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Digital Phosphor Oscilloscopes

TDS7000 Series



Performance, Simplicity and Connectivity

TDS7000 Series oscilloscopes are high performance solutions for verification, debug and characterization of sophisticated electronic designs. The family features exceptional signal acquisition performance, operational simplicity and open connectivity to the design environment. Classic analog-style controls, a large touch-sensitive display and graphical menus provide intuitive control. Open access to the Microsoft Windows operating system enables unprecedented customization and extensibility.

Superior Performance

TDS7000 models range from 500 MHz to 4 GHz bandwidth with single-shot sample rates to 20 GS/s, meeting demands of the latest high speed logic families and multi-Gigabit communication standards. Acquisition memory options from 2 to 32 Megasamples maximize the value of high sample rate and ensure that critical events are captured with fine detail.

High performance jitter analysis to 1.5 ps RMS is achieved through exceptional trigger and acquisition performance, deep memory and applied software.

TDS7000 Series high bandwidth signal access solutions include the P7240 4 GHz (120 ps rise time) active probe and the P7330 3.5 GHz (< 130 ps rise time, typical, < 140 ps guaranteed) differential probe. Small form-factors and a wide array of tip accessories ensure effectiveness. In addition, the TDS7404, TDS7254 and TDS7154 include the TekConnect™ signal interconnect system. This interface replaces traditional BNC input connectors with a convenient positive-locking interface suitable for higher system bandwidths. P7000 Series probes are directly compatible with TekConnect signal interconnect system along with adapters that provide SMA, BNC and N connections.

Features & Benefits

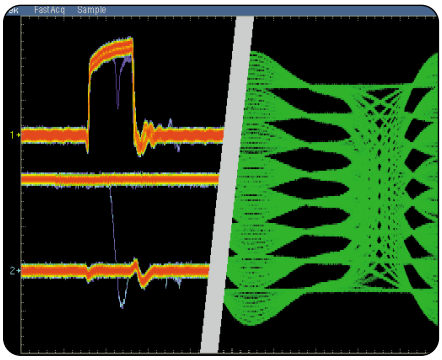
- 4 GHz, 2.5 GHz, 1.5 GHz, 1 GHz and 500 MHz Bandwidth Models
- Up to 20 GS/s Real-time Sample Rate
- Up to 32 Megasamples Memory Depth
- >400,000 Wfms/second Maximum Waveform Capture Rate
- Optional Communications Mask Testing Up to 2.5 Gb/s Rates
- Optional Clock Recovery from Serial Data Streams
- Optional 32-bit Serial Trigger for Isolation of Pattern-dependent Effects
- 10 MHz Timebase Reference Input for Enhanced Accuracy and Repeatability
- Graphical User Interface
- Control via Classic Direct Controls, Touch-sensitive Color Display or Mouse Navigation
- Open Microsoft Windows Environment
- Built-in Networking

Applications

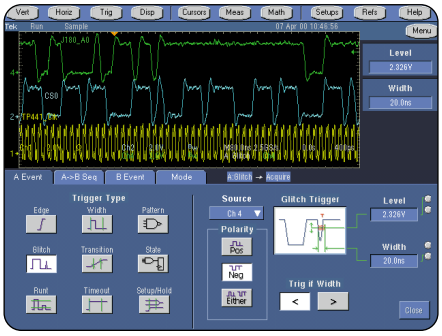
- Verification, Debug and Characterization of Sophisticated Designs
- Design Development and Compliance Testing of Serial Data Streams Up to 2.5 Gb/s Rates for Telecom and Datacom Industry Standards
- Debugging Telecom, Datacom and Storage Area Network Equipment Designs and High Speed Backplanes
- Signal Integrity, Jitter and Timing Analysis
- Spectral Analysis
- Disk Drive Analysis
- Investigation of Transient Phenomena

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Enabling Innovation

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▶ ***Figure 1.*** *Digital Phosphor technology provides unprecedented waveform capture rate, maximizing the probability of discovering hidden faults and revealing dynamic signal behavior.*



▶ ***Figure 2.*** *Extensive use of illustrations helps users locate advanced features quickly and apply them with confidence.*

Digital Phosphor Oscilloscopes

Signal observation time is critical for successful discovery of intermittent faults and characterization of complex dynamic signals. TDS7000 Series Digital Phosphor Oscilloscopes incorporate 3rd generation DPX™ technology to enable maximum waveform capture rates of more than 400,000 waveforms per second. This unprecedented performance allows users to fully visualize signal activity. In troubleshooting applications, Digital Phosphor can save minutes, hours or even days by quickly revealing the nature of faults so sophisticated trigger modes can be applied to isolate them.

