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NeuroPort Biopotential Signal Processing System

User's Manual

Rev. 11.00 / LB-0175 – NeuroPort Biopotential Signal Processing System User's Manual
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Introduction

The Blackrock NeuroPort Biopotential Signal Processing System supports recording, processing and displaying biopotential signals from various types of electrodes. Biopotential signals may include Electrocorticography (ECoG), electroencephalography (EEG), electromyography (EMG), electrocardiography (ECG), electrooculography (EOC) action potentials (AP), and evoked potentials (EP).

The NeuroPort Biopotential Signal Processing System is not a monitoring system. No physiological alarms are provided. The acquisition and display of biopotential signals is for the interpretation and use of the clinician.

System Description

The NeuroPort System is designed to record and process neural signals from up to 256 surface or penetrating electrodes in addition to auxiliary analog signals and digital experimental events. The system can perform real-time signal processing algorithms on neural signals, including noise cancellation, digital filtering, simultaneous extraction of spike and field potentials, and manual and automatic online spike sorting.

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 NeuroPort system. Please contact sales@blackrockmicro.com for more information.

- Microsoft Windows 7 (x64) or Windows 10 (x64)
- AMD or Intel 2.0 GHz Dual Core CPU
- 4 GB of RAM
- 1x Gbps Ethernet interface card
- 1 TB 3 Gbit/s SATA II HDD
- Packing Contents
- Neural Signal Processor (NSP) and Rubber Feet
- Rack Mounting (2) Ears and Screws (4)
- Neural Signal Amplifier & Amplifier Power Supply (APS)
- Amplifier Manifold (1), Manifold Ribbon Cables (4)
- Digital Neural Signal Simulator (DNSS)
- Power Cables and Connectors
- NeuroPort System Software Disk Installation CD

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System Schematic

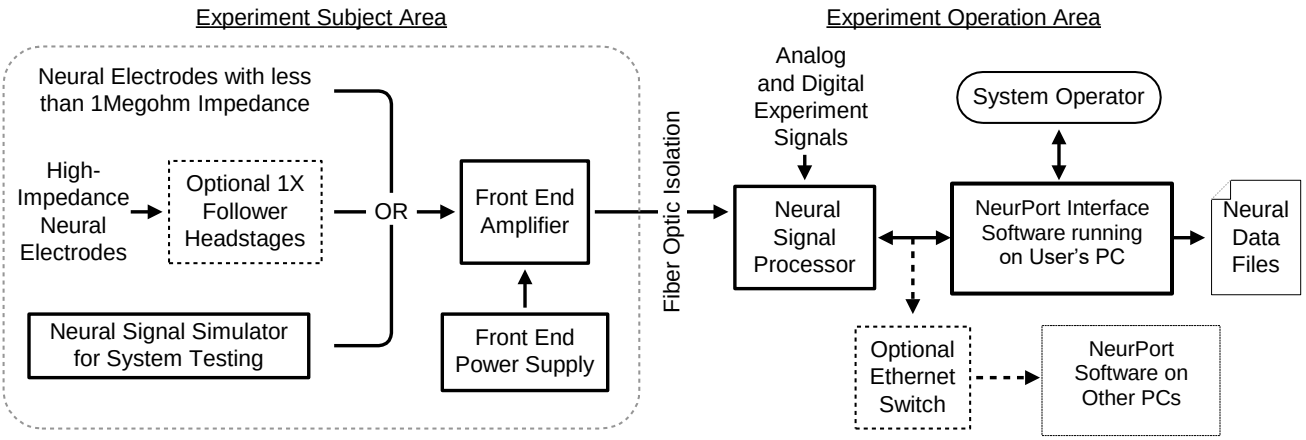

Figure 1–System Overview

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Symbols, Contraindications, Warnings, and Precautions

Symbols

	IEC 60101-0102	Danger of Electrostatic Discharge (ESD)		IEC 60417-5019	Protective earth (ground)
	IEC 60417-5036	Dangerous voltage		IEC 60417-5021	Equipotentiality Connector
	IEC 60417-5333	Type of BF Applied Part		IEC 60417-5007	ON (power)
	IEC 60417-5008	OFF (power)		IEC 60417-5009	Stand-by
CLASS 1 LASER PRODUCT	CSA 60950-1-03 UL 60950-1	Class 1 Laser Product	SN	ISO 7000-2496	Serial Number
	ISO 7000-3082	Manufacturer	EC REP	BS EN 15223-1	EC Representative
	ISO 7000-0434A	Warning		ISO 7000-1641	Read the documentation
LOT	ISO 7000-2492	Batch	REF	ISO 7000-2493	Catalogue Number

Contraindications

The NeuroPort System is a recording system and should not be used in applications involving stimulation.

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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.

