

USER GUIDE GYROPILOT 2



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1 UTILISATION

1.1 GYROPILOT OPERATING PRINCIPLES

Fitted with an electronic Gyrometer, the pilot makes the necessary rudder angle corrections regarding two criteria :

- Distance apart route to the selected steering angle
- The speed of rotation of the boat due to the action on the rudder, the wind or the sea state

The Topline compass, corrected by the Gyrometer data gives the distance apart route data. The correction value is proportional to :

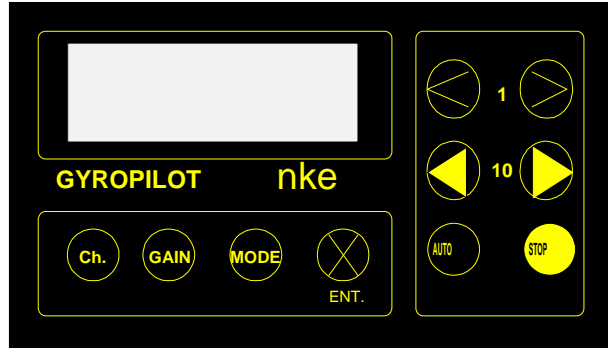
- the distance apart route measured
- the gain value











and inversely proportional to the boat speed

The Gyrometer gives the speed of rotation of the boat and the correction value is proportional to :

- the speed of rotation measured
- the counter rudder value (set in the secondary channel Pb)

1.2 COMMAND DISPLAY



-  Selection of the channel displayed
-  Rudder gain selection
-  Operating mode selection
-  Lights setting local
Light setting general, ccorrecion value confirmation
e.g. secondary channel value, gain value
-  Port 1°
-  Starboard 1°
-  Port 10°
Autotack on Port after 3 s
-  Starboard 10°
Autotack on Starboard after 3 s
-  Engage the pilot on the selected mode
-  Disengage the pilot

1.3 COMMAND DISPLAY CHANNELS

If the Command Display is the master of the Bus, it enables you to read and act on the bus parameters, in addition to Gyropilot own parameters.

rU : rudder angle in degrees
 - **XXX** the boat comes to Port
XXX – the boat comes to starboard

rF : Reference : the value of the selected mode when the pilot is AUTO, e.g. compass heading
Hb : House battery voltage
MP : Average power consumption in the last hour

If the command display is slave, it enables to read and act on the pilot parameters.

SP : Boat Speed
Ad : Apparent wind direction, Port **-XXX**, Starboard **XXX-**
CO : Compass heading

P : Heading and distance to the next WAYPOINT (if pilot in nav mode)

ct : Cross Track Error (if pilot in nav mode)

G : Heading and Speed over the ground

Note : The display will only give access to a given channel if the required sensor is installed in the system, e.g. Navigation channels are only available with the GPS installed in the system

To read the version of the software of the gyropilot multifunction :

- put at posting the channel : "co : non "
- support and maintain to support the key mode until the sound beep (approximately 8 seconds).
- appears on the screen, the address of the gyropilot multifunction (according to the version of the software), then the version log.

1.4 SECONDARY CHANNELS

They permit to do the settings on different parameters :

Settings

- Alarms
- Sensors calibration
- Gyropilot parameters to optimise its behaviour regarding sea state and your boat

The secondary channels linked to the channels **SP** (Boat Speed), **Ad** (Wind Direction), **CO** (Compass) and **Co** (Configuration :language and alarm validation) are explained in the User Guides related to these items.

1.4.1 Channel rF : reference

This channel indicates the value of reference used by the pilot regarding the mode chosen :

- Rudder Mode : selected rudder angle

- Compass Mode : selected heading
- Wind mode : selected wind angle
- Nav mode : Cross Track Error (**ct**)

The secondary channels of the **rF** channel give access to the Gyropilot parameters

1.4.2 List and function of the secondary channels

FO : Alarm Fork, change in wind direction or change in compass heading, factory setting at 15°

SP : Average Boat Speed value used by the pilot computer to adjust the amplitude of the rudder movements

This value enables the pilot to determine a corrective coefficient for the gain. The base principle is “the more important is the boat speed, the less quantity of rudder is necessary to obtain the same angle”.

Corrective coefficient if speedo not connected = 6/SP

The factory setting is at 6, the coefficient is then of 1

Corrective coefficient if speedo connected : SP/Boat Speed measured by the log

e.g. if the boat speed measured is of 12 knots, the coefficient is of 0.5.

AM : Angle of operation. It is the tolerance in heading. The factory setting is at +/- 5°. The weaker th is value is, the better the heading pursuit is, on the other hand, it generates more rudder movements so a greater power consumption...

S : Speed of Autotack, can be set from 1 to 31, factory setting is at 4°.

tA : Tacking Angle value in compass mode, can be set from 70° to 115° by steps of 5°. Factory setting at 100°.

rG : Counter Rudder value, enables to counter the effects of inertia of the boat during fast rotations (e.g. tack) or movements due to the waves in reaching conditions. The computer then corrects the rudder movement to avoid making too much heading change. This function is possible thanks to the Gyrometer which provides an instantaneous measure of the boat rotation speed. The counter rudder can be set from 1 to 9 and on Auto mode (factory setting). In this last case, the counter rudder adjustment is made automatically in function of the gain.

d : dampening of the wind direction when the pilot is used in wind mode, from 0.5s to 128 s (see table below)

d = 0	Automatic dampening
d = 1	Dampening = 0,5 s
d = 2	Dampening = 1 s
d = 3	Dampening = 2 s
d = 4	Dampening = 4 s
d = 5	Dampening = 8 s
d = 6	Dampening = 16 s
d = 7	Dampening = 32 s
d = 8	Dampening = 64 s
d = 9	Dampening = 128 s

If $d = 0$, the dampening adjusts automatically according to the Wind vane oscillations.

e.g. : if the oscillations are of +/- 10°, the dampening is at 2 s.

if the oscillations are of +/- 180°, the dampening is at 72 s.

1.5 ACCESS TO THE SECONDARY CHANNELS

By action on the button **ch.**, bring the desired channel on screen

Press and maintain the **ch.** Button, the secondary channels stream after 2 seconds, at the rythm of 1 per second. When the desired secondary channel appear, loose the **ch.** button.

With the **< (-1)** and **> (+1)** buttons, select the desired value. Confirm your selection by pushing on the button **Ent.**

1.6 LIGHTING

Every action on a button brings lighting for 10 s.

1.6.1 Local

Press and maintain the button **Ent.** until you obtain the desired value (0 to 4).

0 = lighting switched off

4 = lighting maximum

This modifies only the lighting level of the command display.

1.6.2 General

Press and maintain the button **Ent.** until you obtain the desired value (0 to 4), loose the button and press it again until you hear a bip (2 s.).

The selected lighting level is then applied on all the Topline displays of the Bus.

1.7 GAIN

The gain is the necessary quantity of rudder to correct the distance apart.

Up-wind with a calm sea and well balanced boat, you can use a gain between 1 and 3. At gain 1, the gyrometer is not operating and the counter-rudder value is not taken into account until gain 4.

In reaching conditions or with a rough sea, big amplitude movements can be necessary. You then need to select a 4 to 9 gain level. The gyrometer and counter-rudder value are then activated.

Gain adjustment : by successive push on the **Gain** button, select the desired gain value, confirm by pushing on **Ent.**

2 OPERATING MODES

CAUTION : in all situations, put the pilot on STOP before switching off the power supply.

2.1 COMPASS MODE

This mode requires a Topline Compass.

2.1.1 Operation in Compass mode

The pilot follows a determined heading

1. The pilot is on Standby (: are flashing)
2. Bring the boat on the desired heading
3. With the **mode** button, bring compass on the display
4. Push on the **Auto** button, **rF** followed by the selected heading appears and the boat follows it within the angle of operation (**AM**).

The heading can be modified slightly by pushing on the +/- 1° (< or >) and +/- 10° buttons (◀ or ▶).

