

3D Sensor

Part number: 90-60-374-002



USER MANUAL and INSTALLATION SHEET

Version 3.0

nke - Racing

Z.I. Kerandré – Rue Gutenberg – 56700 HENNEBONT- FRANCE

<http://www.nke.fr>

CONTENT

1	USAGE	ERREUR ! SIGNET NON DEFINI.
1.1	INTRODUCTION	ERREUR ! SIGNET NON DEFINI.
1.2	TECHNICAL SPECIFICATIONS	3
1.3	LIST OF CHANNELS CREATED BY THE 3D SENSOR	ERREUR ! SIGNET NON DEFINI.
1.4	CHANNELS FILTERING	4
2	SENSOR'S CALIBRATION	5
2.1	COMPASS' MAGNETIC COMPENSATION	5
2.2	OFFSET SETTING	11
3	INSTALLATION	ERREUR ! SIGNET NON DEFINI.
3.1	MOUNTING THE 3D SENSOR	ERREUR ! SIGNET NON DEFINI.
3.2	INSTALLATION PRECAUTIONS	ERREUR ! SIGNET NON DEFINI.
4	TROUBLE-SHOOTING - 1RST LEVEL	ERREUR ! SIGNET NON DEFINI.

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 calculates the boat's orientation. 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
Gyroscopes:	±450°/s
Accelerometer:	± 8G

WARNING

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

All electrical connections of the **3D Sensor** must be made 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	Affichage	unité	Désignation
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 CHANNEL FILTERING

Channel filtering, for magnetic Heading and heel, is carried out by the **Multigraphic** or **Gyrographic**. Refer to the relevant manual for the filter settings. Filter settings affect the displayed data, not the raw data. Channels for magnetic field, rate of turn and acceleration cannot be filtered.

2 SENSOR CALIBRATION

3D Sensor is factory set. Nevertheless, an offset setting may be required to match the boat's specific characteristics to achieve optimum accuracy. Use the following calibration procedure.

2.1 COMPASS MAGNETIC COMPENSATION

The 3D Sensor can be affected by environmental influences on some boats. Despite a clean installation and an offset setting, deviation between the magnetic heading and true heading may be experienced over 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 larger equipment such as the keel or the engine can generate a magnetic field that adds to the earth's magnetic field, generating deviation. Therefore, the localised electromagnetic fields can induce errors in the magnetic heading, heel and pitch calculation.

There are several sources of magnetic influences:

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

As a general rule, the 3D Sensor must be placed at least one meter away from any potential magnetic 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 calculate 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 create maximum heel and pitch in all orientations.

To do this, you need a 3D sensor connected to a **Processor HR** or **Processor Regatta**, and a computer networked to the **Processor**.



The tools for magnetic calibration can be found on the **Processor's** web page.
The calibration procedure is embedded in the **Processor**.

2.1.2 Procedure for magnetic compensation of the 3D Sensor from a Processor HR



Warning

Auto compensation remains valid as long as the magnetic environment on board does not change. It is recommended to carry out the calibration with the boat in her racing configuration (extra batteries, anchor, etc.). Your calibration remains valid for any location in the world. If your heading compass is the reference, it must be correctly compensated to get an accurate True Wind Direction processed value. It is recommended to run several **360° under sails** to get the best possible calibration result.

Once the computer is connected to the **Processor HR** and the system is running, connect to the web page with the address 192.168.0.232 (refer to the **Processor HR** user manual for details about the connection configuration)

Launch your Internet browser and connect to the **Processor HR**.

In the **Magnetic Calibration** section, you will find several commands.

