

Blackrock 5-Wire Digital Hub

Instruction for Use



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Blackrock 5-Wire Digital Hub - Instructions for Use

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1 5-Wire Digital Hub - Contraindications, Warnings, Cautions, and Specifications

1.1 Contraindications

- The 5-Wire Digital Hub is part of a recording system and should not be used in applications involving stimulation.
- Do not use with devices not approved by Blackrock Microsystems.

1.2 Warnings

- Do not touch any exposed electrical conductors, or use damaged HDMI cabled when using the 5-Wire Digital Hub.
- Keep cables out of traffic paths. Injury to user or patient can occur.
- The user/patient/subject should not attempt to open the 5-Wire Digital Hub.
- Use caution when operating the 5-Wire Digital Hub, especially when connecting and disconnecting cables to minimize risk of 5-Wire Digital Hub falling and/or injury.
- Do not rest objects on or against the 5-Wire Digital Hub.
- Avoid strong static discharges from sources like television or computer monitors; they may damage the electrical components of the system.
- Keep the 5-Wire Digital Hub away from liquids. Contact with water, shower spray, or wet surfaces can lead to the 5-Wire Digital Hub malfunctioning and/or electrical shock.
- Connection of external instruments to the 5-Wire Digital Hub may compromise electrical safety.
- Always use antistatic or electrostatic discharge (ESD) safe gloves when connecting the 5-Wire Digital Hub.
- Use only the supplied Blackrock Microsystems components (Cerebus™ system, 5-Wire Digital Hub, Blackrock provided cables). Substitution of components not supplied by Blackrock Microsystems may affect system performance and patient/ subject safety.
- Do not leave the patient/subject connected to the 5-Wire Digital Hub when the Cerebus™ System is not in use.
- Regularly inspect cables for compromised insulation or bad connections. This can help prevent electrical shock as well as data corruption.

1.3 Cautions

- Read this entire manual prior to using the device.
- This product is for animal use only. This model is not for use with human subjects.

1.4 Specifications

Model Name	Blackrock 5-Wire Digital Hub
Power Requirements	15 VDC, 750 mAmps maximum load
Sampling Frequency	48MHz
Mode of Operation	Continuous
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)

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2 5-Wire CerePlex Headstage - Warnings, Cautions, and Specifications

2.1 Warnings

- Do not touch any exposed electrical conductors when the 5-Wire CerePlex Headstage connector is attached to devices on subject's head as this may result in inducing electric charge to the neural tissue. Irreversible damage may occur.
- The 5-Wire CerePlex Headstage is NOT to be used for stimulation.
- The patient/subject should not attempt to remove the connections themselves.
- Use caution when connecting and disconnecting the Cable to the 5-Wire CerePlex Headstage to minimize the risk of the cable being accidentally pulled or tugged.
- Do not use the 5-Wire CerePlex Headstage 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 5-Wire CerePlex Headstage away from liquids. Contact with water, shower spray, or wet surfaces can lead to the patient receiving an electrical shock.
- Connection of external instruments to the 5-Wire CerePlex Headstage may compromise electrical safety.
- Always use antistatic or electrostatic discharge (ESD) safe gloves when connecting the 5-Wire CerePlex Headstage.
- Use only the supplied Blackrock Microsystems components (Cerebus™ system, Digital Hub128, 5-Wire CerePlex Headstage Cable). Substitution of components not supplied by Blackrock Microsystems may affect system performance and patient/ subject safety.
- Do not leave the patient/subject connected to the 5-Wire CerePlex Headstage when the Cerebus™ System is not in use.
- 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 5-Wire CerePlex Headstage or any other connected devices.

2.2 Cautions

- Read this entire manual prior to using the device.
- This product is for animal research only.

2.3 Specifications

Model Name	Blackrock 5-Wire CerePlex Headstage
Power Requirements	±3 VDC, 150 mAmps maximum load
Resolution	16-bit
Sampling Frequency	30ksps
Mode of Operation	Continuous
Input Frequency Range	0.03 Hz – 7.5k Hz
Input Impedance Range	5kΩ – 1MΩ
Maximum Input Voltage	± 5mV with respect to reference
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)

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3 Introduction

The Blackrock 5-Wire Digital Hub provides an interface between the Cerebus Bio-potential recording system and up to four 32 channel Blackrock 16-bit 5-Wire CerePlex Headstages for high fidelity transmission and recording of extracellular spikes and local field potentials from the brain. The Blackrock 5-Wire Digital Hub converts the digital signal received from the 16-bit headstage to an optic-digital format which is sent directly to the Blackrock Neural Signal Processor (NSP). This dramatically reduces the noise introduced to the signal during transmission. Figure 1 below shows an application overview of how the 5-Wire Digital Hub fits into a complete neural recording system.

