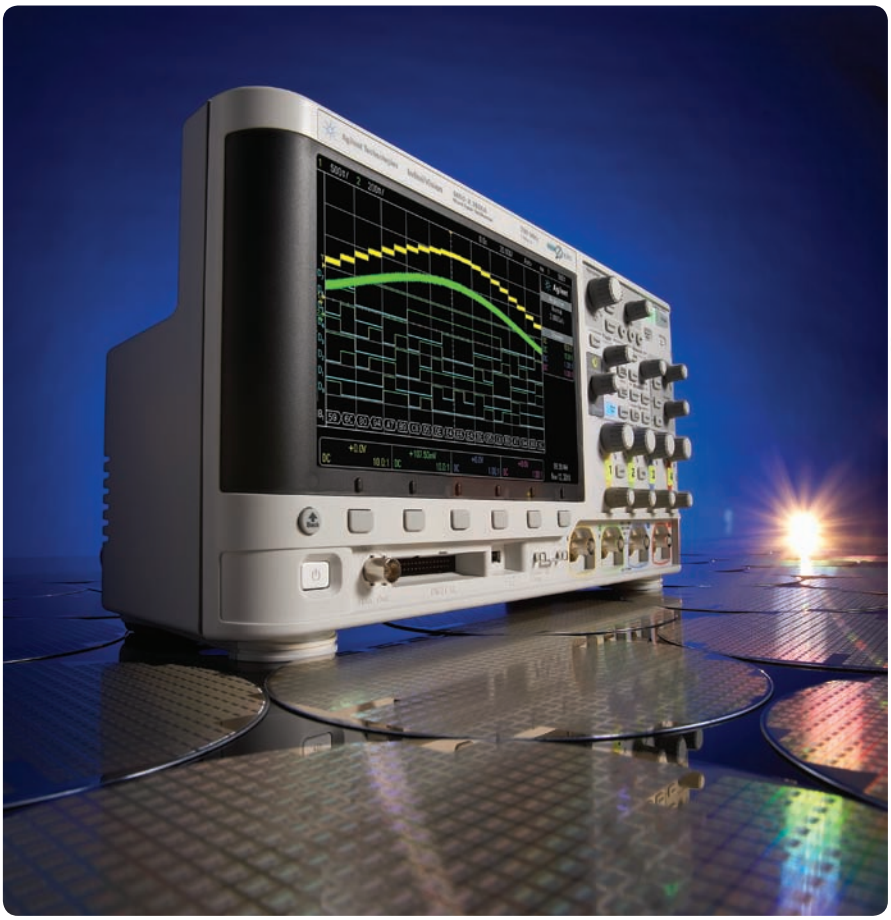
InfiniiVision 2000 X-Series Oscilloscopes

Data Sheet



Oscilloscopes redefined:
Breakthrough technology delivers more scope for the same budget

Anticipate — Accelerate — Achieve

Agilent Technologies

Oscilloscopes redefined: Breakthrough technology delivers more scope for the same budget

Breakthrough technology for budget conscious customers

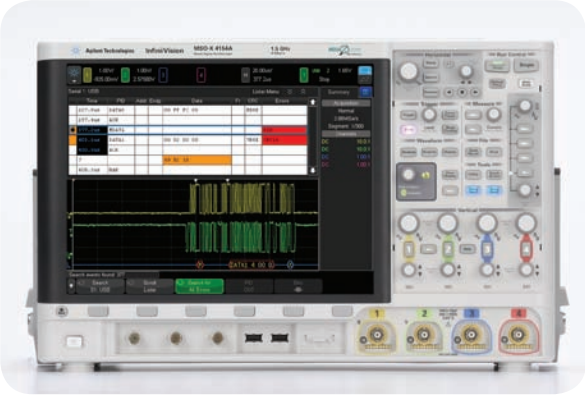
Overview of the Agilent InfiniiVision X-Series oscilloscopes

	InfiniiVision 2000 X-Series	InfiniiVision 3000 X-Series	InfiniiVision 4000 X-Series
Analog channels	2 and 4	2 and 4	2 and 4
Bandwidth (upgradable)	70, 100, 200 MHz	100, 200, 350, 500 MHz, 1 GHz	200, 350, 500 MHz, 1 GHz, 1.5 GHz
Digital channels	8 (MSO models or upgrade)	16 (MSO models or upgrade)	16 (MSO models or upgrade)
Maximum sample rate	2 GSa/s	5 GSa/s (1-GHz models) 4 GSa/s (100-500 MHz models)	5 GSa/s
Maximum memory depth	100 kpts/channel (standard) 1 Mpt/channel (optional)	2 Mpts (standard), 4 Mpts (option)	4 Mpts (standard)
Waveform update rate	> 50,000 waveforms per second	> 1,000,000 waveforms per second	> 1,000,000 waveforms per second
Display	8.5-inch display	8.5-inch display	12.1-inch capacitive touch display
InfiniiScan Zone touch trigger	No	No	Standard
WaveGen 20-MHz function/ arbitrary waveform generator	Single-channel function (option)	Single-channel AWG (option)	Dual-channel AWG (option)
Integrated digital voltmeter	Yes (option)	Yes (option)	Yes (option)
Search and navigate	No	Yes	Yes
Serial protocol analysis	Yes (CAN, LIN, I^2C, SPI, RS232/UART)	Yes (optional: ARINC 429, CAN FlexRay, I^2C, I^2S, LIN, MIL-STD-1553, SPI, UART/RS232)	Yes (optional: ARINC 429, CAN, FlexRay, I^2C, I^2S, LIN, MIL-STD-1553, SPI, UART/RS232, USB 2.0)
Segmented memory	Yes (option)	Yes (option)	Standard
Mask/limit testing	Yes (option)	Yes (option)	Yes (option)
Power analysis	No	Yes (option)	Yes (option)
USB 2.0 signal quality test	No	No	Yes (option)
HDTV analysis	No	Yes (option)	Yes (option)
Advanced waveform math	No	Yes (option)	Standard
Connectivity	Standard USB 2.0 (LAN/ Video option) (GPIB option)	Standard USB2.0 (LAN/Video option) (GPIB option)	Standard USB2.0, LAN, video out (GPIB option)

Need bigger display and state-of-the-art usability?

See the InfiniiVision 4000 X-Series, which redefines the oscilloscope experience.

- Industry's first 12.1-inch capacitive touch display
- InfiniiScan Zone touch trigger capability
- 200 MHz - 1.5 GHz DSO and MSO models
- 1,000,000 wfms/sec
- Standard segmented memory
- Fully upgradable 5 instrument in 1
  - Digital channels (MSO)
  - Protocol analysis including USB 2.0
  - 20 MHz Dual-channel WaveGen with arbitrary waveform and modulation support
  - Digital voltmeter (DVM)
- Application analysis including power analysis, Xilinx FPGA, and USB 2.0 signal quality
- N8900A InfiniiView offline analysis software support
- Standard LAN, USB, and video out connectivity



See **www.agilent.com/find/4000X-Series** for more details.

Oscilloscopes redefined: Breakthrough technology delivers more scope for the same budget

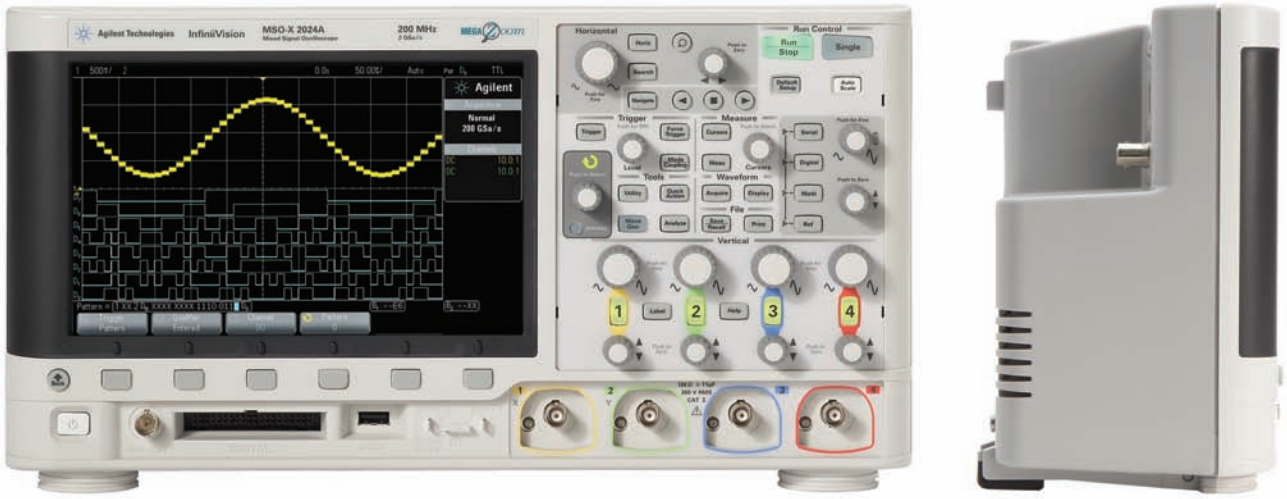
More scope

The InfiniiVision 2000 X-Series offers entry-level price points to fit your budget with superior performance and optional capabilities that are not available in any other oscilloscope in its class. Agilent's breakthrough technology delivers more scope for the same budget.

With more scope, you can:

- **See more** of your signal more of the time with the largest screen in its class, the deepest memory and the fastest waveform update rates
- **Do more** with the power of 5 instruments in 1: oscilloscope, logic timing analyzer, WaveGen built-in 20 MHz function generator (optional), serial protocol triggering and decode (optional), and digital voltmeter (optional)
- **Get more** investment protection with the classes only fully upgradable scope, including memory and bandwidth, and a standard 5 year warranty.*

*5-year warranty applies to new oscilloscopes bought after April 3, 2013.

