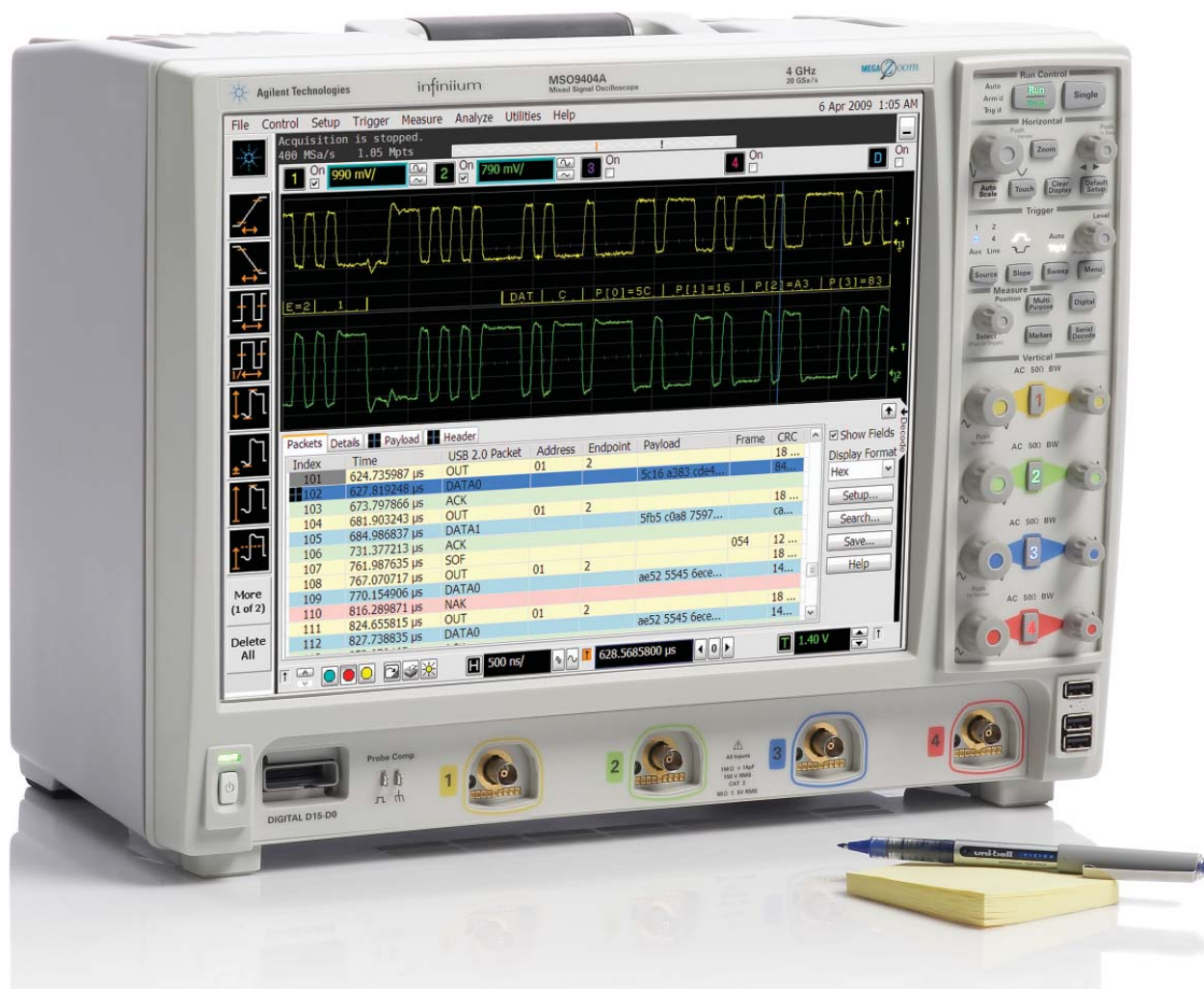


Agilent Technologies Infiniium 9000 Series Oscilloscopes

Data Sheet

Engineered for broadest measurement capability



Agilent Technologies

If you haven't purchased an Agilent scope lately, why should you consider one now?

If you're like most engineers, you never know what your next project will demand from you. You need an oscilloscope that can adapt to a wide variety of debug and test challenges.

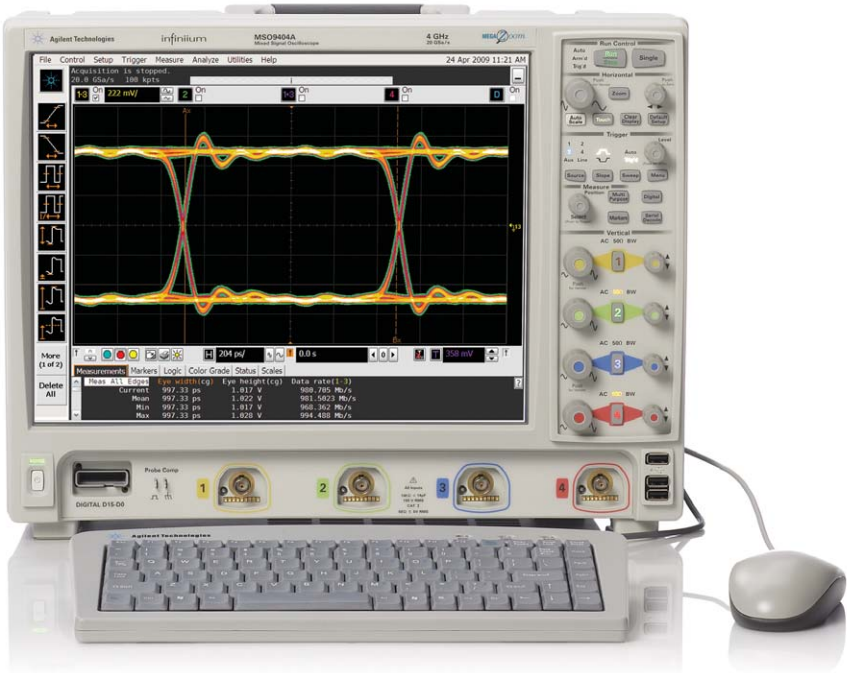
That's why we designed our new Infiniium 9000 Series oscilloscope to meet a full range of needs.

First we built in the powerful features you'd expect in any Infiniium scope. Then we engineered the scope for the broadest measurement capability, so it would be the most indispensable tool in your arsenal.

There is no better way to experience the superiority of the Infiniium 9000 Series scopes than to see it.

Contact Agilent today to request an evaluation.

Or visit:
www.agilent.com/find/9000



The Infiniium 9000 Series offers bandwidths up to 4 GHz. Each model, equipped with a large 15" XGA LCD display, comes in a whisper-quiet package that is just 9" (23 cm) deep and weighs only 26 pounds (11.8 kg).

Model	Analog bandwidth	Analog sample rate 4-channel/2-channel	Standard memory 4-channel/2-channel	Scope channels	Logic channels
DSO9064A	600 MHz	5 GSa/s/10 GSa/s	10 Mpts/20Mpts	4	-
MSO9064A	600 MHz	5 GSa/s/10 GSa/s	10 Mpts/20Mpts	4	16
DSO9104A	1 GHz	10 GSa/s/20 GSa/s	10 Mpts/20Mpts	4	-
MSO9104A	1 GHz	10 GSa/s/20 GSa/s	10 Mpts/20Mpts	4	16
DSO9254A	2.5 GHz	10 GSa/s/20 GSa/s	10 Mpts/20Mpts	4	-
MSO9254A	2.5 GHz	10 GSa/s/20 GSa/s	10 Mpts/20Mpts	4	16
DSO9404A	4 GHz	10 GSa/s/20 GSa/s	10 Mpts/20Mpts	4	-
MSO9404A	4 GHz	10 GSa/s/20 GSa/s	10 Mpts/20Mpts	4	16

What makes the Infiniium 9000 Series the go-to scope for a whole range of test and debug challenges?

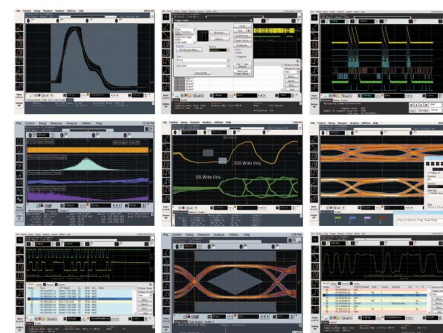
It's three instruments in one

1. Scope: The powerful features of our Infiniium Series oscilloscopes coupled with superior specifications give you precise signal representation.
2. Logic analyzer: Fast deep-memory digital channels let you see critical data values and timing relationships.
3. Protocol analyzer: The world's first scope-based protocol viewer with multi-tab viewing. Quickly drill and move between protocol and physical layers.



It offers the widest range of debug and compliance application software

Need accurate answers to your measurement questions? The Infiniium 9000 Series offers the largest range of application-specific software for debug, analysis and compliance testing. Which application is right for you? Take a look at the possibilities on pages 7-11.



