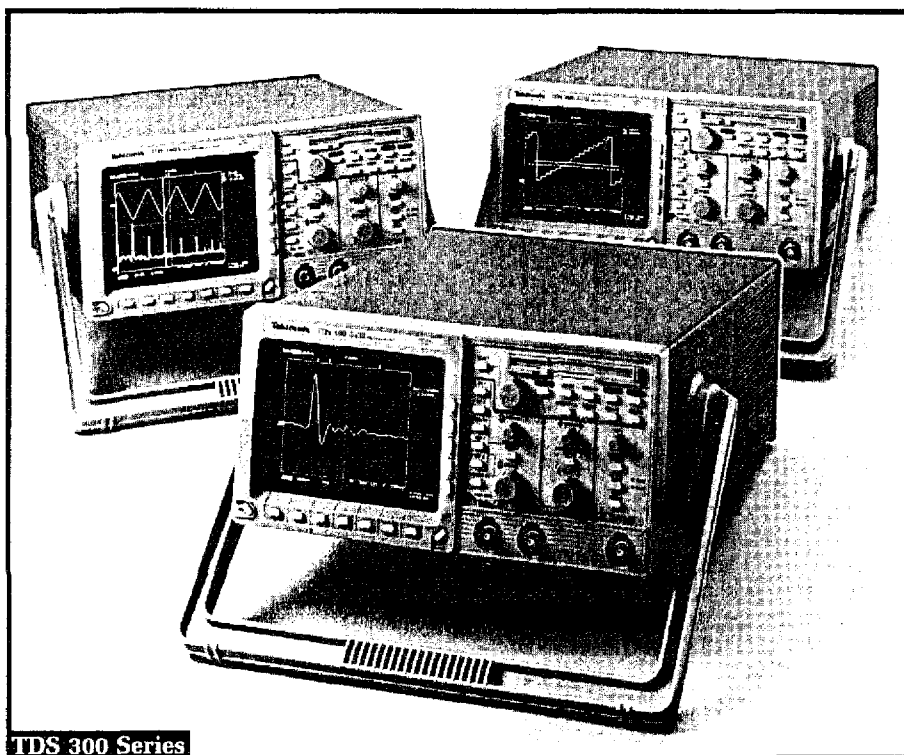# Digital Real-Time™ Oscilloscopes
TDS 340A • TDS 360 • TDS 380

Features

- 100 MHz, 200 MHz, 400 MHz Bandwidths
- 500 MS/s, 1 GS/s, 2 GS/s Sampling Rates
- Two Input Channels
- Built-In 3.5 in. Floppy Disk Drive
- 2 mV/div to 10 V/div
- AutoSetup
- Accumulate Display Modes
- 2% Vertical Accuracy
- 1 K Record Length
- Roll Mode
- 21 Automatic Measurements
- FFT Analysis
- 10 ns Peak Detect for High-speed Glitch Capture
- Option 14 for GPIB, RS-232-C Programmability, Parallel Printer Interface, & VGA Monitor Output

TDS 300 Series

Tektronix Digital Real-Time

With the TDS 300 Series, Tektronix redefines the low-cost digital oscilloscope. No other digital scope offers as much bandwidth and sample rate for the price. By simultaneously sampling at up to five times their bandwidth on both channels, the TDS 300 Series assures you of true acquisitions, minimizing aliasing or other digital sampling effects. Unlike other DSOs, the TDS 300 Series easily gathers enough samples to display waveforms accurately at their full bandwidth. These are the only scopes in their class to reliably acquire high speed transient or single-shot events to their full bandwidth.

Many low-cost DSOs offer only dot displays, which can be hard to interpret, especially for those accustomed to analog oscilloscopes. The TDS 300 Series has Dot, Dot Accumulate, Vector, and Vector Accumulate displays. The Accumulate display modes gather multiple waveforms for a user-defined time (500 ms to ∞), after which the screen is erased. Vector Accumulate mode uses bright vectors to superimpose the current acquisition over the accumulated waveforms. The display is erased at the user-defined time or when the acquisition setting is changed. These modes are useful for doing worst case analysis or signal monitoring. Long term monitoring is easily accomplished by setting the erase time to infinity.

OVERSAMPLING MINIMIZES ALIASING
All of the TDS 300 scopes sample at five times their bandwidth, assuring users of accurate real-time acquisition up to the full bandwidth of the scope, even for single-shot events. This is well beyond the theoretical two samples per period necessary for a DSO to acquire a true signal. If a DSO cannot sample at least twice as fast as the highest frequency component, aliasing occurs and the scope displays a waveform with a lower frequency than that of the actual input signal. The TDS 300 Series' high degree of oversampling not only minimizes aliasing, it also provides a higher resolution waveform.

