pico® Technology

PicoScope® 4000A Series

Crystal-clear waveform analysis

- 2, 4 or 8 channels
- 20 MHz bandwidth
- 12-bit resolution
- 256 MS capture memory
- 80 MS/s sampling rate
- 1% DC accuracy
- Up to 70 dB SFDR
- ±10 mV to ±50 V input ranges
- 40 000 segment waveform buffer

- 14-bit 80 MS/s Arbitrary Waveform Generator
- Low-cost and portable
- SuperSpeed USB 3.0 interface
- Advanced digital triggering
- Decode over 40 industry-standard serial protocols

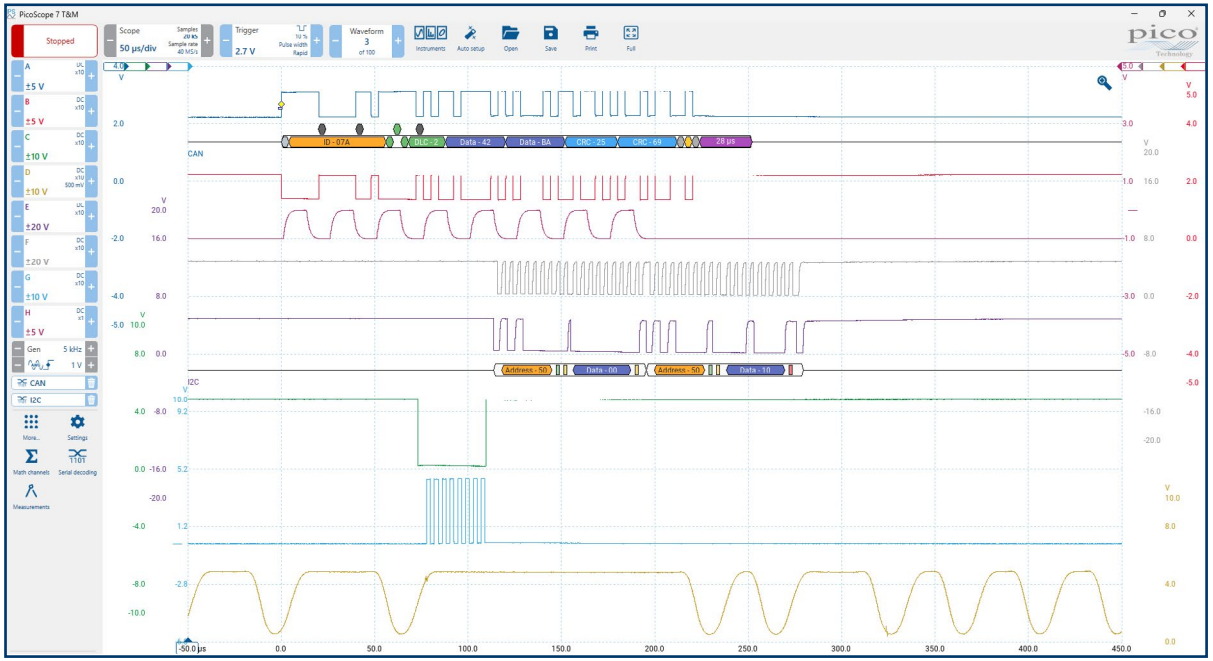
PicoScope®, PicoLog® and PicoSDK® software included

www.picotech.com

Up to 8 high-resolution channels

With the PicoScope 4000A Series offering a choice of 2, 4, or 8 high-resolution analog channels, you can easily view audio, ultrasonic, vibration and power waveforms, analyze the timing of complex systems and perform a wide range of precision measurement tasks on multiple inputs simultaneously. The scopes have a small, compact footprint, yet the BNC connectors with a minimum 20 mm spacing still accept all common probes and accessories.

Despite their 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 4000A Series has the power and functionality to deliver accurate results. With up to 8 channels, these oscilloscopes can analyze multiple serial buses, including UART, I2C, SPI, CAN and LIN, as well as control and driver signals.



Why choose the PicoScope 4000A Series oscilloscopes?

The PicoScope 4000A Series offers 20 MHz bandwidth, low noise, 12-bit resolution, deep capture memory and an integrated function and arbitrary waveform generator in a compact, USB 3.0-connected, PC-based package, along with a proven user interface.

This series of oscilloscopes is especially suited for engineers, scientists and technicians working on a wide range of electrical, mechanical, audio, lidar, radar, ultrasonic, NDT and predictive maintenance systems who need to make precise measurements and analysis of repetitive or single-shot, long-duration waveforms.

Unlike traditional oscilloscopes with 8-bit resolution and limited capture memory, or card-based digitizers that require an expensive mainframe, the PicoScope 4000A Series combines all the following benefits:

- Deep memory and high resolution
- PicoScope user interface with time-, frequency-domain, persistence and XY waveform views
- Automatic measurements of important waveform parameters on up to a million waveform cycles with each triggered acquisition using DeepMeasure™
- Industry-standard serial bus protocol decoding.
- An application programming interface (PicoSDK) that provides direct control of the hardware
- Five year warranty included as standard

Suitable for a broad range of applications, including:

- Power supply start sequencing
- 7-channel audio systems
- Multi-sensor systems
- Multi-phase drives and controls
- Predictive/preventive maintenance
- Complex embedded system development
- Power harmonics analysis
- Vibration analysis and diagnostics
- Long-duration waveform capture
- Lubricant analysis
- Acoustic emission analysis
- Oil condition sensors
- Machine monitoring
- Motor condition monitoring and motor current signature analysis
- Model-based voltage and current systems

Power measurements

The PicoScope 4000A Series 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 an AC/DC current clamp (TA167), AC flex current probe (TA325) or AC 3-phase flex current probe (TA326). In order to improve the efficiency and reliability of power designs by visualizing their characteristics, 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. PicoScope also offers a dedicated suite of power measurements and associated power math channels which include:

- True power
- Apparent power
- Reactive power
- Power factor
- DC power
- Crest factor
- Area at AC
- Area at AC
- −Area at AC
- Abs area at AC
- Area at DC
- +Area at DC
- −Area at DC
- Abs area at DC

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 4000A Series 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.

In a 3-phase distribution system, it is important to characterize and balance loads across phases. With up to 8 channels, the PicoScope 4000A Series can monitor waveforms of current and voltage on all four conductors of a 3-phase plus neutral system. This helps to identify mismatches that can cause breaker tripping or transformer and conductor overheating.

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 up to eight channels, the PicoScope 4000A Series 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 look for data patterns using the 4-input Boolean logic trigger.

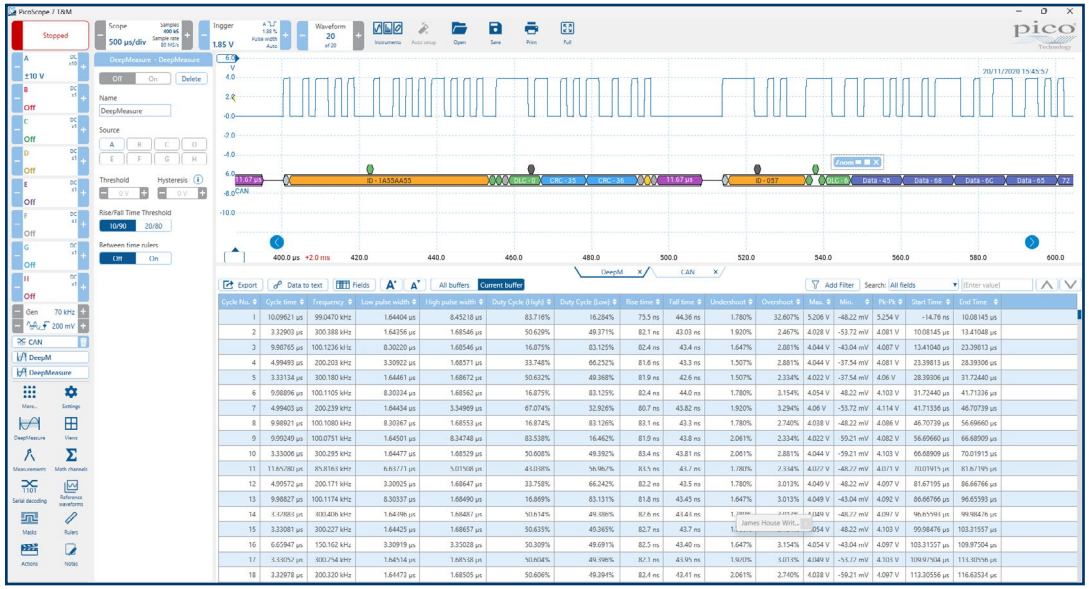
DeepMeasure™

One waveform, millions of measurements.

Measurement of waveform pulses and cycles is crucial for verifying the performance of electrical and electronic devices. DeepMeasure delivers automatic measurements of key waveform parameters, including pulse width, rise time and voltage.

Up to a million cycles can be displayed with each triggered acquisition, or combined across multiple acquisitions. Results can be easily sorted, analyzed and correlated with the waveform display or exported as a .CSV file or spreadsheet for further analysis.

For example, use DeepMeasure to capture up to 40 000 pulses and quickly find those with the largest or smallest amplitude, or use your scope's deep memory to record a million cycles of one waveform and export the rise time of every single edge for statistical analysis.



Waveform navigator

The Waveform Navigator allows you to store and browse waveforms.

PicoScope can store up to 40 000 oscilloscope or spectrum waveforms in its circular buffer. The navigator provides an efficient way to browse and search through these stored waveforms, essentially letting you "turn back time" to view past events.

Identify transient events: It helps catch glitches or other transient events that might be missed during live viewing.

Apply tools: Tools like mask limit testing can be used to scan through each waveform in the buffer to look for mask violations.

Display thumbnails: The Buffer Navigator displays thumbnail pictures of the stored waveforms, allowing you to scroll and review them. Any waveform can be transferred to the main scope view by clicking its thumbnail.

Ultra-high-definition display

PicoScope PC-based instruments use the host computer's display, which is typically larger and of higher resolution than the dedicated displays installed in traditional benchtop oscilloscopes. This allows room for simultaneous display of time- and frequency-domain waveforms, decoded serial bus tables, measurement results with statistics and more.

PicoScope software scales automatically to take full advantage of the improved resolution of larger display sizes, including 4K ultra-high-definition models. At 3840 x 2160 resolution — over eight million pixels — PicoScope allows engineers to get more done in less time through split-screen views of multiple channels (or different views of the same channel) from the device under test. As the example shows, the software can even show multiple oscilloscope and spectrum analyzer traces at once.

Large, high-resolution displays excel when viewing high-resolution signals with the PicoScope 4000A Series. With a 4K monitor, PicoScope can display more than ten times the information of traditional scopes, solving the problem of how to match a big display and features with a small-footprint portable oscilloscope.

PicoScope also supports dual monitors: instrument control and waveforms displayed on the first, and large data sets from serial protocol decoders or DeepMeasure results on the second. You can control the software with a mouse or touchscreen.

