Quick Start Guide

Guide

Rovins

GYRO TO INS

Objective

This guide describes how to install the ROVINS, and the basic configurations required before beginning the positioning

Contents

CONVENTIONS

The following conventions are used in this guide

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

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

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

italic   Italic text is the result of an action in the procedures.

ROVINS SYSTEM OVERVIEW

The ROVINS system is an Inertial Navigation System (INS). It delivers heading and attitude information as well as position and speed, to other systems or to display. It can receive data from other sensors to improve its accuracy. The ROVINS system can also be used as a gyrocompass. The core of ROVINS is an inertial measurement unit (IMU). The IMU is the assembly of three fiber optic gyroscopes (FOG) manufactured by IXSEA and three high precision pendulum-type accelerometers.

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

ROVINS is delivered with a powerful and easy-to-use WEB-Based User Interface, which allows a complete configuration.

VERIFICATION OF PACK CONTENTS

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

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

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

BASIC INSTALLATION

This guide describes how to install ROVINS with a GPS, and the basic configurations required before beginning the positioning. This is the basic installation. If you need to install additional external sensors, to define lever arms and/or to enter installation biases, please refer to ROVINS User Guide. ROVINS being versatile, you have to define its configuration to insure optimal operation.
In this installation, we assume that ROVINS is aligned with respect to the vessel reference frame.

This configuration includes:

• Defining how ROVINS is installed on board (ROVINS orientation with respect to the vessel reference frame, ROVINS and GPS lever arms)
• The cable connections to other equipment (connection to the workstation, connection to the GPS)
• The activation of the product license
• The communication link, the serial or Ethernet link, the activation of the GPS , the pulse input for Time synchronization System i.e., all settings to enter into ROVINS using the WEB-based User Interface
• Navigation

Installing ROVINS + GPS
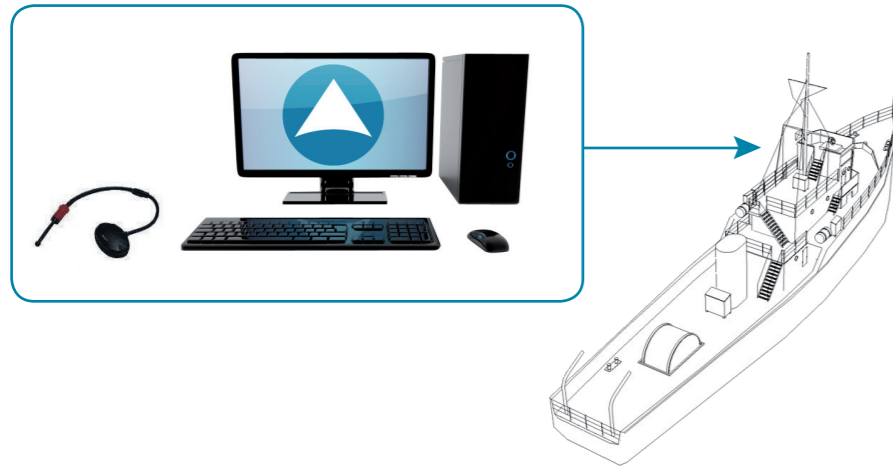
Activating the product license

LICENSE ACTIVATION

Send your license ID below to support. You will receive an activation code by mail to start using the system

License state :	**Not yet activated**
License ID :	**A3D6F534127DDFE4**
Activation code :	

Activate license

Step 3: Configuring

To define the ROVINS orientation, lever arms, and the PC-ROVINS communication parameters
To configure the GPS: serial or Ethernet input parameters, lever arm

To define the Time Synchronisation system

To define the initial position

To activate the license code

To activate the GPS (i.e., to take the GPS data into account by the Kalman filter)

Step 4: Navigating with ROVINS

5 min

Heading standard deviation < 0.1
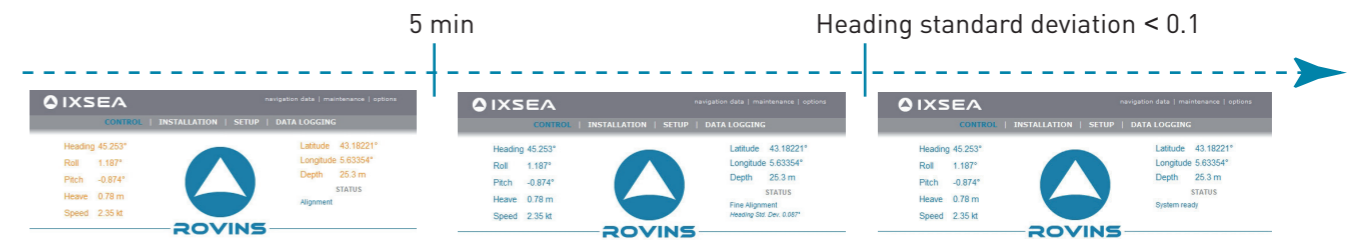
STEP 1- INSTALLING ROVINS

