

ER825 Multichannel C4D System

User Manual V1.2 December 2014

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Introduction

This manual is intended to allow the user to install, check and run the ER825 Multichannel C4D Detector system. It provides detailed information on the system and its operation. Please read this manual carefully before beginning installation or operations.

The ER825 Multichannel C4D Detector system provides the following functions:

- An interface providing all required signals for connection of up to eight eDAQ C4D Head Stages
- An interface to general purpose analog signals from other sensors or detectors.
- Precision data acquisition system that outputs the head stage signals in both analog and serial data formats.

Checking the Instrument

Before you begin working with the device, you should check:

- The contents of the package you received against the packing list
- For any sign of physical damage that might have occurred during transit.

If you find a problem, please contact your eDAQ representative immediately.

Software installation

Prior to connecting the hardware to the computer the appropriate software should be installed.

Three software applications can be used with the system depending on the configuration chosen.

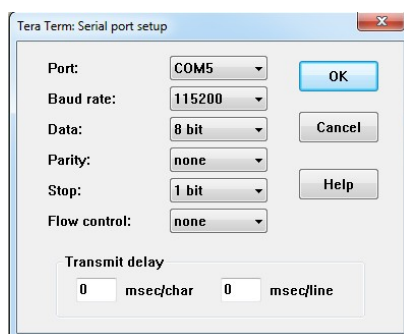
C4D Profiler V2: This stand alone application will allow the C4D Detector to be tested over its complete range of operations and used to obtain an estimate of optimum operating parameters.

C4D Configurator: This utility allows the setting up of the operating parameters of an ER825 C4D detector system in a standalone configuration. This application provides an alternative to the use of direct serial commands as described below. Refer to C4D Configurator User manual.

Chart Software: This general purpose recording and analysis software can be used with the ER825 to record data from the ER825. It is particularly appropriate to use this software in non-chromatography applications – for example for measuring conductivity changes in a capillary. Install Chart software according to instructions supplied.

PowerChrom System: This chromatography data system can use the ER825 as a C4D detector and acquire, display, analyse and identify the resulting peaks. Install the software according to the instructions supplied with the system.

Serial Data communications: You can use any terminal emulation software (for example Tera Term from <http://logmett.com>) to communicate with the ER815 C4D Detector. With a terminal program installed and running and with C4D Detector connected via the USB port to the PC the system will respond to a finite set of commands described in [Table1, see below](#).



The serial port number must first be established. Serial Ports 1 and 2 on Windows computers are reserved for the mother board. Thus it is common to find that the ER815 C4D Detector is located on serial port 3 (COM3) or greater. Use your Terminal software to configure the virtual serial port as shown above.

Once the serial port is set up, type in a ? to get a listing of the available commands listed in Table 1.

TABLE 1 Multiple Channel Serial Dialog (**ER825>** prompt not shown)

Prompt/Command	Action
Channel Specifier <n>: 1, 2 etc or */all help ? version prompt <on off>	Specifies action to specific channel or all channels (*/all) Returns a list of available commands Show firmware version Enable or disable the command prompt ER825>
set f frequency <kHz> set beep <on off> set channel <n> hg headgain <on off> set channel <n> e excite <percent> set channel <n> o offset auto set channel <n> o offset <volts> set channel <n> r range <5 1 0.5 0.05> set channel <n> filter <1 10 10k>	Set excitation frequency to kHz on all channels Enable or disable the error beeper Headstage gain on Channel n to on/off Set excitation level on Channel n in % of full scale Automatically offset output signal on channel n to 0 Set offset on Channel n to specific voltage Set Channel n input range in volts Select Channel n output filter in Hz
get info get frequency get channel <n> headgain get channel <n> excite get channel <n> offset get channel <n> range get channel <n> filter	Show system Information Get excitation frequency (common to all channels) Get headgain setting on Channel n Get excitation level on Channel n Get offset amount on Channel n Get input range on Channel n Get filter setting on Channel n
r s sample [hz] [count] interval [seconds] [count]	Take a single set of readings from all channels Sample at given rate, default 1 Hz, from all channels Take samples at the specified interval from all channels
Info Save Load	Lists System settings information Save current operating parameters Load previously saved operating parameters

