3D Sensor

Part number: 90-60-374-001

USER MANUAL

and

INSTALLATION SHEET

Version 2.0

nke - Racing

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CONTENT

1 USAGE

1.1 INTRODUCTION

3D Sensor is an inertial measurement unit with high accuracy and based on MEMS technology (Micro-electro-mechanical systems). It measures the boat's movements in real time and allows the boat's orientation's calculation. It delivers magnetic heading, roll and pitch, acceleration and rate of turn on 3 axis.

It is connected to the **3D Hull** input of the ***PROCESSOR HR*** or **NMEA 1/compass** input of the **PROCESSOR REGATTA**.

1.2 TECHNICAL SPECIFICATIONS

Power supply: 4.5 to 15VDC
Consumption: 360mW
Angle resolution: 0.05°
Mag. Heading accuracy: <1°
Roll and pitch accuracy: <0.5°
Dynamic accuracy: 2° RMS
Waterproof protection rate:IP67
Weight: 200 g
Operational temperature: -10°C to +50°C
Storage temperature: -20°C to +60°C
3D hull gyroscope: ±150°/s
Accelerometer:± 5 G

WARNING

Please take time to read this manual carefully before you start installation

All electrical connection of the ***3D Sensor*** must be done to a ***PROCESSOR HR*** or a ***PROCESSOR REGATTA.*** Alternatively, it can be connected to a PC via a USB interface, not supplied with the 3D Sensor.

Any work on the ***3D Sensor requires*** the system to be powered off.

1.3 LIST OF CHANNELS CREATED BY THE 3D SENSOR

The ***3D Sensor***, once connected to the ***PROCESSOR HR*** or **PROCESSOR REGATTA,** creates the following channels.

Variables	Display	unit	Description
267	3DH_Lacet	Degree	Yaw rotation angle
266	3DH_Tang	Degree	Pitch angle
265	3DH_Roulis	Degree	Roll angle
256	3DH_AccX	g	Longitudinal Hull acceleration
257	3DH_AccY	g	Transversal Hull acceleration
258	3DH_AccZ	g	Vertical Hull acceleration
259	3DH_GirX	°/s	Turn rate and roll speed
260	3DH_GirY	°/s	Turn rate and pitch speed
261	3DH_GirZ	°/s	Yaw (hull) speed
262	3DH_MagX	A.U.	Hull's magnetic field (longitudinal)
263	3DH_MagY	A.U.	Hull's magnetic field (Transversal)
264	3DH_MagZ	A.U.	Hull's magnetic field (Vertical)

1.4 CHANNELS FILTERING

Channels filtering for magnetic Heading and heel is done from the ***Multigraphic*** or ***Gyrographic***. Refer to the relevant manual for the filters settings. Filtering settings affect the displayed data, not the raw data. Channels for magnetic field, rate of turn and acceleration cannot be filtered.

2 SENSOR'S CALIBRATION

3D Sensor is factory set. Nevertheless, an offset setting can be required to match the boat's specificities and get an optimum measure's accuracy. Follow the following calibration procedure.

2.1 COMPASS' MAGNETIC COMPENSATION

The 3D Sensor can be affected by environmental perturbations on some boats. Despite a clean installation and an offset setting, one can notice important deviation between the magnetic heading and true heading, thus on the whole measurement range from 0 to 359°.

Magnetic sensors are very sensitive to their environment and small metal items such as screws as well as big equipment like the keel or the engine can generate a magnetic field that adds to the earth magnetic field, generating a deviation. Therefore, the electromagnetic measure can induce errors in the magnetic heading, heel and pitch calculation.

There are several sources of magnetic perturbations:

- Perturbations caused by fixed equipment such as brackets or screws.
- Perturbations caused by moving parts like canting keel, non-fixed gas bottles...
- Perturbations caused by equipment generating magnetic radiations all the time, like autopilot power cables, VHF …

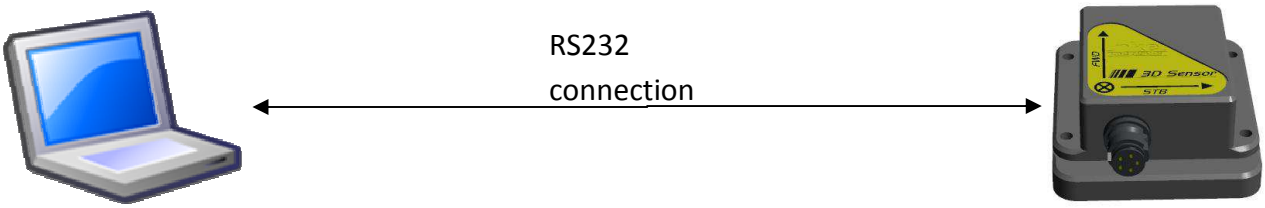
As general rule, the 3D Sensor must be placed at least one meter away from any potential magnetic perturbation source.

2.1.1 Three dimensions calibration principle

The aim of the calibration procedure is to place the 3D Sensor and the boat in all possible orientations including heel and pitch. An algorithm will make the difference between the earth magnetic field and all influences on board for compensation. Therefore, **the whole compensation must be done in a single location.** The calibration is run under sail with enough wind to score a maximum of heel and pitch situations in all orientations.

To perform this, the 3D Sensor is connected to a PC via a specific USB cable to run the application SBG Center (temporarily supplied for the time of the calibration).

During that procedure, the 3D Sensor is not connected to the Processor. Calibration is done point to point.



The application SBG Center saves magnetic calibration points. One can use several calibration points files for a single three dimensions calibration. This allows sequencing the calibration procedure with several steps.

