



QUICK START
GUIDE
PHINS

NAVIGATION & POSITIONING

Objective

This guide describes how to install the PHINS with a GPS, and the basic configurations required before beginning the positioning

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CONVENTIONS

The following conventions are used in this guide

- ▶ The ▶ symbol leads you through nested menu items and/or dialog box options to a final action.
Example:
Logging ▶ Configure Logging Parameters means "Select **Configure Logging Parameters** option from the **Logging** pull down menu".

- bold** Bold text is used for items you must select or click in the software.
It is also used for the field names used in the dialog boxes.

- Courier Text in this font denotes text or characters that you should enter from the keyboard, the proper names of disk Drives, paths, directories, programs, functions, file names and extensions.

- Italic* Italic text is the result of an action in the procedures.

PHINS SYSTEM OVERVIEW

The PHINS system is an Inertial Navigation System (INS). It delivers heading and attitude information as well as position and speed, to other systems or to display. It can receive data from other sensors to improve its accuracy. The PHINS system can also be used as a gyrocompass.

The core of PHINS is an inertial measurement unit (IMU). The IMU is the assembly of three high-class (0.01 deg/h) fibre optic gyroscopes (FOG) manufactured by IXSEA and three high precision pendulum-type accelerometers.

Apart from its IMU, PHINS contains a self-consistent navigation algorithm based on Kalman Filtering. This structure enables PHINS to work either as a black box or to be connected to external sensor systems (GPS, Doppler Velocity Log, Depth sensor, acoustic positioning systems ...). In conjunction with external sensors, PHINS Kalman filter exceeds by several orders of magnitude the performances obtained with traditional navigation approaches

PHINS is delivered with a powerful and easy-to-use iXRepeater software software, which allows a complete configuration.

VERIFICATION OF PACK CONTENTS

You will find in the shipping case a Packing List detailing all the items delivered. This packing has been completed and checked by IXSEA shortly before shipment, and should match the contents of the pack you have received.

However, **we recommend that you check the contents of the pack and the equipment immediately on receipt of your PHINS unit.** Specifically, you should check that all the items referred to above are present on delivery and that none has sustained damage.

If you observe any non-conformity or damage, please inform the carrier and IXSEA without delay by certified mail, describing in detail the problem encountered.

BASIC INSTALLATION

This guide describes how to install the PHINS with a GPS, and the basic configurations required before beginning the positioning. This is the basic installation. If you need to install additional external sensors, to define lever arms and/or to enter installation biases, please refer to PHINS User Guide.

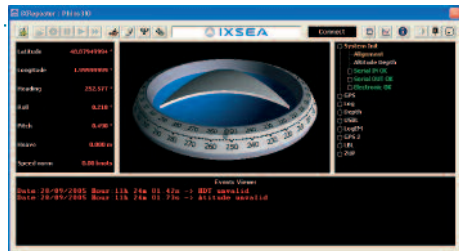
PHINS being versatile, you have to define its configuration to insure optimal operation.

In this installation, we assume that PHINS is aligned with respect to the vessel reference frame.

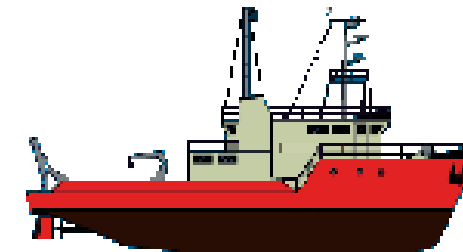
This configuration includes :

- Defining how PHINS is installed on board (Phins orientation with respect to the vessel reference frame, PHINS and GPS lever arms)
- The cable connections to other equipment (connection with the user PC, connection with the GPS)
- The communication port , the serial port, the rejection filter mode for the GPS , the lever arms, the pulse input for Time synchronisation System: settings to enter into the PHINS Prom using iXRepeater software and to save into a file.
- Navigation

Step 1: Installing the IXREPEATER



Step 2: Installing PHINS + GPS



Step 3: Configuring

Step 4: Navigating with PHINS

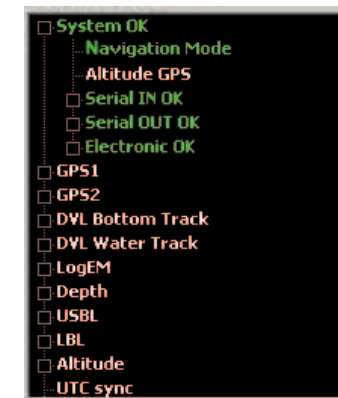
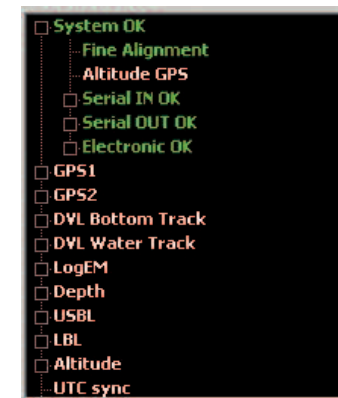
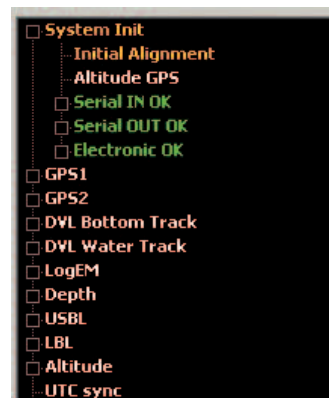
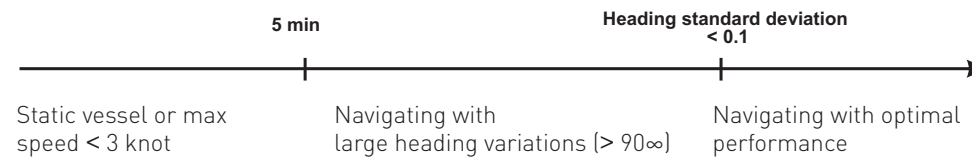
To define the PHINS orientation, lever arm for PHINS, GPS

To configure the serial port(s)
To configure the Pulse input

To define the initial position

To configure the GPS: COM port and rejection filter mode
To define the Time Synchronisation System

To define the COM port (PHINS to PC)
To save the configuration into a file




STEP 1. INSTALLING IXREPEATER SOFTWARE

Required environments: Windows NT ", Windows 2000, or Windows XP.

To install the iXRepeater Software you must have the "administrator privileges".

STEP Action

1 Insert the CD-Rom in the CD drive on the computer, open the relevant folder run the iXRepeater.INS VX_Y ►Setup.exe file.

2 Follow the software instructions displayed on your computer. **iXRepeater software** is now installed, it can be started using the icon  on your desktop or from your **Start** menu: **Start ► Program ► IXSEA ► iXRepeater.INS**

3 End of procedure.

Note : X and Y are related to the iXRepeater version used.

STEP 2. INSTALLING PHINS SYSTEM

PHINS is fixed onboard using four CHC M6 screws. It can be installed with any orientation with respect to the vessel (see the definition of the vessel reference frame hereafter). The alignment of the unit is performed by means of the two centering pins located on the bottom plate of the PHINS. You will find on Figure 1 all the mechanical information necessary to fix PHINS.

