Tektronix®

# 5 Series MSO Low Profile

MSO58LP Datasheet

*More system visibility in less rack space.*

*Standard rack mount configuration*

*Optional bench conversion configuration*

## Strength in numbers

### Input channels

- 8 FlexChannel® inputs
- Each FlexChannel provides:
  - One analog signal that can be displayed as a waveform view, a spectral view, or both simultaneously
  - Eight digital logic inputs with TLP058 logic probe

### Bandwidth (all analog channels)

- 1 GHz

### Sample rate (all analog / digital channels)

- Real-time: 6.25 GS/s
- Interpolated: 500 GS/s

### Record length (all analog / digital channels)

- 125 Mpoints (std.)
- 250, 500 Mpoints (optional)

### Waveform capture rate

- >500,000 waveforms/s

### Vertical resolution

- 12-bit ADC
- Up to 16-bits in High Res mode
- 7.6 ENOB at 1 GHz

### Standard trigger types

- Edge, Pulse Width, Runt, Timeout, Window, Logic, Setup & Hold, Rise/Fall Time, Parallel Bus, Sequence, Visual Trigger, Video (optional), RF vs. Time (optional)
- Auxiliary Trigger ≤5 $V_{RMS}$, 50Ω, 200 MHz (Edge Trigger only)

### Standard analysis

- Measurements: 36
- Spectrum View: Frequency-domain analysis with independent controls for frequency and time domains RF vs. time traces (magnitude, frequency, phase)
- FastFrame™: Segmented memory acquisition mode with maximum trigger rate >5,000,000 waveforms per second
- Plots: Time Trend, Histogram, Spectrum and Phase Noise
- Math: Basic waveform arithmetic, FFT, and advanced equation editor
- Search: Search on any trigger criteria
- Jitter: TIE and Phase Noise

### Optional analysis[1]

- Advanced Jitter and Eye Diagram Analysis
- User-defined filtering
- Advanced Spectrum View
- RF vs. Time traces, triggers, Spectrograms, and IQ capture
- Digital Power Management
- Mask/Limit Testing
- Inverters, Motors, and Drives
- Advanced Power Measurements and Analysis

### Optional serial bus trigger, decode, and analysis[1]

- $I^2C$, SPI, eSPI, I3C, RS-232/422/485/UART, SPMI, SMBus, CAN, CAN FD, LIN, FlexRay, SENT, PSI5, CXPI, Automotive Ethernet, MIPI C-PHY, MIPI D-PHY, USB 2.0, eUSB2, Ethernet, EtherCAT, Audio, MIL-STD-1553, ARINC`429, Spacewire, 8B/10B, NRZ, Manchester, SVID, SDLC, 1-Wire, MDIO

### Arbitrary/Function Generator [1]

- 50 MHz waveform generation
- Waveform Types: Arbitrary, Sine, Square, Pulse, Ramp, Triangle, DC Level, Gaussian, Lorentz, Exponential Rise/Fall, Sin(x)/x, Random Noise, Haversine, Cardiac

### Digital voltmeter [2]

- 4-digit AC RMS, DC, and DC+AC RMS voltage measurements

### Trigger frequency counter [2]

- 8-digit

### Video display output

- High Definition (1,920 x 1,080) resolution video output

### Connectivity

- USB Host (6 ports), USB 3.0 Device (1 port), LAN (10/100/1000 Base-T Ethernet), Display Port, DVI-D, VGA

### e*Scope ®

- Remotely view and control the oscilloscope over a network connection through a standard web browser

### Operating system

- Closed Embedded OS

### Warranty

- 3 years standard

### Dimensions

1 Optional and upgradable.

2 Free with product registration.

- 2U Rack Mount Kit included
- 3.44 in (87.3 mm) H x 17.01 in (432 mm) W x 24.74 in (621.5 mm) D
- Weight: 28 lbs. (12.7 kg)

With a remarkable 8 input channels in a 2U high package and a 12-bit ADC, the 5 Series MSO Low Profile sets a new standard for performance in applications where extreme analog, spectrum, or digital channel density is required.

**Based on the highly successful 5 Series MSO**

The 5 Series MSO Low Profile is based on the 5 Series MSO benchtop platform. The benchtop 5 Series MSO has a remarkably innovative pinch-swipe-zoom touchscreen user interface, the industry's largest high-definition display, and 4, 6, or 8 FlexChannel® inputs that let you measure a single analog channel waveform, a spectral view of the analog input, simultaneous analog and spectral views with independent acquisition controls for each domain, or eight digital logic inputs (with TLP058 logic probe). The 5 Series MSO is ready for today's toughest challenges, and tomorrow's too. It sets a new standard for performance, analysis, and overall user experience.

Like the benchtop 5 Series MSO, the low profile instrument offers FlexChannel inputs, an optional arbitrary/function generator output, and a built-in digital voltmeter and trigger frequency counter. And, if you plug in an external touch-capable monitor you can experience the same revolutionary pinch-swipe-zoom user experience as if you were in front of the benchtop 5 Series MSO.

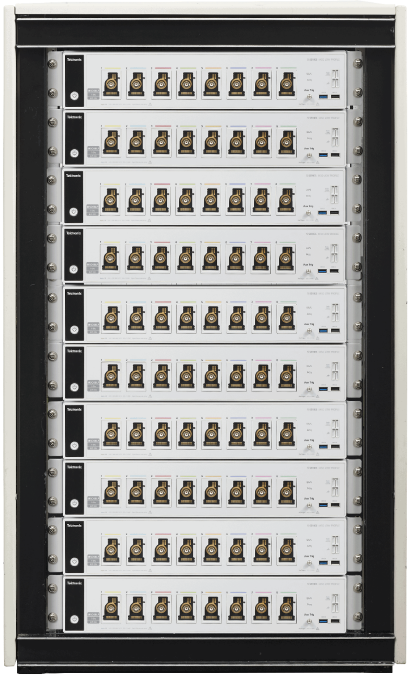
For more information on the capabilities of the benchtop 5 Series MSO, including the revolutionary user experience and the various analysis software options, please see the 5 Series MSO datasheet at *www.tek.com/5SeriesMSO*.

*The 5 Series MSO Low Profile is based on the 5 Series MSO benchtop platform.*

**Low-profile, high-density package saves space**

The 5 Series MSO Low Profile has 8 FlexChannel inputs plus an auxiliary trigger input in a space-saving 2U high package designed to fit into 19-inch wide racks. The instrument has side air vents so that instruments can be mounted in a rack directly on top of one another, saving even more space.

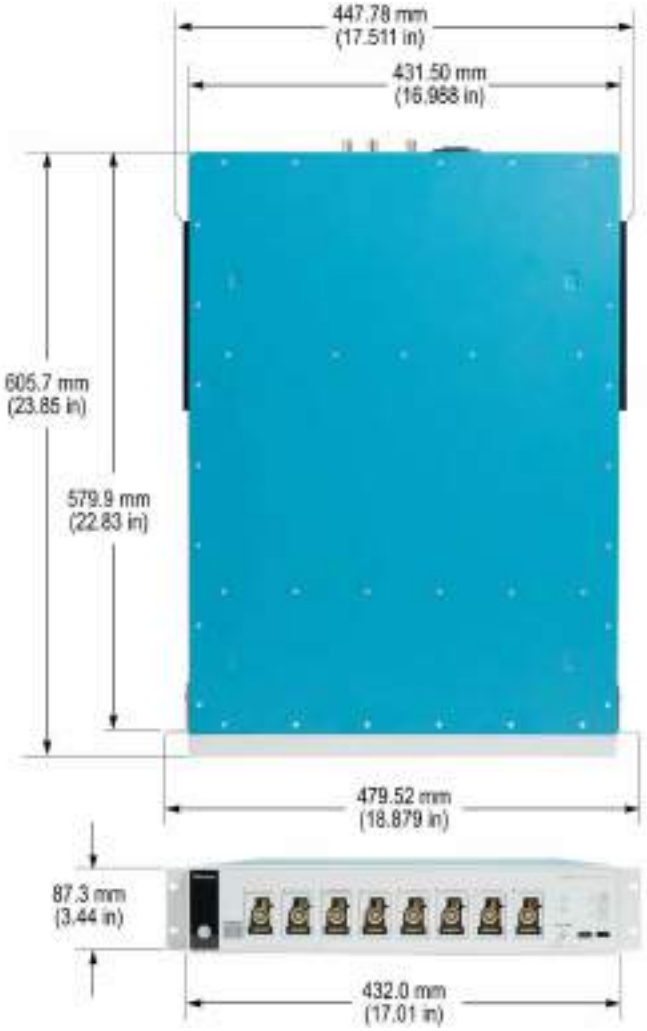
The 5 Series MSO Low Profile comes standard with rack mount brackets installed, ready for mounting into a rack right out of the box.



