Specifications

All specifications are guaranteed unless noted otherwise. All specifications apply to all models unless noted otherwise.

Model overview

Oscilloscope

	MSO54	MSO56	MSO58
FlexChannel inputs	4	6	8
Maximum analog channels	4	6	8
Maximum digital channels (with optional logic probes)	32	48	64
Bandwidth (calculated rise time)	350 MHz (1.15 ns), 500 MHz (800 ps), 1 GHz (400 ps), 2 GHz (225 ps)		
DC Gain Accuracy	< 2 GHz models: 50 Ω: ±1.0%, (±2.0% at ≤ 1 mV/div) ±0.5% of full scale, (±1.0% of full scale at 1 mV/Div and 500 µV/Div Settings) 1 MΩ: ±1.0%, (±2.0% at ≤ 1 mV/div) ±0.5% of full scale, (±1.0% of full scale at 1 mV/Div and 500 µV/Div Settings) 2 GHz models: 50 Ω: ±1.2%, (±2.0% at ≤ 1 mV/div) ±0.6% of full scale, (±1.0% of full scale at 1 mV/Div and 500 µV/Div Settings) 1 MΩ: ±1.0%, (±2.0% at ≤ 1 mV/div) ±0.5% of full scale, (±1.0% of full scale at 1 mV/Div and 500 µV/Div Settings)		
ADC Resolution	12 bits		
Vertical Resolution	8 bits @ 6.25 GS/s 12 bits @ 3.125 GS/s 13 bits @ 1.25 GS/s (High Res) 14 bits @ 625 MS/s (High Res) 15 bits @ 312.5 MS/s (High Res) 16 bits @ ≤125 MS/s (High Res)		
Sample Rate	6.25 GS/s on all analog / digital channels (160 ps resolution)		
Record Length (std.)	62.5 Mpoints on all analog / digital channels		
Record Length (opt.)	125 Mpoints on all analog / digital channels		
Waveform Capture Rate	>500,000 wfms/s		
Arbitrary/Function Generator (opt.)	13 predefined waveform types with up to 50 MHz output		
DVM	4-digit DVM (free with product registration)		
Trigger Frequency Counter	8-digit frequency counter (free with product registration)		

Vertical system - analog channels

Bandwidth selections	50 Ω: 20 MHz, 250 MHz, and the full bandwidth value of your model 1 MΩ: 20 MHz, 250 MHz, 500 MHz
Input coupling	DC, AC
Input impedance	50 Ω ± 1% 1 MΩ ± 1% with 13.0 pF ± 1.5 pF (< 2 GHz models) 1 MΩ ± 1% with 14.5 pF ± 1.5 pF (2 GHz models)

Vertical system - analog channels

Input sensitivity range

1 MΩ	500 µV/div to 10 V/div in a 1-2-5 sequence
50 Ω	500 µV/div to 1 V/div in a 1-2-5 sequence
	Note: 500 µV/div is a 2X digital zoom of 1 mV/div

Maximum input voltage

50 Ω: 5 V_{RMS}, with peaks ≤ ±20 V (DF ≤ 6.25%)

1 MΩ: 300 V_{RMS} , CAT II

For 1 MΩ, derate at 20 dB/decade from 4.5 MHz to 45 MHz;

Derate at 14 dB/decade from 45 MHz to 450 MHz; > 450 MHz, 5.5 V_{RMS}

Effective bits (ENOB), typical

< 2 GHz models, High Res mode, 50 Ω, 10 MHz input with 90% full screen

Bandwidth	ENOB
1 GHz	7.6
500 MHz	7.9
350 MHz	8.2
250 MHz	8.1
20 MHz	8.9

2 GHz models, High Res mode, 50 Ω, 10 MHz input with 90% full screen

Bandwidth	ENOB
1 GHz	7.0
250 MHz	7.8
20 MHz	8.7

Vertical system - analog channels

Random noise, RMS, typical

2 GHz models, High Res mode (RMS)

2 GHz models	50 Ω			1 MΩ		
V/div	1 GHz	250 MHz	20 MHz	500 MHz	250 MHz	20 MHz
≤1 mV/div [3]	66.8 µV	66.8 µV	27.2 µV	208 µV	117 µV	64.6 µV
2 mV/div [4]	96.9 µV	77.5 µV	28.5 µV	224 µV	117 µV	66.7 µV
5 mV/div [5]	202 µV	108 µV	37.4 µV	238 µV	133 µV	68.7 µV
10 mV/div	275 µV	147 µV	56.1 µV	277 µV	173 µV	83.6 µV
20 mV/div	469 µV	251 µV	106 µV	416 µV	278 µV	125 µV
50 mV/div	1.10 mV	589 µV	253 µV	916 µV	620 µV	271 µV
100 mV/div	2.75 mV	1.47 mV	602 µV	1.90 mV	1.36 mV	603 µV
1 V/div	18.4 mV	10.8 mV	4.68 mV	20.3 mV	14.6 mV	6.54 mV

