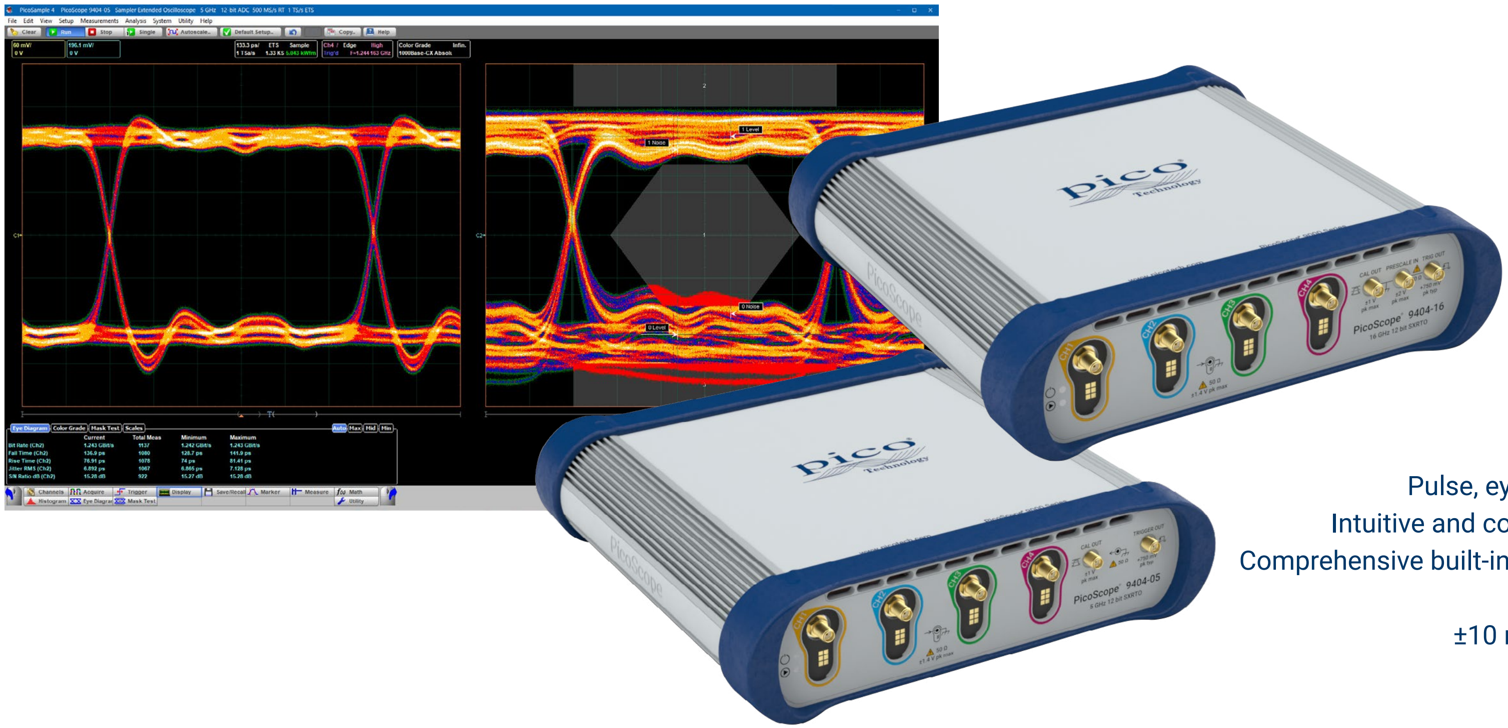
Pico Technology

PicoScope® 9400 Series

SXRTO sampler-extended real-time oscilloscopes



16 GHz and 5 GHz bandwidth models

PicoScope 9404-16

16 GHz bandwidth, 22 ps transition time
5 TS/s (0.2 ps resolution) equivalent-time sampling
8 Gb/s clock recovery (optional)

PicoScope 9404-05

5 GHz bandwidth, 70 ps transition time
1 TS/s (1 ps resolution) equivalent-time sampling
5 Gb/s clock recovery (optional)

Four 12-bit 500 MS/s ADCs
Pulse, eye and mask testing down to 100 ps and up to 8 Gb/s
Intuitive and configurable touch-compatible Windows user interface
Comprehensive built-in measurements, zooms, data masks and histograms
±800 mV full-scale input range into 50 Ω
±10 mV/div to ±0.25 V/div ranges provided by digital gain
Up to 250 kS trace length, shared between channels

www.picotech.com

Product overview

The PicoScope 9400 Series sampler-extended real-time oscilloscopes (SXRTOs) have four high-bandwidth 50 Ω input channels with market-leading ADC, timing and display resolutions for accurately measuring and visualizing high-speed analog and data signals. They are ideal for capturing pulse and step transitions down to 22 ps, impulse down to 100 ps, and clocks and data eyes to 8 Gb/s (with optional clock recovery).

The PicoScope SXRTOs offer equivalent time sampling (ETS) that can readily analyze high bandwidth applications that involve repetitive signals or clock-related streams.

The SXRTO is fast: ETS, persistence displays and statistics all build quickly.

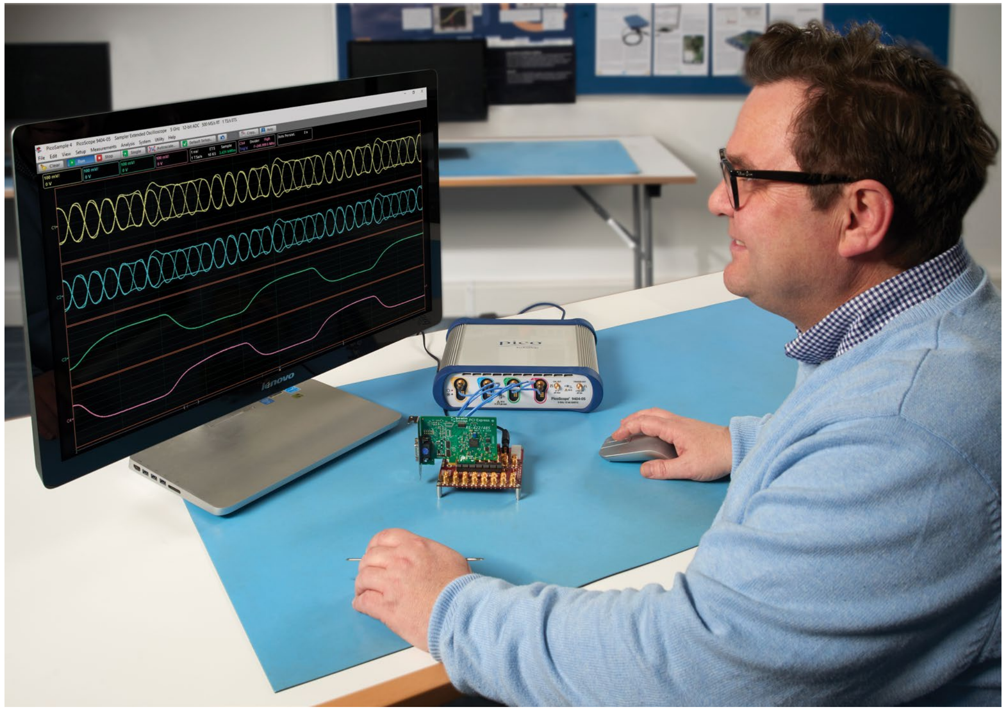
The PicoScope 9400 Series has a built-in trigger on every channel, with pretrigger ETS capture to well above the Nyquist sampling rate. Bandwidth is up to 16 GHz behind a 50 Ω SMA(f) input, and three acquisition modes—real-time, ETS and roll—all capture at 12-bit resolution into a shared memory of up to 250 kS.

The touch-compatible PicoSample 4 software is derived from our existing, and revered, PicoSample 3 sampling oscilloscope software which embodies over ten years of development, customer feedback and optimization.

The display can be resized to fit any window and fully utilize available display resolution, 4k and even larger or across multiple monitors. Four independent zoom channels can show you different views of your data down to a resolution of 0.2 ps. Most of the controls and status panels can be shown or hidden according to your application, allowing you to make optimal use of the display area.

A 2.5 GHz direct trigger can be driven from any input channel, and a built-in divider can extend the off-channel trigger bandwidth to 5 GHz. On the 9404-16 a further external prescaled trigger input allows stable trigger from signals of up to 16 GHz bandwidth and, from the internal triggers, recovered clock trigger is available at up to 8 Gb/s (with optional clock recovery). With this option, recovered clock and data are both made available on SMA outputs on the rear panel.

The price you pay for your PicoScope SXRTO is the price you pay for everything – we don't charge you for software features or updates.



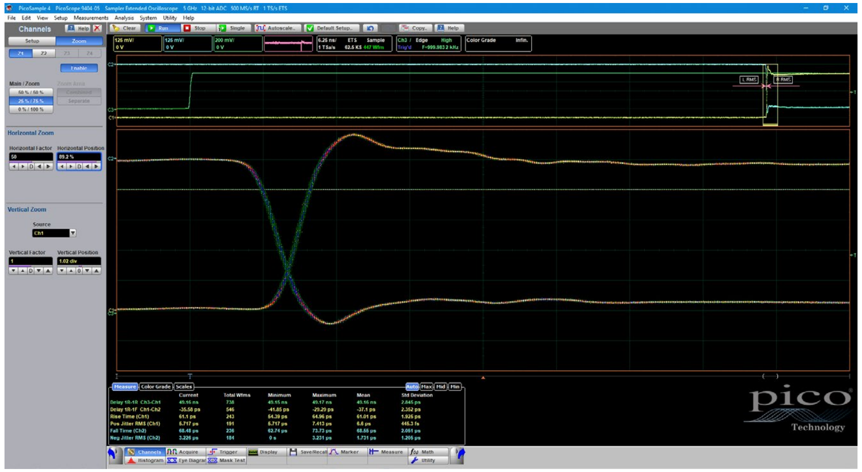
Typical applications

- Telecom and radar test, service and manufacturing
- Optical fiber, transceiver and laser testing (optical to electrical conversion not included)
- RF, microwave and gigabit digital system measurements
- Signal, eye, pulse and impulse characterization
- Precision timing and phase analysis
- Digital system design and characterization
- Eye diagram, mask and limits test up to 8 Gb/s
- Clock and data recovery at up to 8 Gb/s
- Ethernet, HDMI 1, PCI, SATA and USB 2.0
- Semiconductor characterization
- Signal, data and pulse/impulse integrity and pre-compliance testing

ETS (equivalent-time sampling)

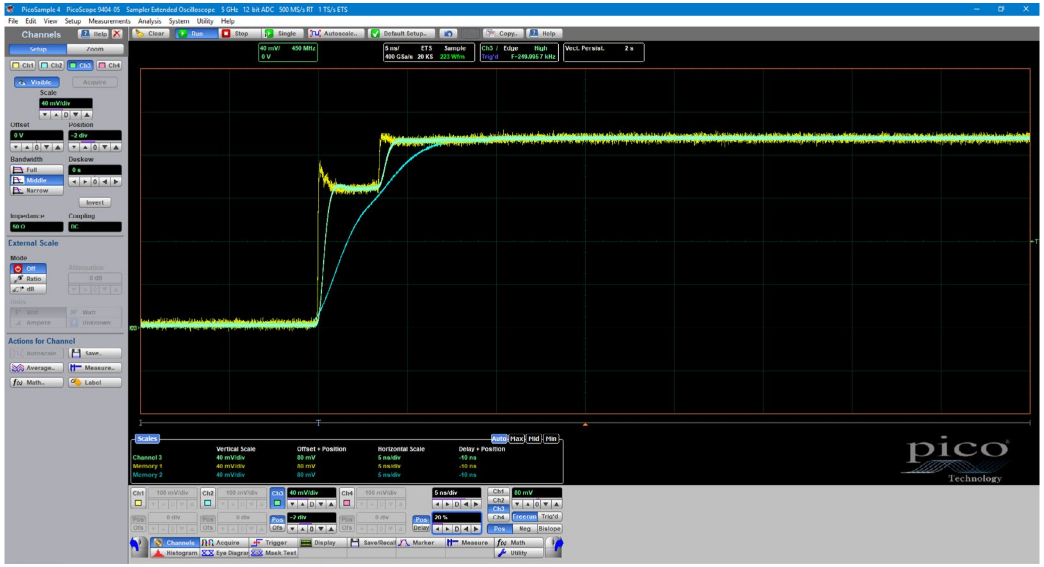
PicoScope 9400 Series SXRTOs use equivalent-time sampling (ETS) to capture high-bandwidth repetitive or clock-derived signals without the expense or jitter of a very high-speed real-time oscilloscope.