Operational Simplicity

The TDS7000 Series graphical user interface delivers sophisticated capability to advanced users without intimidating occasional users. The front panel includes a complete set of classic analog-style controls for most commonly used features. For advanced use, the combination of large 10.4 in. (264 mm) touch sensitive display and graphical interface creates a highly visual environment with explicit illustration of instrument features. The waveform display area remains visible even when displaying control windows, so changes in the waveform aren't missed when making selections or adjustments. Context-Sensitive Help supplements graphic control windows and encourages users to apply advanced capabilities to solve their problems.

The adaptable TDS7000 Series human interface readily supports any operating style and environment. Users can select traditional instrument-style buttons for navigation or switch to a Microsoft Windows menu bar. Classic analog-style controls provide instant access to the most frequently used functions while the large touch sensitive display provides intuitive menu operation. Waveform positions, cursor locations and trigger level can be directly dragged using the touch screen or a mouse. A graphical drag-box can be used to select a waveform area for zooming, histogram analysis or measurement gating. The USB interface allows a mouse, keyboard and other peripherals to be added without powering off the instrument. With this flexibility, TDS7000 Series instruments readily adapt to a cart, cluttered bench top, shelf, floor and other locations that otherwise make operation awkward.

Serial Communications Signal Analysis

Options SM (serial mask testing) and ST (serial trigger) add powerful features for the analysis and testing of serial communications signals, including

- ▶ Mask testing
- ▶ Clock recovery
- ▶ Waveform database acquisition
- ▶ Eye pattern measurements
- ▶ Serial pattern triggering

Mask Testing

Option SM provides a complete portfolio of masks for verifying compliance to serial communications standards up to 2.5 Gb/s rates. Users can easily tailor mask testing for specific requirements through additional features including:

- ▶ One-button mask Autoset
- ▶ Optional Auto-Fit process minimizes hits
- ▶ Mask Margin control adjusts tolerance during testing
- ▶ Hit-counting identifies location and degree of failures
- ▶ Optional test-related actions including notification, logging and hardcopy.
- ▶ Built-in mask editing

Masks for optical standards are included for use with external optical reference receivers (ORR) or O/E converters when ORR performance is not required. The TDS7000 Series is complemented by the CSA7000 Series which includes optical input, ORR filters, clock recovery and serial pattern trigger to provide a versatile solution for verifying compliance to optical and electrical communications standards. Refer to the CSA7000 Series specifications for a detailed list of standards and the powerful array of mask testing features available in both families.

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Clock Recovery

Option SM on the TDS7154, TDS7254 and TDS7404 includes clock recovery for electrical serial data streams from 1.5 Mbaud to 2.5 Gbaud. Users can easily and reliably perform mask testing and parametric analysis with a single connection.

Communications Measurements

Option SM adds a broad suite of eye-pattern related measurements that are fundamental for analysis of serial communications signals, including eye width, eye height, jitter, noise and extinction ratio. These are built on the waveform database acquisition mode which provides information over a much larger sample of data, ensuring stable and accurate results.

Serial Pattern Trigger

Option ST (serial trigger) available on the TDS7154, TDS7254 and TDS7404 models provides hardware-based serial pattern trigger. This option provides a direct means to discriminate patterns within serial data streams and analyze pattern dependent issues, even on a single-shot basis. Users can specify patterns with up to 32 bits, including "don't care" bits. The serial trigger system can be clocked from an external source or internal clock recovery can be applied, providing single connection convenience.

External Timebase Reference

The reference oscillator in TDS7154, TDS7254 and TDS7404 models can be phase-locked to an external 10 MHz source to match stability or synchronize multiple instruments. This phase-lock technique can also enable characterization of very low frequency wander and modulation effects.

