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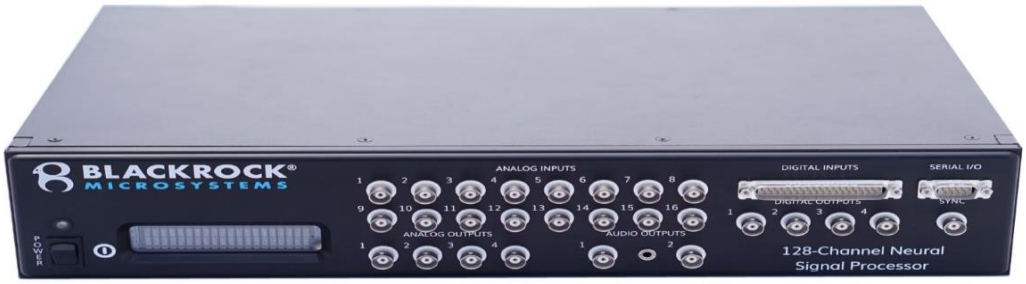
www.blackrockneurotech.com

Cerebus System

Instructions for Use

CAUTION - Device for investigational use in laboratory animals or other tests that do not involve human subjects.



Revision 19.00 / LB-0028 – Cerebus IFU – 2024/02

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What This Manual Covers

The Blackrock Cerebus Neural Processing System supports recording, processing, and displaying bio-potential signals from various types of electrodes. Bio-potential signals may include Electrocorticography (ECoG), electroencephalography (EEG), electromyography (EMG), electrocardiography (ECG), electrooculography (EOG), action potentials (AP), and evoked potentials (EP).

The Cerebus System records and processes neural signals from up to 256 surface or penetrating electrodes in addition to auxiliary analog signals and digital experimental events. Multiple systems can be synchronized to achieve higher input channel counts.

The system can perform real-time signal processing algorithms including noise cancellation, digital filtering, simultaneous extraction of spike and field potentials, manual and automatic online spike sorting. Functionality can be further increased with custom user-defined scripts.

The Cerebus System includes a Digital/Gemini Hub. The Digital/Gemini Hub allows the Cerebus System to be used with CerePlex™ digital headstages which digitize and multiplex neural signals to reduce lead wire size and noise acquisition.

Packing Contents

The Cerebus System is shipped with components listed below. The exact type and quantity of the components can vary depending on the Cerebus model, line voltage (110v or 220v), and total input channel count.

- Neural Signal Processor (NSP) and rubber feet
- Rack mounting ears and screws
- Digital/Gemini Hub and isolated power supply
- Alligator clip to touch proof ground cable
- Power cables and connectors
- Crossover Ethernet cable(s)
- Cerebus user’s manual & Central Suite software installation CD

Host PC Requirements

The recommended specifications for a Cerebus System host PC are mentioned below.

- Microsoft Windows 10 professional
- Intel Core i-series processor
- 8 GB RAM
- 250 GB SSD for operating system
- Separate SSD for data storage

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- Discrete video/graphics card
- 2 gigabit Ethernet Ports

A Host PC that is configured and tested by our engineers is available. Please contact sales@blackrockneuro.com for more information.

Intended Use and Indications for Use

The Blackrock Cerebus Neural Processing System supports recording, processing and displaying bio-potential signals from various types of electrodes. Bio-potential signals may include Electrocorticography (ECoG), electroencephalography (EEG), electromyography (EMG), electrocardiography (ECG), electrooculography (EOG), action potentials (AP), and evoked potentials (EP).

Contraindications, Warnings, and Precautions

Warnings

- Read this entire manual prior to using the device.
- A thorough understanding of the technical principles and risks associated with electrophysiological recording is necessary before using this product.
- Always operate the Cerebus System in a clean environment.
- Only connect Cerebus System components to properly tested, grounded, and dedicated AC outlets using only the Blackrock provided power cable to reduce the risk of electrical shock or malfunction of product. Do not use an adapter for ungrounded wall outlets.
- Do not connect the Cerebus System to an outlet controlled by a wall switch, multiple socket-outlet or extension cord to avoid fires or other electrical hazards.
- Do not use the Cerebus System in the presence of flammable anesthetic agents.
- Do not use the Cerebus System for any use other than its listed intended use.
- Avoid strong static discharges from sources like televisions or computer monitors because it can damage the electrical components of the system.
- Keep the Cerebus System away from liquids. Contact with water, shower spray, or wet surfaces can lead to the patient receiving an electrical shock.
- Connection of external instruments may compromise electrical safety compliance with IEC 60601-1.

