ADC-20 and ADC-24

High-Resolution Data Loggers

User's Guide

Contents

1   Welcome

Thank you for buying a PicoLog ADC-20 or ADC-24 from Pico Technology!

The ADC-20 and ADC-24 high resolution data loggers are multichannel, high-accuracy USB data loggers for use with PCs. Features such as true differential inputs, galvanic isolation and software-selectable sample rates all contribute to a superior noise-free resolution.

The 8 channel ADC-20 is equipped with a 20-bit A/D converter, and can maintain a gain error of 0.2%. The four true differential inputs may be configured as eight single-ended inputs or any combination in between, such as two differential and four single-ended.

The 16 channel ADC-24 is equipped with a 24-bit A/D converter, and can maintain a gain error of 0.1%. The eight true differential inputs may be configured as 16 single-ended inputs or any combination in between.

Power and connection to a PC or laptop is through a USB 1.1, USB 2.0 or 3.0 port. Using our PicoLog data logging software, you can record, monitor and analyze collected data, even exporting to third-party applications such as Microsoft Excel.

PicoLog software is free to download from www.picotech.com/downloads and can be used with any laptop or PC running Windows, macOS or Linux.

The following items are supplied in the package:

- ADC-20 or ADC-24 High-Resolution Data Logger
- Quick Start Guide

For detailed technical information, please refer to the ADC-20 and ADC-24 Data Sheet.

An optional PP310 ADC-20/ADC-24 Terminal Board is designed for use with both data loggers. For simple applications, you can connect sensor wires to the screw terminals on the terminal board, without the need for soldering. For more advanced applications, the terminal board enables you to modify, offset and extend the input ranges and build sensor circuits that condition measurements for the data loggers to process.

Software Development Kit
You can download a free Software Development Kit (SDK) from www.picotech.com/downloads. This enables you to write your own applications to control the ADC-20 and ADC-24. Refer to the *ADC-20 and ADC-24 Programmer's Guide* for further information.

> ⚠ **CAUTION**
>
> For safety information, please read the *Quick Start Guide* supplied with the data logger. For the most recent version of the *Quick Start Guide*, please download it from our website here.

2 General information

2.1 Conformance

The ADC-20 and ADC-24 comply with CE marking regulations and FCC Part 15 Subpart B.

For more information, please refer to your product's EU Declaration of Conformity, available for download from ADC-20-and-ADC-24-manuals.

2.2 Software license conditions

Grant of license. The material contained in this 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.

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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.

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

2.3 Trademarks

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macOS is a trademark of Apple Inc., registered in the U.S. and other countries.

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

2.4 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, 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.

2.5 Minimum system requirements

To ensure that your ADC-20 or ADC-24 data logger operates correctly, you must have a computer with at least the minimum system requirements as shown in the following table. The performance of the data logger will be better with a more powerful PC, and will benefit from a multi-core processor.

	Specification
Operating system	Windows 7, Windows 8, Windows 10. 32-bit and 64-bit versions. Software is also available for Linux (64-bit) and macOS operating systems.
Processor	
Memory	As required by the operating system.
Free disk space	
Ports	USB 3.0 or USB 2.0 port(s)

2.6 Long term support

Software upgrades and beta versions are available to download from our website. You can also call or email our technical specialists for support, or visit our support forum. All of these services are available free of charge for the lifetime of the product.

3   Getting started

3.1   Connecting the data logger

Before you connect the ADC-20 or ADC-24 to your computer for the first time, you must download and install the PicoLog software which is available free from www.picotech.com/downloads.

When you have installed the software, connect the data logger's USB cable to a spare USB port on your computer:

DB25 connector   Status LED and USB cable

3.2   Checking the installation

1. When you have connected the data logger to the PC, click the PicoLog icon on your desktop or if you are using macOS, select it in the Launchpad application launcher to start the software:
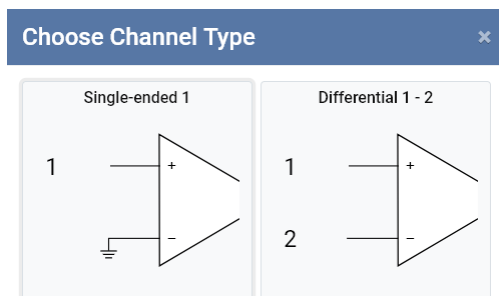

PicoLog icon

2. On the screen you will see an image of the data logger in the **Devices** tab:

3. Select an input channel on the data logger image; then choose either a single ended or differential channel type:

4. Configure the channels accordingly:

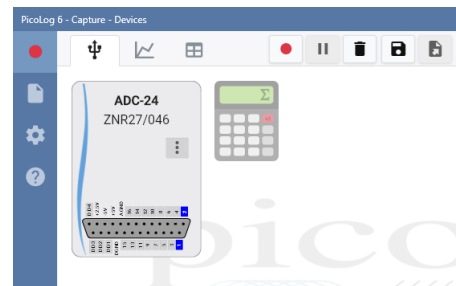Single-ended channel configuration   Differential channel configuration

Advanced options allow selection of sample mode (average or latest sample) and probe or custom scaling (no scaling, equation scaling or table scaling).

