MSO3000 and DPO3000 Series
Digital Phosphor Oscilloscopes
Specifications and Performance Verification

Technical Reference

077-0300-02

Tektronix

MSO3000 and DPO3000 Series Digital Phosphor Oscilloscopes Specifications and Performance Verification

Technical Reference

Revision A

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- 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.

While using this product, you may need to access other parts of a larger system. Read the safety sections of the other component manuals for warnings and cautions related to operating the system.

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 that 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 symbol(s) may appear on the product:

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 have associated procedures listed in the *Performance Verification* section.

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 this manual prior to evaluating specifications. (See page 48.) If the operating temperature changes by more than 10 °C (18 °F), you must perform the SPC operation again.

Analog Channel Input And Vertical Specifications

Table 1: Analog channel input and vertical specifications

Characteristic	Description	
Number of input channels	MSO3054, MSO3034, MOS3014, DPO3054, DPO3034, DPO3014:	4 analog, digitized simultaneously
	MSO3032, MSO3012, DPO3052, DPO3032, DPO3012:	2 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 termination selection	1 MΩ, 50 Ω, or 75 Ω	
✓ Input termination, DC coupled (See page 50.)	For instruments with 500MHz bandwidth (includes MSO/DPO305X models as well as MSO/DPO303X/301X models with 500 MHz upgrade):	VSWR ≤ 1.5:1 from DC to 500 MHz, typical
	For instruments with 300MHz bandwidth (includes MSO/DPO303X models as well as MSO/DPO301X models with 300 MHz upgrade):	VSWR ≤ 1.5:1 from DC to 350 MHz, typical
	For instruments with 100MHz bandwidth (MSO/DPO301X models):	VSWR ≤ 1.5:1 from DC to 100 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.	
Maximum input voltage (1MΩ)	At front panel connector, 300 V_{RMS}, Installation Category II; Apply UL specified voltages for 300 V CAT II	

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

Characteristic	Description
< 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 (See page 51.)	0.2 div with the input DC-50Ω 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 termination set to 50 Ω, DC coupling ≤ 100 ps between any two channels with input termination 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 M Ω input termination 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).
Sensitivity range (coarse)	1 M Ω: 1 mV/div to 10 V/div in a 1-2-5 sequence
	50 Ω and 75 Ω: 1 mV/div to 1 V/div in a 1-2-5 sequence
Sensitivity range (fine)	Allows continuous adjustment from 1 mV/div to 10 V/div, 1 MΩ Allows continuous adjustment from 1 mV/div to 1 V/div, 75 Ω Allows continuous adjustment from 1 mV/div to 1 V/div, 50 Ω
Sensitivity resolution (fine), typical	≤ 1% of current setting

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

Characteristic	Description				
Position range	±5 divisions For firmware versions 2.04 and 2.07 only, the position range is ±4 divisions.				
✓ Analog bandwidth, 50 Ω input termination (See page 53.)	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.				
Instrument Model	Instrument Bandwidth	Vertical Scale Setting			
		10 mV/div to 1 V/div	5 mV/div to 9.98 mV/div	2 mV/div to 4.98mV/div	1 mV/div to 1.99 mV/div
MSO/DPO3054	500 MHz	DC to 500 MHz	DC to 400 MHz	DC to 250 MHz	DC to 150 MHz
DPO3052	500 MHz	DC to 500 MHz	DC to 400 MHz	DC to 250 MHz	DC to 150 MHz
MSO/DPO3034	500 MHz	DC to 500 MHz	DC to 400 MHz	DC to 250 MHz	DC to 150 MHz
	300 MHz	DC to 300 MHz	DC to 300 MHz	DC to 250 MHz	DC to 150 MHz
MSO/DPO3032	500 MHz	DC to 500 MHz	DC to 400 MHz	DC to 250 MHz	DC to 150 MHz
	300 MHz	DC to 300 MHz	DC to 300 MHz	DC to 250 MHz	DC to 150 MHz
MSO/DPO3014	500 MHz	DC to 500 MHz	DC to 400 MHz	DC to 250 MHz	DC to 150 MHz
	300 MHz	DC to 300 MHz	DC to 300 MHz	DC to 250 MHz	DC to 150 MHz
	100 MHz	DC to 100 MHz	DC to 100 MHz	DC to 100 MHz	DC to 100 MHz
MSO/DPO3012	500 MHz	DC to 500 MHz	DC to 400 MHz	DC to 250 MHz	DC to 150 MHz
	300 MHz	DC to 300 MHz	DC to 300 MHz	DC to 250 MHz	DC to 150 MHz
	100 MHz	DC to 100 MHz	DC to 100 MHz	DC to 100 MHz	DC to 100 MHz

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

Characteristic	Description				
Analog bandwidth, 75 Ω input termination, typical	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.				
Instrument Model	Instrument Bandwidth	Vertical Scale Setting			
		10 mV/div to 1 V/div	5 mV/div to 9.98 mV/div	2 mV/div to 4.98mV/div	1 mV/div to 1.99 mV/div
MSO/DPO3054	500 MHz	DC to 230 MHz	DC to 190 MHz	DC to 140 MHz	DC to 100 MHz
DPO3052	500 MHz	DC to 230 MHz	DC to 190 MHz	DC to 140 MHz	DC to 100 MHz
MSO/DPO3034	500 MHz	DC to 230 MHz	DC to 190 MHz	DC to 140 MHz	DC to 100 MHz
	300 MHz	DC to 230 MHz	DC to 190 MHz	DC to 140 MHz	DC to 100 MHz
MSO/DPO3032	500 MHz	DC to 230 MHz	DC to 190 MHz	DC to 140 MHz	DC to 100 MHz
	300 MHz	DC to 230 MHz	DC to 190 MHz	DC to 140 MHz	DC to 100 MHz
MSO/DPO3014	500 MHz	DC to 100 MHz	DC to 100 MHz	DC to 100 MHz	DC to 100 MHz
	300 MHz	DC to 100 MHz	DC to 100 MHz	DC to 100 MHz	DC to 100 MHz
	100 MHz	DC to 100 MHz	DC to 100 MHz	DC to 100 MHz	DC to 100 MHz
MSO/DPO3012	500 MHz	DC to 100 MHz	DC to 100 MHz	DC to 100 MHz	DC to 100 MHz
	300 MHz	DC to 100 MHz	DC to 100 MHz	DC to 100 MHz	DC to 100 MHz
	100 MHz	DC to 100 MHz	DC to 100 MHz	DC to 100 MHz	DC to 100 MHz

