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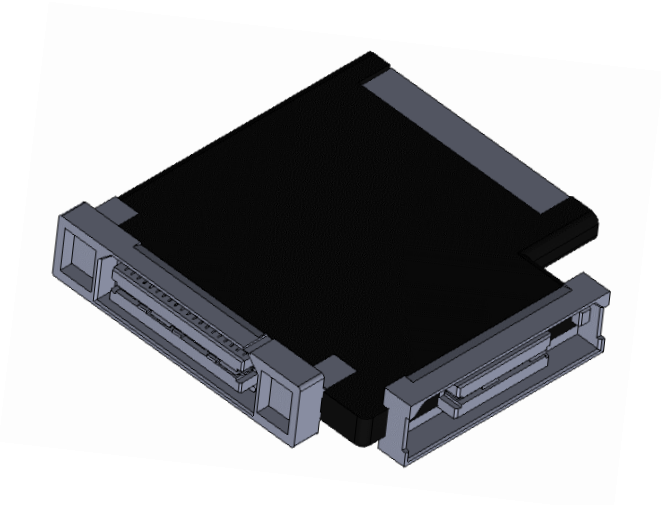
Blackrock Stim Headstage

Instructions for Use



Revision 1.00 / LB-0971 – Stim Head-stage IFU

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What this Manual Covers

This manual covers the specifications and usage of the Stim Head-stage PN 8451 and PN 10745. PN 10745 has a 3 Hz high-pass cutoff frequency of recorded signals and lower charge shunting than PN 8451 which has a 0.3 Hz cut-off frequency. Pinouts for the headstage are provided.

Intended Use and Indications for Use

The Stim Head-stage is intended to facilitate simultaneously stimulating and recording from Utah Array electrodes and other user-supplied electrodes.

Contraindications, Warnings, and Precautions

Warnings

- This product is for animal research only.
- Do not touch any exposed electrical conductors when the adapter connector is attached to devices on the subject's head as this may result in inducing electric charge to the neural tissue. Irreversible damage may occur.
- The patient/subject should not attempt to remove the connections themselves.
- Use caution when connecting and disconnecting the cable to the headstage to minimize the risk of the cable being accidently pulled or tugged.
- Do not use the Stim Head-stage in the presence of flammable anesthetic agents or any other reagents.
- Avoid strong static discharges from sources like television or computer monitors because it can damage the electrical components of the system.
- Keep the Stim Head-stage away from liquids. Contact with water, shower spray, or wet surfaces can lead to the patient receiving an electrical shock.
- Always use antistatic or electrostatic discharge (ESD) safe gloves when connecting the Stim Head-stage.
- Use caution when placing cables and other connectors to minimize the likelihood of tripping or accidentally pulling on cables. Pulled cables may cause damage to the headstage or any other connected devices.

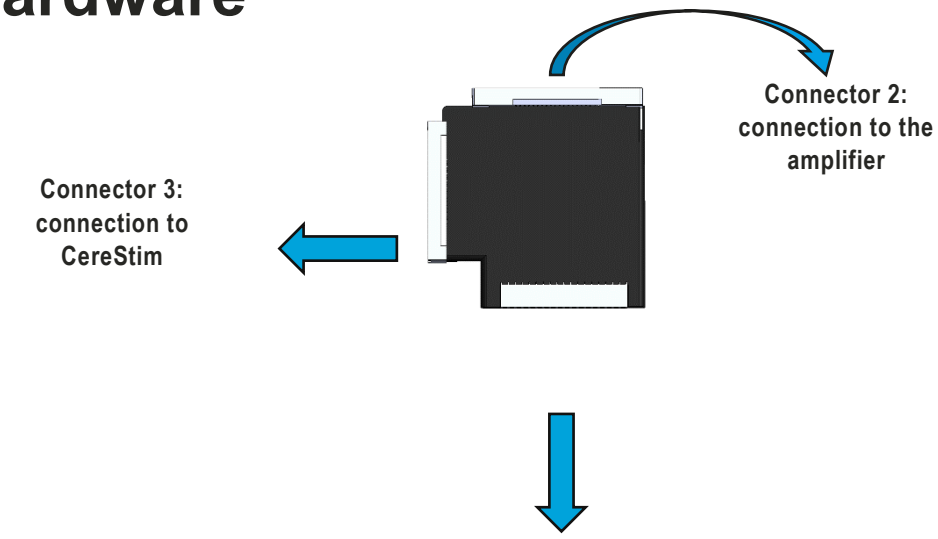
Precautions

- Read this entire manual prior to using the device.
- Connection of external instruments to the Stim Head-stage may compromise electrical safety.
- Use only the supplied Blackrock Microsystems components (CereStim, CerePlex M or Blackrock FEA). Substitution of components not supplied by Blackrock Microsystems may affect system performance and patient/subject safety.

