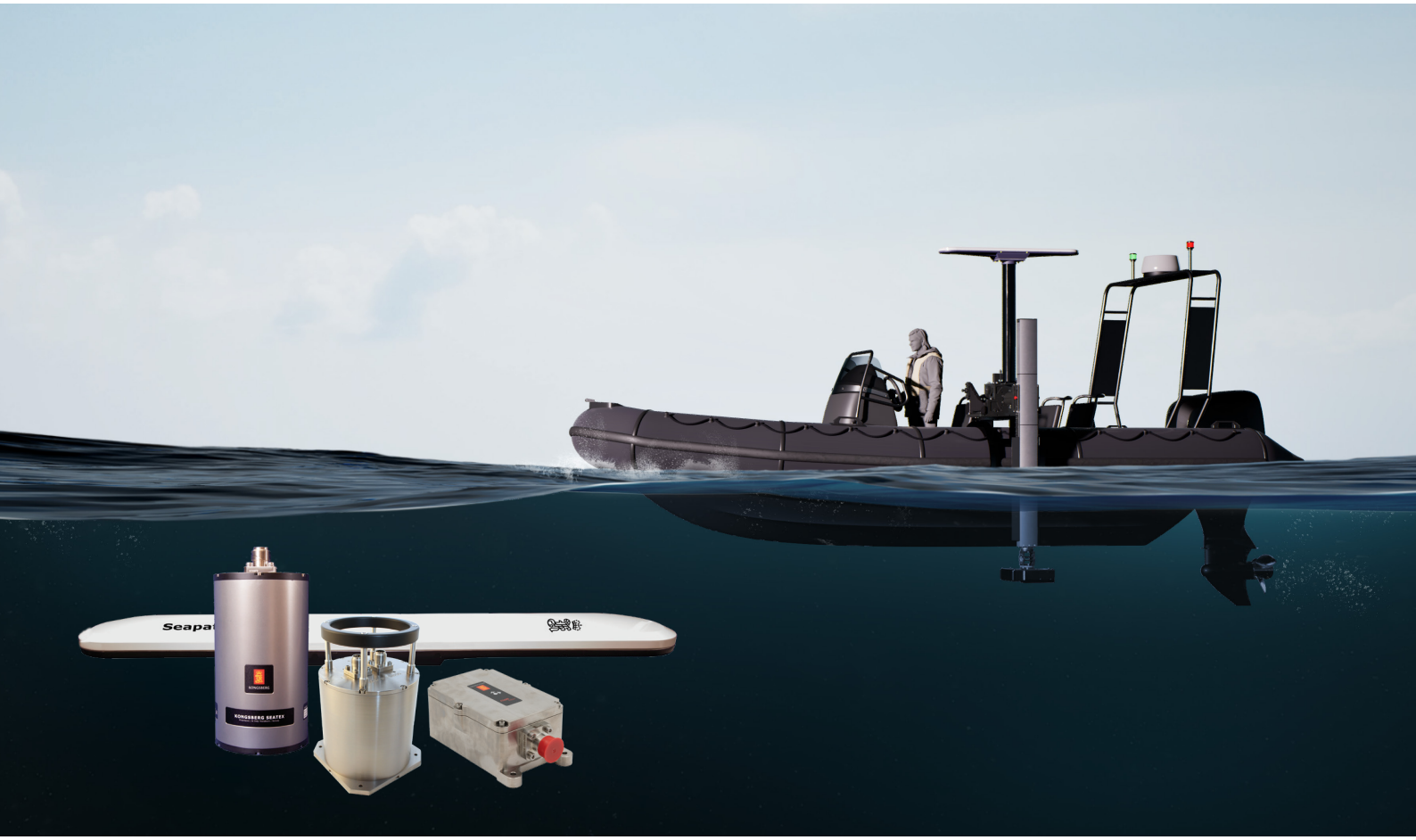
KONGSBERG

Installation manual

Seapath® 130-series

Compact GNSS aided Inertial Navigation System



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Seapath 130

Compact GNSS aided Inertial Navigation System

Installation manual

110-0099522/A

Document history

Document number: 110-0099522 / Revision A		
Rev. A	July 2025	First issue Seapath 130 and 130-R combined. Updated to correspond with Product software version 2.03.00. Installation of miniMRU is included.

Document information

- Product: Seapath 130
- Document: Installation manual
- Document part number: 110-0099522
- Revision: A

Copyright

Warning

The equipment to which this manual applies must only be used for the purpose for which it was designed. Improper use or maintenance may cause damage to the equipment and/or injury to personnel. You must be familiar with the contents of the appropriate manuals before attempting to operate or work on the equipment.

Kongsberg Discovery disclaims any responsibility for damage or injury caused by improper installation, use or maintenance of the equipment.

Disclaimer

Kongsberg Discovery AS endeavours to ensure that all information in this document is correct and fairly stated, but does not accept liability for any errors or omissions.

Support information

If you require maintenance or repair, contact Kongsberg Discovery's support organisation. You can contact us using the following address: support.seatex@kd.kongsberg.com. If you need information about our other products, visit http://www.kongsberg.com/discovery.

Table of contents

About this manual

Purpose of manual

The purpose of this publication is to provide the descriptions and procedures required to install and set up the Seapath 130 product with the Inertial Measurement Unit (IMU) in a subsea bottle.

If your installation is for the IMU without a subsea bottle, please refer to the installation manuals for the respective IMUs. This can be an MRU (Motion Reference Unit), a miniMRU or an MGC (Motion Sensor and Gyro Compass).

Target audience

The publication is intended for technical personnel such as skilled shipyard and factory workers, electricians, qualified engineers, and naval architects.

License information

An export license is required for the export of the Inertial Measurement Units MGC and MRU.

Registered trademarks

Seapath® is a registered trademark of Kongsberg Discovery AS in Norway and the People's Republic of China. MGC® is a registered trademark in Norway and Europe. Windows® is a registered trademark of Microsoft Corporation in the United States and other countries.

Subscriptions

If you want to use the Seastar® high performance position services from Fugro Norway AS, this requires a subscription. For a subscription, contact Seastar® GNSS support.

- https://fsp.support/seastar/index.php?tab=contacts

Maintenance purposes

This publication is also intended as reference material for the maintenance personnel. Keep this publication for later use.

Seapath 130

Topics

System description

The Seapath 130 is developed specifically for hydrographic surveying where high precision heading, position, velocity, roll, pitch, heave and timing are critical measurements. The product combines state-of-the-art dual frequency GNSS receivers (GPS, GLONASS, Galieo, BeiDou), inertial technology and processing algorithms in a compact and portable package.

The main component is the Sensor Unit. It contains the motherboard, GNSS antennas and GNSS receivers. The Sensor Unit is to be mounted on top of a vessel mast or pole.

The product also consists of an Inertial Measurement Unit (IMU). This can be an MRU (Motion Reference Unit), a miniMRU or an MGC (Motion Sensor and Gyro Compass). The IMU is mounted inside a subsea bottle on top of the transducer.

The Seapath operator software is installed on a connected computer for configuration and monitoring.

All the components are connected through a spider cable with IMU connection, three configurable serial lines, DGNSS (Differential GNSS) correction input, 1PPS output, network communication and power inlet.

The Seapath software includes Automatic Online Calibration (AOC) that significantly improves the roll and pitch accuracy. With the AOC functionality, recalibration of the IMU is now longer required.

The Seapath 130 series is delivered in the following product range:

Seapath with MRU (Motion Reference Unit)

- Seapath 130-3 with MRU 3 to 0.010° roll and pitch accuracy
- Seapath 130-5 with MRU 5 to 0.008° roll and pitch accuracy
- Seapath 130-5+ with MRU 5+ to 0.005° roll and pitch accuracy

Note:

The MRU 3 model part of Seapath 130-3 has to be mounted in a fixed direction relative to the vessel and that is with the connector pointing up or down. Else the performance of the Seapath 130-3 will be degraded.

Seapath with miniMRU

- Seapath 130-40 with miniMRU 40 to 0.010° roll and pitch accuracy
- Seapath 130-60 with miniMRU 60 to 0.008° roll and pitch accuracy

Seapath with MGC (Motion Sensor and Gyro Compass)

- Seapath 130-R2 with MGC R2 to 0.008° roll and pitch accuracy
- Seapath 130-R3 with MGC R3 to 0.007° roll and pitch accuracy

The advanced Seapath navigation algorithms integrate the RTK GNSS data with the inertial sensor data. This gives the Seapath 130 unique advantages compared to stand alone RTK products. The Seapath product's accurate roll, pitch and heading measurements allow the RTK antenna position to be referenced to any point on the vessel where accurate position and velocity are required. All the data from Seapath have the same time stamp and the output is in real-time. Subdecimetre position accuracy can be achieved through download of satellite orbit and clock data from internet and by post processing of satellite and IMU (Inertial Measurement Unit) data. The Seapath is robust against GNSS dropouts by using the inertial sensor for dead reckoning navigation in order to provide position, velocity and also heading measurements when GNSS is not available.

The Seapath 130 software has improved algorithms for position drift after GNSS dropout. The plots show typical position drifts.

Figure 1: Typical position drift in meters after GNSS dropout in minutes for MGC R2 and R3

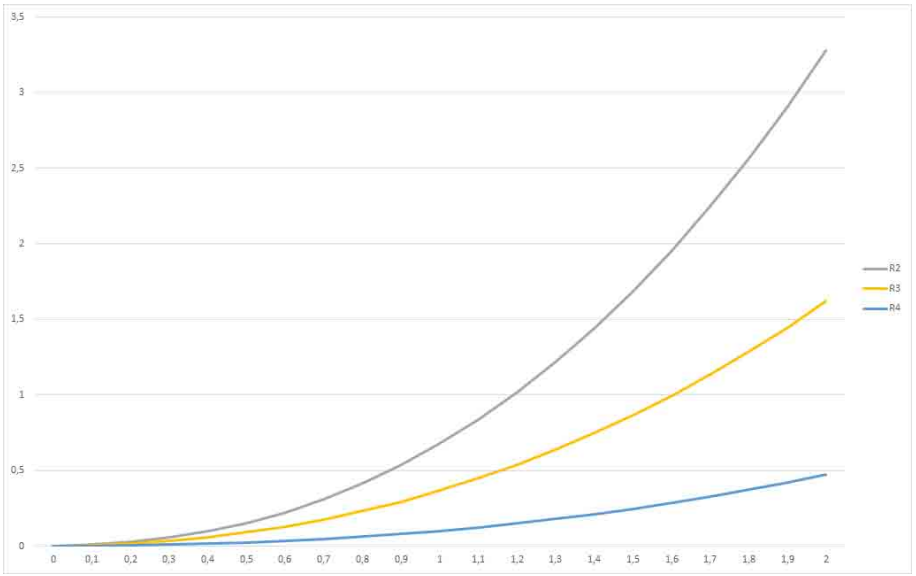
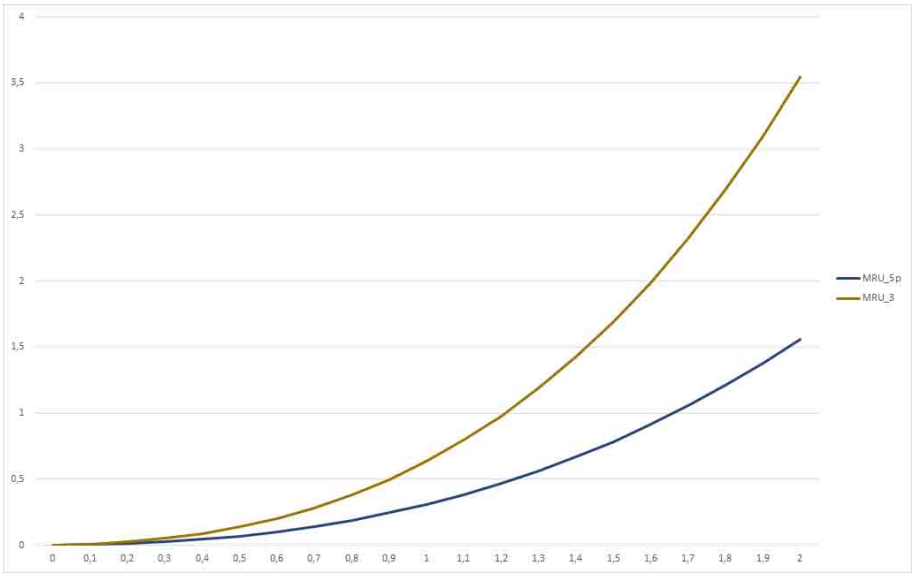


Figure 2: Typical position drift in meters after GNSS dropout in minutes for MRU 3, 5 and 5+



The product has three configurable RS-232/422 serial lines and Ethernet ports for output of motion data and NMEA messages to the multibeam and survey computer. Input of DGNSS corrections of various quality and sources are input on a configurable RS-232/422 serial line or Ethernet.

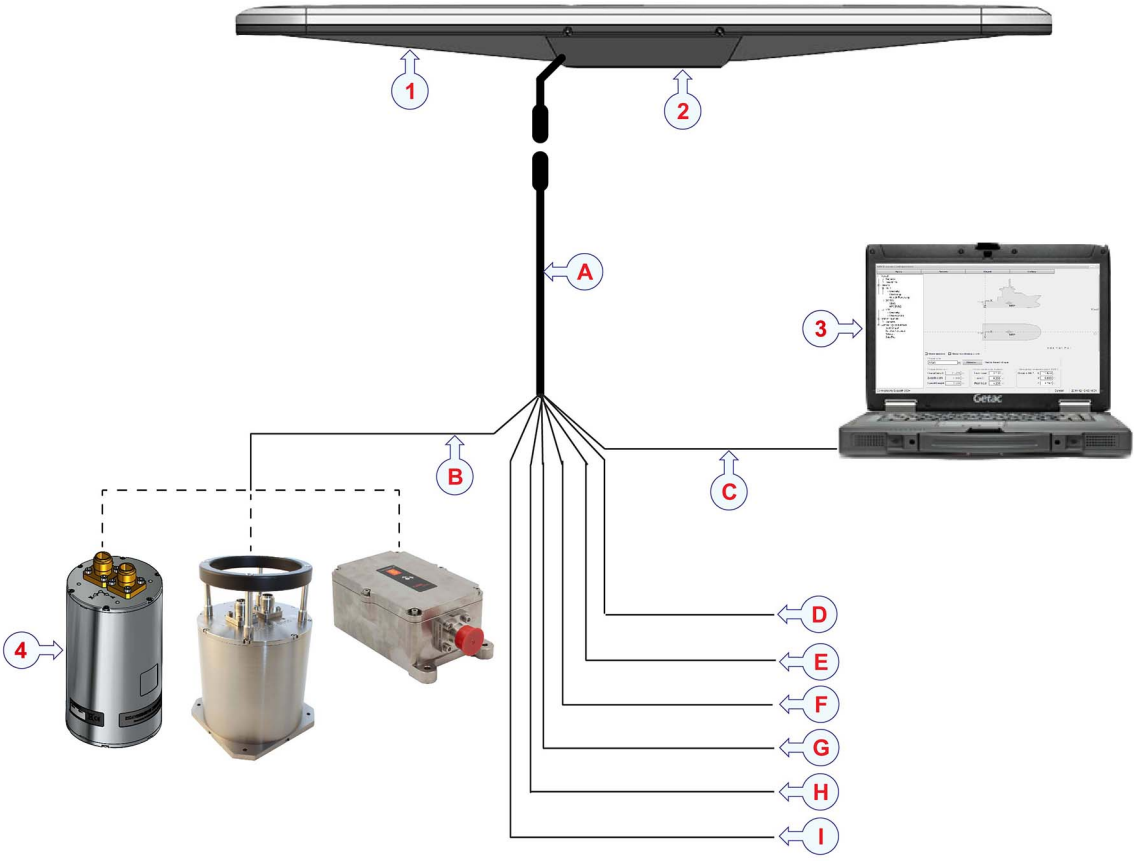
By utilising standard DGNSS, Fugro Seastar® XP2/XP3/G2/G4/G4+, VERIPOS Ultra/ Ultra[2], C-NavC[1], C-NavC[2] and RTK corrections, this system is a unique solution for

hydrographic surveying and dredging work which demand the most comprehensive, most accurate surveying data available.

System diagram

The system diagram identifies the main components of a Seapath system.

The Inertial Measurement Unit (IMU) connected to the Sensor Unit can either be a Motion Sensor and Gyro Compass (MGC), a Motion Reference Unit (MRU) or a miniMRU.



Units

1. *Sensor Unit with 1-metre cable, male connector*
2. *Mounting bracket*
3. *Operator software installed on external computer (Not part of standard delivery)*
4. *Inertial Measurement Unit (MGC, MRU or miniMRU) in subsea bottle*

Cables

A. *Cable to Sensor Unit, part of spider cable, 20 metres length, female connector*

B. *IMU umbilical cable with 8-pin SeaCon connector, 15 metres length*

C. *Ethernet cable to external computer and other users, 5 metres length*

D. *Input serial line cable for DGNSS corrections, 9-pin DSub connector, 5 metres*

E. *Output serial line cable for DGNSS corrections, 9-pin DSub connector, 5 metres*

F. *Output serial line for motion data to multibeam or survey computer, 9-pin DSub connector, 5 metres length*

G. *Output serial line for NMEA data , 9-pin DSub connector, 5 metres length*

H. *1PPS output, 9-pin DSub connector, 5 metres length*

I. *24 VDC input, 5 metres length*

Note:

Input/output serial line for DGNSS corrections is the same cable.

Scope of supply

The Seapath system comprises the Sensor Unit, the spider cable and an Inertial Measurement Unit (IMU). The IMU can be a Motion Sensor and Gyro Compass (MGC), a Motion Reference Unit (MRU) or a miniMRU. The basic items are included in the delivery. Additional optional items can be purchased from Kongsberg Discovery AS.

Basic items

- 1 ea Sensor Unit

  Part number: M340-03

- 1 ea Mounting bracket

  Part number: M340-05

- 1 ea Spider cable

  Part number: M340-20 (20 m length) or Part number: M340-24 short, (8 m length)

- 1 ea Inertial Measurement Unit

  MGC models: R2 SB50 or R3 SB50

MRU models: 3, 5 or 5+

miniMRU models: 40 or 60

- 1 ea Light weight MRU subsea bottle, if IMU is MRU

  Part number: MRU-M-SB12

- 1 ea miniMRU subsea housing (serial), if IMU is miniMRU
  Part number: 110-0067934

- 2 ea End-user documentation

Additional optional items

The following additional optional items can be used together with the Seapath 130.

- 1 ea Junction Box

  Part number: M340-22

  Part number: MRU-E-JB3 for MRU

Main system units

Topics

Seapath 130 sensor unit

The Sensor Unit runs the navigation software.

This software combines the GNSS signal and the inertial measurements to determine accurate position, heading, attitude and heave signal. This software uses Kongsberg Discovery AS advanced true multi-reference algorithms for real-time parallel processing of all available correction signals.

The Sensor Unit includes the following.

- Two GNSS receivers and antennas
- Motherboard
- Connector board for termination of spider cable
- 1-metre cable with male connector
- Mounting bracket

Motion Reference Unit (MRU) description

The MRU (Motion Reference Unit) is a sensor unit designed for motion measurement in marine applications. The unit incorporates 3-axis sensors for linear acceleration and angular rate, along with complete signal processing electronics and power supply. The MRU outputs absolute roll and pitch as well as dynamic acceleration in the north, east and down direction. It also outputs velocity and relative position.

The interior of the MRU is divided into two sub-assemblies consisting of an electronic part and a sensor part. The sensor unit shall not be repaired or serviced by anyone else than Kongsberg Discovery AS.

MRU subsea bottle description

The MRU (Motion Reference Unit) is mounted in a light-weight subsea bottle.

The top and bottom cover plates of the bottle are made of PVC and the cylinder is made of aluminum. The bottle is designed for use down to 10 metres. The MRU is mounted on a steering plate inside the bottle.

On the outside there are four mounting holes (M6) on both cover plates. The mounting direction of the MRU within the bottle is indicated on the bottom cover plate.

The bottle is delivered with two 8-pin Seacon connectors, one for serial and one for Ethernet communication.

MGC (Motion Sensor and Gyro Compass) description

The unit is mounted in a 50–metre depth rated titanium subsea bottle.

The Motion sensor Gyro Compass (MGC) is a full inertial navigation system (INS). It can output heading, roll, pitch, heave and position.

The unit is a north-seeking gyro compass. It is based on three Ring Laser Gyros (RLG) and three linear accelerometers.

The unit can also be operated as an inertial navigation system. Then it will output position and heading.

miniMRU

The miniMRU is designed for motion measurements in marine applications. It is intended for integration into systems which require motion compensation. For example a multibeam transducer head for seabed mapping.

The miniMRU incorporates 3-axis sensors for linear acceleration and angular rate, along with complete signal processing electronics and power supply. The unit outputs absolute roll and pitch as well as dynamic acceleration in the north, east and down direction, velocity and relative position.

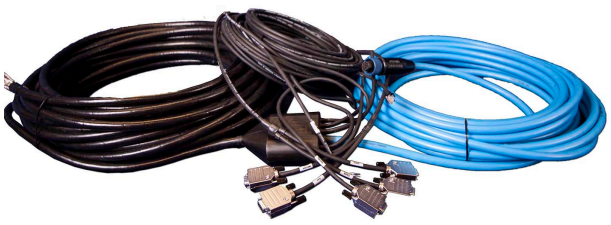
The main component within the unit is the milliMRG sensor element which comprises a MEMS gyro and an accelerometer. The milliMRG is manufactured in different versions depending on the performance required to the particular miniMRU model.

The miniMRU can be delivered in a subsea housing. The housing is depth rated to 80 metres.

Spider cable description

The product is delivered with a spider cable for connection to the Seapath Sensor Unit.

The connection to the Seapath Sensor Unit is through a female connector. The Inertial Measurement Unit (IMU) connection is through an 8-pin Seacon connector. The cable has three configurable serial lines through 9-pin D-sub connectors, 1PPS output



through a 9-pin D-sub connector, network communication and power inlet.

The cable is delivered in either 20 metres length or 8 metres length.

Product restrictions

Restrictions in export

Export of these Inertial Measurement Units (IMU) requires an export license.

- MGC R2/R3
- MRU 5+/5/H
- miniMRU 50/60

Important:

Notice to customer/importer/end user.

The inertial sensor specified here is shipped from Norway in accordance with the Ministry of Foreign Affairs' Official Notification on Export Control and U.S. Export Administration Regulations (EAR).

The inertial sensor will be subject to restrictions from your national export control authorities if resold, transferred or otherwise disposed from your country.

Resale, transfer or otherwise disposal of the inertial sensor to countries, persons or entities under UN, US, EU or Norwegian embargo/sanctions, is prohibited.

Any valid and approved export license granted to Kongsberg Discovery AS from the Norwegian Ministry of Foreign Affairs or the U.S. Government, is not an authorization for you to resell, transfer or other disposal of the inertial sensor.

Limited warranty

Changes or modifications to the product not explicitly approved by Kongsberg Discovery AS will void the warranty.

The liability of Kongsberg Discovery AS is limited to repair of this product only under the given terms and conditions stated in the sales documents. Consequential damages such as customer's loss of profit or damage to other systems traceable back to this product's malfunctions, are excluded.

The warranty does not cover malfunctions of the product resulting from the following conditions.

- The Sensor Unit housing has been opened by the customer.
- The IMU housing has been opened by the customer.
- The Sensor Unit is not shipped in the original transportation box.
- The IMU is not shipped in the original transportation box.
- The Sensor Unit has been exposed to extreme shock and vibrations.
- The IMU has been exposed to extreme shock and vibrations.
- Incorrect power connection.

Restrictions in use

The system requires certain conditions in order to operate.

The Seapath function is based on GNSS signals and requires free sight to the sky. A minimum of four visible satellites. A position dilution of precision (PDOP) value less than six. Otherwise normal conditions.

MRU/miniMRU

It is designed for use on-board marine surface operated vehicles with a linear acceleration less than ±40 m/s^2 (±4g). And an angular rate range less than ±75°/s.

MGC

It is designed for use on-board marine surface operated vehicles with a linear acceleration less than ±45 m/s^2 (±4g). And an angular rate range less than ±125 °/s.

Specifications are valid without multipath, without shadowing of antenna and with vessel in motion.

The Seapath product is intended for use in maritime survey and navigation applications.

Using Seapath as NTP server

The Seapath can be used as an NTP (Network Time Protocol) server for clock synchronization of connected computer systems.

An accuracy better than one millisecond can be achieved in local area networks under ideal conditions.

In order to use the Seapath as the NTP server, the NTP clients have to be configured with the Seapath IP address as the server. How this is done depends on the client software in use. Nothing in the Seapath has to be configured. The NTP server on the Seapath runs in standard mode with the PPS (pulse-per-second) as reference.

Network security

If the Seapath 130 product is connected to a local area network, data security is important.

Equipment manufactured by Kongsberg Discovery is often connected to a local area network (LAN). When you connect a computer to a local area network you will always expose the data on that computer. All the other computers connected to the same network may be able to access your data. Several threats are imminent:

- Remote computers can read your data.
- Remote computers can change your data.
- Remote computers can change the behavior of your computer, for example by installing unwanted software.

Usually, two parameters are used to define the threat level:

1. The likelihood that any remote computer will do any of the above.
2. The damage inflicted if a remote computer succeeds doing any of the above.

Kongsberg Discovery has no information about your complete system installation. Products provided by Kongsberg Discovery are always regarded as stand-alone offline systems. They are regarded as stand-alone even though they may be connected to a local area network for sensor interfaces or data distribution.

Note:

No network safety applications are installed on Kongsberg Discovery computers. The computer is not protected against viruses, malware or unauthorized access by external users.

Securing the Seapath 130 system has no meaning unless you have established a policy that secures all the computers on the network. This policy must include physical access by trained and trusted users. The customer or end user of the Seapath 130 system is responsible for defining and implementing a security policy and providing the relevant network security applications.

Note:

Kongsberg Discovery will not accept any responsibility for errors or damages caused by unauthorized use of or access to the Seapath 130 system.

Support information

If you need technical support for your product you must contact a Kongsberg Discovery office. A list of all our offices is available on our website.

- **Company name**: Kongsberg Discovery AS
- **Address**: Havnegata 9, N-7010 Trondheim, Norway
- **Telephone**: +47 33 03 41 00
- **Telephone, global 24h support**:

  Europe, the Middle East and Africa: +47 33 03 24 07

  Asia Pacific: +65 97 11 24 07

  Americas: +15 04 303 5244
- **E-mail address**: support.seatex@kd.kongsberg.com
- **Website**: http://www.kongsberg.com/discovery

KM-Support App

Kongsberg Discovery support is also available in the KM-Support App. Our support application is available for free in the App Store and Google Play.

Preparing the installation

Topics

Necessary tools and equipment

We assume that you are equipped with a standard set of tools. This tool set must comprise the normal tools for electronic and electromechanical tasks. This includes different screwdriver types, pliers, spanners, a cable stripper, etc. Each tool must be provided in different sizes. We recommend that all tools are demagnetized to protect your equipment.

Unless otherwise stated, all mounting hardware (such as bolts, nuts, washers, screws etc.) referred to in this document is to be supplied by the customer or the shipyard.

Survey equipment

Survey equipment should be made available to determine the Inertial Measurement Unit (IMU) mounting angles in roll, pitch and yaw and the distance vectors from the Origin to the Sensor Unit, the IMU and the monitoring points.

External computer

An external computer is required for the installation of the Seapath operator software. The minimum requirement for the computer is Windows 10 or newer, 2 GHz CPU, 2 GB RAM and 1024 x 768 screen resolution.

Inertial Measurement Unit transportation box

The unit is shipped in a specially designed transportation box. Keep the unit stored within the box until everything is ready for installation of the unit.

Note:

After the unit has been installed, please keep the transportation box. The unit must be shipped in this box for maintenance or repair in order to maintain the warranty.

Drawings

General arrangement drawings of the vessel should be acquired to simplify determination of offsets between the Sensor Unit, the Inertial Measurement Units, the Navigation Reference Point (NRP) and the different monitoring points. The Inertial Measurement Units are the Motion Sensor and Gyro Compass (MGC) or the Motion Reference Unit (MRU).

Locations for the various parts of the system must be decided.

Radio frequency authorisation

Make sure that the data link between the reference station and the mobile Seapath system is assigned to operate on the radio frequencies that will be used in the survey area.

An assigned approval from the local authorities is required before use.

Personnel qualifications

The installation of the Seapath 130 is a demanding task. Installation tasks must only be done by fully trained personnel.

As a minimum, the following certified personnel must be available:

- Electricians
- Mechanical workers

Location of hardware units

Topics

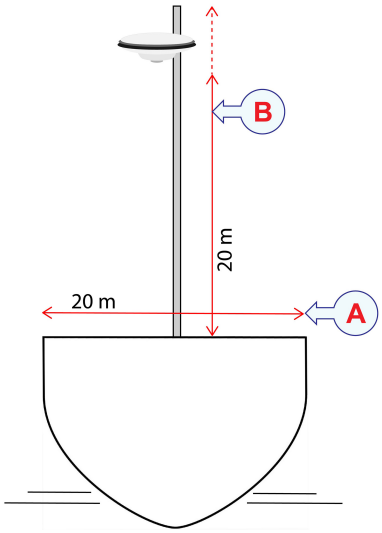
Sensor Unit location

Before mounting the unit, select a location for best possible performance.

Consider these factors when installing the unit.

- The unit should have an unobstructed line-of-sight to the sky.
- Mount the unit in a location protected from direct illumination of radar beams and other transmitting antennas.For example Inmarsat antennas.

  Seapath is more sensitive to blocking and reflections (multipath) of GNSS signals than GNSS sensors which only use pseudo-range data. This is because Seapath also uses carrier phase measurements for heading determination, and both the internal GNSS antennas need to see at least four common satellites at the same time.
- Mount the unit in such a way that blocking of the GNSS signal is avoided.
- In order to reduce problems due to multipath effects, the unit has to be mounted above the nearest deck at a height witch is equal to the width of this deck, or higher.



A. *Width of deck*

B. *Height of antenna must be equal to width of deck or higher*

- Mount the unit in such a way that the torsion movement relative to the vessel's hull is kept at an absolute minimum.

Related tasks

Mounting the Sensor Unit, page 32

Related references

Sensor Unit dimensions, page 156

Inertial Measurement Unit (IMU) location

Correct location of the unit is important for the system performance. Consider these factors when installing the unit.

- When the unit is mounted in a subsea bottle, it is recommended to mount the bottle close to the user equipment of which the unit is supposed to measure the motion.

  This is to avoid errors in alignment with the user equipment.

Be aware of vibrations - MGC

The unit has some sensitivity to vibrations. Direct mounting onto the main hull structure is preferable.

Avoid mounting the unit close to hydraulic pumps and valves where there is high-frequency vibrations. The unit has some sensitivity to vibrations around sequences of 100 Hz (100, 200, 300 Hz and so on). Such vibrations should not exceed 0.5 m/s^2 in any direction.

Be aware of vibrations - MRU

The unit has some sensitivity to vibrations. Direct mounting onto the main hull structure is preferable.

Avoid mounting the unit on a pole that vibrates at high frequencies when the vessel speed increases. The unit has some sensitivity to vibrations around sequences of 100 Hz (100, 200, 300 Hz and so on). Such vibrations should not exceed 0.5 m/s^2 in any direction.

The unit's function may be disturbed if strong vibrations around 14 kHz is present.

Be aware of vibrations - miniMRU

The unit has some sensitivity to vibrations. Direct mounting onto the main hull structure is preferable.

Avoid mounting the unit close to hydraulic pumps and valves where there is high-frequency vibrations. The unit has some sensitivity to vibrations around sequences of 100 Hz (100, 200, 300 Hz and so on). Such vibrations should not exceed 0.5 m/s^2 in any direction.

The unit's function may be disturbed if strong vibrations around 14 kHz is present.

Be aware of resonance - MGC

The unit is sensitive to resonance. Direct mounting to a solid and stable structure is preferable. For example the steel deck.

Care must be taken when mounting the unit to the vessel's hull in order to avoid self-resonance which in turn can amplify the dithering frequencies of the gyroscopes. Frequencies of around 600 Hz. A properly mounted unit will typically emit 58 - 64 dBA (1 metre) and improperly mounted the sound pressure level may increase to 85 dBA.

Related tasks

Mounting the MRU subsea bottle, page 34
Mounting the MGC subsea bottle, page 36
Mounting the miniMRU subsea housing, page 38
Mounting miniMRU in subsea housing, page 39

Related references

MRU subsea bottle SB12 dimensions, page 157
miniMRU subsea housing SH1 dimensions, page 160
MGC subsea bottle SB50 dimensions, page 158

Installation

Topics

Terminating the cable inside the Sensor Unit

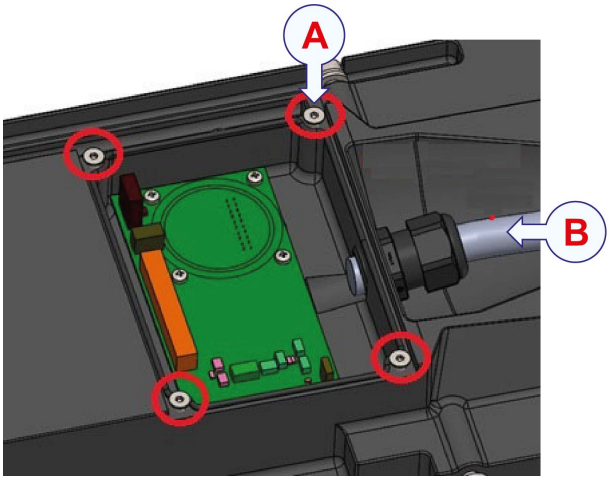
The Sensor Unit cable inside the unit must be terminated before the unit is mounted on the mast or pole.

Context

Normally the unit is delivered with this cable pre-terminated.

Procedure

1. Open the connector board cover at the bottom of the sensor unit by unscrewing the four screws marked with a red circle on the illustration.



A. *Connector board cover screws*

B. *Sensor unit cable*

2. Run the sensor unit cable through the gland and terminate the cable wires on the connector board according to the cable wiring table.

Pin	Signal	Pair	Wire colour		Pin	Signal	Pair	Wire colour
16	PWR+	1	White		10	1PPS TX-B	8	Red
1	PWR-	1	Blue		25	1PPS TX-A	8	Green
17	ETH RXD-	2	Green		9	1PPS GND	9	Red
2	ETH RXD+	2	White		26	Echo GND	9	Grey
18	ETH TXD-	3	Orange		11	Echo TX TX-B	10	Red
3	ETH TXD+	3	White		27	Echo RTS TX-A	10	Brown
19	GNSS CTS RX-A	4	White		12	MRU RX-A	11	Black
4	GNSS RX RX-B	4	Brown		29	MRU RX-B	11	Orange
20	GNSS RTS TX-A	5	White		14	MRU TX-A	12	Black
5	GNSS TX TX-B	5	Grey		28	MRU TX-B	12	Blue

Pin	Signal	Pair	Wire colour		Pin	Signal	Pair	Wire colour
21	GNSS GND	6	Red		13	MRU GND	13	Black
23	Survey GND	6	Blue		30	MRU 1PPS N TX-A	13	Green
8	Survey TX TX-B	7	Red			Not used	14	Black
24	Survey RTS TX-A	7	Orange			Not used	14	Brown

3. Fasten the cable gland to the Sensor Unit chassis.
4. Remount the connector board cover.

Related tasks

Mounting the Sensor Unit, page 32

Mounting the Sensor Unit

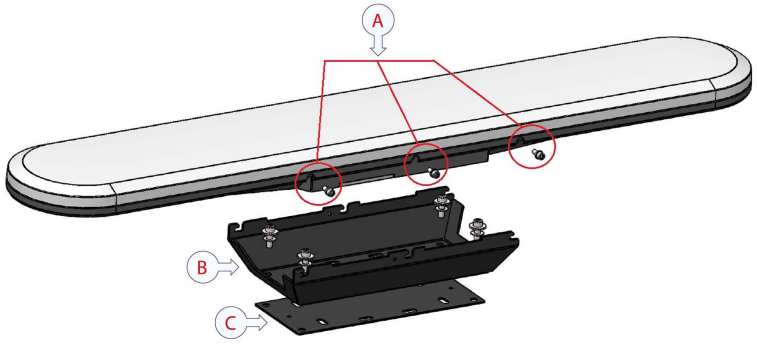
The unit is designed to be mounted horizontally on a mast or pole.

Prerequisites

You have prepared a mounting arrangement for the Sensor Unit mounting bracket.

Procedure

1. Make a holder for the mounting bracket and fasten the holder properly to a mast or pole.
2. Separate the unit from the mounting bracket by unscrewing the three screws on each side.



A. *Mounting bracket screws*

B. *Mounting bracket*

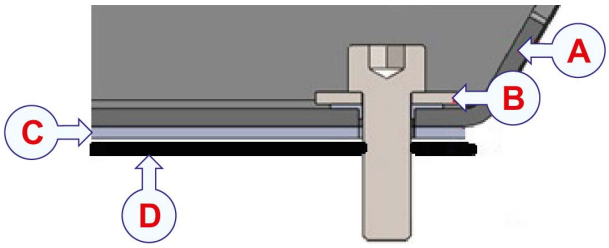
C. *Plastic insulation plate*

3. Bring the Sensor Unit with its cable and mounting bracket as close as possible to the location of the holder.

   The normal orientation of the unit is along ship with the heading reference point number 1 pointing aft. It may, however, be mounted in any orientation provided it is approximately horizontal.

4. Place the supplied insulation plate between the mounting bracket and the holder.

5. Make sure that the four bushings are placed in the mounting holes before you enter the screws.



A. *Mounting bracket*

B. *Plastic bushing*

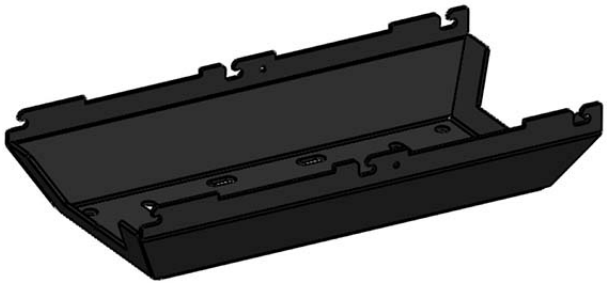
C. *Plastic insulation plate*

D. *Holder*

   The bushings are inserted to make sure that there is galvanic isolation of the Sensor Unit from the mast and to prevent corrosion.

6. Secure the nuts with washers or by using self-locking nuts.

7. Place the mounting bracket in the preferred direction on the holder.



8. Lift the Sensor Unit on top of the mounting bracket.

9. Re-insert the three screws on each side of the mounting bracket and fasten them to the Sensor Unit.

10. Connect the cable from the Sensor Unit to the spider cable.

The two cable connectors

The two cables connected

Related concepts

Sensor Unit location, page 27
Cable plan, page 43

Related tasks

Terminating the cable inside the Sensor Unit, page 30
Cabling for the Seapath 130 system, page 45

Related references

Sensor Unit dimensions, page 156

Mounting the MRU subsea bottle

The Motion Reference Unit (MRU) is delivered mounted in a subsea bottle. The bottle is to be mounted to the vessel or above the transducer head.

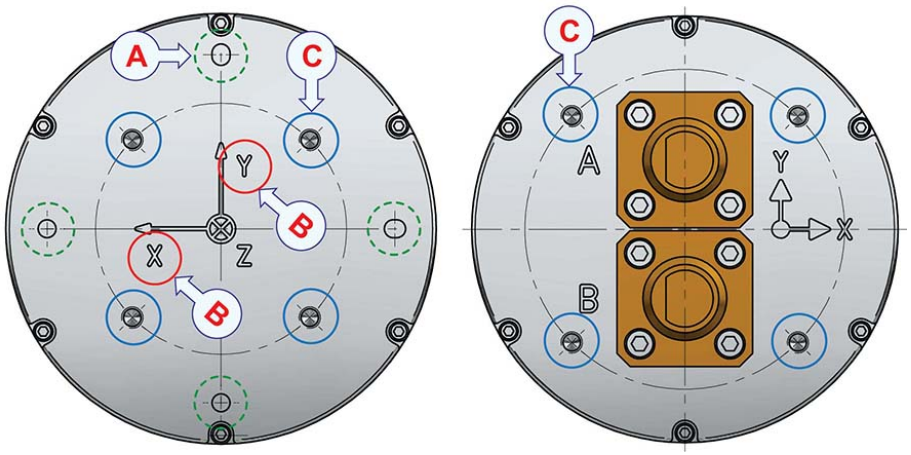
Prerequisites

You have prepared a mounting arrangement for the subsea bottle.

Provide 8 M6 screws of stainless steel for fastening the bottle lids.

Context

It is recommended to make holes for dowel pins for the subsea bottle index lid on the mounting arrangement. Using dowel pins will make it easier to place the subsea bottle in the correct position if it has been moved.



A. *Holes for dowel pins on index lid. Hole max. 7.5 mm, pin Ø 5. 4 in total*

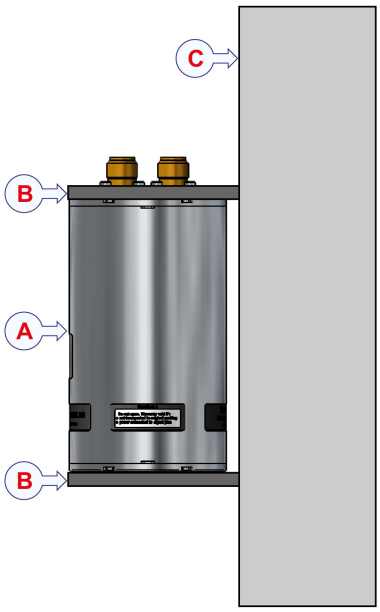
B. *X and Y indications on index lid*

C. *Lid fastening hole for M6 screw, 8 in total*

Procedure

1. Find the location on the vessel where you want to mount the subsea bottle. For example pole or transducer head.
2. If the orientation of the bottle can be freely selected, select an orientation with the x arrow pointing in the bow direction.

   The index lid has indications for dowel pins and x and y arrow.
3. When the mounting location has been identified, prepare fastening plates for the subsea bottle connector lid and index lid screws.