*Multiple MSO58LP instruments installed in a rack, making efficient use of available space.*

An optional bench conversion kit includes four feet and a strap handle for use in a lab environment on a bench surface.

*The MSO58LP with the optional bench conversion kit installed, optimizing the instrument for use on a benchtop.*




*The 5 Series MSO Low Profile saves valuable rack space.*

## Experience the performance difference

With 1 GHz analog bandwidth, 6.25 GS/s sample rate, 500 Mpts record length, and 12-bit analog to digital converters (ADCs), the 5 Series MSO Low Profile has the performance you need to capture accurate waveform data with the best possible signal integrity and vertical resolution for seeing small waveform details.

The 5 Series MSO Low Profile has up to 6.25 GS/s sample rate on all channels, providing more than 5x oversampling, enabling better noise performance and fine timing resolution.

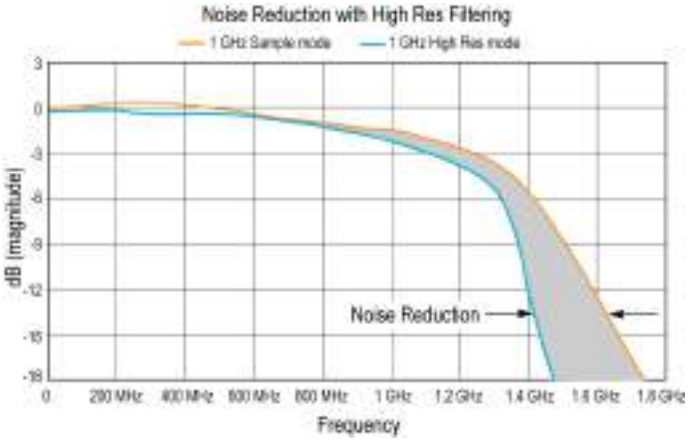
The optional 500 Mpts record length provides 80 ms of acquisition time at the highest sample rate (6.25 GS/s), enabling long time captures while maintaining high timing resolution for more accurate measurements.

**Industry leading vertical resolution**

The 5 Series MSO Low Profile provides the performance to capture the signals of interest while minimizing the effects of unwanted noise

when you need to capture high-amplitude signals while seeing smaller signal details. At the heart of the 5 Series MSO Low Profile are 12-bit analog-to-digital convertors (ADCs) that provide 16 times the vertical resolution of traditional 8-bit ADCs.

A new High Res mode applies a hardware-based unique Finite Impulse Response (FIR) filter based on the selected sample rate. The FIR filter 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.




*1 GHz frequency plot with High Res filter overlaid shows the reduction in noise when High Res mode is enabled*

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. The following table shows the number of bits of vertical resolution for each sample rate setting when in High Res.

| Sample rate | Number of bits of vertical resolution |
|---|---|
| 6.25 GS/s [3] | 8 |
| 3.125 GS/s | 12 |
| 1.25 GS/s | 13 |
| 625 MS/s | 14 |
| 312.5 MS/s | 15 |
| ≤125 MS/s | 16 |

Typical 8-bit ADC oscilloscopes have an Effective Number of Bits (ENOB) of between 4 and 6, depending on bandwidth and vertical scale selected. The 12-bit ADC in the 5 Series MSO Low Profile, coupled with a new low-noise front-end amplifier, provides an ENOB of between 7 and 9 bits, enabling better viewing of fine signal detail in the presence of large amplitude signals.

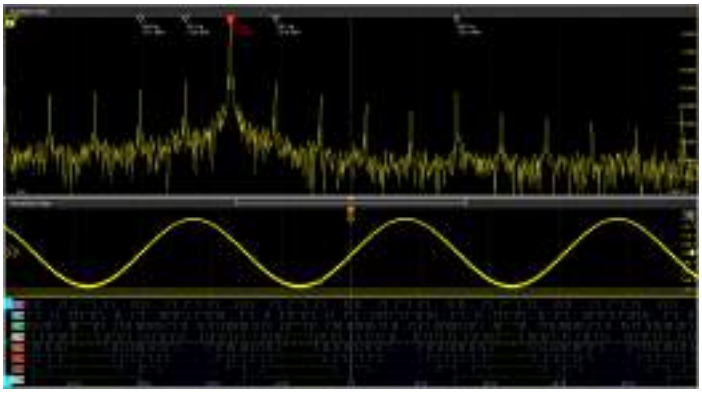
The following table shows the typical ENOB values for the 5 Series MSO Low Profile measured with High Res mode, 50 Ω, 10 MHz input with 90% full screen.

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

### Spectrum View

It is often easier to debug an issue by viewing one or more signals in the frequency domain. Oscilloscopes have included math-based FFTs for decades in an attempt to address this need. However, FFTs are notoriously difficult to use as they are driven by the same acquisition system that's delivering the analog time-domain view. When you optimize acquisition settings for the analog view, your frequency-domain view isn't what you want. When you get the frequency-domain view you want, your analog view is not what you want. With math-based FFTs, it is virtually impossible to get optimized views in both domains.

Spectrum View changes all of this. Tektronix' patented technology provides both a decimator for the time-domain and a digital downconverter for the frequency-domain behind each FlexChannel. The two different acquisition paths let you simultaneously observe both time- and frequency-domain views of the input signal with independent acquisition settings for each domain. Other manufacturers offer various 'spectral analysis' packages that claim ease-of-use, but they all exhibit the limitations described above. Only Spectrum View provides both exceptional ease-of-use and the ability to achieve optimal views in both domains simultaneously.



*Intuitive spectrum analyzer controls like center frequency, span and resolution bandwidth (RBW), independent from time domain controls, provide easy setup for frequency domain analysis. A spectrum view is available for each FlexChannel analog input, enabling multi-channel mixed domain analysis.*

[3] 6.25 GS/s not available as real-time sample rate when High Res is on.

### TekVPI Probe Interface

The TekVPI® probe interface sets the standard for ease of use in probing. In addition to the secure, reliable connection that the interface provides, many TekVPI probes feature status indicators and controls, as well as a probe menu button right on the probe compensation box. The TekVPI interface enables direct attachment of current probes without requiring a separate power supply. TekVPI probes can be controlled remotely through USB or LAN, enabling more versatile solutions in ATE environments. The 5 Series MSO Low Profile provides up to 80 W of power to the front panel connectors, sufficient to power all connected TekVPI probes without the need for an additional probe power supply.

The TekVPI probe interface is key to enabling the high bandwidth and low attenuation versions of the optional TPP Series of passive voltage probes. The TPP Series probes offer all the benefits of general-purpose probes -- high dynamic range, flexible connection options, and robust mechanical design, while providing the performance of active probes. At 1 GHz bandwidth, the optional TPP1000 probes enable you to see high frequency components in your signals, and extremely low 3.9 pF capacitive loading minimizes adverse effects on your circuits. The optional low-attenuation (2x) TPP0502 has 500 MHz bandwidth and is exceptional at measuring low voltages.

*MSO58LP with TekVPI probes and touch monitor attached for use in a lab environment.*

## Designed with your needs in mind

### Remote operation to speed automated test

IVI-COM [4], IVI-C [5], and LabVIEW[4] instrument drivers are available for free and enable easy communication with the oscilloscope using LAN or USBTMC connections from an external PC. A full set of programmatic commands to setup and control the instrument remotely enable easy test automation.

### Building a next-generation test rack

Looking for a modern way to refresh your test rack, view, download or analyze your data? Looking to replace obsolete hardware without rewriting your code?

We understand that test rack designs take time and include numerous tradeoffs. Tektronix has heard your voice loud and clear and is blazing a new path to provide a richer set of tools to enable flexible ways to access data and replace obsolete hardware. If that means you're automating a test rack with LabVIEW, Python or another interface, we have an expanding number of drivers and numerous support resources available.

