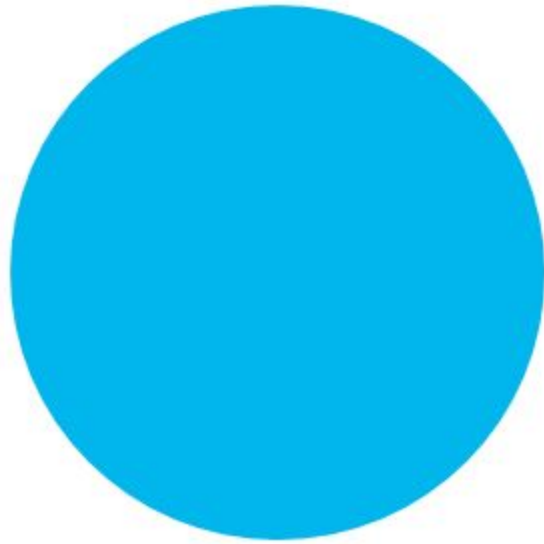




Phins Subsea

Installation & Setup Guide

Revision History

Edition	Date	Comments
A	07/2019	Creation
B	03/2020	Chapters 5.2.1 & 5.5 updated
C	08/2022	Creating a Serial Direct Connection under Windows 10 chapter updated.

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Phins Subsea Documentation

The following documents give all the information you need in order to understand and to use your product.

- **Phins Subsea Technical Description** (*ref.: MU-PHIN6TD-AN-001*)
 - > Phins Subsea and iXblue technology presentation
 - > Technical specifications
 - > Certification and qualification, life cycle
 - > Mechanical, electrical and communication interface description
- **Phins Subsea Installation & Setup Guide** (*ref.: MU-PHIN6ISG-AN-001*)
 - > Conventions
 - > Physical and electrical installation
 - > Connecting to the Web-Based Graphical User Interface
 - > Setup the Phins Subsea
 - > Contacting iXblue support
- **Phins Subsea Operation Guide** (*ref.: MU-PHIN6OG-AN-001*)
 - > Introduction to the Inertial Navigation System
 - > Start-up Phases
 - > Web-Based Graphical User Interface description
 - > Configuring the navigation parameters & managing the external information
 - > Viewing the system information
 - > Recording data
- **Phins Subsea Interface Library** (*ref.: MU-PHIN6IL-AN-001*)
 - > NMEA frames
 - > Digital input and output protocols
 - > Pulses interfaces specification
 - > Control commands
- **Phins Subsea Quick Start Guide**
 - > Pack content verifying
 - > Installing and connecting Phins Subsea
 - > Configuring and operating Phins Subsea
- **SEACON 12 PIN TI 1M Pigtail Cable - Product Description** (Ref.: MU-PDCABLES-AN-001)
 - > cable and pinout of the SEACON 12 pins Pigtail Cable
- **SEACON 19 PIN TI 1M Pigtail Cable - Product Description** (Ref.: MU-PDCABLES-AN-002)
 - > cable and pinout of the SEACON 19 pins Pigtail Cable
- **SEACON 26 PIN TI 1M Pigtail Cable - Product Description** (Ref.: MU-PDCABLES-AN-003)
 - > cable and pinout of the SEACON 26 pins Pigtail Cable
- **SEACON 26 PIN TI 1M Pigtail Cable - Product Description** (Ref.: MU-PDCABLES-AN-009)
 - > cable and pinout of the SEACON 26 pins Pigtail Cable
- **Subsea Inertial Products - Maintenance Manual** (*ref.: MU-SUBSEAMM-AN-001*)
 - > Troubleshooting
 - > Corrective maintenance
- **Subsea Inertial Products - Illustrated Part Catalog** (*ref.: MU-SUBSEADP-AN-001*)

- > Detailed part list
- > Alphanumerical Index
- **Application Note - INS+DVL Calibration** (*ref.: MU-DVLINS-AN-001*)
 - > Configuring the calibration
 - > Calibrating the DVL+INS
- **Application Note - Installation and Configuration of AHRS and INS for Seabed Mapping Measurements** (*ref.: MU-HEAVAPN-AN-001*)
 - > Using heave compensation on seabed mapping
 - > Effect of vehicle transient movements

Phins Subsea Installation & Setup Guide Overview

This document must be read and understood prior to using the product.

The manufacturer shall in no case be held liable for any application or use that does not comply with the stipulations in this manual.

The Phins Subsea Installation & Setup Guide is divided into several parts:

- **Part 1: Definition and Conventions**
This part gives the definition and conventions used in this document and in the product.
- **Part 2: Process to install and enable the system**
This part gives a diagram of the steps to be performed in order to install and enable the system.
- **Part 3: Installing the Phins Subsea**
This part describes the mechanical and electrical installation of the Phins Subsea and how to power the Phins Subsea on.
- **Part 4: Connecting to the Web-Based Graphical User Interface**
This part describes how to connect the Phins Subsea to the Web-Based Graphical User Interface.
- **Part 5: Configuring the Phins Subsea**
This part gives the procedures to configure the Phins Subsea with the Web-Based Graphical User Interface.
- **Part 6: Contacting iXblue support**
This part describes how to contact iXblue support in case of problem.
- **Appendices**
Procedures to connect Phins Subsea to a PC by serial link and to use the simulation mode.

Abbreviations and Acronyms

ACC	Accelerometer
CTD	Conductivity, Temperature, Depth sensor
DVL	Doppler Velocity Log
EGNOS	European Geo-stationary Navigation Overlay Service
GALILEO	European Satellite Navigation System
GGA	Essential fix data which provide 3D location and accuracy data
GLONASS	Global Navigation Satellite System (operated by the Russian Space Forces)
GNSS	Global Navigation Satellite System
GPS	Global Positioning System (operated by the United States Department of Defense)
GST	GPS Pseudo-range Noise (PRN) statistics (The GST message is used to support Receiver Autonomous Integrity Monitoring)
GUI	Graphical User Interface
HRP	Heading, Roll, Pitch
INS	Inertial Navigation System
IP	Internet Protocol
PPS	Pulse Per Second
SD	Standard Deviation
UTC	International acronym for Coordinated Universal Time (CUT)
UTM	Universal Transverse Mercator
VTG	Vector Track and speed over Ground
ZUPT	Zero velocity UPdaTe

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1.1 Reference Frame

Navigation data are given in a reference frame. The reference frame is defined by its center and 3 non coplanar axes (preferably orthogonal).

[illegible]

- > Earth Centered Inertial Fixed
- > It is fixed in space, it points to stars

- > Earth centered, earth fixed

- > Centered on the subsea vehicle
- > Pointing North West Up

- > Reference attached to the subsea vehicle
- > Pointing usually Front Left Up

1.1.1 PHINS SUBSEA REFERENCE FRAME

The Phins Subsea reference frame center, P, is the reference point for the determination of Phins Subsea and external sensor lever arms. The Phins Subsea reference frame center P is the intersection of the three Phins Subsea reference axis X1, X2 and X3.

Axis definition

When horizontal, three orthogonal axes define a reference frame as follows:

- Axis $\underline{X}_1$ is in the product horizontal plane. It is parallel to the thin shape arrow going from the rear side to the front side
- Axis $\underline{X}_3$ is vertical and perpendicular to the Phins Subsea horizontal plane, going from the bottom and pointing upward
- Axis $\underline{X}_2$ is in the horizontal plane, perpendicular to X1, pointing to the left of the product (top view): $\underline{X}_2 = \underline{X}_3 \wedge \underline{X}_1$

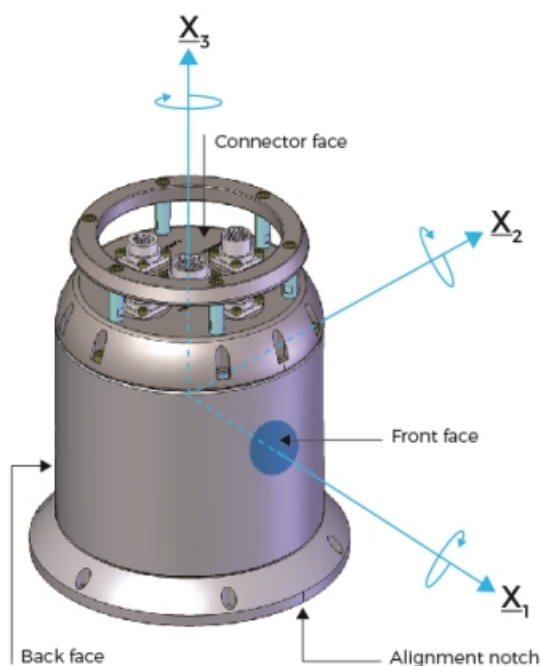


Figure 1 - Definition of axis X1, X2 and X3 and sides

Face Definition

The faces are defined in the figure above. Sign convention is indicated on the top face. The three axes intersect at point P, which is the Phins Subsea reference point.

The logo side and the connector side are used in the installation procedure to configure the inertial product orientation with respect to subsea vehicle (rough misalignment).

1.1.2 VEHICLE REFERENCE FRAME

The vehicle reference frame is defined by the three orthogonal axes $\underline{X}_{V1}$, $\underline{X}_{V2}$ and $\underline{X}_{V3}$ (see Figure 2):

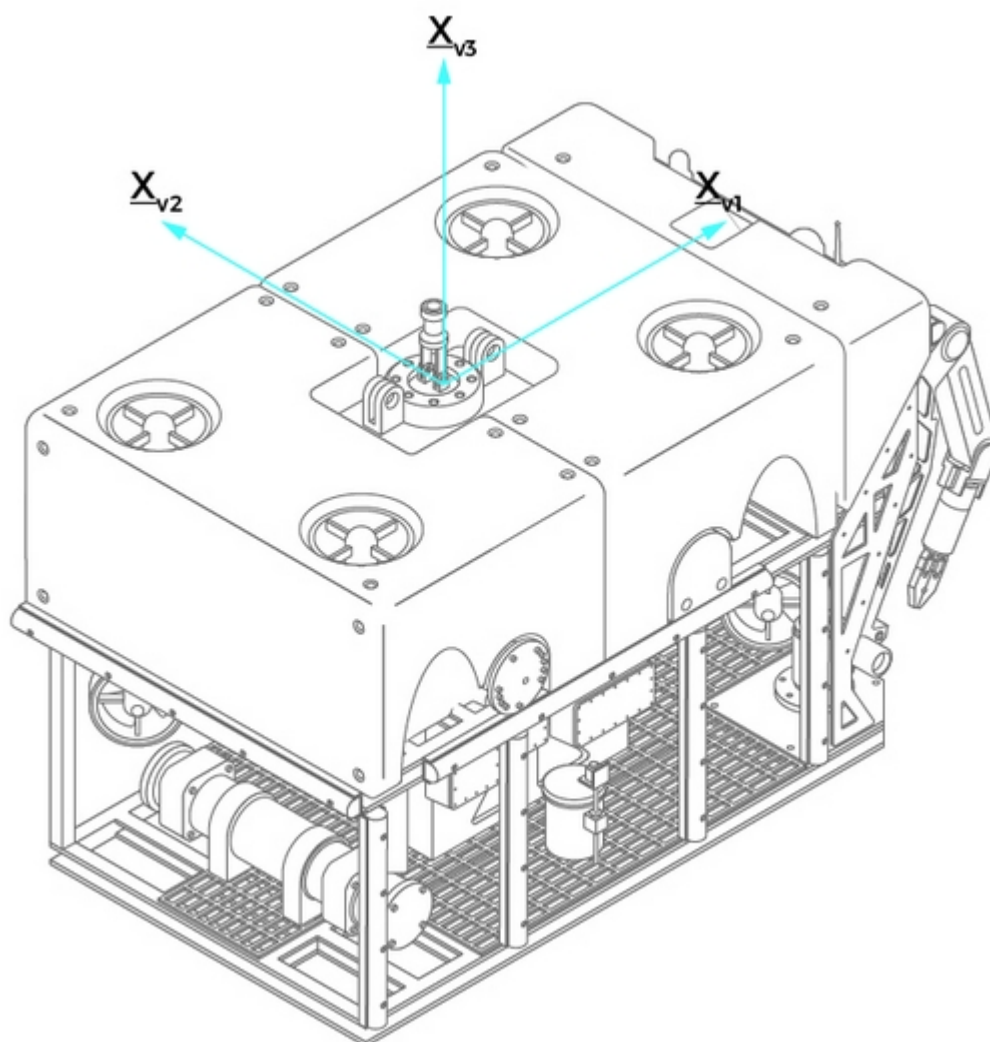


Figure 2 - Definition of the subsea vehicle reference frame

Important

Some applications use different axes conventions (i.e. Vertical axis pointing downward, side axes pointing right ...). Special caution must be taken to use the Phins Subsea convention during the installation process.

1.1.3 VEHICLE HORIZONTAL FRAME

This is the subsea vehicle frame compensated from roll and pitch. ($\underline{X}_{VH1}$ and $\underline{X}_{VH2}$ are in the horizontal plane). It is defined by the three orthogonal axes $\underline{X}_{VH1}$, $\underline{X}_{VH2}$ and $\underline{X}_{VH3}$.

This frame is used to output heave, surge, sway and associated speeds.

It is also used to output longitudinal and transverse speed data.

1.1.4 NAVIGATION FRAME

The navigation frame is the local geographic frame defined by the three axes (see Figure 3):

- $\underline{X}_N$, in the local horizontal plane, pointing towards North
- $\underline{X}_W$, in the local horizontal plane, pointing towards West
- $\underline{X}_{up}$, parallel to the local vertical, pointing up

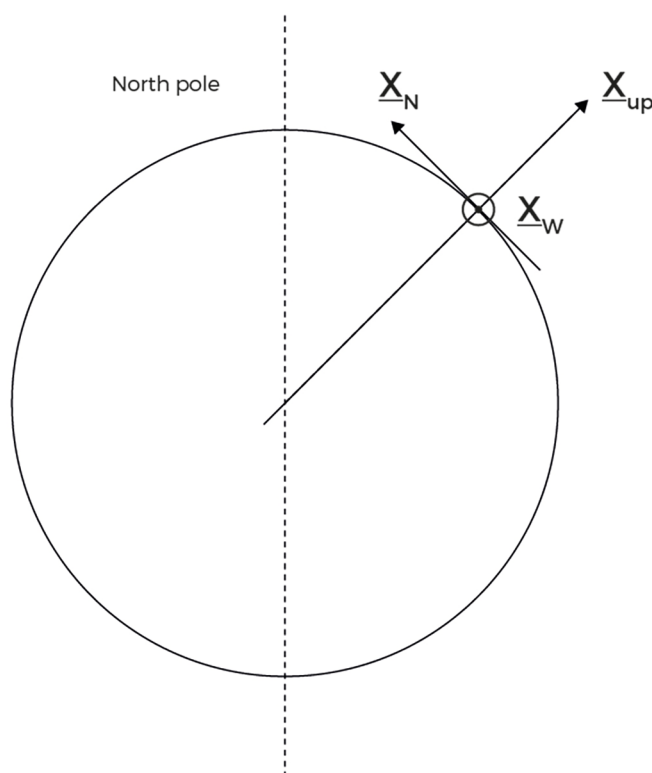


Figure 3 - Definition of the navigation frame

1.2 Attitude and Heading

The angular position of the vehicle is provided in roll, pitch and heading coordinates.

Roll, pitch and heading come from the rotational transformation between the subsea vehicle's frame ($\underline{X}_{V1}$, $\underline{X}_{V2}$, $\underline{X}_{V3}$) and the local geographic frame $\underline{X}_N$, $\underline{X}_W$, $\underline{X}_{Up}$.

This rotational transformation is fully described in Appendix A.1 and is illustrated in the figure below with positive heading and roll angles and negative pitch angle.

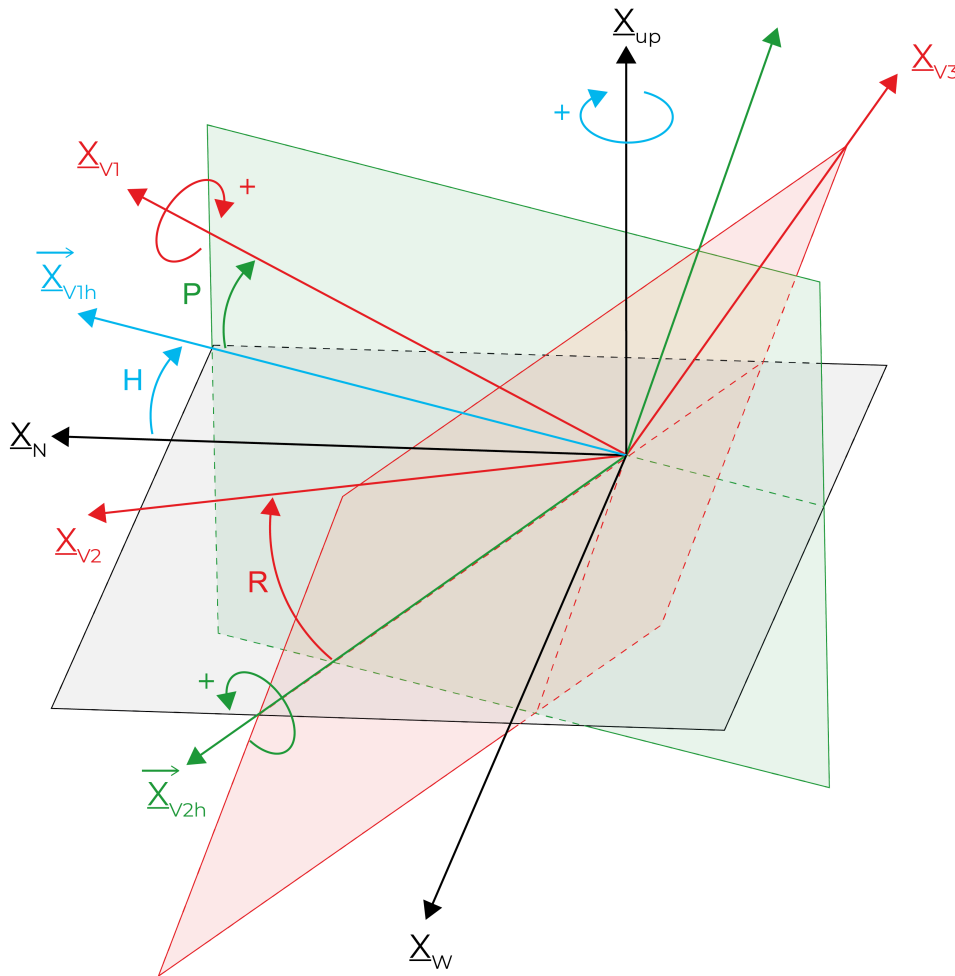


Figure 4 - Definition of heading (H), roll (R) and pitch (P)

The three next sections give the definitions of heading, pitch and roll. They also give simplified situations for a better understanding.

1.2.1 DEFINITION OF HEADING

Heading is the angle between the north axis $\underline{X}_N$ and the projection $\underline{X}_{Vh1}$ of the $\underline{X}_{V1}$ subsea vehicle axis in the local horizontal plane defined by the two vectors $\underline{X}_N$ and $\underline{X}_W$.

Heading is counted positive eastwards from $\underline{X}_N$.

Figure 5 gives a simplified description when pitch and roll are null, and no misalignment is taken into account.

Heading varies from 0 to 360 degrees.

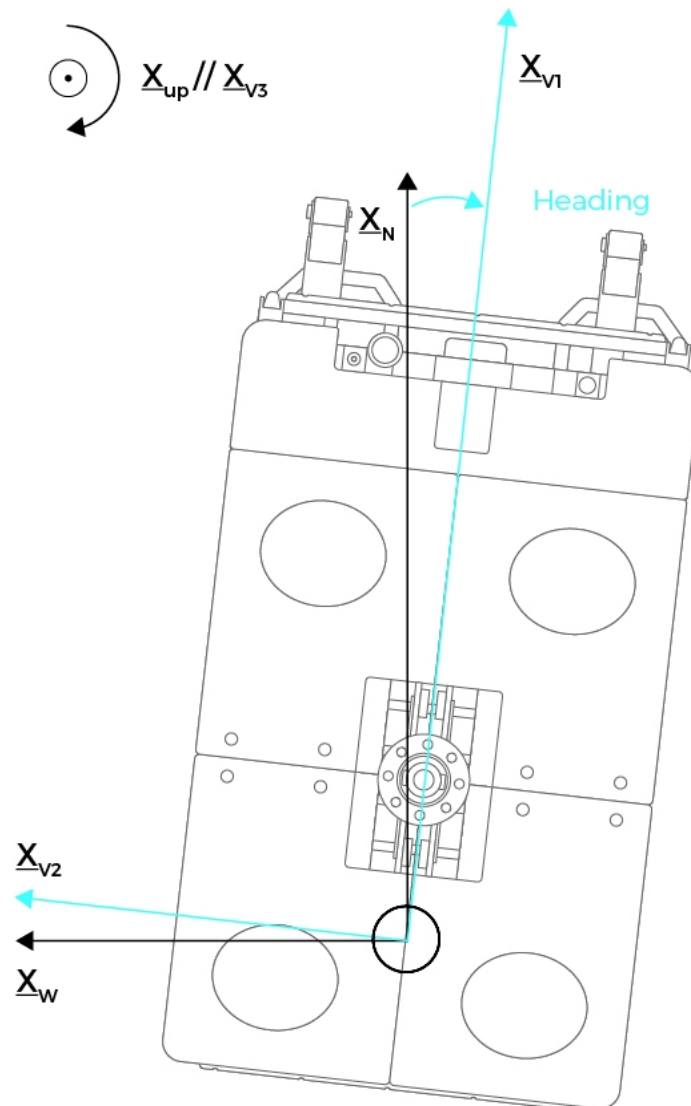


Figure 5 - Definition of heading angle in case of null pitch and roll, and no misalignment

1.2.2 DEFINITION OF ROLL

Roll is the angular rotation around the $\underline{X}_{V1}$ subsea vehicle axis which transforms the subsea vehicle axis $\underline{X}_{V2}$ into $\underline{X}_{V2h}$.

$\underline{X}_{V2h}$ is included into the local horizontal plane defined by vectors $\underline{X}_N$ and $\underline{X}_W$.

Roll is counted positively when turning counter-clockwise around $\underline{X}_{V1}$.

That means that the **roll is counted positive when subsea vehicle port side is up**.

Roll varies from -180 up to +180 degrees.

Figure 6 shows a simplified description of roll when heading and pitch are null and no misalignment is accounted for.

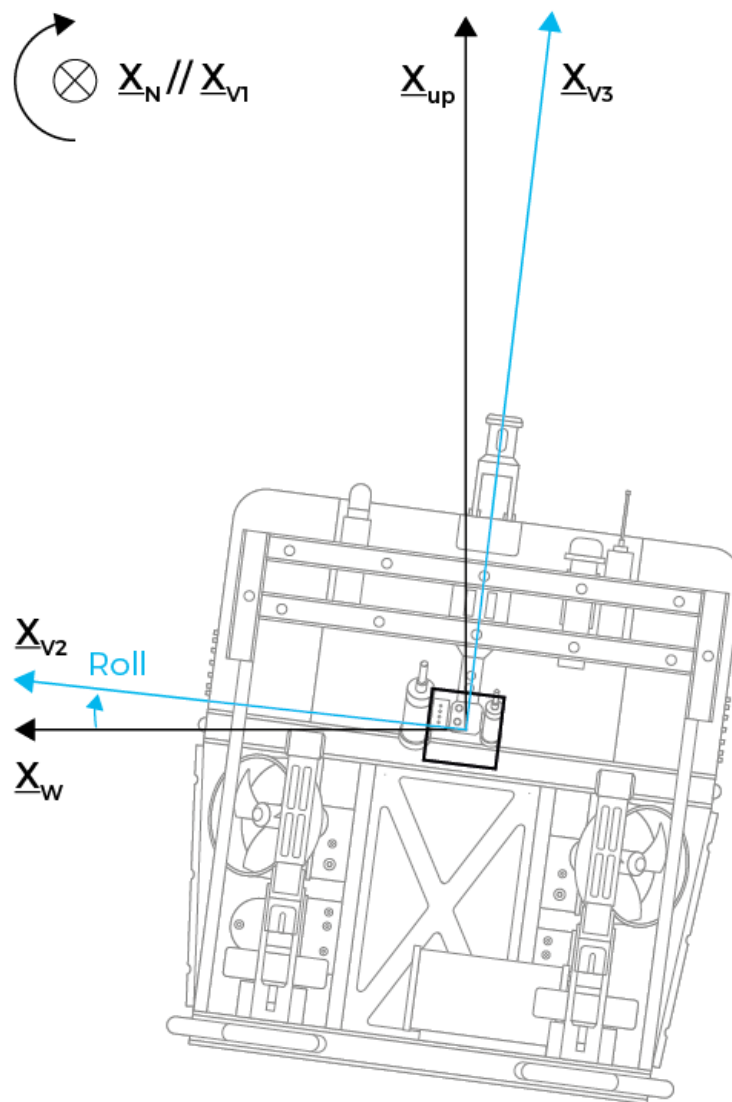


Figure 6 - Definition of the roll angle in case of null heading and pitch, and no misalignment

1.2.3 DEFINITION OF PITCH

Pitch is the angle between the $\underline{X}_{V1}$ subsea vehicle axis and $\underline{X}_{V1h}$.

$\underline{X}_{V1h}$ is the $\underline{X}_{V1}$ axis projection in the local horizontal plane defined by the two vectors $\underline{X}_N$ and $\underline{X}_W$.

Pitch is counted positively from the local horizontal plane to the $\underline{X}_{V1}$ axis when turning counter-clockwise around $\underline{X}_{V2}$.

That means that the **pitch is positive** when the subsea vehicle's bow's front is down.

The Figure 7 gives a simplified description when heading and roll are null, and no misalignment is accounted for.

Pitch varies from -90 up to $+90$ degrees.

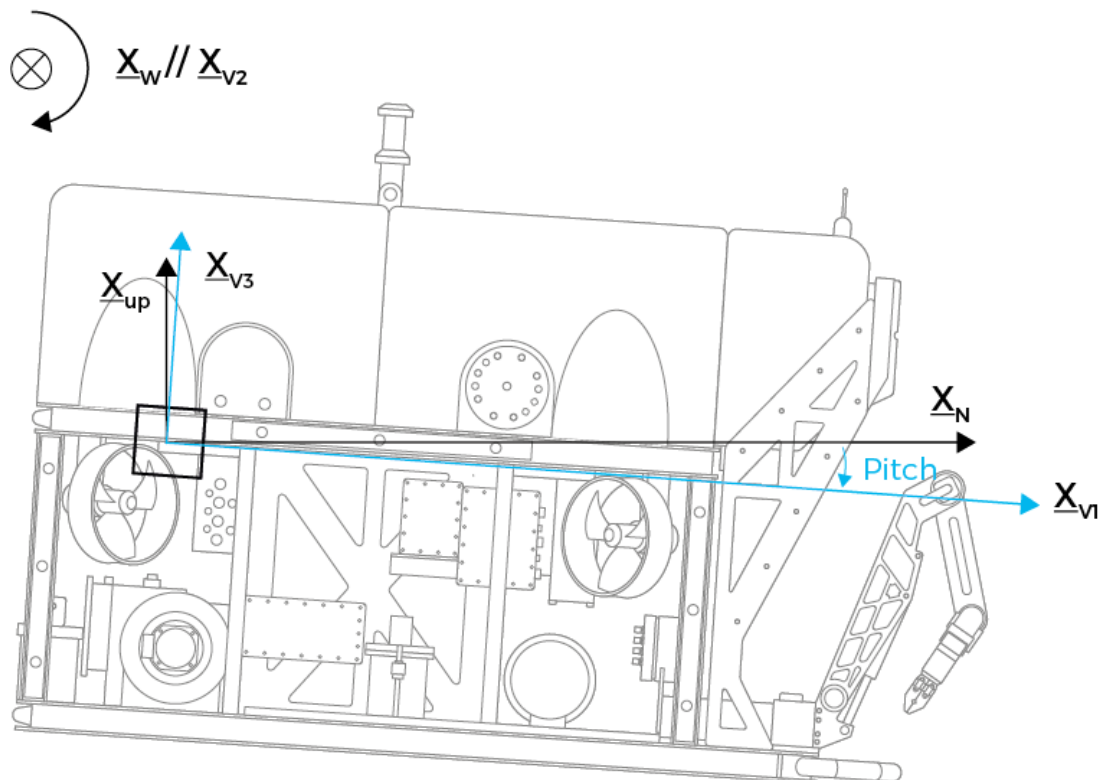


Figure 7 - Definition of pitch angle in case of null heading and roll, and no misalignment

1.3 Position Data

Phins Subsea position is available in usual latitude/longitude/altitude/depth format and in UTM (Universal Transverse Mercator) format.

