Data Sheet

Keysight

InfiniiVision 1000 X-series Oscilloscopes

Scrap the toys, get yourself a real scope!

Keysight's InfiniiVision 1000 X-Series oscilloscopes are engineered to give you quality, industry-proven technology at unbelievably low prices. Now it's easy to get professional measurements and accessible expertise at your fingertips. Don't settle for less – and test to impress.

Models included:

- EDUX1002A 50 MHz, 2 Channel, 1 GSa/s, 100 kpts
- EDUX1002G 50 MHz, 2 Channel, 1 GSa/s, 100 kpts, 20 MHz WaveGen

- DSOX1102A 70/100 MHz, 2-channel, 2 GSa/s, 1 Mpts
- DSOX1102G 70/100 MHz, 2-channel, 2 GSa/s, 1 Mpts, 20 MHz WaveGen

Measurements You Can Trust

Have confidence in your measurements with Keysight-custom technology that leverages more than 60 years of oscilloscope expertise.

Bringing premier test solutions to your test bench has been the goal and the passion of Keysight Technologies ever since we made our first oscillator in 1939. Keysight has always stood for quality and measurement expertise. Now the InfiniiVision 1000X-Series sets a new standard for a user's looking for a value oscilloscope. Starting for as little as $449, the InfiniiVision 1000X-Series is the entry solution for the broad line InfiniiVision and Infiniium (up to 100 GHz+) oscilloscopes.

The InfiniiVision oscilloscopes are designed for the most demanding engineers who want bandwidth, visualization power and the flexibility that comes with integrated capabilities — but with portability, a familiar embedded OS user interface, and an affordable price.

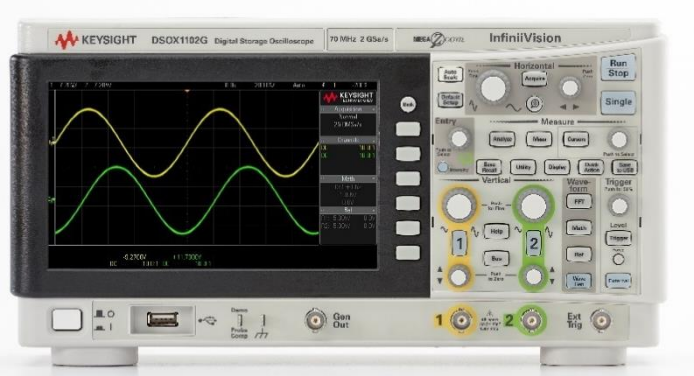
Moving from the training environment to the test bench often requires more capability to take the test and verification to the next level. Keysight provides multiple solutions that can be used to meet your test needs.

	EDUX1002A 50MHz 2 channel	**EDUX1002G** 50MHz 2 channel with Function Generator	**DSOX1002A** 100MHz 2 channel	**DSOX1002G** 100 MHz 2 channel with Function Generator
Analog channels	2	2	2	2
Digital channels	1	1	1	1
Bandwidth	50MHz	50MHz	70 MHz (base) 100MHz (with option DSOX1B7T102)	70 MHz (base) 100MHz (with option DSOX1B7T102)
Maximum sample rate	1GS/s	1GS/s	2GS/s	2GS/s
Maximum memory depth	100kpts	100kpts	1Mpts	1Mpts
Segmented memory	N/A		standard	
Mask/limit testing	N/A		standard	
WaveGen	N/A	20-MHz function generator includes Bode plot test	N/A	20-MHz function generator includes Bode plot test
Serial protocol analysis	optional: I2C, UART/RS-232 - (EDUX1EMBD)		optional: I2C, SPI, UART/RS-232 - (DSOX1EMBD) CAN, LIN - (DSOX1AUTO)	
Waveform math	Add, subtract, Multiply, divide, FFT (Magnitude and phase)			
Integrated digital voltmeter	Free with product registration			
Display	7-inch TFT LCD WVGA			
Waveform update rate	50,000 waveforms per second			
Connectivity	USB 2.0 (Host and device)			

Power packed oscilloscopes at a budget price

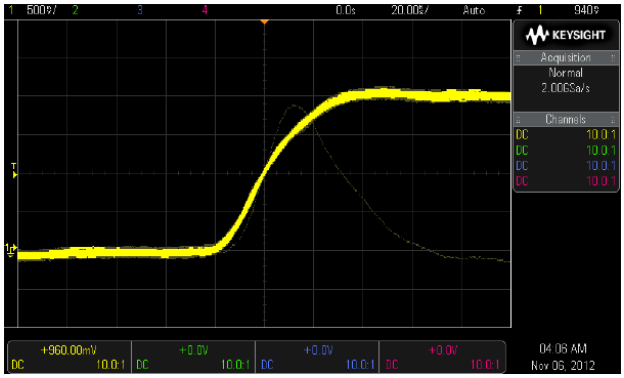
Large clear display

Engineering for the best signal visibility starts with the performance of the display. Clear sharp trace display is the key to understanding the signal that you are probing. With the ability to display 50,000 waveforms/sec, a clean image lets you clearly see the glitches and anomalies that you may miss on other oscilloscopes in this class.



Fastest update rate

With Keysight-designed *MegaZoom IV* custom ASIC technology, the InfiniiVision 1000 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 Keysight do that?

Keysight-designed *MegaZoom IV* custom ASIC technology combines the capabilities of an oscilloscope 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.

Best-in-class oscilloscope

The InfiniiVision 1000 X-Series is more than just an Oscilloscope. Included standard is a Digital Volt Meter (DVM), protocol analyzer, frequency response analyzer, and with the built in Function generator, you can do more without taking up precious bench space.

Do more with the power of 6 instruments in 1

1: Oscilloscope
2: WaveGen built-in 20 MHz function generator (optional)
3: Serial protocol triggering and decode (optional)
4. Digital Volt Meter
5. Frequency counter
6: Frequency Response Analyzer

Analyzing the waveform: Automatic measurements

Automatic measurements enable quick and easy access to typical oscilloscope measurements. Select a channel, and a measurement and any four measurements can be displayed on a continuous update on screen.