ACQUISITION POWER
With edge triggering and basic video triggering as standard features, the TDS 300 Series can capture the waveforms that designers and service technicians must see.

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In addition to 21 automatic waveform measurements, these scopes have four acquisition modes. *Sample* mode provides real-time sampling at the highest throughput rate. At slower sweep speeds, *Peak Detect* indicates if there is higher frequency information buried in a waveform, warning the user to increase the sweep speed to avoid aliasing. *Envelope* mode, by including the highest and lowest points over many acquisitions, shows variations in the signal over time. From several acquisitions, *Average* mode calculates an average value for each waveform point, reducing apparent noise in repetitive signals.

ANALOG SIMPLICITY, DIGITAL PRODUCTIVITY
By balancing the use of on-screen menus with dedicated buttons and knobs, the user-friendly TDS interface retains traditional analog simplicity yet gives quick access to the wide range of digital functions. Frequently used functions, like position and trigger level, are controlled directly with buttons and knobs; secondary functions are menu-driven, eliminating the profusion of buttons found on most low-cost scopes.

The modern graphical user interface dramatically reduces learning time, appealing to users regardless of their digital scope experience. The interface simplifies scope operation without limiting the instrument's capabilities.

3.5 IN. FLOPPY DISK DRIVE
All three models include a 3.5 inch, DOS-compatible floppy disk drive. Simply save screen images or data to disk, then insert the disk into your PC for importing to desktop publishing or spread sheet programs.

ADVANCED MATH SIGNAL PROCESSING/FFT
Waveform functions are extended through the addition of "live" FFT analysis of waveforms. This added function makes the TDS 300 Series ideal for research and analysis applications, such as power supply design and mechanical analysis where power line harmonic distortion and resonance are critical measurements.

COMMUNICATIONS AND PRINTING
Option 14, the communications option, includes GPIB and RS-232-C interfaces, VGA monitor output, and a Centronics-type parallel printer port. With this option one can control the scope from a remote computer for automated testing or waveform and measurement data exchange.

Interleaf (.img), TIF, PCX, BMP, and EPS file formats allow screen captures to be placed directly into desktop published documents. Or, at the push of a button, the scope display can be output directly to a variety of compatible printers.

For service, education, and design work, the *TDS 300 Series is without peer among low-cost DSOs.*

WAVESTAR™ SOFTWARE
WaveStar software is a new Windows 3.1 application (operation verified under Windows 95) that allows the user to quickly create an *electronic lab notebook within their PC. With it,* scientists, engineers, or technicians can record measurements made with any TDS 300 Series, Opt. 14 DSO, along with all related screen shots, scope settings, and notes. WaveStar software also provides a simple link to current spreadsheet and documentation software, enabling the user to analyze measurements and incorporate them in reports and other documents. WaveStar software replaces the DOS-based DocuWave® (S60DWAV) software. An upgrade from DocuWave software to WaveStar software is available, subject to the minimum system requirements associated with WaveStar software.

System/Hardware Requirements – IBM-compatible PC 386 (486 or higher recommended), 4 MB RAM, 5 MB of free hard disk space, Microsoft Windows 3.1, one 3.5 in. high-density disk drive, graphics adapter capable of VGA resolution, Opt. 14 for scope, and National Instruments GPIB interface card (IEEE Std 488.2; Version C.12 or later) with GPIB cable, or one RS-232 COM port with RS-232 cable.

Windows Clipboard – Copy/paste through the Windows Clipboard to other Windows applications as bit maps or Windows metafiles.

Waveform Export Format – Excel 4.0 compatible.

Printer/Plotter Support – Uses standard Windows printer drivers supplied by printer vendor.

Characteristics

SIGNAL ACQUISITION SYSTEM
Bandwidth –
TDS 340A: 100 MHz.
TDS 360: 200 MHz.
TDS 380: 400 MHz.

Sample Rate –
TDS 340A: 500 MS/s on each channel.
TDS 360: 1 GS/s on each channel.
TDS 380: 2 GS/s on each channel.

Channels – Two identical channels, each with invert function.

Sensitivity – 2 mV to 10 V/div (with calibrated fine adjust).

Position Range – ±5 divisions.

Calibrated Offset Ranges –

Volts/Div Setting	Offset Range
2 – 99.5 mV/div	±1 V
100 – 995 mV/div	±10 V
1 – 10 V/div	±100 V

DC Gain Accuracy – ±2%.

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

ACQUISITION MODES
Sample, Envelope, Average

Peak Detect – High frequency and random glitch capture; Captures glitches as narrow as 10 ns using acquisition hardware at all time/div settings between 25 µs/div and 5 s/div (inclusive).

