

Blackrock Digital Hub

Instructions for Use




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Warnings and Contraindications

	IEC60101-0102	Danger of Electrostatic Discharge (ESD)
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- The Digital Hub is part of a recording system and should not be used in applications involving stimulation.
- Do not use the Digital Hub with any device that has not been approved by Blackrock Microsystems.
- Do not touch any exposed electrical conductors, or use damaged HDMI cables when using the 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 Digital Hub.
- Use caution when operating the Digital Hub, especially when connecting and disconnecting cables to minimize risk of Digital Hub falling and/or injury.
- Do not rest objects on or against the Digital Hub.
- Avoid strong static discharges from sources like television or computer monitors; they may damage the electrical components of the system.
- Keep the Digital Hub away from liquids. Contact with water, shower spray, or wet surfaces can lead to the Digital Hub malfunctioning and/or electrical shock.
- Connection of external instruments to the Digital Hub may compromise electrical safety.
- Use antistatic or electrostatic discharge safe gloves when connecting the Digital Hub.
- Use only the supplied Blackrock Microsystems components (Cerebus™ system, Digital Hub, Cables, headstages). 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 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.
- The digital hub power cable must be plugged in to a grounded outlet, otherwise power fluctuations may cause unintended behavior including missing data.

Introduction

The Blackrock Digital Hub provides an interface between the Cerebus Data Acquisition System and the CerePlex series headstages for high fidelity transmission and recording of extracellular spikes and local field potentials from the brain. The Blackrock Digital Hub converts digital signal 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 2-1 below shows an application overview of how the Digital Hub fits into a complete neural recording system using a CerePlex M headstage as an example.

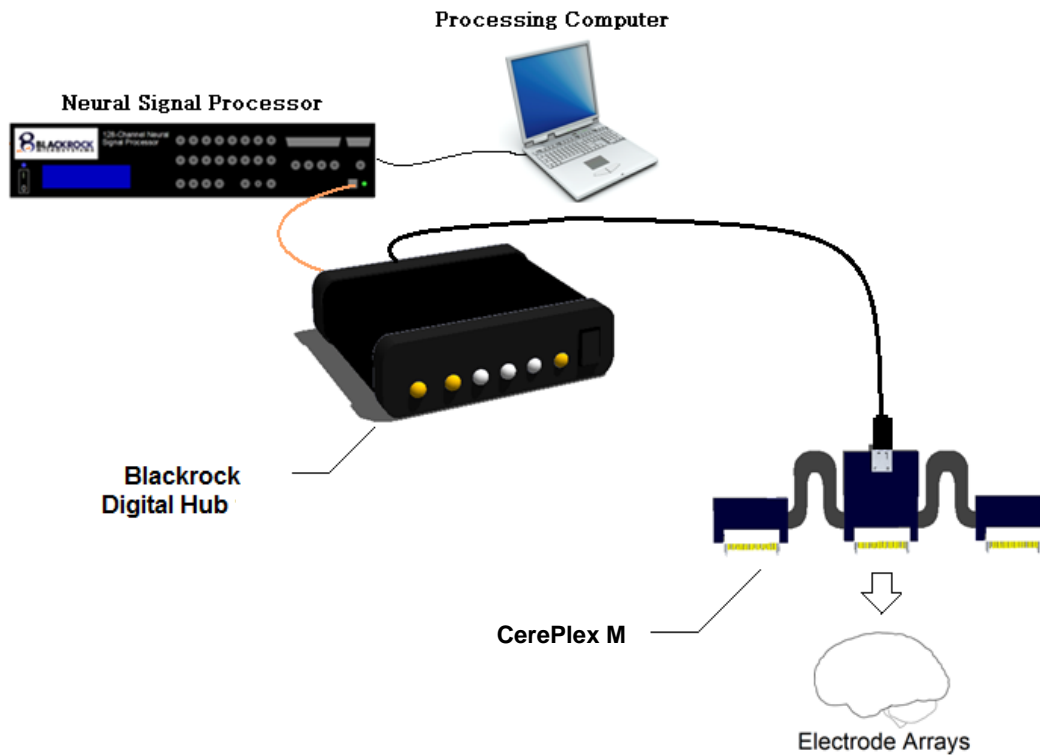


Figure 1: Blackrock Digital System Overview

Specifications

Model Name	Blackrock Digital Hub
Power Requirements	100-240V 50/60 Hz, 1.5A
Sampling Frequency	48MHz or 66MHz
Mode of Operation	Continuous
Input Protocol	Low-voltage differential signaling
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)