1 GHz, 500 MHz, 350 MHz models, High Res mode (RMS)

< 2 GHz models	50 Ω					1 MΩ			
V/div	1 GHz	500 MHz	350 MHz	250 MHz	20 MHz	500 MHz	350 MHz	250 MHz	20 MHz
≤1 mV/div [6]	254 µV	198 µV	141 µV	118 µV	70.0 µV	189 µV	143 µV	118 µV	64.8 µV
2 mV/div	255 µV	198 µV	143 µV	121 µV	70.4 µV	194 µV	145 µV	121 µV	66.0 µV
5 mV/div	262 µV	202 µV	150 µV	133 µV	72.8 µV	196 µV	152 µV	130 µV	69.6 µV
10 mV/div	283 µV	218 µV	169 µV	158 µV	79.8 µV	212 µV	167 µV	154 µV	78.2 µV
20 mV/div	357 µV	273 µV	222 µV	223 µV	102 µV	269 µV	214 µV	223 µV	104 µV
50 mV/div	677 µV	516 µV	436 µV	460 µV	196 µV	490 µV	410 µV	480 µV	207 µV
100 mV/div	1.61 mV	1.23 mV	1.02 mV	1.04 mV	464 µV	1.16 mV	964 µV	1.05 mV	475 µV
1 V/div	13.0 mV	9.88 mV	8.41 mV	8.94 mV	3.77 mV	13.6 mV	10.6 mV	11.1 mV	5.47 mV

Position range ±5 divisions

3 Bandwidth at ≤ 1 mV/div is limited to 175 MHz in 50 Ω.

4 Bandwidth at 2 mV/div is limited to 350 MHz in 50 Ω.

5 Bandwidth at 5 mV/div is limited to 1.5 GHz in 50 Ω.

6 Bandwidth at 500 µV/div is limited to 250 MHz in 50 Ω.

Vertical system - analog channels

Offset ranges, maximum

2 GHz models

Volts/div Setting	Maximum offset range, 50 Ω Input
500 µV/div - 50 mV/div	±1 V
51 mV/div - 99 mV/div	± (-10 * (Volts/div Setting) + 1.5 V)
100 mV/div - 500 mV/div	±10 V
501 mV/div - 1 V/div	± (-10 * (Volts/div Setting) + 15 V)

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

≤ 1 GHz models

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

Offset accuracy	±(0.005 X | offset - position | + DC balance)
Crosstalk (channel isolation), typical	≥ 200:1 up to the rated bandwidth for any two channels having equal Volts/div settings
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) 0.4 div at 500 µV/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) 0.4 div at 500 µV/div with DC-1 MΩ scope input impedance (50 Ω BNC terminated)

Vertical system - digital channels

Number of channels	8 digital inputs (D7-D0) per installed TLP058 (traded off for one analog channel)
Vertical resolution	1 bit
Maximum input toggle rate	500 MHz
Minimum detectable pulse width, typical	1 ns
Thresholds	One threshold per digital channel
Threshold range	±40 V
Threshold resolution	10 mV
Threshold accuracy	± [100 mV + 3% of threshold setting after calibration]

Vertical system - digital channels

Input hysteresis, typical	100 mV at the probe tip
Input dynamic range, typical	30 V_{pp} for F_{in} ≤ 200 MHz, 10 V_{pp} for F_{in} > 200 MHz
Absolute maximum input voltage, typical	±42 V peak
Minimum voltage swing, typical	400 mV peak-to-peak
Input impedance, typical	100 kΩ
Probe loading, typical	2 pF

Horizontal system

Time base range	200 ps/div to 1,000 s/div
Sample rate range	1.5625 S/s to 6.25 GS/s (real time) 12.5 GS/s to 500 GS/s (interpolated)
Record length range	
Standard	1 kpoints to 62.5 Mpoints in single sample increments
Option 5-RL-125M	125 Mpoints
Maximum duration at highest sample rate	10 ms (std.) or 20 ms (opt.)
Time base delay time range	-10 divisions to 5,000 s
Deskew range	-125 ns to +125 ns with a resolution of 40 ps
Timebase accuracy	±2.5 x 10^{-6} over any ≥1 ms time interval

