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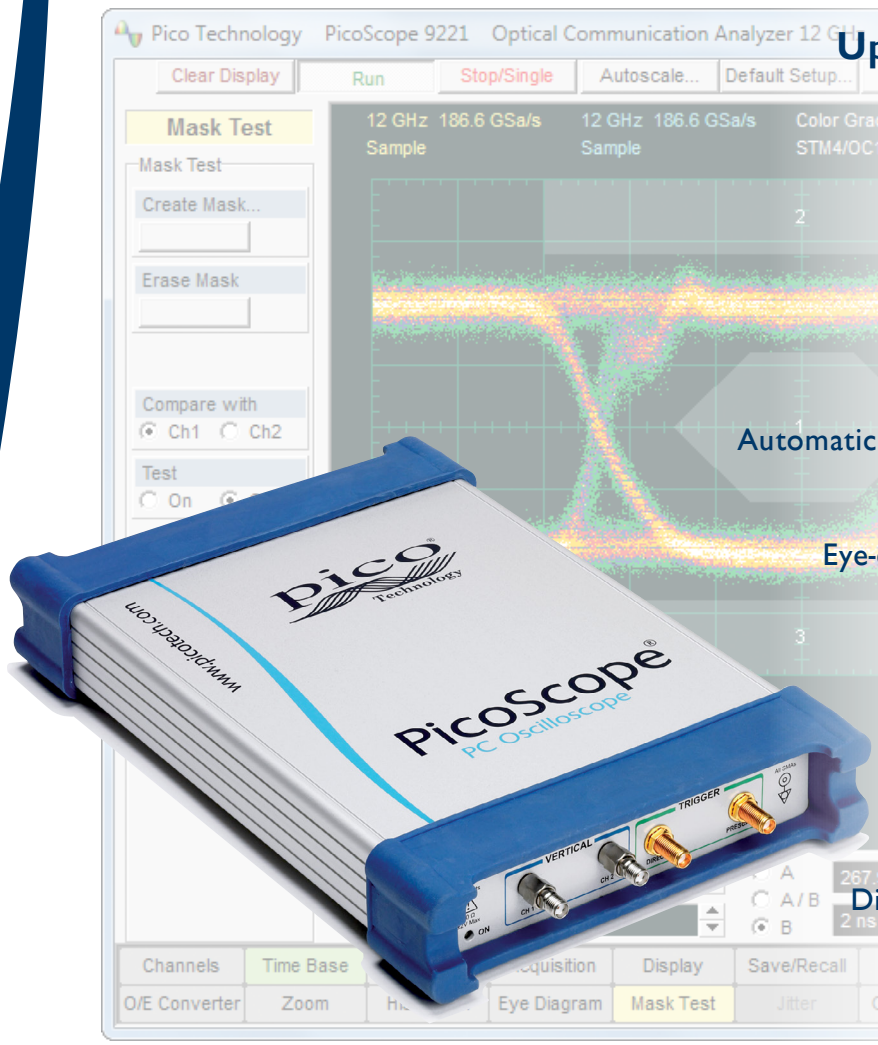
pico® Technology

PicoScope® 9200 Series

PC SAMPLING OSCILLOSCOPES

Complete sampling oscilloscope for your PC

12 GHz bandwidth on 2 channels
Dual timebase from 10 ps/div
Up to 10 GHz trigger bandwidth
Optical and electrical inputs
ActiveX component included



FEATURES INCLUDED

High-resolution cursor measurement
Automatic waveform measurements with statistics
Waveform processing including FFT
Time and voltage histograms
Eye-diagram measurements for NRZ and RZ
Automated mask tests
Intuitive Windows user interface

APPLICATIONS

Standards pre-compliance testing
IC package characterization
Telecom service and manufacturing
Timing analysis
Digital system design and characterization
Mask drawing and display
Automatic pass/fail mask limit testing
High-speed serial bus pulse response

Standard Masks

- SONET/SDH
- OC1/STM0
- OC3/STM1
- OC9/STM3
- OC12/STM4
- OC18/STM6
- OC48/STM16
- FEC2666
- Fiber Channel
- FC133
- FC266
- FC531
- FC1063
- FC2125
- FC4250
- Ethernet
- 1.25 Gb/s
- GB
- 2XGB
- 3.125 Gb/s
- INFINIBAND
- 2.5G
- 5.0 G
- XAUI
- 3.125 Gb/s
- ITU G.703
- DS1
- 2 Mb
- DS2
- 8 Mb
- 34 Mb
- DS3
- 140 Mb
- 155 Mb
- ANSI T1/102
- DS1
- DS1C
- DS2
- DS3
- STS1 Eye
- STS1 Pulse
- STS3
- Rapid IO
- 1.25 Gb/s
- 2.5 Gb/s
- 3.125 Gb/s
- G.984.2
- 3.125 Gb/s
- PCI Express
- 2.5G
- 5.0G
- Serial ATA
- 1.5G
- 3.0G

12 GHz bandwidth

The PicoScope 9200A oscilloscopes uses sequential sampling technology to measure fast repetitive signals without the need for expensive real-time sampling hardware. Combined with an input bandwidth of 12 GHz, this enables acquisition of signals with rise times of 50 ps or even faster. Precise timebase stability and accuracy, and a resolution of 200 fs, allow characterization of jitter in the demanding applications.

