



# **PicoScope 6000A/B/C/D Series**

## **PC Oscilloscopes**

User's Guide



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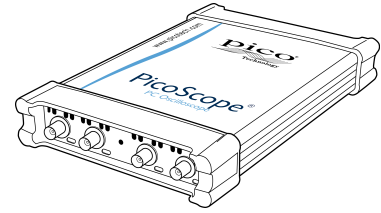
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# 1 Welcome

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.



## Current PicoScope models

Model	<a href="#">Connectivity</a>	<a href="#">Bandwidth</a>	<a href="#">Buffer size</a>	<a href="#">Signal generator</a>
6402C	USB 3.0	250 MHz	256 MS	<a href="#">Function generator</a>
6402D	USB 3.0	250 MHz	512 MS	<a href="#">AWG</a>
6403C	USB 3.0	350 MHz	512 MS	Function generator
6403D	USB 3.0	350 MHz	1 GS	AWG
6404C	USB 3.0	500 MHz	1 GS	Function generator
6404D	USB 3.0	500 MHz	2 GS	AWG

## Discontinued PicoScope models

Model	Connectivity	Bandwidth	Buffer size	Signal generator
6402A	USB 2.0	250 MHz	128 MS	Function generator
6402B	USB 2.0	250 MHz	256 MS	AWG
6403A	USB 2.0	350 MHz	256 MS	Function generator
6403B	USB 2.0	350 MHz	512 MS	AWG
6404A	USB 2.0	500 MHz	512 MS	Function generator
6404B	USB 2.0	500 MHz	1 GS	AWG

These are just 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. All scopes in this series can be connected to USB 2.0 and USB 3.0 ports.
- **Performance:** Up to 5 GS/s sampling, 500 MHz bandwidth and 2 GS buffer.
- **Flexibility:** Use it as an oscilloscope, spectrum analyzer, serial decoder, 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 Pico technical specialists for support. Both of these services are available free of charge for the lifetime of the product.
- **Value for money:** You don't have to pay twice for all of the features already available in your PC, as the PicoScope 6000 Series scope contains the dedicated 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 Safety information

To prevent possible electrical shock, fire, personal injury, or damage to the product, carefully read this safety information before attempting to install or use the product. In addition, follow all generally accepted safety practices and procedures for working with and around electricity.

The product has been designed and tested in accordance with the European standard publication EN 61010-1: 2010, and left the factory in a safe condition.



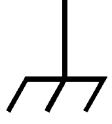
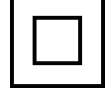




The following safety descriptions are found throughout this guide:

A **WARNING** identifies conditions or practices that could result in injury or death.

A **CAUTION** identifies conditions or practices that could result in damage to the product or equipment to which it is connected.

#### 2.1.1 Symbols

These safety and electrical symbols may appear on the product or in this guide.

Symbol	Description
	Direct current.
	Alternating current.
	Chassis ground terminal. This symbol is now used in place of the equipotential symbol which may appear on older products.
	Equipment protected throughout by double insulation or reinforced insulation.
	Possibility of electric shock.
	Caution.
	Static awareness. Static discharge can damage part(s).
<b>CAT</b>	IEC 61010 overvoltage category.
	Do not dispose of this product as unsorted municipal waste.

### 2.1.2 Maximum input ranges

Observe all terminal ratings and warnings marked on the product.

**WARNING**

PicoScope 6000 Series PC oscilloscopes are designed to measure signals within the range  $\pm 20$  V when set to 1 M $\Omega$  impedance ( $\pm 5$  V when set to 50  $\Omega$  impedance). To prevent electric shock, do not measure voltages outside of this range.

**WARNING**

To prevent electric shock, take all necessary safety precautions when working on equipment where voltages above  $\pm 20$  V may be present. Although the front-panel BNC inputs of the oscilloscope are designed to withstand accidental overloads up to  $\pm 100$  V when set to 1 M $\Omega$  impedance (5.5 V RMS when set to 50  $\Omega$  impedance), contact with voltages outside of the specified measuring range of  $\pm 20$  V presents a risk of electric shock. The rear panel BNCs are protected against accidental overloads up to  $\pm 5$  V.

