PicoScope 2200 Series

PC Oscilloscopes

User's Guide

Contents

1   Welcome

The PicoScope 2200 Oscilloscopes are compact units designed to replace traditional bench-top oscilloscopes costing many times the price.

Here are some of the benefits provided by your PC Oscilloscope:

- Portability: Take the unit with you and plug it in to any Windows PC.
- Performance: Fast sampling from 100 MS/s to to 1 GS/s, probe-tip bandwidths from 10 MHz to 200 MHz and fast USB 2.0 interface. See Model Selector⌐6⌐ for details of each scope model.
- Flexibility: Use it as an oscilloscope, spectrum analyzer, or high-speed data acquisition interface.
- Programmability: The PicoScope 2000 series APIs allow you to 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 specialists for technical support. You can continue to use both of these services free of charge for the lifetime of the product.
- Value for money: Buying a PicoScope PC Oscilloscope means that you don't have to pay twice for all the features that you already have in your PC. The PicoScope 2200 Series oscilloscope contains the special hardware you need and nothing more.
- Convenience: The software makes full use of the display, storage, user interface and networking built in to your PC.
- Dependability: Your scope is backed by a 5-year warranty against manufacturing faults.

Additional information

For full technical specifications, see the following brochure and data sheet:

    For PicoScope models 2204 to 2208: *PicoScope 2000 Series Data Sheet (MM012)*

The following manuals explain how to use the Application Programming Interface (API) to control a PicoScope 2200 Series Oscilloscope:

    For PicoScope models 2204 to 2205: *PicoScope 2000 Series Programmer's Guide*
    For PicoScope models 2206 to 2208: *PicoScope 2000 Series (A API) Programmer's Guide*

These documents are available from http://www.picotech.com.

2   Introduction

2.1   Using this guide

In this guide you will see symbols like this: ⌐2⌐ 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 top of the PicoScope 2200 Series oscilloscopes:

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 connected together. You must therefore take necessary precautions to avoid applying a voltage across the shells of the indicated BNC connectors. Such a voltage could cause a large current to flow, resulting in damage to the oscilloscope and other connected equipment.

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. The PicoScope 2200 Series oscilloscopes are designed to measure voltages in the range -20 V to +20 V. The Ch A and Ch B inputs are protected to ±100 V. Contact with voltages outside the protection range may cause permanent damage to the unit.

Mains voltages. These products are not designed for use with mains (line) voltages. To measure mains, use a differential isolating probe specifically designed for mains voltages.

Safety grounding. The PicoScope 2200 Series 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.

Repairs. The oscilloscope contains no user-serviceable parts. Repair or calibration of the oscilloscope requires specialised test equipment and must be performed by Pico Technology.

2.4 Regulatory notices

FCC Notice

This equipment has been tested to meet CFR47 (2006) Part 15 of the FCC limits for Class A equipment. 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 .

CE Notice

The PicoScope 2200 PC Oscilloscopes meet the intent of the EMC directive 89/336/ EEC and have been designed and tested to EN61326-1 (2006) Class A Emissions and Immunity standard.

The PicoScope 2200 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.

2.5 Software licence conditions

The software supplied with this product 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 Limited 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; for example, 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 14 days of purchase for a full refund.

Upgrades. We provide upgrades, free of charge, from our web site at www.picotech. com. We reserve the right to charge for updates or replacements sent out on physical media.

2.6 Trademarks

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

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

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

2.7 Warranty

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

2.8 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
Sales:	sales@picotech.com
Web site:	www.picotech.com

3   Product information

3.1   Model selector

Model	PicoScope 2204	PicoScope 2205	PicoScope 2206	PicoScope 2207	PicoScope 2208
Number of channels			2		
Vertical resolution [12]			8 bits		
Analog bandwidth [11]	10 MHz	25 MHz	50 MHz	100 MHz	200 MHz
Maximum sampling rate [11]					
Real-time, one channel in use	100 MS/s	200 MS/s	500 MS/s	1 GS/s	1 GS/s
Real-time, two channels in use	50 MS/s	100 MS/s	250 MS/s	500 MS/s	500 MS/s
Equivalent-time (ETS)	2 GS/s	4 GS/s	5 GS/s	10 GS/s	10 GS/s
Buffer size [11] (shared between enabled channels)	8 k	16 k	24 k	32 k	40 k
Dimensions (including connectors)	150 x 100 x 37 mm (5.9 x 3.9 x 1.5 in.)		200 x 140 x 40 mm (7.9 x 5.5 x 1.6 in.)		