The reference ellipsoid is WGS 84 ellipsoid.

1.3.1 LATITUDE, LONGITUDE AND ALTITUDE

The conventions are:

Latitude Convention

- Latitude ranges from 0 to 90 degrees:
 - > Northern hemisphere latitudes
 - > Southern hemisphere latitudes

Longitude Convention

- Longitude ranges from 0 to 180 degrees:
 - > Eastern hemisphere longitudes
 - > Western hemisphere longitudes

Altitude Convention

- For altitude (meters): conventions depend on Phins Subsea, on the output protocol settings and the selected altitude mode. Refer to the altitude modes described in the Phins Subsea Operation Guide.

1.3.2 THE UTM COORDINATE SYSTEM

The UTM coordinate system is made up of 60 vertical (north/south) zones starting at 180 degree longitude meridian and wrapping around the earth towards East.

Each zone is 6 degree wide and is numbered from 1 to 60.

The system is further divided into 20 horizontal (east/west) bands starting at -80 degrees south latitude with band labeled 'C' and ending north at +84 degrees latitude with band 'X' (the letters 'I' and 'O' are not used to avoid confusion with numbers).

Inside each UTM zone, the coordinates of a point on the earth are expressed by two values in meters: UTM Northing and UTM Easting.

These coordinates are obtained by local projection of the earth on a cylinder.

This kind of projection ensures that the deformation due to plane projection is minimized.

The UTM Northing and Easting coordinates are always positive.

1.4 Heave, Surge and Sway

Heave

The heave is the altitude of the subsea vehicle referenced to the mean altitude (the average value of heave over a long period of time is always zero). It is obtained by filtering and integrating vertical acceleration.

The heave is counted positively upward along the local vertical axis $\underline{X}_{V3}$, in meters.

For example, heave measurement is used to compensate for vertical movement due to sea waves in multi-beam or sonar imagery or to stabilize the pointing of a turret or an antenna.

Surge

The surge is the forward displacement of the subsea vehicle referenced to the mean position (the mean of the surge over a long period of time is always zero).

The surge is counted positively forward along the $\underline{X}_{VH1}$ axis, which is the projection of the $\underline{X}_{V1}$ axis in the local horizontal plane, in meters.

Sway

The sway is the starboard displacement of the subsea vehicle referenced to the mean position (the mean of the sway over a long period of time is always zero).

The sway is counted positively left along the $\underline{X}_{VH2}$ axis, in meters.

The heave, surge and sway speeds are measured along the same axis as heave, surge and sway.

1.5 Speeds

By default, the linear speeds are displayed in the Web-Based Graphical User Interface in geographic coordinates (North, East and Up), unit is meter per second.

Depending on the output protocol used to obtain data from the inertial product, the speeds can also be obtained in different frames available.

1.6 Rates and Accelerations

Attitude Rates

Attitude rates measure the speed of heading, roll and pitch.

They are expressed in subsea vehicle horizontal frame around axis $\underline{X}_{VH1}$, $\underline{X}_{VH2}$ and $\underline{X}_{VH3}$.

They follow the same convention as attitude (detailed in section 1.2): heading/roll/pitch rate are positive when heading/roll/pitch increase.

Unit: °/s

Rotation Rates

Rotation rates are expressed in subsea vehicle frame around axis $\underline{X}_{V1}$, $\underline{X}_{V2}$ and $\underline{X}_{V3}$.

They are counted positive clockwise when looking in the direction of ($\underline{X}_{V1}$, $\underline{X}_{V2}$, $\underline{X}_{V3}$).

Unit: °/s

Rotation rate resolution is limited to comply with export regulations⁽¹⁾.

Linear Accelerations

Linear accelerations are measured in subsea vehicle frame along $\underline{X}_{V1}$, $\underline{X}_{V2}$ and $\underline{X}_{V3}$ axis.

Unit: m/s²

Resolution is limited to comply with export regulations⁽¹⁾.

Geographic Accelerations

Geographic accelerations are measured in the navigation frame along $\underline{X}_N$, $\underline{X}_W$ and $\underline{X}_{UP}$ axis.

Unit: m/s²

Resolution is limited to comply with export regulations⁽¹⁾.

⁽¹⁾Refer to the Phins Subsea Technical Description to get the limitation of the rotation rate.

1.7 Standard Deviation Data

The standard deviation data are estimations of the uncertainty on the data provided by the inertial product. The standard deviation data readable from Phins Subsea include:

- Estimated uncertainty of the position
- Estimated uncertainty of the speed
- Estimated uncertainty of the Attitude and Heading

These error estimates are based on theoretical error models of accelerometers and gyrometers associated with external sensor errors estimates. They can be used to monitor the quality of the mission but are not accurate physical measurements of actual errors.

1.8 External Sensor Data

The data of all external sensors connected to Phins Subsea can also be displayed and repeated, unmodified, through the Web-Based Graphical User Interface and/or the outputs protocols.

This feature helps monitoring of external sensor (e.g. quality, performances ...), especially in cases they are exclusively connected to the Phins Subsea.

1.9 Misalignment Definition

Misalignments are the angle between the Phins Subsea reference frame and the subsea vehicle frame.

All measurements are default-done in the Phins Subsea reference frame defined by the 3 vectors $\underline{X}_1$, $\underline{X}_2$ and $\underline{X}_3$.

Misalignment angles can be entered by the user to account for any orientation of Phins Subsea with respect to the subsea vehicle. This feature allows you to “virtually rotate” the product, to align its reference frame with subsea vehicle reference frame (usually called “baseline”).

Two types of angular misalignment between the product and the vehicle are considered and described in the following sections: rough misalignment then fine misalignment.

1.9.1 PHINS SUBSEA TO SUBSEA VEHICLE ROUGH MISALIGNMENT (PHINS SUBSEA POSITION AND ORIENTATION)

Phins Subsea can be set at any location and in any orientation with respect to the subsea vehicle.

The Phins Subsea rough misalignment allows roughly aligning the Phins Subsea reference frame ($\underline{X}_1$, $\underline{X}_2$, $\underline{X}_3$) to the subsea vehicle reference frame ($\underline{X}_{V1}$, $\underline{X}_{V2}$, $\underline{X}_{V3}$) by performing Phins Subsea axis inversion.

The axis inversion transforms the Phins Subsea reference frame ($\underline{X}_1$, $\underline{X}_2$, $\underline{X}_3$) into the ($\underline{X}'_1$, $\underline{X}'_2$, $\underline{X}'_3$) frame. This is performed in the Web-Based Graphical User Interface in two steps:

- Orientation of the Product Logo Side.
- Then orientation of the Connectors Side.

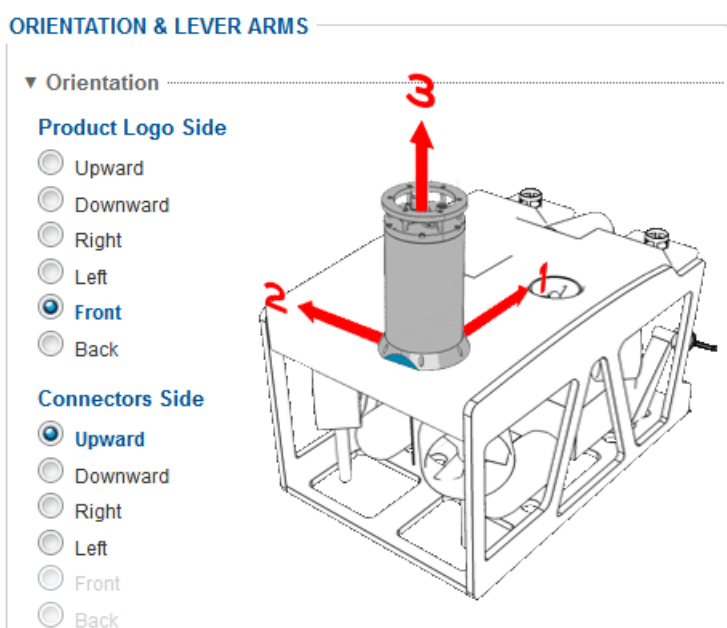


Figure 8 - Phins Subsea orientation in the Web-Based Graphical User Interface

1.9.2 PHINS SUBSEA TO SUBSEA VEHICLE FINE MISALIGNMENT

Once rough misalignment has been taken into account, fine misalignment are determined to correct the residual angular offset between the new Phins Subsea axis ($\underline{X}_1'$, $\underline{X}_2'$, $\underline{X}_3'$) and the subsea vehicle's axis ($\underline{X}_{V1}$, $\underline{X}_{V2}$, $\underline{X}_{V3}$).

This rotational transformation is the product of three plane rotations which are described by the three Euler angles misRoll (roll misalignment), misPitch (pitch misalignment) and misHeading (heading misalignment).

Usually, these residual angular offsets are small as they are due to small angular misalignment of the product with respect to the subsea vehicle.



To align a new Phins Subsea to reference heading, roll and pitch in the subsea vehicle, mainly when one misalignment is greater than 1°, it is recommended to use the excel sheet provided on the product USB flash drive. This table allows to easily compute these misalignment values in order to apply the exact calculation taking into account the sequence of the rotations.

ANGULAR OFFSET CALCULATOR			
"YES" => OCTANS (all generation) or PHINS G3 "NO" => PHINS G2			YES
Actual saved misalignements in MMI			
	Heading (deg) [-180°; +180°]	Roll (deg) [-180°; +180°]	Pitch [-90°; +90°]
AHRS (All Gen.) and INS G3	0,000	0,000	0,000
INS G2	0,000	0,000	0,000
Output readings with above bias			
	Heading (deg)	Roll (deg)	Pitch (deg)
	0,000	30,000	15,000
Reference values that should be output			
	Heading (deg)	Roll (deg)	Pitch (deg)
	0,000	40,000	20,000
New misalignments to be entered in MMI			
	Heading (deg) [-180°; +180°]	Roll (deg) [-180°; +180°]	Pitch [-90°; +90°]

We recommend to do this operation with confirmed metrology laboratory.

However, any angular correction must be taken into account by setting with caution the fine misalignment angles.

Heading Misalignment Bias

The heading misalignment bias (called misheading in the illustration) is the angle between the projection of product $\underline{X}_1'$ axis into the subsea vehicle horizontal plane ($\underline{X}_{V1}$, $\underline{X}_{V2}$) and the subsea vehicle axis $\underline{X}_{V1}$.

In the figure below, the value of the heading misalignment bias to be entered in the Web-Based Graphical User Interface to configure Phins Subsea is positive.

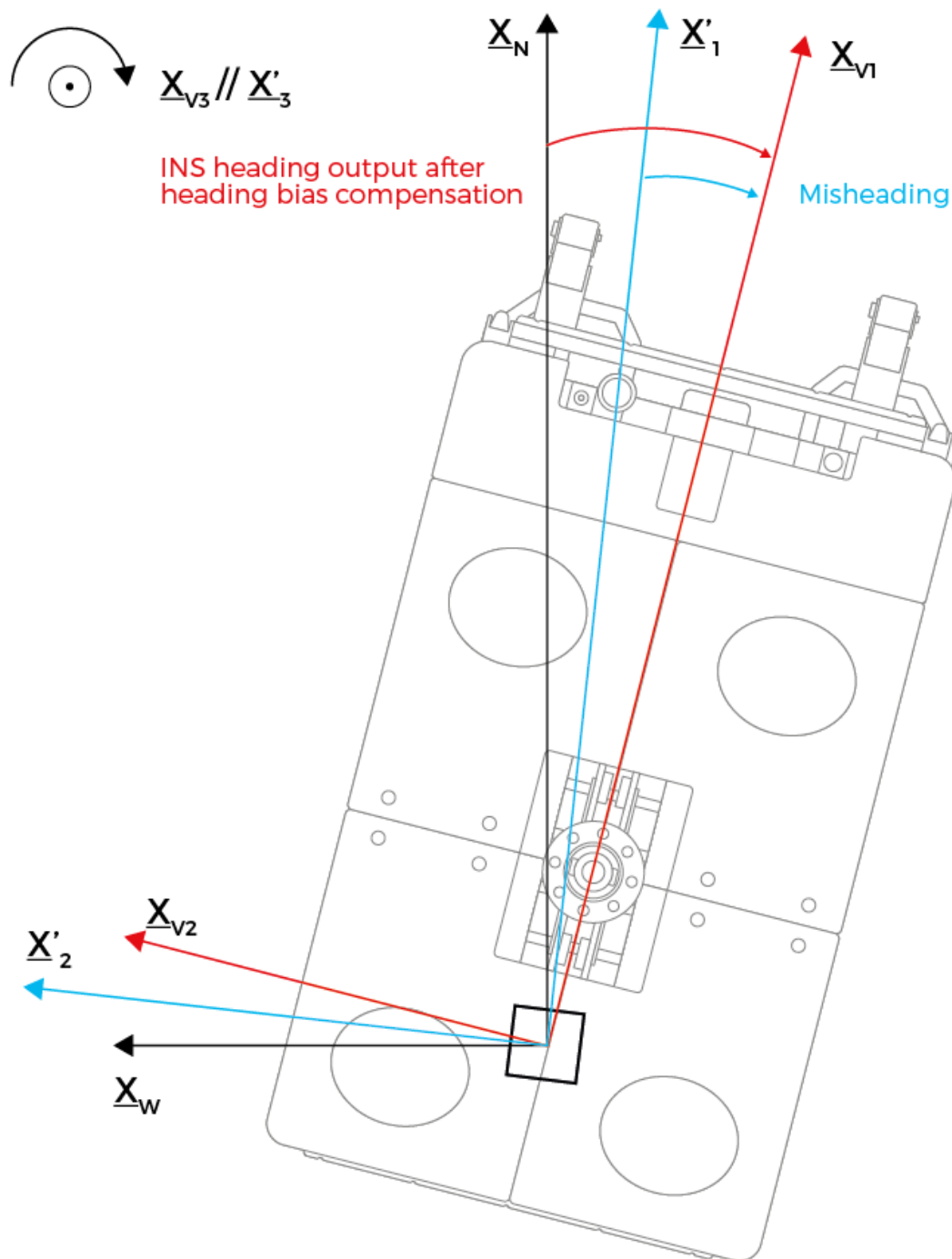


Figure 9 - Heading bias misalignment in case of null roll and pitch

Roll Misalignment Bias

The roll misalignment bias (called misroll in the illustration) is the angle of the rotation around $\underline{X}_1'$ axis which brings $\underline{X}_2'$ axis into the subsea vehicle horizontal plane ($\underline{X}_{V1}$, $\underline{X}_{V2}$).

In the figure below, the value of the roll misalignment bias to be entered in the Web-Based Graphical User Interface to configure Phins Subsea is negative.

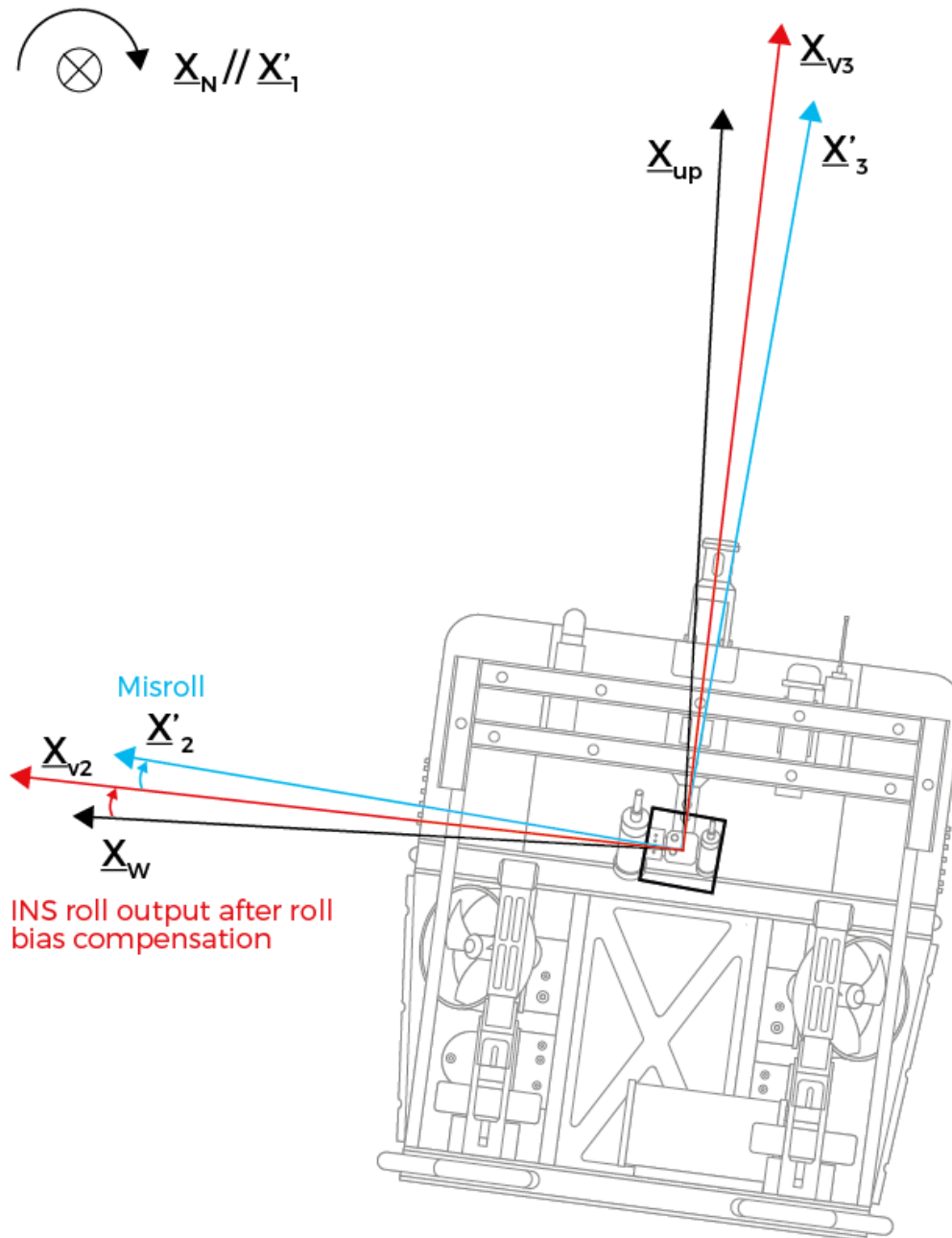


Figure 10 - Roll misalignment bias (in case of null pitch and heading)

Pitch Misalignment Bias

Pitch misalignment bias (called mispitch in the illustration) is the angle between $\underline{X}_1'$ axis and its projection in the subsea vehicle horizontal plane ($\underline{X}_{V1}$, $\underline{X}_{V2}$).

On the figure below, the value of the pitch misalignment bias to be entered in the Web-Based Graphical User Interface to configure Phins Subsea is negative.

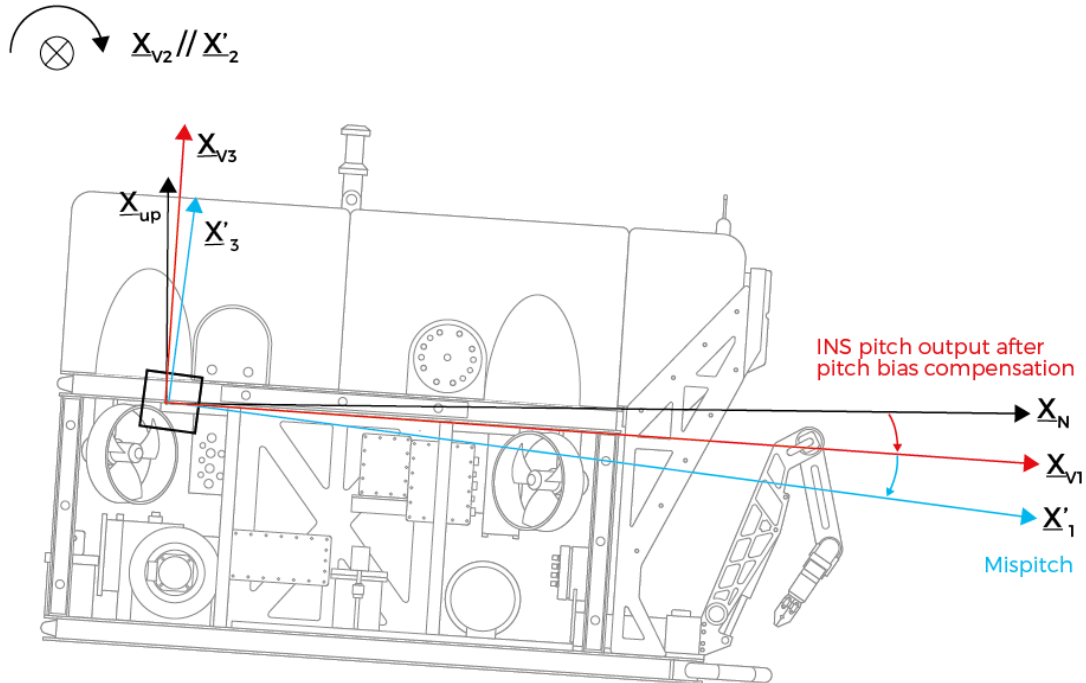


Figure 11 - Pitch misalignment bias in case of null roll and heading

1.9.3 DVL TO PHINS SUBSEA MISALIGNMENT

Phins Subsea can use speed inputs received from external sensors.

When navigating with speed inputs from an external log sensor, the Phins Subsea expects to receive the 3 speed coordinates from the Log sensor in a frame linked to the sensor, without any compensation.

The log sensor reference frame ($\underline{X}_{S1}$, $\underline{X}_{S2}$, $\underline{X}_{S3}$) is either the sensor body frame or the sensor beam frame.

Speed inputs from external Log Sensor are then corrected for angular misalignment between the vehicle reference frame ($\underline{X}_{V1}$, $\underline{X}_{V2}$, $\underline{X}_{V3}$) and the Log Sensor reference frame ($\underline{X}_{S1}$, $\underline{X}_{S2}$, $\underline{X}_{S3}$).

Log Sensor to Phins Subsea misalignment angles are the three Euler angles RS, PS and HS, which allow switching from the vehicle reference frame ($\underline{X}_{V1}$, $\underline{X}_{V2}$, $\underline{X}_{V3}$) to the Log Sensor reference frame.

These angles are defined in the figure below, where Rs is positive, Ps is negative and Hs is positive. Rs and Ps define the misalignment between the Log Sensor horizontal plane and the product horizontal plane. These angles are generally quite small.

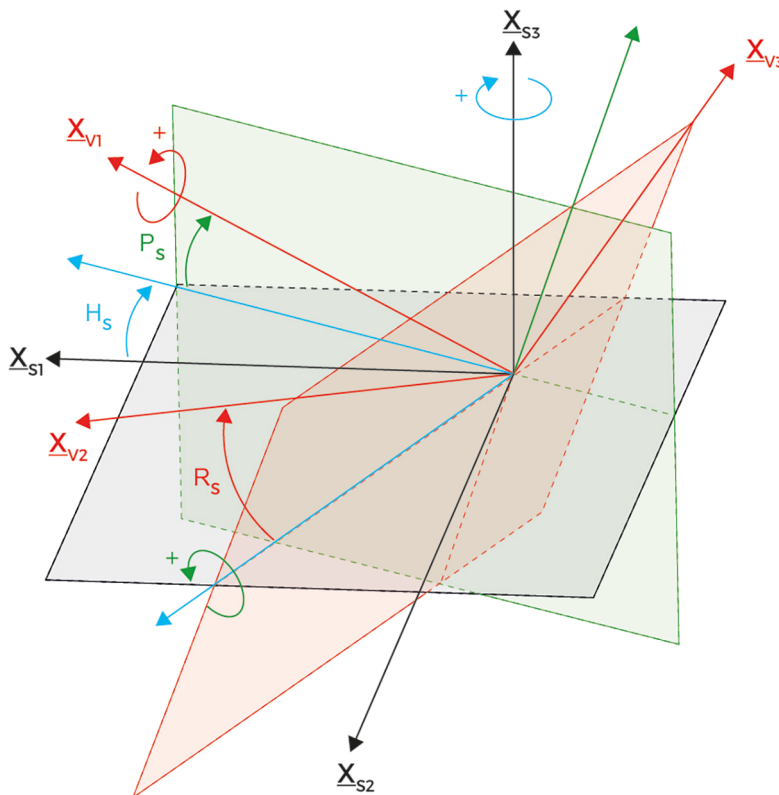


Figure 12 - Definition of Log sensor to Phins Subsea misalignment

1.10 Output Lever Arms

Lever arms are 3 distances along $\underline{X}_{V1}$ / $\underline{X}_{V2}$ and $\underline{X}_{V3}$ that allow transferring data from one point to another one.

Lever arms are used in 3 occasions.

- Phins Subsea is able to calculate the motion of several external monitoring points (one main and three secondary)
- Data calculated by the Phins Subsea is done at the location of the reference point P (center of measurement of the unit)
- Data are applied to the lever arms. Only position and speed are affected by the lever arms

You can also define 3 secondary lever arms in order to use the data at an alternative position for specific requirement. The selection of the lever arm is made in the output configuration. Data on the Web-Based Graphical User Interface is located at the main lever arm location.

The lever arm (of the main Monitoring Point, of the three secondary ones, of the external sensor, and of the Center of gravity of the Phins Subsea) is represented by three coordinates Length L_{V1} , Length L_{V2} , Length L_{V3} defining the position of external monitoring point M in the $(\underline{X}_{V1}, \underline{X}_{V2}, \underline{X}_{V3})$ subsea vehicle's axes.

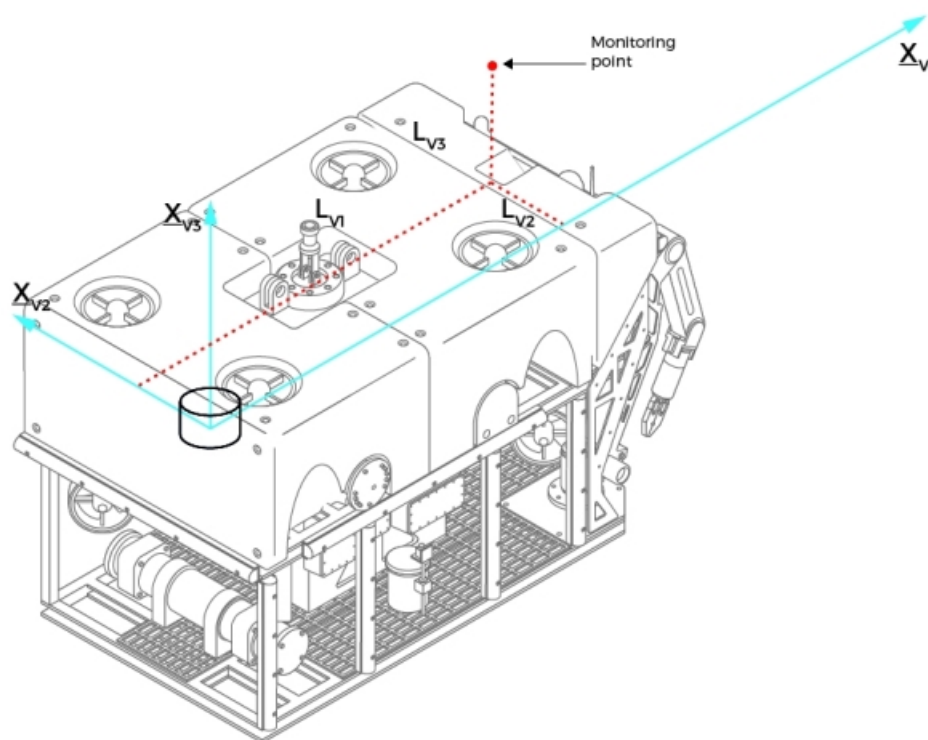


Figure 13 - Definition of Lever Arm

1.11 Center of Gravity (CoG) Lever Arms

Center of Gravity (CoG) lever arm is useful for marine vehicles because a way to avoid the effect of transient Phins Subsea movement is to indicate the COG position by entering lever arms between the unit and the COG of the subsea vehicle.

It is useful only in case of heave, surge and sway being used.

Refer to the Application Note - Installation and Configuration of AHRS and INS for Seabed Mapping Measurements to get more details.