On the 16 GHz model transition time is 22 ps and on the 5 GHz model 70 ps, both typically faster than competing equivalent bandwidth models. ETS mode enables timing resolution down to 0.2 ps and 1 ps respectively.



Bandwidth limit filters

A selectable analog bandwidth limiter (100 or 450 MHz) on each input channel can be used to reject high frequencies and associated noise. The narrow setting can be used as an anti-alias filter in real-time sampling modes.



Trigger modes

Simply feed your signal into one of the input channels.

The oscilloscopes have a DC to 2.5 GHz internal direct trigger from each input channel and 5 GHz from each channel via a divider. The 9404-16 has an external 16 GHz prescaled trigger input.

Optional internal trigger-from-recovered-clock capability is fed from the internal off-channel trigger paths. With this option, clock and data signals are made available on rear panel SMA connectors.

Frequency counter

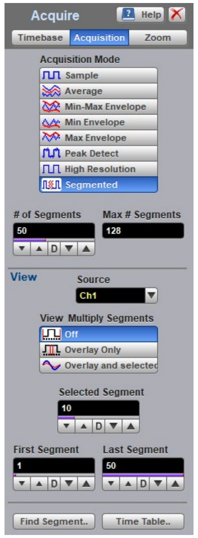
A built-in fast and accurate frequency counter shows signal frequency (or period) at all times, regardless of measurement and timebase settings and with a resolution of 1 ppm.

Clock and data recovery

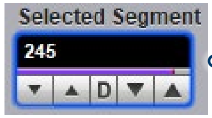
Clock and data outputs on rear panel (optional).

Segmented acquisition mode

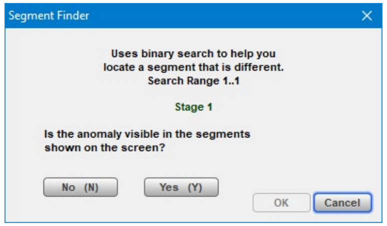
Segmented acquisition mode in the **Acquire** menu partitions the available trace memory length into multiple trace lengths (segments or buffers). Up to 1024 traces can then be captured and either layered or individually selected to display on screen. This is helpful for capturing and viewing rarely occurring events.



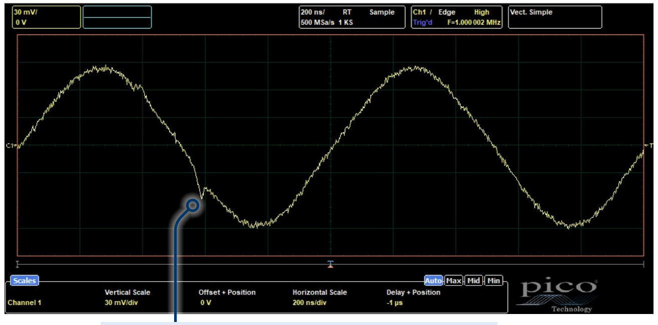
Having captured an anomalous event you can scroll through, or close gates around, an ever smaller block of overlaid traces, until the anomalous trace or traces are found. There is also a segment finder which uses a binary search method to address larger numbers of trace segments:



Selected segment spin-box



Segment finder



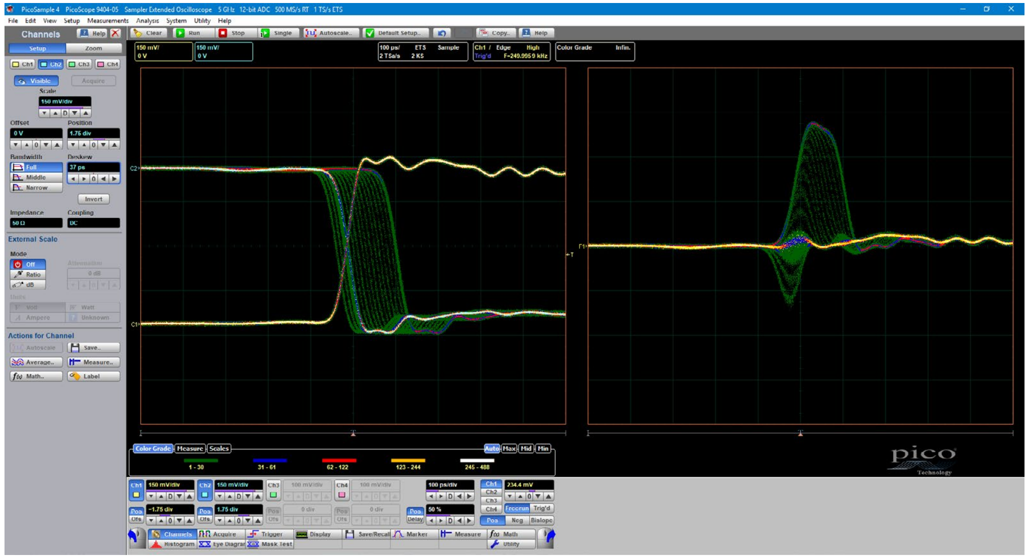
Selected segment with an anomaly

Channel deskew

The deskew variable adjusts the horizontal position (time offset) of one active channel with respect to another on the instrument display. The deskew function has a ±50 ns range. Coarse increment is 100 ps, fine increment is 10 ps. With manual or calculator data entry the increment is four significant digits or 1 ps.

Use the deskew to compensate the time offset between two or more channels. This might result from different cable or probe lengths or might allow an aligned comparison of an input and output waveshape.

Below, deskew is used to precisely align a differential pair. Addition of the traces (right half of the waveform display) allows sensitive alignment for minimum common mode.



SXRTO explained

The basic real-time oscilloscope

Real-time oscilloscopes (RTOs) are designed with a high enough sampling rate to capture a transient, non-repetitive signal with the instrument's specified analog bandwidth. This will reveal a minimum width impulse, but is far from satisfactory in revealing its shape, let alone measurements and characterization. Typical high-bandwidth RTOs exceed this sampling rate by perhaps a factor of two, achieving up to four samples per cycle, or three samples in a minimum-width impulse.

Equivalent-time sampling

For signals close to or above the RTO's Nyquist limit, many RTOs can switch to a mode called equivalent-time sampling (ETS). In this mode the scope collects as many samples as it can for each of many trigger events, each trigger contributing more and more samples and detail in a reconstructed waveform. Critical to alignment of these samples is a separate and precise measurement of time between each trigger and the next occurring sample clock.

After a large number of trigger events the scope has enough samples to display the waveform with the desired time resolution. This is called the effective sampling resolution (the inverse of the effective sampling rate), which is many times higher than is possible in real-time (non-ETS) mode.

As this technique relies on a random relationship between trigger events and the sampling clock, it is more correctly called *random equivalent-time sampling* (or sometimes *random interleaved sampling*, RIS). It can only be used for repetitive signals – those with relatively stable waveshape around the trigger event.

The sampler-extended real-time oscilloscope (SXRTO)

The PicoScope 9404-16 maximum effective sampling rate in ETS is 5 TS/s, with a timing resolution of 0.2 ps, which is 10 000 times higher than the scope's actual sampling rate.

With an analog bandwidth of up to 16 GHz, the PicoScope 9404-16 SXRTO would require a sampling rate exceeeding 32 GS/s to meet Nyquist's criterion and somewhat more than this (perhaps 80 GS/s) to reveal wave and pulse shapes.

Using ETS, the 9404-16 gives us 312 sample points in a single cycle at the scope's rated bandwidth or a generous 110 samples between 10% and 90% of its fastest transition time.

So is the SXRTO a sampling scope?

All this talk of sampling rates and sampling modes may suggest that the SXRTO is a type of sampling scope, but this is not the case. The name sampling scope, by convention, refers to a different kind of instrument. A sampling scope uses a programmable delay generator to take samples at regular intervals after each trigger event. The technique is called *sequential equivalent-time sampling* and is the principle behind the PicoScope 9300 Series sampling scopes. These scopes can achieve very high effective sampling rates but have two main drawbacks: they cannot capture data before the trigger event, and they require a separate trigger signal – either from an external source or from a built-in clock-recovery module.

We've compiled a table to show the differences between the types of scopes mentioned on this page. The example products are all compact, 4-channel, USB PicoScopes.

	Real-time scope	SXRTO	Sampling scope
Model	PicoScope 6407	PicoScope 9400 Series	PicoScope 9300 Series
Analog bandwidth	1 GHz*	Up to 16 GHz	Up to 25 GHz
Real-time sampling?	5 GS/s	500 MS/s	1 MS/s
Sequential equivalent-time sampling?	No	No	15 TS/s
Random equivalent-time sampling?	200 GS/s	Up to 5 TS/s	250 MS/s
Trigger on input channel?	Yes	Yes	Yes, but only to 100 MHz bandwidth – requires external trigger or internal clock recovery option
Pretrigger capture?	Yes	Yes	No
Vertical resolution	8 bits	12 bits	16 bits
Cost (2019 prices)	$10k	$19.5k	$22k

* Higher-bandwidth real-time oscilloscopes are available from other manufacturers. For example, a 16 GHz analog bandwidth, 80 GS/s, 8 bit sampling model is available for a $119,500 starting price.

PicoConnect® 900 Series high-frequency passive probes

The PicoConnect 900 Series is a range of minimally invasive, high-frequency passive probes, designed for microwave and gigabit applications up to 9 GHz and 18 Gb/s. They deliver unprecedented performance and flexibility at a low price and are an obvious choice to use alongside the PicoScope 9400 Series scopes.

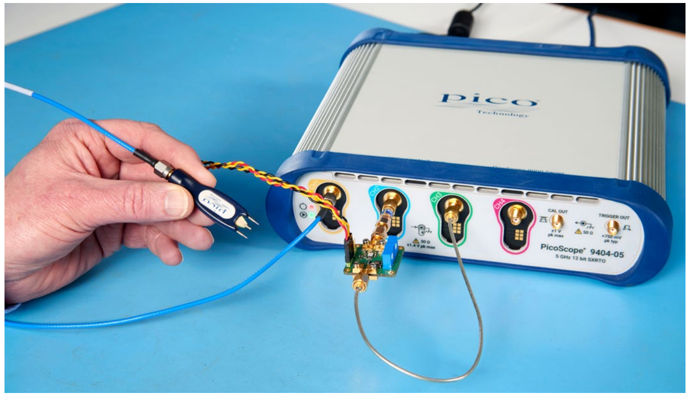
Features of the PicoConnect 900 Series probes

- Extremely low loading capacitance of < 0.3 pF typical, 0.4 pF upper test limit for all models
- Slim, fingertip design for accurate and steady probing or solder-in at fine scale
- Interchangeable SMA probe heads at division ratios of 5:1, 10:1 and 20:1, AC or DC coupled
- Accurate probing of high-speed transmission lines for Z_0 = 0 Ω to 100 Ω
- Class-leading uncorrected pulse/eye response and pulse/eye disturbance

The PicoConnect 910 kit includes six 4 - 5 GHz probes at the three division ratios and AC (>160 kHz) and DC couplings.

