DATA SHEET

InfiniiVision 3000G X-Series Oscilloscopes

Product Overview

The InfiniiVision 3000G X-Series oscilloscopes with bandwidth models ranging from 100 MHz up to 1 GHz offer high-end technology in a small form factor. With an intuitive touch user-interface, industry-leading waveform update rate, zone trigger, and 8 new standard features, you can capture and isolate elusive glitches and anomalies not possible on other oscilloscopes.



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InfiniiVision 3000G X-Series: The Best in Usability Deserves the Best Features

Meet the new generation of Keysight's industry leading InfiniiVision X-Series oscilloscopes. With the best in usability, a comprehensive front panel with quick access buttons, easy-to-use touch operation or mouse-based control through direct connection or web-based UI, the InfiniiVision 3000G X-Series oscilloscope enables you to work in whatever way is best for you.

Keysight's InfiniiVision 3000G X-Series oscilloscope come in 2-channel models, 4-channel models, and mixed signal oscilloscope (MSO) models with bandwidths ranging from 100 MHz up to 1 GHz.

All models are enhanced with **standard features** that you would typically expect to pay extra for including:

- Powerful triggering and decoding serial buses including I^2C, SPI, UART/RS232/RS485, I^2S, and USB-PD
- High performance mask and measurement limit testing enabled in hardware
- Frequency response analysis (Bode plots)
- Waveform & measurement histograms
- Built-in function/arbitrary waveform generator
- HDTV video analysis
- LAN/VGA I/O communication
- PathWave BenchVue Oscilloscope software for control, automation, and offline analysis



Figure 1. InfiniiVision 3000G X-Series with MegaZoom IV smart memory technology

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Touch, Discover, Solve

The InfiniiVision 3000G X-Series oscilloscopes have a capacitive touch screen user-interface that was designed for touch operation. Also included is hardware-based zone triggering combined with an industry-leading uncompromised update rate of 1 million waveform/sec to give you the confidence that you're seeing all of your signal detail and the ability to discover any issues.

The InfiniiVision 3000G X-Series redefines what you can expect in a general-purpose oscilloscope by providing all the performance and capability you need to get to measurement insights faster:

Touch:

- 8.5-inch capacitive touch screen
- Designed-for-touch interface

Discover:

- Industry's fastest uncompromised waveform update rate
- Zone trigger

Solve:

- Wide range of serial decodes
- 7-in-1 instrument integration
- Time/frequency domain correlation

Touch: Designed-for-touch operation to simplify use

From the start of product development, we designed every aspect of this oscilloscope to be seamlessly driven by a touch interface. Large, easy-to-touch targets, a graphical user interface that adapts to show you more and be easier to touch, and a large, sensitive, capacitive touch screen all combine to make operation quick and natural, just like your favorite tablet devices.



Figure 2. An 8.5" capacitive touch display with large, touchable targets.

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Capacitive touch screen technology enables productivity

The user interface allows you to use the alphanumeric pad for quick annotation, place waveforms or cursors in exact positions and drag docking panels across the screen to see more measurement information.

The InfiniiVision 3000G X-Series offers three ways to access key menus and features: touch GUI for those that prefer tablet or smart phone touch interfaces, front panel buttons and knobs for the traditional oscilloscope users, and Keysight Insight pull down menu for users who prefer Windows-like operations. The 3000G X-Series also offers a “touch off” button as well as USB mouse and keyboard support.