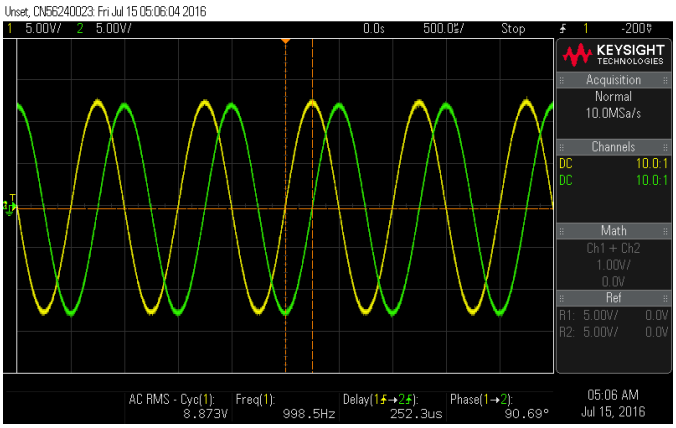


Figure 1: Up to 4 individual measurements are displayed in real time with continuous updates on screen

Figure 2: With 24 built in measurements users can quickly analyze a signals to determine signal parameters.

Analyzing the waveform: Cursors

Cursors enable detailed measurements to be performed on the waveform. Whether measuring voltage, time, frequency, the setting of X and Y cursors support user defined measurement.

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Figure 3: Cursors allow quick and accurate measurements, here measuring the RF burst of 40 usec, and 4 Volts.

DVM and Frequency Counter

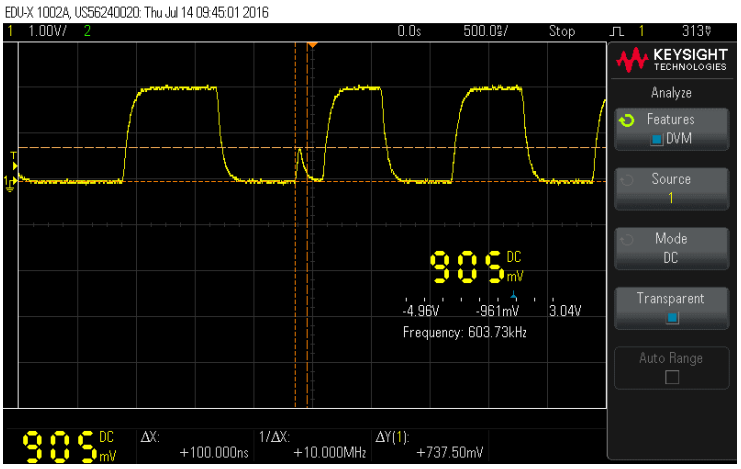


Figure 4: The DVM makes accurate RMS measurements when the signal frequency is between 20 Hz and 100 kHz.

The 1000 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 registering at www.keysight.com/find/DVM to enable this no cost option. Quickly and easily measure AC RMS, DC, DC RMS,

FFT: Fast Fourier Transform

FFT is used to compute the Fast Fourier Transform using analog input channels or an arithmetic operation g(t). FFT takes the digitized time record of the specified source and transforms it to the frequency domain. When the FFT function is selected, the FFT spectrum is plotted on the oscilloscope display as magnitude in dBV versus frequency. The readout for the horizontal axis changes from time to frequency (Hertz) and the vertical readout changes from volts to dB. Use the FFT function to find crosstalk problems, to find distortion problems in analog waveforms caused by amplifier non-linearity, or for adjusting analog filters.

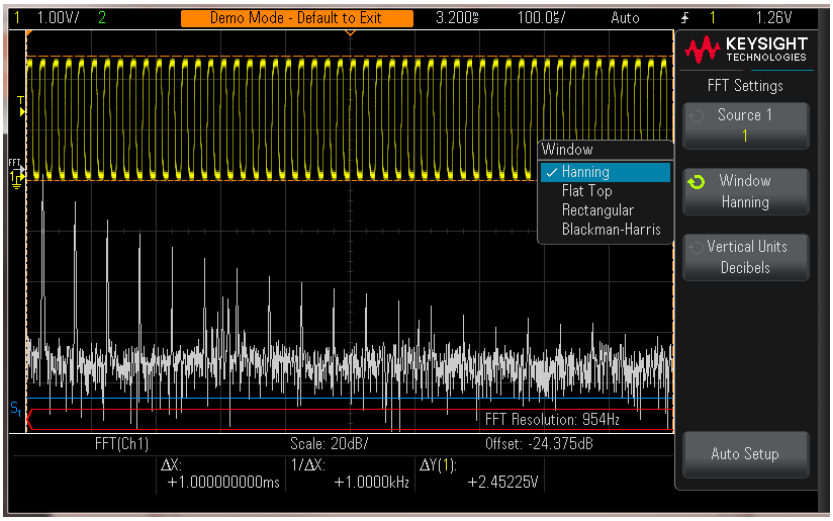


Figure 5: Multiple FFT window functions are supported to provide required signal analysis.

Math

Math functions can be performed on analog channels. The resulting math waveform is displayed in light purple. Perform an arithmetic operation (like add, subtract, or multiply) on analog input channels, or perform a transform function on the result of an arithmetic operation.

Additional analysis by using FFT (Magnitude or phase) or applying a low pass filter are invaluable tools for signal analysis.

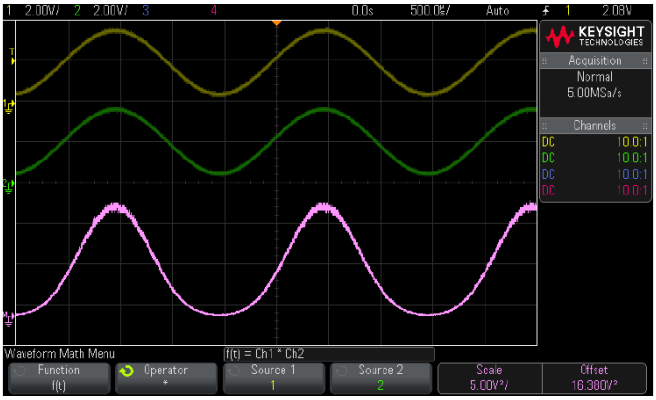


Figure 7 Easily calculate the resulting waveform when adding addition two waveform by using waveform Math.