The PicoConnect 920 kit includes six 6 - 9 GHz gigabit probes at the three division ratios and AC (>160 kHz) and DC couplings.

All probes (chargeable additions) are available individually or as a kit and are supplied with precision low-loss cables, spare probe tips and a solder-in kit all within a convenient storage case.



Software

Application-configurable PicoSample 4 oscilloscope software

The PicoSample 4 workspace takes full advantage of your available single or multiple display size and resolution, allowing you to resize the window to fit any display resolution supported by Windows.

You decide how much space to give to the trace display and the measurements display, and whether to open or hide the control menus. The user interface is fully touch- or mouse-operable, with grabbing and dragging of traces, cursors, regions and parameters. In touchscreen mode, an enlarged parameter control is displayed to assist adjustments on smaller touchscreen displays.

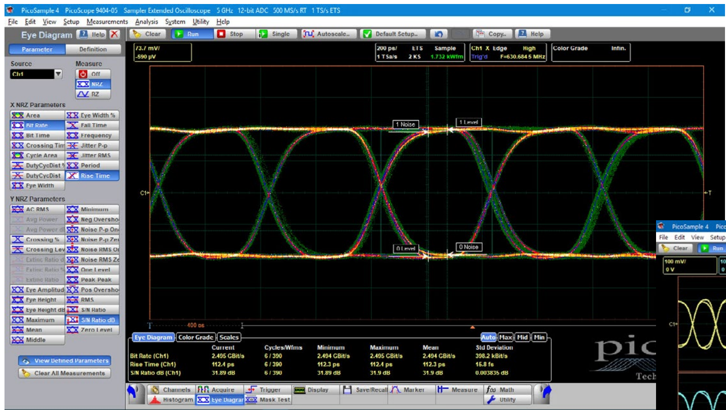
To zoom, either draw a zoom window or use the numerical zoom and offset controls. You can display up to four different zoomed views of the displayed waveforms.

“Hidden trace” icons show a live view of any channels that are not currently displayed on the main display.

The interaction of timebase, sampling rate and capture size is normally handled automatically, but there is also an option to override this and specify the order of priority of these three parameters.

A choice of screen formats

When working with multiple traces, you can display them all on one grid or separate them into two or four grids. You can also plot signals in XY mode with or without additional voltage-time grids. The persistence display modes use color-contouring or shading to show statistical variations in the signal. Trace display can be in either dots-only or vector format and all these display settings can be independent, trace by trace. Custom trace labeling is also available.



PicoSample 4 software

The PicoSample 4 software interface provides access to commands that control all of the instrument's features and functions.

Display area
View live, reference and math waveforms. Drag waveforms to reposition them and drag or draw zoom windows. You can drag markers, bounds and thresholds to configure measurements on the screen. On-screen controls can be hidden to increase trace area.

System controls
Select whether the oscilloscope is running or stopped. Other buttons allow you to reset the oscilloscope to default status, **Autoscale** or erase waveforms from the display.

Status area
Displays acquisition status, mode and number of acquisitions. Also trigger status, date, time and a quick reference to record length and horizontal parameters.

Histogram window
Determines which part of the database is used to analyze and display the histogram (in red). You can set the size and position of this window within the horizontal and vertical scaling limits of the oscilloscope.

Main menu
Provides access to commands that control all instrument features and functions.

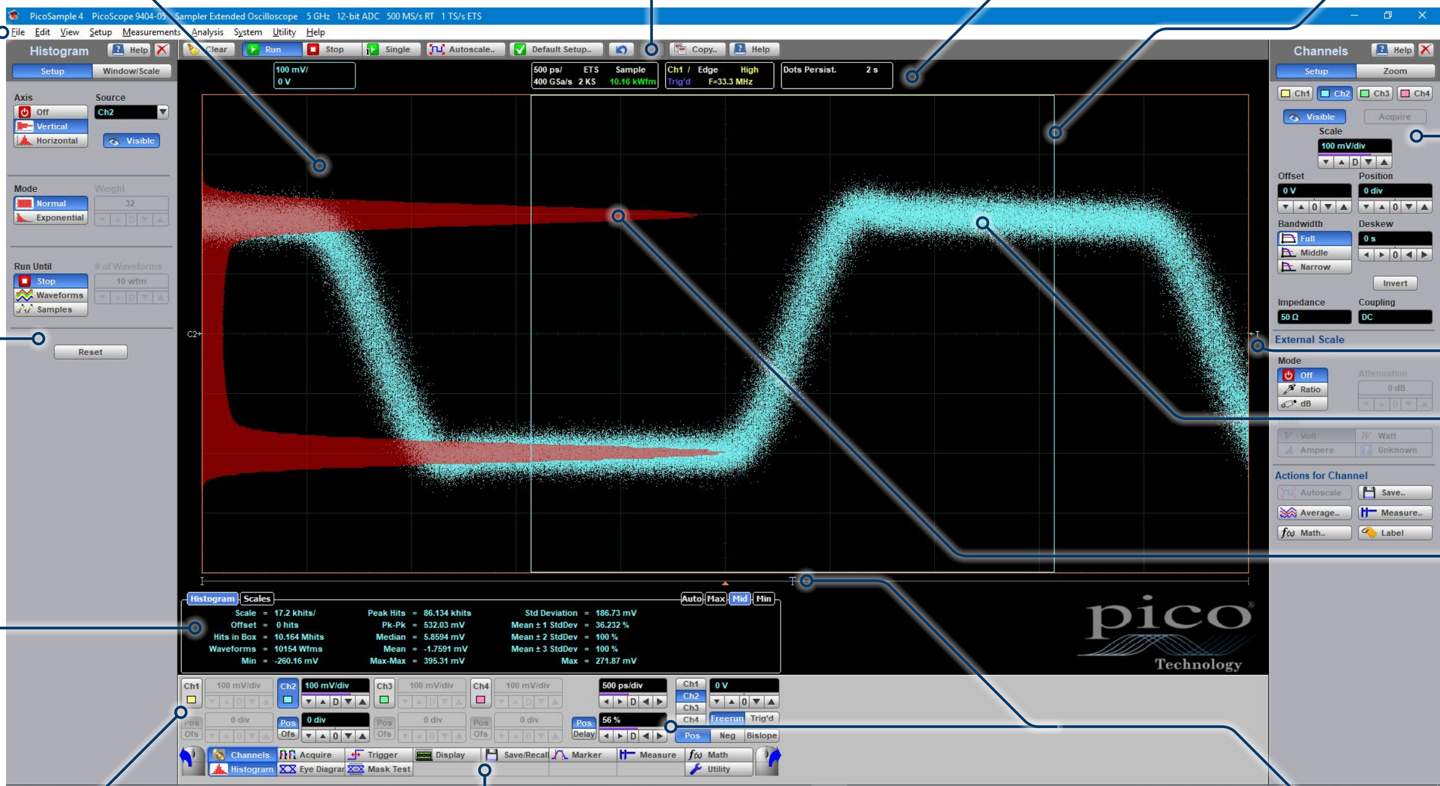
Left side menu
Left-click with your mouse, or tap a button on the **Toolbar** using a touch screen to add the specified menu to the left side menu area.

Measurement area
Allows you to view measurement results within the following scrolling tabs:

- Scales
- Color grade
- Marker
- Measure
- Histogram
- Eye diagram
- Mask test

Resize the display area using the Auto, Max, Min and Mid buttons to show as much or as little data as you require.

Permanent controls
The most common functions that affect the waveform display.



Right side menu
Right-click, or long-touch on a touch screen, a button on the **Toolbar** to add the specified menu to the right side menu area.

Trigger level
Click or tap and drag the **T** icon or use the Trigger position control to change the trigger level for the selected trigger source.

Waveform

Vertical histogram
Both horizontal and vertical (illustrated) histograms with periodically updated measurements allow statistical distributions to be analyzed and displayed over a user-defined region of the signal.

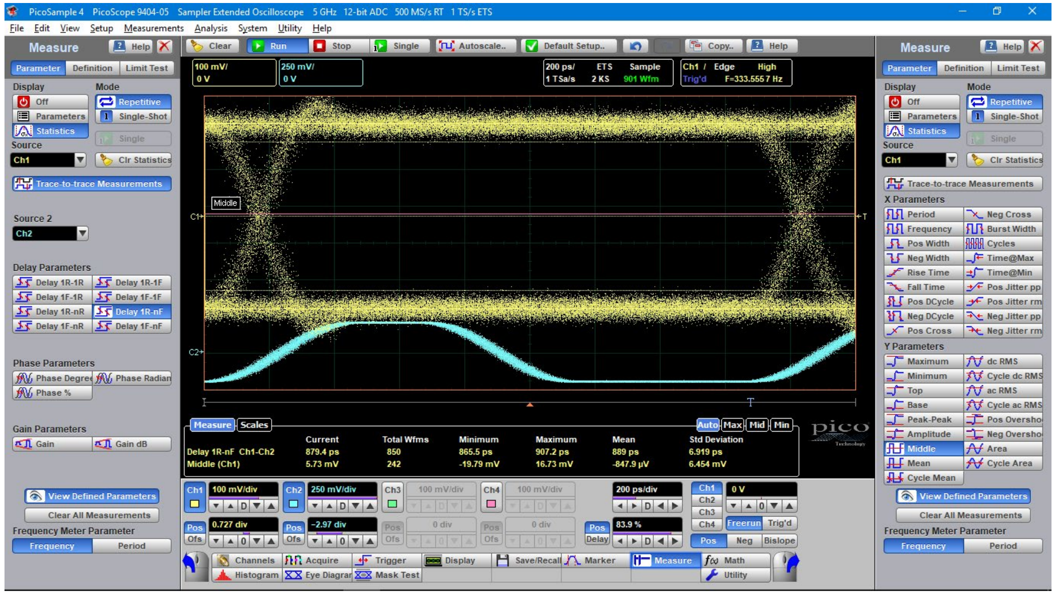
Toolbar
12 buttons to select and set-up oscilloscope operating modes: **Channels**, **Acquire**, **Trigger** and **Display**. You can also set up and execute waveform measurements: **Marker**, **Measure**, **Histogram** and **Eye Diagram**, control file management tasks (**Save/Recall**) and perform waveform analysis (**Math** and **Mask Test**). In addition you can set up and execute instrument calibration and use the demonstration mode (**Utility**).

Trigger position
This **T** icon represents the trigger position. You can move it by adjusting the Trigger position control.

Measurements

Standard waveforms and eye parameters

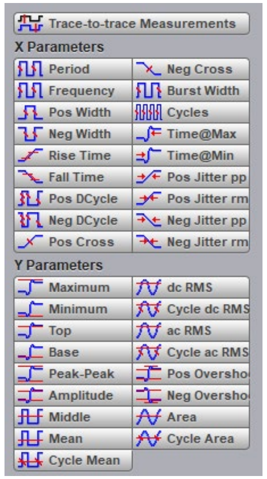
The PicoScope 9400 Series oscilloscopes quickly measure well over 40 standard waveforms and over 70 eye parameters, either for the whole waveform or gated between markers. The markers can also make on-screen ruler measurements, so you don't need to count graticules or estimate the waveform's position. Up to ten simultaneous measurements are possible. The measurements conform to IEEE standard definitions, but you can edit them for non-standard thresholds and reference levels using the advanced menu, or by dragging the on-screen thresholds and levels. You can apply limit tests to up to four measured parameters.