Maybe you require an easy way to view waveforms on a remote computer. Not a problem, Tektronix has a software team designing new ways to control the instrument from a browser (E*Scope), store your data in the cloud (TekCloud), or stream data to our PC (TekScope). Providing modern age tools at your fingertips.

Lastly, users familiar with keyboards, mice, monitors, and KVM switches can continue to operate as they always have!

TekCloud

All your data in one place.

4 Drivers are available from www.tek.com/downloads.

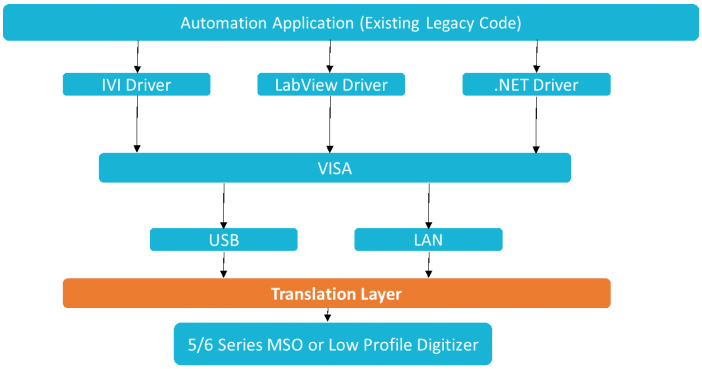
5 Drivers are available from www.ni.com.

### Upgrade Automated Test Equipment (ATE) systems quickly and smoothly

Was your automation code written in the 1970s, 1980s, or 1990s?

Anyone working closely with automated test systems knows that moving to a new model or platform can be painful. Modifying an existing codebase for a new product can be prohibitively expensive and complicated. Now there's a solution.

All 5 and 6 Series Low Profile instruments include a Programmatic Interface (PI) Translator. When enabled, the PI Translator acts as an intermediate layer between your test application and the digitizer. The PI translator recognizes a subset of legacy commands from the popular DPO/MSO5000B, DPO7000C, and DPO70000C oscilloscope platforms and translates them on the fly into supported commands. The interface is designed to be human-readable and easily extensible, which means that you can customize its behavior to minimize the amount of effort required when transitioning from obsolete instruments to the newest Tektronix platform.

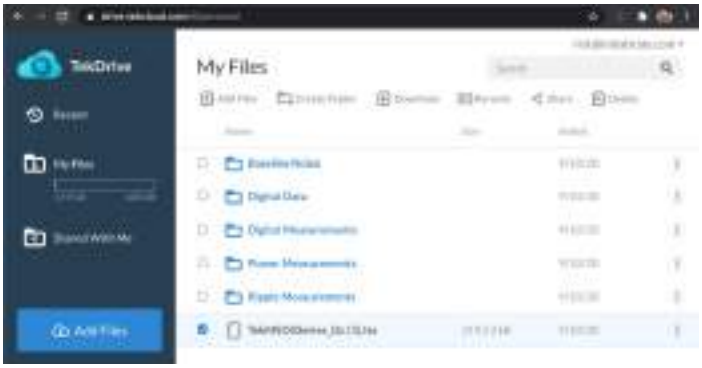



*How the PI Translator works from Automation software to Tek instrument*

### Access data in all the new ways you can dream about

Using TekDrive, you can upload, store, organize, search, download, and share any file type from any connected device. TekDrive is natively integrated into the 5 Series Low Profile instrument for seamless sharing and recalling of files - no USB stick is required. Analyze and explore standard files like .wfm, .isf, .tss, and .csv, directly in a browser with smooth interactive waveform viewers. TekDrive is purpose-built for integration, automation, and security. *www.tekcloud.com/tekdrive*

*Programming with a Low Profile in a test rack has never been easier*

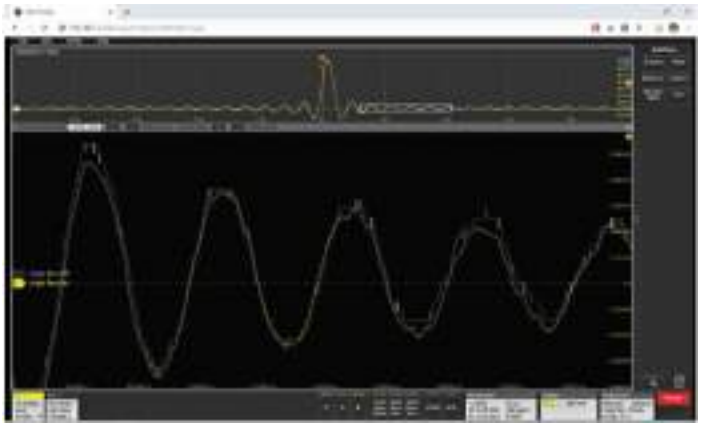



*TekDrive collaborative workspace - save files directly from your 5 Series Low Profile and share across your team*

Get the analysis capability of an award-winning oscilloscope on your PC. Analyze waveforms anywhere, anytime. The basic license lets you view and analyze waveforms, perform many types of measurements and decode the most common serial buses - all while remotely accessing your oscilloscope. Advanced license options add capabilities such as multi-scope analysis, more serial bus decoding options, jitter analysis and power measurements. TekScope Multi-Scope enables you to connect and download data from up to 4 instruments (16-32 max channels) for easy viewing and cross-instrument analysis.

*Two MSO58LP instruments being analyzed on PC running TekScope's 'Multi-Scope*

E*Scope is an easy method of viewing and controlling a 5 Series Low Profile instrument over a network connection in the same way that you do in-person with a monitor or keyboard. Simply type the instrument's IP address into a browser to display the LXI landing page, then select the Instrument Control to access E*Scope. There are no drivers needed. It's all self-contained within the browser and you can control the instrument. It's fast, responsive, and perfect for controlling or visualizing single or multiple instrument situations.



*Live browser control is available using e*Scope via a browser like Chrome, Firefox, or Edge.*

*Tile multiple e*Scope browser tabs on a monitor for viewing live data*

**Enhanced security option**

The 5-SEC enhanced security option enables password-protected enabling/disabling of all USB communication ports and firmware upgrades. In addition, option 5-SEC provides the highest level of security by ensuring that internal memory is clear of all setup and waveform data. This ensures you can confidently move the instrument out of a secure area.

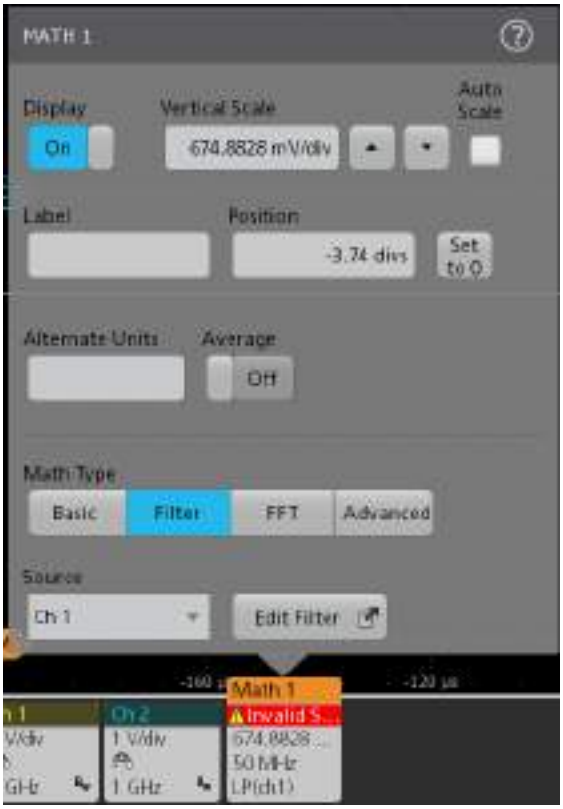
To permanently store data, you can save it to an external flash memory device or programmatically to USBTMC ports in keeping with your lab security protocols.

**User-defined filtering (optional)**

In the broad sense, any system that processes a signal can be thought of as a filter. For example, an oscilloscope channel operates as a low pass filter where its 3 dB down point is referred to as its bandwidth. Given a waveform of any shape, a filter can be designed that can transform it into a defined shape within the context of some basic rules, assumptions, and limitations.

