



Agilent Technologies Infiniium 9000 Series Oscilloscopes

Data Sheet

Engineered for broadest measurement capability



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.

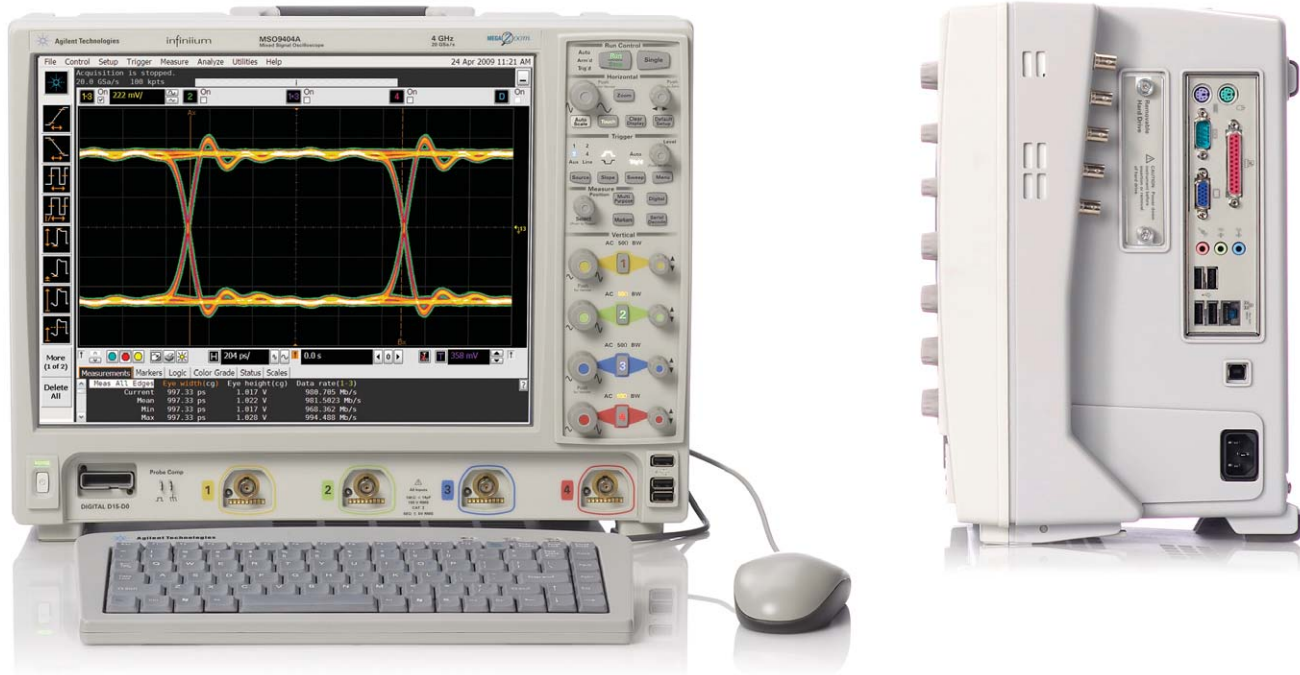
First we built in the powerful features you'd expect in any Infiniium scope. Then we engineered the scope for the broadest measurement capability, so it would be the most indispensable tool in your arsenal.

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).

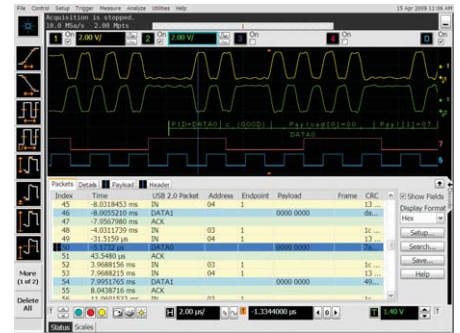
| Model | Analog bandwidth | Max analog sample rate* | Standard memory* | Scope channels | Logic channels |
|-----------|------------------|-------------------------|------------------|----------------|----------------|
| DSO 9104A | 1 GHz | 10 GSa/s | 10 Mpts | 4 | - |
| MSO 9104A | 1 GHz | 10 GSa/s | 10 Mpts | 4 | 16 |
| DSO 9254A | 2.5 GHz | 10 GSa/s | 10 Mpts | 4 | - |
| MSO 9254A | 2.5 GHz | 10 GSa/s | 10 Mpts | 4 | 16 |
| DSO 9404A | 4 GHz | 10 GSa/s | 10 Mpts | 4 | - |
| MSO 9404A | 4 GHz | 10 GSa/s | 10 Mpts | 4 | 16 |

* In 2-channel mode, maximum sample rate and memory depth double to 20 GSa/s and 20 Mpts per channel.

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

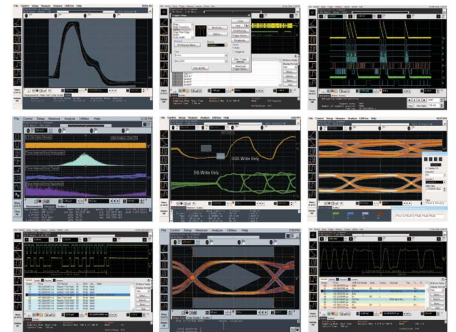
It's three instruments in one

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.

