

6 Series MSO

Mixed Signal Oscilloscope Datasheet

*More speed. Lowest noise.
Exceptional measurement confidence.*



Confidence in numbers

Input channels

- 4 FlexChannel[®] inputs
- Each FlexChannel provides one analog signal input or eight digital logic inputs with TLP058 logic probe

Bandwidth

- 1 GHz, 2.5 GHz, 4 GHz, 6 GHz, 8 GHz (upgradable)

Sample rate (all analog / digital channels)

- Real-time: 25 GS/s
- Interpolated: 2.5 TS/s

Record length (all analog / digital channels)

- 62.5 Mpoints standard
- 125 Mpoints and 250 Mpoints optional upgrades

Waveform capture rate

- >500,000 waveforms/s

Vertical resolution

- 12-bit ADC
- Up to 16 bits in High Res mode

Standard trigger types

- Edge, Pulse Width, Runt, Timeout, Window, Logic, Setup & Hold, Rise/Fall Time, Parallel Bus, Sequence, Visual Trigger
- Auxiliary Trigger $\leq 5 V_{RMS}$, 50 Ω , 400 MHz (Edge Trigger only)

Standard analysis

- Cursors: Waveform, V Bars, H Bars, V&H Bars
- Measurements: 36
- FastFrame[™]: Segmented memory acquisition mode with maximum trigger rate >5,000,000 waveforms per second
- Plots: Time Trend, Histogram and Spectrum
- 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
- Advanced Power Analysis

Optional serial bus trigger, decode and analysis ¹

- I²C, SPI, RS-232/422/485/UART, SPMI, CAN, CAN FD, LIN, FlexRay, SENT, USB 2.0, Ethernet, I²S, LJ, RJ, TDM, MIL-STD-1553, ARINC 429

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

Display

- 15.6-inch (396 mm) TFT color
- High Definition (1,920 x 1,080) resolution
- Capacitive (multi-touch) touchscreen

Connectivity

- USB Host , USB Device (1 port), LAN (10/100/1000 Base-T Ethernet), Display Port, DVI-I, Video Out

e*Scope[®]

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

Warranty

- 3 years standard

Dimensions

- 12.2 in (309 mm) H x 17.9 in (454 mm) W x 8.0 in (204 mm) D
- Weight: <28.4 lbs. (12.88 kg)

¹ Optional and upgradeable.

² Free with product registration.

With the lowest input noise and up to 8 GHz analog bandwidth, the 6 Series MSO provides the best signal fidelity for analyzing and debugging today's embedded systems with GHz clock and bus speeds. The remarkably innovative pinch-swipe-zoom touchscreen user interface coupled with the industry's largest high definition display and 4 FlexChannel® inputs that let you measure one analog or eight digital signals per channel, the 6 Series MSO is ready for today's toughest challenges and tomorrow's too.

FlexChannel® technology enables maximum flexibility and broader system visibility

The 6 Series MSO redefines what a Mixed Signal Oscilloscope (MSO) should be. FlexChannel technology enables each of the inputs on the instrument to be used as a single analog channel or eight digital channels. The conversion is done by simply attaching a TLP058 logic probe to any input. Imagine the flexibility and configurability this provides.

You can change the configuration at any time by simply adding or removing TLP058 logic probes, so you always have the right number of digital channels.

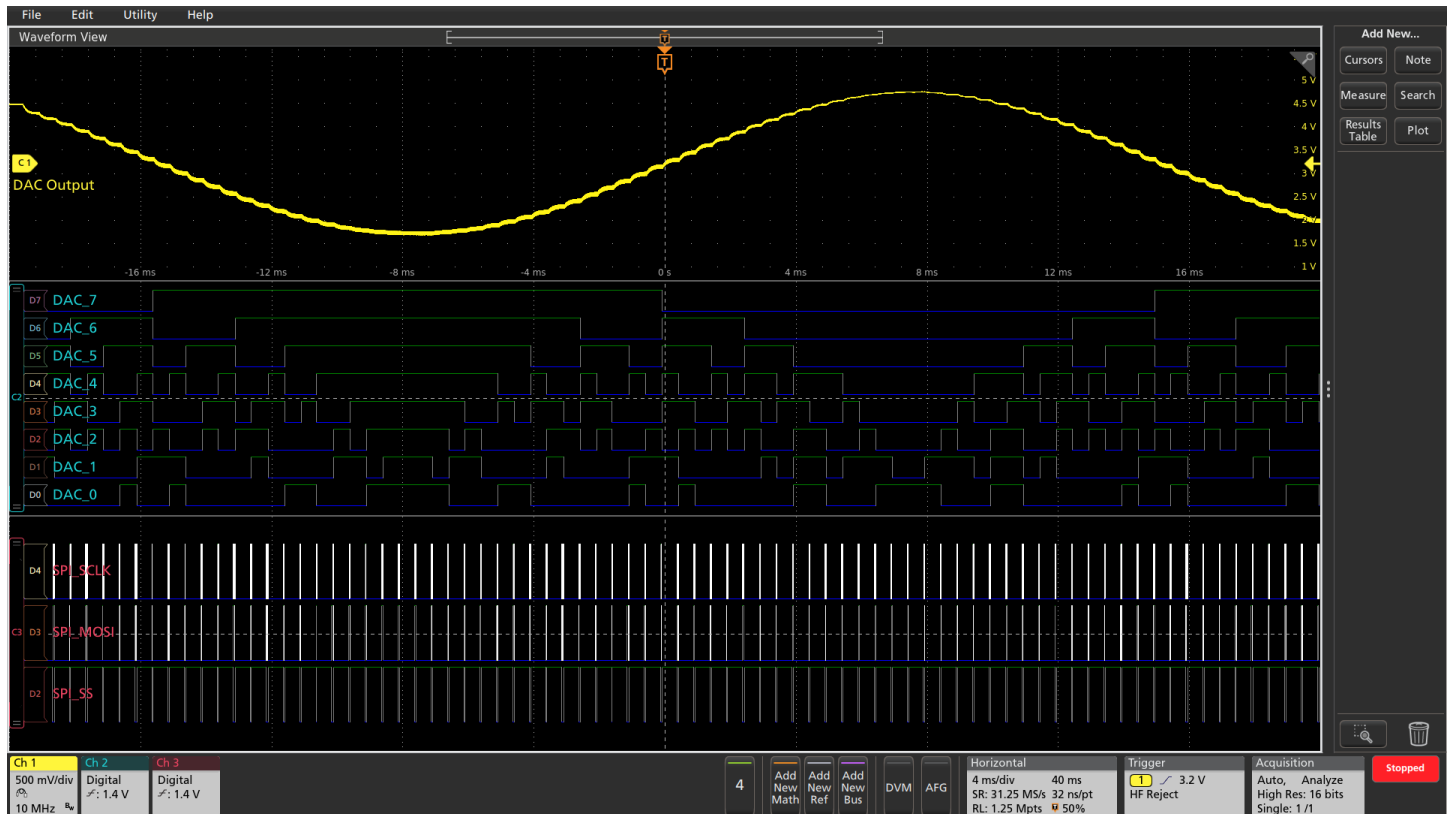


FlexChannel technology enables the ultimate in flexibility. Each input can be configured as a single analog or eight digital channels based on the type of probe you attach.

The 6 Series MSO offers a new level of integration of digital channels. Digital channels share the same high sample rate (up to 25 GS/s) for fine timing resolution, and long record length (up to 250 Mpoints) for long time captures as analog channels. Previous-generation MSOs required tradeoffs, with digital channels having lower sample rates or shorter record lengths than analog channels.



The TLP058 provides eight high performance digital inputs. Connect as many TLP058 probes as you like, enabling up to a maximum of 32 digital channels.



FlexChannel 2 has a TLP058 Logic Probe connected to the eight inputs of a DAC. Notice the green and blue color coding, where ones are green and zeros are blue. Another TLP058 Logic Probe on FlexChannel 3 is probing the SPI bus driving the DAC. The white edges indicate higher frequency information is available by either zooming in or moving to a faster sweep speed on the next acquisition.

Color-coded digital traces make it easy to determine if a logic signal is a one or a zero, even when the trace is flat across the display. Ones are displayed in green and zeros in blue. Unique multiple-transition detection hardware indicates when more than one transition occurs within a sample interval. A white bar on the trace indicates that more information is available by zooming in or acquiring at faster sampling rates. Often, zooming in will reveal a glitch that was previously hidden. Distinct thresholds can be defined for each digital channel, enabling you to easily observe different logic families, unlike other MSOs that have one or two shared thresholds across all digital channels.

Unprecedented signal viewing capability

The stunning 15.6" (396 mm) display in the 6 Series MSO is the largest display in the industry. It is also the highest resolution display, with full HD resolution (1,920 x 1,080), enabling you to see many signals at once with ample room for critical readouts and analysis.

The viewing area is optimized to ensure that the maximum vertical space is available for waveforms. The Results Bar on the right can be hidden, enabling the waveform view to use the full width of the display.



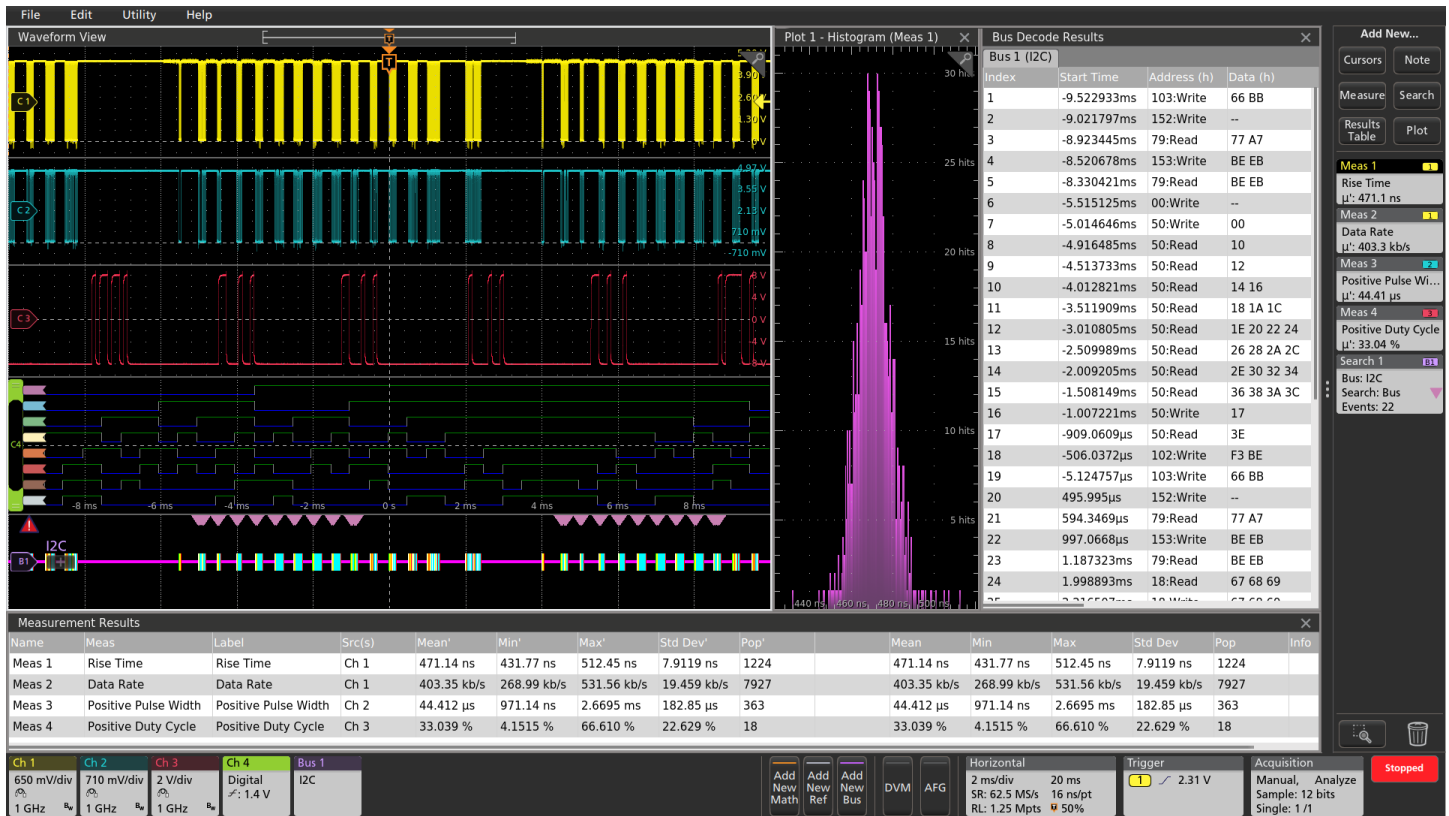
Stacked display mode enables easy visibility of all waveforms while maintaining maximum ADC resolution on each input for the most accurate measurements.

