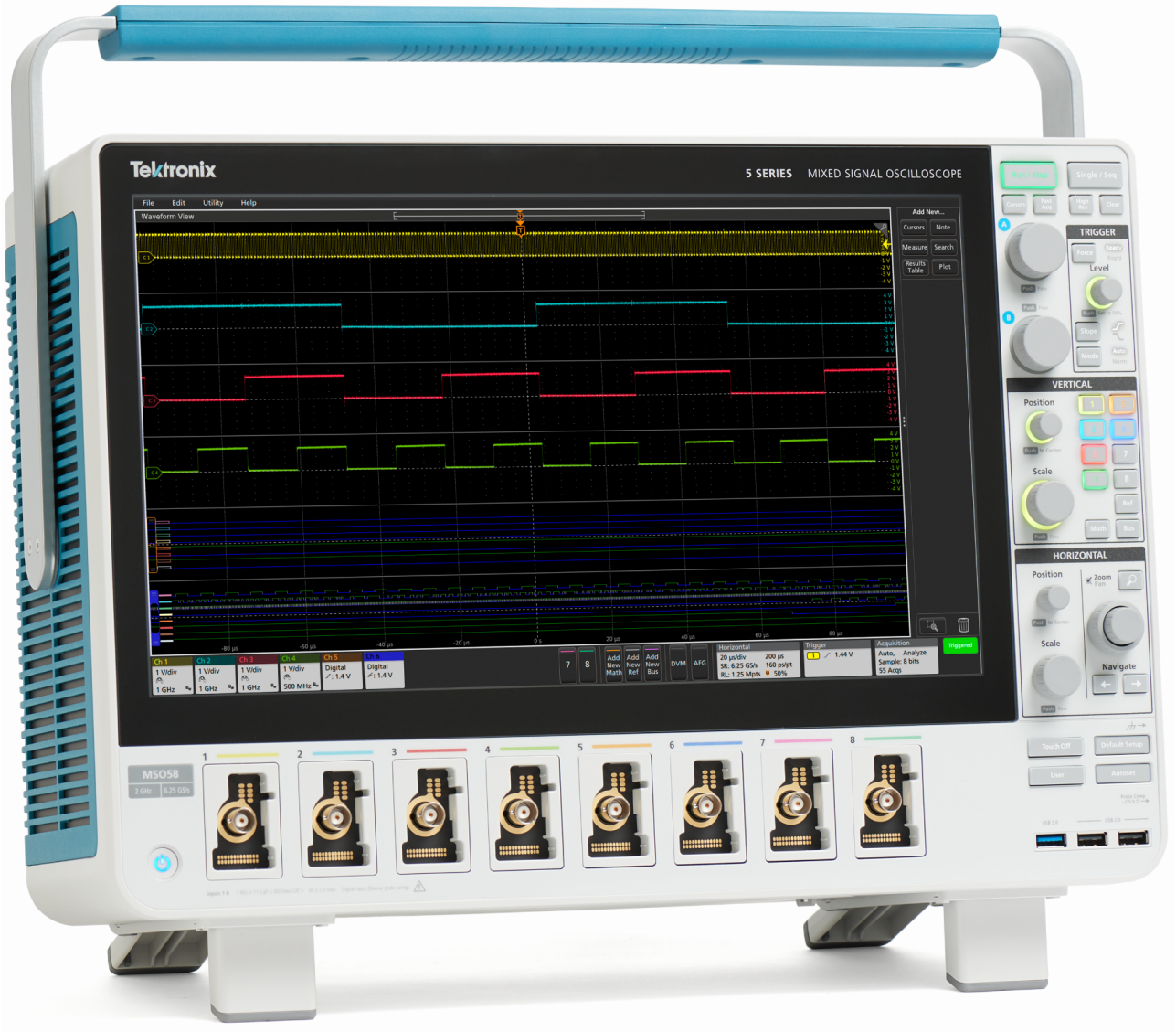
Tektronix®

5 Series MSO

Mixed Signal Oscilloscope Datasheet

The largest display. The most channels. The greatest experience.



Strength in numbers

Input channels

- 4, 6, or 8 FlexChannel™ inputs
- Each FlexChannel provides one analog signal input or eight digital logic inputs with TLP058 logic probe

Bandwidth [1]

- 350 MHz, 500 MHz, 1 GHz, 2 GHz

Sample rate (all analog / digital channels)

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

Record length (all analog / digital channels)

- 62.5 Mpoints standard
- 125 Mpoints optional [1]

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

Standard analysis

- Cursors: Waveform, V Bars, H Bars, V&H Bars
- Measurements: 36
- 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

Optional serial bus trigger, decode and analysis [1]

- I^2C, SPI, RS-232/422/485/UART, CAN, LIN, FlexRay, USB 2.0, Ethernet, I^2S, LJ, RJ, TDM

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 (x7), USB Device, LAN (10/100/1000 Base-T Ethernet; LXI Compliant), Display Port, DVI-D, Video Out

e*Scope ®

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

Standard probes

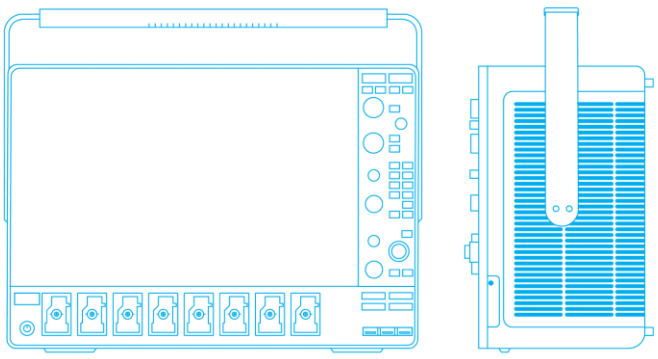
- One 10 MΩ passive voltage probe with less than 4 pF capacitive loading per channel

Warranty

- 3 years standard with optional Total Protection Plans

Dimensions

- 12.2 in (309 mm) H x 17.9 in (454 mm) W x 8.0 in (204 mm)
- Weight: <25 lbs. (11.4 kg)



1 Optional and upgradeable.

2 Free with product registration.

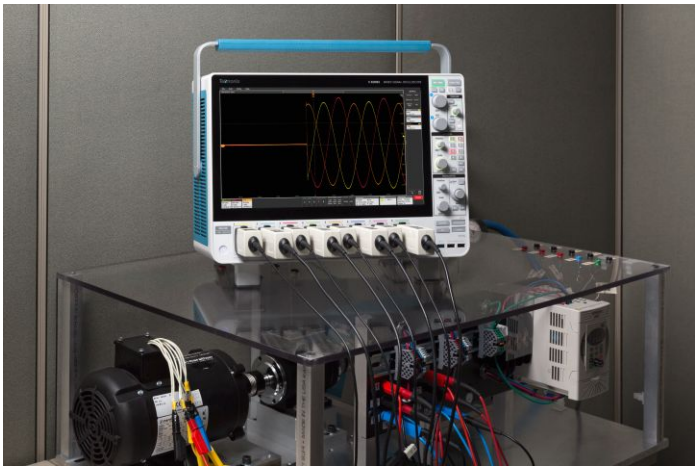
With a remarkably innovative pinch-swipe-zoom touchscreen user interface, the industry's largest high-definition display, and 4, 6, or 8 FlexChannel™ inputs that let you measure one analog or eight digital signals per channel, the 5 Series MSO is ready for today's toughest challenges, and tomorrow's too. It sets a new standard for performance, analysis, and overall user experience.

Never let a lack of channels slow down your verification and debug process again!

The 5 Series MSO offers better visibility into complex systems by offering four, six and eight channel models with a large 15.6" high definition (1,920 x 1,080) display. Many applications, such as embedded systems, three-phase power electronics, automotive electronics, power supply design, and DC-to-DC power converters, require the observation of more than four analog signals to verify and characterize device performance, and to debug challenging system issues.

Most engineers can recall situations in which they were debugging a particularly difficult problem and wanted greater system visibility and context, but the scope they were using was limited to two or four analog channels. Using a second scope involves significant effort to align trigger points, difficulty in determining timing relationships across the two displays, and documentation challenges.

