

# **CysBOX**

# **User Manual**

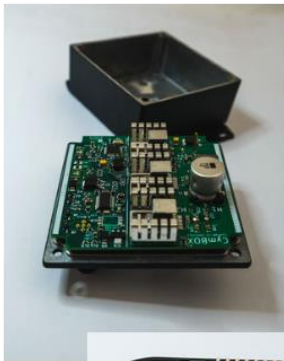
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## 1 SPECIFICATIONS

# CYSBOX SYSTEM

## HIGH PERFORMANCE MARINE OPEN SOLUTIONS



**CysBOX** is an open and scalable system which allows the electronic management of the boat by using the most recent technologies (ARM processors, radio communications, etc.) while remaining compatible with existing wiring (NMEA183, NMEA2000, etc.).

The main application of the CysBOX system is the CyPilot software. CyPilot is an innovative and scalable autopilot that allows different operating modes, from simple PID mode to more advanced modes (auto tuning, etc.). It allows the development of new operating modes based on self-learning algorithms.

CysBOX is an open system that allows the use of most browser software: qtVIm, OpenCPN, Signal K server, etc.

The CysBOX hardware is made up of following modules:

- ◆ **CysBOX:** central unit, "heart" of the system, which offers advanced functionalities based on open-source software: existing software (signal-K server, mapping, etc.) or own developments (pilot, alarm management, etc.)
  - Processor:
    - Quad-core ARM at 1.5GHz (Raspberry Pi4B)
  - Connectivity:
    - **USB:** 3 x USB "Host"
    - **PC:** 1 x USB "Device"
    - **NMEA1, NMEA2:** 2 x NMEA0183
    - **COM1, COM2:** 2 x HS serial links (1 Driver, 1 GP)
    - **CAN:** 1 x NMEA2000
    - **AUDIO:** 1 x Analog/Audio
    - **HDMI:** 1 x Video (optional external screen)
    - **GPS:** 1 x SMA (active GPS antenna)
    - **RF:** 1 x SMA (RF remote control antenna)
    - **LAN:** 1 RJ45 Gigabit/Ethernet
  - Internal functions:
    - Slot Pi4B:
      - I/O 40 and USB3
      - Power management
      - Gigabit/Ethernet and Wi-Fi
      - Bluetooth
    - HUB USB (1 reversible port for PC connection)
    - GPS: update rate up to 18Hz (U-Blox)
    - 9-axis IMU: 10Hz measurement frequency (BNO085-Hillcrestlabs)
    - RF433Mhz: CysRC pilot remote control (RFM69)
    - UART HS:
      - NMEA2000 (CAN gateway ATMEGA64M1)
      - NMEA0183 (2)
    - HS serial port (2 including CysPWR pilot link)
    - 433MHz radio interface (dedicated to the CysRC pilot remote control)
    - Analog / Audio interface
  - Applications:
    - Pilot (CyPilot)
    - Voice alarms (CyAlarm)
    - Open source applications compatible with Raspberry OS
- ◆ **CysPWR:** power unit for helm control
  - Processor:
    - ATMEGA64M1
  - Connectivity:
    - **Power:** 1 x DC04 Power input (max 40A)
    - **Motor:** 1 x DC04 Helm motor output (eg: L&S clutch, max 40A)
    - **Rudder:** 1 x AU05 Rudder angle sensor and temperature probe inputs (*option*)
    - **Clutch:** 1 x AU05 Cylinder clutch output and Bar stop inputs (*option*)
    - **Serial:** 1 x AU05 Serial link HS CysBOX
    - **CAN:** 1 x NMEA2000 (*option*)
- ◆ **CysRC:** remote control (IP68)

## 2 Using the Autopilot

### 2.1 CysBOX – User Interface (UI)

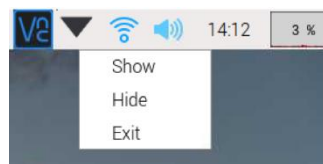
#### 2.1.1 CysBOX – Starting AutoPilot Control

The User Interface is launched by double-clicking UI Icon



This starts the autopilot and activates the remote control.

When Autopilot is active, an icon  appears in the system taskbar.

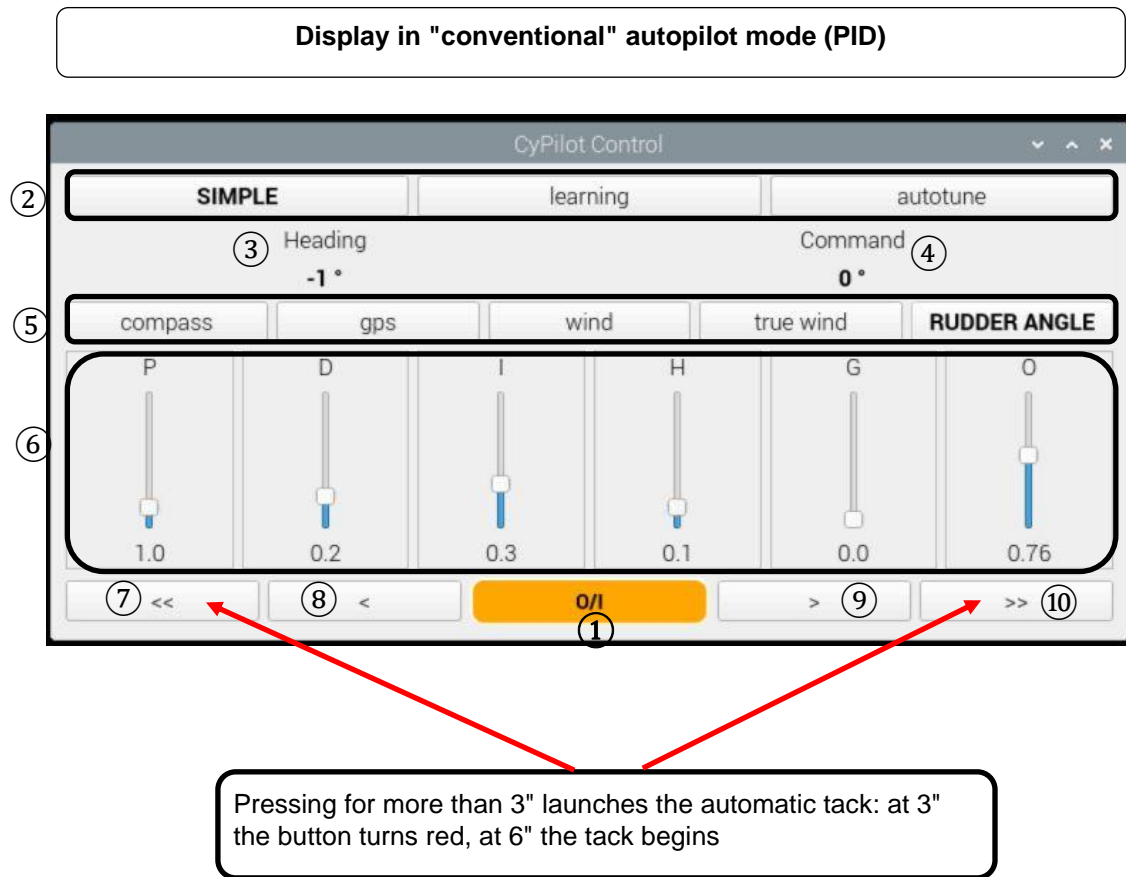


A click on this icon stops the autopilot, and displays or hides the execution log:

```

QT Cypilot
pilot_path > get the lock : autopilot
pilot_imu > Using Hillcrestlabs BNO08X IMU device
nmea > nmea process 20169
nmea > listening on port 20220 for nmea connections
gpsd > GPS Async port disabled
gpsd > GPS Rate changed to 5Hz
gpsd > GPS USB port enabled for UBX and NMEA
gpsd > gpsd: restart device /dev/ttyACM0
gpsd > gps process 20181
perf > [Errno 2] No such file or directory: '/home/pi/.cypilot/interpolate_polar.csv'
perf > Performance data won't be available
ble_calypso > uwble failed to initialize BLE device : Failed to connect to peripheral fd:3d:c3:20:16:a9, addr type: random
  
```

## 2.1.2 CysBOX – AutoPilot Control



This is the main control dialogue of the autopilot

- ① ON/OFF button → the color indicates the mode:
  - Green: ON
  - Orange: OFF
- ② Algorithm Pilot:
  - Simple: basic PID algorithm
  - Auto-tune: automatic selection of the best PID values depending on wind speed, angle, ...
  - Learning: auto-learning algorithm based on recorded navigation data
- ③ Current Heading / wind angle / rudder angle
- ④ Autopilot setpoint (heading, wind angle, rudder angle)
- ⑤ Autopilot Mode:
  - Compass: use compass heading
  - GPS: use GPS heading
  - Wind: use apparent wind angle
  - TrueWind: use True Wind angle
  - Rudder: use rudder angle
- ⑥ Autopilot algorithm settings:
  - P
  - D
  - I
  - H
  - G
  - O
  - M
- ⑦ 10° Port
- ⑧ 1° Port
- ⑨ 1° Starboard
- ⑩ 10° Starboard

Tack command by a long press on («) (»).

Note :

The "simple" and "autotune" modes are based on a PID control algorithm.

PID stands for Proportional, Integral, Derivative:

P: Proportional action: linear reaction proportional to the error

I: Integral action: intervenes to correct the static error

D: Derivative action: intervenes during rapid changes

The additional parameters H, G, O, M make it possible to refine the behavior of the autopilot.

