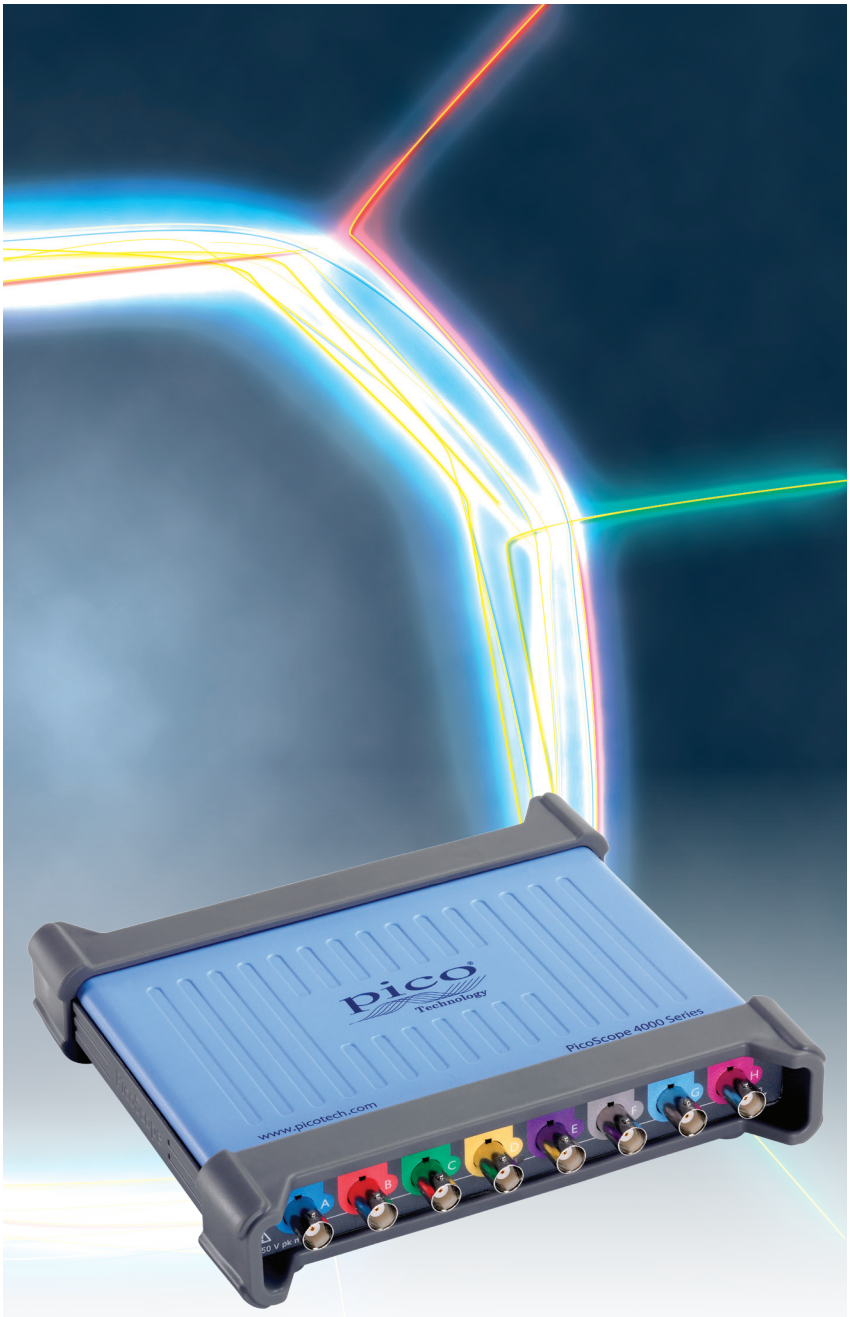
pico® Technology

PicoScope® 4824

High-precision PC oscilloscope



8 channels
20 MHz bandwidth
12 bit vertical resolution
256 MS buffer memory
80 MS/s sampling rate
1% DC accuracy
±10 mV to ±50 V input ranges
10 000 segment waveform buffer
80 MS/s AWG update rate
14 bit resolution AWG
Low-cost and portable
SuperSpeed USB 3.0 interface
Split-screen waveform viewing
Low sine and pulse distortion
Advanced digital triggers
Serial bus decoding

Applications

Power supply start sequencing
7 channel audio systems
Multi-sensor systems
Multi-phase drives and controls
General-purpose and precision testing
Complex embedded system development
5 year warranty

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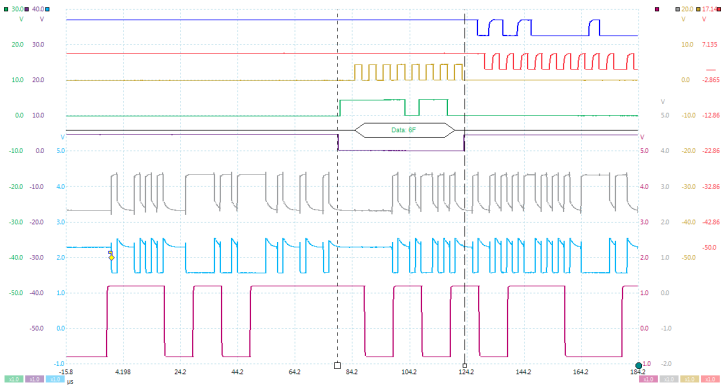
8 channel oscilloscope

With 8 high-resolution analog channels you can easily view audio, ultrasonic, vibration and power waveforms, analyze timing of complex systems, and perform a wide range of precision measurement tasks on multiple inputs at the same time. Although the scope has the same small footprint as Pico's existing 2- and 4-channel models, the BNC connectors with 20 mm spacing still accept all common probes and accessories.

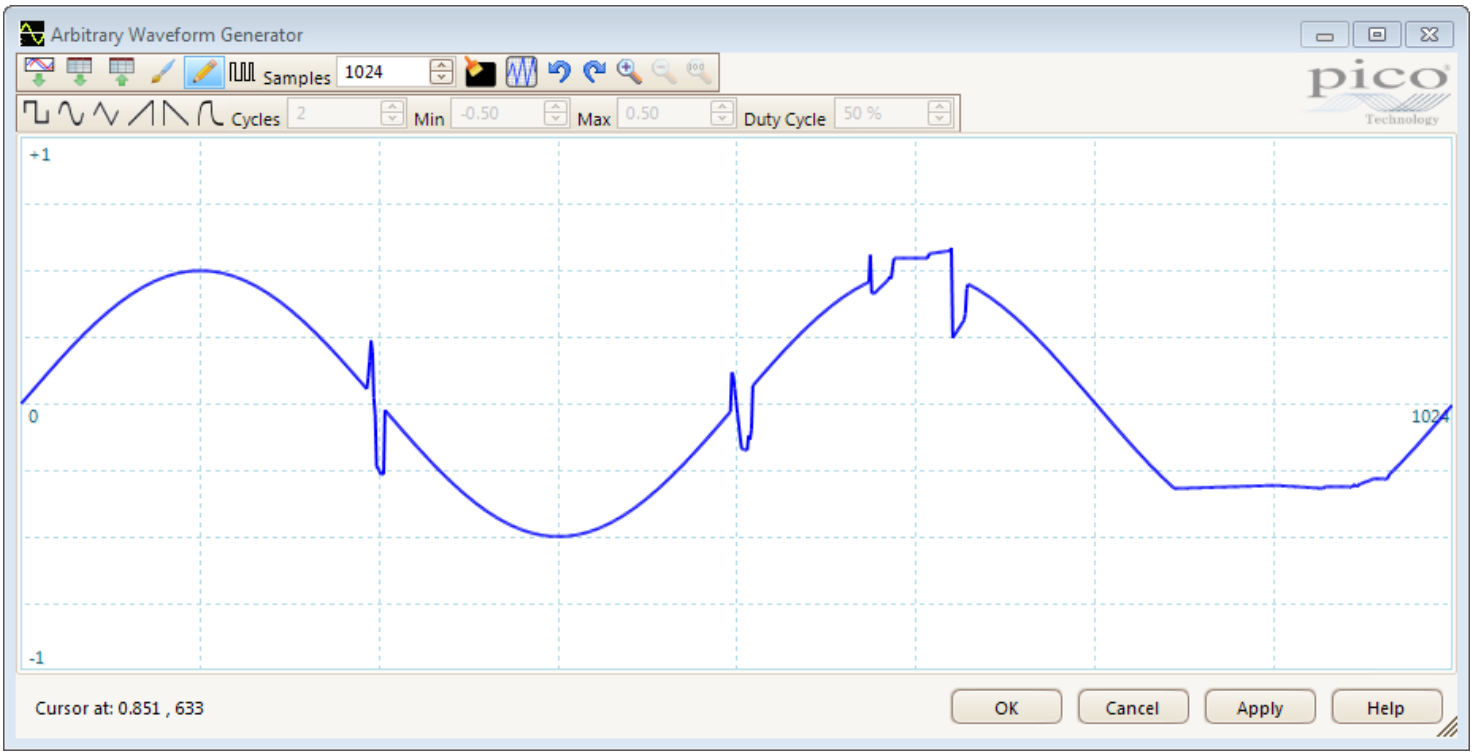
Despite its compact size, there is no compromise on performance. With a high vertical resolution of 12 bits, 20 MHz bandwidth, 256 MS buffer memory, and a fast sampling rate of 80 MS/s, the PicoScope 4824 has the power and functionality to deliver accurate results. It also features deep memory to analyze multiple serial buses such as UART, I²C, SPI, CAN and LIN plus control and driver signals.



