Rovins

Technical Description

iXblue

Revision History

Edition	Date	Comments
A	07/2019	Creation
B	03/2020	Navigation data & settling time chapters updated

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Rovins Documentation

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

- **Rovins Technical Description** *(ref.: MU-ROVINSTD-AN-001*)
  - > Rovins and iXblue technology presentation
  - > Technical specifications
  - > Certification and qualification, life cycle
  - > Mechanical, electrical and communication interface description
- **Rovins Installation & Setup Guide** *(ref.: MU-ROVINSISG-AN-001)*
  - > Conventions
  - > Physical and electrical installation
  - > Connecting to the Web-Based Graphical User Interface
  - > Setup the Rovins
  - > Contacting iXblue support
- **Rovins Operation Guide** *(ref.: MU-ROVINSOG-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
- **Rovins Interface Library** *(ref.: MU-ROVINSIL-AN-001)*
  - > NMEA frames
  - > Digital input and output protocols
  - > Pulses interfaces specification
  - > Control commands
- **Rovins Quick Start Guide**
  - > Pack content verifying
  - > Installing and connecting Rovins
  - > Configuring and operating Rovins
- **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
- **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 vessel transient movements

Rovins Technical Description 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 Rovins Technical Description is divided into several parts:

- **Part 1: Rovins Description**
  This part contains the description of the main product parts and the presentation of iXblue technology.
- **Part 2: Technical Specification**
  This part gives details on the technical specifications, the certification, qualifications and the life cycle.
- **Part 3: Mechanical Description**
  This part describes mechanical aspect of Rovins, except connectors.
- **Part 4: Electrical interface Description**
  This part gives the detail of the electrical interface (connector, pinout description and electrical levels).
- **Part 5: Communication Interface Description**
  This part details the interfaces to communicate with Rovins**.**

Abbreviations and Acronyms

ACC	Accelerometer
EGNOS	European Geo-stationary Navigation Overlay Service
Galileo	European Satellite Navigation System
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
IMU	Inertial Measurement Unit
INS	Inertial Navigation System
IP	Internet Protocol
LVA	Lever Arms
MU	Measurement Unit
PPS	Pulse Per Second
RTK	Real Time Kinematic
SD	Standard Deviation
Seclat	Secant latitude = 1 / cosine latitude
ROV	Remotely Operated Vehicle
UTC	International acronym for Coordinated Universal Time (CUT)
UTM	Universal Transverse Mercator
VTG	Vector Track and speed over Ground
WEEE	Waste Electrical and Electronic Equipment
WGS-84	World Geodetic System 1984
ZDA	Time and Date (The ZDA message identifies UTC time, day, month, and year, local zone number, and local zone minutes)
ZUPT	Zero velocity UPdaTe

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1 Rovins Description

1.1 iXblue technology

iXblue Rovins design is based on fiber-optic gyros (FOG) and quartz accelerometers.
iXblue's fiber-optic gyros are the result of more than 40 years of research and development, and they address the most demanding applications with performance from 0.1 deg/h to 0.001 deg/h.
All main components are designed and manufactured by iXblue. This vertical integration is a key to achieve the high performances, higher quality standards and obsolescence management.

iXblue technology is an interferometric closed loop FOG. It is a high end design made to reach the highest spectrum of gyroscope performances. It has demonstrated superior reliability and navigation performance over many years and thousands of units. iXblue navigation systems have been chosen as the primary and secondary gyrocompas and INSs by the world's leading navies.

FOG Definition

FOG is a solid state / strapdown optical gyroscope technology based on Sagnac effect (one of the physical effects used to create gyroscopes). A FOG is a 2-wave ring interferometer made of a multi-turn fiber coil (see Figure 1). It includes no moving parts or anything that will wear out or require any maintenance.

The Sagnac effect

The Sagnac Effect is a physical phenomenon of relativistic type.
Understanding it requires a good grasp of Special Relativity. However, it is possible to provide a simplified (although representative) physical interpretation of the effect with Newtonian physics.
Let us consider a Multi-Integrated Optical Circuit (MIOC) and a coil of optical fiber (Figure 1). The light entering in the MIOC is separated in two equivalent pulses of light which propagate in opposite direction in the fiber coil.
At rest, the two pulses of light travel at the same velocity (speed of light) along the same path in opposite directions in the coil. As their optical path is equivalent, they return "in phase" at the end of the coil and no signal is measured.
When the FOG is rotating, we can consider that the exit point of light has moved during the travel of light. Thus, the pulse propagating in the opposite direction of the FOG rotation will be late, and a "phase shift" between the two pulses is measured.

FOG Description

Dedicated signal processing allows conversion of the information on optical phase, (carrying information on rotation), into a digital signal useable by a computer.

The difference of transit time is proportional to the product of the rotation rate and the area A enclosed by the coil (calculated as the diameter of the coil multiplied by the number of times the fiber is wound around the coil).

As such the FOG performance improves as FOG diameter increases and the total optical path length increases. For example, increasing the fiber length results in a longer optical path length that will translate into a larger time shift between waves for a given rotation speed.

The fiber optic gyroscope (FOG) is a flexible technology that can meet diverse requirement. It has no moving parts which reduce maintenance and recalibration operations.

It provides a very wide dynamic range and can tolerate extremely demanding mechanical environments without compromise to its performances.

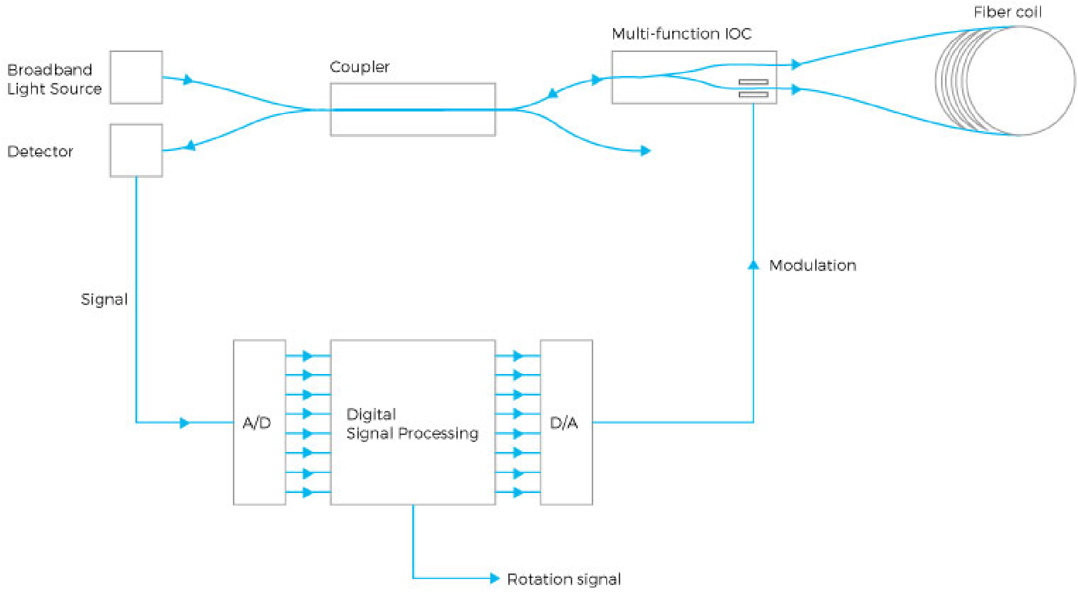


Figure 1 - Optical gyroscope technology

1.2 Rovins Data availability

Rovins provides the ROV survey package and/or ROV control system with full navigation data:

- Position (Latitude and Longitude)
- Speed (North, East, Vertical Speed and ship speeds)
- Depth
- Roll/Pitch and True North Heading
- Polar Heading, Latitude, Longitude, Speed
- Rate of turn and Accelerations (all three axis)
- Heave, Surge, Sway
- True course (depends on availability of external sensors)
- Current speed and direction (depends on availability of external sensors)
- Standard deviation of computed data
- Built In Test Status data

The exhaustive list of output data is detailed in the Rovins Interface Library.