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- The Cerebus System should be disconnected from any electrodes during cardiac defibrillation.
- The conductive parts of electrodes and their connectors, including neural electrodes, should not contact other conductive parts including earth.
- Place the Cerebus system in a secure location.
- Avoid tripping on cords connected to the Cerebus system.
- Repair or maintenance is not allowed during equipment operation.
- Only plug in Blackrock approved equipment into the Cerebus system.
- Do not connect the computer hosting the Central software to the internet.
- Do not turn on the digital hub until connections have been made between the patient and the hub.

Precautions

- Follow the restrictions of use for third party electrodes or arrays.
- Third party recording or control systems connecting to the Cerebus System and components must be electrically isolated for subject safety.
- Note that the fiber-optic cable is very delicate. Do not bend it (bend radius of 5.0 cm) or crush it.
- Device for investigational use in laboratory animals or other tests that do not involve human subjects.

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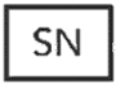
Symbols

ISO 15223-1:2021Medical Devices – Symbols to Be Used with Medical Device Labels, Labeling, and Information to Be Supplied			
Reference	**Symbol**	**Title**	**Meaning**
5.1.1		**Manufacturer**	Indicates the medical device manufacturer.
5.1.6		**Catalog Number**	Indicates the manufacturer's catalog number so that the medical device can be identified. For Blackrock Microsystems it is called the Part Number (PN).
5.1.7		**Serial Number**	Indicates the manufacturer's serial number so that a specific medical device can be identified.
5.4.3		**Consult Instructions for Use**	Indicates the need for the user to consult the instructions for use, which you are currently reading.
5.4.4		**Caution**	Indicates the need for the user to consult the instructions for use for important cautionary information such as warning and precautions that cannot, for a variety of reasons, be presented on the medical device itself.
IEC 60417:2002 DB Graphical Symbols for Use on Equipment			
Reference	**Symbol**	**Title**	**Meaning**
5007		**On (Power)**	To indicate connection to the mains, at least for mains switches or their positions, and all those cases where safety is involved.
5008		**Off (Power)**	To indicate disconnection from the mains, at least for mains switches or

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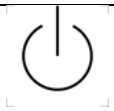
			their positions, and all those cases where safety is involved.
5009		**Standby (Power)**	To identify the switch or switch position by means of which part of the equipment is switched on in order to bring it into the stand-by condition, and to identify the control to shift to or to indicate the state of low power consumption.
IEC 60417:2002 DB Graphical Symbols for Use on Equipment			
Reference	**Symbol**	**Title**	**Meaning**
5036		**Dangerous Voltage**	To indicate hazards arising from dangerous voltages.

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Specifications

Neural Signal Processor

Model Name	Neural Signal Processor
Neural Signal Inputs	Up to 256
Sampling Rate	30,000 Hz
Analog Inputs	Sixteen ±5 V, 16-bit inputs for experiment or neural signal processing
Digital IO	One 16-bit input port (DB-37) with Word and Packet Strobe control lines. One RS232 I/O port (DB-9) with 115k baud input and output. Four single-bit digital outputs (BNC) with programmable monitoring functions. One TTL output (BNC) sampling synchronization output port.
Analog Outputs	Four ±5 V, 600 ohm, 16-bit outputs
Audio Outputs	Two ± 1.5 V line-level outputs
PC Interface	1 Gbps Ethernet
Power Requirements	110 VAC 60 Hz 6.0 A / 240 VAC 50 Hz 3.0 A
Line Noise Serviceable Fuses	5 x 20mm, 250V, 1.6A, Slow Blow
Compliance Standards	IEC 60601-1, IEC 60601-1-2, IEC 60601-2-26, CSA listed
Type of Protection Against Electric Shock	Class I
Degree of Protection	Type BF Applied Part
Mode of Operation	Continuous
Ingress Protection	Ordinary Equipment, not fluid resistant, IPX0

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Operating Environment	10˚C to 35˚C, 5 to 85% R.H. (non-condensing)
Storage Environment	-20˚C to 50˚C, 5 to 95% R.H. (non-condensing)

Digital Hub/Gemini Hub

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

The following diagrams depict overall views of how the Cerebus is integrated within a typical laboratory environment. The experiment subject area is both electrically and optically isolated from the experiment operation and control area. The neural signals are digitized by the CerePlex digital headstages before they enter the Digital or Gemini Hub. The Digital Hub is responsible for converting the digitized signals into fiber optic data and transferring them to the processor via a fiber optic link, whereas the Gemini Hub is responsible for converting the signals into ethernet data.

The figure below (lower panel) also depicts a simplified flowchart to describe the signal processing stages that take place inside the Cerebus system. The signals on both the electrode and reference wire are initially buffered using unity gain amplifiers. The buffered signals then enter a differential amplifier which subtracts the neural signal from the reference to suppress common noise and achieve a bipolar recording. The resultant signal then goes through the gain and filtering stage. The amplified signal is then digitized, converted to fiber optic signal, and transferred to the processor for further analysis, display or storage.

