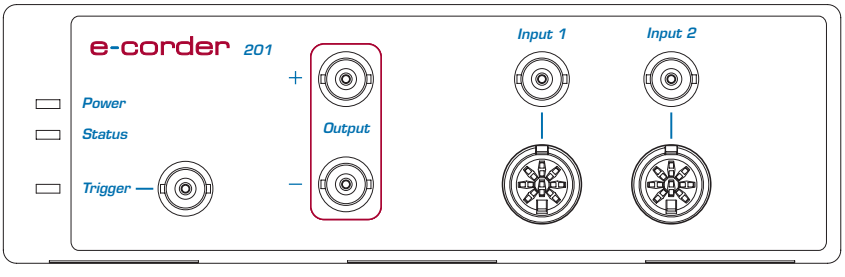
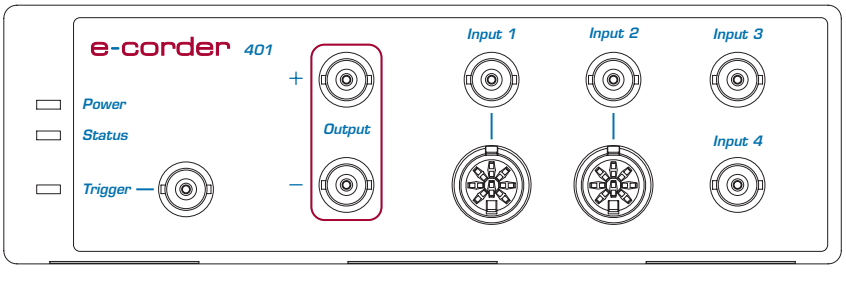
e-corder User Manual

e-corder





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e-corder 401 (ED401)

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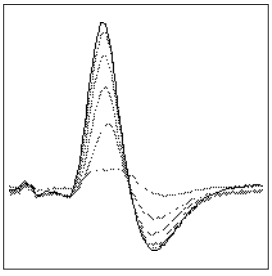

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CHAPTER ONE

Overview

Your e-corder recording unit, together with the Chart and Scope software, provides a versatile data recording and analysis system when used with a Windows or Macintosh computer. This chapter provides an overview of the e-corder system and describes its basic features.

Unpacking

As soon as you unpack your e-corder unit please check that:

- all items described in the packing list are included; and that
- there are no signs of damage that may have occurred during transit.

Contact your eDAQ distributor if you encounter a problem.

How to Use this Guide

This manual describes the features of the e-corder system and its connection to your computer. The appendixes provide technical information about the recording unit, and solutions to problems. Please note that only an authorized eDAQ distributor should attempt repairs. If you modify the recording unit yourself, you void any rights you have under warranty.

The *Chart and Scope Software Manuals* provide detailed information on how to use your e-corder system to acquire, display, and analyze data.

The System

The e-corder system is an integrated system of hardware and software designed to record, display, and analyze experimental data. The hardware comprises the e-corder recording unit and possible ancillary devices (eDAQ Amps, or Pods); the Chart and Scope software run on the computer to which the e-corder is connected.

The Hardware

▲ ***WARNING!***
Applying more than 15 V to the analog inputs can damage the eDAQ unit.

The e-corder 201 (or 401) hardware unit is a two, (or four) channel data acquisition system that accepts analog voltage signals up to ±10 V. It can be directly connected to most laboratory equipment that would otherwise use a chart recorder, XY–plotter, or oscilloscope to record data.

Because the e-corder unit sits outside the computer, connected via a USB interface, it is subject to less electrical interference than an internal data acquisition card. It is also easily transferred from one computer to another.

Apart from amplifying and filtering the signal the e-corder has considerable processing power and performs many tasks that are necessary during data recording. Data is transferred to the computer in packets, though in most cases the software displays data in a smooth scrolling mode. Once on the computer, the data are available for review, analysis, storage, printing, or transfer to other graphing or analysis software.

The Software

Chart and Scope software are provided on the Installer CD that is included with each e-corder. Chart emulates a multi–channel chart recorder (up to 16 channels can be displayed). Scope emulates a two–channel storage oscilloscope or XYT plotter. Both provide many other features in addition to simple data acquisition, including computed functions, triggering options, software–controlled waveform generation, and automated recording and analysis. The *Chart and Scope Software Manuals* on the Installer CD provide more details.

Computer Requirements

Windows

- A computer with a Pentium processor or better
- 32 MB free RAM (48 MB for Windows 2000)
- Windows XP, 2000 or later operating system
- USB installed

Macintosh

- A G3, G4 or later Macintosh computer
- 32 MB free RAM (64 MB recommended)
- Mac OS X or later

- USB installed

Other Hardware

eDAQ has a range of optional preamplifiers that can be connected to the e-corder. eDAQ Amps are automatically recognized and configured by the software.

The range of eDAQ Amps includes the:

- pH/mV Amp, suitable for connection of pH, ion selective, and potentiometric (ORP) electrodes
- Potentiostat, a three–electrode potentiostat that can be used for voltammetric and amperometric experiments. Gain ranges of 20 nA to 100 mA in 1:2:5 steps.
- Picostat, a high sensitivity three–electrode potentiostat suitable for use with carbon fibre and other microelectrodes. Current gain ranges of 10 pA to 100 nA in 1:2:5 steps.
- Bridge Amp, suitable for sensors requiring a low drift, high gain differential amplifier. Also provides DC excitation
- GP Amp, suitable for high output sensors requiring a high impedance single ended or differential amplifier. Also provides DC excitation.

eDAQ Pods our range of miniature preamplifiers:

- pH Pod suitable for use with most combination pH electrodes and combination potentiometric redox (ORP) electrodes.
- Conductivity Pod for use with conductivity cells.
- RTD Pod signal conditioner for 100 Ω Pt RTD's.
- Thermocouple Pod for use with appropriate T– or K–type thermocouple probes.

Other Software

PowerChrom software (chromatographic data collection and analysis) and EChem software (electroanalytical chemistry experiments) are also available for use with your e-corder system.

See our web site at www.eDAQ.com for more information.

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CHAPTER TWO

Setting Up

This chapter starts with the e-corder internal self-test, then looks at how to connect up your e-corder to a computer. It discusses the USB connection in some detail.

The e-corder

First familiarize yourself with some of the external features of your e-corder before connecting it to a power source. The rest of this chapter discusses the different features, connectors, and indicators of the e-corder 201 and e-corder 401.

The Front Panel

The front panel of your e-corder, shown in Figure 2–1, provides most of the connectors for interfacing with external signals, and indicators for various functions. This section describes each of the front panel features.