Heave measurement/ Center of Gravity of the vehicle (COG)

Rovins can output two distinct heave measurements:

- Specific Heave which provides heave in real time.
- Smart Heave^{TM} which provides a measurement of heave with a fixed 100 s delay. In this case heave is compensated for error due to high pass filtering distorsions and is more accurate.

To avoid the effect of transient subsea vehicle movement on the heave measurement, you can define the position of the center of gravity (COG) of the subsea vehicle. When this is done, Rovins will compute heave at the COG and add the heave induced by lever arms from the COG to external monitoring points. For more details refer to Rovins Installation & Setup Guide .

UTC/Time synchro

All data is accurately time stamped with respect to internal reference time, GNSS time or any autonomous external clock.

Rovins internal clock can be synchronized with data coming from an external reference clock (i.e., GNSS clock or autonomous external clock). In this case, internal reference time is synchronized with the input coming from the selected interface with the appropriate protocol.

For more details on time synchronization setting, refer to Rovins Installation & Setup Guide.

Availability of full quality check data

Rovins provides a numeric quality checks indicator (RMS/CEP50/CEP95) for all main navigation data:

- Position standard deviation estimation Latitude and Longitude
- Speed standard deviation estimation (North, East and Vertical Speed)
- Roll/Pitch and Heading standard deviation estimation
- Altitude or Depth standard deviation estimation
- Depth standard deviation estimation

1.3 External sensors

Rovins uses external sensor data to improve its own estimates of position, speed, attitude and heading. The following external sensors can be connected to Rovins:

- GNSS,
- LBL,
- USBL,
- Sparse Array (range meter)
- EM Log,
- DVL,
- CTD/SVP,
- Depth Sensor.

Rovins can simultaneously use all the sensors described above and its Kalman Filter will manage them without any manual intervention.

The system constantly and automatically uses the information form the external sensors when it is available and runs in full free inertial mode when no external information is available. As soon as external information is back, the system will use it. Rovins also integrates a rejection filter that will prevent inconsistent data to be sent to the Kalman Filter.

Rovins can be operated over serial or Ethernet through its embedded Web-Based Graphical User Interface or through a third-party system interface via a control command link.

For more details on:

- Electrical connection of the external sensors: refer to section 4.
- The configuration of the external sensors: refer to the Rovins Installation & Setup Guide.
- The available input protocols for external sensors: refer to Rovins Interface Library.

2 Technical Specification

2.1 Performance prerequisites

The performances listed hereafter are achieved at sea under the following conditions (which complements the environmental conditions stated in section 1).

- **subsea vehicle's motion does not exceed:**

	Amplitude	Period (sinusoidal)
Heading	± 10°	10 s
Roll	± 40°	9 s
Pitch	± 15°	6 s

As some external sensors do not provide any quality indicator with the provided data, some hypothesis of performance have been made in the system for those sensors. This can be manually modified using the advanced filtering page, refer to Rovins Installation & Setup Guide.

- **EM Log sensor**
  Log speed accuracy: 0.5 m/s RMS (with respect to water)
  Ocean current stability: 1 kn (One sigma) 3 hours correlation time
  To ensure EM Log performance, it must be calibrated after installation.
  Log sensor must only be used outside of harbors. During harbor maneuvers erroneous EM Log data could be sent to Rovins, e.g., while working tug boats produce strong local currents over the EM Log sensor, and these erroneous inputs would adversely affect Rovins performance.

- **Doppler Velocity Log (DVL) sensor**:
  Performance using any other technology (i.e.: Correlation Velocity Log [CVL]) should be submitted to qualification testing to evaluate their impact on navigation performance.
  For example CVL technology does not have the same performance as DVL. Navigation performance would be degraded.
  EM Log can be used by selecting an extra DVL input and choosing the corresponding protocol (e.g. EM Log VBW)

2.2 Equipment Data Dynamic Range

Heading	0° to 360°
Roll	-180° to +180°
Pitch	-90° to +90°
Roll / Pitch / Heading Rate	± 750°/s
Geodetic Latitude	90° S to 90° N
Geodetic Longitude	180° E to 180° W
Altitude(1)	Up to altitude saturation (refer to section 1)
Depth(1)	Down to seabed
Speed	Up to speed saturation (refer to section 1)
Linear Acceleration	± 15 g

(1) Depth and altitude data are encoded a single "z" information. Depth being from surface to seabed, altitude being from surface to sky. Note: altitude from seabed is not handled by Rovins.

2.3 External Sensors

	External Sensors
GNSS	up to 2
DVL	up to 2
EM Log	1
CDT/SVP	1
Depth Sensor	1
USBL	Up to 3 beacons
LBL (range meter) Sparse Array	Up to 10 simultaneous beacons
UTC	Up to 2

2.4 Navigation Data

<table>
<tr><th>GPS or USBL or LBL & DVL</th><th>DVL (Bottom Track mode)</th><th>EM Log</th><th>No aiding</th></tr>
<tr><td colspan="4">Position (Latitude and Longitude) accuracy</td></tr>
<tr><td>2 to 3 times better than aiding sensor</td><td>0.1 % (CEP50) of distance travelled</td><td>2 Nm/8 h (TRMS)</td><td>0.15 m after 1 min (CEP50)
4.80 m after 5 min (CEP50)
0.40 Nm/h after 1 hour (CEP50)</td></tr>
<tr><td colspan="4">Speed (North and East) accuracy</td></tr>
<tr><td colspan="2">0.01 knot (RMS)</td><td>0.1 knot (RMS)</td><td>1 knot (RMS)</td></tr>
<tr><td colspan="4">Heading accuracy</td></tr>
<tr><td>0.04° seclat (RMS)</td><td colspan="3">0.07° seclat (RMS)</td></tr>
<tr><td colspan="4">Attitude (Roll and Pitch) accuracy</td></tr>
<tr><td colspan="4">0.01° (RMS)</td></tr>
</table>

With or without aiding:

Dynamic stability[1]	
Heading rate accuracy	0,001°/s RMS
Roll rate accuracy	0.001°/s RMS
Pitch rate accuracy	0.001°/s RMS
Heave Surge Sway	
Heave[2]	5 cm or 5% of movement full amplitude
Smart Heave™[3]	2.5 cm or 2.5% of movement full amplitude
Surge and Sway[4]	5 cm or 5% of movement full amplitude

(1) According to the dynamics stated in the prerequisites in section 2.1.
(2) Whichever is higher for wave periods up to 25 s.
(3) Whichever is higher for wave periods up to 30 s.
(4) Whichever is higher for wave periods up to 15 s.

2.5 Input / Output

Baud rate	600 bauds to 460 kbauds
Data output rate	0.1 Hz to 200 Hz
Data input rate(1)	Up to 5 Hz (1 Hz recommended)
Time stamping accuracy	< 100 µs

(1) 200 Hz update rate for attitude data (Heading, roll, pitch, surge, sway).
Update rate for position is performed at 100 Hz.

