Tektronix

TDS3000B Series
Digital Phosphor Oscilloscopes

071-0972-02

This document supports firmware version 3.00 and above for TDS3000B Series instruments only.

Warning
The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.

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Specifications

This appendix contains specifications for the TDS3000B Series oscilloscopes. All specifications are guaranteed unless noted as "typical." Typical specifications are provided for your convenience but are not guaranteed. Specifications that are marked with the ✓ symbol are checked in *Performance Verification*.

All specifications apply to all TDS3000B models unless noted otherwise. To meet specifications, two conditions must first be met:

- The oscilloscope must have been operating continuously for twenty minutes within the operating temperature range specified.
- You must perform the Compensate Signal Path operation described on page 2–22 prior to evaluating specifications. If the operating temperature changes by more than 10° C, you must perform the Compensate Signal Path operation again.

Table 1-1: Specifications

Acquisition		
Acquisition modes	Sample (Normal), Peak detect, Envelope, and Average	
Single Sequence	*Acquisition mode*	*Acquisition stops after*
	Sample, Peak Detect	One acquisition, all channels simultaneously
	Average, Envelope	N acquisitions, all channels simultaneously, N is settable from 2 to 256 (or ∞ for Envelope)

Table 1-1: Specifications (cont.)

Inputs				
Input coupling	DC, AC, or GND Channel input remains terminated when using GND coupling.			
Input impedance, DC coupled	1 MΩ ±1% in parallel with 13 pF ±2 pF, TekProbe compatible 50 Ω ±1%; VSWR ≤ 1.5:1 from DC to 500 MHz, typical			
Maximum voltage at input BNC (1 MΩ)	*Overvoltage category*	*Maximum voltage*		
	CAT I Environment (refer to page 1-11)	150 V_{RMS} (400 V_{pk})		
	CAT II Environment (refer to page 1-11)	100 V_{RMS} (400 V_{pk})		
	For steady-state sinusoidal waveforms, derate at 20 dB/decade above 200 kHz to 13 V_{pk} at 3 MHz and above.			
Maximum voltage at input BNC (50 Ω)	5 V_{RMS} with peaks ≤ ±30 V			
Maximum floating voltage	0 V from chassis (BNC) ground to earth ground, or 30 V_{RMS} (42 V_{pk}) only under these conditions: no signal voltages >30 V_{RMS} (>42 V_{pk}), all common leads connected to the same voltage, no grounded peripherals attached			
Channel-to-channel crosstalk, typical	Measured on one channel, with test signal applied to another channel, and with the same scale and coupling settings on each channel			
	Frequency range	TDS3012B TDS3014B	TDS3032B TDS3034B	TDS3052B TDS3054B
	≤ 100 MHz	≥ 100:1	≥ 100:1	≥ 100:1
	≤ 300 MHz	—	≥ 50:1	≥ 50:1
	≤ 500 MHz	—	—	≥ 30:1
Differential delay, typical	100 ps between any two channels with the same scale and coupling settings			

Table 1-1: Specifications (cont.)

Vertical				
Number of channels	*TDS3012B, TDS3032B, TDS3052B*		*TDS3014B, TDS3034B, TDS3054B*	
	2 plus external trigger input		4 plus external trigger input	
Digitizers	9-bit resolution, separate digitizers for each channel sample simultaneously			
SCALE Range (at BNC)	*1 MΩ*		*50 Ω*	
	1 mV/div to 10 V/div		1mV/div to 1 V/div	
Fine SCALE	Adjustable with ≥ 1% resolution			
Polarity	Normal and Invert			
Position range	±5 divisions			
⩘ Analog bandwidth, 50 Ω (also typical at 1 MΩ with standard probe)	Bandwidth limit set to Full, operating ambient ≤30 °C, derate 1%/°C above 30 °C			
	Scale range	*TDS3012B TDS3014B*	*TDS3032B TDS3034B*	*TDS3052B TDS3054B*
	5 mV/div to 1 V/div	100 MHz	300 MHz	500 MHz
	2 mV/div to 4.98 mV/div	100 MHz	250 MHz	300 MHz
	1 mV/div to 1.99 mV/div	90 MHz	150 MHz	175 MHz
Calculated rise time, typical	—	3.5 ns	1.2 ns	0.7 ns
Analog bandwidth limit, typical	Selectable between 20 MHz, 150 MHz (not available on TDS3012B or TDS3014B plus external trigger input), or Full			
Lower frequency limit, AC coupled, typical	7 Hz for 1 MΩ, reduced by a factor of ten when using a 10X passive probe; 140 kHz for 50 Ω			

Table 1-1: Specifications (cont.)

