PROCESSOR HR

Part number: 90-60-373

USER MANUAL
AND INSTALLATION GUIDE

Version V3.7

Contents

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1. INTRODUCTION

Thank you for choosing *nke* and the ***PROCESSOR HR.*** You have purchased a processor that sits at the heart of a system which provides the autopilot, the navigation programme, the tactician, the crew and of course the skipper all the data they require. The data provided is optimised for accuracy, responsiveness and performance.

In this manual you will find all the information necessary to:

- Carry out Installation, configuration and calibration of the ***Processor HR*** and sensors

- Access all the functions offered by the ***Processor HR***

- Get the best performance from your boat.

2. THE TOPLINE NETWORK WITH PROCESSOR HR

The **Topline** system consists of sensors and displays networked with a single 3 wire cable (shield: 0V, white: +12V, black: Data). Data is carried on the black "DATA" wire.

Displays have a variable address ranging from 1 to 20 while the sensors have a fixed address with a value comprised between 21 and 210. The network is managed from one of the displays that will be chosen as "MASTER" during the system commissioning. Its address will be "1".

Once turned on, the "MASTER" will scan all the addresses to discover all the displays and sensors which are connected to the network.

Once the "MASTER" has scanned the network, it will ping only the channels it has identified. Also, the "MASTER" will randomly ping the channel "0" (non identified display). A specific answer from a display will generate an address for that display to integrate dynamically with the network.

3. PROCESSOR HR

The ***Processor HR*** provides the following:

1. Performance:
   - Accurate measurement of wind speed and angle (true and apparent), boat speed, speed over ground, the boat movements, all with sensitivity to small changes.
   - Accurate measurement of acceleration and the boat's attitude (magnetic heading, angles, acceleration, turn rates, magnetometric vector)
   - Accurate dynamic calculation of true wind as a result of the compensation of measured data from the masthead sensor, the geometry between the mast and the hull and the use of corrections table.

2. Fast data provision:
  - High speed data flow (fast reactivity to the measurements from sensors providing high speed updates to the autopilot and data display).
  - Fast data rate interface with the on-board PCs for the major navigation packages (via the SailNet protocol on IP and various gateways). Compatible with the Proteus communication system.

3. Safe and secure operation:
  - Integrated safety: various safe modes allow use of the main functions without the Processor Regatta.
  - The use of the lightest possible Linux OS ensures real time operation without background task (or virus) and avoiding mechanical moving parts (such as hard disk, fans…)
  - Auto diagnostic log for a good understanding in case of malfunction.

4. Standardisation :
  Simple and open formats and protocols specified for:
  - Variables logs
  - Variable exchange protocol via fast RS232/NMEA0183 or IP.
  - Adjustment for the linear calibrations, filtering, alarms and non-linear calibration files, polar tables.
  - Use of one single variable definition base for each level: in the remote Gyropilot Graphic display, the **Processor HR**, the variables log, the compatible navigation software (Deckman), the IP broadcast, the post-processing software (Excel..), the diagnostic software (Toplink ...).

5. Post-processing:
  - Internal communication for diagnostics and modelling.

6. Open data:
  - Functions can be customized or translated (display on the *Gyropilot Graphic*, Deckman, Tools).
  - Open IP protocol for « SailNet » variables exchange (Linux/windows libraries with samples supplied, possibility to use several boats and/or navigation programs simultaneously).

7. Upgrades:
  - Easy **Processor HR** update via IP
  - Use of the *Topline* peripherals with a Flash memory for onboard update with PC *Toplink.*
  - **Processor HR** interface page on the Gyropilot Graphic display for easy HCI update.

8. Power management:
  - Allows the on board PC to operate in standby mode while getting the performance data on the **nke** displays.
  - The **Processor HR** enhances the wind data (faster refresh and less noise). As a consequence, the autopilot steering is optimized and reduces the use of the ram's motor.

4. SYSTEM DESCRIPTION (IMOCA TYPE)
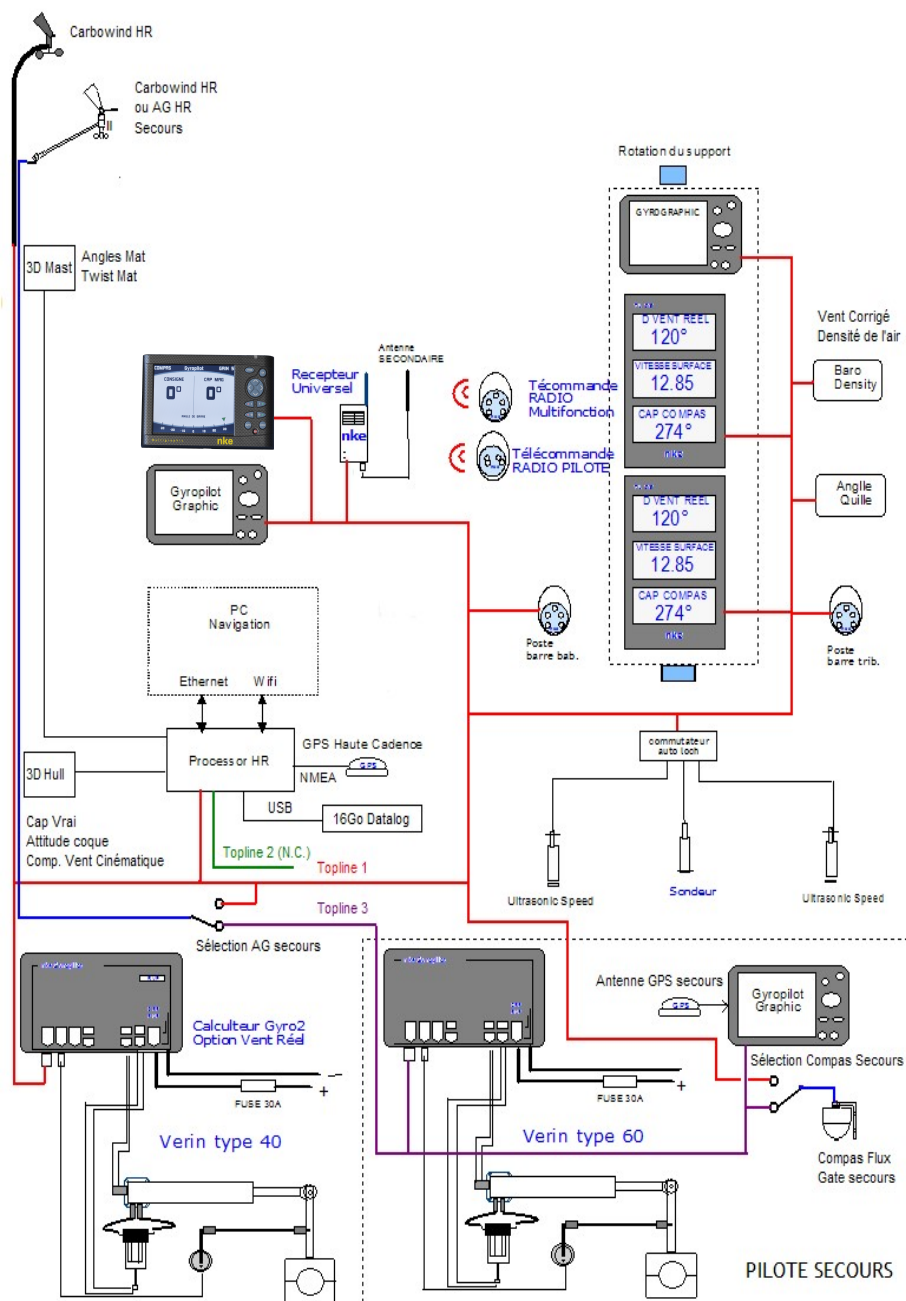
*The equipment featured in this drawing is for indication only.
It does not reflect your own system.*

5. INSTALLATION OF THE PROCESSOR HR

In this chapter we will cover the installation of the unit and all calibration required in the *Topline* network environment.

⚠️ **WARNING**
- Please take time to read this manual carefully before you start installation.
- Any connection to the **TOPLINE bus** must be performed through the specific interface box: 90-60-417.
- Any work on the **TOPLINE bus** requires the system to be powered off.

5.1 Installation of a brand new nke system

All units except the **Processor Regatta** must be installed first. Please refer to the manual for each unit (sensors, displays…). We recommend using the **Mutltigraphic or Gyrographic** as the system's Master.
Once the system is installed, refer to "How to integrate **Processor Regatta** in an existing **nke** system" to complete the installation.

5.2 Installation of the Processor Regatta with an existing nke system

As a first step, you need to update every component connected to the **Topline** network. This is done with the « Toplink2 » software, or alternatively you can send the units to **nke** customer support.

Firmware, database and the Toplink2 software (requires the Topline USB interface 90-60-482) are all available for download at the following address: http://www.nke-marine-electronics.com in the technical area (requires a password – access to trade only).

Table of versions compatibility with the *Processor HR:*

Module type	Description	Minimum Version required
Display	Performance	Limited use
Display	Multigraphic	All versions
Display	Gyropilot Graphic	V3.1
Display	SL50	V1.4
Display	TL25	V1.5
Interface	Remote control (wired)	V2.1
Interface	Radio receiver	V2.4
Interface	NMEA output interface	
Interface	NMEA input interface	V1.2
Interface	Toplink 2	N.A.
Interface	WiFi box	All versions
Sensor	Single battery pack control	Not compatible
Sensor	Dual battery pack control	Not compatible
Sensor	Battery Monitor 500	All versions
Sensor	3D Sensor	N.A.
Sensor	Mast angle sensor	V1.4
Sensor	HR 100 barometric sensor	V1.0
Sensor	Ultrasonic starboard / port	V1.6
Interface	Speed and depth Interface	V2.0
Interface	Dual-speed and depth Interface	V2.0
Sensor	Carbowind HR	V1.8
Sensor	AG HR	V1.8
Sensor	Regatta Compass Interface	V1.4
Sensor	Fluxgate compass	V1.7
Autopilot	Pilot processor	V2.8

Once you have ensured that all units are up to date with a compatible version, you can power the system on and check that it works properly. We strongly recommend choosing a *Multigraphic or Gyropilot Graphic* display as Master of the *Topline* network. This will make the integration of the *Processor Regatta* easier to manage.

⚠ **WARNING**

If the instruments connected to the bus are not up to date with the latest firmware version, the *PROCESSOR HR* cannot work and an error message is displayed in the "Main Events" log to indicate the out of date instrument.

5.3 Adding the Processor HR to your nke system

When all the sensors, displays and interface units have been upgradedcompatible with the **Processor HR** and fully working, you are ready to add the **Processor HR** to the network. Once in place, it will become the Master. Therefore, the existing Master has to be deleted so that the **Topline** network is clean of any Master.

- If the **Multigraphic** (current Master) must be given a new node:
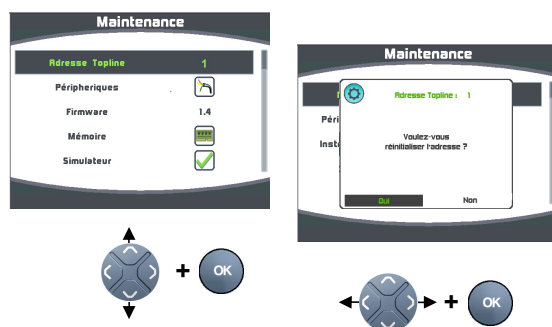
- If the **Gyropilot Graphic** (current Master) must be given a new node:
    - Display the Main Menu (**Menu: main**) with the **Page** key of the **Gyropilot Graphic**

    - Choose **Configuration** and then **Initialisation adress** with the navigation pad

    - Accept with **Ent**,

    - You will get the following message « **To set the address to 0 press Ent**», accept again by pressing **Ent**,

    - the following message will display «**Gyropilot address 0**»

⚠ **WARNING**

The **3D sensor** must be connected to the **« 3D HULL »** connector before connecting the **PROCESSOR HR** (refer to the unit's manual). The **PROCESSOR HR** will automatically detect those sensors (version 2.4 and up).

When powering the Topline network on, a blue LED situated on the front face of the **PROCESSOR HR** indicates the working status. The **PROCESSOR HR** always acts as the Master. When the system is powered on, the Master will create 2 **« Lists »**. Allow 30 seconds for boot completion.

LED status	Working status or fault description
LED off	- Processor is powered off or faulty.
Blue Led	
1 blip every 3 seconds ▲　　3s　　▲	- Processor HR in normal working status - internal auto-check is correct
100ms blip rate ▲ ▲ ▲ ▲ ▲ ▲ ▲	- Processor HR is booting
1 blip per second ▲　　▲　　▲　　▲	- The Processor has detected a serious error (lost a sensor, firmware version is not compatible...
Fixed light	- Processor is out of work or booting.

Once the **PROCESSOR HR** has started (Blue LED blips every 3 seconds), you can give a new node number to the **Gyropilot Graphic** which has been used previously to check the system. Use the following procedure:

For the **Multigraphic:**

Gyropilot Graphic:

– the message « **set an address in the Gyropilot in Menu/Configuration** » is displayed on the **Gyropilot Graphic**. It has not been initialized.

– The system boot must be fully completed before any node can request an address to the **Processor**. Once the data is displayed on the **TL25**, allow another 10 seconds.

– Display the Main Menu (**Menu principal**) with the **Page** key of the **Gyropilot Graphic**

– Choose **Configuration** and then **Initialisation adresse** with the navigation pad

– Accept with **Ent**,

– The following message is displayed « **to get an address press ENT**», press **Ent**,

– The following message is displayed « *liste*» and the *Gyropilot* gets a node number which will be temporarily displayed.

– Press *Page* to exit.

⚠️ **WARNING**

The *List creation* is a long process (30 seconds). Always wait until the *PROCESSOR HR* boot is completed (blue LED = 1 blip every 3 seconds) before asking for a new node number.

5.4 Ethernet configuration

Depending on the network configuration on board your boat, several connection options are possible between your *Processor HR* and the PC.

- Direct Ethernet connection:

The network cable is supplied with the *Processor HR*. It is a crossover cable that allows direct connection to your PC.

RJ45 crossover network cable

- Ethernet connection via a network:

The cable supplied with your *Processor HR* is a crossover cable. It allows connection with the most recent Ethernet Switches. Please check your Ethernet Switch compatibility with crossover cables. If not, you should use a *straight-through* cable.

5.5 Connecting the Processor HR

Prior to connection, you must have configured your PC. The connection will operate via *ftp*, *http*, and the *Sailnet* dll and will allow access to the *calibrations tables*, the log files for trouble-shooting and software updating.

