

WIRELESS NEURAL HEADSTAGE SYSTEM

Features

- Wireless operations across 2.0 meters
- Operates in unlicensed radio band below FCC limits
- Available with 15 channels
- Factory configurable gain from 100 to 800
- Rechargeable battery power with 5 hour operating time without LEDs and 2.5 hour with LEDs on.
- Selectable bandpass filtering per channel
- Weight <10 grams (without connector)

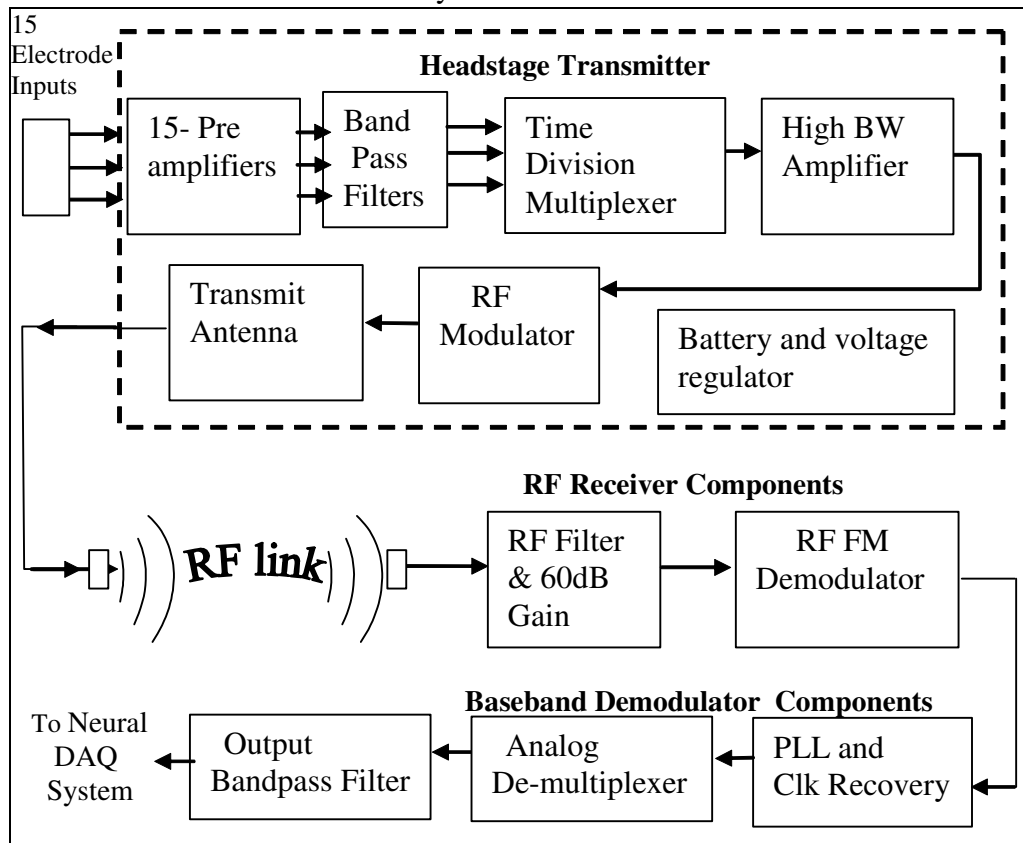
General Description

This wireless neural headstage system includes an analog headstage transmitter and receiver system. The proprietary radio system is used to interface between chronic implanted electrodes and the spike sorting pre-amplifiers and processors. The system incorporates a head-stage transmitter with integrated battery, and the complementary RF receiver/demodulator. As an option, LEDs (blue and Red/Green) can be mounted to the transmitter to facilitate video tracking.

The battery life of the transmitter is 5 hours and is re-charged via the receiver module.

