

# CerePlex Direct

## Instruction for Use



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# Blackrock CerePlex Direct - Instruction for Use

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## Table of Contents

<b>1</b>	<b>Contraindications, Warnings, Cautions, and Specifications.....</b>	<b>4</b>
1.1	Contraindications .....	4
1.2	Warnings .....	4
1.3	Cautions .....	4
1.4	Specifications .....	4
<b>2</b>	<b>Introduction.....</b>	<b>5</b>
2.1	System Requirements.....	5
2.2	Packing Contents.....	6
<b>3</b>	<b>Hardware.....</b>	<b>6</b>
3.1	CerePlex Direct.....	6
3.2	CerePlex Direct Input.....	6
3.2.1	Digital Headstage.....	6
3.2.2	Analog Input.....	7
3.2.3	Fast Settle Input .....	7
3.2.4	Digital Input .....	7
3.3	CerePlex Direct Output.....	8
3.3.1	NeuroMotive Camera Sync .....	8
3.3.2	Host PC .....	8
3.3.3	Audio Output.....	8
3.3.4	Patient Ground .....	8
3.4	CerePlex Direct Status Indicators .....	8
<b>4</b>	<b>Setup.....</b>	<b>8</b>
4.1	Hardware Setup .....	8
4.2	Software Setup.....	9
4.3	NeuroMotive Setup.....	9
4.3.1	Physically Connecting the PC's .....	9
4.3.2	Assigning the NeuroMotive IP Address .....	9
4.3.3	Assigning the CerePlex Direct IP Address.....	10
4.3.4	Configuring the CerePlex Direct Software to Talk to the NeuroMotive Software .....	10
<b>5</b>	<b>Software .....</b>	<b>10</b>
5.1	CerePlex Direct Suite.....	10
5.2	Central Software Suite.....	10
<b>6</b>	<b>Hardware Specification.....</b>	<b>11</b>
<b>7</b>	<b>Troubleshooting .....</b>	<b>12</b>
7.1	Unable to Open Instrument Network .....	12
7.2	Data Recording Terminated.....	12
7.3	Audio Output has distorted noise .....	13
7.4	nPlayServer has Stopped Working.....	13
7.5	Digital Headstage Data Appears Noisy .....	13
7.6	USB LED.....	13

# Blackrock CerePlex Direct - Instruction for Use

---

7.7	Digital Headstage LED.....	14
7.8	Increased Noise Floor on Digital Headstage Signal.....	14
7.9	Contact Customer support for help in resolving any issues.....	14
<b>8</b>	<b>Warranty.....</b>	<b>15</b>
8.1	Return Merchandise Authorization (RMA).....	15

## Table of Figures

Figure 2-1	Blackrock CerePlex Direct with CerePlex M Set-up.....	5
Figure 3-1	Front Panel of the CerePlex Direct.....	6
Figure 3-2	Back Panel of the CerePlex Direct.....	6
Figure 3-3	HDMI Connector Pin-Out.....	7
Figure 3-4	Digital Input Pin-Out.....	7
Figure 4-1	Installing Device Drivers.....	9
Figure 4-2	Device Driver Installed Successfully.....	9
Figure 7-1	Unable to Open Instrument Network Error.....	12
Figure 7-2	Data Recording Terminated.....	12
Figure 7-3	nPlay Server Has Stopped Working.....	13

# Blackrock CerePlex Direct - Instruction for Use

---

## 1 Contraindications, Warnings, Cautions, and Specifications

### 1.1 Contraindications

- Do not use with devices not approved by Blackrock Microsystems.