Arbitrary waveform and function generators

In addition, the PicoScope 4824 has a built-in low-distortion, 80 MS/s, 14 bit arbitrary waveform generator (AWG), which can be used to emulate missing sensor signals during product development, or to stress-test a design over the full intended operating range. Waveforms can be imported from data files or created and modified using the built-in graphical AWG editor.

A function generator is also included, with sine, square, and triangle waves up to 1 MHz, along with DC level, white noise, and many more standard waveforms. As well as level, offset and frequency controls, advanced options allow you to sweep over a range of frequencies. Combined with the spectrum peak hold option, this creates a powerful tool for testing amplifier and filter responses.



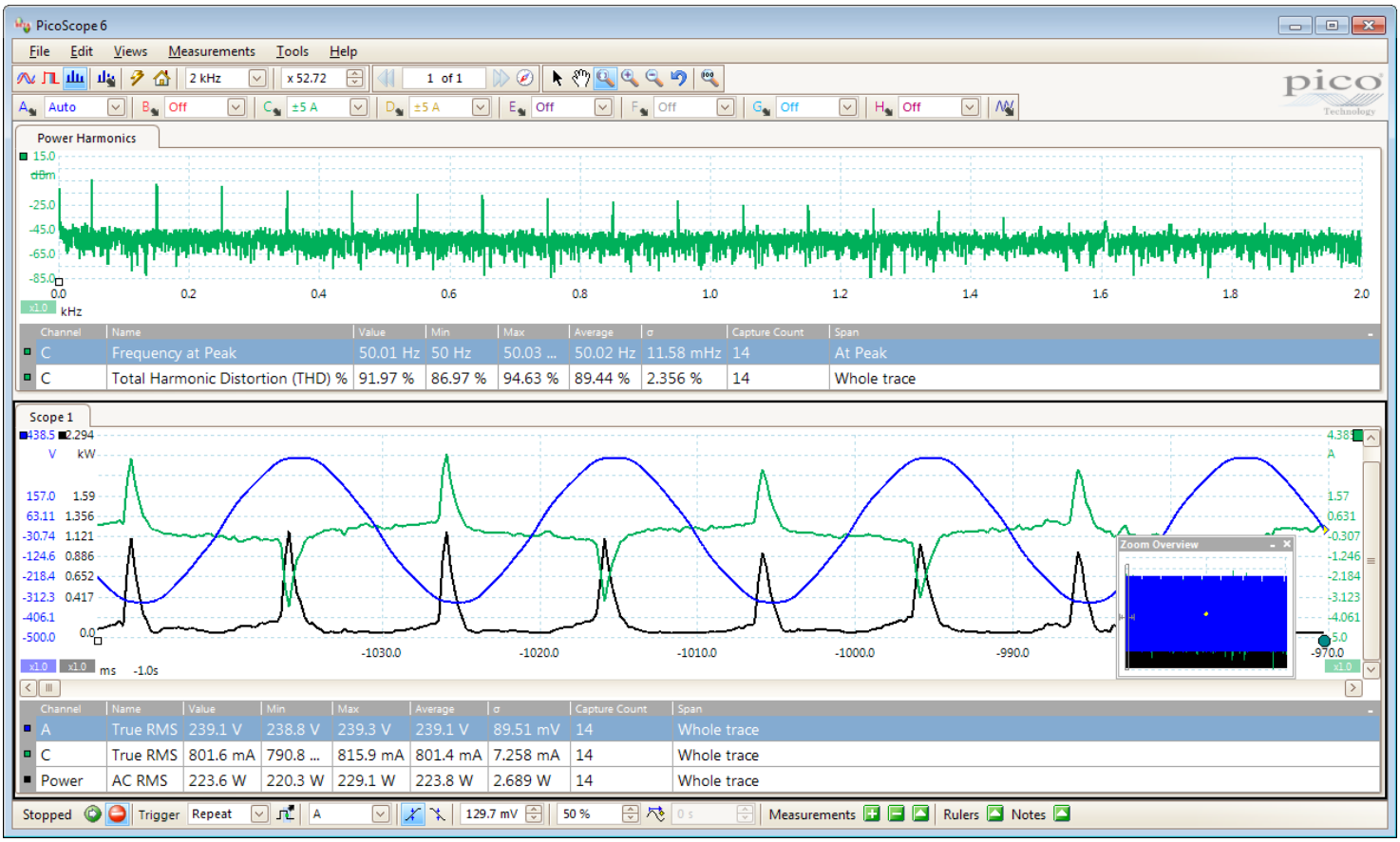
Applications

Power measurements

The PicoScope 4824 is ideal for making a range of power measurements on high voltages and currents and low-voltage control signals. For the best results, use a Pico differential voltage probe (TA041 or TA057) in combination with a current clamp (TA167). To improve the efficiency and reliability of power designs, the scope can display and analyze standby power dissipation, inrush current, and steady-state power consumption. PicoScope's built-in measurements and statistics of parameters such as true RMS, frequency, peak-to-peak voltage and THD allow accurate analysis of power quality.

Nonlinear loads and modern power-conversion equipment produce complex waveforms with significant harmonic content. These harmonics reduce efficiency by causing increased heating in equipment and conductors, misfiring in variable speed drives, and torque pulsations in motors. The 12-bit PicoScope 4824 has the precision to measure distortion typically up to the 100th harmonic. On the supply side, power quality issues such as sags and dips, swells and spikes, flicker, interruptions and long-term voltage and frequency variations can also be checked for regulatory compliance.

In a 3-phase distribution system, it is important to characterize and balance loads across phases. With 8 channels the PicoScope 4824 can monitor waveforms of current and voltage on all 4 conductors of a 3-phase-plus-neutral system. This helps to identify mismatches that can cause breaker tripping, or transformer and conductor overheating.