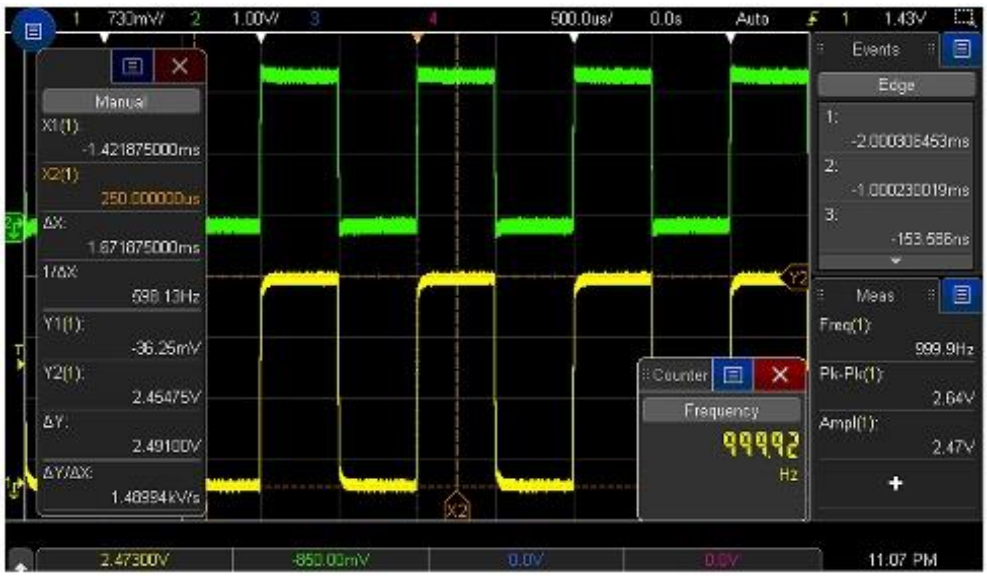


Figure 3. Side bar with movable docks allows information to be placed on the screen precisely where you want it for documentation.

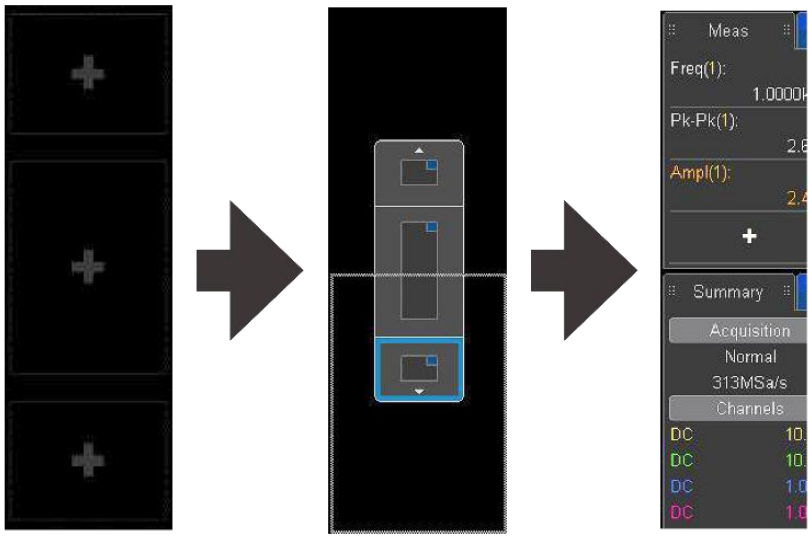


Figure 4. A dock-able sidebar allows you to customize how you view your measurements.

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Touch interface simplifies documentation

The availability of up to 10 annotations on screen makes it easy to highlight key items on screen shots. Streamline documentation with the ability to input information via a pop-up soft keyboard on the touch screen or a USB keyboard. A sidebar displays additional information without covering the waveform graticule and allows you to dock and scroll through multiple measurement values. Touch gestures (like flicking) make navigating lists or moving between segment waveforms easy.

