

User Manual
for the
40 and 72-channel physiological measurement system

QuickAmp-40 and QuickAmp-72

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1 About this manual

This manual, which is intended for the user of the QuickAmp, contains general operating instructions, precautionary measures, maintenance instructions and information about components. To maximize the safety, service life and efficiency of the system, it is important that you read this manual through carefully and familiarize yourself with the various controls and accessories before starting to use the system.

2 Product description / intended use

The QuickAmp-40 and QuickAmp-72 are 40 and 72-channel stationary system for physiological research.

The system has 32 or 64 unipolar electrophysiological ('ExG') inputs, 4 bipolar electrophysiological ('BIP') inputs, 4 so called auxiliary ('AUX') inputs and one digital input-channel (8 bits).

The unipolar electrophysiological inputs are configured as a reference amplifier: all channels are amplified against the average of all connected inputs. With these channels or the Bipolar channels signals like EEG, EMG, ECG, EOG, EGG etc. can be measured.

The auxiliary inputs can be used for measuring temperature, pH, respiration, oxygen saturation etc. Each AUX channel has a +5V and -5V output in order to use active sensors or sensor modules.

An external power supply, which plugs into the mains socket, powers the QuickAmp. The QuickAmp is connected to a PC by means of bidirectional glass fiber in combination with a FUSBI. The QuickAmp is completely controlled by the PC.

The system does not perform any signal interpretation or signal analysis. This is left to the researcher/Physician.

The system is NOT intended for use in a life supporting system.

indications for use

The QuickAmp Amplifier family is intended to be used by or under the direction of a physician for acquisition of EEG, polygraphy and polysomnography signals and transmission of the signals to a PC during recording of neuro-physical/ physiological research and exams.

Polygraphy and Polysomnography may besides EEG, include physiological information such as EMG, ECG, EOG, EGG, PH, Respiration, Temperature and Oxygen Saturation.

3 Warnings and precautionary measures

This section contains general warnings and precautionary measures that are important for the safe use of the system.



Manual contains important safety information



Consult instructions for use



Device is Class II equipment



Device has type CF applied parts



Instructions for Disposal of Waste Electrical and Electronic Equipment (WEEE) by Users in the European Union

This symbol is placed on the product, which indicates that this product must not be disposed of with other waste. Instead, it is the user's responsibility to dispose of their waste equipment by handing it over to a

designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, your household waste disposal service, or TMS International BV.



- Under federal law (only applicable to the USA) this apparatus may only be sold by or on the order of a physician or licensed practitioner.
The apparatus may only be used under the constant supervision of or on the instructions of a physician or other authorized medical professional.
- The **only** external power supply that may be used is the original supply, that came with the QuickAmp. **DO NOT replace it with something else.** If any non-TMSI type of supply is used then patient safety is not guaranteed.
- Make sure that the wall socket is well earthed, to reduce 50 or 60Hz disturbances
- Do not combine the use of the QuickAmp with any other electronic device, except those specified in this manual.
- Sensors with their own power are not to be connected to the AUX inputs.
- This system is not suitable for use in an inflammable mixture of anesthetics and air, oxygen or nitrous oxide.
- Do not expose the system to direct sunlight, heat from a source of thermal radiation, excessive amounts of dust, moisture, vibrations, or mechanical shocks.
- Not to be immersed in any liquid
- If any liquids or moisture penetrate the system or any part thereof, remove the plug from the wall socket and have the system checked by an approved technician.
- Not to be connected to a patient undergoing MRI, Electro surgery or defibrillation.
- Not for critical patient monitoring.
- Not defibrillator proof.
- This system is not suitable for sterilization.
- Disposable electrodes which are used for electrophysiological measurements may be a biohazard. Handle, and when applicable dispose of these materials in accordance with accepted medical practice and any applicable local, state and federal laws and regulations.
- Reusable electrodes present a potential risk of cross-infection especially when used on abraded skin, unless they are restricted to a single patient or sterilized between patients. When sterilizing electrodes, employ only gas sterilization.
- Store electrodes within separate bag within the packaging to prevent contamination
- Take care in arranging patient and sensor cables to avoid risk of patient entanglement or strangulation
- Make sure the PC is installed according to local regulations and safety precautions.
- Do not use an operating cellular phone within 30 cm of the QuickAmp to avoid excessive noise on the signals
- Sharp bends or winding the cables in a loop smaller than 5 cm may damage the cables
- Do not bend the glass fiber too sharply, as it may break.
- The QuickAmp contains recyclable materials that can be harmful for the environment. Specialized companies can separate these materials when the system is disassembled. Before disposing of the apparatus, enquire about the local waste management regulations.
- Cleaning of the QuickAmp can be done with a slightly damp soft cloth. Before cleaning, make sure the QuickAmp is turned off. Never use any aggressive chemicals to clean the QuickAmp.
- Due to design no calibrations are needed.
- There are no known side effects from the use of this equipment.