The Digital Cerebus and Gemini Systems are compatible with the whole family of the Blackrock CerePlex digital headstages. Blackrock digital headstages enable low noise transmission in a minimally invasive package. The output of the CerePlex digital headstages are multiplexed, meaning that only a reduced set of wires are needed to transmit the already digitized data from all the input channels. The following block diagram depicts the different components and their roles within a Cerebus System.

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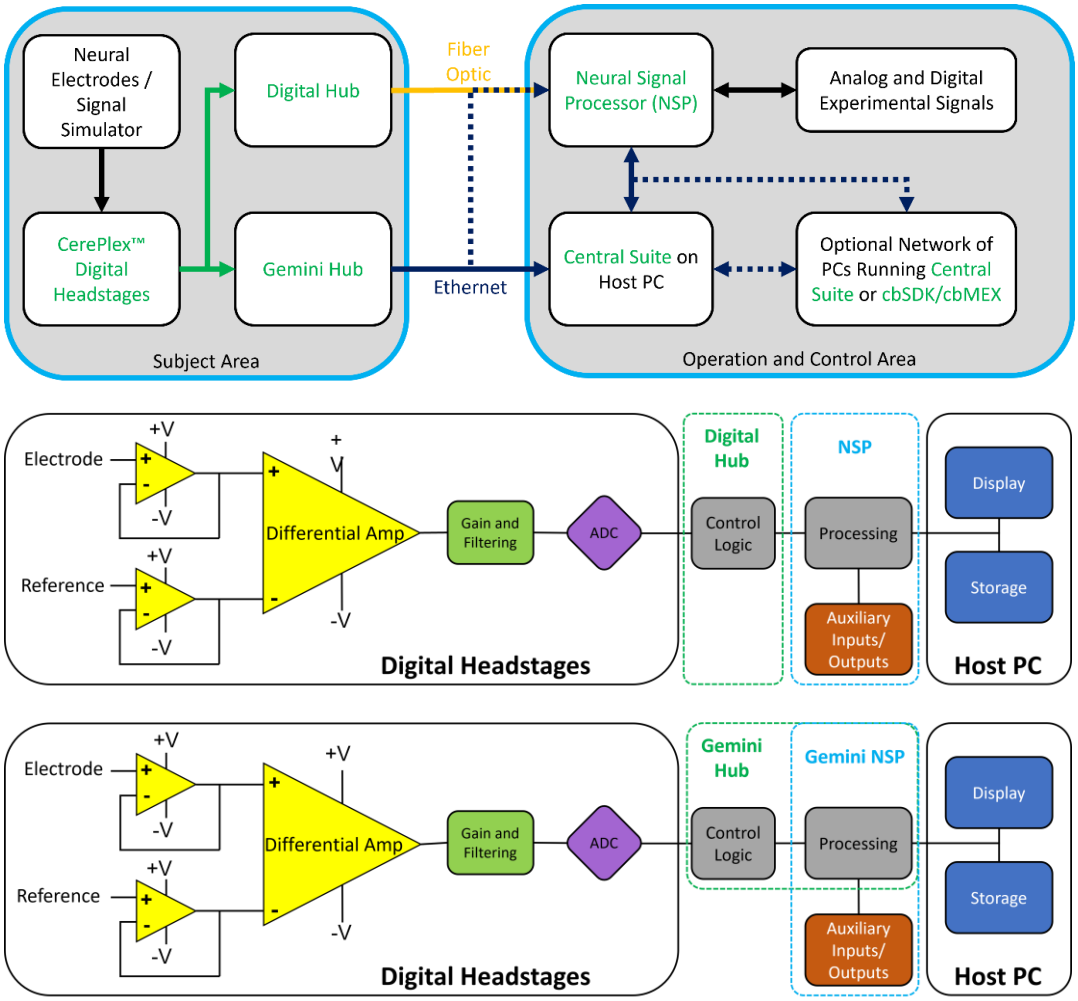

Simplified block diagram showing different components of the Digital Cerebus and their intended function within the system.