Height: 12.9" (33 cm); width: 16.8" (43 cm); depth: 9" (23 cm)

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

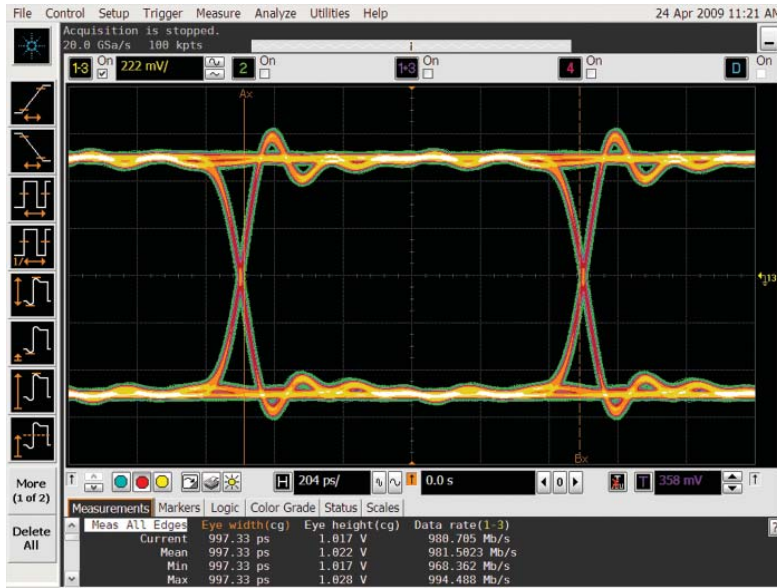
Need to see lots of signals? It has the biggest screen: 15" (23 cm) XGA



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.

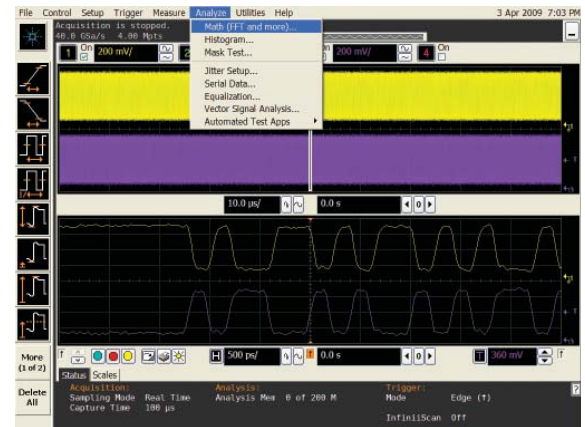
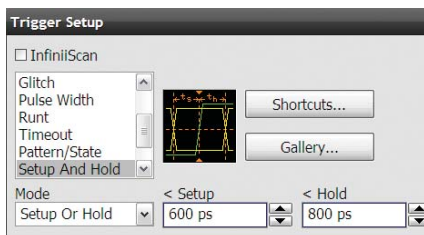
Responsive deep memory

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

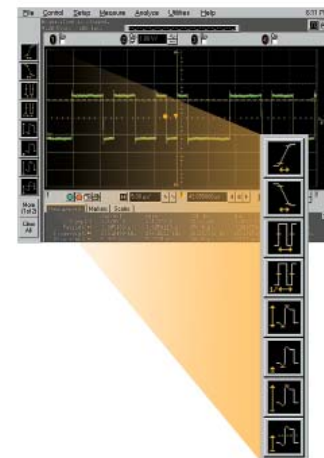
Advanced triggers are essential when you are investigating suspected problems. Infiniium offers a full range of advanced triggers to help you isolate and capture the condition you need to characterize. The 9000 Series simplifies trigger setups by using intuitive dialog boxes with descriptive graphics.



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

Drag and drop measurements

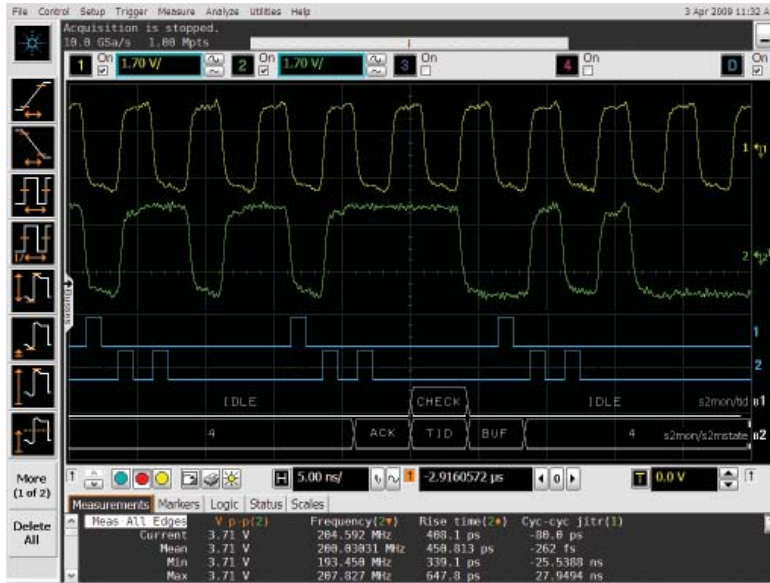
It's simple: drag an icon from the measurement bar and drop it on the cycle you want to measure. You can make up to five measurements on your waveforms, on up to five different cycles. All of the measurements appear at the bottom of the display with statistics and are color-coded to the channel you are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



It's three instruments in one

2. Logic analyzer

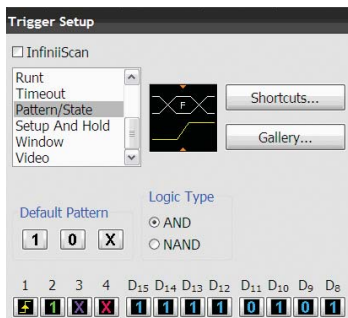
MSO models add 16 high-speed timing channels with standard 128 Mpts digital memory, allowing you to retain fast 2 GSa/s sample rates over long periods of time.