4 Installation

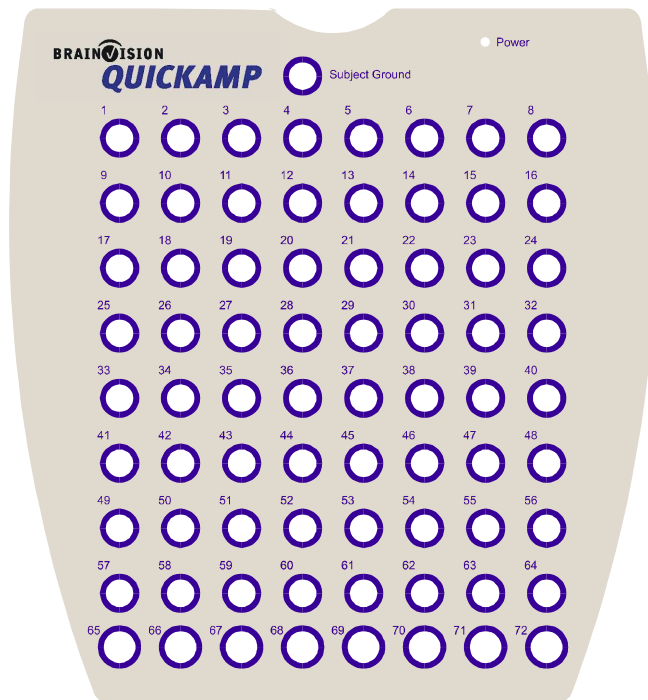
- Install the fiber interface (Fusbi) by placing the hardware and use the drivers software as supplied on the separate CD
- Find a well grounded mains socket for the external power supply, and connect the power connector to the back of the QuickAmp.
- Connect the bidirectional fiber to both the installed interface card and the back of the QuickAmp. A good connection is indicated by a little 'click'.

Turn the QuickAmp on with the switch on the back. The POWER indication should light up. When this is the first time on the PC the PC will ask for the driver software which can be found on the same CD as needed for the fiber interface. The front-end is now ready for use.

5 Operating instructions

The front panel of the QuickAmp has the following items:

Power	Power on indicator (green LED)
1..64	64 EEG / electrophysiological input connectors and bad impedance LED
65..68	4 Bipolar electrophysiological input connectors
69..72	4 Auxiliary channel input connectors
Subject Ground	Subject Ground connection for electrophysiological measurements

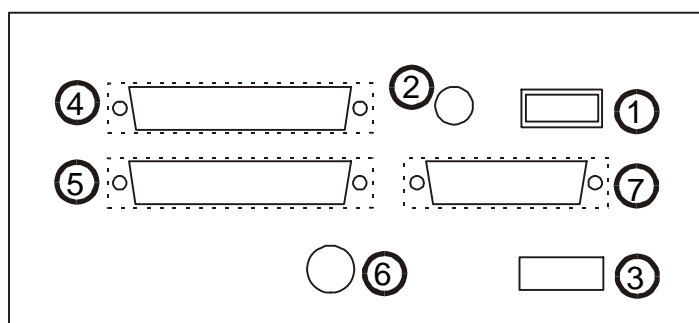


QuickAmp-72 front view

The front panel of the QuickAmp-40 is missing the channels 33 up to 64

On the back panel, the following items can be identified:

- 1 On/off switch
- 2 Connector for external power supply
- 3 Fiber connector
- 4 DB37 first headcap connector
- 5 DB37 second headcap connector not present for QuickAmp-40
- 6 BNC connector for digital input
- 7 DB25 connector for digital input



QuickAmp back panel

Using Subject electrode leads

For unipolar ('reference amplifier') signals: use 2 or more unipolar shielded cables with snap connector or fixed Ag/AgCl electrode cup (micro-coax inputs).