Completion of the Blackrock Microsystems user training program is required prior to the use of the NeuroPort System.

Always operate the NeuroPort System in a clean environment.

Only connect NeuroPort System components to properly tested, grounded and dedicated AC outlets using only the Blackrock provided power cable to reduce the risk of electrical shock. Do not use an adapter for ungrounded wall outlets.

Do not connect the NeuroPort 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 NeuroPort System in the presence of flammable anesthetic agents.

Do not use the NeuroPort 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 NeuroPort 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.

The NeuroPort 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 NeuroPort system in a secure location.

Avoid tripping on cords connected to the NeuroPort system.

Repair or maintenance is not allowed during equipment operation.

Only plug in Blackrock approved equipment into the NeuroPort system.

Precautions

Follow the restrictions of use for third party electrodes or arrays.

Third party recording or control systems connecting to the NeuroPort System and components must be electrically isolated for subject safety.

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Specifications

Model Name	**NeuroPort Neural Signal Processor**
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
Water Ingress Protection	Ordinary Equipment, not fluid resistant, IPX0
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)

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Table 204–Guidance and manufacturer's declaration – electromagnetic immunity – for all EQUIPMENT and SYSTEMS that are not LIFE-SUPPORTING (refer to 60601-1-2).

Guidance and manufacturer's declaration – electromagnetic immunity			
The NeuroPort System is intended for use in the electromagnetic environment specified below. The customer or the user of the NeuroPort system should assure that it is used in such an environment.			
Immunity test	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment — guidance**
			Portable and mobile RF communications equipment should be used no closer to any part of the NeuroPort system, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance**
Conducted RF IEC61000-4-6	3 Vrms 150 kHz to 80 MHz	3 Vrms	$d = 1.2\sqrt{P}$ **150 kHz to 80 MHz**
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = 1.2\sqrt{P}$ **80 MHz to 800 MHz** $d = 2.3\sqrt{P}$ **800 MHz to 2.5 GHz** where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and *d* is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey[a] should be less than the compliance level in each frequency range[b]. Interference may occur in the vicinity of equipment marked with the following symbol:
NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies. NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			
[a] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the NeuroPort system is used exceeds the applicable RF compliance level above, the NeuroPort system should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the NeuroPort system. [b] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than *3V*/m.			

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Table 206–Recommended separation distances between portable and mobile RF communications equipment and the EQUIPMENT or SYSTEM - for EQUIPMENT or SYSTEMS that are not LIFE-SUPPORTING (refer to 60601-1-2).

Recommended separation distances between portable and mobile RF communications equipment and the NeuroPort system			
The NeuroPort system is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the NeuroPort system can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the NeuroPort system as recommended below, according to the maximum output power of the communications equipment.			
Rated maximum output power of transmitter W	**Separation distance according to frequency of transmitter m**		
	150 kHz to 80 MHz $d = [\frac{3.5}{V_1}]\sqrt{P}$	**80 MHz to 800 MHz** $d = [\frac{3.5}{E_1}]\sqrt{P}$	**800 MHz to 2.5 GHz** $d = [\frac{7}{E_1}]\sqrt{P}$
0,01	0.12	0.12	0.23
0,1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23
For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer. NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies. NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

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Hardware

Neural Signal Amplifier

The Amplifier receives analog signals directly from the electrodes or via headstages (e.g. unity-gain voltage followers) depending on the impedance of the electrodes. The analog signals are amplified, filtered (1st-order high-pass at 0.3 Hz and 3rd-order low-pass at 7,500 Hz), and digitized (30 kHz, 16-bits at 250 nV resolution), converted into the optical domain and then transmitted to the NSP via a fiber-optic link, which is immune to electromagnetic field interference. At a later stage, digital filtering will allow these two signals to be separated and recorded in different data files.

Figure 2–Neural Signal Amplifier

The Amplifier case is not connected to the earth ground. The Amplifier ground is isolated and floating. There are ESD shunt circuits that will conduct differences of 1000 V or more.

Amplifier Power Supply (APS)

The APS consists of five analog and digital supply channels with monitoring, sequencing, and emergency shutdown controls.

Figure 3–Amplifier Power Supply

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The On/Off switch is located on the back of the unit. Once it is switched on, the APS will start a power-up sequence of analog and digital supplies ending with the green ON LED illuminating. When the power switch is turned off this sequence is reversed, and the output of the APS is tied to ground. In the event of an error in voltage or power delivery, the APS will shut down and a red error LED will turn on. After checking all Amplifier and patient cable connections for any inadvertent shorting, turn off the APS and turn it back on to reset the error.