The 6 Series MSO offers a revolutionary new Stacked display mode. Historically, scopes have overlaid all waveforms in the same graticule, forcing difficult tradeoffs:

- To make each waveform visible, you vertically scale and position each waveform so that they don't overlap. Each waveform uses a small percentage of the available ADC range, leading to less accurate measurements.
- For measurement accuracy, you vertically scale and position each waveform to cover the entire display. The waveforms overlap each other, making it hard to distinguish signal details on individual waveforms

The new Stacked display eliminates this tradeoff. It automatically adds and removes additional horizontal waveform 'slices' (additional graticules) as waveforms are created and removed. Each slice represents the full ADC range for the waveform. All waveforms are visually separated from each other while still using the full ADC range, enabling maximum visibility and accuracy. And it's all done automatically as waveforms are added or removed! Channels can easily be reordered in stacked display mode by dragging and dropping the channel and waveform badges in the Settings bar at the bottom of the display.

The massive display in the 6 Series MSO also provides plenty of viewing area not only for signals, but also for plots, measurement results tables, bus decode tables and more. You can easily resize and relocate the various views to suit your application.



Viewing three analog channels, eight digital channels, a decoded serial bus waveform, decoded serial packet results table, four measurements, a measurement histogram, measurements results table with statistics and a search on serial bus events - simultaneously!

Exceptionally easy-to-use user interface lets you focus on the task at hand

The Settings Bar - key parameters and waveform management

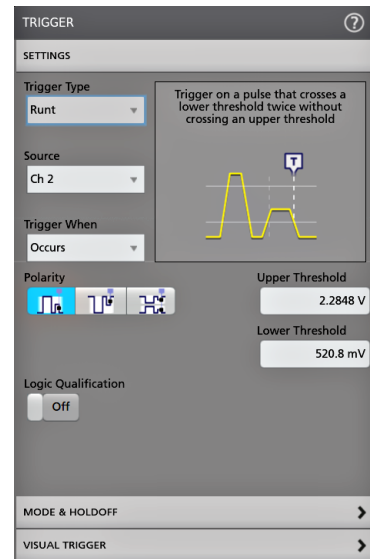
Waveform and scope operating parameters are displayed in a series of "badges" in the Settings Bar that runs along the bottom of the display. The Settings Bar provides Immediate access for the most common waveform management tasks. With a single tap, you can:

- Turn on channels
- Add math waveforms
- Add reference waveforms
- Add bus waveforms
- Enable the integrated Arbitrary/Function generator (AFG)
- Enable the integrated digital voltmeter (DVM)

The Results Bar - analysis and measurements

The Results Bar on the right side of the display includes immediate, one-tap access to the most common analytical tools such as cursors, measurements, searches, measurement and bus decode results tables, plots, and notes.

DVM, measurement and search results badges are displayed in the Results Bar without sacrificing any waveform viewing area. For additional waveform viewing area, the Results Bar can be dismissed and brought back at any time.



Configuration menus are accessed by simply double-tapping on the item of interest on the display. In this case, the Trigger badge was double-tapped to open the Trigger configuration menu.

Touch interaction finally done right

Scopes have included touch screens for years, but the touch screen has been an afterthought. The 6 Series MSO's 15.6" display includes a capacitive touchscreen and provides the industry's first oscilloscope user interface truly designed for touch.

The touch interactions that you use with phones and tablets, and expect in a touch enabled device, are supported in the 6 Series MSO.

- Drag waveforms left/right or up/down to adjust horizontal and vertical position or to pan a zoomed view
- Pinch and expand to change scale or zoom in/out in either horizontal or vertical directions
- Drag items to the trash can to delete them
- Swipe in from the right to reveal the Results Bar or down from the top to access the menus in the upper left corner of the display

Smooth, responsive front panel controls allow you to make adjustments with familiar knobs and buttons, and you can add a mouse or keyboard as a third interaction method.



Interact with the capacitive touch display in the same way you do on your phones and tablets.

Attention to detail in the front-panel controls

Traditionally, the front face of a scope has been roughly 50% display and 50% front panel. The 6 Series MSO display fills about 85% of the face of the instrument. To achieve this, it has a streamlined front panel that retains critical controls for simple intuitive operation, but with a reduced number of menu buttons for functions directly accessed via objects on the display.

Color-coded LED light rings indicate trigger source and vertical scale/position knob assignments. Large, dedicated Run/ Stop and Single Sequence buttons are placed prominently in the upper right, and other functions like Force Trigger, Trigger Slope, Trigger Mode, Default Setup, Autoset and Quick-save functions are all available using dedicated front panel buttons.



Efficient and intuitive front panel provides critical controls while still leaving room for the massive 15.6" high definition display.

Windows or not - you choose

The 6 Series MSO offers you the choice of whether to include a Microsoft Windows™ operating system. Opening an access panel on the bottom of the instrument reveals a connection for a solid state drive (SSD). When the SSD is not present, the instrument boots as a dedicated scope with no ability to run or install other programs.



When the SSD is present, the instrument boots in an open Windows 10 configuration, so you can minimize the oscilloscope application and access a Windows desktop where you can install and run additional applications on the oscilloscope. Or you can connect additional monitors and extend your desktop.

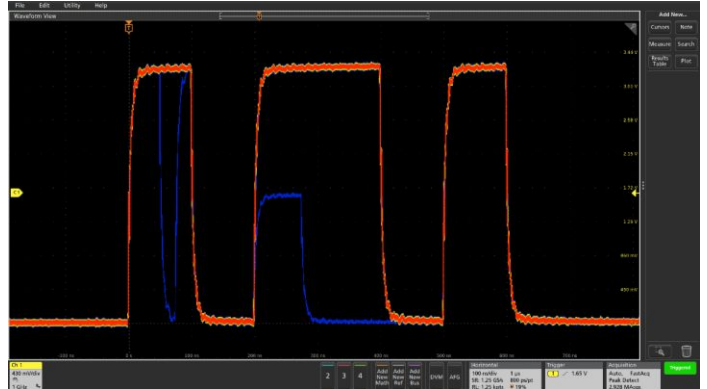
Whether you run Windows or not, the oscilloscope operates in exactly the same way with the same look and feel and UI interaction.

Experience the performance difference

With up to 8 GHz analog bandwidth, 25 GS/s sample rates, standard 62.5 M record length and a 12-bit analog to digital converter (ADC), the 6 Series MSO has the performance you need to capture waveforms with the best possible signal fidelity and resolution for seeing small waveform details.

Digital Phosphor technology with FastAcq™ high-speed waveform capture

To debug a design problem, first you must know it exists. Digital phosphor technology with FastAcq provides you with fast insight into the real operation of your device. Its fast waveform capture rate - greater than 500,000 waveforms per second - gives you a high probability of seeing the infrequent problems common in digital systems: runt pulses, glitches, timing issues, and more. To further enhance the visibility of rarely occurring events, intensity grading indicates how often rare transients are occurring relative to normal signal characteristics.



FastAcq's high waveform capture rate enables you to discover infrequent problems common in digital design.

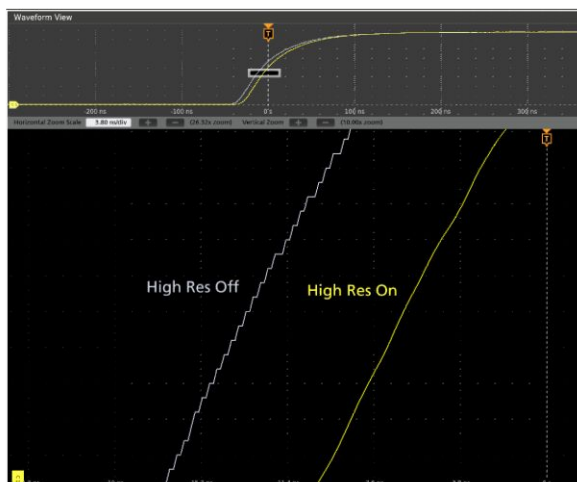
Industry leading vertical resolution and low noise

The 6 Series MSO 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 6 Series MSO are 12-bit analog-to-digital converters (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.

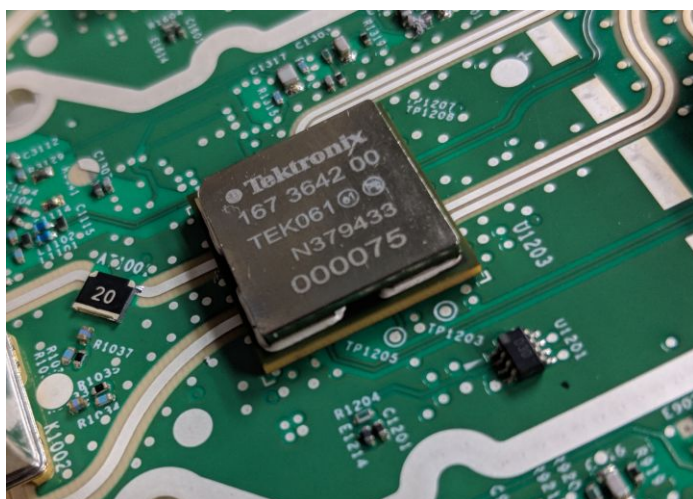
High Res mode always provides at least 12 bits of vertical resolution and extends all the way to 16 bits of vertical resolution at ≤ 625 MS/s sample rates and 200 MHz of bandwidth. The following table shows the number of bits of vertical resolution for each sample rate setting when in High Res.

| Sample rate | Number of bits of vertical resolution |
|-------------|---------------------------------------|
| 25 GS/s | 8 |
| 12.5 GS/s | 12 |
| 6.25 GS/s | 13 |
| 3.125 GS/s | 14 |
| 1.25 GS/s | 15 |
| ≤625 MS/s | 16 |



The 6 Series MSOs 12-bit ADC along with the new High Res mode enable industry leading vertical resolution.

A new TEK061 front end amplifier sets a new standard for low-noise acquisition providing the best signal fidelity to capture small signals with high resolution.



A key attribute to being able to view fine signal details on small, high-speed signals is noise. The higher a measurement systems' intrinsic noise, the less true signal detail will be visible. This becomes more critical on an oscilloscope when the vertical settings are set to high sensitivity (like $\leq 10\text{mV/div}$) in order to view small signals that are prevalent in high-speed bus topologies. The 6 Series MSO has a new front-end ASIC, the TEK061, that enables breakthrough noise performance at the highest sensitivity settings. The table below shows a comparison of typical noise performance of the 6 Series MSO and prior generations of Tektronix oscilloscopes in this bandwidth range.

50 Ω , RMS voltage, typical

| Bandwidth | V/Div | 6 Series MSO | DPO7000C | MSO/ DPO70000C |
|-----------|--------|--------------------|--------------------|-------------------|
| 1 GHz | 1 mV | 54.8 μV | 90 μV^3 | N/A |
| | 10 mV | 90.9 μV | 279 μV | N/A |
| | 100 mV | 941 μV | 2.7 mV | N/A |
| 4 GHz | 1 mV | 97.4 μV | N/A | N/A |
| | 10 mV | 192 μV | N/A | 500 μV |
| | 100 mV | 1.92 mV | N/A | 4.3 mV |
| 8 GHz | 1 mV | 158 μV | N/A | N/A |
| | 10 mV | 342 μV | N/A | 580 μV |
| | 100 mV | 3.46 mV | N/A | 4.5 mV |

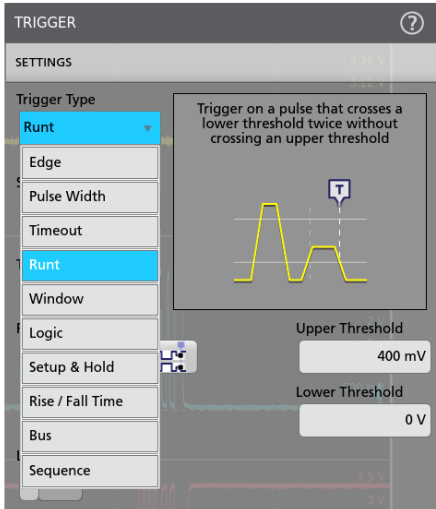
Triggering

Discovering a device fault is only the first step. Next, you must capture the event of interest to identify root cause. The 6 Series MSO provides a complete set of advanced triggers, including:

- Runt
- Logic
- Pulse width
- Window
- Timeout
- Rise/fall time
- Setup and hold violation
- Serial packet
- Parallel data
- Sequence
- Visual Trigger

With up to a 250 Mpoint record length, you can capture many events of interest, even thousands of serial packets in a single acquisition, providing high-resolution to zoom in on fine signal details and record reliable measurements.

³ Bandwidth limited to 200 MHz.

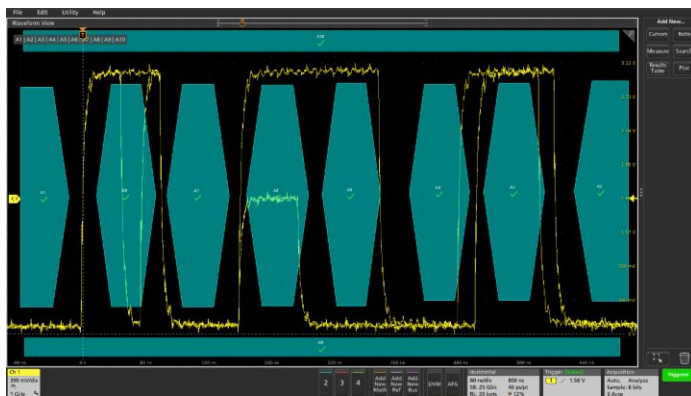


The wide variety of trigger types and context-sensitive help in the trigger menu make it easier than ever to isolate the event of interest.