2 Process to install and enable the system

The following diagram presents all the steps to install and configure Phins Subsea in standard installation with Ethernet connection.

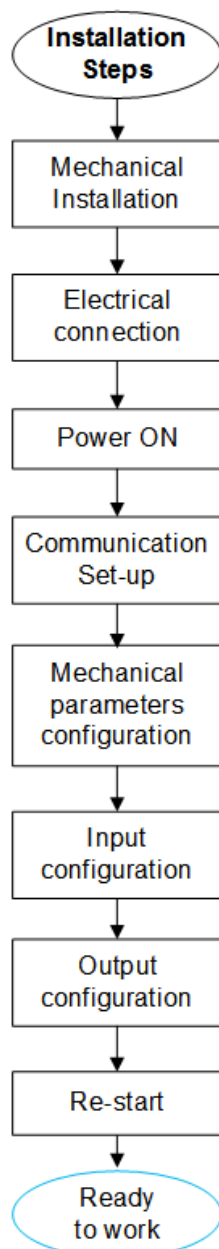


Figure 14 - installation steps

3 Installing the Phins Subsea

3.1 Preparing the Phins Subsea Setup

Before installing and cabling the Phins Subsea, we recommend to prepare the Phins Subsea architecture diagram (power supply, external sensors,...) and by gathering all necessary information:

- Misalignment
- Lever arms
- Center of gravity
- External sensor lever arms
- Type of external sensor and its protocol
- What message, frequency, type of connection, baudrate

All this information could be typed in the Setup Forms file available on the Phins Subsea flash drive.

3.2 Pack content verifying

You will find in the shipping case a Packing List detailing all the items delivered.

However, we recommend checking the equipment of the pack immediately after reception.

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

Phins Subsea



Power supply block



AC cord cable



SEACON 12 pin
Ti C/D/E Pigtail



SEACON 19 pin
Ti Ethernet Pigtail



SEACON 26 pin
Ti A/B Central Pigtail



19 pin Test Ethernet Cable



SEACON 26 pin
Pressure Cap



SEACON 12/19 pin
Pressure Cap



O-Ring kit



O-Ring insertion Tool
for SEACON 12/19 pin



O-Ring insertion Tool
for SEACON 26 pin



3.3 Mechanical Installation

Refer to Phins Subsea Technical Description to get details on Phins Subsea reference frame (P).

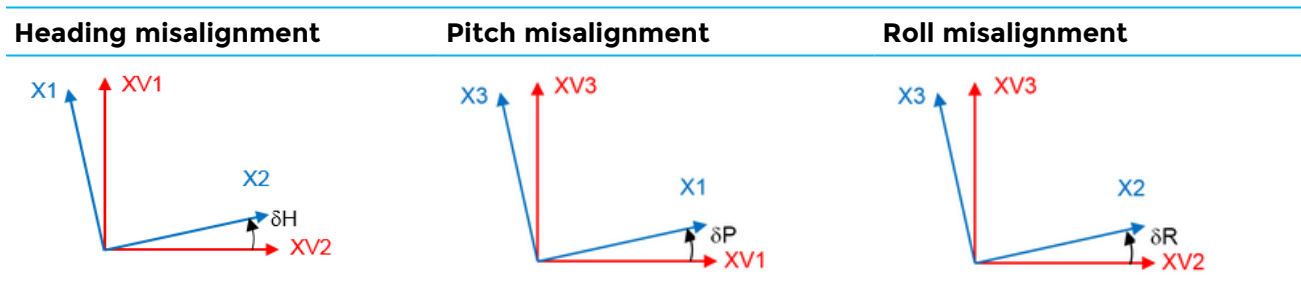
3.3.1 PHINS SUBSEA LOCATION REQUIREMENTS

Phins Subsea can be installed in any position or orientation but its location on board of the subsea vehicle should be chosen taking into account the following recommendations.

- It is recommended to mount the unit on a solid and very stable location (linked to the main subsea vehicle beams) and not too far from the navigation data monitoring point in order to limit the impact of the structure's flexure. Do not put it on a thin wall that can be deformed for instance.
- As far as possible it is recommended to move the unit (accurate measuring instrument) away from equipment potentially disrupting: vibration (e.g.: motors), electromagnetic perturbation (e.g.: electric power systems), high temperature variations (e.g. : radiators), etc.
- Ideally keep a point of aim for alignment sessions on the subsea vehicle.

3.3.2 ALIGNMENT OF PHINS SUBSEA TO SUBSEA VEHICLE REFERENCE FRAME

When Phins Subsea is installed on the subsea vehicle, the misalignment of the Phins Subsea reference frame must be measured with respect to the subsea vehicle reference frame as shown below.



XV1, XV2, XV3: subsea vehicle reference frame.

X1, X2, X3: Phins Subsea reference frame.

Important

The alignment of Phins Subsea to subsea vehicle reference frame must be performed by a professional surveyor.

3.3.3 EXTERNAL SENSOR LEVER ARM

Lever arms values must be measured and entered into the system.

The lever arms are a point coordinates expressed in the vehicle reference frame.

Errors on lever arms have two main possible impacts:

- Error on absolute position calculated by Phins Subsea due to lever arm error with external sensor.
- If lever arms are not sufficiently accurate with respect to GNSS accuracy the Phins Subsea can reject the external sensor when the subsea vehicle is performing accelerations or gyrations.

To avoid that, order of magnitude of lever arm accuracy should be 1/10 of required absolute accuracy. For example if you want to position the subsea vehicle with a 1-meter accuracy, your GNSS lever arms should be measured with a 10-cm accuracy.

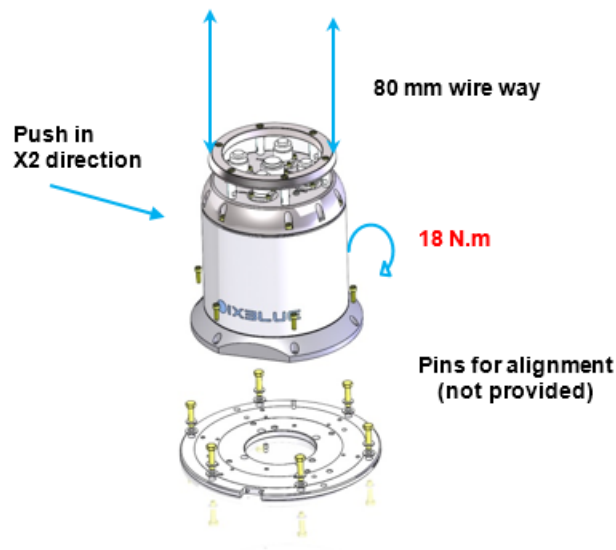
As an example we present accuracy of GNSS lever arm with respect to GNSS accuracy:

GNSS Mode	Standard deviation on position	Accuracy required on lever arm measurement
RTK GNSS	5 cm	5 mm
DGNSS	1 m	10 cm
NATURAL GNSS	10 m	1 m

3.3.4 INSTALLATION PROCEDURE

In this installation, we assume that Phins Subsea is aligned with respect to the subsea vehicle reference frame (XV1, XV2, XV3). Refer to section 1 to get details on the conventions.

1. Fasten Phins Subsea on board using six screws (not part of standard delivery).
In case of installation with alignment pins (e.g. with DVL) it is recommended pushing Phins Subsea against the pins in X2 direction while securing the screws to insure best mounting repeatability.



2. Measure the misalignment and the lever arms.

3.4 Electrical installation

3.4.1 PHINS SUBSEA ELECTRICAL INTERFACE OVERVIEW

Connectors are available on the connector panel of Phins Subsea. These connectors are referenced and identified by markings on the unit. They are all different and fool-proof to avoid any misconnection.

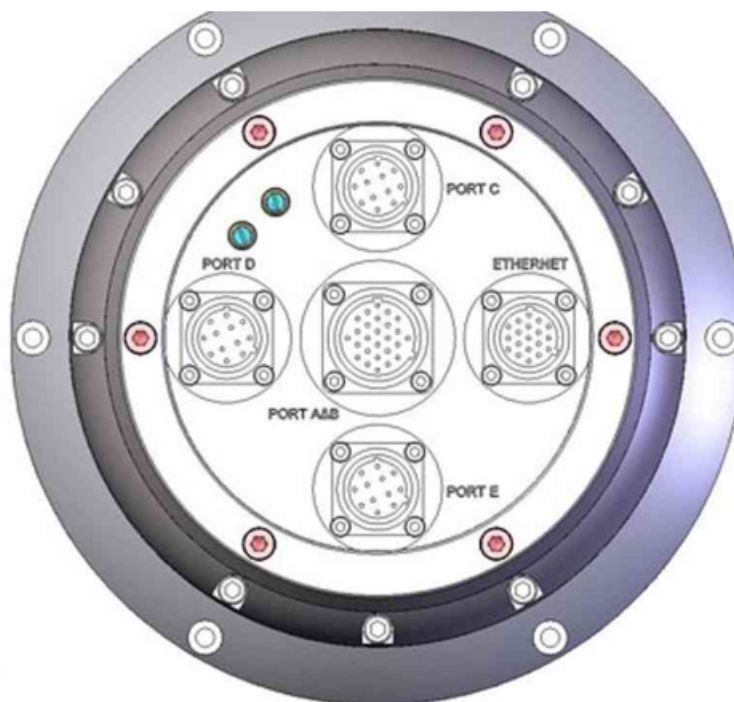


Figure 15 - Phins Subsea connector panel



Do not use two power supplies on the main connector (A&B) and the secondary (Ethernet) in order to prevent product damage.

3.4.2 PRE-REQUISITES

Tools

The person in charge of the wiring must have a standard tool box with equipment in good working condition and a soldering iron with tin for the Phins Subsea connectors (power and digital).

Preparation

The person in charge of the wiring must verify that all cables are present with enough cable length to ensure that the connections are possible.

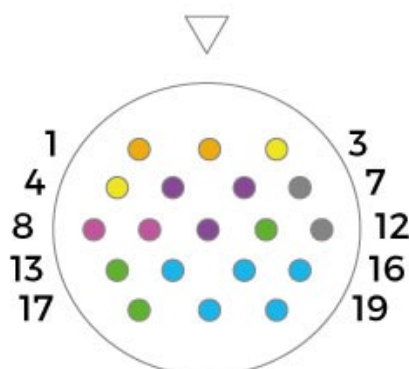
Cabling



It is recommended to use shielded twisted pairs for RS232, RS422 and Pulse communication lines. If you do not use shielded twisted pairs you might encounter cross talk effect. Associate the correct wire with the correct pin position.

3.4.3 ETHERNET CONNECTOR

The Phins Subsea Ethernet connector is a SEACON MINK-FCR, size K 19#22 (19 pins). Refer to the following figure for the corresponding wiring.



PIN	SIGNAL
1	Ext sensor 1 In (+V1)
2	Ext sensor 1 In GND (0/+V1 V) (*)
3	Ext sensor 2 In (+V2)
4	Ext sensor 2 In GND (0/+V2 V) (*)
5	Repeater: RS232 TX(+)
6	Repeater RS232 RX(+)
7	Ext Pulse IN + (***)
8	Phins Subsea Power In (+24 V)
9	Phins Subsea Power In GND (0/24 V) (*)
10	Repeater: GND_R (**)
11	Pulse B: OUT TTL
12	Ext Pulse IN -
13	GND_B
14	Shield Ethernet
15	Ethernet TX(+)
16	Ethernet TX(-)
17	Pulse B: IN TTL
18	Ethernet RX(+)
19	Ethernet RX(-)

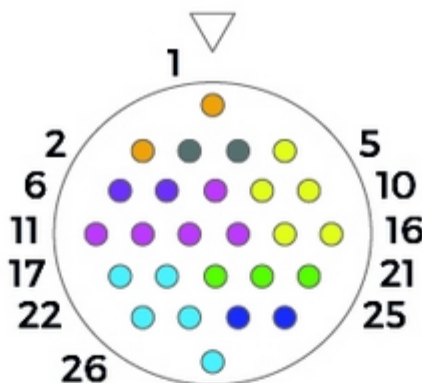
Figure 16 - Ethernet connector pin definition

(*) Phins Subsea and Ext sensor 1 (resp.2) power lines are insulated from each other. Ext sensor 1 (resp. 2) pins of every connector are linked together. If Ext sensor 1 (resp. 2) is powered from 19-pin connector this voltage will be present on 26-pin and 12-pin connectors.
(**) Serial GND and Pulse GND are common for a given port (i.e., GND_A for port A, GND_R for repeater port).

(***) The external trigger lines are insulated. They can be used for example to trigger acoustic emission of a DVL connected to the Phins Subsea. These lines are connected to the external trigger lines of the other connectors to dispatch the signal.

3.4.4 PORT A&B CONNECTOR (CENTRAL CONNECTOR)

Phins Subsea central connector is configured as shown in the following figure.



PIN	SIGNAL
1	System Power In (+24 V)
2	System Power In GND (0/24 V)
3	Ext sensor 1 In (+V1) (*)
4	Ext sensor 1 In GND (0/+V1 V) (*)
5	Repeater: GND_R (**)
6	Ext sensor 2 In (+V2)
7	Ext sensor 2 In GND (0/+V2 V) (*)
8	Port A: GND_A (**)
9	Repeater: RS422 TX (+)(B) / RS232 TX (+)
10	Repeater: RS422 TX (-)(A)
11	Port A: RS422 TX (+)(B) / RS232 TX (+)
12	Port A: RS422 TX (-)(A)
13	Port A: RS422 RX (-)(A) / RS232 RX (+)
14	Port A: RS422 RX (+)(B)
15	Repeater: RS422 RX(-)(A) / RS232 RX(+)
16	Repeater: RS422 RX(+)(B)
17	Port B: RS422 TX(+)(B) / RS232 TX(+)
18	Port B: RS422 TX(-)(A)
19	Pulse A : OUT TTL
20	Pulse A: IN TTL
21	Pulse A: GND_A (**)
22	Port B: RS422 RX(-)(A) / RS232 RX(+)
23	Port B: RS422 RX(+)(B)
24	Ext Pulse IN + (***)
25	Ext Pulse IN -
26	Port B: GND_B(**)

Figure 17 - Central connector

(*) Phins Subsea and Ext sensor 1 (resp.2) power lines are isolated from each other.

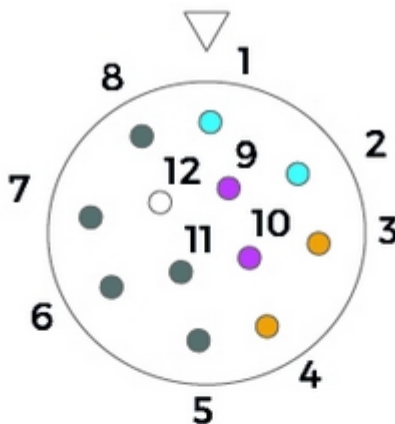
Ext sensor 1 (resp. 2) pins are linked together. If Ext sensor 1 (resp. 2) is powered from 19 pin connector this voltage will be present on 26 pin and 12 pin connectors.

(**) Serial GND and Pulse GND are common for a given port (i.e., GND_A for port A, GND_R for repeater port).

(***) The external trigger lines are isolated. They can be used for example to trigger acoustic emission of a DVL connected to the Phins Subsea.

3.4.5 PORT X (X BEING C, D OR E) CONNECTOR

Phins Subsea Port X connector is configured as shown in the following figure.



PIN	SIGNAL
1	Ext sensor 1 Out (+V1)
2	Ext sensor 1 Out GND (0/+V1 V) (*)
3	Ext sensor 2 Out (+V2)
4	Ext sensor 2 Out GND (0/+V2 V) (*)
5	Port X: RS422 TX(+)(B)/RS232 TX(+)
6	Port X: RS422 TX(-)(A)
7	Port X: RS422 Rx(-)(A) / RS232 Rx(+)
8	Port X: RS422 Rx(+)(B)
9	Ext Pulse OUT + (***)
10	Ext Pulse OUT -
11	Port X: GND_X (**)
12	Reserved except if X=C : Pulse C: IN TTL (****)

Figure 18 - Port X connector

(*) Phins Subsea and Ext sensor 1 (resp.2) power lines are isolated from each other.

Ext sensor 1 (resp. 2) pins are linked together. If Ext sensor 1 (resp. 2) is powered from 19 pin connector this voltage will be present on 26 pin and 12 pin connectors.

(**) Serial GND and Pulse GND are common for a given port (i.e., GND_A for port A, GND_R for repeater port).

(***) The external trigger lines are isolated. They can be used for example to trigger acoustic emission of a DVL connected to the Phins Subsea.

(****) Pulse C only on Port C, Pin 11 common for Pulse and Port C.

3.4.6 PHINS SUBSEA POWER NETWORK

Phins Subsea is equipped with two external sensor power circuitry, see figure below. They are dedicated to supply power to external sensors, such as DVL or Depth Sensor, which are connected directly to the Phins Subsea. The principle is to use a single cable/connector between ROV control unit/bottle and Phins Subsea. This cable would have to handle three power supplies: Phins Subsea, External Sensor 1 and External Sensor 2. The two last are wired to satellite connectors to power individually each external sensor.

Phins Subsea power network is configured as shown in the following figure.

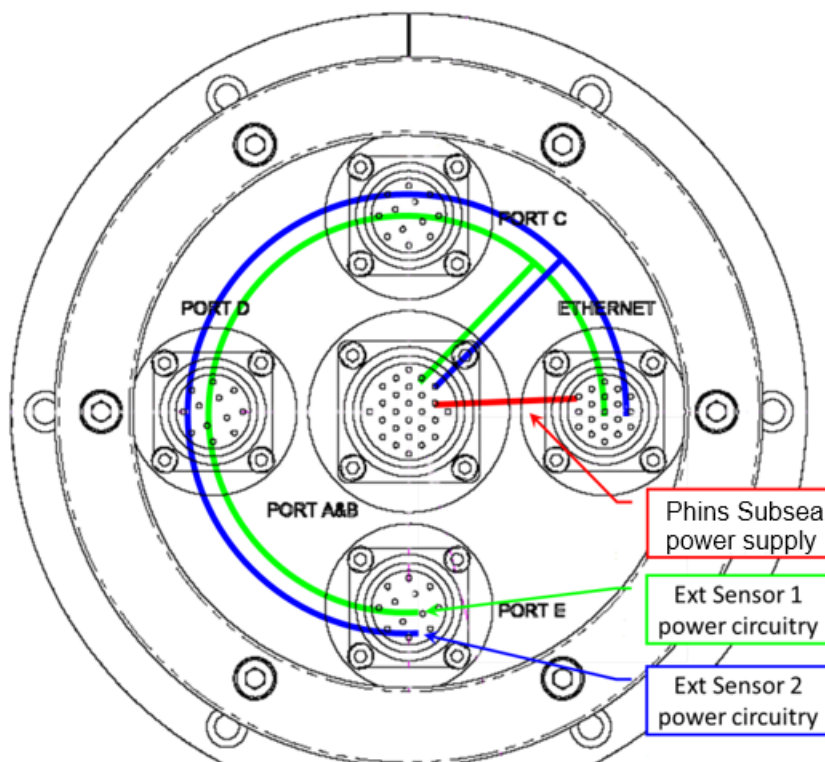


Figure 19 - Power network for the external sensors

To power external sensors to power circuitry can be used:

- with external sensor 1 connected:
 - > on pin 3 and 4 of central connector
 - > or on pin 1 and 2 of Ethernet connector
- with external sensor 2 connected:
 - > on pin 6 and 7 of central connector
 - > or on pin 3 and 4 of Ethernet connector

On these pins, the total maximum current is 3 A and the maximum voltage is 250 V.

3.4.7 CONNECTING PHINS SUBSEA

iXblue recommends to install and connect Phins Subsea in the Ethernet configuration.



It is very important to screw the connectors tight. You might feel resistance, make sure it is tightly screwed otherwise the sealing is not guaranteed.

If one of the connectors is not used, keep the cabochon on.

Important

The electrical ground is different from the mechanical ground.

It is strongly advised against connecting Phins Subsea directly to the subsea vehicle battery.

It is recommended to use a dedicated power supply for instrumentation:

1. stable and filtered out from noise.
2. to prevent loss of current. When it is lost, the alignment must start again.

An added UPS may avoid any issue and secure the whole system.

1. Connect the Ethernet cable to the computer.

2. Connect GNSS sensor to Phins Subsea.

3. Connect the power supply to Phins Subsea: the alignment starts.



There is no ON/OFF switch on the Phins Subsea.

As soon as Phins Subsea is powered on, it starts its alignment procedure.

4 Connecting to the Web-Based Graphical User Interface

4.1 Connecting Phins Subsea directly to a PC/Laptop

A PC/Laptop can be connected directly to Phins Subsea for configuration purposes as well as for data insertion and extraction (data in/out).

Equipment required

- 1 x PC or Laptop (with an unused Ethernet port)
- 1 x Cat 3/Cat 5 Cross Ethernet Cable (with new PC Generation, it is possible to use a straight cable. The PC then manages the pin inversion)
- Internet browser on the PC (Mozilla Firefox)

Setting up the PC

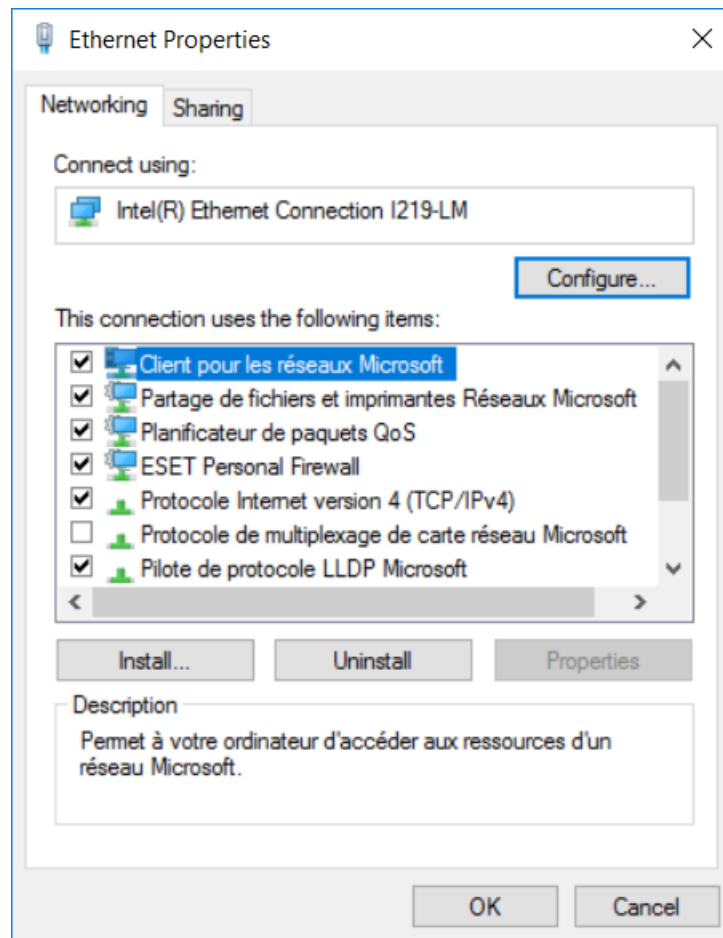
By default, Phins Subsea is already assigned with an IP address. When connecting only one PC to Phins Subsea, it is only necessary to configure the PC to adapt to Phins Subsea default IP configuration.

The Phins Subsea factory default IP address is set to 192.168.36.1XX where XX are the last two digits of the serial number.

Phins Subsea serial number is available on the Phins Subsea label on the product.

Assuming that Phins Subsea has a serial number of PH-1234, the last two digits of the serial number is the number 34 and therefore its factory default IP address would be: 192.168.36.134

-
1. Access to Network Connections Window
 - For Windows 7: open Network Connections by clicking the **Start** button, clicking **Control Panel**, clicking **Network and Internet**, clicking **Network and Sharing Centre**, and then clicking **Manage network connections**.
 - For Windows 10: in Search windows, type Control Panel. Click **Control Panel**, click **Network and Internet**, click **Network and Sharing Centre**, and then click **Change Adapter Settings**.
-
2. Right click on **Local Area Connection** icon and select **Properties**.
The Local Area Connection Properties window opens:



3. Double click on **Internet Protocol (TCP/IPv4)** label text.
The Internet Protocol (TCP/IP) Properties window displays.
4. Select the option **Use the following IP address** and enter **192.168.36.1** for the IP address field and **255.255.0.0** for the Subnet mask. Leave the **Default gateway** and **DNS server addresses** blank.
5. Click on the **OK** button to validate the modifications.



The IP address used here takes into account that Phins Subsea is using its default configuration with its serial number XXXX-1234. You may change its IP address and subnet mask. In either case, the subnet mask of both the PC and Phins Subsea should be the same.

4.2 Launching the Web-Based Graphical User Interface

4.2.1 REQUIRED ENVIRONMENTS

The Web-Based Graphical User Interface has been optimized and qualified on the ESR 78 version of the Firefox browser.

Important

It is highly recommended to update your workstation with the Phins Subsea USB flash drive provided with your product and to disable the automatic updates of these software.

4.2.2 WEB-BASED GRAPHICAL USER INTERFACE VERSION

The Phins Subsea user manuals are applicable from the following software version:

- Pack Name: INS_Pack_12_3_4
- DSP Firmware Version: FrmWDSP4_INS_6_43_5_11
- CINT Firmware Version: : FrmWCINT_INS_6_55_3_1_11

The software versions are displayed on the Web-Based Graphical User Interface by clicking on the Maintenance menu.



Please check the pack name of your unit. Contact iXblue if your pack name is inferior to the pack name displayed above.

4.2.3 LAUNCHING THE WEB-BASED GRAPHICAL USER INTERFACE

In order to configure or operate Phins Subsea:

- Phins Subsea must be connected to a PC through the Ethernet.
- the Web-Based Graphical User Interface must be launched with the product powered on.

Connecting on a Workstation

The Phins Subsea Web-Based Graphical User Interface is launched from the Web browser hosted on the workstation. Its default URL address is 192.168.36.1xx, xx being the two last numbers of the product serial number:



Figure 20 - Example of default URL for Phins Subsea with serial number ending by 22

Connecting on a mobile device

Supports only Wi-Fi connection.

A Wi-Fi router must be connected to the network to which Phins Subsea is connected. With the mobile device, connect to the product network.

Once the connection has been established, enter the IP address of Phins Subsea to launch the Web-Based Graphical User Interface.

Web-Based Graphical User Interface starting process

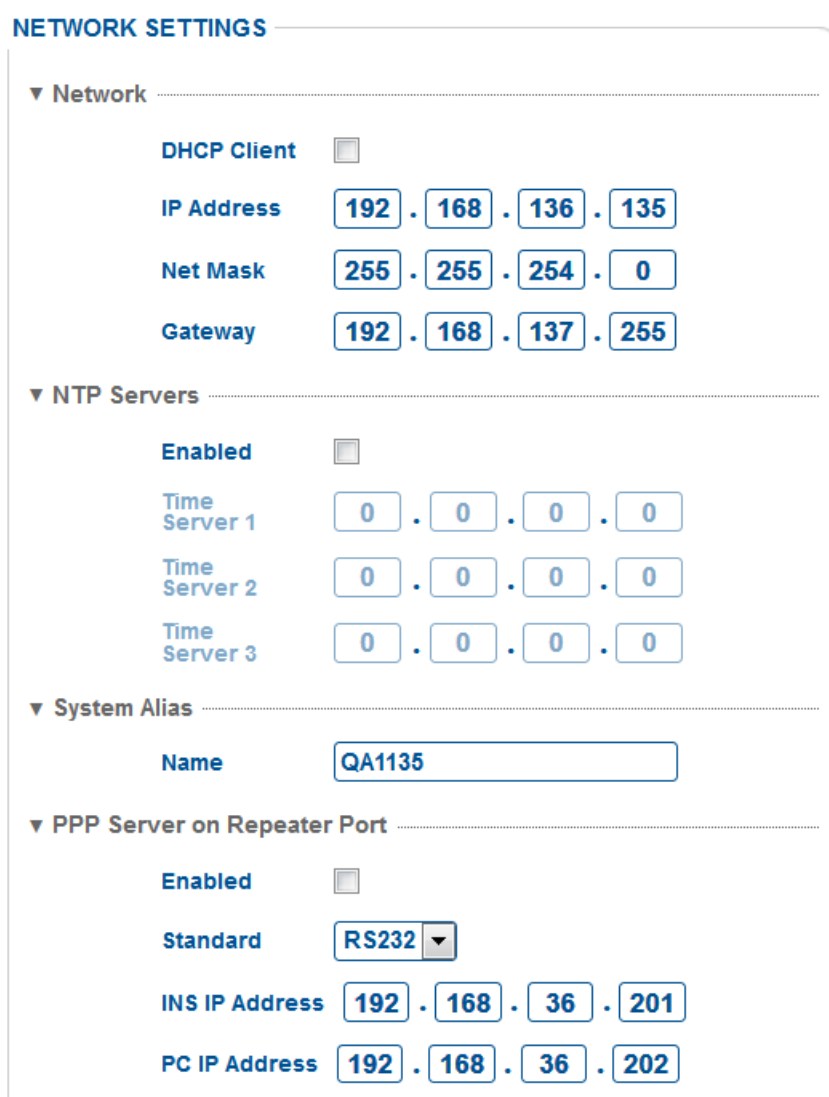
In both cases, during the first seconds the logo is flashing grey-blue indicating that the Web-Based Graphical User Interface is loading the internal configuration of the Phins Subsea. Then the logo turns blue, showing that the alignment sequence of Phins Subsea is starting, refer to Phins Subsea Operation Guide to get details about the start-up phases.

