

**TDS 520A**  
**TDS 524A**  
**TDS 540A**  
**TDS 544A**

**TDS 620A**  
**TDS 640A**  
**TDS 644A**

# Digitizing Oscilloscopes

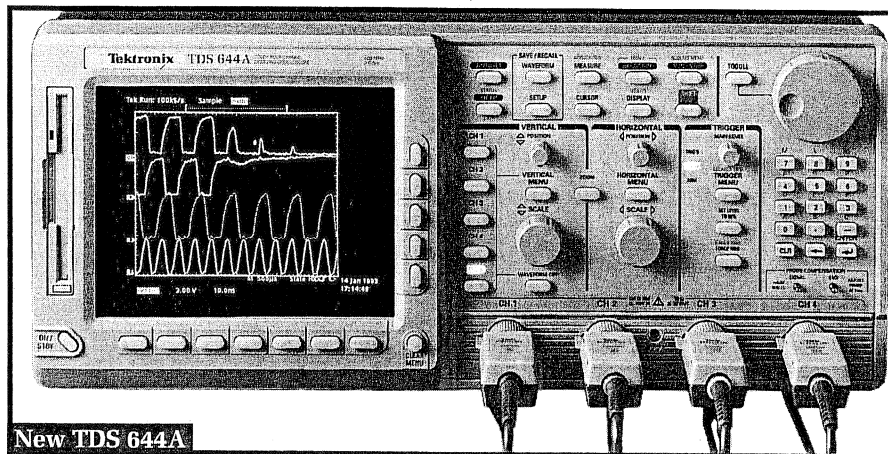
*Designed to keep  
 pace with  
 evolving needs  
 in digital design  
 as well as  
 manufacturing  
 test, R&D and  
 telecommunica-  
 tion applications.*

**TDS 520A/TDS 524A/  
 TDS 540A/TDS 544A/  
 TDS 620A/TDS 640A/  
 TDS 644A**

- 500 MHz Bandwidth
- Sample Rates to 2 GS/s
- 2 and 4 Input Channels
- Time Interval, 2 ns Glitch, Runt, Pattern and State Triggering
- HDTV Video Triggering
- 1 mV/div to 10 V/div Sensitivity
- Infinite and Variable Persistence Displays
- Record Lengths to 50,000 Points
- 8-Bit Vertical Resolution and Up to 12-Bit Resolution with Hi-Res Acquisition Mode
- Vertical Accuracy to 1%
- FFT, Integration and Differentiation
- 25 Automatic Measurements
- 2 pF FET Probes Standard on TDS 600A
- Color Monitor
- 3.5 in. DOS Format Floppy Drive
- VGA-Output to External Monitor
- Waveform Pass/Fail Testing

## APPLICATIONS

- Digital Design and Debug
- Analog Design and Debug
- Manufacture Testing
- Research



**New TDS 644A**

## SIGNAL ACQUISITION SYSTEM

	<b>TDS 520A/524A/620A</b>	<b>TDS 540A/544A/640A/644A</b>
Channels	2 + 2 auxiliary	4
Samplers	2	4
Bandwidth	500 MHz	500 MHz
Sensitivity		
CH 1, CH 2	1 mV to 10 V/div	1 mV to 10 V/div
CH 3, CH 4	NA	Same as CH 1 and CH 2
AUX 1, AUX 2 (TDS 520A/524A)	100 mV, 1.0 V, 10 V/div	NA
AUX 1, AUX 2 (TDS 620A)	Same as CH 1 and CH 2	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
AUX1, AUX2 (TDS 620A)	±10 V from 100 mV to 995 mV/div	±10 V from 100 mV to 995 mV/div
	±100 V from 1 to 10 V/div	±100 V from 1 to 10 V/div
CH 3, CH 4	NA	Same as CH 1 and CH 2
AUX 1, AUX 2 (TDS 520A/524A)	100 mV/div ±5 V	NA
	1 V/div ±5.0 V	
	10 V/div ±50 V	

To order, contact your local sales office (listed on the inside back cover) or call the National Marketing Center at 1-800-426-2200, Ext. 99.

**GPB**  
**IEEE-488**

The TDS Series complies with IEEE Standard 488.2-1987, and with Tektronix Standard Codes and Formats.

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## TIME BASE SYSTEM

	TDS 520A/524A/540A/544A	TDS 620A/640A/644A
Time Bases	Main, Delayed	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

<b>Edge</b> (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.
<b>Pulse</b> (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 returning across the first.
<b>Logic</b> (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 (AUX 1 on TDS 520A/524A/620A) plus clock edge on channel 4 (AUX 2 on TDS 520A/524A/620A). Triggerable on positive or negative clock edge.
<b>Video</b> (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.