2.1.2 Alarms in Compass Mode

If there is a mast-head unit in the installation, it is possible to trigger a wind direction change alarm.

- Press AUTO for 2 seconds until you hear a BIP
- The wind direction change alarm is activated

The reference angle is the one measured when you push on AUTO, the fork is the one selected in the secondary channel FO. If it has not been modified since the installation, the fork is of 15°.

2.1.3 Autotack in compass mode

It is possible to make an Auto Tack on Port or Starboard. The value of Tack can be set between 70 and 115° by steps of 5°.

This value can be set in the secondary channel tA of the channel rF.

To tack on Starboard, press and maintain the button ▶ until you hear a BIP, the tack then starts

To tack on Port, press and maintain the button ◀ until you hear a BIP, the tack then starts

You can adjust from 1 to 32 the speed of Autotack in the secondary channel °S of the rF channel. The factory setting is at 4.

If you want to tack instantaneously, press at the same time on the > and ▶ buttons on the side you want to tack.

2.1.4 Degraded compass mode

If the compass fails and that there is a wind vane on the BUS, the pilot automatically switches in Wind Mode, following the apparent wind angle averaged on the basis of the dampening level.

2.2 WIND MODE

This mode requires a mast-head unit

2.2.1 Operation in Wind Mode

If there is a compass on the system, the pilot constantly adjusts the heading to follow the apparent wind angle specified, dampened between 0.5 to 128 s.

1. The pilot is on Standby (: are flashing)
2. Steer the boat at the desired apparent wind angle
3. With the **mode** button, bring **Wind** on the display
4. Push on the **Auto** button, **rF** followed by the selected apparent wind angle appears and the boat follows it within the angle of operation (**AM**).

The heading can be modified slightly by pushing on the +/- 1° (< or >) and +/- 10° buttons (◀ or ▶).

2.2.2 Degraded Wind Mode

If the compass is not present, the pilot steers at the apparent wind angle averaged on 5 seconds.

2.2.3 Alarms in Wind Mode

If there is a compass on the installation, you can detect a change of wind direction.

An heading alarm can be triggered

- Press AUTO for 2 seconds until you hear a BIP
- The heading change alarm is activated

The reference heading is the one measured when you push on AUTO, the fork is the one selected in the secondary channel FO. If it has not been modified since the installation, the fork is of 15°.

2.2.4 Autotack in Wind Mode

It is possible to make an Auto Tack on Port or Starboard. The value of tack will automatically be the opposite wind angle.

To tack on Starboard, press and maintain the button ▶ until you hear a BIP, the tack then starts

To tack on Port, press and maintain the button ◀ until you hear a BIP, the tack then starts

You can adjust from 1 to 32 the speed of Autotack in the secondary channel S of the rF channel. The factory setting is at 4.

If you want to tack instantaneously, press at the same time on the > and ▶ buttons on the side you want to tack.

2.3 NAVIGATION MODE

This mode requires a GPS

The pilot follows the selected routes given by the GPS which must be in Navigation mode.

The GPS data are available from your GPS connected to your Intercom or from GPS unit connected to the BUS through an nmea input.

The followings channels are available :

p = alternatively Heading and Distance to the next waypoint

ct = cross track error (-0.05 means you are on Starboard of the Route, 0.05- means you are on Port, at 0.05 nm)

G = Heading and Speed Over the Ground

2.3.1 Operation in Navigation Mode

1. The pilot is on Standby (: are flashing)
2. With the **mode** button, bring **GPS** on the display
3. Push on the **Auto** button, rF followed by the cross track error appears

The pilot will now steer the boat to the next waypoint, approaching the ideal route with an accuracy depending on the GPS one.

Note : On engine, the boat's orientation and cross track error are not important. When pushing on **Auto**, the boat will rejoin the route (even by going back if necessary). If the cross track error is superior to 0.4 nm, the boat rejoin the route with a 45° angle. When arriving on the waypoint, the pilot rings, keep the compass heading and switches off the GPS mode. The skipper must then check that the route is clear and the the direction of the next waypoint is correct. If yes, he then pushes on **Auto** to come back to the GPS mode, which will bring the boat to the next waypoint. The procedure is then repeated at each waypoint

2.4 RUDDER MODE

Caution : This is not an automatic pilot mode, but a direct command of the rudder with the buttons +/- 1° (< or >) and +/- 10° (◀ or ▶).
This mode can be used for your harbor manoeuvres or in case of rudder control system damage.

The pilot is on Standby (: are flashing)
With the **mode** button, bring **rUddEr** on the display
Put the rudder at the desired angle
Push on the **Auto** button, rF followed by the rudder angle appears

The pilot is now steering the boat based on the entered rudder angle.

2.5 ACOUSTIC OR VISUAL ALARMS

Regarding the message displayed, check the possible reasons of this alarm.

Caution : If the problem comes from a jamming of the drive unit, switch off the drive unit power supply before attempting anything to remedy to it.

When the pilot switches off after an alarm, push on STOP to put in in manual, switch off the BUS power supply and re-start.

If an alarm is triggered without the pilot switching off, you just need to push on one button of the command display to stop the ringing temporarily.

2.6 TROUBLE SHOOTING

2.6.1 Pilot reacting too slowly

First of all, keep in mind that you can not ask to the pilot more than he can give. If your in strong wind conditions with too much sail surface out, the pilot will react in the same way than you but perhaps a bit slower because of the hard over to hard over time of the drive unit.

- Reduce the sails surface out
- or
- Keep your sails surface as it is and increase the gain, what will generate more ample rudder movements, what will give faster reactions as more rudder angle will be given.

2.6.2 Multiple linear drive movements after an important heading change

It often happens that a boat is badly balanced, what requires a permanent rudder angle. When switching on the system (push on AUTO), the computer tries to keep the heading and by the time going adjusts its rudder angle to counter the imbalance due to the navigation conditions. After 1 or 2 minutes, the permanent rudder angle will be determined and the corrections will be done around this balanced value. If the balance conditions change quickly (sudden wind speed rise or heading change), it will again require 1 or 2 mn to determine the new balanced value. Therefore, during the important heading changes, it is recommended to:

- Put the pilot on STOP and and steer the boat to the new heading
- Once it's done, put he pilot on AUTO and adjust if necessary with the < > buttons.

2.6.3 Abrupt rudder movements

Abrupt rudder movements can be due to the malfunctioning of one or some sensors feeding data into the pilot computer, or due to bad settings.

1. The gain is set between 5 and 9 : this gain level is recommended for use in a rough sea which require ample rudder movements.
 - If the sea conditions are good, reduce your gain level.
2. Without a Topline speedo connected to the pilot, the average boat speed programmed is by far inferior to 6 knots (secondary channel SP, factory setting). The rudder then gives more angle than necessary, the computer will then correct and bring back the boat on the desired heading.
 - Reset the secondary channel SP at 6 knots. The coefficient will then be 1.
3. The Topline speedo is blocked (weed, fail). The actual boat speed transmitted to the pilot computer will fall to 0. The calculation made between the actual value and the one programmed in SP will generate a too strong correction during heading changes.
 - You then need to clean the sensor or if it is faulty, you need to disconnect it from the log/depth sounder junction box, by just removing the cable. (block the cable plug in a dry location to avoid further damage to your sensor)

2.6.4 Hazardous Tack

It can be due to an important perturbation of your compass or of the Gyrometer.

1. Your Topline compass indicates a totally different value than your board compass.
 - Check that no element that could perturbate your compass has been placed next to it. I.e, put a manual compass next to your Topline compass to compare the two values. If the values are close, there is certainly a perturbation source around.
2. If the compass seems good, there may be interferences on the Gyrometer.
 - Do the same verifications on the pilot computer. If the problem re-occur quite often, disconnect the Gyrometer by going in the secondary channel FO and set its value to 0.