The scopes are designed with Pico Technology's PC Oscilloscope architecture to create a compact, lightweight instrument that can be easily carried around with your laptop.

10 GHz prescaled trigger

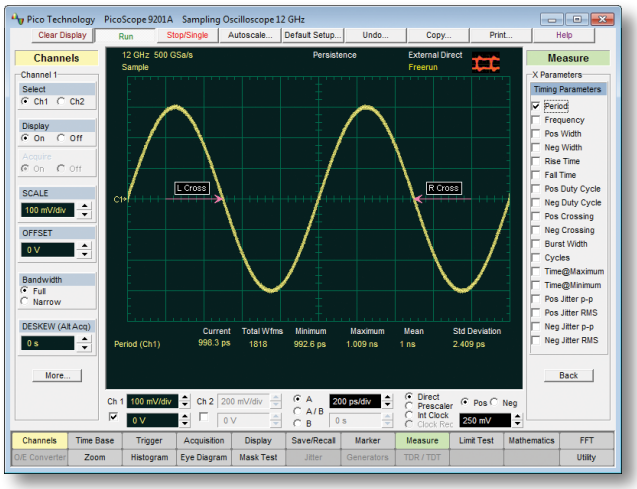
The PicoScope 9200A scopes have a built-in high-frequency trigger with frequency divider. Its typical bandwidth of up to 10 GHz allows measurements of microwave components with extremely fast data rates.

1 GHz full-function direct trigger

The scopes are equipped with a built-in direct trigger for signals up to 1 GHz repetition rate without using additional trigger units.

Built-in 2.7 Gb/s clock data recovery (CDR)

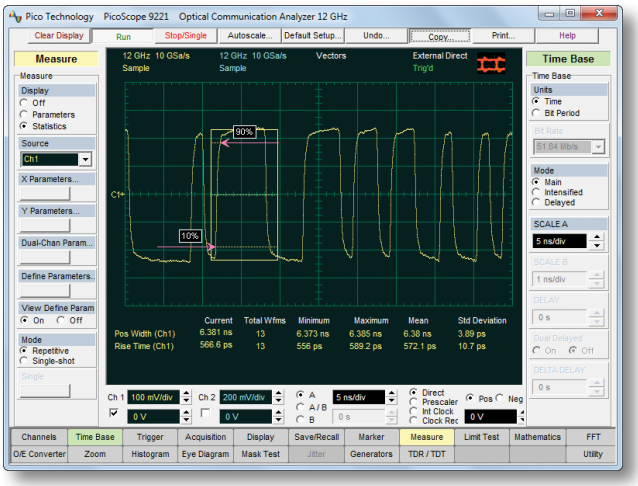
The PicoScope 9211A and 9231A have a dedicated clock-recovery trigger input for serial data from 12.3 Mb/s to 2.7 Gb/s.



Pulse parameter measurements

The PicoScope 9200A scopes quickly measure over 40 pulse parameters, so you don't need to count graticules or estimate the waveform's position. Up to ten simultaneous measurements or four statistics measurements are possible. The measurements conform to the IEEE standards.

Maximum, Minimum, Peak-Peak, Top, Base, Amplitude, Middle, Mean, DC RMS, AC RMS, Area, Cycle Middle, Cycle Mean, Cycle DC RMS, Cycle AC RMS, Cycle Area, Positive/Negative Overshoot, Period, Frequency, Positive/Negative Width, Rise/Fall Time, Positive/Negative Duty Cycle, Positive/Negative Crossing, Burst Width, Cycles, Time at Maximum/Minimum, Delay, Gain, FFT Magnitude, FFT Delta Magnitude, THD, FFT Frequency, FFT Delta Frequency



TDR/TDT analysis

The PicoScope 9211A and 9231A are supplied with a calibrated time-domain reflectometry (TDR) and time-domain transmission (TDT) accessory kit. This is used with the unit's built-in step generators to measure impedance discontinuities in circuit boards, cables and transmission lines, connectors and IC packages, with a horizontal resolution of 200 fs. The results can be displayed as volts, ohms or reflection coefficient (rho) against time or distance.

