



# **PicoScope 4000 Series PC Oscilloscopes**

User's Guide



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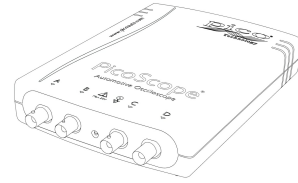
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# 1 Welcome

Thank you for buying a Pico Technology product!

The PicoScope 4000 Series of PC Oscilloscopes from Pico Technology is a range of compact units designed to replace traditional bench-top oscilloscopes costing many times the price.




Here are some of the benefits provided by your new PicoScope 4000 Series PC Oscilloscope:

- Portability: Take the unit with you and plug it in to any Windows PC.
- Performance: 12-bit resolution, large buffer with up to 32 M samples, fast USB 2.0 interface.
- Flexibility: Use it as an oscilloscope, spectrum analyser or high-speed data acquisition interface.
- Programmability: The PicoScope 4000 series API lets you write your own programs, in your chosen programming language, to control all the features of the scope.
- Long-term support: Software upgrades are available to download from our [website](#). You can also call our technical specialists for support. You can continue to use both of these services free of charge for the lifetime of the product.
- Value for money: You don't have to pay twice for all the features that you already have in your PC. The PicoScope 4000 Series scope unit contains the special hardware you need and nothing more.
- Convenience: The software makes full use of the large display, storage, user interface and networking built in to your PC.

## 2 Introduction

### 2.1 Using this guide

You will sometimes see a symbol like this:  This is the cross-reference symbol, and it indicates the number of a page on which you can find more information about a topic.

The abbreviation MS/s is used in this guide to mean megasamples per second.

### 2.2 Safety symbols

The following symbols appear on the front panel of the PicoScope 4000 Series PC Oscilloscope.

Symbol 1: Warning triangle



This symbol indicates that a safety hazard exists on the indicated connections if correct precautions are not taken. Read all safety documentation associated with the product before using it.

Symbol 2: Equipotential



This symbol indicates that the outer shells of the indicated BNC connectors are all at the same potential (shorted together). You must therefore take necessary precautions to avoid applying a potential across the return connections of the indicated BNC terminals. Such a potential could cause a large current to flow, resulting in damage to the product or connected equipment, or both.

### 2.3 Safety warning

We strongly recommend that you read the general safety information below before using your oscilloscope for the first time. Safety protection built in to equipment may cease to function if the equipment is used incorrectly. This could cause damage to your computer, or lead to injury to yourself and others.

Maximum input range

PicoScope 4000 Series PC Oscilloscopes are designed to measure voltages in the range  $\pm 100$  V. All inputs are protected to  $\pm 200$  V. Contact with voltages outside the protection range may cause permanent damage to the unit.

Mains voltages

Pico Technology products are not designed for use with mains voltages. To measure mains, use a differential isolating probe specifically rated for mains use.

Safety grounding

PicoScope 4000 Series PC Oscilloscopes connect directly to the ground of a computer through the USB cable provided to minimise interference.

As with most oscilloscopes, avoid connecting the ground input to any potential other than ground. If in doubt, use a meter to check that there is no significant AC or DC voltage between the ground input of the oscilloscope and the point to which you intend to connect it. Failure to check may cause damage to your computer or injury to yourself and others.

The product does not have a protective safety ground.

## 2.4 FCC notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his or her own expense.

For safety and maintenance information see the [safety warning](#) .

## 2.5 CE notice

The PicoScope 4000 Series PC Oscilloscopes meet the intent of the EMC directive 89/336/EEC and have been designed to EN61326-1 (1997) Class A Emissions and Immunity standard.

PicoScope 4000 Series PC Oscilloscopes also meet the intent of the Low Voltage Directive and have been designed to meet the BS EN 61010-1:2001 IEC 61010-1:2001 Safety requirements for electrical equipment for measurement, control, and laboratory use standard.

## 2.6 Software licence conditions

The material contained in this software release is licensed, not sold. Pico Technology Limited grants a licence to the person who installs this software, subject to the conditions listed below.

### Access

The licensee agrees to allow access to this software only to persons who have been informed of these conditions and agree to abide by them.

### Usage

The software in this release is for use only with Pico products or with data collected using Pico products.

### Copyright

Pico Technology Ltd. claims the copyright of, and retains the rights to, all material (software, documents etc.) contained in this release. You may copy and distribute the entire release in its original state, but must not copy individual items within the release other than for backup purposes.