Vertical		
Peak detect or Envelope pulse response, typical	Minimum width of pulse with amplitude of ≥2 div to capture 50% or greater amplitude	
	Sample rates ≤125 MS/s	*Sample rates ≥250 MS/s*
	1 ns	1/sample rate
DC gain accuracy	± 2%, derated at 0.025%/°C for temperatures below +18° C and above +30° C, in Sample or Average acquisition mode	
DC measurement accuracy	*Measurement type*	*DC Accuracy (in volts)*
Sample acquisition mode, typical	Absolute measurement of any waveform point, and High, Low, Max, and Min measurements.	± [0.02[1] × | reading - (offset - position) | + offset accuracy + 0.15 div + 0.6 mV]
	Delta voltage between any two points on a waveform, and all other automatic measurements.	± [0.02[1] × | reading | + 0.15 div + 1.2 mV]
Average acquisition mode (≥16 averages)	Absolute measurement of any waveform point, and High, Low, Max, and Min measurements.	± [0.02[1] × | reading - (offset - position) | + offset accuracy + 0.1 div]
	Delta voltage between two points on a waveform, and all other automatic measurements.	± [0.02[1] × | reading | + 0.05 div]
Offset range	*Scale range*	*Offset range*
	1 mV/div to 9.95 mV/div	±100 mV
	10 mV/div to 99.5 mV/div	±1 V
	100 mV/div to 995 mV/div	±10 V
	1V/div to 10 V/div	±100 V
Offset accuracy, all ranges	± [0.005 × | offset - position | + 0.1 div] [2]	

1 0.02 term (gain component) derated at 0.00025/°C above 30° C

2 You must convert both the constant offset and position terms to volts by multiplying them by the oscilloscope volts/div setting.

Table 1-1: Specifications (cont.)

Horizontal				
Acquisition (horizontal) resolution	*Normal* (10,000 point record)		*Fast trigger* (500 point record)	
Maximum acquisition rate, typical	*TDS3012B TDS3014B*	*TDS3032B TDS3034B TDS3052B TDS3054B*	*TDS3012B TDS3014B*	*TDS3032B TDS3034B TDS3052B TDS3054B*
	400 wfms/s	700 wfms/s	2,600 wfms/s	3,600 wfms/s
Sample rate range	*TDS3012B TDS3014B*	*TDS3032B TDS3034B*	*TDS3052B TDS3054B*	
Normal	100 S/s to 1 GS/s	100 S/s to 2.5 GS/s	100 S/s to 5 GS/s	
Fast trigger	5 S/s to 1.25 GS/s	5 S/s to 2.5 GS/s	5 S/s to 5 GS/s	
Seconds/division range	4 ns/div to 10 s/div	2 ns/div to 10 s/div	1 ns/div to 10 s/div	
✓ Sample rate and delay time accuracy	±20 ppm over any ≥1 ms time interval			
Trigger				
External trigger input, typical	TDS3012B, TDS3032B, TDS3052B: 1 MΩ in parallel with 17 pF, TekProbe compatible TDS3014B, TDS3034B, TDS3054B: 1 MΩ in parallel with 52 pF, not TekProbe compatible			
External trigger maximum voltage	*Overvoltage category*		*Maximum voltage*	
	CAT I Environment (refer to page 1-11)		150 V_{RMS} (400 V_{pk})	
	CAT II Environment (refer to page 1-11)		100 V_{RMS} (400 V_{pk})	
	For steady-state sinusoidal waveforms, derate at 20 dB/decade above 200 kHz to 13 V_{pk} at 3 MHz and above.			
External trigger maximum floating voltage	0 V from chassis (BNC) ground to earth ground 30 V_{RMS} (42 V_{pk}) only under these conditions: no signal voltages >30 V_{RMS} (>42 V_{pk}), all common leads connected to the same voltage, no grounded peripherals attached			
✓ Edge trigger sensitivity	*Source*		*Sensitivity*	
	Any channel, DC coupled		0.35 div from DC to 50 MHz, increasing to 1 div at oscilloscope bandwidth	

Table 1-1: Specifications (cont.)