4.3 Configuring the link between a PC and Phins Subsea with the Web-Based Graphical User Interface

This chapter describes how to configure the link between a PC and Phins Subsea when the product is directly connected to a PC/laptop or when it belongs to an Ethernet network.

The following procedure helps you to set up the default configuration.

1. Click on **Installation** menu then select **Network** option. The following window is displayed with the Phins Subsea network parameters.



NETWORK SETTINGS

▼ Network

DHCP Client ☐

IP Address 192 . 168 . 136 . 135

Net Mask 255 . 255 . 254 . 0

Gateway 192 . 168 . 137 . 255

▼ NTP Servers

Enabled ☐

Time Server 1 0 . 0 . 0 . 0

Time Server 2 0 . 0 . 0 . 0

Time Server 3 0 . 0 . 0 . 0

▼ System Alias

Name QA1135

▼ PPP Server on Repeater Port

Enabled ☐

Standard RS232 ▼

INS IP Address 192 . 168 . 36 . 201

PC IP Address 192 . 168 . 36 . 202

2. Under **Network** area, select then enter the following parameters:
 - **DHCP Client:** check box to activate DHCP client.
When the check box DHCP Client is selected: the product starts up in DHCP mode. If it has not found an address or a DHCP server after one minute, it starts up with the IP Address defined in the IP address field.

When the check box DHCP is unselected: the product starts up with the last IP Address defined in the IP address field.

- **IP Address:** this is the IP address of the Web-Based Graphical User Interface
- **Net Mask:** this is the common network mask address

3. Under **NTP Servers** area, you can enable and setup 3 time servers which allow you to synchronize the Phins Subsea with the time of the NTP server:

▼ **NTP Servers**

Enabled ☒

Time Server 1	92	.	143	.	15	.	26
Time Server 2	92	.	243	.	3	.	48
Time Server 3	93	.	25	.	56	.	48

- **Enabled:** check box to enable the NTP server. The NTP time is only used if there is no UTC synchronization or if it is lost for 10 s.
You can configure up to 3 NTP servers.
- **Time Server 1:** this is the IP address of the NTP Server number 1
It has priority over the Time Server 2. If it is not available Time Server 2 takes priority.
- **Time Server 2:** this is the IP address of the NTP Server number 2
It has priority over the Time Server 3. If it is not available Time Server 3 takes priority.
- **Time Server 3:** this is the IP address of the NTP Server number 3

The address of the NTP server must be within the range defined by the subnet mask. For example if the address of the Phins Subsea is 192.168.36.100, and the subnet mask is 255.255.0.0, then a valid address for the NTP server must be in the format 192.168.X.Y. where X is a number between 0 and 255 and Y is a number between 0 and 254. The subnet mask defines the IP range addressable by the Phins Subsea.

The NTP server must be a stratum 3 server maximum. If stratum > 3, the Phins Subsea refuses to connect to the NTP server because it considers that the distributed time is not precise enough.

When Phins Subsea is connected to the NTP server the **NTP synchro** status is displayed on the control page of the Web-Based Graphical User Interface. The date and time of the NTP server is then displayed in the Time data of the navigation data menu.

Important: as soon as the UTC synchronization is done (with or without PPS), the NTP is no more used as time system. The status becomes **NTP received**.

To use again the Time server as time system, just uncheck the GNSS and UTC inputs in the Input menu. Wait for about 10 s to get the NTP synchronization again.

4. Under **System Alias** area, enter the name:
 - **Name:** you can define an alias (Name) for your Phins Subsea IP address to avoid using IP address to launch the Web-Based Graphical User Interface for example or to distinguish easily the starboard (right) and port side (left) product if necessary. This Name appears in the events viewer page.

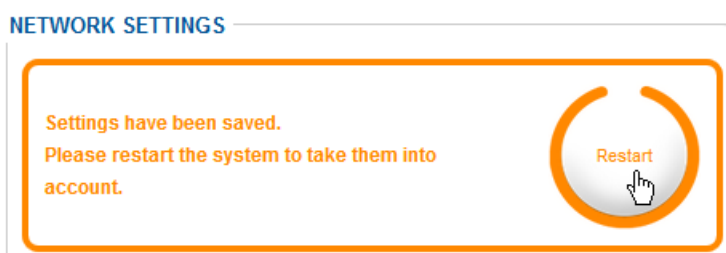
5. Under **PPP Server** area: for using the repeater with PPP server (=Point to Point Protocol)
 - **Enabled** to launch the Web-Based Graphical User Interface via the serial link. When the check box Enabled is selected, the product will start a PPP server listening on repeater serial port at next reboot. When this option is disabled (default), the repeater port outputs PHINS STANDARD protocol.
 - **Standard**: to choose between an RS232 or RS422 serial link
 - **INS IP Address**: by default it is 192.168.100.201
 - **PC IP Address**: by default it is 192.168.100.202

The PC IP address is used in case of the PC is connected to two different inertial units. In this case there must be a different IP address on the PC for each PPP interface.

For example:

192.168.200.1 on the PC PPP link 1 and 192.168.200.2 on the first Phins Subsea
 192.168.200.3 on the PC PPP link 2 and 192.168.200.4 on the second Phins Subsea connected to the PC.

6. Click on the **OK** button to save the modification. Then the following message is displayed on the top of the window:



7. Click on **Restart** button to take the network parameters into account.

If you want to keep the Phins Subsea in its default configuration, just change the IP address on the PC.

The PC IP address must be taken from the same subset as the IP address configured in the product; the subnet mask of both PC and product should be the same.

Important

When you change the Phins Subsea IP address, carefully note down the new IP address, otherwise you may not be able to connect to the system through the Web-Based Graphical User Interface.

Default Configuration

- Enabled (PPP server): **OFF**.
- DHCP Client: **OFF**.
- IP address:
 - > Default address is 192.168.36.1xx for communication through the Ethernet link (xx being the last two number of the INS serial number)
 - > Default address is 192.168.36.201 for communication through the serial link
- Network mask address: 255.255.0.0
- Gateway: by default, it is the Phins Subsea IP address.

5 Configuring the Phins Subsea



Setup forms are available in the installation excel file on the Phins Subsea flash drive.

It is important to fill these forms in order to setup the Phins Subsea parameters in the Web-Based Graphical User Interface.

5.1 Configuring the Mechanical Parameters

This chapter deals with:

- The definition of the Phins Subsea orientation with respect to the subsea vehicle rough misalignment
- The definition of the remaining roll, pitch and heading fine misalignment between the Phins Subsea and the subsea vehicle
- The definition of primary and secondary lever arms
- The definition of the Center of Gravity (COG) for the subsea vehicle (heave computation)



The configuration of rough misalignment is mandatory.

1. In the Web-Based Graphical User Interface, click on the **INSTALLATION** menu then select **MECHANICAL PARAMETERS**.

2. The **Orientation** area allows you to configure the Phins Subsea to the subsea vehicle orientation.

The orientation is used when the product axes orientation is different from subsea vehicle axes orientation (displayed in red), with 90 degrees rotations of any of the product axes with respect to the subsea vehicle axes.

ORIENTATION & LEVER ARMS

▼ Orientation

Product Logo Side

☒ Upward

☐ Downward

☐ Right (starboard)

☐ Left (port side)

☐ Front (bow)

☐ Back (stern)

Connectors Side

☐ Upward

☐ Downward

☐ Right (starboard)

☐ Left (port side)

☐ Front (bow)

☒ Back (stern)

ORIENTATION & LEVER ARMS

▼ Orientation

Product Logo Side

☐ Upward

☐ Downward

☒ Right (starboard)

☐ Left (port side)

☐ Front (bow)

☐ Back (stern)

Connectors Side

☒ Upward

☐ Downward

☐ Right (starboard)

☐ Left (port side)

☐ Front (bow)

☐ Back (stern)

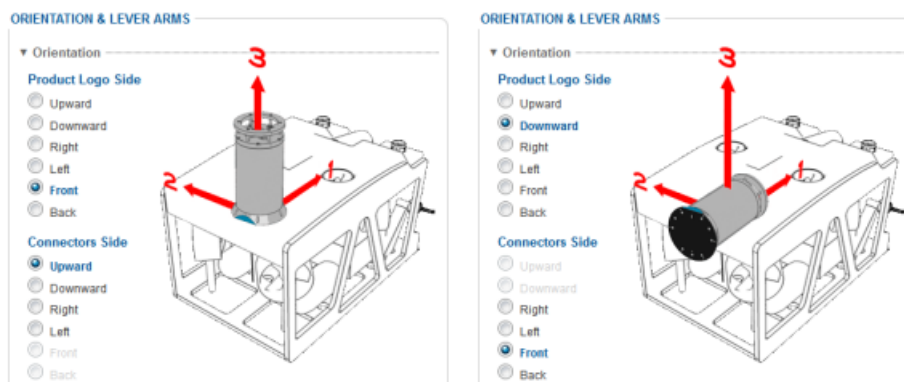
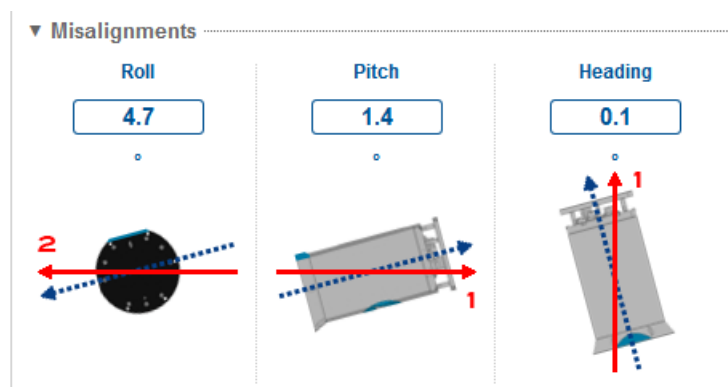


Figure 21 - Illustration of Phins Subsea rough misalignment

3. Click on **Misalignments**: the Misalignment area is displayed.

Misalignment is used once orientation has been set to correct fine biases between the product and the subsea vehicle axes that are due to angular misalignment of the product with respect to the subsea vehicle.



The illustrations help you to see which angle you have to measure precisely.

Enter the following value in degree. Positive and negative values can be entered.

- **Roll** misalignment
- **Pitch** misalignment
- **Heading** misalignment

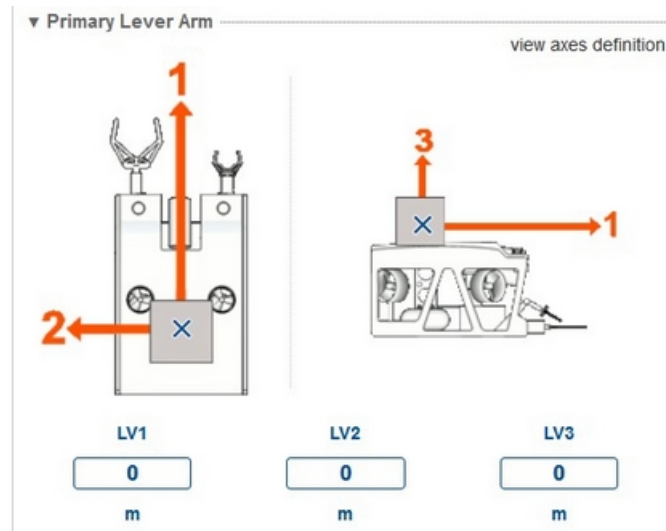
The illustration displays how your product is installed each time the value is entered.

4. Click on **Primary Lever Arm** to configure the primary external monitoring point through its coordinates: the Primary Lever Arm area is displayed.

The primary lever arm corresponds to the lever arm from the product center of measurements in the vehicle reference frame.

The data displayed at the left of the logo provide the Latitude, Heading, Roll, Pitch at the point defined by the primary lever arm coordinates.

The logged Repeater data flow is also computed for the primary lever arm.



Enter the following values in meter. Positive and negative values can be entered.

- **LV1:** the blue cross moves along the first axis
- **LV2:** the blue cross moves according to the LV2 value sign
- **LV3:** the blue cross moves according to the LV3 value sign

A blue cross is displaying on the illustration once the lever arm coordinate is entered in order to show where the monitoring point you just defined is located with respect to the subsea vehicle.

-
5. If needed, click on **Secondary Lever Arm** to configure the secondary external monitoring point through its coordinates: the Secondary Lever Arm area is displayed.
- The secondary lever arms are used to compute the heave, surge and sway at locations different than that of the primary lever arm for the output protocols that provide the heave.
- Up to three secondary lever arms (A, B, C) can be defined.**
-

6. Enter the following values in meter for each A, B, C secondary monitoring points. Positive and negative values can be entered.
- **LV1:** the blue cross and the letter of the monitoring point is displayed along the first axis
 - **LV2:** the blue cross and its attached letter move according to the LV2 value sign
 - **LV3:** the blue cross and its attached letter move according to the LV3 value sign

▼ Secondary Lever Arms

view axes definition

	LV1	LV2	LV3
A	0	0	0
	m	m	m
	LV1	LV2	LV3
B	0	0	0
	m	m	m
	LV1	LV2	LV3
C	0	0	0
	m	m	m

Once the lever arms coordinates of the A, B or C secondary monitoring point are entered, a blue cross with the corresponding letter 'A', 'B' or 'C' is displayed where the secondary monitoring point is located with respect to the vehicle.

- Click on **Vessel Center Of Gravity (Heave computation)** to avoid the effect of transient subsea vehicle movement on heave measurement.

Enable the **Enable Center of Gravity** (tick box) to force the Center of Gravity lever arm, the following window is then displayed:

▼ Vessel Center of Gravity (Heave computation)

view axes definition

Enable Center of Gravity ☒

	LV1	LV2	LV3
	0	0	0
	m	m	m

Please note that in this case the primary lever arm is then not configurable.

-
8. To avoid the effect of transient subsea vehicle movement on heave measurement, type in the position of the center of gravity (COG) of the subsea vehicle by entering the lever arms (LV1, LV2, LV3) between the Phins Subsea center of Measurements and the COG of the subsea vehicle.

Enter the following position of the center of gravity (in meter) of the subsea vehicle by entering lever arms (LV1, LV2, LV3) between the product center of measurements and the COG of the subsea vehicle. Positive and negative values can be entered.

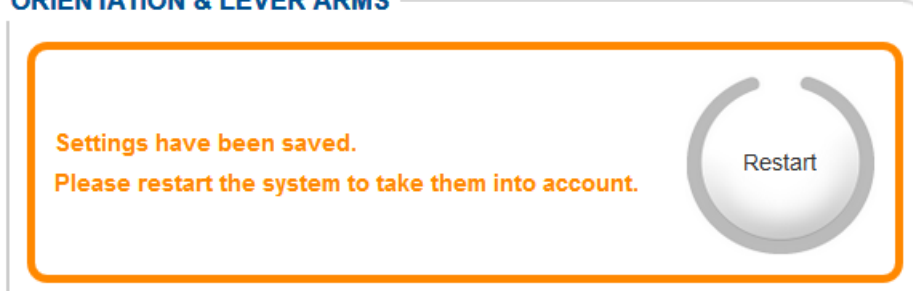
- **LV1:** the blue cross moves along the first axis
- **LV2:** the blue cross moves according to the LV2 value sign
- **LV3:** the blue cross moves according to the LV3 value sign

In this case, Phins Subsea will compute heave data at the COG and add the heave induced by lever arms from the COG to external monitoring points.

To get more detail about the heave measurement refer to the Inertial Products – Application Note - Installation and Configuration of AHRS and INS for Seabed Mapping

-
9. Click on the **OK** button to validate the modifications. The following message is displayed on the top of the window.

ORIENTATION & LEVER ARMS



-
10. Click on the **Restart** button to take the parameters into account.
-

5.2 Configuring Sensor Parameters

Phins Subsea can use external sensor data to improve its performance.

5.2.1 ASSIGNING AN EXTERNAL SENSOR TO AN INPUT

1. Click on the **INSTALLATION** menu then select the **INPUTS** option.
2. Click in the table **to associate the sensor to the input** to which the external sensor is connected (e.g., Input A, Input B, etc.) for the case of an external sensor (or Internal for an internal one).

When the external sensor is assigned to the input, the selection is displayed as follows with a blue circle. The blue circle displays both the external sensor and the input parameters to be configured in one page.

INPUT AND EXTERNAL SENSORS SETTINGS

	Input A	Input B	Input C	Input D	Input E	Input F	Input G
Protocol	NONE	EIVA	NONE	NONE	NONE	NONE	NONE
GNSS 1	●						
GNSS 2							
DVL 1							
DVL 2							
EM Log							
USBL 1							
USBL 2							
USBL 3							
LBL							
Depth							
CTD							
UTC 1							
UTC 2							

3. To configure the input settings, click on the Input “x” text (e.g., Input A, Input B...). Refer to next section to get more details.

INPUT AND EXTERNAL SENSORS SETTINGS

	Input A	Input B	Input C	Input D	Input E	Input F	Input G
Protocol	NONE	EIVA	NONE	NONE	NONE	NONE	NONE
GNSS 1	●						
GNSS 2							
DVL 1							
DVL 2							
EM Log							
USBL 1							
USBL 2							
USBL 3							
LBL							
Depth							
CTD							
UTC 1	●						
UTC 2							

4. To configure the external sensor settings, click on the sensor type in the column at the left of the table. Refer to the section of configuring the sensor following the type of sensor.

INPUT AND EXTERNAL SENSORS SETTINGS

	Input A	Input B	Input C	Input D	Input E	Input F	Input G
Protocol	NONE	EIVA	NONE	NONE	NONE	NONE	NONE
GNSS 1	●						
GNSS 2							
DVL 1							
DVL 2							
EM Log							
USBL 1							
USBL 2							
USBL 3							
LBL							
Depth							
CTD							
UTC 1	●						
UTC 2							

5.2.2 CONFIGURING THE INPUT

Up to 5 serial inputs are available. Up to 7 Ethernet inputs are available. Input F and input G are for Ethernet inputs only.



According to the requirements of IEC 61162-450:2018, the Ethernet connectivity of the Phins Subsea should be considered as an Other Network Function (ONF). Therefore, if connected to an IEC 61162-450 network, the network settings must not use any IP or multicast addresses in the range 239.192.0.1 to 239.192.0.64.

Important

For an external sensor, the input data can be received either on Serial or Ethernet device, but not both.

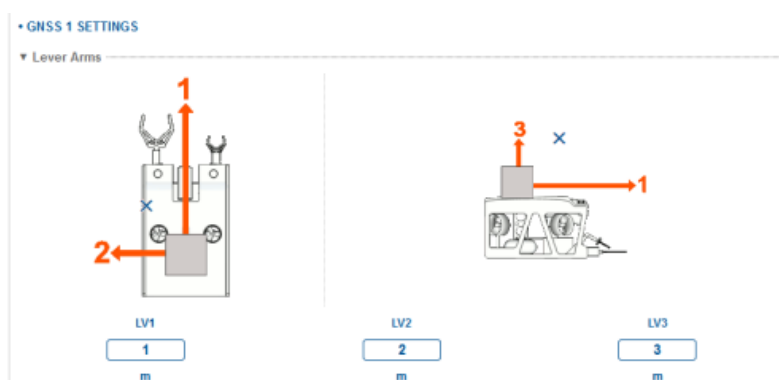
1. Click on the **INSTALLATION** menu then select the **INPUTS** option.
2. Click on the **Input “x”** text (e.g., Input A, Input B...). The input “x” settings area is displayed.

3. Select the input **protocol** in the **Protocol** drop-down list. Each protocol is defined in the Phins Subsea Interface Library document.
4. Select on which device the data will be transmitted in the **Physical Link** drop-down list.
 - **Serial only:** data is only transmitted via the Serial stream.
 - **Ethernet only:** data is only transmitted via the Ethernet stream.
5. When **“Serial only” physical link is selected**, set the following parameters:
 - **Parity:** from Odd, Even or None
 - **Stopbits:** from 0.5, 1, 1.5, or 2
 - **Standard:** electrical standard for serial output: RS232 or RS422.
 - **Baudrate:** from 600 bauds up to 460.8 kBauds
6. When **“Ethernet only” physical link is selected**, set the following parameters:
 - **Transport Layer:** TCP server, TCP client, UDP, UDP broadcast, UDP multicast. Refer to Appendix B.2.1 for details on the transport modes.
 - **IP:** IP address of the target (only used in UDP and TCP client).
 - **Port:** port socket number.

-
7. If needed, click on **Sensor Control Panel** to monitor the external sensor data. Refer to section 5.2.11 to get more details.
-
8. Click on the **OK** button to save the settings.
-

5.2.3 CONFIGURING THE EXTERNAL GNSS SENSOR

1. Click on the **INSTALLATION** menu then select the **INPUTS** option.
2. Click in the table to **associate the sensor to the input** to which the external sensor is connected (e.g., Input A, Input B, etc.) for the case of an external sensor (or Internal for an internal one). When the external sensor is assigned to the input, the selection is displayed with a blue circle.
3. Click on the **GNSS** sensor type in the column at the left of the table. The following parameters are displayed:



4. Enter the **value of the lever arms**.
The external sensor lever arm is the distance from the Phins Subsea center of measurement P to the center of measurement of the external sensor (refer to the external sensor User Manual to locate this point).
 - **LV1** is the signed distance from the product center of measurements to the external sensor along axis XV1
 - **LV2** is the signed distance from the product center of measurements to the external sensor along axis XV2
 - **LV3** is the signed distance from the product center of measurements to the external sensor along axis XV3
5. In the **Advanced Settings** area, tick **Forced Mode** box if you wish the incoming sensor data to bypass the rejection filter and directly feed the Kalman filter.
Activated this mode is not recommended as it may corrupt the Kalman filter with bad external sensor data input. To get more information, refer to the Phins Subsea Operation Manual.
When this mode is selected, it is impossible for the user to enable/disable the related sensor from the **CONTROL** page.
6. Click on the **OK** button to save the settings.
7. Repeat this procedure to configure GNSS2 sensor.

5.2.4 CONFIGURING THE DVL SENSOR



To get details about the DVL calibration, refer to the Application Note - INS+DVL Calibration.

1. Click on the **INSTALLATION** menu then select the **INPUTS** option.
2. Click on the **DVL** sensor type in the column at the left of the table. The following parameters are displayed:

DVL SETTINGS

▼ Lever Arms

LV1: 0 m

LV2: 1 m

LV3: 0 m

▼ Misalignments

Roll: 0 °

Pitch: 1 °

Heading: 0 °

Scale Factor: 0 %

▼ DVL Coupling Mode

DVL coupled to System: ☒

▼ DVL Type

DVL Type: Standard

▼ Advanced Settings

BT Forced Mode: ☐

WT Forced Mode: ☐

3. Enter the **value of the lever arms**. The external sensor lever arm is the distance from the Phins Subsea center of measurement P to the center of measurement of the external sensor (refer to the external sensor User Manual to locate this point).
 - **LV1** is the signed distance from the product center of measurements to the external sensor along axis XV1
 - **LV2** is the signed distance from the product center of measurements to the external sensor along axis XV2
 - **LV3** is the signed distance from the product center of measurements to the external sensor along axis XV3
4. Enter the **Misalignments** values and the scale factor of the DVL in the Misalignments area. The precise values of the misalignment are determined during the DVL sensor calibration.

-
5. Enable **DVL Coupling Mode** by ticking the DVL coupled to system box. The coupling mode is used to indicate if a DVL is coupled to the system. When a DVL is coupled to the Phins Subsea system, DVL calibration values are updated when user misalignment are modified.
-
6. Select the **DVL Type** in the list:
 - **Standard**: to select the standard DVL type (doppler). All the axis of the speed of sound are corrected.
 - **Phased array**: to select the phased array DVL type. This means that only vertical speed of sound is corrected for this type of DVL.
-
7. In the **Advanced Settings** area, select one or several parameters:
 - if you wish the incoming sensor data to bypass the rejection filter and directly feed the Kalman filter, select:
 - BT Forced Mode**: this mode forces data when DVL is in Bottom Track
 - WT Forced Mode**: this mode forces data when DVL is in Water TrackActivated one of these modes is not recommended as it may corrupt the Kalman filter with bad external sensor data input.When one mode is selected, it is impossible for the user to enable/disable the related sensor from the CONTROL page.
For more information on how to enable the external sensors, refer to the Phins Subsea Operation Guide.
-
8. Click on the **OK** button to save the settings.
-
9. Repeat this procedure to configure DVL2 sensor.
-

5.2.5 CONFIGURING THE EM LOG SENSOR

1. Click on the **INSTALLATION** menu then select the **INPUTS** option.

2. Click on the **EM Log** sensor type in the column at the left of the table. The following parameters are displayed:

• EM LOG SETTINGS

▼ Lever Arms

LV1
0
m

LV2
0
m

LV3
0
m

▼ Advanced Settings

Forced Mode ☐

3. Enter the **value of the lever arms**.

The external sensor lever arm is the distance from the Phins Subsea center of measurement P to the center of measurement of the external sensor (refer to the external sensor User Manual to locate this point).

- **LV1** is the signed distance from the product center of measurements to the external sensor along axis XV1
- **LV2** is the signed distance from the product center of measurements to the external sensor along axis XV2
- **LV3** is the signed distance from the product center of measurements to the external sensor along axis XV3

4. Tick the **Forced mode** box if you wish the incoming sensor data to bypass the rejection filter and directly feed the Kalman filter. Activated this mode is not recommended as it may corrupt the Kalman filter with bad external sensor data input. To get more information, refer to the Phins Subsea Operation Guide. When this mode is selected, it is impossible for the user to enable/disable the related sensor from the **CONTROL** page.

5. Click on the **OK** button to save the settings.

5.2.6 CONFIGURING THE LBL SENSOR

Important

You are strongly advised not to use more than 4 LBL beacons simultaneously with USBL beacons.

1. Click on the **INSTALLATION** menu then select the **INPUTS** option.
2. Click on the **LBL** sensor type in the column at the left of the table. The following parameters are displayed:

• LBL SETTINGS

▼ Lever Arms

LV1: 0 m

LV2: 0 m

LV3: 0 m

▼ Advanced Settings

Forced Mode ☐

3. Enter the **value of the lever arms**. The external sensor Lever Arms corresponds to the lever arm from the Phins Subsea center of measurements to the external sensor.
 - **LV1** is the signed distance from the product center of measurements to the external sensor along axis XV1
 - **LV2** is the signed distance from the product center of measurements to the external sensor along axis XV2
 - **LV3** is the signed distance from the product center of measurements to the external sensor along axis XV3
4. Tick the **Forced mode** box if you wish the incoming sensor data to bypass the rejection filter and directly feed the Kalman filter.
 Activated this mode is not recommended as it may corrupt the Kalman filter with bad external sensor data input. To get more information, refer to Phins Subsea Operation Guide. When this mode is selected, it is impossible for the user to enable/disable the related sensor from the **CONTROL** page.
5. Click on the **OK** button to save the settings.