Description	Specification
Factory Tolerance	±5.0 x10^{-7} At calibration, 23 °C ambient, over any ≥1 ms interval
Temperature stability	±5.0 x10^{-7} Tested at operating temperatures
Crystal aging	±1.5 x 10^{-6} . Frequency tolerance change at 25 °C over a period of 1 year

Horizontal system

Delta-time measurement accuracy, nominal

$$DTA_{pp}(typical) = 10 \times \sqrt{\left(\frac{N}{SR_1}\right)^2 + \left(\frac{N}{SR_2}\right)^2 + \left(0.450\ ps + \left(1 \times 10^{-11} \times t_p\right)\right)^2} + TBA \times t_p$$

$$DTA_{RMS} = \sqrt{\left(\frac{N}{SR_1}\right)^2 + \left(\frac{N}{SR_2}\right)^2 + \left(0.450\ ps + \left(1 \times 10^{-11} \times t_p\right)\right)^2} + TBA \times t_p$$

(assume edge shape that results from Gaussian filter response)

The formula to calculate delta-time measurement accuracy (DTA) for a given instrument setting and input signal assumes insignificant signal content above Nyquist frequency, where:

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

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

N = input-referred guaranteed noise limit (V_{RMS})

TBA = timebase accuracy or Reference Frequency Error

t_p = delta-time measurement duration (sec)

Aperture uncertainty	≤ 0.450 ps + $(1 * 10^{-11} *$ Measurement Duration$)_{RMS}$, for measurements having duration ≤ 100 ms
Delay between analog channels, full bandwidth, typical	≤ 100 ps for any two channels with input impedance set to 50 Ω, DC coupling with equal Volts/div or above 10 mV/div
Delay between analog and digital FlexChannels, typical	< 1 ns when using a TLP058 and a passive probe matching the bandwidth of the scope, with no bandwidth limits applied
Delay between any two digital FlexChannels, typical	320 ps
Delay between any two bits of a digital FlexChannel, typical	160 ps

Trigger system

Trigger modes	Auto, Normal, and Single
Trigger coupling	DC, HF Reject (attenuates > 50 kHz), LF Reject (attenuates < 50 kHz), noise reject (reduces sensitivity)
Trigger holdoff range	0 ns to 10 seconds
Trigger jitter, typical	≤ 5 ps_{RMS} for sample mode and edge-type trigger ≤ 7 ps_{RMS} for edge-type trigger and FastAcq mode ≤ 40 ps_{RMS} for non edge-type trigger modes

Trigger system

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
50 Ω path, 1 GHz, 500 MHz, 350 MHz models		The greater of 5.6 mV or 0.7 div from DC to the lesser of 500 MHz or instrument BW, & 7 mV or 0.8 div from > 500 MHz to instrument bandwidth
50 Ω path, 2 GHz models	0.5 mV/div to 0.99 mV/div	3.0 div from DC to instrument bandwidth
	1 mV/div to 9.98 mV/div	1.5 divisions from DC to instrument bandwidth
	≥ 10 mV/div	< 1.0 division from DC to instrument bandwidth
Line		Fixed

Trigger level ranges

Source	Range
Any Channel	±5 divs from center of screen
Line	Fixed at about 50% of line voltage

This specification applies to logic and pulse thresholds.

Trigger frequency counter 8-digits (free with product registration)

Trigger types

Edge: Positive, negative, or either slope on any channel. Coupling includes DC, AC, noise reject, HF reject, and LF reject

Pulse Width: Trigger on width of positive or negative pulses. Event can be time- or logic-qualified

Timeout: Trigger on an event which remains high, low, or either, for a specified time period. Event can be logic-qualified

Runt: Trigger on a pulse that crosses one threshold but fails to cross a second threshold before crossing the first again. Event can be time- or logic-qualified

Window: Trigger on an event that enters, exits, stays inside or stays outside of a window defined by two user-adjustable thresholds. Event can be time- or logic-qualified

Logic: Trigger when logic pattern goes true, goes false, or occurs coincident with a clock edge. Pattern (AND, OR, NAND, NOR) specified for all input channels defined as high, low, or don't care. Logic pattern going true can be time-qualified

Setup & Hold: Trigger on violations of both setup time and hold time between clock and data present on any input channels

Rise / Fall Time: Trigger on pulse edge rates that are faster or slower than specified. Slope may be positive, negative, or either. Event can be logic-qualified

Video (option 5-VID): Trigger on all lines, odd, even, or all fields of NTSC, PAL, and SECAM video signals

Sequence: Trigger on B event X time or N events after A trigger with a reset on C event. In general, A and B trigger events can be set to any trigger type with a few exceptions: logic qualification is not supported, if A event or B event is set to Setup & Hold, then the other must be set to Edge, and Ethernet and High Speed USB (480 Mbps) are not supported

Visual trigger Qualifies standard triggers by scanning all waveform acquisitions and comparing them to on-screen areas (geometric shapes). An unlimited number of areas can be defined with In, Out, or Don't Care as the qualifier for each area. A boolean expression can be defined using any combination of visual trigger areas to further qualify the events that get stored into acquisition memory. Shapes include rectangle, triangle, trapezoid, hexagon and user-defined.