All inertial measurements are default performed with respect to PHINS reference frame (X1, X2, X3). This reference frame is defined in Figure 1.

Motion sensing measurements are default measured at PHINS Centre of Measurement P (see Table in Figure 1).

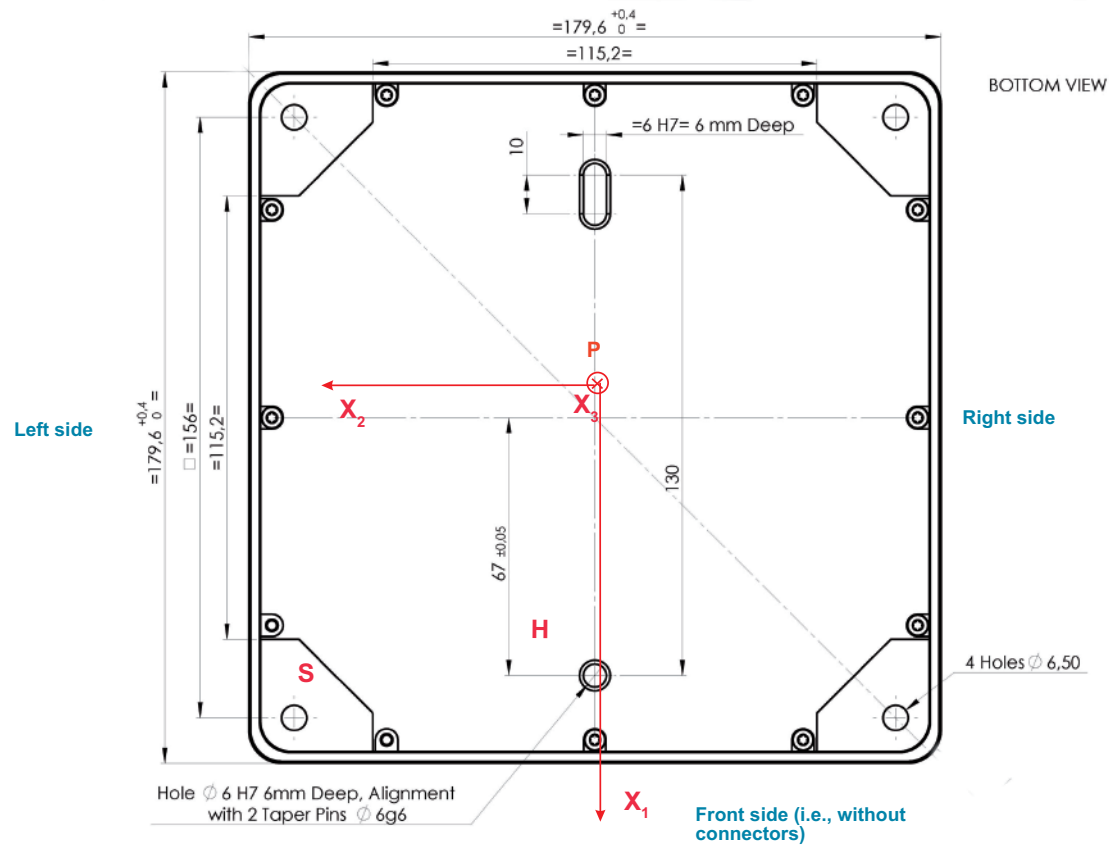
Note : In this installation, we assume that PHINS is aligned with respect to the vessel reference frame.

Recommendations

- Temperature in operation must be in the range -10°C to 50°C
- The dimensions of the PHINS housing are 180 mm x 180 mm x 160 mm. There must be enough places for the wire way on the connector side of PHINS.

IMPORTANT

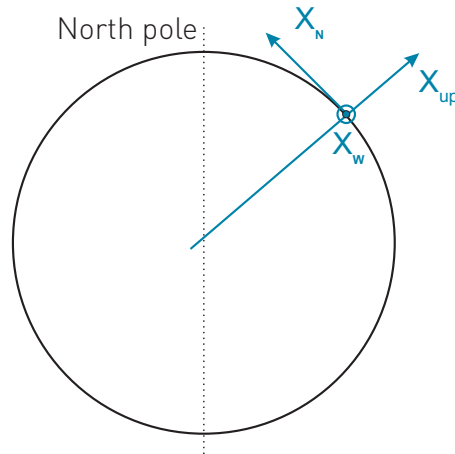
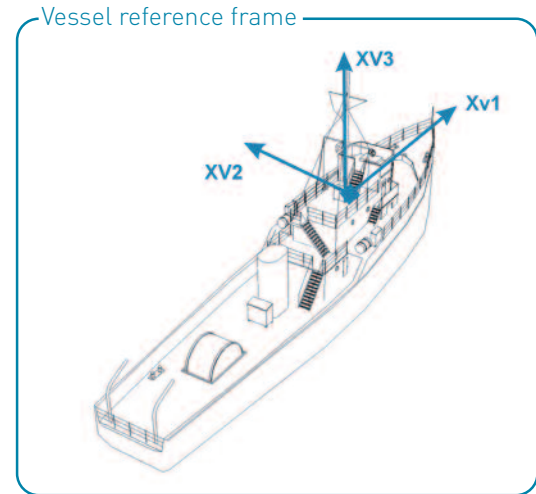
- The rear panel of PHINS is default defined as the one with the connectors.



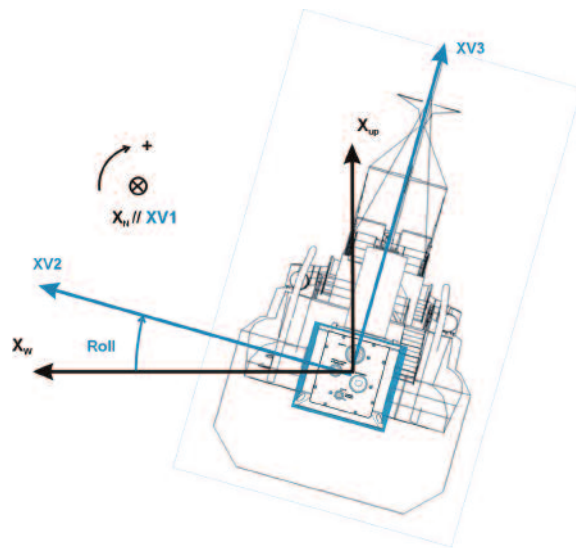
Distances from PHINS centre of measurements P to...	Along PHINS X1 axis (connector to front)	Along PHINS X2 axis (right to left)	Along PHINS X3 axis (bottom to top)
PHINS reference point S	8.62 cm	8.23 cm	-8.76 cm
PHINS reference point H	7.52 cm	0.43 cm	-8.76 cm