5.2.7 CONFIGURING THE USBL SENSOR

1. Click on the **INSTALLATION** menu then select the **INPUTS** option.
2. Click on the **USBL** sensor type in the column at the left of the table. The following parameters are displayed:

• USBL 1 SETTINGS

▼ Lever Arms

LV1 m

LV2 m

LV3 m

▼ Beacon Code

TP Code

▼ Advanced Settings

Forced Mode ☐

3. Enter the **value of the lever arms**. The lever arm of the USBL sensor is the lever arm from the product center of measurements to the beacons. Up to three lever arms can be defined.
 - **LV1** is the signed distance from the product center of measurements to the defined beacon along axis XV1
 - **LV2** is the signed distance from the product center of measurements to the defined beacon along axis XV2
 - **LV3** is the signed distance from the product center of measurements to the defined beacon along axis XV3
4. Enter the **TP code** in the **Beacon code** area.
This is the transponder code used to discriminate between incoming USBL data in the input protocol. You can enter up to 3 alphanumeric characters. For example: Tp1 for USBL 1, Tp2 for USBL 2 and Tp3 for USBL 3.
5. Tick the **Forced mode** box if you wish the incoming sensor data to bypass the rejection filter and directly feed the Kalman filter.
Activated this mode is not recommended as it may corrupt the Kalman filter with bad external sensor data input.
To get more information, refer to Phins Subsea Operation Guide.
When this mode is selected, it is impossible for the user to enable/disable the related sensor from the CONTROL page.
6. Click on the **OK** button to save the settings.

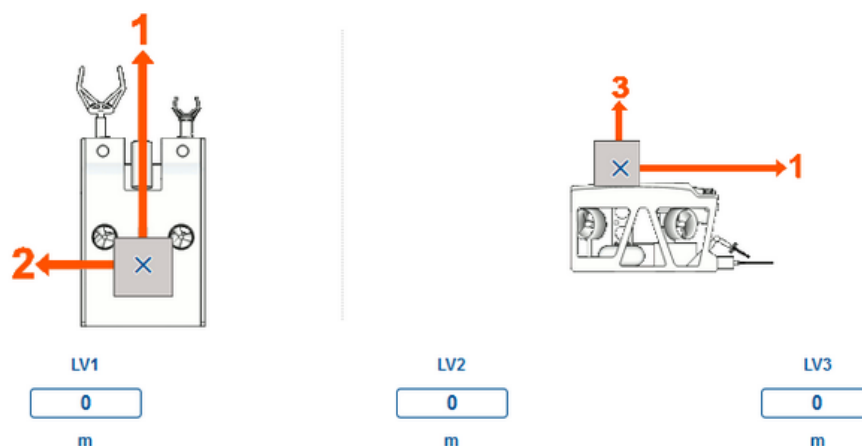
7. Repeat this procedure to configure the other USBL sensors.

5.2.8 CONFIGURING THE DEPTH SENSOR

1. Click on the **INSTALLATION** menu then select the **INPUTS** option.
2. Click on the **Depth** sensor type in the column at the left of the table. The following parameters are displayed:

• DEPTH SETTINGS

▼ Lever Arms



▼ Depth

Depth Offset

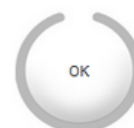
0

m



► Water Type Selection

▼ Advanced Settings

Forced Mode ☐


3. Enter the **value of the lever arms**.
The external sensor lever arm is the distance from the Phins Subsea center of measurement P to the center of measurement of the external sensor (refer to the external sensor User Manual to locate this point).
 - **LV1** is the signed distance from the product center of measurements to the external sensor along axis XV1
 - **LV2** is the signed distance from the product center of measurements to the external sensor along axis XV2

- **LV3** is the signed distance from the product center of measurements to the external sensor along axis XV3

4. Enter the **Depth Offset** in the Depth area.

When clicking on the **Use current depth** button, this offset is set to the current depth measured by the sensor. That means that the Depth sensor can be set to zero using the **Use current depth** button under the DEPTH SETTINGS area.

It can be useful to adjust the depth sensor to zero before submerging it into the sea.

5. Click on the **Water Type Selection** title.

Select the Water Type:

- **Salt Water**. The pressure to depth formula from “Unesco Technical Papers in Marine Science n°44, Algorithms for computation of fundamental properties in seawater” is applied).
- **Fresh Water**. You can enter the volumetric mass density ρ in kg/m^3 with a resolution of 0.1 kg/m^3 . Default value is 1000 kg/m^3 , value from 950.0 to 1100.0 .

Then the following pressure to depth conversion applies:

$z = P / (\rho \cdot g)$ with the pressure P in Pa, ρ in kg/m^3 and the earth gravity g in m/s^2 ($1 \text{ Pascal} = 1 \text{ N/m}^2$. $1 \text{ bar} = 10^5 \text{ Pa}$). The earth gravity g will be the one calculated by the product.

The entered values will be between 950.0 and 1100.0 .

6. Tick the **Forced mode** box if you wish the incoming sensor data to bypass the rejection filter and directly feed the Kalman filter. Activated this mode is not recommended as it may corrupt the Kalman filter with bad external sensor data input.

To get more information, refer to the Phins Subsea Operation Guide.

When this mode is selected, it is impossible for the user to enable/disable the related sensor from the CONTROL page.

7. Click on the **OK** button to save the settings.

5.2.9 CONFIGURING THE UTC SENSOR

If available, it is recommended to add a synchronization pulse (Synchro in from Pulse) with the appropriate protocol to improve precision. However it is not needed when using an internal GNSS sensor.

Phins Subsea internal clock can be synchronized with data frames coming from an external reference clock (i.e., GNSS clock). When sending multiple frames with time the priority is as follows UTC, ZDA, GGA, GLL, RMC. The frame used for the first synchronization will keep being used until the unit is restarted or when the time synchronization on the web interface is disabled and again enabled.

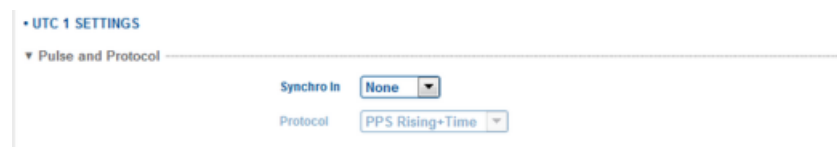
Time will be synchronized with input coming from the selected interface with the appropriate protocol. Phins Subsea updates the offset between UTC time and internal time and uses this offset to convert internal validity time of navigation data into UTC referenced time.

The time synchronization can be done with Time + Pulse Per Second (PPS) signal.

With Time + PPS or PPS + Time, the internal time of reception of the pulse rising / falling edge is latched and the UTC time contained in following / preceding time message is associated to this internal time to determine the UTC offset.

1. Click on the **INSTALLATION** menu then select the **INPUTS** option.
2. Click in the table **to associate the sensor to the input** to which the external sensor is connected (e.g., Input A, Input B, etc.) for the case of an external sensor (or Internal for an internal one).
When the external sensor is assigned to the input, the selection is displayed with a blue circle.

3. Click on the **UTC** sensor type in the column at the left of the table. The following parameters are displayed:



4. Select **from which pulse input the pulse synchronization is coming** in the **Synchro In** drop-down list (e.g., Pulse A).
5. Select **its protocol** in the drop-down Protocol list.
6. Click on the **OK** button to save the settings.
7. Repeat this procedure to configure UTC2 sensor.

5.2.10 CONFIGURING THE CTD SENSOR

There are no parameters to be configured for this external sensor in the Web-Based Graphical User Interface.

5.2.11 MONITORING THE EXTERNAL SENSOR DATA

Any external sensor that inputs data into Phins Subsea can be monitored.

1. Click on the **INSTALLATION** menu then select the **INPUTS** option.
2. In the first row of the INPUTS table, click on the **input** (e.g., Input A) **to which the external sensor to monitor is connected**.
3. Click on the **Sensor Control Panel** label.
A pop-up window is displayed with the sensor data.
In the following example the data of the GNSS connected to Input A is displayed.

EXTERNAL SENSOR DATA Protocol: GPS - Port: A

```

$SENSOR_A: First Test Frame: 01,02,03*
$SENSOR_A: Second Test Frame,04,05,06*
$SENSOR_A: First Test Frame: 01,02,03*
$SENSOR_A: Second Test Frame,04,05,06*
$SENSOR_A: First Test Frame: 01,02,03*
$SENSOR_A: Second Test Frame,04,05,06*
$SENSOR_A: First Test Frame: 01,02,03*
$SENSOR_A: Second Test Frame,04,05,06*
$SENSOR_A: First Test Frame: 01,02,03*
$SENSOR_A: Second Test Frame,04,05,06*
$SENSOR_A: First Test Frame: 01,02,03*
    
```

Stop Capture

 Clear

EXTERNAL SENSOR REQUESTS

Send Request

Send LF (Line Feed) after CR (Carriage Return) ☒

4. From this window, you can:
 - Display the data sent by the external sensor to the product in the dedicated area
 - Stop the display of the data (Stop Capture button) in the dedicated area
 - Reset the display (Clear button) in the dedicated area
 - Send a Request to the external sensor:
 - > Use the dedicated area to type the command
 - > Press enter after the command if the sensor requires a carrier return after commands
 - > Select Send LF (Line Feed) after CR (Carrier Return) option if needed
 - > Click the Send Request button to send the command typed in

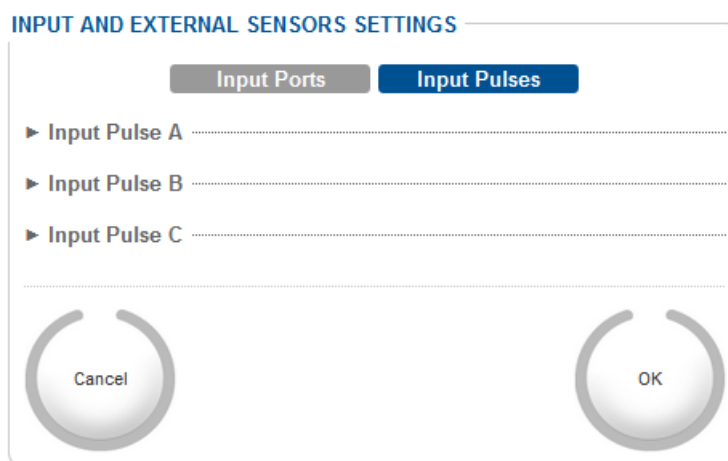
5.3 Configuring the Input Pulses

Input Pulses allow you to configure external events for each input pulse.

For each input pulse, the available parameters are the way to output them and the triggering type.

-
1. Click on the **INSTALLATION** menu then select the **INPUTS** option.
-

2. Select **Input Pulses** tab:



-
3. Click on each **Input Pulse X** text to be configured. The drop-down list is then displayed. Select the **Function** in the drop-down list to select the pulse polarity.
 - **None**: Inactive, no trigger.
 - **Synchro out X**: In this configuration, input pulse is used to trigger protocol output on associated port X during next available output slot (a slot is available each 5 ms).
 - **PPS rising/falling + Time**: In this configuration, the system waits for an input PPS pulse and associated UTC time should be provided in following time frame. UTC time validity corresponds to rising/falling edge of PPS pulse.
 - **Time + PPS rising/falling**: In this configuration, the system waits for an input PPS pulse and associated UTC time should be provided in following time frame. UTC time validity corresponds to rising/falling edge of PPS pulse.
 - **Event Marker Rising**: trigger on rising edge for output in real time.
 - **Event Marker Falling**: trigger on falling edge for output in real time.
-

4. Click on the **OK** button to save the settings
-

5.4 Configuring the Output Ports

The Output data can be duplicated on both Serial and Ethernet devices.

Input and output serial parameters of each port are common. This means that changing output serial parameters of a port impacts the input serial parameters of the port and vice-versa.

Important

While configuring the output port in serial mode, check that sampling period and baud rate are consistent with the protocol data field length. If not, data output will not be correct, and a “SerOut X full” flag will appear in the product detailed status window. Checking procedure is as follows:

- Count the maximum number of bits Nb (including parity and stop bits) in the protocol data frame. ASCII characters are 10 to 12 bits long max. (1 start bit, 8 bit ASCII character, 0 or 1 parity bit, 1 or 2 stop bit).
- Select the Baudrate and Sampling period so that:
$$Nb \times \text{Frequency (Hz)} < \text{Baudrate (in Bauds)}$$

Example

A 30-character protocol set up with 1 stop bit and even parity will generate $30 \times (1(\text{start bit}) + 8(\text{ASCII character}) + 1(\text{stop bit}) + 1(\text{parity bit})) = 330$ bits. If this protocol output rate is 20 Hz (50 ms), the baud rate must be at least 6600 baud. First compatible baudrate in the product is 9600 bauds.

1. Click on the **INSTALLATION** menu then select the **OUTPUTS** option. The following page is displayed:

OUTPUT SETTINGS

Output Ports

Output A **Output B** **Output C** **Output D** **Output E**

▼ **Protocol**

Protocol

Lever Arm

☒ **Rate**

☐ **Synchro In**

▼ **Heave Output**

☒ **Real Time Heave**

☐ **Smart Heave (100s Delayed)**

▼ **Physical Link**

Physical Link

▼ **Advanced Settings**

Altitude Reference

Extrapolation ms

2. Click on the **output port** to be configured (e.g.: Output A to configure Port A).
When the output port is not connected, there is no need to configure the output.
3. Select the **output protocol** in the **Protocol** drop-down list.
Refer to Phins Subsea Interface Library document to get more details about the Phins Subsea protocols.
4. Select the lever arm used in the **Lever Arm** drop-down list. Motion sensing output on the protocol selected will be the motion measured at the external monitoring point defined by the lever arm.
5. Select the **output frequency** in the **Rate** drop-down list to specify the time interval in milliseconds between the beginning of two consecutive outputs. The minimum value is 5 ms, corresponding to a maximum output frequency of 200 Hz.
or

Click on the grey bullet **to select the input pulse synchronization** in the **Synchro** in the drop-down list: when this option is selected, the output frequency is determined by the input coming from the input pulse.

-
6. If needed, click on **Heave Output** text to select the type of heave output (available only if the heave is computed by the system).
Select:
- **Specific Heave**: real-time which provides heave in real-time mode.
 - **Smart Heave**: which provides a measurement of heave with a 100 s fixed delay. This data will give the best accuracy in all sea conditions. This data is available through protocols which output heave.
-
7. Select on **which device the data will be transmitted** in the Physical Link drop-down list.
- **Serial only**: data is transmitted via the Serial stream only. The Serial area is then displayed.
 - **Ethernet only**: data is transmitted via the Ethernet stream only. The Ethernet area is then displayed.
 - **Serial-Ethernet**: data is transmitted via both Ethernet and Serial stream. The Serial and Ethernet areas are then displayed.
-
8. When “**Serial only**” physical link is selected, set the following parameters:
- **Parity**: from Odd, Even or None
 - **Stopbits**: from 0.5, 1, 1.5, or 2
 - **Standard**: electrical standard for serial output: RS232 or RS422
 - **Baudrate**: from 600 bauds up to 460.8 kBauds
-
9. When “**Ethernet only**” physical link is selected, set the following parameters:
- **Transport Layer**: TCP server, TCP client, UDP, UDP broadcast, UDP network broadcast, UDP multicast
Refer to Appendix B.2.1 for details on the transport modes
 - **IP**: IP address of the target (only used in UDP and TCP client)
 - **Port**: port socket number
-
10. If needed, click on **Advanced Settings** text to configure advanced parameters.
If necessary, select the Altitude Reference to be applied:
- **Geoid (MSL)**: altitude is referenced to the Geoid surface also called Mean Sea Level (MSL). It is an equipotential gravity surface of the earth that coincides with the mean ocean surface.
-
11. Enter the **Extrapolation time to anticipate future data by linear extrapolation**. Phins Subsea computes new data each 5 ms, and latency of the full system is, in the best case, 2.35 ms (time between sensor raw data sampling and the first bit of output protocol on serial line).

In some specific applications, the system latency (product intrinsic latency plus additional latency due to other equipment connected to the product) must be compensated to provide real-time data to the target equipment. This usually requires anticipating future data and writing them into protocol frames before they are actually computed by the system.

To perform this anticipation, the Phins Subsea firmware was modified to include a user configurable extrapolation time (Extrapolation field) on each output protocol. By default, extrapolation is disabled on output protocols (Extrapolation = 0).

With this feature, output data is computed as follows:

$$\text{Output data} = \text{DataN} + \text{Extrapolation} * (\text{DataN} - \text{DataN-1}) / \text{SamplingTime}$$

This mechanism is applied on every output data. This linear extrapolation introduces approximation errors that will increase with real signal amplitude and frequency.

The following table gives the examples of error due to this extrapolation on heading. Red cells indicate where the error is above the product specification on the heading (i.e., 0.03° max).

		HRP Frequency					
		0.1Hz	0.5Hz	1Hz	5Hz	10Hz	20Hz
HRP Amplitude	0.1°	9.10^{-7}	2.10^{-5}	9.10^{-5}	0.0025	0.0097	0.038
	1°	9.10^{-6}	$2.4.10^{-4}$	1.10^{-3}	0.024	0.098	0.38
	5°	$4.9.10^{-5}$	0.0012	0.0049	0.12	0.49	1.90
	10°	$9.8.10^{-5}$	0.0025	0.0098	0.25	0.98	3.81
	15°	$1.4.10^{-4}$	0.0037	0.015	0.37	1.47	5.72
	20°	2.10^{-4}	0.0049	0.020	0.49	1.95	7.64

12. Click on the **OK** button to save the settings.

5.5 Configuring the Output Pulses

1. Click on the **INSTALLATION** menu then select the **OUTPUTS** option.
2. Click on the **Output pulses** text in grey. The following page is displayed:

OUTPUT SETTINGS

Output Ports **Output Pulses**

▼ **Output Pulse A**

Function **Output A synchro**

▼ **Output Pulse B**

Function **None**

Cancel OK

For get information on the output pulses, refer to Phins Subsea Interface Library.

3. Click on the **OK** button to save the settings.

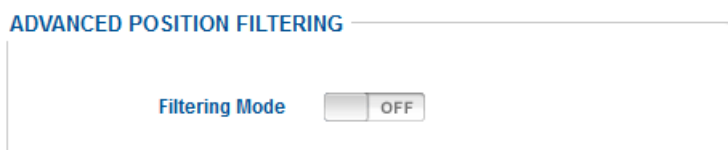
5.6 Configuring the Advanced Position Filtering



The Advanced Position Filtering must be enabled and configured at the Phins Subsea installation with the help of iXblue support.

1. Click on **SETUP** menu then select **ADVANCED POSITION FILTERING** option.

2. To enable the Advanced Position Filtering, click on the **OFF** button until displaying **ON**:



Some parameters are displayed with default values.

To restore the default values, click on the **Default values** button.

3. Select the **Position Input Priority** in order to declare which position sensor has the highest priority between the following choice: GNSS, USBL, none.



- **GNSS**: exclusive priority to GNSS sensor
- **USBL**: exclusive priority to USBL sensor
- **None**: no exclusive priority

For example if USBL is selected only USBL data will be taken into account at Phins Subsea input. If USBL data is lost for a timeout greater than 60 s (drift < 0.8 m in Pure inertial for Phins Subsea) then GNSS data is taken into account. As soon as USBL data is present at input it is taken into account in an exclusive manner. In any case if several USBL beacons and several GNSS are configured at Phins Subsea input the rule applies to any of these position data.

4. Enable the **GNSS Input Filtering and Smoothing** parameters to optimize the position rejection and the GNSS positions smoothing.

▼ GNSS Input Filtering and Smoothing

Reject if Standard Deviation is above m **Enable** ☐

Accepted GNSS Modes

Natural (1) ☒

Differential (2) ☒

Military (3) ☒

RTK (4) ☐

Float RTK (5) ☐

Limit Standard Deviation to at least m **Enable** ☐

- Tick the **Enable** box next to **Reject if Standard Deviation is above** parameter in order to reject the position if the standard deviation is strictly greater than the entered value from 0.01 m to 100 m.
- Select the **Accepted GNSS mode**, one or several modes can be selected. This parameter allows you to define the quality factor values accepted by the Phins Subsea at GNSS input. For any other value than the one selected GNSS data is rejected.
- Tick the **Enable** box next to **Limit Standard Deviation to at least** parameter then enter the value from 0.01 m to 100 m. This is the minimum value of the GNSS standard deviation to optimize the smoothing position.

For example if the user enters a value of 10 m and the standard deviation on position in the GNSS telegram is 0.3 m then the value taken into account by the Phins Subsea will be 10 m. If the value in the GNSS telegram is > 10 m the GNSS telegram value is taken into account. By increasing this value smoothing will be improved but the risk is greater to accept GNSS fix that could be too far from the true position. Trade-off needs to be found.

-
5. Enable **USBL Input Filtering and Smoothing** parameters to optimize the position rejection and the USBL positions smoothing.

▼ USBL Input Filtering and Smoothing

Reject if Standard Deviation is above m **Enable** ☐

Limit Standard Deviation to at least m **Enable** ☐

- Tick the **Enable** box to enable the **Reject if Standard Deviation is above** parameter then enter the value from 0.01 m to 100 m in order to set the level of USBL pre-filtering on the criteria of an input position standard deviation strictly greater than a chosen setting value.
For example if the setting is 0.3 m and the x, y position standard deviation in the USBL telegram is > 0.3 m the position is rejected by the Phins Subsea.
- Tick the **Enable** box to enable the **Limit Standard Deviation to at least** to optimize position smoothing of USBL position when USBL is coupled to Phins Subsea, then enter a minimum position standard deviation associated to input USBL position data in the input field range: 0.01 m to 100 m.

For example if a user enters a value of 10 m and the standard deviation on position in the USBL telegram is 0.3 m then the value taken into account by Phins Subsea will be 10 m. If the value in the USBL telegram is > 10 m the USBL telegram value is taken into account. By increasing this value smoothing will be improved but the risk is greater to accept USBL fix that could be too far from the true position. Trade-off needs to be found.

6. Enter **Adjustment of EM LOG Input Speed Standard Deviation** to set the input standard deviation value associated with the EM LOG by setting a value in the input field range from 0.01 m/s to 100 m/s.

▼ Adjustment of EM LOG Input Speed Standard Deviation

Longitudinal Speed Input Standard Deviation m/s

By reducing the EM LOG standard deviation value, more confidence is associated to the sensor data which will improve the Schuler oscillation filtering on speed data in pure inertial navigation. It can also be used to reduce confidence to gain robustness. The chosen value should be as close as possible to the real speed standard deviation of the EM LOG used. In case of doubt, default value should be set to 0.5 m/s.

7. Enter **Adjustment of DVL Input Speed Standard Deviation** to set the speed standard deviation associated with the input data in the input field range: [0.01 m/s to 10 m/s]. This applies to all input protocols with Water speed and Bottom speed associated with the DVL input. If input protocol sends speed standard deviation then the setting does not apply.

▼ Adjustment of DVL Input Speed Standard Deviation

Bottom Speed Input Standard Deviation m/s

Water Speed Input Standard Deviation m/s

- **Bottom Speed Input Standard Deviation:** value from 0.01 m/s to 10 m/s
 - **Water Speed Input Standard Deviation:** default value is 0.5 m/s
- Standard deviation on speed should be set as close as possible to real speed standard deviation of the sensor. This depends on DVL technology (i.e.: Doppler, correlation...) and application.

8. Enter **Adjustment of Input Depth Standard Deviation** to set the input standard deviation value associated with the depth by setting a value in input field range from 0.01 m to 100 m. This applies to all protocols that send a depth value at Phins Subsea input for depth sensor input.

If input protocol sends depth standard deviation then the setting does not apply.

▼ Adjustment of Input Depth Standard Deviation

Depth Input Standard Deviation m

Depth Input Standard Deviation: value from 0.01 m to 100 m: default value is 1 m.

9. Select **INS Output Mode Control** to control the position output quality factor or force the output quality factor value sent in the GGA string at INS output. This is only applied when INS is coupled to an external sensor.

▼ INS Output Mode Control

- ☐ Limit GNSS Quality to Differential(2) or Natural(1)
- ☐ Force GNSS Quality Factor to Natural(1)
- ☐ Force GNSS Quality Factor to Differential (2)
- ☐ Force GNSS Quality Factor to RTK(4)
- ☐ Copy input GNSS Quality Factor
- ☒ None

- **Limit GNSS quality to Differential (2) or Natural (1)**
- **Force GNSS quality factor to Natural (1)**
- **Force GNSS quality factor to Differential (2)**
- **Force GNSS quality factor to RTK (4)**
- **Copy input GNSS quality factor:** when both GNSS1 and GNSS2 are received, the better quality factor (valid) is used
- **None**

For the following mode “Limit GNSS quality to Differential (2) or Natural (1)”, the following table applies:

Phins Subsea Output table		
SD (m)	Q	After Q limitation
< 0.1	4	2
< 0.3	5	2
< 3	2	2
< 10	1	1
>= 10	6	1

For example if calculated Phins Subsea position SD is < 0.1 m then quality factor output in GGA telegram will be set to Q=2.

10. Click on the **OK** button to save the settings.

5.7 Configuring the Warning

According to the various sensors connected and the parameters chosen for your mission, you can be informed or not (**Do nothing** option) in case of:

- Loss of UTC synchronization (UTC time or PPS lost).
- Loss of one position sensor (configured and activated).
- Loss of one speed sensor (configured and activated).
- Increase of the heading and/or position standard deviation.

When Generate warning option selected, the logo is displayed in orange and some messages will be displayed.

When Generate error option selected, the logo is displayed in red and some messages will be displayed.

-
1. Click on the **SETUP** menu then select the **WARNING CONFIGURATION** option.

-
2. For the **UTC synchronization**, decide whether or not to be informed in case of UTC synchronization loss (UTC time or PPS lost) by clicking on the corresponding check box:

▼ UTC Synchronization Loss Management

☒ Do nothing

☐ Generate warning

☐ Generate error

-
3. For the **external sensor connected**, decide whether or not to be informed in case of synchronization loss of the position and/or speed data by clicking on the corresponding check box:

▼ Position Sensor Loss Management

☒ Do nothing

☐ Generate warning

☐ Generate error

▼ Speed Sensor Loss Management

☒ Do nothing

☐ Generate warning

☐ Generate error

-
4. To generate warning concerning the **standard deviation of the heading and position**, you have to select, in a drop-down list, the thresholds from which warning will be generated:

▼ Heading Standard Deviation Management

Generate a warning if heading standard deviation is above: ▼

▼ Position Standard Deviation Management

Generate a warning if position standard deviation is above: ▼

-
5. Click on the **OK** button to save the settings.
-

5.8 Saving the Phins Subsea Settings

The product configuration can be saved into a text file. Alternatively, the saved configuration can be restored on the product.

The default location of the product settings file is defined by your Web browser options (Download folder).

The name of the product settings file is Settings_product_xxxx-zzz_yymmdd.txt where:

- “product” is the name of your Phins Subsea
- xxxx-zzz is the Phins Subsea serial number
- yymmdd is the creation date of the settings file (year-month-day)

The configuration file can be open with any notepad software.



The compatibility of the configuration file is not guaranteed when the firmware is upgraded.

-
1. Click on the **SETUP** menu then select the **SETTINGS MANAGEMENT** option.
-
2. In the **SAVE SETTINGS** area, click on the Save Settings button. A window is displayed to save the file.
-
3. Click **OK** to save the file. The files are recorded in the default location for download of your web browser and the following message is displayed:

SAVE SETTINGS

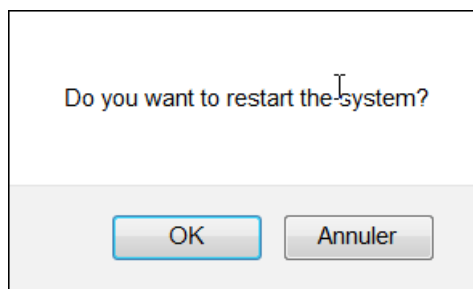
System settings successfully generated.

5.9 Restarting Phins Subsea



The alignment sequence starts again after restarting Phins Subsea.

1. Click on the **maintenance** menu.
2. In the **RESTART SYSTEM** area, click on the **Restart** button.
A confirmation window is displayed.



3. Click on the **OK** button to restart. After restarting, the disc of the Web-Based Graphical User Interface is flashing in grey/blue during the initialization (20 s).

5.10 Loading the Phins Subsea settings



The compatibility of the configuration file is not guaranteed when the firmware is upgraded. During the repair process, the product can be restored as build (keeping the configuration file) or can be upgraded to the latest version but with default factory settings (the configuration file will not be compatible).

1. Click on the **SETUP** menu then select the **SETTINGS MANAGEMENT** option.
2. In the **LOAD SETTINGS** area, browse to find the settings file to be loaded by clicking on the **Browse** button, then select the file.
3. Click on the **Load Settings** button to load the file. The Phins Subsea automatically restarts. The product settings previously saved are now restored on Phins Subsea without the network parameters.
4. Check the **Network Restoration** box to load the network settings from the uploaded file.

