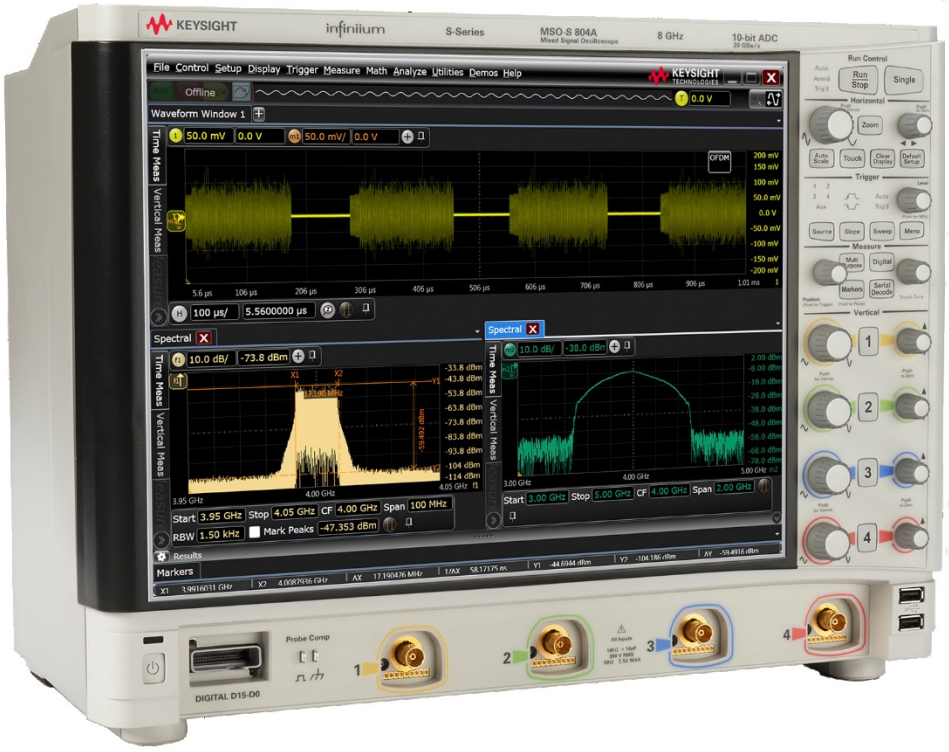
DATA SHEET

Infiniium S-Series

The Standard for Superior Measurements

Infiniium S-Series oscilloscopes incorporate innovative technology like 10-bit ADCs and a low noise front end with industry-leading software, application support, and probing. Combine that with the flexible and powerful Infiniium user interface, and the S-Series sets the standard for superior measurements.



KEYSIGHT TECHNOLOGIES

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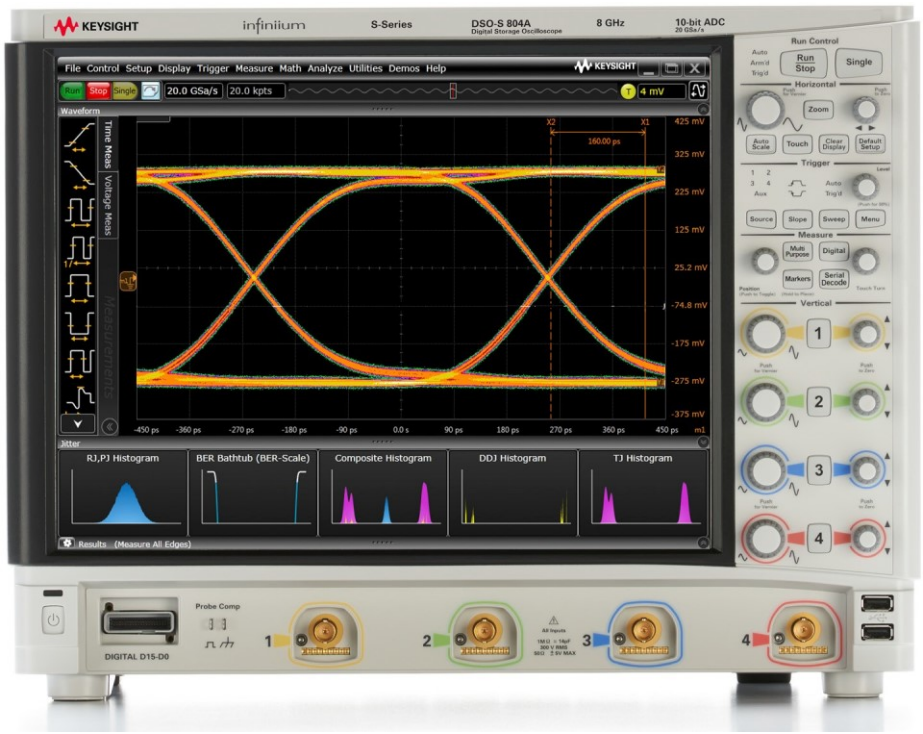
Infiniium S-Series Overview

Infiniium S-Series oscilloscopes incorporate innovative technology designed to deliver superior measurements. Our new 10-bit ADC and low-noise front-end technology work together to provide up to 8 GHz performance with the industry's best signal integrity. We put these in an advanced frame with a solid-state drive for fast boot-up, 15" capacitive touch display for ease of use, and a high-powered motherboard for fast processing. It's all compatible with a myriad of Keysight probes and applications.

Experience the S-Series today!

There is no better way to understand the superiority of the S-Series than to use one. Contact Keysight today to request a demo!



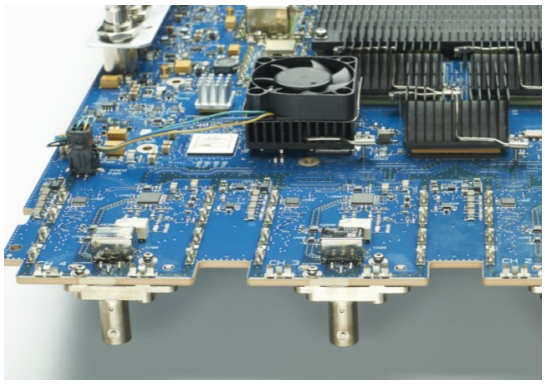
S-Series Model Numbers

DSO Model [1]	MSO Model [1]	Analog Bandwidth	Max Sample Rate	ADC Bits	Maximum Memory Depth
DSOS054A	MSOS054A	500 MHz	20 GSa/s (2 channels) 10 GSa/s (4 channels)	10	800 Mpts/ch (2 channels) 400 Mpts/ch (4 channels)
DSOS104A	MSOS104A	1 GHz			
DSOS204A	MSOS204A	2 GHz			
DSOS254A	MSOS254A	2.5 GHz			
DSOS404A	MSOS404A	4 GHz			
DSOS604A	MSOS604A	6 GHz [2]			
DSOS804A	MSOS804A	8 GHz [2]			

1. DSO and MSO models have 4 analog channels. MSO models include 16 digital channels.
2. 6 GHz and 8 GHz only possible when two channels are active. Four channel bandwidth is 4 GHz.

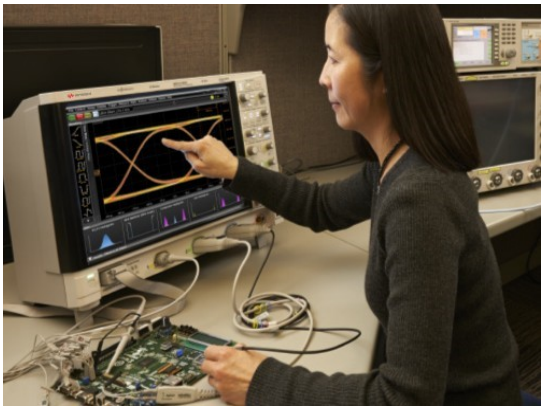
Outstanding signal integrity

- 10-bit ADC up to 8 GHz for additional resolution
- Low-noise front end for precision signal viewing
  - Only 90 uV noise at 1 mV/div and 1 GHz bandwidth
  - System ENOB values in excess of 8
  - SFDR values down to –73 dBC
  - 2 mV/div vertical scaling supported in hardware
  - HW bandwidth limit filters on 50 Ω and 1 MΩ paths
- Precision BNCs with > 8 GHz bandwidth
- Correction filters ensure flat frequency magnitude and phase response
- Low intrinsic jitter (100 fs (typical) for excellent jitter characterization)



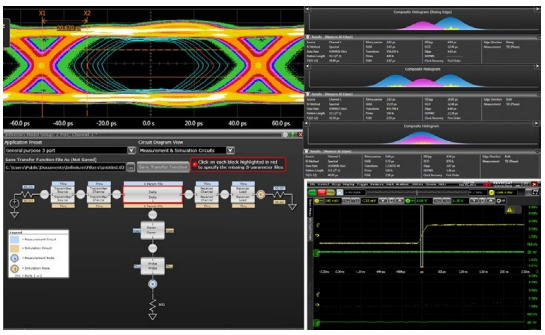
Most advanced platform

- Powerful, flexible Infiniium user interface
- Fast data offload (up to 200 MB/s) via USB 3.0
- Capacitive touch screen with multi-touch, easy-grab handles, and re-sizing touch fields
- Intel i5 and 8 GB RAM for fast processing
- Removable solid state drive (SSD) for fast boot-up and increased reliability and security



Broadest range of capability

- 16 digital channels on MSO models
- Standard feature rich software with > 50 automated measurements, 16 math functions, gating, and spectral viewer
- Expandable with optional software applications and flexible licensing:
  - Add protocol decode/trigger for dozens of serial buses
  - Choose from a large selection of analysis applications including eye diagrams and measurements with SDA, jitter, InfiniiScan, and de-embedding
  - Test to ensure adherence to industry standards with compliance apps
- Support for > 100 probes – current and voltage, active and passive, 1 MΩ and 50 Ω inputs



Advanced Technology Blocks

The heart of the oscilloscope is a 20-layer acquisition board with 16 custom ASICs and FPGAs. New technology blocks deliver superior signal integrity. You'll get superior measurements that you won't get with any other portable scope on the market.

10-bit ADC

Each model incorporates the industry's fastest 10-bit ADC with a sample rate of 40 GSa/s. This yields 2 channels at 20 GSa/s or 4 channels at 10 GSa/s.

- 4X more vertical resolution than 8-bit oscilloscopes
- ADC ENOB up to 8.7 contributes to high system ENOB values
- Up to 16 bits of resolution with high-res mode
- SNR are better than historical 8-bit ADC architectures
- Vertical scaling as low as 2 mV/div supported in hardware

Superior low-noise front end

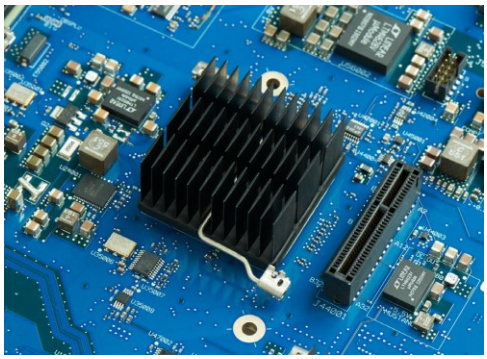
A high-resolution ADC's usefulness is dependent on the low-noise front end that supports the additional quantization levels. Each S-Series oscilloscope incorporates the industry's lowest noise front end for portable oscilloscopes with bandwidth up to 8 GHz. The S-Series front-end includes three custom ICs, including a 130 nm BiCMOS IC that incorporates user-selectable analog filters and bandwidth upgrades via a software license.