Full specifications are listed in the PicoScope 2000 Series datasheet, available on our website.

3.2   Pack contents

Your PicoScope 2200 Series oscilloscope package contains the following items:

Reorder code	Quantity	Description
-	1	PicoScope 2200 Series oscilloscope
MI106	1	USB cable, for connection to the USB port on your PC
DI042	1	Software and Reference CD, with PicoScope [11] software, drivers [11], and example programs.
DO115	1	USB Oscilloscope Installation Guide

3.3   System requirements

To ensure that your PicoScope 2200 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	Absolute minimum	Recommended minimum	Recommended full specification
Operating system	Windows XP SP2 or later, Windows Vista or Windows 7 32-bit or 64-bit		
Processor	As required by Windows	300 MHz	1 GHz
Memory		256 MB	512 MB
Free disk space[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.

3.4   Installation instructions

> **IMPORTANT**
> Do not connect your oscilloscope 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 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 11 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 noise 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 oscilloscope by plugging it into a USB 12 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 2000 series PC Oscilloscope" message. The PC Oscilloscope is then ready for use.
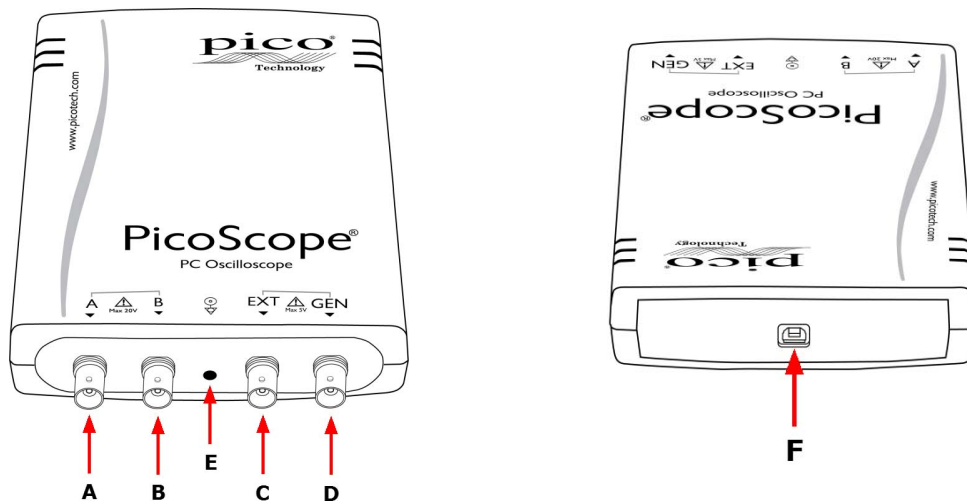
3.5   Connections

3.5.1   Connector diagrams (PicoScope 2204 to 2205)
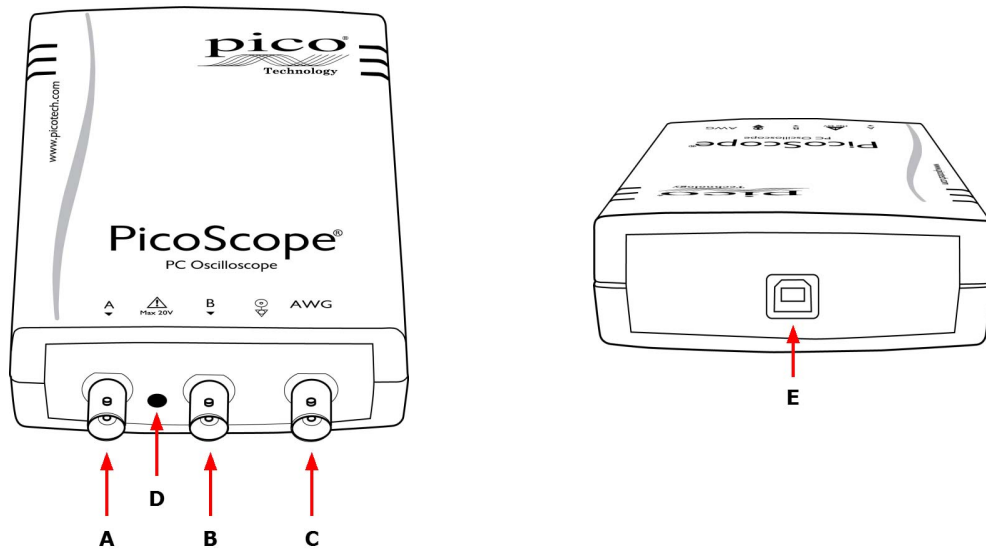
A. Input channel A [9]
B. Input channel B [9]
C. Signal generator output [9]
D. LED: shows when the oscilloscope is sampling data
E. USB port [10]