Visual trigger -Finding the signal of interest quickly

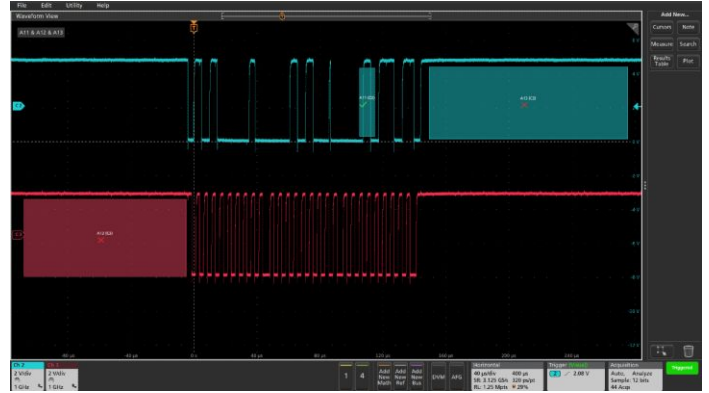
Finding the right cycle of a complex bus can require hours of collecting and sorting through thousands of acquisitions for an event of interest. Defining a trigger that isolates the desired event speeds up debug and analysis efforts.

Visual Trigger extends the 6 Series MSO's triggering capabilities by scanning through all waveform acquisitions and comparing them to on-screen areas (geometric shapes). An unlimited number of areas can be created using a mouse or touchscreen, and a variety of shapes (triangles, rectangles, hexagons, or trapezoids) can be used to specify the desired trigger behavior. Once shapes are created, they can be edited interactively to create custom shapes and ideal trigger conditions.



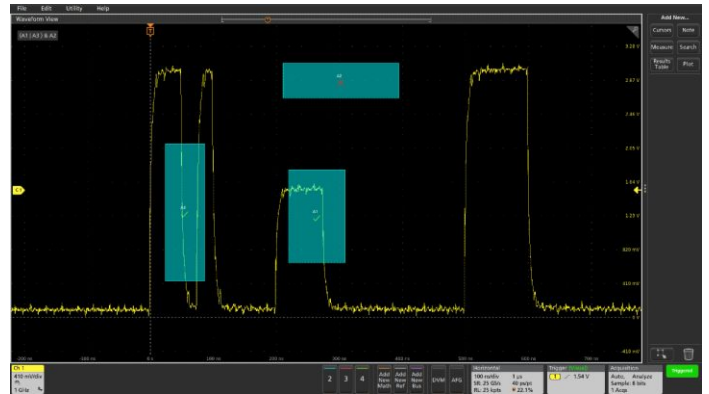
Visual Trigger areas isolate an event of interest, saving time by only capturing the events you want to see.

By triggering only on the most important signal events, Visual Trigger can save hours of capturing and manually searching through acquisitions. In seconds or minutes, you can find the critical events and complete your debug and analysis efforts. Visual Trigger even works across multiple channels, extending its usefulness to complex system troubleshooting and debug tasks.



Multiple channel triggering. Visual Trigger areas can be associated with events spanning multiple channels such as packets transmitted on two bus signals simultaneously.

Once multiple areas are defined, a Boolean logic equation can be used to set complex trigger conditions using on-screen editing features.



Boolean logic trigger qualification. Boolean logic using logical OR allows triggering on a specific anomaly in the signal.

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 comp box itself. This button brings up a probe menu on the oscilloscope display with all relevant settings and controls for the probe. 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 6 Series MSO provides up to 40 W of power to the front panel connectors, sufficient to power all connected TekVPI probes without the need for an additional probe power supply.

Convenient high speed passive voltage probing

The TPP Series passive voltage probes included with every 6 Series MSO 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. Up to 1 GHz analog bandwidth enables you to see high frequency components in your signals, and extremely low 3.9 pF capacitive loading minimizes adverse effects on your circuits and is more forgiving of longer ground leads.

An optional, low-attenuation (2X) version of the TPP probe is available for measuring low voltages. Unlike other low-attenuation passive probes, the TPP0502 has high bandwidth (500 MHz) as well as low capacitive loading (12.7 pF).



6 Series MSOs come standard with one TPP1000 (1 GHz, 2.5 GHz models) probe per channel.

TDP7700 Series TriMode Probes

The TDP7700 Series TriMode probes provide the highest probe fidelity available for real-time oscilloscopes. The TDP7700 is designed for use with the 6 Series MSO, with full AC calibration of the probe and tip's signal path based on unique S-parameter models. The probe communicates the S-parameters to the scope via the TekVPI probe interface and the 6 Series MSO includes them to achieve the very best signal fidelity possible from probe tip to acquisition memory. Connectivity innovations such as solder-down tips with the probe's input buffer mounted only a few millimeters from the end of the tip, the TDP7700 Series probes provide unmatched usability for connecting to today's most challenging electronic designs.



TDP7700 Series probe with a selection of available tips

With TriMode probing one probe setup makes differential, single ended, and common mode measurements accurately. This unique capability allows you to work more effectively and efficiently, switching between differential, single ended and common mode measurements without moving the probe's connection point.

IsoVu™ Isolated Measurement System

Whether designing an inverter, optimizing a power supply, testing communication links, measuring across a current shunt resistor, debugging EMI or ESD issues, or trying to eliminate ground loops in your test setup, common mode interference has caused engineers to design, debug, evaluate, and optimize "blind" until now.

Tektronix' revolutionary IsoVu technology uses optical communications and power-over-fiber for complete galvanic isolation. When combined with the 6 Series MSO equipped with the TekVPI interface, it is the first, and only, measurement system capable of accurately resolving high bandwidth, differential signals, in the presence of large common mode voltage with:

- Complete galvanic isolation
- Up to 1 GHz bandwidth
- 1 Million to 1 (120 dB) common mode rejection at 100 MHz
- 10,000 to 1 (80 dB) of common mode rejection at full bandwidth
- Up to 2,500 V differential dynamic range
- 60 kV common mode voltage range



The Tektronix TIVM Series IsoVu™ Measurement System offers a galvanically isolated measurement solution to accurately resolve high bandwidth, differential signals up to 2,500 Vpk in the presence of large common mode voltages, with the best in class common mode rejection performance across its bandwidth.

Comprehensive analysis for fast insight

Basic waveform analysis

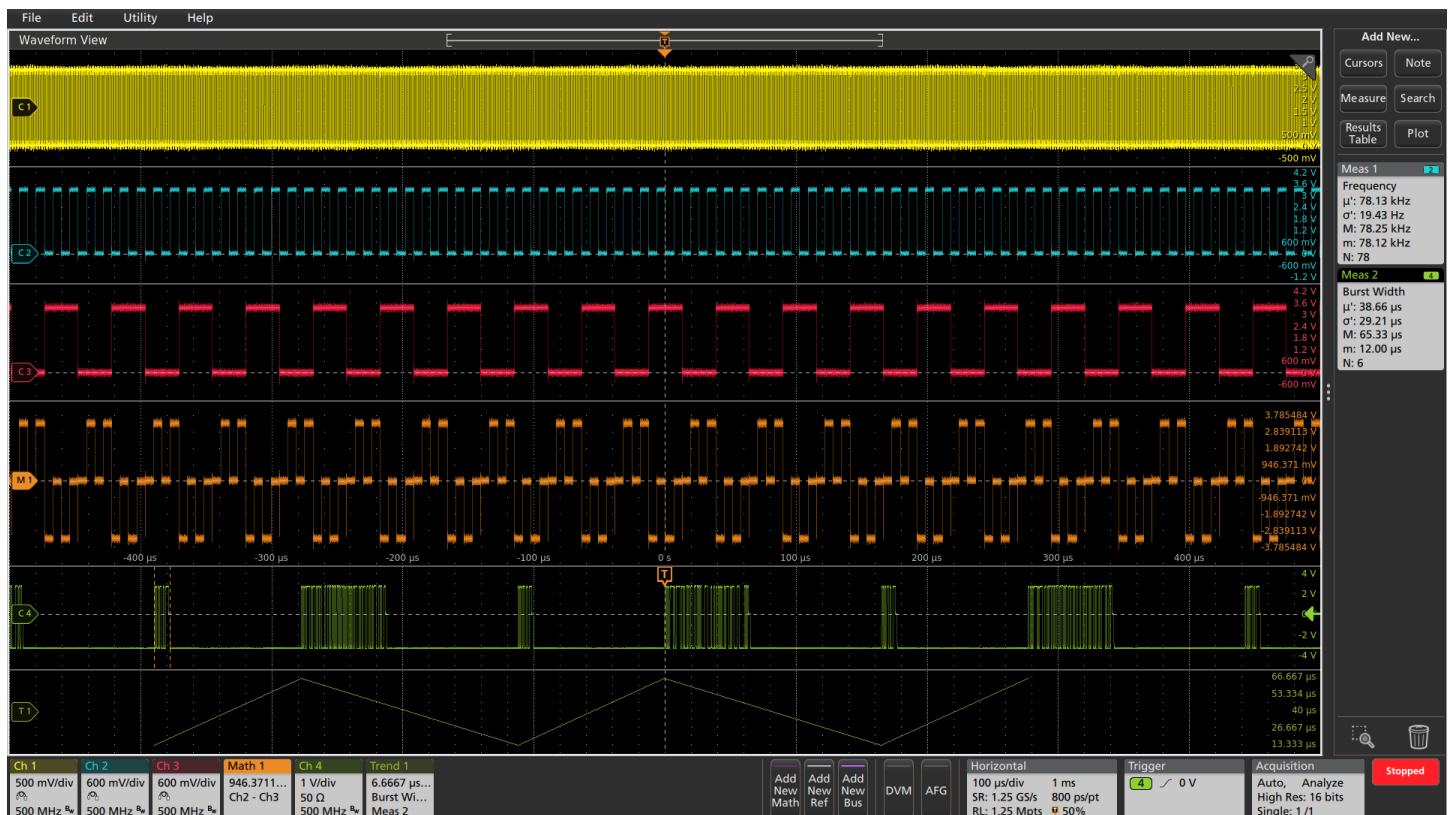
Verifying that your prototype's performance matches simulations and meets the project's design goals requires careful analysis, ranging from simple checks of rise times and pulse widths to sophisticated power loss analysis, characterization of system clocks, and investigation of noise sources.

The 6 Series MSO offers a comprehensive set of standard analysis tools including:

- Waveform- and screen-based cursors
- 36 automated measurements. Measurement results include all instances in the record, the ability to navigate from one occurrence to the next, and immediate viewing of the minimum or maximum result found in the record

- Basic waveform math
- FFT analysis
- Advanced waveform math including arbitrary equation editing with filters and variables
- FastFrame™ Segmented Memory enables you to make efficient use of the oscilloscope's acquisition memory by capturing many trigger events in a single record while eliminating the large time gaps between events of interest. View and measure the segments individually or as an overlay.

Measurement results tables provide comprehensive statistical views of measurement results with statistics across both the current acquisition and all acquisitions.



Using measurements to characterize burst width and Frequency.