Trigger		
Edge trigger sensitivity, typical	*Source*	*Sensitivity*
	External trigger	200 mV from DC to 50 MHz, increasing to 750 mV at 300 MHz
	External/10 trigger	500 mV from DC to 50 MHz, increasing to 3 V at 300 MHz
	Any channel, NOISE REJ coupled	3.5 times the DC-coupled limits
	Any channel, HF REJ coupled	1.5 times the DC-coupled limit from DC to 30 kHz, attenuates signals above 30 kHz
	Any channel, LF REJ coupled	1.5 times the DC-coupled limits for frequencies above 80 kHz, attenuates signals below 80 kHz
Trigger level range	*Source*	*Sensitivity*
	Any channel	±8 divisions from center of screen, ±8 divisions from 0 V if LF REJ trigger coupled
	External trigger	±800 mV
	External/10 trigger	±8 V
	Line	Fixed at the midlevel of the AC line
SET LEVEL TO 50%, typical	Operates with input signals ≥45 Hz	
Trigger level accuracy, typical	*Source*	*Sensitivity*
	Any channel	±0.2 divisions
	External trigger	±20 mV
	External/10 trigger	±200 mV
	Line	N/A
Trigger holdoff range	250.8 ns to 10 s	
Video trigger sensitivity, typical	Triggers on negative sync of NTSC, PAL, or SECAM signal	
	Source	*Sensitivity*
	Any channel	0.6 to 2.5 divisions of video sync tip
	External trigger	150 mV to 625 mV of video sync tip
	External/10 trigger	1.5 V to 6.25 V of video sync tip

Table 1-1: Specifications (cont.)

Trigger		
B Trigger	*Trigger After Time*	Trigger After B Events
Range	13.2 ns to 50 s	1 event to 9,999,999 events
Minimum time between arm and trigger, typical	5ns from the end of the time period and the B trigger event	5 ns between the A trigger event and the first B trigger event
Minimum Pulse Width, typical	—	B event width, 2 ns
Maximum Frequency, typical	—	B event frequency, 250 MHz
Display		
Display screen	6.5 in (165 mm) diagonal color liquid crystal	
Display resolution	640 horizontal by 480 vertical pixels	
Backlight intensity, typical	200 cd/m^2	
Display color	Up to 16 colors, fixed palette	
External display filter	Scratch-resistant tempered glass	
I/O ports		
Ethernet port	RJ-45 female connector 10BaseT	
Parallel printer port	DB-25 female connector, Centronics compatible	
GPIB interface	Available with optional accessory TDS3GV	
RS-232 interface	DB-9 male connector, available with optional accessory TDS3GV	
VGA signal output	DB-15 female connector, 31.6 kHz sync rate, EIA RS-343A compliant, available with optional accessory TDS3GV	
Probe compensator output, typical	5.0 V into ≥1 MΩ load, frequency = 1 kHz	
Miscellaneous		
Nonvolatile memory	Typical retention time ≥ 5 years for front-panel settings, unlimited for saved waveforms and setups	
Floppy disk	3.5 in, DOS format, 720 KB or 1.44 MB compatible	
Internal clock	Provides date/time stamp for stored data and the current time and date to the front panel, if enabled.	

Table 1-1: Specifications (cont.)

Power sources	
AC line power	Operates the oscilloscope and charges the optional internal battery
Source voltage	90 V_{RMS} to 250 V_{RMS}, continuous range (CAT II)
Source frequency	47 Hz to 440 Hz
Power consumption	75 W maximum
Battery power	Optional accessory TDS3BAT, rechargeable NiCd battery pack
Operating time, typical	2 hours, depending on operating conditions
Battery charge time, typical	18 hours in the oscilloscope, 3 hours in the optional external charger TDS3CHG
Line fuse	Internal, not user replaceable
Environmental	
Temperature	Operating range (no disk installed): +5 °C to +50 °C Nonoperating range (no disk installed): –20 °C to +60 °C Typical operating range for floppy disks: +10 °C to +50 °C
Humidity	Operating range (no disk installed): 20% to 80% RH below 32 °C, derate upper limit to 21% RH at 50 °C Nonoperating range (no disk installed): 5% to 90% RH below 41 °C, derate upper limit to 30% RH at 60 °C Typical operating range for floppy disks: 20% to 80% RH below 32 °C, derate upper limit to 21% RH at 50 °C
Pollution Degree	Pollution Degree 2: Typical home or office environment.

