Table des matières

Qu'est-ce qu'OpenPlotter?

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Certains achètent des bateaux quand d'autres les construisent. Pourquoi ne pas construire votre propre électronique ? OpenPlotter est une combinaison de logiciels et de matériels utilisable comme aide à la navigation sur les petites et moyennes embarcations. C'est aussi une solution complète de domotique à destination de votre bateau.

OpenPlotter fonctionne sur les ordinateurs a processeur ARM tel que le Raspberry Pi et est open-source, low-cost et consommant très peu. Sa conception est modulaire, vous pouvez donc n'installer et n'utiliser que ce qui vous est utile.

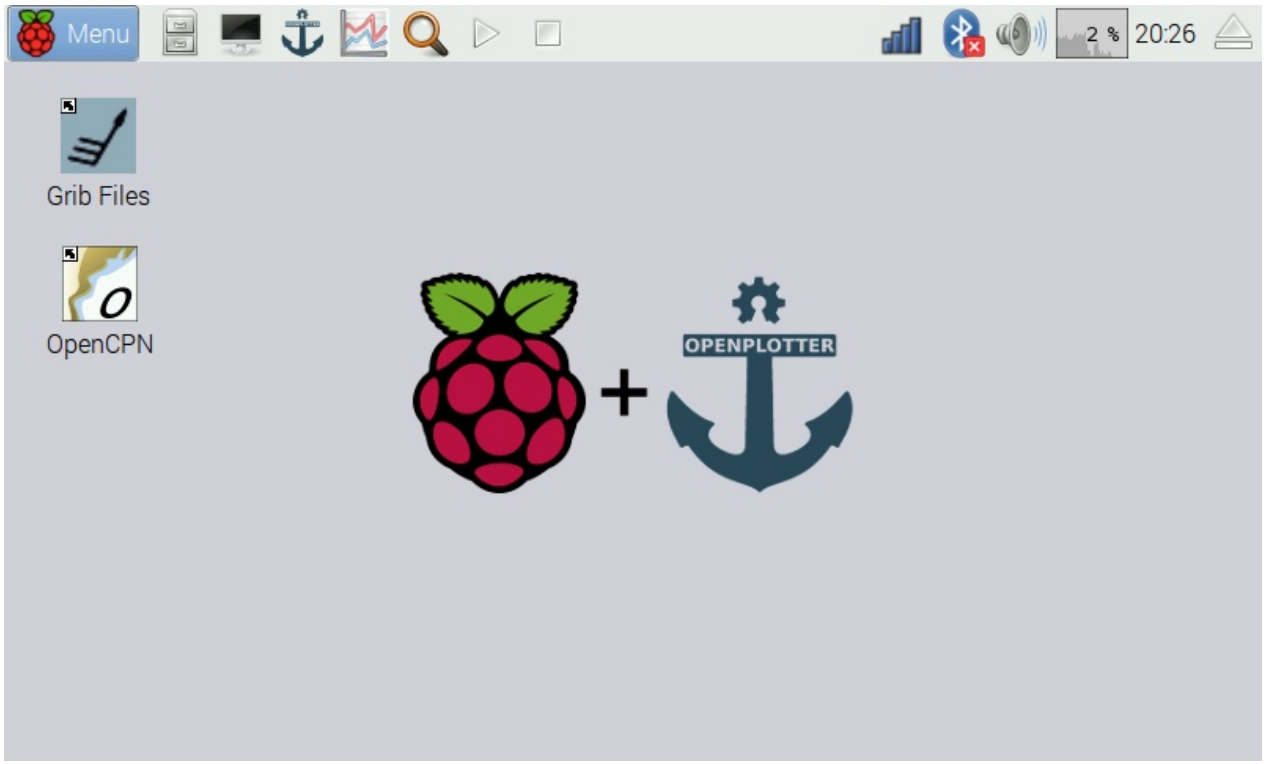
Faites-le vous-même !

Fonctionnalités

- **Traceur de cartes**. Grâce à OpenCPN, logiciel de navigation Open Source réputé et ses nombreux plugins.
- **Prévisions météo**. Téléchargez et visualisez les fichiers Grib avec zyGrib.
- **Multiplexeur NMEA 0183**. Multiplexez et filtrez les données en provenance de sources réseau ou série illimitées. Envoyez ces données vers tout type de sortie.
- **Serveur Signal K (beta)**. OpenPlotter est prêt pour Signal K, le nouveau format gratuit, universel et open-source d'échange de données nautiques.
- **Moniteur NMEA**. Contrôlez les données échangées, diagnostiquez les éventuels conflits.
- **Point d'accès WiFi**. Partagez les données du bord (NMEA 0183, Signal K, bureau à distance, connexion internet) avec vos ordinateurs portables, smartphones, tablettes. Si une connexion internet est disponible, OpenPlotter pourra être votre point d'accès WIFI.
- **Ecran à distance**. Accédez à OpenPlotter de votre cockpit sur vos terminaux mobiles.
- **Headless**. Démarrage facile sans écran.
- **Réception SDR-AIS**. Recevez, décodez et affichez les cibles AIS avec une clé DVD-T USB. Outils de calibration inclus.
- **Compas magnétique et clinomètre**. Ajoutez aux données du bord le cap magnétique et l'angle de gite avec un capteur IMU (Inertial Mesurement Unit). Compensation de la gite, outils de calibration inclus.
- **Baromètre, Thermomètre and Hygromètre**. Enregistrez l'historique de la pression atmosphérique, de la température

et de l'humidité de l'air et affichez ces données pour analyse des tendances météo.

- **Capteurs de température multiples**. Placez des capteurs multiples pour récupérer et afficher les valeurs de température de l'eau, du moteur, du frigo, etc...
- **Capteurs spéciaux**. Détectez les mouvements, l'ouverture d'une porte ou d'un hublot, le niveau de remplissage d'un réservoir, etc...
- **Déclinaison magnétique**. Calcul de la déclinaison magnétique en fonction de votre position et de la date.
- **Cap vrai**. Calcul du cap vrai à partir du cap magnétique et de la déclinaison.
- **Vent vrai**. Déduit le vent vrai des valeurs du vent apparent et de la vitesse du bateau (Loch/speedo ou GPS).
- **Taux de virage**. Calcule la vitesse de virage de l'embarcation.
- **Monitoring à distance**. Envoyez les informations de votre choix via Twitter ou par email.
- **Actions pré-programmées**. Déclenchez des actions pré-définies (alarme, envoi d'un tweet, ...) en fonction des variations d'une ou plusieurs données choisies (température, vitesse du vent, changement de cap, ...)
- **Interrupteurs customs**. Connect external switches and link them with actions.
- Connectez un ou plusieurs interrupteurs pour interagir avec Openplotter (Reboot, déclenchement d'action, ...)
- **Composants additionnels**. Relais, LEDs, buzzers ...
- **Outils de mise à l'heure**. Définissez facilement l'heure du système et le fuseau horaire à partir des données NMEA.
- **Gestion des logiciels au démarrage**. Sélectionnez simplement les logiciels à lancer automatiquement au démarrage du système.



Frequently Asked Questions

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How to collaborate

This chapter needs to be written/updated/translated: http://forum.openmarine.net/forumdisplay.php?fid=16

> Everything takes time, money, and monkeys. You need a lot from any two groups, and a little from the third. An increase in any one reduces the requirement for the other two. Change occurs when one of those three change.

Moe's Law, Navigatrix[1] project.

Time

Get a Raspberry Pi and the required elements, download OpenPlotter RPI and test and test and test ...

Report bugs and request new features on OpenMarine forums[2].

Spread the word among your friends in ports and forums.

Money

This project is financed by selling related and tested products or by voluntary contributions. You can buy or donate on the WebShop[3].

Monkeys

> Men wanted for hazardous journey. Low wages, bitter cold, long hours of complete darkness. Safe return doubtful. Honour and recognition in event of success.

Ernest Shackleton

If you have python skills, push your commits to the github repository[4].

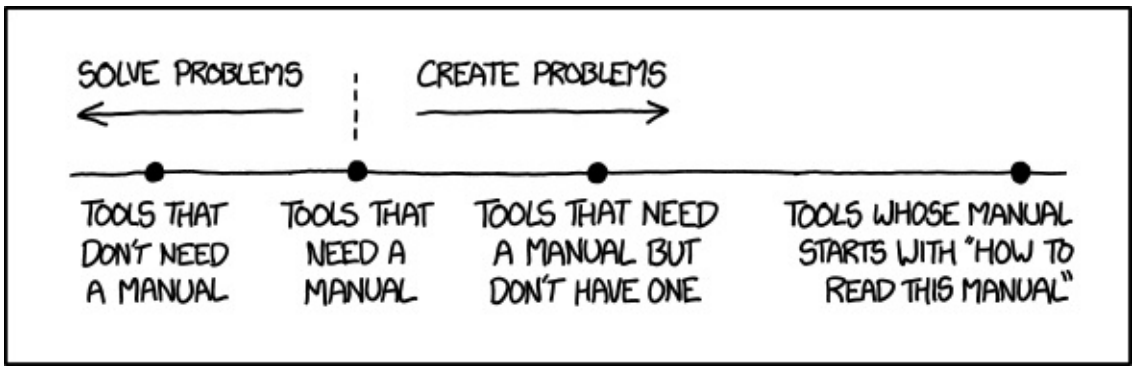
If you have electronics skills, share your work on OpenMarine forums[2].

If you have English language skills, helps us with documentation. Follow the steps in the next chapter Documentation.