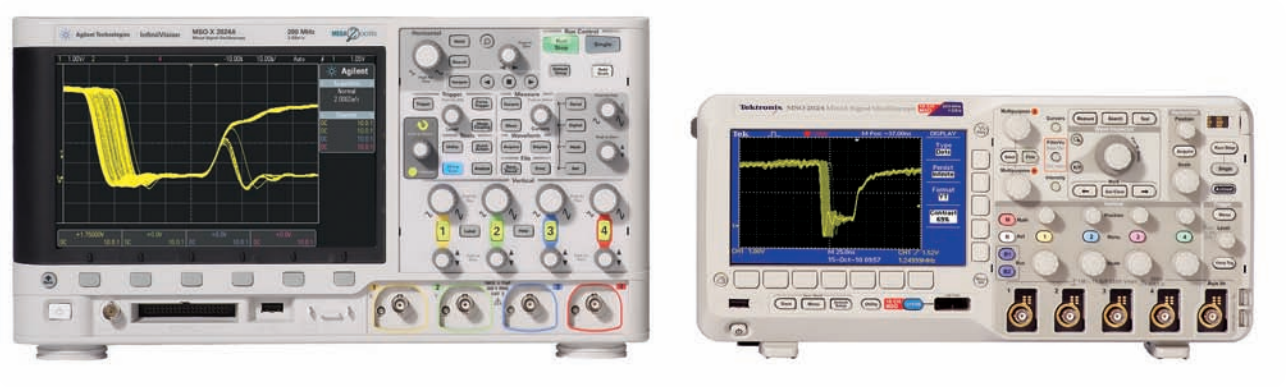


Oscilloscopes redefined: Breakthrough technology delivers more scope for the same budget

See more of your signal, more of the time

Largest display

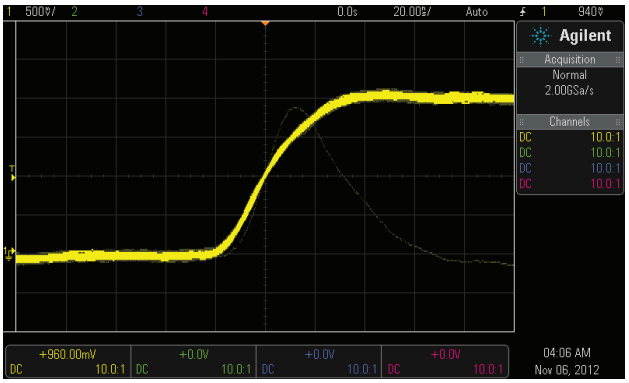
Engineering for the best signal visibility starts with the largest display. Our 8.5-inch WVGA display offers 50% more viewing area with 3.5 times the resolution (WVGA 800 x 480 versus 7-inch WQVGA 480 x 234).



Notice that the Agilent 2000 X-Series allows you to see more of your signals, and captures the infrequent glitch that you are unable to see on other oscilloscopes in this class.

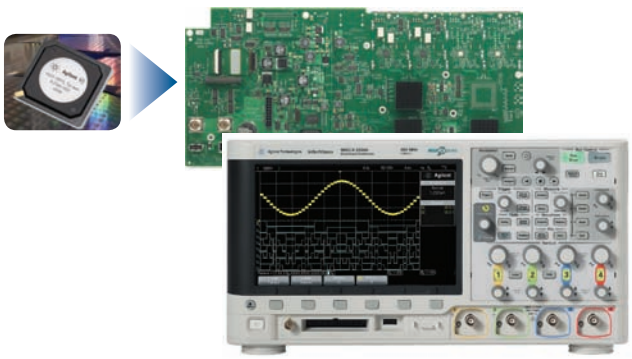
Fastest update rate

With Agilent-designed *MegaZoom* IV custom ASIC technology, the InfiniiVision 2000 X-Series family delivers up to 50,000 waveforms per second. With this speed you can see signal detail and infrequent anomalies more of the time.



How does Agilent do that?

Agilent-designed *MegaZoom IV* custom ASIC technology combines the capabilities of an oscilloscope, logic analyzer, and WaveGen built-in function generator in a compact form factor at an affordable price. 4th generation *MegaZoom* technology enables the industry's fastest waveform update rate with responsive deep memory acquisitions.



Oscilloscopes redefined: Breakthrough technology delivers more scope for the same budget

Do more with the power of 5 instruments in 1

Best-in-class oscilloscope

The InfiniiVision 2000 X-Series features Agilent's patented *MegaZoom* IV smart memory technology that is always enabled and always responsive providing the industry's fastest update rate at up to 50,000 waveforms per second, with no compromise if you turn on measurements or add digital channels. In addition, the 2000 X-Series offers 23 automated measurements such as voltage, time, and frequency as well as five waveform math functions including add, subtract, multiply, divide, and FFT.

Industry's first economy-class mixed signal oscilloscope (MSO)

The 2000 X-Series is the first instrument in its class to offer an integrated logic timing analyzer. Digital content is everywhere in today's designs and with an additional 8 integrated digital timing channels, you now have up to 12 channels of time-correlated triggering, acquisition and viewing on the same instrument. Buy a 2 or 4 channel DSO and at any time, upgrade it yourself to a MSO with a license to turn on those integrated 8 digital timing channels.

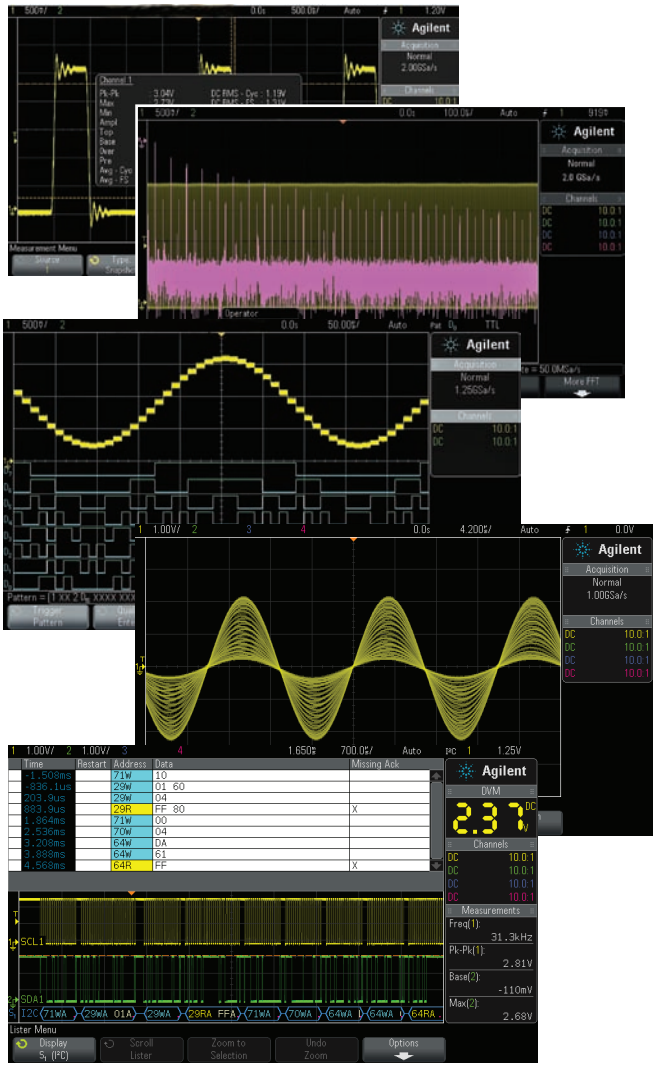
Industry's first WaveGen built-in 20 MHz function generator with a modulation capability

An industry first, the 2000 X-Series offers an integrated 20 MHz function generator, now available with the signal modulation capability. Ideal for educational or design labs where bench space and budget are at a premium, the integrated function generator provides stimulus output of sine, square, ramp, pulse, DC and noise waveforms to your device under test. No need to buy a separate function generator when you can get one integrated in your new oscilloscope. Turn on WaveGen at any time by ordering the DSOX2WaveGen option and install the license yourself.

Hardware-based serial protocol decode and triggering

- Embedded serial triggering and analysis (I^2C, SPI)
- Computer serial triggering and analysis (RS232/422/485/UART)
- Automotive and industrial serial triggering and analysis (CAN,LIN)

Agilent's InfiniiVision Series oscilloscopes are the industry's first scopes to use hardware-based serial protocol decoding. Other vendors scopes use software post-processing techniques to decode serial packets/frames. With these software techniques, waveform and decode-update rates tend to be slow (sometimes seconds per update). That's especially true when using deep memory, which is often required to capture multiple packetized serial bus signals. Faster decoding with hardware-based technology enhances scope usability, and more importantly, the probability of capturing infrequent serial communication errors.



After capturing a long record of serial bus communication using the InfiniiVision scope's MegaZoom IV deep memory, you can easily perform a search operation based on specific criteria, and then quickly navigate to bytes/frames of serial data that satisfy that search criteria. Sometimes it may be necessary to correlate data from one serial bus to another.

Integrated digital voltmeter

An industry first, the 2000 X-Series offers an integrated 3-digit voltmeter (DVM) and 5-digit frequency counter inside the oscilloscopes. The voltmeter operates through the same probes as the oscilloscope channels, however, the measurements are de-coupled from the oscilloscope triggering system so that both the DVM and triggered oscilloscope measurements can be made with the same connection. The voltmeter results are always displayed, keeping these quick characterization measurements at your fingertips. Turn on DVM at any time by ordering the DSOXDVM option.

Oscilloscopes redefined: Breakthrough technology delivers more scope for the same budget

Get more investment protection with the industry's only fully upgradable oscilloscope

Upgradability:

Project needs change, but traditional oscilloscopes are fixed – you get what you pay for at the time of purchase. With the 2000 X-Series, your investment is protected. If you need more bandwidth (up to 200 MHz), digital channels, WaveGen, integrated digital voltmeter, or measurement applications in the future, you can easily add them all after the fact.

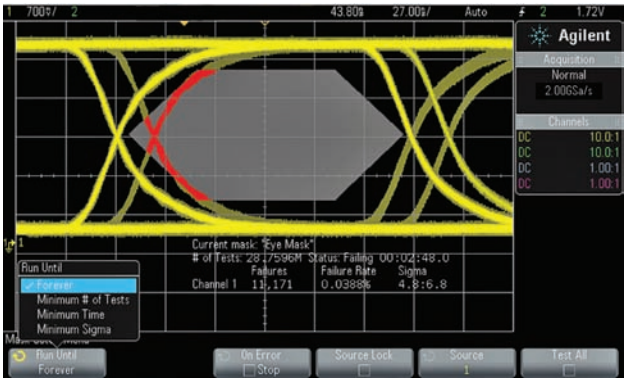
See page 21 for more information on upgradable products.