Table 1-1: Specifications (cont.)

Environmental	
Altitude	Operating limit: 3000 m Nonoperating limit: 15,000 m
Random vibration	Operating: 0.31 g_{RMS} from 5 Hz to 500 Hz, 10 minutes on each axis Nonoperating: 2.46 g_{RMS} from 5 Hz to 500 Hz, 10 minutes on each axis
Drop resistance, typical	Survives a 152 mm (6 in) drop onto concrete with only cosmetic damage
Mechanical	
Size	Height: 176 mm (6.9 in), 229 mm (9.0 in) including handle Width: 375 mm (14.75 in) Depth: 149 mm (5.9 in)
Weight	Oscilloscope only: 3.2 kg (7.0 lbs) With accessories and carry case: 4.1 kg (9.0 lbs) When packaged for domestic shipment: 5.5 kg (12.0 lbs) Optional battery pack: 2 kg (4.5 lbs)

Table 1-1: Specifications (cont.)

EMC certifications and compliances	
European Union	Meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:
	EN 61326, Annex D — EMC requirements for Class A electrical equipment for measurement, control, and laboratory use [1,2]
	IEC 61000-4-2 — Electrostatic discharge immunity
	IEC 61000-4-3 — RF electromagnetic field immunity [3]
	IEC 61000-4-4 — Electrical fast transient/burst immunity
	IEC 61000-4-5 — Power line surge immunity
	IEC 61000-4-6 — Conducted RF immunity [4]
	IEC 61000-4-11 — Voltage dips and interruptions immunity
	EN 61000-3-2 — AC power line harmonic emissions
Australia/ New Zealand	Meets the intent of Australian EMC Framework as demonstrated to the following specification:
	AS/NZS 2064.1/2
Russian Federation	This product was certified by the GOST ministry of Russia to be in compliance with all applicable regulations.
U.S.A.	Emissions do not exceed FCC Code of Federal Regulations 47, Part 15, Subpart B, Class A Limits

1 Emissions that exceed the levels required by this standard may occur when this equipment is connected to a test object.

2 To ensure compliance to the standards listed above, attach only high quality shielded cables to this instrument. High quality shielded cables typically are braid and foil types that have low impedance connections to shielded connectors at both ends.

3 The increase in trace noise is not to exceed 6 major divisions peak-to-peak while the instrument is subjected to a radiated field as defined in standard IEC 61000-4-3. Ambient fields of amplitude ≥3 V/m may induce triggering when the trigger threshold is offset less than 3 major divisions from ground reference.

4 The increase in trace noise is not to exceed 2 major divisions peak-to-peak while the instrument is subjected to a signal (defined in standard IEC 61000-4-6) that is injected into the AC main. Conducted noise of amplitude ≥3 V may induce triggering when the trigger threshold is offset less than 1 major division from ground reference.

Table 1-1: Specifications (cont.)

Safety certifications and compliances	
EC Declaration of Conformity - Low Voltage	Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities: Low Voltage Directive 73/23/EEC as ammended by 93/68/EEC
(TDS3000B Series, P3010, and P6139A)	EN 61010-1/A2:1995 Safety requirements for electrical equipment for measurement, control, and laboratory use
(P3010 and P6139A)	EN 61010-2-031:1995 Particular requirements for hand-held probe assemblies for electrical measurement and test equipment
Approvals	
(TDS3000B Series, P3010, and P6139A)	UL3111-1 - Standard for electrical measuring and test equipment CAN/CSA C22.2 No. 1010.1 - Safety requirements for electrical equipment for measurement, control and laboratory use
(P3010 and P6139A)	EN 61010-2-031:1995 - Particular requirements for hand-held probe assemblies for electrical measurement and test equipment
Installation/ Overvoltage Category Descriptions	Terminals on this product may have different installation category designations. The installation categories are: CAT III Distribution-level mains (usually permanently connected). Equipment at this level is typically in a fixed industrial location CAT II Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected CAT I Secondary (signal level) or battery operated circuits of electronic equipment