And while you might assume that a six and eight channel scope would cost 50% or 100% more than a four channel scope, you'll be pleasantly surprised to find that six channel models are only ~25% more than four channel models and eight channel models are only ~67% more than four channel models. The additional analog channels can pay for themselves quickly by enabling you to keep current and future projects on schedule.



Voltage measurements on a three-phase motor showing the three-phase input voltages after start-up.

FlexChannel™ technology enables maximum flexibility and broader system visibility

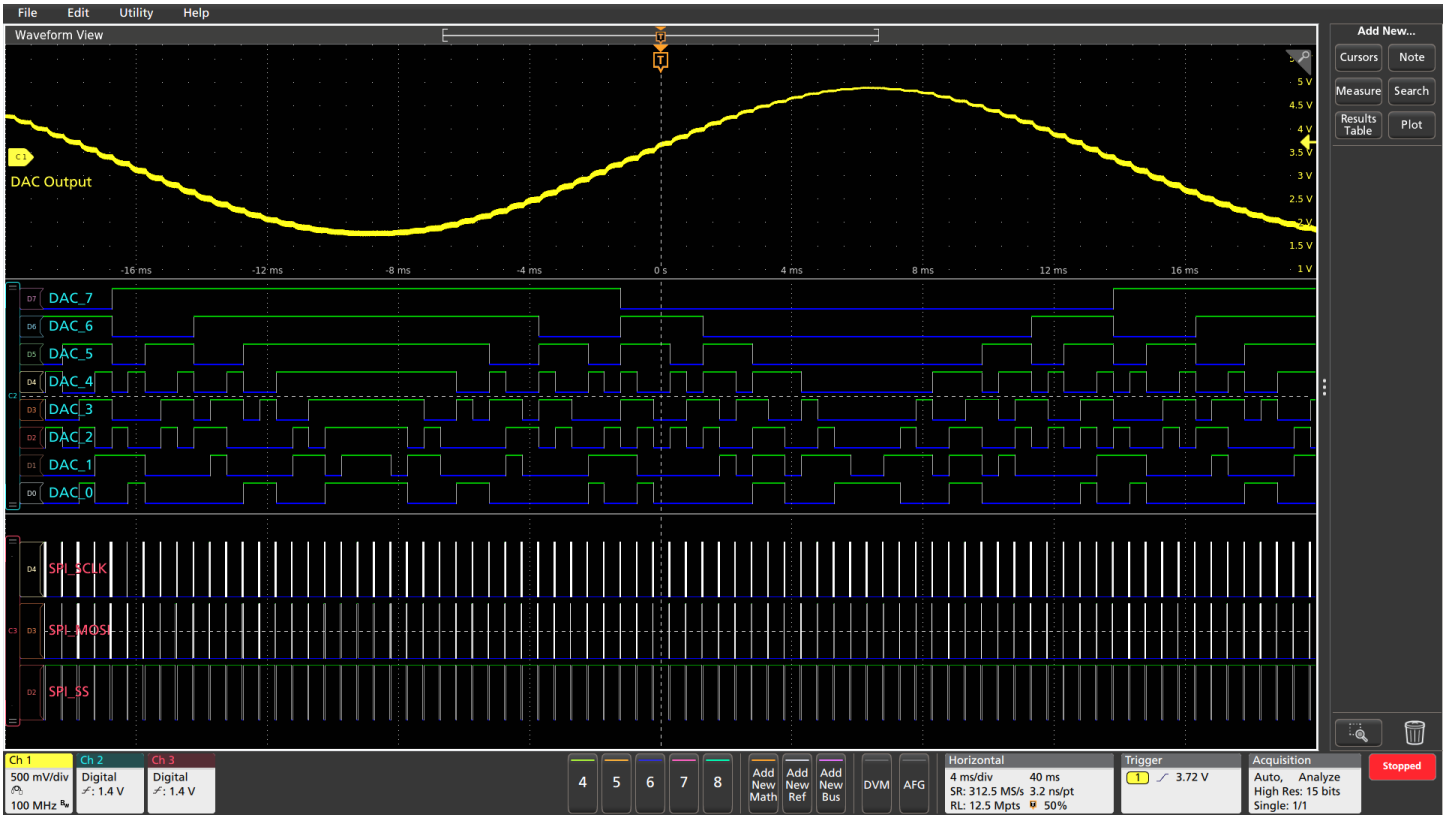
The 5 Series MSO redefines what a Mixed Signal Oscilloscope (MSO) should be. FlexChannel technology enables each of the inputs on the instrument to be used as a single analog channel or eight digital channels. The conversion is done by simply attaching a TLP058 logic probe to any input. Imagine the flexibility and configurability this provides.

With an eight FlexChannel model, you can configure it to look at eight analog and zero digital signals. Or seven analog and eight digital. Or six analog and 16 digital, five analog and 24 digital and so on. 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 5 Series MSO offers a new level of integration of digital channels. Digital channels share the same high sample rate (up to 6.25 GS/s) for fine timing resolution, and long record length (up to 125 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 64 digital channels.



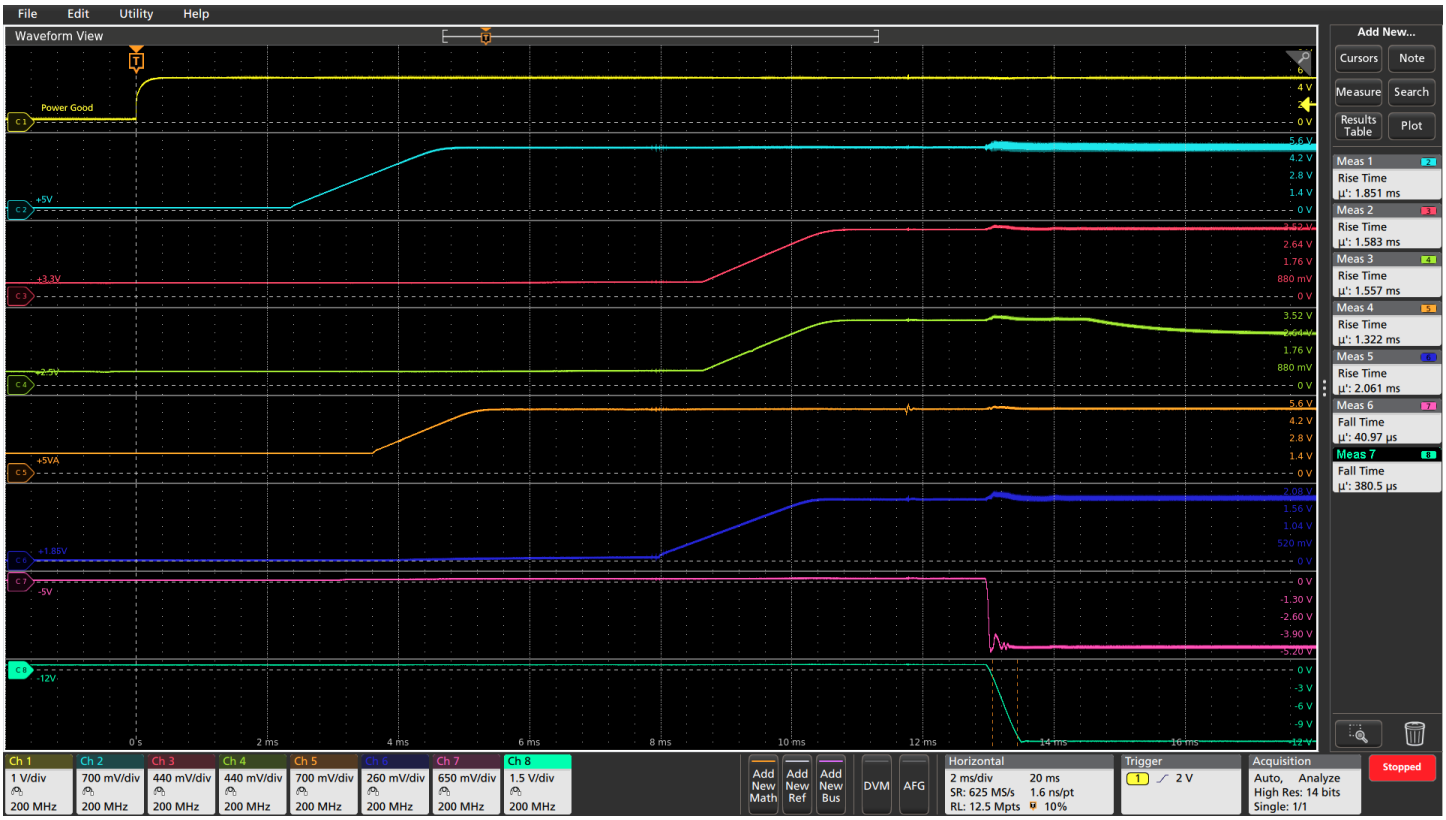
FlexChannel 2 has a TLP058 Logic Probe connected to the eight inputs of a DAC. Notice the green and blue color coding, where ones are green and zeros are blue. Another TLP058 Logic Probe on FlexChannel 3 is probing the SPI bus driving the DAC. The white edges indicate higher frequency information is 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 5 Series MSO is the largest display in the industry, providing 100% more display area than a scope with a 10.4" (264 mm) display. 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.