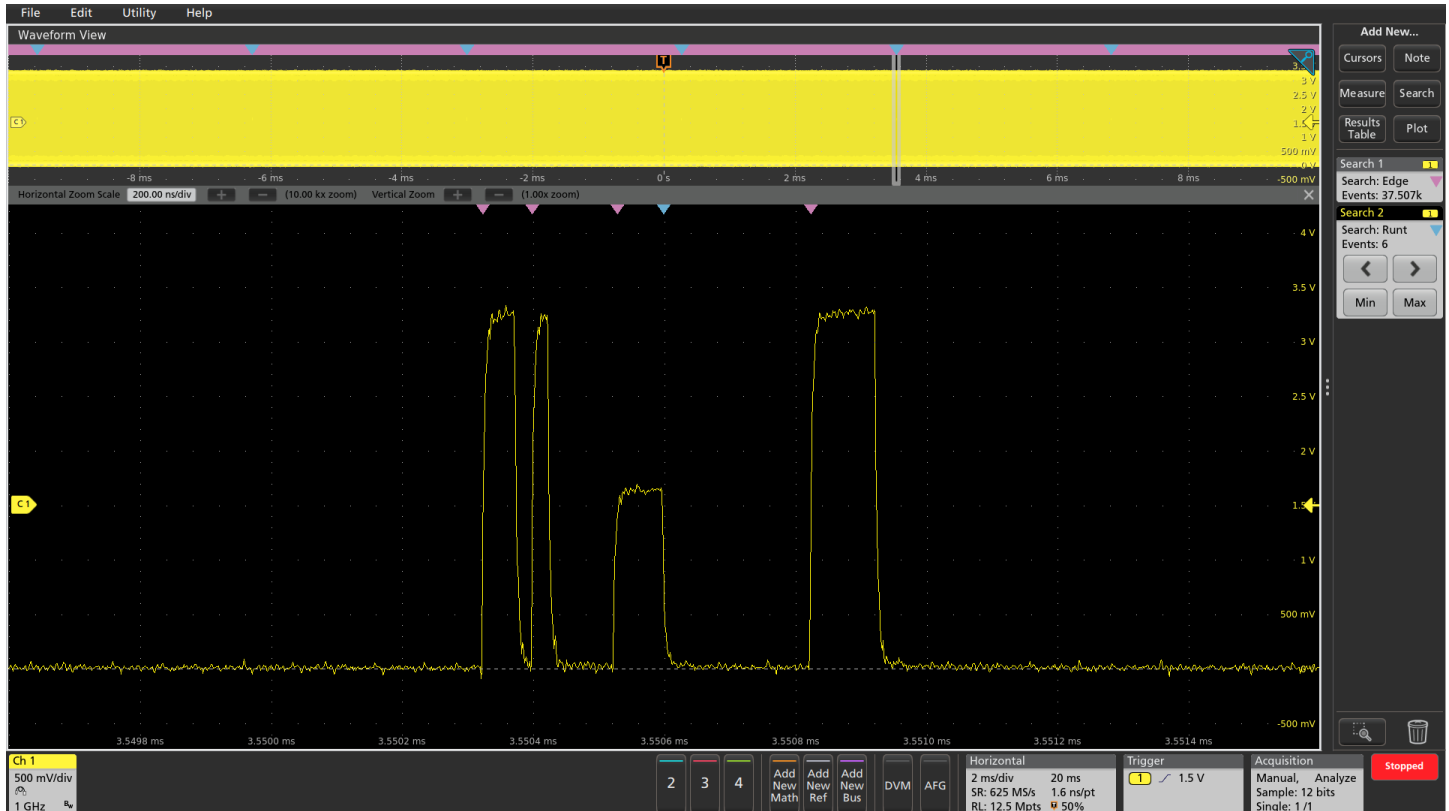
Navigation and search

Finding your event of interest in a long waveform record can be time consuming without the right search tools. With today's record lengths of many millions of data points, locating your event can mean scrolling through literally thousands of screens of signal activity.

The 6 Series MSO offers the industry's most comprehensive search and waveform navigation with its innovative Wave Inspector® controls. These controls speed panning and zooming through your record. With a unique force-feedback system, you can move from one end of your record to the other in just seconds. Or, use intuitive drag and pinch/expand gestures on the display itself to investigate areas of interest in a long record.

The Search feature allows you to automatically search through your long acquisition looking for user-defined events. All occurrences of the event are highlighted with search marks and are easily navigated to, using the Previous (←) and Next (→) buttons found on the front panel or on the Search badge on the display. Search types include edge, pulse width, timeout, runt, window, logic, setup and hold, rise/fall time and parallel/serial bus packet content. You can define as many unique searches as you like.

You can also quickly jump to the minimum and maximum value of search results by using the Min and Max buttons on the Search badge.

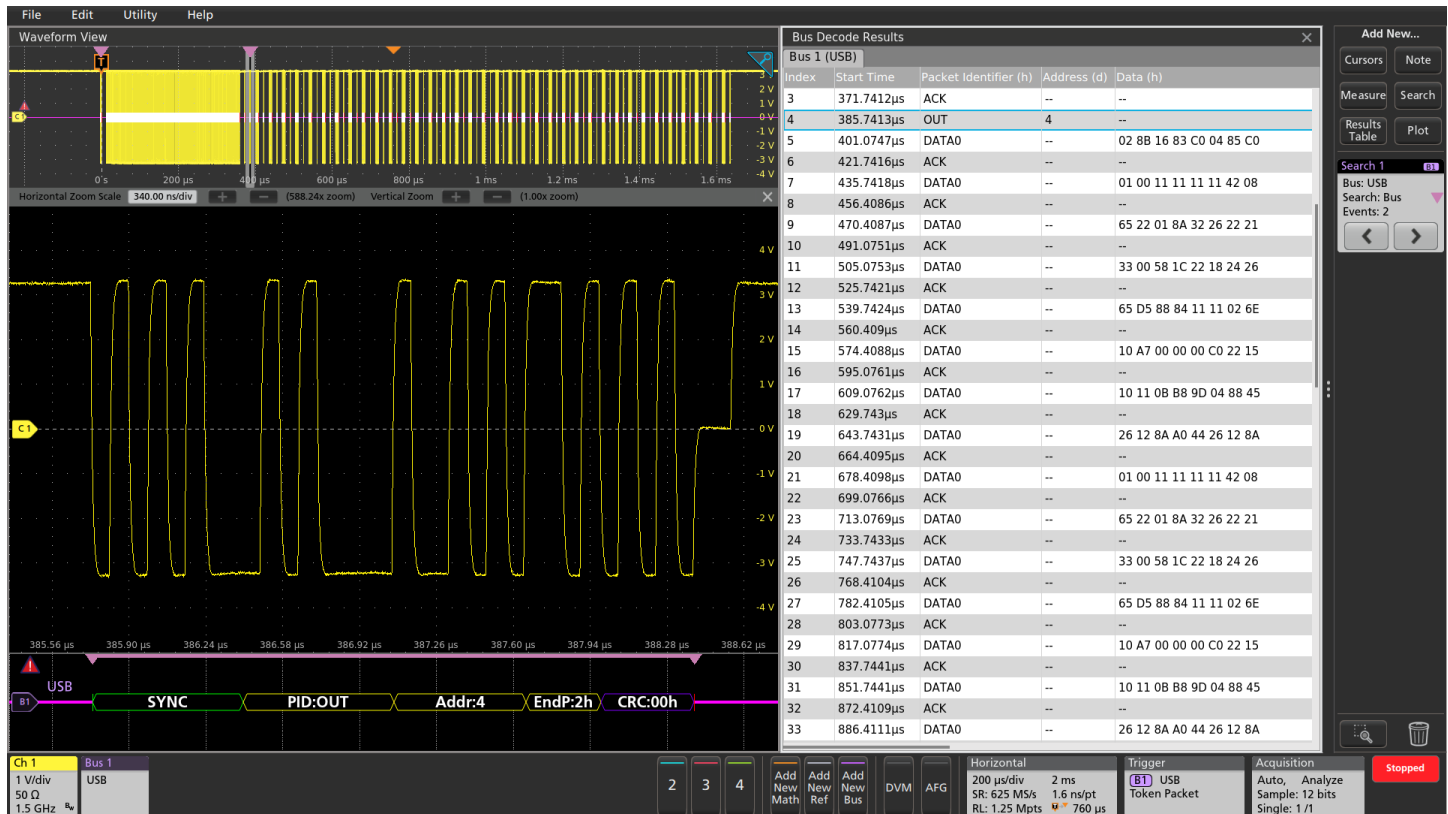


Earlier, FastAcq revealed the presence of a runt pulse in a digital data stream prompting further investigation. In this long 20 ms acquisition, Search 1 reveals that there are approximately 37,500 rising edges in the acquisition. Search 2 (run simultaneously) reveals that there are six runt pulses in the acquisition.

Serial protocol triggering and analysis (optional)

During debugging, it can be invaluable to trace the flow of activity through a system by observing the traffic on one or more serial buses. It could take many minutes to manually decode a single serial packet, much less the thousands of packets that may be present in a long acquisition.

And if you know the event of interest that you are attempting to capture occurs when a particular command is sent across a serial bus, wouldn't it be nice if you could trigger on that event? Unfortunately, it's not as easy as simply specifying an edge or a pulse width trigger.



Triggering on a USB full-speed serial bus. A bus waveform provides time-correlated decoded packet content including Start, Sync, PID, Address, End Point, CRC, Data values, and Stop, while the bus decode table presents all packet content from the entire acquisition.

The 6 Series MSO offers a robust set of tools for working with the most common serial buses found in embedded design including I²C, SPI, RS-232/422/485/UART, SPMI, CAN, CAN FD, LIN, FlexRay, SENT, USB LS/FS/HS, Ethernet 10/100, Audio (I²S/LJ/RJ/TDM), MIL-STD-1553, and ARINC 429.

Serial protocol search enables you to search through a long acquisition of serial packets and find the ones that contain the specific packet content you specify. Each occurrence is highlighted by a search mark. Rapid navigation between marks is as simple as pressing the Previous (←) and Next (→) buttons on the front panel or in the Search badge that appears in the Results Bar.

Parallel buses are still found in many designs. The tools described for serial buses also work on parallel buses. Support for parallel buses is standard in the 6 Series MSO. Parallel buses can be up to 32 bits wide and can include a combination of analog and digital channels.

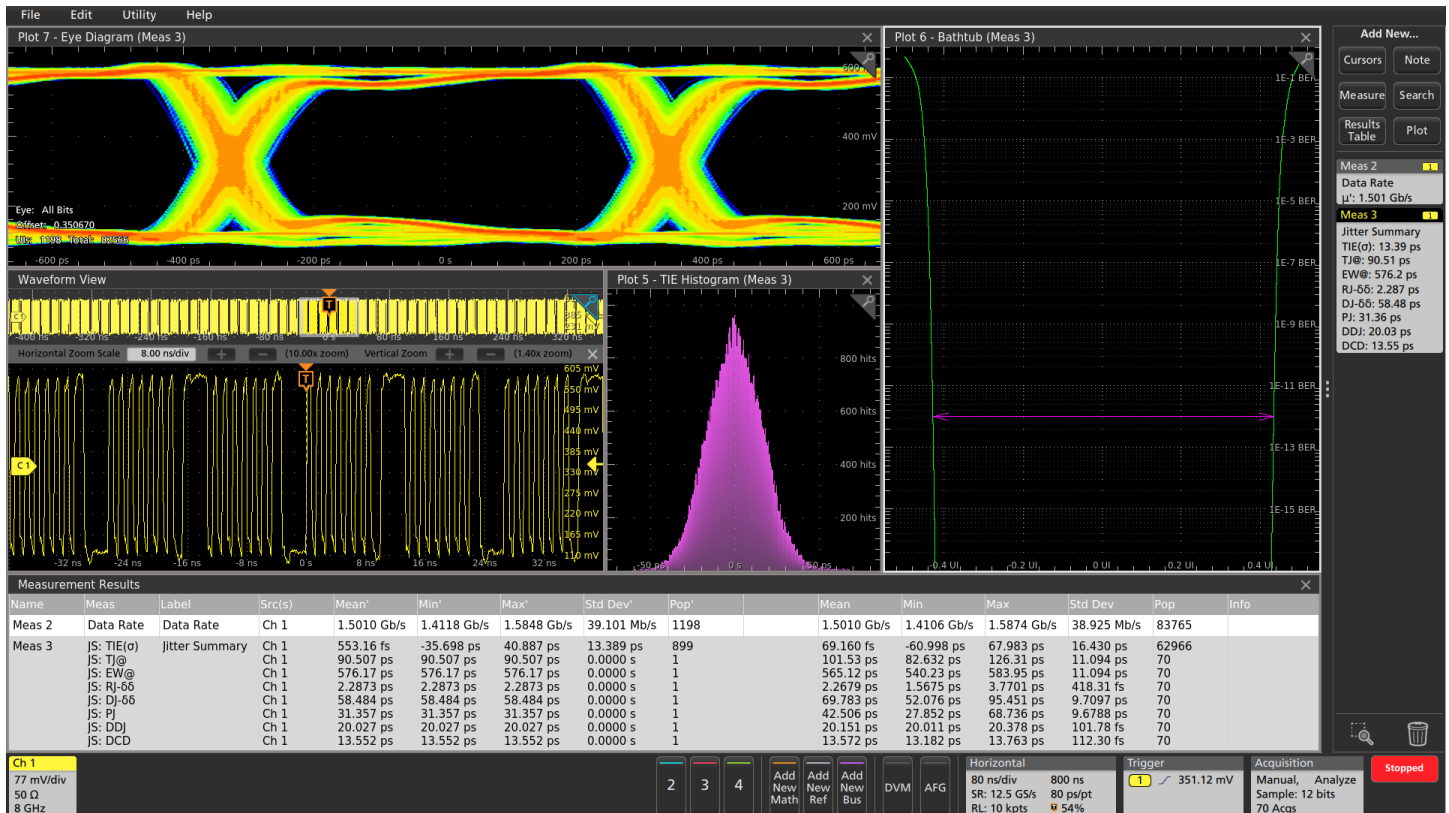
- Serial protocol triggering lets you trigger on specific packet content including start of packet, specific addresses, specific data content, unique identifiers, and errors.
- Bus waveforms provide a higher-level, combined view of the individual signals (clock, data, chip enable, and so on) that make up your bus, making it easy to identify where packets begin and end, and identifying sub-packet components such as address, data, identifier, CRC, and so on.
- The bus waveform is time aligned with all other displayed signals, making it easy to measure timing relationships across various parts of the system under test.
- Bus decode tables provide a tabular view of all decoded packets in an acquisition much like you would see in a software listing. Packets are time stamped and listed consecutively with columns for each component (Address, Data, and so on).