ROVINS is fixed onboard using six CHC M6 screws. It can be installed with any orientation with respect to the vessel (see the definition of the vessel reference frame hereafter). The alignment of the unit is performed by means of the two centering pins located on the bottom plate of the ROVINS. You will find on Figure 1 all the mechanical information necessary to fix ROVINS. All inertial measurements are default performed with respect to ROVINS reference frame (X1, X2, X3). This reference frame is defined in Figure 1. Motion sensing measurements are default measured at ROVINS Center of Measurement P (see Figure 1).
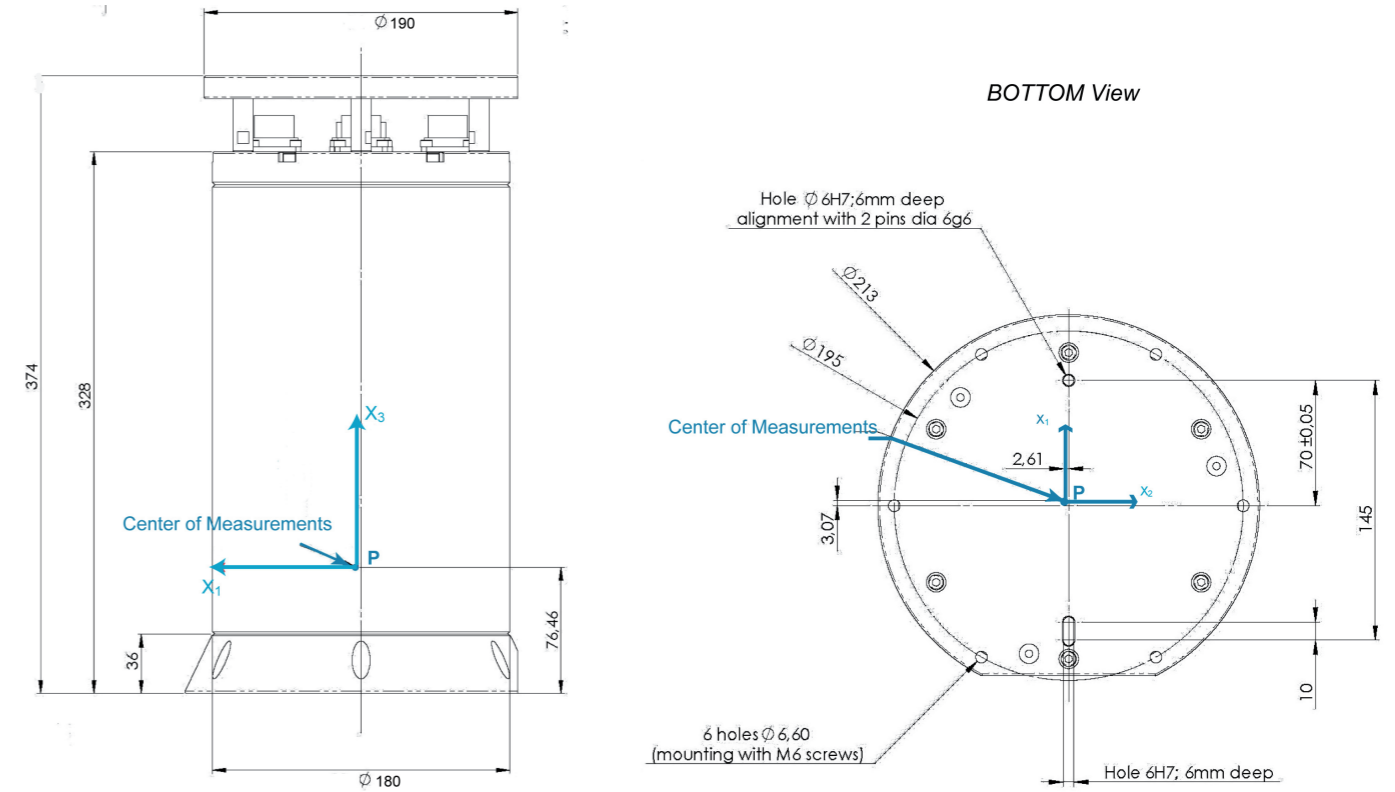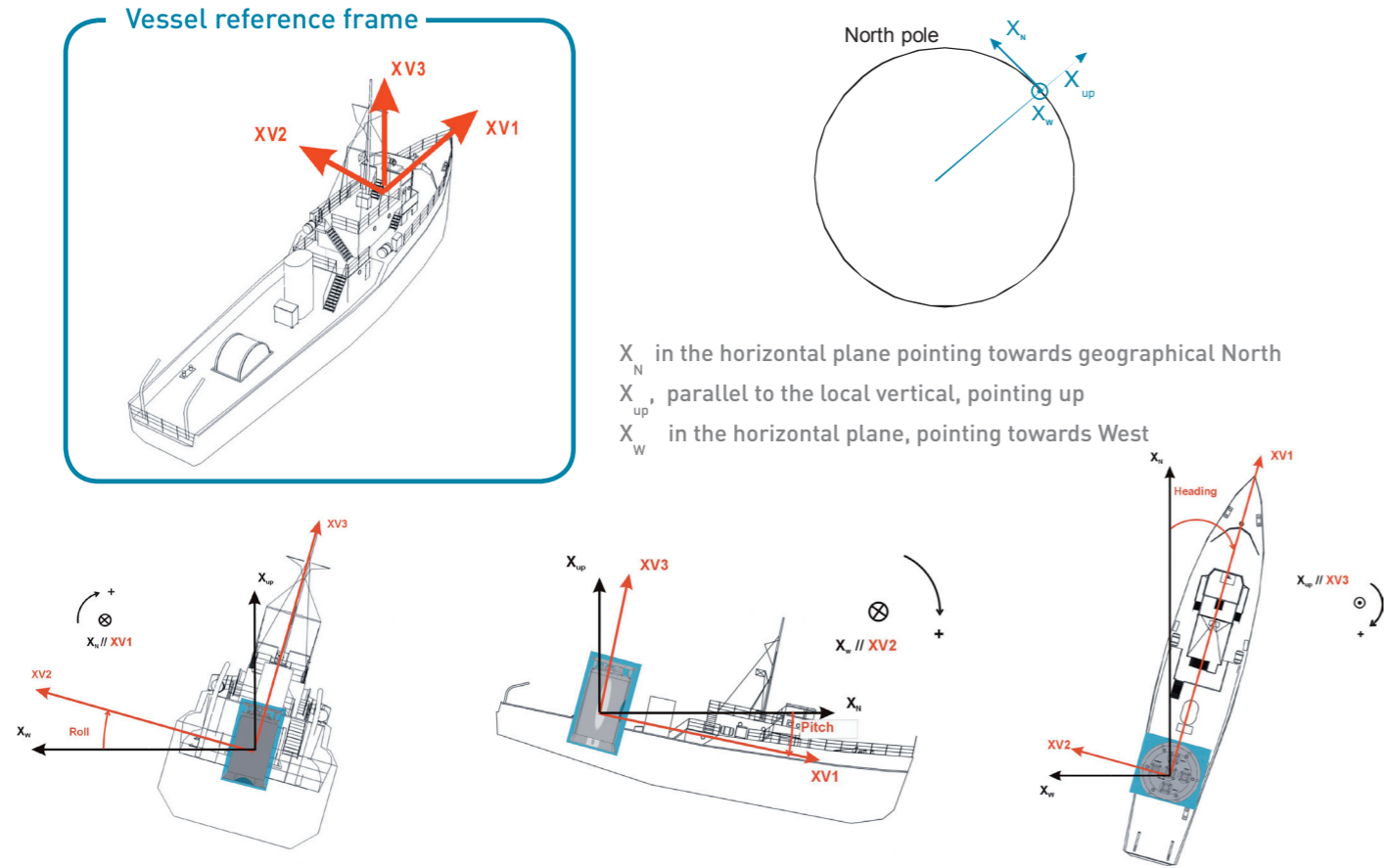

BOTTOM View

Figure 1 – Definition of ROVINS Reference Frame (X1,X2, X3) and P center of measurements

Recommendations and Note

- Temperature in operation must be in the range -20 °C to 55 °C
- The dimensions of the ROVINS housing are ((l x Ø) in mm): 374 x 213. There must be enough place for the wire way on the connector side of ROVINS
- The weight of ROVINS is 14.6 in air and 4.65 in sea water