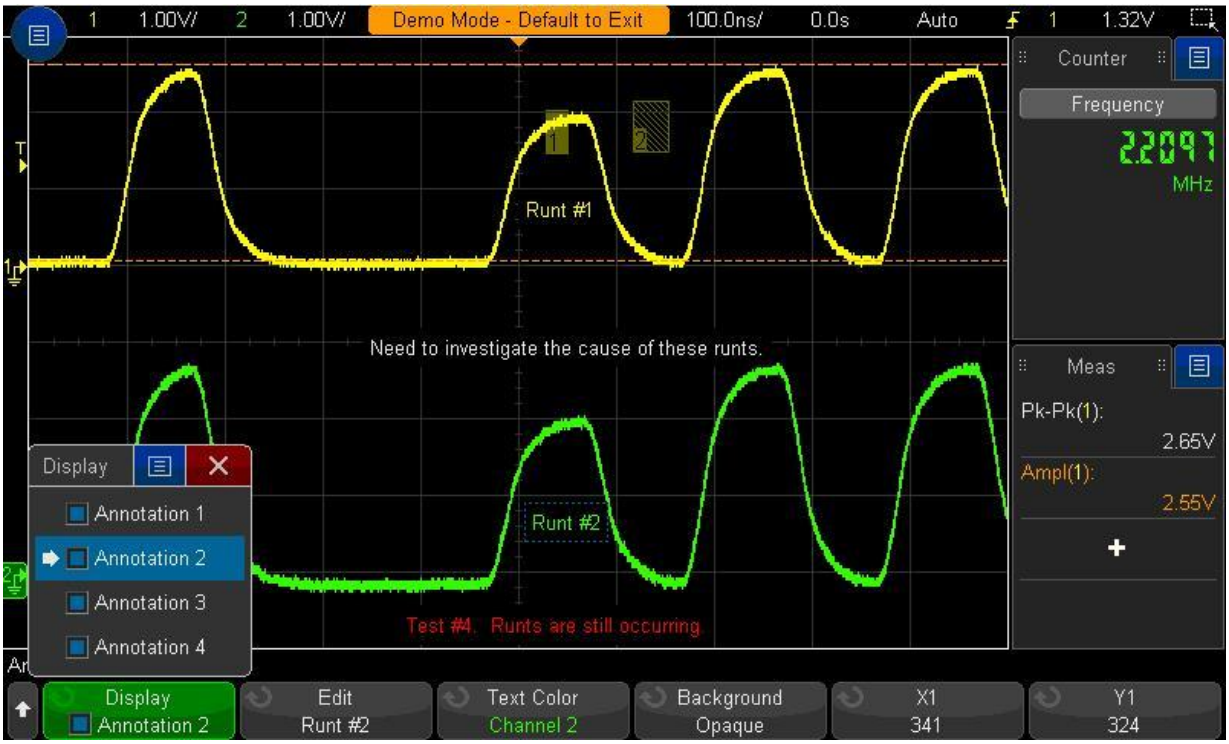


Figure 5. See up to ten annotations on screen at once for documentation. The standard touch screen makes inputting notes simple.

In addition to the benefits of touch, built-in USB host and USB device ports, as well as a LAN port, make PC connectivity easy. The BV0004B oscilloscope control and PC-based software (standard with the purchase of each InfiniiVision X-Series oscilloscope) lets you control and visualize the InfiniiVision 3000G X-Series and multiple measurements simultaneously. It lets you build automated test sequences just as easily as you can with the front panel. Save time with the ability to export measurement data to Excel, Word and MATLAB in three clicks. Monitor and control your 3000G X-Series oscilloscope with a mobile device from anywhere. Simplify your testing with BenchVue software.

Learn more at www.keysight.com/find/BenchVue

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Figure 5. Use BenchVue for remotely logging and plotting measurement data.

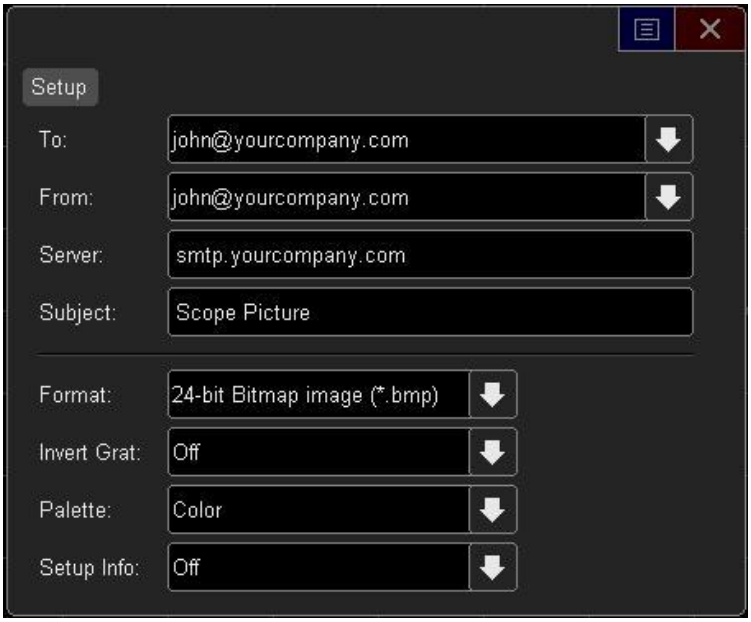


Figure 6. With the standard LAN/VGA module you can email yourself setups, data, and screenshots.

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Redefine your remote web control oscilloscope experience

The InfiniiVision 3000G X-Series oscilloscope offers traditional control via a PC Web browser, but also supports remote control through popular tablet devices when using the standard LAN/VGA interface.