Add at the time of your purchase or upgrade later:

- Bandwidth
- Digital channels (MSO)
- WaveGen built-in 20 MHz function generator
- Integrated digital voltmeter (DVM)
- Serial protocol analysis
- Measurement applications
  - Mask testing
  - Segmented memory
  - Educators' lab kit

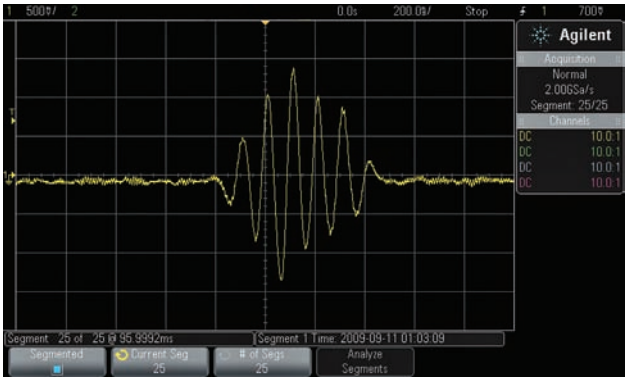
Mask testing

Whether performing pass/fail tests to specified standards in manufacturing or testing for infrequent signal anomalies in R&D debug, the mask test option can be a valuable productivity tool. The 2000 X-Series features hardware-based mask testing and can perform up to 50,000 tests per second.



Segmented memory

When capturing low-duty cycle pulses or data bursts, you can use segmented memory acquisition to optimize acquisition memory. Segmented memory acquisition lets you selectively capture and store important segments of signals without capturing unimportant signal idle/dead-time. Segmented memory acquisition is ideal for applications including packetized serial pulses, pulsed laser, radar bursts and high-energy physics experiments. Up to 25 segments can be captured on the 2000 X-Series models with a minimum re-arm time under 19 µs.



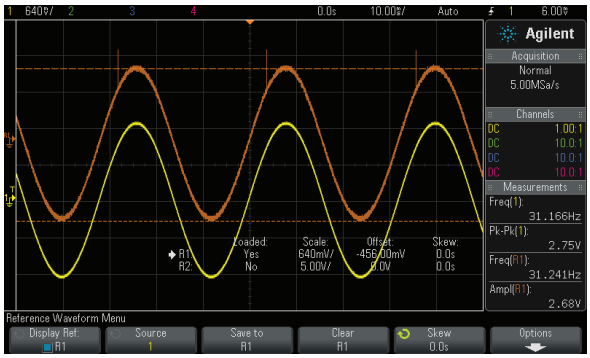
30-day trial license

The 2000 X-Series comes with a one-time 30-day all-optional-features trial license. You can choose to start the 30-day trial at any time. In addition you can redeem individual optional feature 30-day trial licenses at any time by visiting www.agilent.com/find/30daytrial. This enables you to receive in effect 60 days of trial license of each optional feature.

Other productivity tools

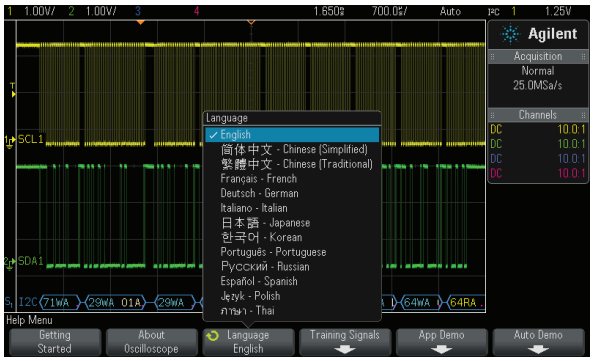
Reference waveforms

Store up to two waveforms in the scope's non-volatile reference waveform memory locations. Compare these reference waveforms with live waveforms, and perform post analysis and measurements of stored data. You can also store waveform data on a removable USB memory device that can be recalled back into one of the available two reference memories of the scope for full waveform measurement and analysis. Save and/or transfer waveforms as XY data pairs in a comma-separated values format (*.csv) for PC analysis. Save screen images to a PC for documentation purposes in a variety of formats including: 8-bit bitmaps (*.bmp), 24-bit bitmaps (*.bmp), and PNG 24-bit images (*.png).



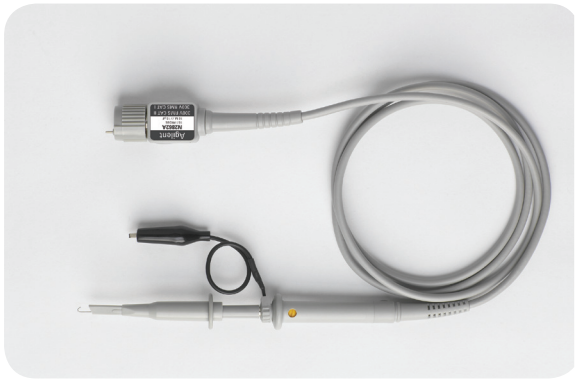
Localized GUI and help

Operate the scope in the language most familiar to you. The graphical user interface, built-in help system, front panel overlays, and user's manual are available in 13 languages. Choose from: English, Japanese, simplified Chinese, traditional Chinese, Korean, German, French, Spanish, Russian, Portuguese, Thai, Polish and Italian. During operation, access the built-in help system just by pressing and holding any button.



Probe solutions

Get the most out of your 2000 X-Series scope, by using the right probes and accessories for your application. Agilent offers a complete family of innovative probes and accessories for the InfiniiVision 2000 X-Series scopes. For the most up-to-date and complete information about Agilent's probes and accessories, please visit our Web site at www.agilent.com/find/scope_probes.



Autoscale

Quickly display any active signals and automatically set the vertical, horizontal and trigger controls for optimal viewing with the press of the autoscale button. (This feature can be disabled or enabled for the education environment via a USB thumb drive file with a SCPI remote command).

Other productivity tools

Connectivity and LXI Compatibility

Built-in USB host (one front, one back) and USB device ports make PC connectivity easy. Operate the scope from your PC and save and recall stored waveforms as well as set-up files via LAN. An optional LAN/VGA module gives you network connectivity and complete LXI class C support as well as the ability to connect to an external monitor. An optional GPIB module is also available. Only one module may be used at a time.

Intuilink toolbars and Data Capture gives you a quick way to move screen shots and data into Microsoft Word® and Excel. These toolbars can be installed from www.agilent.com/find/intuilink

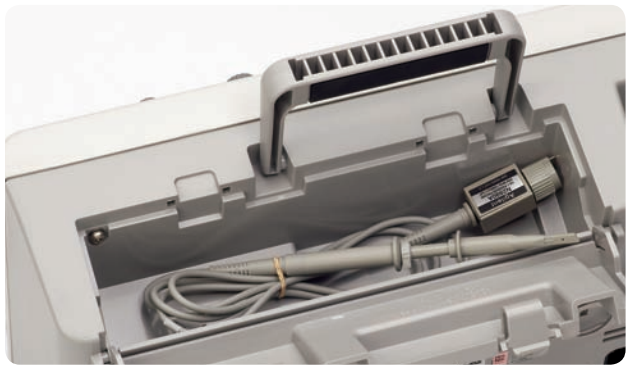
View Scope enables simple and free time-correlated measurements between a 2000 X-Series oscilloscope and an Agilent 16900, 16800, 1690 or 1680 Series logic analyzer.

Virtual Front Panel

In addition to the traditional VNC virtual front panel remote operation through your favorite PC Web browser, the InfiniiVision X-Series supports remote oscilloscope control from your tablet devices. The tablet virtual front panel looks and acts as the real front panel on the oscilloscope. Control the setting, save/recall data, get image, and more.

Secure erase

The secure erase feature comes standard with all InfiniiVision X-Series models. At the press of a button, internal nonvolatile memory is clear of all setup, reference waveforms, and user preferences, ensuring the highest level of security in compliance with National Industrial Security Program Operation Manual (NISPOM) Chapter 8 requirements.



Other productivity tools

InfiniiView Oscilloscope Analysis Software (N8900A)

Agilent's InfiniiView PC-based analysis oscilloscope software allows you to do additional signal viewing, analysis and documentation tasks away from your scope. Capture waveforms on your scope, save to a file, and recall the waveforms into InfiniiView. The application supports a variety of popular waveform formats from multiple oscilloscope vendors and includes the following features:

Navigate

- Pan and zoom to anywhere in the data record. Navigate in time, or between bookmarks.

View

- Up to 8 waveforms simultaneously, 1, 2, or 4 grids (stacked, side by side, custom layout, zoom)

Measurements

- Over 50 automated measurements
- View up to 20 simultaneously
- User-customizable result window (size, position, information)
- X & Y markers with dynamic delta values

Analyze

- 20 math operators including FFT and filters
- Up to four independent/cascaded math functions
- Measurement histogram

View Windows

- Analog, math, spectral, measurement results (simultaneous, tabbed, or undocked)

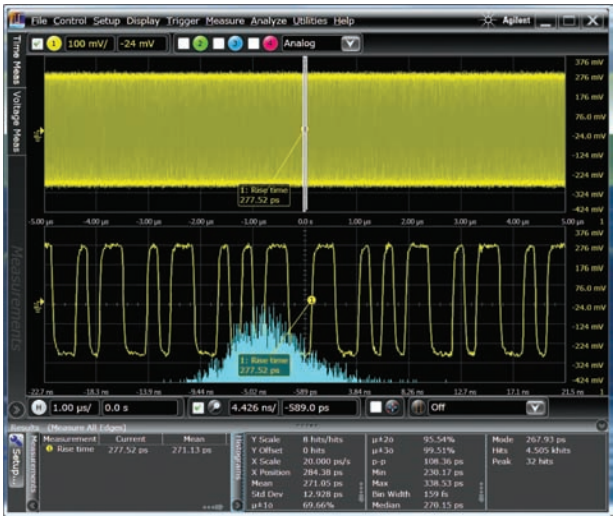
Documentation

- Right-click to copy
- Up to 100 bookmarks
- Annotated axis values
- Markers with dynamic delta value updates when moved
- One step save/load setup and all waveforms

Analysis Upgrades (Optional)

- Protocol decode for I^2C/SPI, RS232/UART, CAN/ LIN/FlexRay, SATA, 8B/10B, digRF v4, JTAG , MIPI D-Phy, SVID, Ethernet 10G KR, PCIe 1, 2, 3, USB 2, 3, HSIC
- Jitter analysis
- Serial data analysis

View and analyze away from your scope and target system



Use familiar scope controls to quickly navigate and zoom in to any event of interest.

