

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

CAN bus decoding

Mask limit testing

350 to 500 MHz spectrum analyzer

Arbitrary waveform generator

Hi-Speed USB 2.0 interface

Software Development Kit

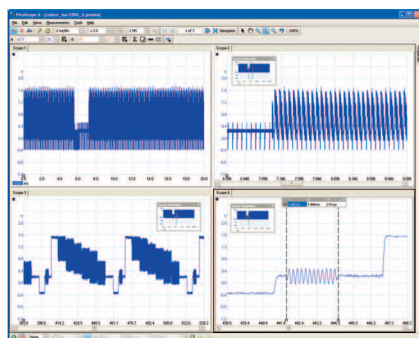
... all included!

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 that we have 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. ETS mode boosts the maximum sampling rate even further, allowing more detailed display of repetitive pulses.



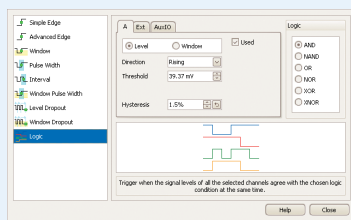
Deep memory allows you to zoom in... and in

Huge buffer memory

The PicoScope 6403 and 6404 give 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. These scopes' huge 1-gigasample buffer 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.

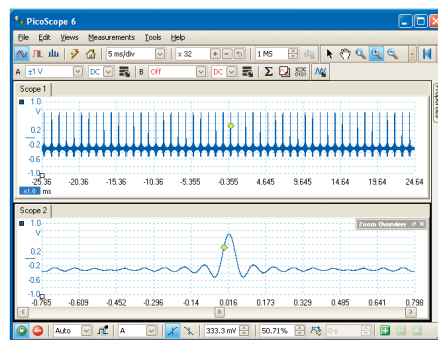


Custom probe settings

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 included.

Rapid triggering

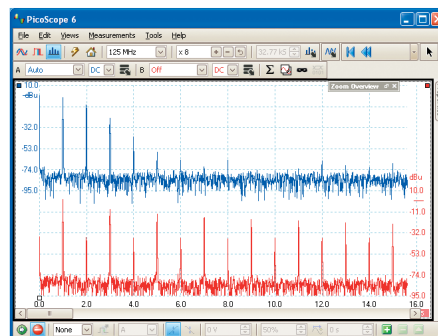
The PicoScope 6000 Series contains special triggering hardware to minimise the dead time between captures. This enables you to collect waveforms at intervals of 1 μ s or less when using a short timebase, improving your chances of spotting an infrequent glitch.



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.



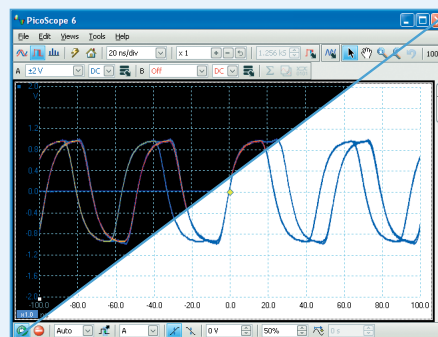
Spectrum analyzer

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

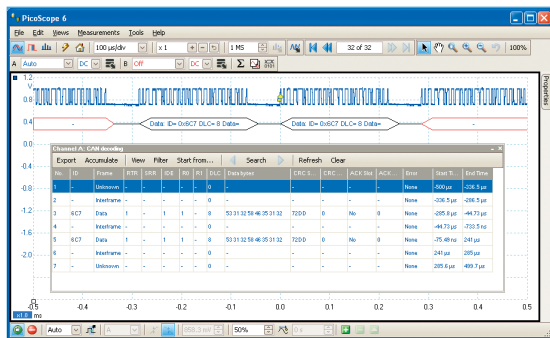
See old and new data superimposed, with new data in a brighter color or shade. This makes it easy to see glitches and dropouts and to estimate their relative frequency. Choose between analog persistence and digital color, or create a custom display mode.



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.



CAN bus decoding

CAN bus decoding

The PicoScope 6000 Series oscilloscopes are recommended for serial decoding as their deep memory 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-billion-sample 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.



