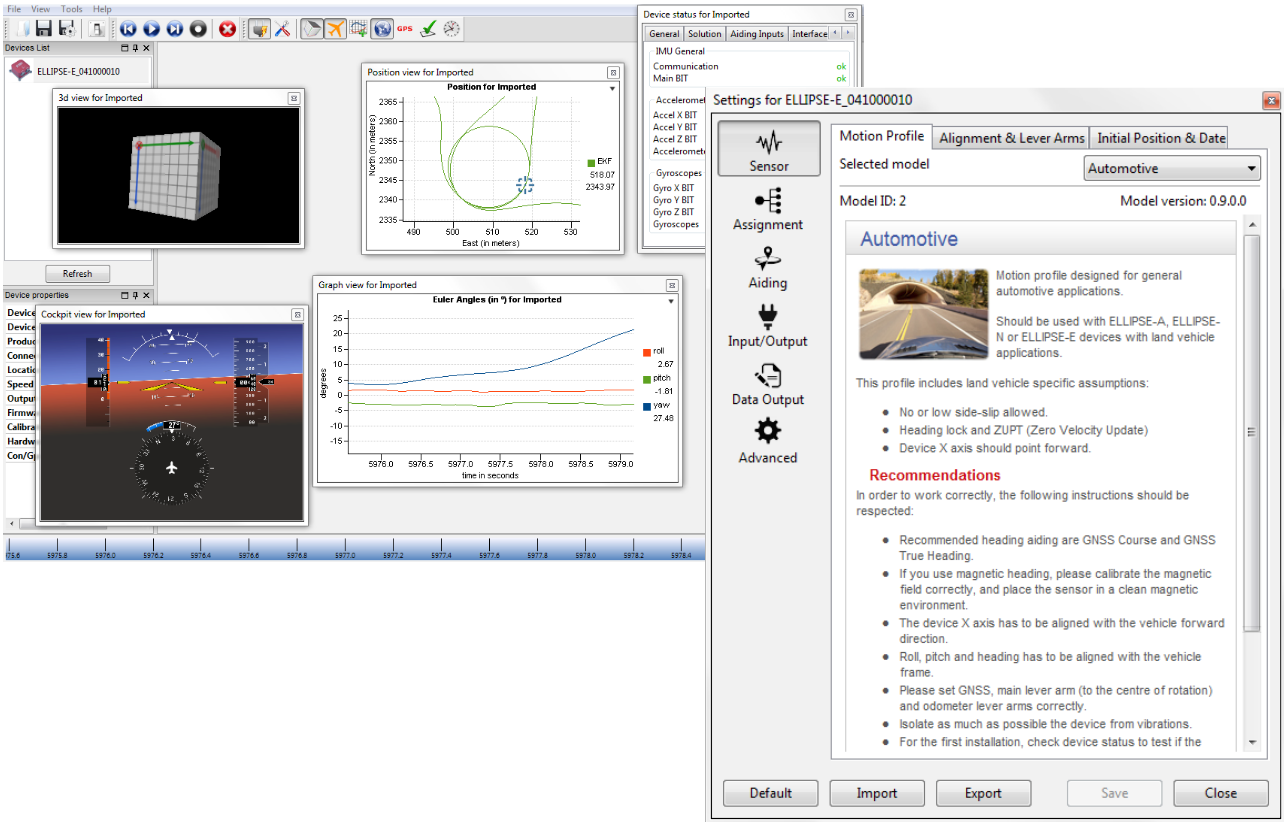
Ellipse AHRS & INS

High Performance, Miniature Inertial Sensors

Configuration using sbgCenter



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Support

EMEA
support@sbg-systems.com
+33 1 80 88 43 70

Americas
support@sbg-systems.com
+1 (657) 549-5807

SBG SYSTEMS

Revision history

Rev.	Date	Author	Information
2	Apr 10, 2018	Raphaël Siryani	Updated company address
1	Oct 6, 2014	Nicolas Michel	First version of this document

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1. Overview

The easiest and fastest way to get an Ellipse configured is to use the sbgCenter interface. This configuration is described in details in the following sections.

1.1. Ellipse configuration window

Once the Ellipse is connected to the sbgCenter, press on top of the interface to access the Ellipse settings, it gives access to different configurations tabs:

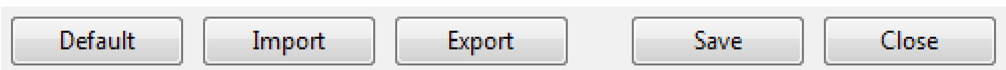
Sensor	Select motion profile Re-align and re-position the sensor Set-up initial position and date
Assignment	Select which aiding device will be used on which port
Aiding	Configure all selected aiding equipment (GNSS, DMI, Magnetometers, ...)
Input/Output	Configure Serial/CAN interfaces and synchronizations
Data Output	Select several outputs in binary of ASCII format
Advanced	Synchronization of internal clock

You can save these settings so it stays after a restart. You can also export them into a file that can be imported later.

It is strongly recommended to do the configuration from top to bottom (from “Sensor” to “Advanced”), if you are doing it for the first time.

1.2. Saving, importing, exporting settings

It is possible to export the settings of the device into a binary file that can be imported later. When you are in the device settings, you can check at the bottom of the interface for the export commands:



Once you defined your settings, press “Save” to apply it and keep it in the flash memory of the device. Then you can press “Export” to save the configuration file on your computer.

When importing a setting file on a different product, it should the same version of Ellipse (A, E, N or D) and the same firmware.

If you need you can press the “Default” button to come back to the default settings.

