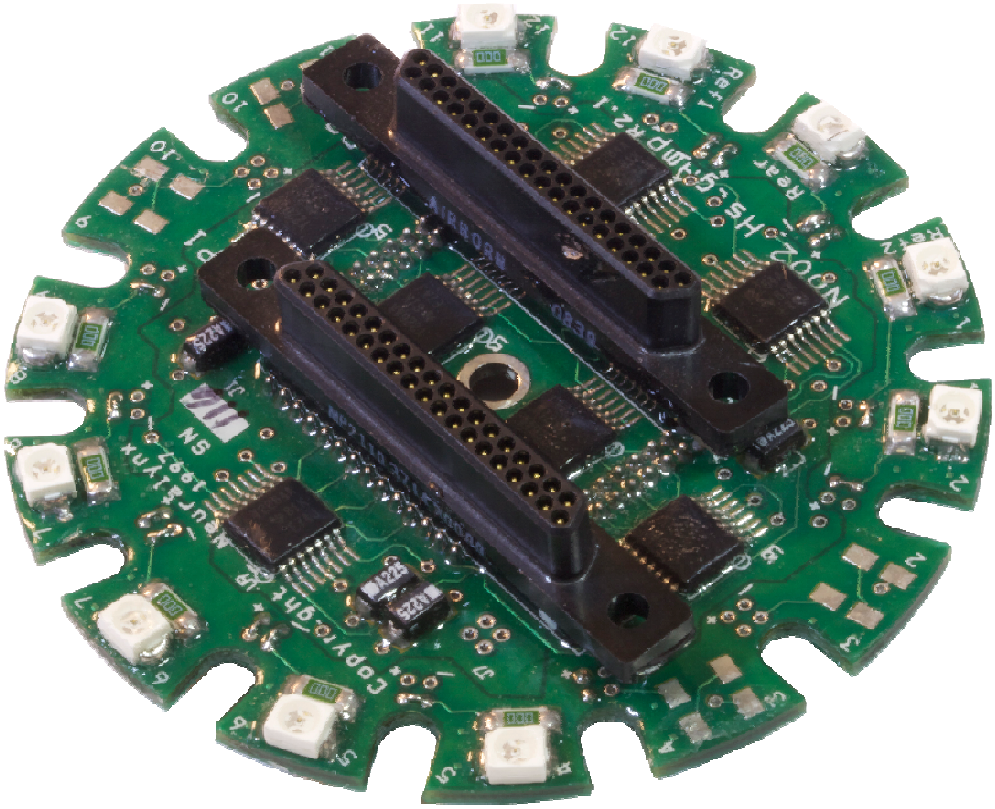
Neuralynx
High Density Electrophysiology Recording Systems



HS-54 User Manual

A preamplifier headstage with 54 channels of unity gain including 48 electrode channels and 6 references.

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1 Document Overview

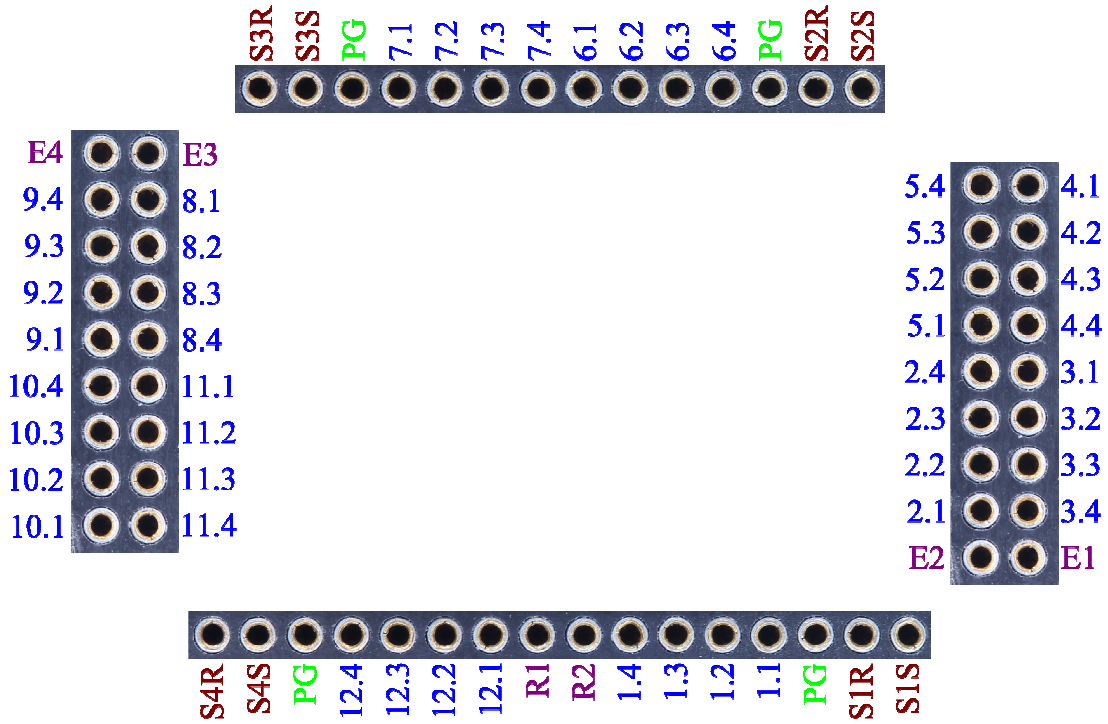
This document will describe the HS-54 features, connector descriptions, power supply requirements, and mounting.