TIME BASE SYSTEM (MAIN AND DELAYED)
Time/Division Range –
TDS 340A: 5 ns to 5 s/div.
TDS 360: 2.5 ns to 5 s/div.
TDS 380: 1 ns to 5 s/div.

Record Length – 1000 sample points per channel.

Horizontal Accuracy – ± 0.01%.

Roll Mode – 0.1 s/div and slower when Auto *Trigger Mode is selected.*

TRIGGERING SYSTEM (MAIN ONLY)
Trigger Types – Edge, Video.

Trigger Modes – Auto, Normal.

Trigger Inputs – CH1, CH2, Line, External.

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Video-Type Trigger Formats and Field Rates –
Triggers on Field 1, Field 2, Any Field (noninterlaced systems), or Lines; from Sync-negative composite video. Triggers on broadcast standard NTSC, PAL, or SECAM video and other interlaced and noninterlaced video with horizontal line rates from 15 to 65 kHz (in 5 ranges) and field rates from 50 to 60 Hz.

DISPLAY
Sin(x)/x Interpolation.

Vector – Connects sample points to display a continuous waveform.

Dots – Displays sample points only.

Vector Accumulate Mode – Accumulates waveform points over a pre-set period of time (500 ms to ∞) and superimposes the current waveform with bright vectors.

Dot Accumulate Mode – Accumulates waveform points over a pre-set period of time (500 ms to ∞).

Format – YT and XY.

AUTOMATIC MEASUREMENTS
Period
Frequency
+Width
–Width
Rise Time
Fall Time
+Duty Cycle
–Duty Cycle
+Overshoot
–Overshoot
High
Low
Max
Min
Pk–Pk
Amplitude
Mean
Cycle Mean
RMS
Cycle RMS
Burst Width.

CURSORS
Types – Horizontal bars, vertical bars, paired (volts @ time).

Measurements – Absolute volts, Δ volts, time, and frequency.

PHYSICAL CHARACTERISTICS

Dimensions	Portable mm	In.	Rackmount mm	In.
Width w/ handle	362	14.3	483	19
Height w/ pouch	191	7.5		
w/o pouch	165	6.5	178	7
Depth (stand alone)	472	18.6	472	18.6
w/ front cover	490	19.3		
w/ handle(s)	564	22.2	518	20.4
Weight	**kg**	**lbs.**	**kg**	**lbs.**
TDS 300	6.9	15.5		
Domestic Shipping	13.1	29	14.4*1	32*1

*1 Weight of conversion kit only.

WAVEFORM PROCESSING
Arithmetic Operators – Add, subtract, multiply.

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

FFT Analysis – A mixed radix FFT routine is applied to the time domain waveforms to analyze frequency content. A Hanning Window is always applied to the acquired signal. The display uses dBV$_{RMS}$ vertical scaling.

NON-VOLATILE STORAGE
Waveforms – Two 1000 point reference waveforms.

Setups – 10 front panel setups.

Floppy Drive – 3.5 in., 1.44 MB or 720 K DOS-compatible; PC formats: .BMP, .TIF, .PCX, .EPS; spreadsheet formats: Excel, Lotus123, and MathCAD for mathematical modeling and analysis.

OPTION 14: I/O INTERFACE
GPIB (IEEE-488.2) Programmability –
Full talk/listen modes; Control of all modes, settings, and measurements.

RS-232-C Interface Programmability –
Full talk/listen modes; Control of all modes, settings, and measurements. Baud Rate up to 38,400. 9-Pin, DTE.

VGA – Monitor output for direct display on large VGA-equipped monitors.

Hardcopy Port – Centronics-type parallel, RS-232-C, or GPIB.

DC Power for Printer

Programmer Manual – (070-9442-00).

HARD COPY CAPABILITY
Graphics File Formats – Interleaf (.img), TIF, PCX (PC Paintbrush), BMP (Microsoft Windows), and Encapsulated PostScript (EPS).

Printer Formats – Thinkjet, Deskjet, Laserjet, Epson (9- & 24-Pin), Seiko DPU 411/II, DPU 412.

MECHANICAL
Cooling Method – Forced air circulation with no air filter.

ENVIRONMENTAL AND SAFETY
Temperature –
–10° to +55° C (operating);
–51° C to +71° C (nonoperating).

Humidity –
Up to 95% RH at or below +40° C;
up to 75% RH from 41° C to 55° C (operating and nonoperating).

Altitude –
To 15,000 ft/4,570 m (operating);
to 40,000 ft/12,190 m (nonoperating).

Electromagnetic Emissions –
Meets EN50081-1; VFG 0243; FCC Rules and Regs, 47 CFR, Part 15, Subpart B, Class A.

Safety – UL 3111-1 Listed, EN61010 Certified CAN/CSA C-22.2 No. 1010.1-92.