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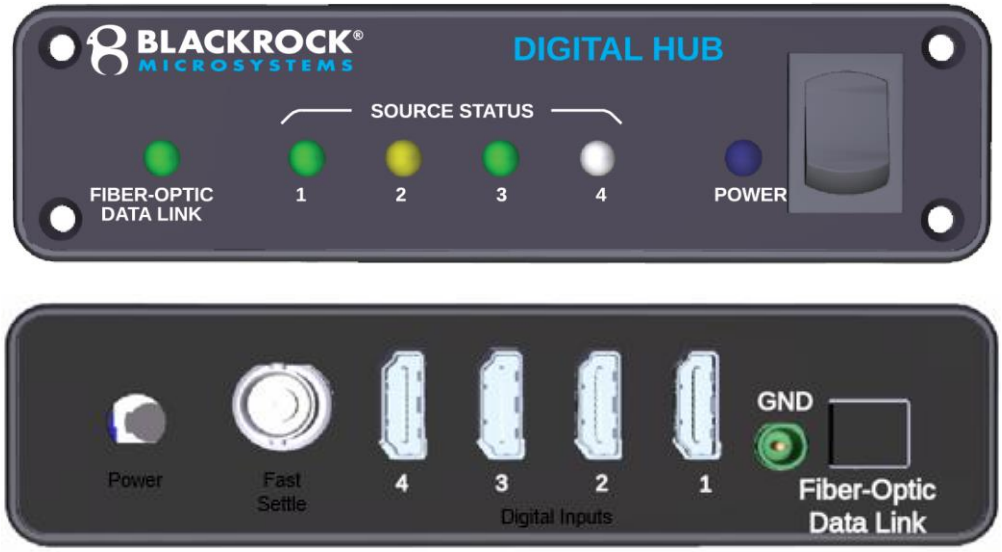
Digital Hub

The Blackrock Digital Hub provides an interface between the NSP and CerePlex digital headstages. The Digital Hub converts digital signal to an optic-digital format which is sent directly to the NSP. This dramatically reduces the noise introduced to the signal during transmission. The Digital Hub can handle many possible configurations when it is connected to multiple CerePlex digital headstages provided that the total number of channels does not exceed maximum 128 channels.

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



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. 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 the image above) the Digital Hub is receiving data from a CerePlex correctly. If the LED is yellow (such as show in input 2 in the image above) data is not being transmitted to the Digital Hub correctly. If the input LED is not lit (such as

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shown in input 4 in the image above) 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. Note that the hub should not be turned on until after connections to the headstage and subject are made.

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.

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.

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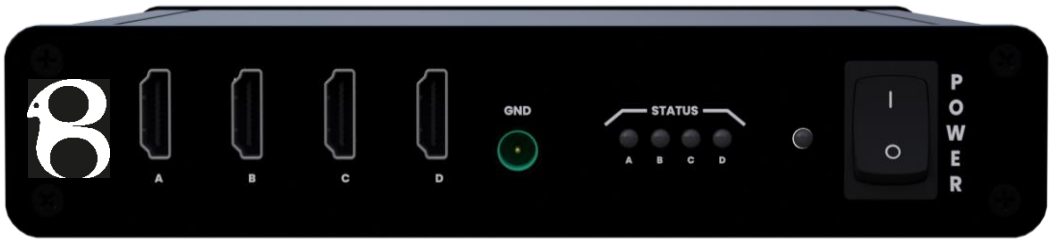
Gemini Hub

The Gemini Hub, like the Digital Hub, receives digital signals from attached digital headstage accessory devices. The functionality of the Gemini Hub is almost exactly like that of the Digital Hub. However, the Fiber Optic Link is replaced by a Network Link, which uses a CAT6 ethernet cable to transmit data to the NSP.

Also note that the front and rear panels of the Gemini Hub differ from the Digital Hub. Note the figure below to see where the connections and indicators reside on the device.



Note: In order to use CerePlex headstages with the Gemini system, you will have to use a Gemini Headstage adapter between the digital data cable and the digital input. CerePlex headstages and assemblies that need this adapter are listed in the table below:

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CerePlex™ Digital Headstages

Blackrock Microsystems manufactures a range of different models of CerePlex digital headstages which are characterized by their low noise, light weight and small physical profile. These headstages are all compatible with the Digital Hub 128. For more detailed information on each type of the headstage please refer to www.blackrockneurotech.com.

Headstage Family	Part numbers
CerePlex M	10531, 10532, 10533, 10534
CerePlex µ	9162, 9714, 9715 (µ HDMI Adapter)
CerePlex E	10510, 10511
CerePlex A	7384
Wireless	9659 (Wireless Receiver) 10451, 10631, 10633

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Neural Signal Processor (NSP)

The NSP is a real-time processor of the Cerebus System which performs all the digital processing, including filtering, spike extraction, spike sorting, and so on. The NSP is built upon a real-time Linux system capable of onboard closed loop processing and rapid data transmission to the Host PC through Ethernet UDP protocol. The NSP has multiple auxiliary analog and digital inputs and outputs that can be programmed through the Cerebus Central Software Suite or one of the supplied Software Development Kits (SDKs). The NSP can also perform real-time closed loop analysis via the Extension Code user-developed applications and communicate the results via the auxiliary ports to third-party equipment or via the Ethernet link to the host PC. Multiple NSPs may also be synchronized for recording signals from more electrodes.