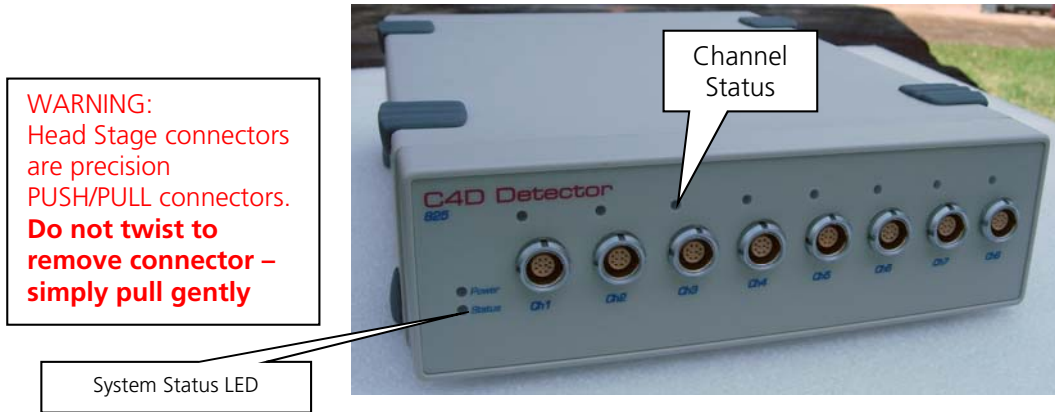
Note 1. The following error messages may be returned due to incorrect spelling or value entered:

- *ERROR Unrecognised parameter* (Attempt to set/get with illegal parameter)
- *ERROR Invalid value* (Illegal parameter encountered)
- *ERROR Unrecognised command* (Illegal command encountered)

Note 2. If you are including these command strings in your own software code, then they should be terminated with a carriage return character, <CR>, ASCII 13. Contact eDAQ for support.

Meet the eDAQ ER825 Multi Channel C4D Detector System

FRONT PANEL — 8 Channel System



System can be configured with 2 to 8 head stage or input channels

ER825 System Indicators

System indicator LEDs, as shown above, reflect the state of the internal hardware and assist in monitoring system operation and diagnosing problems.

Power LED (blue LED)

LED Off = No power

LED ON = Internal power OK.

When power is switched on there will be a small delay while the system performs a self check and then turns on the Blue LED to indicate that all power supplies are in order.

System Status LED: Bicolor LED

GREEN indicates system ready

Amber indicates system is recording

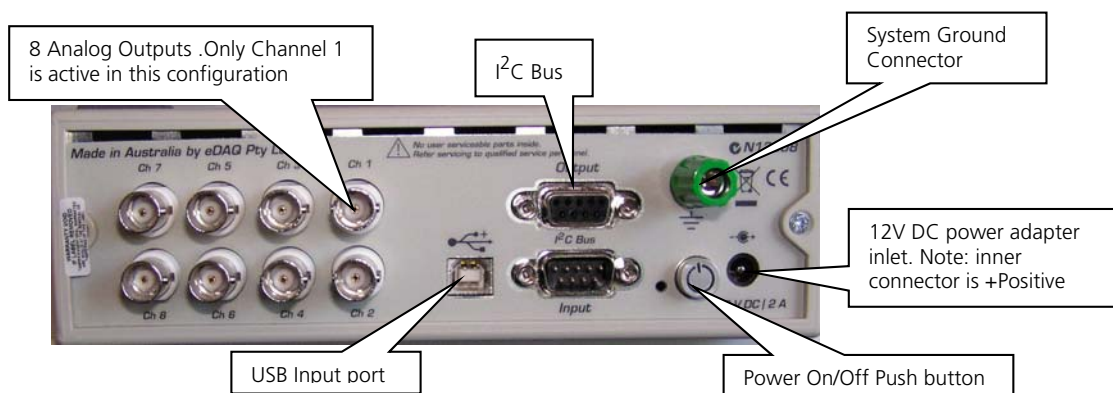
Channel Status LED: Orange LED

OFF: no valid channel installed or faulty input channel

BLINKING: indicates that unit is being setup and configured.