Neural Signal Processor (NSP)

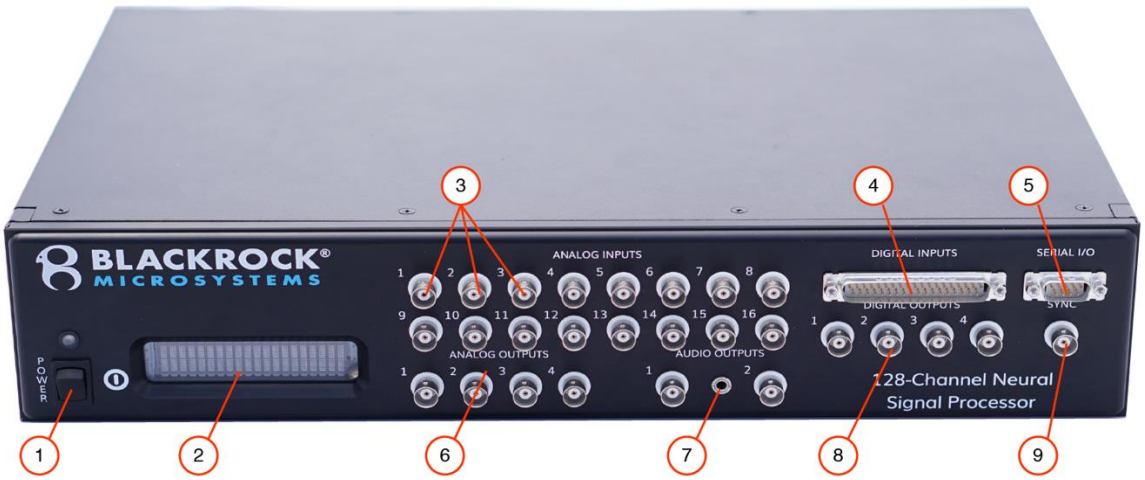

Figure 4–NSP Front

NSP 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 1.75 and above. The location of this port was previously under the sync port on the front panel

The NSP is the real-time processor of the system. It performs all the digital processing of the signals, such as digital filtering, spike extraction, spike sorting. It also processes the data and transmits it to the Host PC through Ethernet UDP protocol. The NSP has multiple analog and digital input and outputs that can be programmed through the software or one of the supplied Software Development Kits (SDKs). Multiple NSPs may be synchronized for recording signals from a very large quantity of electrodes.

1. **Power switch:**
   It is used to turn the NSP ON and OFF. The LED above the switch will illuminate blue when the unit is on.
   Note: On NSP PN-7530, PN-9650, and PN-10411 this switch is a momentary switch to power down the NSP and does not turn main power to the device ON/OFF. See rear panel for mains switch for mentioned part numbers.

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2. **LCD Display:**
   It 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 analog input 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.

4. **Digital Input:**
   Digital events can be recorded through the 16-bit DB37 input port. The pin diagram is shown below. DS is the 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.

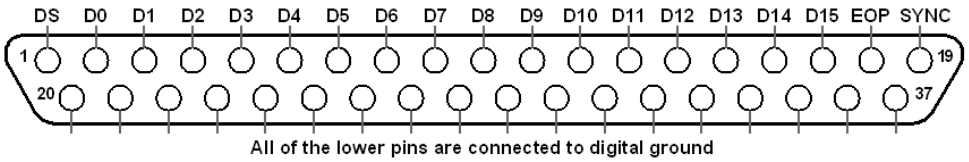

Figure 5–Digital In Pin Diagram

5. **Serial I/O:**
   The port is an RS232 DB9 digital input/output port. The pin diagram is shown below. Currently, the 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.

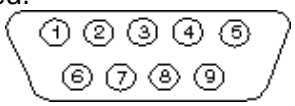

Figure 6–Serial I/O Pin Diagram

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

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7. **Audio Output:**
   The system sends a ±1 V line-level audio signal of the selected data channel to two BNC ports (Left and Right channeled respectively) 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 particular neural 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.

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.

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NSP PN-4176

NSP PN-7530

NSP PN-9650

NSP PN-10411

Figure 7–NSP Back

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1. **Line Noise Cancellation Port:**
   On PN-4176 hardware Line Noise Cancellation receptacle is combined with the main power receptacle. On PN-7530, PN-9650 and PN-10411 a separate power receptacle is used for hardware line noise cancellation. To use this feature, plug a standard power cable into this port and enable the feature in software as described in the Central Software Suite User Manual.
   Note: This receptacle is optional and is not required to power and operate the NSP under normal conditions.
2. **Synchronization Port:**
   This DB9 port is located on the back of the NSP and it is used to synchronize two NSPs. The synchronization occurs automatically as Central runs on both computers if the sync cable (Blackrock Part# 5584) is properly connected between two NSPs. Some models may not have this port. To add synchronization capability to your NSP, please contact Blackrock Microsystems support at sales@blackrockmicro.com
3. **Fiber-optic Link:**
   This port connects to the Amplifier using a fiber-optic cable. An LED to the right of the connector turns green when a link is established and turns yellow when the link is broken.
4. Mains Power Entry:
   This supplies main power to the NSP and is required to power and operate the NSP.
5. **Mains Power Switch:**
   Power switch used to turn main power ON/OFF to the NSP. Ensure this switch is in the ON position marked by the “I” on the switch.

