Technical Reference

Tektronix

MSO3000 and DPO3000 Series Digital Phosphor Oscilloscopes Specifications and Performance Verification

077-0300-01

This document supports firmware version 2.00 and above for MSO3000 and DPO3000 Series instruments.

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.

Contacting Tektronix

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14200 SW Karl Braun Drive
P.O. Box 500
Beaverton, OR 97077
USA

For product information, sales, service, and technical support:

- In North America, call 1-800-833-9200.
- Worldwide, visit www.tektronix.com to find contacts in your area.

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

To Avoid Fire or Personal Injury

Use Proper Power Cord. Use only the power cord specified for this product and certified for the country of use.

Connect and Disconnect Properly. Do not connect or disconnect probes or test leads while they are connected to a voltage source.

Connect and Disconnect Properly. De-energize the circuit under test before connecting or disconnecting the current probe.

Ground the Product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Connect the probe reference lead to earth ground only.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

Power Disconnect. The power cord disconnects the product from the power source. Do not block the power cord; it must remain accessible to the user at all times.

Do Not Operate Without Covers. Do not operate this product with covers or panels removed.

Do Not Operate With Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Avoid Exposed Circuitry. Do not touch exposed connections and components when power is present.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

Provide Proper Ventilation. Refer to the manual’s installation instructions for details on installing the product so it has proper ventilation.

Terms in this Manual

These terms may appear in this manual:

WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*

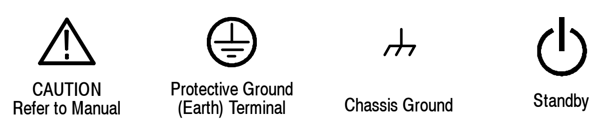
CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Symbols and Terms on the Product

These terms may appear on the product:

- DANGER indicates an injury hazard immediately accessible as you read the marking.
- WARNING indicates an injury hazard not immediately accessible as you read the marking.
- CAUTION indicates a hazard to property including the product.

The following symbols may appear on the product:



Specifications

Specifications

This chapter contains specifications for the MSO3000 and DPO3000 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 MSO3000 and DPO3000 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 Signal Path Compensation (SPC) operation described in the *MSO3000 and DPO3000 Series Digital Phosphor Oscilloscopes User Manual* prior to evaluating specifications. If the operating temperature changes by more than 10 °C (18 °F), you must perform the SPC operation again.

Table 1-1: Analog channel input and vertical specifications

Characteristic	Description	
Number of input channels	*DPO3052, DPO3032, DPO3012, MSO3032, and MSO3012*	*DPO3054, DPO3034, DPO3014, MSO3054, MSO3034, and MSO3014*
	2 analog, digitized simultaneously	4 analog, digitized simultaneously
Input coupling	DC, AC, or GND GND coupling approximates a ground reference by switching the channel's input relay to an internal DAC set to 0V. The signal connected to the input BNC is not disconnected from the channel's input load when the input is set to GND coupling.	
Input resistance selection	1 MΩ, 50 Ω, or 75 Ω	
✓ Input impedance, DC coupled	1 MΩ ±1% in parallel with 11.5 pF ±2 pF 50 Ω ±1% MSO305x and DPO305x: VSWR ≤ 1.5:1 from DC to 500 MHz, typical MSO303x and DPO303x: VSWR ≤ 1.5:1 from DC to 350 MHz, typical MSO301x and DPO301x: VSWR ≤ 1.5:1 from DC to 100 MHz, typical 75 Ω ±1% All models: ≤1.3:1 From DC to 60 MHz, typical	
Maximum input voltage (50 Ω and 75 Ω)	5 V_{RMS} with peaks ≤ ±20 V There is an overvoltage trip circuit, intended to protect against overloads that might damage termination resistors. A sufficiently large impulse can cause damage regardless of the overvoltage protection circuitry, due to the finite time required to detect the overvoltage condition and respond to it.	

Table 1-1: Analog channel input and vertical specifications (Cont.)

Characteristic	Description
Maximum input voltage (1 MΩ)	At front panel connector, 300 V_{RMS}, Installation Category II; Apply UL specified voltages for 300 V CAT II
<100mV/div	Derate at 20 dB/decade above 100 kHz to 30 V_{RMS} at 1 MHz, 10 dB/decade above 1 MHz
≥100mV/div	Derate at 20 dB/decade above 3 MHz to 30 V_{RMS} at 30 MHz, 10 dB/decade above 30 MHz
✓ DC Balance	0.2 div with the input DC-50 Ω coupled and 50 Ω terminated 0.25 div at 2 mV/div with the input DC-50 Ω coupled and 50 Ω terminated 0.5 div at 1 mV/div with the input DC-50 Ω coupled and 50 Ω terminated 0.2 div with the input DC-75 Ω coupled and 75 Ω terminated 0.25 div at 2mV/div with the input DC-75 Ω coupled and 75 Ω terminated 0.5 div at 1mV/div with input DC-75 Ω coupled and 75 Ω terminated 0.2 div with the input DC-1 MΩ coupled and 50 Ω terminated 0.3 div at 1 mV/div with the input DC-1 MΩ coupled and 50 Ω terminated All the above specifications are increased by 0.01 divisions per °C above 40 °C.
Delay between channels, full bandwidth, typical	≤100 ps between any two channels with input impedance set to 50 Ω, DC coupling ≤100 ps between any two channels with input impedance set to 75 Ω, DC coupling Note: all settings in the instrument can be manually time aligned using the Probe Deskew function
Deskew range	-125 ns to +125 ns
Crosstalk (channel isolation), typical	≥ 100:1 at ≤ 100 MHz and ≥ 30:1 at >100 MHz up to the rated bandwidth for any two channels having equal Volts/Div settings
TekVPI Interface	The probe interface allows installing, powering, compensating, and controlling a wide range of probes offering a variety of features The interface is available on all front panel inputs including Aux In. Aux In only provides 1 MΩ input impedance and does not offer 50 Ω or 75 Ω as do the other input channels
Total probe power, typical	Three (MSO30x2 and DPO30x2) or five (DPO30x4 and MSO30x4) TekVPI compliant probe interfaces, 1 per channel 20 W Internally available probe power Provision for 50 W external power from rear panel
Number of digitized bits	8 bits Displayed vertically with 25 digitization levels (DL) per division, 10.24 divisions dynamic range "DL" is the abbreviation for "digitization level." A DL is the smallest voltage level change that can be resolved by an 8-bit A-D Converter. This value is also known as the LSB (least significant bit)

Characteristic	*1 MΩ*	*50 Ω and 75 Ω*
Sensitivity range (coarse)	1 mV/div to 10 V/div in a 1-2-5 sequence	1 mV/div to 1 V/div in a 1-2-5 sequence

Table 1-1: Analog channel input and vertical specifications (Cont.)

<table>
<tr><th>Characteristic</th><th colspan="5">Description</th></tr>
<tr><td>Sensitivity range (fine)</td><td colspan="5">Allows continuous adjustment from 1 mV/div to 10 V/div, 1 MΩ
Allows continuous adjustment from 1 mV/div to 1 V/div, 50 Ω
Allows continuous adjustment from 1 mV/div to 1 V/div, 75 Ω</td></tr>
<tr><td>Sensitivity resolution (fine), typical</td><td colspan="5">≤ 1% of current setting</td></tr>
<tr><td>Position range</td><td colspan="5">±5 divisions

For firmware versions 2.04 and 2.07 only, the position range is ±4 divisions.</td></tr>
<tr><td rowspan="5">✓ Analog bandwidth, 50 Ω</td><td colspan="5">The limits stated below are for ambient temperature of ≤30 °C and the bandwidth selection set to FULL. Reduce the upper bandwidth frequency by 1% for each °C above 30 °C.</td></tr>
<tr><td>Instrument</td><td>10 mV/div to 1 V/div</td><td>5 mV/div to 9.98 mV/div</td><td>2 mV/div to 4.98 mV/div</td><td>1 mV/div to 1.99 mV/div</td></tr>
<tr><td>MSO305x and DPO305x</td><td>DC to 500 MHz</td><td>DC to 400 MHz</td><td>DC to 250 MHz</td><td>DC to 150 MHz</td></tr>
<tr><td>MSO303x and DPO303x</td><td colspan="2">DC to 300 MHz</td><td>DC to 250 MHz</td><td>DC to 150 MHz</td></tr>
<tr><td>MSO301x and DPO301x</td><td colspan="4">DC to 100 MHz</td></tr>
<tr><td rowspan="5">Analog bandwidth, 75 Ω, typical</td><td colspan="5">The limits stated below are for ambient temperature of ≤30 °C and the bandwidth selection set to FULL. Reduce the upper bandwidth frequency by 1% for each °C above 30 °C.</td></tr>
<tr><td>Model</td><td>10 mV/div to 1 V/div</td><td>5 mV/div to 9.98 mV/div</td><td>2 mV/div to 4.98 mV/div</td><td>1 mV/div to 1.99 mV/div</td></tr>
<tr><td>MSO305x and DPO305x</td><td rowspan="2">DC to 230 MHz</td><td rowspan="2">DC to 190 MHz</td><td rowspan="2">DC to 140 MHz</td><td rowspan="2">DC to 100 MHz</td></tr>
<tr><td>MSO303x and DPO303x</td></tr>
<tr><td>MSO301x and DPO301x</td><td colspan="4">DC to 230 MHz</td></tr>
<tr><td rowspan="5">Analog bandwidth,
1 MΩ with P6139A 10X Probe, typical</td><td colspan="5">The limits stated below are for ambient temperature of ≤30 °C and the bandwidth selection set to FULL. Reduce the upper bandwidth frequency by 1% for each °C above 30 °C.</td></tr>
<tr><td>Model</td><td>100 mV/div to 100 V/div</td><td>50 mV/div to 99.8 mV/div</td><td>20 mV/div to 49.8 mV/div</td><td>10 mV/div to 19.9 mV/div</td></tr>
<tr><td>MSO305x and DPO305x</td><td>DC to 500 MHz</td><td>DC to 400 MHz</td><td>DC to 250 MHz</td><td>DC to 150 MHz</td></tr>
<tr><td>MSO303x and DPO303x</td><td colspan="2">DC to 300 MHz</td><td>DC to 250 MHz</td><td>DC to 150 MHz</td></tr>
<tr><td>MSO301x and DPO301x</td><td colspan="4">DC to 100 MHz</td></tr>
</table>

Table 1-1: Analog channel input and vertical specifications (Cont.)

Characteristic	Description				
Calculated rise time, typical	The formula is calculated by measuring -3 dB bandwidth of the oscilloscope. The formula accounts for the rise time contribution of the oscilloscope independent of the rise time of the signal source.				
	Model	*50 Ω:*			
		1 mV/div to 1.99 mV/div	*2 mV/div to 4.98 mV/div*	*5 mV/div to 9.95 mV/div*	*10 mV/div to 1 V/div*
	MSO305x and DPO305x	2 ns	1.2 ns	750 ps	700 ps
	MSO303x and DPO303x	2 ns	1.2 ns		
	MSO301x and DPO301x	3.5 ns			
	Model	*75 Ω:*			
		1 mV/div to 1.99 mV/div	*2 mV/div to 4.98 mV/div*	*5 mV/div to 9.95 mV/div*	*10 mV/div to 1 V/div*
	MSO305x and DPO305x	3 ns	2.1 ns	1.6 ns	1.2 ns
	MSO303x and DPO303x	3 ns	2.1 ns	1.6 ns	1.2 ns
	MSO301x and DPO301x	3.5 ns			
	Model	*1 MΩ (P6139A probe):*			
		1 mV/div to 1.99 mV/div	*2 mV/div to 4.98 mV/div*	*5 mV/div to 9.95 mV/div*	*10 mV/div to 1 V/div*
	MSO305x and DPO305x	2 ns	1.2 ns	750 ps	700 ps
	MSO303x and DPO303x	2 ns	1.2 ns		
	MSO301x and DPO301x	3.5 ns			
Analog bandwidth selections					
MSO305x, DPO305x	20 MHz, 150 MHz, and Full				
MSO303x, DPO303x					
MSO301x, DPO301x	20 MHz				
Lower frequency limit, AC coupled, typical	< 10 Hz when AC to 1 MΩ coupled The AC coupled lower frequency limits are reduced by a factor of 10 when 10X passive probes are used.				
Upper frequency limit, 150 MHz bandwidth limited, typical	150 MHz, +40% -20%				
Upper frequency limit, 20 MHz bandwidth limited, typical	20 MHz, ±35% (all models)				
✓ DC gain accuracy	±2.5% for 1 mV/Div, derated at 0.100%/°C above 30 °C ±2.0% for 2 mV/Div, derated at 0.100%/°C above 30 °C ±1.5% for 5 mV/Div and above, derated at 0.100%/°C above 30 °C ±3.0% Variable Gain, derated at 0.100%/°C above 30 °C				

Table 1-1: Analog channel input and vertical specifications (Cont.)