Once you are ready for calibration, click on: **1 > Start acquisition**

PROCESSOR HR

V3.9

Actions

- [Reboot processor](#)
- [Stop processor](#)
- [Backup on USB key](#)
- [Restore calibrations from USB Key and restart](#)

Installation and Calibration


- [Constants calibration](#)
- [Installation configuration](#)
- [True Wind speed linearisation](#)
- [True Wind Angle linearisation](#)
- [Speed polar](#)
- [Surface speed vs Heel compensation](#)

Magnetic calibration

- [1 > Start acquisition](#)
- [2 > Stop acquisition and compute magnetic calibration](#)
- [3 > Apply and save magnetic calibration](#)
- [Calibration result](#)

Pilot HR

- [Pilot Table](#)
- [Gust Table](#)



Analyse

- [Main events log](#)
- [Low level events log](#)
- [Instruments and Topline status](#)
- [Speed polar graph and limits sectors](#)
- [Optimum on speed polar](#)

Tools

- [Browse the Processor directory](#)
- [Network settings](#)

Datalogs

- [Erase datalog directory](#)
- [Erase archived datalog directory](#)
- [Browse the datalog directory](#)
- [Browse the archived datalog directory](#)

Custom development

- [Stop scripts](#)
- [Restart scripts](#)
- [SailNet configuration](#)
- [Lua Scripts Launcher Configuration](#)
- [Browse scripts Directory](#)

Manual total upgrade from a fimage file (Kernel+processor+configuration)

With this function you can upgrade the whole Processor flash memory. This operation will overwrite all the internal partitions of the Processor erasing your configuration files and polars with defaults files, but your datalogs in external flash will be untouched.

Upgrade unit with a new firmware via HTTP.

Selected the image file: Aucun fichier sélectionné.

A window opens and acquisition is in progress.



Sail in each point of sail for a few minutes with a turn rate of a few degrees per second, playing with heel angle as much as possible. The calibration process will be effective even if you cannot heel the boat in some sectors like “Up Wind”.

Once this sea commissioning is complete you can click on the Back button (arrow located on the top left of your Internet browser) to go to the Home page of the **Processor HR**.

Click on: **2 > Stop the acquisition and compute the magnetic calibration**

PROCESSOR HR

V3.9

Actions

- [Reboot processor](#)
- [Stop processor](#)
- [Backup on USB key](#)
- [Restore calibrations from USB Key and restart](#)

Installation and Calibration


- [Constants calibration](#)
- [Installation configuration](#)
- [True Wind speed linearisation](#)
- [True Wind Angle linearisation](#)
- [Speed polar](#)
- [Surface speed vs Heel compensation](#)

Magnetic calibration

- [1 > Start acquisition](#)
- [2 > Stop acquisition and compute magnetic calibration](#)
- [3 > Apply and save magnetic calibration](#)
- [Calibration result](#)

Pilot HR

- [Pilot Table](#)
- [Gust Table](#)



Analyse

- [Main events log](#)
- [Low level events log](#)
- [Instruments and Topline status](#)
- [Speed polar graph and limits sectors](#)
- [Optimum on speed polar](#)

Tools

- [Browse the Processor directory](#)
- [Network settings](#)

Datalogs

- [Erase datalog directory](#)
- [Erase archived datalog directory](#)
- [Browse the datalog directory](#)
- [Browse the archived datalog directory](#)

Custom development

- [Stop scripts](#)
- [Restart scripts](#)
- [SailNet configuration](#)
- [Lua Scripts Launcher Configuration](#)
- [Browse scripts Directory](#)

Manual total upgrade from a fimage file (Kernel+processor+configuration)

With this function you can upgrade the whole Processor flash memory. This operation will overwrite all the internal partitions of the Processor erasing your configuration files and polars with defaults files, but your datalogs in external flash will be untouched.

Upgrade unit with a new firmware via HTTP.

Selected the image file: Aucun fichier sélectionné.

This window opens, the acquisition is stopped and the corrections are applied.



Go back to the Home page of the **Processor HR**.

