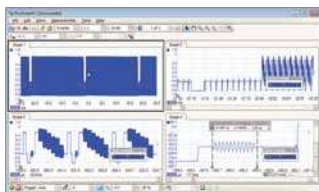


# PicoScope<sup>®</sup> 3000 Series

HIGH-PERFORMANCE 4-CHANNEL OSCILLOSCOPES

Fast, space-saving and USB-powered

Serial decoding • Mask limit testing • Segmented memory



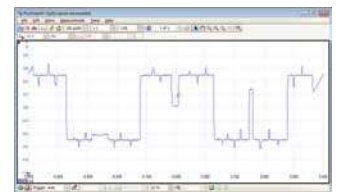
128 MS buffer  
memory



Serial decoding



200 MHz spectrum  
analyzer



Arbitrary waveform  
generator



200 MHz bandwidth

128 MS deep memory

1 GS/s real-time sampling

10 GS/s repetitive sampling

Advanced digital triggering

200 MHz spectrum analyzer

Function generator & AWG

USB 2.0 Hi-Speed

Flexible power



Supplied with a full SDK including example programs • Software compatible with  
Windows XP, Windows Vista and Windows 7 • Free technical support

High-end features as standard

## PicoScope: power, portability and versatility

Pico Technology continues to push the limits of USB-powered oscilloscopes. The new PicoScope 3000 Series offers the highest performance available from any USB-powered oscilloscope on the market today.



The PicoScope 3000 Series has the power and performance for many applications, such as design, research, test, education, service and repair.

Pico USB-powered oscilloscopes are also small, light and portable. They easily slip into a laptop bag making them ideal for the engineer on the move. The new

PicoScope 3000 series 4-channel oscilloscopes feature flexible power options, giving you the option of powering the scope from two USB ports, so you can leave the power supply behind when using the device in the field.

## High bandwidth, high sampling rate

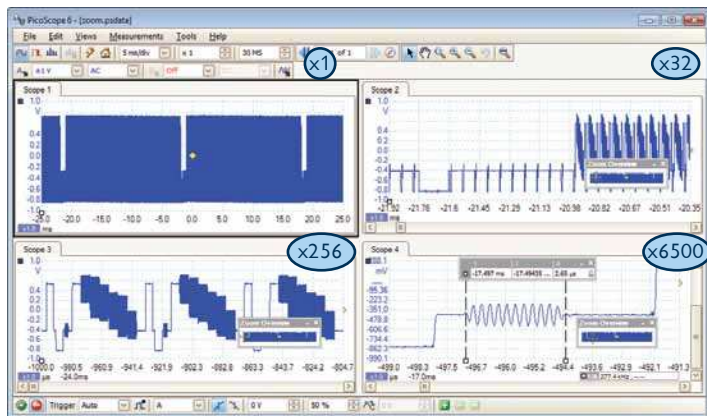
Unlike most USB-powered oscilloscopes, with real-time sampling rates of only 100 or 200 MS/s, the PicoScope 3000 Series delivers a market-leading 1 GS/s. ETS mode boosts the maximum effective sampling rate further to 10 GS/s, enabling even finer time resolution when used with repetitive signals.

## Deep memory

The PicoScope 3000 Series offers memory depths up to 128 million samples, more than any other oscilloscopes in this price range.

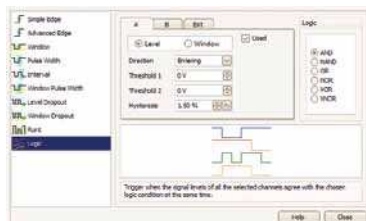
Other oscilloscopes have high maximum sampling rates, but without deep memory they cannot sustain these rates on long timebases. The PicoScope 3406B can sample at 1 GS/s at timebases all the way down to 10 ms/div.

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.

The deep memory can be segmented to store multiple waveforms, and has navigation tools allowing you to review up to 10,000 previous entries. No longer will you see a glitch on the screen only for it to vanish before you stop the scope. A mask can be applied to filter out waveforms of interest.



data you need.