Note: Don't forget to press “Refresh” button if you imported, saved or clicked on “Default” as the baudrate may have changed.

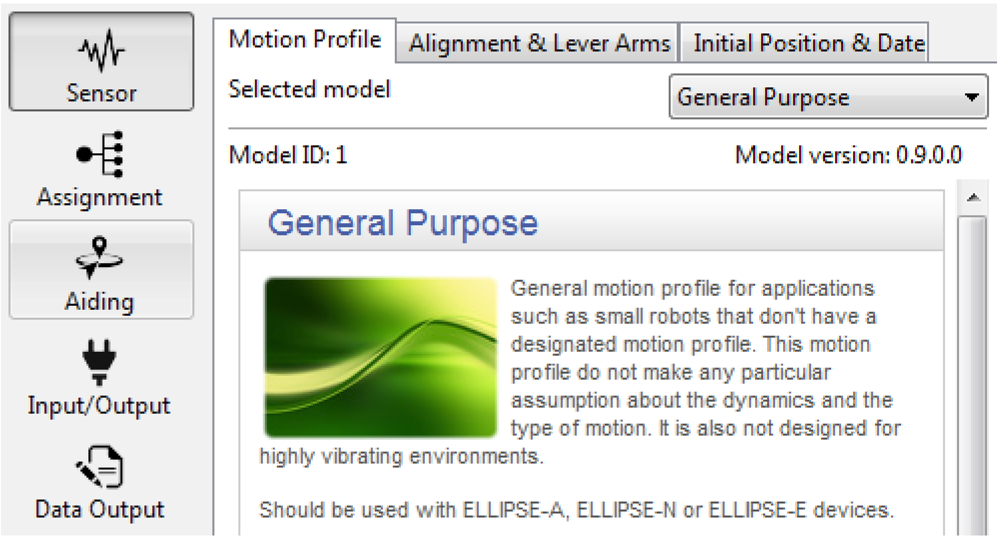
Note: For more details about sbgCenter configuration, please refer to the sbgCenter User Manual.

2. Sensor configuration

2.1. Motion profile selection

The Ellipse sensor uses a Kalman filter to compute orientation and navigation data. This filter can be tuned to answer specific dynamics depending on the application. Motion Profiles are presets of parameters made to optimize the algorithm for a particular dynamic.

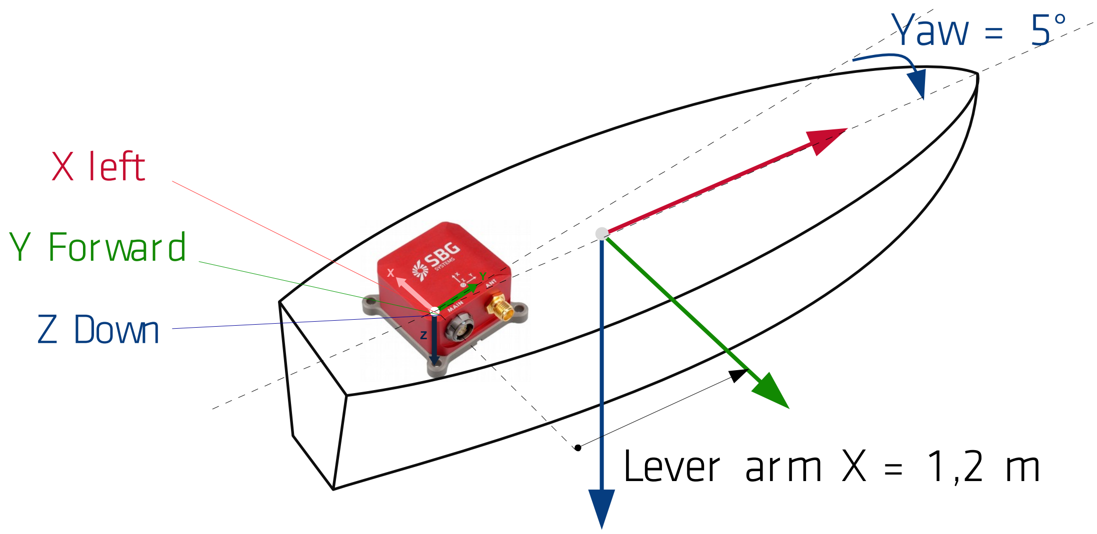
When selecting a motion profile, the configuration interface will display some comments and advises about the motion profile, in order to help you choosing the right model.