A. *Subsea bottle*

B. *Fastening plate (provided by customer)*

C. *Mounting structure*

4. Fasten the index and connector lids to the fastening plates with M6 screws. Four M6 screws for each lid.
5. Connect the MRU cable to connector A on the lid.
6. Connect the provided dummy female connector to connector B on the lid. This is not used in this product.
7. Fasten the MRU cable with cable ties to the structure.

   This is to avoid that the cable vibrates due to vessel movements.

Related concepts

Inertial Measurement Unit (IMU) location, page 28
Cable plan, page 43

Related tasks

Cabling for the Seapath 130 system, page 45

Related references

MRU subsea bottle SB12 dimensions, page 157

Mounting the MGC subsea bottle

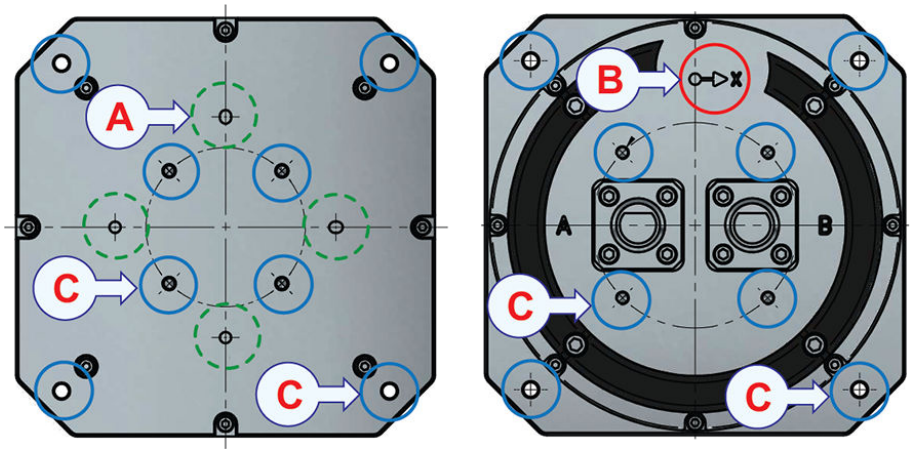
The Motion Sensor and Gyro Compass (MGC) is delivered mounted in a subsea bottle. The bottle is to be mounted to the vessel or above the transducer head.

Prerequisites

You have prepared a mounting arrangement for the subsea bottle.

Provide 8 M6 screws of stainless steel for fastening the bottle lids.

Context



A. *Holes for dowel pins on bottom plate. Hole max. 7.5 mm, pin Ø 5. 4 in total*

B. *X indication on connector lid*

C. *Bottom plate and connector lid fastening hole for M6 screw, 8 in total*

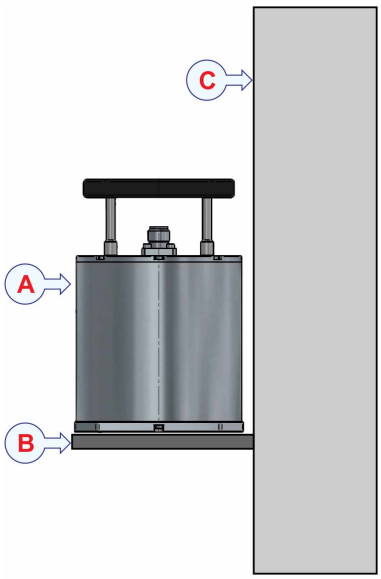
Procedure

1. Find the location on the vessel where you want to mount the subsea bottle. For example pole or transducer head.
2. If the orientation of the bottle can be freely selected, select an orientation with the x arrow pointing in the bow direction.

   The bottom plate has dowel pin holes, four outer mounting holes and four inner mounting holes which are equal to the ones on the MRU subsea bottle.

   The connector lid has an x arrow indication.

3. When the mounting location has been identified, prepare fastening plate for the subsea bottle bottom plate screws.



A. *Subsea bottle*

B. *Fastening plate (provided by customer)*

C. *Mounting structure*

4. Fasten the bottom plate to the fastening plate with four M6 screws.
5. Connect the MGC cable to connector A on the lid.
6. Connect the provided dummy female connector to connector B on the lid. This is not used in this product.
7. Fasten the MGC cable with cable ties to the structure.
   This is to avoid that the cable vibrates due to vessel movements.

Related concepts

Inertial Measurement Unit (IMU) location, page 28
Cable plan, page 43

Related tasks

Cabling for the Seapath 130 system, page 45

Related references

MGC subsea bottle SB50 dimensions, page 158

Mounting the miniMRU subsea housing

The miniMRU is delivered mounted in a subsea housing with serial communication. The housing is to be mounted to the vessel or above the transducer head.

Prerequisites

You have prepared a mounting arrangement for the subsea housing.

Context

The miniMRU subsea housing has part no. miniMRU-M-SH1_S (TC 110-0067934).

It is recommended to make holes and insert dowel pins for the subsea bottle index lid on the mounting arrangement. Using dowel pins will make it easier to place the subsea bottle in the correct position if it has been moved.

Procedure

1. Find the location on the vessel where you want to mount the subsea housing. For example pole or transducer head.
2. If the orientation of the housing can be freely selected, mount the unit with the x arrow and alignment surface parallel with the longitudinal axis of the system which is to be motion compensated.
3. When the mounting location has been found, make three M6 fastening holes for the subsea bottle.
4. Fasten the subsea housing to the mounting arrangement with three M6 screws.
5. Connect the MRU/miniMRU cable to subsea housing connector.
6. Fasten the MRU/miniMRU cable with cable ties to the structure.

   The use of cable ties is to avoid that the cable vibrates due to vessel movements.

Related concepts

Inertial Measurement Unit (IMU) location, page 28
Cable plan, page 43

Related tasks

Cabling for the Seapath 130 system, page 45

Related references

miniMRU subsea housing SH1 dimensions, page 160

Mounting miniMRU in subsea housing

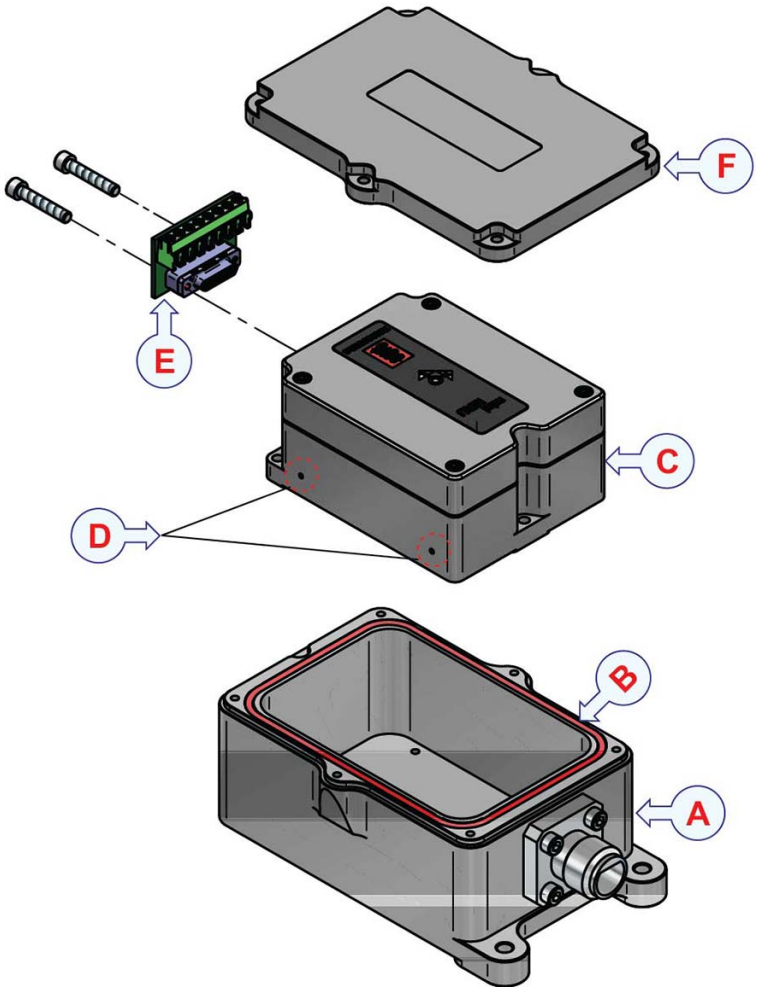
The miniMRU is usually delivered mounted in a subsea housing. The housing is to be mounted to the vessel or the transducer head. If the unit is not pre-mounted you must mount the unit in the subsea housing.

Prerequisites

Make that the subsea housing is of the version with serial communication (part no. miniMRU-M-SH1_S (TC 110-0067934). The subsea housing can also be delivered with Ethernet communication but that is not described in this manual.

Context

This procedure describes how to mount the miniMRU in an empty subsea housing.



A. *Subsea housing*

B. *O-ring*

C. *miniMRU*

D. *Alignment wall inside miniMRU*

E. *Connector board*

F. *Lid*

Procedure

1. Place the subsea housing on a stable surface.

2. Remove the lid from the subsea housing by unscrewing the six M4 screws which hold the lid.
3. Connect the connector board inside the housing to the connector on the miniMRU.
4. Enter the two UNC screws through the connector board and into the miniMRU connector in order to fasten the connector to the miniMRU housing.
5. Tighten the UNC screws.
6. Place the miniMRU into the housing with the cable wires from the Seacon connector above the minuMRU top lid and with the miniMRU connector pointing in the opposite direction as the Seacon connector on the housing.
7. Press the miniMRU against the alignment wall of the housing while fastening the three M4 screws which hold the miniMRU to the housing.
8. Tighten the M4 screws.
9. Make sure that the o-ring on the housing is clean and correctly fit in the o-ring track.
10. Replace the housing lid and re-fasten the screws.

    Use thread lock CRC 6-66 marine spray or similar on the lid screws.

Related concepts

Inertial Measurement Unit (IMU) location, page 28

Related references

miniMRU subsea housing SH1 dimensions, page 160

Subsea bottle connectors and pin configuration

The MRU and MGC bottle includes two 8-pin Seacon connectors. The part number for the Seacon connector is 5506-1508, male. A Seacon pigtail for your own application can be delivered as an option - part no. MRU-E-PT8.

Connector A: Default pin configuration for Seapath	
Pin	**Signal (Seapath compatible)**
1	POWER -
2	POWER +
3	COM1_IN_A-
4	COM1_IN_B+

Connector A: Default pin configuration for Seapath	
Pin	**Signal (Seapath compatible)**
5	COM1_OUT_B+
6	COM1_OUT_A-
7	CGND (Ground ref. for XIN)
8	XIN (Seapath 1PPS)

Connector B: Default pin configuration, Ethernet communication	
Pin	**Signal (Ethernet communication)**
1	POWER -
2	POWER +
3	RD- (RJ_6)
4	RD+ (RJ_3)
5	TD- (RJ_2)
6	TD+ (RJ_1)
7	GGND
8	ALERT

Installing the Seapath operator software

This software is used to set the configuration parameters for the Sensor Unit and to operate the Seapath system.

Prerequisites

A local computer with Windows is required.

Context

A USB flash drive with the software is provided with the delivery.

Procedure

1. Insert the USB flash drive with the software into a USB port on the local computer.
2. Open the removable disk drive to which the USB flash drive is connected.
3. Locate and run the installation file `SeapathHmiInstaller.exe`.

4. Follow the instructions on the screen in order to complete the installation of the **Seapath Operator** program.
5. When you reach the last step, deselect the **Run the application** check box if you do not want to start the operator software immediately after installation.
6. Remove the USB flash drive from the local computer when the installation is finished.

Related concepts

About Portable Hydrographic System (PHS) installation, page 76

Related tasks

Verifying that the Seapath 130 system is ready for operational use, page 151

Uninstalling the Seapath operator software

When you no longer need the Seapath operator software you can remove it from your computer.

Procedure

1. Open the Control Panel on your computer.
2. Select the dialog box where you remove programs.
3. Locate the **Seapath series** program in the list.
4. Select **Uninstall** to remove the program and follow the instructions on the screen.

Related concepts

About Portable Hydrographic System (PHS) installation, page 76

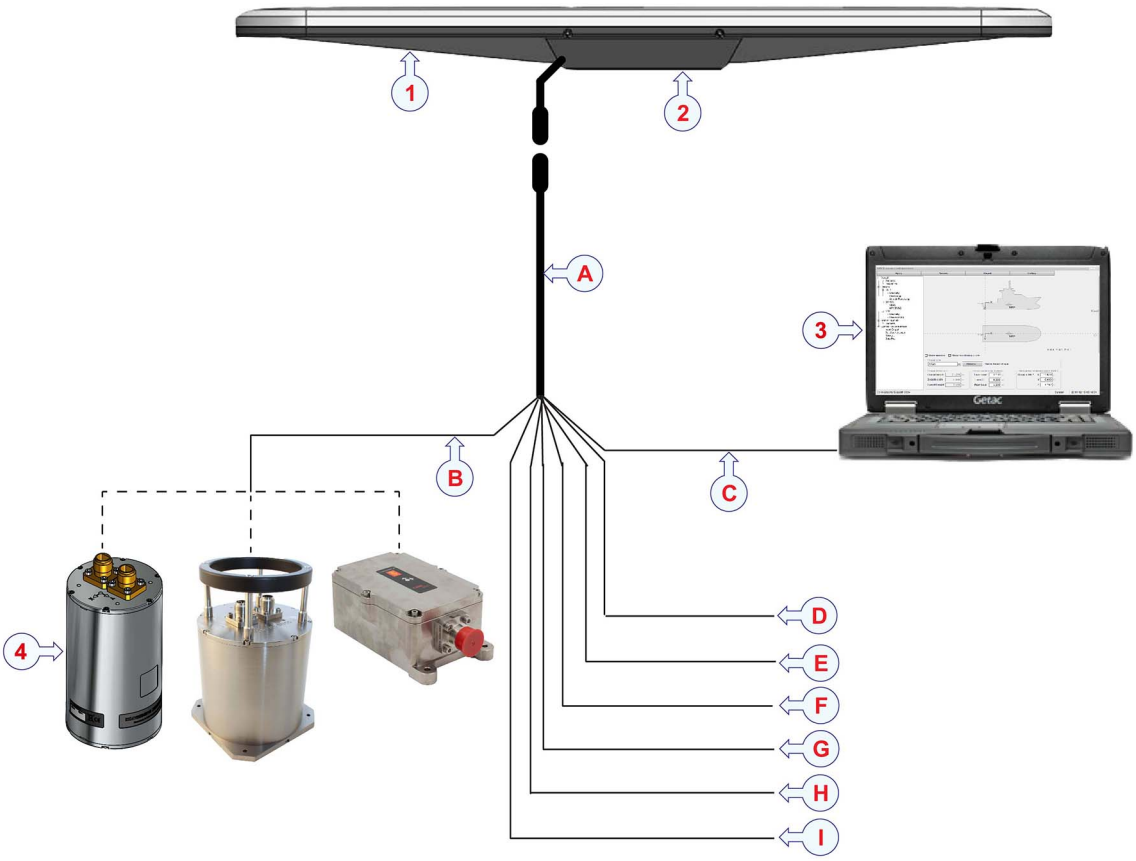
Cable layout and interconnections

Topics

Cable plan

The Sensor Unit is connected to all components through the spider cable. There is IMU connection, three configurable serial lines, DGNSS (Differential GNSS) correction input, 1PPS output, network communication and power inlet.

The Inertial Measurement Unit (IMU) connected to the Sensor Unit can either be a Motion Sensor and Gyro Compass (MGC), a Motion Reference Unit (MRU) or a miniMRU.



Cables

A. *Cable to Sensor Unit, part of spider cable, 20 metres length, female connector*

B. *IMU umbilical cable with 8-pin SeaCon connector, 15 metres length*

C. *Ethernet cable to external computer and other users, 5 metres length*

D. *Input serial line cable for DGNSS corrections, 9-pin DSub connector, 5 metres*

E. *Output serial line to DGNSS receiver, 9-pin DSub connector, 5 metres length*

F. *Output serial line for motion data to multibeam or survey computer, 9-pin DSub connector, 5 metres length*

G. *Output serial line for NMEA data , 9-pin DSub connector, 5 metres length*

H. *1PPS output, 9-pin DSub connector, 5 metres length*

I. *24 VDC input, 5 metres length*

Note:

Input/output serial line for DGNSS corrections is the same cable.

Related tasks

Mounting the Sensor Unit, page 32
Mounting the MRU subsea bottle, page 34
Mounting the MGC subsea bottle, page 36
Mounting the miniMRU subsea housing, page 38

Cabling for the Seapath 130 system

The Seapath system relies on communication between each system unit and between the Seapath system and external devices.

Prerequisites

Make sure that you have the cable types recommended for the installation.

Context

It is very important that all cables are correctly installed, that the proper cable types have been used, and that all cables are connected correctly.

Procedure

1. Connect the cable from the Sensor Unit to the spider cable.
2. Connect the umbilical cable to the Inertial Measurement Unit (IMU).
3. Connect the Ethernet cable to the external computer with the Seapath operator software.
4. Connect the cable with DGNSS RTK corrections to the Sensor Unit cable.
5. Connect the Sensor Unit cable with output data to the survey computer.
6. Connect the Sensor Unit cable with 1PPS output to the Echo sounder.
7. Connect 24 VDC power to the Sensor Unit cable.

Related tasks

Mounting the Sensor Unit, page 32
Mounting the MRU subsea bottle, page 34
Mounting the MGC subsea bottle, page 36
Mounting the miniMRU subsea housing, page 38

Pin layout for connectors

The pin layout for the different connectors is illustrated in the tables.

Ethernet		
Pin	**Connector**	**Cable type/length**
1	Modular 8P8C	CAT 5e STP or better 5 metres
2		
3		
6		

Input/output serial line - DGNSS corrections			
Pin	**Signal**	**Connector**	**Cable type/length**
2	Rx B	Female 9-pin D-sub	Shielded 5 metres
8	Rx A		
5	GND		
3	Tx B		
7	Tx A		

Output serial line for motion data - Multibeam or survey computer			
Pin	**Signal**	**Connector**	**Cable type/length**
2	Rx B	Female 9-pin D-sub	Shielded 5 metres
8	Rx A		
5	GND		

Output serial line NMEA data - Echo sounder			
Pin	**Signal**	**Connector**	**Cable type/length**
2	Rx B	Female 9-pin D-sub	Shielded 4.5 + 0.5 metres
8	Rx A		
5	GND		

PPS pulse - 1PPS output			
Pin	**Signal**	**Connector**	**Cable type/length**
2	1PPS Rx B	Male 9-pin D-sub	Shielded 4.5 + 0.5 metres
8	1 PPS Rx A		
5	GND		

24 VDC power				
Pin	**Signal**	**Colour**		**Cable type/ length**
+	24 VDC	Brown	Ferrules on wires	Shielded 5 metres
-	0 VDC	White		
+	24 VDC	Green		
-	0 VDC	Yellow		

IMU - Umbilical cable with Seacon connector			
Pin	**Signal**	**Connector**	**Cable type/length**
1	0 VDC	Seacon 5501-1508	Umbilical cable, 4 x 2 x 0.75 mm^2 15 metres
2	24 VDC		
5	Tx B		
6	Tx A		
4	Rx B		
3	Rx A		
8	XIN		
7	LGND		

Serial lines

The serial lines can be configured in the Seapath operator software for RS-232 or RS-422 communication.

The signals between the two are shared as follows:

- RTS shares pin with Tx A
- Tx shares pin with Tx B
- CTS shares pin with Rx A

- Rx shares pin with Rx B

Ethernet connections

The system has the possibility to input and output data on individually configurable network ports.

The format and update rate are configured for each port in the **NAV Engine Configuration** > **Network**. The network ports have 10/100 Mbps capacity. For direct connection to a computer you might need a crossover cable instead of a straight-through cable.

The pin wiring for the different cable configurations is according to the table.

Straight-through			**Crossover**			
Signal	**Pin no.**		**Signal**	**Pin no.**	**Pin no.**	**Signal**
Tx+	1		Tx+	1	3	Rx+
Tx-	2		Tx-	2	6	Rx-
Rx+	3		Rx+	3	1	Tx+
Rx-	6		Rx-	6	2	Tx-

Communication interfaces

The Seapath system communicates with external equipment through input and output serial lines.

The table shows all available input/output ports available in the system. Only the DGNSS, ECHO, SURVEY and LAN1 are user configurable.

I/O properties	**Type**	**Connected to**
GNSS1	Serial, GNSS receiver no. 1	Internal GNSS antenna no. 1
GNSS2	Serial, GNSS receiver no. 2	Internal GNSS antenna no. 2
IMU	Bi-directional, RS-422	IMU (MGC, MRU, miniMRU)
DGNSS	Bi-directional, RS-232/422	GNSS corrections, user configurable

I/O properties	Type	Connected to
ECHO	Serial output, RS-232/422	Echo sounder, user configurable
SURVEY	Serial output, RS-232/422	Survey computer, user configurable
1PPS	Serial output, RS-422	External equipment
LAN1	Ethernet port, 10/100 Mbit/s	User configurable

PPS signal output

A 1 pulse-per-second (1PPS) signal synchronized with GNSS time is available from the 9-pin D-sub connector marked **PPS output** on the spider cable.

The output has galvanic separation. This RS-422 1PPS signal originates from the GNSS receiver within the Sensor Unit. The 1PPS signal is buffered and fed to the D-sub at 120 Ohm. The 1PPS signal has a pulse width of 10 ms. The 1PPS is generated exactly once every second with its rising edge synchronised to GPS time. Pin no. 8 (Rx A) on the 9-pin D-sub connector has a rising edge and pin no. 2 (Rx B) has a falling edge at the beginning of the pulse.

DGNSS corrections from Fugro Seastar

The system can receive DGNSS corrections from Fugro Seastar®.

A valid subscription to the Seastar® service must be activated. The Fugro Norway AS support team can be contacted via:

- Phone: +47 2150 1420
- Email: seastarservice@fugro.com

Note:

Please be aware that emails will mainly be read during the European business hours. If the request is urgent, please call the 24/7 duty phone.

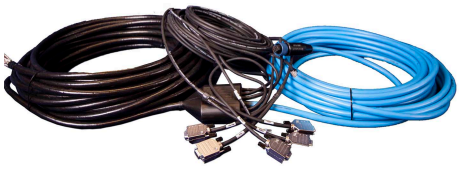
Connection diagrams for interfacing DGNSS correction signals from Fugro Seastar® receiver are illustrated.

3610 DGNSS receiver

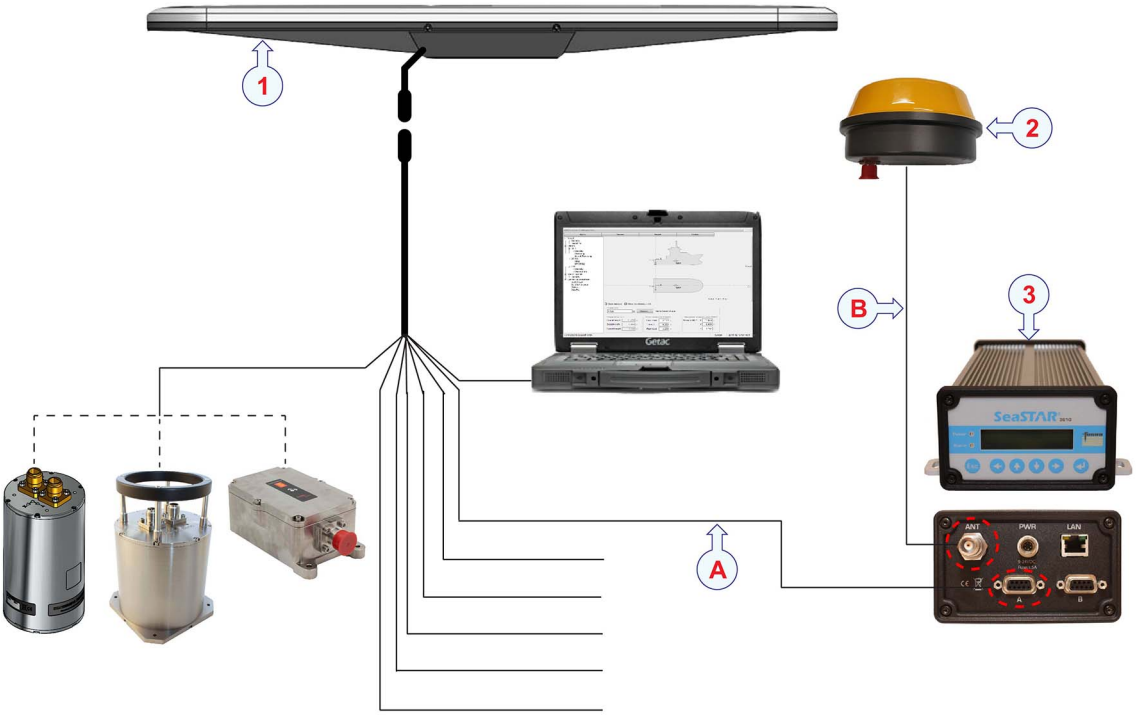
The system has two dedicated interfaces for RTK/DGNSS corrections using RS-232 or RS-422 serial communication. The Sensor Unit is connected to the Fugro Seastar® 3610 DGNSS Receiver through a spider cable.

For more detailed information on the receiver, see the *Fugro Seastar® 3610 DGNSS Receiver User Manual*.

The spider cable connection to the 3610 DGNSS Receiver is illustrated.



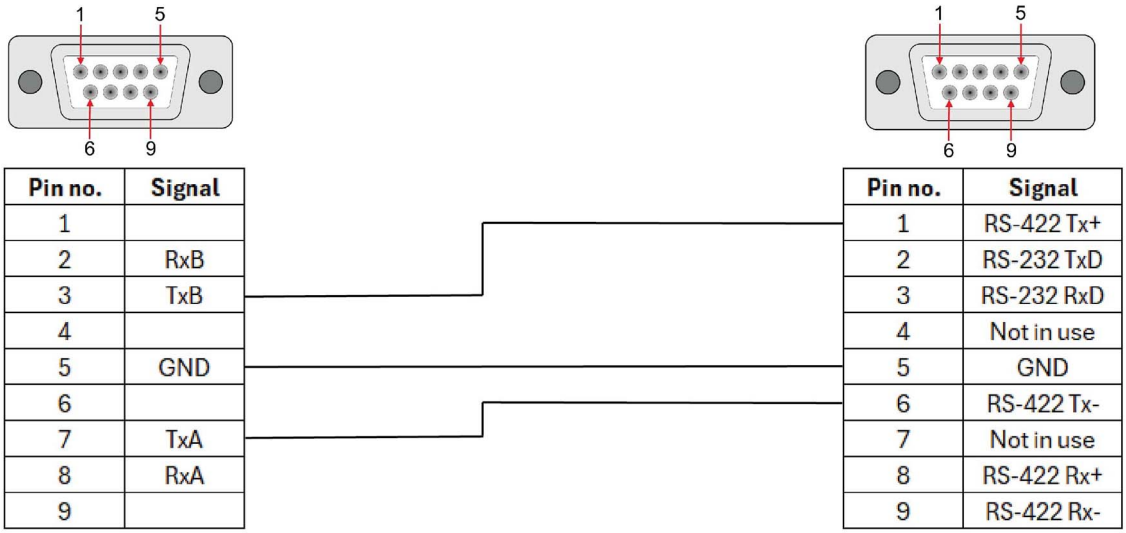
Connectors on spider cable and receiver: 9-pin D-sub, female.



Units	Cables
1. *Sensor Unit*	**A.** *DGNSS serial input/output*
2. *DGNSS antenna*	**B.** *DGNSS antenna cable*
3. *3610 DGNSS Receiver*	

Interface cable for DGNSS corrections

Connectors on interface cable: 9-pin D-sub, male. Cable type: shielded.



Pin no.	Signal
1	
2	RxB
3	TxB
4	
5	GND
6	
7	TxA
8	RxA
9	

Pin no.	Signal
1	RS-422 Tx+
2	RS-232 TxD
3	RS-232 RxD
4	Not in use
5	GND
6	RS-422 Tx-
7	Not in use
8	RS-422 Rx+
9	RS-422 Rx-

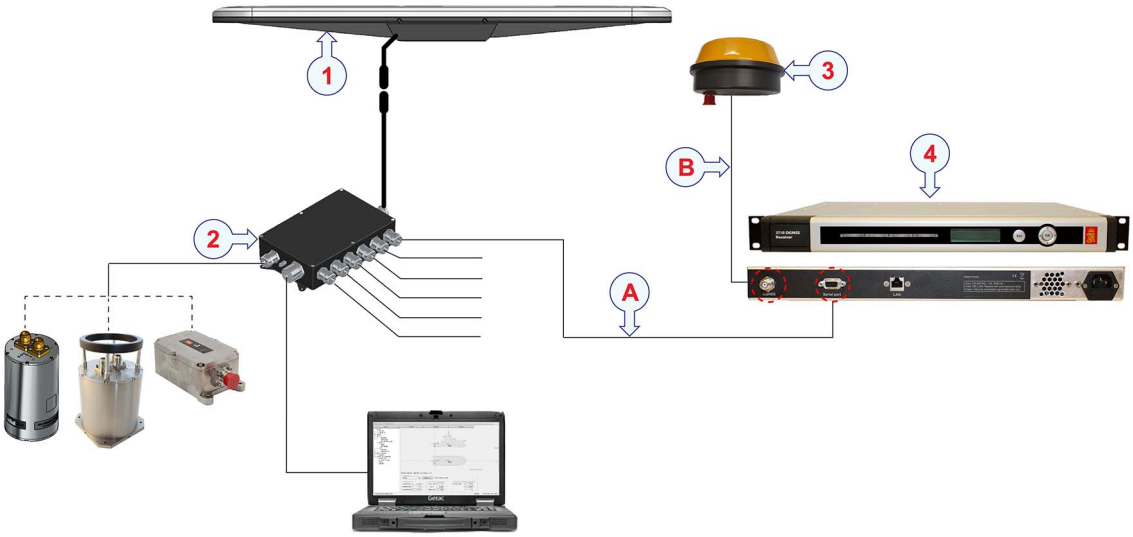
3710 DGNSS receiver

The Sensor Unit is connected to the 3710 DGNSS Receiver through a Junction Box.

The Junction Box has two dedicated interfaces for RS-232/422 serial communication for DGNSS input/output.

For more detailed information on the receiver, see the *3710 DGNSS Receiver Instruction Manual*.

Connector on receiver: 9-pin D-sub, female



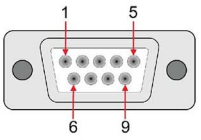
Units	Cables
1. *Sensor Unit*	**A.** *DGNSS serial input/output*
2. *Junction Box*	**B.** *DGNSS antenna cable*
3. *DGNSS antenna*	
4. *3710 DGNSS Receiver*	

Interface cable for DGNSS corrections

The cable is connected to the serial port on the receiver unit and the **GNSS IN** terminal on the Junction Box.

Connector on receiver end of cable: 9-pin D-sub, male. Cable type: shielded.

For pin layout, refer to the label inside the Junction Box.



Pin no.	Signal RS-232/RS-422		Description
1	GND	GND	Ground
2	CTS	Rx A	Input to Seapath
3	Rx	Rx B	Input to Seapath

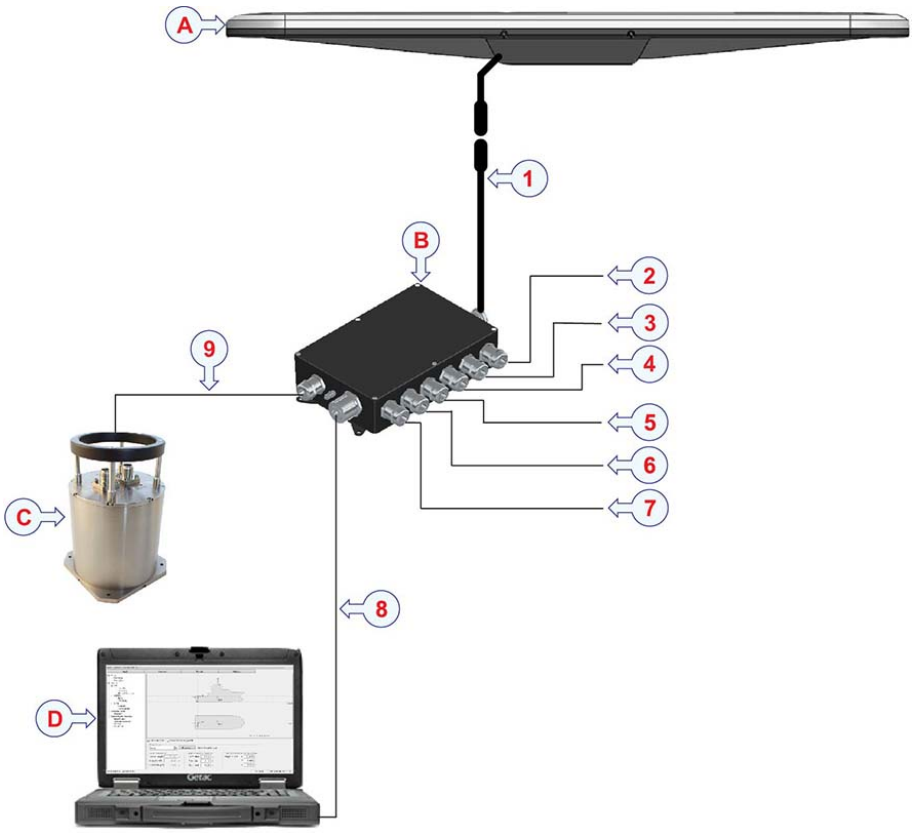
Pin no.	Signal
1	RS-422 Tx+
2	RS-232 TxD
3	RS-232 RxD
4	Not in use
5	GND
6	RS-422 Tx-
7	Not in use
8	RS-422 Rx+
9	RS-422 Rx-

Related concepts

Installation with Seapath 130 Junction Box, page 53

Installation with Seapath 130 Junction Box

For more permanent installations the system can be installed by use of the Seapath 130 Junction Box as an alternative to the spider cable.



Units	Cables
A. *Sensor Unit*	1. *Sensor Unit cable M340-21*
B. *Seapath 130 Junction Box M340-22*	2. *Input signal line for GNSS corrections*
C. *MGC in subsea bottle*	3. *Output signal line to GNSS receiver*
D. *Seapath HMI on external computer*	4. *Output serial line for motion data*
	5. *Output serial line for NMEA data*
	6. *1PPS output*
	7. *24 VDC output*

Connections within the Seapath 130 Junction Box (M340-22)

This applies to the Seapath 130 Junction Box part number: M340-22.

Connections for user side terminals P2 to P9

Note:

Plug the unused cable glands and tighten properly to make sure that they are watertight. This is to fulfil the enclosure protection specifications.

P2 - IMU		
Pin no.	**Signal (RS-422)**	**Description**
1	0 V	Power ground
2	24 V	Power +
3	Rx A	Signal sent to IMU
4	Rx B	Signal sent to IMU
5	Tx B	Signal sent from IMU
6	Tx A	Signal sent from IMU
7	LGND	Logical ground
8	XIN	1PPS input to IMU

P3 - ECHO			
Pin no.	**Signal RS-232**	**Signal RS-422**	**Description**
1	GND	GND	Ground
2	RTS	Tx A	Output from Seapath
3	Tx	Tx B	Output from Seapath

P4 - PPS		
Pin no.	**Signal (RS-422)**	**Description**
1	GND	Ground
2	Tx A	Output from Seapath
3	Tx B	Output from Seapath

P5 - SURVEY			
Pin no.	**Signal RS-232**	**Signal RS-422**	**Description**
1	GND	GND	Ground
2	RTS	Tx A	Output from Seapath
3	Tx	Tx B	Output from Seapath

P6 - GNSS OUT			
Pin no.	**Signal RS-232**	**Signal RS-422**	**Description**
1	GND	GND	Ground
2	RTS	Tx A	Output from Seapath
3	Tx	Tx B	Output from Seapath

P7 - GNSS IN			
Pin no.	**Signal RS-232**	**Signal RS-422**	**Description**
1	GND	GND	Ground
2	RTS	Rx A	Input to Seapath
3	Rx	Rx B	Input to Seapath

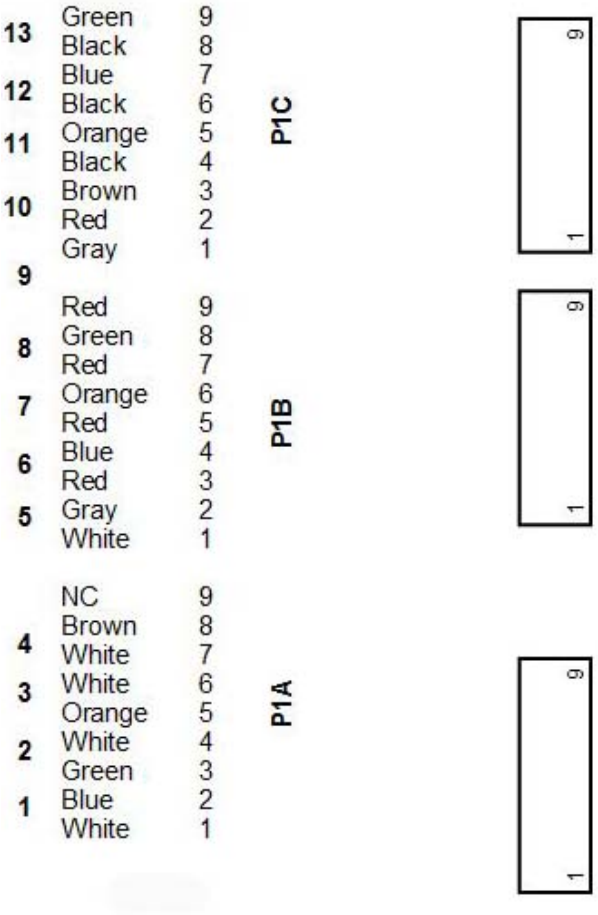
P8 - 24 Volt		
Pin no.	**Signal**	**Description**
1	0 V	Power ground
2	24 V	Power +

P9 - ETHERNET		
Pin no.	**Signal**	**Description**
1	RJ1_Tx D+	TD+, Ethernet
2	RJ2_Tx D-	TD-, Ethernet
3	RJ3_Rx D+	RD+, Ethernet
4	RJ6_Rx D-	RD-, Ethernet

Connections for the Sensor Unit cable (M340-21)

This applies to the Sensor Unit cable part number: M340-21.

Connections for user side terminal P1 of Sensor Unit cable



Cable wiring for Sensor Unit cable

Sensor Unit cable part number: M340-21.

Souriau 26-pin		Signal description	Conductor	
Signal	**Conn.**		**Pair no.**	**Colour**
PWR+	R	Power supply (+24 V)	1a	White
PWR-	B	Power supply (0V)	1b	Blue
ETH Rx D-	C	RD-, Ethernet	2a	White
ETH Rx D+	T	RD+, Ethernet	2b	Orange
ETH Tx D-	S	TD-, Ethernet	3a	White
ETH Tx D+	P	TD+, Ethernet	3b	Green

Souriau 26-pin		Signal description	Conductor	
Signal	**Conn.**		**Pair no.**	**Colour**
GNSS CTS Rx A	G	RS-422A or RS-232 input signal from GNSS receiver	4a	White
GNSS Rx Rx B	H	RS-422B or RS-232 input signal from GNSS receiver	4b	Brown
GNSS RTS Tx A	X	RS-422A/RS-232 output signal to GNSS receiver	5a	White
GNSS Tx Tx B	A	RS-422B/RS-232 output signal to GNSS receiver	5b	Grey
GNSS GND	J	GND GNSS receiver	6a	Red
Survey GND	K	GND survey computer	6b	Blue
Survey Tx Tx B	c	RS-422B+/RS-232 output signal to survey computer	7a	Red
Survey RTS Tx A	M	RS-422A-/RS-232 output signal to	7b	Orange
1PPS Tx B	E	RS-422B+ output 1PPS signal	8a	Red
1PPS Tx A	Y	RS-422A- output 1PPS signal	8b	Green
1PPS GND	a	GND for 1 PPS signal	9a	Red
Echo GND	U	GND for echo sounder	9b	Grey
Echo Tx Tx B	V	RS-422B+/RS-232 output signal to echo sounder	10a	Red
Echo RTS Tx A	L	RS-422A-/RS-232 output signal to echo sounder	10b	Brown
IMU Rx A	Z	RS-422A- input signal from IMU	11a	Black
IMU Rx B	W	RS-422B+ input signal from IMU	11b	Orange
IMU Tx A	b	RS-422A- output signal to IMU	12a	Black
IMU Tx B	F	RS-422B+ input signal from IMU	12b	Blue
IMU GND	D	GND for IMU	13a	Black
IMU 1PPS P Tx B	N	1PPS signal to IMU (XIN)	13b	Green
		Not connected	14a	Black
		Not connected	14b	Brown

Cable wiring for the MRU cable (MRU-E-SP1)

This table applies if your Inertial Measurement Unit (IMU) is a Motion Reference Unit (MRU).

This cable is used for direct connection of the MRU to the Seapath 130 Junction Box.

MRU cable part number: MRU-E-SP1.

Souriau		**Signal description**	**Wire colour**	**Junction Box terminal**
Signal	**Conn.**			
SHIELD	A	Screen connected to MRU housing	Screen	Gland
PWR+	R	Power supply (+24 V)	Red	2
PWR-	B	Power supply (0 V)	Blue	1
Com1 Out B	C	RS-422B+ output data from MRU	Green	5
Com1 Out A	T	RS-422A- output data from MRU	Yellow	6
Com1 In B	S	RS-422B+ input data to MRU	Brown	4
Com1 In A	P	RS-422A- input data to MRU	White	3
CGND/LgnD	a	Communication ground	Pink	7
XIN	U	Signal to MRU, 5 Volt or RS-232 level	Grey	8

MRU cable wiring to Seapath 130 Junction Box

This table applies if your Inertial Measurement Unit (IMU) is a Motion Reference Unit (MRU).

A cable of type 110-0060858, 90.076 or similar is used to connect the MRU signal between the Seapath 130 Junction Box (M340-22) on P2-MRU and the MRU Junction Box (MRU-E-JB3) on P2/P3 side.

