DATA SHEET

Streamline Series P924xA USB Oscilloscopes

Compact InfiniiVision 1 GHz Oscilloscope Technology

Keysight is taking USB instrumentation to a whole new level

Keysight Streamline Series USB oscilloscopes

- P9241A USB oscilloscope – 200 MHz bandwidth
- P9242A USB oscilloscope – 500 MHz bandwidth
- P9243A USB oscilloscope – 1 GHz bandwidth



Compact Form. Zero compromise.

KEYSIGHT TECHNOLOGIES

Overview

The Keysight Streamline Series P924xA USB oscilloscopes bring the InfiniiVision usability and performance to USB oscilloscopes. Keysight Streamline Series USB oscilloscopes provide maximum investment protection and are built with technology that leverages decades of Keysight's high-performance oscilloscope expertise.

Performance

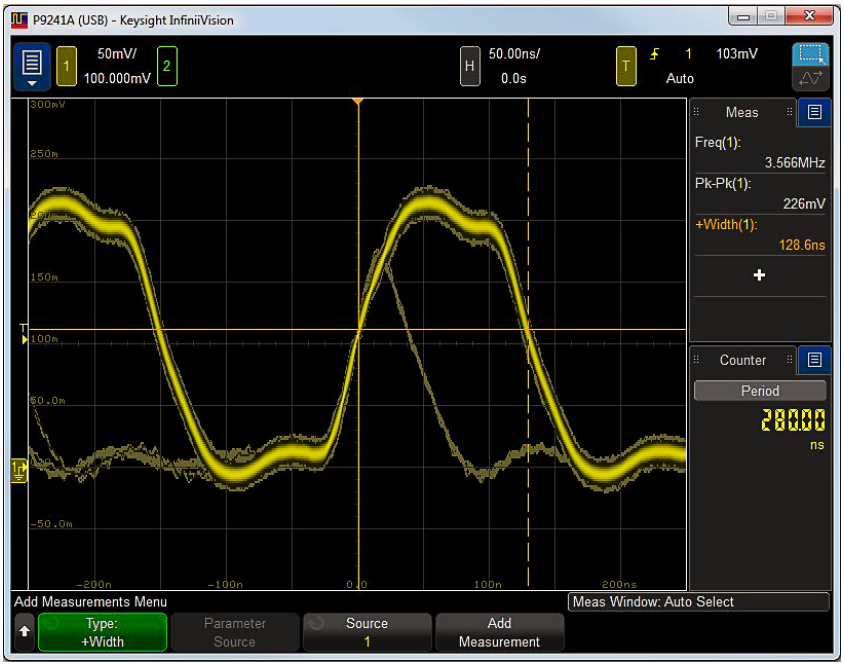
- 200 MHz, 500 MHz or 1 GHz bandwidths available to match your measurement application
- Advanced triggering enables capture and analysis of complex signals
- Visual triggers (zone touch and mask) make trigger and capture of signal errors quick and easy
- Serial protocol analysis and triggering for most common protocols
- Automated FFT and waveform math extend analysis to match your needs
- Segmented memory can analyze 1000 events without ever offloading to a PC

Measurement capability

- Support for a variety of probing solutions
  - Differential and single-ended active probes
  - High-voltage probes
- 30+ automated measurements provide simple-to-access analysis

Multiple instruments in one

- Oscilloscope support for up to 1 GHz bandwidth with 5 GSa/s
- DVM (Digital voltmeter) 3-digit using the same scope probes
- 8-digit counter for integrated totalizer/frequency counter measurements
- Protocol analyzer for I²C, UART, CAN, LIN, CXPI and more
- Spectrum analysis with FFT and channel power measurements
- 20-MHz arbitrary waveform generator

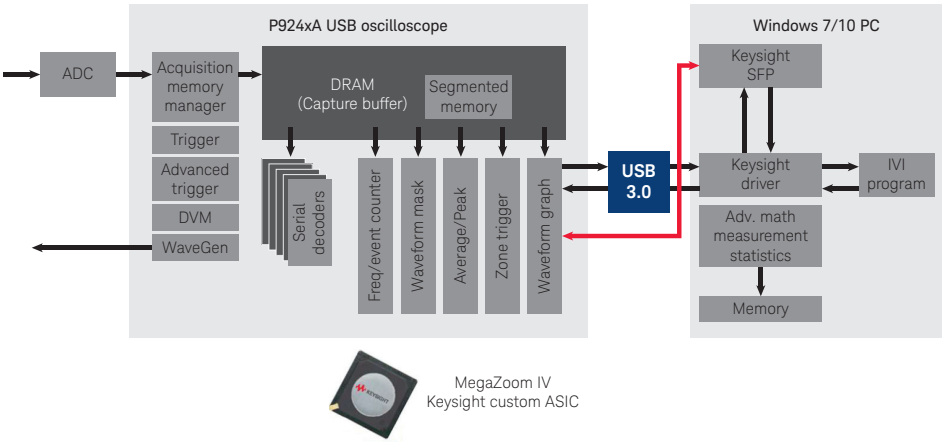


Capturing up to 1,000,000 waveforms/sec makes it easy to find anomalies like this glitch that occur very rarely.

Uncompromising Analysis Capability

Many USB users have been using digitizer hardware with software that simulates an oscilloscope for test and troubleshoot implementation. The limitations of this configuration are often overlooked, but they can cause signification problems. When a instrument says it has a high waveform update rate, people usually expect it to have a higher probability of catching random and infrequent glitches, but this isn't the case for those instruments. In addition, common measurements like waveform averaging and advanced waveform triggers are not available.