[1] http://navigatrix.net [2] http://forum.openmarine.net [3] http://shop.sailoog.com [4] https://github.com/sailoog/openplotter

Documentation

This chapter needs to be written/updated/translated: http://forum.openmarine.net/forumdisplay.php?fid=16



Author: Randall Munroe[1], CC BY-NC 2.5 license.

We have a Github repository[2] for OpenPlotter documentation. This repository is connected to a Gitbook book[3] and we coordinate editors in a forum[4] on OpenMarine.

if you want to help us to write, update, correct or translate you have two options.

You are familiar with Github and Gitbook repositories edition:

- Create an account in **Github**[5]
- Send your Github account user name to the forum[4] and wait for you to be granted permissions to edit the repository.
- From the sticky threads in the forum[4], select a chapter marked in blue and notify your intentions in a new thread.
- Once you have permissions, login to **Gitbook**[6] with your Github account.
- Go to the book[3] and click on the *Edit* button upper right.

You are not familiar with Github and Gitbook repositories edition:

- From the sticky threads in the forum[4], select a chapter marked in blue and notify your intentions in a new thread.
- When you are done, publish text and images into a new thread in the forum[4] and someone will edit the book for you.

Writing

We write the documentation source in English to make easier translating to other languages.

Please do not modify the index or the structure without consulting developers. Once a chapter is done, please notify on the forum[4] to be marked in green.

To include images in the rest of languages from English folder, the path is `../en/xxx.png`

If you want to add images of wiring and connections consider using fritzing[7] application.

Do not modify or translate files names (xxx.md xxx.png xxx.jpg ...) because they are referenced in the text.

---

[1] https://xkcd.com [2] https://github.com/sailoog/openplotter-documentation [3] https://www.gitbook.com/book/sailoog/openplotter-documentation/details [4] http://forum.openmarine.net/forumdisplay.php?fid=16 [5] https://github.com/join [6] https://www.gitbook.com/login [7] http://fritzing.org

Comment ça marche ??

This chapter needs to be written/updated/translated

http://forum.openmarine.net/forumdisplay.php?fid=16

OpenPlotter peut recevoir les données de différentes sources:

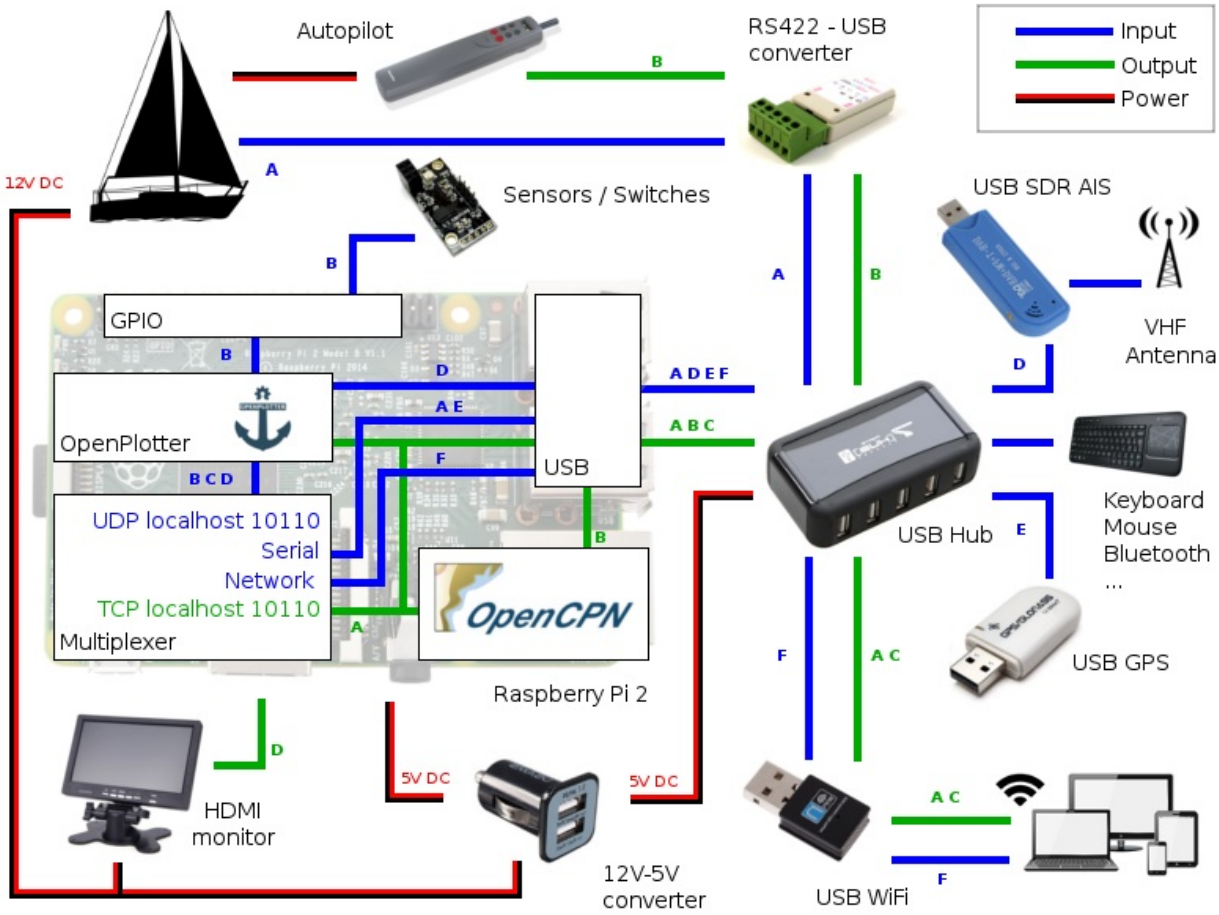
- Capteurs et appareils connectés au GPIO
- Appareils reliés au port USB
- Tout ordinateur ou appareil portable connecté au même réseau.

La plupart de ces sources envoient directement leurs données au format NMEA0183. D'autres données, l'AIS SDR par exemple, doivent être traitées et converties par OpenPlotter. Enfin, il existe des sources qui n'utilisent pas le NMEA.

Toutes les informations de ces sources sont combinées (multiplexées) en un seul flux de données qui peuvent être envoyées à:

- Un traceur de cartes en local (OpenCPN).
- Un calculateur NMEA qui générera de nouvelles données (ex: vent vrai)
- Des détections / actions pré-définies*
- D'autres appareils via une connexion réseau, WIFI ou série.
- Un afficheur de données.
- Un écran d'instruments virtuels
- Un compte Twitter.
- Un compte email.

Les chapitres qui suivent vous indiquent comment faire tout cela !


Autopilot
RS422 - USB converter
Input
Output
Power
12V DC
A
B
Sensors / Switches
USB SDR AIS
VHF Antenna
GPIO
OpenPlotter
BCD
UDP localhost 10110
Serial
Network
TCP localhost 10110
Multiplexer
USB
ADEF
ABC
AE
F
D
OpenCPN
Raspberry Pi 2
USB Hub
Keyboard
Mouse
Bluetooth
...
USB GPS
HDMI monitor
5V DC
5V DC
12V-5V converter
USB WiFi
AC

What do you need?

This chapter needs to be written/updated/translated

http://forum.openmarine.net/forumdisplay.php?fid=16

You will need the required parts and some optional parts. It will depend on what kind of data you want to collect, process or display and what kind of equipment your boat already has.

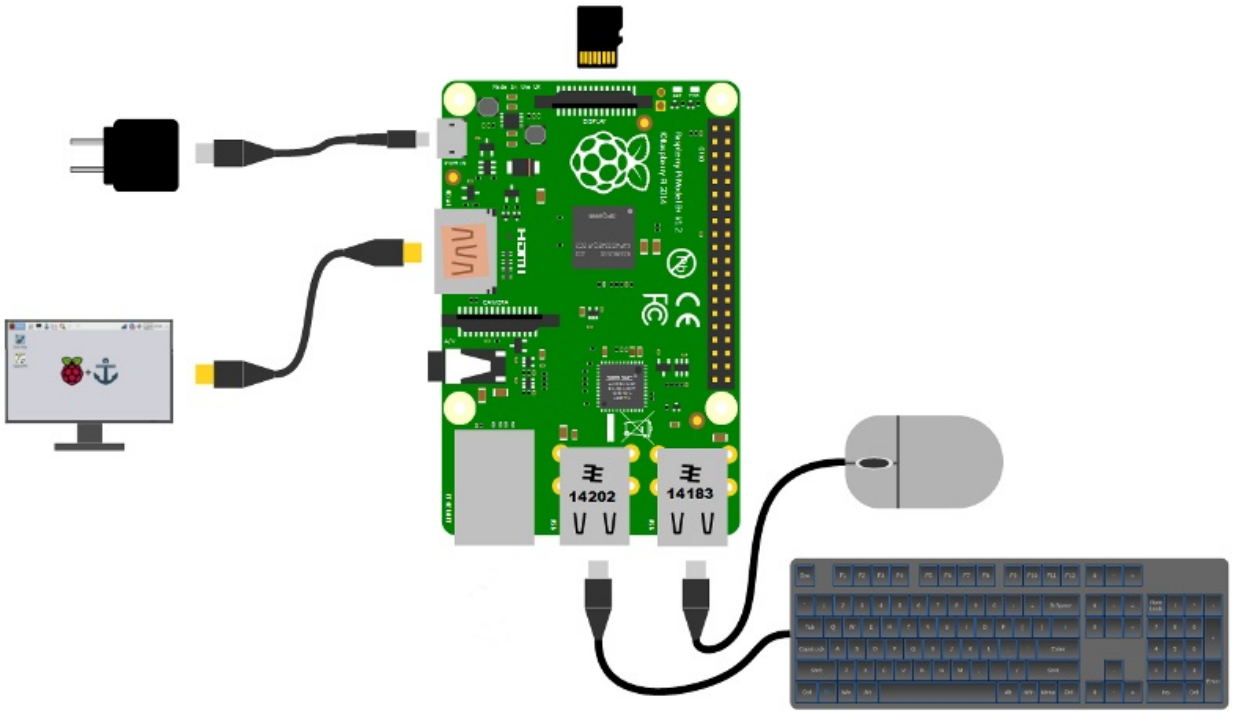
Required items

You need at least these items to run *the software* and you have two options: either **with monitor** or without monitor (**headless**).