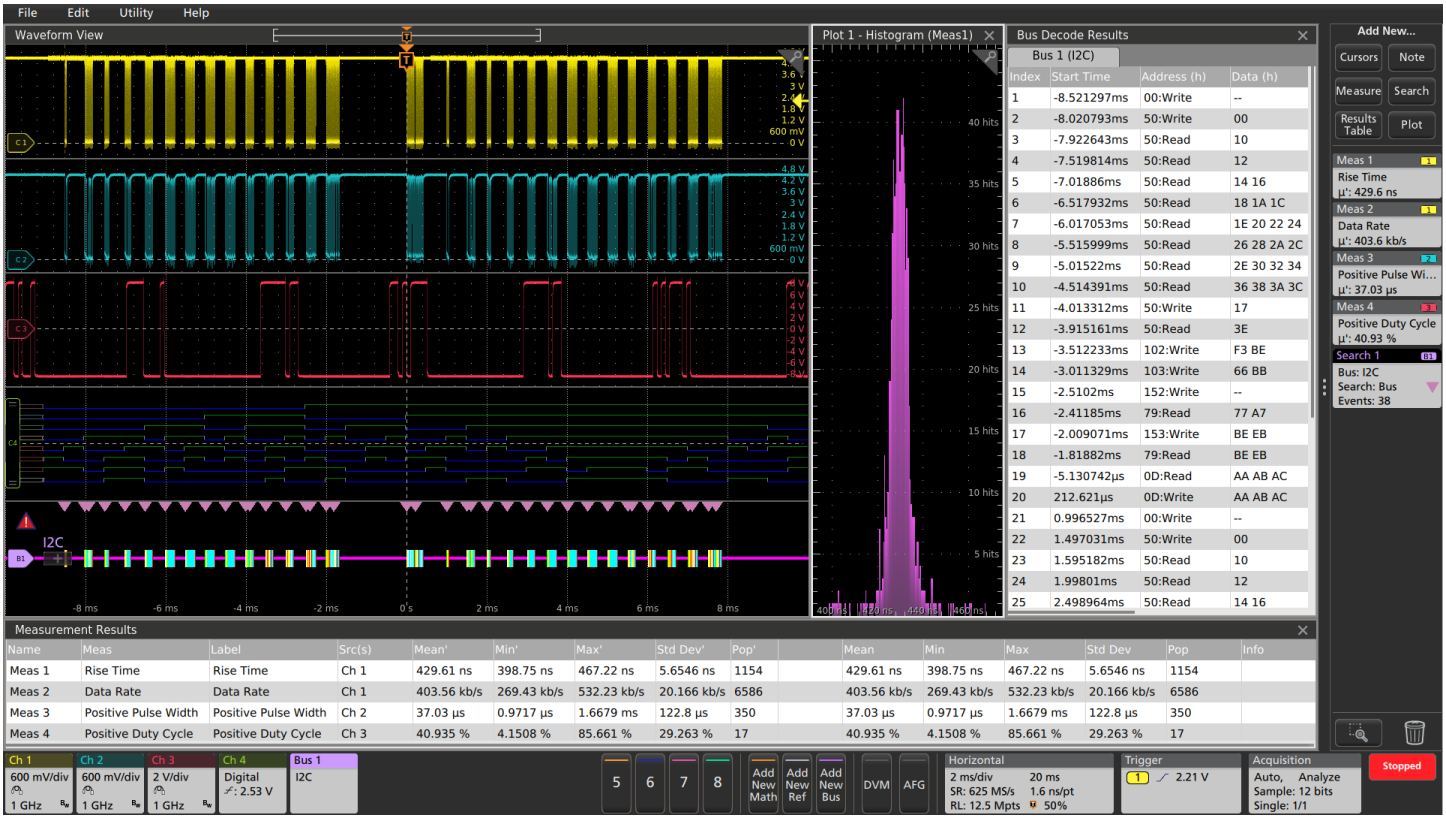
Stacked display mode enables easy visibility of all waveforms while maintaining maximum ADC resolution on each input for the most accurate measurements.

The 5 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!

The massive display in the 5 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

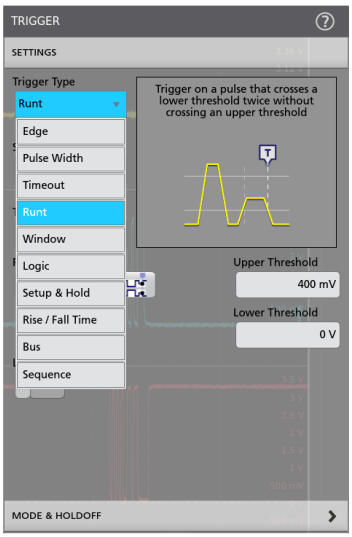
Waveform and scope operating parameters are displayed in a series of "badges" in the Settings Bar that runs along the bottom of the display. The Settings Bar provides Immediate access for the most common waveform management tasks. With a single tap, you can:

- 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 5 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 5 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

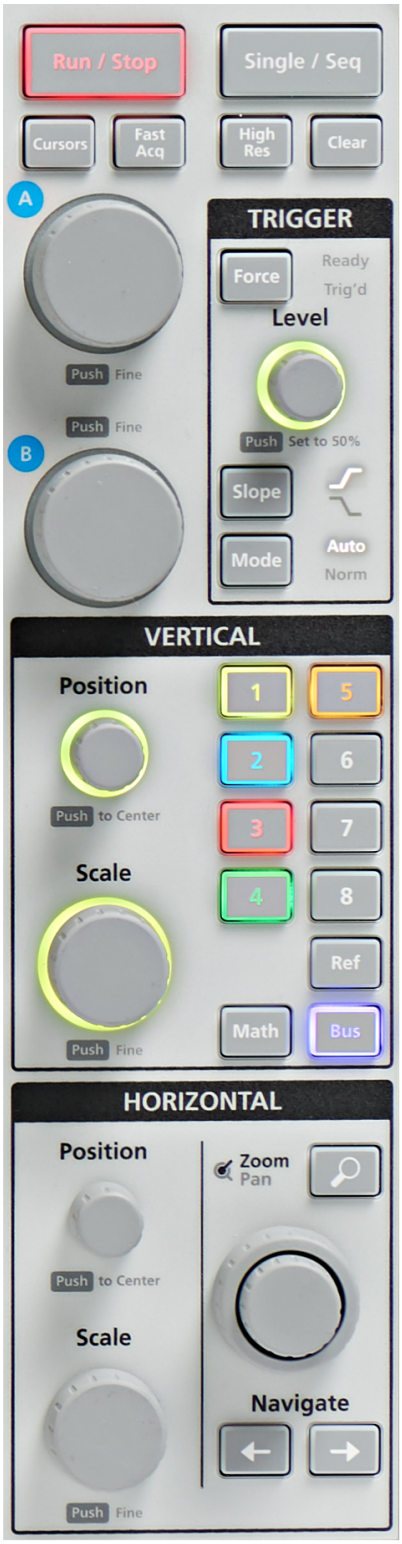
Smooth, responsive front panel controls allow you to make adjustments with familiar knobs and buttons, and you can add a mouse or keyboard as a third interaction method.