It's sized to fit your environment

Limited bench space? It has the smallest footprint, and thinnest profile
Height: 12.9" (33 cm); width: 16.8" (43 cm); depth: just 9" (23 cm)

Need to share the scope? It has the lightest weight: 26 lbs. (11.8 kg)

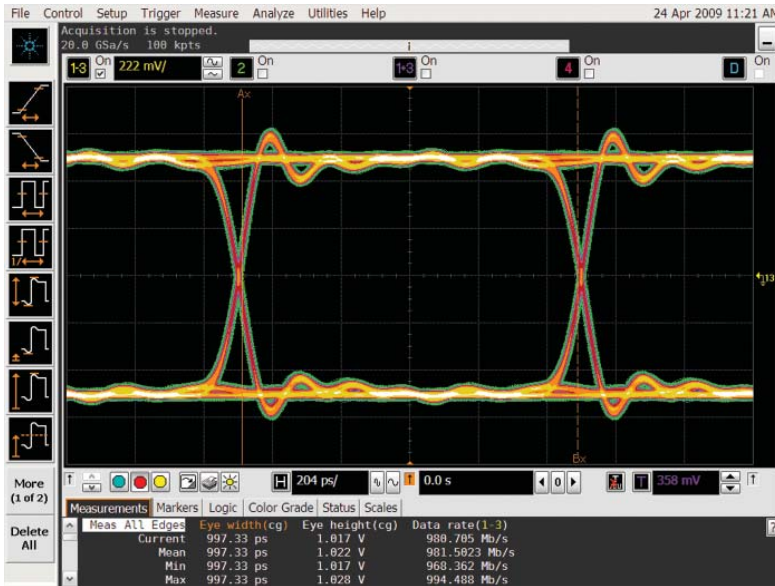
Need to see lots of signals? It has the biggest screen: 15" (23 cm) XGA



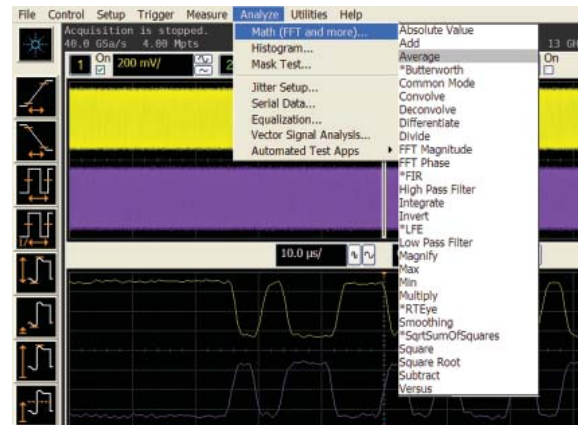
It's three instruments in one

1. Oscilloscope

High-performance scope channels ensure superior viewing of signals under test. All models incorporate a powerful, feature-packed Infiniium oscilloscope with responsive deep memory.



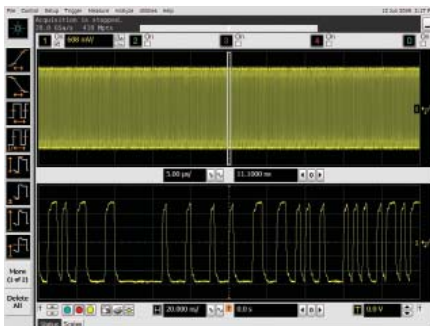
Up to 4 GHz bandwidth and 20 GSa/s high sample rates guarantee you'll see a precise representation of the analog characteristics of signals you're testing.



Mask tests, histograms and a wide variety of functions provide deep signal analysis.

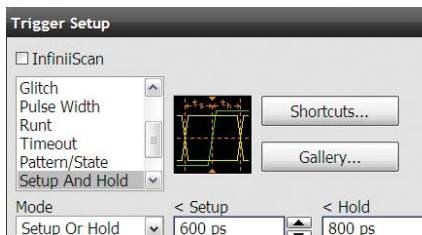
Responsive deep memory

With standard 10 Mpts, and up to 1 Gpts of memory, you can capture long time periods while retaining fast sample rates. Fast update rates mean your scope stays responsive with deep memory on, ensuring precise representation of analog signals.



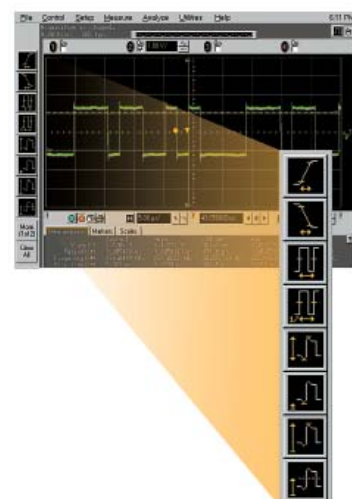
Advanced triggering

Advanced triggers are essential when you are investigating suspected problems. Infiniium offers a full range of advanced triggers to help you isolate and capture the condition you need to characterize. The 9000 Series simplifies trigger setups by using intuitive dialog boxes with descriptive graphics.



Drag and drop measurements

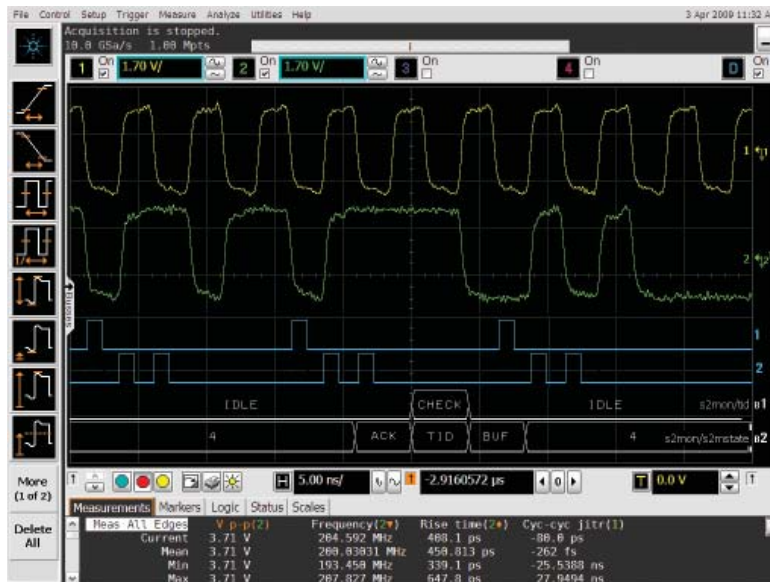
It's simple: drag an icon from the measurement bar and drop it on the cycle you want to measure. You can make up to five measurements on your waveforms, on up to five different cycles. All of the measurements appear at the bottom of the display with statistics and are color-coded to the channel you are measuring.



It's three instruments in one

2. Logic analyzer

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.



Use the timing channels to evaluate control signal relationships and data buses up to 16 bits wide. Use symbols to more quickly interpret waveforms.



Designing with Altera or Xilinx FPGAs? Use the FPGA dynamic probe for rapid internal FPGA measurements. Using I²C, SPI, RS-232, or low- or full-speed USB? Use the digital channels to acquire and decode these buses, preserving analog channels for other time-correlated measurements.

Digital and mixed-signal trigger

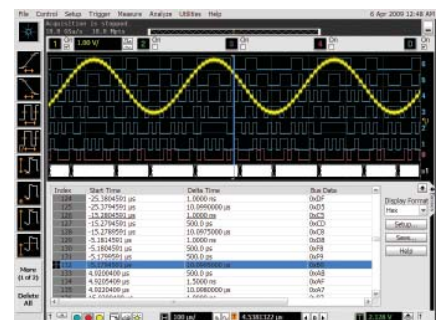
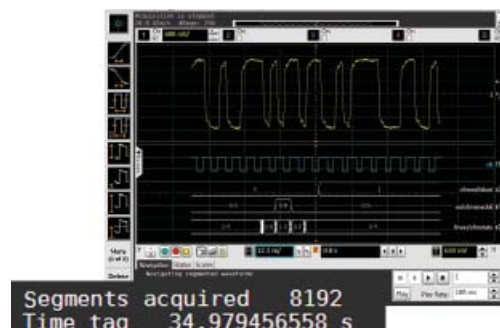
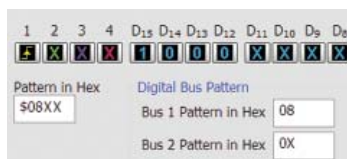
Trigger on and display individual signals or buses. With precise time-correlation between analog and digital signals, confidently trigger across any combination of analog and digital signals simultaneously.

Industry's only segmented memory for both analog and digital channels

Capture short bursts without consuming memory during periods when the trigger condition is not met. Agilent is the only vendor that supports segmented memory capture on both analog and digital channels.

Waveform and Listing Windows

View buses as waveforms or easily follow events in the listing window expandable to the entire display. A blue tracking marker provides time-correlation between waveform and listing displays.

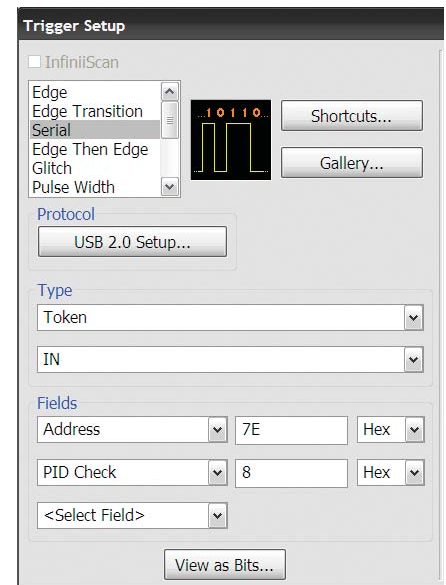


It's three instruments in one

3. Protocol analyzer

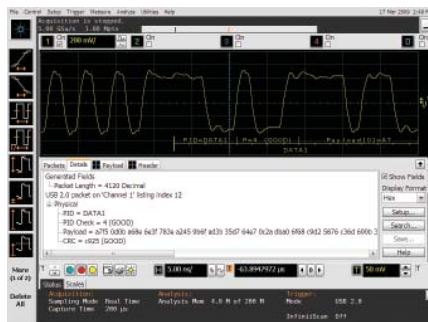
Does your design include a serial bus that is a key point for testing or debugging? Add protocol analysis capability to your scope for:

- I²C
- SPI
- RS-232/UART
- USB
- MIPI D-Phy
- CAN
- FlexRay
- PCIe®
- 8B/10B
- SATA

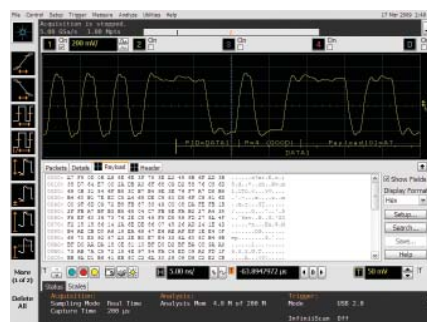


Quickly move between physical and protocol layer information using the time-correlated tracking marker. Display protocol content using waveform symbols and the industry's first multi-tab protocol viewer. The packets tab shows a high level view of the packet over time.