Specifications

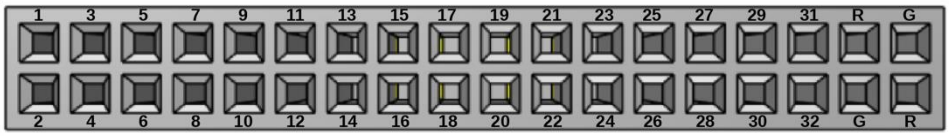
	PN 8451, PN 10745
Connector Model Numbers	Samtec SFMC-118-L1-S-D (Connector 1) Samtec QSE-020-01-H-D-EM2 (Connector 2) Samtec MIS-019-01-H-D-EM2 (Connector 3)
Mode of Operation	Continuous
Number of Channels	32
High-Pass Cutoff Frequency (Hz)	PN 8451: 0.3 PN 10745: 3
Water Ingress Protection	Ordinary Equipment, not fluid resistant, IP20
Operating Environment	10˚C to 40˚C, 5 to 95% R.H. (non-condensing)
Storage Environment	-20˚C to 50˚C, 5 to 100% R.H. (non-condensing)

Hardware

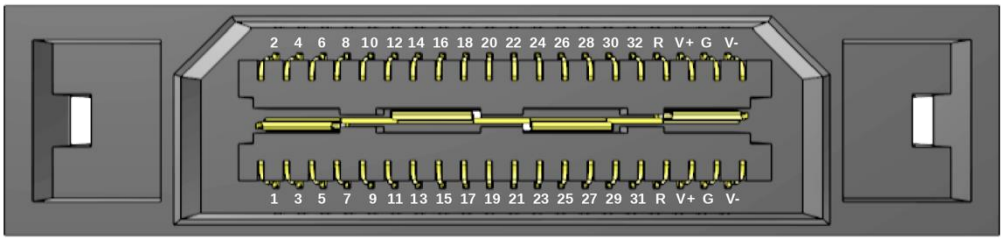


Pinout for Connector #1

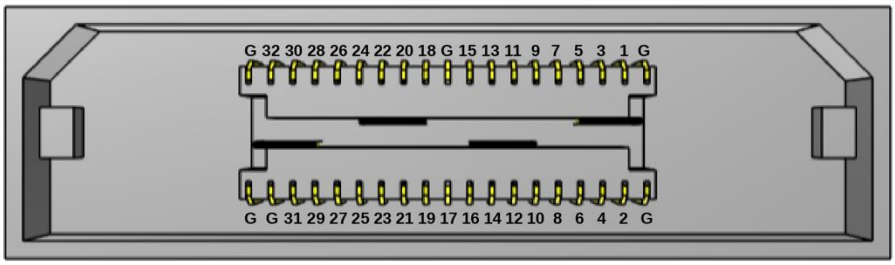
Stimulation Connector



Pinout for Connector #2



Pinout for Connector #3



Stimulation Fidelity

The Stim Head-stage capacitively isolates stimulating and recording hardware at the electrode. Capacitive protection elements in the Stim Head-stage shunt a portion of the applied stimulation current away from the electrode to the patient protection ground of the headstage. The percent of charge delivered to the electrodes is given in the equations below.

$$\text{PN 8451: } Percent\ of\ charge\ delivered\ = \left(\frac{C_e}{1\ nF + C_e}\right) * 100$$

$$\text{PN 10745: } Percent\ of\ charge\ delivered = \left(\frac{\mathrm{C_e}}{100\ \mathrm{pF} + \mathrm{C_e}}\right) * 100$$

$$C_e - Capacitance\ of\ the\ electrode$$

The capacitance of each electrode is unique and depends upon the electrode material, geometry, surface coating, and surrounding tissue. The manufacturer's specification of electrode impedance does not include interactions between the electrode and tissue and is not equivalent to in-vivo electrode impedance. Electrode capacitance values are best determined by applying a constant current stimulation with the CereStim R96 through a complete stimulation/record setup with electrodes attached and implanted. During stimulation, the monitor output voltage may be measured with an oscilloscope. The capacitance of the electrode is given

by the following equation where the differential voltage and time can be measured from the monitor port voltage trace.