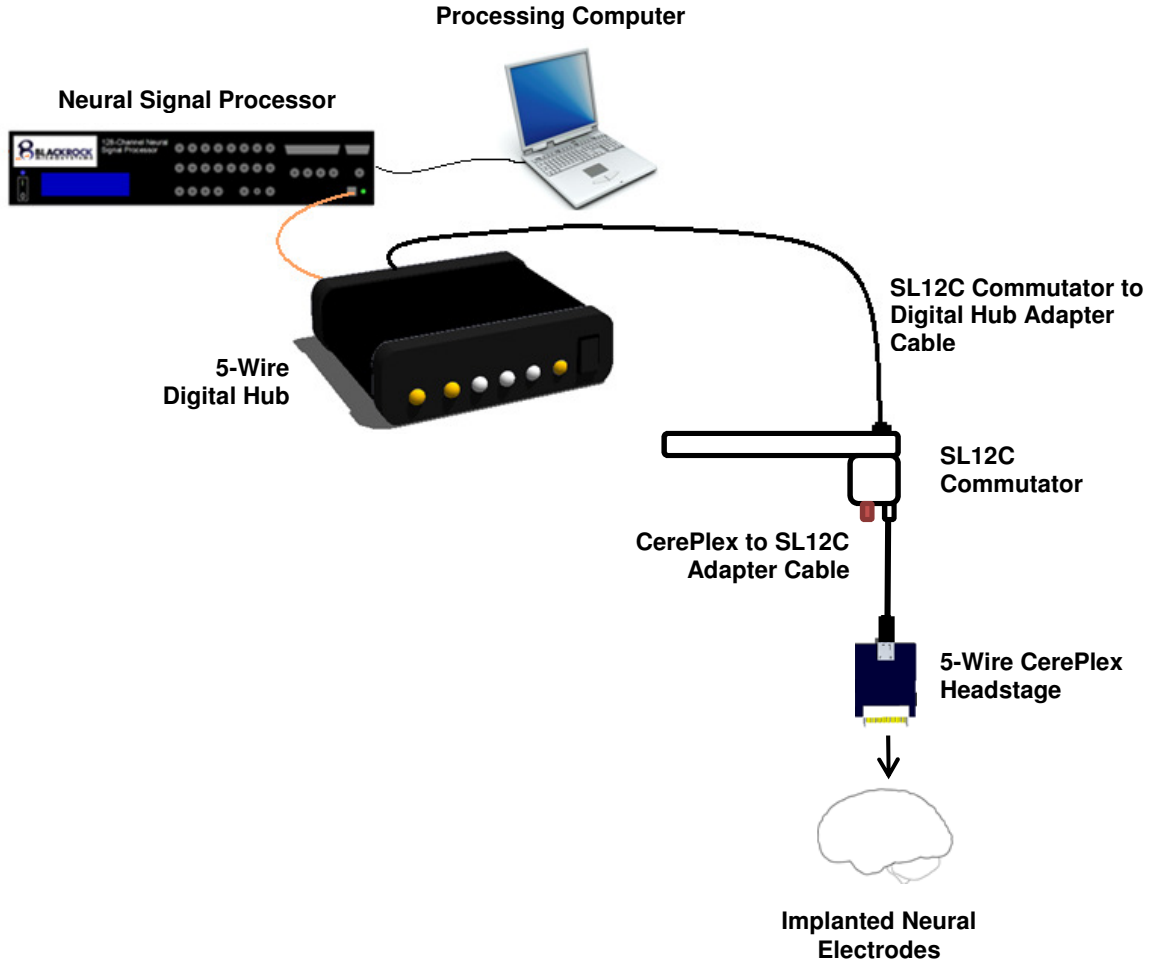


Figure 1: Blackrock Brighton Omnetics Set-up

*NOTE: The Commutator Cables, SL12C Commutator (Plastics1) and 5-Wire CerePlex Headstage are each purchased separately.

