pico ®
Technology

PicoScope 6000 Series

The highest-performance USB oscilloscopes available

4 channels **350 to 500 MHz bandwidths** **5 GS/s sampling** **1 GS memory**

10,000-waveform buffer

x100,000,000 zoom

I^2C, UART, SPI and CAN bus decoding

Mask limit testing

350 to 500 MHz spectrum analyzer

Arbitrary waveform generator

Hi-Speed USB 2.0 interface

Software Development Kit

... all included!

www.picotech.com

PicoScope performance and reliability

With 20 years' experience in the test and measurement industry, we know what's important in a new oscilloscope. The PicoScope 6000 Series have the best bandwidth, sampling rate and memory depth of any USB oscilloscopes. These features are backed up by advanced software developed with the help of feedback from our customers.

High bandwidth, high sampling rate

With a 350 MHz to 500 MHz analog bandwidth complemented by a real-time sampling rate of 5 GS/s, the PicoScope 6000 Series scopes can display single-shot pulses with 200 ps time resolution. In some models, ETS mode boosts the maximum sampling rate to 50 GS/s, giving higher timing resolution for repetitive signals.
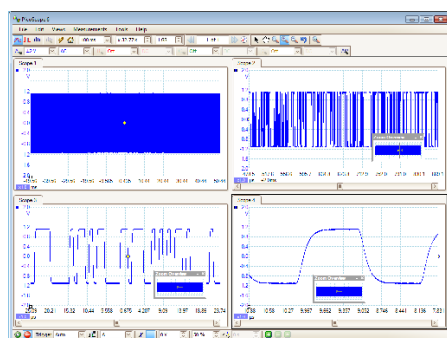
Deep memory allows you to zoom in... and in

Huge buffer memory

The PicoScope 6000 Series gives you the deepest buffer memory available as standard on any oscilloscope. Other oscilloscopes have high maximum sampling rates, but without deep memory they cannot sustain these rates on long timebases. The huge 1-gigasample buffer on most 6000 Series scopes allows them to capture at 5 GS/s down to 20 ms/div – that's a total duration of 200 ms. Managing all this data calls for some powerful tools, so PicoScope has a maximum zoom factor of 100 million combined with a choice of two zoom methods. There's a conventional set of zoom controls, plus an overview window that shows you the whole waveform while you zoom and reposition the display by simply dragging with the mouse.

Advanced triggers

As well as the standard range of triggers found on most oscilloscopes, the PicoScope 6000 Series has a built-in set of advanced triggers to help you capture the data you need.
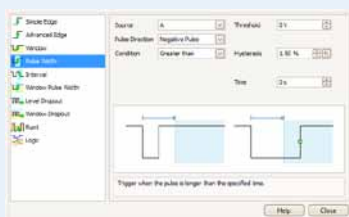
Custom probe settings

The custom probes feature allows you to correct for gain, attenuation, offsets and nonlinearities in special probes, or to convert to different units of measurement. You can save definitions to disk for later use. Definitions for standard Pico-supplied probes are built in.

Rapid triggering

The PicoScope 6000 Series contains special triggering hardware to minimise the dead time between captures. This enables you to collect waveforms at intervals of 1 µs or less when using a short timebase, improving your chances of spotting an infrequent glitch.
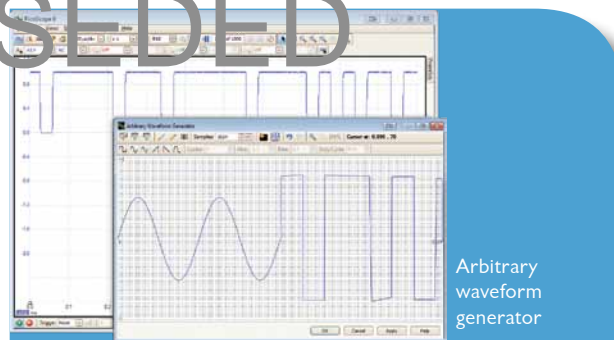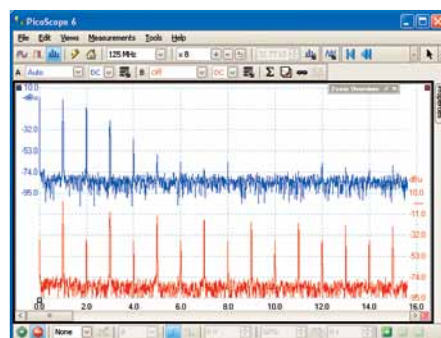
Arbitrary waveform generator

Arbitrary waveform and function generator

Generate standard waveforms from DC to 20 MHz or define your own using the power of the built-in 12-bit, 200 MS/s arbitrary waveform generator. You can import arbitrary waveforms from data files or draw them using the built-in AWG editor.

