Tektronix®

6 Series MSO
MSO64
Specifications and Performance Verification

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

Supports Product Firmware V1.0 and above.

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- Worldwide, visit *www.tek.com* to find contacts in your area.

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Important safety information

This manual contains information and warnings that must be followed by the user for safe operation and to keep the product in a safe condition.

General safety summary

Use the product only as specified. Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. Carefully read all instructions. Retain these instructions for future reference.

This product shall be used in accordance with local and national codes.

For correct and safe operation of the product, it is essential that you follow generally accepted safety procedures in addition to the safety precautions specified in this manual.

The product is designed to be used by trained personnel only.

Only qualified personnel who are aware of the hazards involved should remove the cover for repair, maintenance, or adjustment.

Before use, always check the product with a known source to be sure it is operating correctly.

This product is not intended for detection of hazardous voltages.

Use personal protective equipment to prevent shock and arc blast injury where hazardous live conductors are exposed.

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. Do not use the provided power cord for other products.
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. Do not disable the power cord grounding connection.
Power disconnect	The power cord disconnects the product from the power source. See instructions for the location. Do not position the equipment so that it is difficult to operate the power cord; it must remain accessible to the user at all times to allow for quick disconnection if needed.
Connect and disconnect properly	Do not connect or disconnect probes or test leads while they are connected to a voltage source. Use only insulated voltage probes, test leads, and adapters supplied with the product, or indicated by Tektronix to be suitable for the product.
Observe all terminal ratings	To avoid fire or shock hazard, observe all rating and markings on the product. Consult the product manual for further ratings information before making connections to the product. Do not exceed the Measurement Category (CAT) rating and voltage or current rating of the lowest rated individual component of a product, probe, or accessory. Use caution when using 1:1 test leads because the probe tip voltage is directly transmitted to the product. Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.
Do not operate without covers	Do not operate this product with covers or panels removed, or with the case open. Hazardous voltage exposure is possible.
Avoid exposed circuitry	Do not touch exposed connections and components when power is present.
Do not operate with suspected failures	If you suspect that there is damage to this product, have it inspected by qualified service personnel.

Disable the product if it is damaged. Do not use the product if it is damaged or operates incorrectly. If in doubt about safety of the product, turn it off and disconnect the power cord. Clearly mark the product to prevent its further operation.

Before use, inspect voltage probes, test leads, and accessories for mechanical damage and replace when damaged. Do not use probes or test leads if they are damaged, if there is exposed metal, or if a wear indicator shows.

Examine the exterior of the product before you use it. Look for cracks or missing pieces.

Use only specified replacement parts.

Do not operate in wet/damp conditions

Be aware that condensation may occur if a unit is moved from a cold to a warm environment.

Do not operate in an explosive atmosphere

Keep product surfaces clean and dry

Remove the input signals before you clean the product.

Provide proper ventilation

Refer to the installation instructions in the manual for details on installing the product so it has proper ventilation.

Slots and openings are provided for ventilation and should never be covered or otherwise obstructed. Do not push objects into any of the openings.

Provide a safe working environment

Always place the product in a location convenient for viewing the display and indicators.

Avoid improper or prolonged use of keyboards, pointers, and button pads. Improper or prolonged keyboard or pointer use may result in serious injury.

Be sure your work area meets applicable ergonomic standards. Consult with an ergonomics professional to avoid stress injuries.

Use care when lifting and carrying the product. This product is provided with a handle or handles for lifting and carrying.

⚠ **Warning:** The product is heavy. To reduce the risk of personal injury or damage to the device get help when lifting or carrying the product.

Use only the Tektronix rackmount hardware specified for this product.

Probes and test leads

Before connecting probes or test leads, connect the power cord from the power connector to a properly grounded power outlet.

Keep fingers behind the protective barrier, protective finger guard, or tactile indicator on the probes.

Remove all probes, test leads and accessories that are not in use.

Use only correct Measurement Category (CAT), voltage, temperature, altitude, and amperage rated probes, test leads, and adapters for any measurement.

Terms in the 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.

Terms on the product

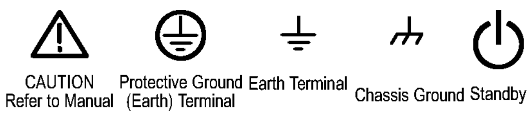
These terms may appear on the product:

- 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.

Symbols on the product

When this symbol is marked on the product, be sure to consult the manual to find out the nature of the potential hazards and any actions which have to be taken to avoid them. (This symbol may also be used to refer the user to ratings in the manual.)

The following symbols may appear on the product:



Specifications

This chapter contains specifications for the instrument. All specifications are guaranteed unless noted as "typical." Typical specifications are provided for your convenience but are not guaranteed. Specifications that are marked with the ✓ symbol are checked in this manual. All specifications apply to all models unless noted otherwise.

To meet specifications, these conditions must first be met:

- The instrument must have been calibrated in an ambient temperature between 18 °C and 28 °C (64 °F and 82 °F).
- The instrument must be powered from a source that meets the specifications.
- The instrument must have been operating continuously for at least 20 minutes within the specified operating temperature range.
- You must perform the Signal Path Compensation procedure after the warmup period. See the online help for instructions on how to perform signal path compensation. If the ambient temperature changes more than 5 °C (9 °F) , repeat the procedure.

Analog channel input and vertical specification

Number of input channels

MSO64 4 BNC

Input coupling DC, AC

Input resistance selection 1 MΩ or 50 Ω

✓Input impedance 1 MΩ DC coupled 1 MΩ ±1%

Input capacitance 1 MΩ DC coupled, typical 14.5 pF ±1.5 pF

✓Input impedance 50 Ω, DC coupled 50 Ω ±3%

Input VSWR, 50 Ω DC-coupled, typical

Input frequency	VSWR < 100 mV/div	VSWR ≥100 mV/div
<2.5 GHz	1.4	1.2
≤8 GHz	1.9	1.6

Maximum input voltage, 1 MΩ

300 V_{RMS} at the BNC

Derate at 20 dB/decade between 4.5 MHz and 45 MHz; derate 14 dB/decade between 45 MHz and 450 MHz. Above 450 MHz, 5.5 V_{RMS}

Maximum peak input voltage at the BNC: ±425 V

Maximum input voltage, 50 Ohm

2.3 V_{RMS} at <100 mV/division, with peaks ≤ ±20 V

5.5 V_{RMS} at >100 mV/division, with peaks ≤ ±20 V

DC balance

✓ 0.1 div with DC-50 Ω oscilloscope input impedance (50 Ω BNC terminated)

✓ 0.2 div at 1 mV/div with DC-50 Ω oscilloscope input impedance (50 Ω BNC terminated)

✓ 0.2 div with DC-1 MΩ oscilloscope input impedance (50 Ω BNC terminated)

Number of digitized bits 8 bits at 25 GS/s; 8 GHz on all channels

12 bits at 12.5 GS/s; 4 GHz on all channels

13 bits at 6.25 GS/s (High Res); 2 GHz on all channels

14 bits at 3.125 GS/s (High Res); 1 GHz on all channels

15 bits at 1.25 GS/s (High Res); 500 MHz on all channels

16 bits at 625 MS/s (High Res); 500 MHz on all channels

For 12-bit mode, there are 4096 DL's [1] (digitizing levels) in a captured waveform. For 8-bit mode, there are 256 DL's.

In an un-zoomed time-domain waveform plot, the full vertical scale of the plot (in 12-bit mode) is 4000 DLs ±48 DLs "off-screen" but are still available for measurements, analysis, and download.

In 8-bit mode, there are 250 DLs displayed. ±3 digitizing levels are "off-screen" but are still available for measurements, analysis, and download.

Sensitivity range, coarse

1 MΩ — 500 µV/div to 10 V/div in a 1-2-5 sequence

50 Ω — 1 mV/div to 1 V/div in a 1-2-5 sequence

Sensitivity range, fine

Allows continuous adjustment from:

1 MΩ — 500 µV/div to 10 V/div

50 Ω — 1 mV/div to 1 V/div

Sensitivity resolution, fine — ≤1% of current setting

✓ DC gain accuracy

50 Ohm

±2.0% [2] (±2.0% at 2 mV/div, ±4% at 1 mV/div, typical)

±1.0% [3] of full scale, (±1.0% of full scale at 2 mV/div, ± 2% at 1 mV/div, typical)

1 Meg Ohm

±2.0%[2] (±2% at 2 mV/div, ±2.5% at 1 mV/div and 500 µV/div, typical)

±1.0%[3] of full scale, (±1.0% of full scale at 2 mV/div, ±1.25% at 1 mV/div and 500 µV/div, typical)

Offset ranges, maximum

Input signal cannot exceed maximum input voltage for the 50 Ω input path.

Volts/div Setting	Maximum offset range, 50 Ω Input
1 mV/div - 99 mV/div	±1 V
100 mV/div - 1 V/div	±10 V

1 DL is the abbreviation for digitization level. A DL is the smallest voltage level change that can be resolved by an A-D Converter. This value is also known as an LSB (least significant bit).

2 Immediately following SPC, add 2% for every 5 °C change in ambient.

3 Immediately following SPC, add 1% for every 5 °C change in ambient.

Volts/div Setting	Maximum offset range, 1 MΩ Input
500 µV/div - 63 mV/div	±1 V
64 mV/div - 999 mV/div	±10 V
1 V/div - 10 V/div	±100 V

Position range ±5 divisions

✓ Offset accuracy ±(0.005 X | offset - position | + DC balance); Offset, position, and DC Balance in units of Volts

Digital nonlinearity INL @ > 2 mV/div: ±16 DL's (12-bit reference)

INL @ ≤ 2 mV/div: ±20 DL's (12-bit reference)

DNL: ±1.0 DL's (12-bit digitizing scale) when oscilloscope is in Hi-Res mode.

Number of waveforms for average acquisition mode 2 to 10,240 Waveforms, default 16 waveforms

DC voltage measurement accuracy, Average acquisition mode

Measurement Type	DC Accuracy (In Volts)
Average of ≥16 waveforms	±((DC Gain Accuracy) * |reading - (offset - position)| + Offset Accuracy + 0.05 * V/div setting)
Delta volts between any two averages of ≥16 waveforms acquired with the same oscilloscope setup and ambient conditions	±(DC Gain Accuracy * |reading| + 0.1 div)

DC voltage measurement accuracy, Sample acquisition mode, typical

Measurement Type	DC Accuracy (In Volts)
Any Sample	±(DC Gain Accuracy * |reading - (offset - position)| + Offset Accuracy + 0.15+0.6 mV)
Delta volts between any two samples acquired with the same scope setup and ambient conditions	±(DC Gain Accuracy * |reading| + 0.15 div +1.2 mV)

Bandwidth selections

8 GHz model, 50 Ohm 20 MHz, 200 MHz, 250 MHz, 350 MHz, 500 MHz, 1 GHz, 2 GHz, 2.5 GHz, 3 GHz, 4 GHz, 5 GHz, 6 GHz, 7 GHz, and 8 GHz

6 GHz model, 50 Ohm 20 MHz, 200 MHz, 250 MHz, 350 MHz, 500 MHz, 1 GHz, 2 GHz, 2.5 GHz, 3 GHz, 4 GHz, 5 GHz, and 6 GHz

4 GHz model, 50 Ohm 20 MHz, 200 MHz, 250 MHz, 350 MHz, 500 MHz, 1 GHz, 2 GHz, 2.5 GHz, 3 GHz, and 4 GHz

2.5 GHz model, 50 Ohm 20 MHz, 200 MHz, 250 MHz, 350 MHz, 500 MHz, 1 GHz, 2 GHz, and 2.5 GHz

1 GHz model, 50 Ohm 20 MHz, 200 MHz, 250 MHz, 350 MHz, 500 MHz, and 1 GHz

1M Ohm 20 MHz, 200 MHz, 250 MHz, 350 MHz, and Full (500 MHz)

Frequency response tolerance/ flatness, 50 Ohm, all modes, typical

±0.5 dB from DC to 80% of bandwidth setting

Not valid for bandwidth settings ≤ 250 MHz or while using peak detect or envelope modes.

Phase response

±2.5 degrees, typical out to 7 GHz.

✓ Analog bandwidth 50 Ω DC coupled

Model	Volts/Div Setting	Bandwidth
MSO64 BW-8000	1 mV/div - 1V/div	DC - 8 GHz
MSO64 BW-6000	1 mV/div - 1V/div	DC - 6 GHz
MSO64 BW-4000	1 mV/div - 1V/div	DC - 4 GHz
MSO64 BW-2500	1 mV/div - 1V/div	DC - 2.5 GHz
MSO64 BW-1000	1 mV/div - 1V/div	DC - 1 GHz

The limits stated above 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.

Analog bandwidth, 1 MΩ, typical

All model bandwidths except 350 MHz

The limits stated above 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.

Volts/Div Setting	Bandwidth
1 mV/div - 10 V/div	DC - 500 MHz
500 µV/div - 995 µV/div	DC - 250 MHz

350 MHz models

Volts/Div Setting	Bandwidth
1 mV/div - 10 V/div	DC - 350 MHz
500 µV/div - 995 µV/div	DC - 250 MHz

Analog bandwidth TPP1000 10X probe

The limits 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.

Model	Volts/Div Setting	Bandwidth
MSO6X, all models	5 mV/div - 100 V/div	DC - 1 GHz

Analog bandwidth, 1 MΩ, 10X probe (P6139B)

MSO6X, all models

Volts/Div Setting	Bandwidth
50 mV/div - 100 V/div	DC - 500 MHz
20 mV/div - 49.8 mV/div	DC - 350 MHz
10 mV/div - 19.9 mV/div	DC - 175 MHz

Lower frequency limit, AC coupled, typical

<10 Hz when AC 1 MΩ coupled. The AC coupled lower frequency limits are reduced by a factor of 10 (<1 Hz) when 10X passive probes are used.

Upper frequency limit, 250 MHz bandwidth limited, typical

50 Ω, DC-coupled	250 MHz, ± 5%
1 MΩ, DC-coupled	250 MHz, ± 25%

Upper frequency limit, 200 MHz bandwidth limited, typical

50 Ω, DC-coupled	200 MHz, ± 5%
1 MΩ, DC-coupled	200 MHz, ± 5%

Upper frequency limit, 20 MHz bandwidth limited, typical

50 Ω, DC-coupled	20 MHz, ± 5%
1 MΩ, DC-coupled	20 MHz, ± 25%

Calculated rise time

Calculated Rise Time (10% to 90%) equals 0.4/BW

Model	**50 Ω**	**TPP1000 Probe**
	1 mV-1 V	**5 mV-10 V**
MSO6X BW-8000	50ps	400ps
MSO6X BW-6000	66.67ps	400ps
MSO6X BW-4000	100ps	400ps
MSO6X BW-2500	160ps	400ps
MSO6X BW-2000	200ps	400ps
MSO6X BW-1000	400ps	400ps

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.

Peak Detect or Envelope mode pulse response, typical

Minimum pulse width is >160 ps (25 GS/s)

Effective bits, 50 Ω, typical

50 mV/div, 25 GS/s, Sample Mode, 50 Ohm						
	Freque ncy					
Bandwidth	**10 MHz**	**250 MHz**	**1 GHz**	**2 GHz**	**4 GHz**	**7 GHz**
8 GHz	6.5	6.5	6.5	6.4	6.4	6.3
7 GHz	6.6	6.6	6.6	6.6	6.5	6.4
6 GHz	6.8	6.8	6.8	6.7	6.7	NA
5 GHz	7	7	6.9	6.9	6.8	NA
4 GHz	7.2	7.2	7.2	7	7	NA
3 GHz	7.4	7.4	7.3	7.3	NA	NA
2.5 GHz	7.6	7.6	7.5	7.4	NA	NA
2 GHz	7.7	7.7	7.7	7.5	NA	NA

Table continued…

50 mV/div, 25 GS/s, Sample Mode, 50 Ohm						
	Frequency					
Bandwidth	10 MHz	250 MHz	1 GHz	2 GHz	4 GHz	7 GHz
1 GHz	8.2	8.2	8	NA	NA	NA
500 MHz	8.4	8.4	NA	NA	NA	NA
350 MHz	8.7	8.7	NA	NA	NA	NA
250 MHz	8.8	9	NA	NA	NA	NA
200 MHz	7.8	NA	NA	NA	NA	NA
20 MHz	7.9	NA	NA	NA	NA	NA

2 mV/div, 25 GS/s, Sample Mode, 50 Ohm						
	Frequency					
Bandwidth	10 MHz	250 MHz	1 GHz	2 GHz	4 GHz	7 GHz
8 GHz	5.1	5.1	5.1	5.1	5.1	5.1
7 GHz	5.3	5.3	5.3	5.3	5.3	5.3
6 GHz	5.5	5.5	5.5	5.5	5.5	NA
5 GHz	5.65	5.65	5.65	5.65	5.65	NA
4 GHz	5.9	5.9	5.9	5.9	5.9	NA
3 GHz	6.05	6.05	6.05	6.05	NA	NA
2.5 GHz	6.2	6.2	6.2	6.2	NA	NA
2 GHz	6.35	6.35	6.35	6.35	NA	NA
1 GHz	6.8	6.8	6.8	NA	NA	NA
500 MHz	7.2	7.2	NA	NA	NA	NA
350 MHz	7.3	7.3	NA	NA	NA	NA
250 MHz	7.5	7.7	NA	NA	NA	NA
200 MHz	7.3	NA	NA	NA	NA	NA
20 MHz	7.6	NA	NA	NA	NA	NA

50 mV/div, 12.5 GS/s, HiRes Mode, 50 Ohm					
	Frequency				
Bandwidth	10 MHz	250 MHz	1 GHz	2 GHz	4 GHz
4 GHz	7.25	7.25	7.25	7.1	7
3 GHz	7.5	7.5	7.5	7.35	NA
2.5 GHz	7.6	7.6	7.6	7.4	NA
2 GHz	7.8	7.8	7.65	7.5	NA
1 GHz	8.2	8.2	8	NA	NA

Table continued…

50 mV/div, 12.5 GS/s, HiRes Mode, 50 Ohm					
	Frequency				
Bandwidth	**10 MHz**	**250 MHz**	**1 GHz**	**2 GHz**	**4 GHz**
500 MHz	8.5	8.5	NA	NA	NA
350 MHz	8.8	8.9	NA	NA	NA
250 MHz	8.9	9	NA	NA	NA
200 MHz	9	NA	NA	NA	NA
20 MHz	9.8	NA	NA	NA	NA

2 mV/div, 12.5 GS/s, HiRes Mode, 50 Ohm					
	Frequency				
Bandwidth	**10 MHz**	**250 MHz**	**1 GHz**	**2 GHz**	**4 GHz**
4 GHz	5.9	5.9	5.9	5.85	5.8
3 GHz	6.1	6.1	6.1	6.1	NA
2.5 GHz	6.2	6.2	6.2	6.2	NA
2 GHz	6.35	6.35	6.35	6.35	NA
1 GHz	6.8	6.8	6.8	NA	NA
500 MHz	7.2	7.2	NA	NA	NA
350 MHz	7.4	7.4	NA	NA	NA
250 MHz	7.5	7.5	NA	NA	NA
200 MHz	7.75	NA	NA	NA	NA
20 MHz	8.8	NA	NA	NA	NA

Effective bits, 50 Ω

50 mV/div, 25 GS/s, Sample Mode, 50 Ohm						
	Frequency					
Bandwidth	**10 MHz**	**250 MHz**	**1 GHz**	**2 GHz**	**4 GHz**	**7 GHz**
8 GHz	6.06	6.06	6.06	5.97	5.97	5.88
7 GHz	6.15	6.15	6.15	6.15	6.06	5.97
6 GHz	6.32	6.32	6.32	6.23	6.23	NA
5 GHz	6.48	6.48	6.40	6.40	6.32	NA
4 GHz	6.63	6.63	6.63	6.48	6.48	NA
3 GHz	6.77	6.77	6.70	6.70	NA	NA
2.5 GHz	6.9	6.9	6.84	6.77	NA	NA
2 GHz	6.96	6.96	6.96	6.84	NA	NA
1 GHz	7.21	7.21	7.12	NA	NA	NA

Table continued…

50 mV/div, 25 GS/s, Sample Mode, 50 Ohm						
	Freque ncy					
Bandwidth	**10 MHz**	**250 MHz**	**1 GHz**	**2 GHz**	**4 GHz**	**7 GHz**
500 MHz	7.29	7.29	NA	NA	NA	NA
350 MHz	7.38	7.38	NA	NA	NA	NA
250 MHz	7.41	7.45	NA	NA	NA	NA
200 MHz	7.02	NA	NA	NA	NA	NA
20 MHz	7.07	NA	NA	NA	NA	NA

2 mV/div, 25 GS/s, Sample Mode, 50 Ohm						
	Freque ncy					
Bandwidth	**10 MHz**	**250 MHz**	**1 GHz**	**2 GHz**	**4 GHz**	**7 GHz**
8 GHz	4.75	4.75	4.75	4.75	4.75	4.75
7 GHz	4.95	4.95	4.95	4.95	4.95	4.95
6 GHz	5.15	5.15	5.15	5.15	5.15	NA
5 GHz	5.30	5.30	5.30	5.30	5.30	NA
4 GHz	5.55	5.55	5.55	5.55	5.55	NA
3 GHz	5.70	5.70	5.70	5.70	NA	NA
2.5 GHz	5.85	5.85	5.85	5.85	NA	NA
2 GHz	6.00	6.00	6.00	6.00	NA	NA
1 GHz	6.45	6.45	6.45	NA	NA	NA
500 MHz	6.85	6.85	NA	NA	NA	NA
350 MHz	6.95	6.95	NA	NA	NA	NA
250 MHz	7.15	7.35	NA	NA	NA	NA
200 MHz	6.95	NA	NA	NA	NA	NA
20 MHz	7.25	NA	NA	NA	NA	NA

