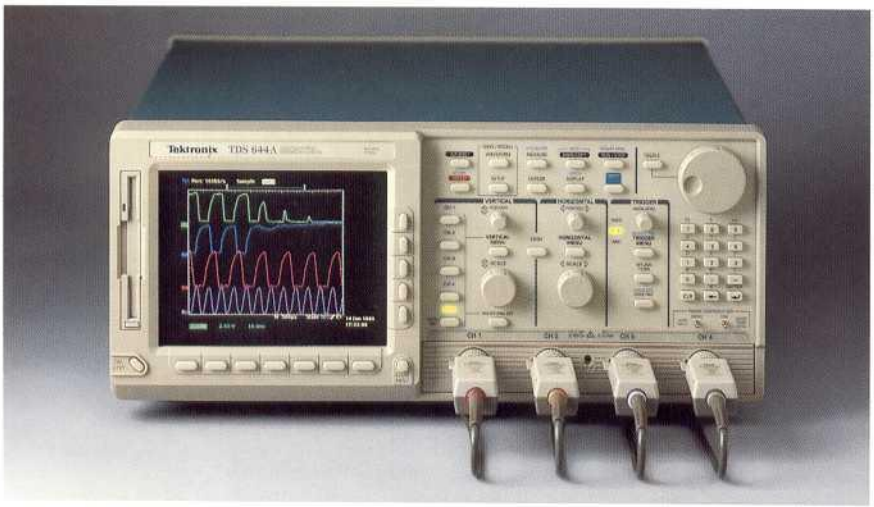
Tektronix

TDS 500 Series
TDS 600 Series
Digitizing Oscilloscopes



2 GS/s sampling on four channels with the TDS 644A and TDS 640 combined with powerful logic, runt and pulse width triggering make them ideal for design and debug of today's higher speed digital systems. The TDS 544A and TDS 540 offer 1 GS/s on a single channel, record lengths to 50,000 points, the same powerful triggering as the TDS 644A and TDS 640 and a unique HiRes mode for single shot acquisition with up to 12 bits of resolution. The TDS 644A and TDS 544A have a high-resolution color monitor and 3.5" floppy disk drive standard as well as a powerful video trigger option.

The TDS 520, 540, 544A, 620, 640, and 644A represent a new generation of digitizing oscilloscopes, designed to keep pace with current and evolving needs in advanced design. They are also powerful tools for manufacturing test, R&D, and telecommunications applications.

Like the other members of the TDS Series, TDS 500 and TDS 600 digitizing oscilloscopes offer significant advantages over other instruments in four major areas:

High-fidelity acquisitions. In addition to their high sample rates, 1 GS/s and 2 GS/s, TDS 500 and TDS 600 Digitizing Oscilloscopes provide wide dynamic range, flat response, 8-bit vertical resolution, fast overdrive recovery, calibrated DC offset, 1 mV/division sensitivity and internal self-calibration. 2 GS/s sampling in the TDS 600 provides a full 500 MHz of real time bandwidth. The TDS 544A improves acquisition memory efficiency with its Fastframe™ segmentable memory.

Powerful and flexible triggering. TDS 500 and TDS 600 scopes help debug digital designs quickly with 10 extended triggering functions, including pulse width, four-input logic state and pattern, glitch and runt. Icons illustrate functions to facilitate learning and operation. A powerful video trigger option is available on the TDS 644A and TDS 544A which provides individual field and line triggering on all popular formats including HDTV.

Multiprocessor architecture. A Motorola 68020, Tek TriStar™ digital signal processor, and a powerful proprietary display processor combine to provide the power for waveform math, high-speed averaging, automatic limit testing, live measurements and variable persistence display.

Affordable performance that is easy to use. Extensive user interface design and testing has led to a truly intuitive line of instrumentation. A familiar front panel layout with dedicated vertical, horizontal and trigger controls, and a graphical user interface with icons help users easily grasp the operating details. A color monitor on the TDS 544A and TDS 644A enables the user to rapidly distinguish multiple waveforms and measurements. On-line help provides a convenient built-in reference manual.