Characteristic	Description		
DC voltage measurement accuracy	*Measurement type*	*DC Accuracy (in volts)*	
Sample acquisition mode, typical	Any sample	±[DC gain accuracy × | reading - (offset - position) | + Offset Accuracy +0.15 div + 0.6 mV]	
	Delta volts between any two samples acquired with the same oscilloscope setup and ambient conditions	±[DC gain accuracy × | reading | + 0.15 div + 1.2 mV]	
	Note: Offset, position, and the constant offset term must be converted to volts by multiplying by the appropriate volts/div term.		
Average acquisition mode	Average of ≥ 16 waveforms	±[DC gain accuracy × | reading - (offset - position) | + Offset Accuracy + 0.1 div]	
	Delta Volts between any two averages of ≥16 waveforms acquired with the same oscilloscope setup and ambient conditions	±[DC gain accuracy × | reading | + 0.05 div]	
	Note: Offset, position, and the constant offset term must be converted to volts by multiplying by the appropriate volts/div term. The basic accuracy specification applies directly to any sample and to the following measurements: High, Low, Max, Min, Mean, Cycle Mean, RMS, and Cycle RMS. The delta volt accuracy specification applies to subtractive calculations involving two of these measurements. The delta volts (difference voltage) accuracy specification applies directly to the following measurements: Positive Overshoot, Negative Overshoot, Pk-Pk, and Amplitude.		
Offset ranges	*Volts/div setting*	*Offset range*	
		1 MΩ input	*50 Ω and 75 Ω input*
	1 mV/div to 99.5 mV/div	±1 V	±1 V
	100 mV/div to 995 mV/div	±10 V	±5 V
	1 V/div to 10 V/div[1]	±100 V	±5 V
	Input Signal cannot exceed Max Input Voltage for the 50 Ω and 75 Ω input paths. Refer to the Max Input Voltage specification for more information.		
Offset accuracy	±[0.005 × | offset - position | + DC Balance] Note: Both the position and constant offset term must be converted to volts by multiplying by the appropriate volts/div term.		

1 For 50 Ω path, 1 V/div is the maximum vertical setting.

Table 1-1: Analog channel input and vertical specifications (Cont.)

Characteristic	Description		
✓ Random Noise, Sample Acquisition Mode	*Model*	*Bandwidth Selection*	*RMS Noise*
	MSO/DPO3054 and DPO3052	Full	<(170 µV + 8% of V/div setting)
		150 MHz	<(90 µV + 6% of V/div setting)
		20 MHz	<(25 µV + 6% of V/div setting)
	MSO303x and DPO303x	Full	<(140 µV + 6% of V/div setting)
		150 MHz	<(80 µV + 6% of V/div setting)
		20 MHz	<(30 µV + 5% of V/div setting)
	MSO301x and DPO301x	Full	<(100 µV + 6% of V/div setting)
		20 MHz	<(100 µV + 6% of V/div setting)

Table 1-2: Digital channel acquisition system specifications

Characteristic	
Threshold Voltage Range	-15 V to +25 V
Digital Channel Timing Resolution	2 ns for the main memory, and 121.2 ps for MagniVu memory
✓ Threshold Accuracy	± [100 mV + 3% of threshold setting after calibration], after valid SPC
Minimum Detectible Pulse	2.0 ns Using MagniVu memory. Specified at the input to the P6316 probe with all eight ground inputs connected to the user's ground. Use of leadsets, grabber clips, ground extenders, or other connection accessories may compromise this specification.
Channel to Channel Skew	500 ps Digital Channel to Digital Channel only This is the propagation path skew and ignores skew contributions due to bandpass distortion, threshold inaccuracies (see Threshold Accuracy), and sample binning (see Digital Channel Timing Resolution)

Table 1-3: Horizontal and acquisition system specifications

Characteristic	Description
✓ Long-term sample rate and delay time accuracy	±10 ppm over any ≥1 ms time interval
Seconds/Division range	1 ns/div to 1,000 s/div

Table 1-3: Horizontal and acquisition system specifications (cont.)

Characteristic	Description
Peak Detect or Envelope mode pulse response, typical	*Minimum pulse width* MSO305x and DPO305x: > 2.0 ns MSO303x and DPO303x: > 2.9 ns MSO301x and DPO301x: > 6.7 ns
Sample-rate range	See Table 1-4 for details
Record length range	5 M, 1 M, 100 K, 10 K, 1 K
Waveform Capture rate	Maximum triggered acquisition rate: >50,000 wfm/s
Aperture Uncertainty, typical	$\leq$ (5 ps + 1 $\times$ 10^{-6} $\times$ record duration)$_{RMS}$, for records having duration $\leq$ 1 minute Also referred to as "Sample Rate Jitter" Record duration = (Record Length) / (Sample Rate)
Number of Waveforms for Average Acquisition Mode	2 to 512 waveforms Default of 16 waveforms
✓ Delta Time Measurement Accuracy	The formula to calculate delta-time measurement accuracy (DTA) for a given instrument setting and input signal is given below (assumes insignificant signal content above Nyquist) SR_1 = Slew Rate (1st Edge) around the 1st point in the measurement SR_2 = Slew Rate (2nd Edge) around the 2nd point in the measurement N = input-referred noise ($volts_{rms}$, refer to the Random Noise, Sample acquisition mode specification) t_{sr} = 1 / (Sample Rate) TBA = timebase accuracy (Refer to the Long-term sample rate and delay time accuracy specification) t_p = delta-time measurement duration RD = (Record Length) / (Sample Rate) $DTA_{PP} = \pm 5 \times \sqrt{2 \times \left[\frac{N}{SR_1}\right]^2 + 2 \times \left[\frac{N}{SR_2}\right]^2 + (5ps + 1E^{-6} \times RD)^2} + 2 \times t_{sr} + TBA \times t_p$ $DTA_{RMS} = \sqrt{2 \times \left[\frac{N}{SR_1}\right]^2 + 2 \times \left[\frac{N}{SR_2}\right]^2 + (5ps + 1E^{-6} \times RD)^2 + \left[\frac{2 \times t_{sr}}{\sqrt{12}}\right]^2} + TBA \times t_p$ Assumes that error due to aliasing is insignificant. The term under the square-root sign is the stability, and is related to the TIE (Time Interval Error). The errors from this term occur throughout a single-shot measurement. The second term is a result of both the absolute center-frequency accuracy and the center-frequency stability of the timebase and varies between multiple single-shot measurements over the observation interval (the amount of time from the first single-shot measurement to the final single-shot measurement).

Table 1-4: Sample rate range detail

<table>
<tr><th>Characteristic</th><th colspan="6">Description</th></tr>
<tr><td rowspan="23">Sample rate range
(Analog Channels)</td><td>Time/Div</td><td>5 M record</td><td>1 M record</td><td>100 K record</td><td>10 K record</td><td>1 K record</td></tr>
<tr><td>1 ns</td><td colspan="5">2.5 GS/s</td></tr>
<tr><td>2 ns</td><td colspan="5">2.5 GS/s</td></tr>
<tr><td>4 ns</td><td colspan="5">2.5 GS/s</td></tr>
<tr><td>10 ns</td><td colspan="5">2.5 GS/s</td></tr>
<tr><td>20 ns</td><td colspan="5">2.5 GS/s</td></tr>
<tr><td>40 ns</td><td colspan="5">2.5 GS/s</td></tr>
<tr><td>80 ns</td><td colspan="4"></td><td>1.25 GS/s</td></tr>
<tr><td>100 ns</td><td colspan="4">2.5 GS/s</td><td></td></tr>
<tr><td>200 ns</td><td colspan="4">2.5 GS/s</td><td>500 MS/s</td></tr>
<tr><td>400 ns</td><td colspan="4">2.5 GS/s</td><td>250 MS/s</td></tr>
<tr><td>800 ns</td><td colspan="3"></td><td>1.25 GS/s</td><td></td></tr>
<tr><td>1 µs</td><td colspan="3">2.5 GS/s</td><td></td><td>100 MS/s</td></tr>
<tr><td>2 µs</td><td colspan="3">2.5 GS/s</td><td>500 MS/s</td><td>50 MS/s</td></tr>
<tr><td>4 µs</td><td colspan="3">2.5 GS/s</td><td>250 MS/s</td><td>25 MS/s</td></tr>
<tr><td>8 µs</td><td colspan="2"></td><td>1.25 GS/s</td><td colspan="2"></td></tr>
<tr><td>10 µs</td><td colspan="2">2.5 GS/s</td><td></td><td>100 MS/s</td><td>10 MS/s</td></tr>
<tr><td>20 µs</td><td colspan="2">2.5 GS/s</td><td>500 MS/s</td><td>50 MS/s</td><td>5 MS/s</td></tr>
<tr><td>40 µs</td><td colspan="2">2.5 GS/s</td><td>250 MS/s</td><td>25 MS/s</td><td>2.5 MS/s</td></tr>
<tr><td>80 µs</td><td></td><td>1.25 GS/s</td><td colspan="3"></td></tr>
<tr><td>100 µs</td><td>2.5 GS/s</td><td></td><td>100 MS/s</td><td>10 MS/s</td><td>1 MS/s</td></tr>
<tr><td>200 µs</td><td>2.5 GS/s</td><td>500 MS/s</td><td>50 MS/s</td><td>5 MS/s</td><td>500 KS/s</td></tr>
<tr><td>400 µs</td><td>1.25 GS/s</td><td>250 MS/s</td><td>25 MS/s</td><td>2.5 MS/s</td><td>250 KS/s</td></tr>
<tr><td></td><td>800 µs</td><td>625 MS/s</td><td colspan="4"></td></tr>
</table>

Table 1-4: Sample rate range detail (Cont.)

Characteristic	Description					
Sample rate range (Analog Channels) (Cont.)	**Time/Div**	**5 M record**	**1 M record**	**100 K record**	**10 K record**	**1 K record**
	1 ms		100 MS/s	10 MS/s	1 MS/s	100 KS/s
	2 ms	250 MS/s	50 MS/s	5 MS/s	500 KS/s	50 KS/s
	4 ms	125 MS/s	25 MS/s	2.5 MS/s	250 KS/s	25 KS/s
	10 ms	50 MS/s	10 MS/s	1 MS/s	100 KS/s	10 KS/s
	20 ms	25 MS/s	5 MS/s	500 KS/s	50 KS/s	5 KS/s
	40 ms	12.5 MS/s	2.5 MS/s	250 KS/s	25 KS/s	2.5 KS/s
	100 ms	5 MS/s	1 MS/s	100 KS/s	10 KS/s	1 KS/s
	200 ms	2.5 MS/s	500 KS/s	50 KS/s	5 KS/s	500 S/s
	400 ms	1.25 MS/s	250 KS/s	25 KS/s	2.5 KS/s	250 S/s
	1 s	500 KS/s	100 KS/s	10 KS/s	1 KS/s	100 S/s
	2 s	250 KS/s	50 KS/s	5 KS/s	500 S/s	50 S/s
	4 s	125 KS/s	25 KS/s	2.5 KS/s	250 S/s	25 S/s
	10 s	50 KS/s	10 KS/s	1 KS/s	100 S/s	10 S/s
	20 s	25 KS/s	5 KS/s	500 S/s	50 S/s	5 S/s
	40 s	12.5 KS/s	2.5 KS/s	250 S/s	25 S/s	2.5 S/s
	100 s	5 KS/s	1 KS/s	100 S/s	10 S/s	
	200 s	2.5 KS/s	500 S/s	50 S/s	5 S/s	
	400 s	1.25 KS/s	250 S/s	25 S/s	2.5 S/s	
	1000 s	500 S/s	100 S/s	10 S/s		

Table 1-5: Trigger specifications

Characteristic	Description
Aux In (External) trigger maximum input voltage	At front panel connector, 300 V_{RMS}, Installation Category II; derate at 20 dB/decade above 3 MHz to 30 V_{RMS} at 30 MHz, 10 dB/decade above 30 MHz
Aux In (External) trigger input impedance, typical	1 MΩ ±1% in parallel with 10 pF ±2 pF
Aux In (External) trigger bandwidth, typical	>200 MHz
Trigger bandwidth, Edge, Pulse, and Logic, typical	MSO305x and DPO305x: 500 MHz MSO303x and DPO303x: 300 MHz MSO301x and DPO301x: 100 MHz

Table 1-5: Trigger specifications (Cont.)