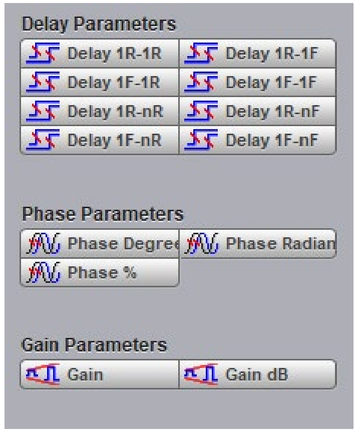


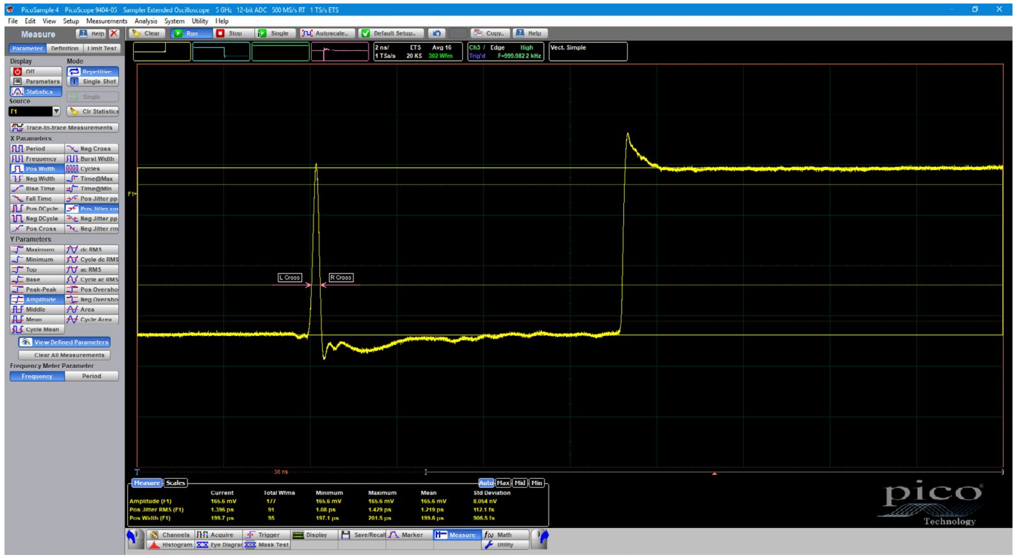
Waveform measurements with statistics

Waveform parameters can be measured in both X and Y axes including X period, frequency, negative or positive cross and jitter. In the Y axis measurements such as max, min, DC RMS and cycle mean are available. Measurements can be within a single trace or trace-to-trace such as phase, delay and gain.

Selection of a measurement parameter displays its values, thresholds and bounds on the main display.

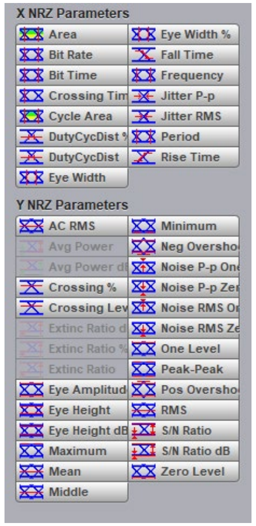


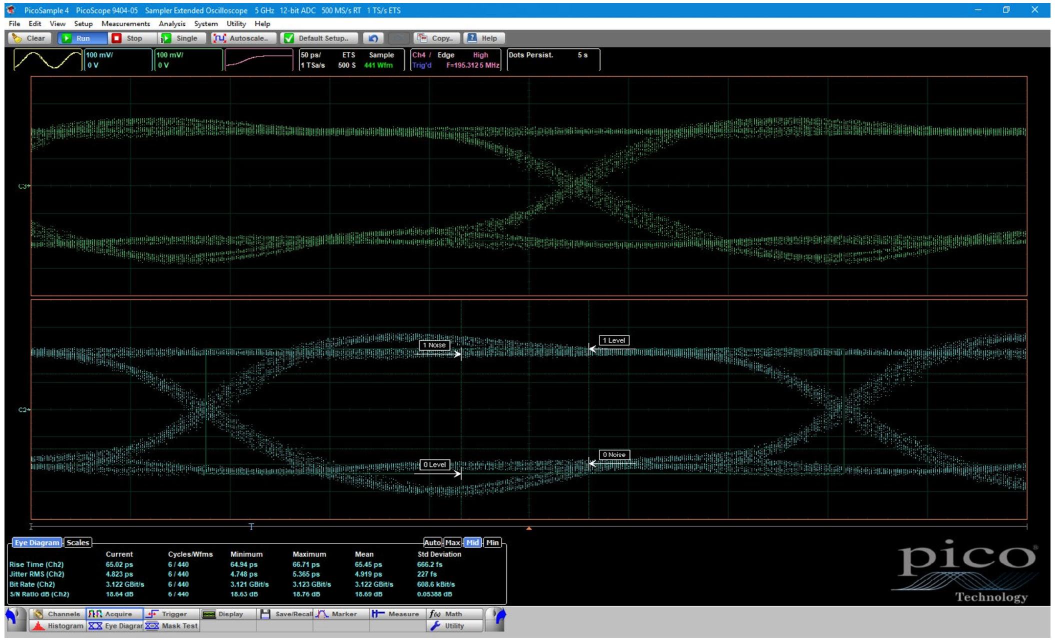




Eye diagram measurements

The PicoScope 9400 Series scopes quickly measure more than 70 fundamental parameters used to characterize non-return-to-zero (NRZ) signals and return-to-zero (RZ) signals.

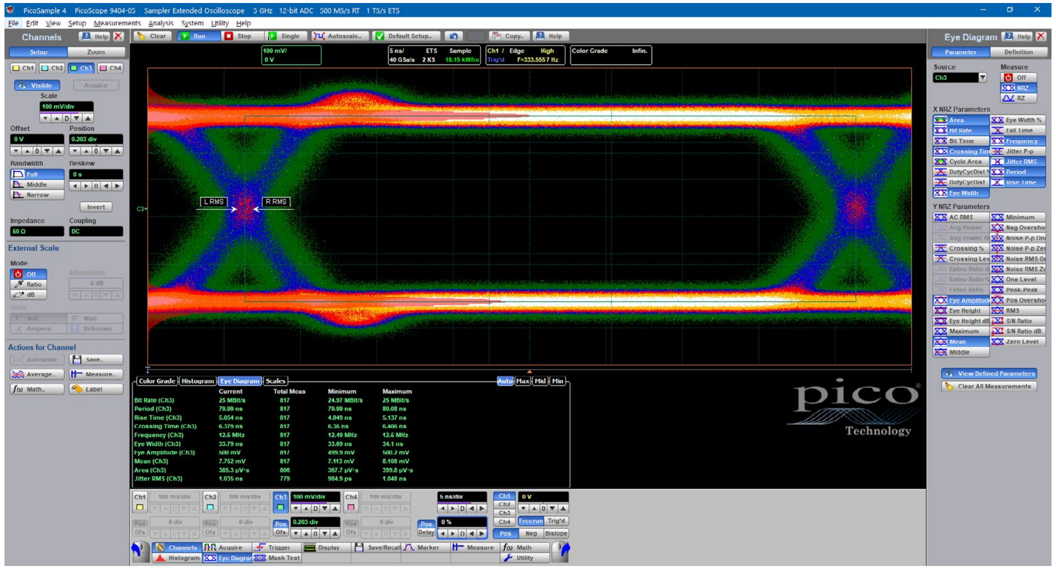




Measurement thresholds and bounds are displayed for the last selected measurement parameter.

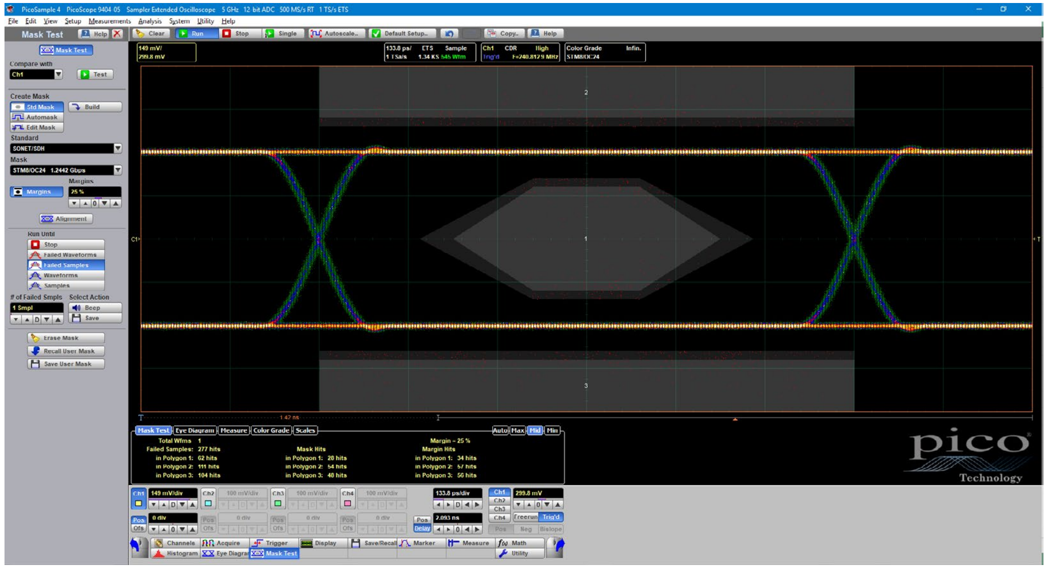
Eye diagram analysis can display data including: bit rate, period, crossing time, frequency, eye width, eye amplitude, mean, area and jitter RMS. Also shown on the graph are left and right RMS jitter markers. These measurements are selectable from within the Eye Diagram side menu and are listed on screen below the graph.

The measurement points and levels used to generate each parameter can optionally be drawn on the trace.



Eye-diagram analysis can be made even more powerful with the addition of mask testing, as described below.

Mask testing



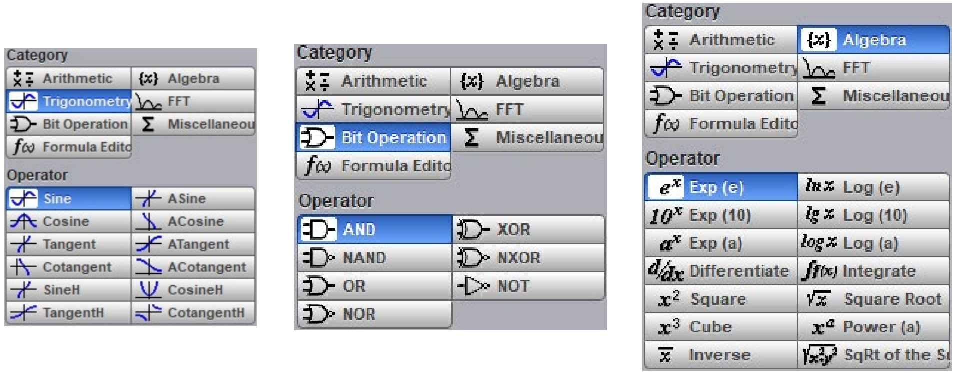
PicoSample 4 has a built-in library of over 130 masks for testing data eyes. It can count or capture mask hits or route them to an alarm or acquisition control. You can stress-test against a mask using a specified margin, and locally compile or edit masks.