The Keysight Streamline Series USB oscilloscopes USB oscilloscopes require minimum support from a central processing unit (CPU), as most of their core operations are handled by the MegaZoom IV smart memory ASIC, which is Keysight proprietary technology. MegaZoom includes hardware serial decoders and hardware mask/limit testing capability; supports GUI operation; and integrates additional instruments like a WaveGen function/arbitrary waveform generator.

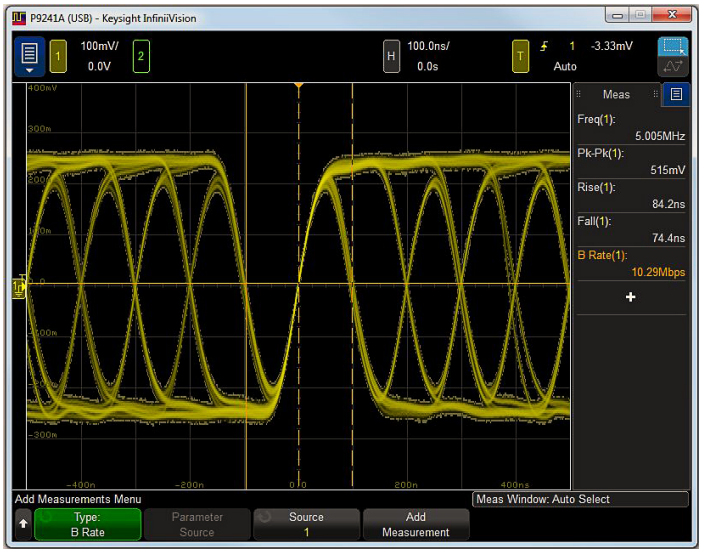


The P924xA USB oscilloscopes utilize hardware to perform many of the functions traditional digitizers do with software on the CPU. By doing more in hardware, P924xA Series oscilloscopes can analyze more of the signal than ever before.

Key to the oscilloscope operation is that the acquisition does the triggering and most of the analysis utilizing onboard hardware. For example, to accomplish 1million waveforms/sec, the waveforms are captured and plotted into hardware on the scope and then the waveform is transferred to the PC for display.

Industry-exclusive Zone Touch Trigger Makes Triggering Simple

Zone touch triggering eliminates the complexity of setting up advanced triggers. If you have a touch-enabled display on your controller, you can trigger on events by simply drawing a box with your finger on the display of the signal you want to isolate. Keysight pioneered the zone touch trigger, which allows easy capture of difficult-to-define trigger events.



Capturing a serial data stream using a simple edge trigger.



Zone Trigger enable quick and easy isolation of the data pattern of interest.

The P924xAs' high, uncompromised update rate increases your chance of seeing random and infrequent signal anomalies, and zone touch trigger helps you isolate the signals. Now your testing can be faster and more thorough.

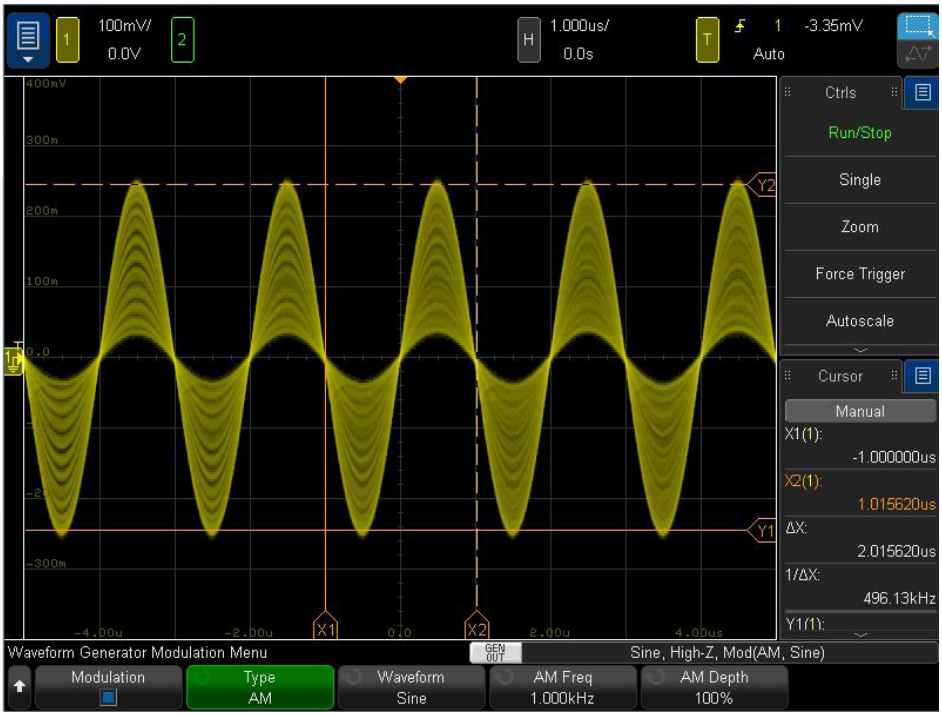
Other Touch-based Operation

Just like Keysight's touch-enabled InfiniiVision benchtop oscilloscopes (3000T, 4000 and 6000 X-Series), the P924xA Keysight Streamline Series USB oscilloscopes also uses touch capability to interact with signal display. In addition to zone touch trigger, these oscilloscopes also let you move the waveform up/down; adjust the time offset and zoom; and define one of the two touch zone triggers. All that is required is a touch-enabled display connected to your USB scope.

Additional Software for Added Functionality

P9240BDLB Application Bundle for Keysight USB Oscilloscopes

Take advantage of a new oscilloscope application bundle that will enable ALL software applications on your Keysight USB oscilloscope for a huge discount over buying the options individually. See a complete list of applications in Step 2 of the configuration table. (page 10)



P9240AWGA WaveGen 20 MHz Function/Arbitrary Waveform Generator

The P924xA Streamline Series USB oscilloscopes offer a 20-MHz built-in function/arbitrary waveform generator. The WaveGen provides standard stimulus output waveforms to your device under test as well as user-definable frequencies, amplitudes, offset and pulse widths and arbitrary waveform capability. The WaveGen output is routed to a MMCX connector on the front panel of the oscilloscope.