Spectrum analyzer

Spectrum analyzer

With the click of a button, you can open a new window to display a spectrum plot of the selected channels. The spectrum analyzer allows signals up to 350 MHz or 500 MHz to be viewed in the frequency domain. A full range of settings give you control over the number of spectrum bands, window types and display modes.

Color persistence modes

See old and new data superimposed, with new data in a brighter color or shade. This makes it easy to see glitches and dropouts and to estimate their relative frequency. Choose between analog persistence and digital color, or create a custom display mode.
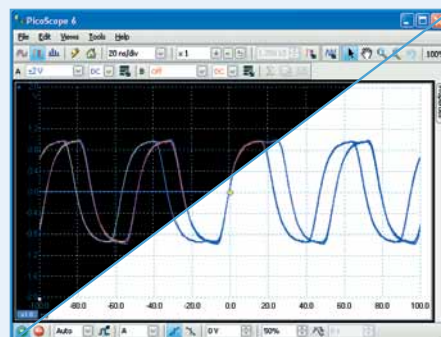
Color persistence modes

## High-speed data acquisition

The drivers and software development kit supplied allow you to write your own software or interface to popular third-party software packages. If the 1 gigasample record length isn't enough, the drivers support data streaming, a mode that captures gap-free continuous data through the USB port directly to the PC's RAM or hard disk at a maximum (PC-dependent) rate of 13 MS/s.

Serial data decoding
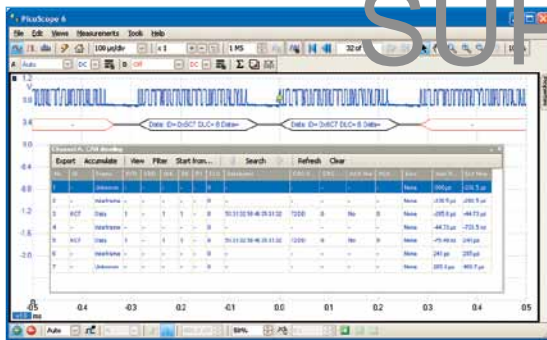
Mask limit testing

Serial data decoding

The PicoScope 6000 Series oscilloscopes are well-suited to serial decoding, with a deep memory buffer that allows them to collect long, uninterrupted sequences of data. The PicoScope 6403 and 6404 can collect many thousands of frames over several seconds into their 1-gigasample memory, and can even decode four buses simultaneously, one on each input channel.

PicoScope displays the decoded data in the format of your choice: "in view", "in window", or both at once. The "in view" format shows the decoded data beneath the waveform on a common time axis, with error frames marked in red. You can zoom in on these frames to look for noise or distortion on the waveform.

"In window" format shows a list of the decoded frames, including the data and all flags and identifiers. You can set up filtering conditions to display only the frames you are interested in, search for frames with specified properties, or define a start pattern that the program will wait for before listing the data.
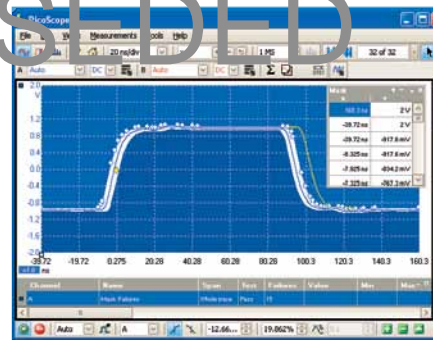
Mask limit testing

This feature is specially designed for production and debugging environments. Capture a signal from a known working system, and PicoScope will draw a mask around it with your specified tolerance. Connect the system under test, and PicoScope will highlight any parts of the waveform that fall outside the mask area. The highlighted details persist on the display, allowing the scope to catch intermittent glitches while you work on something else. The measurements window counts the number of failures, and can display other measurements and statistics at the same time.

