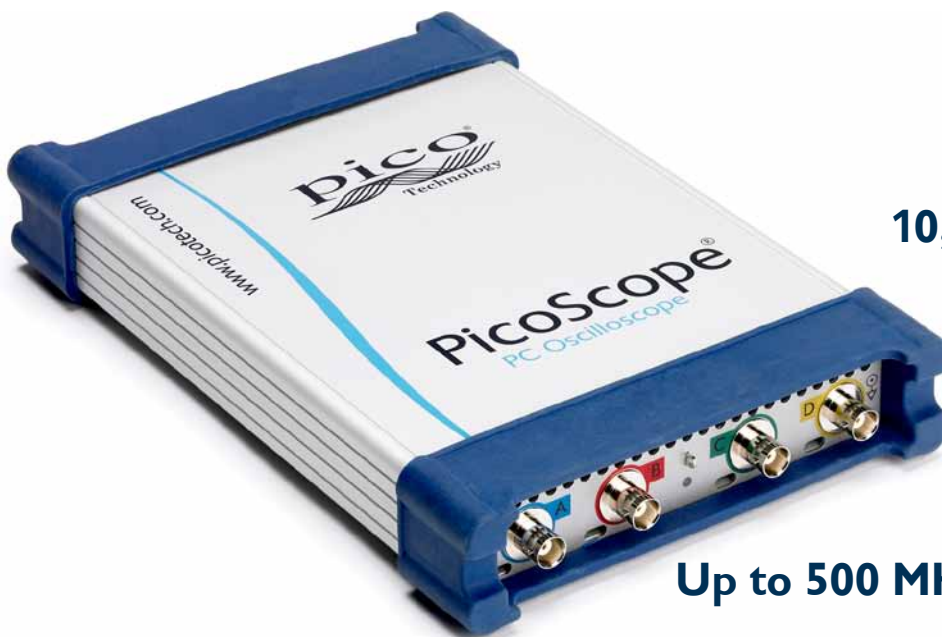


# PicoScope<sup>®</sup> 6000 Series

HIGH-PERFORMANCE USB OSCILLOSCOPES

**Superior specifications. Great value.**

4 CHANNELS • 500 MHz BANDWIDTH • 5 GS/s SAMPLING • 1 GS MEMORY



**10,000-waveform buffer**

**x100,000,000 zoom**

**Mask limit testing**

**Serial bus decoding**

**Up to 500 MHz spectrum analyzer**

**Arbitrary waveform generator**

**Hi-Speed USB 2.0 interface**



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

From a name you can trust...

[www.picotech.com](http://www.picotech.com)

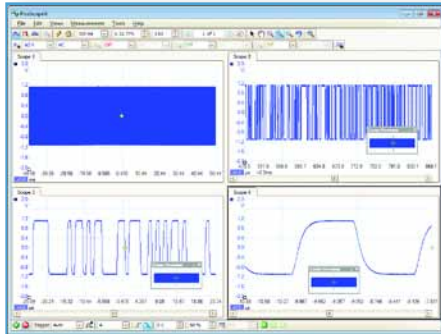
## PicoScope performance and reliability

With 20 years' experience in the test and measurement industry, we know what's important in a new oscilloscope. The PicoScope 6000 Series scopes 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 250 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 to 50 GS/s, giving higher timing resolution for repetitive signals.

## Huge buffer memory

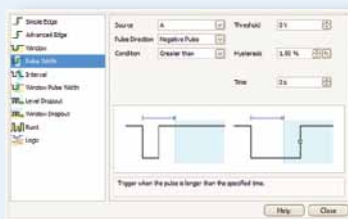


Deep memory allows you to zoom in... and in... and in

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 1-gigasample buffer on the PicoScope 6404B allows it to capture at 5 GS/s down to 20 ms/div for a total duration of 200 ms. To help manage all this data, PicoScope can zoom up to 100 million times using a choice of two zoom methods. There are zoom buttons as well as an overview window that lets 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.



All triggering is digital, resulting in high threshold resolution and excellent waveform stability.