### Liability

Pico Technology and its agents shall not be liable for any loss, damage or injury, howsoever caused, related to the use of Pico Technology equipment or software, unless excluded by statute.

### Fitness for purpose

Because no two applications are the same, Pico Technology cannot guarantee that its equipment or software is suitable for a given application. It is your responsibility, therefore, to ensure that the product is suitable for your application.

### Mission-critical applications

This software is intended for use on a computer that may be running other software products. For this reason, one of the conditions of the licence is that it excludes usage in mission-critical applications such as life-support systems.

### Viruses

This software was continuously monitored for viruses during production, but you are responsible for virus-checking the software once it is installed.

### Support

If you are dissatisfied with the performance of this software, please contact our technical support staff, who will try to fix the problem within a reasonable time. If you are still dissatisfied, please return the product and software to your supplier within 28 days of purchase for a full refund.

### Upgrades

We provide upgrades, free of charge, from our web site at [www.picotech.com](http://www.picotech.com). We reserve the right to charge for updates or replacements sent out on physical media.

### Trademarks

Windows is a trademarks of Microsoft Corporation. Pico Technology and PicoScope are internationally registered trademarks of Pico Technology Ltd.



## 2.7 Trademarks

Windows is a registered trademark or trademark of Microsoft Corporation in the USA and other countries.

Pico Technology Limited and PicoScope are trademarks of Pico Technology Limited, registered in the United Kingdom and other countries.

PicoScope and Pico Technology are registered in the U.S. Patent and Trademark Office.

## 2.8 Warranty

Pico Technology warrants upon delivery, and for a period of 24 months unless otherwise stated from the date of delivery, that the Goods will be free from defects in material and workmanship.

Pico Technology shall not be liable for a breach of the warranty if the defect has been caused by fair wear and tear, wilful damage, negligence, abnormal working conditions or failure to follow Pico Technology's spoken or written advice on the storage, installation, commissioning, use or maintenance of the Goods or (if no advice has been given) good trade practice; or if the Customer alters or repairs such Goods without the written consent of Pico Technology.

## 2.9 Company details

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Sales: [sales@picotech.com](mailto:sales@picotech.com)

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


## 3 Product information

### 3.1 What do I get?

Your PicoScope 4000 Series PC Oscilloscope kit contains the following items:

Reorder code	Quantity	Description
PP492	1	PicoScope 4224 scope unit (PicoScope 4224 kit only)
PP493	1	PicoScope 4424 scope unit (PicoScope 4424 kit only)
MI007	2 or 4	x1/x10 switchable 60 MHz oscilloscope probes (2 with PicoScope 4224, 4 with PicoScope 4424)
MI106	1	USB cable, for connection to the USB 1.1 or USB 2.0 port on your PC
DI025	1	Software and reference CD
DO115	1	USB Oscilloscope Installation Guide
MI144	1	Carry case

### 3.2 System requirements


To ensure that your [PicoScope 4000 Series](#)  PC Oscilloscope operates correctly, you must have a computer with at least the minimum system requirements to run one of the supported operating systems, as shown in the following table. The performance of the software will increase with more powerful PCs, including those with multi-core processors.

Item	Absolute minimum	Recommended minimum	Recommended full specification
Operating system	Windows XP SP2 or Vista (32-bit versions only)		
Processor	As required by Windows	300 MHz	1 GHz
Memory		256 MB	512 MB
Free disk space (Note 1)		1 GB	2 GB
Ports	USB 1.1 compliant port	USB 2.0 compliant port	

Note 1: The PicoScope software does not use all the disk space specified in the table. The free space is required to make Windows run efficiently.

### 3.3 Installation instructions


#### IMPORTANT

Do not connect your [PicoScope 4000 Series](#)  scope device to the PC before you have installed the Pico software. If you do, Windows might not recognise the scope device correctly.

#### Procedure


- Follow the instructions in the USB Oscilloscope Installation Guide included with your product package.
- Connect your PC Oscilloscope to the PC using the USB cable supplied.

#### Checking the installation

Once you have installed the software and connected the PC Oscilloscope to the PC, start the [PicoScope](#)  software. PicoScope should now display any signal connected to the scope inputs. If a probe is connected to your oscilloscope, you should see a small 50 or 60 hertz signal in the oscilloscope window when you touch the probe tip with your finger.

