



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".

- This symbol indicates the result of an action in the procedures.

- 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.

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

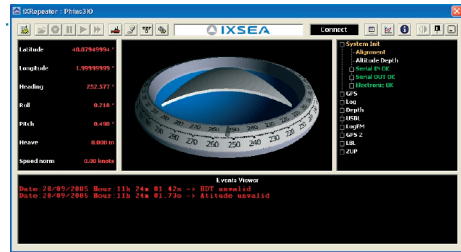
This guide describes how to install the PHINS with a GPS, and the basic configurations required before beginning the positioning. This is the basic installation. If you need to install additional external sensors, to define lever arms and/or to enter installation biases, please refer to PHINS User Guide.

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

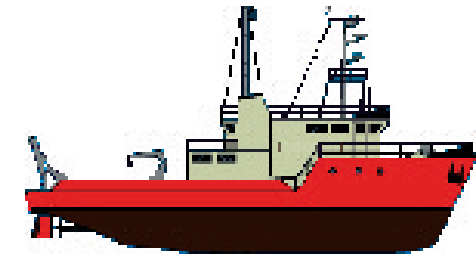
This configuration includes :

- 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

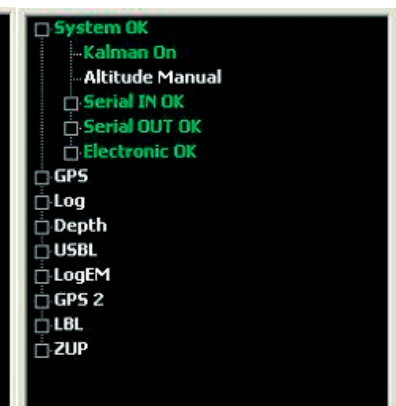
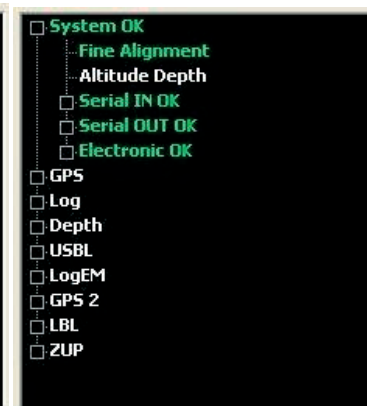
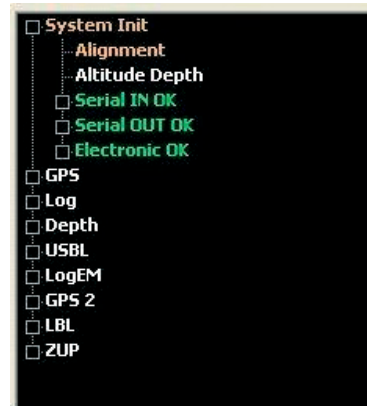
To define the COM port (PHINS to PC)
To save the configuration into a file



Static vessel or max speed < 3 knot

Navigating with large heading variations (> 90°)

Navigating with optimal performance




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 inow installed, itcan 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.