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 5 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 5 Series MSO is the first oscilloscope to offer 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.

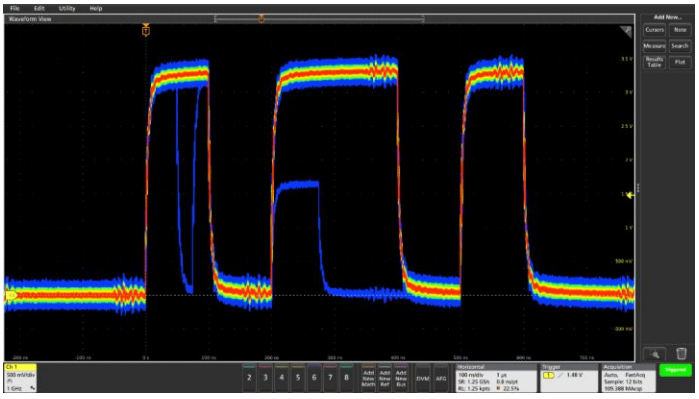
Whether you run Windows or not, the oscilloscope operates in exactly the same way with the same look and feel and UI interaction.

Experience the performance difference

With up to 2 GHz analog bandwidth, 6.25 GS/s sample rates, standard 62.5 M record length and a 12-bit analog to digital converter (ADC), the 5 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.



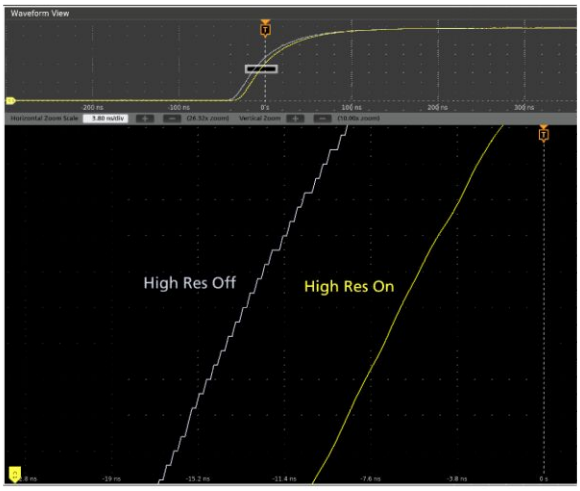
FastAcq's high waveform capture rate enables you to discover infrequent problems common in digital design.

Industry leading vertical resolution

The 5 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 5 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 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 ≤125 MS/s sample rates.

New lower-noise front end amplifiers further improve the 5 Series MSO's ability to resolve fine signal detail.



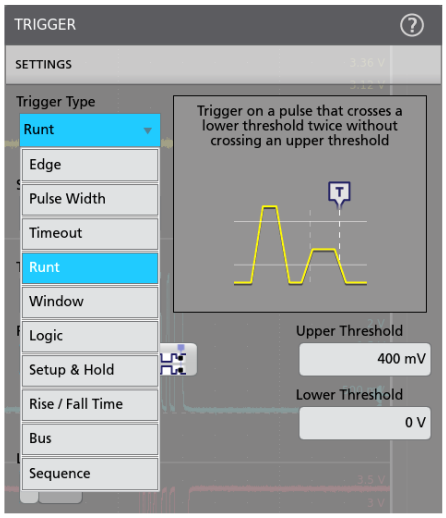
The 5 Series MSO's 12-bit ADC along with the new High Res mode enable industry leading vertical resolution.

Triggering

Discovering a device fault is only the first step. Next, you must capture the event of interest to identify root cause. The 5 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

With up to a 125 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.



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.

Accurate high-speed probing

The TPP Series passive voltage probes included with every 5 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).

5 Series MSOs come standard with one TPP0500B (350 MHz, 500 MHz models) or TPP1000 (1 GHz, 2 GHz models) probe per channel.

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 5 Series MSO provides up to 80 W of power to the front panel connectors, sufficient to power all connected TekVPI probes without the need for an additional probe power supply.

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 5 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
- > 1,000 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 greater than 1,000 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 5 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

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

Using automated measurements to characterize power supply bring up.

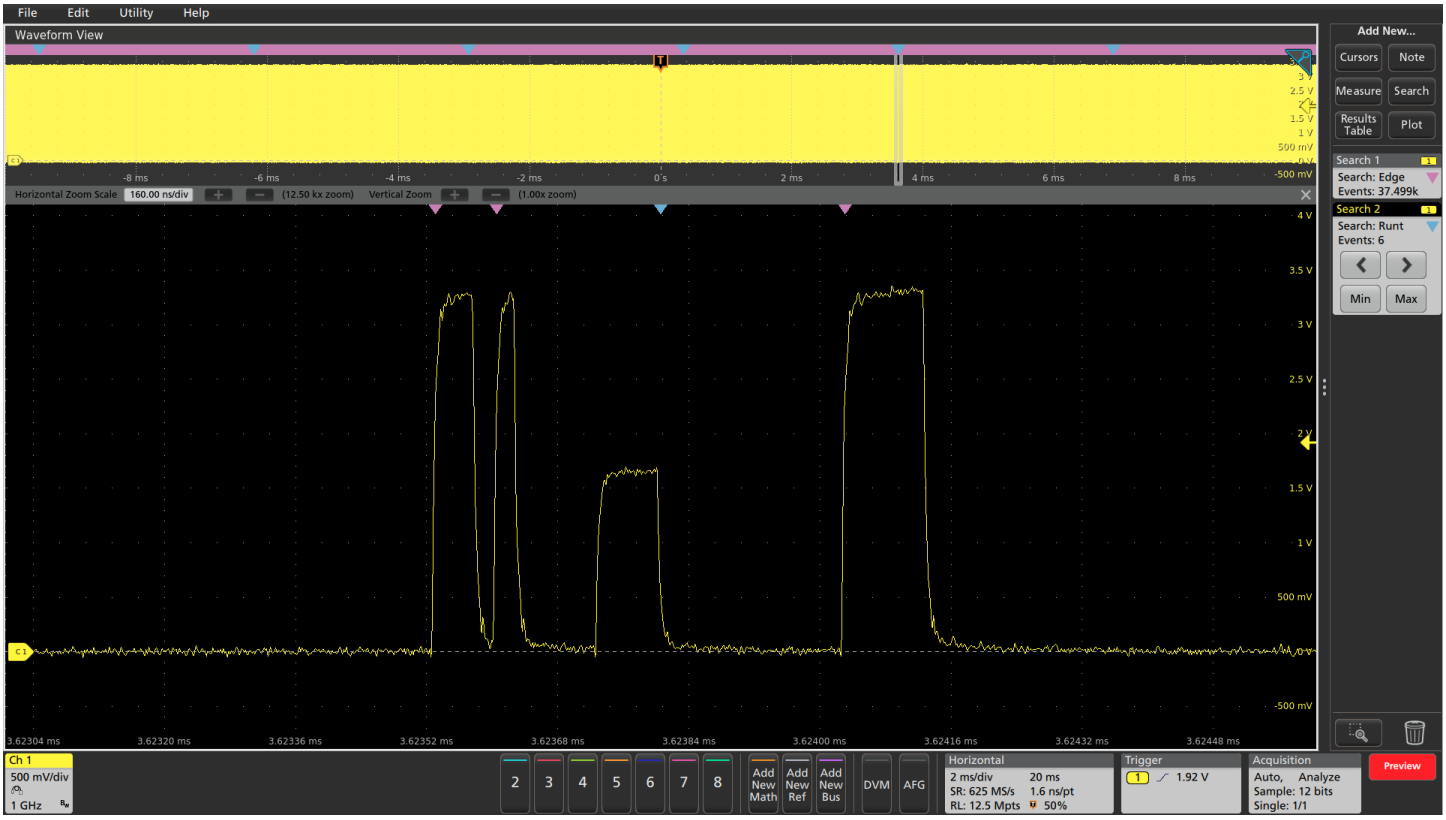
Navigation and search

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 5 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.

