

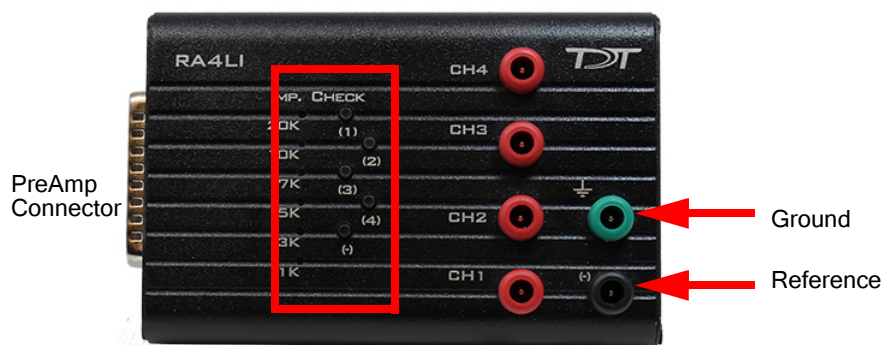
# Low Impedance Headstages

## RA4LI - Four Channel Headstage

The RA4LI headstage is designed for low impedance electrodes with input impedance between  $<1$  kOhm and 20 kOhm. Electrode connectors are standard 1.5 mm safety connectors making it easy to connect to standard needle and surface electrodes for recording evoked potentials and EEG's. The headstage connects directly to the RA4PA Medusa preamplifier's 25-pin connector. A built in impedance checker can be used to test each channel and the reference. Additional 20x gain on the headstage improves signal-to-noise of low voltage signals.

### Impedance Checking with the Low-Impedance Headstage

The Impedance checker on the RA4LI provides a simple check of the channel impedance relative to ground. To check the impedance level, press the button next to the channel indicator. The highest-level light indicates the maximum impedance between the channel and the ground. If all impedance lights are illuminated it is likely that one of the channels is not properly connected. The (-) impedance button checks the impedance between the reference and the ground.



### Headstage Voltage Range

When using a TDT preamplifier the voltage input range of the preamplifier is typically lower than the headstage and must be considered the effective range of the system. Check the specifications of your amplifier for voltage range. Also keep in mind that the range of the headstage varies depending on the power supply provided by the preamplifier. TDT preamplifiers supply  $\pm 1.5$  V, but third party preamplifiers may vary. TDT recommends using preamplifiers which deliver  $\pm 2.5$  V or less. Check the preamplifier voltage input and power supply specifications and headstage gain to determine the voltage range of the system.

The table below lists the input voltage ranges for the RA4LI headstage for either a +/- 1.5 V or +/- 2.5 V power source.

Headstage input range when using +/- 1.5 V power source	Headstage input range when using +/- 2.5 V power source
+/- 33 mV	+/- 80 mV

## Headstage Technical Specifications

**Warning!** When using multiple headstages ensure that all ground pins are connected to a single common node. See “Headstage Connection Guide” on page 6-99, for more information.

<b>Input Referred Noise</b>	rms 0.1 $\mu$ V bandwidth 300-3000 Hz 0.3 $\mu$ V bandwidth 2-8000 Hz
<b>Headstage Gain</b>	20x
<b>Highpass Filter</b>	2.2 Hz
<b>Lowpass Filter</b>	7.5 kHz
<b>Input Impedance</b>	$10^6$ Ohm

## RA16LI - 16 Channel Headstage

The sixteen channel low impedance headstage (RA16LI) is a high quality, low-impedance headstage designed for recording high channel count EEG's.

The RA16LI headstage is designed for low impedance electrodes and electrode caps with input impedance between <1 kOhm and 20 kOhm. Either headstage unit connects to the Medusa preamplifier's 25-pin connector. The simple interface to the RA16PA preamplifier makes it easy to connect your electrodes to our system.

An adapter is also available to connect a low impedance headstage to a PZ preamplifier. See “Preamplifier Adapters” on page 12-23, for more information. A built in impedance checker can be used to test each channel and the reference. Additional 20x gain on the headstage improves signal-to-noise of low voltage signals.



## Impedance Checking with the Low-Impedance Headstage

The Impedance checker on the RA16LI provides a simple check of the channel impedance relative to ground. To check the impedance level, press the button next to the channel indicator. The highest-level light indicates the maximum impedance between the channel and the ground. If all impedance lights are illuminated it is likely that one of the channels is not properly connected. The (-) impedance button checks the impedance between the reference and the ground.

## Headstage Voltage Range

**When using a TDT preamplifier the voltage input range of the preamplifier is typically lower than the headstage and must be considered the effective range of the system. Check the specifications of your amplifier for voltage range.**

Also keep in mind that the range of the headstage varies depending on the power supply provided by the preamplifier. TDT preamplifiers supply  $\pm 1.5$  V, but third party preamplifiers may vary. TDT recommends using preamplifiers which deliver  $\pm 2.5$  V or less. Check the preamplifier voltage input and power supply specifications and headstage gain to determine the voltage range of the system.

The table below lists the input voltage ranges for the RA16LI headstage for either a  $\pm 1.5$  V or  $\pm 2.5$  V power source.

