Compass 9X

Part number: 90-60-534-000

USER MANUAL

and

INSTALLATION SHEET

Version 1.4

nke marine electronics

Z.I. Kerandré – 6 Rue Gutenberg – 56700 HENNEBONT- FRANCE

http://www.nke.fr

CONTENT

1 USAGE

1.1 INTRODUCTION

The nke Compass 9X is a sensor specifically designed for performance sailing needs. It is a 9 axis compass based on the MEMS technology (Micro-electro-mechanical systems). The **Compass 9X** allows real time measurement of the boat motion and the calculation of the boat's orientation. It delivers magnetic heading, Roll Rate and Pitch Rate.

Miniaturization of the sensor and its integration to a new generation watertight case facilitates the installation on board.

1.2 TECHNICAL DATA

Power supply:	9 to 30VDC
Consumption:	<500mW
Angle resolution:	0.01°
Mag. Heading accuracy:	2° (dynamic)
Roll and pitch accuracy:	1° (dynamic)
Waterproof protection rate:	IP67
Weight:	200g
Dimensions:	H68 x Ø78
Operating Temp:	-10°C to +50°C
Storage Temp.:	-20°C to +60°C
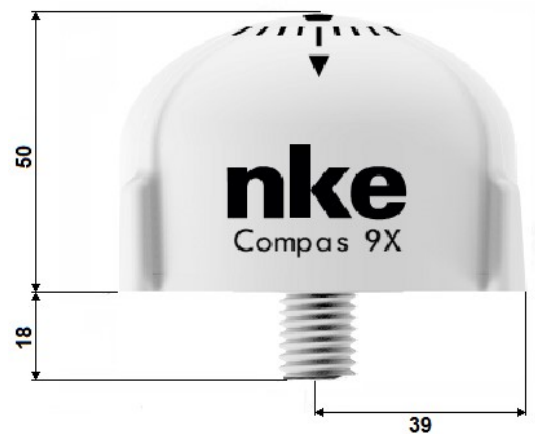
1.3 LIST OF TOPLINE CHANNELS CREATED BY THE COMPASS 9X

Compass 9X is a **nke** sensor that can be directly connected to the **Topline bus**. It automatically creates 6 channels on the bus.
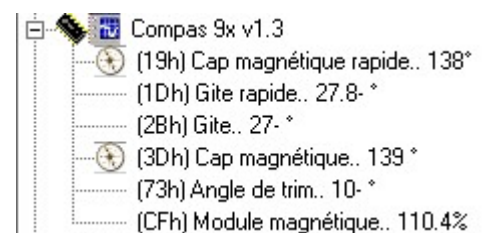
| Chanel	Display	Unit	Description
25	--	Degrees	Quick Compass (not displayed)
29	--	Degrees	Quick Heel Angle (not displayed)
43	Heel angle	Degrees	Heel Angle
61	Mag. Heading	Degrees	Compass
115	Pitch	Degrees	Pitch Rate
207	Mod mag	%	Magnetic module

2   SETTING THE SENSOR

2.1   FILTERING MEASUREMENTS

The user can set a filter for the Magnetic Heading, Heel Angle and Pitch Rate channels.

Via the menu [image], select the data for which you want to set the filter. These filters affect only the displaying.

You can set the filter with a value from 1 to 32 seconds. The lower the filter, the more responsive the data.
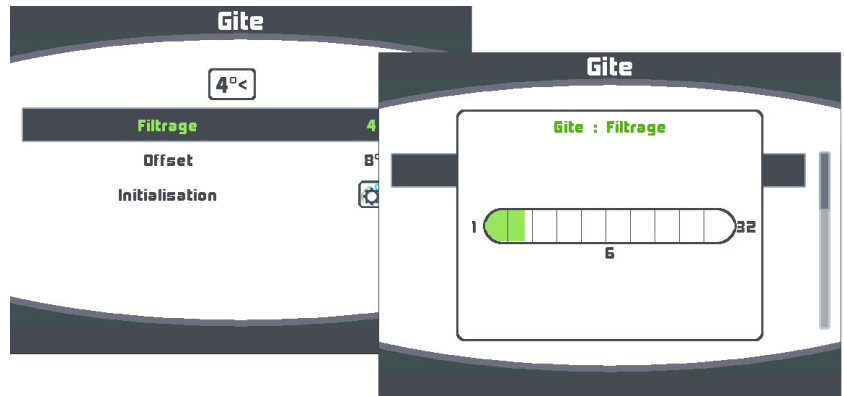
2.2   SETTING THE OFFSET