If you need help with these basic parts see the official Raspberry Pi documentation[1].

Monitor option

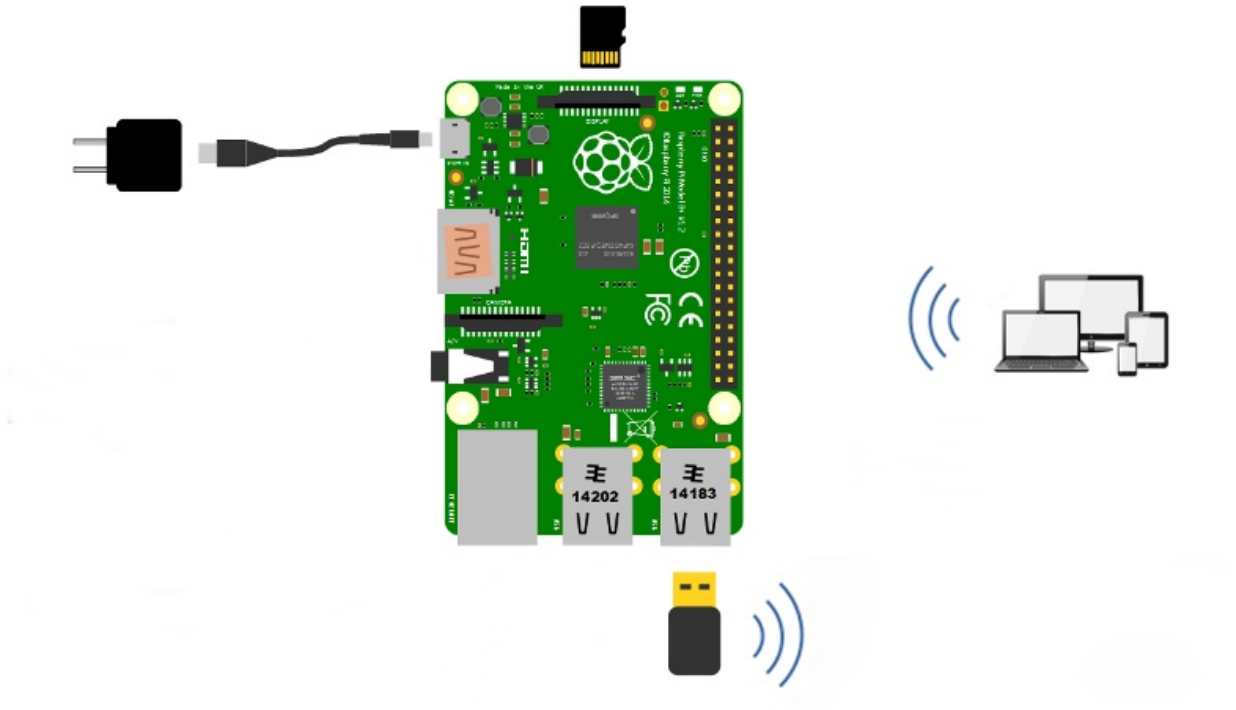
- **Raspberry Pi 3** or Raspberry Pi 2
- **Box**
- **Power supply**
- **HDMI monitor**
- **Keyboard and mouse**
- **SD card with OpenPlotter RPI** (*the software*)



Author: Malcolm Maclean[4], modified by Sailoog.

Headless option

- **Raspberry Pi 3** or Raspberry Pi 2 + WiFi dongle
- **Box**
- **Power supply**
- **SD card with OpenPlotter RPI** (*the software*)
- **Any laptop, tablet or smartphone**



Author: Malcolm Maclean[4], modified by Sailoog.

Where can you find them?

You can buy these basic parts from any official distributor[2] or any Raspberry store.

Occasionally we may have some of them on our store[3].

Optional items

Next chapters contain a list of supported devices to communicate with boat and sensors to collect data from environment.

Where can you find them?

Occasionally we may have some of them on our store[3].

---

[1] https://www.raspberrypi.org/learning/hardware-guide [2] https://www.raspberrypi.org/products [3] http://shop.sailoog.com
[4] https://leanpub.com/RPiMRE/read

Self powered USB Hub

This chapter needs to be written/updated/translated

http://forum.openmarine.net/forumdisplay.php?fid=16

If you are connecting devices which use more power than your Raspberry can provide, you will need a self powered USB Hub.

You can start connecting devices to the raspberry and switch to a self powered hub when you start to see strange behavior of the devices.

Hubs with **FE1.1S** chip work right, avoid hubs with MA8601 chip. Often the same model can contain any of them. And some of them do not contain chip at all! just a glob of black material to hide what is underneath ... nothing.

It would be a good idea to get a Hub with 5V input so that you could power it with the same source as your Raspberry.

You can also get a Hub with 12v input. Sometimes those devices have an output to charge phones or tablets which probably you could use to power your Raspberry.

USB WiFi dongle

This chapter needs to be written/updated/translated

http://forum.openmarine.net/forumdisplay.php?fid=16

You can set OpenPlotter either as access point to allow devices to connect to it or as client to connect to any access point. You can not do this at the same time with just one WiFI device so you will need an extra USB WiFi dongle for Raspberry 3 and two USB WiFi dongles for Raspberry 2 to do this.

Being connected to an access point as client to get Internet connection and at the same time running OpenPlotter as access point, you will be able to share Internet connection with all devices connected to OpenPlotter.

A good WiFi adapter will probably need more power than the Raspberry Pi USB port can provide, especially if there is a large distance from the WiFi adapter to the WiFi Access Point, or it is transferring large amounts of data. Therefore, you may need to plug the WiFi adapter into a powered USB hub.

Not all WiFi dongles can function as access point, only devices with the correct chipset will work. We recommend **RTL8192CU/CUS** chipset.

Settings

See WiFI AP chapter to configure OpenPlotter as client or access point.

USB GPS dongle

This chapter needs to be written/updated/translated

http://forum.openmarine.net/forumdisplay.php?fid=16

If you don't have any GPS on board or you want an extra positioning device, this is the cheapest and most effective way.

Connecting an USB GPS dongle to OpenPlotter will provide accurate position, date/time and speed/course over ground.

> This item is available in our store[1]

Settings

See NMEA 0183 chapter to configure USB GPS dongles.

[1] http://shop.sailoog.com

NMEA 0183 to USB converter

This chapter needs to be written/updated/translated

http://forum.openmarine.net/forumdisplay.php?fid=16

If you have electronics with NMEA 0183 outputs on board (depth, wind, heading...), you will need an USB converter to connect it to OpenPlotter. Additionally, if this converter is bi-directional, you will be able to talk to electronics with NMEA 0183 inputs like the autopilot.

The NMEA 0183 hardware standard uses **RS422** connectors but you may find some devices with **RS232** as well. Find out about what type of connection you need. In general, if you have a TX+ and a TX- and/or a RX- and RX+ you have a RS422 interface. If you ave a RX and a TX and a ground you have an RS232 interface.

> This item is available in our store[1]

Settings

See NMEA 0183 chapter to configure NMEA 0183 to USB converters.

[1] http://shop.sailoog.com

CAN-USB Stick

This chapter needs to be written/updated/translated

http://forum.openmarine.net/forumdisplay.php?fid=16

Project

The CAN-USB Stick project was done to analyse the data stream on a N2K network sending and receiving CAN messages. It is electrically isolated to avoid damages.

The program of the MCU has been re-engineered to work together with CANBOAT project[2], which is used by Signal K project[3]. Both packets are used in OpenPlotter project.

The CAN-USB Stick does also work with OpenSkipper project[4].

Not tested:

- MacENC[5]
- PolarView NS[6]

So it does use the command set which is used in the CANBOAT actisense-serial program. Sending and receiving data into the N2K network can be done directly from OpenPlotter too.

New PGNs are not blocked, as they are on other devices capable to work with CANBOAT. The transmission speed can be set higher than the CAN bus speed. Other devices capable to work with CANBOAT have a lower transferrate than N2K networks and they may suffer a bottleneck.

> This item is available in our store[9]

Hardware

The CAN-USB Stick V2 is based on a stm32 micro-controller (MCU) connected to an isolated CAN transceiver and an USB to serial converter.

Warning / Disclaimer

CAN-USB Stick is a research project on data communication on CAN bus and N2K networks in boats.