Optional 10:1 probes

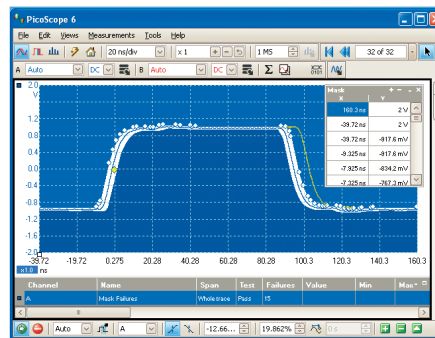
You can buy your PicoScope 6000 Series scope complete with four TA101 or TA133 10:1 probes, or you can buy the probes separately at a later date.

These probes have been designed for use with the PicoScope 6000 Series and are factory-compensated to match the scopes' 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% - 90%)	
Compensation range	7 to 25 pF	
Safety standard	IEC/EN 61010-031	
Cable length	1.2 m	



Mask limit testing

Mask limit testing

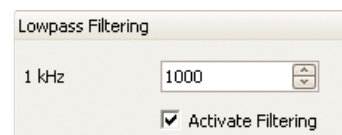
This feature is specially designed for production and debugging environments. Capture a signal from a known working system, and PicoScope will draw a mask around it with your specified tolerance. Connect the system under test, and PicoScope will highlight any parts of the waveform that fall outside the 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

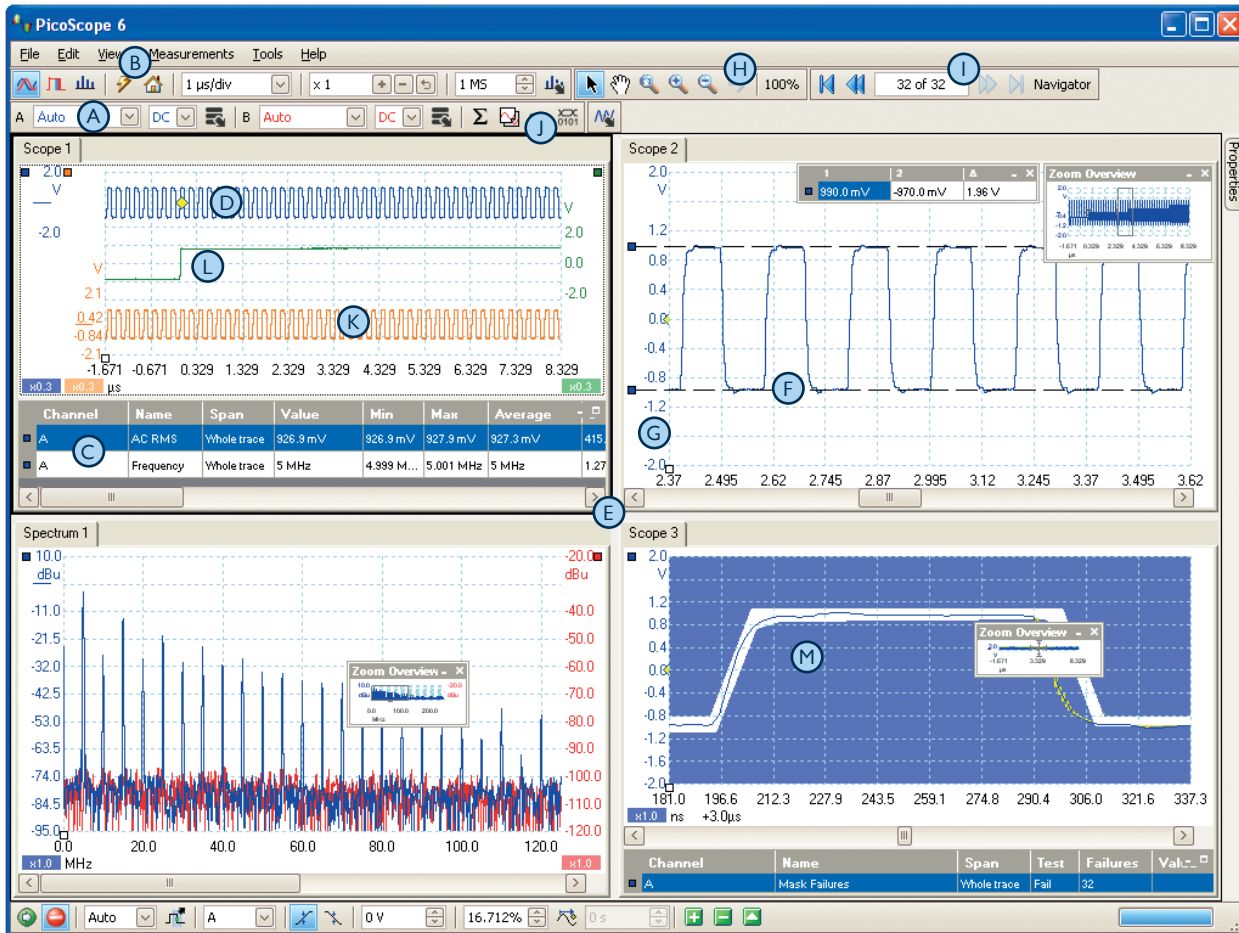
Each input channel has its own digital low-pass filter with independently adjustable cut-off frequency from 1 Hz to the full scope bandwidth.