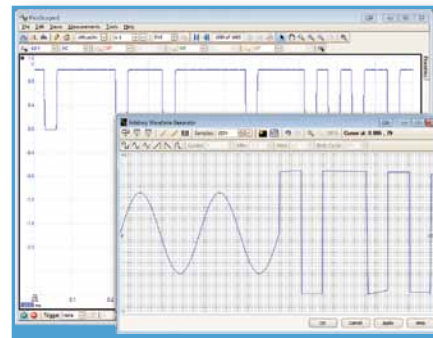
## Custom probe settings

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. Definitions for standard Pico-supplied probes are built in, but you can also save your own definitions to disk for later use.

## Rapid triggering

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

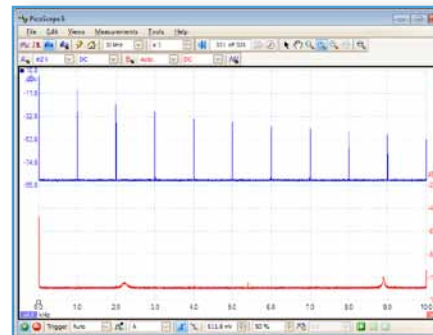
## Arbitrary waveform and function generator



Arbitrary waveform generator

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

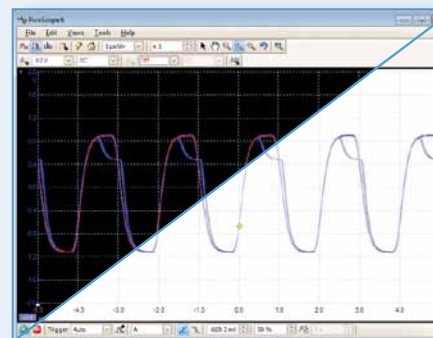
## Spectrum analyzer



Spectrum analyzer

With the click of a button, you can open a new window to display a spectrum plot of selected channels. The spectrum analyzer allows signals up to 500 MHz (depending on the scope model) 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



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.

## 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 of the PicoScope 6404B 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 (PC-dependent) rate of over 10 MS/s.

## Serial data decoding:

CAN • LIN • UART • SPI • I<sup>2</sup>C



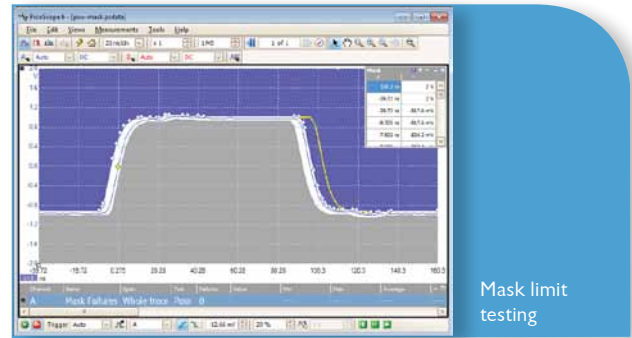
Serial data decoding

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. This allows the capture of thousands of frames or packets of data over several seconds. The scopes can decode up to four buses simultaneously with independent protocol selection for each input channel.

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 it lists the data.

## Mask limit testing



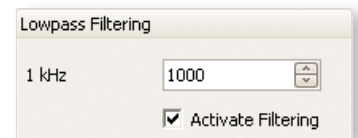
Mask limit testing

This feature is 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 or 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 the others.



## Probes included

Your PicoScope 6000 Series scope is supplied complete with four high-impedance probes. Replacement probes are available.