## Digital triggering

Most digital oscilloscopes sold today still use an analog trigger architecture based on comparators. This can cause time and amplitude errors that cannot always be calibrated out. The use of comparators often limits the trigger sensitivity at high bandwidths and can also create a long trigger "re-arm" delay.

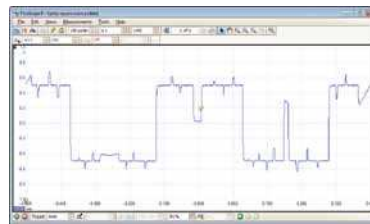
Since 1991 we have been pioneering the use of fully digital triggering using the actual digitized data. This reduces trigger errors and allows our oscilloscopes to trigger on the smallest signals, even at the full bandwidth. Trigger levels and hysteresis can be set with high precision and resolution.

Digital triggering also reduces re-arm delay and this, combined with the segmented memory, allows the triggering and capture of events that happen in rapid sequence. At the fastest timebase you can use rapid triggering to collect 10,000 waveforms in under 20 milliseconds. The mask limit testing function can then scan through these waveforms to highlight any failed waveforms for viewing in the waveform buffer.

## Custom probe settings

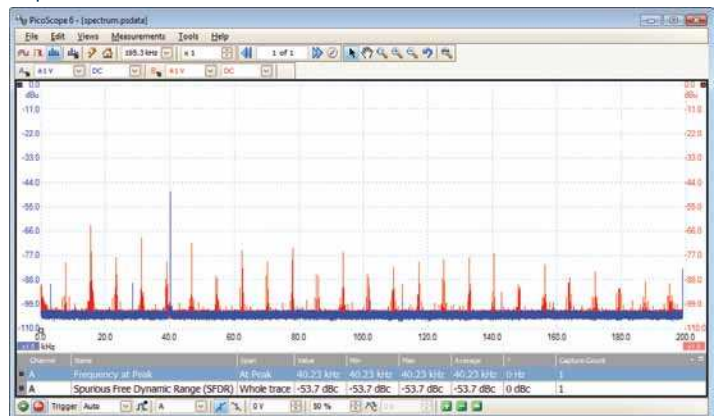
The custom probes feature allows you to correct for gain, attenuation, offsets and nonlinearities in special probes, or to convert to different units of measurement (such as current, power or temperature). You can save definitions to disk for later use. Definitions for Pico oscilloscope probes and current clamps are built in.

## Arbitrary waveform and function generator



All units have a built-in function generator (sine, square, triangle, DC level) with frequency sweeping capability. Combined with the spectrum peak hold option, this makes a powerful tool for testing amplifier and filter responses.

The B models in the PicoScope 3000 Series also include a full arbitrary waveform generator. Waveforms can be created or modified using the built-in AWG editor, imported from oscilloscope traces, or loaded from a spreadsheet.



## Spectrum analyzer

With the click of a button you can display a spectrum plot of the selected channels. The spectrum analyzer allows signals up to 200 MHz to be viewed in the frequency domain. A full range of settings gives you control over the number of spectrum bands, window type and display mode: instantaneous, average, or peak-hold.

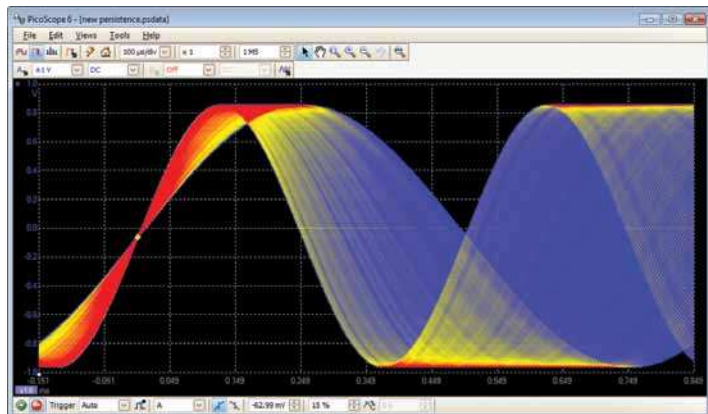
You can display multiple spectrum views with different channel selections and zoom factors, and place these alongside time-domain views of the same data. A comprehensive set of automatic frequency-domain measurements, including THD, THD+N, SNR, SINAD and IMD, can be added to the display.