Use the built-in waveform editor to create custom waveforms to output on the oscilloscope's WaveGen. It is also possible to capture a known good or 'golden' waveform on a scope channel and then save that to the ARB so you can generate it to stimulate your system under test.

Frequency Response Analyzer (Optional)

Frequency response analysis is a critical measurement to characterize the stability of feedback networks and switch-mode power supplies. This capability is achieved with a gain and phase measurement versus frequency (Bode plot). By using the waveform generator output to stimulate your design and probing the input and output signals on channels 1 and 2, the oscilloscope provides a clear report on the gain and phase operation of the system.

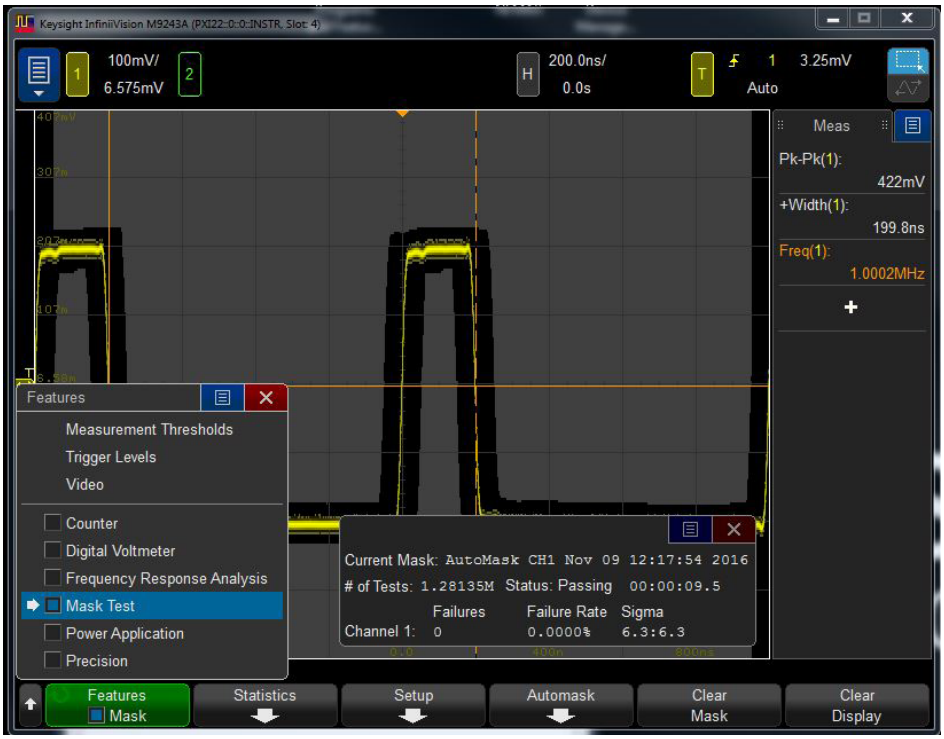


Additional Software for Added Functionality (Continued)

Mask Limit Testing (Optional)

With the mask limit testing measurement application, you can quickly test more than 200,000 waveforms per second to a known good waveform with quick go/no-go test results, saving you valuable test time while providing you with more confidence in test results. Test your signals to specified standards, and uncover unexpected signal anomalies.

Mask testing on other oscilloscopes is usually based on software-intensive processing technology, which tends to be slow. Keysight's InfiniiVision oscilloscopes' mask test option is based on hardware-based technology. This means P924xA oscilloscopes can perform more than 200,000 real-time waveform pass/fail tests per second. This provides testing throughput that is orders of magnitude faster than what is available on other oscilloscope mask test solutions, making valid pass/fail statistics almost instantly.



Enhanced HDTV Triggering And Analysis (Optional)

The P924XA oscilloscopes support a video IRE display grid, as well as cursors measurements performed in video IRE units for the NTSC and PAL standards. This new capability is standard on P924xA oscilloscopes. Optional enhanced HDTV triggering and analysis software provides an array of additional HDTV triggering standards. The additional triggering options speed debug and characterization for engineers working on HDTV video applications.



Additional Software for Added Functionality (Continued)

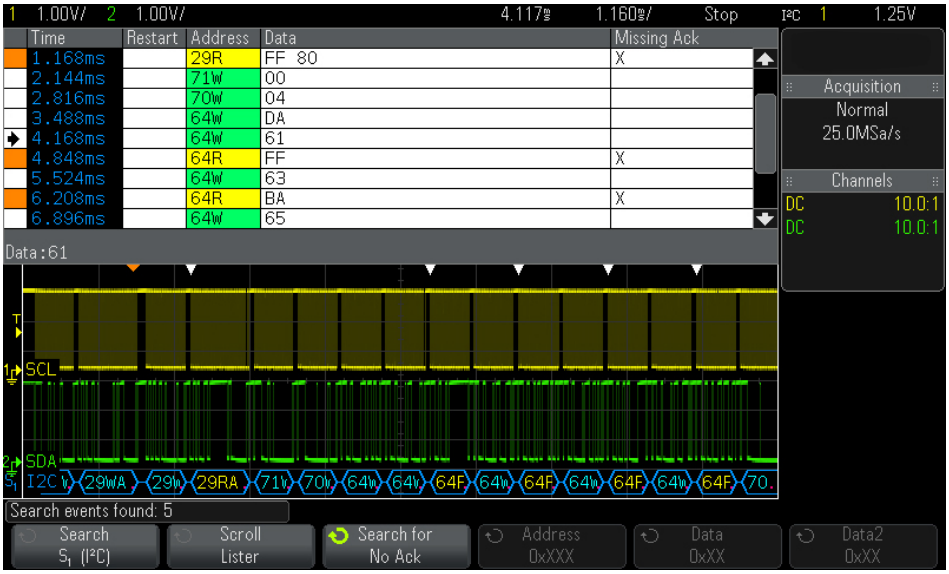
P9240NFCB NFC Triggering

Testing NFC-enabled devices is essential during the design validation and manufacturing test phases to ensure quality and reliability of data transmission. This is especially important when you consider that the data being transferred/exchanged between NFC-enabled devices is often secured financial transactions. The P9240NFCA NFC trigger application enables easy configuration to capture the signals of interest for NFC-A, NFC-B and NFC-F messages.