	Serial (All)	Ethernet 1	Ethernet 2	Ethernet 3	Ethernet 4	Ethernet 5
Jitter	< 200 µs	< 400 µs	< 800 µs			
Fixed Latency	2.35 ms	2.95 ms	3.45 ms	3.95 ms	4.45 ms	4.95 ms
	Input	**Output**	**Configuration & Repeater**			
Serial RS232	5	5	1			
Ethernet(2)	7	5	1			
Max (Serial & Ethernet)	7	5	1			
Pulse Port	3	2	-			

Ethernet(2)	UDP (Unicast, multicast and broadcast)/ TCP client / TCP server (10 / 100 Mbits)
Pulse port	5 V (TTL level)
Input / output formats	Industry standards: NMEA 0183, ASCII, BINARY

(2) All inputs and outputs are available on the Ethernet link. Output can be duplicated both on serial and Ethernet port.

2.6 Power Supply

Power supply / consumption	24 V_{DC} (20 to 32 V) / < 20 W(1)

(1) Typical value @ 24 V and ambient temperature.

2.7 Export Limitations

Rovins is a dual use product and is thus submitted to export limitations on the provided data, and to export restrictions to some countries.

	Limitations
Rotation rate resolution[1]	3.6°/h
Acceleration resolution	1 mg
Heading, Roll, Pitch resolution	0.001°
Speed saturation	80 knots
Altitude saturation	4,000 m
Acceleration saturation	±15 g
Rotation rate saturation	750°/s
Post-processing data output	Available

(1) Additional export restrictions may apply regarding the availability of raw IMU data (set to 0 in output telegrams).

2.8 Settling Time

Power Up

Power up is automatic, as soon as power is applied to the system.

Restart or Power Down

Equipment can be restarted either through the embedded Web-Based Graphical User Interface, in the maintenance menu or by sending a start command.
To power down the equipment, you need to disconnect it from its power source.

Initialization:

The system must be initialized before it will provide fully accurate information. This initialization is performed using external sensor data, during several phases.

Alignment Phases

- **Coarse Alignment**
  Coarse alignment phase is the first step of the alignment of the Rovins. The algorithm determines the vertical and north directions.
  The "Coarse alignment" can be performed at quay or at sea with GNSS/USBL/LBL inputs at constant speed and heading or stationery under DP (Dynamic Position). This alignment can also to be aided by a speed sensor (DVL instead). Rovins coarse alignment must be performed with position information (GNSS or manual position with ZUPT "Manual Position").
- **Heave initialization**
  During the heave filter initialization phase, the heave, surge and sway outputs have not reached full accuracy. Once the heave filter completes its initialization,
  it will accurately measure any variations of Rovins positions in the three directions (heave, surge and sway).
- **Fine Alignment**
  After the coarse alignment phase, Rovins is ready for navigation (free to move).
  Rovins switches to the "fine alignment" phase to improve accuracy on attitude, position and speed by having the Kalman filter estimate the residual biases of accelerometers and gyroscopes. The legacy 'Fine alignment' phase is raised when heading standard deviation gets below 0.1° (no seclat).
  When fine alignment is completed, the system is ready, it does not reach its full performance.
- **Optimal alignment**
  Optimal alignment means that the system is reaching the specified heading performance.
  Optimal Alignment completes when heading standard deviation is below 0.04° seclat RMS.
  When optimal alignment is completed, the system is ready and gives all the data with full performance.

	Static (GNSS, USBL, LBL, ZUPT)	**At sea (USBL or LBL & EM Log or DVL)**
Data availability	5 min	5 min
Roll/Pitch 0.01° RMS	5 min	5 min
Heading 0.1° RMS	35 min	25 min
Heading 0,04° seclat RMS	N/A	45 min*

(*) At a speed of 3 kt and including a heading change of at least 90° and linear acceleration.

2.9 Qualifications

Temperature		
Operating	ISO 8728:2014(E) ISO1638:2014(E)	-20°C to +55°C
Transport and Storage	-40 °C to + 80 °C (7 cycles of 24h with steps at -40°c and 80°C)	
Vibration		
Vibration in operating	ISO 8728:2014(E) ISO1638:2014(E)	5-40Hz 0.51g sinus max
Shock		
Shocks in operation	½ sinus 15 g 11 ms – MIL-STD-810-G	
Magnetic Field		
Operating	1 Gauss	
Water Tightness		
Operating	3,000 m (NFX 10-812 class B)	

2.10 Life Cycle

2.10.1 Packaging, Handling, Storage, Transportation requirements

During storage and transportation, Rovins should be kept locked in its transportation case, it shall have its protective caps installed on its connectors.

2.10.2 Auto-calibration

At each start up, and continuously while aided, Rovins is calibrating its internal gyrometer and accelerometer sensors using external sensors information and its advanced Kalman Filter. Therefore there is no need to recalibrate the system periodically.

2.10.3 Built-in-test

Rovins includes a Continuous Built-In Test (CBIT) that covers internal sensor status verification, system status and algorithm status The Interface Library document details the complete list of parameters that are monitored. Refer to Rovins Interface Library for further detail.

2.10.4 Reliability & maintainability

Due to the technology used in its design, Rovins is a fully strap-down / solid-state equipment. It does not use any gas filled cavity that could leak nor any moving mechanical part that would wear out. As a consequence, Rovins requires no scheduled maintenance.
Rovins does not have any life limited parts and as such, it has no predicted life limitation.
The entire Rovins is the Line Replacement Unit (LRU).

MTBF

- 100,000 hours (System observed)
- 500,000 hours (FOG + Accelerometers)

End-of-life product management

When the product reaches the end of its life, it must be returned to iXblue where it will be sent to a treatment facility appropriated to WEEE.

3 Mechanical Description

3.1 Presentation and overall dimensions

The Rovins overall dimensions are the following:

- Housing footprint (Ø x h): Ø 190 mm x h 274 mm
- Weight (Air/Water): 15 kg / 6.2 kg
- Depth rating: 3000 m
- Construction: Titanium

3.2 Mechanical Alignment

The Rovins base plate is designed with two holes for alignment of Rovins axis X2 with a reference direction on the matching adaptation plate fixed onboard.
For mechanical and installation recommendations, refer to Rovins Installation & Setup Guide.

3.3 Reference Frame Center

All data is calculated at the Rovins reference frame centre 'P point'. This is the reference point from which all of the external sensor lever arms must be measured from. The P point is also the reference frame center for the intersection of the three reference axis X1, X2 and X3.
The Rovins reference frame center, P, is:

- the sensing point of all product measurements
- to be used as a reference point to the determination of Rovins and external sensor lever arms

The reference frame center is shown in figure next page.