This enables you to reject noise on selected channels while viewing high-bandwidth signals on all the other inputs.



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 Cu pads
- 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

- A** 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 Preferences menu.
- B** Auto setup button: Configures the timebase and voltage ranges for a stable display of your signals.

Automatic measurements

- C** 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

Powerful capture & analysis

- D** 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.
- E** 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.

Display tools

- F** Rulers: Each axis has two rulers that can be dragged onto the screen to make quick measurements of amplitude, time and frequency.
- G** 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.
- H** Zoom and pan tools: PicoScope enables a zoom factor of up to 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.
- I** 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.
- J** Serial decoding: Decode a CAN bus signal and display the data alongside the physical signal or as a detailed table.
- K** Math channels: Combine input channels and reference waveforms using simple arithmetic or custom equations with trigonometric and other functions.
- L** Reference channels: Store waveforms in memory or on disk and display them alongside live inputs. Ideal for diagnostics and production testing.
- M** Mask limit testing: Automatically generate a testing 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.

Specifications

Channels (vertical)

Number of channels
Bandwidth (-3 dB)
Bandwidth limiter
Rise time (10% to 90%)
Voltage ranges
Sensitivity
Input coupling
Input impedance
DC accuracy
Input offset (position) adjustment
(range dependent)

Overload protection

PicoScope 6402 & 6403

4 BNC inputs
350 MHz with TA101 probes or on 50 Ω setting
Switchable, 20 MHz
1.0 ns
 ± 50 mV to ± 20 V (up to ± 5 V when 50 Ω input selected)
10 mV/div to 4 V/div at x1 zoom
AC or DC, independently switchable
1 M Ω || 15 pF (AC or DC) or 50 Ω (DC only)

50 mV - 200 mV (1 M Ω) ± 0.5 V
500 mV - 2 V (1 M Ω and 50 Ω) ± 2.5 V
5 V (1 M Ω) ± 20 V
10 V - 20 V (1 M Ω) ± 20 V

50 mV - 200 mV 50 Ω ± 0.5 V

5 V 50 Ω ± 0.5 V

± 100 V to ground (1 M Ω inputs), 5.5 V RMS (50 Ω inputs)

PicoScope 6404

500 MHz with TA133 probes or on 50 Ω setting
Switchable, 25 MHz
700 ps
10 mV/div to 4 V/div at x1 zoom
AC or DC, independently switchable
1 M Ω || 11 pF (AC or DC) or 50 Ω (DC only)

50 mV - 200 mV (1 M Ω and 50 Ω) ± 2 V
500 mV - 2 V (1 M Ω) ± 10 V
5 V (1 M Ω) ± 35 V
10 V (1 M Ω) ± 30 V
20 V (1 M Ω) ± 20 V
500 mV (50 Ω) ± 5 V
1 V (50 Ω) ± 4.5 V
2 V (50 Ω) ± 3.5 V
5 V (50 Ω) ± 0.5 V

Timebase (horizontal)

Timebases
Timebase accuracy

1 ns/div to 200 s/div (real-time)
5 ppm

Trigger

Trigger types
Advanced triggers

Trigger modes
Maximum trigger rate
Trigger sources
Trigger level
Re-arm time
Maximum trigger delay

