

# 64 CHANNEL MULTIPLEXING NEURAL HEADSTAGE SYSTEM

## Features

- 4 wire interface cable for 62 channels with 5 feet standard length
- Size: 5x15x20 mm, Weight < 0.8 grams
- Also available with multiple headstage options for 96, 128, 160, 192, 224 channels with 5, 6, 7, 8, 9 wired cables respectively.
- Available with system gain of 120 and 600
- Bandpass filtering of .8Hz to 7kHz
- Optional Blue, Red and Green LED mounting options for video tracking

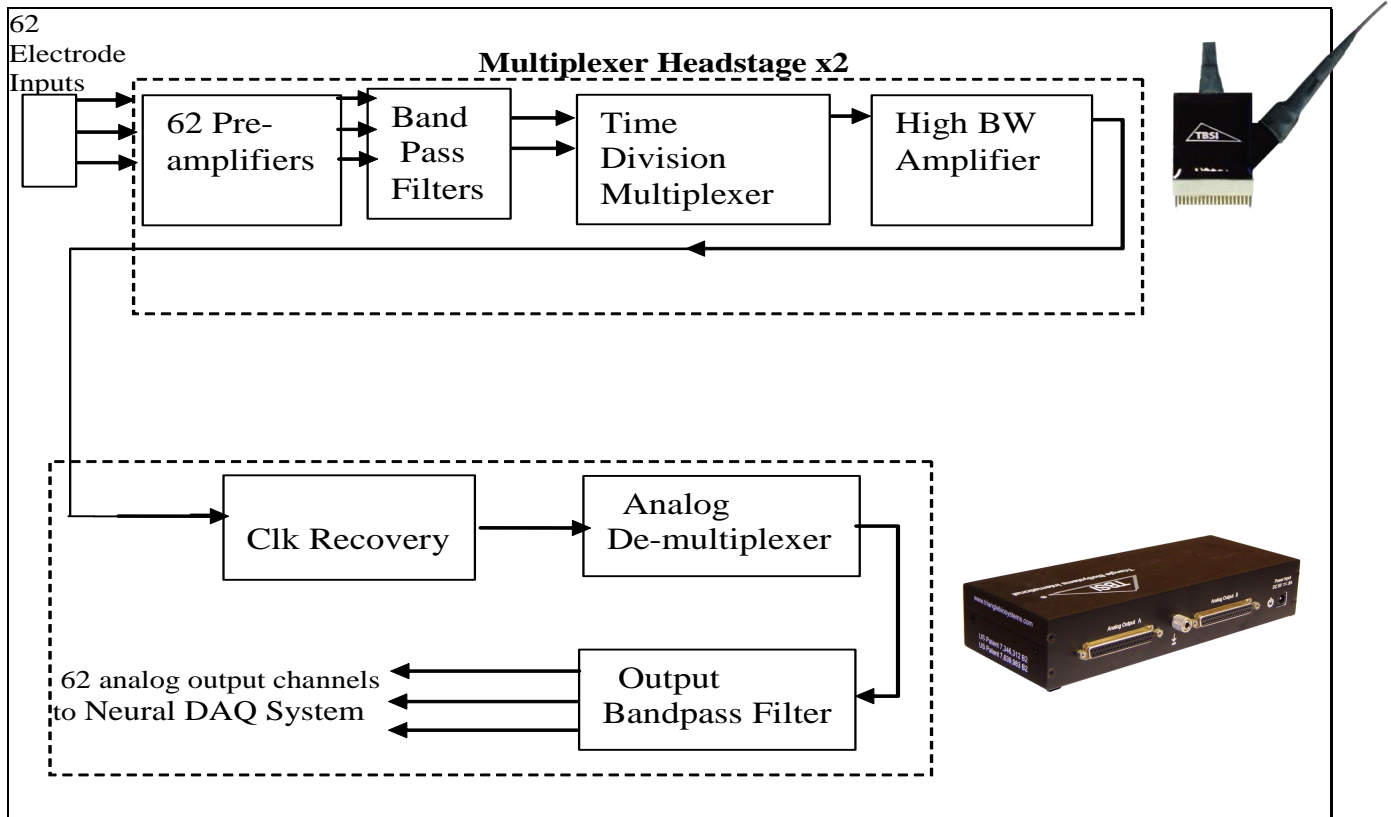
## General Description

Triangle BioSystems, Int'l. offers a family of multiplexing channel analog multiplexing headstage subassemblies that are used to provide a reduced wired connection between implanted electrodes and neural recording and analysis equipment. The main function of the headstage is to precondition the neuron pulse signals and provide a high gain, bandpass filtered buffered connection over a 4 wire cable. Each headstage design is based on a custom, low power VLSI developed by TBSI. The result is a solution with superior performance and reduced wire connection in a very small form-factor with less weight.