Parallel Bus: Trigger on a parallel bus data value. Parallel bus can be from 1 to 64 bits (from the digital and analog channels) in size. Supports Binary and Hex radices

I^2C Bus (option 5-SREMBD): Trigger on Start, Repeated Start, Stop, Missing ACK, Address (7 or 10 bit), Data, or Address and Data on I^2C buses up to 10 Mb/s

SPI Bus (option 5-SREMBD): Trigger on Slave Select, Idle Time, or Data (1-16 words) on SPI buses up to 20 Mb/s

RS-232/422/485/UART Bus (option 5-SRCOMP): Trigger on Start Bit, End of Packet, Data, and Parity Error up to 15 Mb/s

CAN Bus (option 5-SRAUTO): Trigger on Start of Frame, Type of Frame (Data, Remote, Error, or Overload), Identifier, Data, Identifier and Data, End Of Frame, Missing Ack, and Bit Stuff Error on CAN buses up to 1 Mb/s

Trigger system

CAN FD Bus (option 5-SRAUTO):	Trigger on Start of Frame, Type of Frame (Data, Remote, Error, or Overload), Identifier (Standard or Extended), Data (1-8 bytes), Identifier and Data, End Of Frame, Error (Missing Ack, Bit Stuffing Error, FD Form Error, Any Error) on CAN FD buses up to 16 Mb/s
LIN Bus (option 5-SRAUTO):	Trigger on Sync, Identifier, Data, Identifier and Data, Wakeup Frame, Sleep Frame, and Error on LIN buses up to 1 Mb/s
FlexRay Bus (option 5-SRAUTO):	Trigger on Start of Frame, Indicator Bits (Normal, Payload, Null, Sync, Startup), Frame ID, Cycle Count, Header Fields (Indicator Bits, Identifier, Payload Length, Header CRC, and Cycle Count), Identifier, Data, Identifier and Data, End Of Frame, and Errors on FlexRay buses up to 10 Mb/s
SENT Bus (option 5-SRAUTOSEN)	Trigger on Start of Packet, Fast Channel Status and Data, Slow Channel Message ID and Data, and CRC Errors
SPMI Bus (option 5-SRPM):	Trigger on Sequence Start Condition, Reset, Sleep, Shutdown, Wakeup, Authenticate, Master Read, Master Write, Register Read, Register Write, Extended Register Read, Extended Register Write, Extended Register Read Long, Extended Register Write Long, Device Descriptor Block Master Read, Device Descriptor Block Slave Read, Register 0 Write, Transfer Bus Ownership, and Parity Error
USB 2.0 LS/FS/HS Bus (option 5-SRUSB2):	Trigger on Sync, Reset, Suspend, Resume, End of Packet, Token (Address) Packet, Data Packet, Handshake Packet, Special Packet, Error on USB buses up to 480 Mb/s
Ethernet Bus (option 5-SRENET):	Trigger on Start of Frame, MAC Addresses, MAC Q-tag, MAC Length/Type, MAC Data, IP Header, TCP Header, TCP/IPV4 Data, End of Packet, and FCS (CRC) Error on 10BASE-T and 100BASE-TX buses
Audio (I^2S, LJ, RJ, TDM) Bus (option 5-SRAUDIO):	Trigger on Word Select, Frame Sync, or Data. Maximum data rate for I^2S/LJ/RJ is 12.5 Mb/s. Maximum data rate for TDM is 25 Mb/s
MIL-STD-1553 Bus (option 5-SRAERO):	Trigger on Sync, Command (Transmit/Receive Bit, Parity, Subaddress / Mode, Word Count / Mode Count, RT Address), Status (Parity, Message Error, Instrumentation, Service Request, Broadcast Command Received, Busy, Subsystem Flag, Dynamic Bus Control Acceptance, Terminal Flag), Data, Time (RT/IMG), and Error (Parity Error, Sync Error, Manchester Error, Non-contiguous Data) on MIL-STD-1553 buses
ARINC 429 Bus (option 5-SRAERO):	Trigger on Word Start, Label, Data, Label and Data, Word End, and Error (Any Error, Parity Error, Word Error, Gap Error) on ARINC 429 buses up to 1 Mb/s

