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CerePlex Direct

Instructions for Use



Table of Contents

What This Manual Covers	4
Warnings and Precautions	5
Safety Specifications	6
Hardware Specifications	6
Symbols	8
Setting Up the CerePlex Direct	9
Overview of Hardware.....	10
<i>CerePlex Direct Inputs</i>	11
Digital Headstage Input Banks.....	11
Analog Input	12
Digital Input.....	12
Fast Settle Input	12
<i>CerePlex Direct Outputs</i>	12
USB Data Line to PC	12
Patient Ground	13
NeuroMotive Camera Sync.....	13
CerePlex Direct Software Suite.....	13
Cleaning, Maintenance, and Disposal.....	14
<i>Cleaning</i>	14
<i>Maintenance</i>	14
<i>Disposal</i>	15
Magnetic Resonance	15
Troubleshooting.....	15
<i>No CerePlex Direct Detected</i>	15
<i>nPlayServer is Not Running</i>	16
<i>Packet Loss</i>	16

<i>Digital Headstage Connectivity</i>	16
Return Merchandise Authorizations	17
Warranty	17
Support.....	17
<i>Manuals, Software Downloads, and Application Notes</i>	18
<i>Complaints</i>	18
<i>Issues or Questions</i>	18

What This Manual Covers

This manual contains information on the CerePlex Direct, a plug-and-play biosignal data acquisition system. The system is designed for use with many of Blackrock's CerePlex digital headstages and is compatible with the NeuroMotive video tracking system. The CerePlex Direct is capable of recording from 16, 32, 64, 96, 128, or 256 channels over 3 headstage input banks, depending on the model.



Figure 1 - CerePlex Direct Data Acquisition System

This manual will cover the system requirements, associated software, and an overview of the system's hardware features. Note that the CerePlex Direct is offered in a number of system packages, so the exterior packaging may be labeled with a different part number than listed in this document.

For questions on this product or any other Blackrock products, contact our 24/7 support service at support@blackrockmicro.com.

Warnings and Precautions

- Do not use with devices not approved by Blackrock Microsystems.
- Do not touch any exposed electrical conductors or use damaged digital data 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.
- Always operate the CerePlex Direct system in a clean environment.
- Keep the CerePlex Direct system away from liquids. Contact with water, shower spray, or wet surfaces can result in a device malfunction 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.
- Read this entire manual prior to using the device.

Safety Specifications

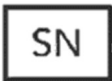
Model Name	CerePlex Direct
Power Requirements	100 – 220 V (50-60 Hz) , 0.32 – 0.17 A
Serviceable Fuses	1/4" x 1 1/4", 250 V, 2 Amps, Slow Blow
Mode of Operation	Continuous
Input Protocol	Low-voltage differential signaling
Water Ingress Protection	Ordinary equipment, not fluid resistant, IP20
Operating Environment	10° C to 40° C, 5 to 95% relative humidity (non-condensing)
Storage Environment	-20° C to 50° C, 5 to 100% relative humidity (non-condensing)

Hardware Specifications

Model Name	CerePlex Direct
Digital Signal Processing	Adaptive line noise cancellation filter, 4 th -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	16, 32, 64, 96, 128, or 256 Channels, Depending on Model
Input Protocol	Low-voltage differential signaling
Sampling Frequency	30 kHz maximum data acquisition rate, 50 MHz data transfer
Experimental Analog Inputs	Three ±5 V inputs for experiment or neural signal processing
Analog to Digital Conversion	16-bit digital output, with 0.25 µV per bit resolution
Maximum Input Voltage Range	Up to ±5 V between any input and ground

Fast Settle Inputs	One ± 5 V input for controlling fast settle functionality of the connected headstages
Common Mode Rejection Ratio	>90 dB at 50/60 Hz
Experimental Digital Inputs	Sixteen 0-5 V TTL Logic Level inputs for experiment event signaling
Power Supply	Standard 3-pin PC power connector for accepting 110-240 VAC, 50-60 Hz
PC Hardware Interface	Hi-Speed USB 2.0
PC Software OS supported	Windows 7 – 32 and 64 bit, Windows 10 - 32 and 64 bit

Symbols

ISO 15223-1: 2016 Medical 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.
5.1.5		Batch Code	Indicates the manufacturer's batch or lot code.
5.1.6		Catalog Number	Indicates the manufacturer's catalog number so that the device may 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.
5.2.8		Do Not Use if Package is Damaged	Indicates that a medical device should not be used if the package has been damaged or opened.
5.4.3		Consult Instructions for Use	Indicates the need for the user to consult the instructions for use, which you are currently reading.
ISO 15223-1: 2016 Medical Devices – Symbols to Be Used with Medical Device Labels, Labeling, and Information to Be Supplied			
Reference	Symbol	Title	Meaning
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.