2.7 USUAL SETTINGS

d = dampening of the wind direction

- **up wind, calm sea, stable wind :**

Gain = 1
d= 1 if wind mode

- **up wind, formed sea, changeable wind :**

Gain = 2 to 3
d= 3 to 5 if wind mode

- **reaching conditions, rough sea :**

Gain = 4 to 9

Note : If your wind data is coming from an NMEA 0183 source (other manufacturer's instruments), set the dampening at the fastest rate (d=1). The best is to initialise only the minimum of necessary sentences (boat speed and wind data) so that the refreshment rate is not slowed too much.

2.8 FINE SETTINGS

2.8.1 Boat Speed input

Principle : The input of boat speed improves general control and the tacking ability. The slower the boat is, the greater the rudder angle that is necessary. Therefore, the angle of rudder needed is different according to the instantaneous speed.

Your Gyropilot uses this information in two ways:

1. An average speed of the boat is programmed at 6 knots (factory setting).
2. The log sensor transmits the speed value to the calculator via the BUS.

If your Gyropilot is not connected to a log sensor

The calculator uses only the programmed value for speed.

The pilot is programmed for most of the conditions, close to the average boat speed. If you feel that your autopilot generates very abrupt heading changes, you can compensate by entering a different gain setting.

If you want to keep all of your gain settings, you can adjust the factory speed setting in the sub-channels, by entering your real average speed.

We recommend to use this only when encountering peculiar conditions, to avoid continuous setting changes, adjustment of the gain setting being by far easier as it accessible directly from the keyboard.

If your log is connected to the Gyropilot

You then benefit of a perfect control of the pilot adapted to your boat speed!

Your pilot will use the two bits of information, programmed value and real value, in order to determine an optimum coefficient to choose the ideal rudder angle. This procedure has been chosen to avoid major “tacks” if your sensor happened to be out of the water or blocked, which would give a zero speed value and therefore a strong reaction of the pilot at the next heading change...

You still have the ability to change your programmed value to a value that better represents your average boat speed (ie : 7.4 Kt instead of the 6Kt factory setting)

2.9 POWER CONSUMPTION OF THE GYROPILOT

This information is available after one hour of working with the Pilot. After pressing the “Ch” button, you will need to select the sub-menu **Mp** (average power consumption).

Displayed is the average power consumption of the last operating hour (in Watts), the value is updated every hour. A value of 30.5 would mean that the last hour’s consumption has been 30.5 watts.

2.10 MESSAGES

2.10.1 System Messages

8888	LCD segments test	These three messages appear during the initialisation procedure of the command display, starting with the buzzer
LIGHT	Light panels test	
Init	Re-set of the numbers of the command display	

MESSAGE	SIGNIFICANCE
TES	Autotest at the initialisation of the system
STB	Move the rudder to bring the boat to starboard (initialisation of the installation)
PORT	Move the rudder to bring the boat to port
Centre	Move the rudder to the centre
HEAD C	Change of Compass heading during wind mode
WIND C	Change of wind direction in Compass mode
Arr WP	Arrival at a WAYPOINT, the pilot switches to compass mode until you push a button
Route	The pilot used full rudder (held for more than 10 s.) but the boat still can not resume the right heading

2.10.2 Error Messages

EproM	EPROM faulty	These messages concern components mounted on the electronic boards, which have become faulty. The multifunction board has to be replaced.
RaM	RAM faulty	
9346	9346 faulty	

MESSAGE	- SIGNIFICANCE AND ELEMENTS TO CHECK
bAt bUS	- Bus power supply battery or voltage too weak (voltage < 10 volts)
A cc bUS	- Access denied to the Bus, the command display has not been recognized when creating list, or it cannot communicate with the master : switch off and re-start the system, if the problem still occurs, change command display - When pushing on Auto, AccBus appears and if the channel rU is showing :----, it means that the command unit does not recognize the pilot computer. It certainly means that the BUS has been switched on before the power to the computer. Start again the system with the power on the computer.
bAt PUI	- Backup battery discharged
DatA	- Data is missing or incomplete: check the sensor's wiring and the output. Is the pilot switched to degraded mode or on STOP
NMEA	- The received NMEA data is not valid (disappearance of the XTE message) with the pilot switched to compass mode: check the Nav. Equipment's NMEA output.
Malt	- The master display is missing in the system or there is a communication problem on the black wire. Check that there are no connection problems on the black wire, if the problem persists, re-init the system and name the master.
CrEAT (*)	- Creation of the list (message displayed by the master at each start)
LIStE (*)	- Message displayed by a slave unit at each start.

(*)	<ul style="list-style-type: none"> - If the displays stay on CREA^t or LIStE : - Check for a short-circuit in a junction box between the black wire and other wires coming from another display or sensor - Check that there are no faulty items (display, sensor, calculator)
Pan	<ul style="list-style-type: none"> - After pushing on the Gain or Mode buttons, there is no answer from the Gyropilot calculator: check that the Battery Power arrives directly on the calculator before the Bus starts, check that the bus cable is correctly wired to the command display. If this does not solve the problem, the calculator is faulty.
ERR 03	<ul style="list-style-type: none"> - If the ERR 03 is irregular, check the wiring: bad connections to the linear drive engine - Linear drive engine faulty - Power transistors faulty (only if ERR 03 permanent) <p>Autopilot will shut down</p>
ERR 04	<ul style="list-style-type: none"> - Rudder is blocked (can't move) - Clutch faulty - Air in the hydraulic circuit. - Bad mechanical connection of the rudder angle sensor - Rudder angle sensor plug not connected to the calculator - Rudder angle sensor faulty <p>Autopilot will shut down.</p>
ERR 05	<ul style="list-style-type: none"> - Heater Temperature > 80 °C <p>An alarm is switched on – Shut down and ventilate the system.</p>
ERR 06	<ul style="list-style-type: none"> - Heater Temperature > 120 °C <p>An alarm is switched on – Shut down and ventilate the system.</p>
ERR 07	<ul style="list-style-type: none"> - Average intensity is too high, there is a too much power consumption. Check that nothing obstructs the linear drive movements <p>Autopilot will shut down</p>
ERR 08	<ul style="list-style-type: none"> - Average intensity is too high, see ERR 07.
ERR 09	<ul style="list-style-type: none"> - Instantaneous intensity too high: there are voltage spikes on the power supply <p>Autopilot will shut down</p>
ERR 10	<ul style="list-style-type: none"> - Instantaneous default on the power board <p>Autopilot resume functioning</p>
ERR 11	<ul style="list-style-type: none"> - Power battery weaker than the selected alarm level
ERR 12	<ul style="list-style-type: none"> - Power Transistors Out of Order
ERR 13	
ERR 14	
ERR 15	
ERR 16	<ul style="list-style-type: none"> - Clutch solenoid not connected or faulty
Err BUS	<ul style="list-style-type: none"> - The necessary sensors have been faulty for more than 6 seconds <p>Autopilot will shut down</p>

3 INSTALLATION

3.1 INTRODUCTION

Before beginning the installation, keep in mind that a good initial installation will enable you to avoid further problems. We then recommend to you to follow methodically the installation procedure.

To connect the elements together, always proceed as follows :

- All cables should be ran as far as possible of electric or electronic elements that could generate perturbations (ie : fridge, radio transmitter, important metal parts, etc)
- All cables and connections should be ran in safe and DRY locations.
- Iron all the wires ends to insure good connections and prevent corrosion.

Prepare all your tools before starting the installation :

- ✓ Drill
- ✓ Hacksaw
- ✓ Drills of diameter 7 – 10 – 15 mm
- ✓ Flat keys
- ✓ Screw driver flat and cross
- ✓ Rings to fix electrical wires
- ✓ A cutter
- ✓ Screws 5 x 20

3.2 ELEMENTS SUPPLIED

- ✓ Pilot Computer including wires for power and the drive unit
- ✓ Command multifunction display with 3 meters of bus cable attached
- ✓ Hydraulic linear drive (with the Gyropilot Packs only)
- ✓ Rudder angle sensor with wire/plug
- ✓ Threaded rod connection arm for the rudder angle sensor
- ✓ Stainless steel clevis pin with nylock nut, washer and split pin
- ✓ Fluxgate compass with 3 meters cable
- ✓ Bracket and screws for fluxgate compass sensor
- ✓ 15 meters of bus cable
- ✓ Junction boxes with connector strips/blocks

3.3 COMPUTER INSTALLATION

The gyrometer is mounted in the computer, and a good positioning is necessary for a proper operation of the Gyropilot.