#### Moving your PicoScope PC Oscilloscope to another USB port

##### ● Windows XP SP2

When you first installed the PicoScope 4000 Series PC Oscilloscope by plugging it into a [USB](#)  port, Windows associated the Pico driver with that port. If you later move the oscilloscope to a different USB port, Windows will display the "New Hardware Found Wizard" again. When this occurs, just click "Next" in the wizard to repeat the installation. If Windows gives a warning about Windows Logo Testing, click "Continue Anyway". As all the software you need is already installed on your computer, there is no need to insert the Pico Software CD again.

##### ● Windows Vista

The process is automatic. When you move the device from one port to another, Windows displays an "Installing device driver software" message and then a "PicoScope 4000 series PC Oscilloscope" message. The PC Oscilloscope is then ready for use.

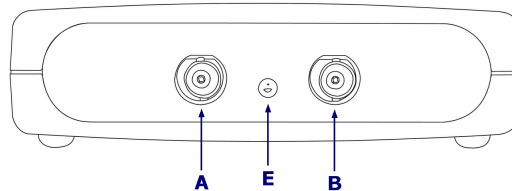
### 3.4 Connections

Standard oscilloscope connectors

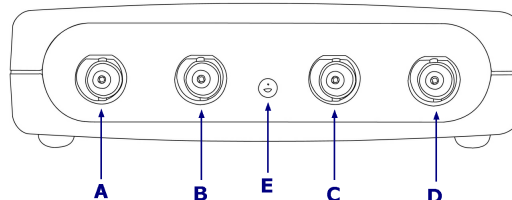
[PicoScope 4000 Series](#) <sup>11</sup> PC Oscilloscopes have BNC oscilloscope connectors. The inputs have an impedance of 1 M $\Omega$ , so they are compatible with all standard scope probes including x1, x10 and x1/x10 attenuated types.

Connector diagrams

Front panel



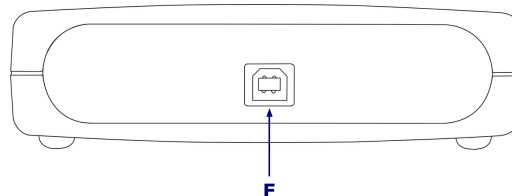
[PicoScope 4224](#) <sup>11</sup>



[PicoScope 4424](#) <sup>11</sup>

- A. Input channel A
- B. Input channel B
- C. Input channel C
- D. Input channel D
- E. LED: shows when the oscilloscope is sampling data

Rear panel



[PicoScope 4224](#) <sup>11</sup>

[PicoScope 4424](#) <sup>11</sup>

- F. USB 2.0 port

### 3.5 Specifications

Variant	<a href="#">PicoScope 4224</a> <sup>[11]</sup>	<a href="#">PicoScope 4424</a> <sup>[11]</sup>
Number of channels	2	4
<a href="#">Vertical resolution</a> <sup>[12]</sup>	12 bits	
<a href="#">Analog bandwidth</a> <sup>[11]</sup>	20 MHz (10 MHz on ±50 mV range)	
<a href="#">Maximum sampling rate</a> <sup>[11]</sup> (real-time sampling) One channel in use Two channels in use Three or four channels in use	80 MS/s 80 MS/s (A+C, A+D, B+C, B+D) 20 MS/s (all other combinations) 20 MS/s	
<a href="#">Buffer size</a> <sup>[11]</sup>	32 MS shared between enabled channels	
Inputs Input characteristics Coupling <a href="#">Voltage ranges</a> <sup>[12]</sup>	BNC, 1 MΩ    22 pF Software-selectable AC/DC ±50 mV, ±100 mV, ±200 mV, ±500 mV, ±1 V, ±2 V, ±5 V, ±10 V, ±20 V, ±50 V, ±100 V ±200 V	
Overload protection		
Timebase Ranges	100 ns/div to 200 s/div (real-time sampling)	
Operating environment Temperature range Humidity	0°C to 45°C for normal operation 5% to 80% RH, non-condensing	
Storage environment Temperature range Humidity	-20°C to +60°C 5% to 95% RH, non-condensing	
PC connection	USB 2.0 Compatible with USB 1.1	
Power supply	5 V @ 0.5 A max. (from USB port)	
Dimensions	200 mm x 140 mm x 35 mm	
Weight	< 0.5 kg	
Compliance	<a href="#">European EMC and LVD standards</a> <sup>[3]</sup> <a href="#">FCC Rules Part 15 Class A</a> <sup>[3]</sup>	
Performance specifications		
Timebase accuracy	50 ppm	
Voltage accuracy	1% of full scale (20 °C to 40 °C)	
Trigger resolution	1 LSB	
Overshoot	12% max.	