Figure 1 - Fixing PHINS/ Reference Frame (X1,X2, X3) and P centre of measurement

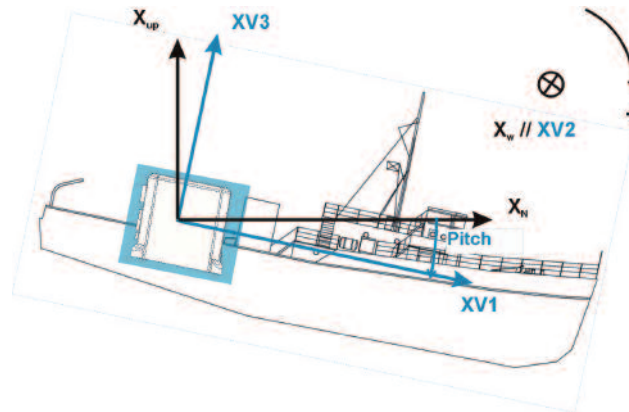
True Heading, Roll & Pitch definitions



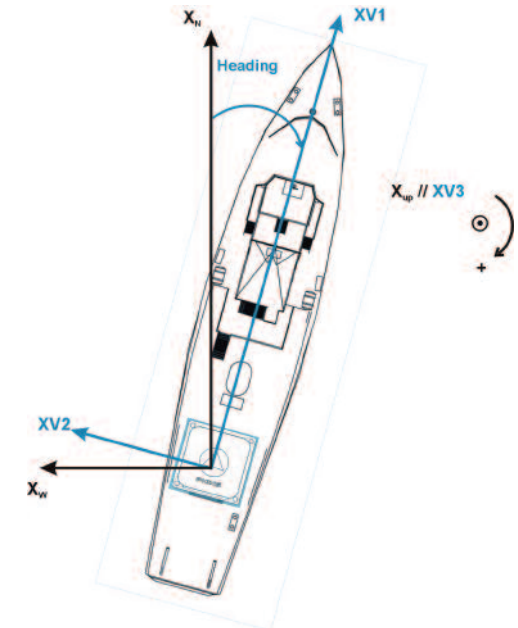
X_N in the horizontal plane pointing towards geographical north
 X_{up} parallel to the local vertical, pointing up
 X_w in the horizontal plane, pointing towards West



The roll is defined as the angle of rotation performed around the vessel $XV1$ so that the vessel axis $XV2$ lies in the local horizontal plane. This angle is default defined positive in the direction of axis $XV1$, i.e., when the boat port side is up. It varies between -180° and $+180^\circ$. The figure above is an illustration of the roll angle with null pitch.



Once the axis $XV2$ lies in the local horizontal plane, the pitch is the angle between the axis $XV1$ of the vessel and its projection in the local plane. This angle is default defined positive in the direction of axis $Xv2$, i.e., when the boat bow is down. It varies from -90° to $+90^\circ$. The figure above is an illustration of the pitch angle in case of null roll



Once the axes $XV2$ and $XV1$ lie in the local horizontal plane, the true heading is the angle between the vertical plane oriented in the North direction and the vertical plane passing through the vessel. Heading is counted positive from North, varying from 0° to 360° . The orientation of this angle is given above in case of null pitch and roll.

Electrical Connections: GPS+PPS (optional, for Time Synchro)

Standard case defined as follows:

External sensor connected to the serial port A of PHINS: GPS

Output protocol on serial port A: GPS like

PPS time synchronization pulse from the GPS cabled on the Pulse input port A of PHINS

Pulse In	Digital connector Port Pin n°			
Function	Port A	Port B	Port C	Port D
Rx	j	h	q	S
Rx GND	i	T	p	V

RS232	Digital connector Port Pin n°				
Function	Port A	Port B	Port C	Port D	Port E
Tx	B	E	H	P	n
Rx	Y	a	c	g	r
Tx Rx GND	A	D	G	N	k

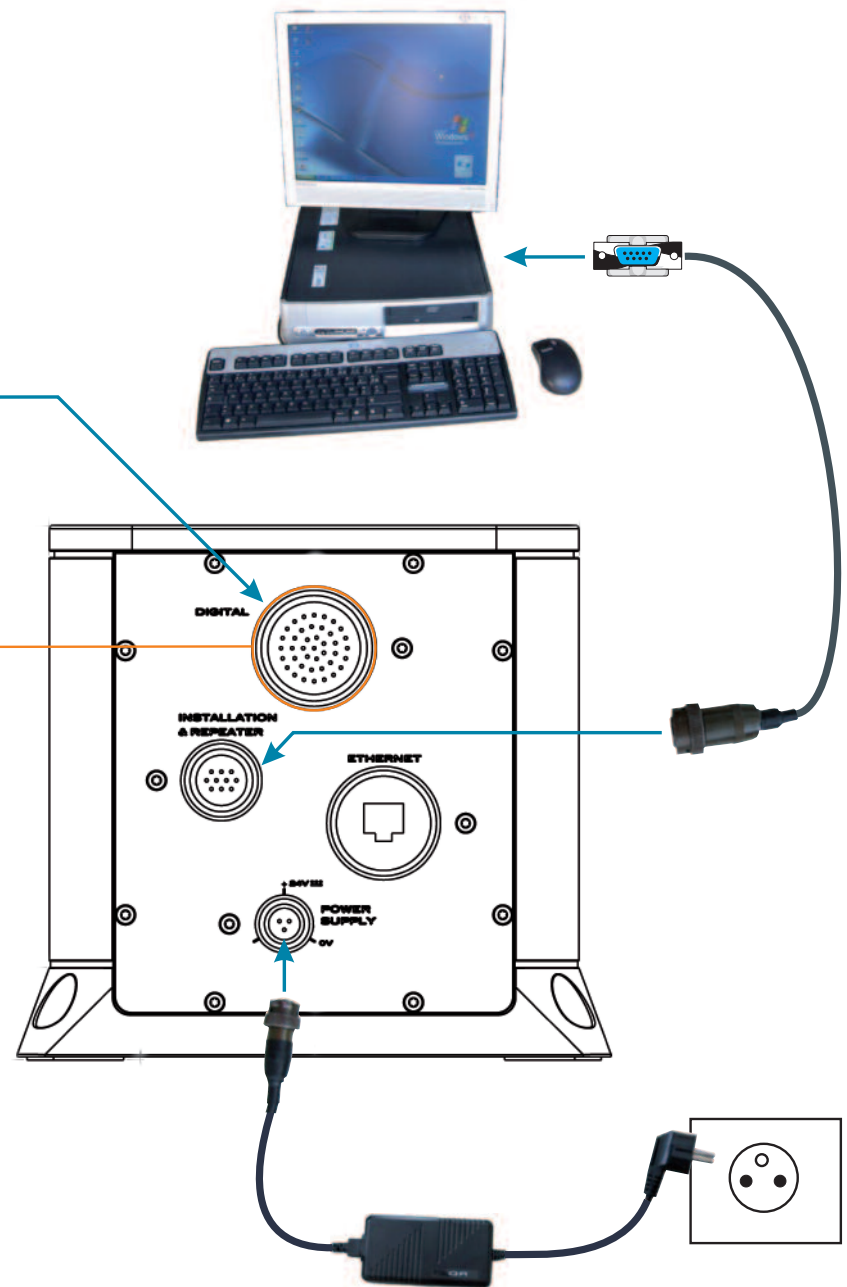
RS422	Digital connector Port Pin n°				
Function	Port A	Port B	Port C	Port D	Port E
Tx +	B	E	H	P	n
Tx -	C	F	J	R	m
Rx -	Y	a	c	g	r
Rx +	X	Z	b	f	s
Tx Rx GND	A	D	G	N	k

Port A on Digital connector
Pulse In Port A on Digital connector

GPS Antenna connected to Digital Connector

Voltage > 5 V when loaded

For RS232/422 connections:
It is recommended to use Twisted shielded Pairs.