The 64 channel high gain, bandpass filter headstages are available with system gain of 120 and 600 with an adjustable bandpass filtering from the factory.

## System Block Diagram

The multiplexer neural headstage system consists of a multiplexer headstage and de-multiplexer subsystems are shown below:



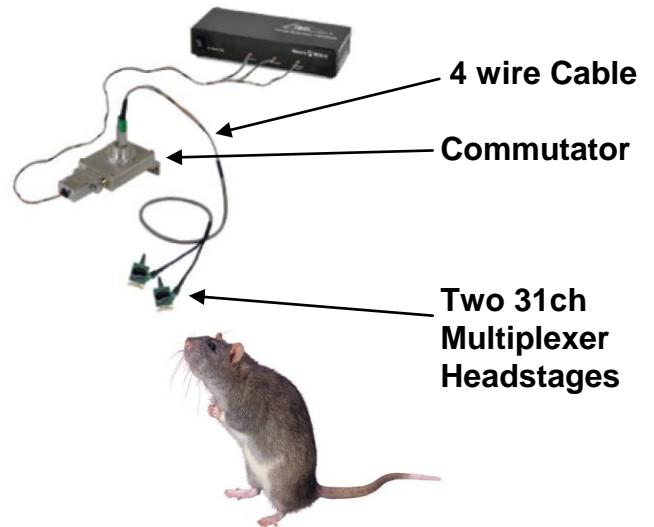
NOTE: These products are not for human use.

## 1.0 System Configuration

The multiplexer system consists of a multiplexer headstage, headstage cable, optional commutator, and de-multiplexer receiver.

3 wires are needed for 32ch (single headstage)  
 4 wires are needed for 64ch (dual , 32 ch headstages)  
 5 wires are needed for 96ch (triple, 32 ch headstages)  
 6 wires are needed for 128ch (quad ,32 ch headstages)  
 See Section 12, Multiple headstage options of this document.