Application-specific Extensions

Applied measurement extensions can be installed to enhance TDS7000 capabilities. These software applications build on the precision acquisition performance of TDS7000 Series to address the need for application specific measurements to quickly quantify device and system performance. Optional applications include:

- Jitter analysis for high speed clock and data signal characterization
- Compliance testing for signaling defined in ITU-T G.703 and ANSI T1.102 communications standards
- Compliance testing for signaling defined in USB1.0 standard and USB2.0 draft standard
- Disk drive read channel, head and media measurements to IDEMA standards; PRML measurements
- VocalLink™ voice control software for TDS7000 Series oscilloscopes

Application-specific Extensions

The TDS7000 family contains many extended features to quantify and document signal characteristics. These features remain close at hand without cluttering the human interface. Applied measurement extensions can be installed to enhance TDS7000 capabilities. Optional applications include jitter analysis (TDSJIT2) and disk drive measurements (TDSDDM2). These applications build on the precision signal acquisition performance of the TDS7000 Series to address the need for application-specific measurements to quickly quantify device performance.

Intuitive Zooming

TDS7000 acquired waveforms are always horizontally fit into the display. This "big picture" is retained for context while zoom is used to select areas of specific interest. Waveform zoom can be directly controlled with knobs or the graphical user interface for intuitive interaction.

Parametric Measurements

The TDS7000 includes a complete parametric measurement system for signal characterization. Direct selection from a graphical palette makes locating choices simple. Users can quickly reassign measurements to a different waveform, simplifying verification tasks. Split cursors make it easy to measure trace-to-trace timing characteristics. Measurement statistics can be gathered for deeper insight. Measurement results are easily extracted for inclusion in a document or analysis in a spreadsheet using the Microsoft Windows clipboard or an Export function.

Powerful Math

The TDS7000 Series allows user defined math expressions to be performed on waveform data giving them the opportunity to get on-screen results in terms that they can define. Common waveform math functions are provided at the touch of a button. For advanced applications, algebraic expressions consisting of waveform sources, math functions, measurement values and scalars can be created easily using a calculator-style editor. This allows users to quickly transform raw waveform data into powerful information that is readily interpreted.

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Enhanced Spectral Analysis

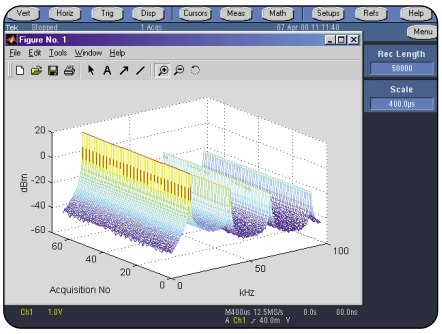
The TDS7000 Series includes a unique spectrum-analyzer style interface for performing frequency domain analysis. Controls such as center frequency, frequency span, resolution bandwidth and reference level provide access to wide- or narrow-band frequency, phase and group delay information. A gating function allows selection of only a portion of the time-domain signal for analysis.

Complete Connectivity

The TDS7000 Series combines a high performance real-time oscilloscope with a PC processor in a self-contained unit. With open access to the Windows operating environment, built-in applications such as WordPad, Paint and Internet Explorer allow users to concurrently maintain lab notes and reference design information while working with the instrument, saving time and reducing errors. The built-in floppy disk drive provides a convenient means of transporting results while the standard network interfaces allow easy file sharing and remote control. The analysis and connectivity software of the TDS7000 Series provides a comprehensive software infrastructure for faster, more versatile operations. Industry-standard protocols, such as VISA and ActiveX Controls, are included for using and enhancing Windows applications such as Excel for data analysis and documentation. Or, create custom software to automate multi-step processes in waveform collection and analysis with Visual BASIC, C, C++, MATLAB, HP VEE, and other common development environments. By hosting applications on the instrument and using the embedded PCI bus, waveform data can be moved directly from the acquisition system to analysis applications at much faster speeds than conventional cable connections. Integration of the instrument with external PCs and non-Windows hosts is also supported by TDS7000 Series software solutions. Plug-and-play drivers are included to enable fast and easy communication with LabVIEW, Lab Windows and HP VEE programs using GPIB and LAN connections. Applications using a local area network can connect directly to a TDS7000 Series analyzer using the VXI 11.2 server included in the instrument.

View The Microsoft Windows Desktop On A Separate Monitor

TDS7000 can also be expanded with the addition of an external monitor. With dual-monitor mode enabled, the instrument retains live scope displays while other applications such as publishing, analysis or browsing tools reside on the external monitor. Users can easily transfer images and waveform data from TDS7000 to the locally running application or view Web-based reference information while using the scope for design work.



