



HS-18-CNR Manual

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1 Document Overview

The Neuralynx Headstage-18 (HS-18-CNR) Amplifier is the active electronic part of the Electrode Interface Board (EIB) / Headstage / Tether system. It provides 16 channels of unity gain amplification, one reference, ground, and differential stimulation lines. One end of the HS-18-CNR provides connections for electrode inputs from an EIB-18. The other end connects to a 28-conductor tether. The HS-18-CNR is approximately 20 mm high and 10 mm wide. Weighing only 600mg, the HS-18-CNR is a good choice for use with small animals. The HS-18-CNR uses low noise, low power, and low input bias current op amps instead of the “Source Follower FET circuit” typically used by other headstage manufacturers. The op amps used on the Neuralynx HS-18-CNR have many advantages:

- Precise unity gain greatly improves the Common Mode Rejection Ratio (CMRR), preserving the integrity of the amplified signal
- High performance for the entire recording system for artifact and other common mode noise signal rejection
- Lower output impedance reduces noise susceptibility of the tether and other signal cabling
- Provide critical antistatic protection on each input channel
- Insure low input bias current levels
- Eliminate signal distortion

2 Input Connector Pinout

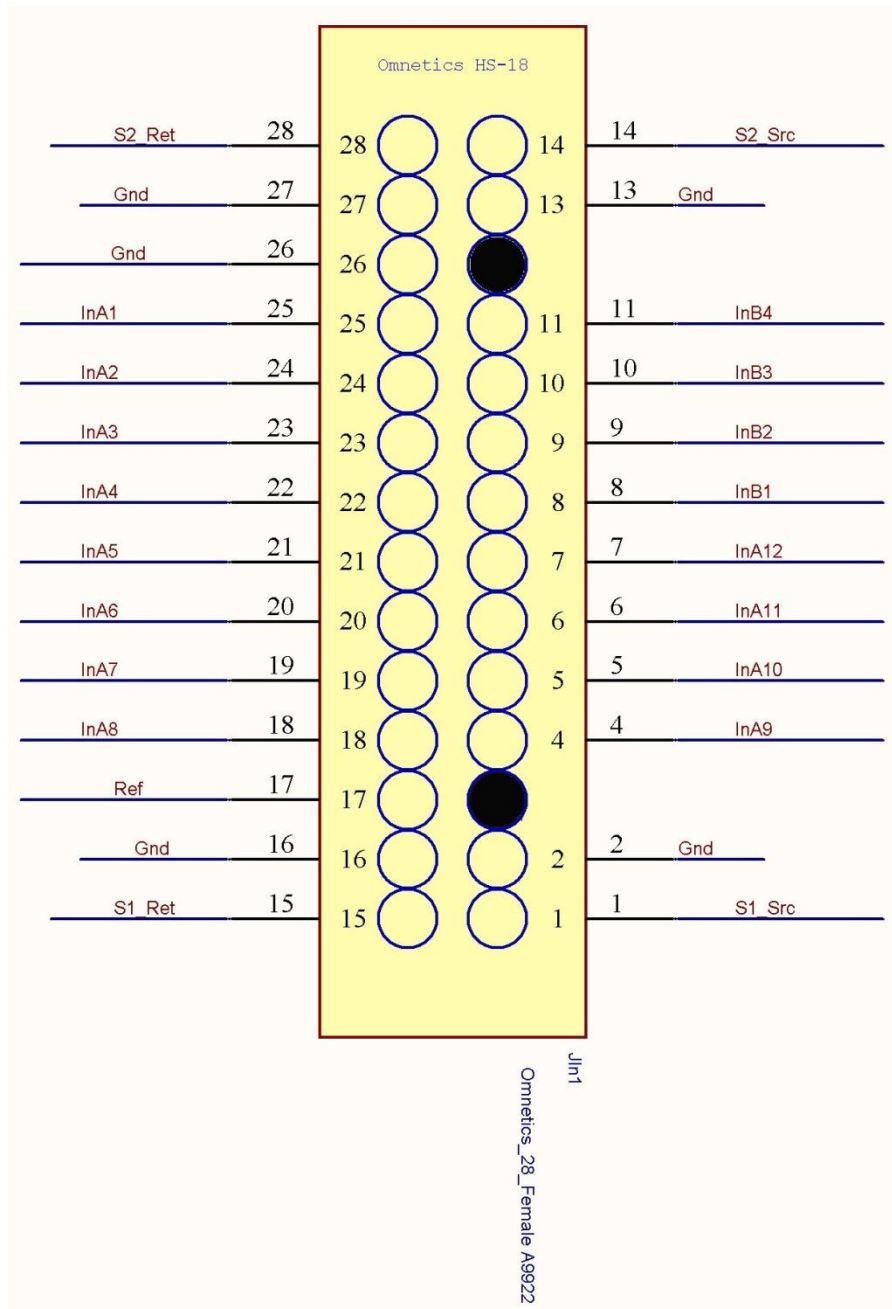


Figure 2-1 Input Connector

The input connector is an Omnetics 28 pin connector. Figure 2-1 shows the pinout as seen when facing the connector. The two darkened pins on the right side of Figure 2-1 mark the location of alignment posts which insure proper connector orientation when connecting a HS-18-CNR and EIB-18.