M340-22 P2-MRU	Signal	Description	MRU Junction Box	MRU connector
Pin no.			Pin no.	Pin no.
1	GND (0 V)	Power ground	2 (P2 side)	B
2	24V_MRU	Power +	1 (P2 side)	R
3	Rx A	Signal sent to MRU	4 (P2 side)	T
4	Rx B	Signal sent to MRU	3 (P2 side)	C
5	Tx B	Signal sent from MRU	5 (P2 side)	S
6	Tx A	Signal sent from MRU	6 (P2 side)	P
7	LGND	Logical ground	24 (P2 side)	a
8	XIN	1PPS input to MRU	23 (P2 side)	U

Related concepts

DGNSS corrections from Fugro Seastar, page 49

Surveying sensors on vessels

Topics

About sensor survey

In order to achieve the specified accuracy of the Seapath system, the different sensor parts of the system have to be surveyed. The position and orientation (mounting angles) of each sensor shall be referred to the vessel coordinate system.

The sensors which are used in this system are:

- The Inertial Measurement Unit (IMU) in subsea bottle

  The IMU can be an MRU (Motion Reference Unit), a miniMRU or an MGC (Motion Sensor and Gyro Compass).

- The Sensor Unit (position and heading)

For information on sensor point location for the MGC, MRU and miniMRU, refer to their respective installation manuals.

Related tasks

Entering antenna location parameters, page 104
Setting MRU location and mounting angles, page 111
Setting MGC location and mounting angles, page 115
Setting miniMRU location and mounting angles, page 119

Vessel coordinate system

The vessel coordinate system is established in order to define the relative physical locations and orientations of systems and sensors. It is a Cartesian coordinate system using three axes: X, Y and Z. X is positive forwards, Y is positive toward starboard and Z is positive downwards.

The coordinate system must be well defined. It is usually established by surveying and documenting coordinates of several points on the vessel. The X axis is in the longitudinal direction of the vessel. The Y axis is in the transverse direction of the vessel. The Z axis is perpendicular to the X and Y axes.

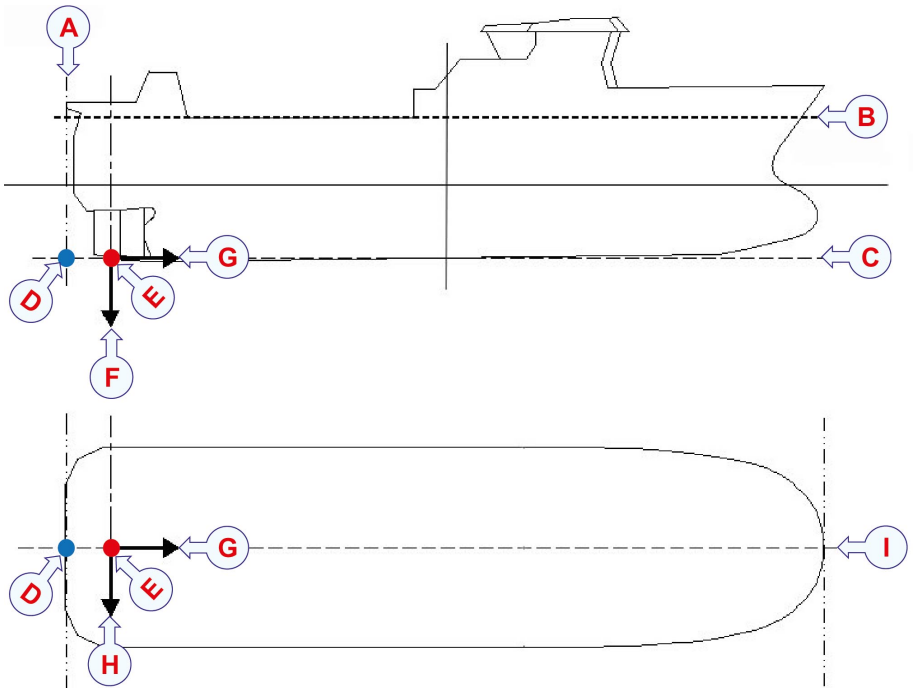
The X and Y axes constitute the reference plane on the vessel. This can be a best-fit plane on the main deck or a best-fit plane through the draught marks on the hull.

When establishing the vessel coordinate system, the origin can be freely chosen. Typical choices for origin are frame 0 at keel level, the vessel's centre of gravity (CG) or the location of the Inertial Measurement Unit. But any convenient point can be used.

In addition to the coordinate system it is useful to have an approximate X, Y and Z offset from the common reference point (CRP) to origin. The common reference point (CRP) is defined to be the intersection between stern, centre line and keel.

The chosen conventions must be made clear to all parties involved. Both to the survey personnel performing the survey and to the users of the survey results. Any deviation from the defined coordinate system should be well described in both text and drawings to avoid common misunderstandings.

The illustration shows the definition of origin on the vessel and positive X, Y and Z axes directions.



A. *Stern*

B. *Main deck*

C. *Keel*

D. *CRP (common reference point)*

E. *Origin*

F. *+Z axis*

G. *+X axis*

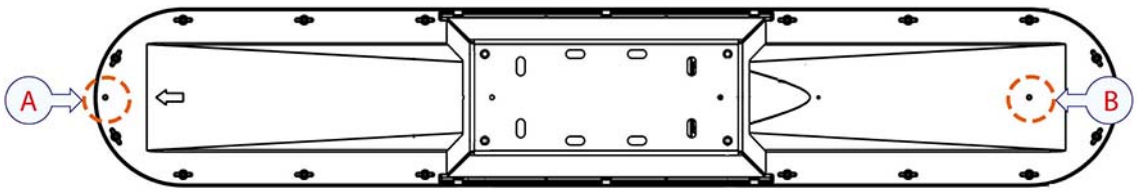
H. *+Y axis*

I. *CL (centre line)*

Determining the Sensor Unit position and orientation

The reference points on the Sensor Unit are used to determine the position and orientation of the unit on the vessel where it is mounted.

The reference points on the unit are illustrated.

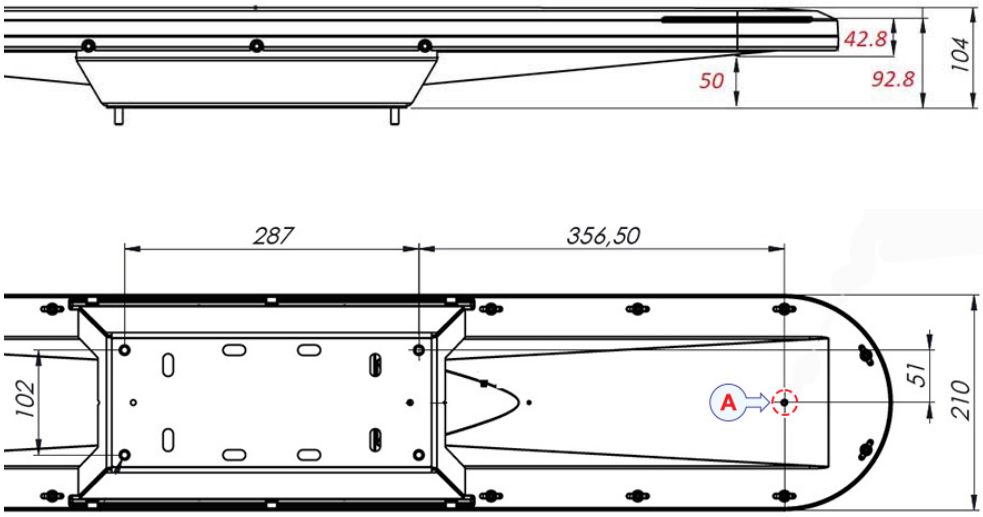


A. *Heading reference point #2*

B. *Position reference point and centre of the internal GNSS antenna no. 1 and Heading reference point #1.*

Position reference point

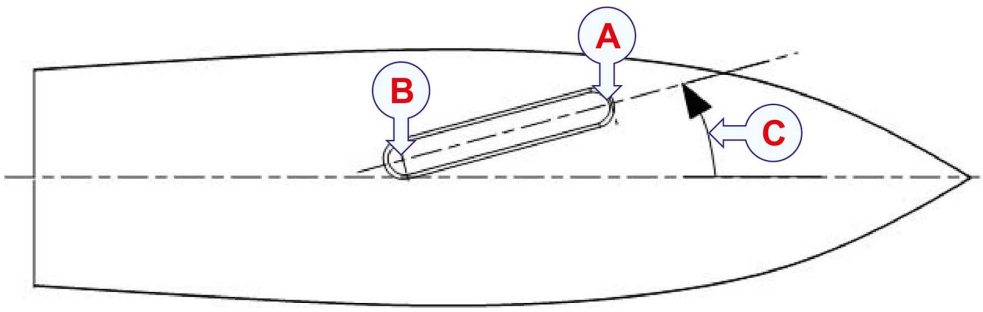
The illustrations show the location of the position reference point in the Z direction. The height of the point is 92.8 mm above the Sensor Unit holder.



A. *Position reference point (sensor point)*

Heading reference points

The location of the two heading reference points is used for determining the mounting angle, or the heading offset. The angular offset between the line from heading reference point #1 to heading reference point #2 and the vessel centre line (CL) has to be determined and entered into the **NAVEngine configuration** as the heading offset.



A. *Heading reference point #2*

B. *Heading reference point #1*

C. *Heading offset*

Related tasks

Entering antenna location parameters, page 104

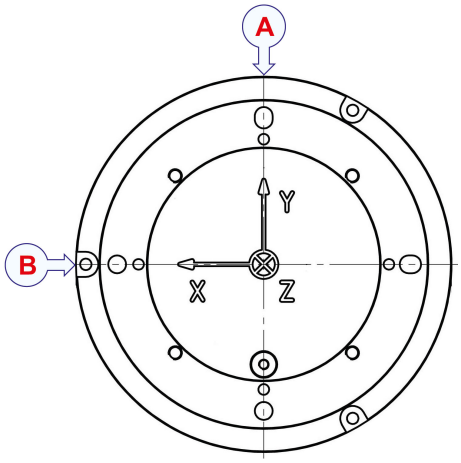
Determining the MRU mounting orientation

The default mounting position is defined with the MRU (Motion Reference Unit) connector facing downward, the x-axis pointing forward and the y-axis pointing to starboard. The directions marked on the MRU housing (x, y, z) should be aligned with the vessel axes in the following way:

- The x-axis (x arrow) points in the bow (forward) direction of the vessel
- The y-axis (y arrow) points horizontally and starboard
- The z-axis points in the downward direction

Top view of MRU with x, y and z direction

The illustration shows the mounting orientation of the x, y and z indexes at the top of the MRU according to the axes of the vessel.

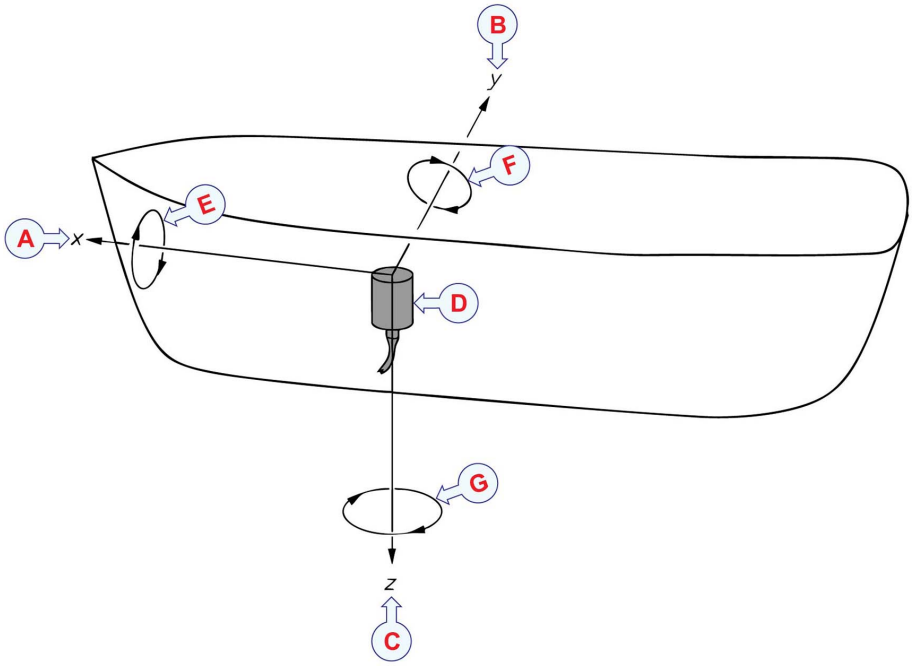


A. *To starboard*

B. *Bow direction*

Default MRU mounting position

The illustration shows the default mounting position of the MRU.



A. *x-axis*

x = Bow (forward) direction

B. *y-axis*

y = Starboard

C. *z-axis*

Ships down (not vertical)

D. *MRU location - normal mounting with connector downward*

E. *Positive roll means starboard side down*

F. *Positive pitch means bow up*

G. *Positive yaw (heading) turn starboard*

Positive (+) output signals from the MRU include:

- Positive pitch means bow up, or a clockwise rotation about the y-axis.
- Positive roll means starboard (right) side facing downward, or a clockwise rotation about the x-axis.
- Positive yaw (heading, azimuth) means a turn to starboard (right), or a clockwise rotation about the z-axis.

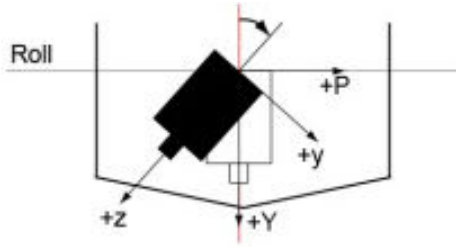
The MRU is best mounted with the logical axes in the direction described above to avoid confusion and problems with the definition of the roll, pitch and yaw output angles. However, the MRU can be mounted in any orientation relative to the above mentioned logical axes. In this case, the offset angles between the MRU axes (x, y, z) and the ship's axes (R, P, Y) are simply entered in the **NAV Engine configuration**, under **Sensors** > **MRU** > **Geometry**.

The MRU Mounting Wizard is available to assist in determining the MRU mounting angles. This mounting wizard starts with applying the main rotation which means to change the mounting angles in steps of 90-degrees for each axis. After applying the main rotation of the MRU, the subsea bottle offset angles are defined as the remaining offset angles of the MRU axes (x, y, z) relative to the ship's axes (R, P, Y). The roll and pitch bracket offset angles can be interpreted as the bottle's tilt angles relative to the ship's deck plane (horizontal plane). Be aware that these angles are not exactly the same as the MRU roll and pitch mounting angles. The MRU mounting angle wizard will convert the measured offset bottle angles into the corresponding roll, pitch and yaw mounting angles (Euler angles) which are used in the MRU.

The bottle offset angles are defined as:

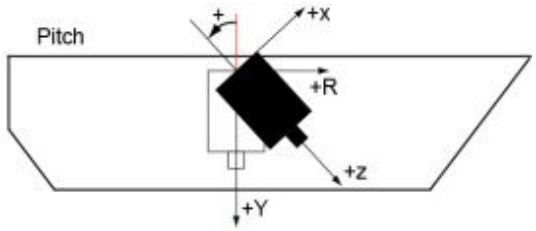
Roll offset angle

The angle between the ship's Y-axis and the projection of the MRU z- axis in the ship's PY-plane.



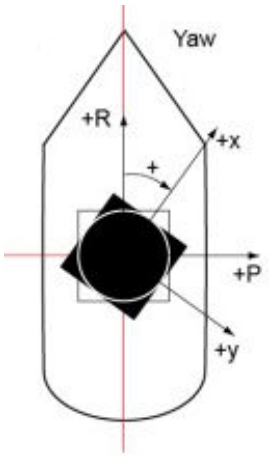
Pitch offset angle

The angle between the ship's Y-axis and the projection of the MRU z-axis in the ship's RY-plane.



Yaw offset angle

The angle between the ship's R-axis and the projection of the MRU x-axis in the ship's RP-plane.



The illustrations show the positive roll offset angle if the bottle tilts to starboard. The positive pitch offset angle if the bottle tilts to stern and the positive yaw offset angle if bottle is rotated clockwise.

Note:

Mounting of the MRU with the x-axis (x arrow) pointing up (0, 90, 0) or down (0, -90, 0) should be avoided due to the fact that there is a singularity in the Euler angle representation for a 90-degree pitch angle. Therefore, the MRU mounting wizard does not support these orientations.

Note:

If the offset angles exceed 45 degrees, another main rotation should be selected.

Related tasks

Setting MRU location and mounting angles, page 111

Determining the MGC mounting orientation

The default mounting orientation of the Motion Sensor and Gyro Compass (MGC) is defined with the top cover facing downward and the x-axis pointing forward. This is the main orientation direction for the MGC. The sensor is then rotated 180 degrees round the x-axis.

The body axes will then be:

- The R-axis (x arrow) points in the bow (forward) direction of the vessel.
- The P-axis points horizontally and starboard.

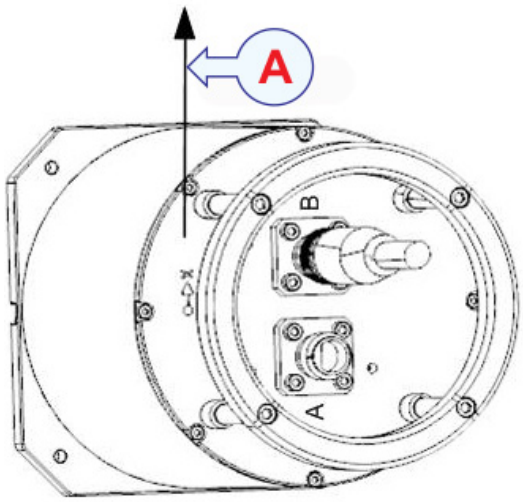
- The Y-axis points in the downward direction.

Note:

The x, y, z axes with the x arrow marked on the top cover is the axes orientation in the sensor frame. When mounting angles are input in the sensor configuration the sensor output axes is rotated form the sensor-frame to the body-frame (R, P, Y axes).

MGC with bow direction indicated

The illustration shows the MGC mounting orientation with the SB50 subsea bottle. The connector faces upward and the bow direction, R, is indicated.



A. *Bow direction (R)*

Positive (+) output signals from the MGC include:

- Positive pitch means bow up, or a clockwise rotation about the P-axis.
- Positive roll means starboard (right) side facing downward, or a clockwise rotation about the R-axis.
- Positive yaw (heading, azimuth) means a turn to starboard (right), or a clockwise rotation about the Y-axis.

Related tasks

Setting MGC location and mounting angles, page 115

Determining the miniMRU mounting orientation

The default mounting orientation is defined with the connector and x-axis pointing forward, the y-axis pointing to starboard and the z-axis pointing downward.

The illustration shows the mounting orientation with the miniMRU sensor unit connector facing forward. This is the main orientation direction for this sensor. The sensor is then rotated 180 degrees around the x-axis.

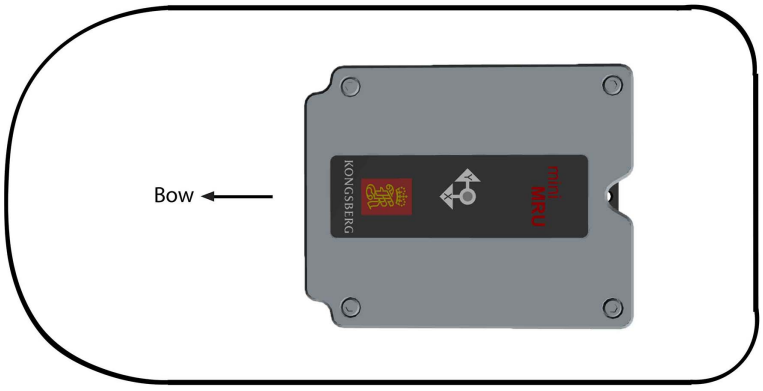
The body axes will then be:

- The R-axis (x arrow) points in the bow direction of the vehicle
- The P-axis (y arrow) points horizontally and starboard.
- The Y-axis points in the downward direction.

Note:

The x, y, z axes with the x and y arrow marked on the sensor top is the axes orientation in the sensor frame. When mounting angles are input in the sensor configuration, the sensor output axes are rotated from the sensor-frame to the body-frame (R, P, Y axes).

The illustration shows the default mounting orientation for the sensor unit with the x arrow pointing in the bow direction of the vessel. The top view of the sensor unit with bow and x arrow direction is indicated.



Related tasks

Setting miniMRU location and mounting angles, page 119

Surveying the Sensor Unit

For the Sensor Unit the following should be surveyed:

- The position reference point(X, Y, Z) on the Sensor Unit.

  The distance vector from the origin to the position reference point has to be measured up.

- The mounting angle in heading.

  The angular offset between the vessel centre line (CL) and the line from heading reference point #1 to heading reference point #2 and has to be determined and input as heading offset in the **NAVEngine configuration**.

Related concepts

Survey accuracy values, page 75

Related tasks

Entering antenna location parameters, page 104

Surveying the MRU subsea bottle

For the Motion Reference Unit (MRU) subsea bottle the following should be surveyed:

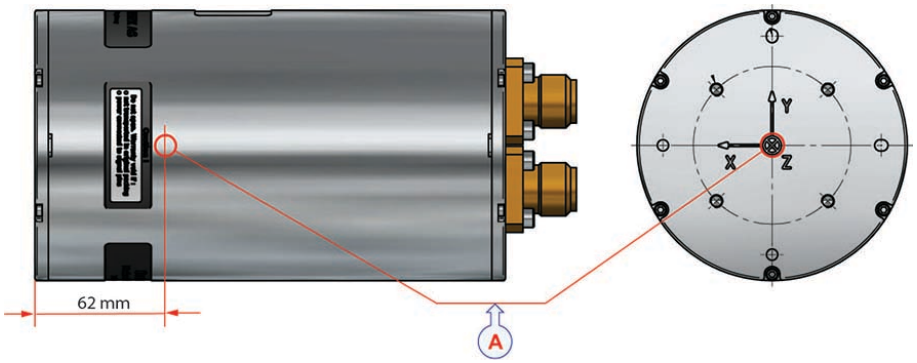
- The position (X, Y, Z) of the sensor point on the MRU.

  The axis cross centre on the MRU subsea bottle index lid. The distance vector from the origin to the MRU sensor point has to be measured up.

- The mounting angles in roll, pitch and yaw (heading).

  The MRU misalignment angles in roll, pitch and yaw with the vessel's axis have to be measured up.

Sensor point and position for the MRU subsea bottle



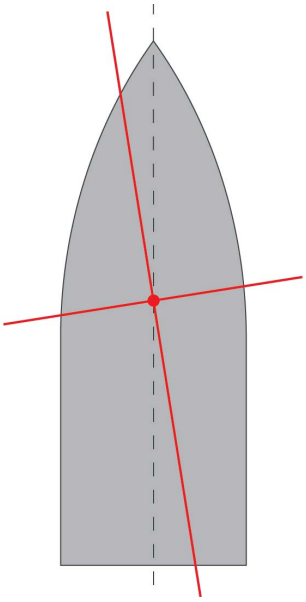
A. *Sensor point and position (0, 0, 0) for the subsea bottle*

Alignment axis

After the mechanical installation is completed, the MRU x, y and z axes must be aligned to the corresponding vessel axes or the axes of the system to be compensated. To achieve the MRU's specified roll and pitch accuracy, any misalignment of the MRU axes with the vessel axes must be precisely calculated and accounted for.

A typical alignment process consists of aligning the MRU axes to an external reference. The type of reference must be determined according to the required accuracy.

The illustrations shows the alignment of the MRU yaw axis to the vessel's longitudinal axis.



Related concepts

Survey accuracy values, page 75

Related tasks

Setting MRU location and mounting angles, page 111

Surveying the MGC subsea bottle

Fort the Motion Sensor and Gyro Compass (MGC) the following should be surveyed:

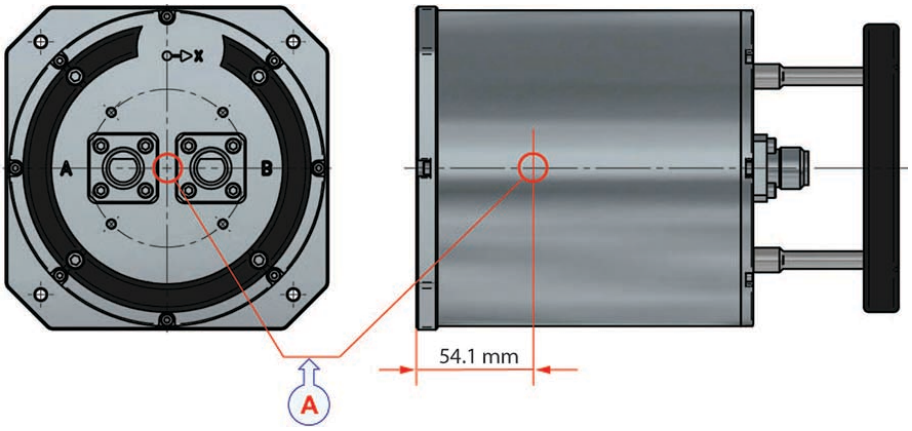
- The position (X, Y, Z) of the sensor point on the MGC subsea bottle.

  The distance vector from the origin to the MGC sensor point has to be measured up.

- The mounting angles in roll, pitch and yaw (heading).

  The MGC misalignment angles in roll, pitch and yaw with the vessel's axes have to be measured up.

Sensor point and position for the MGC subsea bottle



A. *Sensor point and position (0, 0, 0) for the subsea bottle*

Related concepts

Survey accuracy values, page 75

Related tasks

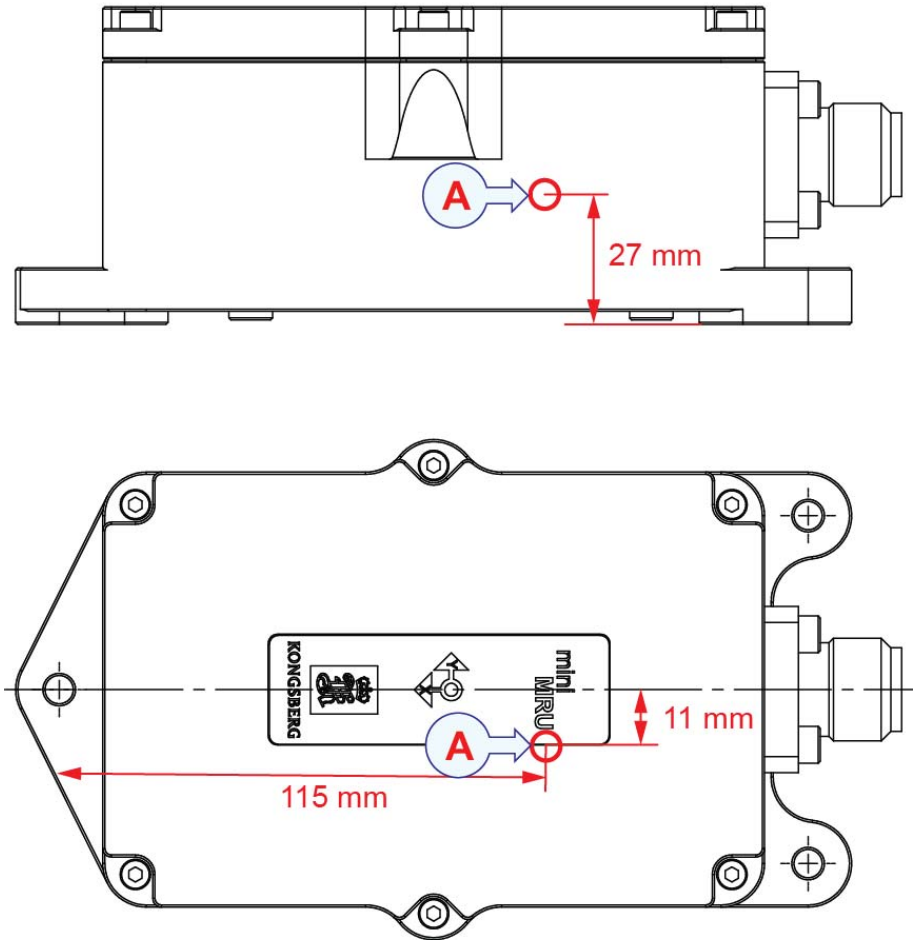
Setting MGC location and mounting angles, page 115

Surveying the miniMRU subsea housing

For the miniMRU subsea housing the following should be surveyed:

- The position (X,Y,Z) of the sensor point. The axis cross centre on the miniMRU subsea housing is illustrated.
- The mounting angles in roll, pitch and yaw (heading).

The illustration shows the sensor point and position (0, 0, 0) for all miniMRU subsea housings.



A. *Sensor point and position (0, 0, 0) for the subsea housing*

Related concepts

Survey accuracy values, page 75

Related tasks

Setting miniMRU location and mounting angles, page 119

Determining the system coordinates

The Inertial Measurement Unit (IMU) and the Sensor Unit both measure the motion for the location where they are positioned. These measurements must be transformed to be able to measure the motion in a common reference point, the navigation reference point (NRP). The NRP is the reference point for all measurements in this system.

The coordinates for the sensor positions, the navigation reference point (NRP) and the monitoring points (MP) relative to origin must be determined and input to the operator software.

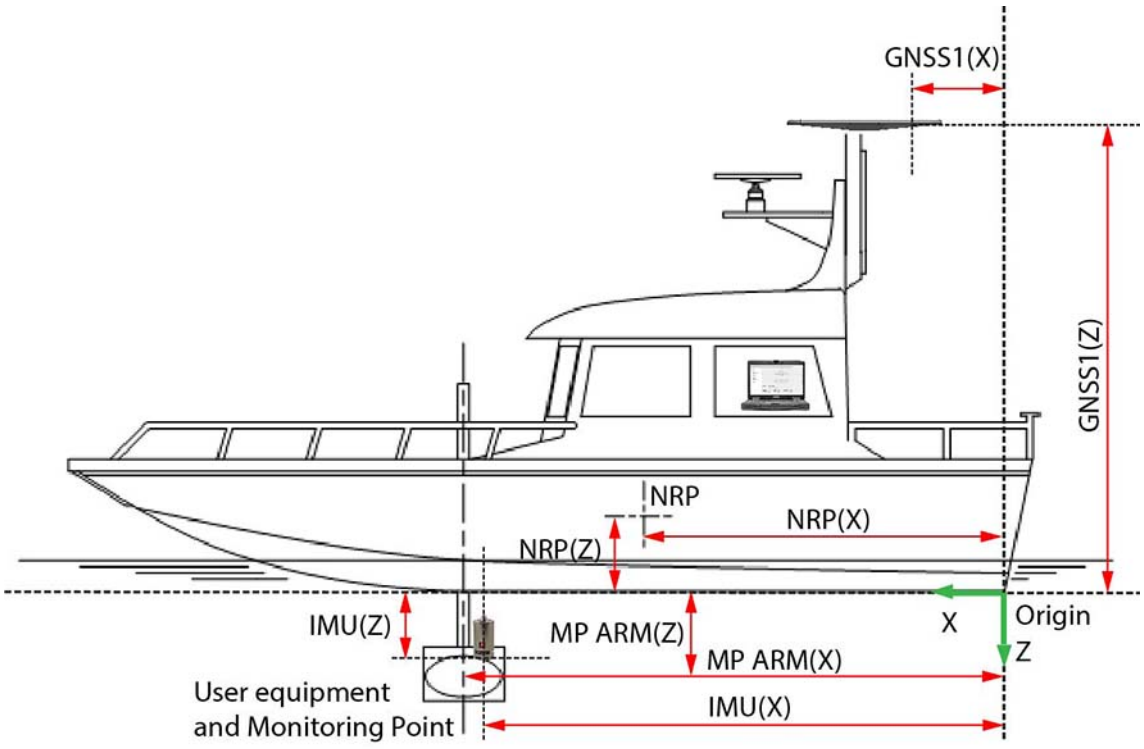
- The distance vector from origin to the position reference point, GNSS antenna #1. (Coordinates for the GNSS antenna.)
- The distance vector from origin to the Inertial Measurement Unit (IMU) location. (Coordinates for the IMU location.)
- The distance vector from origin to the selected navigation reference point (NRP) location. (Coordinates for the selected NRP location.)
- The distance vector from origin to each of the monitoring points. (Coordinates for each of the monitoring points.) Maximum eight monitoring points (MP) in this system.

All these distance vectors have to be measured or calculated based upon drawings or previously measured points. These coordinates must be measured within a specific accuracy.

Positive directions for these parameters are:

- X – positive forwards
- Y – positive towards starboard
- Z – positive downwards, with origin as the reference point

The illustration shows the coordinates for the different components.



Related tasks

Setting vessel dimensions and reference points, page 101
Entering antenna location parameters, page 104
Setting MRU location and mounting angles, page 111
Setting MGC location and mounting angles, page 115
Setting miniMRU location and mounting angles, page 119
Setting monitoring points, page 125

Survey accuracy values

The system must be surveyed according to the given accuracy level. If not, the performance of the system will be degraded.

- The coordinates for the Sensor Unit position reference point (X, Y, Z) < 0.01 metre
- The coordinates for the user defined monitoring points (MP) (X, Y, Z): < 0.01 metre
- The coordinates for the selected navigation reference point (NRP) location (X, Y, Z): < 0.01 metre
- The IMU offset angles (roll, pitch) with the vessel axis: < 0.1°
- The IMU yaw offset angles with the vessel axis: < 0.1°

Related concepts

Surveying the Sensor Unit, page 70
Surveying the MRU subsea bottle, page 70
Surveying the MGC subsea bottle, page 71
Surveying the miniMRU subsea housing, page 72

Related tasks

Setting vessel dimensions and reference points, page 101
Entering antenna location parameters, page 104
Using Calibration Wizard to determine antenna parameters, page 106
Setting MRU location and mounting angles, page 111
Using Mounting Wizard to determine MRU mounting angles, page 112
Setting MGC location and mounting angles, page 115
Using Mounting Wizard to determine MGC mounting angles, page 117
Setting miniMRU location and mounting angles, page 119
Using Mounting Wizard to determine miniMRU mounting angles, page 121
Setting monitoring points, page 125

Portable Hydrographic System (PHS) installation

Topics

About Portable Hydrographic System (PHS) installation

These are instructions for a Seapath 130 installation when it is included as a part of the Portable Hydrographic System (PHS).

Note:

A PHS installation only applies if your installation is with a Motion Reference Unit (MRU).

A PHS system is delivered completely set up. The software is delivered on a USB flash drive and it is pre-configured. If you want to change the configuration you must install the Seapath Operator software on a local computer. The system can also be delivered

with an over-the-side pole where all the offsets are known. All you need to do is to let the system know where on the vessel the Survey Origin of the system is located and the vertical axis offset.

This means that the Seapath is delivered already configured for being used as a part of the PHS system. Dependent on what is stated in the order acknowledgement, the Seapath will be configured according to part no. M340–SW_2040P-SIS4 or M340–SW_2040P-SIS5. This includes antenna and MRU offsets as well as serial and Ethernet outputs.

The Portable Processing Unit (PPU) has a proprietary plug for the Seapath and the Motion Reference Unit (MRU) which allows you to power the Seapath and the MRU from the PPU and use the PPU as a central hub for a single cable interface.

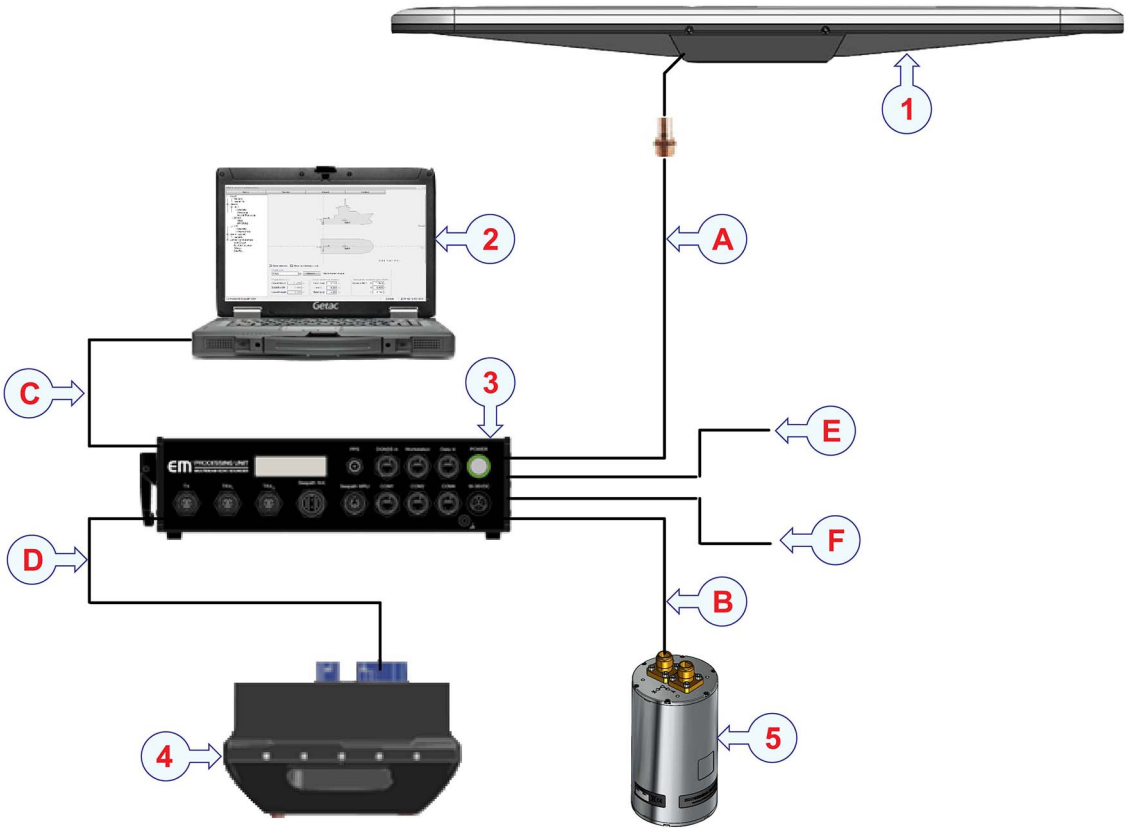
Related tasks

Installing the Seapath operator software, page 41
Uninstalling the Seapath operator software, page 42

System diagram

The system diagram identifies the main components of a Seapath 130 system installed as a part of a Portable Hydrographic System (PHS) installation.

The Inertial Measurement Unit (IMU) connected to the Sensor Unit is a Motion Reference Unit (MRU).



Units

1. *Sensor Unit with 1-metre cable, male connector*
2. *Operator software on USB flash drive to be installed on local computer*
3. *EM Portable Processing Unit (PPU)*
4. *EM2040P transducer head*
5. *Motion Reference Unit (MRU) in subsea bottle*

Cables

A. *Cable to Sensor Unit, 15 metres length with connector to PPU, part no. M340-24*

B. *MRU umbilical cable, 6 or 15 metres length with connector to PPU, part no. MRU-E-CS10*

C. *Ethernet cable to local computer and other users, 5 metres length*

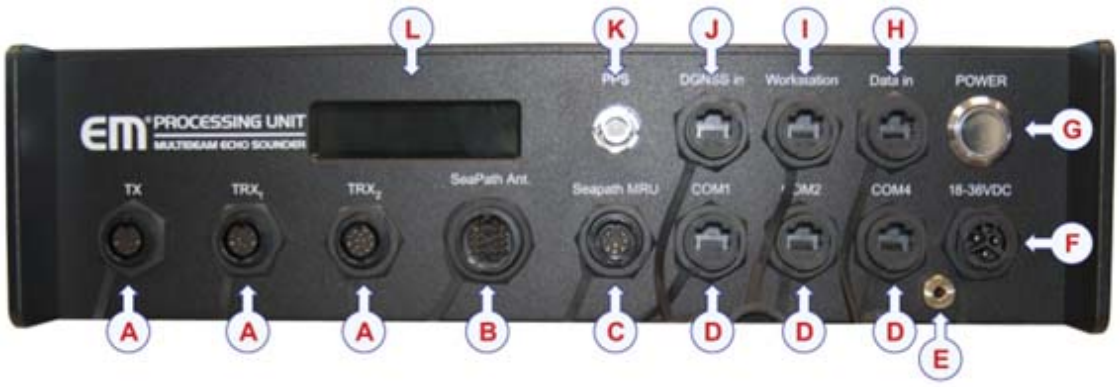
D. *Cable from PPU to EM2040P transducer head*

E. *Cable for 24 VDC input, 3 metres length*

F. *Cable for DGNSS corrections input, 4.5 metres length*

Front interfaces Processing Unit

The illustration shows the front interfaces of the Portable Processing Unit (PPU).