3.5.2   Connector diagrams (PicoScope 2206 to 2208)

A. Input channel A [9]
B. Input channel B [9]
C. EXT trigger input [9]
D. Signal generator output [9]
E. LED: shows when the oscilloscope is sampling data
F. USB port [10]

3.5.3 Signal inputs

The PicoScope 2200 Series oscilloscopes have BNC oscilloscope connectors. The inputs have an impedance of 1 MΩ, so they are compatible with all standard scope probes including x10 attenuated types.

3.5.4 Compensating probes

We recommend that you compensate each oscilloscope probe before using it with your PicoScope. Compensation instructions specific to the probe are included in the leaflet supplied with the probe.

Connecting a probe for compensation

1. Connect your probe to the signal generator output as shown on the right.

2. Run the PicoScope software.

3. Click the AWG button and set the AWG to generate a 1 kHz 1 volt square wave.

4. Follow the compensation (or 'trimming') instructions in the probe leaflet.

3.5.5 AWG connector

The AWG connector (labelled GEN or Signal Out on some oscilloscopes) on the front panel carries the output of the oscilloscope's built-in signal generator, which can generate a number of built-in waveforms, as well as arbitrary waveforms from a user-defined table of data.

Instructions for use

- If you are using the PicoScope 6 program, refer to the *PicoScope 6 User's Guide* for information on how to configure the signal generator.
- If you are writing your own software, refer to the relevant *Programmer's Guide* 1 .

AWG output specifications

Refer to the PicoScope 2000 Series datasheet, available on our website.

3.5.6 EXT connector

The EXT (External) trigger input on some models can be used as a trigger source. The trigger source is selected using the trigger drop-down menu in the PicoScope software, or using a function call if you are writing your own software.

The EXT input uses dedicated circuitry with a software-configurable threshold to detect a trigger signal. This has the advantage of freeing both analog channels for viewing signals. However, if trigger timing accuracy and resolution are critical, we recommend using the channel A or B input as the trigger source. These channels use digital triggering, which is accurate to one sample period and has a vertical resolution of 1 LSB.

3.5.7   USB port

Connect the oscilloscope's USB port to your PC's USB 2.0 port using the USB cable
supplied. The oscilloscope will work if connected to a USB 1.1 port but will operate at
greatly reduced speed.

4   Glossary

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

Block mode—A fast data collection mode. The PicoScope software puts the oscilloscope into this mode to achieve the fastest possible sampling rates. The oscilloscope collects data as fast as possible and then stops to transfer the data to the PC. During data transfer to the PC in block mode, the oscilloscope cannot sample data from its inputs.

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

Coupling mode—To switch from AC coupling to DC coupling, or vice versa, 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.

Device Manager—Device Manager is a Windows program that displays the current hardware configuration of your computer. On Windows XP or Vista, right-click on '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 2000 Series PC Oscilloscopes is supplied in the form of 32-bit Windows DLLs, `ps2000.dll and ps2000a.dll`. These are used by the PicoScope software to control the oscilloscope.

ETS—Equivalent Time Sampling. Constructs a picture of a repetitive signal by accumulating information over many similar wave cycles. This allows the oscilloscope to create a composite cycle that has more samples, and therefore better time resolution, than a single cycle. ETS cannot be used for one-shot signals.

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—Millions of samples per second. Used to quantify the sampling rate of an oscilloscope.

Oversampling—A technique for reducing noise in sampled signals. Measurements are taken more frequently than the requested sample rate, and then merged 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 [12] of the oscilloscope.