Digital filters have some significant advantages over analog filters. For example, the tolerance values of analog filter circuit components are high enough that high order filters are difficult or even impossible to implement. High order filters are easily implemented as digital filters. Digital filters can be implemented as Infinite Impulse Response (IIR) or Finite Impulse Response (FIR). The choice of IIR or FIR filters are based upon design requirements and application.

The MSO58LP has the ability to apply designated filters to math waveforms through a MATH arbitrary function. Option 5-UDFLT takes this functionality a level deeper, providing more than MATH arbitrary basic functions and adds flexibility to support standard filters and can be used for application centric filter designs.




*Filters can be created through the Math dialog. Once a filter is edited, it can be easily applied, saved, and recalled for use or modification later.*

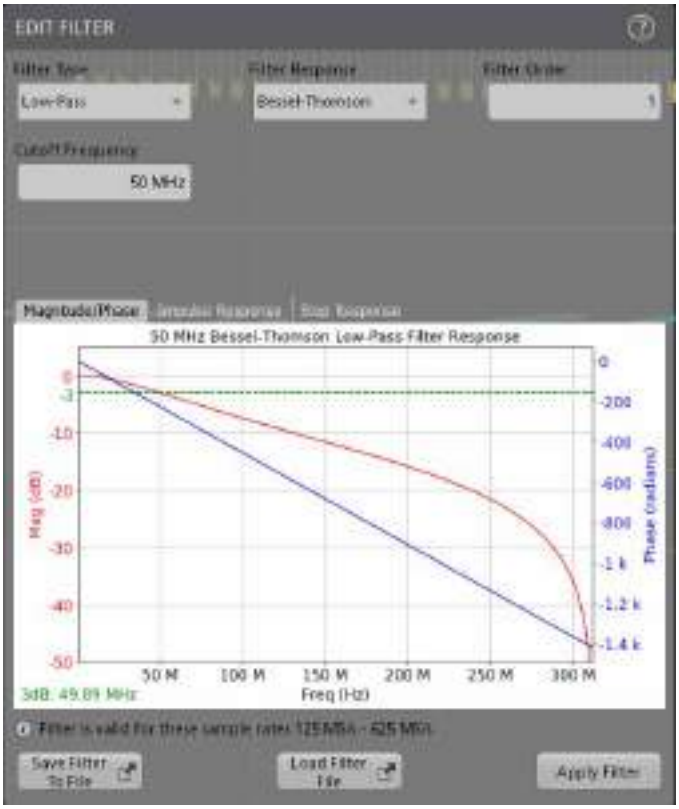
Filter types supported on the MSO58LP include:

- Low pass
- High pass
- Band pass
- Band stop
- All pass
- Hilbert
- Differentiator
- Custom

Filter response types supported on the MSO58LP include:

- Butterworth
- Chebyshev I
- Chebyshev II
- Elliptical
- Gaussian
- Bessel-Thomson

The Filter Response control is available for all Filter Types except All-pass, Hilbert, or Differentiator.




*Filter creation dialog showing selection for Filter Type, Filter Response, Cutoff Frequency, Filter Order, and a graphical representation of Magnitude/Phase, Impulse Response, and Step Response*

Filter designs can be saved, recalled, and applied once any editing has been completed.

**Quickly transition from the lab to manufacturing**

The 5 Series MSO Low Profile is based on the successful 5 Series MSO platform. This means you can use the benchtop 5 Series MSO with its beautiful 15.6-in touch display and its full measurement analysis capabilities during the development process. Then, when you are ready to transition your product to manufacturing, you can use the same software and test routines developed during R&D in your manufacturing test application, saving time and rack space.

*Use the benchtop 5 Series MSO during R&D, then seamlessly transition to the low profile version for manufacturing test.*

**The Low Profile family**

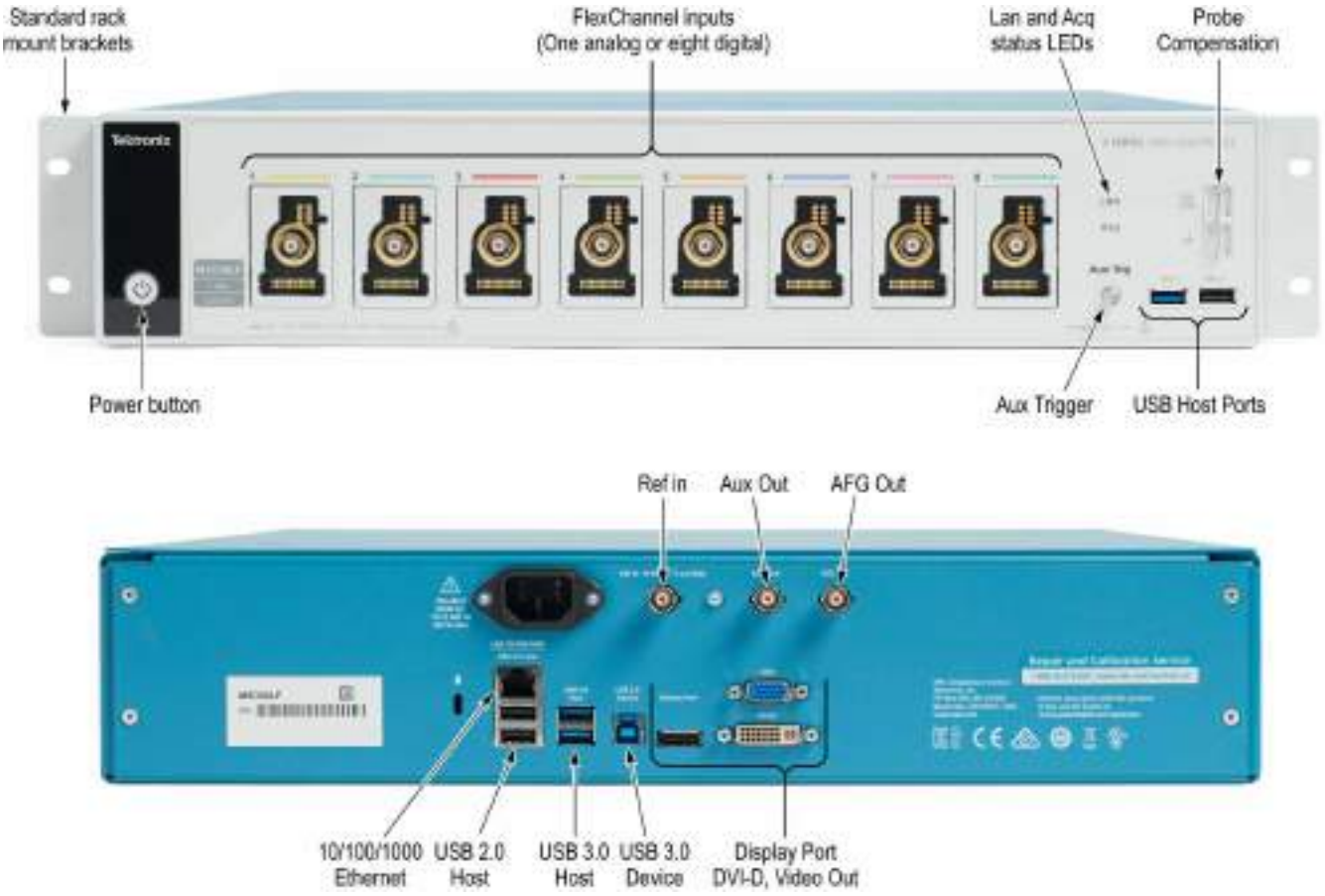
The 6 Series Low Profile Digitizer expands the performance of the 5 Series MSO Low Profile by adding twice the number of Tektronix TEK049 ASICS in the same 2U footprint. Now with 25 GS/s and up to 8 GHz on all channels. Low Profile users now have the choice of extreme high channel count or extreme performance in the same rack form factor.