Depending on the system installed on board, it may be necessary to set an offset for **Magnetic Heading, heel angle** and **pitch**.

2.3   SETTING THE HEADING ALARM

Via the **Alarm** menu, select the **Magnetic Heading** function for which you want to set an alarm. Then you can choose a heading value as a reference (base) and an angular sector (range) setting angle ends to trigger alarm.
Thus, setting an alarm on the compass allows efficient monitoring of the boat's heading.
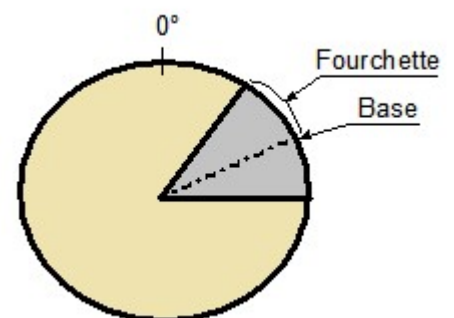
3 SENSOR CALIBRATION

The **Compass 9X** is factory calibrated. However, a synchronisation is required to take the magnetic environment of the boat into account and get the expected accuracy. Follow the calibration procedure below.

3.1 WHY AN AUTO-COMPENSATION

On some boats, the **Compass 9X** might be perturbed by the equipment on board. Despite a correct/appropriate installation and an offset value, a discrepancy may remain between the displayed heading and the effective magnetic Heading, and this on various sectors on 360°.

Magnetic sensors are very sensitive to their environment. Small metallic items such as screws as well as larger 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:

- The deviation can be caused by fixed magnetic metals like the keel, and equipment such as a speaker, a life-raft.
- Deviation caused by moving equipment: tool boxes, life-jackets, non-fixed gas bottles, non-fixed life-raft, laptops…
- Perturbations caused by equipment generating constantly changing magnetic radiations, like autopilot power cables, transponder, VHF radio…

Generally, the 9D Sensor must be placed at least one meter away from any potential magnetic perturbation source.

3.1.1 Three dimension auto-compensation principle

This auto-compensation procedure aims to recognize all magnetic perturbation sources on board. An algorithm will make the difference between the earth magnetic field and all influences on board for compensation. Therefore, the auto-compensation must be carried in an area free from any magnetic influence (far enough from the marina and any metallic structure). Ideally, for optimal results, the auto-compensation is carried in 3 dimensions. Therefore, we try to place the sensor in all possible orientations; including pith and heel angle up to 30° so that the **Compass 9X** can acknowledge as many magnetic errors as possible. Synchronization is done by hand to obtain the maximum pitch and roll in all orientations.

To do so, you need a Multigraphic with a firmware version <u>V2.4</u> or higher.

## 3.1.2 Compensation of the magnetic deviation with a Multigraphic V2.4

> ⚠️ **WARNING**
> The compensation remains valid as long as the magnetic environment on board does not change, whatever the position on the globe.
> If the helm compass is used as a reference, it must be correctly compensated.