500 MHz bandwidth

Sample rates to 2 GS/s on four channels

2 and 4 input channels

Pulse width, 2 ns glitch, runt, pattern and state triggering

1 mV/div –10 V/div sensitivity

Infinite and variable persistence

Record lengths to 50,000 points per channel

8-bit vertical resolution and up to 12 bits with HiRes

High resolution color monitor

3.5" DOS floppy disk drive

Color Grading

Vertical accuracy to 1%

Tek TriStar™ (DSP) processor for fast waveform processing and live measurement updates

Advanced signal processing functions

Waveform pass/fail testing

25 automatic measurements

Full GPIB programmability

Desktop publishing outputs

3 year warranty

HDTV Video trigger option

Segmentable acquisition memory

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Unique and advanced performance features include:

Limit testing. Compares waveforms against a template "on-the-fly", stopping acquisition or automatically saving the waveform whenever it violates the template. The TDS 644A and TDS 544A allow for template comparisons of math waveforms such as FFT. Templates can be easily created on-board by specifying waveform tolerances or down-loaded over the GPIB and saved in non-volatile waveform memories or on floppy disk.

Color graded variable persistence. The TDS 544A and TDS 644A provide historical information by color grading samples as they are acquired over time. TDS520/540/620/640 have intensity graded variable persistence for displaying signal changes.

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.

TEKPROBE™ interface. Provides flexible probing solutions including the P6205 high bandwidth active probe. The TDS 500/600 with the P6205 reduces adverse loading effects with 1 MΩ input impedance and less than 2 picofarads of capacitance. What you see is really what is there. The P6205 comes standard with the TDS 600 Series and optionally with the TDS 500 Series.

Advanced signal processing. TDS 500/600 waveform analysis can be extended through the addition of live FFT analysis, waveform integration, and differentiation.

TDS 500 Series TDS 600 Series Electrical Characteristics

	TDS 520/620	TDS 540/640/544A/644A
Channels	2 + 2 auxiliary	4
Samplers	2	4
Bandwidth[1]	500 MHz[2]	500 MHz[3]
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 520)	100 mV, 1.0 V, 10 V/div	NA
AUX 1, AUX 2 (TDS 620)	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 620)	±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	±1 V from 1 to 99.5 mV/div
AUX 1, AUX 2 (TDS 520)	100 mV/div ±.5 V 1 V/div ±5.0 V 10 V/div ±50 V	NA

Maximum Sample Rate

	TDS 520	TDS 540/544A	TDS 620	TDS 640/644A
One Channel	500 MS/s	1 GS/s	2 GS/s	2 GS/s
Two Channels	250 MS/s	500 MS/s	2 GS/s	2 GS/s
Four Channels	NA	250 MS/s	NA	2 GS/s

Vertical System

DC Gain Accuracy – TDS 500 ±1.0%; TDS 600 ±1.5%.

Vertical Resolution – 8 bits (256 levels over 10.24 vertical divisions).

Analog Bandwidth Selections – 20 MHz, 100 MHz, and full (Except Aux 1 and Aux 2 on TDS 520 are full BW only).

Input Coupling – ac, dc or GND.

Input Impedance Selections – 1 MΩ 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 MΩ or GND coupled.

Channel Isolation – ≥100:1 at 100 MHz and ≥30:1 at bandwidth for any two channels having equal Volts/div settings.

AC Coupled Low Frequency Limit – ≤10 Hz when ac 1 MΩ coupled. ≤200 kHz when ac 50 Ω coupled.

Acquisition Modes

Peak Detect (TDS 520/540/544A only) – High frequency and random glitch capture. Captures glitches of 4 ns 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.

Hi-Res (TDS 520/540/544A only) – Vertical resolution improvement and noise reduction on low-frequency signals, e.g. 12 bits at 50 µs/div and slower.

FastFrame™ (TDS 544A 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).