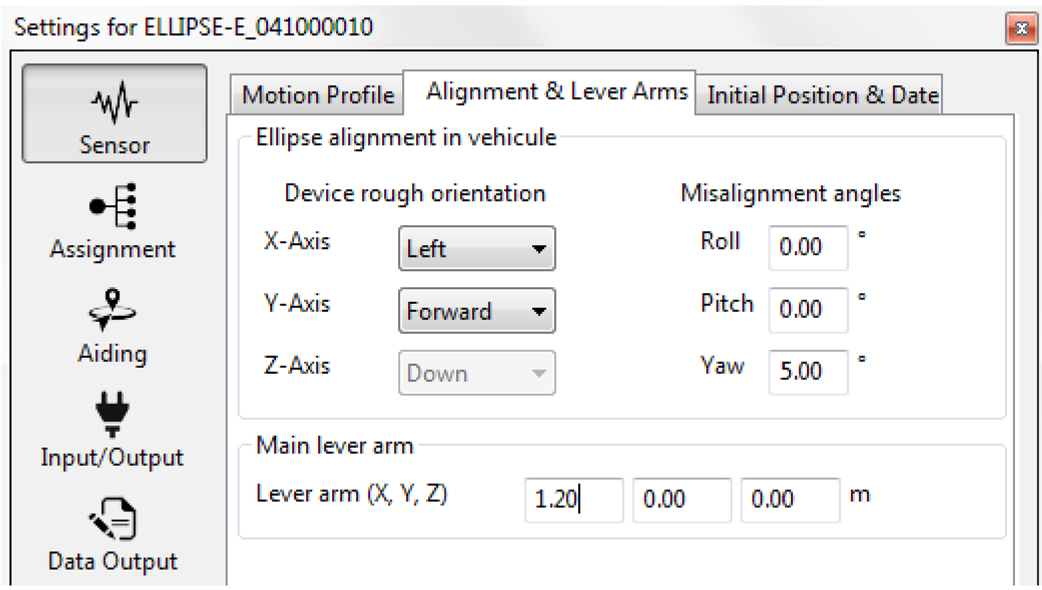
2.2. Alignment and Main lever Arm

The sensor can be placed in any physical orientation, but should be realigned in this part of the configuration.

In the following example, the **device** X axis is turned towards the left **of the ship**, the Y axis is pointing toward front, and Z axis downward. Finally, the there is a 5° misalignment on Yaw to correct.



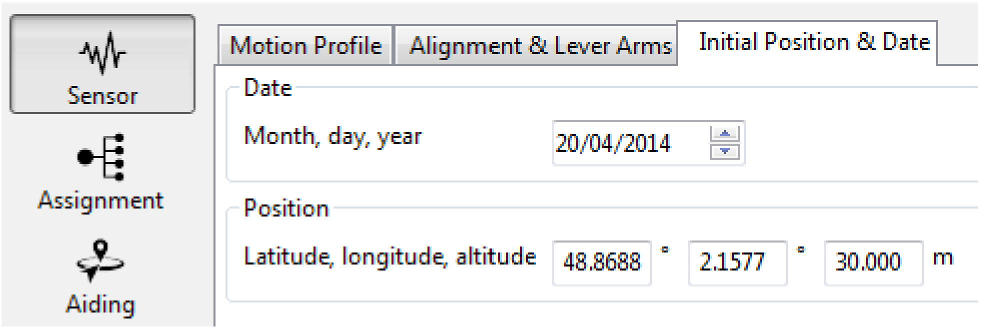
Which gives the following configuration:



2.3. Initial position and date

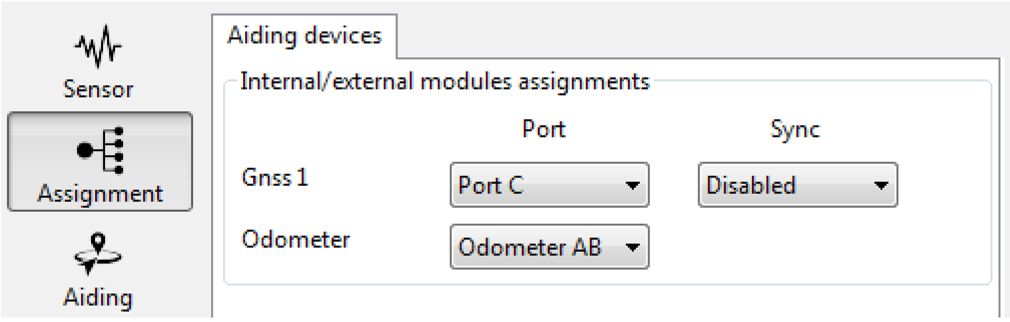
This is the position and date the device will have until UTC time is receive from GPS (if available). By default the position of SBG Systems office is defined.

Note: When the device mode switches to "Nav Position" the position will jump from the default position to the actual one.



3. Aiding sensor assignments

You can select several aiding equipments to use on your device. For instance using an Ellipse-E, it is possible to use an external GNSS receiver and an odometer at the same time:



The Odometer is using the input synchronization A for single channel, or A and B if direction is given.

The enabled devices will appear in new thumbnails in the next window called “Aiding”.

4. Aiding sensor configuration

4.1. Common considerations

4.1.1. Aiding categories

External equipment can provide different kind of aiding:

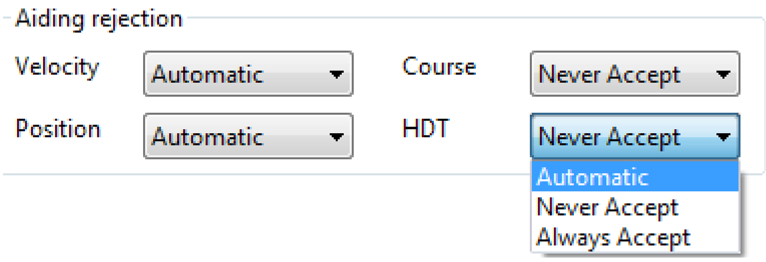
- **Position** (GNSS)
- **Velocity** (GNSS, Odometer)
- **Heading** (Magnetometer, Dual Antenna GNSS)

For instance GNSS equipment can be used to provide only position or velocity or both. When several equipments are providing the same aiding (for instance GNSS and Odometer) the Kalman filter will use both and automatically estimate errors to improve the aiding measurements.

4.1.2. Rejection options of aiding sensors

When adding an aiding equipment, it is possible to configure it with:

- **Always Accept:** always use the data, even if inaccurate. Recommended for testing only.
- **Never Accept:** reject data. This is used to disable an aiding (for instance refuse Heading from GPS)
- **Automatic:** Kalman filter will estimate when to accept or reject the data based on its confidence. This should be preferred over "Always Accept" mode.