50 mV/div, 12.5 GS/s, HiRes Mode, 50 Ohm					
	Frequen cy				
Bandwidth	**10 MHz**	**250 MHz**	**1 GHz**	**2 GHz**	**4 GHz**
4 GHz	6.90	6.90	6.90	6.65	6.45
3 GHz	7.15	7.15	7.15	7.00	NA
2.5 GHz	7.25	7.25	7.25	7.05	NA
2 GHz	7.45	7.45	7.30	7.15	NA
1 GHz	7.85	7.85	7.65	NA	NA
500 MHz	8.15	8.15	NA	NA	NA

Table continued…

50 mV/div, 12.5 GS/s, HiRes Mode, 50 Ohm					
	Frequency				
Bandwidth	10 MHz	250 MHz	1 GHz	2 GHz	4 GHz
350 MHz	8.45	8.55	NA	NA	NA
250 MHz	8.55	8.65	NA	NA	NA
200 MHz	8.65	NA	NA	NA	NA
20 MHz	8.90	NA	NA	NA	NA

2 mV/div, 12.5 GS/s, HiRes Mode, 50 Ohm					
	Frequency				
Bandwidth	10 MHz	250 MHz	1 GHz	2 GHz	4 GHz
4 GHz	5.55	5.55	5.55	5.50	5.45
3 GHz	5.75	5.75	5.75	5.75	NA
2.5 GHz	5.85	5.85	5.85	5.85	NA
2 GHz	6.00	6.00	6.00	6.00	NA
1 GHz	6.45	6.45	6.45	NA	NA
500 MHz	6.85	6.85	NA	NA	NA
350 MHz	7.05	7.05	NA	NA	NA
250 MHz	7.15	7.15	NA	NA	NA
200 MHz	7.40	NA	NA	NA	NA
20 MHz	8.45	NA	NA	NA	NA

Random noise, sample acquisition mode

✓50 Ω

Table 1: 25 GS/s, Sample Mode, RMS

V/div	1 mV/div	2 mV/div	5 mV/div	10 mV/div	20 mV/div	50 mV/div	100 mV/div	1 V/div
8 GHz	223 µV	224 µV	293 µV	482 µV	890 µV	2.1 mV	4.88 mV	42 mV
7 GHz	199 µV	202 µV	271 µV	440 µV	793 µV	1.85 mV	4.4 mV	37 mV
6 GHz	179 µV	180 µV	233 µV	388 µV	691 µV	1.67 mV	3.83 mV	33.4 mV
5 GHz	158 µV	160 µV	210 µV	338 µV	630 µV	1.49 mV	3.42 mV	29.7 mV

Table 2: 12.5 GS/s, HiRes Mode, RMS

V/div	1 mV/div	2 mV/div	5 mV/div	10 mV/div	20 mV/div	50 mV/div	100 mV/div	1 V/div
4 GHz	138 µV	139 µV	175 µV	271 µV	486 µV	1.15 mV	2.71 mV	23.1 mV
3 GHz	117 µV	119 µV	149 µV	226 µV	398 µV	960 µV	2.28 mV	19.2 mV
2.5 GHz	108 µV	110 µV	133 µV	203 µV	363 µV	856 mV	2.03 mV	17.1 mV
2 GHz	96.3 µV	97.6 µV	118 µV	186 µV	320 µV	745 µV	1.81 mV	14.9 mV
1 GHz	77.3 µV	72.4 µV	89.6 µV	128 µV	226 µV	534 µV	1.33 mV	10.8 mV
500 MHz	56 µV	56.2 µV	68 µV	91.9 µV	162 µV	396 µV	941 µV	7.92 mV
350 MHz	47.7 µV	47.3 µV	56.5 µV	77.3 µV	133 µV	307 µV	792 µV	6.14 mV
250 MHz	46.1 µV	46.7 µV	54 µV	77.4 µV	120 µV	280 µV	722 mV	5.6 mV
200 MHz	37.9 µV	38 µV	44.4 µV	65.8 µV	106 µV	247 µV	666 µV	4.94 mV
20 MHz	13 µV	13.3 µV	15.6 µV	22.6 µV	41.2 µV	105 µV	236 µV	2.11 mV

50 Ω, typical

Table 3: 25 GS/s, Sample Mode, RMS

V/div	1 mV/div	2 mV/div	5 mV/div	10 mV/div	20 mV/div	50 mV/div	100 mV/div	1 V/div
8 GHz	158 µV	158 µV	208 µV	342 µV	630 µV	1.49 mV	3.46 mV	29.7 mV
7 GHz	141 µV	143 µV	192 µV	311 µV	562 µV	1.31 mV	3.11 mV	26.2 mV
6 GHz	127 µV	127 µV	165 µV	274 µV	489 µV	1.18 mV	2.71 mV	23.6 mV
5 GHz	112 µV	113 µV	149 µV	239 µV	446 µV	1.05 mV	2.42 mV	21.1 mV

Table 4: 12.5 GS/s, HiRes Mode, RMS

V/div	1 mV/div	2 mV/div	5 mV/div	10 mV/div	20 mV/div	50 mV/div	100 mV/div	1 V/div
4 GHz	97.4 µV	98.7 µV	124 µV	192 µV	344 µV	817 µV	1.92 mV	16.3 mV
3 GHz	82.9 µV	84 µV	105 µV	160 µV	282 µV	680 µV	1.62 mV	13.6 mV
2.5 GHz	76.5 µV	77.5 µV	93.8 µV	144 µV	257 µV	606 µV	1.44 mV	12.1 mV

Table continued…

2 GHz	68.1 µV	69.1 µV	83.6 µV	131 µV	226 µV	528 µV	1.28 mV	10.6 mV
1 GHz	54.8 µV	51.2 µV	63.4 µV	90.9 µV	160 µV	378 µV	941 µV	7.65 mV
500 MHz	39.7 µV	39.8 µV	48.1 µV	65.1 µV	115 µV	280 µV	666 µV	5.6 mV
350 MHz	33.8 µV	33.5 µV	40 µV	54.8 µV	94.3 µV	217 µV	560 µV	4.35 mV
250 MHz	30.8 µV	31.2 µV	36.1 µV	49.9 µV	80.3 µV	187 µV	482 µV	3.75 mV
200 MHz	25.3 µV	25.4 µV	29.7 µV	44 µV	70.7 µV	165 µV	445 µV	3.3 mV
20 MHz	8.68 µV	8.9 µV	10.4 µV	15.1 µV	27.5 µV	70.4 µV	158 µV	1.41 mV

1 MΩ, 12.5 GS/s, High Res mode (RMS), typical

V/div	1 mV/div	2 mV/div	5 mV/div	10 mV/div	20 mV/div	50 mV/div	100 mV/div	1 V/div
500 MHz	186 µV	202 µV	210 µV	236 µV	288 µV	522 µV	1.25 mV	13.4 mV
350 MHz	134 µV	138 µV	145 µV	163 µV	216 µV	391 µV	974 µV	10.6 mV
250 MHz	108 µV	110 µV	114 µV	131 µV	182 µV	374 µV	838 µV	9.63 mV
200 MHz	106 µV	108 µV	109 µV	117 µV	149 µV	274 µV	674 µV	8.01 mV
20 MHz	73 µV	73.2 µV	78.1 µV	99.6 µV	158 µV	361 µV	801 µV	8.29 mV

Crosstalk (channel isolation), typical

≥70 dB up to 2 GHz

≥60 dB up to 5 GHz

≥45 dB up to 8 GHz

for any two channels set to 200 mV/div.

Overdrive recovery time, typical

50 Ω, no probe, 1 GHz bandwidth

Vertical scale	500% overdrive			5000% overdrive		
	5%	1%	0.2%	5%	1%	0.2%
1 mV/div	<1 µs	2.0 ms	2.0 ms	---	---	---
10 mV/div	<1 µs	3.0 ms	33 µs	<1.2 µs	<4.7 µs	---
100 mV/div	<1 µs	<1 µs	5.8 µs	---		---

50 Ω, no probe, 2 GHz bandwidth

Vertical scale	500% overdrive			5000% overdrive		
	5%	1%	0.2%	5%	1%	0.2%
1 mV/div	<1 µs	110 µs	2.0 ms	---	---	---
10 mV/div	<1 µs	<1 µs	2.0 ms	<1 µs	<1 µs	---
100 mV/div	<1 µs	<1 µs	2.3 ms	---		---

TPP1000 Probe

Vertical scale	500% overdrive			5000% overdrive		
	5%	1%	0.2%	5%	1%	0.2%
10 mV/div	20 µs	2.0 ms	2.0 ms	30 µs	50 µs	2.2 ms
20 mV/div	14 µs	2.0 ms	2.0 ms	30 µs	50 µs	110 µs
50 mV/div	12 µs	60 µs	2.0 ms	---	---	---
100 mV/div	12 µs	60 µs	2.0 ms	---	---	---

SFDR analog channels, typical

SFDR, Single Tone		
Bandwidth	50 mV/div	2 mV/div
8 GHz	-45 dB	-42 dB
4 GHz/High Res	-51 dB	-51 dB
2 GHz/High Res	-56 dB	-56 dB

Combined TDP7700 and MSO6 flatness, typical

±0.6 dB from DC to 80% of nominal BW when used with P77C292MM (SMA Probe Tip)

Not valid while using peak detect or envelope mode.

Valid for probe modes A, B, and D

Delay between analog channels, full bandwidth, typical

≤ 10 ps for any two channels with input impedance set to 50 Ω, DC coupling with equal Volts/div or above 10 mV/div

Deskew range

-125 ns to +125 ns with a resolution of 40 ps (for Peak Detect and Envelope acquisition modes).

-125 ns to +125 ns with a resolution of 1 ps (for all other acquisition modes).

Digital skew, typical

Digital-to-Analog skew 1 ns

Digital-to-Digital skew 320 ps from bit 0 of any TekVPI+ channel to bit 0 of any TekVPI+ channel.

Digital skew within a FlexChannel 160 ps within any TEKVPI+ channel

Total probe power

TekVPI Compliant probe interfaces: 4

MSO64: 80 W maximum, (40 W maximum for channels 1 through 2, 40 W maximum for channels 3 through 4)

Probe power per channel

Voltage	Max Amperage	Voltage Tolerance
5 V	60 mA	±10%
12 V	A (20 W maximum software limit)	±10%

TekVPI interconnect All analog channel inputs on the front panel conform to the TEKVPI specification.

Timebase system

✓Timebase accuracy

±1.0 x10^{-7} over any ≥1 ms time interval

Description	Specification
Factory Tolerance	±12 ppb At calibration, 25 °C ambient, over any ≥1 ms interval
Temperature stability	±20 ppb across the full operating range of 0 °C to 50 °C, after a sufficient soak time at the temperature Tested at operating temperatures
Crystal aging	±300 ppb Frequency tolerance change at 25 °C over a period of 1 year

Sample rate

Model	Number of channels in use	Maximum hardware capability
MSO64	4	25 GS/s on all channels

Interpolated waveform rate range 2.5 TS/sec, 1 TS/sec, 500 GS/sec, 250 GS/sec, 100 GS/sec, 50 GS/sec, and 25 GS/sec (Interpolated HIRes)

Record length range

Applies to analog and digital channels. All acquisition modes are 250 M maximum record length, down to 1 k minimum record length, adjustable in 1 sample increments.

Standard: 62.5 Mpoints

Option 6-RL-1: 125 Mpoints

Option 6-RL-2: 250 Mpoints

Seconds/Division range

Model	1 K	10 K	100 K	1 M	10 M	62.5 M	125 M	250 M	500 M	1 G
MSO64 Standard 62.5 M	40 ps - 16 s	400 ps - 160 s	4 ns - 1000 s			2.5 µs - 1000 s	N/A	N/A	N/A	N/A
MSO64 Option 6-RL-1 125 M	40 ps - 16 s	400 ps - 160 s	4 ns - 1000 s			2.5 µs - 1000 s	5 µs - 1000 s	N/A	N/A	N/A
MSO64 Option 6-RL-2 250 M	40 ps - 16 s	400 ps - 160 s	4 ps - 1000 s			2.5 µs - 1000 s	5 µs - 1000 s	10 µs - 1000 s	N/A	N/A
Option 6-RL-3 500 Mpts	40 ps - 16 s	400 ps - 160 s	4 ps - 1000 s			2.5 us - 1000 s	5 us - 1000 s	10 us - 1000 s	20 us - 1000 s	N/A
Option 6-RL-4: 1 Gpts	40 ps - 16 s	400 ps - 160 s	4 ps - 1000 s			2.5 us - 1000 s	5 us - 1000 s	10 us - 1000 s	20 us - 1000 s	40 us - 1000 s

Aperture uncertainty (sample jitter)

Time duration	Typical jitter
<1 µs	80 fs
<1 ms	130 fs

Delta-time measurement accuracy, nominal

The formulas to calculate the peak-to-peak or rms nominal delta-time measurement accuracy (DTA) for a given instrument setting and input signal is as follows (assumes insignificant signal content above Nyquist frequency):

$$DTA_{RMS} = \sqrt{\left(\frac{N}{SR_1}\right)^2 + \left(\frac{N}{SR_2}\right)^2 + t_j^2} + TBA \times t_p$$

Where:

N = RSS of input-referred noise (V_{RMS}) and dynamic noise estimate (V_{RMS})

SR_1 = Slew Rate (1st Edge) around 1st point in measurement

SR_2 = Slew Rate (2nd Edge) around 2nd point in measurement

Dynamic noise estimate [4]=

$$Dynamic\ noise\ estimate^* = \sqrt{\frac{BW}{8\ GHz}}\ X\ 19.9\ X\ 10^{-3}\ X\ volts/div$$

Tj = aperture uncertainty (sec rms -- 80 fs for short durations)

t_p = delta-time measurement duration (sec)

TBA = timebase accuracy or Reference Frequency Error (which is 20 ppb)

(Assumes insignificant error due to aliasing or over-drive.)

The term under the square root sign is the stability and is due to TIE (Time Interval Error). The errors due to this term occur throughout a single-shot measurement. The second term is due to 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).

⚠ **Note:** The formulas assume negligible errors due to measurement interpolation, and apply only when the interpolated sample rate is 25 GS/s or higher.

Trigger system

Trigger bandwidth (edge, pulse and logic), typical

Model	Trigger type	Trigger bandwidth
MSO64 8 GHz	Edge	8 GHz
MSO64 8 GHz	Pulse, Logic	4 GHz
MSO64 6 GHz	Edge	6 GHz
MSO64 6 GHz	Pulse, Logic	4 GHz
MSO64 4 GHz, 2.5 GHz, 1 GHz:	Edge, Pulse, Logic	Product Bandwidth

Maximum triggered acquisition rate, typical

Analog or digital channels: single channel [Analog or Digital 8-bit channel] on screen, measurements and math turned off. >40 wfm/sec

FastAcq Update Rate (analog only, peak detect or envelope mode): >460 K/second with one channel active and >100 K/second with all active.

FastAcq Update Rate (All other acquisition Modes, one analog channel): 18 k/second .

Fast Frame Rate (50-point frames): 664 K/second

Digital channel: >40/second with one channel (8-bits) active. There is no FastAcq for digital channels, but they do not slow down FastAcq for active analog channels.

AUX Trigger skew between instruments, typical

±100 ps jitter on each instrument with up to 1.5 ns skew; ≤1.5 ns total between instruments.

Edge-type trigger sensitivity, DC coupled, typical

Path	Range	Specification
1 MΩ path (all models)	0.5 mV/div to 0.99 mV/div	5 mV from DC to instrument bandwidth
	≥ 1 mV/div	The greater of 5 mV or 0.7 div from DC to lesser of 500 MHz or instrument BW, & 6 mV or 0.8 div from > 500 MHz to instrument bandwidth

Table continued…

4 Dynamic noise is noise that appears with a signal applied (such as distortion or interleave errors).

Path	Range	Specification
50 Ω path	1 mV/div to 9.98 mV/div	3.0 div from DC to instrument bandwidth
	≥ 10 mV/div	< 1.0 division from DC to instrument bandwidth
Line	90 V to 264 V line voltage at 50 - 60 Hz line frequency	103.5 V to 126.5 V
AUX Trigger in		250 mV_{PP}, DC to 400`MHz

Edge-type trigger sensitivity, not DC coupled, typical

Trigger Coupling	Typical Sensitivity
NOISE REJ	2.5 times the DC Coupled limits
HF REJ	1.0 times the DC Coupled limits from DC to 50 kHz. Attenuates signals above 50 kHz.
LF REJ	1.5 times the DC Coupled limits for frequencies above 50 kHz. Attenuates signals below 50 kHz.

Trigger jitter, typical

≤ 1.5 ps_{RMS} for sample mode and edge-type trigger

≤ 2 ps_{RMS} for edge-type trigger and FastAcq mode

≤ 40 ps_{RMS} for non edge-type trigger modes

≤ 40 ps_{RMS} for AUX trigger in, Sample acquisition mode, edge trigger (MSO58LP only)

Lowest frequency for successful operation of Set Level to 50% function, typical

45 Hz

Pulse-type runt trigger sensitivities, typical

2.0 division at vertical settings ≥5 mV/div.

Pulse-type trigger width and glitch sensitivities, typical

2.0 divisions at vertical settings ≥5 mV/div.

Logic-type, logic qualified trigger, or events-delay sensitivities, DC coupled, typical

2.0 divisions, at vertical settings ≥5 mV/div.

Logic-type triggering, minimum logic or rearm time, typical

Triggering type	Pulse width	Rearm time	Time skew needed for 100% and no triggering [5]
Logic	40 ps + t_{rise}	40 ps + t_{rise}	>360 ps / <150 ps
Time qualified logic	80 ps + t_{rise}	80 p + t_{rise}	>360 ps / <150 ps

t_{rise} is rise time of the instrument.

5 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 Events, the time is the minimum time between a main and delayed event that will be recognized if more than one channel is used.

Minimum clock pulse widths for setup/hold time violation trigger, typical

Minimum pulsewidth, clock active [6]	Minimum pulsewidth, clock inactive [7]
80 ps + t_{rise}	80 ps +t_{rise}

t_{rise} is rise time of the instrument.

Setup + Hold must be less than the clock period.

Setup/hold violation trigger, setup and hold time ranges, typical

Feature	Min	Max
Setup Time	0 ns	20 s
Hold Time	0 ns	20 s
Setup + Hold Time	80 ps	22 s

Input coupling on clock and data channels must be the same.

For Setup Time, positive numbers mean a data transition before the clock.

For Hold Time, positive numbers mean a data transition after the clock edge.

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

Pulse type trigger, minimum pulse, rearm time, transition time

Pulse class	Minimum pulse width	Minimum rearm time
Runt	40 ps + t_{rise}	40 ps + t_{rise}
Time-Qualified Runt	40 ps + t_{rise}	40 ps + t_{rise}
Width	40 ps + t_{rise}	40 ps + t_{rise}

Trigger class	Minimum transition time	Minimum rearm time
Rise/Fall Time	40 ps + t_{rise}	40 ps + t_{rise}

For trigger class width, pulse width refers to the width of the pulse being measured. Rearm time refers to the time between pulses.

For trigger class runt, pulse width refers to the width of the pulse being measured. Rearm time refers to the time between pulses.

t_{rise} is rise time of the instrument.

Time range for glitch, pulse width, timeout, time-qualified runt, or time-qualified window triggering

40 ps to 20 s.

Time accuracy for pulse, glitch, timeout, or width triggering

Time Range	Accuracy
320 ps to 500 ns	±(40 ps +Time Base Error * Setting).

Table continued…

6 Active pulsewidth is the width of the clock pulse from its active edge (as defined in the Clock Edge menu item) to its inactive edge.

Time Range	Accuracy
520 ns to 1 s	±(40 ps +Time Base Error * Setting).

B trigger after events, minimum pulse width and maximum event frequency, typical

Minimum pulse width: 40 ps + t_{rise}

Maximum event frequency: Instrument bandwidth.

t_{rise} is rise time of the instrument.

B trigger, minimum time between arm and trigger, typical

80 ps

For trigger after time, this is the time between the end of the time period and the B trigger event.

For trigger after events, this is the time between the last A trigger event and the first B trigger event.

B trigger after time, time range

40 ps to 20 seconds

Accuracy = ± (40ps + (Time-Base-Error * Setting))

B trigger after events, event range

1 to 65,471

Trigger level ranges

Source	Range
Any Channel	±5 divs from center of screen
Aux In Trigger	±5 V
Line	Fixed at about 50% of 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:

Source	Range
Any Input Channel	±0.20 div
Line	N/A

Trigger holdoff range

0 ns to 10 seconds

Serial Trigger specifications

Maximum serial trigger bits

128 bits

Optional serial bus interface triggering

Please refer to the *Serial Triggering and Analysis 3 Series MDO, 4/5/6 Series MSO Applications Datasheet* (part number 61W-61101-x), located on the Tektronix Web site, for information on available serial triggering options and their triggering capabilities.

7 Inactive pulsewidth is the width of the pulse from its inactive edge to its active edge.

Digital acquisition system

Digital channel maximum sample rate	25 GS/s
Transition detect (digital peak detect)	Displayed data at sample rates less than 25 GS/s (decimated data), that contains multiple transitions between sample points will be displayed with a bright white colored edge.

Digital volt meter (DVM)

Measurement types DC, AC_{RMS}+DC, AC_{RMS} , Trigger frequency count

Voltage resolution 4 digits

✓Voltage accuracy

DC: ±((1.5% * |reading - offset - position|) + (0.5% * |(offset - position)|) + (0.1 * Volts/div))

De-rated at 0.100%/°C of |reading - offset - position| above 30 °C

Signal ± 5 divisions from screen center

AC: ± 3% (40 Hz to 1 kHz) with no harmonic content outside 40 Hz to 1 kHz range

AC, typical: ± 2% (20 Hz to 10 kHz)

For AC measurements, the input channel vertical settings must allow the V_{PP} input signal to cover between 4 and 10 divisions and must be fully visible on the screen

Trigger frequency counter

Resolution 8-digits

✓Accuracy ±(1 count + time base accuracy * input frequency)

The signal must be at least 8 mV_{pp} or 2 div, whichever is greater.