There's a choice of gray-scale and color-graded display modes, and a histogramming feature, all of which aid in analyzing noise and jitter in eye diagrams. There is also a statistical display showing a failure count for both the original mask and the margin.

The extensive menu of built-in test waveforms is invaluable for checking your mask test setup before using it on live signals.

Mask test features	Masks	Number of masks	
		9404-05	9404-16
• Standard predefined mask • Automask • Mask saved on disk • Create new mask • Edit any mask.	SONET/SDH	8	
	Ethernet	7	
	Fibre channel	23	30
	PCI Express	29	41
	InfiniBand	12	15
	XAUI	4	
	RapidIO	9	
	Serial ATA	24	
	ITU G.703	14	
	ANSI T1.102	7	

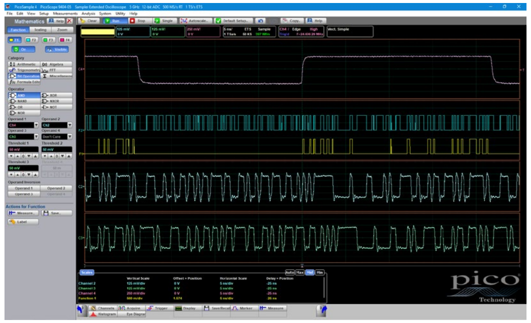
Powerful mathematical analysis



The PicoScope 9400 Series scopes support up to four simultaneous mathematical combinations or functional transformations of acquired waveforms.

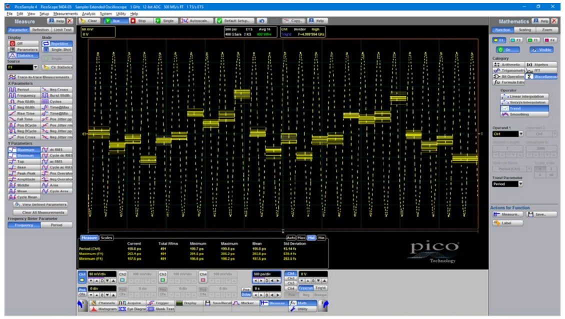
You can select any of the mathematical functions to operate on either one or two sources. All functions can operate on live waveforms, waveform memories or even other functions. There is also a comprehensive equation editor for creating custom functions of any combination of source waveforms.

- Choose from 60 math functions, or create your own.
- Add, subtract, multiply, divide, invert, absolute, exponent, logarithm, differentiate, integrate, inverse, FFT, interpolation, smoothing, trending and boolean bit operation.

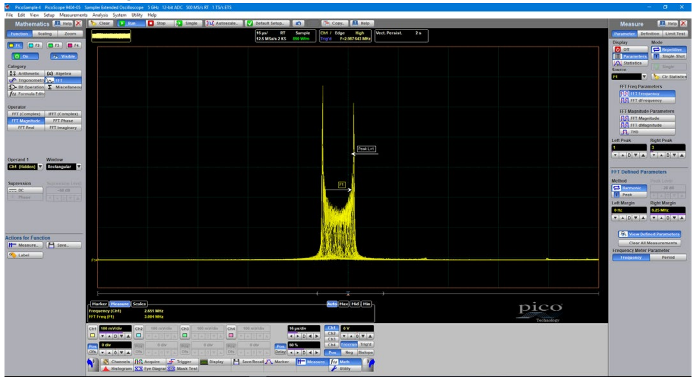


Trending

Trending allows you to plot a measured time parameter, such as pulse width, period or transition time as an additional trace.

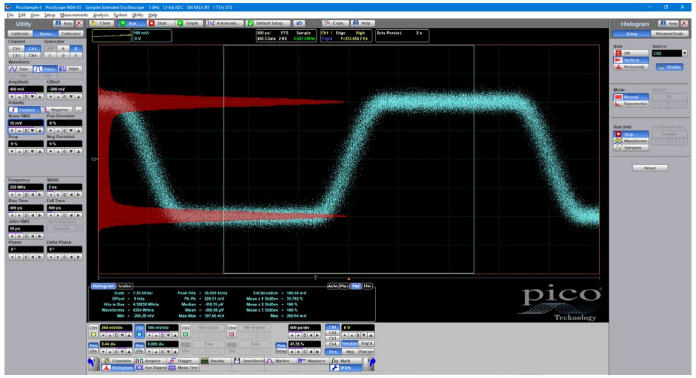


FFT analysis



All PicoScope 9400 Series oscilloscopes can calculate real, imaginary and complex Fast Fourier and Inverse Fast Fourier Transforms of input signals using a range of windowing functions. The results can be further processed using the math functions. FFTs are useful for finding crosstalk and distortion problems, adjusting filter circuits, testing system impulse responses and identifying and locating noise and interference sources.

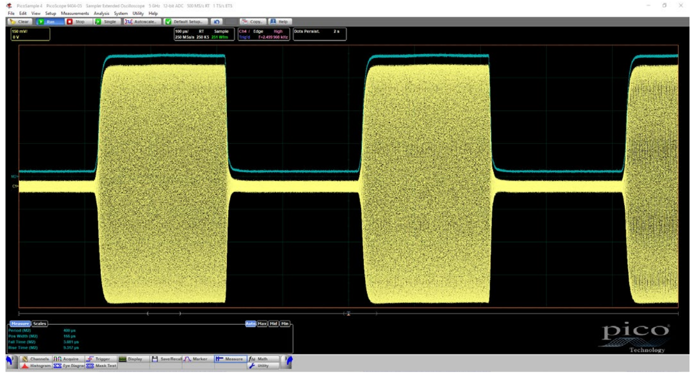
Histogram analysis



Behind the powerful measurement and display capabilities of the 9400 Series lies a fast, efficient data histogram capability. A powerful visualization and analysis tool in its own right, the histogram is a probability graph that shows the distribution of acquired data from a source within a user-definable window.

Histograms can be constructed on waveforms on either the vertical or horizontal axes. The most common use for a vertical histogram is measuring and characterizing noise and pulse parameters. A horizontal histogram is typically used to measure and characterize jitter.

Envelope acquisition



Pulsed RF carriers lie at the heart of our modern communications infrastructures, yet the shape, aberrations and timings of the final carrier pulse (at an antenna, for example) can be challenging to measure. If we choose demodulation, we are subject to the limitations of the demodulator; its bandwidth and distortions.

Envelope acquisition mode allows waveform acquisition and display showing the peak values of repeated acquisitions over a period of time.

Shown above on a PicoScope 9404 SXRTO is a real-time capture of pulsed amplitude 2.4 GHz carrier.

The yellow trace is an alias of the 2.4 GHz carrier displayed at a timebase of 100 µs/div. The blue trace, offset slightly for clarity, is a **Max Envelope** capture of the yellow trace.

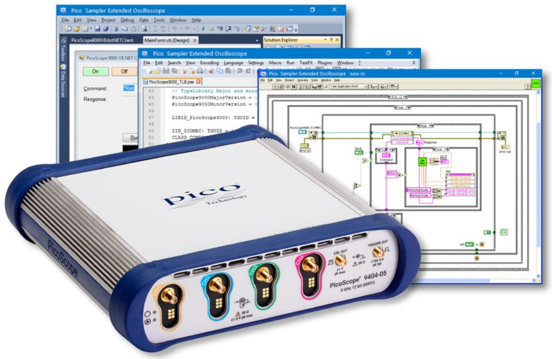
The enveloped waveform shows the maximum excursions of the carrier envelope and its pulse parameters can then be measured (bottom left of the image).

This measurement is limited by the maximum real-time sampling rate of the SXRTO (500 MS/s) and so has a Nyquist demodulation bandwidth of 250 MHz. Three other channels on the oscilloscope remain available to monitor, for example, modulating data and power supply voltages or currents feeding to the sourcing RF power amplifier.

Software development kit

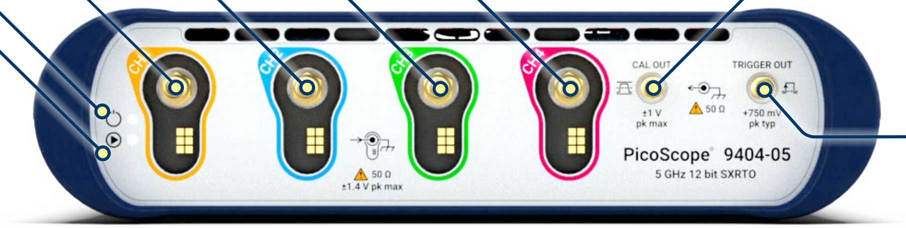
The PicoSample 4 software can operate as a standalone oscilloscope program or under ActiveX remote control. The ActiveX control conforms to the Windows COM interface standard so that you can embed it in your own software. Unlike more complex driver-based programming methods, ActiveX commands are text strings that are easy to create in any programming environment. Programming examples are provided in Visual Basic (VB.NET), MATLAB, LabVIEW and Delphi, but you can use any programming language or standard that supports the COM interface, including JavaScript and C. National Instruments LabVIEW drivers are also available. All the functions of the PicoScope 9400 and the PicoSample software are accessible remotely.

We supply a comprehensive programmer's guide that details every function of the ActiveX control. The SDK can control the oscilloscope over the USB or the LAN port.



PicoScope 9400 Series inputs, outputs and indicators

9404-05 front panel



9404-16 front panel

Power LED: Green under normal operation

Status/trigger LED: Indicates connection progress and trigger

Channel inputs: The PicoScope 9404 has four input channels: Ch 1 to Ch 4. You can enable any number of channels without affecting the sampling rate; only the capture memory (250 kS) is shared between the enabled channels.

Built-in CAL test signal: The calibrator output (**CAL OUT**) provides a DC, 1 kHz or variable frequency square wave output. This can be used to verify the scope's inputs.

TRIGGER OUT: Can be used to synchronize an external device to the PicoScope 9404's rising edge, falling edge and end of holdoff triggers

PRESCALE (9404-16 only): 16 GHz external prescaled trigger.

9400 Series rear panel

RST (reset button)

USB: The USB 2.0 port is used to connect the oscilloscope to the PC. If no USB host is found, the oscilloscope tries to connect through the LAN port.

LAN: LAN settings must be supplied initially by connecting to the USB port. Once configured, the oscilloscope uses the LAN port if no USB host is detected.

One of up to eight PicoScope 9400 units can be addressed from PicoSample 4 software.

CLK & DATA: Recovered clock and data from the currently selected trigger source and the built-in clock recovery module (optional).