TRUE HEADING, ROLL AND PITCH DEFINITIONS

Vessel reference frame

North pole

X_N in the horizontal plane pointing towards geographical North

X_{up}, parallel to the local vertical, pointing up

X_W in the horizontal plane, pointing towards West

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

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

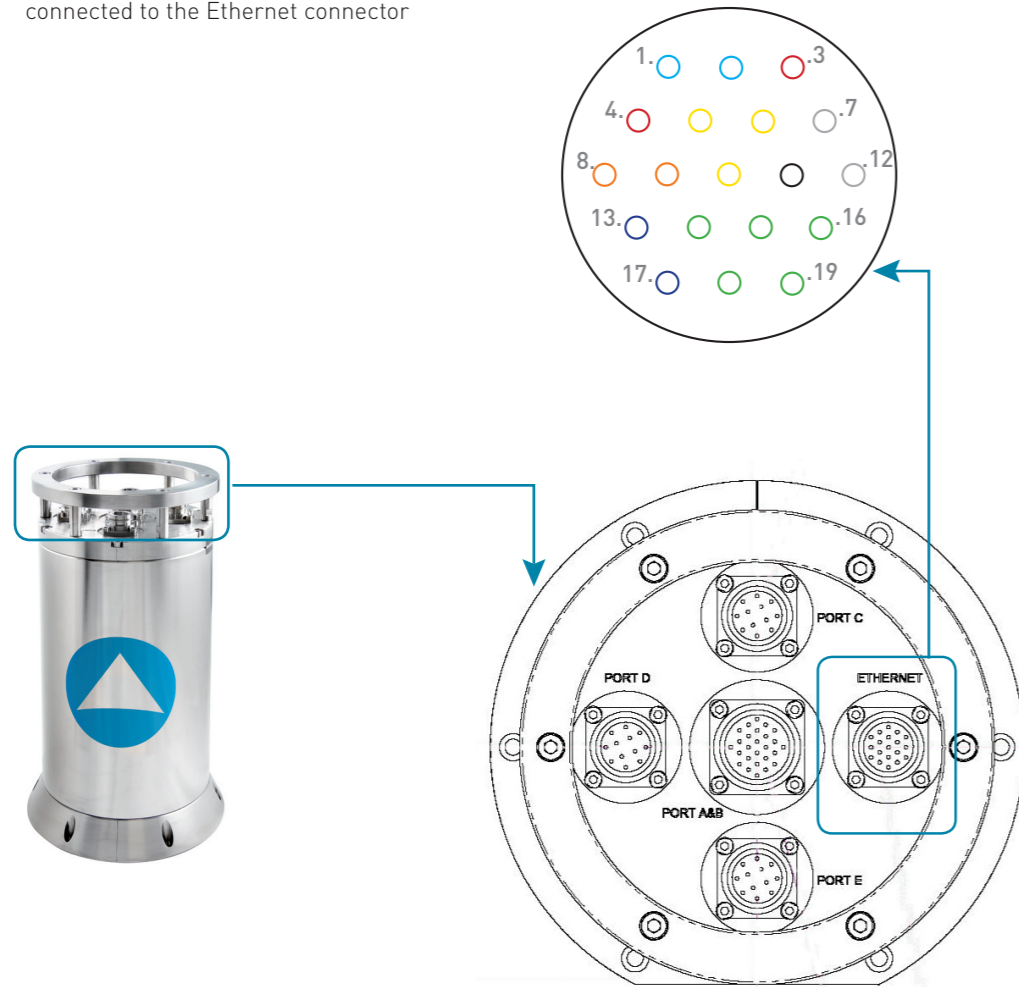Once the axes XV2 and XV1 lie in the local horizontal plane, the true heading is the angle between the vertical plane oriented in the North direction and the vertical plane passing through the vessel. Heading is counted positive from North, varying from 0 to 360°. The orientation of this angle is given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

Electrical Connections: GPS + PPS (optional for Time synchonization) Standard Ethernet Link Case

Standard case defined as follows:
External sensor connected to the ethernet stream A of ROVINS:
GPS Output protocol on stream A: GPS like
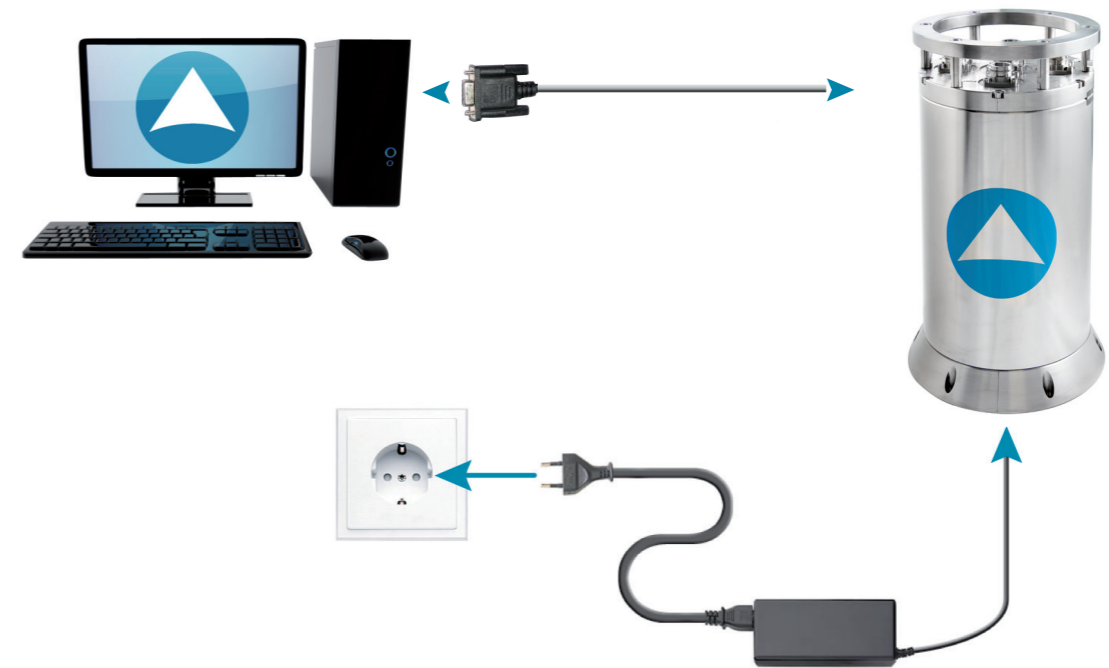PPS time synchronization pulse from the GPS cabled on the Pulse input B of ROVINS

To the Ethernet connector

To the Ethernet connector
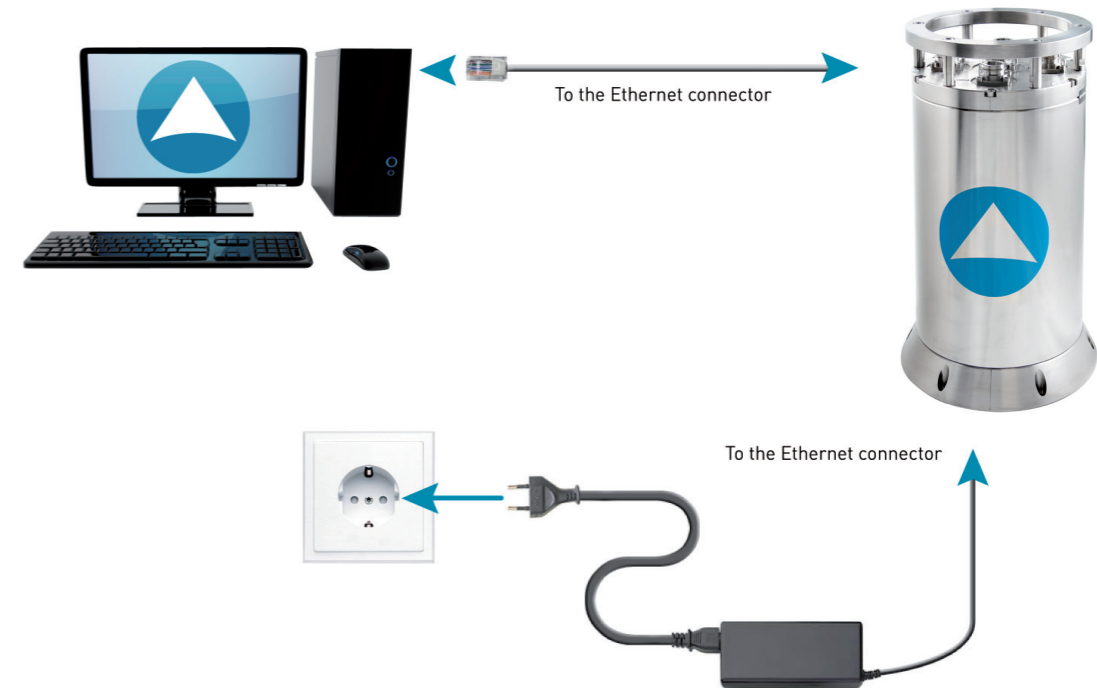
GPS Antenna, Power supply, workstation
connected to the Ethernet connector