Characteristic	Description	
Time accuracy for Pulse, Glitch, or Width triggering	*Time range*	*Accuracy*
	1 ns to 500 ns	±(20% of setting + 0.5 ns)
	520 ns to 1 s	±(0.01% of setting + 100 ns)
Edge-type trigger sensitivity, DC coupled, typical	*Trigger Source*	*Sensitivity*
	Any input channel	0.50 div from DC to 50 MHz, increasing to 1 div at oscilloscope bandwidth
	Aux in (External)	200 mV from DC to 50 MHz, increasing to 500 mV at 250 MHz
	Line	Fixed
Edge trigger sensitivity, not DC coupled, typical	*Trigger Coupling*	*Typical Sensitivity*
	AC	1.5 times the DC Coupled limits for frequencies above 10 Hz. Attenuates signals below 10 Hz
	NOISE REJ	2.5 times the DC-coupled limits
	HF REJ	1.5 times the DC-coupled limit from DC to 50 kHz. Attenuates signals above 50 kHz
	LF REJ	1.5 times the DC-coupled limits for frequencies above 50 kHz. Attenuates signals below 50 kHz
Trigger level ranges	*Source*	*Sensitivity*
	Any input channel	±8 divisions from center of screen, ±8 divisions from 0 V when vertical LF reject trigger coupling is selected
	Aux In (External)	±8 V
	Line	Not applicable
	The line trigger level is fixed at about 50% of the line voltage. This specification applies to logic and pulse thresholds.	
Lowest frequency for successful operation of "Set Level to 50%" function, typical	45 Hz	
Trigger level accuracy, DC coupled typical	For signals having rise and fall times ≥ 10 ns, the limits are as follows:	
	Source	*Range*
	Any channel	±0.20 divisions
	Aux In (external trigger)	±(10% of setting + 25 mV)
	Line	Not applicable
Trigger holdoff range	20 ns minimum to 8 s maximum	
Video-type trigger sensitivity, typical	The limits for both delayed and main trigger are as follows:	
	Source	*Sensitivity*
	Any input channel	0.6 to 2.5 divisions of video sync tip
	Aux In (External)	Video not supported through Aux In (External) input

Table 1-5: Trigger specifications (Cont.)

<table>
<tr><th>Characteristic</th><th colspan="4">Description</th></tr>
<tr><td>Video-type trigger formats and field rates</td><td colspan="4">Triggers from negative sync composite video, field 1 or field 2 for interlaced systems, on any field, specific line, or any line for interlaced or non-interlaced systems. Supported systems include NTSC, PAL, and SECAM.</td></tr>
<tr><td>Logic-type or logic qualified trigger or events-delay sensitivities, DC coupled, typical</td><td colspan="4">1.0 division from DC to maximum bandwidth</td></tr>
<tr><td>Pulse-type runt trigger sensitivities, typical</td><td colspan="4">1.0 division from DC to maximum bandwidth</td></tr>
<tr><td>Pulse-type trigger width and glitch sensitivities, typical</td><td colspan="4">1.0 division</td></tr>
<tr><td rowspan="5">Logic-type triggering, minimum logic or rearm time, typical</td><td colspan="4">For all vertical settings, the minimums are:</td></tr>
<tr><td>Trigger type</td><td>Minimum pulse width</td><td>Minimum re-arm time</td><td>Minimum time between channels[1]</td></tr>
<tr><td>Logic</td><td>Not applicable</td><td>2 ns</td><td>2 ns</td></tr>
<tr><td>Time Qualified Logic</td><td>4 ns</td><td>2 ns</td><td>2 ns</td></tr>
<tr><td colspan="4">[1] For logic, time between channels refers to the length of time a logic state derived from more than one channel must exist to be recognized. For Time Qualified Logic events, the time is the minimum time between a main and delayed event that will be recognized if more than one channel is used.</td></tr>
<tr><td rowspan="4">Minimum clock pulse widths for setup/hold time violation trigger, typical</td><td colspan="4">For all vertical settings, the minimums are:</td></tr>
<tr><td colspan="2">Minimum pulse width, clock active[2]</td><td colspan="2">Minimum pulse width, clock inactive[2]</td></tr>
<tr><td colspan="2">User hold time + 2.5 ns[3]</td><td colspan="2">2 ns</td></tr>
<tr><td colspan="4">[2] An active pulse width is the width of the clock pulse from its active edge (as defined through the Define Inputs lower-bezel button and the Clock Edge side-bezel menu) to its inactive edge. An inactive pulse width is the width of the pulse from its inactive edge to its active edge.
[3] The User hold time is the number selected by the user through the Setup and Hold trigger menu.</td></tr>
<tr><td rowspan="2">Setup/hold violation trigger, setup and hold time ranges</td><td colspan="2">Analog Channels</td><td colspan="2">Digital Channels</td></tr>
<tr><td>Min</td><td>Max</td><td>Min</td><td>Max</td></tr>
<tr><td>Setup time</td><td>0 ns</td><td>8 s</td><td>-0.5 ns</td><td>1.0 ms</td></tr>
<tr><td>Hold time</td><td>4 ns</td><td>8 s</td><td>1 ns</td><td>1.0 ms</td></tr>
<tr><td rowspan="2">Setup + Hold time</td><td>4 ns</td><td>16 s</td><td>0.5 ns</td><td>2.0 ms</td></tr>
<tr><td colspan="4">Input coupling on clock and data channels must be the same.
For Setup time, positive numbers mean a data transition before the clock.
For Hold time, positive numbers mean a data transition after the clock edge.
Setup + Hold time is the algebraic sum of the Setup Time and the Hold Time programmed by the user.</td></tr>
</table>

Table 1-5: Trigger specifications (Cont.)

Characteristic	Description		
Pulse type trigger, minimum pulse, rearm time, minimum transition time	*Pulse class*	*Minimum pulse width*	*Minimum rearm time*
	Glitch	4 ns	2 ns + 5% of glitch width setting
	Runt	4 ns	2 ns
	Time-qualified runt	4 ns	8.5 ns + 5% of width setting
	Width	4 ns	2 ns + 5% of width upper limit setting
	Slew rate	4 ns	8.5 ns + 5% of delta time setting
	For the trigger class width and the trigger class runt, the pulse width refers to the width of the pulse being measured. The rearm time refers to the time between pulses. For the trigger class slew rate, the pulse width refers to the delta time being measured. The rearm time refers to the time it takes the signal to cross the two trigger thresholds again.		
Transition time trigger, delta time range	4 ns to 8 s		
Time range for glitch, pulse width, or time-qualified runt triggering	4 ns to 8 s		
B trigger after events, typical			
Minimum pulse width	1 / (2 × Rated Instrument Bandwidth)		
Maximum event frequency	Rated Instrument Bandwidth		
B trigger, minimum time between arm and trigger, typical	8 ns For trigger after time, this is the time between the end of the time period and the B trigger event. For trigger after events, this is the time between the last A trigger event and the first B trigger event.		
B trigger after time, time range	8 ns to 8 s		
B trigger after events, event range	1 to 9,999,999		
Maximum serial trigger bits	128 bits		

Table 1-5: Trigger specifications (Cont.)

Characteristic	Description
Standard serial bus interface triggering	**I^2C** **Address Triggering:** 7 and 10 bit user specified address, as well as General Call, START byte, HS-mode, EEPROM, and CBUS **Data Trigger:** 1 to 5 bytes of user specified data **Trigger On:** Start, Repeated Start, Stop, Missing Ack, Address, Data, or Address and Data **Maximum Data Rate:** 10 Mb/s
	SPI **Data Trigger:** 1 to 16 bytes of user specified data **Trigger On:** SS Active, MOSI, MISO, or MOSI and MISO **Maximum Data Rate:** 10 Mb/s
	CAN **Data Trigger:** 1 to 8 bytes of user specified data, including qualifiers of equal to (=), not equal to (<>), less than (<), greater than (>), less than or equal to (<=), greater than or equal to (>=) **Trigger On:** Start of Frame, Type of Frame, Identifier, Data, Identifier and Data, End of Frame, Missing Ack, or Bit Stuffing Error **Frame Type:** Data, Remote, Error, Overload **Identifier:** Standard (11 bit) and Extended (29 bit) identifiers **Maximum Data Rate:** 1 Mb/s
	RS-232/422/485/UART **Data Trigger:** Tx Data, Rx Data **Trigger On:** Tx Start Bit, Rx Start Bit, Tx End of Packet, Rx End of Packet, Tx Data, Rx Data, Tx Parity Error, or Rx Parity Error **Maximum Data Rate:** 10 Mb/s
	LIN **Data Trigger:** 1 to 8 Bytes of user-specified data, including qualifiers of equal to (=), not equal to (<>), less than (<), greater than (>), less than or equal to (<=), greater than or equal to (>=). **Trigger On**: Sync, Identifier, Data, Identifier & Data, Wakeup Frame, Sleep Frame, or Error **Maximum Data Rate:** 1 Mb/s (by LIN definition, 20 kbit/s)
	I^2S **Data Trigger:** 32 bits of user-specified data in a left word, right word, or either, including qualifiers of equal to (=), not equal to <>, less than (<), greater than (>), less than or equal to (<=), greater than or equal to (>=), inside range, outside range **Trigger on:** Word Select, Data **Maximum Data Rate:** 12.5 Mb/s

Table 1-5: Trigger specifications (Cont.)

Characteristic	Description
Standard serial bus interface triggering (Cont.)	**Left Justified** **Data Trigger:** 32 bits of user-specified data in a left word, right word, or either, including qualifiers of equal to (=), not equal to <>, less than (<), greater than (>), less than or equal to (<=), greater than or equal to (>=), inside range, outside range **Trigger on:** Word Select, Data **Maximum Data Rate:** 12.5 Mb/s
	Right Justified **Data Trigger:** 32 bits of user-specified data in a left word, right word, or either, including qualifiers of equal to (=), not equal to <>, less than (<), greater than (>), less than or equal to (<=), greater than or equal to (>=), inside range, outside range **Trigger on:** Word Select, Data **Maximum Data Rate:** 12.5 Mb/s
	TDM **Data Trigger:** 32 bits of user-specified data in a channel 0-7, including qualifiers of equal to (=), not equal to <>, less than (<), greater than (>), less than or equal to (<=), greater than or equal to (>=), inside range, outside range **Trigger on:** Frame Sync, Data **Maximum Data Rate:** 25 Mb/s

Table 1-6: Display specifications

Characteristic	Description
Display type	9″ WVGA LCD display with CCFL backlight Display Area - 196.8 mm (H) x 118.08 mm (V). 230 mm diagonal
Display resolution	800 x 480 pixels, each made up of 3 vertical stripe sub-pixels colored red, green, and blue
Luminance, typical	400 cd/m^2 at IBL = 5.0 mA$_{rms}$/lamp

Table 1-7: Input/Output port specifications

Characteristic	Description
Ethernet interface	Standard on all models: 10/100 Mb/s
GPIB interface	Available as an optional accessory that connects to USB Device and USB Host port. with the TEK-USB-488 GPIB to USB Adapter Control interface is incorporated in the instrument user interface
USB interface	1 Device and 2 Host connectors (all models)

Table 1-7: Input/Output port specifications (Cont.)

<table>
<tr><th>Characteristic</th><th colspan="2">Description</th></tr>
<tr><td>Device port</td><td colspan="2">USB 2.0 High Speed; also supports Full Speed and Slow Speed Modes</td></tr>
<tr><td>Host ports</td><td colspan="2">Two USB 2.0 high speed ports; one on front, one on rear</td></tr>
<tr><td>Video signal output</td><td colspan="2">A 15 pin, SVGA RGB-type connector</td></tr>
<tr><td>Probe compensator output voltage and frequency, typical</td><td colspan="2">Output voltage: 0 V to 2.5 V ±1% behind 1 kΩ ±2%
Frequency: 1 kHz ±20%</td></tr>
<tr><td rowspan="4">Trigger (Auxiliary) output (AUX OUT)</td><td colspan="2">LOW TRUE. A negative pulse indicates that a trigger has occurred. The logic levels are:</td></tr>
<tr><td>Characteristic</td><td>Limits</td></tr>
<tr><td>Vout (HI)</td><td>≥3.25 V open circuit; ≥2.2 V into a 50 Ω load to ground</td></tr>
<tr><td>Vout (LO)</td><td>≤0.4 V into a load of ≤4 mA; ≤0.30 V into a 50 Ω load to ground</td></tr>
</table>

Table 1-8: Power source specifications

Characteristic	Description
Source voltage	100 V to 240 V ±10%
Source frequency 100 V to 240 V 100 V to 132 V	 50/60 Hz 400 Hz ±10%
Fuse rating	T3.15 A, 250 V The fuse is not customer replaceable

Table 1-9: Data storage specifications

Characteristic	Description
Nonvolatile memory retention time, typical	No time limit for front-panel settings, saved waveforms, setups, and calibration constants
Real-time clock	A programmable clock providing time in years, months, days, hours, minutes, and seconds

Table 1-10: Environmental specifications

Characteristic	Description
Temperature	Operating: 0 °C to +50 °C (+32 °F to +122 °F) Nonoperating: -40 °C to +71 °C (-40 °F to +160 °F)
Humidity	Operating: 5% to 95% relative humidity (% RH) at up to +30 °C, 5% to 45% RH above +30 °C up to +50 °C, non-condensing, and as limited by a Maximum Wet-Bulb Temperature of +38 °C (derates relative humidity to 45 % RH at +50 °C) Nonoperating: 5% to 95% RH (Relative Humidity) at up to +30 °C, 5% to 45% RH above +30 °C up to +50 °C, non-condensing, and as limited by a Maximum Wet-Bulb Temperature of +38 °C (derates relative humidity to 27% RH at +60 °C)
Pollution Degree	Pollution Degree 2, indoor use only
Altitude	Operating: 3,000 m (9,843 ft) Nonoperating: 12,000 m (39,370 ft)

Table 1-11: Mechanical specifications

Characteristic	Description	
Dimensions		
Height	**mm**	**In.**
Handle down	203.2	8.0
Handle up	254	10.3
Width	416.6	16.4
Depth	147.4	5.8
Weight	**kg**	**Lb.**
Stand alone, no front cover	4.2	9.2
With accessories and carry case	6.8	15.0
Packaged for domestic shipment	8.6	19.0

Table 1-12: P6316 Digital probe input characteristics

Characteristic	Description
Number of input channels	16 Digital Inputs
Input resistance, typical	101 KΩ to ground
Input capacitance, typical	8 pF[1]
Minimum Input Signal Swing, typical	500 mV_{p-p}[1]
DC Input Voltage Range	+30V, -20V
Maximum Input Dynamic Range	50 Vp-p, dependant on threshold setting

1 **Specified at the input to the P6316 probe with all eight ground inputs connected to the user's ground. Use of leadsets, grabber clips, ground extenders, or other connection accessories may compromise this specification.**

Performance Verification

Performance Verification

This chapter contains performance verification procedures for the specifications marked with the ✓ symbol. The following equipment, or a suitable equivalent, is required to complete these procedures.