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

Characteristic	Description				
Analog bandwidth, 1 MΩ input termination with P6139A or P6139B 10X probe, typical	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.				
Instrument Model	Instrument Bandwidth	Vertical Scale Setting			
		100 mV/div to 100 V/div	5 mV/div to 9.98 mV/div	20 mV/div to 49.8mV/div	10 mV/div to 19.9 mV/div
MSO/DPO3054	500 MHz	DC to 500 MHz	DC to 400 MHz	DC to 250 MHz	DC to 150 MHz
DPO3052	500 MHz	DC to 500 MHz	DC to 400 MHz	DC to 250 MHz	DC to 150 MHz
MSO/DPO3034	500 MHz	DC to 500 MHz	DC to 400 MHz	DC to 250 MHz	DC to 150 MHz
	300 MHz	DC to 300 MHz	DC to 300 MHz	DC to 250 MHz	DC to 150 MHz
MSO/DPO3032	500 MHz	DC to 500 MHz	DC to 400 MHz	DC to 250 MHz	DC to 150 MHz
	300 MHz	DC to 300 MHz	DC to 300 MHz	DC to 250 MHz	DC to 150 MHz
MSO/DPO3014	500 MHz	DC to 500 MHz	DC to 400 MHz	DC to 250 MHz	DC to 150 MHz
	300 MHz	DC to 300 MHz	DC to 300 MHz	DC to 250 MHz	DC to 150 MHz
	100 MHz	DC to 100 MHz	DC to 100 MHz	DC to 100 MHz	DC to 100 MHz
MSO/DPO3012	500 MHz	DC to 500 MHz	DC to 400 MHz	DC to 250 MHz	DC to 150 MHz
	300 MHz	DC to 300 MHz	DC to 300 MHz	DC to 250 MHz	DC to 150 MHz
	100 MHz	DC to 100 MHz	DC to 100 MHz	DC to 100 MHz	DC to 100 MHz

Table 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.				
Instrument Model	Instrument Bandwidth	Vertical Scale Setting			
		10 mV/div to 1 V/div	5 mV/div to 9.98 mV/div	2 mV/div to 4.98 mV/div	1 mV/div to 1.99 mV/div
MSO/DPO3054	500 MHz	700 ps	750 ps	1.2 ns	2 ns
DPO3052	500 MHz	700 ps	750 ps	1.2 ns	2 ns
MSO/DPO3034	500 MHz	700 ps	750 ps	1.2 ns	2 ns
	300 MHz	1.2 ns	1.2 ns	1.2 ns	2 ns
MSO/DPO3032	500 MHz	700 ps	750 ps	1.2 ns	2 ns
	300 MHz	1.2 ns	1.2 ns	1.2 ns	2 ns
MSO/DPO3014	500 MHz	700 ps	750 ps	1.2 ns	2 ns
	300 MHz	1.2 ns	1.2 ns	1.2 ns	2 ns
	100 MHz	3.5 ns	3.5 ns	3.5 ns	3.5 ns
MSO/DPO3012	500 MHz	700 ps	750 ps	1.2 ns	2 ns
	300 MHz	1.2 ns	1.2 ns	1.2 ns	2 ns
	100 MHz	3.5 ns	3.5 ns	3.5 ns	3.5 ns
Analog bandwidth limit filter selections	For instruments with 500MHz or 300MHz analog bandwidth: 20 MHz, 150 MHz, and Full				
	For instruments with 100MHz analog bandwidth: 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 limit filter, typical	150 MHz, +40%, and -20%				
Upper frequency limit, 20 MHz bandwidth limit filter, typical	20 MHz, ±35% (all models)				
DC gain accuracy (See page 55.)	±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: 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 X | 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 X | 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 X | 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 X | 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.* ***NOTE.*** *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, Peak-Peak, and Amplitude.*		
Offset ranges	*Volts/div setting*	*Offset range*	
		1 MΩ input	*50 Ω and 75 Ω input* [1]
	1 mV/div to 99.5 mV/div	±1 V	±5 V
	100 mV/div to 995 mV/div	±10 V	±5 V
	1 V/div to 10 V/div	±100 V	±5 V
	NOTE. *The input signal cannot exceed the maximum input voltage for the 50 Ω and 75 Ω input paths. Refer to the Maximum input voltage specifications (earlier in this table) for more information.*		

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

Characteristic	Description			
✓ Offset accuracy (See page 57.)	±[0.005 X | 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.*			
✓ Random noise, sample acquisition mode (See page 59.)	*Model*	Instrument Bandwidth	Bandwidth Limit Filter Selection	*RMS Noise*
	MSO/DPO-3054 and DPO3052	500 MHz	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	500 MHz	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)
		300 MHz	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	500 MHz	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)
		300 MHz	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)
		100 MHz	Full	<(100 µV + 6% of V/div setting)
			20 MHz	<(100 µV + 6% of V/div setting)

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

Digital Channel Acquisition System Specifications

Table 2: Digital channel acquisition system specifications

Characteristic	Description
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 (See page 61.)	± [100 mV + 3% of threshold setting after calibration], after valid SPC
Minimum detectable 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).

Horizontal And Acquisition System Specifications

Table 3: Horizontal and acquisition system specifications

Characteristic	Description
✓ Long-term sample rate and delay time accuracy (See page 64.)	±10 ppm over any ≥ 1 ms time interval
Seconds/division range	1 ns/div to 1,000 s/div
Peak detect or envelope mode pulse response, typical	*Minimum pulse width* For instruments with 500MHz bandwidth: > 2 ns For instruments with 300MHz bandwidth: > 2.9 ns For instruments with 100MHz bandwidth: > 6.7 ns
Sample-rate range	See Sample Rate Range detail table. (See page 11.)
Record length range	1K, 10K, 100K, 1M, 5M
Waveform capture rate	Maximum triggered acquisition rate: > 50,000 wfm/s
Aperture uncertainty, typical (also called “sample rate jitter”)	≤ $(5\ ps + 1 \times 10^{-6} X\ record\ duration)_{RMS}$, for records having duration ≤ 1 minute Record duration = (Record Length) / (Sample Rate)

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

Characteristic	Description
Number of waveforms for average acquisition mode	2 to 512 waveforms Default of 16 waveforms
Delta time measurement accuracy (See page 65.)	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 above) t_p = delta-time measurement duration RD = (Record Length) / (Sample Rate)
	$DTA_{PP} = \pm 5 \times \sqrt{2 \times \left[\frac{N}{SR_1}\right]^2 + 2 \times \left[\frac{N}{SR_2}\right]^2 + \left(5ps + 1E^{-6} \times RD\right)^2} + 2 \times t_{sr} + TBA \times t_p$
	$DTA_{RMS} = \sqrt{2 \times \left[\frac{N}{SR_1}\right]^2 + 2 \times \left[\frac{N}{SR_2}\right]^2 + \left(5ps + 1E^{-6} \times RD\right)^2 + \left[\frac{2 \times t_{sr}}{\sqrt{12}}\right]^2} + TBA \times t_p$
	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).