- 50 Ω and 1 MΩ input support, each path with bandwidth limit filter support
- Analog and DSP bandwidth limit filters to reduce unwanted noise
- 90 uV noise at 1 GHz bandwidth allows viewing of small signal detail
- 2 mV/div vertical scaling in hardware (in combination with ADC)
- HW bandwidth limit filters on both 50 Ω and 1 MΩ paths
- Gold-plated precision BNCs rated in excess of 8 GHz bandwidth
- Electronic attenuators for decreased noise and increased reliability
- Lower bandwidth models are upgradable to any higher bandwidth model with an instant user-installed software license

Superior time base

Time scale accuracy is critical, especially for deep-memory applications. Measurement of jitter is necessary for ensuring high-speed system reliability. Intrinsic jitter associated with an oscilloscope includes the jitter measurement internal to the scope. The lower the value, the better you'll be able to characterize your device. S-Series scopes achieve precise time accuracy with a next-generation time base architecture. The S-Series has a best-in-industry time scale accuracy of 12 ppb (after calibration) for accurate deep memory measurements, and a low jitter measurement floor with 100 fs (typical) of intrinsic jitter.

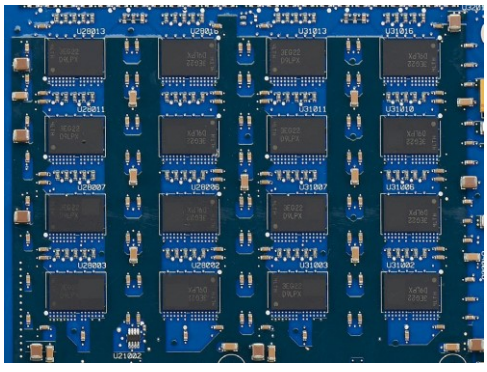
Signal processing in hardware



S-Series oscilloscopes are built with an advanced FPGA dedicated for fast and precise signal processing. The technology produces the fastest deep memory responsiveness in the industry and provides additional hardware filtering for superior measurements.

- Hardware-based algorithms for accelerated drawing to display (pixel placement) enable fast pan and zoom even with deep memory
- Frequency-response correction filters produce flat responses for both magnitude and phase for more accurate waveforms
- User-selectable hardware bandwidth-limiting correction filters from 500 MHz up to the oscilloscope's bandwidth reduce unwanted noise, plus additional front end filters provide even more bandwidth limiting options
- Supports cabled 2-channel differential inputs (channels 1 to 3 or channels 2 to 4) without requiring a differential probe
- The DSP technology block supports rapid optional de-embedding technologies such as InfiniiSim, Precision Probe, and equalization

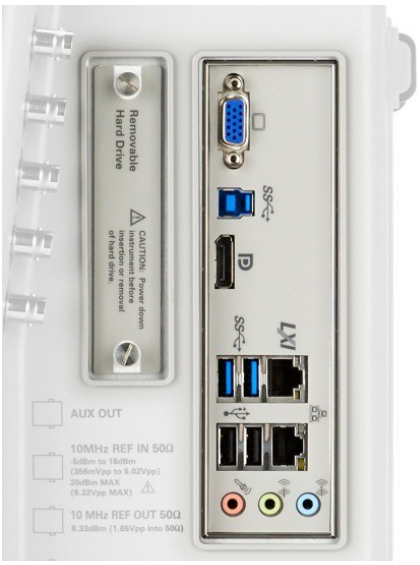
Responsive deep memory



S-Series oscilloscopes come with the industry's most responsive deep memory. With standard 100 Mpts/channel on all four channels simultaneously, and up to 820 Mpts/ch optional, capture long time periods while retaining fast sample rates. Fast update rates mean your oscilloscope will stay responsive with deep memory on to ensure precise representation of analog signals.

Powerful PC-based architecture

240 GB removeable SSD



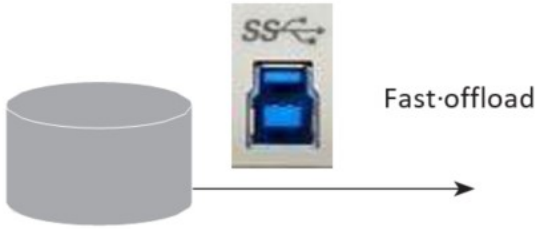
- SSD for fast bootup times of under a minute
- Increased reliability with the latest version of Windows 10
- Easy to remove for secure environments – or order spares (see ordering guide)

Powerful motherboard

- 3 GHz quad-core Intel i5 processor with 8 GB of RAM enables fast computation, even when using advanced math or deep memory
- Ethernet 10/100/1000bT ports for LAN connectivity
- 6 USB ports: 2x 2.0 on front, 2x 2.0 and 3x 3.0 on side
- DisplayPort and VGA out for simultaneous display support

Fast data offload

- Up to 200 MB/s offload via USB 3.0
- Up to 80 MB/s offload via 1000bT Ethernet



User Interface

Personalized viewing

- Determine how much space to give to results versus waveforms using sliders
- View waveforms on the same graticule or separate them with up to 16 waveform viewing areas
- Plug in a second monitor for even more customization of the interface

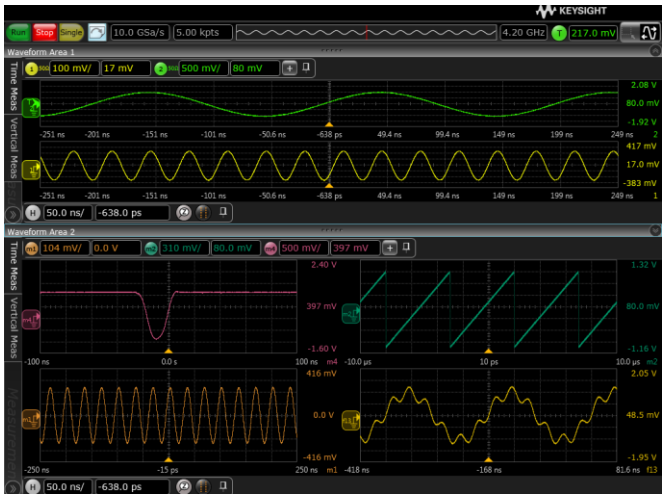
Faster and better documentation

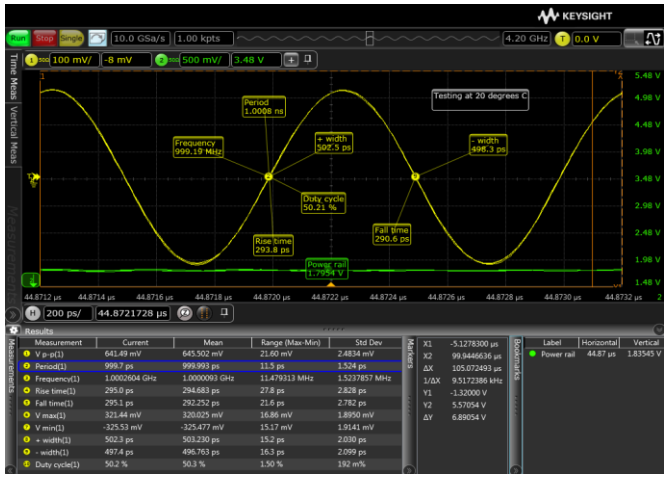
- Select from over 50 measurements. View up to 20 measurements at once, with statistics
- Select from over 40 automatic math functions, and display up to 16 at once on screen
- Vertical and horizonal scales on axes
- Add annotations using bookmarks, measurement callouts, and dynamic delta marker readouts
- Right-click to copy image without ever having to save to a file
- Quickly save all waveforms, memories, functions, and setups in a single .osc file for later recall on an oscilloscope or PC
- Save screen images as .jpg, .png, .gif, or .tiff

Best usability, including touch screen

Extensive research testing led to several touch-screen innovations not found in other oscilloscopes.

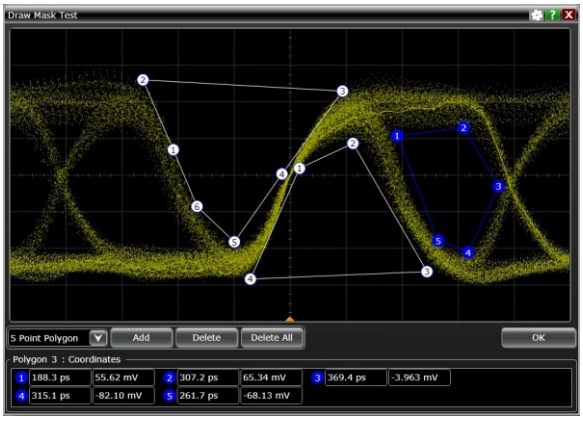
- Click once to see handles that enable touch manipulation of markers, trigger level, and waveform-tasks that previously required a mouse
- Multi-touch support for multi-touch (gestures) such as zooming and panning
- Auto-sizing when touch button is turned on/off optimizes fields for fingers or a mouse
- Traditional menu operation to quickly find settings or advanced features





Custom mask editor

Drag and drop up to 15 points on screen to create mask files in seconds.

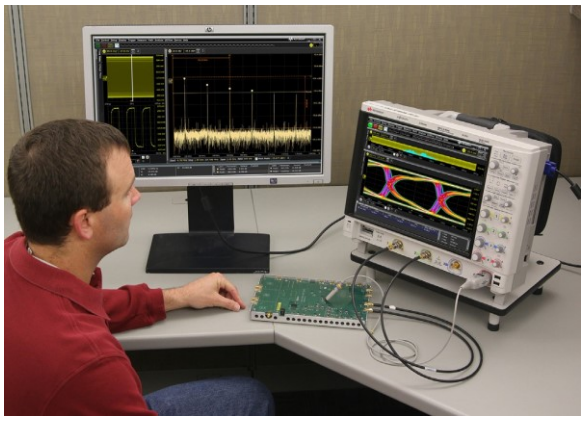


Analysis gallery

Easily find and run the test you need from the list of analysis/ measurement options represented graphically in the analysis gallery.

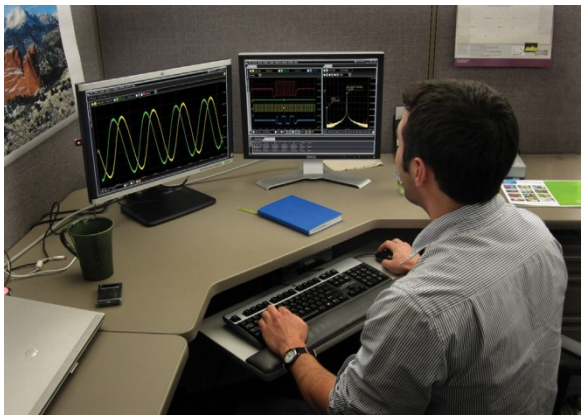
Using an external monitor

Undock and move a window to an external monitor using tabbed layout. The S-Series supports both VGA and DisplayPort IO.



Infiniium offline application

View and analyze results at your desk. Save your oscilloscope file, then view and analyze on your PC without needing additional access to your scope. Use waveform math, filtering, and FFT spectral analysis and to get more insight. Need to see protocol decode, analyze jitter, or view eye diagrams? Infiniium Offline helps you get insight into all of these areas. See the ordering guide for details.