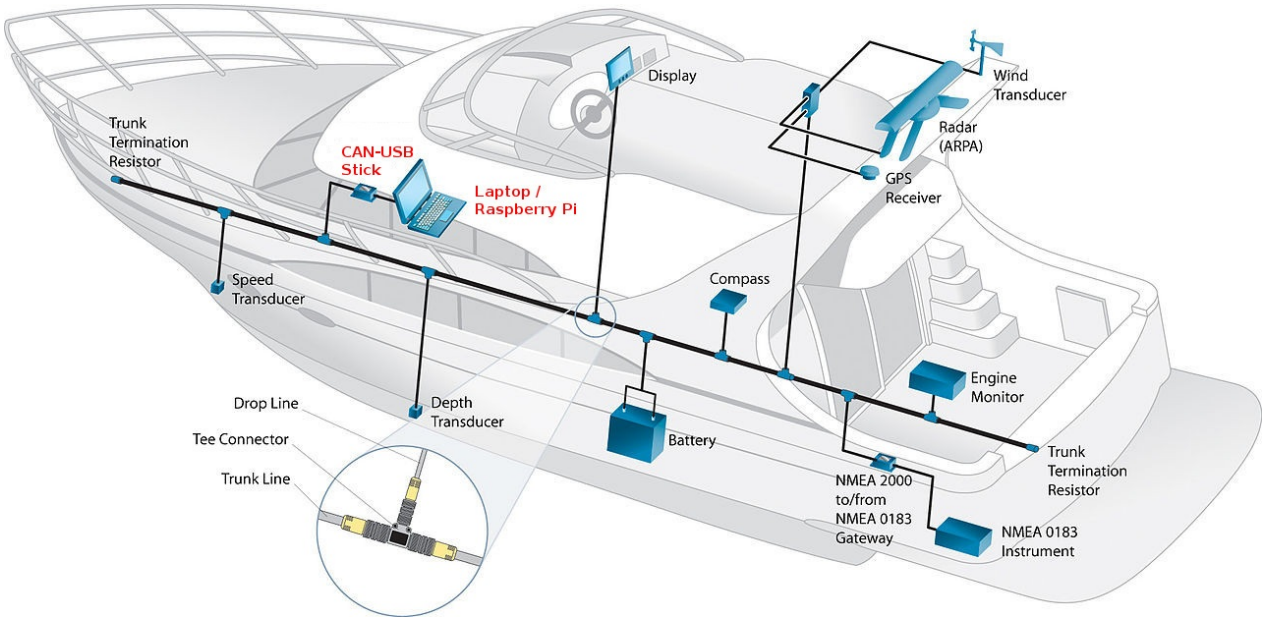
The software is still under development and has not been fully tested. Malfunctions of the CAN-USB Stick or any connected device might be possible at any time. Manipulating your N2K network could cause damage to connected devices.

Do not rely on data from this device and do not use it as primary source for navigation. Liability cannot be accepted for any damages, personal injuries or malfunctions caused by this device.

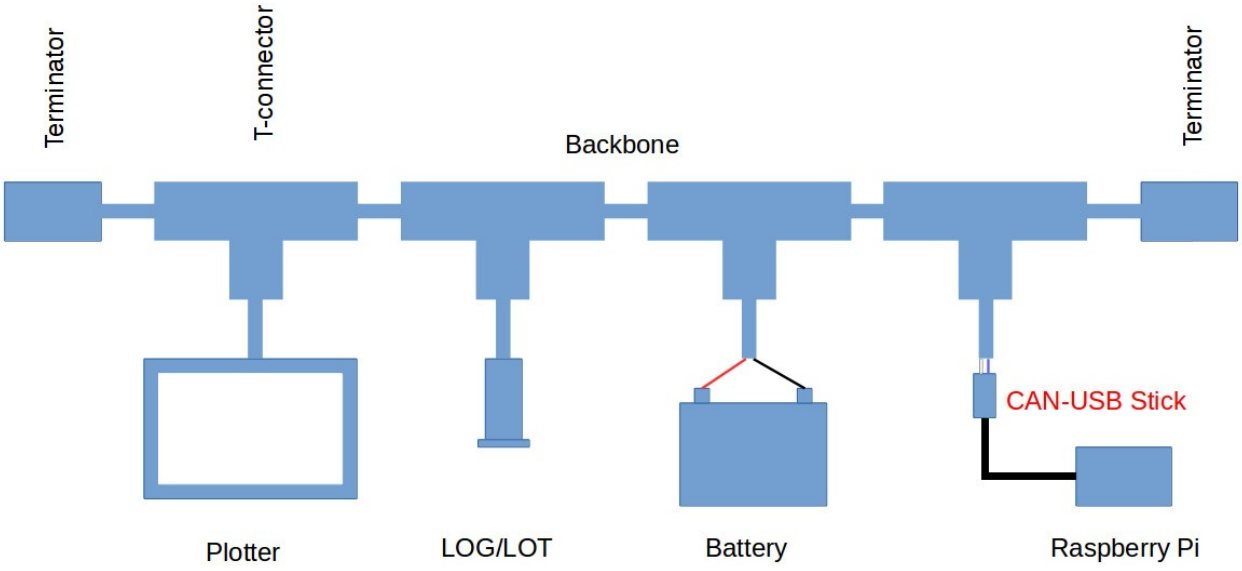
The CAN-USB Stick is not certified by NMEA®.

It is not allowed to use the Actisense® NMEA Reader software for the CAN-USB Stick.

N2K networks



Author: Femnett/Maretron[1], modified by Sailoog, CC BY 2.5 license.



Example of a small N2K Network.

N2K networks are described in Wikipedia[7]. The backbone (or trunk) starts with a 120Ω terminator and ends with a 120Ω terminator. Two resistors are working in parallel, so the resistance is 120Ω/2=60Ω. If there is a broken connection in the backbone you can measure only 120Ω or nothing but not 60Ω. That is a very easy way to check the bus.

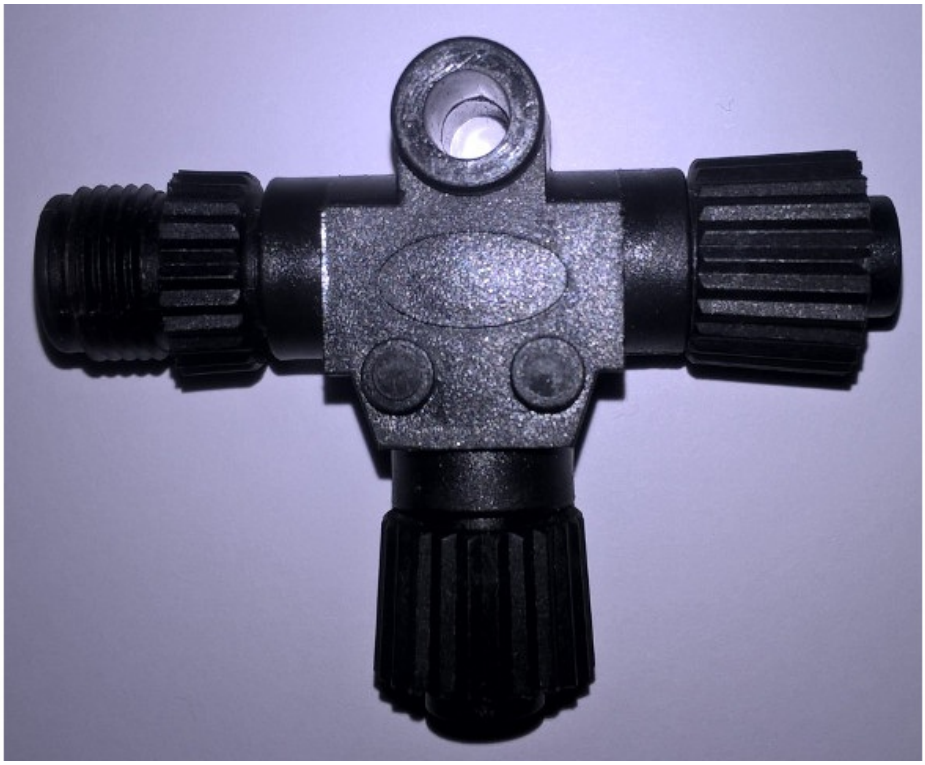
M12 male 120Ω terminator

The drop line to devices should not be longer than 6 m. The backbone can have 100m in length.