The numerical and graphical mask editors (both shown above) can be used separately or in combination, allowing you to enter accurate mask specifications and to modify existing masks. You can import and export masks as files.

Digital low-pass filtering

Each input channel has its own digital low-pass filter with independently adjustable cut-off frequency from 1 Hz to the full scope bandwidth. This enables you to reject noise on selected channels while viewing high-bandwidth signals on all the other inputs.
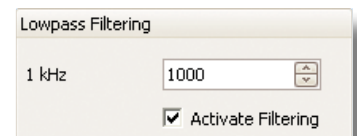
Optional 10:1 probes

You can buy your PicoScope 6000 Series scope complete with four 10:1 probes, or you can buy the probes separately at a later date.

These probes have been designed for use with the PicoScope 6000 Series and are factory-compensated to match each scope's input characteristics.

Each high-quality probe is supplied with a range of accessories for convenient and accurate high-frequency measurements.

Probe specifications	TA101	TA133
Attenuation	10:1	
Impedance at probe tip	10 MΩ || 9.5 pF	
Scope input impedance	1 MΩ AC/DC	
Compatibility	PicoScope 6402/6403	PicoScope 6404
Probe bandwidth	500 MHz (-3 dB)	
System bandwidth	350 MHz (-3 dB)	500 MHz (-3 dB)
Risetime	700 psec (10% to 90%)	
Compensation range	10 to 25 pF	
Safety standard	IEC/EN 61010-03	
Cable length	1.2 m	1.3 m

Accessories included

*   Instruction manual
*   Spring tip 0.5 mm
*   Solid tip CuBe 0.5 mm
*   Coding rings, 3 x 4 colours
*   Ground lead 15 cm
*   Ground blade 2.5 mm
*   2 self-adhesive CB pads

*   Ground Spring
*   Trim Tool
*   Insulating cap 2.5 mm
*   Protection cap 2.5 mm
*   IC caps 0.5 to 1.27 mm pitch
*   Sprung hook 2.5 mm
*   PCB adapter kit 2.5 mm

Oscilloscope controls. Commonly-used controls such as voltage range selection, timebase, memory depth and channel selection are placed on the toolbars for quick access, leaving the main display area clear for waveforms. More advanced controls and functions are located in the Tools menu.

The PicoScope display can be as simple or as complex as you need. Begin with a single view of one channel, and then expand the display to include any number of live channels, math channels and reference waveforms.

Tools>Math channels: Combine input channels and reference waveforms using simple arithmetic, or create custom equations with trigonometric and other functions.

Tools>Serial decoding: Decode a serial data signal and display the data alongside the physical signal or as a detailed table.

Tools>Reference channels: Store waveforms in memory or on disk and display them alongside live inputs. Ideal for diagnostics and production testing.

Auto setup button. Configures the timebase and voltage ranges for stable display of your signals.

Waveform replay tool: PicoScope automatically records up to 10,000 of the most recent waveforms. You can quickly scan through to look for intermittent events.

Views. PicoScope is carefully designed to make the best use of the display area. You can add new scope and spectrum views, all of which are fully adjustable in size and shape.

Rulers: Each axis has two rulers that can be dragged onto the screen to make quick measurements of amplitude, time and frequency.