The hardware and architecture inside the NSP are both periodically optimized to improve the overall performance and reliability of the system. Blackrock Microsystems has so far released four different versions of the NSP mentioned below:

- NSP 1.0 (Part number 4176)
- NSP 1.5 (Part number 7530)
- NSP 1.75 (Part number 9650)
- NSP 2.0 (Part number 10411)
- Gemini NSP (Part number 12125)

NSP 1.0 architecture was based on an Intel® Pentium 4 processor. The processor in the NSP 1.5 was upgraded to multi-core Intel® i7 technology. The mentioned upgrade provides users with the NSP versions 1.5 and above an option to directly upload their custom-built software into the NSP for real-time execution via the Blackrock's Extension Software package. For detailed information about Extension software and example application notes, please refer to www.blackrockneurotech.com.

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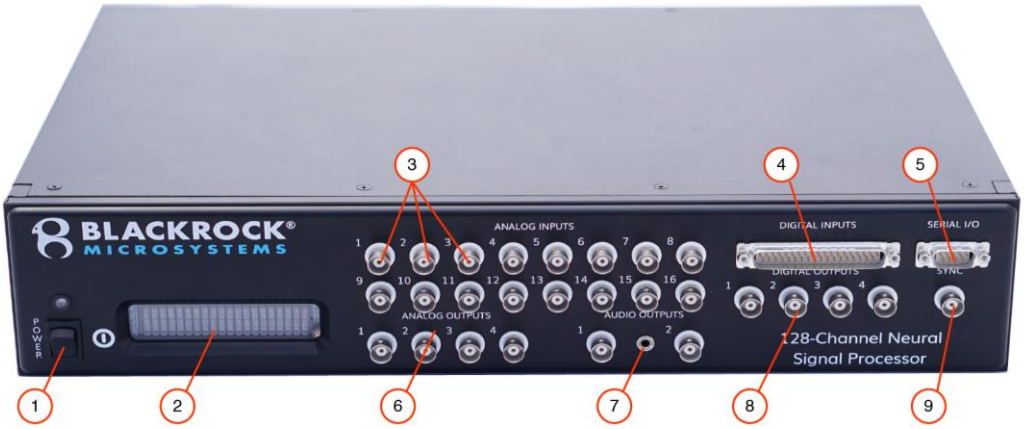
NSP 2.0 is equipped with an additional fiber optic input link therefore it can receive and process 256 channels of neural data simultaneously. All previous versions of the NSP can handle maximum 128 channels via a single fiber optic link.



Front side of the NSP 1.75 showing the power switch (1), LCD display (2), analog inputs (3), digital inputs (4), serial I/O (5), analog outputs (6), audio outputs (7), digital outputs (8), and sync port (9).

Note: The fiber optic link input connector has been relocated to the back panel in NSP versions

The available input and output connection ports on the NSP are detailed in the following sections.

NSP Front Panel

The front panel of the NSP (see picture above) consists of the following input and output ports:

1. Power switch:
   The power switch turns the NSP on and off. The LED above the switch will illuminate when the unit is on. For the Gemini NSP, you must hold the power button for 8 seconds to power it off.

2. LCD Display:
   The LCD displays the current operating status of the unit. The statuses include “Initializing”, “NSP Startup”, “NSP Running”, “NSP Standby”, and “Synchronized”.

3. Analog Inputs:
   Auxiliary analog signals can be recorded through 16 BNC ports. The analog source may range ±5.0 V and should come from a source impedance of less than 100 Ω. The coupling of each input channel can be manually selected in the software. By default, channels 1-8 are AC-coupled and channels 9-16 are DC-coupled.

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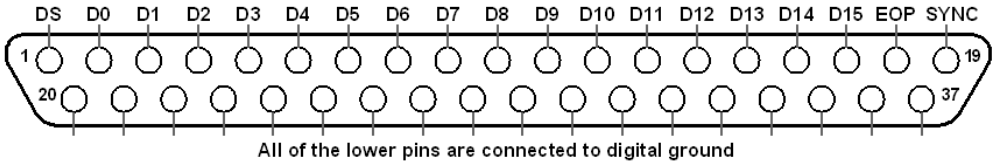
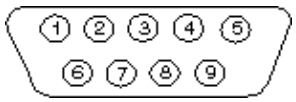
4. Digital Input:
   Digital events can be recorded through the 16-bit DB37 input port. The pinout is shown below. DS is a digital strobe pin. D0-15 are data pins. EOP is reserved. SYNC is an output pin and can be used with external equipment to indicate when the port is scanned. Input range is 0V-5V TTL levels. The port is polled every 1/30000 of a second. Strobed data is buffered up to 10 strobes per 1/30000 of a second and is latched on the rising edge of the DS pin.



5. Serial I/O:
   The port is an RS232 DB9 digital input/output port. The pin diagram is shown below. Currently, the NSP firmware software only supports this port as an input.