Acquisition system

Sample	Acquires sampled values
Peak Detect	Captures glitches as narrow as 640 ps at all sweep speeds
Averaging	From 2 to 10,240 waveforms
Envelope	Min-max envelope reflecting Peak Detect data over multiple acquisitions
High Res	Applies a unique Finite Impulse Response (FIR) filter for each sample rate that maintains the maximum bandwidth possible for that sample rate while preventing aliasing and removing noise from the oscilloscope amplifiers and ADC above the usable bandwidth for the selected sample rate. High Res mode always provides at least 12 bits of vertical resolution and extends all the way to 16 bits of vertical resolution at ≤ 125 MS/s sample rates.
FastAcq®	FastAcq optimizes the instrument for analysis of dynamic signals and capture of infrequent events by capturing >500,000 wfms/s (one channel active; >100K wfms/s with all channels active).
Roll mode	Scrolls sequential waveform points across the display in a right-to-left rolling motion, at timebase speeds of 40 ms/div and slower, when in Auto trigger mode.
FastFrame™	Acquisition memory divided into segments. Maximum trigger rate >5,000,000 waveforms per second Minimum frame size = 50 points Maximum Number of Frames: For frame size ≥ 1,000 points, maximum number of frames = record length / frame size. For 50 point frames, maximum number of frames = 950,000

Waveform measurements

Cursor types

Waveform, V Bars, H Bars, V&H Bars, and Polar (XY/XYZ plots only)

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 + 0.1 * 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| + 0.05 div)

Automatic measurements

36, of which an unlimited number can be displayed as either individual measurement badges or collectively in a measurement results table

Amplitude measurements

Amplitude, Maximum, Minimum, Peak-to-Peak, Positive Overshoot, Negative Overshoot, Mean, RMS, AC RMS, Top, Base, and Area

Timing measurements

Period, Frequency, Unit Interval, Data Rate, Positive Pulse Width, Negative Pulse Width, Skew, Delay, Rise Time, Fall Time, Phase, Rising Slew Rate, Falling Slew Rate, Burst Width, Positive Duty Cycle, Negative Duty Cycle, Time Outside Level, Setup Time, Hold Time, Duration N-Periods, High Time, and Low Time

Jitter measurements (standard)

TIE and Phase Noise

Measurement statistics

Mean, Standard Deviation, Maximum, Minimum, and Population. Statistics are available on both the current acquisition and all acquisitions

Reference levels

User-definable reference levels for automatic measurements can be specified in either percent or units. Reference levels can be set to global for all measurements, per source channel or signal, or unique for each measurement

Gating

Screen, Cursors, Logic, Search, or Time. Specifies the region of an acquisition in which to take measurements. Gating can be set to Global (affects all measurements set to Global) or Local (all measurements can have a unique Time gate setting; only one Local gate is available for Screen, Cursors, Logic, and Search actions).

Measurement plots

Histogram, Time Trend, Spectrum, Eye Diagram (TIE measurement only), Phase Noise (Phase Noise measurement only)

Measurement limits

Pass/fail testing for user-definable limits on measurement values. Act on event for measurement value failures include Save Screen Capture, Save Waveform, System Request (SRQ), and Stop Acquisitions

Inverter Motor Drive Analysis (option 5-IMDA) adds the following:

Measurements

Input Analysis (Power Quality, Harmonics, Input Voltage, Input Current, Input Power)

Ripple analysis (Line ripple, Switching Ripple)

Output analysis (Phasor Diagram, Efficiency)

Measurement plots

Harmonics Bar Graph, Phasor Diagram

Jitter analysis (option 5-DJA) adds the following:

Measurements

Jitter Summary, TJ@BER, RJ- δδ, DJ- δδ, PJ, RJ, DJ, DDJ, DCD, SRJ, J2, J9, NPJ, F/2, F/4, F/8, Eye Height, Eye Height@BER, Eye Width, Eye Width@BER, Eye High, Eye Low, Q-Factor, Bit High, Bit Low, Bit Amplitude, DC Common Mode, AC Common Mode (Pk-Pk), Differential Crossover, T/nT Ratio, SSC Freq Dev, SSC Modulation Rate

Measurement plots

Eye Diagram and Jitter Bathtub

Fast eye rendering: Shows the Unit Intervals (UIs) that define the boundaries of the eye along with a user specified number of surrounding UIs for added visual context

Complete eye rendering: Shows all valid Unit Intervals (UIs)

Waveform measurements

Measurement limits	Pass/fail testing for user-definable limits on measurement values. Act on event for measurement value failures include Save Screen Capture, Save Waveform, System Request (SRQ), and Stop Acquisitions
Eye diagram mask testing	Automated mask pass/fail testing