Zoom and pan tools: PicoScope enables a zoom factor of up 100 million, which is necessary when working with the deep memory of the 6000 Series scopes. Use the conventional zoom-in, zoom-out and pan tools, or try the zoom overview window for fast navigation.
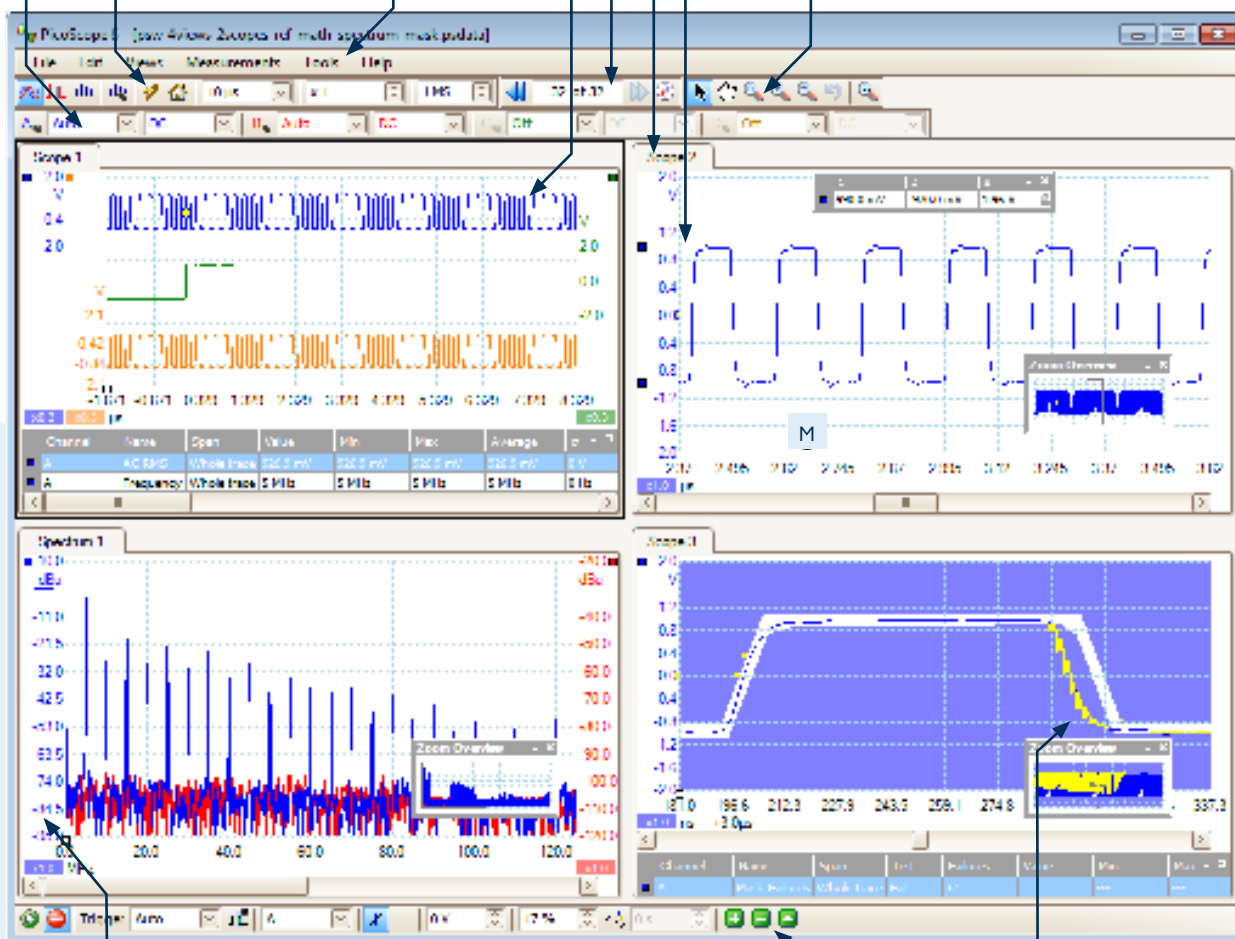
Movable axes: The vertical axes can be dragged up and down. This feature is particularly useful when one waveform is obscuring another. There's also a command to rearrange all the axes automatically.

Automatic measurements. Display calculated measurements for troubleshooting and analysis. You can add as many measurements as you need on each view. Each measurement includes statistical parameters showing its variability.

Built-in measurements: AC RMS, True RMS, DC Average, Cycle Time, Frequency, Duty Cycle, Falling Rate, Fall Time, Rising Rate, Rise Time, High Pulse Width, Low Pulse Width, Maximum, Minimum, Peak to Peak.

Mask limit testing: Automatically generate a test mask from a waveform or draw one by hand. PicoScope highlights any parts of the waveform that fall outside the mask and shows error statistics.