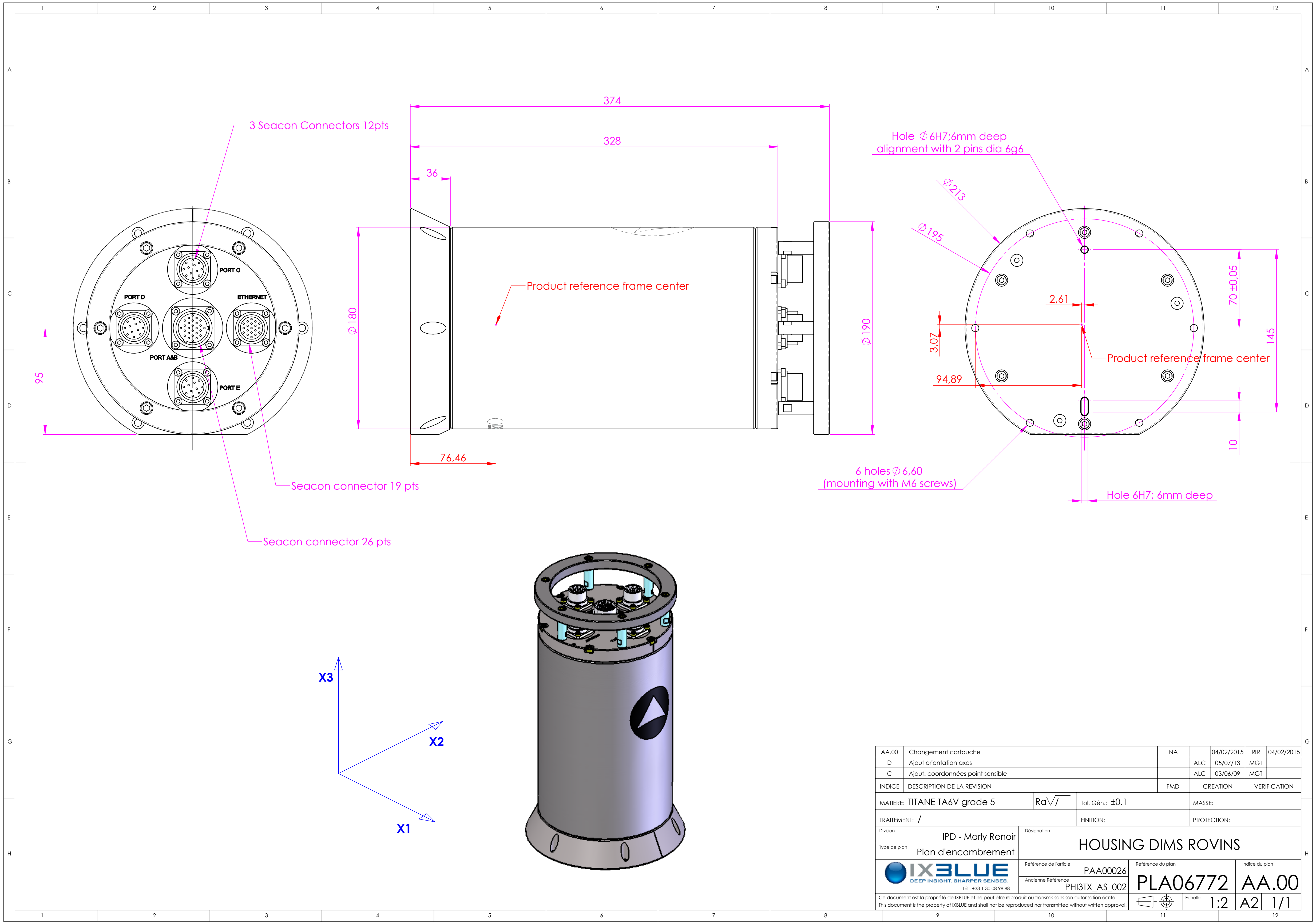


Figure 2 - Rovins housing dimensions and centre point P

4 Electrical Interface Description

4.1 Overview of electrical interface

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

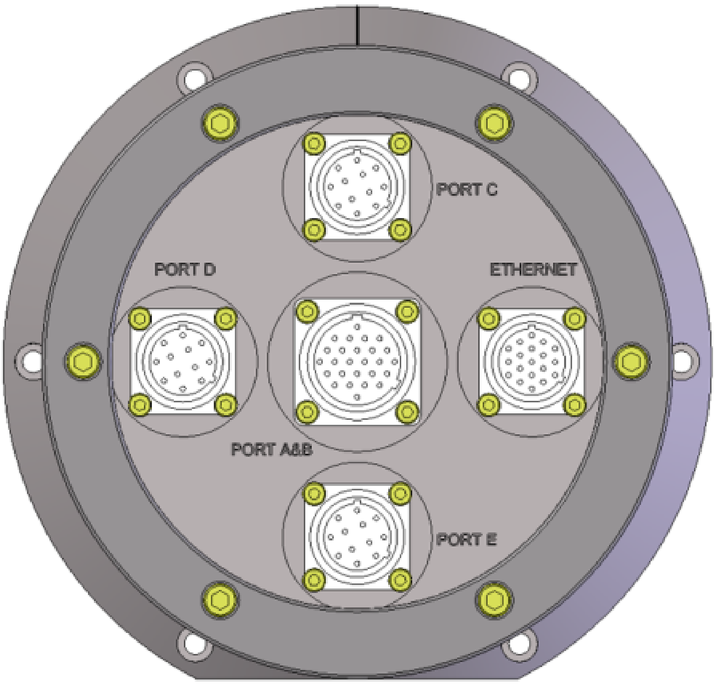


Figure 3 - Rovins connector panel

The connector types are the following

- 1 Ethernet FCR bulkhead SEACON MINK-FCR, size K 19#22 (19 pins).
- The reference of the corresponding plug to be plugged directly to the Ethernet connector is MINK-19#22-CCP-TI.
- 3 FCR bulkheads SEACON MINK-FCR, size K 12#22 (12 pins) dedicated to external sensors marked as Port C, Port D and Port E.
  The reference of the corresponding plug to be plugged directly to the "Port C", "Port D" or Port E" connector is MINK-12#22-CCP-TI.
- 1 central FCR bulkhead (marked as Port A&B) SEACON MINM-FCR, size M 26#20 (26 pins) for powering, external sensors and configuration. The reference of the corresponding plug to be plugged directly to the central connector is MINM-26#20-CCP-TI.

4.2 Listing of Interfaces

Rovins is fitted with 5 connectors configured to provide the following:

	Ethernet connector	**Central connector A&B**	**Peripheral connector C / D / E**
Power system supply	X	X	
2 independent power lines for external sensor allowing to power sensors with different voltages: for example, a DVL powered in 24 V and a SVP sensor powered with 12 V	IN	IN	OUT
1 Repeater and configuration port either through the Ethernet connector or through the Port A&B one (in both RS232 and 422)	X	RS232 or RS422	
Ethernet inputs	7		
Ethernet outputs	5		
RS232 or RS422 inputs		2	1 each
RS232 or RS422 outputs		2	1 each
3 user-configurable pulse Inputs A, B and C	Pulse B	Pulse A	Pulse C on Port C only
2 user configurable pulse Outputs A and B	Pulse B	Pulse A	
1 external pulse (coming from the surface through the central connector and then dispatched to all other connectors): it can be used to output a trigger for the DVL (i.e., to allow the DVL to ping at chosen time)	IN	IN	OUT

The I/O port configuration is done through embedded Rovins Web-Based Graphical User Interface accessible via PC web browser or through a third party system interface via a control command link.
Refer to Rovins Installation & Setup Guide (Ref.: MU-ROVINSISG-AN-001) for details.

4.3 Ethernet Connector Specification

4.3.1 Definition

The Ethernet connector provides the following inputs and outputs:

- 1 Ethernet 10/100Mbit port used to transport up to 7 input/ 5 output streams user-configured either with UDP or TCP. Configuration is made through the Web-Based Graphical User Interface.
- 1 repeater serial port in RS232 used to monitor system state and send configuration commands in serial mode.
- 1TTL input pulse user-configurable, usually used to send PPS time synchronization.
- 1 TTL output pulse user-configurable
- 1 Ext pulse to trigger external sensors (common to the other connectors external pulse)
- System power supply (+24V)
- 2 different power supplies (Ext sensor 1 Out (+V1) and Ext sensor 2 Out (+V2)) for powering external sensors

These interfaces are user configurable (except for the dedicated configuration I/O) through the Web-based Graphical User Interface or through a third party system interface via a control command link. For details, refer to the documents:

- Installation & Setup Guide (Ref.:MU-ROVINSISG-AN-001)
- Interface Library (Ref.: MU-ROVINSIL-AN-001)

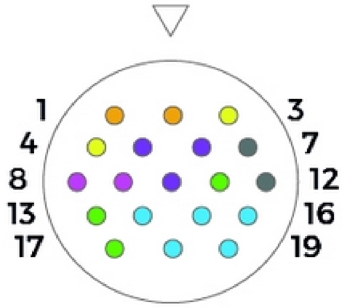
Do not use both the Ethernet link and the serial one to configure Rovins in the same time. The use of the supplied power supply converter should be restricted to situations where the mains power supply is stable and filtered out. In particular, it is not recommended for use outside land grid, on board a vehicle.