ON: indicates that an operating channel has been identified and configured.

REAR Panel All Configuration



Installing hardware

Before installing the hardware ensure that all required software has been installed. The installation of multiple head stages requires some care and is described in APPENDIX C.

Special Note on Input connectors.

The system uses precision multi pin connectors which need to be handled with some care. Incorrect usage may damage the pins and require non – warranty replacement.



Note 1: The “**red dot**” on the connector should be facing to “3 o’clock” as shown above.

Note 2: Never force a connector to make a connection. A gentle push is sufficient to insert the connector if it is properly oriented with the **red dot** at 3 O’clock.

Note 3: Never twist a connector in order to insert or remove it. To disconnect the connector grasp the body of the connector and pull back gently as shown above, this releases the locking mechanism and allows the connector to be pulled out.

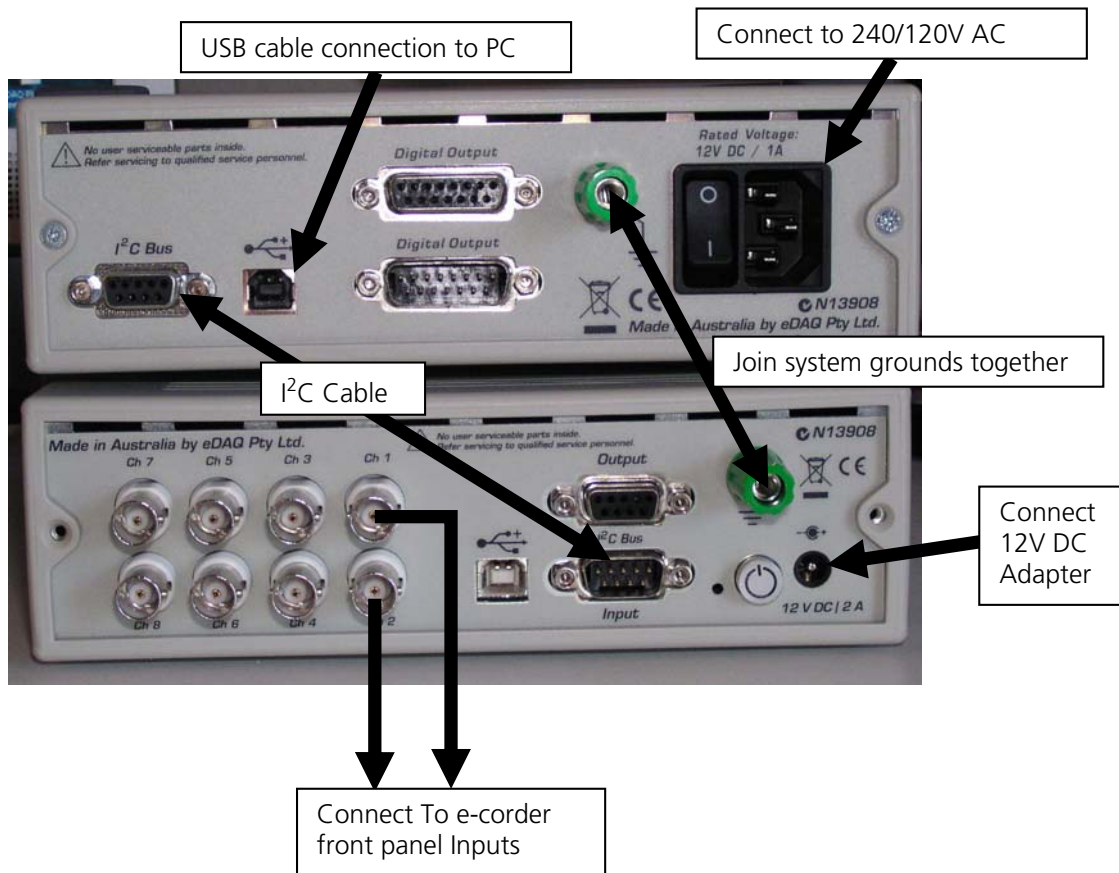
Standard System configurations

The ER825 can be used as:

- **e-corder amplifier configuration** provides analog signals to an **e-corder** (1 – 8 channels) or **PowerChrom** (1 – 2 channels) data acquisition system. The unit functions as a front –end and is controlled by Chart or PowerChrom software. The full capability of Chart or PowerChrom software is available.
- **Stand-alone detector** for connection to a third party data acquisition system/software. The ER825 system provides both analog and serial data output suitable for integration with third party data systems and software. The third party system is responsible for the display and analysis of the data. A Terminal emulation program can be used to set up parameters and to display the raw data generated by the ER825 C4D Detector as columns of text. The **C4D Configurator** utility provides an easier way to setup the system parameters.

Hardware installation instructions for the above configurations are described below.

e-corder Amplifier Configuration

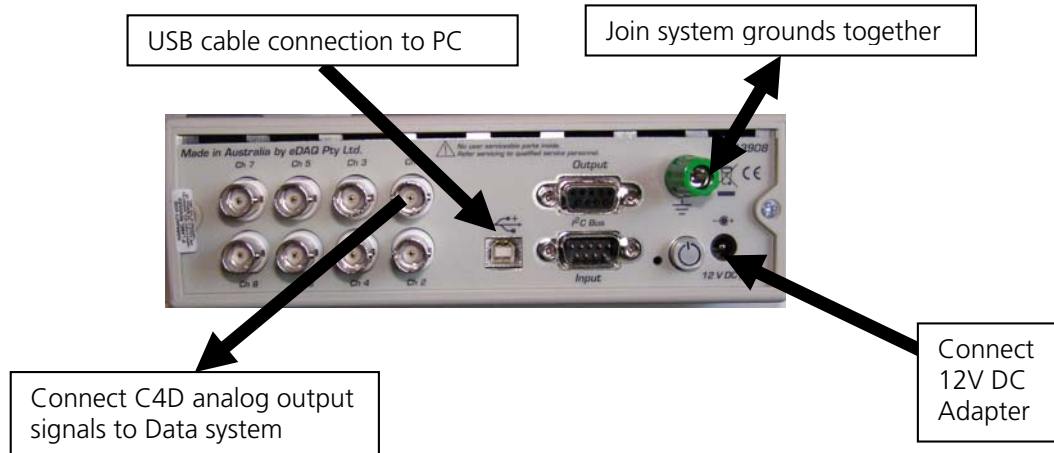


The above figure shows a system configured with two C4D channels. All connections should be made, otherwise the system will not operate correctly.

- Each operating ER825 channel should be connected to an e-corder Input. Otherwise the presence of the corresponding C4D channel will not be detected by Chart software.
- I²C cable connects the ER825 to the e-corder and provides all necessary control lines to allow the ER824 to be controlled by the e-corder and Chart application.
- Only the e-corder is connected to the USB port on the PC. Control of the ER825 is performed by the e-corder via the I²C bus.
- Both units need to be powered – the e-corder with a 240/120 V AC supply and the ER825 with a supplied 12 V DC power pack.
- System grounds should be connected together.
- Head stages should be connected to the appropriate connectors on the front panel.

Once all the connections have been made as described above, power can be applied, and once the system has powered up the appropriate software can be launched and system operations begun.

Stand Alone Configuration



In this configuration the ER825 is used as a C4D detector to an existing data system. The ER825 generates both analog data and serial data representing the changes in conductivity within each Head stage. The external data system must be capable of accepting either analog signals or serial data. The unit is controlled and set up by the firmware in the ER825 unit. Up to eight C4D channels can be displayed and recorded in this configuration. Note that:

- Each operating C4D Detector channel should be connected to the external data system.
- The I²C cable is not used in this configuration.
- The ER825 C4D detector should be connected to the PC via the supplied USB cable.
- The ER825 C4D detector needs to be connected to its 12 V DC power adapter.
- The system grounds should be connected together.
- Head stages should be connected to the appropriate connectors on the front panel.
- Once all the connections have been made as described above, power can be applied, and the appropriate software can be launched.