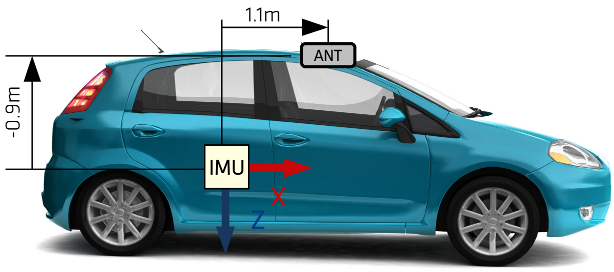
4.2. GPS configuration

> **Note:** This thumbnail will only appear if a port has been assigned to "GNSS" in the previous window "Assignment".

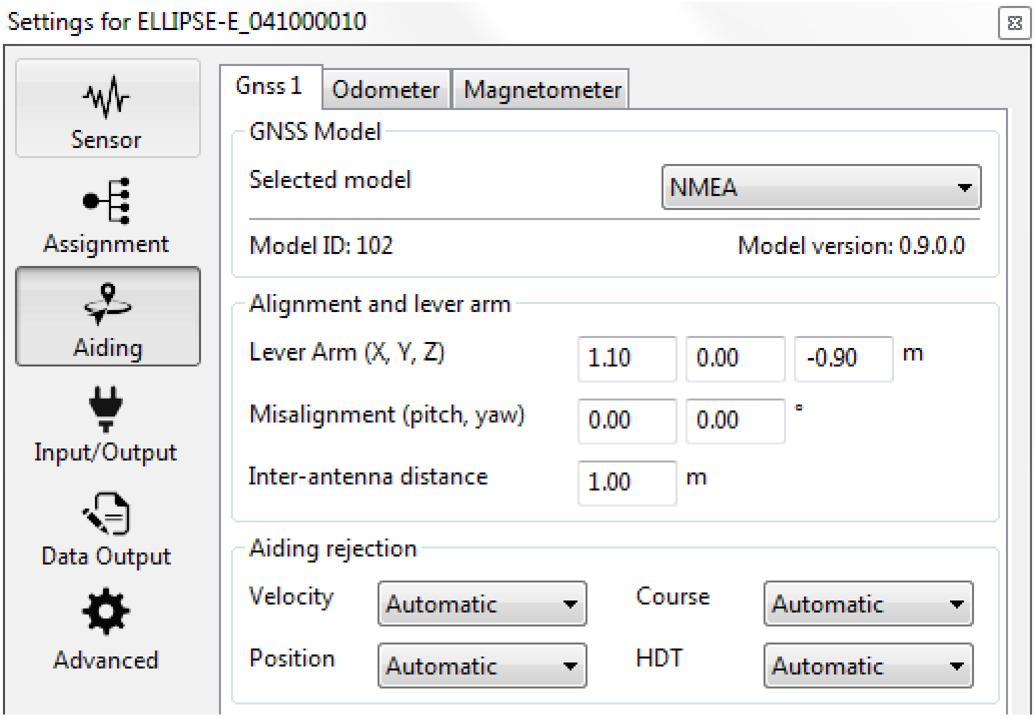
The GPS is configured differently depending on model of product:

- Ellipse-E: select the model to define which protocol is being used (NMEA, ublox, ...)
- Ellipse-N: select the constellation model (GPS+GLONASS, GPS+BEIDOU, or High Dynamics)

Then set up the lever arm from the device to the antenna, like in the following example:



In case a single antenna is used, the Inter-antenna distance does not matter, here we left it to 1 meter.



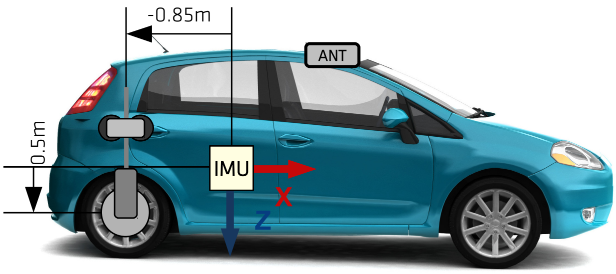
4.3. Odometer configuration

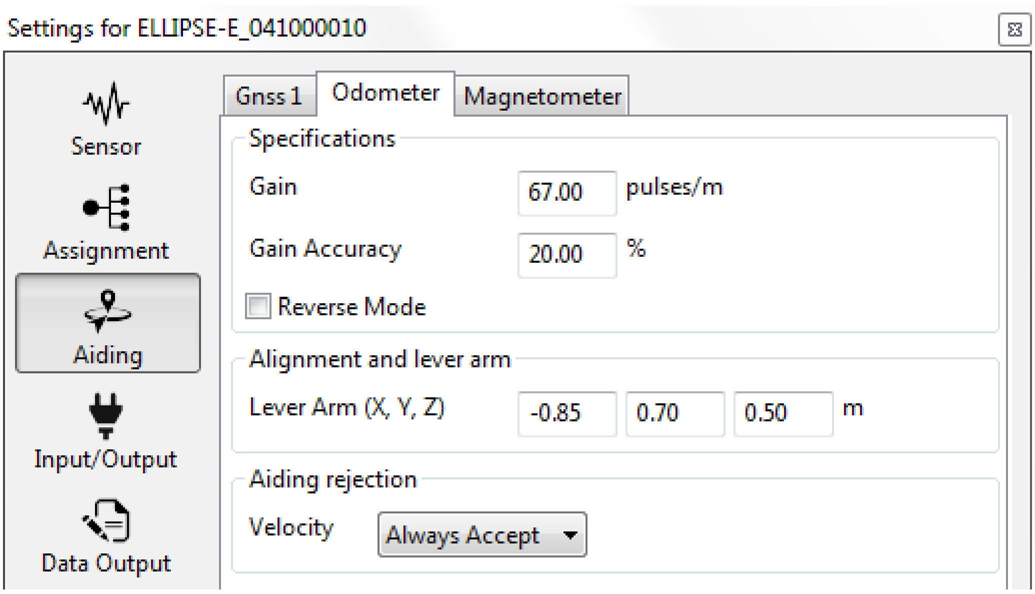
> **Note:** This thumbnail will only appear if a port has been assigned to “GNSS” in the previous window “Assignment”.