H: Heel: coefficient to correct the heel

G: Gain: coefficient to correct the amplitude of the helm command according to the speed of the boat

O: Overlay: adds additional processing (PID)

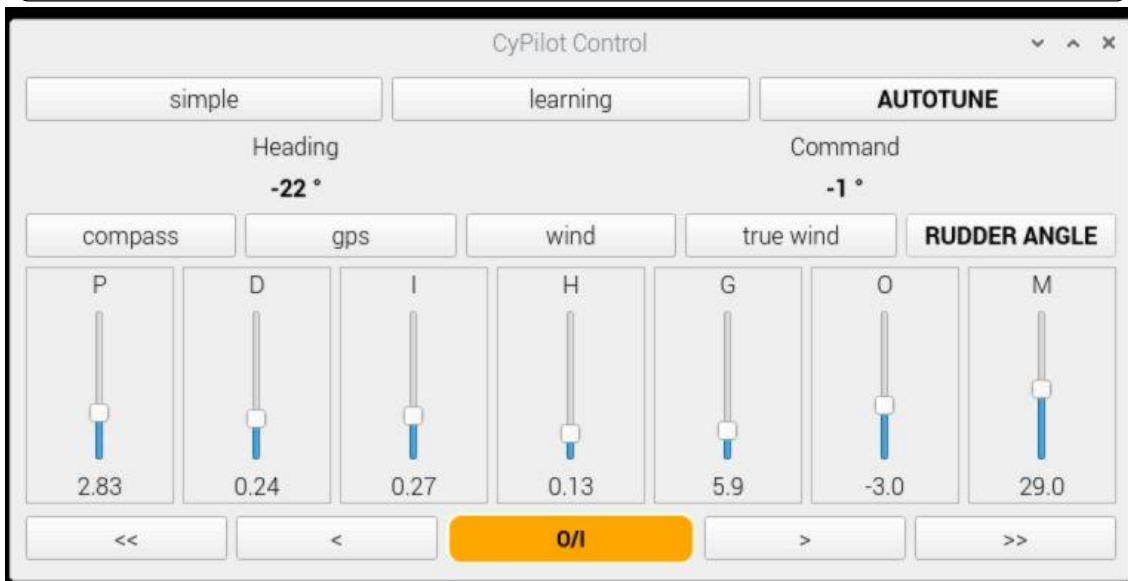
M: Calculation time of average wind conditions in Autotune mode

## Display in "learning" autopilot mode



Choice of model for the learning algorithm

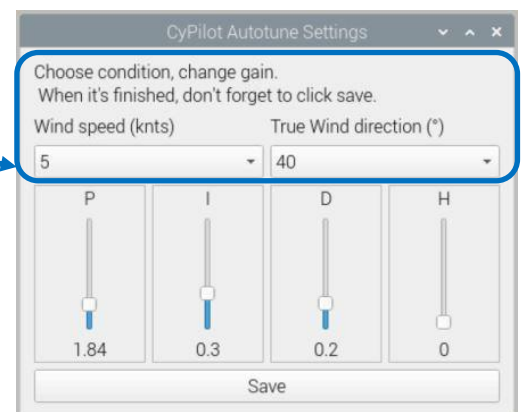
## Display in "autotune" autopilot mode



A long press on the "AUTOTUNE" button activates the selection dialog parameters depending on the wind conditions.

Operation in "autotune" mode is the same as in "simple" mode but the P/I/D/H parameters are automatically selected according to the navigation conditions.

The file: **"autotune\_settings.txt"** in the configuration directory: **/home/pi/cypilot-settings** allows to define the sets of parameters for different conditions of wind mode and wind speed

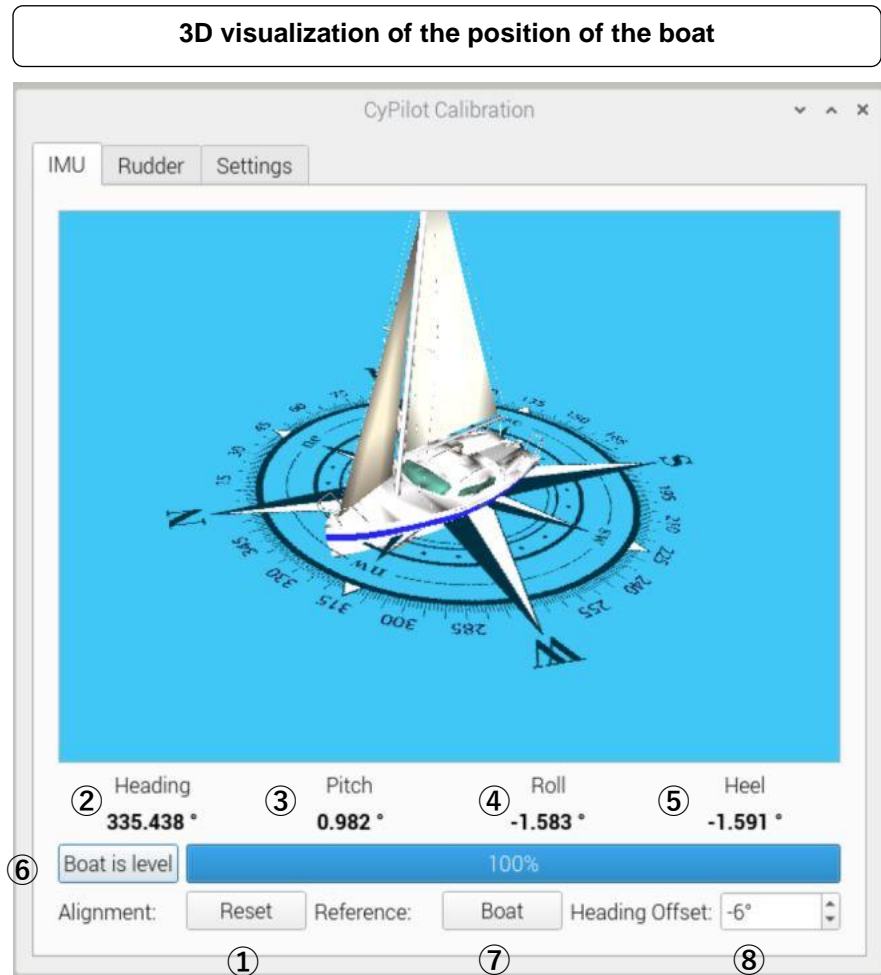




## 2.2 CysBOX – Calibration dialog


The In the main menu, open the file **CyPilot tools**→**Calibration client** to launch the calibration procedures: alignment of the inertial unit (IMU), rudder control settings (Rudder), and settings (Settings)

### 2.2.1 Alignment



- ① Resetting the alignment settings of the boat,
  - ② Current heading
  - ③ Angle on the pitch axis in degrees
  - ④ Angle on the roll axis in degrees
  - ⑤ Angle on the heel axis in degrees
  - ⑥ Initialization of boat alignment settings (IMU) based on the current position of the boat
- Progress of the alignment procedure
- ⑦ Visualization of the boat according to:
    - sea
    - boat
  - ⑧ Setting the heading correction

### Alignment procedure

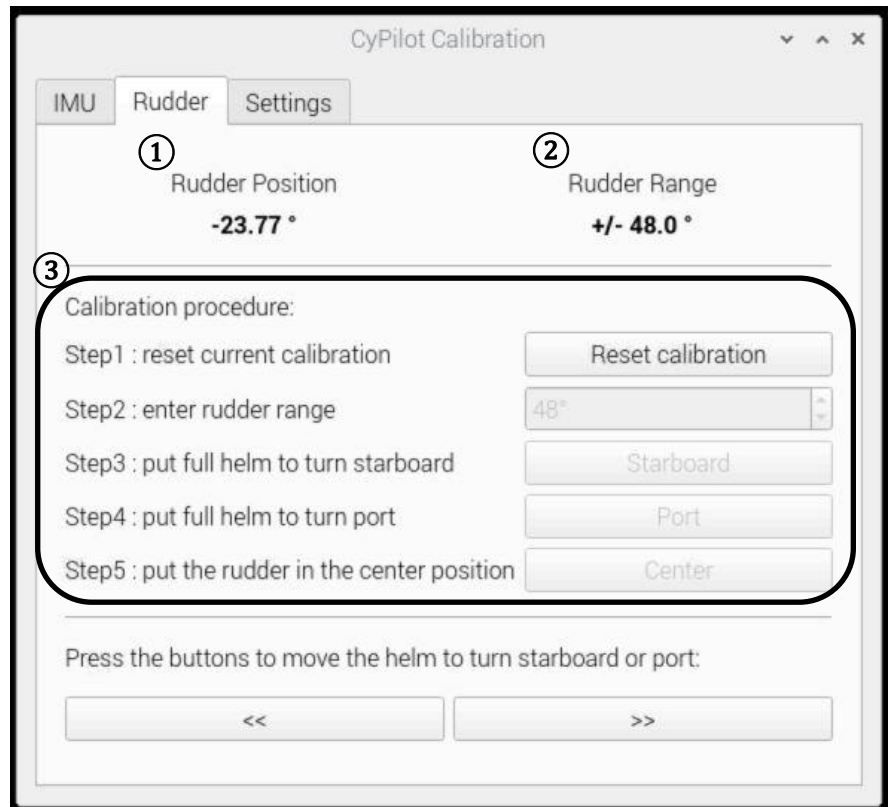
The autopilot  must be stopped (Disengaged).

1. Click on the "Boat is level" button when the boat is stable in navigation position.  
The progress bar allows you to follow the alignment procedure.  
The calibration values "Pitch" "Roll" "Heel" must be close to 0 and the model of the boat aligned.
2. Adjust the exact "Heading" by setting the "Offset" field → the compass heading of the boat must be equal to that of the "Heading".