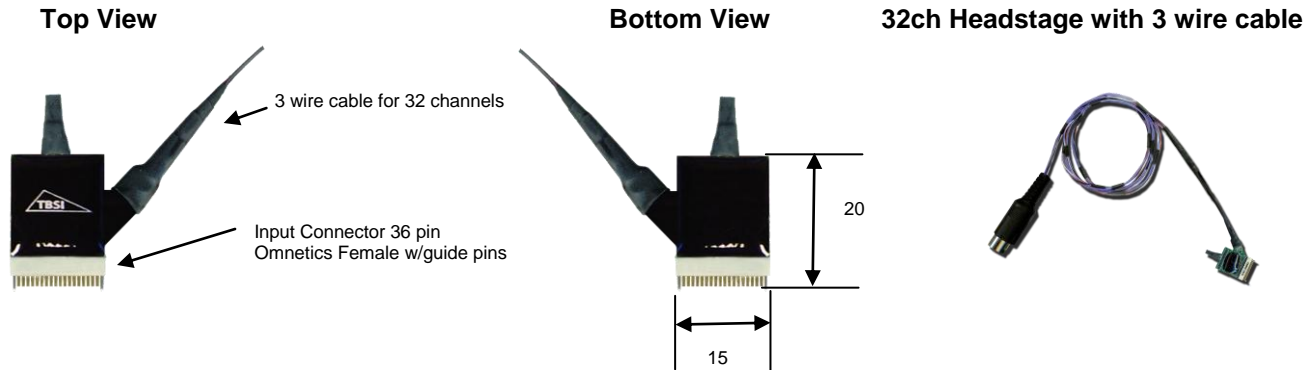
### 62ch Multiplexer Recording System



## 2.0 Headstage Transmitter Specifications

| Parameter                   | Min  | Typ | Max  | Units  | Notes   |
|-----------------------------|------|-----|------|--------|---|
| <b>Power Supply</b>         |      |     |      |        |   |
| Headstage Power supply      | 2.99 | 3.0 | 3.01 | Volts  | 3.0 Bipolar power (+2.1v, -.9v and ACgnd @ 0v)      |
| Average Icc 3.0v            | 5.6  | 6.1 | 6.7  | ma     | Without LEDs  |
| <b>Analog Channel</b>       |      |     |      |        |   |
| Max Input voltage range     | -2   |     | +2   | mVolts | For gain of 800 System (headstage gain of 100)      |
| Max Output voltage range    | -1.2 |     | +1.2 | Volts  | Measured at DB37 connector of receiver              |
| Common mode center          |      | 0   |      | Volts  | ACgnd @ 0v  |
| dc Offset                   | -10  | 0   | 10   | mVolts | For bipolar power supplies only                     |
| System Gain 120             | 115  | 120 | 125  |        | Factory selectable gain                             |
| System Gain 600             | 590  | 600 | 610  |        | Factory selectable gain                             |
| Bandwidth @ 3v              | .8   |     | 7000 | Hz     | -3dB input signal level BW                          |
| Input impedance             |      | 11  |      | Mohms  | At 1kHz   |
| Output impedance            |      | 158 |      | ohms   | At 1kHz   |
| Input referred noise        |      | 8.5 |      | µVrms  | for DC - 10khz frequency with all inputs grounded   |
| Input referred noise        |      | 5.5 |      | µVrms  | for 500Hz – 5kHz frequency with all inputs grounded |
| Channel sample Rate         |      | 50  |      | kHz    | Per channel sampling rate                           |
| THD                         |      |     | -63  | dB     | @ 5kHz and 1 volt p-p input                         |
| Phase Delay                 |      | 30  |      | uSecs  | @ 5 kHz input                                       |
| <b>Headstage Mechanical</b> |      |     |      |        |   |
| Length, Width, Height       | 15   | 20  | 5    | mm     | Dimensions of headstage board only                  |
| Weight                      |      |     | .8   | grams  | Headstage only (wire not included in weight)        |

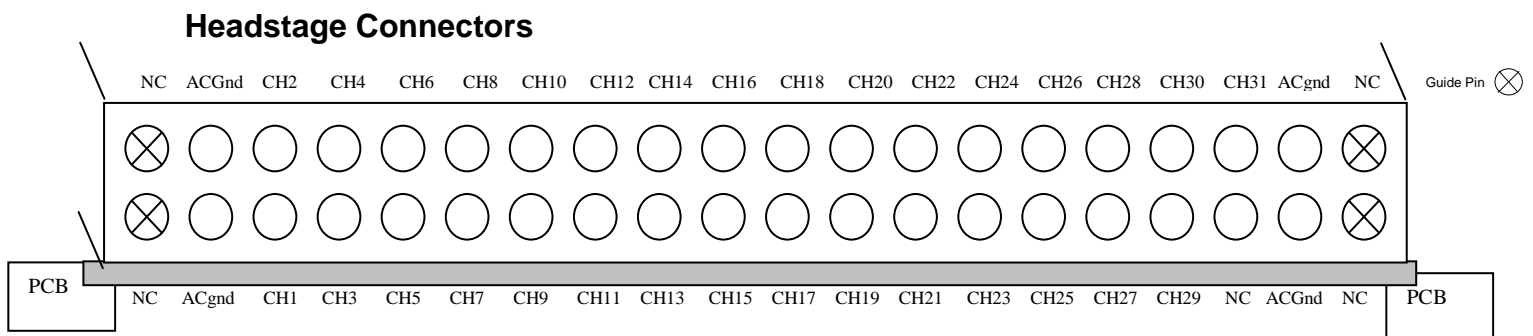
### 3.0 Headstage Mechanical Overview



Note1: all dimensions are in mm (millimeters)