For bipolar signals: use 1 or more bipolar cables (4-pin bipolar inputs).

The numbers placed near the connector correspond to the QuickAmp output channels.

For a good measuring, make sure the electrodes make a good contact with the subject. Ag/AgCl electrodes are recommended, because of their excellent signal quality and stability.

Subject ground

Always use one unipolar shielded cable (snap connector or fixed Ag/AgCl electrode cup) for subject ground (GND connection).

It is very important, that the impedance of the subject ground is kept low, if possible below 5kOhm. To guarantee that the impedance of the subject ground has low impedance several measures can be taken, like cleaning the skin or adding a lot of gel. We recommend a special electrode, the wrist belt electrode. This electrode is shown in the figure below. The electrode is saturated with water, and fastened on the wrist.



Using Auxiliary sensors

Connect the auxiliary sensor (e.g. 3D-accelerometer) to one (or more, if required) of the 5-pin auxiliary inputs. The numbers placed near the connector correspond to the QuickAmp output channels.

6 Technical background

In the QuickAmp-system the following items can be identified:

- Subject Ground connector
- electrophysiological (ExG) and (BIP) input connectors
- headcap connectors
- auxiliary (AUX) input connectors
- ExG impedance measurement
- ExG calibration
- digital input
- external power supply connection
- bi-directional glass fiber

Subject Ground connector

The Subject Ground electrode is meant as a way to keep subject potential and QuickAmp amplifier potential at about the same level. It is not an active input. For good disturbance-free measurements make sure that the subject ground electrode has low impedance.

Electrophysiological (ExG) and (BIP) input connectors

The ExG inputs on the front of the QuickAmp are used to perform ExG (EEG, ECG, EOG, etc) measurements. All electrode cables are individual shielded (active shield). This ensures a disturbance free measurement. 50 Hz mains interference and cable movement artefacts are reduced to a minimum.

Inputs that are not connected to an electrode cable are automatically switched off.

It is advisable to use only one type of electrodes (e.g. Ag/AgCl, Sintered chloride, Gold, tin) at a time, including the subject ground electrode. Different metals will cause large electrode offset differences, which might overflow the amplifiers.

Headcap connectors

The headcap connectors (situated at the back side of the box) are another way to connect the subject to the front-end. The inputs are connected directly to the accompanying unipolar ExG input. The active shielding signals are not present on the headcap connectors. Appendix 3 shows the list of pin numbers of the connectors.

Auxiliary (AUX) input connectors

The auxiliary inputs can be used to connect active sensors like SaO₂ sensors, 3D-accelerometer, respiration bands, nasal flow sensors, pH sensors etc.

Each auxiliary input has a 5-pin connector. Signals on this connector are +5V output, -5V output, GND, +signal input and -signal input.

An unconnected input will automatically be switched off (i.e. will show a zero signal).

In Appendix 3 the pin-out of the AUX connector is given.

ExG impedance measurement

The QuickAmp contains a circuit to perform ExG electrode impedance measurements.

The impedance measurement can be started with the PC. The PC-controlled impedance measurement starts by sending the front-end an impedance measurement command and an impedance threshold value. Like in the manual mode, all channels that have an impedance higher than the threshold value will have their LEDs turned on.

At power-up of the QuickAmp system all LED's will be turned on for about 1 second.

ExG calibration

The PC can put the front-end in calibration mode in order to test the ExG amplifiers. This mode is indicated by a blinking impedance LED. Select the calibration mode only if no subject is connected to the input. Otherwise the subjects EEG will interfere with the calibration signals.

Digital input

On the backside of the system a DB25 connector and a BNC connector are available to be used as a digital input (8 bits DB25 and 1 bit BNC). On this input one can connect e.g. the sync-output of a stimulator in order to trigger on certain events. The inputs are electrically isolated from the rest of the system by means of optocouplers.

External power supply

To get the best signal quality (minimum 50 Hz interference) make sure that a well grounded mains outlet is used. The external power supply guarantees patient safety during all circumstances. Do **NEVER** use a power supply other than the one that came with the front-end.

A switch on the back of the External power supply turns the system on or off.