These probes have been designed for use with individual models of 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	TA150	TA133
Attenuation	10:1	
Resistance at probe tip	10 MΩ	
Capacitance at probe tip	9.5 pF	
Scope input impedance	1 MΩ	
Compatibility	PicoScope 6402A/B, 6403A/B	PicoScope 6404A/B
Bandwidth (3 dB)	350 MHz	500 MHz
Risetime (10% to 90%)	1 ns	700 ps
Compensation range	10 to 25 pF	
Safety standard	IEC/EN 61010-031	
Cable length	1.3 m	



## Accessories included

### TA150

- Instruction manual
- Solid tip 0.5 mm
- Coding rings, 3 x 4 colors
- Ground lead 15 cm
- Ground spring 2.5 mm
- Trim tool
- Insulating cap 2.5 mm
- Sprung hook 2.5 mm

### TA133

- Instruction manual
- Solid tip 0.5 mm
- Coding rings, 3 x 4 colors
- Ground lead 15 cm
- Ground spring 2.5 mm
- Trim tool
- Insulating cap 2.5 mm
- Sprung hook 2.5 mm
- Spring tip 0.5 mm
- Ground blade 2.5 mm
- 2 self-adhesive copper pads
- Protection cap 2.5 mm
- IC caps 0.5 to 1.27 mm pitch
- PCB adapter kit 2.5 mm



# 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.

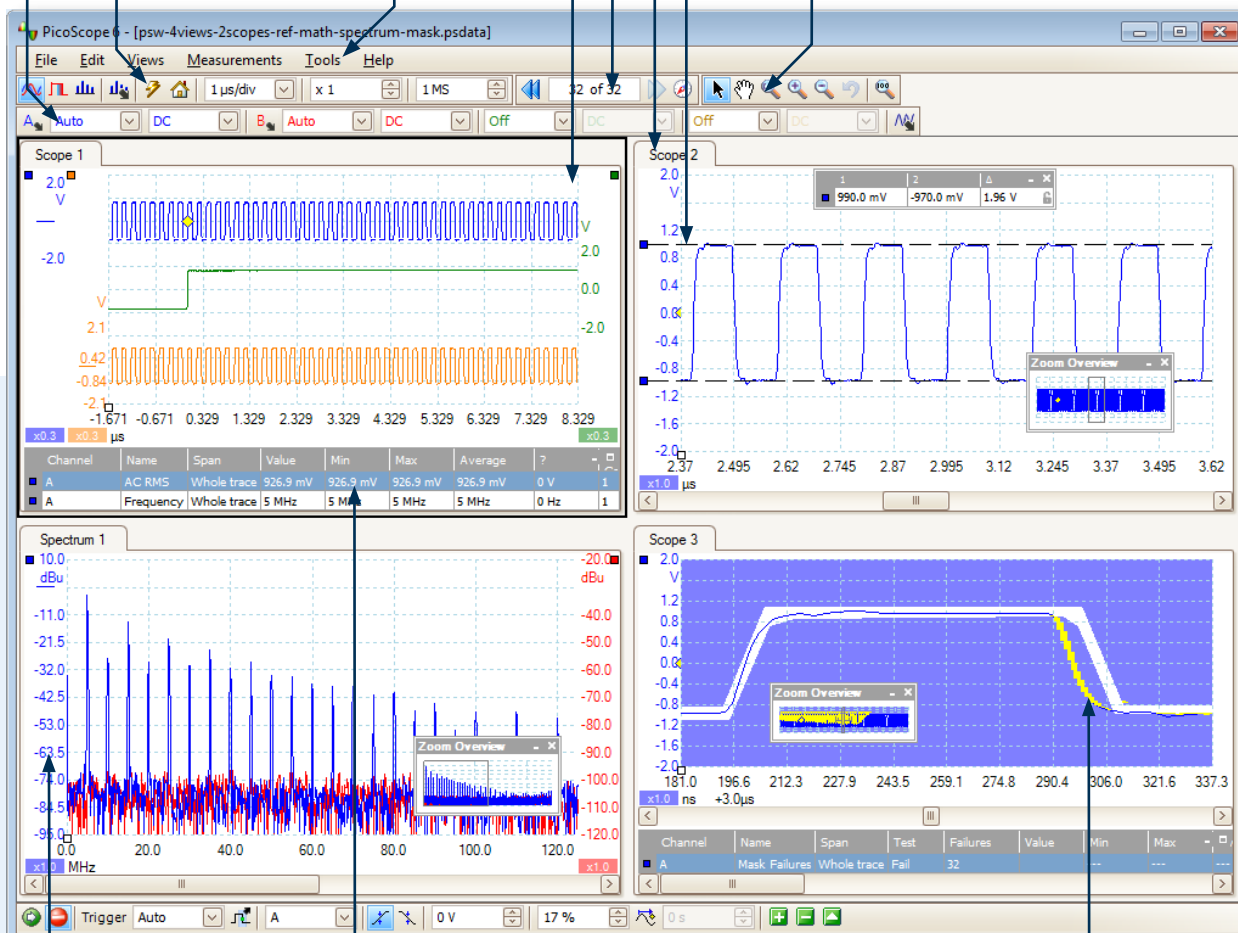
**PicoScope:** the display can be as simple or as complex as you need. Begin with a single view of one channel, and then expand the display to include any number of live channels, math channels and reference waveforms.