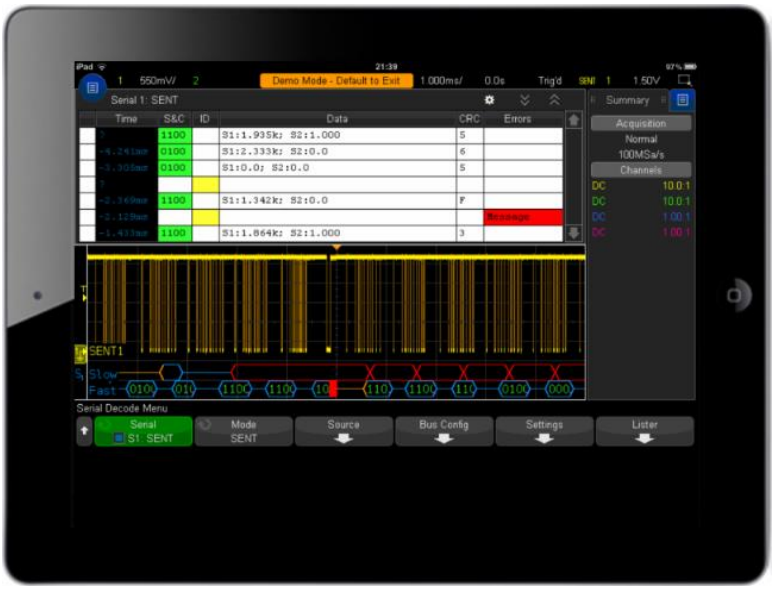


Figure 7. Remotely control the InfiniiVision 3000G X-Series oscilloscope via tablet device.

Discover: Fast Update Rate and Zone Triggering Uncover Hidden Signal Problems

Industry-leading uncompromised update rate

If you can't see the problem, you can't fix the problem. With an industry-leading update rate of over one million waveforms per second, the InfiniiVision 3000G X-Series oscilloscope gives you the highest probability of capturing random and infrequent events that you would miss on an oscilloscope with a lower waveform update rate.

Powered by MegaZoom IV smart memory technology, the InfiniiVision 3000G X-Series not only lets you see more waveforms, but it has the uncompromised ability to find the most difficult problems in your design under any conditions. Unlike other oscilloscopes, uncompromised ability means:

- Always-fast, responsive operation
- No slowdown with logic channels on
- No slowdown with protocol decoding on
- No slowdown with math functions on
- No slowdown with measurements on
- No slowdown with vectors on
- No slowdown with sinx/x interpolation on

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What is waveform update rate?

As oscilloscopes acquire data, process it, and plot it to the screen, there is inevitable “dead time,” or the time oscilloscopes miss signals completely while processing waveform data from the previous acquisition. In general, the faster the waveform update rate, the shorter the dead time. The shorter the dead time, the more likely an oscilloscope is to capture anomalies and infrequent events. This is why it is important to select an oscilloscope with a fast waveform update rate. Figures 9 and 10 demonstrate the difference between a slower update rate and a faster update rate.

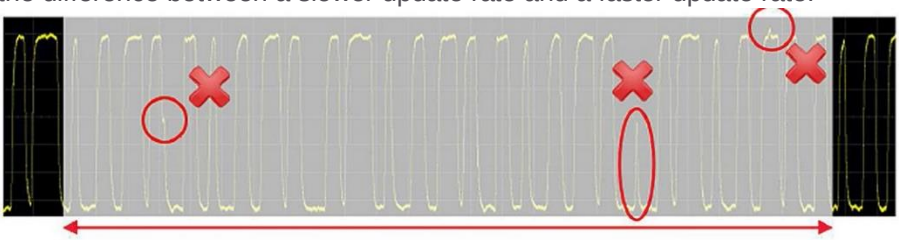


Figure 9. Another vendor’s oscilloscope with 50,000 waveforms/second. A long dead time decreases your chances of capturing infrequent events.

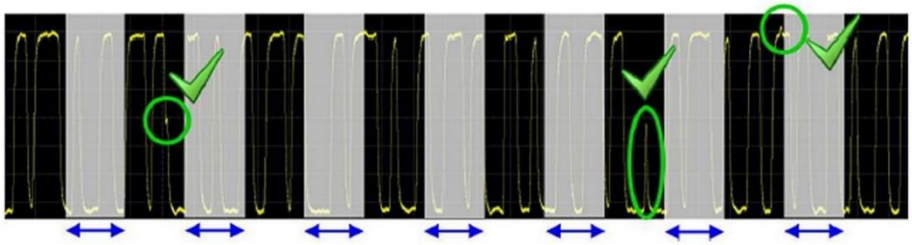


Figure 10. InfiniiVision 30000G X-Series with 1,000,000 waveforms/second. A short dead time increases the probability of capturing infrequent events.

But all specs aren’t equal. Many vendors may claim a fast update rate specification, but that is only in a special mode, or without any features turned on. Table 1 shows the 3000G X-Series’ update rate versus a competing oscilloscope.

While all scopes update rate will vary to some degree by the timebase setting, it is critical that the update rate remain constant regardless of the functionality you are using within the oscilloscope.

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Table 1. Measured update rate between the 3000G X-Series and the Danaher Tektronix MDO3000. Note how the update rate fluctuates wildly on the MDO3000 based on different settings/features.