Sample Rate Range Detail

Table 4: Sample rate range detail

Characteristic	Description					
Sample rate range (Analog Channels)	**Time/Div**	**5 M record**	**1 M record**	**100 K record**	**10 K record**	**1 K record**
	1 ns	2.5 GS/s				
	2 ns	2.5 GS/s				
	4 ns	2.5 GS/s				
	10 ns	2.5 GS/s				
	20 ns	2.5 GS/s				
	40 ns	2.5 GS/s				
	80 ns					1.25 GS/s
	100 ns	2.5 GS/s				
	200 ns	2.5 GS/s				500 MS/s
	400 ns	2.5 GS/s				250 MS/s
	800 ns				1.25 GS/s	
	1 µs	2.5 GS/s				100 MS/s
	2 µs	2.5 GS/s			500 MS/s	50 MS/s
	4 µs	2.5 GS/s			250 MS/s	25 MS/s
	8 µs			1.25 GS/s		
	10 µs	2.5 GS/s			100 MS/s	10 MS/s
	20 µs	2.5 GS/s		500 MS/s	50 MS/s	5 MS/s
	40 µs	2.5 GS/s		250 MS/s	25 MS/s	2.5 MS/s
	80 µs		1.25 GS/s			
	100 µs	2.5 GS/s		100 MS/s	10 MS/s	1 MS/s
	200 µs	2.5 GS/s	500 MS/s	50 MS/s	5 MS/s	500 KS/s
	400 µs	1.25 GS/s	250 MS/s	25 MS/s	2.5 MS/s	250 KS/s
	800 µs	625 MS/s				

Table 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		

Trigger Specifications

Table 5: Trigger specifications

Characteristic	Description		
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.		
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
Lowest frequency for "Set Level to 50%" function, typical	45 Hz		
Trigger holdoff range	20 ns minimum to 8 s maximum		
Trigger sensitivity	Edge trigger, 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, 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
	Logic (pattern) trigger, DC coupled, typical:		1.0 division from DC to maximum bandwidth

Table 5: Trigger specifications (cont.)

Characteristic	Description				
	Trigger using a logic qualifier, DC coupled, typical:	1.0 division from DC to maximum bandwidth			
	Delay-by-events sequence trigger, DC coupled, typical:	1.0 division from DC to maximum bandwidth			
	Runt trigger, typical:	1.0 division from DC to maximum bandwidth			
	Pulse-width and glitch trigger, typical:	1.0 division			
	Video trigger, 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		
Aux In (External trigger)	Maximum input voltage:	At front panel connector, 300 VRMS, Installation Category II; Derate at 20 dB/decade above 3 MHz to 30 V_{RMS} at 30 MHz, 10 dB/decade above 30 MHz			
	Input termination, typical:	1 MΩ ±1% in parallel with 10 pF ±2 pF			
	Bandwidth, typical:	> 200 MHz			
Edge, Pulse, and Logic trigger bandwidth, typical	For instruments with 500 MHz bandwidth (includes MSO/DPO305X models as well as MSO/DPO303X/301X models with 500 MHz upgrade):	500 MHz			
	For instruments with 300 MHz bandwidth (includes MSO/DPO303X models as well as MSO/DPO301X models with 300 MHz upgrade):	300 MHz			
	For instruments with 100 MHz bandwidth (MSO/DPO301X models):	100MHz			
Time accuracy for Pulse-width or Glitch triggering	*Time range*	*Accuracy*			
	4 ns to 500 ns	±(20% of setting + 0.5 ns)			
	520 ns to 8 s	±(0.01% of setting + 100 ns)			
Video trigger formats and field rates	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, which are standard, as well as HDTV and custom scan rates, which require a DPO3VID application module.				
Logic trigger, minimum logic or re-arm time, typical	For all vertical settings, the minimums are:				
	Trigger type	*Minimum pulse width*	*Minimum re-arm time*	*Minimum time between channels* [1]	
	Logic	Not applicable	2 ns	2 ns	
	Time Qualified Logic	4 ns	2 ns	2 ns	

Table 5: Trigger specifications (cont.)

Characteristic	Description				
Setup/hold time violation trigger					
Minimum clock pulse widths, typical	For all vertical settings, the minimum clock pulse widths are:				
	Clock Active [2]		*Clock Inactive* [2]		
	User hold time + 2.5 ns [3]		2 ns		
Setup and hold time ranges		*Analog Channels*		*Digital Channels*	
		Min	*Max*	*Min*	*Max*
	Setup time [4]	0 ns	8 s	-0.5 ns	1.0 ms
	Hold time [4]	4 ns	8 s	1 ns	1.0 ms
	Setup + Hold time [4]	4 ns	16 s	0.5 ns	2.0 ms
	NOTE. *Input coupling on clock and data channels must be the same.*				
Minimum pulse width and rearm time	*Trigger type*	*Minimum pulse width*	*Minimum rearm time*		
	Glitch	4 ns	2 ns + 5% of glitch width setting		
	Pulse-width	4 ns	2 ns + 5% of width upper limit setting		
		NOTE. *For the pulse-width trigger class, pulse-width refers to the width of the pulse being measured. The rearm time refers to the time between pulses.*			
	Runt	4 ns	2 ns		
		NOTE. *For the runt trigger class, pulse width refers to the width of the pulse being measured. The rearm time refers to the time between pulses.*			
	Time-qualified runt	4 ns	8.5 ns + 5% of width setting		
	Rise/fall time	4 ns	8.5 ns + 5% of delta time setting		
		NOTE. *For the rise/fall time trigger class, 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.*			
Rise/fall time trigger, delta time range	4 ns to 8 s				
Glitch, pulse-width, or time-qualified runt trigger, time range	4 ns to 8 s				
B trigger (A/B sequence trigger), time range	Trigger after events, minimum pulse width, typical: [5]		1 / (2 X Rated Instrument Bandwidth)		
	Trigger after events, maximum event frequency, typical: [5]		Rated Instrument Bandwidth		
	Minimum time between arm and trigger, typical:		8 ns		
	B trigger after time, time range:		8 ns to 8 s		
	B trigger after events, event range:		1 to 4,000,000		

Table 5: Trigger specifications (cont.)

Characteristic	Description	
Standard serial bus interface triggers	Maximum serial trigger bits:	128 bits
I^2C (Requires a DPO3EMBD app. module)	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 Address and Data
	Maximum Data Rate:	10 Mb/s
SPI (Requires a DPO3EMBD app. module)	Data Trigger:	1 to 16 bytes of user specified data
	Trigger On:	SS Active MOSI MISO MOSI and MISO
	Maximum Data Rate:	10 Mb/s
RS-232/422/485/UART (Requires a DPO3COMP app. module)	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 Rx Parity Error
	Maximum Data Rate:	10 Mb/s

Table 5: Trigger specifications (cont.)