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Connectors, Cables, etc.

Headstage Requirements

The high input impedance and low bias current of the Amplifier inputs make it possible to connect microelectrodes with 20 kΩ (at 1kHz) or lower impedance values directly to the Amplifier inputs without the need for a headstage. This configuration has the advantage of avoiding noise added to the signals by the headstage, but it makes the application more susceptible to environmental electromagnetic noise. To minimize environmental noise, it is recommended to keep direct electrode connections shorter than 20 cm (8 inches). For longer connections, headstages from Blackrock Microsystems are recommended. Headstages allow microelectrodes with impedances up to 5-MΩ (at 1kHz), and cables up to 6 feet in length.

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ICS Connectors

The HSF-32 is built to work with Samtec (www.samtec.com) connectors and it is designed to mate with the ICS family of array holders from Blackrock Microsystems. If you are using an ICS array holder without a headstage, you will need to use a HBA-32 headstage bypass adaptor instead. To use the ICS-96, you will need a group of three CHA-32 adapters that are mounted together with a shared reference. To select Ref 1 or Ref 2 on the ICS-96, place a reference jumper on the CHA-32 board connected to Bank A or Bank C. To select Ground as reference, place a jumper on CHA-32 board connected to Bank B.

The connector board has up to four Samtec FTSH 36-pin connectors; pins 1-32 are the electrodes, pin 33 is the reference, pins 34 and 35 is ground, and pin 36 is bus. It can be connected to either unity gain (1x amplification) headstage followers (HSF-32 – Blackrock Part #4078 or equivalent) or Headstage bypass adapter boards (HBA-32 – Blackrock Part #4103) and then connected to the inputs of the Amplifier with Samtec ribbon cables; Bank A to A, Bank B to B, etc.

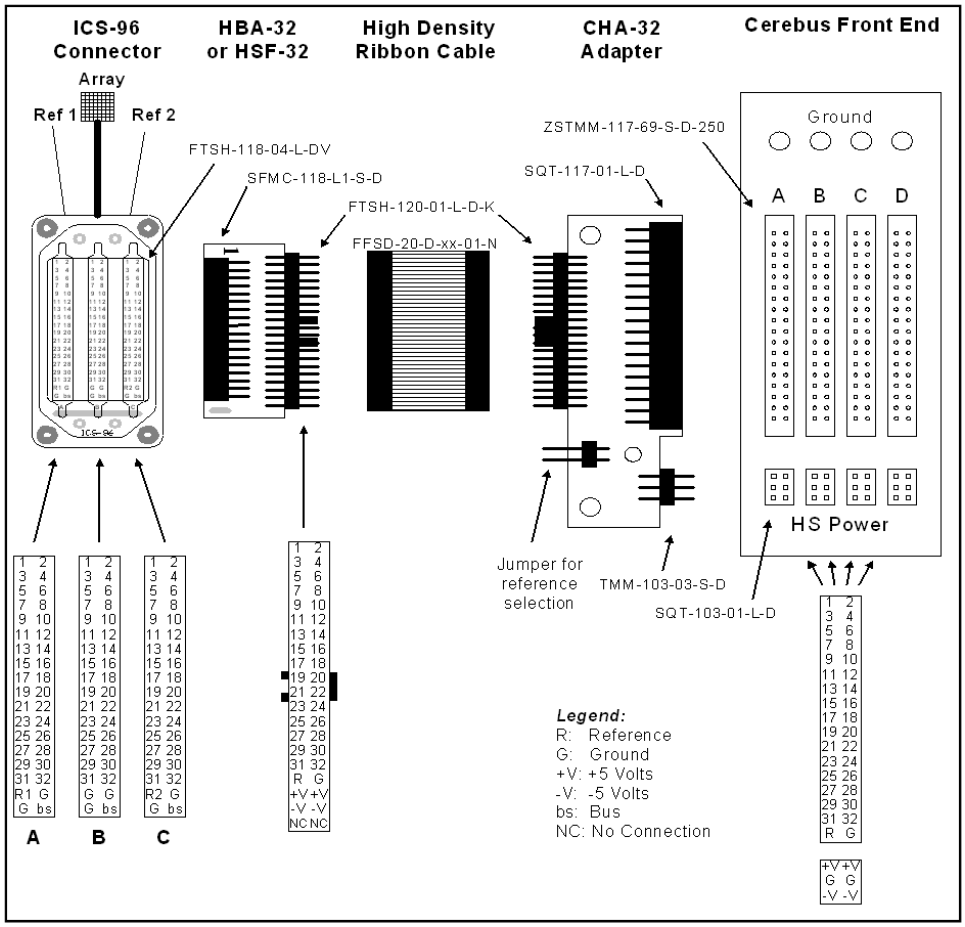

Figure 5– Assembly and Connections

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Neural Signal Amplifier Input