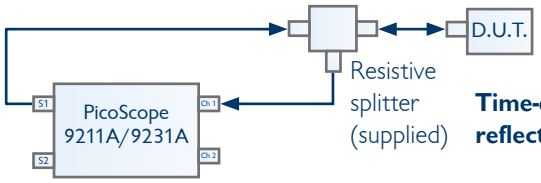
The TDR/TDT scopes also include all the features of the PicoScope 9201A, such as eye diagram analysis and mask testing.

TDR/TDT analysis

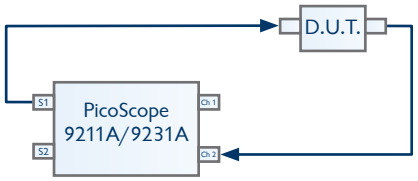
Measured parameters
Propagation delay
Gain
Gain dB

Step generators
Dual outputs
Adjustable de-skew
Programmable polarity
100 ps (typical) rise/fall times, 20% to 80%
Step, coarse timebase and pulse modes
NRZ and RZ patterns with variable length

Horizontal units
Time
Meter
Foot
Inch



Time-domain reflectometry



Time-domain transmission

Powerful mathematical analysis

The PicoScope 9200A scopes support up to four simultaneous mathematical combinations and 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.

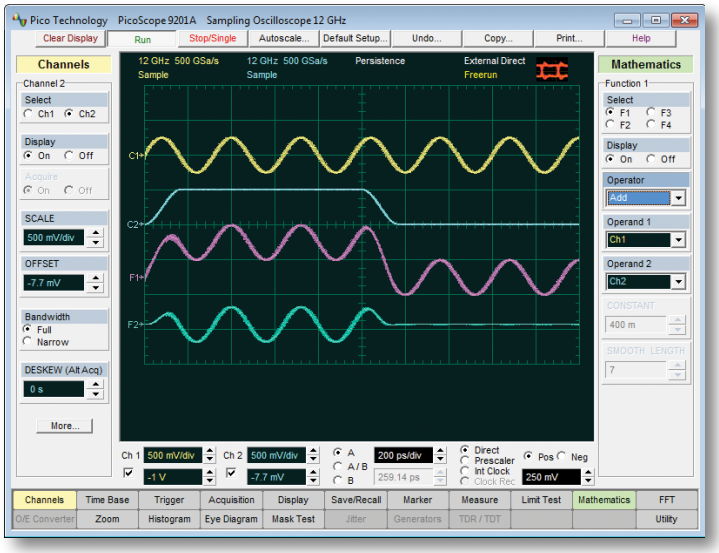
Mathematical functions

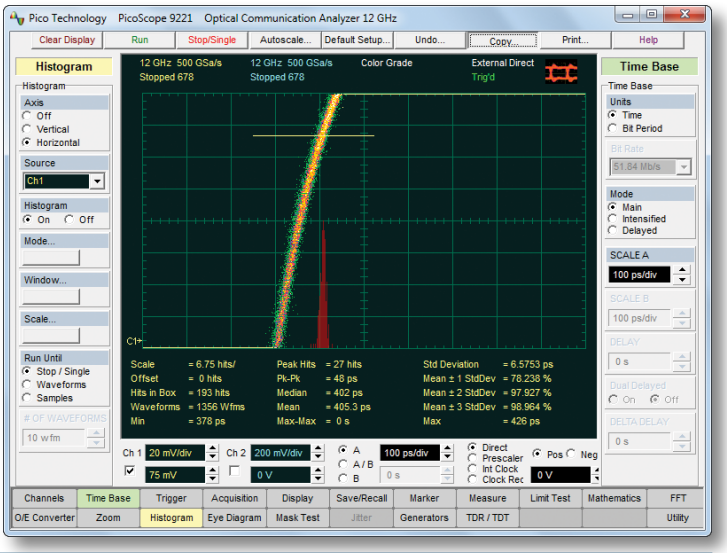
A + B	− A
A − B	|A|
A x B	log(A)
A ÷ B	dA/dt
	∫A.dt
	interpolate(A)
	smooth(A)

Histogram analysis

A histogram is a probability graph that shows the distribution of acquired data from a source within a user-definable window. The information gathered by the histogram is used to perform statistical analysis on the source.

Histograms can be constructed on waveforms on either the vertical or horizontal axes. The most common use for a vertical histogram is measuring and characterising noise, while the most common use for a horizontal histogram is measuring and characterizing jitter.