Setting Up the CerePlex Direct

The software CD included with the CerePlex Direct contains two executable installers:

CerePlex-Direct-Central-Suite-7.X.X.msi installs the CerePlex Direct Software Suite and USB drivers for communicating with the CerePlex Direct. The latest version can be downloaded from the 'Software Downloads' section of the Blackrock Microsystems website.

MCRInstaller-7.16.exe is the MATLAB Compiler Runtime installer—this is required to use Central's custom digital filter editor.

NOTE: Before installing: make sure the CerePlex Direct is **not** plugged into the PC with the USB A-B cable. Installing the CerePlex Direct Software Suite with the CerePlex Direct connected to the host PC may result in driver installation issues and cause the host PC to fail to recognize the CerePlex Direct. If this happens, please refer to the 'Troubleshooting' section of this manual or contact Blackrock Support.

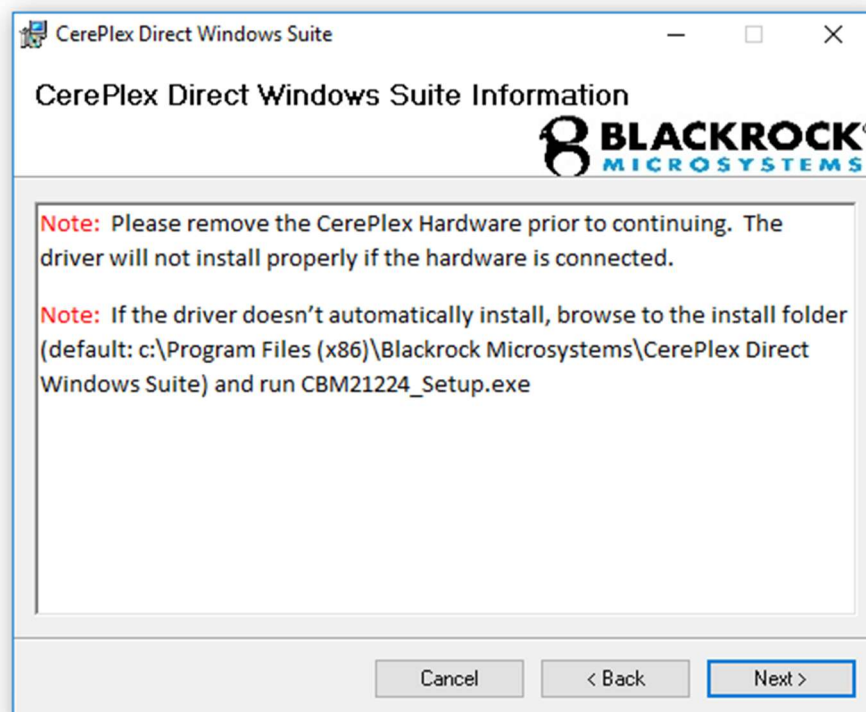


Figure 2 - CerePlex Direct Driver Installer

To start the installation process, run **CerePlex-Direct-Central-Suite-X.X.X.msi** and follow the onscreen instructions from the installation wizard (as shown in the figure above). After installing the software, the CerePlex Direct can be connected to the host PC via the USB A-B cable. When plugged into a USB port for the first time, the CerePlex Direct will install the device drivers. Windows will re-install these drivers when the USB port is changed.

If you intend on using Central's custom digital filter editor to create your own filters, you will need to run **MCRInstaller-7.16.exe**.

Overview of Hardware

The CerePlex Direct is a non-real-time data acquisition system that collects data from up to 256 digital data channels, 3 analog inputs, and a 16-bit digital input. Data is sampled at 30,000 samples/second and transmitted over hi-speed USB to a host PC with a bandwidth of 50 Mbps.

The CerePlex Direct is designed to have several isolated ground planes. The CerePlex Direct chassis is tied to earth ground through the ground pin of the power plug. Patient ground is found on the digital headstage connections and the touchproof ground connector on the front panel. It is not recommended to bridge these isolated ground planes; it can introduce noise into the signal and compromise the safety isolation of the patient circuitry.