On this window you define the “Gain” in pulses per meter and the “Gain Accuracy”, which is the percentage of error you expect the odometer to have. A good odometer will have about 10% error, when the worse will be 100%. If you don't know how accurate is your odometer, you can set up 100% so the Kalman filter will completely estimate it by itself. It is better to overestimate the error rather than being too confident into the odometer, because the Kalman filter will compensate it.

The reverse mode should be selected when the odometer provides a negative value when moving forward. If a single synchronization is used, this parameter does not matter.

The Lever arm is calculated from the device to the Odometer in the realigned coordinate frame. For example an odometer of 128 pulses per rotation placed on a right wheel of 60 cm will be configured as follow:



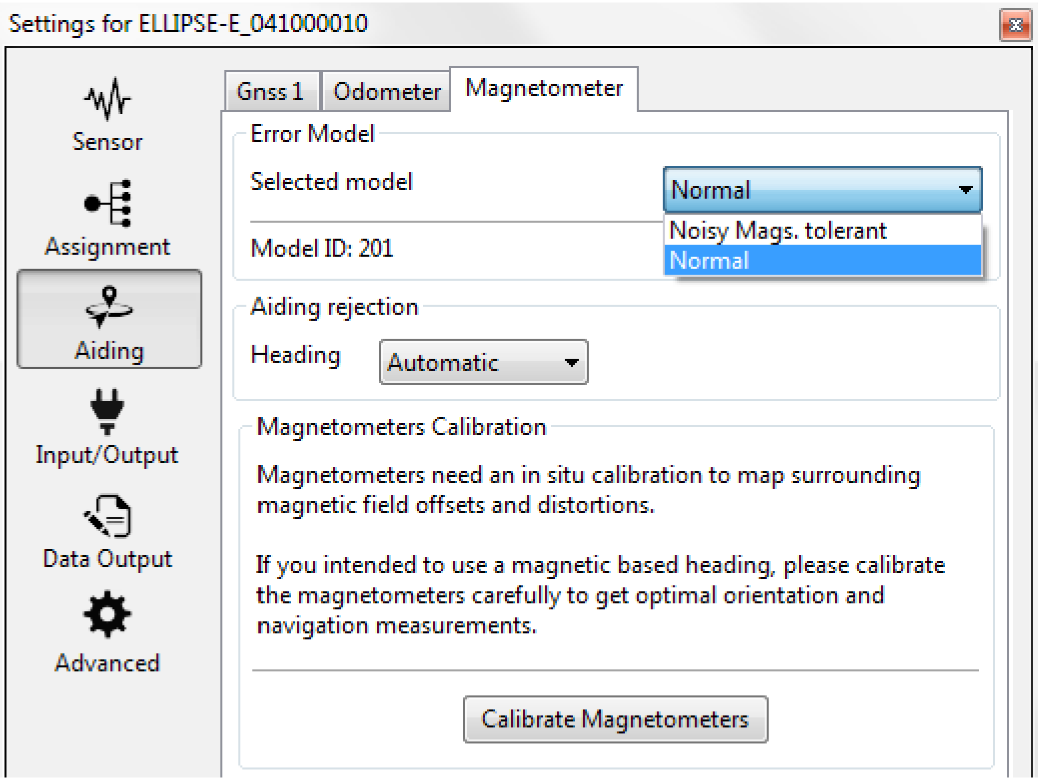


The Ellipse will be detecting pulses on rising edge.

4.4. Magnetometer configuration

Several models are available for the magnetometers depending on the magnetic environment:

- **Noisy Mags tolerant:** Select this if the magnetic field is disturbed (e.g: in a car)
- **Normal:** select this if the magnetic field nearby is clean (e.g: underwater without close contacts)



If you plan to use the magnetometers for heading, it is mandatory to do a magnetic calibration in order to have a reliable heading. Please refer to the documentation "Hard and Soft Iron Calibration Manual" for more details about that procedure.