## MAXIMUM SAMPLE RATE

	TDS 520A/524A	TDS 540A/544A	TDS 620A	TDS 640A/644A
Single Channel	500 MS/s	1 GS/s	2 GS/s	2 GS/s
Dual Channels	250 MS/s	500 MS/s	2 GS/s	2 GS/s
Four Channels	NA	250 MS/s	NA	2 GS/s

## CONFIGURATION

Feature	TDS 520A/540A TDS 620A/640A	TDS 524A/544A TDS 644A
Monitor	Mono	Color
VGA-out	Mono	Color
Floppy Drive	Optional	Standard
DSP Math	Optional	Standard
RS232 and Centronics	Optional	Standard

## VERTICAL SYSTEM

**DC Gain Accuracy** – TDS 500A ±1.0%;  
TDS 600A ±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 520A/524A are full BW only).

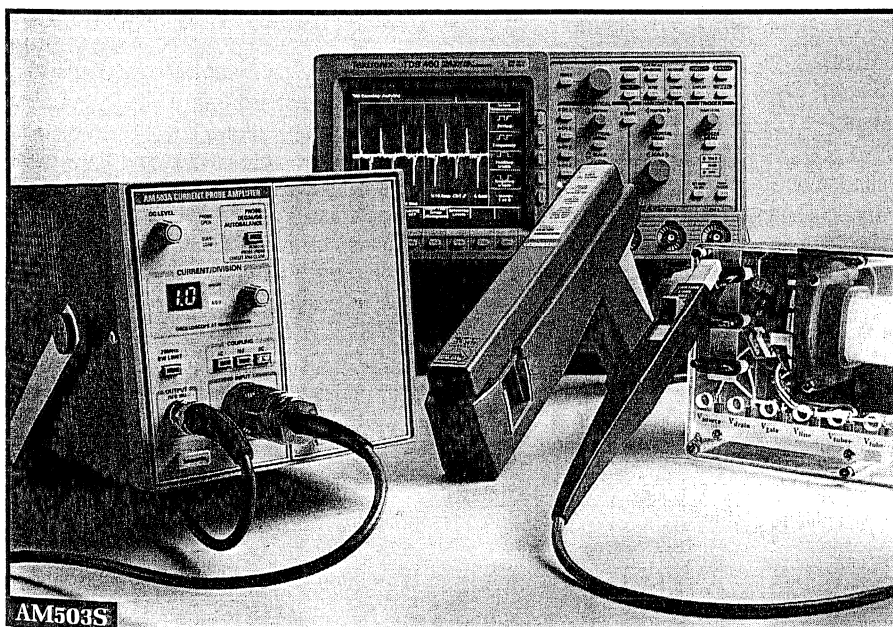
**Input Coupling** – AC, DC or GND.

**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.



## • ACCESSORY •

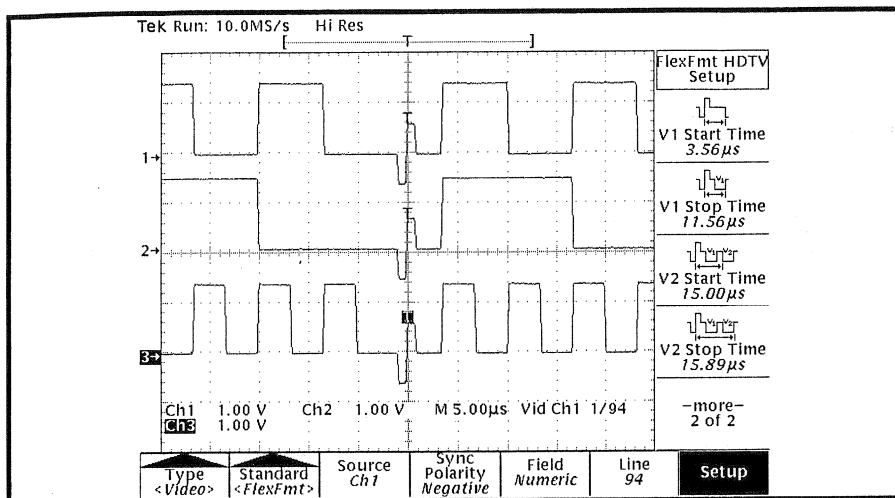
### Current Measurement Power AM503S

- Simultaneous AC/DC broadband current measurement system.
- DC to 50 MHz (20A continuous/100A peak) with A6302 probe.
- DC to 15 MHz (100A continuous/500A peak) with A6303 probe.
- Clip onto conductor without having to break circuit.

For complete selection information on all Accessory products, see page 424.

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# Digitizing Oscilloscopes



## ACQUISITION MODES

**Peak Detect** (TDS 500A only) – High frequency and random glitch capture. Captures glitches of 4 ns using acquisition hardware at all realtime 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 500A only) – Vertical resolution improvement and noise reduction on low-frequency signals, e.g. 15 bits at 5 ms/div and slower.