### 1.2 Warnings

- Do not touch any exposed electrical conductors, or use damaged HDMI cables when using the CerePlex Direct.
- Keep cables out of traffic paths. Injury to user or patient can occur.
- The user/patient/subject should not attempt to open the CerePlex Direct.
- Use caution when operating the CerePlex Direct, especially when connecting and disconnecting cables to minimize risk of CerePlex Direct falling and/or injury.
- Do not rest objects on or against the CerePlex Direct.
- Avoid strong static discharges from sources like television or computer monitors; they may damage the electrical components of the system.
- Keep the CerePlex Direct away from liquids. Contact with water, shower spray, or wet surfaces can lead to the CerePlex Direct malfunctioning and/or electrical shock.
- Connection of external instruments to the CerePlex Direct may compromise electrical safety.
- Always use antistatic or electrostatic discharge (ESD) safe gloves when connecting the CerePlex Direct.
- Use only Blackrock Microsystems supplied components (CerePlex Direct, CerePlex Headstages, Blackrock Microsystems Cables and Adaptors). 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 CerePlex Direct when system is not in use.
- Plug in all connections and wires to the patient / subject and the system prior to powering on the CerePlex Direct.
- Power off the system prior to removing or disconnecting any cables from the patient / subject and the system.
- 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 non-human use only. This model is not for use with human subjects.

### 1.4 Specifications

<b>Model Name</b>	Blackrock CerePlex Direct
<b>Power Requirements</b>	110 (at 60 Hz) or 220 (at 50 Hz) VAC, 220 mA / 118mA maximum load
<b>Serviceable Fuses</b>	.25" x 1.25", 250V, 2 A, Slow Blow
<b>Sampling Frequency</b>	30 KHz data acquisition, 50MHz data transfer
<b>Mode of Operation</b>	Continuous
<b>Input Protocol</b>	Low-voltage differential signaling
<b>Water Ingress Protection</b>	Ordinary Equipment, not fluid resistant, IP20
<b>Operating Environment</b>	10°C to 40°C, 5 to 95% R.H. (non-condensing)
<b>Storage Environment</b>	-20°C to 50°C, 5 to 100% R.H. (non-condensing)

# Blackrock CerePlex Direct - Instruction for Use

## 2 Introduction

The Blackrock CerePlex Direct is a data acquisition system. It can capture up to three 32 channels (or any combination totaling 96 channels) Blackrock 16-bit CerePlex Headstages for high fidelity transmission and recording of bio-potential signals. Data is sampled at 30 kS/s and sent to a Host PC via Hi-Speed USB at 50MHz. The data is in digital format from the Headstages up; the overall noise of the system is reduced. Figure 2-1 below shows an application overview of how the CerePlex Direct fits into a complete neural recording system.