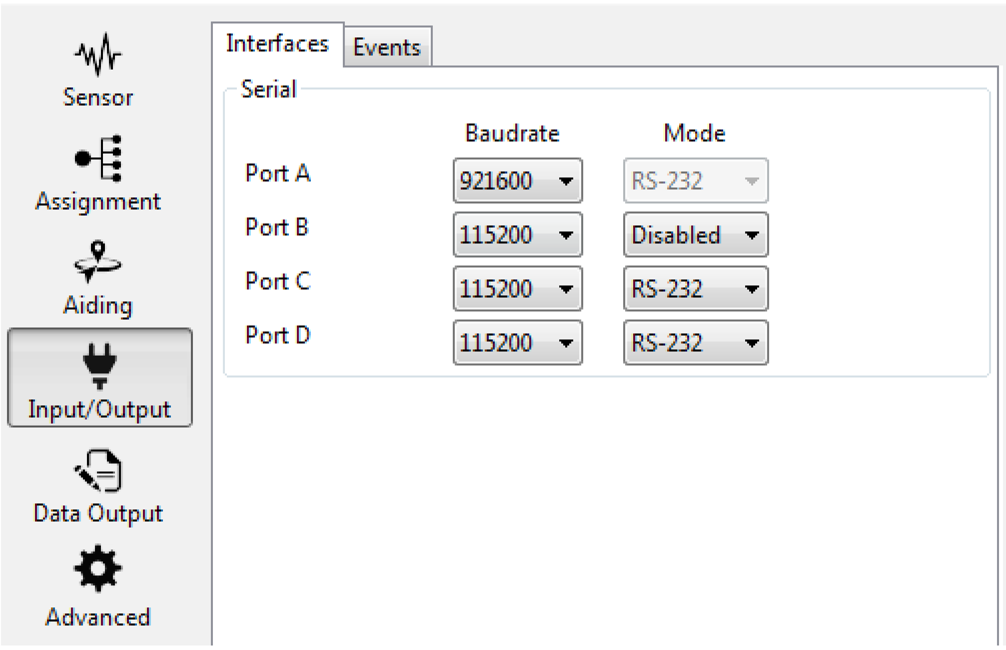
In case you don't want magnetometers as a heading source, you should select "Never accept" to disable them. They can still be used to log magnetic environments, this option only prevent the Kalman filter to use them as a reference.

5. Interfaces and logic input/output configuration

5.1. Serial ports

Each port can be configured with its specific baudrate and define in RS-232 or RS-422 for port B, C and D. Depending on the device (Ellipse-A, E, N or D) you may have a different number of serial port available.

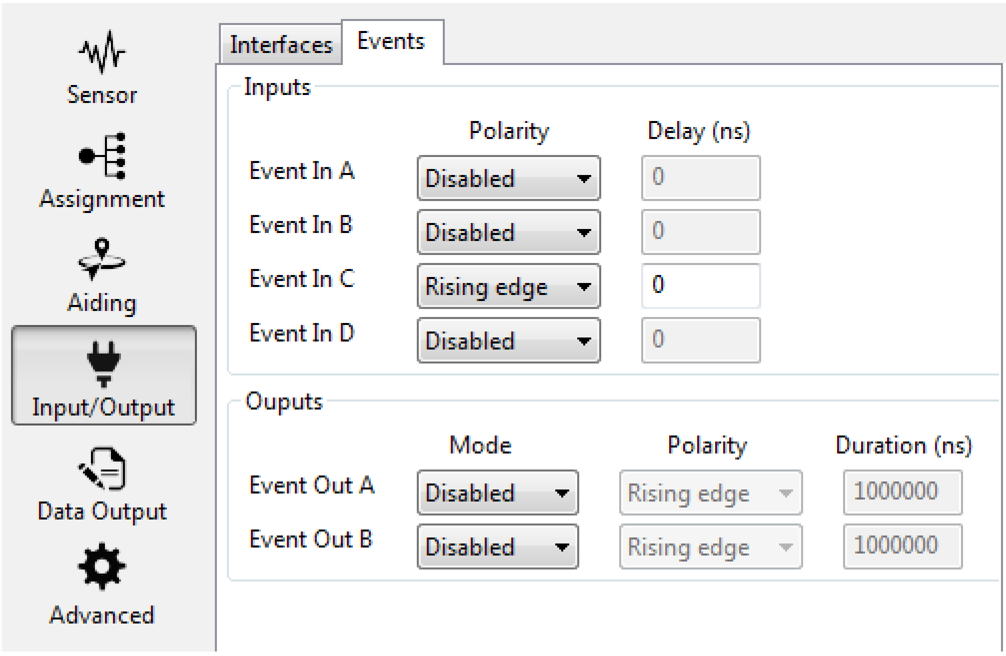
Port A is defined in RS2-232 by default, and can be defined as RS-422 if pin 5 of main connector is wired to ground.



Be aware than serial ports on low baudrates can be easily saturating if you have high outputs frequencies defined in “Data Output”.

5.2. Logic inputs/output

Several synchronizations are available on input and output. You may eventually set up a negative delay if you want to compensate a long transmission time. However this is usually not necessary.

