



HS-16-CNR Manual

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1 Document Overview

This manual should be used with the **Neuralynx Electrode Interface Board 16 channel (EIB-16)** manual.

The Neuralynx Headstage 16 (HS-16-CNR) Amplifier is the active electronic part of the Electrode Interface Board / Headstage / Tether system. It provides 16 channels of Unity Gain amplification (buffering). It also provides connections for the electrode inputs to the EIB-16 and an output connector for a 20-conductor tether.

The Headstage Amplifier size is approximately 20 mm high by 10 mm wide. Weighing only 600mg, the HS-16-CNR is a good choice for small animals. One connector on the bottom of the board is used to connect the Headstage Amplifier to the Neuralynx Electrode Interface Board. Low noise, low power, low input bias current Op amps have been used on this device instead of the traditional “Source Follower FET circuit” used in the traditional headstage amplifier design in order to:

- obtain exact unity gain which greatly improves Common Mode Rejection Ratio (CMRR)
- performance for the entire recording system for artifact and other common mode noise signal rejection;
- lower output impedance to reduce noise susceptibility of the tether and other signal cabling;
- provide integral antistatic protection on each input channel;
- insure low input bias current levels; and
- eliminate signal distortion.

Because an Op amp is used for the unity gain buffer amplifiers, special care and attention must be given to the power supply design and power application and removal sequencing. The input protection circuitry will lower the input impedance if the input voltage exceeds power supply voltage. This can occur if the input voltage exceeds the power supply voltage or by the loss of power supply voltage. The Neuralynx EEG/Reference Panel contains power supplies which properly sequence power supply voltage and monitor headstage currents.

2 Input Connector Pin Out

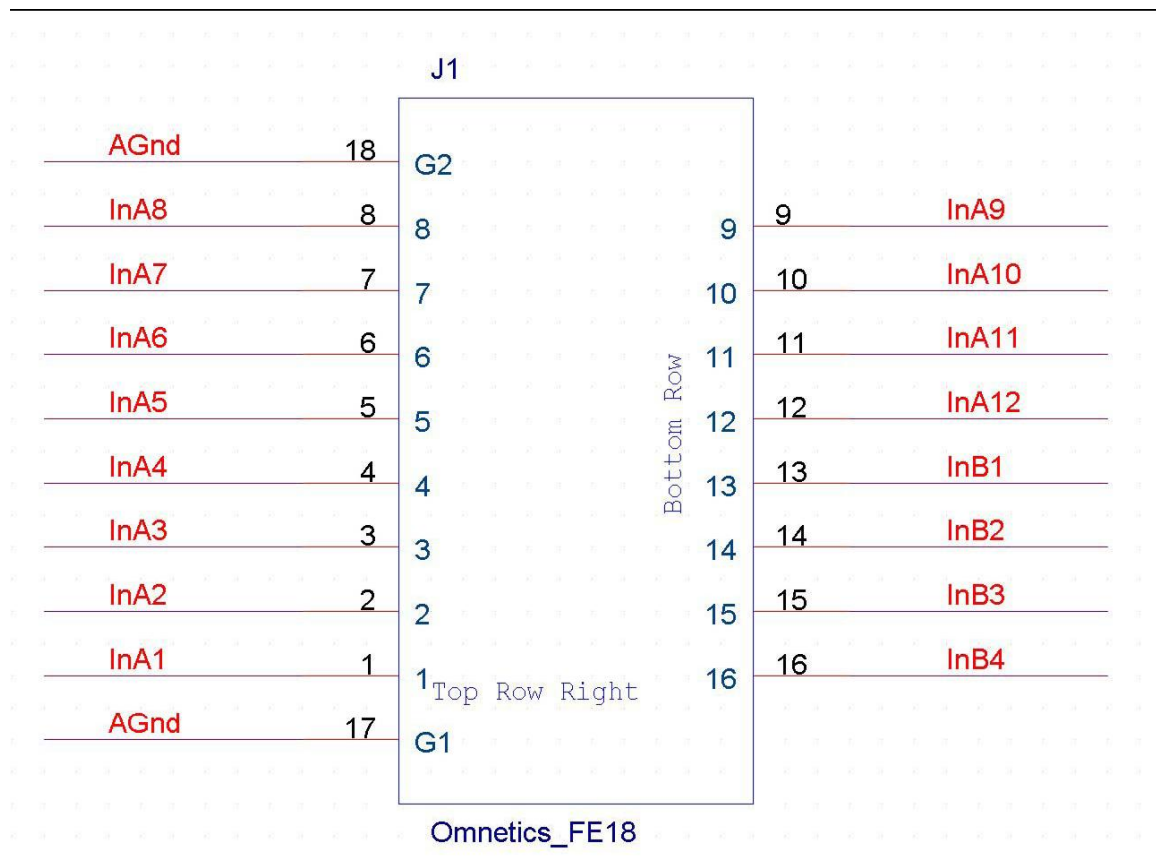


Figure 2-1 Pin Out For Omnetics

The input connector is an Omnetics 20 pin connector. The top and bottom pins (17 & 18) are used as ground connections. This view of this connector would be as looking down from the top of the HS-16, or the top side of the mating EIB-16 connector. The missing pins on the top and bottom pins on the right side of this diagram are used for the alignment posts which insure proper connector orientation and alignment between the HS-16-CNR and EIB-16.