Important

RS232/RS422 ports have to be wired with twisted shielded pairs.

4.3.2 Connector & Pin out

The Rovins 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	Rovins Power In (+24 V)
	9	Rovins 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 4 - Ethernet connector pin definition

(*) Rovins 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 Rovins. These lines are connected to the external trigger lines of the other connectors to dispatch the signal.

4.4 Port A&B Connector (Central Connector) Specifications

4.4.1 DEFINITION

The central connector can be used as an alternative to the Ethernet connector.

It provides power and connection of the Rovins to a PC for installation, for configuration and display purposes through the Web-Based Graphical User Interface which is embedded in the unit.

In this configuration, the Web server connection will need to be configured in PPP (TCP/IP over serial port). Alternatively control commands can be sent trough the "repeater port", refer to Rovins Interface Library.

The Central connector provides the following inputs and outputs:

- 1 repeater serial port in RS232 or RS422 used to monitor system state and send configuration commands in serial mode.
- 2 user-configurable serial input (RX). Pin assignment in RS232 or RS422 electrical levels is detailed in Table 2 RS232 input signal should provide a voltage min ± 5 V to ± 20 V when loaded.
- 2 user-configurable serial output (TX). Pin assignment in RS232 or RS422 electrical levels is detailed in Table 2 RS232 output signal level is ± 5 V min when load is 3 kΩ.
- 1 TTL input pulse user-configurable, usually used to send PPS time synchronization.
- 1 TTL output pulse user-configurable
- 1 Ext pulse coming from the central connector to trigger external sensors (common with other connector external pulse)
- System power supply (+24 VDC)
- 2 different power supplies (Ext sensor 1 Out (+V1) and Ext sensor 2 Out (+V2)) for powering external sensors

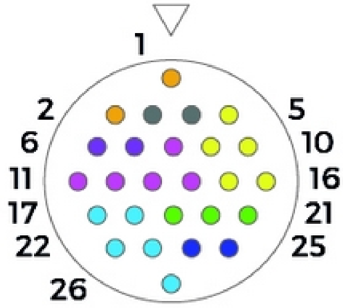
Do not use both the Ethernet link and the serial one to configure Rovins in the same time. The use of the supplied power supply converter should be restricted to situations where the mains power supply is stable and filtered out. In particular, it is not recommended for use outside land grid, on board a vehicle.

Important

RS232/RS422 ports have to be wired with twisted shielded pairs.

4.4.2 Connector and Pinout

Rovins 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 5 - Central connector

(*) Rovins 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 Rovins.

4.5 Port X (X being C, D, or E) Connector Specifications

4.5.1 Definition

The Port C, Port D and Port E connectors are used to connect external sensors and system to Rovins.
These inputs/outputs are user-configurable through the embedded Web-Based Graphical User Interface, refer to Rovins Installation & Setup Guide for details on Rovins configuration with this Web-Based Graphical User Interface.

The Port X (for C, D and E) connector provides the following inputs and outputs:

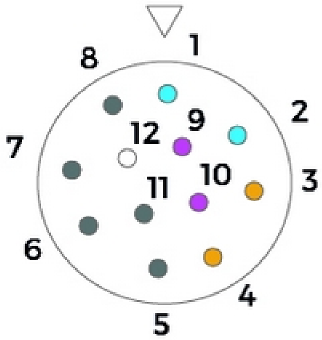
- 1 user-configurable serial input (RX). RS232 input signal should provide a voltage min ± 5 V to ± 20 V when loaded.
- 1 user-configurable serial output (TX). RS232 output signal level is ± 5 V min when load is 3 kΩ.
- 1 TTL pulse input. This pulse is only available on the Port C.
- 1 Ext pulse coming from the central connector
- 2 different power supplies (Ext sensor 1 Out (+V1) and Ext sensor 2 Out (+V2)) for powering external sensor. These lines are common to all other connectors.

Important

RS232/RS422 ports have to be wired with twisted shielded pairs.

4.5.2 Connector and Pinout

Rovins 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 6 - Central connector

(*) Rovins 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 Rovins.

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

4.6 Rovins Power Network

4.6.1 Power Supply Definition

Rovins 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 Rovins. The principle is to use a single cable/connector between ROV control unit/bottle and Rovins. This cable would have to handle three power supplies:Rovins, External Sensor 1 and External Sensor 2. The two last are wired to satellite connectors to power individually each external sensor.

4.6.2 Power Supply Pinout

Rovins power network is configured as shown in the following figure.

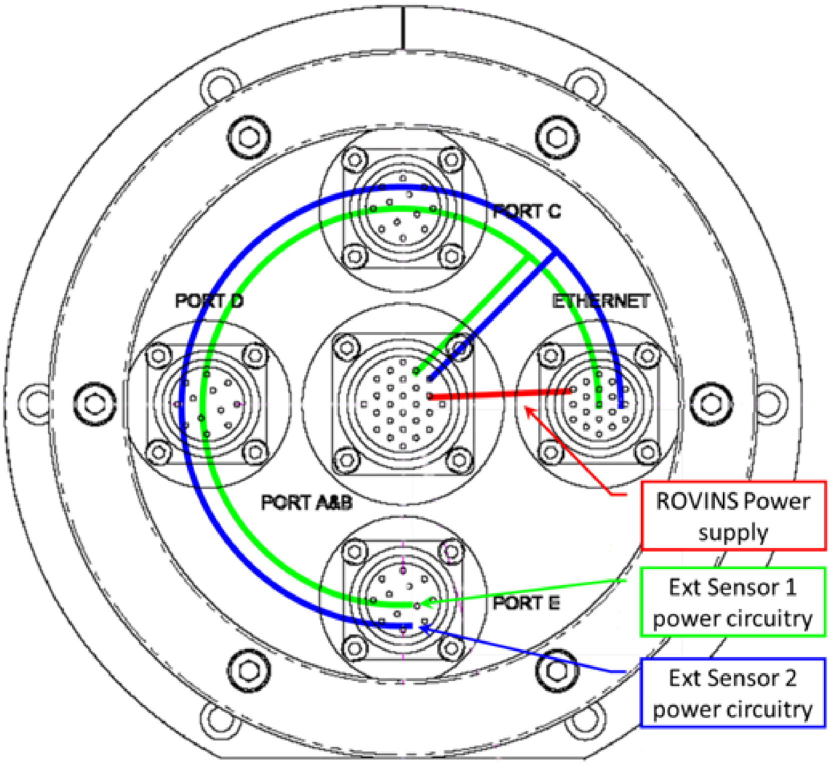


Figure 7 - Power network for the external sensors

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.

4.7 Recommended Wiring

The recommended wiring with Shielded Twisted Pairs for RS232 (Output and Input), RS422 (Output and Input), and Pulse (Output and Input) cables are described hereafter.

Important

If you do not use shielded multi-twisted pairs, you may encounter cross-talk problems between input and output, and this may give error or dysfunction. Shield link should be done at one end only to avoid ground loops unless shield is used as an electrical ground.

It is recommended to link external cable shielding to mechanical ground. It is recommended to link the wires not used to the mechanical ground of the related port.