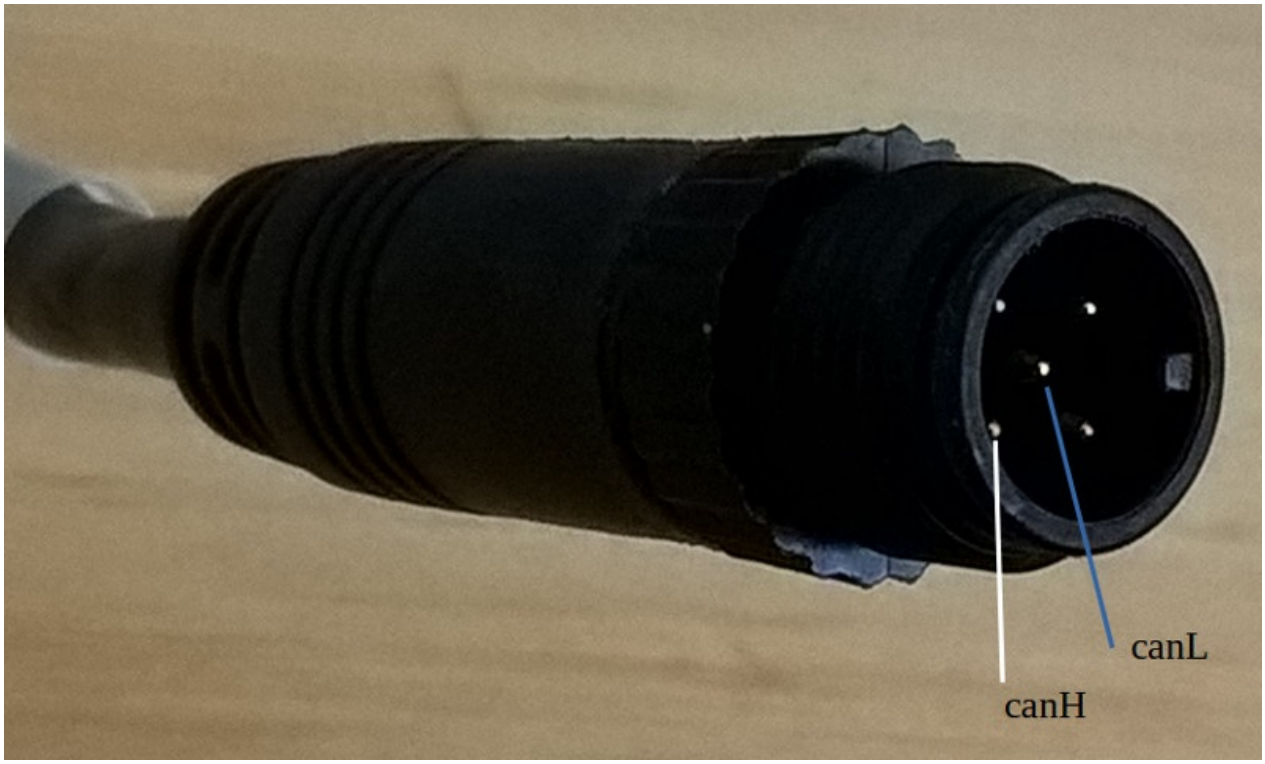
The CAN-USB Stick is electrically isolated so devices and your computer are protected even if they are powered by a diffent source than your N2K network.

Connection

To connect the CAN-USB Stick to the network you need a free T-connector on your backbone and a drop line. The drop line should have a M12 5 pin male connector in one side and 5 wires (but we only need 2) in the other side. The HIRSCHMANN ELST 5012 PG7 connector has a screw terminal.

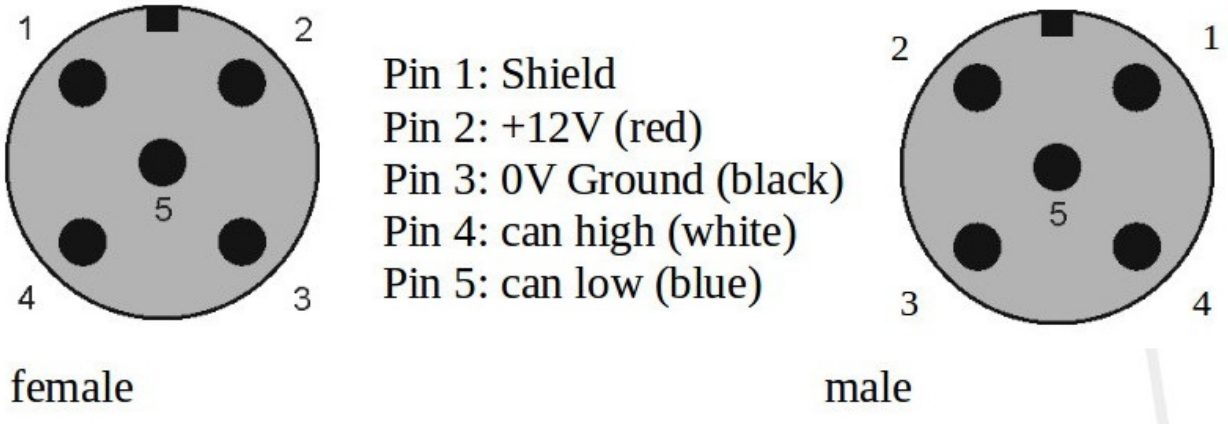


T-connector



Drop line M12 5 pins male connector side

Drop line wires side



- Pull out the green screw terminal of the stick.
- Connect the drop line blue wire from pin 5 (pin in the middle) to the green terminal on CANL.
- Connect the drop line white wire from pin 4 to the green terminal on CANH.
- Turn off the main power switch to be sure that there is no power on the network.
- Connect the drop line to the free T-connector on your backbone.
- Use a multimeter and measure the resistance between CANH and CANL (on the screws). The resistance should be around 60 Ohm.
- Connect the green screw terminal to the CAN-USB Stick.
- Check again the 60 Ohm between CANH and CANL.
- On the drop line there are three cables left. They have to be isolated.
- Turn on the main power.
- Switch on instrumentation.

To configure your CAN-USB Stick, see the chapter N2K. On Windows use OpenSkipper.

LED

The CAN-USB Stick LED will be **OFF** 10" during the boot secuence and then:

- Fixed **ON** if it is not connected to the network.
- **ON** for a second if it is connected to the network.
- Fixed **OFF** if there are not input data.
- **FLASHING** if there are input data.

Support

If you need support or you have any suggestion you can publish your questions on OpenMarine forum[8].

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[1] https://commons.wikimedia.org/wiki/File:NMEA2000_Modified_motor_yacht.jpg [2] https://github.com/canboat/canboat [3] http://signalk.org [4] http://openskipper.org [5] http://macenc.com [6] http://www.polarnavy.com [7] https://en.wikipedia.org/wiki/NMEA_2000 [8] http://forum.openmarine.net/forumdisplay.php?fid=11 [9] http://shop.sailoog.com

USB DVB-T dongle

This chapter needs to be written/updated/translated

http://forum.openmarine.net/forumdisplay.php?fid=16

DVB-T dongles based on the Realtek **RTL2832U** chip can be used as cheap one channel AIS receptors. You can also receive the entire VHF marine band.

These devices are called Software Defined Radio (SDR) receivers.

SDR receivers will need more power than the Raspberry Pi USB port can provide. You need to plug the dongle into a self powered USB hub.

> This item is available in our store[4]

Antenna

The most important factor for good reception is the antenna. Any VHF antenna will work right. You can build some proficient homemade antennas[1][2][3].

Settings

Some SDR devices need calibration to receive AIS signal. See SDR receiver chapter to configure USB DVB-T dongles as AIS or marine radio receivers.

[1] http://www.radioforeveryone.com/p/ais-antennas.html [2] http://nmearouter.com/docs/ais/aerial.html [3] https://www.youtube.com/watch?v=SdEglNHyHB4 [4] http://shop.sailoog.com

IMU sensor

This chapter needs to be written/updated/translated

http://forum.openmarine.net/forumdisplay.php?fid=16

If you don't have a electronic compass on board you will need an IMU.

An Inertial Measurement Unit, or IMU, measures and reports on velocity, orientation and gravitational forces, using a combination of an accelerometer, gyroscope, and a magnetometer.

Connecting an IMU to OpenPlotter will provide magnetic heading which is needed to calculate true heading and true wind. You will have heel angle data as well.

> This item is available in our store[1]

Supported IMU sensors

- InvenSense MPU-9150 single chip IMU.
- InvenSense MPU-6050 plus HMC5883 magnetometer on MPU-6050's aux bus (handled by the MPU-9150 driver).
- InvenSense MPU-6050 gyros + acclerometers. Treated as MPU-9150 without magnetometers.
- InvenSense MPU-9255 single chip IMU (I2C and SPI).
- STM LSM9DS0 single chip IMU.
- STM LSM9DS1 single chip IMU.
- L3GD20H + LSM303D (optionally with the LPS25H) as used on the Pololu AltIMU-10 v4.
- L3GD20 + LSM303DLHC as used on the Adafruit 9-dof (older version with GD20 gyro) IMU.

- L3GD20H + LSM303DLHC (optionally with BMP180) as used on the new Adafruit 10-dof IMU.
- Bosch BMX055 (although magnetometer support is experimental currently).
- Bosch BNO055 IMU with onchip fusion. Note: will not work reliably with RaspberryPi/Pi2 due to clock-stretching issues.

Wiring

IMU sensors have to be connected by I2C interface. See chapter Wiring I2C sensors.

Settings

See Compass chapter to configure IMU sensors.

