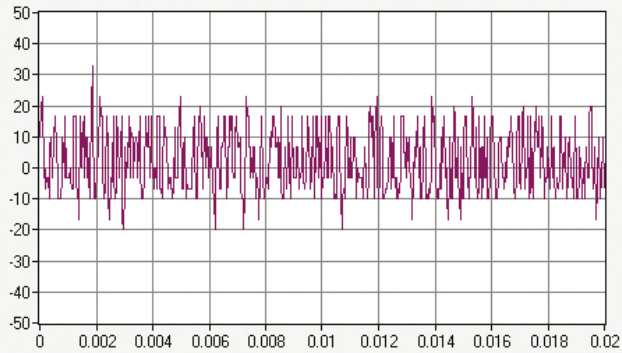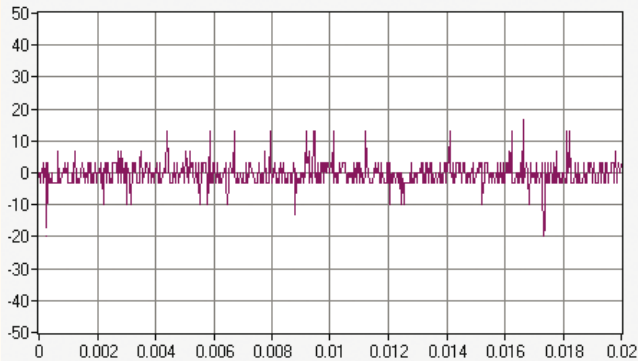## Recorded noise performance

Above is a short section of a recording of a single channel connected to a 500KΩ resistor. The Y-axis is in μV, the time axis is in seconds. The measured noise was 55μV p-p (6σ, 10^6 points) The theoretical Johnson noise of the resistor alone is 45μV p-p (6σ). Below is a similar recording made using a 10KΩ resistor. This demonstrates that the noise is determined by the electrode impedance, not the logger's electronics. One advantage of a small wireless logger is the intrinsic insensitivity to 50/60Hz line frequency interference.

Complete Kits

Neurolog-16 is supplied as part of a complete kit. Typically a kit will contain four neural logger boards, two radio transmitters, two synchronizing transceivers, two accessories for downloading and charging, one signal test accessory, the full software suite and all the cables, antennas and documentation needed.

Synchronizing Transceiver

- All input and output events can be recorded with timestamp on neural logger
- Accurate timing independent of host computer's latency
- Four BNC connectors for digital inputs
- Programmable pulse train outputs
- IRIG time signal outputs
- Optional GPS receiver
- Optional analog inputs and outputs
- Custom versions can be quickly configured

About Deuteron Technologies

Deuteron Technologies Ltd is a company located in Jerusalem, Israel that is now dedicated to developing and producing ultra-small electronic instrumentation for electrophysiology experiments on freely moving animals. Previously, it made a variety of custom analog-based electronic instruments. In 2010 it produced its first wireless programmable stimulus generator for rats. In 2012, this 8-gram circuit was miniaturized to 1 gram. Development of wireless neural recording equipment started in 2012. The first research results that utilized Deuteron's 6-gram neural recording and stimulation system for bats were published in 2013.

Deuteron continues to decrease the size, add features and improve the performance of its growing range of wireless neural recording and stimulation systems. Deuteron has primarily developed products to serve the needs of laboratories in Israel. Following the Society for Neuroscience conference in November 2014, Deuteron's products will be offered to the global neuroscience research community.

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Deuteron Technologies Ltd
Electronics for Neuroscience

Neurolog-16

Tiny wireless 16-channel neural data logger with stimulus generator and motion recorder

- **2 hour recording at 29.3Ks/s**
- **External event synchronization**
- **9-Axis motion sensor**
- **7-channel stimulus generator**
- **3.9-gram circuit board**

Neurolog-16

Neurolog-16 is a lightweight wirelessly controlled neural data recorder designed for neuroscience experimentation with freely moving animals. It has 16 input channels for neural signal sensing. The neural data is recorded in on-board flash memory. Neurolog-16 also provides a 7-channel electrical stimulus generator and a 9-axis motion sensor.