Electrical Connections: GPS+PPS (optional, for Time Synchro) - A - Serial Link Case

Standard case defined as follows:

External sensor connected to the Ethernet stream A of PHINS: GPS

Output protocol on stream A: GPS like

Time synchronisation given by the GPS on the pulse in A

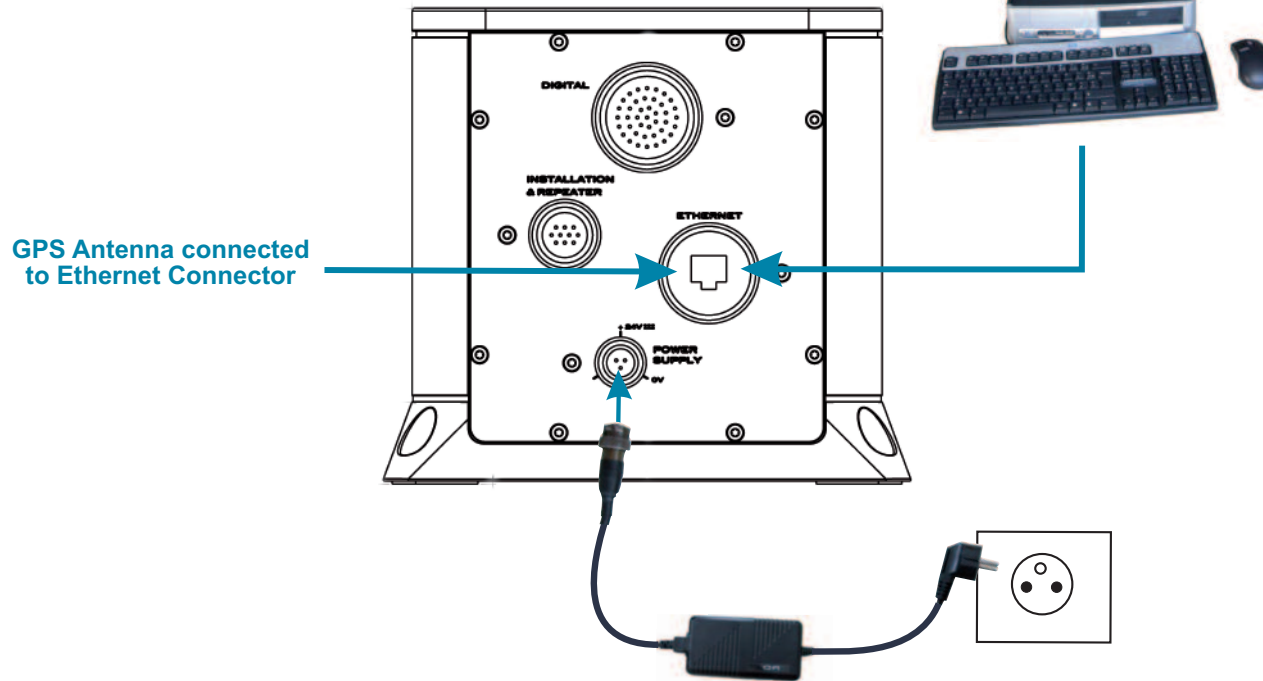
Default Settings for an Ethernet communication PC <-> PHINS:

IP address: 192.168.36.1xx, xx being the last two numbers of the PHINS serial number

Transport= TCP Client

Mode: DHCP

Network mask address: 255.255.0.0



GPS Antenna connected to Ethernet Connector

As soon as PHINS is powered up it starts its alignment phase starting with the manually input position stored into PHINS PROM. It is required that a valid initial position is input manually (see Step 3) or is given by the GPS.

The alignment sequence is detailed in Step 4.

STEP 3. CONFIGURING PHINS

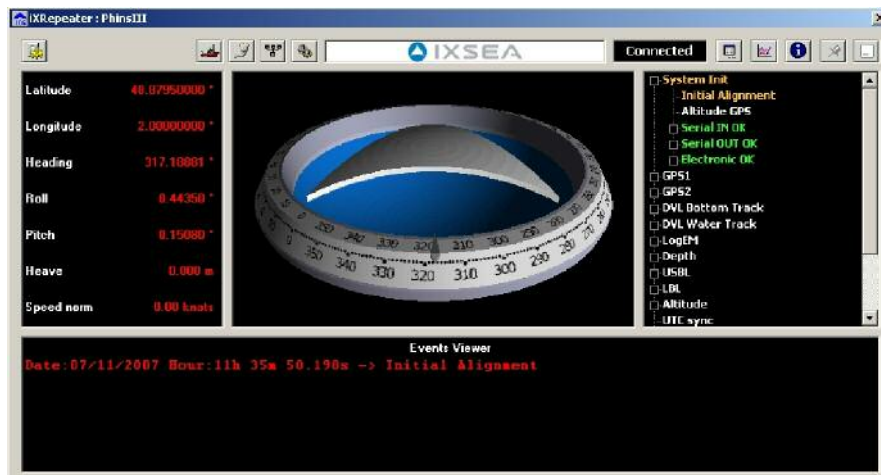
Configuring the link between PHINS and the Workstation (standalone mode)

The communication with the PC is performed

- Either through a dedicated COM port on the PC. This COM port should be selected. Default factory setting is COM 1.
- Or through the Ethernet connector. The default IP address is 192.168.36.1xx, xx being the last two numbers of the PHINS serial number, the transport is TCP Client, the default mode is DHCP and the network mask address is 255.255.0.0

STEP Action


- 1 Start the iXRepeater software by double-clicking on its application icon.
The following window should appear:



- 2 End of procedure.

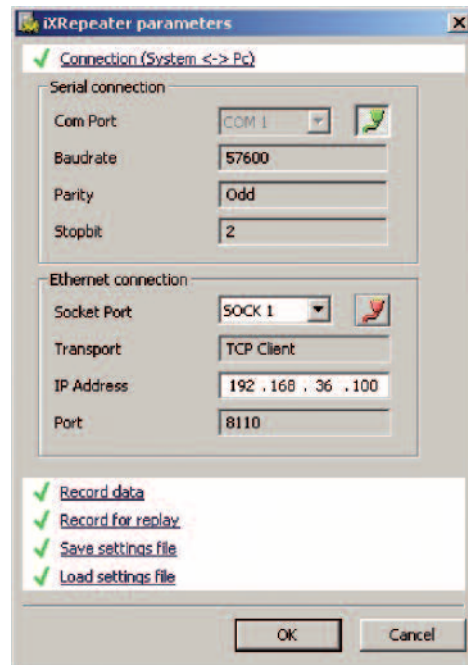
During the first seconds a progress bar will appear indicating that the iXRepeater Software is uploading the internal configuration of PHINS. If it is not the case or if the bar is stuck, the following points should be checked:

- Check that PHINS is powered on.
- Check that PHINS is connected to the appropriate COM (for a serial connection default setting is COM 1) or SOCKET (for an Ethernet connection, the default IP address is 192.168.36.1xx, xx being the last two numbers of the PHINS serial number) of your PC). If this is not the case:

1. Click on 

The iXRepeater parameters window opens.