Figure 3 - CerePlex Direct Front Panel



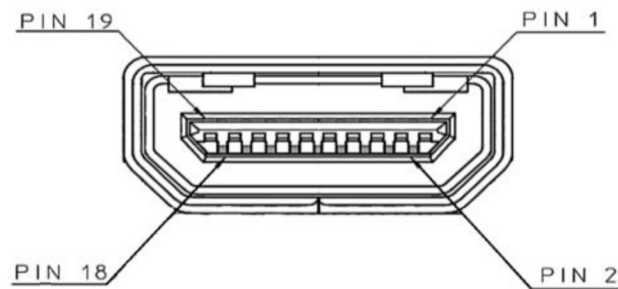
Figure 4 - CerePlex Direct Rear Panel

CerePlex Direct Inputs

Digital Headstage Input Banks

The CerePlex Direct has 3 digital headstage input connectors located on the front panel labeled A, B, and C for digital headstage inputs.

There is an LED on each of the digital headstage input banks that will be lit blue when the Direct is receiving valid data packets from the digital headstage. For more information on the LED light conditions, please see the troubleshooting section.



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

Figure 5 – Digital Data Cable Pinout

Analog Input

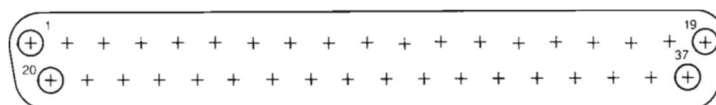
Auxiliary analog signals can be recorded through three analog input BNC ports located to the left of the digital headstage input connectors on the front panel. The analog input range is ± 5.0 V and should come from a source of less than 100 Ω .

Digital Input

Digital events can be recorded through the 16-bit DB37 input port.

Fast Settle Input

The CerePlex Direct has a BNC connector located on the back panel labeled 'FS' that serves as a fast settle input. The fast settle connector is tied to each of the digital headstage banks in the front. The signal fed into the BNC connector is passed straight through the system to Pin 14 on the digital data connector, so that downstream digital headstages can receive a fast settle signal. The two other BNC connectors are labeled NC and reserved for future feature use.



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 6 - Digital Input Port Pinout

CerePlex Direct Outputs

USB Data Line to PC

The CerePlex Direct has a Hi-Speed USB 2.0 B connector on the back panel that can connect the CerePlex Direct to the host PC via a USB A-B cable.

The USB LED on the front panel indicates the status of the CerePlex Direct: upon powering on the CerePlex Direct, the USB will be a brightly lit yellow. When CerePlex Direct Suite is initialized, the LED will flash blue briefly, then turn yellow while Central loads the configuration file. Once the configurations have been loaded by Central, the LED will turn continuously blue.

Patient Ground

The CerePlex Direct has a touch-proof connector to patient ground located on the front panel to the right of the digital headstage digital headstage banks labeled 'G.' The digital data cable and headstage also communicate patient ground through the pin 19 of the digital headstage input. The touchproof connector provides an additional low-impedance connection to patient ground.

NeuroMotive Camera Sync

If using the NeuroMotive video tracking system, the CerePlex Direct can be hardware synchronized with the tracking and recording system. The BNC connector outputs a TTL digital signal to trigger the NeuroMotive camera.

CerePlex Direct Software Suite

The CerePlex Direct Software Suite consists of two applications that run simultaneously: nPlayServer and Central Software Suite via nPlay File Control.

Upon running CerePlex Direct Software Suite, a window titled, 'CerePlex Direct' will briefly open:

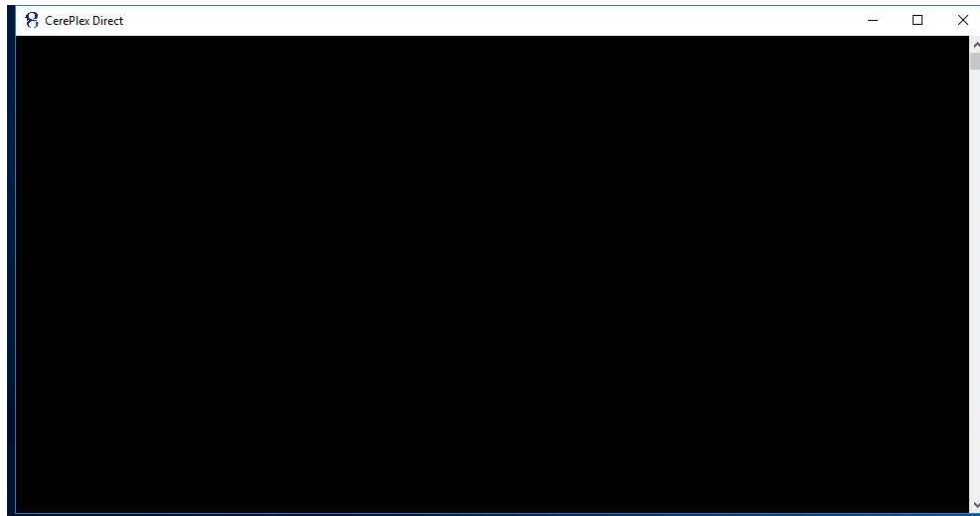


Figure 7 - Temporary Window Indicating a CerePlex Direct Software Launch

The 'CerePlex Direct' window will close, and Central will launch and run simultaneously with nPlayServer in the background:

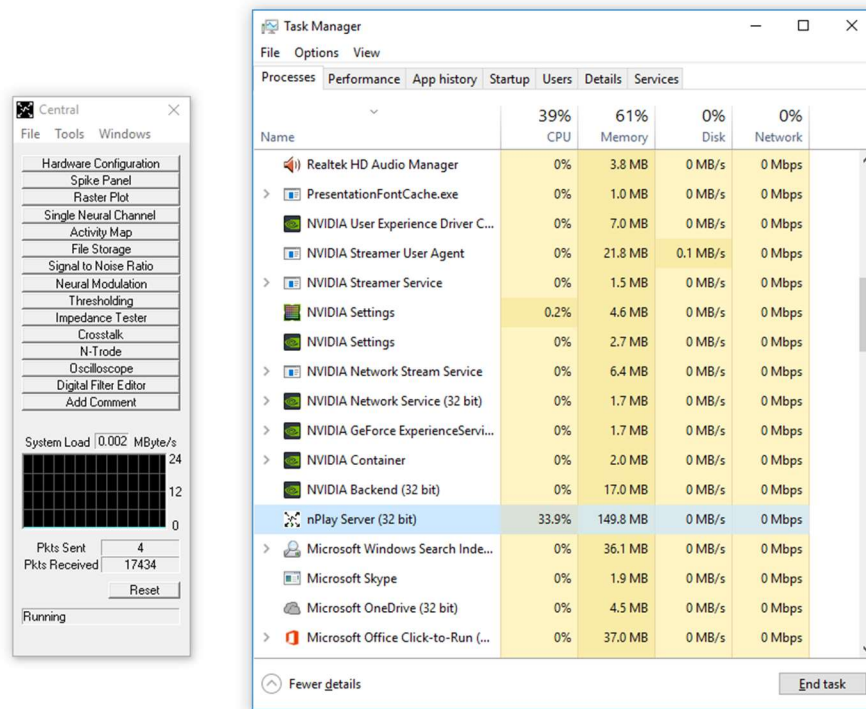


Figure 8 - nPlayServer Process Running in Background

nPlayServer receives data from the CerePlex Direct then broadcasts this data to Central for visualization and analysis. The end user interface is identical to Central. For more detailed instructions and use on Central Software Suite, please see LB-0574 Central Software Suite IFU.

Cleaning, Maintenance, and Disposal

Cleaning

The CerePlex Direct may be cleaned with solutions that are safe for cleaning general purpose electronics such as screen cleaners and cloths damp with water.

Maintenance

The CerePlex Direct requires no ongoing maintenance and no calibration. There are no user serviceable components.

Disposal

All devices, both used and unused, should not be disposed with household waste. Return to a recycling point for electric and electronic devices.

Magnetic Resonance

The CerePlex Direct has not been evaluated for safety and compatibility in the MR environment. The CerePlex Direct has not been tested for heating, migration, or image artifact in the MR environment.