Serial Trigger & Decode

I²C Serial Trigger And Decode (Optional)

The I²C serial decode for P924xA Streamline Series USB oscilloscopes displays responsive, time-aligned, on-screen decode of Inter-Integrated Circuit (I²C) serial communication. Because this capability is hardware-based, it provides the fastest throughput solution for triggering on and analyzing I²C serial buses found in a wide variety of embedded designs. You can easily isolate serial packets to find sources of errors due to hardware- or software-related problems. Sometimes it may be necessary to correlate data from one serial bus to another. Keysight's P924xA oscilloscopes can decode two serial buses simultaneously using hardware-based decoding.



UART (RS232/422/285) Serial Trigger And Decode (Optional)

The RS232/422/485/UART serial triggering and decode for P924xA oscilloscopes displays responsive, time-aligned, on-screen decode of RS-232/422/485 and other UART serial buses. It provides triggering capabilities on specified transmit or receive values, as well as on parity errors. Trigger on and acquire RS-232/422/485/UART signals using either oscilloscope or logic channels. Hardware-based decode means the scope stays responsive and fast when decode is turned on. Real-time counters continually count transmit and receive frames and errors.

Automotive (CAN, CAN FD, LIN) Serial Trigger And Decode (Optional)

The automotive serial triggering and analysis (CAN, LIN) for P924xA oscilloscopes allows you to trigger on either standard or extended CAN message IDs, including the message ID of a remote transfer request frame. It supports triggering on a data frame and allows you to specify message IDs, data and data length for filtering messages of interest. Triggering on active error frames is also supported. In addition, it supports triggering on LIN frame IDs and data and includes color-coded parity and check sums errors. You can easily isolate serial packets to find sources of errors due to hardware- or software-related problems.



Serial Trigger & Decode (Continued)

SENT (Single Edge Nibble Transmission) Trigger And Analysis (Optional)

The SENT (single edge nibble transmission) is a point-to-point serial bus that interfaces sensors to ECUs and is used primarily in automotive applications. Keysight's P924xA Series oscilloscopes provide decoding of fast and slow channel serial data and also offers extensive triggering selections, including the ability to trigger on various error conditions that can accelerate efficiency in debugging this bus.

Keysight's P924xA Streamline USB oscilloscopes can display captured data from multiple buses in a time-interleaved "lister" display. Sometimes it may be necessary to correlate data from one serial bus to another, such as CAN to SENT.

CXPI Trigger And Decode (Optional)

CXPI (clock extension peripheral interface) is the next-generation automotive communication protocol intended to reduce the number and weight of wiring harnesses by making multiplexing possible even in advanced, multifunction HMI (human machine interface) automotive systems. In many cases, CXPI is an alternative serial bus used in place of many of today's LIN serial bus applications for automotive body control.

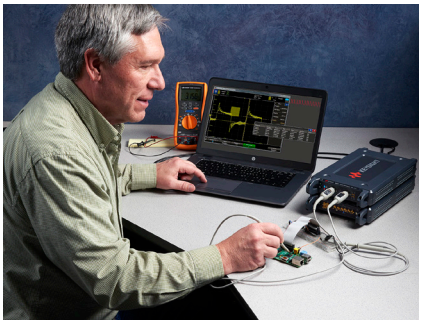
Keysight's for P924xA oscilloscopes provide decoding of standard and long CXPI frames and also offers extensive triggering selections, including the ability to trigger on various error conditions that can accelerate the engineer's efficiency in debugging this bus.

Keysight's P924xA oscilloscopes can display captured data from multiple buses in a time-interleaved "lister" display. This allows correlation of data being passed through gateways, such as CAN to CXPI.

MIL-STD 1553 and ARINC 429 Triggering And Analysis (Optional)

The MIL-STD 1553 serial bus is primarily used to interconnect avionics equipment in military aircrafts. This bus is based on tri-level signaling (high, low and idle) and requires dual-threshold triggering, which the P924xA Streamline Series USB oscilloscopes support. This bus is also implemented as a redundant multi-lane bus (dual-bus analysis), which is also supported.

The ARINC 429 serial bus is used to interconnect avionics equipment in civilian aircrafts. This bus is also based on tri-level signaling (high, low and null) and requires dual-threshold triggering. Since ARINC 429 is a point-to-point bus, multi-lane analysis is also required to capture both send and receive data.