**WARNING**

To prevent injury or death, the oscilloscope must not be directly connected to the mains (line power). To measure mains voltages, use a differential isolating probe specifically rated for mains use, such as the TA041 listed on the Pico website.

**CAUTION**

Exceeding the overload protection range on any connector can cause permanent damage to the oscilloscope and other connected equipment.

### 2.1.3 Grounding

**WARNING**

The oscilloscope's ground connection through the USB cable is for measurement purposes only. The oscilloscope does not have a protective safety ground.

**WARNING**

Never connect the ground input (chassis) to any electrical power source. To prevent personal injury or death, use a voltmeter to check that there is no significant AC or DC voltage between the oscilloscope ground and the point to which you intend to connect it.

**CAUTION**

Applying a voltage to the ground input is likely to cause permanent damage to the oscilloscope, the attached computer, and other equipment.

**CAUTION**

To prevent measurement errors caused by poor grounding, always use the high-quality USB cable supplied with the oscilloscope.

## 2.1.4 External connections

**WARNING**

To prevent injury or death, only use the power cord and adaptor supplied with the product. These are approved for the voltage and plug configuration in your country.

## 2.1.5 Environment

**WARNING**

To prevent injury or death, do not use in wet or damp conditions, or around explosive gas or vapor.

**CAUTION**

To prevent damage, always use and store your oscilloscope in appropriate environments.

	Storage	Operating
<b>Temperature</b>	-20 °C to +60 °C	0 °C to +40 °C (+20 to +30 °C for quoted accuracy)
<b>Humidity</b>	5% to 95% RH (non-condensing)	5 % to 85% RH (non-condensing)

## 2.1.6 Care of the product

The product contains no user-serviceable parts. Repair, servicing and calibration require specialized test equipment and must only be performed by Pico Technology or an approved service provider. There may be a charge for these services unless covered by the Pico five year warranty.

**WARNING**

To prevent injury or death, do not use the product if it appears to be damaged in any way, and stop use immediately if you are concerned by any abnormal operations.

**CAUTION**

Do not tamper with or disassemble the oscilloscope, connectors or accessories. Internal damage will affect performance.

**CAUTION**

Do not block the air vents at the back or front of the instrument as overheating will damage the oscilloscope.

**CAUTION**

When cleaning the product, use a soft cloth and a solution of mild soap or detergent in water. Do not allow water to enter the oscilloscope casing, as this will cause damage to the electronics inside.



## 2.2 Conformance

### 2.2.1 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](#).

### 2.2.2 CE notice

The product meets the intent of the **EMC directive 2004/108/EC** and has been tested to **EN61326-1:2006 Class A Emissions and Basic Immunity**.

The product also meets the intent of the **Low Voltage Directive** and has been designed to meet **BS EN 61010-1:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use**.

## 2.3 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 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.

## 2.4 Returns and upgrades

**Returns.** If you are dissatisfied with this product, please return it to your supplier within fourteen days of purchase for a full refund.

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

## 2.5 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.

## 2.6 Warranty

Pico Technology **warrants** upon delivery, and for a period of five 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, willful 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.

## 2.7 Company details

<b>Address</b>	Pico Technology James House Colmworth Business Park St. Neots Cambridgeshire PE19 8YP United Kingdom
<b>Phone</b>	+44 (0) 1480 396 395
<b>Fax</b>	+44 (0) 1480 396 296
<b>Email</b>	
Technical Support	<a href="mailto:support@picotech.com">support@picotech.com</a>
Sales	<a href="mailto:sales@picotech.com">sales@picotech.com</a>
<b>Website</b>	<a href="http://www.picotech.com">www.picotech.com</a>