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

ELECTRICAL CONNECTIONS: GPS + PPS (OPTIONAL FOR TIME SYNCHONIZATION) SERIAL LINK CASE (WHEN ETHERNET CONNECTION IS NOT POSSIBLE)

Case when Ethernet connection is not possible:
External sensor connected to the serial link A of ROVINS: GPS
Output protocol on serial link A: GPS like
PPS time synchronization pulse from the GPS cabled on the Pulse input
A of ROVINS In this case the workstation establishes a PPP connection with ROVINS
Refer to the ROVINS User Manual to know how to configure this PPP connection

RS232	Cenral connector
Function	**Link A**
Tx	Pin 11
Rx	Pin 13
Tx Rx GND_A	Pin 8

RS422	Cenral connector
Function	**Link A**
Tx +	Pin 11
Tx -	Pin 12
Rx +	Pin 14
Rx -	Pin 13
Tx Rx GND_A	Pin 8

Power	Cenral connector
Function	
In	Pin 1
In GND	Pin 2

Repeater/com with worksation RS422	Cenral connector
Function	**Repeater**
Tx +	Pin 9
Tx -	Pin 10
Rx +	Pin 16
Rx -	Pin 15
Tx Rx GND_R	Pin 5

Repeater/com with worksation RS232	Cenral connector
Function	**Repeater**
Tx	Pin 9
Rx	Pin 15
Tx Rx GND_R	Pin 5

Pulse In	Cenral connector
Function	**Pulse A**
IN TTL	Pin 20
GND_A	Pin 21

STEP 2. ACTIVATING THE PRODUCT LICENSE (ONLY FOR UPGRADE CASE)

As soon as ROVINS is powered up it starts its alignment phase starting with the manually input position stored into RO-VINS PROM. It is required that a valid initial position is input manually (see Step 3) or is given by the GPS. The alignment sequence is detailed in Step 4.
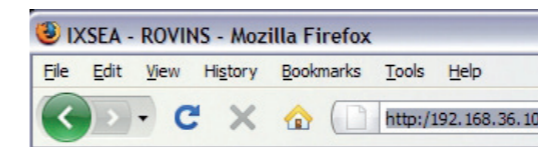
Launching the WEB-based User Interface

Required environment :
- The workstation must be equipped with one of the following Web browser:
  Mozilla Firefox version 3.5 and higher
  Chrome version 4 and higher
  Safari version 4 and higher
  Opera version 10 and higher
  Internet Explorer version 7 and higher

- Flash Player version 10 (and higher) must be installed on the workstation to visualize the compass

- For the data logging: Java Runtime Environment 1.6 (and higher)

They can be installed on your workstation from the provided IXSEA CD-ROM.

The communication with the workstation is performed directly through the Ethernet link.

ROVINS *Web-based User Interface* is then launched from the WEB browser hosted on the workstation. Its URL address is 192.168.36.1xx, xx being the two last numbers of the ROVINS serial number:

The Control Pages opens:
During the first seconds the IXSEA logo is flashing gray/blue indicating that the *Web-based User Interface* is loading the internal configuration of ROVINS. Then the logo turns blue, the alignment sequence of ROVINS begins.

Maintenance page :
Firmware upgrades, system restaring, factory settings reset, support contact.

Menu Bar
The menu is blue when selected

options page :
position selection, language selection , day/night mode selection

Navigation data window:
It displays all data either computer by ROVINS or coming from external sensors

Heading, Roll, Pitch,Heave and Speed data

System Status: color and verbose display

Latitude,Longitude and Depth or UTM positions and Depth data

Compass area

IXSEA logo handling

A click on the IXSEA logo opens the detailed status/activation pop-up window and the compass disappears.
This window:
• Sums-up the status of
                The input ports
                The output ports
                The system
                The external sensors
• Enables the external sensors activation

You can close the pop-up by clicking on the IXSEA logo.

<u>Color Code</u>

The color code applies for the indicators and text labels displayed in this pop-up window.
When a problem occurs, the color of the IXSEA logo changes and the detailed status pop-up automatically appears showing immediately which equipment has raised the problem.

Table 1 – Color code definition

Color	Definition
Grey	inactivity
Flashing Grey/Blue	System Configuration (during initialization for example)
Blue	Activity, nominal operation
Orange	Activity, warning
Red	Activity, alarm

<u>General Rules for Using Command Windows</u>

The command windows allow you to display or modify ROVINS configuration parameters. At first delivery, these parameters are set to default values. You have to modify them to fit your needs:

Scrolling list selection

- By selecting it directly in the scrolling list:
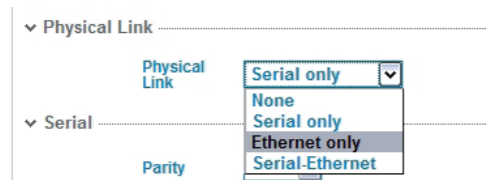
Note
you can also use the up arrow ([⇧]) and down arrow ([⇩]) keys to scroll in the list.

Tick box

- By selecting it by clicking in the dedicated box:

Text box

- By typing it in the dedicated area:

Note
You can also use the up arrow ([⇧]) and down arrow ([⇩]) keys to increase or decrease the numerical values.
Incorrect value are immediately indicated by red color:
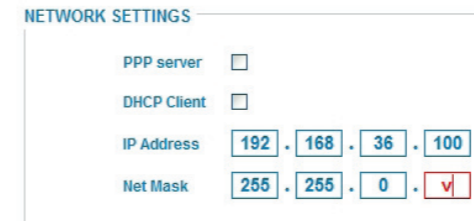
Expanding hidden area

In order to keep each web-based page as small as possible, only the main parameters are default visible. You can expand the hidden area by clicking on its text label title:

OK/Cancel buttons

Each command page contains the same buttons, they appear as soon as a modification or a selection has been made in the command page:

 To validate the new configuration and store it in the ROVINS PROM.

