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
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, I^C, 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.

![Zoom function](image)

**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.

> 60 dB SFDR

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**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.
Serial decoding

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.

### Serial protocols

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<thead>
<tr>
<th>UART/RS-232</th>
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<tbody>
<tr>
<td>SPI</td>
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<tr>
<td>I²C</td>
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<tr>
<td>I²S</td>
</tr>
<tr>
<td>CAN</td>
</tr>
<tr>
<td>LIN</td>
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<tr>
<td>FlexRay</td>
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</tbody>
</table>

### 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 V 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.

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

**Spectrum view**: View FFT data alongside scope view or independently.
### At a glance

<table>
<thead>
<tr>
<th>Model</th>
<th>Input channels</th>
<th>Bandwidth (~3 dB)</th>
<th>Maximum sampling rate</th>
<th>Buffer memory</th>
<th>Arbitrary waveform generator</th>
</tr>
</thead>
<tbody>
<tr>
<td>PicoScope 4824</td>
<td>8</td>
<td>20 MHz</td>
<td>80 MS/s</td>
<td>256 MS</td>
<td>80 MS/s</td>
</tr>
</tbody>
</table>

### Detailed specifications

**VERTICAL**

<table>
<thead>
<tr>
<th>Input channels</th>
<th>BNC, 20 mm spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth (~3 dB)</td>
<td>20 MHz (50 mV to 50 V ranges) 10 MHz (10 mV and 20 mV ranges)</td>
</tr>
<tr>
<td>Rise time (calculated)</td>
<td>17.5 ns (50 mV to 50 V ranges) 35.0 ns (10 mV and 20 mV ranges)</td>
</tr>
<tr>
<td>Vertical resolution</td>
<td>12 bits</td>
</tr>
<tr>
<td>Software-enhanced vertical resolution</td>
<td>Up to 16 bits</td>
</tr>
<tr>
<td>Input ranges</td>
<td>±10 mV to ±50 V full scale, in 12 ranges</td>
</tr>
<tr>
<td>Input sensitivity</td>
<td>2 mV/div to 10 V/div (10 vertical divisions)</td>
</tr>
<tr>
<td>Input coupling</td>
<td>AC / DC</td>
</tr>
<tr>
<td>Input characteristics</td>
<td>1 MΩ</td>
</tr>
<tr>
<td>DC accuracy</td>
<td>±1% of full scale ±300 μV</td>
</tr>
<tr>
<td>Analog offset range (vertical position adjustment)</td>
<td>±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)</td>
</tr>
<tr>
<td>Overvoltage protection</td>
<td>±100 V (DC + AC peak)</td>
</tr>
</tbody>
</table>

**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 (at scope input) | 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, 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, PC, 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 single USB 3.0 port or two USB 2.0 ports
- **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
- **Software requirements**: Microsoft Windows XP (SP3), Windows Vista, Windows 7 or Windows 8 (not Windows RT)
- **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
Optional accessories

<table>
<thead>
<tr>
<th>Passive voltage probe</th>
<th>M1007 General-purpose probe providing an economical way to connect test signals to the scope.</th>
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<tbody>
<tr>
<td>Active differential probe</td>
<td>TA041 Ideal for motor speed controls, uninterruptible and switch mode power supplies, and process controllers.</td>
</tr>
<tr>
<td>Active differential probe</td>
<td>TA057 Ideal for motor speed controls, uninterruptible and switch mode power supplies, and process controllers.</td>
</tr>
<tr>
<td>Optional power supply</td>
<td>PS008 For use with the TA041 and TA057 active differential probes.</td>
</tr>
<tr>
<td>2000 A AC/DC current clamp</td>
<td>TA167 Ideal for use with industrial controls, photovoltaic inverters, and uninterruptible power supplies.</td>
</tr>
</tbody>
</table>

Pack contents

- PicoScope 4824 oscilloscope
- USB 3.0 cable 1.8 m
- USB 2.0 cable 1.8 m, double-headed
- Quick Start Guide
- Software and reference CD

PicoScope

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<th>Description</th>
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<td>Ultra-compact and handheld</td>
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<tr>
<td>3000 Series</td>
<td>General-purpose and MSO models</td>
</tr>
<tr>
<td>4000 Series</td>
<td>High precision 12 to 16 bits</td>
</tr>
<tr>
<td>5000 Series</td>
<td>Flexible resolution 8 to 16 bits</td>
</tr>
<tr>
<td>6000 Series</td>
<td>High performance Up to 1 GHz</td>
</tr>
<tr>
<td>9000 Series</td>
<td>Sampling scopes and TDR to 20 GHz</td>
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</table>