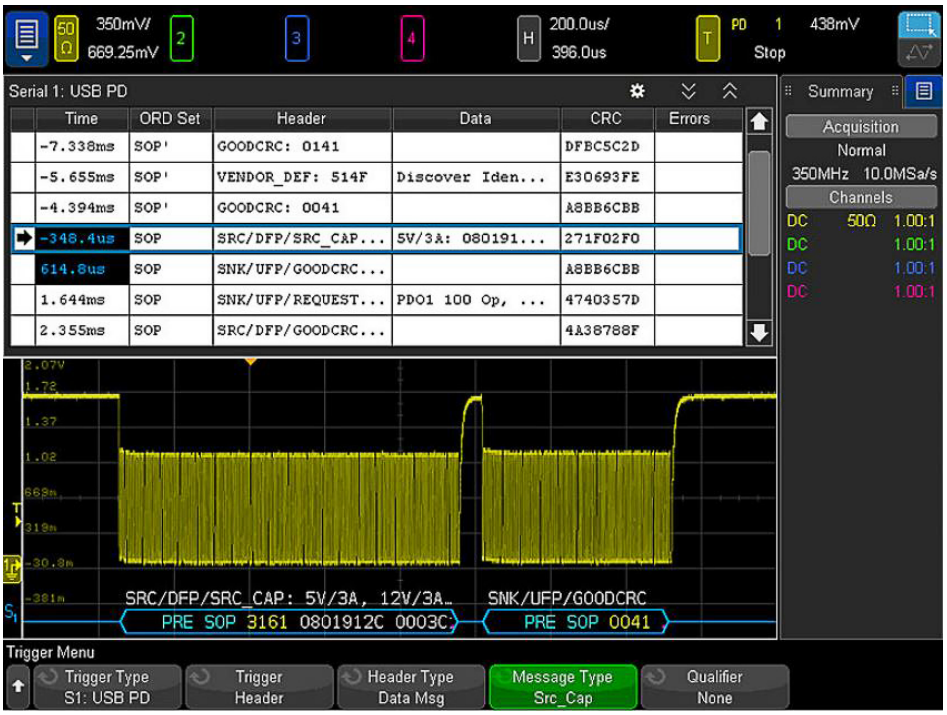


User-definable Manchester and NRZ Trigger And Analysis (Optional)

Keysight's Manchester and NRZ decode and trigger software supports user-defined protocols, offering flexibility and preventing the need to define multiple specific protocol decoding and triggering. This trigger and decode software application is geared toward automotive customers, who commonly use Manchester and NRZ encoded buses (ex: Profibus PA, DALI, PSI5, etc.).

USB Power Delivery (USB PD) Triggering And Analysis (Optional)

The USB Type-C connection has broadened the range of USB usability by incorporating a dynamic power system called USB Power Delivery (USB PD). Negotiating required power between various USB devices is achieved over the USB's Type-C connector's CC line utilizing a serial protocol based on bi-phase marked coding (BMC). The USB PD protocol software for USB oscilloscopes provides an easy way to debug the 300 kbps signal to provide protocol-level debug information of the USB PD serial bus.



Configuration

Step 1. Choose your bandwidth

P9241A – 2 channel, 200 MHz
P9242A – 2 channel, 500 MHz
P9243A – 2 channel, 1 GHz

Step 2. Select hardware upgrades

Hardware Upgrade	Description	Model number to order
WaveGen	Built-in 20 MHz function/AWG waveform generator	P9240AWGA

Step 3. Select software

Licensed Software	Description	Model number to order
Embedded Software Package	I2C, UART (RS232/422/485), and USB PD serial trigger & decode, plus Mask Limit Testing, Frequency Response Analysis (Bode plots), and Enhanced Video Analysis	P9240GENC
Automotive Software Package	CAN (symbolic with .dbc file), CAN FD (symbolic with .dbc file), LIN (symbolic with .ldf file), SENT, CXPI, PSI5 (user-definable Manchester), and User-definable NRZ serial trigger & decode, plus Mask Limit Testing (CAN/CAN FD mask files available to download) and Frequency Response Analysis (Bode plots)	P9240AUTC
Aero Software Package	MIL-STD 1553 and ARINC 429 serial trigger & decode, plus Mask Limit Testing (standard mask files available to download), Frequency Response Analysis (Bode plots), and Enhanced Video Analysis	P9240AERC
NFC Software Package	NFC trigger software	P9240NFCC
Ultimate Bundle Software Package	I2C, UART, CAN, CAN FD, LIN, CXPI, PSI5 (User-definable Manchester), User-definable NRZ, USB PD, MIL-STD 1553, and ARINC 429 serial trigger & decode, plus Mask Limit Testing, Frequency Response Analysis (Bode plots), Enhanced Video Analysis, NFC trigger	P9240BDLC



Configuration (Continued)

Step 4. Choose your probes

The P924xA Series oscilloscopes includes 2 N2843A 500 MHz passive probes.

Other probes are supported but must be purchased as separate products. Please note that only passive probes are supported on the P924xA Streamline Series USB oscilloscopes.

Probe Solutions

Complete family of innovative probes and accessories for the InfiniiVision USB scopes.

Probes	Description	P924xA Oscilloscopes
N2843A	500 MHz 10:1 passive probe	2 included standard with all models
N2842A	300 MHz 10:1 passive probe	Optional
N2841A	150 MHz 10:1 passive probe	Optional
N2840A	50 MHz 10:1 passive probe	Optional
N2894A	700 MHz 10:1 passive probe	Optional
N2142A	75 MHz 1:1, 10:1 switchable passive probe	Optional
N2140A	200 MHz 1:1, 10:1 switchable passive probe	Optional
N2862B	150 MHz 10:1 passive probe	Optional
N2863B	300 MHz, 10:1 passive probe	Optional
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
1146B	1146A 100 kHz, 100 A, AC/DC current probe	Optional
N7040A	23 MHz, 3 kA, AC current probe - Rogowski	Optional
N7041A	30 MHz, 600 A, AC current probe - Rogowski	Optional
N7042A	30 MHz, 300 A, AC current probe - Rogowski	Optional
N7026A	150 MHz high sensitivity clamp-on current probe	Optional

For probing information, see the Keysight Oscilloscope Probes and Accessories Selection Guide, publication number 5968-8153EN.