 To return to the previous entered values.

Other Button

On "mouse over" action, orange color may surround a button to indicate that the action performed by clicking on the button has consequences.

Examples of such action:

- ROVINS restart (the alignment process is repeated)
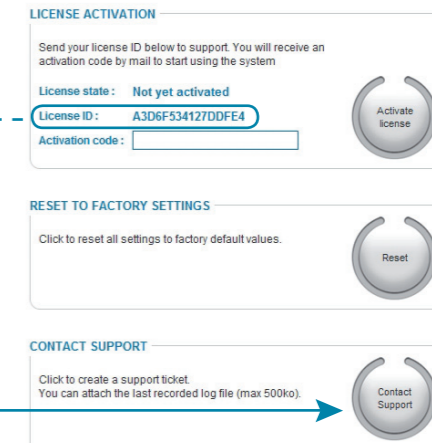- Reset to factory settings (the customized configuration is lost)

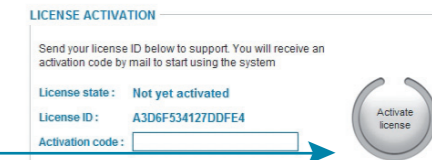## PRODUCT LICENSE ACTIVATION (ONLY IN CASE OF UPGRADE)

ROVINS

Alert : Product License not activated !
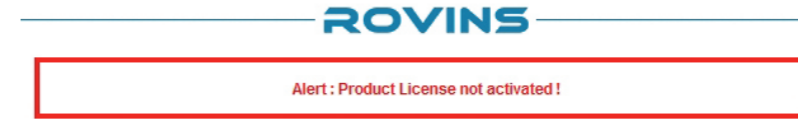
Step 1: Ask for the activation code: click on maintenance menu on the ROVINS Web-based User Interface.

IXSEA   navigation data | maintenance | options

CONTROL | INSTALLATION | SETUP | DATA LOGGING

Step 2: To recover the activation code, using the «Contact Support» button, send a message to IXSEA support giving your ROVINS license ID.

LICENSE ACTIVATION

Send your license ID below to support. You will receive an activation code by mail to start using the system

License state :   Not yet activated
License ID :   A3D6F534127DDFE4
Activation code :

Activate license

License ID   A3D6F534127DDFE4

RESET TO FACTORY SETTINGS

Click to reset all settings to factory default values.

Reset

CONTACT SUPPORT

Click to create a support ticket.
You can attach the last recorded log file (max 500ko).

Contact Support

Step 3: Enter the recovered activation code in the dedicated text box and click «Activate License» button.

LICENSE ACTIVATION

Send your license ID below to support. You will receive an activation code by mail to start using the system

License state :   Not yet activated
License ID :   A3D6F534127DDFE4
Activation code :

Activate license

WEB-BASED USER INTERFACE - MENUS AND OPTIONS OVERVIEW

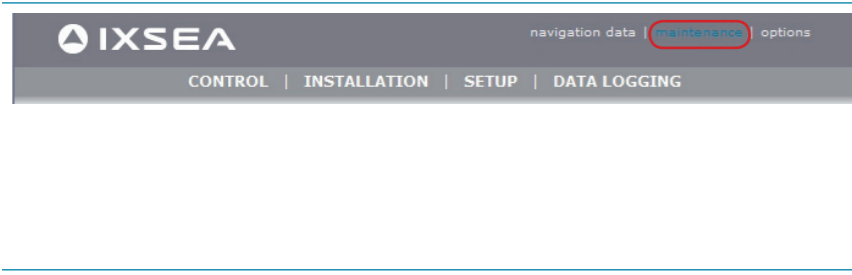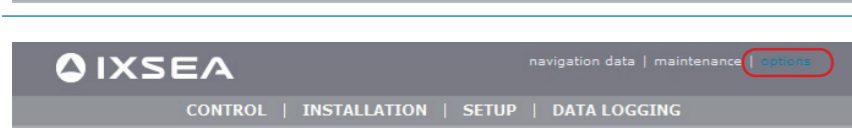Find hereafter all the menus and options of the WEB-based User Interface and their uses

Menu /options	Used to ...
	Define the ROVINS orientation, possible roll, pitch and heading misalignments, primary and secondary lever arms useful to compute the heave and position for the output protocols that provide it
	Define the couple (external sensor or UTC, input link): the protocol used to input the data, the serial (parity, baud rate, standard (RS232 or RS422) and stop bit) or Ethernet (transport layer, IP address, Port number) parameters, and the external sensor parameters (lever arms, misalignments (for the DVL), beacon selection (for the USBL) Define the Time synchronization settings (UTC): pulse input selection for the PPS signal, the protocol to use for the PPS signal

Menu /options	Used to ...
	Define the outputs: the protocol used to output the data, the lever Arm to use, the data rate or the input pulse to use to synchronize the output data, the serial (parity, baud rate, standard (RS232 or RS422) and stop bit)or Ethernet (transport layer, IP address, Port number) parameters, the pulse output to output the envelop, the heave filter to use
	Define the Network parameters for communication through a serial link (PPP option) or through Ethernet one (DHCP client mode activation, ROVINS IP address and Network mask to use)
	• Enter the initial position, save it, update it • Choose the Zero Velocity mode

	• To be informed in case of warning or error for
	    UTC synchronization loss
	    Position sensor loss
	    Speed loss
	• To generate a warning when the heading and/or the position standard deviation cross a defined threshold

Menu /options	Used to ...
	To launch the DVL calibration
	To save /restore product settings
	Log the data of the repeater output or of any A to E output.
	• Restart your ROVINS Unit • Update the system: firmware, loader, and/or WEBBasedUser Interface versions • To activate your license by entering the activation code • Get ROVINS serial number and WEB-based User Interface • Contact IXSEA Support
	Display all navigation data computed and received by ROVINS
	Choose the position coordinate representation (latitude/longitude or UTM coordinates)
	Choose the display mode (night/day mode)
	Choose the WEB-based language (English or French)

STEP 3. CONFIGURING ROVINS

CONFIGURING THE ROVINS ORIENTATION WITH RESPECT TO THE VEHICLE

As ROVINS can be installed with any orientation with respect to the vehicle, ROVINS axes orientation can be different from vehicle axes orientation, with 90 degrees rotations of any of the ROVINS axis with respect to the vehicle axes.

Step 1: Choose **MECHANICAL PARAMETERS** under **INSTALLATION** Menu

Step 2: • The direction to which the IXSEA logo side is pointing.
→*In the illustration, ROVINS logo side points to the chosen direction.*

• The direction to which the ROVINS connectors side is pointing.
→*In the illustration, ROVINS connectors side points to the chosen direction.*

Step 3: Click the **OK** button to validate your choice.