2 HS-54 Overview

The Neuralynx HS-54 Amplifier is the active electronic part of the Headstage/Tether system. It provides 48 channels of unity gain amplification, two references, ground, and differential stimulation lines. One end of the HS-54 provides connections to an Electrode Interface Board(EIB) like the Neuralynx EIB-54-Kopf. The other end connects to two TETH-HS-27s. The HS-54 is a flat headstage, measuring approximately 57 mm wide and 14 mm high. Weighing 15g, the HS-54 is a good choice for larger animals. The HS-54 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-54 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
- Ensure low input bias current levels
- Eliminate signal distortion

3 Input Connector Pinout



Unique Layout

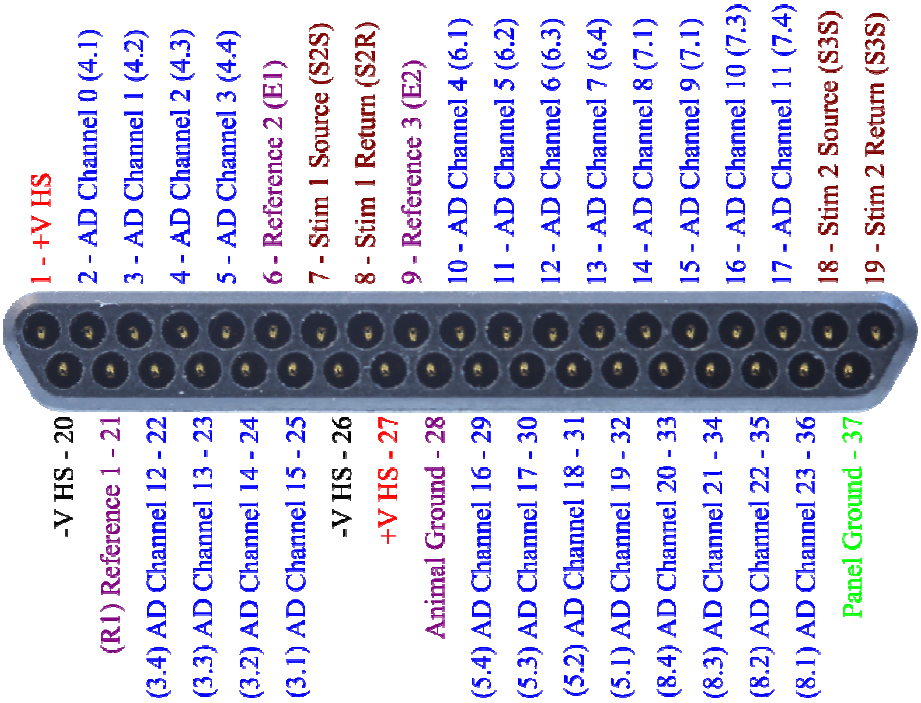
Figure 1 HS-54 Input Pinout

4 Stimulus Connections

As shown in the above figure, the stimulus connections are passed through the headstage to the input connector. EIBs like the EIB-54-Kopf contain four vias connected to these stimulus channels.