RF Measurement Capabilities

With a built-in spectral viewer, controls, gated FFTs, 10-bit ADCs, and excellent SFDR values, the S-Series oscilloscopes provide an excellent scope platform for FFT measurements.

FFTs

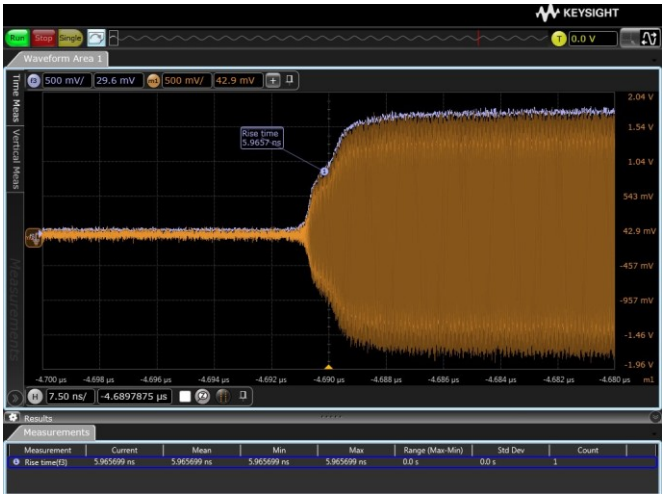
Need to see frequency domain in additional to time domain? The standard spectral viewer includes FFT controls like start/stop RBW and CF/span. Readout includes power and frequency axis annotation and a peak table.

Gated FFTs

Infiniium supports gated math and analysis including FFTs. Use any of the standard 16 independent gates to narrow FFT computations to a specific time window. Drag the gate in the time domain and see time correlated FFT measurements for specified time periods. The example at the right shows two simultaneously FFTs.

Envelope measurements

Need to see the rise time of a burst? Add a rise time measurement to an envelope function that provides an AM demodulation of a burst



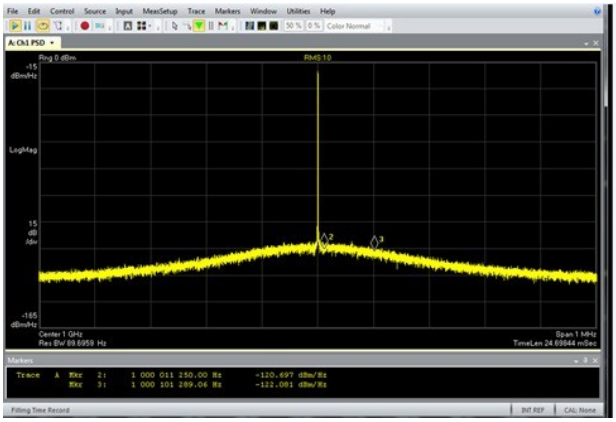
Wideband and multi-channel FFTs

Need to see >1 GHz signal spectral bandwidth and/or multiple FFTs simultaneously? Oscilloscopes offer wider bandwidth than spectrum analyzers and come standard with four ports (channels) per instrument. The Infiniium S-Series enables users to make wideband measurements up to 8 GHz and view up to 16 simultaneous FFTs. Analyze even higher bandwidth signals by using a downconverter.

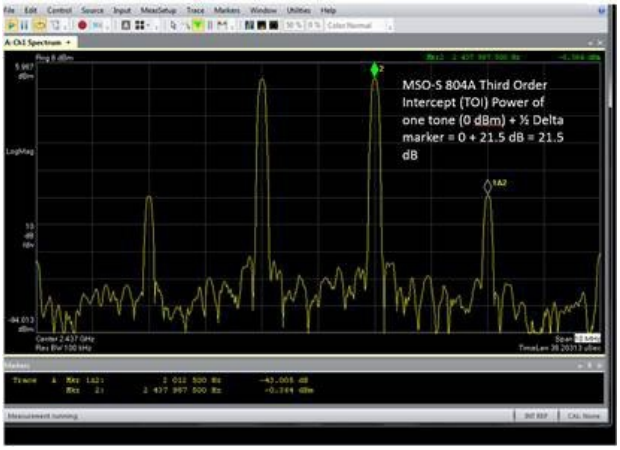
Trying to interpret traditional oscilloscope time-domain specifications can be challenging in determining if a specific scope can be recommended for RF/uW/mmW measurements. With correction filters, low-noise front end, and the 10-bit ADC, S-Series oscilloscopes can be used for wideband RF applications. Typical RF characteristics for the S-Series are listed in the performance characteristics section, with graphs below showing some characterization results.

Additionally, you can expand your oscilloscope with the 89601B vector signal analysis software. This application takes data from the scope and provides spectrum analysis and digital modulation analysis for wireless communication.

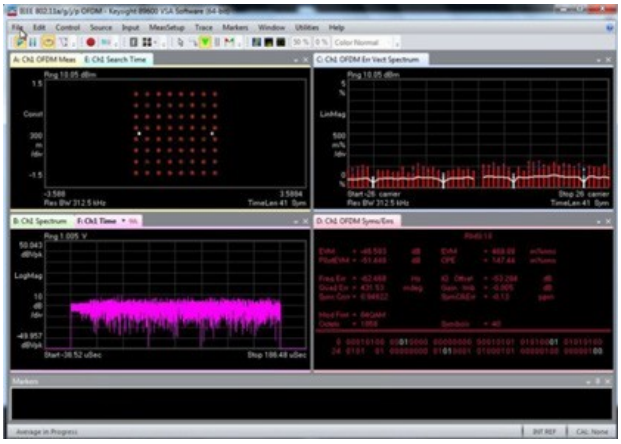
Use Infiniium capture and analysis of radar bursts, as shown in this OFDM example.



Using data acquired from S-Series, VSA shows phase noise of -121 dBc/Hz at 10 kHz and -122 dBc/Hz at 100 kHz.



Using data acquired from S-Series, VSA shows an excellent TOI value of 25 dBm.

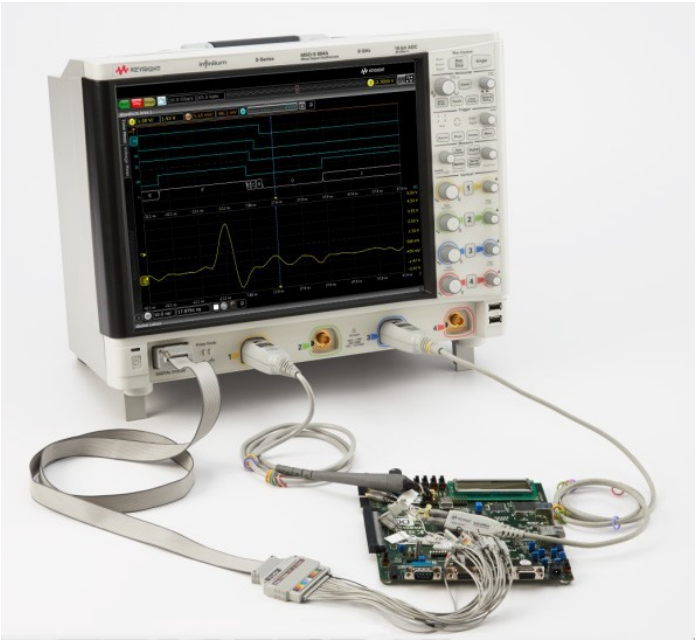


Using data acquired from S-Series, VSA shows an EVM for IEEE 802.11 QAM 64 of 0.47%.

MSO Model Details

MSO models add 16 high-speed timing channels with standard 128 Mpts digital memory, allowing you to retain fast 2 GSa/s sample rates over long periods of time. All existing DSOs are user-upgradable to MSOs with part N2901E, or can be ordered as MSOs up front. The required upgrade time is less than 5 minutes.

- Use the digital channels to evaluate control signal relationships and data buses up to 16 bits wide
- Use symbols to quickly interpret waveforms
- Trigger on and view specific control or data flow events
- Use digital channels for protocol trigger and decode (I²C, SPI, RS-232, JTAG, USB and more)
- Capture data from FPGA debug ports
- Trigger on and monitor power rail sequencing timing relationships
- Combine with oscilloscope channels to trigger across up to 20 channels simultaneously

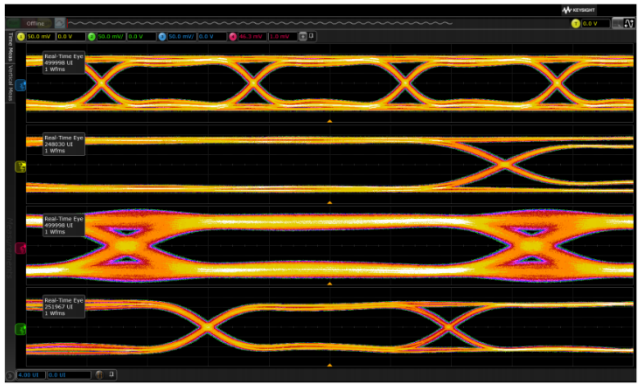


Analysis Applications

The S-Series scope comes with a variety of analysis capabilities standard, but some more specialized tools are available as options. These are specialty tools designed to help you gain additional, rapid insight to your designs. See the ordering guide section for ordering information.

Serial data analysis

Provided standard on all S-Series oscilloscopes, High-speed Serial Data Analysis (SDA) software provides you with a fast and easy way to pinpoint signal integrity problems and validate performance for serial interface designs. A wizard walks you quickly through the steps required to setup and perform a measurement. Intuitive displays and clear labeling of information make it easy to comprehend measurement results. Perform mask testing, characterize serial data that employs embedded clocks, and decode 8b/10b data.



Eye mask tests

If you identify a failure of an eye mask, you can unfold the eye diagram to show the specific unit interval that caused the failure. When used with the 8b/10b decoding feature you can identify data dependent errors that result in eye mask violations caused by Inter-Symbol Interference (ISI).

Real time eye diagrams

SDA provides a real-time eye menu. The menu is located in the display menu under color grade view. Use this menu to change scaling, look only at worst case edges, and decide which bits you want to include in your real-time eye.