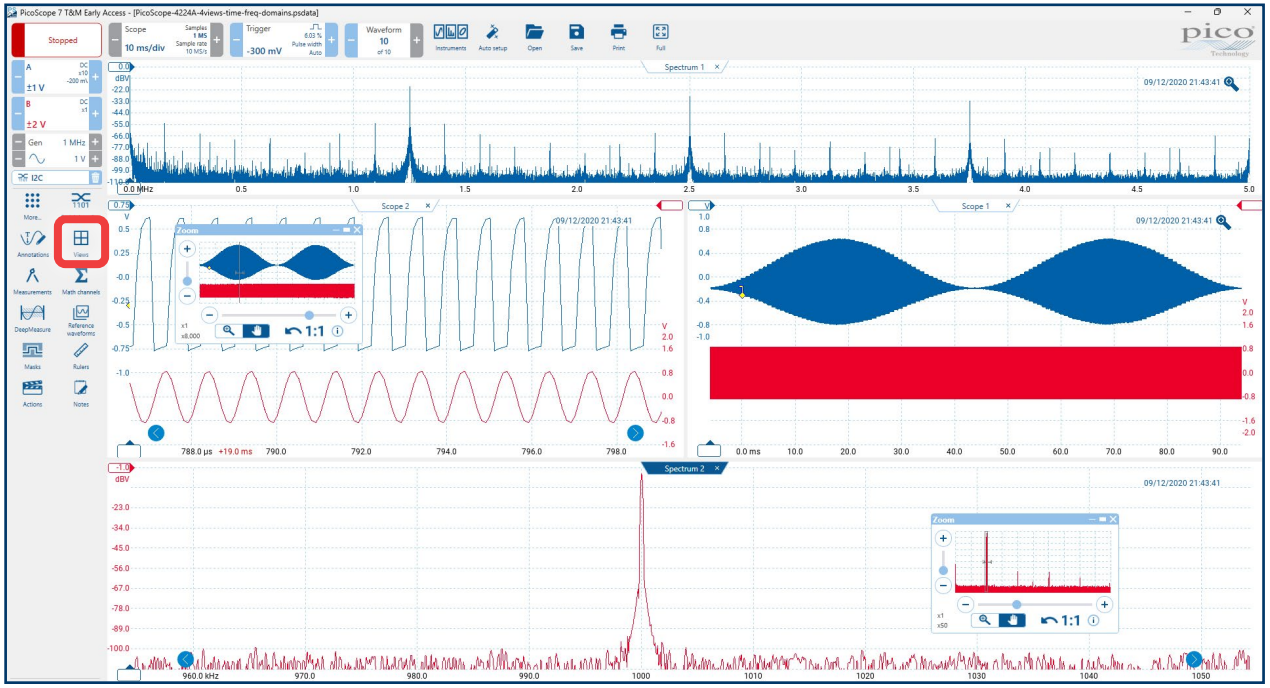
View per channel option

Multiple channels can be displayed in their own viewport in PicoScope with full vertical resolution for each channel.

When multiple channels are active, select **Views** > **View per ch.**

You can arrange the position of each view to suit your display preferences by dragging. You can tessellate each channel view into a grid, display channels in rows or columns or combine them.

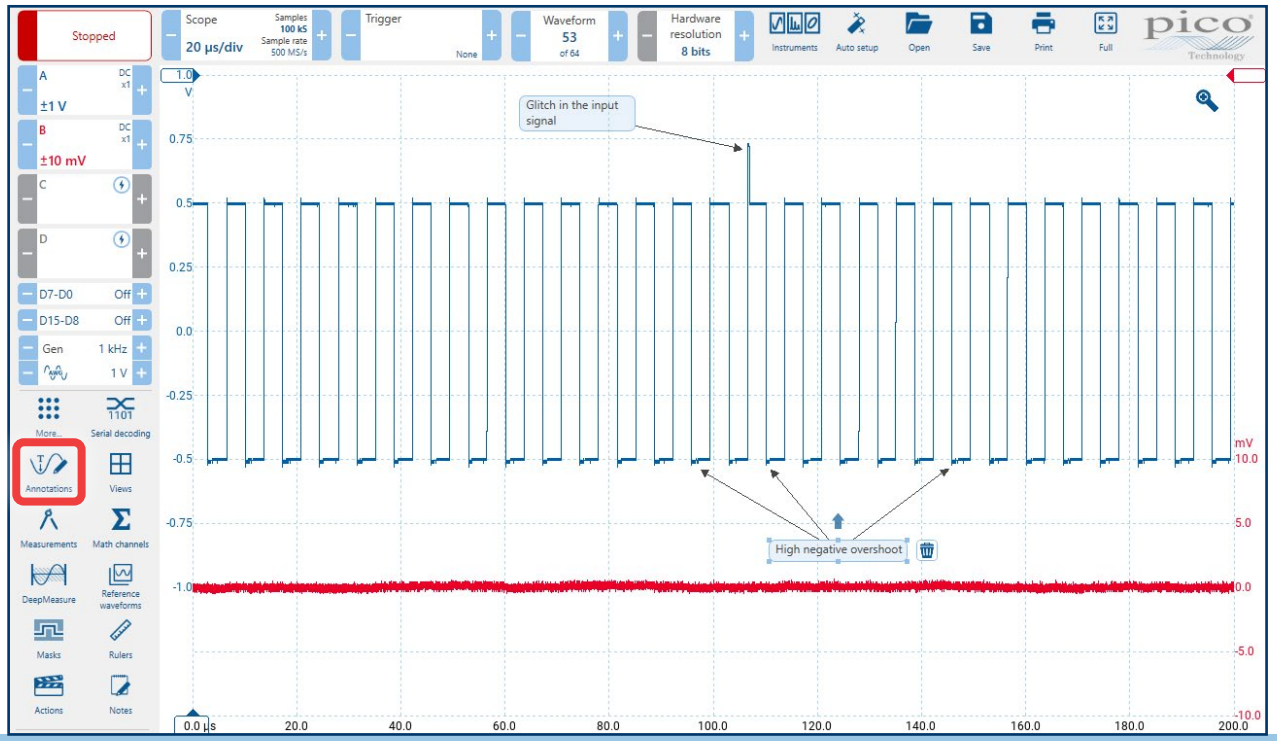
In the screenshot opposite, you can see four views with default labels — **Spectrum 1**, **Scope 2**, **Scope 1**, and **Spectrum 2** — arranged in a grid.



Waveform annotations

The waveform annotation tool helps design and test engineers to manage complex test scenarios involving multiple channels and events of interest that need to be displayed ad communicated across project teams. Live presentation and documentation of key waveform events helps to improve understanding of circuit behaviour and expedite the development process.

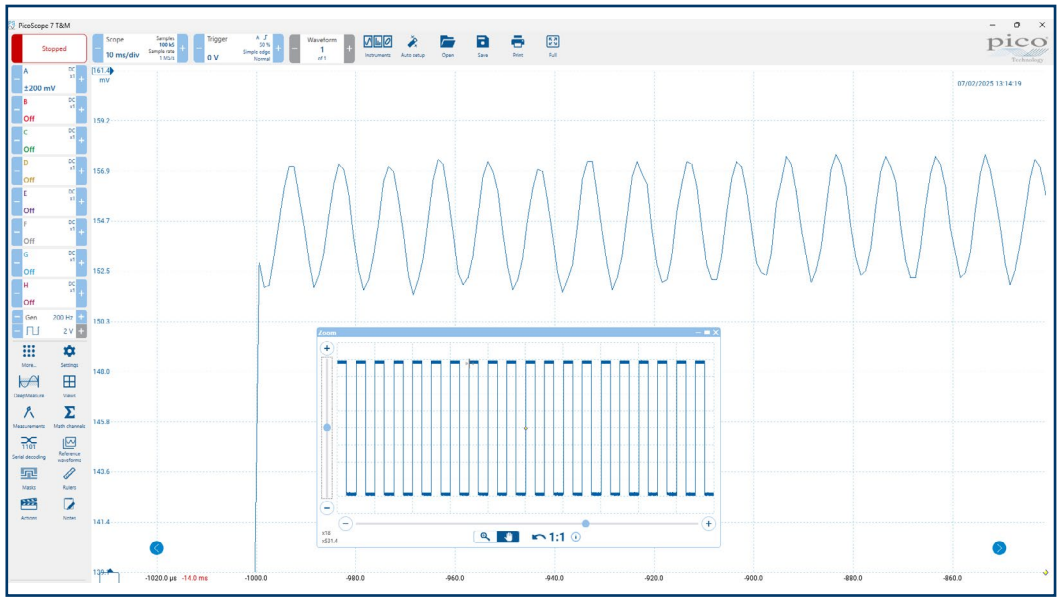
This tool gives the ability to add freeform text boxes onto the waveform view and edit them, as well as drag fixed pinpoint arrows to specific events or anomalies in the data to draw attention to or help explain what is shown. Additionally, these annotations are visible on printouts, in image exports and are saved in .psdata files for sharing and distribution.



Zoom in and capture every last detail

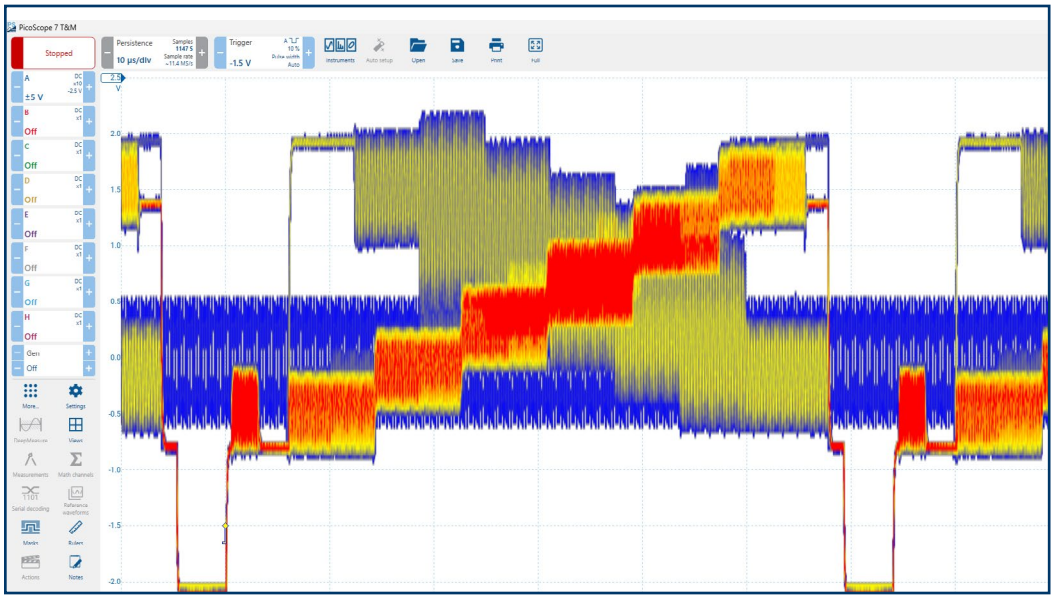
The PicoScope zoom function lets you take a closer look at the fine detail on your signals. Using simple point-and-click tools you can quickly zoom in on both axes and reveal every last detail of the signal, whilst the undo zoom function lets you return to the previous view.

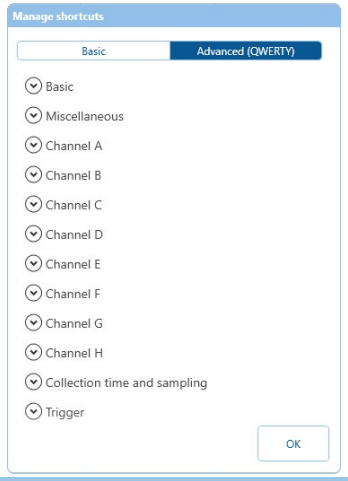
The zoom overview window provides a graphical representation of the entire captured waveform, highlighting the currently zoomed region. This allows for easier navigation across large datasets and facilitates the identification of specific areas of interest without losing context.