Trigger frequency counter source Any analog input channel.

✓ Maximum input frequency 10 Hz to maximum bandwidth of the analog channel

The signal must be at least 8 mV_{pp} or 2 div, whichever is greater.

Arbitrary function generator

Modes of operation Off, Continuous, Burst

Function types Arbitrary, sine, square, pulse, ramp, triangle, DC level, Gaussian, Lorentz, exponential rise/fall, sin(x)/x, random noise, Haversine, Cardiac

Amplitude range Values are peak-to-peak voltages

Waveform	50 Ω	1 MΩ
Arbitrary	10 mV to 2.5 V	20 mV to 5 V
Sine	10 mV to 2.5 V	20 mV to 5 V

Table continued…

Waveform	50 Ω	1 MΩ
Square	10 mV to 2.5 V	20 mV to 5 V
Pulse	10 mV to 2.5 V	20 mV to 5 V
Ramp	10 mV to 2.5 V	20 mV to 5 V
Triangle	10 mV to 2.5 V	20 mV to 5 V
Gaussian	10 mV to 1.25 V	20 mV to 2.5 V
Lorentz	10 mV to 1.2 V	20 mV to 2.4 V
Exponential Rise	10 mV to 1.25 V	20 mV to 2.5 V
Exponential Fall	10 mV to 1.25 V	20 mV to 2.5 V
Sine(x)/x	10 mV to 1.5 V	20 mV to 3.0 V
Random Noise	10 mV to 2.5 V	20 mV to 5 V
Haversine	10 mV to 1.25 V	20 mV to 2.5 V
Cardiac	10 mV to 2.5 V	20 mV to 5 V

Maximum sample rate 250 MS/s

Arbitrary function record length 128 K Samples

Sine waveform

Frequency range 0.1 Hz to 50 MHz

Frequency setting resolution 0.1 Hz

Frequency accuracy 130 ppm (frequency ≤ 10 kHz), 50 ppm (frequency > 10 kHz)

This is for Sine, Ramp, Square and Pulse waveforms only.

Amplitude range 20 mV_{pp} to 5 V_{pp} into Hi-Z; 10 mV_{pp} to 2.5 V_{pp} into 50 Ω

Amplitude flatness, typical ±0.5 dB at 1 kHz

±1.5 dB at 1 kHz for < 20 mV_{pp} amplitudes

Total harmonic distortion, typical 1% for amplitude ≥ 200 mV_{pp} into 50 Ω load

2.5% for amplitude > 50 mV AND < 200 mV_{pp} into 50 Ω load

This is for Sine wave only.

Spurious free dynamic range, typical 40 dB (V_{pp} ≥ 0.1 V); 30 dB (V_{pp} ≥ 0.02 V), 50 Ω load

Square and pulse waveform

Frequency range 0.1 Hz to 25 MHz

Frequency setting resolution 0.1 Hz

Duty cycle range 10% - 90% or 10 ns minimum pulse, whichever is larger

Minimum pulse time applies to both on and off time, so maximum duty cycle will reduce at higher frequencies to maintain 10 ns off time

Duty cycle resolution 0.1%

Minimum pulse width, typical	10 ns. This is the minimum time for either on or off duration.
Rise/Fall time, typical	5 ns, 10% - 90%
Pulse width resolution	100 ps
Overshoot, typical	< 6% for signal steps greater than 100 mV_{pp} This applies to overshoot of the positive-going transition (+overshoot) and of the negative-going (-overshoot) transition
Asymmetry, typical	±1% ±5 ns, at 50% duty cycle
Jitter, typical	< 60 ps TIE_{RMS}, ≥ 100 mV_{pp} amplitude, 40%-60% duty cycle Square and pulse waveforms, 5 GHz measurement BW.

Ramp and triangle waveform

Frequency range	0.1 Hz to 500 kHz
Frequency setting resolution	0.1 Hz
Variable symmetry	0% - 100%
Symmetry resolution	0.1%

DC level range	±2.5 V into Hi-Z ±1.25 V into 50 Ω

Gaussian pulse, Haversine, and Lorentz pulse

Maximum frequency	5 MHz

Exponential rise fall maximum frequency	5 MHz

Sin(x)/x

Maximum frequency	2 MHz

Random noise amplitude range	20 mV_{pp} to 5 V_{pp} into Hi-Z 10 mV_{pp} to 2.5 V_{pp} into 50 Ω For both isolated noise signal and additive noise signal.
✓Sine and ramp frequency accuracy	130 ppm (frequency ≤10 kHz) 50 ppm (frequency >10 kHz)
✓Square and pulse frequency accuracy	130 ppm (frequency ≤10 KHz); 50 ppm (frequency >10 KHz)
Signal amplitude resolution	1 mV (Hi-Z) 500 µV (50 Ω)
✓Signal amplitude accuracy	±[(1.5% of peak-to-peak amplitude setting) + (1.5% of absolute DC offset setting) + 1 mV] (frequency = 1 kHz)

DC offset range	±2.5 V into Hi-Z ±1.25 V into 50 Ω
DC offset resolution	1 mV (Hi-Z) 500 µV (50 Ω)
✓DC offset accuracy	±[(1.5% of absolute offset voltage setting) + 1 mV] Add 3 mV of uncertainty per 10 °C change from 25 °C ambient. Refer *DC Offset Accuracy test record*
Cardiac maximum frequency	500 kHz

Display system

Display type	Display area - 13.55 inches (344.16 mm) (H) x 7.62 inches (193.59 mm) (V), 15.55 inches (395 mm) diagonal, 6-bit RGB color, (1920 X 1080) TFT liquid crystal display (LCD) with capacitive touch
Resolution	1,920 horizontal × 1,080 vertical pixels (High Definition)
Luminance, typical	250 cd/m^2, (Minimum: 200 cd/m^2) Display luminance is specified for a new display set at full brightness.
Color support	262K (6-bit RGB) colors.

Processor system

Host processor	Intel i5-4400E, 2.7 GHz, 64-bit, dual core processor, 8 GB system RAM

Input/Output port specifications

Ethernet interface	An 8-pin RJ-45 connector that supports 10/100/1000 Mb/s
Video signal output	A 29-pin HDMI connector Recommended resolution: 1920 x 1080 @ 60 Hz. Note that video out may not be hot pluggable. HDMI cable may need to be attached before power up for dual display functions to work depending upon the instrument firmware revision
DVI connector	A 29-pin DVI-I connector; connect to show the oscilloscope display on an external monitor or projector Maximum supported resolution, Windows: 1920 x 1200 @ 60 Hz Maximum supported resolution, Linux: 1920 x 1080 @ 60 Hz Only a single TMDS link is provided Analog VGA signaling is not provided
DisplayPort connector	A 20-pin DisplayPort connector; connect to show the oscilloscope display on an external monitor or projector Maximum supported resolution, Windows: 2560 x 1440 @ 60Hz

	Maximum supported resolution, Linux: 1920 x 1080 @ 60 Hz DP++ adapter: Maximum supported resolution: 2560 x1440 @ 60 Hz
Simultaneous displays	Up to 3 displays (including the internal display) with a maximum of 1 display per port.
USB interface (Host, Device ports)	Front panel USB Host ports: Two USB 2.0 Hi-Speed ports, one USB 3.0 SuperSpeed port All instruments, Rear panel USB Host ports: Two USB 2.0 Hi-Speed ports, two USB 3.0 SuperSpeed ports All instruments, Rear panel USB Device port: One USB 3.0 SuperSpeed Device port providing USBTMC support

Probe compensator signal output voltage and frequency, typical

Characteristic	Value
Output Voltage	Default: 0-2.5 V amplitude
Impedance	1 kΩ
Frequency	1 kHz

Auxiliary output, AUX OUT, Trigger Out, Event, or Reference Clock Out

Selectable output	Acquisition Trigger Out Reference Clock Out AFG Trigger Out
Acquisition Trigger Out	User selectable transition from HIGH to LOW, or LOW to HIGH, indicates the trigger occurred. The signal returns to its previous state after approximately 100 ns
Acquisition trigger jitter	< 50ps standard deviation
Reference Clock Out	Reference clock output tracks the acquisition system and can be referenced from either the internal clock reference or the external clock reference
AFG Trigger Out	The output frequency is dependent on the frequency of the AFG signal as shown in the following table:

AFG signal frequency	AFT trigger frequency
≤ 4.9 MHz	Signal frequency
> 4.9 MHz to 14.7 MHz	Signal frequency / 3
> 14.7 MHz to 24.5 MHz	Signal frequency / 5
> 24.5 MHz to 34.3 MHz	Signal frequency / 7
> 34.3 MHz to 44.1 MHz	Signal frequency / 9
> 44.1 MHz to 50 MHz	Signal frequency / 11

AUX OUT Output Voltage

Characteristic	Limits
Vout (HI)	≥ 2.5 V open circuit; ≥ 1.0 V into a 50 Ω load to ground
Vout (LO)	≤ 0.7 V into a load of ≤ 4 mA; ≤0.25 V into a 50 Ω load to ground

External reference input

Nominal input frequency	10 MHz
Frequency Variation Tolerance	9.99999 MHz to 10.00001 MHz ($\pm 1.0 \times 10^{-6}$)
Sensitivity, typical	V_{in} 1.5 $V_{p\text{-}p}$ using a 50 Ω termination
Maximum input signal	7 V_{pp}
Impedance	745 Ohms ±20% in parallel with 18.5 pf ±20%

AUX trigger input

Interface:	SMA
Input Impedance:	50 Ω
Maximum Input Voltage:	5 V_{RMS}
Sensitivity:	Edge-type trigger sensitivity, DC-coupled

Data storage specifications

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

Nonvolatile memory capacity

Instrument S/N	A 2 kbit EEPROM on the main board that stores the instrument serial number, instrument start up count, total uptime and administration passwords.
Companion CvP	A pair of 16 Mbit flash memory devices that stores a portion of the Companion FPGA image data. One device serves as a backup for the other device.
AFG S/N	A 2 kbit EEPROM on the AFG riser card that stores a copy of the instrument serial number which is used to validate the AFG calibration.
Front Panel ID	A 64 kbit EEPROM on the LED board that stores the USB vendor ID and device ID for the internal front panel controller.
BIOS	A 128 Mbit flash memory device that stores the firmware image and device configuration for the host processor and chipset sub-processors. This includes the Basic Input Output System (BIOS), Management Engine (ME), Embedded Controller (EC) and Network Interface Controller (NIC). The Ethernet MAC address is stored in this device.
CMOS Memory	The host processor chipset includes an integrated memory device, powered by the real-time clock (RTC) battery, which stores BIOS configuration settings. A customer accessible switch disconnects the RTC battery from the chipset which clears the contents of the integrated CMOS memory device.
Memory SPD	Each SODIMM (memory module) contains a serial presence detect (SPD) memory device implemented using an unspecified memory technology. Each SPD device contains the parameter data specific to its memory module. All SPD devices are treated by the instrument as read only. The size of a given SPD is unspecified. The 4 channel instrument includes 4 SPD devices.
UCD9248	The instrument includes 3 UCD9248 power supply controllers. Each controller contains an *unspecified* quantity of nonvolatile memory that stores various power supply configuration settings.
PMU	A power management unit (PMU) microcontroller is used to manage instrument power supplies and hardware initialization. The PMU includes 32 KB of nonvolatile memory for storage of its own binary executable and redundant storage of UCD9248 device settings.

Analog Board Controller	A microcontroller is used to manage analog board operation. The PMU includes 64 KB of nonvolatile memory for storage of its own binary executable.
Carrier FPGA	The carrier FPGA stores its own configuration in its own internal 0.33 Mbit nonvolatile memory. The carrier FPGA implements simple "glue logic" for the instrument.

Mass storage device capacity

Linux	≥80 GB. Form factor is an 80 mm m.2 card with a SATA-3 interface. Waveforms and setups are stored on a hard disk drive or solid state drive. Provides storage for saved customer data, all calibration constants and the Linux operating system. Not customer serviceable. A ~42 GB partition on the device is available for the storage of saved customer data.
Windows (optional):	≥ 480 GB. Form factor is a 2.5-inch SSD with a SATA-3 interface. This drive is customer installable and provides storage for the Windows operating system option, and saved customer data. Not available for MSO58LP.

Power supply system

Power

Power consumption	400 Watts maximum
Source voltage	100 - 240 V ±10% (50 Hz to 60 Hz)
Source frequency	50 Hz to 60 Hz ±10%, at 100 - 240 V ±10% 400 Hz at 115 V ±10%
Fuse Rating	12.5 A, 250 V_{ac}

Safety characteristics

Safety certification	US NRTL Listed - UL61010-1 and UL61010-2-030 Canadian Certification - CAN/CSA-C22.2 No. 61010.1 and CAN/CSA-C22.2 No 61010.2.030 EU Compliance - Low Voltage Directive 2014-35-EU and EN61010-1. International Compliance - IEC 61010-1 and IEC61010-2-030
Pollution degree	Pollution degree 2, indoor, dry location use only

Environmental specifications

Temperature

Operating	+0 °C to +50 °C (32 °F to 122 °F)
Non-operating	-20 °C to +60 °C (-4 °F to 140 °F)

Humidity

Operating	5% to 90% relative humidity (% RH) at up to +40 °C 5% to 55% RH above +40 °C up to +50 °C, noncondensing
Non-operating	5% to 90% relative humidity (% RH) at up to +60 °C, noncondensing

Altitude

Operating	Up to 3,000 meters (9,843 feet)
Non-operating	Up to 12,000 meters (39,370 feet)

Mechanical specifications

Weight	MSO64: 28.4 lbs (12.88 kg)
Dimensions, 6 Series MSO	Height: 12.2 in (309 mm), feet folded in, handle to back Height: 14.6 in (371 mm) feet folded in, handle up Width: 17.9 in (454 mm) from handle hub to handle hub Depth: 8.0 in (205 mm) from back of feet to front of knobs, handle up Depth: 11.7 in (297.2 mm) feet folded in, handle to the back
Cooling	The clearance requirement for adequate cooling is 2.0 in (50.8 mm) on the right side of the instrument (when viewed from the front) and on the rear of the instrument

Performance verification procedures

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.

Required equipment

Required equipment	Minimum requirements	Examples
DC voltage source	3 mV to 4 V, ±0.1% accuracy	Fluke 9500B Oscilloscope Calibrator with a 9530 Output Module
Leveled sine wave generator	50 kHz to 8 GHz, ±4% amplitude accuracy	
Time mark generator	80 ms period, ±1.0 x 10^{-6} accuracy, rise time <50 ns	
Logic probe	Low capacitance digital probe, 8 channels.	TLP058 probe
BNC-to-0.1 inch pin adapter to connect the logic probe to the signal source.	BNC-to-0.1 inch pin adapter; female BNC to 2x16 .01 inch pin headers.	Tektronix adapter part number 878-1429-00; to connect the Fluke 9500B to the TLP058 probe.
Digital multimeter (DMM)	0.1% accuracy or better	Tektronix DMM4020
One 50 Ω terminator	Impedance 50 Ω; connectors: female BNC input, male BNC output	Tektronix part number 011-0049-02
One 50 Ω BNC cable	Male-to-male connectors	Tektronix part number 012-0057-01
Optical mouse	USB, PS2	Tektronix part number 119-7054-00
RF vector signal generator	Maximum bandwidth of instrument	Tektronix TSG4100A
Frequency counter	parts per billion accuracy	Tektronix FCA3000 Timer/Counter/Analyzer

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

These procedures cover all MSO64 models. Disregard 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 return the instrument to Tektronix for adjustment or repair.

Test records

Instrument information, self test record

Model	**Serial #**	**Procedure performed by**	**Date**

Test	**Passed**	**Failed**
Self Test		

Input impedance test record

Input Impedance				
Performance checks	Vertical scale	Low limit	Test result	High limit
All models				
Channel 1 Input Impedance, 1 MΩ	100 mV/div	990 kΩ		1.01 MΩ
Channel 1 Input Impedance, 50 Ω	10 mV/div	48.5 Ω		51.5 Ω
	100 mV/div	48.5 Ω		51.5 Ω
Channel 2 Input Impedance, 1 MΩ	100 mV/div	990 kΩ		1.01 MΩ
Channel 2 Input Impedance, 50 Ω	10 mV/div	48.5 Ω		51.5 Ω
	100 mV/div	48.5 Ω		51.5 Ω
Channel 3 Input Impedance, 1 MΩ	100 mV/div	990 kΩ		1.01 MΩ
Channel 3 Input Impedance, 50 Ω	10 mV/div	48.5 Ω		51.5 Ω
	100 mV/div	48.5 Ω		51.5 Ω
Channel 4 Input Impedance, 1 MΩ	100 mV/div	990 kΩ		1.01 MΩ
Channel 4, Input Impedance, 50 Ω	10 mV/div	48.5 Ω		51.5 Ω
	100 mV/div	48.5 Ω		51.5 Ω

DC Balance test record

DC Balance				
Performance checks	**Vertical scale**	**Low limit**	**Test result**	**High limit**
All models				
Channel 1 DC Balance, 50 Ω, 20 MHz BW	1 mV/div	-0.2 mV		0.2 mV
	2 mV/div	-0.2 mV		0.2 mV
	5 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-1 mV		1 mV
	20 mV/div	-2 mV		2 mV
	49.8 mV/div	-4.98 mV		4.98 mV
	50 mV/div	-5 mV		5 mV
	100 mV/div	-10 mV		10 mV
	200 mV/div	-20 mV		20 mV
	500 mV/div	-50 mV		50 mV
	1 V/div	-100 mV		100 mV
Channel 1 DC Balance, 1 MΩ, 20 MHz BW	1 mV/div	-0.2 mV		0.2 mV
	2 mV/div	-0.4 mV		0.4 mV
	5 mV/div	-1 mV		1 mV
	10 mV/div	-2 mV		2 mV
	20 mV/div	-4 mV		4 mV
	100 mV/div	-20 mV		20 mV
	500 mV/div	-100 mV		100 mV
	1 V/div	-200 mV		200 mV
	10 V/div	-2 V		2 V
Channel 1 DC Balance, 50 Ω, 250 MHz BW	20 mV/div	-2 mV		2 mV
Channel 1 DC Balance, 1 MΩ, 250 MHz BW	20 mV/div	-4 mV		4 mV
Channel 1 DC Balance, 50 Ω, Full BW	20 mV/div	-2 mV		2 mV
Channel 1 DC Balance, 1 MΩ, Full BW	20 mV/div	-4 mV		4 mV
Channel 2 DC Balance, 50 Ω, 20 MHz BW	1 mV/div	-0.2 mV		0.2 mV
	2 mV/div	-0.2 mV		0.2 mV
	5 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-1 mV		1 mV
	20 mV/div	-2 mV		2 mV
	49.8 mV/div	-4.98 mV		4.98 mV
	50 mV/div	-5 mV		5 mV

Table continued…

DC Balance				
Performance checks	**Vertical scale**	**Low limit**	**Test result**	**High limit**
	100 mV/div	-10 mV		10 mV
	200 mV/div	-20 mV		20 mV
	500 mV/div	-50 mV		50 mV
	1 V/div	-100 mV		100 mV
Channel 2 DC Balance, 1 MΩ, 20 MHz BW	1 mV/div	-0.2 mV		0.2 mV
	2 mV/div	-0.4 mV		0.4 mV
	5 mV/div	-1 mV		1 mV
	10 mV/div	-2 mV		2 mV
	20 mV/div	-4 mV		4 mV
	100 mV/div	-20 mV		20 mV
	500 mV/div	-100 mV		100 mV
	1 V/div	-200 mV		200 mV
	10 V/div	-2 V		2 V
Channel 2 DC Balance, 50 Ω, 250 MHz BW	20 mV/div	-2 mV		2 mV
Channel 2 DC Balance, 1 MΩ, 250 MHz BW	20 mV/div	-4 mV		4 mV
Channel 2 DC Balance, 50 Ω, Full BW	20 mV/div	-2 mV		2 mV
Channel 2 DC Balance, 1 MΩ, Full BW	20 mV/div	-4 mV		4 mV
Channel 3 DC Balance, 50 Ω, 20 MHz BW	1 mV/div	-0.2 mV		0.2 mV
	2 mV/div	-0.2 mV		0.2 mV
	5 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-1 mV		1 mV
	20 mV/div	-2 mV		2 mV
	49.8 mV/div	-4.98 mV		4.98 mV
	50 mV/div	-5 mV		5 mV
	100 mV/div	-10 mV		10 mV
	200 mV/div	-20 mV		20 mV
	500 mV/div	-50 mV		50 mV
	1 V/div	-100 mV		100 mV
Channel 3 DC Balance, 1 MΩ, 20 MHz BW	1 mV/div	-0.2 mV		0.2 mV
	2 mV/div	-0.4 mV		0.4 mV
	5 mV/div	-1 mV		1 mV
	10 mV/div	-2 mV		2 mV
	20 mV/div	-4 mV		4 mV