▶ ***Figure 4.*** *Open access to the Microsoft Windows desktop allows users to leverage standard tools for documentation, analysis, information browsing and communications.*

Standard Interfaces

The TDS7000 includes standard interfaces for control and peripheral expansion. The GPIB command set shares a high degree of commonality with previous TDS500/700-class instruments while increasing hardware and software performance. Both USB and PS-2 interfaces are included for mouse, keyboard and other peripheral expansion. USB offers the advantage of hot-insertion and removal so devices can be added or removed without cycling power. The TDS7000 also includes a LAN interface for network connection.

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▶ Characteristics

▶ Vertical System

	TDS7054	TDS7104	TDS7154/TDS7254	TDS7404
Input Channels	4	4	4	4
Analog Bandwidth (–3 dB)	500 MHz	1 GHz	2.5 GHz (TDS7254) 1.5 GHz (TDS7154)	4 GHz
Calculated Risetime 10 mV/div to 1 V/div	800 ps	400 ps	160 ps (TDS7254) 240 ps (TDS7154)	100 ps
Hardware Bandwidth Limits	250 MHz or 20 MHz			
Input Coupling	AC, DC, Gnd		DC, Gnd	DC, Gnd
Input Impedance	1 MΩ ± 0.5% or 50 Ω ± 1%		50 Ω ± 2.5%	50 Ω ± 2.5%
Input Sensitivity, 1 MΩ	1 mV/div to 10 V/div			
Input Sensitivity, 50 Ω	1 mV/div to 1 V/div		2 mV/div to 1 V/div	2 mV/div to 1 V/div
Vertical Resolution	8-Bit (> 11-Bit w/averaging)		8-Bit (> 11-Bit w/averaging)	8-Bit (> 11-Bit w/averaging)
Max Input Voltage, 1 MΩ	± 150 V CAT I Derate at 20 dB/decade to 9 V_{RMS} above 200 kHz			
Max Input Voltage, 50 Ω	5 V_{RMS}, with peaks less than ± 30 Volts		Determined by TekConnect™ Accessory	Determined by TekConnect Accessory
DC Gain Accuracy	1.00%		± (2% + (2% * offset))	± (2% + (2% * offset))
Offset Range	1 mV/div to 100 mV/div ± 1 V 101 mV/div to 1 V/div ± 10 V 1.01 V/div to 10 V/div ± 100 V		2 mV to 50 mV/div ± 0.5 V 50.5 mV to 99.5 mV ± 0.25 V 100 mV to 500 mV ± 5 V 505 mV to 1 V/div ± 2.5 V	2 mV to 50 mV/div ± 0.5 V 50.5 mV to 99.5 mV ± 0.25 V 100 mV to 500 mV ± 5 V 505 mV to 1 V/div ± 2.5 V
Channel-to-channel Isolation Any Two Channels at Equal Vertical Scale Settings	≥100:1 at 100 MHz and ≥30:1 at the Rated Bandwidth		≥100:1 at < 2-5 GHz and ≥40:1 at 4 GHz	≥100:1 at < 2-5 GHz and ≥40:1 at 4 GHz

Note: Typical system bandwidth of TDS7404 with P7240: 4 GHz.

Note: Typical system bandwidth of TDS7404 with P7330: 3.5 GHz.

Timebase System

	TDS7054 TDS7104	TDS7154/TDS7254	TDS7404
Timebase Range	200 ps/div to 40 s/div	50 ps to 10 s/div	50 ps to 10 s/div
Timebase Delay Time Range	16 ns to 250 s	16 ns to 250 s	16 ns to 250 s
Channel-to-channel Deskew Range	± 25 ns	± 25 ns	± 25 ns
Delta Time Measurement Accuracy	± (0.06 sample interval) + (15 ppm * reading) RMS	0.06/sample rate + 2.5 ppm * reading RMS	0.06/sample rate + 2.5 ppm * reading RMS
Trigger Jitter (RMS)	8 ps RMS (typical)	6 ps RMS (typical)	6 ps_{RMS} typical
Long Term Sample Rate and Delay Time Accuracy	± 15 ppm over ≥1 ms interval	± 2.5 ppm over any ≥100 ms interval	± 2.5 ppm over any ≥100 ms interval