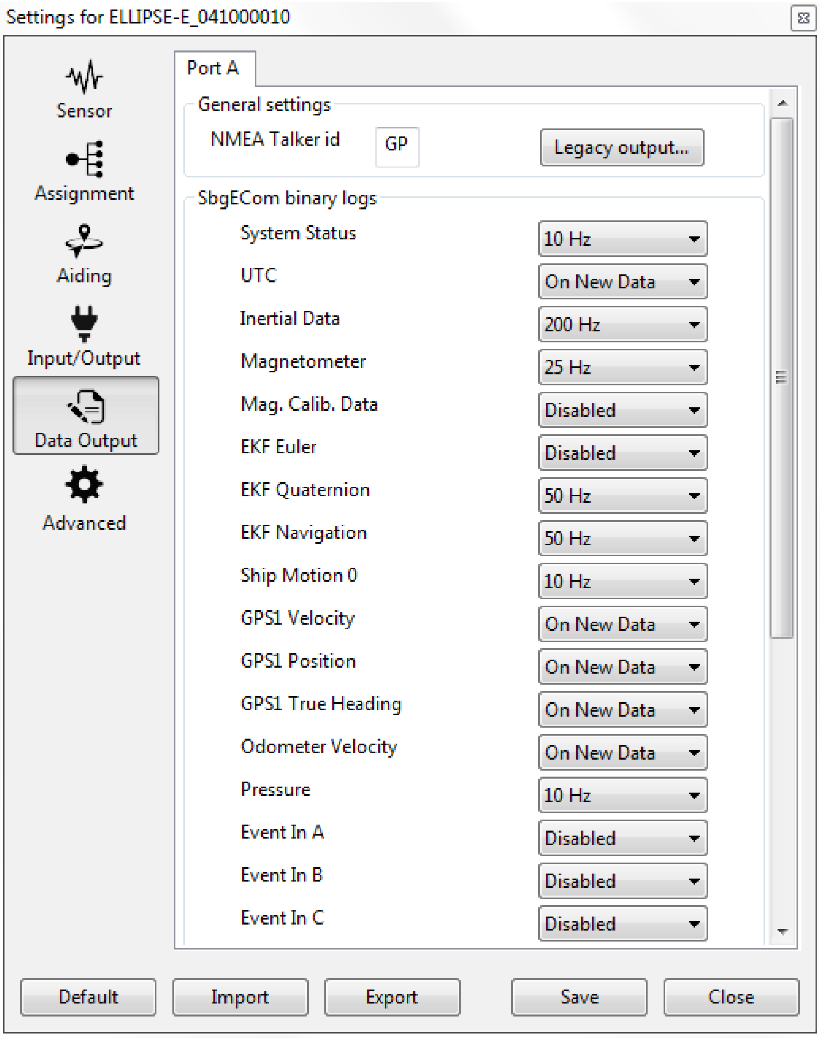


If the odometer is enabled, it will be already using the input synchronizations port A and eventually B as well. In that case the “Event In A” and “Event in B” will not be available in this panel.

6. Data output configuration

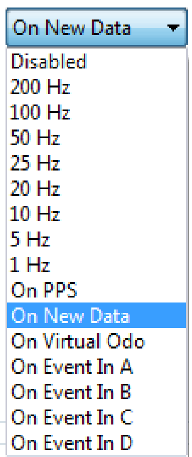
6.1. Binary

The binary messages are send using the proprietary format from SBG Systems with sbgECom library.



Each individual message can be defined to its own frequency from 1 to 200 Hz. They can also be triggered on input synchronizations or on a virtual odometer.

The option "New Data" triggers the output only when a new value is received. It is best used on GPS data. For instance the GPS is sending data at 10Hz to the Ellipse, there is no need to send it at 200Hz, so use this option to output it at 10Hz. If you change the GPS configuration, the output will then adapt to that new configuration. This avoid outputting 20 times the same data, and helps keeping data transmission efficient.



For each output you can refer to the “Ellipse Firmware Reference Manual” to have the detail of each individual message. For instance, the EKF Euler frame includes:

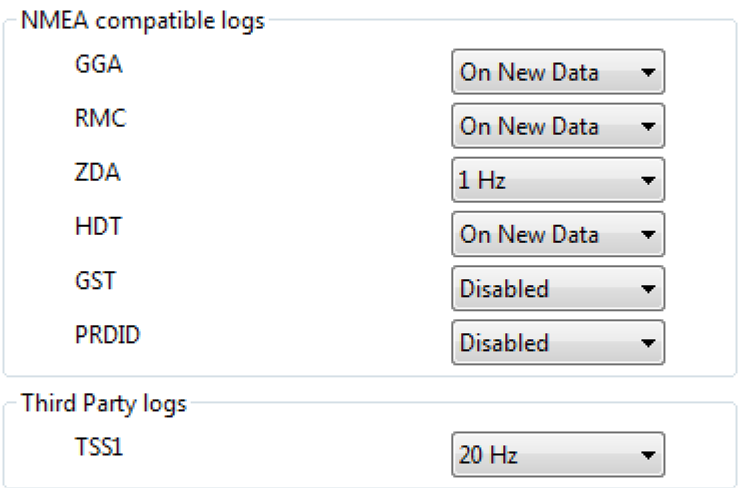
2.3.3.1. SBG_ECOM_LOG_EKF_EULER (06)

Provides computed orientation in Euler angles format.

Field	Description	Unit	Format	Size	Offset
TIME_STAMP	Time since sensor is powered up	µs	uint32	4	0
ROLL	Roll angle	rad	float	4	4
PITCH	Pitch angle	rad	float	4	8
YAW	Yaw angle (heading)	rad	float	4	12
ROLL_ACC	1σ Roll angle accuracy	rad	float	4	16
PITCH_ACC	1σ Pitch angle accuracy	rad	float	4	20
YAW_ACC	1σ Yaw angle accuracy	rad	float	4	24
SOLUTION_STATUS	Global solution status. See SOLUTION_STATUS definition for more details.	-	uint32	4	28
				Total size	32