Characteristic	Description	
CAN (Requires a DPO3AUTO app. module)	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 Bit Stuffing Error
	Frame Type:	Data, Remote, Error, Overload
	Identifier:	Standard (11 bit) and Extended (29 bit) identifiers
	Maximum Data Rate:	1 Mb/s
LIN (Requires a DPO3AUTO app. module)	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 Error
	Maximum Data Rate:	1 Mb/s (by LIN definition, 20 kbit/s)

Table 5: Trigger specifications (cont.)

Characteristic	Description	
FlexRay (Requires a DPO3FLEX app. module)	Trigger on:	Start Of Frame Indicator Bits (Normal, Null, Payload, Sync, Startup) Identifier (trigger when equal to (=), not equal to <>, less than (<), greater than (>), less than or equal to (<=), greater than or equal to (>=), inside range, outside range) Cycle Count (trigger when equal to (=), not equal to <>, less than (<), greater than (>), less than or equal to (<=), greater than or equal to (>=), inside range, outside range) Header Fields (Indicator Bits, Identifier, Payload Length, Header Crc, Cycle Count) Data (number of bits 1–16; byte offset 'don't care' – 253; trigger 10 Mb/swhen equal to (=), not equal to <>, less than (<), greater than (>), less than or equal to (<=), greater than or equal to (>=), inside range, outside range) Id And Data End Of Frame (Static, Dynamic (Dts), All) Error (Header Crc, Trailer Crc, Null Frame, Sync Frame, Startup Frame)
	Maximum Data Rate:	10 Mb/s
MIL-STD-1553 (Requires a DPO3AERO app. module)	Trigger on:	Sync Word Type (Command, Status, Data) Command Word (set the following individually: RT Address (trigger when equal to (=), not equal to <>, less than (<), greater than (>), less than or equal to (<=), greater than or equal to (>=), inside range, outside range), T/R, Sub-Address/Mode, Data Word Count/Mode Code, And Parity) Status Word (set the following individually: RT address (trigger when equal to (=), not equal to <>, less than (<), greater than (>), less than or equal to (<=), greater than or equal to (>=), inside range, outside range), message error, instrumentation, service request bit, broadcast command received, busy, subsystem flag, dynamic bus control acceptance (DBCA), terminal flag, and parity) Data Word (user-specified 16–bit data value) Error (Sync, Parity, Manchester, Non-Contiguous Data Idle Time (minimum time selectable from 4 µs to 100 µs; maximum time selectable from 12 µs to 100 µs; trigger on < minimum, > maximum, inside range, outside range)
	Maximum Data Rate:	Up to 1Mb/s (for automated decoding of bus)
I^2S (Requires a DPO3AUDIO app. module)	Trigger on:	Word Select Data
	Maximum Data Rate:	12.5 Mb/s

Table 5: Trigger specifications (cont.)

Characteristic	Description	
Left Justified (Requires a DPO3AUDIO app. module)	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 (Requires a DPO3AUDIO app. module)	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 (Requires a DPO3AUDIO app. module)	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

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.

2 An active pulse width is the width of the clock pulse from its active edge (as defined through the Define Inputs button on the lower menu and the Clock Edge button on the side 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.

4 Setup + Hold time is the algebraic sum of the Setup Time and the Hold Time programmed by the user.

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.

5 Trigger after events is the time between the last A trigger event and the first B trigger event.

Trigger after time is the time between the end of the time period and the B trigger event.

Display Specifications

Table 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

Input/Output Port Specifications

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

Power Source Specifications

Table 8: Power source specifications

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

Data Storage Specifications

Table 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

Environmental Specifications

Table 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)

Mechanical Specifications

Table 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 & carry case	6.8	15.0
	Packaged for domestic shipment	8.6	19.0

P6316 Digital Probe Input Characteristics

Table 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}
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

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 P6316 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	
One 50Ω BNC cable	Male-to-male connectors	Tektronix part number 012-0057-01 (43 inch)
One BNC feed-through terminator	50 Ω	

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/downloads 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.*

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

The oscilloscope displays a message when the installation is complete.

Test Record

Print this section for use during the Performance Verification.

Model number	Serial number	Procedure performed by	Date

Test	Passed	Failed
Self Test		

Input Termination Tests

Table 13: Input termination

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

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

DC Balance Tests

Table 14: DC Balance

Performance checks	Vertical scale	Low limit	Test result	High limit
Channel 1				
Channel 1 DC Balance, 50Ω, 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, 75Ω, 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, 50Ω, 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, 75Ω, 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

Table 14: DC Balance (cont.)

Performance checks	Vertical scale	Low limit	Test result	High limit
Channel 1 DC Balance, 50Ω, 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, 75Ω, 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				
Channel 2 DC Balance, 50Ω, 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, 75Ω, 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

Table 14: DC Balance (cont.)

Performance checks	Vertical scale	Low limit	Test result	High limit
Channel 2 DC Balance, 50Ω, 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, 75Ω, 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, 50Ω, 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, 75Ω, 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

Table 14: DC Balance (cont.)

Performance checks	Vertical scale	Low limit	Test result	High limit
Channel 3 [1]				
Channel 3 DC Balance, 50Ω, 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 DC Balance, 75Ω, 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 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 DC Balance, 50Ω, 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 DC Balance, 75Ω, 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 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

Table 14: DC Balance (cont.)

Performance checks	Vertical scale	Low limit	Test result	High limit
Channel 3 DC Balance, 50Ω, 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 DC Balance, 75Ω, 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 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]				
Channel 4 DC Balance, 50Ω, 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 DC Balance, 75Ω, 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 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

Table 14: DC Balance (cont.)

Performance checks	Vertical scale	Low limit	Test result	High limit
Channel 4 DC Balance, 50Ω, 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 DC Balance, 75Ω, 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 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 DC Balance, 50Ω, 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 DC Balance, 75Ω, 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 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.

