

PicoScope 3000 Series Automotive

User guide

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1 Introduction

1.1 Overview

The PicoScope 3000 Series Automotive PC Oscilloscopes are a range of high-speed PC oscilloscopes for automotive diagnostic use. They are fully USB 2.0-capable and backwards-compatible with USB 1.1. There is no need for an external power supply as power is supplied from the USB port, making these oscilloscopes highly portable.

With the PicoScope software, PicoScope 3000 Series Automotive PC Oscilloscopes can be used as PC oscilloscopes, spectrum analysers and meters.

A PicoScope 3000 Series Automotive PC Oscilloscope is supplied with the following items:

- USB cable, for use with USB 1.1 and USB 2.0 ports
- Automotive software and reference CD
- Quick start guide

1.2 Minimum PC requirements

For your PicoScope 3000 Series Automotive PC Oscilloscope to operate correctly, you must connect it to a computer with the minimum requirements to run Windows or the following (whichever is the higher specification):

Processor	Pentium-class processor or equivalent minimum.
Memory	32 MB minimum.
Disk space	10 MB minimum.
Operating system	Microsoft Windows 98 SE, ME, 2000, XP or later.
Ports	USB 1.1 compliant port minimum. USB 2.0 compliant port recommended. Must be connected directly to the port or a powered USB hub. Will not work on a passive hub.

1.3 Installation instructions

Important

You must install the PicoScope software before connecting a PicoScope 3000 Series Automotive PC Oscilloscope to your PC for the first time.

Install the software by following the steps in the quick start guide supplied with your oscilloscope. You can then connect your oscilloscope to the PC. **To minimise the risk of electromagnetic interference, please use the USB cable supplied.** There is no need for an additional power supply, as the unit draws its power from the USB port.

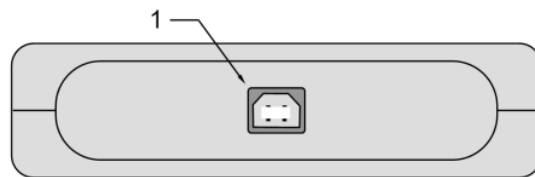
Checking the installation

Once the software has been installed, ensure that the oscilloscope is connected to the PC and then start the PicoScope software. The software should now display the voltage of any signal that is connected to the oscilloscope. If you are using an oscilloscope probe and PicoScope, you should see a small 50 Hz or 60 Hz mains signal in the oscilloscope window when you touch the probe tip with your finger.

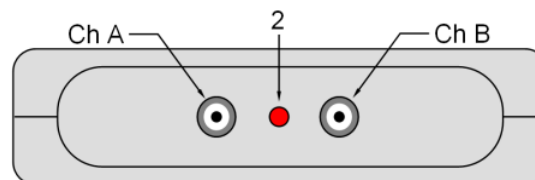
Standard oscilloscope connectors

The PicoScope 3000 Series Automotive PC Oscilloscopes have standard oscilloscope connectors. As the input impedance is also standard, the x10 function on oscilloscope probes works correctly.

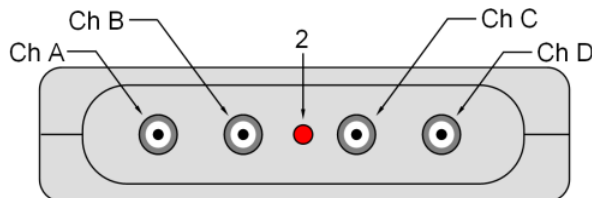
Connector diagrams



Rear view, all models



Front view, PicoScope 3223



Front view, PicoScope 3423

- 1.** USB port connector. Compatible with USB 1.1 and USB 2.0 ports.
- 2.** LED. Lights up when the PicoScope 3000 Series Automotive PC Oscilloscope is first powered up, switches off when the PicoScope software begins to run, and then lights up again when the oscilloscope is sampling data.
- 3.** Ch A. Input channel A. Similarly for B, C and D.