3 Tether Signal Connections

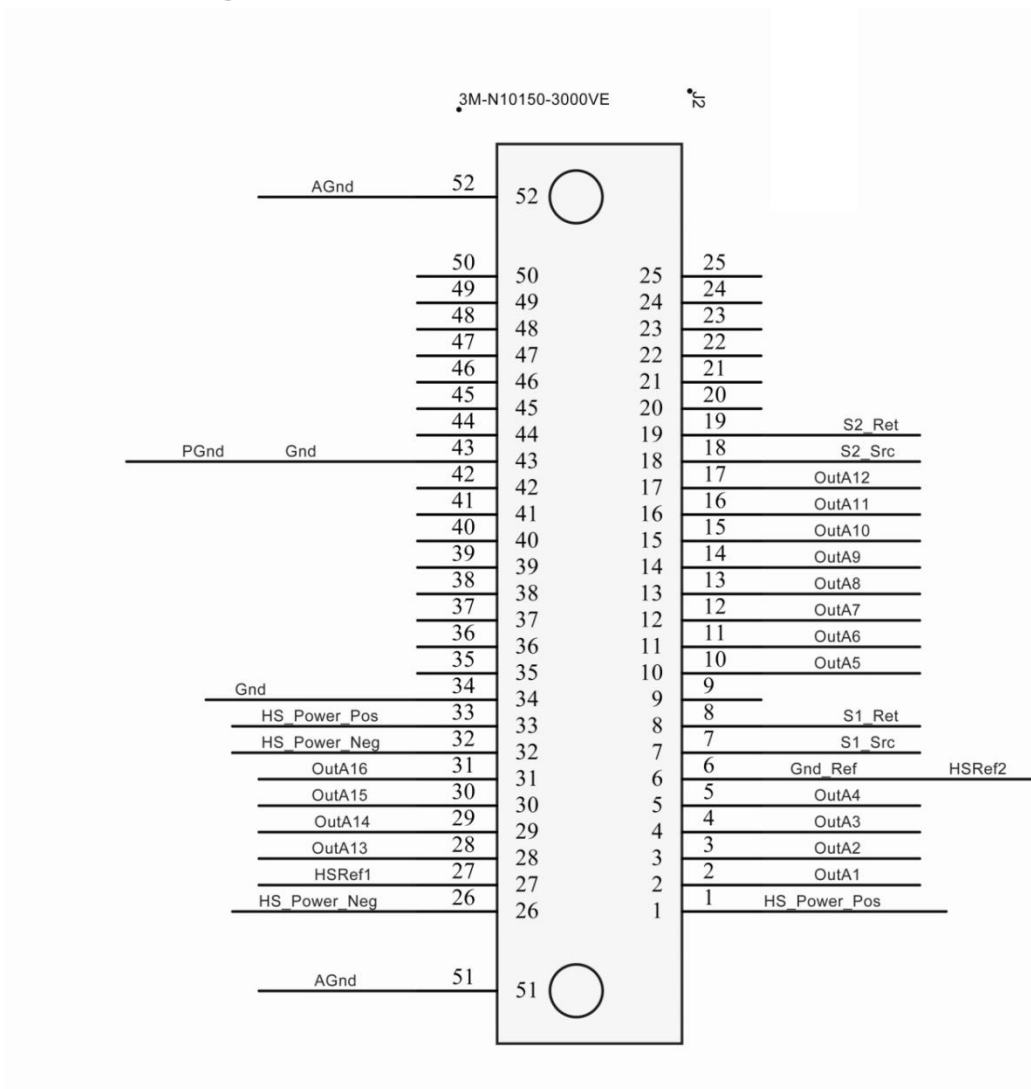


Figure 3-1 MDR50 Connector for HS-18-CNR

A 50 pin MDR connector made by 3M is used for the headstage tether connection. The tether cable consists of 28 unshielded conductors. This cable is unjacketed and unshielded to allow maximum flexibility and lowest possible mass; which is desirable when working with small animals. The 28 wire tether is tied at intervals with lightweight dental floss. The individual wires in the tether are 38 gauge, 7 strand wires with a resistance of approximately 3 ohms per meter. The tether wires are soldered directly to the HS-18-CNR circuit board to eliminate the mass of an additional connector. Figure 3-1 shows the pinout of the 50 pin MDR connector which is compatible with all of Neuralynx EEG/Reference/Panels (ERP-27, ERP-54, ERP-144, DRS input board):

- Pin 27 is the dedicated reference channel.
- Also note that pin 34, Gnd, is connected to the HS-18-CNR Ground at the circuit board. This is a non-current-carrying ground signal which is the same as on the HS-27.
- The HS-18-CNR Gnd (pin 34) can be used as the reference on the ERP-27. 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.
- Pin 43 is the HS-18-CNR panel ground.
- +5V power is connected to pin 33. -5V is connected to pin 32. This pinout for buffer op amp power is the same as on the HS-27.
- Pin 7 is S1_Src and pin 8 is S1_Ret. Pin 18 is S2_Src and pin 19 is S2_Ret. These connections are your stimulus source and return lines.