2. If its parameters area is not expanded yet, click on the label Connection (System ↔ PC) to access the communication port parameters:





3. For a serial connection:

- If this icon  is displayed in the Serial connection area click on it otherwise go to next step.
*The icon turns red, selection in the **COM port** drop-down list becomes available.*
- Select the correct port in the drop-down **COM port** list.
- Click on the  icon.

The icon turns green. The communication is established, real time data are displayed for Latitude, Heave, Heading, Roll, and Pitch and norm speed fields. The configuration is loaded.

4. For an Ethernet connection:

- If this icon  is displayed in the Ethernet connection area click on it otherwise go to next step. *The icon turns red, Selection in the **Socket port** drop-down list becomes available.*
- Check its IP address.
- Select an available socket port in the drop down list.
- Click on the  icon.

For 30 s, the iXRepeater tries to connect to PHINS, the buttons are greyed, the iXRepeater is indicating 'Connecting...'. When connection establishes, the icon turns green and the iXRepeater status indicates 'Connected'. Real time data are displayed for Latitude, Heave, Heading, Roll, and Pitch and norm speed fields. The configuration is loaded.

- Check the link between PHINS and PC. Check that there are no conflicts between the different serial COMs of the PC. Check that the cable and connector are not defective.

When iXRepeater is launched, and communicating with PHINS, the main iXRepeater window is displayed:

Configuration Area

- To define lever arms (one primary, three secondary ones) or to add installation biases
- To configure the digital, analogue and pulse interfaces
- To configure the GPS
- To enter the position parameters,

3-D Compass Area

It gives the heading on 3D compass display

Display Area

- To display all the data provided by PHINS and external sensor
- To follow the computed real-time heading, roll, pitch and speed norm
- To get the PHINS serial number, firmware and software versions

IXREPEATER

Parameters button:
To define the communication port, to record data, to save/load settings file

Instantaneous Data Area

Provides the instantaneous Latitude, Longitude, Heading, Roll, Pitch, Heave, and Speed norm computed data for the point defined by the primary Lever Arm coordinates, in the vessel reference frame, using PHINS conventions

red-display: data are not valid (during initialisation phase , after a modification....)
White-display: data are correct

Event viewer area

It displays:

- errors
- Alignment status
- Events such 'Restart system'

Status Area

Provides (click on the corresponding box to expand the tree):

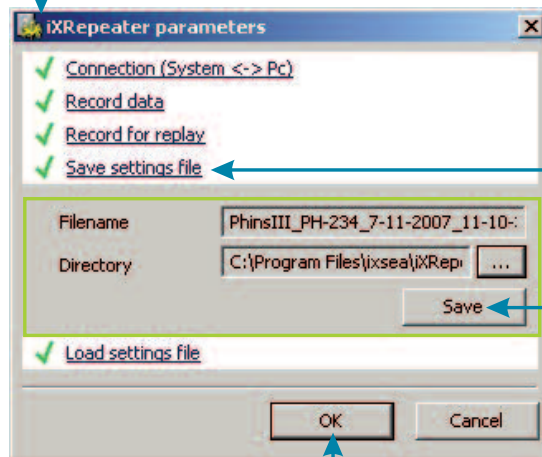
- System status:
 - * **green-display** if it is OK,
 - * **orange-display** during the initialisation Phase,
 - * **Red-display** if there is a problem.
- GPS status:
 - * **green-display** if it is OK,
 - * **orange-display** during the initialisation Phase,
 - * **red-display** if there is a problem.

Saving the Factory Configuration

Before configuring your PHINS, we recommend to save the factory configuration by following the next steps:



Step 1: Click on iXRepeater parameters button
>The iXrepeater parameters window opens



Step 2: Click on Save settings file text label to expand the dedicated area

Step 3: Click on Save button

>2 files are created:
-PhinsIII_XXXX-ZZZ_DD-MM-YYYY_HH-mm-SS.txt:
with all information related to PHINS configuration
-PhinsIII_xxxx-zzz_dd-mm-yy_hh-mm-ss.dat:
a dedicated file used to check that the configuration file
will deliver parameters consistent with the PHINS configuration

Where:

XXXX-ZZZ is the PHINS serial number

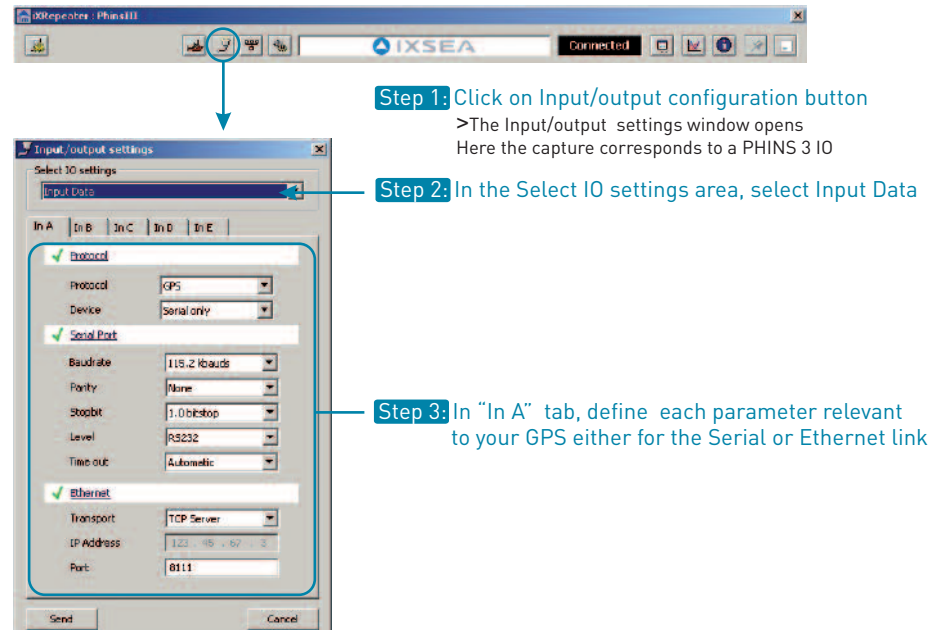
DD-MM-YYYY is the creation date of the configuration file

HH-mm-SS is the creation time of the configuration file

Step 4: Click on OK button

Do not forget to note the names of the factory configuration files.