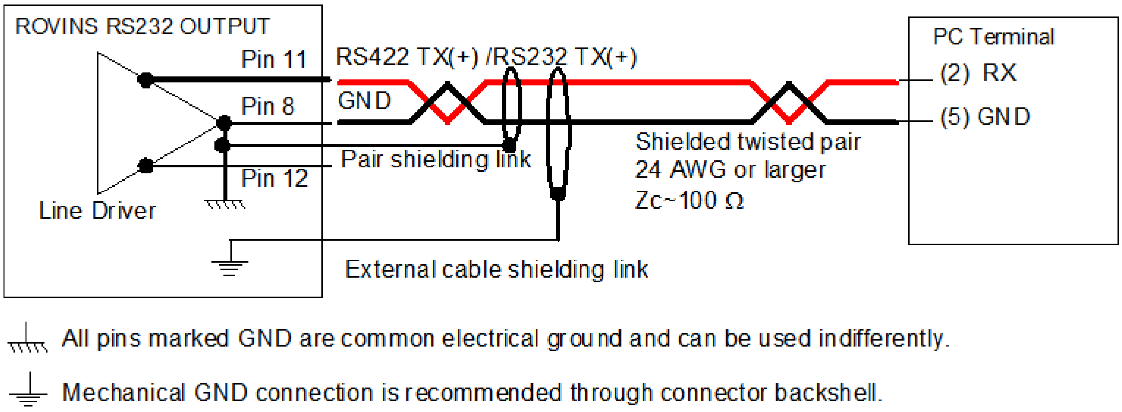


Figure 8 - Description of mono-directional RS232 Output wiring (Port A example)

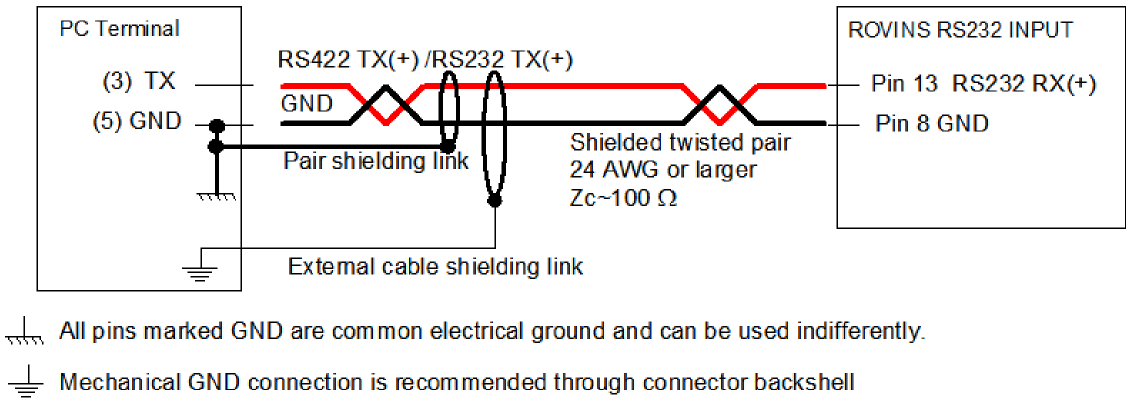
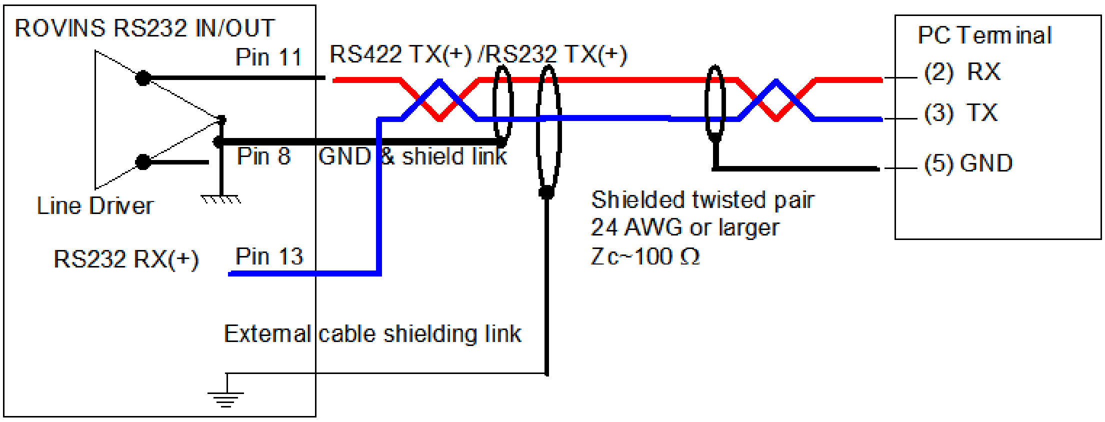


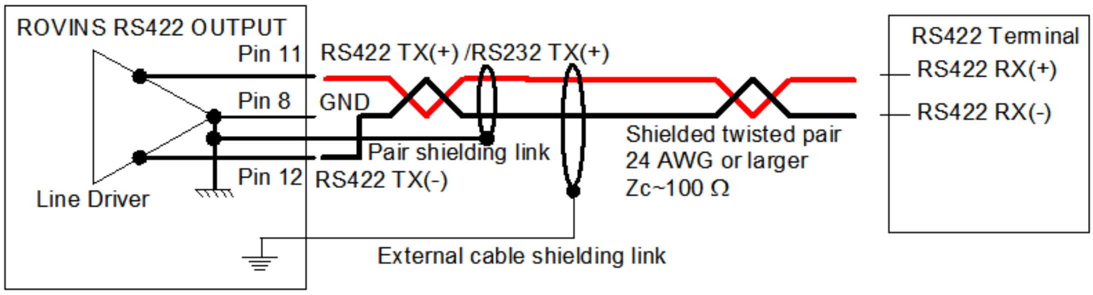
Figure 9 - Description of mono-directional RS232 Input wiring (Port A example)



All pins marked GND are common electrical ground and can be used indifferently.

Mechanical GND connection is recommended through connector backshell.

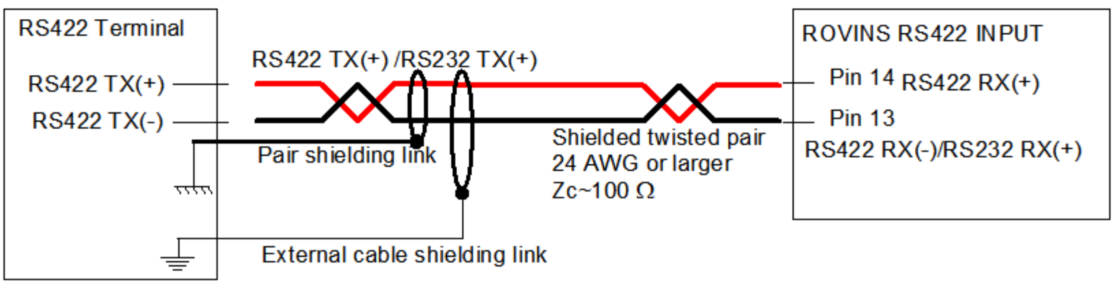
Figure 10 - Description of bi-directional RS232 Output wiring (Port A example)



All pins marked GND are common electrical ground and can be used indifferently.

Mechanical GND connection is recommended through connector backshell.

Figure 11 - Description of the RS422 Output wiring with a Shielded Twisted Pair (Port A example)



All pins marked GND are common electrical ground and can be used indifferently.

Mechanical GND connection is recommended through connector backshell.