The pilot computer has to be installed :

- On a vertical surface, with the wires coming out on the bottom
- In a dry and well ventilated place (max temperature : 50°C)
- With low vibrations (not in the engine room)
- Away from electromagnetic fields (at least 50 cm)
- Run the power wires and connections as per the instructions in section 3.1

The fixation is insured by 4 screws on each corner.

3.4 COMMAND DISPLAY INSTALLATION

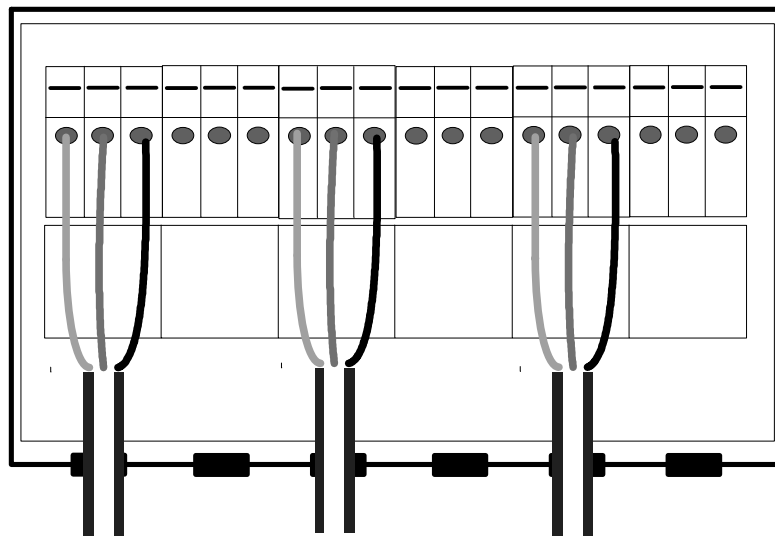
Perfectly watertight, it is wired on the BUS as all Topline sensors and displays.

Several considerations should be kept in mind when installing the display :

- Away (at least 10 centimeters) from magnetic compasses
- Away (at least 1 meter from a radio receiver/transmitter
- Located for easy access and clear viewing, and of course next to the rudder
- Installed in a location that is safe from excessive impact (spinnaker poles, winch handles, etc)

3.4.1 Installation procedure

- Drill a hole of 14 mm at the chosen location
- Remove the nut from the mounting stud on the back of the display
- Apply sealant to the back of the display around the threaded stud and around the edge of the back panel
- Feed the wire through the hole
- Mount the display
- Hand tighten the nut on the back of the display (**DO NOT OVER TIGHTEN THIS NUT**, it could break the stud and endanger the box watertightness !)
- Prepare the wires and connect them into the junction box.



TOPLINE BUS CABLE

3.5 INSTALLING THE FLUXGATE COMPASS

The compass must be positioned carefully,

- as close as possible from the boat's axes.
- at least one meter away of the magnetic compass.
- as far as possible from all the potential sources of the magnetic disturbances, at least one meter away from speakers, radio transmitters or receivers or other items :

hi-fi equipment
 radar
 boat's engine
 battery generator and charger
 fridge
 electric engines
 tool box
 anchor
 electric panels
 metallic casing for electric cables
 all portable electronic units
 etc

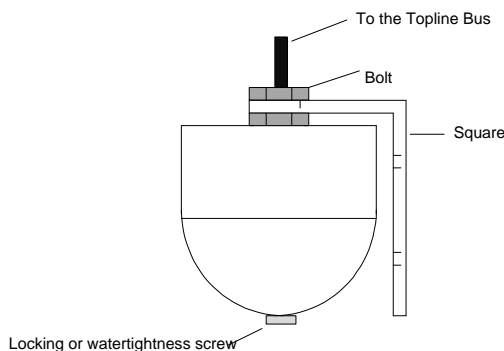
3.5.1 Choice of the compass location

With the above advice in mind, select a location for the compass, and check that there is no major electromagnetic disturbance with the following procedure :

- Put a manual compass at the chosen location and compare the value to the board compass. If the error is less than 10°, the location is suitable. Ideally, the best way to check would be to steer the boat in circle and check the suitability on 360°.

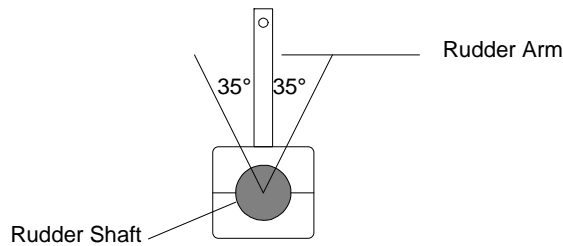
3.5.2 Mounting

- Position the square vertically and mount it with the two amagnetic screws
- Unscrew the nut at the top of the sensor and put the threaded rod in the square's notch
- Tighten lightly the nut
- Position the cable (still as far as possible from the magnetic sources) and wire it to the BUS with a junction box



You'll tighten definitely the compass nut after the initialisation.

3.6 INSTALLING THE RUDDER ARM



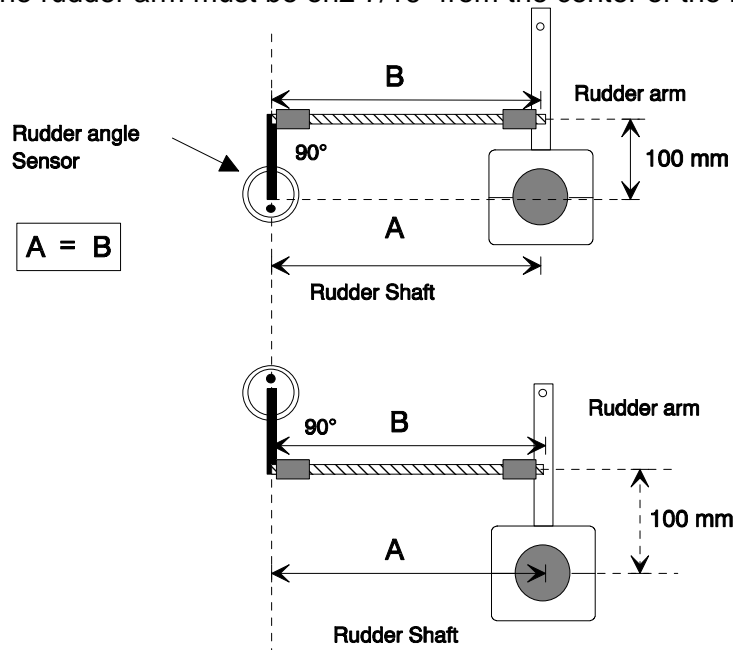
If you can not install the drive unit directly to the steering quadrant, then you will have to buy and install a rudder arm for your rudder shaft. The rudder arm can be mounted on the rudder shaft in any direction. Make sure that the ruder arm can freely move 35° in both directions and that there is enough room available to mount the drive unit and rudder angle sensor as per the following sections.

Note : Make sure that the clamp screws are tight and that the rudder arm is firmly mounted on the rudder shaft, i. e., it can not slip.
 Check with your boat manufacturer for special instructions on mounting autopilots to your rudder shaft or your quadrant.

3.7 INSTALLING THE RUDDER ANGLE SENSOR

Install the rudder angle sensor with the following considerations in mind :

- The sensor arm must be able to move + or – 150° UN OBSTRUCTED.
- When the rudder is center line, the sensor arm must also be centered (in relation to the center screw head-see below).
- Distance “A” must be equal to “B”.
- The sensor connector must be 90° to the rudder arm (rudder centered).
- It must be installed in a safe/dry location and away from interfering equipment (radio receivers, compressors, speakers, generators, etc.)
- The connection on the rudder arm must be on 2 7/16” from the center of the rudder shaft.