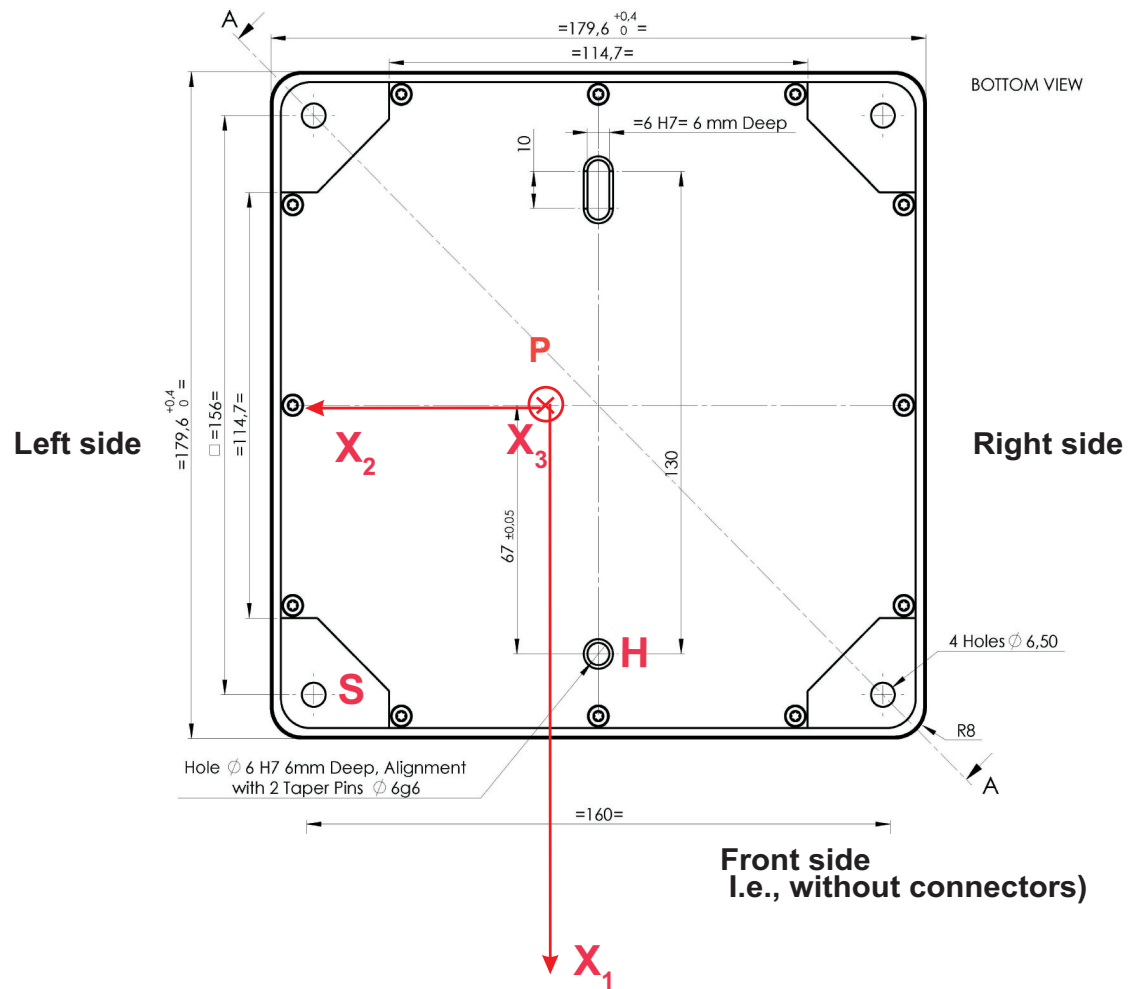
STEP 2. INSTALLING PHINS SYSTEM

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.

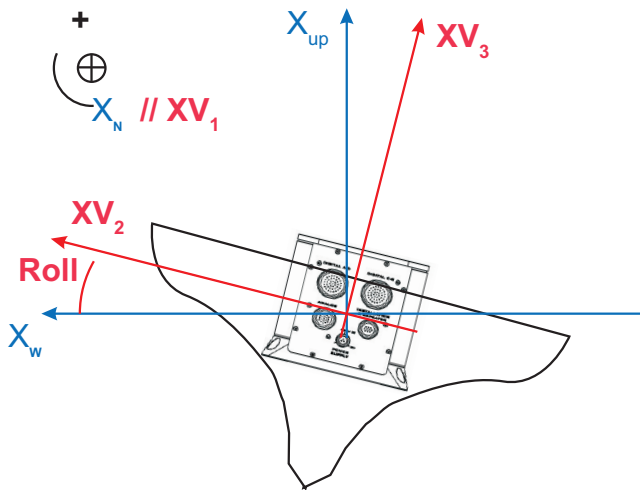
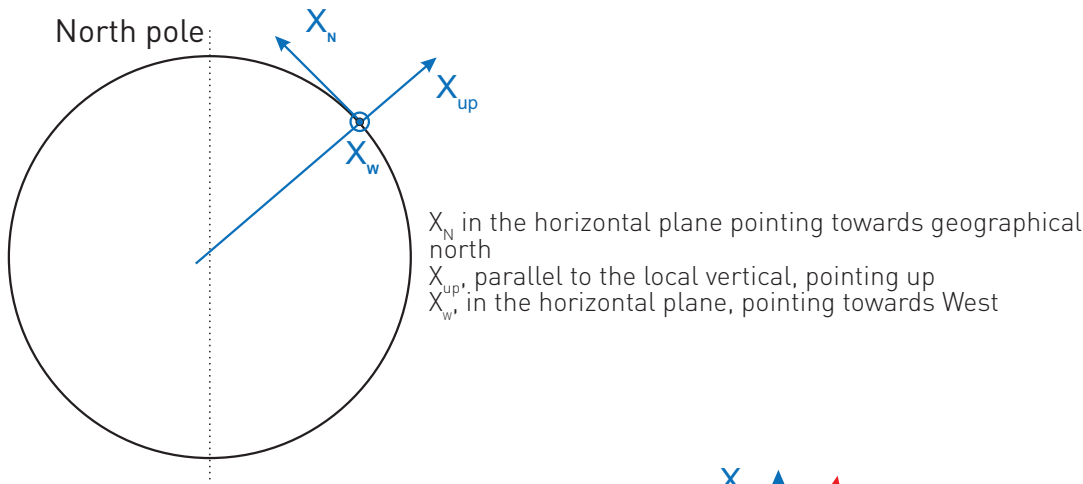
Motion sensing measurements are default measured at PHINS Centre of Measurement P (see Table in Figure 1).