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

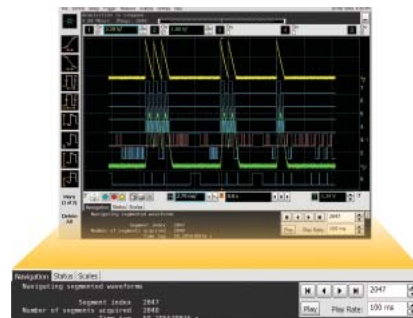
Digital and mixed-signal trigger

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.



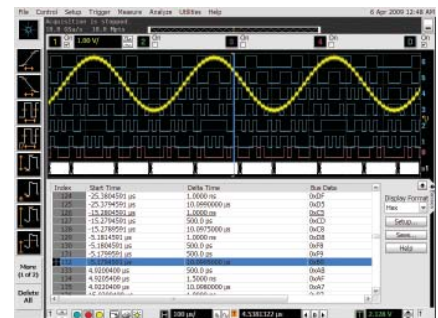
Industry's only segmented memory for both analog and digital channels

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.



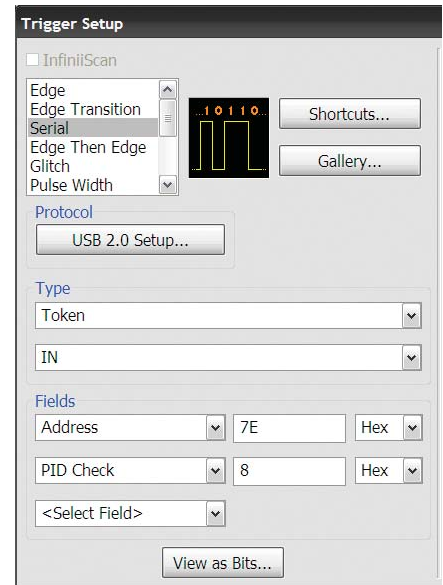
Designing with Altera or Xilinx FPGAs? Use the FPGA dynamic probe for rapid internal FPGA measurements. Using I²C, SPI, RS-232, or low- or full-speed USB? Use the digital channels to acquire and decode these buses, preserving analog channels for other time-correlated measurements.

It's three instruments in one

3. Protocol analyzer

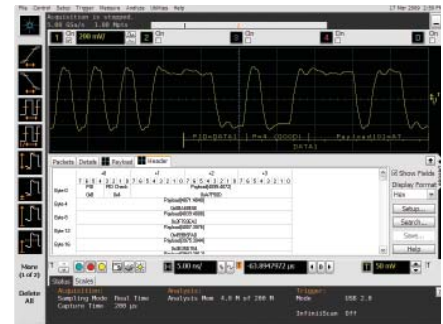
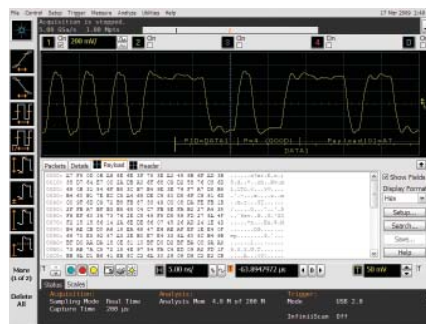
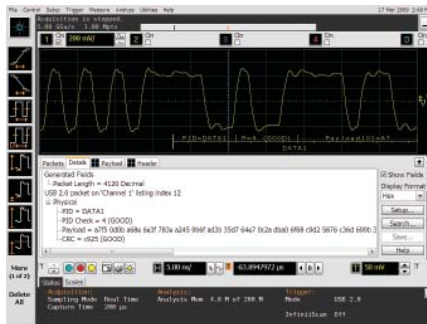
Does your design include a serial bus that is a key point for testing or debugging? Add protocol analysis capability to your scope for:

- I²C
- SPI
- RS-232/UART
- USB
- CAN
- FlexRay
- PCIe®
- 8B/10B



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.

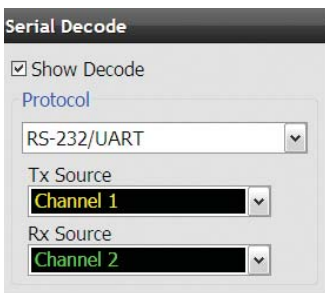
I²C/SPI serial trigger and decode (N5391B or Option 007 on new scope purchases)

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)

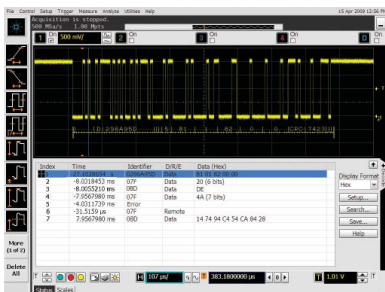
This application eliminates the need to manually decode bus traffic. Using data captured on the scope or logic channels, the application lets you easily view the information sent over an RS-232 or other UART serial bus.

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.

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-LIN



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.

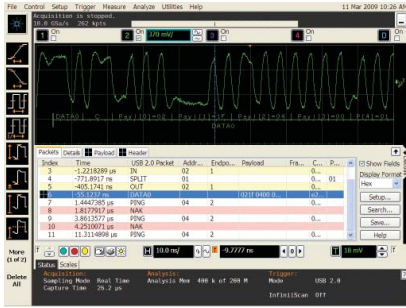
Trigger on and view CRC, 8B/10B and disparity errors.

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 others



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 BitStuff.

This application is supported on scope channels of all models.

For more information:

www.agilent.com/find/9000_USB



Rapid FPGA debug.