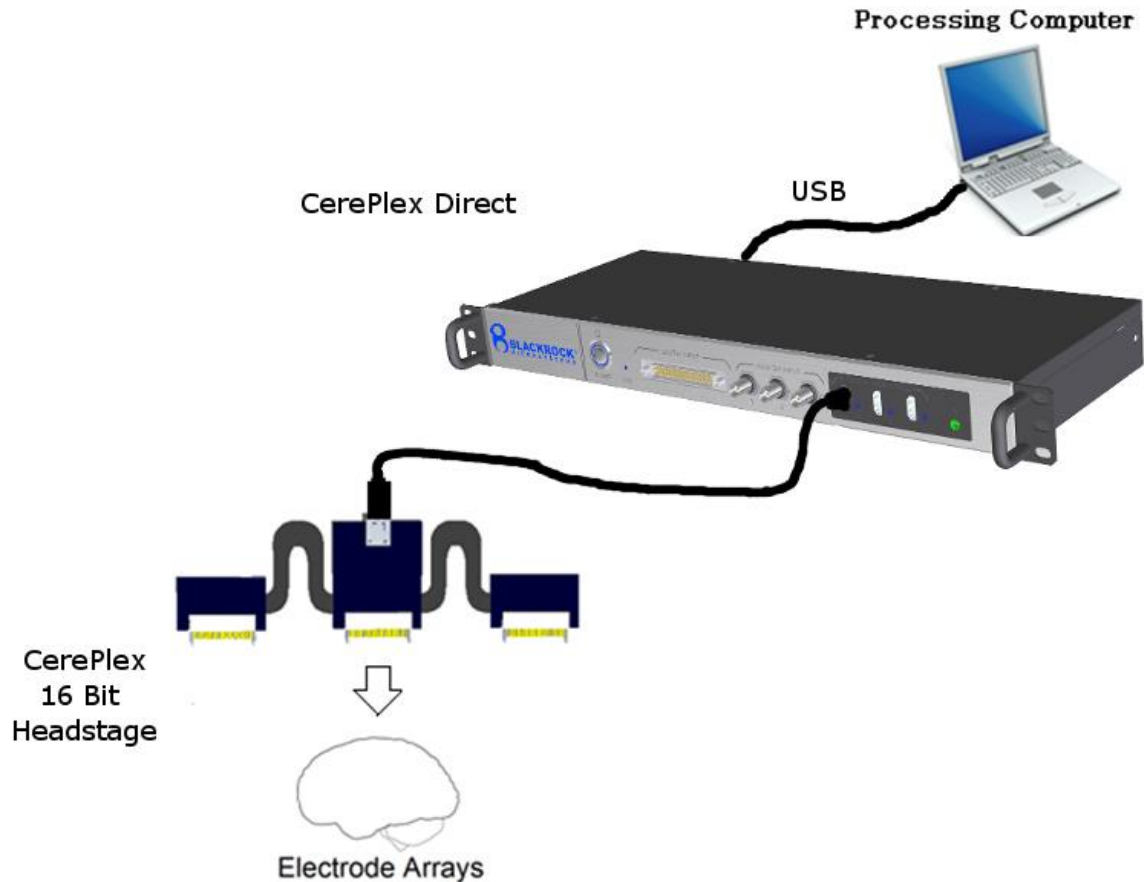


Figure 2-1 Blackrock CerePlex Direct with CerePlex M Set-up

### 2.1 System Requirements

The specifications listed below are the minimum required by the software to run. Blackrock supplies an optional Host PC that is configured and tested by our engineers before it ships with your CerePlex Direct system. Please contact [sales@blackrockmicro.com](mailto:sales@blackrockmicro.com) for more information.

- Microsoft Windows XP Professional (32-bit) or Microsoft Windows 7 Professional (32-bit or 64-bit)
- AMD or Intel 2.2 GHz Quad Core CPU
- 4 GB of RAM
- 1 TB 3 Gbit/s SATA II HDD

# Blackrock CerePlex Direct - Instruction for Use

## 2.2 Packing Contents

- CerePlex Direct
- Rubber Feet
- Rack Mounting Hardware
- Power Cable
- USB Cable
- Cat 5e Ethernet Cable
- CerePlex Direct User's Manual and Software Disk
- TouchProof Ground Cable w/Alligator Clip

## 3 Hardware

### 3.1 CerePlex Direct

The CerePlex Direct is a non-real-time data acquisition system. It serves as the main processing unit that collects data from up to 96 digital data channels, 3 analog inputs, and 16 digital inputs. This information is sampled at 30 kS/s and transmitted over Hi-Speed USB to a Host PC with a bandwidth of 50 Mbps. This data is then read from file and broadcast over UDP to the Central Software Suite. The CerePlex Direct consists of several islands of isolation, which lead to several different ground potentials in the system. The digital input, analog input, and digital headstage each have their own grounds. The case is tied to earth ground. Patient ground is found on the Digital Headstage connections as well as the touch proof ground connector (G) on the front panel. It is not recommended to bridge these isolated ground planes as it could introduce noise into the signal and violate the safety isolation of the patient circuitry.



Figure 3-1 Front Panel of the CerePlex Direct



Figure 3-2 Back Panel of the CerePlex Direct

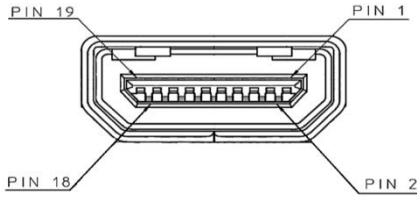
### 3.2 CerePlex Direct Input

#### 3.2.1 Digital Headstage

The CerePlex Direct has several possible configurations which arise from its ability to transmit 96 channels of data. For instance, the CerePlex Direct can be used with one 96 channel Headstage, three 32-channel Headstages or a 32 channel and a 64-channel Headstage. The Three Banks of