System Block Diagram

The wireless neural headstage system consists of a wireless transmitter headstage, an RF receiver and baseband demodulation subsystems as shown below:



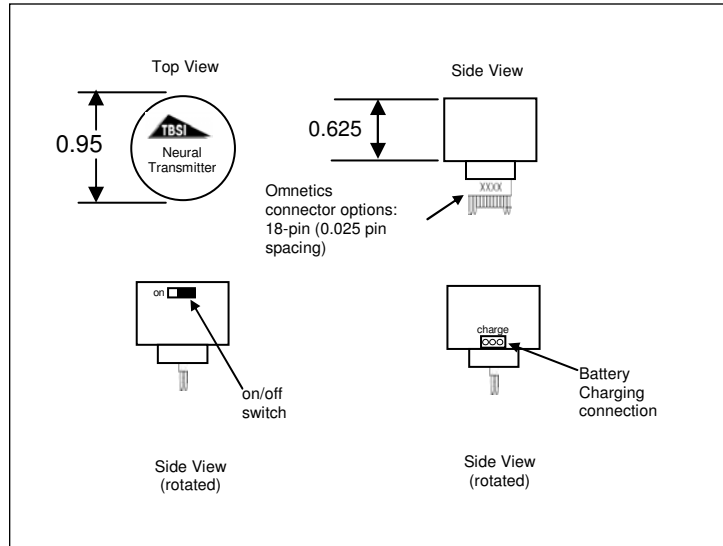


Functional Description

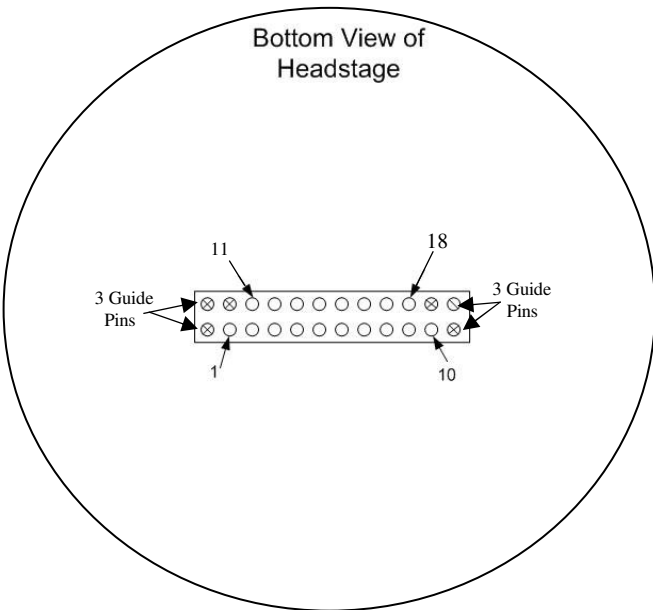
15-Channel Headstage Electrical

Parameter	Min	Typ	Max	Units	Notes
Power Supply					
3 volt supply	3.0	3.6	4.2	Volts	Power consumption 14.0ma (typical)
Battery life		5		hours	Re-chargeable battery time 2hrs
Analog Input Specs					
Input voltage range		1.25		Volts	
Common mode center					
Gain selection		500			Factory selectable gain
Bandwidth	1.0		8000	Hz	-3dB input signal level BW
Input impedance		22M		ohms	At 1kHz
Input connector options					Omnetics 18-pin (0.025 pin spacing) Omnetics 36-pin (0.025 pin spacing) Omnetics 20-pin (0.05 pin spacing)
Input referred noise		10		μVrms	for DC - 10khz frequency
Sampling Rates		50		kHz	Headstage and DAC sampling rates
Mechanical Specs					
Diameter		0.95		in	
Height		0.625		in	Without connector
Weight			9.6	grams	
Battery charger cable					3 pin cable from RF system
Radio Specs					
Center frequency		3.4		GHz	With +/- 100 MHz bandwidth
Transmit power			300	μV @ 3 meters	FCC Sec.15.109B(a)
Transmit antenna		3.4		GHz	Tuned patch type antenna
Transmit range		1.5m			With receiver on top of cage

15 Channel Head stage Mechanical Overview



15-channel Wireless Headstage Pinout – (18-pin Omnetics connector “Neuro15RadioHS_025_18”)