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[1] http://shop.sailoog.com

Environment sensors

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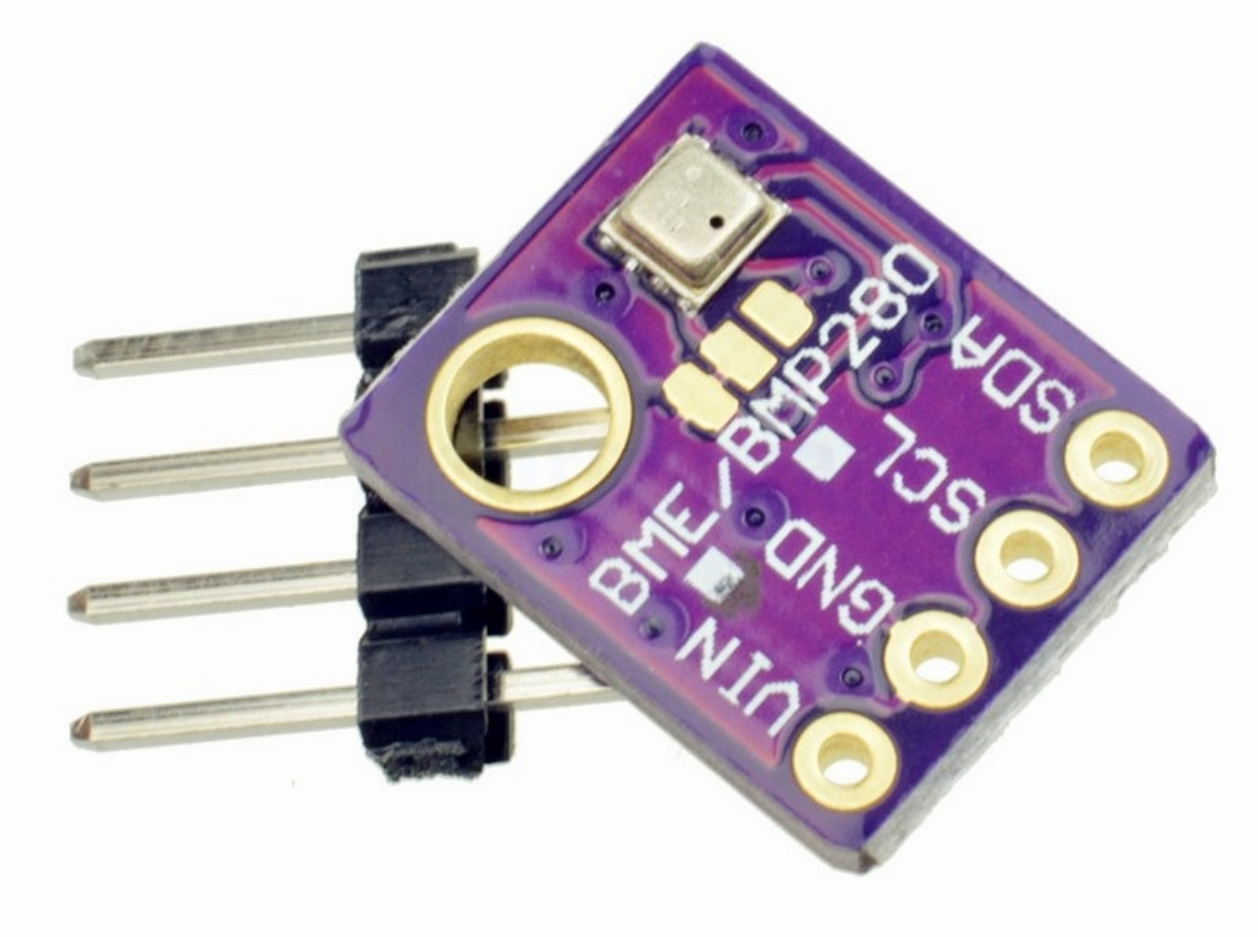
http://forum.openmarine.net/forumdisplay.php?fid=16



Connecting a little environment sensor to OpenPlotter will provide air pressure, temperature or humidity data to monitor weather.

> This item is available in our store[1]

Supported environment sensors

- BME280 (pressure, temperature, humidity)
- BMP180 (pressure, temperature)
- LPS25H (pressure, temperature)
- MS5611 (pressure, temperature)
- MS5637 (pressure, temperature)
- HTS221 (humidity, temperature)
- HTU21D (humidity, temperature)

Wiring

Environment sensors have to be connected by I2C interface. See chapter Wiring I2C sensors.

---

[1] http://shop.sailoog.com

1W temperature sensor

This chapter needs to be written/updated/translated

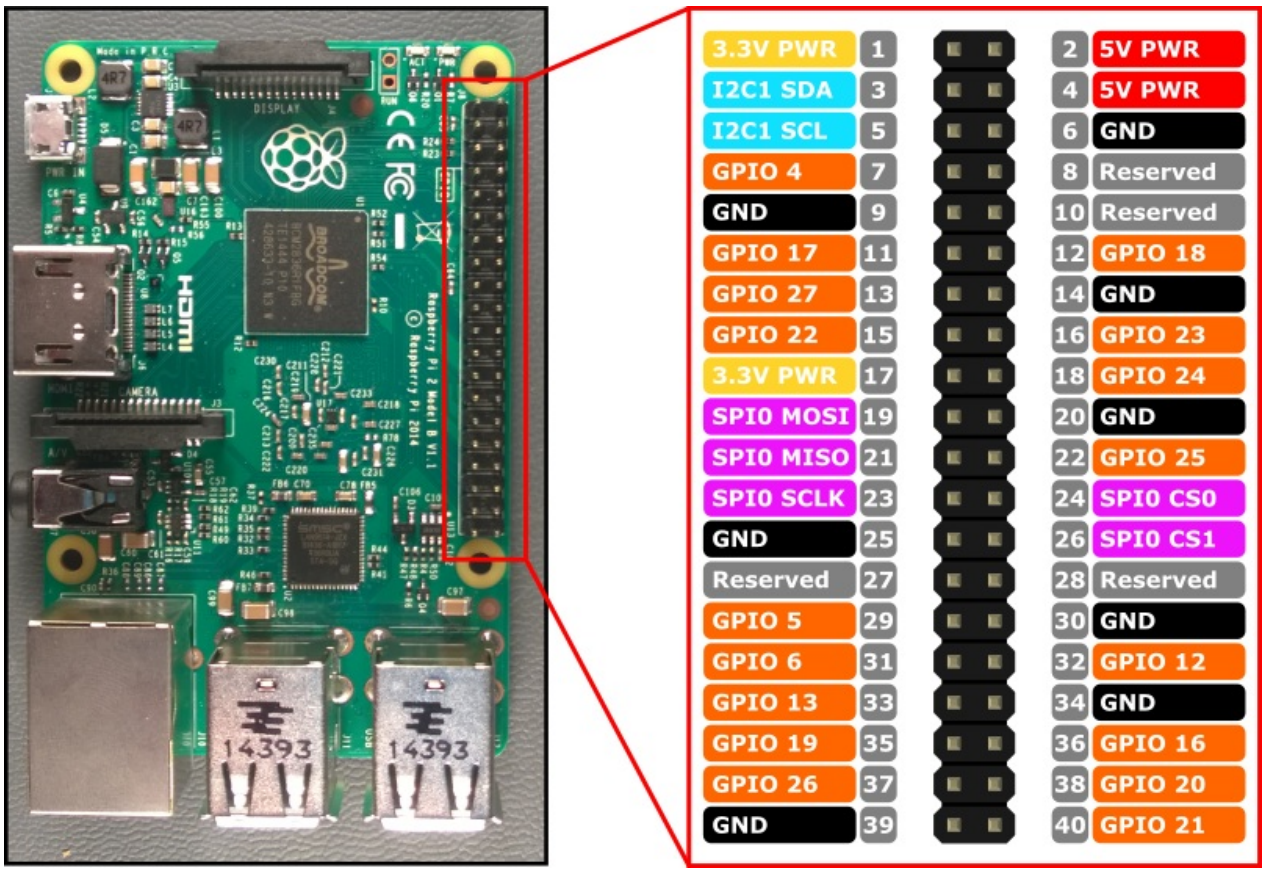
http://forum.openmarine.net/forumdisplay.php?fid=16

You can connect one wire (1W) **DS18B20** sensors to OpenPlotter. This sensor is waterproof and can withstand high temperatures. Connecting multiple DS18B20 in parallel to the same pins, you will be able to get temperature data from coolant engine, exhaust, engine room, fridge, sea ...

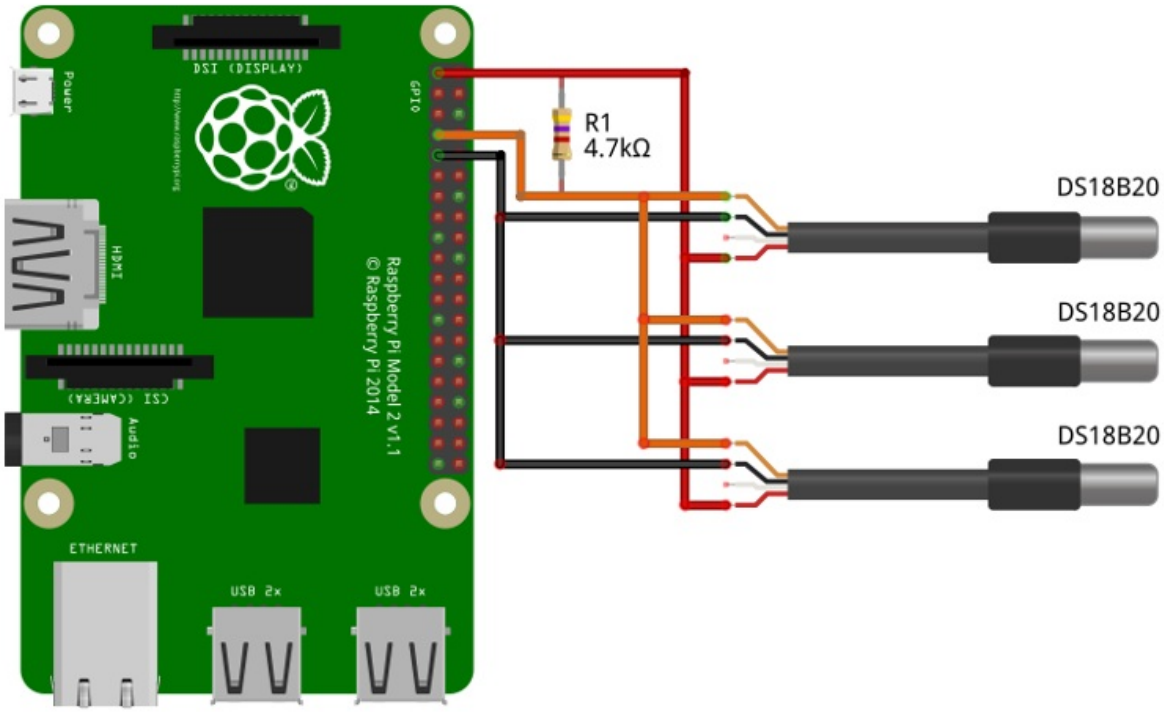
> This item is available in our store[1]

Wiring

Pins names are according to the diagram below.