Data acquisition

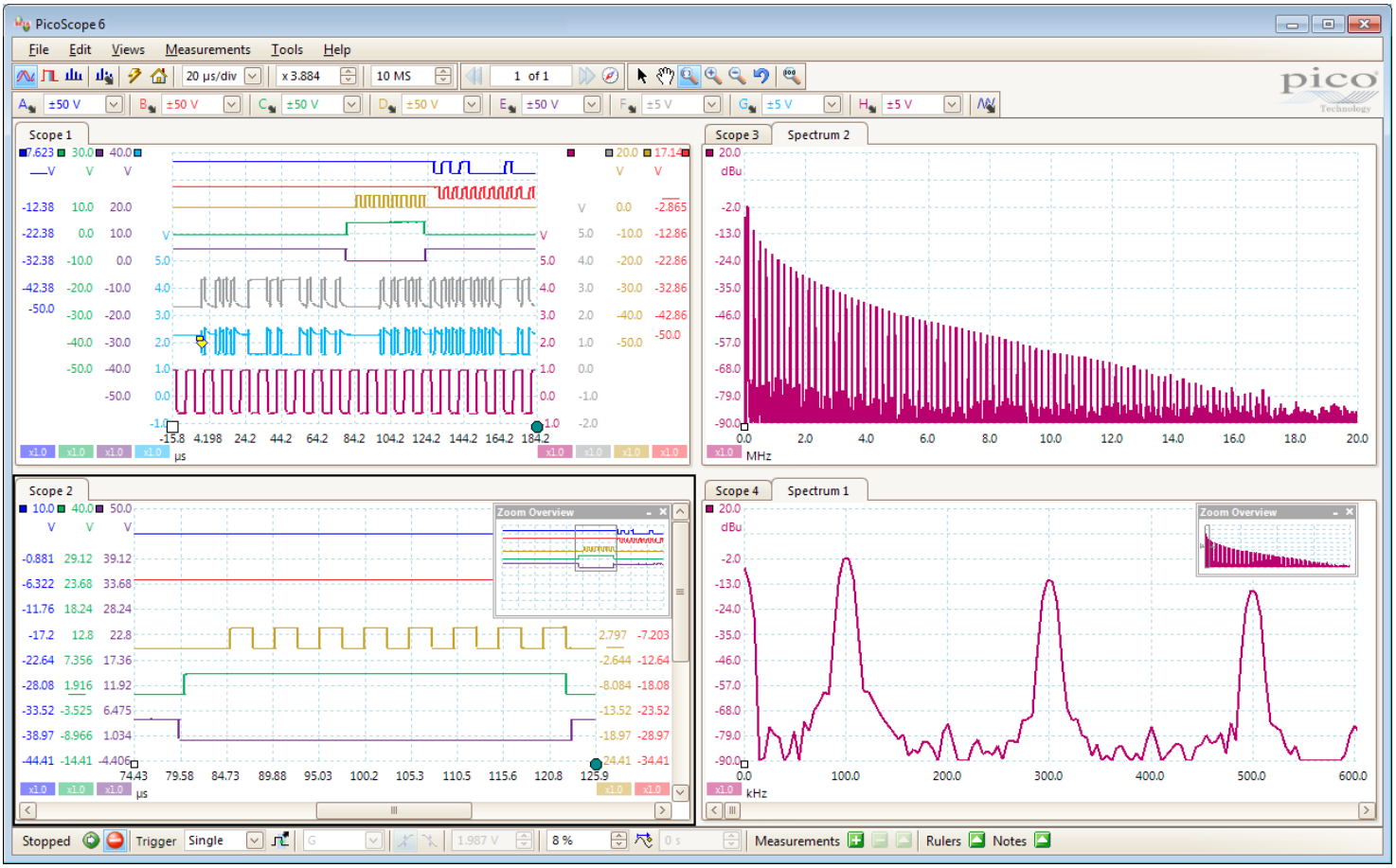
With 256 Msamples of buffer memory the scope can capture over 5 minutes of continuous 50/60 Hz waveform data with high timing resolution. Using the Software Development Kit (SDK) you can write custom applications with storage limited only by the PC hard disk size.

Complex embedded systems

When debugging an embedded system with a scope, you can quickly run out of channels. You may need to look at an I²C or SPI bus at the same time as multiple power rails, DAC outputs and logic signals. With eight channels, the PicoScope 4824 can cope with all of this. Choose whether to decode up to eight serial buses, with analog waveforms and decoded data both visible, or a combination of serial buses and other analog or digital signals. PicoScope provides advanced triggering on all channels, so you can search for runt pulses, dropouts and noise as well as looking for data patterns using the 4-input Boolean logic trigger.

Split-screen display

The PicoScope 6 software can display up to 16 scope and spectrum views at once, making comparisons and analysis even clearer. The split-screen display can be customized to show whichever combination of waveforms you need, to display multiple channels or different variants of the same signal. As the example above shows, the software can even show both oscilloscope and spectrum analyzer traces at once. Additionally, each waveform shown works with individual zoom, pan, and filter settings for ultimate flexibility. This flexibility, alongside the facility to use monitors many times larger than a fixed scope display, are further benefits to choosing a USB oscilloscope over a traditional benchtop model.



USB connectivity

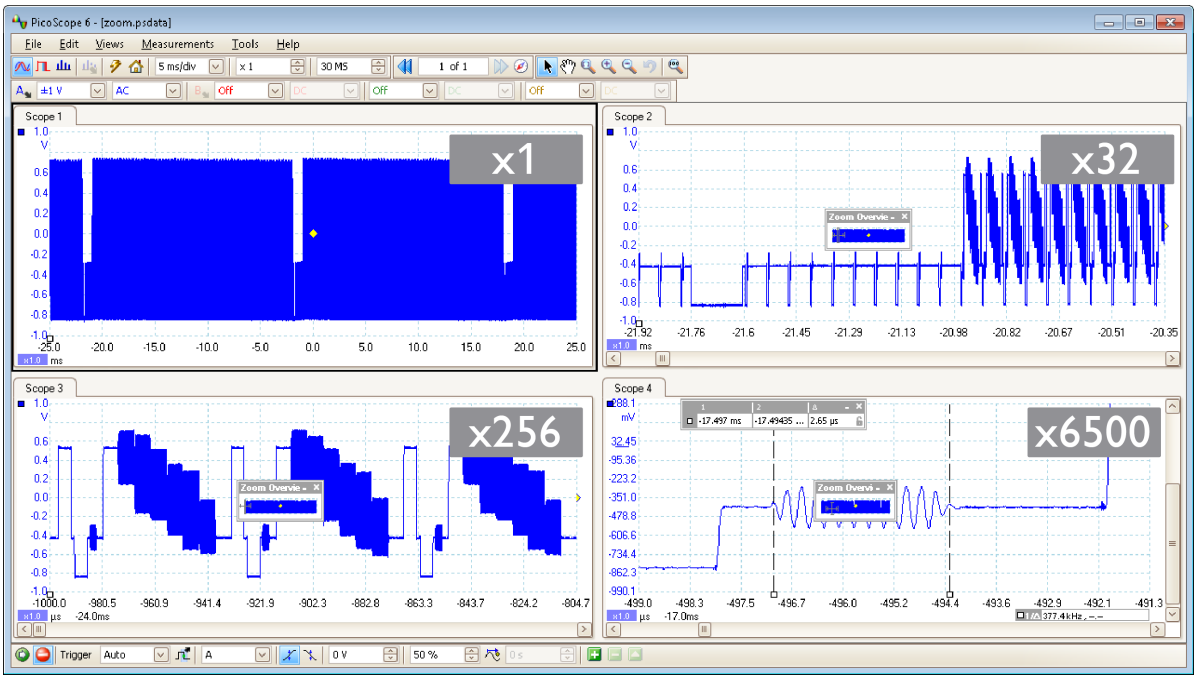
The SuperSpeed USB 3.0 connection not only allows high-speed data acquisition and transfer, but also makes printing, copying, saving, and emailing your data from the field quick and easy. USB powering removes the need to carry around a bulky external power supply, making the kit even more portable for the engineer on the move.

PicoScope performance and reliability

With over 20 years' experience in the test and measurement industry, we know what's important in an oscilloscope. The PicoScope 4824 delivers value for money by including a wide range of high-end features as standard. The PicoScope 6 software includes options such as serial decoding and mask limit testing, and new functionality is regularly delivered through free upgrades to ensure that your device does not quickly become outdated. All Pico Technology devices are optimized with the help of feedback from our customers.