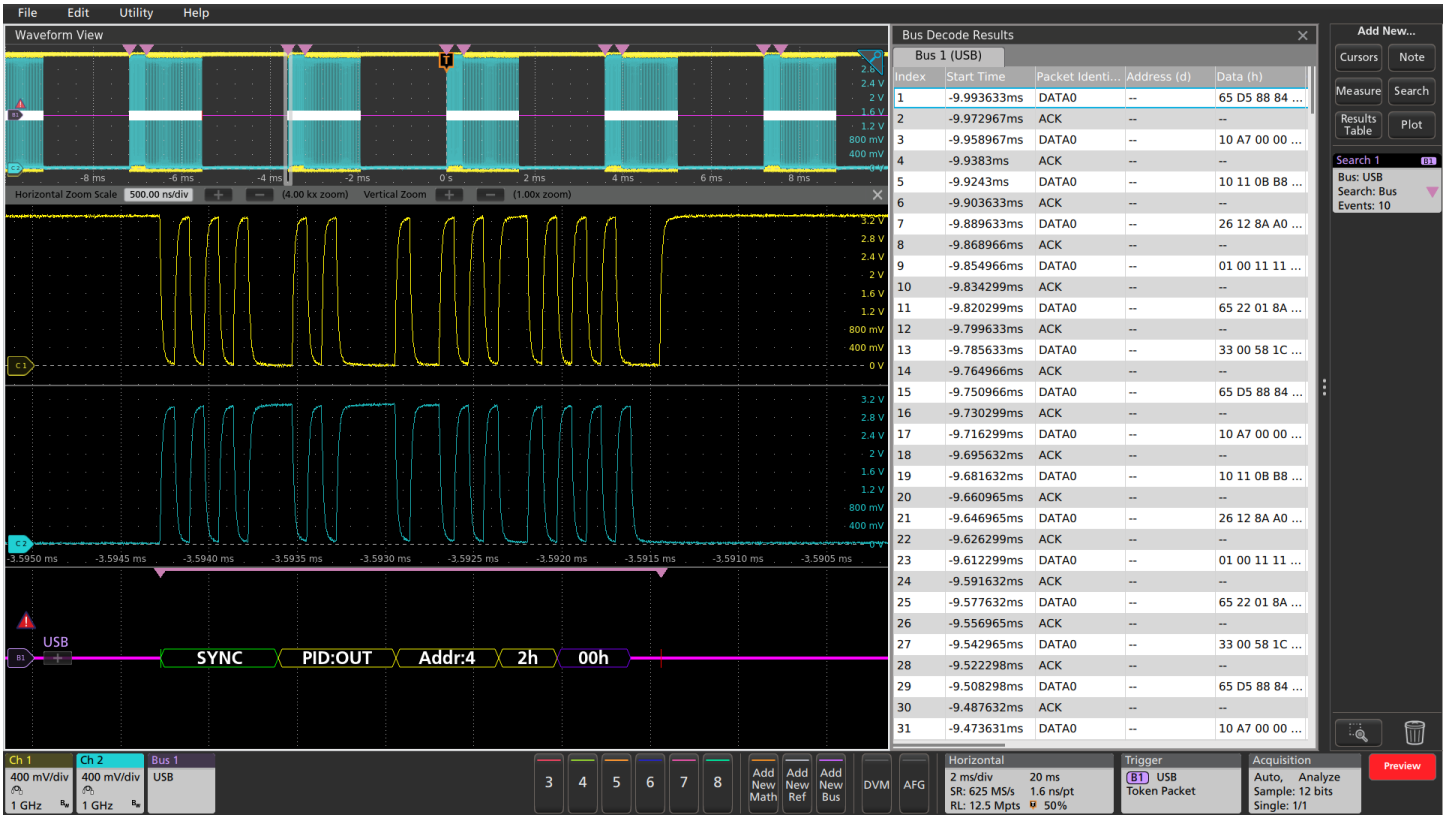


Earlier, FastAcq revealed the presence of a runt pulse in a digital data stream prompting further investigation. In this long 20 ms acquisition, Search 1 reveals that there are approximately 37,500 rising edges in the acquisition. Search 2 (run simultaneously) reveals that there are six runt pulses in 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're 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 5 Series MSO offers a robust set of tools for working with the most common serial buses found in embedded design including I^2C, SPI, RS-232/422/485/UART, CAN, LIN, FlexRay, USB LS/FS/HS, Ethernet 10/100, and Audio (I^2S/LJ/RJ/TDM):

- 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).

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.

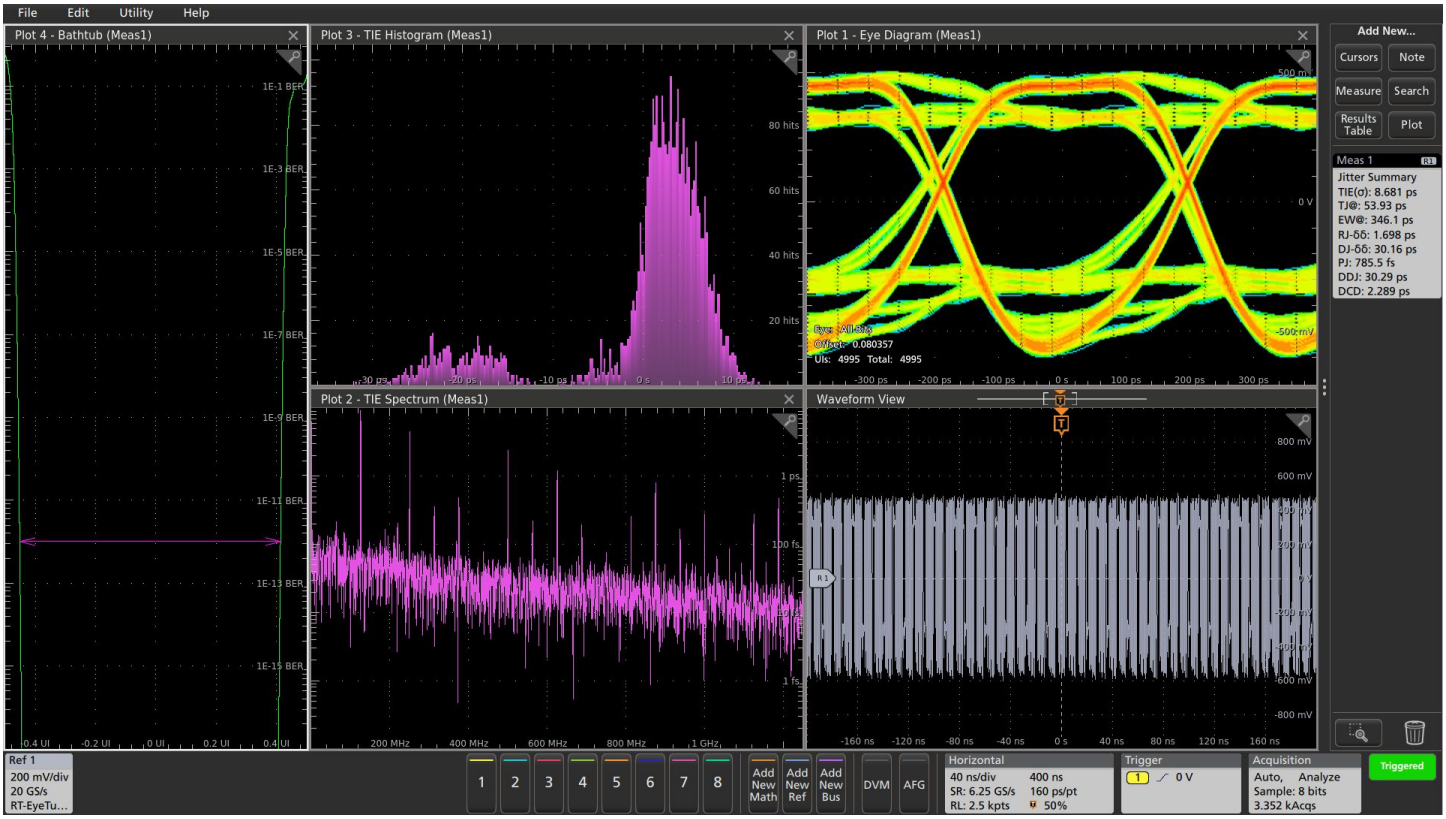
Parallel buses are still found in many designs. The tools described above for serial buses also work on parallel buses. Support for parallel buses is standard in the 5 Series MSO. Parallel buses can be up to 64 bits wide and can include a combination of analog and digital channels.