	10 ns/div			
	Keysight 3000G X-Series		Tektronix MDO3000 Series	
Max with no features on	Update rate	Probability	Update rate	Probability
Max with digital ch on	1,114,000	94%	281,000	50%
Max with measurements on	1,101,000	94%	132	0.03%
Max with FFT on	1,114,000	94%	2,200	0.55%
Max with serial on	1,114,000	94%	2,200	0.55%
Max with search on	1,100,000	94%	1,800	0.45%
Max with ref wfms on	1,113,000	94%	2,200	0.55%

Why is an uncompromised update rate important?

When debugging or troubleshooting a project, it is important that you see as much signal detail as possible. A fast update rate is just part of the overall equation to determine the likelihood of seeing an anomaly. The frequency of the anomaly, the timebase setting of the oscilloscope and the amount of time you allow the oscilloscope to see the anomaly all come in to play:

$P_t = 100 \times (1-[1-RW]^{(U \times t)})$

Where:

Pt = Probability of capturing anomaly in “t” seconds

t = Observation time

U = Scope’s measured waveform update rate

R = Anomalous event occurrence rate

W = Display acquisition window = Timebase setting x 10

Therefore, it is important to select an oscilloscope with the fastest uncompromised update rate to allow enough time to increase your chances of seeing the glitch. In Table 1, in addition to the measured update rate, we show the probability of seeing a glitch that happens 5 times a second while allowing the oscilloscope to acquire for 5 seconds. With the 3000G X-Series you maximize your chances of seeing the infrequent glitch. With the competing scope, if you are using any of the other features like measurements, or search or digital channels, the update rate slows considerably. The only option you have in this case is to allow the oscilloscope to run longer. For example, if you are using digital channels, you’ll have to let the scope run over 8,000 times longer to get a similar probability to the uncompromised update rate of the 3000G X-Series. That’s almost 12 hours of time versus 5 seconds!

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MegaZoom IV smart memory technology enables uncompromised update rate

Traditionally, CPU processing was the major bottleneck for oscilloscope waveform update rate and responsiveness. Typically, the CPU handles interpolations, logic channel plotting, serial bus decoding, measurements and more, and the waveform update rate drops dramatically as these features are turned on.

The InfiniiVision 3000G X-Series requires minimum support from a CPU, as most core operations are handled by Keysight proprietary technology, the MegaZoom IV smart memory ASIC. MegaZoom includes hardware serial decoders and hardware mask limit testing capability, plots analog and digital data directly to the display, supports GUI operation, and integrates additional instruments like the WaveGen function/arbitrary waveform generator.

