV to 10 V/div	NA
Position Range	± 5 Divisions	± 5 Divisions
Offset		
CH 1, CH 2	± 1 V from 1 to 99.5 mV/div	± 1 V from 1 to 99.5 mV/div
AUX 1, AUX 2 (TDS 620B)	± 10 V from 100 mV to 995 mV/div ± 100 V from 1 to 10 V/div	± 10 V from 100 mV to 995 mV/div ± 100 V from 1 to 10 V/div
CH 3, CH 4	NA	(Same as CH 1, CH 2)
AUX 1, AUX 2 (TDS 520B/724A)	100 mV/div ± .5 V 1 V/div ± 5.0 V 10 V/div ± 50 V	NA

Maximum Sample Rate

	TDS 510A	TDS 520B/724A	TDS 540B	TDS 620B	TDS 644B	TDS 754A	TDS 744A
Any One Channel	500 MS/s	1 GS/s	2 GS/s	2.5 GS/s	2.5 GS/s	2 GS/s	2 GS/s
Any Two Channels	500 MS/s	500 MS/s	1 GS/s	2.5 GS/s	2.5 GS/s	2 GS/s	1 GS/s
Four Channels	250 MS/s	NA	500 MS/s	NA	2.5 GS/s	1 GS/s	500 MS/s

¹ Reduce the upper bandwidth frequencies by 2.5 MHz for each °C above 30°C.

² TDS 510A/500B: 1 mV/div: 450 MHz, 2 mV/div: 350 MHz. TDS 600B: 1 mV/div: 250 MHz, 2 mV/div: 300 MHz, 5 mV/div: 450 MHz. TDS 744A: 1 mV/div: 450 MHz.

Maximum Record Length

	TDS 510A	TDS 520B/724A	TDS 540B	TDS 620B	TDS 644B	TDS 754A	TDS 744A
Any 1 channel	50K	50K pts (250K opt.)	50K (500K opt.)	15K	15K	50K (500K opt.)	50K (500K opt.)
Any 2 channels	50K	50K pts (130K opt.)	50K (250K opt.)	15K	15K	50K (250K opt.)	50K (250K opt.)
Any 4 channels	50K	N/A	50K (130K opt.)	15K	15K	50K (130K opt.)	50K (130K opt.)

Time Base System

Time Bases — Main, Delayed.

Time Base Range — 500 ps to 10 s/div.

Time Base Accuracy (over any interval ≥ 1 ms) —
TDS 510A/500B — ± 25 ppm.
TDS 600B — ± 100 ppm.
TDS 700A — ± 25 ppm.

Pre-Trigger Position — 0% to 100% of any record.

Delay Between Channels (any 2 channels with equal V/div and coupling) —

TDS 510A — ≤ 250 ps.
TDS 500B — ≤ 50 ps.
TDS 600B — ≤ 100 ps.
TDS 700A — ≤ 50 ps.

Vertical System

DC Gain Accuracy —

TDS 510A — $\pm 1.0\%$ ($\pm 0.7\%$ typical).
TDS 500B — $\pm 1.0\%$ ($\pm 0.7\%$ typical).
TDS 600B — $\pm 1.5\%$ ($\pm 1.05\%$ typical).
TDS 700A — $\pm 1.0\%$ ($\pm 0.7\%$ typical).

Vertical Resolution — 8 bits (256 levels over 10.24 vertical divisions). >13 bits with HiRes on TDS 700A — >12 bits with HiRes on TDS 500B/TDS 510A — >11 bits with averaging.

Analog Bandwidth Selections —

TDS 510A — 20 MHz, 100 MHz, and full;
TDS 500B/620B/644B/700A — 20 MHz, 250 MHz and full.

Step Response Setting — $\leq 0.5\%$ error within 20 ns of a ≤ 2 V step.

Effective Bits (typical) —

TDS 510A — 6.2 bits (1 MHz @ 500 MS/s).
TDS 754A/744A/540B — 6.8 bits (500 MHz @ 2 GS/s) HiRes: 9.7 bits (1 MHz @ 10 MS/s). TDS 520B/724A: 6.5 (500 MHz @ 1 GS/s). HiRes: 9.7 bits (1 MHz @ 10 MS/s). TDS 600B — 6.3 (500 MHz @ 2.5 GS/s).

Input Coupling — AC, DC or GND.

Input Impedance Selections — 1 M Ω in parallel with 10 pF, or 50 Ω (AC and DC coupling).