12 V DC input: Use only the earthed mains adaptor supplied with the oscilloscope

PicoScope 9404 specifications

	9404-05	9404-16
Vertical		
Number of input channels	Four channels. All channels are identical and digitized simultaneously.	
***Analog bandwidth (–3 dB)[1]**	Full: DC to 5 GHz	Full: DC to 16 GHz
	Middle: DC to 450 MHz Narrow: DC to 100 MHz	
***Passband flatness**	Full: ±1 dB to 3 GHz	Full: ±1 dB to 5 GHz
Calculated rise time (Tr), typical	Calculated from the bandwidth: 10% to 90%: calculated from Tr = 0.35/BW; 20% to 80%: calculated from Tr = 0.25/BW	
	Full: 10% to 90%: ≤ 70 ps, 20% to 80%: ≤ 50 ps	Full: 10% to 90%: ≤ 22 ps, 20% to 80%: ≤ 15.7 ps
	Middle: 10% to 90%: ≤ 780 ps, 20% to 80%: ≤ 560 ps Narrow: 10% to 90%: ≤ 3.5 ns. 20% to 80%: ≤ 2.5 ns	
Step response, typical (full bandwidth)	Overshoot and ringing: ±8% to 3 ns, ±4% to 100ns, ±2% to 400 ns.	Overshoot and ringing: ±8% to 3 ns, ±4% to 100 ns, ±2% to 400 ns in 10 GHz bandwidth
***RMS noise**	Full: 1.8 mV, maximum, 1.6 mV, typical	Full: 2.4 mV, maximum, 2.2 mV, typical
	Middle: 0.8 mV, maximum, 0.65 mV, typical Narrow: 0.6 mV, maximum, 0.45 mV, typical	
Scale factors (sensitivity)	10 mV/div to 250 mV/div Full scale is 8 vertical divisions Adjustable in a 10-12.5-15-20-25-30-40-50-60-80-100-125-150-200-250 mV/div sequence. Also adjustable in 1% fine increments or better. With manual or calculator data entry the increment is 0.1 mV/div.	
***DC gain accuracy**	±2% of full scale. ±1.5% of full scale, typical	
Position range	±4 divisions from center screen	
DC offset range	Adjustable from –1 V to +1 V in 10 mV increments (coarse). Also adjustable in fine increments of 2 mV. With manual or calculator data entry the increment is 0.01 mV for offset between –99.9 and 99.9 mV, and 0.1 mV for offset between –999.9 and 999.9 mV. Referenced to the center of display graticule.	
*** Offset accuracy**	±2 mV ±2% of offset setting. ±1 mV ±1% of offset setting, typical	
Operating input voltage	±800 mV	
Vertical Zoom and Position	For all input channels, waveform memories, or functions Vertical factor: 0.01 to 100 Vertical position: ±800 divisions maximum of zoomed waveform	
Channel-to-channel crosstalk (channel isolation)	≥ 50 dB (316:1) for input frequency DC to 1 GHz ≥ 40 dB (100:1) for input frequency > 1 GHz to 3 GHz ≥ 36 dB (63:1) for input frequency > 3 GHz to ≤ 5 GHz	
Delay between channels	≤ 10 ps, typical Between any two channels, full bandwidth, equivalent time	
ADC resolution	12 bits	

	9404-05	9404-16
Hardware vertical resolution	0.4 mV/LSB without averaging	
Overvoltage protection	±1.4 V (DC + peak AC)	
*** Input impedance**	(50 ±1.5) Ω. (50 ±1) Ω, typical	
Input match	Reflections for 70 ps rise time: 10% or less, <–20 dB	Reflections for 30 ps rise time: 10% or less, <–20 dB
Input coupling	DC	
Input connectors	SMA female	
Internal probe power	6.0 W total maximum with PSU as supplied.	
Probe power per probe	3.3 V: 100 mA maximum 12 V: 500 mA maximum to total probe power stated above.	
Attenuation		
Attenuation factors may be entered to scale the oscilloscope for external attenuators connected to the channel inputs.		
Range	0.0001:1 to 1 000 000:1	
Units	Ratio or dB	
Scale	Volt, Watt, Ampere, or unknown	
Horizontal		
Timebase	Internal timebase common to all input channels.	
Timebase range	Full horizontal scale is 10 divisions Real-time sampling: 10 ns/div to 1000 s/div	
	Random equivalent time sampling: 50 ps/div to 5 µs/div	10 ps/div to 5 µs/div
	Roll: 100 ms/div to 1000 s/div Segmented: Total number of segments: 2 to 1024. Rearm time between segments: <1 µs (trigger hold-off setting dependent)	
Horizontal zoom and position	For all input channels, waveform memories, or functions Horizontal factor: From 1 to 2000 Horizontal position: From 0% to 100% non-zoomed waveform	
Timebase clock accuracy	Frequency: 500 MHz Initial set tolerance: ±10 ppm @ 25 °C ±3 °C * Overall frequency stability: ±50 ppm over operating temperature range	
Aging	±7 ppm over 10 years @ 25 °C	
Timebase resolution (with random equivalent time sampling)	1 ps	0.2 ps
*** Delta time measurement accuracy**	±(50 ppm * reading + 0.1% * screen width + 5 ps)	
Pre-trigger delay	Record length ÷ current sampling rate (when delay = 0)	
Post-trigger delay	0 to 4.28 s. Coarse increment is one horizontal scale division, fine increment is 0.1 horizontal scale division, manual or calculator increment is 0.01 horizontal scale division.	

	9404-05	9404-16
Channel-to-channel deskew range	±50 ns range. Coarse increment is 100 ps, fine increment is 10 ps. With manual or calculator data entry the increment is four significant digits or 1 ps	
Acquisition		
Sampling modes	Real-time: Captures all of the sample points used to reconstruct a waveform during a single trigger event Random equivalent time: Acquires sample points over several trigger events, requiring the input waveform to be repetitive Roll: Acquisition data is displayed in a rolling fashion starting from the right side of the display and continuing to the left side of the display (while the acquisition is running)	
Maximum sampling rate	Real-time: 500 MS/s per channel simultaneously	
	Random equivalent time: Up to 1 TS/s or 1 ps trigger placement resolution	Random equivalent time: Up to 5 TS/s or 0.2 ps trigger placement resolution
Record length	Real-time sampling: From 50 S/ch to 250 kS/ch for one channel, to 125 kS/ch for two channels, to 50 kS/ch for three and four channels Random equivalent time sampling: From 500 S/ch to 250 kS/ch for one channel, to 125 kS/ch for two channels, to 50 kS/ch for three and four channels	
Duration at highest sample rate	0.5 ms for one channel, 0.25 ms for two channels, 0.125 ms for three and four channels	
Acquisition modes	Sample (normal): Acquires first sample in decimation interval and displays results without further processing Average: Average value of samples in decimation interval. Number of waveforms for average: 2 to 4096. Envelope: Envelope of acquired waveforms. Minimum, Maximum or both Minimum and Maximum values acquired over one or more acquisitions. Number of acquisitions is from 2 to 4096 in ×2 sequence and continuously. Peak detect: Largest and smallest sample in decimation interval. Minimum pulse width: 1/(sampling rate) or 2 ns @ 50 µs/div or faster for single channel. High resolution: Averages all samples taken during an acquisition interval to create a record point. This average results in a higher-resolution, lower-bandwidth waveform. Resolution can be expanded to 12.5 bits or more, up to 16 bits. Segmented: Number of segments: 1 to 1024. Rearm time: <1 µs or user defined hold-off time, whichever is larger (minimum time between trigger events). User can view selected segment, overlaid segments or selected plus overlay. Search segments: step through, gated block and binary search. Segments are delta and absolute time stamped.	
Trigger		
Trigger sources	Internal from any of four channels	Internal from any of four channels, external prescaled
Trigger mode	Freerun: Triggers automatically but not synchronized to the input in absence of trigger event. Normal (triggered): Requires trigger event for oscilloscope to trigger. Single: SW button that triggers only once on a trigger event. Not suitable for random equivalent time sampling.	
Trigger holdoff mode	Time or random	
Trigger holdoff range	Holdoff by time: Adjustable from 500 ns to 15 s in a 1-2-5-10 sequence or in 4 ns fine increments. Random: This mode varies the trigger holdoff from one acquisition to another by randomizing the time value between triggers. The randomized time values can be between the values specified in the Min Holdoff and Max Holdoff.	
Trigger frequency counter	Direct trigger: 1 µHz to 2.5 GHz Resolution: ≥100 Hz ≤1 ppm, <100 Hz ≤5 ppm ±0.25 µHz Read rate: 1.5 s or 31 cycles (whichever is greater) Range extends to 5 GHz for trigger off channel via divider. Range extends 500 MHz to 16 GHz for trigger from external prescale input.	

	9404-05	9404-16
Internal trigger		
Internal trigger style	Edge: Triggers on a rising and falling edge of any source from DC to 2.5 GHz. Divider: The trigger source is divided down four times (/4) before being applied to the trigger system. It has a trigger frequency range up to 5 GHz.	
	Clock recovery (optional): This trigger is used when the trigger signal is an NRZ data pattern with any data rate between 6.5 Mb/s and 5 Gb/s	Clock recovery (optional): This trigger is used when the trigger signal is an NRZ data pattern with any data rate between 6.5 Mb/s and 8 Gb/s
Internal trigger bandwidth and sensitivity	Low sensitivity: 100 mV p-p DC to 100 MHz increasing linearly from 100 mV p-p at 100 MHz to 200 mV p-p at 5 GHz. Pulse Width: 100 ps @ 200 mV p-p typical. * High sensitivity: 30 mV p-p DC to 100 MHz increasing linearly from 30 mV p-p at 100 MHz to 70 mV p-p at 5 GHz. Pulse Width: 100 ps @ 70 mV p-p.	
Internal trigger level range	–1 V to +1 V in 10 mV increments (coarse). Also adjustable in fine increments of 1 mV.	
Internal edge trigger slope	**Positive**: Triggers on rising edge **Negative**: Triggers on falling edge **Dual slope**: Triggers on both edges of the signal	
* Internal RMS trigger jitter	Combined trigger and interpolator jitter + delay clock stability Edge and divided trigger: 2 ps + 0.1 ppm of delay, maximum Clock recovery trigger (optional): 2 ps + 1.0% of unit interval + 0.1 ppm delay, maximum	
Internal trigger coupling	DC	
External prescaled trigger		
External prescaled trigger coupling	50 Ω, AC coupled, fixed level zero volts	
*External prescaled trigger bandwidth and sensitivity	N/A	200 mV p-p from 1 GHz to 16 GHz (sine wave input)
*External prescaled RMS trigger jitter	2 ps + 0.1 ppm of delay, maximum. For trigger input slope > 2 V/ns. Combined trigger and interpolator jitter + delay clock stability	
Prescalar ratio	Divided by 1 / 2 /4 / 8, programmable.	
External prescaled trigger maximum safe input voltage	±2 V (DC+peak AC)	
External prescaled trigger input connector	SMA female	
Display		
Persistence	**Off**: No persistence **Variable persistence**: Time that each data point is retained on the display. Persistence time can be varied from 100 ms to 20 s. **Infinite persistence**: In this mode, a waveform sample point is displayed forever. **Variable Gray Scaling**: Five levels of a single color that is varied in saturation and luminosity. Refresh time can be varied from 1 s to 200 s. **Infinite Gray Scaling**: In this mode, a waveform sample point is displayed forever in five levels of a single color. **Variable Color Grading**: With Color Grading selected, historical timing information is represented by a temperature or spectral color scheme providing “z-axis” information about rapidly changing waveforms. Refresh time can be varied from 1 to 200 s. **Infinite Color Grading**: In this mode, a waveform sample point is displayed forever by a temperature or spectral color scheme.	