**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 6000 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.

**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.

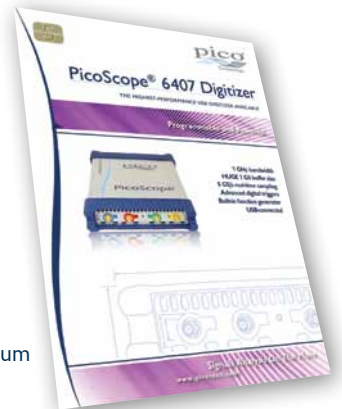
## Specifications

	PicoScope					
	6402A	6402B	6403A	6403B	6404A	6404B
<b>Channels (vertical)</b>	Number of channels Bandwidth (-3 dB) Bandwidth limiter Rise time (10% to 90%, calculated) Voltage ranges Sensitivity Input coupling Input impedance Input offset (position) adjustment DC accuracy Overload protection					
	250 MHz (TA150 probes/50 Ω) 200 MHz (±50 mV range) Switchable, 20 MHz 1.4 ns		4 (BNC connectors) 350 MHz (TA150 probes/50 Ω) 250 MHz (±50 mV range) Switchable, 20 MHz 1.0 ns		500 MHz (TA133 probes/50 Ω)  Switchable, 25 MHz 0.7 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 (1 MΩ) or DC (50 Ω)					
	1 MΩ    15 pF, or 50 Ω					
	<u>Input range</u> 50 to 200 mV 500 mV 1 V 2 V 5 V 10 V 20 V		<u>Offset range</u> ±0.5 V ±2.5 V ±2.5 V ±2.5 V ±20 V (50 Ω: ±0.5 V) ±20 V ±20 V		<u>Input range</u> 50 to 200 mV 500 mV 1 V 2 V 5 V 10 V 20 V	<u>Offset range</u> ±2 V ±10 V (50 Ω: ±5 V) ±10 V (50 Ω: ±4.5 V) ±10 V (50 Ω: ±3.5 V) ±35 V (50 Ω: ±0.5 V) ±30 V ±20 V
	3% ±100 V to ground (1 MΩ inputs), 5.5 V RMS (50 Ω inputs)					
<b>Timebase (horizontal)</b>	Timebases (real-time sampling) Timebases (equivalent-time sampling/ETS) Timebase accuracy					
	10 ns/div to 1000 s/div 1 ns/div to 1000 s/div 5 ppm					
<b>Acquisition</b>	ADC resolution Maximum real-time sampling rate Maximum equivalent-time sampling (ETS) rate Buffer size (shared between active channels) Maximum buffer segments Maximum streaming data rate					
	8 bits (up to 12 bits in resolution enhancement mode) 5 GS/s (one channel enabled), 2.5 GS/s (two channels enabled), 1.25 GS/s (three or four channels enabled) 50 GS/s (any number of channels)					
	128 MS 125 000	256 MS 250 000	256 MS 250 000	512 MS 500 000	512 MS 500 000	1 GS 1 000 000
	1 MS/s in PicoScope software. >10 MS/s using supplied SDK (PC-dependent)					
<b>Trigger</b>	Basic triggers Advanced triggers Trigger modes Maximum trigger rate Trigger timing resolution Trigger sources Trigger level Re-arm time Maximum pre-trigger capture Maximum post-trigger delay					
	Rising, falling Edge, Pulse width, Window, Window pulse width, Dropout, Window dropout, Level, Interval, Logic level, Runt pulse None, Single, Repeat, Auto, Rapid, ETS Up to 10,000 waveforms in a 10 ms burst 1 sample period Channels A to D, AUX Adjustable over whole of selected voltage range Less than 1 μs on fastest timebase 100% of capture size 4 billion samples					
<b>AUX input</b>	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					
<b>Function generator and arbitrary waveform generator (AWG)</b>	Function generator frequency range Function generator waveforms (A models) Function generator waveforms (B models) DAC resolution / DC accuracy Amplitude range Offset adjustment Output impedance AWG buffer size AWG sample rate					