The default address of the *Processor HR* is *192.168.0.232* and the connection credential is:
Login name: *root*
Password: *pass*

Please check the following points before any connection:
- The blue LED indicates that the *Processor HR* works properly
- On the Ethernet RJ45 on: yellow LED indicates activity / green LED indicates physical connection
- Firewall: allow all ports for 192.168.0.232
- If you use a Proxy: in the advanced connection settings of your web browser, add "192.168.0.232" in the section "not use Proxy for the addresses".
- The HR processor does not manage DHCP server. If you use a point to point Ethernet and don't have an IP address automatically attributed by DHCP, you should give your PC a fixed IP address such as *192.168.0.X* where X is different from 232, which is the default address of the *Processor HR*. (see *addendum A - Connecting the Pocessor HR*)

With the http protocol:

Open your Internet browser (Internet explorer, Firefox etc.) and type in the address *http://192.168.0.232* in the address bar and press « Enter » or click on the connection button to accept.

The *Processor HR* configuration page will appear.

With the FTP protocol:
To connect to the FTP server from your PC without having a user name and a password, type in an Explorer window the address:
ftp://root:pass@192.168.0.232
You can access to the internal USB key by typing:
ftp://root:pass@192.168.0.232/var/usbdisk/
Access to the configuration files for *Processor HR* is available at:
ftp://root:pass@192.168.0.232/mnt/flash/processor/

With Telnet protocol:
In the command prompt of the Start menu, type *telnet 192.168.0.232* and press "Enter". A « dos » window will open. For security reasons a credential will be asked to be filled in.
Login name: *root*
Password: *pass*
Alternatively, you can use the login name: *p* which does not require a password.

If you have difficulties connecting to the *Processor HR*, refer to the paragraph "*Configuration of my computer for the first connection to the Processor HR* "

5.6 Connection to the Topline bus

The Processor HR features a *Topline* plug for connection to the *Topline* bus which carries the *12 volts* power supply as well.
Cable: twisted pair with aeronautical type shield.
Connector:

Wire Colour		Termination
Blue	Topline Data	3 and 5 together
White	+12V	4
Shield	Common	1
Not connected	+5V OUT	2

5.7 Connector 3D Hull and 3D Mast

The 3D Sensor is connecting to the 3D Hull connector.
Cable: 3 wires + aeronautical type shield
Connector: Binder 5 contacts series 620

Cable: 90-60-392 (5 Meters)

Wires Colour	Function	Termination
Blue	TX Processor	5
White	RX Processor	3
Shield	Common	1
Orange	+12V OUT	4

The 3D Mast is not used.

Please note: *Compass Regatta* can be powered and communicate with this connector which can also receive data from the *3D Sensor*.

5.8 NMEA1/NMEA2 connectors

These connectors can power and receive data from an NMEA device up to 115kb. Refer to **6. Configuration of the Processor HR** for the port configuration.

NMEA1 is an IN/OUT port and NMEA2 is just INPUT port.
Cable: 3 wires + aeronautical type shield
Connector: Binder 5 contacts series 620

Cable: 90-60-522

Wire colour	Function	Termination	Termination DB9
Blue	TX Processor = RX NMEA	5	2
White	RX Processor = TX NMEA	3	3
Shield	Common	1	5
Orange	+12V OUT	4	Isolate

5.9 NMEA input

Below is the list of NMEA sentences accepted by the *Processor HR*
Each NMEA sentence matches with channels on the *Topline* bus
Channels are automatically detected. NMEA channels created by the *Multigraphic or Gyropilot Graphic* remain as priority input on the NMEA port of the *Processor HR*

NMEA Code	Function number	Possible Functions associated
APB	64	XTE (Cross Track Error)
	70	Autopilot status
	71	Bearing Origin Waypoint to Destination Waypoint
BOD	71	Bearing Origin Waypoint to Destination Waypoint
BWC	62	Distance to waypoint
	63	Bearing to waypoint
BWR	62	Distance to waypoint
	63	Bearing to waypoint
CUR	76	Drift (current)
	77	Set (current)
DBT	22	Depth
DPT	22	Depth
GGA	86	Latitude Degrees and Minutes
	87	Latitude Minutes decimals
	88	Longitude Degrees and Minutes
	89	Longitude Minutes decimals
GLL	86	Latitude Degrees and Minutes
	87	Latitude Minutes decimals
	88	Longitude Degrees and Minutes
	89	Longitude Minutes decimals
GNS	86	Latitude Degrees and Minutes
	87	Latitude Minutes decimals
	88	Longitude Degrees and Minutes
	89	Longitude Minutes decimals
HDG		True Heading - geographical North
	198	Magnetic Heading – Safe Mode
KVH	198	Magnetic Heading – Safe Mode
	199	Heel Angle – Safe Mode
	200	Trim Angle – Safe Mode
MDA	48	Air Temperature

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	49	Water Temperature
	119	Barometric pressure – High resolution
MMB	119	Barometric pressure – High resolution
MTA	48	Air Temperature
MTW	49	Water Temperature
MWV	192	Apparent Wind Speed – High resolution
	193	Apparent Wind Angle – High resolution
RMB	62	Distance to Waypoint
	63	Bearing to Waypoint
	64	XTE (Cross Track Error)
	67	VMG to Waypoint
RMC	27	UTC minutes and seconds
	47	UTC Hour and Day
	69	UTC Year and Month
	86	Latitude Degrees and Minutes
	87	Latitude Minutes decimals
	88	Longitude Degrees and Minutes
	89	Longitude Minutes decimals
	208	Speed Over Ground
	209	Course Over Ground
ROT	207	Rate of turn and direction of turn.
VBW	21	Boat Speed
	42	Dead reckoned drift angle
	208	Speed Over Ground
	209	Course Over Ground
VDR	76	Drift (current)
	77	Set (current)
VHW	21	Boat Speed
	118	True Heading - geographical North
VLW	32	Log
	31	Trip Log
VTG	208	Speed Over Ground
	209	Course Over Ground
VWR	192	Apparent Wind Speed – High resolution
	193	Apparent Wind Angle – High resolution
WCV	67	VMG to Waypoint
XTE	64	XTE (Cross Track Error)
	70	Autopilot status
XTR	64	XTE (Cross Track Error)
ZDA	27	UTC minutes and seconds
	47	UTC Hour and Day
	69	UTC Year and Month
ZDL_R	62	Distance to Waypoint
	222	Time to Waypoint
ZDL_T	225	Distance to Layline
	226	Time to Layline

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5.10 NMEA sentences input priority rules

A priority order is given to the data coming from the **Topline** bus on NMEA data.
NMEA sentences from the displays have a priority order on those coming from the processor.
Each Function can be fed by several NMEA sentences. The table below indicates priority between NMEA sentences.

Num	Variable	High	Medium High	Medium Low	Low
21	Boat Speed	VBW	VHW		
22	Depth	DPT	DBT		
27	UTC minutes and seconds	ZDA	RMC		
32	Log	VLW			
31	Trip Log	VLW			
47	UTC Hour and Day	ZDA,	RMC		
48	Air Temperature	MTA	MDA		
49	Water Temperature	MTW	MDA		
62	Distance to Waypoint	BWC	RMB	BWR	ZDL_R
63	Bearing to Waypoint	BWC	RMB	BWR	
64	XTE (Cross Track Error)	RMB	APB	XTE	XTR
67	VMG to Waypoint	WCV	RMB		
69	UTC Year and Month	ZDA	RMC		
70	Autopilot status	APB	XTE		
71	Bearing Origin Waypoint to Destination Waypoint	APB	BOD		
76	Drift (current)	VDR			
77	Set (current)	VDR			
86	Latitude Degrees and Minutes	GNS	GGA	RMC	GLL
87	Latitude Minutes decimals	GNS	GGA	RMC	GLL
88	Longitude Degrees and Minutes	GNS	GGA	RMC	GLL
89	Longitude Minutes decimals	GNS	GGA	RMC	GLL
	True Heading - geographical North				
119	Barometric pressure – High resolution	MMB	MDA		
192	Apparent Wind Speed – High resolution	MWV	VWR		
193	Apparent Wind Angle – High resolution	MWV	VWR		
198	Magnetic Heading – Safe Mode	KVH	HDG		
199	Heel Angle – Safe Mode	KVH			
200	Trim Angle – Safe Mode	KVH			
207	Rate of turn and direction of turn	ROT			
208	Speed Over Ground	VBW	RMC	VTG	
209	Course Over Ground	VBW	RMC	VTG	
225	Distance to Layline	ZDL_T			
226	Time to Layline	ZDL_T			
222	Time to Waypoint	ZDL_R			

5.11 NMEA output

Output frequency is linked to the baud rate selected.

The table below shows all NMEA sentences that can be output from the processor. An NMEA sentence will be available for output if at least one value contained in the sentence is used by the processor.

NMEA sentence	Description
$INDBT …	Depth below keel
$INDPT …	Depth below keel
$INGGA …	Global Positioning System Fix Data
$INGLL …	Geographic position
$INHDG …	Heading – Deviation and Variation
$INHDT …	True Heading
$INMTW …	Sea Temp
$INMWV,x.x,R …	Apparent Wind Angle and Speed
$INMWV,x.x,T …	True Wind Angle and Speed
$INMWD …	True Wind Direction and Speed
$INRMB …	Recommended Minimum Navigation
$INRMC …	Recommended Minimum GNSS Data
$INRSA …	Rudder angle
$INVDR …	Set and Drift
$INVHW …	Water Speed and Heading
$INVLW …	Dual Ground/Water Distance
$INVPW …	VMG
$INVTG …	Course/Speed Over Ground
$INWCV …	Waypoint closure velocity
$INXDR …,C,x.x,C,AIRT …	Air Temperature
$INXDR …,P,x.x,B,BARO …	Barometer
$INXDR …,N,x.x,N,FRST …	Forestay
$INXDR …,A,x.x,D,ROLL …	Heel angle
$INIXDR ...,H,x.x,P,HYGR …	Humidity
$INXDR …,A,x.x,D,KEEL …	Keel Angle
$INXDR …,A,x.x,D,LEEW …	Leeway angle
$INXDR …,A,x.x,D,MAST …	Mast angle
$INXTE …	Cross Track Error, measured
$INZDA …	UTC Time and Date

5.12 Option Connector

No cable is supplied by default. The connector is a Binder 4 contacts series 620
(IP67/snap-in/Dext=11.5mm).
The pin assignment is as follows:

Function	Termination
+12V OUT	1
ACS OUT	3

Pins 1 & 3 + 12V OUT and OUT allow ACS command a
solenoid (electromagnet, power relays ...). By default, this output is
dedicated to anti- capsize or keel release system.

Please note: ACS OUT output is open drain type and is limited to 2A / 16V on
a few seconds.

6. CONFIGURATION OF THE PROCESSOR HR

In this chapter we will cover the configuration of the **Processor HR** for your electronics and information system.

You can access the **Processor Regatta** home page by typing this address in your Internet browser: http://192.168.0.232 (refer to addendum A for Computer configuration).

In this page you can find several links to the calibration tools.

6.1 Action of the links

6.1.1 Actions
- **Reboot processor**: Restart the Processor HR
- **Stop processor:** Stop the **PROCESSOR HR**
- **Save a backup on the USB stick:** Backup all calibrations and tables in USB stick.
- **Refresh calibrations from the USB stick and restart:** Load all backup calibration parameters and tables from the USB stick and restart the PROCESSOR HR.

6.1.2 Installation and calibrations
- **Calibrating the constants**
  The access to the file "Cali.ini" is on the following path:
  ftp://root:pass@192.168.0.232/mnt/flash/processor/constants

Some constants, not accessible from a **Display**, can be adjusted here. It contains two sections.

```
[Dampings]
USspdDampLost  = 15   ; Filtering speedometer's losses US (seconds)
MastAngDamp    = 3    ; Filtering mast angles   (table 0..31)


[Constants]
HdgOff         = 0.0  ; Additional heading offset   (degrees)
MastRotOff     = 0.0  ; Mast twist offset    (degrees)
MastDeflOff    = 0.0  ; Mast tilt/deflection  (degrees)
WindShear      = 0.0  ; Windshear   (degrees)
AWSOff         = 0.0  ; Apparent Wind Speed offset (knots)
FailSafeBS     = 6.0   ; Spare Boat Speed (knots)
MeasLeewayOff  = 0.0  ; Drift sensor offset  (degrees)


[MotionWindComp]
WindVaneHigh   = 30.0 ; Aerial sensor's height / Rotation centre with heel
(metres)
Coef1          = 6 ;   (3DHV2 = 6) (KVH = 4)
Coef2          = 3 ;   (3DHV2 = 3) (KVH = 2)

[Anticapsize]
HeelAcsLimit   = 35.0 ; Heel angle limit to
prevent capsize (degrees, 0=no)
TrimAcsLimit   = 35.0 ; Pitch angle limit to prevent capsize (degrees,
0=no)
AccXAcsLimit   = -15  ; m/(s*s).0=no)
AcsConfTime    = 0    ; Confirmation time-laps ACS (ms)
AcsCmdTime     = 500  ; Command time ACS output   (ms)


[PilotHR]
TackingSpeed  = 20 ; Rate of turn when tacking /s)
GibingSpeed   = 10 ; Turn rate when gybing /s)
SecPerBoomTp  = 1  ; Gybing: number of seconds per timeout unit for boom
shift (s)
GibingBoomOff = 0  ; Gybing: Angle offset when the boom shifts over
(degrees)
TackOffset    = 5  ; Offset value to catch up speed after tacking
(degrees) -1=disabled
```

The "Coef" value is entered according to the sensor connected to the 3Dhull.

⚠️ **WARNING**

The default configuration of this file is correct for 60' Open but you can apply modifications should you want to customize your system.
Modifications are saved by pressing « *Save File* » and will be applied after you reboot the *Processor HR*. This is done by pressing « *Reboot Processor*».