Table continued…

DC Balance				
Performance checks	**Vertical scale**	**Low limit**	**Test result**	**High limit**
	100 mV/div	-20 mV		20 mV
	500 mV/div	-100 mV		100 mV
	1 V/div	-200 mV		200 mV
	10 V/div	-2 V		2 V
Channel 3 DC Balance, 50 Ω, 250 MHz BW	20 mV/div	-2 mV		2 mV
Channel 3 DC Balance, 1 MΩ, 250 MHz BW	20 mV/div	-4 mV		4 mV
Channel 3 DC Balance, 50 Ω, Full BW	20 mV/div	-2 mV		2 mV
Channel 3 DC Balance, 1 MΩ, Full BW	20 mV/div	-4 mV		4 mV
Channel 4 DC Balance, 50 Ω, 20 MHz BW	1 mV/div	-0.2 mV		0.2 mV
	2 mV/div	-0.2 mV		0.2 mV
	5 mV/div	-0.5 mV		0.5 mV
	10 mV/div	-1 mV		1 mV
	20 mV/div	-2 mV		2 mV
	49.8 mV/div	-4.98 mV		4.98 mV
	50 mV/div	-5 mV		5 mV
	100 mV/div	-10 mV		10 mV
	200 mV/div	-20 mV		20 mV
	500 mV/div	-50 mV		50 mV
	1 V/div	-100 mV		100 mV
Channel 4 DC Balance, 1 MΩ, 20 MHz BW	1 mV/div	-0.2 mV		0.2 mV
	2 mV/div	-0.4 mV		0.4 mV
	5 mV/div	-1 mV		1 mV
	10 mV/div	-2 mV		2 mV
	20 mV/div	-4 mV		4 mV
	100 mV/div	-20 mV		20 mV
	500 mV/div	-100 mV		100 mV
	1 V/div	-200 mV		200 mV
	10 V/div	-2 V		2 V
Channel 4 DC Balance, 50 Ω, 250 MHz BW	20 mV/div	-2 mV		2 mV
Channel 4 DC Balance, 1 MΩ, 250 MHz BW	20 mV/div	-4 mV		4 mV
Channel 4 DC Balance, 50 Ω, Full BW	20 mV/div	-2 mV		2 mV

Table continued…

DC Balance				
Performance checks	**Vertical scale**	**Low limit**	**Test result**	**High limit**
Channel 4 DC Balance, 1 MΩ, Full BW	20 mV/div	-4 mV		4 mV

DC Gain Accuracy test record

DC Gain Accuracy					
Performance checks	Bandwidth	Vertical scale	Low limit	Test result	High limit
Channel 1 DC Gain Accuracy, 0 V offset, 0 V vertical position, 50 Ω	20 MHz	1 mV/div	-4%		4%
		2 mV/div	-2%		2%
		5 mV/div	-2%		2%
		10 mV/div	-2%		2%
		20 mV/div	-2%		2%
		50 mV/div	-2%		2%
		100 mV/div	-2%		2%
		200 mV/div	-2%		2%
		500 mV/div	-2%		2%
		1 V/div	-2%		2%
	250 MHz	20 mV/div	-2%		2%
	FULL	20 mV/div	-2%		2%

Table continued…

DC Gain Accuracy					
Performance checks	Bandwidth	Vertical scale	Low limit	Test result	High limit
Channel 1 DC Gain Accuracy, 0 V offset, 0 V vertical position, 1 MΩ	20 MHz	1 mV/div	-2.5%		2.5%
		2 mV/div	-2%		2%
		5 mV/div	-2%		2%
		10 mV/div	-2%		2%
		20 mV/div	-2%		2%
		50 mV/div	-2%		2%
		100 mV/div	-2%		2%
		200 mV/div	-2%		2%
		500 mV/div	-2%		2%
		1 V/div	-2%		2%
	250 MHz	20 mV/div	-2%		2%
	FULL	20 mV/div	-2%		2%

Table continued…

DC Gain Accuracy					
Performance checks	Bandwidth	Vertical scale	Low limit	Test result	High limit
Channel 2 DC Gain Accuracy, 0 V offset, 0 V vertical position, 50 Ω	20 MHz	1 mV/div	-4%		4%
		2 mV/div	-2%		2%
		5 mV/div	-2%		2%
		10 mV/div	-2%		2%
		20 mV/div	-2%		2%
		50 mV/div	-2%		2%
		100 mV/div	-2%		2%
		200 mV/div	-2%		2%
		500 mV/div	-2%		2%
		1 V/div	-2%		2%
	250 MHz	20 mV/div	-2%		2%
	FULL	20 mV/div	-2%		2%

Table continued…

DC Gain Accuracy					
Performance checks	Bandwidth	Vertical scale	Low limit	Test result	High limit
Channel 2 DC Gain Accuracy, 0 V offset, 0 V vertical position, 1 MΩ	20 MHz	1 mV/div	-2.5%		2.5%
		2 mV/div	-2%		2%
		5 mV/div	-2%		2%
		10 mV/div	-2%		2%
		20 mV/div	-2%		2%
		50 mV/div	-2%		2%
		100 mV/div	-2%		2%
		200 mV/div	-2%		2%
		500 mV/div	-2%		2%
		1 V/div	-2%		2%
	250 MHz	20 mV/div	-2%		2%
	FULL	20 mV/div	-2%		2%

Table continued…

DC Gain Accuracy					
Performance checks	Bandwidth	Vertical scale	Low limit	Test result	High limit
Channel 3 DC Gain Accuracy, 0 V offset, 0 V vertical position, 50 Ω	20 MHz	1 mV/div	-4%		4%
		2 mV/div	-2%		2%
		5 mV/div	-2%		2%
		10 mV/div	-2%		2%
		20 mV/div	-2%		2%
		50 mV/div	-2%		2%
		100 mV/div	-2%		2%
		200 mV/div	-2%		2%
		500 mV/div	-2%		2%
		1 V/div	-2%		2%
	250 MHz	20 mV/div	-2%		2%
	FULL	20 mV/div	-2%		2%

Table continued…

DC Gain Accuracy					
Performance checks	Bandwidth	Vertical scale	Low limit	Test result	High limit
Channel 3 DC Gain Accuracy, 0 V offset, 0 V vertical position, 1 MΩ	20 MHz	1 mV/div	-2.5%		2.5%
		2 mV/div	-2%		2%
		5 mV/div	-2%		2%
		10 mV/div	-2%		2%
		20 mV/div	-2%		2%
		50 mV/div	-2%		2%
		100 mV/div	-2%		2%
		200 mV/div	-2%		2%
		500 mV/div	-2%		2%
		1 V/div	-2%		2%
	250 MHz	20 mV/div	-2%		2%
	FULL	20 mV/div	-2%		2%

Table continued…

DC Gain Accuracy					
Performance checks	Bandwidth	Vertical scale	Low limit	Test result	High limit
Channel 4 DC Gain Accuracy, 0 V offset, 0 V vertical position, 50 Ω	20 MHz	1 mV/div	-4%		4%
		2 mV/div	-2%		2%
		5 mV/div	-2%		2%
		10 mV/div	-2%		2%
		20 mV/div	-2%		2%
		50 mV/div	-2%		2%
		100 mV/div	-2%		2%
		200 mV/div	-2%		2%
		500 mV/div	-2%		2%
		1 V/div	-2%		2%
	250 MHz	20 mV/div	-2%		2%
	FULL	20 mV/div	-2%		2%
Channel 4 DC Gain Accuracy, 0 V offset, 0 V vertical position, 1 MΩ	20 MHz	1 mV/div	-2.5%		2.5%
		2 mV/div	-2%		2%
		5 mV/div	-2%		2%
		10 mV/div	-2%		2%
		20 mV/div	-2%		2%
		50 mV/div	-2%		2%
		100 mV/div	-2%		2%
		200 mV/div	-2%		2%
		500 mV/div	-2%		2%
		1 V/div	-2%		2%
	250 MHz	20 mV/div	-2%		2%
	FULL	20 mV/div	-2%		2%

DC Offset Accuracy test record

Offset Accuracy					
Performance checks	Vertical scale	Vertical offset [8]	Low limit	Test result	High limit
All models					
Channel 1 DC Offset Accuracy, 20 MHz BW, 50 Ω	1 mV/div	900 mV	895.3 mV		904.7 mV
	1 mV/div	-900 mV	-904.7 mV		-895.3 mV
	100 mV/div	5.0 V	4.965 V		5.035 V
	100 mV/div	-5.0 V	-5.035 V		-4.965 V
Channel 1 DC Offset Accuracy, 20 MHz BW, 1 MΩ	1 mV/div	900 mV	895.3 mV		904.7 mV
	1 mV/div	-900 mV	-904.7 mV		-895.3 mV
	100 mV/div	1.0 V	0.975 V		1.025 V
	100 mV/div	- 1.0 V	-1.025 V		-0.975 V
	500 mV/div	9.0 V	8.855 V		9.145 V
	500 mV/div	- 9.0 V	-9.145 V		-8.855 V
	1.01 V/div	10.0 V	9.75 V		10.25 V
	1.01 V/div	-10.0 V	-10.25 V		-9.75 V
	5 V/div	10.0 V	8.95 V		11.05 V
	5 V/div	-10.0 V	-11.05 V		-8.95 V
Channel 2 DC Offset Accuracy, 20 MHz BW, 50 Ω	1 mV/div	900 mV	895.3 mV		904.7 mV
	1 mV/div	-900 mV	-904.7 mV		-895.3 mV
	100 mV/div	5.0 V	4.965 V		5.035 V
	100 mV/div	-5.0 V	-5.035 V		-4.965 V
Channel 2 DC Offset Accuracy, 20 MHz BW, 1 MΩ	1 mV/div	900 mV	895.3 mV		904.7 mV
	1 mV/div	-900 mV	-904.7 mV		-895.3 mV
	100 mV/div	1.0 V	0.935 V		1.065 V
	100 mV/div	- 1.0 V	-1.065 V		-0.935 V
	500 mV/div	9.0 V	8.855 V		9.145 V
	500 mV/div	- 9.0 V	-9.145 V		-8.855 V
	1.01 V/div	10.0 V	9.3 V		10.7 V
	1.01 V/div	-10.0 V	-10.7 V		-9.3 V
	5 V/div	10.0 V	8.5 V		11.5 V
	5 V/div	-10.0 V	-11.5 V		-8.5 V
Channel 3 DC Offset Accuracy, 20 MHz BW, 50 Ω	1 mV/div	900 mV	895.3 mV		904.7 mV
	1 mV/div	-900 mV	-904.7 mV		-895.3 mV
	100 mV/div	5.0 V	4.965 V		5.035 V
	100 mV/div	-5.0 V	-5.035 V		-4.965 V

Table continued…

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

Offset Accuracy					
Performance checks	Vertical scale	Vertical offset [8]	Low limit	Test result	High limit
Channel 3 DC Offset Accuracy, 20 MHz BW, 1 MΩ	1 mV/div	900 mV	895.3 mV		904.7 mV
	1 mV/div	-900 mV	-904.7 mV		-895.3 mV
	100 mV/div	1.0 V	0.935 V		1.065 V
	100 mV/div	- 1.0 V	-1.065 V		-0.935 V
	500 mV/div	9.0 V	8.855 V		9.145 V
	500 mV/div	- 9.0 V	-9.145 V		-8.855 V
	1.01 V/div	10.0 V	9.3 V		10.7 V
	1.01 V/div	-10.0 V	-10.7 V		-9.3 V
	5 V/div	10.0 V	8.5 V		11.5 V
	5 V/div	-10.0 V	-11.5 V		-8.5 V
Channel 4 DC Offset Accuracy, 20 MHz BW, 50 Ω	1 mV/div	900 mV	895.3 mV		904.7 mV
	1 mV/div	-900 mV	-904.7 mV		-895.3 mV
	100 mV/div	5.0 V	4.965 V		5.035 V
	100 mV/div	-5.0 V	-5.035 V		-4.965 V
Channel 4 DC Offset Accuracy, 20 MHz BW, 1 MΩ	1 mV/div	900 mV	895.3 mV		904.7 mV
	1 mV/div	-900 mV	-904.7 mV		-895.3 mV
	100 mV/div	1.0 V	0.935 V		1.065 V
	100 mV/div	- 1.0 V	-1.065 V		-0.935 V
	500 mV/div	9.0 V	8.855 V		9.145 V
	500 mV/div	- 9.0 V	-9.145 V		-8.855 V
	1.01 V/div	10.0 V	9.3 V		10.7 V
	1.01 V/div	-10.0 V	-10.7 V		-9.3 V
	5 V/div	10.0 V	8.5 V		11.5 V
	5 V/div	-10.0 V	-11.5 V		-8.5 V

Analog Bandwidth test record

Analog Bandwidth							
Performance checks							
Bandwidth at Channel	Impedance	Vertical scale	Horizontal scale	V_{in-pp}	V_{bw-pp}	Limit	Test result Gain = V_{bw-pp}/V_{in-pp}
All models							

Table continued…

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

Analog Bandwidth							
Performance checks							
Bandwidth at Channel	Impedance	Vertical scale	Horizontal scale	V_{in-pp}	V_{bw-pp}	Limit	Test result Gain = V_{bw-pp}/V_{in-pp}
Channel 1	50 Ω	1 mV/div	1 ns/div			≥ 0.707	
		2 mV/div	1 ns/div			≥ 0.707	
		4 mV/div	1 ns/div			≥ 0.707	
		10 mV/div	1 ns/div			≥ 0.707	
		25 mV/div	1 ns/div			≥ 0.707	
		50 mV/div	1 ns/div			≥ 0.707	
		100 mV/div	1 ns/div			≥ 0.707	
Channel 1	1 MΩ, typical	1 mV/div	1 ns/div			≥ 0.707	
		2 mV/div	1 ns/div			≥ 0.707	
		4 mV/div	1 ns/div			≥ 0.707	
		10 mV/div	1 ns/div			≥ 0.707	
		25 mV/div	1 ns/div			≥ 0.707	
		50 mV/div	1 ns/div			≥ 0.707	
		100 mV/div	1 ns/div			≥ 0.707	
Channel 2	50 Ω	1 mV/div	1 ns/div			≥ 0.707	
		2 mV/div	1 ns/div			≥ 0.707	
		4 mV/div	1 ns/div			≥ 0.707	
		10 mV/div	1 ns/div			≥ 0.707	
		25 mV/div	1 ns/div			≥ 0.707	
		50 mV/div	1 ns/div			≥ 0.707	
		100 mV/div	1 ns/div			≥ 0.707	
Channel 2	1 MΩ, typical	1 mV/div	1 ns/div			≥ 0.707	

Table continued…

Analog Bandwidth							
Performance checks							
Bandwidth at Channel	Impedance	Vertical scale	Horizontal scale	V_{in-pp}	V_{bw-pp}	Limit	Test result Gain = V_{bw-pp}/V_{in-pp}
		2 mV/div	1 ns/div			≥ 0.707	
		4 mV/div	1 ns/div			≥ 0.707	
		10 mV/div	1 ns/div			≥ 0.707	
		25 mV/div	1 ns/div			≥ 0.707	
		50 mV/div	1 ns/div			≥ 0.707	
		100 mV/div	1 ns/div			≥ 0.707	
Channel 3	50 Ω	1 mV/div	1 ns/div			≥ 0.707	
		2 mV/div	1 ns/div			≥ 0.707	
		4 mV/div	1 ns/div			≥ 0.707	
		10 mV/div	1 ns/div			≥ 0.707	
		25 mV/div	1 ns/div			≥ 0.707	
		50 mV/div	1 ns/div			≥ 0.707	
		100 mV/div	1 ns/div			≥ 0.707	
Channel 3	1 MΩ, typical	1 mV/div	1 ns/div			≥ 0.707	
		2 mV/div	1 ns/div			≥ 0.707	
		4 mV/div	1 ns/div			≥ 0.707	
		10 mV/div	1 ns/div			≥ 0.707	
		25 mV/div	1 ns/div			≥ 0.707	
		50 mV/div	1 ns/div			≥ 0.707	
		100 mV/div	1 ns/div			≥ 0.707	
Channel 4	50 Ω	1 mV/div	1 ns/div			≥ 0.707	
		2 mV/div	1 ns/div			≥ 0.707	

Table continued…

Analog Bandwidth							
Performance checks							
Bandwidth at Channel	Impedance	Vertical scale	Horizontal scale	V_{in-pp}	V_{bw-pp}	Limit	Test result Gain = V_{bw-pp}/V_{in-pp}
		4 mV/div	1 ns/div			≥ 0.707	
		10 mV/div	1 ns/div			≥ 0.707	
		25 mV/div	1 ns/div			≥ 0.707	
		50 mV/div	1 ns/div			≥ 0.707	
		100 mV/div	1 ns/div			≥ 0.707	
Channel 4	1 MΩ, typical	1 mV/div	1 ns/div			≥ 0.707	
		2 mV/div	1 ns/div			≥ 0.707	
		4 mV/div	1 ns/div			≥ 0.707	
		10 mV/div	1 ns/div			≥ 0.707	
		25 mV/div	1 ns/div			≥ 0.707	
		50 mV/div	1 ns/div			≥ 0.707	
		100 mV/div	1 ns/div			≥ 0.707	

Random Noise, sample acquisition mode test record

Random Noise, sample acquisition mode: All models				
Performance checks			50 Ω	
	V/div	Bandwidth [9]	Test result (mV)	High limit (mV)
All models				
Channel 1	1 mV/div	8 GHz		0.223
		7 GHz limit		0.199
		6 GHz limit		0.179

Table continued…

9 Start with the highest bandwidth setting you can select.

Random Noise, sample acquisition mode: All models				
Performance checks			50 Ω	
	V/div	Bandwidth [9]	Test result (mV)	High limit (mV)
		5 GHz limit		0.158
	2 mV/div	8 GHz		0.224
		7 GHz limit		0.202
		6 GHz limit		0.180
		5 GHz limit		0.160
	5 mV/div	8 GHz		0.293
		7 GHz limit		0.271
		6 GHz limit		0.233
		5 GHz limit		0.210
	10 mV/div	8 GHz		0.482
		7 GHz limit		0.440
		6 GHz limit		0.388
		5 GHz limit		0.338
	20 mV/div	8 GHz		0.890
		7 GHz limit		0.793
		6 GHz limit		0.691
		5 GHz limit		0.630
	50 mV/div	8 GHz		2.10
		7 GHz limit		1.85
		6 GHz limit		1.67
		5 GHz limit		1.49

Table continued…

9 Start with the highest bandwidth setting you can select.

Random Noise, sample acquisition mode: All models				
Performance checks			50 Ω	
	V/div	Bandwidth [9]	Test result (mV)	High limit (mV)
	100 mV/div	8 GHz		4.88
		7 GHz limit		4.4
		6 GHz limit		3.83
		5 GHz limit		3.42
	1 V/div	8 GHz		42.0
		7 GHz limit		37.0
		6 GHz limit		33.4
		5 GHz limit		29.7
Channel 2	1 mV/div	8 GHz		0.223
		7 GHz limit		0.199
		6 GHz limit		0.179
		5 GHz limit		0.158
	2 mV/div	8 GHz		0.224
		7 GHz limit		0.202
		6 GHz limit		0.180
		5 GHz limit		0.160
	5 mV/div	8 GHz		0.293
		7 GHz limit		0.271
		6 GHz limit		0.233
		5 GHz limit		0.210
	10 mV/div	8 GHz		0.482

Table continued…

9 Start with the highest bandwidth setting you can select.

Random Noise, sample acquisition mode: All models				
Performance checks			50 Ω	
	V/div	Bandwidth [9]	Test result (mV)	High limit (mV)
		7 GHz limit		0.440
		6 GHz limit		0.388
		5 GHz limit		0.338
	20 mV/div	8 GHz		0.890
		7 GHz limit		0.793
		6 GHz limit		0.691
		5 GHz limit		0.630
	50 mV/div	8 GHz		2.10
		7 GHz limit		1.85
		6 GHz limit		1.67
		5 GHz limit		1.49
	100 mV/div	8 GHz		4.88
		7 GHz limit		4.4
		6 GHz limit		3.83
		5 GHz limit		3.42
	1 V/div	8 GHz		42.0
		7 GHz limit		37.0
		6 GHz limit		33.4
		5 GHz limit		29.7
Channel 3	1 mV/div	8 GHz		0.223
		7 GHz limit		0.199

Table continued…

9 Start with the highest bandwidth setting you can select.

Random Noise, sample acquisition mode: All models				
Performance checks			50 Ω	
	V/div	Bandwidth [9]	Test result (mV)	High limit (mV)
		6 GHz limit		0.179
		5 GHz limit		0.158
	2 mV/div	8 GHz		0.224
		7 GHz limit		0.202
		6 GHz limit		0.180
		5 GHz limit		0.160
	5 mV/div	8 GHz		0.293
		7 GHz limit		0.271
		6 GHz limit		0.233
		5 GHz limit		0.210
	10 mV/div	8 GHz		0.482
		7 GHz limit		0.440
		6 GHz limit		0.388
		5 GHz limit		0.338
	20 mV/div	8 GHz		0.890
		7 GHz limit		0.793
		6 GHz limit		0.691
		5 GHz limit		0.630
	50 mV/div	8 GHz		2.10
		7 GHz limit		1.85
		6 GHz limit		1.67

Table continued…

9 Start with the highest bandwidth setting you can select.

Random Noise, sample acquisition mode: All models				
Performance checks			50 Ω	
	V/div	Bandwidth [9]	Test result (mV)	High limit (mV)
		5 GHz limit		1.49
	100 mV/div	8 GHz		4.88
		7 GHz limit		4.4
		6 GHz limit		3.83
		5 GHz limit		3.42
	1 V/div	8 GHz		42.0
		7 GHz limit		37.0
		6 GHz limit		33.4
		5 GHz limit		29.7
Channel 4	1 mV/div	8 GHz		0.223
		7 GHz limit		0.199
		6 GHz limit		0.179
		5 GHz limit		0.158
	2 mV/div	8 GHz		0.224
		7 GHz limit		0.202
		6 GHz limit		0.180
		5 GHz limit		0.160
	5 mV/div	8 GHz		0.293
		7 GHz limit		0.271
		6 GHz limit		0.233
		5 GHz limit		0.210

Table continued…

9 Start with the highest bandwidth setting you can select.

Random Noise, sample acquisition mode: All models				
Performance checks			50 Ω	
	V/div	Bandwidth [9]	Test result (mV)	High limit (mV)
	10 mV/div	8 GHz		0.482
		7 GHz limit		0.440
		6 GHz limit		0.388
		5 GHz limit		0.338
	20 mV/div	8 GHz		0.890
		7 GHz limit		0.793
		6 GHz limit		0.691
		5 GHz limit		0.630
	50 mV/div	8 GHz		2.10
		7 GHz limit		1.85
		6 GHz limit		1.67
		5 GHz limit		1.49
	100 mV/div	8 GHz		4.88
		7 GHz limit		4.4
		6 GHz limit		3.83
		5 GHz limit		3.42
	1 V/div	8 GHz		42.0
		7 GHz limit		37.0
		6 GHz limit		33.4
		5 GHz limit		29.7

9 Start with the highest bandwidth setting you can select.

Random Noise, High Res mode test record

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [10]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
All models (MSO64)						
Channel 1	1 mV/div	4 GHz	-	-		0.138
		3 GHz limit	-	-		0.117
		2.5 GHz limit	-	-		0.108
		2 GHz limit	-	-		0.0963
		1 GHz limit	-	-		0.0773
		500 MHz limit		0.262		0.056
		350 MHz limit		0.190		0.0477
		250 M GHz limit		0.153		0.0461
		200 MHz limit		0.149		0.0379
		20 MHz limit		0.103		0.013
	2 mV/div	4 GHz	-	-		0.139
		3 GHz limit	-	-		0.119
		2.5 GHz limit	-	-		0.110
		2 GHz limit	-	-		0.0976
		1 GHz limit	-	-		0.0724
		500 MHz limit		0.285		0.562
		350 MHz limit		0.195		0.0473
		250 M GHz limit		0.155		0.0467
		200 MHz limit		0.153		0.038
		20 MHz limit		0.103		0.0133

Table continued…

10 Full = the highest bandwidth setting you can select.

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [10]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
	5 mV/div	4 GHz	-	-		0.175
		3 GHz limit	-	-		0.149
		2.5 GHz limit	-	-		0.133
		2 GHz limit	-	-		0.118
		1 GHz limit	-	-		0.0896
		500 MHz limit		0.297		0.068
		350 MHz limit		0.205		0.0565
		250 M GHz limit		0.161		0.054
		200 MHz limit		0.154		0.0444
		20 MHz limit		0.110		0.0156

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [11]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
All models (MSO64)						
Channel 1	10 mV/div	4 GHz	-	-		0.271
		3 GHz limit	-	-		0.226
		2.5 GHz limit	-	-		0.203
		2 GHz limit	-	-		0.186
		1 GHz limit	-	-		0.128
		500 MHz limit		0.334		0.0919
		350 MHz limit		0.231		0.0773

Table continued…

[10] Full = the highest bandwidth setting you can select.
[11] Full = the highest bandwidth setting you can select.