Add bookmarks and call outs to produce friendly and useful documentation.

Other productivity tools

Agilent Spectrum Visualizer (ASV) Software

This PC-based software package connects to the scope via USB or ethernet connection and uses the Agilent I/O libraries to communicate. It provides advanced FFT frequency domain analysis at a cost-effective price as well as spectrum and spectrogram analysis with an intuitive user interface that RF engineers are familiar with. Tools include:

Spectrum Measurements

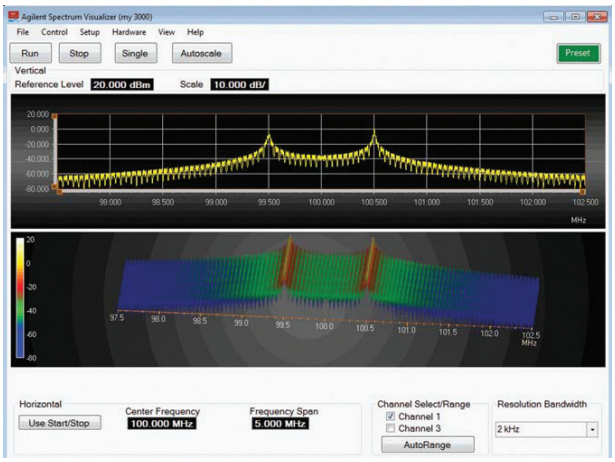
- Power (dBm) vs. frequency
- Horizontal (x-axis): Specify center frequency and frequency span, or start and stop frequencies
- Vertical (y-axis): Specify reference level (dBm) and scale (dB/div)
- Settable resolution bandwidth
- Flat top, Gaussian, or Hanning windows applied to the time domain data for the FFT analysis
- Marker to peak amplitude, and marker to center frequency.
- Marker peak search can be enabled for time-varying signals
- Multiple marker, with delta X and delta Y readouts

Acquisition and Display Modes

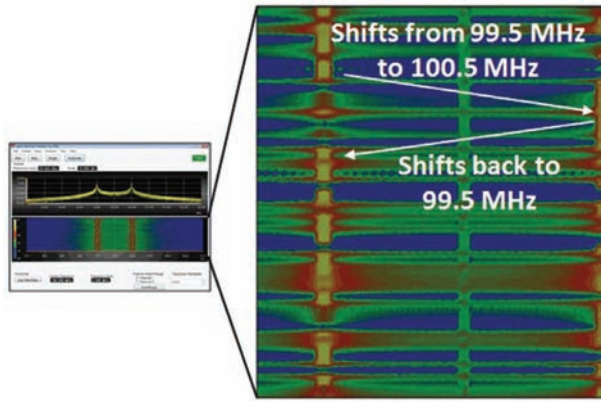
- Free Run (continuous), Triggered, Stop, Single, Preset
- Triggered mode: specify trigger power level (dBm), single or continuous sweep
- Enable/disable y-axis label
- Enable/disable main trace display
- Max hold display mode
- Gated Measurements
- Multiple viewing options
  - Spectrogram
  - waterfall
  - 3D
- Changeable scaling settings on main window
- Local language support
- Multiple oscilloscopes can be configured to allow user to rapidly switch between multiple instruments

Arbitrary Waveform Generator Source Control

- 20 MHz sine wave
- 10 MHz square wave
- Pulsed waveform
- WaveGen source settings can be altered while ASV is running for interactive signal source and analysis capability



Waterfall View for ASV Spectrogram Measurement



Close-Up Detail on Frequency Shift Keying (FSK) Characteristics with the ASV Spectrogram Measurement

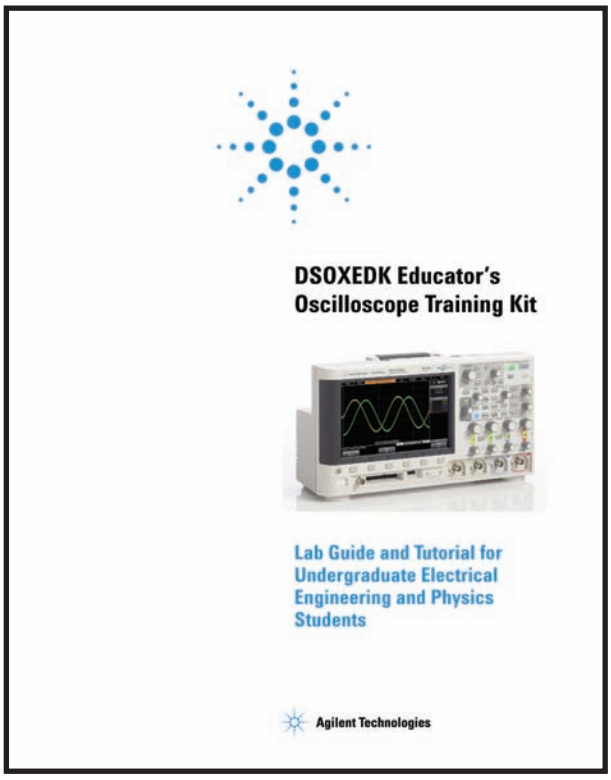
Designed with education in mind

Quickly and easily set up or upgrade a teaching lab

Teach your students what an oscilloscope is and how to perform basic measurements with the Educator's Oscilloscope Training Kit (DSOXEDK). It includes training tools created specifically for electrical engineering and physics undergraduate students and professors. It contains an array of built-in training signals, a comprehensive oscilloscope lab guide and tutorial written specifically for the undergraduate student, and an oscilloscope fundamentals PowerPoint slide set for professors and lab assistants. For more information, refer to www.agilent.com/find/EDK. Also available are DreamCatcher's full semester application-specific courseware written around Agilent test and measurement equipment: www.dreamcatcher.asia/cw. With features such as the ability to disable autoscale and the 50- Ohm input data path, the InfiniiVision X-Series is a perfect choice for education.

Get your students to quickly put the scope to work

Intuitive localized front panel design with pushable knobs for quick access to commonly used oscilloscope functions helps students spend more time learning the concepts and less time learning how to use the oscilloscope. Enable your students to answer their own questions with the localized built-in help system that provides quick access by simply pressing and holding any button.



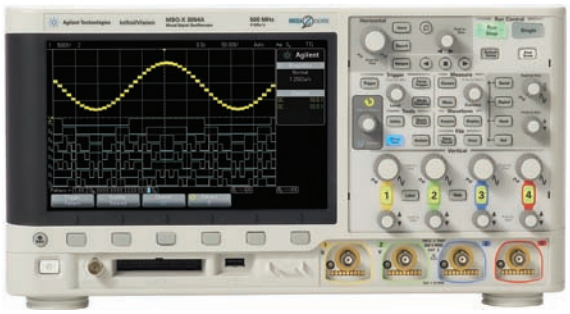
Stretch your budget over the long term

Save money with an industry-exclusive built-in 20 MHz WaveGen, instead of a separate function generator. Buy what you need today and protect your investment in the future with the only oscilloscopes in this class with upgradable bandwidth, 8 digital channels (MSO), WaveGen, integrated digital voltmeter and measurement applications. Get long scope life and keep repair costs to a minimum with a standard 5-year warranty*, and an instrument reliability you've come to expect from the leader in test and measurement equipment.

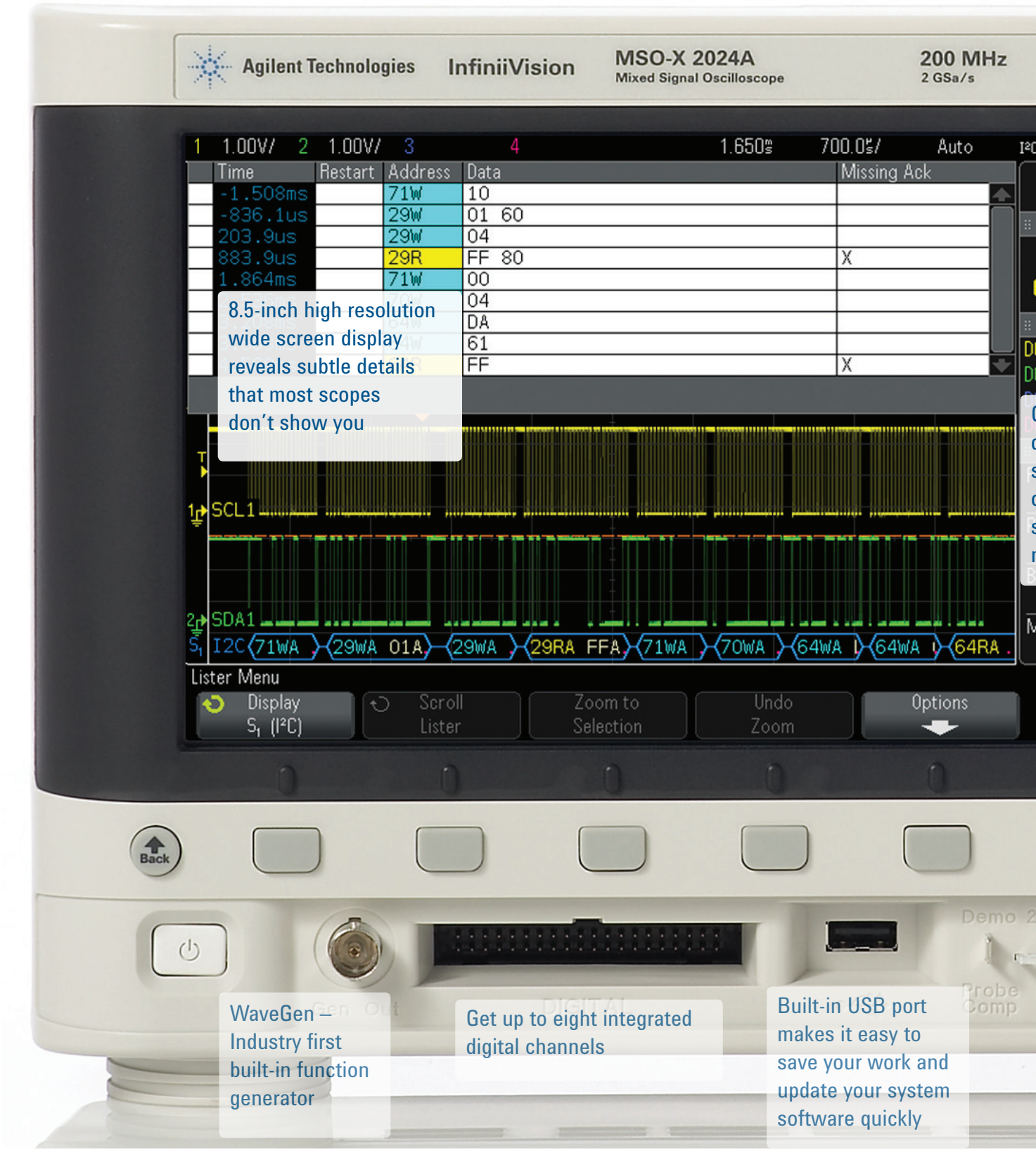
*Applies to new oscilloscopes bought after April 3, 2013.