The calibration movement is broken down into 7 sub-movements which are to be carried out consecutively. The top of the compass will be oriented in 7 different directions:

- High (sensor in normal position head up)
- low
- port
- starboard
- front
- back
- High (we return to the first orientation)
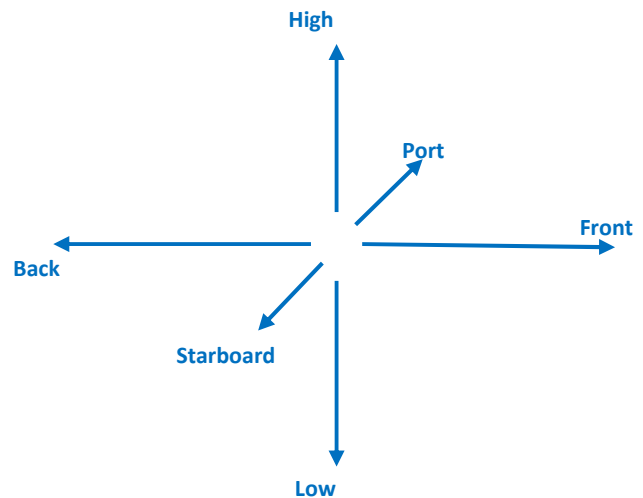
The sub-movement to be performed is as follows:

- The compass should rotate 360° one way and then the other
- During the 360°, it is necessary to make an oscillating movement to put a bit of roll and pitch
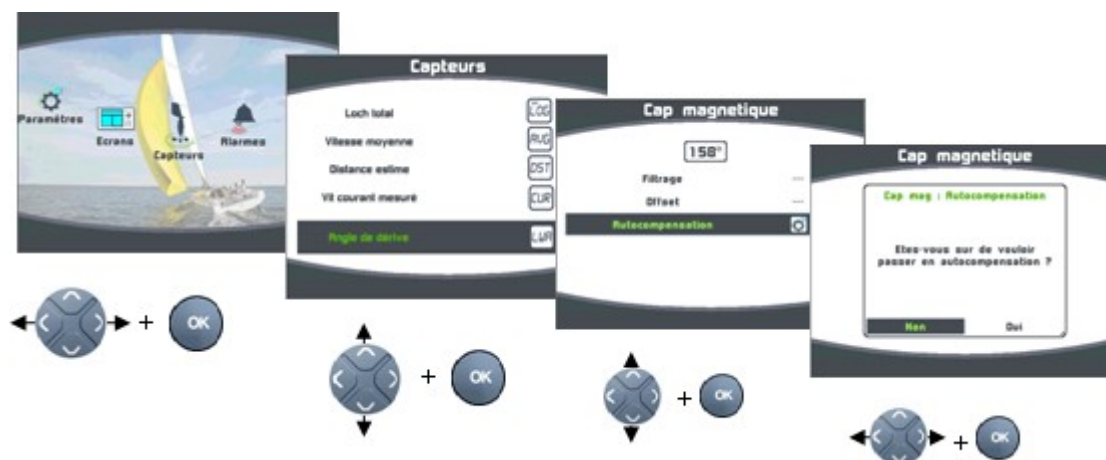- The movements must be quite slow 30 seconds to one minute per sub-movement
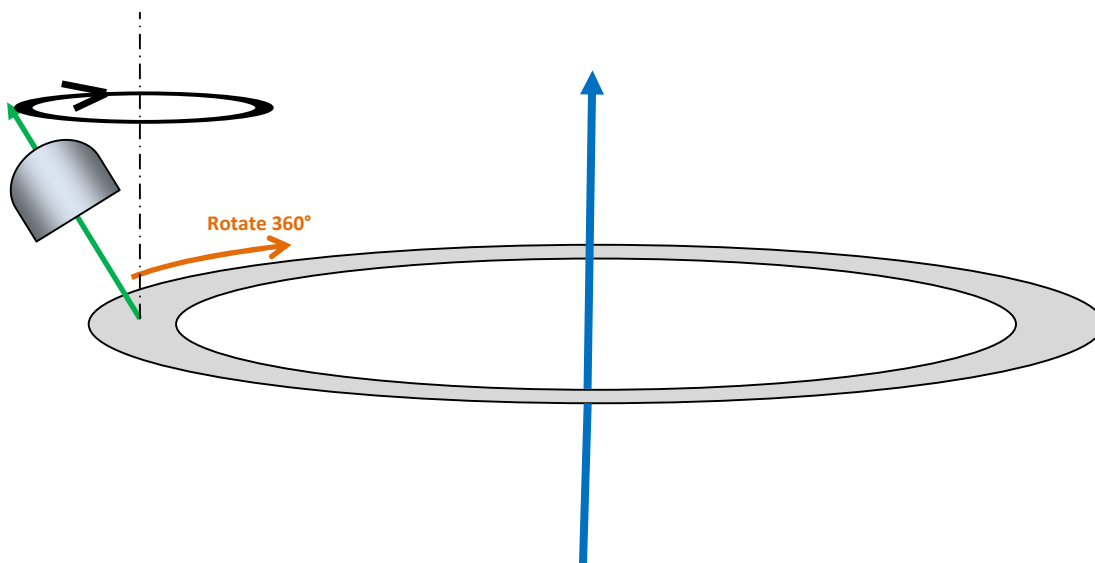
A video is available on YouTube showing the movements to be made for this synchronization.
https://www.youtube.com/watch?v=CVnp6bKbUik