Description	Minimum requirements	Examples
DC voltage source	3 mV to 4 V, ±0.1% accuracy	Fluke 9500 Oscilloscope Calibrator with a 9510 Output Module An appropriate BNC-to-0.1 inch pin adapter between the Fluke 9500 and P6516 probe
Leveled sine wave generator	50 kHz to 1000 MHz, ±4% amplitude accuracy	
Time mark generator	80 ms period, ±1 ppm accuracy, rise time < 50 ns	
Digital Multimeter (DMM)	0.1% accuracy or better	Fluke digital multimeter
One 50 Ω BNC cable	Male-to-male connectors	Tektronix part number 012-0057-01 (43 inch)

You may need additional cables and adapters, depending on the actual test equipment you use.

These procedures cover all MSO/DPO3000 models. Please disregard any checks that do not apply to the specific model you are testing.

Print the test record on the following pages and use it to record the performance test results for your oscilloscope.

NOTE. *Completion of the performance verification procedure does not update the stored time and date of the latest successful adjustment. The date and time are updated only when the adjustment procedures in the service manual are successfully completed.*

The performance verification procedures verify the performance of your instrument. They do not adjust your instrument. If your instrument fails any of the performance verification tests, you should perform the factory adjustment procedures as described in the *MSO3000 and DPO3000 Series Service Manual*.

Upgrade the Firmware

For the best functionality, you can upgrade the oscilloscope firmware. To upgrade the firmware, follow these steps:

1. Open a Web browser and go to www.tektronix.com/software. Use the Software and Firmware Finder to locate the most recent firmware upgrade.
2. Download the latest firmware for your oscilloscope onto your PC.
3. Unzip the files and copy the “firmware.img” file into the root folder of a USB flash drive.
4. Power off your oscilloscope.
5. Insert the USB flash drive into a USB Host port on the front or back of the oscilloscope.
6. Power on the oscilloscope. The oscilloscope automatically recognizes the replacement firmware and installs it.

   If the instrument does not install the firmware, rerun the procedure. If the problem continues, contact qualified service personnel.

***NOTE**. Do not power off the oscilloscope or remove the USB flash drive until the oscilloscope finishes installing the firmware.*

   The oscilloscope displays a message when the installation is complete.

7. Power off the oscilloscope and remove the USB flash drive.
8. Power on the oscilloscope.
9. Push the **Utility** front-panel button.
10. Push the **Utility Page** lower-bezel button.
11. Turn multipurpose knob **a** and select **Config**.
12. Push the **About** lower-bezel button. The oscilloscope displays the firmware version number.
13. Confirm that the version number matches that of the new firmware.

Test Record

Print pages 2-3 through 2-22 for use during the Performance Verification.

Model number	Serial number	Procedure performed by	Date

Test	Passed	Failed
Self Test		

Input Impedance

Performance checks	Vertical scale	Low limit	Test result	High limit
Channel 1 Input Impedance, 1 MΩ	10 mV/div	990 kΩ		1.01 MΩ
	100 mV/div	990 kΩ		1.01 MΩ
Channel 1 Input Impedance, 75 Ω	100 mV/div	74.25 Ω		75.75 Ω
Channel 1 Input Impedance, 50 Ω	100 mV/div	49.5 Ω		50.5 Ω
Channel 2 Input Impedance, 1 MΩ	10 mV/div	990 kΩ		1.01 MΩ
	100 mV/div	990 kΩ		1.01 MΩ
Channel 2 Input Impedance, 75 Ω	100 mV/div	74.25 Ω		75.75 Ω
Channel 2 Input Impedance, 50 Ω	100 mV/div	49.5 Ω		50.5 Ω
Channel 3[1] Input Impedance, 1 MΩ	10 mV/div	990 kΩ		1.01 MΩ
	100 mV/div	990 kΩ		1.01 MΩ
Channel 3[1] Input Impedance, 75 Ω	100 mV/div	74.25 Ω		75.75 Ω
Channel 3[1] Input Impedance, 50 Ω	100 mV/div	49.5 Ω		50.5 Ω
Channel 4[1] Input Impedance, 1 MΩ	10 mV/div	990 kΩ		1.01 MΩ
	100 mV/div	990 kΩ		1.01 MΩ
Channel 4[1] Input Impedance, 75 Ω	100 mV/div	74.25 Ω		75.75 Ω
Channel 4[1] Input Impedance, 50 Ω	100 mV/div	49.5 Ω		50.5 Ω

1 **Channels 3 and 4 are only on four-channel oscilloscopes**

DC Balance				
Performance checks	**Vertical scale**	**Low limit**	**Test result**	**High limit**
Channel 1 DC Balance, 50 Ω, 20 MHz BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 1 DC Balance, 75 Ω, 20 MHz BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 1 DC Balance 1 MΩ, 20 MHz BW	1 mV/div	-0.3 mV		0.3 mV
	2 mV/div	-0.4 mV		0.4 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 1 DC Balance, 50 Ω, 150 MHz BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 1 DC Balance, 75 Ω, 150 MHz BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 1 DC Balance 1 MΩ, 150 MHz BW	1 mV/div	-0.3 mV		0.3 mV
	2 mV/div	-0.4 mV		0.4 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV

DC Balance (Cont.)				
Performance checks	**Vertical scale**	**Low limit**	**Test result**	**High limit**
Channel 1 DC Balance, 50 Ω, Full BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 1 DC Balance, 75 Ω, Full BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 1 DC Balance 1 MΩ, Full BW	1 mV/div	-0.3 mV		0.3 mV
	2 mV/div	-0.4 mV		0.4 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 2 DC Balance, 50 Ω, 20 MHz BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 2 DC Balance, 75 Ω, 20 MHz BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 2 DC Balance 1 MΩ, 20 MHz BW	1 mV/div	-0.3 mV		0.3 mV
	2 mV/div	-0.4 mV		0.4 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV

DC Balance (Cont.)				
Performance checks	**Vertical scale**	**Low limit**	**Test result**	**High limit**
Channel 2 DC Balance, 50 Ω, 150 MHz BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 2 DC Balance, 75 Ω, 150 MHz BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 2 DC Balance 1 MΩ, 150 MHz BW	1 mV/div	-0.3 mV		0.3 mV
	2 mV/div	-0.4 mV		0.4 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 2 DC Balance, 50 Ω, Full BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 2 DC Balance, 75 Ω, Full BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 2 DC Balance 1 MΩ, Full BW	1 mV/div	-0.3 mV		0.3 mV
	2 mV/div	-0.4 mV		0.4 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV

DC Balance (Cont.)				
Performance checks	**Vertical scale**	**Low limit**	**Test result**	**High limit**
Channel 3[1] DC Balance, 50 Ω, 20 MHz BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 3[1] DC Balance, 75 Ω, 20 MHz BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 3[1] DC Balance 1 MΩ, 20 MHz BW	1 mV/div	-0.3 mV		0.3 mV
	2 mV/div	-0.4 mV		0.4 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 3[1] DC Balance, 50 Ω, 150 MHz BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 3[1] DC Balance, 75 Ω, 150 MHz BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 3[1] DC Balance 1 MΩ, 150 MHz BW	1 mV/div	-0.3 mV		0.3 mV
	2 mV/div	-0.4 mV		0.4 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV

DC Balance (Cont.)				
Performance checks	**Vertical scale**	**Low limit**	**Test result**	**High limit**
Channel 3[1] DC Balance, 50 Ω, Full BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 3[1] DC Balance, 75 Ω, Full BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 3[1] DC Balance 1 MΩ, Full BW	1 mV/div	-0.3 mV		0.3 mV
	2 mV/div	-0.4 mV		0.4 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 4[1] DC Balance, 50 Ω, 20 MHz BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 4[1] DC Balance, 75 Ω, 20 MHz BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 4[1] DC Balance 1 MΩ, 20 MHz BW	1 mV/div	-0.3 mV		0.3 mV
	2 mV/div	-0.4 mV		0.4 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV

DC Balance (Cont.)				
Performance checks	**Vertical scale**	**Low limit**	**Test result**	**High limit**
Channel 4[1] DC Balance, 50 Ω, 150 MHz BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 4[1] DC Balance, 75 Ω, 150 MHz BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 4[1] DC Balance 1 MΩ, 150 MHz BW	1 mV/div	-0.3 mV		0.3 mV
	2 mV/div	-0.4 mV		0.4 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 4[1] DC Balance, 50 Ω, Full BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 4[1] DC Balance, 75 Ω, Full BW	1 mV/div	-0.5 mV		0.5 mV
	2 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV
Channel 4[1] DC Balance 1 MΩ, Full BW	1 mV/div	-0.3 mV		0.3 mV
	2 mV/div	-0.4 mV		0.4 mV
	10 mV/div	-2.0 mV		2.0 mV
	100 mV/div	-20.0 mV		20.0 mV
	1 V/div	-200.0 mV		200.0 mV

1 **Channels 3 and 4 are only on four-channel oscilloscopes**

Performance checks: Bandwidth						
Bandwidth at Channel	**Impedance**	**Vertical scale**	V_{in-pp}	V_{bw-pp}	**Limit**	**Test result** *Gain =* V_{bw-pp}/V_{in-pp}
1	50 Ω	10 mV/div			≥ 0.707	
	50 Ω	5 mV/div			≥ 0.707	
	50 Ω	2 mV/div			≥ 0.707	
	50 Ω	1 mV/div			≥ 0.707	
2	50 Ω	10 mV/div			≥ 0.707	
	50 Ω	5 mV/div			≥ 0.707	
	50 Ω	2 mV/div			≥ 0.707	
	50 Ω	1 mV/div			≥ 0.707	
3[1]	50 Ω	10 mV/div			≥ 0.707	
	50 Ω	5 mV/div			≥ 0.707	
	50 Ω	2 mV/div			≥ 0.707	
	50 Ω	1 mV/div			≥ 0.707	
4[1]	50 Ω	10 mV/div			≥ 0.707	
	50 Ω	5 mV/div			≥ 0.707	
	50 Ω	2 mV/div			≥ 0.707	
	50 Ω	1 mV/div			≥ 0.707	

1 **Channels 3 and 4 are only on four-channel oscilloscopes**

DC Gain Accuracy				
Performance checks	**Vertical scale**	**Low limit**	**Test result**	**High limit**
Channel 1 0 V offset, 0 V vertical position, 20 MHz BW, 1 MΩ	1 mV/div	-1.5%		1.5%
	2 mV/div	-1.5%		1.5%
	4.98 mV/div	-3.0%		3.0%
	5 mV/div	-1.5%		1.5%
	10 mV/div	-1.5%		1.5%
	20 mV/div	-1.5%		1.5%
	49.8 mV	-3.0%		3.0%
	50 mV/div	-1.5%		1.5%
	100 mV/div	-1.5%		1.5%
	200 mV/div	-1.5%		1.5%
	500 mV/div	-1.5%		1.5%
	1 V/div	-1.5%		1.5%
Channel 2 0 V offset, 0 V vertical position, 20 MHz BW, 1 MΩ	1 mV/div	-1.5%		1.5%
	2 mV/div	-1.5%		1.5%
	4.98 mV/div	-3.0%		3.0%
	5 mV/div	-1.5%		1.5%
	10 mV/div	-1.5%		1.5%
	20 mV/div	-1.5%		1.5%
	49.8 mV	-3.0%		3.0%
	50 mV/div	-1.5%		1.5%
	100 mV/div	-1.5%		1.5%
	200 mV/div	-1.5%		1.5%
	500 mV/div	-1.5%		1.5%
	1 V/div	-1.5%		1.5%