[1]Reduce the upper bandwidth frequencies by 2.5 MHz for each °C above 30°C.
[2]1 mV/div: 250 MHz, 2 mV/div: 350 MHz
[3]1 mV/div: 200 MHz, 2 mV/div: 300 MHz

Electrical Characteristics (continued)

Time Base System

	TDS 520/540/544A	TDS 620/640/644A
Time Bases	Main, Delayed.	
Time/Division Range	500 ps to 10 s/div	500 ps to 5 s/div.
Time Base Accuracy	±25 ppm over any interval ≥ 1 ms	±100 ppm over any interval ≥ 1 ms
Record Length	500 to 15000 pts. (50K pts. optional)	500 to 2000 pts.
Pre-Trigger Position	0 to 100% of record	20% to 80% of record

Trigger Types

EDGE (main and delayed)	Conventional level driven trigger. Positive or negative slope on any channel or rear panel auxiliary input (Except TDS 520). 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 2 ns to 1 s.
GLITCH	Trigger on or reject glitches of positive, negative or either polarity. Minimum glitch width threshold is 2.0 ns, 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.
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 520/620) plus clock edge on channel 4 (AUX2 on TDS 520/620). Triggerable on positive or negative clock edge.
Video (TDS 644A and TDS 544A option)	
NTSE, 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, 781.5/60) 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.

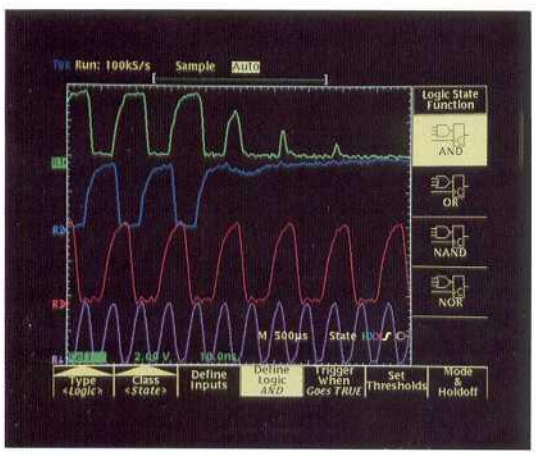
Main Trigger Modes – Auto, Normal, Single.

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 520) ≥1.5 kΩ; Max input voltage is ±20 V (dc + ac peak).



Pulse and logic triggering in the TDS 500 and 600 help quickly isolate fault conditions in high speed digital systems. The TDS 644A/544A color monitor makes complex displays easy to read.

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 644A/544A 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 (TDS 520/540/620/640) – With variable persistence selected, waveform points time-decay through 16 levels of intensity.

Update Rate – For 500 point waveforms with infinite persistence mode selected: 130/sec (TDS 500); 100/sec (TDS 600) typically.

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 Hi-Res or Average acquisition modes, Zoom provides an effective vertical dynamic range of 1000 divisions or 100 screens.

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.

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 – 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, PostScript, Interleaf, Deskjet, Laserjet, color PostScript, TIFF, PCX, BMP (Microsoft Windows), DPU 411/412, PCX color, RLE color.

Plotter – HPGL.

Interface – GPIB standard.

Hardcopy Interface (Standard on TDS 544A/644A, optional on TDS 520/540/620/640) – Centronics and RS-232.

Storage

Waveforms – (TDS 520/540/544A) 4 full 15,000 point records (50 K with option). (TDS 620/640/644A) 4 full 2000 point waveforms

Setups – 10 front panel setups.

Floppy Drive (TDS 644A/544A only) – Store reference waveforms, setups, and image files on 3.5" 1.44 MByte or 720 KByte DOS format floppy disk.

CRT

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

Type (TDS 644A/544A) – 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 – 47 to 63 Hz.

Power Consumption – 300 Watts max.

Environmental and Safety

Temperature – Operating: 0 to +50°C, Nonoperating: –40 to +75°C (with floppy drive +4 to +50°C).