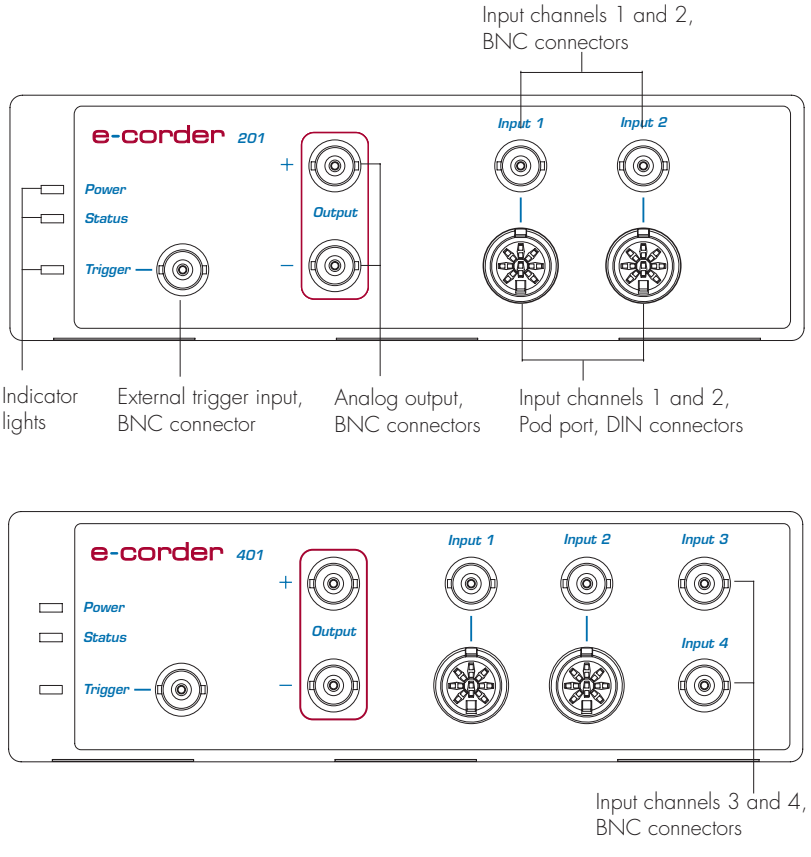


Figure 2–1
The e-corder front panels.

Indicator Lights

There are three lights that indicate when power is on, recording status, and trigger state.

All three should turn on at least briefly when the e-corder is first turned on. The Power indicator should glow blue and then stay lit, the Status indicator should flash yellow and then stay green, and the Trigger indicator should flash yellow and then turn off. When an external trigger signal is received, the Trigger indicator will glow yellow. The Status indicator provides some visual indication of what the e-corder is doing, and will flash different patterns and colors depending on the state of the e-corder, Table 2–1. These lights are used in the e-corder self test on power up (page 16)

Table 2–1
Status indicator functions.

Status Indicator	*Meaning*
Off	Idle and not yet initialized by the software.
Green	Idle, initialized, and waiting for a command from the computer.
Yellow	Sampling, or communicating with the computer.
Four red flashes and one yellow one	The e-corder has detected a low-level software or firmware fault. It will repeat until the power to the e-corder is turned off.
Red flashes	The e-corder has detected an internal fault during the power-up test. It will repeat until the power to the e-corder is turned off.

Analog Inputs

Each e-corder analog input has an independently programmable gain amplifier with its own filtering, and AC/DC coupling. You can set up each input with separate amplification and filtering settings to suit your requirements — see the *Chart and Scope Software Manuals* on the Installer CD.

▲ ***WARNING!***
Applying more than 15 V to the analog inputs can damage the eDAQ unit.

Each e-corder input has gains of up to ×5000 making it possible to record many signal ranges up to ±10 V without the need for an intervening preamplifier. The input amplifiers can be operated with or without AC coupling. The AC coupling mode is equivalent to applying a 0.1 Hz high pass filter to remove the DC (baseline) signal

▲ ***CAUTION!***
e-corder inputs and outputs are not electrically isolated. If an isolated input is required a suitable isolated preamplifier must be used.

component. Low pass digital filtering can be selected in software from 1 Hz to 2 kHz. Note that each input is fitted with a fixed 20 kHz anti–aliasing low pass filter, which is the effective upper limit of the bandwidth. This filter is active even when the software selectable digital filters are turned off.

The impedance of the e-corder inputs is one megohm (1 MΩ). If you are using high impedance transducers (> 10 kΩ) you should consider using the GP Amp or pH Amp, which provide input impedances of 10^8 and 10^{13} Ω respectively, or other suitable high input impedance preamplifier.

The e-corder grounds the amplifiers of those input channels not in use. It also grounds each amplifier and measures the DC offset voltage when the gain is changed. In this way, the software corrects for any DC drift or offset in the circuits that may develop over time or between readings. The operation of the input amplifiers is illustrated by the block diagrams shown in Figure 2–2.

BNC Input Connectors

Each analog input channel is fitted with a BNC connector on the front panel of the e-corder unit (Input 1, Input 2 etc.). These connectors are used for single–ended signals (difference between signal and ground). The outer shell of each of the BNC connectors is equivalent to the Input Reference pin of the Pod DIN connector (Figure 2–3) and provides a pathway to ground via the equivalent circuit shown in Figure 2–2.

Pod Input Connectors

Input channels 1 and 2 also have alternative Pod 8–pin DIN connectors. Pod connectors allow the connection of eDAQ Pods — our range of miniature preamplifiers. The Pod DIN connectors can also be used to connect transducers requiring power (±5 V DC at 50 mA continuous), and/or differential input (separate + and – signal components as well as ground). Pod inputs also provide several grounding options which can be useful in electrically noisy environments.

Do not attempt to record from both the BNC and Pod connectors of the same input channel at the same time — the signals will compete and the results will be unpredictable.