5.11 Resetting the Parameters to the Factory Default Values



Reload the factory default setting on the product overwrites the user settings except the network setting.

1. Click on the **maintenance** menu.
2. In the **RESET TO FACTORY SETTINGS** area, click on the **Reset** button

RESET TO FACTORY SETTINGS

Click to reset all settings to factory default values.



5.12 Managing the Passwords

A password management mechanism has been integrated to the Web-Based Graphical User Interface to avoid unexpected device parameter changes.

Important

Only the administrator can manage the passwords.

Three different user roles can be selected to manage security access:

- **Navigator:** the navigator can only view the system computed data by taping in the address bar of the web browser the following link:
http://192.168.36.1xx/control_expertview/
 xx being the two last numbers of the product serial number.
- **Operator:** the operator can view the system computed data and control basic system settings, but is not allowed to change the mechanical or installation settings.
- **Administrator:** the administrator can view and modify all system parameters and can also perform maintenance tasks.

The list of access rights per role is defined in the following table.

	Administrator	Operator	Navigator
Control page	✓	✓	✗
Navigation data page	✓	✓	✓
Options page	✓	✓	✗
Navigation parameters	✓	✓	✗
Mechanical installation page	✓	✗	✗
Input setting page	✓	✗	✗
Output setting page	✓	✗	✗
Network setting page	✓	✗	✗
Maintenance page	✓	✗	✗
DVL calibration page	✓	✗	✗
Warning configuration page	✓	✗	✗

	Administrator	Operator	Navigator
Setup page	✓	✗	✗
Advanced Position Filtering page	✓	✗	✗

Activation rules

Access control is disabled by default. The administrator will need to configure passwords to activate security mechanisms in the dedicated password setup page (see procedure after). Passwords are activated page by page. Once activated, you will be asked to log in before the page can be displayed.

Navigator and Operator passwords cannot be created if the administrator password does not exist.

When only an administrator password is defined, any user can freely connect to the system and use it as an operator, so long as he does not access the administrator restricted pages, where a login is required.

If an operator/navigator password is set, you will need to login before being able to use the system as an operator/navigator. The login page asks for both role and password.

Once an access control has been granted, it remains valid until the browser is closed or the browser cache is cleaned (the password session time management depends on the browser options).

**Operator/
Navigator**

If the operator or navigator user cannot remember its password or if he wants to modify it, he should ask the administrator to change it.

Administrator

If the administrator has lost the administrator password: refer to the Phins Subsea Interface Library for the control commands.



To log out the Web-Based Graphical User Interface, press Ctrl+Shift+Del keys in order to delete the browser history. Then the next user must press the F5 function key to load the page again and to get the password input window relative to his user role.

1. Click on the **SETUP** menu then select the **PASSWORDS** option. The following page is displayed.

PASSWORDS CONFIGURATION

▼ Administrator Account

Name

Password

▼ Operator Account

Name

Password

▼ Navigator Account

Name

Password

The password shall contain only alpha-numeric characters. The length of the password shall be 15 characters maximum, and shall be a multiple of 3. If those constraints are not fulfilled, Phins Subsea will require a password reset done by using a specific control command. Refer to Phins Subsea Interface Library InterfaceControlDocument.

2. First, configure the **Administrator** Account by entering a Name (login) then a password (15 alphanumerical characters maximum). Enter the Administrator password again to confirm it in the Confirmation text box.
3. Click on the **OK** button to save the settings.
4. If needed, configure the **Navigator** Account by entering a Name (login) then a password (15 alphanumerical characters maximum). Enter the Operator password again to confirm it in the Confirmation text box.
5. Click on the **OK** button to save the settings.
6. If needed, configure the **Operator** Account by entering a Name (login) then a password (15 alphanumerical characters maximum). Enter the Operator password again to confirm it in the Confirmation text box.
7. Click on the **OK** button to save the settings.

6 Contacting iXblue Support

**For 24/7
URGENT
support by
phone**

- North America / NORAM
+1 617 861 4589
- Europe Middle-East Africa Latin-America / EMEA-LATAM
+33 1 30 08 98 98
- Asia Pacific / APAC
+65 6747 7027

**For non-
URGENT
support**

- By email: support@ixblue.com
- Using the form on the iXblue web site www.ixblue.com
- Through the Web-Based Graphical User Interface, you can create a support ticket to send directly to iXblue support through an email (assuming the computer is connected to the World Wide Web, and the setting of the email tool has been correctly done)

Please note the following information before contacting the iXblue support:

- Serial number of your unit
- Firmware/loader versions
- Pack name
- User interface version you are using
- Record the configuration file
- Record a set of data for analysis
- The latitude/longitude where currently the system is running
- Description of your application / potential problem you are facing to

Appendices

A Rotational and Vectorial Transformation

A.1 Rotational Transformation between Frames

This section describes the conventions used to perform a transformation between two frames each defined by a triplet of three orthogonal vectors ($\underline{A}$, $\underline{B}$, $\underline{C}$) and ($\underline{A'}$, $\underline{B'}$, $\underline{C'}$).

This transformation is described by three plane rotations around 3 orthogonal axes, with angles Ψ , θ and ϕ (Euler angles) that correspond to heading, roll and pitch angles.

This rotational transformation is for instance used to define the inertial product fine misalignment with respect to the vehicle reference frame (see section 1.9) and to define the angular position of the vehicle with respect to the local geographic frame.

To transform the ($\underline{A}$, $\underline{B}$, $\underline{C}$) frame into the ($\underline{A'}$, $\underline{B'}$, $\underline{C'}$) frame the following plane rotations are performed:

1. Rotation of ($\underline{A}$, $\underline{B}$, $\underline{C}$) around the $\underline{C}$ axis, **angle Ψ** (see the Figure 22) to yield ($\underline{A_h'}$, $\underline{B_h'}$, $\underline{C}$).

This plane rotation is described by the orthogonal matrix $M_{\Psi}(\Psi)$, defined as:

$$M_{\Psi}(\Psi) = \begin{pmatrix} \cos(\Psi) & \sin(\Psi) & 0 \\ -\sin(\Psi) & \cos(\Psi) & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

Ψ is defined positive clockwise around $\underline{C}$; Ψ is positive so that it corresponds to heading sign convention (opposite to usual Euler sign convention).

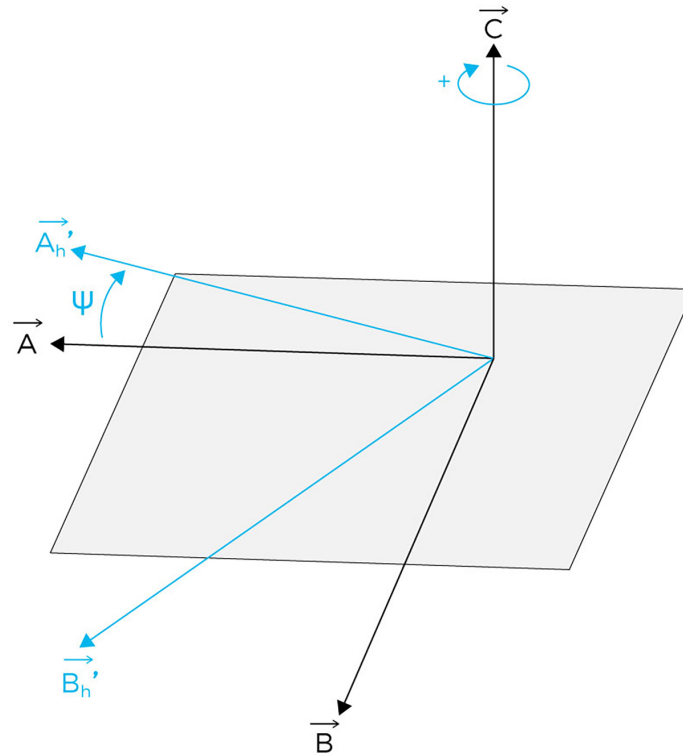


Figure 22 - Illustration of the first rotation around $\underline{C}$

2. Rotation of $(\underline{A}_h', \underline{B}_h', \underline{C})$ around $\underline{B}_h'$ **angle θ** (see the Figure 23) to yield $(\underline{A}', \underline{B}_h', \underline{C}'')$.

This plane rotation is described by the orthogonal matrix $M_\theta(\theta)$, defined as:

$$M_\theta(\theta) = \begin{pmatrix} \cos(\theta) & 0 & \sin(\theta) \\ 0 & 1 & 0 \\ -\sin(\theta) & 0 & \cos(\theta) \end{pmatrix}$$

θ is defined positive counter-clockwise around $\underline{B}_h'$, the rotation angle θ is negative.

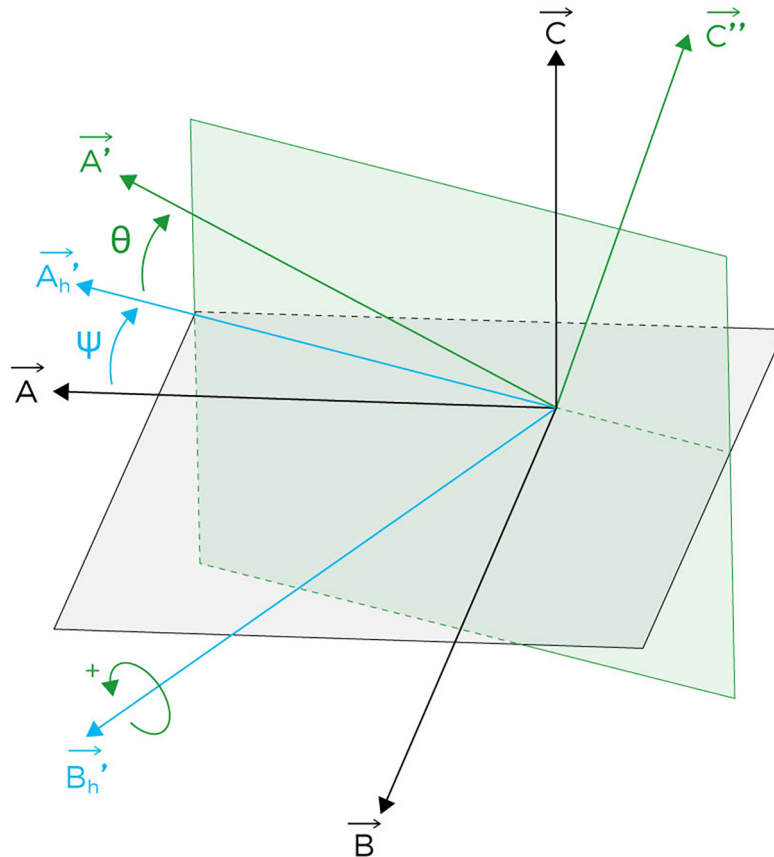


Figure 23 - Illustration of the second rotation around $\underline{B}_h'$

3. Rotation of $(\underline{A''}, \underline{B_h'}, \underline{C''})$ around $\underline{A'} = \underline{A''}$;

angle φ (see Figure 24) to yield $(\underline{A'}, \underline{B'}, \underline{C'})$.

φ is defined positive counter-clockwise around $\underline{A'}$, φ is positive.

This plane rotation is described by the orthogonal matrix $M_\varphi(\varphi)$, defined as:

$$M_\varphi(\varphi) = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos(\varphi) & -\sin(\varphi) \\ 0 & \sin(\varphi) & \cos(\varphi) \end{pmatrix}$$

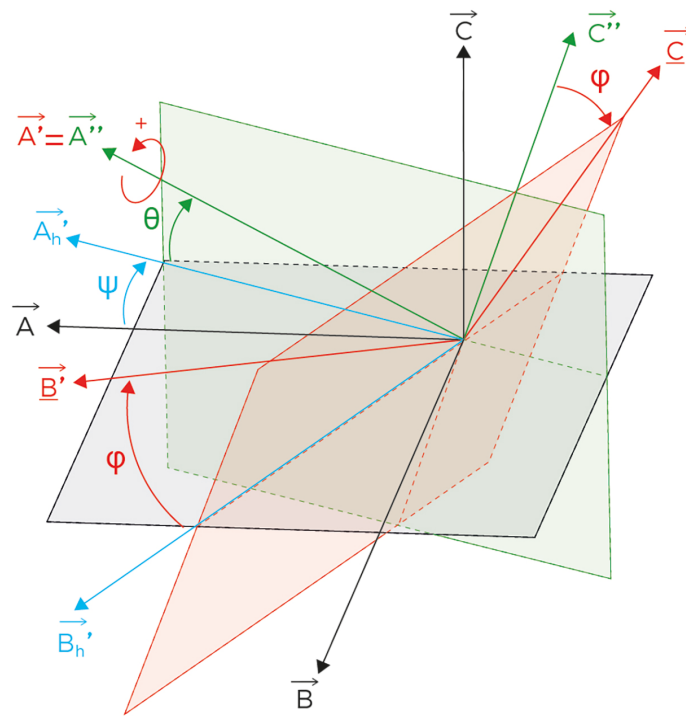


Figure 24 - Illustration of the third rotation around $\underline{A'}$

Important

The relationship between the coordinates (a, b, c) in the $(\underline{A}, \underline{B}, \underline{C})$ frame and the coordinates (a', b', c') in the $(\underline{A'}, \underline{B'}, \underline{C'})$ frame of a vector $\underline{V}$ is:

$$\begin{pmatrix} a \\ b \\ c \end{pmatrix} = M_\Psi(\Psi) \times M_\theta(\theta) \times M_\varphi(\varphi) \begin{pmatrix} a' \\ b' \\ c' \end{pmatrix}$$

A.2 Vectorial Transformation between Phins Subsea and Vehicle (Rotation Matrix)

The relationship between the coordinates ($\underline{a}_{v1}, \underline{a}_{v2}, \underline{a}_{v3}$) in the ($\underline{X}_{V1}, \underline{X}_{V2}, \underline{X}_{V3}$) reference frame and the coordinates ($\underline{a}'_1, \underline{a}'_2, \underline{a}'_3$) in the ($\underline{X}'_1, \underline{X}'_2, \underline{X}'_3$) frame of vector is:

$$\begin{pmatrix} a_{v1} \\ a_{v2} \\ a_{v3} \end{pmatrix} = M_{\Psi}(\text{misheading}) \times M_{\theta}(\text{mispitch}) \times M_{\phi}(\text{misroll}) \begin{pmatrix} a'_1 \\ a'_2 \\ a'_3 \end{pmatrix}$$

The matrices M_{Ψ} , M_{θ} and M_{ϕ} are defined in section A.1.

A.3 Vectorial Transformation Between Local Geographic Frame and Vehicle

The relationship between the coordinates $\underline{a}_v = (\underline{a}_{v1}, \underline{a}_{v2}, \underline{a}_{v3})$ in the ($\underline{X}_{V1}, \underline{X}_{V2}, \underline{X}_{V3}$) subsea vehicle body frame and the coordinates $\underline{a}_n = (\underline{a}_N, \underline{a}_W, \underline{a}_{Up})$ in the ($\underline{X}_N, \underline{X}_W, \underline{X}_{Up}$) navigation frame of the vector $\underline{V}$ is:

$$\begin{pmatrix} a_N \\ a_W \\ a_{Up} \end{pmatrix} = M_{\Psi}(\text{Heading}) \times M_{\theta}(\text{Pitch}) \times M_{\phi}(\text{Roll}) \begin{pmatrix} a_{v1} \\ a_{v2} \\ a_{v3} \end{pmatrix}$$

The matrices M_{Ψ} , M_{θ} and M_{ϕ} are defined in section A.1.

Important

Notice that the order of the matrix multiplication is extremely important since inverting the matrices will produce erroneous results.

The preceding product of matrix is:

$$C_v^n = \begin{pmatrix} \cos(\theta) \cdot \cos(\Psi) & \cos(\phi) \cdot \sin(\Psi) + \sin(\phi) \cdot \sin(\theta) \cdot \cos(\Psi) & -\sin(\phi) \cdot \sin(\Psi) + \cos(\phi) \cdot \sin(\theta) \cdot \cos(\Psi) \\ -\cos(\theta) \cdot \sin(\Psi) & \cos(\phi) \cdot \cos(\Psi) - \sin(\phi) \cdot \sin(\theta) \cdot \sin(\Psi) & -\sin(\phi) \cdot \cos(\Psi) - \cos(\phi) \cdot \sin(\theta) \cdot \sin(\Psi) \\ -\sin(\theta) & \sin(\phi) \cdot \cos(\theta) & \cos(\phi) \cdot \cos(\theta) \end{pmatrix}$$

n: navigation frame

b: subsea vehicle frame

B Advanced Communication Setup

B.1 Configuring Phins Subsea in an Ethernet Network

Inserting Phins Subsea into an Ethernet network allows you to configure it and access to its data from any part of the network.

By default, the Phins Subsea is already assigned with an IP address.

Depending on the nature of the network where it is inserted, the Phins Subsea is required to be configured so that it adapts to the Ethernet network. If the Ethernet network has not been setup, the user may take reference from the next section to select IP addresses.

Equipment Required

- 1 x Ethernet Wireless Router with incorporated wired switch (Router should have LAN address configuration functionality)
- 1 x PC/Laptop with a free Ethernet port or a wireless adaptor
- 2 x Cat 3/Cat 5 Straight Ethernet Cable

Only 1 cable is required if the PC/Laptop has a wireless adaptor.

B.1.1 CHOOSING AN IP ADDRESS

If you decide to change the default configuration of Phins Subsea, you will need to provide two IP addresses for both Phins Subsea and the PC/Laptop.

It is important to keep track of the addresses entered on both systems as their addresses are different.

You will need to setup a private network between the PC and the inertial product, thus you will need to select an address for the PC and the inertial product.

In private network addresses, it is usually recommended to use addresses of

- Either Class B (169.254.0.0 to 169.254.255.255) – Subnet Mask: 255.255.0.0
- Or Class C (192.168.0.0 to 192.168.255.255) – Subnet Mask: 255.255.255.0

Important

For Class C, the first (e.g. 192.168.0.0) and last (e.g. 192.168.255.255) addresses are reserved and therefore they cannot be used.

It is recommended to select two addresses from the same range set:

- Either 169.254.0.1 for the inertial product and 169.254.0.2 for the PC (Subnet 255.255.0.0)
- Or 192.168.1.10 for the inertial product and 192.168.1.11 for the PC (Subnet 255.255.255.0)

IP address options

Inserting the inertial product into the network mainly depends on the configuration of the local private network.

The system integrator can have:

- Either set DHCP=ON, so that the inertial product will acquire IP address information from the local DHCP Server/Router. No setting of IP address will be required.
- Or set DHCP=OFF, and the user will need to specify an address for the inertial product, which is taken from the same subset of the local private network.

Phins Subsea DHCP Option

Most routers sold today do come along with DHCP functionality. This allows the router to automatically assign unused IP addresses to all devices connected to the network.

- If the network where the inertial product is inserted is DHCP enabled, you may use this option for the setup.
- If the network is not DHCP enabled, you will need to specify an address for the inertial product, which is taken from the same subset of the local private network.

Refer to section 4.3 to configure DHCP functionality.

B.1.2 RETRIEVING THE IP ADDRESS OF PHINS SUBSEA

If you do not know the Phins Subsea IP address or if you want to know which IP address was attributed by the DHCP server, connect the repeater cable to your PC and start a serial terminal (HyperTerminal, BBTALK, etc.) configured at 19200 baud, no parity, 1 stop bit, 8 data bits. Reboot the inertial product once connected. You will get the Phins Subsea boot sequence message that contains its attributed IP address (line beginning with "IFCONF"):

```
Image QNX iXSea vXXX
Welcome to eOCTANS
DRV : 0 00198C000199
WAIT_EN : 0
IFCONF 1 : 0 192.168.36.199
IF_UP 1 : 0
IDEQNX3 : 0
FIN ---
```

B.1.3 TESTING THE CONNECTION

Checking the Connection with a Ping Command

The ping command is a computer network utility used to test whether a particular host is reachable across an Internet Protocol network and to measure the round-trip time for packets sent from the local host to a destination system, including the local host own interfaces.

You need to know the IP address of Phins Subsea to perform the procedure:

- The default IP address is 192.168.36.1xx, xx being the two last digits of the serial number of your unit.
- See section B.1.2 to retrieve a lost IP address.

1. Open the command window: from Start menu, type in cmd in the search box then press [Enter].

The command window opens:

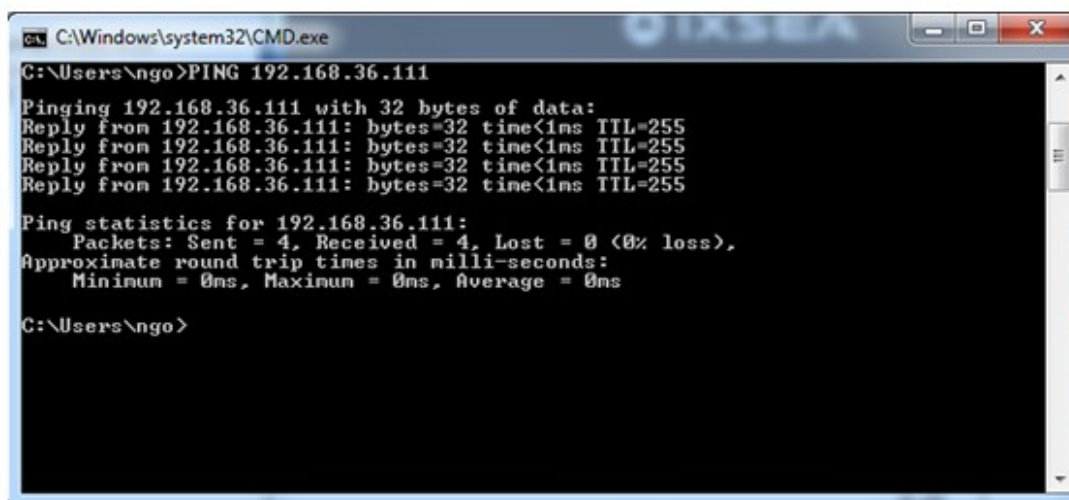


2. In the command window, type in:

```
PING yyy.yyy.yyy.yyy
```

replacing yyy.yyy.yyy.yyy by the IP address of your inertial system unit.

The successful command reply is looking like the following: here it is the example for the IP address 192.168.36.111



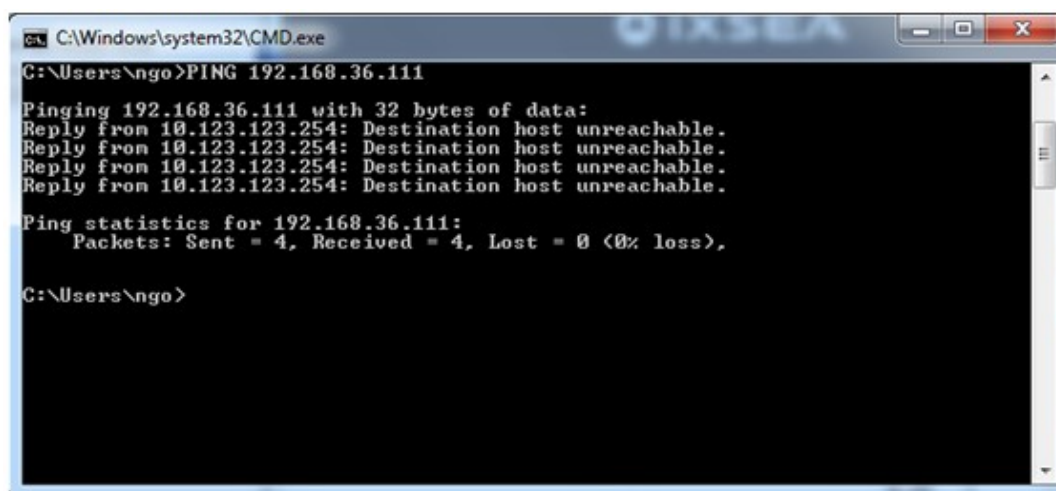
```
C:\Windows\system32\CMD.exe
C:\Users\ngo>PING 192.168.36.111

Pinging 192.168.36.111 with 32 bytes of data:
Reply from 192.168.36.111: bytes=32 time<1ms TTL=255
Reply from 192.168.36.111: bytes=32 time<1ms TTL=255
Reply from 192.168.36.111: bytes=32 time<1ms TTL=255
Reply from 192.168.36.111: bytes=32 time<1ms TTL=255

Ping statistics for 192.168.36.111:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\Users\ngo>
```

The unsuccessful command reply is looking like the following: here it is the example for the IP address 192.168.36.111



```
C:\Windows\system32\CMD.exe
C:\Users\ngo>PING 192.168.36.111

Pinging 192.168.36.111 with 32 bytes of data:
Reply from 10.123.123.254: Destination host unreachable.
Reply from 10.123.123.254: Destination host unreachable.
Reply from 10.123.123.254: Destination host unreachable.
Reply from 10.123.123.254: Destination host unreachable.

Ping statistics for 192.168.36.111:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

C:\Users\ngo>
```

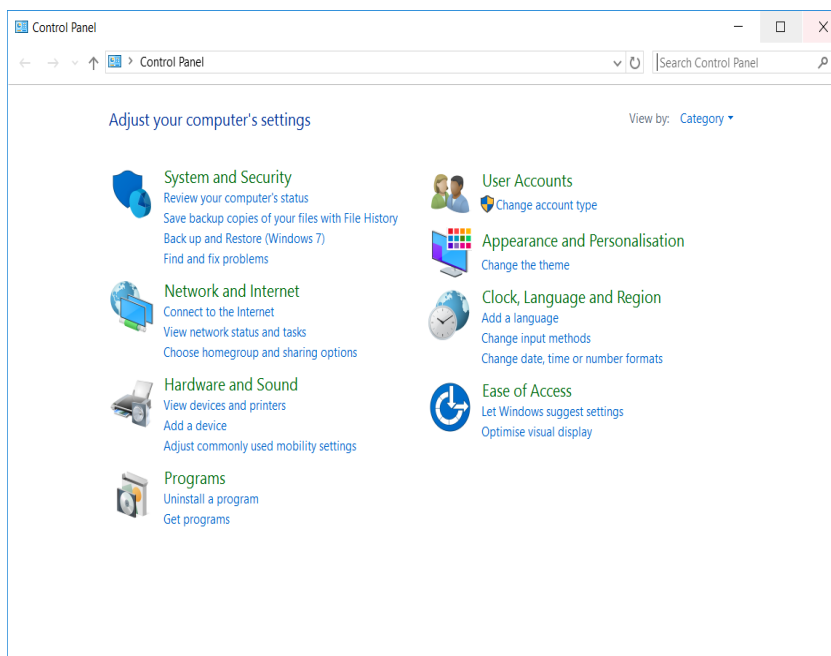
If you could not reach your inertial system using the ping command, you have to check the setting of your computer (see section 1), the issue may be on your side due to wrong settings of your PC.

Reading the Data Flow with a Telnet Command

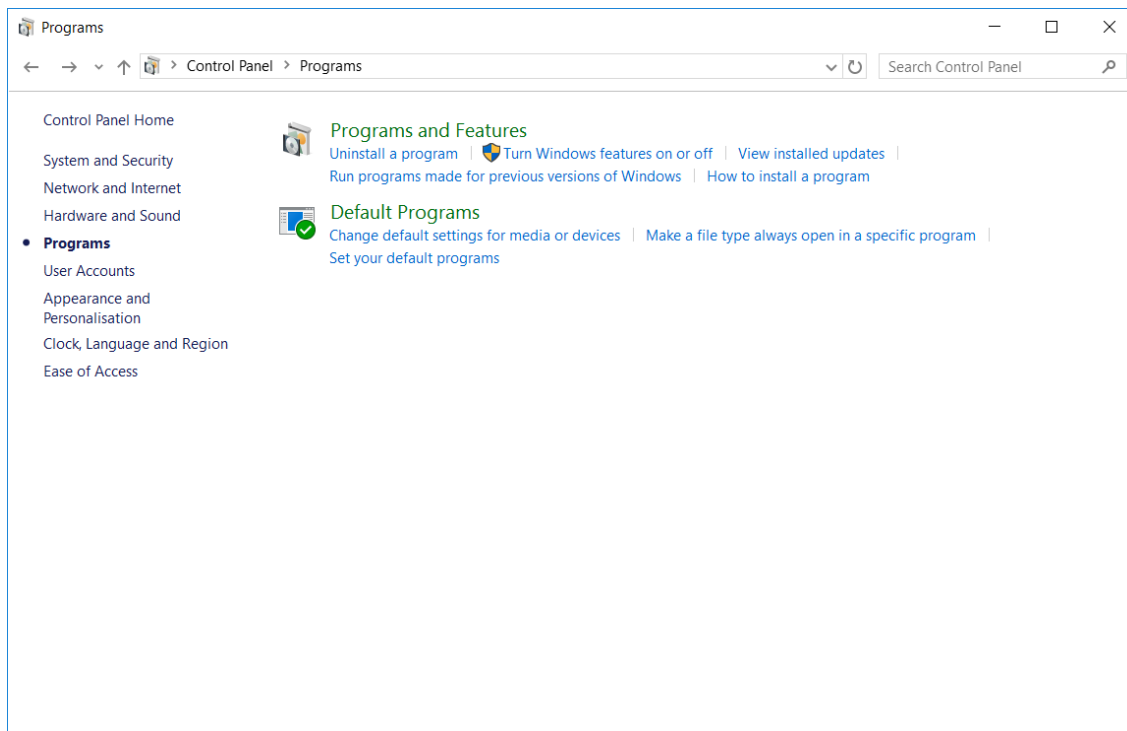
You can check the Phins Subsea data flow using a Telnet command.
You need to activate the telnet command before using it.