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- **Installation configuration**
  The access to the file "Cali.ini" is on the following path:
  ftp://root:pass@192.168.0.232/mnt/flash/processor/instal
  This file controls the configuration of your *Processor HR*. It contains sub-sections.

```
[Language]
Language      = 0 ; Customs labels and proHR on gyrographic pages (on
restart 0=French 1=English 2=Spanish 3=Italian)

[Compute]
BoatSpdLinHeel= N ; Uses the speed linearisation file according to heel
angle
TrueWindTable = N ; Uses the True Wind correction table (+ back-
processing AW)
Performance   = Y ; Processes performance data with the polar tables .
```
Calculation is made with the polar table saved in the PROCESSOR (Speed.polar) and broadcast on the Topline bus. Should you not wish to broadcast the Performance channel of the Processor on the TOPLINE bus, set the value from Y to N.
```
Variation =Y ; Processes the magnetic variation
UseMechMastRot= Y ; Uses the mechanical mast sensor in priority
HeelTackSelect= 3 ; Selection between 2 ultrasonic speed sensors on the
Topline bus
              ; 0= choice for tack with AWA +/-10 deg
              ; a a 100

[Datalog]
ValidDatalog   = Y ; Enables the datalogs save (Y or N)
CompressDatalog = N ; Enables the gzip compression of data-logs (Y or N).
```
Y for enabling and N for disabling. They are saved in the "Archive" folder. d' battery capacity USB.
```
HoursDL        = 1 ; Time length of file (hours)

[3Dhull]
```
[3Dhull] 3D Hull port settings. 255 = auto-detection of the source.
```
3DH_Valid    = Y   ; Validate 3D Hull (X=North, Y=West, Z=Height)
3DH_Instal   = 255 ; Type and frame of the sensor
              ; 7 = 3D Sensor (X' forward, Y' starboard,  Z' down)
              ; 10 = Regatta Compass
              ; 11 = KVH Compass
              ; 13 = 3D Fusion (X' forward, Y' starboard,  Z' down)
              ; 255 = AUTODETECT
3DH_Baudrate = 4800 ; Baudrate of datas in NMEA0183 mode
3DH_FusionMode= 0  ; 0 = 3D sensor mode (magnetic heading measurement)
```
The heading is supplied by the 3D Fusion magnetometer.
```
              ; 1 = 3D fusion GPS compass (fusion on true heading
and SOG , COG and POSITION from gps)
```
Heading and SOG are delivered by the compass GPS and corrected by the 3D fusion. COG and position are delivered directly by the compass GPS.
```
              ; 2 = 3D fusion compass + raw GPS (fusion on true
heading , COG/SOG and position from gps)
```
Heading is delivered by the compass GPS and corrected by the 3D fusion. COG, SOG and position are delivered directly by the compass GPS.

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```
3DH_GPS_X      = 0   ; GPS antenna position in X from 3D unit  See below for
GPS/3D fusion antenna settings.
3DH_GPS_Y      = 0   ; GPS antenna position in Y from 3D unit
3DH_GPS_Z      = 0   ; GPS antenna position in Z from 3D unit
3DH_GPS_BIAS   = 0   ; GPS heading bias with 3D unit
3DH_LogLevel   = 0   ; Log level Data ( 0 = Mini, 3 = Max )  Generates sailnet
variables for 3D fusion debug.


[NMEA1]  NMEA1 port settings
ValidNmeaIn    = N    ; Validates the main NMEA183 input
ValidNmeaOut   = N    ; Validate the NMEA183 output
NmeaBaudrate   = 4800 ; Rate NMEA183IN&OUT(4800 or 38400)


[NMEA2]  NMEA2 port settings
ValidNmea2In   = N    ; Validate the NMEA183 secondary input
Nmea2Baudrate  = 4800 ; Rate secondary NMEA183IN (4800 or 38400)


[NMEAUdp]  UDP port settings
ValidUdpNmeaIn  = N    ; Validates NMEA183 on UDP/IP
UdpNmeaInPort   = 1001 ; UDP port for Nmea183 input on UDP/IP
ValidUdpNmeaOut = N    ; Validates NMEA183 output on IP
UdpNmeaOutPort  = 1000 ; Port UDP de la sortie Nmea183 sur IP
UdpNmeaOutIP    = 192.168.0.255 ; IP address for the destination PC
(x.x.x.255 in broadcast mode)


[PilotHR]  Pilot HR settings
ValidPilotHR   = Y   ; Validates the autopilot steering
PilotKey       = -1  ; Pilot HR licence key (decimal)  Key to activate PILOT
HR. The key is calculated from the serial number mentioned in the events log at the "Pilotkey
(serial $xxxx)" line.
RudderLimit    = 30  ; Software rudder end (inside physical rudder
ends)  Indicates the lowest value from the 2 rudder ends. Used for automatic tacking and gybing.
VitesseCoque   = -1  ; Upwind target speed with 15 knots of wind  Upwind
boat speed when sailing with 15 knots wind speed on flat sea
AsservSpeed    = 3   ; 0-> low control 5 -> high control. Default = 3
HardRudderLimit = 30  ; Physical rudder end when commissioning the
autopilot (smallest value)
PlanningRdrLimit= 30  ; Virtual rudder end when the boat is planning
Maximum rudder angle you allow when the boat is planning.
TablePilotHR   = N   ; Validate the use of the autopilot table
ModeRafale     = Y   ; Validate the use of the Gust mode
ModeSurf       = Y   ; Validate the use of the Surf mode
Surf_Max_Val   = 10  ; Maximum Offset for Surf mode   Maximum Offset applied
on Course To Steer in SURF mode.
AutoDeadAngle  = N   ; Automatic switching of dead angle


[SailNet]
ValidSailNet   = N   ; Validate the SailNet interface
SailNetOutIP   = 192.168.0.233 ; IP address of recipient, 192.168.0.233
= PC, 127.0.0.1=localHost
SailNetOutPort = 4003 ; IP port for SailNet output
SailNetInPort  = 4004 ; IP port for SailNet Input


[Anticapsize]
ValidAcs       = N   ; Validate the anti-capsize (ACS)


[Custom]
```

```
LuaLauncher      = N    ; Validates the lua script management launch
ComputeStat      = N    ; Validates the customized statistics process
```
GPS/3D fusion antenna location settings:
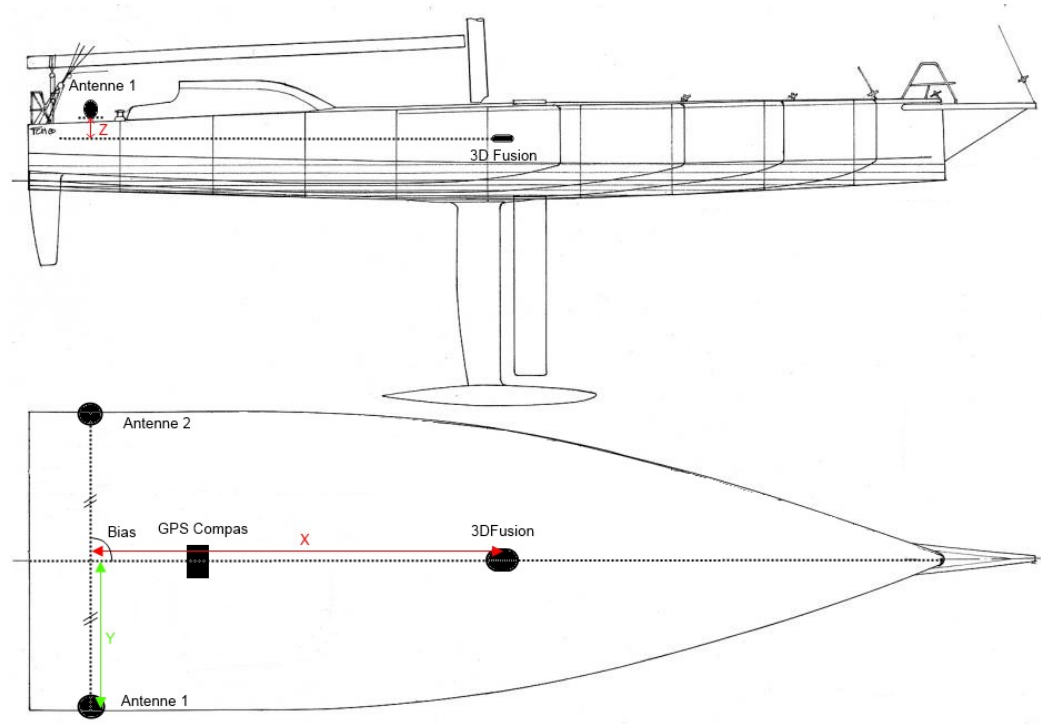
X, Y, and Z in metres.
X is negative if antenna 1 is behind the 3D Fusion
Y is positive if antenna 1 is on starboard (on the right side of the 3D Fusion).
Z is negative if the 3D Fusion is lower than the antenna 1.

"Bias" = 0° if the angle is 90°. It is positive if the angle < 90° and negative if the angle is >90°.

⚠️ **WARNING**

These data will be taken into account once the system has been restarted twice after having saved the "Instal.ini" file.

- **Correcting True Wind Speed**
  Gives ccess to the True Wind Speed correction table located at the following address:
  http://192.168.0.232/mnt/flash/processor/tables/Adjvt.d
  The correction table allows True Wind Speed calibration (refer to "Calibrating your system").

- **True Wind Angle correction**
  Gives access to the True Wind Angle correction table located at the following address:
  http://192.168.0.232/mnt/flash/processor/tables/Adjwa.d
  The correction table allows True Wind Angle calibration (refer to "Calibrating your system").

- **Polar table**
  Gives access to the Polar Table located at the following address:
  http://192.168.0.232/mnt/flash/processor/tables/speedpolar.pol
  The Polar table target Boat Speed data is entered in this file (refer to "Performance and Polar table")

- **Autopilot table**
  Gives access to the Pilot HR settings table located at the following address:
  http://192.168.0.232/mnt/flash/processor/tables/pilot.d
  The Pilot HR settings are entered in this table according to True Wind Speed and Angle. This table feeds the Autopilot HR with these data when the following value is set: **Configuration installation/ [pilotHR],** *TablepilotHR* = Y.

TWS	HDG			Heel		Trim		PilotDamp		TWA
	P	I	D	P	D	P	D	TWA	Spd	A1
5.0	3	3	3	0	0	0	0	4	0	45
7.0	4	4	4	0	0	0	0	4	0	45
10.0	4	4	4	0	0	0	0	5	0	45
15.0	5	5	5	0	0	0	0	5	0	45
17.0	6	6	6	0	0	0	0	5	0	45
21.0	7	7	7	0	0	0	0	5	0	45
25.0	8	8	8	0	0	0	0	5	0	45

The Autopilot table is used to enter various settings (from 0 to 9) which are applied to the Autopilot for the 3 wind angle sectors (**TWA**), upwind, beam reaching and downwind with 7 Wind Speeds (**TWS**).

The **HDG** column is used for **P**roportional yaw; **I**ntegral yaw and **D**erivative yaw (refer to the PILOT HR manual to know more about each setting parameter).

The **Heel** column is used for **P**roportional roll; **I**ntegral roll and **D**erivative roll (refer to the PILOT HR manual to know more about each setting parameter).

The **Trim** column is used for **P**roportional pitch; **I**ntegral pitch and **D**erivative pitch (refer to the PILOT HR manual to know more about each setting parameter).

The column **PilotDamp/TWA** is used to enter a Hybridization filter setting to give more or less weight to the wind or to the heading for the Course To Steer (refer to the "PILOT HR" manual to know more about these settings).

- **Gust Table**
  Gives access to the Pilot HR Gust table settings located at the following address:
  http://192.168.0.232/mnt/flash/processor/tables/rafale.d
  Allows setting various strategies to manage gusts by playing on the True Wind Angle to Steer.

- **Correction of Boat Speed according to heel angle**
  Give access to the Boat Speed correction table according to heel angle located at the following address:
  http://192.168.0.232/mnt/flash/processor/tables/ BtSpdHeel.txt
  That correction table allows Boat Speed calibration according to heel angle (refer to "Calibrating your system").

⚠️ **WARNING**

When you modify tables, don't forget to save changes by pressing **"Save File"**. Once the file is saved the **PROCESSOR HR** must be restarted to take the modifications in account, using the command **"Reboot Processor"**.

6.1.3 Parameters directly settable from the Multigraphic

- *Choice of the speed source for the Processor*:*
  Menu sensor/speed Processor/source/Boat Speed or Over Ground

  Boat Speed = speed given by the speedometer
  Over Ground = speed given by the GPS (SOG)
  *Speed used for the True Wind processing and PILOT HR control.

  From the Multigraphic

- *True Wind filtering:*
  Menu sensor/True Wind Speed/filtering
  Allows the display update rate to be set for the speed and True Wind Angle . The setting acts only on the data display and does not affect the autopilot.

- *Filtering Performance Data*
  Menu Sensor/ polar table efficiency/filtering
  Allows the display update rate to be set for the performance data (Target Speed, Performance downwind...)

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- *Filtering Speed Over Ground*
  Menu Sensor/Speed Over Ground /filtering
  Allows the display update rate to be set for Speed Over Ground.

- *Filtering Course Over Ground*
  Menu Sensor/Course Over Ground /filtering
  Allows the display update rate to be set for Course Over Ground.

6.1.4 Analyse

- **Main events**
  Gives access to the log where important information regarding the Linux system and the *PROCESSOR HR* are stored:
  http://192.168.0.232/var/log/messages
  The Main Events Log can be downloaded via ftp and is editable with a text editor. It is stored as rolling data in the *PROCESSOR HR* memory with a 40 Ko memory allocation.

- Low level Events
  Gives access to debug information for the Linux system and the *PROCESSOR HR* stored in a log file located at the following address (typically, details on all sub-channel access, eeprom):
  http://192.168.0.232/var/log/debug
  The Low Level Events Log can be downloaded via ftp and is editable with a text editor. It is stored in a Volatile Memory in the *PROCESSOR HR*, so it must be saved before switching off.

- **Instruments and Topline bus status**
  Gives access to the files which are saved for the Topline Bus status at the following address:
  ftp://root:pass@192.168.0.232/var/log/topline

  ⚠ **WARNING**

  This link always points to IP 192.168.232. To access this file should you change your *Processor HR* IP address, you will need to enter the following path in the navigation bar: "ftp://root:pass@192.168.0.xxx/var/log/topline".

- **Polar curve and limit sectors**

Gives access to a ".csv" file for the polar table calculated by the **PROCESSOR HR** from the data entered in the polar tables and the limit sectors for upwind and downwind speeds according to True Wind Speed. That file is saved in the USB key with the following address:
ftp://root:pass@192.168.0.232/var/usbdisk/perf/proHrSpeedPolar.csv

---

⚠️ **WARNING**

This link always points to IP 192.168.232. To access this file, should you change your **Processor HR** IP address, you will needto enter the following path in the navigation bar: " ftp://root:pass@192.168.0.xxx/var/usbdisk/perf/proHrSpeedPolar.csv".

- **Optimum calculated on the Polar Table**
  Gives access to a ".csv" file for the polar table calculated by the **PROCESSOR HR** from the data entered in the polar tables and the limit sectors for upwind as well as optimum angles and speeds upwind and downwind. This file is saved in the USB key with the following address:
  ftp://root:pass@192.168.0.232/var/usbdisk/perf/proHrOptOnPolar.csv

  Up.Vs   Boat Speed for the best VMG upwind
  Up.Bt   Upwind Angle for the best VMG upwind
  Up.Vmg best VMG upwind

  Up.Vs   Boat Speed for the best VMG downwind
  Dn.Bt   Reaching Angle for the best VMG downwind
  Dn.Vmg   best VMG downwind

⚠️ **WARNING**

This link always points to IP 192.168.232. To access this file, should you change your Processor HR IP address, you will need to enter the following path in the navigation bar: " ftp://root:pass@192.168.0.xxx/var/usbdisk/perf/proHrOptOnPolar.csv".

6.1.5 Tools

- **Browse the Processor's directory**
  This link gives access to the various folders in the **PROCESSOR HR**.

- **Network configuration**
  For the **PROCESSOR HR** configuration in the Network environment.
  IP= «192.168.0.232 » IP address (Internet Protocol) allocated to the **Processor HR** for identification on the Network.
  NETMASK = "255.255.255.0" sub-network mask, additive to the IP address

BROADCAST= "192.168.0.255" broadcast IP address (in that case, the messages are sent to all machines wearing an IP address between 192.168.0.1 and 192.168.0.254).
GATEWAY= "192.168.0.1" IP address for the gateway.

<div style="border:1px solid black; padding:10px;">

⚠️ **WARNING**

The default configuration of this file is correct but you can apply modifications should you want to customize your system.
Modifications are saved by pressing « *Save File* » and will be applied after you reboot the *Processor HR*. This is done by pressing « *Reboot Processor*».

</div>

6.1.6 *Datalogs*

- **Browse the recent files folder**
  Here you can see the current files saved on the USB stick.
  You can download these files via ftp at the following address:
  ftp://root:pass@192.168.0.xxx//var/usbdisk/datalog

- **Browse the archives files folder**
  Here you can see the archive files saved and stored on the USB stick. These files are compressed when you have enabled datalog compression in the installation file.
  You can download these files via ftp at the following address:
  ftp://root:pass@192.168.0.xxx/var/usbdisk/lost+found

- **Browse the recent statistics folder**

- **Browse the archive statistics folder**

6.1.7 *Support*

- **Link to the nke technical website**
  This link points to a technical section of the nke marine electronics website where the firmware can be downloaded

6.2 Software update

To run a "softwre update", the image file " ProHR_Vx.x_xxxxxx" must be placed in a folder on the PC.
Vx.x = software version
Xxxxxx = date of compilation AAMMJJ

Select the image file with the "Browse" button and then start the update clicking on "Full Manual Update" and wait for completion. The *Processor HR* will restart autocratically.

> ⚠️ **WARNING**
>
> Configuration files and tables will be replaced by default ones. You must previously backup the data in the USB key with the command "Save a backup to USB key". Once the backup is saved, data can be restored with the command "Restore calibrations from the USB key and relaunch" (see § 6.1.1).
> **Do not turn the PROCESSOR HR off during the software update.**

6.3 Configure the file variable.csv

This file controls the way the functions are displayed on the *Gyropilot Graphic* and determine the variables on the NMEA input. It must be downloaded via the "ftp" protocol at:
ftp://root:pass@192.168.0.232/mnt/flash/processor/SailNet/
Once modified and saved, it has to be uploaded to the same address in the *Processor HR.* A "*Reboot*" will be required.

Num: id of the variable.
Help: English description of the variable.
En10Name: English name of variable.
En3Unit: Unit of variable (English).
Aide : French description of the variable.
Fr10Nom: French name of the variable.
Fr3Unit: Unit of variable (French).
View : toggle the variable display on *Gyropilot Graphic*. N = not displayed, Y = displayed.

Group : Name of the group of the variable.
ToplineDef: Name of the Topline variable. (Do not modify. For internal use only)
IntFormat: Format of the variable in the Topline bus and datalog files. (Do not modify. For internal use only)
FloatForm: Format of the variable in the Topline bus and datalog files. (Do not modify. For internal use only)
Zoom: Coefficient used to enhance data presence in data log files. (user can adjust this value)
HzTopline: Definition of variables use rate in Topline bus. (Do not modify. For internal use only)
NmeaIN: This column indicates the NMEA sentences used on the NMEA input.
Custom : Gives authorization for a user's variable coming from a NMEA input and a LUA file.

6.4 Choosing the language

The default language of the *Processor HR* is French. This means that data in the files Variables.csv and UserVariables.csv areseparated by a semicolon. In the English version of Excel the csv separator is a comma. To use the csv files with an English version of Excel, you have to set the Processor HR in English to generate the correct format. This is done with a patch activated in a Telnet window. This patch turns the constants files and Ini files to English format.

