



miniLogger 32

v1

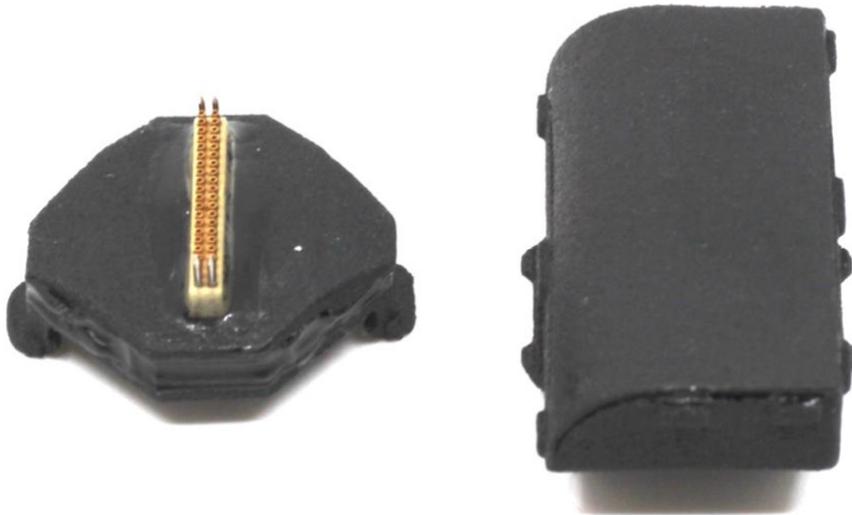


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miniLogger 32

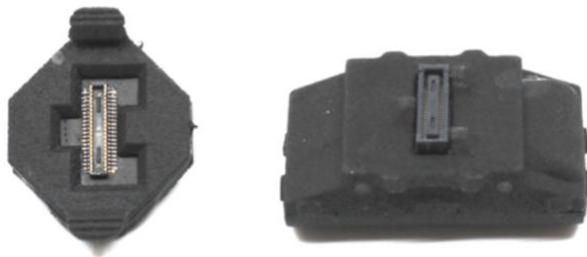


Figure 1- Mini logger bottom and mini-logger processor top with 110 mAh battery

Introduction

The miniLogger 32 is a miniaturized system equipped with all of the hardware required for freely-moving electrophysiology in mice and larger animals. The miniLogger 32 amplifies and digitizes 32 neural channels and either logs data directly to a micro SD card (untethered mode) or live streams data directly to the MCU (tethered mode). Its compact size (15 mm tall, weighs 3 grams without battery), versatility, and automated software program for processing and syncing the data (neural recording, video, environmental) make this system well-equipped for scalable recording.

This system consists of two components: 1.) a miniLogger processor top which contains all of the major processing components of the system- the battery, FPGA board, and the microSD card slot 2.) a base, permanently installed on the head of the animal that can be used again in future implants. The processor top can be easily removed and switched out with another top for longer recording sessions or so one processor top can be shared between multiple animals.

The miniLogger 32 can be used in conjunction with a SpikeGadgets Logger Dock, (in lieu of an MCU for data acquisition) streamlining high-throughput experiments.

It is recommended that a Logger Dock be purchased along with the miniLogger 32 processor for battery charging, data upload, and synchronization with the miniLogger. Options for data upload and charging provided in this manual below.

miniLogger 32 headstage specifications

Channel Count	32
Connector from base to processor top	40-pin Hirose mezzanine connector
Sampling rate	30 and 20 kHz supported
Bit depth (ADC's)	12-bit and 16-bit supported
Weight	3 grams + weight of battery
Height	15mm (base + processor top)
Data logging	Full data-rate broadband data, 70 minutes with 110 mAh battery and 8GB SD card
Sensors	3-axis accelerometer, 3-axis gyro
Radio synchronization range (during data logging)	15 feet

Weight, Dimensions, and Recording Time

The data logging processor top is available with different sizes as based on experimental recording needs and size restrictions. Below are the specifications of the processing tops available.

Battery	Total system weight	Dimensions (x,y)	Height (z)	Recording time
110 mAh	6g	17mm, 30mm	15mm	70 minutes
400 mAh	13g	27mm, 37mm	15mm	250 minutes