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4 Hardware

4.1 Blackrock 5-Wire Digital Hub Input

The Blackrock 5-Wire Digital Hub has 4 input connectors that are capable of transmitting up to 128 channels of data to the Data Acquisition System. These connections are shown in Figure 2 as the receptacle connector for a HDMI Type A connector.

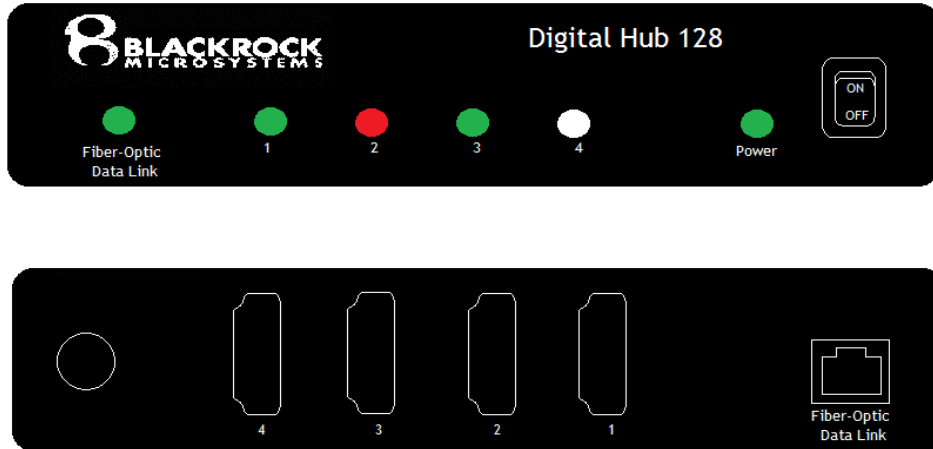


Figure 2: Front (top) and Back (bottom) of the 5-Wire Digital Hub.

The 5-Wire Digital Hub is designed so that input one has the highest priority, then input two, and so forth. This means that if two 96 channel CerePlex Headstages are connected, in inputs two and three respectively, input two will send the entire 96 channels to the Neural Signal Processor (NSP) but input three will send only the first 32 channels to the NSP. The 5-Wire Digital Hub will always send the first 128 channels to the NSP in this way, unless there are less than 128 channels in which case it will send all channels.

There are six LED's on the 5-Wire Digital Hub which can give the user information about the device status. If the 5-Wire Digital Hub is powered (plugged in) the "Power" LED will be green as in Figure 2 above. If the fiber-optic connection between the NSP and the 5-Wire Digital Hub is present, the "Fiber Optic Data Link" LED will be green (otherwise red). Finally, LED's 1-4 show the source status of the incoming data streams. If the LED is green for an input (such as inputs 1 & 3 in Fig 2) the 5-Wire Digital Hub is receiving data from the CerePlex correctly. If the LED is red (such as show in input 2 in Figure 2) data is not being transmitted to the 5-Wire Digital Hub correctly. If the input LED is not lit (such as shown in input 4 Figure 2) there is either no data being received or the HDMI cable is not plugged into the input slot. The HDMI connector pin-out is shown in Figure 3 below.

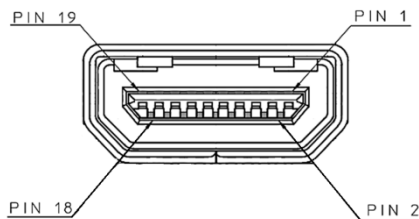


Figure 3: 5-Wire Digital Hub Input Connector Pin-Out

HDMI Pin #	Description
10	Clock
17	V-
19	Ground
18	V+
7	Data

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4.2 Blackrock 5-Wire CerePlex Headstage Pin-Out

The 5-Wire CerePlex Headstage provides an interface between the Cerebus Data Acquisition system and a set of implanted microelectrode arrays for high fidelity transmission and recording of extracellular spikes and local field potentials from the brain. The pin-out for the input and output connectors of the 5-Wire CerePlex Headstage are provided in the figures below.