## Advanced triggers

As well as the standard range of triggers found on all oscilloscopes, the PicoScope 3000 Series offers a class-leading set of advanced triggers including pulse width, windowed, dropout and logic triggers to help you capture the



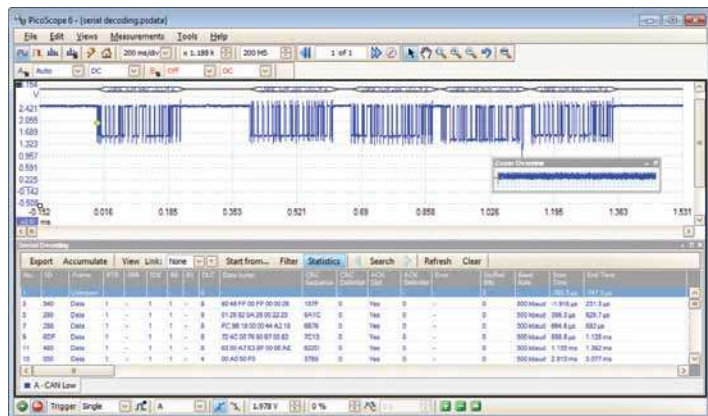
## Advanced display modes



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.

The design of the PicoScope software ensures that maximum display area is available for waveform viewing. Even with a laptop you have a much bigger viewing area and higher resolution than a typical benchtop scope.

## Serial decoding



The deep-memory PicoScope 3000 Series is ideal for serial decoding as it can capture thousands of frames of uninterrupted data.

Protocols currently supported are I<sup>2</sup>C, SPI, RS232/UART, CAN, LIN and FlexRay. Expect this list to grow with free software updates.

PicoScope displays the decoded data in the format of your choice: “in view”, “in window”, or both at once.

“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. You can also create a spreadsheet to fully decode the hex data into plain text.

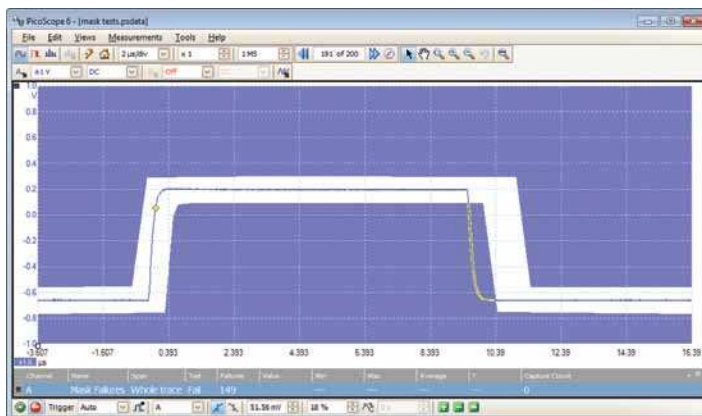
## High-speed data acquisition/digitizing

The drivers and software development kit supplied allow you to write your own software or interface to popular third-party software packages such as LabVIEW.

If the 128 MS record length isn't enough, the driver supports streaming mode, which captures gap-free continuous data through the USB port directly to the PC's RAM or hard disk at a rate of over 10 MS/s. Maximum speed depends on the PC's capabilities.

## 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 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.

## High-end features as standard

Buying a scope from some companies is a bit like buying a car. By the time you have added all the optional extras you need, the price has gone up considerably. With the PicoScope 3000 Series, high-end features such as mask limit testing, serial decoding, advanced triggering, measurements, math, XY, digital filtering and segmented memory are all included in the price.

