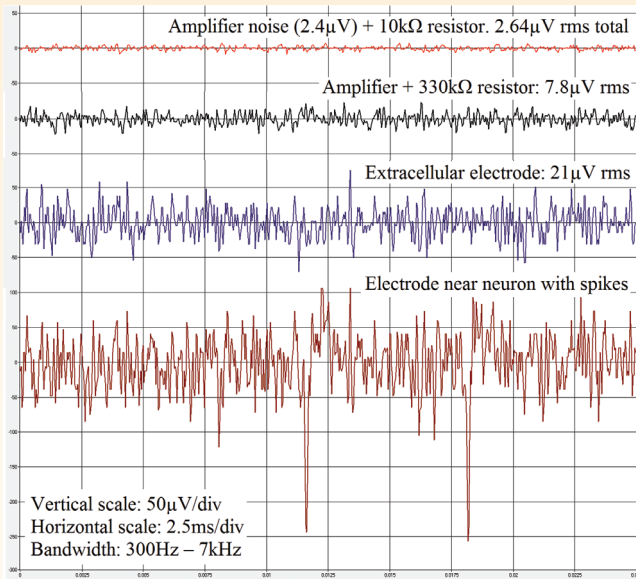


## Recorded Noise Performance

When neural spike waveforms are recorded with this system, most of the noise seen between the spikes originates within the brain tissue, and the noise due to the preamplifier's electronic noise is insignificant in comparison. The first waveform shown below is mostly the amplifier's  $2.4\mu\text{V}$  rms electronic noise. The next waveform shows the Johnson noise of a  $330\text{k}\Omega$  resistor; a typical electrode's impedance will produce at least this much Johnson noise. The next waveform shows the neural background noise from a relatively quiet extracellular location in a brain, and the last waveform shows spikes from a nearby electrode that picks up neural spikes. The electronic noise in the first waveform is clearly insignificant relative to the noise level observed between the spikes.



## Complete Kits

RatLog-64 is supplied as part of a complete kit. Typically a kit will contain 4 processor boards, 4 or 8 headstages, 4 memory cards, 8 batteries, 2 synchronizing transceivers, 2 chargers, 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



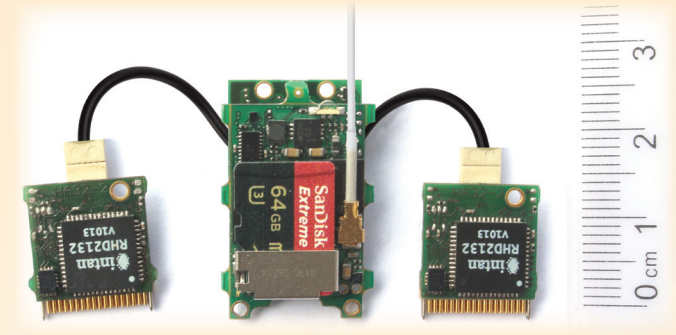
## Related Products

The synchronizing transceiver can also be used to operate any other wireless devices from Deuteron Technologies. Compatible devices include:

- ▶ **SpikeLog-16:** Single board 16-channel neural logger with motion sensor and stimulator
- ▶ **Mouselog-16:** Lightweight wireless (1.6g) 16-channel neural logger
- ▶ **Microstim-6:** 6-channel programmable electrical stimulus generator

# Deuteron Technologies Ltd

*Electronics for Neuroscience*



## RatLog-64

Modular, wireless 64-channel neural logger

- ▶ Small enough to be mounted on a rat's head
- ▶ Modular component system
- ▶ 1.92 gram processor card
- ▶ 4.8 gram total for 64 channel system
- ▶ 32kHz sample rate per channel
- ▶ Wireless preview of data
- ▶ Synchronization with lab events
- ▶ 16, 32 or 64 channel configurations

### Optional features:

- ▶ 7-channel electrical stimulator
- ▶ 9-Axis motion sensor
- ▶ Audio recording and logging

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# RatLog-64

RatLog-64 is a modular, lightweight, wireless system for recording neural signals on small animals such as rats. It is designed to be small enough for all of its parts to be mounted on the head of a rat. Its component modules can be selected for 16, 32 or 64 channels of neural inputs.

## Neural recording

Each channel is amplified relative to a selectable reference input, digitized at 32ks/s and continuously recorded on a MicroSD memory card.