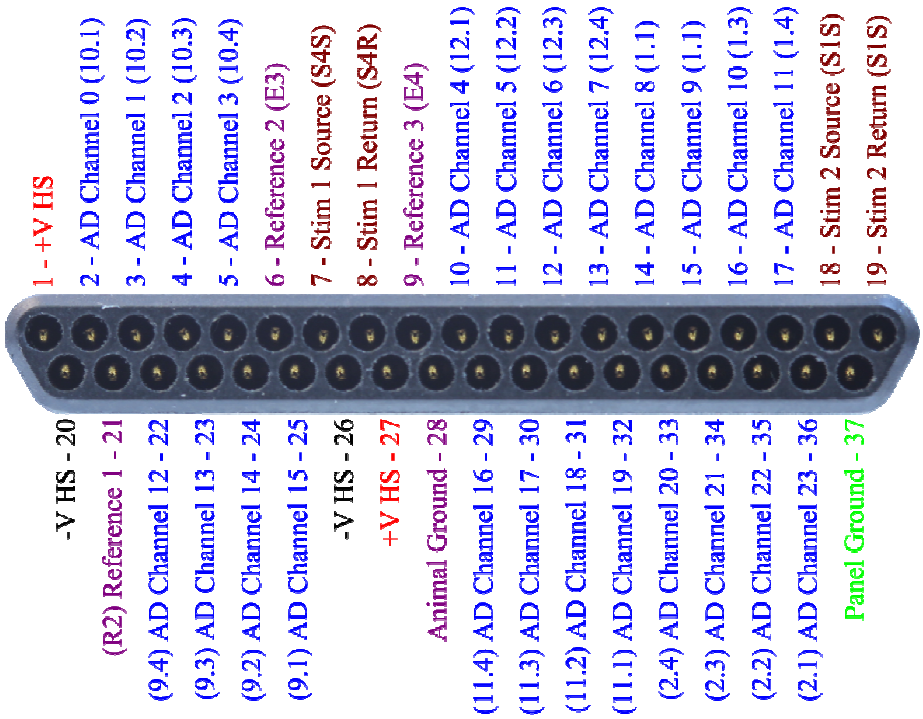
5 Tether Signal Connections

Two 37 pin microDB(uDB37) connectors made by AirBorn are used for the headstage tether connection. The TETH-HS-27s consist of 37 shielded conductors. The figures below show the pinout of each uDB37 connector.



Male µDB37 Connector

Figure 2 HS-54 Ouput Pinout(1)



Male µDB37 Connector

Figure 3 HS-54 Ouput Pinout(2)

- The names contained in the "( )" match the naming of the Input Connector and the EIB.
- Pin 21 is the dedicated reference channel.
- Also note that pin 28 on each connector, Animal Ground, is connected to the HS-54 Panel Ground at the circuit board. This is a non-current-carrying ground signal.
- Pin 37 on each connector is the HS-54 Panel Ground.
- +5V power is connected to pins 1 and 27 on each connector. -5V is connected to pins 20 and 26 on each connector.

6 Power Supply Requirements

The HS-54 amplifier requires +5V and -5V for the buffer op amps. Current draw is about 12 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 Digital Lynx SX contains power supplies which properly sequence power supply voltage and monitor headstage currents.

7 Mounting the Headstage to the EIB

The HS-54 connects to EIBs like the EIB-54-Kopf. When connecting the HS-54 to an EIB, insert the male Mill-Max pins into the headstage and be sure to align the pins on the HS-54 with the holes on the EIB. Headstage power should be turned off when connecting and disconnecting to the animal. If the male Mill-Max pins are damaged contact Neuralynx for replacements.