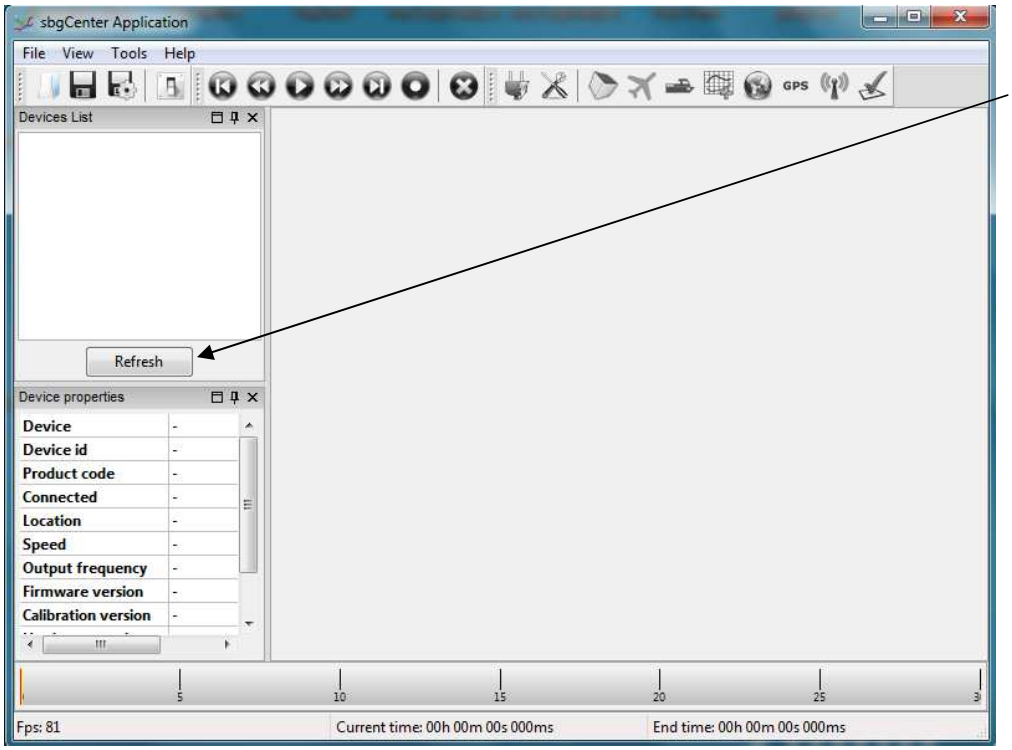
2.1.2 Magnetic compensation procedure for the 3D Sensor using SBG Center

CAUTION:

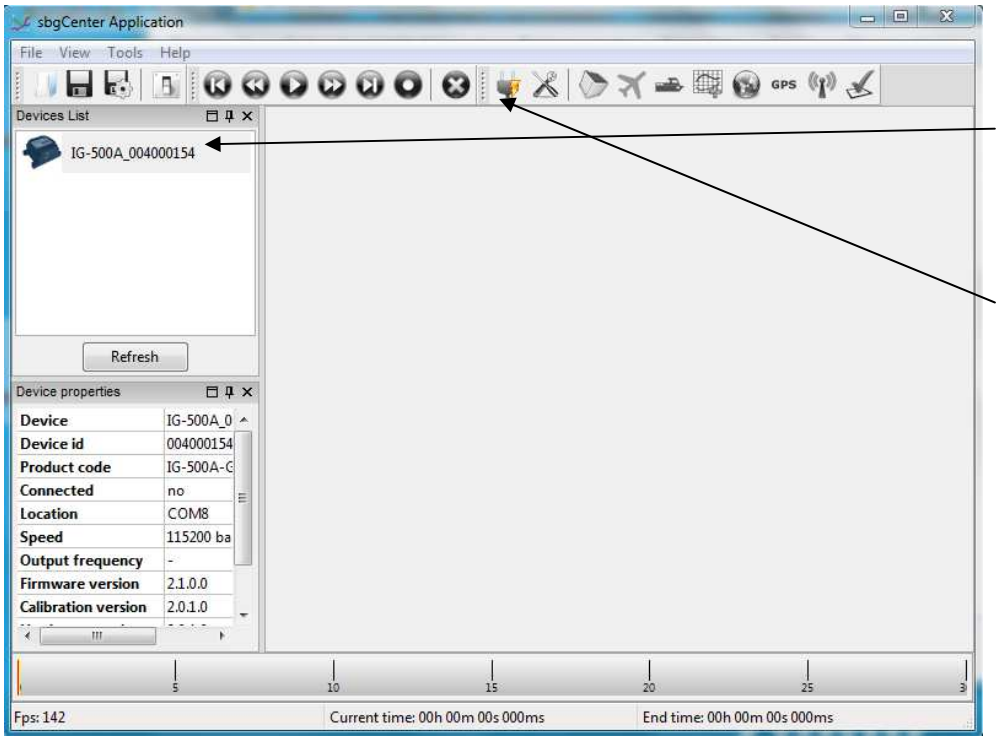
The compensation is valid as long as the magnetic environment on board remains the same. It is recommended to run the compensation procedure with the boat set in racing configuration (batteries, anchors, etc.) The whole compensation must be run in the same location.
I.e. file for a calibration done in Lorient: do not add any file save in another location.
The calibration is valid globally.
If the steering compass is used as reference, it must be adjusted in order to get an accurate True Wind Direction.

The USB/ Serial interface is automatically detected by Windows 7 (and up). The Com port number can be check in the device control panel.

Once the connection is done with the USB cable, start the application SBG Center.