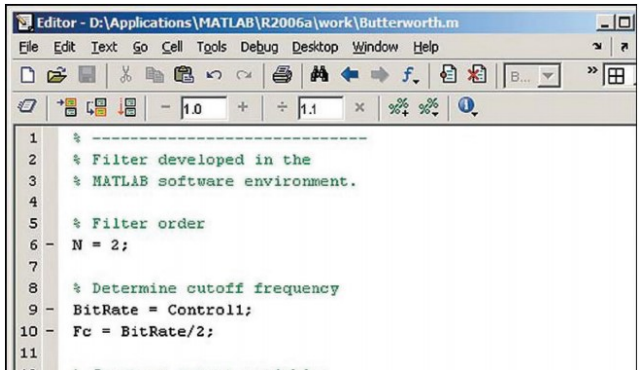
Clock recovery

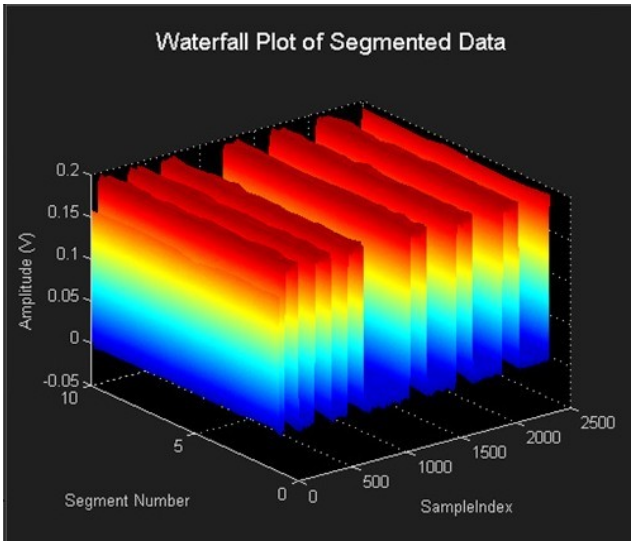
You can choose constant-frequency, first-order phase-locked loop (PLL), or second-order PLL clock recovery. You can adjust the center frequency and bandwidth, and in the case of second-order PLL, the damping factor. For PCI Express, the clock recovery algorithm specified by the PCI-SIG® is provided. A specific clock recovery algorithm is also available for SATA, HDMI, MHL, DisplayPort, USB, PCI Express, CEI, Fibre Channel, FlexRay, and MIPI® technologies. When you choose PLL clock recovery, the clock recovery algorithm requires some time at the start of each record to lock to the data. This interval cannot be viewed or analyzed. The serial data wizard will indicate the required time period for the clock recovery algorithm to lock.

User defined function

Have you ever wanted to create your own math functions or filters for your specific needs? Now, Keysight and MathWorks have teamed up to offer the perfect solution to meet your specific needs – on demand. User Defined Function for editing and execution allows you to create and execute your own custom math and analysis functions using the power of the MATLAB software environment all in a single software package. Keysight's UDF allows you to display your math and analysis functions created in MATLAB live on the oscilloscope screen, just like any of the scope's standard functions. Or, you can interactively analyze and visualize your results in the MATLAB environment, with capabilities such as graphically plotting results or automatically generating reports.

View the page and datasheet for N6171A to determine what version of MATLAB is right for you if you don't have a license already.



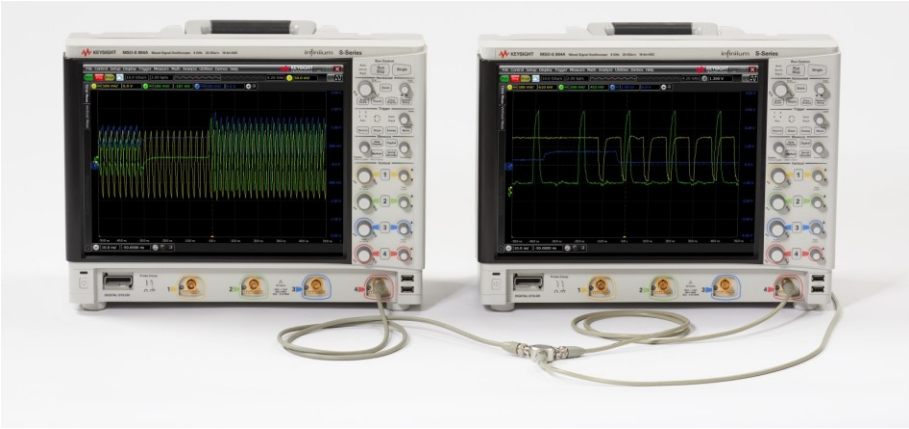


MultiScope

Need more than four simultaneous oscilloscope channels? MultiScope allows connection of 2 to 10 oscilloscopes to achieve up to 40 channels on a single timebase. Each oscilloscope is daisy chained via cables and power splitters to the first oscilloscope, called the leader.

Automated calibration is available to allow channel correlation across frames down to less than 1 ps. All oscilloscopes connect to a control PC via LAN or USB. The PC runs the Infiniium user interface and shows all waveforms, measurements and analysis in addition to controlling the oscilloscope settings. The leader can also work as the controller in the absence of a control PC.

If your need for more than four simultaneous channels goes away, each oscilloscope can be used independently and then brought back together when there are future needs for more than four channel measurements.



Jitter and Phase Noise

D9010JITA offers advanced statistical analysis of high speed digital interfaces in the vertical (voltage) and horizontal (time) domains, as well as phase noise analysis. The result: the industry's most complete jitter and noise analysis software for real-time oscilloscopes.

Power Integrity

D9010POWA is a powerful tool for analyzing power supply induced jitter or switching current loads on a DC supply due to its ability to analyze adverse interactions and their effects without the need for simulation or complex modeling. Together with an N7020A or N7024A power rail probe, you get an even more powerful means of measuring and analyzing power integrity.

De-Embedding

D9010DMBA includes PrecisionProbe and InfiniiSim Basic, two tools designed to de-embed the effect of cables and fixtures from measurements. PrecisionProbe allows you to characterize the response of a probe or cable; InfiniiSim basic lets you model out probes or cables from a measurement.

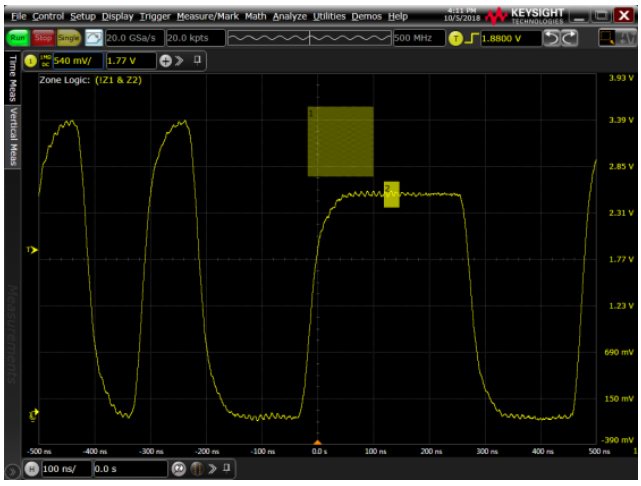
Crosstalk and Equalization

D9020ASIA is intended for anyone working in high speed digital applications where eyes are closed. As data rates go up, the signal deteriorates from the transmitter to the receiver due to ISI, noise, and other factors. The more loss that occurs, the more difficult it is for a receiver comparator to distinguish a “1” from a “0”. A high data rate coupled with a lossy channel will cause an open eye at a transmitter to be closed at the receiver. Equalization, InfiniiSim Advanced, and Crosstalk/Power Integrity packages enable deep analysis as to why an eye is closed, and what it will take to open it.

PAM-N

The Keysight D9010PAMA PAM-N analysis software extends the ease-of-use advantages of the Infiniium oscilloscopes to the analysis of PAM-3 or PAM-4 signals. A wizard walks you quickly through the steps required to setup measurements for a PAM encoded signal, to select methods for clock recovery, and then the measurements you wish to have performed on your PAM signal. Our PAM software is also able to accurately set the individual threshold levels of your PAM signal and render each individual eye.

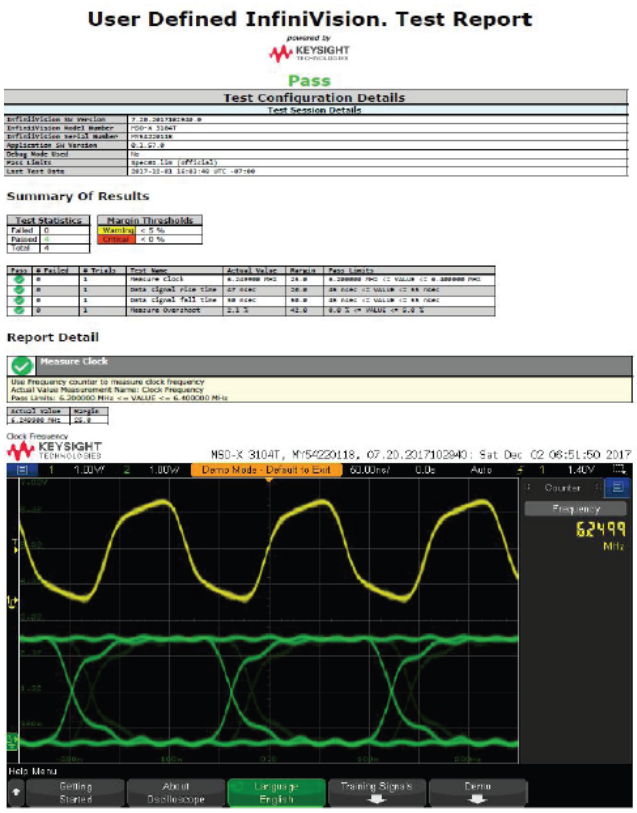
InfiniiScan



D9010SCNA uses software to overcome the limitations of hardware triggering. InfiniiScan inspects individual waveforms and lets you know where the anomalies are, moving an oscilloscope a few steps closer to the ideal of a “Find Problem” button. InfiniiScan can also isolate events as narrow as 35 ps – well beyond the limitations of hardware-based approaches. InfiniiScan consists of two key components: software finders and measurement limit testing. An added benefit is the ability to add InfiniiScan as an extra trigger stage, allowing up three-stage triggering.

User Defined Application

D9010UDAA is an easy-to-use tool that lets you generate custom GUIs for test automation applications with minimum programming. It provides full automation, including the ability to control other Keysight instruments, external applications such as MATLAB, and your DUT software. UDA also provides the ability to add custom tests to your compliance applications. You can automate testing, generate reports, test consistently across your organization, control switch matrices for multi-lane testing, all while adding analysis to your compliance or debug software.



External Mixing Assistant (for E-band test)

The E-band signal analysis reference solution combines the power of Keysight software and hardware to deliver an integrated solution.

Using an S-Series oscilloscope, D9010EXMA software, an external mixer, and signal generator provides an integrated block down-conversion system that delivers 2.5 GHz of analysis bandwidth over the E-band frequency range of 55 to 90 GHz.

Protocol Applications

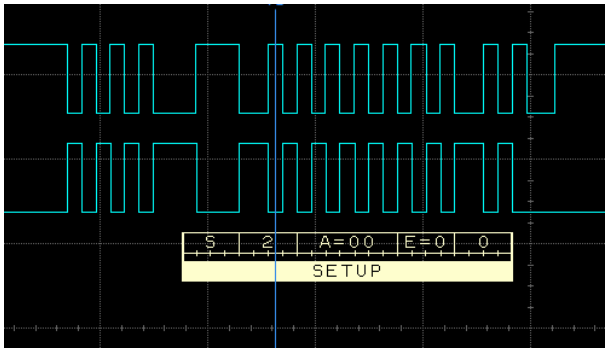
Does your design include a serial bus that is a key point for debug or test? Use one of Keysight's protocol decoding and triggering application packages for increased productivity. The software converts DSO or MSO physical layer acquisitions into packets for specific protocols. Specify trigger conditions at the packet level. Quickly move between physical and protocol layer information using the time-correlated tracking marker. Display protocol content in waveforms and/or listing.