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [11]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
		250 M GHz limit		0.186		0.0747
		200 MHz limit		0.165		0.0658
		20 MHz limit		0.141		0.0226
	20 mV/div	4 GHz	-	-		0.486
		3 GHz limit	-	-		0.398
		2.5 GHz limit	-	-		0.363
		2 GHz limit	-	-		0.320
		1 GHz limit	-	-		0.226
		500 MHz limit		0.407		0.162
		350 MHz limit		0.305		0.133
		250 M GHz limit		0.257		0.120
		200 MHz limit		0.211		0.106
		20 MHz limit		0.224		0.0412
	50 mV/div	4 GHz	-	-		1.15
		3 GHz limit	-	-		0.960
		2.5 GHz limit	-	-		0.856
		2 GHz limit	-	-		0.745
		1 GHz limit	-	-		0.534
		500 MHz limit		0.737		0.396
		350 MHz limit		0.553		0.307
		250 M GHz limit		0.528		0.280
		200 MHz limit		0.387		0.247

Table continued…

11 Full = the highest bandwidth setting you can select.

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [11]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
		20 MHz limit		0.510		0.105

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [12]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
All models (MSO64)						
Channel 1	100 mV/div	4 GHz	-	-		2.71
		3 GHz limit	-	-		2.28
		2.5 GHz limit	-	-		2.03
		2 GHz limit	-	-		1.81
		1 GHz limit	-	-		1.33
		500 MHz limit		1.77		0.941
		350 MHz limit		1.38		0.792
		250 M GHz limit		1.18		0.722
		200 MHz limit		0.952		0.666
		20 MHz limit		1.13		0.236
	1 V/div	4 GHz	-	-		23.1
		3 GHz limit	-	-		19.2
		2.5 GHz limit	-	-		17.1
		2 GHz limit	-	-		14.9
		1 GHz limit	-	-		10.8
		500 MHz limit		19		7.92

Table continued…

[11] Full = the highest bandwidth setting you can select.
[12] Full = the highest bandwidth setting you can select.

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [12]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
		350 MHz limit		14.9		6.14
		250 M GHz limit		13.6		5.6
		200 MHz limit		11.3		4.94
		20 MHz limit		11.7		2.11

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [13]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
All models (MSO64)						
Channel 2	1 mV/div	4 GHz	-	-		0.138
		3 GHz limit	-	-		0.117
		2.5 GHz limit	-	-		0.108
		2 GHz limit	-	-		0.0963
		1 GHz limit	-	-		0.0773
		500 MHz limit		0.262		0.056
		350 MHz limit		0.190		0.0477
		250 M GHz limit		0.153		0.0461
		200 MHz limit		0.149		0.0379
		20 MHz limit		0.103		0.013
	2 mV/div	4 GHz	-	-		0.139
		3 GHz limit	-	-		0.119
		2.5 GHz limit	-	-		0.110

Table continued…

12 Full = the highest bandwidth setting you can select.
13 Full = the highest bandwidth setting you can select.

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [13]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
		2 GHz limit	-	-		0.0976
		1 GHz limit	-	-		0.0724
		500 MHz limit		0.285		0.562
		350 MHz limit		0.195		0.0473
		250 M GHz limit		0.155		0.0467
		200 MHz limit		0.153		0.038
		20 MHz limit		0.103		0.0133
	5 mV/div	4 GHz	-	-		0.175
		3 GHz limit	-	-		0.149
		2.5 GHz limit	-	-		0.133
		2 GHz limit	-	-		0.118
		1 GHz limit	-	-		0.0896
		500 MHz limit		0.297		0.068
		350 MHz limit		0.205		0.0565
		250 M GHz limit		0.161		0.054
		200 MHz limit		0.154		0.0444
		20 MHz limit [13]		0.110		0.0156

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [14]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
All models (MSO64)						

Table continued…

13 Full = the highest bandwidth setting you can select.
14 Full = the highest bandwidth setting you can select.

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [14]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
Channel 2	10 mV/div	4 GHz	-	-		0.271
		3 GHz limit	-	-		0.226
		2.5 GHz limit	-	-		0.203
		2 GHz limit	-	-		0.186
		1 GHz limit	-	-		0.128
		500 MHz limit		0.334		0.0919
		350 MHz limit		0.231		0.0773
		250 M GHz limit		0.186		0.0747
		200 MHz limit		0.165		0.0658
		20 MHz limit		0.141		0.0226
	20 mV/div	4 GHz	-	-		0.486
		3 GHz limit	-	-		0.398
		2.5 GHz limit	-	-		0.363
		2 GHz limit	-	-		0.320
		1 GHz limit	-	-		0.226
		500 MHz limit		0.407		0.162
		350 MHz limit		0.305		0.133
		250 M GHz limit		0.257		0.120
		200 MHz limit		0.211		0.106
		20 MHz limit		0.224		0.0412
	50 mV/div	4 GHz	-	-		1.15

Table continued…

14 Full = the highest bandwidth setting you can select.

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [14]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
		3 GHz limit	-	-		0.960
		2.5 GHz limit	-	-		0.856
		2 GHz limit	-	-		0.745
		1 GHz limit	-	-		0.534
		500 MHz limit		0.737		0.396
		350 MHz limit		0.553		0.307
		250 M GHz limit		0.528		0.280
		200 MHz limit		0.387		0.247
		20 MHz limit		0.510		0.105

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [15]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
All models (MSO64)						
Channel 2	100 mV/div	4 GHz	-	-		2.71
		3 GHz limit	-	-		2.28
		2.5 GHz limit	-	-		2.03
		2 GHz limit	-	-		1.81
		1 GHz limit	-	-		1.33
		500 MHz limit		1.77		0.941
		350 MHz limit		1.38		0.792
		250 M GHz limit		1.18		0.722

Table continued…

[14] Full = the highest bandwidth setting you can select.
[15] Full = the highest bandwidth setting you can select.

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [15]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
		200 MHz limit		0.952		0.666
		20 MHz limit		1.13		0.236
	1 V/div	4 GHz	-	-		23.1
		3 GHz limit	-	-		19.2
		2.5 GHz limit	-	-		17.1
		2 GHz limit	-	-		14.9
		1 GHz limit	-	-		10.8
		500 MHz limit		19		7.92
		350 MHz limit		14.9		6.14
		250 M GHz limit		13.6		5.6
		200 MHz limit		11.3		4.94
		20 MHz limit		11.7		2.11

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [16]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
All models (MSO64)						
Channel 3	1 mV/div	4 GHz	-	-		0.138
		3 GHz limit	-	-		0.117
		2.5 GHz limit	-	-		0.108
		2 GHz limit	-	-		0.0963
		1 GHz limit	-	-		0.0773

Table continued…

15 Full = the highest bandwidth setting you can select.
16 Full = the highest bandwidth setting you can select.

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [16]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
		500 MHz limit		0.262		0.056
		350 MHz limit		0.190		0.0477
		250 M GHz limit		0.153		0.0461
		200 MHz limit		0.149		0.0379
		20 MHz limit		0.103		0.013
	2 mV/div	4 GHz	-	-		0.139
		3 GHz limit	-	-		0.119
		2.5 GHz limit	-	-		0.110
		2 GHz limit	-	-		0.0976
		1 GHz limit	-	-		0.0724
		500 MHz limit		0.285		0.562
		350 MHz limit		0.195		0.0473
		250 M GHz limit		0.155		0.0467
		200 MHz limit		0.153		0.038
		20 MHz limit		0.103		0.0133
	5 mV/div	4 GHz	-	-		0.175
		3 GHz limit	-	-		0.149
		2.5 GHz limit	-	-		0.133
		2 GHz limit	-	-		0.118
		1 GHz limit	-	-		0.0896
		500 MHz limit		0.297		0.068

Table continued…

[16] Full = the highest bandwidth setting you can select.

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [16]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
		350 MHz limit		0.205		0.0565
		250 M GHz limit		0.161		0.054
		200 MHz limit		0.154		0.0444
		20 MHz limit		0.110		0.0156

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [17]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
All models (MSO64)						
Channel 3	10 mV/div	4 GHz	-	-		0.271
		3 GHz limit	-	-		0.226
		2.5 GHz limit	-	-		0.203
		2 GHz limit	-	-		0.186
		1 GHz limit	-	-		0.128
		500 MHz limit		0.334		0.0919
		350 MHz limit		0.231		0.0773
		250 M GHz limit		0.186		0.0747
		200 MHz limit		0.165		0.0658
		20 MHz limit		0.141		0.0226
	20 mV/div	4 GHz	-	-		0.486
		3 GHz limit	-	-		0.398
		2.5 GHz limit	-	-		0.363

Table continued…

16 Full = the highest bandwidth setting you can select.
17 Full = the highest bandwidth setting you can select.

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [17]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
		2 GHz limit	-	-		0.320
		1 GHz limit	-	-		0.226
		500 MHz limit		0.407		0.162
		350 MHz limit		0.305		0.133
		250 M GHz limit		0.257		0.120
		200 MHz limit		0.211		0.106
		20 MHz limit		0.224		0.0412
	50 mV/div	4 GHz	-	-		1.15
		3 GHz limit	-	-		0.960
		2.5 GHz limit	-	-		0.856
		2 GHz limit	-	-		0.745
		1 GHz limit	-	-		0.534
		500 MHz limit		0.737		0.396
		350 MHz limit		0.553		0.307
		250 M GHz limit		0.528		0.280
		200 MHz limit		0.387		0.247
		20 MHz limit		0.510		0.105

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [18]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
All models (MSO64)						

Table continued…

[17] Full = the highest bandwidth setting you can select.
[18] Full = the highest bandwidth setting you can select.

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [18]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
Channel 3	100 mV/div	4 GHz	-	-		2.71
		3 GHz limit	-	-		2.28
		2.5 GHz limit	-	-		2.03
		2 GHz limit	-	-		1.81
		1 GHz limit	-	-		1.33
		500 MHz limit		1.77		0.941
		350 MHz limit		1.38		0.792
		250 M GHz limit		1.18		0.722
		200 MHz limit		0.952		0.666
		20 MHz limit		1.13		0.236
	1 V/div	4 GHz	-	-		23.1
		3 GHz limit	-	-		19.2
		2.5 GHz limit	-	-		17.1
		2 GHz limit	-	-		14.9
		1 GHz limit	-	-		10.8
		500 MHz limit		19		7.92
		350 MHz limit		14.9		6.14
		250 M GHz limit		13.6		5.6
		200 MHz limit		11.3		4.94
		20 MHz limit		11.7		2.11

[18] Full = the highest bandwidth setting you can select.

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [19]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
All models (MSO64)						
Channel 4	1 mV/div	4 GHz	-	-		0.138
		3 GHz limit	-	-		0.117
		2.5 GHz limit	-	-		0.108
		2 GHz limit	-	-		0.0963
		1 GHz limit	-	-		0.0773
		500 MHz limit		0.262		0.056
		350 MHz limit		0.190		0.0477
		250 M GHz limit		0.153		0.0461
		200 MHz limit		0.149		0.0379
		20 MHz limit		0.103		0.013
	2 mV/div	4 GHz	-	-		0.139
		3 GHz limit	-	-		0.119
		2.5 GHz limit	-	-		0.110
		2 GHz limit	-	-		0.0976
		1 GHz limit	-	-		0.0724
		500 MHz limit		0.285		0.562
		350 MHz limit		0.195		0.0473
		250 M GHz limit		0.155		0.0467
		200 MHz limit		0.153		0.038
		20 MHz limit		0.103		0.0133
	5 mV/div	4 GHz	-	-		0.175

Table continued…

19 Full = the highest bandwidth setting you can select.

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [19]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
		3 GHz limit	-	-		0.149
		2.5 GHz limit	-	-		0.133
		2 GHz limit	-	-		0.118
		1 GHz limit	-	-		0.0896
		500 MHz limit		0.297		0.068
		350 MHz limit		0.205		0.0565
		250 M GHz limit		0.161		0.054
		200 MHz limit		0.154		0.0444
		20 MHz limit		0.110		0.0156

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [20]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
All models (MSO64)						
Channel 4	10 mV/div	4 GHz	-	-		0.271
		3 GHz limit	-	-		0.226
		2.5 GHz limit	-	-		0.203
		2 GHz limit	-	-		0.186
		1 GHz limit	-	-		0.128
		500 MHz limit		0.334		0.0919
		350 MHz limit		0.231		0.0773
		250 M GHz limit		0.186		0.0747

Table continued…

19 Full = the highest bandwidth setting you can select.
20 Full = the highest bandwidth setting you can select.

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [20]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
		200 MHz limit		0.165		0.0658
		20 MHz limit		0.141		0.0226
	20 mV/div	4 GHz	-	-		0.486
		3 GHz limit	-	-		0.398
		2.5 GHz limit	-	-		0.363
		2 GHz limit	-	-		0.320
		1 GHz limit	-	-		0.226
		500 MHz limit		0.407		0.162
		350 MHz limit		0.305		0.133
		250 M GHz limit		0.257		0.120
		200 MHz limit		0.211		0.106
		20 MHz limit		0.224		0.0412
	50 mV/div	4 GHz	-	-		1.15
		3 GHz limit	-	-		0.960
		2.5 GHz limit	-	-		0.856
		2 GHz limit	-	-		0.745
		1 GHz limit	-	-		0.534
		500 MHz limit		0.737		0.396
		350 MHz limit		0.553		0.307
		250 M GHz limit		0.528		0.280
		200 MHz limit		0.387		0.247
		20 MHz limit		0.510		0.105

20 Full = the highest bandwidth setting you can select.

Random Noise, High Res mode: All models						
Performance checks			1 MΩ		50 Ω	
	V/div	Bandwidth [21]	Test result (mV)	High limit (mV)	Test result (mV)	High limit (mV)
All models (MSO64)						
Channel 4	100 mV/div	4 GHz	-	-		2.71
		3 GHz limit	-	-		2.28
		2.5 GHz limit	-	-		2.03
		2 GHz limit	-	-		1.81
		1 GHz limit	-	-		1.33
		500 MHz limit		1.77		0.941
		350 MHz limit		1.38		0.792
		250 M GHz limit		1.18		0.722
		200 MHz limit		0.952		0.666
		20 MHz limit		1.13		0.236
	1 V/div	4 GHz	-	-		23.1
		3 GHz limit	-	-		19.2
		2.5 GHz limit	-	-		17.1
		2 GHz limit	-	-		14.9
		1 GHz limit	-	-		10.8
		500 MHz limit		19		7.92
		350 MHz limit		14.9		6.14
		250 M GHz limit		13.6		5.6
		200 MHz limit		11.3		4.94
		20 MHz limit		11.7		2.11

[21] Full = the highest bandwidth setting you can select.

Long Term Sample Rate			
Performance checks	Low limit	Test result	High limit
Long Term Sample Rate	9.999997 MHz		10.000003 MHz

AUX Out output voltage levels				
Performance checks	Vout	Low limit	Test result	High limit
Output levels, 1 MΩ input impedance	Max	≥ 2.5 V		n/a
	Min	n/a		≤ 700 mV
Output levels, 50 Ω Input Impedance,	Max	≥ 1.0 V		n/a
	Min	n/a		≤ 250 mV

DVM voltage accuracy (DC)					
Channel 1					
Vertical Scale	Input Voltage	Offset Voltage	Low limit	Test result	High limit
1	–5	–5	-5.125		-4.875
0.5	–2	–2	-2.06		-1.94
0.5	–1	–0.5	-1.06		-0.94
0.2	–0.5	–0.5	-0.5225		-0.4775
0.01	0.002	0	0.00097		0.00303
0.2	0.5	0.5	0.4775		0.5225
0.5	1	0.5	0.94		1.06
0.5	2	2	1.94		2.06
1	5	5	4.875		5.125
Channel 2					
Vertical Scale	Input Voltage	Offset Voltage	Low limit	Test result	High limit
1	–5	–5	-5.125		-4.875
0.5	–2	–2	-2.06		-1.94
0.5	–1	–0.5	-1.06		-0.94
0.2	–0.5	–0.5	-0.5225		-0.4775
0.01	0.002	0	0.00097		0.00303
0.2	0.5	0.5	0.4775		0.5225
0.5	1	0.5	0.94		1.06

Table continued…

DVM voltage accuracy (DC)					
0.5	2	2	1.94		2.06
1	5	5	4.875		5.125
Channel 3					
Vertical Scale	Input Voltage	Offset Voltage	Low limit	Test result	High limit
1	-5	-5	-5.125		-4.875
0.5	-2	-2	-2.06		-1.94
0.5	-1	-0.5	-1.06		-0.94
0.2	-0.5	-0.5	-0.5225		-0.4775
0.01	0.002	0	0.00097		0.00303
0.2	0.5	0.5	0.4775		0.5225
0.5	1	0.5	0.94		1.06
0.5	2	2	1.94		2.06
1	5	5	4.875		5.125
Channel 4					
Vertical Scale	Input Voltage	Offset Voltage	Low limit	Test result	High limit
1	-5	-5	-5.125		-4.875
0.5	-2	-2	-2.06		-1.94
0.5	–1	-0.5	-1.06		-0.94
0.2	-0.5	-0.5	-0.5225		-0.4775
0.01	0.002	0	0.00097		0.00303
0.2	0.5	0.5	0.4775		0.5225
0.5	1	0.5	0.94		1.06
0.5	2	2	1.94		2.06
1	5	5	4.875		5.125

DVM voltage accuracy (AC)				
All models				
Channel 1				
Vertical Scale	Input Signal	Low limit	Test result	High limit
5 mV	20 mV_{pp} at 1 kHz	9.700 mV		10.300 mV
10 mV	50 mV_{pp} at 1 kHz	24.25 mV		25.750 mV
100 mV	0.5 V_{pp} at 1 kHz	242.500 mV		257.500 mV
200 mV	1 V_{pp} at 1 kHz	485.000 mV		515.000 mV
1 V	5 V_{pp} at 1 kHz	2.425 V		2.575 V
Channel 2				
Vertical Scale	Input Signal	Low limit	Test result	High limit

Table continued…

DVM voltage accuracy (AC)				
5 mV	20 mV$_{pp}$ at 1 kHz	9.700 mV		10.300 mV
10 mV	50 mV$_{pp}$ at 1 kHz	24.25 mV		25.750 mV
100 mV	0.5 V$_{pp}$ at 1 kHz	242.500 mV		257.500 mV
200 mV	1 V$_{pp}$ at 1 kHz	485.000 mV		515.000 mV
1 V	5 V$_{pp}$ at 1 kHz	2.425 V		2.575 V
Channel 3				
Vertical Scale	Input Signal	Low limit	Test result	High limit
5 mV	20 mV$_{pp}$ at 1 kHz	9.700 mV		10.300 mV
10 mV	50 mV$_{pp}$ at 1 kHz	24.25 mV		25.750 mV
100 mV	0.5 V$_{pp}$ at 1 kHz	242.500 mV		257.500 mV
200 mV	1 V$_{pp}$ at 1 kHz	485.000 mV		515.000 mV
1 V	5 V$_{pp}$ at 1 kHz	2.425 V		2.575 V
Channel 4				
Vertical Scale	Input Signal	Low limit	Test result	High limit
5 mV	20 mV$_{pp}$ at 1 kHz	9.700 mV		10.300 mV
10 mV	50 mV$_{pp}$ at 1 kHz	24.25 mV		25.750 mV
100 mV	0.5 V$_{pp}$ at 1 kHz	242.500 mV		257.500 mV
200 mV	1 V$_{pp}$ at 1 kHz	485.000 mV		515.000 mV
1 V	5 V$_{pp}$ at 1 kHz	2.425 V		2.575 V

