# Digital Phosphor Oscilloscopes

TDS5000 Series

## Characteristics

**Vertical System**

| | TDS5032/ TDS5034 | TDS5052/ TDS5054 | TDS5104 |
|---|---|---|---|
| Input Channels | 2/4 | 2/4 | 4 |
| Analog Bandwidth (-3 dB) 5 mV/div - 1 V/div | 350 MHz | 500 MHz | 1 GHz |
| Calculated Rise Time 5 mV/div (typical) | 1.15 ns | 800 ps | 300 ps |
| Hardware Bandwidth Limits | 150 MHz or 20 MHz | | |
| Input Coupling | AC, DC, GND | | |
| Input Impedance, 1 MΩ | ±1% | | |
| Input Impedance, 50 Ω | ±1% | | ±2.5% |
| Input Sensitivity, 1 MΩ | 1 mV/div to 10 V/div | | |
| Input Sensitivity, 50 Ω | 1 mV/div to 1 V/div | | |
| Vertical Resolution | 8-bits (>11-bits 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 <±30 V | | |
| DC Gain Accuracy | 1.5% with offset set to 0 V | | |
| Offset Range, 1 MΩ | 1 mV/div - 99.5 mV/div ±1 V<br><br>100 mV/div - 1 V/div ±10 V<br><br>1.01 V/div - 10 V/div ±100 V | | |
| Offset Range, 50 Ω | 1 mV/div - 99.5 mV/div ±1 V<br><br>100 mV/div -1 V/div ±10 V | | 1 mV - 50 mV/div ±0.5 V<br><br>50.5 mV - 99.5 mV ±0.25 V<br><br>100 mV - 500 mV ±5 V<br><br>505 mV - 1 V/div ±2.5 V |

| | TDS5032/ TDS5034 | TDS5052/ TDS5054 | TDS5104 |
|---|---|---|---|
| Channel-to-channel Isolation Any Two Channels at Equal Vertical Scale | ≥100:1 at ≤100 MHz and ≥30:1 at >100 MHz up to the rated bandwidth | | |

**Timebase System**

| | All Models |
|---|---|
| Timebase Range | 200 ps/div to 40 s/div |
| Timebase Delay Time Range | 16 ns to 250 s |
| Channel-to-channel Deskew Range | ±75 ns |
| Delta Time Measurement Accuracy | ±(0.30 sample interval) + (15 ppm * reading) |
| Trigger Jitter (RMS) | 8 $ps_{RMS}$ (typical) |
| Long Term Sample Rate and Delay Time Accuracy | ±15 ppm over ≥1 ms interval |

**Acquisition System**

| | 2 Ch Models (TDS5032/5052) | 4 Ch Models (TDS5034/5054/5104) |
|---|---|---|
| Real-time Sample Rates | | |
| 1 Channel (max) | 5 GS/s | |
| 2 Channels (max) | 2.5 GS/s | |
| 3-4 Channels (max) | -- | 1.25 GS/s |
| Equivalent Time Sample Rate (max) | 250 GS/s | |
| Maximum Record Length per Channel with Standard Memory | 400 k (1 ch) 200 k (2 ch) | 400 k (1 ch), 200 k (2 ch), 100 k (4 ch) |
| With Opt. 1M | 2 M (1 ch), 1 M (2 ch) | 2 M (1 ch), 1 M (2 ch), 500 k (4 ch) |
| With Opt. 2M | 8 M (1 ch), 4 M (2 ch) | 8 M (1 ch), 4 M (2 ch), 2 M (4 ch) |

**Maximum Duration at Highest Real-time Resolution (1 ch)**

| | All Models |
|---|---|
| Time Resolution (single shot) | 200 ps (5 GS/s) |
| Max Duration with Standard Memory | 80 µs |
| Max Duration with Opt. 1M | 400 µs |

All Models

| | |
|---|---|
| Max Duration with Opt. 2M | 1.6 ms |

**Acquisition Modes**

All Models

| | |
|---|---|
| FastAcq Acquisition | FastAcq optimizes the instrument for analysis of dynamic signals and capture of infrequent events |
| Maximum FastAcq Waveform Capture Rate | 100,000 wfms/s |
| Sample | Acquire sampled values |
| Peak Detect | Captures narrow glitches at all real-time sampling rates |
| Minimum Peak Detect Pulse Width | <1 ns |
| Averaging | From 2 to 10,000 waveforms included in average |
| Envelope | From 2 to 2 x $10^9$ 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 >225,000 waveforms per second. |