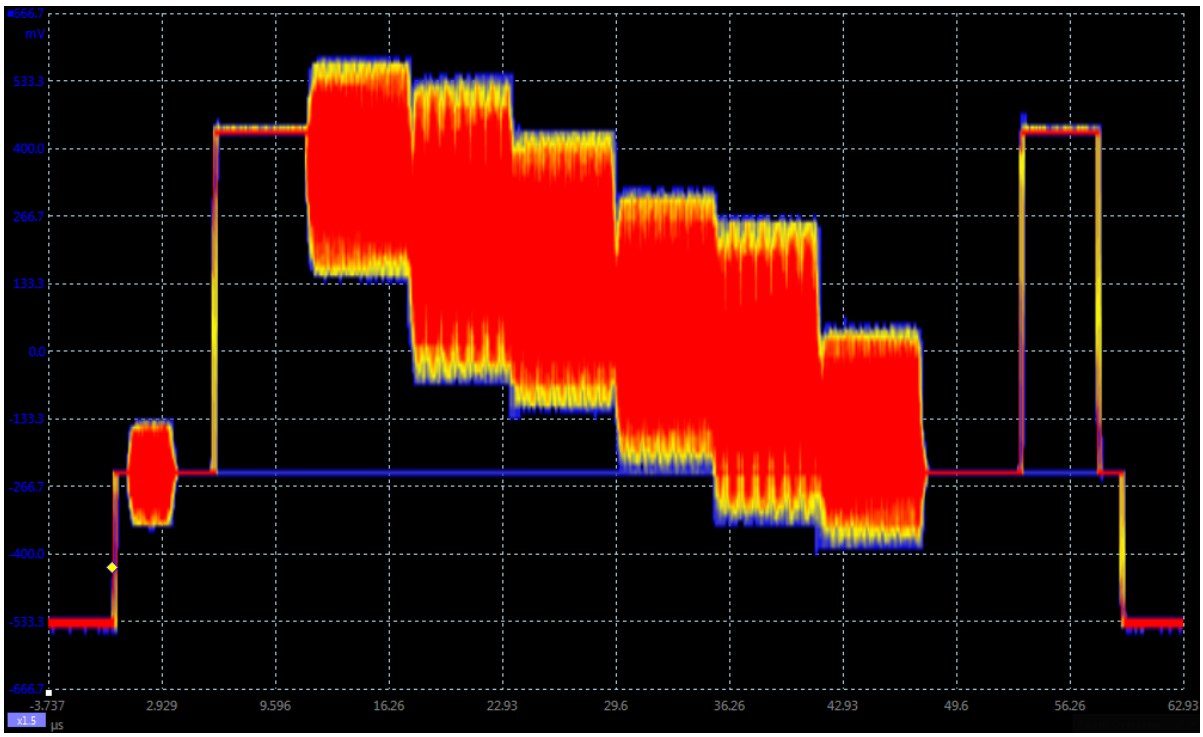
Zoom in and capture every last detail

The PicoScope zoom function lets you take a closer look at the fine detail on your signals. Using simple point-and-click tools you can quickly zoom in on both axes and reveal every last detail of the signal, whilst the undo zoom function lets you return to the previous view.



Color persistence modes

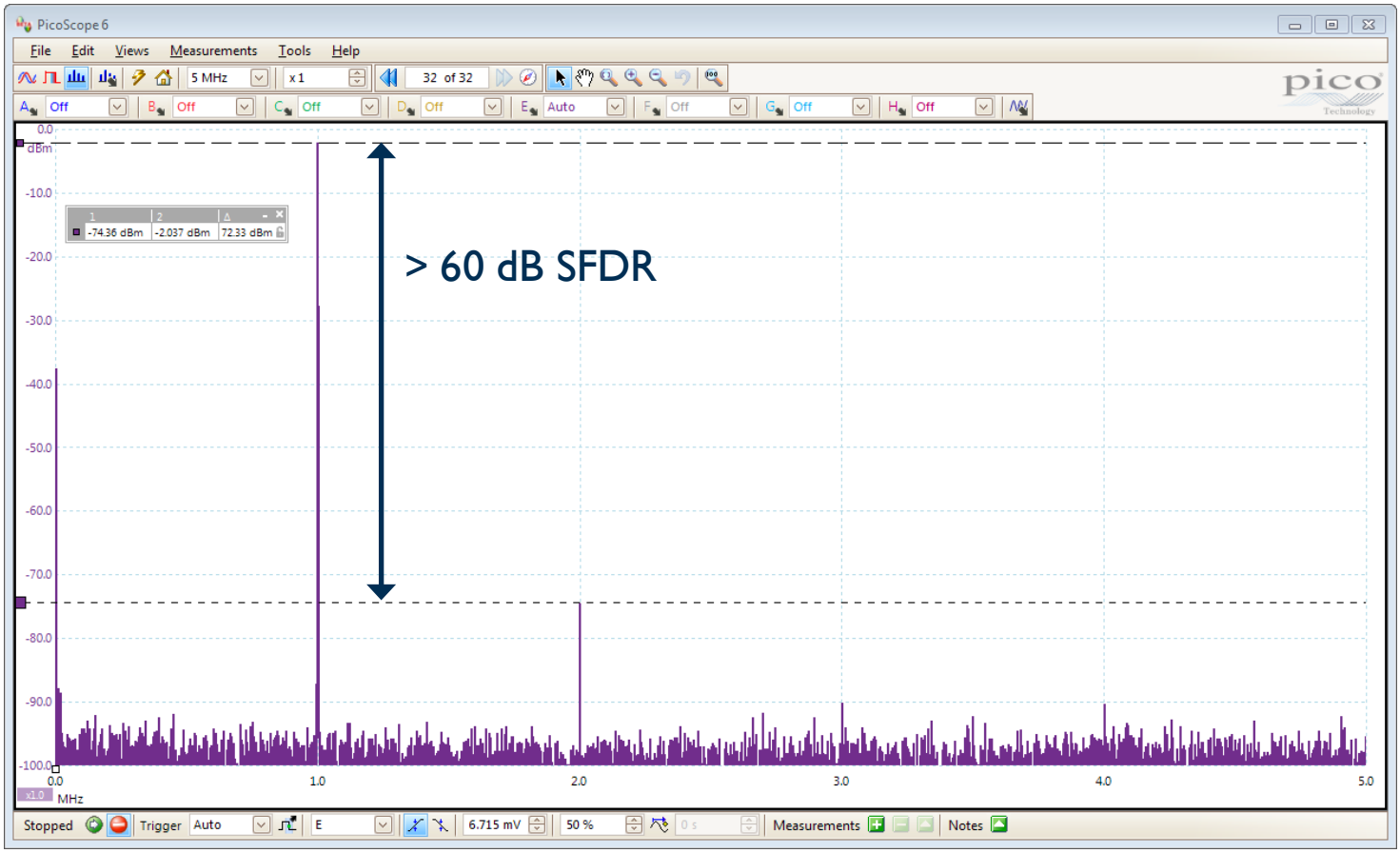
Advanced display modes allow you to see old and new data superimposed, with new data in a brighter color or shade. This makes it easy to see glitches and dropouts and to estimate their relative frequency. Choose between analog persistence, digital color, or custom display modes.



Spectrum analyzer

With the click of a button, you can open a new window to display a spectrum plot of selected channels up to the full bandwidth of the oscilloscope. A comprehensive range of settings gives you control over the number of spectrum bands, window types and display modes.

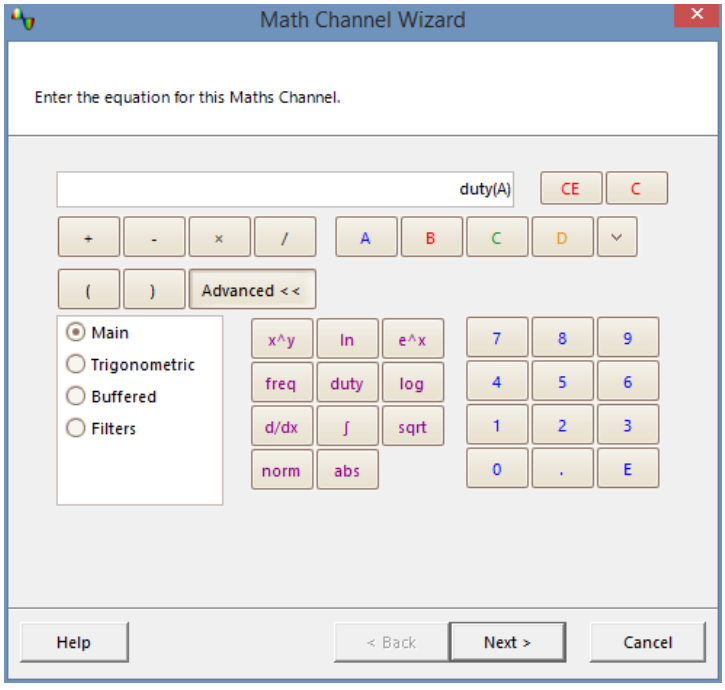
A comprehensive set of automatic frequency-domain measurements can be added to the display, including THD, THD+N, SINAD, SNR, and IMD. You can even use the AWG and spectrum mode together to perform swept scalar network analysis.