Trigger frequency accuracy and trigger frequency counter maximum input frequency				
All models				
Channel 1				
	Hz	Low limit	Test result	High limit
	100 Hz	99.999999 Hz		100.00000 Hz
	1 kHz	999.99999 Hz		1.0000000 KHz
	10 kHz	9.9999999 KHz		10.000000 kHz
	100 kHz	99.999999 kHz		100.00000 kHz
	1 MHz	999.99999 kHz		1.0000000 MHz
	10 MHz	9.999997 MHz		10.000003 MHz
	100 MHz	99.999999 MHz		100.00000 MHz
	1 GHz	999.99999 MHz		1.0000000 GHz
	2 GHz	1.9999999 GHz		2.0000000 GHz
	4 GHz	3.999999959 GHz		4.000000041 GHz
	6 GHz	5.999999938 GHz		6.000000062 GHz

Table continued…

Trigger frequency accuracy and trigger frequency counter maximum input frequency				
	8 GHz	7.999999918 GHz		8.000000082 GHz
Channel 2				
	Hz	Low limit	Test result	High limit
	100 Hz	99.999999 Hz		100.00000 Hz
	1 kHz	999.99999 Hz		1.0000000 KHz
	10 kHz	9.9999999 KHz		10.000000 kHz
	100 kHz	99.999999 kHz		100.00000 kHz
	1 MHz	999.99999 kHz		1.0000000 MHz
	10 MHz	9.999997 MHz		10.000003 MHz
	100 MHz	99.999999 MHz		100.00000 MHz
	1 GHz	999.99999 MHz		1.0000000 GHz
	2 GHz	1.9999999 GHz		2.0000000 GHz
	4 GHz	3.999999959 GHz		4.000000041 GHz
	6 GHz	5.999999938 GHz		6.000000062 GHz
	8 GHz	7.999999918 GHz		8.000000082 GHz
Channel 3				
	Hz	Low limit	Test result	High limit
	100 Hz	99.999999 Hz		100.00000 Hz
	1 kHz	999.99999 Hz		1.0000000 KHz
	10 kHz	9.9999999 KHz		10.000000 kHz
	100 kHz	99.999999 kHz		100.00000 kHz
	1 MHz	999.99999 kHz		1.0000000 MHz
	10 MHz	9.999997 MHz		10.000003 MHz
	100 MHz	99.999999 MHz		100.00000 MHz
	1 GHz	999.99999 MHz		1.0000000 GHz
	2 GHz	1.9999999 GHz		2.0000000 GHz
	4 GHz	3.999999959 GHz		4.000000041 GHz
	6 GHz	5.999999938 GHz		6.000000062 GHz
	8 GHz	7.999999918 GHz		8.000000082 GHz
Channel 4				
	Hz	Low limit	Test result	High limit
	100 Hz	99.999999 Hz		100.00000 Hz
	1 kHz	999.99999 Hz		1.0000000 KHz
	10 kHz	9.9999999 KHz		10.000000 kHz
	100 kHz	99.999999 kHz		100.00000 kHz
	1 MHz	999.99999 kHz		1.0000000 MHz
	10 MHz	9.999997 MHz		10.000003 MHz

Table continued…

Trigger frequency accuracy and trigger frequency counter maximum input frequency				
	100 MHz	99.999999 MHz		100.00000 MHz
	1 GHz	999.99999 MHz		1.0000000 GHz
	2 GHz	1.9999999 GHz		2.0000000 GHz
	4 GHz	3.999999959 GHz		4.000000041 GHz
	6 GHz	5.999999938 GHz		6.000000062 GHz
	8 GHz	7.999999918 GHz		8.000000082 GHz

AFG sine and ramp frequency accuracy

Performance checks

Waveform type	Minimum	Test result	Maximum
Sine, 1 MHz	0.999950 MHz		1.000050 MHz
Ramp, 500 KHz	499.975 kHz		500.025 kHz

AFG square and pulse frequency accuracy

Performance checks

Waveform type	Minimum	Test result	Maximum
Square, 1 MHz	0.999950 MHz		1.000050 MHz
Pulse, 1 MHz	0.999950 MHz		1.000050 MHz

AFG signal amplitude accuracy

Performance checks

Amplitude	Minimum	Test result	Maximum
30.0 mV_{PP}	28.55 mV_{PP}		31.45 mV_{PP}
300.0 mV_{PP}	294.5 mV_{PP}		305.5 mV_{PP}
800.0 mV_{PP}	787.0 mV_{PP}		813.0 mV_{PP}
1.500 V_{PP}	1.4765 V_{PP}		1.5235 V_{PP}
2.000 V_{PP}	1.9690 V_{PP}		2.0310 V_{PP}
2.500 V_{PP}	2.4615 V_{PP}		2.5385 V_{PP}

AFG DC offset accuracy			
Performance checks			
Offset	**Minimum**	**Test result**	**Maximum**
1.25 V	1.23025 Vdc		1.26975 Vdc
0 V	- 0.001 Vdc		+ 0.001 Vdc

Performance tests

This section contains a collection of manual procedures for checking that the instrument performs as warranted. They check all the characteristics that are designated as checked in *Specifications.* (The characteristics that are checked appear with a ✓ in *Specifications*).

Prerequisites

The tests in this section comprise an extensive, valid confirmation of performance and functionality when the following requirements are met:

- The instrument must be in its normal operating configuration (no covers removed).
- You must have performed and passed the procedures under *Self Test*. (See *Self test* on page 79.)
- A signal-path compensation must have been done within the recommended calibration interval and at a temperature within ±5 ºC (±9 ºF) of the present operating temperature. (If the temperature was within the limits just stated at the time you did the prerequisite *Self Test,* consider this prerequisite met). A signal-path compensation must have been done at an ambient humidity within 25% of the current ambient humidity and after having been at that humidity for at least 4 hours.
- The instrument must have been last adjusted at an ambient temperature between +18 ºC and +28 ºC (+64 ºF and +82 ºF), must have been operating for a warm-up period of at least 20 minutes, and must be operating at an ambient temperature as listed in the specifications. The warm-up requirement is usually met in the course of meeting the Self Test prerequisites listed above.
- The instrument must be powered from a source maintaining voltage and frequency within the limits described in the *Specifications* section.
- The instrument must be in an environment with temperature, altitude, humidity, and vibration within the operating limits described in the *Specifications* section.

Self test

This procedure verifies that the instrument passes the internal diagnostics and performs signal path compensation. No test equipment or hookups are required.

Equipment required	Prerequisites
None	Power on the instrument and allow a 20 minute warm-up period before performing this procedure.

1. *Run the System Diagnostics (may take a few minutes):*
   a. Disconnect all probes and/or cables from the oscilloscope inputs.
   b. Tap **Utility > Self Test**. This displays the **Self Test** configuration menu.
   c. Tap the **Run Self Test** button.
   d. The internal diagnostics perform an exhaustive verification of proper instrument function. This verification may take several minutes. When the verification is finished, the status of each self test is shown in the menu.

e. Verify that the status of all tests is **Pass**.
f. Tap anywhere outside the menu to exit the menu.

2. *Run the signal-path compensation routine (may take 5 to 15 minutes per channel):*
   a. Tap **Utility > Calibration**. This displays the **Calibration** configuration menu.
   b. Tap the **Run SPC** button to start the routine.
   c. Signal-path compensation may take 5 to 15 minutes to run per channel.
   d. Verify that the **SPC Status** is **Passed**.
3. *Return to regular service:* Tap anywhere outside the menu to exit the **Calibration** menu.

The self test procedures are completed. If any of the above tests failed, run the tests again. If there are still failures, contact Tektronix Customer Support.

Note: You cannot run the remaining performance tests until the self tests pass and the SPC has successfully run.

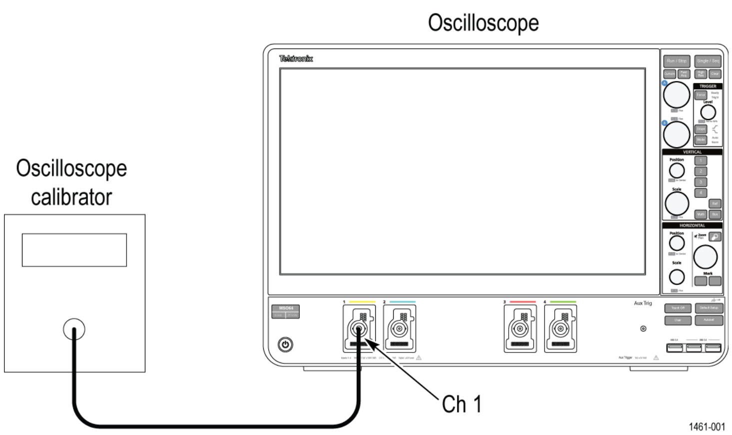
Check input impedance

This test checks the input impedance on all channels.

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

   Warning: Be sure to set the generator to Off or 0 volts before connecting, disconnecting, and/or moving the test hookup during the performance of this procedure. The generator is capable of providing dangerous voltages.

   Note: Impedance measuring equipment that produces a voltage across the channel that exceeds the measurement range of the instrument may report erroneous impedance results. A measurement voltage exceeds the measurement range of the instrument when the resulting trace is not visible on the graticule.

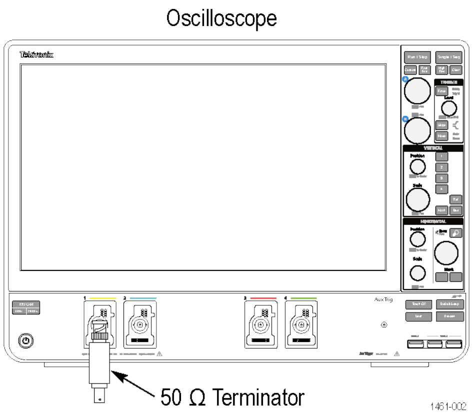


2. Set the calibrator to measure 1 MΩ impedance.
3. Tap **File** > **Default Setup**.
4. *Test 1 MΩ input impedance as follows:*
   a. Tap the channel **1** button on the Settings bar.
   b. Double tap the **Ch 1** badge to open its menu.
   c. Set **Termination** to **1 MΩ**.
   d. Set the **Vertical Scale** to the value to test in the test record (first value is **10 mV/div**).
5. Use the calibrator to measure the input impedance of the oscilloscope and enter the value in the test record.
6. Repeat steps *4.d* on page 80 and *5* on page 80 for all vertical scale settings in the test record for the channel.

7. *Test 50 Ω input impedance as follows:*
   a. Set the calibrator impedance to measure 50 Ω impedance.
   b. Double-tap the **Ch 1** badge and set **Termination** to **50 Ω**.
   c. Repeat steps *4.d* on page 80 through *6* on page 80 for all vertical scale settings in the test record for the channel.
8. *Repeat the procedures for all remaining channels as follows:*
   a. Turn the calibrator output Off.
   b. Move the calibrator connection to the next channel to test.
   c. Double-tap the channel badge of the channel that you have finished testing and set **Display** to **Off**.
   d. Tap the channel button on the Settings bar of the next channel to test.
   e. Starting from step *2* on page 80, repeat the procedures until all channels have been tested.

Check DC balance

This test checks the DC balance. You do not need to connect any test equipment (other than the 50 Ω terminator) to the oscilloscope to perform this check.



1. Attach a 50 Ω terminator to the oscilloscope channel 1 input.
2. Tap **File** > **Default Setup**.
3. Double-tap the **Horizontal** badge on the Settings bar and set the **Horizontal Scale** to **1 ms/div**.
4. Tap the channel **1** button on the oscilloscope Settings bar to display a channel badge.
5. Double tap the **Ch 1** badge to open its menu.
6. Set the **Vertical Scale** to **1 mV/div**.
7. Set the channel 1 **Termination** to **50 Ω**.
8. Tap the **Bandwidth Limit** field and select **20 MHz**.
9. Tap outside the menu to close it.
10. Double-tap the **Acquisition** badge and set the **Acquisition Mode** to **Average**.
11. Set the **Number of Waveforms** to **16**.
12. Tap outside the menu to close it.
13. Double-tap the **Trigger** badge and set the **Source** to **AC line**.
14. Tap outside the menu to close it.
15. Add a Mean amplitude measurement for channel 1 to the Results bar:
    a. Tap the **Add New... Measure** button to open the **Add Measurements** menu.
    b. Set the **Source** to **Ch 1**.

c. In the **Amplitude Measurements** panel, double-tap the **Mean** button to add the **Mean** measurement badge to the Results bar.

16. Tap outside the menu to close it.
17. Double-tap the **Mean** results badge.
18. Tap **Show Statistics in Badge**.
19. Tap **FILTER/LIMIT RESULTS** to open the panel.
20. Tap **Limit Measurement Population** to toggle it to **On.**
21. Tap outside the menu to close it.
22. Enter the mean value as the test result in the test record.
23. Repeat steps 6 on page 81 through 22 on page 82 for each vertical scale setting in the test record.
24. Repeat steps 3 on page 81 through 23 on page 82 for each bandwidth setting in the test record table.
25. *Repeat the channel tests at 1 MΩ impedance as follows:*

    a. Double-tap the channel 1 badge.
    b. Set the **Termination** to **1M Ω**.
    c. Repeat steps 8 on page 81 through 24 on page 82.

26. *Repeat the procedure for all remaining channels as follows:*

    a. Move the 50 Ω terminator to the next channel input to be tested.
    b. Double-tap the channel badge of the channel that you have finished testing and set **Display** to **Off**.
    c. Tap the channel button on the Settings bar of the next channel to test.
    d. Starting from step 6 on page 81, repeat the procedures until all channels have been tested. To change the source for the Mean measurement for each channel test:

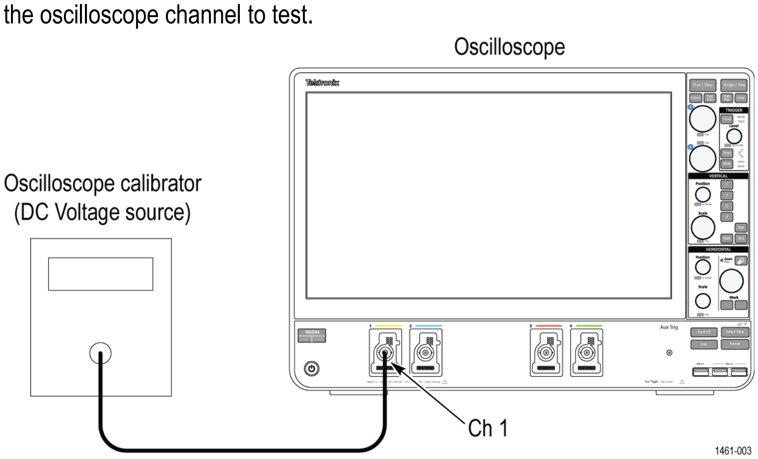
        i. Double-tap the **Mean** measurement badge.
        ii. Tap the **Configure** panel.
        iii. Tap the **Source 1** field and select the next channel to test.

27. Tap outside the menu area to close the configuration menu.

Check DC gain accuracy

This test checks the DC gain accuracy.

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



Warning: Set the generator output to Off or 0 volts before connecting, disconnecting, and/or moving the test hookup during the performance of this procedure. The generator is capable of providing dangerous voltages.

2. Tap **File** > **Default Setup**.
3. Double-tap the **Acquisition** badge and set **Acquisition Mode** to **Average**.
4. Set the **Number of Waveforms** to **16**.
5. Tap outside the menu to close the menu.
6. Double-tap the **Trigger** badge and set the trigger **Source** to **AC line**.
7. Tap outside the menu to close it.
8. Add the **Mean** measurement to the Results bar:
   a. Tap the **Add New... Measure** button to open the **Add Measurements** menu.
   b. Set the **Source** to **Ch 1**.
   c. In the **Amplitude Measurements** panel, double-tap the **Mean** button to add the Mean measurement badge to the Results bar.
9. Tap outside the menu to close it.
10. Double-tap the **Mean** results badge.
11. Tap **Show Statistics in Badge**.
12. Tap **FILTER/LIMIT RESULTS** to open the panel.
13. Tap **Limit Measurement Population** to toggle it to **On.**
14. Tap outside the menu to close it.
15. Tap the channel button of the channel to test, to add the channel badge to the Settings bar.
16. Double tap the channel to test badge to open its menu and set the channel settings:
    a. Set **Vertical Scale** to **1 mV/div**.
    b. Set **Termination** to **50 Ω**.
    c. Tap **Bandwidth Limit** and set to **20 MHz**.
    d. Tap outside the menu to close it.
17. Record the negative-measured and positive-measured mean readings in the *Expected gain worksheet* as follows:
    a. On the calibrator, set the DC Voltage Source to the $V_{negative}$ value as listed in the 1 mV row of the worksheet.
    b. Double-tap the **Acquisition** badge and tap **Clear** to reset the measurement statistics.
    c. Enter the **Mean** reading in the worksheet as $V_{negative-measured}$.
    d. On the calibrator, set the DC Voltage Source to $V_{positive}$ value as listed in the 1 mV row of the worksheet.
    e. Double-tap the **Acquisition** badge (if not open) and tap **Clear**.
    f. Enter the **Mean** reading in the worksheet as $V_{positive-measured}$.

Table 5: Expected gain 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				
5 mV/div	35 mV	-17.5 mV	+17.5 mV				
10 mV/div	70 mV	-35 mV	+35 mV				
20 mV/div	140 mV	-70 mV	+70 mV				

Table continued…

Oscilloscope vertical scale setting	$V_{diffExpected}$	$V_{negative}$	$V_{positive}$	$V_{negative\text{-}measured}$	$V_{positive\text{-}measured}$	V_{diff}	Test result (Gain accuracy)
50 mV/div	350 mV	-175 mV	+175 mV				
100 mV/div	700 mV	-350 mV	+350 mV				
200 mV/div	1400 mV	-700 mV	+700 mV				
500 mV/div	3500 mV	-1750 mV	+1750 mV				
1.0 V/div	7000 mV	-3500 mV	+3500 mV				
20 mV/div at 250 MHz	140 mV	-70 mV	+70 mV				
20 mV/div at Full BW	140 mV	-70 mV	+ 70 mV				

18. Calculate Gain Accuracy as follows:

a. Calculate V_{diff} as follows:

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

b. Enter V_{diff} in the worksheet.

c. Calculate *Gain Accuracy* as follows:

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

d. Enter the *Gain Accuracy* value in the worksheet and in the test record.

19. Repeat steps 16 on page 83 through 18 on page 84 for all vertical scale settings in the work sheet and the test record.

20. *Repeat tests at 1 MΩ impedance as follows:*

a. Set the calibrator to **0** volts and **1 MΩ** output impedance.

b. Double-tap the badge of the channel being tested.

c. Set the **Termination** to **1 MΩ**

d. Repeat steps 16 on page 83 through 19 on page 84 for all vertical scale settings in the test record.

21. *Repeat the procedure for all remaining channels:*

a. Set the calibrator to **0** volts and **50 Ω** output impedance.

b. Move the calibrator output to the next channel input to be tested.

c. Double-tap the channel badge of the channel that you have finished testing and set **Display** to **Off**.

d. Double-tap the **Mean** measurement badge.

e. Tap the **Configure** panel.

f. Tap the **Source 1** field and select the next channel to test.

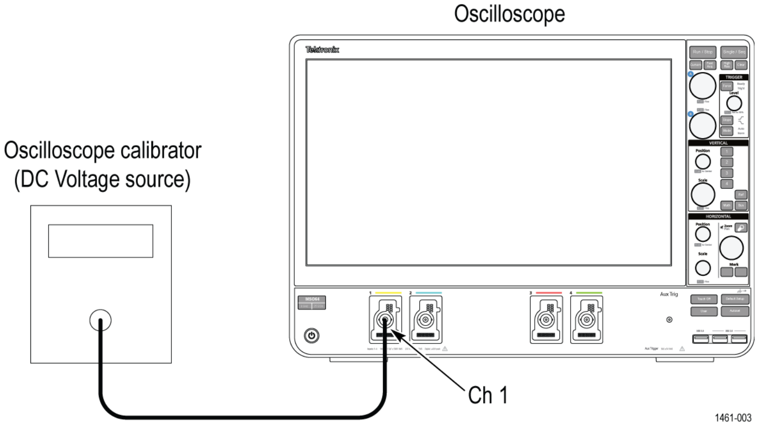
g. Starting from step16 on page 83, set the values from the test record for the channel under test, and repeat the above steps until all channels have been tested.

22. Touch outside a menu to close the menu.

Check DC offset accuracy

This test checks the offset accuracy at 50 Ω and 1 MΩ input impedances.

1. Connect the oscilloscope to a calibrated DC voltage source. If you are using the Fluke 9500B calibrator as the DC voltage source, connect the calibrator head to the oscilloscope channel 1.



Warning: Set the generator output to Off or 0 volts before connecting, disconnecting, or moving the test hookup during the performance of this procedure. The generator is capable of providing dangerous voltages.