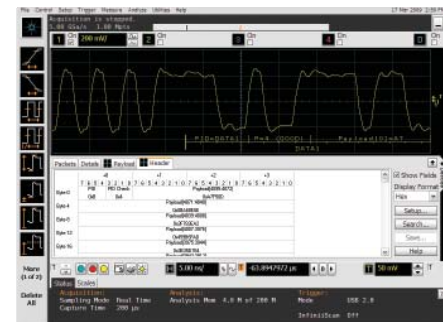
Protocol-level triggering makes it easy to isolate events with pinpoint accuracy.



Details tab breaks the packets into easy-to-read textual fields.



Payload tab shows data carried by packet in byte-by-byte HEX and ASCII.



Header tab shows packets in a databook format. Hovering on any tab reveals additional detail.

Widest range of debug and compliance software applications: serial protocol-level



Trigger and view on-screen serial decode of I²C packets.

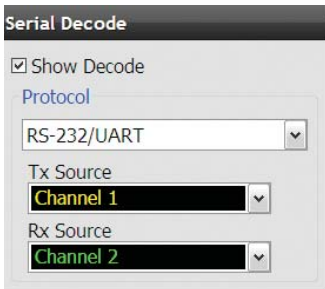
I²C/SPI serial trigger and decode (N5391B or Option 007 on new scope purchases)

This application displays real-time time-aligned decode of I²C and SPI serial buses. Hardware-based triggering means the scope triggers consistently, even on infrequent events.

This application works on all models and can use any combination of scope or logic acquisition channels.

For more information:

www.agilent.com/find/9000_I2C-SPI



Trigger on and decode RS-232/UART transmission.

RS-232/UART serial decode and trigger (N5462B or Option 001 on new scope purchases)

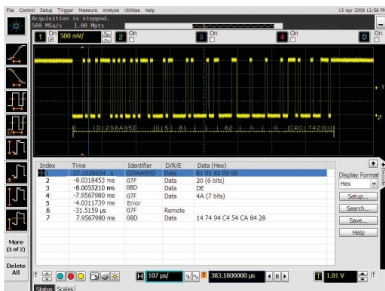
This application eliminates the need to manually decode bus traffic. Using data captured on the scope or logic channels, the application lets you easily view the information sent over an RS-232 RS-422, RS-485 or other UART serial buses.

Display real-time time-aligned decode of transmit and receive lines. The application also enables hardware-based triggering on RS-232/UART conditions.

This application works on all models and can use any combination of the scope or logic acquisition channels.

For more information:

www.agilent.com/find/9000_RS-232



Trigger on and decode CAN/FlexRay serial packets.

CAN/FlexRay triggering and decode (N8803A or Option 008 on new scope purchases)

Trigger on and view both protocol layer information and physical layer signal characteristics for CAN and FlexRay buses. Numerical decode values are automatically displayed and synchronized below the captured signal or seen in protocol viewer.

The application enables software-based protocol triggering. This application works on all models and can use any combination of scope or logic acquisition channels.

For more information:

www.agilent.com/find/9000_CAN



Trigger on and decode PCIe serial packets.

PCI Express® serial trigger and protocol viewer (N5463B or Option 006 on new scope purchases)

This application provides protocol-level triggering and viewing of a PCIe lane. Quickly view packets, payload, header, and detail information. Powerful time-correlated views of waveform, symbol, character, link and transaction layer packet data down to the bit level make it easy to isolate communication faults to logic or analog sources.

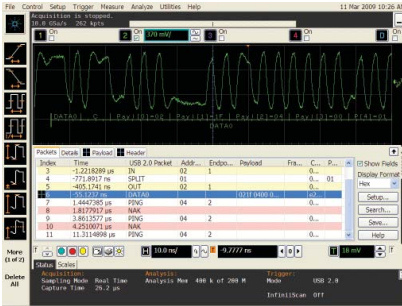
Trigger on and view CRC, 8B/10B and disparity errors.

This application is supported on scope channels of 4 GHz models.

For more information:

www.agilent.com/find/9000_PCI

Widest range of debug and compliance software applications: serial protocol and FPGA



Trigger on and decode USB packets.

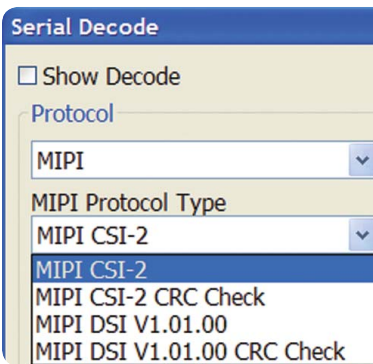
USB serial trigger and protocol viewer (N5464B or Option 005 on new scope purchases)

Trigger on and quickly view USB packets, payload, header and detail information. Powerful time-correlated views of waveform and symbol, to the bit level, make it easy to isolate communication faults to logic or analog sources. Trigger on errors such as CRC and Bit Stuff.

Low and full-speed USB protocol is supported on digital and scope channels of all models. High-speed USB protocol is supported on scope channels of 2.5 GHz and 4 GHz models.

For more information:

www.agilent.com/find/9000_USB



Trigger on and decode MIPI packets

MIPI D-Phy serial decode and trigger (N8802A or Option 019 on new scope purchases)

This application eliminates the need to manually decode bus traffic. Using data captured on the scope, the application lets you easily view the information sent over MIPI serial buses.

The application also enables software-based protocol triggering.

This application works on all 4 GHz models and can use any combination of the scope channels

For more information:

www.agilent.com/find/N8802A



Trigger on and decode SATA serial packets

SATA triggering and decode (N8801A or option 038 on new scope purchases)

Trigger on and view both protocol layer information and physical layer signal characteristics for SATA 1 (1.5 GB/s). Numerical decode values are automatically displayed and synchronized below the capture signal or seen in protocol viewer.

This application enables software-based protocol triggering. This application works on 4 GHz and can use any combination of scope channels

For more information:

www.agilent.com/find/N8801A



Rapid FPGA debug.

FPGA dynamic probe application (N5397A for Xilinx, N5433A for Altera, or Option 016 and 017 on new scope purchases)

Agilent's MSO FPGA dynamic probe provides internal FPGA visibility and quick instrument setup using an innovative core-assisted debug approach. Measurement tasks that previously took hours can be done in seconds with a few mouse clicks.

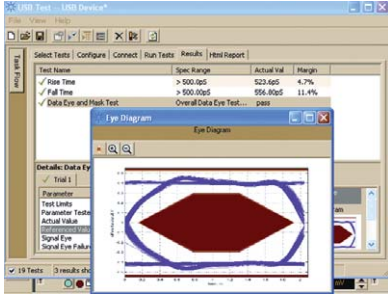
This application is supported on all MSO models.

For more information:

www.agilent.com/find/9000_altera

www.agilent.com/find/9000_xilinx

Widest range of debug and compliance software applications: serial physical-layer



Check for USB compliance.

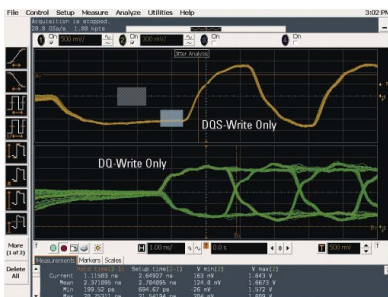
USB 2.0 compliance testing (N5416A or Option 029 on new scope purchases)

Quickly determine USB compliance with this USB-IF recognized solution. A setup wizard guides you through test selection and configuration.

This application is USB-IF approved and supported on all 2.5 GHz and 4 GHz models.

For more information:

www.agilent.com/find/9000_USB-compliance



Test DDR memory.

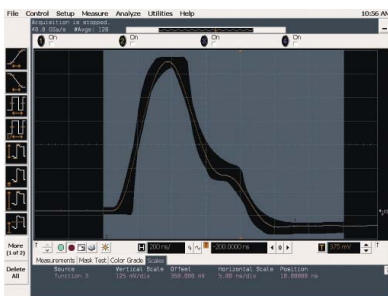
DDR1/DDR2/DDR3 compliance testing (U7233A/N5413A/U7231A or Options 031/032/033 on new scope purchases)

Quickly and easily evaluate and characterize your memory designs. Automated testing based on JEDEC specifications saves time. The application also includes additional debug and compliance capabilities.

This application is supported on all models. However, the DDR technology you are using may dictate the minimal bandwidth required for your scope.

For more information:

www.agilent.com/find/9000_DDR



Validate Ethernet compliance.

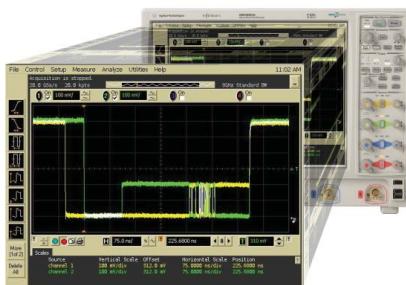
Ethernet compliance testing (N5392A or Option 021 on new scope purchases)

Perform a wide range of electrical tests for 10-, 100-, and 1000-Base-T systems. An N5395B test fixture and N5396A jitter test cable speed compliance testing.

This application is supported on all 1 GHz and higher bandwidth models.

For more information:

www.agilent.com/find/9000_ethernet



Check for MIPI compliance.