```
⚠  WARNING

If the files "Calib.ini", "instal.in" and "Variables.csv" have been changed before
running the patch, it is better to save them, because they will be erased.  If this
occurs the PROCESSOR HR will need a new calibration.
```

6.4.1 Patch installation procedure

The patch is available on the nke-marine-electronics website at the technical section:
http://www.nke-marine-electronics.com identification "processor-hr", password "HR".
- Connect via "ftp" (see §5.5) at:
- ftp://root:pass@192.168.0.232/mnt/flash/processor/patchs
- Copy the patch in the folder.
- Shut the "ftp" connexion
- Connect to PROCESSOR HR via Telnet (see § 5.5)
- Go to the folder "patch" by typing the command "cd patch"
- Run the patch by typing the command:
  "sh patch.sh *ProHR_XXXXFiles.patch.tar"* where XXXX is *English* or *French*
  according to the language you want to apply.
  The patch is automatically deleted after installation.

7. ALGORITHM FOR THE PROCESSED FUNCTIONS

This section describes the algorithms used to process the main functions used for the true wind calculation and data for the autopilot. The following diagrams will help you understand the system.

The following symbols will be used:

7.1 Functions for boat motion

7.2 Functions for boat speed

```
┌──────────────┐   ┌──────────────────┐   ┌──────────┐   ┌──────────────────┐
│ Port Ultrasonic│   │Starboard Ultrasonic│   │   SOG    │   │ Coefficient x AWS│
└──────┬───────┘   └────────┬─────────┘   └────┬─────┘   └────────┬─────────┘
       │                    │                  │                  │
┌──────▼───────┐   ┌────────▼─────────┐        │                  │
│  CA_VitSuBa  │   │    CA_VitSuTr    │        │                  │
│Port Boat Speed│   │StarbordSurface Speed│     │                  │
│Linear Calibration│ │ Linear Calibration│      │                  │
└──────┬───────┘   └────────┬─────────┘        │                  │
       │                    │                  │                  │
┌──────▼───────┐   ┌────────▼─────────┐        │                  │
│  OF_VitSuBa  │   │    OF_VitSuTr    │        │                  │
│Boat Speed Offset│  │Boat Speed Offset │       │                  │
│     Port     │   │    Starboard     │        │                  │
└──────┬───────┘   └────────┬─────────┘        │                  │
       │                    │                  │                  │
┌──────▼───────┐   ┌────────▼─────────┐        │                  │
│   PortUsBs   │   │     StbdUsBs     │        │                  │
└──────┬───────┘   └────────┬─────────┘        │                  │
    2Hz│               2Hz  │                  │                  │
       ▼                    ▼                  │                  │
   ◇Heel tack◇         ◇AWA tack◇              │                  │
   ◇selection◇         ◇selection◇             │                  │
       │                    │                  │                  │
       └─────────┬──────────┘                  │                  │
                 ▼                             │                  │
         ┌───────────────┐                     │                  │
         │Speed Calibration│                   │                  │
         │According to the heel│               │                  │
         │  BtSpdHeel.txt │     ◇Backup Selection◇◄──────────────┘
         └───────┬───────┘     ◇  Boat Speed   ◇
                 │                  │       │
         ┌───────▼───────┐          │       │
         │  _FI_VitSurf  │◄─────────┘       │  8Hz
         │    Surface    │                  ▼
         │ Speed Damping │          ┌───────────────────┐
         └───────┬───────┘          │Surface Boat Speed pilot│
                 │                  │    (BtSpdPil)     │
         ┌───────▼───────┐          └───────────────────┘
         │  Boat Speed   │
         │  (Boatspeed)  │
         └───────────────┘
```
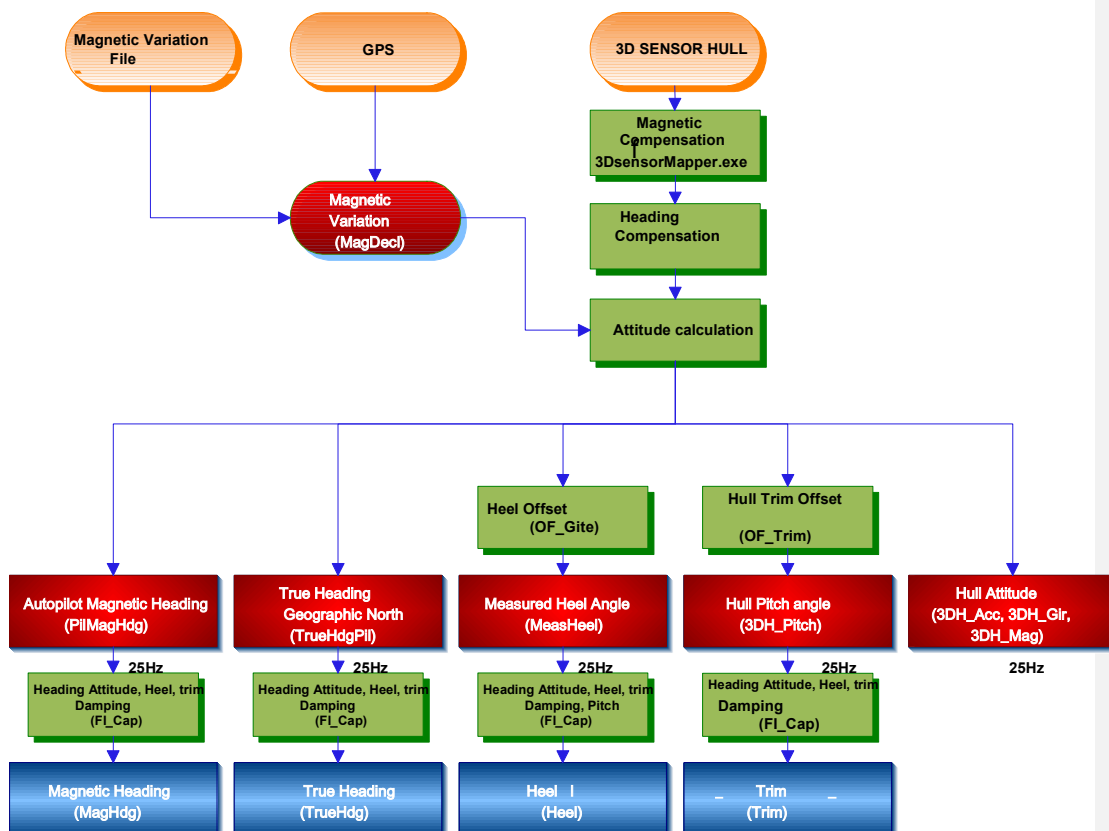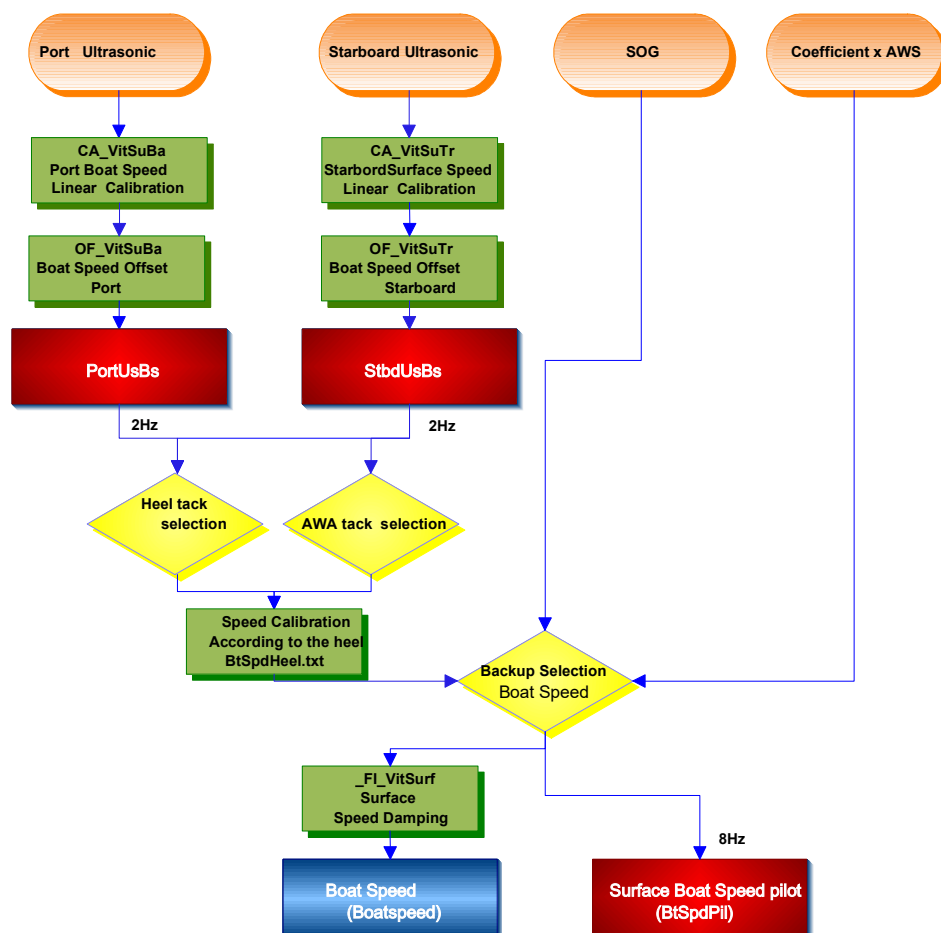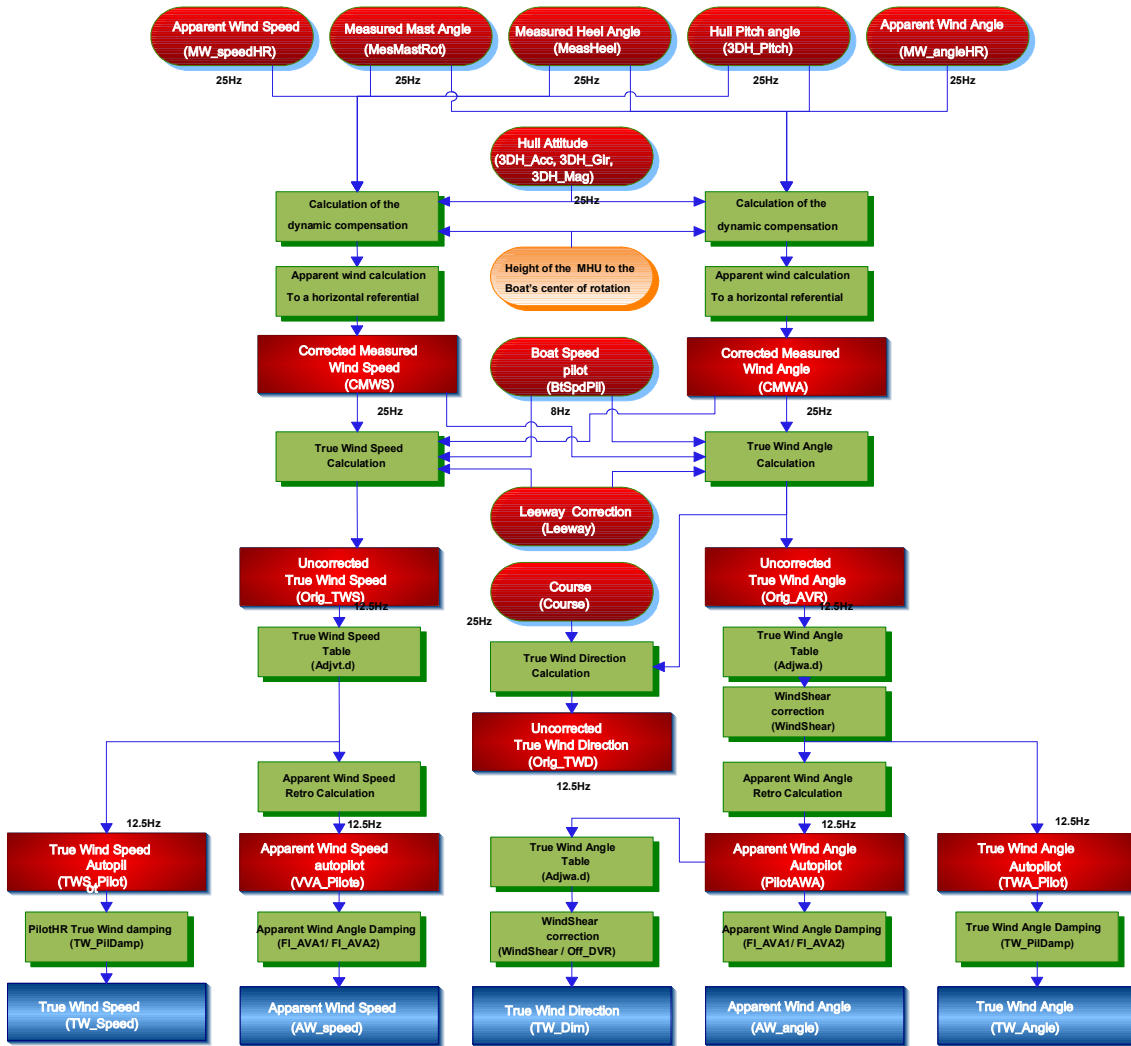