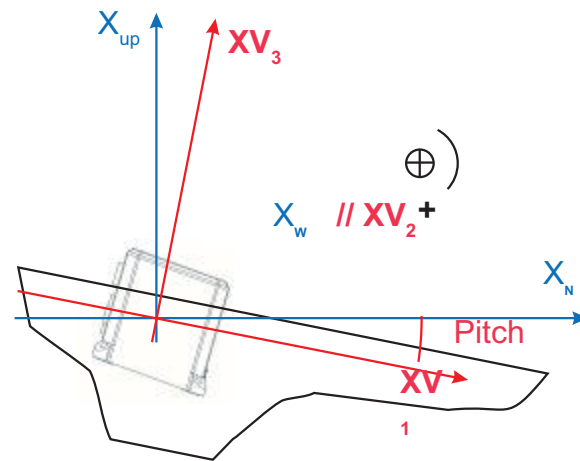
Distances from PHINS centre of measurements P to...	Along PHINS X1 axis (connector to front)	Along PHINS X2 axis (right to left)	Along PHINS X3 axis (bottom to top)
PHINS reference point S	7.96 cm	+6.8 cm	-8.15 cm
PHINS reference point H	6.86 cm	- 1 cm	-8.15 cm

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

True Heading, Roll and Pitch Definitions

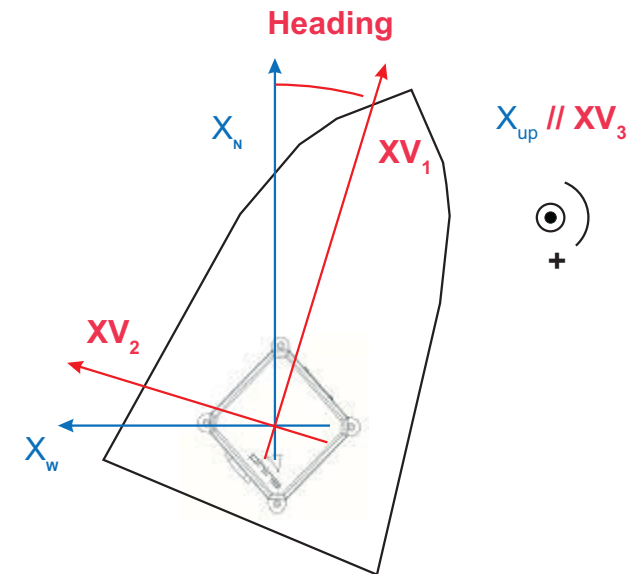


The roll is defined as the angle of rotation performed around the vessel XV_1 so that the vessel axis XV_2 lies in the local horizontal plane. This angle is default defined positive in the direction of axis XV_1 , i.e., when the boat port side is up. It varies between -180 and $+180^\circ$. The figure above is an illustration of the roll angle with null pitch.



Once the axis XV_2 lies in the local horizontal plane, the pitch is the angle between the axis XV_1 of the vessel and its projection in the local plane. This angle is default defined positive in the direction of axis XV_2 , 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.

Vessel reference frame



Once the axes XV_2 and XV_1 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.

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.

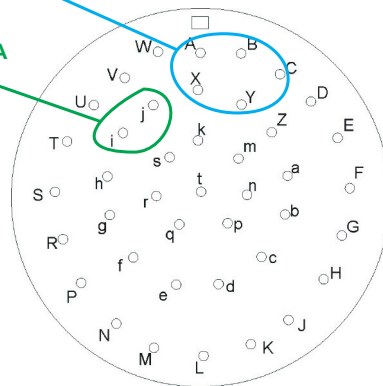
Standard case defined as follows:
 External sensor connected to the serial port B of PHINS: GPS
 Output protocol on serial port A: GPS like
 Time synchronisation given by the GPS on the pulse in port A

GPS Receiver connected to Digital A-D Connector

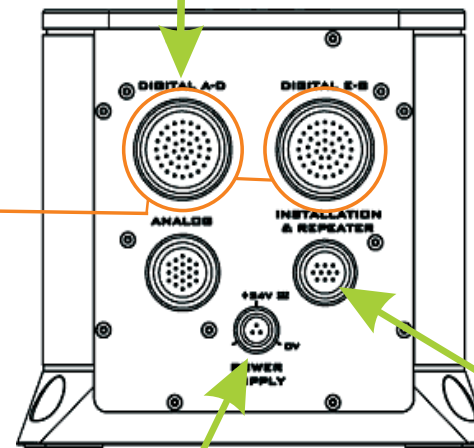
Pulse In	Digital A-D connector Port Pin n°	
Function	Port A	Port B
Rx	j	h
Rx GND	i	g