# Blackrock CerePlex Direct - Instruction for Use

inputs are labeled A, B, C; where A is the highest priority and C the lowest. This means that if two 64 channel CerePlex Headstages are plugged into Bank B and Bank C, then only the first 32 Channels of Bank C will be valid. The CerePlex Direct will always process the first 96 Channels in this way, unless there are less than 96 Channels, then it will send as many channels as it has and the other Channels will be filled with 0 data. The Connectors for the Banks are the Female adapter for a male A-D HDMI cable.



**Figure 3-3 HDMI Connector Pin-Out**

HDMI/D Pin #	Description
10	Clock+
12	Clock-
14	Fast Settle
17	V-
19	Ground
18	V+
7	Data+
9	Data-

### 3.2.2 Analog Input

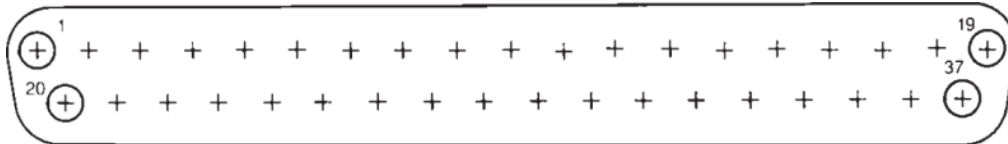
Auxiliary analog signals can be recorded through the 3 analog input BNC ports. The Analog range is  $\pm 5.0$  V and should come from a source impedance of less than 100 Ohm.

### 3.2.3 Fast Settle Input

There are three fast settle input BNC connectors located on the back of the CerePlex Direct. Each connector is tied to a single digital headstage bank in the front. The fast settle inputs are labeled A B C, which correspond to the digital headstage banks A B C. The signal fed into the BNC connector is passed straight through the system to Pin 14 on the HDMI connector. This way downstream digital headstages can receive a fast settle signal.

### 3.2.4 Digital Input

Digital events can be recorded through the 16-bit DB37 input port. The Pin diagram is shown below.



Digital Input Pin#	Description
1,18,19	NC
2	Dig In 0
3	Dig In 1
...	...
16	Dig In 14
17	Dig In 15
20-37	GND

**Figure 3-4 Digital Input Pin-Out**

# Blackrock CerePlex Direct - Instruction for Use

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## 3.3 CerePlex Direct Output

### 3.3.1 **NeuroMotive Camera Sync**

This allows hardware synchronization between the CerePlex Direct and NeuroMotive tracking and recording system. The connector is a BNC connector where the output is a trigger for the attached camera. The output is a LVTTTL digital signal.

### 3.3.2 **Host PC**

This is a Hi-Speed USB 2.0 B Connector that connects the CerePlex Direct to the Host PC.

### 3.3.3 **Audio Output**

The System sends a  $\pm 1$  V line-level audio signal of the selected data channel to an audio port on the Host PC that is selected in the Central Software.

### 3.3.4 **Patient Ground**

This Connector is located on the Front Panel and is labeled with “G”. This is the patient ground connector if needed for a ground.

## 3.4 CerePlex Direct Status Indicators

There are five LED’s on the CerePlex Direct which can give the user information about the device status.

- **Power LED** – This LED is off when the System is Powered down and Blue when power is applied to the system and the pushbutton is pushed in.
- **USB Status LED** – This LED has 3 states; Off, Blue, and Red. When off it means data is not being sent from the CerePlex Direct to the Host PC. This could be if there is no USB Cable Plugged in, or if the CerePlex Direct Software is not running. It is Blue when valid data is being sent. If invalid data is sent it will turn Red for a half second for every bad data packet. Upon first starting the software this LED should go Red for a brief second then Blue.
- **Digital Headstage Status LEDs** – These LEDs have 3 states as well; Off, Blue and Red. When off it means that either no data is being sent from that Bank, or that the Data being collected is not being used, in the case that a higher priority Bank is already sending 96 Channels. It will be Blue if the data being sent is valid. If invalid data is sent then for every packet received it will turn Red for a half second. Upon first plugging in a CerePlex Headstage the LED should go Red then Blue.