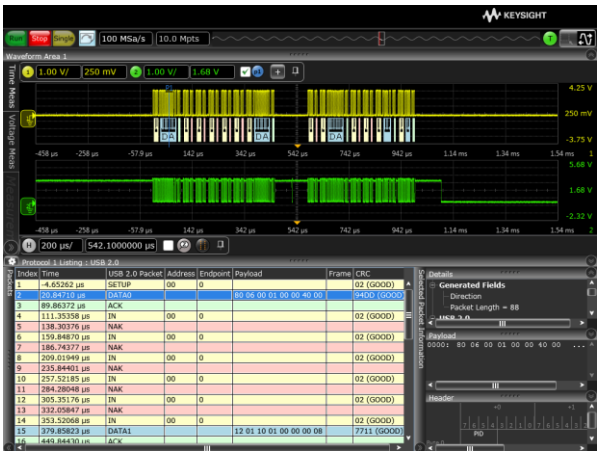
The table below shows what protocols are available for the S-Series; refer to the configuration guide to learn what specific option model numbers to order. Use those model numbers to find respective data sheets for protocol specifications.

Low Speed	MIPI
I2C	C-PHY
SPI	D-PHY
Quad SPI	RFEE
eSPI	I3C
Quad eSPI	SPMI
RS232/UART	LLI
I2S	UFS
SVID	M-PHY CSI-3
JTAG	DigRF v4
Manchester	UniPro

Automotive	Military / Aero
CAN / CAN FD	ARINC 429
LIN	MIL STD 1553
FlexRay	SpaceWire
SENT	
Automotive Ethernet	

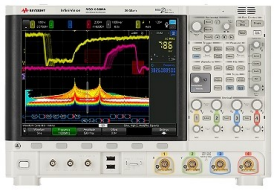
USB	Etc.
USB 2.0	PCIe Gen 1/2
USB 3.0	10/100 Ethernet
USB 3.1	
USB-PD	
USB SSIC	

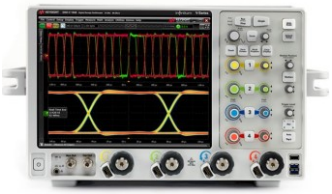




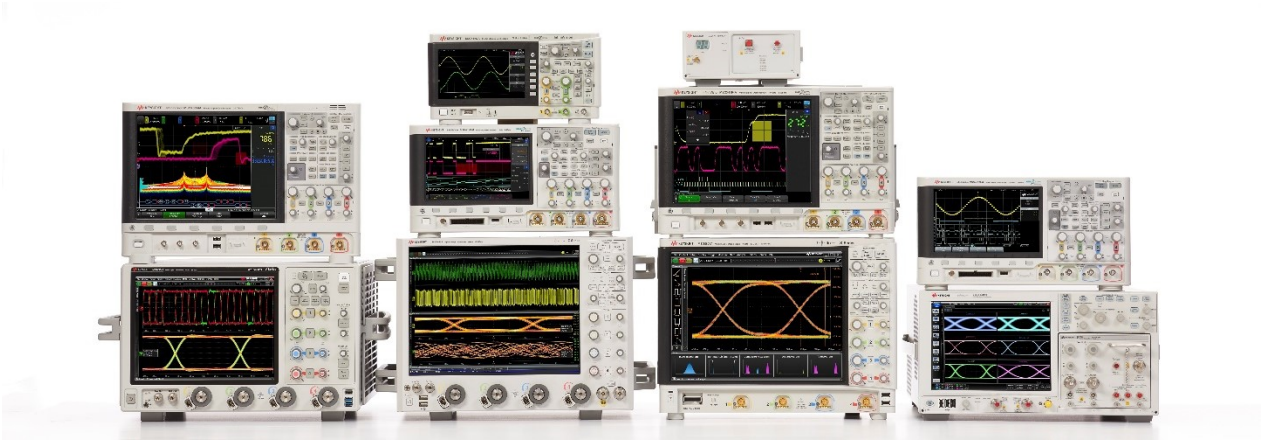
Oscilloscope Portfolio Comparison

Keysight offers a wide range of oscilloscopes at all performance levels, from 70 MHz to 110 GHz. See below for similar oscilloscopes to the S-Series or visit our website for the full portfolio.





	6000 X-Series	S-Series	V-Series
Optimized for	Fastest update rate	Signal integrity	Signal integrity
Bandwidth	1 GHz – 6 GHz	500 MHz – 8 GHz	8 GHz – 33 GHz
Max memory (2 ch)	4 Mpts	820 Mpts	2 Gpts
ADC Bits	8	10	8
Inputs	50Ω, 1 MΩ	50Ω, 1 MΩ	50Ω
Operating System	Embedded	Windows 10	Windows 10
Hard drive	None	256 GB Removable SSD	512 GB Removable SSD
Motherboard	N/A	Quad core i5, 8 GB RAM	Quad code i5, 16 GB RAM
Data offload	USB 2.0, 100BASE-T LAN	USB 3.0, 1000BASE-T LAN	USB 3.0, 1000BASE-T LAN



Infiniium S-Series Ordering Guide and Information

Ordering your S-Series oscilloscope couldn't be easier. Select a model, memory or DSA options, probes, accessories, and software. These pages will describe your options. Contact your Keysight representative or authorized partner for more information, or to place an order: www.keysight.com/find/contactus

Standard accessories

All models ship standard with: Four N2873A 500-MHz passive probes, probe accessory pouch, Keysight I/O libraries suite driver CD, localized power cord, front panel cover, 8 GHz BNC calibration cable, keyboard, and mouse. User guide and programmer's guide ship on the oscilloscope hard drive. Service guide available on Keysight.com. MSO models ship with 16-channel flying lead logic probe and calibration fixture.

Main model configuration

All S-Series models have 4 analog channels. MSO models include 16 digital channels. For information on bandwidth and MSO upgrades, see the post-purchase upgrades section of this ordering guide.

S-Series Model Numbers

Model [1]	Bandwidth	10/90% rise time [2]	ENOB [3]
DSOS054A / MSOS054A	500 MHz	860 ps	8.1
DSOS104A / MSOS104A	1 GHz	430 ps	7.8
DSOS204A / MSOS204A	2 GHz	215 ps	7.5
DSOS254A / MSOS254A	2.5 GHz	172 ps	7.4
DSOS404A / MSOS404A	4 GHz	107.5 ps	7.2
DSOS604A / MSOS604A	6 GHz [4]	71.7 ps	6.8
DSOS804A / MSOS804A	8 GHz [4]	53.8 ps	6.4

1. DSO and MSO models have 4 analog channels. MSO models include 16 digital channels.
2. Calculation passed on 0.43/BW.
3. Typical specification, not warranted.
4. 6 GHz and 8 GHz only possible when two channels are active. Four channel bandwidth is 4 GHz.

All S-Series models come standard with 100 Mpts of memory on four channels simultaneously, or 200 Mpts of memory when only two channels are active. That can be increased with these options:

S-Series Memory Options

200 / 400 Mpts (4 channel / 2 channel)	DSOS000-200
400 / 800 Mpts (4 channel / 2 channel)	DSOS000-400

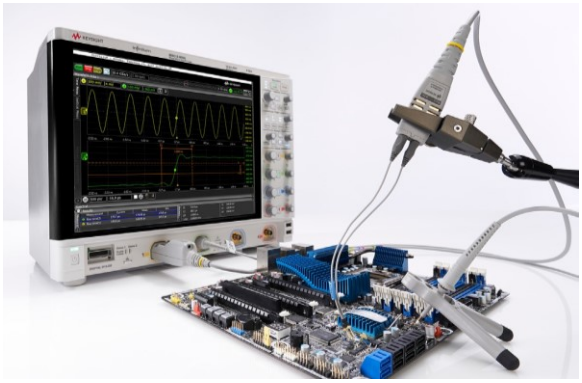
The S-Series offers a Digital Signal Analysis (DSA) option, which can only be installed on new units. It includes the following:

S-Series DSA Option

Model	Includes
DSOS001-DSA	200 / 400 Mpts memory option (DSOS000-200) EZJit Complete (timing jitter and vertical noise only) [5]

5. DSA version of EZJIT Complete is not equivalent to D9010JITA and does not include phase noise measurements. No special software support subscription required.

Probes and Accessories



S-Series oscilloscopes include both 1 MΩ and 50 Ω paths. This expands their flexibility by making them compatible with a wider range of probes than high-performance oscilloscopes that only support a 50 Ω path. All S-Series models ship standard with four 700 MHz passive probes and support a wide range of about 100 compatible current and voltage probes. The table below highlights probes commonly used with the S-Series. Read The Infiniium Oscilloscope Probes and Accessories guide for additional information, or visit the Probe Resource Center at prc.keysight.com.

Infiniium Probes [1]	
Description	**Model(s)**
Standard (free w/ scope)	N2873A
General purpose passive	N287xA, 10070D, 10073D, 1165A, N7007A
High voltage passive	10076C
Current	1146/47B, N2780/81/82/83B, N2893A, N7026A, N282xA, N704xA
Single ended active	N2795/96/97A, N7020/24A
Differential active	N2790/91A, N2818/19A, N2804/05A
InfiniiMode	N2750/51/52A
InfiniiMax	N2830A/31B/32B, 1130/31/32/34B, 1168/69B

1. Please reference document 5968-7141EN for a complete list of compatible probes and information.

Calibration and Accessories[1]	
Description	**Model(s)**
Precision BNC(m) to SMA(f) adapters	DSOS000-821
17025 compliant calibration ➔ With accreditation	DSOS000-1A7 DSOS000-AMG
ANSI-Z540 compliant calibration	DSOS000-A6J
8U Rackmount kit	N2902B
Additional 256 GB SSD (with Windows 10)	N2153A
GPIB adapter	N4865A

Analysis software packages

The S-Series is perfectly suited for a variety of advanced signal analysis, with its low noise and high-resolution front end. No other oscilloscope in this class offers this breadth of analysis capabilities.

Analysis Software Packages

Option [1]	Description	Details
D9010JITA	EZJit Complete	Timing jitter, vertical noise, and phase noise analysis
D9010SCNA	InfiniiScan Trigger	InfiniiScan visual- and measurement-based triggering
D9010UDAA	User Defined Application	Remote measurement automation and test reports
D9010DMBA [1]	De-Embedding	PrecisionProbe and InfiniiSim Basic for modeling cables, probes and fixtures
D9010ASIA [1]	Advanced Signal Integrity	Equalization, InfiniiSim Advanced, Crosstalk, and Power Integrity
D9010POWA [1]	Power Integrity	Power integrity analysis (PSIJ, SSN, victim/aggressor, etc).)
D9010PAMA	PAM-N Analysis	PAM-4 measurements
D9010EXMA [2]	External Mixer Assistant	Wideband RF signal measurements

1. D9010ASIA is a superset of D9010DMBA and D9010POWA. You do not need to purchase both.
2. D9010EXMA is part of a larger E-Band signal analysis solution. Reference document 5992-1420EN to learn more.

Protocol decode and trigger software packages

Does your design include a serial bus that is a key point for debug or test? Use one of Keysight's protocol decoding and triggering application packages for increased productivity. Specify trigger conditions at the packet level. Reference the table below to find the right solution for you!

Need more than one package? Check D9010BDLP to see if you can get them bundled together!