Note: a declination and deviation table allow precise correction according to the magnetic heading.  
(Settings directory: **/home/pi/.cypilot**, File: **cypilot\_deviation.conf** )

### 2.2.2 Rudder

- ① Rudder angle
- ② Max angle of the port/starboard rudder
- ③ Resetting rudder stops



#### Rudder angle sensor calibration procedure

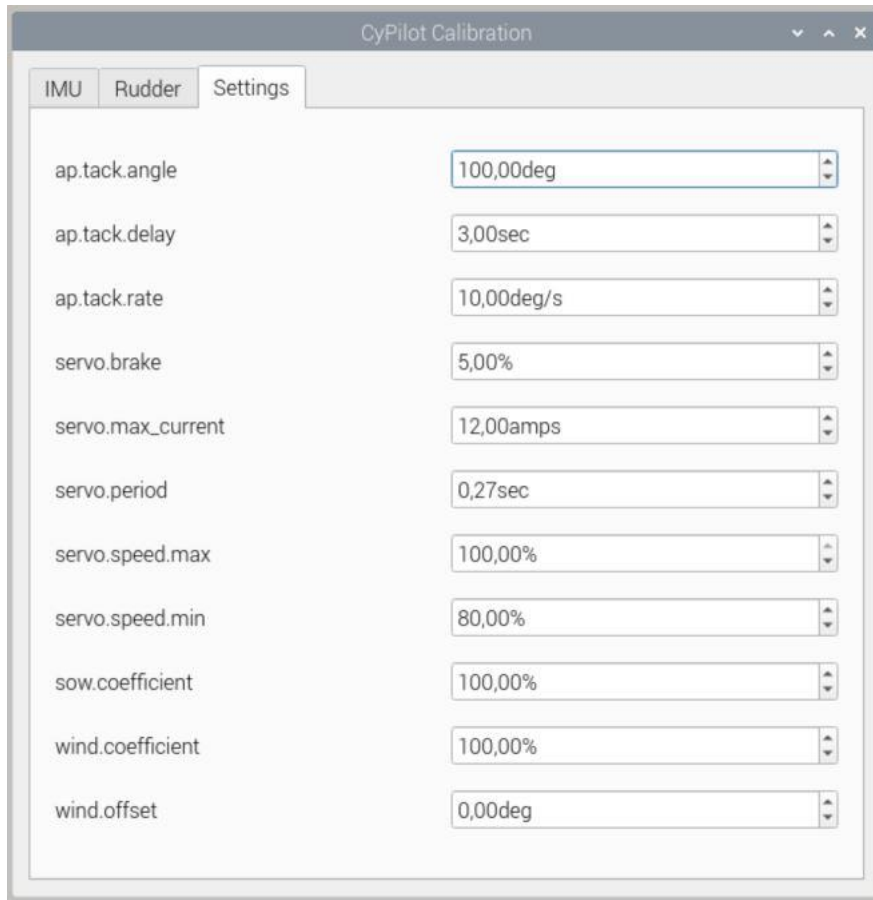
The autopilot on must be stopped (Disengaged).

1. Click on the "Reset calibration" button → Step2 and Step3 are now accessible
2. Follow Step2 to 5

Note: provide a margin of safety before mechanical stops

Note: If the control servomotor cannot be mechanically disengaged, e.g. in the case of an external actuator, it is possible to position the bar with the buttons («) (»)). The bar movements are of low amplitude as long as the calibration procedure is not complete, to avoid stress on the mechanical stops. When the calibration is complete, the "Starboard" "Port" "Rudder centered" buttons and the "range" field are grayed out and the "Offset" "Scale" and "non-linearity" values are displayed.

### 2.2.3 Settings



This dialog allows you to choose the main parameters:

ap.tack.angle	Tack angle	degree
ap.tack.delay	Delay before tacking	seconds
ap.tack.rate	Tacking rate	degree/second
servo.brake	End of bar movement braking	%
servo.max_current	Max servomotor current	amperes
servo.period	Rudder control period	seconds
servo.speed.max	Max servomotor speed	%
sow.coefficient	Surface speed	%
wind.coefficient	Wind patch	%
servo.speed.min	Min servomotor speed	%
wind.offset	Wing angle offset	degrees

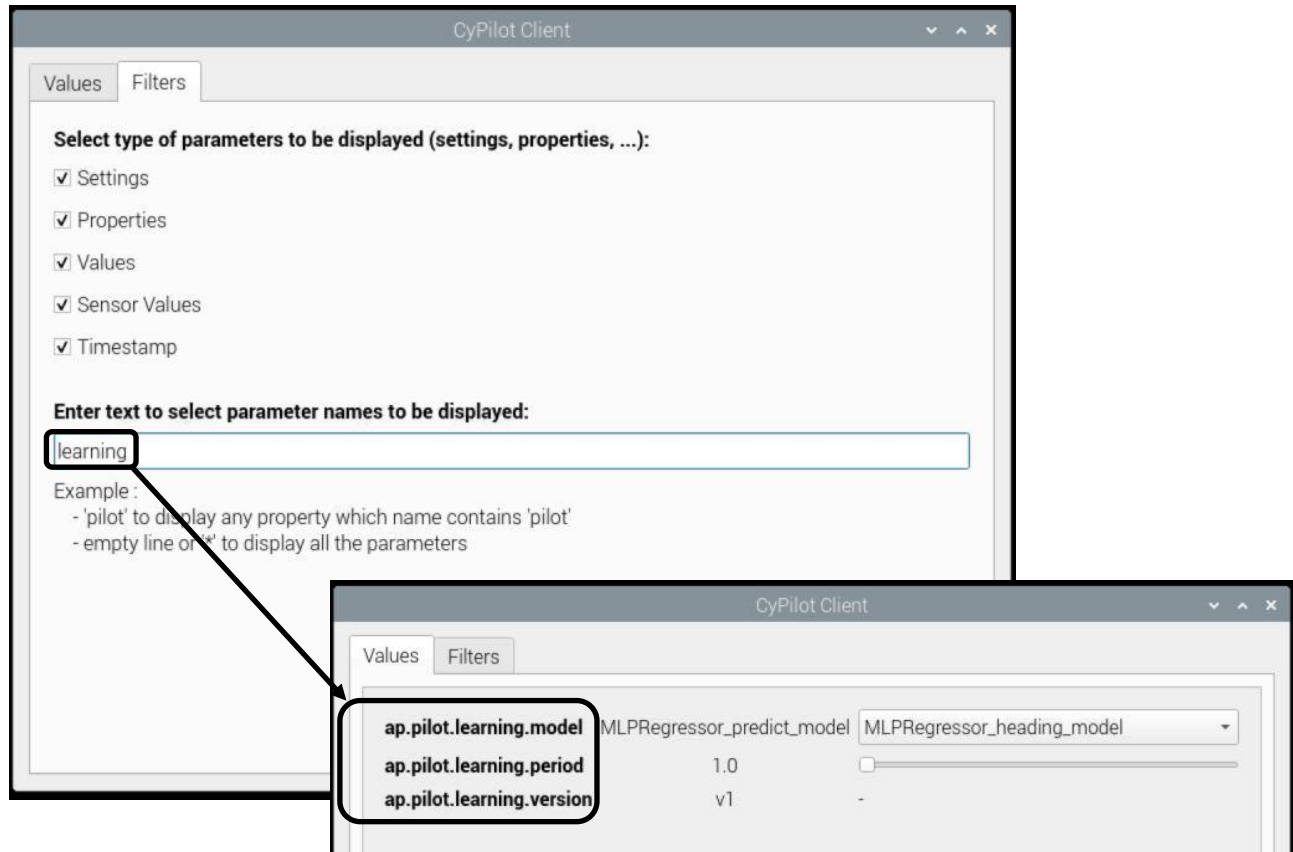
## 2.3 CysBOX – Configuration dialog



The main parameters are accessible through the calibration dialog.  
The **Client** dialog allows the reading of all parameters.

The "Filters" tab allows you to choose the values saved on the autopilot server that are displayed:

- depending on the type of value:
  - Settings: configuration parameters
  - Sensor Values: sensor values (wind, gps..)
  - etc....
- depending on the name



### 2.4 CyPilot-Dashboard

CyPilot Dashboard is launched by double clicking on the icon



Real-time data display

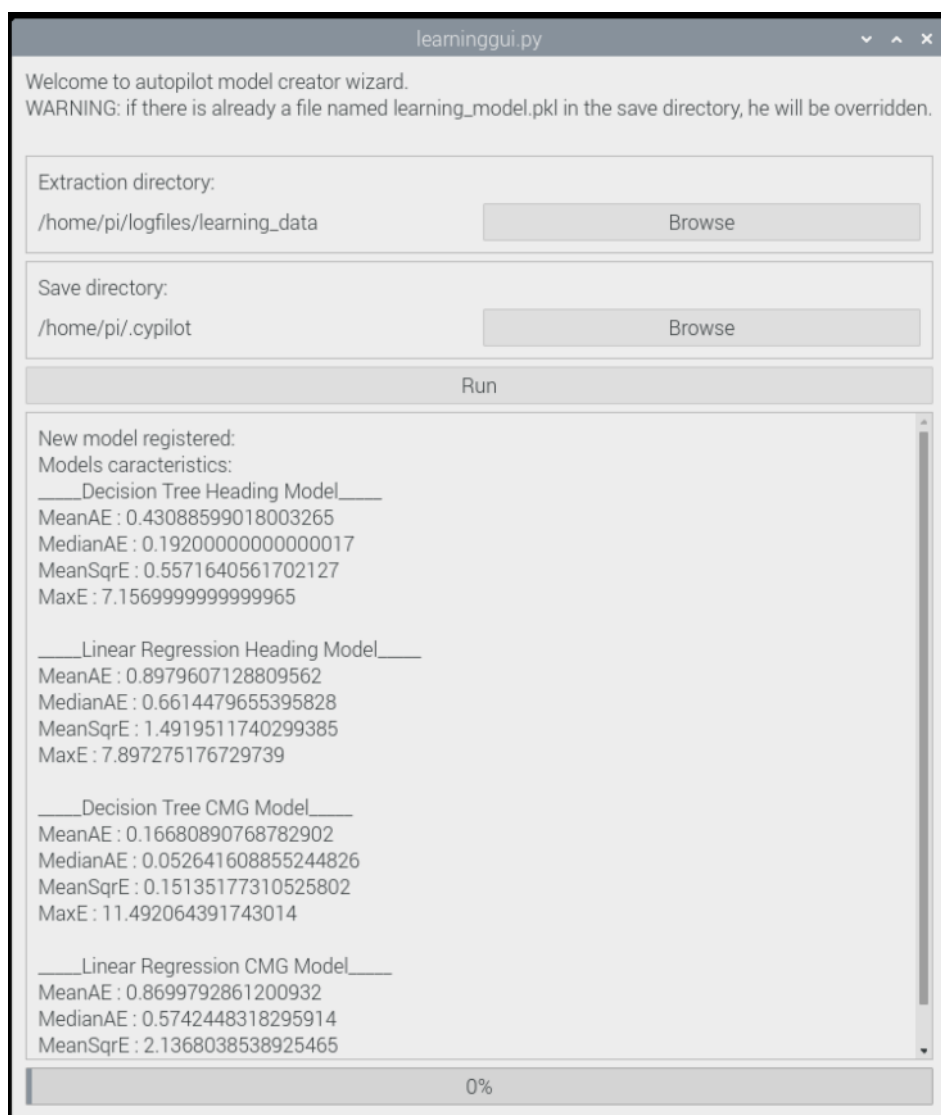
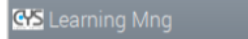
CyPilot Dashboard			
POLAR SPD	TWS	SOG	SOW
4.3 kt	10.3 kt	5.7 kt	5.7 kt
AWA	AWS	TWA	DRIFT DIR
20.0 °	15.5 kt	31.0 °	79.0 °

To choose the parameters displayed: left or right click in each data panel and scroll.