Jitter analysis

The 5 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 5-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.

Designed with your needs in mind

Connectivity

The 5 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 5 Series MSO to the rest of your design environment.

Remote operation

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 5 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 5 Series MSO is compatible with Tektronix' ArbExpress PC-based waveform creation and editing software, making creation of complex waveforms fast and easy.

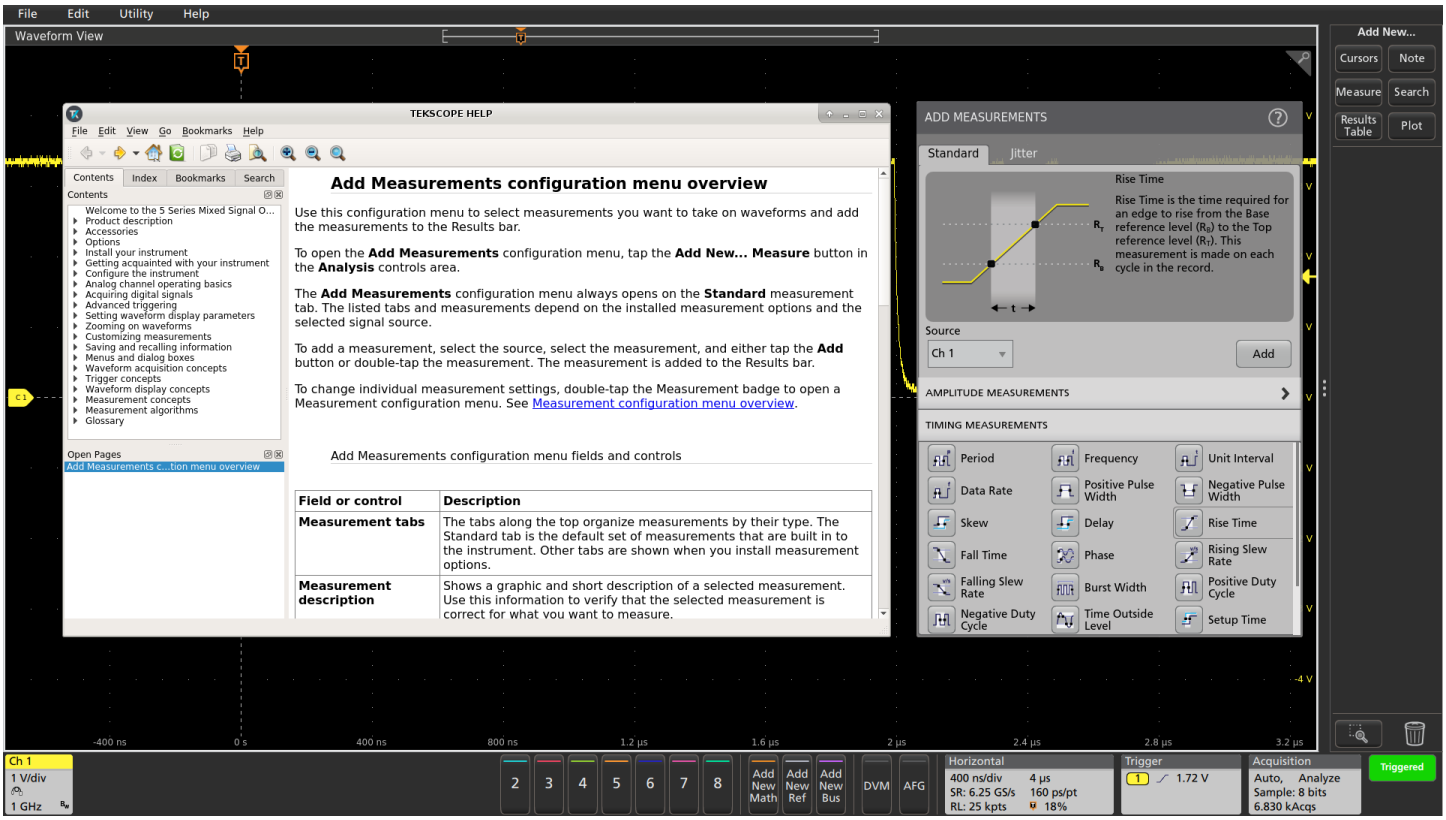
Digital Voltmeter (DVM) and Trigger Frequency Counter

The 5 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.

Help when you need it

The 5 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.



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

	MSO54	MSO56	MSO58
FlexChannel inputs	4	6	8
Maximum analog channels	4	6	8
Maximum digital channels (with optional logic probes)	32	48	64
Bandwidth (calculated rise time)	350 MHz (1.15 ns), 500 MHz (800 ps), 1 GHz (400 ps), 2 GHz (225 ps)		
DC Gain Accuracy	2 GHz models, 50 Ω: ±1.2%, (±2.0% at ≤ 1 mV/div), derated at 0.1 %/°C above 30°C 2 GHz models, 1 MΩ: ±1.0%, (±2.0% at ≤ 1 mV/div), derated at 0.1 %/°C above 30°C < 2 GHz models, 50 Ω, 1 MΩ: ±1.0%, (±2.0% at ≤ 1 mV/div), derated at 0.1 %/°C above 30°C		
ADC Resolution	12 bits		
Vertical Resolution	8 bits @ 6.25 GS/s 12 bits @ 3.125 GS/s 13 bits @ 1.25 GS/s (High Res) 14 bits @ 625 MS/s (High Res) 15 bits @ 312.5 MS/s (High Res) 16 bits @ ≤125 MS/s (High Res)		
Sample Rate	6.25 GS/s on all analog / digital channels (160 ps resolution)		
Record Length (std.)	62.5 Mpoints on all analog / digital channels		
Record Length (opt.)	125 Mpoints on all analog / digital channels		
Waveform Capture Rate	>500,000 wfms/s		
Arbitrary/Function Generator (opt.)	13 predefined waveform types with up to 50 MHz output		
DVM	4-digit DVM (free with product registration)		
Trigger Frequency Counter	8-digit frequency counter (free with product registration)		

Vertical system - analog channels

Bandwidth selections	20 MHz, 250 MHz, and the full bandwidth value for your model.
Input coupling	DC, AC
Input impedance	50 Ω ± 1% 1 MΩ ± 1% with 14.5 pF ± 1.5 pF (2 GHz models) 1 MΩ ± 1% with 13.0 pF ± 1.5 pF (< 2 GHz models)
Input sensitivity range	
1 MΩ	500 µV/div to 10 V/div in a 1-2-5 sequence
50 Ω	500 µV/div to 1 V/div in a 1-2-5 sequence

Vertical system - analog channels

Maximum input voltage

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

1 MΩ: 300 V_{RMS}, CAT II

Derate at 20 dB/decade from 4.5 MHz to 45 MHz;

Derate 14 dB/decade from 45 MHz to 450 MHz;

> 450 MHz, 5.5 V_{RMS}

Effective bits (ENOB), typical

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

Bandwidth	ENOB
1 GHz	7.0
250 MHz	7.8
20 MHz	8.7

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

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

Vertical system - analog channels

Random noise, RMS, typical

2 GHz models, High Res mode (RMS)

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

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

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

Position range ±5 divisions

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

4 Bandwidth at 1 mV/div is limited to 350 MHz in 50 Ω.

5 Bandwidth at 1 mV/div is limited to 1.5 GHz in 50 Ω.

Vertical system - analog channels

Offset ranges, minimum

2 GHz models

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

Volts/div Setting	1 MΩ Input
	Offset Range
500 µV/div - 63 mV/div	±1 V
64 mV/div - 999 mV/div	±10 V
1 V/div - 10 V/div	±100 V

< 2 GHz models

Volts/div Setting	Minimum Offset Range	
	50 Ω Input	1 MΩ Input
500 µV/div - 63 mV/div	±1 V	±1 V
64 mV/div - 999 mV/div	±10 V	±10 V
1 V/div - 10 V/div	±10 V	±100 V