Bandwidth Tests

Table 15: Bandwidth

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

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

DC Gain Accuracy Tests

Table 16: 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	-2.5%		2.5%
	2 mV/div	-2.0%		2.0%
	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	-2.5%		2.5%
	2 mV/div	-2.0%		2.0%
	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%

Table 16: 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	-2.5%		2.5%
	2 mV/div	-2.0%		2.0%
	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	-2.5%		2.5%
	2 mV/div	-2.0%		2.0%
	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 Tests

Table 17: 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

Table 17: 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

Table 18: Performance

Performance checks	Low limit	Test result	High limit
Sample Rate and Delay Time Accuracy	-0.5 division		+2 division

Auxiliary (Trigger) Output Tests

Table 19: Auxiliary (Trigger) Output

Auxiliary (Trigger) Output		Low limit	Test result	High limit
Trigger Output	Low 1 MΩ	—		≤ 0.4 V
	High 1 MΩ	≥ 3.25 V		—
	Low 50Ω	—		≤ 0.30 V
	High 50Ω	≥ 2.2 V		—

Random Noise, Sample Acquisition Mode Tests

Table 20: Random Noise, Sample Acquisition Mode

Random Noise, Sample Acquisition Mode		Bandwidth Selection	Test result	High limit
For instruments with 500 MHz bandwidth (includes MSO/DPO305X models as well asMSO/DPO303X/301X models with 500 MHz upgrade)	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
For instruments with 300 MHz bandwidth (includes MSO/DPO303X models as well as MSO/DPO301X models with 300 MHz upgrade)	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

Table 20: Random Noise, Sample Acquisition Mode (cont.)

Random Noise, Sample Acquisition Mode		Bandwidth Selection	Test result	High limit
For instruments with 100 MHz bandwidth (MSO/DPO301X models)	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 Tests

Table 21: Delta Time Measurement Accuracy

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
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**

Table 21: Delta Time Measurement Accuracy (cont.)

	5 mV	40 mV		3.8 µs
	100 mV	800 mV		2.8 µs
	500 mV	4 V		2.8µs
	1 V	4 V		5.4µs
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
	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

Table 21: Delta Time Measurement Accuracy (cont.)

	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		3.8µs
	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
	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**

Table 21: Delta Time Measurement Accuracy (cont.)

	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		5.4µs
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

Table 21: Delta Time Measurement Accuracy (cont.)

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 µ3
100 mV	800 mV		2.8 µ3
500 mV	4 V		2.8 µ3
1 V	4 V		5.4 µ3

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

Digital Threshold Accuracy Tests

Table 22: Digital Threshold Accuracy

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
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

Table 22: Digital Threshold Accuracy (cont.)

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**
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 *Self Tests — System Diagnostics and Signal Path Compensation* section below.) 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 all the procedures 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 Tests — System Diagnostics and Signal Path Compensation

These procedures use 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:

Run the System Diagnostics (may take several minutes):

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

Run the signal path compensation routine (may take 5 to 15 minutes):

1. Push **Default Setup** on the front panel.
2. Push **Utility** .
3. Push **Utility Page** on the lower menu.
4. Turn **Multipurpose knob "a"** to select **Calibration**.
5. Push **Signal Path** on the lower menu.
6. Push **OK-Compensate Signal Paths** on the side menu.

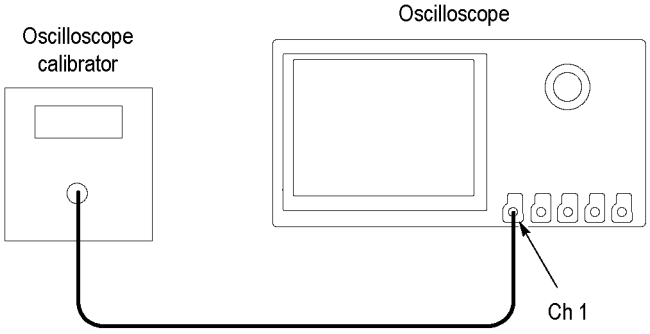
7. When the signal path compensation is complete, push **Menu Off** twice to clear the dialog box and Self Test menu.
8. Check the **Signal Path** button on the lower menu to verify that the status is **Pass**. If it does not pass, then recalibrate the instrument or have the instrument serviced by qualified service personnel.

This completes the procedure.

Check Input Termination, DC Coupled (Resistance)

This test checks the Input Termination for 1 MΩ, 75Ω or 50Ω settings.

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



2. Push **Default Setup** on the front panel to set the instrument to the factory default settings.
3. Push the channel button on the front panel 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 termination and calibrator impedance are both set to 1 MΩ. The default **Termination** 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). (See page 26, *Input Termination Tests*.)
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 termination to 75 Ω and calibrator impedance to 50 Ω and repeat steps 5 through 7.
9. Change the oscilloscope termination 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**).

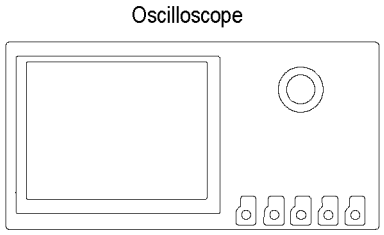
This completes the procedure.

Check DC Balance

This test checks the DC balance.

You do not need to connect the oscilloscope to any equipment to run this test. The only piece of equipment needed is a BNC feed-through 50 Ω terminator.

1. For 50 Ω coupling, attach a 50 Ω terminator to the channel input of the oscilloscope being tested.



2. Push **Default Setup** on the front panel to set the instrument to the factory default settings.
3. Push the channel button on the front panel 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 termination to 50 Ω. Push **Termination** on the lower menu to select **50 Ω**.
5. Push **Bandwidth** on the lower menu, and push the appropriate bandwidth button on the side menu for **20MHz**, **150MHz**, or **Full**, as given in the test record.
6. Turn the Horizontal **Scale** knob to 1 ms/division.

NOTE. *Step 6 only needs to be done once, at the beginning of the test.*

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 **Acquire** on the front panel.

NOTE. *Steps 8, 9, and 10 only need to be performed once, at the beginning of this test.*

9. Push **Mode** on the lower menu, and then, if needed, push **Average** on the side menu.
10. If needed, adjust the number of averages to **16** using **Multipurpose knob "a"** .
11. Push the Trigger **Menu** button on the front panel.

NOTE. *Steps 11, 12, and 13 only need to be performed once, at the beginning of this test.*

12. Push **Source** on the lower menu.
13. Select the **AC Line** trigger source on the side menu using **Multipurpose knob "a"**. You do not need to connect an external signal to the oscilloscope for this DC Balance test.
14. On the front panel, push the **Measure** button on the Wave Inspector.

NOTE. *Steps 14 though 17 must be performed once for each input channel under test.*

15. Push **Add Measurement** on the lower menu.

16. Use **Multipurpose knob "b"** to select the **Mean** measurement. If needed, use **Multipurpose knob "b"** to select the channel input being tested.

17. Push **OK Add Measurement** on the side menu, and then **Menu Off** on the front panel.

18. View the mean measurement value in the display and enter that mean value as the test result in the test record. (See page 27, *DC Balance Tests*.)

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

20. Push the channel button on the front panel, then change the oscilloscope bandwidth (for example, 20 MHz, 150 MHz, or Full), and repeat step 7, step 18, and step 19.