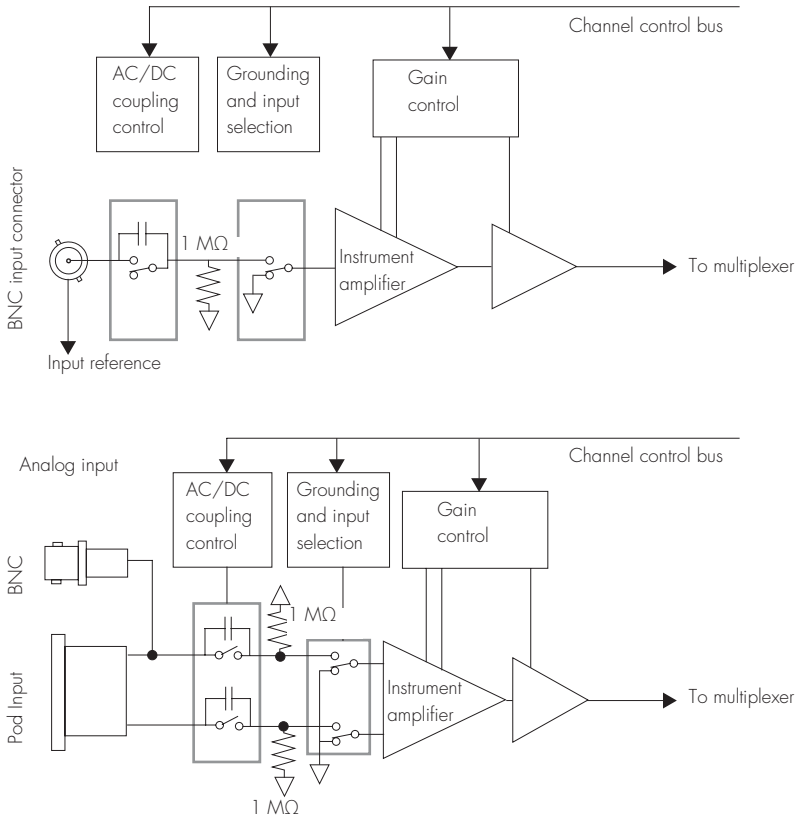


Figure 2–2
Block diagram of the e-corder input circuits.

For a transducer, or other device, requiring single–ended connection (without shield) use the 'Signal input +' and 'Input reference' pin positions. This is equivalent to using the input channel BNC connector. In rare cases the 'Analog Ground' position may provide less noise than the 'Input reference' position. If the connection cable also uses a shield, then this can be connected to the 'Digital Ground' position.

Signals from transducers requiring differential input may be monitored by connecting them to the 'Signal input +' and 'Signal input –' pin positions. If a shield is also required then connect it to the 'Digital Ground' position.

The SCL and SDA pin positions are special control lines for eDAQ Pods — you should never connect other devices to these.

Please take care when wiring transducers or other equipment to the Pod connectors. Incorrect or faulty wiring can lead to damage of the

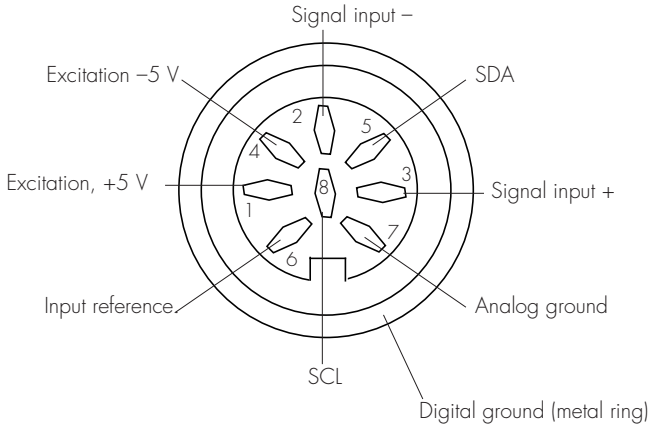


Figure 2–3
Pod input connector pin assignments

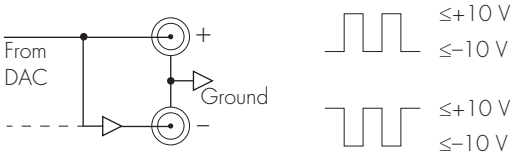


Figure 2–4
e-corder analog output circuit.

e-corder, the transducer (or other equipment) or both. Such damage is not covered under the terms of your warranty.

Analog Output

The e-corder can produce an analog voltage signal via its Output sockets. The output is bipolar, that is, mirror image waveforms are provided by the Output + and Output – connectors, Figure 2–4. For example, if a 2.5 V pulse is configured in the software, then a +2.5 V pulse will appear at the Output + connector and a –2.5 V pulse at the Output – connector. A maximum output of ±10 V can be applied with a maximum current sink of 25 mA.

Control of the output is via a 14 bit DAC (digital–to–analog convertor) inside the e-corder, that is configured by using the Stimulator commands in the Chart and Scope software.

Trigger

The trigger connector (external trigger) enables an external signal to be used to synchronize recording with an external device. The trigger input can be software–configured to respond to a standard TTL or contact closure signal. The trigger signal must be present for at least 5 µs to register as an event. When a trigger event occurs, the trigger indicator light will glow yellow.

The TTL threshold level, above which a trigger event is registered, is 2.9 V ± 0.25 V, however, once on, the trigger turns off at 1.8 V ±0.25 V, giving a hysteresis voltage of 1.1 V. The external trigger input draws 1 mA at the threshold, 2.2 mA at 5 V and 5.5 mA at 10 V. The input will be overloaded if the voltage exceeds ±12 V.

When TTL configured, a voltage must be applied across the outer ring and the inner pin of the Trigger BNC connector. In this mode the trigger input is optically isolated, as shown in Figure 2–5. Note that there is no

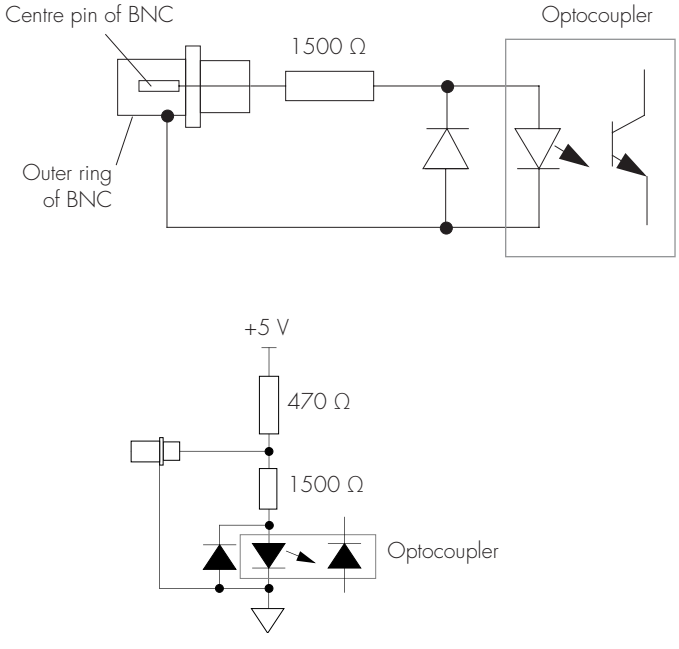


Figure 2–5
e-corder trigger circuit.