Note2: Complete headstage weight is .9 grams with LEDs and .75 grams without LEDs

### 4.0 Headstage Pinout (Front View looking into headstage connector)

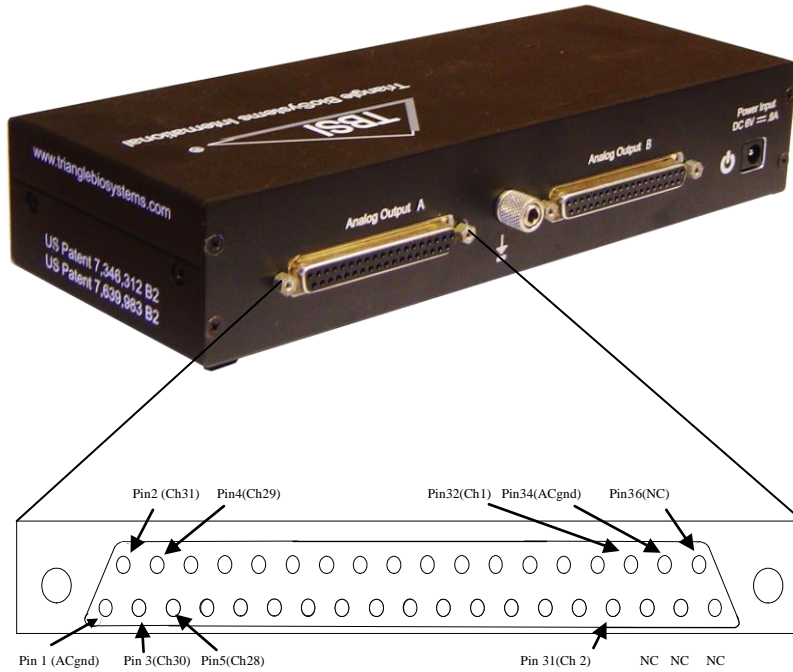


**Omnetics Male, Dual Row 25 mil nano, 36 pin, A8829**

**Note this Omnetics connector and channel pinouts match all tethered 32 channel headstage pinouts**

## 5.0 De-multiplexer Receiver

The headstage multiplexer signal is demodulated by a custom digital signal processing system. The signal processing system incorporates a high speed analog to digital converter for demodulating the receiver signal. The demodulated signal is then conditioned via the DSP and converted to an analog output signal. Each of the 32 ch headstage outputs exit from a DB37 female connector with connector pin-out shown below:



| DB 37Pin # | Description       |
|------------|-------------------|
| 1          | ACGnd             |
| 2          | Channel 31 Output |
| 3          | Channel 30 Output |
| 4          | Channel 29 Output |
| 5          | Channel 28 Output |
| 6          | Channel 27 Output |
| 7          | Channel 26 Output |
| 8          | Channel 25 Output |
| 9          | Channel 24 Output |
| 10         | Channel 23 Output |
| 11         | Channel 22 Output |
| 12         | Channel 21 Output |
| 13         | Channel 20 Output |
| 14         | Channel 19 Output |
| 15         | Channel 18 Output |
| 16         | Channel 17 Output |
| 17         | Channel 16 Output |
| 18         | Channel 15 Output |
| 19         | Channel 14 Output |
| 20         | Channel 13 Output |
| 21         | Channel 12 Output |
| 22         | Channel 11 Output |
| 23         | Channel 10 Output |
| 24         | Channel 9 Output  |
| 25         | Channel 8 Output  |
| 26         | Channel 7 Output  |
| 27         | Channel 6 Output  |
| 28         | Channel 5 Output  |
| 29         | Channel 4 Output  |
| 30         | Channel 3 Output  |
| 31         | Channel 2 Output  |
| 32         | Channel 1 Output  |
| 33         | NC(No Connect)    |
| 34         | ACGnd             |
| 35         | NC(No Connect)    |
| 36,37      | NC(No Connect)    |

