SpikeGadgets

# Table of Contents

32-Channel Mini Mouse Headstage (MM32)

Introduction

The mini mouse 32-channel headstage is an improved adaptation of our classic small-animal upright headstage (UH32) and works in conjunction with the Headstage Signal Converter (HSC). The MM32 amplifies and digitizes 32-channels of neural data and improves upon the UH32 with a lower-profile HDMI connection mated to a thin and ultra-flexible cable. This low-profile and lightweight design provides increased ease of movement; ideal for experiments with small animals or where high mobility is key.

MM32 Headstage Specifications

Channel count	32 Channels
Connector to headstage	Low-profile HDMI
Connector to HCU/commutator	Micro HDMI
Connector to array	Omnetics 36-pin connector with 4 guide pins
Sampling Rate	20KHz or 30KHz
Input Range	±5.0mV
Bit Depth	16-bit
Weight	1.1g (without tether)
Height	11.45mm

Headstage Connection

Omnetics logo

G = ground   R = reference   Guide pin
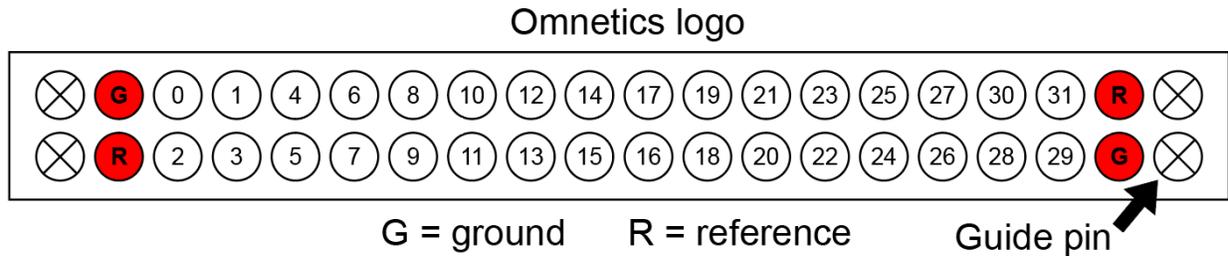
Figure 1 | MM32 pinout. Hardware channel mapping for the Omnetics connector when looking at the bottom of the plug/headstage.

The MM32's low-profile and lightweight design is accomplished by moving the processor to the Headstage Signal Converter (HSC), which connects to the SpikeGadgets General Purpose Commutator or General Purpose Commutator with Through-Bore. The headstage connects to the animal via 36-pin Omnetics connector, which has 32 channels for neural data, 2 ground channels, 2 reference channels and 4 guide pins as seen above in Fig. 1.

The Omnetics connection can be used to connect to a wide array of commercially available and custom-built passive probes. It also connects to the SpikeGadgets 32-channel electrode interface board (EIB) for experiments using tetrodes and/or drivable arrays.
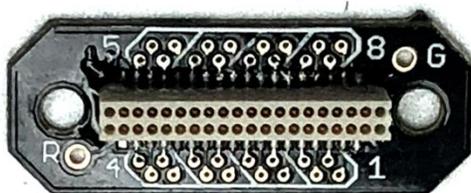
Figure 2 | SpikeGadgets 32-channel EIB. More information about the 32-channel EIB can be found on the SpikeGadgets website.

Configuration

Tethered Recording Setup

The MM32 is designed for tethered recording and is connected to the SpikeGadgets Main Control Unit (MCU) via the Headstage Signal Converter (HSC). The MM32 can also be paired with a SpikeGadgets commutator and the cable stiffening kit for experiments where cable tangling is an issue.

The MM32 connects to the HSC via the ultra-flexible tether's micro HDMI connection (Fig. 4c), which can then be connected to either the MCU or a SpikeGadgets commutator. When using a commutator, the HSC is connected directly to the commutator via micro-HDMI (Fig. 4a & 4b). The commutator connects to the MCU using a standard HDMI-A connection. When connected to the MCU using the HSC, if the MM32 is properly detected, the MCU's power indicator LED will change from blinking amber to solid green.