Humidity – Operating and nonoperating: Up to 95% relative humidity at or below +40°C; to 75% relative humidity from +41 to +50°C (with floppy drive: operating to 80% at or below 29°C, to 20% from +30°C to +50°C.

Non-operating to 90% at or below 41°C, to 5% from +41°C to 50°C.)

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

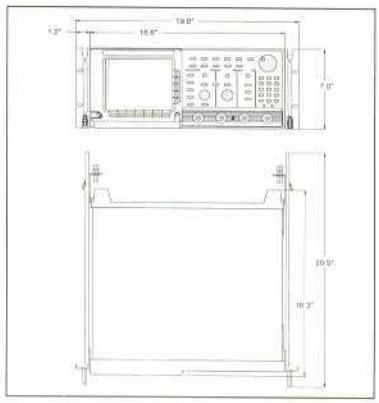
Electromagnetic Compatibility – Meets MIL-STD-461C, CE-03, Part 4, Curve #1, meets VDE 0871, Category B, FCC rules and regulations, Part 15, Subpart J, Class A.

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

Physical Characteristics

Weight – Net: Approximately 12.3 kg (27 lb). Shipping: Approximately 20.0 kg (44 lb).

Dimensions – Height: 236 mm (9.3 in.) with feet; 193 mm (7.6 in.) without feet. Width: 445 mm (17.5 in.) with handle. Depth: 432 mm (17.0 in) with front cover installed.



Ordering Information

TDS 500
TDS 600
Digitizing Oscilloscopes

TDS 520/540/544A Standard Accessories

- ☐ 2 ea P6139A Probes (TDS 520)
- ☐ 4 ea P6139A Probes (TDS 540/544A)
- ☐ Reference (070-8316-01)
- ☐ User Manual (070-8317-01)
- ☐ Programmer Manual (070-8318-04)
- ☐ Front Cover (200-3696-00)
- ☐ U.S. Power Cord (161-0230-01)

TDS 620/640/644A Standard Accessories

- ☐ 2 ea P6205 FET Probes (TDS 620)
- ☐ 4 ea P6205 FET Probes (TDS 640/644A)
- ☐ Reference (070-8505-01)
- ☐ User Manual (070-8506-01)
- ☐ Programmer Manual (070-8318-04)
- ☐ Front Cover (200-3696-00)
- ☐ U.S. Power Cord (161-0230-01)

Instrument Options

- ☐ **Option 05 (TDS 644A/544A only) –** Add Video Trigger; NTSC, PAL, HDTV, FlexFormat™
- ☐ **Option 1K –** K218 scope cart without power strip
- ☐ **Option 1M (TDS 520/540/544A only) –** 50K Memory Length
- ☐ **Option 1P –** HC100 4 pen plotter
- ☐ **Option 2P –** Tektronix Phaser 200e thermal wax transfer color printer
- ☐ **Option 1R –** Rack Mount
- ☐ **Option 2D (TDS 620 only) –** Delete 2 ea P6205 active probes
- ☐ **Option 2F –** Extended waveform math; FFT, Integration, Differentiation
- ☐ **Option 4D (TDS 640/644A only) –** Delete 4 ea P6205 active probes
- ☐ **Option 13 (TDS 520/540/620/640 only) –** Add RS-232C and Centronics hardcopy interfaces.
- ☐ **Option 9C –** NIST and MIL-STD-45662A Calibration Certificate
- ☐ **Option 22 (TDS 520 only) –** Two additional P6139A Probes
- ☐ **Option 23 (all except TDS 640/644A) –** Add 2 ea P6205 active probes
- ☐ **Option 24 (TDS 620/640/644A only) –** Add 4 ea P6139A probes
- ☐ **Option 29 (TDS 520/540/620/640 only) –** TD100 Data Manager
- ☐ **Option B1 –** Service Manual
- ☐ **Option M2 –** Extends warranty coverage through the first five years of product ownership
- ☐ **Option M3 –** Extends warranty coverage through the first five years of product ownership and provides 4 ea calibrations; one each in years two, three, four, and five.
- ☐ **Option M8 –** Provides 4 ea calibrations; one each in years two, three, four, and five.