Maximum Input Voltage — ± 400 V (DC+ peak AC). Derate at 20 dB/decade above 1 MHz. 1 M Ω or GND coupled. TDS 510A ± 300 V CAT II.

Channel Isolation — $\geq 100:1$ at 100 MHz and $\geq 30:1$ at bandwidth for any two channels having equal Volts/div settings.

AC Coupled Low Frequency Limit — ≤ 10 Hz when AC 1 M Ω coupled. ≤ 200 kHz when AC 50 Ω coupled.

¹ Feature not available on TDS 510A.

Acquisition Modes

InstaVu™ (TDS 500B/700A only) —

Instantaneous capture of random glitches and changing signals. Captures over 400,000 waveforms per second (TDS 744A and TDS 754A); 180,000 wfms/sec (TDS 724A); 100,000 wfms/sec (TDS 520B/540B). Uses color grading to show relative occurrence of events. (Mono-chrome on TDS 500B).

Peak Detect — High frequency and random glitch capture. Captures glitches of 1 ns (2ns, TDS 510A) using acquisition hardware at all real-time sampling rates.

Sample — Sample data only.

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

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

HiRes (TDS 510A/500B/700A only) — Vertical resolution improvement and noise reduction on low-frequency signals, e.g. 13 bits at 50 μ s/div and slower (12 bits for TDS 500B/510A).

FastFrame™ (TDS 500B/700A only) — Acquisition memory size segmentable with trigger rate up to 50,000 per second from 50 to 5,000 points per frame (independent of the number of channels).

Single Sequence — Use Run/Stop button to capture a single triggered acquisition at a time which may be automatically saved to NVRAM with AutoSave.¹

Trigger Types

EDGE (main and delayed) —

Conventional level driven trigger. Positive or negative slope on any channel or rear panel auxiliary input. Coupling Selections: DC, AC, noise reject, HF reject, LF reject.

PULSE (main) —

 **WIDTH**


Trigger on width of positive or negative pulse either within or not within selectable time limits. Time limits settable from 1 ns to 1 s (2 ns to 1 s with TDS 600B/510A).

 **GLITCH**

Trigger on or reject glitches of positive, negative or either polarity. Minimum glitch width threshold is 1.0 ns (2.0 ns for TDS 600B/510A), with 200 ps resolution.

 **RUNT**

Trigger on a pulse that crosses one threshold but fails to cross a second threshold before crossing the first again.

 **SLEW RATE¹**


Trigger on pulse edge rates that are either faster or slower than a set rate. Edges can be rising, falling, or either.


 **TIME OUT¹**


Trigger on an event which remains high, low, or either, for a user-specified time. Time range is settable from 1 ns to 1 s, with 200 ps resolution.

Trigger Types (Continued)

LOGIC (main) —

 **PATTERN** Specifies a logical combination (AND, OR, NAND, NOR) of the four input channels (Hi, Lo, Don't Care). Trigger when pattern stays True or False for user specified time.

 **STATE** Any logical pattern of channels 1, 2 and 3 (AUX1 on TDS 520B/724A/620B) plus clock edge on channel 4 (AUX2 on TDS 520B/724A/620B). Triggerable on positive or negative clock edge.

 **SETUP & HOLD¹** Trigger on violations of both setup time and hold time between clock and data which are on separate input channels.

Video (Optional) NTSC, PAL, HDTV, FlexFormat™ Video Trigger—

Trigger on a particular line of individual, odd/even, or all fields. Trigger on a specific pixel of a line by using video trigger with delay by events. Choose horizontal sync polarity. Choose from popular HDTV formats (1125/60, 1050/60, 1250/50, 787.5/60) or use FlexFormat™ Video Trigger for other HDTV-type formats by defining frame rep rate, number of lines and fields, and sync timing structure.

Triggering System

Triggers — Main, Delayed.

Main Trigger Modes — Auto, Normal, Single.

Delayed Trigger — Delayed by time, events, or events and time.

Time Delay Range — 16 ns to 250 s.

Events Delay Range — 1 to 9,999,999 events (TDS 510A, 2 to 10,000,000).

External Rear Input — $\geq 1.5 \text{ k}\Omega$; Max input voltage is $\pm 20 \text{ V}$ (DC + AC peak).