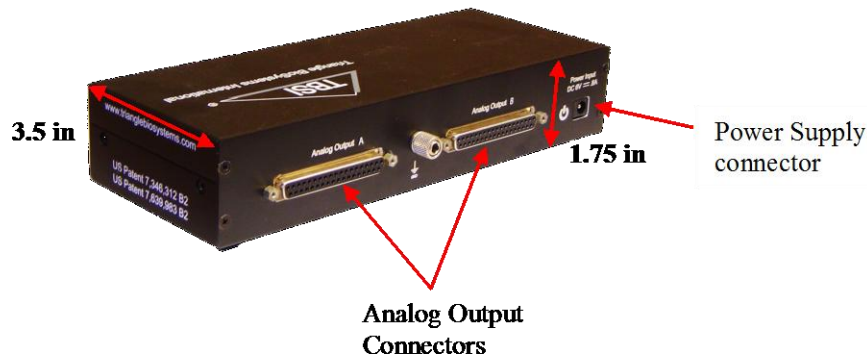
The bottom DB37 connector is for the single 32 channel headstage and the top and bottom DB37 connector is used with the dual, 64 channel headstages. The 96 channel and 128 channel use 4, DB37 connectors or 1 DB37 connector for each 32 channel headstage all with the same pinout characteristics.

**6.0 Power Supply**

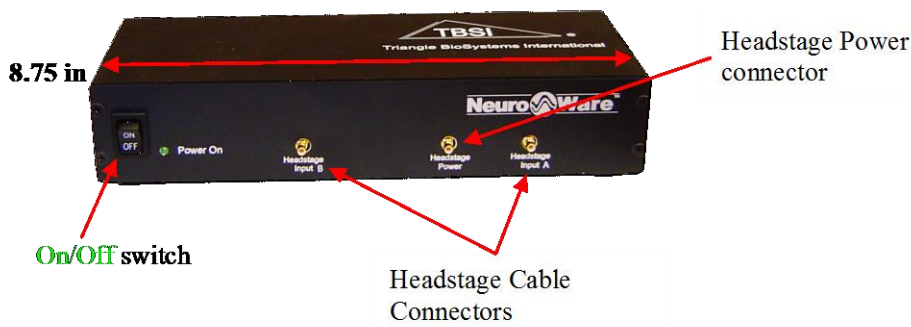
The recording system is powered by an AC line adapter transformer/regulator manufactured by Cincon Electronics. This power unit connects to a 100-240V, at 47-63 hz and is rated at .7 amps AC power source and is UL approved. The model number of this wall unit is TR25150.

**7.0 Receiver Mechanical (62 ch receiver)**

**Back View**



**Front View**



**8.0 Multiplexer system parts ship list:**

**32 Channel Headstage(s)**



**De-Multiplexer Receiver**



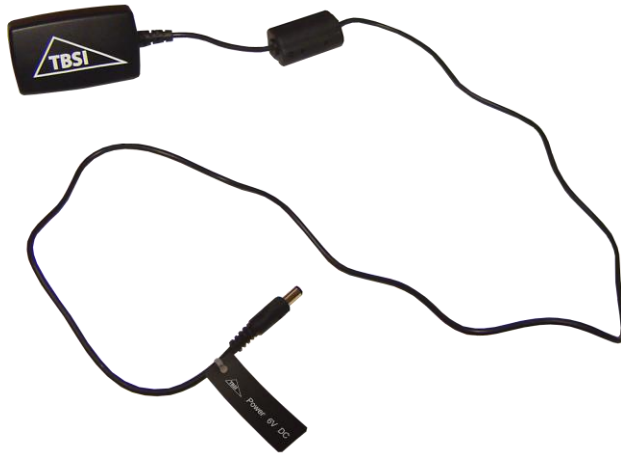
**For 32ch or 64ch**

OR



**For 96ch or 128ch**

**Power Supply**



**Electrode Mating Connector**

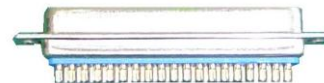
**Omnetics Male Dual row Nano  
36 Pin Vertical P/N A9707-001**