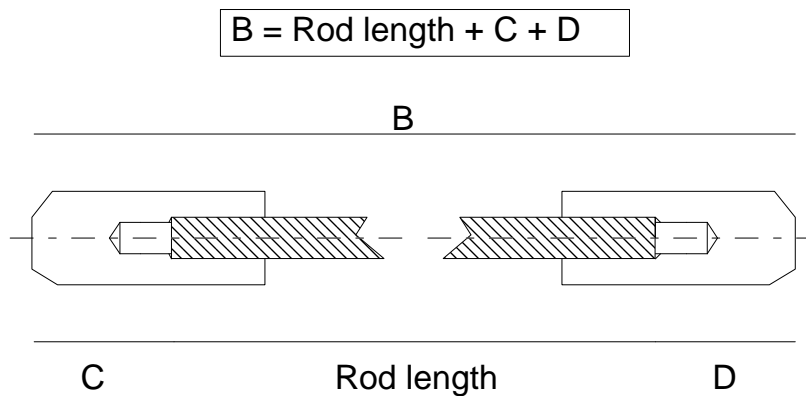


The rudder angle sensor can either be positioned next or behind the rudder arm, the pilot will detect its mounting at the initialisation.

3.7.1 Installation procedure

Follow these steps to install the rudder angle sensor :

1. Present the threaded rod in front of the rudder shaft, measure the maximum distance where you can place the sensor, in function of the rod length. The sensor arm will have to be able to rotate by 160° in both ways.
2. Measure precisely the A value
3. Select the mounting location (existing or made by yourself), which is perfectly rigid and which enables that **the rudder arm and the sensor arm are in the same horizontal plan**
4. Carefully center the sensor in the way that the straight line going by the axis of the sensor arm and the blocking nut is parallel to the rudder arm.
5. Drill the mounting holes (dia 7 mm) and fasten down the sensor
6. Attach the threaded connector arm to the rudder arm and the sensor arm



7. Once this done, you need to cut the threaded rod such as value A = value B. B being the rod length + the length after tapping (C or D).
8. Mount the tips on the threaded rod, and block them with the counter nuts.
9. Before mounting the rod and tips on the connector arm, test your installation manually, maintain the tips just above each connector, and move the rudder from Port to starboard. If the parallelism is good, you can mount the tips on the connector arms.

NOTE :

1. When the rudder is centered, the arm of the rudder angle sensor must also be centered, parallel to the rudder arm
2. The threaded rod must always be parallel to the linear drive axis, otherwise, the rod axis and the sensor arm axis could come into the same vertical plan. In that case, you would no longer have a rotation of the sensor arm, BUT a traction on it! This could seriously damage the sensor

3.8 DRIVE UNIT INSTALLATION

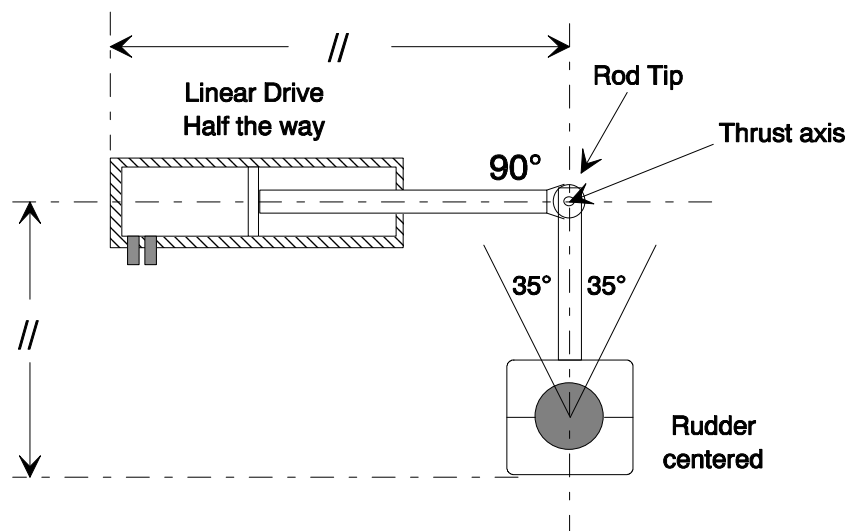
NOTE :

The force developed by an hydraulic linear drive is very important and could occasion important damage if it was badly installed.

3.8.1 Preparation

- The linear drive and the hydraulic pump must be positioned on an horizontal plan
- To choose the fixing location of the linear drive, check that when the rudder is centered, the linear axis is at 90° of the rudder arm.
- The fixing of the linear must be very rigid and you should not hesitate to stenghten it with a stainless stell plate strongly attached to the boat.
- Make sure that the linear drive support is positionned in the way that the rudder arm or rudder sector are in the same horizontal plan than the linear drive axis.
- Unscrew half the way the tip at the end of the drive rod, and pull the rod half the way out (see on the drive specs the rod dimensions). You will then be able to determine at what distance the linear support should be from the rudder shaft, with the rudder centered.

3.8.2 Mounting diagram



3.8.3 Mounting

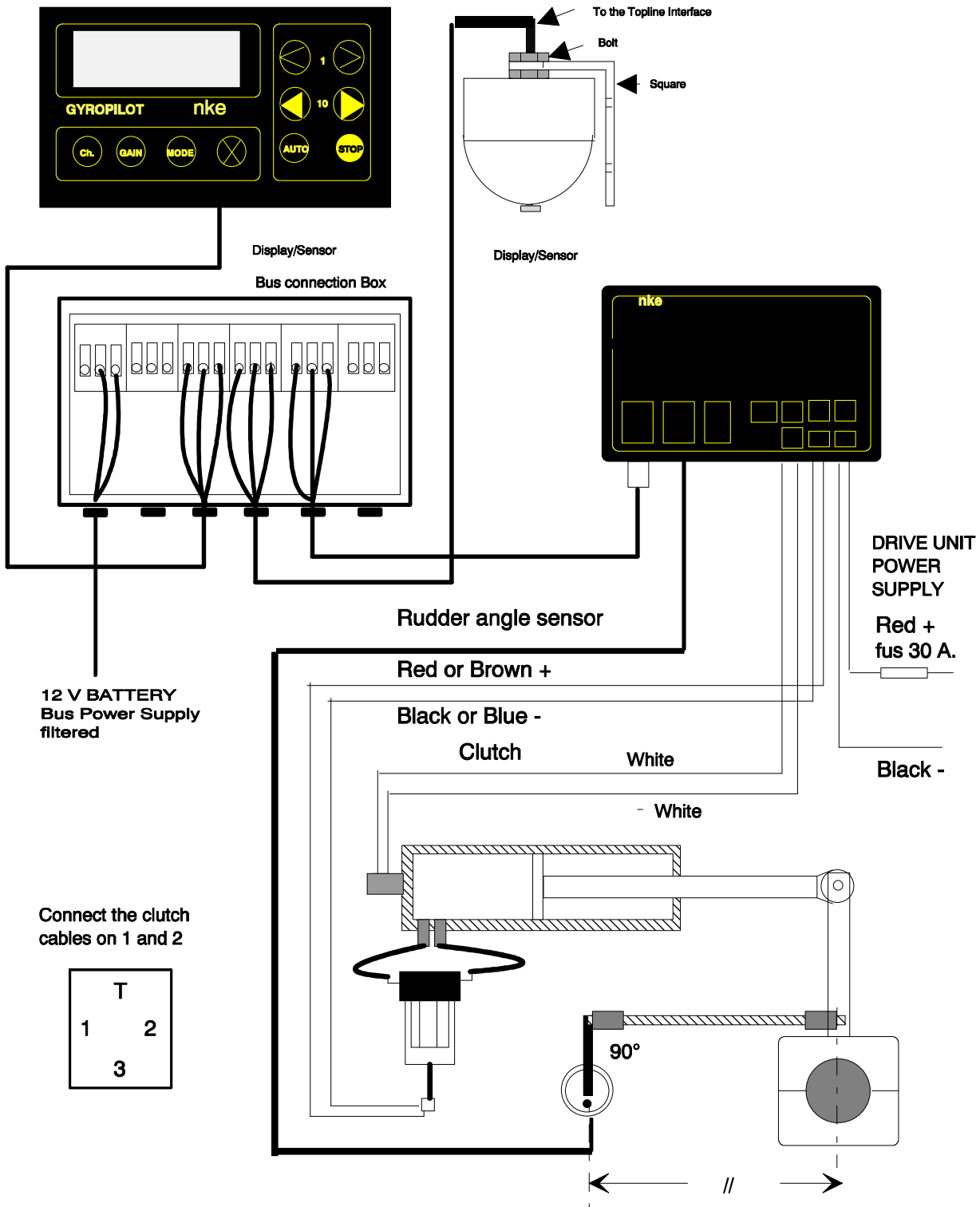
- Put the rudder to the center
- Unscrew half the way the tip at the end of the drive rod, and pull the rod half the way out such as the length between the center of the linear support and the thrust axis is equal to the rod length
- Place the linear drive at 90° of the rudder arm
- Fix it with stainless steel nuts*.
- Grease the thrust axis of the linear drive and fix it on the rudder arm or rudder sector with the supplied nylstop nut.
- Adjust the rod tip on the same axis than the thrust axis and block it in position with the counter-nut.
- Insert the thrust axis in the rod tip and block it with a linch pin.