To protect your investment, both the PC software and firmware inside the unit can be updated. We have a long history of providing new features for free via software downloads. Other companies make vague promises about future enhancements but we deliver on our promises year after year. Users of our products reward us by becoming lifelong customers, frequently recommending us to their colleagues.

## Dependable signal integrity

Most oscilloscopes are built down to a price; ours are built up to a specification.



Careful front-end design and shielding reduces noise, crosstalk and harmonic distortion. Years of oscilloscope experience leads to improved pulse response and bandwidth flatness.

We are proud of the dynamic performance of our products and publish these specifications in detail. The result is simple: when you probe a circuit, you can trust in the waveform you see on the screen.

# PicoScope 3000 Series 4-Channel Oscilloscopes - The PicoScope Display

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

**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 multiple serial data signals 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 signals.

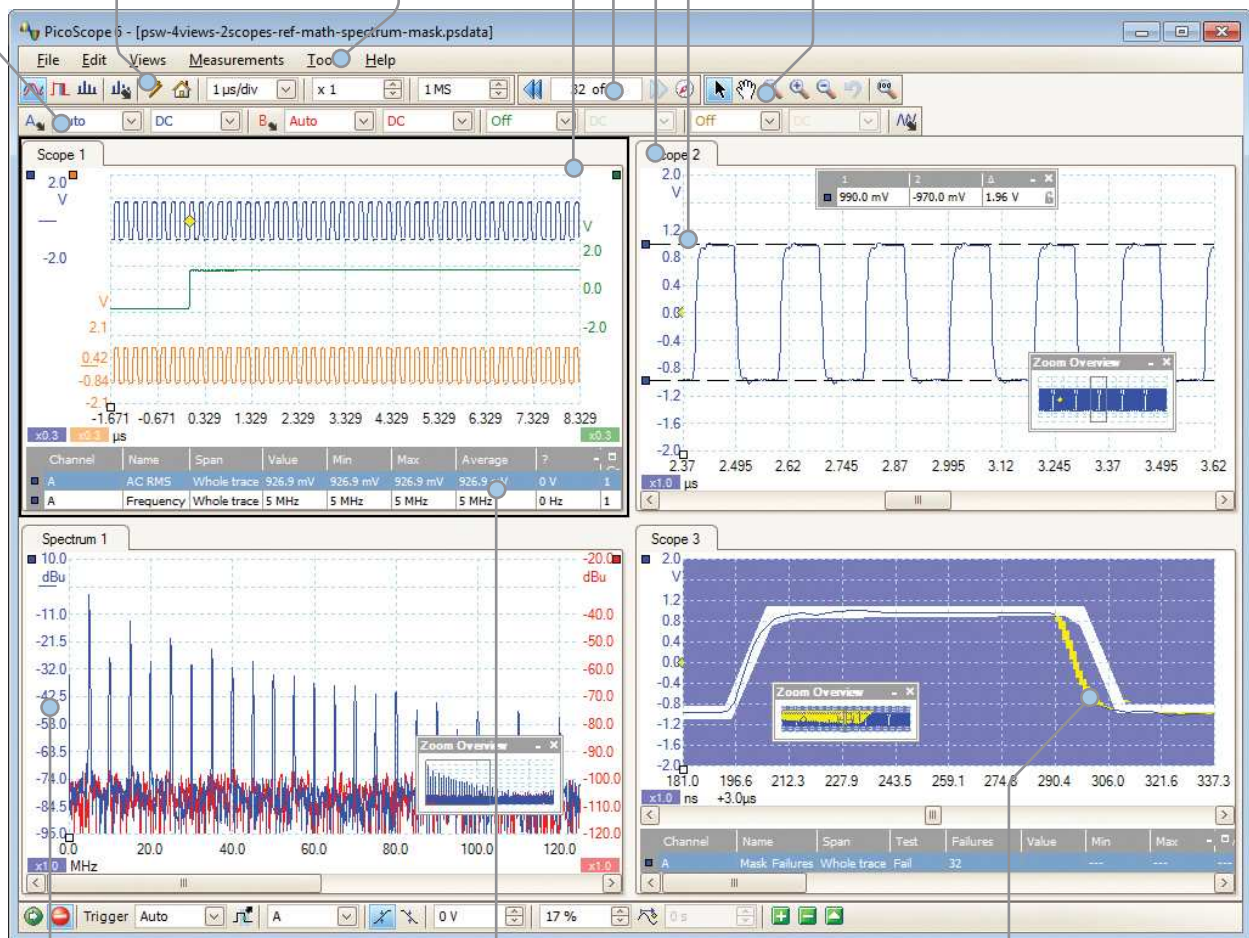
**PicoScope:** the display can be as simple or as complex as you need. Begin with a single view of one channel, and then expand the display to include any number of live channels, math channels and reference waveforms.