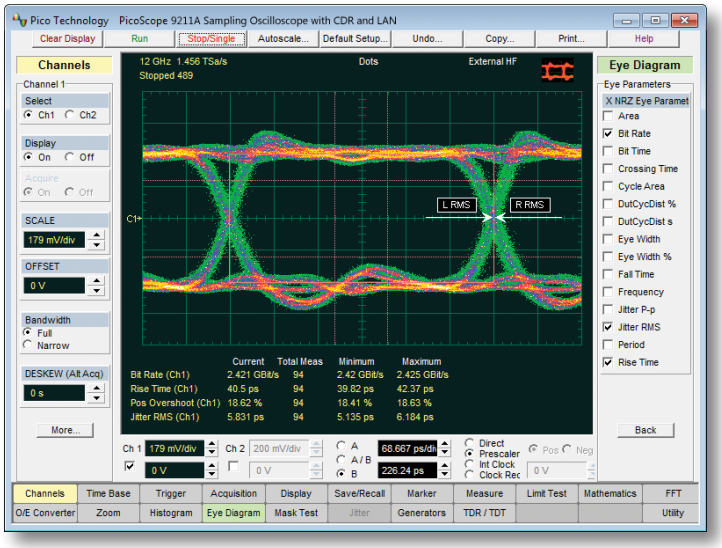


Eye-diagram analysis

The PicoScope 9200A scopes quickly measure more than 30 fundamental parameters used to characterize non-return-to-zero (NRZ) signals and return-to-zero (RZ) signals. Up to four parameters can be measured simultaneously, with statistics also shown.

The measurement points and levels used to generate each parameter can be shown dynamically.

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



Mask testing

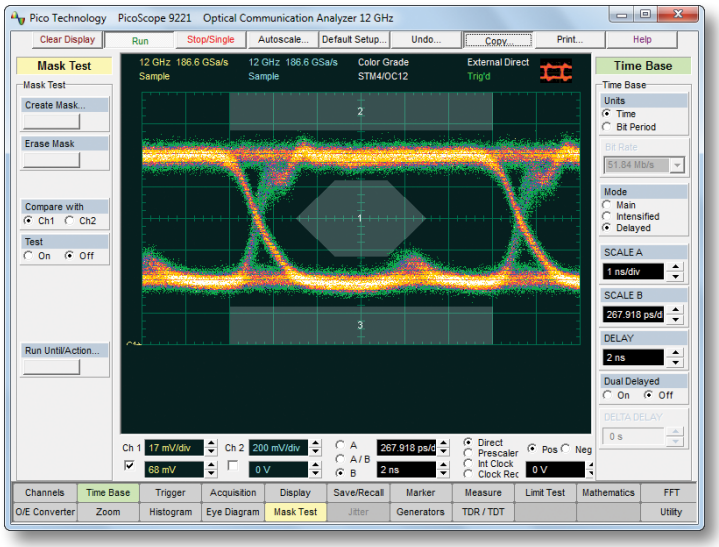
For eye-diagram masks, such as those specified by the SONET and SDH standards, the PicoScope 9200A scopes support on-board mask drawing for visual comparison. There is a library of built-in masks (listed in the column on the left), and custom masks can be automatically generated and modified using the graphical editor. A specified margin can be added to any mask.

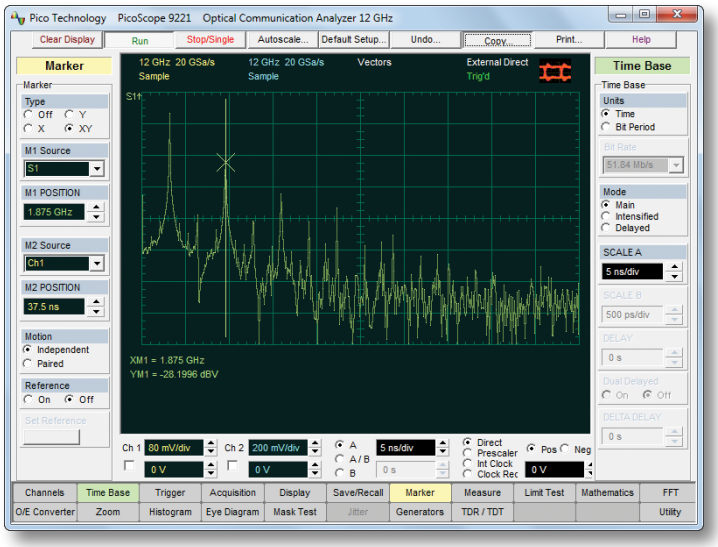
The display can be grey-scaled or colour-graded to aid in analyzing noise and jitter in eye diagrams. There is also a statistical display showing the number of failures in both the original mask and the margin.