Power analysis (option 5-PWR) adds the following:	
Measurements	Input Analysis (Frequency, V_{RMS}, I_{RMS}, voltage and current Crest Factors, True Power, Apparent Power, Reactive Power, Power Factor, Phase Angle, Harmonics, Inrush Current, Input Capacitance)
	Amplitude Analysis (Cycle Amplitude, Cycle Top, Cycle Base, Cycle Maximum, Cycle Minimum, Cycle Peak-to-Peak)
	Timing Analysis (Period, Frequency, Negative Duty Cycle, Positive Duty Cycle, Negative Pulse Width, Positive Pulse Width)
	Switching Analysis (Switching Loss, dv/dt, di/dt, Safe Operating Area, R_{DSon})
	Magnetic Analysis (Inductance, I vs. Intg(V), Magnetic Loss, Magnetic Property)
	Output Analysis (Line Ripple, Switching Ripple, Efficiency, Turn-on Time, Turn-off Time)
	Frequency Response Analysis (Control Loop Response Bode Plot, Power Supply Rejection Ratio, Impedance)
Measurement Plots	Harmonics Bar Graph, Switching Loss Trajectory Plot, and Safe Operating Area
Measurement limits	Pass/fail testing for user-definable limits on measurement values. Act on event for measurement value failures include Save Screen Capture, Save Waveform, System Request (SRQ), and Stop Acquisitions

Digital power management (option 5-DPM) adds the following:	
Measurements	Ripple Analysis (Ripple)
	Transient Analysis (Overshoot, Undershoot, Turn On Overshoot, DC Rail Voltage)
	Power Sequence Analysis (Turn-on, Turn-off)
	Jitter Analysis (TIE, PJ, RJ, DJ, Eye Height, Eye Width, Eye High, Eye Low)

Digital Power Management Basic (option 5-DPMBAS) adds the following:	
Measurements	Ripple Analysis (Ripple)
	Transient Analysis (Overshoot, Undershoot)
	Power Sequence Analysis (Turn-on, Turn-off)

LVDS debug and analysis option (option 5-DBLVDS) adds the following:	
Data Lane Measurements	Generic Test (Unit Interval, Rise Time, Fall Time, Data Width, Data Intra Skew (PN), Data Inter Skew (Lane-to-Lane), Data Peak-to-Peak)
	Jitter Test (AC Timing, Clock Data Setup Time, Clock Data Hold Time, Eye Diagram (TIE), TJ@BER, DJ Delta, RJ Delta, DDJ, De-Emphasis Level)
Clock Lane Measurements	Generic Test (Frequency, Period, Duty Cycle, Rise Time, Fall Time, Clock Intra Skew (PN), Clock Peak-to-Peak)
	Jitter Test (TIE, DJ, RJ)
	SSC On (Mod Rate, Frequency Deviation Mean)

Waveform math

Number of math waveforms	Unlimited
Arithmetic	Add, subtract, multiply, and divide waveforms and scalars
Algebraic expressions	Define extensive algebraic expressions including waveforms, scalars, user-adjustable variables, and results of parametric measurements. Perform math on math using complex equations. For example (Integral (CH1 - Mean(CH1)) X 1.414 X VAR1)
Math functions	Invert, Integrate, Differentiate, Square Root, Exponential, Log 10, Log e, Abs, Ceiling, Floor, Min, Max, Degrees, Radians, Sin, Cos, Tan, ASin, ACos, and ATan
Relational	Boolean result of comparison >, <, ≥, ≤, =, and ≠
Logic	AND, OR, NAND, NOR, XOR, and EQV
Filtering function	User-definable filters. Users specify a file containing the coefficients of the filter
FFT functions	Spectral Magnitude and Phase, and Real and Imaginary Spectra
FFT vertical units	Magnitude: Linear and Log (dBm) Phase: Degrees, Radians, and Group Delay
FFT window functions	Hanning, Rectangular, Hamming, Blackman-Harris, Flattop2, Gaussian, Kaiser-Bessel, and TekExp

Spectrum View

Center Frequency	Limited by instrument analog bandwidth
Span	18.6 Hz to 312.5 MHz 18.6 Hz to 500 MHz (with option 5-SV-BW-1) Coarse adjustment in a 1-2-5 sequence
RF vs. Time Traces	Magnitude vs. time, Frequency vs. time, Phase vs. time
Resolution Bandwidth (RBW)	93 µHz to 62.5 MHz 93 µHz to 100 MHz (with option 5-SV-BW-1)
Window types and factors	