For more information on the capabilities of the 6 Series Low Profile Digitizer, please see the datasheet at *www.tek.com/high-speed-digitizer/*

*Two 6 Series Low Profile Digitizers (left) and two 5 Series MSO Low Profile oscilloscopes (right)*

| Quick Comparison | 6 Series Low Profile Digitizer | 5 Series MSO Low Profile Digitizer |
|---|---|---|
| Sample Rate | 25 GS/s | 6.25 GS/s |
| Analog Bandwidth | Up to 8 GHz | 1 GHz |
| RF (DDC) Span Bandwidth | 2 GHz | 500 MHz |
| ENOB @ 1 GHz | 8.2 bits | 7.6 bits |
| LXI compliance version | 1.5 | - |
| Rack Dimensions | 2U | 2U |

**5 Series MSO Low Profile - The highest channel density and greatest performance in its class**



# Specifications

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

## Model overview

### Oscilloscope

| | MSO58LP, MSO58LPGSA |
|---|---|
| FlexChannel inputs | 8 |
| Maximum analog channels | 8 |
| Maximum digital channels (with optional logic probes) | 64 |
| Bandwidth (calculated rise time) | 1 GHz (400 ps) |
| DC Gain Accuracy | 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)<br>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<br>12 bits @ 3.125 GS/s<br>13 bits @ 1.25 GS/s (High Res)<br>14 bits @ 625 MS/s (High Res)<br>15 bits @ 312.5 MS/s (High Res)<br>16 bits @ ≤125 MS/s (High Res) |
| Sample Rate | 6.25 GS/s on all analog / digital channels (160 ps resolution) |
| Record Length | Up to 500 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** | 20 MHz, 250 MHz, and 1 GHz |
| **Input coupling** | DC, AC |
| **Input impedance** | 50 Ω ± 1% 1 MΩ ± 1% with 13.0 pF ± 1.5 pF |
| **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<br>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**

**< 1 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 |

**Random noise, RMS, typical**

**1 GHz, High Res mode (RMS)**

| 1 GHz | 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 |

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

**DC gain accuracy**

| | |
|---|---|
| ✓**50 Ohm** | ±2.0%[7] (±2.0% at 2 mV/div, ±4% at 1 mV/div, typical)<br>±1.0%[8] of full scale, (±1.0% of full scale at 2 mV/div, ± 2% at 1 mV/div, typical) |
| **Position range** | ±5 divisions |

**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 |

| | |
|---|---|
| **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)<br>0.2 div at 1 mV/div with DC-50 Ω oscilloscope input impedance (50 Ω BNC terminated)<br>0.4 div at 500 µV/div with DC-50 Ω oscilloscope input impedance (50 Ω BNC terminated)<br>0.2 div with DC-1 MΩ oscilloscope input impedance (50 Ω BNC terminated)<br>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** | 300 ps |
| **Thresholds** | One threshold per digital channel |
| **Threshold range** | ±40 V |

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

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

| | |
|---|---|
| **Threshold resolution** | 10 mV |
| **Threshold accuracy** | ± [100 mV + 3% of threshold setting after calibration] |
| **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)<br>12.5 GS/s to 500 GS/s (interpolated) |
| **Record length range** | |
| **Standard** | 1 kpoints to 125 Mpoints in single sample increments |
| **Optional 5-RL-250M** | 250 Mpoints |
| **Optional 5-RL-500M** | 500 Mpoints |
| **Aperture uncertainty** | ≤ 0.450 ps + (1 * $10^{-11}$ * Measurement Duration)$_{RMS}$, for measurements having duration ≤ 100 ms |
| **Timebase accuracy** | ±2.5 x $10^{-6}$ over any ≥1 ms time interval |

| Description | Specification |
|---|---|
| Factory Tolerance | ±5.0 x$10^{-7}$<br>At calibration, 23 °C ambient, over any ≥1 ms interval |
| Temperature stability | ±5.0 x$10^{-7}$<br>Tested at operating temperatures |

Table continued…

| Description | Specification |
|---|---|
| Crystal aging | ±1.5 x $10^{-6}$<br>Frequency tolerance change at 25 °C over a period of 1 year |

**Delta-time measurement accuracy, nominal**

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

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

*(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 = time base accuracy or reference frequency error

$t_p$ = delta-time measurement duration (sec)

**Maximum duration at highest sample rate**

20 ms (std.) or 80 ms (optional)

**Time base delay time range**

-10 divisions to 5,000 s

**Deskew range**

-125 ns to +125 ns with a resolution of 40 ps

**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** | 200 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 |

**Edge-type trigger sensitivity, DC coupled, typical**

| Path | Range | Specification |
|---|---|---|
| 1 MΩ path (all models) | 0.5 mV/div to 0.99 mV/div | 4.5 div 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 | | 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 |
| Line | | Fixed |
| AUX Trigger in | | 200 $mV_{PP}$, DC to 250 MHz |

**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

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

≤ 200 $ps_{RMS}$ for AUX trigger in, Sample acquisition mode, edge trigger (MSO58LP only)

≤ 220 $ps_{RMS}$ for AUX trigger in, FastAcq acquisition mode, edge trigger (MSO58LP only)

**AUX In trigger skew between instruments, typical**

±100 ps jitter on each instrument with 150 ps skew; ≤350 ps total between instruments. With manual deskewing of individual channels, total instrument skew can reach 200 ps between different instrument channels.

Skew improves for sinusoidal input voltages ≥500 mV

**Trigger level ranges**

| Source | Range |
|---|---|
| Any Channel | ±5 divs from center of screen |
| Aux In Trigger | ±5 V |

Table continued…

| Source | Range |
|---|---|
| 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 |
| **$I^3C$ Bus (option 5-SRI3C)** | Trigger on Start, Repeated Start, Stop, Address, Data, $I^3C$ SDR Direct, $I^3C$ SDR Broadcast, Missing ACK, T-Bit Error, Broadcast Address Error, Hot-Join, HDR Restart, HDR Exit on $I^3C$ 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 |

| | |
|---|---|
| **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 |
| **RF Magnitude vs. Time and RF Frequency vs. Time (option 5-SV-RFVT):** | Trigger on edge, pulse width and timeout events |

## 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<br>Maximum averaging speed = 180 waveforms/s |
| **Fast Hardware Averaging** | An acquisition mode for acquiring a large number of averages in a short amount of time. Fast hardware averaging optimizes the acquisition path, reducing storage truncation error and smoothing out fine scale non-linearity imperfections via an optional offset dithering technique. This feature is available through programmatic interface commands.<br>From 2 to 1,000,000 waveforms<br>Maximum averaging speed = 32,000 waveforms/s |

| | |
|---|---|
| **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.<br>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. |
| **History mode** | Makes use of the maximum record length, allowing you to capture many triggered acquisitions, stop when you see something of interest, and quickly review all stored triggered acquisitions.The number of available acquisitions stored in history is (Maximum record length) / (Current record length setting). |
| **FastFrame™** | Acquisition memory divided into segments.<br>Maximum trigger rate >5,000,000 waveforms per second<br>Minimum frame size = 50 points<br>Maximum Number of Frames: For frame size ≥ 1,000 points, maximum number of frames = record length / frame size.<br>For 50 point frames, maximum number of frames = 1,000,000 |

## 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, Low Time, Time to Minimum, and Time to Maximum |
| **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** | Time Trend, Histogram, Spectrum, Eye Diagram (TIE measurement only), and Phase Noise (Phase Noise measurement only) plots are available for all standard 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 |

**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<br>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<br>Complete eye rendering: Shows all valid Unit Intervals (UIs) |
| **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 )<br>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, $R_{DSon}$) |
| | Output Analysis (Line Ripple, Switching Ripple, Efficiency, Turn-on Time, Turn-off Time) |
| | Magnetic Analysis (Inductance, I vs. Intg(V), Magnetic Loss, Magnetic Property) |
| | 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) |

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

| | |
|---|---|
| **Measurements** | Input Analysis (Power Quality, Harmonics, Input Voltage, Input Current, and Input Power), Ripple analysis (Line Ripple and Switching Ripple), Output analysis (Phasor Diagram and Efficiency), DQ0 analysis (DQ0) Requires option 5-IMDA-DQ0 |
| **Measurement plots** | Harmonics Bar Graph and Phasor Diagram |

**Invertor Motor Drive Analysis Mechanical Measurements (option 5-IMDA-MECH: requires option 5-IMDA) adds the following:**

| | |
|---|---|
| **Sensors supported** | Hall sensors, QEI (Quadrature Encoder Interface) |
| **Measurements** | Electrical Analysis (Power Quality, Harmonics, Ripple, DQ0, and Efficiency), Mechanical Analysis (Speed, Acceleration, Angle (QEI method), Direction, and Torque) |
| **Measurement plots** | Time Trend, Acquisition Trend, Phasor Diagram, Harmonics Bar Graph, DQ0, and Histogram (speed distribution) |