Step 4: Click on **Restart** button in the warning window that appears in the upper part of the Mechanical Parameters page.
→*ROVINS restarts, and alignment sequence (see step. 4) is repeated.*
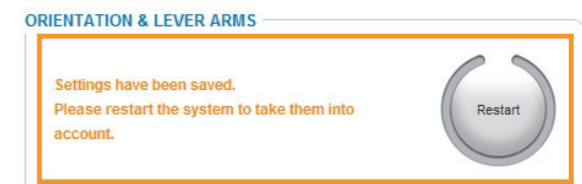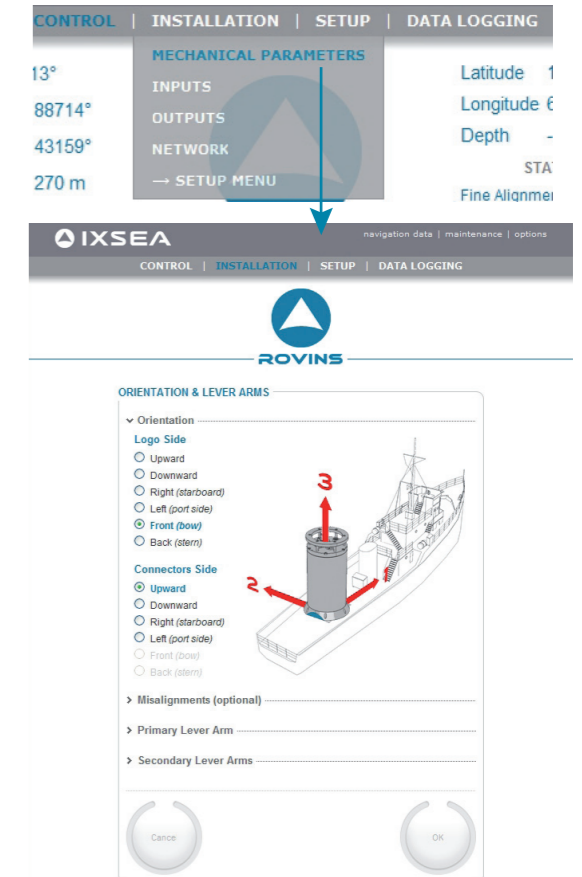
CONFIGURING THE GPS INPUT STREAM AND GPS PARAMETERS

Step 1: Choose **INPUTS** under **INSTALLATION** Menu

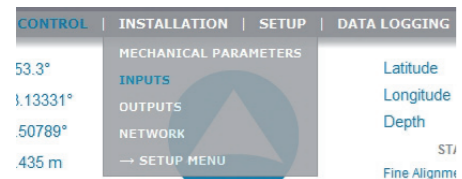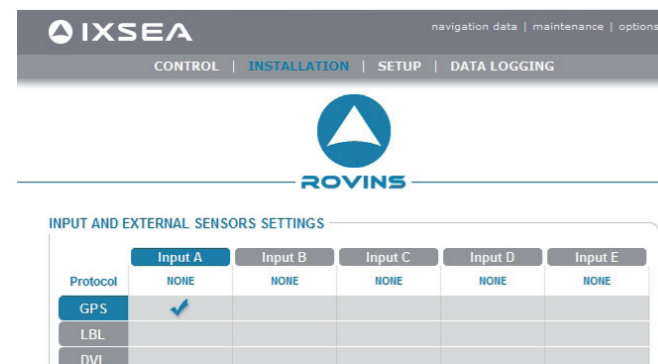| CONTROL	INSTALLATION	SETUP	DATA LOGGING
	MECHANICAL PARAMETERS		
53.3°	INPUTS		Latitude
3.13331°	OUTPUTS		Longitude
50789°	NETWORK		Depth
435 m	→ SETUP MENU		ST/
			Fine Alignm(

Step 2: Associate **GPS** to **INPUT A** by clicking in the intersection of the **INPUT A** column and **GPS** row

◊ IXSEA   navigation data | maintenance | options

CONTROL | INSTALLATION | SETUP | DATA LOGGING

▲ ROVINS

INPUT AND EXTERNAL SENSORS SETTINGS

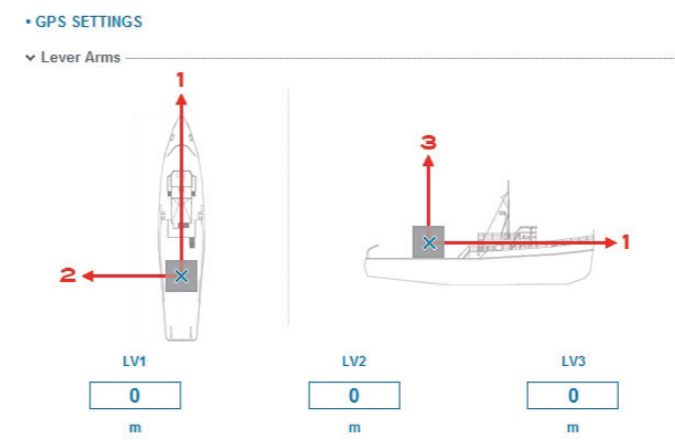|	Input A	Input B	Input C	Input D	Input E
Protocol	NONE	NONE	NONE	NONE	NONE
GPS	✔				
LBL					
DVL					

Step 3: Configure the relevant parameters of the **INPUT A** by choosing them in the various drop-down lists of the Protocol, Physical Link, Serial and/or Ethernet areas.

• INPUT A SETTINGS

˅ Protocol
  Protocol   NONE ▾

˅ Physical Link
  Physical Link Serial only ▾

˅ Serial
  Parity   None ▾
  Stopbits   1.0 bitstop ▾
  Standard   RS232 ▾
  Baudrate   9.6 kbauds ▾

Step 4: Define the GPS lever arms:

- LV1 is the signed distance from the ROVINS center of measurements to the GPS along axis 1 of the illustration

- LV2 is the signed distance from the ROVINS center of measurements to the GPS along axis 2 of the illustration

- LV3 is the signed distance from the ROVINS center of measurements to the GPS along axis 3 of the illustration

• GPS SETTINGS

˅ Lever Arms

LV1	LV2	LV3
0	0	0
m	m	m

**Step 5:** Click **OK** to validate and save your choices.

OK

Step 6: Activate the GPS (i.e., take into account the GPS data into the ROVINS Kalman filter): In EXTERNAL SENSORS area (that is the detailed status pop-up in the CONTROL page), set the activation parameter of the GPS to ON position by clicking on OFF button.

EXTERNAL SENSORS   EXTERNAL SENSORS
GPS   [OFF]   →   GPS   [ON]

CONFIGURING THE PPS FOR USING TIME SYNCHRONIZATION SYSTEM

Step 1: Choose **INPUTS** under **INSTALLATION** Menu
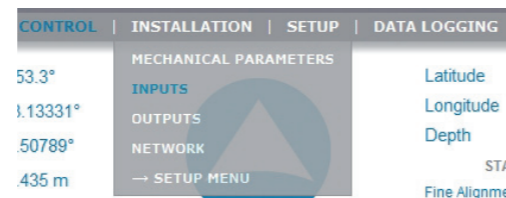
Step 2: Associate **UTC** to **INPUT A** by clicking in the intersection of the **INPUT A** column and **UTC** row

Step 3: • For an Ethernet link, the pulse input will come from pulse input B: choose Ethernet for the Physical Link then select Pulse B for Synchro In and the desired protocol

• For a serial link, the pulse input will come from pulse input A: choose Serial for the Physical Link then select Pulse A for Synchro In and the desired protocol.