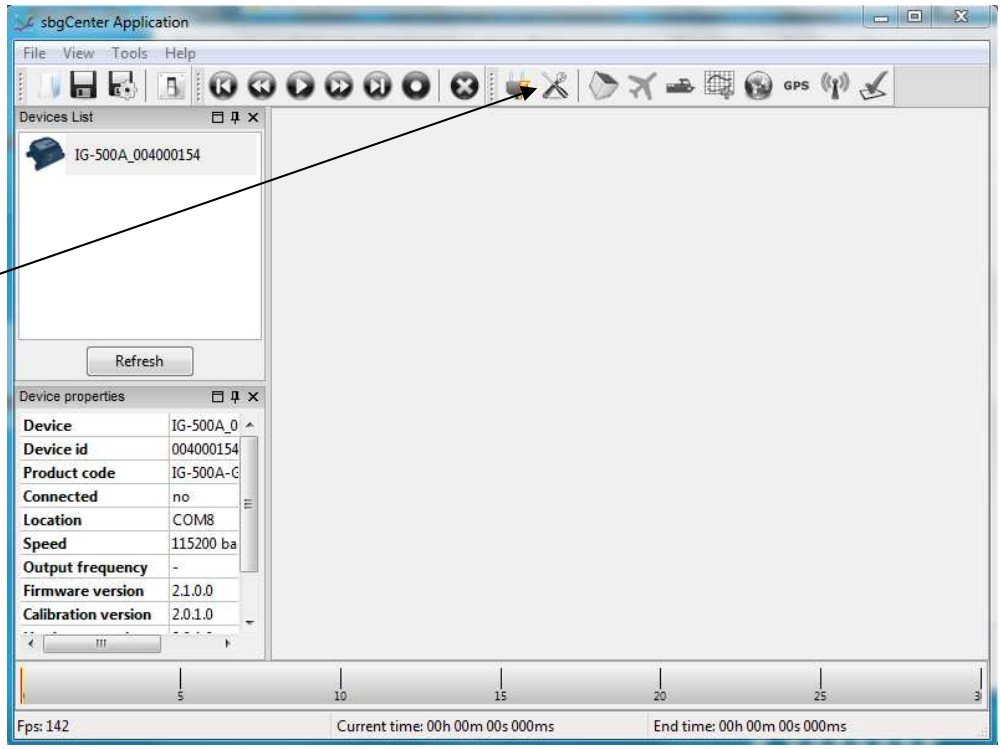
Click on Refresh.



