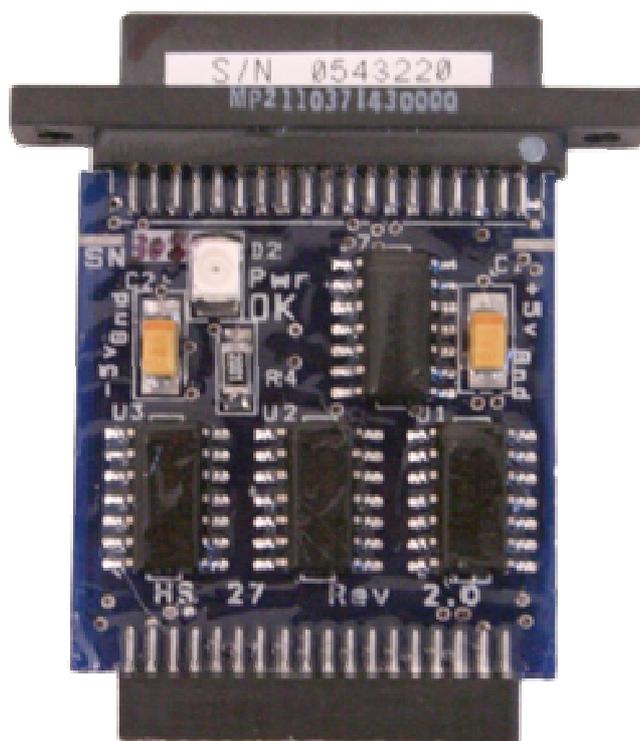




Neuralynx

High Density Electrophysiology Recording Systems



HS-27 Manual

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Revision 1.2
5/2/2013

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1 Headstage 27 Overview

The Neuralynx Headstage 27 (HS-27) Amplifier is the active electronic part of the Electrode Interface Board /Headstage / Tether system. It provides 27 channels of Unity Gain amplification (buffering). It also provides connections for the electrode inputs to the EIB-27 and an output connector for a single cable 36-conductor tether.

The Headstage Amplifier size is approximately 35 mm high by 25 mm wide. One 37 pin micro-D connector is used for tether connections. 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.

NOTE: 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 by either raising the input voltage signal above the power supply voltage or by the loss of power supply voltage. The HS-27 contains active power supply voltage monitoring circuitry which will not apply op-amp power supply voltages until the power supply voltages exceed the minimum normal operating voltage. The Neuralynx EEG/Reference Panel contains power supplies, which properly sequence power supply voltage and monitor headstage currents.

2 Glossary

EIB – An Electrode Interface Board (EIB) is the interface between experiment electrodes in a microdrive and the appropriate headstage.

3 Power Supply Monitoring Circuitry

The HS-27 PC board contains active circuitry, which monitors the total voltage of the positive and negative power supplies. When the sum of the power supplies exceeds 8 volts, power will be applied to the op-amp buffer amplifiers on the PC board and the Blue LED on the topside of the board will be illuminated. If the voltage of the power supplies drops below 8 volts, power to the op-amps will be turned off and the blue LED will be extinguished. The purpose of this circuitry is to protect the electrodes (and cells around electrode tips) against loss of one of the power supplies, which causes the op-amps to enter an “input protection” mode which causes an increased leakage current to flow from the op-amp inputs and thus damaging tissue.

4 Tether Signal Connections

One 37-pin micro-D type connector is used for the headstage-tether connection. Tether cable consists of a shielded 36-conductor with overall shields. The individual wires in the Tether are 44 gage, stranded conductors with a resistive measurement of approximately 3 ohms per meter. The Shield (pin 37) has a resistance measurement of about 1-ohm total for a 5-meter cable.