Offset accuracy	±(0.005 X |offset - position | + DC balance)
Crosstalk (channel isolation), typical	≥ 200:1 at ≤ 100 MHz and ≥ 100:1 at > 100 MHz, up to the rated bandwidth for any two channels having equal Volts/div settings
DC balance	0.1 div with DC-50 Ω oscilloscope input impedance (50 Ω BNC terminated) 0.2 div at 1 mV/div with DC-50 Ω oscilloscope input impedance (50 Ω BNC terminated) 0.4 div at 500 µV/div with DC-50 Ω oscilloscope input impedance (50 Ω BNC terminated) 0.2 div with DC-1 MΩ oscilloscope input impedance (50 Ω BNC terminated) 0.4 div at 500 µV/div with DC-1 MΩ scope input impedance (50 Ω BNC terminated)

Vertical system - digital channels

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

Vertical system - digital channels

Threshold accuracy	± [100 mV + 3% of threshold setting after calibration]
Input hysteresis, typical	100 mV at the probe tip
Input dynamic range, typical	30 V_{pp} for F_{in} ≤ 200 MHz, 10 V_{pp} for F_{in} > 200 MHz
Absolute maximum input voltage, typical	±42 V peak
Minimum voltage swing, typical	400 mV peak-to-peak
Input impedance, typical	100 kΩ
Probe loading, typical	2 pF

Horizontal system

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

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

Horizontal system

Delta-time measurement accuracy

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

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

(assume edge shape that results from Gaussian filter response)

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

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

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

N = input-referred guaranteed noise limit (volts rms)

TBA = timebase accuracy or Reference Frequency Error

t_p = delta-time measurement duration (sec)

Aperture uncertainty	≤ 0.450 ps + $(1 * 10^{-11} *$ Measurement Duration$)_{RMS}$, for measurements having duration ≤ 100 ms
Delay between analog channels, full bandwidth, typical	≤ 100 ps for any two channels with input impedance set to 50 Ω, DC coupling with equal Volts/div or above 10 mV/div
Delay between analog and digital FlexChannels, typical	< 1 ns when using a TLP058 and a TPP1000/TPP0500B 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 holdoff range	0 ns to 20 seconds
Trigger jitter, typical	≤ 5 ps_{RMS} for sample mode and edge-type trigger ≤ 7 ps_{RMS} for edge-type trigger and FastAcq mode ≤ 40 ps_{RMS} for non edge-type trigger modes

Trigger system

Edge-type trigger sensitivity, DC coupled, typical

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

Trigger level ranges: ±5 divs from center of screen

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

Trigger types

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

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

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

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

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

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

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

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

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

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

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

SPI Bus (option 5-SREMBD): Trigger on Slave Select, Idle Time, or Data (1-16 words) on SPI buses up to 10 Mb/s

RS-232/422/485/UART Bus (option 5-SRCOMP): Trigger on Start Bit, End of Packet, Data, and Parity Error up to 10 Mb/s

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

LIN Bus (option 5-SRAUTO): Trigger on Sync, Identifier, Data, Identifier and Data, Wakeup Frame, Sleep Frame, and Error on LIN buses up to 1 Mb/s

FlexRay Bus (Option 5-SRAUTO): Trigger on Start of Frame, Indicator Bits (Normal, Payload, Null, Sync, Startup), Frame ID, Cycle Count, Header Fields (Indicator Bits, Identifier, Payload Length, Header CRC, and Cycle Count), Identifier, Data, Identifier and Data, End Of Frame, and Errors on FlexRay buses up to 10 Mb/s

USB 2.0 LS/FS/HS Bus (option 5-SRUSB2): Trigger on Sync, Reset, Suspend, Resume, End of Packet, Token (Address) Packet, Data Packet, Handshake Packet, Special Packet, Error on USB buses up to 480 Mb/s

Trigger system

Ethernet Bus (option 5-SRENET):	Trigger on Start of Frame, MAC Addresses, MAC Q-tag, MAC Length/Type, MAC Data, IP Header, TCP Header, TCP/IPV4 Data, End of Packet, and FCS (CRC) Error on 10BASE-T and 100BASE-TX buses
Audio (I^2S, LJ, RJ, TDM) Bus (option 5-SRAUDIO):	Trigger on Word Select, Frame Sync, or Data. Maximum data rate for I^2S/LJ/RJ is 12.5 Mb/s. Maximum data rate for TDM is 25 Mb/s

Acquisition system

Sample	Acquires sampled values
Peak Detect	Captures glitches as narrow as 640 ps at all sweep speeds
Averaging	From 2 to 10,240 waveforms
Envelope	Min-max envelope reflecting Peak Detect data over multiple acquisitions
High Res	Applies a unique Finite Impulse Response (FIR) filter for each sample rate that maintains the maximum bandwidth possible for that sample rate while preventing aliasing and removing noise from the oscilloscope amplifiers and ADC above the usable bandwidth for the selected sample rate. High Res mode always provides at least 12 bits of vertical resolution and extends all the way to 16 bits of vertical resolution at ≤ 125 MS/s sample rates.
FastAcq®	FastAcq optimizes the instrument for analysis of dynamic signals and capture of infrequent events by capturing >500,000 wfms/s.

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

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

Waveform measurements

Measurement plots	Time Trend, Histogram, and Spectrum plots are available for all standard measurements
Jitter analysis (option 5-DJA) adds the following:	
Measurements	Jitter Summary, TJ@BER, RJ- δδ, DJ- δδ, PJ, RJ, DJ, DDJ, DCD, SRJ, J2, J9, NPJ, F/2, F/4, F/8, Eye Height, Eye Height@BER, Eye Width, Eye Width@BER, Eye High, Eye Low, Q-Factor, Bit High, Bit Low, Bit Amplitude, DC Common Mode, AC Common Mode (Pk-Pk), Differential Crossover, T/nT Ratio, SSC Freq Dev, SSC Modulation Rate
Measurement Plots	Eye Diagram and Jitter Bathtub

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, and Blackman-Harris

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.

Display

Display type	15.6 in. (395 mm) liquid-crystal TFT color display
Display resolution	1,920 horizontal × 1,080 vertical pixels (High Definition)
Display modes	Overlay: traditional oscilloscope display where traces overlay each other Stacked: display mode where each waveform is placed in its own slice and can take advantage of the full ADC range while still being visually separated from other waveforms.
Zoom	Horizontal and vertical zooming is supported in all waveform and plot views.
Interpolation	Sin(x)/x and Linear

Display

Waveform styles	Vectors, dots, variable persistence, and infinite persistence
Graticules	Grid, Time, Full, and None
Color palettes	Normal and inverted
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

Sine waveform

Frequency range	0.1 Hz to 50 MHz
Frequency setting resolution	0.1 Hz
Frequency accuracy	130 ppm (frequency ≤ 10 kHz), 50 ppm (frequency > 10 kHz)
Amplitude range	20 mV_{pp} to 5 V_{pp} into Hi-Z; 10 mV_{pp} to 2.5 V_{pp} into 50 Ω
Amplitude flatness, typical	±0.5 dB at 1 kHz ±1.5 dB at 1 kHz for < 20 mV_{pp} amplitudes
Total harmonic distortion, typical	1% for amplitude ≥ 200 mV_{pp} into 50 Ω load 2.5% for amplitude > 50 mV AND < 200 mV_{pp} into 50 Ω load
Spurious free dynamic range, typical	40 dB (V_{pp} ≥ 0.1 V); 30 dB (V_{pp} ≥ 0.02 V), 50 Ω load

Square and pulse waveform

Frequency range	0.1 Hz to 25 MHz
Frequency setting resolution	0.1 Hz
Frequency accuracy	130 ppm (frequency ≤ 10 kHz), 50 ppm (frequency > 10 kHz)
Amplitude range	20 mV_{pp} to 5 V_{pp} into Hi-Z; 10 mV_{pp} to 2.5 V_{pp} into 50 Ω
Duty cycle range	10% - 90% or 10 ns minimum pulse, whichever is larger Minimum pulse time applies to both on and off time, so maximum duty cycle will reduce at higher frequencies to maintain 10 ns off time
Duty cycle resolution	0.1%
Minimum pulse width, typical	10 ns. This is the minimum time for either on or off duration.
Rise/Fall time, typical	5 ns, 10% - 90%
Pulse width resolution	100 ps
Overshoot, typical	< 6% for signal steps greater than 100 mV_{pp} This applies to overshoot of the positive-going transition (+overshoot) and of the negative-going (-overshoot) transition
Asymmetry, typical	±1% ±5 ns, at 50% duty cycle
Jitter, typical	< 60 ps TIE_{RMS}, ≥ 100 mV_{pp} amplitude, 40%-60% duty cycle