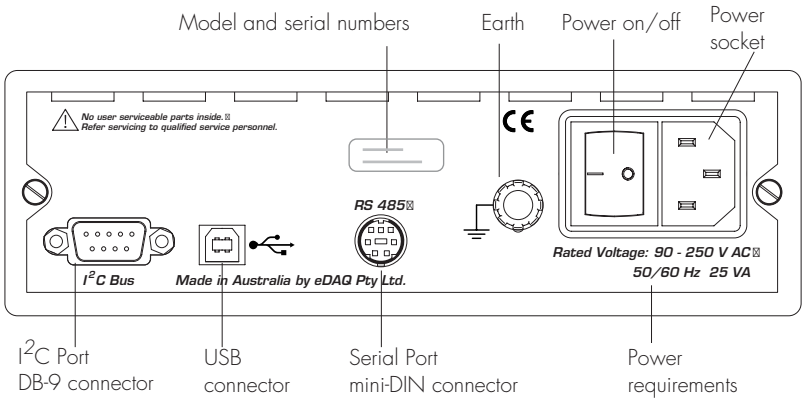


Figure 2–6
The e-corder back panel.

electrical connection between the external trigger ground and the ground of the triggering device. This removes ground noise and current loop problems, and improves static discharge immunity.

In the external contact closure mode, the trigger input will respond to a direct short between the centre pin and outer ring of the BNC connector. This is typically achieved with an external relay contact, a manual push–button, or a microswitch. The trigger input is not electrically isolated when configured for contact closure.

The Back Panel

The e-corder back panel is shown in Figure 2–6. This section describes each of the back panel features. The back panels are the same for the e-corder 201 and e-corder 401.

I²C Output

The I²C output is a special port designed to connect to eDAQ Amps made by eDAQ. It supplies power and communications. An e-corder can have as many eDAQ Amps connected as it has input channels (two or four), connected in a daisy-chain arrangement. Further details can be found in your specific eDAQ Amp Manual located on the Install CD.

Note. You should not attempt to run other external devices from the I²C port: it is designed for use only with eDAQ Amps.

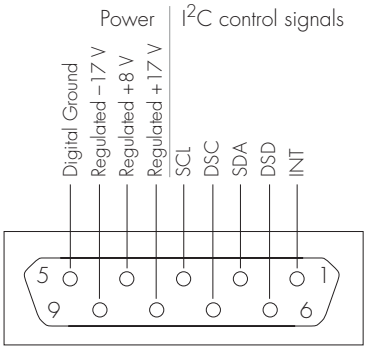


Figure 2–7
I²C connector pin assignments

USB Port

The e-corder connects to your computer using a USB (universal serial bus) port. This works with USB 1.1 or USB 2 compliant computers (Windows XP or 2000 or later, or Macintosh with OS 8.5 or later).

You can safely turn on or off, or disconnect or reconnect, the e-corder while the computer remains on. The Chart or Scope software must not be running while this occurs. Read the details on USB in Chapter 2 of this guide before connecting your e-corder to your computer using USB.

Auxiliary Ground

An auxiliary ground 4 mm terminal post has been provided on the back panel of the e-corder. It can be used as a convenient location for grounding Faraday cages, preamplifiers, or otherwise unearthed ancillary equipment.

Serial Port

The RS485 serial port connector, Figure 2–8, is for factory diagnostic and testing procedures only. It should NOT be used to connect to your computer!

Power

The power switch on the back panel of the e-corder turns the e-corder on and off. A 3-pin IEC power socket is used to connect your e-corder

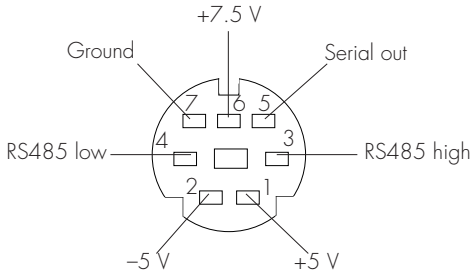


Figure 2–8
Serial port pin assignments.

to a 3-pin earthed (grounded) power cable. Unearthed (2-pin) power sockets or adaptors do not provide safe operation! The e-corder universal power supply can use mains power supplies between 90–260 V AC, 50/60 Hz.

Self-Test

Now that you are familiar with some of the features of your e-corder, you should check that it is working properly before you connect it to your computer.

The e-corder performs a diagnostic self-test each time it is switched on, whether or not it is connected to a computer. To test that your e-corder is functioning properly when you turn it on, follow the instructions below:

1. Connect the e-corder to a power outlet using the power cable that came with your unit. Turn the power on at the wall.

2. Turn on the power switch located on the rear of the unit.

3. All three labelled indicators on the front panel should turn on at least briefly while the e-corder is started up. The Power indicator (Figure 2–1) on the front panel should glow blue while the e-corder is on. If the internal diagnostic check finds no problems, the Status indicator should flash yellow, and then stay green. The Trigger indicator should flash yellow, and then turn off.

If the indicators perform as described above, then your e-corder can be safely connected to your computer.

If the Power indicator does not glow blue when the power switch is turned on, then there is a problem with the power source, power cable, or e-corder itself — check all connections.

If an error is detected during the self-test, the Status indicator will flash red, which means there is a hardware fault. Turn everything off, and then after at least five seconds turn the e-corder back on again. This should clear a temporary problem. If the Status indicator continues to flash red, then the e-corder may need repair and you should contact your eDAQ representative.

If a problem persists contact your authorized eDAQ representative. Do not attempt to repair the e-corder yourself (this will void your rights under warranty).

USB Connection

The e-corder is fitted with a USB (universal serial bus) port, with which it is connected to a USB 1.1 or 2 compliant computers.

All the devices on a USB network have a common communication pathway, if you have many devices with a lot of information to transfer, they compete for capacity (bandwidth). Using a video camera and a scanner at the same time as an e-corder may limit the sampling rates considerably (in Chart) or increase delay times between sweeps (in Scope). To ensure maximum reliability we recommend avoiding using such devices while the e-corder is acquiring data.

The USB standard allows for two types of cable:

- low-speed cables suitable for mice and keyboards.
- high speed detachable USB cables. These are fully shielded twisted-pair cables, with standard USB connectors: a narrow rectangular 'A plug' at one end and a nearly square 'B plug' with a bevelled top at the other.

The e-corder is provided with a suitable high-speed cable.

Connecting the e-corder

Use the USB cable supplied with your e-corder to connect the USB port on its back panel to the USB port on the computer, or to an active USB hub connected to the computer. USB ports and cables should be marked with a trident-like icon,  , (or the letters 'USB').