## 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 (standard)** | Loading of user-definable filters. Users specify a file containing the coefficients of the filter. |
| **Filtering function (option 5-UDFLT)** | |
| **Filter types** | Low pass, High pass, Band pass, Band stop, All pass, Hilbert, Differentiator, and Custom |
| **Filter response types** | Butterworth, Chebyshev I, Chebyshev II, Elliptical, Gaussian, and Bessel-Thomson |
| **FFT functions** | Spectral Magnitude and Phase, and Real and Imaginary Spectra |
| **FFT vertical units** | Magnitude: Linear and Log (dBm)<br>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)<br>Coarse adjustment in a 1-2-5 sequence |
| **RF Measurements** | Channel Power (CHP), Adjacent Channel Power Ratio (ACPR), and Occupied Bandwidth (OBW) measurements on Spectrum View trace data and display |
| **RF vs. Time Traces** | Magnitude vs. time, Frequency vs. time, Phase vs. time (with option 5-SV-RFVT) |
| **RF vs. Time Trigger** | Edge, pulse width, and timeout trigger on RF Magnitude vs. Time and RF Frequency vs. Time (with option 5-SV-RFVT) |
| **Spectrograms** | RF Frequency vs. Time vs. Amplitude display with frequency on x-axis, time on y-axis, and power level indicated by variations in color (with option 5-SV-RFVT) |
| **Resolution Bandwidth (RBW)** | 93 µHz to 62.5 MHz<br>93 µHz to 100 MHz (with option 5-SV-BW-1) |
| **IQ capture** | The data is stored as in-phase and quadrature (I&Q) samples and precise synchronization is maintained between the time domain data and the I&Q data.<br>When RF vs. Time traces are activated (with option 5-SV-RFVT), IQ data can be captured and exported to file for more analysis within 3rd party applications.<br>The max acquisition time varies with span and sample rate. At 6.25 GS/s and 500 MHz span, the max acquisition time is 0.086 seconds. For 312.5 MHz span, the max acquisition time is 0.172 seconds. For 40 MHz span, the max acquisition time is 0.687 seconds. For 1 MHz span, the max acquisition time is 43.980 seconds. |

**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 |

| | |
|---|---|
| **Vertical units** | dBm, dBµW, dBmV, dBµV, dBmA, dBµA |
| **Vertical scaling** | Linear, Log |
| **Horizontal scaling** | Linear, Log |
| **Multi-channel spectrum analysis** | Each FlexChannel input can be configured with Spectrum View, RF vs. Time traces (with option RFVT), and Spectrogram (with option RFVT).<br>Multiple RF measurements can be performed simultaneously across channels.<br>Spectrum Time and Center Frequency settings can be unlocked and moved independently from each other across channels. All Spectrum View channels must share the same Span, Resolution Bandwidth and Window Type. |

## 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 (available only through the video out ports or e*Scope)

| | |
|---|---|
| **Display type** | External monitor |
| **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<br>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)<br>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<br>±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<br>2.5% for amplitude > 50 mV AND < 200 $mV_{pp}$ into 50 Ω load<br>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<br>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 $mV_{pp}$<br>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<br>±1.25 V into 50 Ω |
| **Random noise amplitude range** | 20 $mV_{pp}$ to 5 $V_{pp}$ into Hi-Z<br>10 $mV_{pp}$ to 2.5 $V_{pp}$ into 50 Ω |

**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** | $1.3 \times 10^{-4}$ (frequency ≤10 kHz) |
| | $5.0 \times 10^{-5}$ (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 ]<br>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))<br>De-rated at 0.100%/°C of \|reading - offset - position\| above 30 °C<br>Signal ± 5 divisions from screen center |
| **AC:** | ± 2% (40 Hz to 1 kHz) with no harmonic content outside 40 Hz to 1 kHz range<br>AC, typical: ± 2% (20 Hz to 10 kHz)<br>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)<br>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<br>The signal must be at least 8 $mV_{pp}$ or 2 div, whichever is greater. |

## Processor system

| | |
|---|---|
| **Host processor** | Intel i5-4400E, 2.7 GHz, 64-bit, dual core processor |
| **Operating system** | Default instrument: Closed Linux |
| **Internal storage** | ≥ 80 GB. Form factor is an 80 mm m.2 card with a SATA-3 interface |

## 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 front panel of the instrument |
| **Amplitude:** | 0 to 2.5 V |
| **Frequency:** | 1 kHz |
| **Source impedance:** | 1 kΩ |

**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: One USB 2.0 Hi-Speed port, one USB 3.0 SuperSpeed port

Rear panel USB Host ports: Two USB 2.0 Hi-Speed ports

Rear panel USB Device port: One 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 |

**Aux Trigger In**

| | |
|---|---|
| **Connection** | Front-panel SMA connector |
| **Input impedance** | 50 Ω |
| **Maximum input** | ≤5 $V_{RMS}$ |

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

## Power source

**Power**

| | |
|---|---|
| **Power consumption** | 400 Watts maximum |
| **Source voltage** | 100 - 240 V ±10% at 50 Hz to 60 Hz<br>115 V ±10% at 400 Hz ±10% |

## Physical characteristics

| | |
|---|---|
| **Dimensions** | Height: 3.44 in (87.3 mm)<br>Width: 17.01 in (432 mm)<br>Depth: 23.85 in (605.7 mm)<br>Fits rack depths from 24 inches to 32 inches |
| **Weight** | 25.5 lbs (11.6 kg) |
| **Cooling** | The clearance requirement for adequate cooling is 2.0 in (50.8 mm) on the left and right sides of the instrument (when viewed from the front). Air flows through the instrument from left to right |
| **Rackmount configuration** | 2U (rack mounts and screws come standard) |

## 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<br>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<br>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) |

**Random vibration**

| | |
|---|---|
| **Operating** | 0.31 GRMS, 5-500 Hz, 10 minutes per axis, 3 axes (30 minutes total) |
| **Non-operating** | 2.46 GRMS, 5-500 Hz, 10 minutes per axis, 3 axes (30 minutes total) |

## EMC, Environmental, and Safety

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

## 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. |
| **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*. |

# Ordering information

Use the following information to select the appropriate instrument and options for your measurement needs.

## Step 1

**Start by selecting the 5 Series MSO Low Profile model that you need.**

| Model | Description |
|---|---|
| *MSO58LP BW-1000RL* | Low Profile Mixed Signal Oscilloscope; 1 GHz bandwidth, (8) FlexChannels with 125 M record length |
| *MSO58LPGSA BW-1000RL* | Low Profile Mixed Signal Oscilloscope; 1 GHz bandwidth, (8) FlexChannels with 125 M record length; Trade Agreements Act (TAA) compliant |

| Each model includes |
|---|
| Rackmount attachments installed |
| Installation and safety manual (translated in English, Japanese, Simplified Chinese ) |
| Embedded Help |
| Power cord |
| Calibration certificate documenting traceability to National Metrology Institute(s) and ISO9001/ISO17025 quality system registration |
| Three -year warranty covering all parts and labor on the instrument. |

## Step 2

**Add instrument functionality**

Instrument functionality can be ordered with the instrument or later as an upgrade kit.

| Instrument Option | Built-in Functionality |
|---|---|
| 5-RL-250M | Extend record length from 125 Mpoints/channel to 250 Mpoints/channel |
| 5-RL-500M | Extend record length from 125 Mpoints/channel to 500 Mpoints/channel |
| 5-AFG | Add Arbitrary / Function Generator |
| 5-SEC [9] | Add enhanced security for instrument declassification and password-protected enabling and disabling of all USB ports and firmware upgrade. |

Each purchased bundle has two duration options:

- A 1-year subscription includes all features and free upgrades for the purchased bundle for one year; after which time the features are disabled. Additional 1-year subscription can be purchased for the selected bundle.
- A perpetual subscription enables all features for the purchased bundle permanently. A perpetual subscription includes 1-year of free upgrades to the bundle feature set. After the year, the feature set is frozen to those enabled by the last update made.

[9] This option must be purchased at the same time as the instrument. Not available as an upgrade.