Step 4: Click **OK** to validate and save your choices.

CONFIGURING THE OUTPUT STREAM

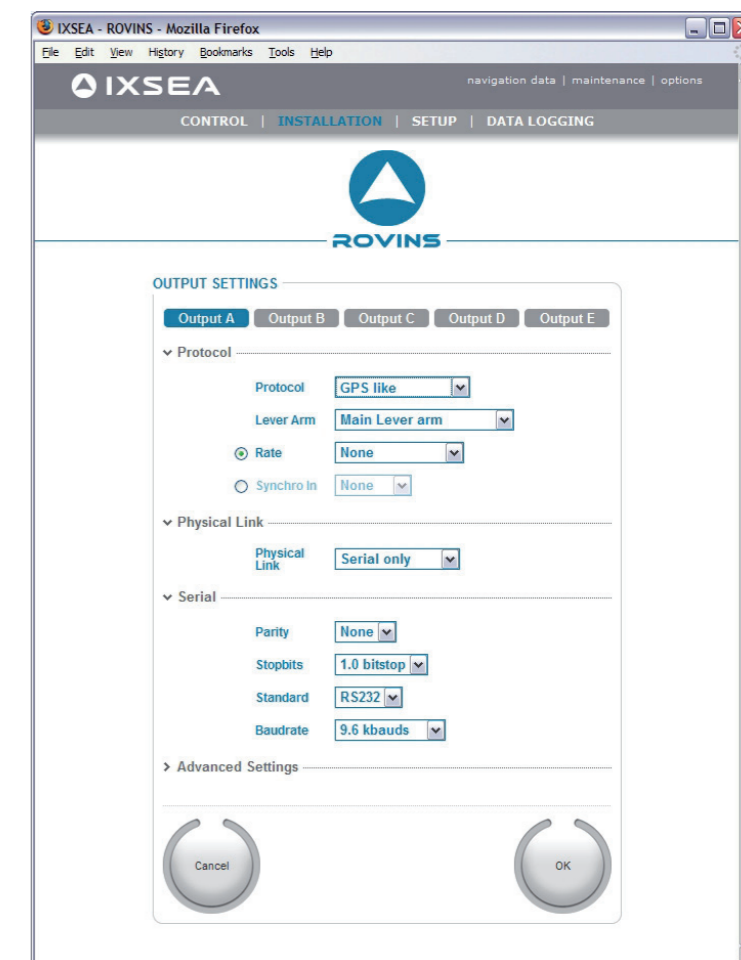**Step 1:** Choose **OUTPUTS** under **INSTALLATION** Menu

Step 2: Click on **Output A**.

Step 3: Choose «GPS like» in the **Protocol** list

Step 4: Select the **Physical Link** and configure its parameters if needed.

Step 5: Click **OK** to validate and save your choices.
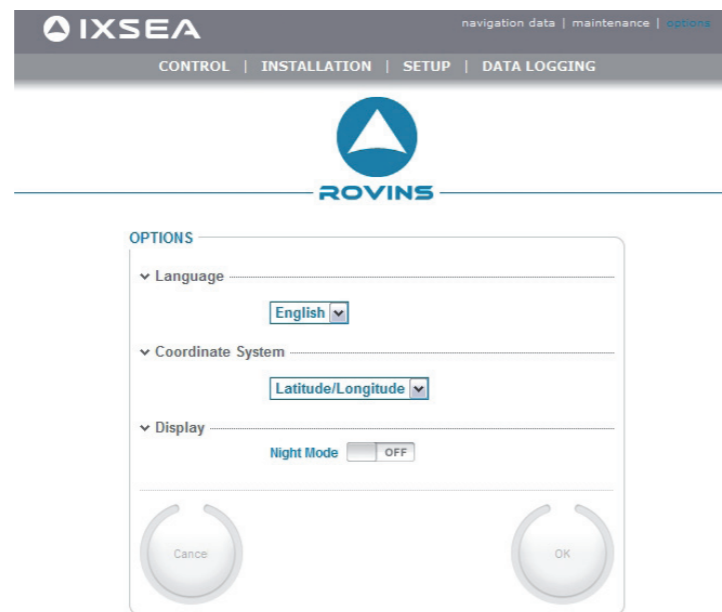
ENTERING THE INITIAL POSITION

Entering the initial position is only necessary if no GPS is available upon starting ROVINS. Once saved by clicking on OK button, the entered position is used at next ROVINS start.

Step 1: To define the position :

• Click options menu

In the Coordinate System area :

• Either select Latitude/longitude option
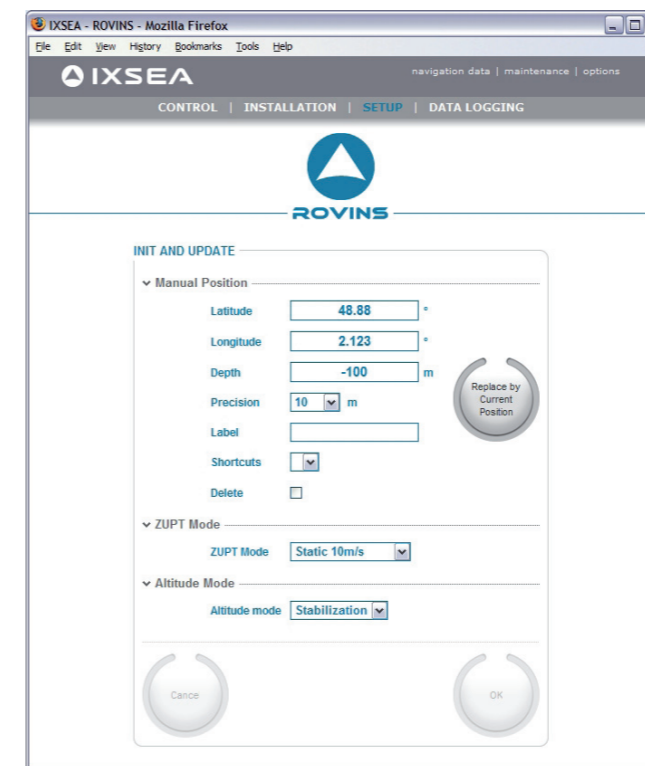• Or UTM option
• Click **OK** button to validate