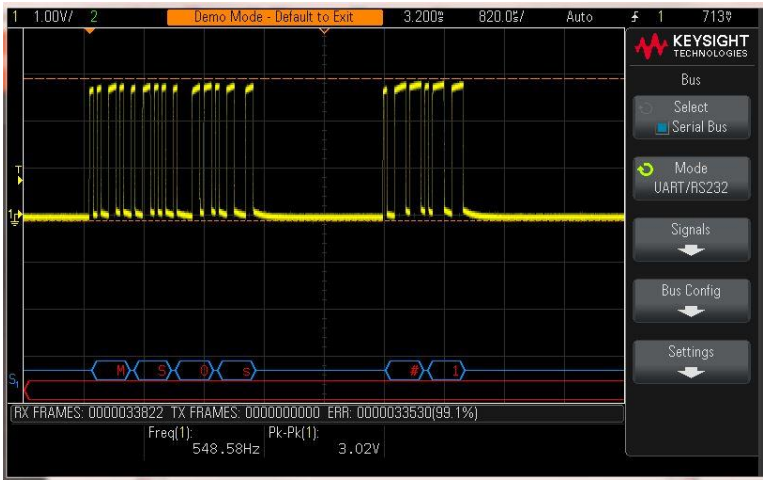
Figure 6: Define the exact FFT required with simple controls to set the analysis bandwidth.

Hardware-based Serial Protocol Decode and Triggering

Protocols supported

- I²C, UART/RS232 for EDU models - EDUX1EMBD
- I²C, SPI, UART/RS232 for DSO models - DSOX1EMBD
- CAN, LIN (Automotive) for DSO models - DSOX1AUTO

Keysight's InfiniiVision Series oscilloscopes are the industry's first scopes to use hardware-based serial protocol decoding. Other vendors' oscilloscopes use software post-processing techniques that slow down both waveform and decode update rate. 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.



Analog Bus testing

Often testing of circuit designs requires the combining to related signals to each other. The Keysight 1000X oscilloscopes enable the combining of multiple signals to create a logical “bus”. The information from both analog channels and the external trigger are combined and can be displayed as a ASCII, hex, or binary value.

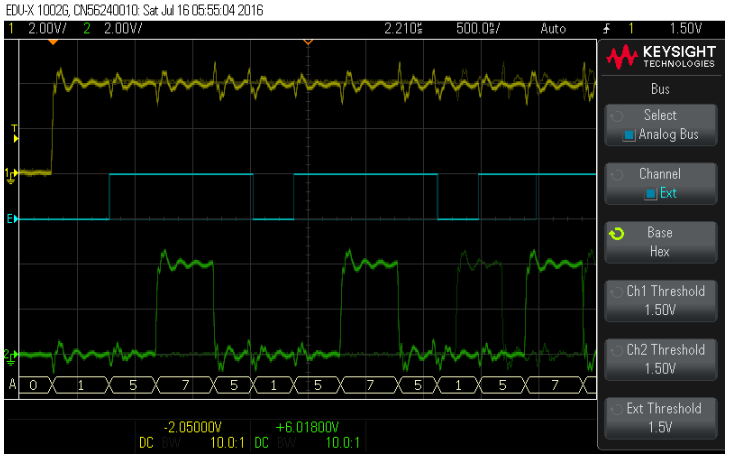


Figure 8: Channel1, 2, and external trigger are can be combined to form a bus, with ASCII, hex, or binary values displayed as the bus along the bottom of the display.

Mask Test [1]

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 1000 X-Series features hardware-based mask testing and can perform up to 50,000 tests per second.

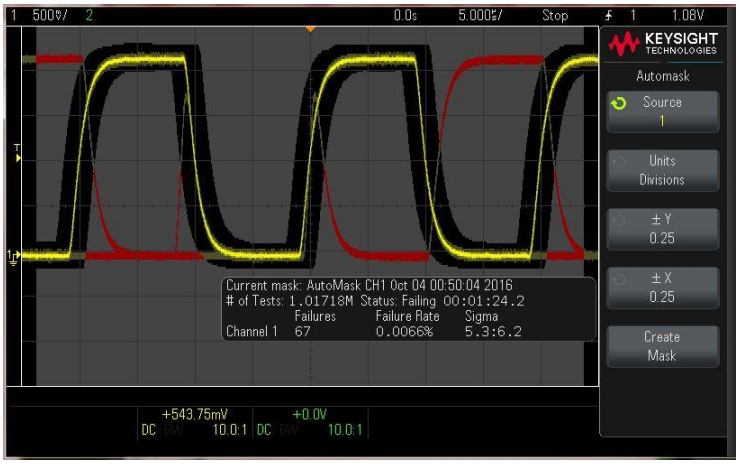


Figure 9: Mask testing can quickly validate a signal quality and detect errors.

Segmented memory [1]

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 50 segments can be captured on the 1000 X-Series models with a minimum re-arm time under 19 µs.

[1] DSOX1102A or DSOX1102G only

Powerful WaveGen [2]

Built-in 20 MHz function generator with a modulation capability

The 1000 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. Built-in waveform generator ("G" models only) includes sine, square, ramp, pulse, DC, noise signals. Add modulation to the signal with customizable settings for AM, FM and FSK support.

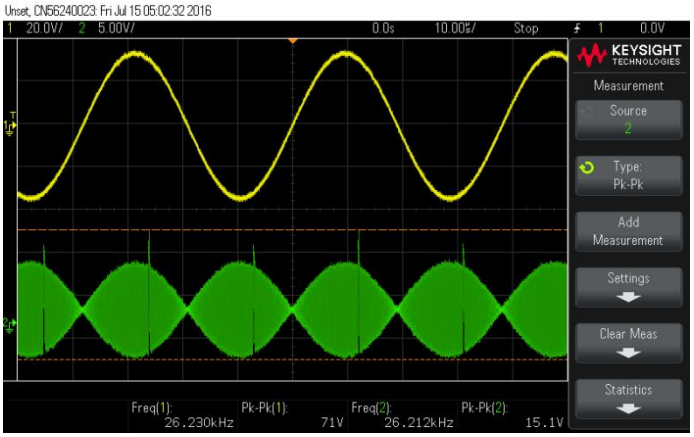


Figure 10: The WaveGen function enables the definition of multiple waveforms including Amplitude modulated signals.

Frequency Response Analysis [2]

The analysis is basically a gain & phase measurement versus frequency (Bode plot), which is a critical measurement to characterize the stability of feedback networks and switch-mode power supplies. Vector Network Analyzers (VNA) and low-cost FRAs are typically used for these measurements. Now by utilizing the Built in WaveGen on Keysight adds easy to use Gain and Phase analysis to the oscilloscope.