Figure 12 - Description of the RS422 Input wiring with a Shielded Twisted Pair (Port A example)

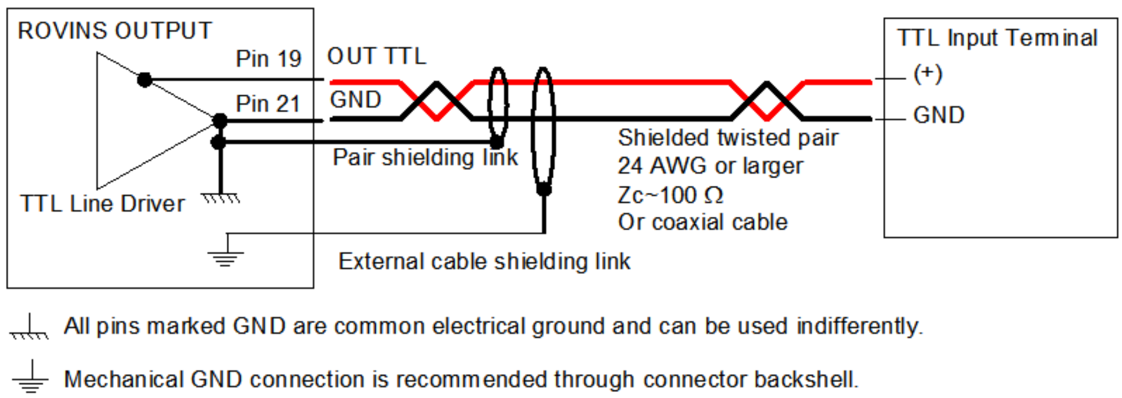


Figure 13 - Description of the Pulse Output wiring with a Shielded Twisted Pair (Pulse A example)

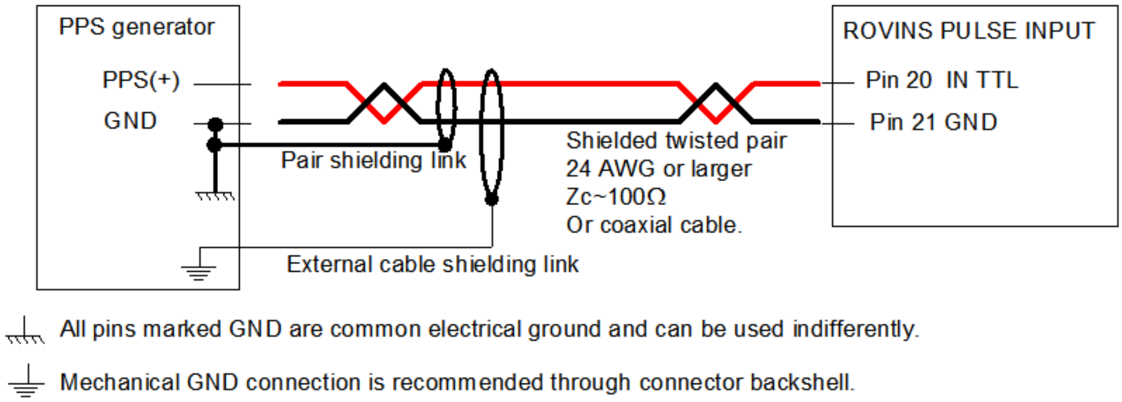


Figure 14 - Description of the Pulse Input wiring with a Shielded Twisted Pair (Port A example)

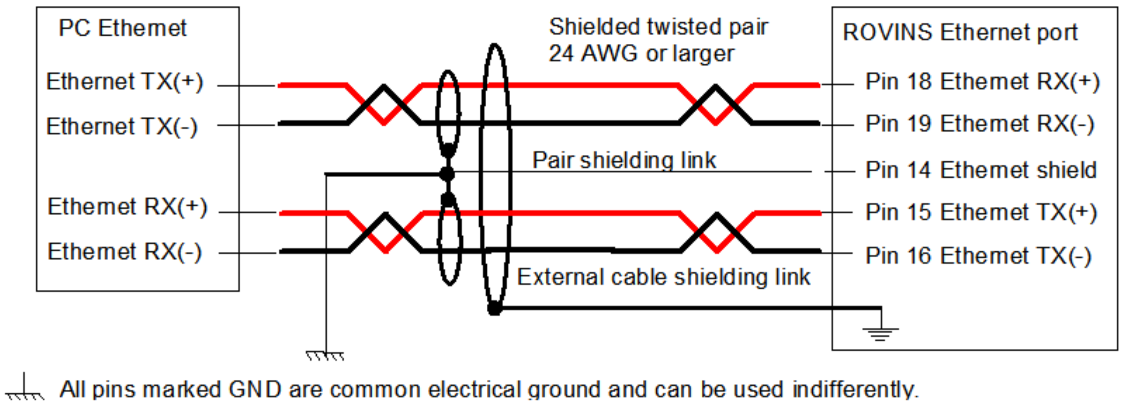
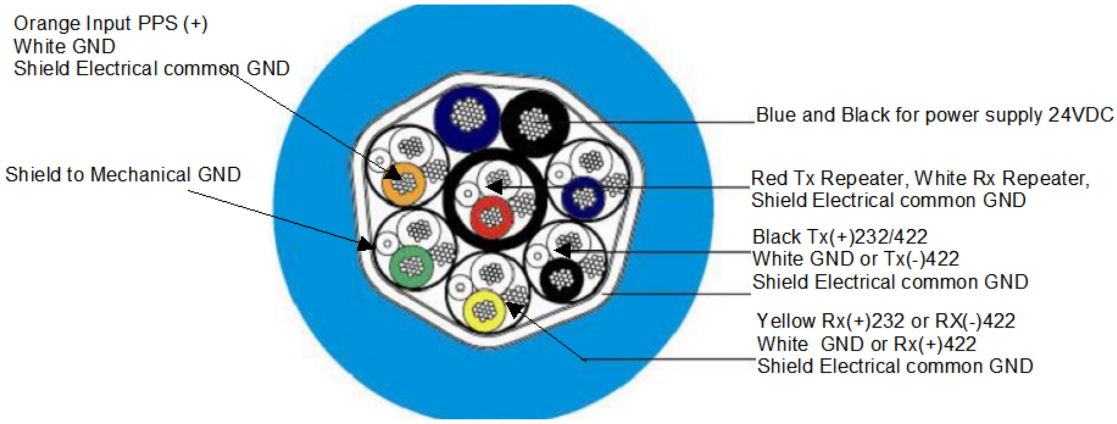


Figure 15 - Description of the Ethernet wiring with Shielded Twisted Pairs

Example of cabling with a multi twisted pair MacArtney ref. 4622



4.8 RS232/RS422 Input and Output Characteristics

Each RS232 and RS422 input and output is based on a separate MAX3160 driver powered by its own DC/DC converter and isolated from each other and from the internal digital power by an ISO7220AD isolator.

The following table details input impedance of each port and voltage requirements for each port:

Table 1 - RS232/RS422 Input characteristics

	RS232	RS422
Input impedance	5 kΩ	48kΩ
Minimum input LOW threshold	0.8 V	N/A
Maximum input HIGH threshold	2.4 V	N/A
Minimum differential threshold	N/A	200 mV

The following table details output impedance of each port and maximal output current that can be delivered by each port driver.