**Headstage Signal cable for Testing**



**Analog output mating connector (DB37)**

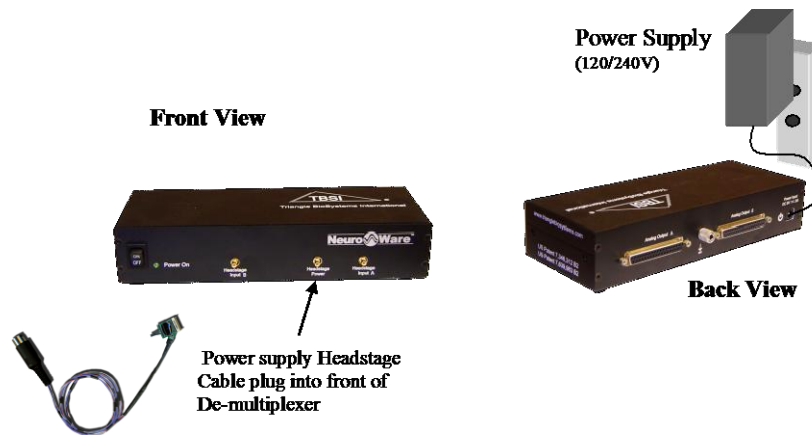


## 9.0 System Setup and Test

Below are instructions to validate the system setup:

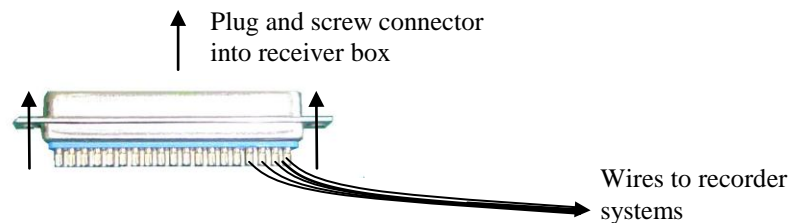
### 1) Connect power supply and headstage to de-multiplexer receiver

The power supply cable will plug directly into back of receiver into the power jack connector.



### 2) Connect signal cable to receiver analog output DB37 connector

Signal wires and a ground wire can be added to the DB37 mating connector to check for signal output. The length of the wires are not critical and depend on how far the wires need to be routed to the recording system. The analog output wire channel positions are described on page 4 of this document.



### 3) Turn on Receiver

Push the Green on/off button of the receiver to turn the receiver on and off. The button will light up **green** when the receiver is turned on and the light goes away when the receiver is turned off.

### 4) Connect a function generator to the headstage via headstage signal cable

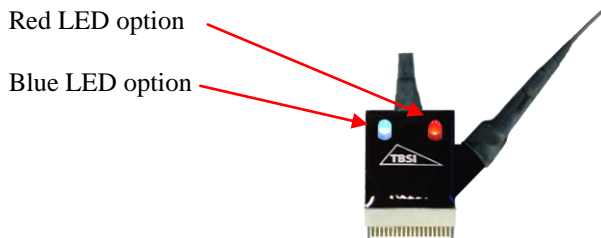
A function generator can be attached to the headstage input signal cable. Note the function generator signal output voltage cannot exceed 4mVp-p otherwise the headstage input voltage range will saturate. The frequency of the input signal can be set to 1Khz.



When the cable is attached to the headstage, the headstage will **TURN ON** and the LEDs will light. Hence do not forget to unplug the headstage when not being used. Otherwise the battery will be drained.

