



# **PicoScope 6000A/B Series**

## **PC Oscilloscopes**

User's Guide



# Contents

1 Welcome .....	1
2 Introduction .....	2
<b>1 Using this guide</b> .....	2
<b>2 Safety symbols</b> .....	2
<b>3 Safety warnings</b> .....	2
<b>4 FCC notice</b> .....	3
<b>5 CE notice</b> .....	3
<b>6 Software licence conditions</b> .....	3
<b>7 Returns and upgrades</b> .....	4
<b>8 Trademarks</b> .....	4
<b>9 Warranty</b> .....	4
<b>10 Company details</b> .....	4
3 Product information .....	5
<b>1 Package contents</b> .....	5
<b>2 Selection table</b> .....	5
<b>3 Minimum PC requirements</b> .....	5
<b>4 Installation instructions</b> .....	6
<b>5 Connections</b> .....	7
4 Glossary .....	8
Index .....	9



# 1 Welcome

Thank you for buying a PicoScope 6000 Series oscilloscope from Pico Technology!

The PicoScope 6000 Series scopes have comparable features and specifications to traditional bench-top oscilloscopes, but are more economical and take up only a fraction of the space.



This manual describes the following oscilloscopes:

PicoScope 6402A	250 MHz oscilloscope with <a href="#">Function Generator</a>
PicoScope 6402B	250 MHz oscilloscope with <a href="#">AWG</a>
PicoScope 6403A	350 MHz oscilloscope with <a href="#">Function Generator</a>
PicoScope 6403B	350 MHz oscilloscope with <a href="#">AWG</a>
PicoScope 6404A	500 MHz oscilloscope with <a href="#">Function Generator</a>
PicoScope 6404B	500 MHz oscilloscope with <a href="#">AWG</a>

Here are some of the benefits provided by your new PicoScope 6000 Series oscilloscope:

- **Portability:** Take the unit with you and plug it in to any Windows PC.
- **Performance:** Up to 5 GS/s sampling, 500 MHz bandwidth and 1 [GS](#) buffer.
- **Flexibility:** Use it as an oscilloscope, spectrum analyzer or high-speed data acquisition interface.
- **Programmability:** The PicoScope 6000 Series SDK 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, as the PicoScope 6000 Series scope contains the special hardware you need and nothing more.
- **Convenience:** The software makes full use of the full-sized display, disk storage, user interface and networking built in to your PC.
- **Five-year warranty:** Your oscilloscope is covered for five years from the day of purchase against manufacturing faults. We don't charge a penny extra for this benefit.

## 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.

### 2.2 Safety symbols

The following symbols appear on the front panel of the PicoScope 6000 Series 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 warnings



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.

**DO NOT** exceed the overload protection range. The product is designed to measure signals within the range  $\pm 20$  V. The inputs can withstand  $\pm 100$  V to ground (when set to 1 M  $\Omega$  impedance) or 5.5 V RMS (when set to 50  $\Omega$  impedance). Contact with voltages outside the overload protection range may cause permanent damage to the unit.

**DO NOT** connect to mains voltages. The product is not designed for use with mains (line) voltages. To measure mains voltages, use a differential isolating probe specifically rated for mains use.

**DO NOT** rely on the scope's ground as a safety ground. The product connects directly to the ground of a computer through the USB cable provided. This ground is for signaling and shielding, and is not a safety ground.

**DO NOT** connect 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. Connecting the ground input to a voltage source may cause damage to the scope and the computer, and injury to yourself and others.

## 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 product meets the intent of the EMC directive 89/336/EEC and has been tested to EN61326-1:2006 Class A Emissions and Immunity standard.

The product also meets the intent of the Low Voltage Directive and has 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 ('Pico') grants a license 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 and agree to abide by these conditions.

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

**Copyright.** Pico claims the copyright of and reserves the rights to all material (software, documents etc.) contained in this release.

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

**Fitness for purpose.** No two applications are the same, so Pico cannot guarantee that its equipment or software is suitable for a given application. It is therefore the user's responsibility to ensure that the product is suitable for the user's application.

**Mission-critical applications.** Because the software runs on a computer that may be running other software products, and may be subject to interference from these other products, this license specifically excludes usage in 'mission-critical' applications, for example life-support systems.

**Viruses.** This software was continuously monitored for viruses during production. However, the user is responsible for virus checking the software once it is installed.