1.4 Safety symbols

Symbol 1: Warning Triangle



This symbol indicates that a safety hazard exists on the indicated connections if you do not take correct precautions. Ensure that you read in detail 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 (i.e. are shorted together). You must therefore take necessary precautions to avoid applying a potential across the return connections of the indicated BNC terminals as this may result in a large current flow, causing damage to the product and connected equipment.

1.5 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 3000 Series Automotive PC Oscilloscopes are designed to measure voltages in the range -50V to +50V. Any voltages in excess of $\pm 100V$ may cause physical damage.

Mains voltages

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

Safety grounding

PicoScope 3000 Series Automotive PC Oscilloscopes connect direct to the ground of a computer via the interconnecting cable provided. This method minimises interference.

As with most oscilloscopes, avoid connecting the ground input to any source other than ground. If in doubt, use a meter to check that there is no significant AC or DC voltage. Failure to check may cause damage to your computer, or lead to injury to

yourself and others.

You should assume that the product does not have a protective safety earth.

Repairs

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

1.6 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](#).

1.7 CE notice

The PicoScope 3000 Series Automotive PC Oscilloscopes meet the intent of the EMC directive 89/336/EEC and are designed to the EN61326-1 (1997) Class B Emissions and Immunity standard.

PicoScope 3000 Series Automotive products also meet the intent of the Low Voltage Directive and are designed to the BS EN 61010-1:2001 IEC 61010-1:2001 (safety requirements for electrical equipment, control, and laboratory use) standard.

1.8 Legal information

The material contained in this 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

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Fitness for purpose

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 use 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 28 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.

Trademarks

Windows and Excel are either trademarks or registered trademarks of Microsoft Corporation. Quattro is a registered trademark of Corel Corporation. Pico Technology Limited and PicoScope are internationally registered trademarks.

1.9 Company details

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2 Product information

2.1 Specifications

	PicoScope 3223	PicoScope 3423
Vertical Resolution	12 bits	
Analog Bandwidth	10 MHz*	
Channels	2	4
Maximum Sampling Rate Single channel Dual channel Three or four channel	20 MS/s 10 MS/s N/A	20 MS/s 10 MS/s 5 MS/s
Buffer Size Single channel Dual channel Three or four channels	512 ksamples 256 ksamples N/A	512 ksamples 256 ksamples 128 ksamples
Inputs	2 x BNC input 1 M Ω impedance	4 x BNC input 1 M Ω impedance
Voltage Ranges	± 50 V, ± 20 V, ± 10 V, ± 5 V, ± 2 V, ± 1 V, ± 500 mV, ± 200 mV, ± 100 mV, ± 50 mV, ± 20 mV	
Accuracy	Voltage: 1% Time: 100 ppm	
Operating Environment Temperature range Humidity	0°C to 70°C (20°C to 30°C for quoted accuracy) 20% to 90% RH	
Overload Protection	± 100 V	
PC Connection	USB 2.0 Compatible with USB 1.1	
Power Supply	From USB port: 500 mA @ 4.5 V No external power supply required	
Dimensions	140 mm x 190 mm x 45 mm	
Compliance	CE standard ; FCC standard	

* 5 MHz on ± 20 mV range

3 Advanced features

3.1 Sampling modes

PicoScope 3000 Series Automotive PC Oscilloscopes run in various sampling modes. At high sampling rates, the oscilloscope collects data much faster than a PC can read it. To compensate for this, the oscilloscope stores a block of data in an internal memory buffer, delaying transfer to the PC until the required number of data points have been sampled. This is called [block mode](#). At very low sampling rates, you may want to switch to [streaming mode](#). This allows data to be transferred back to the PC as it is collected.

3.2 More on block mode

In block mode, the computer prompts a PicoScope 3000 Series Automotive PC Oscilloscope to collect a block of data into its internal memory. When the oscilloscope has collected the whole block, it will signal it is ready and transfer the whole block into the computer memory via the USB port. The maximum number of samples in each block depends upon the size of the oscilloscope's memory.

3.3 More on streaming mode

In streaming mode, the computer prompts the PicoScope 3000 Series Automotive PC Oscilloscope to start collecting data. The data is then transferred back to the PC without being stored in oscilloscope memory. Data can be sampled with a period of between 1 ms and 60 s, and the maximum number of samples is limited only by the amount of free space on the PC's hard disk.