Window type	Factor
Blackman-Harris	1.90
Flat-Top 2	3.77
Hamming	1.30
Hanning	1.44
Kaiser-Bessel	2.23
Rectangular	0.89

Spectrum Time	FFT Window Factor / RBW
Reference level	Reference level is automatically set by the analog channel Volts/div setting Setting range: -42 dBm to +44 dBm
Vertical Position	-100 divs to +100 divs

Spectrum View

Horizontal scaling	Linear, Log
Vertical units	dBm, dBµW, dBmV, dBµV, dBmA, dBµA

Search

Number of searches	Unlimited
Search types	Search through long records to find all occurrences of user specified criteria including edges, pulse widths, timeouts, runt pulses, window violations, logic patterns, setup & hold violations, rise/fall times, and bus protocol events. Search results can be viewed in the Waveform View or in the Results table.

Save

Waveform Type	Tektronix Waveform Data (.wfm), Comma Separated Values (.csv), MATLAB (.mat)
Waveform Gating	Cursors, Screen, Resample (save every nth sample)
Screen Capture Type	Portable Network Graphic (*.png), 24-bit Bitmap (*.bmp), JPEG (*.jpg)
Setup Type	Tektronix Setup (.set)
Report Type	Adobe Portable Documents (.pdf), Single File web Pages (.mht)
Session Type	Tektronix Session Setup (.tss)

Display

Display type	15.6 in. (395 mm) liquid-crystal TFT color display
Display resolution	1,920 horizontal × 1,080 vertical pixels (High Definition)
Display modes	Overlay: traditional oscilloscope display where traces overlay each other Stacked: display mode where each waveform is placed in its own slice and can take advantage of the full ADC range while still being visually separated from other waveforms. Groups of channels can also be overlaid within a slice to simplify visual comparison of signals.
Zoom	Horizontal and vertical zooming is supported in all waveform and plot views.
Interpolation	Sin(x)/x and Linear
Waveform styles	Vectors, dots, variable persistence, and infinite persistence
Graticules	Movable and fixed graticules, selectable between Grid, Time, Full, and None
Color palettes	Normal and inverted for screen captures Individual waveform colors are user-selectable
Format	YT, XY, and XYZ
Local Language User Interface	English, Japanese, Simplified Chinese, Traditional Chinese, French, German, Italian, Spanish, Portuguese, Russian, Korean
Local Language Help	English, Japanese, Simplified Chinese

Arbitrary/Function Generator (optional)

Function types	Arbitrary, sine, square, pulse, ramp, triangle, DC level, Gaussian, Lorentz, exponential rise/fall, sin(x)/x, random noise, Haversine, Cardiac
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
Frequency accuracy	130 ppm (frequency ≤ 10 kHz), 50 ppm (frequency > 10 kHz)
Amplitude range	20 mV_{pp} to 5 V_{pp} into Hi-Z; 10 mV_{pp} to 2.5 V_{pp} into 50 Ω
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
Ramp and triangle waveform	
Frequency range	0.1 Hz to 500 kHz
Frequency setting resolution	0.1 Hz
Frequency accuracy	130 ppm (frequency ≤ 10 kHz), 50 ppm (frequency > 10 kHz)
Amplitude range	20 mV_{pp} to 5 V_{pp} into Hi-Z; 10 mV_{pp} to 2.5 V_{pp} into 50 Ω
Variable symmetry	0% - 100%
Symmetry resolution	0.1%
DC level range	±2.5 V into Hi-Z ±1.25 V into 50 Ω
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

Arbitrary/Function Generator (optional)

Sin(x)/x	
Maximum frequency	2 MHz
Gaussian pulse, Haversine, and Lorentz pulse	
Maximum frequency	5 MHz
Lorentz pulse	
Frequency range	0.1 Hz to 5 MHz
Amplitude range	20 mV_{pp} to 2.4 V_{pp} into Hi-Z
	10 mV_{pp} to 1.2 V_{pp} into 50 Ω
Cardiac	
Frequency range	0.1 Hz to 500 kHz
Amplitude range	20 mV_{pp} to 5 V_{pp} into Hi-Z
	10 mV_{pp} to 2.5 V_{pp} into 50 Ω
Arbitrary	
Memory depth	1 to 128 k
Amplitude range	20 mV_{pp} to 5 V_{pp} into Hi-Z
	10 mV_{pp} to 2.5 V_{pp} into 50 Ω
Repetition rate	0.1 Hz to 25 MHz
Sample rate	250 MS/s
Signal amplitude accuracy	±[(1.5% of peak-to-peak amplitude setting) + (1.5% of absolute DC offset setting) + 1 mV] (frequency = 1 kHz)
Signal amplitude resolution	1 mV (Hi-Z)
	500 µV (50 Ω)
Sine and ramp frequency accuracy	1.3×10^{-4} (frequency ≤10 kHz)
	5.0×10^{-5} (frequency >10 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