3 Tether Signal Connections

One 50 Pin 3M MDR connector is used for the headstage tether connection. The tether cable consists of a 20 unshielded conductors. This cable is unjacketed and unshielded to allow maximum flexibility and lowest possible mass; which is desirable when working with very small animals. The 20 wire tether is tied/wrapped with lightweight dental floss.

The individual wires in the Tether are 38 gauge, 7 strand wires with a resistive measurement of approximately 3 ohms per meter. The tether wires are soldered directly to the HS-16 PC Board to eliminate the need for an additional connector and the associated mass. The following figure shows the pin out of the 3M MDR connector, which is compatible with the standard pin out of the Neuralynx EEG/Reference/Panels (ERP-27, ERP-54,ERP-144).

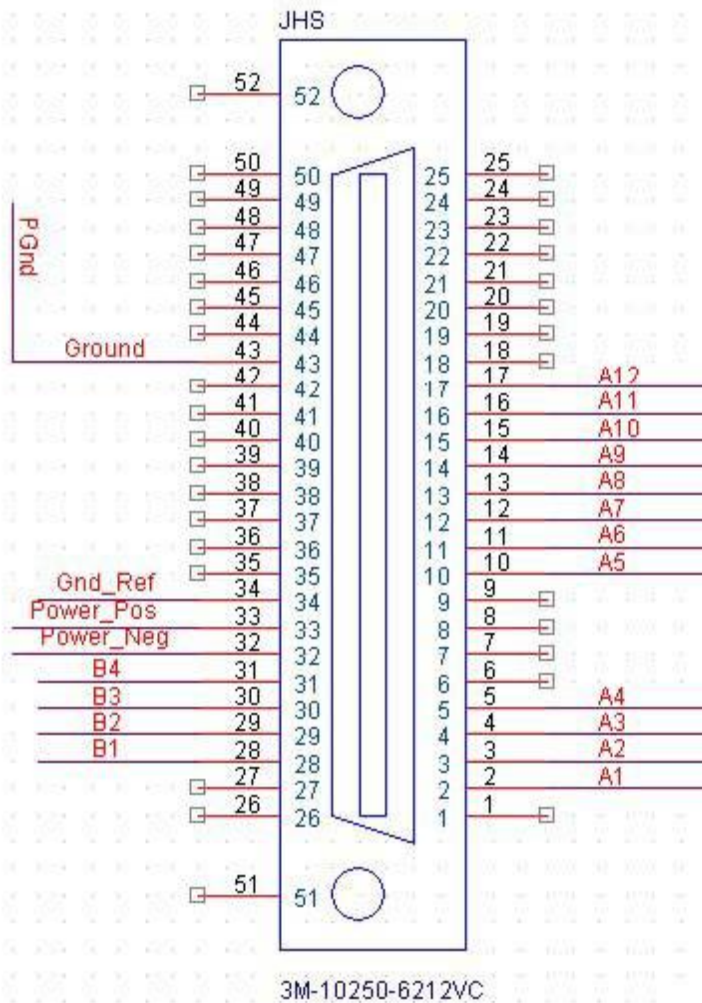


Figure 3-1 3M 50 Pin MDR Tether Connector

Notes: The HS-16 does NOT have a separate REFERENCE channel buffer amplifier or input connection for a separate reference electrode, normally Pin #27 on the HS-27. This was by design to conserve weight and size of this device.

- Also note that the HS-16-CNR does NOT have the E1 and E2 buffer amplifiers as does the HS-27.
- Also note that Pin 34, Gnd_Ref, is connected to the HS-16 Ground at the PC Board. This is a “Non-Current-Carrying Ground Signal” which is the same as on the HS-27.
- Pin 43 is used for Power Ground for the HS-16-CNR Opamp power as on the HS-27

- Power (+5v & -5v for buffer op-amps) is connected to pins 33 and 32 respectively as connected on the HS-27.
- Therefore the HS-16 Gnd_Ref (pin 34) noncurrent carrying ground connection is usually used as the primary reference on the ERP-27 EEG/Reference/Patch panel. This signal is connected to the AGND banana jack on the ERP-27, and is usually connected to the REF-D ERP-27 reference signal.