Then, click on: **3 > Apply and save the Magnetic calibration**

PROCESSOR HR

V3.9

Actions

- [Reboot processor](#)
- [Stop processor](#)
- [Backup on USB key](#)
- [Restore calibrations from USB Key and restart](#)

Installation and Calibration


- [Constants calibration](#)
- [Installation configuration](#)
- [True Wind speed linearisation](#)
- [True Wind Angle linearisation](#)
- [Speed polar](#)
- [Surface speed vs Heel compensation](#)

Magnetic calibration

- [1 > Start acquisition](#)
- [2 > Stop acquisition and compute magnetic calibration](#)
- [3 > Apply and save magnetic calibration](#)
- [Calibration result](#)

Pilot HR

- [Pilot Table](#)
- [Gust Table](#)



Analyse

- [Main events log](#)
- [Low level events log](#)
- [Instruments and Topline status](#)
- [Speed polar graph and limits sectors](#)
- [Optimum on speed polar](#)

Tools

- [Browse the Processor directory](#)
- [Network settings](#)

Datalogs

- [Erase datalog directory](#)
- [Erase archived datalog directory](#)
- [Browse the datalog directory](#)
- [Browse the archived datalog directory](#)

Custom development

- [Stop scripts](#)
- [Restart scripts](#)
- [SailNet configuration](#)
- [Lua Scripts Launcher Configuration](#)
- [Browse scripts Directory](#)

Manual total upgrade from a fimage file (Kernel+processor+configuration)

With this function you can upgrade the whole Processor flash memory. This operation will overwrite all the internal partitions of the Processor erasing your configuration files and polars with defaults files, but your datalogs in external flash will be untouched.

Upgrade unit with a new firmware via HTTP.

Selected the image file: Aucun fichier sélectionné.

This window opens, the calibration is saved in the 3D Sensor V3.



Go back to the Home page of the **Processor HR**.

The result of the calibration can be displayed in: **Calibration result**.

PROCESSOR HR

V3.9

Actions

- [Reboot processor](#)
- [Stop processor](#)
- [Backup on USB key](#)
- [Restore calibrations from USB Key and restart](#)

Installation and Calibration

- [Constants calibration](#)
- [Installation configuration](#)
- [True Wind speed linearisation](#)
- [True Wind Angle linearisation](#)
- [Speed polar](#)
- [Surface speed vs Heel compensation](#)

Magnetic calibration

- [1 > Start acquisition](#)
- [2 > Stop acquisition and compute magnetic calibration](#)
- [3 > Apply and save magnetic calibration](#)
- [Calibration result](#)

Pilot HR

- [Pilot Table](#)
- [Gust Table](#)

Analyse

- [Main events log](#)
- [Low level events log](#)
- [Instruments and Topline status](#)
- [Speed polar graph and limits sectors](#)
- [Optimum on speed polar](#)

Tools

- [Browse the Processor directory](#)
- [Network settings](#)

Datalogs

- [Erase datalog directory](#)
- [Erase archived datalog directory](#)
- [Browse the datalog directory](#)
- [Browse the archived datalog directory](#)

Custom development

- [Stop scripts](#)
- [Restart scripts](#)
- [SailNet configuration](#)
- [Lua Scripts Launcher Configuration](#)
- [Browse scripts Directory](#)

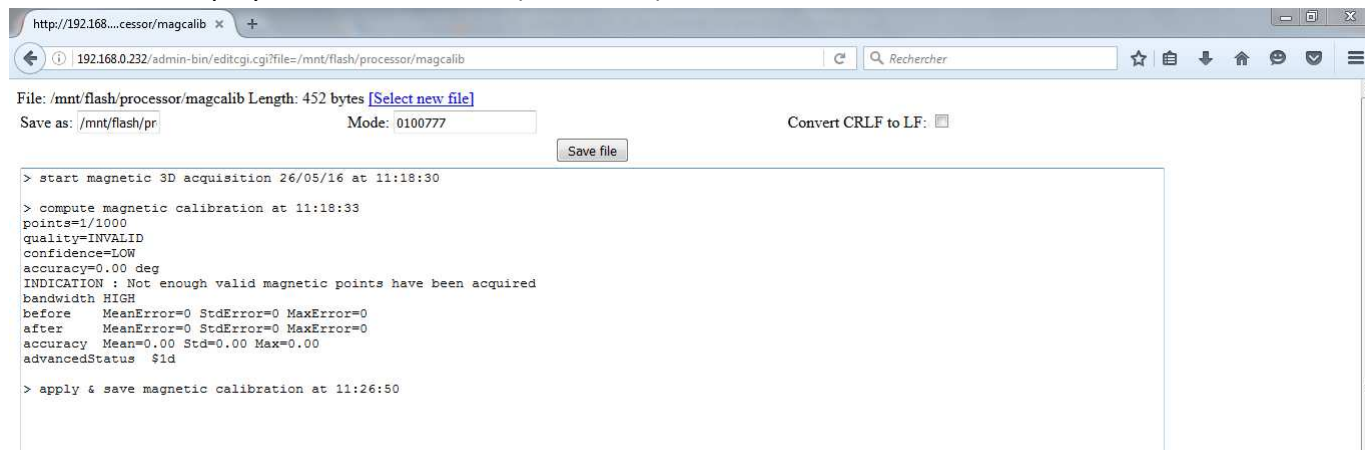
Manual total upgrade from a fimage file (Kernel+processor+configuration)