Port A on Digital A-D connector

Pulse In Port A on Digital A-D connector



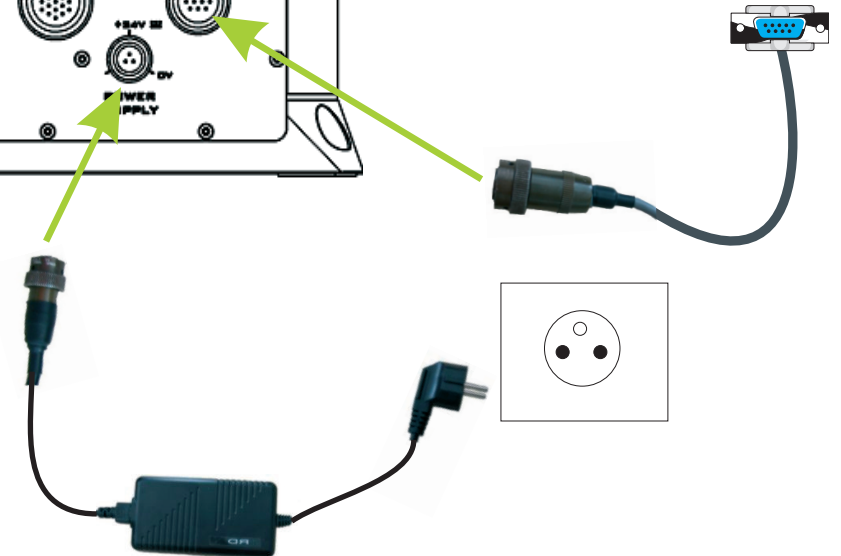
Voltage → 4 V when loaded



RS232	Digital A-D connector Port Pin n°				Digital E-F connector Port Pin number	
Function	Port A	Port B	Port C	Port D	Port E	Port F
Tx	B	E	H	L	B	E
Rx	Y	a	c	e	Y	a
Tx GND	A	D	G	K	A	D
Rx gnd	X	Z	b	d	X	Z

RS422	Digital A-D connector Port Pin n°				Digital E-F connector Port Pin n°	
Function	Port A	Port B	Port C	Port D	Port E	Port F
Tx +	B	E	H	L	B	E
Tx -	C	F	J	M	C	F
Rx -	Y	a	c	e	Y	a
Rx +	X	Z	b	d	X	Z
Tx Rx GND	A	D	G	K	A	D

For RS232/422 connections:
 It is recommended to use Shielded Twisted Pairs for communication wiring. Shield is connected to connector backshell for optimum EMI performances (pin N can also be used).



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 section Step 3] or is given by the GPS. The alignment sequence is detailed in Step 4.

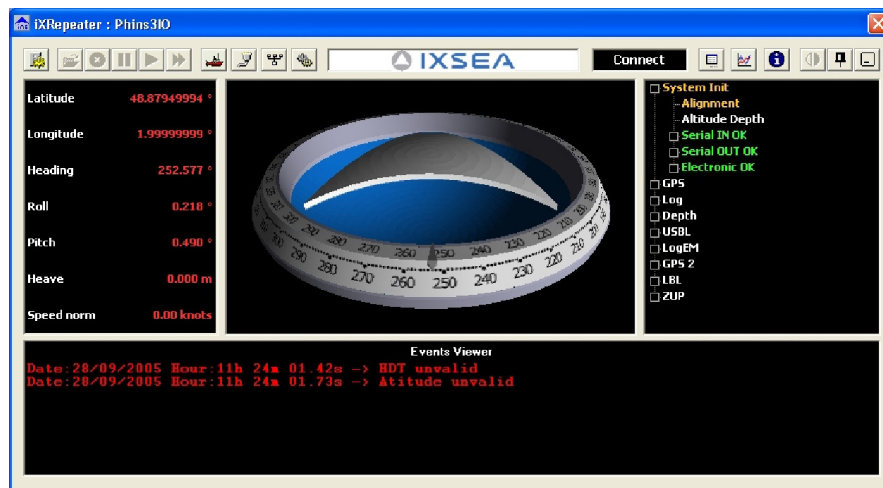
STEP 3. CONFIGURING PHINS

Configuring the Communication Port

The communication with the PC is performed through a dedicated COM port on the PC. This COM port should be selected. Default factory setting is COM 1.

STEP Action


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



- 2 End of procedure.

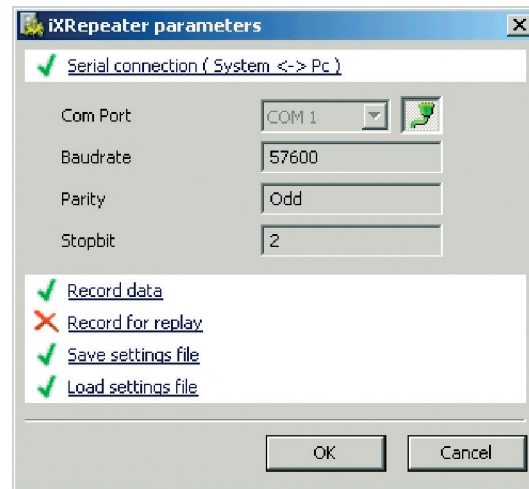
During the first seconds a progress bar will appear indicating that the IXREPEATER Software is uploading the internal configuration of PHINS. If it is not the case or if the bar is stuck, the following points should be checked:

- Check that PHINS is powered on.
- Check that PHINS is connected to COM1 of your PC (default setting). If this is not the case:

1. Click on 

The IXREPEATER parameters window opens.