   Pin 2 is “Receive Data”, pin 3 is “Transmit Data”, and pin 5 is “Ground”. The configuration of the port is: Baud rate: 115200, Data bits: 8, Parity: none, Stop bits: 1, Flow control: disabled.

6. Analog Outputs:
   Four ±5.0 V analog output BNC connectors can be used to send monitoring signals or stimulus waveforms to other connectors.

7. Audio Output:
   The system sends a ±1.5 V line-level audio signal of the selected data channel to two BNC ports and one 3.5mm female stereo audio connector simultaneously.

8. Digital Outputs:
   Four single-bit digital BNC outputs can be programmed for monitoring or timing functions. These ports can be setup to send a TTL signal if spike activity is detected on any channel. They can also be configured to output a digital pulse train at a user-defined frequency and duty cycle. Digital Output 1 can also be used for syncing external equipment by sending a unique pulse every 14 seconds. The entire sync pattern will repeat every hour. See the Central Software Suite User Manual for more details.

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9. Sync Port:
   A synchronization pulse can be set as an optional line to inform external equipment when the NSP neural signal inputs and front panel ports are scanned. It is active on the rising edge of the signal.

NSP Back Panel

The back panel of the NSP includes the following ports and connectors:

10. Line Noise Cancellation Port:
    On NSP 1.5 and higher versions, the adaptive line noise cancellation port is separated from the NSP's main power input connector. To use the adaptive line noise cancellation, plug a standard power cable into this port and enable the feature in software as described in the Central Software Suite User Manual which is available for download from the Blackrock Microsystems website.

11. Synchronization Port:
    This DB9 port is located on the back of the NSP and it is used to synchronize two or more NSPs. Once the sync cable (Blackrock PN 5584) is properly connected between NSPs, they will automatically synchronize. Some older NSP models may not have this port. To add synchronization capability to your NSP, please contact Blackrock Microsystems at sales@blackrockneuro.com.

12. Fiber Optic Link:
    This port connects to the Digital Hub using a fiber optic cable. A LED to the right of the connector turns green when an optical link is established and, in the newest model of the Neural Signal Processor (NSP 2.0 and above) turns yellow when the link is broken. Older models of the device have a red LED when the link is broken. The Fiber Optic connector is located on the front side in NSP models 1.5 and 1.0. The NSP 2.0 is equipped with an additional fiber optic input connector which enables the NSP 2.0 to communicate with more than one Digital Hub.

13. Main Power:

    All NSPs must take an AC power cable into this port to properly power on.

14. Main Power Switch:

    NSPs with PNs 7530, 9650, 10411, and 12125 have a main power switch on the power supply. This power switch controls all power to the unit. If this switch is off, the power switch on the front of the unit will not function.

15. Network Links:

    NSPs with PN 12125 do not use fiber-optic links to communicate with the Gemini Hub. This NSP uses ethernet cables to transfer information between the two units. These network links are also used to connect the NSP to the host PC.

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NSP 1.0

NSP 1.5

NSP 1.75

NSP 2.0

Gemini NSP

Back panel view of different versions of NSP showing the adaptive Line Noise Cancellation plug (10), Synchronization Port (11), Fiber Optic input connector(s) (12), main power (13), main power switch (14), and network links (15).

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Quick Setup Guide

Setting up the Digital Cerebus System

1. Remove the NSP, Digital Hub and Digital Hub's power supply from the shipping boxes.
2. Attach the NSP rack-mount brackets to install it in an equipment rack, or rubber feet to place it on a table.
3. Plug in the NSP and the Hub power supply to electrical outlets.
4. Connect the power supply to the Digital Hub.
5. Connect one end of the fiber-optic cable to the NSP and the other end to the Digital Hub.
6. Turn on the NSP, then the Digital Hub.
7. If available, connect a CerePlex headstage to the Digital Hub via an appropriate HDMI cable.
8. The LEDs on the Hub and the NSP should turn green if everything is connected properly.

Setting up the Gemini System

1. Remove the NSP (if present) and Gemini Hub from the shipping boxes.
2. Attach the NSP rack-mount brackets to install it in an equipment rack, or rubber feet to place it on a table.
3. Plug in the NSP and the Hub to electrical outlets.
4. Connect one end of the Ethernet cable to the Gemini Hub.
    a. If using an NSP:
        i. Connect the other end of the Ethernet cable to the back of the NSP.
        ii. Connect a second Ethernet cable between the NSP and host PC
    b. If not using an NSP:
        i. Connect the other end of the Ethernet cable directly to the host PC.
5. Turn on the NSP (if present), then the Gemini Hub.

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6. If available, connect a CerePlex headstage to the Gemini Hub via an appropriate HDMI cable.
7. The Status LEDs on the Hub should not be blinking and the NSP should not display “No neural channels” if everything is connected properly.
    i. Note: The status LEDs on the Gemini Hub will blink green when connected directly to a host PC without an NSP. This is expected behavior.