Via the menu select **Magnetic Heading** in the list of sensors.

Then, run the compensation following the instructions below.

A page will appear to control the compensation process, allowing you to check the heading and heel.
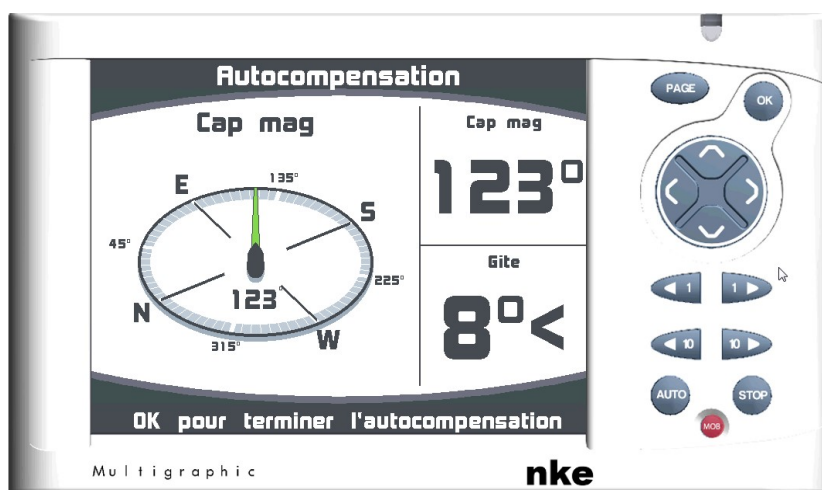
Now proceed to sail in circles with various heel angles to get as many measures of magnetic errors as possible.

There is no time limit to complete this procedure. Once you think that you have sailed with the most possible situations, press OK to launch the compensation data process.

### 3.1.3 Interpretation of results for the compensation process

After pressing OK to complete the procedure, you will see the following message:

<u>Calibration successful:</u>

The compensation has been successfully completed and the deviation correction factors have been calculated. A quality rate is displayed. The closest the value to 1.0 the better.
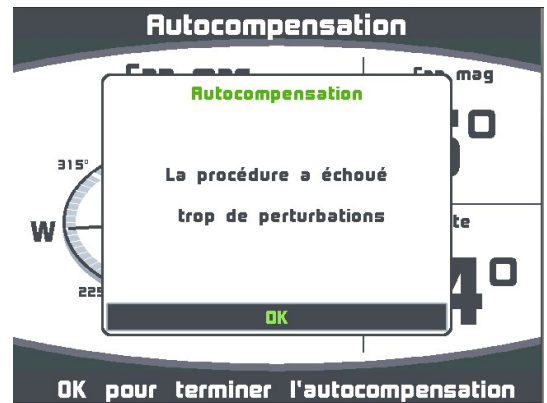
Select/press YES to save the new settings.
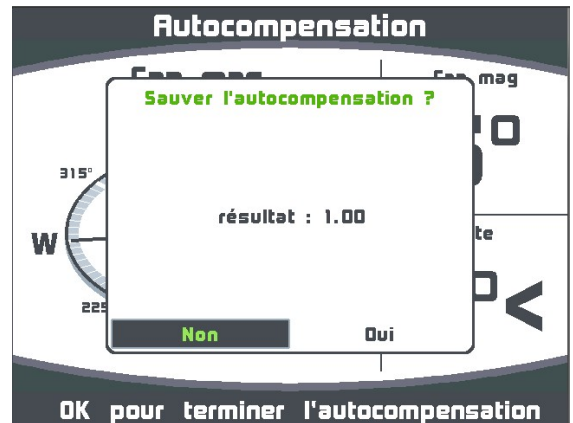
<u>Error 1:</u>