**Support.** No software is ever error-free, but if you are dissatisfied with the performance of this software, please contact our technical support staff.

## 2.7 Returns and upgrades

Returns. If you are dissatisfied with this product, please return it to your supplier within 14 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.

## 2.8 Trademarks

*Windows* is a trademark of Microsoft Corporation in the United States and other countries. *Pico Technology* and *PicoScope* are internationally registered trademarks of Pico Technology Ltd. *Pico Technology* 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.

## 2.9 Warranty

Pico Technology warrants upon delivery, and for a period of 5 years 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.

## 2.10 Company details

Address: Pico Technology  
James House  
Colmworth Business Park  
St. Neots  
Cambridgeshire  
PE19 8YP  
United Kingdom

Phone: +44 (0) 1480 396 395

Fax: +44 (0) 1480 396 296

Email:

Technical Support: [support@picotech.com](mailto:support@picotech.com)

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

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

## 3 Product information

### 3.1 Package contents

- PicoScope 6000 Series oscilloscope
- Set of factory-compensated probes:
  - 4 x TA131 x1/x10 250 MHz probe with PicoScope 6402A & 6402B
  - 4 x TA101 x10 350 MHz probe with PicoScope 6403A & 6403B
  - 4 x TA133 x10 500 MHz probe with PicoScope 6404A & 6404B
- MI106 USB cable
- PS010 Universal mains (AC) power supply
- MI247 UK mains lead [other types supplied according to region]
- DO115 Installation Guide
- DI025 Software and Reference CD
- MI272 Carrying case

### 3.2 Selection table

PicoScope model number	6402A	6402B	6403A	6403B	6404A	6404B
Channels	4					
<a href="#">Vertical resolution</a>	8 bits					
<a href="#">Bandwidth</a>	250 MHz		350 MHz		500 MHz	
<a href="#">Maximum sampling rate</a>	5 GS/s					
<a href="#">Timebases</a>	10 ns/div to 200 s/div (1 ns/div to 200 s/div with <a href="#">ETS</a> )					
<a href="#">Buffer memory</a>	128 MS	256 MS		512 MS		1 GS
Signal generator	<a href="#">Function</a>	<a href="#">AWG</a>	<a href="#">Function</a>	<a href="#">AWG</a>	<a href="#">Function</a>	<a href="#">AWG</a>

For full specifications, see the PicoScope 6000 Series Data Sheet available from [picotech.com](http://picotech.com).

### 3.3 Minimum PC requirements

To ensure that your PicoScope 6000 Series 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	Specification
Operating system	Windows XP SP2 Windows Vista Windows 7 32 bit and 64* bit versions supported
Processor	As required by Windows
Memory	
Free disk space	
Ports	USB 1.1 compliant port (absolute minimum)** USB 2.0 compliant port (recommended)

\* While the driver will run on a 64 bit operating system, the driver itself is 32 bit, and therefore will run as 32 bit.

\*\* The oscilloscope will run slowly on a USB 1.1 port. This configuration is not recommended.

## 3.4 Installation instructions

### IMPORTANT

Always install the PicoScope software before connecting your PicoScope 6000 Series oscilloscope to the PC. This ensures that Windows will correctly recognize the oscilloscope.

#### Procedure

- Follow the instructions in the USB Oscilloscope Installation Guide included with your product package.
- Connect the AC adapter (supplied) to a power socket using the appropriate cable (also supplied), and connect the DC output of the AC adapter to the "DC Power" socket on the back of the oscilloscope.
- Connect the oscilloscope to the PC using the USB cable supplied.

#### Checking the installation

Once you have installed the software and connected the 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 noise signal in the oscilloscope window when you touch the probe tip with your finger.

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

##### ● Windows XP SP2

When you first installed the 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 and Windows 7

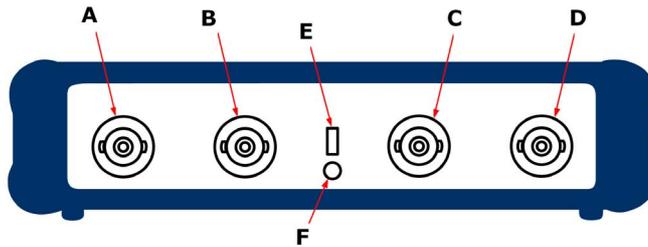
The process is automatic. When you move the device from one port to another, Windows displays an "Installing device driver software" message and then a "PicoScope 6000 Series oscilloscope" message. The oscilloscope is then ready for use.