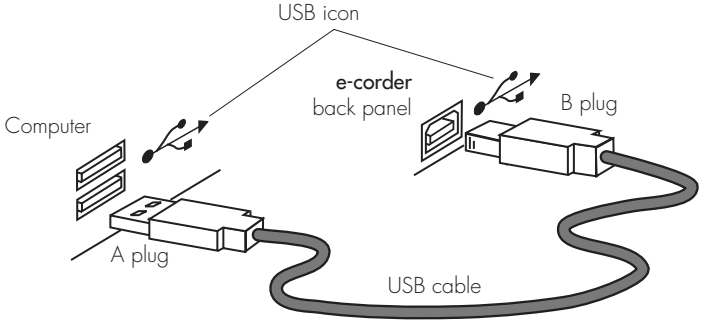


Figure 2–9
Connection to a computer

Note that you can have more than one USB device connected to your computer at one time. However you should observe the following rules when working with USB devices:

- *Cable length should be less than 5 m (16 feet) between USB devices (including USB hubs).*
  You can have up to five intervening hubs, so the maximum distance is 30 m (98 feet) between the computer and the e-corder.

- *Never attempt to make your own USB cable, or modify one.*
  USB is sensitive to cable impedances and cable lengths. Only use a certified USB cable from a reliable supplier. Your e-corder is supplied with a suitable USB cable. If you need additional USB cables, you should buy high–speed cables (fully shielded, twisted-pair, and with standard USB connections) for reliable results.

- *Don't disconnect the e-corder while the Chart or Scope software is using it.*
  Stop sampling and quit the software before disconnecting an e-corder.

You can safely turn on or off, or disconnect or reconnect, an e-corder while the computer remains on, as long as the Chart or Scope software is off. Although USB is a 'hot–pluggable' standard, Windows 2000 may bring up an alert if you attempt to disconnect the e-corder while the computer is on. The alert lets you install a control in your taskbar to avoid potential future problems.

A

APPENDIX A

Technical Aspects

This appendix gives an overview as to how the e-corder works. You do not need to know the material here to use your e-corder, but it may be of interest to the technically minded. You should not use this information as a service manual: user modification of the e-corder voids your rights under warranty.

How Does it Work?

The e-corder is essentially a smart peripheral device designed to perform the various functions needed for data acquisition, signal conditioning, and pre–processing. It contains its own microprocessor, memory, and specialized analog amplifiers for signal conditioning. The block diagrams in Figure A–1 and Figure A–2 show the essential elements of each e-corder.

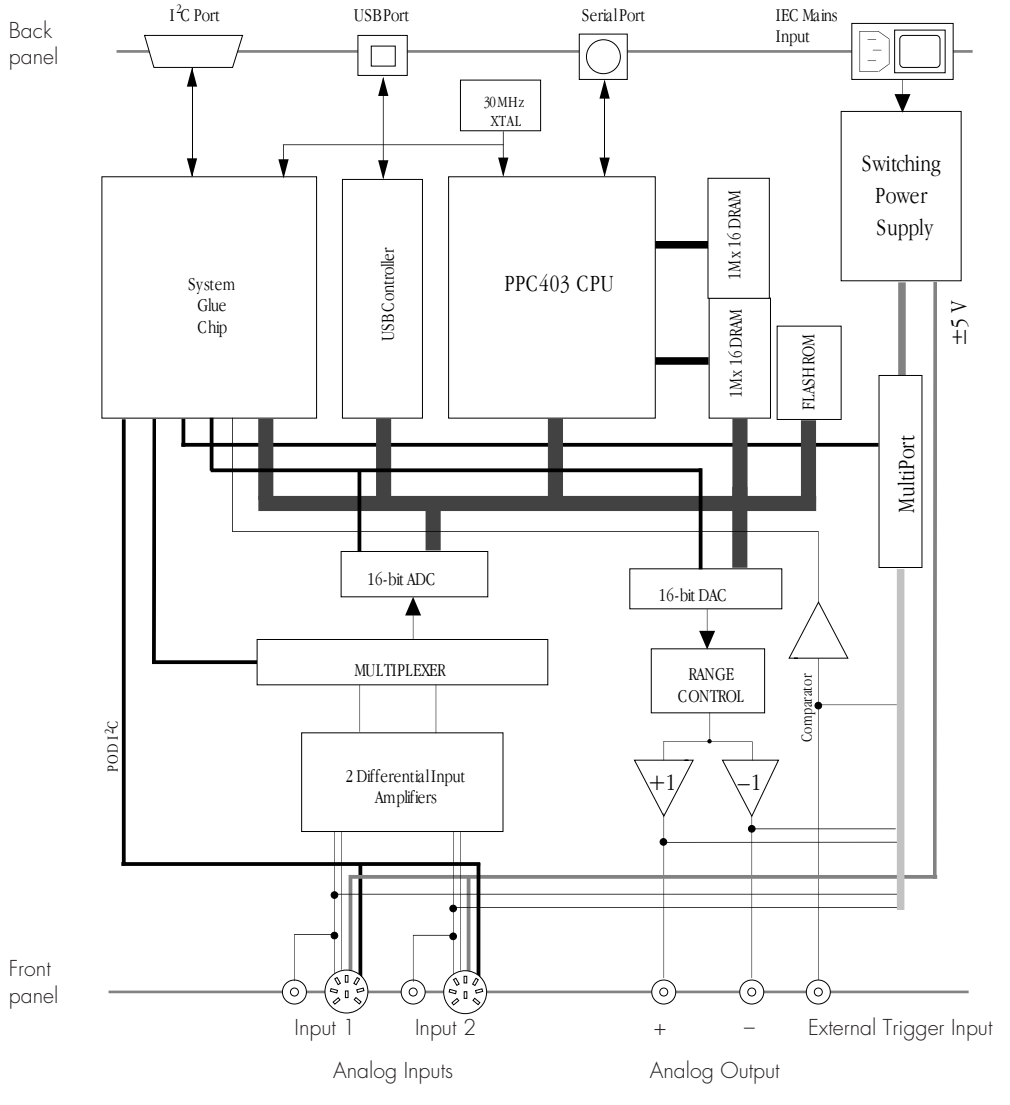
All sampling, output, and communication functions are controlled by an internal PowerPC microprocessor running at 60 MHz. This microprocessor has access to 4 MB of internal dynamic RAM for data storage and buffering. The e-corder uses USB–2 (universal serial bus) to communicate with the computer.

The e-corder analog inputs are multiplexed to a 16 bit ADC (analog-to-digital converter). The ADC can sample at a maximum rate of 100 kHz. The sampling process is handled independently of the processor core through a control engine using direct memory access. The CPU assembles groups of samples into blocks and then transmits them to the computer, where the software receives, records, and displays the data.