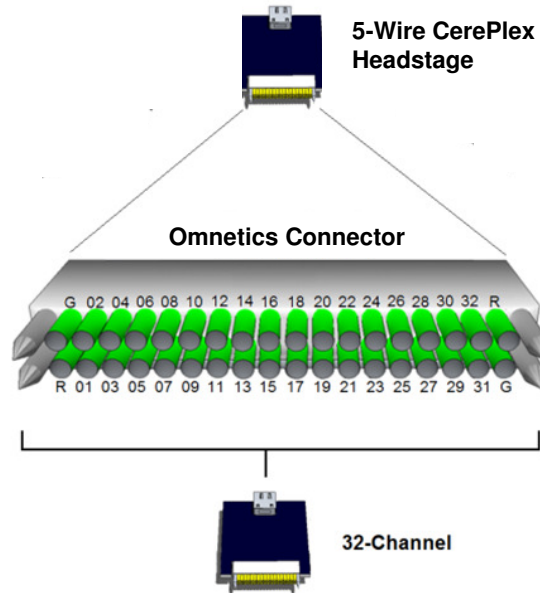
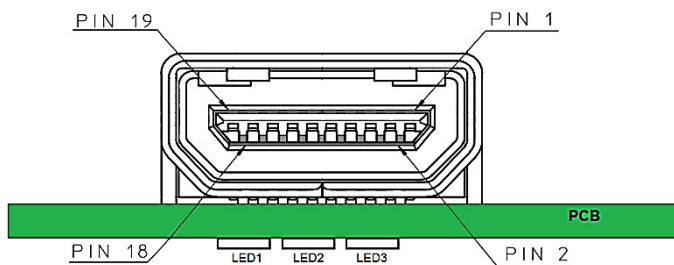


Figure 4: Brighton Omnetics Input Connector Pin-Out. G=Ground, R=Reference. Viewed looking into the connector.



HDMI/D Pin #	Description
12	Clock
16	V-
1	Ground
19	V+
9	Data

*All other channels are for internal use only

Figure 5: Brighton Omnetics Output Connector Pin-Out. Viewed looking into the connector.

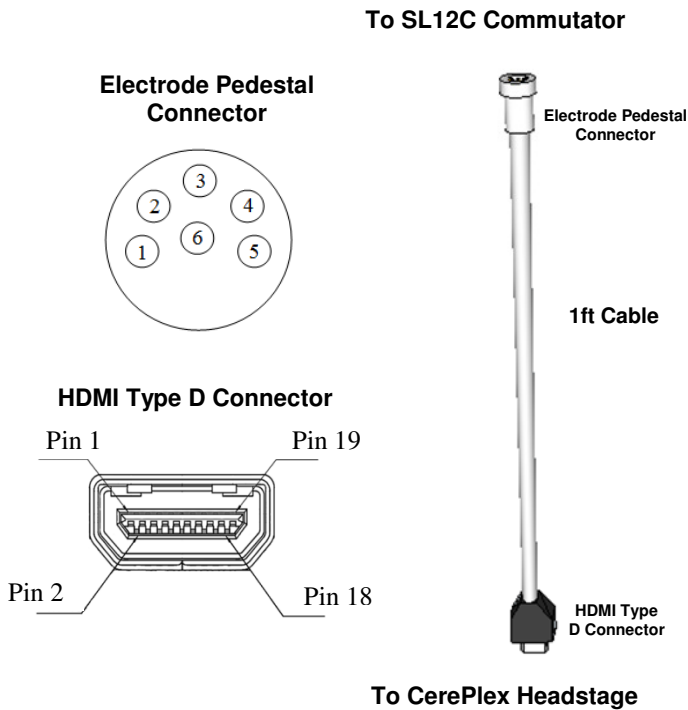
Figure 5 shows the pin-out of the output connector. The three LEDs under the board are Power (LED1), Clock (LED2) and Error (LED3). LED1 will light up while the headstage is being powered. LED2 will blink on a one second interval as the correct clock cycle is received. LED3 only lights up when the conversion of analog to digital is saturated.

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4.3 Commutator Cables

The CerePlex to SL12C Adapter Cable provides an interface between the 5-Wire CerePlex Headstage and the SL12C Commutator, while the SL12C Commutator to Digital Hub Adapter Cable provides an interface between the SL12C Commutator and the 5-Wire Digital Hub. The pin-out for these cables are provided in the figures below.