Jitter analysis

The 6 Series MSO has seamlessly integrated the DPOJET Essentials jitter and eye pattern analysis software package, extending the oscilloscope's capabilities to take measurements over contiguous clock and data cycles in a single-shot real-time acquisition. This enables measurement of key jitter and timing analysis parameters such as Time Interval Error and Phase Noise to help characterize possible system timing issues.

Analysis tools, such as plots for time trends and histograms, quickly show how timing parameters change over time, and spectrum analysis quickly shows the precise frequency and amplitude of jitter and modulation sources.

Option 6-DJA adds additional jitter analysis capability to better characterize your device's performance. The 31 additional measurements provide comprehensive jitter and eye-diagram analysis and jitter decomposition algorithms, enabling the discovery of signal integrity issues and their related sources in today's high-speed serial, digital, and communication system designs.

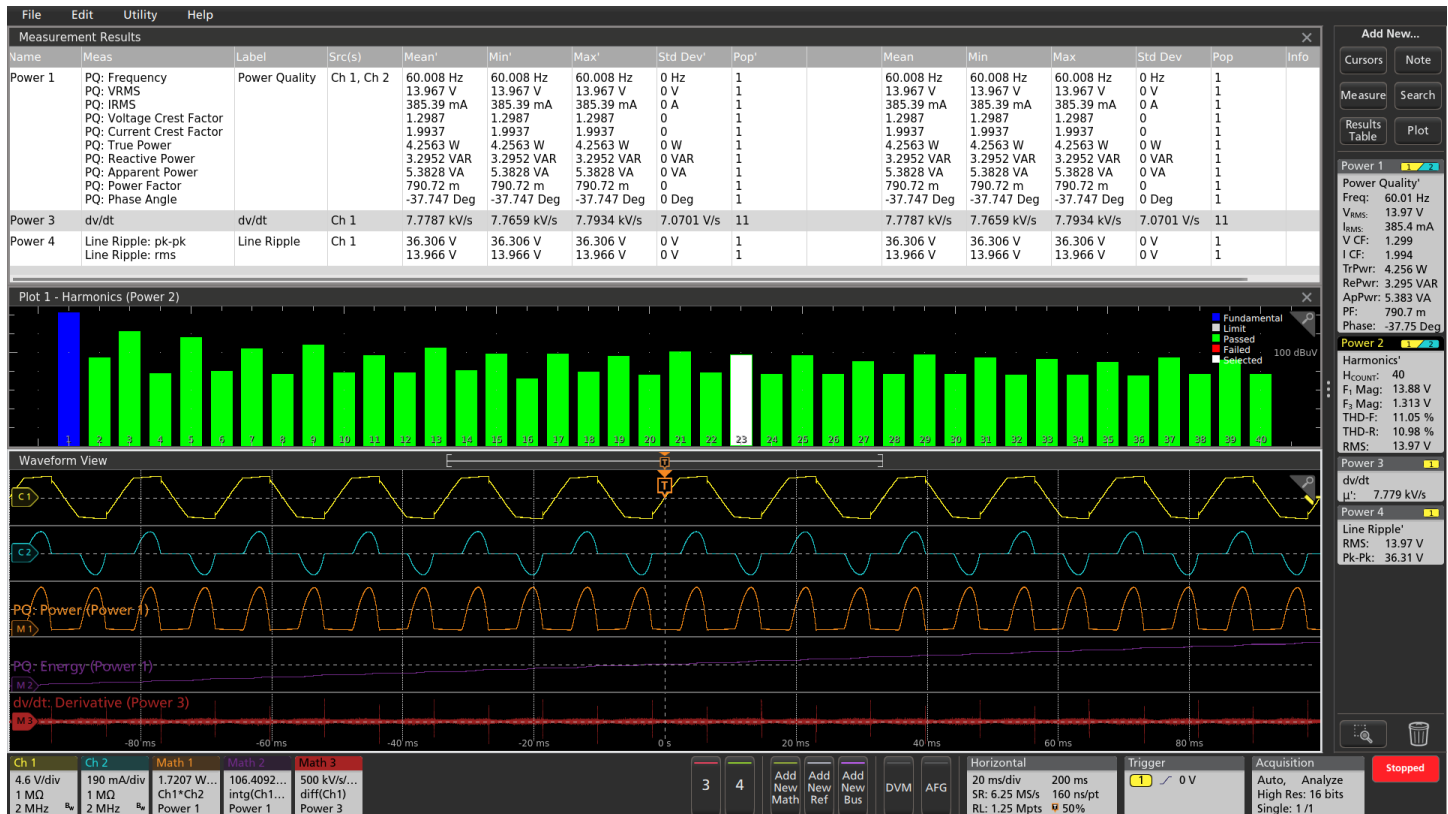


The unique Jitter Summary provides a comprehensive view of your device's performance in a matter of seconds.

Power analysis

The 6 Series MSO has also integrated the optional 6-PWR power analysis package into the oscilloscope's automatic measurement system to enable quick and repeatable analysis of power quality, input capacitance, in-rush current, harmonics, switching loss, safe operating area (SOA), modulation, ripple, magnetics measurements, efficiency, amplitude and timing measurements, and slew rate (dv/dt and di/dt).

Measurement automation optimizes the measurement quality and repeatability at the touch of a button, without the need for an external PC or complex software setup.



The Power Analysis measurements display a variety of waveforms and plots.

Compliance test

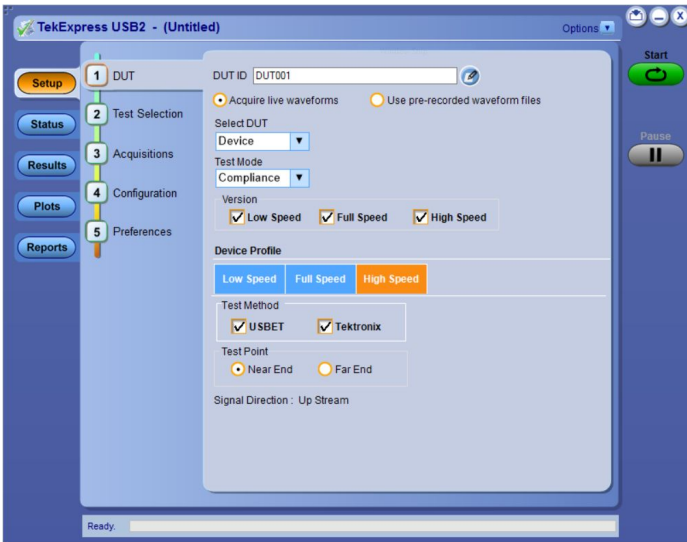
A key focus area for embedded designers is testing various embedded and interface technologies for compliance. This ensures the device passes the logo certification at plugfests and achieves successful interoperability when working with other compliant devices.

The compliance test specifications for high speed serial standards like USB, Ethernet, Memory, Display and MIPI are developed by the respective consortiums, or governing bodies. Working closely with these consortiums, Tektronix has developed oscilloscope-based compliance applications that not only focus on providing pass/fail results but also provide deeper insight into any failures by providing relevant measurement tools such as jitter and timing analysis to debug failing designs.

These automated compliance applications are built on a framework that provides:

- Complete test coverage per the specification.
- Fast test times with optimized acquisitions and test sequencing based on customized settings.

- Analysis based on previously-acquired signals, allowing the device under test (DUT) to be disconnected from the setup once all acquisitions are completed. This also allows analysis of waveforms acquired on a different oscilloscope or captured at a remote lab, facilitating a very collaborative test environment.
- Signal validation during acquisition to ensure the right signals are being captured.
- Additional parametric measurements for design debug.
- Custom eye diagram mask testing for insight into design margin.
- Detailed reports in multiple formats with setup information, results, margins, waveform screenshots and plot images.



TekExpress USB2 (Option 6-CMUSB2) DUT panel configures the DUT-specific settings



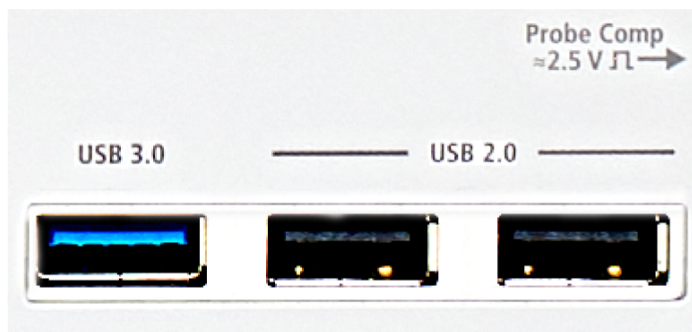
6 Series MSO running 6-CMUSB2 Compliance Measurements as per USB 2.0 Specification

Designed with your needs in mind

Connectivity

The 6 Series MSO contains a number of ports which you can use to connect the instrument to a network, directly to a PC, or to other test equipment.

- Two USB 2.0 and one USB 3.0 host ports on the front and four more USB host ports (two 2.0, two 3.0) on the rear enable easy transfer of screen shots, instrument settings, and waveform data to a USB mass storage device. A USB mouse and keyboard can also be attached to USB host ports for instrument control and data entry.
- The rear panel USB device port is useful for controlling the oscilloscope remotely from a PC.
- The standard 10/100/1000BASE-T Ethernet port on the rear of the instrument enables easy connection to networks and provides LXI Core 2011 compatibility.
- DVI-D, Display Port and VGA ports on the rear of the instrument lets you export the display to an external monitor or projector.



The I/O you need to connect the 6 Series MSO to the rest of your design environment.

Remote operation to improve collaboration

Want to collaborate with a design team on the other side of the world?

The embedded e*Scope[®] capability enables fast 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. Control the oscilloscope remotely in the exact same ways you do in-person. Alternatively, you can use Microsoft Windows Remote Desktop[™] capability to connect directly to your oscilloscope and control it remotely.

The industry-standard TekVISA[™] protocol interface is included for using and enhancing Windows applications for data analysis and documentation. IVI-COM instrument drivers are included to enable easy communication with the oscilloscope using LAN or USBTMC connections from an external PC.



e*Scope provides simple remote viewing and control using common web browsers.

Arbitrary/Function Generator (AFG)

The 6 Series MSO contains an optional integrated arbitrary/function generator, perfect for simulating sensor signals within a design or adding noise to signals to perform margin testing. The integrated function generator provides output of predefined waveforms up to 50 MHz for sine, square, pulse, ramp/triangle, DC, noise, sin(x)/x (Sinc), Gaussian, Lorentz, exponential rise/fall, Haversine and cardiac. The arbitrary waveform generator provides 128 k points of record for loading saved waveforms from an internal file location or a USB mass storage device. The 6 Series MSO is compatible with Tektronix' ArbExpress PC-based waveform creation and editing software, making creation of complex waveforms fast and easy.

Digital Voltmeter (DVM) and Trigger Frequency Counter

The 6 Series MSO contains an integrated 4-digit digital voltmeter (DVM) and 8-digit trigger frequency counter. Any of the analog inputs can be a source for the voltmeter, using the same probes that are already attached for general oscilloscope usage. The counter provides a very precise readout of the frequency of the trigger event on which you're triggering. Both the DVM and trigger frequency counter are available for free and are activated when you register your product.

Enhanced security option

The optional 6-SEC enhanced security option enables password-protected enabling/disabling of all instrument I/O ports and firmware upgrades. In addition, option 6-SEC provides the highest level of security by ensuring that internal memory is clear of all setup and waveform data in compliance with National Industrial Security Program Operating Manual (NISPOM) DoD 5220.22-M, Chapter 8 requirements as well as Defense Security Service Manual for the Certification and Accreditation of Classified Systems under the NISPOM. This ensures you can confidently move the instrument out of a secure area.

Help when you need it

The 6 Series MSO includes several helpful resources so you can get your questions answered rapidly without having to find a manual or go to a website:

- Graphical images and explanatory text are used in numerous menus to provide quick feature overviews.
- All menus include a question mark icon in the upper right that takes you directly to the portion of the integrated help system that applies to that menu.
- A short user interface tutorial is included in the Help menu for new users to come up to speed on the instrument in a matter of a few minutes.

The screenshot displays the TekScope oscilloscope interface. A help window titled "Add Measurements configuration menu overview" is open, providing instructions on how to use the "Add Measurements" menu. The help window includes a table of fields and controls:

| Field or control | Description |
|--------------------------------|---|
| Measurement tabs | The tabs along the top organize measurements by their type. The Standard tab is the default set of measurements that are built in to the instrument. Other tabs are shown when you install measurement options. |
| Measurement description | Shows a graphic and short description of the selected measurement. Use this information to verify that the selected measurement is |

The background shows a digital waveform with a yellow trace. The "ADD MEASUREMENTS" panel is visible on the right, showing tabs for Standard, Jitter, and Power. The "Amplitude" measurement is selected, and the "Source" is set to "Ch 1". The "Amplitude" measurement is described as the difference between the Top value and the Base value. The "Amplitude Measurements" section includes buttons for Amplitude, Peak-to-Peak, Mean, Top, Maximum, Positive Overshoot, RMS, Base, Minimum, Negative Overshoot, AC RMS, and Area. The "Time Measurements" and "Jitter Measurements" sections are also visible.

