

Wireless Recording with SpikeGadgets Protocol

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Part 1 - Setting up a wireless recording experiment:

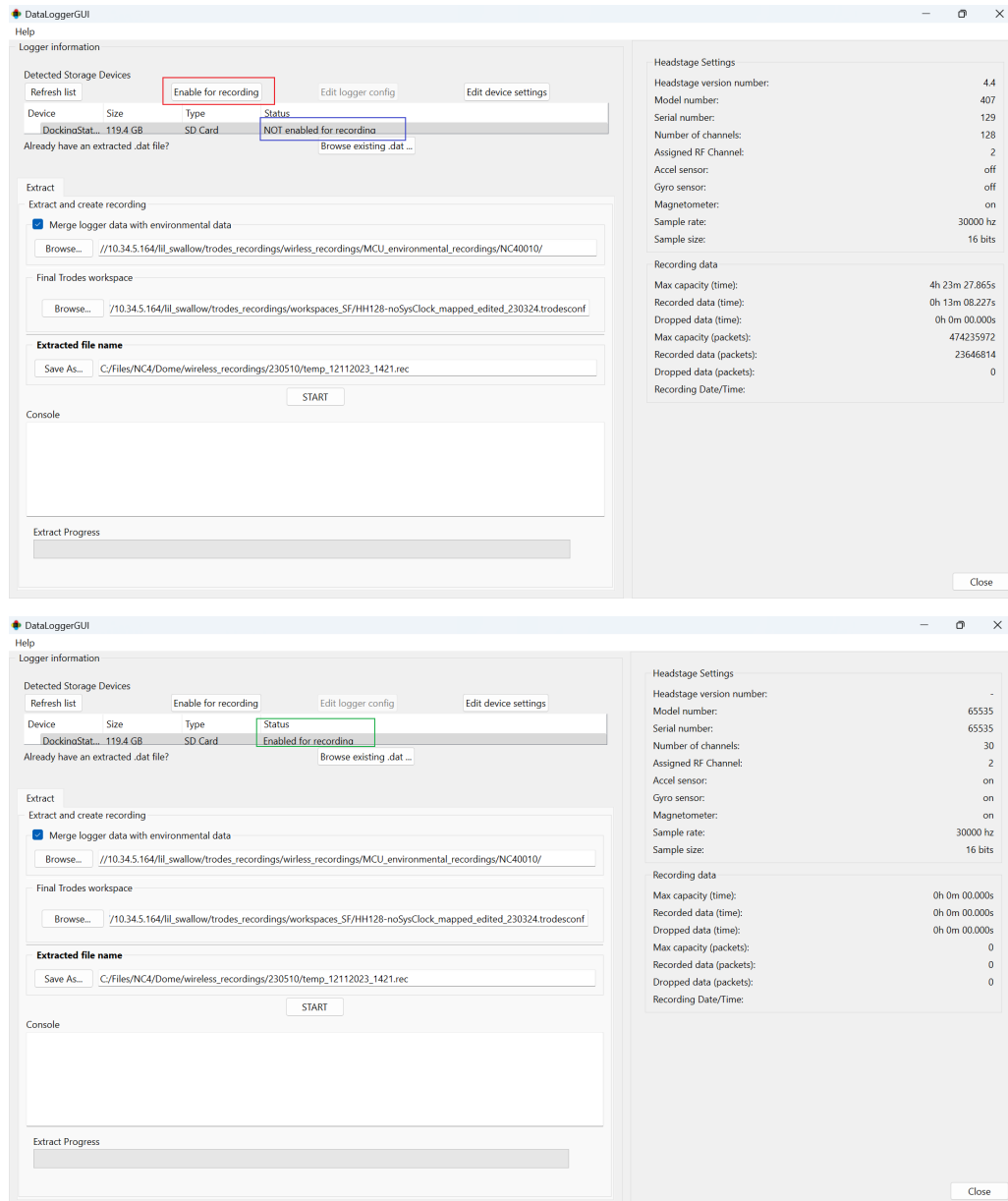
Note: This part is copied from “Setting up an Untethered Data Logging Experiment” on <https://docs.spikegadgets.com/en/latest/basic/Untethered.html>. It should be good to do these step just once but it’s a good idea to check step 3 for each wireless recording session.