The external trigger input (marked 'Trigger' on the front panel) allows either a voltage level or a contact closure to trigger recording.

A single 16-bit DAC (digital-to-analog converter) is used to provide an analog output or stimulation capability through the analog outputs of the e-corder (marked 'Output' on the front panel). Output pulse frequency is independent of the analog input sampling rate. The output of the DAC is fed through a programmable attenuation network to produce different output ranges. The signal is then split into a positive

Figure A–1
Block diagram of the e-corder 201.

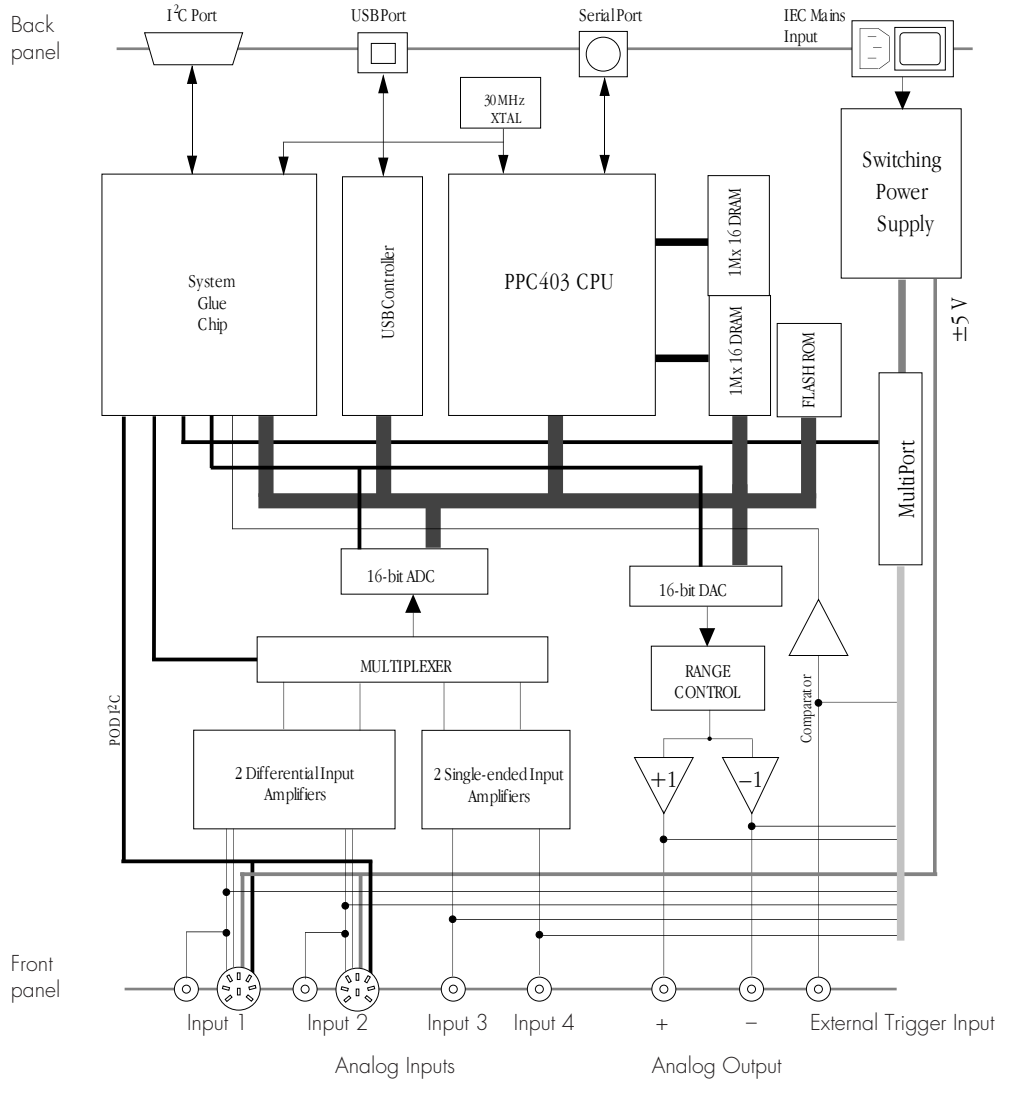


and negative output through buffer amplifiers. The outputs are capable of driving up to 12 mA into a load.

e-corder Accuracy

Each e-corder is factory calibrated to an accuracy of better than 0.1%. Some 'zero drift' or 'gain drift' can occur with time. The unit can be

Figure A–2
Block diagram of the e-corder 401.



factory recalibrated if required, but for most applications this is unnecessary because of:

- **DC drift compensation**. Each time that recording is started manually, or by triggering, or when the gain is changed, the input to the amplifier is grounded and any DC due to the amplifier's drift with temperature and age is measured. The measured voltage is removed from the readings for that input through software correction, in a process transparent to the user.

- **Units Conversion**. If you are calibrating the transducer by using known physical quantities with the Units Conversion feature (for example you can calibrate a force transducer by using two known masses) then the raw voltage signal will be converted so that the transducer readings are displayed in the appropriate units. Any offset on the raw signal will be effectively removed by this process. More extensive calibration can be performed in the Chart software by use of the Multipoint Calibration feature which can also correct for a non–linear signal.

B

APPENDIX B

Troubleshooting

This appendix describes most of the common problems that can occur with your e-corder unit. If the solutions here do not work then please your eDAQ representative, or email us on support@edaq.com

Checking for missing, loose or inappropriate connections solves many problems. For example a transducer may be incorrectly connected to the e-corder Output + connector rather than an input connector. Please make sure that all cables are correctly and firmly connected to their relevant connectors.

The e-corder Status indicator light flashes red, or red and yellow, when the e-corder is turned on (see Self-Test, page 16)

- Turn the e-corder off, and then after at least five seconds turn the e-corder back on again. This should clear a temporary problem. If not, then please contact your eDAQ representative.

The computer refuses to boot with the e-corder connected, or the computer can't find the e-corder

- The e-corder may be off, or the power is switched off at the wall, the power cable is not connected firmly, or a fuse has blown — check all switches, power connections, and fuses.
- Ensure that the USB cable is firmly attached at both ends and try again. If there is still a problem, try a new cable if possible.
- Turn the e-corder and computer off, and then after at least five seconds turn the them back on again and try using the software again.

• Your might not properly support USB make sure that it meets the requirements listed in Chapter 1, page 3.

The computer hangs up while recording, or there is data loss

• There may be a poor connection between e-corder and computer, or bad cable. Ensure that the cable is firmly attached at both ends and try again. If there is still a problem, try a new cable.

The e-corder doesn't work or the program crashes after a short time

• A poor connection between e-corder and computer, or bad cable. Proceed as above.