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

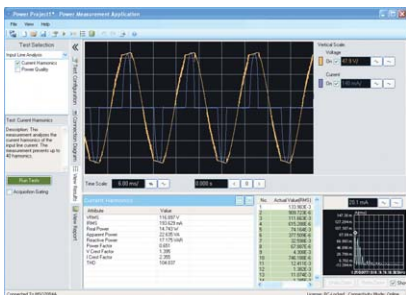
Agilent's MSO FPGA dynamic probe provides internal FPGA visibility and quick instrument setup using an innovative core-assisted debug approach. Measurement tasks that previously took hours can be done in seconds with a few mouse clicks.

This application is supported on all MSO models.

For more information:

www.agilent.com/find/9000_altera

www.agilent.com/find/9000_xilinx



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

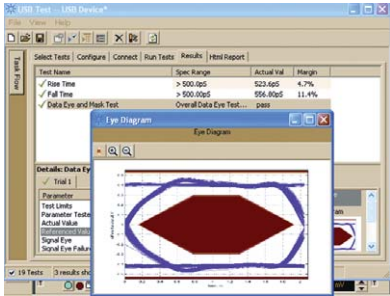
ANSI T1.102, ITU-T G.703, and IEEE 802.3 communication signal mask templates.

This application is supported on all models.

For more information:

www.agilent.com/find/9000_comm

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 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)

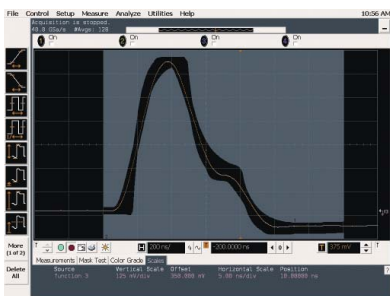
Quickly and easily evaluate and characterize your memory designs. Automated testing based on JEDEC specifications saves time. The application also includes additional debug and compliance capabilities.

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.

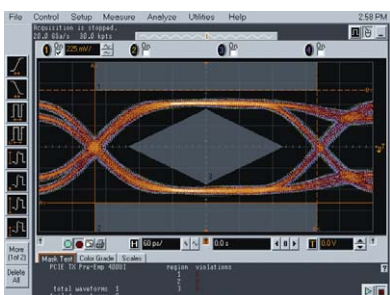
Ethernet compliance testing (N5392A or Option 021 on new scope purchases)

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 models.

For more information:

www.agilent.com/find/9000_ethernet



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.

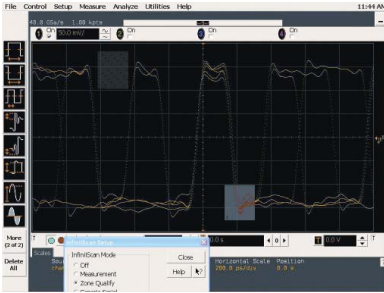
The SDA package also includes bit-level triggering and decode for 8B/10B.

This application is supported on all models.

For more information:

www.agilent.com/find/9000_SDA

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



Identify signal integrity issues with InfiniiScan Zone – Qualify triggering.

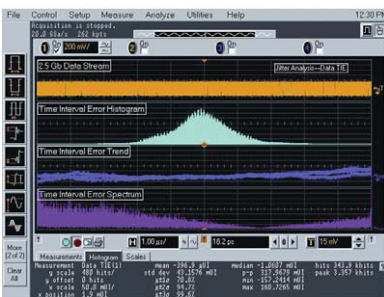
InfiniiScan event identification (N5415A or Option 009 on new scope purchases)

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.

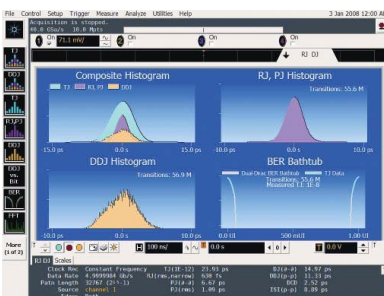
EZJIT analysis software (E2681A or option 002 on new scope purchases)

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.

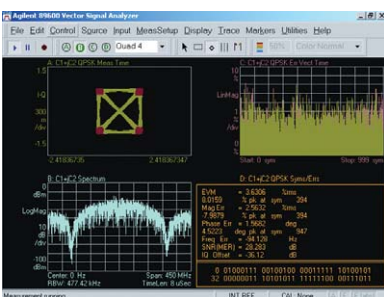
EZJIT Plus analysis software (N5400A or Option 004 on new scope purchases. To upgrade from EZJIT to EZJIT Plus, order N5401A.)

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



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

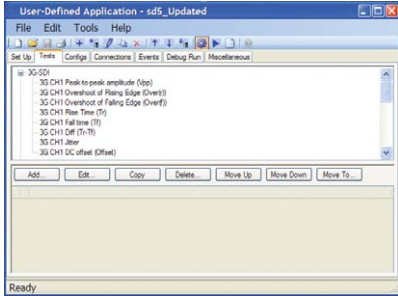
wireless networking signals such as 802.11 WiFi and 802.16 WiMax.

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

For more information:

www.agilent.com/find/VSA

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



Quickly automate oscilloscope measurements.

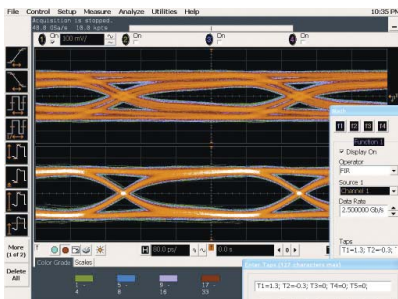
User-definable application (N5467A or Option 040 on new scope purchases)

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.

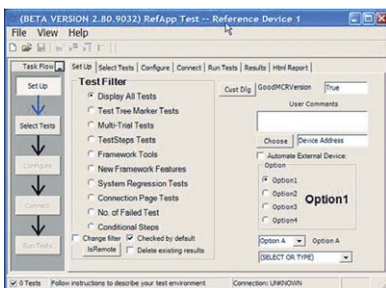
User-defined function (N5430A or Option 010 on new scope purchases)

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.