MIPI compliance testing (U7238A or Option 035 on new scope purchased)

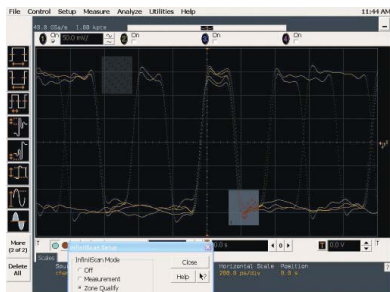
Quickly validate your embedded D-Phy data link for CSI and DSI architectures. This software performs a wide range of tests required for meeting MIPI D-Phy physical layer requirements.

This application is supported on analog channels of all 4 GHz models.

For more information:

www.agilent.com/find/U7238A

Widest range of debug and compliance software applications: InfiniiScan and jitter analysis



Identify signal integrity issues with InfiniiScan Zone – Qualify triggering.

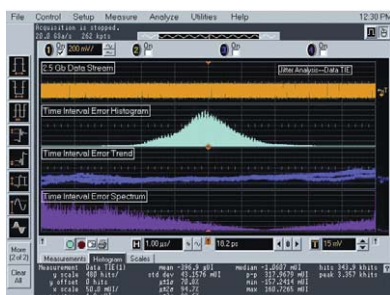
InfiniiScan event identification (N5415A or Option 009 on new scope purchases)

Rapidly trigger on complex events and identify signal integrity issues. This innovative software quickly scans through thousands of acquired waveform cycles and isolates anomalous signal behavior.

This application is supported on all models.

For more information:

www.agilent.com/find/infiniiScan



Conduct jitter analysis.

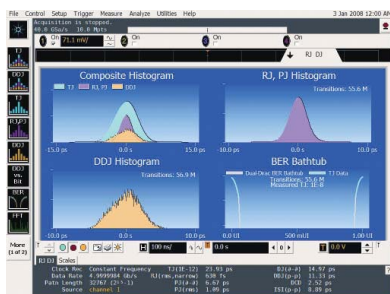
EZJIT analysis software (E2681A or option 002 on new scope purchases)

Quickly characterize and evaluate most commonly needed jitter measurements, including cycle-cycle, N-cycle, period, time-interval, error, setup and hold time, histograms, measurement trending and jitter spectrum.

This application is supported on all models.

For more information:

www.agilent.com/find/EZJIT



Analyze jitter plus RJ/DJ separation.

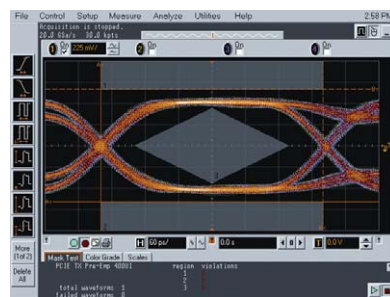
EZJIT Plus analysis software (N5400A or Option 004 on new scope purchases. To upgrade from EZJIT to EZJIT Plus, order N5401A.)

EZJIT Plus adds additional compliance views and an expanded measurement setup wizard to simplify and automate RJ/DJ separation for testing against industry standards.

This application is supported on all models.

For more information:

www.agilent.com/find/EZJITPlus



Recover embedded clocks with serial data analysis (SDA).

High-speed serial data analysis software (N5384A or Option 003 on new scope purchases)

Quickly validate signal integrity for high-speed serial interfaces with embedded clocks. Recover embedded clocks synchronized with the analog waveform view. Build and validate eye diagrams.

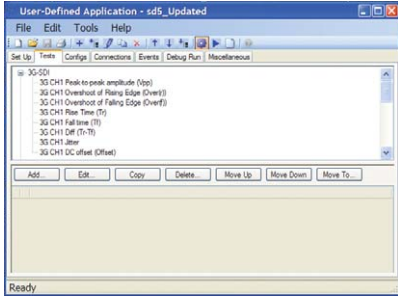
The SDA package also includes software-based bit-level triggering and decode for 8B/10B.

This application is supported on all models.

For more information:

www.agilent.com/find/9000_SDA

Widest range of debug and compliance software applications: viewing and analysis



Quickly automate oscilloscope measurements.

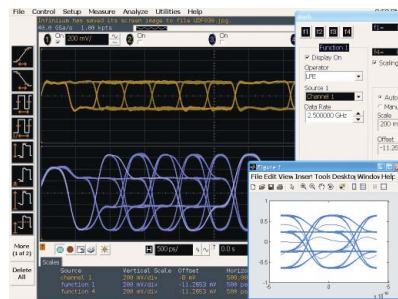
User-definable application (N5467A or Option 040 on new scope purchases)

Rapidly develop your own automated measurements and tests. This application provides the framework you need to quickly program and automate any single or set of measurements the oscilloscope can make.

The application also provides full control of other Agilent instruments and HTML reporting capabilities.

For more information:

www.agilent.com/find/9000_UDA



Signal equalization using user-defined function.

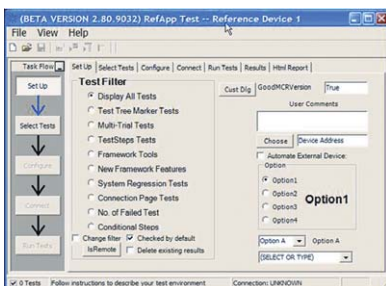
User-defined function (N5430A or Option 010 on new scope purchases)

Install MATLAB® on your scope and add your favorite MATLAB .m scripts as function operators and use them as standard waveform functions.

This application is supported on all models and requires MATLAB software (not included with UDF)

For more information:

www.agilent.com/find/UDF



Operate your applications remotely.

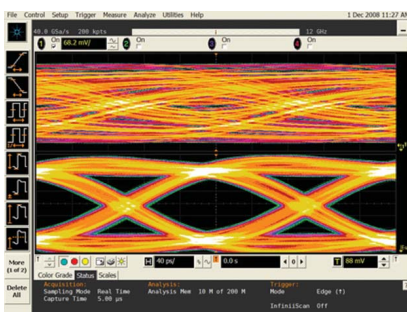
Infiniium application remote interface (N5452A or Option 006 on new scope purchases)

Operate your Infiniium compliance and validation applications remotely using .NET languages.

This application is supported on all models.

For more information:

www.agilent.com/find/RPI



Reduce receiver errors by opening tightly shut eyes.

Equalization and InfiniSim Waveform Transformation Toolset (N5461A and N5465A or Option 012, 013, and 014 on new scope purchases)

Measure at the pin and use equalization to see a virtual eye on the other side of an equalizer. Use the InfiniSim toolset to combine measurements and models to view simulated scope measurement results at any location in your

design. Import design models (s-parameters or transfer functions), acquire real-time scope data, and transform to measurement locations you need.

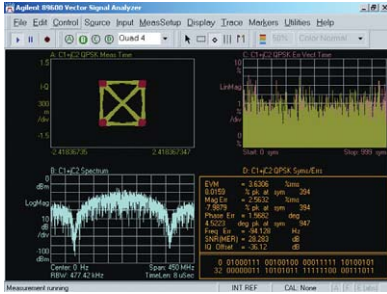
This application is supported on all models.

For more information:

www.agilent.com/find/9000_InfiniSim

www.agilent.com/find/9000_SDE

Infiniium 9000 Series applications and upgrades



Use vector signal analysis software to see FFT-based spectrum analysis.

Vector signal analysis software (89601A)

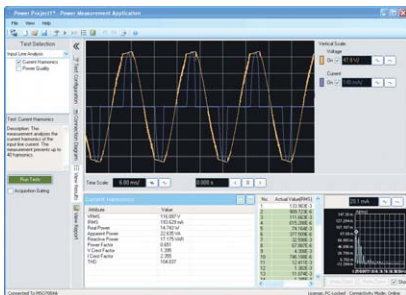
Expand the measurement capability of your scope with the 89601A vector signal analysis software. This advanced DSP-based software takes the digitized signal data from the scope. Then it provides FFT-based spectrum analysis and wide-bandwidth digital modulation analysis for wireless communication signals such as WCDMA and cdma2000 and

wireless networking signals such as 802.11 WiFi and 802.16 WiMax.

Take advantage of the super-wide bandwidth of your scope to capture and evaluate radar signals.

For more information:

www.agilent.com/find/VSA



Use your scope to quickly make and analyze power measurements.

Power application (U1882A or Option 015 on new scope purchases)

Agilent's power application provides a full suite of power measurements. Make more accurate power-supply efficiency measurements by using an U1880A de-skew fixture to de-skew your voltage and current probes.

This application is supported on all models.

For more information:

www.agilent.com/find/9000_power-app



Prove your designs conform to industry standards with a communication mask test kit.

Communication mask test kit (E2625A)

Take the frustration out of communications testing and prove your designs conform to industry standards with the communication mask test kit option.

The kit comes with a set of electrical communication adapters to ensure convenient, reliable, and accurate connections to your device under test. The kit includes more than 20 industry-standard

ANSI T1.102, ITU-T G.703, and IEEE 802.3 communication signal mask templates.

This application is supported on all models.

For more information:

www.agilent.com/find/9000_comm



Upgrade your DSO to an MSO at any time after purchase.

DSO to MSO upgrades (N2901A/B/C/D)

Upgrade your existing DSO to an MSO model in 5 minutes. The upgrade kit turns on all MSO capability and includes an MSO cable, 16-channel lead set with grabbers, an MSO-enabled sticker, and a digital-analog deskew fixture.

For more information:

www.agilent.com/find/9000_MSO

Agilent Infiniium portfolio

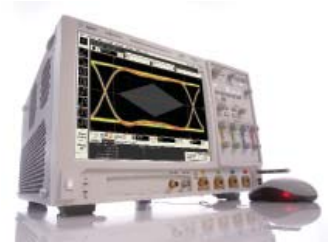
Agilent's Infiniium lineup includes 8000, 9000 and 90000A Series oscilloscopes. These share a number of advanced hardware and software technology blocks. Use the following selection guide to determine which best matches your specific needs.