ERP-27 Panel Reference Connection and Use

The HS-18-CNR has the standard buffered reference channel in addition to the standard signal connections of the HS-16. Users also have two optional extra references.

Extra Reference 1

Use the non-current carrying animal ground connection from the HS-18-CNR. To use the Animal Ground connection from the HS-18-CNR simply use the ERP-27 (or through the software with the DRS-36) reference banana wire connections in the “normal” connection scheme with the A1 through A12 and B1 through B4 reference selection switches set to the “D” position (to select the Agnd reference source). Please refer to the ERP-27 user manual for further details on using the banana jumper cables and referencing.

Extra Reference 2

Use one of the 16 electrode channels that have low noise. To use an electrode channel as a reference, connect a banana wire from the desired channel to the “Panel Reference A” banana jack. Then set the A1 through B4 reference switches to the “A” position. See the ERP-27 manual for a more detailed explanation of this type of reference selection.

4 Power Supply Requirements

The HS-18-CNR amplifier requires +5V and -5V for the buffer op amps. Current draw is about 4 mA.

Because op amps are used for the unity gain buffer amplifiers, special care and attention must be given to the power supply design, power application and power removal. 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.

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

The EIB-18 is usually permanently attached to the animal or used with one of the Neuralynx microdrives. 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.

6 Using the SM-18 Signal Mouse

To test your HS-18-CNR with your Neuralynx acquisition system, you will need a SM-18 Signal Mouse and a signal generator. The Minirator, available from Neuralynx, is a compact battery powered signal generator that can fit in your hand.

To setup testing, plug the HS-18-CNR into the signal mouse. Then connect your signal mouse to a signal generator using a BNC cable. Set your signal generator to output:

Waveform - square wave
Amplitude - 1 V peak-to-peak
Frequency - 20 Hz

The signal mouse will divide the generated signal by 1000 and feed it into all HS-18-CNR inputs at the same time. The switch in the center labeled Ref controls whether the inputs to the HS-18-CNR are referenced to ground (down) or the signal from the signal generator (up). Each of the other switches is labeled according to which bank of 4 channels it controls. The (up) position passes the signal generator input on to the HS-18-CNR for the associated bank of channels and the (down) position grounds that bank of channels.

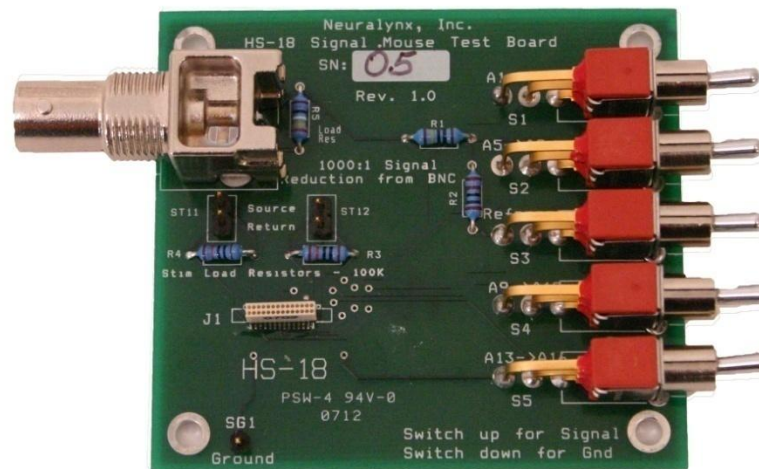


Figure 6-1 Signal Mouse for the HS-18-CNR

6.1 Antistatic Precautions

As with all electronics, static discharge may cause damage to semiconductor devices and especially to high impedance inputs. The op amp inputs are protected against a 2000-volt discharge but caution must still be used when handling and using a headstage amplifier.

Please observe the following guidelines:

- Always wear a grounding wrist strap when handling an animal which is connected for recording.
- Always wear a grounding wrist strap when handling a headstage amplifier.
- When a headstage is not connected to a research subject, store it in the black antistatic protective box in which it was shipped. Static discharge damage will usually result in lower amplifier input impedance and noisier amplifier channel performance.

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 a headstage amplifier physically connected to the SM-18 Signal Mouse 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 Maintenance and Cleaning Information

Headstage amplifiers are coated with a Mil-Spec conformal coating and are therefore protected from dirt, animal food, fingerprint and waste contamination. The board may be cleaned with hot soapy water. We recommend Ivory dish soap. The board should then be rinsed 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.

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