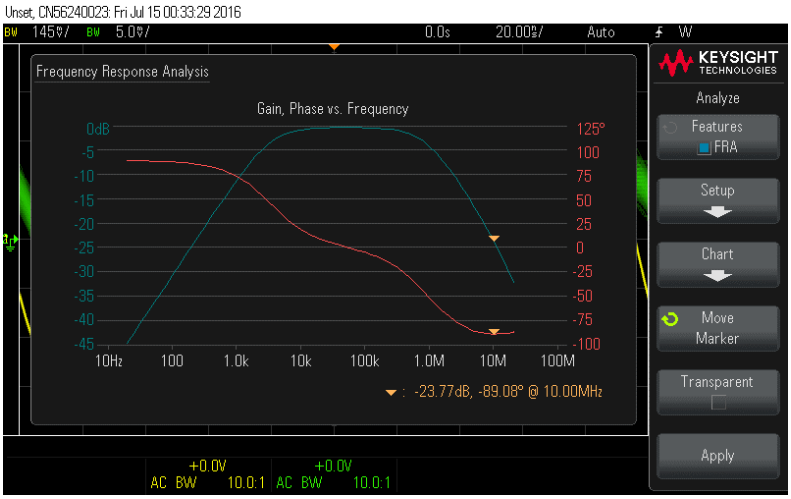


Figure 11: Measure and plot the Frequency and gain of any circuit from 20 Hz to 20 MHz.

[2] EDUX1002G or DSOX1102G models only

Easy to Learn – For Students or Beginners

Test quickly and easily with a simple, intuitive user-interface and access to built-in help and training features.

The EDU versions of the 1000 X-Series oscilloscopes are specifically designed to meet the budget requirements of training engineers and technicians while delivering the measurement tools expected of advanced scopes.

The Educator's Resource Kit comes standard on all 1000 X-Series oscilloscopes and includes teaching labs. The Educator's Oscilloscope Training Kit provides an array of built-in training signals so electrical engineering and physics students can easily learn how to use an oscilloscope and perform basic measurements. Also included in the kit is a comprehensive oscilloscope lab guide and tutorial written specifically for the undergraduate student.

All Keysight InfiniiVision X-series oscilloscopes now include the training signals as a standard feature on all models. When used with the EDUkit Lab training materials you have all of the information to quickly teach, and users to learn how to effective use an oscilloscope to make measurements on complex signals. Just search for "Oscilloscope Training" on www.keysight.com to access all labs, teaching presentations, and posters to access the materials to maximize training.

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. 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.

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. Built-in training signals provide a variety of signals for teaching important concepts.

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, WaveGen, integrated digital voltmeter and measurement applications.

Optimize lab bench space

With 5 instruments in 1, you will save on precious lab bench space by getting an oscilloscope, serial protocol analyzer, WaveGen function generator, Frequency response analyzer, and integrated digital voltmeter all in one innovative instrument with a footprint that is only 5.1 inches deep. With the 7-inch

WVGA display, you can easily view all signals on one screen with enough viewing area for more than one student to view.

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, simplified Chinese, traditional Chinese, Japanese, Korean, German, French, Spanish, Russian, Portuguese, Thai, Polish, Italian, Czech, and Turkish. During operation, access the built-in help system just by pressing and holding any button.

Figure 12: Keypad overlays as well on screen information is available in 13 local languages.

Probe solutions

Get the most out of your 1000 X-Series scope, by using the right probes and accessories for your application. Keysight offers a complete family of innovative probes and accessories for the InfiniiVision 1000 X-Series scopes. For the most up-to-date and complete information about Keysight's probes and accessories, please visit our Web site at www.keysight.com/find/scope_probes

Figure 13: Includes standard 1:1 or 10:1 switchable probes.

USB save

Documentation is fast and easy with storage of screenshots or binary data for create PC based reports.
Oscilloscope setups, reference waveforms, and mask files can be saved to internal oscilloscope memory or to a USB storage device and recalled later. You can also recall default or factory default setups. Oscilloscope screen images can be saved to a USB storage device in BMP or PNG formats. Acquired waveform data can be saved to a USB storage device in comma-separated value (CSV), ASCII XY, and binary (BIN) formats.

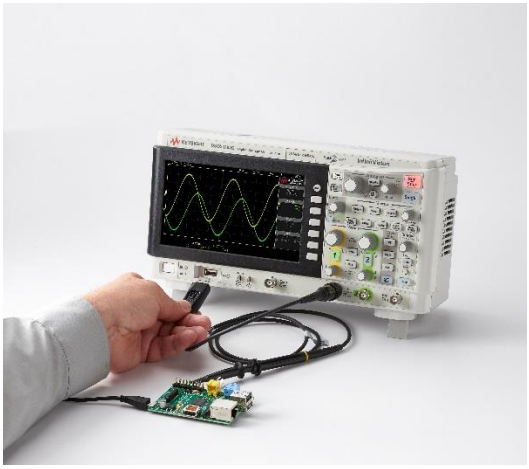


Figure 14: Convenient USB storage of data, screenshots, and scope setup files make documentation a breeze.

Connectivity compatibility

Built-in USB host and USB device ports make PC connectivity easy.
BV0000A BenchVue lets you visualize the 1000 X-Series and multiple measurements simultaneously. Save time with the ability to export measurement data to Excel, Word and MATLAB in three clicks. Monitor and control your 1000 X-Series with a mobile device from anywhere. Learn more at www.keysight.com/find/BenchVue.

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.

Infiniium Offline oscilloscope analysis software (N8900A)