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▶ Acquisition System

	TDS7054	TDS7104	TDS7154/TDS7254	TDS7404
Real-time Sample Rates				
1 channel (max)	5 GS/s	10 GS/s	20 GS/s	20 GS/s
2 channels (max)	5 GS/s	5 GS/s	10 GS/s	10 GS/s
3-4 channels (max)	2.5 GS/s	2.5 GS/s	5 GS/s	5 GS/s
Equivalent Time Sample Rate (max)	250 GS/s	250 GS/s	250 GS/s	250 GS/s
Maximum record length per channel with standard memory	400 k (1-CH.), 200 k (2-CH.), 100 k (4-CH.)			
with Memory Opt. 1M	2 M (1-CH.), 1 M (2-CH.), 500 k (4-CH.)			
with Memory Opt. 2M	8 M (1-CH.), 4 M (2-CH.), 2 M (4-CH.)			
with Memory Opt. 3M	16 M (1-CH.), 8 M (2-CH.), 4 M (4-CH.)			
with Memory Opt. 4M				32 M (1-CH.), 16 M (2-CH.), 8 M (4-CH.)

Maximum Duration at Highest Real-time Resolution (1-CH)

	TDS7054	TDS7104	TDS7154/TDS7254/TDS7404
Time Resolution (Single-shot)	200 ps (5 GS/s)	100 ps (10 GS/s)	50 ps (20 GS/s)
Max Duration with Standard Memory	80 µs	40 µs	20 µs
Max Duration with Opt. 1M	400 µs	200 µs	100 µs
Max Duration with Opt. 2M	1.6 ms	800 µs	400 µs
Max Duration with Opt. 3M	3.2 ms	1.6 ms	800 µs
Max Duration with Opt. 4M			1.6 ms

Acquisition Modes

	TDS7054	TDS7104	TDS7154/TDS7254	TDS7404
FastAcq Acquisition	FastAcq optimizes the instrument for analysis of dynamic signals and capture of infrequent events			
Maximum FastAcq Waveform Capture Rate	> 200,000 wfms/sec		> 400,000 wfms/sec	> 400,000 wfms/sec
Waveform Database (requires Option SM)	Accumulate Waveform DataBase providing three-dimensional array of amplitude, time and counts			
Sample	Acquire sampled values			
Peak Detect	Captures narrow glitches at all real-time sampling rates			
Minimum Peak Detect Pulse Width	≤1 ns		400 ps	400 ps
Averaging	From 2 to 10,000 waveforms included in average			
Envelope	From 2 to $2x10^9$ waveforms included in min-max envelope			
Hi-Res	Real-time boxcar averaging reduces random noise and increases resolution			
FastFrame™ Acquisition	Acquisition memory divided into segments; maximum trigger rate > 160,000 waveforms per second. Time of arrival recorded with each event			

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▶ Trigger System

	TDS7054	TDS7104	TDS7154/TDS7254	TDS7404
Sensitivity				
Internal DC Coupled	0.35 div DC to 50 MHz increasing to 1 div at 500 MHz	0.35 div DC to 50 MHz increasing to 1 div at 1 GHz	0.35 div DC to 50 MHz increasing to 1.5 div at 3 GHz	0.35 div DC to 50 MHz increasing to 1.5 div at 3 GHz
External (Auxiliary Input)	400 mV from DC to 50 MHz increasing to 750 mV at 100 MHz	250 mV from DC to 50 MHz increasing to 500 mV at 100 MHz	250 mV from DC to 50 MHz increasing to 350 mV at 500 MHz	250 mV from DC to 50 MHz increasing to 350 mV at 500 MHz
Main Trigger Modes	Auto, Normal and Single			
Trigger Sequences	Main, Delayed by Time, Delayed by Events. All sequences can include separate horizontal delay after the trigger event to position the acquisition window in time			
Trigger Characteristics				
Standard Trigger Types	Edge, Glitch, Runt, Width, Transition time, Timeout, Pattern, State, Setup/Hold			
Communications-related Triggers (requires Option SM)	Support for AMI, HDB3, BnZS, CMI, MLT3 and NRZ encoded communications signals. Select between isolated positive or negative one, zero pulse form or eye patterns as applicable to standard			
Serial Pattern Trigger (requires Option ST)	32 bit serial word recognizer, bits specified in binary (high, low, don't care) or hex format. Trigger on NRZ-encoded data up to 1.25 GBaud			
Trigger Level Range				
Internal	± 12 divisions from center of screen			
External (Auxiliary In)	± 8 V			
Line	fixed at 0 V			
Trigger Coupling	DC, AC (attenuates < 60 Hz), HF Rej (attenuates > 30 kHz), LF Rej (attenuates < 80 kHz), Noise Reject (reduce sensitivity)			
Trigger Holdoff Range	250 ns minimum to 12 s maximum			