Specifications correct at 18 August 2008

## 4 Programming with the PicoScope 4000 Series

An Application Programming Interface (API) is supplied free of charge with the PicoScope 4000 Series scopes. You can install it from the product CD (if you enable this option in the installer) or by downloading it from our website at [www.picotech.com](http://www.picotech.com). The software includes a Programmer's Guide in PDF format.

## 5 Glossary

**AC/DC switch.** To switch between AC coupling and DC coupling, select AC or DC from the control on the PicoScope toolbar. The AC setting filters out very low-frequency components of the input signal, including DC, and is suitable for viewing small AC signals superimposed on a DC or slowly changing offset. In this mode you can measure the peak-to-peak amplitude of an AC signal but not its absolute value. Use the DC setting for measuring the absolute value of a signal.

**Analog bandwidth.** The input frequency at which the measured signal amplitude is 3 decibels below the true signal amplitude.

**Buffer size.** The size of the oscilloscope buffer memory, measured in samples. The buffer allows the oscilloscope to sample data faster than it can transfer it to the computer.

**Device Manager.** Device Manager is a Windows program that displays the current hardware configuration of your computer. On Windows XP or Vista, right-click 'My Computer,' choose 'Properties', then click the 'Hardware' tab and the 'Device Manager' button.

**Driver.** A program that controls a piece of hardware. The driver for the PicoScope 4000 Series PC Oscilloscopes is supplied in the form of a 32-bit Windows DLL, `ps4000.dll`. This is used by the PicoScope software, and by user-designed applications, to control the oscilloscopes.

**Maximum sampling rate.** A figure indicating the maximum number of samples the oscilloscope can acquire per second. The higher the sampling rate of the oscilloscope, the more accurate the representation of the high-frequency details in a fast signal. "MS/s" is an abbreviation for megasamples (millions of samples) per second.

**Oversampling.** Oversampling is taking measurements more frequently than the requested sample rate, and then combining them to produce the required number of samples. If, as is usually the case, the signal contains a small amount of noise, this technique can increase the effective [vertical resolution](#)<sup>[12]</sup> of the oscilloscope.

**PC Oscilloscope.** A virtual instrument formed by connecting a PicoScope 4000 Series scope unit to a computer running the PicoScope software.

**PicoScope 4000 Series.** Pico Technology's high-resolution PC Oscilloscopes.

**PicoScope 4224.** The digits in the part number have the following meanings: 4\_\_\_\_ = 4000 Series; \_2\_ = 2 channels; \_\_2\_ = 12-bit resolution; \_\_\_\_4 = 80 MS/s sampling rate.

**PicoScope 4424.** The digits in the part number have the following meanings: 4\_\_\_\_ = 4000 Series; \_4\_ = 4 channels; \_\_2\_ = 12-bit resolution; \_\_\_\_4 = 80 MS/s sampling rate.

**PicoScope software.** A software product that accompanies all Pico PC Oscilloscopes. It turns your PC into an oscilloscope, spectrum analyser, and meter display.

**Timebase.** The timebase controls the time interval that each horizontal division of a scope view represents. There are ten divisions across the scope view, so the total time across the view is ten times the timebase per division.

USB 1.1. Universal Serial Bus (Full Speed). This is a standard port used to connect external devices to PCs. A typical USB 1.1 port supports a data transfer rate of 12 megabits per second, so is much faster than an RS232 COM port.

USB 2.0. Universal Serial Bus (High Speed). This is a standard port used to connect external devices to PCs. A typical USB 2.0 port supports a data transfer rate 40 times faster than USB 1.1 when used with a USB 2.0 device, but can also be used with USB 1.1 devices.

Vertical resolution. A value, in bits, indicating the precision with which the oscilloscope converts input voltages to digital values. [Oversampling](#)<sup>[11]</sup> (see above) can improve the effective vertical resolution.

Voltage range. The range of input voltages that the oscilloscope can measure. For example, a voltage range of  $\pm 100$  mV means that the oscilloscope can measure voltages between -100 mV and +100 mV. Input voltages outside this range will not damage the instrument as long as they remain within the protection limits stated in the [Specifications](#)<sup>[9]</sup> table.



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