PicoScope 6000 Series PC Oscilloscopes

Specifications

	PicoScope 6402 and 6403	PicoScope 6404
Channels (vertical)		
Number of channels	4 BNC inputs	
Bandwidth (-3 dB)	350 MHz with TA101 probes or on 50 Ω setting; 250 MHz on ±50 mV range	500 MHz with TA133 probes or on 50 Ω setting
Bandwidth limiter	Switchable, 20 MHz	Switchable, 25 MHz
Rise time (10% to 90%, calculated)	1.0 ns	700 ps
Voltage ranges	±50 mV to ±20 V (up to ±5 V when 50 Ω input selected)	
Sensitivity	10 mV/div to 4 V/div at x1 zoom	
Input coupling	AC or DC (1 MΩ) or DC (50 Ω)	
Input impedance	1 MΩ || 15 pF or 50 Ω	1 MΩ || 10 pF or 50 Ω
DC accuracy	3%	

Input offset (position) adjustment

	6402/6403		6404	
	50 mV to 200 mV	±0.5 V	50 mV to 200 mV	±2 V
	500 mV	±2.5 V	500 mV	±10 V (50 Ω: ±5 V)
	1 V	±2.5 V	1 V	±10 V (50 Ω: ±4.5 V)
	2 V	±2.5 V	2 V	±10 V (50 Ω: ±3.5 V)
	5 V	±20 V (50 Ω: ±0.5 V)	5 V	±35 V (50 Ω: ±0.5 V)
	10 V	±20 V	10 V	±30 V
	20 V	±20 V	20 V	±20 V

Overload protection	±100 V to ground (1 MΩ inputs), 5.5 V RMS (50 Ω inputs)
Timebase (horizontal)	
Timebases	10 ns/div to 200 s/div (real-time), 1ns/div to 200 s/div (ETS, 6402/6403 only)
Timebase accuracy	5 ppm

Trigger

Basic triggers	Rising, falling

Advanced triggers

Edge:	single edge or dual edge; adjustable hysteresis
Pulse width:	negative or positive pulse; wider or narrower than a specified width
Window:	entering or leaving a voltage range
Dropout:	inactivity over a user-defined time interval
Logic level:	arbitrary logic state of Channels A to D and AUX
Runt pulse:	crosses one threshold but not the other

Trigger modes	None, Single, Repeat, Auto, Rapid, ETS
Maximum trigger rate	Up to 10,000 waveforms in a 10 ms burst
Trigger timing resolution	1 sample period
Trigger sources	Channels A to D, AUX
Trigger level	Adjustable over whole of selected voltage range
Re-arm time	Less than 1 µs on fastest timebase
Maximum trigger delay	Pre-trigger: 100% of capture duration; post-trigger: 4 billion samples

AUX input

External clock input	Reference frequency 5 MHz to 25 MHz
Input type	50 Ω, BNC, ±1 V threshold adjustment range, ±5 V protection range, DC coupled

Acquisition

ADC resolution	8 bits (up to 12 bits in resolution enhancement mode)
Maximum real-time sampling rate	5 GS/s (one channel), 2.5 GS/s (two channels), 1.25 GS/s (three or four channels)
Maximum equivalent-time (ETS) sampling rate	50 GS/s (any number of channels)
Minimum ETS timebase	1 ns/div
Buffer size	32 MS (PicoScope 6402), 1 GS (PicoScope 6403 and 6404), shared between active channels
Maximum buffer segments	32, 768 (PicoScope 6402), 1 million (PicoScope 6403 & 6404)
Maximum streaming data rate	1 MS/s in PicoScope software. >10 MS/s using supplied SDK (PC-dependent)

Function generator and arbitrary waveform generator (AWG)

Function generator frequency range	DC to 20 MHz
Function generator waveforms	Sine, square, triangle, ramp, sin (x)/x, Gaussian, half-sine, white noise, PRBS, DC level
DAC resolution / DC accuracy	12 bits / 1%
Amplitude range	±250 mV to ±2 V
Offset adjustment	±1 V (max. combined output ±2.5 V)
Output impedance	50 Ω
AWG buffer size	16 384 samples
AWG sample rate	200 MS/s