Troubleshooting

No CerePlex Direct Detected

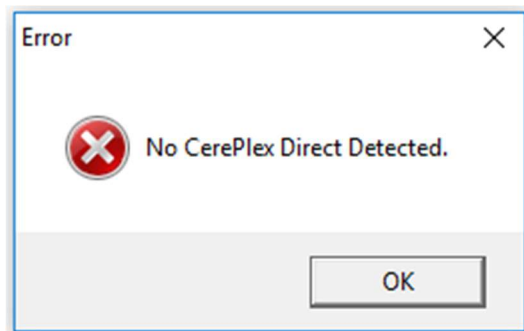


Figure 9 - Error Message Showing No CerePlex Direct Detected

This error indicates an error has occurred in communication between nPlayServer and Central Software Suite. If the CerePlex Direct and the PC are connected through the USB cable and the CerePlex Direct is powered on, this may be caused by an error with the USB driver.

To correct this, uninstall the Total Phase USB driver in the Control Panel's Programs and Features menu.

After the uninstall is complete, run CDM21224_Setup.exe from the installation directory of the software.

nPlayServer is Not Running

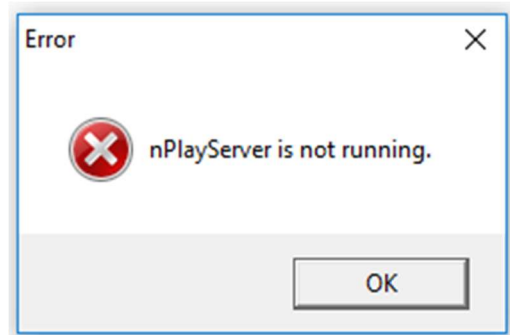


Figure 10 - Error Message Showing nPlayServer Is Not Running

This error occurs when a previous instance of nPlayServer has not closed properly and is still running in the background. In the Windows Task Manager (accessible with CTRL+SHIFT+ESC), close any instances of nplay.exe and nplayserver.exe before starting CerePlex Direct Suite again.

Packet Loss

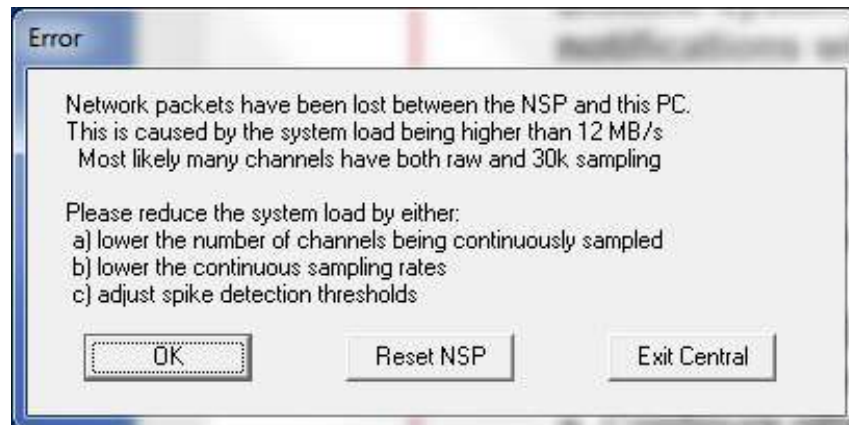


Figure 11 - Packet Drop/Loss Error Message

In rare cases, USB hardware can have compatibility conflicts with the CerePlex Direct, causing periodic packet loss between the Direct and host PC. If this happens, try switching to a different USB port on the PC (e.g., moving from a front cap to a rear port or vice versa; moving between USB 3.0 to USB 2.0, et cetera). If the problem persists, please contact Blackrock Microsystems Support.

Digital Headstage Connectivity

The LED near the digital headstage connector will briefly flash yellow upon initially plugging in the digital headstage, then turn blue. A continuously blue LED means that the bank is plugged in and receiving valid signals from the headstage.

If the LED turns yellow again, it indicates a data transmission error and packets may have been invalidated. If this happens, check that the digital data cable is plugged into the bank securely. If the LED stays unlit, this indicates that the Direct is not recognizing and powering the headstage. Contact Blackrock Support at support@blackrockmicro.com for assistance with headstage compatibility issues if this occurs.

Return Merchandise Authorizations

In the 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 via email at 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 device arrived in for return shipment. Please address the package as follows:

Blackrock Microsystems
ATTN: RMA # XXXX
630 S. Komas Drive, Suite 200
Salt Lake City, UT 84108 USA
T +1 801 582 5533

Warranty

Blackrock Microsystems ("Blackrock") warrants 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.

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

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.blackrockmicro.com/technical-support

support@blackrockmicro.com

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

The CerePlex Direct is not for use on human subjects.