	9404-05	9404-16
Style	**Dots**: Displays waveforms without persistence, each new waveform record replaces the previously acquired record for a channel. **Vector**: This function draws a straight line through the data points on the display. Not suited to multi-value signals such as an eye diagram.	
Graticule	**Full** Grid, **Axes** with tick marks, **Frame** with tick marks, **Off** (no graticule).	
Format	**Auto**: Automatically places, adds or deletes graticules as you select more or fewer waveforms to display. **Single XT**: All waveforms are superimposed and are eight divisions high. **Dual YT**: With two graticules, all waveforms can be four divisions high, displayed separately or superimposed. **Quad YT**: With four graticules, all waveforms can be two divisions high, displayed separately or superimposed. When you select dual or quad screen display, every waveform channel, memory and function can be placed on a specified graticule. **XY**: Displays voltages of two waveforms against each other. The amplitude of the first waveform is plotted on the horizontal X axis and the amplitude of the second waveform is is plotted on the vertical Y axis. **XY + YT**: Displays both XY and YT pictures. The YT format appears on the upper part of the screen, and the XY format on the lower part of the screen. The YT format display area is one screen and any displayed waveforms are superimposed. **XY + 2YT**: Displays both YT and XY pictures. The YT format appears on the upper part of the screen, and the XY format on the lower part of the screen. The YT format display area is divided into two equal screens. **Tandem**: Displays graticules to the left and to the right.	
View Color	You may choose a default color selection, or select your own color set. Different colors are used for displaying selected items: background, channels, functions, waveform memories, FFTs, TDR/TDTs, and histograms.	
Trace annotation	The instrument gives you the ability to add an identifying label, bearing your own text, to a waveform display. For each waveform, you can create multiple labels and turn them all on or all off. Also, you can position them on the waveform by dragging or by specifying an exact horizontal position.	
Save/Recall		
Management	Store and recall setups, waveforms and user mask files to any drive on your PC. Storage capacity is limited only by disk space.	
File extensions	Waveform files: .wfm for binary format .txt for verbose format (text) .txty for Y values formats (text) Database files: .wdb Setup files: .set User mask files: .pcm	
Operating system	Microsoft Windows 7, 8 and 10, 32-bit and 64-bit.	
Waveform save/recall	Up to four waveforms may be stored into the waveform memories (M1 to M4), and then recalled for display.	
Save to/recall from disk	You can save or recall your acquired waveforms to or from any drive on the PC. To save a waveform, use the standard Windows Save as dialog box. From this dialog box you can create subdirectories and waveform files, or overwrite existing waveform files. You can load, into one of the Waveform Memories, a file with a waveform you have previously saved and then recall it for display.	
Save/recall setups	The instrument can store complete setups in the memory and then recall them.	
Screen image	You can copy a screen image into the clipboard with the following formats: Full Screen, Full Window, Client Part, Invert Client Part, Oscilloscope Screen and Oscilloscope Screen.	
Autoscale	Pressing the Autoscale key automatically adjusts the vertical channels, the horizontal scale factors, and the trigger level for a display appropriate to the signals applied to the inputs. The Autoscale feature requires a repetitive signal with a frequency greater than 100 Hz, duty cycle greater than 0.2%, amplitudes greater than 100 mV p-p. Autoscale is operative only for relatively stable input signals.	

	9404-05	9404-16
Marker		
Marker type	**X-Marker**: vertical bars (measure time) **Y-Marker**: horizontal bars (measure volts) **XY-Marker**: waveform markers	
Marker measurements	Absolute, Delta, Volt, Time, Frequency and Slope	
Marker motion	**Independent**: both markers can be adjusted independently. **Paired**: both markers can be adjusted together.	
Ratiometric measurements	Provide ratiometric measurements between measured and reference values. These measurements give results in such ratiometric units as %, dB, and degrees.	
Measure		
Automated measurements	Up to ten simultaneous measurements are supported.	
Automatic parametric	53 automatic measurements available.	
Amplitude measurements	Maximum, Minimum, Top, Base, Peak-Peak, Amplitude, Middle, Mean, Cycle Mean, DC RMS, Cycle DC RMS, AC RMS, Cycle AC RMS, Positive Overshoot, Negative Overshoot, Area, Cycle Area.	
Timing measurements	Period, Frequency, Positive Width, Negative Width, Rise Time, Fall Time, Positive Duty Cycle, Negative Duty Cycle, Positive Crossing, Negative Crossing, Burst Width, Cycles, Time at Maximum, Time at Minimum, Positive Jitter p-p, Positive Jitter RMS, Negative Jitter p-p, Negative Jitter RMS.	
Inter-signal measurements	Delay (8 options), Phase Deg, Phase Rad, Phase %, Gain, Gain dB.	
FFT measurements	FFT Magnitude, FFT Delta Magnitude, THD, FFT Frequency, FFT Delta Frequency.	
Measurement statistics	Displays current, minimum, maximum, mean and standard deviation on any displayed waveform measurements.	
Method of top-base definition	Histogram, Min/Max, or User-Defined (in absolute voltage).	
Thresholds	Upper, middle and lower horizontal bars settable in percentage, voltage or divisions. Standard thresholds are 10–50–90% or 20–50–80%.	
Margins	Any region of the waveform may be isolated for measurement using left and right margins (vertical bars).	
Measurement mode	**Repetitive** or **Single-shot**	
Mathematics		
Waveform math	Up to four math waveforms can be defined and displayed using math functions F1 to F4	
Categories and math operators	Arithmetic: Add, Subtract, Multiply, Divide, Ceil, Floor, Fix, Round, Absolute, Invert, Common, Rescale Algebra: Exponentiation (e), Exponentiation (10), Exponentiation (a), Logarithm (e), Logarithm (10), Logarithm (a), Differentiate, Integrate, Square, Square Root, Cube, Power (a), Inverse, Square Root of the Sum Trigonometry: Sine, Cosine, Tangent, Cotangent, ArcSine, Arc Cosine, ArcTangent, Arc Cotangent, Hyperbolic Sine, Hyperbolic Cosine, Hyperbolic Tangent, Hyperbolic Cotangent FFT: Complex FFT, FFT Magnitude, FFT Phase, FFT Real part, FFT Imaginary part, Complex Inverse FFT, FFT Group Delay Bit operator: AND, NAND, OR, NOR, XOR, XNOR, NOT Miscellaneous: Autocorrelation, Correlation, Convolution, Track, Trend, Linear Interpolation, Sin(x)/x Interpolation, Smoothing Formula editor: You can build math waveforms using the Formula Editor control window.	
Operands	Any channel, waveform memory, math function, spectrum, or constant can be selected as a source for one of two operands.	

	9404-05	9404-16
FFT	FFT frequency span: Frequency Span = Sample Rate / 2 = Record Length / (2 × Timebase Range) FFT frequency resolution: Frequency Resolution = Sample Rate / Record Length FFT windows: The built-in filters (Rectangular, Hamming, Hann, Flattop, Blackman–Harris and Kaiser–Bessel) allow optimization of frequency resolution, transients, and amplitude accuracy. FFT measurements: Marker measurements can be made on frequency, delta frequency, magnitude, and delta magnitude. Marker measurements can be made on frequency, delta frequency, magnitude, and delta magnitude. Automated FFT Measurements include: FFT Magnitude, FFT Delta Magnitude, THD, FFT Frequency, and FFT Delta Frequency.	
Histogram		
Histogram axis	Vertical, Horizontal or Off Both vertical and horizontal histograms, with periodically updated measurements, allow statistical distributions to be analyzed over any region of the signal.	
Histogram measurement set	Scale, Offset, Hits in Box, Waveforms, Peak Hits, Pk-Pk, Median, Mean, Standard Deviation, Mean ±1 Std Dev, Mean ±2 Std Dev, Mean ±3 Std Dev, Min, Max-Max, Max	
Histogram window	The histogram window determines which part of the database is used to plot the histogram. You can set the size of the histogram window to be any size that you want within the horizontal and vertical scaling limits of the scope.	
Eye diagram		
Eye diagram	The PicoScope 9400 can automatically characterize an NRZ and RZ eye pattern. Measurements are based upon statistical analysis of the waveform.	
NRZ measurement set	X: Area, Bit Rate, Bit Time, Crossing Time, Cycle Area, Duty Cycle Distortion (%, s), Eye Width (%, s), Fall Time, Frequency, Jitter (p-p, RMS), Period, Rise Time Y: AC RMS, Crossing %, Crossing Level, Eye Amplitude, Eye Height, Eye Height dB, Max, Mean, Mid, Min, Negative Overshoot, Noise p-p (One, Zero), Noise RMS (One, Zero), One Level, Peak-Peak, Positive Overshoot, RMS, Signal-to-Noise Ratio, Signal- to-Noise Ratio dB, Zero Level	
RZ measurement set	X: Area, Bit Rate, Bit Time, Cycle Area, Eye Width (%, s), Fall Time, Jitter P-p (Fall, Rise), Jitter RMS (Fall, Rise), Negative Crossing, Positive Crossing, Positive Duty Cycle, Pulse Symmetry, Pulse Width, Rise Time Y: AC RMS, Contrast Ratio (dB, %, ratio), Eye Amplitude, Eye High, Eye High dB, Eye Opening Factor, Max, Mean, Mid, Min, Noise P-p (One, Zero), Noise RMS (One, Zero), One Level, Peak-Peak, RMS, Signal-to-Noise, Zero Level	
Mask test		
Mask test	Acquired signals are tested for fit outside areas defined by up to eight polygons. Any samples that fall within the polygon boundaries result in test failures. Masks can be loaded from disk, or created automatically or manually.	

<table>
<tr><th></th><th>9404-05</th><th>9404-16</th></tr>
<tr><td rowspan="9">Standard mask</td><td colspan="2">Standard predefined optical or standard electrical masks can be created.
SONET/SDH: OC1/STMO (51.84 Mb/s) to FEC 2666 (2.6666 Gb/s)</td></tr>
<tr><td rowspan="2">Fibre Channel: FC133 Electrical (132.8 Mb/s) to FC2125E Abs Gamma Tx.mask (2.125 Gb/s)</td><td>Fibre Channel: FC133 Electrical (132.8 Mb/s) to FC2125E Abs Gamma Tx.mask (2.125 Gb/s)</td></tr>
<tr><td>Fibre Channel: FC4250 Optical PI Rev13 (4.25 Gb/s) to FC4250E Abs Gamma Tx.mask (4.25 Gb/s)</td></tr>
<tr><td colspan="2">Ethernet: 100BASE-BX10 (125 Mb/s) to 3.125 Gb/s 10GBase-CX4 Absolute TP2 (3.125 Gb/s)</td></tr>
<tr><td>2.5 G InfiniBand driver test points (2.5 Gb/s). Ten masks. Test points 1 to 10</td><td>2.5 G InfiniBand driver test points (2.5 Gb/s). Ten masks, test points 1 to 10
5.0G InfiniBand driver test point 1 (5 Gb/s)
5.0G InfiniBand driver test point 6 (5 Gb/s)
5.0G InfiniBand transmitter pins (5 Gb/s)</td></tr>
<tr><td colspan="2">XAUI: 3.125 Gb/s XAUI Far End (3.125 Gb/s) to XAUI-E Near (3.125 Gb/s)
ITU G.703: DS1, 100 Ω twisted pair (1.544 Mb/s) to 155 Mb 1 Inv, 75 Ω coax (155.520 Mb/s)
ANSI T1/102: DS1, 100 Ω twisted pair (1.544 Mb/s) to STS3, 75 Ω coax, (155.520 Mb/s)
RapidIO: RapidIO Serial Level 1, 1.25G Rx (1.25 Gb/s) to RapidIO Serial Level 1, 3.125G Tx SR (3.125 Gb/s)</td></tr>
<tr><td rowspan="2">PCI Express: R1.0a 2.5G Add-in Card Transmitter Non-Transition bit mask (2.5 Gb/s) to R1.1 2.5G Transmitter Transition bit mask (2.5 Gb/s)</td><td>PCI Express: R1.0a 2.5G Add-in Card Transmitter Non- Transition bit mask (2.5 Gb/s) to R1.1 2.5G Transmitter Transition bit mask (2.5 Gb/s)</td></tr>
<tr><td>PCI Express: R2.0 5.0G Add-in Card 35 dB Transmitter Non-Transition bit mask (5 Gb/s) to R2.1 5.0G Transmitter Transition bit mask (5 Gb/s)</td></tr>
<tr><td colspan="2">Serial ATA: Ext Length, 1.5G 250 Cycle, Rx Mask (1.5 Gb/s) to Gen1m, 3.0G 5 Cycle, Tx Mask (3 Gb/s)</td></tr>
<tr><td>Mask margin</td><td colspan="2">Available for industry-standard mask testing</td></tr>
<tr><td>Automask creation</td><td colspan="2">Masks are created automatically for single-valued voltage signals. Automask specifies both delta X and delta Y tolerances. The failure actions are identical to those of limit testing.</td></tr>
<tr><td>Data collected during test</td><td colspan="2">Total number of waveforms examined, number of failed samples, number of hits within each polygon boundary</td></tr>
<tr><td colspan="3">Calibrator output</td></tr>
<tr><td>Calibrator output mode</td><td colspan="2">DC, 1 kHz or variable frequency (15.266 Hz to 500 kHz) square wave</td></tr>
<tr><td>Output DC level</td><td colspan="2">Adjustable from –1 V to +1 V into 50 Ω. Coarse increment: 50 mV, fine increment: 1 mV.</td></tr>
<tr><td>* Output DC level accuracy</td><td colspan="2">±1 mV ±0.5% of output DC level</td></tr>
<tr><td>Output impedance</td><td colspan="2">50 Ω nominal</td></tr>
<tr><td>Rise/fall time</td><td colspan="2">150 ns, typical</td></tr>
<tr><td>Output connectors</td><td colspan="2">SMA female</td></tr>
<tr><td colspan="3">Trigger output</td></tr>
<tr><td>Timing</td><td colspan="2">Positive transition equivalent to acquisition trigger point. Negative transition after user holdoff.</td></tr>
<tr><td>Low level</td><td colspan="2">(–0.2 ±0.1) V. Measured into 50 Ω</td></tr>
<tr><td>Amplitude</td><td colspan="2">(900 ±200) mV. Measured into 50 Ω</td></tr>
<tr><td>Rise time</td><td colspan="2">10% to 90%: ≤ 0.45 ns; 20% to 80%: ≤ 0.3 ns</td></tr>
</table>