**Trigger System**

All Models

| | |
|---|---|
| Sensitivity | |
| Internal DC Coupled | 0.35 div DC to 50 MHz increasing to 1 div at rated bandwidth |
| External (auxiliary input) | 400 mV from DC to 50 MHz increasing to 750 mV at 100 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 Level Range | |
| Internal | ±10 divisions from center of screen |

| | |
|---|---|
| External (auxiliary in) | ±8 V |
| Line | Fixed at 0 V |
| Trigger Coupling | DC, AC (attenuate <60 Hz), HF reject (attenuate >30 kHz)<br><br>LF reject (attenuates <80 kHz) Noise reject (reduce sensitivity) |
| Trigger Holdoff Range | 250 ns minimum to 12 s maximum |

TRIGGER MODES

**Edge -** Positive or negative slope on any channel or front panel auxiliary input. Coupling includes DC, AC, noise reject, HF reject, and LF reject.

**Video -** Trigger on NTSC, PAL, SECAM, analog HDTV, and non-standard video formats.

**Glitch -** Trigger on or reject glitches of positive, negative or either polarity. Minimum glitch width is 1.0 ns with 200 ps resolution.

**Width -** Trigger on width of positive or negative pulse either within or out of selectable time limits ranging from 1 ns to 1 s 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. Event can be time or logic qualified (logic on 4 channel models only).

**Window -** Trigger on an event that enters or exits a window defined by two user-adjustable thresholds. Event can be time or logic qualified (logic on 4 channel models only).

**Timeout -** Trigger on an event which remains high, low or either, for a specified time period, selectable from 1 ns to 1 s with 200 ps resolution.

**Transition -** Trigger on pulse edge rates that are faster or slower than specified. Slope may be positive, negative or either.

**Setup/Hold -** Trigger on violations of both setup time and hold time between clock and data present on any two input channels.

**Pattern -** Trigger when pattern goes false or stays true for specified period of time. Pattern (AND, OR, NAND, NOR) specified for four input channels defined as High, Low or Don't Care.

**State -** Any logical pattern of channels (1, 2, 3) clocked by edge on channel 4 (channel 2 on TDS5052). Trigger on rising or falling clock edge.

**Trigger Delay by Time -** 16 ns to 250 seconds.

**Trigger Delay by Events -** 1 to 10,000,000 Events.

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 (optional) -** Waveform count, Hits in box, Peak hits, Median, Maximum, Minimum, Peak to Peak, Mean (μs), Standard Deviation (sigma), μ+1 (σ), μ+2 (σ), μ+3 (σ).

WAVEFORM PROCESSING/MATH
**Standard Math**

**Arithmetic -** Add, subtract, multiply, and divide waveforms.

**FFT -** Magnitude.

**Vertical Units -** Magnitude: Linear, dB, dBm.

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

**Optional Math**

**Algebraic Expressions -** Define extensive algebraic expressions including waveforms, scalars, and results of parametric measurements e.g. (Integral (Ch1-Mean(Ch1))*1.414).

**Calculus -** Integrate, differentiate.

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

**Additional Vertical Units -** Phase: degrees, radians.

DISPLAY CHARACTERISTICS
**Display Type -** Liquid crystal active-matrix color display.

**Display Size -** 211.2 mm (W) x 158.4 mm (H), 264 mm (10.4 in) diagonal.

**Display Resolution -** 640 horizontal x 480 vertical pixels.

**Waveform Styles -** Vectors, Dots, Intensified Samples, Variable Persistence, Infinite Persistence.

COMPUTER SYSTEM AND PERIPHERALS
**CPU -** Intel Celeron Processor, 1.2 GHz.

**PC System Memory -** 256 MB.

**Hard Disk Drive -** ≥20 GB capacity.

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

**CD-ROM Drive -** Side panel CD-ROM drive.

**CD-RW Drive (Optional) -** Side panel CD-RW drive.

**Printer (Optional) -** Built-in thermal printer.

**Mouse -** Logitech thumb wheel model included, USB interface.

**Keyboard -** Order 119-6633-00 (USB interface).

OPENCHOICE SOFTWARE

**TekVISA -** Application Programmers Interface (API) for Windows developers. Documentation includes descriptions and samples of programming test and measurement applications on the unit in Visual BASIC, C and C++.