## 2.5 Learning Manager

In order to exploit the **"learning"** mode of the autopilot, it is necessary to create a **"learning model"** file from the recorded navigation data **"learning data"**.

The program for creating the **"learning model"** is launched by the shortcut **"Learning Manager"** installed on the desktop in the **"CyPilot Tools"** directory:





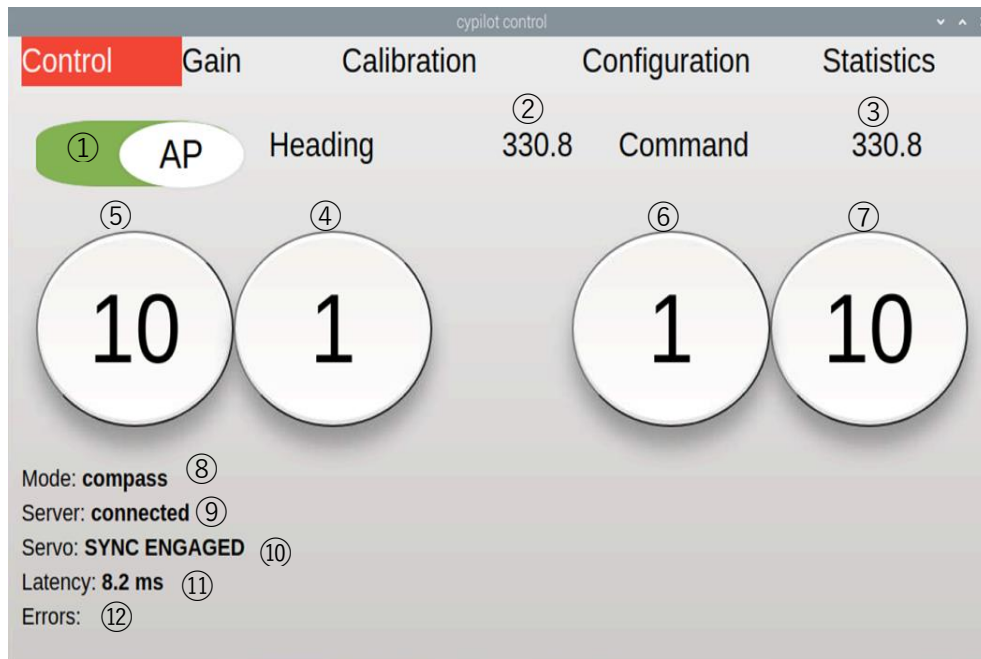
## 2.6 CysBOX - Interface Web (WebUI)

The Web User interface is launched by double-clicking the WebUI icon



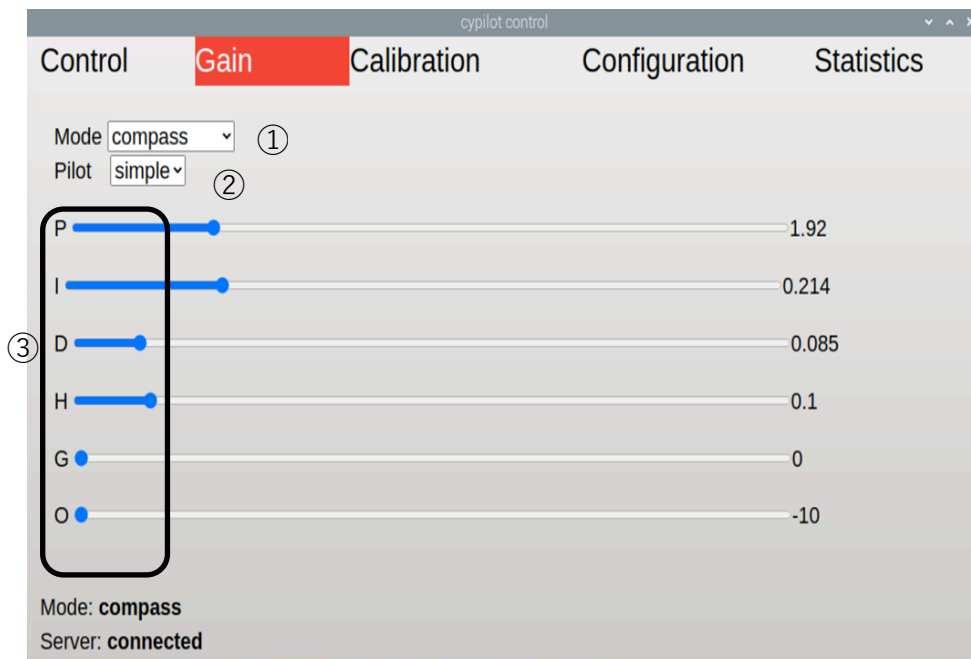
This launches the autopilot and activates the remote control.

### 2.6.1 CysBOX - Control



- ① ON/OFF button → the color indicates the mode:
  - White: OFF
  - Green: ON
- ② Heading / wind angle / rudder angle
- ③ AutoPilot setpoint (heading, wind angle, rudder angle)
- ④ 1° Port
- ⑤ 10° Port
- ⑥ 1° Starboard
- ⑦ 10° Starboard
- ⑧ Reminder of the operating mode: Compass, GPS, Wind, True Wind, Rudder
- ⑨ AutoPilot Server Status
- ⑩ Servomotor status
- ⑪ Server response time
- ⑫ Errors and servomotor link information

## 2.6.2 CysBOX - Gain



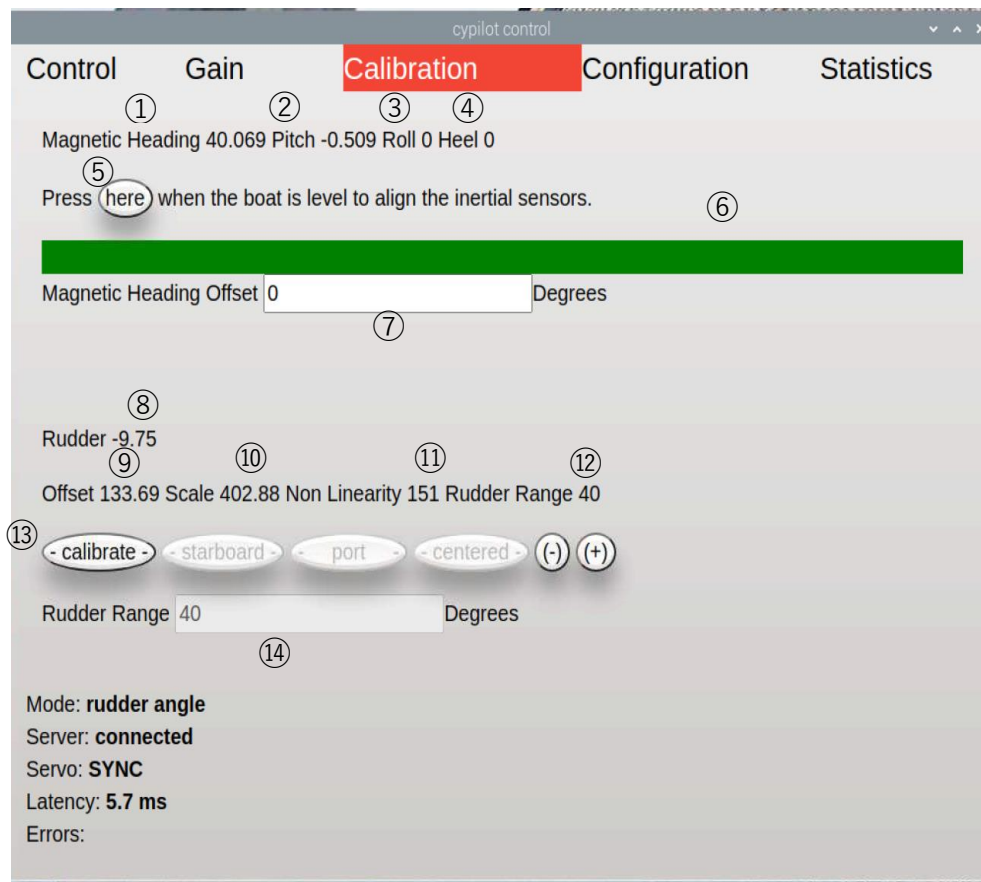
① Operating mode: Compass, GPS, Wind, True Wind, Rudder

② Pilot algorithm: simple, auto learning

③ Algorithm parameters


- P
- I
- D
- H
- G
- O

### 2.6.3 CysBOX - Calibration




- ① Current heading
- ② Angle on the pitch axis in degrees
- ③ Angle on the roll axis in degrees
- ④ Angle on the gite axis in degrees
- ⑤ Initializing Boat Alignment Settings (IMU) depending on the current position of the boat
- ⑥ Alignment progress
- ⑦ Setting the heading correction
- ⑧ Rudder angle
- ⑨ ⑩ ⑪ ⑫ Rudder angle sensor calibration value
- ⑬ Resetting rudder stops
- ⑭ Max angle of the port/starboard rudder

### Alignment procedure

The autopilot  must be stopped (Disengaged).