You have to connect these sensors to **GPIO4** (aka GCLK), **GND** and **3.3V** pins. Some sensors may have a fourth wire which do not need to be connected. You need to use a pull-up resistor as shown in the image below. You can connect multiple sensors in paralel using just one resistor.



If you want to change the GPIO pin, edit the file config.txt typing in a terminal:

```
sudo nano /boot/config.txt
```

At the end of the file you should see a line like this

dtoverlay=w1-gpio

replace it by

dtoverlay=w1-gpio,gpiopin=x

where x is your desired GPIO pin. Save and reset.

Settings

See 1W chapter to configure DS18B20 sensors.

---

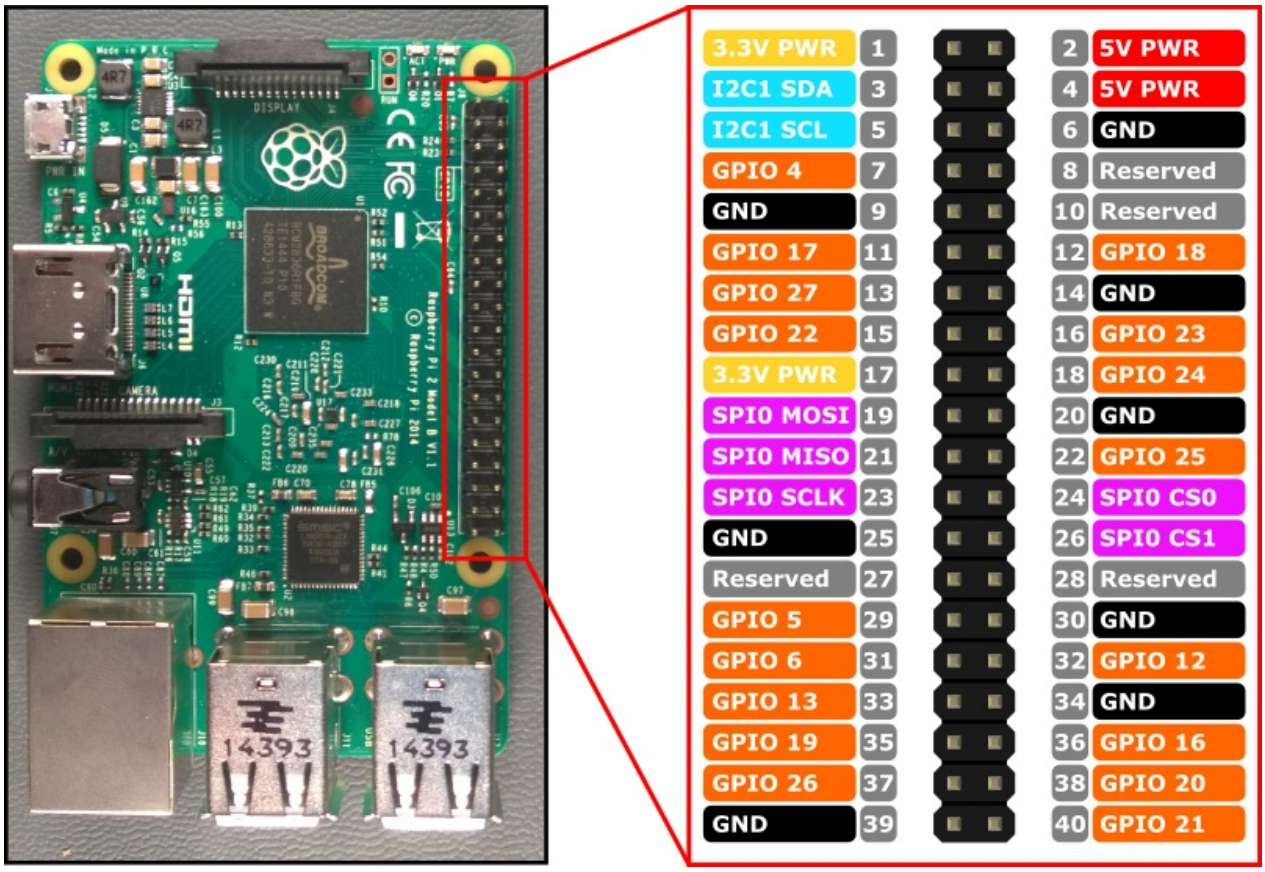
[1] http://shop.sailoog.com

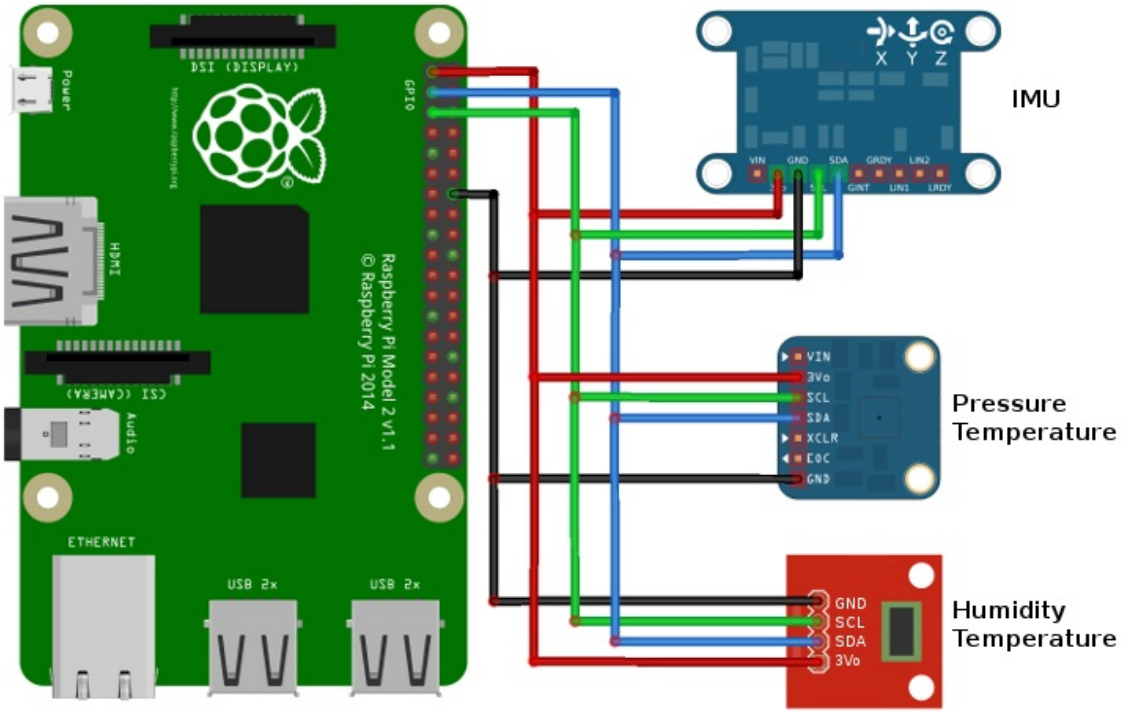
Wiring I2C sesnsors

This chapter needs to be written/updated/translated

http://forum.openmarine.net/forumdisplay.php?fid=16

Pins names are according to the diagram below.



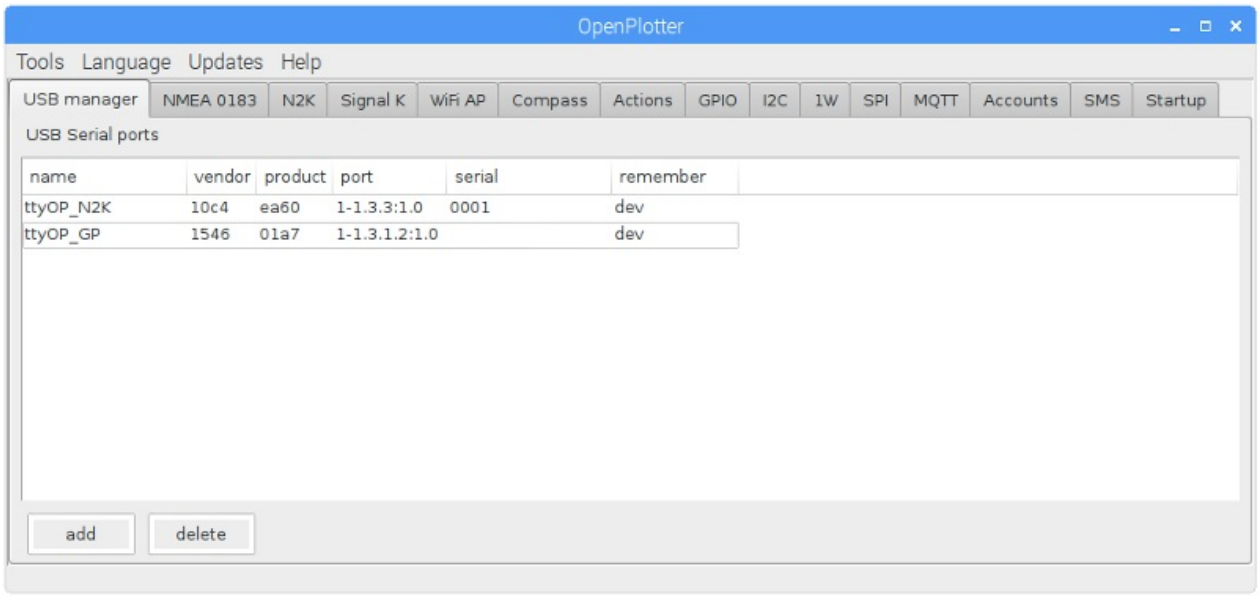

DSI (DISPLAY)
Power
GPIO
HDMI
(CAMERA) CSI
Audio
ETHERNET
USB 2x
USB 2x
Raspberry Pi Model 2 v1.1
© Raspberry Pi 2014
X Y Z
IMU
VIN
GND
SDA
GRDY
LIN2
GINT
LIN1
LRDY
VIN
3Vo
SCL
SDA
XCLR
EOC
GND
Pressure
Temperature
GND
SCL
SDA
3Vo
Humidity
Temperature

OpenPlotter Tabs

This chapter needs to be written/updated/translated

http://forum.openmarine.net/forumdisplay.php?fid=16

Most of the core features of OpenPlotter can be configured from controls located on tabs.