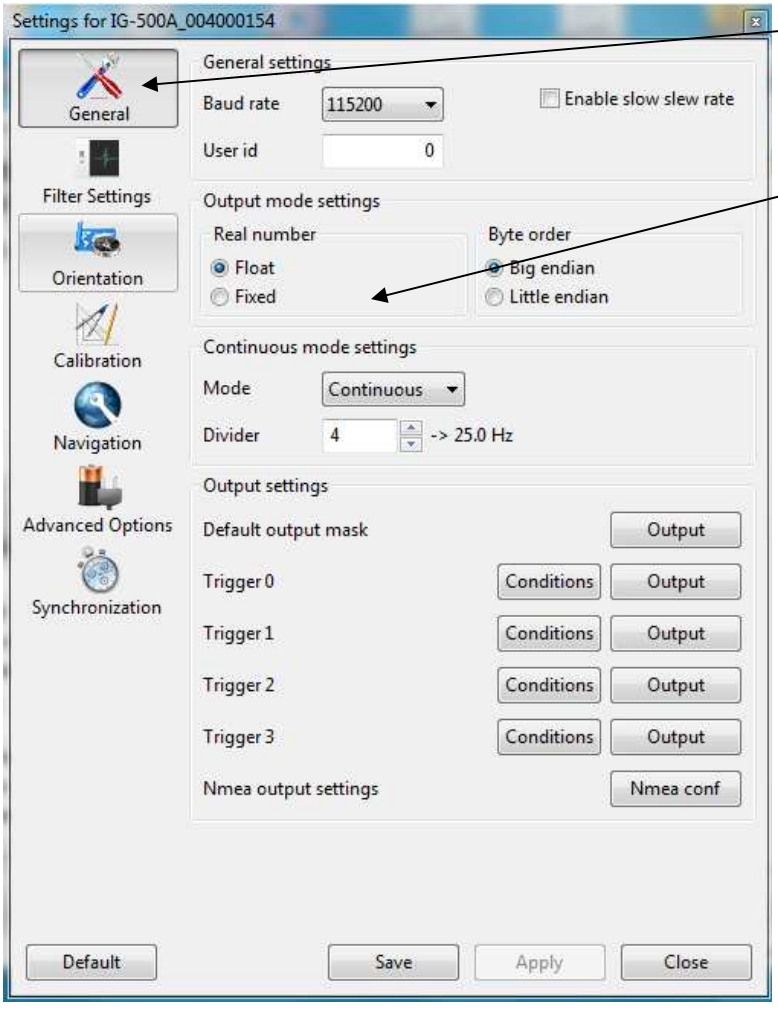
Click on the detected sensor

Then, click on Connect

Click on this icon to access the configuration

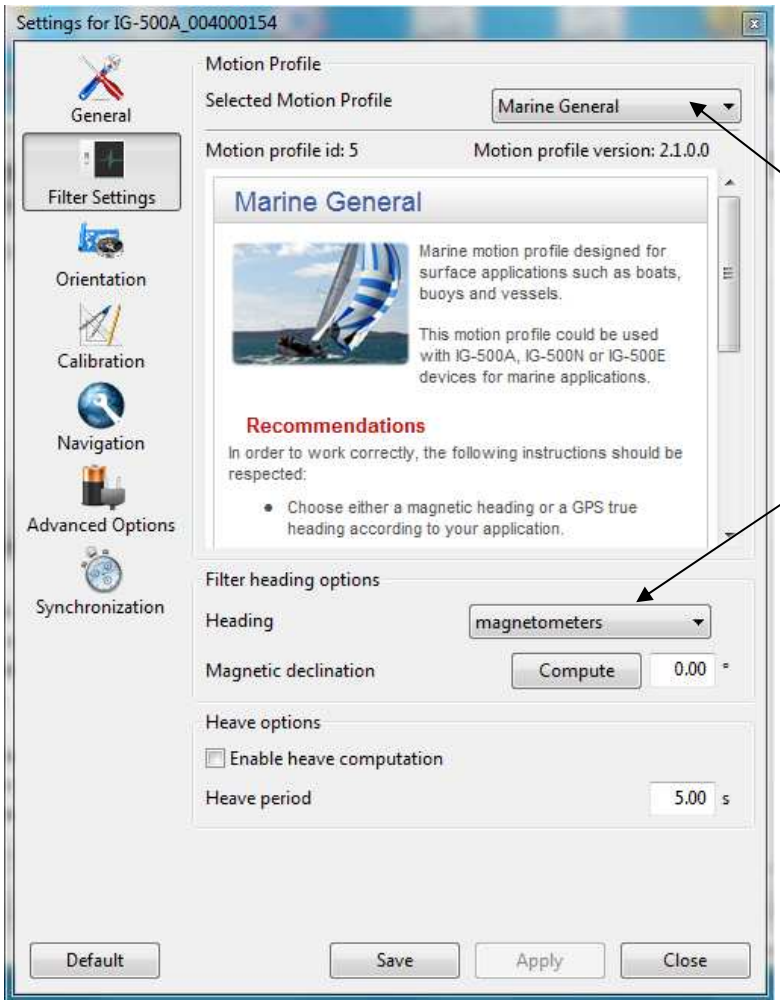


The following window is displayed.



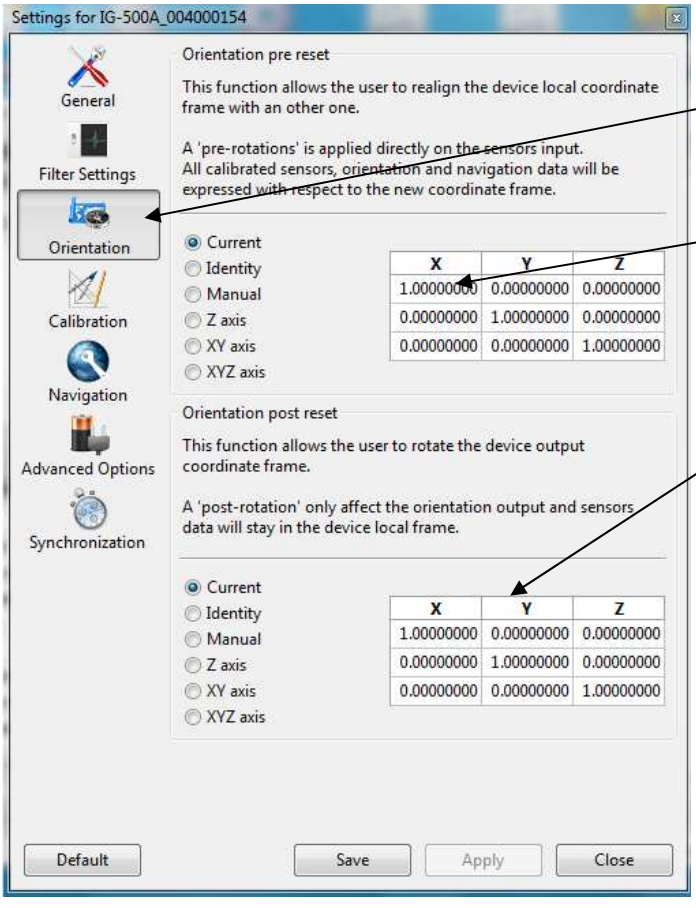
In the General tab

Check the divider is **4** (25Hz) and all parameters are identical.