Cables and connectors

A. *Transducer cable input*

B. *Seapath Sensor Unit interface cable, part no. M340-24*

C. *MRU interface cable, part no. MRU-E-CS10*

D. *Processing Unit serial COM ports (COM3 available from Seapath)*

E. *Ground connector*

F. *18 - 36 VDC power input socket*

G. *Power on/off button*

H. *External data input over Ethernet including attitude velocity*

I. *Hydrographic Work Station input*

J. *DGNSS corrections input*

K. *1PPS input*

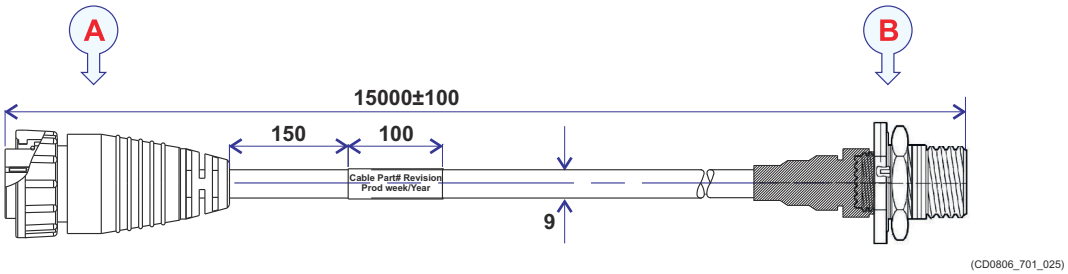
L. *Processing Unit display*

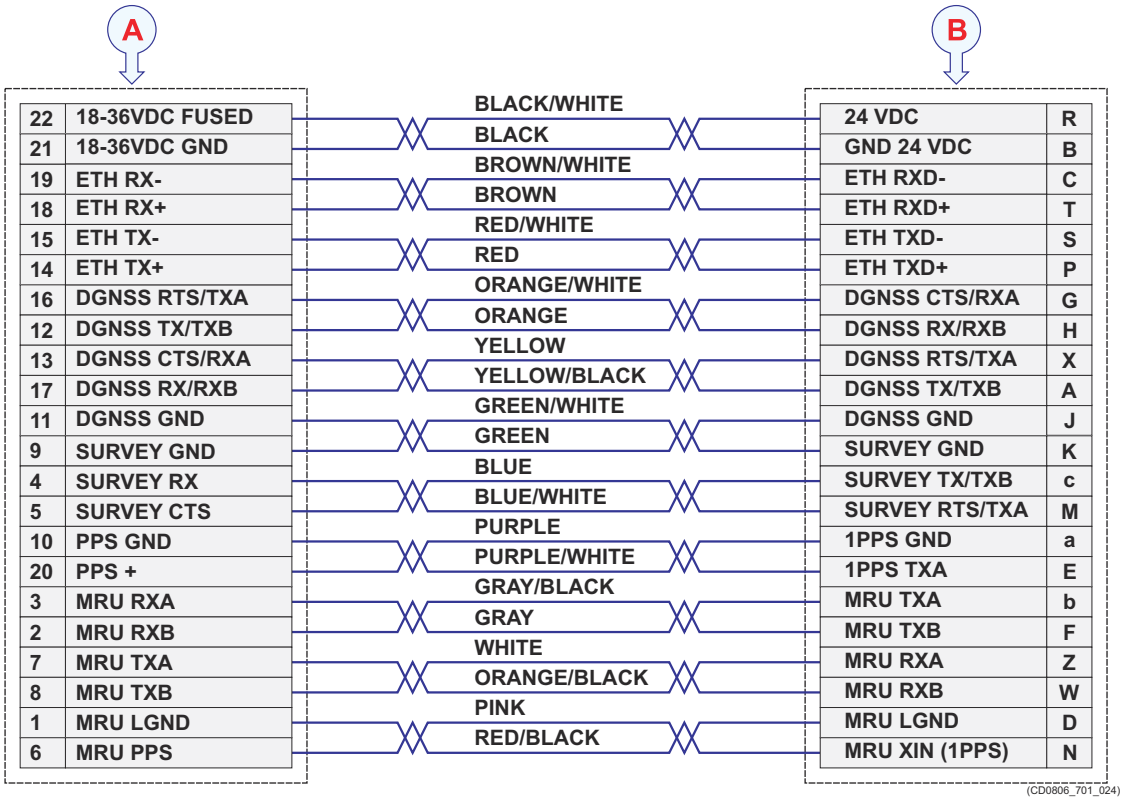
The power on/off button indicates correct direct current polarity by a green light emitting diode (LED).

Interface cables to Portable Processing Unit

The Seapath 130 is interfaced to the Portable Hydrographic System (PHS) through two cables. The interface cable between the Sensor Unit and the Portable Processing Unit (PPU), part no. M340-24, and the interface cable between the Motion Reference Unit (MRU) and the PPU, part no. MRU-E-CS10.

Wiring for cable between Sensor Unit and PPU, M-340-24



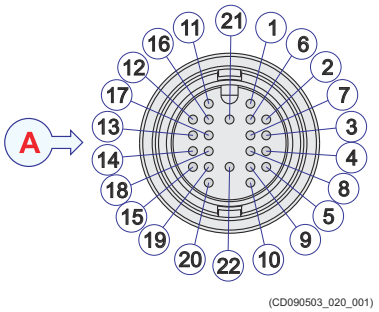


A. *Local connection*

Amphenol LTW DU-22BFFA-SL7000

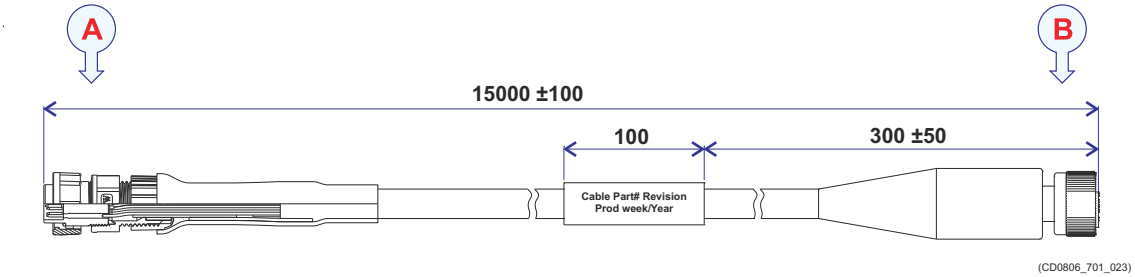
B. *Connection to Seapath antenna*

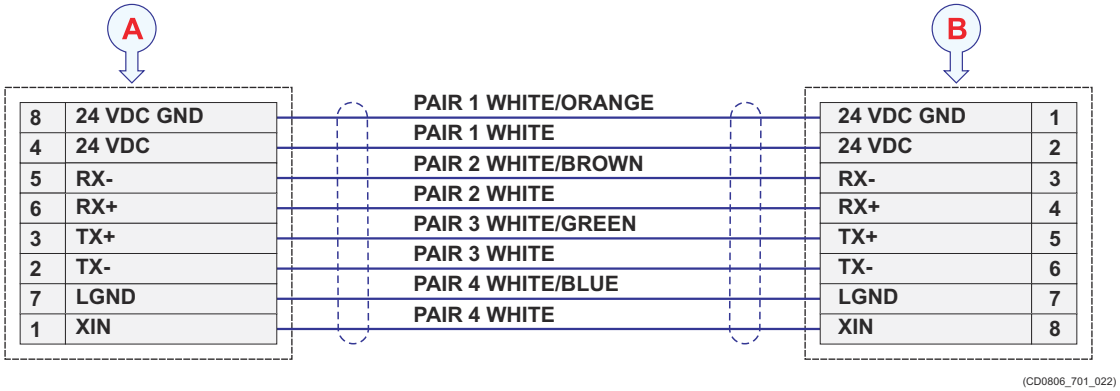
JVS07A1726SN



The DGNSS signal can be configured to be either RS-232 or RS-422.

Wiring for cable between MRU and PPU, MRU-E-CS10



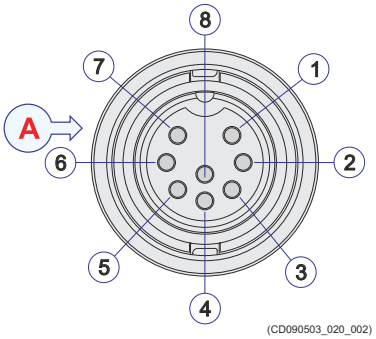


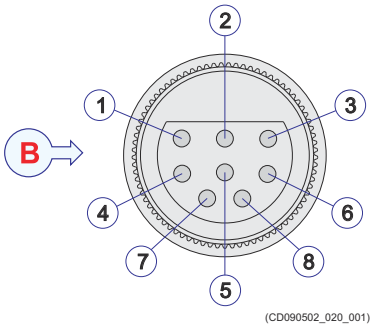
A. *Local connection*

Amphenol LTW CD-08BFMA-LL7001

B. *Connection to Seapath MRU*

Seacon 5501-1508

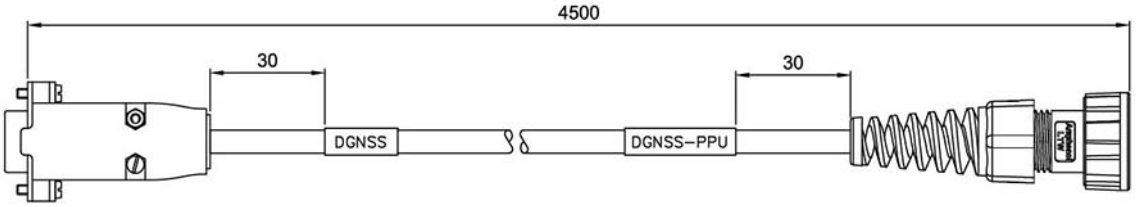




Cable specification

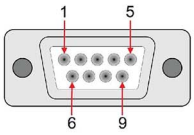
- Cable length: 15 m
- Maximum outer diameter: 12.6 mm
- Minimum bending radius: 10 x diameter
- Conductors: 4 pairs, 23 AWG

Wiring for cable between DGNSS receiver and PPU, ELD234244

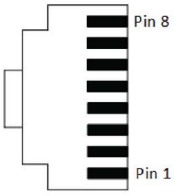


Note:

Twisted pair 6 and 8. Screen to be connected in each end.



Pin no.	Signal
1	RS-422 Tx+
2	RS-232 TxD
3	RS-232 RxD
4	Not in use
5	GND
6	RS-422 Tx-
7	Not in use
8	RS-422 Rx+
9	RS-422 Rx-



1	
2	
3	
4	Ground
5	
6	Rx (input)
7	
8	Tx (output)

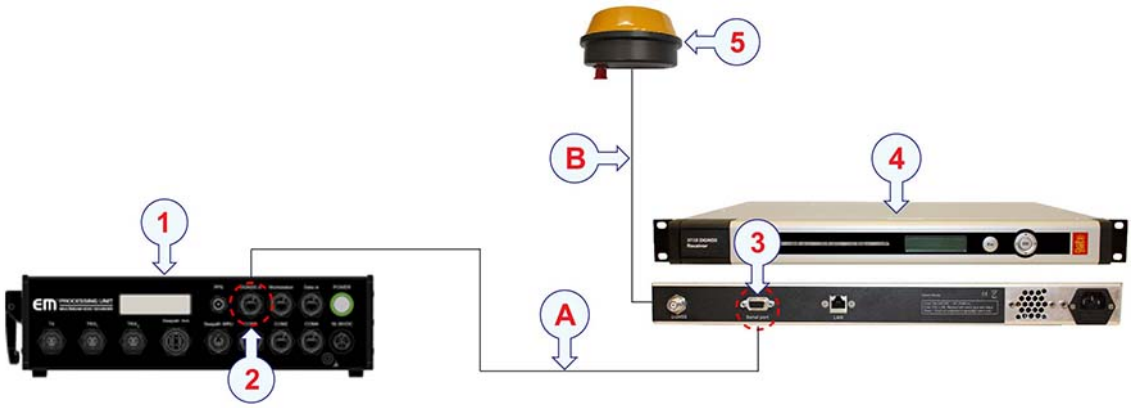
Connection diagram for 3710 DGNSS Receiver to EM PPU

EM 2040P splash-proof Processing Unit to 3710 DGNSS Receiver.

Note:

The EM 2040P Portable Processing Unit (PPU) has a dedicated interface for GNSS corrections using RS-422 or RS-232 serial communication.

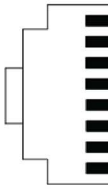
For more information on the PPU, see the *EM 2040P Installation Manual*. For more information on the DGNSS receiver unit, see the *3710 DGNSS Receiver Instruction Manual*.



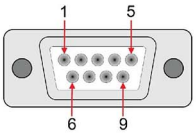
RS-232 serial connection diagram for DGNSS input.

Connectors:

- Portable Processing Unit end: RJ45 connector (RS-232)
- 3710 DGNSS Receiver end: 9-pin male D-Sub connector. Cable type: shielded.



1	
2	
3	
4	Ground
5	
6	Rx (input)
7	
8	Tx (output)



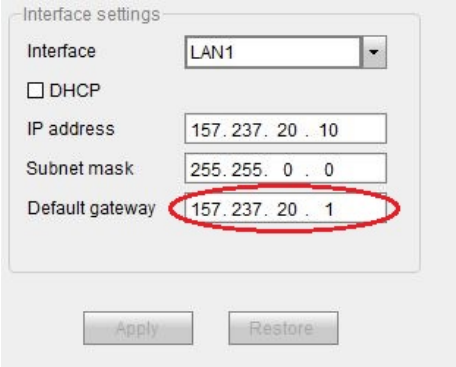
Pin no.	Signal
1	RS-422 Tx+
2	RS-232 TxD
3	RS-232 RxD
4	Not in use
5	GND
6	RS-422 Tx-
7	Not in use
8	RS-422 Rx+
9	RS-422 Rx-

General Seapath configuration for PHS

Internet protocol (IP) setup

The EM Multibeam system is set up to work in the 157.237.xx.xx IP range. As everything is connected through the same LAN, and the Seapath Operator software needs to reach the Seapath Sensor Unit through that same network, the Seapath too needs to be set up to this range. The below settings should be applied for the Seapath Sensor Unit to work seamlessly with the Portable Processing Unit (PPU).

Select **System** menu > **NAVEngine** > **Standard** > **Network**



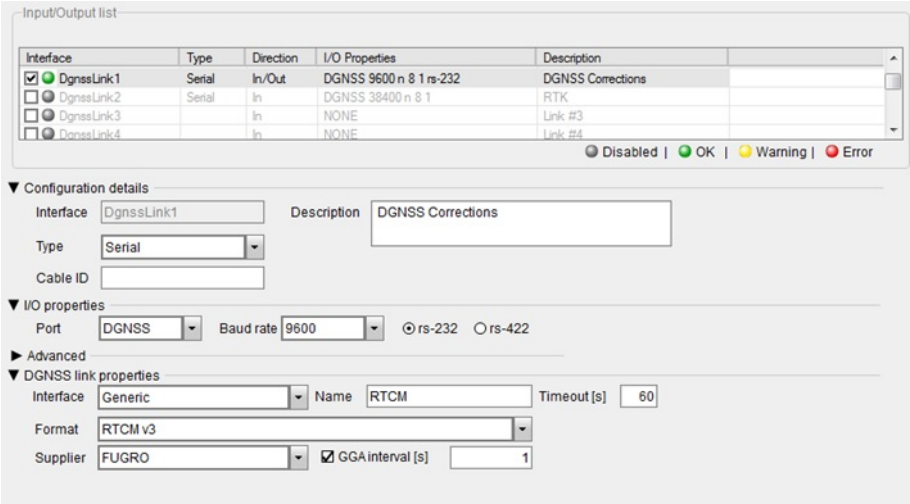
The **Default gateway** configuration (red circle) is important. While it is irrelevant for the setup, the Seapath will reset everything upon restart if the **Default gateway** is not in the same IP range.

DGNSS input setup

The DGNSS serial port as well as some generic outputs are always the same regardless of the version of SIS software package used. The DGNSS serial port is set up to receive standard RTK over RS-232 serial line.

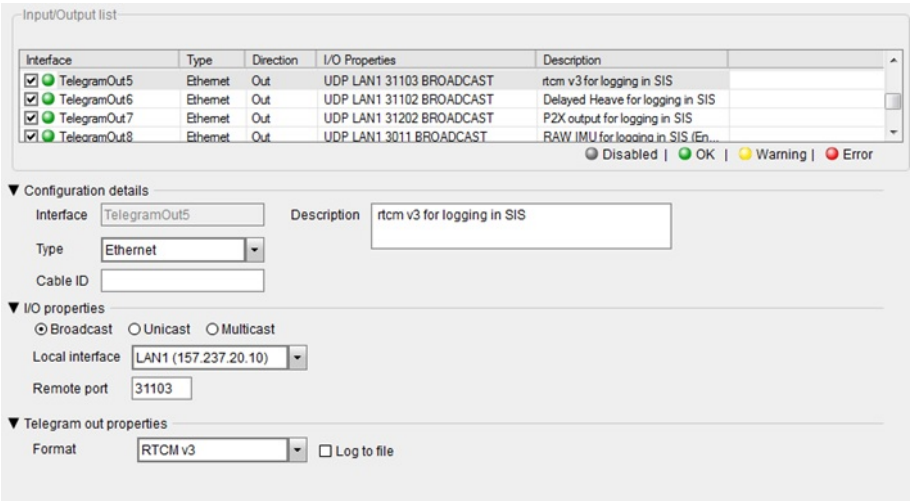
Delayed heave set to 100 Hz over UDP port 31102. RTCM v3, IMU raw data and NMEA P25/P26/P27 are configured to be output, but not logged on file on the Seapath. Enabling logging in SIS 4 or 5 should be a matter of just pressing the Enable button in SIS. The DGNSSLink1 supplies the PHS system with RTK corrections.

The DGNSS correction is received on the DGNSS line at baud 9600 and with 1 Hz rate.



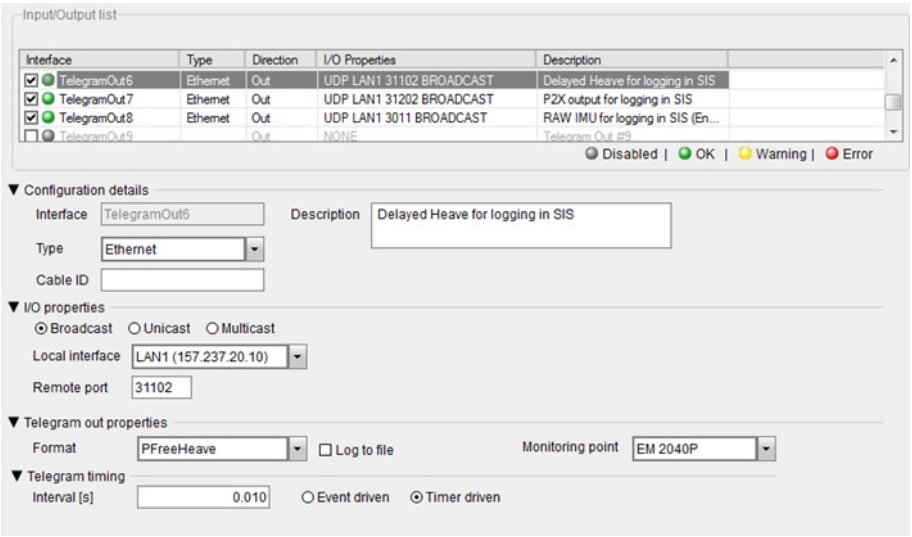
TelegramOut5 setup

TelegramOut5 is set up to output raw GNSS data on RTCM format to allow for a lot of positioning post processing options (PPP and PPK). Generally, it is recommended to log this output in SIS if you are not using a correctional service to improve your position and can be logged in SIS.



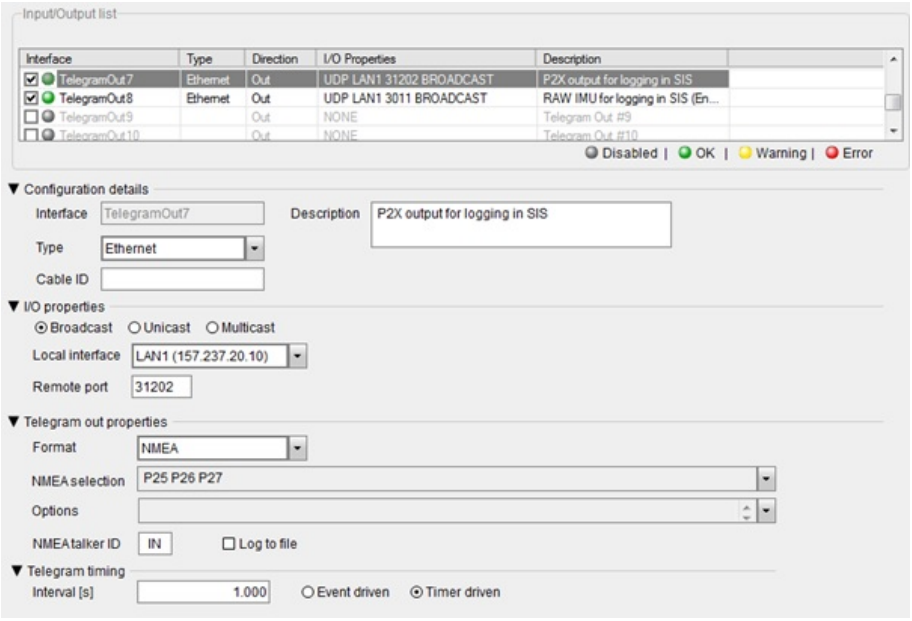
TelegramOut6 setup

TelegramOut6 is set up to output delayed heave over UDP port 31102 at 100 Hz rate. The delayed heave can be logged on SIS. It is important to reference the delayed heave to the sonar head because some post processing software will struggle to manage the delayed heave in post processing if this is not done.



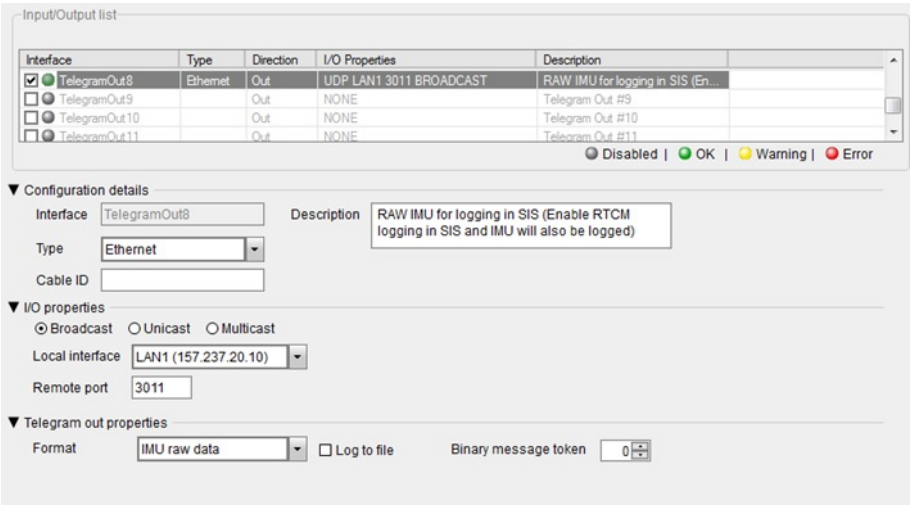
TelegramOut7 setup

TelegramOut7 is set up to output Seapath installation settings. Logging P2X creates a new file every time you change offsets or other installation settings in the Seapath. It is handy for post processing and can be logged in SIS.



TelegramOut8 setup

TelegramOut8 is set up to output raw IMU data. Logging of raw IMU data allows for post processing of IMU data (smoothing and other) and can be logged in SIS.

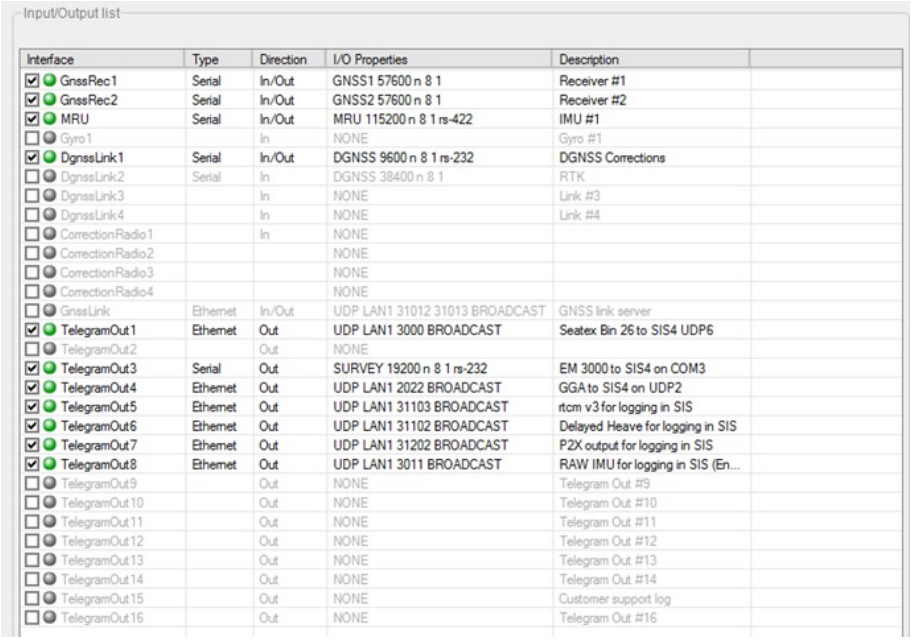


Related tasks

Setting up the DGNSS correction link parameters, page 131
Setting up the Telegram out interface, page 129

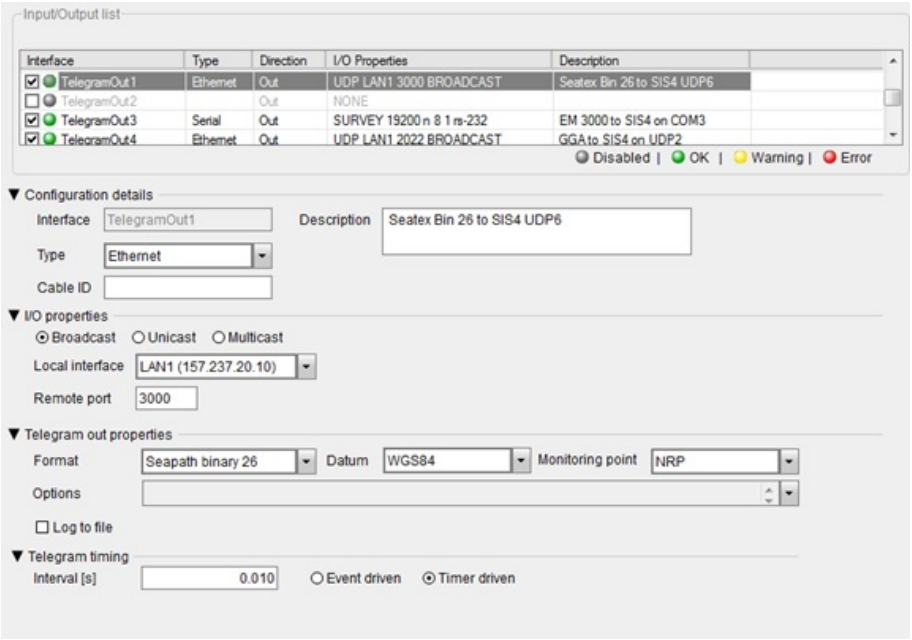
Setting up Seapath for SIS version 4 users

For Seapath 130 deliveries with the configuration option M340–SW_2040P-SIS4, the Seapath interfaces are configured as shown in the illustrations below.



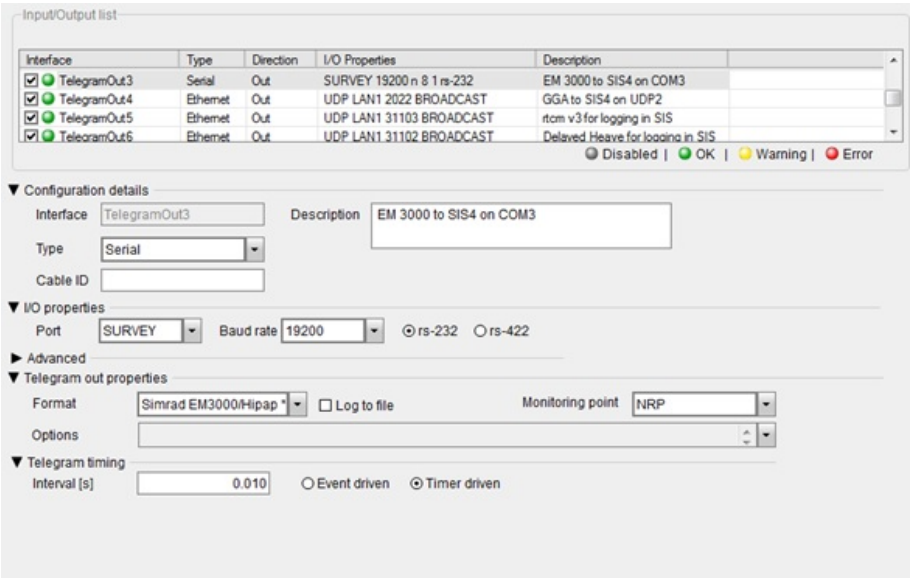
TelegramOut1

TelegramOut1 supplies the PHS system with attitude velocity corrections. Broadcast as Seatex Binary 26 format over Ethernet at 100 Hz.



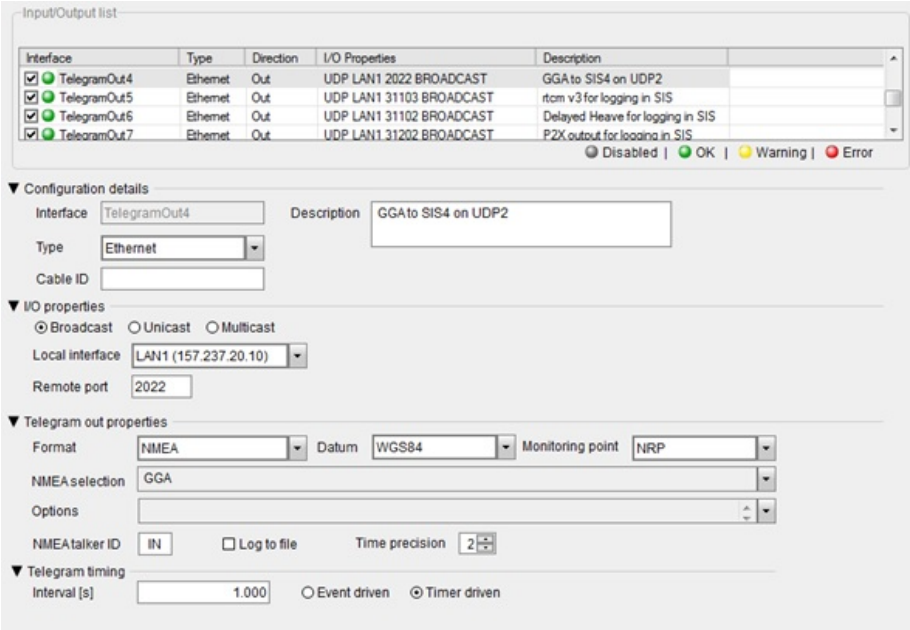
TelegramOut3

TelegramOut3 supplies the PHS system with motion data. Broadcast as EM 3000 format over the SURVEY serial line at 19200 baud and 100 Hz output rate.



TelegramOut4

TelegramOut 4 supplies the PHS system with NMEA GGA position input. Broadcast as NMEA GGA over Ethernet at 1 Hz rate.

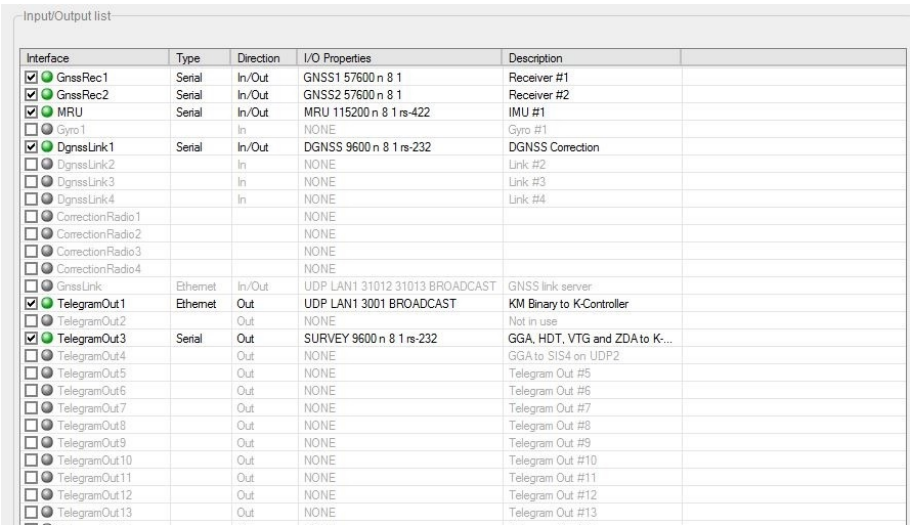


Related tasks

Setting up the Telegram out interface, page 129

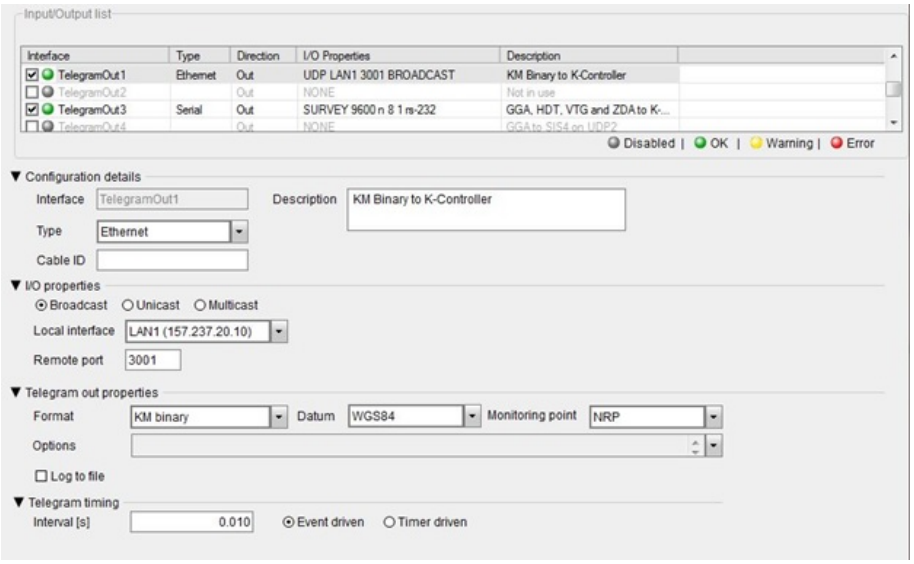
Setting up Seapath for K-Controller users (SIS version 5)

For Seapath 130 deliveries with the configuration option M340–SW_2040P-SIS5, the Seapath is configured as shown in the illustrations below. The K-Controller allows reception of all available data from Seapath over Ethernet and a setup different from that for SIS4 is therefore required.



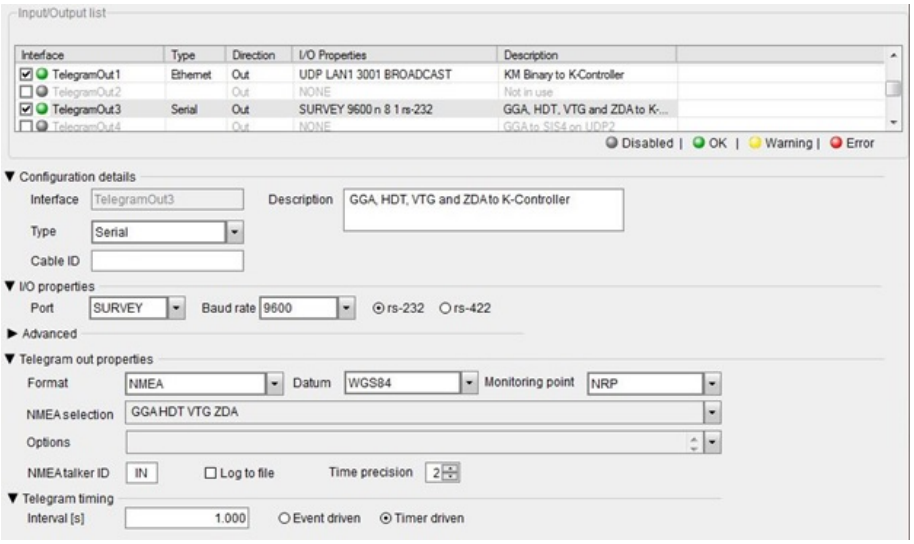
TelegramOut1

TelegramOut1 supplies the PHS system with motion and attitude velocity data as well as time and date. Broadcast as KM Binary format over Ethernet at 100 Hz.



TelegramOut3

TelegramOut3 supplies the PHS system with NMEA GGA, HDT, VTG and ZDA data. Broadcast over the SURVEY serial line at 9600 baud and with 1 Hz rate.



Related tasks

Setting up the Telegram out interface, page 129

Setting to work

Topics

Setting to work summary

When all hardware units have been installed, and all the cables have been connected, the Seapath system can be turned on and set to work.

Prerequisites

- All system units have been installed.
- All system cables are connected.
- All cable connections are made.
- Correct operating power is available. The system operates on 10 - 36 VDC.
- All external devices which shall communicate with the Seapath are available and operational.

- All relevant personnel and tools are available.

Procedure

1. Verify that all hardware and cable installation have been made correctly.
2. Make sure that the Seapath operator software is installed on a local computer.
3. Provide power to the Seapath system.
4. Set up the Seapath system for operational use.
   a. Determine the location and heading offset for the Sensor Unit.
   b. Determine the location and mounting angles for the IMU.
   c. Determine the location of the monitoring points.
   d. Set up communication interfaces.
5. Set up interfaces to external devices.
6. Create a backup with the system configuration and software installation.
7. Verify that the Seapath system is operational.

Related concepts

Entering the system configuration, page 93

Related tasks

Mounting the Sensor Unit, page 32
Mounting the MRU subsea bottle, page 34
Mounting the MGC subsea bottle, page 36
Mounting the miniMRU subsea housing, page 38
Applying power to the Seapath system, page 93
Installing the Seapath operator software, page 41
Entering antenna location parameters, page 104
Setting MRU location and mounting angles, page 111
Setting MGC location and mounting angles, page 115
Setting miniMRU location and mounting angles, page 119
Verifying that the Seapath 130 system is ready for operational use, page 151
Creating a backup of the configuration and software installation, page 152

Applying power to the Seapath system

There is no on/off switch to turn on the Seapath system. It starts up when power is connected.

Prerequisites

Make sure that all system cables are correctly connected.

Procedure

1. Make sure that all cables are connected to the Sensor Unit and the Inertial Measurement Unit (IMU).
2. Apply 24 VDC power to the system.

   The power connection for the spider cable is according to the table.

Signal	Sensor Unit (wire colours)	IMU (wire colours)
PWR+ (+24 VDC)	Brown	Green
PWR- (0 VDC)	White	Yellow

   To turn off the system, disconnect the input power.

Related tasks

Verifying that the Seapath 130 system is ready for operational use, page 151

How the configuration of the system works

Topics

Entering the system configuration

The setup parameters are available from:

- The **System** menu > **NAV Engine** > **Standard** for system setup.

- The **System** menu > **Operator SW** for display views setup.

To be able to make changes to the setup you must be in *Configuration* mode for standard configuration tasks or *Engineering* mode for advanced configuration and diagnostic tasks.

Note:

Advanced NAV Engine configuration is for service personnel only.

Related tasks

Changing system modes, page 96

NAV Engine Configuration description

You can set up the system parameters from the **NAV Engine Configuration** dialog box.

The dialog box consists of a list of configuration options, a parameter settings section, an exit button and three buttons which each has different properties with regard to configuration changes.

Apply

Select **Apply** to apply the configuration changes to the system. This button is disabled until you have made changes to the configuration. The button will be disabled when there are no changes to apply.

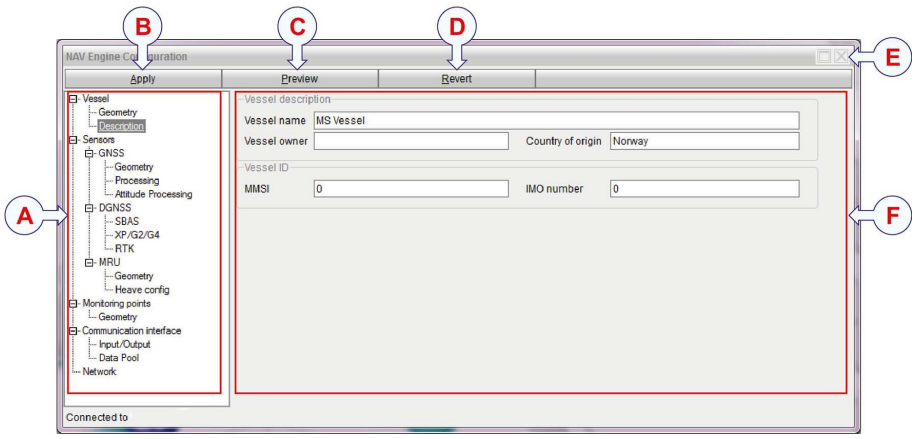
Preview

Select **Preview** to see which parameters have changed since the configuration was loaded. Changed settings are highlighted in bold face. This button is disabled until you have made any changes to the configuration.

Please note that monitoring point changes are displayed in the coordinate system in which they are actually stored by the configuration. For example related to the navigation reference point rather than origin.

Revert

Select **Revert** to reject all changes you made since the configuration was loaded. The button is disabled until changes have been made.



A. *Configuration options list*

B. *Apply confirmation changes button*

C. *Preview last configuration settings button*

D. *Revert to previous settings button*

E. *Exit NAV Engine Configuration*

F. *Parameter settings section*

Operator software configuration description

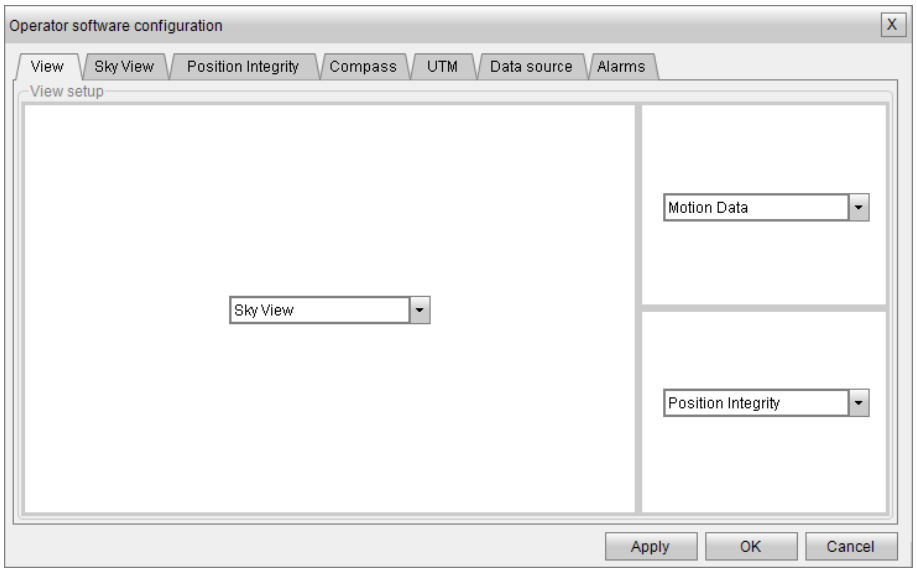
You can adjust the appearance of the display views through the **Operator software configuration** dialog box.

The dialog box contains tab pages for various presentation options. Each page contains two confirmation buttons with different properties and a cancel button.

- **OK button**: Selecting the **OK** button will save the changes and close the **Operator software configuration** dialog box.
- **Apply button**: Selecting the **Apply** button will save the changes but the c dialog box will not close.
- **Cancel button**: Selecting the **Cancel** button will close the **Operator software configuration** dialog box and changes will not be saved.

Note:

*The position properties selected in the **Operator software configuration** dialog box are only for display purposes.*



Changing system modes

The system has three modes: *Operation*, *Configuration* and *Engineering*. To be able to make changes to the setup you must be in *Configuration* or *Engineering* mode.