Bi-directional glass fiber

The glass fiber interface takes care of the bi-directional communication between QuickAmp and PC. Through this link the PC can set the sample frequency of the QuickAmp, control the measurement mode (normal, impedance, calibration) etc. The signal data from the ADCs is sent from the QuickAmp to the PC over the fiber in high speed and at high resolution.

Appendix 1

Specifications

Type

QuickAmp-40 and QuickAmp-72

Classification

according to MDD



Class IIa

CE-certified, see declaration of conformity

Dimensions

External dimensions

210 x 207 x 92 mm (l x w x h)

External power supply:

Input

110-240V AC, 50 - 60 Hz

Output voltage

10V DC

Output current

max. 350 mA

Isolation voltage

> 4000V

Leakage current

< 3 μ A



safety according to IEC 60601-1 class II type CF

Unipolar ExG inputs (EEG, ECG, EOG, EMG etc):

Number (QuickAmp-40)

32

Number (QuickAmp-72)

64

Noise

< 1 μ Vrms (@ lowest sample rate)

Gain

26,55 x

Input signal difference

-150mV / +150mV

Input common mode range

-2V / +2V

Input impedance

> $10^{12} \Omega$

CMRR

100 dB (typical), minimal 90 dB

Connector

micro coax, active shielding // subD37 female connector

Bipolar ExG inputs (ECG, EOG, EMG etc):

Number

4

Noise

< 1 μ Vrms (@ lowest sample rate)

Gain

26,55 x

Input signal difference

-150mV / +150mV

Input common mode range

-2V / +2V

Input impedance

> $10^{12} \Omega$

CMRR

100 dB (typical), minimal 90 dB

Connector

4 pin BINDER, active shielding

AUX inputs:

Number

4

Noise

< 20 μ Vrms (@ lowest sample rate)

Gain

1 x

Input signal range (diff)

-3V -+3V

Input common mode range

-4V - +4V

Input impedance

> $10^{12} \Omega$

CMRR

80 dB (typical), minimal 70 dB

Output voltage

+5V, -5V, max 5mA per channel, or 20mA for all channels together

Connector

5 pin BINDER

Digital input

Connector

DB25, 8 signal, 1 common ground (bit 0 also by BNC)

Input

turn-on current = 2 mA @ $V_{in} = 3.0V$, $V_{in_max} = 5V$

Isolation

> 4000 V, by means of optocoupler (H11L1)

Sampling:

Number of channels	40 or 72 channels simultaneously
Resolution	24 bits, ExG//BIP 18.39 nV per bit, AUX 0.48828 µV per bit
Sample frequency	2000 Hz, 1000 Hz, 500 Hz, 250 Hz, 125 Hz
Output (QuickAmp-40)	42 channels: 1-32=Unipolar ExG 33-36 = Bipolar ExG 37-40 = AUX 41=Digital (bit 0-7=digital trigger input (inverted)) 42=Digital (bit 0-14=sawtooth test signal)
Output (QuickAmp-72)	74 channels: 1-64=Unipolar ExG 65-68 = Bipola ExG 69-72 = AUX 73=Digital (bit 0-7=digital trigger input (inverted)) 74=Digital (bit 0-14=sawtooth test signal)

Filtering/gain:

Gain	ExG 26.55 x, fixed (= 37,7 mV/V), BIP 26.55 x, fixed (= 37,7 mV/V), AUX 1 x, fixed (= 1 V/V)
Highpass	none
Lowpass	digital FIR filter, cutoff frequency = guaranteed 0.2 * sample frequency. This means that the -3dB point is higher than 0.2 * sample frequency

Fiber communication:

Max supported sample rate	2000 Hz
Fiber length	up to 70m
Required interface	FUSBI, USB2.0 port on PC

Storage and transportation conditions:

temperature	-10°C - +50°C
humidity	10% - 100%
pressure	500 hPa - 1060 hPa

Usage conditions:

temperature	0°C - +40°C
humidity	10% - 90%
pressure	500 hPa - 1060 hPa

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Technical changes reserved

Appendix 2 Channel overview

Channel list QuickAmp-40:

nr	name	function	resolution	range
1	ExG1	Unipolar input 1	0.01839 μ V	-150mV / +150mV
2	ExG2	Unipolar input 2	0.01839 μ V	-150mV / +150mV
3	ExG3	Unipolar input 3	0.01839 μ V	-150mV / +150mV
4	ExG4	Unipolar input 4	0.01839 μ V	-150mV / +150mV
5	ExG5	Unipolar input 5	0.01839 μ V	-150mV / +150mV
6	ExG6	Unipolar input 6	0.01839 μ V	-150mV / +150mV
7	ExG7	Unipolar input 7	0.01839 μ V	-150mV / +150mV
8	ExG8	Unipolar input 8	0.01839 μ V	-150mV / +150mV
9	ExG9	Unipolar input 9	0.01839 μ V	-150mV / +150mV
10	ExG10	Unipolar input 10	0.01839 μ V	-150mV / +150mV
11	ExG11	Unipolar input 11	0.01839 μ V	-150mV / +150mV
12	ExG12	Unipolar input 12	0.01839 μ V	-150mV / +150mV
13	ExG13	Unipolar input 13	0.01839 μ V	-150mV / +150mV
14	ExG14	Unipolar input 14	0.01839 μ V	-150mV / +150mV
15	ExG15	Unipolar input 15	0.01839 μ V	-150mV / +150mV
16	ExG16	Unipolar input 16	0.01839 μ V	-150mV / +150mV
17	ExG17	Unipolar input 17	0.01839 μ V	-150mV / +150mV
18	ExG18	Unipolar input 18	0.01839 μ V	-150mV / +150mV
19	ExG19	Unipolar input 19	0.01839 μ V	-150mV / +150mV
20	ExG20	Unipolar input 20	0.01839 μ V	-150mV / +150mV
21	ExG21	Unipolar input 21	0.01839 μ V	-150mV / +150mV
22	ExG22	Unipolar input 22	0.01839 μ V	-150mV / +150mV
23	ExG23	Unipolar input 23	0.01839 μ V	-150mV / +150mV
24	ExG24	Unipolar input 24	0.01839 μ V	-150mV / +150mV
25	ExG25	Unipolar input 25	0.01839 μ V	-150mV / +150mV
26	ExG26	Unipolar input 26	0.01839 μ V	-150mV / +150mV
27	ExG27	Unipolar input 27	0.01839 μ V	-150mV / +150mV
28	ExG28	Unipolar input 28	0.01839 μ V	-150mV / +150mV
29	ExG29	Unipolar input 29	0.01839 μ V	-150mV / +150mV
30	ExG30	Unipolar input 30	0.01839 μ V	-150mV / +150mV
31	ExG31	Unipolar input 31	0.01839 μ V	-150mV / +150mV
32	ExG32	Unipolar input 32	0.01839 μ V	-150mV / +150mV
33	BIP33	Bipolar input 33	0.01839 μ V	-150mV / +150mV
34	BIP34	Bipolar input 34	0.01839 μ V	-150mV / +150mV
35	BIP35	Bipolar input 35	0.01839 μ V	-150mV / +150mV
36	BIP36	Bipolar input 36	0.01839 μ V	-150mV / +150mV
37	AUX37	Auxiliary input 37	0.48828 μ V	-3.0V / +3.0V
38	AUX38	Auxiliary input 38	0.48828 μ V	-3.0V / +3.0V
39	AUX39	Auxiliary input 39	0.48828 μ V	-3.0V / +3.0V
40	AUX40	Auxiliary input 40	0.48828 μ V	-3.0V / +3.0V
41	Digi	Digital channel (bits)	1 (bit)	0 / 255
		0 Digital input bit 0		
		1 Digital input bit 1		
		2 Digital input bit 2		
		3 Digital input bit 3		
		4 Digital input bit 4		
		5 Digital input bit 5		
		6 Digital input bit 6		
		7 Digital input bit 7		
42	Saw	8-15 reserved	1 (bit)	0 / 32767
		Sawtooth test signal (bits)		
		0-14 Sawtooth test signal		
		15 Always 0		