APPENDIX A System Technical Description

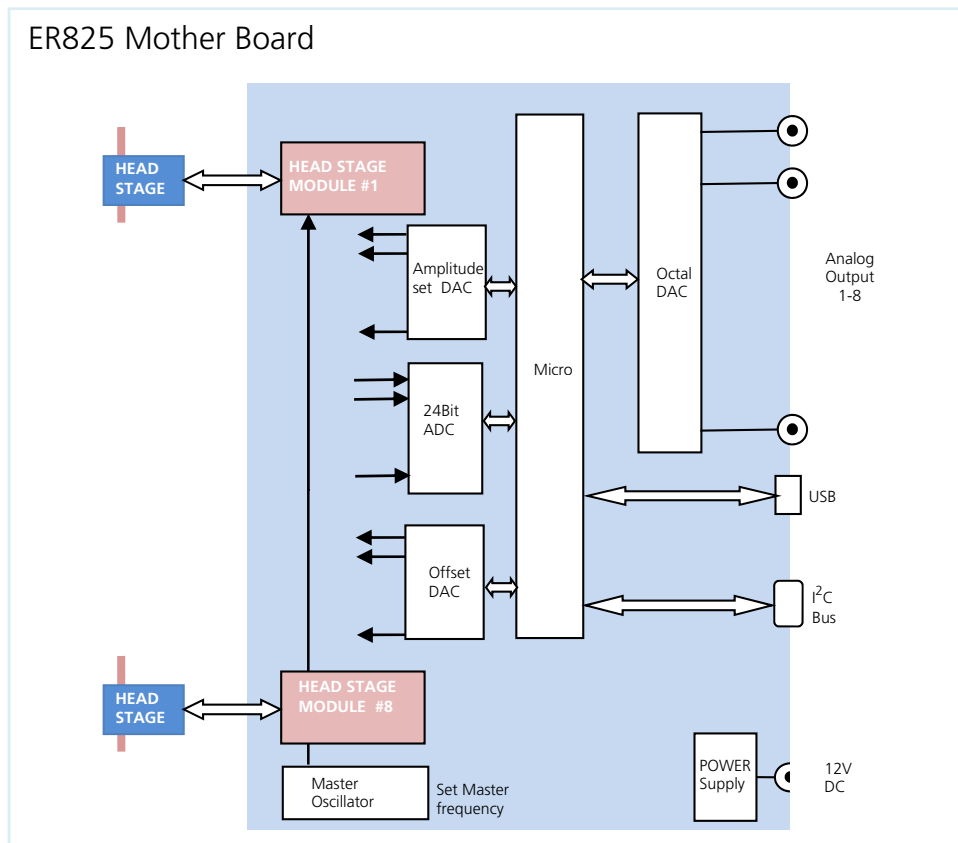
Capacitively-Coupled Contactless Conductivity Detection (C4D) systems couples an AC voltage via a transmitter electrode to a capillary or channel containing a conductive buffer (electrolyte solution). The AC signal is coupled capacitively to the sample, which conducts the signal, proportional to the sample conductivity to a receiver electrode. The received AC current signal is amplified and demodulated to provide a DC signal proportional to the conductivity between the electrodes. See <http://www.edaq.com> for a more detailed description.

This process occurs inside a headstage, which outputs the DC signal to the C4D Detector.

The Multichannel C4D Detector (Model ER825) consists of a motherboard which supports from one to eight headstage module (EA025) described below.

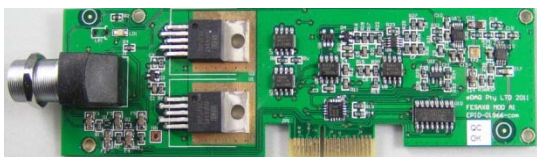
ER825 Mother board

The ER825 Mother board provides the headstage power and control, excitation signal (in the range of 10 kHz to 2 MHz) and the means to convert the headstage analog data to low noise precision digital data available on the USB serial port. In addition the headstage analog data is available on the system rear panel for connection to a suitable data system as shown in the block diagram below.