Ideal for rackmount

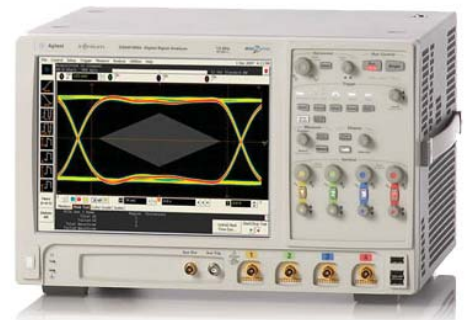


Widest range of applications.
Biggest display plus thin depth



Lowest noise, highest bandwidth

	8000 Series	9000 Series	90000 Series
600 MHz bandwidth	•	•	
1 GHz bandwidth	•	•	
2.5 GHz and 4 GHz bandwidth		•	•
> 4 GHz bandwidth			•
Bandwidth upgradability		•	•
50 Ω & 1 M Ω inputs	•	•	
MSO models	•	•	
Max 2-channel (4-channel) sample rate	4 GSa/s (2 GSa/s)	20 GSa/s (10 GSa/s)	40 GSa/s (40 GSa/s)
GPIO	standard	GPIO to LAN adapter	Built in option
Rackmount height	5U	8U	7U
Display size	8"	15"	12.1"
Footprint (HxWxD)	8.5" x 17.2" x 17.3" 22 cm x 44 cm x 44 cm	12.9" x 16.8" x 9" 33 cm x 43 cm x 23 cm	11.1" x 17" x 19.9" 28 cm x 43 cm x 51 cm



Agilent Infiniium 9000 Series oscilloscopes

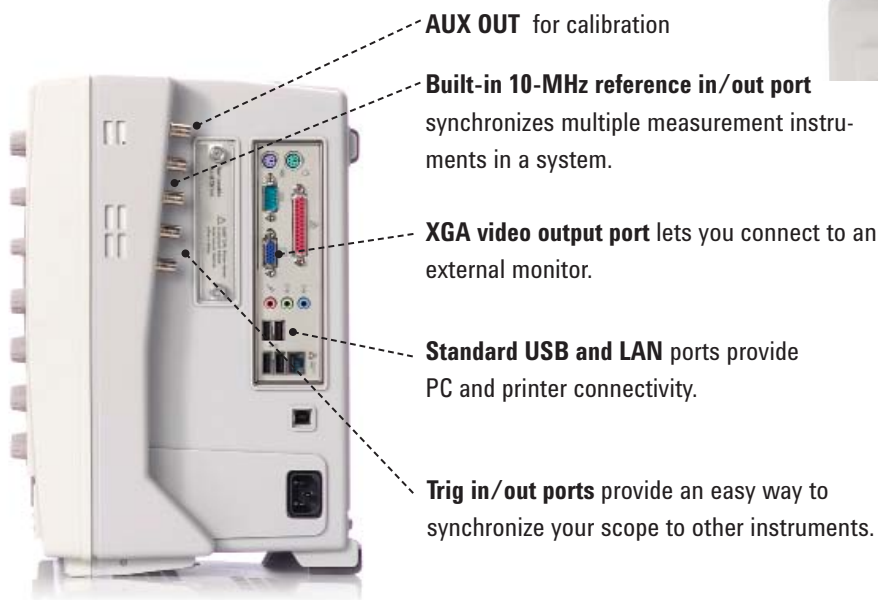
15" XGA display makes it easier to view analog, digital and serial signals.

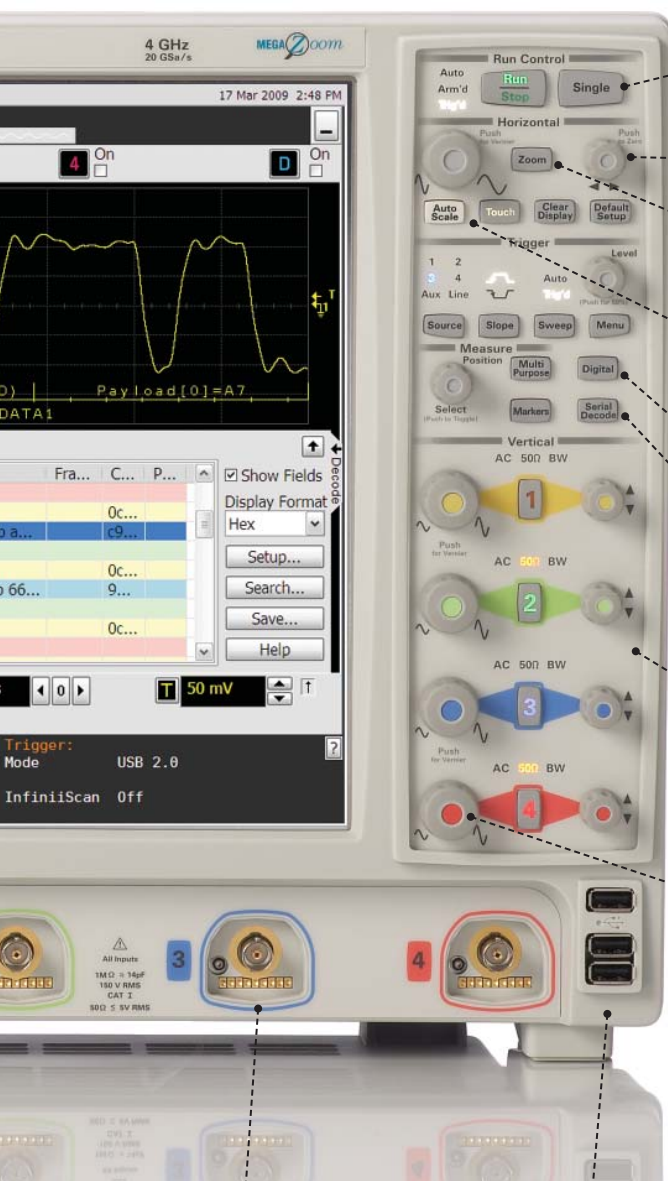
Comprehensive built-in information system gives you fast answers to your questions. The task-oriented setup guide provides step-by-step instructions for several measurement procedures.

Touchscreen display comes standard for mouse-free operation.

Drag-and-drop measurements from the measurement bar provide an intuitive way to make a measurement on a particular cycle of your waveform.

Mixed-signal oscilloscope (MSO) models seamlessly integrate four analog scope channels with 16 digital channels.





Dedicated **single acquisition button** provides better control to capture a unique event.

Pressing **horizontal delay knob** sets the delay to zero. A **zoom button** provides quick access to two screen-zoom modes.

MegaZoom instant response and optimum resolution allows you to pan and zoom quickly.

Autoscale lets you rapidly display any analog or digital active signals, automatically setting the vertical, horizontal and trigger controls for the best display, while optimizing memory.

Digital channel button provides quick setup access.

Serial decode button enables quick setup access.

Dedicated per-channel front panel controls make it easy to access the vertical and horizontal scaling and offset.

Quick access to fine/vernier control by pressing the horizontal and vertical sensitivity knobs.

AutoProbe interface automatically configures the attenuation ratio of the probe and provides probe power for Agilent's active probes.

Built-in USB ports makes it easy to save your work and update your system software quickly.



Accessory pouch detaches easily.

Connectivity and probing

Connectivity

Industry compatibility

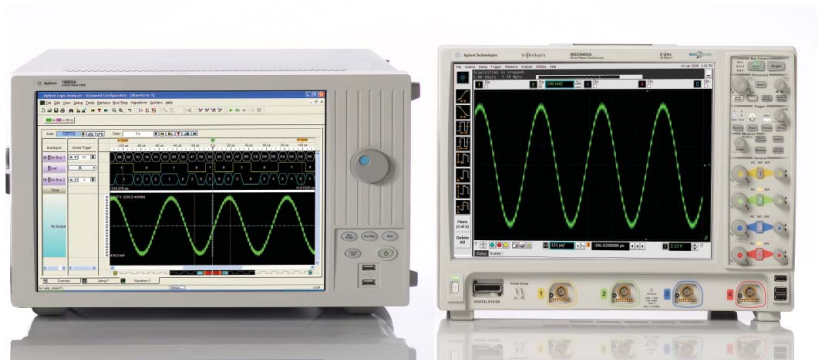
Export screen shots and waveforms in numerous industry-standard formats. In addition, the 9000 Series supports compatibility with the following

- MATLAB Basic and Advanced (add as 061 and 062 on new scope orders)
- IVI COM driver for application development environments such as Visual Studio, Agilent VEE, NI LabView and MATLAB instrument control toolbox.
www.agilent.com/find/adn
- IntuiLink tool bars and data capture.
www.agilent.com/find/intuilink
- LXI Class C including built-in Web control
- NI LabView PnP and IVI drives

View Scope logic analyzer and oscilloscope correlation

Use simple time-correlated measurements between your scope and Agilent 16900, 16800, 1680, or 1690 Series logic analyzer at no charge. Scope and logic waveforms are integrated into a single logic analyzer

display for easy viewing analysis – all with a simple point-to-point LAN connection. You can also cross trigger the instruments, automatically de-skew the waveforms and maintain marker tracking between the instruments.



http://sine.ni.com/apps/utf8/niid_web_display.model.page?p_model_id=16301

Probing

Each Infiniium 9000 Series oscilloscope ships with four N2873A 10:1 divider passive probes and probe accessory pouch.

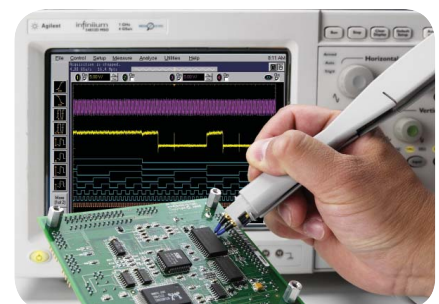
With both 50 Ω and 1 M Ω inputs, Infiniium 9000 Series scopes support a wide range of probes, including Agilent's InfiniiMax Series probes.