Probe calibration output

Signal output type	1 kHz square wave, 2 V pk-pk, 600 Ω

Spectrum analyzer

Frequency range	DC to 350 MHz	DC to 500 MHz
Display modes	Magnitude, average, peak hold	
Windowing functions	Rectangular, Gaussian, triangular, Blackman, Blackman-Harris, Hamming, Hann, flat-top	
Number of FFT points	Selectable power of 2 from 128 to 1048576	

Math channels

Functions	−x, x+y, x−y, x*y, x/y, sqrt(x), x^y, exp(x), ln(x), log(x), abs(x), norm(x), sign(x), sin(x), cos(x), tan(x), arcsin(x), arccos(x), arctan(x), sinh(x), cosh(x), tanh(x)
Operands	Input channels A to D, time, reference waveforms, π

Serial bus decoding

Baud rate	10 kb/s to 1 Mb/s, auto-detect with manual override
Threshold voltage	Adjustable: auto-detect with manual override
Data formats	CAN H, CAN L, I²C, UART, SPI

Mask limit testing

Horizontal resolution	1 000 to 10 000 points
Statistics	Pass/fail, failure count, total count

Display

Interpolation	Linear or sin (x)/x
Persistence modes	Digital color, analog intensity, custom, or none

General

|		
Dimensions (including connectors and end caps)	255 x 170 x 40 mm (approx. 10.0" x 6.7" x 1.6")	280 x 170 x 40 mm (approx. 11.0" x 6.7" x 1.6")
Weight	1 kg (approx. 2 lb 3 oz)	1.3 kg (approx. 2 lb 14 oz)
Operating temperature range	0 °C to 40 °C (20 °C to 30 °C for stated accuracy)	
Compliance	EU: EMC, LVD, RoHS, WEEE. USA: FCC Part 15 Class A	
PC connector	USB 2.0 (USB 1.1 compatible)	
Power supply	AC adapter and cable (cord) supplied	
Languages supported	English, French, Italian, German, Spanish, Czech, Polish, Romanian, Greek, Turkish, Danish, Finnish, Hungarian, Norwegian, Swedish, Dutch, Japanese	

Basic kit contents

The basic PicoScope 6000 Series scope kit contains the following items:

- PicoScope 6000 Series oscilloscope
- USB cable
- Universal mains (AC) power supply
- Mains lead (power cord)
- Quick Start Guide
- Software and Reference CD
- Carrying case

Probe kit contents

The PicoScope 6000 Series kit with oscilloscope probes contains the following additional items:

- Four 500 MHz 10:1 probes (see inside for further details)
- One 2-footed probe stand for hands-free use of probes
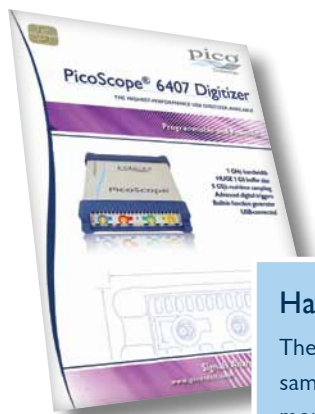
Have you seen our PicoScope 6407 Digitizer?

The PicoScope 6407 Digitizer has four 1 GHz inputs and a sampling rate of up to 5GS/s. See www.picotech.com for more information.

Ordering information	GBP	USD	EUR
PP628 PicoScope 6402 350 MHz PC Oscilloscope (32 MS buffer memory)	2,995	4,942	3,504
PP629 PicoScope 6402 with 4 x 10:1 probes	3,495	5,767	4,089
PP630 PicoScope 6403 350 MHz PC Oscilloscope (1 GS buffer memory)	3,995	6,592	4,674
PP631 PicoScope 6403 with 4 x 10:1 probes	4,495	7,417	5,259
PP748 PicoScope 6404 500 MHz PC Oscilloscope (1 GS buffer memory)	4,995	8,242	6,045
PP749 PicoScope 6404 with 4 x 10:1 probes	5,495	9,067	6,650
TA101 10:1 oscilloscope probe for 350 MHz scopes	125	206	146
TA133 10:1 oscilloscope probe for 500 MHz scope	125	206	146
Accessory packs for TA101 and TA133 probes	See website		

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