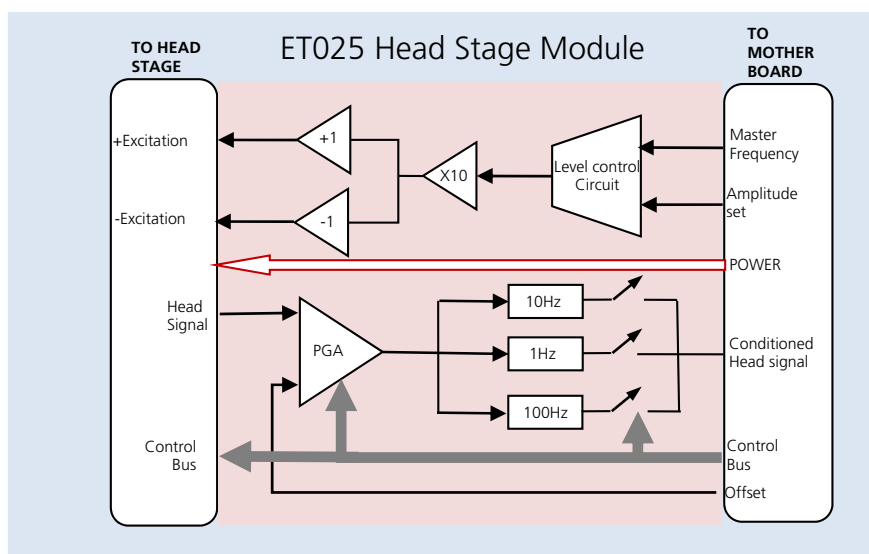


Headstage Module (Model EA025).

This module provides the interface between C4D head stages and an ER825 system. It can also be used to monitor external analog signals e.g. other Chromatography detectors.



The EA025 Headstage module provides all necessary means to control the associated C4D head stages or input signal. All headstages operate at the same user specified MASTER excitation frequency. Gain, offset and excitation levels can be set independently on each headstage (see diagram below).



The excitation output can be configured as a single ended or differential output. The resulting signal can be offset and amplified in the programmable gain amplifier (PGS) before it is processed by the user selectable filters.

Headstage modules can also be used with other types of analog inputs for example: pH, Temperature or other detector signals in the range $\pm 50\text{mV}$ to $\pm 5\text{ V}$. A special cable is required for this function –contact EDAQ for details.

Note: Expanding an ER825 system by the addition of EA025 Head Stage module requires return to factory.

The following head stages are available and supported by EA025 Headstage module

- ET120 CE Headstage for Capillary electrophoresis (150 μm and 380 μm)
- ET125 General purpose Headstage for tubing size from (380 μm to 1600 μm)
- ET225 Micronit Microchip platform

APPENDIX B Specifications

Specification ER825

Number of input channels	1 Minimum, 8 Maximum
Excitation frequency	Sinusoidal 10 kHz to 2000 kHz (10 Hz resolution)
Excitation output	2 V peak to peak – amplitude controlled
ADC	8 differential channels 24 bit resolution (18 bits effective)
ADC output rate	Max 100 samples per second per channel
ADC range FS	±5 V
ADC offset	< 100 µV
ADC Gain error	0.1%
Analog Outputs	8 channels (one per headstage module) ±10 V available on rear panel BNC
Communication	USB 2 with virtual serial channel implemented.
I ² C	Standard I ² C DB 9 connector for connection to e-corders.
Serial Port	Optional internal RS232C implemented (for OEM use)
Displays	Power LED. Blue = Power ON. Status LED. Green = On-line . Amber = sampling. Individual Headstage modules LED: Connected. Blinking = OverRange
Buzzer	Over-range buzzer sounds when head signal exceeds 3 V
Power requirements	12 V nominal DC @ 10 W max 8 channels (Mains module supplied)
Dimensions	65 x 200 x 250mm (2.6 x 7.9 x 9.8 inches)
Weight	1.8 kg (4.3 lbs)
Operating temperature range	0 – 35°C