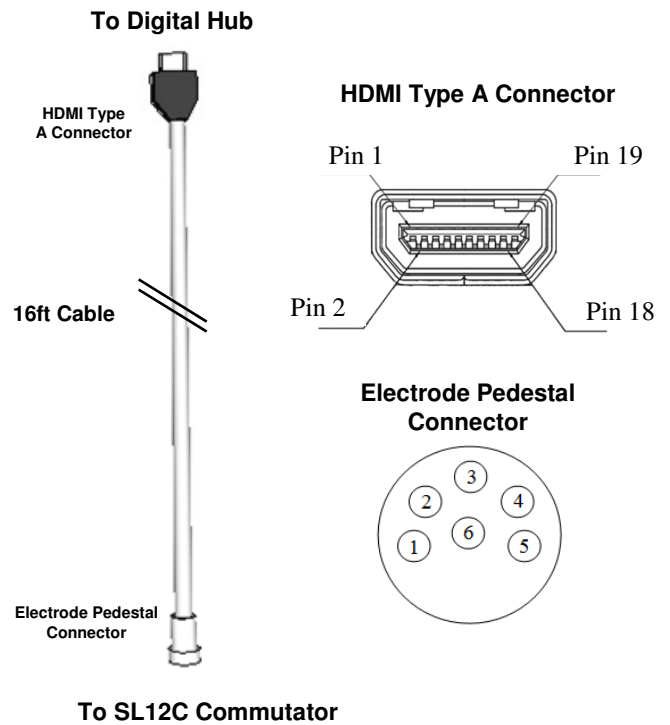
CerePlex to SL12C Commutator Adapter Cable



CerePlex to SL12C Commutator Cable Wiring

Electrode Pedestal Connector Pin	HDMI Type D Connector Pin
1	1 (Ground)
2	9 (Data)
3	12 (Clock)
4	16 (V-)
5	19 (V+)
6	Not Connected

SL12C Commutator to Digital Hub Adapter Cable



SL12C Commutator to Digital Hub Cable Wiring

Electrode Pedestal Connector Pin	HDMI Type A Connector Pin
1	19 (Ground)
2	7 (Data)
3	10 (Clock)
4	17 (V-)
5	18 (V+)
6	Not Connected

****NOTE:** Connectors are viewed looking into the connector.

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5 Instruction for Assembly

1. The following instructions are for the 5-Wire Digital Hub which is capable of supporting up to 128 channels of data.
2. Make sure the 5-Wire Digital Hub is plugged in, and the power switch is in the “Off” position, before making any connections.
3. Connect the fiber optic cable from the back of the 5-Wire Digital Hub to the Neural Signal Processor.
 - a. The “Power” switch can be switched to the “On” position now to verify the 5-Wire Digital Hub is powered and to verify a fiber-optic connection is present if the Neural Signal processor is also turned on.
 - b. Switch the 5-Wire Digital Hub to the “Off” position.
4. Plug the HDMI Type A connector of the SL12C Commutator to Digital Hub Cable into one of the HDMI connectors on the back panel of the 5-Wire Digital Hub.
5. Plug the other end of the SL12C Commutator to Digital Hub Cable into the 6-pin connector on the SL12C Commutator that is directly across from the 6-pin connector from step 6.
6. Connect the 5-Wire CerePlex Headstage to the electrode termination.
7. Plug the HDMI Type D connector of the CerePlex to SL12C Commutator Cable into the output connector on the 5-Wire CerePlex main board.
8. Plug the other end of the CerePlex to SL12C Commutator Cable into one of the 6-pin connectors on the SL12C commutator
9. Make sure the connections are secured.
10. Turn on the power of the 5-Wire Digital Hub for recording. The specific input LED where the HDMI cable was plugged in from the headstage to the 5-Wire Digital Hub should be green.

**Power off the system prior to disconnecting any cables.

6 Warranty

Blackrock Microsystems, LLC warrants that its products are free from defects in materials and manufacturing for a period of one year from the date of shipment. Blackrock will, at its option, 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.

This constitutes the sole warranty made by Blackrock, LLC. There are no other warranties, expressed or implied, which extend beyond those described herein or to anyone other than the original purchaser, including the implied warranties of merchantability and fitness for a particular purpose. In no event shall Blackrock Microsystems, Inc. be liable for any incidental or consequential damages, or for the infringement of any patent rights or third party rights due to the use of its products.

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6.1 Return Merchandise Authorization (RMA)

In the unlikely event that your adaptor needs to be returned to Blackrock for service 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 (801) 582-5533 or toll free at (866) 806-3692.

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#
391 Chipeta Way, Suite G
Salt Lake City, UT 84108 USA
Tel: (801) 582-5533