Math channels

With PicoScope 6 you can perform a variety of mathematical calculations on your input signals and reference waveforms.

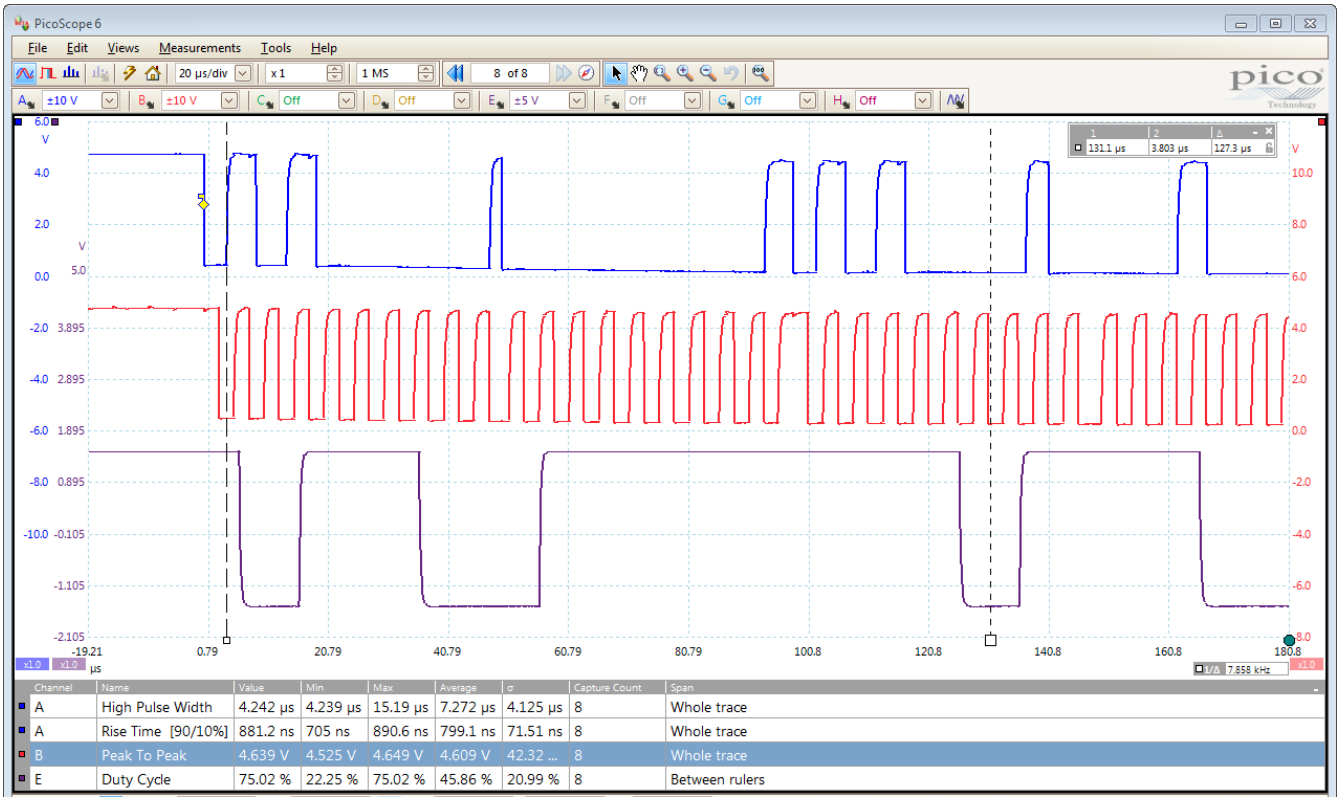
Use the built-in list for simple functions such as addition and inversion, or open the equation editor and create complex functions involving trigonometry, exponentials, logarithms, statistics, integrals and derivatives, filters, averaging and peak-detection.



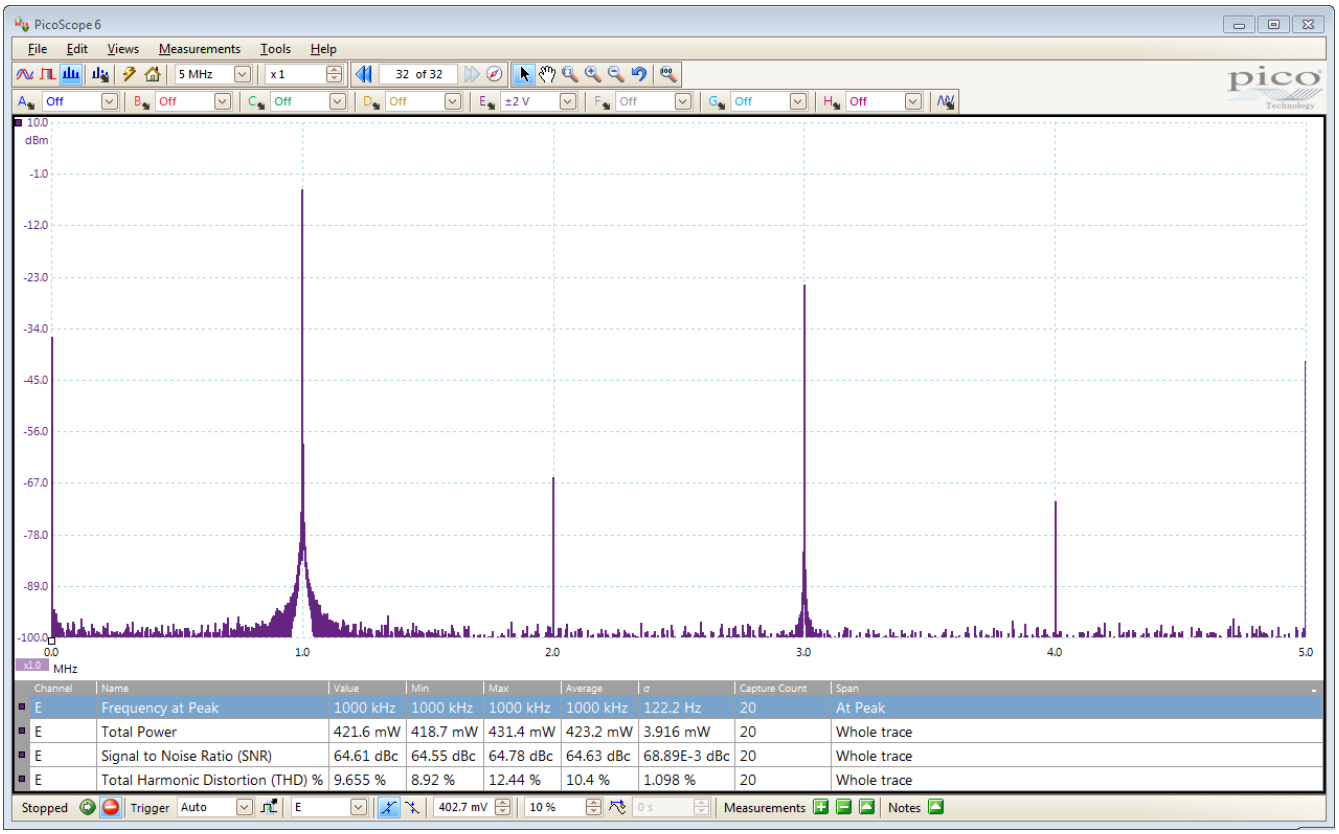
Automatic measurements

PicoScope allows you to automatically display a table of calculated measurements for troubleshooting and analysis.