3.4 AC/DC coupling

Each channel can be set to either AC or DC coupling. When AC coupling is used, any DC component of the signal is filtered out. This mode is useful for viewing ripple on signals such as the alternator and fuel pump currents, where the DC level of the signal is of no interest. DC coupling is recommended for most other automotive measurements.

To switch from alternating current to direct current, or vice versa, select AC or DC from the control on the oscilloscope toolbar of the PicoScope software application. The setting should be adjusted to suit the characteristics of the input signal.

3.5 Oversampling

When the oscilloscope is operating in block mode at speeds that are less than maximum, it is possible to oversample. Oversampling is taking more than one measurement during a time interval and returning an average. This reduces the effects of noise, and increases the effective resolution of the oscilloscope.

4 Glossary

AC/DC control

Each channel can be set to either AC coupling or DC coupling. With DC coupling, the voltage displayed on the screen is equal to the true voltage of the signal with respect to ground. With AC coupling, any DC component of the signal is filtered out, leaving only the variations in the signal (the AC component).

Analog bandwidth

All oscilloscopes have an upper limit to the range of frequencies at which they can measure accurately. The analog bandwidth of an oscilloscope is defined as the frequency at which a displayed sine wave has half the power of the input sine wave (about 71% of the amplitude).

Block mode

A sampling mode in which the computer prompts the oscilloscope to collect a block of data into its internal memory before stopping the oscilloscope and transferring the whole block into computer memory. This mode of operation is effective when the input signal being sampled is high frequency. Note: To avoid aliasing effects, the maximum input frequency must be less than half the sampling rate.

Buffer size

The size of the oscilloscope buffer memory. The buffer memory is used by the oscilloscope to temporarily store data. This helps to compensate for the differences in data transfer rate from one device to another.

Maximum sampling rate

A figure indicating the maximum number of samples the oscilloscope is capable of acquiring per second. Maximum sample rates are usually given in MS/s (megasamples per second) or GS/s (gigasamples per second.) The higher the sampling capability of the oscilloscope, the more accurate the representation of the fine details in a fast signal.

PC Oscilloscope

A generic term used to describe a PicoScope 3000 Series Automotive PC Oscilloscope and the PicoScope software application.

PicoScope 3000 Series Automotive

An oscilloscope range comprising the PicoScope 3223 and PicoScope 3423 Automotive PC Oscilloscopes.

PicoScope software

This is a software product that accompanies all our oscilloscopes. It turns your PC into an oscilloscope, spectrum analyser, and meter display.

Spectrum analyser

An instrument that measures the energy content of a signal in each of a large number of frequency bands. It displays the result as a graph of energy (on the vertical axis) against frequency (on the horizontal axis). The PicoScope software includes a spectrum analyser.

Streaming mode

A sampling mode in which the oscilloscope samples data and returns it to the computer in an unbroken stream. This mode of operation is effective when the input signal being sampled is low frequency.

Timebase

The timebase controls the time interval across the scope display. If you select **Timebase is time per division** in the **Preferences** dialogue box, this works like a traditional bench top scope. There are ten divisions across the screen, so the total time interval is ten times the timebase.

USB 1.1

USB is the abbreviation for Universal Serial Bus. This is a standard port that enables you to connect external devices to PCs. A typical USB 1.1 port supports a data transfer rate of 12 Mbps (12 megabits per second), and is much faster than a serial port.

USB 2.0

USB is the abbreviation for Universal Serial Bus. This is a standard port that enables you to connect external devices to PCs. A typical USB 2.0 port supports a data transfer rate that is 40 times faster than that supported by USB 1.1. An additional feature of USB 2.0 is that it is backwards compatible with USB 1.1.

Vertical resolution

A value, in bits, indicating the degree of precision with which the oscilloscope can turn input voltages into digital values. Calculation techniques can improve the effective resolution.

Voltage range

The voltage range is the range between the maximum and minimum voltages that can be accurately captured by the oscilloscope.

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