In the Filter Settings tab
Check the profile is Marine General

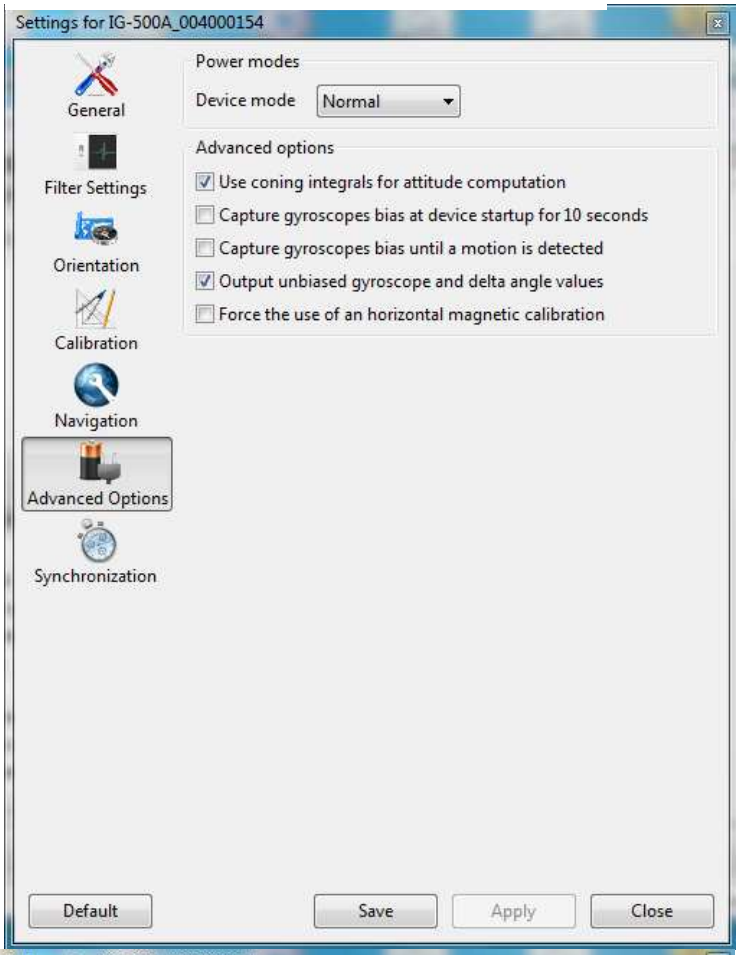
Check that Heading is magnetometers

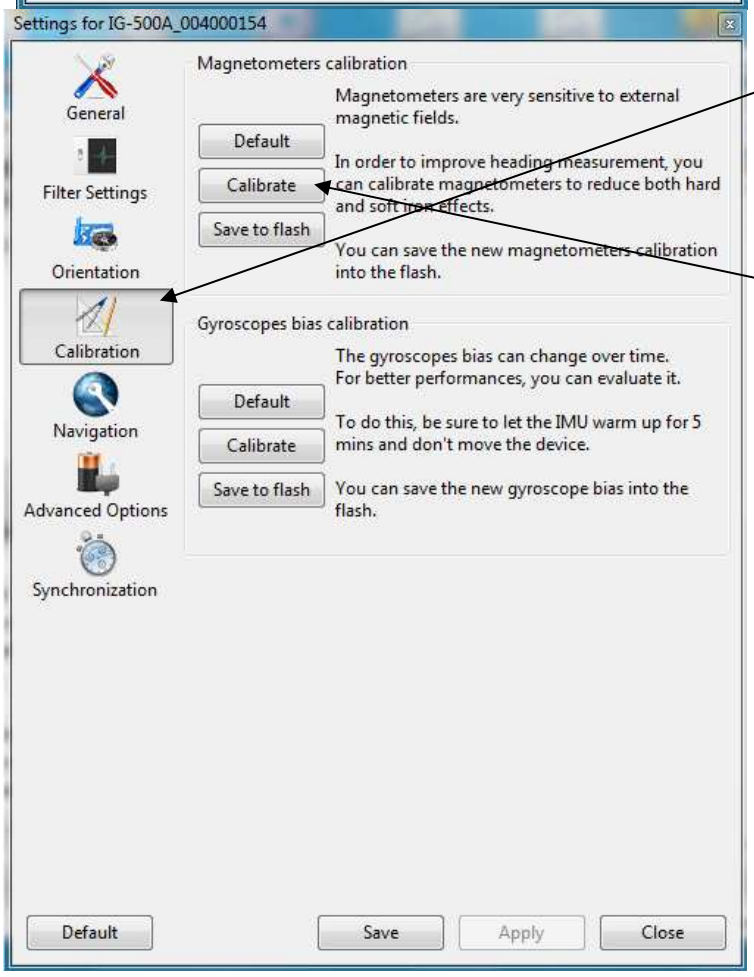


In the Orientation tab
Check that the tables are identical

In Advance Option tab

Check that the configuration is identical

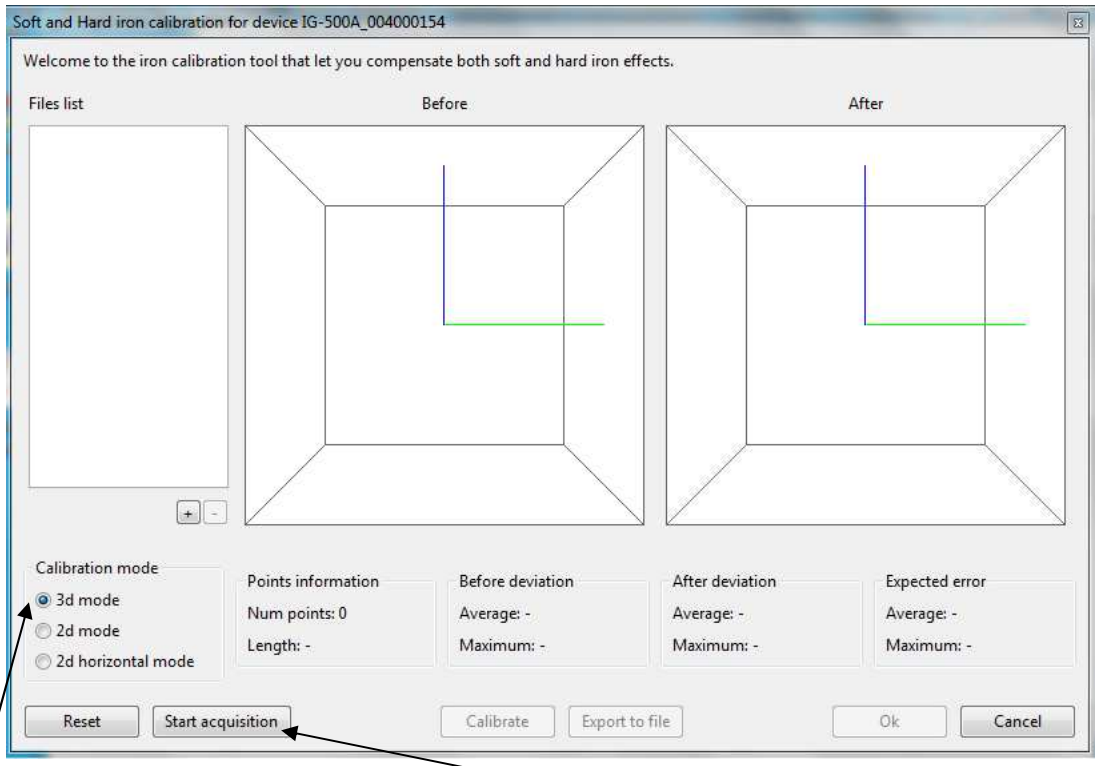




In the Calibration tab

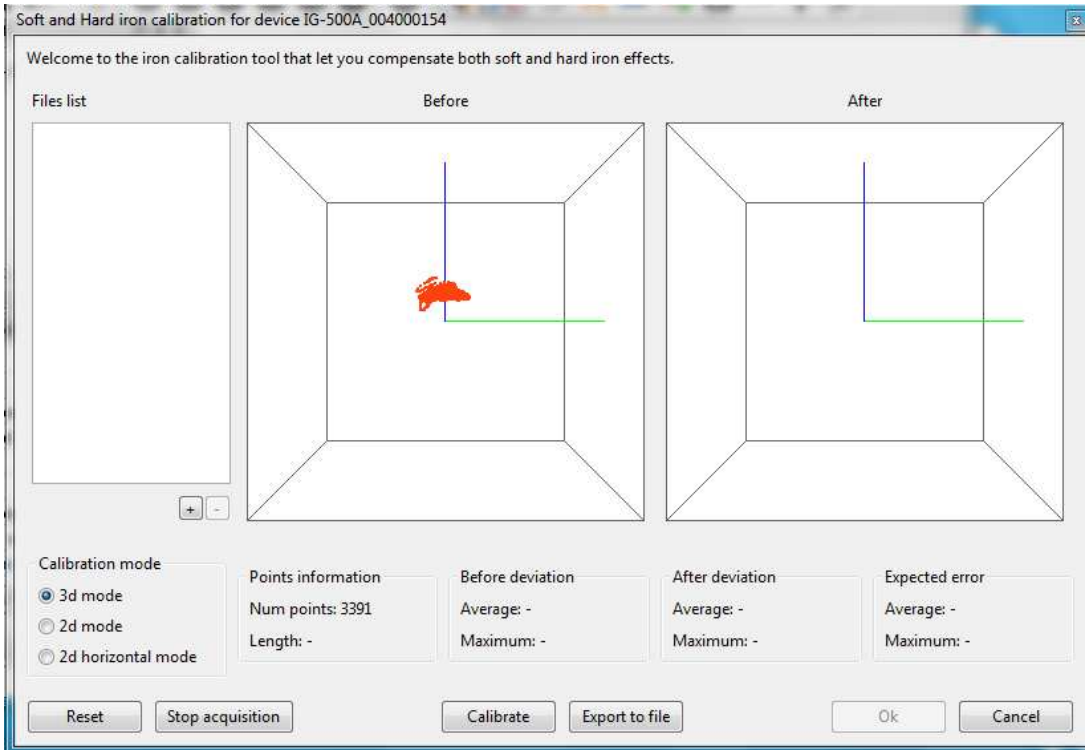