7.3 Function for wind data

Apparent Wind Speed (MW_speedHR) — 25Hz
Measured Mast Angle (MesMastRot) — 25Hz
Measured Heel Angle (MeasHeel) — 25Hz
Hull Pitch angle (3DH_Pitch) — 25Hz
Apparent Wind Angle (MW_angleHR) — 25Hz

Hull Attitude (3DH_Acc, 3DH_Gir, 3DH_Mag) — 25Hz

Calculation of the dynamic compensation
Calculation of the dynamic compensation

Height of the MHU to the Boat's center of rotation

Apparent wind calculation To a horizontal referential
Apparent wind calculation To a horizontal referential

Corrected Measured Wind Speed (CMWS) — 25Hz
Boat Speed pilot (BtSpdPil) — 8Hz
Corrected Measured Wind Angle (CMWA) — 25Hz

True Wind Speed Calculation
True Wind Angle Calculation

Leeway Correction (Leeway)

Uncorrected True Wind Speed (Orig_TWS) — 12.5Hz
Course (Course) — 25Hz
Uncorrected True Wind Angle (Orig_AVR) — 12.5Hz

True Wind Speed Table (Adjvt.d)
True Wind Direction Calculation
True Wind Angle Table (Adjwa.d)

WindShear correction (WindShear)

Uncorrected True Wind Direction (Orig_TWD) — 12.5Hz

Apparent Wind Speed Retro Calculation
Apparent Wind Angle Retro Calculation

True Wind Speed Autopil (TWS_Pilot) — 12.5Hz
Apparent Wind Speed autopilot (VVA_Pilote) — 12.5Hz
True Wind Angle Table (Adjwa.d)
Apparent Wind Angle Autopilot (PilotAWA) — 12.5Hz
True Wind Angle Autopilot (TWA_Pilot) — 12.5Hz

PilotHR True Wind damping (TW_PilDamp)
Apparent Wind Angle Damping (FI_AVA1/ FI_AVA2)
WindShear correction (WindShear / Off_DVR)
Apparent Wind Angle Damping (FI_AVA1/ FI_AVA2)
True Wind Angle Damping (TW_PilDamp)

True Wind Speed (TW_Speed)
Apparent Wind Speed (AW_speed)
True Wind Direction (TW_Dim)
Apparent Wind Angle (AW_angle)
True Wind Angle (TW_Angle)

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8. THE PILOT HR

The **PILOT HR** is a software module integrated to the **PROCESSOR HR.** It manages a robust deterministic auto-steering process that is widely adjustable with 3 dimensions of movement.
The system is designed for easy expansion and detects and evaluates the introduction of new technologies including the Inertial Reference Systems with MEMS (3D sensors), the new sensors or advanced algorithms for control command as soon as they are introduced

The **PILOT HR**:

- It allows the data coming from the Inertial Reference System 3d Sensor Hull to be used with critical high quality information to calculate a Course To Steer at a higher rate.
- Sends a rudder angle command at high frequency to the Gyropilot2 which acts accordingly.
- Manages the user interface. The Multigraphic display and/or Gyropilot Graphic is then used like a terminal.

8.1 Activation

By default, the Pilot HR is not enabled. To activate the Pilot HR a software key supplied by nke is required. Thae key is calculated from the serial number mentioned in the events log at the "Pilotkey (serial $xxxx)" line) ».

8.2 Selecting the HR Autopilot on the Multigraphic

The selection is made in the Autopilot menu "Pilot" of the Multigraphic.
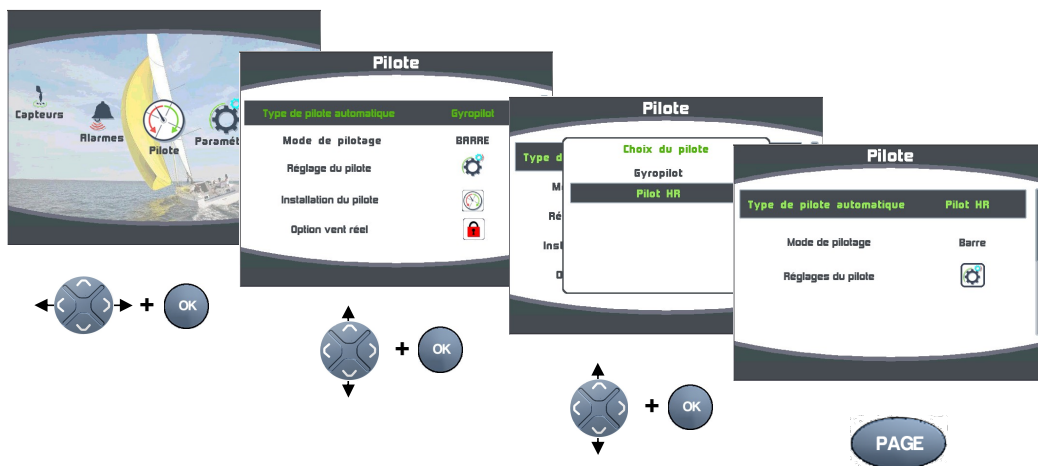
8.3 Selection of Pilot HR with the Gyrographic

A page dedicated to the Pilot HR has been created in the Gyrographic. Just select that page to use it.

Retour Menu Processor

Sélection du Mode

Réglages du pilote

Nom à façon

Icône du mode actif

Gain global

Mode actif

Valeur de la Consigne (ou Off ou Gyro)

Valeur instantanée
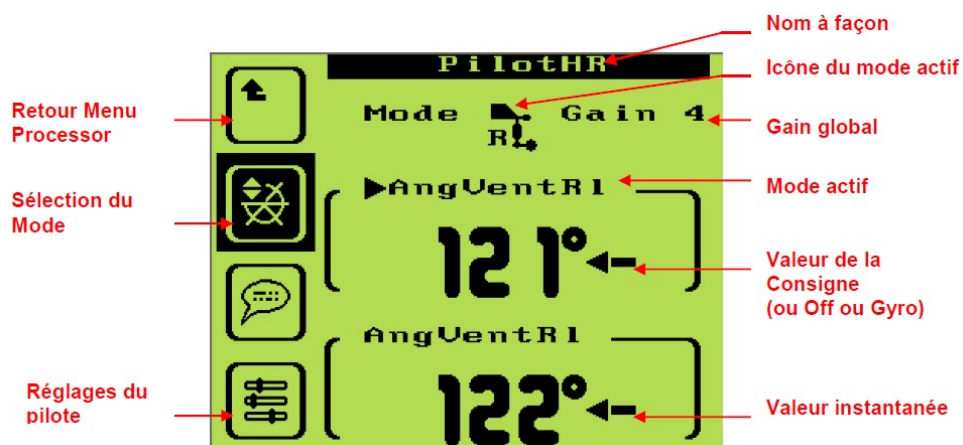
9. CALIBRATING YOUR SYSTEM

9.1 Introduction

Performance data is calculated and displayed using the polar table in the *Processor HR*. It is important that wind, speed and compass sensors are correctly calibrated to achieve accurate data for true wind direction and speed, target boat speed, VMG...

Wrong calibration may cause mistakes in tactical decisions.

9.2 Calibration order

Prior to typing values in the true wind angle table, all calibrations for the primary sensors must have been achieved:

- Compass
- Speed sensors
- Wind sensors

We recommend processing the calibrations in the following order:

```
Compass calibration
        ↓
Roll and pitch offset
        ↓
Boatspeed
        ↓
Leeway
        ↓
Mast angle
        ↓
Apparent wind angle
        ↓
True wind angle
```
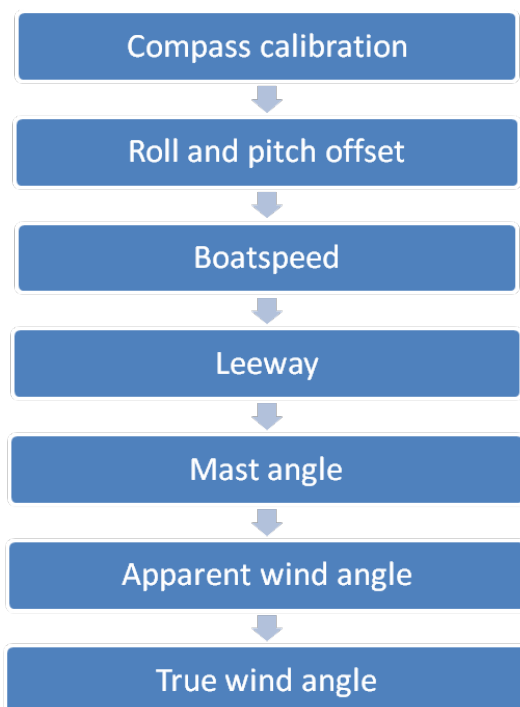
9.3 Calibrating the compass

Please refer to the calibration section in the sensor's manual.

9.4 Roll and pitch calibration

The calibration of these parameters can be achieved using a digital or laser level. Place the level on the reference surface indicated by the architect. The *3D Sensor* or *Compass Regatta* must be free from any heavy metal presence such as a pontoon or a cargo ship within a 20 meters radius. The boat must be well balanced. Check that the weight distribution is normal on board. Ideally, the boat should be empty of all sails, anchors, safety equipment, food, etc… Run this operation in calm water.

The calibration values will be typed in the following *Gyropilot Graphic* menu:

Page ► Configuration ► calibration ► Heel angle ► Offset

Page ► Configuration ► calibration ► Trim angle ► Offset

The calibration values will be typed in the following *Multigraphic* menu:

Press Page during 2Sec ► Sensors ► Heel ► Offset

Press Page during 2Sec ► Sensors ► Pitch ► Offset

9.5 Calibrating boat speed

Boat speed is measured in the boundary layer which varies from one boat to another.
Paddle-wheel sensors measure boat speed inside a disrupted and accelerated water flow.
The measurement is not linear and the resulting error may vary against the heel angle.
The water speed measurement by ultrasonic speed sensors is about ten centimetres away from the hull. The water flow is much less disrupted and the measure is linear. Nevertheless, these measurements tend to be 1 or 2% optimistic when the boat is strongly heeling. This is due to the growth of the boundary layer and the calibration being made with the boat not heeling.

Calibration can be done in two different ways:

Consecutive runs on a given course:

With this method you need to choose a course with known distance, for example between two buoys. Reset the log at the starting point, and motor between the two points. Note the log once reaching the second point. Repeat the run in the opposite way, and note again the log's value.

Example:

Run 1: measured log 1.05

Run 2: measured log 1.09

The true distance between the two buoys is 0.97 miles.

nke
MARINE ELECTRONICS

Run 1: $\dfrac{0.97}{1.05} = 0.92$

Run 2: $\dfrac{0.97}{1.09} = 0.88$

The calibration adjustment is: $\dfrac{0.88 + 0.92}{2} = 0.9$

Calibration using SOG as the reference:

With this method you need to motor at ten knots on two consecutive runs at opposite headings (in order to eliminate the effect of the current). Both runs must be of equivalent distance. SOG from the GPS will be the reference speed. The calibration adjustment will be the result from averaged boat speed and averaged Speed Over Ground.

The calibration adjustment value can be calculated from the data logged in the internal USB key. Useful data will be extracted for use with the formula below. Navigation software which features a boat speed calibration tool can also be used.

$$GainVs = \dfrac{\dfrac{VitesseFondMoy1}{VitesseSurfMoy1} + \dfrac{VitesseFondMoy2}{VitesseSurfMoy2}}{2}$$

Useful tip:

If the boat's system has two **_ultrasonic sensors_** connected to an **_Interface Dual_**, you can proceed as follows:

The calibration adjustment value will be entered for each sensor by identifying the correct side and by forcing the heel with an offset greater than 3° for each. Heel values are negative on the **_Gyropilot Graphic_** for a starboard side heel.

Page ► Configuration ► calibration ►Boat speed ►Calibration

With the **_Multigraphic:_**

Press Page during 2Sec ► Sensors ► Boat speed ► Offset

9.5.1 Linear boat speed response against boat's heel angle

Modern monohull designs such as the Open 60, with flat bottoms and a hard chine, have a wetted area where the longitudinal axis is different when heeling (such as a catamaran with asymmetric hulls). Therefore the speed sensor cannot be aligned correctly when the boat is flat or heeling. You may have to adjust the boat speed against the heel angle.

For that purpose, a table « BtSpdHeel.txt » is available in the **Processor HR** at the following address: ftp://root:pass@192.168.0.232/mnt/flash/processor/tables

It can also be accessed from the home page by pressing the *« Calibration »* button, and further the *« Boat Speed vs Heel »* button.

PROCESSOR HR V3.7

Actions
- Reboot processor
- Stop processor
- Fait une sauvegarde sur la clef USB
- Restitue les calibrations de la clef USB et relance

Installation et calibrations
- Calibration des constantes
- Configuration de l'installation
- Correction de la Vitesse Vent Réel
- Correction de l'Angle Vent Réel
- Polaire de vitesse
- Table Pilote
- Table Rafale
- Table Relance
- Correction de la Vitesse Surface en fonction de la gîte

Développement à façon
- Stop des scripts
- Restart des scripts
- Paramétrage de SailNet
- Gestionnaire de lancement des scripts
- Parcourir le répertoire des scripts

Analyse
- Evènements principaux
- Evènements de bas niveau
- Status des instruments et bus Topline
- Graphe polaire de vitesse et secteurs limites
- Optimum calculés sur la polaire de vitesse

Outils
- Parcourir le répertoire courant du Processor
- Configuration réseau

Datalogs
- Supprime les logs récents de la clef USB
- Supprime les logs archivés de la clef USB
- Parcourir le répertoire des enregistrements récents
- Parcourir le répertoire des enregistrements archivés
- Parcourir le répertoire des statistiques récentes
- Parcourir le répertoire des statistiques archivées

Support
- Lien vers le site web technique nke

Mise a jour totale manuelle à partir d'un fichier image (noyau+processor+configurations+polaires)

Heel	BsCal
-40.0	0.960
-25.0	0.980
-10.0	0.990
0.0	1.000
10.0	0.990
25.0	0.980
40.0	0.960

Apply the same method as described for the boat speed calibration adjustment for each heel angle (several runs at constant speed and heel angle). Enter the values in the « BsCal » of the table.

9.6 Calibrating for drift

Drift angle is not easy to evaluate, calculate or measure. It is linked to the hull shape, the presence and design of centreboards, foils, canting keel… Set and Drift is also a factor to consider.

The drift angle is determined between the longitudinal axis of the boat and the progression vector over the water surface. The issue being that the boat progresses on the longitudinal axis of the wetted area, which makes an angle with the longitudinal axis of the boat when heeling.

There are two methods to adjust the calibration for drift.

9.6.1 Using a drift calibration adjustment value:

This value is found on the **Multigraphic**

Press Page during 2Sec ► Sensors ► Leeway ► Offset

This value is found on the **Gyropilot Graphic**

Page ► Configuration ► calibration ►Leeway angle

The drift formula is as below:

$$Drift = \frac{Drift\ adjustment \times Heel\ angle}{Boat\ speed^2}$$

Where drift unit is degrees, heel angle unit is degrees, boat speed unit is knots and drift will be °/nd². Drift adjustment is a global value applying to all conditions. You can either use an average value for all conditions or change that value for each wind force. The drift angle against boat speed and heel angle can be found in the polar provided by the architect. The drift adjustment values can be recalculated with the formula below, and averaged.

$$Drift\ adjustment = \frac{Drift \times Boat\ speed^2}{Heel\ angle}$$

This value is around 9 to 12 for sail boat.

9.7 Calibrating true wind speed

Even placed a metre away from the mast head on top of a carbon arm, the measure made by the aerial sensor may suffer from disruption. When sailing downwind, the mainsail creates an acceleration of the wind. Heel angle also has an influence on wind speed measurement. For all these reasons we recommend calibrating for wind speed.

The correction table « Adjvt.d » is available in the **Processor HR** at the following address: ftp://root:pass@192.168.0.232/mnt/flash/processor/tables

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MARINE ELECTRONICS

It can also be accessed from the home page by pressing the **« Calibration »** button, and further the **« True Wind Speed »** button.

If the table is already filled with values, the corrections will have to be added to the existing values.

PROCESSOR HR   **V3.7**

Measurement procedure:

First, place the boat upwind and average the value read for wind speed.

Then, measurements have to be made in various wind strengths ranging from 5 to 30 knots. It is a continuous process. Note the wind speed values as you sail upwind, reaching and downwind. You may find it useful to populate the correction table with the results from averaging these values.