Display

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 (TDS 754A/744A/724A/644B only) — With variable persistence selected, historical timing information is represented by temperature or spectral color scheme providing "z-axis" information about rapidly changing waveforms.

Gray Scaling — With variable persistence selected, waveform points time-decay through 16 levels of intensity.

¹ Not available on TDS 510A.

Display (Continued)

Waveform Capture Rate — For 500 point waveforms with infinite persistence mode selected: 180/sec (TDS 510A); 150/sec (TDS 700A/500B); 100/sec (TDS 600B) typically. With InstaVu on TDS 700A: > 400,000/sec; (TDS 744A/754A) > 400,000 wfms/sec; (TDS 724A) $\geq 180,000$ wfms/sec; (TDS 500B) $\geq 100,000$ wfms/sec.

Graticules — Full, grid, cross hair, frame. NTSC and PAL with video trigger option.

Format — YT and XY.

Fit to Screen — Entire acquisition memory displayed on screen.

Zoom

The zoom feature allows waveforms to be expanded or compressed in both vertical and horizontal axes. Allows precise comparison and study of fine waveform detail without affecting ongoing acquisitions. When used with HiRes or Average acquisition modes, Zoom provides an effective vertical dynamic range of 1000 divisions or 100 screens.

Dual Window Zoom¹ — Dual graticules simultaneously show selected and zoomed waveforms. Up to two zoom boxes show areas on the selected trace that are being magnified, and the two magnified areas can be overlapped for quick comparison. Color of zoomed trace matches selected trace.

Measurement System

Automatic Waveform Measurements —

Period	Frequency
High	Low
+ Width Maximum	– Width 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	

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

Thresholds — Settable in percentage or voltage.

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. NTSC IRE and Line Number with video trigger option.

Measurement System (Continued)

Time Measurements Accuracy — (Single Shot Typical) TDS 754A/744A/TDS 540B: <80 ps @ 2 GS/s. TDS 600B: <110 ps @ 2.5 GS/s. TDS 520B/724A: <150ps @ 1 GS/s.

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

Waveform Processing

Waveform Functions — Interpolate-selectable $\sin(x)/x$ or linear, Average, Envelope.

Advanced Waveform Functions (Standard on TDS 724A/644B/754A/744A) — FFT, Integration, Differentiation.

Arithmetic Operators — Add, Subtract, Multiply, Divide, Invert.

Autosetup — Single button, automatic setup on selected input signal for vertical, horizontal and trigger systems.

Waveform Limit Testing — Compares incoming or math waveform to a reference waveform's upper and lower limits.

Computer Interface

GPIB (IEEE-488.2) Programmability — Full talk/listen modes. Control of all modes, settings, and measurements.

Hardcopy

Printer¹ — HPThinkjet, Epson, Interleaf, Deskjet, Laserjet, EPS Color Plot, TIFF, PCX, BMP (Microsoft Windows), DPU 411/412, RLE.

Plotter — HPGL.

Data² — MathCad, Spreadsheet formats.

Interface — GPIB standard.

Hardcopy Interface (Standard on TDS 724A/754A/744A/644B) — Centronics and RS-232. (Talk-only).

Storage

Waveforms³ — TDS 510A/520B/724A: 2 full 50 K point records (with Option 1M: 2 full 130 K point records, 1 full 250 K point records). TDS 600B: 4 full 15,000 point waveforms. TDS 540B/TDS 754A/744A: 4 full 50 K point records (with Option 1M: 2 full 130 K point records, 1 full 250 K point records, or 1 compressed 500 K point records waveform).

Setups — 10 front panel setups.

Floppy Drive (Standard on TDS 510A/724A/644B/744A/754A) — Store reference waveforms, setups, and image files on 3.5" 1.44 MByte or 720 KByte DOS format floppy disk.

CRT

Type (TDS 510A/520B/540B/620B) — 7 in. diagonal, magnetic deflection. Horizontal raster-scan. P4 White phosphor.

Type (TDS 724A/644B/754A/744A) — 7 in. diagonal, NuColor™ liquid crystal full color

¹ Some instruments do not offer Deskjet color or RLE.

² Data Format on TDS 510A is internal Binary.

³ Option 1M with 50 K memory is standard on TDS 510A.

CRT (Continued)

Resolution — 640 horizontal by 480 vertical displayed pixels (VGA).

Power Requirements

Line Voltage Range — 90 to 250 V RMS.

Line Frequency — 45 to 440 Hz.