Perpetual bundles can continue to receive upgrades following the 1 year activation period with the purchase of a maintenance license. Maintenance license information can be found in the maintenance license table below and must be purchased for an existing Starter, Pro, or Ultimate bundle.

| Maintenance license | Description |
|---|---|
| 5-STARTER-MNT-1Y | Includes Perpetual Starter Bundle updates for 1 Year on 5 Series MSO |
| 5-PRO-MNT-1Y | Includes Perpetual Pro Bundle updates for 1 Year on 5 Series MSO |
| 5-ULTIMATE-MNT-1Y | Includes Perpetual Ultimate Bundle updates for 1 Year on 5 Series MSO |

## Step 3

**Add optional serial bus triggering, decode, and search capabilities**

Choose the serial support you need today by choosing from these serial analysis options. You can upgrade later by purchasing an upgrade kit.

| Instrument Option | Serial Buses Supported |
|---|---|
| 5-SRAERO | Aerospace (MIL-STD-1553, ARINC 429) |
| 5-SRAUDIO | Audio ($I^2S$, LJ, RJ, TDM) |
| 5-SRAUTO | Automotive (CAN, CAN FD, LIN, FlexRay, and CAN symbolic decoding) |
| 5-SRAUTOSEN | Automotive sensor (SENT) |
| 5-SRCOMP | Computer (RS-232/422/485/UART) |
| 5-SRCXPI | CXPI (decode and search only) |
| 5-SRDPHY | MIPI D-PHY (DSI-1, CSI-2 decode and search only) |
| 5-SREMBD | Embedded ($I^2C$, SPI) |
| 5-SRENET | Ethernet (10BASE-T, 100BASE-TX) |
| 5-SRESPI | eSPI (decode and search only) |
| 5-SRI3C | MIPI I3C |
| 5-SRETHERCAT | EtherCAT (decode and search only) |
| 5-SRMDIO | MDIO (decode and search only) |
| 5-SRPM | Power Management (SPMI) |
| 5-SRPSI5 | PSI5 (decode and search only) |
| 5-SRSDLC | Synchronous Data Link Control Protocol Decode & Search |
| 5-SRSMBUS | SMBus (decode and search only) |
| 5-SRSPACEWIRE | Spacewire (decode and search only) |
| 5-SRVID | SVID |
| 5-SRUSB2 | USB (USB2.0 LS, FS, HS) |
| 5-SREUSB2 | eUSB2.0 (decode and search only) |

Differential serial bus? Be sure to check *Add analog probes and adapters* for differential probes.

## Step 4

**Add optional analysis capabilities**

| Instrument Option | Advanced Analysis |
|---|---|
| 5-DJA | Advanced Jitter and Eye Analysis |
| 5-DPM | Digital Power Management |
| 5-DPMBAS | Basic Digital Power Management |
| 5-MTM | Mask and Limit testing |
| 5-PS2[10 11] | Power Solution Bundle (5-PWR, THDP0200, TCP0030A, 067-1686-xx deskew fixture) |
| 5-PS2FRA[10 11] | Power Solution Bundle (5-PWR, THDP0200, TCP0030A, two TPP0502, 067-1686-xx deskew fixture) |
| 5-PWR [12] | Power Measurement and Analysis |
| 5-SV-BW-1 | Increase Spectrum View Capture Bandwidth to 500 MHz |
| 5-SV-RFVT | Spectrum View RF vs. Time traces, triggers, Spectrograms, and IQ capture |
| 5-UDFLT | User Defined Filter Creation Tool |
| 5-VID | NTSC, PAL, and SECAM video triggering |

## Step 5

**Add analog probes and adapters**

Add additional recommended probes and adapters

| Recommended Probe / Adapter | Description |
|---|---|
| TAP1500 | 1.5 GHz TekVPI® active single-ended voltage probe, ±8 V input voltage |
| TAP2500 | 2.5 GHz TekVPI® active single-ended voltage probe, ±4 V input voltage |
| TCP0030A | 30 A AC/DC TekVPI® current probe, 120 MHz BW |
| TCP0020 | 20 A AC/DC TekVPI® current probe, 50 MHz BW |
| TCP0030A | 30 A AC/DC TekVPI current probe, 120 MHz BW |
| TCP0150 | 150 A AC/DC TekVPI® current probe, 20 MHz BW |
| TRCP0300 | 30 MHz AC current probe, 250 mA to 300 A |
| TRCP0600 | 30 MHz AC current probe, 500 mA to 600 A |
| TRCP3000 | 16 MHz AC current probe, 500 mA to 3000 A |
| TDP0500 | 500 MHz TekVPI® differential voltage probe, ±42 V differential input voltage |
| TDP1000 | 1 GHz TekVPI® differential voltage probe, ±42 V differential input voltage |
| TDP1500 | 1.5 GHz TekVPI® differential voltage probe, ±8.5 V differential input voltage |

Table continued…

10 This option is not compatible with option 5-PWR.

| Recommended Probe / Adapter | Description |
|---|---|
| TDP7704 | 4 GHz TriMode™ voltage probe |
| TDP7710 | 10 GHz TriMode™ voltage probe |
| THDP0100 | ±6 kV, 100 MHz TekVPI® high-voltage differential probe |
| THDP0200 | ±1.5 kV, 200 MHz TekVPI® high-voltage differential probe |
| TMDP0200 | ±750 V, 200 MHz TekVPI® high-voltage differential probe |
| TPR1000 | 1 GHz, Single-Ended TekVPI® Power-Rail Probe; includes one TPR4KIT accessory kit |
| TIVP02 | Isolated Probe; 200 MHz, ±5 V to ±2500 V depending on tip; 2 meter cable |
| TIVP02L | Isolated Probe; 200 MHz, ±5 V to ±2500 V depending on tip; 10 meter cable |
| TIVP05 | Isolated Probe; 500 MHz, ±5 V to ±2500 V depending on tip; 2 meter cable |
| TIVP05L | Isolated Probe; 500 MHz, ±5 V to ±2500 V depending on tip; 10 meter cable |
| TIVP1 | Isolated Probe; 1 GHz, ±5 V to ±2500 V depending on tip; 2 meter cable |
| TIVP1L | Isolated Probe; 1 GHz, ±5 V to ±2500 V depending on tip; 10 meter cable |
| TPP0500B | 500 MHz, 10X TekVPI® passive voltage probe, 1.3 Meter Cable |
| TPP0502 | 500 MHz, 2X TekVPI® passive voltage probe, 12.7 pF input capacitance |
| TPP0850 | 2.5 kV, 800 MHz, 50X TekVPI® passive high-voltage probe |
| TPP1000 | 1 GHz, 10X TekVPI® passive voltage probe, 1.3 Meter cable, 3.9 pF input capacitance |
| P6015A | 20 kV, 75 MHz high-voltage passive probe |
| TPA-BNC [13] | TekVPI® to TekProbe™ BNC adapter |
| TEK-DPG | TekVPI deskew pulse generator signal source |
| 067-1686-xx | Power measurement deskew and calibration fixture |

Looking for other probes? Check out the probe selector tool at *www.tek.com/probes*.

## Step 6

**Add digital probes**

Each FlexChannel input can be configured as eight digital channels simply by connecting a TLP058 logic probe. TLP058 probes are ordered separately.

| For this instrument | Order | To add |
|---|---|---|
| MSO58LP, MSO58LPGSA | 1 to 8 TLP058 Probes | 8 to 64 digital channels |

## Step 7

**Add accessories**

| Optional Accessory | Description |
|---|---|
| 020-3180-xx | Benchtop conversion kit including four (4) instrument feet and a strap handle |

Table continued…

[11] This option must be purchased at the same time as the instrument. Not available as an upgrade.

| Optional Accessory | Description |
|---|---|
| 016-2139-xx | Hard transit case with handles and wheels for easy transportation |
| GPIB to Ethernet adapter | Order model 4865B (GPIB to Ethernet to Instrument Interface) directly from ICS Electronics<br>*www.icselect.com/gpib_instrument_intfc.html* |

## Step 8

**Select power cord option**

| Power Cord Option | Description |
|---|---|
| A0 | North America power plug (115 V, 60 Hz)<br>Includes mechanism that retains power cord to instrument |
| A1 | Universal Euro power plug (220 V, 50 Hz) |
| A2 | United Kingdom power plug (240 V, 50 Hz) |
| A3 | Australia power plug (240 V, 50 Hz) |
| A5 | Switzerland power plug (220 V, 50 Hz) |
| A6 | Japan power plug (100 V, 50/60 Hz) |
| A10 | China power plug (50 Hz) |
| A11 | India power plug (50 Hz) |
| A12 | Brazil power plug (60 Hz) |
| A99 | No power cord |