NOTE : 1. Check carefully that the linear drive can not come to contact with a part of the boat or of any item around the rudder.

2. Check that the mechanical stops of the rudder act before the linear drive come to its stops.

* When your installation is fully completed and that you have tested it, you can apply cellulosic glue on the thread to avoid any movement.

3.9 WIRING DIAGRAM : RVP TYPE



WARNING :

ALTHOUGH THE GYROPILOT 2 COMPUTER CAN POWER 24 VOLTS LINEAR DRIVES, YOUR TOPLINE INSTRUMENTS WOULD BE PERMANENTLY DAMAGED IF POWERED IN 24 VOLTS! THEREFORE : YOU CAN POWER THE POWER SIDE OF THE COMPUTER IN 24 VOLTS DC FOR A 24 VOLTS ACTUATOR, BUT **THE TOPLINE BUS MUST BE POWERED IN 12 VOLTS.**

3.10 WIRINGS

3.10.1 Cables sections

Length from the battery to the engine	Recommended section
3 m	2.5 mm ²
5 m	4 mm ²
7 m	6 mm ²
10 m	10 mm ²

A too small cable section generates power losses in the wiring and affects the pilot performances.

3.10.2 Wiring to the power unit

The power unit must be powered with a different battery park than the **TOPLINE BUS**. The cables to the power unit battery park must not pass through the board electric panel, but go straight to the battery park.

The red wire (+12 v) must go to the plus of the battery through a fuse or a circuit breaker (25 – 30 amps).

3.10.3 Wiring to the BUS cable

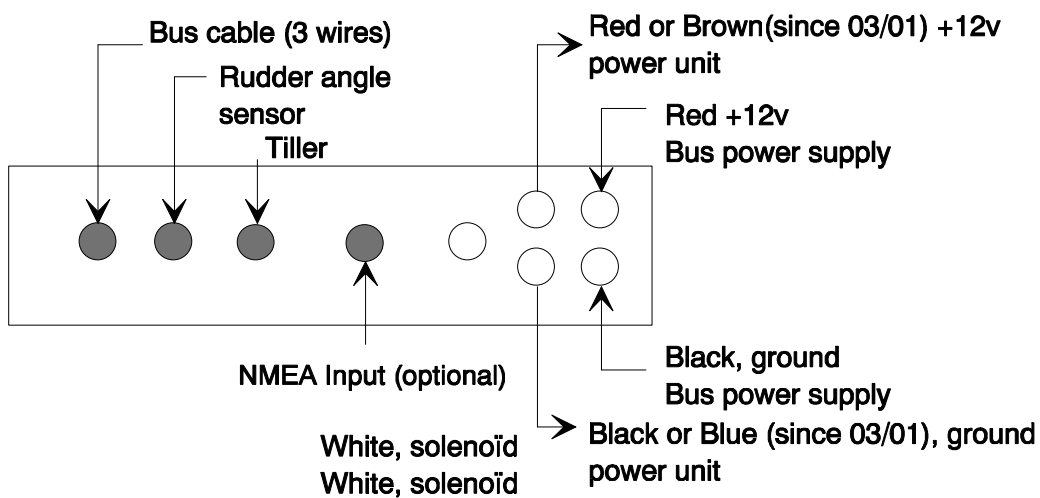
The BUS cable, connected on the computer box must be wired colour to colour on the compass cable, command display cable and on the rest of the Topline installation.

You need to carefully denude the wires ends to avoid any mis-connection. A cut on the black wire could block the display in **list** mode when switching on the BUS.

If there is no nke instruments (log, depth, mast-head unit, ...), the BUS cable must be wired in the following way :

- White wire : + 12 volts of the electric panel with a switch.
- Bare wire : (-) of the electric panel
- Black wire : carefully isolated

3.10.4 Computer box wiring : RVP TYPE



4 INITIALISATION

4.1 INSTALLATION INITIALISATION

4.1.1 Introduction

After having carefully checked the mechanical and electrical installations (wires well connected, no inversion in the power wires, etc), you can proceed to the initialisation. This procedure goal is to inform the computer on the following characteristics :

- Centre position of the rudder
- Maximum of rudder to Starboard
- Maximum of rudder to Port
- Sense of mounting of the rudder angle sensor
- Sense of mounting of the linear drive
- Control of the engine wiring

4.1.2 Procedure

1. Switch on the power supply of the drive unit BEFORE the power supply of the bus, otherwise the command display (who is the master) won't recognise the autopilot channels and it won't function
2. Switch on the autopilot (BUS) from the switch or the circuit breaker of the electric panel
3. If it is the first utilisation or a re-initialisation, push on one button of the display (anyone), it then displays **Creat Liste** and the data
4. Change the language
5. Put the rudder to the centre
6. Push and maintain the **STOP** button, push on the button > until the message **STB** appears
7. Push the rudder all the way to COME TO starboard
8. Push and maintain the **STOP** button, push on the button > until the message **PORT** appears. Loose the buttons, the computer has recognised the Maximum of rudder to Starboard
9. Push the rudder all the way to COME TO port
10. Push and maintain the **STOP** button, push on the button > until the message **CENTER** appears. Loose the buttons, the computer has recognised the Maximum of rudder to Port
11. Put the rudder to the centre
12. Push and maintain the **STOP** button, push on the button > until the message **tESt** appears. Loose the buttons.

The computer then does :

- a complete test of the wiring
- a short operation of the linear drive to recognise the sense of mounting of the linear drive and the rudder angle sensor.

YOUR PILOT IS THEN READY FOR THE FIRST SEA TRIALS

Note : If you do not manage to obtain the STB, Port or tESt messages, you then need to re-initialise the command display. This operation will restore the factory settings of the display.

4.1.3 Re-init procedure

1. Switch off the BUS power supply
2. Push and maintain the button > (1° Starboard)
3. Switch on the BUS
4. Loose the > button when you hear a beep and that 8888 is displayed, wait until the end of the beep.
5. Switch off the BUS without pushing on any buttons of the display(s). Your display has the number 0.
6. Re-start the initialisation procedure at step 2

4.1.4 Change the language

First, you will need to change the language in the installation procedure (step 4). To do so, go on the secondary channel **Co** (push successively on the **Ch.** Button until the channel **Co** appears. Then push and maintain the button Ch. Until the secondary channel **LA : Fran** appears, loose the **Ch.** Button, you can then select English by pushing on the button > until **LA : engl** appears. Your system language is then set in English

4.2 SWINGING THE TOPLINE COMPASS

4.2.1 Adjustment

Note : First, make sure you have the following conditions :

- All the boat's equipment is stored in its usual location
- No current
- Flat seas
- No wind
- Away from magnetic fields (for example, large ships).

