hedrot

Installing and Using the Head Tracker

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# Assembling the Head tracker

## Required parts

* 1 Teensy 3 board (tested with versions 3.1 and 3.2)
* 1 USB to Micro-USB 2.0 cable, minimum length 1.5 m
* 1 gy85 IMU daughter board with the following sensors:
  + 1 Analog Devices ADXL345 accelerometer
  + 1 Honeywell HMC5883L compass (magnetometer)
  + 1 Invensense ITG3200 gyroscope
* 1 straight multipin connector, 4 or 5 pins
* 1 angled multipin connector, 4 or 5 pins
* 2 short electronic connection cables



## Schematics



## Setting the multipin connectors on the Teensy board

The straight multipin connector has two functions:

* connect pins 18 and 19 from Teensy to respectively pins SDA and SDL of the GY-85 daughter board.
* stabilize the daughter board on the main board mechanically

**Only both pins 18 and 19 are to be connected! All other metallic connections should be removed. However the plastic connection should be larger as two pins, in order to ensure a mechanical stability of the daughter board (see photo below)**.

The angled multipin connector has no connection function, **no pin of the daughter board should be connected to it**. Its only function is the mechanical stabilization of the other side of the daughter board.



## Set both cables on GND and +3.3V pins of the GY-85 board



## Connect both cables on the main board, install the daughter board on the main board and solder



Side view



Rear view

# Install/Update the hedrot Firmware in the Teensy 3.1

## Download the latest version of the Teensy loader

...on Teensy's website <https://www.pjrc.com/teensy/>

## Load the head tracker firmware

### Important Notice

**Before any update of the firmware, it is highly recommended to save the head tracker calibration settings:**

* Start hedrotReceiver
* Start the head tracking (click on "Headtracker is off"). If "Autodiscover" is off (in "Headtracker settings"), select the right serial port (typically "/dev/cu.usbmodemXXXXXX" on macs). If "Autodiscover" is on, nothing has to be done
* When the head tracker is connected to hedrotReceiver, click "export calibration settings". Save the calibration settings in a text file

### Loading/Updating the Firmware

* Start the program "teensy.app"
* Drag & drop the current version of the firmware provided with the distribution of hedrot (file "hedrot-firmware\_version\_XX.hex", where "XX" is the version number of the firmware)
* Click on the reset button on the teensy board
* If calibration settings were saved before updating the firmware, import them in the head tracker: when the head tracker is connected to hedrotReceiver, click on "import calibration settings". Select the text file containing the calibration settings

### First use of the head tracker

**After the firmware has been uploaded for the first time in the head tracker, settings have to be initialized!!!**

* Start hedrotReceiver
* Start the head tracking (click on "Headtracker is off"). If "Autodiscover" is off (in "Headtracker settings"), select the right serial port (typically "/dev/cu.usbmodemXXXXXX" on macs). If "Autodiscover" is on, nothing has to be done
* Click on "Headtracker Settings". In the new window, click on "reset all headtracker settings"

# Axes conventions, positioning the head tracker

## Axes convention

Looking at the Teensy board with the USB connector below and on the left side (the GY-85 daughter board is above the Teensy):

* the x axis points to the front
* the y axis points to the right
* the y axis points down

## Positioning the Head tracker on the Headphone

* The head tracker must be positioned on the top of the
* The GY-85 daughter board should be on the top, the USB connector below and on the left side, so that the USB cable is connected on the left side of the board

# Starting the Head tracker

* Start hedrotReceiver
* Start the head tracking (click on "Headtracker is off"). If "Autodiscover" is off (in "Headtracker settings"), select the right serial port (typically "/dev/cu.usbmodemXXXXXX" on macs). If "Autodiscover" is on, nothing has to be done
* When the connection has been established and if the calibration is valid, the data should be transmitted regularly
* If the connection has been established but if the calibration has not being done yet or if it's not valid, hedrotReceiver will show an error message

# Calibrating the Head tracker

## To show the head tracker raw and calibrated data

* Start hedrotReceiver
* Click on "Calibration". On the new window that appears, the raw data is shown above, the calibrated data below
* For the accelerometer, the calibrated data should ideally always remain within -1 and 1 when the head tracker is still, and the norm should always stay close to 1. If this is not the case, it means that the calibration has not been done properly and should be redone
* For the magnetometer, the calibrated data should ideally always remain within -1 and 1, and the norm should always stay close to 1. If this is not the case, it means that the magnetic environment changed and that calibration has to be redone. Remember that the compass is very sensitive to the presence of any ferromagnetic interference (metallic cases, magnetic fields etc.)
* For the gyroscope, the calibrated data should stay around 0 when the head tracker is still.

## Calibrating the accelerometer

The accelerometer should normally be calibrated only once, and the head tracker does not need to be attached to the headphone for this.

In order to calibrate the accelerometer:

* Click on "Headtracker Settings"
* Click on "calibrate accelerometer"
* Click on "start calibrating"
* Turn the head tracker in as many direction as possible, at least around x, y and z-axes, **AND AS SLOW AS POSSIBLE**
* At the end, click on "stop calibrating", and confirm the data export to the head tracker

## Calibrating the magnetometer

The magnetometer is very sensitive to the presence of ferromagnetic material and to magnetic fields, and needs to be calibrated quickly **on the headphone and at its definitive position** each time:

* its position relative to the headphone changed
* a new headphone is being used
* the magnetic environment changed. This can happen for example with a laptop if one sits closer or farther to it.

In order to double-check if a new calibration is required or not, check the calibrated data as explained above.

In order to calibrate the magnetometer:

* Click on "Headtracker Settings"
* Click on "calibrate magnetometer"
* Click on "start calibrating"
* Turn the head tracker in as many direction as possible, at least around x, y and z-axes. It does not need to be done slowly as for the accelerometer
* At the end, click on "stop calibrating", and confirm the data export to the head tracker