Blackrock Digital Neural Signal Simulator
PN-8282

Caution: Federal (U.S.A.) law restricts this device to sale by or on the order of a physician.

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+1-801-582-5533
1 Warnings, Cautions, and Specifications

1.1 Warnings
- The DNSS contains a Lithium-Polymer battery. Do not: incinerate, disassemble, short terminals, expose to high temperatures above 140°F (60°C), risk of fire, explosion.
- If the device is not likely to be used for some time the battery should be removed from the device.
- Avoid strong static discharges from sources like television or computer monitors because it can damage the electrical components of the system.
- Keep the DNSS away from liquids. Contact with water, shower spray, or wet surfaces can lead to the electrical failure and electrical shock.
- Always use antistatic or electrostatic discharge (ESD) safe gloves when connecting the DNSS.
- Use caution when placing cables and other connectors to minimize the likelihood of tripping or accidentally pulling on cables. Pulled cables may cause damage to the DNSS or any other connected devices.

1.2 Cautions
- Read this entire manual prior to using the device.
- Charge the DNSS battery completely before first use.

1.3 Specifications

<table>
<thead>
<tr>
<th>Model Name</th>
<th>Blackrock Digital Neural Signal Simulator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Requirements</td>
<td>±5 VDC, 32 mAmperes maximum load</td>
</tr>
<tr>
<td>Mode of Operation</td>
<td>Continuous</td>
</tr>
<tr>
<td>Water Ingress Protection</td>
<td>Ordinary Equipment, not fluid resistant, IP20</td>
</tr>
<tr>
<td>Charge</td>
<td>0 to +45°C</td>
</tr>
<tr>
<td>Discharge/Operating</td>
<td>-20 to +60°C</td>
</tr>
<tr>
<td>Storage Environment</td>
<td>Less than 1 month at -20°C to +45°C</td>
</tr>
<tr>
<td></td>
<td>Less than 6 months at -20°C to +35°C</td>
</tr>
<tr>
<td></td>
<td>Humidity: 65 ± 20% RH</td>
</tr>
</tbody>
</table>

2 Introduction

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.
3 Hardware

3.1 DNSS Features

1. Three LED’s indicate the current state and status of the DNSS.
   a. Power
      - External Power (Solid Blue LED)
      - Battery Power (Solid Green LED)
      - Low Battery Power (Blinking Green LED)
      When battery power is low and has less than 1 hour of use left the green LED will start to blink. Plug into a power source to charge the battery and avoid any interrupted use.
   b. Battery
      - Charging (Solid Orange LED)
      - Charge Complete (Solid Green LED)
   c. Status
      - Valid HDMI data received (Blinking Blue LED)
      - System Startup (Solid Yellow LED)

2. On/Off switch for power.  
   *Note: When the DNSS is plugged into an external power source the external power source will override the battery to save on battery.*
3. The DNSS is capable of simulating two distinct wave forms for testing purposes.
   a. Neural Signal
      Three different spike waveforms are added onto a LFP signal comprised of superimposed sine waves.

        ![Image of Neural Signal Configuration](image)

   b. Sine Sweep
      The mixed sine waveform has a period of 2 seconds which include a 1-second 1Hz sine followed by a 0.5-second 10Hz sine with a subsequent 0.25-second 100Hz sine followed by a 0.25-second 1000Hz sine. A time-domain plot for this mixed sine signal is shown below.

        ![Image of Sine Sweep](image)

4. HDMI type D connector for use with a Blackrock Digital System. Note that while the DNSS is plugged into a Blackrock HDMI source it will provide power to the DNSS.
5. USB Micro B connector for charging the DNSS when plugged into a standard 5V USB port. Note: USB power may be very noisy and could induce unwanted noise into the Neural Signals being generated by the DNSS. It is not recommended to use the device while it is being charged.

6. Auxiliary port for the connection of devices or adapter boards (sold separately). The Auxiliary port connector provides simulated signals with a delay between each of the four signal lines to allow the detection of crosstalk. Samtec P/N SMM-103-02-L-D.
7. 32-ch Samtec P/N QSE-020-01-L-D-A connector.

8. 16-ch Omnetics P/N A79018-001 connector.

9. 32-ch Omnetics P/N A79026-001 connector.
10. 32-ch Samtec P/N FTSH-118-04-L-D connector.

11. 128-ch Blackrock pedestal.

12. 1.5mm TouchProof ground connector.
4 Battery

WARNING: The DNSS contains a lithium battery pack and an incorrect replacement could result in an unacceptable RISK. Replacement by inadequately trained personnel could result in a HAZARD such as excessive temperatures, fire or even explosion.

ONLY A BLACKROCK APPROVED BATTERY SHOULD BE USED:

<table>
<thead>
<tr>
<th>Blackrock Part Number</th>
<th>Manufacture</th>
<th>Model Name</th>
<th>Manufacture Part Number</th>
<th>Rated Capacity</th>
<th>Watt-Hour Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>8595</td>
<td>Varta</td>
<td>EZPack L</td>
<td>EZPack L – VKB 56446 701 099</td>
<td>1130mAh</td>
<td>4.2Wh</td>
</tr>
</tbody>
</table>

4.1 Battery Recharge
The DNSS battery pack can be charged by plugging in an HDMI cable to a Blackrock Digital Cerebus System, a Blackrock CerePlex Direct System, or by connecting a USB cable into a standard 5V USB port.

4.2 Battery Removal
1. Make sure the DNSS Battery Switch is set to Off and no power source is plugged in.
2. Turn the DNSS over on a padded surface being careful to not damage any connectors.
3. Remove the 4 padded feet to expose the 4 Philips screws.
4. Using a #1 Philip screw driver remove the four screws
5. The bottom case will now pull apart from the top case.
6. On the bottom case remove the three screws that hold the Battery Housing cover in place using a #1 Philip screw driver.
7. Remove the battery.
Warning: The battery is a Lithium-Polymer battery and should be discarded properly and not thrown away.

4.3 Battery Replacement and Assembly

1. Replace with new Blackrock approved battery only.
2. Reverse Battery Removal instructions for reassembly of the DNSS.

*Note: The battery cover is keyed so the battery will only fit in one way during re-assembly.*
5 Warranty

Blackrock Microsystems, LLC. 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, LLC. 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, LLC. 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.

5.1 Return Merchandise Authorization (RMA)

In the unlikely event that your product 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.

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#
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Salt Lake City, UT 84108 USA
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