Setting up the Ethernet Link

The network interface card on the Host PC needs to be configured as follows for connecting the Host PC to the NSP:

1. In Windows click on Start and search for “View Network Connections”.
2. Right click on the correct Ethernet Adaptor (usually, Local Area Connection) and click on Properties.
3. Uncheck all services except for Internet Protocol (TCP/IP) or Internet Protocol Version 4 (TCP/IPv4).
4. Click on Internet Protocol (TCP/IP) and click on Properties
5. For IP, Address enter 192.168.137.1 for Analog or Digital Cerebus; enter 192.168.137.199 for Gemini Cerebus. For Subnet Mask, enter 255.255.255.0. and leave the remaining fields blank.
6. Click on OK to save changes.

Up to 16 PCs can be connected to the same NSP using a business class 1-Gbps network switch. For other PCs connected using a network switch, IP addresses should increment, such as 192.168.137.2, 192.168.137.3, etc. The NSP’s IP address is currently fixed at 192.168.137.128.

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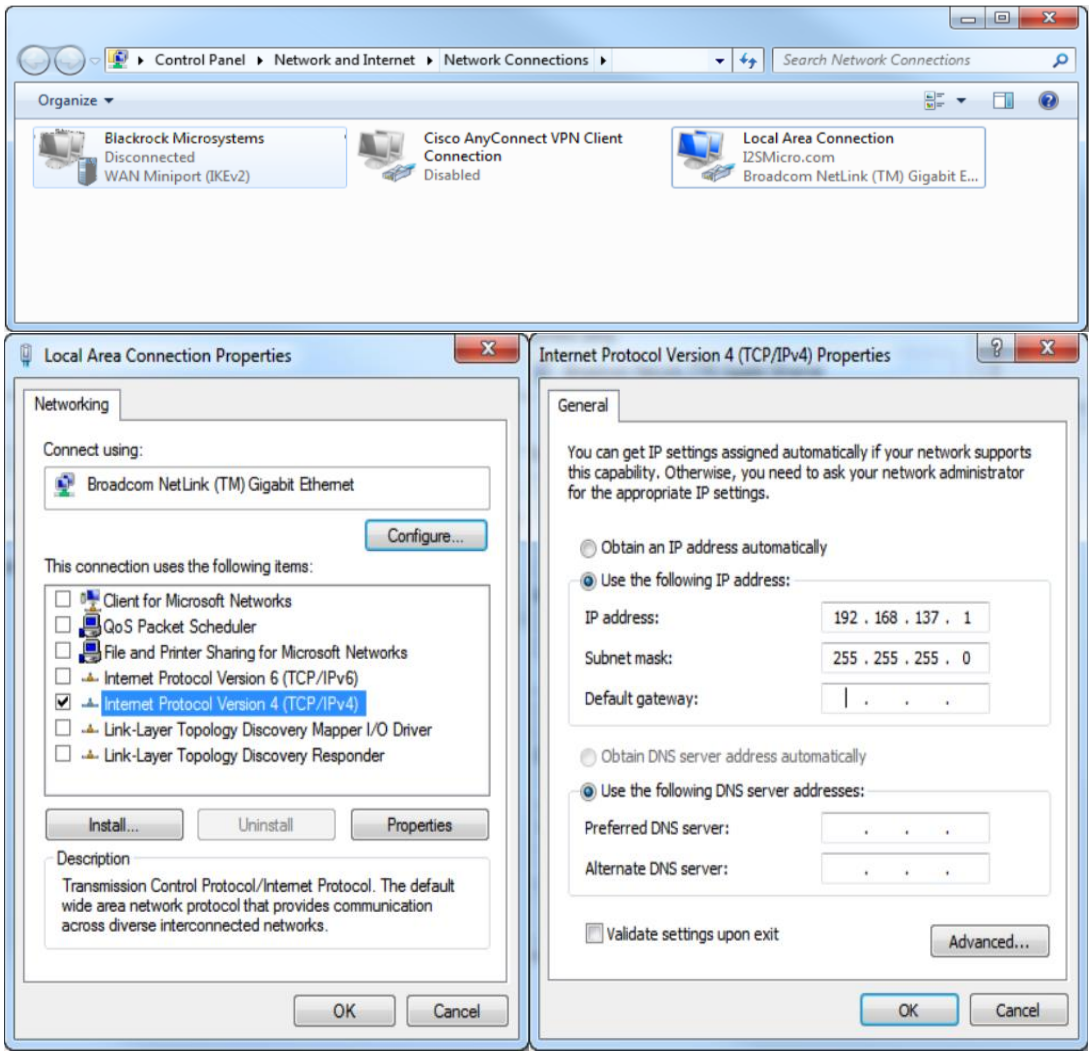

Setting the network properties on the Host PC.