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

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

ps2200.en

Signal generator—Generates a waveform and outputs it on the BNC socket marked AWG, GEN or Signal Out. This output 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 arbitrary waveforms defined by the user.

Streaming mode—A data collection mode in which the oscilloscope samples data and returns it to the computer in a continuous stream. This mode allows the capture of more data than will fit in the oscilloscope's memory buffer, at sampling rates above 1 million samples per second. The PicoScope program selects this mode for long timebases to enable the capture of very long sets of data.

Timebase—A timer that controls the speed at which the scope device captures data. At slow timebases this process is visible as PicoScope draws the trace across the scope view from left to right, but at fast timebases PicoScope draws the whole trace in a single operation. The timebase is measured in units of time (such as seconds) per division. There are ten divisions across the scope view, so the total time across the width of the view is ten times the "per division" setting.

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 or '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 (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 ±100 mV means that the oscilloscope can measure voltages between -100 mV and +100 mV. Input voltages outside this range will not be measured correctly, but will not damage the instrument as long as they remain within the protection limits of ±100 V.

5 Appendix A: Declarations of Conformity

pico ®
Technology

Pico Technology
James House
Colmworth Business Park
Eaton Socon
St Neots   PE19 8YP
Tel: 01480 396395
Fax: 01480 396296

EC Declaration of Conformity

Pico Technology, as suppliers of the following products:

PS2203, PS2204 & PS2205 dual channel oscilloscopes.

Declare that they meet the Electromagnetic Compatibility requirements specified in the European Community Directive EMC Directive 89/336/EEC as amended by: 92/31/EEC & 93/68/EEC.

The following standards have been applied :

EN61326-1:2006   Electrical equipment for measurement, control and laboratory use – EMC requirements.
Class A emissions (emissions section only)

EN61326-1:2006   Electrical equipment for measurement, control and laboratory use – EMC requirements.
Industrial Location Immunity (immunity section only)

CFR 47: 2006   Code of Federal Regulations Part 15 Subpart B – Radio
Class A   Frequency Devices – unintentional Radiators.

Signed

Alan Tong
Managing Director
10th January 2008

Pico Technology Limited is an internationally registered trade mark
Registered in England and Wales No. 2626181

pico ®
Technology

Pico Technology
James House, Marlborough Road.
Colmworth Business Park.
Eaton Socon, St Neots, Cambridgeshire.
PE19 8YP United Kingdom.
Tel: +44 1480 396395. Fax: +44 1480 396296

EC Declaration of Conformity

Pico Technology declares that the following products comply with the requirements of the specified Directives and Standards as listed below. Technical documentation required to demonstrate compliance to the standards is available for inspection by the relevant enforcement authorities. Products carry the CE mark.

Products covered by this Declaration:

PicoScope 2206, 2207 & 2208 two channel USB oscilloscopes

EU Directives covered by this Declaration:

2004/108/EC Electromagnetic Compatibility Directive.
2006/95/EC   Low Voltage Equipment Directive.

The Basis on which Conformity is being Declared:

EN61010-1:2001	Safety requirements for electrical equipment for measurement, control and laboratory use, general equipment requirements.
EN61326-1:2006	EMC Immunity and Emissions for measurement, control and laboratory equipment - general requirements. Test limits and frequencies are specified in CISPR11 and EN61000-4.
CISPR11:2006	Industrial, scientific and medical equipment – radio frequency disturbance characteristics – limits and methods of measurement. Radiated and Conducted emissions. Class A emissions.
CFR 47:2009	Code of Federal Regulations FCC: part 15 Subpart B – Frequency devices – unintentional Radiators. Radiated emissions standard. Class A emissions.
EN61000-4 EN61000-4-2:1995 +A1:1998 +A2:2001 EN61000-4-3:2006 EN61000-4-4:2004 EN61000-4-6:2007	Radiated and Conducted Immunity., including Electrostatic Discharge. Radiated RF. Electrical fast transients and bursts. Conducted RF

Alan Tong   **Signed**
Managing Director
October 2011

Pico Technology Limited is an internationally registered trade mark
Registered in England and Wales No. 2626181

Index

Pico Technology

ps2200.en-1

14.10.11