DC Gain Accuracy (Cont.)				
Performance checks	**Vertical scale**	**Low limit**	**Test result**	**High limit**
Channel 3[1] 0 V offset, 0 V vertical position, 20 MHz BW, 1 MΩ	1 mV/div	-1.5%		1.5%
	2 mV/div	-1.5%		1.5%
	4.98 mV/div	-3.0%		3.0%
	5 mV/div	-1.5%		1.5%
	10 mV/div	-1.5%		1.5%
	20 mV/div	-1.5%		1.5%
	49.8 mV	-3.0%		3.0%
	50 mV/div	-1.5%		1.5%
	100 mV/div	-1.5%		1.5%
	200 mV/div	-1.5%		1.5%
	500 mV/div	-1.5%		1.5%
	1 V/div	-1.5%		1.5%
Channel 4[1] 0 V offset, 0 V vertical position, 20 MHz BW, 1 MΩ	1 mV/div	-1.5%		1.5%
	2 mV/div	-1.5%		1.5%
	4.98 mV/div	-3.0%		3.0%
	5 mV/div	-1.5%		1.5%
	10 mV/div	-1.5%		1.5%
	20 mV/div	-1.5%		1.5%
	49.8 mV	-3.0%		3.0%
	50 mV/div	-1.5%		1.5%
	100 mV/div	-1.5%		1.5%
	200 mV/div	-1.5%		1.5%
	500 mV/div	-1.5%		1.5%
	1 V/div	-1.5%		1.5%

1 **Channels 3 and 4 are only on four-channel oscilloscopes**

DC Offset Accuracy					
Performance checks	Vertical scale	Vertical offset [1]	Low limit	Test result	High limit
All models					
Channel 1 20 MHz BW, 1 MΩ	1 mV/div	700 mV	696.2 mV		703.8 mV
	1 mV/div	-700 mV	-703.8 mV		-696.2 mV
	2 mV/div	700 m	696.1 mV		703.9 mV
	2 mV/div	-700 mV	-703.9 mV		-696.1 mV
	10 mV/div	1 V	993 mV		1007 mV
	10 mV/div	-1 V	-1007 mV		-993 mV
	100 mV/div	10.0 V	9.930 V		10.07 V
	100 mV/div	-10.0 V	-10.07 V		-9.930 V
	1 V/div	100 V	99.30 V		100.7 V
	1 V/div	-100 V	-100.7 V		-99.30 V
	1.01 V/div	100 V	99.30 V		100.7 V
	1.01 V/div	-100 V	-100.7 V		-99.30 V
Channel 2 20 MHz BW, 1 MΩ	1 mV/div	700 mV	696.2 mV		703.8 mV
	1 mV/div	-700 mV	-703.8 mV		-696.2 mV
	2 mV/div	700 mV	696.1 mV		703.9 mV
	2 mV/div	-700 mV	-703.9 mV		-696.1 mV
	10 mV/div	1 V	993 mV		1007 mV
	10 mV/div	-1 V	-1007 mV		-993 mV
	100 mV/div	10.0 V	9.930 V		10.07 V
	100 mV/div	-10.0 V	-10.07 V		-9.930 V
	1 V/div	100 V	99.30 V		100.7 V
	1 V/div	-100 V	-100.7 V		-99.30 V
	1.01 V/div	100 V	99.30 V		100.7 V
	1.01 V/div	-100 V	-100.7 V		-99.30 V

1 **Use this value for both the calibrator output and the oscilloscope offset setting.**

DC Offset Accuracy (Cont.)					
Performance checks	Vertical scale	Vertical offset [1]	Low limit	Test result	High limit
Channel 3[2] 20 MHz BW, 1 MΩ	1 mV/div	700 mV	696.2 mV		703.8 mV
	1 mV/div	-700 mV	-703.8 mV		-696.2 mV
	2 mV/div	700 mV	696.1 mV		703.9 mV
	2 mV/div	-700 mV	-703.9 mV		-696.1 mV
	10 mV/div	1 V	993 mV		1007 mV
	10 mV/div	-1 V	-1007 mV		-993 mV
	100 mV/div	10.0 V	9.930 V		10.07 V
	100 mV/div	-10.0 V	-10.07 V		-9.930 V
	1 V/div	100 V	99.30 V		100.7 V
	1 V/div	-100 V	-100.7 V		-99.30 V
	1.01 V/div	100 V	99.30 V		100.7 V
	1.01 V/div	-100 V	-100.7 V		-99.30 V
Channel 4[2] 20 MHz BW, 1 MΩ	1 mV/div	700 mV	696.2 mV		703.8 mV
	1 mV/div	-700 mV	-703.8 mV		-696.2 mV
	2 mV/div	700 mV	696.1 mV		703.9 mV
	2 mV/div	-700 mV	-703.9 mV		-696.1 mV
	10 mV/div	1 V	993 mV		1007 mV
	10 mV/div	-1 V	-1007 mV		-993 mV
	100 mV/div	10.0 V	9.930 V		10.07 V
	100 mV/div	-10.0 V	-10.07 V		-9.930 V
	1 V/div	100 V	99.30 V		100.7 V
	1 V/div	-100 V	-100.7 V		-99.30 V
	1.01 V/div	100 V	99.30 V		100.7 V
	1.01 V/div	-100 V	-100.7 V		-99.30 V

1 Use this value for both the calibrator output and the oscilloscope offset setting

2 Channels 3 and 4 are only on four-channel oscilloscopes

Performance checks	Low limit	Test result	High limit
Sample Rate and Delay Time Accuracy	-2 divisions		+2 divisions

Auxiliary (Trigger) Output		Low limit	Test result	High limit
Trigger Output	Low 1 MΩ	—		≤ 0.4 V
	High 1 MΩ	≥ 3.25 V		—
	Low 50 Ω	—		≤ 0.20 V
	High 50 Ω	≥ 2.2 V		—

Random Noise, Sample Acquisition Mode		Bandwidth Selection	Test result	High limit
MSO/DPO305x	Channel 1	Full		8.170 mV
		150 MHz		6.090 mV
		20 MHz		6.025 mV
	Channel 2	Full		8.170 mV
		150 MHz		6.090 mV
		20 MHz		6.025 mV
	Channel 3[1]	Full		8.170 mV
		150 MHz		6.090 mV
		20 MHz		6.025 mV
	Channel 4[1]	Full		8.170 mV
		150 MHz		6.090 mV
		20 MHz		6.025 mV
MSO/DPO303x	Channel 1	Full		6.140 mV
		150 MHz		6.080 mV
		20 MHz		5.030 mV
	Channel 2	Full		6.140 mV
		150 MHz		6.080 mV
		20 MHz		5.030 mV
	Channel 3[1]	Full		6.140 mV
		150 MHz		6.080 mV
		20 MHz		5.030 mV
	Channel 4[1]	Full		6.140 mV
		150 MHz		6.080 mV
		20 MHz		5.030 mV

Random Noise, Sample Acquisition Mode		Bandwidth Selection	Test result	High limit
MSO/DPO301x	Channel 1	Full		6.100 mV
		20 MHz		6.100 mV
	Channel 2	Full		6.100 mV
		20 MHz		6.100 mV
	Channel 3[1]	Full		6.100 mV
		20 MHz		6.100 mV
	Channel 4[1]	Full		6.100 mV
		20 MHz		6.100 mV

1 **Channels 3 and 4 are only on four-channel oscilloscopes**

Delta Time Measurement Accuracy (Cont.)			
Channel 1			
MSO/DPO = 4 ns/Div, Source frequency = 240 MHz			
MSO/DPO V/Div	**Source V_{pp}**	**Test Result**	**High Limit**
5 mV	40 mV		240 ps
100 mV	800 mV		240 ps
500 mV	4 V		240 ps
1 V	4 V		240 ps
MSO/DPO = 40 ns/Div, Source frequency = 24 MHz			
MSO/DPO V/Div	**Source V_{pp}**	**Test Result**	**High Limit**
5 mV	40 mV		450 ps
100 mV	800 mV		360 ps
500 mV	4 V		360 ps
1 V	4 V		590 ps
MSO/DPO = 400 ns/Div, Source frequency = 2.4 MHz			
MSO/DPO V/Div	**Source V_{pp}**	**Test Result**	**High Limit**
5 mV	40 mV		3.8 ns
100 mV	800 mV		2.8 ns
500 mV	4 V		2.8 ns
1 V	4 V		5.4 ns

Delta Time Measurement Accuracy (Cont.)			
MSO/DPO = 4 µs/Div, Source frequency = 240 kHz			
MSO/DPO V/Div	**Source V_{pp}**	**Test Result**	**High Limit**
5 mV	40 mV		38 ns
100 mV	800 mV		28 ns
500 mV	4 V		28 ns
1 V	4 V		54 ns
MSO/DPO = 40 µs/Div, Source frequency = 24 kHz			
MSO/DPO V/Div	**Source V_{pp}**	**Test Result**	**High Limit**
5 mV	40 mV		380 ns
100 mV	800 mV		280 ns
500 mV	4 V		280 ns
1 V	4 V		540 ns
MSO/DPO = 40 µs/Div, Source frequency = 2.4 kHz			
MSO/DPO V/Div	**Source V_{pp}**	**Test Result**	**High Limit**
5 mV	40 mV		3.8 µs
100 mV	800 mV		2.8 µs
500 mV	4 V		2.8 µs
1 V	4 V		5.4 µs
Channel 2			
MSO/DPO = 4 ns/Div, Source frequency = 240 MHz			
MSO/DPO V/Div	**Source V_{pp}**	**Test Result**	**High Limit**
5 mV	40 mV		240 ps
100 mV	800 mV		240 ps
500 mV	4 V		240 ps
1 V	4 V		240 ps
MSO/DPO = 40 ns/Div, Source frequency = 24 MHz			
MSO/DPO V/Div	**Source V_{pp}**	**Test Result**	**High Limit**
5 mV	40 mV		450 ps
100 mV	800 mV		360 ps
500 mV	4 V		360 ps
1 V	4 V		590 ps

Delta Time Measurement Accuracy (Cont.)			
MSO/DPO = 400 ns/Div, Source frequency = 2.4 MHz			
MSO/DPO V/Div	Source V_{pp}	Test Result	High Limit
5 mV	40 mV		3.8 ns
100 mV	800 mV		2.8 ns
500 mV	4 V		2.8 ns
1 V	4 V		5.4 ns
MSO/DPO = 4 μs/Div, Source frequency = 240 kHz			
MSO/DPO V/Div	Source V_{pp}	Test Result	High Limit
5 mV	40 mV		38 ns
100 mV	800 mV		28 ns
500 mV	4 V		28 ns
1 V	4 V		54 ns
MSO/DPO = 40 μs/Div, Source frequency = 24 kHz			
MSO/DPO V/Div	Source V_{pp}	Test Result	High Limit
5 mV	40 mV		380 ns
100 mV	800 mV		280 ns
500 mV	4 V		280 ns
1 V	4 V		540 ns
MSO/DPO = 40 μs/Div, Source frequency = 2.4 kHz			
MSO/DPO V/Div	Source V_{pp}	Test Result	High Limit
5 mV	40 mV		3.8 μs
100 mV	800 mV		2.8 μs
500 mV	4 V		2.8 μs
1 V	4 V		5.4 μs
Channel 3[1]			
MSO/DPO = 4 ns/Div, Source frequency = 240 MHz			
MSO/DPO V/Div	Source V_{pp}	Test Result	High Limit
5 mV	40 mV		240 ps
100 mV	800 mV		240 ps
500 mV	4 V		240 ps
1 V	4 V		240 ps

Delta Time Measurement Accuracy (Cont.)