## TRIGGERING SYSTEM

**Triggers** – Main, Delayed.

**Main Trigger Modes** – Auto, Normal, Single.

**Delayed Trigger** – Delay 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).

**FastFrame™** (TDS 500A only) – Segment acquisition memory into as many as 910 segments for trigger rates over 50,000 per second.

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

**External Rear Input** – (except TDS 520A/524A) >1.5 kΩ; Max input voltage is ±20 V (DC + AC peak).

## DISPLAY

**Waveform Style** – Dots or vectors. Infinite and variable persistence selectable from 250 ms to 10 s.

**Gray Scaling** – With variable persistence selected, waveform points gradually decay through 16 levels of intensity, providing “z-axis” information about rapidly changing waveforms.

**Color Grading** (TDS 524A/544A/644A only) – With variable persistence selected, waveform points gradually decay through the color spectrum, providing historical information.

**Update Rate** – [For 500 point waveforms with infinite persistence display mode selected] 200 waveforms per sec (TDS 500A). 100 waveforms per sec (TDS 600A).

**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.

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

**Color CRT Type** (TDS 524A/544A/644A) – 7 in. diagonal NuColor™ liquid crystal full-color shutter with 256 levels.

**CRT Resolution** – 640 horizontal by 480 vertical displayed pixels for both monochrome and color displays.

## ZOOM

The zoom feature allows waveforms to be expanded, compressed and positioned 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.

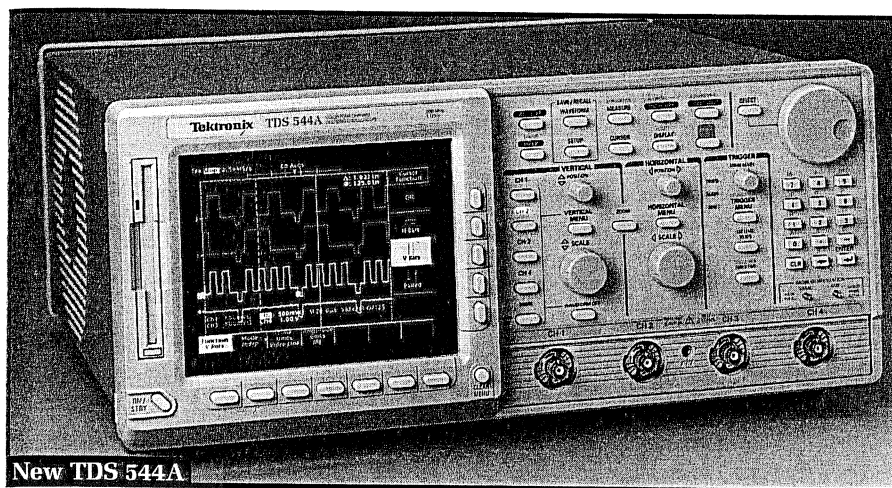
## MEASUREMENT SYSTEM

### 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.

# Digitizing Oscilloscopes



New TDS 544A

## VERTICAL SYSTEM

**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; 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** (Optional with TDS 520A/540A/620A/640A) – FFT, Integration, Differentiation.

**FFT** – Frequency Range: DC to 500 MHz. Amplitude Display: Power is dBV RMS, Linear RMS. Phase is degrees, radians. Signal to Noise: 55 to 65 dB (Avg or HiRes). Transform Size: 500 to 10,000 points selectable. Windowing: Rectangular, Hamming, Hanning, Blackman-Harris.

**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.

## HARD COPY/DESKTOP PUBLISHING

**Printer** – Tektronix Phaser, 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). (Centronics and RS-232 are optional with TDS 520A/540A/620A/640A.)

**Floppy Disk Drive** (Optional with TDS 520A/540A/620A/640A) – 3.5 in. 1.44 MB DOS format.

**VGA Output** – 15-Pin analog output. Color for TDS 524A/544A/644A and monochrome for TDS 520A/540A/620A/640A.

## STORAGE

**Waveforms** – (TDS 520A/524A/544A) 4 full 50,000 point records. (TDS 620A/640A/644A) 4 full 2000 point waveforms. 1,436 50K pt. waveforms to 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.

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## 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. 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 J, Class A.

**Safety** – Listed UL 1244, certified to CAN/CSA – C 22.2 No. 231-M89.

## PROBES

**P6205 Active Probe** – 10 x, 2 pF, 750 MHz FET (standard with TDS 600A).

**P6139A Passive Probe** – 10 x, 8 pF, 500 MHz (standard with TDS 500A).

## 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
<b>Weight</b>	<b>kg</b>	<b>lb.</b>
Net ≈	12.3	27
Shipping ≈	20.0	44