Additional Accessories

Model	Description
Option AMG	Calibration uncertainties/guardbanding (accredited)
N2150A	CD, P92xxA oscilloscope software including electronic manuals and IO Libraries[1]
Y1700A	1U side by side rackmount kit for Streamline Series
Y1710A	Transit case for Streamline Series

1. All software and manuals are available for immediate download from the product website

Performance Characteristics

P924xA Keysight Streamline Series USB Oscilloscopes

P924xA USB oscilloscopes overview			
	P9241A	**P9242A**	**P9243A**
Bandwidth (–3 dB) [1]	200 MHz	500 MHz	1 GHz
Calculated rise time (10 to 90%)	≤ 1.75 ns	≤ 700 ps	≤ 450 ps
Input channels	2	2	2
Maximum sample rate	5 GSa/s one channel, 2.5 GSa/s two channels		
Maximum memory depth	Standard 4 Mpts, standard segmented memory		
Waveform update rate	≥ 1,000,000 waveforms/sec [2]		

Vertical system analog channels				
		P9241A	**P9242A**	**P9243A**
Hardware bandwidth limits		Approximately 20 MHz (selectable)		
Input coupling		AC, DC		
Input impedance		Selectable: 1 MΩ ± 1% (15 pF), 50 Ω ± 3%		
Input sensitivity range		1 mV/div to 5 V/div (1 MΩ and 50 Ω)		1 mV/div to 5 V/div (1 MΩ)
				1 mV/div to 1 V/div (50 Ω)
Vertical resolution		8 bits (measurement resolution is 12 bits with averaging)		
Maximum input voltage		135 Vrms		
		Probing technology allows testing of higher voltages. For example the included N2843A 10:1 probe supports testing of up to 300 Vrms.		
DC vertical accuracy		± [DC vertical gain accuracy + DC vertical offset accuracy + 0.21% full scale] [3]		
DC vertical gain accuracy [1]		± 2.0% full scale		
DC vertical offset accuracy		± 0.1 div ± 2 mV ± 1% of offset setting		
Channel-to-channel skew		> 100:1 from DC to maximum specified bandwidth of each model (measured with same V/div and coupling on channels)		
Offset range		± 2 V (1 mV/div to 200 mV/div)		
		± 50 V (> 200 mV/div to 5 V/div)		
Time base range		2 ns/div to 50 s/div	1 ns/div to 50 s/div	500 ps/div to 50 s/div
Time base accuracy [1]	Pre-trigger	± 1.6 ppm + aging factor (1st year: ± 0.5 ppm, 2nd year: ± 0.7 ppm, 5 years: ± 1.5 ppm, 10 years: ± 2.0 ppm)		
Time base delay time range	Post-trigger	Greater of 1 screen width or 250 µs		
		1 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) ± 100 ps		
Modes		Main, Zoom, XY, and Roll		
XY mode		Z Blanking on Ext Trigger Input, 1.4 V threshold Bandwidth = Max oscilloscope bandwidth, Phase error at 1 MHz < 0.5 degree		

1. Denotes warranted specifications. All others are typical.
2. Requires infinite persistence in order to visually display 1,000,000 wfm/sec.
3. Specifications are valid after a 30-minute warm-up period and ± 10 °C from firmware calibration temperature. 1 mV/div and 2 mV/div are 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 Characteristics (Continued)

Acquisition system					
		P9241A	**P9242A**	**P9243A**	
Maximum analog channels sample rate		5 GSa/s half channel interleaved, 2.5 GSa/s all channel			
Maximum analog channels record length		4 Mpts half channels, 2 Mpts all channels			
Acquisition mode	Normal	Default mode			
	Peak detect	Capture glitches as narrow as 250 ps at all-time base settings			
	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 to 12 bits of resolution when ≥ 10 µs/div at 5 GSa/s or ≥ 20 µs/div at 2.5 GSa/s			
	Segmented	Segmented memory optimizes available memory for data streams that have long dead times between activity. Maximum segments = 1000. Re-arm time = 1 µs (minimum time between trigger events)			
Time mode	Normal	Default mode			

Trigger system				
	P9241A	**P9242A**	**P9243A**	
Trigger sources	Analog channel (1-2), external, WaveGen (1 or mod) (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, press [Single] again for scope to find another trigger event, or press [Run] to trigger continuously in either Auto or Normal mode			
	Force: Trigger immediately and display acquisition			
Trigger coupling	DC: DC coupled trigger			
	AC: AC coupled trigger, cutoff frequency: < 10 Hz (internal); < 50 Hz (external)			
	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	40 ns to 10.00 s			
Trigger sensitivity				
Internal [1]	< 10 mV/div: Greater of 1 div or 5 mV; ≥ 10 mV/div: 0.6 div			
External [1]	200 mVpp from DC to 100 MHz			
	350 mVpp 100 to 200 MHz			
Trigger level range				
Any channel	± 6 div from center screen			
External	± 8 V			

1. Denotes warranted specifications. All others are typical.

Performance Characteristics (Continued)