Signals seem weak or interacting on Input 1 or 2

• You may be using both the BNC connector and the Pod connector for an input at the same time, with resultant signal competition. Make certain that you use only *one* of the alternative connectors (BNC or Pod) for an input when recording.

When Windows starts up, it doesn't recognize the e-corder

• This should happen only the first time e-corder hardware is connected to the computer. Windows may bring up the New Hardware wizard, and ask if you want to install a driver. Insert the Software Installer CD, leave the wizard on its default settings, and continue.

There is an alert when the e-corder is disconnected or turned off

• USB is a 'hot-pluggable' standard, meaning that you should be able to turn on or off, or disconnect or reconnect, a USB-connected e-corder safely while the computer remains on, as long as the Chart or Scope is off when you do it. However Windows 2000 may still bring up an alert which asks you install a control in your taskbar. Install the control, and use it before you disconnect or turn off the e-corder, to avoid the alert in the future.

C

APPENDIX C

Specifications

e-corder Specifications

Input

Number of inputs:	2 (eDAQ 201), 4 (eDAQ 401)
Input configuration:	Single–ended (via BNC connector) or differential (via DIN connector)
Amplification ranges:	±20 mV to ±10 V full scale in 9 steps: ± 10 V ± 5 V ± 2 V ± 1 V ± 500 mV ± 200 mV ± 100 mV ± 50 mV ± 20 mV
Maximum input voltage:	±15 V
Input impedance:	≈ 1 MΩ || 47 pF @ DC
Low-pass filtering:	Anti–aliasing 20 kHz fixed 2nd–order Other digital filtering options in software
AC coupling:	DC or 0.1 Hz (software-selectable)
Frequency response (–3 dB):	20 kHz @ ±10 V full scale, all ranges

DC drift:	Software-corrected
CMRR (differential):	96 dB @ 50 Hz (typical)
Input crosstalk:	–110 dB typical
Input noise:	<2.4 μV_{rms} referred to input, DC to 20 kHz
Pod connectors:	Combine power, I^2C and single-ended or differential analog input signals on one connector, support pods, particular transducers, etc.
Supply voltage:	±5 V regulated
Maximum current:	50 mA per pod port
Communications:	2–wire I^2C
Signal input:	Positive and negative analog inputs
Connector type:	8–pin DIN.

Sampling

Input resolution:	16 bits, Chart software 12 bits, Scope software 16 bits, EChem software 16–24 bits PowerChrom software
Linearity error:	±2 LSB (from 0 °C to 70 °C)
Maximum sampling rates:	100 kHz on one channel; 40 kHz on two channels.
Available sampling rates:	<1 Hz – 100 kHz with Chart 2 Hz – 100 kHz with Scope 100 Hz – 10 kHz with EChem

Output Amplifier

Output configuration:	Single–ended or bipolar
Maximum output current:	100 mA continuous

Output impedance:	0.1 Ω typical
Slew rate:	6 V/µs
Settling time:	2 µs (to 0.01% of FSR for LSB change)
Linearity error:	±1 LSB (from 0 °C to 70 °C)
Output ranges:	±200 mV to ±10 V full scale in six steps ± 10 V ± 5 V ± 2 V ± 1 V ± 500 mV ± 200 mV

External Trigger

Trigger threshold:	+2.9 V ±0.25 V or contact closure (software-selectable)
Hysteresis:	1.1 V (turns off at +1.8 V ±0.25 V)
Input load:	2.2 mA at 5 V, 5.5 mA at 10 V
Maximum input voltage:	±12 V
Minimum trigger time:	5 µs

Microprocessor and Data Communication

Processor:	PPC403 GCX (60 MHz internal)
Memory:	4 MB DRAM
Data communication:	USB

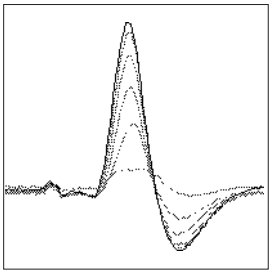
Expansion Ports

I^2C expansion port:	Power and control bus for eDAQ Amps.

Physical Configuration

Dimensions (w × h × d):	200 mm × 65 mm × 250 mm (7.9″ × 2.6″ × 9.8″); excludes connectors
Weight:	2.0 kg (4 lb 6 oz)
Operating voltage:	90–260 V AC 50/60 Hz
Nominal power needs:	6 VA (25 mA @ 240 V or 52 mA @ 115 V); no eDAQ Amps or pods attached
Maximum power needs:	<18 VA (with eDAQ Amps and Pods)
Operating temperature range:	0 to 35 °C, 0 to 90% humidity (non-condensing)

eDAQ reserves the right to alter these specifications at any time.



Glossary

This glossary covers terms used in this manual.

AC coupling. When AC coupling is chosen, a 0.1 Hz high-pass filter before the first amplification stage which can be used to remove signal drift.

ADC (analog–to–digital convertor). A device that converts analog information into some corresponding digital voltage or current.

amplitude. The maximum vertical distance of a periodic wave from the zero or mean position about which the wave oscillates.

analog. An analog signal varies continuously over time, rather than changing in discrete steps.

analog input. This refers to the connectors on the front of the e-corder marked 'Input'. These inputs are designed to accept up to ±10 V. Inputs can be either single–ended or differential.

analog output. This refers to the connectors on the front of the e-corder marked 'Output'. The analog output provides a software-controlled variable output (±10 V) that can be used with applications either directly as a stimulator, or to control peripheral devices.

analysis mode. When the e-corder is not connected to the computer, then Chart or Scope software can be used to analyze and manipulate existing files if the analysis option is chosen.

BNC (bayonet nut connector). A sort of cable or connector; a BNC–to–BNC cable connects two BNC connectors.

bridge transducer. A type of transducer using a Wheatstone bridge circuit. In its basic form, the bridge consists of four two–terminal elements (usually strain gauges) connected to form a quadrilateral. An excitation source is connected across one diagonal, and the transducer output is taken across the other.

bus. A data–carrying electrical pathway.

Chart. The Chart software is supplied with the e-corder and emulates a multi–channel chart recorder.

connector. A plug, socket, jack, or port used to connect one electronic device to another (via a cable).

CPU (central processing unit). A hardware device that performs logical and arithmetical operations on data as specified in the instructions: the heart of most computers.

DAC (digital–to–analog convertor). A device that converts digital information into some corresponding analog voltage or current.