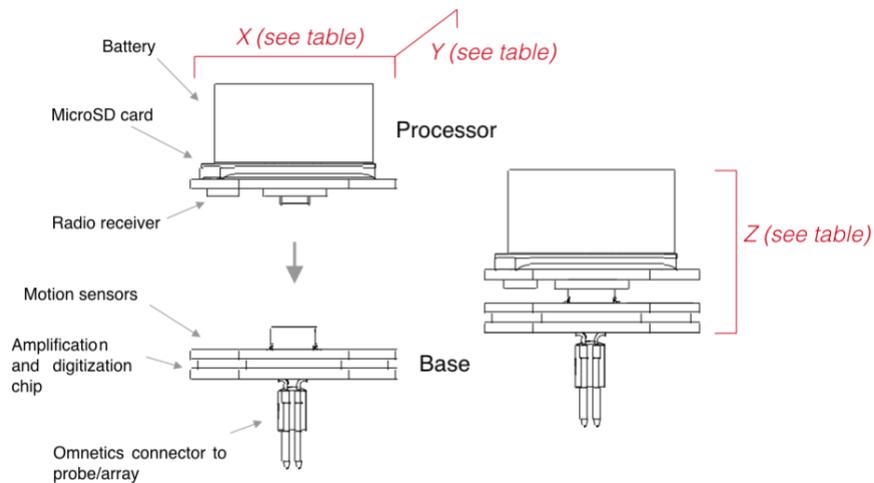


Figure 2 miniLogger 32 size specifications



Figure 3- Mini logger bottom and mini-logger processor top with 110 mAh battery

Mini Logger Connection

All of the heaviest components including the battery, microSD card slot and the FPGA board are contained in the removable miniLogger 32 processor “top.” This miniLogger processor utilizes a 40-pin Hirose mezzanine connector to the miniLogger base which interfaces with the EIB or probe array via a commonly-used 36-pin Omnetics connector.



Figure 4- Pin out for 32-channel logger bottom



Figure 5- miniLogger 32 base with 36-pin Omnetics connector, Figure 6- miniLogger 32 base and processor base with 40-pin Hirose connector

Configuration

The miniLogger 32 top is capable of recording and logging neural data onto a MicroSD card on the device itself in untethered mode. The SD card configuration file (.config) is a binary text file that configures the processor with different recording options. These options include the number of channels to record, which sensors to enable or disable, which RF channel is being used, and any functions that should be overridden (e.g. wait for RF pulse function or Intan check function).

Before using the headstage in the untethered mode, make sure the battery is charged (see the section on charging for more information) and the SD card is enabled for recording.

For untethered recording the headstage and the data acquisition device (Logger Dock or MCU) should be set to the same sampling rate to ensure the locally collected data can later be merged with the environmental record. Sampling rates are by default set at 20kHz and can be adjusted in the Datalogger GUI.

Card Enable

This enable step has to be repeated after every completed recording (this is a safety step to make sure data is not overwritten on the SD card before it has been downloaded to the computer).

1. Connect the processor top to the logger dock. When plugging the top and bottom together (as well as the top and the logger dock), make sure the text is facing the same direction (text on battery and text on station).
2. Charge the system by connecting to the SpikeGadgets Logger Dock (recommended) or through a 3rd party lithium charger. (See charging and data upload section)
3. To communicate with the SD card on the headstage, plug the logger dock into the SD-USB adaptor and the adaptor into a windows computer. Once a recording is complete, use the DataLogger GUI to download data and enable the SD card for recording.

The Datalogger GUI is an interface that checks the data on SD cards, configures the card, extracts the data, and converts/merges them into playback files compatible with the rest of the SpikeGadgets software suite.

https://bitbucket.org/mkarlsson/trodes/downloads/DataLoggerGUI_1_5_windows.zip

Or for Ubuntu:

https://bitbucket.org/mkarlsson/trodes/downloads/DataLoggerGUI_1_5_Ubuntu.tar.gz

Alternately, all of this can be done using command prompt scripts.

Data Upload

Once the temporary .dat file has been extracted from the SD card, the file will need to be converted into a format that is used by the Trodes suite. This means that a proper header needs to be appended to the beginning of the file that contains information about the contents. There are two ways to do this:

1. If the data does not need to be combined with a simultaneous environmental recording from the MCU and ECU, then the helper program (included in the Trodes software suite) called “sdtorec” will simply add the desired workspace info to the output file. From the command line, use the following syntax:

```
sdtorec -sd [SDRECORDING.dat] -numchan [NUMCHANNELS] -mergeconf [WORKSPACE.trodesconf]
```

2. If the data needs to be combined with a simultaneous environmental recording from the MCU and ECU, then the helper program (included in the Trodes software suite) called “mergesdrecording” will merge the neural recording from the SD card with the environmental recording taken using Trodes. From the command line, use the following syntax:

```
mergesdrecording -rec [ENVIRONMENTALRECORDING.rec] -sd [SDRECORDING] -numchan [NUMCHANNELS] -mergeconf [WORKSPACE.trodesconf]
```

Power on/error check

Connect the processor top to the miniLogger 32 base to power it on. There is an alignment system on these devices that will only connect in the correct orientation.