FFT analysis

All PicoScope 9000 Series oscilloscopes can perform up to 2 Fast Fourier Transforms of input signals using a range of windowing functions. FFTs are useful for finding crosstalk problems, finding distortion problems in analog waveforms caused by non-linear amplifiers, adjusting filter circuits designed to filter out certain harmonics in a waveform, testing impulse responses of systems, and identifying and locating noise and interference sources.

Windowing functions
Rectangular
Hamming
Hann
Flat-top
Blackman-Harris
Kaiser-Bessel





Optical-to-electrical converter

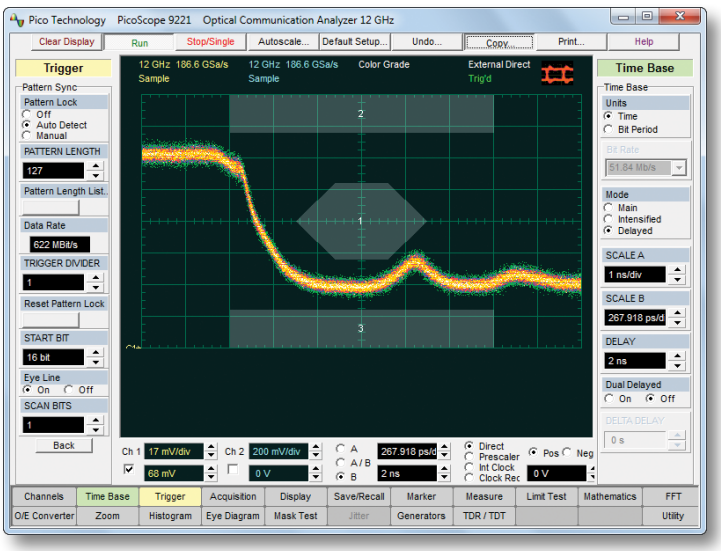
The PicoScope 9231A has a built-in 8 GHz optical electrical converter. This allows analysis of optical signals such as SONET/SDH OC1 to OC48, Fibre Channel FC133 to FC4250, and G.984.2. The converter input accepts both single-mode (SM) and multimode (MM) fibers and has a wavelength range of 750 to 1650 nm.

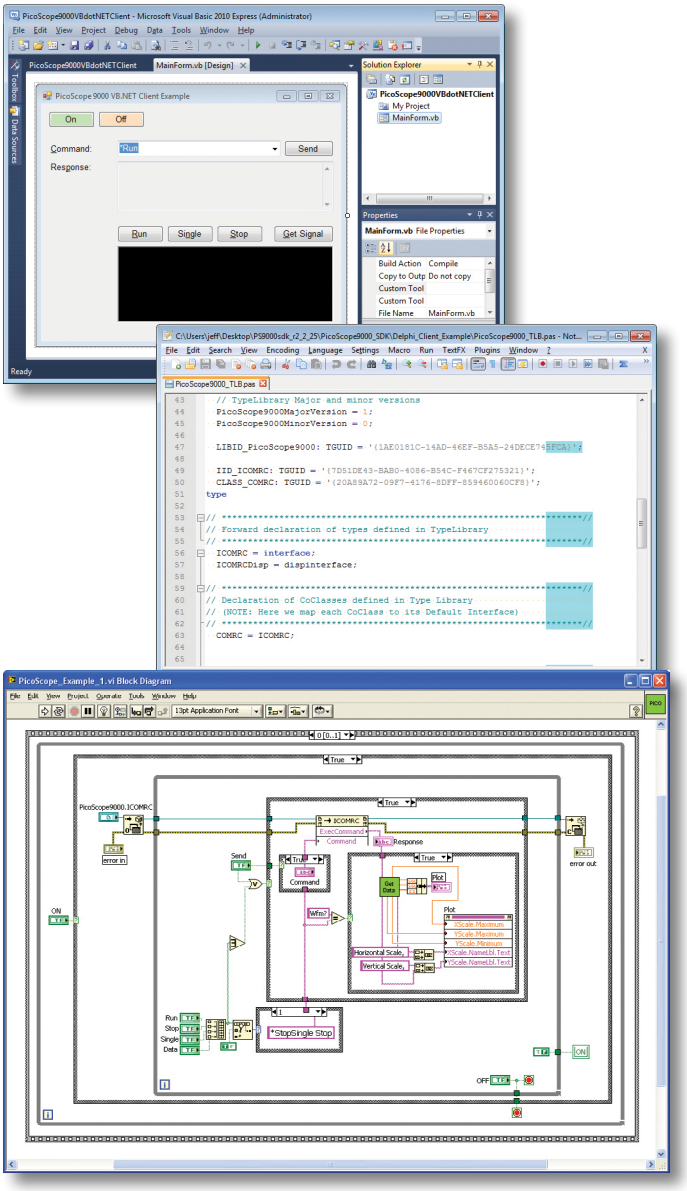
A selection of Bessel-Thomson filters can be purchased separately for use with specific optical standards (see back page).