Agilent offers an innovative family of probes that are engineered for signal access and measurement accuracy. Whether you're looking for simple passive probes, the high bandwidth and low loading of an active probe, or specialty probes for current or high voltage, we can meet your needs. Our innovative accessories allow reliable connection to challenging components like small pitch devices, surface mount ICs, and DDR BGA packages – even hands free! To see our entire award-winning portfolio of passive, single-ended active, differential active, and current probes as well as an oscilloscope compatibility chart, please view the Agilent Probes and Accessories Selection Guide. publication number 5989-6162EN.



Recommended optional active probes

- DSO/MS09404A 1132A InfiniiMax 5 GHz probe
- DSO/MS09254A 1131A InfiniiMax 3.5 GHz probe
- DSO/MS09104A 1130A InfiniiMax 1.5 GHz probe



Infiniium 9000 Series performance characteristics

Vertical: scope channels	9064A	9104A	9254A	9404A
Analog bandwidth (–3 dB) 50 Ω ¹	600 MHz	1.0 GHz	2.5 GHz	4 GHz
Typical Rise Time / Fall Time 10% to 90% at 50 Ω	540 ps	253 ps	142 ps	85 ps
Typical Rise Time / Fall Time 20% to 80% at 50 Ω	360 ps	174 ps	98 ps	59 ps
Input channels	DSO9000 – 4 analog MSO9000 – 4 analog + 16 digital			
Input impedance ¹	50 Ω \pm 2.5%, 1 M Ω \pm 1% (11pF typical)			
Input sensitivity ³	1 M Ω : 1 mV/div to 5 V/div 50 Ω : 1 mV/div to 1 V/div			
Input coupling	1 M Ω : AC (3.5 Hz), DC 50 Ω :DC			
Hardware bandwidth limit	20 MHz on 1 M Ω input			
Vertical resolution ^{2,3}	8 bits, \geq 12 bits with averaging			
Channel-to-channel isolation	DC to 50 MHz: 50 dB >50 MHz to 1 GHz: 40 dB >1 GHz to 4 GHz: 25 dB			
DC gain accuracy ^{2,3}	\pm 2% of full scale at full resolution on channel scale \pm 5 °C from cal temp			
Maximum input voltage ¹	1 M Ω : 150V RMS or DC, CAT I \pm 250 V (DC + AC) in AC coupling 50 Ω : 5 Vrms			
Offset range	Vertical sensitivity		Available offset	
1 M Ω	1 mV to <10 mV/div		\pm 2 V	
	10 mV to <20 mV/div		\pm 5 V	
	20 mV to <100 mV/div		\pm 10 V	
	100 mV to <1 V/div		\pm 20 V	
	1 V to 5 V/div		\pm 100 V	
50 Ω			\pm 12 div or \pm 4V, whichever is smallest	

¹ Denotes warranted specifications, all others are typical. Specifications are valid after a 30-minute warm-up period and \pm 5 °C from firmware calibration temperature.

² Vertical resolution for 8 bits = 0.4% of full scale, for 12 bits = 0.024% of full scale.

³ 50 Ω input: Full scale is defined as 8 vertical divisions. Magnification is used below 10mV/div, full-scale is defined as 80 mV. The major scale settings are 5mV, 10mV, 20mV, 50 mV, 100mV, 200 mV, 500 mV, 1V.

1M Ω input: Full scale is defined as 8 vertical divisions. Magnification is used below 5mV/div, full-scale is defined as 40 mV. The major scale settings are 5mV, 10mV, 20mV, 50 mV, 100 mV, 200 mV, 500 mV, 1V,2V, 5V.

Infiniium 9000 Series performance characteristics

Vertical: scope channels (con't)

Offset accuracy ³	± (1.25% of channel offset +1% of full scale + 1 mV)
Dynamic range	1 MΩ: ± 8 div from center screen 50 Ω: ± 8 div from center screen
DC voltage measurement accuracy ^{1,2}	Dual cursor ± [(DC gain accuracy)+(resolution)] Single cursor ± [(DC gain accuracy)+(offset accuracy)+(resolution/2)]

Vertical: digital channels

On all MSO Models

Input channels	16 digital channels
Threshold groupings	Pod 1: D7 – D0 Pod 2: D15 – D8
Threshold selections	TTL (1.4V), CMOS, (5.0V, 3.3V, 2.5V), ECL (-1.3V), PECL (3.7V), user defined (±8.00 V in 100 mV increments)
Maximum input voltage	±40 V peak CAT I
Threshold accuracy	±(100 mV + 3% of threshold setting)
Input dynamic range	±10 V about threshold
Minimum input voltage swing	500 mV peak-to-peak
Input impedance (flying leads)	100 kΩ ± 2% (~ 8 pF) at probe tip
Resolution	1 bit
Analog bandwidth	400 MHz

RMS noise floor (scope only)				
Volts/div	9064A	9104A	9254A	9404A
5 mV	159 µV	240 µV	273 µV	402 µV
10 mV	234 mV	276 µV	311 µV	470 µV
20 mV	453 mV	481 µV	445 µV	627 µV
50 mV	1.15 mV	1.24mV	1.22mV	1.63mV
100 mV	2.27 mV	2.43 mV	2.54 mV	3.17 mV
200 mV	4.47 mV	4.85 mV	5.06 mV	6.18 mV
500 mV	11.4 mV	12.3 mV	12.2 mV	15.8 mV
1V	22.7 mV	24.3 mV	25.2 mV	31.5 mV

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 Vertical resolution for 8 bits = 0.4% of full scale, for 12 bits = 0.024% of full scale.

3 50Ω input: Full scale is defined as 8 vertical divisions. Magnification is used below 10mV/div, full-scale is defined as 80 mV. The major scale settings are 5mV, 10mV, 20mV, 50 mV, 100 mV, 200 mV, 500 mV, 1V.

1MΩ input: Full scale is defined as 8 vertical divisions. Magnification is used below 5mV/div, full-scale is defined as 40 mV. The major scale settings are 5mV, 10mV, 20mV, 50 mV, 100 mV, 200 mV, 5 00mV, 1V,2V, 5V.

Infiniium 9000 Series performance characteristics

Horizontal

Channel-to-channel skew (digital)	2 ns typical
Glitch detect (digital)	≥ 2.0 ns
Main time base range	5 ps/div to 20 s/div
Horizontal position range	0 to ± 200 s
Delayed sweep range	1 ps/div to current main time base setting
Resolution	1 ps
Modes	Main, delayed, roll
Reference positions	Left, center, right
Channel deskew	- 1 ms to +1 ms range
Time scale accuracy	± (0.4 + 0.5 * YrsSinceCal) ppm pk

Delta-time measurement accuracy^{2,3,4,5}

Signal time measurement accuracy		x=	y=
Absolute averaging disabled	$\sqrt{\left(\frac{x * Noise}{SlewRate}\right)^2 + y * 10^{-24} + \frac{TimeScaleAccy * Reading}{2}} \text{ sec pk}$	9064	4.8 20
		9104	4.8 15
		9254	4.0 15
		9404	5.0 20
-----		x=	y=
Absolute >256 averages	$\sqrt{\left(\frac{x * Noise}{SlewRate}\right)^2 + y * 10^{-24} + \frac{TimeScaleAccy * Reading}{2}} \text{ sec pk}$	9064	.33 .1
		9104	.33 .05
		9254	.33 .10
		9404	.35 .15
-----		y=	
Standard deviation averaging disabled	$\sqrt{\left(\frac{1.4 * Noise}{SlewRate}\right)^2 + y * 10^{-24}} \text{ sec}_{rms}$	9064	.75
		9104	.65
		9254	.75
		9404	.80

Standard deviation >256 averages	$\sqrt{\left(\frac{0.1 * Noise}{SlewRate}\right)^2 + 0.01 * 10^{-24}} \text{ sec}_{rms}$		

Jitter measurements floor ^{2,3}		x=	y=
Time interval error ⁴	$\sqrt{\left(\frac{x * Noise}{SlewRate}\right)^2 + y * 10^{-24}} \text{ sec}_{rms}$	9064	1.0 1.0
		9104	1.0 0.5
		9254	.95 1.1
		9404	.95 1.2
-----		y=	
Period jitter	$\sqrt{\left(\frac{1.4 * Noise}{SlewRate}\right)^2 + y * 10^{-24}} \text{ sec}_{rms}$	9064	.75
		9104	.65
		9254	.75
		9404	.80
-----		y=	
N-cycle, cycle-cycle jitter	$\sqrt{\left(\frac{2.4 * Noise}{SlewRate}\right)^2 + y * 10^{-24}} \text{ sec}_{rms}$	9064	1.8
		9104	1.4
		9254	1.9
		9404	2.0

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 Noise is the displayed noise floor. SlewRate is the displayed slew rate of the signal at the threshold crossings. Sample rate = max, sin(x)/x interpolation enabled.

3 Measurement threshold = fixed voltage at 50% level.

4 Time ranges ≤ 10 μs.

5 Values represent time error between two edges on a single channel. Standard deviation value refers to the standard deviation of 256 consecutive measurements performed using an individual instrument. Reading is the displayed DTMA measurement value.