**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 with automatic or custom layouts.

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

**Zoom and pan tools:** PicoScope allows a zoom factor of up to 100 million, which is necessary when working with the deep memory of the 3000 Series scopes. Either use the zoom-in, zoom-out and pan tools, or click and drag in 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 an **Auto Arrange Axes** command.

**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.

**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 3000 Series 4-Channel Oscilloscopes - Specifications

## PRODUCT SELECTOR

MODEL	BANDWIDTH	SAMPLING	MEMORY	WAVEFORM	PROBES SUPPLIED
PicoScope 3404A	60 MHz	1 GS/s	4 MS	Function generator	4
PicoScope 3404B	60 MHz	1 GS/s	8 MS	Func. gen. + AWG	4
PicoScope 3405A	100 MHz	1 GS/s	16 MS	Function generator	4
PicoScope 3405B	100 MHz	1 GS/s	32 MS	Func. gen + AWG	4
PicoScope 3406A	200 MHz	1 GS/s	64 MS	Function generator	4
PicoScope 3406B	200 MHz	1 GS/s	128 MS	Func. gen. + AWG	4

MODEL	PicoScope 3404A/B	PicoScope 3405A/B	PicoScope 3406A/B
<b>VERTICAL</b>			
Bandwidth (-3 dB)	60 MHz	100 MHz	200 MHz
Bandwidth limiting (-3 dB)	20 MHz, switchable		
Rise time (calculated)	5.8 ns	3.5 ns	1.75 ns
Resolution	8 bits		
Input channels	4		
Input characteristics	1 MΩ ±1%, in parallel with 14 pF ±1 pF		
Input coupling	AC/DC		
Input sensitivity	10 mV/div to 4 V/div (10 vertical divisions)		
Input ranges	±50 mV to ±20 V in 9 ranges		
Analog offset range (vertical position adjustment)	±250 mV (50 mV, 100 mV, 200 mV ranges) ±2.5 V (500 mV, 1 V, 2 V ranges) ±20 V (5 V, 10 V, 20 V ranges)		
DC accuracy	±3% of full scale		
Overload protection	±100 V (DC + AC Peak)		

<b>HORIZONTAL</b>			
Max. sampling rate (real time)	1 GS/s (1 ch), 500 MS/s (2 ch), 250 MS/s (3 or 4 ch)		
Max. effective sampling rate (repetitive signals)	2.5 GS/s	5 GS/s	10 GS/s
Sampling rate (cont. USB streaming)	≥10 MS/s (PC dependent)		
Timebase ranges	2 ns/div to 200 s/div	1 ns/div to 200 s/div	500 ps/div to 200 s/div
Buffer memory* (A models)	4 MS	16 MS	64 MS
Buffer memory* (B models)	8 MS	32 MS	128 MS
Waveform buffer (no. of segments)	1 to 10,000		
Timebase accuracy	±50 ppm		
Sample jitter	< 5 ps RMS		