The Amplifier has four 34-pin banks. Each bank consists of 32 channels, a bank reference pin, and a ground pin. The electrodes within each bank are differentially amplified with respect to the reference input of the same bank. If channels on all banks are to be electrically measured with respect to a common reference, this reference needs to be connected to the reference input on every bank.

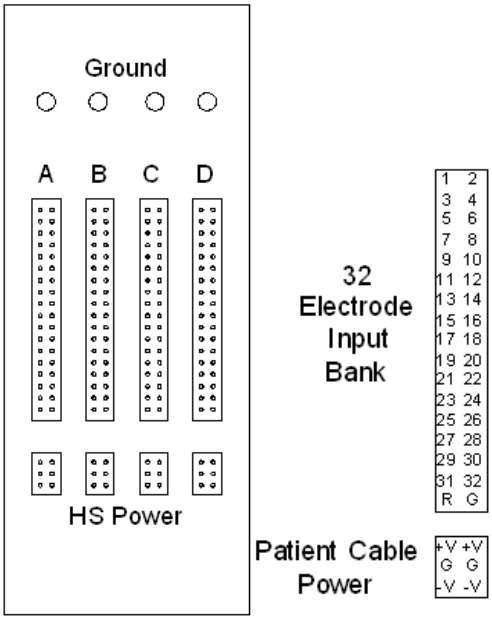

Figure 6–Amplifier Input Schematic

Additionally, four 6-pin APS banks provide power (±5V) to the headstage and can deliver 130 mA of combined current from the Amplifier. The ground pins on every bank are tied together. For best results, the Amplifier should be the central grounding point for electrical ground connections to the research subject.

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Cables

Included with the system is a power cable for the NSP (not shown), a power cable for the APS (not shown), a fiber-optic link that connects the Amplifier to the NSP, a crossover Ethernet cable that connects the NSP to the host PC, and a cable that connects the APS to the Amplifier.

Note that the fiber-optic cable is very delicate. Please do not bend it (bend radius of 5.0 cm) or crush it!

Figure 7–Fiber-optic Cable

Figure 8–Crossover Cable

Figure 9–Amplifier Power Supply (APS) Cable

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Digital Neural Signal Simulator (DNSS)

The Digital Neural Signal Simulator (DNSS) supplies simulated field potentials and action potentials (spikes) as well as sine waves at different frequencies. It can be used to test a recording system in lieu of being connected to a subject.

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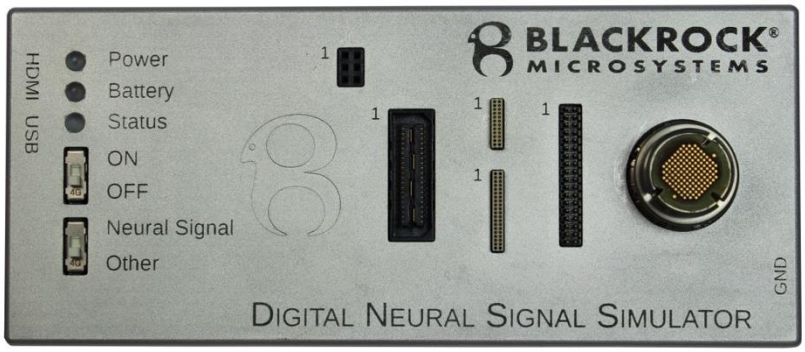

Figure 10–Digital Neural Signal Simulator

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Setup

Hardware Setup

Ethernet Card Setup

Note: If you purchased the NeuroPort Host PC, the Ethernet card is pre-installed and configured in your PC.

The supplied 1-Gbps PCI Ethernet card needs to be installed in a 64-bit PCI slot of the host PC and a crossover Ethernet cable (included) is needed to directly connect the host PC to the NSP. The host PC and the NSP can also be connected through a 1-Gbps Business Class Ethernet switch (not a router or a hub), in which case a regular Ethernet cable is needed.