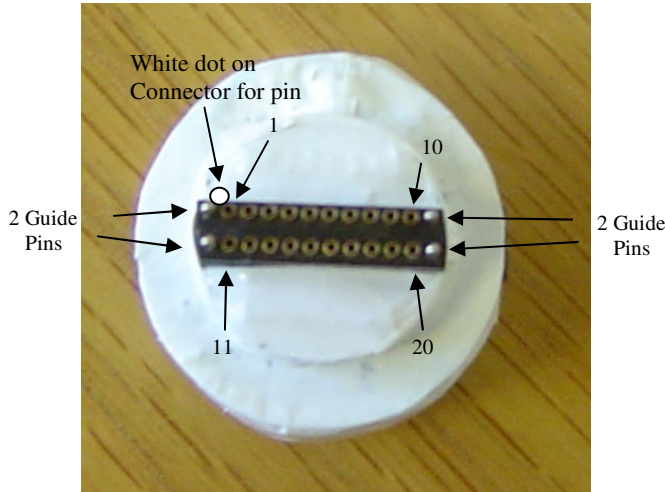


Pin	Connection
1	No Connection
2	No Connection
3	Channel 9
4	Channel 10
5	Channel 11
6	Channel 12
7	Channel 13
8	Channel 14
9	Channel 15
10	AC Ground
11	Channel 1
12	Channel 2
13	Channel 3
14	Channel 4
15	Channel 5
16	Channel 6
17	Channel 7
18	Channel 8

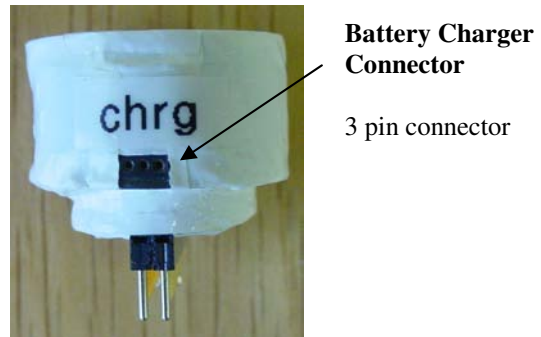
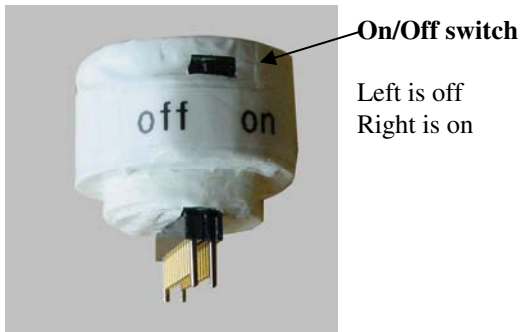
Interface Options

Dual 10 pin (0.05" Omnetics connector) "Neuro15RadioHS_050_20"

Headstage Bottom view



Pin	Connection
1	Channel 1
2	Channel 2
3	Channel 3
4	Channel 4
5	Channel 5
6	Channel 6
7	Channel 7
8	Channel 8
9	AC Ground
10	AC Ground
11	No Connection
12	Channel 9
13	Channel 10
14	Channel 11
15	Channel 12
16	Channel 13
17	Channel 14
18	Channel 15
19	AC Ground
20	AC Ground



RF Receiver

Specification summary

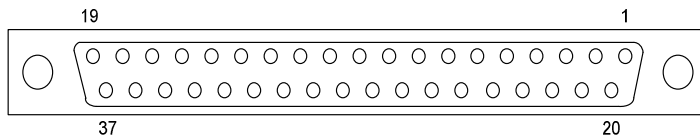
- 3.4 GHz center transmit frequency with +/-100MHz FM bandwidth
- 1.5 meter max. range between headstage transmitter and receiver (assuming Plexiglas cage)
- Cable for headstage battery recharging
- Front-end Gain: 60 dB
- Intermediate gain, 10-20 dB
- Input referred noise, typical 4 uVrms
- Input voltage range, +/- 0.5V
- Bandwidth typ. 20 kHz
- DC offset, < 100uVdc
- Phase delay typ. 30 usec at 10kHz
- Receive antenna - black square area on bottom of box
- Signal lock indicator LED on front panel