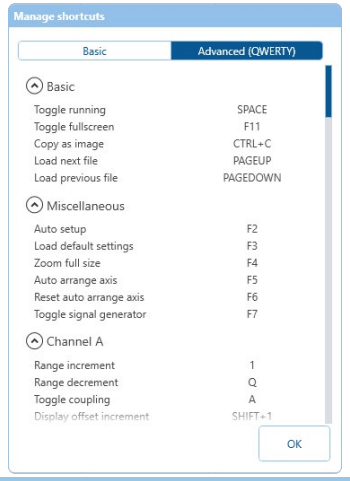


Color persistence modes

Advanced display modes enable you to view old and new data simultaneously, with new data displayed in a brighter color or shade. This makes it easy to see glitches and dropouts and to estimate their relative frequency. Choose between time persistence mode, where the newest waveforms are drawn with highest intensity and fade gradually over time, or frequency persistence mode (opposite), where those waveform elements which repeat most often display in a warmer color (shades of reds/yellows) and infrequent or intermittent events in a cooler color (shades of blue).







Keyboard shortcuts

PicoScope offers a very comprehensive set of keyboard shortcuts to improve speed and usability, reducing the reliance on mouse or touch screen interactions.

Math channels

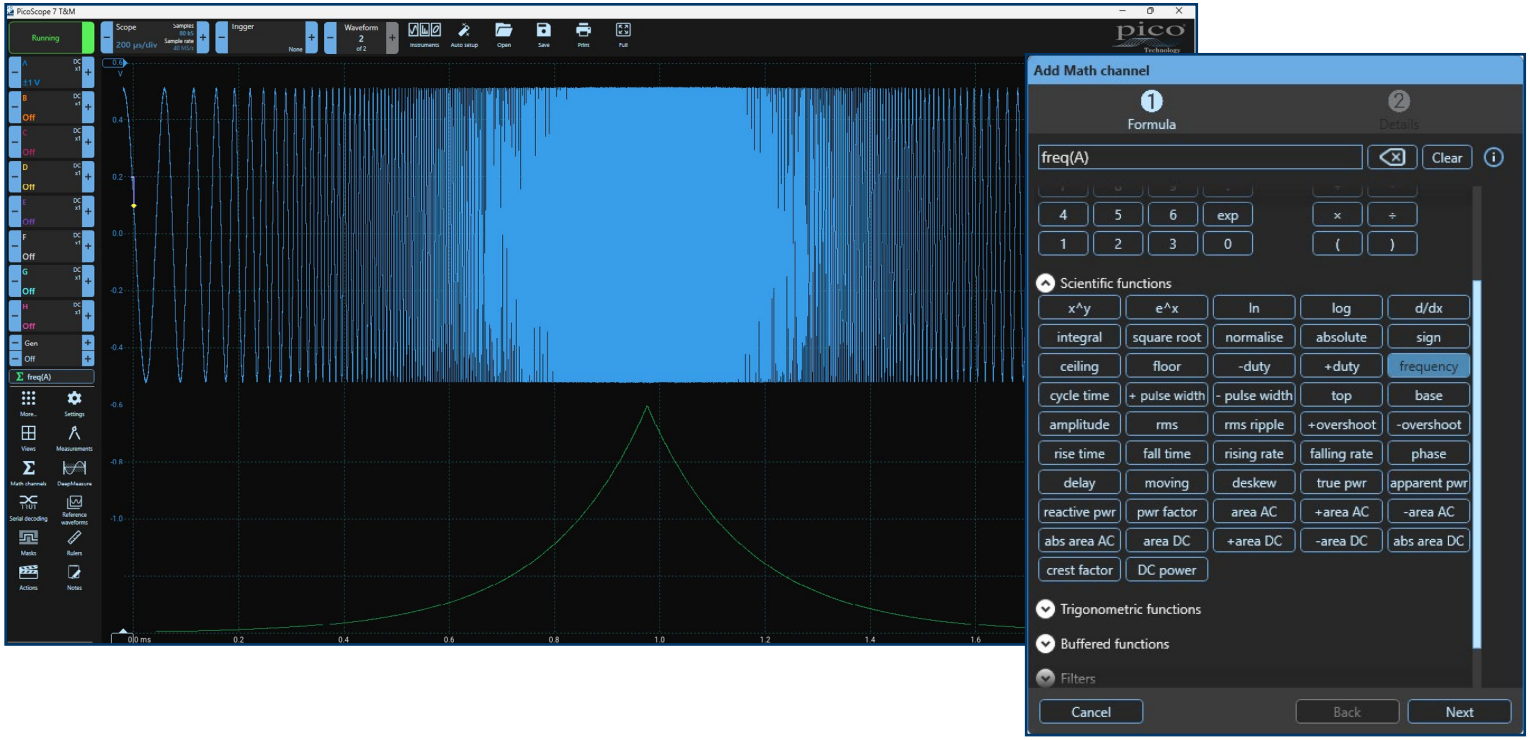
With PicoScope 7 you can perform a variety of mathematical calculations on your input signals and reference waveforms.

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.

Many PicoScope 7 automated measurements can also be plotted as math channels so, instead of a scalar value, trends can be seen in a graphical plot of all the data from a chosen channel.

You can plot a math channel that references signals (like A, B, Ref1) and/or time (T) and if it uses functions like +, –, *, /, ^, sin, exp, sqrt, etc.

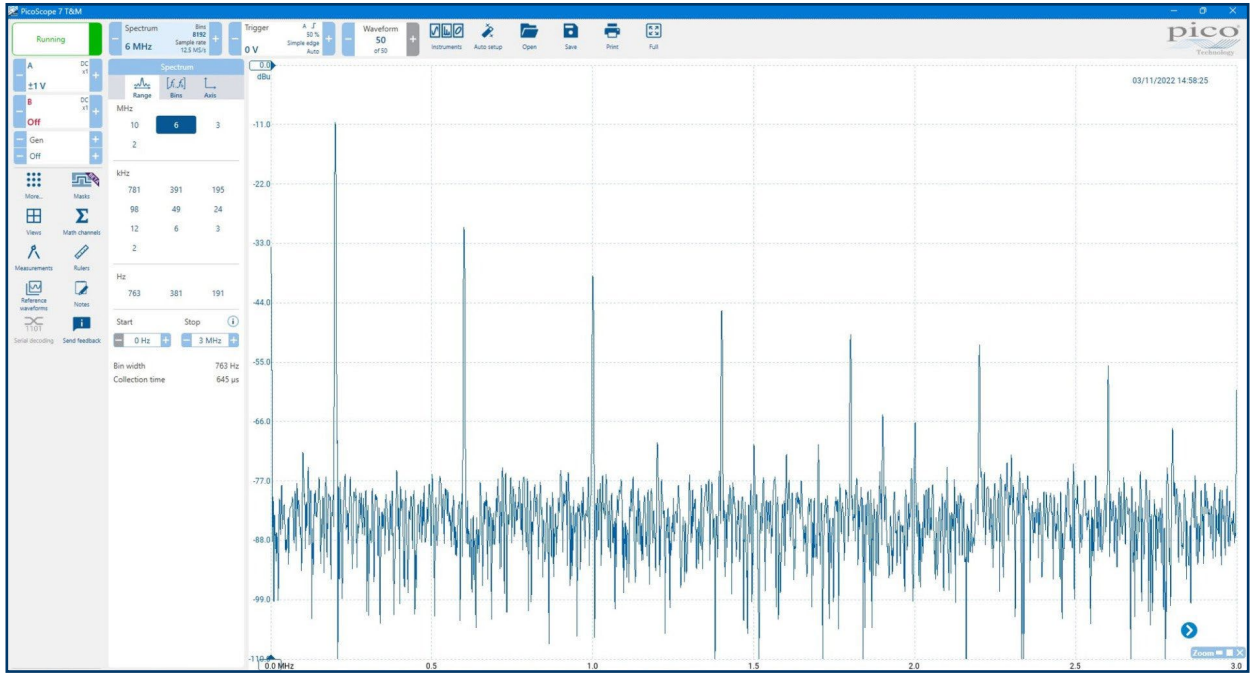
In the screenshot opposite, the measurement “frequency” is as also listed as a math channel “freq(A)”, and plotted here, in green.



Spectrum analyzer

With the click of a button, you can 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.

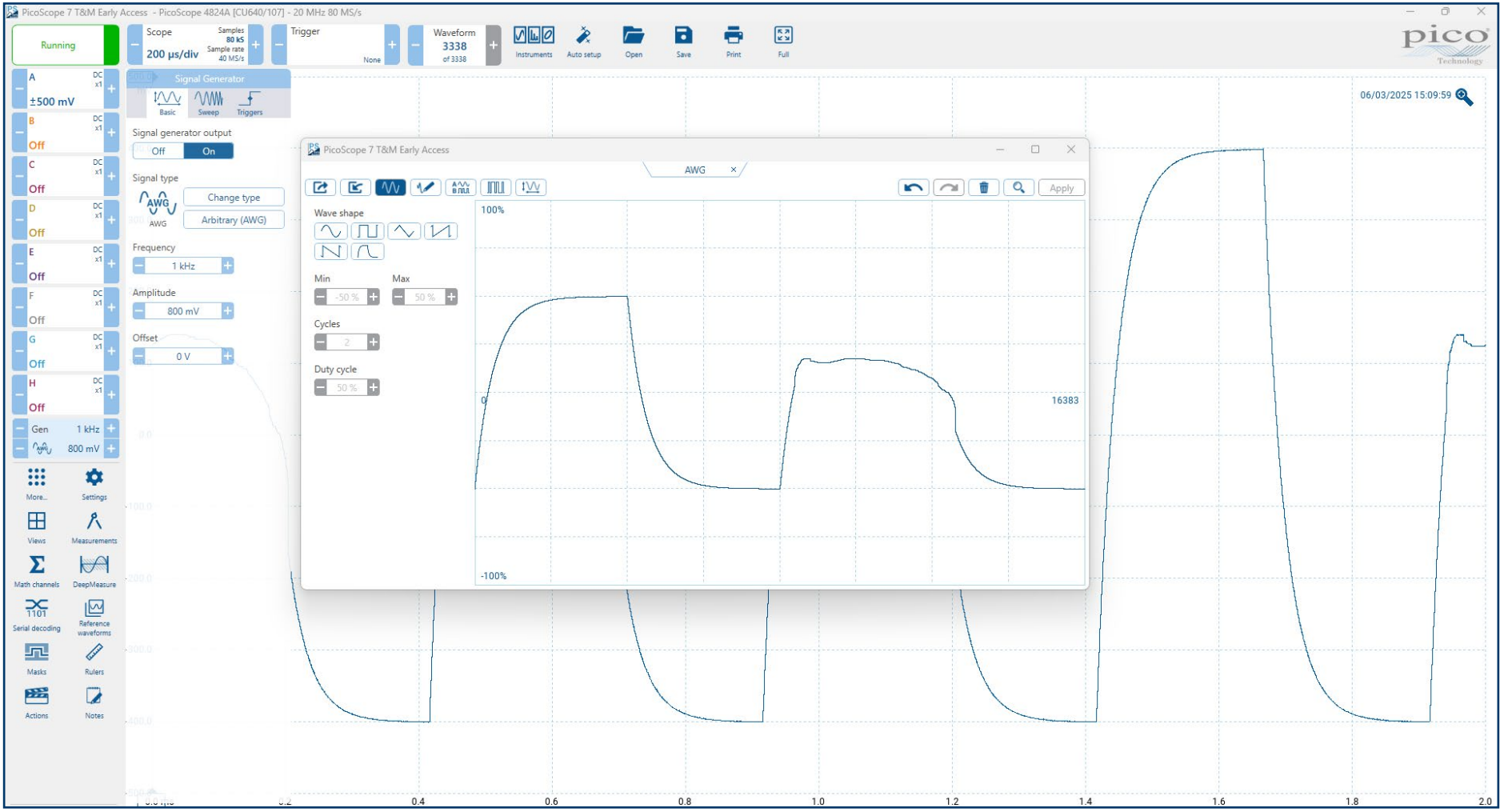
Automatic frequency-domain measurements can be added to the display, including THD, THD+N, SINAD, SNR, SFDR and IMD. You can even use the AWG and spectrum mode together to perform swept scalar network analysis, and you can apply mask testing to the spectrum display to speed up fault-finding.