Rising, falling or dual edge; hysteresis; logic level; pulse width; runt pulse; dropout; window; delayed
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
Delay: nth event after trigger event, with optional delay
Logic level: arbitrary logic state of Channels A to D and AUX
Runt pulse: crosses one threshold but not the other
None, Single, Repeat, Auto, Rapid
Up to 10,000 waveforms in a 10 ms burst
Ch A to Ch D, AUX
Adjustable over whole of selected voltage range
Less than 1 μ s on fastest timebase
Pre-trigger: 100% of capture size; post-trigger: 4 billion samples

AUX input

External clock input
Input type

Reference frequency 5 MHz to 25 MHz
50 Ω , BNC, ± 1 V threshold adjustment range, ± 5 V protection range, DC coupled

Acquisition

ADC resolution
Maximum real-time sampling rate
Buffer size
Maximum buffer segments
Maximum streaming data rate

8 bits (up to 12 bits in resolution enhance mode)
5 GS/s (one channel), 2.5 GS/s (two channels), 1.25 GS/s (three or four channels)
32 MS (PicoScope 6402), 1 GS (PicoScope 6403 & 6404), shared between active channels
32, 768 (PicoScope 6402), 1 million (PicoScope 6403 & 6404)
13 MS/s (PC-dependent)

Function generator and arbitrary waveform generator (AWG)

Function generator frequency range
Function generator waveforms
DAC resolution / DC accuracy
Amplitude range
Offset adjustment
Output impedance
AWG buffer size
AWG sample rate

DC to 20 MHz
Sine, square, triangle, ramp, (sin x)/x, Gaussian, half-sine, white noise, PRBS, DC level
12 bits / 1%
 ± 250 mV to ± 2 V
 ± 1 V (max. combined output ± 2.5 V)
50 Ω
16,384 samples
200 MS/s

Probe calibration output

Signal output type

1 kHz square wave, 2 V pk-pk, 600 Ω

Spectrum analyzer

Frequency range
Display modes
Windowing functions
Number of FFT points

DC to 350 MHz
Magnitude, average, peak hold
Rectangular, Gaussian, triangular, Blackman, Blackman-Harris, Hamming, Hann, flat-top
Selectable power of 2 from 2^{-7} to 2^{+20}

Math channels

Functions
Operands

$-x$, $x+y$, $x-y$, $x*y$, x/y , \sqrt{x} , x^y , $\exp(x)$, $\ln(x)$, $\log(x)$, $\text{abs}(x)$, $\text{norm}(x)$, $\text{sign}(x)$, $\sin(x)$, $\cos(x)$, $\tan(x)$, $\arcsin(x)$, $\arccos(x)$, $\arctan(x)$, $\sinh(x)$, $\cosh(x)$, $\tanh(x)$, π
A to D (input channels), T (time), reference waveforms, π

Serial bus decoding

Baud rate
Threshold voltage
Data formats

10 kb/s to 1 Mb/s, auto-detect with manual override
Adjustable: auto-detect with manual override
CAN H, CAN L, I²C, UART, SPI

Mask limit testing

Horizontal resolution
Statistics

1000 to 10,000 points, adjustable
Pass/fail, failure count, total count

Display

Interpolation
Persistence modes

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

General

Dimensions
(including connectors and end caps)
Weight
Operating temperature range
Compliance
PC connection
Power supply
Languages supported

255 x 170 x 40 mm
(approx. 10.0" x 6.7" x 1.6")
< 1 kg (approx. 35 oz)
0 $^{\circ}$ C to 40 $^{\circ}$ C (20 $^{\circ}$ C to 30 $^{\circ}$ C for stated accuracy)
EU: EMC, LVD, RoHS, WEEE. USA: FCC Part 15 Class A
USB 2.0 (USB 1.1 compatible)
AC adapter and cable (cord) supplied
English, French, Italian, German, Spanish



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



Ordering information

PP628 PicoScope 6402 PC Oscilloscope (32 MS buffer memory)

PP629 PicoScope 6402 with 4 x 10:1 probes

PP630 PicoScope 6403 PC Oscilloscope (1 GS buffer memory)

PP631 PicoScope 6403 with 4 x 10:1 probes

PP748 PicoScope 6404 PC Oscilloscope (1 GS buffer memory)

PP749 PicoScope 6404 with 4 x 10:1 probes

TA101 10:1 oscilloscope probe for 350 MHz scopes

TA133 10:1 oscilloscope probe for 500 MHz scope

Accessory packs for TA101 and TA133 probes

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