## 10.0 LED Headstage Options

Red and blue LED options are available for the 32 channel headstage for video tracking. The LEDs are placed facing upward on the top headstage and plenty bright enough to allow for video tracking. Both LEDs turn on with the On/Off switch.



## 11.0 Multiple headstages and demux receivers

The 32, 64, 96, and 128 channel M-series are show below:

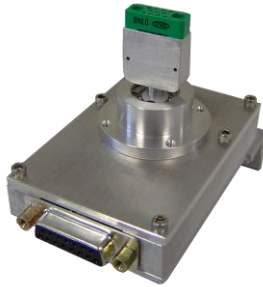


The 32ch and 64ch demux receivers have 2, DB37 (A, B) for analog output connectors. The bottom DB37 connector (A) is for the 32ch headstage and connector A and B is for the 64ch headstage.

The 96ch and 128ch demux receivers are taller and have 4, DB37 connectors (A, B, C, D) for analog output connections. Connector A,B,C are used of the 96ch outputs and A,B,C, and D are used for the 128ch outputs.

## 12.0 Commutator Options

There are 2 commutator options that are available which are sold with our multiplexer system separately. The Dragonfly SL10 and Plastics One 4ch swivel are shown below.



*DragonFly's SL10*

**DRAGONFLY RESEARCH & DEVELOPMENT, INC.**  
PO BOX 507, RIDGELEY, WV 26753  
PH: (304) 738-3609 FAX: 304-738-3607

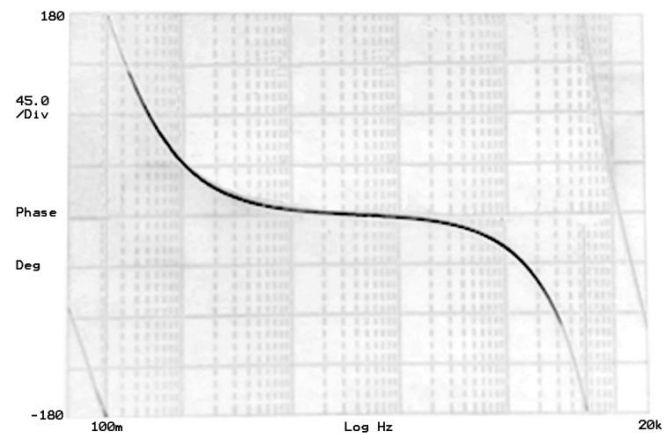
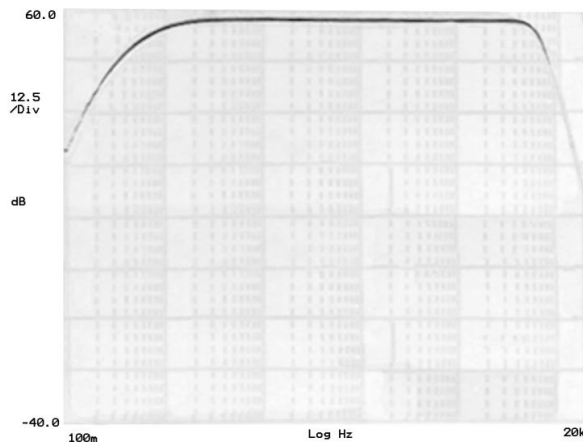


*Plastics One 4ch Swivel SL2 + 2C/SB*

**Plastics One Inc**  
6591 Merriman Rd, Roanoke Virginia  
Phone 540.772.7950

## 13.0 Gain and Phase Response

Please refer to section 2.0 of this document for numerical data on bandwidth and input referred noise.



## 14.0 Troubleshooting

**Problem:** No neural signals are visible on any of the Analog Outputs at the DB37 connector

**Solution:** Verify the AC power connection is in place and the Green "Power" LED is illuminated on the de-multiplexer receiver, as well as the Green LED on the power button on the Signal Demodulator Unit.

**Problem:** Not all channels are visible on the neural signal.

**Solution:** Make sure the headstage connection is secure to the animal.

Call customer TBSI customer support (919) 361-2663 if there are any problems with system setup and function.