## 4 Setup

### 4.1 Hardware Setup

The CerePlex Direct is designed as a 1U rack mountable enclosure to be placed in standard rack configurations, or as a desktop unit. Below are the series of steps required to setup the CerePlex Direct in either of the two configurations.

- If rack mounting your CerePlex Direct, Remove the mounting hardware from the antistatic bag and screw the ears into both sides of the CerePlex Direct with the supplied Hardware.
- Place the CerePlex Direct in the desired rack location and use the supplied hardware to secure it to the rack.
- If leaving on a desktop, Separate the four rubber feet and remove the adhesive backing. Place on the underside of the CerePlex Direct in the four Corners.
- Plug the Power Cord into the Power AC Inlet on the back face of the CerePlex Direct; ensure that the fuse rating on the outlet is set appropriately for your AC voltage. (Red Window should show 115V for 110VAC and 230 for 220VAC) Plug the other end of the power cord into your AC Outlet.



# Blackrock CerePlex Direct - Instruction for Use

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- Plug in the USB Cable to the Host PC slot on the back face plate. Do not plug the other end into your computer until after installing the software.
- Ensure that the Power is off before connecting any CerePlex Headstages.
- Plug the HDMI Cable into the Headstage prior to connecting it to the CerePlex Direct.
- \*\*After recording, turn off power before disconnecting any cables.

## 4.2 Software Setup

The software CD has two installation packages on it. The first is the CerePlex Direct Software Suite, and the second is the Matlab Compiler Runtime. The CerePlex Direct Software installation package will install the software suite and USB drivers for communicating with the CerePlex Direct. The Matlab Compiler Runtime is required for creating custom digital filters. Follow the onscreen instructions from the installation wizard for installing the software suite and MCR. After installing the software you can plug in the USB cable to your PC. Prior to running the CerePlex Direct Software Suite let windows install the drivers. You should see the following two messages to notify you of this process. Any time you change the USB port that the CerePlex Direct is plugged into, Windows will reinstall these drivers for that port.

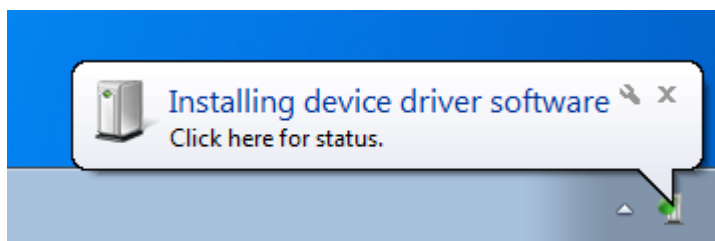


Figure 4-1 Installing Device Drivers

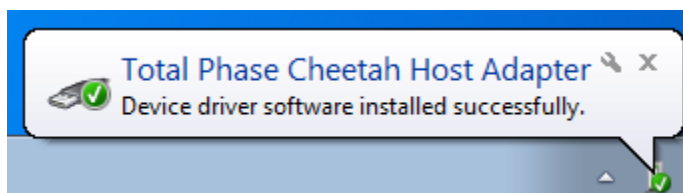


Figure 4-2 Device Driver Installed Successfully

## 4.3 NeuroMotive Setup

The CerePlex Direct is capable of syncing data with a NeuroMotive Tracking system. This is possible with either hardware sync, or software sync. Under both configurations, the two PC's (NeuroMotive PC and CerePlex Direct PC) need to be configured to communicate with each other. This is accomplished by creating a network between the two computers by manually assigning IP addresses to them and connecting the two computers directly together with an Ethernet cable. Below are the steps for connecting the CerePlex Direct PC to the NeuroMotive PC.