$$C_e = I_{Stim} * \partial t/\partial V$$

$$\partial t - Stimulation\ phase\ width\ in\ seconds$$

$$I_{stim} - Stimulation\ current\ in\ amperes$$

$$\partial V - Change\ in\ monitor\ port\ voltage\ in\ volts$$

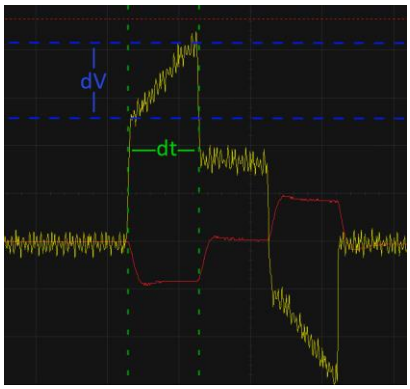


Figure 1-Oscilloscope trace of the monitor port. Stimulation current shown in red, stimulation voltage shown in yellow

In cases where the electrode has been explanted and capacitance cannot be readily measured, the following equation can be used to calculate electrode capacitance based on impedance values previously measured at 1 kHz.

$$C_e = ((Z_e - 2800)^{-1} - 500000^{-1})/(2000 * \pi)$$

$$Z_e = Electrode\ impedance\ in\ ohms$$

Charge delivered per phase can be estimated from the stimulation current, pulse width, and percent of charge delivered.

$$\text{PN 8451: } Charge\ delivered\ per\ phase = I_{Stim} * T_{Stim}\left(\frac{C_e}{1\ nF + C_e}\right)$$

$$\text{PN 10745: } Charge\ delivered\ per\ phase = I_{Stim} * T_{Stim}\left(\frac{C_e}{100\ pF + C_e}\right)$$

Cleaning and Maintenance

The Stim Head-stage should be kept dry and free of debris. A gentle cleaning with small amounts of distilled water can be used to clean the outside of the adapter if necessary.

The Stim Head-stage can be reused as needed. Follow WEEE standards for disposal of the device.

Magnetic Resonance

The Stim Head-stage has not been evaluated for safety and compatibility in the MR environment. The Stim Head-stage has not been tested for heating, migration, or image artifact in the MR environment.

Troubleshooting

If problems arise concerning the recording or stimulus after connecting the headstage, verify that the stimulating and recording systems are plugged into the correct side of the headstage. Refer to the hardware section on page 4 for guidance. If problems continue consult Blackrock's CereStim IFU or contact Blackrock Microsystems support using the information below.

Warranty

Blackrock Microsystems, LLC ("Blackrock") warrants that its products are free from defects in materials and manufacturing for a period of one year from the date of shipment. At its option, Blackrock will repair or replace any product that does not comply with this warranty. This warranty is voided by: (1) any modification or attempted modification to the product done by anyone other than an authorized Blackrock employee; (2) any abuse, negligent handling or misapplication of the product; or (3) any sale or other transfer of the product by the original purchaser.

Except for the warranty set forth in the preceding paragraph, Blackrock provides no warranties of any kind, either express or implied, by fact or law, and hereby disclaims all other warranties, including without limitation the implied warranties of merchantability, fitness for a particular purpose, and non-infringement of third-party patent or other intellectual property rights.

Blackrock shall not be liable for special, indirect, incidental, punitive, exemplary or consequential damages (including without limitation, damages resulting from loss of use, loss of profits, interruption or loss of business or other economic loss) arising out of non-compliance with any warranty. Blackrock's entire liability shall be limited to providing the remedy set forth in the previous paragraph.

Return Merchandise Authorization (RMA)

In the unlikely event that your device needs to be returned to Blackrock for repair or maintenance, do not send any equipment back without a Return Merchandise Authorization Number. An RMA number will be issued to you by a Blackrock representative. If you need to obtain an RMA number, you may contact a product support representative at +1 (801) 582-5533 or by emailing support@blackrockmicro.com.

Once an RMA number has been issued, it is important to safely pack the returned item for shipping back to Blackrock. It is preferred that you save the original boxes and packing materials that your system arrived in for return shipment. Please address the package as follows:

Blackrock Microsystems, LLC
ATTN: RMA#
630 S. Komas Dr., Suite 200
Salt Lake City, UT 84108 USA
Tel: +1 (801) 582-5533

Support

Blackrock prides itself in its customer support. For additional information on this product or any of our products, you can contact our Support team through the contact information below:

Manuals, Software Downloads, and Application Notes

www.blackrockmicro.com/technical-support

Issues or Questions

www.blackrockmicro.com/technical-support

support@blackrockmicro.com

U.S.: +1 (801) 582-5533

Complaints

When filing a complaint, please provide the product description, product number, software version (if applicable), lot number, complainant's name and address, and the nature of the complaint.