2. Click on the label **Connection (system ↔ PC)** to access the communication port parameters.



3. Click on the  icon.

The icon turns red, selection in the Computer port drop-down list becomes available.

4. Select the correct port in the drop-down Computer port list.

5. Click on the  icon.

The icon turns green. The communication is established, real time data are displayed for Latitude, longitude, 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 levers 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 0)
 White-display: data are correct

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.

Event viewer area
 It displays:
 - errors
 - Alignment status
 - Events such 'Restart system'

Events Viewer
 Date: 15/09/2006 Hour: 10h 39m 11.200s -> Attitude invalid
 Date: 15/09/2006 Hour: 10h 39m 11.264s -> HDT invalid

Saving the Factory Configuration

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

1 - Click on IXREPEATER parameters button
→ The IXREPEATER parameters window opens

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

3 - Click on Save button
→ 2 files are created:
-PhinsnIO_XXXX-ZZZ_DD-MM-YYYY_HH-mm-SS.txt: with all information related to PHINS configuration
-PhinsnIO_XXXX-zzz_dd-mm-yyyy_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

4- Click on OK button

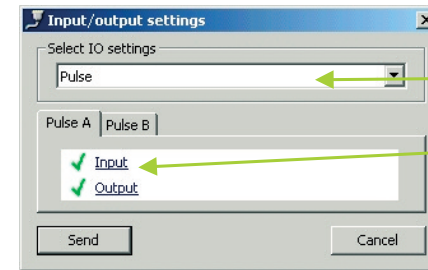
Do not forget to note the names of the factory configuration files.

Configuring the Serial Port and Input PPS of the GPS

Defining the PPS input for using Time Synchronisation System

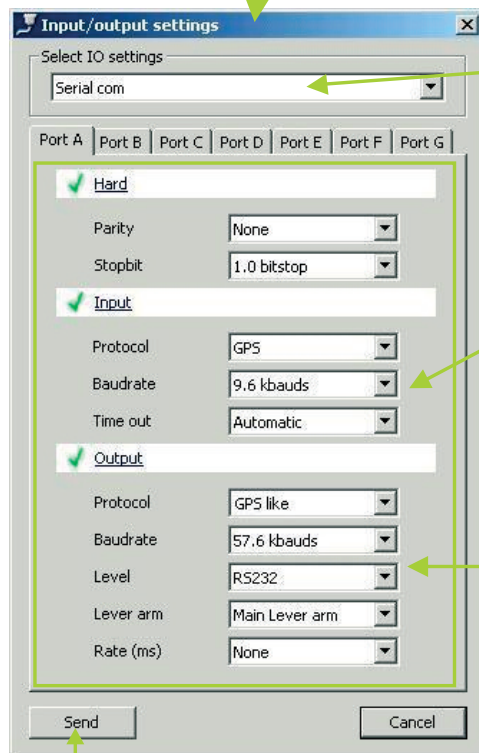


1 - Click on Input/output configuration button
→The Input/output settings window opens



6 - In the Select IO settings area, select Pulse com

7 - In Pulse A tab, click on Input label text to expand the dedicated area

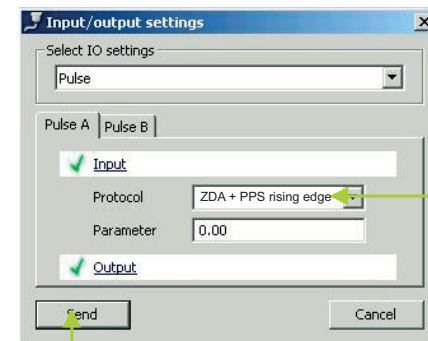


2 - In the Select IO settings area, select Serial com

3 - In Port A tab, in the Input area, define each parameter relevant to your GPS

4 - In Output area, choose GPS like for the output protocol

5 - Click on Send button

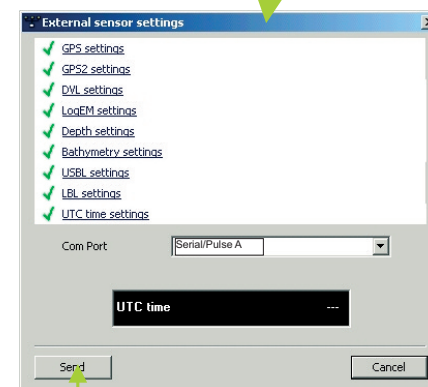


8 - Select PPS protocol: it can be ZDA+PPS rising edge, for example

9 - Click on Send button



10 - Click on External sensor settings button
→The external sensor settings window opens



11 - Click on UTC time settings to expand the dedicated area

12 - Choose Serial/Pulse A for the Com Port parameter.