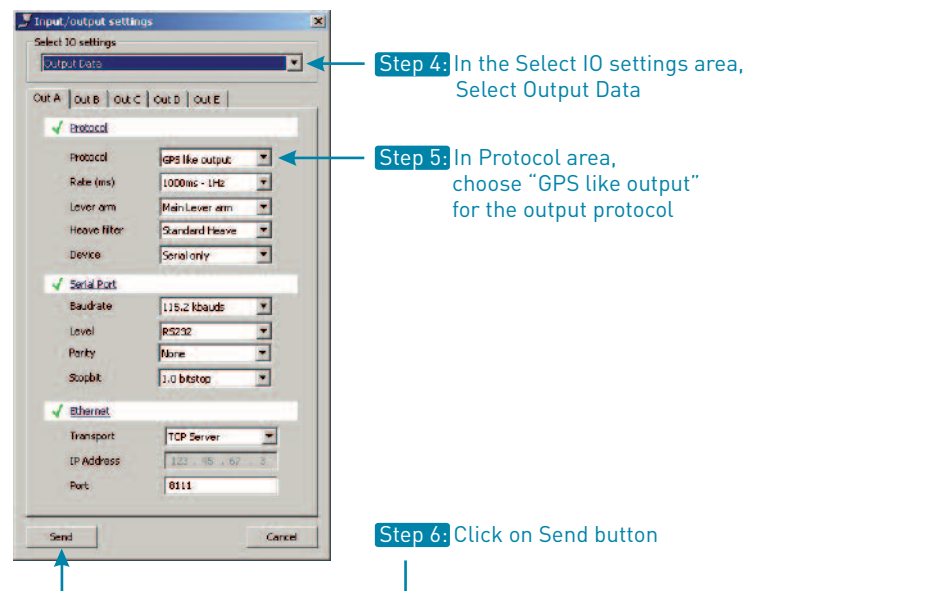
Configuring the Input/Output Stream and Input PPS of the GPS



Step 1: Click on Input/output configuration button
 >The Input/output settings window opens
 Here the capture corresponds to a PHINS 3 IO

Step 2: In the Select IO settings area, select Input Data

Step 3: In "In A" tab, define each parameter relevant to your GPS either for the Serial or Ethernet link



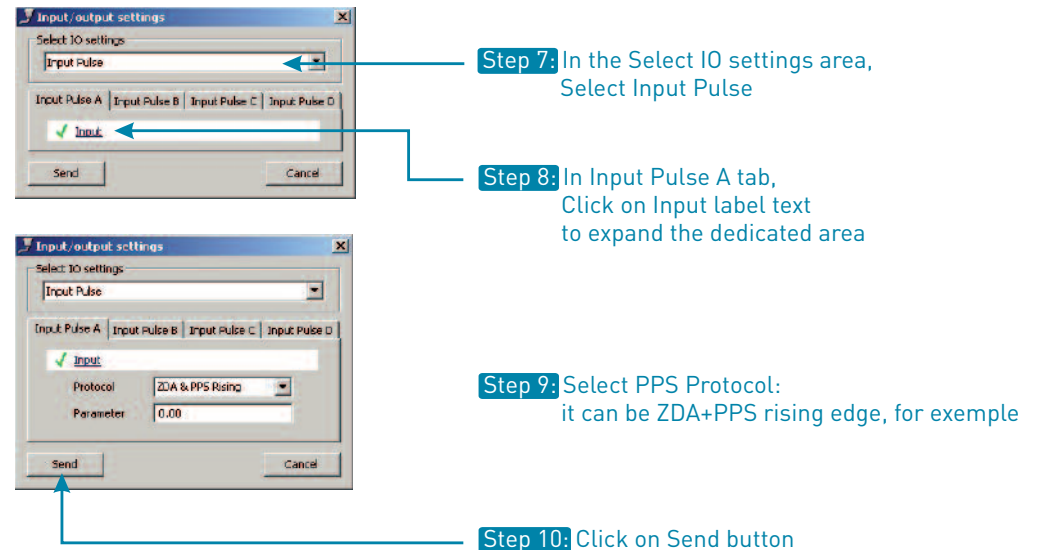
Step 4: In the Select IO settings area, Select Output Data

Step 5: In Protocol area, choose "GPS like output" for the output protocol

Step 6: Click on Send button

Note : Send command stores the configuration into the PHINS non volatile memory

Defining the PPS input for using Time Synchronisation System

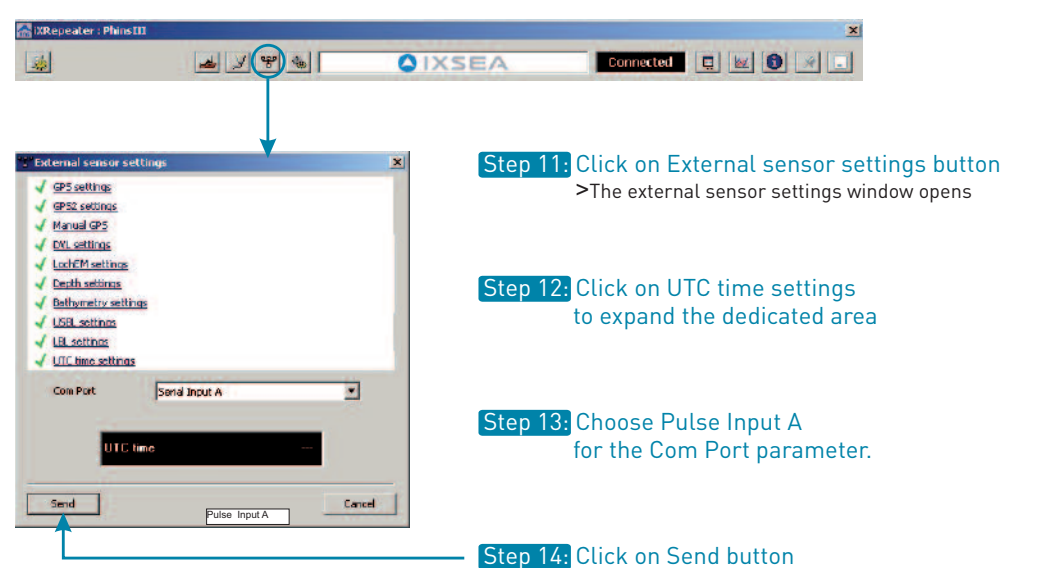


Step 7: In the Select IO settings area, Select Input Pulse

Step 8: In Input Pulse A tab, Click on Input label text to expand the dedicated area

Step 9: Select PPS Protocol: it can be ZDA+PPS rising edge, for example

Step 10: Click on Send button



Step 11: Click on External sensor settings button
 >The external sensor settings window opens

Step 12: Click on UTC time settings to expand the dedicated area

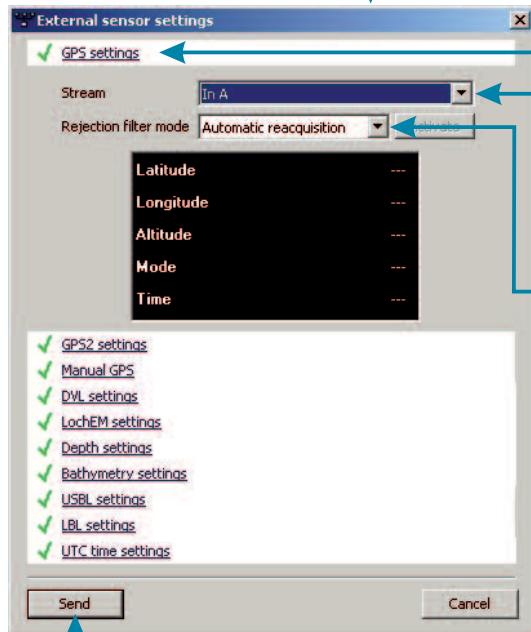
Step 13: Choose Pulse Input A for the Com Port parameter.