An example of the wind speed correction table is shown below. The column on the left shows the wind speed. For each wind speed there are correction factors at various wind angles, where V is the correction (in knots) and A is the wind angle (in degrees).

	v1	a1	v2.	a2	v3.	a3
5.0	0.0	44	-0.3	93	-0.6	141
10.0	0.0	38	-0.6	96	-1.2	153
15.0	0.0	36	-0.9	95	-1.8	154
20.0	0.0	37	-1.2	93	-2.4	148
25.0	0.0	39	-1.5	96	-3.0	152
30.0	0.0	41	-1.8	98	-3.6	155
35.0	0.0	42	-2.1	100	-4.2	158
50.0	0.0	42	-3.0	100	-6.0	158

⚠️ **WARNING**

This is a very sensitive table and we recommend you use with the highest care.
Always save the modifications by pressing "**Save File"**. Once the file has been saved, you must reboot the **Processor HR** for the changes to be taken in account. This is done by pressing "Reboot Processor".

9.8 Apparent Wind Angle

Calibrating the Apparent Wind Angle will adjust the mast alignment error and apply corrections for the wind shear effects.

This can be done only if the rig (backstays, headstay, kicker…) and sail tuning is absolutely identical on port and starboard whilst sailing and carrying out the calibration. The helmsman must keep focused on the telltales and completely ignore any information coming from electronic instruments to avoid influences. Boat speed and heel must also be identical from one side to the other. Set the correct sails for the weather conditions. We recommend at least four legs are sailed in order to compare the readings and determine an offset value to apply.

Inhibit the true wind correction table and reset the wind shear adjustment value. This can be done from the home page by pressing on the "*Calibration Installation*" button, and then choose "*Constants Calibration*" (refer to § 6.1.2).

To measure the Apparent Wind Angle you can use the performance software or make the calculation on your own using the data logged on the USB key embedded in the *Processor HR*, or alternatively use the application of the *Multigraphic or Gyropilot Graphic.*

Warning! If you work with asoftware such as "**Tactique**" from **Adrena**, the offset is calculated from the function "Apparent Wind Angle". This function is reverse calculated from the true wind angle and damped for display. Therefore you have to reset the true wind table, as well as wind shear, and you must apply the offset to the existing value if different from 0.

The *nke* calibration wizard uses the raw data.

AWA -24°   AWA 27°
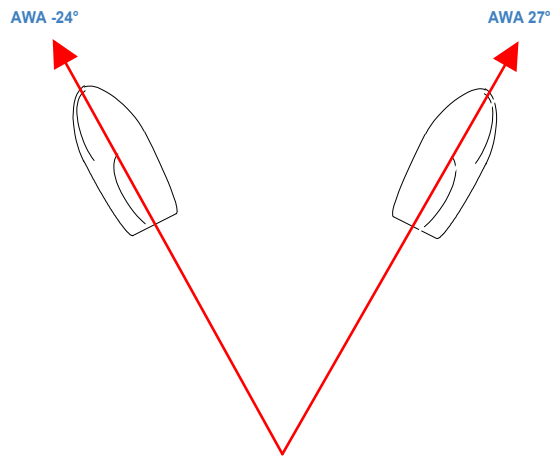
Apply the offset with the *Gyropilot Graphic*:

Page ► Configuration ► calibration ► App wind angle ► manual

Apply the offset with the *Multigraphic*:

Press Page during 2Sec ► Sensors ► Apparent Wind Angle ► Offset

If AWA port > AWA starboard:

Add half the difference between the two values

If AWA port < AWA starboard:

Subtract half of the difference between the two values

9.9 Calibrating True Wind Angle

The True Wind Angle table allows correction of the True Wind Angle without exploring the causes of the angles discrepancies. This method is a global correction of all repeatable errors (twist, flow acceleration downwind, sensor).

To complete the true wind calibration, it is necessary to tack often and record the True Wind Direction values. We recommend running these measures with a fairly stable wind, on several navigation sessions with wind speed ranging from 5 to 30 knots.

Tribord amure TWD 250° · Bâbord amure TWD 260° · Compas 210° · Compas 300° · 10° · 45° · 45°
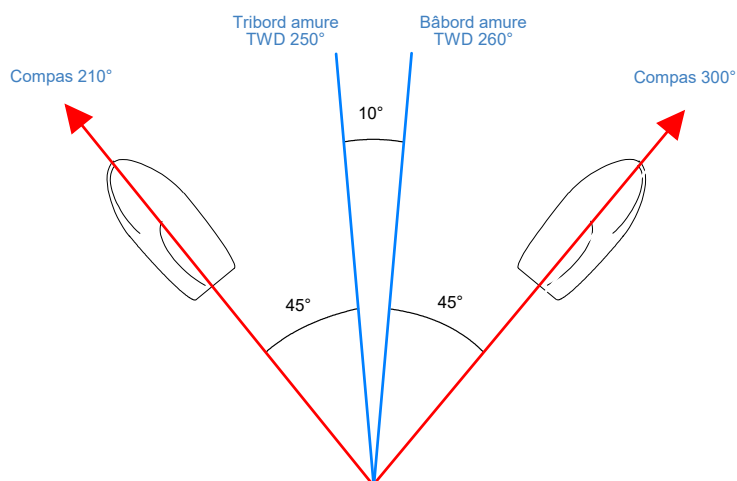
TWD port > TWD starboard:

Add half of the difference between both values.

For this purpose a correction table "Adjwa.d" is available at the following address in the *Processor HR:*
ftp://root:pass@192.168.0.232/mnt/flash/processor/tables ,
Alternatively, you can access that table from the home page "*True Wind Angle Correction".*

If the table already contains values, the corrections will be added to the existing entries.

Actions

- Reboot processor
- Stop processor
- Fait une sauvegarde sur la clef USB
- Restitue les calibrations de la clef USB et relance

Installation et calibrations

- Calibration des constantes
- Configuration de l'installation
- Correction de la Vitesse Vent Réel
- Correction de l'Angle Vent Réel
- Polaire de vitesse
- Table Pilote
- Table Rafale
- Table Relance
- Correction de la Vitesse Surface en fonction de la gîte

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- Restart des scripts
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- Gestionnaire de lancement des scripts
- Parcourir le répertoire des scripts

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- Evènements principaux
- Evènements de bas niveau
- Status des instruments et bus Topline
- Graphe polaire de vitesse et secteurs limites
- Optimum calculés sur la polaire de vitesse

Outils

- Parcourir le répertoire courant du Processor
- Configuration réseau

Datalogs

- Supprime les logs récents de la clef USB
- Supprime les logs archivés de la clef USB
- Parcourir le répertoire des enregistrements récents
- Parcourir le répertoire des enregistrements archivés
- Parcourir le répertoire des statistiques récentes
- Parcourir le répertoire des statistiques archivées

Support

- Lien vers le site web technique nke

Mise a jour totale manuelle à partir d'un fichier image (noyau+processor+configurations+polaires)

The table below is a True Wind Angle correction example. The column on the left shows true wind speed in knots. V1 is the correction in degrees. A1 is the angle for which the correction is applied. Same for V2 and A2 (reaching) ; and V3 and A3 (downwind).

	v1	a1	v2.	a2	v3.	a3
0.0	-7.0	44	-2.0	93	4.0	141
5.0	-7.0	44	-2.0	93	4.0	141
10.0	-3.0	38	-1.0	96	3.0	153
15.0	-2.5	36	0.0	95	1.0	154
20.0	4.5	37	1.0	93	-1.0	148
25.0	6.5	39	1.0	96	-1.0	152
30.0	8.0	41	1.5	98	-2.0	155
35.0	8.0	42	1.5	100	-2.0	158
50.0	8.0	42	1.5	100	-2.0	158

⚠️ **WARNING**

Always save the modifications by pressing "*Save File*". Once the file has been saved, you must reboot the *Processor HR* for the changes to be taken in account. This is done by pressing "Reboot Processor".

10. PERFORMANCE AND POLAR TABLES

To optimize the boat's performance it is essential to constantly understand the theorical optimum speed of the boat against the wind speed and angle. The target boat speed is a guide to fine tuning the sails and determining the optimum wind angle upwind as well as downwind.

The polar table enables you to display the "Performance" functions. It can be loaded in the Processor HR via a ftp link or the *nke* calibration wizard.

Polar tables are supplied by the architect or the boat builder. You can build your own by recording the boat speed against wind angle for each wind speed.

The polar table is stored in the "***Processor HR"*** at the following address:
ftp://root:pass@192.168.0.232/mnt/flash/processor/Tables/SpeedPolar.pol

Alternatively, you can access that table from the home page under "***Calibration"*** and then "***Boat Speed Polar"***.

A default polar table is stored in the ***Processor HR***. It needs to be updated for your boat.

⚠️ **WARNING**

Always save the modifications by pressing "***Save File"***. Once the file has been saved, you must reboot the ***Processor HR*** for the changes to be taken in account. This is done by pressing "Reboot Processor".

10.1 Reading a polar table

The table below is an example of a polar table in the **Processor HR**. The index on the top line shows the true wind speed in knots. The column on left shows the true wind angles in degrees. Boat speeds are in knots.

TWA	4	6	8	10	12	14	16	20	25	30
33	2.761	4.076	5.08	5.624	5.904	6.044	6.107	6.104	5.84	5.176
36	3.043	4.448	5.475	5.975	6.23	6.354	6.422	6.446	6.28	5.802
39	3.302	4.782	5.806	6.259	6.477	6.587	6.654	6.694	6.594	6.277
50	4.07	5.688	6.572	6.882	7.052	7.172	7.26	7.361	7.368	7.256
60	4.541	6.156	6.918	7.251	7.437	7.581	7.695	7.85	7.932	7.899
70	4.821	6.383	7.107	7.542	7.762	7.942	8.101	8.352	8.534	8.583
80	4.925	6.456	7.206	7.708	8.063	8.308	8.524	8.876	9.223	9.434
90	4.974	6.664	7.422	7.796	8.253	8.662	8.949	9.526	10.134	10.566
105	5.055	6.682	7.495	8.106	8.559	8.962	9.404	10.567	11.631	12.578
120	4.695	6.456	7.339	7.943	8.679	9.454	10.104	11.327	13.237	15.149
135	4.085	5.849	6.926	7.676	8.433	9.235	10.102	12.202	14.791	17.174
140	3.805	5.538	6.723	7.491	8.213	9.048	10.07	11.912	15.335	17.898
150	3.246	4.833	6.166	7.019	7.683	8.373	9.187	11.582	15.493	18.583
165	2.494	3.77	4.988	6.076	6.876	7.511	8.122	9.662	12.464	16.247

The polar table file has the ".pol" extension. The format is 16 lines for 11 columns, tabulation separator and point decimal sign.

If that format is not followed, an error message will appear in the log file of the **Processor HR**.

10.2 Reading a polar diagram

The diagram below shows both sides, but usually, only the port side is shown, as both tacks should be same.