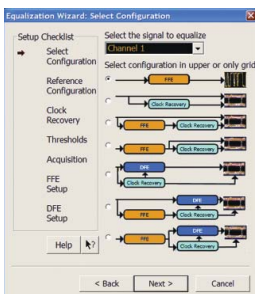
Infiniium application remote interface (N5452A or Option 006 on new scope purchases)

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



High-speed signal emulation.

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

Take scope measurements at the receiver pin and use serial data equalization to emulate the signal at the transmitter. 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.

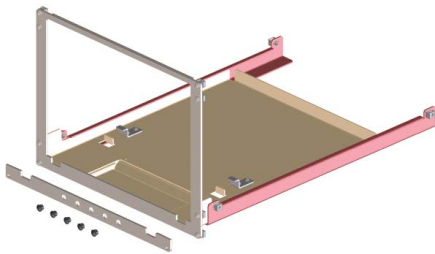
This application is supported on all models.

For more information:

www.agilent.com/find/9000_InfiniSim

www.agilent.com/find/9000_SDE

Infiniium 9000 Series accessories and upgrades



9000 Series rackmount kit (N2902A or Option 1CM)

The rackmount kit consists of a support shelf and hardware for mounting the 9000 Series scopes into an Electronic Industries Association (EIA) standard 19-inch (487-mm) rack cabinet.

For more information:

www.agilent.com/find/9000_rackmount

Mount your 9000 Series scope in a rack.



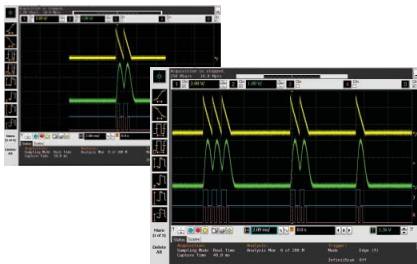
Removable hard drive – installed (Option 801 on new scope purchases)

Order an internal hard disk with a removable storage device for added flexibility and security. For 9000 Series units with Option 801, additional removable hard disk drives can be ordered (N2903A).

For more information:

www.agilent.com/find/9000_N2903A

Quickly remove your hard drive for additional security.



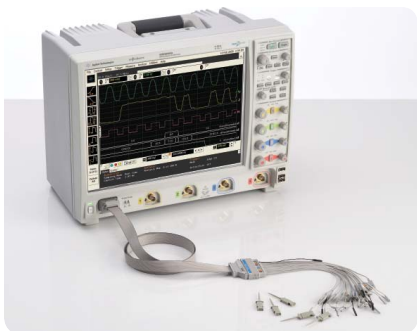
Additional acquisition memory (N2900A or options 20, 50, 100, 200, and 500 on new scope purchases)

Increase memory depth to capture longer time periods and maintain faster sampling speeds. Memory depth doubles in 2-channel mode.

For more information:

www.agilent.com/find/9000_memory

Increase your memory depth at any time after purchase.



DSO to MSO upgrades (N2901A/B/C)

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_MS0

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

Agilent Infiniium portfolio

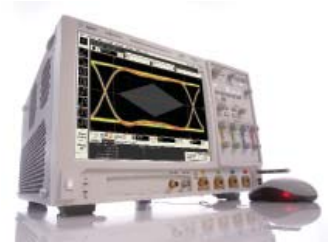
Agilent's Infiniium lineup includes 8000, 9000 and 90000A Series oscilloscopes. These share a number of advanced hardware and software technology blocks. Use the following selection guide to determine which best matches your specific needs.



Lowest cost, 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 MΩ 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) |
| Built-in GPIB available | • | - | • |
| 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.