Integrated help answers your questions rapidly without having to find a manual or go to the internet.

Specifications

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

Model overview

Oscilloscope

| | MSO64 |
|---|--|
| FlexChannel inputs | 4 |
| Maximum analog channels | 4 |
| Maximum digital channels (with optional logic probes) | 32 |
| Bandwidth (calculated rise time) | 1 GHz (400 ps), 2.5 GHz (160 ps), 4 GHz (100 ps), 6 GHz (66.67 ps), 8 GHz (50 ps) |
| DC Gain Accuracy | 50 Ω : $\pm 2.0\%$, ($\pm 4.0\%$ at 1 mV/Div) 50 Ω : $\pm 1.0\%$ of full scale, ($\pm 2.0\%$ of full scale at 1 mV/div), 1 M Ω : $\pm 1.0\%$, ($\pm 2.5\%$ at 1 mV/Div and 500 μ V/Div Settings) 1 M Ω : $\pm 0.5\%$ of full scale, ($\pm 1.0\%$ of full scale at 1 mV/div and 500 μ V/div) |
| ADC Resolution | 12 bits |
| Vertical Resolution | 8 bits @ 25 GS/s 12 bits @ 12.5 GS/s 13 bits @ 6.25 GS/s (High Res) 14 bits @ 3.125 GS/s (High Res) 15 bits @ 1.25 GS/s (High Res) 16 bits @ ≤ 625 MS/s (High Res) |
| Sample Rate | 25 GS/s on all analog / digital channels (40 ps resolution) |
| Record Length | 62.5 Mpoints on all analog / digital channels, 125 Mpoints on all analog / digital channels optional, and 250 Mpoints on all analog / digital channels optional |
| Waveform Capture Rate | >500,000 wfms/s (Peak Detect, Envelope acquisition mode), >30,000 wfms/s (all other acquisition modes) |
| 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

Input coupling DC, AC

Input impedance 1 M Ω DC coupled 1 M Ω $\pm 1\%$

Input capacitance 1 M Ω DC coupled, typical 14.5 pF ± 1.5 pF

Input impedance 50 Ω , DC coupled 50 Ω $\pm 3\%$

Input sensitivity range

1 M Ω 500 μ V/div to 10 V/div in a 1-2-5 sequence
Note: 500 μ V/div is a 2X digital zoom of 1 mV/div.

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

Vertical system - analog channels

Maximum input voltage

50 Ω: 2.5 V_{RMS} at <100 mV, with peaks ≤ ±20 V (DF ≤ 6.25%)
 50 Ω: 5 V_{RMS} at ≥100 mV, with peaks ≤ ±20 V (DF ≤ 6.25%)
 1 MΩ: 300 V_{RMS}
 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 mV/div, High Res mode,
 50 Ω, 10 MHz input with 90%
 full screen**

| Bandwidth | ENOB |
|-----------|------|
| 4 GHz | 5.9 |
| 3 GHz | 6.1 |
| 2.5 GHz | 6.2 |
| 2 GHz | 6.35 |
| 1 GHz | 6.8 |
| 500 MHz | 7.2 |
| 350 MHz | 7.4 |
| 250 MHz | 7.5 |
| 200 MHz | 7.75 |
| 20 MHz | 8.8 |

**50 mV/div, High Res mode,
 50 Ω, 10 MHz input with 90%
 full screen**

| Bandwidth | ENOB |
|-----------|------|
| 4 GHz | 7.25 |
| 3 GHz | 7.5 |
| 2.5 GHz | 7.6 |
| 2 GHz | 7.8 |
| 1 GHz | 8.2 |
| 500 MHz | 8.5 |
| 350 MHz | 8.8 |
| 250 MHz | 8.9 |
| 200 MHz | 9 |
| 20 MHz | 9.8 |

Vertical system - analog channels

2 mV/div, Sample mode, 50 Ω ,
10 MHz input with 90% full
screen

| Bandwidth | ENOB |
|-----------|------|
| 8 GHz | 5.1 |
| 7 GHz | 5.3 |
| 6 GHz | 5.5 |
| 5 GHz | 5.65 |
| 4 GHz | 5.9 |
| 3 GHz | 6.05 |
| 2.5 GHz | 6.2 |
| 2 GHz | 6.35 |
| 1 GHz | 6.8 |
| 500 MHz | 7.2 |
| 350 MHz | 7.3 |
| 250 MHz | 7.5 |
| 200 MHz | 7.3 |
| 20 MHz | 7.6 |

50 mV/div, Sample mode,
50 Ω , 10 MHz input with 90%
full screen

| Bandwidth | ENOB |
|-----------|------|
| 8 GHz | 6.5 |
| 7 GHz | 6.6 |
| 6 GHz | 6.8 |
| 5 GHz | 7 |
| 4 GHz | 7.2 |
| 3 GHz | 7.4 |
| 2.5 GHz | 7.6 |
| 2 GHz | 7.7 |
| 1 GHz | 8.2 |
| 500 MHz | 8.4 |
| 350 MHz | 8.7 |
| 250 MHz | 8.8 |
| 200 MHz | 7.8 |
| 20 MHz | 7.9 |

DC balance

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

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

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

Position range

± 5 divisions

Vertical system - analog channels

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 |

| 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 |

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

Bandwidth selections

| | |
|------------------------------|---|
| 8 GHz model, 50 Ohm | 20 MHz, 200 MHz, 250 MHz, 350 MHz, 500 MHz, 1 GHz, 2 GHz, 2.5 GHz, 3 GHz, 4 GHz, 5 GHz, 6 GHz, 7 GHz, and 8 GHz |
| 6 GHz model, 50 Ohm | 20 MHz, 200 MHz, 250 MHz, 350 MHz, 500 MHz, 1 GHz, 2 GHz, 2.5 GHz, 3 GHz, 4 GHz, 5 GHz, and 6 GHz |
| 4 GHz model, 50 Ohm | 20 MHz, 200 MHz, 250 MHz, 350 MHz, 500 MHz, 1 GHz, 2 GHz, 2.5 GHz, 3 GHz, and 4 GHz |
| 2.5 GHz model, 50 Ohm | 20 MHz, 200 MHz, 250 MHz, 350 MHz, 500 MHz, 1 GHz, 2 GHz, and 2.5 GHz |
| 1 GHz model, 50 Ohm | 20 MHz, 200 MHz, 250 MHz, 350 MHz, 500 MHz, and 1 GHz |
| 1M Ohm | 20 MHz (HW), 200 MHz, 250 MHz (HW), 350 MHz, and Full (500 MHz) |

Bandwidth filtering optimized for Flatness or Step response

Vertical system - analog channels

Random noise, RMS, typical

50 Ω , High Res mode (RMS)

| V/div | 1 mV/div | 2 mV/div | 5 mV/div | 10 mV/div | 20 mV/div | 50 mV/div | 100 mV/div | 1 V/div |
|---------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|---------|
| 4 GHz | 97.4 μ V | 98.7 μ V | 124 μ V | 192 μ V | 344 μ V | 817 μ V | 1.92 mV | 16.3 mV |
| 3 GHz | 82.9 μ V | 84 μ V | 105 μ V | 160 μ V | 282 μ V | 680 μ V | 1.62 mV | 13.6 mV |
| 2.5 GHz | 76.5 μ V | 77.5 μ V | 93.8 μ V | 144 μ V | 257 μ V | 606 μ V | 1.44 mV | 12.1 mV |
| 2 GHz | 68.1 μ V | 69.1 μ V | 83.6 μ V | 131 μ V | 226 μ V | 528 μ V | 1.28 mV | 10.6 mV |
| 1 GHz | 54.8 μ V | 51.2 μ V | 63.4 μ V | 90.9 μ V | 160 μ V | 378 μ V | 941 μ V | 7.65 mV |
| 500 MHz | 39.7 μ V | 39.8 μ V | 48.1 μ V | 65.1 μ V | 115 μ V | 280 μ V | 666 μ V | 5.6 mV |
| 350 MHz | 33.8 μ V | 33.5 μ V | 40 μ V | 54.8 μ V | 94.3 μ V | 217 μ V | 560 μ V | 4.35 mV |
| 250 MHz | 30.8 μ V | 31.2 μ V | 36.1 μ V | 49.9 μ V | 80.3 μ V | 187 μ V | 482 μ V | 3.75 mV |
| 200 MHz | 25.3 μ V | 25.4 μ V | 29.7 μ V | 44 μ V | 70.7 μ V | 165 μ V | 445 μ V | 3.3 mV |
| 20 MHz | 8.68 μ V | 8.9 μ V | 10.4 μ V | 15.1 μ V | 27.5 μ V | 70.4 μ V | 158 μ V | 1.41 mV |

1 M Ω , High Res mode (RMS)

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

50 Ω , Sample mode (RMS),
typical

| V/div | 1 mV/div | 2 mV/div | 5 mV/div | 10 mV/div | 20 mV/div | 50 mV/div | 100 mV/div | 1 V/div |
|---------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|---------|
| 8 GHz | 158 μ V | 158 μ V | 208 μ V | 342 μ V | 630 μ V | 1.49 mV | 3.46 mV | 29.7 mV |
| 7 GHz | 141 μ V | 143 μ V | 192 μ V | 311 μ V | 562 μ V | 1.31 mV | 3.11 mV | 26.2 mV |
| 6 GHz | 127 μ V | 127 μ V | 165 μ V | 274 μ V | 489 μ V | 1.18 mV | 2.71 mV | 23.6 mV |
| 5 GHz | 112 μ V | 113 μ V | 149 μ V | 239 μ V | 446 μ V | 1.05 mV | 2.42 mV | 21.1 mV |
| 4 GHz | 97.4 μ V | 98.7 μ V | 134 μ V | 216 μ V | 402 μ V | 949 μ V | 2.16 mV | 19 mV |
| 3 GHz | 82.9 μ V | 91.1 μ V | 114 μ V | 188 μ V | 350 μ V | 846 μ V | 1.9 mV | 16.9 mV |
| 2.5 GHz | 76.5 μ V | 77.5 μ V | 103 μ V | 173 μ V | 323 μ V | 790 μ V | 1.71 mV | 15.8 mV |
| 2 GHz | 69.7 μ V | 70.7 μ V | 93.8 μ V | 158 μ V | 295 μ V | 706 μ V | 1.6 mV | 14.1 mV |
| 1 GHz | 56 μ V | 57.5 μ V | 80.8 μ V | 127 μ V | 231 μ V | 534 μ V | 1.18 mV | 10.7 mV |
| 500 MHz | 44.5 μ V | 46.7 μ V | 62.7 μ V | 88.8 μ V | 178 μ V | 444 μ V | 1.06 mV | 8.88 mV |
| 350 MHz | 38.8 μ V | 39.3 μ V | 64.2 μ V | 88.8 μ V | 168 μ V | 419 μ V | 888 μ V | 8.38 mV |
| 250 MHz | 33.4 μ V | 35.4 μ V | 55.9 μ V | 70.5 μ V | 141 μ V | 353 μ V | 747 μ V | 7.05 mV |
| 200 MHz | 33.4 μ V | 37.5 μ V | 63.4 μ V | 106 μ V | 211 μ V | 528 μ V | 1.06 mV | 10.6 mV |
| 20 MHz | 19.4 μ V | 26.6 μ V | 41.9 μ V | 83.8 μ V | 168 μ V | 419 μ V | 838 μ V | 8.38 mV |

1 M Ω , Sample mode (RMS),
typical

Vertical system - analog channels

| V/div | 1 mV/div | 2 mV/div | 5 mV/div | 10 mV/div | 20 mV/div | 50 mV/div | 100 mV/div | 1 V/div |
|---------|--------------|--------------|--------------|-------------|-------------|-------------|------------|---------|
| 500 MHz | 186 μ V | 202 μ V | 220 μ V | 262 μ V | 380 μ V | 781 μ V | 1.69 mV | 18.3 mV |
| 350 MHz | 134 μ V | 138 μ V | 158 μ V | 199 μ V | 335 μ V | 634 μ V | 1.47 mV | 15.8 mV |
| 250 MHz | 108 μ V | 111 μ V | 130 μ V | 183 μ V | 282 μ V | 704 μ V | 1.41 mV | 15.6 mV |
| 200 MHz | 108 μ V | 108 μ V | 124 μ V | 171 μ V | 282 μ V | 704 μ V | 1.41 mV | 15.4 mV |
| 20 MHz | 72.2 μ V | 78.4 μ V | 99.4 μ V | 160 μ V | 282 μ V | 704 μ V | 1.41 mV | 14.1 mV |

Crosstalk (channel isolation), typical

- ≥ 70 dB up to 2 GHz
- ≥ 60 dB up to 5 GHz
- ≥ 45 dB up to 8 GHz

for any two channels set to 200 mV/div.