The boat line is vertical, with the bow on the top. The radius feature the true wind angle.
Each curve represents the boat speed for a given wind speed.
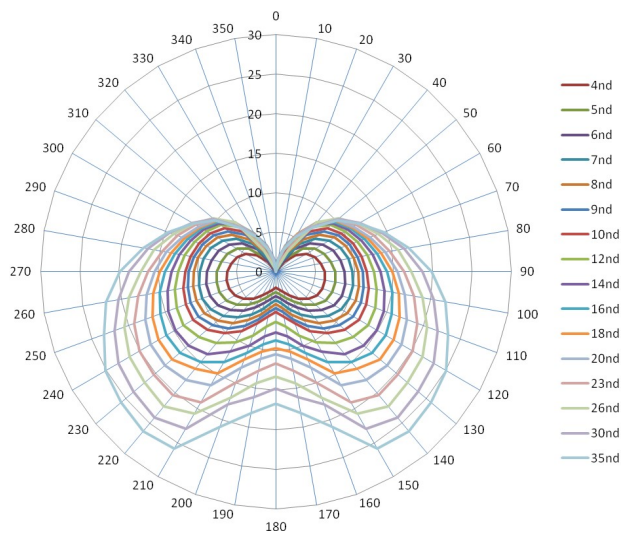
The diagram shows the target boat speed against wind speed and wind angle.
As shown on the picture below, a target boat speed upwind is determined with a line perpendicular to the boat speed axis and tangential to the highest point of the curve.

HR_PROCESSOR_um_EN_37
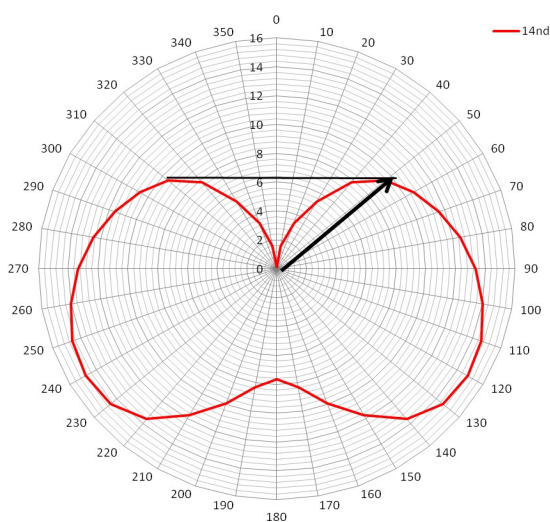
10.3 Performance functions

The *Processor HR* generates performance functions from the polar table. They are displayed on the following *nke* displays:
Multigraphic
Gyropilot Graphic
TL25
SL50

These functions are a guide for fine tuning. Displaying these data in real time gives information about boat speed and wind angle against the target (theoretical values).
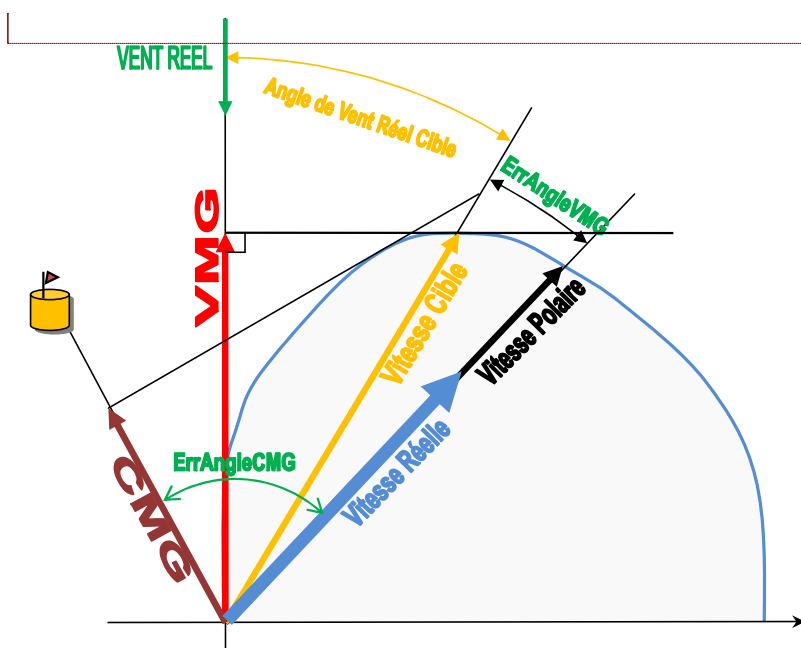
- **VMG:**

Stands for Velocity Made Good.

It is the component of velocity that is in the direction of the mark, should it be upwind or downwind. In the case of sailing upwind, it is actually the speed towards the wind. It is a useful indication

Wind

VMG
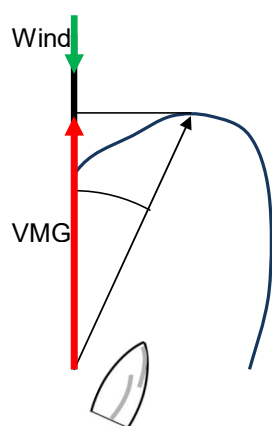
VMG = boat speed Xcosine (True Wind Angle)

- **CMG:**

Stands for Course Made Good.

It is the speed towards the mark.

Upwind and downwind it is not very relevant, while sailing reaching it is a very valuable data.

Route

Wind

CMG

Tangential to polar
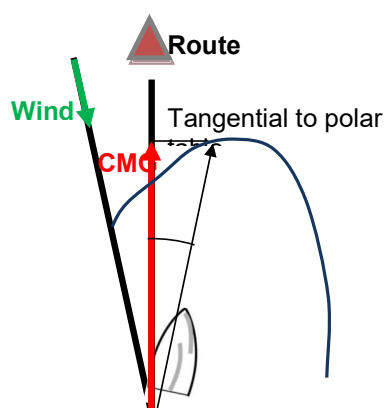
CMG = Boat speed * cosine (Heading - Marks bearing)

- **Target Boat Speed:**
  It is the theoretical best VMG. Useful information when sailing downwind or upwind. For other conditions it is better to use the polar speed.

- **True Wind Angle:**
  It is the optimum wind angle for a given wind speed. This angle gives the best VMG

- **Polar speed:**
  This function is calculated from the polar table against the wind speed and wind angle. It shows the optimum speed for the wind conditions.

- **% Target Boat Speed:**
  It is the ratio between the actual boat speed and the target boat speed

- **% Polar speed:**
  It is the ratio between the actual boat speed and the polar boat speed

- **Angle error VMG:**
  It is the error between the actual wind angle in degrees and the angle at VMG.

- **Angle error CMG:**
  It is the error between the actual wind angle in degrees and the angle at CMG.

- **% target VMG:**
  It is the ratio between the component of the velocity towards the wind and the target VMG

- **% target CMG:**
  It is the ratio between the component of the velocity towards the wind and the target CMG

11. ADDENDUM A

11.1 Configuring the PC for the first connection to the *Processor HR*

11.1.1 Connecting the Processor HR to the PC

Connect the *Processor HR* to your PC with the crossover cable.

### 11.1.2 Configuring the network connection with Windows XP

For installations where the *Processor HR* and the PC are networked with a RJ-45 cable. Each has an IP address to communicate with each other. The local network IP can be fixed or dynamic. Given that neither the PC or the Processor operate as a DHCP server managing dynamic addresses, the connection must have a fixed IP.

Set a fixed IP to your PC:
Run the control panel from the start menu

Double-click the icon "Network connections". It opens a new window
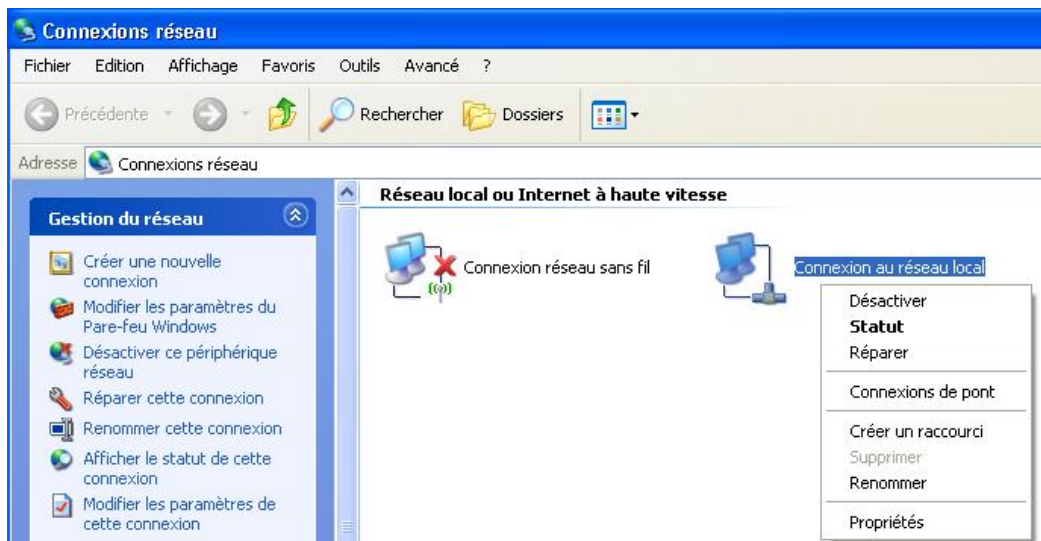
Click on the icons **Connection to a local network.** Select **Properties** with the right click

In the new window, select "Internet Protocol" and "properties".
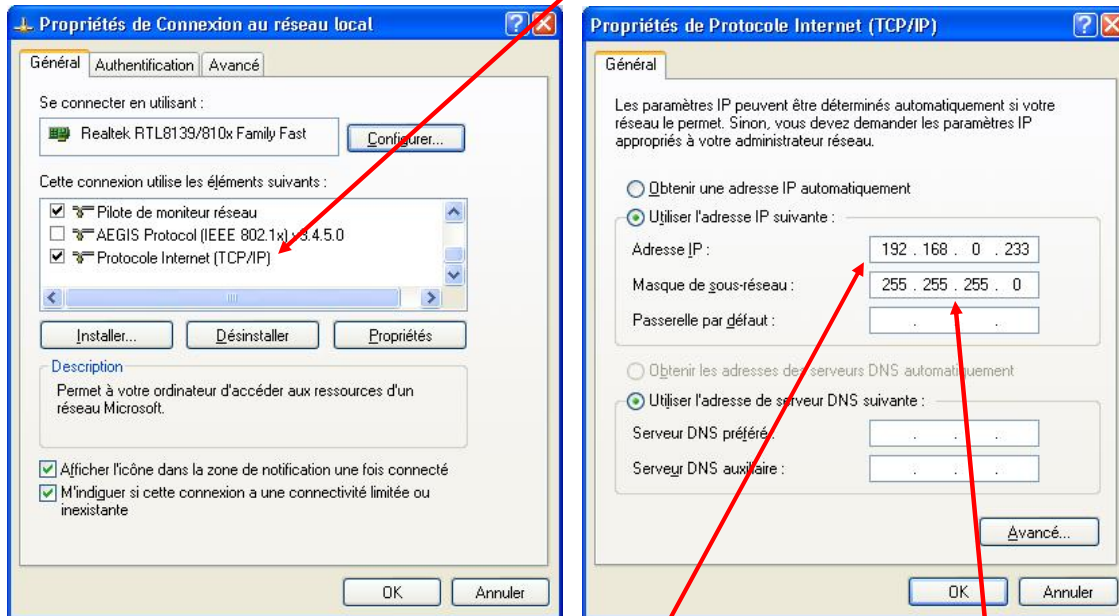
Choose **Use the following IP address**. In **Adresse IP** enter 192.168.0.233 (where 233 can be replaced by any number between 2 et 254, except 232), in **Subnet mask** address **enter** 255.255.255.0

Click on **OK**
Now you have set up an IP address you can connect to the Processor Regatta.

If you connect through a company network using a Proxy, it must be activated. Proxy configuration:
With Internet Explorer, go into **Internet Options**, **Connection tab and Network**

11.1.3 Configuring the network connection with Windows Seven
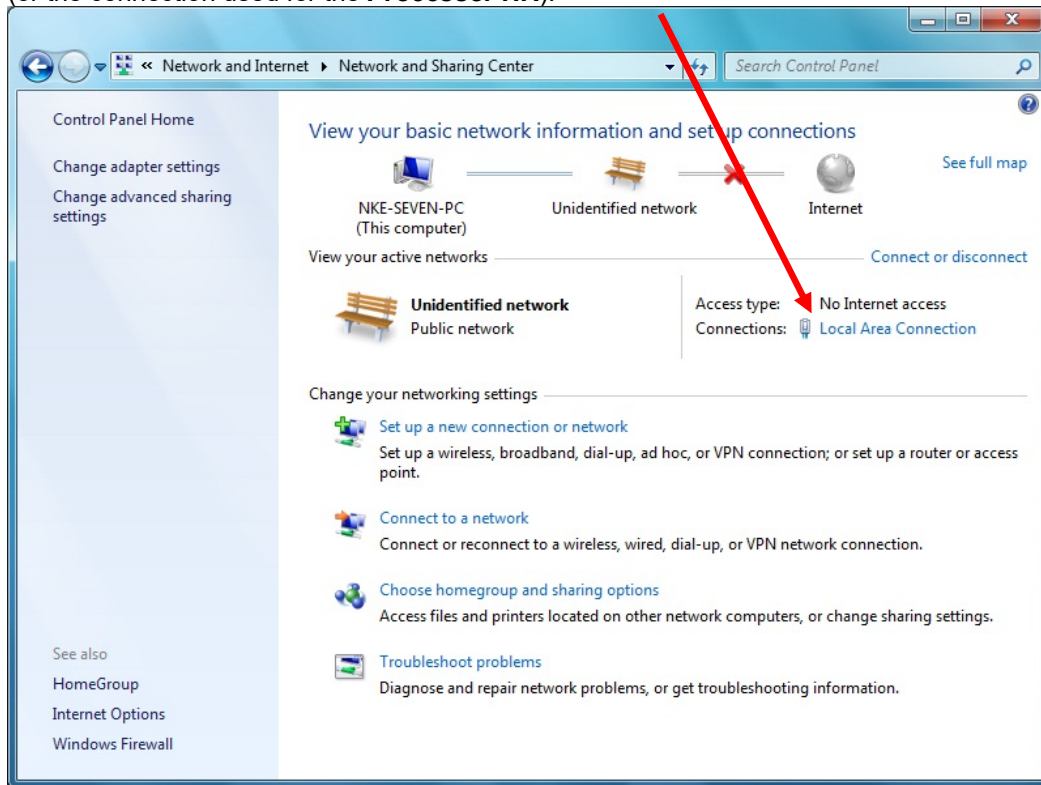

Set a local fixed IP for your PC:
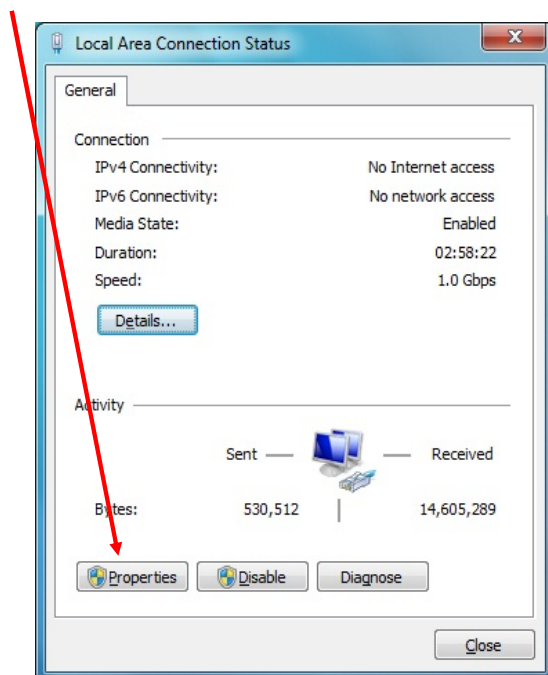Open the **control panel** from the **start** *menu*
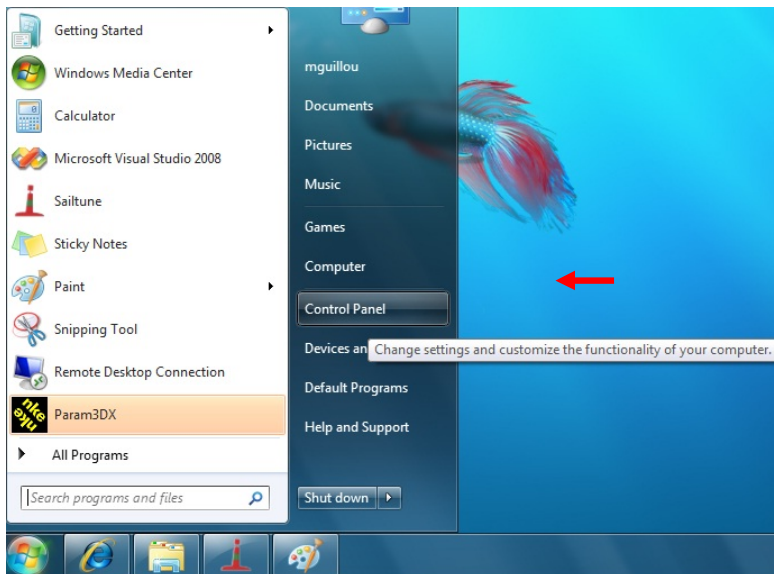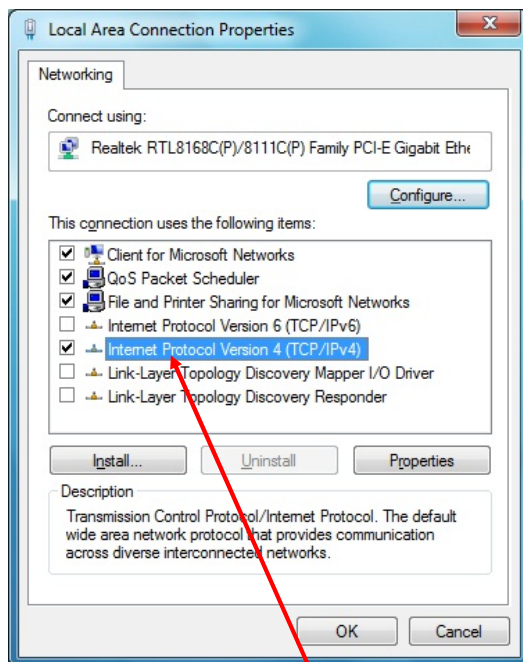
Click on "View Network status and tasks"
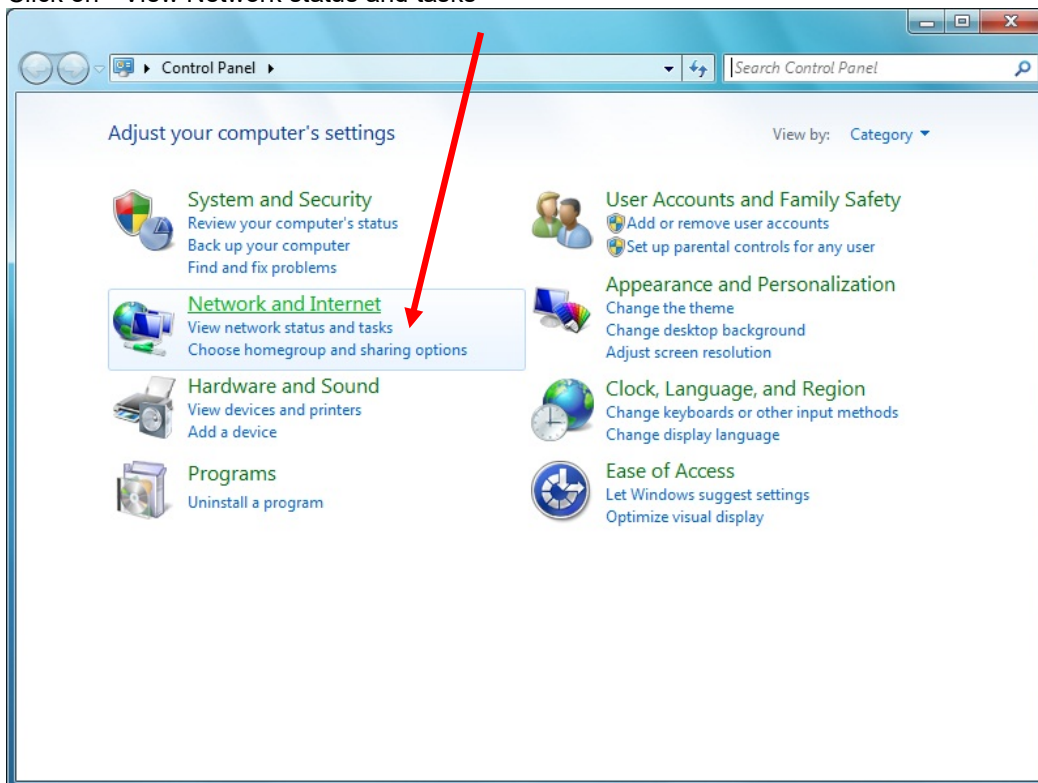
On the right side, click on "Local area Connection":
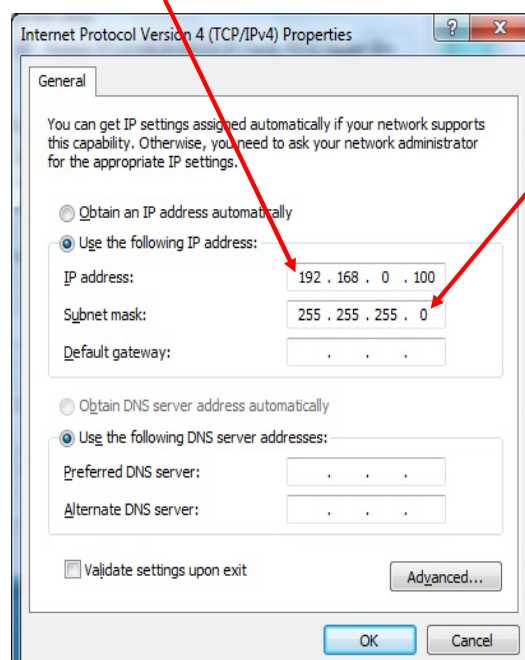(or the connection used for the **Processor HR**).

Right-click on Local area **Connection** and choose **Properties**.

Double-click on Internet Protocol version 4 (TCP/IPv4). Tick the box, use the following IP address and enter 192.168.0.233 ((where 233 can be replaced by any number between 2 et 254, except 232), and **Subnet Mask** = 255.255.255.0

Click **OK**.

11.1.4 Testing the connection with the Processor HR
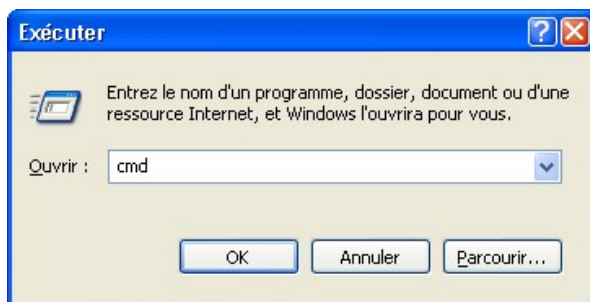
We shall run a PING command to check the connection.
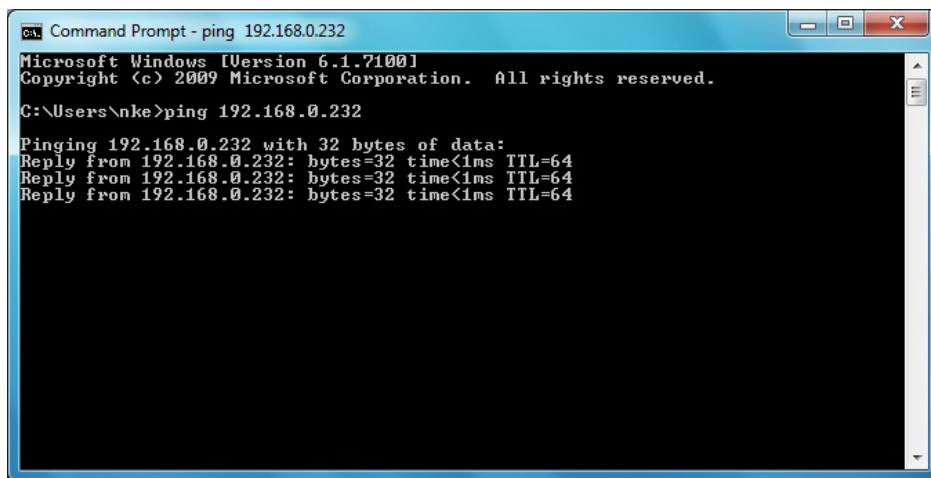
Windows XP:
Start \ Run

Windows Seven

Start \ Programs \ Accessories \ Run

The following window opens:

Type **cmd** and clic **OK**. A DOS prompt will open in which you type **ping 192.168.0.232**

The **Processor HR** is now connected

12. FREQUENTLY ASKED QUESTIONS

1. **Message on Gyropilot Graphic "Too many errors on the bus"**
   There may be a conflict between addresses on the Topline bus. Disconnect the Processor and check each node address. Make sure there is no master on the bus. You should see the message "Master missing" on each display. Then reconnect the Processor.

2. **Message on Gyropilot Graphic "Master not present"**
   There is no Master. Check the data wire connections.

3. **No deviation and / or the time is different from UTC**
   The deviation value is 0. Check the deviation on local official charts or navigation aids. The deviation is a calculated value resulting from GPS data. Check that the Processor receives all GPS data correctly and particularly that the status of position in the GPGLL sentence is « A » (valid data)

4. **The control led flashes once per second**
   Error mode. Disconnect all the elements from the bus, leaving only the Processor. Power off the system again. If the led keeps on flashing, contact your dealer.

5. **Boat speed shows "failure"**
   The Ultrasonic speed sensor cannot read flow (happens when the boat does not move). In the event that boat speed is not available, the wind data will be calculated using over ground speed if available on the bus. If not, a boat speed will be simulated (see 6.3 « FAIL SAFE BS »).

6. **No compass data**
   This data comes from the Topline compass or from the 3D Sensor. Check the sensor's parameters (see the sensors manual).

7. **No True Wind data**
   Running safe mode, if the apparent wind data is correct, check boat speed. If boat speed is correct reset the true wind calibration.

8. **Message on Gyropilot Graphic « Défaut capteur 59 178 »**
   Apparent wind damping is over 32. Change it to a better value.

9. **The Gyropilot Graphic does not accept a node address**
   With the Processor connect the Gyropilot Graphic on the Topline bus with the address 0. If it rejects the address given by the Processor and automatically turns Master, there is a Topline bus reading error. Check errors in the log file. If there is no Topline bus error, the file mvn.cfg is probably broken

10. **Is it possible to export log files while the pilot is on?**
    In theory, yes. But this requires all the Processor's resources. Therefore, the Processor may slow down and this would disrupt the autopilot. To avoid any risk, we recommend not doing this operation while the pilot is on.

11. **Target boat speed function displays erratic values such as 300%...**
The polar file is corrupted. Checks the format see **Reading a polar** ~~Reading a polar~~

12. **Does the Processor work without 3D Sensor?**
Without 3D Sensor the system works. This means the Processor will not crash, but many variables will not be processed with Course Over Ground, such as True Wind Direction, True Heading,…

13. **My Target Boat Speed shows inconsistent values, 300%...**
The Polar Table file is corrupted. Check the format. To do so, refer to the section: 10.2 Read a polar table page 48

14. **I cannot download a new firmware with Toplink**
To download a new firmware with Toplink, you must disconnect the *Processor HR* from the Topline Bus.

15. **The Gyrographic(s) sounds a continuous bip at the start lasting for 30 seconds**
Critical data is missing on the Topline bus. This data can be Boat Speed (Ultrasonic Speedometer not hooked up) and Speed Over Ground, data from the aerial sensor or compass.