MSO/DPO = 40 ns/Div, Source frequency = 24 MHz

MSO/DPO V/Div	Source V_{pp}	Test Result	High Limit
5 mV	40 mV		450 ps
100 mV	800 mV		360 ps
500 mV	4 V		360 ps
1 V	4 V		590 ps

MSO/DPO = 400 ns/Div, Source frequency = 2.4 MHz

MSO/DPO V/Div	Source V_{pp}	Test Result	High Limit
5 mV	40 mV		3.8 ns
100 mV	800 mV		2.8 ns
500 mV	4 V		2.8 ns
1 V	4 V		5.4 ns

MSO/DPO = 4 μs/Div, Source frequency = 240 kHz

MSO/DPO V/Div	Source V_{pp}	Test Result	High Limit
5 mV	40 mV		38 ns
100 mV	800 mV		28 ns
500 mV	4 V		28 ns
1 V	4 V		54 ns

MSO/DPO = 40 μs/Div, Source frequency = 24 kHz

MSO/DPO V/Div	Source V_{pp}	Test Result	High Limit
5 mV	40 mV		380 ns
100 mV	800 mV		280 ns
500 mV	4 V		280 ns
1 V	4 V		540 ns

MSO/DPO = 40 μs/Div, Source frequency = 2.4 kHz

MSO/DPO V/Div	Source V_{pp}	Test Result	High Limit
5 mV	40 mV		3.8 μs
100 mV	800 mV		2.8 μs
500 mV	4 V		2.8 μs
1 V	4 V		5.4 μs

Delta Time Measurement Accuracy (Cont.)			
Channel 4[1]			
MSO/DPO = 4 ns/Div, Source frequency = 240 MHz			
MSO/DPO V/Div	**Source V_{pp}**	**Test Result**	**High Limit**
5 mV	40 mV		240 ps
100 mV	800 mV		240 ps
500 mV	4 V		240 ps
1 V	4 V		240 ps
MSO/DPO = 40 ns/Div, Source frequency = 24 MHz			
MSO/DPO V/Div	**Source V_{pp}**	**Test Result**	**High Limit**
5 mV	40 mV		450 ps
100 mV	800 mV		360 ps
500 mV	4 V		360 ps
1 V	4 V		590 ps
MSO/DPO = 400 ns/Div, Source frequency = 2.4 MHz			
MSO/DPO V/Div	**Source V_{pp}**	**Test Result**	**High Limit**
5 mV	40 mV		3.8 ns
100 mV	800 mV		2.8 ns
500 mV	4 V		2.8 ns
1 V	4 V		5.4 ns
MSO/DPO = 4 μs/Div, Source frequency = 240 kHz			
MSO/DPO V/Div	**Source V_{pp}**	**Test Result**	**High Limit**
5 mV	40 mV		38 ns
100 mV	800 mV		28 ns
500 mV	4 V		28 ns
1 V	4 V		54 ns

Delta Time Measurement Accuracy (Cont.)			
MSO/DPO = 40 µs/Div, Source frequency = 24 kHz			
MSO/DPO V/Div	**Source V_{pp}**	**Test Result**	**High Limit**
5 mV	40 mV		380 ns
100 mV	800 mV		280 ns
500 mV	4 V		280 ns
1 V	4 V		540 ns
MSO/DPO = 40 µs/Div, Source frequency = 2.4 kHz			
MSO/DPO V/Div	**Source V_{pp}**	**Test Result**	**High Limit**
5 mV	40 mV		3.8 µs
100 mV	800 mV		2.8 µs
500 mV	4 V		2.8 µs
1 V	4 V		5.4 µs

1 **Channels 3 and 4 are only on four-channel oscilloscopes**

Digital Threshold Accuracy (MSO3000 series only)

Digital channel	Threshold	V_{s-}	V_{s+}	Low limit	Test result $V_{sAvg} = (V_{s-} + V_{s+})/2$	High limit
D0	0 V			-0.1 V		0.1 V
	4 V			3.78 V		4.22 V
D1	0 V			-0.1 V		0.1 V
	4 V			3.78 V		4.22 V
D2	0 V			-0.1 V		0.1 V
	4 V			3.78 V		4.22 V
D3	0 V			-0.1 V		0.1 V
	4 V			3.78 V		4.22 V
D4	0 V			-0.1 V		0.1 V
	4 V			3.78 V		4.22 V
D5	0 V			-0.1 V		0.1 V
	4 V			3.78 V		4.22 V
D6	0 V			-0.1 V		0.1 V
	4 V			3.78 V		4.22 V
D7	0 V			-0.1 V		0.1 V
	4 V			3.78 V		4.22 V

Digital Threshold Accuracy (MSO3000 series only)						
Digital channel	Threshold	V_{s-}	V_{s+}	Low limit	Test result $V_{sAvg} = (V_{s-} + V_{s+})/2$	High limit
D8	0 V			-0.1 V		0.1 V
	4 V			3.78 V		4.22 V
D9	0 V			-0.1 V		0.1 V
	4 V			3.78 V		4.22 V
D10	0 V			-0.1 V		0.1 V
	4 V			3.78 V		4.22 V
D11	0 V			-0.1 V		0.1 V
	4 V			3.78 V		4.22 V
D12	0 V			-0.1 V		0.1 V
	4 V			3.78 V		4.22 V
D13	0 V			-0.1 V		0.1 V
	4 V			3.78 V		4.22 V
D14	0 V			-0.1 V		0.1 V
	4 V			3.78 V		4.22 V
D15	0 V			-0.1 V		0.1 V
	4 V			3.78 V		4.22 V

Performance Verification Procedures

The following three conditions must be met prior to performing these procedures:

1. The oscilloscope must have been operating continuously for twenty (20) minutes in an environment that meets the operating range specifications for temperature and humidity.
2. You must perform a signal path compensation (SPC). See *Signal Path Compensation* in the *MSO3000 and DPO3000 Series Digital Phosphor Oscilloscopes User Manual*. If the operating temperature changes by more than 10 °C (18 °F), you must perform the signal path compensation again.
3. You must connect the oscilloscope and the test equipment to the same AC power circuit. Connect the oscilloscope and test instruments into a common power strip if you are unsure of the AC power circuit distribution. Connecting the oscilloscope and test instruments into separate AC power circuits can result in offset voltages between the equipment, which can invalidate the performance verification procedure.

The time required to complete the entire procedure is approximately one hour.

WARNING. *Some procedures use hazardous voltages. To prevent electrical shock, always set voltage source outputs to 0 V before making or changing any interconnections.*

Self Test

This procedure uses internal routines to verify that the oscilloscope functions and passes its internal self tests. No test equipment or hookups are required. Start the self test with these steps:

1. Disconnect all probes and cables from the oscilloscope inputs.
2. Push the front-panel **Default Setup** button to set the instrument to the factory default settings.
3. Push the **Utility** menu button.
4. Push the **Utility Page** lower-bezel button, and turn the **Multipurpose a** knob to select **Self Test**.
5. Push the **Self Test** lower-bezel button. The Loop X Times side-bezel menu will be set to **Loop 1 Times**.
6. Push the **OK Run Self Test** side-bezel button.

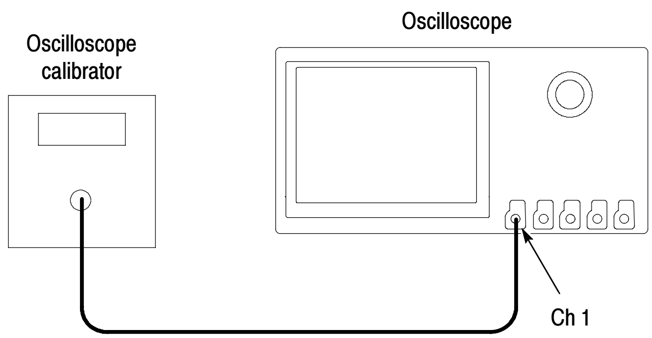
7. Wait while the self test runs. When the self test completes, a dialog box displays the results of the self test.

8. Cycle the oscilloscope power off and back on before proceeding.

Check Input Impedance (Resistance)

This test checks the Input Impedance.

1. Connect the output of the oscilloscope calibrator (for example, Fluke 9500) to the oscilloscope channel 1 input, as shown below.



2. Push the front-panel **Default Setup** button to set the instrument to the factory default settings.

3. Push the front-panel channel button for the oscilloscope channel that you are testing, as shown in the test record (for example, **1**, **2**, **3**, or **4**).

4. Confirm that the oscilloscope and calibrator impedances are both set to 1 MΩ. The default **Impedance** setting is **1 MΩ**.

5. Turn the **Vertical Scale** knob to set the vertical scale, as shown in the test record (for example, 10 mV/div, 100 mV/div, 1 V/div).

6. Measure the input resistance of the oscilloscope with the calibrator. Record this value in the test record.

7. Repeat steps 5 and 6 for each volt/division setting in the test record.

8. Change the oscilloscope impedance to 75 Ω and calibrator impedance to 50 Ω and repeat steps 5 through 7.

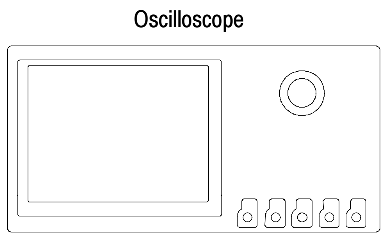
9. Change the oscilloscope impedance to 50 Ω and repeat steps 5 through 7.

10. Repeat steps 4 through 9 for each channel listed in the test record and relevant to the model of oscilloscope that you are testing, as shown in the test record (for example, **2**, **3**, or **4**).

Check DC Balance

This test checks the DC balance.

You do not need to connect the oscilloscope to any equipment to run this test.



1. Attach a 50 Ω terminator to the channel input of the oscilloscope being tested.
2. Push the front-panel **Default Setup** button to set the instrument to the factory default settings.
3. Push the front-panel channel button for the oscilloscope channel that you are testing, as shown in the test record (for example, **1**, **2**, **3**, or **4**).
4. Set the oscilloscope impedance to 50 Ω. Push the **Impedance** lower-bezel button to select **50 Ω**.
5. Push the lower-bezel **Bandwidth** button and push the appropriate bandwidth side-bezel button for **20MHz**, **150MHz**, or **Full**, as given in the test record.
6. Turn the Horizontal **Scale** knob to 1 ms/division.
7. Turn the Vertical **Scale** knob to set the vertical scale, as shown in the test record (for example, 1 mV/div, 2 mV/div, 10 mV/div, 100 mV/div, 1 V/div).
8. Push the front-panel **Acquire** button.
9. Push the **Mode** lower-bezel button, and then, if needed, push the **Average** side bezel button.
10. If needed, adjust the number of averages to **16** with the **Multipurpose a** knob.
11. Push the Trigger **Menu** front-panel button.
12. Push the **Source** lower-bezel button.
13. Select the **AC Line** trigger source on the side menu. You do not need to connect an external signal to the oscilloscope for this DC Balance test.
14. Push the front-panel Wave Inspector **Measure** button.
15. Push the **Add Measurement** lower bezel button.
16. Use the **Multipurpose a** knob to select the **Mean** measurement.

17. Push the **OK Add Measurement** side-bezel button, and then the **Menu Off** front-panel button.

18. View the mean measurement value in the display and enter that mean value as the test result in the test record.

19. Repeat steps 7 through 18 for each volts/division value listed in the results table.

20. Push the front-panel channel button, change the oscilloscope bandwidth (for example, 20 MHz, 150 MHz, or Full), and repeat steps 5 through 19.

21. Change the oscilloscope impedance to 1 MΩ and repeat steps 5 through 20.

22. Repeat steps 3 through 20 for each channel combination listed in the test record and relevant to your model of oscilloscope (for example, **1**, **2**, **3**, or **4**).

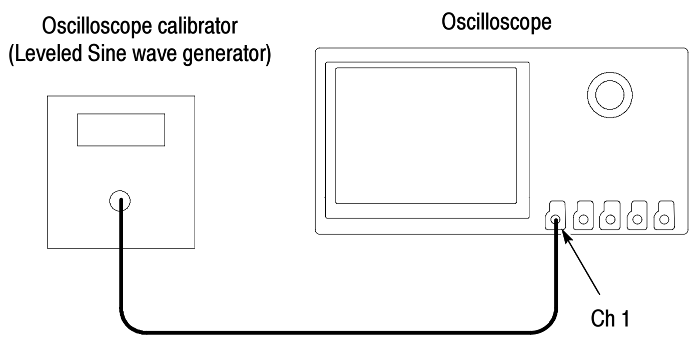
23. Change the oscilloscope impedance to 75 Ω and repeat steps 5 through 20.

24. Repeat steps 3 through 20 for each channel combination listed in the test record and relevant to your model of oscilloscope (for example, **1**, **2**, **3**, or **4**).

Check Bandwidth

This test checks the bandwidth at 50 Ω for each channel.

1. Connect the output of the leveled sine wave generator (for example, Fluke 9500) to the oscilloscope channel 1 input as shown below.



2. Push the front-panel **Default Setup** button to set the instrument to the factory default settings.

3. Push the channel button (**1**, **2**, **3**, or **4**) for the channel that you want to check.

4. Set the calibrator to 50 Ω output impedance (50 Ω source impedance) and to generate a sine wave.

5. Set the oscilloscope impedance to 50 Ω. Push the **Impedance** lower-bezel button to select **50 Ω**.

6. Turn the Vertical **Scale** knob to set the vertical scale, as shown in the test record (for example, 1 mV/div, 2 mV/div, 5 mV/div).

7. Push the front-panel **Acquire** button.

8. Confirm that the mode is set to **Sample**. If not, push the **Mode** lower-bezel button, if needed, and then push the **Sample** side bezel button.

9. Adjust the signal source to at least 6 vertical divisions at the selected vertical scale with a set frequency of 50 kHz. For example, at 5 mV/div, use a ≥ 30 mV_{p-p} signal, at 2 mV/div, use a ≥ 12 mV_{p-p} signal, at 1 mV/div, use a ≥ 6 mV_{p-p} signal. Use a sine wave for the signal source.

10. Turn the Horizontal **Scale** knob to 40 μs/division.

11. Push the front-panel Wave Inspector **Measure** button, and then the lower-bezel **Add Measurement** button.

12. Use the **Multipurpose a** knob to select the **Peak-to-peak** measurement, and then press the **OK Add Measurement** side-bezel button.