Overview of Hardware

Blackrock Digital Hub Input

The Blackrock Digital Hub has several possible configurations which arise from its ability to transmit 128 channels of data. For instance, the Digital Hub can be used with:

- Four 32-channel CerePlex M headstages
- Two 64-channel CerePlex M headstages
- One 32-channel and one 96-channel CerePlex M headstage
- One CerePlex E

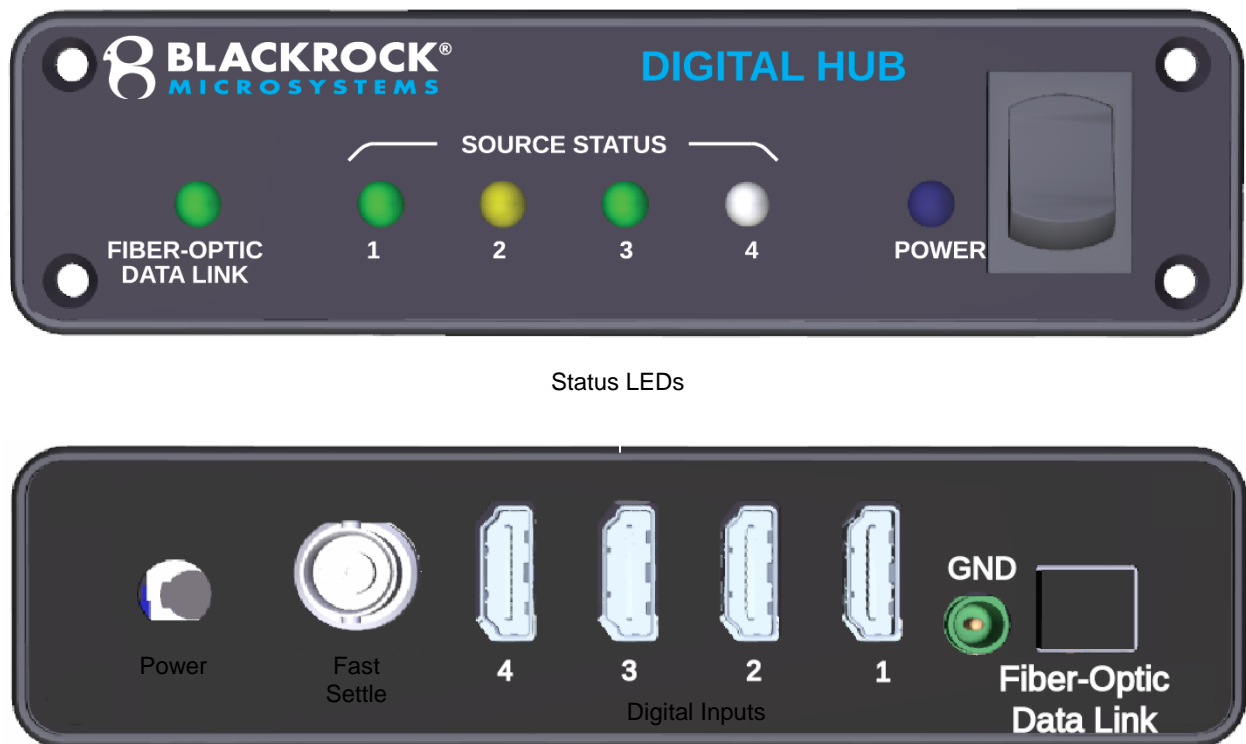


Figure 2: Front (top) and Back (bottom) of the Digital Hub

Status LEDs

There are six LED's on the Digital Hub which can give the user information about the device status. If the Digital Hub is powered (plugged in) the "Power" LED will be blue as in Fig 3-1. If the fiber-optic connection between the NSP and the Digital Hub is present, the "Fiber Optic Data Link" LED will be green (otherwise yellow). 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 3-1) the Digital Hub is receiving data from a CerePlex correctly. If the LED is yellow (such as show in input 2 in Fig 3-2) data is not being transmitted to the Digital Hub correctly. If the input LED is not lit (such as shown in input 4 Fig 3-1) there is either no data being received or the HDMI cable is not plugged into the input slot.

Power

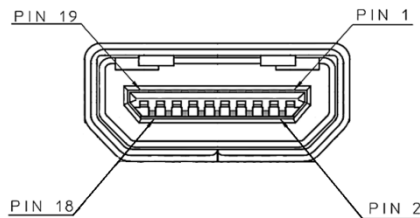
The Digital Hub is powered by a medical grade power supply that is included as part of the Digital Hub packaging. The blue LED labeled “Power” will light up when the external power supply is connected to the unit and turned on.