### 4.3.1 Physically Connecting the PC's

- Connect both PC's together by plugging in the supplied Ethernet cable or standard cat 5e Ethernet cable to the network port on both computers

### 4.3.2 Assigning the NeuroMotive IP Address

- On the PC that is connected to the IR or Color Camera (NeuroMotive PC) open the network and sharing center

# Blackrock CerePlex Direct - Instruction for Use

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- Under Connections click on the local area connection.
- On the window that pops up click on the Properties button.
- Double click on the Internet Protocol Version 4 (TCP/IPv4) Properties.
- Click the radio button “Use the following IP Address” followed by the advanced button at the bottom.
- On the IP Settings tab click the Add button.
- For IP Address enter 192.168.137.2, for Subnet Mask enter 255.255.255.0 and click Add.
- Close out of the settings.

## 4.3.3 Assigning the CerePlex Direct IP Address

- On the PC that is connected to the CerePlex Direct, follow the steps for assigning the NeuroMotive IP Address, but enter the following two IP Addresses instead.
- For the first IP Address enter 192.168.137.1 and for the Subnet Mask enter 255.255.255.0 and click Add.
- After adding the first IP Address, click Add again to assign a second IP Address. For the second IP Address, enter 192.168.137.128 and for the Subnet Mask 255.255.255.0 and click Add.
- Close out of the settings.

## 4.3.4 Configuring the CerePlex Direct Software to Talk to the NeuroMotive Software

- Right click on the shortcut used to launch the CerePlex Direct Software.
- Select Properties.
- On the Shortcut tab in the text box located next to the Target: label, add ‘-n’ at the very end of the string following the closing quotation mark. Make sure that there is a space after the closing quotation mark.

## 5 Software

### 5.1 CerePlex Direct Suite

The CerePlex Direct Software Suite consists of two applications that run simultaneously. The first is nPlayServer, this application is communicating with the CerePlex Direct via the Cheetah Host Adapter board. It receives the data from the CerePlex Direct and then broadcasts it to the second application which is the main user interface via nPlay File Control. The user interface is the central software, except nPlay File Control is locked down so that none of the settings can be changed. This lock down of features is required for nPlayServer to broadcast the data from the Direct to the Central Software. Since nPlay File Control is not accessible from the CerePlex Direct Software, the Central Software Suite must also be installed to play back files.

### 5.2 Central Software Suite

The Central Software Suite is the main software for all of Blackrock’s Data Acquisition systems. The latest version of this software is launched when the CerePlex Direct Software Suite Icon is clicked. See LB-0574 1.00 Central Software Suite IFU for detailed instructions and use.

# Blackrock CerePlex Direct - Instruction for Use

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## 6 Hardware Specification

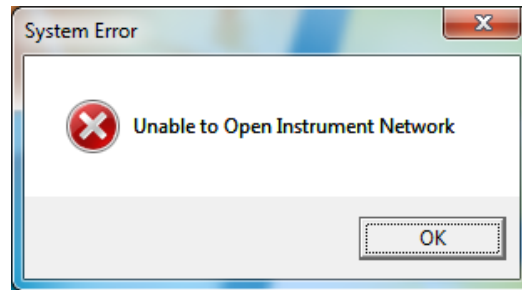
Digital Signal Processing	Adaptive Line Noise Cancellation filter, 4 <sup>th</sup> -order hi/lo pass digital filtering for all channels. Separate filters for simultaneous continuous and spike streams along with online spike classification using time/amplitude and/or template matching.
Neural Signal Inputs	Up to 96-Channels
Neural Signal Input Sample Rate	30,000 Samples/second
Experimental Analog Inputs	Three $\pm 5$ V, inputs for experiment or neural signal processing
Analog to Digital Conversion	16-bit digital output, with 0.25 $\mu$ V per bit resolution
Maximum Input Voltage Range	up to $\pm 5.0$ V between any input and ground
Common Mode Rejection Ratio	> 90 dB at 50/60 Hz
Experimental Digital Inputs	Sixteen 0-5V TTL Logic Level inputs for experiment event signaling
Power Supply	Standard 3-pin PC power connector accepting 110-240 VAC, 50-60 Hz
PC Hardware Interface	Hi-Speed USB 2.0
PC Software OS's Supported	Windows XP Pro or Windows 7 32 & 64 Bit