## Step 9

**Add extended service and calibration options**

| Service Option | Description |
|---|---|
| T3 | Three-year Total Protection Plan, includes repair or replacement coverage from wear and tear, accidental damage, ESD or EOS. |
| R3 | Standard warranty extended to 3 years. Covers parts, labor and 2-day shipping within country. Guarantees faster repair time than without coverage. All repairs include calibration and updates. Hassle free - a single call starts the process. |
| C3 | Calibration service for 3 years. Includes traceable calibration or functional verification where applicable, for recommended calibrations. Coverage includes the initial calibration plus 2 years of calibration coverage. |
| T5 | Five year Total Protection Plan, includes repair or replacement coverage from wear and tear, accidental damage, ESD or EOS. |

Table continued…

12 This option is not compatible with option 5-PS2 or 5-PS2FRA.

13 Recommended for connecting your existing TekProbe probes to the MSO58LP Low Profile .

| Service Option | Description |
|---|---|
| R5 | Standard warranty extended to 5 years. Covers parts, labor and 2-day shipping within country. Guarantees faster repair time than without coverage. All repairs include calibration and updates. Hassle free - a single call starts the process. |
| C5 | Calibration service for 5 years. Includes traceable calibration or functional verification where applicable, for recommended calibrations. Coverage includes the initial calibration plus 4 years of calibration coverage. |
| D1 | Calibration data report |
| D3 | Calibration data report 3 years (with Option C3) |
| D5 | Calibration data report 5 years (with Option C5) |

## Feature upgrades after purchase

**Add feature upgrades in the future**

You can easily add functionality after the initial purchase. Node-locked licenses permanently enable optional features on a single product. Floating licenses allow license-enabled options to be easily moved between compatible instruments.

| Upgrade feature | Node-locked license upgrade | Floating license upgrade | Description |
|---|---|---|---|
| Add instrument functions | SUP5-AFG | SUP5-AFG-FL | Add arbitrary function generator |
| | SUP5-RL-125MT250M | SUP5-RL-125MT250M-FL | Extend record length from 125 Mpts to 250 Mpts |
| | SUP5-RL-125MT500M | SUP5-RL-125MT500M-FL | Extend record length from 125 Mpts to 500 Mpts |
| | SUP5-RL-250MT500M | SUP5-RL-250MT500M-FL | Extend record length from 250 Mpts to 500 Mpts |
| Add protocol analysis | SUP5-SRAERO | SUP5-SRAERO-FL | Aerospace serial triggering and analysis (MIL-STD-1553, ARINC 429) |
| | SUP5-SRAUDIO | SUP5-SRAUDIO-FL | Audio serial triggering and analysis ($I^2S$, LJ, RJ, TDM) |
| | SUP5-SRAUTO | SUP5-SRAUTO-FL | Automotive serial triggering and analysis (CAN, CAN FD, LIN, FlexRay, and CAN symbolic decoding) |
| | SUP5-SRAUTOSEN | SUP5-SRAUTOSEN-FL | Automotive sensor serial triggering and analysis (SENT) |
| | SUP5-SRCOMP | SUP5-SRCOMP-FL | Computer serial triggering and analysis (RS-232/422/485/UART) |
| | SUP5-SRCXPI | SUP5-SRCXPI-FL | CXPI serial decoding and analysis |
| | SUP5-SRDPHY | SUP5-SRDPHY-FL | MIPI D-PHY (DSI-1, CSI-2 decode and search only) |
| | SUP5-SREMBD | SUP5-SREMBD-FL | Embedded serial triggering and analysis ($I^2C$, SPI) |
| | SUP5-SRENET | SUP5-SRENET-FL | Ethernet serial triggering and analysis (10Base-T, 100Base-TX) |
| | SUP5-SRESPI | SUP5-SRESPI-FL | eSPI serial decoding and analysis |
| | SUP5-SRETHERCAT | SUP5-SRETHERCAT-FL | EtherCAT serial decoding and analysis |
| | SUP5-SRI3C | SUP5-SRI3C-FL | MIPI I3C serial triggering and analysis |
| | SUP5-SRMDIO | SUP5-SRMDIO-FL | Management Data Input/Output serial decoding and analysis |
| | SUP5-SRPM | SUP5-SRPM-FL | Power Management serial triggering and analysis (SPMI) |
| | SUP5-SRPSI5 | SUP5-SRPSI5-FL PSI5 | Serial decoding and analysis |
| | SUP5-SRSDLC | SUP5-SRDLC-FL | Synchronous Data Link Control Protocol (decode and search only) |
| | SUP5-SRSMBUS | SUP5-SRSMBUS-FL | SMBus serial decoding and analysis |
| | SUP5-SRSPACEWIRE | SUP5-SRSPACEWIRE-FL | Spacewire serial analysis |
| | SUP5-SRSVID | SUP5-SRSVID-FL | Serial Voltage Identification (SVID) serial triggering and analysis |
| | SUP5-SRUSB2 | SUP5-SRUSB2-FL | USB 2.0 serial bus triggering and analysis (LS, FS, and HS) |
| | SUP5-SREUSB2 | SUP5-SREUSB2-FL | Embedded USB2 (eUSB2) serial decoding and analysis |

Table continued…

| Upgrade feature | Node-locked license upgrade | Floating license upgrade | Description |
|---|---|---|---|
| Add advanced analysis | SUP5-DJA | SUP5-DJA-FL | Advanced jitter and eye analysis |
| | SUP5-DPM | SUP5-DPM-FL | Digital Power Management |
| | SUP5-MTM | SUP5-MTM-FL | Mask and Limit Testing |
| | SUP5-DPMBAS | SUP5-DPMBAS-FL | Basic digital power management |
| | SUP5-PWR | SUP5-PWR-FL | Advanced power measurements and analysis |
| | SUP5-SV-BW-1 | SUP5-SV-BW-1-FL | Increase Spectrum View Capture Bandwidth to 500 MHz |
| | SUP5-SV-RFVT | SUP5-SV-RFVT-FL | Spectrum View RF vs. Time traces, triggers, Spectrograms, and IQ capture |
| | SUP5-UDFLT | SUP5-UDFLT-FL | User Defined Filter Creation Tool |
| | SUP5-VID | SUP5-VID-FL | NTSC, PAL, and SECAM video triggering |
| Add digital voltmeter | N/A | N/A | Add digital voltmeter / trigger frequency counter<br>(Free with product registration at *www.tek.com/register4mso*) |

Tektronix is ISO 14001:2015 and ISO 9001:2015 certified by DEKRA.

Product Area Assessed: The planning, design/development and manufacture of electronic Test and Measurement instruments.

**ASEAN / Australasia** (65) 6356 3900
**Belgium** 00800 2255 4835*
**Central East Europe and the Baltics** +41 52 675 3777
**Finland** +41 52 675 3777
**Hong Kong** 400 820 5835
**Japan** 81 (120) 441 046
**Middle East, Asia, and North Africa** +41 52 675 3777
**People's Republic of China** 400 820 5835
**Republic of Korea** +822 6917 5084, 822 6917 5080
**Spain** 00800 2255 4835*
**Taiwan** 886 (2) 2656 6688

**Austria** 00800 2255 4835*
**Brazil** +55 (11) 3759 7627
**Central Europe & Greece** +41 52 675 3777
**France** 00800 2255 4835*
**India** 000 800 650 1835
**Luxembourg** +41 52 675 3777
**The Netherlands** 00800 2255 4835*
**Poland** +41 52 675 3777
**Russia & CIS** +7 (495) 6647564
**Sweden** 00800 2255 4835*
**United Kingdom & Ireland** 00800 2255 4835*

**Balkans, Israel, South Africa and other ISE Countries** +41 52 675 3777
**Canada** 1 800 833 9200
**Denmark** +45 80 88 1401
**Germany** 00800 2255 4835*
**Italy** 00800 2255 4835*
**Mexico, Central/South America & Caribbean** 52 (55) 56 04 50 90
**Norway** 800 16098
**Portugal** 80 08 12370
**South Africa** +41 52 675 3777
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* European toll-free number. If not accessible, call: +41 52 675 3777

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