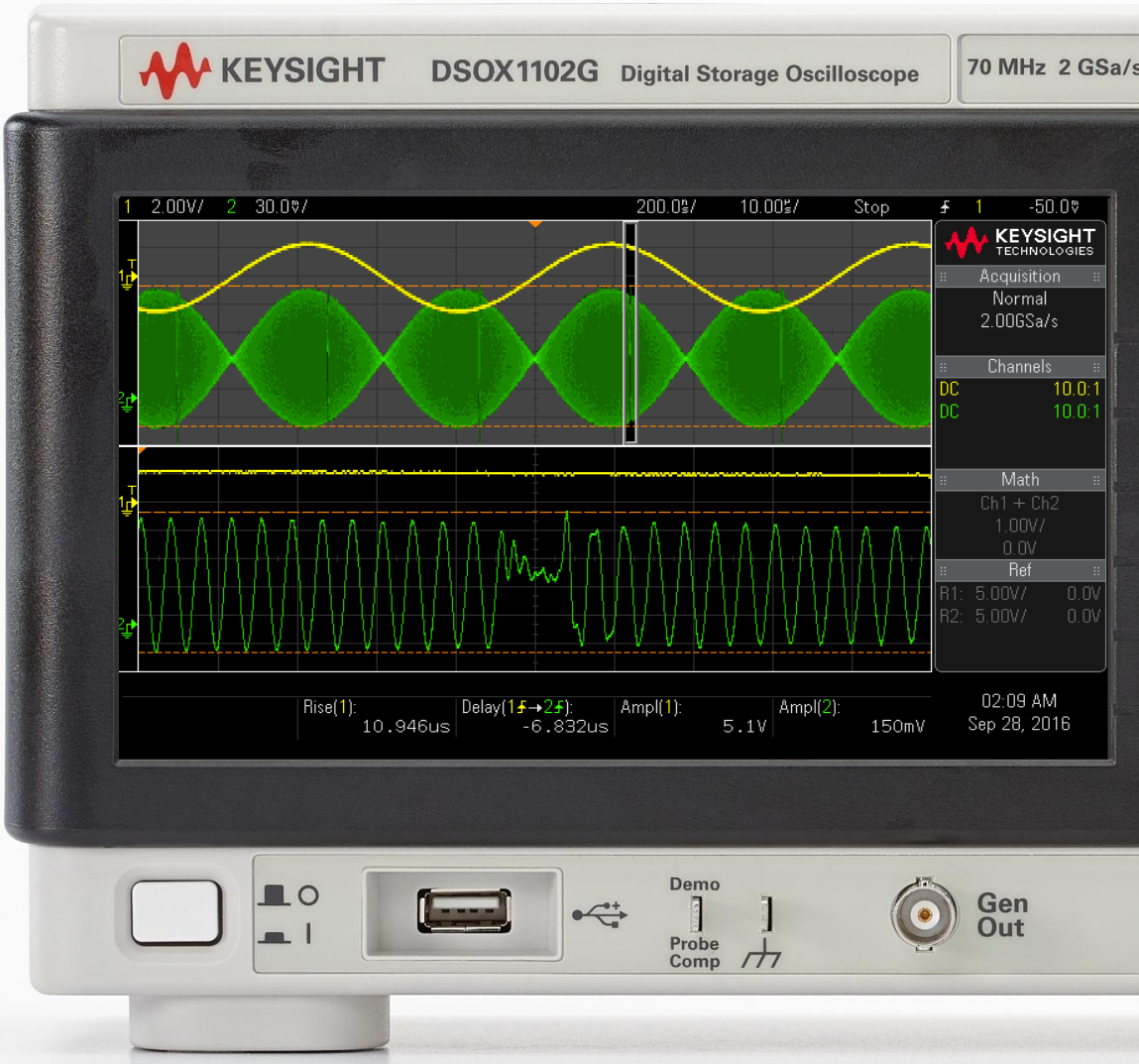
Keysight's Infiniium Offline PC-based analysis oscilloscope software allows you to do additional signal viewing, analysis and documentation tasks away from your scope. Capture waveforms on your scope, save to a file, and recall the waveforms into Infiniium Offline.

Keysight delivers more in a low cost Oscilloscope

Measurement clarity with crisp 7” WVGA display that presents key measurement information in an easy to understand and utilize format.

Display performance with fast 50,000 waveforms/sec update rate helps you quickly see signal glitches and errors.

InfiniiVision is the design engineers preferred choice in and easy to use and highly capable oscilloscope system.



Multiple instruments in one package.

- Oscilloscope
- Digital Volt Meter
- Frequency counter
- Protocol Analyzer
- Function generator
- Frequency response analyzer

Compact size: 314 mm (12.4 in) x 165 mm (6.5 in) x 130 mm (5.1 in)

Training signals for learning are included standard in all models of the 1000 X-Series Oscilloscope, enabling you to train users quickly to troubleshoot many common signal problems.

Built in function generator enables you to generate the signals you need to stimulate your design simple and quickly. Signals are easily synchronized for measuring stimulus/response testing.

Fast and easy operation with the common oscilloscope controls at your fingertips. All buttons provide instant access to language localized help by simply holding down the button that you want explained.

Need to perform signal measurements? Press the measure key to access 24 built in measurement.

Custom measurements are easy with “Cursors”. Measure any value or the difference using 4 powerful cursors.

Press “Analyze” to access

- Frequency Response Analysis (Bode Plot)
- Mask Test
- DVM
- And more

Waveform tools include quick access to waveform Math, like FFT (magnitude and phase), add, subtract, multiply and divide. Reference waveforms allow quick comparison of stored waveforms.

Included probes are switchable 1:1 / 10:1 probes supporting most probing requirements up to 100 MHz

Built-in WaveGen supports Sine, Square, Ramp, Pulse, DC, and Noise with amplitude and frequency modulation.

External trigger can be used as a 3rd channel and displayed on screen to create bus type display.

The InfiniiVision X-Series Family

Want to Touch operation to Discover and Solve your problem?

See the InfiniiVision 3000T X-Series.

See www.keysight.com/find/3000TX-Series for more details.

- First in class 8.5-inch capacitive touch display
- Zone touch trigger capability
- 100 MHz to 1 GHz DSO and MSO models
- > 1,000,000 wfms/sec
- Standard segmented memory
- Fully upgradable 6 instrument in 1
    - Digital channels (MSO)
    - Protocol analysis including new CAN-FD and SENT bus support
    - 20 MHz WaveGen with arbitrary waveform and modulation support
    - 3-digit digital voltmeter (DVM)
    - 8-digit counter/totalizer
- Get professional-level oscilloscope functionality with industry-leading software analysis and 6-in-1 instrument integration

The InfiniiVision X-Series offers multiple price points to fit your budget with superior performance and optional capabilities that are not available in any other oscilloscope in its class. This Keysight Technologies, Inc. breakthrough technology delivers more scope for the same budget.