13. Push the **More** lower-bezel button to select **Gating**, and then push the **Off (Full Record)** side-bezel button.

14. Push the **Menu Off** front-panel button. This will allow you to see the display. Note the mean V_{p-p} of the signal. Call this reading V_{in-pp}.

    Record the value of V_{in-pp} (for example, 816 mV) in the test record.

15. Turn the Horizontal **Scale** knob to 10 ns/division.

16. Adjust the signal source to the maximum bandwidth frequency for the bandwidth and model desired, as shown in the following worksheet. Measure V_{p-p} of the signal on the oscilloscope using statistics, as in the previous step, to get the mean V_{p-p}. Call this reading V_{bw-pp}.

Record the value of V_{bw-pp} in the test record.

***NOTE**. For more information on the contents of this worksheet, refer to the bandwidth specifications in Table 1-1, starting on page 1-3.*

Table 2-1: Maximum Bandwidth Frequency worksheet

Impedance	Vertical Scale	Maximum bandwidth frequency
Model: MSO/DPO305x		
50 Ω	10 mV/div	500 MHz
50 Ω	5 mV/div	400 MHz
50 Ω	2 mV/div	250 MHz
50 Ω	1 mV/div	150 MHz
Model: MSO/DPO303x		
50 Ω	5 mV/div	300 MHz
50 Ω	2 mV/div	250 MHz
50 Ω	1 mV/div	150 MHz
Model: MSO/DPO301x		
50 Ω	1 mV/div	100 MHz

17. Use the values of $V_{bw\text{-}pp}$ and $V_{in\text{-}pp}$ obtained above and stored in the test record to calculate the *Gain* at bandwidth with the following equation:

$Gain = V_{bw\text{-}pp}/V_{in\text{-}pp}$.

To pass the performance measurement test, Gain should be ≥ 0.707.

Enter *Gain* in the test record.

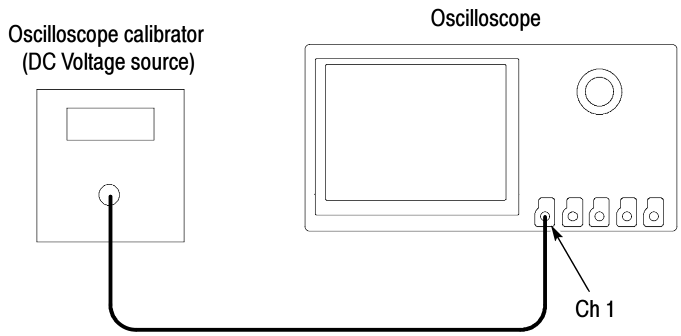
18. Repeat steps 9 through 17 for the other oscilloscope volts/div settings listed in the test record.

19. Repeat steps 3 through 18 for each channel combination listed in the test record and relevant to your model of oscilloscope (for example, **1**, **2**, **3**, or **4**).

Check DC Gain Accuracy

This test checks the DC gain accuracy.

1. Connect the oscilloscope to a DC voltage source. If using the Wavetek 9500 calibrator, connect the calibrator head to the oscilloscope channel to test.



2. Push the front-panel **Default Setup** button to set the instrument to the factory default settings.
3. Push the channel button (**1**, **2**, **3**, or **4**) for the channel that you want to check.
4. Confirm that the oscilloscope and calibrator impedances are both set to 1 MΩ. Push the **Impedance** lower-bezel button to select **1 MΩ**.
5. Push the **20 MHz** side-bezel button to select the bandwidth (push the lower-bezel **Bandwidth** button if necessary to activate the Bandwidth menu).
6. Push the front-panel **Acquire** button.
7. Push the **Mode** lower-bezel button, and push the **Average** side bezel button. The default number of averages is **16**.
8. Push the front-panel Wave Inspector **Measure** button, and then the **Add Measurement** lower-bezel button.
9. Use the **Multipurpose a** knob to select the **Mean** measurement.
10. Push the **OK Add Measurement** side-bezel button.
11. Push the Trigger **Menu** front-panel button.
12. Push the **Source** lower-bezel button.
13. Turn the **Multipurpose a** knob to select the **AC Line** as the trigger source.
14. Turn the vertical **Scale** knob to the next setting to measure, as shown in Table 2-2.

15. Set the DC Voltage Source to $V_{negative}$ (see Table 2–2). Push the **Measure** front-panel button, push the **More** lower-bezel button to select **Statistics**, push the **Reset Statistics** side-bezel button, and then push the **Menu Off** front-panel button. Enter the mean reading into Table 2–2 as $V_{negative\text{-}measured}$.

16. Set the DC Voltage Source to $V_{positive}$ (see Table 2–2). Push the **More** lower-bezel button to select **Statistics**, push the **Reset Statistics** side-bezel button, and then push the **Menu Off** front-panel button. Enter the mean reading into Table 2–2 as $V_{positive\text{-}measured}$.

Table 2-2: Gain Expected worksheet

Oscilloscope Vertical Scale Setting	$V_{diffExpected}$	$V_{negative}$	$V_{positive}$	$V_{negative\text{-}measured}$	$V_{positive\text{-}measured}$	V_{diff}	Test Result (Gain Accuracy)
1 mV/div	7 mV	-3.5 mV	+3.5 mV				
2 mV/div	14 mV	-7 mV	+7 mV				
4.98 mV	34.86 mV	-17.43 mV	+17.43 mV				
5 mV	35 mV	-17.5 mV	+17.5 mV				
10 mV	70 mV	-35 mV	+35 mV				
20 mV	140 mV	-70 mV	+70 mV				
49.8 mV	348.6 mV	-174.3 mV	+174.3 mV				
50 mV	350 mV	-175 mV	+175 mV				
100 mV	700 mV	-350 mV	+350 mV				
200 mV	1400 mV	-700 mV	+700 mV				
500 mV	3500 mV	-1750 mV	+1750 mV				
1.0 V	7000 mV	-3500 mV	+3500 mV				

17. Calculate V_{diff} as follows:

$$V_{diff} = |V_{negative\text{-}measured} - V_{positive\text{-}measured}|$$

Enter V_{diff} in Table 2–2.

18. Calculate *GainAccuracy* as follows:

$$GainAccuracy = ((V_{diff} - V_{diffExpected})/V_{diffExpected}) \times 100\%$$

Write down *GainAccuracy* in Table 2–2 and in the test record.

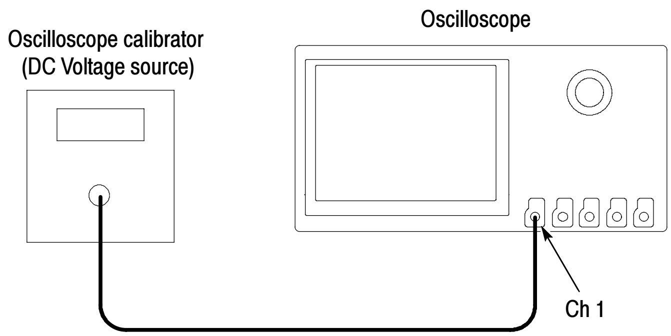
19. Repeat steps 14 through 18 for each volts/division value in the test record.

20. Repeat steps 3 through 19 for each channel of the oscilloscope that you want to check.

Check Offset Accuracy

This test checks the offset accuracy.

1. Connect the oscilloscope to a DC voltage source to run this test. If using the Wavetek calibrator as the DC voltage source, connect the calibrator head to the oscilloscope channel to test.



2. Push the front-panel **Default Setup** button to set the instrument to the factory default settings.
3. Push the channel button (**1**, **2**, **3**, or **4**) for the channel that you want to check.
4. Confirm that the oscilloscope and calibrator impedances are both set to 1 MΩ. Push the **Impedance** lower-bezel button to select **1 MΩ**.
5. Set the calibrator to the vertical offset value shown in the test record (for example, 700 mV for a 1 mV/div setting). Set the calibrator to the same impedance as you set for the oscilloscope.
6. Push the oscilloscope **More** lower-bezel button repeatedly to select **Offset**.
7. Set the oscilloscope to the vertical offset value shown in the test record (for example, 700 mV for a 1 mV/div setting).
8. Turn the vertical **Scale** to match the value in the test record (for example, 1 mV/division).
9. Turn the Horizontal **Scale** knob to 1 ms/div.
10. Push the lower-bezel **Bandwidth** button.
11. Push the side-bezel button to set the bandwidth to **20 MHz**.
12. Check that the vertical position is set to 0 divs. If not, turn the appropriate **Vertical Position** knob to set the position to 0 divs.

    Or, push the lower-bezel **More** button repeatedly to select **Position**, and then press the side-bezel **Set to 0 divs** button.
13. Push the front-panel **Acquire** button.

14. Push the **Mode** lower-bezel button, and push the **Average** side bezel button. The default number of averages is **16**.

15. Push the front-panel Trigger **Menu** button.

16. Push the **Source** lower-bezel button.

17. Turn the **Multipurpose a** knob to select the **AC Line** as the trigger source.

18. Push the front-panel Wave Inspector **Measure** button.

19. Push the **Add Measurement** lower bezel button.

20. Use the **Multipurpose a** knob to select the **Mean** measurement.

21. Push the **OK Add Measurement** side-bezel button, and then the **Menu Off** button. The mean value should appear in a measurement pane at the bottom of the display.

22. Enter the measured value in the test record.

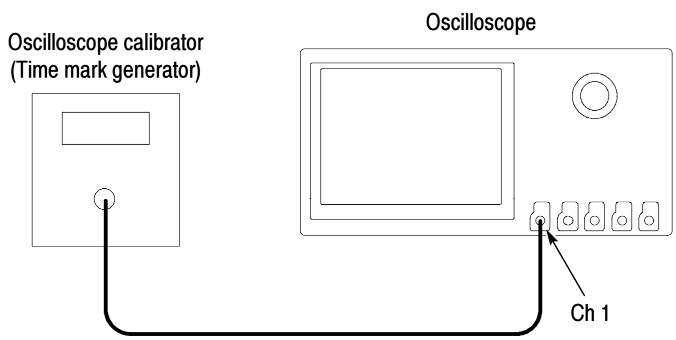
23. Repeat the procedure for each volts/division setting shown in the test record.

24. Repeat steps 3 through 23 for each channel of the oscilloscope that you want to check.

Check Sample Rate and Delay Time Accuracy

This test checks the sample rate and delay time accuracy (time base).

1. Connect the output of the time mark generator to the oscilloscope channel 1 input using a 50 Ω cable.



2. Set the time mark generator period to **80 ms**. Use a time mark waveform with a fast rising edge.

3. Push the front-panel **Default Setup** button to set the instrument to the factory default settings.

4. Push the channel **1** button.

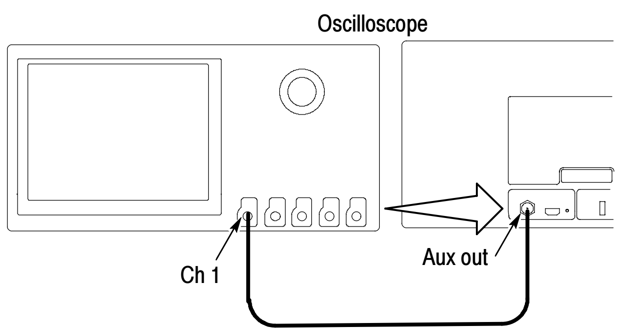
5. Set the impedance to 50 Ω. Push the **Impedance** lower-bezel button to select **50 Ω**.
6. If adjustable, set the time mark amplitude to approximately **1** $\mathbf{V_{p\text{-}p}}$.
7. Set the Vertical **SCALE** to **500 mV**.
8. Set the Horizontal **SCALE** to **20 ms**.
9. Adjust the Vertical **POSITION** knob to center the time mark signal on the screen.
10. Adjust the Trigger **LEVEL** knob as necessary for a triggered display.
11. Adjust the Horizontal **POSITION** knob to move the trigger location to the center of the screen (50%).
12. Turn the Horizontal **POSITION** knob counterclockwise to set the delay to exactly **80 ms**.
13. Set the Horizontal **Scale** to **400 ns/div**.
14. Compare the rising edge of the marker with the center horizontal graticule line. The rising edge should be within ±1 divisions of center graticule. Enter the deviation in the test record.

***NOTE**. One division of displacement from graticule center corresponds to a 5 ppm time base error.*

Check Aux Out

This test checks the Aux Output.

1. Connect the Aux Out signal from the rear of the instrument to the channel 1 input using a 50 Ω cable.



2. Push the front-panel **Default Setup** button to set the instrument to the factory default settings.

3. Push the channel **1** button.
4. Set the oscilloscope impedance to 1 MΩ. The default **Impedance** setting is **1MΩ**.
5. Set the horizontal to 4 uS/div and the vertical to 1 V/div.
6. Push the front-panel Wave Inspector **Measure** button.
7. Push the **Add Measurement** lower-bezel button.
8. Use the **Multipurpose a** knob to select **Low** in the Measurements menu, and then push the **OK Add Measurement** side-bezel button.
9. Use the **Multipurpose a** knob to select **High** in the Measurements menu, and then push the **OK Add Measurement** side-bezel button.
10. Push the **Menu Off** button.
11. Record the high and low measurements (for example, low = 200 mV and high = 3.52 V).
12. Repeat the procedure, using **50 Ω** instead of **1 MΩ** in step 4.