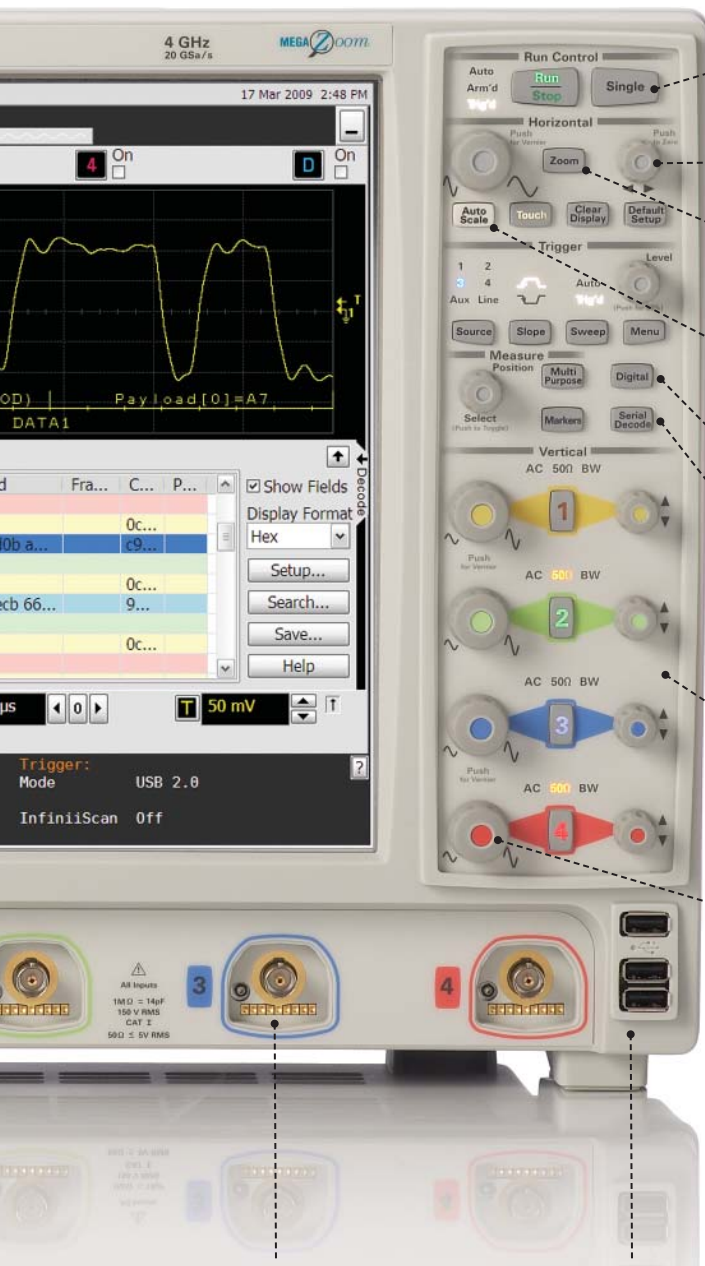
AUX OUT for calibration

Built-in 10-MHz reference in/out port synchronizes multiple measurement instruments in a system.

XGA video output port lets you connect to an external monitor.

Standard USB and LAN ports provide PC and printer connectivity.

Trig in/out ports provide an easy way to synchronize your scope to other instruments.



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 set-up 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 port makes it easy to save your work and update your system software quickly.



Accessory pouch detaches easily.

Connectivity and probing

Connectivity

Industry compatibility

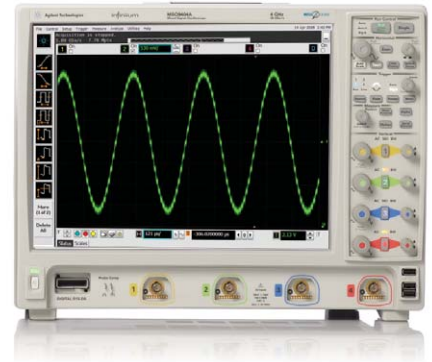
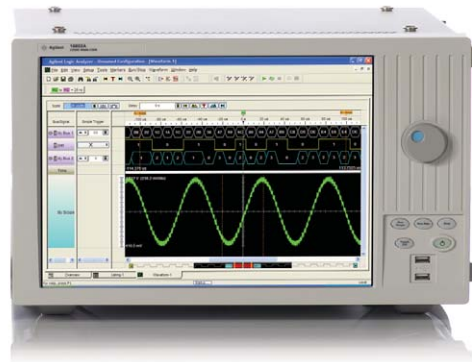
Export screen shots and waveforms in numerous industry-standard formats. In addition, the 9000 Series supports compatibility with the following

- 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

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.



Probing

The Infiniium 9000 Series oscilloscopes ship with four N2873A 10:1 divider passive probes per scope 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.



Infiniium 9000 Series performance characteristics

| Vertical: scope channels | 9104A | 9254A | 9404A |
|---|---|---------------------------------------|--------|
| Analog bandwidth (–3 dB) 50 Ω ¹ | 1.0 GHz | 2.5 GHz | 4 GHz |
| Calculated Rise Time / Fall Time 10% to 90% at 50 Ω | 400 ps | 160 ps | 100 ps |
| Calculated Rise Time / Fall Time 20% to 80% at 50 Ω | 268 ps | 107 ps | 67 ps |
| Input channels | DSO9000 – 4 analog MSO9000 – 4 analog + 16 digital | | |
| Input impedance ¹ | 50 Ω ± 2.5%, 1 MΩ ± 1% (11pF typical) | | |
| Input sensitivity ³ | 1 MΩ: 1 mV/div to 5 V/div 50 Ω: 1 mV/div to 1 V/div | | |
| Input coupling | 1 MΩ: AC, DC 50 Ω: DC | | |
| Hardware bandwidth limit | 20 MHz on 1 MΩ input | | |
| Vertical resolution ^{2,3} | 8 bits, ≥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} | ± 2% of full scale at full resolution on channel scale ± 5 °C from cal temp | | |
| Maximum input voltage ¹ | 1 MΩ: 150V RMS or DC, CAT I ± 250 V (DC + AC) in AC coupling 50 Ω: 5 Vrms | | |
| Offset range | Vertical sensitivity | Available offset | |
| 1 MΩ | 1 mV to <10 mV/div | ± 2 V | |
| | 10 mV to <20 mV/div | ± 5 V | |
| | 20 mV to <100 mV/div | ± 10 V | |
| | 100 mV to <1 V/div | ± 20 V | |
| | 1 V to 5 V/div | ± 100 V | |
| 50 Ω | | ±12 div or ±4V, whichever is smallest | |

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, 100mV, 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, 500 mV, 1V,2V, 5V.

Infiniium 9000 Series performance characteristics

Vertical: scope channels (con't)

| | |
|--|---|
| Offset accuracy ^{3,4,6} | $\pm (1.25\% \text{ of channel offset} + 1\% \text{ of full scale} + 1 \text{ mV})$ |
| Dynamic range | 1 M Ω : ± 8 div from center screen 50 Ω : ± 8 div from center screen |
| DC voltage measurement accuracy ^{1,2,3} | Dual cursor $\pm [(\text{DC gain accuracy}) + (\text{resolution})]$ Single cursor $\pm [(\text{DC gain accuracy}) + (\text{offset accuracy}) + (\text{resolution}/2)]$ |