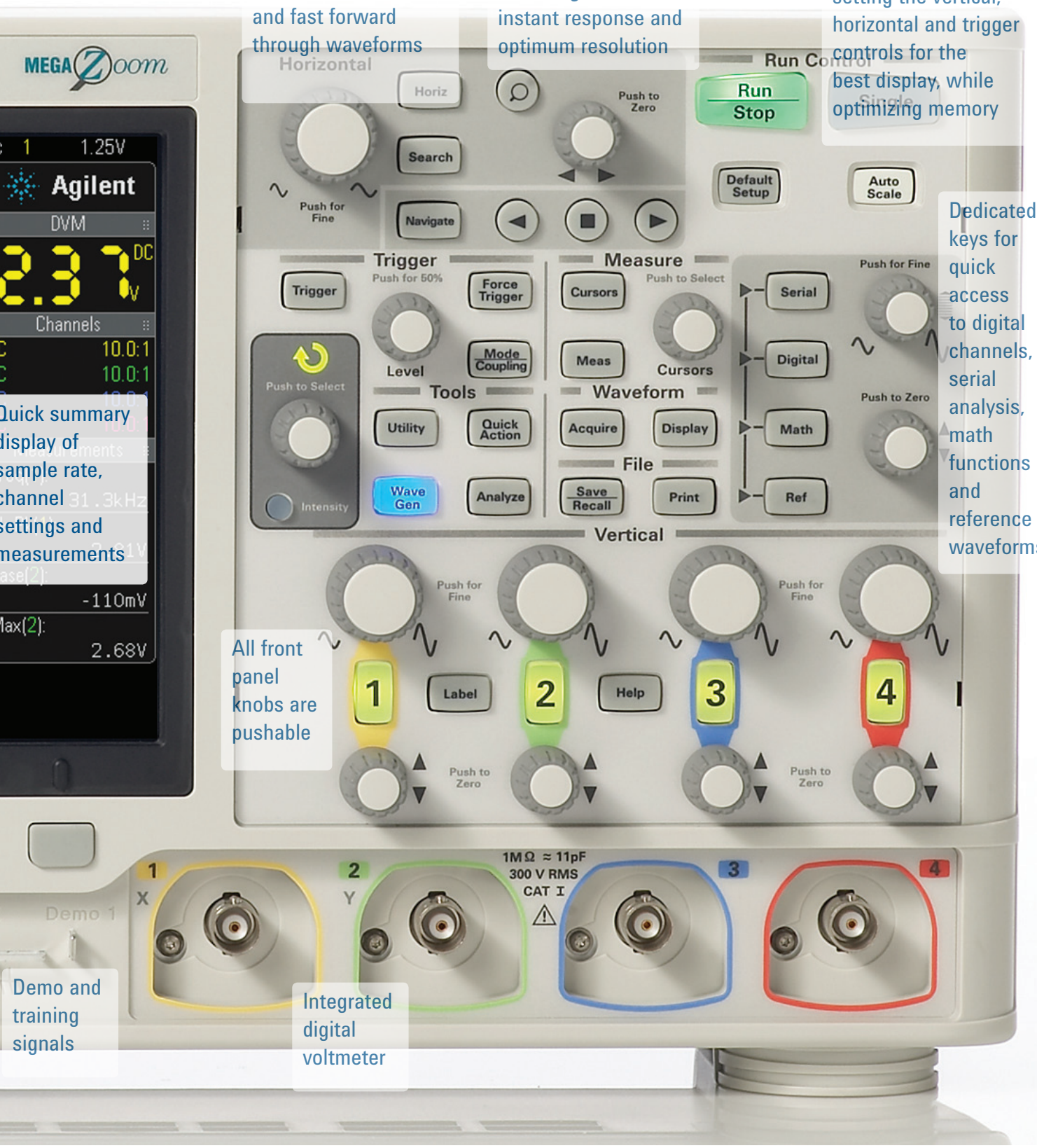
Optimize lab bench space

With 5 instruments in 1, you will save on precious lab bench space by getting an oscilloscope, logic timing analyzer, serial protocol analyzer, WaveGen function generator and integrated digital voltmeter all in one innovative instrument with a footprint that is only 5.57 inches deep. With the large 8.5-inch WVGA display, you can easily view all signals on one screen with enough viewing area for more than one student to view.



Oscilloscope shown actual size




Navigation front panel controls make it easy to play, stop, rewind and fast forward through waveforms
Quickly pan and zoom for analysis with *MegaZoom* IV's instant response and optimum resolution
Autoscale lets you quickly display any analog or digital active signals, automatically setting the vertical, horizontal and trigger controls for the best display, while optimizing memory
Dedicated keys for quick access to digital channels, serial analysis, math functions and reference waveforms
Quick summary display of sample rate, channel settings and measurements
All front panel knobs are pushable
Demo and training signals
Integrated digital voltmeter
MEGAZoom
Agilent
DVM
Channels
Horizontal
Horiz
Search
Navigate
Push to Zero
Push for Fine
Run Control
Run
Stop
Single
Default Setup
Auto Scale
Trigger
Trigger
Push for 50%
Force Trigger
Level
Mode Coupling
Measure
Cursors
Push to Select
Meas
Cursors
Serial
Digital
Math
Ref
Push for Fine
Push to Zero
Push to Select
Intensity
Tools
Utility
Quick Action
Wave Gen
Analyze
Waveform
Acquire
Display
File
Save Recall
Print
Vertical
Push for Fine
Label
Help
1
2
3
4
Push to Zero
1MΩ ≈ 11pF
300 V RMS
CAT I
X
Y
Demo 1

Oscilloscopes redefined: Breakthrough technology delivers more scope for the same budget

Configuring your InfiniiVision X-Series oscilloscope

Step 1. *Choose your bandwidth and channel count.*

InfiniiVision 2000 X-Series scopes							
		2002A	2004A	2012A	2014A	2022A	2024A
Bandwidth* (–3 dB)		70 MHz		100 MHz		200 MHz	
Calculated rise time (10-90%)		≤ 5 ns		≤ 3.5 ns		≤ 1.75 ns	
Input channels	DSOX	2	4	2	4	2	4
	MSOX	2 + 8	4 + 8	2 + 8	4 + 8	2 + 8	4 + 8

* For example, if you chose 100 MHz, 2+8 channels, the model number will be MSOX2014A.

Step 2. *Tailor your scope with measurement applications to save time and money*[1]

Application	2000 X-Series
1 Megapoint memory upgrade	DSOX2MEMUP (-040)
Embedded serial triggering and analysis (I^2C, SPI)	DSOX2EMBD (-LSS)
Computer serial triggering and analysis (RS232/422/485/UART)	DSOX2COMP (-232)
Automotive serial triggering and analysis (CAN, LIN)	DSOX2AUTO (-AMS)
WaveGen (built-in function generator)	DSOX2WAVEGEN (-001)
Integrated digital voltmeter	DSOXDVM (-DVM)
Educator's kit	DSOXEDK (-EDK)
Mask testing	DSOX2MASK (-LMT)
Segmented memory	DSOX2SGM (-SGM)
InfiniView oscilloscope analysis software	N8900A
Agilent spectrum visualizer (ASV)	64997A

1. See pages 20-21 for more detailed information on upgradability, and installation process.

Step 3. *Choose your probes*[2]

Probes	2000 X-Series
N2862B 150 MHz 10:1 passive probe	Standard one per channel for 70 and 100 MHz models
N2863B 300 MHz, 10:1 passive probe	Standard one per channel for 200 MHz models
N6459-60001 8-channel logic probe and accessory kit	Standard on MSO models or with DSOX2MSO upgrade
N2889A 350 MHz 10:1/1:1 passive probe	Optional
10070D 20 MHz 1:1 passive probe with probe ID	Optional
10076A 250 MHz 100:1, 4 kV high-voltage passive probe with probe ID	Optional
N2791A 25 MHz, ±700 V high-voltage differential probe	Optional
N2792A 200 MHz 10:1 differential probe	Optional
1146A 100 kHz, 100 A, AC/DC current probe	Optional

2. See page 20 for probe compatibilty table. For more information on probes and accessories, see the Agilent literature 5968-8153EN

Step 4. *Add the final touches.*

Recommended accessories	2000 X-Series
LAN/VGA connection module	DSOXLAN
GPIB connection module	DSOXGPIB
Rack mount kit	N6456A
Soft carrying case and front panel cover	N6457A
Hard copy manual	N6458A
Front panel cover (only)	N2747A

Oscilloscopes redefined: Breakthrough technology delivers more scope for the same budget

Performance characteristics

Specification overview

		2002A	2004A	2012A	2014A	2022A	2024A
Bandwidth * (–3 dB)		70 MHz		100 MHz		200 MHz	
"Calculated rise time (10-90%)"		≤ 5 ns		≤ 3.5 ns		≤ 1.75 ns	
Input channels	DSOX	2	4	2	4	2	4
	MSOX	2 + 8	4 + 8	2 + 8	4 + 8	2 + 8	4 + 8
Maximum sample rate		2 GSa/s half-channel interleaved, 1 GSa/s per channel					
Maximum memory depth		100 kpts per channel (standard), 1 Mpt per channel (optional with DSOX2MEMUP)					
Display size and type		8.5-inch WVGA with 64 levels of intensity grading					
Waveform update rate		> 50,000 waveforms per second					