Click on Calibrate

The following window is displayed



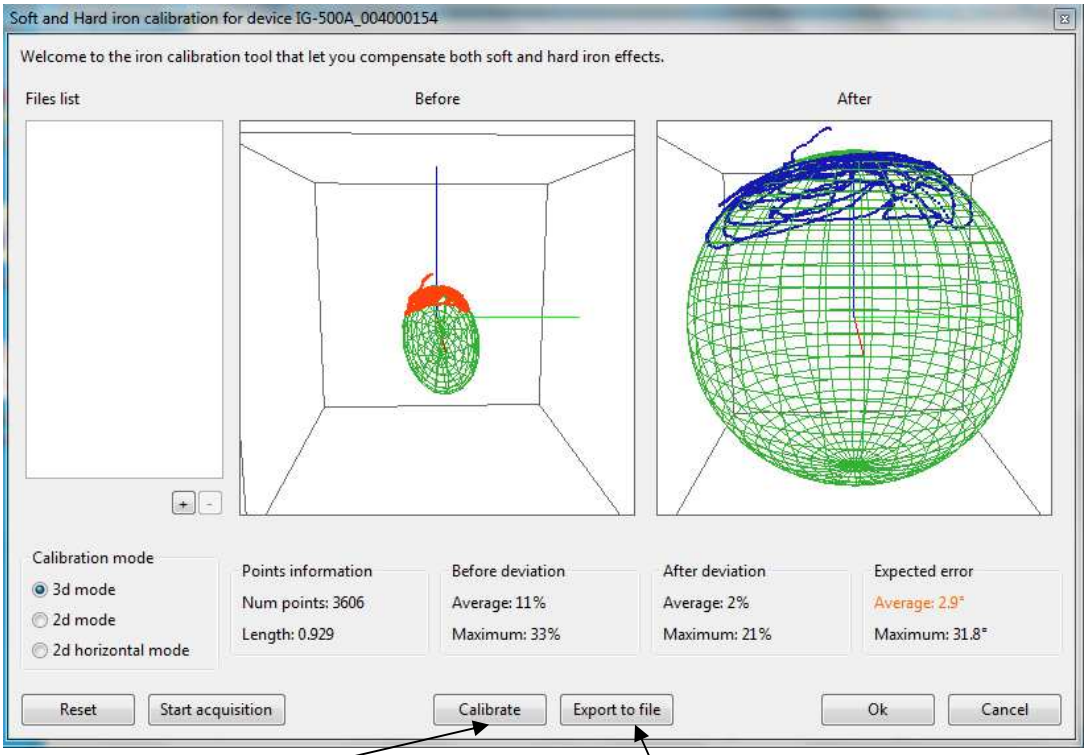
Check that Calibration mode is in 3D mode.

then, you can run acquisition.



Once you have performed 360° under sail, check the number of points in "**Points information**'
It must be over 3000 points. If not, go ahead for a second 360°.
Once this is done, click on Stop Acquisition.

Once acquisition is stopped.