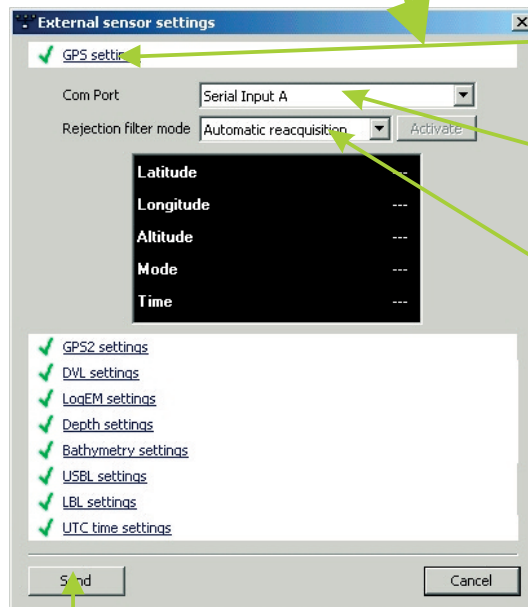
13 - Click on Send button

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

Defining the GPS Communication Port



1 - Click on External sensor settings button
→ The External sensor settings window opens



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

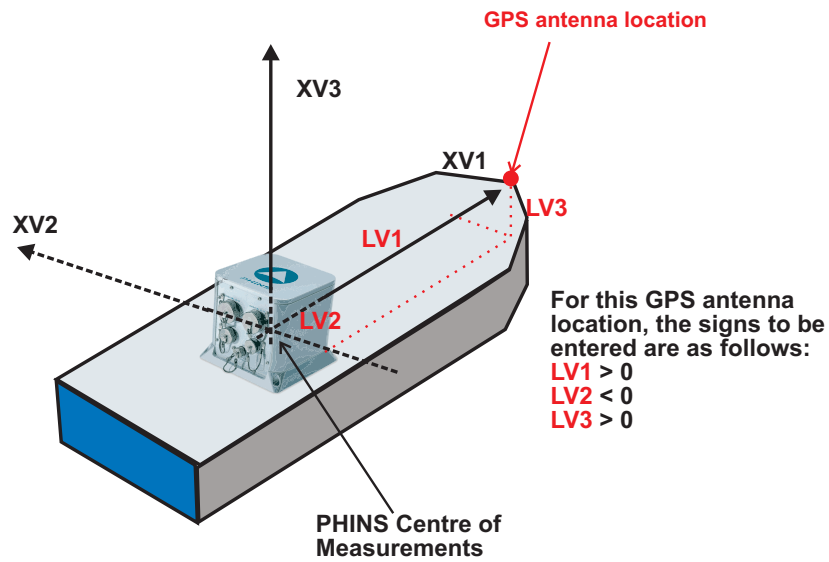
3 - Select the GPS Communication Port: Serial Input A

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

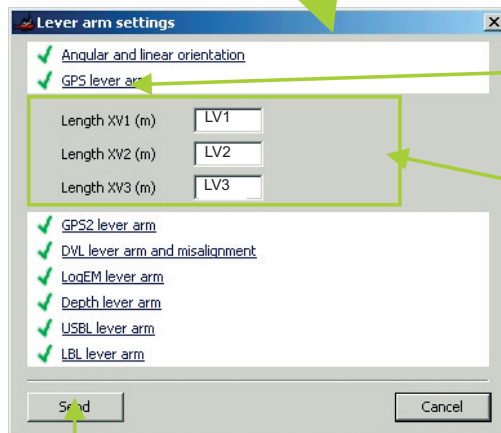
5 - Click on Send button

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:



1 - Click on Lever arms configuration button
→ The Lever arms configuration window opens



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

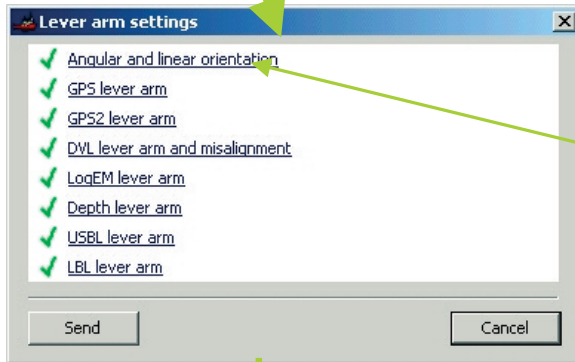
3 - Enter the GPS lever arm: these are the GPS coordinates in the vessel frame centered on the PHINS center of measurement P