Context

The *Configuration* or *Engineering* modes are password protected. The password is **STX**. The password is not case sensitive. It is not possible to change the password.

You can change the system mode via the **System** menu or using key commands directly from the display.

Procedure

1. **Via System menu**
   a. Select the **System** menu > **Change system mode**.
   b. Select either **Configuration** or **Engineering**.
   c. Type the password: **stx**.
   d. Select **OK**.
2. **With keyboard commands**
   a. In the display:
      - Press CTRL+E to enter *Configuration* mode
      - Press CTRL+A to enter *Engineering* mode
   b. Type the password: **stx**.
   c. Select **OK**.

Result

You are now able to carry out changes and/or set system parameters.

Related concepts

Entering the system configuration, page 93

Communication interface description

You must set up the communication interfaces for the system to be able to communicate with and interface to other systems and equipment.

Context

The communication interfaces are set in **NAV Engine Configuration** under **Communication** > **Input/Output**. The **Input/Output list** shows all input and output ports which are available in the system. When you select an **Interface** in the **Input/Output list**, the **Configuration details** part for that particular interface will appear in the lower part of the page. These details will change based on the interface type you have selected, Serial or Ethernet. You must select either **Serial** or **Ethernet** for all available interfaces before you select the specific parameters for a particular interface.

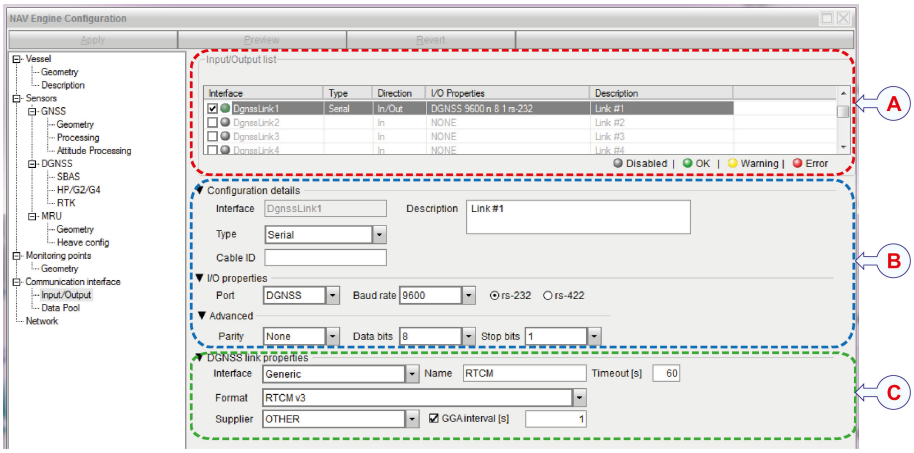
Select the arrow next to the group headings to show or hide the information.

To be able to get a properly working system you must set up these communication interfaces:

- MGC (When the Inertial Measurement Unit (IMU) is a Motion Sensor and Gyro Compass (MGC).
- Telegram out
- DGNSS link

Note:

You are not able to configure the GnssReceiver interface and the MRU interface.



A. *Selected interface in Input/Output list*

B. *Type of interface selection: Serial or Ethernet*

C. *Specific configuration details for the selected interface*

This procedure sums up the steps you have to go through to set up the communication interfaces for the system.

Procedure

1. Select the **System** menu > **NAVEngine** > **Standard**.
2. Select **Communication interface** > **Input/Output**.
3. Select the interface you want to set up in the **Input/Output list**.

   Observe that the **Configuration details** parameters appear at the lower part of the page.
4. Select which type of interface you want to use from the **Type** list: Serial or Ethernet.
5. Select the wanted I/O parameters. These will vary depending on the type of interface you selected.
6. Select the specific parameters you want for the interface you selected.
7. Select **Apply** to save your settings without closing the dialog box.

Related tasks

Setting up the Telegram out interface, page 129
Setting up the DGNSS correction link parameters, page 131
Setting up NTRIP client, page 142
Setting up the MGC as an inertial navigation system (INS), page 140
Selecting heading input format from a gyro compass, page 139

Using the Serial interface

The Serial interface allows you to decide how the Processing Unit shall communicate with and interface to other equipment.

Context

If you have decided to use a Serial interface, you must set up the port number, the baud rate and select RS-232 or RS-422 mode.

Procedure

1. Select the **System** menu > **NAVEngine** > **Standard**.
2. Select **Communication interface** > **Input/Output**.
3. Select the interface you want to set up in the **Input/Output list**.
   Observe that the **Configuration details** parameters appear at the lower part of the page.
4. Select **Serial** in the **Type** list.
5. Type an informative text about the interface in the **Description** box. This is optional.
6. Type a short identification text for the cables connected to the Processing Unit in the **Cable ID** box This is optional.
7. Select which port to use from the **Port** list.
   The serial port number corresponds with the number on the Processing Unit.
8. Select which baud rate you want to use from the **Baud rate** list.
   Maximum baud rate is 115200 bits/second.
9. Depending on which port you selected, select if you want to use RS-232 or RS-422 for the electrical interface.
10. Select the properties for the interface you selected in the **Input/Output list**.

Result

You are now ready to set the specific parameters for the interface you have selected. See separate sections for selection details.

Related tasks

Setting up the Telegram out interface, page 129
Setting up the DGNSS correction link parameters, page 131
Setting up NTRIP client, page 142
Setting up the MGC as an inertial navigation system (INS), page 140
Selecting heading input format from a gyro compass, page 139

Using the Ethernet interface

The Ethernet interface allows you to decide how the Processing Unit shall communicate via the internet protocol (IP) network.

Context

Broadcasting is a method of transferring a message to all recipients simultaneously. Unicast transmission is the sending of messages to a single network destination identified by a unique address. Multicast (one-to-many or many-to-many distribution) is group communication where information is addressed to a group of destination computers simultaneously.

Procedure

1. Select the **System** menu > **NAVEngine** > **Standard**.
2. Select **Communication interface** > **Input/Output**.
3. Select the interface you want to set up in the **Input/Output list**.

   Observe that the **Configuration details** parameters appear at the lower part of the page.
4. Select **Ethernet** in the **Type** list.
5. Type a short identification text for the cables connected to the Processing Unit in the **Cable ID** box This is optional.
6. Select the wanted connection type: Broadcast, Unicast or Multicast.
   - **Local interface**: The LAN port on the Processing Unit.
   - **Local port**: When receiving, this is the port on which the unit listens.
   - **Remote port**: When transmitting, this is the port to which the unit sends.
   - **IP address Unicast**: The target IP address, to which the unit is receiving or sending.
   - **IP address Multicast**: The multicast group address. Recommended range: 239.255.000.000 to 239.255.255.255.

   Note:

   It is recommended to use the same port number for both Local and Remote ports.
7. Depending on the connection type you have selected, select which local interface you want to use from the **Local interface** list.
8. Select the properties for the interface you selected in the **Input/Output list**.

Result

You are now ready to set the specific parameters for the interface you have selected. See separate sections for selection details.

Related tasks

Setting up the Telegram out interface, page 129
Setting up the DGNSS correction link parameters, page 131
Setting up NTRIP client, page 142
Setting up the MGC as an inertial navigation system (INS), page 140
Selecting heading input format from a gyro compass, page 139

Required system configuration

Topics

Setting vessel dimensions and reference points

You must define the dimensions and the reference points for the vessel which hosts the Seapath system and the origin of the vessel coordinate system.

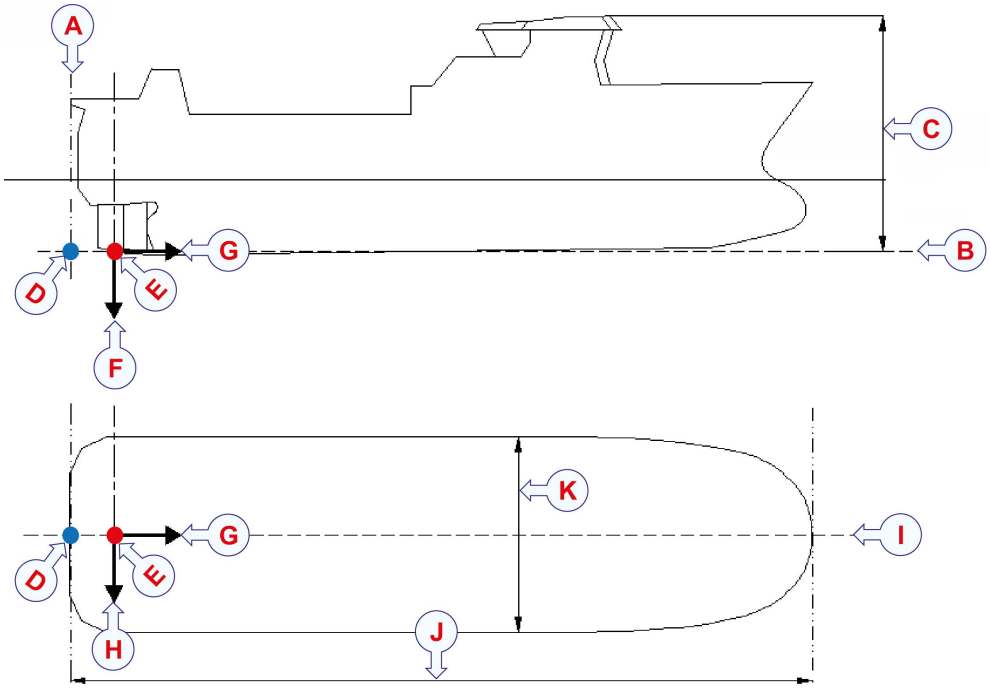
Prerequisites

The navigation reference points you type here must be measured or defined before you start the configuration process.

Context

This is information you need in order to specify correct location of various sensors, equipment and monitoring points on a vessel. The information you enter here will help you later in the configuration process. The drawing is correctly scaled based on the vessel dimensions to make sure that the various points are correctly indicated. The measurement unit of the entered coordinates is metres.

The illustration shows different vessel dimensions and location of origin. If a survey report is available, the vessel origin should be located in the common reference point (CRP) used in the report.



A. *Stern*

B. *Keel*

C. *Overall height*

D. *CRP (common reference point)*

E. *Origin*

F. *+Z axis*

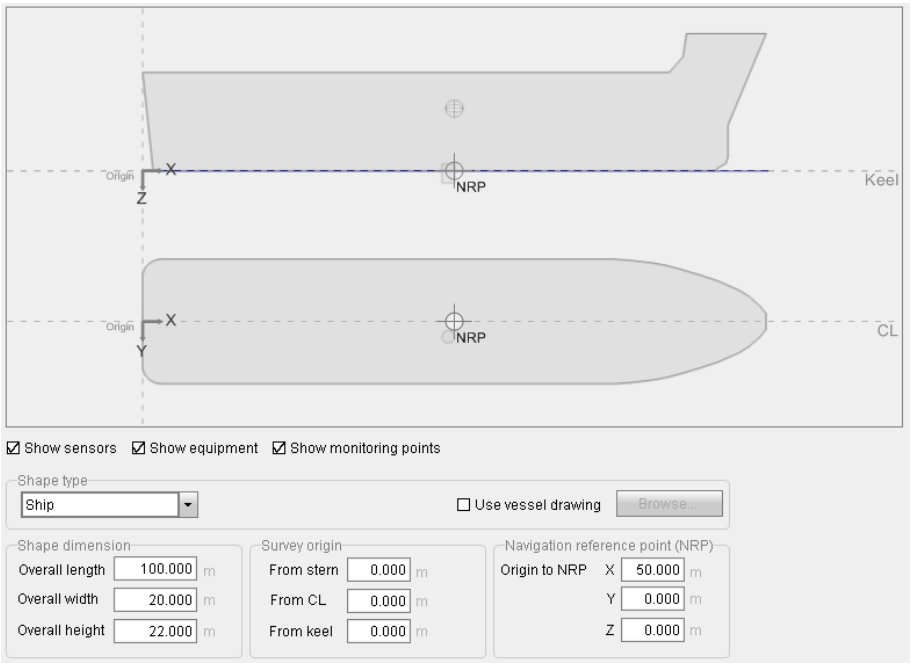
G. *+X axis*

H. *+Y axis*

I. *CL (centre line)*

J. *Overall length*

K. *Overall width*



Procedure

1. Select the **System** menu > **NAVEngine** > **Standard**.
2. Select **Vessel** > **Geometry**.
3. Select the shape of your vessel from the **Shape type** list or select **Use vessel drawing** if you have a specific vessel shape file you want to use. Select the **Browse** button to search for the wanted file.

   If you select **Use vessel drawing**, the **Shape dimension** parameters will be locked.
4. Type the overall length, width and height dimensions of your vessel.
5. Type the parameters for location of origin (survey origin).
6. Type the navigation reference point location, X, Y, Z.
7. Select **Show sensors**, **Show equipment** and/or **Show monitoring points** if you want to display these objects in the vessel illustration.
8. Select **Apply** to save your settings without closing the dialog box.

Related concepts

Determining the system coordinates, page 73
Survey accuracy values, page 75

Related tasks

Entering antenna location parameters, page 104

Related references

Vessel Geometry page, page 206

Entering antenna location parameters

The antenna position is a critical parameter in the system. It is used for Inertial Measurement Unit (IMU) integration and calculation of monitoring points and heading. The antennas are located inside the Sensor Unit.

Prerequisites

The distance vector from the origin to the GNSS antenna #1 has to be measured before you can enter the parameters into the configuration.

The Sensor Unit location parameters have to be measured before you can enter the parameters into the configuration.

- For **Antenna location (from Survey origin)**: The coordinates for the position reference point, X, Y, Z. The distance vector from origin to the position reference point.
- For **Antenna offset (from antenna 1 to antenna 2)**: The mounting angle in heading. The angular offset between the vessel centre line (CL) and the line from the heading reference point #1 to heading reference point #2, called heading offset.

Context

You can either drag and place the antenna symbol in the vessel illustration or you can enter the parameters directly into the table.

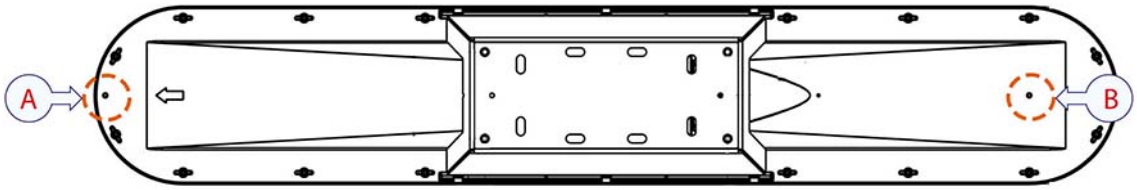
Important:

If you move the antenna after the system has been installed and configured, you must update the distance vector measurements and re-configure the antenna location. This must be done both for the Seapath system and for the connected DP (dynamic positioning) system.

Calibration Wizard

The first time you install the system you can use the **Calibration wizard** to calculate the correct height difference.

The reference points on the Sensor Unit are used to determine the position and orientation of the unit on the vessel where it is mounted.



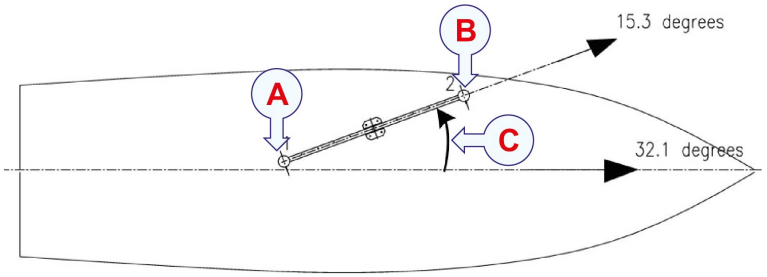
A. *Heading reference point #2*

B. *Position reference point and centre of the internal GNSS antenna no. 1 and Heading reference point #1.*

The location of the two heading reference points is used to determine the mounting angle, or the heading offset. The angular offset between the line from the heading reference point #1 to the heading reference point #2 and the vessel centre line (CL) have to be determined and entered into the NAVEngine Configration as the **Heading offset**.

Heading offset calculation example

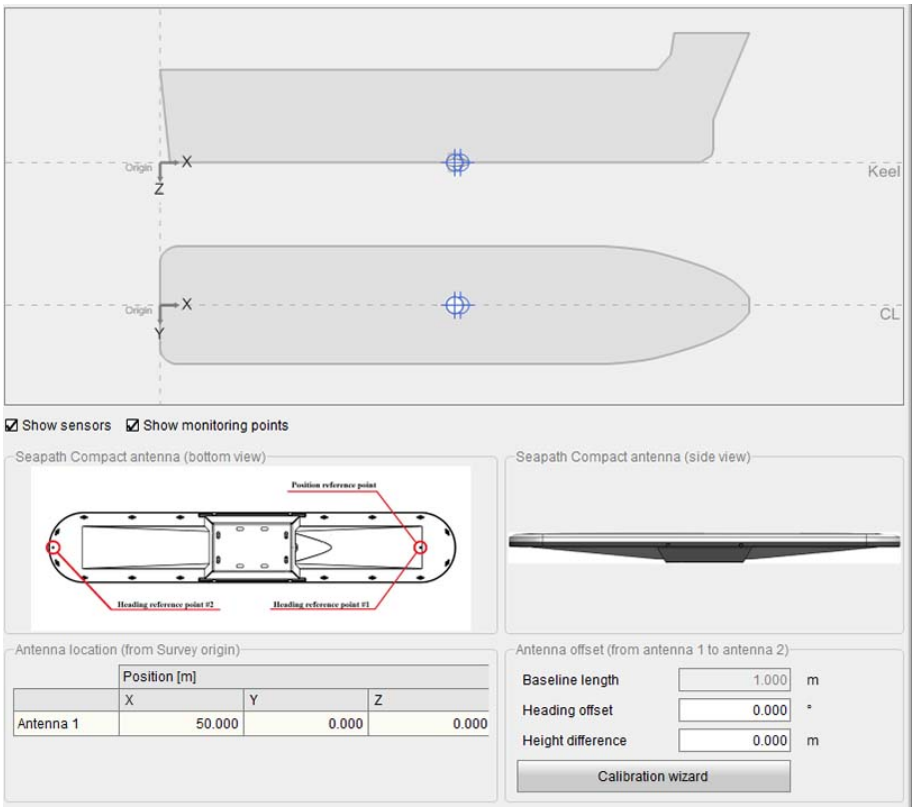
If the reference heading is found to be 32.1 degrees and the GNSS heading after the calibration is 15.3 degrees, the Determined heading offset will be 32.1 - 15.3. Observe that the heading offset is positive counterclockwise, and in the range [0,360> degrees.



A. *Antenna 1*

B. *Antenna 2*

C. *Heading offset*



Procedure

1. Select the **System** menu > **NAV Engine** > **Standard** > **Sensors** > **GNSS** > **Geometry**.
2. Select **Show sensors**, **Show monitoring points** if you want to display these objects in the vessel illustration.
3. Type the surveyed distance vector to the position reference point (Antenna 1), X, Y, Z coordinates, in the table **Antenna location (from Survey origin)**. The value is metres.
4. Type the surveyed **Heading offset** in degrees.
5. Type the **Height difference** in metres.
6. Make sure that the Sensor Unit has been located in the expected spot in the vessel illustration.

   If the Sensor Unit does not appear where you expect it to in the vessel illustration. observe the coordinates entered for Antenna 1, the vessel dimensions and the entered location of origin.
7. Select **Apply** to save your settings without closing the dialog box.

Related concepts

About sensor survey, page 60
Determining the Sensor Unit position and orientation, page 62
Surveying the Sensor Unit, page 70
Determining the system coordinates, page 73
Survey accuracy values, page 75

Related tasks

Setting vessel dimensions and reference points, page 101
Using Calibration Wizard to determine antenna parameters, page 106

Related references

Sensors GNSS Geometry page, page 208

Using Calibration Wizard to determine antenna parameters

You can use the **Calibration Wizard** to determine the heading offset and the antenna height difference for the Sensor Unit.

Prerequisites

Readings of the vessel reference heading data on another computer or by manual readings, have to be available before you start the wizard.

Context

Calibrating the direction of the Sensor Unit against an external reference. The type of reference must be decided according to the required accuracy.

The following calibration parameters have to be determined:

- The **Heading offset**. The direction of the Sensor Unit relative to the vessel's longitudinal axis is measured in degrees.
- The **Height difference**. The height difference between the two internal antennas within the Sensor Unit according to the vessel's horizontal plane is measured in metres. This is the height to Antenna #1 minus the height to Antenna #2, compensated for the vessel's roll and pitch.

It is of crucial importance to calibrate the heading offset correctly. During this calibration, several accurate reference measurements of the vessel heading must be read/logged simultaneously with the heading output from the Seapath. The data logging should continue for at least two hours under calm conditions alongside a quay. The best results are achieved if continuous logging of both the reference system and the Seapath measurements can be performed during the calibration period. If simultaneous logging of the two systems is not possible, one reading from both systems should be done at least every 30 seconds for a minimum of two full hours.

The long calibration time is necessary in order to eliminate errors in the Seapath measurements caused by multipath effects, which may be particularly pronounced in the static conditions of a harbour area.

Note:

*Before you start the **Calibration wizard**, make sure that all configuration changes, including the correct IMU mounting angles, are applied by pressing the **Apply** button on the menu bar. See **Sensors** > **MGC/MRU** > **Geometry** for mounting angles.*

Also, make sure that the roll, pitch and heading measurements are indicated as valid (green) in the top bar of the Seapath user interface before starting the wizard.

Procedure

1. Select the **System** menu > **NAV Engine** > **Standard** > **Sensors** > **GNSS** > **Geometry**.
2. Select the **Calibration Wizard**.

   The system will indicate when the calibration measurements are ready.

3. In page 1, **Input parameters**, you can modify the calibration accuracy and period parameters.
   a. Modify the **Calibration baseline length accuracy** and **Calibration height difference accuracy** values, if needed.

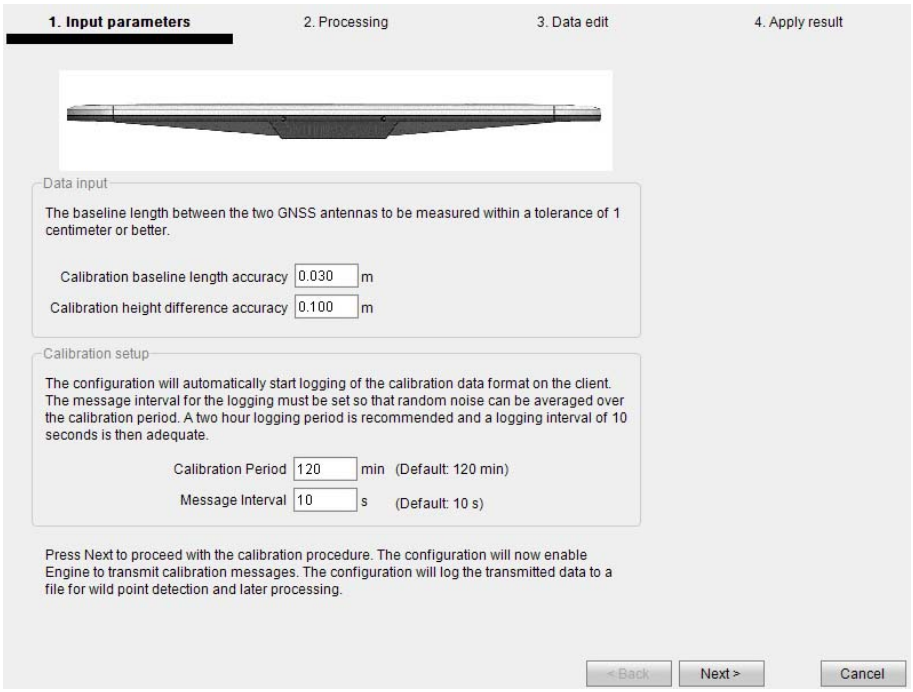
      If calibration measurements are unavailable, select **Cancel** and make sure that the mounting angles are correct and that the roll, pitch and heading measurements are valid.

      Restart the **Calibration Wizard**. The **Next** button will be active as soon as the measurements are ready.

   b. Modify the **Calibration period** and **Message interval**, if needed.

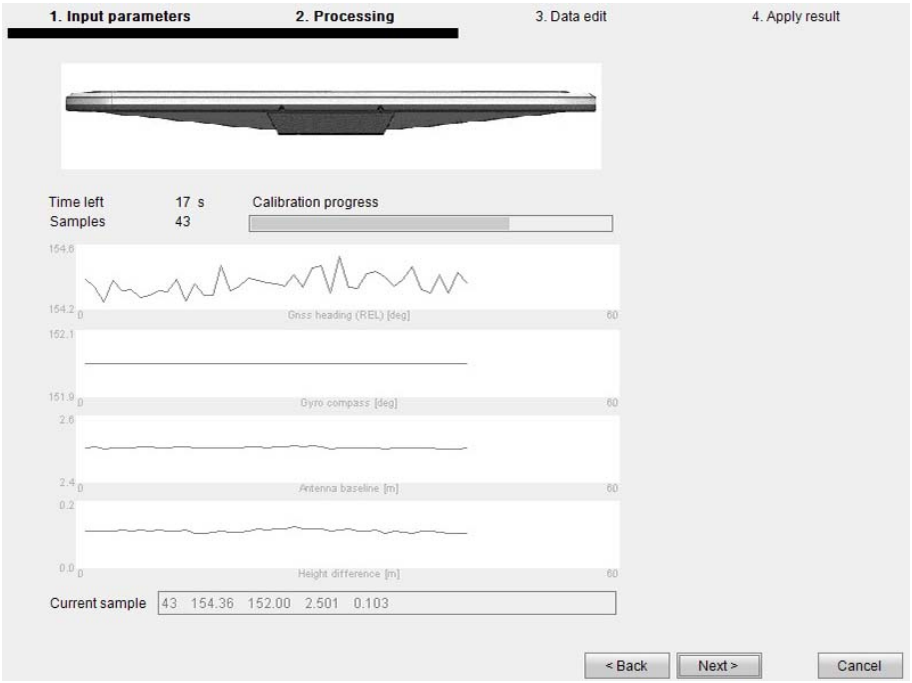
      The default values are recommended.

      Before you select **Next** to start the calibration logging, it is recommended to start recording data of the vessel reference heading on a different computer, or by manual readings.

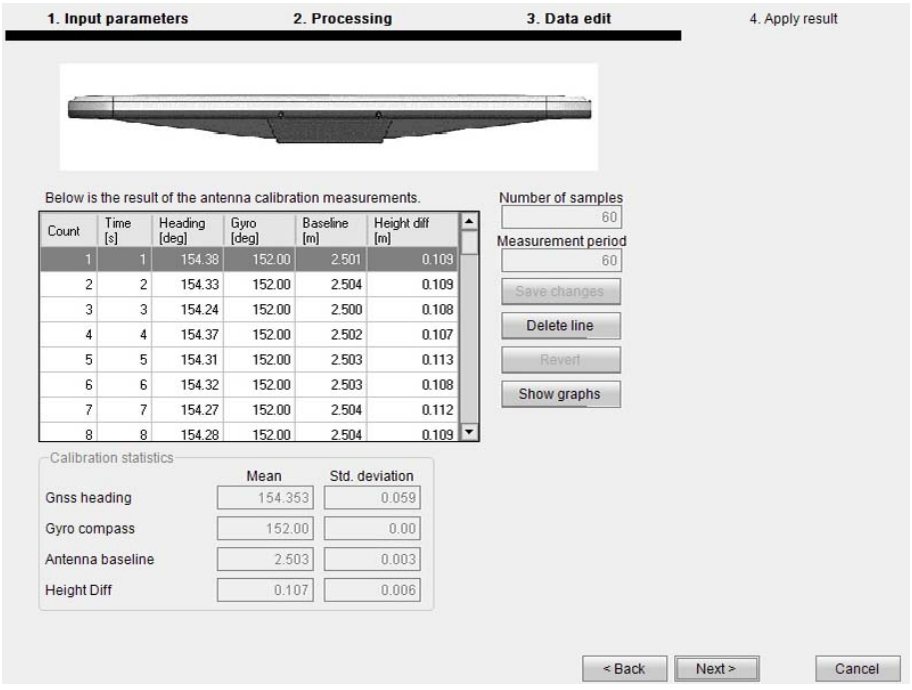


4. Select **Next** to continue to page 2, **Processing**.

   The progress of the logging is indicted on the screen with a graphical presentation of the measured data.



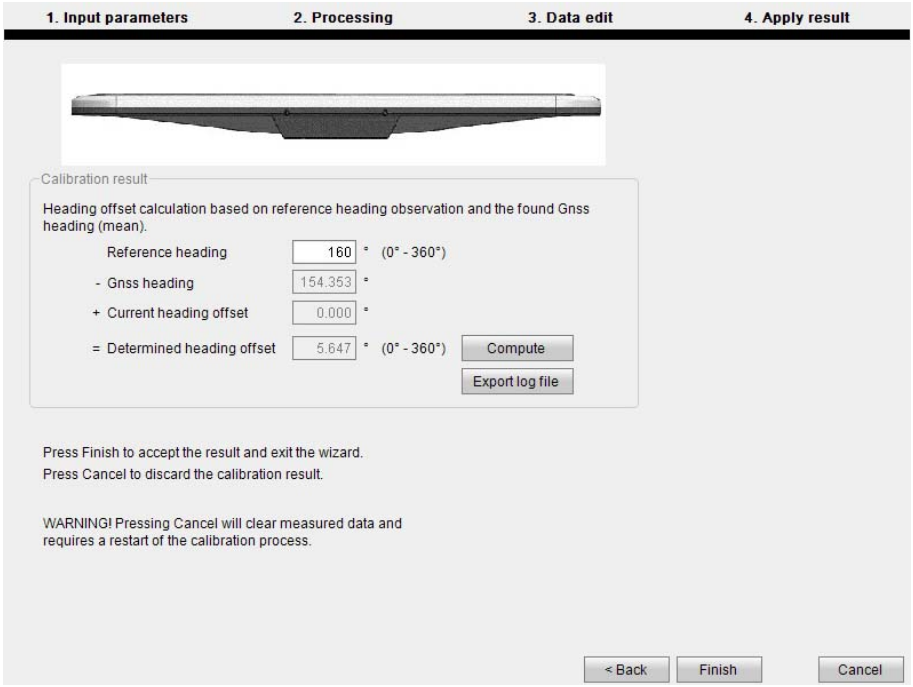
5. Select **Next** to continue to page 3, **Data edit**.
   Under **Data edit** you can inspect the logged data.



Count	Time [s]	Heading [deg]	Gyro [deg]	Baseline [m]	Height diff [m]
1	1	154.38	152.00	2.501	0.109
2	2	154.33	152.00	2.504	0.109
3	3	154.24	152.00	2.500	0.108
4	4	154.37	152.00	2.502	0.107
5	5	154.31	152.00	2.503	0.113
6	6	154.32	152.00	2.503	0.108
7	7	154.27	152.00	2.504	0.112
8	8	154.28	152.00	2.504	0.109

6. Delete possible wild points. Select the corresponding row in the table > **Delete line**.

7. When the calibration result is acceptable, select **Next** to continue to page 4, **Apply result**.



8. Enter the mean value for the vessel **Reference heading**.
9. Select **Compute** to calculate the heading offset.
10. Select **Export log** if you want the calibration data for post processing.
11. Select **Finish** to accept the result and exit the **Calibration Wizard**.

    The **Baseline length**, **Heading offset** and **Height difference** values are automatically updated upon successful completion of the wizard.
12. Select **Apply** at the top of the dialog box to save the calibration information.

Related concepts

Survey accuracy values, page 75

Related tasks

Entering antenna location parameters, page 104

Related references

Sensors GNSS Geometry page, page 208

Setting MRU location and mounting angles

The physical location of the MRU relative to the origin and its mounting angles is required for the Seapath system to be able to calculate position, roll, pitch and heading correctly.

Prerequisites

For accurate location of the MRU (Motion Reference Unit) a survey has to be carried out.

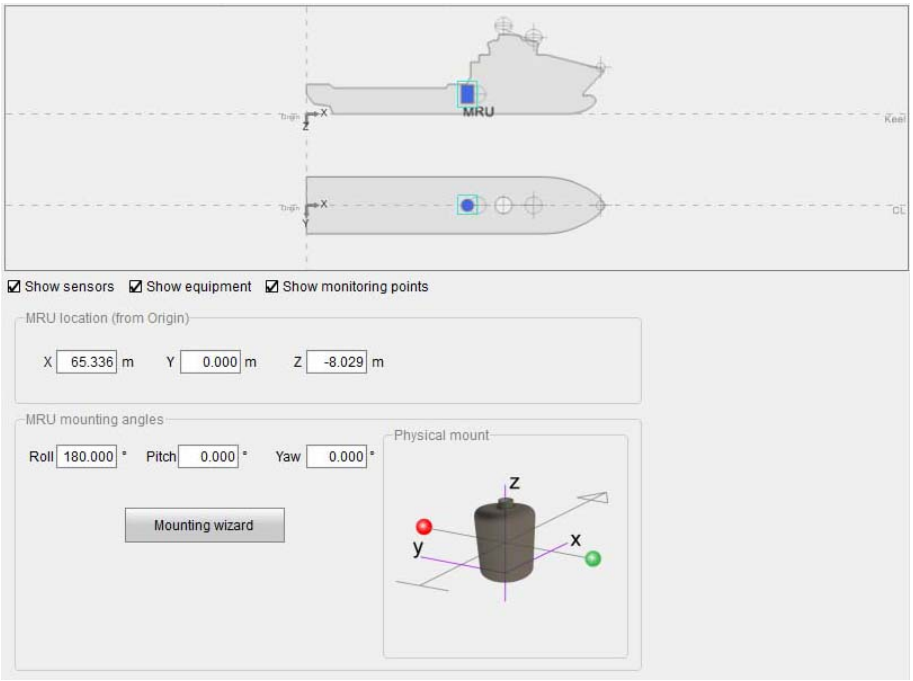
Context

The MRU measures the roll, pitch, yaw and heave motions of the vessel.Under **MRU Geometry** you must define the physical location of the unit related to the origin location you created under **Vessel Geometry**.

In the **MRU Geometry** page you enter the MRU location parameters, the X, Y and Z coordinates in meters, and the MRU mounting angles, the roll, pitch and yaw parameters in degrees. Look at the vessel illustration in the page to help you enter the correct signs for the coordinates. The illustration will show if the MRU appears at the expected location on the vessel.

If something looks out of place, check the signs and X, Y, Z coordinates you typed for the unit location and/or return to the **Vessel Geometry** page and check the vessel shape dimensions, the origin location and the navigation reference point (NRP) location.

The MRU mounting angles can either be input manually or determined by use of the Mounting wizard.The Mounting Wizard is located in the **NAV Engine Configuration** > **Sensors** > **MRU** > **Geometry**.



Procedure

1. Select the **System** menu > **NAV Engine** > **Standard** > **Sensors** > **MRU** > **Geometry**.
2. Type the X, Y and Z coordinates in metres from Origin to the unit location.
3. Type the unit's mounting angles in degrees for roll, pitch and yaw.

   If the mounting angle values are not known to you, use the Mounting Wizard to calculate these values.
4. Select **Apply** to save your settings without closing the dialog box.

Related concepts

About sensor survey, page 60
Determining the MRU mounting orientation, page 64
Surveying the MRU subsea bottle, page 70
Determining the system coordinates, page 73
Survey accuracy values, page 75

Related tasks

Using Mounting Wizard to determine MRU mounting angles, page 112

Related references

Sensors MRU Geometry page, page 210

Using Mounting Wizard to determine MRU mounting angles

Use the Mounting Wizard to determine the roll, pitch and yaw mounting angles in degrees for the MRU.

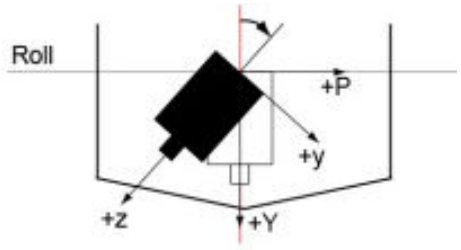
Prerequisites

The MRU mounting bracket offset angles have to be available from a survey report or through other methods with similar accuracy.

Context

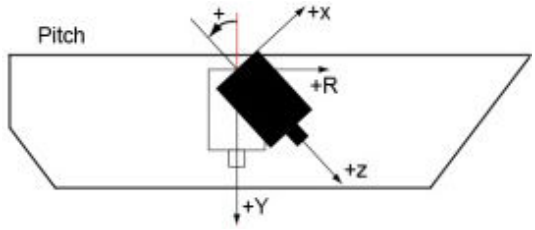
The mounting bracket offset angles which have to be entered are roll, pitch and yaw.

Roll offset angle
: The angle between the ship's Y-axis and the projection of the unit's z-axis in the ship’s PY-plane. Positive roll offset angle if the bracket tilts to starboard.



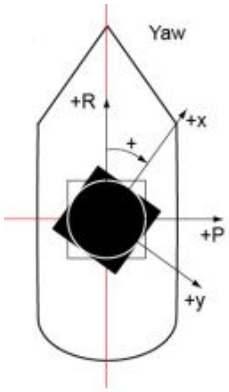
Pitch offset angle

The angle between the ship’s Y-axis and the projection of the unit's z-axis in the ship’s RY-plane. Positive pitch offset angle if the bracket tilts to stern.



Yaw offset angle

The angle between the ship’s R-axis and the projection of the unit's x-axis in the ship’s RP-plane. Positive yaw offset angle if the bracket is rotated clockwise.



Note:

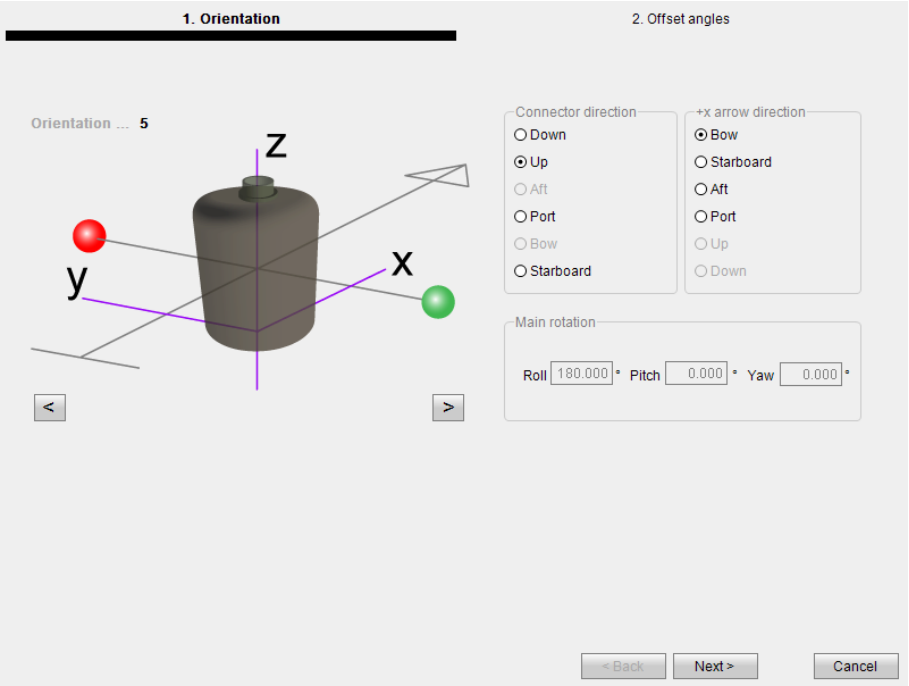
If the mounting bracket offset angles exceed 45 degrees, another main rotation should be selected.

Procedure

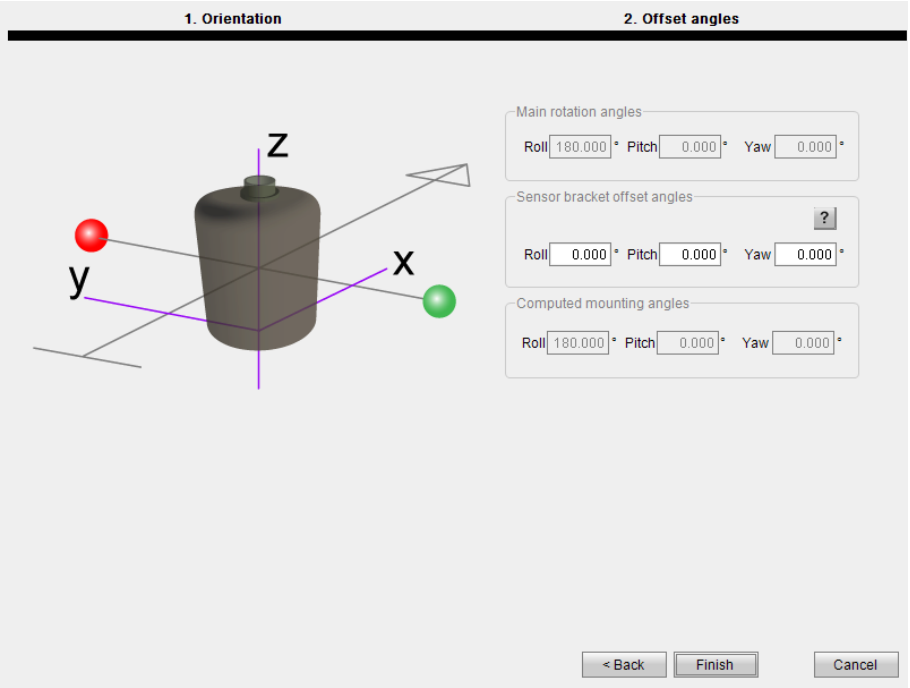
1. Select the **System** menu > **NAV Engine** > **Standard** > **Sensors** > **MRU** > **Geometry**.
2. Select the `Mounting Wizard` button and use the wizard to calculate the roll, pitch and yaw mounting angles.

   The red circle indicates Port. The green circle indicates Starboard. The arrow points in the bow direction.

3. In step 1, **Orientation**, you shall determine the orientation of the unit. There are two ways to determine the orientation.
   a. Select the < or > buttons to turn the unit around in 90-degree steps, axis by axis. Click until the correct mounting orientation of the unit has been found.
      Observe that the parameters for roll, pitch and yaw under**Main rotation** are automatically updated with the actual main rotation of the unit.
   b. Select the **Connector direction** options or the **+x arrow direction** options to select the unit orientation.