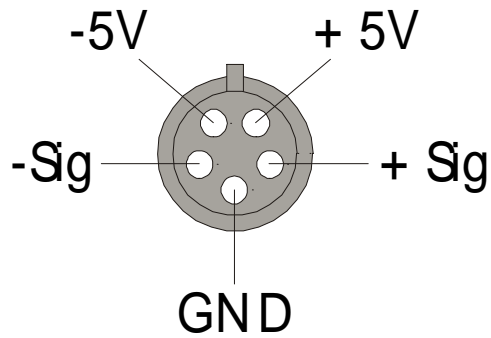
Channel list QuickAmp-72:

nr	name	function	resolution	range
1	ExG1	Unipolar input 1	0.01839 μ V	-150mV / +150mV
2	ExG2	Unipolar input 2	0.01839 μ V	-150mV / +150mV
3	ExG3	Unipolar input 3	0.01839 μ V	-150mV / +150mV
4	ExG4	Unipolar input 4	0.01839 μ V	-150mV / +150mV
5	ExG5	Unipolar input 5	0.01839 μ V	-150mV / +150mV
6	ExG6	Unipolar input 6	0.01839 μ V	-150mV / +150mV
7	ExG7	Unipolar input 7	0.01839 μ V	-150mV / +150mV
8	ExG8	Unipolar input 8	0.01839 μ V	-150mV / +150mV
9	ExG9	Unipolar input 9	0.01839 μ V	-150mV / +150mV
10	ExG10	Unipolar input 10	0.01839 μ V	-150mV / +150mV
11	ExG11	Unipolar input 11	0.01839 μ V	-150mV / +150mV
12	ExG12	Unipolar input 12	0.01839 μ V	-150mV / +150mV
13	ExG13	Unipolar input 13	0.01839 μ V	-150mV / +150mV
14	ExG14	Unipolar input 14	0.01839 μ V	-150mV / +150mV
15	ExG15	Unipolar input 15	0.01839 μ V	-150mV / +150mV
16	ExG16	Unipolar input 16	0.01839 μ V	-150mV / +150mV
17	ExG17	Unipolar input 17	0.01839 μ V	-150mV / +150mV
18	ExG18	Unipolar input 18	0.01839 μ V	-150mV / +150mV
19	ExG19	Unipolar input 19	0.01839 μ V	-150mV / +150mV
20	ExG20	Unipolar input 20	0.01839 μ V	-150mV / +150mV
21	ExG21	Unipolar input 21	0.01839 μ V	-150mV / +150mV
22	ExG22	Unipolar input 22	0.01839 μ V	-150mV / +150mV
23	ExG23	Unipolar input 23	0.01839 μ V	-150mV / +150mV
24	ExG24	Unipolar input 24	0.01839 μ V	-150mV / +150mV
25	ExG25	Unipolar input 25	0.01839 μ V	-150mV / +150mV
26	ExG26	Unipolar input 26	0.01839 μ V	-150mV / +150mV
27	ExG27	Unipolar input 27	0.01839 μ V	-150mV / +150mV
28	ExG28	Unipolar input 28	0.01839 μ V	-150mV / +150mV
29	ExG29	Unipolar input 29	0.01839 μ V	-150mV / +150mV
30	ExG30	Unipolar input 30	0.01839 μ V	-150mV / +150mV
31	ExG31	Unipolar input 31	0.01839 μ V	-150mV / +150mV
32	ExG32	Unipolar input 32	0.01839 μ V	-150mV / +150mV
33	ExG33	Unipolar input 33	0.01839 μ V	-150mV / +150mV
34	ExG34	Unipolar input 34	0.01839 μ V	-150mV / +150mV
35	ExG35	Unipolar input 35	0.01839 μ V	-150mV / +150mV
36	ExG36	Unipolar input 36	0.01839 μ V	-150mV / +150mV
37	ExG37	Unipolar input 37	0.01839 μ V	-150mV / +150mV
38	ExG38	Unipolar input 38	0.01839 μ V	-150mV / +150mV
39	ExG39	Unipolar input 39	0.01839 μ V	-150mV / +150mV
40	ExG40	Unipolar input 40	0.01839 μ V	-150mV / +150mV
41	ExG41	Unipolar input 41	0.01839 μ V	-150mV / +150mV
42	ExG42	Unipolar input 42	0.01839 μ V	-150mV / +150mV
43	ExG43	Unipolar input 43	0.01839 μ V	-150mV / +150mV
44	ExG44	Unipolar input 44	0.01839 μ V	-150mV / +150mV
45	ExG45	Unipolar input 45	0.01839 μ V	-150mV / +150mV
46	ExG46	Unipolar input 46	0.01839 μ V	-150mV / +150mV
47	ExG47	Unipolar input 47	0.01839 μ V	-150mV / +150mV
48	ExG48	Unipolar input 48	0.01839 μ V	-150mV / +150mV
49	ExG49	Unipolar input 49	0.01839 μ V	-150mV / +150mV
50	ExG50	Unipolar input 50	0.01839 μ V	-150mV / +150mV
51	ExG51	Unipolar input 51	0.01839 μ V	-150mV / +150mV
52	ExG52	Unipolar input 52	0.01839 μ V	-150mV / +150mV
53	ExG53	Unipolar input 53	0.01839 μ V	-150mV / +150mV