Using the built-in measurement statistics you can see the average, standard deviation, maximum and minimum of each measurement as well as the live value. You can add as many measurements as you need on each view. Each measurement includes statistical parameters showing its variability. For information on the measurements available in scope and spectrum modes, see **Automatic Measurements** in the **Specifications** table.

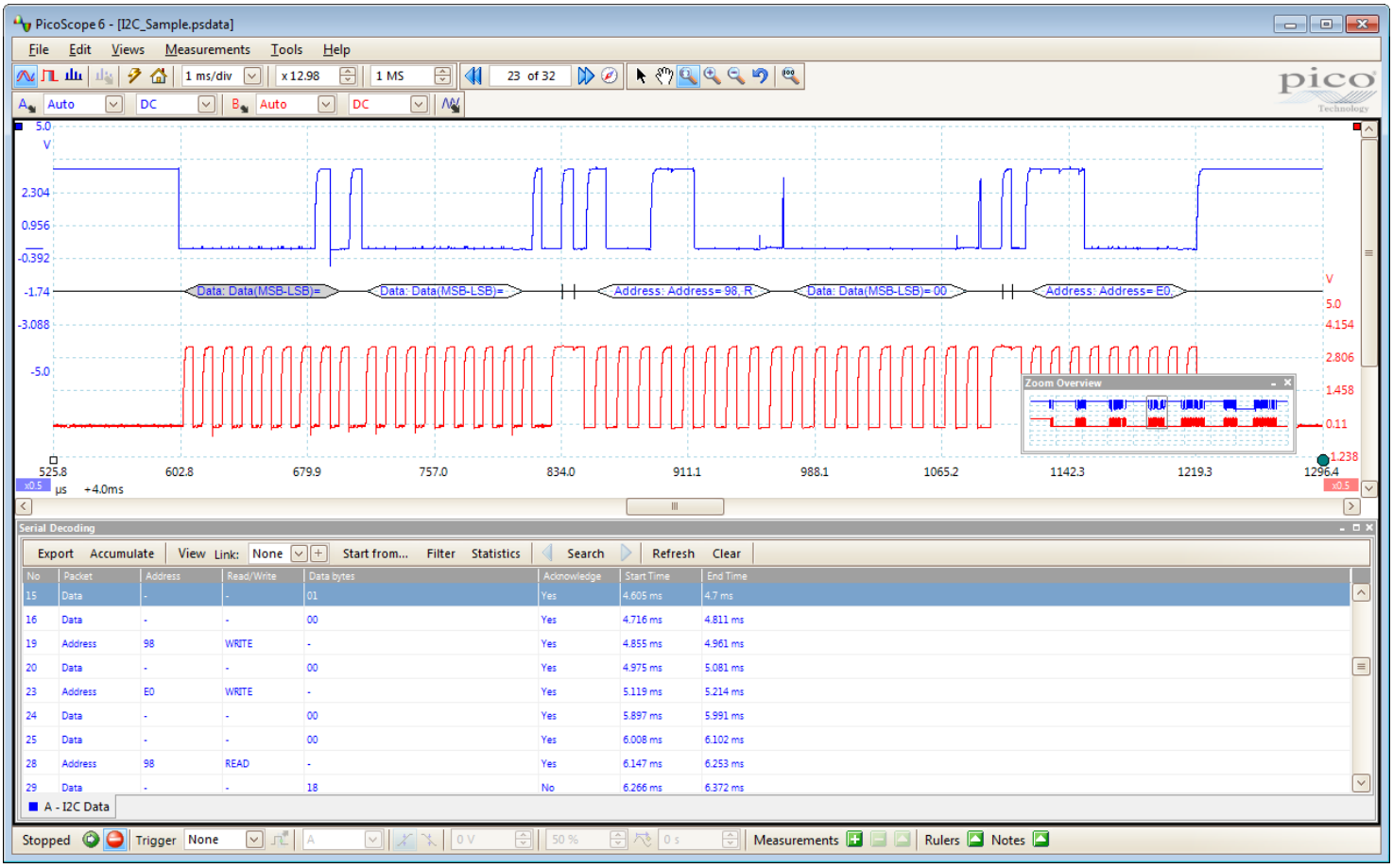


15 scope mode measurements



11 spectrum mode measurements

Serial decoding



Serial protocols
UART/RS-232
SPI
I^2C
I^2S
CAN
LIN
FlexRay

The PicoScope 4824 includes serial decoding capability across all 8 channels as standard. The decoded data can be displayed in the format of your choice: **in graph**, **in table**, or both at once.

- **In graph** format shows the decoded data beneath the waveform on a common time axis, with error frames marked in red. These frames can be zoomed to investigate noise or distortion.

- **In table** 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 to signal when the program should list the data.

PicoScope can also import a spreadsheet to decode the hexadecimal data into user-defined text strings.

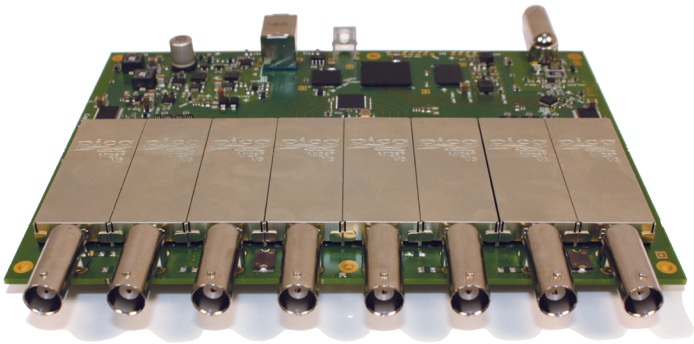
High-speed data acquisition and digitizing

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

The driver supports data streaming, a mode that captures gap-free continuous data over USB 3.0 direct to the PC's RAM or hard disk at a rate of 10 MS/s when using PicoScope 6 software (160 MS/s across all channels when using supplied SDK), so you are not limited by the size of the scope's buffer memory. Sampling rates in streaming mode are subject to PC specifications and application loading.

High signal integrity

Most oscilloscopes are built down to a price. PicoScopes are built up to a specification.



Careful front-end design and shielding reduces noise, crosstalk and harmonic distortion, meaning we are proud to publish the specifications for our scopes in detail. Decades of oscilloscope design experience can be seen in both improved pulse response and bandwidth flatness, and low distortion. The scope features 12 input ranges from ±10 mV to ±50 V full scale, a huge dynamic range, and 60 dB SFDR. The result is simple: when you probe a circuit, you can trust in the waveform you see on the screen.

Digital triggering

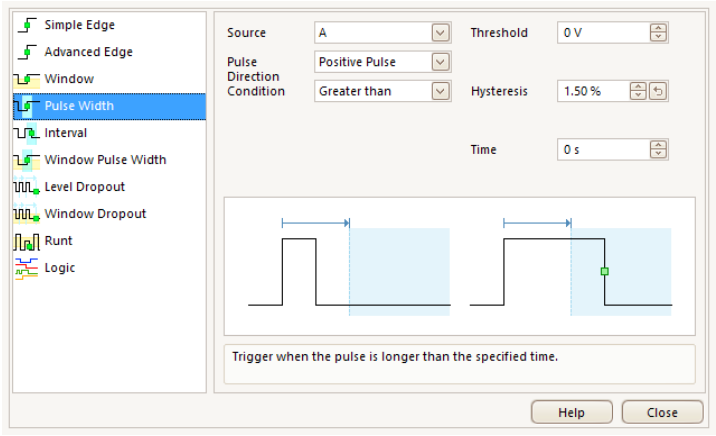
Most digital oscilloscopes still use an analog trigger architecture based on comparators. This can cause time and amplitude errors that cannot always be calibrated out. The use of comparators often limits the trigger sensitivity at high bandwidths and can also create a long trigger rearm delay.

For over 20 years Pico have been pioneering the use of full 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. All triggering is digital, resulting in high threshold resolution with programmable hysteresis and optimal waveform stability.