8 Using the SM-54 Signal Mouse

8.1 Major Component Layout

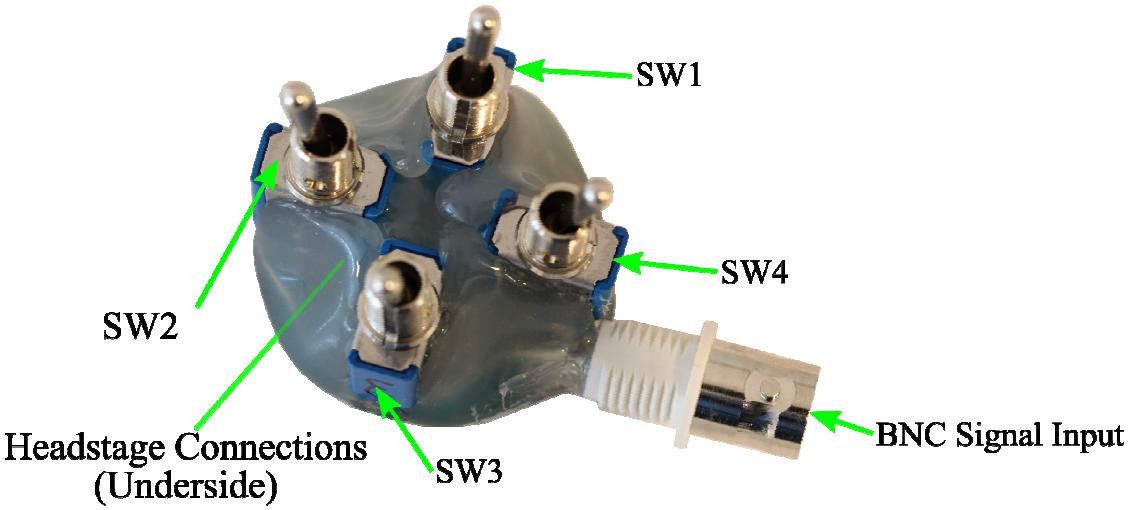


Figure 4 Labeled Signal Mouse

The **BNC Signal Input** is used to input a test signal from function generator such as the Minirator provided by Neuralynx. Note that the Signal Mouse has a 1000Ω input impedance and reduces the input signal by 1000:1.

The **Headstage Connections** are Mill-Max connectors that interface with HS-54. When connecting a Headstage with a Mill-Max connector be sure to align the pins before fully inserting.

Toggle Switches **SW1-SW4** control the inputs to the Headstage as described in the table below.

Switch	Switch State	Result	Headstage Bank Channels
			HS-54
SW1 (Bank1)	In	Bank 1 Driven	Channels 1-4 Channels 13-20 Channels 41-44 Channels 53-56
	Out	Bank 1 Grounded	
SW2 (Bank2)	In	Bank 2 Driven	Channels 5-12
	Out	Bank 2 Grounded	
SW3 (Bank3)	In	Bank 3 Driven	Channels 21-24 Channels 33-40 Channels 45-52
	Out	Bank 3 Grounded	
SW4 (References)	In	References Driven	References
	Out	References Grounded	

Table 5-1 Toggle Switch Functionality

8.2 Normal Usage

The Signal Mouse is typically used to test a system from the Headstage inputs all the way through the acquisition hardware to the software display.

The following method is usually used:

1. Attach the Headstage to the correct connection on the Signal Mouse.
2. Connect the other end of the Headstage to the Neuralynx Data Acquisition System.
3. Connect the Minirator provided by Neuralynx to the Signal Mouse and configure it to output a 1V Square Wave at 20 Hz.
4. Set the Signal Switches to the In Position.
5. Set the Reference Switch to the Out Position.
6. Boot the Data Acquisition System Hardware and Software configured to your desired settings and Start Acquisition.

This will connect a 2mV Square Wave at 20Hz to all channel inputs on the Headstage and ground the reference inputs. If all channels are configured to reference against one of these grounded references, Cheetah will display the input signal with signal conditioning based on Cheetah Software Settings. If the Reference Switch is set to the In position all channels should flatline and show the baseline noise of the system.

9 Appendix

9.1 Channel Mapping

Tetrode # on the EIB Board	Tether (labeled on HS)	*Via #1 (AD Channel)	*Via #2 (AD Channel)	*Via #3 (AD Channel)	*Via #4 (AD Channel)
TT1	P2	8	9	10	11
TT2	P2	23	22	21	20
TT3	P1	15	14	13	12
TT4	P1	0	1	2	3
TT5	P1	19	18	17	16
TT6	P1	4	5	6	7
TT7	P1	8	9	10	11
TT8	P1	23	22	21	20
TT9	P2	15	14	13	12
TT10	P2	0	1	2	3
TT11	P2	19	18	17	16
TT12	P2	4	5	6	7

Table 5-2 HS-54 Channel Mapping

Reference Channels on EIB	Tether (labeled on HS)	References Labeled in DRS	References Labeled on ERP-27
E1	P1	Ref 2	E1
E2	P1	Ref 3	E2
E3	P2	Ref 2	E1
E4	P2	Ref 3	E2
R1	P1	Ref 1	Ref
R2	P2	Ref 1	Ref

Table 5-3 HS-54 Reference Mapping