Neural recording

The 16 neural input signals channels are amplified relative to a selectable reference input, digitized at 29.3Ks/s, and stored on the on-board 8-GB flash memory, enough for 2 hours of continuous recording Any one of the 16 inputs or ground can be selected to be the reference channel.

Stimulus Generator

A 7-channel programmable electrical stimulus generator is provided. For most applications the waveforms generated are bipolar constant-current pulses, but the system is fully programmable, and a wide variety of other waveforms can be provided.

Synchronization

A wide variety of synchronization options are provided to allow the time scale of the recorded data to be accurately correlated with events on other laboratory equipment. The radio transceiver includes a synchronization processor that has several BNC connectors for connection to fixed laboratory equipment.

Motion sensor

A 9-axis motion sensor is included. This comprises a 3-axis accelerometer and gyroscope and a 3-axis magnetic compass. The motion data can be optionally recorded alongside the neural data.

Wide radio range option

Deuteron's unique radio communication protocol allows the option to control the system at distances up to hundreds of meters
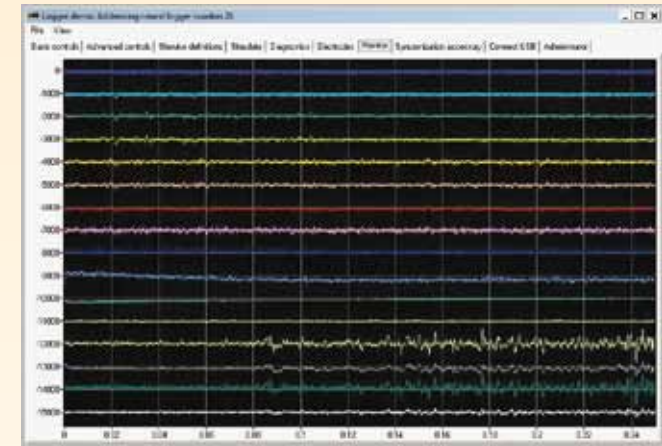
Specifications

Property	Value
Neural inputs	
Signal range	10mV p-p
Resolution	3.3μV
Random noise	Determined by electrode impedance
Input capacitance	15pF
Bandwidth	Switchable 1Hz-7KHz or 300Hz-7KHz
Connector	Omnetics A79041-001
Data storage	
Data capacity	8Gbyte (2 hours)
Download rate	6Mbyte/s. with USB2
Stimulator	
Output channels	7
Current range	Configurable. Initially 200μA
Compliance	14V peak-peak
Timing resolution	5μs
Connector	Omnetics A79040-001
Synchronization	
External connections	5 BNCs for digital input or output
Signaling LED on logger	2 pairs of omni-directional LEDs,fully programmable
Radio link	
Radio band	915MHz or 433MHz band
Range	10m monitor, 40m recording and control. Optional 200m range
Mechanical	
Dimensions	Width: 30mm Height: 22mm
Mass	3.9g (circuit only)
Battery	Lithium polymer single cell
Power consumption	140mW in recording mode
Housing	

The connector on this logger is not designed to support weight, so this logger should not be mounted with its battery on a freely moving animal by its connector alone. Deuteron will work with each user to provide a housing that provides support and protection for this logger compatible with the animal and its electrode assembly

Features

Preview monitor

One can view some of the signals in real time on the host computer using the radio link. This can be use to check signal quality before starting a long recording

Channel control

Any neural input channel, or ground, can be selected to be the reference that will be subtracted from all other signals before amplification.

Bandwidth

The normal signal bandwidth is switch able in real time between 1Hz-7KHz and 300Hz-7KHz, and the signals are digitized at 29.3Ks/s. Other bandwidth options and sampling rate options are available on request.

Customized versions

Many researchers have unique requirements for the experiments they are planning, so customized versions of the software or hardware can be provided where needed.

USB data download

Recorded data is transferred to a computer via a USB adapter cable. The logger appears as a USB drive. Downloading nearly 4GB from a 1-hour recording takes about 10 minutes.

PC software suite

A suite of software for a Windows computer is provided. Included is a general control panel for controlling all the logger's features, controlling the synchronizing transceiver, for firing of stimuli, logging external events, and for monitoring signals in real time.