Protocol Decode/Trigger Packages

Option	Description	Details
D9010LSSP	Low Speed Serial	I^2C, SPI, Quad SPI, eSPI, Quad eSPI, RS232, UART, JTAG, I^2S, SVID, Manchester
D9010EMBP	Embedded	PCIe Gen 1/2, USB 1.x and 2.0, 10/100 Mb/s Ethernet, USB-PD
D9010AUTP	Low Speed Automotive	CAN, LIN, CAN-FD, FlexRay, SENT
D9020AUTP	High Speed Automotive	100BASE-T1, formerly BroadR-Reach
D9010USBP	USB	USB 1.x, 2.0, 3.0, 3.1, 3.2 [2]
D9010MPLP	MIPI Low Speed	RFFE, I^3C, SPMI
D9010MCDP	MIPI CSI/DSI	C-PHY [2] and D-PHY
D9010MPMP	MIPI M-PHY	DigRF, LLI, CSI-3, UniPro, UFS, SSIC
D9010MILP	Military	ARINC 429, MIL-STD 1553, SpaceWire
D9010PCIP	PCI and Storage	PCIe Gen 1/2/3/4 [2], SATA, SAS
D9010BDLP [1]	Protocol Decode Bundle	Everything above except: SENT, 100BASE-T1, SpaceWire and Quad SPI [3]

1. D9010BDLP is only offered as a node locked license. See product's datasheet for more information.
2 C-PHY, USB 3.1 Gen2, USB 3.2, and PCIe Gen3/Gen4 it will not work on an S-Series. Consider a Keysight oscilloscope with higher bandwidth to test these protocols.

Protocol Compliance Testing

All compliance applications can be ordered as fixed, floating, or server-based licenses. Many of these compliance applications listed below require other software options installed to work correctly. Please contact Keysight or reference the specific application's datasheet for ordering information. If viewing this document on a computer, all model numbers below are hyperlinks. BW denotes the minimum required bandwidth model to use the application. [SD] means "see datasheet", as there may be many factors that determine the right bandwidth for you.

Display	Option	BW
HDMI 1.4	N5399F	8 GHz
HDMI Electrical	N5399D	8 GHz
USB	**Option**	**BW**
USB 2.0	N5416B	2 GHz
USB-PD	N8840A	500 MHz
Automotive	**Option**	**BW**
MOST	N6466B	1 GHz
100BASE-T1	N6467B	1 GHz
PCI Express	**Option**	**BW**
Gen 1-4 2.5 GT/s, and Refclk test	N5393G	6 GHz
Memory	**Option**	**BW**
DDR1 / LPDDR1	U7233B	2 GHz
DDR2 / LPDDR2	N5413C	4 GHz
DDR3 / LPDDR3 [1]	U7231C	4 GHz
ONFI	N6474A	4 GHz
eMMC	N6465B	1 GHz

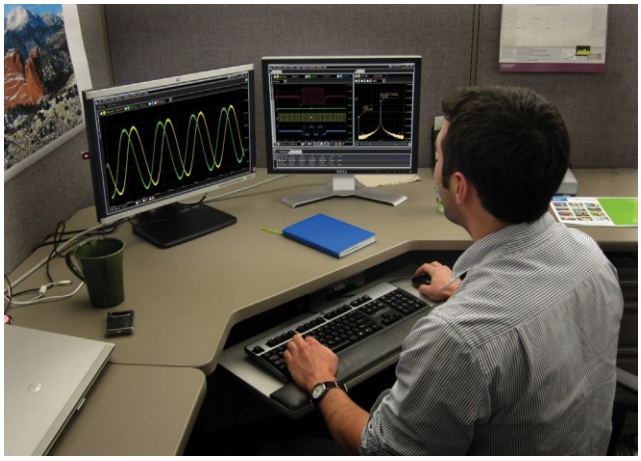
1 DDR3 testing on an S-Series is limited to 1600 MT/s.

Ethernet	Option	BW
1000BaseT1 Transmitter	E6960A	1 GHz
10/100/1G Energy Efficient Ethernet	N5392C	[SD]
MGBASE-T (2.5G / 5G) NBASE-T (2.5G / 5G) 10GBASE-T	U7236A	2.5 GHz
XAUI 10GBASE-CX4 CPRI OBSAI Serial RapidIO	N5431B	8 GHz
MIPI	**Option**	**BW**
C-PHY	U7250A	4 GHz
D-PHY 2.0	U7238E	4 GHz
M-PHY	U7249E	6 GHz

Offline Testing

View and analyze test results at your desk! Save an oscilloscope file, the view and analyze on your PC using the full Infiniium user interface without needing additional access to your scope.

Use waveform math, filtering, FFT, protocol decoding, jitter analysis, eye diagrams and more to get more insight. Infiniium offline is a truly powerful software tool to help you get your job done faster while freeing up precious hardware resources.



Infiniium Offline Ordering Information

Option	Description	Details
D9010BSEO	Infiniium Offline base software	Required as baseline software. Prerequisite to all other options.
D9010JITO	EZJit Complete	Timing jitter, vertical noise, and phase noise analysis.
D9010ASIO	Advanced Signal Integrity	Equalization, InfiniiSim, PAM-N analysis, and crosstalk
D9010LSPO	Low Speed Protocol Package	I2C, SPI, SR232/UART, JTAG, CAN, CAN-FD, LIN, FlexRay, SVID, USB 2.0, USB-PD, MIPI RFFE, eSPI, I2S, Ethernet 10/100BaseT, SpaceWire, SPMI, 100BASE-T1, Manchester, ARINC429, MIL-STD1553)
D9010HSPO	High Speed Protocol Package	DDR2/3/4, LPDDR2/3/4, Ethernet 10GBASE-KR 64/66, Ethernet 100Base KR/CR, MIPI [CSI-3, DigRF v4, D-PHY, LLI, RFFE, UniPro], PCIe Gen 1/2/3, SATA/SAS, UFS, USB 2.0, USB 3.0, USB 3.0 SSIC, USB 3.1, C-PHY

Software license terms and support

Keysight offers a variety of flexible licensing options to fit your needs and budget. Choose your license term, license type, and KeysightCare software support subscription.

License Terms

Perpetual – Perpetual licenses can be used indefinitely.
Time-based – Time-based licenses can be used through the term of the license only (6, 12, 24, or 36 months).

License Types

Node-locked – License can be used on one specified instrument/computer.
Transportable – License can be used on one instrument/computer at a time but may be transferred to another using Keysight Software Manager (internet connection required).
USB Portable – License can be used on one instrument/computer at a time but may be transferred to another using a certified USB dongle (available for additional purchase with Keysight part number E8900-D10).
Floating (single site) – Networked instruments/computers can access a license from a server one at a time. Multiple licenses can be purchased for concurrent usage.

KeysightCare Software Support Subscription provides peace of mind amid evolving technologies.

- Ensure your software is always current with the latest enhancements and measurement standards.
- Gain additional insight into your problems with live access to our team of technical experts.
- Stay on schedule with fast turnaround times and priority escalations when you need support.

KeysightCare Software Support Subscriptions

Perpetual licenses are sold with a 12 (default), 24, 36, or 60-month software support subscription. Support subscriptions can be renewed for a fee after that. Time-based licenses include a software support subscription through the term of the license.

Selecting your license

Step 1. Choose your software product (eg. D9010AUTP).
Step 2. Choose your license term: perpetual or time-based.
Step 3. Choose your license type: node-locked, transportable, USB portable, or floating.
Step 4. Depending on the license term, choose your support subscription duration.

Examples

If you selected:	Your quote will look like:	
D9010UDAA node-locked perpetual license with a 12-month support subscription	**Part Number**	**Description**
	D9010UDAA	User Defined Application Software
	R-B5P-001-A	Node-locked perpetual license
	R-B6P-001-L	KeysightCare software support subscription, node-locked–12 months
D9010UDAA transportable time-based 6-month license	**Part Number**	**Description**
	D9010UDAA	User Defined Application Software
	R-B4P-001-F	6-months, node-locked KeysightCare software support subscription

To configure your product and request a quote: http://www.keysight.com/find/software

Post-purchase upgrades

Are you looking to upgrade an S-Series you've already purchased? See below for a list of available options. All probes, accessories, and software are orderable as previously described.

S-Series Upgrades	
Description	**Model(s)**
Add 16 MSO logic channels	N2901E
Upgrade memory to 200/400 Mpts/ch [1]	N2113A-200
Upgrade memory to 400/800 Mpts/ch [1]	N2113A-400
Upgrade Windows 7 to Windows 10	N2151A
Add DSA functionality [2]	N2113A-200 D9010JITA
Bandwidth upgrade to 1 GHz	DSOS1GBW-005 (from 500 MHz)
Bandwidth upgrade to 2 GHz	DSOS2GBW-005 (from 500 MHz) DSOS2GBW-010 (from 1 GHz)
Bandwidth upgrade to 2.5 GHz	DSOS2G5BW-005 (from 500 MHz) DSOS2G5BW-010 (from 1 GHz) DSOS2G5BW-020 (from 2 GHz)
Bandwidth upgrade to 4 GHz	DSOS4GBW-005 (from 500 MHz) DSOS4GBW-010 (from 1 GHz) DSOS4GBW-020 (from 2 GHz) DSOS4GBW-025 (from 2.5 GHz)
Bandwidth upgrade to 6 GHz	DSOS6GBW-005 (from 500 MHz) DSOS6GBW-010 (from 1 GHz) DSOS6GBW-020 (from 2 GHz) DSOS6GBW-025 (from 2.5 GHz) DSOS6GBW-040 (from 4 GHz)
Bandwidth upgrade to 8 GHz	DSOS8GBW-005 (from 500 MHz) DSOS8GBW-010 (from 1 GHz) DSOS8GBW-020 (from 2 GHz) DSOS8GBW-025 (from 2.5 GHz) DSOS8GBW-040 (from 4 GHz) DSOS8GBW-060 (from 6 GHz)

1. The stated numbers are for (3 or 4 channels) / (1 or 2 channels) of operation.
2. This is not the same as the DSA option when buying new and is subject to a support subscription. See the software license terms and support page.