Demodulator/Signal Processing Unit

The RF receiver 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. The analog interface is available via a DB37 female connector, connector pin-out below:



DB37 Connector



Pin #	Description
20	Channel 15
21	Channel 14
22	Channel 13
23	Channel 12
24	Channel 11
25	Channel 10
26	Channel 9
27	Channel 1
28	Channel 2
29	Channel 3
30	Channel 4
31	Channel 5
32	Channel 6
33	Channel 7
34	Channel 8
35	n/c
1-17,36	GND
18,19,37	No Connection

Note: Actual connector is mounted in flipped orientation to the diagram shown (see photo).

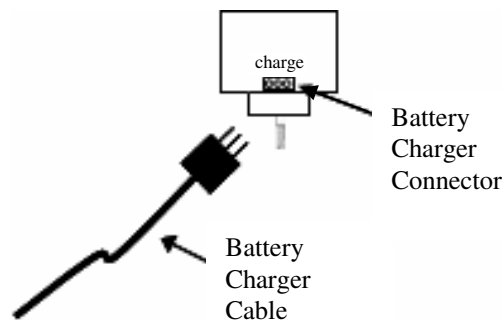
Power Supply

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.

Charging the Headstage Battery

The wireless headstage includes an integrated rechargeable battery which must be recharged after approximately 5 hours of use. Recharging is accomplished by the following procedure:

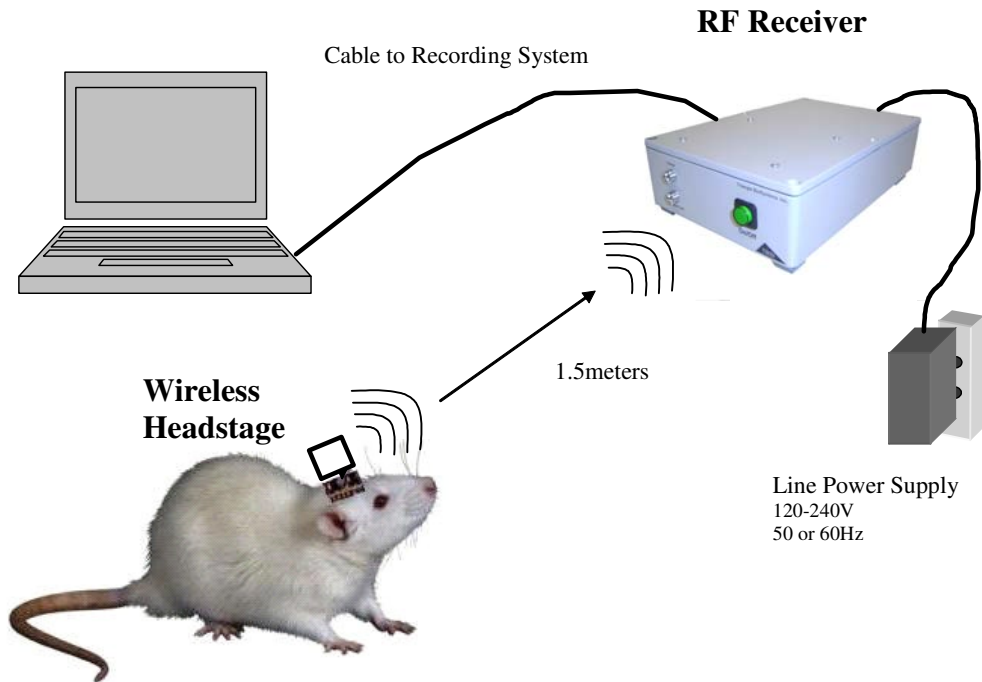
1. Turn off receiver unit.
2. Turn off wireless headstage
3. Connect battery charging cable to the “Charge Cable” connector on the back panel of the receiver.
4. Plug opposite end of the charging cable into the 3-hole “Charge” socket on the wireless headstage (see diagram below). Note: do not worry about the orientation of the 3-pin connector. It is wired to work in either direction.
5. Turn on the receiver (the “Charge” Red LED on the front panel of the receiver should now be illuminated)
6. The battery will be fully charged in about 2 hours (the “Charge” light on the receiver will turn off when battery is fully charged).