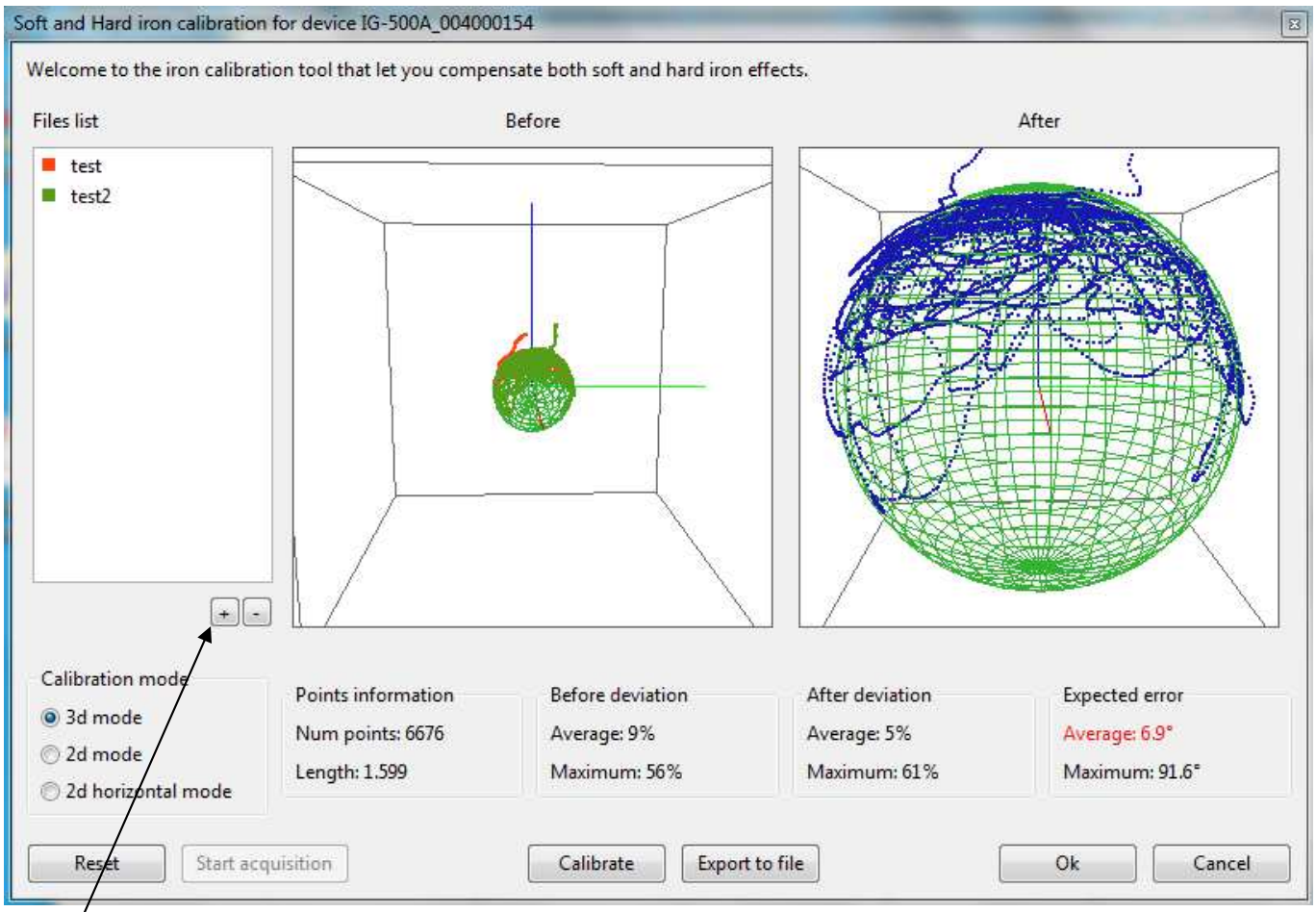
Click on Calibrate to process the data
and expected error calculation.
A good calibration produce generally a very low level of error,
below 5° and 15° as a maximum.

Click on export to file to save
your calibration

One can make several calibrations and save them. They can further be complied in one single deviation correction saved in the 3D Sensor. This gives the possibility to make calibrations in several orientations.

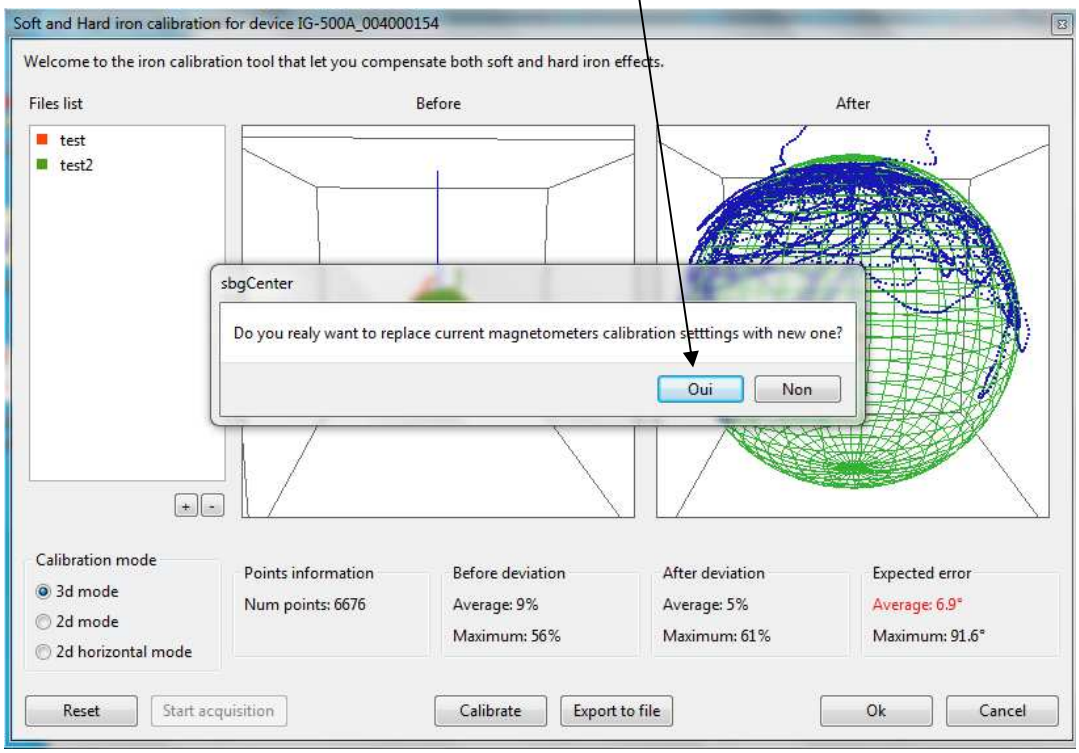
CAUTION

Running several calibrations is not an obligation. A single calibration can be enough for a perfect result.