## Real time monitor over radio link

Neural signals can be viewed on a computer screen using the radio link.

## Guaranteed data integrity

Storing data on an animal-borne memory card ensures that the recorded data is never interrupted and always free of artifacts.

## Synchronization

Many synchronization options are provided to ensure that the time scale of the recorded data is perfectly correlated with events on other laboratory equipment. The radio transceiver includes a synchronization processor and has several BNC connectors for connection to fixed laboratory equipment.

## Ultra-low power

The system can work with batteries as light as 1 gram.

## Many optional modules and features

- ▶ Electrical stimulator: 7 channel
- ▶ Headstage with microphone for audio recording
- ▶ 9-axis motion sensor: Three axes each of gyroscope, accelerometer and compass
- ▶ Custom headstages
- ▶ Custom wiring assemblies
- ▶ Programmable current source for lasers or high power LEDs for optogenetics
- ▶ Long range radio: Up to 200 meters (Not available in USA)

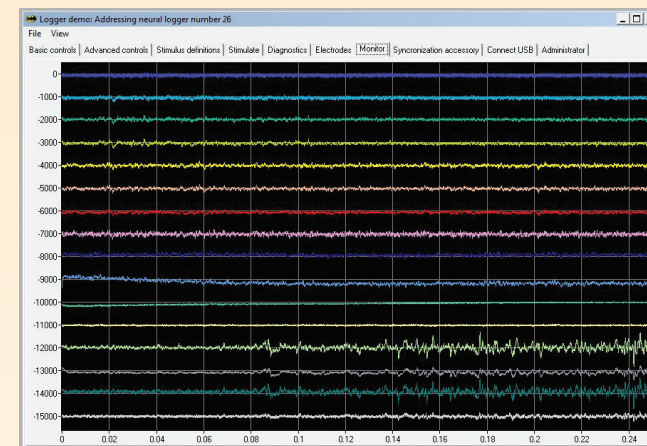
# Specifications

Property	Value
<b>Neural inputs</b>	
Signal range	10mV p-p
Resolution	0.2 $\mu$ V
Random noise	2.4 $\mu$ V rms for 7kHz bandwidth
Sampling rate	32.0k samples per second
Input capacitance	15pF
Analog bandwidth	Fully software selectable Low limit: 0.2Hz to 500Hz High limit: 30Hz to 10KHz
Channels	16, 32 or 64
Connector	Omnetics A79025-001 on standard 32-channel headstage
<b>Data storage</b>	
Data capacity	8.6 hours, 64 channel, 64GB MicroSD card
<b>Synchronization</b>	
External connections	5 BNCs for digital input or output
Signaling and tracking LEDs	2 pairs per headstage, 1 multicolor on processor
<b>Radio link</b>	
Radio band	915MHz or 433MHz band
Range	20 meters or optional 200 meters (200m range not available in the USA)
<b>Mechanical</b>	
Dimensions	Width: 15mm Height: 24mm
Mass of processor	1.92g (Including MicroSD card)
Mass of headstage	0.96g (Standard 32-channel)
Mass of wiring assembly	1.00g (or 0.5g for flex-PCB)
Mass of lithium polymer battery	1.20g (40mAh: 1hr 32 channel) 3.2g (160mAh: 2hr 64 channel)
Power consumption	275mW, 64 channel 200mW, 32 channel
<b>Housing and mounting</b>	
Protective housings must be provided as appropriate for the animal used, its environment and the selected battery size. The standard headstages can be supported solely by their connector.	

# Features

## Preview monitor

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



## Reference channel control

On each headstage, the user can select a reference source whose voltage will be subtracted from all other signals before amplification. The standard 32-channel headstage allows the selection of any one of 13 input pins, a dedicated reference pin, or ground, as the reference input.

## Customized versions

Customized versions of the software or hardware can be provided where needed. Custom headstages can be produced in about 8 weeks.

## Wired or stacked headstages

Headstages can be connected to the processor either by a thin flexible cable or they can plug directly into the back of the processor board to make a single rigid assembly.

## Battery options

The user can select an appropriate battery size. The required battery mass is about 1.5 grams per hour of 64-channel recording, or 1 gram per hour for 32-channel recording.

## PC software suite

A suite of software for a Windows computer is provided. Included is a general control panel for setting up and controlling all the logger's features, controlling the synchronizing transceiver and logging external events.