2. Tap **File** > **Default Setup**.
3. Double-tap the **Acquisition** badge and set **Acquisition Mode** to **Average**.
4. Set the **Number of Waveforms** to **16**.
5. Tap outside the menu to close the menu.
6. Double-tap the **Trigger** badge and set the trigger **Source** to **AC line**.
7. Add the **Mean** measurement to the Results bar:
   a. Tap the **Add New... Measure** button to open the **Add Measurements** menu.
   b. Set the **Source** to **Ch 1**.
   c. In the **Amplitude Measurements** panel, double-tap the **Mean** button to add the Mean measurement badge to the Results bar.
8. Tap outside the menu to close it.
9. Double-tap the **Mean** results badge.
10. Tap **Show Statistics in Badge**.
11. Tap **FILTER/LIMIT RESULTS** to open the panel.
12. Tap **Limit Measurement Population** to toggle it to **On.**
13. Tap outside the menu to close it.
14. Tap the channel button on the Settings bar to add the channel under test to the Settings bar.
15. Double-tap the channel under test badge to open its configuration menu and change the vertical settings:
   a. Set **Vertical Scale** to **1 mV/div**.
   b. Set **Offset** to **900 mV**.
   c. Set **Position** to 0 by tapping **Set to 0**.
   d. Set **Termination** to **50 Ω**.
   e. Tap **Bandwidth Limit** and set to **20 MHz**.
   f. Tap outside the menu to close it.
16. Set the calibrator output to **+900 mV**, as shown in the test record, and turn the calibrator output On.
17. Enter the Mean measurement value in the test record.
18. Double-tap the channel under test badge to open its configuration menu and change the **Offset** to **-900 mV**.
19. Set the calibrator output to **-900 mV**, as shown in the test record.
20. Enter the Mean measurement value in the test record.

21. Repeat step *15* on page 85 through *20* on page 85, changing the channel vertical settings and the calibrator output as listed in the test record for the channel under test.

22. *Repeat the channel tests at 1 MΩ impedance as follows:*

a. Set the calibrator output to Off or 0 volts.

b. Change the calibrator impedance to **1 MΩ** and voltage to **+900 mV**.

c. Turn the calibrator output On.

d. Repeat steps *15* on page 85 through *20* on page 85, changing the channel **Termination** to **1 MΩ** and the vertical Offset value and the calibrator output as listed in the 1 MΩ test record for the channel under test.

23. *Repeat the procedure for all remaining channels as follows:*

a. Double-tap the **Mean** measurement badge.

b. Tap the **Configure** panel.

c. Tap the **Source 1** field and select the next channel to test.

d. Set the calibrator to **0** volts and **50 Ω** output impedance.

e. Move the calibrator output to the next channel input to test.

f. Double-tap the channel badge of the channel that you have finished testing and set **Display** to **Off**.

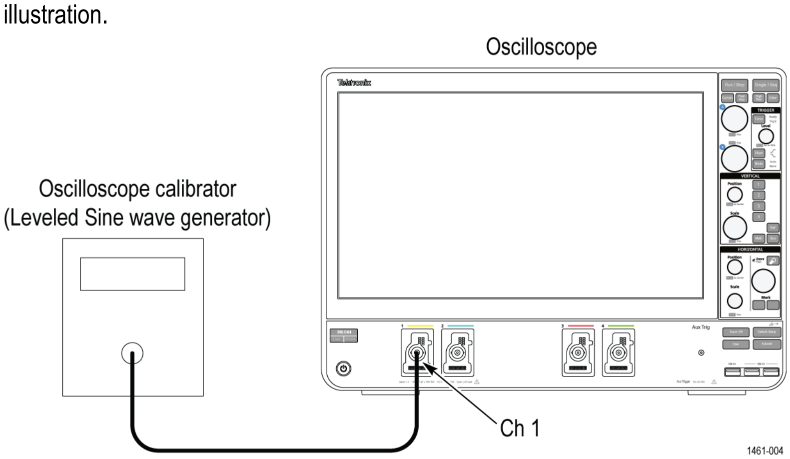
g. Tap the channel button on the oscilloscope Settings bar of the next channel to test.

h. Starting from step *14* on page 85 , repeat the procedure until all channels have been tested.

Check analog bandwidth

This test checks the bandwidth at 50 Ω and 1 MΩ terminations for each channel. The typical bandwidth at 1 M Ω termination is checked on the products as a functional check.

1. Connect the output of the calibrated leveled sine wave generator to the oscilloscope channel 1 input as shown in the following illustration.



⚠ **Warning:** Set the generator to off or 0 volts before connecting, disconnecting, and/or moving the test hookup during the performance of this procedure. The generator is capable of providing dangerous voltages.

2. Tap **File** > **Default Setup** to reset the instrument and add the channel 1 badge and signal to the display.

3. *Add the peak-to-peak measurement as follows:*

a. Tap the **Add New. Measure** button.

b. Set the **Source** to the channel under test.

c. In the **Amplitude Measurements** panel, double-tap the **Peak-to-Peak** measurement button to add the measurement badge to the Results bar.

d. Tap outside the menu to close it.

e. Double-tap the **Peak-to-Peak** results badge.
f. Tap **Show Statistics in Badge**.
g. Tap **FILTER/LIMIT RESULTS** to open the panel.
h. Tap **Limit Measurement Population** to toggle it to **On.**
i. Tap outside the menu to close it.

4. Set the channel under test settings:
   a. Double-tap the badge of the channel under test to open its configuration menu.
   b. Set **Vertical Scale** to **1 mV/div**.
   c. Set **Termination** to **50 Ω**.
   d. Tap outside the menu to close it.
5. Adjust the leveled sine wave signal source to display a waveform of 8 vertical divisions at the selected vertical scale with a set frequency of **10 MHz**. For example, at 5 mV/div, use a ≥40 mV_{p-p} signal; at 2 mV/div, use a ≥16 mV_{p-p} signal.

   ⚠ **Note:** At some V/div settings, the generator may not provide 8 vertical divisions of signal. Set the generator output to obtain as many vertical divisions of signal as possible.
6. Double-tap the **Horizontal** badge in the Settings bar.
7. Set the **Horizontal Scale** to **1 ms/division**.
8. Tap outside the menu to close it.
9. Record the **Peak-to-Peak** measurement in the $\mathbf{V}_{in\text{-}pp}$ entry of the test record.
10. Double-tap the **Horizontal** badge in the Settings bar.
11. Set the **Horizontal Scale** to **1 ns/division** .
12. Adjust the signal source to the maximum bandwidth frequency for the bandwidth and model being tested.
13. *Record the peak-to-peak measurement as follows:*
    a. Record the **Peak-to-Peak** measurement at the new frequency in the $\mathbf{V}_{bw\text{-}pp}$ entry of the test record.
14. Use the values of *V bw-pp* and *V in-pp* recorded in the test record, and the following equation, to calculate the Gain at bandwidth:

    Gain = Vbw-pp / Vin-pp.

    To pass the performance measurement test, Gain should be ≥ 0.707. Enter *Gain* in the test record.
15. Repeat steps *4* on page 87 through *14* on page 87 for all combinations of Vertical Scale settings listed in the test record.
16. *Repeat the tests at 1 MΩ impedance as follows:*
    a. Set the calibrator output to Off or 0 volts.
    b. Change the calibrator impedance to **1 MΩ**.
    c. Double-tap the badge of the channel under test to open its menu.
    d. Set the **Termination** to **1 MΩ**.
    e. Repeat steps *4* on page 87 through *16* on page 87 , but leave the termination set to **1 MΩ** .
17. *Repeat the test for all remaining channels as follows:*
    a. Set the calibrator to **0** volts and **50 Ω** output impedance.
    b. Move the calibrator output to the next channel input to be tested.
    c. Double-tap the channel badge of the channel that you have finished testing and set **Display** to **Off**.
    d. Tap the channel button on the oscilloscope Settings bar of the next channel to test.
    e. Double-tap the **Peak-to-Peak** measurement badge.
    f. Tap the **Configure** panel.
    g. Tap the **Source 1** field and select the next channel to test.

h. Starting from step *4* on page 87, repeat the procedure until all channels have been tested.

Check random noise, sample acquisition mode (8 and 6 GHz options)

This test checks random noise at 50 Ω for each channel in Sample acquisition mode. You do not need to connect any test equipment to the oscilloscope for this test.

1. Disconnect everything from the oscilloscope inputs.

2. Tap **File** > **Default Setup**.

3. Add the **AC RMS** measurement:

   a. Tap the **Add New... Measure** button.

   b. Set the **Source** to the channel being tested.

   c. In the **Amplitude Measurements** panel, double-tap the **AC RMS** measurement button to add the measurement badge to the Results bar.

   d. Tap outside the menu to close it.

   e. Double-tap the **AC RMS** measurement badge and tap **Show Statistics in Badge** to display statistics in the measurement badge.

   f. Tap the **Filter / Limit Results** panel.

   g. Turn on **Limit Measurement Population**.

   h. Set the limit to **100**.

   i. Tap outside the menu to close it.

4. Set up the Horizontal mode:

   a. Double-tap the **Horizontal** setting badge.

   b. Set **Horizontal Mode** to **Manual**.

   c. Set the **Sample Rate** to **25 GS/s**.

   d. Set the **Record Length** to **2 Mpts**.

   e. Tap outside the menu to close it.

5. Double-tap the Channel badge of the channel being tested.

6. Set the **Vertical Scale** value to **1 mV**.

7. *Check **50 Ω** termination as follows:*

   a. In the Channel badge, set **Termination** to **50 Ω**.

   b. Tap the **Bandwidth Limit** field and select the highest frequency listed.

   c. Set the channel vertical Position value to **340 mdivs**.

   d. Once the measurement count (N) in the measurement badge reaches 100, record the AC RMS Mean value (the **μ** readout).

   e. Set the channel vertical Position value to **360 mdivs**.

   f. Once the measurement count (N) in the measurement badge reaches 100, record the AC RMS Mean value (the **μ** readout).

   g. Average the two values and record the result in the **1 mV/div** row of the **50 Ω** column of the Test Result record.

8. Repeat step *7* on page 88 for all frequencies above 4 GHz

9. *Repeat the 50 Ω test at all V/div settings for the current channel:*

   a. In the Channel badge, set the **Vertical Scale** setting to the next value in the test record (2`mV, 5`mV, and so on, up to 1`V/div).

   b. Repeat steps *7* on page 88 through *8* on page 88.

10. *Repeat all tests for the remaining input channels:*

   a. Double-tap the **AC RMS** measurement badge.

   b. Tap the **Configure** panel.

   c. Tap the **Source 1** field and select the next channel to test.

- **d.** Double-tap the channel badge of the channel that you have finished testing and set **Display** to **Off**.
- **e.** Tap the channel button on the oscilloscope Settings bar of the next channel to test.
- **f.** Double-tap the channel badge for the channel being tested.
- **g.** Starting at step *6* on page 88, repeat these procedures for each input channel.

Check random noise, High Res mode

This test checks random noise at 1 M Ω and 50 Ω for each channel in High Res acquisition mode. You do not need to connect any test equipment to the oscilloscope for this test.

1. Disconnect everything from the oscilloscope inputs.
2. Tap **File** > **Default Setup**.
3. Double-tap the **Acquisition** badge and set **Acquisition Mode** to **High Res**.
4. Add the **AC RMS** measurement:
   - **a.** Tap the **Add New... Measure** button to open the **Add Measurements** menu.
   - **b.** Set the **Source** to the channel being tested.
   - **c.** In the **Amplitude Measurements** panel, double-tap the **AC RMS** button to add the measurement badge to the Results bar.
   - **d.** Tap outside the menu to close it.
   - **e.** Double-tap the **AC RMS** measurement badge and tap **Show Statistics in Badge** to display statistics in the measurement badge.
   - **f.** Tap the **Filter/Limit Results** panel.
   - **g.** Turn on **Limit Measurement Population**.
   - **h.** Set the limit to **100**.
   - **i.** Tap outside the menu to close it.
5. Set up the Horizontal mode:
   - **a.** Double-tap the **Horizontal** setting badge.
   - **b.** Set Horizontal Mode to **Manual**.
   - **c.** Set the Sample rate to **12.5 GS/s**.
   - **d.** Set the Record Length to **2 Mpts**.
   - **e.** Tap outside the menu to close it.
6. *Check **1 M Ω** termination as follows:*
   - **a.** Double-tap the Channel badge of the channel being tested.
   - **b.** Set the **Vertical Scale** value to **1 mV**.
   - **c.** Set **Termination** to **1 M Ω**.
   - **d.** Tap the **Bandwidth Limit** field and select the highest frequency listed.
   - **e.** Set the channel **Position** value to **340 mdivs**.
   - **f.** Once the measurement count (N) in the measurement badge reaches 100, record the AC RMS Mean value (the **µ** readout).
   - **g.** Set the channel **Position** value to **-340 mdivs**.
   - **h.** Once the measurement count (N) in the measurement badge reaches 100, record the AC RMS Mean value (the **µ** readout).
   - **i.** Average the two values and record the result in the **1 mV/div** row of the **1 MΩ** column of the random noise, High Res mode Test Result record.
7. Repeat step *6* on page 89 for all frequencies below 500`MHz
8. *Check **50 Ω** termination as follows:*
   - **a.** In the Channel badge, set **Termination** to **50 Ω**.
   - **b.** Tap the **Bandwidth Limit** field and select 4`GHz or the highest frequency listed.

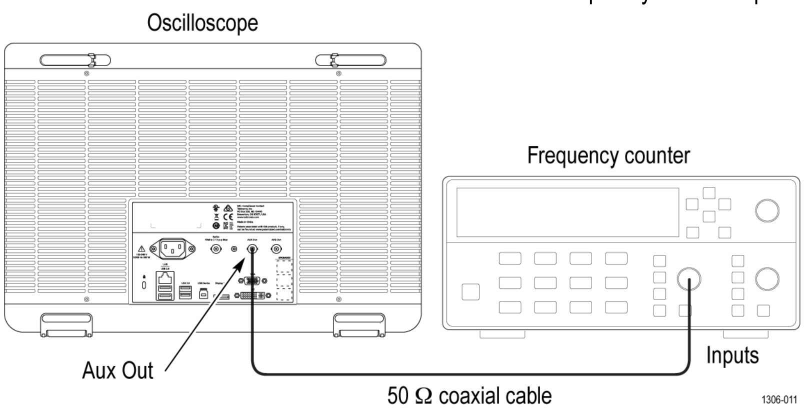
c. Set the channel **Position** value to **340 mdivs**.
d. Once the measurement count (N) in the measurement badge reaches 100, record the AC RMS Mean value (the **µ** readout).
e. Set the channel **Position** value to **-340 mdivs**.
f. Once the measurement count (N) in the measurement badge reaches 100, record the AC RMS Mean value (the **µ** readout).
g. Average the two values and record the result in the **1 mV/div** row of the **50 Ω** column of the random noise, High Res mode Test Result record.

9. Repeat step *8* on page 89 for all frequencies below 4`GHz.
10. *Repeat 1 MΩ and 50 Ω tests at all V/div settings for the current channel:*
    a. In the Channel badge, set the **Vertical Scale** setting to the next value in the test record (2`mV, 5`mV, and so on, up to 1`V/div).
    b. Repeat steps *6* on page 89 through *9* on page 90.
11. *Repeat all tests for the remaining input channels:*
    a. Double-tap the **AC RMS** measurement badge.
    b. Tap the **Configure** panel.
    c. Tap the **Source 1** field and select the next channel to test.
    d. Double-tap the channel badge of the channel that you have finished testing and set **Display** to **Off**.
    e. Tap the channel button on the oscilloscope Settings bar of the next channel to test.
    f. Double-tap the channel badge for the channel being tested.
    g. Starting at step *6* on page 89, repeat these procedures for each input channel.

Check long term samples rate and delay time accuracy

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

1. Connect a 50 Ω cable from the Aux Out connector to the frequency counter input as shown in the following figure.



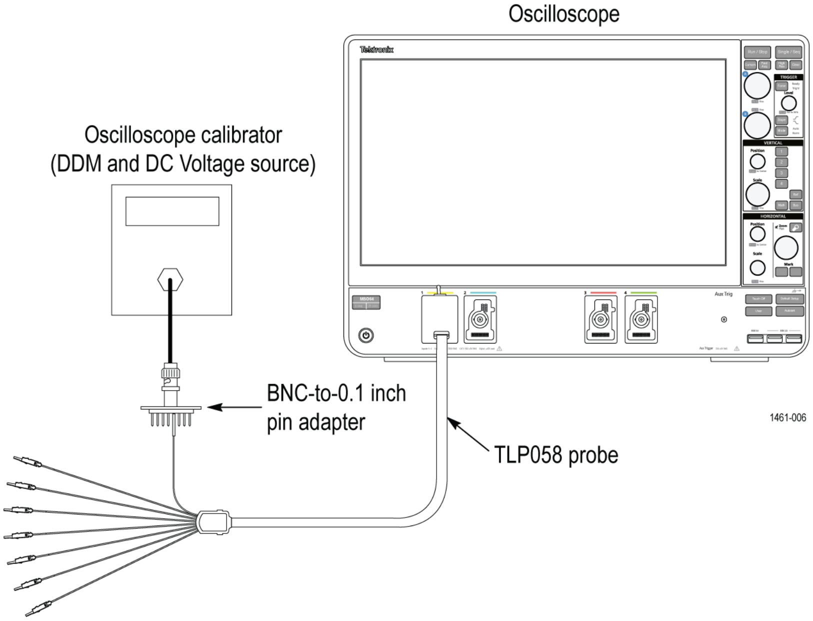
2. Tap **File** > **Default Setup**.
3. Tap **Utility** > **I/O**.
4. Tap **AUX OUT** to open its configuration menu.
5. Tap **Reference Clock** to send the clock to the **Aux Out** connector.
6. Check the reading on the frequency counter. Enter the value in the Test record.

Check digital threshold accuracy

This test checks the threshold accuracy of the logic probe digital channels D0-D7 at 0 V and 25 °C, for all oscilloscope input channels.

Note: Threshold Accuracy is a function of the logic probe only. It is a typical specification. The Threshold Accuracy test checks the typical logic probe performance, and may be considered a functional check of the oscilloscope digital input.

1. Connect the TLP058 digital probe to channel 1.



2. Connect the DC voltage source to digital channel **D0**.

   Warning: Set the generator output to Off or 0 volts before connecting, disconnecting, or moving the test hookup during the performance of this procedure. The generator is capable of providing dangerous voltages.

   If you are using the Fluke 9500 calibrator as the DC voltage source, connect the calibrator head to the digital channel D0, using the BNC-to-0.1 inch pin adapter listed in the *Required equipment* table. Be sure to connect channel D0 to both the corresponding signal pin and to a ground pin on the adapter.
3. Tap **File** > **Default Setup**. This resets the instrument and adds the channel 1 badge and signal to the display.
4. *Display the digital channels and set the thresholds as follows:*
   a. Double-tap the badge of the channel under test on the Settings bar.
   b. Double-tap the **Threshold** field at the bottom of the menu and set the value to **0 V**.
   c. Tap **Set All Thresholds**. All thresholds are now set for the 0 V threshold check.
   d. Tap outside the menu to close it.
5. Double-tap the **Horizontal** badge in the Settings bar.
6. Set the **Horizontal Scale** to **10 ns/div**.
7. Tap outside the menu to close it.
8. Set the calibrator DC voltage output (Vs) to **-400 mV**.
9. Wait 1 second. Verify that the logic level is low on **D0**.
10. Increment Vs by **+10 mV**. Wait 1 second and check the logic level of the channel D0 signal display.

    If the signal level is a logic low or is alternating between high and low, continue to increment Vs by +10 mV, wait 1 second, and check the logic level until the logic state is a steady high.
11. Record this Vs value as **Vs-** for D0 of the test record.
12. Double-tap the **Trigger** badge and set the **Slope** to **Falling** edge.
13. Set the DC voltage source (Vs) to **+400 mV**.
14. Wait 1 second. Verify that the logic level is high.
15. Decrement Vs by **-10 mV**. Wait 1 second and check the logic level of the channel D0 signal display.

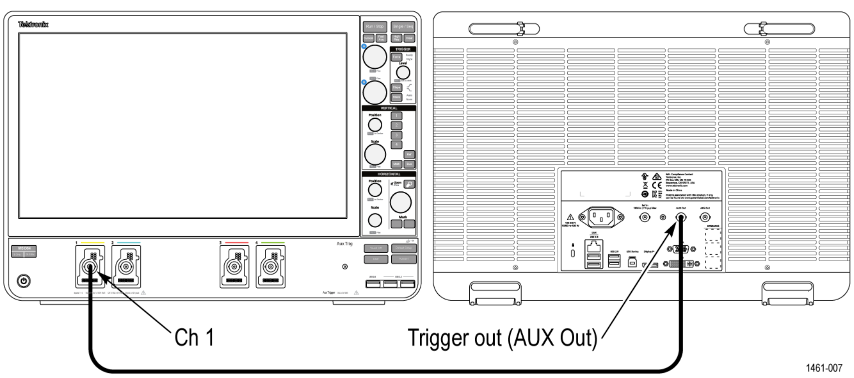
If the signal level is a logic high or is alternating between high and low, continue to decrement Vs by -10 mV, wait 1 second, and check the logic level until the logic state is a steady low.

16. Record this Vs value as **Vs+** for D0 of the test record.
17. Find the average using this formula: $V_{sAvg} = (V_{s-} + V_{s+})/2$.
18. Record the average as the test result for D0 in the test record. The test result should be between the low and high limits.
19. *Repeat the procedure for all remaining digital channels as follows:*
    a. Connect the next digital channel to be tested (D1, D2, and so on) to the DC voltage source.
    b. Repeat steps *8* on page 91 through *19* on page 92, until all digital channels have been tested for this input channel.
20. *Repeat the procedure for all remaining input channels as follows:*
    a. Move the TLP058 digital probe from channel 1 to channel 2.
    b. Set the generator output to 0 volts and Off.
    c. Repeat steps starting at *2* on page 91 for the channel being tested (channel 2, channel 3, and so on).

Check AUX Out output voltage levels

This test checks the output voltage levels from the AUX Out connector.

1. Use a 50 Ω cable to connect the AUX Out signal from the rear of the instrument to the channel 1 input of the same instrument, as shown in the following illustration.