Headstage input range when using $\pm 1.5$ V power source	Headstage input range when using $\pm 2.5$ V power source
$\pm 33$ mV	$\pm 80$ mV

## Headstage Technical Specifications

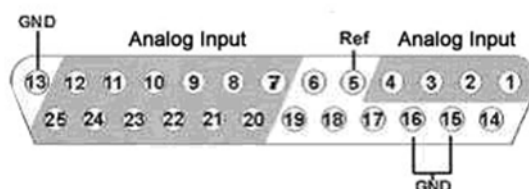


**WARNING!** When using multiple headstages ensure that all ground pins are connected to a single common node. See “Headstage Connection Guide” on page 6-99, for more information.

<b>Input Referred Noise</b>	rms 0.1 $\mu$ V bandwidth 300-3000 Hz 0.3 $\mu$ V bandwidth 2-8000 Hz
<b>Headstage Gain</b>	20x
<b>Highpass Filter</b>	2.2 Hz
<b>Lowpass Filter</b>	7.5 kHz
<b>Input Impedance</b>	$10^6$ Ohm

## Electrode Connector Pinout

The electrode connector is a 25-pin connector. Information on the pin inputs is provided below.



**Note:** Pins 6, 14, 17, 18 and 19 are not connected.

Pin	Name	Description	Pin	Name	Description	
1	A1	Analog Input Channels	14	NA	Not Used	
2	A2		15	GND	Ground	
3	A3		16	GND		
4	A4		17	NA	Not Used	
5	Ref	18	NA			
6	NA	19	NA			
7	A5	Analog Input Channels	20	A6	Analog Input Channels	
8	A7		21	A8		
9	A9		22	A10		
10	A11		23	A12		
11	A13		24	A14		
12	A15		25	A16		
13	GND		Ground			

## RA16LI-D - 16 Channel Headstage with Differential

The RA16LI-D headstage is designed for fully differential recordings from low impedance electrodes and electrode caps with input impedance between  $<1$  kOhm and 20 kOhm. It connects to the Medusa preamplifier's 25-pin connector. The simple interface to the RA16PA preamplifiers makes it easy to connect your electrodes to our system. An adapter is also available to connect a low impedance headstage to a PZ preamplifier. See "DBF-MiniDBM Low Impedance Headstage to PZ Preamplifier (16-channels)" on page 23, for more information.

The differential inputs allow for improved common mode rejection on all channels. Because of the increased complexity of the circuitry, the RA16LI-D does not have impedance checking. The headstage connector is a DB44. The pin out diagram is shown below.

### Headstage Voltage Range

When using a TDT preamplifier the voltage input range of the preamplifier is typically lower than the headstage and must be considered the effective range of the system. Check the specifications of your amplifier for voltage range.

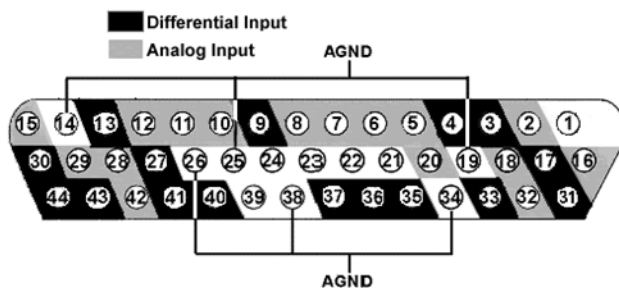
## Headstage Technical Specifications



**WARNING!** When using multiple headstages ensure that all ground pins are connected to a single common node. See “Headstage Connection Guide” on page 6-99, for more information.

<b>Input Referred Noise</b>	rms 0.1 $\mu$ V bandwidth 300-3000 Hz 0.3 $\mu$ V bandwidth 2-8000 Hz
<b>Headstage Gain</b>	20x
<b>Highpass Filter</b>	2.2 Hz
<b>Lowpass Filter</b>	7.5 kHz
<b>Input Impedance</b>	$10^6$ Ohm

## Pinout Diagram



**Note:** Pins 1, 21-24 and 39 are not connected.

Pin	Name	Description	Pin	Name	Description
1	NA	Not Used	25	AGND	Analog Ground
2	A2	Analog Input	26	AGND	
3	D3	Differential Input	27	D12	Differential Input
4	D5		28	A14	Analog Input
5	A5	Analog Input	29	A15	
6	A7		30	D16	Differential Input
7	A8		31	D1	
8	A9		32	A3	Analog Input
9	D9		Differential Input	33	D4
10	A10	Analog Input	34	AGND	Analog Ground
11	A11		35	D6	Differential Input
12	A12	36	D7		
13	D13	Differential Input	37	D8	
14	AGND	Analog Ground	38	AGND	Analog Ground
15	A16	Analog Input	39	NC	
16	A1		40	D10	Differential Input
17	D2	Differential Input	41	D11	
18	A4	Analog Input	42	A13	Analog Input
19	AGND	Analog Ground	43	D14	Differential Input
20	A6	Analog Input	44	D15	
21	NA	Not Used			
22	NA				
23	NA				
24	NA				