1. Click on the Press "Here" button when the boat is stable in navigation position  
The progress bar allows you to follow the alignment procedure. The calibration values "Pitch" "Roll" "Heel" must be close to 0.
2. Adjust the exact "Heading" by setting the "Magnetic Heading Offset" field → the compass heading of the boat must be equal to that of the "Magnetic Heading"

### Rudder angle sensor calibration procedure

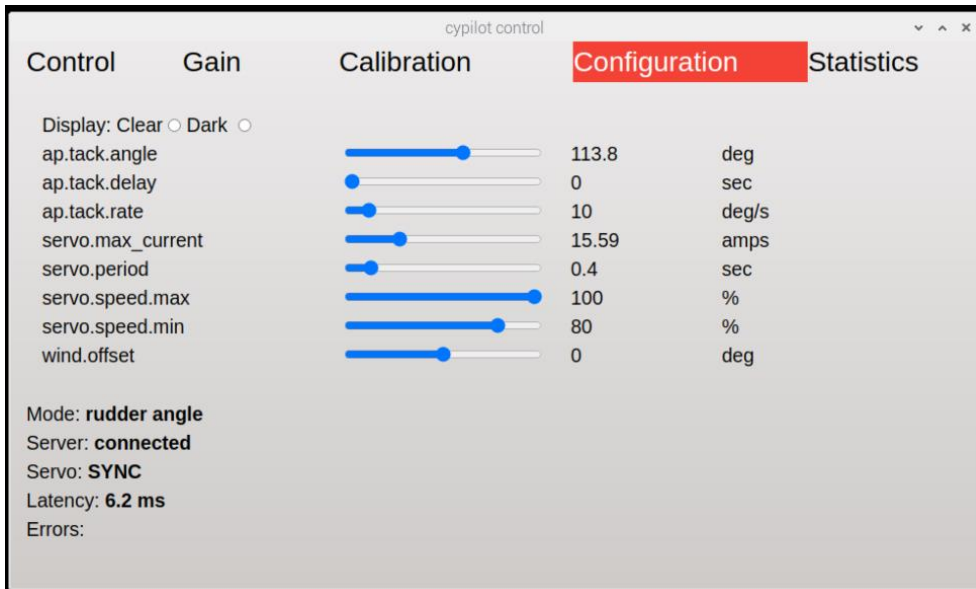
The autopilot  must be stopped (Disengaged).

1. Click on the "Calibrate" button → the "Starboard" "Port" "Centered" buttons and the "Rudder Range" field are now accessible.
2. Set the maximum bar travel in the "Rudder Range" field
3. Manually set the bar successively in each of the positions "Starboard" "Port" "Centered" and click on the corresponding button when the bar is in the desired position.

Note: provide a margin of safety before mechanical stops.

Note: If the control servomotor cannot be mechanically disengaged, e.g. in the case of an external actuator, it is possible to position the rudder with the buttons (-) (+). The rudder movements are of low amplitude as long as the calibration procedure is not complete, to avoid stress on the mechanical stops. When the calibration is complete, the "Starboard" "Port" "Centered" buttons and the "Rudder Range" field are grayed out and the "Offset" "Scale" and "Non-Linearity" values are displayed.

### 2.6.4 CysBOX - Configuration

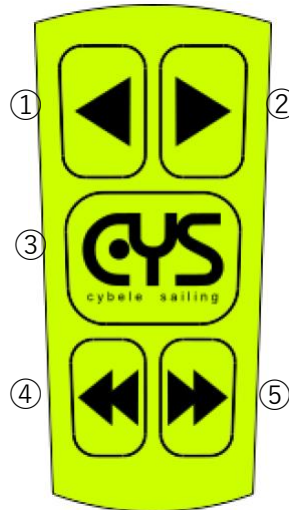


This dialog allows you to choose the main parameters:

ap.tack.angle	Tack angle	degree
ap.tack.delay	Delay before tacking	seconds
ap.tack.rate	Tacking rate	degree/second
servo.max_current	Max servomotor current	amperes
servo.period	Rudder control period	seconds
servo.speed.max	Max servomotor speed	%
servo.speed.min	Min servomotor speed	%
wind.offset	Wing angle offset	degrees

## 2.7 RC - Remote Control

- ① 1° port
- ② 1° starboard
- ③ ON/OFF
- ④ 10° port
- ⑤ 10° starboard



- Pairing with the **CysBOX** → press +10° and -10° at the same time
- Change mode (wind/compass) → press +1° and -1° at the same time
- Tack to starboard → +1° and ON/OFF at the same time
- Tack to port → -1° and ON/OFF at the same time

## 3 CYPILOT SOFTWARE INSTALLATION

Current CysBOX software has been tested under Raspberry Pi OS bullseye (Debian version 11) which must be installed on CysBOX Raspberry Pi4B

### 3.1 Install the cypilot package

#### 3.1.1 Install package

While pip alone is sufficient to install from pre-built binary archives, up to date copies of the setuptools and wheel projects are useful to ensure you can also install from source archives:

```
sudo python3 -m pip install --upgrade pip setuptools wheel
```

Install **cypilot** from wheel file:

```
sudo pip3 install cypilot-1.0.0-cp39-cp39-linux_aarch64.whl
```

or, to install from pypi the latest officially published release:

```
sudo pip3 install cypilot
```

note: to uninstall = `sudo pip3 uninstall cypilot==1.0.0`

#### 3.1.2 Complete installation

After package has been installed, installation must be completed using the **cypilot\_init** command:  
**cypilot\_init**

At least, select **-1-** from main menu, then step **-1,2,3-** from the opened submenu, and **-4-** to reboot.

#### 3.1.3 Customize configuration to match your boat specifications.

Update the configuration files which are located in \$HOME/.cypilot directory:

- NMEA, COM, ... ports assignment
- sensor priorities
- ...

Calibrate IMU (mounting position, gyro, heading, ...) using **cypilot\_calibration** utility.

### 3.2 Settings files

The /home/pi/.cypilot directory contains the software's data and configuration files. Parameterization files allow to adapt the system to the configuration of the boat.

#### 3.2.1 *cypilot\_deviation.conf*

Compass deviation to apply to magnetic headings:

```
{  
  "0": 0,  
  "90": 10,  
  "180": 20,  
  "270": 10,  
  "360": 0  
}
```

The deviation value is added to the value indicated by the magnetometer to calculate the true heading. For example, with the values above, the magnetic heading 090 indicated by the magnetometer is corrected by +10°.

Note: the correction applied is not really the "deviation", but rather the sum of "deviation+declination"

#### 3.2.2 *cypilot\_sensors.conf*

Priority of the different sources for the sensors:

```
{  
  "priority": {  
    "gpsd": 4,  
    "servo": 1,  
    "ble": 1,  
    "serial": 2,  
    "tcp": 3,  
    "signalk": 4,  
    "none": 5  
  }  
}
```

If a value is published by different sources, only the source with the highest priority will be retained (1 = highest priority).

For example, with the default values above, if the apparent wind speed is supplied both by the BLE anemometer and by the serial link NMEA bus, the value supplied by the BLE anemometer will be retained.



### 3.2.3 cypilot\_serial.conf

The **cypilot\_serial.conf** file is used to define the operating parameters for each serial port. For example, for the **/dev/ttysNMEA1** port associated with the **NMEA1** connector:

```
{
  "path": "/dev/ttysNMEA1",
  "baudrate": 4800,
  "protocol": "nmea",
  "input_filter": [],
  "output_msgs": [],
  "description": "NKE Display Output"
}
```

For each serial port, the following parameters can be defined:

- **"path"**: device path
- **"baudrate"**: baudrate
- **"protocol"**: nmea, gps, servo
- **"input\_filter"**: list of NMEA messages to filter
- **"output\_msgs"**: list of NMEA messages to send
- **"description"**: free text

The **"path"** parameter selects the serial port:

- external connections:
  - o **/dev/ttysNMEA1** (CysBOX-V3 alias /dev/ttyUSB0): **NMEA1** connector (NMEA0183)
  - o **/dev/ttysNMEA2** (CysBOX-V3 alias /dev/ttyUSB1): **NMEA2** connector (NMEA0183)
  - o **/dev/ttysCOM1** (CysBOX-V3 alias /dev/ttyUSB2): **COM1** connector (RS232)
  - o **/dev/ttysCOM2** (CysBOX-V3 alias /dev/ttyUSB3): **COM2** connector (RS232)
- built-in peripherals:
  - o **/dev/typCAN** (CysBOX-V3 alias /dev/ttyAMA0) = CAN/NMEA2000 gateway
  - o **/dev/ttyuGPS** (CysBOX-V3 alias /dev/ttyACM0) = uBlox GPS

The **"protocol"** parameter selects the use of the port and the associated communication protocol:

- **"nmea"**: NMEA0183 connections or CAN/NMEA2000 gateway
- **"gps"**: GPS connection
- **"servo"**: CysPWR power unit connection

The **"input\_filter"** and **"output\_msgs"** parameters define the behavior of the system for the reception and transmission of NMEA messages on the communication ports:

- NMEA message reception from external equipment:
  - o TCP port:
    - the message is decoded and the sensor values are updated
    - the message is forwarded to all active TCP connections
  - o COM/NMEA serial port:
    - if the message type **is** in the **"input\_filter"** list :
      - the message is ignored
    - if the message type **is not** in the **"input\_filter"** list :
      - the message is decoded and the sensor values are updated
      - the message is forwarded to all active TCP connections
- transmission of an NMEA message from the internal sensors (XDR,HDM,RMC,GLL,MWV,RSA) :
  - o TCP port:
    - the message is encoded and transmitted to all active TCP connections
  - o COM/NMEA serial port:
    - the message is transmitted on the serial link if the message type is in the **"output\_msgs"** list

cypilot\_serial.conf file, default values for CysBOX-V3:

```
[
  {
    "path": "/dev/ttyNMEA1",
    "baudrate": 4800,
    "protocol": "nmea",
    "input_filter": [],
    "output_msgs": [],
    "description": "NKE Display Output"
  },
  {
    "path": "/dev/ttyNMEA2",
    "baudrate": 38400,
    "protocol": "nmea",
    "input_filter": [],
    "output_msgs": [],
    "description": "Vesper AIS Input"
  },
  {
    "path": "/dev/ttyCOM1",
    "baudrate": 38400,
    "protocol": "servo",
    "input_filter": [],
    "output_msgs": [],
    "description": "CysPWR Rudder Servo Input/Output"
  },
  {
    "path": "/dev/ttyCOM2",
    "baudrate": 4800,
    "protocol": "nmea",
    "input_filter": [],
    "output_msgs": [
      "RMC",
      "GLL"
    ],
    "description": "NKE TopLine Input/VHF ASN GPS Output"
  },
  {
    "path": "/dev/typCAN",
    "baudrate": 115200,
    "protocol": "nmea",
    "input_filter": [],
    "output_msgs": [],
    "description": "CysBOX NMEA2000 GW Input/output"
  },
  {
    "path": "/dev/ttyGPS",
    "baudrate": 115200,
    "protocol": "gps",
    "input_filter": [],
    "output_msgs": [],
    "description": "CysBOX U-Blox GPS Input/Output"
  }
]
```

### 3.2.4 *cypilot\_dprint.conf*

When the Autopilot program is launched separately by the Autopilot shortcut or by the Autopilot system menu, an execution log is displayed in a window.