The reduced rearm delay provided by digital triggering, together with segmented memory, allows the capture of events that happen in rapid sequence. At the fastest timebase, rapid triggering can capture a new waveform every 3 microseconds until the buffer is full. The mask limit testing function helps to detect waveforms that fail to meet your specifications.

Advanced triggers

As well as the standard range of triggers found on most oscilloscopes, the PicoScope 4824 has a comprehensive set of advanced triggers built in to help you capture the data you need. These include pulse width, windowed, and dropout triggers to help you find and capture your signal quickly.



High-end features as standard

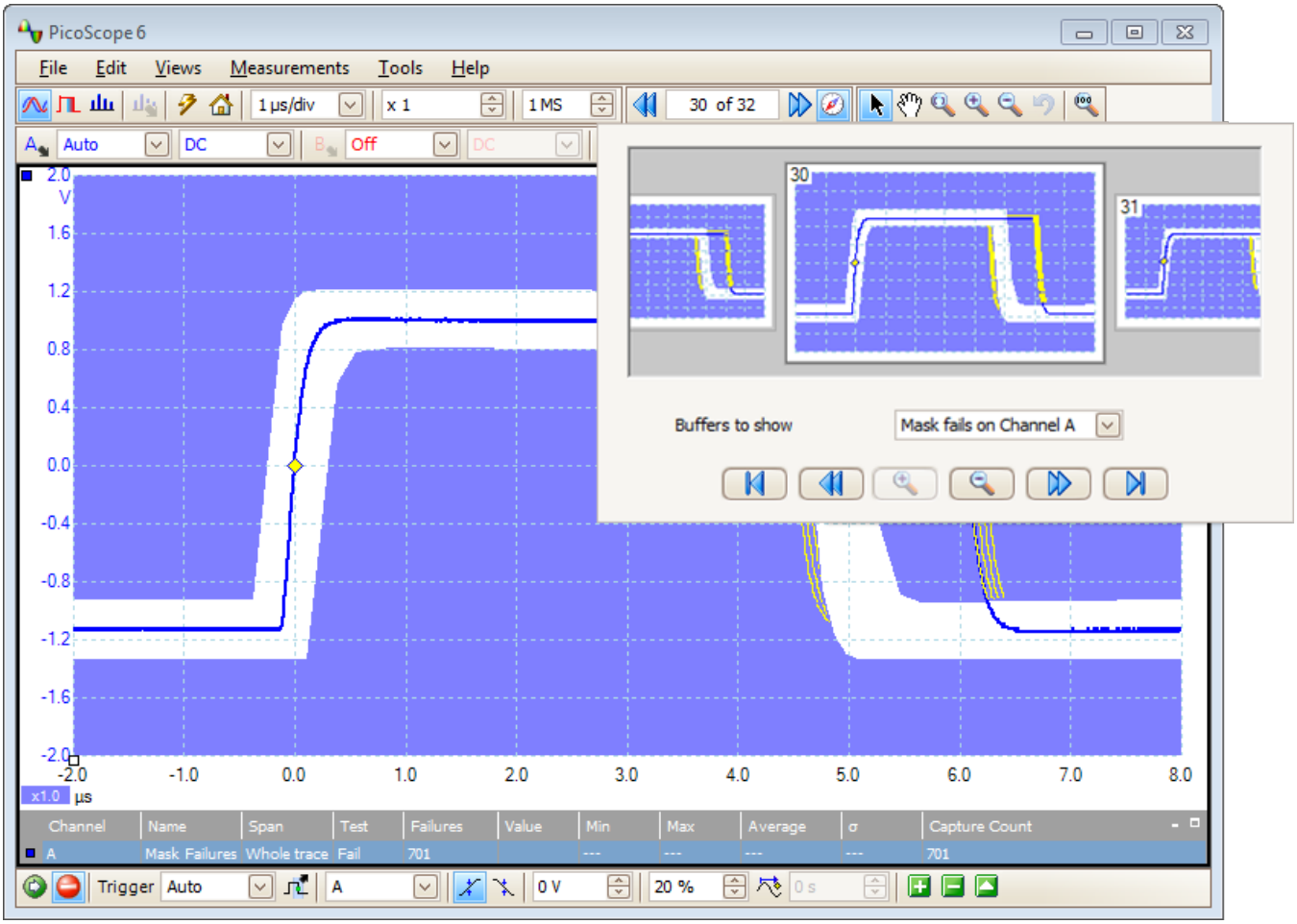
Buying a PicoScope is not like making a purchase from other oscilloscope companies, where optional extras considerably increase the price. With our scopes, high-end features such as resolution enhancement, mask limit testing, serial decoding, advanced triggering, automatic measurements, math channels, XY mode, segmented memory, and a signal generator are all included in the price.

To protect your investment, both the PC software and firmware inside the scope can be updated. Pico Technology have a long history of providing new features for free through software downloads. We deliver on our promises of future enhancements year after year, unlike many other companies in the field. Users of our products reward us by becoming lifelong customers and frequently recommending us to their colleagues.

Mask limit testing

PicoScope allows you to draw a mask around any signal with user-defined tolerances. This has been designed specifically for production and debugging environments, enabling you to compare signals. Simply capture a known good signal, draw a mask around it, and then attach the system under test. PicoScope will capture any intermittent glitches and can show a failure count and other statistics in the **Measurements** window.

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

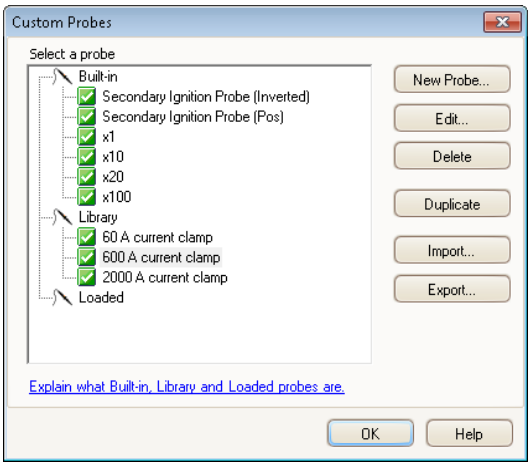


Digital low-pass filtering

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

Custom probe settings

The custom probes menu allows you to correct for gain, attenuation, offsets and nonlinearities of probes and transducers, or convert to different measurement units. Definitions for standard Pico-supplied probes are built in, but you can also create your own using linear scaling or even an interpolated data table, and save them to disk for later use.



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

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.
Tools > Masks: 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.

Channel options: Set axis offset and scaling, DC offset, zero offset, resolution enhancement, custom probes, and filtering here.

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

Trigger marker: Drag to adjust trigger level and pre-trigger time.

Oscilloscope controls: Controls such as voltage range, channel enable, timebase and memory depth are placed on the toolbar for quick access, leaving the main display area clear for waveforms.

Waveform replay tools: PicoScope automatically records up to 10 000 of the most recent waveforms. You can quickly scan through to look for intermittent events, or use the **Buffer Navigator** to search visually.

Zoom and pan tools: PicoScope makes it easy to zoom into large waveforms. Either use the zoom-in, zoom-out and pan tools, or click and drag in the **Zoom Overview** window for fast navigation.

Views: PicoScope is carefully designed to make the best use of the display area. The waveform view is much bigger and of a higher resolution than with a typical benchtop scope. 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, frequency and phase.

Signal generator: Generates standard signals or arbitrary waveforms. Includes frequency sweep mode.

Ruler legend: Absolute and differential ruler measurements are listed here.

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.

Trigger toolbar: Quick access to main controls, with advanced triggers in a pop-up window.

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.

Zoom overview: Click and drag for quick navigation in zoomed views.

Spectrum view: View FFT data alongside scope view or independently.