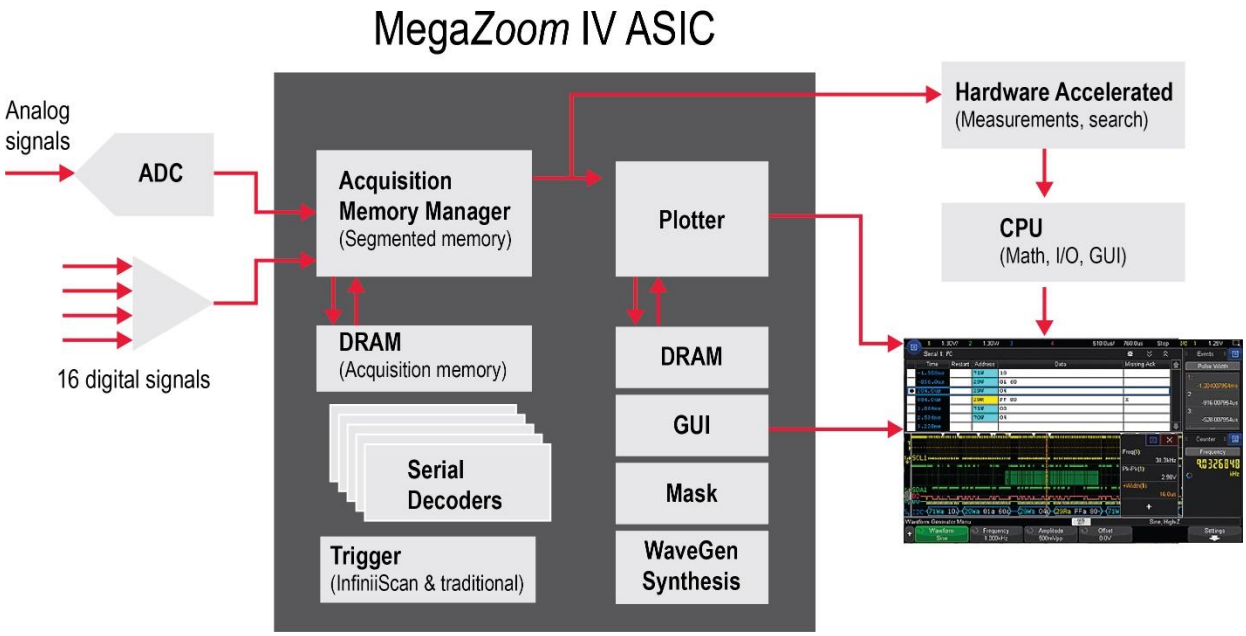


Figure 11. The 3000G X-Series oscilloscopes' uncompromised responsiveness, speed and waveform update rate are enabled by the MegaZoom IV, smart memory ASIC. The CPU is not used for core waveform operations.

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Excellent signal integrity allows you to see more signal detail

The 3000G X-Series has excellent signal integrity, including full bandwidth to 1 mV/div and the ability to obtain up to 12-bits of resolution using the high-resolution acquisition mode.

Some oscilloscopes in this class limit their bandwidth at lower volt-per-division settings without on-display user notifications. This is likely to keep the noise acceptable at lower volt-per-division settings.

Table 2 shows a comparison of the typical noise floor at 20 µs/div between the normal and high-resolution mode. You will notice that the noise floor performance improves as much as five times.

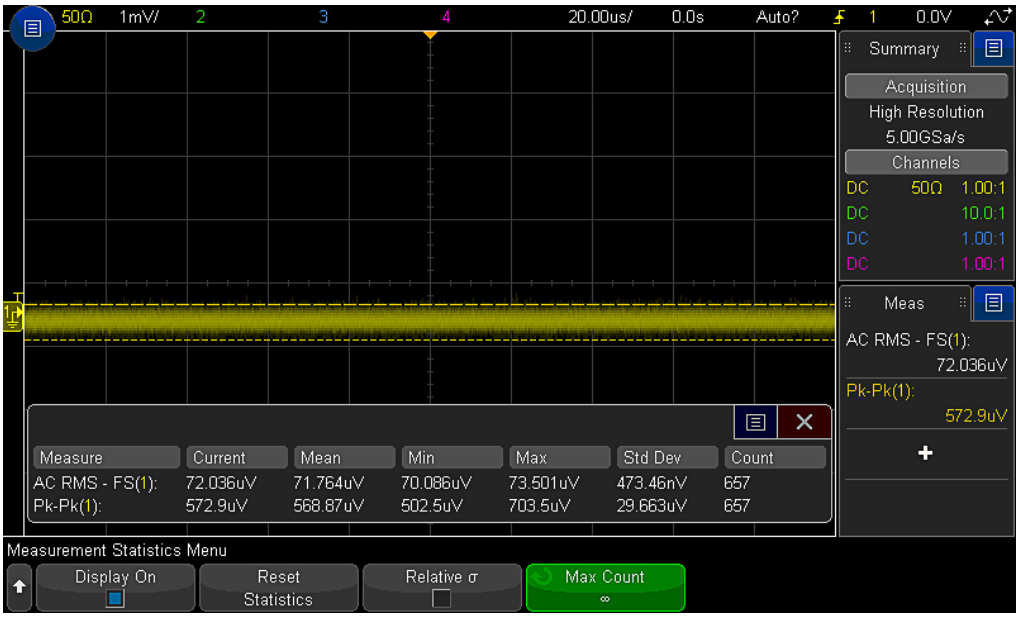


Figure 12. High resolution mode allows you to lower your noise and increase your resolution up to 12-bits.

Table 2. Noise comparison between the normal and high-resolution mode at 20 µs/div.

50 Ω 1 GHz bandwidth Vrms measurement (units = mV)			
Vertical setting	**Normal mode**	**High resolution mode**	**Notes**
1 mV	0.277	0.072	Some other manufacturers will limit their bandwidth significantly at these vertical settings, but the Keysight 3000G X-Series provides full bandwidth at all settings.
2 mV	0.277	0.072	
5 mV	0.297	0.081	
10 mV	0.352	0.081	
20 mV	0.597	0.102	
50 mV	1.500	0.340	
100 mV	2.560	0.480	
200 mV	5.500	1.050	
500 mV	15.200	3.630	
1 V	26.000	4.830	

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Zone trigger makes triggering on complex signals simple

An uncompromised update rate allows you to see an anomaly, but to continue the debug process you must isolate it. Setting up advanced trigger conditions has been a challenge since oscilloscopes introduced triggered waveforms. While oscilloscopes have added more and more triggering capability over the years, setting up specialized trigger conditions has remained complex at best and impossible at worst.