Pattern sync trigger and eye line mode

The PicoScope 9211A and 9231A can internally generate a pattern sync trigger derived from bit rate, pattern length, and trigger divide ratio. This enables it to build up an eye pattern from any specified bit or group of bits in a sequence.

Eye line mode works with the pattern sync trigger to isolate any one of the 8 posssible paths, called eye lines, that the signal can make through the eye diagram. This allows the instrument to display averaged eye diagrams showing a specified eye line.





Software Development Kit

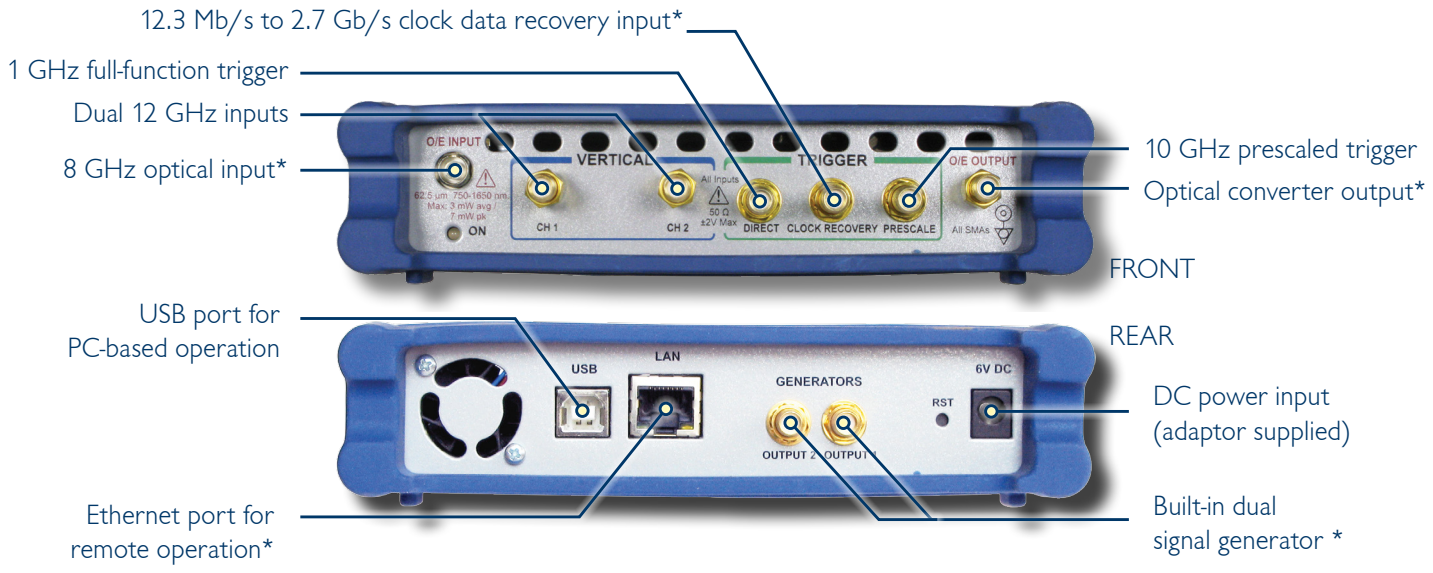
The PicoScope 9000 software can be operated as a standalone oscilloscope program and as an ActiveX control. The ActiveX control conforms to the Windows COM model and can be embedded in your own software. Programming examples are provided in Visual Basic (VB.NET), LabVIEW and Delphi, but any programming language or standard that supports the COM standard can be used, including JavaScript and C. National Instruments LabVIEW drivers are also available.

A comprehensive Programmer's Guide is supplied that details every function of the ActiveX control.

The SDK can control the oscilloscope over the USB or the LAN port.

ActiveX command categories	**ActiveX command types**
Header	Execution
System	On/off
Channels	On/off group
Timebase	Selector
Trigger	Integer
Acquisition	Float
Display	Data
Save/Recall	
Markers	
Measurements (Time Domain)	
Measurements (Spectrum)	
Limit Tests	
Mathematics	
FFT	
Histogram	
Mask Testing	
Eye Diagrams	
Utilities	
Waveforms	

PicoScope 9200A inputs and outputs



*Not on all models. See feature chart on back page.