Arbitrary waveform and function generators

In addition, all models in the PicoScope 4000A Series have 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.



Serial decoding

The PicoScope 4000A Series includes serial decoding capability across all channels as standard. PicoScope software can decode 1-Wire, ARINC 429, CAN, CAN FD, CAN J1939, CAN XL, DALI, DCC, Differential Manchester, DMX512, Ethernet 10BASE-T, Ethernet 10BASE-T1S, Extended UART, FlexRay, I2C, I2S, LIN, Manchester, MIL-STD-1553, MODBUS ASCII, MODBUS RTU, NMEA-0183, Parallel Bus, PMBus, PS/2, PSI5 (Sensor), Quadrature, UART (RS-232, RS-422, RS-485 and others), SBS Data, SENT Fast, SENT Slow, SENT SPC, SMBus, SPI-MISO/MOSI, SPI-SDIO, USB (1.0/1.1) and Wind Sensor protocol data as standard (subject to scope bandwidth and number of channels available). More protocols are in development to be available in the future with free-of-charge software upgrades.

Graph format shows the decoded data (in hex, binary, decimal or ASCII) in a data-bus timing format beneath the waveform on a common time axis, with error frames marked in red. These frames can be zoomed to investigate noise or signal integrity issues.

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 or search for frames with specified properties. The statistics option reveals more detail about the physical layer such as frame times and voltage levels. Click on a frame in the table to zoom the oscilloscope display and show the waveform for that frame.

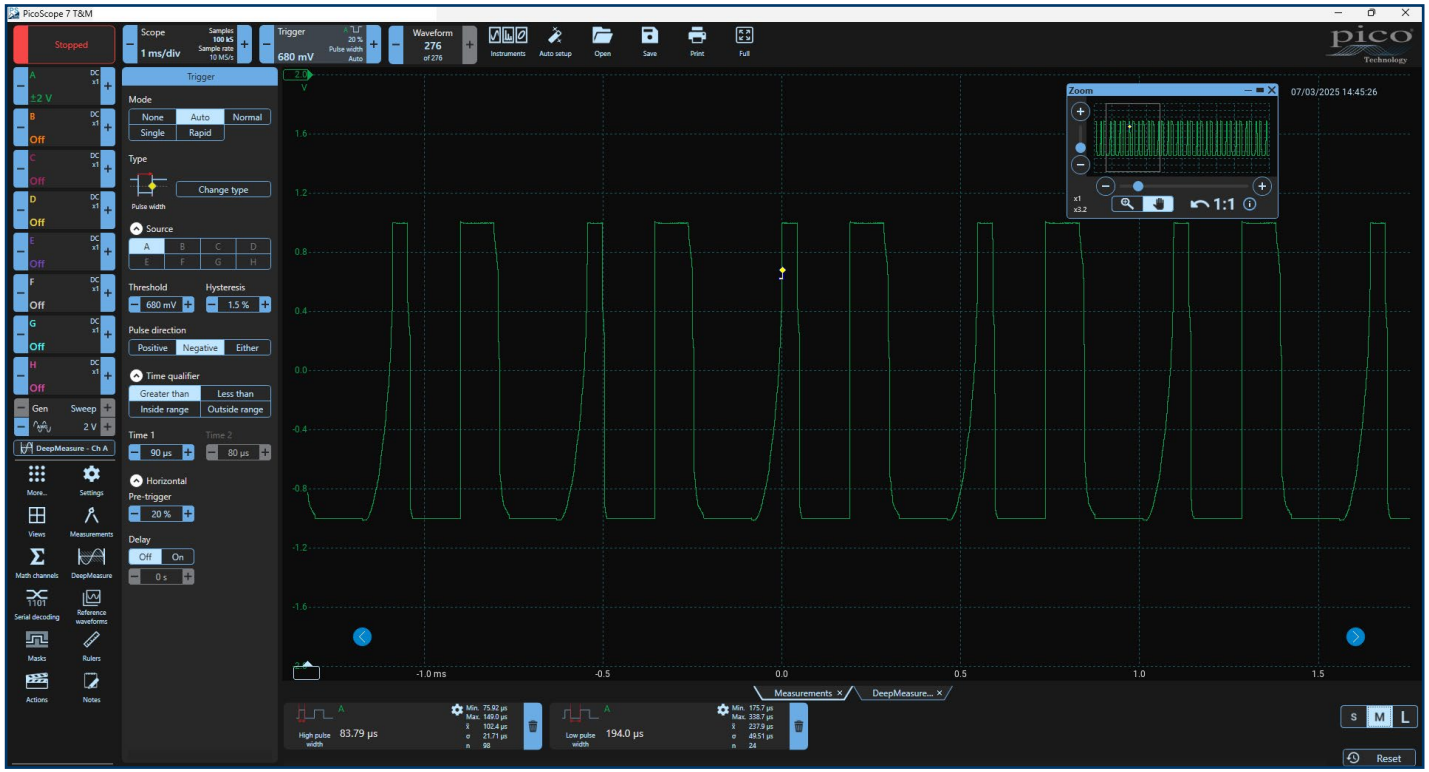
PicoScope can also import a “Link File” spreadsheet to decode the data into user-defined text strings. This helps to speed analysis by cross referencing hexadecimal field values into human readable form. So, for example, instead of displaying “Address: 7E” in the Table View, the corresponding text “Set Motor Speed” will be shown instead, or whatever is appropriate. The Link File template with all field headings can be created directly from the serial table toolbar and edited manually as a spreadsheet to apply the cross-reference values.

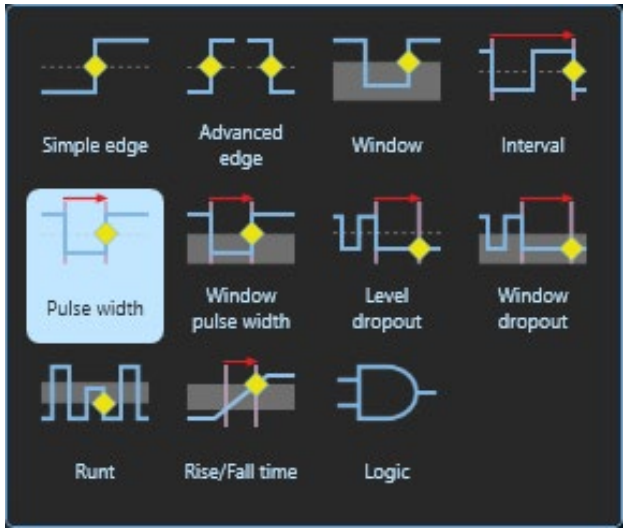
Digital triggering

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.

In 1991 Pico set an innovation milestone by 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 real-time 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 µs until the buffer is full.



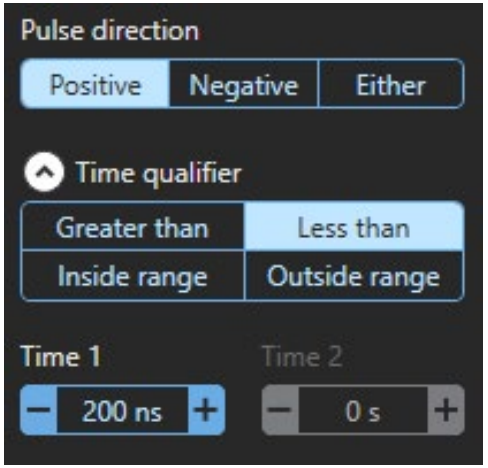


Advanced triggers

As well as the standard range of triggers found on most oscilloscopes, the PicoScope 4000A Series has a comprehensive set of advanced triggers built in to help you capture the data you need. These include simple edge, advanced edge, window, interval, pulse width, window pulse width, level dropout, window dropout, runt, rise/fall time and logic.

Each advanced trigger type includes controls to precisely configure the events to be triggered on. For example, with the pulse width trigger you can select positive, negative or either-direction pulses, and the time condition to be applied:

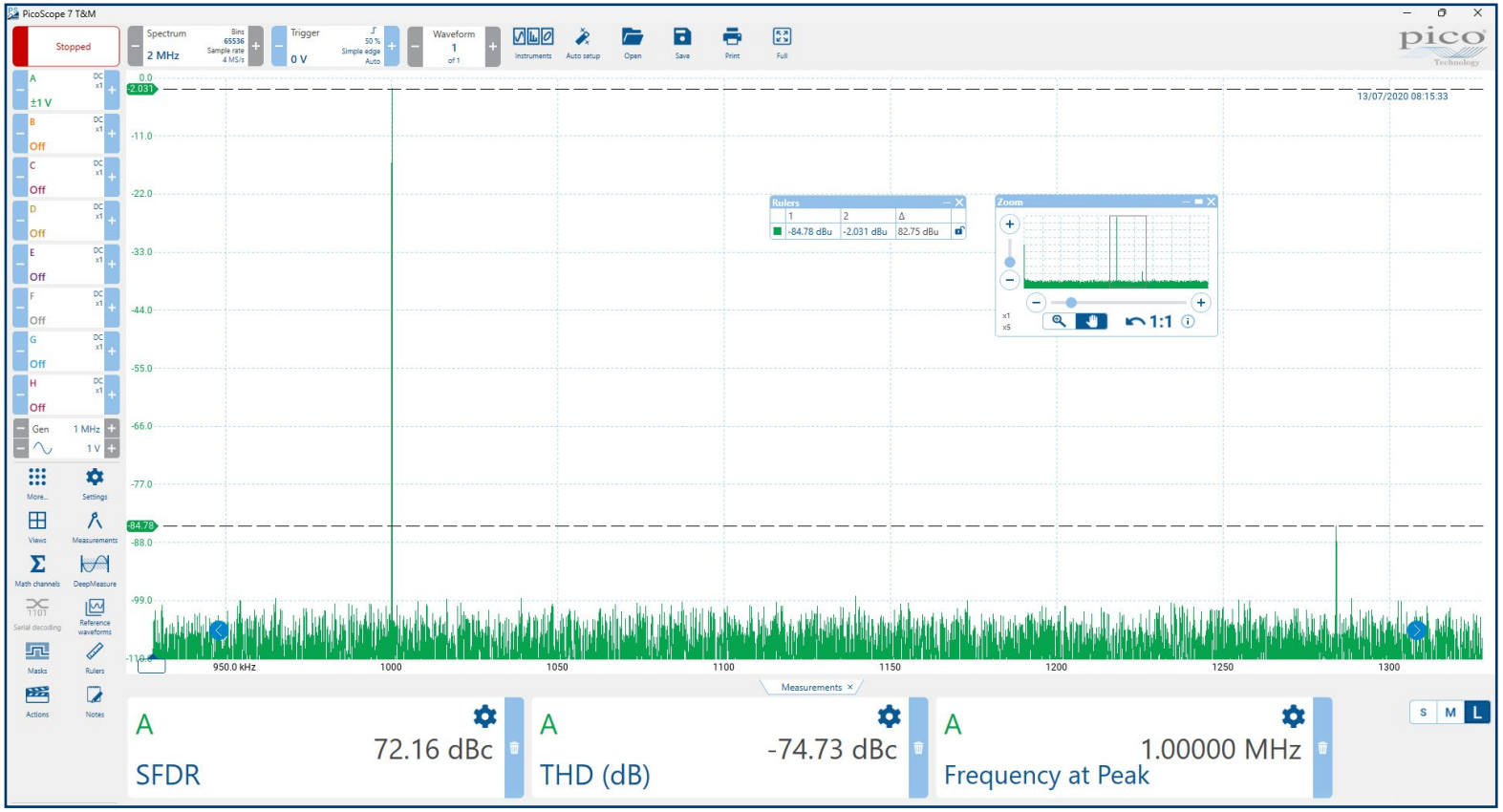
- Less than a minimum duration
- Greater than a maximum duration
- Inside the range between two user-specified time limits
- Outside a range