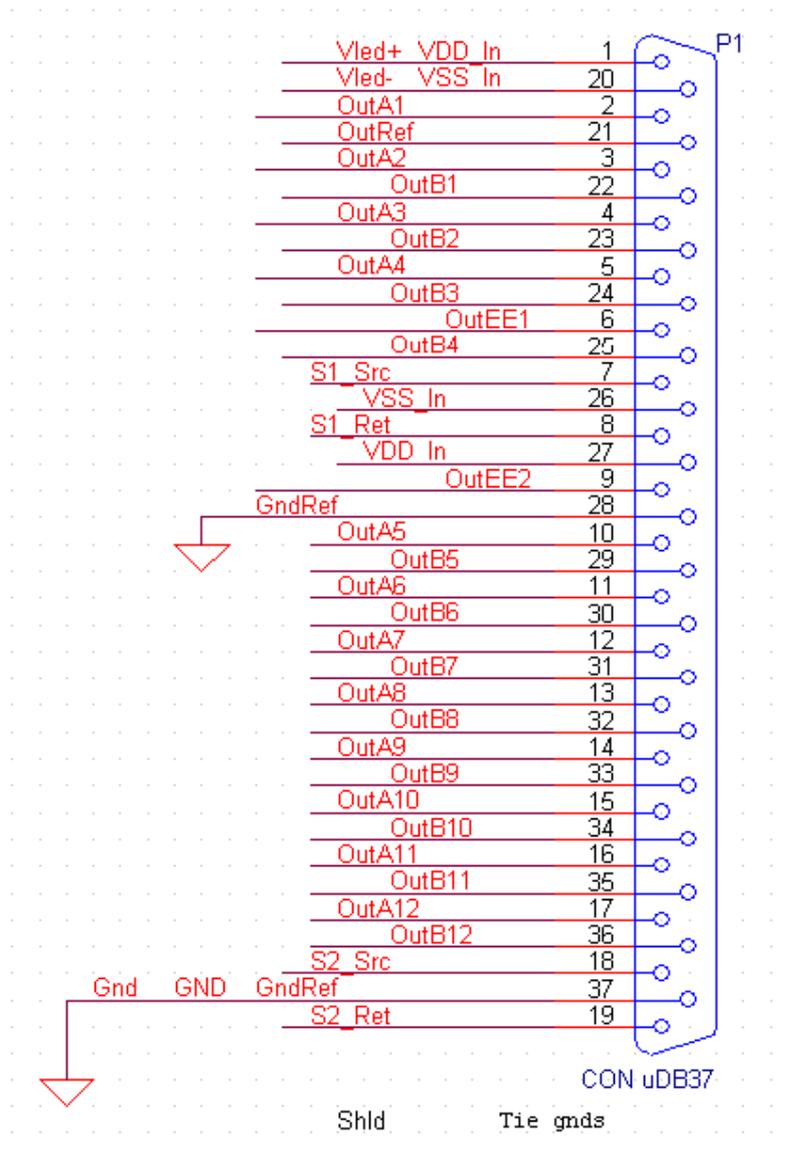


Figure 4-1 : Pin Out of the uD37 Tether Connector

Note: The ground signals on pin 37 and 28 are connected together on the headstage amplifier board.