Ramp and triangle waveform

Frequency range	0.1 Hz to 500 kHz
Frequency setting resolution	0.1 Hz
Frequency accuracy	130 ppm (frequency ≤ 10 kHz), 50 ppm (frequency > 10 kHz)
Amplitude range	20 mV_{pp} to 5 V_{pp} into Hi-Z; 10 mV_{pp} to 2.5 V_{pp} into 50 Ω

Arbitrary/Function Generator (optional)

Variable symmetry	0% - 100%
Symmetry resolution	0.1%
DC level range	±2.5 V into Hi-Z ±1.25 V into 50 Ω
Random noise amplitude range	20 mV_{pp} to 5 V_{pp} into Hi-Z 10 mV_{pp} to 2.5 V_{pp} into 50 Ω
Sin(x)/x	
Maximum frequency	2 MHz
Gaussian pulse, Haversine, and Lorentz pulse	
Maximum frequency	5 MHz
Lorentz pulse	
Frequency range	0.1 Hz to 5 MHz
Amplitude range	20 mV_{pp} to 2.4 V_{pp} into Hi-Z 10 mV_{pp} to 1.2 V_{pp} into 50 Ω
Cardiac	
Frequency range	0.1 Hz to 500 kHz
Amplitude range	20 mV_{pp} to 5 V_{pp} into Hi-Z 10 mV_{pp} to 2.5 V_{pp} into 50 Ω
Arbitrary	
Memory depth	1 to 128 k
Amplitude range	20 mV_{pp} to 5 V_{pp} into Hi-Z 10 mV_{pp} to 2.5 V_{pp} into 50 Ω
Repetition rate	0.1 Hz to 25 MHz
Sample rate	250 MS/s
Signal amplitude accuracy	±[(1.5% of peak-to-peak amplitude setting) + (1.5% of absolute DC offset setting) + 1 mV] (frequency = 1 kHz)
Signal amplitude resolution	1 mV (Hi-Z) 500 µV (50 Ω)
Sine and ramp frequency accuracy	1.3×10^{-4} (frequency ≤10 kHz) 5.0×10^{-5} (frequency >10 kHz)
DC offset range	±2.5 V into Hi-Z ±1.25 V into 50 Ω
DC offset resolution	1 mV (Hi-Z) 500 µV (50 Ω)
DC offset accuracy	±[(1.5% of absolute offset voltage setting) + 1 mV] Add 3 mV of uncertainty per 10 °C change from 25 °C ambient

Digital volt meter (DVM)

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

Trigger frequency counter

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

Processor system

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

Input-Output ports

DisplayPort connector	A 20-pin DisplayPort connector
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 located on the lower right-hand side of the instrument
Amplitude:	0 to 2.5 V
Frequency:	1 kHz
Source impedance:	1 kΩ
External reference input	Time-base system can phase lock to an external 10 MHz reference (±4 ppm)

Input-Output ports

USB interface

Three USB Host ports on the front of the instrument: two USB 2.0 High Speed ports and one USB 3.0 Super Speed port

Four USB Host ports on the rear of the instruments: two USB 2.0 High Speed ports and two USB 3.0 Super Speed ports

One USB 3.0 Super Speed Device port on the rear of the instrument providing USBTMC support

Ethernet interface

10/100/1000 Mb/s

Auxiliary output

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

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

Kensington-style lock

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

LXI

Class: LXI Core 2011

Version: 1.4

Power source

Power

Power consumption

400 Watts maximum

Source voltage

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

115 V ±10% at 400 Hz ±10%

Physical characteristics

Dimensions

Height: 12.2 in (309 mm), feet folded in, handle to back

Height: 14.6 in (371 mm) feet folded in, handle up

Width: 17.9 in (454 mm) from handle hub to handle hub

Depth: 8.0 in (205 mm) from back of feet to front of knobs, handle up

Depth: 11.7 in (297.2 mm) feet folded in, handle to the back

Weight

< 25 lbs (11.4 kg)

Cooling

The clearance requirement for adequate cooling is 2.0 in (50.8 mm) on the right side (when looking at the front of the instrument) 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, non-condensing, and as limited by a maximum wet-bulb temperature of +39 °C
Non-operating	5% to 90% relative humidity (% RH) at up to +40 °C 5% to 39% RH above +40 °C up to +50 °C, non-condensing, 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

Software

Software	
IVI driver	Provides a standard instrument programming interface for common applications such as LabVIEW, LabWindows/CVI, MicrosoftNET, and MATLAB.
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 a 5 Series MSO model based on the number of FlexChannel inputs you need. Each FlexChannel input supports 1 analog or 8 digital input signals, interchangeably.

Model	Number of FlexChannels
MSO54	4
MSO56	6
MSO58	8

Every 5 Series MSO includes

- One passive analog probe per FlexChannel:
  - TPP0500B 500 MHz probes with 350 MHz or 500 MHz bandwidth models
  - TPP1000 1 GHz probes with 1 GHz or 2 GHz bandwidth models
- 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 quality system registration
- Three-year warranty covering all parts and labor on the 5 Series MSO 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
5-BW-350	350 MHz
5-BW-500	500 MHz
5-BW-1000	1 GHz
5-BW-2000	2 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
5-RL-125	Extend record length to 125 Mpoints/channel
5-WIN	Add removable SSD with Windows 10 license
5-AFG	Add Arbitrary / Function Generator

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
5-SRAUDIO	Audio (I^2S, LJ, RJ, TDM)
5-SRAUTO	Automotive (CAN, LIN, FlexRay)
5-SRCOMP	Computer (RS-232/422/485/UART)
5-SREMBD	Embedded (I^2C, SPI)
5-SRENET	Ethernet (10BASE-T, 100BASE-TX)
5-SRUSB2	USB (USB2.0 LS, FS, HS [6])

Differential serial bus? Be sure to check Step 7 for differential probes.

Step 5

Add optional analysis capabilities

Instrument Option	Advanced Analysis
5-DJA	Advanced Jitter and Eye Analysis

Step 6

Add digital probes

Each FlexChannel input can be configured as eight digital channels simply by connecting a TLP058 logic probe to a FlexConnect input. You can order TLP058 probes with the instrument or separately.

For this instrument	Order	To access
MSO54	1 to 4 TLP058 Probes	8 to 32 digital channels
MSO56	1 to 6 TLP058 Probes	8 to 48 digital channels
MSO58	1 to 8 TLP058 Probes	8 to 64 digital channels

6 USB high-speed supported only on models with ≥1 GHz bandwidth

Step 7

Add additional recommended probes and adapters

Recommended Probe / Adapter	Description
TLP058	8-channel general purpose logic probe. Includes accessory kit.
TAP1500	1.5 GHz TekVPI® active single-ended voltage probe, ±8 V differential input voltage
TAP2500	2.5 GHz TekVPI® active single-ended voltage probe, ±4 V differential 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
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
TPA-BNC [7]	TekVPI® to TekProbe™ BNC adapter
TEK-DPG	TekVPI deskew pulse generator signal source
067-1686-xx	Power measurement deskew and calibration fixture

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

Step 8

Add traveling or mounting accessories

Optional Accessory	Description
HC5	Hard carrying case
RM5	Rackmount kit

7 Recommended for connecting your existing TekProbe probes to the 5 Series MSO.

Step 9

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 10

Add extended service and calibration

Service Option	Description
T3	Three Year Total Protection Plan, includes repair or replacement coverage from wear and tear, accidental damage, ESD or EOS plus preventive maintenance. Includes 5-day turnaround time and priority access to customer support.
T5	Five Year Total Protection Plan, includes repair or replacement coverage from wear and tear, accidental damage, ESD or EOS plus preventive maintenance. Includes 5-day turnaround time and priority access to customer support.
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)

CE

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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For Further Information. Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit www.tek.com.

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