PicoScope 9200 Series Specifications

VERTICAL	
Number of channels	2 (simultaneous acquisition)
Bandwidth	Full: DC to 12 GHz Narrow: DC to 8 GHz
Pulse response rise time	10% to 90%, calculated from Tr = 0.35/BW Full bandwidth: : 29.2 ps Narrow bandwidth: 43.7 ps
RMS noise, maximum	Full bandwidth: 2 mV Narrow bandwidth: 1.5 mV With averaging: 100 µV system limit
Scale factors (sensitivity)	2 mV/div to 500 mV/div. 1-2-5 sequence and 0.5% fine increments.
Nominal input impedance	(50 ± 1) Ω
Input connectors	SMA (F)
TIMEBASES	
Timebases	10 ps/div to 50 ms/div (main, intensified, delayed, or dual delayed)
Delta time interval accuracy	±0.2% of of delta time interval ±15 ps
Time interval resolution	200 fs minimum
TRIGGER	
Trigger sources	External direct trigger, external prescaled trigger, internal clock trigger, clock recovery trigger (not 9201A)
Direct trigger bandwidth and sensitivity	DC to 100 MHz : 100 mV p-p 100 MHz to 1 GHz: increasing linearly from 100 mV p-p to 200 mV p-p
Prescaled trigger bandwidth and sensitivity	1 to 7 GHz: 200 mV p-p to 2 V p-p 7 to 8 GHz: 300 mV p-p to 1 V p-p 8 to 10 GHz typical: 400 mV p-p to 1 V p-p
Trigger RMS jitter, maximum	4 ps + 20 ppm of delay setting
ACQUISITION	
ADC resolution	16 bits
Digitizing rate	DC to 200 kHz maximum
Acquisition modes	Sample (normal), average, envelope
Data record length	32 to 4096 points maximum per channel in x2 sequence
DISPLAY	
Display resolution	Variable
Display style	Dots, vectors, variable or infinite persistence, variable or infinite grey scaling, variable or infinite color grading
MEASUREMENTS AND ANALYSIS	
Marker	Vertical bars, horizontal bars (measure volts) or waveform markers (x and +)
Automatic measurements	Up to 40 automatic pulse measurements
Histogram	Vertical or horizontal
Mathematics	Up to four math waveforms can be defined and displayed
FFT	Up to two FFTs simultaneously, with built-in filters (rectangular, Nicolson, Hann, flat-top, Blackman-Harris and Kaiser-Bessel)
Eye diagram	Automatically characterizes NRZ and RZ eye patterns. Measurements are based on statistical analysis of the waveform.
Mask test	Acquired signals are tested for fit outside areas defined by up to eight polygons. Standard or user-defined masks can be selected.
CLOCK RECOVERY AND PATTERN SYNC TRIGGER (PicoScope 9211A and 9231A only)	
Clock recovery sensitivity	12.3 Mb/s to 1 Gb/s : 50 mV p-p 1 Gb/s to 2.7 Gb/s: 100 mV p-p Continuous rate.
Pattern sync trigger	10 Mb/s to 8 Gb/s with pattern length from 7 to 65,535 max.
Recovered clock trigger jitter, maximum	1 ps + 1.0% of unit interval
Maximum safe trigger input voltage	±2 V (DC + peak AC)
Trigger input connector	SMA (F)
SIGNAL GENERATOR OUTPUT (9211A and 9231A)	
Rise/fall times	100 ps (20% to 80%) typical
Modes	Step, coarse timebase, pulse, NRZ, RZ
OPTICAL-ELECTRICAL (O/E) CONVERTER (9231A only)	
Unfiltered bandwidth	DC to 8 GHz typical. DC to 7 GHz guaranteed at full electrical bandwidth.
Effective wavelength range	750 nm to 1650 nm
Calibrated wavelengths	850 nm (MM), 1310 nm (MM/SM), 1550 nm (SM)
Transition time	10% to 90% calculated from Tr = 0.48 / BW: 60 ps max.
RMS noise, maximum	4 µW (1310 & 1550 nm), 6 µW (850 nm)
Scale factors (sensitivity)	1 µV/div to 400 µV/div (full scale is 8 divisions)
DC accuarcy, typical	±25 µW ±10% of vertical scale
Maximum input peak power	+7 dBm (1310 nm)
Fiber input	Single-mode (SM) or multi-mode (MM)
Fiber input connectore	FC/PC
Input return loss	SM: -24 dB, typical MM: -16 dB, typical, -14 dB, maximum
GENERAL	
Operating temperature range	+5 °C to +35 °C (+15 °C to +25 °C for stated accuracy)
Power	+6 V DC ± 5% PicoScope 9201A:1.9 A max. PicoScope 9211A: 2.6 A max. PicoScope 9231A: 2.9 A max. Mains adaptor supplied for UK/US/EU/AUS/NZ.
PC connection	USB 2.0 (compatible with USB 1.1)
LAN connection	10/100 Mbit/s (9211A and 9231A only)
PC requirements	Windows XP (SP3), Windows Vista, Windows 7, Windows 8 or Windows 10, 32-bit or 64-bit
Dimensions	W 170 mm x D 260 mm x H 40 mm
Weight	1.1 kg

Note: more detailed specifications can be found in the *PicoScope 9200 Series User's Guide*, available for download from www.picotech.com.