	InfiniiVision Oscilloscopes				
	1000X-Series	2000X-Series	3000T X-Series	4000X-Series	6000X-Series
Analog Channels	2	2 or 4	2 or 4	2 or 4	2 or 4
Bandwidth	50, 70, 100 MHz	70, 100, 200 MHz	100,200, 350, 500, MHz , 1 GHz	200, 350, 500, MHz , 1, 1.5 GHz	1, 2.5, 4, 6 GHz
Max Sample rate	2 GS/s	2 GS/s	5 GS/s	5 GS/s	20 GS/s
Max memory depth	1 Mpts	1 Mpts	4 Mpts	4 Mpts	4 Mpts
Waveform update rate	> 50,000 wfm/s	> 50,000 wfm/s	> 1,000,000 wfm/s	> 1,000,000 wfm/s	> 450,000 wfm/s
Display	7" WVGA	8.5" WVGA	8.5" WVGA Capacitive Touch	12.1" SVGA Capacitive Touch	12.1" SVGA Capacitive Touch
MSO (digital channels)	1 channel	8 channels	16 channels	16 channels	16 channels
Datasheet #		5990-6618EN	5992-0140EN	5991-1103EN	5991-4087EN

Configuring Your InfiniiVision X-Series Oscilloscope

Step 1. Choose your Oscilloscope

EDUX1002A	50MHz 2 channel
EDUX1002G	50MHz 2 channel with AWG
DSOX1002A	70MHz 2 channel
DSOX1002G	70MHz 2 channel with AWG

Step 2. Select Bandwidth upgrades

DSOX1B7T102	Upgrade bandwidth from 70MHz to 100MHz	Compatible with DSOX1102A or DSOX1102G

Step 3. Add desired decodes

EDUX1EMBD	Decodes and analysis for I2C, UART(RS-232) protocols	Compatible with EDUX1002A or EDUX1002G

DSOX1EMBD	Decodes and analysis for I2C, SPI, UART(RS-232) protocols	Compatible with DSOX1102A or DSOX1102G
DSOX1AUTO	Decodes and analysis for CAN, LIN protocols	Compatible with DSOX1102A or DSOX1102G

Step 3. Choose Accessories

N2142A	1:1, 10:1 switchable 70MHz	2 probes included Standard with EDUX1002A and EDUX1002G
N2140A	1:1, 10:1 switchable 200MHz	2 probes included Standard with DSOX1102A and DSOX1102G

N2738A	Soft carrying case for 1000X oscilloscopes	<picture>
N2133A	Rackmount Kit for 1000X Oscilloscopes	<picture>

Step 4. Select language options (User Guide is not included unless ordered.)

	Front Panel Overlay	**User's Guide: N2132A**
English	standard	N2132A-ABA
Chinese (Simplified)	DSOX1000-AB2	N2132A-AB2
Chinese (Traditional)	DSOX1000-AB0	N2132A-AB0
Czech	DSOX1000-AKB	not available
French	DSOX1000-ABF	N2132A-ABF
German	DSOX1000-ABD	N2132A-ABD
Italian	DSOX1000-ABZ	N2132A-ABZ

Japanese	DSOX1000-ABJ	N2132A-ABJ
Korean	DSOX1000-AB1	N2132A-AB1
Polish	DSOX1000-AKD	not available
Portuguese	DSOX1000-AB9	not available
Russian	DSOX1000-AKT	N2132A-AKT
Spanish	DSOX1000-ABE	N2132A-ABE
Thai	DSOX1000-AB3	N2132A-AB9
Turkish	DSOX1000-AB8	not available

Performance Characteristics
1000 X-series Oscilloscopes

Oscilloscopes overview		
	EDUX1002A / EDUX1002G	DSOX1102A / DSOX1102G
Bandwidth [3] [4](-3dB)	50 MHz	70 MHz Upgradeable to 100 MHz
Calculated rise time (10% to 90%)	≤ 7 ns	≤ 5 ns ≤ 3.5 ns (100MHz model)
Input channels	2	2
Maximum sample rate	1 GS/s	2 GS/s
Maximum memory depth	100 kpts	1 Mpts
Waveform update rate	≥ 50,000 waveforms/sec	≥ 50,000 waveforms/sec

Vertical system analog channels		
	EDUX1002A / EDUX1002G	DSOX1102A / DSOX1102G
Input coupling	DC, AC (10 Hz cutoff frequency)	
Input Impedance/Capacitance	1MΩ ±2% / 16pF ±3pF	
Input sensitivity range[5]	500 µV/div to 10V/div	500 µV/div to 10V/div
Standard probes	N2142A 1/10 switchable 75 MHz (2 included)	N2140A 1/10 switchable 200 MHz (2 included)
Probe Attenuation Factor	0.1X to 1000X in 1-2-5 sequence; (-20dB to +80dB in 0.1dB steps)	
Hardware bandwidth limits	Approximately 20 MHz (selectable)	
Vertical resolution	8 bits	
Invert Signal	Selectable	
Maximum input voltage	150Vrms, 200Vpk [1]	
DC vertical accuracy	± [DC vertical gain accuracy + DC vertical offset accuracy + 0.25% full scale]	
DC vertical gain accuracy[6]	+3% full scale (>10 mV/div) +4% full scale (<10 mV/div)	
DC vertical offset accuracy	± 0.1 div ± 2 mV ± 1% of offset setting	
Skew	Channel to channel: 0.5 ns Channel to external: 2 ns	

[3] Denotes warranted specifications, all others are typical. Specifications are valid after a 30-minute warm-up period and from ± 10 °C user calibration temperature.
[4] For 1mV/div to 10V/div settings. Bandwidth is 20 MHz at the 500uV/div setting.
[5] 500uV/div is a magnification of 1mV/div setting.
[6] Denotes warranted specifications, all others are typical. Specifications are valid after a 30-minute warm-up period and from ± 10 °C firmware calibration temperature

Offset range		500uV/div to 200mV/div: +2V >200mV/div to 10V/div: +100V
Time base range		2 ns/div to 50 s/div
Time base accuracy [7]		50 ppm ± 5 ppm per year (aging)
Time base delay time range	Pre-trigger	Greater of 1 screen width or 200 µs
	Post trigger	1 s to 500 s
Channel to channel deskew range		± 100 ns
Δ Time accuracy (Using cursors)		± (time base acc. x reading) ± (0.0016 x screen width) ± 200 ps (same channel)
Modes		Main, zoom, roll, XY
XY		X = channel 1, Y = channel 2, Z = External trigger, 1.4 V Blanking
		Bandwidth: Maximum bandwidth. Phase error at 1 MHz: < 0.5 degree