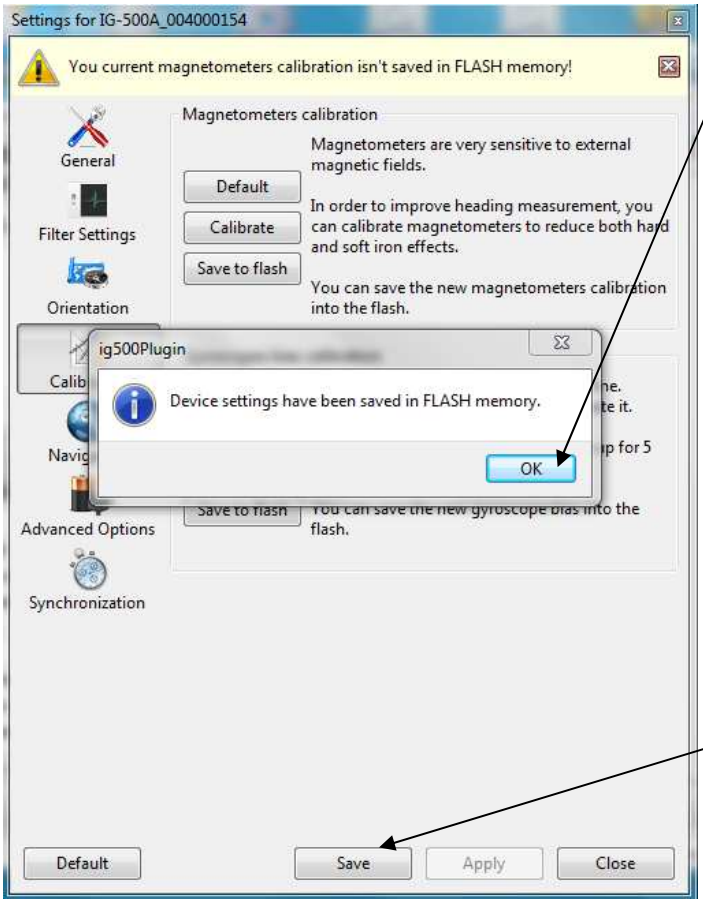


Click on + to upload the calibrations.

Click on Calibrate to compile several calibrations. Click on **OK** to save the calibration in the 3D Sensor and confirm with **yes.**



Click on **Save to flash**



Click on **OK**

Click on **Save**

Your 3D Sensor is now calibrated. You can exit the application

CAUTION

The points acquired during a calibration are not linked to the points acquired during a previous calibration. Therefore, if you sequence the calibration with several procedures and files, think about selecting all the files before processing the data.

2.2 OFFSET SETTING

Once the 3D Sensor is installed and calibrated, it can be required to set an offset, so that the magnetic heading, the heel and pitch match the real magnetic heading.

Refer to the ***Multigraphic's manual*** for this.

3 INSTALLATION

Carefully choose a location for the sensor's installation. Indeed, the ***3D Sensor***, like you heading compass, is sensitive to any metal mass, the boats moves and the perturbations created by electric equipment. The installation must be made with a lot of care to get an optimum measure accuracy.

3.1 MOUNTING THE 3D SENSOR

Install the 3D Sensor on :

an horizontal surface
a vertical surface with a bracket (not supplied)
The 3D Sensor **must be** oriented with: X line in direction of the bow, Y to starboard and Z upwards. (Binder connector to the boats stern and Lexan upwards)
Fixation is made with hook and loop tape (or plastic/non-magnetic screws).

3.2 INSTALLATION PRECAUTIONS

Ideally, the 3D Sensor must be installed as close as possible to the boat's centre of rotation, away from metal masses and electric cables. As general rule, the 3D Sensor must be placed at least one meter away

from any potential magnetic perturbation source. Mount carefully the 3D Sensor with X line parallel to the boat's mid-line and X and Y on horizontal plan, to minimize offsets values.

The mechanical adjustment of the 3D Sensor to minimize the offset value (<3°) is essential for the good operation of the anti-capsize function (and makes the datalogs process easier).

CAUTION

Never expose the 3D Sensor to strong magnetic fields (magnets, compass, degausser). The 3D Sensor contains as minimum ferromagnetic materials as possible. Nevertheless, some minor components can be affected permanently by exposure to magnetic fields. This would not damage the 3D Sensor, but would make the compensation impossible.

Warning: do not store the 3D Sensor close to strong magnetic fields.

4 TROUBLE-SHOOTING - 1RST LEVEL

This chapter can help you quickly to face small incidents that do not require a specialist. Before contacting the customer support, read carefully the following trouble-shooting table

Faults	Possible causes and solutions
No Compass, heel and pitch data	Refer to the Processor's manual and check the configuration of the 3D Sensor port on the Processor.
The magnetic heading is displayed, but very different from the steering compass.	Check that no equipment can interfere with the 3D Sensor or your steering compass: Check the list of equipment featured in the Installation chapter. Check the steering compass adjustment. Process to a three dimensions compass calibration.

If you cannot solve the problem, contact your distributor.