Each line begins with the name of the module that publishes the information: pilot\_imu, nmea, gpsd, autotune, ...

It is possible to filter this information by the name of the module:

- allowed: list of authorized modules ("any" = all)
- excluded: list of filtered modules ("none" = none)

```
{
  "allowed": [
    "any"
  ],
  "excluded": [
    "none"
  ]
}
```

Example:

- - to display only the tracks from the "autotune" and "gpsd" modules:

```
{
  "allowed": [
    "autotune", "gpsd"
  ],
  "excluded": [
    "none"
  ]
}
```

- - to display all traces except those from the "signalk" module:

```
{
  "allowed": [
    "any"
  ],
  "excluded": [
    "signalk"
  ]
}
```

### 3.2.5 *cypilot\_calypso.conf*

Calypso BLE Anemometer MAC Address and Reading Period:

```
{"mac_address":"fd:3d:c3:20:16:a9","poll_period":0.01}
```

## 4 CONFIGURATION - SETTINGS

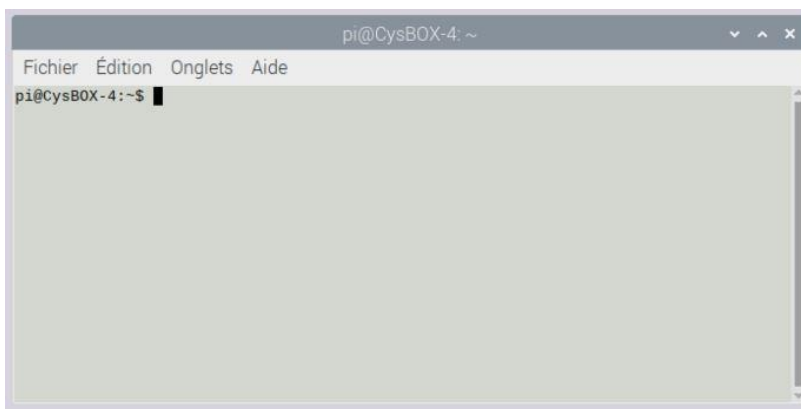
### 4.1 IMU Device

For IMU calibration (BNO085), set the autopilot to Stop

Click

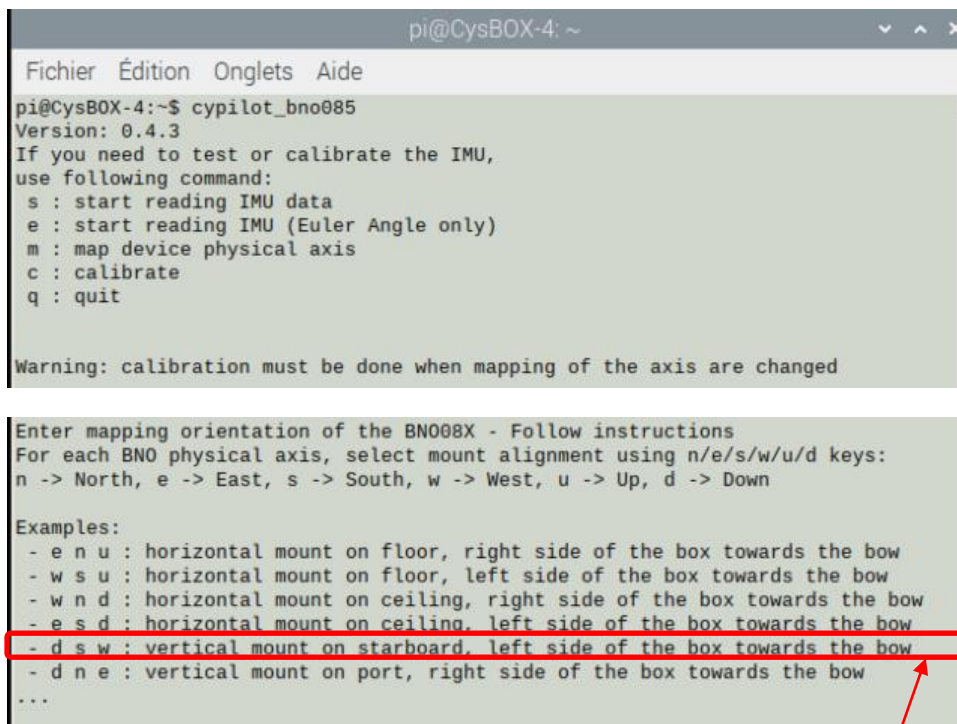


Type **cypilot\_bno085** in the window:



Define how the **CysBOX** will be mounted in the boat,  
type **m**

and carefully follow the instructions displayed by selecting the different mounting axes of the box



For example for an assembly of the vertical **CysBOX** to starboard: choose **d s w**

```
Enter BNO X physical axis alignment (n/e/s/w/u/d) or q to quit
BNO X Axis is aligned Down
Enter BNO Y physical axis alignment (n/e/s/w/u/d) or q to quit
BNO Y Axis is aligned South
Enter BNO Z physical axis alignment (n/e/s/w/u/d) or q to quit
BNO Z Axis is aligned West
Hit <space> to continue and save mapping data, q to quit

Physical orientation set : ('d', 's', 'w')
Please run calibration procedure now
```

Perform the calibration procedure with the **c** command

```
If you need to test or calibrate the IMU,
use following command:
s : start reading IMU data
e : start reading IMU (Euler Angle only)
m : map device physical axis
c : calibrate
q : quit

Execute factory calibration - Follow instructions

Clearing current calibration ...

Step 1 : Position the device in a relatively clean magnetic environment
Begin observing the Status bit of the Magnetic Field output
Rotate the device in a figure 8 until calibration quality is high
(hit <space> to continue, q to quit)

Magnetometer Calibration quality: High Accuracy, (3)

Step 2 : Perform the accelerometer calibration
Calibrate the accelerometer by positioning the device in 4-6 unique orientations
Ensure the device is stable for ~1s in each orientation
(hit <space> to continue, q to quit)

Step 3 : Perform the gyroscope calibration
Set the device down on a stationary surface for ~2-3 seconds to calibrate the gyroscope
(hit <space> to continue, q to quit)

Step 4 : Perform the magnetometer calibration motions
Rotate the device ~180° and back to the beginning position in each axis (roll, pitch, yaw)
Rotation speed should be about 2 seconds per axis
(hit <space> to continue and save calibration data, q to quit)
```

Run the **e** command to read the data from the IMU

```
If you need to test or calibrate the IMU,
use following command:
s : start reading IMU data
e : start reading IMU (Euler Angle only)
m : map device physical axis
c : calibrate
q : quit

Start reading IMU data - Press any key to stop
FusionPose (deg): 3.120, 0.697, 35.240
```

Roll, pitch, heading data are in degrees

Launch



**CysBOX:** Calibration Alignment

Check on the model and adjust, if necessary, the offset on the heading

### 4.2 Calypso Ultrasonic Wired BLE

For pairing the anemometer with the **CysBOX**, set the autopilot to Off

Click



Type **cypilot\_ble** in the window:

```
pi@CysBOX-4: ~
Fichier  Édition  Onglets  Aide
pi@CysBOX-4:~$
```

```
pi@CysBOX-4:~$ cypilot_ble
ble_calypso > Version: 0.3.6
ble_calypso > If you need to pair a Calypso BLE anemometer,
use following command:
a : enter Calypso Anemometer MAC Address
c : print current configuration file
w : start wind measurement
s : stop wind measurement
q : quit
```

Enter a

```
ble_calypso > Version: 0.3.6
ble_calypso > If you need to pair a Calypso BLE anemometer,
use following command:
a : enter Calypso Anemometer MAC Address
c : print current configuration file
w : start wind measurement
s : stop wind measurement
q : quit

ble_calypso > uwble failed to initialize BLE device : Failed to connect to peripheral c8:3a:cf:52:22:aa, addr type: random
ble_calypso > Enter the MAC Address of the Calypso wind sensor (example: c8:3a:cf:52:22:aa)
MAC Address: c8:3a:cf:52:22:aa
```

Fill in the MAC Address of the Calypso

```
pi@CysBOX-4:~$ cypilot_ble
ble_calypso > Version: 0.3.6
ble_calypso > If you need to pair a Calypso BLE anemometer,
use following command:
a : enter Calypso Anemometer MAC Address
c : print current configuration file
w : start wind measurement
s : stop wind measurement
q : quit

ble_calypso > uwble failed to initialize BLE device : Failed to connect to peripheral c8:3a:cf:52:22:aa, addr type: random
ble_calypso > Enter the MAC Address of the Calypso wind sensor (example: c8:3a:cf:52:22:aa)
MAC Address: c8:3a:cf:52:22:aa
ble_calypso > uwble config has been written: {"mac_address":"c8:3a:cf:52:22:aa", "poll_period":0.01}
```