6.2. ASCII

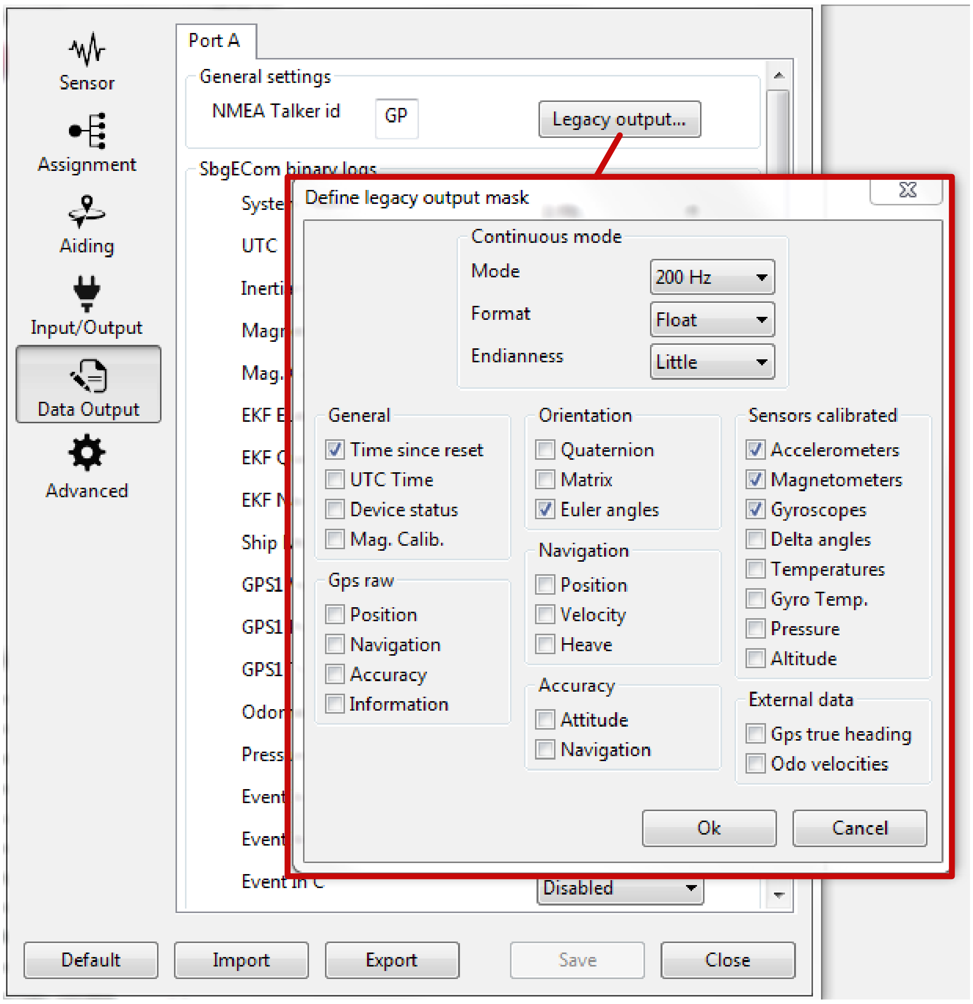
Ellipses can output binary and ASCII logs on port A, with each message having its own frequency. These messages includes standard NMEA frames and other Third Party logs, such as TSS1.



6.3. Legacy

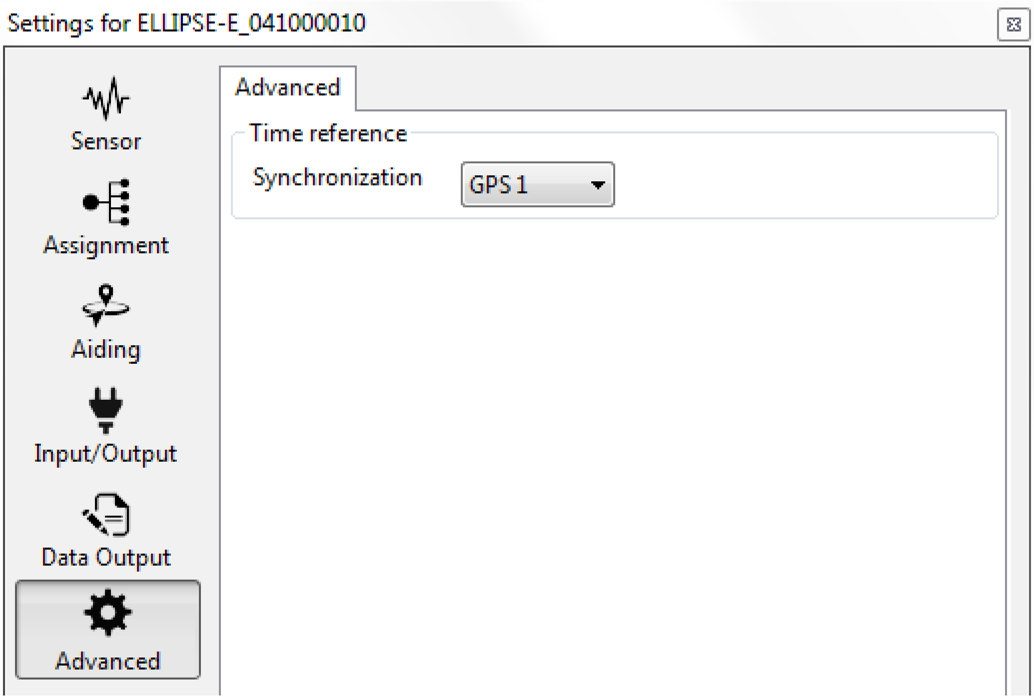
In order to keep compatibility with systems previously using IG-500 sensors, the Ellipse can output in "Legacy" mode: this means the frame will be sent with the binary protocol used by the IG-500. All selected outputs are sent in a single frame at the defined frequency.

When this mode is enabled, the Ellipse can still send binary in sbgECom protocol or other ASCII messages, so remember to disable these messages if you don't need them.



7. Advanced settings

This settings allows to synchronize the internal clock of the Ellipse to an external synchronization. By default the PPS from the GPS is used.



8. Support

Our goal is to provide the best experience to our customers. If you have any question, comment or problem with the use of your product, we would be glad to help you, so feel free to contact us:

EMEA:

SBG Systems S.A.S.
1 avenue Eiffel
78420 Carrières-sur-Seine
FRANCE

Phone: +33 1 80 88 43 70
support@sbg-systems.com

Americas:

SBG Systems North America, Inc
5932 Bolsa Avenue, Suite #103
Huntington Beach, CA 92649
USA

Phone: +1 (657) 549-5807
support@sbg-systems.com