Table 2 - RS232/RS422 Output characteristics

	RS232	RS422
Output impedance	100 Ω	40 Ω
Max. output drive current	110 mA	260 mA
Output voltage (no load)	±11 V	10.4 V differential
Output voltage (loaded)	10.8 V (3 kΩ)	7.5 V differential (100 Ω)

4.9 Input Pulses Electrical Characteristics

Following table details input pulse characteristics:

Table 3 - Input Pulse Electrical Characteristics

	Symbol	Min	Max	Unit
Input pulse width	TW	1	-	µs
Low to High transition voltage	VLH	2	-	V
High to Low transition voltage	VHL	-	0.8	V
Input voltage	VIN	- 0.5	5.5	V
Input current	IIN	- 10	10	µA
Pulse internal latency	TL	-	10	µs

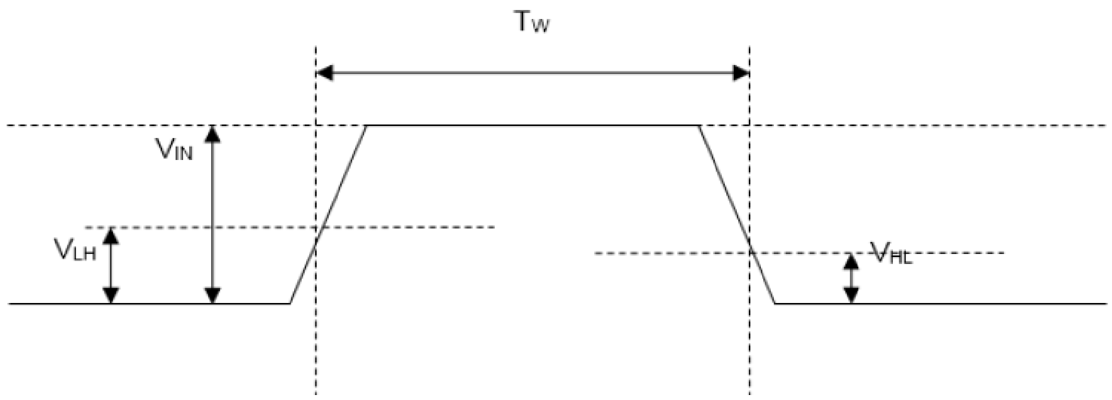


Figure 16 - Input Pulse Diagram

4.10 Output Pulses Electrical Characteristics

Following table details output pulse characteristics:

Table 4 - Output Pulse Electrical Characteristics

	Symbol	Min	Max	Unit
Output voltage at logic low	VL	0	0.4	V
Output voltage at logic high	VH	4.8	5	V
Output current	IOUT	-	4	mA

5 Communication Interface Description

5.1 Communication Link

Rovins is able to receive and transmit data through 5 configurable asynchronous serial communication lines (digital I/O):

- Baud rates, parity and number of stop bits can be configured independently for each of the 5 serial links
- Electrical level (RS-232 or RS-422) can be configured independently for each of the 5 serial links

Rovins is able to receive and transmit data through a 10/100 Mbits/s Ethernet link:

- TCP/IP and UDP protocols are available
- 7 input / 5 output virtual ports can be opened simultaneously

The output frequency can be selected as presented in the Interface Library document.

Rovins can be connected to a PC for configuration, installation and display purposes through the Web-Based Graphical User Interface. The I/O signal is available:

- Either through the Ethernet connector (see section 4.3).
- Or through the digital I/O connector (see section 1).

In default configuration, access to the Web-Based Graphical User Interface is only possible through the Ethernet connector.
On RSXX2 serial link, the Installation and Repeater output has to be configured in PPP mode to have access to the Web-Based Graphical User Interface (refer to Rovins Installation & Setup Guide for more details).

For the Ethernet link, the following parameters are defined by default:

- IP Address: 192.168.36.1xx, xx being the last two numbers of the Rovins serial number
- Connection through http web server (port 80)
- Repeater flow available in TCP (port 8110)

By default, serial repeater link is configured as follows:

- Protocol used : PHINS Standard, refer to Rovins Interface Library for a description of PHINS Standard data frame output
- Baudrate : 57.6 kBauds
- Flow Control : Odd, 2 stop bits
- Refresh rate : 5 Hz (200 ms)

5.2 Software Interfaces and Library

Input and output digital interfaces are user-configurable with a comprehensive set of protocols (or formats) to be selected from the digital interface library.

Digital protocols in binary format and NMEA compliant ASCII format are available for input and output data. To get details on protocols, please refer to Rovins Interface Library.

System configuration and operation can be performed either through the Web-Based Graphical User Interface (refer to Rovins Operation Guide) or with text control command (refer to Rovins Interface Library).

5.3 Web-Based Graphical User Interface

Rovins is delivered with iXblue established Web-Based Graphical User Interface. It runs either on a workstation or on a laptop and allows system configuration.
The embedded Web-Based Graphical User Interface has been optimized and qualified with PC running Windows 10 operating system on the Firefox version ESR 45 and Chrome version 61 browsers.

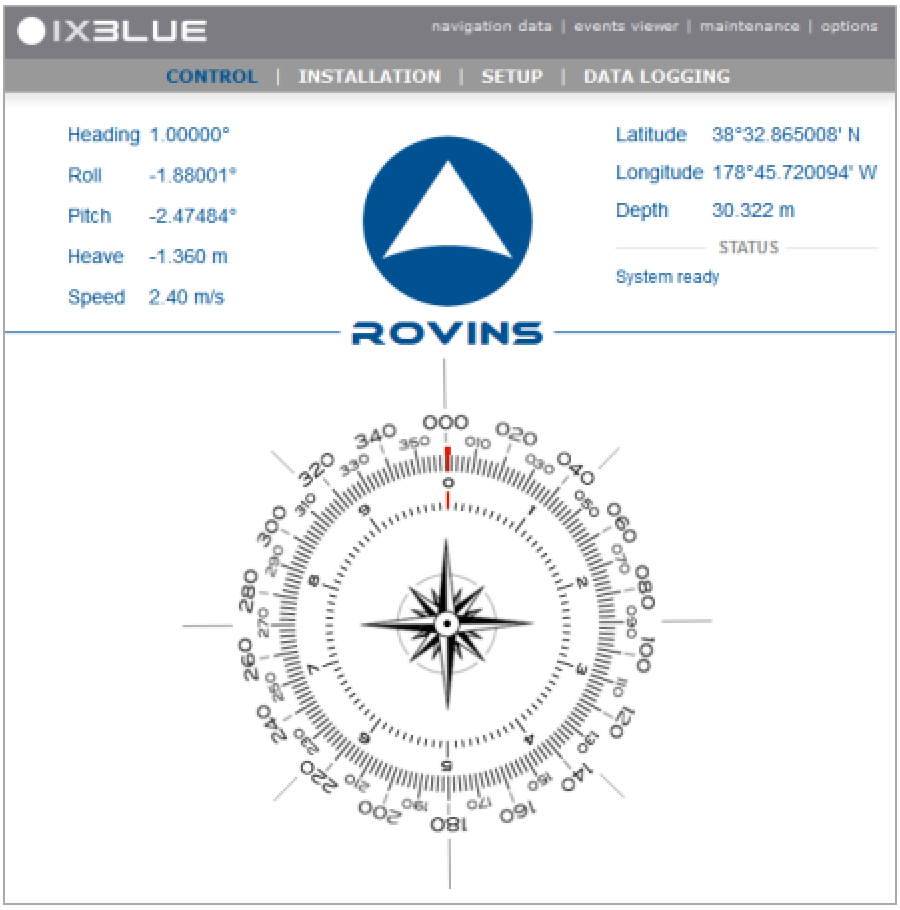


Figure 17 - Rovins Web-based Graphical User Interface

An USB flash drive is provided with the product, it contains web brower software, product user manuals and drawings.

5.4 Control Command

The control commands give access to the following features:

- Installation
  - Misalignment configuration
  - Level arms configuration
  - Communication link configuration (physical parameter and software parameters)
  - External sensor configuration
  - Depth management
- Operation
  - Software reset
  - User position fix
  - Software activation / deactivation of external sensor
  - Data display (including all navigation and quality check data)

Refer to Rovins Interface Library to get details on the control commands.

iXblue CONTACT - SUPPORT

For non-URGENT support:

- by email: support@ixblue.com
- using the form on the iXblue web site www.ixblue.com

For 24/7 URGENT SUPPORT:

- 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