Performance Characteristics

Analog channel specifications								
		S-054A	S-104A	S-204A	S-254A	S-404A	S-604A	S-804A
Input Channels		DSO: 4 analog; MSO: 4 analog, 16 digital						
Bandwidth (-3db)	50 Ω [1] 1 MΩ	500 MHz 500 MHz	1 GHz 500 MHz	2 GHz 500 MHz	2.5 GHz 500 MHz	4 GHz 500 MHz	6 GHz [5] 500 MHz	8 GHz [5] 500 MHz
Vertical resolution [2][3]		10 bits, up to 16 bits with high-resolution mode						
Typical rise/fall time [4] 10/90% 20/80%		 860 ps 620 ps	 430 ps 310 ps	 215 ps 155 ps	 172 ps 124 ps	 107.5 ps 77.5 ps	 71.7 ps 51.7 ps	 53.8 ps 33.8 ps
ENOB (typical)		8.1	7.8	7.5	7.4	7.2	6.8	6.4
Input impedance [1]		50 Ω ± 3.5% (typically ±1% at 25°C); 1 MΩ ±1% (14 pF typical)						
Input sensitivity [3]		50 Ω: 1 Mv/div to 1 V/div; 1 MΩ: 1 mV/div to 5 V/div						
Input coupling		50 Ω: DC; 1 MΩ: DC, AC (>11 Hz)						
Bandwidth limit filters		Analog: 20 MHz, 200 MHz Digital (brickwall DSP): Increments of 500 MHz up to scope bandwidth						
Channel-to-channel isolation		DC to 100 MHz: 50 dB; 100 MHz to 1 GHz: 40 dB; >1 GHz: 30 dB						
DC gain accuracy [1][2][3]		±2% full scale (±1% typical)						
Max input voltage [1]		50 Ω: ±5 V; 1 MΩ: 300 V_{RMS} or DC and ±400 V_{PP} (DC+AC)						
Offset range	50 Ω	All vertical ranges: ±12 divisions or ±4 V, whichever is smaller						
	1 MΩ	< 10 mV/div: ±2 V ≥ 10 mV/div: ±5 V ≥ 20 mV/div: ±10 V ≥100 mV/div: ±20 V ≥1 V/div: ±100 V						
Offset accuracy [1][3]		<2 V: ± 0.1 div ± 2 mV ± 1%; ≥2 V: ± 0.1 div ± 2 mV ± 1.5%						
Dynamic range [6]		±4 divisions from center screen						
DC voltage measurement accuracy [2]		Dual cursor: ± [(DC gain accuracy) + (resolution)] Single cursor: ± [(DC gain accuracy) + (offset accuracy) + (resolution/2)]						

Digital channel specifications (MSO models only)	
Analog bandwidth	400 MHz
Max input voltage	±40 V_{PEAK}
Input dynamic range	±10 V about threshold
Minimum input voltage swing	500 mV_{P-P}
Input impedance	100 kΩ ±2% (~8 pF) at probe tip
Resolution	1 bit
Channel to channel skew	500 ps (typical)
Threshold selections	TTL, CMOS (5.0 V, 3.3 V, 2.5 V), ECL, PECL, User-defined (±8 V in 10 mV increments)
Threshold accuracy	±(100 mV + 3% of threshold setting)

1 Denotes warranted specifications, all others are typical. Specifications are valid after a 30-minute warm-up period and ± 5 °C from firmware calibration temperature. Input impedance is valid when V/div scaling is adjusted to show all waveform vertical values within the oscilloscope display.
2 Vertical resolution is 8 bits at ≤ 5 GSa/s, or 10 bits at 10 GSa/s or 20 GSa/s.
3 Full scale is defined as 8 vertical divisions. Magnification is used below 2 mV/div, full-scale is defined as 16 mV. Testing is at maximum sample rate.
50 Ω input: The major scale settings are 5 mV, 10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV, 1 V.
1 MΩ input: The major scale settings are 5 mV, 10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV, 1 V, 2 V, 5 V.
4 10/90 calculation based on Tr = 0.43/BW. 20/80 calculation based on Tr = 0.31/BW
5 6 GHz and 8 GHz bandwidth supported in 2-channel mode. If all four channels are on, a maximum bandwidth of 4 GHz is supported.
6 For a 10:1 probe on the 1 MΩ input, vertical scaling is multiplied by 10.

RMS noise floor ($V_{RMS\ AC}$) on 50Ω inputs							
Vertical setting	**S-054A**	**S-104A**	**S-204A**	**S-254A**	**S-404A**	**S-604A**	**S-804A**
1 mV/div	74 uV	90 uV	120 uV	120 uV	153 uV	195 uV	260 uV
2 mV/div	74 uV	90 uV	120 uV	130 uV	153 uV	195 uV	260 uV
5mV/div	77 uV	94 uV	129 uV	135 uV	173 uV	205 uV	320 uV
10 mV/div	87 uV	110 uV	163 uV	172 uV	220 uV	256 uV	390 uV
20 mV/div	125 uV	163 uV	233 uV	254 uV	330 uV	446 uV	620 uV
50 mV/div	372 uV	456 uV	610 uV	650 uV	768 uV	1.3 mV	1.4 mV
100 mV/div	780 uV	960 uV	1.2 mV	1.3 mV	1.6 mV	2.3 mV	3.1 mV
200 mV/div	1.6 mV	2.0 mV	2.6 mV	2.8 mV	3.4 mV	4.9 mV	6.4 mV
500 mV/div	3.5 mV	4.2 mV	5.5 mV	6.0 mV	7.3 mV	10.0 mV	13.3 mV
1 V/div	5.1 mV	6.8 mV	9.2 mV	10.1 mV	12.5 mV	17.6 mV	24.1 mV

Front end and RF		
Sensitivity / noise density [1]		-160 dBm/Hz
Noise figure [1]		14 dB
SnR / dynamic range [2]		108 dB
Absolute amplitude accuracy		±1 dB (0 to 7.5 GHz)
Deviation from linear phase		±7 degrees (0 to 7.5 GHz)
Phase noise (at 1 GHz)	10 kHz offset	-121 dBc/Hz
	100 kHz offset	-122 dBc/Hz
EVM [3]		-47 dB (0.47%)
SFDR [4]		72 dB
Harmonic distortion [4]	2^{nd}	-64 dBc
	3^{rd}	-46 dBc
Two-tone TOI Point		+21.5 dBm
Input match (0 to 7 GHz)	<50 mV/div	-15 dB, 1.4 VSWR
	≥50 mV/div	-19 dB, 1.25 VSWR

1 Tested at 1 mV/div, -38 dBm, 1.0001 GHz CF, 500 kHz span, 3 kHz RBW.
2 Tested with 0 dBm 1 GHz input carrier, 0dBm scope input range. 1 GHz CF, 100 MHz span, 1 kHz RBW, measured +20 MHz from center.
3 Tested with 802.121 2.4 GHz carrier, 20 MHz wide, 64 QAM.
4 Tested with 1 GHz, 0dBm signal at input, FFT with 3 GHz CF, 5 GHz span, 100 kHz RBW.
5 Tested with 0 dBm, 2.436 GHz and 2.438 GHz input tones (2 MHz separation). 2.437 GHz CF, 10 MHz span, 30 kHz RBW, 8 dBm input range.

Horizontal		
Main timebase range	Real time: Equivalent time: Segmented: Roll mode:	5 ps to 200 s 5 ps to 5 µs 5 ps to 200 s 5 ps to 1000 s
Resolution	1 ps	
Horizontal position range	0 s to ±500 s, Continuously adjustable	
Delayed sweep range	1 ps/div to current main time scale setting	
Time scale accuracy [1][7]	± (12 ppb initial + 75 ppb/year aging)	
Oscilloscope channel de-skew range	±1 ms	
Intrinsic jitter [5]	100 ns/div: 100 fs_{RMS} 1 µs/div: 123 fs_{RMS} 10 µs/div: 138 fs_{RMS} 100 µs/div: 145 fs_{RMS} 1 ms/div: 200 fs_{RMS} (145 fs_{RMS} possible with external reference)	
Inter-channel intrinsic jitter [3]	100 fs_{RMS}	
Inter-channel skew drift [3][6]	<500 fs_{MAX}	
Jitter measurement floor [2]	Time interval error: $\sqrt{\left(\frac{\text{noise floor}}{\text{slew rate}}\right)^2 + (\text{intrinsic jitter})^2}$ Period jitter: $\sqrt{2} \times \sqrt{\left(\frac{\text{noise floor}}{\text{slew rate}}\right)^2 + (\text{intrinsic jitter})^2}$ Cycle-cycle / N-cycle jitter: $\sqrt{3} \times \sqrt{\left(\frac{\text{noise floor}}{\text{slew rate}}\right)^2 + (\text{intrinsic jitter})^2}$	
Inter-channel jitter measurement floor [2][3][4]	$\sqrt{\left(\begin{matrix}\text{Time interval}\\ \text{error (edge 1)}\end{matrix}\right)^2 \left(\begin{matrix}\text{Time interval}\\ \text{error (edge 2)}\end{matrix}\right)^2 \left(\begin{matrix}\text{inter}-\text{channel}\\ \text{intrinsic jitter}\end{matrix}\right)^2}$	
Delta time measurement accuracy	Intra-channel	$\pm\left[\frac{5}{n} + \sqrt{\left[\begin{matrix}\text{Time interval}\\ \text{error (edge 1)}\end{matrix}\right]^2 + \left[\begin{matrix}\text{Time interval}\\ \text{error (edge 2)}\end{matrix}\right]^2} + \left(\left(\begin{matrix}\text{Time scale}\\ \text{accuracy}\end{matrix}\right) \times \left(\begin{matrix}\text{Delta}\\ \text{time}\end{matrix}\right)\right)\right]$
	Inter-channel	$\pm\left[\frac{5}{n} + \sqrt{\left[\begin{matrix}\text{Time interval}\\ \text{error (edge 1)}\end{matrix}\right]^2 + \left[\begin{matrix}\text{Time interval}\\ \text{error (edge 2)}\end{matrix}\right]^2 + \left[\begin{matrix}\text{Interchannel}\\ \text{intrinsic jitter}\end{matrix}\right]^2} + \left(\left(\begin{matrix}\text{Time scale}\\ \text{accuracy}\end{matrix}\right) \times \left(\begin{matrix}\text{Delta}\\ \text{time}\end{matrix}\right)\right) + \left(\begin{matrix}\text{Intechannel}\\ \text{skew drift}\end{matrix}\right)\right]$

1 Denotes warranted specifications, all others are typical. Specifications are valid after a 30-minute warm-up period and ± 5 °C from firmware calibration temperature.
2 Sample rate at maximum. Noise and slew rate determined at fixed-voltage measurement threshold, near middle of signal. Displayed signal not vertically clipped. Slew rate of sine wave = (peak signal amplitude) 6 2 6 π 6 f, slew rate of fast step ~= (10 to 90% rise time).
3 Intra-channel = both edges on the same channel, Inter-channel = two edges on different channels. Time Interval Error(Edge1) = time-interval error measurement floor of first edge, Time Interval Error(Edge2) = time-interval error measurement floor of second edge.
4 Scope channels and signal interconnect de-skewed prior to measurement.
5 External timebase reference values measured using a Wenzel 501-04608A 10 MHz reference. Intrinsic jitter value depends on acquisition time range for Time Interval Error formula and depends on delta-time between edges for all two-edge formulas.
6 Skew between channels caused by ± 5 degrees C temperature change.
7 Initial = immediately after factory or user calibration.
8 Reading is the displayed Delta Time Measurement Accuracy measurement value. Do not double the listed Time Scale Accuracy value in Delta Time Measurement Accuracy formula.