4- Click on Send button

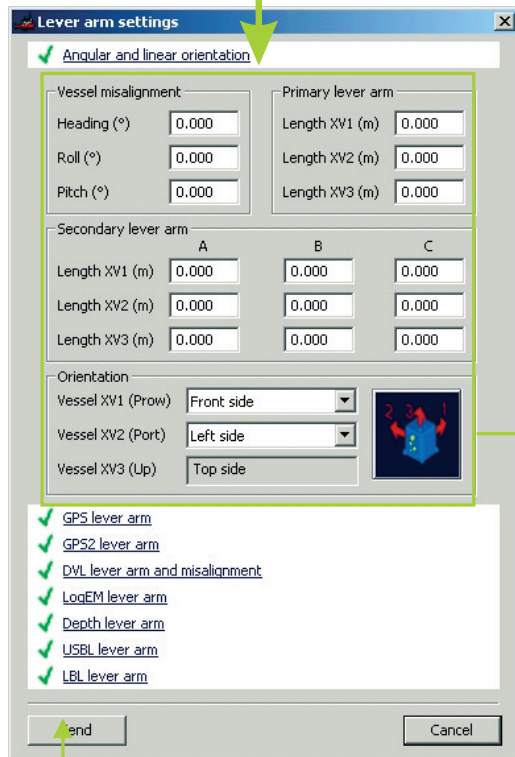
Configuring PHINS Geometric Parameters



1 - Click on Lever Arm button
→The Lever Arm settings window opens



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



3 - Check that the orientation is the same as that seen here

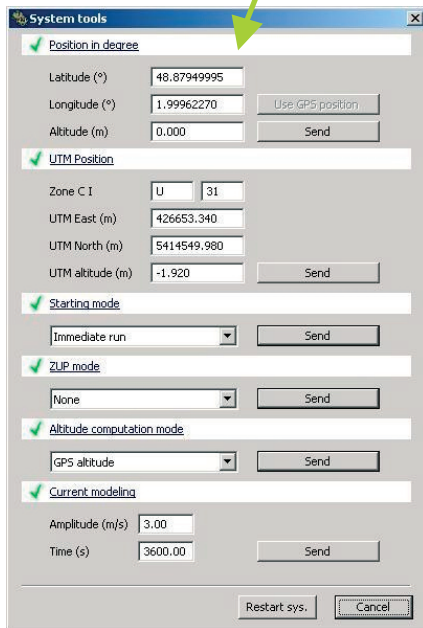
4 - Click on Send button

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.



1 - Click on System tools button
→The system tools window opens



The System tools window contains the following sections:

- Position in degree:** Latitude (°) 48.87949995, Longitude (°) 1.99962270, Altitude (m) 0.000. Includes a "Use GPS position" button and a "Send" button.
- UTM Position:** Zone C I U 31, UTM East (m) 426653.340, UTM North (m) 5414549.980, UTM altitude (m) -1.920. Includes a "Send" button.
- Starting mode:** Immediate run. Includes a "Send" button.
- ZUP mode:** None. Includes a "Send" button.
- Altitude computation mode:** GPS altitude. Includes a "Send" button.
- Current modeling:** Amplitude (m/s) 3.00, Time (s) 3600.00. Includes a "Send" button.

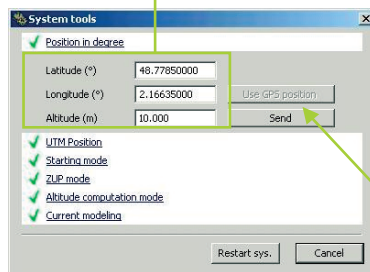
Buttons at the bottom: Restart sys., Cancel.

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

3 - Enter the initial position:

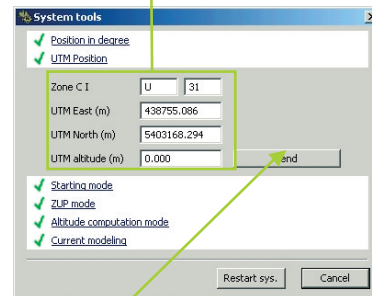
- Either latitude (in degrees), longitude (in degrees) and altitude (in meters)

- the UTM definition of this position



The Position in degree section is highlighted with a green box, showing Latitude (°) 48.77850000, Longitude (°) 2.16635000, and Altitude (m) 10.000. A green arrow points to the "Send" button.

OR



The UTM Position section is highlighted with a green box, showing Zone C I U 31, UTM East (m) 438755.086, UTM North (m) 5403168.294, and UTM altitude (m) 0.000. A green arrow points to the "Send" button.

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.