Random Noise, Sample Acquisition Mode

This test checks random noise. You do not need to connect any test equipment to the oscilloscope for this test.

1. Disconnect everything connected to the oscilloscope inputs.
2. Push the front-panel **Default Setup** button to set the instrument to the factory default settings. This sets the oscilloscope to Channel 1, Full Bandwidth, 1 MΩ input impedance, 100 mV/div, and 4.00 μs/div.
3. Set the input impedance to 50 Ω:
   a. Press the front-panel button for the channel being tested (1, 2, 3, or 4) [1] to display the channel input menu.
   b. Press the bottom-bezel **Impedance** button to select **50 Ω**.
4. Set **Gating** to **Off**:
   a. Press the front-panel Wave Inspector **Measure** button.
   b. Press the bottom-bezel **More** button to select **Gating**.
   c. Press the side-bezel **Off (Full Record**) button.
5. Select the RMS measurement:
   a. Press the bottom-bezel **Add Measurement** button.

b. Use the Multipurpose **a** knob to select the **RMS** measurement.

c. If necessary, use the Multipurpose **b** knob to select the channel being tested as the source for the RMS measurement.

d. Press the side-bezel **OK Add Measurement** button.

6. Press the bottom-bezel **More** button to select **Statistics**, and then press the side-bezel **Reset Statistics** button.

7. Press the front-panel **Menu Off** button to remove the menus from the display.

8. Read the RMS Mean value. This is the Sampled Mean Value (SMV).

9. Press the Horizontal **Acquire** button and then, if necessary, press the bottom-bezel **Mode** button to display the Acquisition Mode menu.

10. Press the side-bezel **Average** button and, if necessary, use the multipurpose **a** knob to set the number of averages to 16.

11. Press the front-panel Wave Inspector **Measure** button and then, if necessary, press the bottom-bezel **More button** to select **Statistics**, and then press the side-bezel **Reset Statistics** button.

12. Press the front-panel **Menu Off** button to remove the menus from the display.

13. Read the RMS Mean value. This is the Averaged Mean Value (AMV).

14. Calculate the RMS noise (RMS noise = SMV - AMV), and enter the calculated RMS noise into the appropriate segment of the Test Record.

15. Set the Acquisition Mode to Sample:

    a. Press the front-panel Horizontal **Acquire** button.

    b. If necessary, press the bottom-bezel **Mode** button to display the Acquisition Mode menu.

    c. Press the side-bezel **Sample** button.

16. Set the bandwidth to 150 MHz:

    a. Press the front-panel button for the channel being tested (1, 2, 3, or 4)[1].

    b. Press the bottom-bezel **Bandwidth** button, and then press the side-bezel **150MHz** button.

17. Press the front-panel Wave Inspector **Measure** button, and repeat steps 6 through 15.

18. Set the channel under test bandwidth to 20 MHz:

a. Press the front-panel button for the channel being tested (1, 2, 3, or 4)[1].

b. Press the bottom-bezel **Bandwidth** button, and then press the side-bezel **20MHz** button.

19. Press the front-panel Wave Inspector **Measure** button, and then repeat steps 6 through 15.

20. Select the next channel (2, 3, or 4) [1] to test.

21. Repeat steps 3 through 20 until all channels have been tested.

1 **Channels 3 and 4 are only on four-channel oscilloscopes**

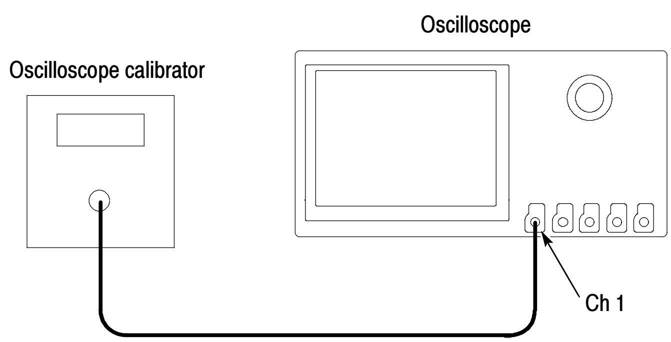
Delta Time Measurement Accuracy

This test checks the Delta-time measurement accuracy (DTA) for a given instrument setting and input signal.

1. Set the sine wave generator output impedance to 50 Ω.

2. Press the oscilloscope front-panel **Default Setup** button, and then press the **Menu Off** button to remove the side-bezel menu.

3. Connect a 50 Ω coaxial cable from the signal source to the oscilloscope channel being tested.



4. Press the channel **1** button to display the channel 1 menu.

5. Press the bottom-bezel **Impedance** button to set the channel to **50 Ω**.

6. Press the front-panel Trigger **Menu** button and then, if necessary, set the trigger source to the channel being tested:

   a. Press the bottom-bezel **Source** button.

   b. Use the Multipurpose **a** knob to select the channel being tested.

7. Press the Wave Inspector **Measure** button, and then press the bottom-bezel **Add Measurement** button.

8. Use the Multipurpose **a** knob to select the **Burst Width** measurement, and then press the side-bezel **OK Add Measurement** button.

9. Press the bottom-bezel **More** button to select Statistics and, if necessary, use the mutipurpose **a** knob to set the **Mean & Std Dev Samples** to 100, as shown in the side menu.

10. Press the front-panel **Menu Off** button to remove the Statistics menu.

11. Refer to the Test Record *Delta Time Measurement Accuracy* table. Set the oscilloscope and the signal source as directed there.

12. Press the bottom-bezel **More** button to select Statistics and the press the side-bezel **Reset Statistics** button and wait five or 10 seconds for the oscilloscope to acquired all the samples before taking the reading.

13. Verify that the **Std Dev** is less than the upper limit shown for each setting, and note the reading in the Test Record.

14. Repeat steps 11 through 13 for each setting combination shown in the Test Record for the channel being tested.

15. Press the front-panel channel button for the next channel to be tested, and move the coaxial cable to the appropriate input on the oscilloscope.

16. Repeat steps 5 through 15 until all channels have been tested.

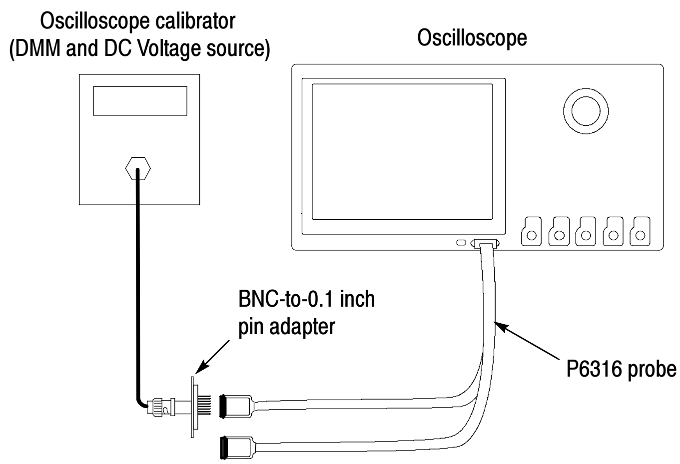
Check Digital Threshold Accuracy (MSO3000 only)

For the MSO3000 series only, this test checks the threshold accuracy of the digital channels. This procedure applies to digital channels D0 through D15, and to channel threshold values of 0 V and +4 V.

1. Connect the P6316 digital probe to the MSO3000 series instrument.

2. Connect the P6316 Group 1 pod to the DC voltage source to run this test. You will need a BNC-to-0.1 inch pin adapter to complete the connection.

   If using the Wavetek calibrator as the DC voltage source, connect the calibrator head to the P6316 Group 1 pod. You will need a BNC-to-0.1 inch pin adapter to complete the connection.



3. Push the front-panel **Default Setup** button to set the instrument to the factory default settings.

4. Push the front-panel **D15-D0** button.

5. Push the **D15-D0 On/Off** lower-bezel button.

6. Push the **Turn On D7 - D0** and the **Turn On D15 - D8** side-bezel buttons. The instrument will display the 16 digital channels.

7. Push the **Thresholds** lower-bezel button.

8. Before you change the threshold value, push the **Fine** front-panel button to turn off the fine adjustment and make adjusting the value quicker. Turn the Multipurpose **a** knob (for channels D7 - D0) or Multipurpose **b** knob (for channels D15 - D8) to set the threshold value to **0.00 V** (0 V/div).

   The thresholds are set for the 0 V threshold check. You need to record the test values in the test record row for 0 V for each digital channel.

9. Push the front-panel Trigger **Menu** button.

10. Push the **Source** lower-bezel button, and turn Multipurpose **a** knob to select the appropriate channel, such as D0.

    By default, the Type is set to Edge, Coupling is set to DC, Slope is set to Rising, Mode is set to Auto, and Level is set to match the threshold of the channel being tested.

11. Set the DC voltage source (Vs) to -400 mV. Wait 3 seconds. Check the logic level of the corresponding digital channel in the display.

    If the channel is a static logic level high (green), change the DC voltage source Vs to -500 mV.

12. Increment Vs by +20 mV. Wait 3 seconds and check the logic level of the corresponding digital channel in the display. If the channel is at a static logic level high (green), record the Vs value as in the 0 V row of the test record.

    If the channel is a logic level low (blue) or is alternating between high and low, repeat this step (increment Vs by 20 mV, wait 3 seconds, and check for a static logic high). Continue until a value for **Vs-** is found.

***NOTE.** In this procedure, the channel might not change state until after you pass the set threshold level.*

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13. Push the **Slope** lower-bezel button to change the slope to Falling.

14. Set the DC voltage source (Vs) to +400 mV. Wait 3 seconds. Check the logic level of the corresponding digital channel in the display.

    If the channel is a static logic level low (blue), change the DC voltage source Vs to +500 mV.

15. Decrement Vs by -20 mV. Wait 3 seconds and check the logic level of the corresponding digital channel in the display. If the channel is at a static logic level low, record the Vs value as **Vs+** in the 0 V row of the test record.

    If the channel is a logic level high (green) or is alternating between high and low, repeat this step (decrement Vs by 20 mV, wait 3 seconds, and check for a static logic low). Continue until a value for **Vs+** is found.

16. Find the average, V_{sAvg} = (Vs- + Vs+)/2. Record the average as the test result in the test record.

    Compare the test result to the limits. If the result is between the limits, continue with the procedure to test the channel at the +4 V threshold value.

17. The remaining part of this procedure is for the +4 V threshold test. Push the front-panel **D15-D0** button. The **Thresholds** menu should display.

18. With the Fine front-panel button turned off, turn the Multipurpose **a** knob (for channels D7 - D0) or Multipurpose **b** knob (for channels D15 - D8) to set the threshold value to **4.00 V** (+4.0 V/div). To remove the menu from the display, push the front-panel **Menu Off** button.

19. Set the DC voltage source (Vs) to +4.4 V. Wait 3 seconds. Check the logic level of the corresponding digital channel in the display.

    If the channel is a static logic level low (blue), change the DC voltage source Vs to +4.5 V.

20. Decrement Vs by –20 mV. Wait 3 seconds and check the logic level of the corresponding digital channel in the display. If the channel is at a static logic level low, record the Vs value as **Vs+** in the 4 V row of the test record.

    If the channel is a logic level high (green) or is alternating between high and low, repeat this step (decrement Vs by 20 mV, wait 3 seconds, and check for a static logic low). Continue until a value for **Vs+** is found.

21. Push the front–panel Trigger **Menu** button.

22. Push the **Slope** lower–bezel button to change the slope to **Rising**.

23. Set the DC voltage source (Vs) to +3.6 V. Wait 3 seconds. Check the logic level of the corresponding digital channel in the display.

    If the channel is a static logic level high (green), change the DC voltage source Vs to +3.5 V.

24. Increment Vs by +20 mV. Wait 3 seconds and check the logic level of the corresponding digital channel in the display. If the channel is at a static logic level high, record the Vs value as in the 4 V row of the test record.

    If the channel is a logic level low (blue) or is alternating between high and low, repeat this step (increment Vs by 20 mV, wait 3 seconds, and check for a static logic high). Continue until a value for **Vs–** is found.

25. Find the average, V_{sAvg} = (Vs– + Vs+)/2. Record the average as the test result in the test record.

    Compare the test result to the limits. If the result is between the limits, the channel passes the test.

26. Push the front–panel **D15–D0** button. The **Thresholds** menu should display.

27. Repeat the procedure starting with step 8 for each remaining digital channel in the pod.

28. Disconnect the P6316 Group 1 pod from the BNC–to–0.1 inch pin adapter and connect the Group 2 pod in its place.

29. Repeat the procedure starting with step 8 for each digital channel in the Group 2 pod.

This completes the performance verification procedure.