Setting up the NSP, Neural Signal Amplifier, and Amplifier Power Supply (APS)

1. Remove the NSP, Amplifier and APS 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 APS to electrical outlets. It is recommended to use a power conditioner to remove any line noise.
4. Connect one end of the APS cable to the APS and the other end to the Amplifier. The cable needs to click and lock in place.
5. Connect one end of the fiber-optic cable to the NSP and the other end to the Amplifier.
6. Attach the CHA-32 connector to the Amplifier front port.
7. Attach one end of the gray ribbon cables to the Amplifier CHA-32 connector and, using the supplied HBA-32 bypass adaptors, connect the other end to the DNSS.
8. Turn on the NSP, the APS and the DNSS.
9. The LED on the APS, Amplifier, and the NSP should turn green.

Software Setup

Setting up the Ethernet Card

Note: If you purchased the NeuroPort Host PC, the Ethernet card is pre-installed and configured in your PC.

1. Once installed, the card needs to be configured to connect to the NSP.
2. Click on Start and search for “View Network Connections”.
3. Right click on the correct Ethernet Adaptor (usually, Local Area Connection) and click on Properties.
4. Uncheck all services except for Internet Protocol (TCP/IP) or Internet Protocol Version 4 (TCP/IPv4).
5. Click on Internet Protocol (TCP/IP) and click on Properties
6. For IP Address enter 192.168.137.1, for Subnet Mask enter 255.255.255.0 and leave the rest blank.

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7. Click on OK to save changes.

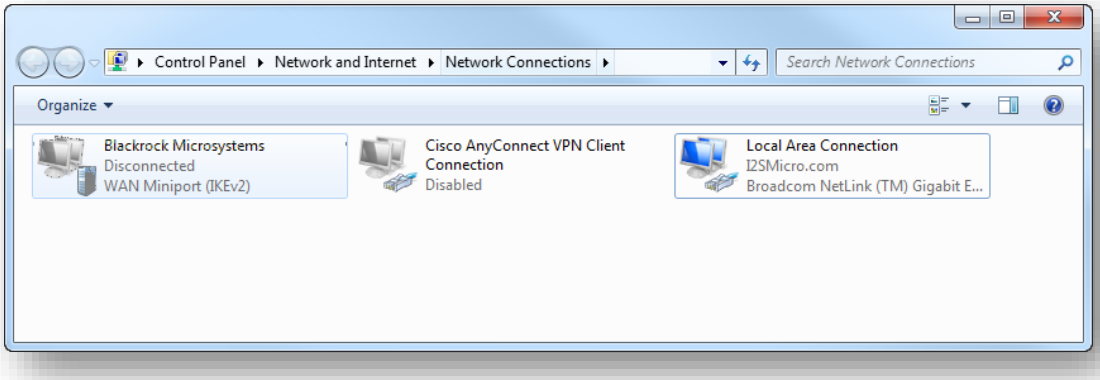

Figure 14 - Network Connections Window

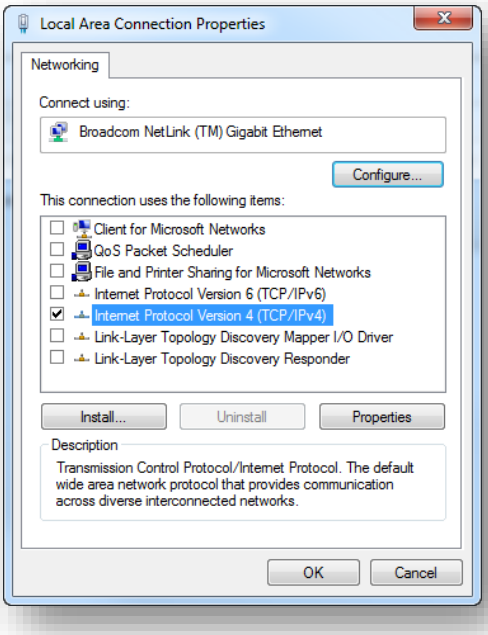

Figure 11 - Local Area Connections Properties

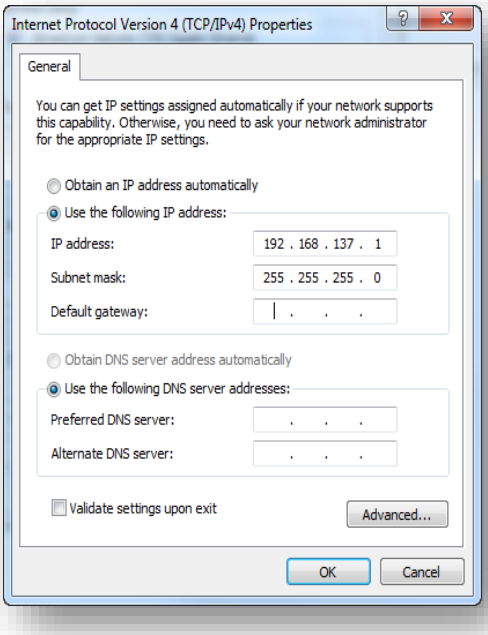

Figure 126 - IPv4 Properties

Note: Up to 16 PCs can be connected to the same NSP using a business class 1-Gbps network switch with QoS feature. For other PCs connected using a network switch, IP addresses should increment, such as 192.168.137.2, 192.168.137.3, etc.