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Waveform Measurements

Amplitude – Amplitude, High, Low, Maximum, Minimum, Peak to Peak, Mean, Cycle Mean, RMS, Cycle RMS, Positive Overshoot, Negative Overshoot.

Time – Rise time, Fall time, Positive Width, Negative Width, Positive Duty Cycle, Negative Duty Cycle, Period, Frequency, Delay.

Combination – Area, Cycle Area, Phase, Burst Width.

Histogram-related – Waveform count, Hits in box, Peak hits, Median, Maximum, Minimum, Peak to Peak, Mean (μ), Standard Deviation (sigma), μ+1 (sigma), μ+2 (sigma), μ+3 (sigma).

Waveform Processing/Math

Algebraic Expressions – Define extensive algebraic expressions including waveforms, scalars and results of parametric measurements e.g. (Integral (CH.1-Meas(CH.1))*1.414.

Arithmetic – Add, subtract, multiply, divide waveforms and scalars.

Relational – Boolean result of comparison >, <, >=, <=, ==, !=.

Calculus – Integrate, differentiate.

Frequency Domain Functions – Spectral magnitude and phase, real and imaginary spectra.

Vertical Units – Magnitude: Linear, dB, dBm; Phase: Degrees, radians.

Window Functions – Rectangular, Hamming, Hanning, Kaiser-Bessel, Blackman-Harris, Gaussian, Flattop2, Tek Exponential.

Display Characteristics

Display Type – Liquid crystal active-matrix color display.

Display Size – 211.2 mm (8.32 in.) (W) x 158.4 mm (6.24 in.) (H), 264 mm (10.4 in.) diagonal.

Display Resolution – 640 horizontal x 480 vertical pixels.

Waveform Styles – Vectors, Dots, Variable Persistence, Infinite Persistence.

Computer System and Peripherals

CPU – Intel Celeron processor, 566 MHz.

PC System Memory – 256 MB.

Hard Disk Drive – Rear-panel, removable hard disk drive, > 4.3 GB capacity.

Floppy Disk Drive – Front-panel 3.5 in floppy disk drive, 1.44 MB capacity.

CD-ROM Drive – Rear-panel CD-ROM drive.

Mouse – Logitech thumb wheel model included, USB interface.

Keyboard – Order 118-9402-00 for small keyboard (fits in pouch); PS-2 interface. Order 119-6297-00 for full-size keyboard; USB interface and hub.

Input/Output Ports

Probe Compensator Output – Front panel BNC connector, requires Probe Cal-Deskew Fixture (included) for probe attachment. Amplitude 200 mV ± 20% into a ≥50 Ω load, frequency 1 kHz ± 5%.

Analog Signal Output Amplitude – Front-panel BNC connector, provides a buffered version of the signal that is attached to the Ch 3 input when Ch 3 is selected as trigger source. 20 mV/div ± 20% into a 1 MΩ load, 10 mV/div ± 20% into a 50 Ω load.

Analog Signal Output Bandwidth, Typical – TDS7054, TDS7104: 100 MHz into a 50 Ω load. TDS7254/TDS7404: 1 GHz into a 50 Ω load.

External Timebase Reference In – Rear-panel BNC connector, timebase system can phase-lock to external 10 MHz reference.

Timebase Reference Out – Rear-panel BNC connector, accepts TTL-compatible output of internal 10 MHz reference oscillator. TDS7254/TDS7404: 1 GHz into a 50 Ω load.

Auxiliary Output Levels – Front-panel BNC connector, provides a TTL-compatible, polarity switchable pulse when the oscilloscope triggers.

Parallel Port – IEEE 1284, DB-25 connector.

Audio Ports – Miniature phone jacks for stereo microphone input and stereo line output.

USB Port – Allows connection or disconnection of USB keyboard and/or mouse while oscilloscope power is on.