Vertical system analog channels

Input coupling		AC, DC
Input sensitivity range		1 mV/div to 5 V/div**
Input impedance		1 MΩ ± 2% (11 pF)
Vertical resolution		8 bits
Dynamic range		±8 divisions from center screen
Maximum input voltage		CAT I 300 Vrms, 400 Vpk; transient overvoltage 1.6 kVpk
		CAT II 300 Vrms, 400 Vpk; with N2862B or N2863B 10:1 probe: 300 Vrms
DC vertical accuracy		±[DC vertical gain accuracy + DC vertical offset accuracy + 0.25% full scale] **
DC vertical gain accuracy*		±3% full scale (≥ 10 mV/div); ±4% full scale (< 10 mV/div) **
DC vertical offset accuracy		±0.1 div ± 2mV ±1% of offset setting
Channel-to-channel isolation	200 MHz ~ 1 GHz	≥ 40 dB from DC to maximum specified bandwidth of each model
	1.5 GHz	≥ 40 dB from DC to 1 GHz, ≥ 35 dB from 1 GHz to 1.5 GHz
Position/offset range	1 MΩ	1 mV to 200 mV/div: ±2 V, > 200 mV to 5 V/div: ± 50V
Hardware bandwidth limits		Approximately 20 MHz (selectable)

Horizontal system analog channels

		2002A	2004A	2012A	2014A	2022A	2024A
Time base range		5 ns/div to 50 s/div			2 ns/div to 50 s/div		
Horizontal resolution		2.5 ps					
Time base accuracy*		25 ppm ±5 ppm per year (aging)					
Time base delay time range	Pre-trigger	Greater of 1 screen width or 200 µs (400 µs in interleaving mode)					
	Post-trigger	1 s to 500 s					
Channel-to-channel deskew range		± 100 ns					
Δ Time accuracy (using cursors)		± (time base accuracy* reading) ± (0.0016 * screen width) ± 100 ps					

* Denotes warranted specifications, all others are typical.
Specifications are valid after a 30-minute warm-up period and from ±10 °C firmware calibration temperature.
** 1 mV/div and 2 mV/div is a magnification of 4 mV/div setting. For vertical accuracy calculations, use full scale of 32 mV for 1 mV/div and 2 mV/div sensitivity setting.

Performance characterisitics

Acquisition modes

Normal	
Peak detect	Capture glitch as narrow as 500 ps at all timebase settings.
Averaging	Select from 2,4,8,16, 64... to 65,536
High resolution mode	12 bits of resolution when ≥ 20 µs/div
Segmented	Re-arm time= 19 µs (minimum time between trigger events)

Trigger system

Trigger modes	• Normal (triggered): requires trigger event for scope to trigger • Auto: triggers automatically in absence of trigger event • Single: triggers only once on a trigger event, press **[Single]** again for scope to find another trigger event, or press **[Run]** to trigger continuously in either Auto or Normal mode • Force: front panel button that forces a trigger
Trigger coupling	Coupling selections: AC, DC, noise reject, LF reject and HF reject.
Trigger source	Each analog channel, each digital channel (MSO models or DSOX2MSO upgrade, Ext, WaveGen, line)
Trigger sensitivity (internal)*	< 10 mV/div: greater of 1 div or 5 mV; ≥ 10 mV/div: 0.6 div
Trigger sensitivity (external)*	200 mV (DC to 100 MHz); 350 mV (100 MHz - 200 MHz)
External trigger input	Included on all models

Trigger type selections

	All 2000 X-Series models
Edge	Trigger on a rising, falling, alternating or either edge of any source
Pulse width	Trigger on a pulse on a selected channel, whose time duration is less than a value, greater than a value, or inside a time range • Minimum duration setting: 2 ns- 10 ns (depends on bandwidth) • Maximum duration setting: 10 s
Pattern	Trigger when a specified pattern of high, low, and don't care levels on any combination of analog, digital, or trigger channels is [entered | exited]. Pattern must have stabilized for a minimum of 2 ns to qualify as a valid trigger condition.
Video	Trigger on all lines or individual lines, odd/even or all fields from composite video, or broadcast standards (NTSC, PAL, SECAM, PAM-M)
I²C (optional)	Trigger on I²C (Inter-IC bus) serial protocol at a start/stop condition or user defined frame with address and/or data values. Also trigger on missing acknowledge, address with no accq, restart, EEPROM read, and 10-bit write.
SPI (optional)	Trigger on SPI (Serial Peripherial Interface) data pattern during a specific framing period. Supports positive and negative Chip Select framing as well as clock Idle framing and userspecified number of bits per frame.
CAN (optional)	Trigger on CAN (controller area network) version 2.0A and 2.0B signals. Trigger on the start of frame (SOF) bit (standard). Remote frame ID (RTR), data frame ID (~RTR), remote or data frame ID, data frame ID and data, error frame, all errors, acknowledge error and overload frame.
LIN (optional)	Trigger on LIN (Local Interconnect Network) sync break, sync frame ID, or frame ID and data.
RS232/422/485/UART (optional)	Trigger on Rx or Tx start bit, stop bit or data content

* Denotes warranted specifications, all others are typical.
Specifications are valid after a 30-minute warm-up period and from ±10 °C firmware calibration temperature.

Performance characterisitics

Cursors	
Types	Amplitude, time , frequency (FFT), manual, tracking, binary, HEX
Measurements	ΔT, 1/ΔT, ΔV/X, 1/ΔX, ΔY, Phase and Ratio
Cursors**	• Single cursor accuracy: ±[DC vertical gain accuracy + DC vertical offset accuracy + 0.25% full scale] • Dual cursor accuracy: ±[DC vertical gain accuracy + 0.5% full scale]*

Automatic waveforms measurements	
Voltage	Snapshot all, maximum, minimum, peak-to-peak, top, base, amplitude, overshoot, preshoot, average- N cycles, average-full screen, DC RMS- N cycles, DC RMS- full screen, AC RMS- N cycles
Time	Period, frequency, rise time, fall time, + width, – width, duty cycle, delay A→B (rising edge), delay A→B (falling edge), phase A→B (rising edge,) and phase A→B (falling edge)

Waveform math	
Operators	Add, subtract, multiply, FFT
FFT	Windows: Hanning, flat top, rectangular; Blackman-Harris - up to 64 kpts resolution
Sources	Math functions available between any two channels

Display characteristics	
Display	8.5-inch WVGA
Resolution	800 (H) x 480 (V) pixel format (screen area)
Interpolation	Sin(x)/x interpolation (using FIR filter; used when there is less than one sample per column of the display)
Persistence	Off, infinite, variable persistence (100ms-60s)
Intensity gradation	64 intensity levels
Modes	Normal XY - XY mode changes the display from voltage versus time scale to a volts versus volts scale Roll – Displays the waveform moving across the screen from right to left much like a strip chart recorder

MSO (digital channels)	
Upgradable from DSO	Yes
MSO channels	8 channels (D0 to D7)
Maximum sample rate	1 GSa/s
Maximum record length	50 kpts per channel (digital channels only) 12.5 kpts per channel (analog and digital channels)
Threshold selections	TTL (+1.4 V), CMOS (+2.5 V), ECL (-1.3 V), User-definable (±8.0 V in 10 mV stops)
Threshold accuracy*	± (100 mV + 3% of threshold settings)
Maximum input dynamic range	±10 V about threshold
Minimum voltage swing	500 mVpp
Input impedance	100 kΩ ± 2% at probe tip, ~8 pF
Minimum detectable pulse width	5 ns
Channel-to-channel skew	2 ns (typical), 3 ns (maximum)

* Denotes warranted specifications, all others are typical.
Specifications are valid after a 30-minute warm-up period and from ±10 °C firmware calibration temperature.

** 1 mV/div and 2 mV/div is a magnification of 4 mV/div setting. For vertical accuracy calculations, use full scale of 32 mV for 2 mV/div sensitivity setting.

Performance characteristics

WaveGen – built-in function generator	
Waveforms	Sine, square, pulse, triangle, ramp, noise, DC
Sine	• Frequency range: 0.1 Hz to 20 MHz • Amplitude flatness: ±0.5 dB (relative to 1 kHz) • Harmonic distortion: –40 dBc • Spurious (non harmonics): –40 dBc • Total harmonic distortion: 1% • SNR (50 ohm load, 500 MHz BW) : 40 dB (Vpp ≥ 0.1 V); 30 dB (Vpp <0.1 V)
Square wave/pulse	• Frequency range: 0.1 Hz to 10 MHz • Duty cycle: 20 to 80% • Duty cycle resolution: Larger of 1% or 10 ns • Pulse width: 20 ns minimum • Pulse width resolution: 10 ns or 5 digits, whichever is larger • Rise/fall time: 18 ns (10 to 90%) • Overshoot: < 2% • Asymmetry (at 50% DC): ±1% ± 5 ns • Jitter (TIE RMS): 500 ps
Ramp/triangle wave	• Frequency range: 0.1 Hz to 100 kHz • Linearity: 1% • Variable symmetry: 0 to 100% • Symmetry resolution: 1%
Noise	Bandwidth: 20 MHz typical
Frequency	• Sine wave and ramp accuracy: ◦ 130 ppm (frequency < 10 kHz) ◦ 50 ppm (frequency > 10 kHz) • Square wave and pulse accuracy: ◦ [50+frequency/200] ppm (frequency < 25 kHz) ◦ 50 ppm (frequency ≥ 25 kHz) • Resolution: 0.1 Hz or 4 digits, whichever is larger
Amplitude	• Range: ◦ 20 mVpp to 5 Vpp into Hi-Z ◦ 10 mVpp to 2.5 Vpp into 50 ohms • Resolution: 100 µV or 3 digits, whichever is larger • Accuracy: 2% (frequency = 1 kHz)
DC offset	• Range: ◦ ±2.5 V into Hi-Z ◦ ±1.25 V into 50 ohms • Resolution: 100 µV or 3 digits, whichever is larger • Accuracy: ±1.5% of offset setting ±1.5% of amplitude ±1 mV
Trigger output	Trigger output available on Trig out BNC

Performance characteristics

WaveGen – built-in function generator *(Continued)*

Modulation	Modulation types: AM, FM, FSK Carrier waveforms: sine, ramp Modulation source: Internal (no external modulation capability) AM: Modulation waveform: sine, square, ramp Modulation frequency (1Hz to 20 kHz) Depth: 0% to 100% FM: Modulation: sine, square, ramp (1 Hz to 20 kHz) Modulation frequency (1 Hz to 20 kHz) Minimum carrier frequency: 10 kHz Minimum deviation: 1 Hz Maximum deviation: 100 kHz or (carrier frequency - 9 kHz), whichever is smaller. FSK: Modulation: 50% duty cycle square wave FSK rate: 1 Hz to 20 kHz Minimum carrier frequency: 10 kHz Minimum hop frequency: 2 * FSK rate

Integrated Digital Voltmeter

Functions	ACrms, DC, DCrms, Frequency
Resolution	ACV/DCV: 3 digits Frequency: 5.5 digits
Measuring rate	100 times/ second
Autoranging	Automatic adjustment of vertical amplification to maximize the dynamic range of measurements.
Range meter	Graphical display of most recent measurement, plus extrema over the previous 3 seconds.