21. For 1 MΩ coupling, change the oscilloscope termination 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**).

NOTE. *The BNC 50Ω terminator needs to be moved to next input channel.*

23. For 75 Ω coupling, change the oscilloscope termination to 75 Ω and repeat steps 5 through 20.

NOTE. *The BNC 50Ω terminator needs to be moved to next input channel.*

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**).

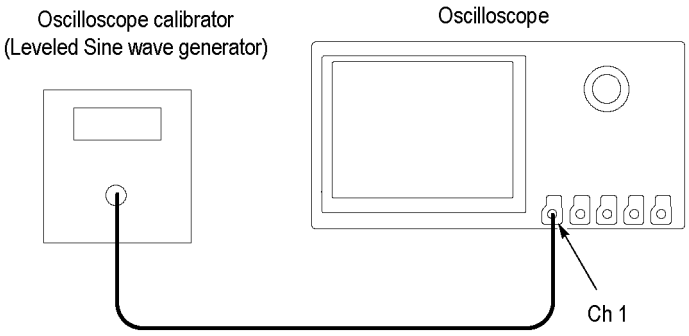
NOTE. *The BNC 50Ω terminator needs to be moved to next input channel.*

This completes the procedure.

Check Analog Bandwidth, 50Ω

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 **Default Setup** on the front panel to set the instrument to the factory default settings.
3. Push 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 termination to 50 Ω. Push **Termination** on the lower menu 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 **Acquire** on the front panel.
8. Confirm that the mode is set to **Sample**. If not, push **Mode** on the lower menu, 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 ³ 6 mV_{p-p} signal. Use a sine wave for the signal source.
10. Turn the Horizontal **Scale** knob to 40 µs/division.
11. On the front panel, push the **Measure** button on the Wave Inspector, and then push **Add Measurement** on the lower menu.

NOTE. *Steps 11 though 14 must be performed once for each input channel under test.*

12. Use **Multipurpose knob "b"** to select the **Peak-to-peak** measurement. Use **Multipurpose knob "a"** to select the input channel being tested, and then push **OK Add Measurement** on the side menu.
13. Push **More** on the lower menu to select **Gating**, and then push **Off (Full Record)** on the side menu.
14. Push **Menu Off** on the front panel. 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 mean value of V_{in-pp} (for example, 816 mV) in the test record. (See page 33, *Bandwidth Tests*.)
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 Analog Channel Input and Vertical Specifications table. (See page 1, Analog Channel Input And Vertical Specifications.)*

Table 23: Maximum Bandwidth Frequency worksheet

Termination	Vertical Scale	Maximum Bandwidth Frequency
For instruments with 500MHz bandwidth (includes MSO/DPO305X models as well as MSO/DPO303X/301X models with 500 MHz upgrade):		
50Ω	10 mV/div	500 MHz
50Ω	5 mV/div	400 MHz
50Ω	2 mV/div	250 MHz
50Ω	1 mV/div	150 MHz
For instruments with 300MHz bandwidth (includes MSO/DPO303X models as well as MSO/DPO301X models with 500 MHz upgrade):		
50Ω	5 mV/div	300 MHz
50Ω	2 mV/div	250 MHz
50Ω	1 mV/div	150 MHz
For instruments with 100MHz bandwidth (MSO/DPO301X models):		
50Ω	1 mV/div	100 MHz

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

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

18. To pass the performance measurement test, Gain should be ≥ 0.707. Enter *Gain* in the test record.

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

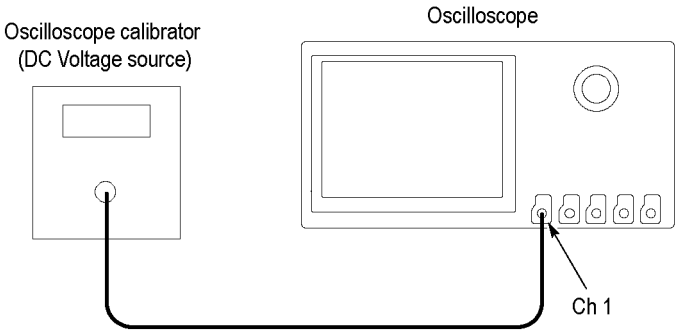
20. Repeat steps 3 through 18 for each channel combination listed in the test record and relevant to your model of oscilloscope (for example, **1**, **2**, **3**, or **4**).

This completes the procedure.

Check DC Gain Accuracy

This test checks the DC gain accuracy.

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



2. Push **Default Setup** on the front panel to set the instrument to the factory default settings.
3. Push channel button **1**,**2**,**3**, or **4** to select the channel that you want to check.
4. Confirm that the oscilloscope termination and calibrator impedance are both set to 1 MΩ. On the oscilloscope, push **Termination** on the lower menu to select **1 M Ω**.
5. Push **20 MHz** on the side menu to select the bandwidth (push **Bandwidth** on the lower menu, if necessary, to activate the Bandwidth menu).
6. Push **Acquire** on the front panel.
7. Push **Mode** on the lower menu, and then push **Average** on the side menu. Use the default number of averages (16).
8. On the front panel, push the **Measure** button on the Wave Inspector, and then **Add Measurement** on the lower menu.
9. Use **Multipurpose knob "b"** to select the **Mean** measurement. Use **Multipurpose knob "a"** to select the input channel to be tested.
10. Push **OK Add Measurement** on the side menu.
11. Push the Trigger **Menu** button on the front panel.
12. Push **Source** on the lower menu.
13. Turn **Multipurpose knob "a"** to select **AC Line** as the trigger source. Push Menu Off on the front panel.
14. Turn the vertical **Scale** knob to the next setting to measure, as shown in the Gain Expected worksheet below.
15. Set the DC Voltage Source to $V_{negative}$. Push **Measure** on the front panel, then push **More** on the lower menu to select **Statistics**. Push **Reset Statistics** on the side menu, and then push **Menu Off** on the front panel.
16. Enter the mean reading into Gain Expected worksheet below as $V_{negative\text{-}measured}$.
17. Set the DC Voltage Source to $V_{positive}$. Push **More** on the lower menu to select **Statistics**, push the **Reset Statistics** on the side menu, and then push **Menu Off** on the front panel. Enter the mean reading into the Gain Expected worksheet as $V_{positive\text{-}measured}$.

Table 24: Gain Expected worksheet

Oscilloscope Vertical Scale Setting	$V_{diffExpected}$	$V_{negative}$	$V_{positive}$	$V_{negative-measured}$	$V_{positive-measured}$	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				

18. Calculate V_{diff} as follows:

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

Enter V_{diff} in the Gain Expected worksheet.