Keyboard Port – PS-2 compatible.

Mouse Port – PS-2 compatible.

LAN Port – RJ-45 connector, supports 10Base-T and 100Base-T.

Serial Port – DB-9 COM1 port.

SVGA Video Port – DB-15 female connector; connect a second monitor to use dual-monitor display mode. Supports basic requirements of PC99 specifications.

GPIB Port – IEEE 488.2 standard.

Scope VGA Video Port – DB-15 female connector, 31.6 kHz sync, EIA RS-343A compliant, connect to show the oscilloscope display, including live waveforms on an external monitor or projector.

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Power Source

Power – 100 to 240 V_{RMS}, ±10%, 50/60 Hz; 115 V_{RMS} ±10%, 400 Hz; CAT II, < 300 W (450VA).

Physical Characteristics Benchtop Configuration

Dimensions	mm	in.
Height	277	10.9
Width	455	17.9
Depth	425	16.75
Weight	**kg**	**lbs.**
Net	18	39
Shipping	37	80

Physical Characteristics Rackmount Configuration

Dimensions	mm	in.
Height	277	10.5
Width	502	19.75
Depth	486	19.125
Weight	**kg**	**lbs.**
Net	19	41
Kit	5.6	12.25

Mechanical

Cooling – Required Clearance

	in.	mm
Top	0 or > 3	0 or > 76
Bottom	0	0
Left side	3	76
Right side	3	76
Front	0	0
Rear	0	0

Environmental

Temperature

Operating – 0°C to +50°C, excluding floppy disk and CD-ROM drives; +10°C to +45°C, including floppy disk and CD-ROM drives.

Nonoperating – –22°C to +60°C.

Humidity

Operating – 20% to 80% relative humidity with a maximum wet bulb temperature of +29°C at or below +50°C, noncondensing. Upper limit derated to 25% relative humidity at +50°C.

Nonoperating – With no diskette in floppy disk drive. 5% to 90% relative humidity with a maximum wet bulb temperature of +29°C at or below +60°C, non-condensing. Upper limit derated to 20% relative humidity at +60°C.

Altitude

Operating – 10,000 ft. (3,048 m).

Nonoperating – 40,000 ft. (12,190 m).

Random Vibration

Operating – 0.00015 G^2/Hz from 5 to 350 Hz, –3 dB/octave from 350 to 500 Hz, 0.000105 G^2/Hz at 500 Hz. Overall level of 0.27 G_{RMS}.

Nonoperating – 0.0175 G^2/Hz from 5 to 100 Hz, –3 dB/octave from 100 to 200 Hz, 0.00875 G^2/Hz from 200 to 350 Hz, –3 dB/octave from 350 to 500 Hz, 0.006132 G^2/Hz at 500 Hz. Overall level of 2.28 G_{RMS}.

Electromagnetic Compatibility – 89/336/EEC.

Safety

UL 3111-1, CSA1010.1, EN61010-1, IEC 61010-1.

▶ Ordering Information

TDS7054

500 MHz Digital Phosphor Oscilloscope.

TDS7104

1 GHz Digital Phosphor Oscilloscope.

TDS7154

1.5 GHz Digital Phosphor Oscilloscope.

TDS7254

2.5 GHz Digital Phosphor Oscilloscope.

TDS7404

4 GHz Digital Phosphor Oscilloscope.

All Models Include: Accessory pouch, front cover, mouse, probe calibration and deskew fixture (067-0405-00), quick reference (020-2335-00), user reference (071-0700-00), GPIB programmer's reference, TDS7000 Series product software CD-ROM, TDS7000 Series operating system restoration CD-ROM, Performance verification procedure PDF file, NIST, MIL-STD-45662A and ISO9000 Calibration Certificate, power cord, one year warranty.

TDS7054 Also Includes: (4) P6139A 500 MHz, 10x Passive Probes.

TDS7154/TDS7254 Also Include: (4) TekConnect™ to BNC adapters (TCA-BNC).

TDS7404 Also Includes: (4) TekConnect to SMA adapters (TCA-SMA).