Once this is checked, begin the adjustment :

- Switch on the installation
- Put a multifunction on the CO channel (Compass)
- Direct the boat on the magnetic North
- Unscrew the bolt at the top of the sensor
- Swing the compass to bring the displayed heading to the North
- Tighten the bolt to block the sensor in position

To receive the most accurate information from the fluxgate compass, the compass must be initialized for deviation.

4.2.2 Swinging the compass

1. Begin moving your boat at a constant 2-3 knots in a clockwise circle that is about 4-5 times the size (in radius) of your boat.
 2. Push the initialisation button (see below for which button on push on the different types of NKE Topline displays
- Autopilot command display : With the window on CO, push the MODE key for 8 seconds until you hear a beep.

- Double multifunction display : With the top window on CO, push the button n°3 (lower left key) until you hear a beep.
- Datacom : With the 3rd window displayed (includes CO), push the right arrow key once so that the cursor flashes on the CO channel, then push simultaneously the L1 + 5 keys (eg. To obtain the letter I = init)

Note : As soon as the compensation procedure starts and the circle begins, the Compass windows in the Topline system will alternate between displaying compass heading* (CO : 325°), and the number of circles and the difference with the preceding circle (CO:3002, eg. 3rd circle, 2° difference)

At least two circles are necessary :

Circle n°0 : between the mode start and the first time the boat points North.

Circle n°1 : following circle necessary to measure the circle time

Circle n°2 : compass table up-date

Following circles compass table up-date, if important differences are measured from one circle to another, the system automatically goes out of the compensation mode. You then need to re-start the procedure.

From the circle n°3, you can store whenever you want the calculated data by going out of the compensation mode :

- Simple or Double Multifunction display : press the button n°3 for 8 seconds until you hear a BIP
- Datacom : press simultaneously the L1 + 5 buttons (eg. To obtain the letter I = init)
- Autopilot command display : press the MODE button for 8 seconds until you hear a BIP

The compass function has now been compensated for deviation, and will store this compensation in memory.

Check the accuracy of the fluxgate against your fluid compass on all quadrants. Remember, fluid compasses usually have a deviation chart that will tell you the correct readings of the fluid compass. This should be used when checking the quadrants.

If the readings on the fluxgate are not correct, the procedure will have to be performed again. This procedure may require some patience. Sometimes, this procedure has to be performed more than once before an accurate reading is displayed. Each additional attempt should be made under slightly different circling conditions : Different boat speed or different circle sizes.

4.2.3 Manual compensation

1. Make a note of the value to the right or left of North that the Compass displays when the boat is pointed to due North (Mag.).
2. Access the secondary channel “**OF**” (press and maintain the **Ch.** Button in the **CO** channel until **OF** appears)
3. Enter a + or – value to bring the compass reading to zero :

Example :

Enter a + value if the Compass reading is to the left of 0°

Enter a – value if the Compass reading is to the right of 0°

4. Push the buttons 1 & 2 simultaneously to set the change in memory.

4.2.4 Manual calibration using the Datacom

The fluxgate compass can also be manually calibrated using the Datacom display.

Follow the instructions in your Datacom manual, except use the following procedure to access the table of corrections (this is different from the datacom manual), as follows :

1. Push the 3 key
2. Push the arrow key until the cursor is on CO
3. Simultaneously push the L2 and 9 keys

You have now accessed the table of corrections. Enter the correction values as per the Datacom manual.

Note: The auto-initialisation must be performed before you can access the Datacom table of corrections.

4.3 CLEARING THE MEMORY OF THE COMPASS

The memory of the compass must be cleared whenever the compensation procedure is performed after an initial attempt, i. e., for a second time.

Use the following procedure to clear the compass memory :

1. Turn the system on.
2. Push the initialisation button for 8 seconds until you hear a beep (use key that corresponds to the type of display that you're using – see below) :

Autopilot command display : With the window on CO, push the MODE key for 8 seconds until you hear a beep.

Simple or Double Multifunction display : With the top window on CO, push the button n°3 (lower left key) until you hear a beep.

Datacom : With the 3rd window displayed (includes CO), push the right arrow key once so that the cursor flashes on the CO channel, then push simultaneously the L1+ 5 keys

3. Turn the system off.

The compass memory has been cleared, and is ready for another attempt at the compensation procedure.

5 BASE PRINCIPLE OF THE TOPLINE BUS

5.1 ARCHITECTURE

The BUS or network is made of sensors and displays linked together by a 3 wires cable (0 v = bare wire, +12 v = white wire, data = black wire).

The BUS system is a proprietary protocol that is organised by one of the displays present on the BUS. This display is the “MASTER”, designated by you at the initialisation of the system. Every display has a designated number on the BUS that appears at the starting of the system.

0 = display NOT numbered

1 = master display

2 to 20 = slave display

The numbering of the displays is made as you like, but it can also depend of the type of displays you have.

If you have a Topline Datacom :

The Datacom is initialised in production to be the MASTER of the BUS on your installation. It then has the number 1.

If you have a remote control :

On the BUS, the Remote Control appears as a display and initialises as a display. Therefore, it has a number between 2 and 20. This remote control is able to act only on the displays which have a number inferior to its own one. If you want to be able to act on all the displays, you then need to number it in latest.

5.2 NUMBERING OF THE DISPLAYS

On the first starting of the system, all the displays show - - - - -

The BUS is not active as all the new displays have the number 0. The control of the BUS being taken care by the MASTER, you then need to designate one at the first starting.

To designate the MASTER :

You designate the MASTER by pushing on one button of this display. It then takes number 1.

The MASTER then display “CREAT LISTE” for a few seconds, and displays the data supplied by the sensors present on the BUS.

To designate the SLAVE displays :

Press on one button of a display, which will take number 2. The display then shows LISTE (meanwhile the MASTER displays CREAT LISTE for a few seconds and comes back to the data display).

Repeat this operation on all the displays with a minimum 5 seconds delay between each display.

Switch off the power

The displays now have their number and can communicate.

5.2.1 Normal Operation after initialisation :

After these settings, all the displays are numbered. At the starting, each display shows shortly its number and then the MASTER displays "CREAT LISTE". (meanwhile, it interrogates all the elements of the BUS to constitute the LIST), and then the number of all the displays present. (e.g. : 3 slave displays 2 3 4)

Note : if there has been an error during the numbering, you need to erase the number and restart the procedure.

5.3 WEARING AWAY OF THE NUMBER : INITIALISATION

5.3.1 Simple or double multifunction

If there is a problem of communication on the BUS, the reason can either be a faulty connection or a conflict on the BUS (e.g., if there is a two MASTERS conflict on the BUS), you need to re-organise the network by following the procedure below :

- Switch off the power of the system
- Press and maintain one of the buttons of the display that you want to reset (number 0)
- Switch on the power with this button maintained
- As soon as the display shows 88 and ring, loose the button and wait for the end of the ringing
- Switch off the power without pushing on any button
- The display is then reseted.
- Restart the numbering procedure on the displays you want to re-number

5.3.2 Remote control

To number it to 0 :

- Switch off the system
- Press and maintain one of the low buttons of the remote control
- Switch on the power
- After a second, loose the button
- Switch off the system without pushing any button

The remote control then has the number 0. See the numbering procedure to re-number it so that it can act again on the displays.