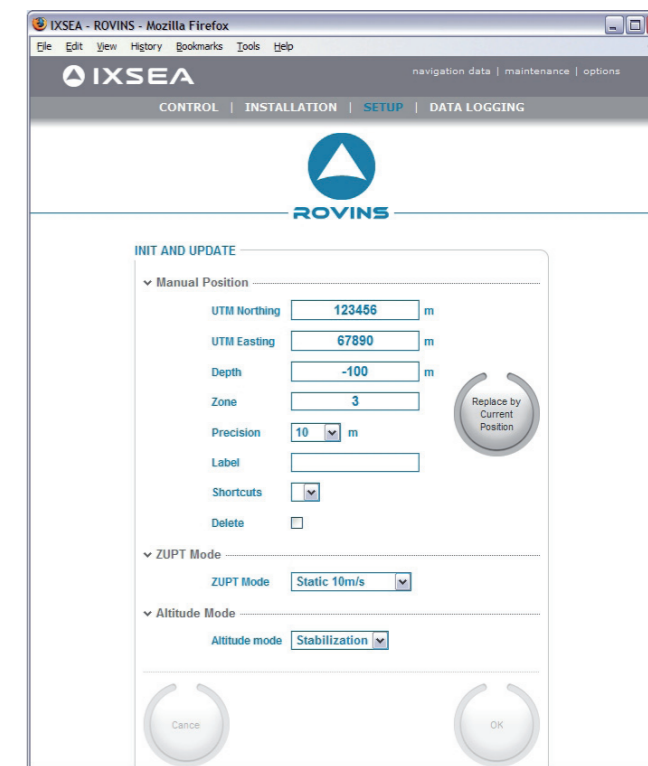**Step 2:** Choose **INIT&UPDATE** under **SETUP** Menu

Step 3: Enter the initial position:

• Either Latitude (in degrees), Longitude (in degrees) and depth (in meters)

• or the UTM coodinates of this position

Step 4: Click **OK** to validate and save your choices.

STEP 4. NAVIGATING WITH ROVINS

As soon as ROVINS is powered on, it starts its alignment phase with the manually input position stored into ROVINS PROM.

- During the first five minutes after powering-on, ROVINS performs its coarse alignment: ROVINS inertial sensor data (accelerometers and gyrometers) are computed to estimate heading, roll and pitch angles. At sea it is recommended that the system is kept as steady as possible during coarse alignment: oscillations around a mean position are permitted but accelerations should be avoided. Leaving the vessel adrift for 5 minutes would lead to satisfactory conditions for coarse alignment.

- After the first fine minutes long coarse alignment phase, ROVINS switches to the "fine alignment" phase to improve the accuracy of roll, pitch and heading estimations. Such improved accuracy is useful if data from external sensors are not available right at the beginning of the mission. Any movement is allowed during the fine alignment. 90 degrees rotations are even recommended so that the Kalman filter assesses the sensors bias on different axes. The fine alignment is ended automatically by ROVINS when the heading covariance is below 0.1degree.

- At the end of the fine alignment process, ROVINS is ready for navigation with optimal performances.

	Navigation = Static or max speed < 3 knot	Navigation with large heading variations (>90°)	Time in minutes
Heading & Attitude	Invalid output	Reliable output	Full accuracy output
Position	= Position given by the GPS	Reliable output	Full accuracy output
Flag in the System status area	Alignement	Fine Alignement	System ready

MORE...

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

ROVINS TO VEHICLE MISALIGNMENT

ROVINS measures heading and attitude with respect to its reference frame defined by the 3 axes X1, X2 and X3 (see Figure 1). ROVINS reference frame may not be parallel to the vehicle reference frame. In such case, heading and attitude outputs can be compensated for angular misalignments of ROVINS relative to the vehicle reference frame so that ROVINS outputs heading and attitude of the vehicle.
This is done by setting misalignment bias for the three reference axis. These biases are the Euler angles which relate ROVINS and vehicle reference frame. Vehicle reference frame is depicted on Figure 2.
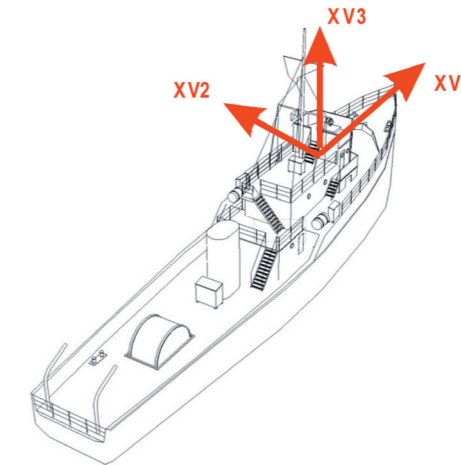

Figure 2 - Vehicle Reference Frame

For more details about the misalignment bias, refer to Part 2 of the ROVINS User Guide.

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

External monitoring points are defined by their "Lever Arm" to ROVINS center of measurement P. This lever arm is the triplet of cartesian coordinates (LV1, LV2, LV3) defining the position of external monitoring point M with respect to ROVINS center of measurement P (defined in Figure 1) in the vessel reference frame (XV1, XV2, XV3) - see Figure 3.
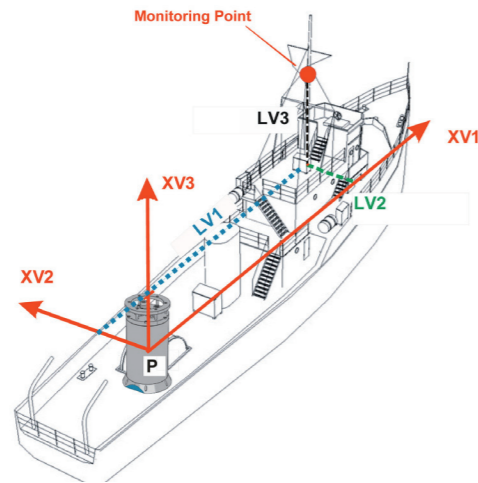

Figure 3 - Definition of lever arms

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

ROVINS uses external sensor data to improve its own estimates of position, speed, attitude and, heading. In order to prevent corrupted external data to degrade the estimation of ROVINS, external sensor data passe through a rejection filter before being incorporate into ROVINS main computation Kalman filter.
The following external sensors can be added:
• A DVL
• A LBL
• An USBL (up to three beacons)
• A CTD
• A depth sensor

For more details about the external sensors, refer to part 4 of the ROVINS User GUIDE

ETHERNET INPUT/OUTPUT

Five Ethernet inputs/outputs are available on ROVINS.

For more details about
• **The Ethernet connector, refer to Part 2 of the ROVINS User Guide**
• **The available protocols for this connectors, refer to part 5 of the ROVINS User Guide.**

PULSE INPUT/OUTPUT

Four pulse inputs and two external pulse coming from the central connector are available on ROVINS.

For more details about the pulse connector pins, refer to Part 2 of the ROVINS User Guide.

EXTENDED FUNCTIONS OF THE WEB-BASED USER INTERFACE

Recording data: you can record the data coming from the repeater port or of any of the A to E output. **For more details about the data recording refer to Part 4 of the ROVINS User Guide**.
Observing the input data flow coming from any input stream. For more details refer to Part 4 of ROVINS User Guide.
System Information: to accede to the serial number and firmware version of your ROVINS unit, click on **maintenance** menu of the WEB-based User Interface.
Note: these information are useful when you contact IXSEA technical support.

ROVINS ZERO VELOCITY UPDATE (ZUPT) MODES

These modes have been designed to use ROVINS for specific applications when no external sensor is connected.
For more details about ZUPT mode, refer to part 4 of the ROVINS User Guide.

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PERSONAL NOTES