Trigger type selections			
	P9241A	P9242A	P9243A
Zone touch trigger	Trigger on user-defined zones drawn on the display. Applies to one analog channel at a time. Specify zones as either “must intersect” or “must not intersect.” Up to two zones. > 200,000 scans/sec update rate		
	Supported modes: normal, peak detect, high resolution		
	Also works simultaneously with the serial trigger and mask/limit test		
Edge	Trigger on a rising, falling, alternating or either edge of any source		
Edge then edge (B trigger)	Arm on a selected edge, wait a specified time, then trigger on a specified count of another selected edge		
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 (500 MHz, 1 GHz), 6 ns (200 MHz)		
	Maximum duration setting: 10 s		
	Range minimum: 10 ns		
Runt	Trigger on a position runt pulse that fails to exceed a high level threshold. Trigger on a negative runt pulse that fails to exceed a low level threshold. Trigger on either polarity runt pulse based on two threshold settings. Runt triggering can also be time-qualified (< or >) with a minimum time setting of 2~10 ns and maximum timesetting of 10 s		
	Minimum time setting: 6 ns (200 MHz), 2 ns (500 MHz, 1 GHz)		
Setup and hold	Trigger and clock/data setup and/or hold time violation. Setup time can be set from –7 to 10 s. Hold time can be set from 0 s to 10 ns		
Rise/fall time	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: 1 ns (500 MHz, 1 GHz), 3 ns (200 MHz)		
	Maximum: 10 s		
N^{th} edge burst	Trigger on the Nth (1 to 65535) edge of a pulse burst. Specify idle time (10 ns to 10 s) for framing		
Pattern	Trigger when a specified pattern of high, low and don’t care levels on any combination of analog or trigger channels is [entered | exited]. Pattern must have stabilized for a minimum of 2 ns to qualify as a valid trigger condition		
	Minimum duration setting: 2 ns (500 MHz, 1 GHz), 6 ns (200 MHz)		
	Maximum duration setting: 10 s		
	Range minimum: 10 ns		
Or	Trigger on any selected edge across multiple analog channels		
Video	Trigger on all lines or individual lines, odd/even or all fields from composite video or broadcast standards (NTSC, PAL, SECAM, PAM-M)		
Enhanced Video (optional)	Trigger on lines and fields of enhanced and HDTV standards (480p/60, 567p/50, 720p/50, 720p/60, 1080p/24, 1080p/25, 1080p/30, 1080p/50, 1080p/60, 1080i/50, 1080i/60)		
I^2C (optional)	Trigger at a start/stop condition or user defined frame with address and/or data values. Also trigger on missing acknowl-edge, address with no accq, restart, EEPROM read, and 10-bit write		
RS-232/422/485/UART (optional)	Trigger on Rx or Tx start bit, stop bit or data content or parity error		
CAN (optional)	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 (optional)	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)		
MIL-STD 1553 (optional)	Trigger on MIL-STD 1553 signals based on word type (data or command/status), remote terminal address, data and errors (parity, sync, Manchester encoding)		
ARINC 429 (optional)	Trigger and decode on ARINC429 data. Trigger on word start/stop, label, label + bits, label range, error conditions (parity, word, gap, word or gap, all), all bits (eye), all 0 bits, all 1 bits		

Performance Characteristics (Continued)

Trigger type selections (Continued)			
	P9241A	P9242A	P9243A
SENT (optional)	Trigger and decode on SENT bus, start of fast channel message, start of slow channel message, fast channel SC and data, slow channel message ID, slow channel message ID and data, tolerance violation, fast channel CRC error, slow channel CRC error, all CRC errors, pulse period error, successive sync pulses error (1/64)		
CXPI (optional)	Trigger and decode on CXPI data. Trigger on frame, PTYPE, frame ID or error by type. Decodes all message types and errors		
NFC (optional)	Trigger for NFC-A, NFC-B,and NFC-F		

Waveform measurements				
		P9241A	P9242A	P9243A
Cursors		Single cursor accuracy: ± [DC vertical gain accuracy + DC vertical offset accuracy + 0.21% full scale]		
		Dual cursor accuracy [1]: ± [DC vertical gain accuracy + 0.42% full scale]		
		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 all: Measure all single waveform measurements (31) – 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		
Counter		Built-in frequency counter		
		Source: On any analog		
		Resolution: 8 digits		
		Maximum frequency: Bandwidth of scope		
Waveform math				
Number of math functions		Two, displays FFT and one math simultaneously. Can be cascaded		
Arithmetic		Add, subtract, multiply, divide, differentiate, integrate, FFT, Ax + B, squared, square root, absolute value, common logarithm, natural logarithm, exponential, base 10 exponential, low pass filter, high pass filter, averaged value, smoothing, envelope, magnify, max hold, min hold, measurement trend, chart logic bus (timing or state)		
Enhanced FFT	Record size	Up to 64 kpts resolution		
	Window types	Hanning, Flat Top, Rectangular, Blackman-Harris		
	Time gated FFT	Gate the time range of data for FFT analysis in the zoom view. For time and frequency domain correlated analysis		
	Waveforms	FFT, max hold, min hold, average		
	Peak search	Max 11 peaks, threshold and excursion control		
	Channel power	Power across one frequency range		
	Occupied bandwidth	Percentage of the total power, centered on an assigned channel frequency as specified by user		
	Adjacent channel power ratio	Ratio the power in the main frequency range to the power contained in one or more sidebands		
	Total harmonic distortion	Ratio the power in the fundamental frequency to the power contained in the rest of the harmonics and noise		

1. Denotes warranted specifications. All other are typical.

Performance Characteristics (Continued)

Search, navigate and lister				
		P9241A	P9242A	P9243A
Type		Edge, pulse width, rise/fall, runt, frequency peak, serial bus 1, serial bus 2		
Copy		Copy to trigger, copy from trigger		
Frequency peak	Source	Math functions		
	Max # of Peaks	11		
	Control	Results order in frequency or amplitude		
Result display		Event lister or navigation. Manual or auto scroll via navigation or touch event lister entry to jump to a specific event		

WaveGen – Built-in function/arbitrary waveform generator (specifications are typical)				
	P9241A	P9242A	P9243A	
WaveGen out	Front-panel MMCX connector			
Waveforms	Sine, square, ramp, pulse, DC, noise, sine cardinal (sinc), exponential rise, exponential fall, cardiac, Gaussian pulse and arbitrary			
Modulation	Modulation types: AM, FM, FSK			
	Carrier waveforms: Sine, ramp, sine cardinal, exponential rise, exponential fall and cardiac			
	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 bandwidth): 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			
	Rise/fall time: 19 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%			