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Troubleshooting

For latest troubleshooting articles please visit https://blackrockneurotech.com/research/support/ and click on the Knowledge Base. Below you can find more information on some of the commonly asked questions.

Problem	Symptom	Failure	Potential fix
The NSP does not boot up	The NSP is tuck on the “Initializing Step 2” display	Potential cause: Internal boards dislodged from their slots on the motherboard. Loose internal cables and connectors. Other hardware error on the motherboard.	Please contact Support for detailed troubleshooting instructions. If that doesn’t fix the problem, then the NSP must be sent back as RMA for further inspections.
Central throws an error message immediately after startup	Central shows 0 packets received.	Central and the firmware on the Cerebus system are not compatible.	Check the currently installed firmware version by referring to the NSP’s LCD panel. Check the Central version by going to *Windows > About Central*. If the first two values of the firmware and software (i.e. XX and YY in vXX.YY.ZZ) are not the same, then the firmware and software are incompatible. Visit https://blackrockneurotech.com/research/support/#manuals-and-software-downloads to find the installer you need. If you need assistance updating your firmware or software, contact Blackrock Support. IMPORTANT: If the currently installed firmware version is below 4.00, DO NO perform this upgrade and contact Support for more information.

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Problem	Symptom	Failure	Potential fix
No neural data is streaming to Central.	The fiber optic LED indicator is illuminating yellow or red.	The Digital Hub is powered off or there are issues in its power supply Fiber optic cable is not properly connected on both ends. The fiber optic cable or its connector are damaged. Hardware error to the NSP or the Digital Hub.	Make sure that the Digital Hub is powered on. Check whether the fiber optic cable is properly connected. Also check for any visible damage to fiber optic cable or the connector.
No neural data is streaming to Central	The Gemini Hub status LEDs indicator are blinking orange	The Gemini Hub is not connected to an NSP in its intended configuration. This is normal behavior and does not need any troubleshooting. The ethernet cable between the Gemini Hub and NSP has become disconnected or damaged. Hardware error to the NSP or the Digital Hub. Central hasn't been started.	Make sure that the NSP is powered on. Check whether the ethernet cable is properly connected to the NSP. Check for any visible damage to the ethernet cable or the connections. Start Central and see if the blinking stops.
No neural data is streaming to Central	The Gemini NSP screen says "No Neural Channels"	The Gemini Hub is not connected to an NSP in its intended configuration. This is normal behavior and does not need any troubleshooting. The ethernet cable between the Gemini Hub and NSP has become disconnected or damaged.	Make sure that the NSP is powered on. Check whether the ethernet cable is properly connected to the NSP Check for any visible damage to the ethernet cable or the connections. Start Central and see if the blinking stops.

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Problem	Symptom	Failure	Potential fix
		Hardware error to the NSP or the Digital Hub. Central hasn't been started.	
The Digital Hub is receiving invalid data from the Headstage or not receiving/processing data from the bank	The source status LED on Digital Hub is illuminating yellow (not receiving/processing data) or red (invalid data).	LED can become yellow/red if there is a bad connection between the CerePlex Headstage and Digital Hub or if the data packets are not valid. A turned off LED means that no Headstage is plugged into that bank, or that the Digital Hub is already processing a full 128 channels from higher priority banks.	For no LED problem, check the HDMI cables and ensure they are properly plugged into both the Headstage and the Digital Hub. Also ensure that not more than 128 Channels are plugged into the higher priority banks. Bank A is the highest priority and Bank D the lowest. For the yellow/red LED error, check the connectors on both the Digital Hub and the Headstage to ensure that there is no damage and that the connectors are not pulling out. Unplug the Headstage and plug it back in to reset it and see if it syncs back up. Upon plugging in a CerePlex headstage to Digital Hub, the status LED will briefly flash yellow/red to verify that it is working. This will allow users to be confident that if there is a problem they will be alerted. If the Headstage LED does not initially turn yellow/red or if the LED remains yellow/red contact Blackrock support.
The Central application fails to start	The Central Suite application fails to start with "The system is initializing…	The NSP is not turned on. Problems with the NSP network connection: Disconnected or a bad ethernet cable or problems with the IP address or other network settings.	Check whether the NSP is powered on with the Firmware version visible on the ethernet settings

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Problem	Symptom	Failure	Potential fix
	” pop-up message	Firmware or Hardware issues on the NSP.	

Return Merchandise Authorization

In the event of a returned material authorization (RMA) or complaint, please provide the product description, product number, lot number, person requesting the RMA or complaint and address, and the nature of the RMA and complaint.

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 (RMA). 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@blackrockneuro.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

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Warranty

Blackrock Microsystems (“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 performed 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.

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

https://blackrockneurotech.com/research/support/

Complaints

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

Issues or Questions

www.blackrockneuro.com/research/support

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