With this function you can upgrade the whole Processor flash memory. This operation will overwrite all the internal partitions of the Processor erasing your configuration files and polars with defaults files, but your datalogs in external flash will be untouched.

Upgrade unit with a new firmware via HTTP.

Selected the image file: Aucun fichier sélectionné.

The result is displayed in a text format (see below):



Example of a good calibration.

> start magnetic 3D acquisition 26/05/16 at 13:36:53

Launch the calibration

> compute magnetic calibration at 13:52:58

Stop and process the calibration

points=560/1000

Number of points kept for calibration

quality=OPTIMAL

Quality of the calibration

confidence=HIGH

Link to number of points

accuracy=1.02 deg

Average deviation

INDICATION :

Indication about calibration

bandwidth HIGH

Band Width for points acquisition

before MeanError=6 StdError=2 MaxError=10

after MeanError=1 StdError=1 MaxError=4

accuracy Mean=1.02 Std=0.84 Max=5.29

Calibration result

advancedStatus \$0

> apply & save magnetic calibration at 13:53:37

Save the calibration in the 3DV3

Below are some messages that can be displayed in the calibration result

- Quality: Optimal / Good / Poor / Invalid **Mainly dependent of influences occurring around the system during the calibration**
- Confidence: High / Medium / Low **Mainly dependent on the number of points taken to cover the calibration needs**
- Indication :
 - Vide : OK
 - No Enough Points: **Calibration must be repeated with more points**
 - Too much distortion: **There may be influences around the system**
 - X motion issue: **More Roll (heel) must be applied**
 - Y motion issue: **More Pitch must be applied**
 - Z motion issue: **More Yaw must be applied**
 - Alignment issue: **Influence located too close to the system**



WARNING

A stopped calibration cannot be resumed. It must be started again from scratch.

Any calibration saved in the 3Dsensor cannot be retrieved.

It is possible to get a good calibration even with a message in the **INDICATION field**.

When a calibration is perfectly achieved the **INDICATION field does not display**.

2.2 OFFSET SETTING

Once the 3D Sensor is installed and calibrated, it may 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. The **3D Sensor**, like your heading compass, is sensitive to any metal mass, the boat movement and the influences created by electric equipment. The installation must be made with a lot of care to achieve optimum accuracy.

3.1 MOUNTING THE 3D SENSOR

Install the **3D Sensor** on:

A 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)

Fixing 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 a general rule, the 3D Sensor must be placed at least one meter away from any potential magnetic source. Mount the 3D Sensor carefully with X line parallel to the boat's mid-line and X and Y on horizontal pla 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 datalog process easier).



Never expose the 3D Sensor to strong magnetic fields (magnets, compass, degausser). The 3D Sensor contains as few magnetic 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 1RST LEVEL TROUBLE-SHOOTING.

This chapter can help you quickly deal with small incidents that do not require a specialist. Read the following trouble-shooting table carefully before contacting customer support.

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. Carry out a three compass calibration.

If you cannot solve the problem, contact your distributor.