Automatic measurements

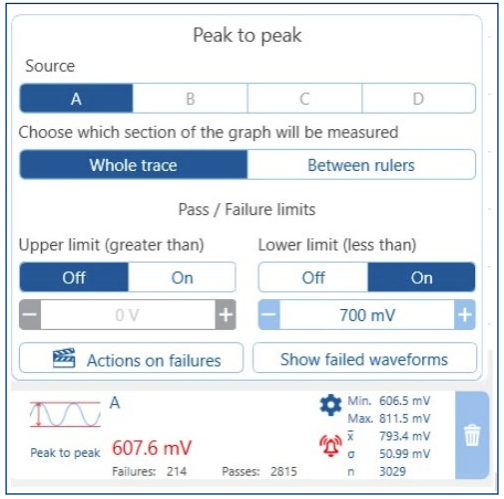
PicoScope 7 provides dozens of automated measurements both for the oscilloscope and spectrum analyzer, not just standard ones like frequency but more complex measurements such as overshoot, edge count, phase, power factor, THD and SINAD. Statistics can be displayed to show the Mean, Maximum, Minimum, Standard Deviation and a count of the number of waveforms. Measurements are highly configurable, allowing you to measure across the whole waveform, between rulers or a single cycle.

Many of the automatic measurements can also be plotted as math channels, instead of showing a scalar measurement.



Measurements: pass/failure limits

PicoScope software offers pass/failure limits for any measurement. This gives a visual indication within the measurement window whenever the measurement result goes above or below a specified value. Pass/failure limits can be combined with actions to immediately alert the user or execute other actions when a measurement threshold has been exceeded, either above or below set limits. By filtering the waveform buffer to show only those waveforms failing a measurement limit, you can quickly identify points of interest out of the thousands of waveforms captured in the deep memory of your PicoScope.

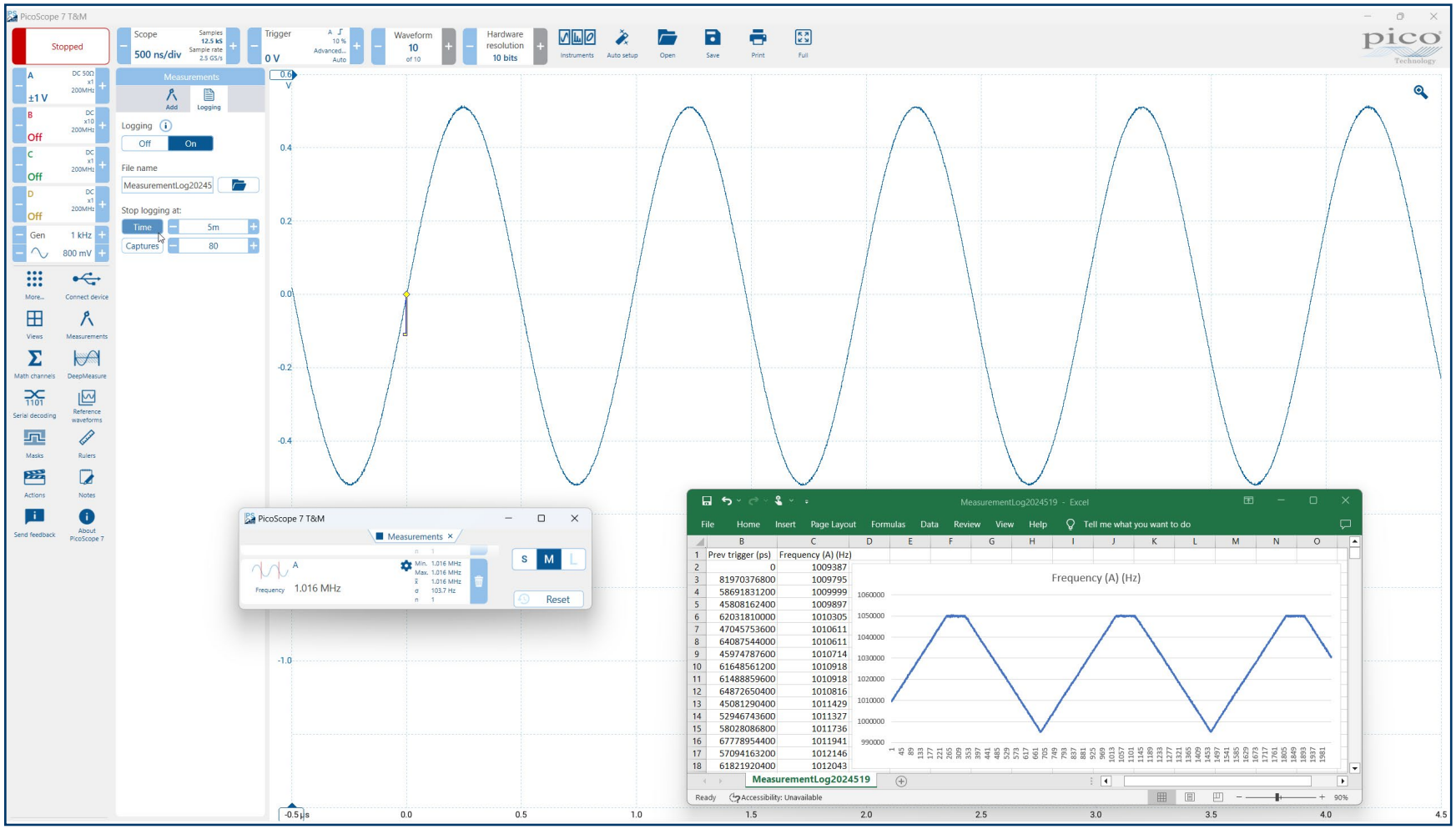


Measurements: logging (trending)

PicoScope allows the results of measurements to be recorded in a file for later analysis. The resulting log can be used to characterize the performance of a circuit over medium or long-duration tests – such as when evaluating drift due to thermal and other effects, or can be used to check functionality against an externally controlled variable such as supply voltage.

The maximum number of rows recorded is limited by the user-set constraints or disk capacity.

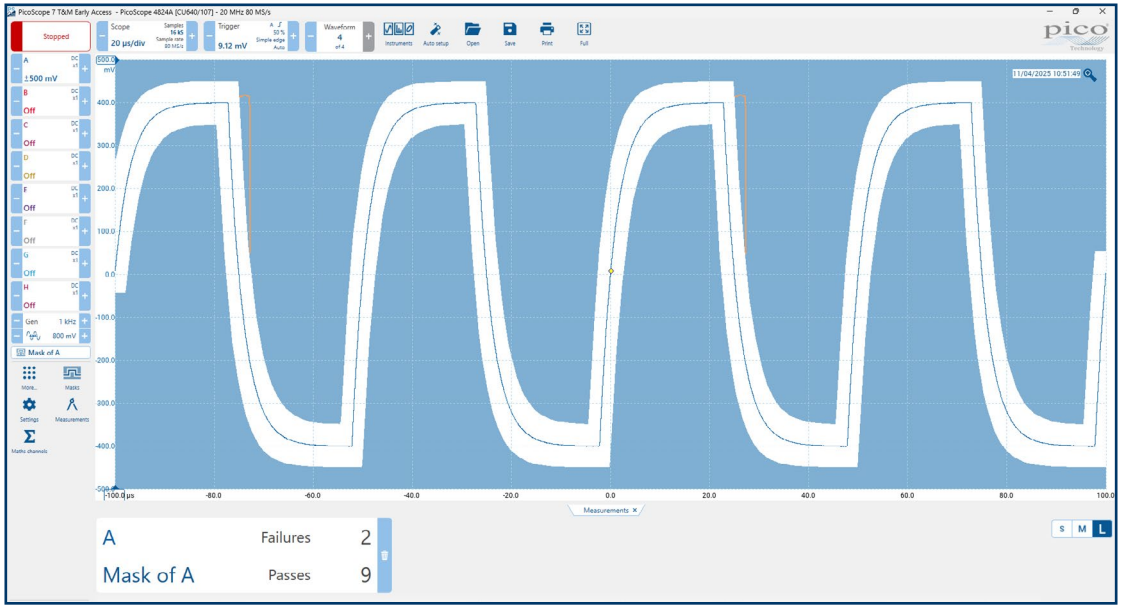
Read more about Measurements.



Mask limit testing

Mask limit testing allows you to compare live signals against known good signals, and is designed for production and debugging environments. Simply capture a known good signal and use it to auto-generate a mask and then measure the system under test.

PicoScope will check for mask violations and perform pass/fail testing, capture intermittent glitches and can show a failure count and other statistics in the Measurements window. Masks can be saved in a library for future use, and exported or imported to share with other PicoScope users.



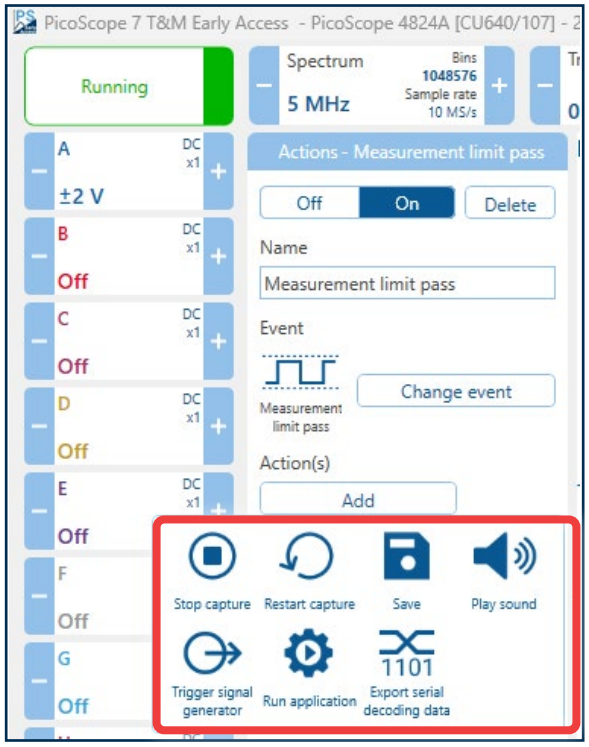
Actions

PicoScope can be programmed to execute actions when certain events occur. The events that can trigger an alarm include mask limit fails, trigger events and buffers full. The actions that PicoScope can execute include:

- Stop the capture
- Save waveform to disk in your choice of format including .csv, .png and .matlab
- Play a sound
- Trigger signal generator or AWG
- Run an external application or script
- Export serial-decoded data to a file on disk

Actions, coupled with mask limit testing and measurements, create a powerful and time-saving waveform monitoring tool. Capture a known good signal, auto-generate a mask around it and then use actions to automatically save any waveform (complete with a time/date stamp) that does not meet specification.