System Interconnections

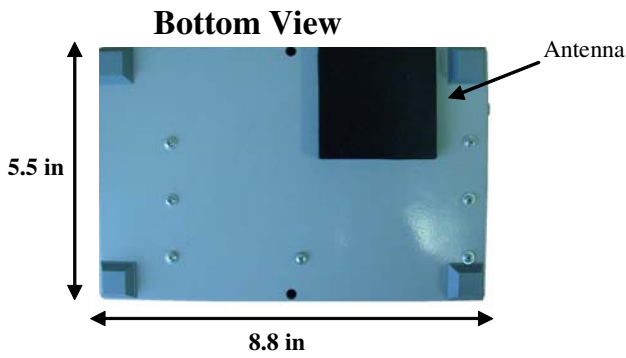
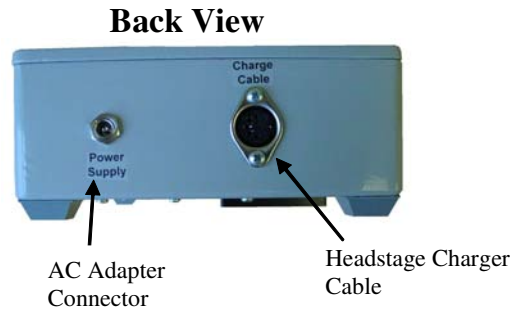
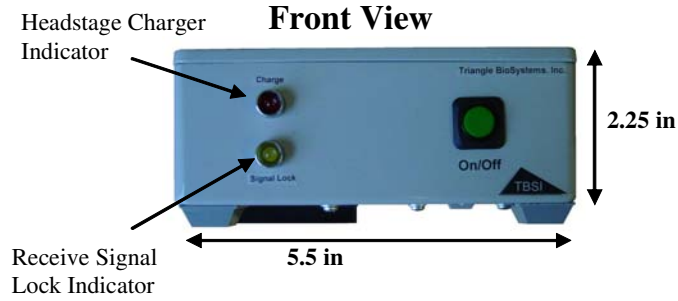
The wireless headstage system interconnections and set-up is shown below:

1. Connect power supply unit to “AC Adapter” connector on the back of the receiver.
Plug power supply into AC outlet
2. Connect neural recording system input to “Analog Outputs” connector on the side of the receiver with an appropriate cable.
3. Plug wireless headstage into electrode connector.
4. Turn on headstage via “on/off” switch on side of headstage.
5. Turn on receiver via “on/off” switch on the front of the receiver. Confirm that on/off button is illuminated.
6. Confirm that “Signal Lock” light on the front of the receiver is illuminated.





Receiver Mechanical



Trouble Shooting

Problem: No neural signals are visible on either Analog Outputs or recording software

Solution: Verify the AC power connection is in place and the Green “Power” LED is illuminated on the RF Receiver Box, as well as the Green LED on the power button on the Signal Demodulator Unit. Also, verify that “Signal Lock” light is illuminated which confirms that the receiver is receiving the transmitted signal from the headstage.

Problem: Visible neural signal is missing information.

Solution: Keep the animal within the 1.5 meter range of the receiver. If you exceed this range, the radio signal from the headstage will not be strong enough to maintain reliable signal monitoring of the animal. Also, be sure to keep the area under the RF Receiver unit’s antenna free from metallic objects, which will reduce signal range.

Note: the Wireless Headstage is a low-power device, it is critical that the RF receiver be carefully located for the system to operate. DO NOT place the RF receiver on top of a wire cage. Try to minimize the distance between the RF receiver and the Wireless Headstage. The best orientation is the RF receiver directly above the Wireless Headstage. Make sure the receiver antenna on the bottom of the box is unobstructed.

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

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

Packing List

Your shipment includes one of each of the following:

1. Wireless Neural Headstage
2. Radio Frequency (RF) Receiver/Demod unit
3. Battery Charging Cable
4. Power Transformer with DC power cable
5. Informational documents: this document: “Wireless System Specification”