4. Select `Next` to continue to step 2, **Offset angles**.
   Observe that the roll, pitch and yaw mounting angles are now indicated under **Main rotation angles**.
5. Type the surveyed unit bracket offset angles in degrees for roll, pitch and yaw.
   The system calculates the mounting angles automatically and the values appear under **Computed mounting angles**.



6. Select `Finish` when you are ready to complete the offset angle setting.
   This will exit the wizard and take you back to the initial **MRU Geometry** page.
7. Select **Apply** to save your settings without closing the dialog box.

Related concepts

Survey accuracy values, page 75

Related tasks

Setting MRU location and mounting angles, page 111

Related references

Sensors MRU Geometry - Mounting Wizard, page 211

Setting MGC location and mounting angles

The physical location of the MGC relative to the origin and its mounting angles is required for the Seapath system to be able to calculate position, roll, pitch and heading correctly.

Prerequisites

For accurate location of the MGC (Motion Sensor and Gyro Compass) a survey has to be carried out.

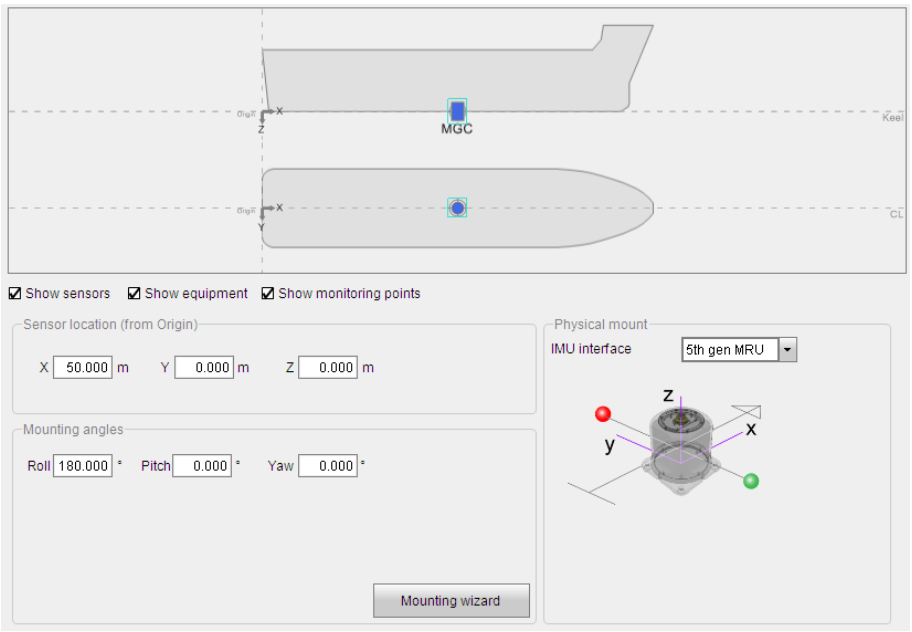
Context

The MGC measures the roll, pitch, yaw and heave motions of the vessel. Under **MGC Geometry** you must define the physical location of the unit related to the origin location you created under **Vessel Geometry**.

In the **MGC Geometry** page you enter the MGC location parameters, the X, Y and Z coordinates in meters, and the MGC mounting angles, the roll, pitch and yaw parameters in degrees. Look at the vessel illustration in the page to help you enter the correct signs for the coordinates. The illustration will show if the MGC appears at the expected location on the vessel.

If something looks out of place, check the signs and X, Y, Z coordinates you typed for the unit location and/or return to the **Vessel Geometry** page and check the vessel shape dimensions, the origin location and the navigation reference point (NRP) location.

The MGC mounting angles can either be input manually or determined by use of the Mounting wizard. The Mounting Wizard is located under **NAV Engine Configuration** > **Sensors** > **MGC** > **Geometry**.



Procedure

1. Select the **System** menu > **NAV Engine** > **Standard** > **Sensors** > **MGC** > **Geometry**.
2. Select the type of unit which is connected to your vessel.
3. Type the X, Y and Z coordinates in metres from Origin to the unit location.
4. Type the unit's mounting angles in degrees for roll, pitch and yaw.

   If the mounting angle values are not known to you, use the Mounting Wizard to calculate these values.
5. Select **Apply** to save your settings without closing the dialog box.

Related concepts

About sensor survey, page 60
Determining the MGC mounting orientation, page 67
Surveying the MGC subsea bottle, page 71
Determining the system coordinates, page 73
Survey accuracy values, page 75

Related tasks

Using Mounting Wizard to determine MGC mounting angles, page 117

Related references

Sensors MGC Geometry page, page 214

Using Mounting Wizard to determine MGC mounting angles

Use the Mounting Wizard to determine the roll, pitch and yaw mounting angles in degrees for the MGC.

Prerequisites

The MGC offset angles have to be available from a survey report or through other methods with similar accuracy.

Context

The mounting bracket offset angles which have to be entered are roll, pitch and yaw.

Note:

If the mounting bracket offset angles exceed 45 degrees, another main rotation should be selected.

Procedure

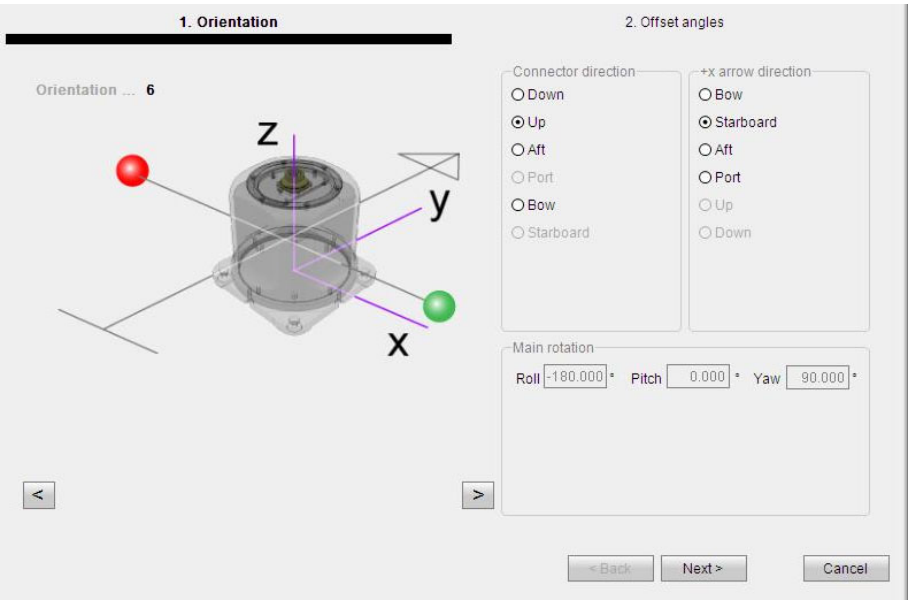
1. Select the **System** menu > **NAV Engine** > **Standard** > **Sensors** > **MGC** > **Geometry**.
2. Select the `Mounting Wizard` button and use the wizard to calculate the roll, pitch and yaw mounting angles.

   The red circle indicates Port. The green circle indicates Starboard. The arrow points in the bow direction.

3. In step 1, **Orientation**, you shall determine the orientation of the unit. There are two ways to determine the orientation.
   a. Select the < or > buttons to turn the unit around in 90-degree steps, axis by axis. Click until the correct mounting orientation of the unit has been found.

      Observe that the parameters for roll, pitch and yaw under**Main rotation** are automatically updated with the actual main rotation of the unit.

   b. Select the **Connector direction** options or the **+x arrow direction** options to select the unit orientation.

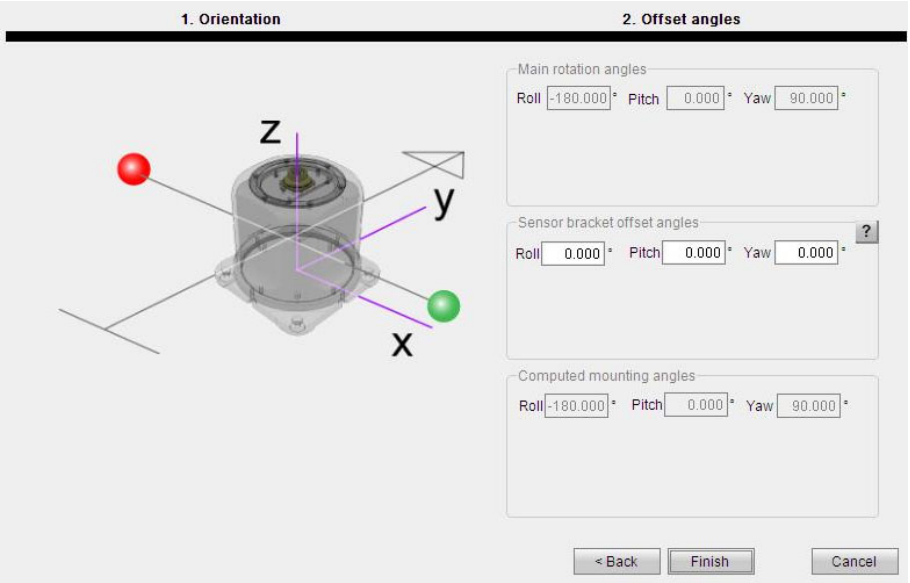


4. Select `Next` to continue to step 2, **Offset angles**.

   Observe that the roll, pitch and yaw mounting angles are now indicated under **Main rotation angles**.

5. Type the surveyed unit bracket offset angles in degrees for roll, pitch and yaw.

   The system calculates the mounting angles automatically and the values appear under **Computed mounting angles**.



6. Select `Finish` when you are ready to complete the offset angle setting.
   This will exit the wizard and take you back to the initial **MGC Geometry** page.
7. Select **Apply** to save your settings without closing the dialog box.

Related concepts

Survey accuracy values, page 75

Related tasks

Setting MGC location and mounting angles, page 115

Related references

Sensors MGC Geometry - Mounting Wizard, page 215

Setting miniMRU location and mounting angles

The physical location of the miniMRU relative to the origin and its mounting angles is required for the Seapath system to be able to calculate position, roll, pitch and heading correctly.

Prerequisites

For accurate location of the MRU (Motion Reference Unit) a survey has to be carried out. You will need detailed vessel drawings.

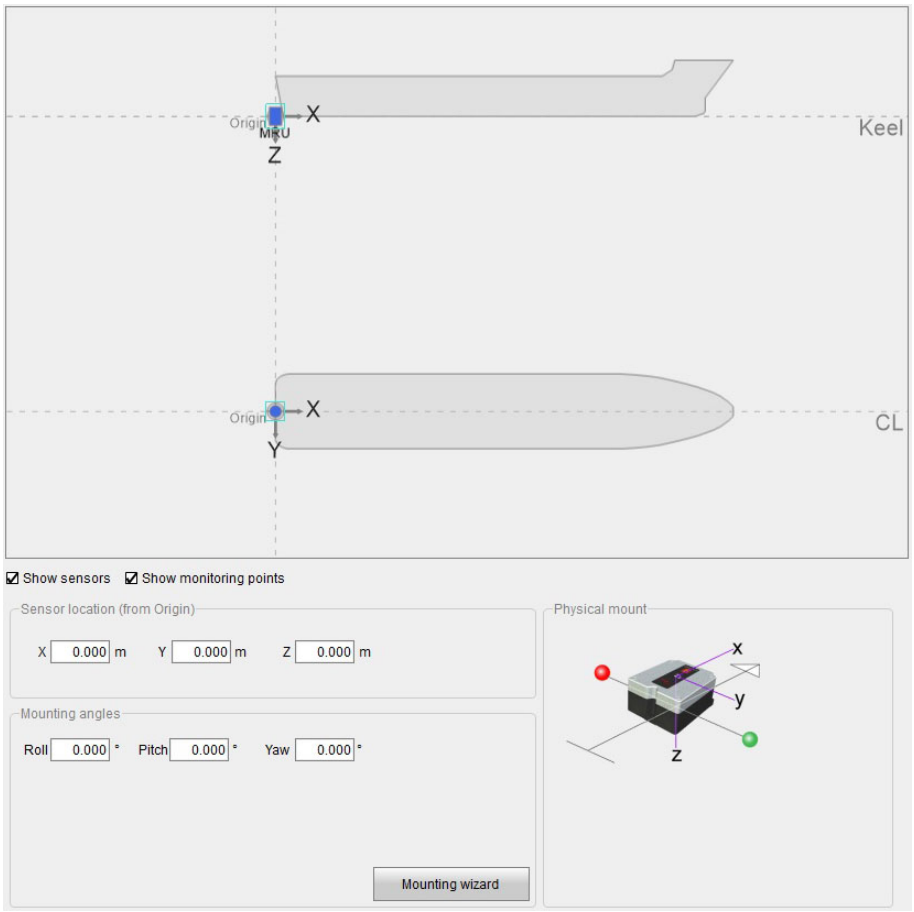
Context

The MRU measures the roll, pitch, yaw and heave motions of the vessel.Under **MRU Geometry** you must define the physical location of the unit related to the origin location you created under **Vessel Geometry**.

In the **MRU Geometry** page you enter the MRU location parameters, the X, Y and Z coordinates in meters, and the MRU mounting angles, the roll, pitch and yaw parameters in degrees. Look at the vessel illustration in the page to help you enter the correct signs for the coordinates. The illustration will show if the MRU appears at the expected location on the vessel.

If something looks out of place, check the signs and X, Y, Z coordinates you typed for the unit location and/or return to the **Vessel Geometry** page and check the vessel shape dimensions, the origin location and the navigation reference point (NRP) location.

The MRU mounting angles can either be input manually or determined by use of the Mounting wizard.The Mounting Wizard is located in the **NAV Engine Configuration** > **Sensors** > **MRU** > **Geometry**.



Procedure

1. Select the **System** menu > **NAV Engine** > **Standard** > **Sensors** > **MRU** > **Geometry**.
2. Type the X, Y and Z coordinates in metres from Origin to the unit location.
3. Type the unit's mounting angles in degrees for roll, pitch and yaw.

   If the mounting angle values are not known to you, use the Mounting Wizard to calculate these values.

4. Select **Apply** to save your settings without closing the dialog box.

Related concepts

About sensor survey, page 60
Determining the miniMRU mounting orientation, page 69
Surveying the miniMRU subsea housing, page 72
Determining the system coordinates, page 73
Survey accuracy values, page 75

Related tasks

Using Mounting Wizard to determine miniMRU mounting angles, page 121

Related references

Sensors MRU Geometry page, page 210

Using Mounting Wizard to determine miniMRU mounting angles

Use the Mounting Wizard to determine the roll, pitch and yaw mounting angles in degrees for the MRU.

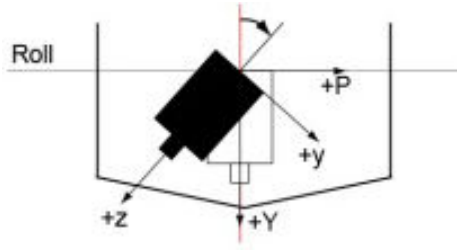
Prerequisites

The MRU mounting bracket offset angles have to be available from a survey report or through other methods with similar accuracy.

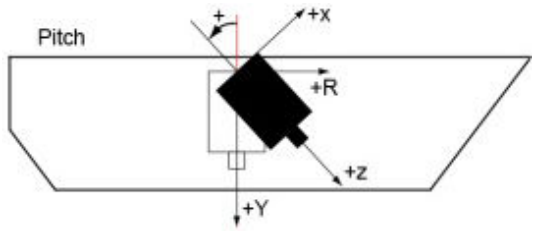
Context

The mounting bracket offset angles which have to be entered are roll, pitch and yaw.

Roll offset angle
: The angle between the ship's Y-axis and the projection of the unit's z-axis in the ship’s PY-plane. Positive roll offset angle if the bracket tilts to starboard.

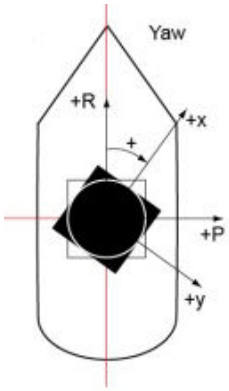


Pitch offset angle
: The angle between the ship’s Y-axis and the projection of the unit's z-axis in the ship’s RY-plane. Positive pitch offset angle if the bracket tilts to stern.



Yaw offset angle

The angle between the ship's R-axis and the projection of the unit's x-axis in the ship's RP-plane. Positive yaw offset angle if the bracket is rotated clockwise.



Note:

If the mounting bracket offset angles exceed 45 degrees, another main rotation should be selected.

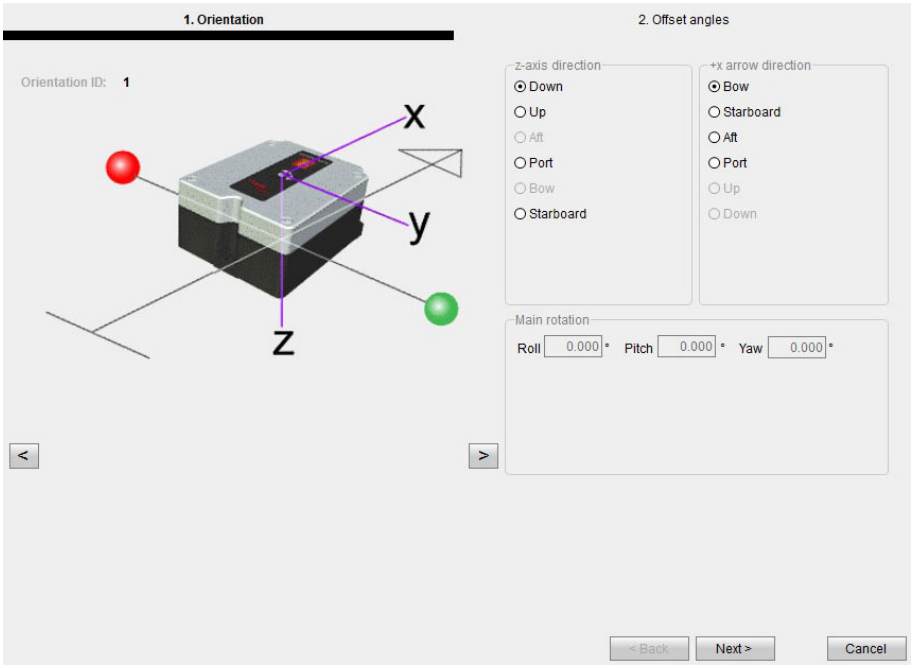
Procedure

1. Select the **System** menu > **NAV Engine** > **Standard** > **Sensors** > **MRU** > **Geometry**.
2. Select the `Mounting Wizard` button and use the wizard to calculate the roll, pitch and yaw mounting angles.

   The red circle indicates Port. The green circle indicates Starboard. The arrow points in the bow direction.
3. In step 1, **Orientation**, you shall determine the orientation of the unit. There are two ways to determine the orientation.
   a. Select the < or > buttons to turn the unit around in 90-degree steps, axis by axis. Click until the correct mounting orientation of the unit has been found.

      Observe that the parameters for roll, pitch and yaw under**Main rotation** are automatically updated with the actual main rotation of the unit.

   b. Select the **Connector direction** options or the **+x arrow direction** options to select the unit orientation.

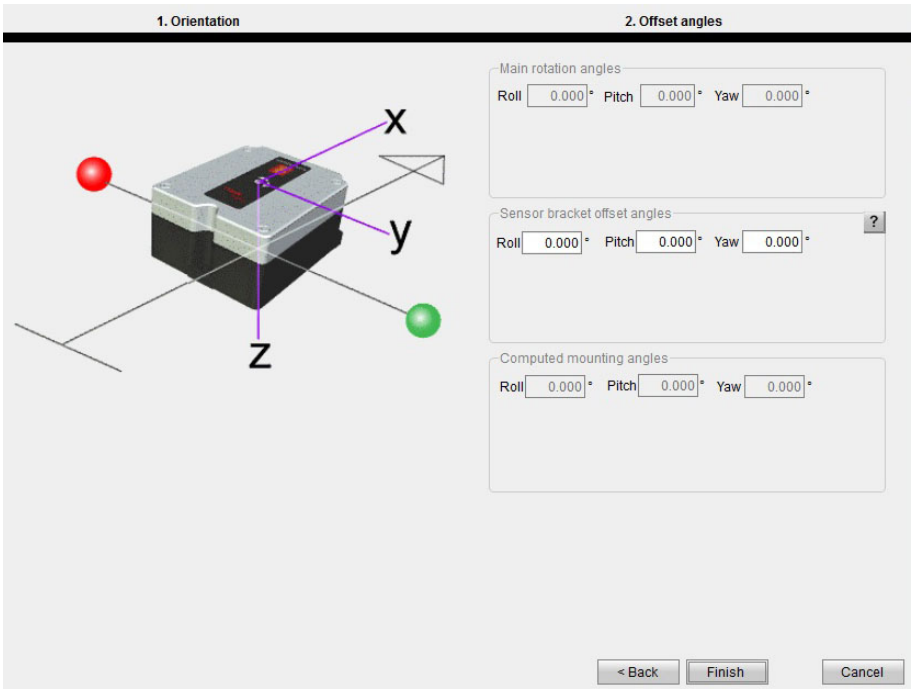


4. Select Next to continue to step 2, **Offset angles**.

   Observe that the roll, pitch and yaw mounting angles are now indicated under **Main rotation angles**.

5. Type the surveyed unit bracket offset angles in degrees for roll, pitch and yaw.

   The system calculates the mounting angles automatically and the values appear under **Computed mounting angles**.



6. Select `Finish` when you are ready to complete the offset angle setting.
   This will exit the wizard and take you back to the initial **MRU Geometry** page.
7. Select **Apply** to save your settings without closing the dialog box.

Related concepts

Survey accuracy values, page 75

Related tasks

Setting miniMRU location and mounting angles, page 119

Related references

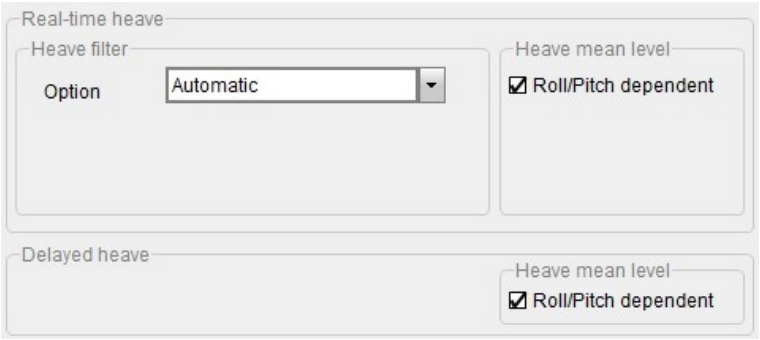
Sensors MRU Geometry - Mounting Wizard, page 211

Selecting heave filter options

The heave configuration parameters allow you to tune the heave parameters to the vessel motion characteristics for the actual weather conditions. This is important when using real-time heave measurements in order to achieve optimum heave performance.

Context

Before a survey and/or during operation check the heave performance and tune the heave parameters until the best heave performance is achieved. An alternative is to select **Automatic** or **GNSS aided** and let the system automatically choose the best settings.



Procedure

1. Select the **System** menu > **NAVEngine** > **Standard** > **Sensors** > **MGC/MRU** > **Heave config**.
2. Select the **heave filter** mode you want to use from the **Options** list.
3. If you select **Hydrographic survey** or **General purpose**, type the wanted filter period.
   Values are between 1 and 25 seconds.

Or you can select **Automatic** or **GNSS aided** for the system to estimate the heave filter parameters.

4. Select the **Roll/Pitch dependent** box if you want the heave measurements dependent on the roll and pitch measurements.

   There are separate selections for the real time heave and the delayed heave (PFreeHeave).

5. Select **Apply** to save your settings without closing the dialog box.

Related references

Sensors MRU/MGC Heave config page, page 218

Setting monitoring points

You must define the locations on the vessel for which you want the system to calculate the position.

Prerequisites

To get exact coordinates from origin to each monitoring point, each monitoring point has to be measured or calculated based upon drawings or previously measured points.

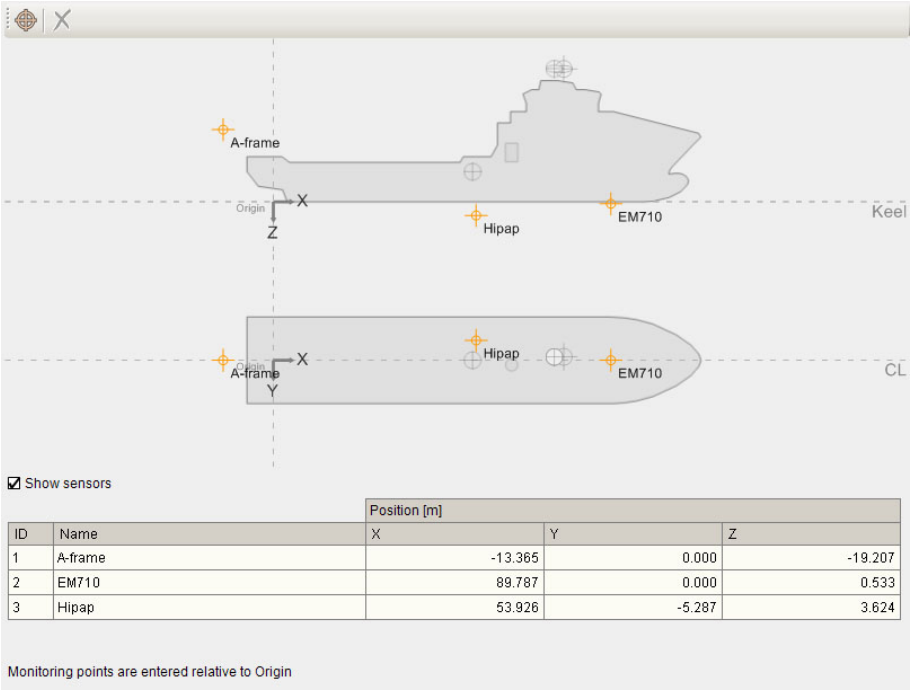
Context

You must define points (monitoring points) on the vessel where you want the position measurements to be output. The monitoring points are given relative to origin (positive forward, towards starboard and down). The position of a monitoring point relative to the origin is indicated in the vessel illustration when the cursor is over the monitoring point. As soon as a monitoring point has been defined, its location is indicated in the vessel illustration. If a monitoring point appears incorrect, check the signs and the coordinates input for each monitoring point and the vessel dimensions and the entered location of origin in the **Vessel Geometry** page.

The system supports up to eight user definable monitoring points.

Deleting a monitoring point

You can delete a monitoring point by selecting the wanted point in the table and clicking the `Delete` button,  .

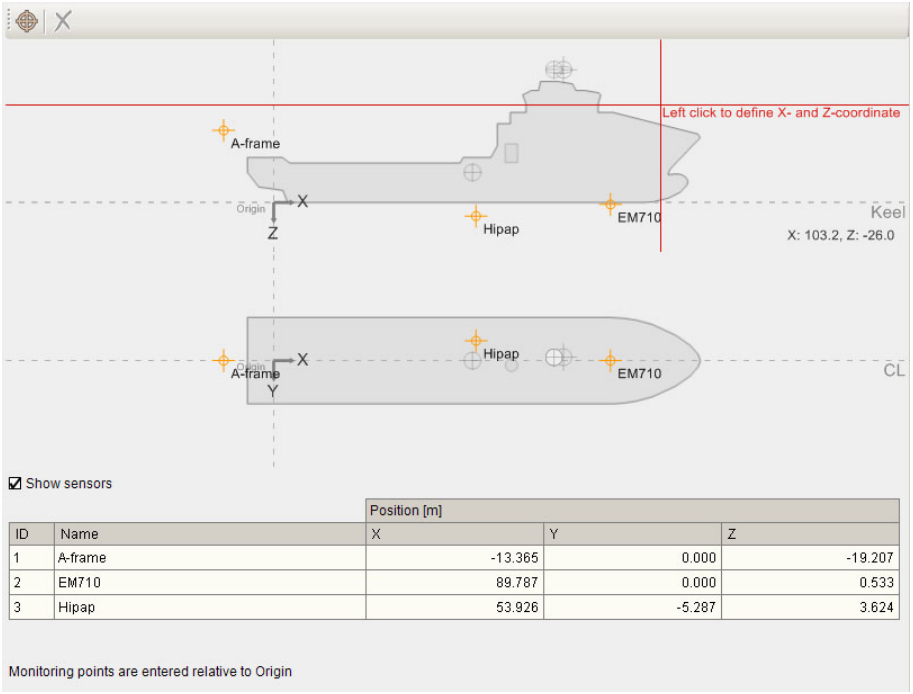


Procedure

1. Select the **System** menu > **NAV Engine** > **Standard** > **Monitoring points** > **Geometry**.

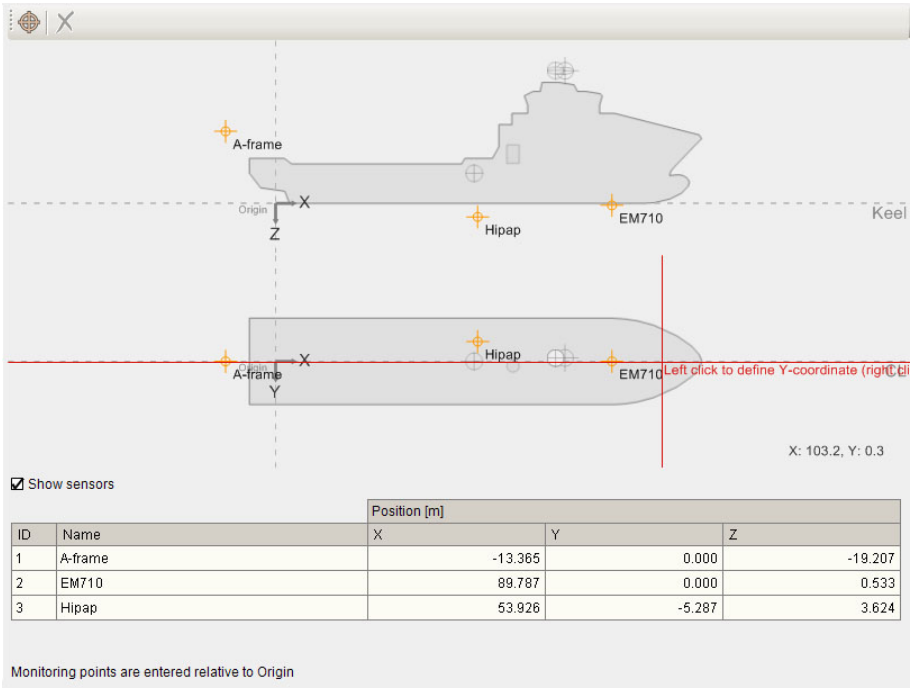
2. Select the Add button  at the top of the page to add a monitoring point.
   Observe that the cursor changes to two red lines which will help you to place the new monitoring point in the vessel illustration.

3. Drag the cursor to the location on the upper vessel illustration where you want to add the X and Z coordinates for your monitoring point and left-click the mouse button.



4. Continue and drag the cursor to the location in the lower vessel illustration where you want to add the **Y** coordinate for your monitoring point and left-click the mouse button.

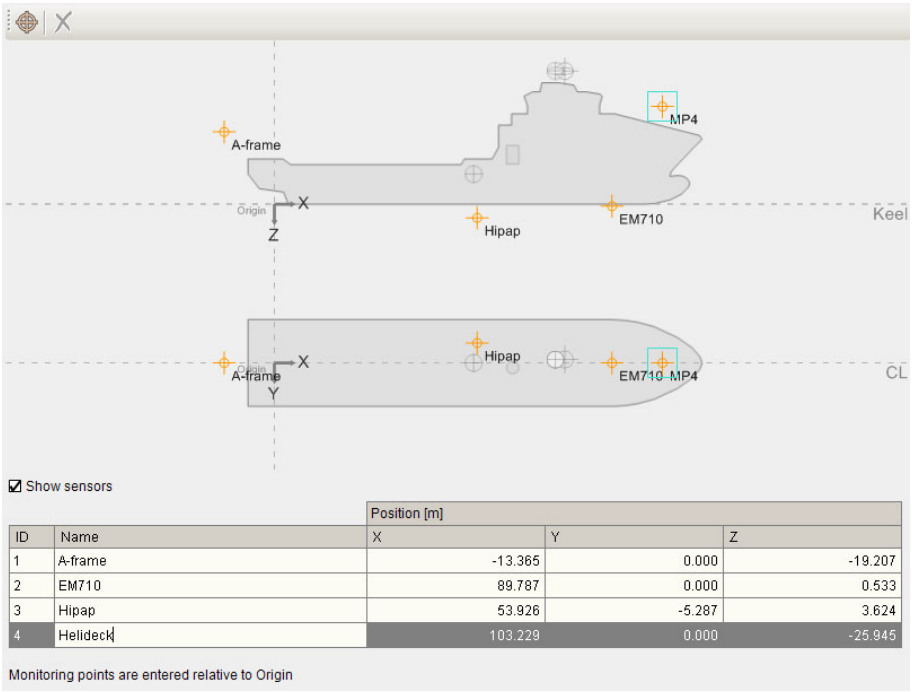
   Observe that the coordinates for the new monitoring point appear in the monitoring points table. The table will also help you to get the wanted location for your monitoring point.



		Position [m]		
ID	Name	X	Y	Z
1	A-frame	-13.365	0.000	-19.207
2	EM710	89.787	0.000	0.533
3	Hipap	53.926	-5.287	3.624

Monitoring points are entered relative to Origin

5. Select the **Name** column in the table and type an identifying name for your monitoring point. Press `Enter` to confirm.



		Position [m]		
ID	Name	X	Y	Z
1	A-frame	-13.365	0.000	-19.207
2	EM710	89.787	0.000	0.533
3	Hipap	53.926	-5.287	3.624
4	Helideck	103.229	0.000	-25.945

Monitoring points are entered relative to Origin

6. Select the **X**, **Y** and **Z** columns and adjust the coordinates by typing the exact location of the monitoring point. If necessary. Press `Enter` to confirm.

7. Select **Apply** to save your settings without closing the dialog box.

Related concepts

Determining the system coordinates, page 73
Survey accuracy values, page 75

Related references

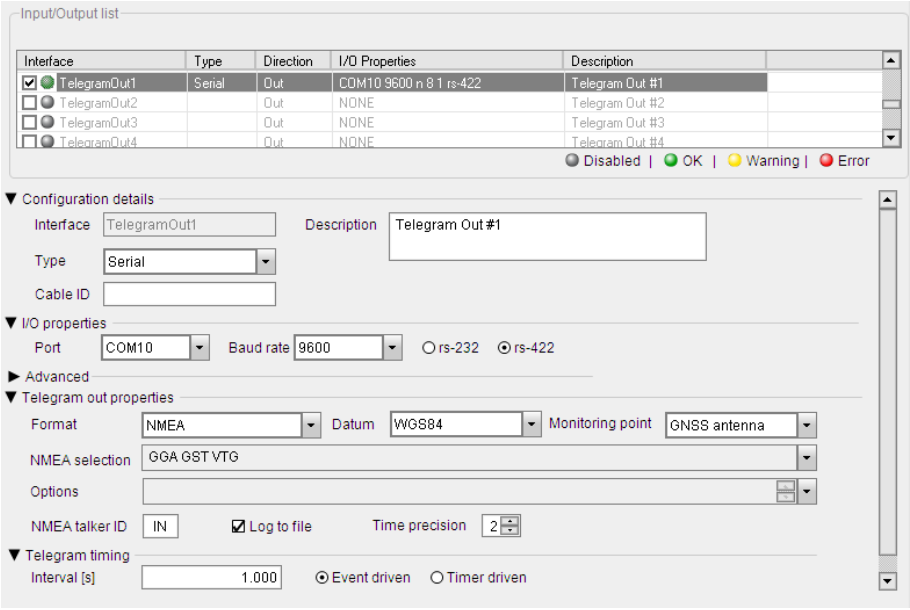
Monitoring points Geometry page, page 219

Setting up the Telegram out interface

The **TelegramOut** function allows you to enable and set up data messages transmitted to external equipment.

Context

Up to 16 serial and/or network interfaces can be configured.



Procedure

1. Select the **System** menu > **NAV Engine** > **Standard** > **Communication interface** > **Input/Output**.
2. Select the **TelegramOut** interface you want to set up in the **Input/Output list**.

   Observe that the **Configuration details** parameters appear at the lower part of the page.
3. Select either **Ethernet** or **Serial** in the **Type** list.

   Enter the appropriate parameters for the selected interface type.
4. Continue to **Telegram out properties.**.

5. Select the wanted output telegram format from the **Format** list.
   If you select NMEA as telegram format, the **NMEA selection** list becomes active.
6. If NMEA is selected, select the wanted NMEA telegrams to use from the **NMEA** list.
7. Select the wanted datum format from the **Datum** list.
8. Select the wanted monitoring point from the **Monitoring point** list.
9. Type the talker ID of NMEA messages sent from this output in the **NMEA talker ID** box.
   The default value is IN for systems with an Inertial Measurement Unit (IMU) connected. The default value is GP for systems without an IMU connected.
10. Select the **Log to file** box if you want to log the measurements to file internally in the Seapath system.
11. Select the wanted number of decimals in the time field in the NMEA telegrams containing time information from the **Time precision** box
12. Under **Telegram timing**, type the wanted output interval for the messages.
    - **Event driven**: This parameter outputs data only when the data are calculated or when a change occurs. Output data are delayed.
    - **Timer driven**: This is the interval between each sample, Type the wanted interval in seconds in the **Interval** box. The range is 0.01 to 3000 seconds.
13. Select **Apply** to save the settings.

Related concepts

General Seapath configuration for PHS, page 84
Setting up Seapath for SIS version 4 users, page 87
Setting up Seapath for K-Controller users (SIS version 5), page 89

Related tasks

Communication interface description, page 97
Using the Serial interface, page 99
Using the Ethernet interface, page 100

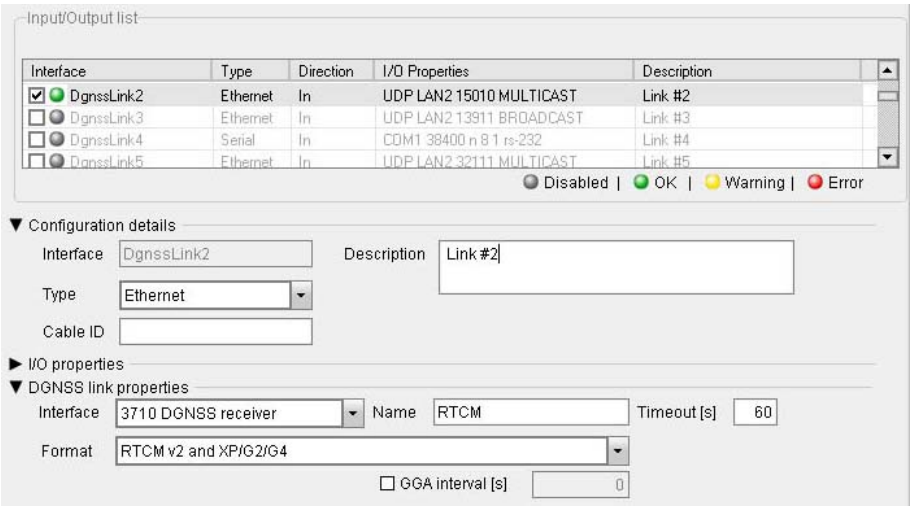
Related references

Communication interface - TelegramOut interface page, page 223

Setting up the DGNSS correction link parameters

You can set up the system to receive various types of corrections which will improve the position accuracy.

Context



Procedure

1. Select the **System** menu > **NAV Engine** > **Standard** > **Communication interface** > **Input/Output**.
2. Select the **DGNSSLink** interface you want to set up in the **Input/Output list**.
   Observe that the **Configuration details** parameters appear at the lower part of the page.
3. Select either **Serial** or **Ethernet** in the **Type** list.
   Enter the appropriate parameters for the selected interface type.
4. Continue to **DGNSS link properties**.
5. Select the wanted interface from the **Interface** list.
   The content of the **Format** list will depend on this selection.
6. Select the wanted format from the **Format** list.
7. Type the name of the DGNSS correction link.
   This name will be displayed in the DGNSS link status bar at the bottom of View 1.
8. Type the correction **Timeout** age limit in seconds.
   If the age of the corrections exceeds this limit, the corrections are invalid.
9. Select the **GGA Interval** box if you want the system to send GGA messages to the DGNSS receiver. Type the wanted interval in seconds between the telegrams.
10. Select **Apply** to save the settings.

Related concepts

General Seapath configuration for PHS, page 84

Related tasks

Communication interface description, page 97
Using the Serial interface, page 99
Using the Ethernet interface, page 100

Related references

Communication interface - DgnssLink interface page, page 226

Changing the Sensor Unit IP address

You must enter the Internet Protocol (IP) address for the Sensor Unit so it can communicate on the local area network (LAN).

Context

Under **Interface settings** you can modify the IP address of the physical interface selected in the **Interface** list.

The Sensor Unit communicates with the operator software using multicast UDP/IP. Any client may join the configured multicast group provided that the network hardware between the Sensor Unit and the client supports multicast forwarding.

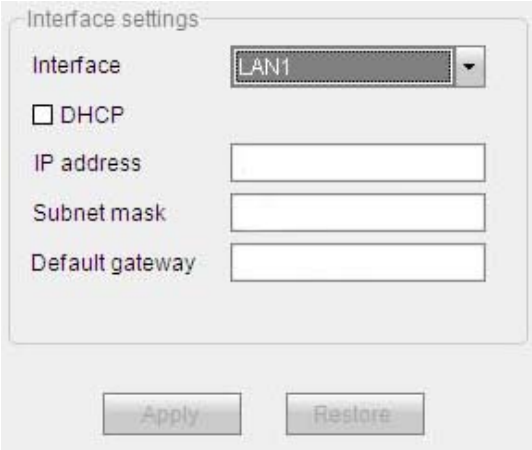
The default IP address for the Sensor Unit is: 192.168.1.10

The default multicast address for the Sensor Unit is: 239.255.0.3.

The default subnet mask for the Sensor Unit is: 255.255.255.0.

The computer which runs the operating software needs to be on the same subnet. Unless the IP address of the Sensor Unit is changed, the valid IP address for the computer would be 192.168.1.0-255, excluding the address of the Sensor Unit itself.

Contact the network administrator for advice on IP address assignments.



Procedure

1. Select the **System** menu > **NAV Engine** > **Standard** > **Network**.
2. Select the interface for which you want to change the IP address.
3. Type the new IP address for the interface.This is recommended.