The calibration has failed because the samples of measures are not consistent. The deviation is abnormal and cannot be compensated.

Before starting a new calibration, check the magnetic environment around the **_Compass 9X_**. Check that no magnetic mass is close to the sensor and sail away from metallic boats.

<u>Error 2:</u>

The calibration has failed because the compensation algorithm does not have enough data samples available.

You must start a new calibration, sailing several times at 360° with the boat heeling as much as possible.
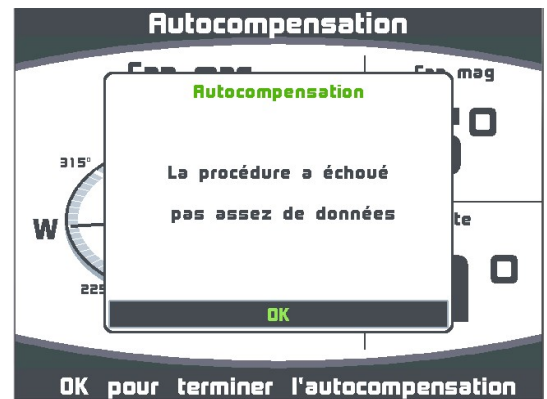
<u>Error 1 and 2:</u>

The calibration has failed. The sensor indicates abnormal deviation values linked to too important perturbations (Error 1) and not enough data (Error 2).

Refer to the indications in the previous paragraphs (**cf Error 1 and Error 2**).

3.1.4 Magnetic Module

The magnetic module channel gives an indication of the quality of calibration in relation to the magnetic environment of 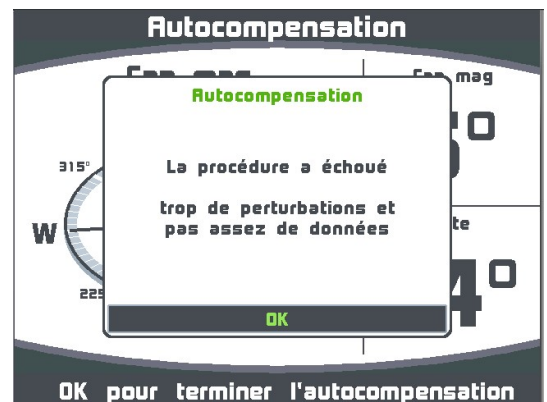your 9X compass. The value is in %. It approaches 100% and should not fluctuate to much in the order of 10%. This fluctuation is the parameter to take into account first.

3.2 CORRECTION TABLE

The correction table can be used with a Multigraphic V2.6 or higher. This table allows you to make an adjustment of the magnetic heading if you still observe after compensation of the heading offsets compared to your reference. Compensation of the 9x compass is mandatory.

Use the method, which consists of reading the deflection curve every 30° by taking readings on alignments, or by comparing the different headings compared to a calibrated compass and manually filling the correction table.