Data acquisition and streaming are controlled using Trodes via the MCU, which connects to the local machine running Trodes using Ethernet or USB. Once the MCU has been connected to Trodes, the MM32 headstage setting can be modified in Trodes using the Settings dropdown menu under:

Headstage > Headstage Settings

MCU settings can also be modified under the Settings dropdown menu under "MCU Settings..."

Figure 3 | Headstage Signal Converter. The HSC connects to SpikeGadgets commutators via HDMI-A. (seen above in both images). The MM32 tether connects to the HSC via a recessed micro HDMI port (right).
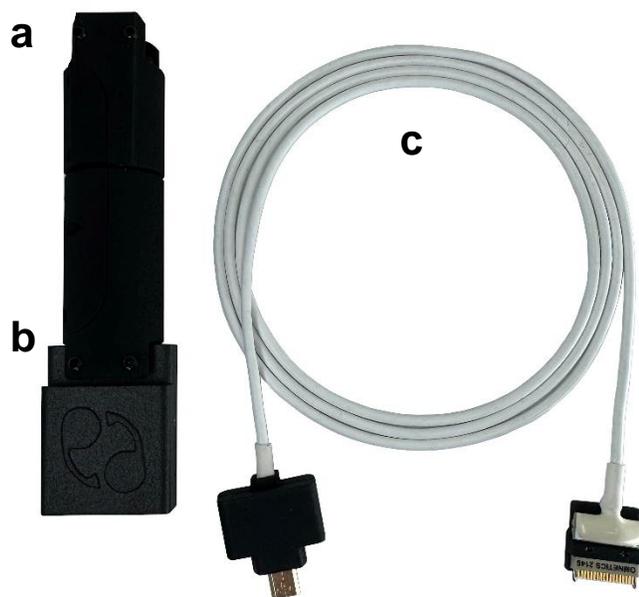
Figure 4 | Commutator, Converter & MM32 with tether. a) General Purpose Commutator connected to b) the Headstage Signal Converter via HDMI. c) MM32 headstage and ultra-flexible tether.

Connecting to your MCU via Trodes is done under the Connection dropdown menu in the Trodes Workspace:

Connection > Source > SpikeGadgets > USB **OR** Ethernet

The following recording settings can be modified under the Settings dropdown menu in your Trodes Workspace:

- **Auto Settle –** Large transient electrical events (caused by electrical stimulation, physical bumping, etc.) can cause extended amplifier ringing. The Auto settle function resets the amplifiers when this occurs and allows you to set a voltage and channel count threshold for triggering the reset.

  IMPORTANT NOTE: Auto settle channel threshold should always be set to a value greater than zero. Failure to do this can result in high amplitude noise "ticks" occurring at a 500ms interval across all neural data channels.

- **Sampling Sequence Correction (on/off) –** Eliminates temporal referencing error associated with the sequential nature of how channels are sampled. It is highly recommended to turn this on when using digital reference.

- **3-axis accelerometer (on/off) –** The accelerometer range is +/- 2g, encoded in signed 16-bit integers. This means each step is 2/32767g or 0.000061g.

- **3-axis gyro (on/off) –** The gyro range is +/- 2000 degrees/second at 16 bits, or 0.061deg/sec per step.

NOTE: Headstage and MCU settings cannot be changed while streaming data.

More in depth information about Trodes can be found in the Trodes wiki.

Initiating a Tethered Recording

1. Open Trodes and create a new Workspace "From Scratch" under the Create/Edit Workspace menu or open the Workspace you have already created. Detailed information about Workspace setup can be found here.

2. Once you have opened your Workspace, connect your headstage to the MCU and enable the connection to your MCU via Trodes using the Connection dropdown menu as mentioned above.

3. Click "Stream from source" under the Connections dropdown menu to begin streaming from your headstage.

4. To create a new recording file, select "New recording" under the File dropdown menu. You will be prompted to select a recording directory using the file explorer pop-up window.

5. Begin recording by hitting the record button.

6. To end your recording, hit the pause button, then disconnect your stream.

Information about data export options can be found here.

Additional Resources

Trodes Wiki: Detailed information about Trodes, SpikeGadgets open-source software suite, can be found here.

Additional Documentation about SpikeGadgets Control Units (MCU, ECU, HCU, etc.) and other products can be found here.

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.