Acquisition: analog channels				
			1 or 2 channels used	3 or 4 channels used
Maximum real-time sample rate			20 GSa/s	10 GSa/s
Standard memory depth			200 Mpts	100 Mpts
Memory options	Option 200		400 Mpts	200 Mpts
	Option 400 (single/run)	at 20 GSa/s	800 / 400 Mpts	Not available
		at 10 GSa/s	400 / 200 Mpts	400 / 200 Mpts
		at ≤5 GSa/s	536 / 268 Mpts	400 / 200 Mpts

			Notes
Sampling modes	Real time		
	Peak detect		
	High resolution		11 to 16 bits user selectable, real time with boxcar averaging [5]
	Equivalent time		338 fs
	Roll		
	Segmented	Min. time between segments:	3.3 us
		Max number of segments:	16384 (standard) 32767 (Option 200) 65536 (Option 400)
Filters			Sin(x)/x interpolation

Acquisition: digital channels		
Maximum sample rate		2 GSa/s
Maximum memory depth (single/run)	at 2 GSa/s:	128 / 64 Mpts
	under 2 GSa/s:	64 / 32 Mpts
Minimum glitch detectable		2 ns

Triggering system: analog channels	
Triggerable channels	All analog channels, aux-in, power supply line frequency
Max trigger frequency (50 Ω path)	≤ 2.5 GHz models: Full bandwidth; > 4 GHz models: 3 GHz
Trigger level range	±4 divisions from center screen (auxiliary: ±5 V, max input 5 V_{PP})
Trigger hold off range	100 ns to 10 s (fixed or random)
Trigger coupling	DC, AC, LF reject (50 kHz HPF), HF reject (50 kHz LPF)
Sweep modes	Auto, triggered, single
Trigger jitter [2][3][4]	520 fs_{RMS}
Max waveform update rate	>300,000 wfm/s (in segmented memory mode)

Edge trigger sensitivity						
Bandwidth (HW or SW limit)→		20 MHz	200 MHz	1 GHz	2.5 GHz	> 2.5 GHz
1 MΩ path	< 5 mV/div	< 0.7 div	< 1.0 div	< 1.4 div to BW limit (500 MHz)		
	≥ 5 mV/div	< 0.3 div	< 0.5 div	< 0.8 div to BW limit (500 MHz)		
50 Ω path	< 5 mV/div	< 0.15 div	< 0.2 div	< 0.3 div	< 0.45 div	< 1.6 div
	≥ 5 mV/div	0 div	0 div	0 div	< 0.1 div	< 0.6 div

Triggering system: digital channels	
Threshold range	±8.0 V (in 10 mV increments)
Threshold accuracy	±(100 mV + 3% of threshold setting)

1 Denotes warranted specifications, all others are typical. Specifications are valid after a 30-minute warm-up period and ± 5 °C from firmware calibration temperature.
2 Internal edge trigger mode with JitterFree correction. Value depends on scope settings and trigger signal characteristics, and is equal to Time Interval Error value expressed in the formula above using the minimum Time Scale Accuracy value.
3 Value shown represents typical Display jitter for DSOS404A at 100 mV/div triggering on 500 mVpp 2 GHz sin wave signal.
4 Sample rate at maximum. Noise and slew rate determined at fixed-voltage trigger threshold, near middle of signal. Displayed signal not vertically clipped.
5 High resolution allows for 11 or 12 bit "minimum" where resolution will dynamically scale higher with lower sample rates, or 11 to 16 bit "fixed" where sample rate is locked in place. Here is a list of all resolutions with their respective sample rate and bandwidths (not warranted): 10 bits (20 GSa/s, 8 GHz), 11 bits (5 GSa/s, 1 GHz), 12 bits (2.5 GSa/s, 500 MHz), 13 bits (1.25 GSa/s, 250 MHz), 14 bits (625 MSa/s, 125 MHz), 15 bits (313 MSa/s, 65 MHz), 16 bits (125 MSa/s, 25 MHz)

Available triggers		
Trigger type	**Channels available on**	**Description**
Edge	Analog and digital	Triggers on a specified slope (rising, falling, alternating) and voltage level
Edge transition	Analog only	Trigger on rising or falling edges that cross two voltage levels in less or greater than the amount of time specified. Minimum 250 ps.
Edge then edge (time)	Analog and digital	The trigger is qualified by an edge. After a specified time delay between 10 ns to 10 s, a rising or falling edge on any one selected input will generate the trigger.
Edge then edge (event)	Analog and digital	The trigger is qualified by an edge. After a specified delay between 1 to 16,000,000 rising or falling edges, another rising or falling edge on any one selected input will generate the trigger.
Pulse width	Analog and digital	Trigger on a pulse that is wider or narrower than specified. Pulse width range setting is 250 ps to 10 s for analog channels, and 2 ns to 10 s for digital channels.
Glitch	Analog and digital	Triggers on glitches narrower than the other pulses in your waveform by specifying a width less than your narrowest pulse and a polarity. Glitch range settings equal pulse width settings.
Runt	Analog only	Triggers on a pulse that crosses one threshold but fails to cross a second threshold before crossing the first again. Runt settings equal pulse width settings
Timeout	Analog and digital	Trigger when a channel stays high, low, or unchanged for too long. Timeout settings equal pulse width settings.
Pattern	Analog and digital	Triggers when a specified logical combination of the channels is entered, exited, present for a specified period of time, or is within a specified time range or times out. Each channel can have a value of High (H), Low (L) or Don’t care (X)
State	Analog and digital	Pattern trigger clocked by the rising, falling or alternating between rising and falling edge of one channel.
Setup / hold	Analog only	Triggers on setup, hold, or setup and hold violations in your circuit. Requires a clock and data signal on any two inputs (except aux or line) channels as trigger sources. Setup and/or hold time must then be specified.
Window	Analog only	Trigger on entering, exiting, or inside specified voltage range
Protocol	Bus dependent	Requires a protocol option.
InfiniiScan	Analog only	Requires InfiniiScan software. SW-based triggering across up to 8 user-drawn zones. For each zone, user specifies “must or must not intersect.” Zones can be drawn on analog channels and combined using Boolean logic.

Measurements	
Maximum at once	20 in either main, zoom, or gated region (up to 16 gates)
Voltage (analog)	Amplitude, average, base, crossing point, maximum, minimum, overshoot and preshoot (as a percentage or voltage), Vpp contrast, peak to peak, pulse (amplitude, base, top), RMS, top, thresholds (lower, middle, upper), voltage @ time
Time (analog)	Rise time, fall time, period, frequency, pulse width (+/-), duty cycle, T_{MIN}, T_{MAX}, crossing point time, delta time, pulse count, bursts (width, period, interval), s/h time
Time (digital)	Period, frequency, pulse width (+/-), duty cycle, delta time
Mixed (analog)	Area, slew rate, charge (requires N282xA probe)
Frequency domain	FFT frequency and magnitude (and deltas between), channel power, power spectral density, occupied bandwidth
Level qualification	Make timing measurements only when other input signal level conditions are true. Requires InfiniiScan software. Any channels that are not involved in a measurement can be used to level-qualify all timing measurements.
Eye diagrams	Eye height, eye width, eye jitter, crossing percentage, Q factor, duty-cycle distortion
Statistic modes	Mean, standard deviation, minimum, maximum, count

Math	
Sources	Any analog or digital channel, waveform memory, or other math functions
Maximum at once	16
Functions	Math: Add, Subtract, Multiply, Divide, Absolute Value, Average, Delay, Invert, Magnify / Duplicate, Max, Min, Versus XY, Versus XYZ Qualified, Differentiate, Integrate, Square, and Square Root math functions. Filter/Smoothing: High Pass Filter, Low Pass Filter, and Smoothing math functions. FFT:Magnitude and Phase. Differential: Common Mode. Visualizations: Envelope, Amplitude Demodulation, Bus Chart, Histogram (Measurement), Measurement Trend, and Pattern Average math functions. User Defined: Gives you a way to add your own mathematical transform as a math function. The input source data is passed to a MATLAB script you create to process the data. The processed data is passed back to the oscilloscope to be displayed as a function in the waveform window. MATLAB (.m) scripts for: Butterworth, FIR, LFE, RTEye, and SqrtSumOfSquare.[1]

Histogram	
Sources	Any waveform or measurement
Orientation	Vertical for timing and jitter. Horizontal for noise and amplitude
Measurements	Mean, standard deviation, mean ±1σ/2σ/3σ, median, mode, peak-to-peak, min, max, total hits, peak (area of most hits), X scale hits, and X offset hits, bin width

FFT	
Range	DC to Nyquist frequency (1/2 sample rate, e.g. 10 GHz @ 20 GSa/s)
Resolution	Sample rate / memory depth
Windows	Flattop, rectangular, Hanning, Blackman Harris, Hamming

1 MATLAB scripts require software and a license to run.

Display	
Size	15” capacitive touch
Resolution	XGA (1024x768)
Annotations	Up to 100, floating or anchored
Grids	Up to 16
Windows	Up to 8 waveform windows
Waveform modes	Connected samples (sinc or lines), dots only
Persistence modes	Infinite, variable, color graded

Computer system	
Operating system	Windows 10
CPU	Intel i5 quad core (3 GHz)
System memory	8 GB
Hard drives	256 GB removeable SSD
Peripherals	Optical USB mouse and compact keyboard provided
LXI compliance	Class C

I/O	
LAN	RJ-45 connector, supports 10/100/1000Base-T. Enables Web-enabled remote control, email on trigger, data/file transfers and network printing (supports up to 80 MB/s data offloading)
USB	4x USB 2.0 host ports, 2x USB 3.0 host ports, 1x USB 3.0 device port (supports up to 200 MB/s data offloading)
Audio	Microphone, line in, line out
Display out	DisplayPort and VGA (supports up to two simultaneous displays)
Trigger out	TTL levels, high impedance load
Auxiliary out	Configurable: DC level, probe compensation, trigger out, or a demo signal
Timebase reference output	Amplitude into 50Ω: 1.65 ± 0.05 Vpp (8.3 ± 0.3 dBm) sine wave (internal or external timebase reference selected) Frequency: 10 MHz ± (12 ppb initial + 75 ppb/year aging) when internal timebase reference is selected; external reference frequency when external timebase reference is selected
External timebase reference input	Frequency: 10 MHz ± 20 ppm Amplitude: 356 mV_{PP} (-5 dBm) to 5 V_{PP} (+18 dBm) sine, 285 mV_{PP} to 4 V_{PP} square Input impedance: 50Ω

Supported file types	
Compressed waveforms	.fm, .bin, .h5, .osc
Larger formats	.csv, .tsv, .txt
Digital formats	.osc, .h5
Image formats	.bmp, .tiff, .png, .jpg

Environmental, safety and dimensions		
Temperature	Operating: Non-operating:	+5 to +40°C -40 to +65°C
Humidity	Operating: Non-operating:	≤80% relative humidity (non-condensing) at +40°C ≤90% relative humidity (non-condensing) up to +40°C
Altitude	Operating: Non-operating:	up to 4,000 m / 13,123 ft up to 15,300 m / 50,196 ft
Vibration	Operating: Non-operating:	random 5 to 500 Hz, 10 minutes per axis, 0.3 g_{rms} random 5 to 500 Hz, 10 minutes per axis, 2.41 g_{rms}; resonant search 5 to 500 Hz, swept sine, 1 octave/minute sweep rate, (0.75 g), 5 minute resonant dwell at 4 resonances per axis
Power	100 to 120 V @ 50/60/400 Hz 100 to 240 V @ 50/60 Hz Max power dissipated: 380 W	
Noise	35 dB (front of instrument)	
Weight	Frame: Shipping:	12 kg / 26.4 lbs 20 kg / 44.1 lbs
Dimensions (feet retracted)	Height: Width: Depth:	33 cm (12.9 in) 43 cm (16.8 in) 23 cm (9 in)
Safety	CAN/CSA22.2 No. 61010-1-12 ANSI/UL Std. 61010-1:2012 (3rd edition)	
EM standards	CISPR 11/EN 55011 IEC 61000-4-2/EN 61000-4-2 IEC 61000-4-3/EN 61000-4-3 IEC 61000-4-4/EN 61000-4-4 IEC 61326-1:2005/EN 61326-1:2006	
MTBF	110,000 hours (typical)	

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