Fast Settle

The fast settle input connector is located on the back panel of the Digital Hub. This connector is tied to each of the four HDMI inputs. The signal fed into the BNC connector is passed through the system to pin 14 on the HDMI connector, providing a fast settle signal to the attached digital headstage(s).

Digital Inputs

The 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 M’s 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 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. The HDMI connector pin-out is shown in Figure 3-2 below.



HDMI/D Pin #	Description
10	Clock+
12	Clock-
14	Fast Settle
15,19	Ground
16,18	V+
7	Data+
9	Data-
2, 5, 8, 11	Shield Ground

Figure 3: Input Connector Pin-Out

Patient Ground

This connector is located on the back panel of the Digital Hub and is labeled as “GND.” This is the patient ground connector if needed for a reference ground.

Fiber Optic Link

This connector is located on the back panel of the Digital Hub and provides a connection to the Blackrock Neural Signal Processor via a fiber optic cable.

Setting Up the CerePlex Exilis

This section describes how to connect the components of the Digital Hub system to conduct a recording session. This set of instructions uses the CerePlex M as an example for the digital headstage. For instructions regarding assembly with the CerePlex E, refer to the CerePlex E Instructions for Use (see Blackrockmicrosystems.com for complete listing of product manuals).

1. The following instructions are for the Digital Hub which can support up to 128 channels of data. Assembly illustrations are shown in Figure 4.
2. Make sure the 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 Digital Hub to the Neural Signal Processor.
 - a. The “Power” switch can be switched to the “On” position now to verify the 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 Digital Hub to the “Off” position.
4. Plug the HDMI cable to the output connector on the CerePlex M main board after the CerePlex M is fully connected to the electrode termination.
5. Plug the other end of the HDMI cable to the connector on the back of the Digital Hub.
6. Make sure the connections are secured.
7. Turn on the power of the Digital Hub for recording. The specific input LED where the HDMI cable was plugged in from the headstage to the Digital Hub should be green.

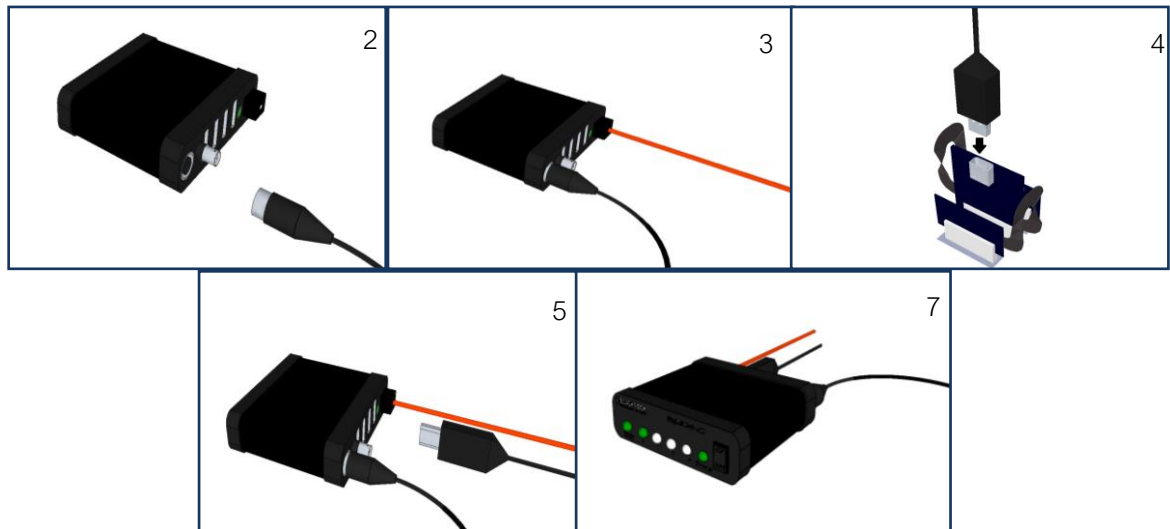


Figure 4: Instruction for Assembly

**After recording, turn off power before disconnecting any cables.

Cleaning and Maintenance

Warning: Unplug the device from all power and devices before performing any cleaning and/or maintenance.

The Digital Hub should be kept dry and free of debris. A gentle cleaning with small amounts of isopropyl alcohol can be used to clean the outside of the device if necessary.

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) 839 1062
Europe +49 (0) 511 132 211 10