19. Calculate *GainAccuracy* as follows:

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

Write down *GainAccuracy* in the Gain Expected worksheet and in the test record. (See page 34, *DC Gain Accuracy Tests*.)

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

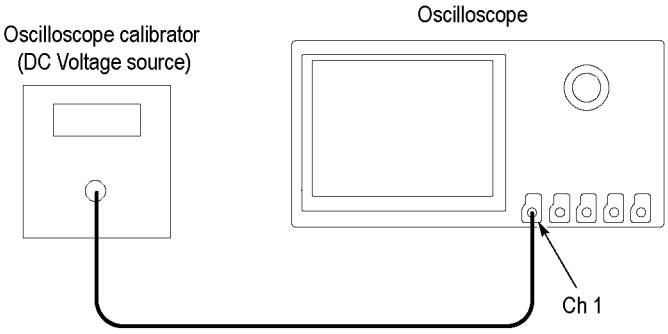
21. Repeat steps 3 through 19 for each channel of the oscilloscope that you want to check.

This completes the procedure.

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 Fluke 9500 calibrator as the DC voltage source, connect the calibrator head to the oscilloscope channel to test.



2. Push **Default Setup** on the front panel to set the instrument to the factory default settings.
3. Push channel button **1**,**2**,**3**, or **4** to select the channel you want to check.
4. Confirm that the oscilloscope termination and calibrator impedance are both set to 1 MΩ. Push **Termination** on the lower menu 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 impedance to match the termination setting for the oscilloscope.
6. On the oscilloscope, push **More** on the lower menu 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** knob 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 **Bandwidth** on the lower menu.
11. Push **20 MHz** on the side menu.
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 **More** on the lower menu repeatedly to select **Position**, and then push **Set to 0 divs** on the side menu.
13. Push **Acquire** on the front panel.
14. Push **Mode** on the lower menu, and then push **Average** on the side menu. Use the default number of averages (16).
15. Push the Trigger **Menu** button on the front panel.
16. Push **Source** on the lower menu.
17. Turn **Multipurpose knob "a"** to select **AC Line** as the trigger source.
18. On the front panel, push the **Measure** button on the Wave Inspector.
19. Push **Add Measurement** on the lower menu.
20. Use **Multipurpose knob "b"** to select the **Mean** measurement. Use **Multipurpose knob "a"** to select the input channel to be tested.

21. Push **OK Add Measurement** on the side menu, and then **Menu Off** on the front panel. The mean value should appear in a measurement pane at the bottom of the display.

22. Enter the measured value in the test record. (See page 36, *DC Offset Accuracy Tests*.)

23. Repeat the procedure (steps 6, 7, 8 and 22) for each volts/division setting shown in the test record.

24. Repeat all steps, starting with step 1, for each oscilloscope channel you want to check.

This completes the procedure.

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 **Default Setup** on the front panel to set the instrument to the factory default settings. This sets the oscilloscope to Channel 1, Full Bandwidth, 1 MΩ input termination, 100 mV/div, and 4.00 µs/div.
3. Set the input termination to 50 Ω:
   a. Push channel 1, 2, 3, or 4 [1] to display the channel input menu.
   b. Push **Termination** on the lower menu to select **50 Ω** .
4. Set **Gating** to **Off**:
   a. On the front panel, push the **Measure** button on the Wave Inspector.
   b. Push **More** on the lower menu to select **Gating**.
   c. Push **Off (Full Record)** on the side menu.
5. Select the **RMS** measurement:
   a. Push **Add Measurement** on the lower menu.
   b. Use **Multipurpose knob "b"** to select the **RMS** measurement.
   c. If necessary, use **Multipurpose knob "a"** to select the channel being tested as the source for the RMS measurement.
   d. Push **OK Add Measurement** on the side menu.
6. Push **More** on the lower menu to select **Statistics**, and then push **Reset Statistics** on the side menu.
7. Push **Menu Off** on the front panel to remove the menus from the display.
8. Read the RMS Mean value. This is the Sampled Mean Value (SMV).
9. Push the Horizontal **Acquire** button and then, if necessary, push **Mode** on the lower menu to display the Acquisition Mode menu.
10. Push **Average** on the side menu, and if necessary, use **Multipurpose knob "a"** to set the number of averages to 16.
11. On the front panel, push the **Measure** button on the Wave Inspector. Then, if necessary, push **More** on the lower menu to select **Statistics**, and then push **Reset Statistics** on the side menu.
12. Push **Menu Off** on the front panel 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 Random Noise, Sample Acquisition Mode test record. (See page 39, *Random Noise, Sample Acquisition Mode Tests*.)
15. Set the Acquisition Mode to Sample:
    a. Push the Horizontal **Acquire** button on the front panel.
    b. If necessary, push **Mode** on the lower menu to display the Acquisition Mode menu.
    c. Push **Sample** on the side menu.

16. Set the bandwidth to 150 MHz:

a. Push channel 1, 2, 3, or 4 [1] to select the channel you want to test.

b. Push **Bandwidth** on the lower menu, and then push **150MHz** on the side menu.

17. On the front panel, push the **Measure** button on the Wave Inspector, and repeat steps 6 through 15.

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

a. Push channel 1, 2, 3, or 4 [1].

b. Push **Bandwidth** on the lower menu, and then push **20MHz** on the side menu.

19. On the front panel, push the **Measure** button on the Wave Inspector, and repeat steps 6 through 15.

20. Select the next channel to test.

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

[1] **Channels 3 and 4 are only available on three or four channel oscilloscopes.**

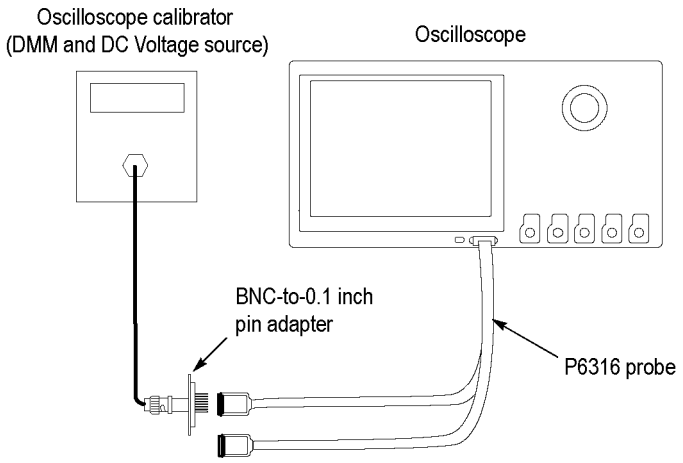
This completes the procedure.

Check Digital Threshold Accuracy (MSO3000 models 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.