1. Open the Control Panel (**Start** menu, **Control Panel** option)

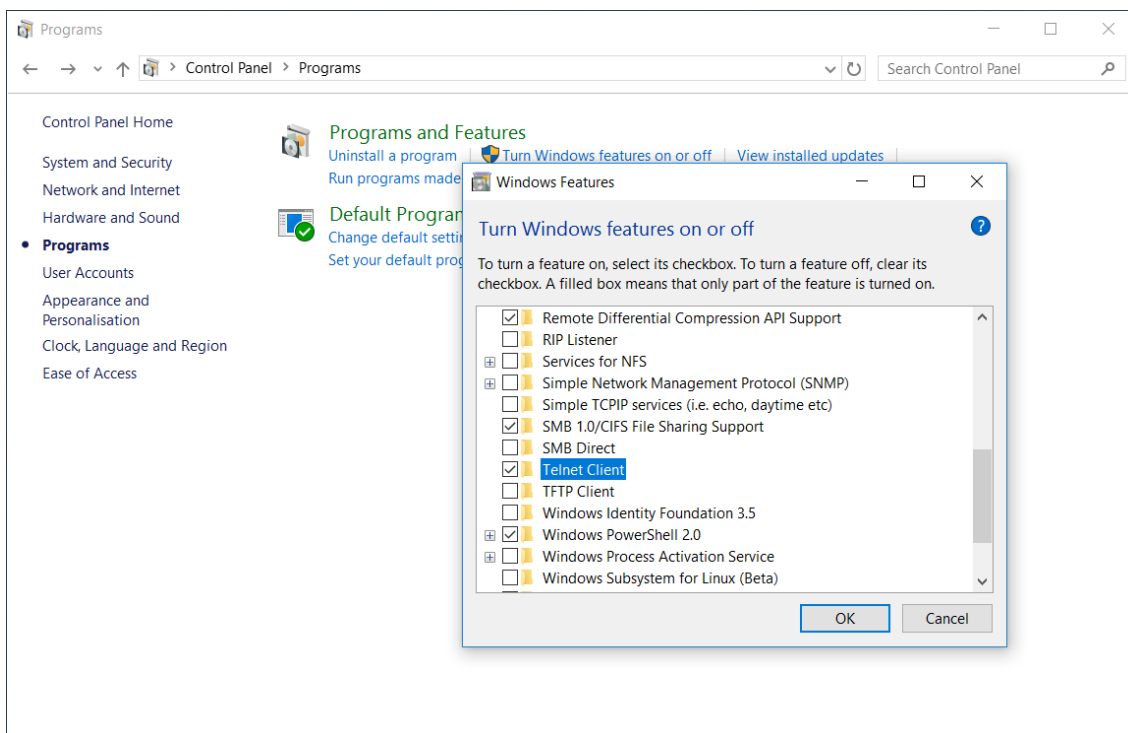
The Control Panel opens:



2. Click **Programs** then under **Programs and Features** menu, choose **Turn Windows features on or off** option:



3. In the Windows Features window that displays select **Telnet Client** by clicking in the associated tick box then click **OK**.



4. Close the Control Panel.

Launching the Telnet command

You need to know the IP address of Phins Subsea to perform the procedure:

- The default IP address is 192.168.36.1xx, xx being the two last digits of the serial number of your unit.
- See section B.1.2 to retrieve a lost IP address.

1. Open the command window: from **Start** menu, type in cmd in the search box then press **[Enter]**.

The command window opens:

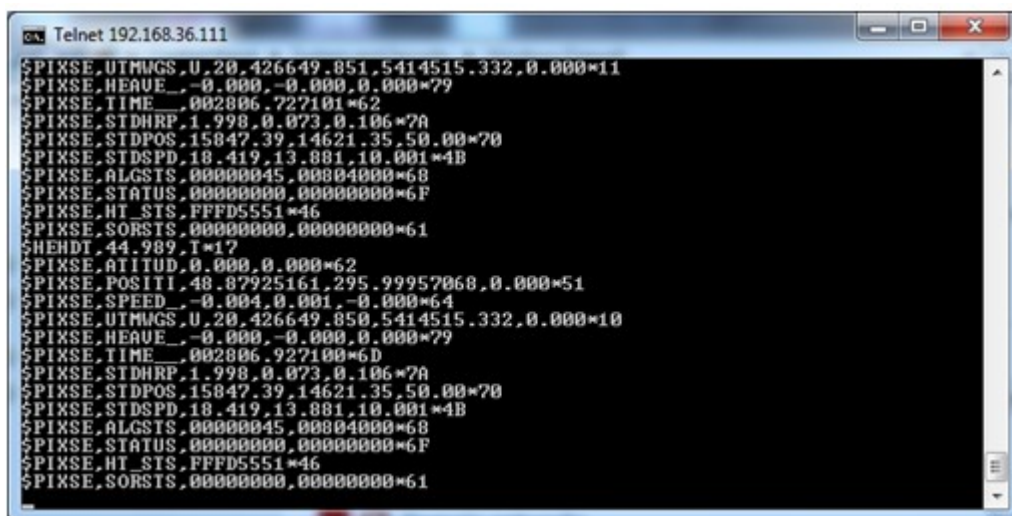


-
2. In the command window, type in:

```
TELNET yyy.yyy.yyy.yyy 8110
```

Replacing yyy.yyy.yyy.yyy by the IP address of Phins Subsea.

The successful command reply is looking like the following: here it is the example of a product with the IP address 192.168.36.111.



B.2 Setting up the Phins Subsea Data Connection

The Phins Subsea features several data outputs/inputs. All these inputs and outputs can be accessed via one single Ethernet cable.

To differentiate between the individual inputs and outputs within the Ethernet connection, the data is transmitted using different port numbers. Each port number used will be represented by one socket port.

B.2.1 TRANSPORT MODES

There are four transport modes available, namely:

- **TCP Server**
 - > Protocol used: TCP
 - > Address specified: N.A
 - > This requires a client to establish the connection to the inertial product
The address for the client to access the inertial product is the same address used in the repeater port.
- **TCP Client**
 - > Protocol used: TCP
 - > Address specified: address of the server that receives the data
 - > Phins Subsea will establish the connection to the server
- **UDP**
 - > Protocol used: UDP
 - > Address specified: address of terminal that receives the data
 - > The specific terminal will need to listen for the data from Phins Subsea. Other terminals in the network will not be able to receive this data through normal means.
- **UDP Broadcast**
 - > Protocol used: UDP
 - > Address specified: broadcast address is limited to subnet mask. For example, if the subnet mask is 255.255.0.0 and system IP is 192.168.36.3, the broadcast address will be 192.168.255.255
 - > All connected terminals will be able to receive the same data simultaneously by opening the same port to listen for the data
- **UDP Network Broadcast**
 - > Unlike UDP broadcast, UDP network broadcast is not targeted to all hosts on a network, but to all hosts on a subunit. Since a physical network can contain different subnets/networks e.g 192.168.0.0 and 200.200.200.0, the purpose of this special broadcast is to send a message to all the hosts in a particular subnet
 - > The IP broadcast is not set to 255.255.255.255 but is set to the subnet broadcast address
- **UDP Multicast**
 - > Protocol used: UDP
 - > Address specified: multicast subscription group that receives the data
 - > Equipment that needs to receive the output flow will have to subscribe to the same UDP multicast address and port. Multicast transmission method allows sending the same information to several different targets without broadcasting it to the entire network, thus saving network bandwidth.



For the Ethernet version of the Repeater port, the Graphical User Interface uses TCP Client as default transport mode to access to Phins Subsea. This setting cannot be changed. This means there can be only one terminal connected to the Phins Subsea repeater port.

B.2.2 PORT NUMBERS

In computer applications, port numbers are used to identify how data come from the process that produces the data, to the end process which receives the data.

Phins Subsea uses port numbers to separate data from each port so that data that come from the IP address can be differentiated.

You can select any number above 1024 as port numbers.

Port number for repeater port is fixed at 8110.

By default, the 8111 to 8120 are used for outputs and inputs of Phins Subsea.

Important

To prevent conflicts with other systems or applications, it is important that no identical numbers are used and that reserved ports are not used.

B.2.3 CONFIGURING A PORT WITH THE TCP TRANSPORT MODES

The following parameters and their values will be needed to configure the port:

- Transport: TCP Server or TCP Client
- Port: any 4-digit number you want that is above 1024 (e.g. 8111)

The selected port number must be the same as the one used on the server or client.

The choice between Server and Client depends on the configuration of the whole system.

Whether Phins Subsea establishes the connection or the server is the one that establishes the connection.

B.2.4 CONFIGURING A PORT WITH THE UDP TRANSPORT MODES



iXblue recommends to set up input and output on different port numbers.

Unlike TCP which requires TCP clients to establish a connection/handshake with the server before data is streamed, UDP packets will be streamed onto the network once the inertial product is powered ON. This means that the data transmission is unsecured and the server does not guarantee the data packets are received in order/sequence at the client side.

There will be instances where packets are dropped. Such instances mainly depend on the integrity of the network. Fortunately, UDP still ensures that the data received is same as it is transmitted.

However, UDP has its advantages.

UDP is faster, throughput is better than TCP due to smaller packet headers used.

Selecting **UDP Broadcast** option under Transport field, Phins Subsea will stream data onto the network. This means everyone connected to that network will be able to receive the data, in other words for the same output port number, more than one computer will be able to receive the same data.

Configuring for a UDP connection is similar to configure a TCP connection. The only difference will be to select **UDP** or **UDP Broadcast** under **Transport** option.

B.3 Connecting Phins Subsea directly to a PC/laptop by serial link

Equipment required

- 1 x PC or Laptop (with an unused Serial port)
- 1 x test Serial Cable (provided)
- 1 x Cat 3/Cat 5 Cross Ethernet Cable (for changing the inertial product IP address) (With new PC Generation, it is possible to use a straight cable. The PC then manages the pin inversion)

Approach

The connection between Phins Subsea and the PC is made through a serial link. Phins Subsea works as a PPP Server that provides the ability to transport TCP/IP traffic over the serial link.

Phins Subsea Configuration

Phins Subsea is already assigned with an IP address. Before connecting the serial link, you need to activate the PPP mode using an Ethernet link and the Web-Based Graphical User Interface .

When PPP mode is activated, Phins Subsea will start a PPP server listening on repeater serial port at next reboot.

In this configuration, the Phins Subsea IP address over PPP will be automatically set to 192.168.36.201 and the PC will connect as a PPP client to Phins Subsea using a dial-up connection.

Thus, to connect to the Phins Subsea Web pages in PPP mode, open <http://192.168.36.201> on your browser after that the PC/Phins Subsea connection is established. Note that in this mode, first page loading can take several minutes.

B.3.1 ACCESS TO NETWORK CONNECTION WINDOW

In Windows 10: Open **Network Connections** by clicking the Start button, clicking Control Panel, clicking Network and Internet, clicking Network and Sharing Centre, and then clicking Manage network connections.

B.3.2 CREATING A DIRECT CONNECTION BETWEEN PHINS SUBSEA AND YOUR PC

1. Connect Phins Subsea to your PC using the provided test cable.
2. Access to **Network Connections** Window.
3. On the left panel of the **Network Connections** window, click on **Create a New connection**.
The New Connection wizard opens.
4. Read the Welcome page then click **Next**. *The Connection Type Selection appears.*
5. Select **Set up an advanced connection** then click **Next**. *The Advanced Connection Options page appears.*
6. Choose **Connect directly to another computer** then click **Next**. *The Host or Guest? page appears.*
7. Choose **Guest** then click **Next**.
The Connection Name page appears.
8. In the **Computer name** box, type a name for the connection.
On the Select a Device page, select a **Communications Port**, and then click **Next**.
9. If you want this connection to be made available to all users of this computer, on the **Connection Availability** page, click **Anyone's use** and then click **Next**.
10. If you want to reserve the connection for yourself, select **My use only**, and then click **Next**.
The Completing the New Connection Wizard page appears.
11. Click **Finish**.
12. Once created, right-click on the new connection name created and choose **Properties...**
The Properties window of the new connection appears.
13. Under **General tab**, click **Configure** button. The Modem Configuration window opens, set the **Maximum speed (bps)** to **57 600** and unselect '**Enable hardware flow control**' option then click **OK**.
14. Under **Options tab**, unselect '**Prompt for name and password, certificate, etc.**' option and click **OK**.
15. Click **OK** in the Properties window.

B.3.3 ACTIVATING THE NEW CONNECTION

1. Access to **Network Connections** Window. Refer to Appendix B.3.1
2. In the **Network Connections** window, activate the new connection by **double-clicking on its name**.

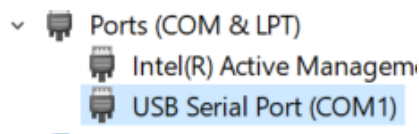
B.3.4 CREATING A SERIAL DIRECT CONNECTION UNDER WINDOWS 10



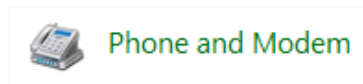
Remove the Ethernet connection from the Inertial Product. Check that there is a serial connection between the computer and the inertial product.
The following procedures must be performed in Administrator mode.

Creation of the modem

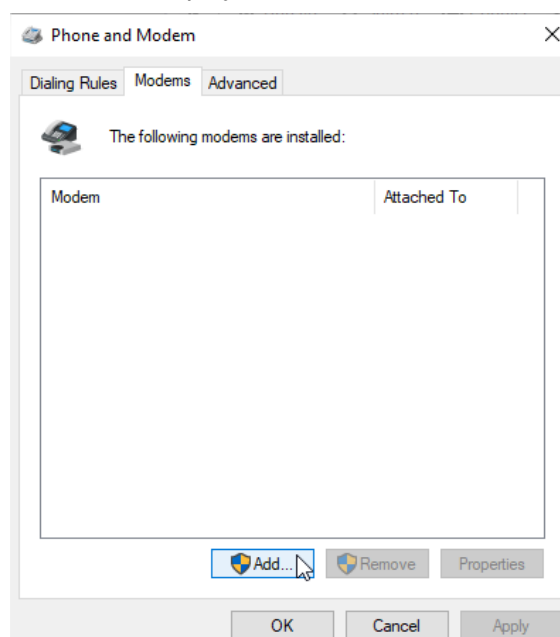
1. Open Device Manager and check that PORT 1 corresponds to the COM port to which is connected the system repeater port.



2. Search and find **Phone and Modem** in the control panel.

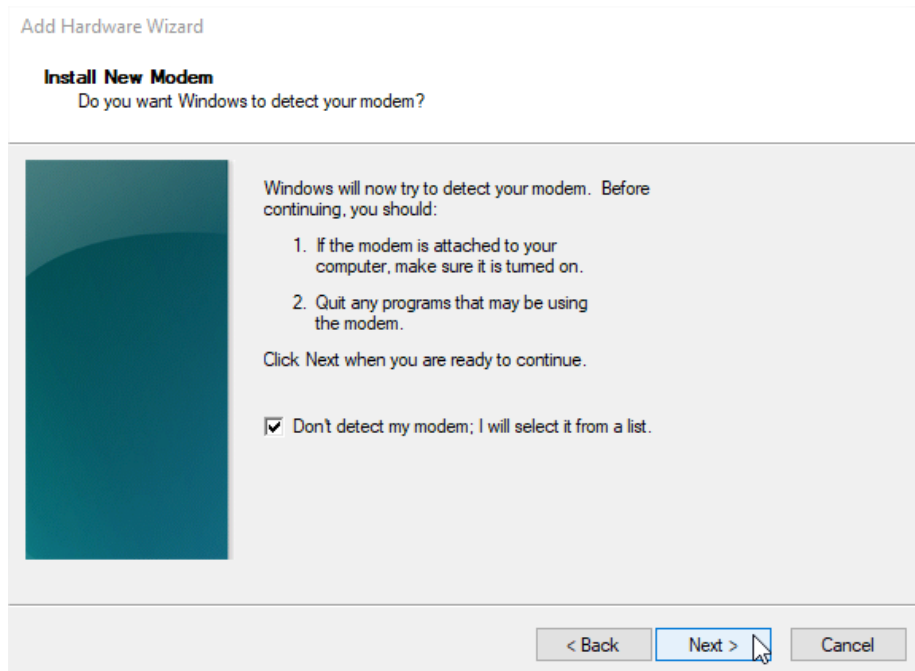


The Phone and Modem window is displayed.



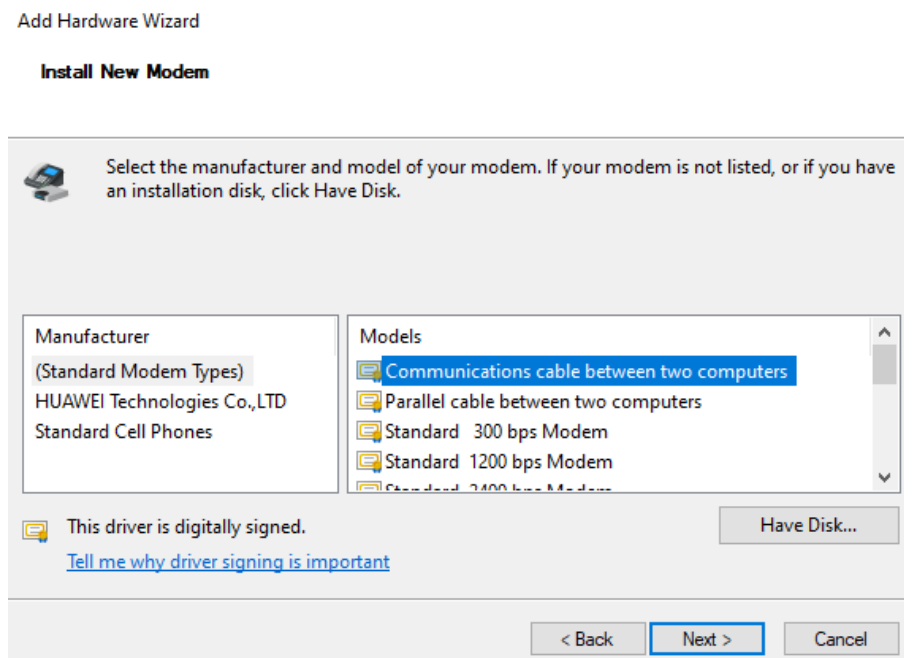
3. Click on **Modems** tab then click on **Add...** button.

The Install New Modem window is displayed.



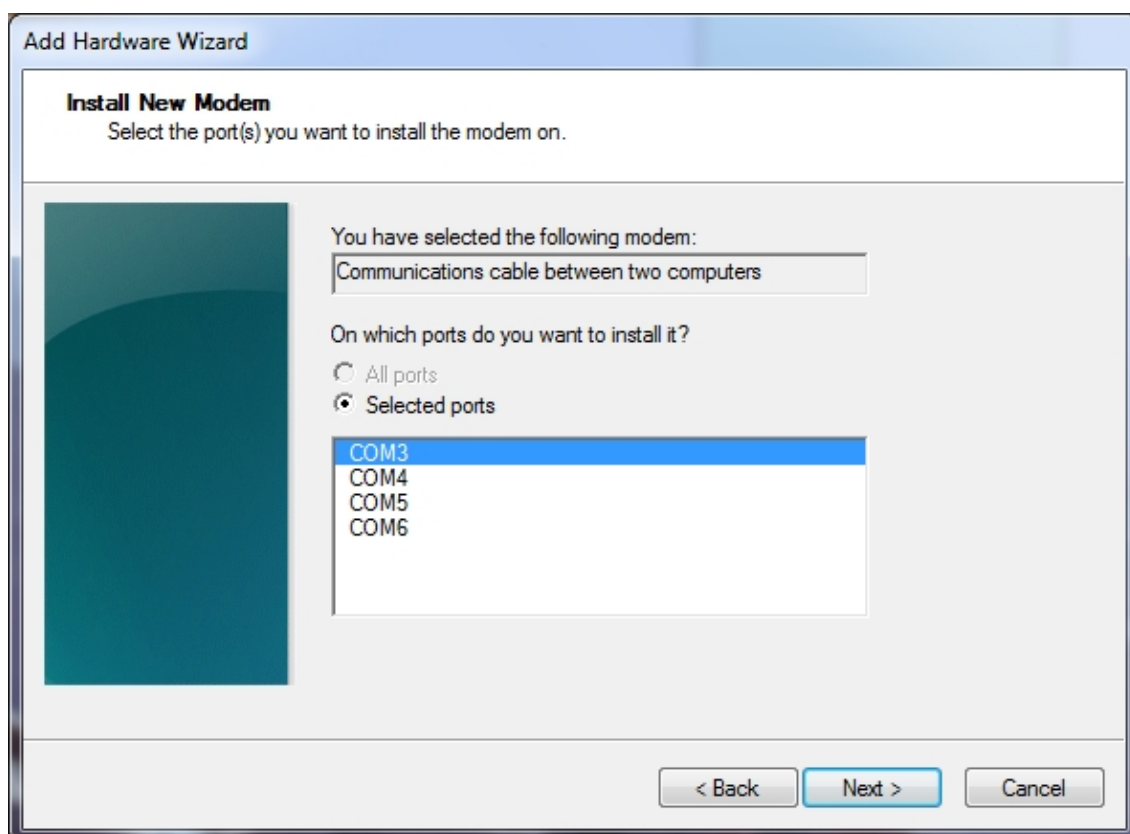
4. Select **Don't detect my modem; I will select it from a list.** option then click on **Next** button.

A new window is then displayed.



5. Under **Models** list, select **Communications cable between two computers** option then click **Next** button.

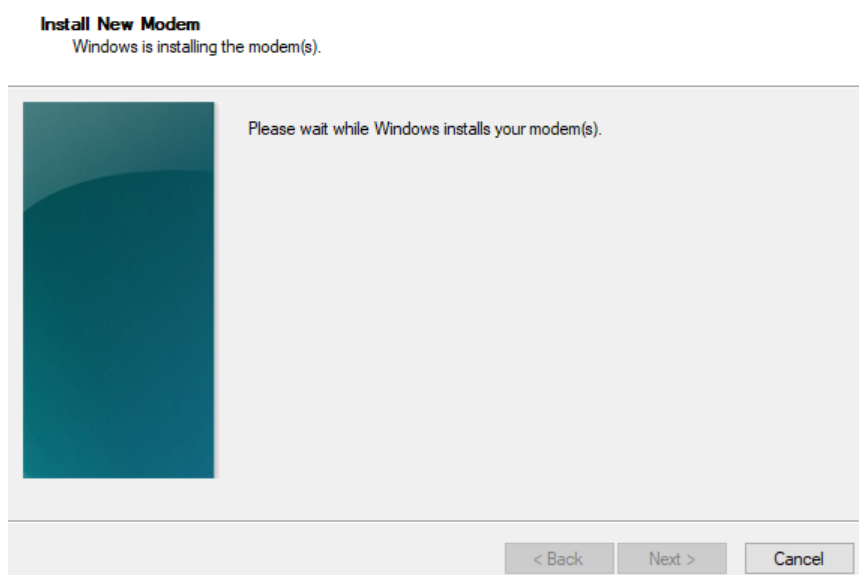
Another window is then displayed.



6. Choose **Selected ports**. *The available list of ports displays.*

7. Choose the port which is connected to Phins Subsea then click on **Next** button.
Following windows are displayed.

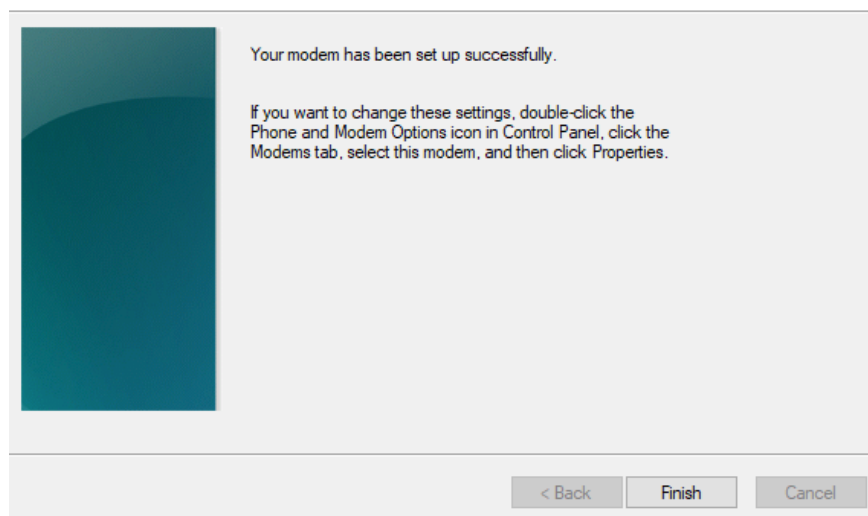
Add Hardware Wizard (Not Responding)



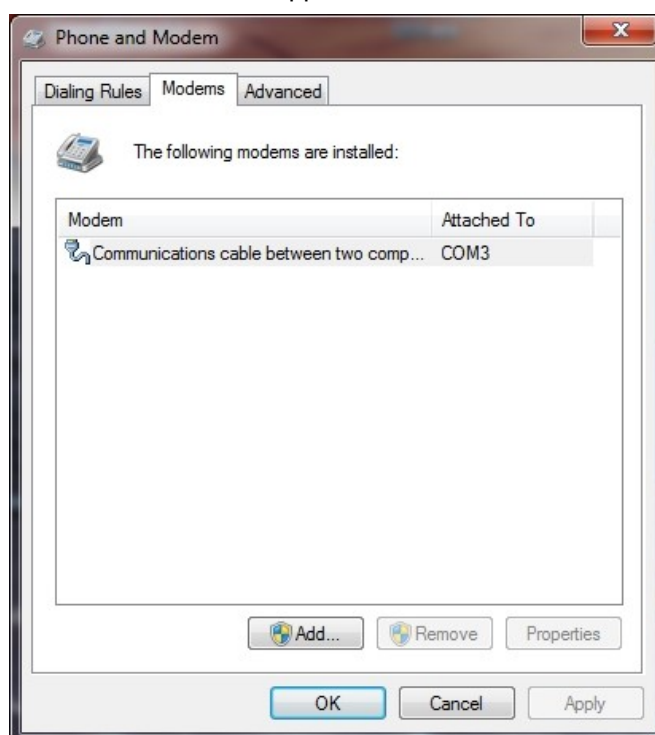
Add Hardware Wizard

Install New Modem

Modem installation is finished!