Measurement Range

	Frequency Range	Vertical Range	Vertical Accuracy
ACRms	20 Hz - 100 KHz	100 MHz to 500 MHz: 1 mV/div to 5 V/div** (1 MΩ and 50 Ohm) 1 GHz model: 1 mV/div to 5 V/div** (1 MΩ), 1mV/div to 1V/div (50 Ohm)	[DC vertical gain accuracy + 0.5% full scale
DCRms	20 Hz - 100 KHz		[DC vertical gain accuracy + DC vertical offset accuracy + 0.25% full scale]
DC	NA		[DC vertical gain accuracy + DC vertical offset accuracy + 0.25% full scale]
Frequency counter	1Hz – BW of Scope	<10 mV/div: greater of 1 div or 5 mV; ≥ 10 mV/div: 0.6 div	25 ppm ± 5 ppm per year (aging)

InfiniiVision X-Series physical characteristics

Connectivity

Standard ports	One USB 2.0 hi-speed device port on rear panel. Supports USBTMC protocol. Two USB 2.0 hi-speed host ports, front and rear panel Supports memory devices and printers
Optional ports	GPIB, LAN, WVGA video out

General and environmental characteristics

Power line consumption	100 watts
Power voltage range	100-120V, 50/60/400 Hz; 100-240V, 50/60 Hz ±10% auto ranging
Temperature	Operating: 0 to +55 °C Non-operating: –30 to +71 °C
Humidity	Operating: Up to 80% RH at or below +40 °C; up to 45% RH up to +50 °C Non-operating: Up to 95% RH up to 40 °C; up to 45% RH up to 50 °C
Altitude	Operating: up to 4,000 m, Non-operating 15,300 m
Electromagnetic compatibility	Meets EMC Directive (2004/108/EC), meets or exceeds IEC 61326-1:2005/EN 61326-1:2006 Group 1 Class A requirement CISPR 11/EN 55011 IEC 61000-4-2/EN 61000-4-2 IEC 61000-4-3/EN 61000-4-3 IEC 61000-4-4/EN 61000-4-4 IEC 61000-4-5/EN 61000-4-5 IEC 61000-4-6/EN 61000-4-6 IEC 61000-4-11/EN 61000-4-11 Canada: ICES-001:2004 Australia/New Zealand: AS/NZS
Safety	UL61010-1 2nd edition, CAN/CSA22.2 No. 61010-1-04
Dimensions	381 mm (15 in) W x 204 mm (8 in) H x 142 mm (5.6 in) D
Weight	Net: 3.9 kg (8.5 lbs), shipping: 4.1 kg (9.0 lbs)

Nonvolatile storage

Reference waveform display	2 internal waveforms or USB thumb drive
Waveform storage	Set up, .bmp, .png, .csv, ASCII, XY, reference waveforms, .alb, .bin, lister, mask , HDFS
Max USB flash drive size	Supports industry standard flash drives
Set ups without USB flash drive	10 internal setups
Set ups with USB flash drive	Limited by size of USB drive

Included standard with oscilloscope

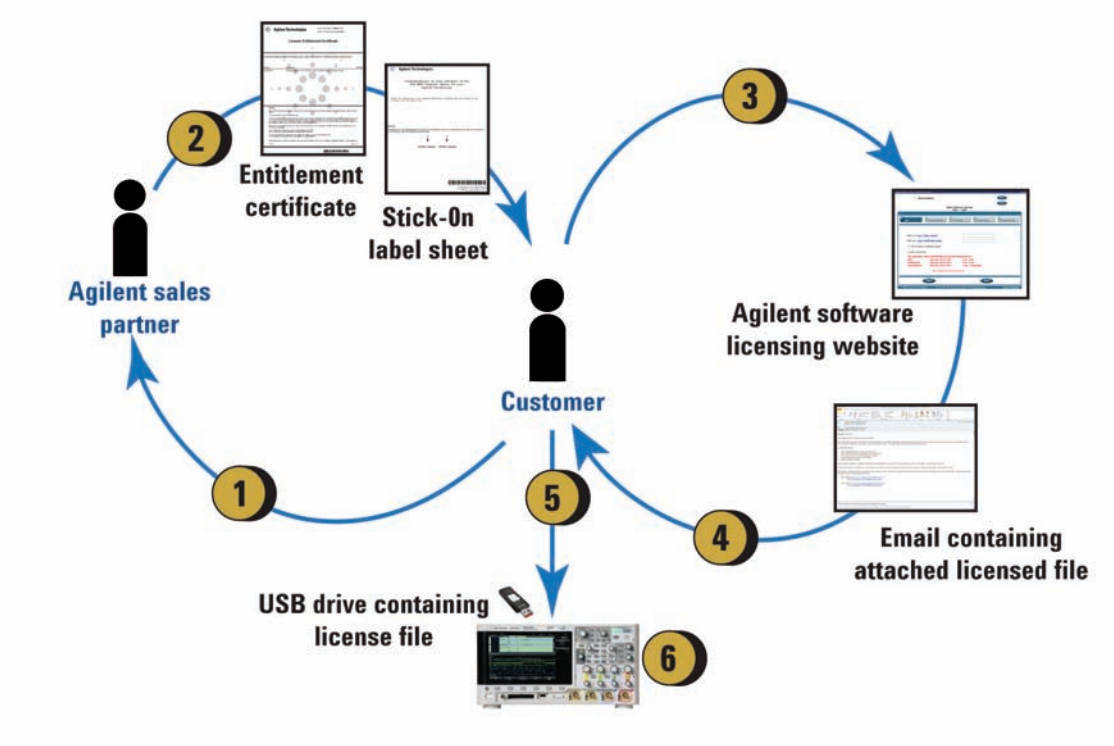
Standard 5-year warranty*	
Standard secure erase	
Standard Probe	
N2862B 150 MHz 10:1 passive probe	Standard one per channel for 70 and 100 MHz models
N2863B 300 MHz, 10:1 passive probe	Standard one per channel for 200 MHz models
N6459-60001 8-channel logic probe and accessory kit	Standard on MSO models or with DSOX2MSO upgrade
Built-in help language support for English, Japanese, simplified Chinese, traditional Chinese, Korean, German, French, Spanish, Russian, Portuguese and Italian, Certificate of Calibration, Documentation CD	
Interface language support GUI menus: English, Japanese, simplified Chinese, traditional Chinese, Korean, German, French, Spanish, Russian, Portuguese, Thai, Polish and Italian	
Localized power cord	

*Applies to new oscilloscopes bought after April 3, 2013.

For MET/CAL procedures, click on the Cal Labs solutions link below Cal Labs Solutions
http://www.callabsolutions.com/MetCALandCLS.asp
These procedures are FREE to customers.

Oscilloscopes redefined: Breakthrough technology delivers more scope for the same budget

License-only bandwidth upgrades and measurement applications



Bandwidth upgrade models

2000 X-Series

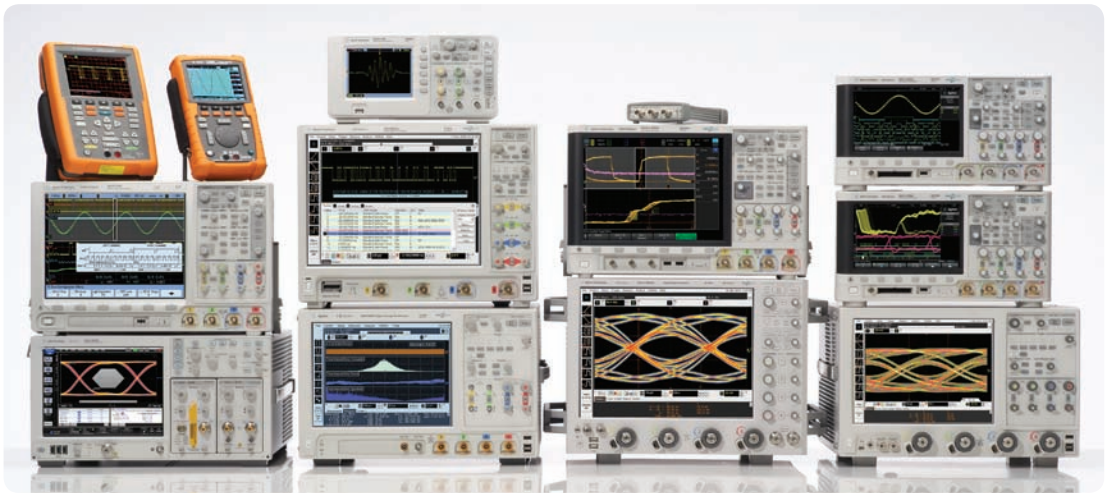
DSOX2BW12	70 MHz to 100 MHz, 2 ch, License only
DSOX2BW14	70 MHz to 100 MHz, 4 ch, License only
DSOX2BW22	100 MHz to 200 MHz, 2 ch, License only
DSOX2BW24	100 MHz to 200 MHz, 4 ch, License only