NOTE. *If using the Fluke 9500 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 **Default Setup** on the front panel to set the instrument to the factory default settings.
4. Push **D15-D0** on the front panel.
5. Push **D15-D0 On/Off** on the lower menu.
6. Push **Turn On D7 - D0** and **Turn On D15 - D8** on the side menu. The instrument will display the 16 digital channels.
7. Push **Thresholds** on the lower menu.
8. Before you change the threshold value, push **Fine** on the front panel to turn off the fine adjustment and make adjusting the value quicker.

   Turn **Multipurpose knob "a"** (for channels D7 - D0) or **Multipurpose knob "b"** (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. (See page 46, *Digital Threshold Accuracy Tests*.)
9. Push the Trigger **Menu** button on the front panel.
10. Push **Source** on the lower menu, and then turn **Multipurpose knob "a"** 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.*

13. Push **Slope** on the lower menu 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 **D15-D0** on the front panel. The **Thresholds** menu should display.

18. With the Fine button on the front panel turned off, turn **Multipurpose knob "a"** (for channels D7 - D0) or **Multipurpose knob "b"** (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 **Menu Off** on the front panel.

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 Trigger **Menu** button on the front panel.

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 **D15-D0** on the front panel. 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.

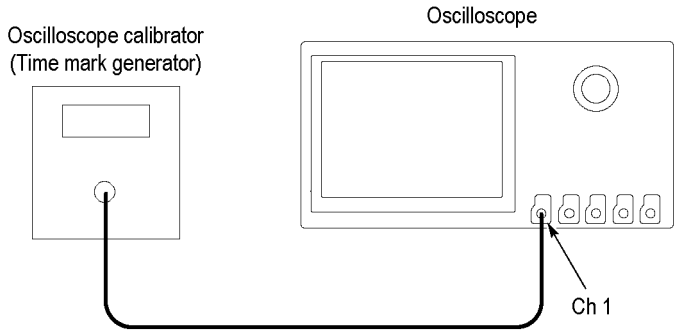
29. Repeat the procedure starting with step 8 for each digital channel in the Group 2 pod.

This completes the procedure.

Check Long-term 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 **100 ms**. Use a time mark waveform with a fast rising edge.
3. Push **Default Setup** on the front panel to set the instrument to the factory default settings.
4. Push the channel **1** button.
5. Set the termination to 50 Ω. Push **Termination** on the lower menu to select **50 Ω**.
6. If adjustable, set the time mark amplitude to approximately **1 V_{p-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 **100 ms**.
13. Set the Horizontal **Scale** to **2 µs/div**.
14. Compare the rising edge of the marker with the center horizontal graticule line. The rising edge should be within 0.5 division of the center graticule. Enter the deviation in the test record. (See page 38, *Performance Checks*.)

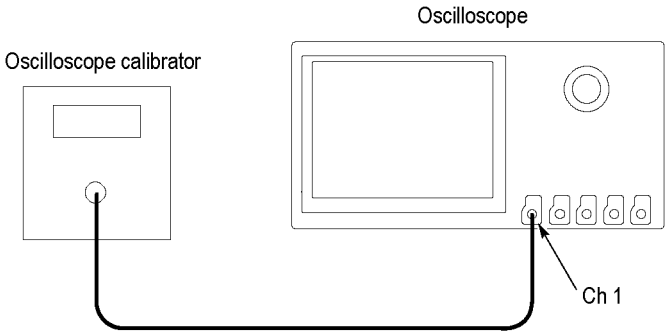
NOTE. *One division of displacement from graticule center corresponds to a 5 ppm time base error.*

This completes the procedure.

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. Push the oscilloscope **Default Setup** button on the front panel, and then push **Menu Off**.
3. Connect a 50 Ω coaxial cable from the signal source to the oscilloscope channel being tested.



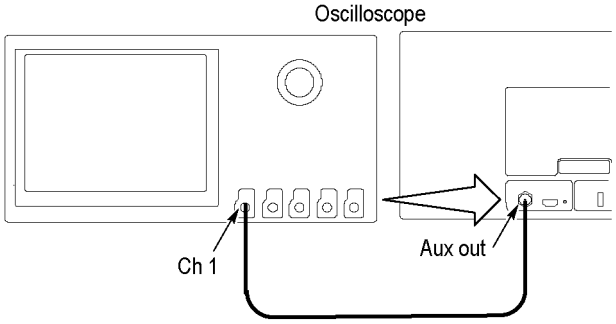
4. Push the channel **1** button to display the channel 1 menu.
5. Push **Termination** on the lower menu to set the channel to **50 Ω**.
6. Push the Trigger **Menu** button on the front panel, and then, if necessary, set the trigger source to the channel being tested:
   a. Push **Source** on the lower menu.
   b. Use **Multipurpose Knob "a"** to select the channel being tested.
7. On the front panel, push the **Measure** button on the Wave Inspector, and then push **Add Measurement** on the lower menu.
8. Use **Multipurpose Knob "b"** to select the **Burst Width** measurement, and then push **OK Add Measurement** on the side menu. Use **Multipurpose Knob "a"** to select the input channel to be tested.
9. Push **More** on the lower menu to select **Statistics** and, if necessary, use **Multipurpose Knob "a"** to set the **Mean & Std Dev Samples** to 100, as shown in the side menu.
10. Push **Menu Off** on the front panel to remove the Statistics menu.
11. Refer to the Test Record *Delta Time Measurement Accuracy* table. (See page 65, *Delta Time Measurement Accuracy*.) Set the oscilloscope and the signal source as directed there.
12. Push **More** on the lower menu to select **Statistics**, and then push **Reset Statistics.** Wait five or 10 seconds for the oscilloscope to acquire 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. Push the channel button on the front panel 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.

This completes the procedure.

Check Aux Out

This test checks the Auxiliary 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 **Default Setup** on the front panel to set the instrument to the factory default settings.
3. Push the channel **1** button.
4. Set the oscilloscope termination to 1 MΩ. The default **Termination** setting is **1M Ω**.
5. Set the horizontal to 4 uS/div and the vertical to 1 V/div.
6. On the front panel, push the **Measure** button on the Wave Inspector.
7. Push **Add Measurement** on the lower menu.
8. Use **Multipurpose Knob "b"** to select **Low** in the Measurements menu, and then push **OK Add Measurement** on the side menu.
9. Use **Multipurpose Knob "b"** to select **High** in the Measurements menu, and then push **OK Add Measurement** on the side menu.
10. Push **Menu Off** on the front panel.
11. Record the high and low measurements in the test record (for example, low = 200 mV and high = 3.52 V). (See page 38, *Auxiliary (Trigger) Output Tests*.)
12. Repeat the procedure, using **50 Ω** instead of **1 MΩ** in step 4.

This completes the procedure.