5. Click **Add channel** and either a single channel will be highlighted or if differential was chosen, two channels will be assigned and highlighted:
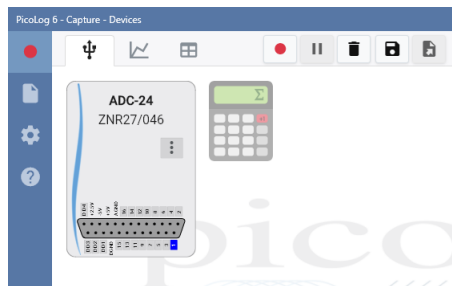
Single-ended channel assigned   Differential channel assigned

6. Connect a suitable voltage (for example, from a 1.5 V battery) to a single-ended channel to make a simple check. Pin connections are marked on the logger and also listed in the Analog connector topic.

7. Click the red **Start recording** button and choose a Capture setting of either **Unlimited** or **Fixed** length. Don't forget to ensure there is sufficient PC storage capacity:
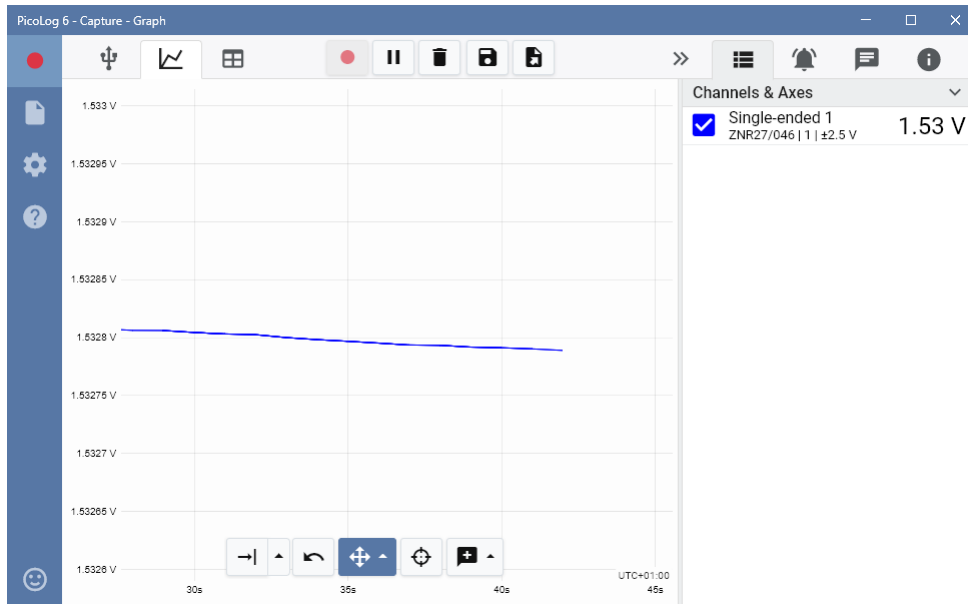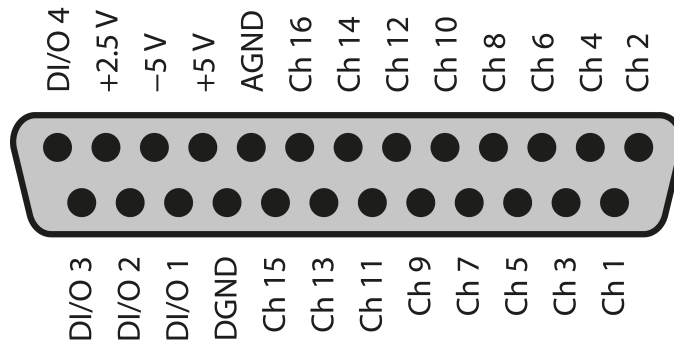

8. Click **Start capture** to begin recording data.

9. Click the **Graph** tab to view the trace of recorded voltage data. The measured voltage value is displayed in the **Channels & Axes** list on the right of the screen:

4   About the unit

4.1   DB25 analog connector

Analog inputs are connected to the ADC-20 and ADC-24 through the female DB25 connector. The connections are as follows:


Pin	Function	Pin	Function
1	Channel 2 (Channel 1−)	14	Channel 1
2	Channel 4 (Channel 3−)	15	Channel 3
3	Channel 6 (Channel 5−)	16	Channel 5
4	Channel 8 (Channel 7−)	17	Channel 7
5	Channel 10 (Channel 9−)	18	Channel 9
6	Channel 12 (Channel 11−)	19	Channel 11
7	Channel 14 (Channel 13−)	20	Channel 13
8	Channel 16 (Channel 15−)	21	Channel 15
9	Analog Ground (AGND)	22	Digital Ground (DGND)
10	+5 volts	23	Digital I/O 1
11	−5 volts	24	Digital I/O 2
12	+2.5 volts	25	Digital I/O 3
13	Digital I/O 4		

Note 1:   Channel numbers in brackets apply when the input is set to differential mode.

Note 2:   Channels 9 to 16 exist only on the ADC-24.

Note 3:   Digital I/Os 1 to 4 exist only on the ADC-24.

Note 4:   Pins 10 and 11 are low-current outputs for powering small sensors. Do not exceed the current limits given in the specifications.

Note 5:   The analog and digital grounds are not connected together inside the unit. You should not connect them together externally, as this would degrade the accuracy of the unit.

Note 6:   For easy connection to the DB25 connector, we recommend that you use the ADC-20/ADC-24 terminal board.

4.2   ADC-20/ADC-24 terminal board

For easy connection to the DB25 connector, we recommend that you use the ADC-20/ADC-24 terminal board, part number PP310. This has screw terminals to allow you to connect wires to all of the data logger's inputs and outputs without soldering. It also has space for voltage-divider resistors, a temperature sensor and a quad op-amp:
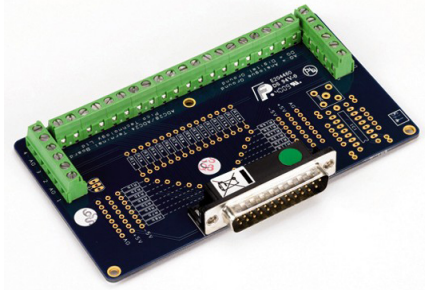
See the *ADC-20/ADC-24 Terminal Board User's Guide* for instructions on connecting signals to the terminal board. If you are not using a terminal board, you can still refer to the *Terminal Board User's Guide* for information on connecting various types of signal to the data logger.

4.3   LED

The ADC-20 and ADC-24 have an LED next to the entry point of the USB cable that you can use to verify that the unit is working. The LED flashes whenever the unit is taking readings. It also flashes briefly during "enumeration" which is the process that PicoLog uses to detect all Pico USB devices plugged in to the computer.

5   Glossary

Data logger. A measuring instrument that monitors one or more analog signals, samples them at pre-programmed intervals, then accurately converts the samples to digital data and stores them in memory. The ADC-20 and ADC-24 use your PC for storage and display.

EMC. Electromagnetic compatibility. The ability of a device to operate in proximity with other devices without causing or suffering undue interference from electromagnetic fields or conducted electrical noise.

Gain error. Gain error is the worst deviation of a measurement from the true value, measured over the whole input range and expressed as a percentage.

Galvanic isolation. A barrier between two parts of an electrical circuit that prevents noise and voltage offsets in one part from affecting the other part.

Noise-free resolution. Any measurement is subject to noise. In a digital measuring instrument, a result with a resolution of n bits may include m bits of noise. The noise-free resolution is then n-m bits.

Resolution. A value, in bits, indicating the number of unique digital values that the converter can produce. If the resolution is n bits, then the number of unique values is 2 to the power n.

USB. Universal Serial Bus. This is a standard port that enables you to connect external devices to PCs. A full-speed USB 2.0 port operates at up to 480 megabits per second. The ADC-20 and ADC-24 are also compatible with any USB port from USB 1.1 upwards.

UK headquarters:

Pico Technology
James House
Colmworth Business Park
ST NEOTS
Cambridgeshire
PE19 8YP
United Kingdom

Tel: +44 (0) 1480 396 395

sales@picotech.com
support@picotech.com

www.picotech.com

USA regional office:

Pico Technology
320 N Glenwood Blvd
Tyler
Texas 75702
United States of America

Tel: +1 800 591 2796

sales@picotech.com
support@picotech.com

Asia-Pacific regional office:

Pico Technology
Room 2252, 22/F, Centro
568 Hengfeng Road
Zhabei District
Shanghai 200070
PR China

Tel: +86 21 2226-5152

pico.china@picotech.com