Step 14: Click on Send button

Defining the GPS Communication Port



Step 1: Click on External sensor settings button
>The External sensor settings window opens



Step 2: Click on GPS settings text label
to expand the dedicated area

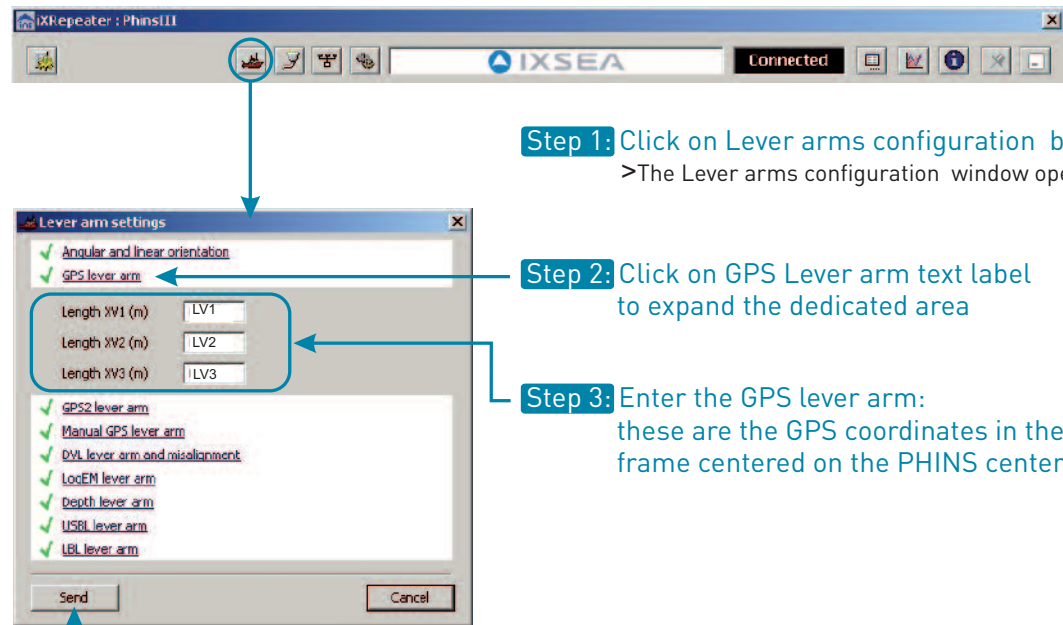
Step 3: Select the GPS Communication Port: In A

Step 4: Check that Rejection filter mode
is set to 'Automatic reacquisition'

Step 5: Click on Send button

Defining the GPS Lever Arm

The GPS lever arms are the coordinates of the GPS antenna with respect to the vessel reference frame centered on PHINS Center of measurements:



Step 1: Click on Lever arms configuration button
>The Lever arms configuration window opens

Step 2: Click on GPS Lever arm text label to expand the dedicated area

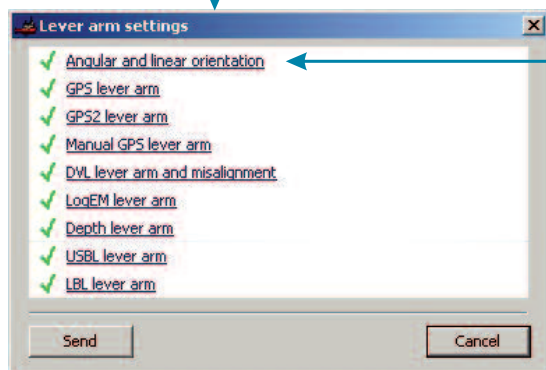
Step 3: Enter the GPS lever arm: these are the GPS coordinates in the vessel frame centered on the PHINS center of measurement P

Step 4: Click on Send button

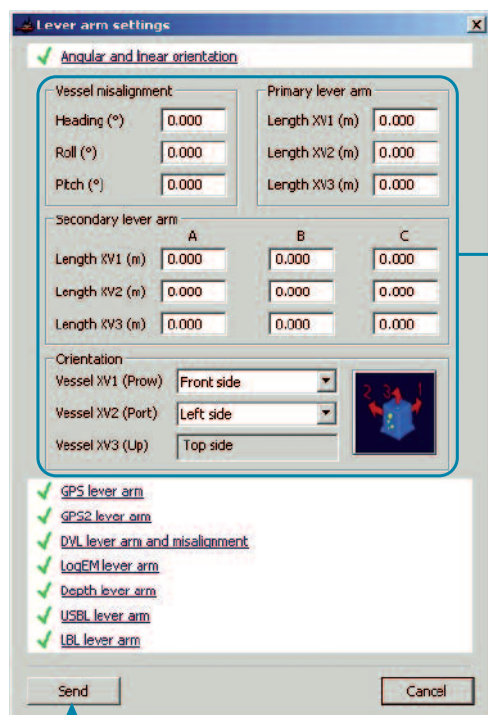
Configuring PHINS Geometric Parameters



Step 1: Click on Lever Arm button
>The Lever Arm settings window opens



Step 2: Click on Angular and linear orientation text label to expand the dedicated area



Step 3: Check that the orientation is the same as that seen here

Step 4: Click on Send button

Entering the initial position

Entering the initial position is only necessary if no GPS is available upon Starting PHINS. The entered value is automatically save into PHINS PROM and it is used at next system start.



Step 1: Click on System tools button
>The system tools window opens

Step 2: To define the position
- either click on **Position in degree** text label
- or on **UTM Position**

Step 3: Enter the initial position:

- Either latitude (in degrees), longitude (in degrees) and altitude (in meters)

- the UTM definition of this position

OR

Step 4: Click on Send button

Saving your PHINS configuration

At the end of your PHINS configuration, we recommend that you save your configuration. Perform the same procedure than in section Saving the Factory Configuration.

Note : By pressing SEND button at each modification, PHINS settings are stored in the PHINS internal memory. These parameters will be automatically used at next power ON

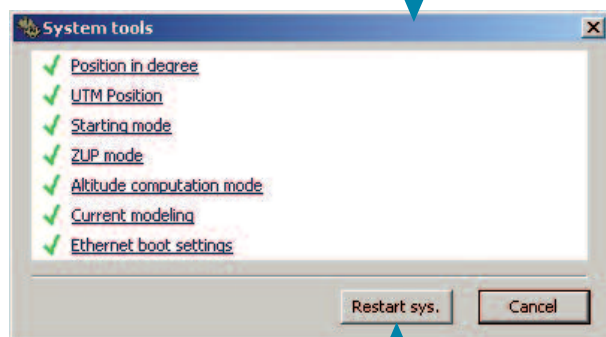
Restarting

To take into account the modification of the configuration, it is recommended to restart your system.