8. The message “**Your modem has been set up successfully**” is displayed.
9. Click on **Finish** button. This new modem appears now in the **Phone and Modem** window:

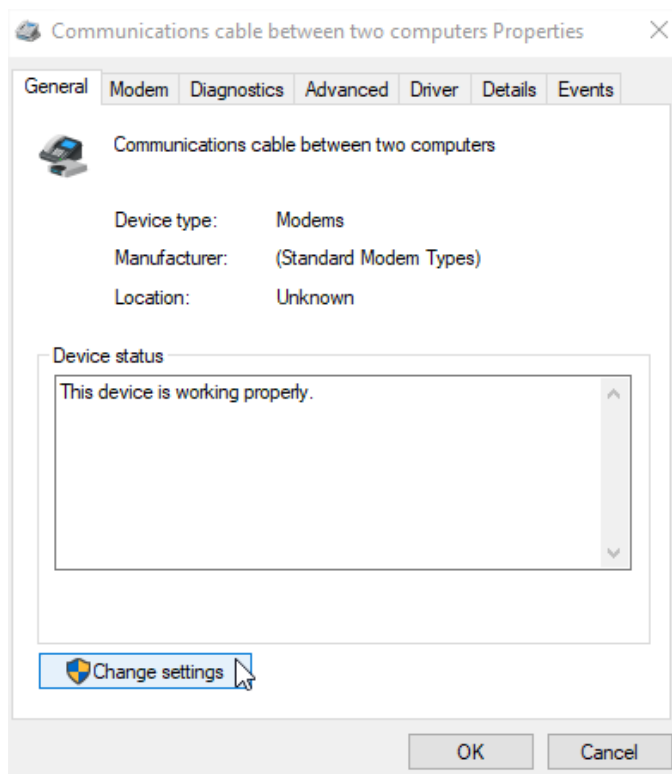


10. The modem is created.

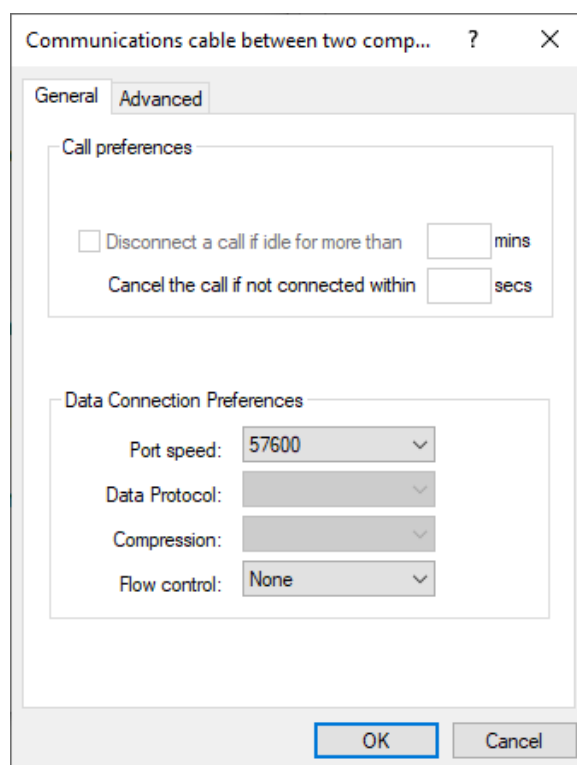
**Configuring
the modem**

1. In the previous window, click on the created modem then click on **Properties** button to modify the parameters of the created modem.

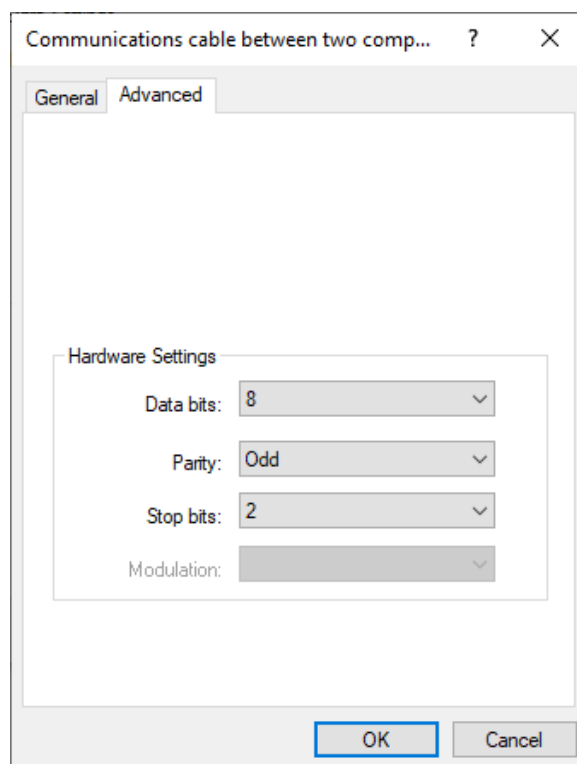
The following window is displayed:



2. In the **General** tab, click on **Change settings** button.
3. Click on **Modem** tab. In the Maximum Port Speed are, select the baudrate in the list: **57600** bauds.
4. Click on **Advanced** tab then click on **Change Default Preferences** button.
5. In the **General** tab, modify the parameters with the **following parameters**:



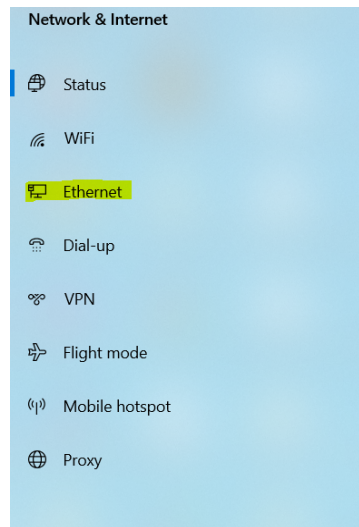
-
6. In the **Advanced** tab, **modify as it is displayed below**:



-
7. Click on **OK** button on all the windows.
-
8. Shutdown the computer then start it again.
-

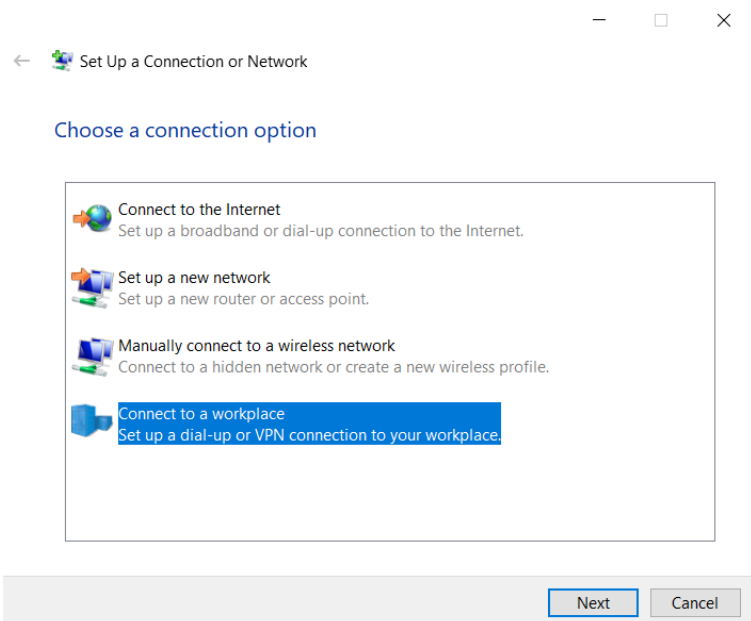
Creating the PPP connection

1. Click on your Wifi/Ethernet icon. Open **Network & internet** settings.



2. Click on the **Ethernet** menu.
3. At the right side of the screen, click on **Change adapter options** option.
4. Open the **Control Panel** then select **Network and Sharing Center** menu.
5. In the **Change your networking settings** area, click on **Set up a new connection or network** text label.

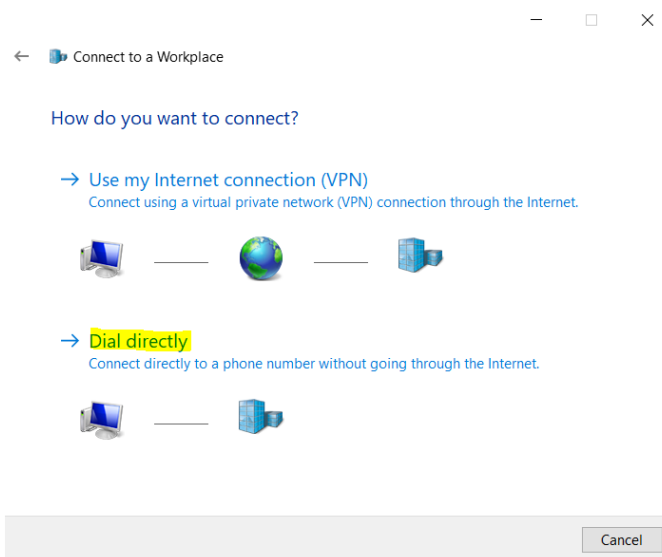
The window Set up a Connection or Network opens.



6. Choose **Connect to a workplace** option then click on **Next** button.

7. Choose to **create a new one** then click on **Next** button.

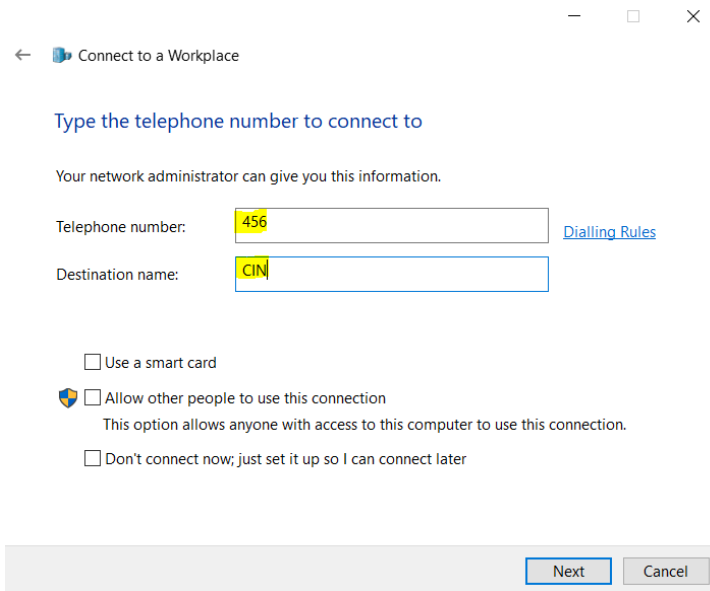
The following window is displayed:



8. Click on the **Dial directly** option.

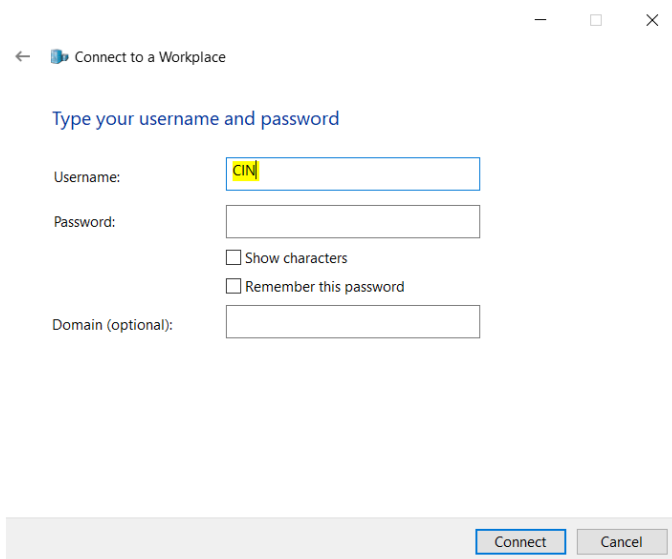
9. Select the modem previously configured by clicking on **Communications cable between two computers**.

The following window is displayed:



10. Enter **456** as telephone number and **CIN** as a destination name, then click on **Next** button.

The following window is displayed:



← Connect to a Workplace

Type your username and password

Username: CIN

Password:

☐ Show characters

☐ Remember this password

Domain (optional):

Connect Cancel

11. Create the **username**.

12. Click on **Connect** button.

13. **Windows will try to connect, interrupt him by clicking on Skip button.**

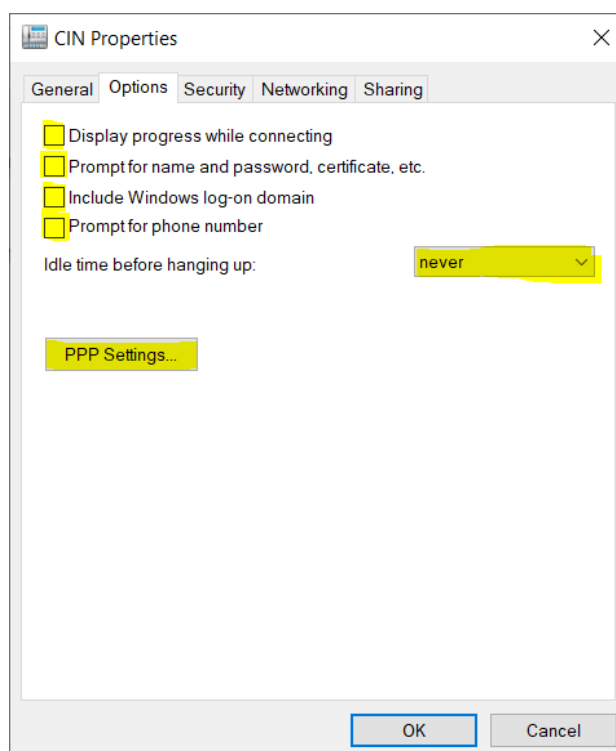
Configuring the PPP connection

1. Go to **Control Panel**, click on **Network and Internet**. Click on **Network connections**.

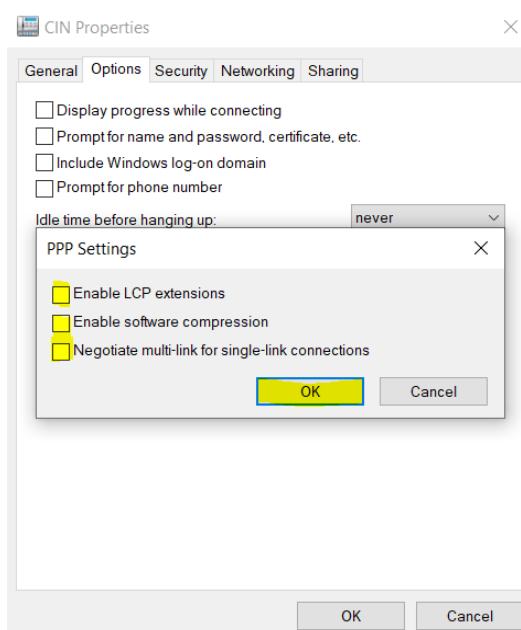
2. Click right on **your new connection** then select the **Properties** option.

3. In the **General** tab, select **Communication cable between the two computers** previously created.

4. Click on **Options** tab.
The following window is displayed:

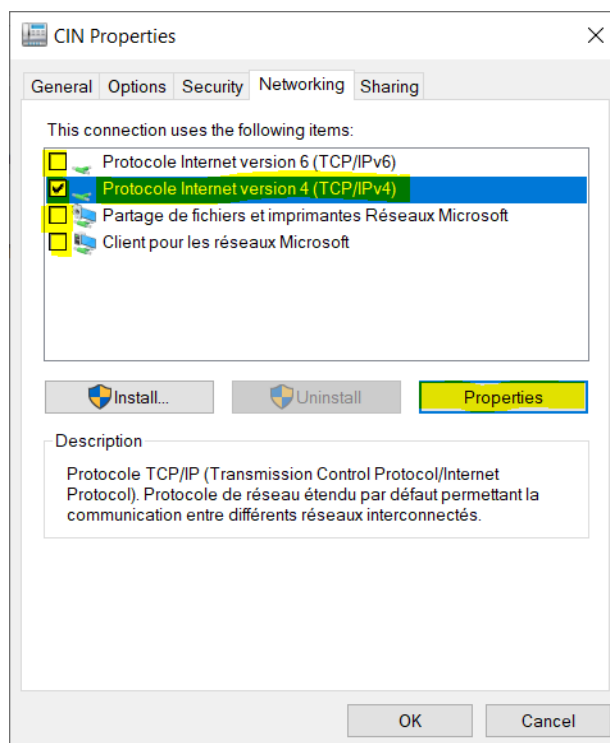


5. **Uncheck all the parameters.** In the list select **never**, then click on **PPP settings** button.
The following window is displayed:



6. **Uncheck all the parameters** again and click on **OK** button.

7. Click on **Networking** tab.
The following window is displayed:

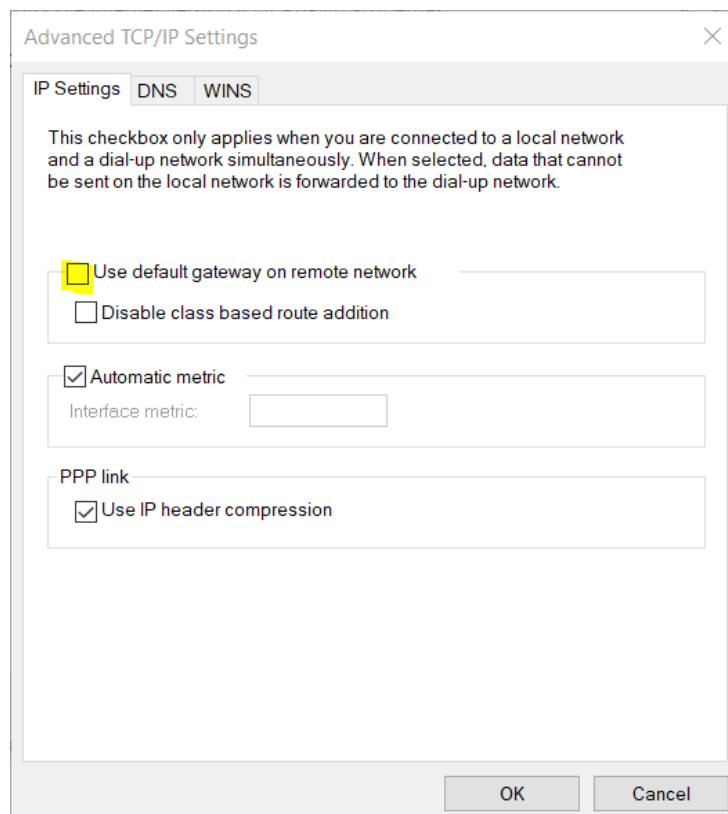


8. Unselect all the parameters.

9. Select the **Protocol Internet version 4 (TCP.IPv4)** then click on **Properties** button.

10. Click on **Advanced** button.

The following window is displayed:

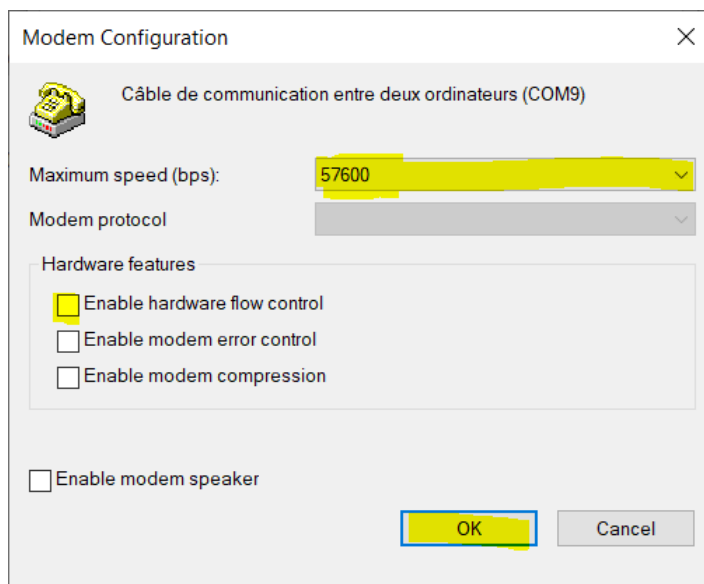


11. Uncheck **Use default gateway on remote network** and click on **OK** button.

12. Click on the **General** tab.

13. Click on **Configure** button.

The following window is displayed:



14. Set the baudrate to **57600**.

15. **Uncheck the other parameters** then click on **OK** button.

16. Click on **OK** button to close the Connection Properties window..

Connecting to the PPP connection



Check that the system is configured in PPP and that the repeater port is connected to the previously configured serial port.

1. Go to **Control Panel**, click on **Network and Internet**. Click on **Network connections**.

2. Click right on the **PPP connection** named PPP.

3. Click on **Status** then click on **Connect** button.

-
4. Wait few secondes for connecting PPP.
-
5. Open a web browser then type in the address bar : **192.168.36.201** (IP address of the system in PPP by default)
-
6. Check that the web-based graphical interface is displayed and the alignment phases run.
-

Disconnecting the PPP

-
1. Go to **Control Panel**, click on **Network and Internet**. Click on **Network connections**.
-
2. Click right on the **PPP connection** named PPP.
-
3. Click on **Status** then click on **Disconnect** button.
-

B.3.5 PHINS SUBSEA CONFIGURATION

Important

To launch the Web-based User Interface through a direct serial link:

- The PPP mode must have been activated
 - A direct connection must have been created.
-

Before connecting the serial link, you need to activate the PPP (Point to Point Protocol) mode using an Ethernet link and the Web-based User Interface:

-
1. In the Web-Based Graphical User Interface, click on the Installation menu then select the Network option.
-
2. Under **PPP Server area** for using the repeater with PPP server.
 - **Enabled** to launch the Web-Based Graphical User Interface via the serial link. When the check box Enabled is selected, the product will start a PPP server listening on repeater serial port at next reboot. When this option is disabled (default), the repeater port outputs PHINS STANDARD protocol.
 - **Standard**: to choose between an RS232 or RS422 serial link
 - **INS IP Address**: by default it is 192.168.100.201
 - **PC IP Address**: by default it is 192.168.100.202

The PC IP address is used in case of the PC is connected to two different inertial units. In this case there must be a different IP on the PC for each PPP interface.

For example:

192.168.200.1 on the PC PPP link 1 and 192.168.200.2 on the first Phins Subsea
192.168.200.3 on the PC PPP link 2 and 192.168.200.4 on the second Phins Subsea connected to the PC.
-

When PPP mode is activated, the Phins Subsea will start a PPP server listening on repeater serial port at next reboot.

In this configuration, the Phins Subsea IP address over PPP will be automatically set to 192.168.36.201 and the PC will connect as a PPP client to the product using dialup connection. Thus, to connect to the Phins Subsea web pages in PPP mode, open <http://192.168.36.201> on your browser after that the PC/product connection is established. Note that in this mode, first page loading can take several minutes.

C Enabling the Simulation Mode

When the simulation mode is enabled, all DSP computed data from the interface board is ignored and replaced by simulated values.

Each simulated value is directly entered under the SIMULATION PARAMETERS area. Thus the Web-Based Graphical User Interface and all output protocols will output simulated values instead of live ones.

Important

The simulation mode can be used during customer protocol debug and to check installation repeaters.

Simulated parameters

The list below details all parameters that can be simulated (refer to Table 1 to know the range and step value of each simulated parameter):

- Heading, roll and pitch and associated standard deviations
- Main lever arm position and associated standard deviations
- Linear speeds and associated standard deviations
- Heave, surge and sway
- Rotation rates
- Accelerations
- Accelerations in body frame
- Sensor and algorithm statuses

A simulated sensor status (default to 0) will allow dummy system (without FOG and ACC) to run without having sensor error flags raised in the Web-Based Graphical User Interface.

The system outputs heading, roll and pitch and linear speeds as configured sinus signal, defined by the following equation:

$$\text{Value}(t) = \text{Mean} + ((\text{Amplitude peak-peak})/2) * \sin(2 * \pi * t / \text{Period})$$

Where Mean, Amplitude peak-peak and Period are to be entered in the simulation page.

Table 1 - List of product parameters in simulation mode

Phins Subsea Output Parameters	Name and location in simulation page	Range	Step
Heading⁽³⁾			
Mean value	Heading / Mean (°)	0 to 360	0.001
Period	Heading / Period (s)	0 to 100	0.001
Amplitude	Heading / Amplitude (°)	0 to 360	0.001
Attitude: Roll			
Mean value	Attitude / Roll / Mean (°)	-180 to +180	0.001
Period	Attitude / Roll / Period (s)	0 to 100	0.001
Amplitude	Attitude / Roll / Amplitude (°)	-180 to +180	0.001
Attitude: Pitch			
Mean value	Attitude / Pitch / Mean (°)	-90 to 90	0.001
Period	Attitude / Pitch / Period (s)	0 to 100	0.001
Amplitude	Attitude / Pitch / Amplitude (°)	-90 to 90	0.001
Heading and Attitude Standard Deviation			
Heading	Attitude Std. Dev. / Heading Std. Dev. (°)	0.01 to 5	0.01
Roll	Attitude Std. Dev. / Roll Std. Dev. (°)	0.01 to 5	0.01
Pitch	Attitude Std. Dev. / Pitch Std. Dev. (°)	0.01 to 5	0.01
Position			
LATITUDE	Position / Latitude (°)	-90 to 90	0.000001
LONGITUDE	Position / Longitude (°)	0 to 360	0.000001
ALTITUDE	Position / Altitude (m)	-15000 to 15000	0.001
Position Standard Deviation			
LATITUDE STD	Position Std. Dev. / Latitude Std. Dev. (m)	0.01 to 500	0.01
LONGITUDE STD	Position Std. Dev. / Longitude Std. Dev. (m)	0.01 to 500	0.01
ALTITUDE STD	Position Std. Dev. / Altitude Std. Dev. (m)	0.01 to 500	0.01
Linear Speeds: North XV1 ⁽²⁾ Linear speed / XV1 -250 to 250 0.01			
Mean	Linear speed / XV1 / Mean (m/s)	-250 to 250	0.01
Period	Linear speed / XV1 / Period (s)	0 to 100	0.01
Amplitude	Linear speed / XV1 / Amplitude (m/s)	-250 to 250	0.01
Linear speed: East XV2 ⁽²⁾			
Mean	Linear speed / XV2 / Mean (m/s)	-250 to 250	0.01
Period	Linear speed / XV2 / Period (s)	0 to 100	0.01

Phins Subsea Output Parameters	Name and location in simulation page	Range	Step
Amplitude	Linear speed / XV2 / Amplitude (m/s)	-250 to 250	0.01
Linear speed: Vertical XV3 ⁽²⁾			
Mean value	Linear speed / XV3 / Mean (m/s)	-250 to 250	0.01
Period	Linear speed / XV3 / Period (s)	0 to 100	0.01
Amplitude	Linear speed / XV3 / Amplitude (m/s)	-250 to 250	0.01
Heave, Surge and Sway			
SURGE	Heave, Surge, Sway / Surge (m)	-10 to 10	0.01
SWAY	Heave, Surge, Sway / Sway (m)	-10 to 10	0.01
HEAVE	Heave, Surge, Sway / Heave (m)	-10 to 10	0.01
Accelerations			
North XV1	Acceleration / XV1 or North Acceleration (m/s ²)	-300 to 300	0.01
East XV2	Acceleration / XV2 or East Acceleration (m/s ²)	-300 to 300	0.01
Vertical XV3	Acceleration / XV3 or Vertical Acceleration (m/s ²)	-300 to 300	0.01
Rotation Rates			
Roll XV1 ⁽¹⁾	Rotation rates / Roll rate (°/s)	-750 to 750	0.001
Pitch XV2 ⁽¹⁾	Rotation rates / Pitch rate (°/s)	-750 to 750	0.001
Heading XV3 ⁽¹⁾	Rotation rates / Heading rate (°/s)	-750 to 750	0.001
Sensor status			
FOG Error	N/A	N/A	N/A
ACC Error	N/A	N/A	N/A
Source Error	N/A	N/A	N/A
Temperature Error	N/A	N/A	N/A
Degraded Mode	N/A	N/A	N/A
Failure Mode	N/A	N/A	N/A
Algo Status			
Alignment	N/A	N/A	N/A
Navigation	N/A	N/A	N/A
Altitude Saturation	N/A	N/A	N/A
Speed Saturation	N/A	N/A	N/A

(1) Rotation rate inputs of the simulation page will be used as both Heading Roll Pitch rates and body rotation rates to limit the number of inputs in the page.

(2) Linear speed inputs of the simulation page will be used as geographical speeds, body speeds and heave, surge and sway speeds to limit the number of inputs in the page.

(3) True course value will be assigned the input heading value

1. Click on the **SETUP** menu then select the **SIMULATION MODE** option. The following page is displayed:

The image displays two screenshots of the 'SIMULATION PARAMETERS' dialog box. The top screenshot shows the 'Enable Simulation Mode' switch set to 'OFF'. The bottom screenshot shows the same dialog box with the switch set to 'ON'. Both screenshots include 'Cancel' and 'OK' buttons.

2. In the **SIMULATION PARAMETERS** area, click on the **Enable Simulation mode** switch until displaying **ON**. Then the page is displayed completely with all the parameters.
3. **Enter and/or notch the parameters** to be simulated.
4. Click on the **OK** button to save the settings. The message “simulation mode” is displayed in the Status area of the control page to warn that the system output data is not lived.



To disable the simulation mode, unselect the Enable Simulation Mode option then click OK. The protocol outputs the real data and the interface too.