	9404-05	9404-16
RMS jitter	2 ps typical	
Output delay	4 ±1 ns	
Output coupling	DC coupled	
Output connectors	SMA female	
Clock recovery trigger - recovered data output (optional)		
Data rate	6.5 Mb/s to 5 Gb/s	6.5 Mb/s to 8 Gb/s
Eye amplitude	250 mV p-p, typical	
Eye rise/fall time	20%–80%: 75 ps, typical. Measured at PicoScope 9404-05.	20%–80%: 50 ps, typical. Measured at PicoScope 9404-16
RMS jitter	2 ps +1% of unit interval, typical	
Output coupling	AC-coupled	
Output connections	SMA female	
Clock recovery trigger - recovered clock output (optional)		
Output frequency	Half full rate clock output, 3.25 MHz to 2.5 GHz	Half full rate clock output, 3.25 MHz to 4 GHz
Output amplitude	250 mV p-p, typical	
Output coupling	AC-coupled	
Output connectors	SMA female	
General		
Power supply voltage	+12 V ±5%	
Power supply current	2.6 A maximum and 3.3 A inclusive of active accessory loadings	2.7 A maximum and 3.3 A inclusive of active accessory loadings
Protection	Automatic shutdown on excess or reverse voltage	
AC-DC adaptor	Universal adaptor supplied	
PC connection	USB 2.0 (high speed). Also compatible with USB 3.0. Ethernet LAN	
Software	PicoSample 4: Windows 7, 8 and 10 (32-bit and 64-bit versions).	
PC requirements	Processor, memory and disk space: as required by the operating system	
Temperature range	Operating: +5 °C to +40 °C for normal operation, +15 °C to +25 °C for quoted accuracy Storage: –20 °C to +50 °C	
Humidity range	Operating: Up to 85 %RH (non-condensing) at +25 °C Storage: Up to 95 %RH (non-condensing)	
Environment	Up to 2000 m altitude and EN61010 pollution degree 2	
Dimensions	Height: 60 mm; Width: 245 mm; Depth: 232 mm	
Net weight	1.4 kg	
Compliance	CFR-47 FCC (EMC), EN61326-1:2013 (EMC) and EN61010-1:2010 (LVD)	
Warranty	5 years	

* Specifications marked with (*) are checked during performance verification.
[1] These specifications are valid after a 30-minute warm-up period and ±2 °C from firmware calibration temperature.

Kit contents and accessories

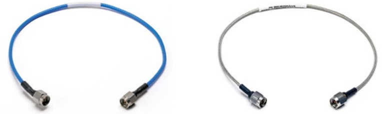
Your PicoScope 9400 Series oscilloscope kit contains the following items:

- PicoScope 9400 Series sampler-extended real-time oscilloscope (SXRTO)
- PicoSample 4 software (supplied on a USB stick and also available as a free download from www.picotech.com)
- Quick start guide
- 12 V power supply, IEC inlet
- 3 x localized IEC mains leads
- USB cable, 1.8 m
- SMA / PC3.5 / 2.92 wrench
- Storage / carry case
- LAN cable, 1 m

Optional accessories

Order code	Description	USD*	EUR*	GBP*
Adaptors				
TA313	3 GHz SMA(f)-BNC(m) interseries adaptor	19	16	13
TA314	18 GHz SMA(f) to N(m) interseries adaptor	119	99	81
TA170	18 GHz 50 Ω SMA(m-f) connector saver adaptor	20	18	14
TA172	18 GHz 50 Ω N(f) to SMA(m) interseries adaptor	129	119	92
Bessel-Thomson reference filters				
TA124	Bessel-Thomson reference filter 2.488 Gb/s / 2.5 Gb/s	129	119	92
TA123	Bessel-Thomson reference filter 1.25 Gb/s	129	119	92
TA121	Bessel-Thomson reference filter 155 Mb/s	129	119	92
TA120	Bessel-Thomson reference filter 51.8 Mb/s	129	119	92
TA122	Bessel-Thomson reference filter 622 Mb/s	129	119	92
PicoConnect 900 Series passive probes				
TA274	PicoConnect 911 20:1 960 Ω AC-coupled 4 GHz RF, microwave and pulse probe	699	579	459
TA275	PicoConnect 912 20:1 960 Ω DC-coupled 4 GHz RF, microwave and pulse probe	699	579	459
TA278	PicoConnect 913 10:1 440 Ω AC-coupled 4 GHz RF, microwave and pulse probe	699	579	459
TA279	PicoConnect 914 10:1 440 Ω DC-coupled 4 GHz RF, microwave and pulse probe	699	579	459
TA282	PicoConnect 915 5:1 230 Ω AC-coupled 5 GHz RF, microwave and pulse probe	849	709	559
TA283	PicoConnect 916 5:1 DC-coupled 5 GHz RF, microwave and pulse passive probe	849	709	559
TA272	PicoConnect 921 20:1 AC-coupled 6 GHz gigabit passive probe	1 005	839	659
TA273	PicoConnect 922 20:1 DC-coupled 6 GHz gigabit passive probe	1 005	839	659
TA276	PicoConnect 923 10:1 AC-coupled 7 GHz gigabit passive probe	1 165	969	769
TA277	PicoConnect 924 10:1 DC-coupled 7 GHz gigabit passive probe	1 165	969	769
TA280	PicoConnect 925 5:1 AC-coupled 9 GHz gigabit passive probe	1 395	1 165	919
TA231	PicoConnect 926 5:1 DC-coupled 9 GHz gigabit passive probe	1 395	1 165	919

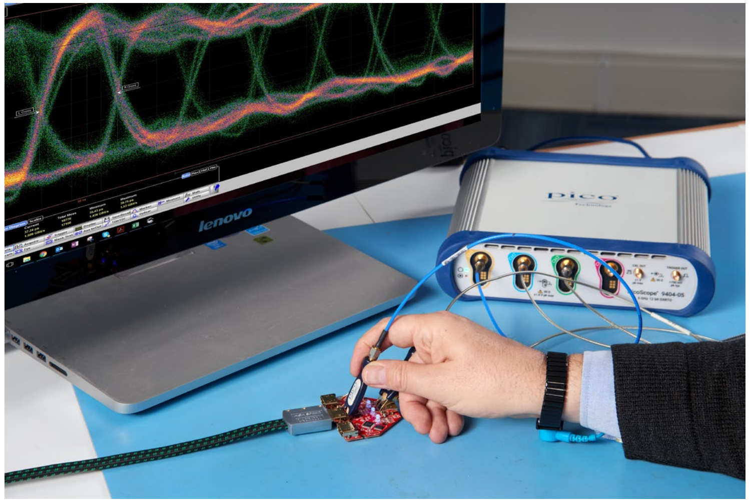
Optional accessories

Order code	Description	USD*	EUR*	GBP*	
PicoConnect 900 Series Kits					
PQ067	PicoConnect 910 Kit: all six microwave and pulse probe heads with two cables	3 095	2 595	2 045	
PQ066	PicoConnect 920 Kit: all six gigabit probe heads with two cables	5 105	4 285	3 375	
TA315	PicoConnect probe tips and solder-in kit	39	33	26	
Attenuators					
TA181	Attenuator 3 dB 10 GHz 50 Ω SMA (m-f)	75	67	53	
TA261	Attenuator 6 dB 10 GHz 50 Ω SMA (m-f)	75	67	53	
TA262	Attenuator 10 dB 10 GHz 50 Ω SMA (m-f)	75	67	53	
TA173	Attenuator 20 dB 10 GHz 50 Ω SMA (m-f)	75	67	53	
Coaxial cable assemblies					
TA263	Precision high-flex unsleeved coaxial cable 60 cm SMA(m-m) 1.9 dB loss @ 13 GHz	75	67	53	
TA264	Precision high-flex unsleeved coaxial cable 30 cm SMA(m-m) 1.1 dB loss @ 13 GHz	65	58	46	
TA265	Precision sleeved coaxial cable 30 cm SMA(m-m) 1.3 dB loss @ 13 GHz	65	58	46	
TA312	Precision sleeved coaxial cable 60 cm SMA(m-m) 2.2 dB loss @ 13 GHz	70	59	47	
Tools					
TA358	Dual-break torque wrench N-type 1 N·m (8.85 in·lb)	199	169	139	
TA356	Dual-break torque wrench SMA/PC3.5/K, 1 N·m (8.85 in·lb)	199	169	139	

PicoScope 9400 Series ordering information

Description	Bandwidth (GHz)	Channels	Order code	USD*	EUR*	GBP*
PicoScope 9404-05 sampler-extended real-time oscilloscope with clock recovery (please contact us at the addresses below, or your local distributor)						
PicoScope 9404-05 sampler-extended real-time oscilloscope	5	4	PQ181	14 995	11 995	10 995
PicoScope 9404-16 sampler-extended real-time oscilloscope with clock recovery (please contact us at the addresses below, or your local distributor)						
PicoScope 9404-16 sampler-extended real-time oscilloscope	16	4	PQ182	19 495	17 245	14 995

* Prices correct at time of publication. Sales taxes not included. Please contact Pico Technology for the latest prices before ordering.



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* Prices correct at the time of publication. Sales taxes not included. Please check www.picotech.com for the latest prices before ordering.
Errors and omissions excepted.

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