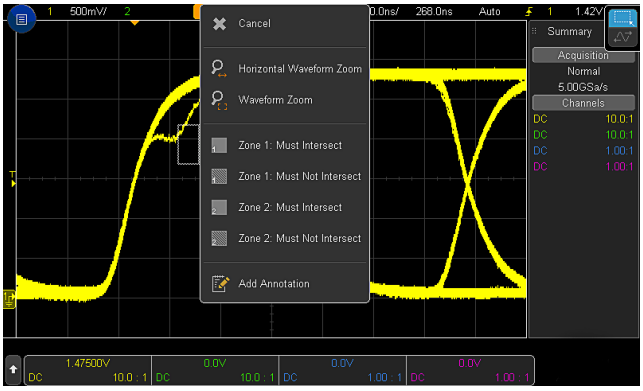
Zone trigger eliminates the complexity of setting up advanced triggers. Now, if you can see an infrequent event on the display of the oscilloscope, you can trigger on it by simply drawing a box that intersects a portion waveform you want to isolate.

See how easy Zone touch triggering can be with these examples:

Steps to isolate a non-monotonic edge: 3000G X-Series:

- Draw box on the infrequent non-monotonic edge
- Select “must intersect”

In some cases, you may have to select the appropriate source/channel if it wasn’t already selected.



Traditional scopes with advanced triggers

(assuming the update rate is fast enough to see what you want to trigger on):

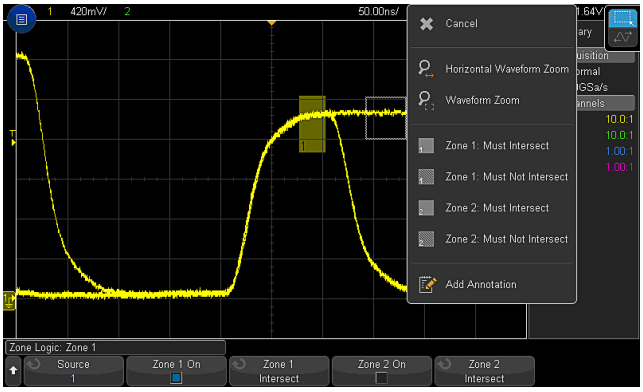
1. Determine what trigger makes the most sense for the signal you are trying to isolate. In this case, we’ll try a rise-time trigger first.
2. Select cursors
3. Move cursor a to 10% level
4. Move cursor b to 90% level on the non-monotonic edge
5. Obtain the delta time (rise time) between the cursors
6. Select trigger menu
7. Press trigger type
8. Select Rise/Fall time Trigger
9. Select your source
10. Select your slope
11. Select when you want it to trigger – is it less than, greater than, equal to, not equal to. We’ll select greater than.
12. Dial in the “greater than” setting to the measured rise time
13. Adjust your low threshold to the 10% level
14. Adjust your high threshold to the 90% level

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Steps to trigger on a runt signal: 3000G X-Series

1. Draw box on the infrequent runt pulse
2. Select “must intersect”
3. Draw a second box if needed to further isolate the runt from other runts
4. Select “must intersect” or “must not intersect”

In some cases, you may have to select the appropriate source/channel if it wasn’t already selected.



Traditional scopes with advanced triggers

(Assuming the update rate is fast enough to see what you want to trigger on).

Determine what trigger makes the most sense for the signal you are trying to isolate. In this case, we’ll use a runt trigger first.

1. Select trigger menu
2. Press trigger type
3. Select runt Trigger
4. Select your source
5. Select the runt’s polarity
6. Adjust your low threshold to below the runt
7. Adjust your high threshold to above the runt
8. Select when you’ll trigger – in this case, we want to trigger on the exact pulse width of the runt
9. Select cursors
10. Move cursor a to the rising edge of the pulse at the 50% mark
11. Move cursor b to the falling edge of the pulse at the 50% mark
12. Obtain the delta time (pulse width) between the cursors
13. Adjust the runt width to be equal to the pulse width that was measure

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Standard segmented smart memory allows you to capture longer periods of time at higher sample rates

Acquisition memory size is an essential oscilloscope specification because it determines sustainable sample rate and the amount of time you can capture in a single acquisition. In general, longer memory is better. However, no memory will always be long enough to capture all the signals you need, especially when capturing infrequent anomalies, data bursts, or multiple serial bus packets. Segmented memory acquisition lets you selectively capture and store important signal activity without capturing unimportant signal idle time. In addition, it provides a time stamp of each segment relative to the first trigger event to enable analysis of the frequency of the event. Segmented memory comes standard on the InfiniiVision 3000G X-Series oscilloscope.