\* Shared between active channels

<b>DYNAMIC PERFORMANCE (typical)</b>	
Crosstalk	Better than 400:1 up to full bandwidth (equal voltage ranges)
Harmonic distortion	< -50 dB at 100 kHz full scale input
SFDR	52 dB typical
ADC ENOB	7.6 bits
Noise	180 μV RMS (on most sensitive range)
Pulse response	< 5% overshoot
Bandwidth flatness	(+0.3 dB, -3 dB) at scope input, from DC to full bandwidth

<b>TRIGGER</b>	
Trigger modes	Auto, repeat, single, none, rapid (segmented memory)
Advanced digital triggers (Ch A to D)	Edge, window, pulse width, window pulse width, dropout, window dropout, interval, logic, runt pulse
Trigger sensitivity (Ch A to D)	Digital triggering provides 1 LSB accuracy up to full bandwidth of scope
Max. pre-trigger capture	Up to 100% of capture size
Max. post-trigger delay	Up to 4 billion samples
Trigger re-arm time	< 2 μs on fastest timebase
Max. trigger rate	Up to 10,000 waveforms in a 20 ms burst

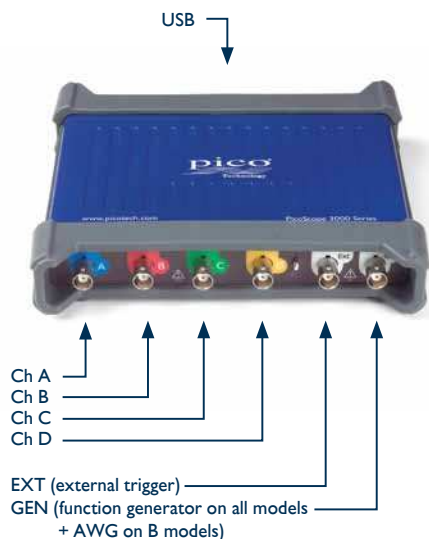
<b>EXTERNAL TRIGGER INPUT</b>			
Trigger types	Edge, pulse width, dropout, interval, logic, delayed		
Input characteristics	Front panel BNC, 1 MΩ ±1% in parallel with 14 pF ±1 pF		
Bandwidth	60 MHz	100 MHz	200 MHz
Voltage range	±5 V, DC coupled		
Overvoltage protection	±100 V (DC + AC peak)		