Step 1: Click on System tools button

>The System tools window opens



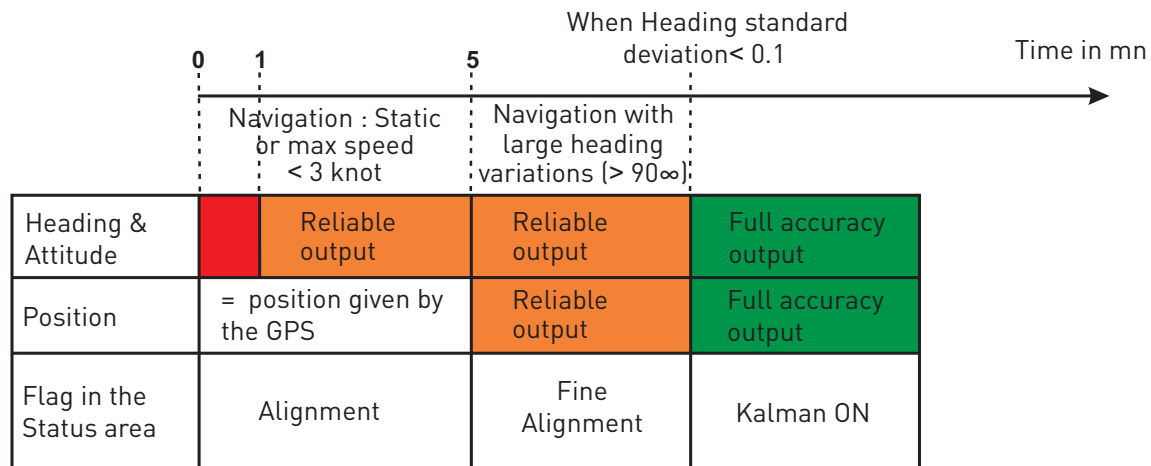
Step 2: Click on Restart sys. Button

>Soft restart will completely restart PHINS, and re-launch the alignment sequence (see next section).

STEP 4. ALIGNING PHINS

As soon as PHINS is restarted, it starts its alignment phase with the manually input position stored into PHINS PROM.

- During the first five minutes after powering-on, PHINS performs its coarse alignment: PHINS inertial sensor data (accelerometers and gyrometers) are computed to estimate heading, roll and pitch angles. At sea, it is recommended that the system is kept as steady as possible during coarse alignment: oscillations around a mean position are permitted but accelerations should be avoided. Leaving the vessel at drift for 5 minutes would also lead to satisfactory conditions for coarse alignment.
- After the first five minutes long coarse alignment phase, PHINS switches to the “fine alignment” phase to improve the accuracy of roll, pitch and heading estimations. Any movement is allowed during the fine alignment. 90 degrees rotations are even highly recommended so that the Kalman filter assesses the sensors bias on different axes. The fine alignment is ended automatically by PHINS when the heading covariance is below 0.1 degree.
- At the end of the fine alignment process, PHINS is ready for navigation with optimal performances.



More...

The previous steps consist only of the basic installation of your PHINS system. You will find hereafter a list of other possible configurations. Details on these configurations can be found in the PHINS User Guide.

PHINS to Vessel Fine misalignment

PHINS measures heading and attitude with respect to its reference frame defined by the 3 axes X1, X2 and X3 (see Figure 1). PHINS reference frame may not be parallel to the vessel reference frame. In such case, heading and attitude outputs can be compensated for angular misalignments of PHINS relative to the vessel reference frame so that PHINS outputs heading and attitude of the vessel.

This is done by setting misalignment bias for the three reference axes. These biases are the Euler angles which relate PHINS and vessel reference frame.

For more details about the fine misalignment, refer to Part 2 of the PHINS User Guide.

External Monitoring Points

PHINS is able to calculate the heave of several external monitoring point: one primary and three “secondary” monitoring points can be user-configured. The secondary lever arms are used to compute the heave for the output protocols that provide it (see Part IV- Setting to Work to define the secondary lever arms of the PHINS User guide), the output position being always given for the Primary lever arm.

External monitoring points are defined by their “Lever Arm” to PHINS centre of measurement P. This lever arm is the triplet of the cartesian coordinates (LV1, LV2, LV3) defining the position of external monitoring point M with respect to PHINS centre of measurement P [defined in Figure 1) in the vessel reference frame (XV1, XV2, XV3) – see Figure 2.

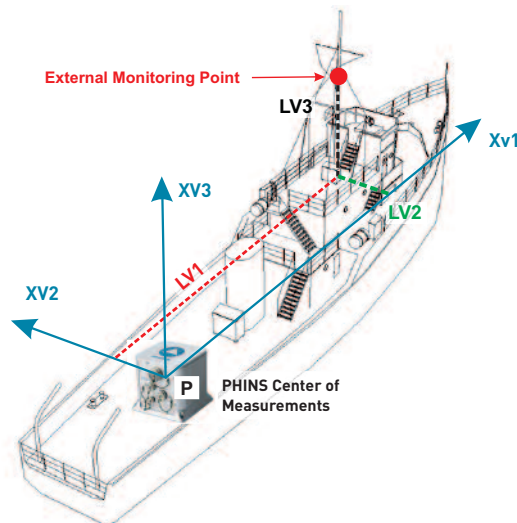


Figure 2 - Definition of lever arm

For more details about the external monitoring points, refer to Part 2 of the PHINS User Guide

External sensors

PHINS uses external sensor data to improve its own estimates of position, speed, attitude and heading. In order to prevent corrupted external data to degrade the estimation of PHINS, external sensor data passes through a rejection filter before being incorporated into PHINS main computation and Kalman filter.

The following external sensors can be added:

- An additional GPS
- A logEM
- A DVL
- A depth sensor
- An USBL (up to three beacons)
- A LBL

For more details about the external sensors, refer to Part 4 (configuration) and part 5 (input/output protocols) of the PHINS User Guide.

For more details about the rejection filter mode of the external sensors, refer to part 4 of the PHINS User guide.

Ethernet Input/Output

Five Ethernet inputs/outputs are available on PHINS.

For more details about

- **The Ethernet connector, refer to Part 2 of the PHINS User Guide.**
- **The available protocols for this connector, refer to Part 5 of the PHINS User Guide.**


Pulse Input/Output

Four pulse Inputs and two pulse outputs are available on PHINS.

For more details about

- **The pulse connector pins, refer to Part 2 of the PHINS User Guide.**
- **The protocols available for this connector, refer to Part 5 of the PHINS User Guide.**

Extended Functions of the iXRepeater

- **Logging data:** you can record PHINS data in a text file with the *iXRepeater Software*. **For more details about this record refer to Part 4 of the PHINS User Guide.**
- **System information:** To accede to the serial number and the firmware version of PHINS, click on  icon in the main window of the iXRepeater.

Note : these information are useful when you contact IXSEA technical support.

PHINS Computing modes

The estimation of altitude cannot be done by pure inertial means otherwise the error would increase exponentially. The altitude of PHINS can also be stabilised by using data coming from external sensor.

For more details about the altitude calculation mode, refer to part 4 of the PHINS User Guide.

The Zero Velocity Update (ZUP) modes have been designed to use PHINS for specific applications when no external sensor is connected.

For more details about the ZUP mode, refer to part 4 of the PHINS User Guide.

IXSEA Contact and Customer Support

To obtain information on any IXSEA products, a general mail box is available with the following address:
info@ixsea.com. You can also contact IXSEA headquarters in France, or one of its representatives around the world:

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Customer Support

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