Once the processor top and base are connected, it will cycle through two phases as demonstrated by the LED indicator lights:

1. Any existing data on the SD card will be deleted. This is indicated with a flashing green LED.
2. The miniLogger 32 will enter standby mode as indicated by the breathing green LED.

Once the miniLogger 32 has reached this second cycle, standby mode, it is ready to receive RF pulses and begin recording.

LED Indications (Untethered mode)

Light Color	Pulse	Meaning
Red	fast	SD card not enabled
	solid	no Intan chip recognized
	random blip during recording	dropped packet(s)
	breathing	card full
Green	fast	mounting and erasing SD card (can take several minutes depending on the card)
	breathing	ready to record, waiting for RF start command from MCU
	3 blinks	Start pulse received
	blip every 10 seconds (when recording)	received RF timesync pulse (used to merge .dat and .rec generated from MCU/Trodes)

RF Channel Synchronization (Untethered recording)

The RF transceiver (antenna connected to MCU or logger dock) transmits start/stop recording pulses and sync pulses every 10 seconds to enable synchronization between the wireless recording and the environmental record in Trodes.

The "Start" signal will be emitted from the RF transceiver (when streaming is initiated from the Trodes software or the Logger Dock. Trodes will save the digital inputs (coming from your other gear) and the RF signals from the MCU, and you will later merge the Trodes file and the data on the SD card using the Datalogger GUI.

By default, both the miniLogger32 and the MCU/Logger Dock are set to RF channel 2.

To set the MCU's RF channel, open the script `set_MCU_rf` in administrator mode, enter the desired RF channel, and hit enter.

To set the datalogger's RF channel, open datalogger GUI and hit the "edit card config" button. Enter the desired RF channel in the RF channel box and hit OK.

Note: Keeping the RF antenna connected while the base is in live streaming mode (tethered recording) will create an error in Trodes.

Wireless (Untethered Recording)

Checklist

- MCU or Logger Dock connected to computer
- RF transceiver (antenna) connected to MCU or Logger Dock
- miniLogger 32 base and processor top charged, with SD card enabled

Start Recording

To record in untethered mode connect the miniLogger 32 processor top to the base. The LED indicator lights should blink green, once the indicators switch to breathing green the headstage is ready to record.

In Trodes choose Auto Connect, choose type of connection from your MCU or Logger Dock to your computer, check the settings, and click Open. From there streaming can begin. Once streaming starts look for a series of 3 green blinks from the LED indicator on the miniLogger 32 to indicate recording has begun.

Note: If after 30-60 seconds the LED indicators are still breathing green, disconnect the recording and check the config settings in the Datalogger GUI. Once common error is that the headstage and the RF transceiver are not set to the same channel.

Live Streaming (Tethered Recording)

Checklist

- MCU connected to computer
- 32ch active commutator
- HDMI cables to connect headstage to commutator to MCU
- miniLogger 32 base

Start Recording

In tethered mode an adapter is connected to the top of the miniLogger base. An HDMI to Micro HDMI cable plugs into the adapter and streams data to the computer.

1. Enter Trodes and select a 32-channel workspace or autoconnect, click open.
2. Once the workspace is open, navigate to Connection > Stream from source.
3. Your headstage will begin streaming live data to Trodes (what is an indicator that this is working?)

Processor charging and data upload

To charge the miniLogger 32, first remove it from the base which can remain on the animal. For a longer recording session, swap out the processor top with another, fully charged one.

Each miniLogger 32 is shipped with a full battery. However, it is recommended to plug it into the Logger Dock until it shows a full charge before the first recording.



Figure 7- miniLogger 32 charging on a Logger Dock

Logger Dock

The Logger Dock is a docking station for charging, upload, and acquisition. This is the preferred method for uploading data and charging the battery on SpikeGadgets' miniLogger headstages. For detailed instructions, see the Logger Dock Manual.

3rd party charging/upload

The miniLogger 32 headstage can be charged and data can be uploaded from 3rd party accessories. However, in this case, an MCU is needed to control start/stop recording.

To charge the processor battery, plug a Lithium Ion/Lithium Polymer battery charger into the USB mini port on the processor top. Example picture below.



Figure 8- Processor top with 3rd party battery charger

For data upload from the processor top, plug a USB portable card reader into your computer, and the headstage into the portable card reader. Example picture below.



Figure 9- Processor top with USB portable card reader for 3rd party data upload

About SpikeGadgets

SpikeGadgets is trying something new. Our hybrid approach is to design and sell powerful hardware that interfaces with an open-source software platform supported by a large community of scientists and developers. Our goal is to support the efforts of the open-source community in a commercially-sustainable way.

Technical Support

If you would like technical support, please email us at support@spikegadgets.com.