PicoScope 9200 Series models compared

	PicoScope 9201A	PicoScope 9211A	PicoScope 9231A
12 GHz bandwidth	•	•	•
USB port	•	•	•
LAN port		•	•
Clock data recovery (CDR) trigger		•	•
Pattern sync trigger		•	•
Dual signal generator outputs		•	•
Electrical TDR/TDT capability		•	•
8 GHz optical-electrical converter			•

Kit contents

All the PicoScope 9200 Series oscilloscope kits contain:

PicoScope 9200 Series PC sampling oscilloscope

PicoScope 9000 software CD

Quick Start Guide

6 V power supply, universal input

Localized mains lead (line cord)

USB cable, 1.8 m

SMA / PC3.5 / 2.92 wrench

Storage and carry case

18 GHz 50 Ω SMA(m-f) connector saver adaptor (one fitted to each input channel)

The following items are supplied with the PicoScope 9211A and 9231A models only:

	Order code
LAN cable, 1 m	Not available separately
Attenuator 3 dB 10 GHz SMA (m-f)	TA181
14 GHz 25 ps TDR/TDT kit	TA237
4 GHz power divider kit	TA239

14 GHz 25 ps TDR/TDT kit contents (TA237)

- 18 GHz 50 Ω SMA(m-m) within-series adaptor
- 18 GHz SMA(f) reference short
- 18 GHz SMA(f) reference load

4 GHz power divider kit contents (TA239)

- 4 GHz 50 Ω SMA(f-f-f) 3-resistor 6 dB power divider
- 30 cm precision coaxial SMA(m-m) cable
- 80 cm precision coaxial SMA(m-m) cable

Ordering information

		Order code	GBP*	USD*	EUR*
PicoScope 9201A	12 GHz Sampling Oscilloscope	PP463	5995	9895	7555
PicoScope 9211A	12 GHz Sampling Oscilloscope with CDR, LAN, and TDR/TDT	PP473	7495	12 365	9445
PicoScope 9231A	12 GHz Sampling Oscilloscope with 8 GHz optical input, CDR, LAN, and TDR/TDT	PP664	13 995	23 095	17 635

Optional accessories

	Order code	GBP*	USD*	EUR*
Active oscilloscope probes				
TETRIS 1000 1 GHz high-impedance active oscilloscope probe 10:1 (with accessory kit)	TA112	599	989	789
TETRIS 1500 1.5 GHz high-impedance active oscilloscope probe 10:1 (with accessory kit)	TA222	659	1085	869
TETRIS 2500 2.5 GHz high-impedance active oscilloscope probe 10:1 (with accessory kit)	TA223	1215	2005	1605
800 MHz 15 V differential oscilloscope probe 10:1	TA046	729	1205	1025
Passive oscilloscope probes				
1.5 GHz low-impedance passive oscilloscope probe 10:1 with SMA	TA061	199	329	279
Bessel-Thomson reference filters *For use with the PicoScope 9231 O/E converter, to reduce peaking and ringing. Choice of filter depends on the bit rate of the signal under analysis*				
51.8 Mb/s bit rate (OC1/STM0)	TA120	79	129	99
155 Mb/s bit rate (OC3/STM1)	TA121	79	129	99
622 Mb/s bit rate (OC12/STM4)	TA122	79	129	99
1.250 Gb/s bit rate (GBE)	TA123	79	129	99
2.488 Gb/s bit rate (OC48/STM16) / 2.500 Gb/s bit rate (Infiniband 2.5G)	TA124	79	129	99
Attenuators				
Attenuator 3 dB 10 GHz 50 Ω SMA (m-f)	TA181	45	75	60
Attenuator 6 dB 10 GHz 50 Ω SMA (m-f)	TA261	45	75	60
Attenuator 10 dB 10 GHz 50 Ω SMA (m-f)	TA262	45	75	60
Attenuator 20 dB 10 GHz 50 Ω SMA (m-f)	TA173	45	75	60
Other optional accessories				
14 GHz 25 ps TDR/TDT kit	TA237	199	329	259
4 GHz power divider kit	TA239	249	409	329

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

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