2. Tap **File** > **Default Setup**. This resets the instrument and adds the channel 1 badge and signal to the display.
3. Double-tap the badge of the channel 1 badge to open its configuration menu.
4. Set the **Vertical Scale** to **1 V/div**.
5. Tap outside the menu to close it.
6. Double-tap the **Horizontal** badge in the Settings bar.
7. Set the **Horizontal Scale** to **400 ns/div**.
8. Tap outside the menu to close it.
9. *Record the Maximum and Minimum measurements at 1 MΩ termination as follows:*
    a. Tap the **Add New... Measure** button.
    b. In the Amplitude Measurements panel, set the **Source** to **Ch 1**.
    c. Double-tap the **Maximum** button to add the measurement badge to the Results bar.
    d. Double-tap the **Minimum** button to add the measurement badge to the Results bar.
    e. Tap outside the menu to close it.
    f. Double-tap the **Maximum** results badge.

g. Tap **Show Statistics in Badge**.
h. Tap **FILTER/LIMIT RESULTS** to open the panel.
i. Tap **Limit Measurement Population** to toggle it to **On**.
j. Tap outside the menu to close it.
k. Double-tap the **Minimum** results badge.
l. Tap **Show Statistics in Badge**.
m. Tap **FILTER/LIMIT RESULTS** to open the panel.
n. Tap **Limit Measurement Population** to toggle it to **On**.
o. Tap outside the menu to close it.
p. Enter the Maximum and Minimum measurement readings in the 1 MΩ row of the test record.

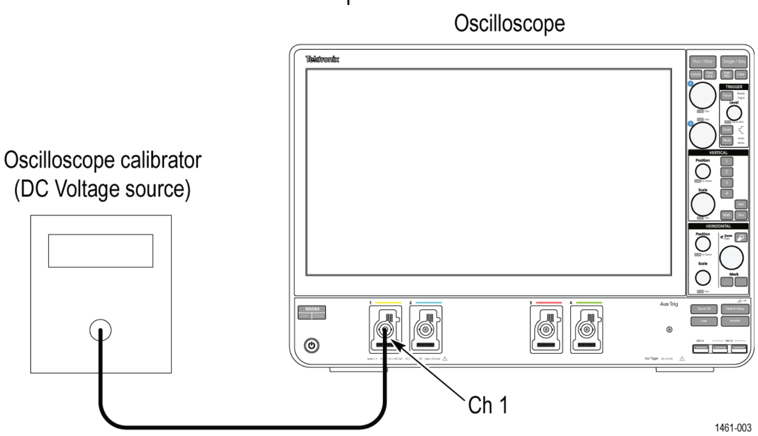
10. *Record the Maximum and Minimum measurements at 50 Ω termination as follows:*
    a. Double-tap the **Ch 1** badge to open its configuration menu.
    b. Set **Termination** to **50 Ω**.
    c. Tap outside the menu to close it.
    d. Enter the Maximum and Minimum measurement readings in the 50 Ω row of the test record.

Check DVM voltage accuracy (DC)

This test checks the DC voltage accuracy of the Digital Volt Meter (DVM) option. The DVM option is available for free when you register the instrument at tek.com.

Procedure

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.



Warning: Set the generator output to Off or 0 volts before connecting, disconnecting, or moving the test hookup during the performance of this procedure. The generator is capable of providing dangerous voltages.

2. Set the calibrator impedance to **1 MΩ**.
3. Tap **File** > **Default Setup**. This resets the instrument and adds the channel 1 badge and signal to the display.
4. *Set the channel settings:*
   a) Double tap the badge of the channel under test to open its menu.
   b) Check that **Position** is set to **0 divs**. If not, set the position to 0 divisions.
   c) Confirm that **Termination** is set to **1 MΩ**.
   d) Set the **Bandwidth Limit** to **20 MHz**.

5. Set the calibrator impedance to **1 MΩ**.
6. Double-tap the **Horizontal** badge and set **Horizontal Scale** to **1 ms/div**.
7. Tap outside the menu to close it.
8. Double-tap the **Acquisition** badge and set the **Acquisition Mode** to **Average**.
9. Verify or set the **Number of Waveforms** to **16**.
10. Tap outside the menu to close it.
11. Double-tap the **Trigger** badge and set the **Source** to **AC Line**.
12. Tap outside the menu to close it.
13. Tap the **DVM** button to add the DVM badge to the Results bar.
14. In the **DVM** menu, set **Source** to the channel to be tested.
15. Set **Mode** to **DC**.
16. Tap outside the menu to close it.
17. Set the calibrator to the input voltage shown in the test record (for example, –5 V for a 1V/div setting).
18. In the channel under test menu, set the **Offset** value to that shown in the test record (for example, –5 V for –5 V input and 1 V/div setting).
19. Set the **Vertical Scale** field to match the value in the test record (for example, 1 V/div).
20. Enter the measured value on the DVM badge into the DVM Voltage Accuracy Tests record.
21. Repeat the procedure (steps *17* on page 94, *18* on page 94, *19* on page 94 and *20* on page 94) for each volts/division setting shown in the test record.
22. Repeat all steps, starting with step *4* on page 93, for each oscilloscope channel to check. To set the next channel to test:
    a) Double tap the badge of the channel under test to open its menu.
    b) Set **Display** to **Off.**
    c) Tap the channel button in the Settings bar of the next channel to test to add that channel badge and signal to the display.

Check DVM voltage accuracy (AC)

This test checks the AC voltage accuracy of the Digital Volt Meter (DVM) option. The DVM option is available for free when you register the instrument at tek.com.

Procedure

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

   ⚠ **Warning:** Set the generator output to Off or 0 volts before connecting, disconnecting, or moving the test hookup during the performance of this procedure. The generator is capable of providing dangerous voltages.
2. Set the generator to **50 Ω** output impedance (50 Ω source impedance).
3. Set the generator to produce a square wave of the amplitude and frequency listed in the test record (for example, 20 mV_{pp} at 1 kHz).
4. Tap **File** > **Default Setup** to reset the instrument and add the channel 1 badge and signal to the display.
5. Tap the **DVM** button to add the DVM badge to the Results bar.
6. Set the DVM **Mode** to **AC RMS**.
7. In the DVM menu, set **Source** to the channel to be tested.
8. Double-tap the channel badge of the channel being tested to open its configuration menu.
9. Set **Termination** to **50 Ω**.
10. Use the **Vertical Scale** controls to set the signal height so that the signal covers between 4 and 8 vertical divisions on the screen.
11. Enter the DVM measured value in the test record.
12. Repeat steps *10* on page 94 and *11* on page 94 for each voltage and frequency combination shown in the record.
13. Repeat all steps to test all remaining oscilloscope channels. To set the next channel to test:

a) Double tap the badge of the channel under test to open its menu.
b) Set **Display** to **Off.**
c) Tap the channel button in the Settings bar of the next channel to test to add that channel badge and signal to the display.

Check trigger frequency accuracy and maximum input frequency

This test checks trigger frequency counter accuracy. The trigger frequency counter is part of the free DVM and trigger frequency option that is available when you register the instrument at tek.com.

Procedure

1. Tap **File** > **Default Setup** to reset the instrument and add the channel 1 badge and signal to the display.
2. Connect the **10 MHz Reference out** from the time mark generator to the **Ref In** connector on the back of the oscilloscope.
3. Connect the output of the time mark generator to the oscilloscope channel input being tested using a 50 Ω cable. Set the time mark generator to a 50 Ω source and a fast rising edge waveform (≥ 3 mV/ns).
4. Set the time mark generator frequency to the first value shown in the test record, starting at **100 Hz**.
5. Set the mark amplitude to **1 V** $_{pp}$, which makes a 2 divisions high waveform.
6. Double-tap the channel badge being tested (starting with channel 1) and set **Termination** to **50 Ω**.
7. Set the channel **Vertical Scale** to **500 mV/div**.
8. Tap outside the menu to close it.
9. Double-tap the **Acquisition** badge and set the **Timebase Reference Source** to **External (±2 ppm)** .
10. Tap outside the menu to close it.
11. Double-tap the **Horizontal** badge and use the **Horizontal Scale** controls to display at least 2 cycles of the waveform.
12. Tap outside the menu to close it.
13. Double-tap the **Trigger** badge to open its menu.
    a) Set the **Source** field to the input channel being tested.
    b) Tap the **Set to 50%** button to obtain a stable display.
    c) Tap the **Mode & Holdoff** panel to open the **Mode & Holdoff** configuration menu.
    d) In the **Mode & Hold Off** menu, set the **Trigger Frequency Counter** to **On**. The trigger frequency readout is at the bottom of the Trigger badge.
    e) Tap outside the menu to close it.
14. Double-tap the channel badge being tested (starting with channel 1) and use the **Position** controls to vertically center the time mark in the waveform graticule.
15. Enter the value of the trigger frequency (**F** readout in the **Trigger** badge) in the test record for that frequency.
16. Repeat this procedure for each frequency setting shown in the record. Make sure to adjust the Horizontal scale after each calibrator frequency change to show at least two cycles of the waveform on the screen.
17. Repeat all these steps to test each oscilloscope channel.

Arbitrary function generator

Check AFG sine and ramp frequency accuracy

This test verifies the frequency accuracy of the arbitrary function generator. All output frequencies are derived from a single internally generated frequency. Only one frequency point of channel 1 is required to be checked.

1. Connect a 50 Ω cable from the **AFG Out** connector to the frequency counter input as shown in the following figure.

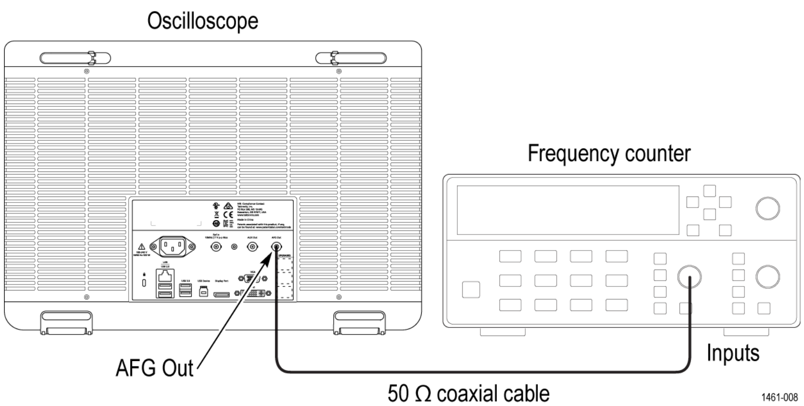


Figure 1: Frequency/period test

2. Tap **File** > **Default Setup** to set the instrument to the factory default settings.
3. Tap the **AFG** button to open the **AFG** menu.
4. Set the arbitrary function generator output as follows:

Select menu	Setting
Output	On
Waveform Type	Sine
Frequency	1.000000 MHz
Amplitude	1.00 V_{PP}

5. Turn on the frequency counter:
   a. Double-tap the **Trigger** badge to open its menu.
   b. Set the **Source** field to the input channel being tested.
   c. Tap the **Set to 50%** button to obtain a stable display.
   d. Tap the **Mode & Holdoff** panel to open the Mode & Holdoff configuration menu
   e. In the Mode & Hold Off menu, set the **Trigger Frequency Counter** to **On**. The trigger frequency readout is at the bottom of the Trigger badge.
   f. Tap outside the menu to close it.
6. Check that the reading of the frequency counter is between **0.999950 MHz** and **1.000050 MHz**. Enter the value in the Test record.
7. Set the arbitrary function generator output as follows:

Select menu	Setting
Waveform Type	Ramp
Frequency	500 kHz

8. Check that reading of the frequency counter is between **499.975 kHz** and **500.025 kHz**. Enter the value in the Test record.

Check AFG square and pulse frequency accuracy

This test verifies the frequency accuracy of the arbitrary function generator. All output frequencies are derived from a single internally generated frequency. Only one frequency point of channel 1 is required to be checked.

1. Connect the arbitrary function generator to the frequency counter as shown in the following figure.

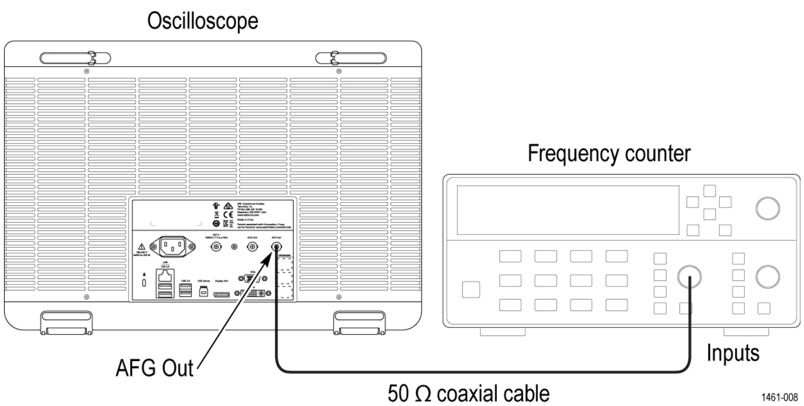


Figure 2: Frequency/period test

2. Tap **File** > **Default Setup** to set the instrument to the factory default settings.
3. Tap the **AFG** button to open the AFG menu.
4. Set the arbitrary function generator as follows:

Select menu	Setting
Waveform Type	Square
Frequency	1.000000 MHz
Amplitude	1.00 V_{PP}
Output	On

5. Turn on the frequency counter:
   a. Double-tap the **Trigger** badge to open its menu.
   b. Set the **Source** field to the input channel being tested.
   c. Tap the **Set to 50%** button to obtain a stable display.
   d. Tap the **Mode & Holdoff** panel to open the Mode & Holdoff configuration menu
   e. In the Mode & Hold Off menu, set the **Trigger Frequency Counter** to **On**. The trigger frequency readout is at the bottom of the Trigger badge.
   f. Tap outside the menu to close it.
6. Check that the frequency counter readout is between **0.999950 MHz** and **1.00005 MHz**. Enter the value in the Test record.
7. Set up the arbitrary function generator as follows:

Select menu	Setting
Waveform Type	Pulse

8. Check that reading of the frequency counter is between **0.999950 MHz** and **1.000050 MHz**. Enter the value in the Test record.

Check AFG signal amplitude accuracy

This test verifies the amplitude accuracy of the arbitrary function generator. All output amplitudes are derived from a combination of attenuators and 3 dB variable gain. Some amplitude points are checked. This test uses a 50 Ω terminator. It is necessary to know the accuracy of the 50 Ω terminator in advance of this amplitude test. This accuracy is used as a calibration factor.

1. Connect the 50 Ω terminator to the DMM as shown in the following figure and measure the resistance value.

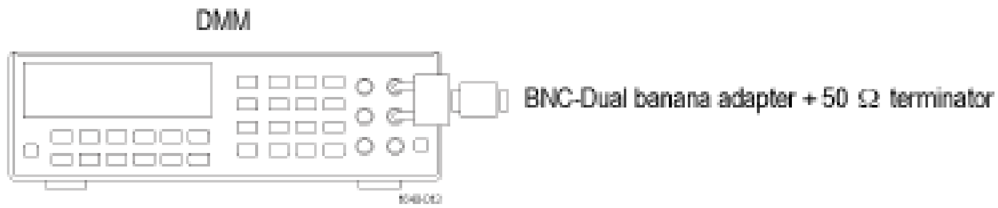


Figure 3: 50 Ω terminator accuracy

2. Calculate the 50 Ω calibration factor (CF) from the reading value and record as follows:

Table 6: CF (Calibration Factor) = 1.414 × ((50 / Measurement Ω) + 1)

Measurement (reading of the DMM)	Calculated CF

Examples:

For a measurement of 50.50 Ω, CF = 1.414 (50 / 50.50 + 1) = **2.814**.

For a measurement of 49.62 Ω, CF = 1.414 (50 / 49.62 + 1) = **2.839**.

3. Connect the arbitrary function generator output to the DMM as shown in the following figure. Be sure to connect the 50 Ω terminator to the **AFG Out** connector.

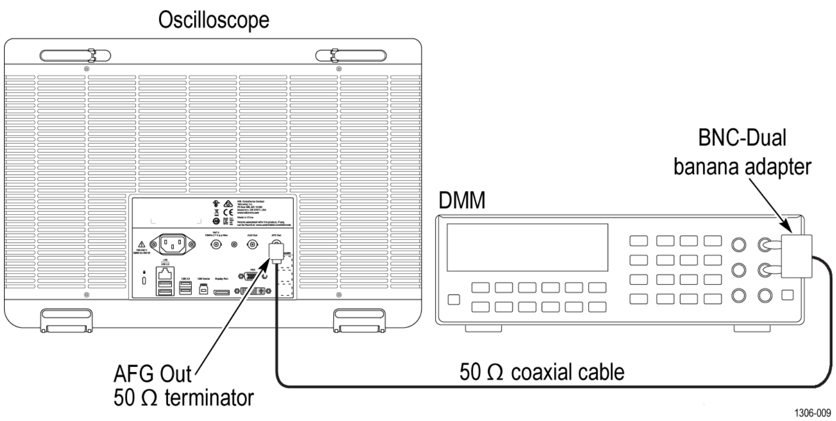


Figure 4: Amplitude test

4. Tap the **AFG** button and set up the arbitrary function generator output as follows:

Select menu	Setting
Waveform Type	Sine
Frequency	1.000000 kHz
Amplitude	30 mV_{PP}
Load Impedance	50 Ω
Output	On

5. Measure the **AC RMS** voltage readout on the DMM.
6. Multiply the DMM voltage by the calculated CF to get the corrected peak to peak voltage. Enter the resulting value in the Measurement field in the following table.
7. Change the AFG output amplitude to the next value in the table.

8. Repeat steps *5* on page 98 through *7* on page 98 for each amplitude value. Check that the peak to peak voltages are within the limits in the table below. Enter the values in the test record.

Waveform Type	Frequency	Amplitude	Measurement	Range
Sine	1.000 kHz	30.0 mV_{PP}		28.55 mV_{PP} - 31.45 mV_{PP}
Sine	1.000 kHz	300.0 mV_{PP}		294.5 mV_{PP} - 305.5 mV_{PP}
Sine	1.000 kHz	800.0 mV_{PP}		787.0 mV_{PP} - 813.0 mV_{PP}
Sine	1.000 kHz	1.500 V_{PP}		1.4765 V_{PP} - 1.5235 V_{PP}
Sine	1.000 kHz	2.000 V_{PP}		1.969 V_{PP} - 2.031 V_{PP}
Sine	1.000 kHz	2.500 V_{PP}		2.4615 V_{PP} - 2.5385 V_{PP}

Check AFG DC offset accuracy

This test verifies the DC offset accuracy of the arbitrary function generator. This test uses a 50 Ω terminator. It is necessary to know the accuracy of the 50 Ω terminator in advance of this test. This accuracy is used as a calibration factor.

1. Connect the 50 Ω terminator to the DMM as shown in the following figure and measure the resistance value.

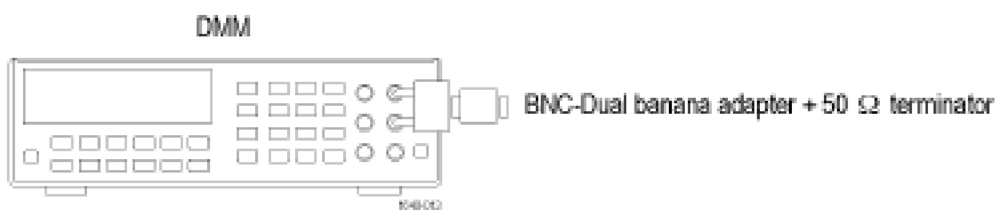


Figure 5: 50 Ω terminator accuracy

2. Calculate the 50 Ω calibration factor (CF) from the reading value and record as follows:

Table 7: CF (Calibration Factor) = 0.5 × ((50 / Measurement Ω) + 1)

Measurement (reading of the DMM)	Calculated CF

Examples:

- For a measurement of 50.50 Ω, CF = 0.5 (50 / 50.50 + 1) = **0.9951**.
- For a measurement of 49.62 Ω, CF = 0.5 (50 / 49.62 + 1) = **1.0038**.

3. Connect the arbitrary function generator output to the DMM as shown in the following figure. Be sure to connect the 50 Ω terminator to the arbitrary function generator **AFG Output** connector.

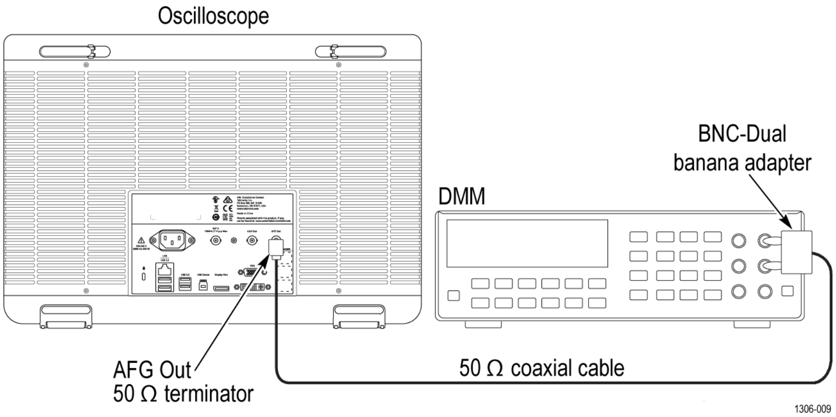


Figure 6: DC offset tests

4. Tap the **AFG** button and set up the arbitrary function generator as follows:

Select menu	Setting
Waveform Type	DC
Offset	+ 1.25 V
Output	On

5. Measure the voltage readout on the DMM.
6. Multiply the DMM voltage by the calculated CF to get the corrected offset voltage. Enter the resulting value in the Measurement field in the following table.

Function	Offset	Measurement	Range
DC	+ 1.25 Vdc	Vdc	1.23025 Vdc to 1.26975 Vdc
DC	0.000 Vdc	Vdc	- 0.001 Vdc to + 0.001 Vdc
DC	- 1.25 Vdc	Vdc	-1.26975 Vdc to -1.23025 Vdc

7. Change the AFG output amplitude to the next value in the table, measure the voltage readout on the DMM, multiply the DMM readout by the calculated CF to get the corrected offset voltage, and enter the resulting value in the Measurement field in the table.
8. Verify that the corrected offset measurements are within the range.

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