Acquisition system			
		EDUX1002A / EDUX1002G	DSOX1102A / DSOX1102G
Maximum sample rate		1 GS/s	2 GS/s
Maximum analog channels record length		100 kpts	1 Mpts
Acquisition mode	Normal	Default mode	
	Peak detect	Capture glitches as narrow as 10 ns at all time base settings	Capture glitches as narrow as 10 ns at all time base settings (70 MHz)
			Capture glitches as narrow as 5 ns at all time base settings (100 MHz)
	Averaging	Selectable from 2, 4, 8, 16, 64, ... to 65,536	
	High resolution	Real time boxcar averaging reduces random noise and effectively increases vertical resolution 12 bits of resolution when ≥ 20 µs/div at 2GSa/s	
	Segmented	Not available	Segmented memory optimizes available memory for data streams that have long dead times between activity. Maximum segments = 50. Re-arm time = 1 µs (minimum time between trigger events)
Time mode	Normal	Default mode	
	Roll	Displays the waveform moving across the screen from right to left. Available at the time base 50 ms/div or slower	
	XY	Displays the volts-versus-volts display. X = channel 1, Y = channel 2 Z = Ext Trig, 1.4V blanking. Phase error @ 1 MHz: <0.5 degree	

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

Autoscale	Finds and displays all active channels and Ext Trig. Sets edge trigger mode on external trigger first, then highest numbered active channel. Sets vertical sensitivity. Sets time base to display ~1.8 periods. Requires minimum voltage >10 mVpp (channel)

Trigger system		
	EDUX1002A / EDUX1002G	DSOX1102A / DSOX1102G
Trigger sources	Analog channel (1, 2), line[8], external, WaveGen, WaveGen modulation FM/FSK	
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	
	Force: front panel button that forces a trigger	
Trigger coupling	DC: DC coupled trigger	
	AC: AC coupled trigger, cutoff frequency: ~ 10 Hz	
	HF Reject: High frequency reject, cutoff frequency ~ 50 kHz	
	LF Reject: Low frequency reject, cutoff frequency ~ 50 kHz	
	Noise Reject: Selectable OFF or ON, decreases sensitivity 2x	
Trigger holdoff range	60 ns to 10 s	
Trigger sensitivity		
Internal [9]	Greater of: 0.6 div or 2.5mV (≤10 MHz) 0.9 div or 3.8mV (10 MHz to 50 MHz) 0.9 div or 3.8mV (10 MHz to 70 MHz) 1.2 div or 5 mV (70 MHz to 100 MHz)	
External	≤10MHz: 250mVpp 10MHz to 50 MHz: 500mVpp	≤10MHz: 50mVpp (1.6V range) 250mVpp (8V range) 10MHz to 100 MHz: 100mVpp (1.6V range) 500mVpp (8V range)
Trigger level range		
Internal	± 6 div from center screen	
External [10]	± 8 V	± 1.6 V or ± 8 V selectable

[8] Line trigger to ≤ 60Hz

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

[10] Input voltage must remain within these limits for proper operation.

Trigger type selections		
	EDUX1002A / EDUX1002G	DSOX1102A / DSOX1102G
Trigger types	Edge, Pulse width, Video	Edge, Pulse width, Video Rise/Fall time, Setup and Hold, Pattern/State
Edge	Trigger on a rising, falling, alternating or either edge of any source	
Pattern/State	Trigger when a specified pattern/state on any combination inputs is entered. [11]	
Pulse width	Not available	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
		Range minimum: 10 ns, 10s max
Setup and hold	Not available	Trigger and clock/data setup and/or hold time violation. Setup time can be set from –7 s to 10 s. Hold time can be set from 0 s to 10 ns
Rise/fall time	Not available	Trigger on rise-time or fall-time edge speed violations (< or >) based on user-selectable threshold
		Select from (< or >) and time settings range between
		Minimum: 5 ns
		Maximum: 10 s
Video	Trigger on all lines or individual lines, odd/even or all fields from composite video, or broadcast standards (NTSC, PAL, SECAM, PAM-M)	
I^2C - EDUX1EMBD option - DSOX1EMBD option	Trigger 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	
RS-232/422/485/UART - EDUX1EMBD option - DSOX1EMBD option	Trigger on Rx or Tx start bit, stop bit or data content or parity error	
SPI - DSOX1EMBD option	Not available	Trigger on SPI (Serial Peripheral Interface) data pattern during a specific framing period. Supports positive and negative Chip Select framing as well as clock Idle framing and user-specified number of bits per frame. Supports MOSI and MISO data

[11] Pattern must have stabilized for a minimum of 5 ns to qualify as a valid trigger condition

CAN - DSOX1EMBD option	Not available	Trigger on CAN (controller area network) version 2.0A,2.0B, and CAN-FD (Flexible Data-rate) signals. Trigger on the start of frame (SOF), the end of frame (EOF), data frame ID, data frame ID and data (non-FD), data frame ID and data (FD), remote frame ID, remote or data frame ID, error frame, acknowledge error, from error, stuff error, CRC error, spec error (ack or form or stuff or CRC), all errors, BRS Bit (FD), CRC delimiter bit (FD), ESI bit active (FD), ESI bit passive (FD), overload frame., message, message and signal (non-FD), message and signal (FD, first 8 bytes only)
LIN - DSOX1EMBD option	Not available	Trigger on LIN (Local Interconnect Network) sync break, sync frame ID, or frame ID and data, parity error, checksum error, frame (symbolic), frame and signal (symbolic)

Waveform measurements			
		EDUX1002A / EDUX1002G	DSOX1102A / DSOX1102G
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] [1]	
		Units: Seconds(s), Hz (1/s), phase (degrees), ratio (%)	
Automatic measurements		Measurements continuously updated with statistics. Cursors track last selected measurement. Select up to eight measurements from the list below:	
	Snapshot	Measure all single waveform measurements (23)	
	Voltage	Peak-to-peak, maximum, minimum, amplitude, top, base, overshoot, pre-shoot, average- N cycles, average- full screen, DC RMS- N cycles, DC RMS- full screen, AC RMS- N cycles, AC RMS- full screen (std deviation), ratio- N cycle, ratio- full screen	
	Time	Period, frequency, counter, + width, - width, burst width, +duty cycle, -duty cycle, bit rate, rise time, fall time, delay, phase, X at min Y, X at max Y	
	Count	Positive pulse count, negative pulse count, rising edge count, falling edge count	
	Mixed	Area- N cycles, area- full screen	
Automatic measurement logging		Available via BenchVue BV0000A	
Waveform math			
Arithmetic		Add, subtract, multiply, divide, FFT	
FFT	Record size	Up to 64 kpts resolution	
	Window types	Hanning, Flat Top, Rectangular, Blackman-Harris	

WaveGen – Built-in function waveform generator (specifications are typical)
Note: Only available on WaveGen models EDUX1002G and DSOX1102G. WaveGen cannot be added to the other models.