Note: For your reference, the NSP's IP address is 192.168.137.128.

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Hardware Specifications

NEUROPORT NEURAL SIGNAL AMPLIFIER / DIGITIZER		NEUROPORT NEURAL SIGNAL PROCESSOR	
Input Range	± 8.192 mV	Digital Signal Processing	Adaptive Line Noise Cancellation filter, 4th-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.
Analog to Digital Conversion	16-bit digital output, with 0.25 µV per bit resolution		
Input Impedance	> 10^{12} ohms || 3pF		
Input Bias/Leakage	+5pA typical, ±20pA max		
Input Referred Noise	< 3.0µVrms (14µVp-p)	Neural Signal Inputs	Up to 256-Channels
Common Mode Rejection Ratio	> 90 dB at 50/60 Hz	Neural Signal Input Sample Rate	30,000 Samples/second
Common Mode Input Range	up to ±3.0 V between inputs and ground	Experimental Analog Inputs	Sixteen ±5 V, 16-bit inputs for experiment or neural signal processing
Differential Input Range	up to ±3.0 V between electrode and reference inputs	Experimental Digital I/O	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.
Maximum Input Voltage Range	up to ±5.0 V between any input and ground		
Crosstalk between channels	< 1 LSB for all configurations		
Filter characteristics	1st order Butterworth (high), 3rd order Butterworth (low)		
High Pass Cutoff Freq	0.3 Hz (full-bandwidth mode)	Experiment Analog Outputs	Four ±5 V, 600 ohm, 16-bit outputs for monitoring and stimulus waveforms
Low Pass Cutoff Freq	7.5 kHz	Audio Outputs	Two ± 1 V line-level outputs
Headstage Power Supply	±5.0 V output, up to 150 mA for powering optional headstages	Multi-NSP Synchronization	From PC trigger to digital or serial input ports
Control/Data Output Connection	MT-RJ fiber-optic port with 2-way 150 Mbps 8B/10B encoded data-stream and 32-bit CRC data validation	PC Hardware Interface	1 Gigabit Ethernet
		PC Software Interface	Windows 7 x64 or Windows 10 x64
External Power Supply	Five channel with monitoring, sequencing, and emergency shutdown control Input: 120 or 240 VAC, 50-60Hz Outputs: +5.0 V, 500 mA analog –5.0 V, 500 mA analog +3.3 V, 300 mA digital +3.3 V, 500 mA digital +5.0 V, 300 mA digital	Power Supply	Standard 3-pin PC power connector accepting 110-240 VAC, 50-60 Hz

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Return Merchandise Authorization (RMA)

In the unlikely event that your NeuroPort system 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 support representative at +1 (801) 582-5533 or via email 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 NeuroPort system arrived in for return shipment. Please address the package as follows:

Blackrock Microsystems
ATTN: RMA #
630 S. Komas Drive, Suite 200
Salt Lake City, UT 84108 USA
Tel: +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 PRECEDING PARAGRAPH.

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Disposal

This product has to be disposed separately from ordinary household wastes at its end of life. Please kindly be aware that this is your responsibility to dispose electronic equipment at recycling centers so as to help conserve natural resources. For information about your recycling drop off point, please contact your local related electrical and electronic equipment waste management authority.

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

Notice to the user and/or patient that any serious incident that has occurred in relation to the device should be reported to the manufacturer and the competent authority of the member state in which the user and/or patient is established.

CAUTION

Caution: Federal law restricts this device to sale by or on the order of a physician.

CE 0123

This device complies with part 18 of the FCC rules

EC REP

MDSS GmbH
Schiffgraben 41
30175 Hannover, Germany

C US

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Cleaning and Maintenance

The neural signal processor and amplifier of the NeuroPort System are intended for multiple use. To clean the NeuroPort System, the exterior of NeuroPort System devices may be wiped down with standard hospital-grade sanitizing wipes. Dust and debris on the exterior connectors/ports may be removed with compressed air. Maintenance on interior components of the NeuroPort System should only be carried out by or on the instructions of an authorized Blackrock Microsystems representative.

Troubleshooting

Visit support.blackrockmicro.com and click on Knowledge Base to see the latest troubleshooting articles.

Extraneous Noise

You will find that the NeuroPort system is very sensitive to extraneous electromagnetic signals. It is designed to detect microvolt level signals.