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▶ Instrument Options (available where indicated by "x")

Acquisition Memory Options		TDS7054	TDS7104	TDS7154	TDS7254	TDS7404
1M	2 Msamples max, 500 ksamples/ch	x	x	x	x	x
2M	8 Msamples max, 2 Msamples/ch	x	x	x	x	x
3M	16 Msamples max, 4 Msamples/ch	x	x	x	x	x
4M	32 Msamples max, 8 Msamples/ch			x	x	x
Mounting Options						
1K	K4000 Scope Cart	x	x	x	x	x
1R	Rackmount Kit	x	x	x	x	x
Software Options						
J1	TDSJIT2 Jitter Analysis Software	x	x	x	x	x
J2	TDSDDM2 Disk Drive Analysis Software	x	x	x	x	x
CP2*[1]	TDSCPM2-ANSI/ITU Telecom Pulse Compliance Testing	x	x	x	x	x
USB	TDSUSBS-USB2.0 Compliance Test S/W Only	x	x	x	x	x
Probe Options						
33	Add (1) P6158 3 GHz, 20x Low C Probe		x			
34	Add (1) P6247 1.0 GHz Differential Probe	x				
35	Add (1) P6243 1.0 GHz Active Probe	x				
36	Add (1) P6139A 500 MHz, 10x Passive Probe	x	x			
37	Add (1) P6245 1.5 GHz Active Probe		x	x		
39	Add (1) P6248 1.7 GHz Differential Probe		x	x		
51	Add (1) P7240 4 GHz Active Probe				x	x
52	Add (1) P7330 3 GHz Differential Probe				x	x
Service Options						
D1	Calibration Data Report	x	x	x	x	x
C3	Additional 2 Years of Calibration	x	x	x	x	x
D3	Calibration Data Report for Option C3	x	x	x	x	x
R3	Additional 2 Years of Repair	x	x	x	x	x
Additional Options						
SM	Serial Comm Mask Testing	x	x	x	x	x
ST	Serial Pattern Trigger			x	x	x
UBF	USB Test Fixture	x	x	x	x	x

*[1] Requires Option SM.

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Power Cord Options for All Models

Opt. A1 – Universal European power cord (220 V, 50 Hz).

Opt. A2 – UK power cord (240 V, 50 Hz).

Opt. A3 – Australia power cord (240 V, 50 Hz).

Opt. A5 – Switzerland power cord (220 V, 50 Hz).

Opt. A99 – No power cord.

Opt. AC – China power cord.

Recommended Accessories

AFTDS – Telecom differential electrical interface adapter (for line rates < 8 MB/sec; requires TCA-BNC adapter).

Keyboard (USB interface) – Order 119-6297-00.

Service Manual – Order 071-0711-00.

Transit Case – Order 016-1522-00.

TekConnect Adapters –

TCA-SMA TekConnect-to-SMA Adapter.

TCA-N TekConnect-to-N Adapter.

TCA-BNC TekConnect-to-BNC Adapter.

Scope Cart – Order K4000.

TDSUBF – USB Test Fixture; used in conjunction with Opt. USB, USB2.0 Compliance Test Software.

Software

WSTRO – Wavestar™ waveform capture and documentation software.

▶ Acquisition Memory Upgrades

	To Opt. 1M	To Opt. 2M	To Opt. 3M	To Opt. 4M
From Standard Memory	Opt M01	Opt M02	Opt M03	Opt M04
From Opt. 1M	–	Opt M12	Opt M13	Opt M14
From Opt. 2M	–	–	Opt M23	Opt M24
From Opt. 3M	–	–	–	Opt M34

Cables

GPIB Cable (1 m) – Order 012-0991-01.

GPIB Cable (2 m) – Order 012-0991-00.

RS-232 Cable – Order 012-1298-00.

Centronics Cable – Order 012-1250-00.

Instrument Upgrades

Order a TDS7UP kit and select the appropriate option from the following list according to current and intended configuration.

Acquisition Memory Upgrades

Acquisition memory upgrades equivalent to Options 1M – 4M can be ordered to extend instrument performance after initial purchase. Users can install upgrades without opening the instrument case or requiring on-site service.

For example, to upgrade from Standard Memory to Option 4M, order TDS7UP Option M04.

Software Upgrade Options

Opt J1 – TDSJIT2 Jitter Analysis Software

Opt J2 – TDSDDM2 Disk Drive Analysis Software

Opt CP2 – TDSCPM2 Compliance Testing for ITU-T G.703 and ANSI T1.102 communications standards. Requires Option SM.

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