Procedure for complete the correction table
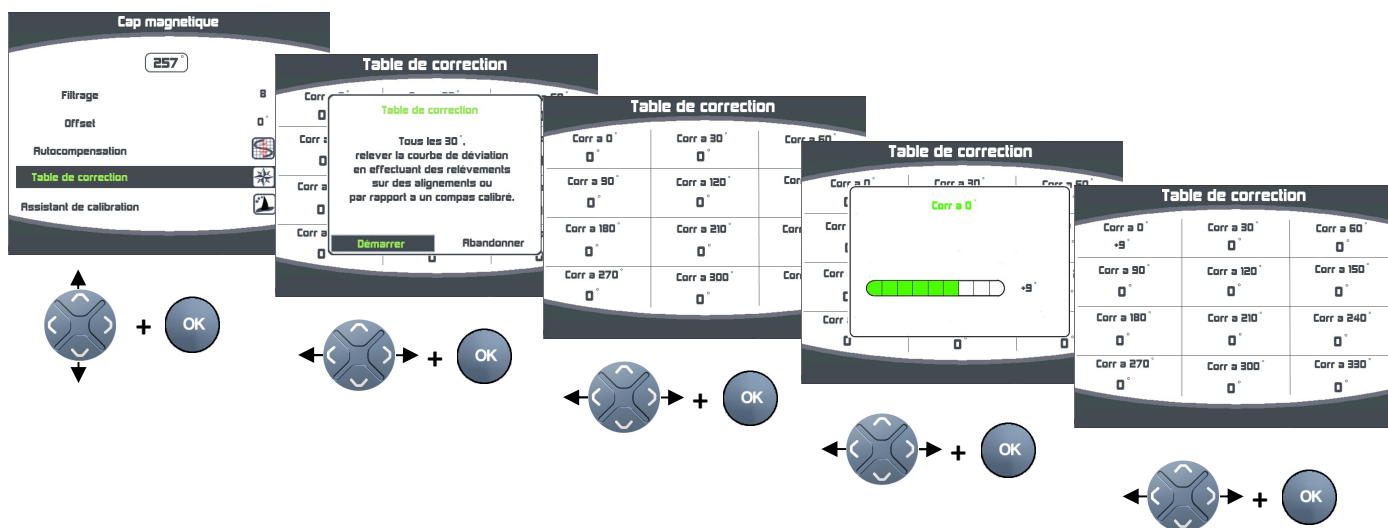
Once this correction table is completed, your 9X compass is corrected for the deviation curve.

4 NMEA OUTPUT

The Compass 9X features a RS232 output used to transmit the sensor's measured data using the protocol NMEA 0183 Version 4.1. The default data rate is 38 400 bauds. It can be changed with the Toplink maintenance tool. Only HDG and XDR sentences are output on a 9X Compass. The PRDID phrase is factory locked. However, it is possible to unlock it using the Toplink software by asking the technical service.

When the **Compass 9X** is powered, an id sentence is transmitted. This proprietary sentence allows to check the firmware version of the product.

```
$PNKEV,Compass 3D nke 1,V1.0,Sep 19 2017,08:37:54,03881091,V1.2.1*33<CR><LF>
```

```
          |            |    |              |        |              |        \
          |            |    |              |        |              |         \          Magnetometers Version
          |            |    |              |        |              \          Magnetometers serial numbers
          |            |    |              \        \        Date and time of the compilation
          |            |    \
          |            \    Firmware Version
          \        Hardware revision number
   Product Description
```

The boat motion is communicated with the proprietary/owner sentence $PRDID according to the format described below. This sentence is sent at 25Hz.

```
$PRDID,+007.48,+024.51,274.28*7B<CR><LF>
          |        |          \
          |        \        Magnetic Heading
          \        Roll Rate (positive value when heeling on port)
   Pitch (positive value when bow up)
```

The Magnetic Heading is given by the sentence $HCHDG at 10 Hz.

```
$HCHDG,296.74,,,,*7C<CR><LF>
          \
   Magnetic Heading
```

The internal temperature of the sensor and the Topline Bus voltage are given the sentence $YXXDR at 10 Hz.

```
$YXXDR,C,35.9,C,TEMP,U,12.169,V,VBUS*50<CR><LF>
          |                  \
          \              Bus Voltage (V)
   Internal Temperature (°Celcius)
```

The table here below indicates band width occupation available at 38 400 bauds with the default transmission rate.

