

# Low Impedance Headstages

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Hardware Reference



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# Low Impedance Headstages

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## RA4LI - Four Channel Headstage

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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 (black connector) and the ground (green connector).

## Headstage Voltage Range

When using a TDT preamplifier the voltage input range of the preamplifier (PZ5, Subject Interface, RA16PA) is typically lower than the headstage and must be considered the effective range of the system. Also keep in mind that the output range of the headstage varies depending on the power supply provided by the preamplifier. PZ5 and Subject Interface supply  $\pm 2.5$  V. PZ2 and RA16PA preamplifiers supply  $\pm 1.5$  V. Third party preamplifiers may vary. TDT recommends using preamplifiers which deliver  $\pm 2.5$  V or less. The table below lists the input voltage ranges for the RA4LI headstage for either  $\pm 1.5$  V or  $\pm 2.5$  V power sources.

Power Source	Headstage Input Range
$\pm 1.5$ V	$\pm 33$ mV
$\pm 2.5$ V	$\pm 80$ mV

## RA4LI Technical Specifications

Input referred noise	0.1 $\mu$ Vrms bandwidth 300-3000 Hz 0.3 $\mu$ Vrms bandwidth 2-8000 Hz
Headstage Gain	20x
Highpass Filter	2.2 Hz
Lowpass Filter	7.5 kHz
Input Impedance	1e6 ohms

## RA16LI - 16 Channel Headstage

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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](#) 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 (PZ5, Subject Interface, RA16PA) is typically lower than the headstage and must be considered the effective range of the system. Also keep in mind that the output range of the headstage varies depending on the power supply provided by the preamplifier. PZ5 and Subject Interface supply  $\pm 2.5$  V. PZ2 and RA16PA preamplifiers supply  $\pm 1.5$  V. Third party preamplifiers may vary. TDT recommends using preamplifiers which deliver  $\pm 2.5$  V or less. The table below lists the input voltage ranges for the RA16LI headstage for either  $\pm 1.5$  V or  $\pm 2.5$  V power sources.

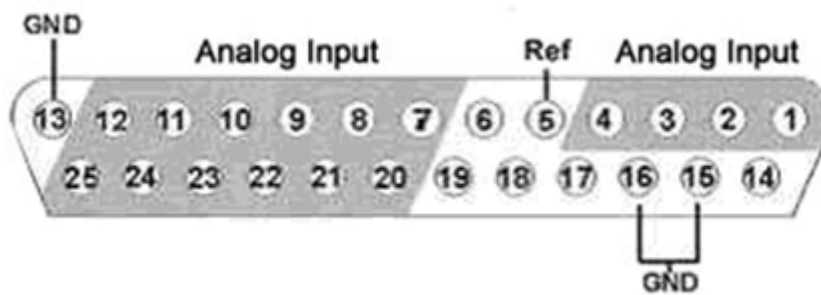
Power Source	Headstage Input Range
$\pm 1.5$ V	$\pm 33$ mV
$\pm 2.5$ V	$\pm 80$ mV

## RA16LI Technical Specifications

Input referred noise	0.1 uVrms bandwidth 300-3000 Hz 0.3 uVrms bandwidth 2-8000 Hz
Headstage Gain	20x
Highpass Filter	2.2 Hz
Lowpass Filter	7.5 kHz
Input Impedance	1e6 ohms

### 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	Reference	18	NA	Headstage Detect
6	NA	Not Used	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

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The RA16LI-D headstage is designed for fully differential recordings from low impedance electrodes and electrode caps with input impedance between <math><1\text{ k}\Omega</math> and DBF-MiniDBM Low Impedance Headstage to PZ Preamplifier (16-channels) 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.



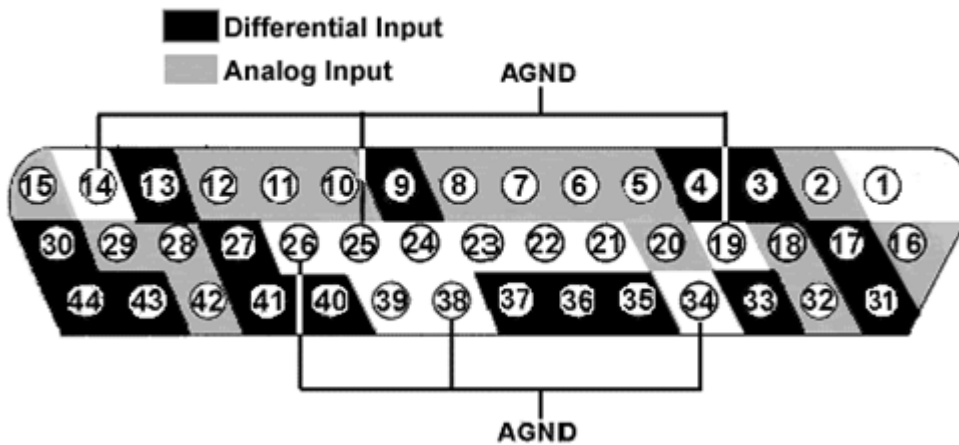
## Headstage Voltage Range

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.

## RA16LI-D Technical Specifications

Input referred noise	0.1 uVrms bandwidth 300-3000 Hz 0.3 uVrms bandwidth 2-8000 Hz
Headstage Gain	20x
Highpass Filter	2.2 Hz
Lowpass Filter	7.5 kHz
Input Impedance	1e6 ohms

## Pinout Diagram



### Note

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

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