## 3 Product information

### 3.1 Package contents

Order code	Description	Package information
-	PicoScope 6000 Series oscilloscope	
TA150	Factory-compensated probes x10 350 MHz	x4, 6402 and 6403 models
TA133	Factory-compensated probes x10 500 MHz	x4, 6404 models
MI106	USB 2.0 cable	A/B models (discontinued)
TA155	USB 3.0 cable	C/D models (current)
PS010	Universal mains AC power supply	
MI247	UK mains lead (other types supplied according to region)	
DO115	Installation guide	
DI025	PicoScope software and reference CD	
MI272	Carry case	

### 3.2 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, such as those with multi-core processors.

Item	Specification
<b>Operating system</b>	Windows XP (SP3), Windows Vista, Windows 7, Windows 8 (not Windows RT)
	32 bit and 64 bit versions supported*
<b>Processor</b>	As required by Windows
<b>Memory</b>	
<b>Free disk space</b>	
<b>Ports</b>	<a href="#">USB 2.0</a> compliant port** <a href="#">USB 1.1</a> compliant port (absolute minimum)***

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

\*\* USB 3.0 recommended for 6000C/D Series.

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

### 3.3 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 SP3

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, Windows 7 and Windows 8

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.

### 3.4 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.

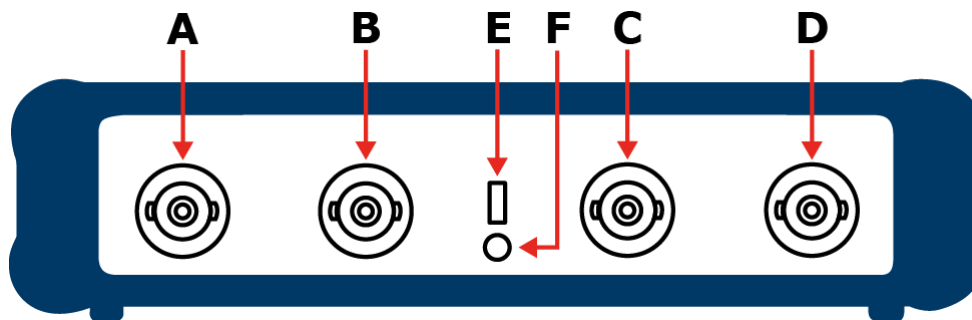
In 50  $\Omega$  mode, you can connect a signal from a 50  $\Omega$  source using a 50  $\Omega$  BNC cable without the need for an external terminator. This creates an impedance-matched connection for minimal reflections, losses and distortion.



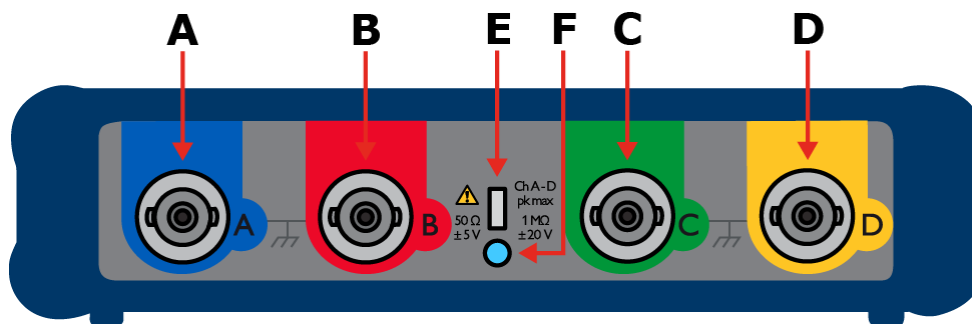
#### CAUTION

The input voltage range is reduced to 5.5 V RMS when using 50  $\Omega$  input mode.