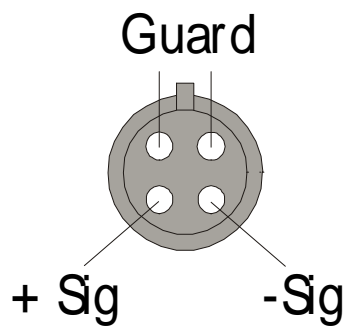
54	ExG54	Unipolar input 54	0.01839 μ V	-150mV / +150mV
55	ExG55	Unipolar input 55	0.01839 μ V	-150mV / +150mV
56	ExG56	Unipolar input 56	0.01839 μ V	-150mV / +150mV
57	ExG57	Unipolar input 57	0.01839 μ V	-150mV / +150mV
58	ExG58	Unipolar input 58	0.01839 μ V	-150mV / +150mV
59	ExG59	Unipolar input 59	0.01839 μ V	-150mV / +150mV
60	ExG60	Unipolar input 60	0.01839 μ V	-150mV / +150mV
61	ExG61	Unipolar input 61	0.01839 μ V	-150mV / +150mV
62	ExG62	Unipolar input 62	0.01839 μ V	-150mV / +150mV
63	ExG63	Unipolar input 63	0.01839 μ V	-150mV / +150mV
64	ExG64	Unipolar input 64	0.01839 μ V	-150mV / +150mV
65	BIP65	Bipolar input 65	0.01839 μ V	-150mV / +150mV
66	BIP66	Bipolar input 66	0.01839 μ V	-150mV / +150mV
67	BIP67	Bipolar input 67	0.01839 μ V	-150mV / +150mV
68	BIP68	Bipolar input 68	0.01839 μ V	-150mV / +150mV
69	AUX69	Auxiliary input 69	0.48828 μ V	-3.0V / +3.0V
70	AUX70	Auxiliary input 70	0.48828 μ V	-3.0V / +3.0V
71	AUX71	Auxiliary input 71	0.48828 μ V	-3.0V / +3.0V
72	AUX72	Auxiliary input 72	0.48828 μ V	-3.0V / +3.0V
73	Digi	Digital channel (bits)	1 (bit)	0 / 255
		0	Digital input bit 0	
		1	Digital input bit 1	
		2	Digital input bit 2	
		3	Digital input bit 3	
		4	Digital input bit 4	
		5	Digital input bit 5	
		6	Digital input bit 6	
		7	Digital input bit 7	
		8-15	reserved	
74	Saw	Sawtooth test signal (bits)	1 (bit)	0 / 32767
		0-14	Sawtooth test signal	
		15	Always 0	

Appendix 3 Connector pinout

AUX Connector (front view)



BIP Connector (Front view)



Digital input DB25 connector

Pin	Input	
2	bit 0 (LSbit)	(parallel to BNC connector in software)
3	bit 1	
4	bit 2	
5	bit 3	
6	bit 4	
7	bit 5	
8	bit 6	
9	bit 7	
25	common ground	

Headcap connector

This table describes the relation between signal channel numbers and headcap connector pin numbers.

Channel number	DB37 pin number		Channel number	DB37 pin number Not present for QuickAmp 40
-	1		-	1
1	20		33	20
2	2		34	2
3	21		35	21
4	3		36	3
5	22		37	22
6	4		38	4
7	23		39	23
8	5		40	5
9	24		41	24
10	6		42	6
11	25		43	25
12	7		44	7
13	26		45	26
14	8		46	8
15	27		47	27
16	9		48	9
17	28		49	28
18	10		50	10
19	29		51	29
20	11		52	11
21	30		53	30
22	12		54	12
23	31		55	31
24	13		56	13
25	32		57	32
26	14		58	14
27	33		59	33
28	15		60	15
29	34		61	34
30	16		62	16
31	35		63	35
32	17		64	17
Subject Ground	36		Subject Ground	36
-	18		-	18
-	37		-	37
-	19		-	19