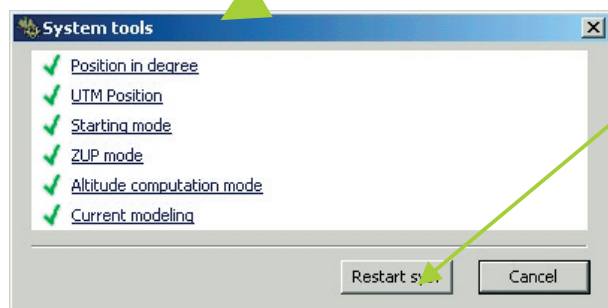
Note : By pressing SEND button at each modification, PHINS settings are stored in the PHINS internal memory. These parameters will be automatically used at next power ON

Restarting

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



1 - Click on System tools button
→The System tools window opens



2 - Click on Restart sys. Button
→ Soft restart will completely restart PHINS, and re-launch the alignment sequence (see next section).

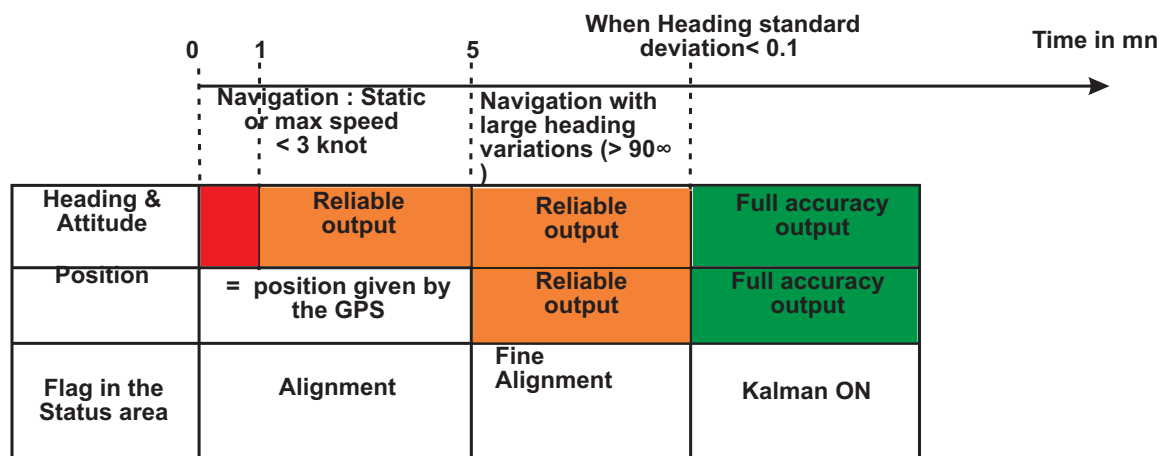
STEP 4. ALIGNING PHINS

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 adrift for 5 minutes would 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.



 Invalid data

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.

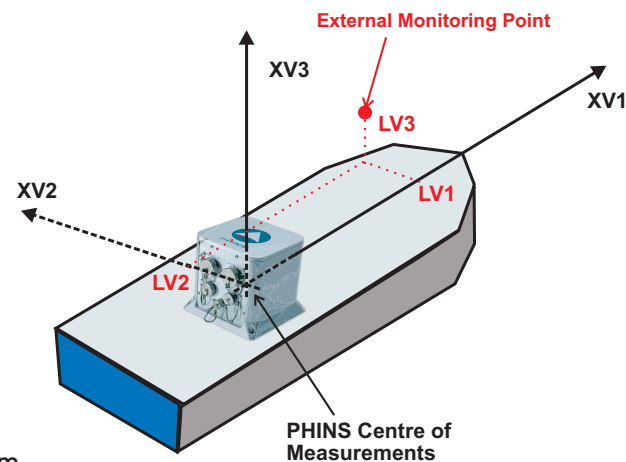


Figure 2 - Definition of lever arm

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 6 (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.

Analog Output

Four analog outputs are available on PHINS.

For more details about

- **The analog connector, refer to Part 2 of the PHINS User Guide.**
- **The available protocols for this connector, refer to Part 6 of the PHINS User Guide.**


Pulse Input/Output

Two pulse Inputs/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 6 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 5 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:

CONTACT	PHONE	FAX
IXSEA SAS FRANCE	+33 (0)1 30 08 98 88	+33 (0)1 30 08 88 01
IXSEA BV THE NETHERLANDS	+31 (0)23 750 5110	+31 (0)23 750 5111
IXSEA Ltd - Main office IXSEA Ltd - Aberdeen office UNITED KINGDOM	+ 44 1730 260222 + 44 1224 355160	+44 1730 260333
IXSEA Inc USA	+1 (781) 937 8800	+1 (781) 937 8806
IXSEA Pte Ltd SINGAPORE	+65 6747 4912	+65 6747 4913
IXSEA Pte Ltd CHINA	+86 (0)10 6211 4716	+86 (0)10 6211 4718

A detailed description of our products and a list of our representatives are available on our website: www.ixsea.com

Customer Support

THE WORLDWIDE 24/7 TELEPHONE SUPPORT LINE NUMBERS ARE:

EMEA	+33 (0)1 30 08 98 98
USA	+1 781 937 8803
	+1 888 660 8836 (toll free)
ASIA	+65 6747 7027

PERSONAL NOTES