5.4 TOPLINE DISPLAYS ERROR MESSAGES

EproM	EPROM faulty	These messages concern components mounted on the electronic boards, which have become faulty. The multifunction board has to be replaced.
RaM	RAM faulty	
9346	9346 faulty	
If the displays stay on CREAt or LIStE :		<ul style="list-style-type: none"> - Check for a short-circuit in a junction box between the black wire and other wires coming from another display or sensor - Check that there are no faulty items (display, sensor, calculator)
MAItrE AbSEnt		- The master display is missing in the system or there is a communication problem on the black wire. Check that there are no connection problems on the black wire, if the problem persists, re-init the system and name the master.
DEFAU bAtt		- The BUS power supply battery or the voltage are too weak on the display
FAIL		- This message appears after a channel name (SP, Ad, etc) means that the related sensor is no longer sending data, the black wire is disconnected or the sensor is faulty
UoIR bUS		- This message appears if you try to go into the secondary channels of a sensor that is not detected by the BUS.

6 BUILT-IN NMEA OPTION

6.1 INSTALLATION

1. Choose a safe and dry location for the interface, such as the cables and cover of the box are easily accessible.
2. Make sure that the two systems (Topline and other) are switched off.
3. Connect the white cable of the interface to the BUS cable, colour to colour
 - White : + 12 V
 - Bare : -
 - Black : TOPLINE data
4. Connect the black cable of the interface to the NMEA Output of the apparatus (GPS, Other instrument system)
 - Blue : -
 - White : NMEA data

6.2 INITIALISATION

1. Press and hold the button « Reset NMEA » on the front of the pilot computer.



2. Switch on the TOPLINE system.
3. Loose the button.
4. To enable the TOPLINE system to register the interface, your NMEA Output provider needs to transmit messages on the NMEA Input interface for a few minutes :

Switch on the NMEA Output provider. If you want to obtain data from a GPS, start a route on this unit so that your GPS is sending NMEA Messages for Waypoints (Heading and Distance) and Pilot Messages.

5. Press again the button, and loose it.
6. Switch off the TOPLINE system.
7. Wait for about ten seconds.
8. Switch on the TOPLINE system.
 - The initialisation procedure is activated and the data channels to create on the Topline BUS are recorded in the interface.
 - A channel is created by the interface :
 - . If it does not already exists on the TOPLINE BUS.
 - . If the corresponding NMEA data has been transmitted at least every 64 seconds.

6.3 NMEA DATA CHARACTERISTICS

- NMEA 183 V2.00 or inferior
- Power input 0-5V (not protected).
- 4800 bauds.
- 1 start bit, 1 stop bit
- 8 bits with the bit 7 to 0.
- Maximum Flow Authorized (without time gap between).
- Read a maximum of 68 characters of the string between '\$' and '*' or <CR> (included).
If the string is longer, the end is ignored (ie : name WP in BMC).
- Checksum is not verified and not compulsory.
- « the identifier » (2 letters after « \$ ») is ignored.
- Distances are shortened (inferior value).
- Other values are rounded to the nearest value (ie : to the degrees for the the angles).
- A sentence can be partially empty between the comma
 - The software will take the missing value in another sentence (ie speedo in VWH and Heading in HDG)
 - The interface can take the depth in feet if it does not exists in meters.
- A channel can be read in different sentences (ie Compass can be read priority in HDG, otherwise in HDM or VHW).
- If the Heading Over the Ground or the Heading to a Waypoint does not exist in magnetic, the true Heading is taken into account.
- A channel disappear (or is taken in a less priority sentence) if the sentence disappear for more than 64 seconds (end of route, satellite loss on the GPS, etc...).
- Forestay tension sentence : \$IIXDR,L,x.x,,+3Kgf <CR> <LF> x.x = force in Kgf
Switchs centrale NAVTEC on 0101XX

6.4 CHANNELS CREATED

TOPLINE CHANNEL	NMEA STRINGS	INFORMATION
Compass	CO : HDG, HDM, VHW	If HDG, addition deviation if it exists
Fast Compass	HDG, HDM, VHW	Useful to the pilot
Depth	dE : DPT, DBT	if DPT takes keel or surface according to the offset
Hour	XX :XX :XX ZDA	Actualised according to the string frequency
Date	XX :XX :XX ZDA	
Trip log	tL : VLW	Limit at 99.99 N
Total log	LG : VLW	Limit at 9999 N
Air Temperature	At : MTA	Limit at -17.77°C
Sea Temperature	St : MTW	
Atmospheric pressure	AP : MMB	
Boat Speed	SP : VHW	
Apparent Wind Speed	AS : MWV, VWR	
Apparent Wind Angle	Ad : MWV, VWR	
Apparent Wind Angle fast	Ad : MWV, VWR	useful to the pilot

Forestay Tension	fs :	XDR	Display in kgf, limited to 10 tons
Distance to WP	P :	BWC	Displays V1.2 : XXX.X miles
Heading to WP	P :	BWC	Magnetic or true
Cross track error	ct :	APA, APB,XTE	Limited to 9.99 N
SOG	Sg :	VTG	
COG	hg :	VTG	Magnetic or true
Origin/destination heading		APA,APB	useful to the pilot
Pilot status		APA,APB,XTE	
Position	LAT LONG	GGA	
Target speed		\$PNKEP,01	Performance display
Heading on next tack		\$PNKEP,02	Performance display
Optimum Wind Angle		\$PNKEP,03	Performance display
% on tack		\$PNKEP,03	Performance display
% on reaching		\$PNKEP,03	Performance display
Angle to optimise CMG		\$PNKEP,04	Performance display
Angle to optimise VMG		\$PNKEP,04	Performance display
Gain to optimise CMG		\$PNKEP,04	Performance display
Gain to optimise VMG		\$PNKEP,04	Performance display
Tide Direction		\$PNKEP,05	Performance display
Tide speed		\$PNKEP,05	Performance display

NB :

Other channels can be created (True Wind direction, leeway, Corrected Heading, MOB, etc).

No alarms or offsets settings allowed. The access to the secondary channels could create a 'Err BUS' or 'Acc BUS' message.

The units are given by the interface.

6.5 TRUE WIND & SOG MODE OPTION FOR THE GYROPILOT 2

The Gyropilot 2 can offer you the option of a 5th mode of steering of the pilot: the True Wind & SOG mode option with a protected access by a coded key. To obtain access to this mode, you need to enter through the pilot command display the password supplied. You will then have the ability to use the True Wind Mode as well as selecting the boat speed origin (log or Speed Over the Ground). The pilot computer calculates the true wind angle using the speed origin selected.

6.5.1 “Unlocking” of the True Wind and SOG mode

To un-lock the mode, you have to enter the code supplied in the secondary channel of the channel rU (rudder angle).

1. Bring the rU channel on screen using the **CH** button of the command unit.
2. Press and hold the CH button to enter the secondary channels (OF, n1 and n2).
3. Select the secondary channel n2.
4. Enter the code using the +1° and -1° buttons.
5. Valid your code by pressing on Ent.

From then, you have access to the True Wind Mode and Speed origin selection.

Note: If you have lost your code, you will need to tell us the serial number of your pilot computer that you can read in the secondary channel n1. The code and serial number are hexadecimal values; it is therefore normal that the serial number appears in letters and numbers (I.e. a6b2).

6.5.2 Selecting the speed origin

This new parameter enables you to select the Speedo source, either from the GPS or the log (paddlewheel or Electromagnetic log).

1. Bring the reference channel on the pilot command unit screen (rF).
2. Press and hold the CH button to enter the rF channel secondary channels.
3. Select the secondary channel Speedo origin (So).
4. Select the Speedo origin (log or GPS) using the +1° or -1° buttons.
6. Valid your selection by pressing on Ent.

The Gyropilot will take into account the Speedo origin selected.

6.5.3 Setting of the tP temporisation

This temporisation is used to “force” the Gyropilot to “keep” the rudder in case of a bus breaking. The default setting is of 6 seconds and can be set up to 60 seconds. You can modify this setting at any time in the secondary channels of the rF channel.

CAUTION: In the event of a bus breaking (i.e. black data wire cut), the pilot continues to steer using only the gyrometer data. The bus being broken, it is impossible to put the pilot on Stop during this temporisation, only a total switch off of the power supply enable you to take control during the temporisation.