Performance Characteristics (Continued)

WaveGen – Built-in function/arbitrary waveform generator (specifications are typical)			
	P9241A	**P9242A**	**P9243A**
Noise	Bandwidth: 20 MHz typical		
Sine cardinal (sinc)	Frequency range: 0.1 Hz to 1.0 MHz		
Exponential rise/fall	Frequency range: 0.1 Hz to 5.0 MHz		
Cardiac	Frequency range: 0.1 Hz to 200.0 kHz		
Gaussian pulse	Frequency range: 0.1 Hz to 5.0 MHz		
Arbitrary	Waveform length: 1 to 8k points		
	Amplitude resolution: 10 bits (including sign bit) [1]		
	Repetition rate: 0.1 Hz to 12 MHz		
	Sample rate: 100 MSa/s		
	Filter bandwidth: 20 MHz		
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 Ω		
	Resolution: 100 µV or 3 digits, whichever is higher		
	Accuracy: 2% (frequency = 1 kHz)		
DC offset	Range: – ± 2.5 V into Hi-Z – ± 1.25 V into 50 Ω		
	Resolution: 100 µV or 3 digits, whichever is higher		
	Accuracy (waveform modes): ± 1.5% of offset setting ± 1% of amplitude ± 1 mV		
	Accuracy (DC mode): ± 1.5% of offset setting ± 3 mV		
Trigger output	Trigger output available on trig out MMCX		
Main output	Impedance: 50 Ω typical		
	Isolation: Not available		
	Protection: Overload automatically disables output		
Output mode	Normal		
	Single-shot (arbitrary, sine, ramp, sine cardinal, exp rise/fall, cardiac, Gaussian pulse)		

1. Full resolution is not available at output due to internal attenuator stepping.

Note: Gaussian pulse: 4 Vpp maximum into Hi-Z; 2 Vpp maximum into 50 Ω.

Performance Characteristics (Continued)

Digital voltmeter (specifications are typical)				
		P9241A	**P9242A**	**P9243A**
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		

Precision counter/totalizer (specifications are typical)				
		P9241A	**P9242A**	**P9243A**
Counter	Source	Any analog channel or trigger qualified event		
	Resolution	8 digits (for trigger qualified event)		
	Max frequency	1 GHz		
	Trig qual events	1/(trigger hold off time) for trigger qualified events (max 25 MHz, minimum dead time of 40 ns)		
Measurement		Frequency, period, totalize		
Totalizer	Counter size	64-bit totalizing counter		
	Edge	Rise or fall		
	Gating	Positive or negative level. Select from analog channels except the source		

Connectivity

Physical and virtual connections			
P9241A	**P9242A**	**P9243A**	
Probe	50 Ω /1 MΩ		
WaveGen connector	MMCX		
External trigger	MMCX 30Vrms/60Vdc max		
Auxiliary output	MMCX		
Reference I/O	MMCX		

General and Environmental Characteristics

General and environmental			
	P9241A	**P9242A**	**P9243A**
Power consumption	35 W (typical) power from included external power adapter (no power is used from the USB connection)		
	+ 3.3 V 3.2 A (typical)		
	+ 12 V 2.0 A (typical)		
	Operating	**Storage**	
Temperature	0 to 55 °C	–40 to 70 °C	
Altitude	Up to 3000 m	Up to 4500 m	
Humidity	Type tested 95% RH @ 40C non-condensing (on second line) decreasing linearly to 50% RH at 55 °C		
Dimensions	177 mm X 335 mm X 50 mm (WxDxH)		
Weight	2.5 Kg		
Safety	UL61010-1 3rd edition, CAN/CSA-C22.2 No. 61010-1-12		
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		

System requirements			
	P9241A	**P9242A**	**P9243A**
Operating systems	Windows 10 (64-bit)		
	Windows 7 SP1 (64-bit)		
Processor speed	1 GHz 64-bit (x64)		
Memory	Available memory 1.5 GB minimum		
Disk	Available disk space 2.5 GB available hard disk space		
Required application	Keysight IO Libraries Suite 2018 Update 1.0		
	Microsoft .NET Framework		
Display minimum	1024 x 768, 96 or 120 DPI		

Included standard with oscilloscope			
	P9241A	**P9242A**	**P9243A**
Calibration	2 year		

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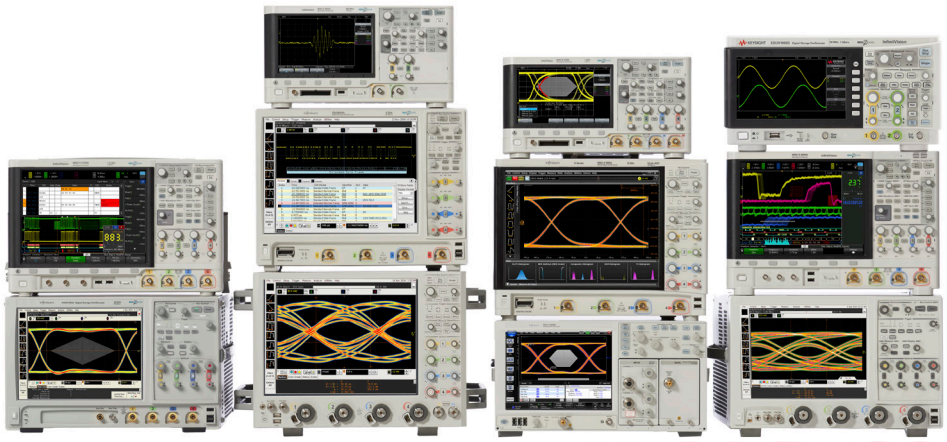

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