Infiniium 9000 Series performance characteristics

Acquisition	9104, 9254, 9404	9064					
Maximum real-time sample rate	4 ch x 10 GS/s or 2 ch x 20 GS/s	4 ch x 5 GSa/s or 2 ch x 10 GSa/s					
Memory depth per channel							
Standard	10 Mpts on 4 channels, 20 Mpts on 2 channels						
Option 20M	20 Mpts on 4 channels, 40 Mpts on 2 channels						
Option 50M	50 Mpts on 4 channels, 100 Mpts on 2 channels						
Option 100	100 Mpts on 4 channels, 200 Mpts on 2 channels						
Option 200	200 Mpts on 4 channels, 400 Mpts on 2 channels						
Option 500	500 Mpts/ 250 Mpts on 4 channels, 1 Gpts/ 500 Mpts on 2 channels (single/repetitive mode)						
Sampling Modes							
Real-time							
Real-time with peak detect							
Real-time with high resolution							
Equivalent-time (1.0 ps fine interpolator resolution yields a maximum effective sample rate of 1,000 GSa/s)							
Segmented memory							
Up to 4096 segments for 10 Mpts standard memory, up to 131,072 segments with Option 500							
Maximum time between triggers is 562,950 seconds (6.5 days)							
Re-arm time (minimum time between trigger events) is 4.5 μs with analog channels, 5.8 μs with digital channels on							
Filters	Sin (x) / x Interpolation						
Acquisition: digital channels							
Maximum real time sample rate	2 GSa/s						
Maximum memory depth per channel	128/ 64 Mpts with 2 GSa/s. 64/32 Mpts with sampling < 2 GSa/s (single/repetitive mode).						
Minimum width glitch detection	2 ns						
Trigger: scope channels							
Trigger sources	Channel 1, channel 2, channel 3, channel 4, aux, and line						
Sensitivity	1 MΩ input, edge trigger, DC to 500 MHz: 0.6 div 50 Ω DC to 2 GHz, 1.0 div 2 GHz to 4 GHz: 0.5 div Auxiliary DC to 700 MHz: 300 mVp-p						
Trigger level range – scope channel 1, 2, 3, 4	± 4 div from center screen (50 Ω and 1 MΩ, all modes except edge) Internal ± 8 div from center screen (1 MΩ, edge mode) Auxiliary ± 5 V						
Sweep modes	Auto, triggered, single						
Display jitter (displayed trigger jitter) ^{1,2}	$\sqrt{\left(\frac{1.0 * \text{Noise}}{\text{SlewRate}}\right)^2} + y * 10^{-24} \text{ sec}_{\text{rms}}$	<table><tr><td>y=</td></tr><tr><td>9064 .50</td></tr><tr><td>9104 .35</td></tr><tr><td>9254 .50</td></tr><tr><td>9404 .40</td></tr></table>	y=	9064 .50	9104 .35	9254 .50	9404 .40
y=							
9064 .50							
9104 .35							
9254 .50							
9404 .40							
Trigger holdoff range	100 ns to 10 s fixed and random						
Trigger actions	Specify an action to occur, and the frequency of the action, when a trigger condition occurs. Actions include: e-mail on trigger and execute “multipurpose” user settings						
Trigger coupling	1 MΩ: DC, AC, (10 Hz) low frequency reject (50 kHz high pass filter), high frequency reject (50 kHz low pass filter)						

1. Internal edge trigger mode. Trigger threshold = fixed voltage at 50% level. The slew rate independent value in the formula represents the traditional trigger jitter.

2. Display jitter example. At 100 mV/div typical noise values are 3.2 mV RMS for 9404 models, 2.5 mV RMS for 9254A models, and 2.4 mV RMS for 9104A models. For slew rate of 500 mVpp sin wave with frequency equal to max analog bandwidth of each model, typical display jitter is .95 ps RMS for 9404A models, .97ps for 9254A models, and 1.7 ps RMS for 9104A models.

Infiniium 9000 Series performance characteristics

Trigger: digital channels MSO Models

Threshold range (user defined)	±8.0 V in 100-mV increments
Threshold accuracy ¹	±(100 mV + 3% of threshold setting)

Measurements and math

Waveform measurements

Voltage (scope channels)	Peak-to-peak, minimum, maximum, average, RMS, amplitude, base, top, overshoot, preshoot, upper, middle, lower, crossing point voltage
Time (digital channels)	Period, frequency, positive width, negative width, duty cycle, delta time
Time (scope channels)	Rise time, fall time, period, frequency, positive width, negative width, duty cycle, burst width, Tmin, Tmax, Tvolt, channel-to-channel delta time, channel-to-channel phase
Mixed (scope channels only)	Area, slew rate
Frequency domain	FFT frequency, FFT magnitude, FFT delta frequency, FFT delta magnitude
Level qualification	Any channels that are not involved in a measurement can be used to level-qualify all timing measurements

Eye-diagram measurements Eye height, eye width, eye jitter, crossing percentage, Q factor, and duty-cycle distortion

Measurement modes

Statistics	Displays the mean, standard deviation, minimum, maximum range, and number of measurement values for the displayed automatic measurements
Histograms (scope channels)	
Source	Waveform or measurement
Orientation	Vertical (for timing and jitter measurements) or horizontal (noise and amplitude change) modes, regions are defined using waveform markers
Measurements	Mean, standard deviation, mean ± 1, 2, and 3 sigma, median, mode, peak-to-peak, min, max, total hits, peak (area of most hits), X scale hits, and X offset hits
Marker modes	Manual markers, track waveform data, track measurements
Waveform math	
Number of functions	Four
Operators	Absolute value, add, average, Butterworth ² , common mode, differentiate, divide, FFT magnitude, FFT phase, FIR ¹¹ , high pass filter, integrate, invert, LFE ² , low pass filter (4th-order Bessel Thompson filter), magnify, max, min, multiply, RT Eye ² , smoothing, SqrtSumOfSquare ² , square, square root, subtract, versus Chartstate (MSO models), charttiming (MSO models)

Automatic measurements	Measure menu access to all measurements, five measurements can be displayed simultaneously
Multipurpose	Front-panel button activates five pre-selected or five user-defined automatic measurements
Drag-and-drop measurement toolbar	Measurement toolbar with common measurement icons that can be dragged and dropped onto the displayed waveforms

FFT

Frequency range	DC to 10 GHz (at 20 GSa/s) or 5 GHz (at 10 GSa/s)
Frequency resolution	Resolution = sample rate/memory depth
Window modes	Hanning, flattop, rectangular

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 Requires MATLAB software.

Infiniium 9000 Series performance characteristics

Trigger modes

Edge (analog and digital)	Triggers on a specified slope (rising, falling or alternating between rising and falling) and voltage level on any channel.
Edge transition (analog)	Trigger on rising or falling edges that cross two voltage levels in > or < the amount of time specified. Edge transition setting from 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.
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
Line	Triggers on the line voltage powering the oscilloscope.
Pulse width (analog and digital) 4 GHz model	Trigger on a pulse that is wider or narrower than specified. Minimum detectable pulse width: 125 ps for analog channels, 1 ns for digital channels. Pulse width range settings: 250 ps to 10 s for analog channels, 2 ns to 10 s for digital channels.
2.5 GHz model	Minimum detectable pulse width: 200 ps for analog channels, 1 ns for digital channels. Pulse width range settings: 350 ps to 10 s for analog channels, 2 ns to 10 s for digital channels.
1 GHz model	Minimum detectable pulse width: 500 ps for analog channels, 1 ns for digital channels. Pulse width range settings: 700 ps to 10 s for analog channels, 2 ns to 10 s for digital channels.
Runt (analog)	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/pulse range (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)	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)	Trigger on entering, exiting, or inside specified voltage range
Video (analog)	NTSC, PAL-M(525/60), PAL, SECAM(625,50) EDTV(480p/60), EDTV(576/50), HDTV(720p/60), HDTV(720p/50) HDTV(1080i/60)
Serial (analog and digital)	Requires specified serial software option, I ² C, SPI, CAN, FlexRay, RS-232/UART, USB, PCIe, generic 8B/10B

Infiniium 9000 Series performance characteristics

Display

Display	15 inch color XGA TFT-LCD with touch screen
Display intensity grayscale	64-level intensity-graded display
Resolution	1024 pixels horizontally x 768 pixels vertically
Annotation	Up to 12 labels, with up to 100 characters each, can be inserted into the waveform area
Grids	Can display 1, 2 or 4 waveform grids
Waveform styles	Connected dots, dots, infinite persistence, color graded infinite persistence. Includes up to 64 levels of intensity-graded waveforms.
Waveform update rate	
Real time mode	Maximum of 1,800 waveforms/sec. Typical of 300 waveforms/sec (memory depth: 1 Mpts, sampling rate: 10 GS/s, 50 ns/div, sin(x)/x: on).

Computer system and peripherals, I/O ports

Computer system and peripherals	
Operating system	Windows XP Pro®
CPU	Intel®Celeron™ M530 1.733 GHz microprocessor
PC system memory	2 GB
Drives	≥ 250-Gb internal hard drive (optional removable hard drive), external DVD-RW drive (optional)
Peripherals	Optical USB mouse and compact keyboard supplied. All Infiniium models support any Windows-compatible input device with a PS/2 or USB interface.
File types	
Waveforms	Compressed internal format (*.wfm), comma separated values (*.csv), .hdf5, .bin, tab separated values (*.tsv) and Y value files (*.txt)
Images	BMP, TIFF, GIF, PNG or JPEG
I/O ports	
LAN	RJ-45 connector, supports 10Base-T, 100Base-T, and 1000Base-T. Enables Web-enabled remote control, e-mail on trigger, data/file transfers and network printing.
RS-232 (serial)	COM1, printer and pointing device support
Parallel	Centronics printer port
PS/2	Two ports. Supports PS/2 pointing and input devices.
USB 2.0 Hi-Speed	Three 2.0 high-speed ports on front panel plus four ports on side panel. Allows connection of USB peripherals like storage devices and pointing devices while the oscilloscope is on. One device port on side.
Dual-monitor video output	15 pin XGA on side of scope, full color output of scope waveform display or dual monitor video output
Auxiliary output	DC (± 2.4 V); square wave ~755 Hz with ~200 ps rise time.
Time base reference output	10 MHz, Amplitude into 50 ohms: 800 mV pp to 1.26 V pp (4 dBm \pm 2 dB) if derived from internal reference. Tracks external reference input amplitude \pm 1 dB if applied and selected.
Time base reference input	Must be 10 MHz, input Z = 50 ohms. Minimum 500 mV pp (–2 dBm), maximum 2.0 V pp (+10 dBm).
LXI compliance	LXI Class C