But actions aren't limited to mask violations. They can also be triggered when a measurement goes out of range, serving as an automated alarm system for any unexpected deviations. Whether it's logging data, triggering alerts or saving waveforms for further analysis, actions help ensure that no critical event goes unnoticed.



Actions selection

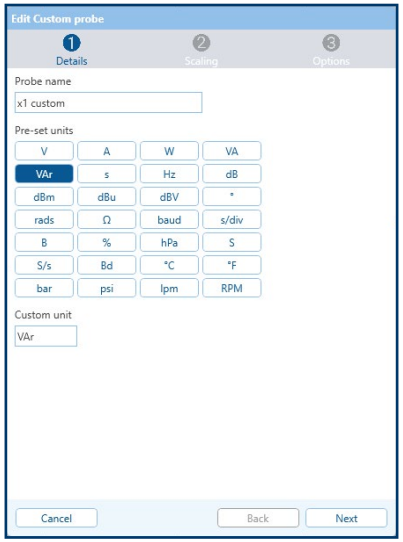
Event selection

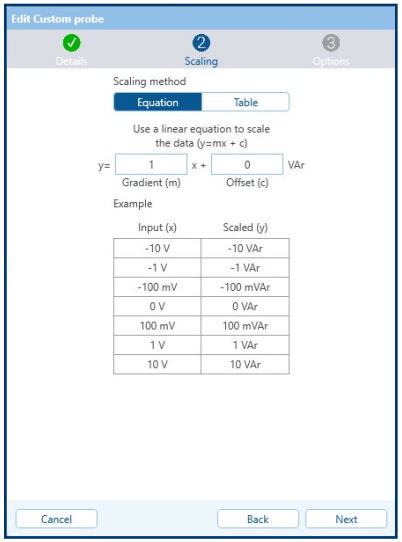
Digital low-pass filtering

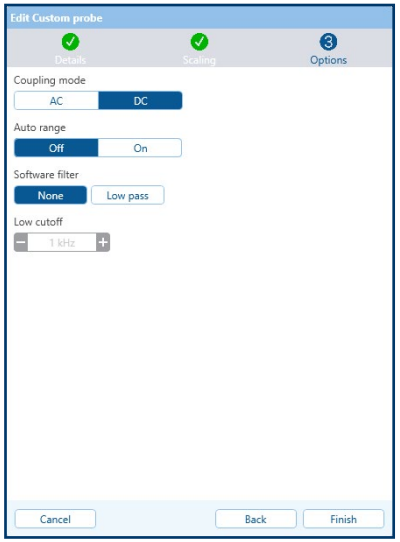
Each input channel has its own digital low-pass filter with independently adjustable cut-off frequency from 1 Hz to the full bandwidth of the scope. This enables noise reduction on selected channels while viewing high-bandwidth signals on the others.

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, and you can also create your own using linear scaling or even an interpolated data table, and save them for later use.

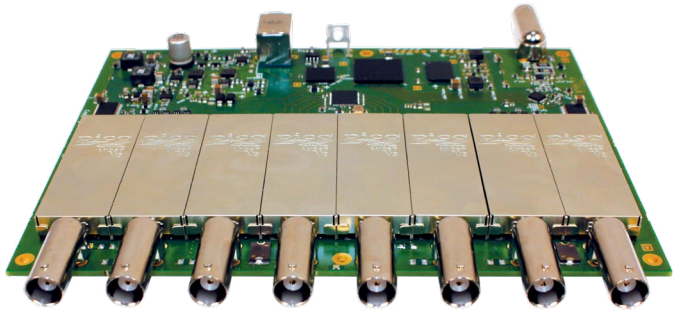






High signal integrity

Careful front-end design and shielding reduce 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 superior pulse response, bandwidth flatness and low distortion. The scope features 12 input ranges from ±10 mV to ±50 V full scale and a huge spurious free dynamic range of up to 70 dB. The result is simple: when you probe a circuit, you can trust in the waveform you see on the screen.



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 has 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.

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.

When using the Pico Software Development Kit (PicoSDK), the fast USB 3.0 connectivity allows continuous streaming of data up to the full 80 MS/s sample rate of the scope with no limit on the capture time, subject only to the host PC's ability to process or store the data.

PicoScope performance and reliability

With over 30 years' experience in the test and measurement industry, we know what's important in an oscilloscope. The PicoScope 4000A Series delivers value for money by including a wide range of high-end features as standard. The PicoScope 7 software includes 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.

PicoScope 7 software - time domain view

Running/Stopped control: Click to start displaying waveforms. Click again to stop. The keyboard space bar has the same function.

Timebase sampling controls: Set the timing of an acquisition using the seconds/division control. **Sampling** controls provide a choice of timebase operating modes: **Buffer memory** priority adjusts the sampling rate to maintain a fixed capture memory depth. **Sample rate** priority adjusts memory depth to maintain a fixed sampling rate.

Trigger marker (yellow diamond): Shows the channel, signal level and time of the trigger event. Drag to adjust.

Trigger controls: Quick access to main controls and advanced triggers.

Waveform buffer navigator: PicoScope can store the last 40 000 oscilloscope or spectrum waveforms in a circular waveform buffer. The buffer navigator provides an efficient way of navigating and searching through waveforms.

Channel controls: Each channel corresponds to one of the PicoScope input connectors. Use controls to manage probe types, assign channel names, set vertical scaling, offset, input coupling and other signal conditioning parameters before making measurements on the DUT.

Serial protocol decoding: Serial decoders in use are listed here.

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.

DeepMeasure: Delivers automatic measurement of important waveform parameters on up to a million waveform cycles on each triggered acquisition.

Reference waveforms: Waveforms can be saved and displayed for comparison with live data.

Rulers: Help to make on-screen waveform measurements without having to count graticule marks. **Track** option (in **Rulers** settings) allows automatic read of Y-axis values.

Views: Display separate scope, spectrum or XY views which can also be moved to different screens.

Zoom: Zoom-in to magnify and click or drag to pan around.

Actions: These are things that the PicoScope can be programmed to do when certain events occur. Actions include: **Stop capture**, **Save waveform**, **Play sound**, **Trigger signal generator** and **Run application.**

Masks: Mask limit testing allows the comparison of live signals against known good signals and is designed for production and debugging environments. Simply capture a known good signal, generate a mask around it and then monitor the device under test.

Serial decoding: PicoScope has built-in serial protocol decoders for over 40 common protocols. They are all included as standard at no extra cost.

Math channels: Advanced scientific, trigonometric, buffer, filter and coupler functions as well as basic arithmetic

PicoScope 7 software - frequency domain (spectrum analyzer) view

Spectrum controls: Set the frequency range, window functions (**Blackman**, **Gaussian**, **Triangular**, **Hamming**, **Hann**, **Blackman-Harris**, **Flat-top** or **Rectangular**), number of bins (bin width and collection time are calculated and displayed) and XY axis settings.

Trigger controls: The full advanced trigger capabilities of the scope are available in spectrum mode, to capture the frequency spectrum of a single event.

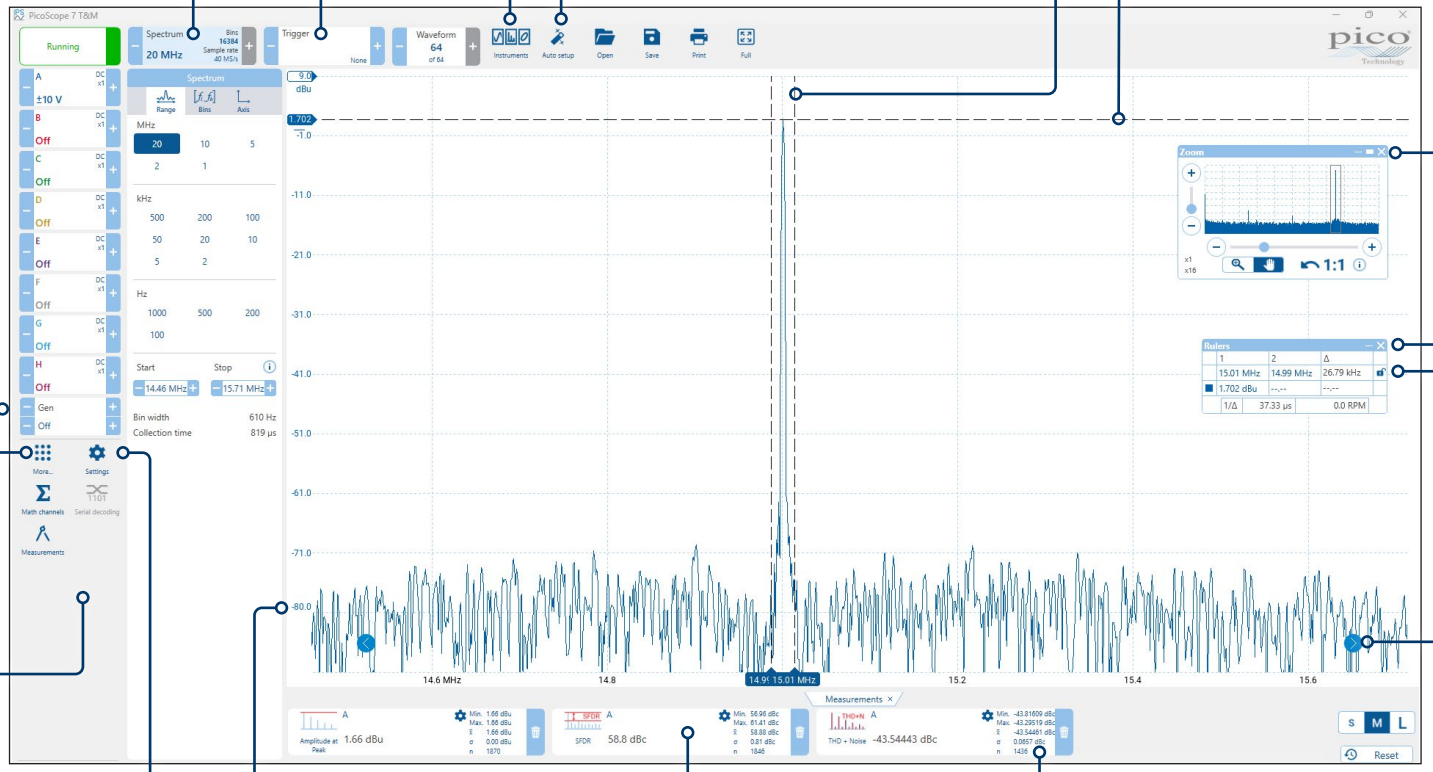
Instruments: Switches between the following modes: scope, spectrum, XY and persistence.

Auto setup: Click this first to find your signal, then adjust using the other controls.