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, 5.0V CMOS, 3.3V CMOS, 2.5V CMOS, ECL, PECL, user defined |
| User-defined threshold range | $\pm 8.00 \text{ V}$ in 10 mV increments |
| Maximum input voltage | $\pm 40 \text{ V}$ peak CAT I |
| Threshold accuracy | $\pm (100 \text{ mV} + 3\% \text{ of threshold setting})$ |
| Input dynamic range | $\pm 10 \text{ V}$ about threshold |
| Minimum input voltage swing | 500 mV peak-to-peak |
| Input impedance (flying leads) | 100 k Ω $\pm 2\%$ (~ 8 pF) at probe tip |
| Resolution | 1 bit |

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

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

5 Calculated from the bandwidth

6 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, 100 mV, 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, 500mV, 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 |
| Reference positions | Left, center, right |
| Channel deskew | - 1 ms to +1 ms range |
| Time scale accuracy ¹ | ± (0.4 + 0.5 * YrsSinceCal) ppm pk |

Delta-time measurement accuracy for MSO/DSO9404A^{2,3,4}

Absolute, averaging disabled

$$\sqrt{\left(\frac{5.0 \cdot \text{Noise}}{\text{SlewRate}}\right)^2 + 23 \times 10^{-24}} + \frac{\text{TimeScaleAccy} \cdot \text{Reading}}{2} \text{ sec pk}$$

Absolute, >- 256 averages

$$\sqrt{\left(\frac{0.35 \cdot \text{Noise}}{\text{SlewRate}}\right)^2 + 0.2 \times 10^{-24}} + \frac{\text{TimeScaleAccy} \cdot \text{Reading}}{2} \text{ sec pk}$$

Standard deviation, averaging disabled

$$\sqrt{\left(\frac{1.4 \cdot \text{Noise}}{\text{SlewRate}}\right)^2 + 1.0 \times 10^{-24}} \text{ sec}_{\text{rms}}$$

Standard deviation, >- 256 averages

$$\sqrt{\left(\frac{0.1 \cdot \text{Noise}}{\text{SlewRate}}\right)^2 + 0.01 \times 10^{-24}} \text{ sec}_{\text{rms}}$$

Jitter measurement floor^{2,3}

Time interval error⁴

$$\sqrt{\left(\frac{1.0 \cdot \text{Noise}}{\text{SlewRate}}\right)^2 + 1.1 \times 10^{-24}} \text{ sec}_{\text{rms}}$$

Period jitter

$$\sqrt{\left(\frac{1.4 \cdot \text{Noise}}{\text{SlewRate}}\right)^2 + 1.0 \times 10^{-24}} \text{ sec}_{\text{rms}}$$

N-cycle, cycle-cycle jitter

$$\sqrt{\left(\frac{2.4 \cdot \text{Noise}}{\text{SlewRate}}\right)^2 + 1.8 \times 10^{-24}} \text{ sec}_{\text{rms}}$$

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. TimeScaleAccy is the oscilloscope's specified time scale accuracy.

Infiniium 9000 Series performance characteristics

Acquisition

| | |
|---|--|
| Maximum real-time sample rate | 4 ch x 10 GS/s or 2 ch x 20 GS/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 on 4 channels, 1 Gpts on 2 channels |
| Sampling Modes | |
| Real-time | |
| Real-time with peak detect | |
| Real-time with high resolution | |
| Equivalent-time | |
| Segmented memory | |
| Up to 4096 segments for 10 Mpts standard memory, up to 131,072 segments with Option 500 | |
| Maximum time between segments 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 M with 2 GSa/s. 64 Mpts with sampling < 2 GSa/s. |
| 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 | $\sqrt{\left(\frac{1.0 \cdot \text{Noise}}{\text{SlewRate}}\right)^2 + 0.6 \times 10^{-24}} \text{ sec}_{\text{rms}}$ |
| 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, 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.

Infiniium 9000 Series performance characteristics

Trigger: digital channels MSO Models

| | |
|----------------------------------|---|
| Threshold range (user defined) | ±8.0 V in 100-mV increments |
| Threshold accuracy ¹⁰ | ±(100 mV + 3% of threshold setting) |
| Predefined thresholds | TTL=1.4 V, 5.0 V CMOS=2.5 V, 3.3 V CMOS=1.65 V, 2.5 V CMOS=1.25 V, ECL=-1.3 V, PECL=3.7 V |

Measurements and math

Waveform measurements

| | |
|-----------------------------|--|
| Voltage (scope channels) | Peak-to-peak, minimum, maximum, average, RMS, amplitude, base, top, overshoot, preshoot, upper, middle, lower |
| 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 ¹¹ , common mode, differentiate, divide, FFT magnitude, FFT phase, FIR ¹¹ , high pass filter, integrate, invert, LFE ¹¹ , low pass filter (4th-order Bessel Thompson filter), magnify, max, min, multiply, RT Eye ¹¹ , smoothing, SqrtSumOfSquare ¹¹ , square, square root, subtract, ver- |

sus

| | |
|-----------------------------------|--|
| 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.

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) | Trigger on a pulse that is wider or narrower than specified. |
| 4 GHz model | 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 (nominal) | 300 waveforms/sec (memory depth: 10 Mpts, sampling rate: 10 GS/s, 50 ns/div, connect dots: on, sin(x)/x: on, color graded: off), |
|--------------------------|--|

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), .bin, tab separated values (*.tsv) and Y value files (*.txt) |
| Images | BMP, PCX, 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 ± 2 dB) if derived from internal reference. Tracks external reference input amplitude ± 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 |
|----------------|-------------|

Infinium 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 dBa 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

Infiniium 9000 Series ordering information

| Model | Analog bandwidth | Max analog sample rate* | Standard memory* | Scope channels | Logic channels |
|-----------|------------------|-------------------------|------------------|----------------|----------------|
| DSO 9104A | 1 GHz | 10 GSa/s | 10 Mpts | 4 | - |
| MSO 9104A | 1 GHz | 10 GSa/s | 10 Mpts | 4 | 16 |
| DSO 9254A | 2.5 GHz | 10 GSa/s | 10 Mpts | 4 | - |
| MSO 9254A | 2.5 GHz | 10 GSa/s | 10 Mpts | 4 | 16 |
| DSO 9404A | 4 GHz | 10 GSa/s | 10 Mpts | 4 | - |
| MSO 9404A | 4 GHz | 10 GSa/s | 10 Mpts | 4 | 16 |

* In 2-channel mode, maximum sample rate and memory depth double to 20 GSa/s and 20 Mpts per channel.