	EDUX1002G	DSOX1102G
WaveGen out	Front-panel BNC connector	
Waveforms	Sine, Square, Ramp, Pulse, DC, Noise	
Modulation	Modulation types: AM, FM, FSK Carrier waveforms: sine, ramp Modulation source: internal (no external modulation capability) AM: Modulation: sine, square, ramp Modulation frequency: 1 Hz to 20 kHz Depth: 0% to 100% FM: Modulation: sine, square, ramp Modulation frequency: 1 Hz to 20 kHz Minimum carrier frequency: 10 Hz Deviation: 1 Hz to carrier frequency or (2e12 / carrier frequency), whichever is smaller FSK: Modulation: 50% duty cycle square wave FSK rate: 1 Hz to 20 kHz Hop frequency: 2 x FSK rate to 10 MHz	
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 Ω load, 500 MHz BW): 40 dB (typical); 30 dB (min)	
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	
	Rise/fall time: 18 ns (10 to 90%)	
	Pulse width resolution: 10 ns or 5 digits, whichever is larger	
	Overshoot: < 2%	
	Asymmetry (at 50% DC): ± 1% ± 5 ns	
	Jitter (TIE RMS): 500 ps	
Ramp/triangle wave	Frequency range: 0.1 Hz to 200 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	Square, Pulse, Ramp: • 2mVpp to 20Vpp into Hi-Z (offset ≤ ±0.4V) • 1mVpp to 10Vpp into 50 ohms (offset ≤ ±0.4V) • 50mVpp to 20Vpp into Hi-Z (offset > ±0.4V) • 25mVpp to 10Vpp into 50 ohms (offset > ±0.4V) Sine: • 2mVpp to 12Vpp into Hi-Z (offset ≤ ±0.4V) • 1mVpp to 9Vpp into 50 ohms (offset ≤ ±0.4V) • 50mVpp to 12Vpp into Hi-Z (offset > ±0.4V) 25mVpp to 9Vpp into 50 ohms (offset > ±0.4V)
	Resolution**:** ≤1% of Amplitude
	Accuracy**:** 2% (Frequency = 1kHz)
DC offset	Square, Pulse, Ramp: • ±[10V – ½ Amplitude] into Hi-Z • ±[5V – ½ Amplitude] into 50 ohms Sine: • ±[8V – ½ Amplitude] into Hi-Z • ±[4.5V – ½ Amplitude] into 50 ohms
	Resolution: larger of 250uV or 3 digits
	Accuracy: ±1.5% of Offset Setting ±1.5% of Amplitude ±1mV
Main output	Impedance: 50 Ω typical
	Isolation: Not available, main output BNC is grounded
	Protection: Overload automatically disables output
	Single-shot (arbitrary, sine, ramp, sine cardinal, exp rise/fall, cardiac, Gaussian pulse)

Digital Voltmeter (Specifications are typical)		
	EDUX1002A / EDUX1002G	DSOX1102A / DSOX1102G
Functions	ACrms, DC, DCrms	
Resolution	ACV/DCV: 3 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	

Frequency Response Analysis (Bode plot)		
	EDUX1002A / EDUX1002G	DSOX1102A / DSOX1102G
Dynamic range	> 80dB (typical)	
Input and output sources	Channel-1 or -2	
Frequency range	20 Hz to 20 MHz	
Number of test points	10 points per decade	
Test amplitude	10 mVpp to 9 Vpp into 50-Ω Fixed amplitude across entire sweep	
Test results	Logarithmic overlaid gain & phase plot	
Manual measurements	Single pair of tracking gain & phase markers	
Plot scaling	Auto-scaled during test and manual	

Environmental

Connectivity		
	EDUX1002A / EDUX1002G	DSOX1102A / DSOX1102G
Standard ports	One USB 2.0 hi-speed device port on rear panel. Supports USBTMC protocol One USB 2.0 hi-speed host ports, front panel, Supports memory devices, printers and keyboards	
General and environmental characteristics		
Power line consumption	50 W max	
Power voltage range	100 to 120 V, 50/60/400 Hz; 100 to 240 V, 50/60 Hz	
Temperature	Operating: 0 to +50 °C Non-operating: –40 to +70 °C	
Humidity	Operating: Up to 95% RH at or below +40 °C (Non Condensing) Non-operating: Up to 90% RH up to 65 °C (Non Condensing)	
Altitude	Operating: Up to 2,000 m, Non-operating 15,300 m	

Electromagnetic compatibility	Meets EMC Directive (2004/108/EC), meets or exceeds IEC 61326-1:2005/EN61326-1:2013 (Basic) 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 61000-4-8/EN 61000-4-8 IEC 61000-4-11/EN 61000-4-11 Canada: ICES/NMB-001:2006 Australia/New Zealand: AS/NZS CISPER 11:2011	
Safety	UL61010-1 3rd edition, CAN/CSA-C22.2 No. 61010-1-12	
Dimensions (W x H x D)	314 mm (12.4 in) x 165 mm (6.5 in) x 130 mm (5.1 in)	
Weight	Net: 3.12 kg (6.9 lbs), shipping: 4.1 kg (9.0 lbs)	
Display	7.0" diagonal color TFT LCD WVGA [12]	
Nonvolatile storage		
Reference waveform display	2 internal waveforms or USB thumb drive	
Waveform storage	Set up, .bmp, .png, .csv, ASCII-XY, reference waveforms,.bin, mask , HDF5	
Max USB flash drive size	Supports industry standard flash drives	
Set ups without USB flash drive	10 internal setups	
Limited by size of USB drive	Limited by size of USB drive	
Included standard with oscilloscope		
Warranty	Standard 3-year warranty (90 days for unserialized accessories such as passive probes) Warranty upgradable to 5 year	
Secure erase	Supported on all models	
Standard probe	N2142A 75 MHz passive switchable probe	N2140A 200 MHz passive switchable probe
Built-in help language support	13 languages Choose from: English, simplified Chinese, traditional Chinese, Japanese, Korean, German, French, Spanish, Russian, Portuguese, Thai, Polish, Italian, Czech, and Turkish.	
Interface language support GUI menus	13 languages Choose from: English, simplified Chinese, traditional Chinese, Japanese, Korean, German, French, Spanish, Russian, Portuguese, Thai, Polish, Italian, Czech, and Turkish.	
Power cord	Localized power cord	

[12] *Display can have a maximum of 5 total stuck bright or stuck dark sub pixels (0.000434%) without being regarded as a failure.*