### 3.5 Connections

#### Standard oscilloscope connectors

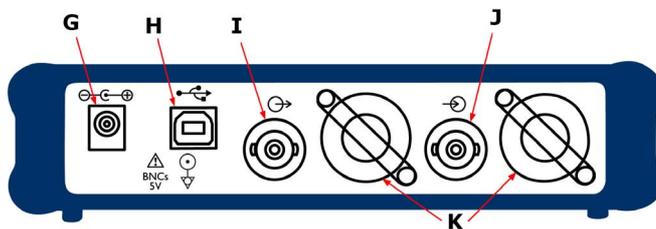
The PicoScope 6000 Series oscilloscopes have standard BNC input and output connectors. The channel inputs have switchable impedances of 50  $\Omega$  or 1 M $\Omega$ . In high-impedance mode, they are compatible with all standard scope probes including 10:1 attenuated types. To ensure that you obtain the rated bandwidth from the scope, we recommend that you use the compensated high-frequency probes supplied with it.

#### Connector diagrams



Front panel  
PicoScope 6000 Series

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



Rear panel  
PicoScope 6000 Series

- G. DC power socket: for use with the AC adaptor supplied with the unit
- H. USB 2.0 port: connects to your PC using the Hi-Speed USB cable supplied
- I. SIGNAL OUT connector: carries the output of the [signal generator](#) and (if present) [arbitrary waveform generator](#)
- J. AUX IN connector: carries the auxiliary (AUX) trigger and reference clock inputs
- K. Ventilation holes. Do not block the air intake holes or insert any objects through them, as this could damage the unit and cause injury.

## 4 Glossary

AWG. Arbitrary waveform generator. A signal generator that can play back a waveform of any shape defined by the user.

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.

ETS. Equivalent time sampling. A sampling mode that increases the effective sampling rate of the oscilloscope by capturing multiple cycles of a signal and combining them. This technique works only with repetitive, stable signals such as pulse trains.

Function generator. A signal generator that produces standard waveforms such as sine and square waves.

GS. Gigasamples (approx. 1 billion samples).

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. Megasamples (approx. 1 million samples).

PC Oscilloscope. A virtual instrument formed by connecting a PicoScope oscilloscope to a computer running the PicoScope software.

PicoScope software. A software product that accompanies all PicoScope oscilloscopes. It turns your PC into an oscilloscope, spectrum analyzer and multimeter.

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 2.0. Universal Serial Bus. This is a standard port used to connect external devices to PCs. The port supports a data transfer rate of up to 480 megabits per second, so is much faster than the RS-232 COM ports found on older PCs.

Vertical resolution. A value, in bits, indicating the precision with which the oscilloscope converts input voltages to digital values.

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 [Safety warnings](#).

# Index

## A

AWG 5

## B

Bandwidth 5

BNC connector 7

Buffer memory 5

## C

Cable, USB 5

Calibration output 7

Carry case 5

CD, software and reference 5

CE notice 3

Channels 5

Company information 4

Connections 7

Contact details 4

## E

EMC Directive 3

External trigger 7

## F

FCC notice 3

Function generator 5

## G

Grounding 2

## I

Installation 6

## L

LED 7

Low Voltage Directive (LVD) 3

## M

Mains voltages 2

Maximum sampling rate 5

## O

Oscilloscope probe 7

## P

PC requirements 5

Pico Technical Support 4

PicoScope 6000 Series 1

PicoScope software 6

Power socket 7

Probes 5

## R

Returns 4

## S

Safety

    symbols 2

    warning 2

Scope probe 7

Signal generator 5

    output 7

Software license conditions 3

## T

Technical support 4

Trademarks 4

Trigger

    external 7

## U

Upgrades 4

USB 5

    cable 5

    changing ports 6

## W

Warning triangle 2

Warranty 4







## Pico Technology

James House  
Colmworth Business Park  
ST. NEOTS  
Cambridgeshire  
PE19 8YP  
United Kingdom  
Tel: +44 (0) 1480 396 395  
Fax: +44 (0) 1480 396 296  
[www.picotech.com](http://www.picotech.com)

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