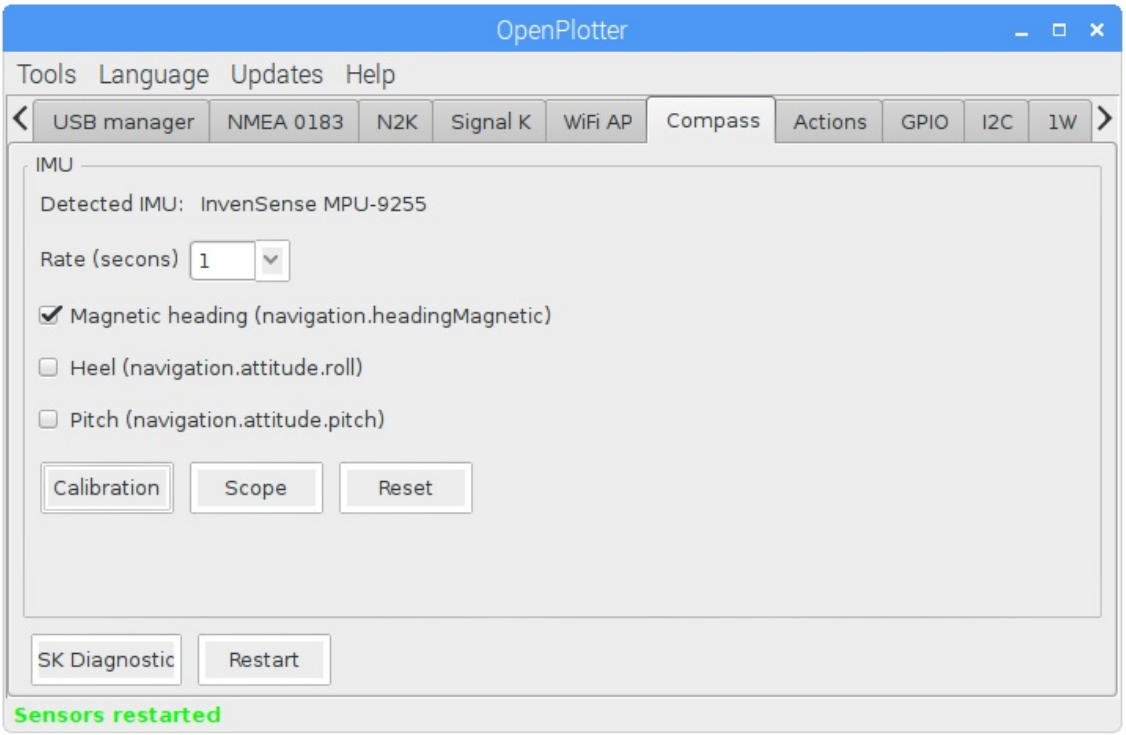
Compass

This chapter needs to be written/updated/translated

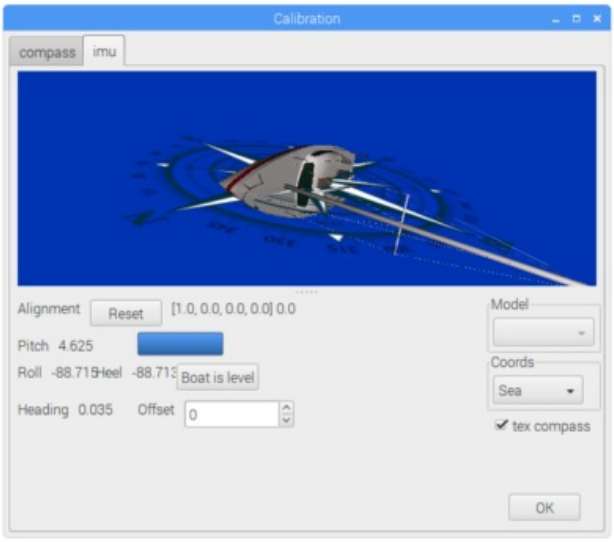
http://forum.openmarine.net/forumdisplay.php?fid=16

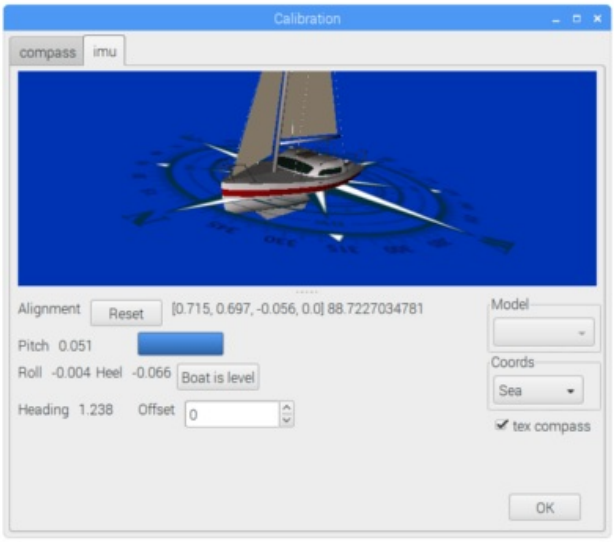
Place the IMU on his final position on board and away from possible metallic sources of interference, especially from speakers. After connecting the IMU, it should be detected on *Compass* tab.

Enable reception of at least one of the 3 possible magnitude and press *Calibration*.

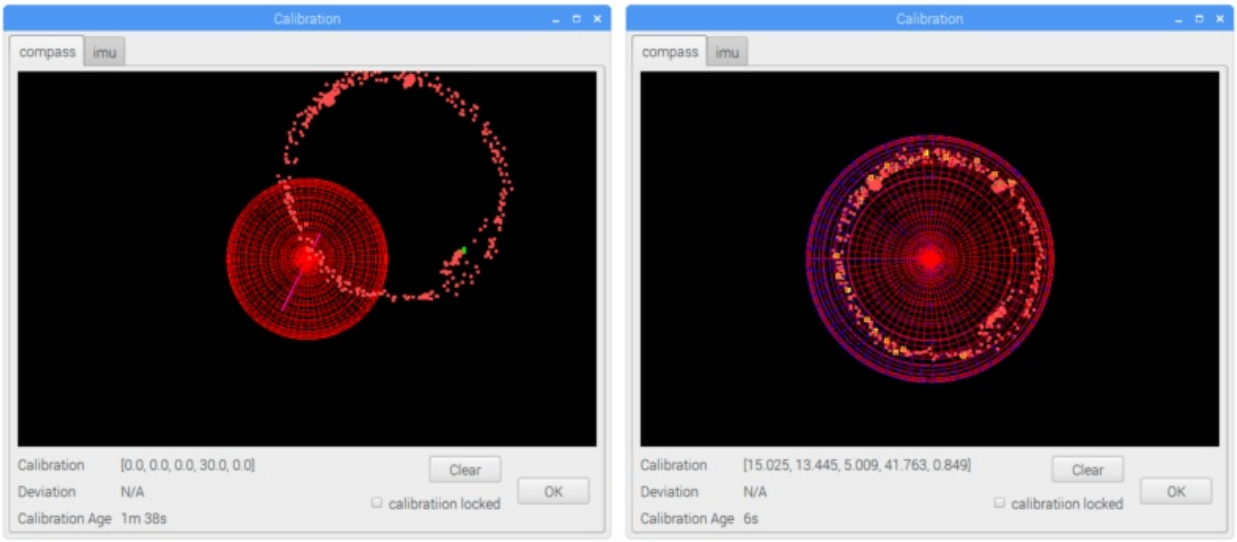


Being moored in port and the boat as more leveled as possible, select the *imu* tab and press *Boat is level*. After few seconds the 3D boat should be leveled.





Do not close the Calibration window, select the *compass* tab and go sailing normally. The system will collect data from the IMU during 2 minutes and if there is more than 60 degrees of heading variation and the collected data is valid, it will calibrate the IMU. A blue sphere should appear and the cloud of points should fit the red sphere.



The system will keep re-calibrating all the time every 2 minutes if reception of any of the IMU magnitudes is enabled and it has collected enough valid data. Every 10 minutes calibration and level data are saved to be used on next sesions.