The anemometer is paired with the **CysBOX**



### 4.3 Remote Control

For pairing the remote control with the **CysBOX**, set the autopilot to Off

Click



Type **cypilot\_rc** in the window:

```
pi@CysBOX-4: ~
Fichier Édition Onglets Aide
pi@CysBOX-4:~$
```

```
pi@CysBOX-4:~$ cypilot_rc
receiver > Version: 0.3.6
receiver > Use CysBoxRC key to control.
If you need to appair a new device,
use following command:
y : enter in appair mode
n : return to transmit mode
d : debug
r : RSSI measure
q : quit
```

Taper y

```
pi@CysBOX-4:~$ cypilot_rc
receiver > Version: 0.3.6
receiver > Use CysBoxRC key to control.
If you need to appair a new device,
use following command:
y : enter in appair mode
n : return to transmit mode
d : debug
r : RSSI measure
q : quit
receiver > Appair mode
```

Then start pairing following the procedure:

Press the 2 down arrows simultaneously  
Then release





```

pi@CysBOX-4: ~
Fichier  Édition  Onglets  Aide
pi@CysBOX-4:~$ cypilot_rc
receiver    > Version: 0.3.6
receiver    > Use CysBoxRC key to control.
If you need to appair a new device,
use following command:
y : enter in appair mode
n : return to transmit mode
d : debug
r : RSSI measure
q : quit

receiver    > Appair mode
receiver    > 20
receiver    > Someone ask for key
receiver    > Sending appair key
receiver    > Returned to transmit mode

```

The remote control is paired.

## 4.4 GPS

The setting of the GPS receiver can be done with a PC connected via USB to **CysBOX**. However, the measurement frequency is always updated by the autopilot when it is initialized.

### Prerequisite:

- PC windows10 with U-Blox U-Center software ( <https://www.u-blox.com/>)
- USB cable type USB B male to USB A male

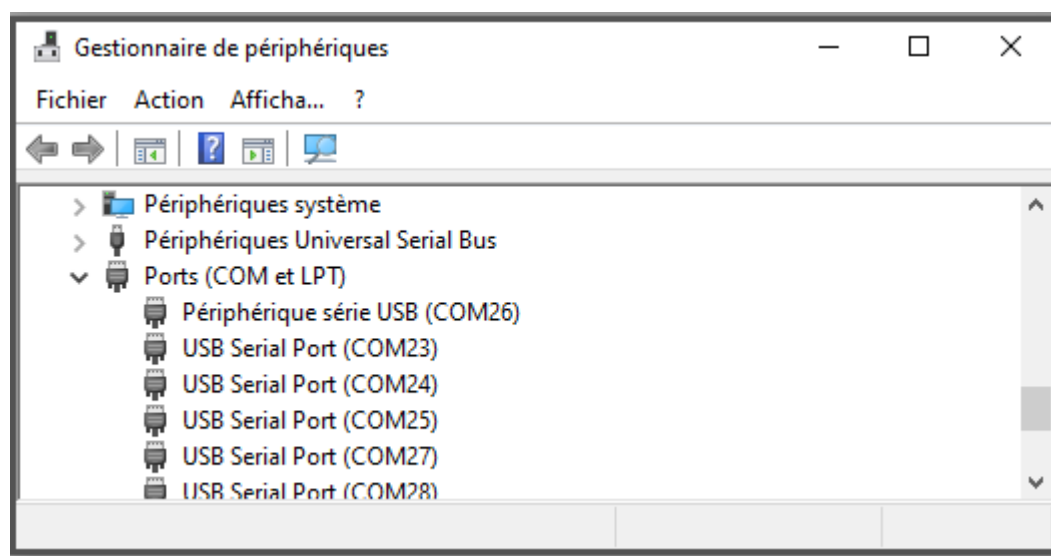
Install U-Blox software

Connect the PC to the **CysBOX** PC connector

Launch the U-Center software

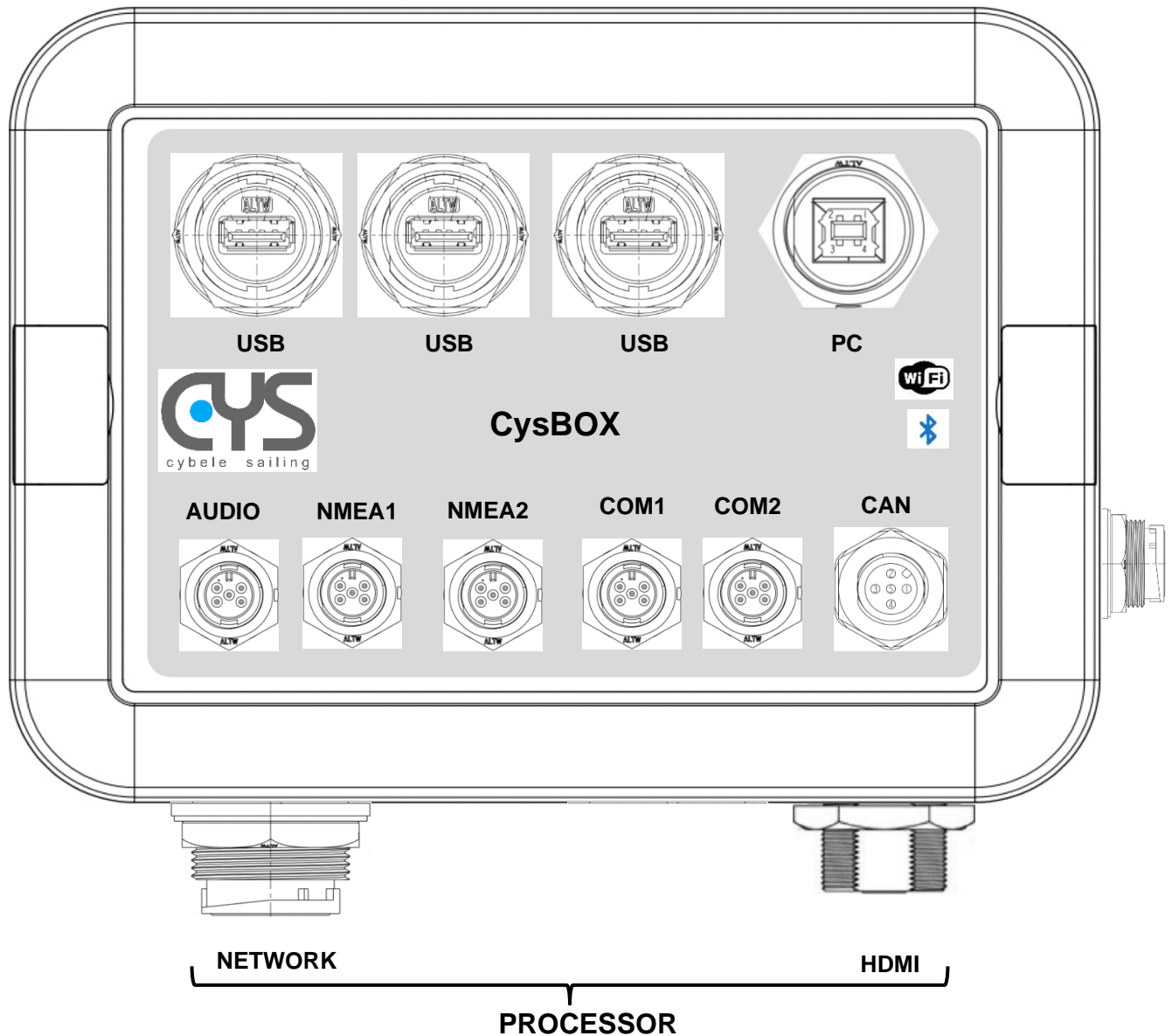
The port used appears in Windows Device Manager as:

"Serial Port USB (COMXX)"



## 5 INSTALLATION

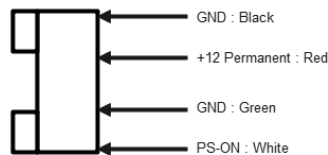
### 5.1 Connections CysBOX



### 5.1.1 Power

The **CysBOX** module is supplied with 12V via a 4-conductor cable:

Alim BOX  
Top View

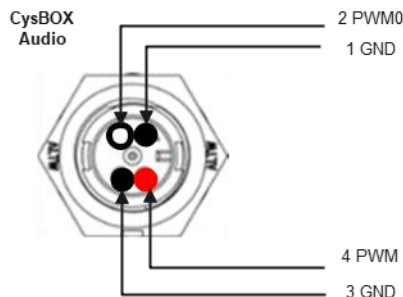


- 1 GND (Black)
- 2 +12V (Red) to connect on permanent 12V power supply via a 2A fuse
- 3 GND (Green)
- 4 POWER (White) to be connected to the On/Off control switch on the board

The **CysBOX** module is permanently powered, the On/off status is controlled by the POWER wire and a two-tone LED is used to control the status of the system:

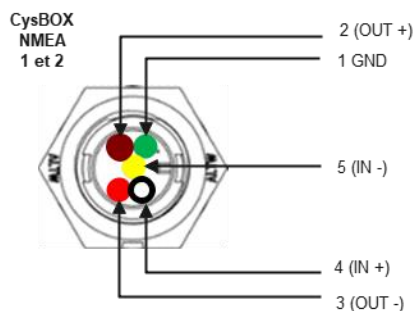
- Off: Powered down
- Startup: blue then high intensity orange during startup, then low intensity blue in operation
- Shutdown: blue then high intensity orange during shutdown, then low intensity blue before extinguishing

### 5.1.2 Audio



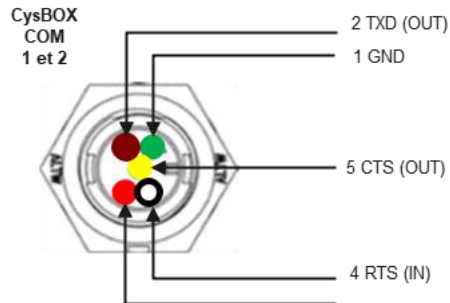
The PWM0 and PWM1 outputs allow the broadcast of Audio messages. This possibility is exploited by the CyAlarm monitoring software for the emission of alarms by voice messages.