Probes

- ☐ **P6139A –** Passive Probe
- ☐ **P6205 –** FET Probe
- ☐ **P6408 –** TTL Logic Probe
- ☐ **P6711 –** 500 nm to 950 nm optical converter
- ☐ **P6713 –** 1100 nm to 1700 nm optical converter
- ☐ **P6009A –** High Voltage Probe
- ☐ **AM 503S –** DC/AC Current Probe System*

Recommended Accessories

- ☐ Service Manual 070-8312-01 (TDS 520); 070-8314-01 (TDS 540); 070-8507-01 (TDS 620); 070-8508-01 (TDS 640); 070-8713-00 (TDS 544A); 070-8718-00 (TDS 644A)
- ☐ Tektronix Phaser 200e Color Printer
- ☐ K218 Scope Cart
- ☐ TVC 501 Time Interval to Voltage Converter (requires TM 500/5000 mainframe)
- ☐ C-9 Scope Camera
- ☐ C-9 Hood Adaptor (016-1145-00)
- ☐ Security Cable (012-1388-00)
- ☐ Soft-sided Carrying Case (016-0909-01)
- ☐ Transit Case (016-1135-00)

Software

- ☐ **S45F030 –** EZ TEST Program Generator
- ☐ **S3FT400 –** WaveWriter; AWG and waveform creation
- ☐ **S3FT001 –** Tek TMS; Test Management System
- ☐ **S3FG910 –** Labwindows

Cables

- ☐ RS232 (012-1298-00)
- ☐ Centronix (012-1250-00)
- ☐ GPIB (1 meter) (012-0991-01)
- ☐ GPIB (2 meters) (012-0991-00)

International Power Options

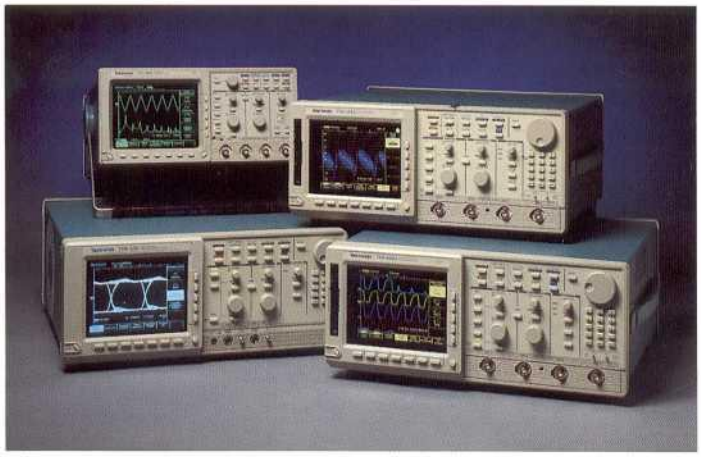
- ☐ **Option A1 –** Universal Euro. 220 V, 50 Hz
- ☐ **Option A2 –** UK 240 V, 50 Hz
- ☐ **Option A3 –** Australian 240 V, 50 Hz
- ☐ **Option A4 –** North American 240 V, 60 Hz
- ☐ **Option A5 –** Switzerland 220 V, 50 Hz

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

Warranty Information

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

The TDS Family of Digitizing Oscilloscopes



In addition to the TDS 500 and TDS 600 Series, the Tektronix TDS family of digitizing oscilloscopes includes the:

- TDS 400 Series with four channels at 100 MS/s and 150 MHz to 350 MHz bandwidth for electronic and electro-mechanical design applications.
- TDS 820 with 8 GHz bandwidth and 0.4 ps timing resolution for cost effective device characterization and telecommunciations installation and manufacturing applications.

Choose from a broad selection of accessories including the Tektronix Phaser 200e color printer.

For further information, contact:

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