#### Connector diagrams

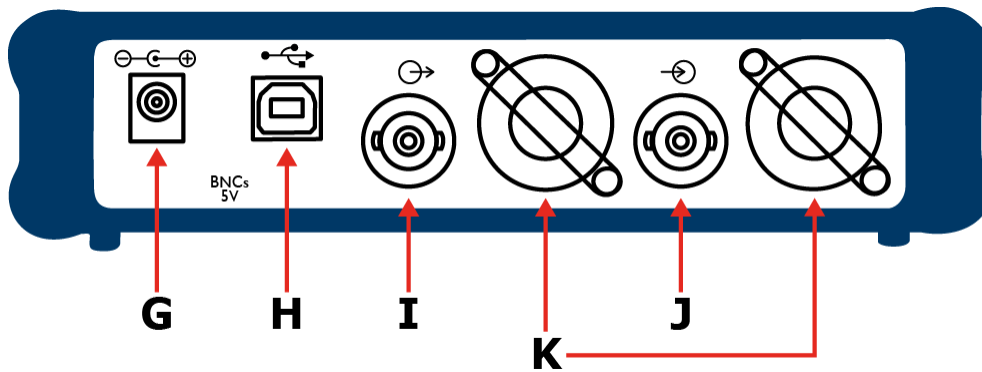


#### Front panel: A and B models

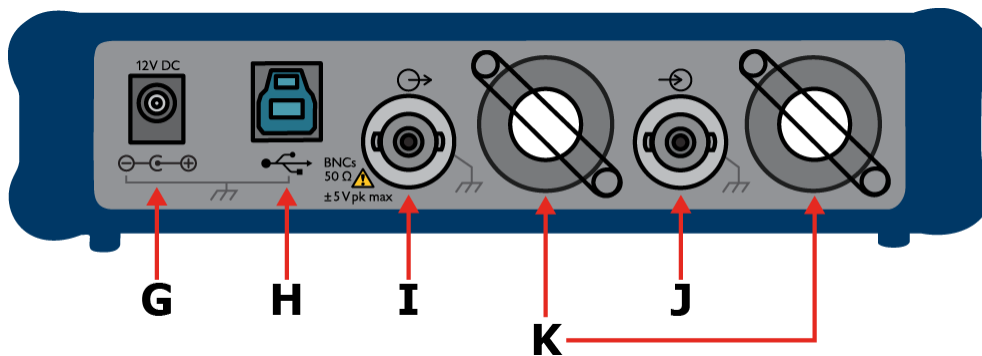


#### Front panel: C and D models

- A.** Input channel A
- B.** Input channel B
- C.** Input channel C
- D.** Input channel D
- E.** Probe compensation output
- F.** LED to indicate when the oscilloscope is sampling data



**Rear panel: A and B models**



**Rear panel: C and D models**

- G.** DC power socket, for use with the AC adaptor supplied with the unit.
- H.** USB 3.0/2.0 port, providing connectivity to your PC using the high-quality USB cable supplied.
- I.** SIGNAL OUT connector, carrying the output of the [signal generator](#) and [arbitrary waveform generator](#) (where available).
- J.** AUX IN connector, carrying the auxiliary (AUX) trigger and reference clock inputs.
- K.** Air vents (present on the front and back of the scope).



**CAUTION**

To prevent overheating and other damage, do not block the air vents or insert any objects through them.

## 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 (approximately 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 (approximately 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.

**Signal generator.** Generates a waveform which can be used to drive a test signal through a BNC cable into an external circuit or into one of the oscilloscope's input channels. The PicoScope software allows the generator to output standard waveforms, such as sine and square waves or, if the hardware allows, arbitrary waveforms defined by the user.

**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 (USB) is a standard port that enables you to connect external devices to PCs. A USB 1.1 port uses signaling speeds of up to 12 megabits per second, much faster than an RS-232 port.

**USB 2.0.** The second generation of USB interface. The port supports a data transfer rate of up to 480 megabits per second.

**USB 3.0.** A USB 3.0 port uses signaling speeds of up to 5 gigabits per second and is backwards-compatible with USB 2.0 and USB 1.1.

**Vertical resolution.** A value, in bits, indicating the number of voltage levels that the oscilloscope can distinguish.

**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](#).



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