At a glance

Model	Input channels	Bandwidth (−3 dB)	Maximum sampling rate	Buffer memory	Arbitrary waveform generator
PicoScope 4824	8	20 MHz	80 MS/s	256 MS	80 MS/s

Detailed specifications

VERTICAL	
Input channels	8
Connector type	BNC, 20 mm spacing
Bandwidth (−3 dB)	20 MHz (50 mV to 50 V ranges) 10 MHz (10 mV and 20 mV ranges)
Rise time (calculated)	17.5 ns (50 mV to 50 V ranges) 35.0 ns (10 mV and 20 mV ranges)
Vertical resolution	12 bits
Software-enhanced vertical resolution	Up to 16 bits
Input ranges	±10 mV to ±50 V full scale, in 12 ranges
Input sensitivity	2 mV/div to 10 V/div (10 vertical divisions)
Input coupling	AC / DC
Input characteristics	1 MΩ ‖ 19 pF
DC accuracy	±1% of full scale ±300 µV
Analog offset range (vertical position adjustment)	±250 mV (10 mV to 500 mV ranges) ±2.5 V (1 V to 5 V ranges) ±25 V (10 V to 50 V ranges)
Overvoltage protection	±100 V (DC + AC peak)
HORIZONTAL (TIMEBASE)	
Maximum sampling rate (real-time)	80 MS/s (1 to 4 channels in use) 40 MS/s (5 to 8 channels in use)
Maximum sampling rate (streaming)	10 MS/s using PicoScope 6 software 80 MS/s per channel using supplied API. 160 MS/s total across all channels. (PC-dependent)
Timebase ranges (real time)	20 ns/div to 5000 s/div
Buffer memory (shared between active channels)	256 MS
Buffer memory (streaming mode)	100 MS in PicoScope software. Up to available PC memory when using supplied API
Waveform buffer	10 000 segments
Timebase accuracy	±20 ppm (+5 ppm/year)
Sampling jitter	25 ps RMS typical
DYNAMIC PERFORMANCE (typical)	
Crosstalk (full bandwidth)	20 000:1, DC to 20 MHz
Harmonic distortion	< −60 dB, 10 mV range < −70 dB, 20 mV and higher ranges
SFDR	> 60 dB, 20 mV and 10 mV ranges > 70 dB, 50 mV and higher ranges
Noise	45 µV RMS on 10 mV range
ADC ENOB	11.3 bits
Pulse response	< 1% overshoot
Bandwidth flatness	DC to full bandwidth (+0.2 dB, −3 dB)
TRIGGERING	
Source	Channels A to H
Trigger modes	None, auto, repeat, single, rapid (segmented memory)
Advanced trigger types	Edge, window, pulse width, window pulse width, dropout, window dropout, interval, runt, logic
Trigger types	Rising or falling edge
Trigger sensitivity	Digital triggering provides 1 LSB accuracy up to full bandwidth
Maximum pre-trigger capture	Up to 100% of capture size
Maximum post-trigger delay	Up to 4 billion samples
Trigger rearm time	< 3 µs on fastest timebase
Maximum trigger rate	Up to 10 000 waveforms in a 30 ms burst
Advanced digital trigger levels	All trigger levels, window levels and hysteresis values settable with 1 LSB resolution across input range
Advanced digital trigger time intervals	All time intervals settable with 1 sample resolution from 1 sample (minimum 12.5 ns) up to 4 billion sample intervals

FUNCTION GENERATOR	
Standard output signals	Sine, square, triangle, DC voltage, ramp, sinc, Gaussian, half-sine, white noise, PRBS
Standard signal frequency	DC to 1 MHz
Sweep modes	Up, down, dual with selectable start/stop frequencies and increments
Triggering	Can trigger a counted number of waveform cycles or sweeps (up to 1 billion) from the scope trigger or manually from software.
Output frequency accuracy	±20 ppm
Output frequency resolution	< 20 mHz
Output voltage range	±2 V
Output voltage adjustments	Signal amplitude and offset within ± 2V range. Adjustable in approx 300 µV steps.
Amplitude flatness	< 0.5 dB to 1 MHz typical
DC accuracy	±1% of full scale
SFDR	87 dB typical
Output characteristics	Rear panel BNC, 600 Ω output impedance
Overvoltage protection	±10 V
ARBITRARY WAVEFORM GENERATOR	
Update rate	80 MS/s
Buffer size	16 kS
Resolution	14 bits
Bandwidth	1 MHz
Rise time (10% to 90%)	150 ns
SPECTRUM ANALYZER	
Frequency range	DC to 20 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 up to 1 million in powers of 2
MATH CHANNELS	
Functions	−x, x+y, x−y, x*y, x/y, x^y, sqrt, exp, ln, log, abs, norm, sign, sin, cos, tan, asin, acos, atan, sinh, cosh, tanh, freq, duty, derivative, integral, min, max, average, peak, delay, lowpass, highpass, bandpass, bandstop
Operands	Input channels A to H, reference waveforms, time, π
AUTOMATIC MEASUREMENTS	
Scope mode	AC RMS, true RMS, cycle time, DC average, duty cycle, falling rate, fall time, frequency, high pulse width, low pulse width, maximum, minimum, peak to peak, rise time, rising rate.
Spectrum mode	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
SERIAL DECODING	
Protocols	CAN, LIN, I²C, I²S, UART/RS-232, SPI, FlexRay
MASK LIMIT TESTING	
Statistics	Pass/fail, failure count, total count
DISPLAY	
Interpolation	Linear or sin(x)/x
Persistence modes	Digital color, analog intensity, custom, or none
GENERAL	
PC connectivity	SuperSpeed USB 3.0 (USB 1.1 and USB 2.0 compatible)
Power requirements	Powered from a single USB 3.0 port or two USB 2.0 ports (double-headed cable available separately)
Dimensions (including connectors)	190 x 170 x 40 mm
Weight	< 0.55 kg
Temperature range	Operating: 0 °C to 45 °C (20 °C to 30 °C for stated accuracy). Storage: −20 °C to +60 °C.
Humidity range	Operating: 5% to 80% RH non-condensing. Storage: 5% to 95% RH non-condensing.
Safety approvals	Designed to EN 61010-1:2010
Compliance	RoHS, WEEE, and LVD compliant. Tested to meet EN61326-1:2006 and FCC Part 15 Subpart B.
Software included	PicoScope 6 and SDK for Windows. Example programs (C, Visual Basic, Excel VBA, LabVIEW).
Software available for free download	PicoScope 6 Beta and drivers for Linux and Mac OS X
PicoScope software PC requirements	Microsoft Windows XP (SP3), Windows Vista, Windows 7, Windows 8 (not Windows RT) or Windows 10
Languages	English, Chinese (simplified), Chinese (traditional), Czech, Danish, Dutch, Finnish, French, German, Greek, Hungarian, Italian, Japanese, Korean, Norwegian, Polish, Portuguese, Romanian, Russian, Spanish, Swedish, Turkish

Input channels A to H

Pack contents

- PicoScope 4824 oscilloscope
- USB 3.0 cable 1.8 m
- Quick Start Guide
- Software and reference CD

Arbitrary waveform generator output

USB port

Earth terminal

Optional accessories

Passive voltage probe 60 MHz x1/x10	MI007	General-purpose probe providing an economical way to connect test signals to the scope.
Active differential probe 25 MHz x10/x100, ±700 V CAT III	TA041	Ideal for motor speed controls, uninterruptible and switch mode power supplies, and process controllers.
Active differential probe 25 MHz x20/x200, ±1400 V CAT III	TA057	
Optional power supply	PS008	For use with the TA041 and TA057 active differential probes.
2000 A AC/DC current clamp	TA167	Ideal for use with industrial controls, photovoltaic inverters, and uninterruptible power supplies.

PicoScope 2000 Series
Ultra-compact and handheld

PicoScope 3000 Series
General-purpose and MSO models

PicoScope 4000 Series
High precision 12 to 16 bits

PicoScope 5000 Series
Flexible resolution 8 to 16 bits

PicoScope 6000 Series
High performance Up to 1 GHz

PicoScope 9000 Series
Sampling scopes and TDR to 20 GHz

Ordering information

Order code	Description
PP916	PicoScope 4824 8 channel oscilloscope
MI007	60 MHz x1/x10 passive voltage oscilloscope probe
TA041	25 MHz x10/x100 active differential probe, ±700 V CAT III
TA057	25 MHz x20/x200 active differential probe, ±1400 V CAT III
PS008	Optional power supply for TA041 and TA057 probes
TA167	2000 A AC/DC current clamp

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