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.

MSO models additionally ship with channel flying lead set logic probe, MSO cable and calibration fixture.

Optional accessories

| | |
|---------------------------------|---|
| DSO9000A-820 | External DVD-RW with USB connection |
| N2902A or Option 1CM | 9000 Series oscilloscope rackmount kit |
| N2903A | Additional removable hard disk drive |
| Gemstar 5000 custom-molded case | Available from www.gemstarmfg.com |

Post-sales upgrades

DSO → MSO upgrades

| | |
|--------|----------------------------------|
| N2901A | DSO9104A to MSO9104A Upgrade Kit |
| N2901B | DSO9254A to MSO9254A Upgrade Kit |
| N2901C | DSO9404A to MSO9404A Upgrade Kit |



Infiniium 9000 Series ordering information

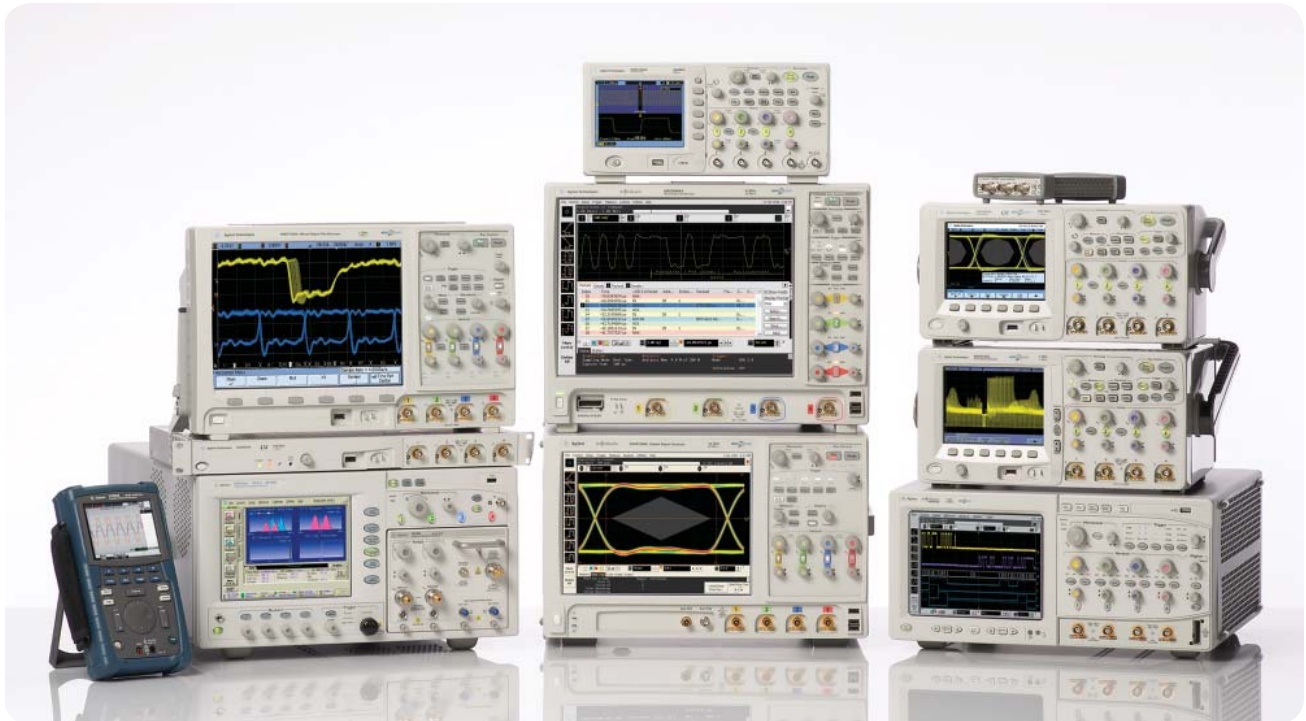
| SW Applications | Factory-installed option for new scope purchases | User-installed stand-alone product number | User-installed floating license (N5435A option) |
|---|---|--|--|
| RS-232/UART triggering and decode | 001 | N5462B | 031 |
| EZJIT jitter analysis software | 002 | E2681A | 002 |
| High-speed 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 | |
| Infiniium signal equalization | 012 | N5461A | 025 |
| Infiniium basic signal de-embedding | 013 | N5465A 001 | 026 |
| Infiniium 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 | | |
| 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 |
| User definable application | 040 | N5467A | |
| Communication mask test kit | | E2625A | |
| VoiceControl software for Infiniium scopes | | E2682A | |

Memory upgrades

| Memory per scope channel (2X in 2-channel mode) | Factory-installed option for new scope purchases | User-installed option (N2900A) |
|--|---|---------------------------------------|
| 20 Mpts | 20M | 020 |
| 50 Mpts | 50M | 050 |
| 100 Mpts | 100 | 100 |
| 200 Mpts | 200 | 200 |
| 500 Mpts | 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 |



Multiple form factors from 20 MHz to >90 GHz | Industry leading specs | Powerful applications