# PicoScope 3000 Series 4-Channel Oscilloscopes - Specifications (continued)

MODEL	PicoScope 3404A/B	PicoScope 3405A/B	PicoScope 3406A/B
<b>FUNCTION GENERATOR (all models)</b>			
Output waveforms	All models: Sine, square, triangle, DC voltage. B models: ramp, sinc, Gaussian, half-sine, white noise, PRBS.		
Output frequency range	DC to 1 MHz		
Sweep modes	Up, down, dual with selectable start/stop frequencies and increments		
Bandwidth	> 1 MHz		
Output frequency accuracy	±50 ppm		
Output frequency resolution	< 0.01 Hz		
Output voltage range	±2 V with ±1% DC accuracy		
Output voltage adjustment	Signal amplitude and offset adjustable in approx. 1 mV steps within overall ± 2 V range		
Amplitude flatness	< 0.5 dB to 1 MHz, typical		
SFDR	> 60 dB, 10 kHz full scale sine wave		
Connector type	Front panel BNC with 600 Ω output impedance		
Overvoltage protection	±10 V		
<b>AWG (B models only)</b>			
Update rate	20 MS/s		
Buffer size	8 kS	8 kS	16 kS
Resolution	12 bits (output step size approx. 1 mV)		
Bandwidth	> 1 MHz		
Rise time (10 - 90%)	< 100 ns		
<b>PROBE COMPENSATION OUTPUT</b>			
1 kHz square wave, 1.6 V pk-pk (typ.), 600 Ω			
<b>SPECTRUM ANALYZER</b>			
Frequency range	DC to 60 MHz	DC to 100 MHz	DC to 200 MHz
Display modes	Magnitude, average, peak hold		
Windowing functions	Rectangular, Gaussian, triangular, Blackman, Blackman-Harris, Hamming, Hann, flat-top		
Number of FFT points	Selectable from 128 to 1 million in powers of 2		
<b>MATH CHANNELS</b>			
Functions	-x, x+y, x-y, x*y, x/y, x^y, sqrt, exp, ln, log, abs, norm, sign, sin, cos, tan, arcsin, arccos, arctan, sinh, cosh, tanh, freq, derivative, integral, min, max, average, peak		
Operands	A, B, C, D (input channels), T (time), reference waveforms, constants, pi		
<b>AUTOMATIC MEASUREMENTS</b>			
Oscilloscope	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		
Spectrum	Frequency at peak, amplitude at peak, average amplitude at peak, total power, THD %, THD dB, THD+N, SFDR, SINAD, SNR, IMD		
Statistics	Minimum, maximum, average and standard deviation		
<b>SERIAL DECODING</b>			
CAN, LIN, FlexRay, I <sup>2</sup> C, SPI, and RS232/UART protocols			
<b>MASK LIMIT TESTING</b>			
Statistics: pass/fail, failure count, total count			
<b>DISPLAY</b>			
Interpolation	Linear or sin(x)/x		
Persistence modes	Digital color, analog intensity, custom, or none		
<b>GENERAL</b>			
PC connection	USB 2.0 hi-speed		
Power requirements	Powered from 2 USB ports or from AC adaptor supplied (1000 mA at 5 V)		
Dimensions	190 x 170 x 40 mm (including connectors)		
Weight	< 0.5 kg		
Temperature range	Operating: 0 °C to 40 °C (20 °C to 30 °C for stated accuracy)		
Safety approvals	Designed to EN 61010-1:2010		
EMC approvals	Tested to EN61326-1:2006 and FCC Part 15 Subpart B		
Environmental approvals	RoHS and WEEE compliant		
Software/PC requirements	PicoScope 6, SDK and example programs. Microsoft Windows XP, Windows Vista or Windows 7.		
Languages (full support):	English, French, German, Italian, Spanish		
Languages (UI only):	Simplified Chinese, Traditional Chinese, Czech, Danish, Dutch, English, Finnish, French, German, Greek, Hungarian, Italian, Japanese, Korean, Norwegian, Polish, Portuguese, Romanian, Spanish, Swedish, Turkish		

## Connections



## Kit contents



Your PicoScope 3000 Series oscilloscope kit contains the following items:

- PicoScope 3000 Series oscilloscope
- 4 10:1 probes
- Single-headed USB cable
- Double-headed USB cable
- AC power adapter
- Installation Guide
- Software and Reference CD

## Software Development Kit

The PicoScope 3000 Series SDK is available for free download. It contains drivers and programming examples in the following languages and development environments:

- C
- C#
- Excel
- LabVIEW

## High-quality probes

The probes supplied with these oscilloscopes are chosen to obtain the specified system bandwidth.

- MI007 (supplied with PicoScope 3404A/B)
- TA132 (supplied with PicoScope 3405A/B)
- TA131 (supplied with PicoScope 3406A/B)

## Ordering information

ORDER CODE	DESCRIPTION	£	US\$*	€*
PP846	PicoScope 3404A (60 MHz, func. gen., probes)	599	988	725
PP847	PicoScope 3404B (60 MHz, func. gen.+AWG, probes)	749	1236	906
PP848	PicoScope 3405A (100 MHz, func. gen., probes)	899	1483	1088
PP849	PicoScope 3405B (100 MHz, func. gen.+AWG, probes)	1049	1731	1269
PP850	PicoScope 3406A (200 MHz, func. gen., probes)	1199	1978	1451
PP851	PicoScope 3406B (200 MHz, func. gen.+AWG, probes)	1349	2226	1632



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\*US\$ and € prices are correct at the time of publication. Please contact Pico Technology for the latest prices before ordering. Errors and omissions excepted. Copyright © 2012 Pico Technology Ltd. All rights reserved.

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