Power Consumption — 300 Watts max.

Environmental and Safety

Temperature —

Operating —
0°C to 50°C (floppy not used).
+4°C to +50°C (floppy in use).
Nonoperating — -22°C to +60°C.

Humidity —

Operating (floppy not used) —
To 80% RH at ≤ 32°C.
Derates to 30% RH at +45°C.

Operating (floppy in use) —
To 80% RH at ≤ 32°C.
Derates to 30% RH at +45°C.

Nonoperating —
To 90% RH at ≤ 40°C.
Derates to 30% RH at +60°C.

Altitude —

Operating — 15,000 ft.
Nonoperating — 40,000 ft.

Electromagnetic Compatibility —

Meets or exceeds Vfg. 243/1991 amended per Vfg. 46/1992; FCC 47 CFR, Part 15, Subpart B, Class A; EN 50081-1; and EN 50082-1, EN 55022 Class B, EN 60555-2, IEC 801-2, IEC 801-3, IEC 801-4, IEC 801-5.

Safety — Listed UL 1244; CSA - C22

No. 23; Tektronix self-certification to comply with IEC 348 recommendations. TDS 510A — Listed UL 3111-1; CAN/CSA - C22.2 No. 1010.1; EN 61010-1.

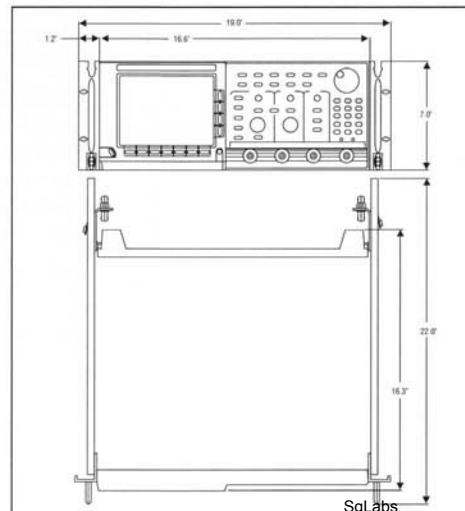
Physical Characteristics

Weight —

Net — Approximately 14.1 kg (31 lb).
Shipping — Approximately 25.4 kg (56 lb).

Dimensions —

Height — 193 mm (7.6 in.) with feet; 178 mm (7.0 in.) without feet. Width — 445 mm (17.5 in.) with handle. Depth — 434 mm (17.1 in) with front cover installed.



Ordering Information

TDS 510A
TDS 500B
TDS 600B
TDS 700A
500 MHz
Digitizing
Oscilloscopes

Standard Accessories

	TDS 700A	TDS 600B	TDS 500B	TDS 510A
Probes 2 Ch 4 Ch	2 ea P6139A 4 ea P6139A	2 ea P6243 4 ea P6243	2 ea P6139A 4 ea P6139A	4 ea P6139A
Quick Reference	070-9382-01	070-9382-01	070-9382-01	020-9758-00
User Manual	070-9719-00	070-9719-00	070-9719-00	070-9701-00
Technical Reference	070-9720-00	0070-9720-00	070-9720-00	070-9706-00
Programmer Manual	070-9556-00	070-9556-00	070-9556-00	NA as standard
Front Cover	200-3696-01	200-3696-01	200-3696-01	200-3696-01
U.S. Power Cord	161-0230-01	161-0230-01	161-0230-01	161-0230-01
Accessory Pouch	016-1268-00	016-1268-00 (TDS 644B only)	NA	NA
Programmer Disk (Manual)				063-2619-00