**TekVisa Control (TVC) -** Active controls to make access to TekVISA easy for integration into Microsoft Windows applications.

**VXI-11 server -** An Application Programmers Interface (API) for LAN connectivity from a variety of external host computers.

For information regarding TDS5000 Series compatibility with National Instruments hardware and software products, contact your local Tektronix account manager.

For information about using a TDS5000 Series oscilloscope as a GPIB controller, contact your local Tektronix account manager.

**Plug-and-play Drivers -** Provides support to run National Instrument's LabVIEW and LabWindows on an external PC connected to a TDS5000 Series oscilloscope.

**IVI Drivers -** Provides support for new and existing program environments utilizing the IVI instrumentation standard, such as LabVIEW, LabWindows/CVI, MATLAB, Visual BASIC, and C/C++.

**Excel Toolbar -** Provides direct access to waveforms and measurements on the oscilloscope from a toolbar in Excel.

**Report Generator -** Enables the ability to design and create customized report templates that extract the oscilloscope's waveforms, settings, measurements, and other on-screen information with a click of the mouse.

**LabVIEW and MATLAB -** 30 day evaluation copies plus non-expiring demo programs that perform a variety of LabVIEW and MATLAB display and analysis functions with the oscilloscope.

**Software Developer’s Kit (SDK) -** a CD is included in the *Getting Started With OpenChoice*™ book. This SDK includes a wealth of documentation, programming tools, and examples to assist programmers working with the TDS5000 Series.

INPUT/OUTPUT PORTS

**Auxiliary Input -** Front panel BNC connector. Trigger level range is adjustable from +8 V to -8 V. The maximum input voltage is ±20 V.

**Probe Compensator Output -** Front panel pins. Amplitude 1 V ± 1% into a ≥10 kΩ load, frequency 1 kHz ±5%.

**Analog Signal Output Amplitude -** Rear-panel BNC connector, provides a buffered version of the signal that is attached to the Channel 3 input. 20 mV/div ±20% into a 1 MΩ load, 10 mV/div ±20% into a 50 Ω load (4 channel models only).

**Analog Signal Output Bandwidth, Typical -** 100 MHz into a 50 Ω load (4 channel models only).

**Auxiliary Output Levels -** Rear-panel BNC connector, provides a TTL-compatible, negative polarity pulse when the oscilloscope triggers.

**External Reference In -** Rear-panel BNC connector. 9.8 MHz to 10.2 MHz.

**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.

POWER SOURCE
**Power -** 100 to 240 $V_{RMS}$ ±10%, 47 to 63 Hz; CAT II, <220 W.

**Physical Characteristics**

Benchtop Configuration

Dimensions mm in.

Weight kg lbs.

Rackmount Configuration

Dimensions mm in.

Weight kg lbs.

Mechanical

Dimensions mm in.

| | | |
|---|---|---|
| Height | 285 | 11.2 |
| Width | 447 | 17.6 |
| Depth | 288 | 11.35 |
| Net | 10.55 | 23.25 |
| Shipping | 25 | 55 |
| Height | 267 | 10.5 |

Benchtop Configuration

Dimensions mm in.

Weight kg lbs.

Rackmount Configuration

Dimensions mm in.

Weight kg lbs.

Mechanical

Dimensions mm in.

| | | |
|---|---|---|
| Width | 483 | 19 |
| Depth | 288 | 11.35 |
| Net | 11.8 | 26 |
| Kit | 5 | 11 |
| Cooling - Required Clearance for Benchtop Configuration | | |
| Top | 0 | 0 |
| Bottom | 0 | 0 |
| Left Side | 76 | 3 |
| Right Side | 0 | 0 |
| Front | 0 | 0 |
| Rear | 0 | 0 |

ENVIRONMENTAL

**Temperature**

**Operating -** +5 °C to +45 °C.

**Nonoperating -** -20 °C to +60 °C without diskette in floppy drive.

**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, noncondensing. 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 -** 0.1 GRMS from 5 to 500 Hz, 10 minutes each axis, 3-axes, 30 minutes total.

**Nonoperating -** 2.0 GRMS from 5 to 500 Hz, 10 minutes each axis, 3-axes, 30 minutes total.

**Electromagnetic Compatibility -** 89/336/EEC.

**Safety -** UL 3111-1, CSA-22.2 No. 1010.1, EN61010-1, IEC61010-1/A2.

---