   Or you can select the **DHCP** box if the IP address is given by a DHCP server. The rest of the parameters will then be disabled.
4. Type the subnet mask address for this interface.
5. Type the IP address for the default gateway.
6. Select **Apply** to save the settings.
7. Restart the Sensor Unit for these changes to take effect and or the new settings to be used by NAV Engine.

Further requirements

To restart the Sensor Unit, select the **System** menu > **Restart** > **Sensor Unit**.

If you select **Restore**, you will return to the previous interface settings.

Related references

Network page, page 228

Additional system configuration

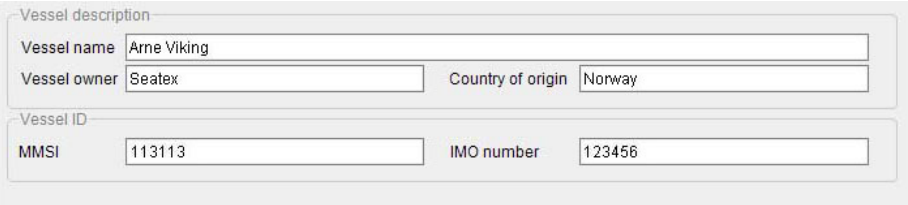
Topics

Enabling Fugro high precision services, page 138
Selecting heading input format from a gyro compass, page 139
Setting up the MGC as an inertial navigation system (INS), page 140
Setting up NTRIP client, page 142

Entering vessel identification parameters

The vessel **Description** parameters allow you to enter information about the vessel which is needed for identification purposes.

Context



Procedure

1. Select the **System** menu > **NAV Engine** > **Standard** > **Vessel** > **Description**.
2. Type the name of your vessel. This box cannot be empty. The default value is **VESSEL**.
3. Type the name of the **vessel owner**. This is optional information.
4. Type the **country of origin** for the vessel. This is optional information.
5. Type the MMSI number assigned to the vessel. The default value is 0.
6. Type the IMO number assigned to the vessel. The default value is 0.
7. Select **Apply** to save the settings.

Related references

Vessel Description page, page 207

Importing vessel shape from file

You can load a vessel model from file in order to get accurate dimensions for your vessel.

Context

The pre-defined scalable vessel shapes represent the actual vessel outline only in rare cases. In order to configure the accurate location of various sensors, equipment and monitoring points, it is recommended to load a separate vessel model from file.

The system supports two types of two dimensional outlines: side view (towards starboard) and top view. Three file types are available: **Vessel models** (*.svm), **Vessel vector images** (*.svi) and **Old vessel images** (*.txt).

The vessel image file must meet the following requirements:

- The vessel data have to be in an ASCII file generated by Excel, Notepad or similar tools.
- The file head includes Overall length (LOA), Overall width, Overall height and Stern to Origin data in metres.
- Profile (side view) data in X and Z coordinates must be in metres, related to the origin. The coordinates are specified clockwise from a point aft of the origin, and the last coordinate has to equal the first coordinate to form a closed polygon.
- The top view data in X and Y coordinates must be in metres. The first coordinate has to be aft of the origin along the centre line. Successive coordinates are specified clockwise, and the last coordinate has to equal the first to form a closed polygon.

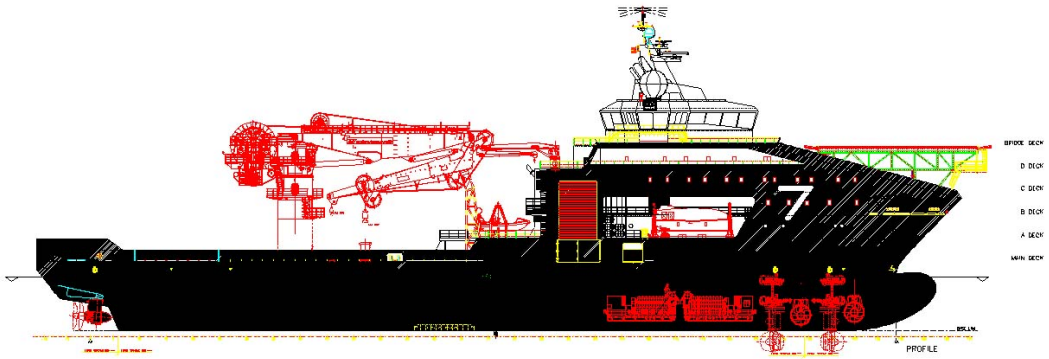
Vessel image files can be created by Kongsberg Discovery AS upon customer request. General arrangement (GA) drawings or similar are required to create vessel image files.

Procedure

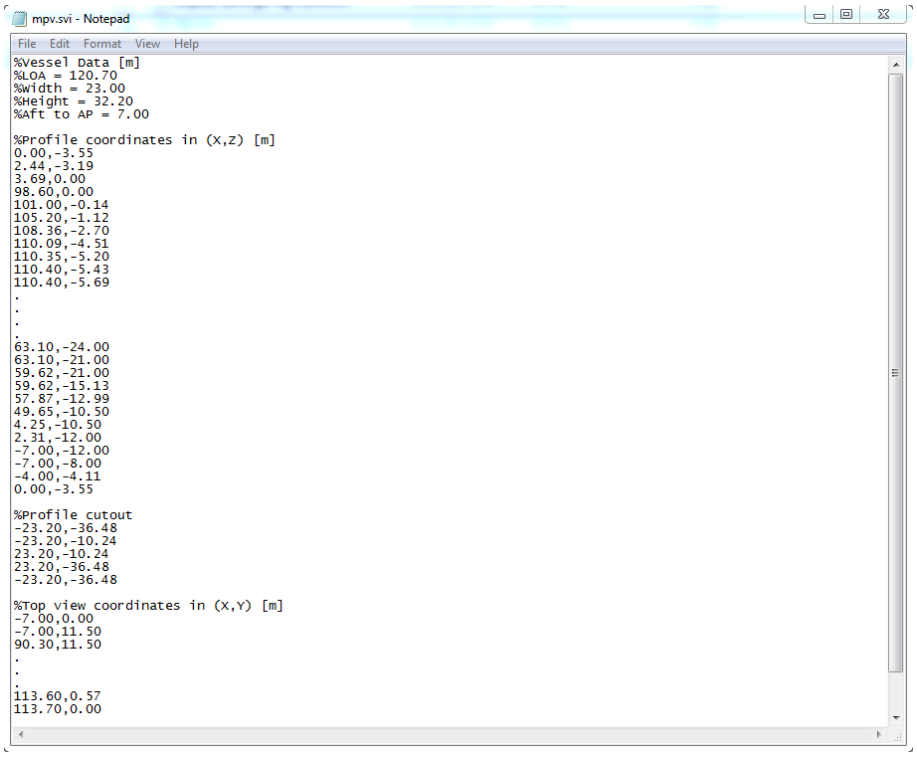
1. Select the **System** menu > **NAV Engine** > **Standard** > **Vessel** > **Geometry**.
2. Select **Use vessel drawing**. The **Shape dimension** parameters will be locked.
3. Type the parameters for the location of origin (survey origin).
4. Type the navigation reference point location.X, Y, Z.
5. Select **Apply** to save the settings.

Vessel shape from file

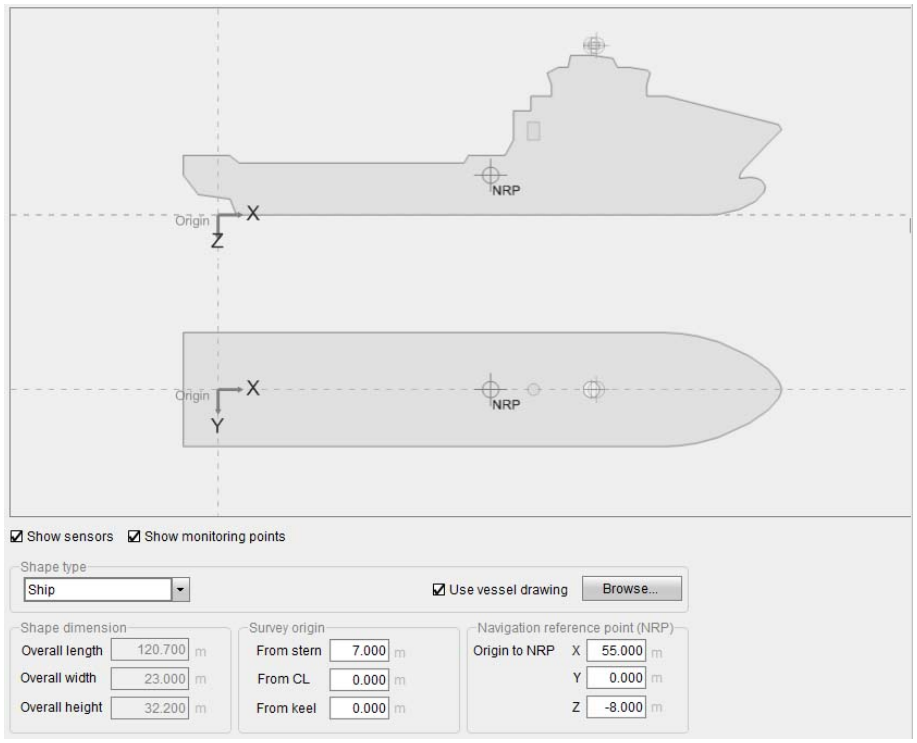
The illustration shows an example of a GA drawing of a multi-purpose vessel.



A user text file from Notepad may look like this.



The vessel shape in the **NAV Engine Configuration** looks like this.



In the example, only the port side of the vessel top view is defined in the file. Symmetry is assumed, so this is sufficient to draw a symmetric vessel shape. If the

vessel is not symmetric, use the section code **%Top view coordinates in (X,Y) [m] Complete** and give the coordinates along the complete shape, defined clockwise.

It is possible to define cutouts within the profile or top view polygons. For profile cutout, use **%Profile cutout n**, where **n** identifies the cutout.

Related references

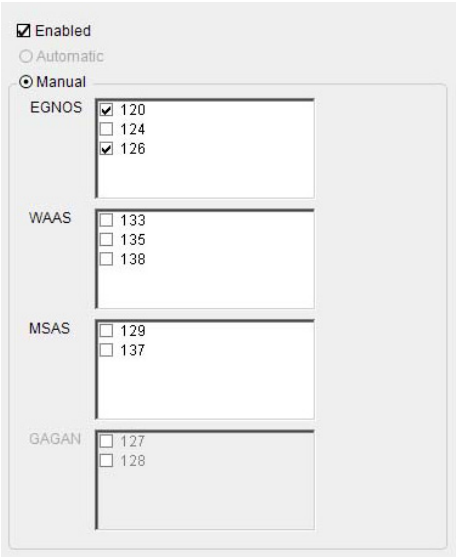
Vessel Geometry page, page 206

Selecting SBAS satellites

The SBAS parameters allow you enable tracking of SBAS satellites. You can set up automatic or manual tracking of the SBAS satellites.

Context

Maximum two SBAS satellites can be tracked by the receiver. If you manually select two SBAS satellites, the system will automatically use data from the best satellite. If no specific satellite is selected, the system will select and use data from the best of the available satellites.



Procedure

1. Select the **System** menu > **NAV Engine** > **Standard** > **Sensors** > **DGNSS** > **SBAS**.
2. Select **Enable** to enable tracking of SBAS satellites.
3. If you want the system to track SBAS satellites automatically, select **Automatic**.
4. If you want to select which SBAS satellites to use yourself, instead of automatic selection by the system, select **Manual**
5. Select which SBAS satellites to use. You can select maximum two satellites.

6. Select **Apply** to save the settings.

Related references

Sensors DGNSS SBAS page, page 229

Enabling Fugro high precision services

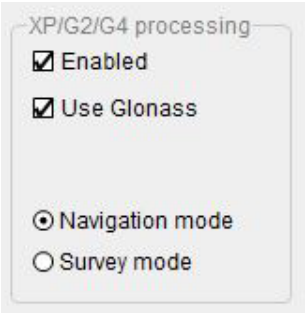
The **XP/G2/G4** parameters allow you to use high precision services to improve the accuracy of the GNSS signals which results in a more accurate position.

Prerequisites

A Fugro demodulator has to be connected and activated. A valid subscription to the Fugro high performance positioning service is required.

Context

You must enable the use of high precision services as this setting is not enabled by default.



Procedure

1. Select the **System** menu > **NAVEngine** > **Standard**.
2. Select **Sensors** > **DGNSS** > **XP/G2/G4**
3. Select the **Enabled** box to enable the use of high precision services.
4. Select **Glonass** if you want the system to use GLONASS corrections.
5. If you want more reliability during difficult conditions, select **Navigation mode** or if you want high accuracy, select **Survey mode**.
6. Select **Apply** to save the settings.

Related references

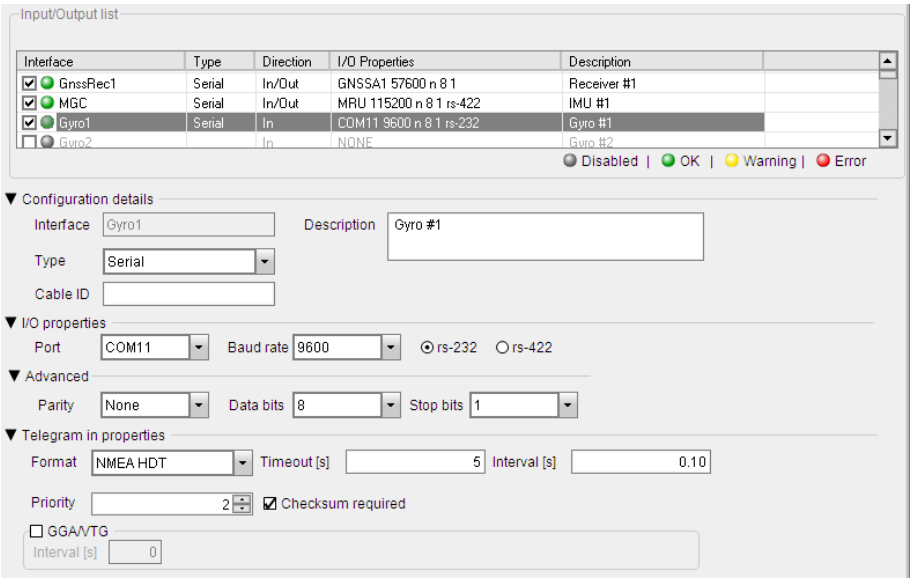
Sensors DGNSS XP/G2/G4 page, page 230

Selecting heading input format from a gyro compass

Heading input from a gyro compass or similar can be input to the Seapath system as a backup to improve reliability.

Context

Heading input from a gyro compass, or heading input from the DP system, are used in the position filter and can be used to display heading and speed in the displays. In addition, heading is necessary to use the built-in lever arm compensation. Several types of heading formats are accepted by the system.



Procedure

1. Select the **System** menu > **NAV Engine** > **Standard** > **Communication interface** > **Input/Output**.
2. Select the **Gyro** interface you want to set up in the **Input/Output list**.

   Observe that the **Configuration details** parameters appear at the lower part of the page.
3. Select either **Ethernet** or **Serial** in the **Type** list.

   Enter the appropriate parameters for the selected interface type.
4. Continue to **Telegram in properties.**.
5. Select the wanted gyro telegram from the **Format** list.
6. Type the wanted **Timeout** age limit in seconds.

   If the age of the gyro message exceeds this limit, the gyro message is invalid.
7. Type the wanted **Interval** for seconds between the incoming telegrams

8. Type a number for which priority the heading input shall have in the Seapath system
9. Select the **Checksum required** box if you want NMEA checksum to be required.
   This selection is selected by default. This is the recommended setting.
10. Select the **GGA/VTG** box if you want the system to send GGA and VTG messages to the gyro at specified intervals.
11. Select **Apply** to save the settings.

Related tasks

Communication interface description, page 97
Using the Serial interface, page 99
Using the Ethernet interface, page 100

Related references

Communication interface - Gyro interface page, page 231

Setting up the MGC as an inertial navigation system (INS)

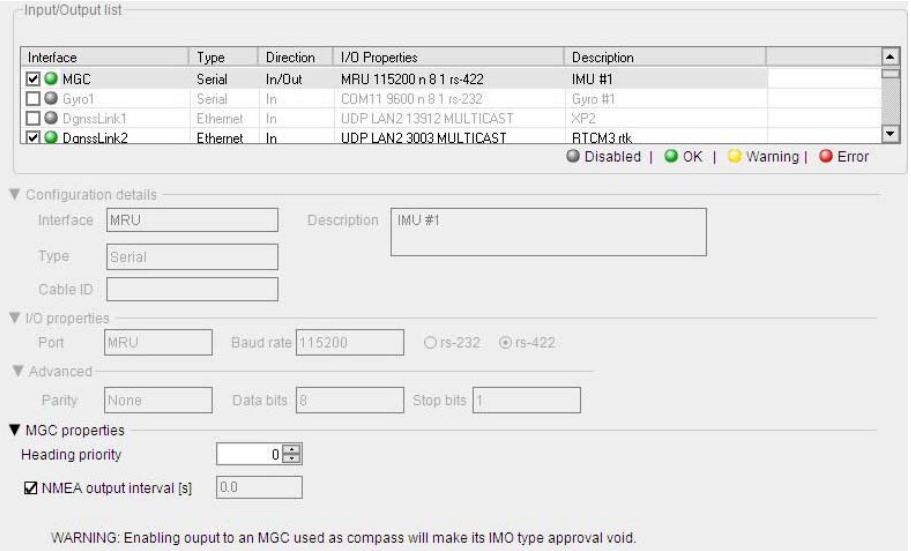
You can set up the Motion Sensor and Gyro Compass (MGC) to operate as an inertial navigation system (INS).

Context

When the Motion Sensor and Gyro Compass (MGC) shall operate as an inertial navigation system (INS) in addition to being an Inertial Measurement Unit (IMU) for the Seapath system, the MGC requires input of the NMEA messages GGA, VTG and ZDA.

Note:

For some installations it will be convenient to send these NMEA messages from the Sensor Unit to the MGC instead of interfacing an external GNSS receiver to the MGC. However, if the MGC is installed as a type approved IMO gyro compass, these NMEA messages must be input from an IMO approved GNSS receiver. Otherwise the type approval will be voided.



Procedure

1. Select the **System** menu > **NAV Engine** > **Standard** > **Communication interface** > **Input/Output**.
2. Select the **MGC** interface in the **Input/Output list**.

   Observe that the **MGC properties** parameters appear at the lower part of the page.
3. Select **NMEA output interval** to enable output of NMEA GGA, VTG and ZDA messages to the MGC.
4. Set **Heading priority** to 0.
5. Select **Apply** to save the settings.

Related tasks

Communication interface description, page 97
Using the Serial interface, page 99
Using the Ethernet interface, page 100

Related references

Communication interface - MGC interface page, page 227

Setting up NTRIP client

An NTRIP client is provided to ease access to external corrections provided over an internet connection. The Seapath unit needs to have access to internet trough one of it's Ethernet devices.

Prerequisites

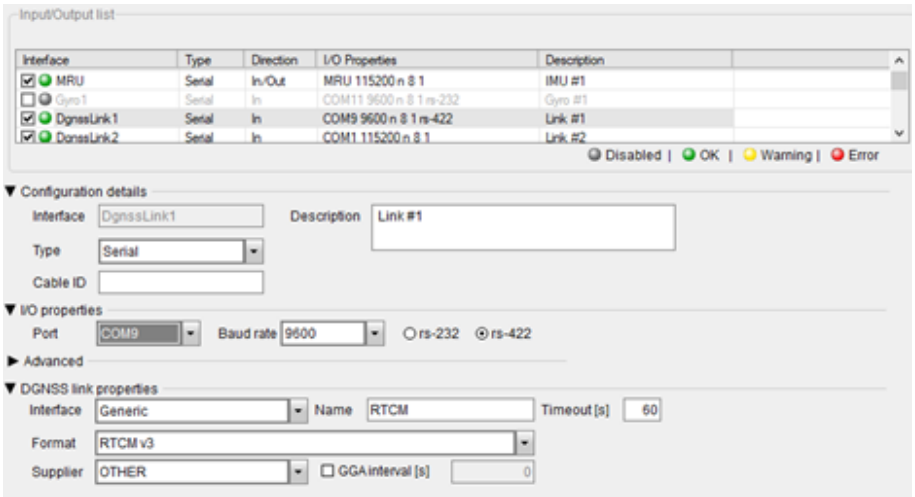
You must enable a DGNSS link in **NAV Engine** > **Standard** before you can set up an NTRIP client. The NTRIP client configuration is done from **NAV Engine** > **Advanced** configuration.

Context

The Seapath software release 2.03.00 introduces an NTRIP client.

Procedure

1. **DGNSS link setup**:
   a. Select the **System** menu > **NAV Engine** > **Standard** > **Communication interface** > **Input/Output**.
   b. Select the **DGNSSLink** interface you want to set up in the **Input/Output list**.
      It does not matter which DGNSSLink you use for this purpose.
      Observe that the **Configuration details** parameters appear at the lower part of the page.



   c. Select either **Serial** or **Ethernet** in the **Type** list. It does not matter which you choose for the NTRIP functionality.

Note:

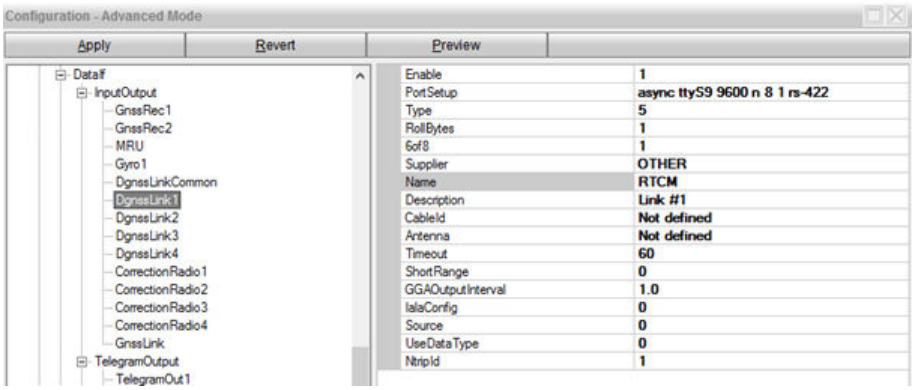
The COM port, UDP port or IP address are not important as long as the settings do not give conflicting settings for other IO settings.

d. Select **Apply** to save the settings.

2. **Modifying the DGNSS link parameter**:

a. Select the **System** menu > **NAV Engine** > **Advanced**.

b. Navigate to **InputOutput**, select the DGNSS link you set up previously.



c. Set **GGAOutputInterval** to 1.

This parameter is set to match the requirements for the NTRIP network. In this example it is 1 Hz.

d. Set **Ntripid** to 1.

This parameter is set to match the NTRIP client link ID to be configured. In this example it is 1.

3. **Configuring the NTRIP client**:

a. Select the **System** menu > **NAV Engine** > **Advanced**.

b. Navigate to **NTRIP 1**.

c. Set the **IP** parameter to the requirement for the NTRIP network IP address.

d. Set the **Port** parameter to the requirement for the NTRIP network.

e. Set the **MountPoint** parameter to the available mount points from the NTRIP network.

Note:

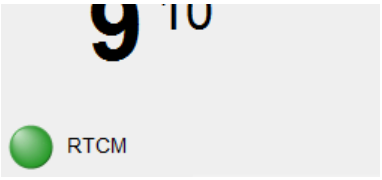
The input value must be preceded by / (forward slash). For example: / CPOSRTCM32

f. Set the **Protocol** parameter: 0 = TCP. 1 = UDP.

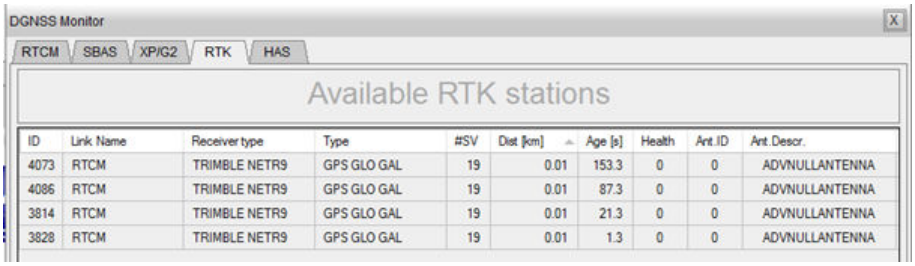
g. Select **Apply** to save the settings.

Result

When the settings are applied, a successful connection will be displayed as a green RTCM link lamp in the DGNSS link status bar.



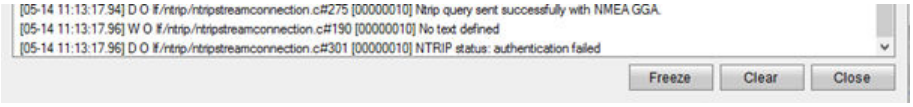
Select the link lamp to get more information about the received DGNSS data. The information is available in the **RTK** tab in the **DGNSS Monitor**.



Further requirements

If the RTCM link lamp turns red you can find debug information for Seapath NAV Engine by selecting the **Alarm** menu > **NAV Engine debug**

The illustration shows an example of wrong user name and password, which results in authentication failure.



This information must be provided to the Kongsberg Discovery AS customer support for further fault finding of the issue.

Related tasks

Communication interface description, page 97
Using the Serial interface, page 99
Using the Ethernet interface, page 100

Related references

Communication interface - DgnssLink interface page, page 226

Operator software configuration

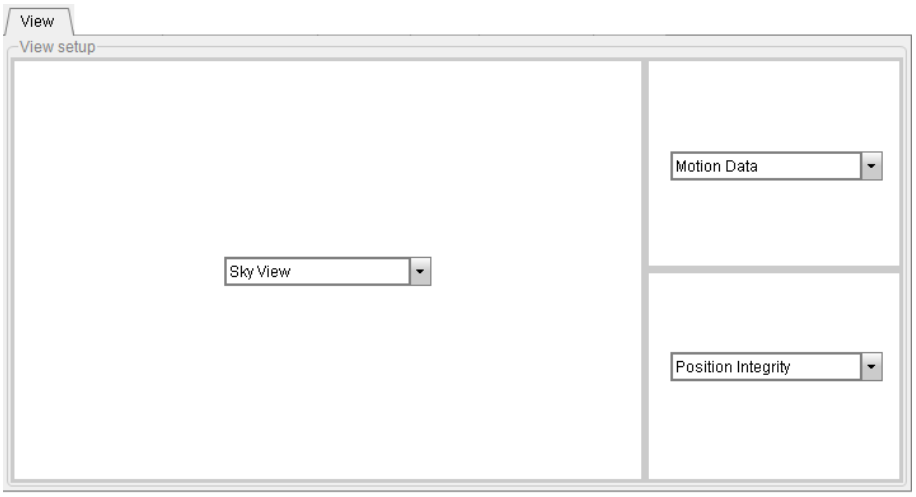
Topics

Selecting the position of views in the display

The **View** page allows you to select the contents of each view when the HMI (Human Machine Interface) application starts.

Context

Two views cannot have the same contents. When one view is selected as contents in View 1, other contents will automatically be selected for View 2.



Procedure

1. Select the **System** menu > **Operator SW** > **View**.
2. Select which view you want for View 1 and View 2 from the drop-down lists.
3. Select **Apply** to save the settings.

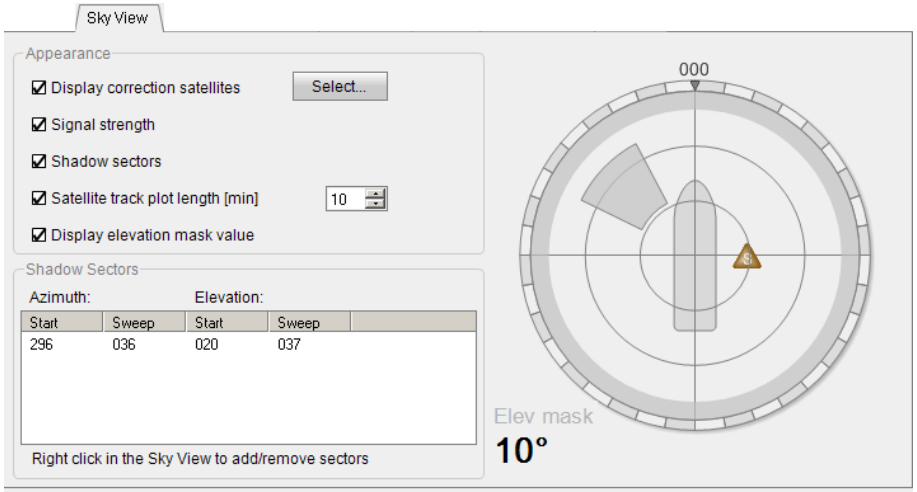
Related references

Operator software configuration - View page, page 233

Selecting the appearance of the Sky view

The *Sky View* can contain various information. You can define what information and objects you want to appear in the *Sky View*.

Context



Procedure

1. Select the **System** menu > **Operator SW** > **Sky View**.
2. Select **Display correction satellites.** Observe that the `Select` button appears.
3. Select this button to open the **Select Correction Satellites** dialog box.
4. Select the satellites you want to appear in the Sky view. Select **OK**.
5. Select **Signal strength** if you want to display the signal bar under the satellites in the Sky view.
6. Add shadow sectors to be able to display them in the Sky view.
   a. Place the cursor over the sky view area to the right in the Sky view page.
   b. Right-click and select **Add sector**.
      Observe that the sector appears in the sky view area and in the table under **Shadow Sectors**.The table shows your shadow sectors.
   c. Hover the cursor over the shadow sector. Observe that the cursor changes to arrow symbols.
   d. Drag the arrows horizontally and vertically to create your shadow sector. Observe the **Azimuth** and **Elevation** values in degrees.
7. Delete shadow sectors if they are no longer applicable.
   a. Select a sector in the sky view area to the right in the **Sky View** page.

b. Right-click and select **Remove sector**.

Observe that the shadow sector disappears from the sky view area and from the table.

8. Select **Satellites track plot length** if you want to show this in the Sky view. Observe that the **Satellite track plot length** list appears.
9. Select the wanted value for the satellite track plot length in minutes.
10. Select **Display elevation mask value** if you want the value to appear in the Sky view.
11. Select **Apply** to save the settings.

Related references

Operator software configuration - Sky view page, page 233

Adjusting the Integrity view

The **Position Integrity** tab allows you to adjust the scaling of the Integrity view.

Context

Procedure

1. Select the **System** menu > **Operator SW** > **Position Integrity**.
2. Type the **Max ellipse EPE** in metres.
3. Type the steps for **Ellipse diagram resolution**.
4. Select **Apply** to save the settings.

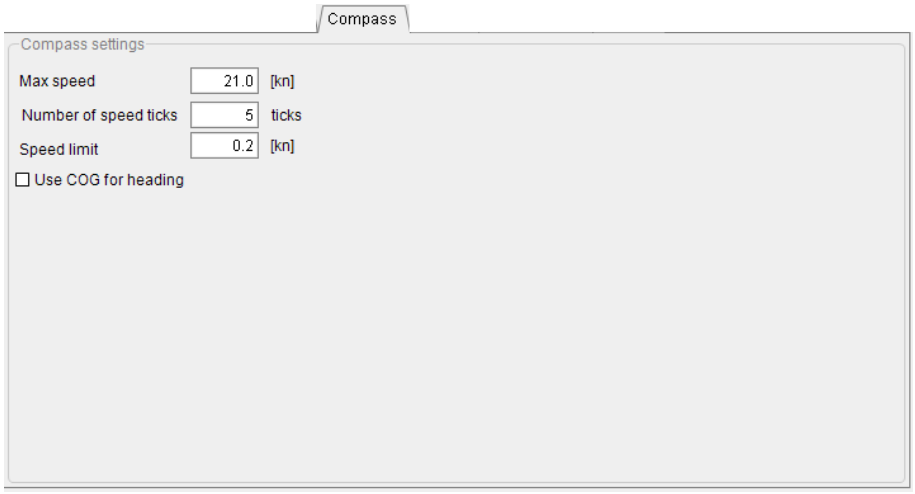
Related references

Operator software configuration - Position Integrity page, page 235

Adjusting the Compass view

The **Compass** page allows you to adjust the speed scaling of the Compass view.

Context



Procedure

1. Select the **System** menu > **Operator SW** > **Compass**.
2. Type the maximum vessel speed, **Max speed**, to be displayed in the Compass view.
3. Type the number of circles to be displayed, **Number of speed ticks**.
4. Type the lower **Speed limit** for when COG (Course Over Ground) and SOG (Speed Over Ground) shall be displayed in the Compass view.
5. Select the **Use COG for heading** box if true heading is unavailable.
6. Select **Apply** to save the settings.

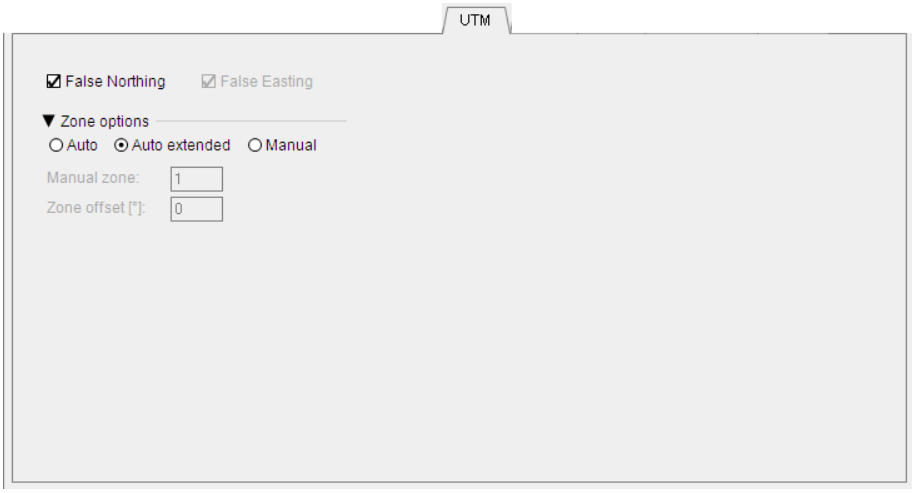
Related references

Operator software configuration - Compass page, page 236

Adjusting UTM presentation

You can control how UTM positions are treated by the application. UTM is the Universal Transverse Mercator coordinate system.

Context



Procedure

1. Select the **System** menu > **Operator SW** > **UTM**.
2. Clear the **False Northing** check box if you want positions south of the equator o be presented as negative values in the Position data when displaying position as UTM.
3. Select which **zone options** you want to use. If you select Manual:
   a. Type the value for the zone you want to use.
   b. Type the zone offset for this zone, range 1 to 60.
4. Select **Apply** to save the settings.

Related references

Operator software configuration - UTM page, page 237

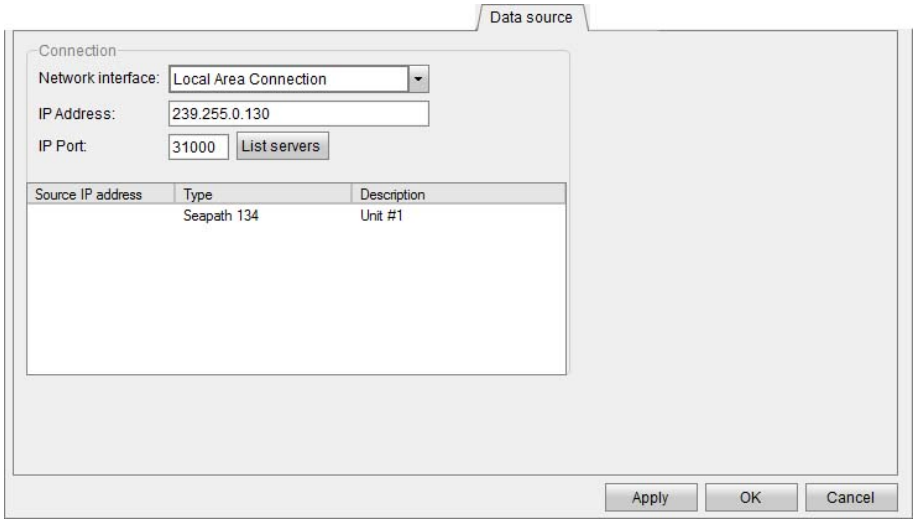
Selecting the Seapath Operator software data source

You can select the data source which the operator software receives its data from.

Context

The operator software will automatically detect the default IP address for the Sensor Unit. If you want to receive data from another unit, you can select which unit from this page.

Select **Refresh** to update the list of available units. If the wanted data source is not displayed in the list, you can check the network connections and that all equipment is switched on.



Procedure

1. Select the **System** menu > **Operator SW** > **Data Source**.
2. Select the wanted data source from the list.
3. Select **Apply** to save the settings.

Related references

Operator software configuration - Data source page, page 238

Selecting reception of alarm messages

You can define how to receive alarm messages.

Prerequisites

UDP Broadcast is the default (and recommended) setting. Defining a multicast address for alarm message distribution requires advanced network configuration skills.

Context

Procedure

1. Select the **System** menu > **Operator SW** > **Alarms**.
2. Select the wanted connection type: **UPD Multicast** or **UDP Broadcast**.
3. Select **Apply** to save the settings.

Related references

Operator software configuration - Alarms page, page 239

Verifying that the Seapath 130 system is ready for operational use

When the Seapath system configuration is completed, you must verify that the system is operational.

Context

Observe these steps Seapath to make sure that the system is ready for operation.

Procedure

1. Make sure that all cables are properly connected.
2. Make sure that the Inertial Measurement Unit (IMU) cable is connected to connector A on the subsea bottle.
3. Make sure that the power supply is correct.

   The system operates on 24 VDC power.

4. Make sure that the Seapath operator software has been installed on an external computer.

Related tasks

Installing the Seapath operator software, page 41
Applying power to the Seapath system, page 93

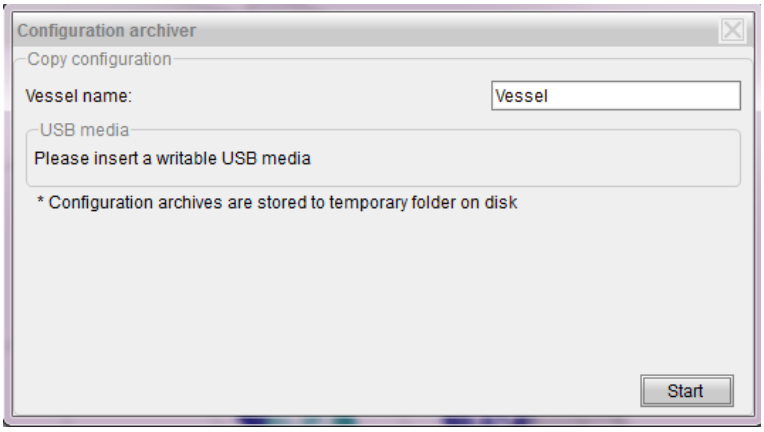
Creating a backup of the configuration and software installation

If you have a complex configuration setup in your system, it can be useful to make a copy of this configuration in case you should need it later. The **Copy Configuration** tool will copy the system configuration to a disk based archive file or to a USB flash drive.

Context

Note:

This procedure will only copy the configuration setup and not a full image of the installed system.



Note:

If a USB flash drive is not inserted, the archive will be stored in a temporary location on the local disk. In this case, the archive will only be available for restore until the next reboot.

Procedure

1. Insert a USB flash drive into a USB port on the computer with the Seapath operator software installed.

2. Select the **Tools** menu > **Copy Configuration**.
3. The configured vessel name is automatically entered into the **Vessel name** box but you can change this if you want.
4. Select **Start** to copy the configuration files to the USB flash drive.

   The copied configuration will be stored as a compressed archive (ZIP file) under the **ConfigBackup** folder in the root of the USB flash drive.

Result

You can use the USB flash drive with the copied configuration to restore the system configuration at a later date.

Restoring the configuration backup

If you need to restore the configuration setup to your system, you can use the USB flash drive with a copy of your configuration which you created with the **Copy Configuration** tool.

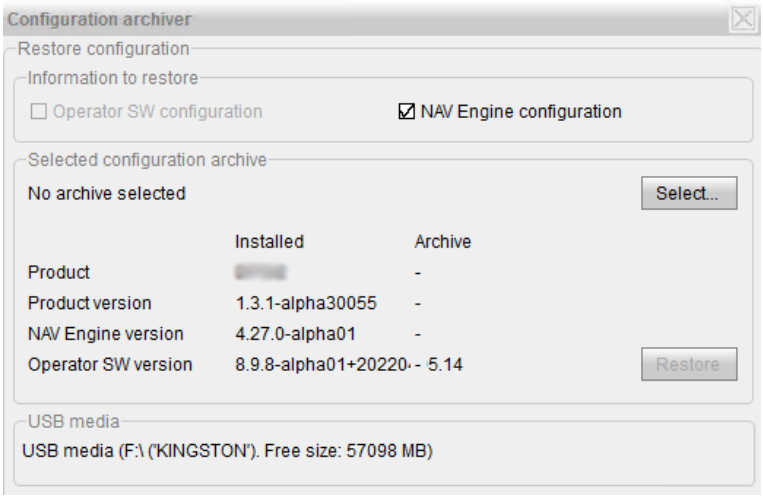
Prerequisites

A USB flash drive with the Seapath application must be available.

Context

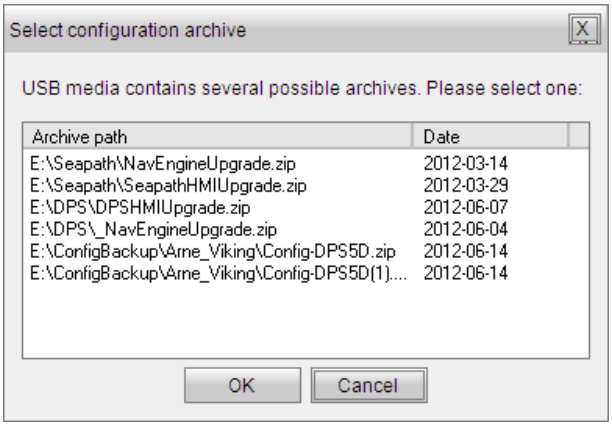
Note:

*The **Restore Configuration** tool will stop NAV Engine before restoring the configuration. NAV Engine will be restarted automatically.*



Procedure

1. Insert a USB flash drive into a USB on the computer with the Seapath operator software installed.
2. Select the **System** menu > **Change system mode** > **Engineering**.
3. Type the password: **stx**. The password is not case sensitive.
4. Select the **Tools** menu > **Restore configuration**.
5. Select **NAV Engine configuration**.
6. Select **Select...**.
7. Select the wanted configuration archive from the list. Select **OK**.