DC offset. The amount of DC (direct current) voltage present at the output of an amplifier when zero voltage is applied to the input; or the amount of DC voltage present in a transducer in its equilibrium state.

differential input. Input using both positive and negative inputs on An e-corder. The recorded signal is the difference between the positive and negative input voltages: if both were fed exactly the same signal, zero would result. Can reduce the noise from long leads.

digital. Varying in discrete steps. A digital signal increments in discrete steps rather than varying continuously. The size of the steps is determined by the resolution (16 bit, 12 bit etc.) and the full scale range of the input channel.

DIN (Deutsche Industrie Norm). An electronic standard.

eDAQ Amp. Software controlled preamplifiers that can be used with your e-corder. eDAQ Amps are recognized automatically by the e-corder system and seamlessly integrated into its applications, operating under full software control.

envelope. The overall shape of a signal, outlined by the minimum and maximum recorded values. Often used to display quickly changing signals.

excitation. The voltage supplied to a transducer or other device in order to power it.

external trigger. The input connector on the front of the e-corder marked 'Trigger'. This lets one start recording from an external source. The trigger level (the voltage needed to have an effect) depends on the hardware and cannot be changed. The /20 series e-corders can also be triggered by contact closure if this is set up in the software.

filter. A mechanism whereby the frequency components of the signal are altered. Low pass filters remove high frequency (noise) components. High pass filters remove low frequency (drift) components.

frequency. The number of cycles per to occur in a waveform per unit. Frequency is usually expressed in the SI unit of Hertz, Hz (cycles per second, s^{-1}), but is also sometimes expressed in beats per minute (bpm, min^{-1}), revolutions per minute (rpm, min^{-1}), cycles per hour (cph, h^{-1}), etc.

frequency response. The bandwidth in which a circuit passes a signal without significant attenuation. A low pass filter's frequency response is the frequency where the signal is attenuated by 3 decibels, that is the frequency in filtered signal has an amplitude of 0.707 ($1/\sqrt{2}$) of the frequency in the input signal.

gain. The amount of amplification of a signal.

half–bridge transducer. A bridge transducer only using half of the full-bridge circuit. It consists of two elements of equal value with an excitation voltage applied across them. The output of the transducer is taken at the junction of the two elements.

Hertz (Hz). See 'frequency'.

high pass filter (HPF). See 'filter'.

I^{2}C. The I^{2}C connection is used by the e-corder to control eDAQ Amps.

IEC. International Electrotechnical Commission.

low pass filter (LPF). See 'filter'.

PCI (peripheral component interconnect). An architecture for connecting peripheral devices (such as USB cards) to computers.

Pod connector. A special 8-pin DIN connector on some e-corder inputs providing differential or single-sided connection, and they can also provide ±5 V power.

Pods. Miniature preamplifiers that connect to the e-corder Pod connectors.

port. A socket where you plug in a cable for connection to a network or a peripheral device.

range. The full scale input range is region over which signals can be recorded. The e-corder has ranges of ±2 mV to ±10 V, in 12 steps. (Range is inversely proportional to gain, the extent of amplification.)

Scope. Scope software is supplied with the e-corder. It emulates a two–channel storage oscilloscope or XYT plotter.

serial. A connection protocol for sending information sequentially, one bit at a time, over a single wire.

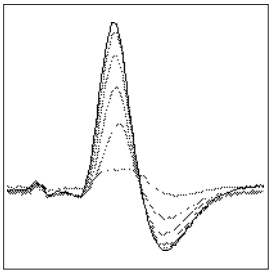
transducer. A physical device that converts one energy form into another (usually an electrical signal). For example transducers can provide an electrical signal related to the amount of measured force, displacement, temperature, pressure, pH, etc. Ideally the signal varies in a proportional manner to the measured parameter, but this is not always so.

trigger. A signal such as a voltage pulse, used to determine when sampling will begin. Sampling can be made to begin when the trigger level is reached, after it, or even prior to it. See also external trigger.

TTL (transistor transistor logic). A family of integrated circuits with bipolar circuit logic, used in computers and related devices. TTL is also a standard for interconnecting such ICs, defining the voltages used to represent logical zeroes and ones (binary 0 and 1).

USB. Universal serial bus.

waveform. The shape of a wave; a graph of a wave's amplitude versus time.



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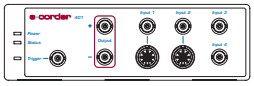

License & Warranty

Trademarks

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Responsibilities

You and any others using any eDAQ product agree to use it in a sensible manner for purposes for which it is suited, and agree to take responsibility for their actions and the results of their actions.

If problems arise with an eDAQ product, eDAQ will make all reasonable efforts to fix them. This service may incur a charge, depending on the nature of the problems, and is subject to the other conditions in this Agreement.

Hardware Warranty

eDAQ Pty Ltd warrants the **e-corder** to be free of defects in material and workmanship for one year from the date of purchase. eDAQ Pty Ltd will repair or replace defective equipment as appropriate.

To obtain a warranty repair/replacement you must first notify us before return of the instrument and we will issue you with a RAN (return authorization number). You must ship the defective product at your expense. We will pay return shipping. The product should be packed safely (preferably in its original packaging) and have the RAN on the shipping label. Returns sent without a RAN may be refused delivery.

This warranty does not cover hardware that has:

- been modified by the user in any way;
- been subjected to unusual physical, electrical, or environmental stress. This includes damage due to faulty power sockets, inadequate earthing, or power spikes or surges;
- been damaged because of incorrect wiring to ancillary equipment, or because of substandard, connectors or cables; or
- had the original identification marks removed or altered.

Software License

You have the non-exclusive right to use the supplied eDAQ software (Chart, Scope etc). Your employees or students, for example, are entitled to use it, provided they adhere to this agreement. Each separate purchase of the eDAQ software licenses it to be used on two computers at any given time (on one computer for data acquisition with a **e-corder** hardware unit, and on a second computer for the

analysis of existing data files). Although multiple copies of a program may exist on several computers, more than two copies must not be used simultaneously. Departmental/company licences are available if you wish to run more than two copies simultaneously.

Technical Support

Please register your unit to receive technical support. Technical assistance is available via email. Please describe the problem with as much detail as possible. Include a small example data file, if appropriate. Please also state:

- the model and serial number of your **e-corder** unit.
- the type of computer and operating system being used (for example Windows XP, or Macintosh OS 10.2)
- the software version you are using (for example Chart v5.1.2)

We endeavor to answer all your questions, but in some cases, for example where the problem relates to the other equipment that you are using, a nominal fee may be charged.

Jurisdiction

eDAQ Pty Ltd is bound by the laws of New South Wales in Australia, and any proceedings shall be heard by the Supreme Court of New South Wales in Australia.

Disclaimer

eDAQ reserves the right to alter specifications of hardware and software without notice.

No liability can be accepted for consequential damages resulting from use of eDAQ products.