Specification EA025

Output Driver Single Ended	20 V Peak to peak sine wave (100% range) 30 mA max (Head stage setting)
Output Driver Differential	40 V Peak to peak effective (100% range) 30 mA max (Head stage setting)
Output Frequency	10 kHz to 2000 kHz
Input connector	10 Pin Lemo equivalent with following pin out Pin 1 EXC OUT Negative or SGND if single-ended output Pin 2 +5 V Pin 3 HGain Pin 4 KSIG Conductivity Signal from headstage Pin 5 HEAD_SCL Pin 6 SIG GND Pin 7 HEAD_SDA Pin 8 EXC OUT Positive to headstage Pin 9 -5V Pin10 HDAUX auxiliary I/O
PGA Amplifier	Programmable Gain amplifier. x1, x10, x100 user selectable
Input range	±10 V
Offset range	±5 V
Drift RTI	2 µV + (6/Gain) µV/°C
Noise	<5 µV RMS measured with 50 Ohm input at Gain = 100 and 100 Hz filter
Frequency response	0 to 1000 Hz
Filters	Selectable: No filter (1000 Hz) , 10 Hz and 1 Hz Low pass 3 pole Bessel

APPENDIX C ER825 Multiple Heads stage Installation

Special Note on Input connectors.

The system uses precision multi pin connectors which need to be handled with some care to prevent damage. Incorrect usage may damage the pins and require non – warranty replacement.



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Note 2: Never force a connector to make a connection. A gentle push is sufficient to insert the connector if it is properly oriented with the red dot at 3 o'clock.

Note 3: Never twist a connector in order to insert or remove it. To disconnect the connector grasp the body of the connector and pull back gently as shown above, this releases the locking mechanism and allow the connector to be pulled out.

System cabling Check list (refer to user manual for details)

ER825 e-corder amplifier configuration

Analog cables connected between ER825 and E-corder input channels

I2C cable between e-corder and ER825

12V Power adapter cable

System ground connection between ER825 and e-corder (may not be necessary)

USB cable connected from e-corder to PC or USB hub. **NO USB connection to ER825.**

C4D head stages connected to front panel input connectors

System Ventilation

ER825 e-corder amplifier configuration

When fitted with the maximum number of input channels and working head stages the unit must be well ventilated. The front panel of the unit has ventilation slots on the bottom edge of the front panel. These provide the necessary ventilation for the unit and must not be blocked off inadvertently. Ensure there is at least 10mm of clearance between the bottom of the front panel and the surface the unit is resting on.

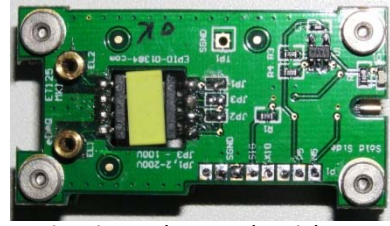
Multiple C4D configuration using ET125 Head Stages

Excitation electrode  is at a high voltage

Sensor Electrode  is at 0 volts



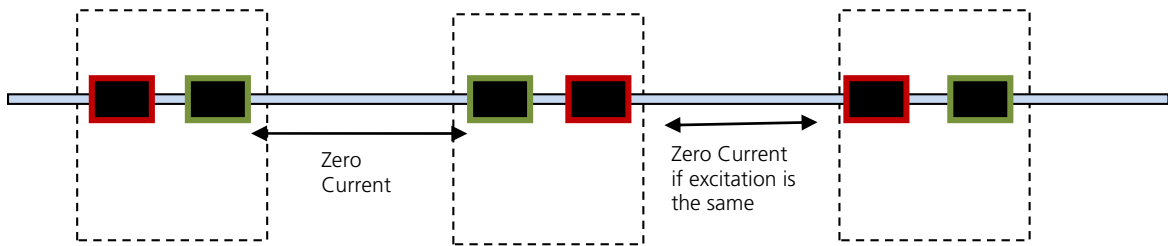
Sensor Electrode side



Excitation electrode side

Head stages should be installed to the pattern shown below.

Correct electrode placement – minimizes interaction between head stages



Wrong electrode placement – maximizes interaction between head stages