Frequency rulers: Drag ruler from left to right to mark a point on the x-axis. The ruler legend displays the frequency at each ruler and the difference between them. **Track** option (in **Rulers** settings) allows automatic read of dB/voltage values in the **Ruler legend** without the need for a horizontal ruler.

dB/voltage rulers: Drag up or down to mark a point on the y-axis. The ruler legend will display the dB/voltage value at each ruler and the difference between them.

Signal generator: For oscilloscopes with a built-in arbitrary waveform generator (AWG). Generates standard signals or arbitrary waveforms. Includes frequency sweep mode.



Zoom window: Shows the full waveforms on all active channels. The grey rectangle indicates the area that is visible in the current view.

Ruler legend: Displays the positions of all the rulers you have placed on the view. It appears automatically whenever you position a ruler on the view. **Track** option (in **Rulers** settings) allows automatic read of Y-axis values.

More..: Click to display all available tools to select and favorite for quick access. The Tools menu is categorized to assist with locating the tools you need.

Lock rulers: When two rulers are placed on a channel or time/frequency axis, an unlocked padlock appears in the **Rulers** legend. Click it to lock the rulers together — moving one moves the other while preserving their separation. The padlock icon updates to indicate locking.

Favorite tools or functions such as **Measurements**, **Math channels**, **Serial protocol decoding**, **Rulers**, **Reference waveforms**, **Masks**, **Annotations** and **Actions** are one touch away in a custom UI panel.

Settings: Configure software startup, usage statistics and the UI color theme. You can also set trace line thickness, adjust scope settings panel behavior and position, choose your preferred measurement system and manage keyboard shortcuts.

Channel axis: Each channel has a color-coded axis. Drag it up or down to position the channel. Selecting or dragging also brings the associated waveform to the front if it overlaps others. You can also roll your mouse scroll wheel to adjust the scaling.

Measurements window: Dynamically updated automatic measurements. Choose from a rich set of time-domain and frequency-domain measurement types. The measurements window can be un-docked from the main display, and even moved to another monitor.

Measurement statistics: The minimum, maximum, average and standard deviation of each measurement are calculated and displayed.

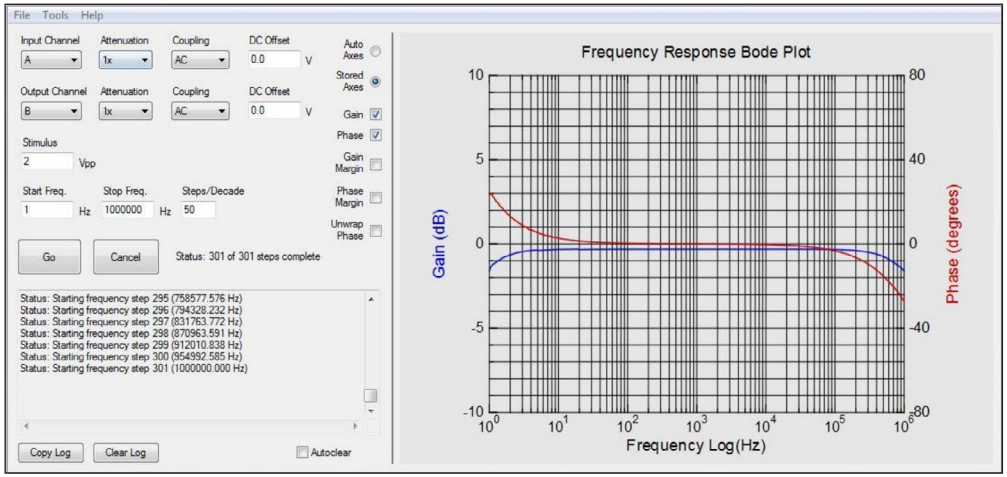
Navigate waveform: When zoomed-in, click to pan up or down the frequency range.

PicoSDK - write your own apps

Our free software development kit, PicoSDK, allows you to write your own software and includes drivers for Windows, macOS and Linux. Example code supplied on our GitHub organization page shows how to interface to third-party software packages such as National Instruments LabVIEW and MathWorks MATLAB, as well as programming languages including C/C++, C# and Python.

Among other features, the drivers support data streaming, a mode that captures continuous gap-free data directly to your PC or host computer at rates of up to 80 MS/s, so you are not limited by the size of your scope's capture memory. Sampling rates in streaming mode are subject to PC specifications and application loading.

There is also an active community of PicoScope users who share both code and whole applications on our Test and Measurement Forum and the PicoApps section of the website. The Frequency Response Analyzer shown here is a popular application on the forum.



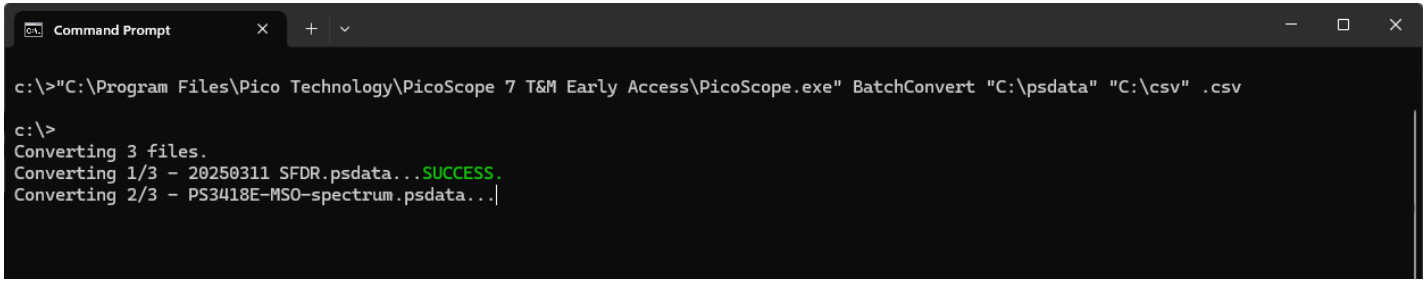

```
ScopeSettingsPropTree.clear();
    wstring appVersionStringW = wstring_convert<codecvt_utf8<wchar_t>>().from_bytes(appVersionString);
    ScopeSettingsPropTree.put( L"appVersion", appVersionStringW );
    ScopeSettingsPropTree.put( L"picoScope.inputChannel.name", L"A" );
    ScopeSettingsPropTree.put( L"picoScope.inputChannel.attenuation", ATTEN_1X );
    ScopeSettingsPropTree.put( L"picoScope.inputChannel.coupling",PS_AC );
    ScopeSettingsPropTree.put( L"picoScope.inputChannel.dcOffset", L"0.0" );
    ScopeSettingsPropTree.put( L"picoScope.inputChannel.startingRange", -1 ); // Base on stimulus
    ScopeSettingsPropTree.put( L"picoScope.outputChannel.name", L"B" );
    ScopeSettingsPropTree.put( L"picoScope.outputChannel.attenuation", ATTEN_1X );
    ScopeSettingsPropTree.put( L"picoScope.outputChannel.coupling", PS_AC );
    ScopeSettingsPropTree.put( L"picoScope.outputChannel.dcOffset", L"0.0" );
    ScopeSettingsPropTree.put( L"picoScope.outputChannel.startingRange", pScope->GetMinRange(PS_AC) );

    midSigGenVpp = floor((pScope->GetMinFuncGenVpp() + pScope->GetMaxFuncGenVpp()) / 2.0);

    stimulusVppSS << fixed << setprecision(1) << midSigGenVpp;
    maxStimulusVppSS << fixed << setprecision(1) << pScope->GetMaxFuncGenVpp();
    startFreqSS << fixed << setprecision(1) << (max(1.0, pScope->GetMinFuncGenFreq())); // Make frequency at least 1.0 since 0.0 (DC) makes no sense for FRA
    stopFreqSS << fixed << setprecision(1) << (pScope->GetMaxFuncGenFreq());
```


Convert PicoScope files from the command line interface (CLI)

PicoScope can be invoked from the Windows, macOS or Linux command line to convert PicoScope data (.psdata) files in an input folder into CSV, text or MATLAB files in an output folder. This enables bulk conversion of saved PicoScope files into other formats for further analysis or processing in external programs.



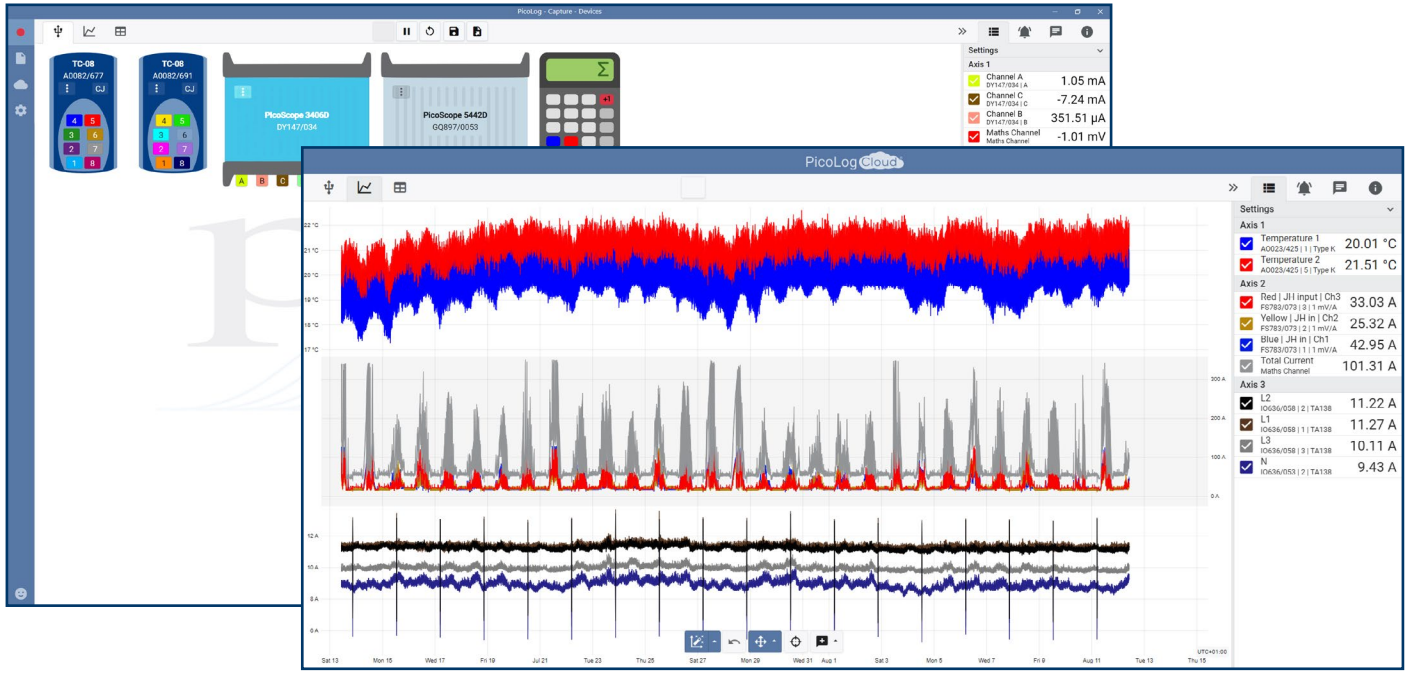
PicoLog 6 software

The PicoScope 4000A Series oscilloscopes are also supported by the PicoLog 6 data logging software, allowing you to view and record signals on multiple units in one capture.