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 $\pm [100 \text{ mV} + 3\% \text{ of threshold setting after calibration}]$

Input hysteresis, typical 100 mV at the probe tip

Input dynamic range, typical $30 V_{pp}$ for $F_{in} \leq 200 \text{ MHz}$, $10 V_{pp}$ for $F_{in} > 200 \text{ MHz}$

Absolute maximum input voltage, typical ± 42 V peak

Minimum voltage swing, typical 400 mV peak-to-peak

Input impedance, typical 100 k Ω

Probe loading, typical 2 pF

Horizontal system

| | | | | | | | | | | |
|---|---|--|-------------------|---------------|------------|-------------|---------------|--------------|-----------------|--|
| Time base range | 40 ps/div to 1,000 s/div | | | | | | | | | |
| Sample rate range | 6.25 S/s to 25 GS/s (real time) 50 GS/s to 2.5 TS/s (interpolated) | | | | | | | | | |
| Record length range | Applies to analog and digital channels. All acquisition modes are 250 M maximum record length, down to 1 k minimum record length, adjustable in 1 sample increments. Standard: 62.5 Mpoints Option 6-RL-1: 125 Mpoints Option 6-RL-2: 250 Mpoints | | | | | | | | | |
| Seconds/Division range | Model | 1 K | 10 K | 100 K | 1 M | 10 M | 62.5 M | 125 M | 250 M | |
| | MSO6X Standard 62.5 M | 40 ps - 16 s | 400 ps - 160 s | 4 ns - 1000 s | | | | | | |
| | MSO6X Option 6- RL-1 125 M | 40 ps - 16 s | 400 ps - 160 s | 4 ns - 1000 s | | | | | | |
| | MSO6X Option 6- RL-2 250 M | 40 ps - 16 s | 400 ps - 160 s | 4 ps - 1000 s | | | | | 40 ps - 1 ms | |
| Sample jitter | Time duration | Typical jitter | | | | | | | | |
| | <1 μ s | 80 fs | | | | | | | | |
| | <1 ms | 130 fs | | | | | | | | |
| Timebase accuracy | $\pm 1.0 \times 10^{-7}$ over any ≥ 1 ms time interval | | | | | | | | | |
| | Description | Specification | | | | | | | | |
| | Factory Tolerance | ± 20 ppb. At calibration, 25 °C ambient, over any ≥ 1 ms interval | | | | | | | | |
| | Temperature stability | ± 20 ppb. Tested at operating temperatures | | | | | | | | |
| | Crystal aging, typical | ± 300 ppb. Frequency tolerance change at 25 °C over a period of 1 year | | | | | | | | |
| Delta-time measurement accuracy | $DTA_{pp}(\text{typical}) = 10 \times \sqrt{\left(\frac{N}{SR_1}\right)^2 + \left(\frac{N}{SR_2}\right)^2 + \left(0.450 \text{ ps} + \left(1 \times 10^{-11} \times t_p\right)\right)^2} + TBA \times t_p$ $DTA_{RMS} = \sqrt{\left(\frac{N}{SR_1}\right)^2 + \left(\frac{N}{SR_2}\right)^2 + \left(0.450 \text{ ps} + \left(1 \times 10^{-11} \times t_p\right)\right)^2} + TBA \times t_p$ <p>(assume edge shape that results from Gaussian filter response)</p> <p>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:</p> <p>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)</p> | | | | | | | | | |
| Maximum duration at highest sample rate | 2.5 ms (std.) or 5 ms (opt. 6-RL-1, 125 Mpoints) or 10 ms (opt. 6-RL-2, 250 Mpoints) | | | | | | | | | |
| Time base delay time range | -10 divisions to 5,000 s | | | | | | | | | |

Horizontal system

| | |
|--|--|
| Deskew range | -125 ns to +125 ns with a resolution of 40 ps (for Peak Detect and Envelope acquisition modes). -125 ns to +125 ns with a resolution of 1 ps (for all other acquisition modes). |
| Delay between analog channels, full bandwidth, typical | ≤ 10 ps for any two channels with input impedance set to 50 Ω, DC coupling with equal Volts/div or above 10 mV/div |
| Delay between analog and digital FlexChannels, typical | < 1 ns when using a TLP058 and a TPP1000 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, AC, HF reject (attenuates > 50 kHz), LF reject (attenuates < 50 kHz), noise reject (reduces sensitivity) |

| Trigger bandwidth (edge, pulse and logic), typical | Model | Trigger type | Trigger bandwidth |
|--|------------------------------|--------------------|-------------------|
| | MSO64 8 GHz | Edge | 8 GHz |
| | MSO64 8 GHz | Pulse, Logic | 4 GHz |
| | MSO64 6 GHz | Edge | 6 GHz |
| | MSO64 6 GHz | Pulse, Logic | 4 GHz |
| | MSO64 4 GHz, 2.5 GHz, 1 GHz: | Edge, Pulse, Logic | Product Bandwidth |

| 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 | 1 mV/div to 9.98 mV/div | 3.0 div from DC to instrument bandwidth |
| | | ≥ 10 mV/div | < 1.0 division from DC to instrument bandwidth |
| Line | | Fixed | |
| AUX Trigger in | | 250 mV _{pp} , DC to 400 MHz | |

| Edge-type trigger sensitivity, not DC coupled, typical | Trigger Coupling | Typical Sensitivity |
|--|------------------|--|
| | NOISE REJ | 2.5 times the DC Coupled limits |
| | HF REJ | 1.0 times the DC Coupled limits from DC to 50 kHz. Attenuates signals above 50 kHz. |
| | LF REJ | 1.5 times the DC Coupled limits for frequencies above 50 kHz. Attenuates signals below 50 kHz. |

| | |
|-------------------------|--|
| Trigger jitter, typical | ≤ 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 ≤ 200 ps _{RMS} for AUX trigger in, Sample acquisition mode, edge trigger ≤ 220 ps _{RMS} for AUX trigger in, FastAcq acquisition mode, edge trigger |
|-------------------------|--|

Trigger system

Trigger jitter, AUX input, typical ≤ 200 pS_{RMS} for sample mode and edge-type trigger
 ≤ 220 pS_{RMS} for edge-type trigger and FastAcq mode

AUX In trigger skew between instruments, typical ± 100 ps jitter on each instrument with 150 ps skew; ≤ 350 ps total between instruments.
 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 |
| 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

Run: 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

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 32 bits (from the digital and analog channels) in size. Supports Binary and Hex radices

I²C Bus (option 6-SREMBD): Trigger on Start, Repeated Start, Stop, Missing ACK, Address (7 or 10 bit), Data, or Address and Data on I²C buses up to 10 Mb/s

SPI Bus (option 6-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 6-SRCOMP): Trigger on Start Bit, End of Packet, Data, and Parity Error up to 15 Mb/s

CAN Bus (option 6-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 6-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 6-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 6-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 6-SRAUTOSEN) Trigger on Start of Packet, Fast Channel Status and Data, Slow Channel Message ID and Data, and CRC Errors

Trigger system

| | |
|--|--|
| SPMI Bus (option 6-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 6-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 6-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 (I²S, LJ, RJ, TDM) Bus (option 6-SRAUDIO): | Trigger on Word Select, Frame Sync, or Data. Maximum data rate for I ² S/LJ/RJ is 12.5 Mb/s. Maximum data rate for TDM is 25 Mb/s |
| MIL-STD-1553 Bus (option 6-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 6-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 |
| Trigger holdoff range | 0 ns to 20 seconds |

Acquisition system

| | |
|------------------------------|---|
| Sample | Acquires sampled values |
| Peak Detect | Captures glitches as narrow as 160 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 ≤ 625 MS/s sample rates. |
| FastAcq[®] | FastAcq optimizes the instrument for analysis of dynamic signals and capture of infrequent events. Maximum waveform capture rate: >500,000 wfms/s (Peak Detect or Envelope Acquisition mode) >30,000 wfms/s (All other acquisition modes) |
| 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 = 691,000 |

Waveform measurements

Cursor types Waveform, V Bars, H Bars, and V&H Bars

| DC voltage measurement accuracy, Average acquisition mode | Measurement Type | DC Accuracy (In Volts) |
|--|---|--|
| | Average of ≥ 16 waveforms | $\pm((\text{DC Gain Accuracy}) * \text{reading} - (\text{offset} - \text{position}) + \text{Offset Accuracy} + 0.05 * \text{V/div setting})$ |
| Delta volts between any two averages of ≥ 16 waveforms acquired with the same oscilloscope setup and ambient conditions | $\pm(\text{DC Gain Accuracy} * \text{reading} + 0.1 \text{ div})$ | |

Automatic measurements 36 of which an unlimited number can be displayed at once 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 or unique for each measurement

Gating Isolate the specific occurrence within an acquisition to take measurements on, using either the screen or waveform cursors. Gating can be set to global for all measurements or a to local where a second type of gating can be used.

Measurement plots Time Trend, Histogram, and Spectrum plots are available for all standard measurements

Jitter analysis option adds the following:

Measurements Jitter Summary, TJ@BER, RJ- $\delta\delta$, DJ- $\delta\delta$, 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

Power analysis option 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, $R_{DS(on)}$)

Magnetic Analysis (Inductance, I vs. Intg(V), Magnetic Loss, Magnetic Property)

Output Analysis (Line Ripple, Switching Ripple, Efficiency, Turn-on Time, Turn-off Time)

Measurement Plots Harmonics Bar Graph, Switching Loss Trajectory Plot, and Safe Operating Area

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 |

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. |

Display

| | |
|-----------------|--|
| Display type | 15.6 in. (395 mm) liquid-crystal TFT color 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 |
| 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 | Grid, Time, Full, and None |
| Color palettes | Normal, inverted, and inverted for screen captures |
| Format | YT, XY, and XYZ |

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

Amplitude range Values are peak-to-peak voltages

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

Sine waveform

Frequency range 0.1 Hz to 50 MHz

Frequency setting resolution 0.1 Hz

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

Spurious free dynamic range, typical 40 dB ($V_{pp} \geq 0.1$ V); 30 dB ($V_{pp} \geq 0.02$ 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 $\pm 1\% \pm 5$ ns, at 50% duty cycle

Jitter, typical < 60 ps TIE_{RMS}, ≥ 100 mV_{pp} amplitude, 40%-60% duty cycle

Arbitrary/Function Generator (optional)

Ramp and triangle waveform

| | |
|------------------------------|---|
| Frequency range | 0.1 Hz to 500 kHz |
| Frequency setting resolution | 0.1 Hz |
| Frequency accuracy | 130 ppm (frequency \leq 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 | \pm 2.5 V into Hi-Z \pm 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 |
|------------------------------|---|

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 | \pm [(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 μ V (50 Ω) |
|-----------------------------|---|

| | |
|----------------------------------|---|
| Sine and ramp frequency accuracy | 1.3×10^{-4} (frequency \leq 10 kHz) 5.0×10^{-5} (frequency $>$ 10 kHz) |
|----------------------------------|---|

| | |
|-----------------|--|
| DC offset range | \pm 2.5 V into Hi-Z \pm 1.25 V into 50 Ω |
|-----------------|--|

Arbitrary/Function Generator (optional)

| | |
|----------------------|---|
| DC offset resolution | 1 mV (Hi-Z) 500 μ V (50 Ω) |
| DC offset accuracy | \pm [(1.5% of absolute offset voltage setting) + 1 mV] Add 3 mV of uncertainty per 10 $^{\circ}$ C change from 25 $^{\circ}$ C ambient |

Digital volt meter (DVM)

| | |
|--------------------|---|
| Measurement types | DC, AC _{RMS} +DC, AC _{RMS} , Trigger frequency count |
| Voltage resolution | 4 digits |
| Voltage accuracy | |
| DC: | $\pm(1.5\% * \text{reading} - \text{offset} - \text{position}) + (0.5\% * (\text{offset} - \text{position})) + (0.1 * \text{Volts/div})$ De-rated at 0.100%/ $^{\circ}$ C of $ \text{reading} - \text{offset} - \text{position} $ above 30 $^{\circ}$ C Signal \pm 5 divisions from screen center |
| AC: | \pm 3% (40 Hz to 1 kHz) with no harmonic content outside 40 Hz to 1 kHz range AC, typical: \pm 2% (20 Hz to 10 kHz) For AC measurements, the input channel vertical settings must allow the V_{pp} input signal to cover between 4 and 10 divisions and must be fully visible on the screen |