Figure 13 shows segmented memory successfully capturing 100 small and large glitch events at 5 GSa/s in 47 seconds. Traditional memory architecture would require almost 203G points of memory to accomplish the same result! This memory is not available on any scope in the market.

Furthermore, segmented memory discovered that the worst offender glitch happened 40 seconds from the first trigger event, or at the 95th glitch. It also found out a unique glitch took place 13 seconds after the first glitch. As shown in figure 14, you can overlay all segments to have a comprehensive view as well.



Figure 13. Segmented memory reveals different types of glitches are taking place.

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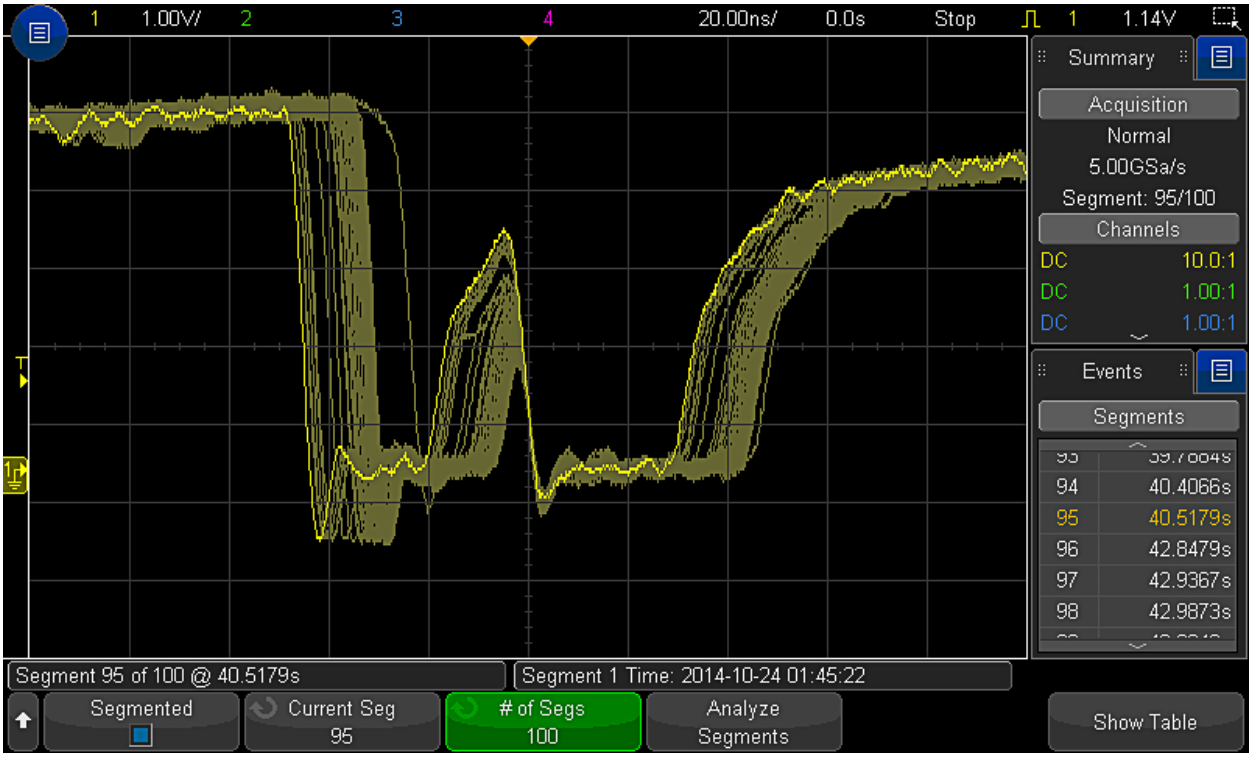


Figure 14. Screen showing an overlay of all 100 segments for worst case waveform analysis.

Dedicated search & navigation helps you navigate deep memory

Parametric and serial bus search and navigation comes standard on the InfiniiVision 3000G X-Series oscilloscopes. When you are capturing long, complex waveforms using an oscilloscope's acquisition memory, manually scrolling through stored waveform data to find specific events of interest can be slow and cumbersome. With automatic search and navigation capability, you can easily set up specific search criteria and then quickly navigate to "found and marked" events. Available search criteria include edges, pulse width (time-qualified), rise/fall times (time-qualified), runt pulses (time-and level-qualified), frequency peaks (FFT function, threshold and excursion qualified), and serial bus frames, packets, and errors.



Close-up on buttons on the front panel of the scope. Alternatively, you also can use the touch navigation control.

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