4 ERP-27 Panel Reference Connection and Use

Because the HS-16 does NOT have the standard Reference and E1/E2 buffer amplifiers and signal connections HS-16 users will have two main options for References: 1) use the non-current carrying Animal Ground connection from the HS-16; and 2) use one of the 16 channels (a quiet electrode channel). To use the Animal Ground connection from the HS-16 simply use the ERP-27 reference banana wire connections in the “normal” connection scheme as shown below with the A1->A12 and B1->B4 reference selection switches set to the “D” position (to select the Agnd reference source).

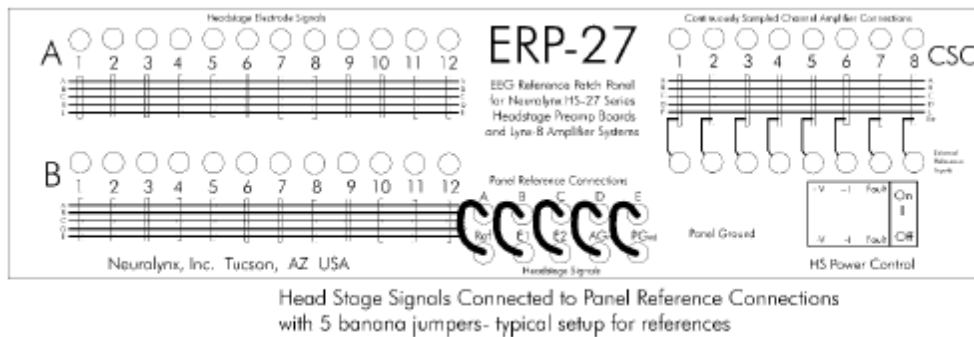


Figure 4-1 Front Panel ERP-27

To use a quiet electrode as a reference connect a banana wire from the desired channel to the “Panel Reference A” banana jack and then set the A1->B4 reference switches to the “A” position. See the ERP-27 manual for a more detailed explanation of this type of reference selection.

5 Power Supply Requirements

The Headstage Amp requires a dual supply, +5v and -5v for the buffer Opamp amplifiers. Current draw will be about 4 milliamps.

6 Mounting the Headstage to the Electrode Interface Board (EIB)

The EIB-16 is usually permanently attached to the animal or the 4-Drive miniature hyperdrive. The Headstage Amplifier is mounted to the EIB by placing the Headstage Amplifier on top of the EIB and carefully pressing the connectors together. Headstage power should be turned off when connecting and disconnecting to the animal.

7 Using the SM-16 Signal Mouse

If you wish to test your HS-16-CNR and associated equipment just plug the HS-16-CNR into the signal mouse. Then connect a signal generator (a minirator available from Neuralynx works well) set to 1v peak- peak square wave at frequency of 20Hz. The signal mouse will divide the signal by 1000 and feed it into all inputs at the same time.



Figure 7-1 Signal Mouse 16

7.1 Practical Tips

ALWAYS WEAR AN ANTISTATIC WRIST STRAP WHEN HANDLING AN ANIMAL OR WHEN HANDLING THE HEADSTAGE AMPLIFIER.

These are available at most electronics stores. It is very convenient to leave the Headstage Amplifier physically connected to the SM-16 (see below) in between experiment recording sessions. When this is done, protect the Headstage by placing it in the black antistatic shipping box. A piece of black conductive foam in the bottom of the box will also help.

7.2 Antistatic Precautions

As with all electronics, static discharges may cause damage to semiconductor devices and especially to high impedance inputs. The Op amp inputs are protected against a 2000-volt discharge but care must still be used when handling and using the Headstage Amplifier. Please observe the following guidelines:

- 1) Always wear a grounding wrist strap when handling an animal which is connected for recording;
- 2) Always wear a grounding wrist strap when handling the Headstage Amplifier; and
- 3) Store the headstage in the black antistatic protective box in which it was shipped when not connected to your research subject. Static discharge damage will usually result in lower amplifier input impedance and noisier amplifier channel performance.

8 Maintenance and Cleaning Information

The Headstage Amplifier is coated with a Mil-Spec conformal coating and is therefore NOT susceptible to contamination from dirt, animal food, fingerprints and wastes. The board may be cleaned with hot soapy water (Ivory dish soap is the best) followed by a rinse with a 50% alcohol-deionized water solution. Shake excess rinse solution off. The board must be air dried before using. This is the process used for final cleaning after assembly at Neuralynx. Also note that Neuralynx highly recommends the use of a static wrist strap whenever handling ANY exposed electronics or when handling ANY implanted animal because cell damage will occur in the event of even slight static discharge to implanted electrode connections.

If you have any questions regarding the use of the Shorting Plug or proper usage of Static Protection including Static Wrist Straps please contact Neuralynx at 406-585-4542 or email Support@Neuralynx.com