Infiniium 9000 Series performance characteristics

General characteristics

Temperature	
Operating	5 °C to + 40 °C
Non-operating	–40 °C to + 70 °C
Humidity	
Operating	Up to 95% relative humidity (non-condensing) at +40 °C
Non-operating	Up to 90% relative humidity at +65 °C
Altitude	
Operating	Up to 4,000 meters (12,000 feet)
Non-operating	Up to 15,300 meters (50,000 feet)
Vibration	
Operating	Random vibration 5-500 Hz, 10 minutes per axis, 0.3 g (rms)
Non-operating	Random vibration 5-500 Hz, 10 minutes per axis, 2.41 g (rms); resonant search 5-500 Hz, swept sine, 1 octave/minute sweep rate, (0.75 g), 5 minute resonant dwell at 4 resonances per axis
Power	100-120 V, 50/60/400 Hz 100-240 V, 50/60 Hz Max power dissipated: 375 W
Typical operator noise	30 dB at front of instrument
Weight	Net: 11.8 kg (26 lbs.) Shipping: 17.8 kg (39 lbs.)
Dimensions (with feet retracted)	Height: 12.9 in (33 cm); width: 16.8 in (43 cm); depth: 9 in (23 cm)
Safety	Meets IEC1010-1 +A2, CSA certified to C22.2 No.1010.1, Self certified to UL 3111

Infinitiium 9000 Series ordering information

Model	Analog bandwidth	Max analog sample rate*	Standard memory*	Scope channels	Logic channels
DSO9064A	600 MHz	5 GSa/s	10 Mpts	4	-
MSO9064A	600 MHz	5 GSa/s	10 Mpts	4	16
DSO9104A	1 GHz	10 GSa/s	10 Mpts	4	-
MSO9104A	1 GHz	10 GSa/s	10 Mpts	4	16
DSO9254A	2.5 GHz	10 GSa/s	10 Mpts	4	-
MSO9254A	2.5 GHz	10 GSa/s	10 Mpts	4	16
DSO9404A	4 GHz	10 GSa/s	10 Mpts	4	-
MSO9404A	4 GHz	10 GSa/s	10 Mpts	4	16

* In 2-channel mode, maximum sample rate and memory depth double.

Accessories included:

All models ship standard with: 1-year warranty, four N2873A 500 MHz passive probes, probe accessory pouch (mounts on rear of instrument), Agilent I/O libraries suite 15.0, localized power cord, front panel cover, keyboard, mouse, and stylus. User guide and programmer's guide ship on oscilloscope hard drive. Service guide available on Agilent.com. MSO models additionally ship with channel flying lead set logic probe, MSO cable and calibration fixture.

Additional options and accessories

Option A6J	ANSI Z540 compliant calibration
DSO9000A-820	External DVD-RW with USB connection
N2902A or Option 1CM (8U)	9000 Series oscilloscope rackmount kit
Option 801	Removable hard drive
N2903A (requires option 801)	Additional removable hard disk drive
Gemstar 5000 custom-molded case	Available from www.gemstarmfg.com
N2918B	Infinitiium Evaluation Kit

Post-sales upgrades

DSO → MSO upgrades

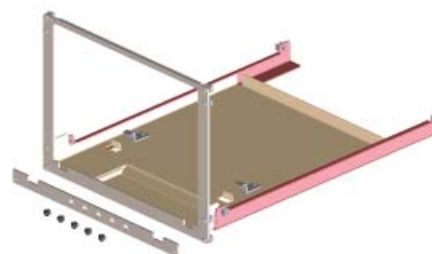
N2901D	DSO9064A to MSO9064A Upgrade Kit
N2901A	DSO9104A to MSO9104A Upgrade Kit
N2901B	DSO9254A to MSO9254A Upgrade Kit
N2901C	DSO9404A to MSO9404A Upgrade Kit

Oscilloscopes bandwidth upgrades

N2905A	Upgrade to 2.5 GHz bandwidth
N2904A	Upgrade to 4.0 GHz bandwidth

Memory depth upgrades

N2900A	Upgrade to 20 Mpts, 50 Mpts, 100 Mpts, 200 Mpts, or 500 Mpts or double this depth in 2-channel mode.
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Mount your 9000 Series scope in an 8U high, 19" (487mm) wide rack with option 1CM.



Quickly remove your hard drive for additional security with option 801.

Infiniium 9000 Series ordering information

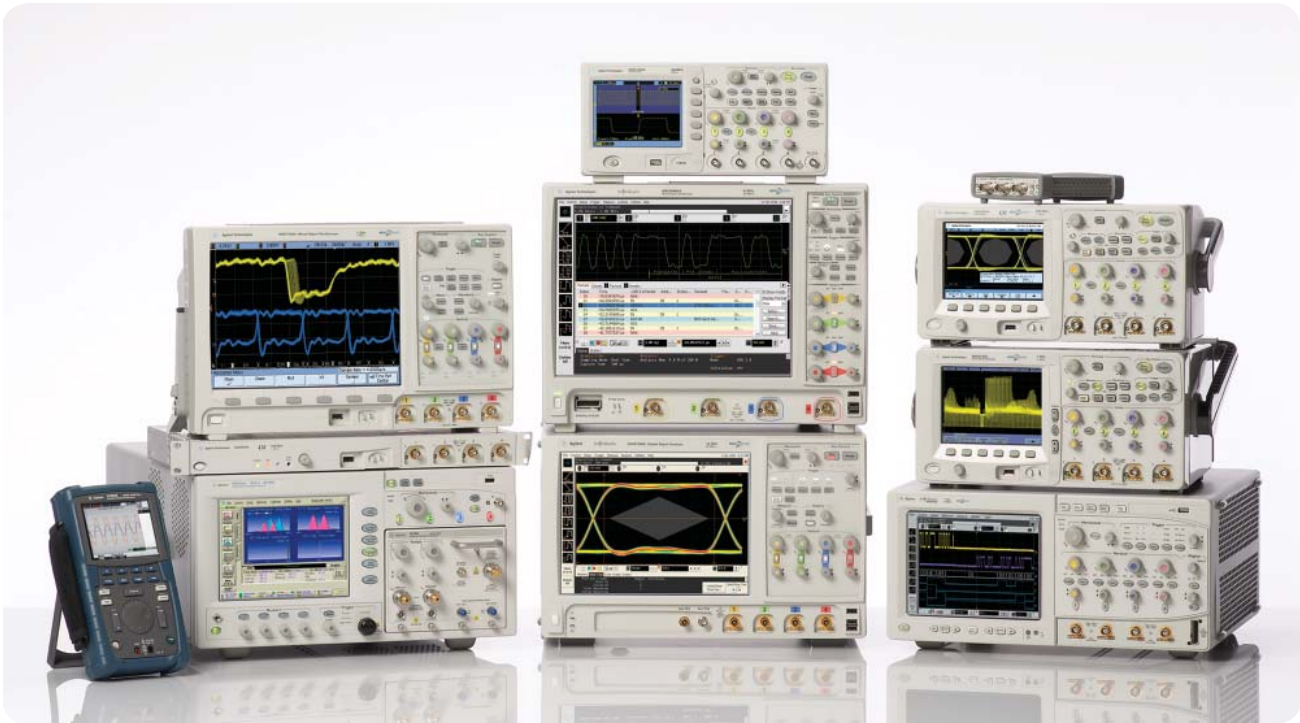
SW Applications	Factory-installed option for new scope purchases	User-installed stand-alone product number	User-installed floating license (N5435A option)
RS-232/UART triggering and decode	001	N5462B	031
EZJIT jitter analysis software	002	E2681A	002
High-speed SDA and clock recovery	003	N5384A	003
EZJIT Plus jitter analysis software	004	N5400A	001
USB triggering and decode	005	N5464B	034
PCI Express 1.1 triggering and decode	006	N5463B	032
I ² C/SPI triggering and decode	007	N5391B	006
CAN/FlexRay triggering and decode	008	N8803A	033
InfiniiScan	009	N5415A	004
User-defined function	010	N5430A	005
Application remote programming interface	011	N5452A	
InfiniiSim signal equalization	012	N5461A	025
InfiniiSim basic signal de-embedding	013	N5465A 001	026
InfiniiSim advanced signal de-embedding	014	N5465A 002	027
Power measurement application software	015	U1882A	
Xilinx FPGA dynamic probe	016	N5397A	
Altera FPGA dynamic probe	017	N5433A	
RS-232, SPI and I ² C triggering and decode bundle	018		
MIPI D-Phy Triggering and decode	019	N8802A	036
Ethernet compliance application	021	N5392A	008
USB2.0 compliance application	029	N5416A	017
DDR1 validation application	031	U7233A	021
DDR2 validation application	032	N5413A	016
DDR3 up to 800 MHz validation application	033	U7231A	020
MIPI D-Phy compliance application	035	U7238A	022
SATA1 (1.5 GB/s triggering and decode)	038	N8801A	035
User definable application	040	N5467A	
Communication mask test kit		E2625A	
MATLAB basic	061		
MATLAB advanced	062		

Memory upgrades

Memory per scope channel (4-channel/ 2-channel mode)	Factory-installed option for new scope purchases	User-installed option (N2900A)
20 Mpts/40 Mpts	20M	020
50 Mpts/100 Mpts	50M	050
100 Mpts/200 Mpts	100	100
200 Mpts/400 Mpts	200	200
500 Mpts/1 Gpts	500	500

Related Literature

Publication Title	Publication Number
<i>Infiniium 9000 Series Quick Demo Guide</i>	5990-3773EN
<i>Infiniium 9000 Series Quick Fact Sheet</i>	5990-3772EN
<i>Agilent Technologies Oscilloscope Family Brochure</i>	5989-7650EN
<i>Agilent Technologies Probes and Accessories Selection Guide</i>	5989-6162EN
<i>VSA Ultra-Wideband Vector Signal Analyzer</i>	5989-6144EN
<i>Agilent N2870A Series Passive Probes and Accessories</i>	5990-3930EN



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