Measurement applications

DSOX2MEMUP	Upgrade to 1 Mpts per channel
DSOX2COMP	Computer serial triggering and analysis (RS232/422/485/UART)
DSOX2AUTO	Automotive serial triggering and analysis (CAN, LIN)
DSOX2EMBD	Embedded serial triggering and analysis (I^2C, SPI)
DSOX2WAVEGEN	WaveGen (built-in function generator)
DSOXDVM	Integrated digital voltmeter
DSOXEDK	Educator's kit
DSOX2MASK	Mask testing
DSOX2SGM	Segmented memory
DSOX2MSO	Upgrade to 8 digital timing channels

Process description

1. Place order for a license only bandwidth upgrade or measurement appliction product to an Agilent sales partner. If multiple bandwidth upgrade steps are needed, order all the corresponding upgrade products required to get from current bandwidth to desired bandwidth. In the case where the new bandwidth requires higher bandwidth passive probes, they are included with the upgrade. For the DSOX2BW22 and DSOX2BW24, the N2863B 10:1 300 MHz passive probes (1 per channel) will be sent with the upgrade.
2. Receive a paper or electronic .pdf Entitlement Certificate document for any of the orderable measurement applications For bandwidth upgrades only, you receive a stick-on label document indicating upgraded bandwidth specification.
3. Use Entitlement Certificate or electronic .pdf document containing instructions and certificate number needed to generate a license file for a particular 2000 or 3000 X-Series oscilloscope model number and serial number unit.
4. Receive the licensed file and installation instructions via email.
5. Copy license file (.lic extension) from email to a USB drive and follow instructions in email to install the purchased bandwidth upgrade or measurement application on the oscilloscope.
6. For bandwidth upgrades only, attach bandwidth upgraded stick-on labels to front and rear panels of the oscilloscope. Model number and serial number of the oscilloscope do not change.



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Revised: October 11, 2012

Product specifications and descriptions in this document subject to change without notice.

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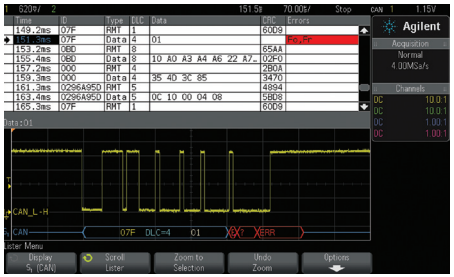
5990-6618EN

Agilent Technologies

Quick Fact Sheet

InfiniiVision X-Series Oscilloscope Measurement Options

Agilent offers a variety of application-specific measurement options and PC-based software packages for the InfiniiVision 2000, 3000, and 4000 X-Series oscilloscopes that can accelerate debugging and characterizing your designs.

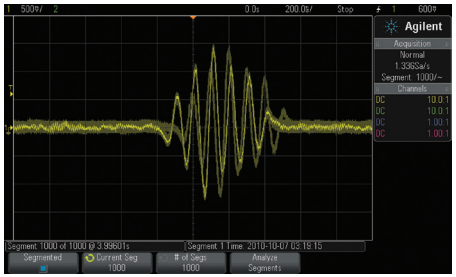


Serial bus options

With one or more of the serial bus options on your Agilent InfiniiVision X-Series oscilloscope, your scope will automatically decode and trigger on serial bus traffic based on the specific protocol. The following are supported:

- I^2C/SPI **(DSOX2EMBD, DSOX3EMBD, DSOX4EMBD)**
- RS232/UART **(DSOX2COMP, DSOX3COMP, DSOX4COMP)**
- Low-/full-speed USB **(DSOX4USBFL)**
- Hi-speed USB **(DSOX4USBH)**
- USB 2.0 signal quality test **(DSOX4USBSQ)**
- CAN/LIN **(DSOX2AUTO, DSOX3AUTO, DSOX4AUTO)**
- FlexRay **(DSOX3FLEX, DSOX4FLEX)**
- I^2S **(DSOX3AUDIO, DSOX4AUDIO)**
- Mil-STD 1553/ARINC 429 **(DSOX3AERO, DSOX4AERO)**

With the industry's only hardware-based decoding, the waveforms and decoding are virtually real time. This insures that infrequent serial communication errors are quickly captured. Up to two serial busses can be decoded simultaneously with the industry's only time-interleaved "lister" display.



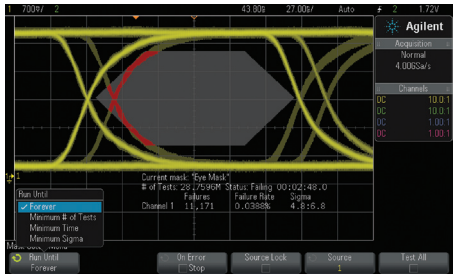
Segmented memory option

DSOX2SGM, DSOX3SGM, or standard on 4000 X-Series

When capturing low-duty cycle pulses or data bursts, segmented memory acquisition can be used to **optimize acquisition memory** by selectively capturing and storing important segments of signals without consuming memory on unimportant signal idle/dead-time.

Record up to 1000 occurrences of a trigger event (up to 250 on a 2000 X-Series oscilloscope) and then play them back to easily spot anomalies for further examination. Segmented memory acquisition is ideal for applications including:

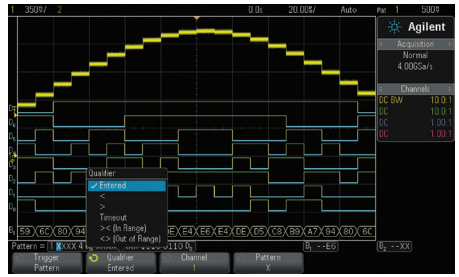
- Pulsed laser
- Radar bursts
- High-energy physics experiments
- Serial bus packets



Mask testing option

DSOX2MASK, DSOX3MASK, or DSOX4MASK

Whether performing pass/fail tests to specified standards in the manufacturing test environment, or testing for infrequent signal anomalies in the R&D debugging environment, the mask test option on Agilent's InfiniiVision X-Series oscilloscopes can be a valuable productivity tool. With the oscilloscope industry's only hardware-based mask testing, up to 270,000 waveforms can be tested each second on 3000 and 4000 X-Series models, and up to 50,000 tests per second can be performed on the 2000 X-Series models.



MSO option

DSOX2MSO, DSOX3MSO, or DSOX4MSO

A mixed signal oscilloscope (MSO) is a synergistic combination of an oscilloscope with 2 or 4 channels of analog acquisition along with an easy-to-use logic timing analyzer with 8 or 16 channels of digital acquisition. Not only does an MSO provide additional channels of acquisition, it also enables additional parallel pattern and serial bus triggering possibilities to help you debug your digital and mixed-signal designs faster.

Although you can initially purchase an InfiniiVision X-Series oscilloscope as a pre-configured MSO model, you can also upgrade your existing DSO to add MSO acquisition and display capabilities.

Quick Fact Sheet

InfiniiVision X-Series Oscilloscope Measurement Options

Power measurements option (3000 and 4000 X-Series models only)

DSOX3PWR or DSOX4PWR
Provides a full suite of power measurements and analysis that runs in the oscilloscope.

Measurements include:

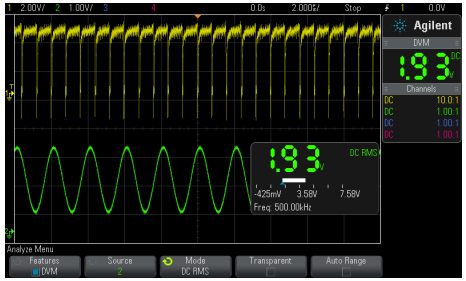
- Current harmonics
- Efficiency
- Inrush current
- Modulation
- Power quality
- Switching loss
- Transient response
- Turn on/Turn off
- Output ripple
- Power supply rejection ratio (PSRR)
- Slew rate

Also included, is a license for the U1881A PC-based power analysis software package that provides additional offline power measurements and report generation. For more information, refer to the Power Measurements data sheet (5990-8869EN).

WaveGen Function/Arbitrary Waveform Generator option (AWG available in 3000 and 4000 X-Series models only)

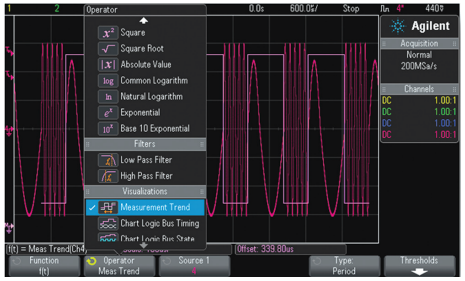
DSOX2WAVEGEN, DSOX3WAVEGEN, or DSOX4WAVEGEN2
When you need to make stimulus-response measurements, the WaveGen option adds a built-in 20 MHz function generator. Wave shapes available on the InfiniiVision 2000 X-Series oscilloscope includes sine, square, pulse, ramp, noise, and DC.

The WaveGen option on the InfiniiVision 3000 and 4000 X-Series oscilloscope includes additional wave shapes including sinc, exponential rise/fall, cardiac, Gaussian pulse, and arbitrary.



Integrated digital voltmeter option

DSOXDVM
When making measurements, the DSOXDVM option provides a 3 digit voltmeter (DVM) and 5 digit frequency counter inside the oscilloscope. The voltmeter operates through the same probes as the oscilloscope channels, however, the measurements are de-coupled from the oscilloscope triggering system so that both the DVM and triggered oscilloscope measurements can be made with the same connection. The voltmeter results are always displayed, keeping these quick characterization measurements at your fingertips.



Advanced math analysis

DSOX3ADVMATH or standard on 4000 X-Series
In addition to the standard waveform math functions (add,subtract, multiply, integrate, differentiate, square root, FFT), the optional DSO3ADVMATH application provides additional advanced waveform transforms, filters, and visualization tools including:

Transforms

- Ax + B
- Square (x2)
- Absolute value (|x|)
- Common logarithm (log)
- Natural logarithm (ln)
- Exponential (eX)
- Base 10 exponential (10X)

Filters

- Low pass filter (4th order Bessel-Thompson filter with selectable –3 dB frequency)
- High pass filter (single-pole high pass filter with selectable –3 dB frequency)

Visualizations Tools

- Magnify
- Measurement trend
- Chart logic bus timing
- Chart logic bus state

5990-6676EN

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