# Blackrock CerePlex Direct - Instruction for Use

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## 7 Troubleshooting

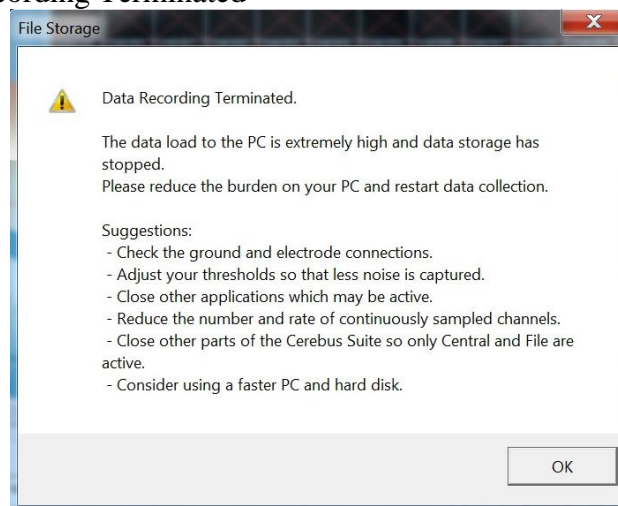
### 7.1 Unable to Open Instrument Network



**Figure 7-1 Unable to Open Instrument Network Error**

- **Problem:** This Error occurs when there is a problem with nPlayServer communicating with the Central Software.
- **Causes:** It can occur when the USB cable is not connected between the CerePlex Direct and the PC, or if the drivers have not been installed yet.
- **Troubleshooting:** Check to ensure the USB cable is plugged in. Unplug the USB cable and plug back in to another USB Port. Verify when USB cable is plugged in that Total Phase Cheetah Host Adapter shows up under the Universal Serial Bus Controllers in Device Manager.

### 7.2 Data Recording Terminated



**Figure 7-2 Data Recording Terminated**

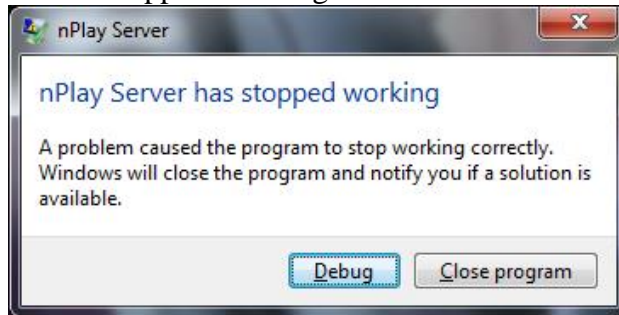
- **Problem:** Overloaded Computer System, the load of the software is greater than the CPU can handle.
- **Causes:** Multiple applications running, or PC does not meet minimum computer system requirements, on antivirus software is running a scan.
- **Troubleshooting:** Close all other programs and restart the CerePlex Direct Software Suite. Check to ensure that your CPU is a quad core processor. Verify that CPU usage is not maxed out in Windows Task Manager. Verify that antivirus software is not running.

# Blackrock CerePlex Direct - Instruction for Use

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- 7.3 Audio Output has distorted noise
- Problem: Overloaded computer system, samples are not able to be sent to audio out at a constant rate, which causes a frequency shift which sounds like garbled noise.
  - Causes: Multiple applications running, or PC does not meet minimum computer system requirements, on antivirus software is running a scan.
  - Troubleshooting: Close all other programs and restart the CerePlex Direct Software Suite. Check to ensure that your CPU is a quad core processor. Verify that CPU usage is not maxed out in Windows Task Manager. Verify that antivirus software is not running.