PicoLog 6 allows sample rates of up to 1 kS/s per channel. This is ideal for long-term observation of general parameters such as voltage or current levels on several channels at the same time. However, PicoScope 7 software is more suitable for waveshape or harmonic analysis.

You can also use PicoLog 6 to view data from your oscilloscope alongside a data logger or other device. For example, you could measure voltage and current with your PicoScope and plot both against temperature using a TC-08 thermocouple data logger.

PicoLog 6 is available for Windows, macOS, Linux and Raspberry Pi OS.



Pack contents

- PicoScope 4000A Series 2-, 4- or 8-channel oscilloscope
- Oscilloscope probes
- USB 3.0 cable 1.8 m
- USB-C to USB-B cable, 1.8 m
- Quick Start Guide

PicoScope 4000A Series specifications

	PicoScope 4224A	PicoScope 4424A	PicoScope 4824A
Vertical			
Input channels	2	4	8
Connector type	BNC		
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 type	Single-ended		
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		
Maximum input voltage	±50 V DC / 42.4 V pk max AC		
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)		
Analog offset control accuracy	±1% of offset setting additional to basic DC accuracy		
Overvoltage protection	±100 V (DC + AC peak)		
Horizontal timebase			
Maximum sampling rate (real-time)	80 MS/s (up to four channels in use) 40 MS/s (five or more channels in use)		
Maximum sampling rate (USB 3.0 streaming)	20 MS/s using PicoScope software, shared between channels 80 MS/s max. for a single channel using PicoSDK. 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)	250 MS in PicoScope software. Up to available PC memory when using PicoSDK		
Waveform buffer	40 000 segments (rapid block mode) 40 000 waveforms (PicoScope 7 circular buffer)		
Timebase accuracy	±20 ppm (+5 ppm/year)		
Sampling jitter	25 ps RMS typical		

	PicoScope 4224A	PicoScope 4424A	PicoScope 4824A
Dynamic performance (typical)			
Crosstalk (full bandwidth)	−76 dB		
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		
Pulse response	< 1% overshoot		
Bandwidth flatness	DC to full bandwidth (+0.2 dB, −3 dB)		
Triggering			
Source	All channels		
Trigger modes	None, auto, repeat, single, rapid (segmented memory)		
Advanced trigger types	Edge (rising, falling, rising-or-falling), window (entering, exiting, entering-or-exiting), pulse width (positive or negative or either pulse), window pulse width (time inside, outside window or either), level dropout (including high/low or either), window dropout (including inside, outside or either), interval, runt (positive or negative), transition time (rise/fall), logic Logic trigger capabilities: AND/OR function of up to 8 channels NAND/NOR/XOR/XNOR function of up to four channels (PicoScope 7) User-defined Boolean function of up to four channels (PicoSDK only)		
Trigger sensitivity	Digital triggering provides 1 LSB accuracy up to full bandwidth		
Pre-trigger capture	Up to 100% of capture size		
Post-trigger delay	Zero to 4 billion samples (settable in 1 sample steps)		
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, ramp up, ramp down, sin(x)/x, Gaussian, half-sine, DC voltage, AWG		
Pseudorandom output signals	White noise, selectable amplitude and offset within output voltage range Pseudorandom binary sequence (PRBS), selectable high and low levels within output voltage range, selectable bit rate up to 1 Mb/s		
Standard signal frequency	0.03 Hz to 1 MHz		
Output frequency accuracy	±20 ppm ± output frequency resolution		
Output frequency resolution	< 0.02 Hz		
Sweep modes	Up, down, up down, down up, selectable start/stop frequencies and increments		
Triggering	Free-run, or from 1 to 1 billion counted waveform cycles or frequency sweeps. Triggered from scope trigger or manually from software.		
Output voltage range	±2 V		
Output voltage adjustment	Signal amplitude and offset are adjustable in approximately 300 µV steps, within an overall ±2 V range.		
DC accuracy	±1% of full scale		
Amplitude flatness	< 0.5 dB to 1 MHz, typical		

		PicoScope 4224A	PicoScope 4424A	PicoScope 4824A
SFDR		87 dB typical		
Output resistance		600 Ω		
Connector type		Rear-panel BNC		
Overvoltage protection		±10 V		
Arbitrary waveform generator				
Update rate		80 MS/s		
Buffer size		16 k samples		
Vertical resolution		14 bits (output step size approximately 300 µV)		
Bandwidth		1 MHz		
Rise time (10% to 90%)		150 ns		
Sweep modes, triggering, frequency accuracy and resolution, voltage range and accuracy and output characteristics as for function generator.				
Spectrum analyzer				
Frequency range		DC to 20 MHz		
Display modes		Magnitude, average, peak hold		
Y axis		Logarithmic (dbV, dBu, dBm, arbitrary dB) or linear (volts)		
X axis		Linear or logarithmic		
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		
Math channels				
General scientific functions (Functions in bold can be plotted)		x^y, e^x, ln(x), log(x), d/dx, integral, square root, normalize, absolute, sign, ceiling, floor, – duty, + duty, frequency, cycle time, + pulse width, – pulse width, top, base, amplitude, rms, rms ripple, + overshoot, – overshoot, rise time, fall time, rising rate, falling rate, phase, delay, moving, deskew, true power, apparent power, reactive power, power factor, area AC, + area AC, – area AC, abs area AC, area DC, + area DC, – area DC, abs area DC, crest factor, DC power		
Trigonometric functions		sin, cos, tan, arcsin, arccos, arctan, sinh, cosh, tanh		
Filtered functions		Lowpass, highpass, bandstop, bandpass		
Buffered functions		Min, max, average, peak		
Operands		A to B, D or H (input channels), T (time), reference waveforms, pi, constants		
Automatic measurements				
Scope mode	**Amplitude**	Minimum, maximum, base, top, negative overshoot, positive overshoot, peak to peak, amplitude, mean, RMS, RMS ripple		
	Time	Frequency, cycle time, negative duty cycle, positive duty cycle, edge count (rising, falling, either), high pulse width, low pulse width, rise time, fall time, rising rate, falling rate		
	Multi-channel	Phase, delay		
	Power	True power, apparent power, reactive power, power factor, DC power, crest factor, area at AC, positive area at AC, negative area at AC, absolute area at AC, area at DC, positive area at DC, negative area at DC, absolute area at DC		
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, standard deviation		

	PicoScope 4224A	PicoScope 4424A	PicoScope 4824A
DeepMeasure™			
Parameters	Cycle number, cycle time, frequency, low pulse width, high pulse width, duty cycle (high), duty cycle (low), rise time, fall time, undershoot, overshoot, max. voltage, min. voltage, voltage peak to peak, start time, end time		
Serial decoding			
Protocols	1-Wire, ARINC 429, CAN, CAN FD, CAN J1939, CAN XL, DALI, DCC, Differential Manchester, DMX512, Ethernet 10BASE-T, Ethernet 10BASE-T1S, Extended UART, FlexRay, I2C, I2S, LIN, Manchester, MIL-STD-1553, MODBUS ASCII, MODBUS RTU, NMEA-0183, Parallel Bus, PMBus, PS/2, PSI5 (Sensor), Quadrature, UART (RS-232, RS-422, RS-485 and others), SBS Data, SENT Fast, SENT Slow, SENT SPC, SMBus, SPI-MISO/MOSI, SPI-SDIO, USB (1.0/1.1) and Wind Sensor protocol data as standard (subject to scope bandwidth and number of channels available)		
Mask limit testing			
Statistics	Pass/fail, failure count, total count		
Mask creation	Auto-generated from waveform or imported from file		
Display			
Interpolation	Linear or sin(x)/x		
Persistence modes	Time, frequency, fast		
Output			
File formats	csv, mat, pdf, png, psdata, pssettings, txt		
Functions	Save, copy to clipboard, print		
General			
PC connectivity	USB 3.0 SuperSpeed USB 2.0 Hi-Speed compatible		
PC connector type	USB 3.0 type B		
PC requirements	Processor, memory and disk space: as required by the operating system Ports: USB 3.0 (recommended) or 2.0 (compatible)		
Power requirements	Powered from USB		
Ground terminal	M4 screw terminal, rear panel		
Dimensions	190 x 170 x 40 mm (including connectors)		
Weight	0.55 kg		
Temperature range	Operating: 0 to 45 °C (20 to 30 °C for stated accuracy) Storage: −20 to +60 °C		
Humidity range	Operating: 5 to 80 %RH non-condensing Storage: 5 to 95 %RH non-condensing		
Altitude range	Up to 2000 m		
Pollution degree	EN 61010 pollution degree 2: “only nonconductive pollution occurs except that occasionally a temporary conductivity caused by condensation is expected”		
Safety compliance	Designed to EN 61010-1; LVD compliant		
EMC compliance	Tested to meet EN 61326-1 and FCC Part 15 Subpart B		
Environmental compliance	RoHS and WEEE		
Warranty	5 years		

	PicoScope 4224A	PicoScope 4424A	PicoScope 4824A
Software			
Windows software (64-bit)*	PicoScope 7, PicoLog 6, PicoSDK		
macOS software (64-bit)*	PicoScope 7, PicoLog 6 and PicoSDK		
Linux software (64-bit)*	PicoScope 7 software and drivers, PicoLog 6 (including drivers). See Linux Software and Drivers to install drivers only		
Raspberry Pi 4B and 5 (32-bit Raspberry Pi OS)*	PicoLog 6 (including drivers) See Linux Software and Drivers to install drivers only		
* See the picotech.com/downloads page for more information. Users writing their own apps can find example programs for all platforms on the Pico Technology organization page on GitHub).			
Languages supported, PicoScope 7	Bulgarian, Chinese (simplified), Chinese (traditional), Croatian, Czech, Danish, Netherlands Dutch, English (UK), English (US), Finnish, French, German, Greek, Hungarian, Italian, Japanese, Korean, Norwegian, Polish, Portuguese, Portuguese-Brazilian, Romanian, Russian, Serbian, Slovene, Spanish, Swedish, Turkish		
Languages supported, PicoLog 6	Simplified Chinese, Dutch, English (UK), English (US), French, German, Italian, Japanese, Korean, Russian, Spanish		

PicoScope 4000A Series inputs and outputs

PicoScope 4224A

Input channels A and B

PicoScope 4424A

Input channels A to D

PicoScope 4824A

Input channels A to H

Rear panel

Function generator and
arbitrary waveform generator output

USB port

Ground terminal

Ordering information

Order code	Description
PQ288	PicoScope 4224A 2-channel 20 MHz oscilloscope kit with 2 TA375 probes
PQ289	PicoScope 4424A 4-channel 20 MHz oscilloscope kit with 4 TA375 probes
PQ290	PicoScope 4824A 8-channel 20 MHz oscilloscope kit with 4 TA375 probes
Optional accessories	
TA375	100 MHz 1:1/10:1 passive switchable probe
TA041	25 MHz 10:1/100:1 active differential probe, ±700 V CAT III
TA057	25 MHz 20:1/200:1 active differential probe, ±1400 V CAT III
TA044	70 MHz 100:1/1000:1 differential probe, ±7000 V
TA531	USB to DC jack power cable for differential probes: TA041, TA057 and TA044
TA167	2000 A AC/DC current clamp
TA325	30/300/3000 A AC 3-phase flex current probe
TA326	30/300/3000 A AC flex current probe
PP877	Three-axis accelerometer and oscilloscope interface
PP969	Carry case

Calibration service

Order code	Description
CC028	Calibration certificate for the PicoScope 4000A Series oscilloscopes

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