Digital volt meter (DVM)

Measurement types	DC, AC_{RMS}+DC, AC_{RMS}
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:	± 2% (40 Hz to 1 kHz) with no harmonic content outside 40 Hz to 1 kHz
	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

Accuracy	±(1 count + time base accuracy * input frequency)
	The signal must be at least 8 mV_{pp} or 2 div, whichever is greater.
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.
Resolution	8-digits

Processor system

Host processor	Intel i5-4400E, 2.7 GHz, 64-bit, dual core processor
Internal storage	≥ 80 GB. Form factor is an 80 mm m.2 card with a SATA-3 interface
Operating system	Instrument with option 5-WIN installed: Microsoft Windows 10 [7]
Solid State Drive (SSD) with Microsoft Windows 10 OS (option 5-WIN)	≥ 480 GB SSD. Form factor is a 2.5-inch SSD with a SATA-3 interface. This drive is customer installable and includes the Microsoft Windows 10 Enterprise IoT 2016 LTSB (64-bit) operating system

Input-Output ports

DisplayPort connector	A 20-pin DisplayPort connector; connect to show the oscilloscope display on an external monitor or projector
DVI connector	A 29-pin DVI-D connector; connect to show the oscilloscope display on an external monitor or projector
VGA	DB-15 female connector; connect to show the oscilloscope display on an external monitor or projector
Probe compensator signal, typical	
Connection:	Connectors are located on the lower right-hand side of the instrument
Amplitude:	0 to 2.5 V
Frequency:	1 kHz
Source impedance:	1 kΩ

7 Option 5-WIN is not available for MSO58LP instrument.

Input-Output ports

External reference input
The time-base system can phase lock to an external 10 MHz reference signal (±4 ppm).

USB interface (Host, Device ports)
Front panel USB Host ports: Two USB 2.0 Hi-Speed ports, one USB 3.0 SuperSpeed port

Rear panel USB Host ports: Two USB 2.0 Hi-Speed ports, two USB 3.0 SuperSpeed ports

Rear panel USB Device port: One USB 3.0 SuperSpeed Device port providing USBTMC support

Ethernet interface
10/100/1000 Mb/s

Auxiliary output
Rear-panel BNC connector. Output can be configured to provide a positive or negative pulse out when the oscilloscope triggers, the internal oscilloscope reference clock out, or an AFG sync pulse

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

Kensington-style lock
Rear-panel security slot connects to standard Kensington-style lock

LXI
Class: LXI Core 2011

Version: 1.4

Power source

Power

Power consumption
400 Watts maximum

Source voltage
100 - 240 V ±10% at 50 Hz to 60 Hz

115 V ±10% at 400 Hz ±10%

Physical characteristics

Dimensions
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

Weight
< 25 lbs (11.4 kg)

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

Rackmount configuration
7U (with optional RM5 Rackmount Kit)

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, and as limited by a maximum wet-bulb temperature of +39 °C
Non-operating	5% to 90% relative humidity (% RH) at up to +40 °C
	5% to 39% RH above +40 °C up to +50 °C, noncondensing, and as limited by a maximum wet-bulb temperature of +39 °C
Altitude	
Operating	Up to 3,000 meters (9,843 feet)
Non-operating	Up to 12,000 meters (39,370 feet)

EMC, Environmental, and Safety

Regulatory	CE marked for the European Union and UL approved for the USA and Canada
	RoHS compliant

Software

Software	
IVI driver	Provides a standard instrument programming interface for common applications such as LabVIEW, LabWindows/CVI, Microsoft .NET, and MATLAB. Compatible with Python, C/C++/C# and many other languages through VISA.
e*Scope®	Enables control of the oscilloscope over a network connection through a standard web browser. Simply enter the IP address or network name of the oscilloscope and a web page will be served to the browser. Transfer and save settings, waveforms, measurements, and screen images or make live control changes to settings on the oscilloscope directly from the web browser.
LXI Web interface	Connect to the oscilloscope through a standard Web browser by simply entering the oscilloscope's IP address or network name in the address bar of the browser. The Web interface enables viewing of instrument status and configuration, status and modification of network settings, and instrument control through the e*Scope web-based remote control. All web interaction conforms to LXI Core specification, version 1.4.
Programming Examples	Programming with the 4/5/6 Series platforms has never been easier. With a programmers manual and a GitHub site you have many commands and examples to help you get started remotely automating your instrument. See https://github.com/tektronix/Programmatic-Control-Examples.