Sentence type	Description	Nbr of digits (with checksum)	Transmitting rate	Transmission time (@38400bauds)	Band width occupation
$PNKEV	Identification	70	0 Hz	18.3 ms	0
$PRDID	Attitude	34	25 Hz	8.8 ms	22.1%
$HCHDG	Magnetic Heading	22	10 Hz	5.7 ms	5.7%
$YXXDR	T° and Bus Voltage	41	10 Hz	10.7 ms	10.7%
Total				**43.4 ms**	**38.5%**

5 INSTALLATION

Before starting the installation of your **Compass 9X**, take the time to define the best location for that sensor. Like every compass on board your boat, the **Compass 9X** is sensitive to magnetic masses, boat's motion and interferences due to electric equipment. Even though it can run an automatic calibration, the installation must be made with a lot of care to get the optimums measuring accuracy.

5.1 MOUNTING THE COMPASS 9X

The **Compass 9X** is mounted on a vertical bulkhead with the supplied bracket. Choose the location as close as possible to the boat's centre of rotation. It must be distant from any magnetic mass (keel, alternator, etc.) and electric cable runs. Generally, the 9D Sensor must be placed at least one meter away from any potential magnetic perturbation source. **Take care of mounting the sensor horizontally and orientated towards the bow (see the mark on the bottom of the case).** The longitudinal axis of the **Compass 9X** must be parallel to the boat's axis. This will avoid setting high offset values (<5°).

Note: A heel angle 10° port side is displayed **10°<** on a Multigraphic Display.

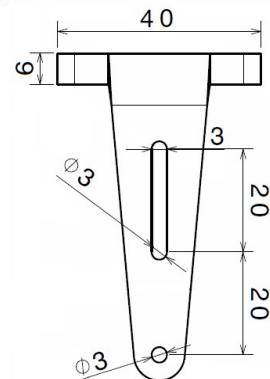*Mounting bracket (31-03-015)*

Drilling template

Warning :

The tightening of the four lobe nut must be done by hand without forcing. Once tightened check that the compass cannot be turned by hand.
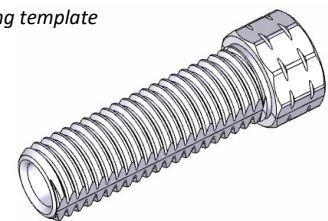
If required, a 50 mm extension (not supplied) can be screwed on the bottom of the case to mount the **Compass 9X** on a thick surface (< 40 mm).

Fixamo M14 (30-95-031)

5.2 ELECTRIC INSTALLATION

The **Compass 9X** is delivered with a bus cable featuring 5 wires and a braid. The colour code is described below:

- White: +12Vdc
- Black: Topline Data
- Shield: GND / NMEA Out -
- Red: NMEA Out +
- Yellow: RS232 - TX
- Green: RS232 - RX   } *Connection to PC*

The electrical connection on the *Topline bus* must be made with the bus connection box : 90-60-121 or *Topline bus* connection box with NMEA input : 90-60-417

Warning :
It is important to leave several loops on the cable under the support to allow synchronization of the sensor in good condition.

6 TROUBLE-SHOOTING - 1ST LEVEL

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

Faults	Possible causes and solutions
No Information about Compass, heel angle and pitch on nke displays.	Check the wiring of the sensor, refer to chapter Electric installation.
The magnetic heading is displayed, but very different from the steering compass.	Check the orientation of the sensor, refer to chapter Installation of the *Compass 9X* Check that no equipment that can be a source of magnetic perturbation is close to the *Compass 9X*. Check that the helm compass used as a reference is also free from perturbation sources and that its deviation compensation is properly done. Make a calibration of the *Compass 9X* following the procedure **Compensation of the magnetic deviation**.

If you can't solve the problem, contact your distributor.

7 SOFTWARE EVOLUTION OF THE 9X COMPASS

REV	Dated	Information
V1.0	22/06/2018	- Original version
V1.1	04/12/2018	- Compatibility with V2 chips - Correction of the roll sign in the NMEA sentence
V1.2	28/12/2018	- Addition of the Magnetic Module Channel
V1.3	21/02/2019	- New calibration parameter
V1.4	03/09/2019	- Integration of the correction table