	DC to 20 MHz Sine, square, triangle, DC As A models plus ramp, sin(x)/x, Gaussian, half-sine, white noise, PRBS 12 bits / 1% ±250 mV to ±2 V ±1 V (max. combined output ±2.5 V) 50 Ω					
	N/A N/A	16 kS 200 MS/s	N/A N/A	16 kS 200 MS/s	N/A N/A	16 kS 200 MS/s
<b>Probe calibration output</b>	1 kHz square wave, 2 V pk-pk, 600 Ω					
<b>Spectrum analyzer</b>	Frequency range Display modes Windowing functions Number of FFT points					
	DC to 250 MHz		DC to 350 MHz Magnitude, average, peak hold		DC to 500 MHz	
	Rectangular, Gaussian, triangular, Blackman, Blackman-Harris, Hamming, Hann, flat-top Selectable power of 2 from 2 <sup>7</sup> to 2 <sup>20</sup>					
<b>Math channels</b>	Functions Operands					
	-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 Input channels A to D, reference waveforms, time, π					
<b>Serial bus decoding</b>	Baud rate Threshold voltage Data formats					
	10 kb/s to 1 Mb/s, auto-detect with manual override Auto or manual CAN, LIN, I <sup>2</sup> C, UART/RS-232, SPI					
<b>Mask limit testing</b>	Statistics					
	Pass/fail, failure count, total count					
<b>Display</b>	Interpolation Persistence modes					
	Linear or sin(x)/x Digital color, analog intensity, custom, or none					
<b>General</b>	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. 2 lb 3 oz)			280 x 170 x 40 mm (approx. 11.0" x 6.7" x 1.6") 1.3 kg (approx. 2 lb 14 oz)		
	0 °C to 40 °C (20 °C to 30 °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 Simplified Chinese, Traditional Chinese, Czech, Danish, Dutch, English, Finnish, French, German, Greek, Hungarian, Italian, Japanese, Norwegian, Polish, Portuguese, Romanian, Spanish, Swedish, Turkish					



## Product pack contents

- PicoScope 6000 Series oscilloscope
- Four factory-compensated probes
- USB cable
- Universal mains (AC) power supply
- Mains lead (power cord)
- Installation Guide
- Software and Reference CD
- Carrying case



## Have you seen the PicoScope 6407 Digitizer?

The PicoScope 6407 Digitizer has four 1 GHz inputs and a maximum sampling rate of 5 GS/s. See [picotech.com](http://picotech.com) for more information.

## Ordering information

Description
PP838 PicoScope 6402A 250 MHz Oscilloscope with probes
PP839 PicoScope 6402B 250 MHz Oscilloscope with AWG and probes
PP840 PicoScope 6403A 350 MHz Oscilloscope with probes
PP841 PicoScope 6403B 350 MHz Oscilloscope with AWG and probes
PP842 PicoScope 6404A 500 MHz Oscilloscope with probes
PP843 PicoScope 6404B 500 MHz Oscilloscope with AWG and probes
TA150 Replacement x10 probe for PicoScope 6402A/B & 6403A/B
TA133 Replacement x10 probe for PicoScope 6404A/B
Accessory packs for TA150 and TA133 probes



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