7.4 nPlayServer has Stopped Working



**Figure 7-3 nPlay Server Has Stopped Working**

- Problem: nPlayServer crashed upon opening.
  - Causes: USB drivers not installed correctly, or Cheetah Host Adapter library issues.
  - Troubleshooting: Unplug USB cable and plug back in, ensure that cheetah.dll is located in your install directory under the nPlayServer folder.
- 7.5 Digital Headstage Data Appears Noisy
- Problem: Digital Headstage data appears noisy in spike panel or in oscilloscope mode of the central software.
  - Causes: Upon first plugging in a Headstage or first powering up the system digital data will appear noisy as the system is equilibrating. This could also occur if there is not an adequate reference signal or ground signal attached at the digital Headstage.
  - Troubleshooting: Attach a digital ground connector to the patient ground connector on the green touch proof connector on the front of the CerePlex direct. Try changing reference signal and seeing if noise is reduced. Follow basic guidelines to reduce EMI noise around electrodes and Headstages to eliminate a noisy environment.
- 7.6 USB LED
- Problem: USB LED is red signifying that data sent from the CerePlex Direct to the Host PC is invalid. USB LED is off signifying that data is not being sent from the CerePlex Direct to the Host PC.
  - Causes: Red LED means that the CRC for the packet that was sent is not valid and that the data is corrupted. The LED will be red for a half second after the last invalid packet. A Red LED could also occur if the header for the data packet is also incorrect. No LED means that no data is being sent or that the Cheetah Host Adapter is not receiving power or configured correctly.
  - Troubleshooting: If LED is red, turn off the program and power down the system and remove the USB cable. Upon powering back up and plugging in the cable and starting the software verify that LED changed to blue. If the LED does not come back on, contact customer support as the cheetah board may have become damaged. NOTE: upon first starting the software the USB LED should flash red briefly signifying to the user that the LED is working

# Blackrock CerePlex Direct - Instruction for Use

---

and will alert the user to possible communication errors, ensuring that data being received is valid. If the LED does not flash red contact customer support.

## 7.7 Digital Headstage LED

- Problem: Digital Headstage bank LED is red signifying that the CerePlex Direct is receiving invalid data from the Digital Headstage. If the LED is off it signifies that the CerePlex Direct is not receiving or not processing data from that bank.
- Causes: Red LED can be caused if there is a bad connection between the Headstage and the CerePlex direct or if the data packets are not valid. No Led means that there is on Headstage plugged into that bank, or that the CerePlex Direct is already processing a full 96 channels from higher priority banks.
- Troubleshooting: For no LED check the cables and ensure plugged into both the Headstage and the CerePlex Direct and ensure that not more than 96 Channels are plugged into the higher priority banks. Bank A is the highest priority and Bank C the lowest. Red LED's check the connectors on both the CerePlex Direct 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. NOTE: upon first plugging in a Headstage the LED will flash red to verify that it is working; this will allow the user to be confident that if there is a problem they will be alerted. If the Headstage LED does not initially turn red or if the LED remains red contact customer support.

## 7.8 Increased Noise Floor on Digital Headstage Signal

- Problem: The signal from the Digital Headstage input has increased noise on the line, making it difficult to see the data being received.
- Causes: Most likely a result of poor ground connections. Either the patient ground connection is poor, or a ground loop has occurred between the patient ground and one of the other ground planes found in the system.
- Troubleshooting: Run a patient ground connection from the CerePlex Direct Front Panel (G) down to the headstage / array implant. Ensure that earth ground, or analog ground is not creating a ground loop with the Patient Ground (do not have headstage connected to analog or digital inputs or the CerePlex direct case). Connecting the case to patient ground may reduce the noise, but bypasses the patient isolation circuitry.

## 7.9 Contact Customer support for help in resolving any issues

Web Address: <http://support.blackrockmicro.com>  
Email: support@blackrockmicro.com  
Phone: 1-801-839-1062

# Blackrock CerePlex Direct - Instruction for Use

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## 8 Warranty

Blackrock Microsystems, Inc. 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, Inc. 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.

### 8.1 Return Merchandise Authorization (RMA)

In the unlikely event that your device 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, Inc.**  
**ATTN: RMA#**  
**630 Komas Drive, Suite 200**  
**Salt Lake City, UT 84108 USA**  
**Tel: (801) 582-5533**