Instrument Options

- Option 05** — Add Video Trigger; NTSC, PAL, HDTV, FlexFormat Video Trigger.
- Option 1F (520B/540B/620B only)** — Add 3.5" floppy disk drive.
- Option 1K** — K420 scope cart without power strip.
- Option 1M** — TDS 520B/724A: 250K Memory Length. TDS 540B/754A/744A: 500K Memory Length on 1 channel.
- Option 1R** — Rack Mount.
- Option 2D (TDS 520B/724A/620B only)** — Delete 2 ea standard probes.
- Option 2F (TDS 510A/520B/540B/620B only)** — Extended waveform math; FFT, Integration, Differentiation.
- Option 3I¹** — 220 V Tektronix Phaser 140 Color Inkjet printer and cable.
- Option 3P¹** — 110 V Tektronix Phaser 140 Color Inkjet printer and cable.
- Option 4D (TDS 754A/744A/540B)** — Delete 4 ea standard probes.
- Option 13 (TDS 510A/520B/540B/620B only)** — Add RS 232-C and Centronics interface ports.
- Option 20 (TDS 510A/500B/700A)** — TCP 202 Current Probe.
- Option 21 (TDS 510A/500B/700A)** — TCP 202 Current Probe and P5205 High Voltage Probe.
- Option 22 (TDS 520B/724A only)** — Two additional P6139A Passive Probes.
- Option 23 (TDS 500B/724A/754A/744A)** — Add 2 ea P6243 Active FET Probes.
- Option 24 (TDS 600B only)** — Add 4 ea P6139A Passive Probes.
- Option 28 (TDS 500B/700A)** — ADA400A Differential Preamplifier.
- Option 95** — NIST, MIL-STD-45662A and ISO 9000 calibration certification.

¹ Not available as an option on TDS 510A, orderable as an accessory.

Instrument Options (Continued)

- Option L1** — French user manual.
- Option L3** — German user manual.
- Option L5** — Japanese user manual.
- Option L9** — Korean user manual (Not available on TDS 510A).

International Power Options

Options A1 - A5 — Available.

Probes

- P6139A** — 500 MHz Passive Probe.
- P6205** — 750 MHz FET Probe.
- P6243** — 1 GHz FET Probe.
- P6245** — 1.5 GHz FET Probe.
- P6563AS** — 4 SMD Probes.
- P6711** — 450 nm to 1000 nm optical converter.
- P6713** — 1100 nm to 1700 nm optical to electrical converter.
- P5100** — High Voltage Probe.
- P5205** — High Voltage Differential Probe.
- TCP 202** — DC Coupled Current Probe.
- AM 503S** — DC/AC Current Probe System.*
- ADA400A** — 10 μ V Differential Preamplifier.

Recommended Accessories

- 070-9702-00** — TDS 510A Programmer Manual.
- 070-9721-00** — TDS 500B/600B/700A Service Manual.
- 070-9704-00** — TDS 510A Service Manual.
- 016-0909-01** — Soft-sided Carrying Case.
- 016-1135-00** — Transit Case.
- HC100** — Four Color Plotter.

Software

- WSTR31** — WaveStar™ documentation software.
- TTiP** — Telecommunications templates and i-Pattern software.
- LVWIN** — LabView for PC Windows system.
- S3FT400** — WaveWriter™ software; AWG and waveform creation.
- LWDOS** — Labwindows for DOS system.
- LWCVI** — Labwindows for CVI system.

Cables

- 012-1298-00** — RS232.
- 012-1250-00** — Centronics.
- 012-0991-01** — GPIB (1 meter).
- 012-0991-00** — GPIB (2 meters).

Warranty Information

Three years warranty, covering all labor and parts, including CRT, but excluding probes.

For further information, contact Tektronix:

World Wide Web: <http://www.tek.com>; **ASEAN Countries** (65) 356-3900; **Australia & New Zealand** 61 (2) 888-7066; **Austria** 43 (1) 7 0177-261; **Belgium** 32 (2) 725-96-10; **Brazil and South America** 55 (11) 3741 8360; **Canada** 1 (800) 661-5625; **Denmark** 45 (44) 850700; **Finland** 358 (0) 4783 400; **France & North Africa** 33 (1) 69 86 81 81; **Germany, Eastern Europe, & Middle East** 49 (221) 94 77-0; **Hong Kong** (852) 2585-6688; **India** 91 (80) 2275577; **Italy** 39 (2) 250861; **Japan** (Sony/Tektronix Corporation) 81 (3) 3448-4611; **Mexico, Central America, & Caribbean** 52 (5) 666-6333; **The Netherlands** 31 23 56 95555; **Norway** 47 (22) 070700; **People's Republic of China** (86) 10-62351230; **Republic of Korea** 82 (2) 528-5299; **Spain & Portugal** 34 (1) 372 6000; **Sweden** 46 (8) 629 6500; **Switzerland** 41 (42) 219192; **Taiwan** 886 (2) 765-6362; **United Kingdom & Eire** 44 (1628) 403300; **USA** 1 (800) 426-2200

From other areas, contact: Tektronix, Inc. Export Sales, P.O. Box 500, M/S 50-255, Beaverton, Oregon 97077-0001, USA (503) 627-1916



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