Trigger frequency counter

| | |
|-------------------------|---|
| Resolution | 8-digits |
| Accuracy | $\pm(1 \text{ count} + \text{time base accuracy} * \text{input frequency})$ The signal must be at least 8 mV _{pp} or 2 div, whichever is greater. |
| Maximum input frequency | Maximum bandwidth of the analog channel 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 |
| Internal storage | \geq 80 GB. Form factor is an 80 mm m.2 card with a SATA-3 interface |
| Operating system | Closed Linux |
| Solid State Drive (SSD) with Microsoft Windows 10 OS (option 6-WIN) | \geq 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 LTSC (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-I 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 front right of the instrument | | | | | | |
| Amplitude: | 0 to 2.5 V | | | | | | |
| Frequency: | 1 kHz | | | | | | |
| Source impedance: | 1 k Ω | | | | | | |
| External reference input | Time-base system can phase lock to an external 10 MHz reference There are two ranges for the reference clock. The instrument can accept a high accuracy reference clock of 10 MHz +/- 2 ppm or a lower accuracy reference clock of 10 MHz +/- 1 kppm. | | | | | | |
| USB interface (Host, Device ports) | Front panel USB Host ports: Two USB 2.0 High Speed ports, one USB 3.0 Super Speed port Rear panel USB Host ports: Two USB 2.0 High Speed ports, two USB 3.0 Super Speed ports Rear panel USB Device port: One USB 3.0 Super Speed 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 | | | | | | |
| | <table border="1"> <thead> <tr> <th>Characteristic</th> <th>Limits</th> </tr> </thead> <tbody> <tr> <td>Vout (HI)</td> <td>≥ 2.5 V open circuit; ≥ 1.0 V into a 50 Ω load to ground</td> </tr> <tr> <td>Vout (LO)</td> <td>≤ 0.7 V into a load of ≤ 4 mA; ≤ 0.25 V into a 50 Ω load to ground</td> </tr> </tbody> </table> | 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 |
| 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 $\pm 10\%$ at 50 Hz to 60 Hz $\pm 10\%$ 115 V $\pm 10\%$ at 400 Hz $\pm 10\%$ |

Physical characteristics

| | |
|--------------------------------|---|
| Dimensions | <p>Height: 12.2 in (309 mm), feet folded in, handle to back</p> <p>Height: 14.6 in (371 mm) feet folded in, handle up</p> <p>Width: 17.9 in (454 mm) from handle hub to handle hub</p> <p>Depth: 8.0 in (205 mm) from back of feet to front of knobs, handle up</p> <p>Depth: 11.7 in (297.2 mm) feet folded in, handle to the back</p> |
| Weight | < 28.4 lbs (12.88 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 |

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 +60 °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, MicrosoftNET, 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. |

Ordering information

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

Step 1

Start by selecting the MSO64 model.

| Model | Number of FlexChannels |
|-------|------------------------|
| MSO64 | 4 |

Each instrument includes

- Four TPP1000 1 GHz probes.
- Installation and safety manual (translated in English, Japanese, Simplified Chinese)
- Integrated online help
- Front cover with integrated accessory pouch
- Mouse
- 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. One-year warranty covering all parts and labor on included probes

Step 2

Configure your oscilloscope by selecting the analog channel bandwidth you need

Choose the bandwidth you need today by choosing one of these bandwidth options. You can upgrade it later by purchasing an upgrade kit.

| Bandwidth Option | Bandwidth |
|------------------|-----------|
| 6-BW-1000 | 1 GHz |
| 6-BW-2500 | 2.5 GHz |
| 6-BW-4000 | 4 GHz |
| 6-BW-6000 | 6 GHz |
| 6-BW-8000 | 8 GHz |

Step 3

Add instrument functionality

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

| Instrument Option | Built-in Functionality |
|----------------------|---|
| 6-RL-1 | Extend record length from 62.5 Mpoints/channel to 125 Mpoints/channel |
| 6-RL-2 | Extend record length from 62.5 Mpoints/channel to 250 Mpoints/channel |
| 6-WIN ⁴ | Add removable SSD with Microsoft Windows 10 operating system license |
| 6-AFG | Add Arbitrary / Function Generator |
| 6-SEC ^{5 6} | Add enhanced security for instrument declassification and password protected enabling and disabling of all USB and Ethernet ports and firmware upgrade. |

Step 4

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 |
|-------------------|--|
| 6-SRAERO | Aerospace (MIL-STD-1553, ARINC 429) |
| 6-SRAUDIO | Audio (I ² S, LJ, RJ, TDM) |
| 6-SRAUTO | Automotive (CAN, CAN FD, LIN, FlexRay) |
| 6-SRAUTOSEN | Automotive sensor (SENT) |
| 6-SRCOMP | Computer (RS-232/422/485/UART) |
| 6-SREMBD | Embedded (I ² C, SPI) |
| 6-SRENET | Ethernet (10BASE-T, 100BASE-TX) |
| 6-SRPM | Power Management (SPMI) |
| 6-SRUSB2 | USB (USB2.0 LS, FS, HS) |

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

⁴ This option is not compatible with option 6-SEC.

⁵ This option is not compatible with option 6-WIN.

⁶ This option must be purchased at the same time as the instrument. Not available as an upgrade.

Step 5

Add optional serial bus compliance testing

Choose the serial compliance testing packages you need today by choosing from these options. You can upgrade later by purchasing an upgrade kit.

| Instrument Option | Serial Buses Supported |
|-------------------|--|
| 6-CMAUTOEN | Automotive Ethernet automated compliance test solution (100BASE-T1 and 1000BASE-T1). Requires option 6-WIN (SSD with Microsoft Windows 10 operating system) 2 GHz bandwidth required for 1000BASE-T1 |
| 6-CMUSB2 | USB2.0 automated compliance test solution. Requires option 6-WIN (SSD with Microsoft Windows 10 operating system) Requires TDSUSBF USB test fixture 2 GHz bandwidth required for high-speed USB |

Step 6

Add optional analysis capabilities

| Instrument Option | Advanced Analysis |
|----------------------|---|
| 6-DJA | Advanced Jitter and Eye Analysis |
| 6-PWR ⁷ | Power Measurement and Analysis |
| 6-PS2 ^{8 9} | Power Solution Bundle (6-PWR, THDP0200, TCP0030A, 067-1686-xx deskew fixture) |

Step 7

Add digital probes

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

| For this instrument | Order | To add |
|---------------------|----------------------|--------------------------|
| MSO64 | 1 to 4 TLP058 Probes | 8 to 32 digital channels |

⁷ This option is not compatible with option 6-PS2.

⁸ This option is not compatible with option 6-PWR.

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

Step 8

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 |
| TAP3500 | 3.5 GHz TekVPI® active single-ended voltage probe, ±4 V input voltage |
| TAP4000 | 4 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 |
| 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 |
| TDP3500 | 3.5 GHz TekVPI® differential voltage probe, ±2 V differential input voltage |
| TDP4000 | 4 GHz TekVPI® differential voltage probe, ±2 V differential input voltage |
| 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 |
| TIVH02 | Isolated Probe; 200 MHz, ±2500 V, TekVPI, 3 Meter Cable |
| TIVH02L | Isolated Probe; 200 MHz, ±2500 V, TekVPI, 10 Meter Cable |
| TIVH05 | Isolated Probe; 500 MHz, ±2500 V, TekVPI, 3 Meter Cable |
| TIVH05L | Isolated Probe; 500 MHz, ±2500 V, TekVPI, 10 Meter Cable |
| TIVH08 | Isolated Probe; 800 MHz, ±2500 V, TekVPI, 3 Meter Cable |
| TIVH08L | Isolated Probe; 800 MHz, ±2500 V, TekVPI, 10 Meter Cable |
| TIVM1 | Isolated Probe; 1 GHz, ±50 V, TekVPI, 3 Meter Cable |
| TIVM1L | Isolated Probe; 1 GHz, ±50 V, TekVPI, 10 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 |
| P6015A | 20 kV, 75 MHz high-voltage passive probe |
| TPA-BNC ¹⁰ | TekVPI® to TekProbe™ BNC adapter |
| 103-0503-xx | BNC-to-SMA adapter; rated to 12 GHz |
| TEK-DPG | TekVPI deskew pulse generator signal source |
| 067-1686-xx | Power measurement deskew and calibration fixture |
| TEK-CDA | Probe compensation and deskew accessory. Perform DC compensation on TDP7700 Series TriMode probes and deskew on any TekVPI compatible probe. |

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

¹⁰ Recommended for connecting your existing TekProbe probes to the 6 Series MSO.

Step 9

Add accessories

Add traveling or mounting accessories

| Optional Accessory | Description |
|--------------------|--------------------|
| HC5 | Hard carrying case |
| RM5 | Rackmount kit |

Step 10

Select power cord option

| Power Cord Option | Description |
|-------------------|--|
| A0 | North America power plug (115 V, 60 Hz) |
| 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 11

Add extended service and calibration options

| Service Option | Description |
|----------------|---|
| G3 | Three Year Gold Care Plan. Includes expedited repair of all product failures including ESD and EOS, access to a loaner product during repair or advanced exchange to reduce downtime, priority access to Customer Support among others. |
| G5 | Five Year Gold Care Plan. Includes expedited repair of all product failures including ESD and EOS, access to a loaner product during repair or advanced exchange to reduce downtime, priority access to Customer Support among others. |
| 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. |
| C3 | Calibration service 3 Years. Includes traceable calibration or functional verification where applicable, for recommended calibrations. Coverage includes the initial calibration plus 2 years calibration coverage. |
| C5 | Calibration service 5 Years. Includes traceable calibration or functional verification where applicable, for recommended calibrations. Coverage includes the initial calibration plus 4 years 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 The 6 Series MSO products offer many ways to 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 | SUP6-AFG | SUP6-AFG-FL | Add arbitrary function generator |
| | SUP6-RL-1 | SUP6-RL-1-FL | Extend record length to 125 Mpts / channel |
| | SUP6-RL-2 | SUP6-RL-2-FL | Extend record length to 250 Mpts / channel |
| | SUP6-RL-1T2 | SUP6-RL-1T2-FL | Extend record length to 125 Mpts to 250 Mpts / channel |
| | SUP6-WIN | N/A | Add removable SSD with Windows 10 operating system |
| Add protocol analysis | SUP6-SRAERO | SUP6-SRAERO-FL | Aerospace serial triggering and analysis (MIL-STD-1553, ARINC 429) |
| | SUP6-SRAUDIO | SUP6-SRAUDIO-FL | Audio serial triggering and analysis (I ² S, LJ, RJ, TDM) |
| | SUP6-SRAUTO | SUP6-SRAUTO-FL | Automotive serial triggering and analysis (CAN, CAN FD, LIN, FlexRay) |
| | SUP6-SRAUTOSEN | SUP6-SRAUTOSEN-FL | Automotive sensor serial triggering and analysis (SENT) |
| | SUP6-SRCOMP | SUP6-SRCOMP-FL | Computer serial triggering and analysis (RS-232/422/485/UART) |
| | SUP6-SREMBD | SUP6-SREMBD-FL | Embedded serial triggering and analysis (I ² C, SPI) |
| | SUP6-SRENET | SUP6-SRENET-FL | Ethernet serial triggering and analysis (10Base-T, 100Base-TX) |
| | SUP6-SRPM | SUP6-SRPM-FL | Power Management serial triggering and analysis (SPMI) |
| | SUP6-SRUSB2 | SUP6-SRUSB2-FL | USB 2.0 serial bus triggering and analysis (LS, FS, HS) |
| Add serial compliance | SUP6-CMAUTOEN | SUP6-CMAUTOEN-FL | Automotive Ethernet automated compliance test solution (100BASE-T1 and 1000BASE-T1) Requires SSD with Microsoft Windows 10 operating system |
| | SUP6-CMUSB2 | SUP6-CMUSB2-FL | USB 2.0 automated compliance test solution Requires SSD with Microsoft Windows 10 operating system |
| Add advanced analysis | SUP6-DJA | SUP6-DJA-FL | Advanced jitter and eye analysis |
| | SUP6-PWR | SUP6-PWR-FL | Advance power measurements and analysis |
| Add digital voltmeter | SUP6-DVM | N/A | Add digital voltmeter / trigger frequency counter (Free with product registration at www.tek.com/register6mso) |

Bandwidth upgrades after purchase

Add bandwidth upgrades in the future

The analog bandwidth of 6 Series MSO products can be upgraded after initial purchase. Bandwidth upgrades are purchased based on the current bandwidth and the desired bandwidth. All bandwidth upgrades can be performed in the field by installing a software license and a new front panel label.

| Model to be upgraded | Bandwidth before upgrade | Bandwidth after upgrade | Order this bandwidth upgrade |
|----------------------|--------------------------|-------------------------|------------------------------|
| MSO64 | 1 GHz | 2.5 GHz | SUP6-BW10T254 |
| | 1 GHz | 4 GHz | SUP6-BW10T404 |
| | 1 GHz | 6 GHz | SUP6-BW10T604 |
| | 1 GHz | 8 GHz | SUP6-BW10T804 |
| | 2.5 GHz | 4 GHz | SUP6-BW25T404 |
| | 2.5 GHz | 6 GHz | SUP6-BW25T604 |
| | 2.5 GHz | 8 GHz | SUP6-BW25T804 |
| | 4 GHz | 6 GHz | SUP6-BW40T604 |
| | 4 GHz | 8 GHz | SUP6-BW40T804 |
| | 6 GHz | 8 GHz | SUP6-BW60T804 |



Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.



Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.



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

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