### 5.1.3 NMEA1 – NMEA2



The NMEA1 and NMEA2 connectors allow the connection of NMEA0183 devices.  
Related devices: **/dev/ttyUSB0** and **/dev/ttyUSB1**

## 5.1.4 COM1 – COM2

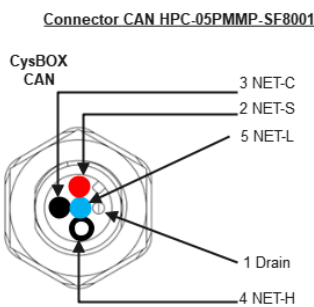


The COM1 and COM2 connectors allow the connection of equipment via serial links: isolation  $\pm 50V$ , EIA/TIA-232 and V.28/V.24 standards with high speed up to 250kbps.

One of these connections is used for connecting the **CysPWR** power module to the **CysBOX** module.

Related devices: `/dev/ttyUSB2` and `/dev/ttyUSB3`

## 5.1.5 CAN



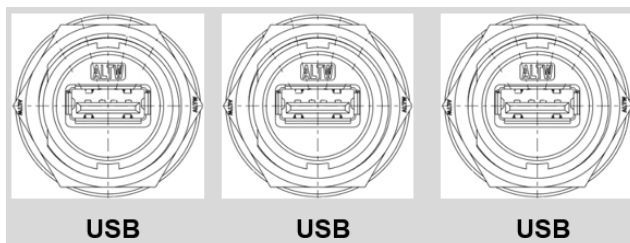
The CAN connector allows the connection of NMEA2000 type equipment.

Interconnection is provided by an Atmel ATMEGA64M1 processor that can be programmed to provide NMEA2000 gateway functionality.

By default, it is programmed in NMEA2000/NMEA0183 mode with management of PGN Heading, Variation, Speed, Depth, Position, Wind to a 115200bps serial connection. It can be reprogrammed using the Arduino environment via the standard bootloader, or Atmel Solution via the programming connector hard the board.

Associated device: `/dev/ttyUSB4`

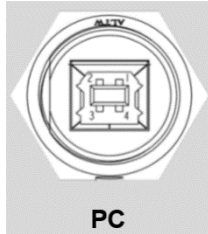
## 5.1.6 USB



Three **USB Host** connectors allow the connection of external USB 2.0 devices: keyboard, mouse, or external USB sensors.

An external Bluetooth V4.0 interface allows a better range for Bluetooth V4.0 devices than the interface integrated into the CysBOX module and may be required to use for example the Calypso Ultrasonic anemometer.

### 5.1.7 PC

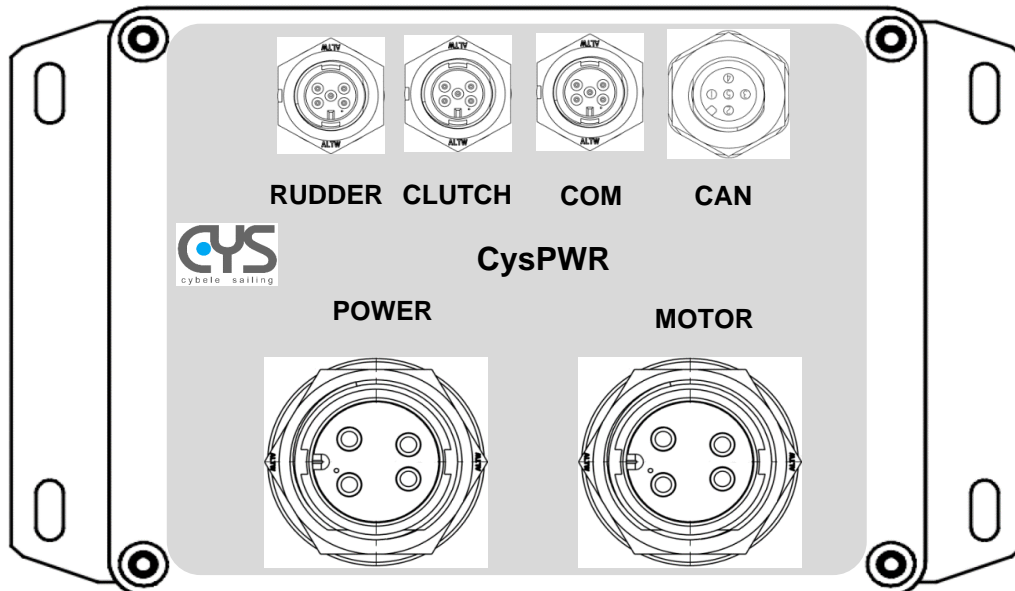


If a PC is connected to the **USB Device** connector, all the peripherals and sensors in the **CysBOX** module can be directly controlled by the PC instead of the local processor.  
It is thus possible to use a PC to reprogram the **CysPWR** rudder control processor, the CAN/NMEA2000 interface processor, to set up the GPS module, to test the connectivity of all the sensors, or to use the **CysBOX** module as a simple PC peripheral set.

### 5.1.8 HDMI - Network

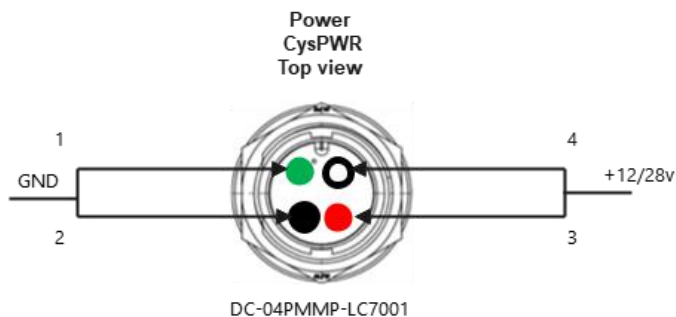
The HDMI and Network RJ45 connectors are managed by the PI4 processor internal to the **CysBOX** module: they allow the use of an external display and connection to a wired network.

## 5.2 Connections CysPWR



### 5.2.1 Power

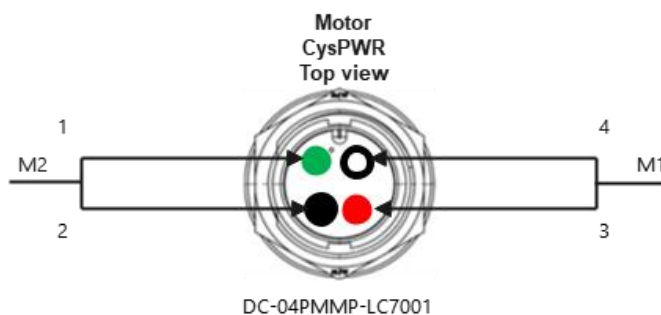
Power input connected to the battery:



Max current: 40A

### 5.2.2 Motor

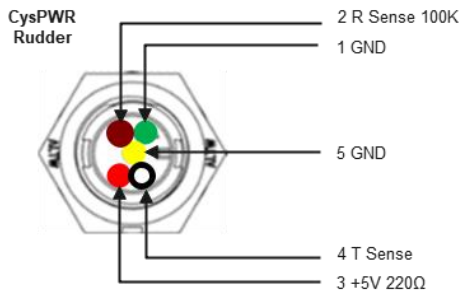
Rudder control power output:



Adjustable max current 0-40A (PWM output)

## 5.2.3 Rudder

Rudder angle sensor:

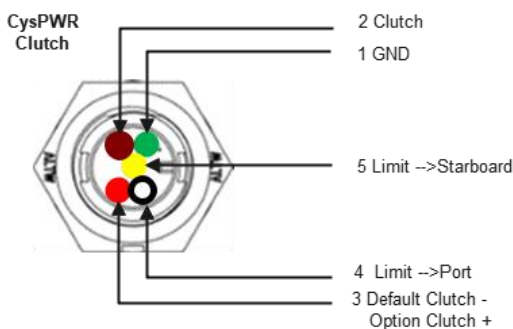


- 1 : GND
- 2 : Rudder angle sensor input
- 3 : 5V Rudder angle sensor power supply
- 4 : Optional temperature sensor input
- 5 : GND

Example: NKE rudder angle sensor wiring uses pins 1, 2, and 3

## 5.2.4 Clutch

Rudder servomotor clutch:



- 1 : GND
- 2 : Clutch : control (active : 0V)
- 3 : Clutch : power supply (output 12V 2A)
- 4 : port mechanical stop detection (option)
- 5 : starboard mechanical stop detection (option)

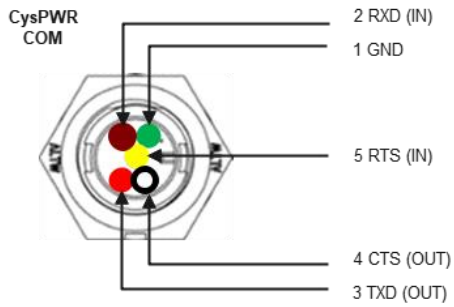
Note:

- the Clutch output can be configured for use of pins 2 and 3 in common control outputs active at 0V. In this case the max current reaches 4A and an external 12V connection must be connected directly to the clutch solenoid.

## 5.2.5 COM

Serial link: interconnection with the **CysBOX** module

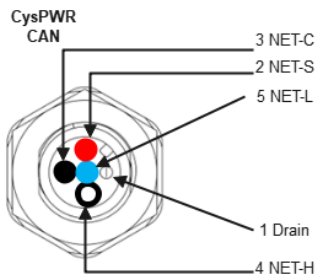
Isolation  $\pm 50V$ , standard EIA/TIA-232 et V.28/V.24 with transmission rate up to 250kbps.



## 5.2.6 CAN

Connector CAN/NMEA2000 (*option*)

Connector CAN HPC-05PMMP-SF8001





## 5.3 Example : GD testing equipment