5 Input Connector Pin out

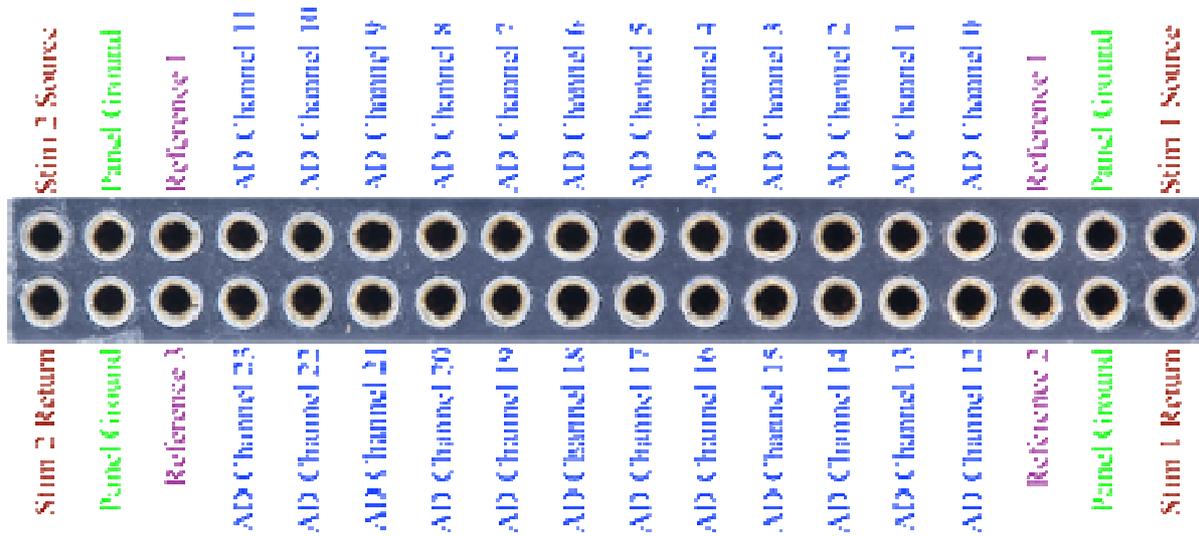


Figure 5-1 MillMax Connector

The input connector is a dual row 36-pin (2 X 18) MillMax .050" connector. This connector mates with the connector on the EIB-27 series of Electrode Interface Boards. Odd number pins are on the topside of the connector and all even numbered pins are on the bottom.

6 Power Supply Requirements

The Headstage Amp requires a dual supply, +5v and -5v for the buffer Op-amp amplifiers. Current draw will be about 7 milliamps.

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

The EIB-27 is usually permanently attached to the animal. The Headstage Amplifier is mounted to the EIB by placing the Headstage Amplifier on top of the EIB and carefully pressing the connectors together. Each board has a female socket type connector to reduce the possibility of damage to the board assemblies. An additional connector set, “double-male headers,” is used to make the connections between the two boards allowing for easy replacement of a damaged header.

Note: The header pins should normally be left with the Headstage Amplifier and not with the Electrode Interface Board. Headstage power should be turned off when connecting and disconnecting to the animal. The Blue LED (white packaged surface mount component) indicates the TOP side of the HS-27.

When connecting to the EIB-27 the BLUE LED side (the top side) of the HS -27 PC board should be aligned with the “A1-12” inputs side of the EIB-27. If the HS-27 is reversed when connecting to the EIB-27 all inputs will be connected to inputs and grounds to grounds so there will not be any damage to the animal or tissue; but all signals will be reversed and the reference and EE1/EE2 signals will be also swapped.

A spare double male header connector is included with the Headstage Amplifier. Extra sets of the header connectors may be ordered from Neuralynx.

WARNING: If stimulus lines are connected to electrodes, ensure they are not shorted to +5V before turning on headstage power. Failure to check this may result in paralysis or death of the test subject. This will happen if the stimulation plug is inserted and electrodes are connected to the stimulation vias on the EIB.

8 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 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. Keep the double-male header connector attached to bottom side of the Headstage Amplifier and not to the top of the Electrode Interface Board (attached to the animal). A small amount of heat glue or other removable adhesive can be used to hold the double-male header connectors to the bottom side of the Headstage Amplifier. This will help the header connectors stay with the Headstage Amplifier when the animal is disconnected. Remember that you will want to replace the header connectors if one is damaged or bent.

8.1 Antistatic Precautions

As with all electronics, static discharges cause damage to semiconductor devices and especially to 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.

Static discharge damage will usually result in lower amplifier input impedance and noisier amplifier channel performance.

8.2 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 de-ionized water solution. Shake excess rinse solution off. The board must be dried before using and may be placed in a dry incubator at 40 degrees C. This is the process used for final cleaning after assembly at Neuralynx.

8.3 Shorting Plug Board Description and Use

Each Headstage is shipped with a "shorting plug" (a double-male header connector with all pins shorted with solder) to protect the Headstage Electrode Input signal connections. This Shorting Plug provides additional static protection during shipping. It should also be used between recording sessions or whenever the headstage/recording system will not be used for an extended period of time.

Please note that the Headstage Op-amps contain “electronics industry standard” static protection circuitry, which protects against damage when applied to the “standard human body discharge” model, therefore it is safe under normal handling conditions during animal/EIB connection. We recommend placing the shorting plugs as shipped in-between recording sessions as an additional static protection measure.

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.