These steps provide an overview of basic setup for untethered recording. For more detailed headstage-specific instructions, please see the user manual or Wiki entry for the specific headstage you are using.

1. Open Trodes and either create a new workspace “From Scratch” under the Create/Edit Workspace menu or open the workspace you have already created.
2. Connect your headstage to the MCU via HDMI, and link your MCU to Trodes using the “Connection” dropdown menu by selecting: Source > SpikeGadgets > USB OR Ethernet.
 - Your SD card should not be inserted into the headstage yet.
3. Under the “Settings” dropdown menus, set the MCU and headstage RF channel and sampling rate to the same values and select the session ID mode checkbox for both:
MCU: Settings > MCU Settings...
Headstage: Settings > Headstage Settings...
4. Apply your settings above, then save your Workspace. This Workspace can be used later as the basis for the Workspace used to merge your neural and environmental data.

Part 2 - Instructions for each wireless recording session:

1. Charge the battery before the recording session with the Logger Dock or battery charger. The LED indicator turns green from red when the battery is fully charged.
2. Enable the SD card on the DataLoggerGUI. Make sure the recording data on the SD card has been extracted. Status should be “Enabled for recording” after clicking [Enable for recording].



3. Plug wires for synchronization in the Main Control Unit (MCU). Also, check the other ends are in Arduino. (This inputs the behavioral timestamps to MCU)

4. Disconnect the headstage from the MCU, connect the headstage to battery power, insert your enabled SD card into the headstage and power the headstage on. Check the LED on the headstage, it should be breathing yellow. (See the LED Status Indicators table at the end of this document.)
5. Open Trodes and open the Workspace with neural channel count set to zero. This workspace will be used to acquire the environmental record.
6. Connect the RF transceiver to the Aux 1 port on the front of the MCU.
7. On the opened zero-channel workspace, connect to MCU, and set your RF channel and sampling rate to match the settings you previously applied to your headstage settings, also making sure Session ID mode is checked. (Refers to steps 2 and 3 in Part 1)
8. When you are ready to begin recording, select “Stream from source” from the Connections menu. **This will trigger the headstage to begin recording.** For Dome experiments, put the rat in and check his/her behavior is normal and then start behavioral (ROS) recording first, headstage recording second.
9. To initiate recording with the MCU, select “New Recording...” from the File dropdown menu and select your recording directory.
10. Observe the LED on the headstage to check if it’s working normally.
11. Hit the red “record” button to **begin recording your environmental record with the MCU.**
12. To end your recording, hit the pause button (**MCU recording** will be ended or paused), and disconnect your stream (**headstage recording** will be ended).

Part 3 - Transferring Data to Computer and Merging Files

(Copied from <https://docs.spikegadgets.com/en/latest/basic/Untethered.html>)

Once your untethered recording session has ended, the data recorded by both systems will need to be merged before further processing and analysis will be possible. Three files are required for merging the data:

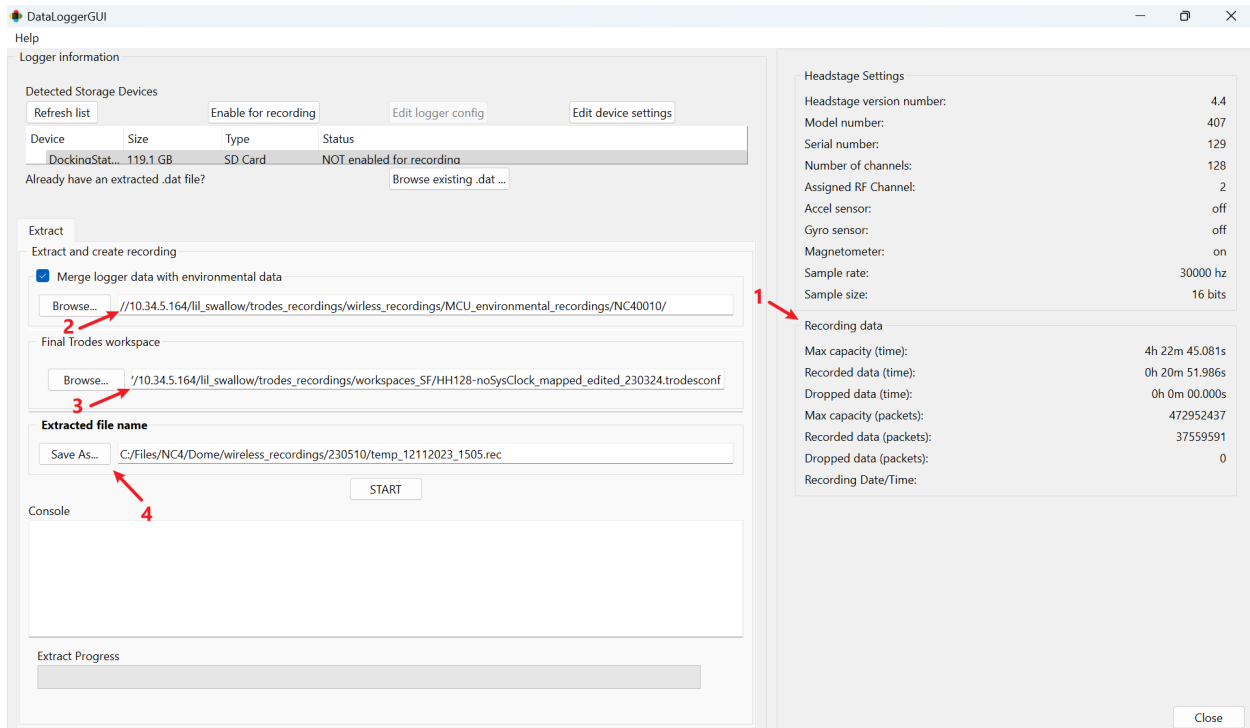
- 1) The neural data file recorded to SD
- 2) The environmental data file recorded to your computer
- 3) A Workspace file to be appended to the merged data.

The Workspace file required should contain all the settings that would have been used if the recording had been taken in tethered mode. This Workspace will include accurate channel count and nTrodes mapping from your headstage AND any settings relevant for recording the environmental record, such

as the ECU being added to your Workspace Hardware Device list. Once you have these files, the data can be merged using the Data Logger GUI application that can be found in the Trodes directory.

(Copying ends)

Below is a screenshot of Data Logger GUI and some explanations:



A SD card with recording data will show the status as “Not enabled for recording.”

Arrow 1: details of the recording data on the SD card.

Arrow 2: path to the environmental data file recorded to your computer via MCU

Arrow 3: path to the Workspace file to be appended to the merged data.

Arrow 4: where you want to save the merged file

Click [START] to begin extracting and merging, the extract progress can be seen at the bottom of the GUI.

Resources:

<https://docs.spikegadgets.com/en/latest/basic/Untethered.html>

https://spikegadgets.wpenginepowered.com/wp-content/uploads/2023/04/HH128_Headstage_Manual_Rev2e_0423.pdf

LED Status Indicators

Upon powering on the HH128 headstage, the Yellow and Red onboard LEDs will blink simultaneously once to indicate the headstage is powered on.

Headstage Status Indicators

Following the startup blink mentioned above, the headstage will blink in different patterns or colors to provide status indications

LED Color	Pulse type	Meaning
Red and yellow	Simultaneous Blink	Headstage powered on
Red	Fast (4Hz) blink	SD card is not enabled for recording
	Breathing	SD card is full; recording stopped
	Random blip during recording	Dropped packet(s). If it happens often, consider upgrading to an SD card with faster writing speed.
Yellow	Fast (4Hz) blink	SD card is being erased
	Slow (2 Hz) blink	SD card mounting error. Often resolved by removing SD, re-enabling & re-inserting SD.
	Breathing	SD card mounted and enabled; ready to record
	4x blinks	Recording has started

NOTE: When the MCU and headstage are configured for untethered recording and the RF transceiver is connected to the MCU, the headstage's yellow LED will blip intermittently. This is expected behavior resulting from the MCU transmitting periodic commands to the headstage.