When the simulator is attached to the system, touching or just holding your hand near the ribbon cables will cause noise on Spike Panel and Raster Plot. This is not a fault but an indication that the location and arrangement of the connecting cables is critical to optimal performance.

Make sure that the cables connecting the Amplifier to the NeuroPort NSP are kept away from the ribbon cables that input signals to the Amplifier to avoid feedback problems and cross-talk between channels. The simulator is an excellent tool to detect subtle problems in the system setup.

Computer monitors can also be a major source of noise and should be kept away from the instrumentation field.

Contact support by sending an email to support@blackrockmicro.com or calling +1 (801) 582-5533 for noise troubleshooting assistance.

No Power to NeuroPort System

In the event that the NeuroPort system does not power on, check the following:

Verify that the NeuroPort system is plugged into a working outlet, and verify that all power cords are plugged into the NeuroPort.

Verify the position of the power switch in the rear of the NeuroPort and make sure it is in the ON position. If the power switch is in the ON position, turn it to the off position then wait at least five seconds before turning the NSP back on. (It is recommended that when restarting the NSP, always wait at least five seconds before turning the unit back on. This will ensure a proper system reset.)

Contact support by sending an email to support@blackrockmicro.com for assistance.

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The NSP Stuck in Initializing

If the NSP is stuck in initializing mode, contact support by sending email to support@blackrockmicro.com or calling +1 (801) 582-5533 for assistance.

No Neural Activity on any Channels

If NeuroPort is turned on and running but there is no apparent activity on any of the channels from an implant or from the simulator, verify the following:

Open Central.exe and verify that packets are being received from the NeuroPort system. If the PC is not receiving packets from the NeuroPort system, see troubleshooting section “Lost Packet Error Notification” above.

Verify that the fiber optic data link between the Amplifier and the NeuroPort NSP is plugged in and that the green light next to the fiber optic data port on the NSP is illuminated. If the light is red, there is no fiber optic link present. Check the LED next to the fiber optic port on the back of the Amplifier to verify that it has power. If the LED is not illuminated, check the APS and verify that it is turned on and not in standby mode. Are the cables securely plugged in?

Windows Compatibility Issues

On certain PCs running the Windows operating system, some of the software modules or executable files rarely experience graphical issues. If this happens, set the compatibility mode in the file properties of the software to correct the issue.

Open the folder that Central Software Suite is installed on your PC (e.g. c:\Program Files (x86)\Blackrock Microsystems\...) then right-click the module/executable file and select Properties.

From the file properties screen, click the Compatibility tab at the top of the window then click the box in the Compatibility mode section to run the program in compatibility mode for Windows 2000.

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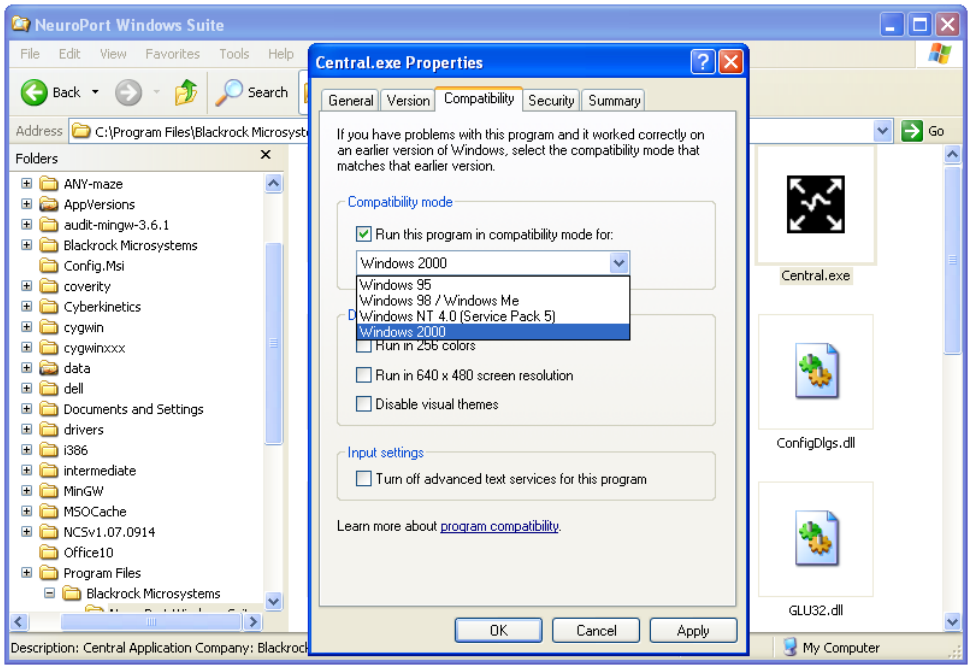

Figure 137 – Central.exe Compatibility Mode

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