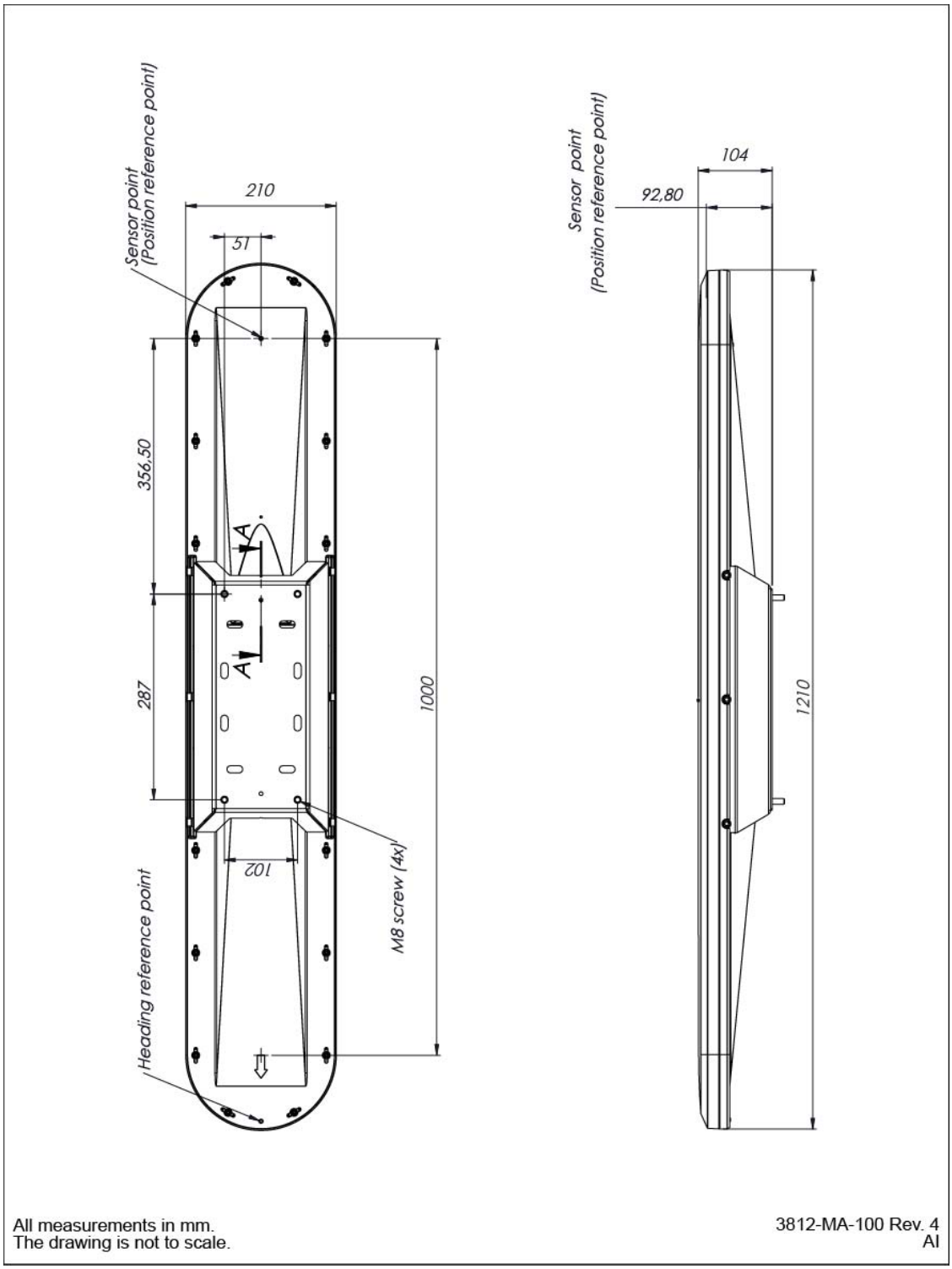


8. Select at least one option under **Information to restore** in the **Configuration archiver** dialog box. This will enable the **Restore** button.
9. Select **Restore** to restore the wanted configuration.

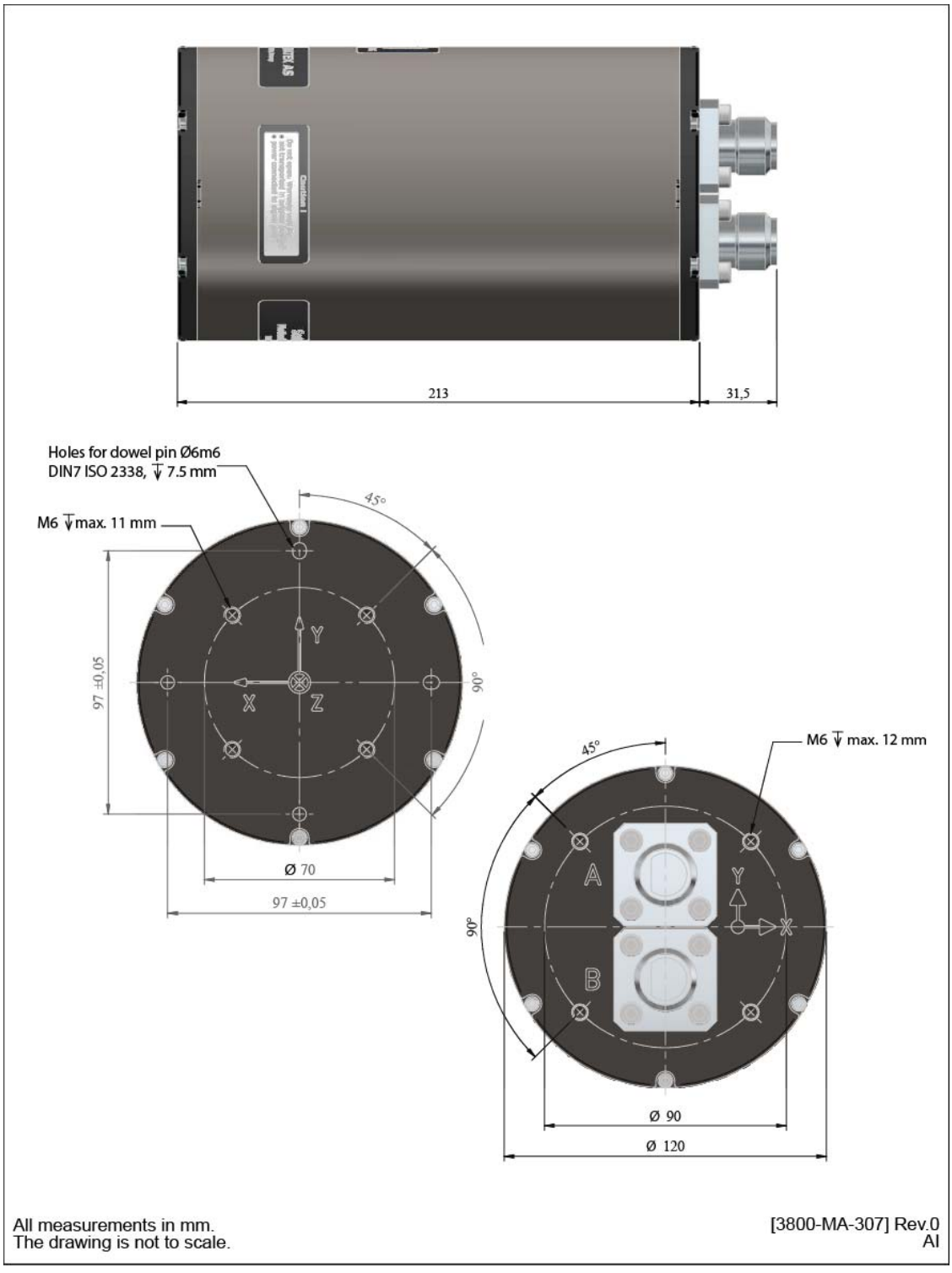
Drawings

Topics

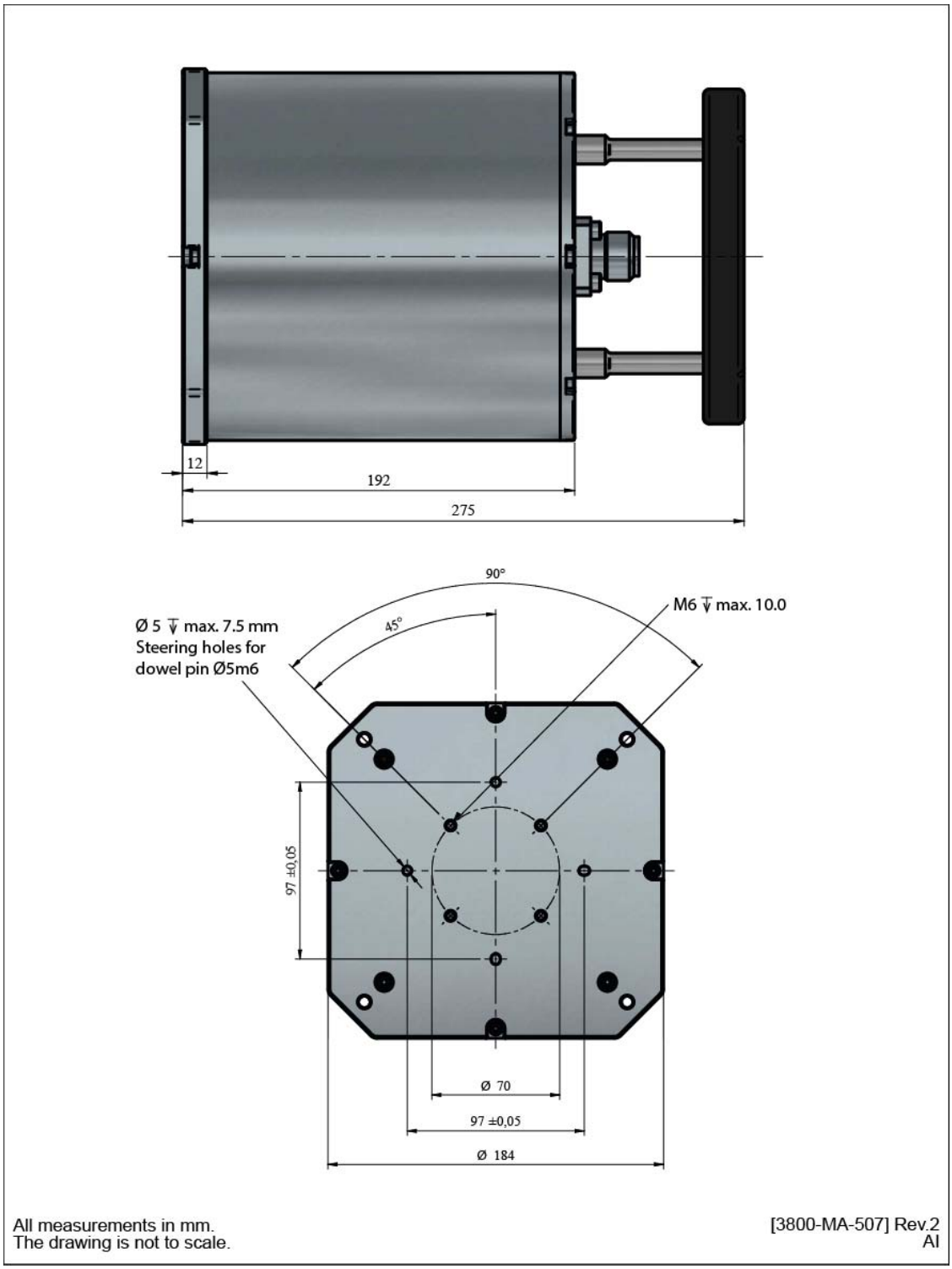
Sensor Unit dimensions

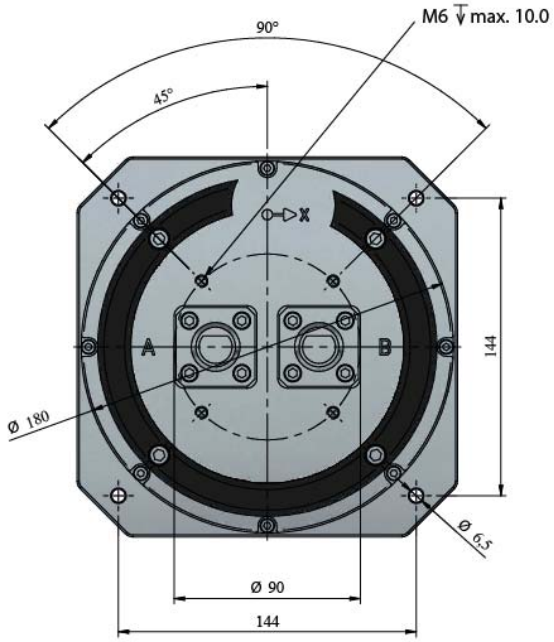


MRU subsea bottle SB12 dimensions



MGC subsea bottle SB50 dimensions

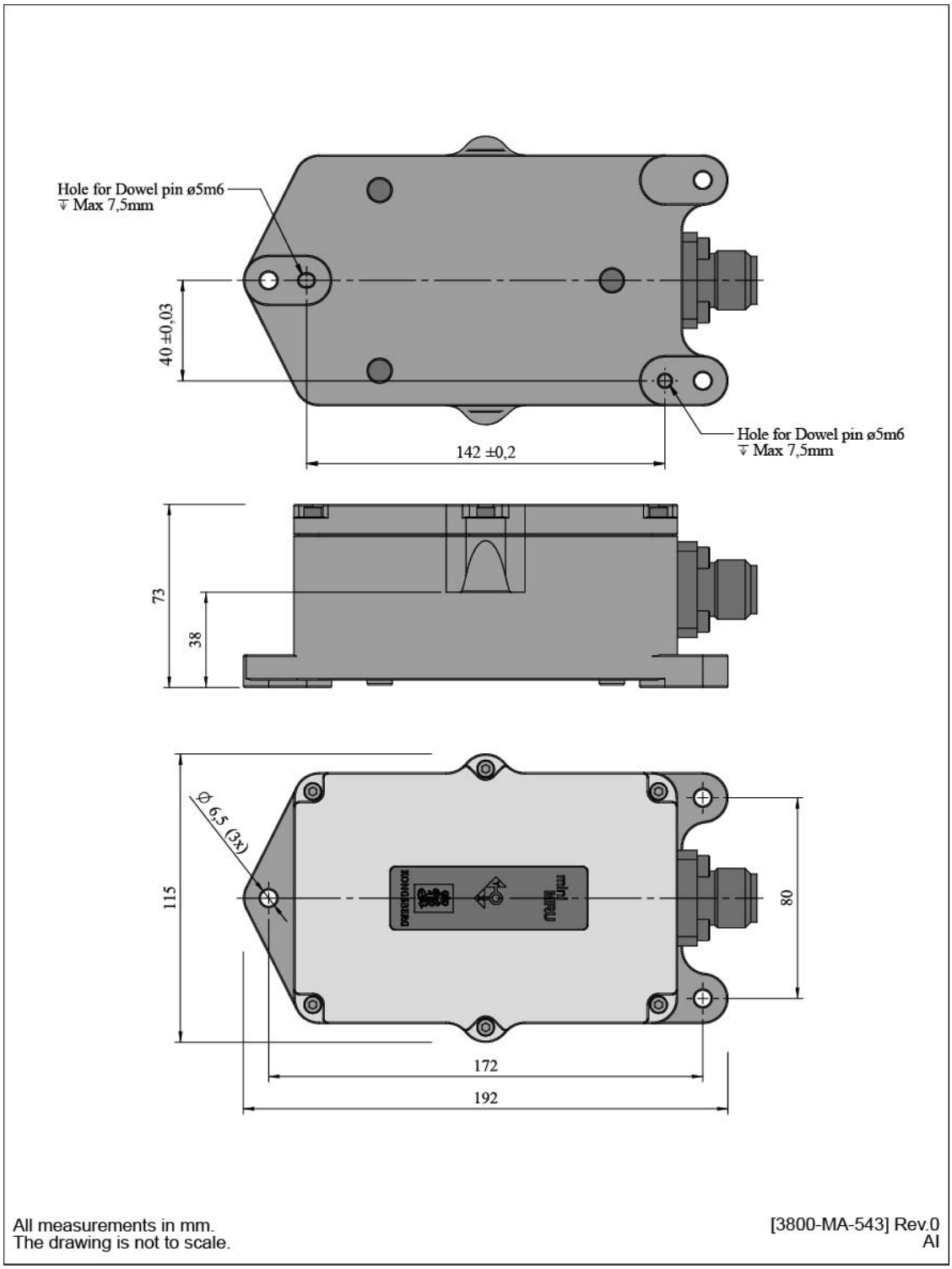




All measurements in mm.
The drawing is not to scale.

[3800-MA-507] Rev.2
AI

miniMRU subsea housing SH1 dimensions



Technical specifications

Topics

Weights and outline dimensions

Sensor Unit

- **Outline dimensions**:
  - **Length**: 1210 mm
  - **Width**: 210 mm
  - **Height**: 94 mm
- **Weight**: 7.7 kg, incl. 1 m cable

MRU subsea bottle

- **Type**: MRU-M-SB12
- **Outline dimensions**:
  - **Height**: 209 mm, 240.5 mm incl. connectors
  - **Diameter**: 120 mm
- **Weight**:
  - **Dry weight**: 3.7 kg, incl. MRU
  - **Submerged weight**: 1.3 kg, incl. MRU
- **Depth**: 10 m
- **Connectors**: 2 x 8-pin Seacon

MGC subsea bottle

- **Type**: MGC-S-R2/R3-SB50
- **Outline dimensions**:
  - **Length**: 184 mm
  - **Width**: 184 mm
  - **Height**: 275 mm
- **Weight**:
  - **Dry weight**: 10.5 kg, incl. MGC
  - **Submerged weight**: 5.5 kg, incl. MGC
- **Connectors**: 2 x 8-pin Seacon, 5506-1508 (male)

miniMRU subsea housing

- **Type**: miniMRU-M-SH1
- **Outline dimensions**:
  - **Length**: 192 mm
  - **Width**: 115 mm
  - **Height**: 73 mm
- **Weight**:
  - **Dry weight**: 2.9 kg, incl. miniMRU
  - **Submerged weight**: 1.8 kg, incl. miniMRU
- **Depth**: 80 m
- **Connectors**: 8-pin Seacon

Power specifications

Sensor Unit

- **Voltage**: 10 - 36 VDC
- **Voltage, recommended**: 24 VDC
- **Power consumption**: 10 W (max), typical 8 W

MRU subsea bottle

- **Voltage**: 10 - 36 VDC
- **Voltage, recommended**: 24 VDC
- **Power consumption MRU 5, MRU 5+, MRU H**: 12 W (max) , typical 8 W
- **Power consumption MRU 3**: 5 W (max)

MGC subsea bottle

- **Voltage**: 18 - 32 VDC
- **Voltage, recommended**: 24 VDC
- **Power consumption**: 12 W (max) , typical 11 W

miniMRU subsea housing

- **Voltage**: 10 - 36 VDC
- **Voltage, recommended**: 24 VDC
- **Power consumption**: 6 W (max)

Environmental specifications

Sensor Unit

- **Operating temperature**: -40 - 70 °C
- **Storage temperature**: -40 - 70 °C
- **Operating humidity**: Sealed, no limit
- **Storage humidity**: Sealed, no limit
- **Ingress protection**: IP56
- **Enclosure material**: Aluminium, polyurethane
- **Electromagnetic compatibility (immunity/emission)**: IEC 60945/EN 60945

- **Vibration**: IEC 60945/EN 60945

MRU subsea bottle

- **Operating temperature**: -5 - 55 °C
- **Storage temperature**: -25 - 70 °C
- **Operating humidity**: Sealed, no limit
- **Storage humidity**: Sealed, no limit
- **Ingress protection**: IP68, depth rated to 10 metres
- **Enclosure material**: Anodised aluminium
- **Electromagnetic compatibility (immunity/emission)**: IEC 60945/EN 60945
- **Vibration**: IEC 60945/EN 60945
- **Shock non-operational**: 1000 m/s^2, max (10 ms peak)
- **MTBF**: 50000 hours (computed)
- **MTBF**: 100000 hours (service history based)

MGC subsea bottle

- **Operating temperature**: -15 - 55 °C
- **Storage temperature**: -25 - 70 °C
- **Operating humidity**: Sealed, no limit
- **Storage humidity**: Sealed, no limit
- **Ingress protection**: IP68, depth rated to 50 metres
- **Enclosure material**: Titanium
- **Electromagnetic compatibility (immunity/emission)**: IEC 60945/EN 60945
- **Vibration**: IEC 60945/EN 60945
- **Shock non-operational**: 1000 m/s^2, max (10 ms peak)
- **MTBF**: 50000 hours (computed)
- **MTBF**: 100000 hours (service history based)

miniMRU subsea housing

- **Operating temperature**: -5 - 55 °C
- **Storage temperature**: -25 - 70 °C
- **Operating humidity**: Sealed, no limit
- **Storage humidity**: Sealed, no limit

- **Ingress protection**: IP68, depth rated to 80 metres
- **Enclosure material**: Titanium
- **Electromagnetic compatibility (immunity/emission)**: IEC 60945/EN 60945
- **Vibration**: IEC 60945/EN 60945
- **Shock non-operational**: 1000 m/s^2, max (10 ms peak)
- **MTBF**: 50000 hours (computed)
- **MTBF**: 100000 hours (service history based)

Related concepts

Storage, page 242

Interface specifications

Sensor Unit

- **Output serial ports**: 3 non-dedicated isolated ports, RS-232/RS-422
- **Input serial ports**: 1 non-dedicated isolated ports, RS-232/RS-422
- **Baud rate**: Up to 115 200 bytes/sec
- **LAN**: 1 Ethernet port
- **Data output rate**: Up to 100 Hz
- **Timing accuracy**: 1 ms
- **Data delay**: All data in real-time (0 ms) plus transmission delay

Performance specifications - MRU and miniMRU

Roll, pitch and heading accuracy

- **Roll and pitch accuracy ±5° amplitude**: 0.010° RMS - Seapath 130-3/40
- **Roll and pitch accuracy ±5° amplitude**: 0.008° RMS - Seapath 130-5/60
- **Roll and pitch accuracy ±5° amplitude**: 0.005° RMS - Seapath 130-5+
- **Heading accuracy**: 0.10° RMS - Seapath 130-3/40

- **Heading accuracy**: 0.08° RMS - Seapath 130-5/60 and 5+

Heave accuracy and heave motion

- **Heave accuracy (real-time output)**: 5 cm or 5 %, whichever is highest
- **Heave motion periods (real-time output)**: 0 - 18 seconds - Seapath 130-3/40
- **Heave motion periods (real-time output)**: 0 - 25 seconds - Seapath 130-5/60 and 5+
- **Heave accuracy (delayed signal, PFreeHeave®**: 2 cm or 2 %, whichever is highest
- **Heave motion periods (delayed signal, PFreeHeave®**: 0 - 50 seconds

Position accuracy

- **Position accuracy with DGNSS**: 0.5 m RMS or 1 m 95 % CEP
- **Position accuracy with SBAS**: 0.5 m RMS or 1 m 95 % CEP
- **Position accuracy with Fugro Seastar® XP2/XP3/G2/G2+/G4/G4+**: 0.05 m RMS or 0.1 m 95 % CEP
- **Position accuracy with VERIPOS Ultra/Ultra²**: 0.05 m RMS or 0.1 m 95 % CEP
- **Position accuracy with C-NavC¹, C-NavC²**: 0.05 m RMS or 0.1 m 95 % CEP
- **Position accuracy with RTK (x and y)**: 1 cm + 1 ppm RMS

  The accuracy is dependent on GPS satellite geometry, environment, ionospheric conditions and distance to the reference station. Excessive multipath, GPS signal obstructions or interference may also reduce the performance.

- **Position accuracy with RTK (z)**: 2 cm + 1 ppm RMS

  The accuracy is dependent on GPS satellite geometry, environment, ionospheric conditions and distance to the reference station. Excessive multipath, GPS signal obstructions or interference may also reduce the performance.

Position drift, horizontal

- **Typical position drift 1 minute after GNSS dropout (RTK)**: 1.6 m, Seapath 130-3/40
- **Typical position drift 1 minute after GNSS dropout (RTK)**: 0.6 m, Seapath 130-5/60
- **Typical position drift 1 minute after GNSS dropout (RTK)**: 0.3 m, Seapath 130-5+

Velocity accuracy

- **Velocity accuracy**: 0.03 m/s RMS or 0.07 m/s 95 % CEP

Performance specifications - MGC

Roll, pitch and heading accuracy

- **Roll and pitch accuracy ±5° amplitude**: 0.008° RMS - Seapath 130-R2
- **Roll and pitch accuracy ±5° amplitude**: 0.007° RMS - Seapath 130-R3
- **Heading accuracy** : 0.06° RMS - Seapath 130-R2
- **Heading accuracy** : 0.05° RMS - Seapath 130-R3

Heave accuracy and heave motion

- **Heave accuracy (real-time output)**: 5 cm or 5 %, whichever is highest
- **Heave motion periods (real-time output)**: 0 - 25 seconds
- **Heave accuracy (delayed signal, PFreeHeave®**: 2 cm or 2 %, whichever is highest
- **Heave motion periods (delayed signal, PFreeHeave®**: 0 - 50 seconds

Position accuracy

- **Position accuracy with DGNSS**: 0.5 m RMS or 1 m 95 % CEP
- **Position accuracy with SBAS**: 0.5 m RMS or 1 m 95 % CEP
- **Position accuracy with Fugro Seastar® XP2/XP3/G2/G2+/G4/G4+**: 0.05 m RMS or 0.1 m 95 % CEP
- **Position accuracy with VERIPOS Ultra/Ultra[2]**: 0.05 m RMS or 0.1 m 95 % CEP
- **Position accuracy with C-NavC[1], C-NavC[2]**: 0.05 m RMS or 0.1 m 95 % CEP
- **Position accuracy with RTK (x and y)**: 1 cm + 1 ppm RMS

  The accuracy is dependent on GPS satellite geometry, environment, ionospheric conditions and distance to the reference station. Excessive multipath, GPS signal obstructions or interference may also reduce the performance.

- **Position accuracy with RTK (z)**: 2 cm + 1 ppm RMS

  The accuracy is dependent on GPS satellite geometry, environment, ionospheric conditions and distance to the reference station. Excessive multipath, GPS signal obstructions or interference may also reduce the performance.

Position drift, horizontal

- **Typical position drift 1 minute after GNSS dropout (RTK)**: 0.6 m, Seapath 130-R2
- **Typical position drift 1 minute after GNSS dropout (RTK)**: 0.2 m, Seapath 130-R3

Velocity accuracy

- **Velocity accuracy**: 0.03 m/s RMS or 0.07 m/s 95 % CEP

Data output specifications

Sensor Unit

- **Message format**:
  - Simrad EM 3000
  - Seapath binary format 3, 11, 23, 26
  - Calibration format
  - Echo sounder format
  - Echo sounder format 18, TSS1
  - RD Instrument ADCP proprietary NMEA format "PRDID"
  - KM binary
  - 1 PPS time tag, NMEA ZDA message and Trimble compatible messages
  - Atlas Fansweep format
  - RTCM v3, raw GNSS output
  - PFreeHeave® format
  - IMU raw data output
  - NMEA 0183 v3.0, Proprietary
- **Message types NMEA**:
  - DTM, GBS, GGA, GGK, GLL, GNS, GRS, GSA, GST, GSV, HDT, RMC, ROT, THS VBW, VTG, PTNL, ZDA.
  - NMEA proprietary: PSXN20, PSXN21, PSXN22, PSXN23, PSXN24,.PSXN25, PSXN26, PSXN27.

Data input specifications

Sensor Unit

- **DGNSS corrections**: Seastar® XP2/XP3, Seastar® G2/G2+/G4/G4+, RTCM-SC104 v. 2.2, 2.3, 3.0 and 3.2, VERIPOS Ultra/Ultra[2], C-NavC[1], C-NavC[2], Trimble CMR
- **Gyro compass**: NMEA 0183 HDM, HDT, HRC, PSXN10, PSXN23, Robertson LR22 BCD format, EM3000

Datum specifications

Sensor Unit

- **Datum types**: NAD27, ED50, WGS84, MINNA, ARATU Bahia, ARATU Campos, ARATU ES, ARATU Santos, SIRGAS2000 and CAMACUPA.

These datum types can only be selected if the corrections input to the product are in WGS84. Or if no corrections are input.

Cable specifications

Sensor Unit cable

- **Type**: Heavy duty screened, 14 x 2 x 0.25 mm^2
- **Length**: 20 m
- **Diameter**: 13.5 mm
- **Weight**: 0.27 kg/m
- **Flame retardation**: IEC 60332-1
- **Insulation**: PP (conductors) and PUR (outer cover)
- **Cable screen**: Cu-braid
- **Bending radius**: 100 mm

IMU umbilical cable

- **Type**: Umbilical cable, 4 x 2 x 0.75 mm^2
- **Length**: 15 or 30 m
- **Diameter**: 12.6 mm
- **Weight - in air**: 241 kg/km
- **Weight - in sea**: 112 kg/km
- **Cable screen**: Alum/braid
- **Bending radius - static/dynamic**: 150 mm (min.)

Manufacturer’s conformity declaration

This product is in compliance with relevant directives and product standards.

KONGSBERG

EU DECLARATION OF CONFORMITY

Manufacturer's name: **Kongsberg Discovery AS**

Manufacturer's address: **Havnegata 9, N-7010 Trondheim, Norway**

declares that the product:

Product name: **Seapath 130 series**

Product items: **Seapath 130-3, 130-H, 130-5, 130-5+, 130-R2, 130-R3**

is in conformity with the **Radio Equipment Directive, RED, 2014/53/EU** and with reference to ETSI guide **ETSI EG 203 367,** using relevant sections of the following product standards:

Essential requirements	**Standards**
Health and Safety (Article 3.1(a)	EN 61010-1:2010/IEC 61010-1:2010
EMC (Article 3.1(b) (GNSS receivers)	EN 301 489 V2.1.1 (2017-02), EN 301 489-19 (2017-03)
EMC (Article 3.1(b) (Sensor Unit)	EN 60945:2002
Spectrum (GNSS receivers)	EN 303 413 V1.1.0

Test reference
File: *Seapath 130 series TCF*, **SPH130S-2017-1**, issued by Kongsberg Seatex AS.

RoHS
To the best of our knowledge, with reference to standard **EN IEC 63000:2018,** the product is compliant with Directive **2011/65/EU** as amended by Commission Delegated Directive **EU 2015/863**.

Supplementary information
The product was tested in its normal configuration.

Date and signature
2023-11-21

Erlend Vågsholm, Vice President R&D

110-0058553/A

NMEA telegram output options

When you set up the **TelegramOut** interface, the contents of some of the available NMEA telegrams may be modified according to options listed in the **Options** list in the NAVEngine configuration. This is for example useful when interfacing to older equipment.

This list holds a description of the various options.

Output residuals on Ashtech RRE format (GRS)

Use this option if you have enabled the GRS sentence and want the residuals output on the Ashtech RRE format instead.

Send VHW message after VTG using ground speed from VTG

Use this option when a VHW sentence is needed, and vessel heading and vessel speed relative to the water are not available. When this option is enabled, an NMEA VHW sentence is output, using SOG as Speed, and COG as heading. The VHW sentence is output immediately after the VTG sentence.

Output empty fields in NMEA HDT and NMEA THS messages also for reduced accuracy

Use this option when you want to set invalid heading (empty HDT/THS field) when heading status is reduced (low accuracy).

Use inertial roll, pitch and heave only

Use this option if you want the output of roll, pitch and heave to be calculated from IMU measurements only (no GNSS).

Use time from dataset in NMEA ZDA message

GNSS systems: Use this option if you want the time stamp in the NMEA ZDA message to be equal to the time stamp of the GNSS data set and the GGA message.

Disable additional GNS messages when diffcorr is used for both GPS and GLONASS

Use this option if you do not want additional NMEA messages if differential corrections are used for both GPS and GLONASS.

Limit correction age to 9.9 sec in GGA

Use this option if your system does not handle correction ages above 9.9 seconds in the GGA sentence. If this option is enabled, the correction age will increase and stop at 9.9 seconds even if the correct correction age is more than 9.9 seconds.

Use GNSS solution only

Integrated systems only: Use this option if you want to output position based on GNSS only (no IMU).

Set GGA quality indicator to 5 if converged high precision

Use this option if you want the Quality Indicator in the NMEA GGA sentence set to 5, when position solution is converged clock orbit or float filter (XP, G2, Ultra, Apex etc).

Freeze NMEA position if invalid

Use this option if you want the position output to use the last known valid position when the current position becomes invalid.

Use current GNSS info if only integrated position is valid

Integrated systems only: Use this option if you want to output current HDOP, number of satellites and corrections age in the GGA message though the GNSS position is invalid and the integrated position is valid.

Allow more than 12 satellites in GGA message

The NMEA standard limits the number of satellites in the GGA sentence to 12. Use this option if you want the GGA sentence to use the actual number of satellites.

Use modified quality indicator in GGA message

Use this option if you want the quality indicator in the NMEA GGA sentence to be replaced by GQI.

Use external attitude for lever arm compensation

Use this option if you want to use external attitude for lever arm compensation and velocity decomposition.

Use DQI(0-9) as GGA quality indicator

DP only: Use this option if you want to use talker DP and output DQI instead of NMEA Quality Indicator for GGA.

Send each NMEA telegram in separate UDP datagram

Use this option if TelegramOut is configured to send on UDP, and you want each NMEA telegram to be sent in a separate UDP telegram.

Use 2 decimals instead of 1 for velocity in NMEA VTG and RMC

Use this option if you want the velocity field in NMEA VTG and NMEA RMC messages to contain 2 decimals instead of the default 1.

Stop GGA, GLL, GNS and RMC output if invalid position

Use this option if you want the output of the position telegrams to stop if the position is invalid.

Telegram specifications

Topics

NMEA DDC

The NMEA DDC sentence provides controls for equipment display dimming presets and a display brightness percentage.

The sentence is as specified in NMEA standard 0183, version 4.0.

Format

```
$--DDC,a,xx,a,a*hh
```

Description

1. **a**: Display dimming preset

   D = Day time setting

   K = Dusk setting

   N = Night time setting

   O = Backlighting off setting

2. **xx**: Brightness percentage, 00 - 99
3. **a**: Colour palette

   D = Day time setting

   K = Dusk setting

   N = Night time setting

   O = Backlighting off setting

4. **a**: Sentence status flag. This shall not be a null field.

R = Status report

C = Configuration or command to change a setting

NMEA DTM

The DTM sentence contains local geodetic datum and datum offsets from a reference datum.

The sentence is as specified in NMEA standard 0183, version 3.0.

Format

```
$--DTM,ccc,a,x.x,a,x.x,a,x.x,ccc*hh
```

Description

1. **ccc**: Local datum code. Null field.
2. **a**: Local datum subdivision code
3. **x.x**: Latitude offset, minutes, North/South
4. **a**: North/South
5. **x.x**: Longitude offset, minutes, East/West
6. **a**: East/West
7. **x.x**: Altitude offset, metres, (+/—)
8. **ccc**: Reference datum code (WGS84 = W84)
9. ***hh**: Checksum

NMEA GBS

The NMEA GBS sentence is used to support RAIM (Receiver Autonomous Integrity Monitoring). It reports the integrity checks of the position quality of the position solution.

The sentence is as specified in NMEA standard 0183, version 3.0.

Format

```
$--GBS,hhmmss.ss,x.x,x.x,x.x,xx,x.x,x.x,x.x*hh
```

Description

1. **hhmmss.ss**: UTC of the GGA or GNS fix associated with this sentence. Hours, minutes and seconds.
2. **x.x**: Expected error in latitude.
3. **x.x**: Expected error in longitude.
4. **x.x**: Expected error in altitude.
5. **xx**: ID number of most likely failed satellite.GPS: 1–32, WAAS: 33–64, GLONASS: 65–96.
6. **x.x**: Probability of missed detection for most likely failed satellite.
7. **x.x**: Estimate of bias in metres on lost likely failed satellite.
8. **x.x**: Standard deviation of bias estimate.
9. ***hh**: Checksum

NMEA GGA

The NMEA GGA sentence transfers the time, position and fix related data from a global positioning system (GPS).

The sentence is as specified in NMEA standard 0183, version 3.0.

Format

```
$--
GGA,hhmmss.ss,llll.ll,a,yyyyy.yy,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx*hh
```

Description

1. **hhmmss.ss**: UTC of position (Hours, minutes and seconds)
2.
3. **llll.ll**: Latitude (Degrees, minutes and fractions of minutes)
4. **a** : Latitude sector, North/South
5. **yyyyy.yy**: Longitude (Degrees, minutes and fractions of minutes)
6.
7. **a** : Longitude sector,
8. **x**: GPS quality indicator. This shall not be a null field.

   0 = Fix not available or invalid

1 = GPS/GLONASS, Fix valid

2 = DGPS/DGLONASS, Fix valid

5 = Float RTK fix

6 = Estimated (dead reckoning) Mode

9. **xx**: Number of satellites in use, 00 - 12
10. **x.x**: Horizontal dilution of precision (HDOP)
11. **x.x**: Altitude, ref: mean-sea level (geoid)
12. **M**: Altitude unit, M = Metres
13. **x.x**: Geoidal separation

    The difference between the WGS-84 earth ellipsoid surface and mean-sea-level (geoid) surface.
14. **M**: Geoidal separation unit, M = Metres
15. **x.x**: Age of differential GPS data

    Time i seconds. Null field if DGPS is not used.
16. **xxxx**: Differential reference station ID, 0000 - 1023
17. ***hh**: Checksum

NMEA GGK

The NMEA GGK datagram is used to decode the PTNL, Time, Position, Type and DOP (Dilution of Precision) string of the NMEA 0183 output.

The sentence is as specified in NMEA standard 0183, version 3.0.

Format

```
$--
GGK,hhmmss.ss,ddmmyy,nnnnn.nnnnnnnn,a,yyyyy.yyyyyyyy,a,x,zz,w.w,EHTe
eeeee,u*hh<CR><LF>
```

Description

1. **hhmmss.ss**: Coordinated Universal Time (UTC) of the current position
2. **ddmmyy**: Day, month and year
3. **nnnnn.nnnnnnnn**: Latitude, Degrees, minutes and hundredths
4. **a**: Direction of latitude

- **N** = North
- **S** = South

5. **yyyyy.yyyyyyyy**: Longitude, Degrees, minutes and hundredths
6. **a**: Direction of longitude
   - **E** = East
   - **W** = West
7. **x**: Quality indicator for the GPS (Global Positioning System) (Refer to the NMEA standard for further information about the GPS quality indicator.)
8. **zz**: Number of satellites in use
9. **w.w**: PDOP (Position dilution of precision)
10. **EHTeeeeee**: Ellipsoidal height of fix
11. **u**: Unit of height measurement
12. ***hh**: Checksum

NMEA GLL

The NMEA GLL sentence transfers the latitude and longitude of vessel position, the time of the position fix and the current status from a global positioning system (GPS).

The sentence is as specified in NMEA standard 0183, version 3.0.

Format

```
$--GLL,llll.ll,a,yyyyy.yy,a,hhmmss.ss,A,a*hh
```

Description

1. **llll.ll**: Latitude (Degrees, minutes and fractions of minutes)
2. **a** : Latitude sector,
3. **yyyyy.yy**: Longitude (Degrees, minutes and fractions of minutes)
4. **a** : Longitude sector,
5. **hhmmss.ss**: UTC of position (Hours, minutes and seconds)
6. **A**: Status

   A = The data are valid.

   V = The data are not valid.

7. **a**: Mode indicator

   A = Autonomous

   D = Differential

   N = The data are not valid.

8. ***hh**: Checksum

NMEA GNS

This sentence provides position fix data for GPS, GLONASS, possible future satellite systems and systems combining these.

The sentence is as specified in NMEA standard 0183, version 3.0.

Format

```
$--GNS,hhmmss.ss,llll.ll,a,yyyyy.yy,a,c--c,xx,x.x,x.x,x.x,x.x,x.x*hh
```

Description

1. **hhmmss.ss**: UTC of position (Hours, minutes and seconds)
2. **llll.ll**: Latitude
3. **a**: North/South
4. **yyyyy.yy**: Longitude
5. **a**: Longitude/West
6. **c--c**: Mode indicator. The first character indicates the use of GPS/GLONASS satellites.

   N = No fix

   A = Autonomous mode

   D = Differential mode

7. **xx**: Number of satellites in use, 00 – 99
8. **x.x**: HDOP
9. **x.x**: Antenna altitude, Metres, Ref: mean-sea level (geoid)
10. **x.x**: Geoidal separation, Metres, Difference between the earth ellipsoid and mean-sea level
11. **x.x**: Age of differential data

12. **x.x**: Differential reference station ID
13. ***hh**: Checksum

NMEA GRS

This message is used to support Receiver Autonomous Integrity Monitoring (RAIM). It reports the range residuals in the position solution.

The sentence is as specified in NMEA standard 0183, version 3.0.

Format

```
$--
GRS,hhmmss.ss,x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x*hh
```

Description

1. **hhmmss.ss**:UTC time of the GGA or GNS fix associated with this sentence (Hours, minutes and seconds)
2. **x**: Mode indicator, 1 or 0
3. **x.x ..... x.x**: Range residuals in metres for satellites used in the navigation solution. Order must match order of the satellite ID numbers in GSA. When GRS is used, GSA and GSV are generally required.
4. ***hh**: Checksum

NMEA GSA

The NMEA GSA sentence transfers the satellites used in the navigation solution and the dilution of precision (DOP) values.

The sentence is as specified in NMEA standard 0183, version 3.0.

Format

```
$--GSA,a,x,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,x.x,x.x,x.x*hh
```

Description

1. **a**: Mode

   M = Manual

   A = Automatic

2. **x**: Mode

   1 = Fix not available

   2 = 2D

   3 = 3D

3. **xx**: Identification numbers for satellites used in solution

   Satellite numbers 1 - 32 for GPS satellites

   Satellite numbers 33 - 64 for WAAS satellites

   Satellite numbers 65 - 96 for GLONASS satellites

4. **x.x**: PDOP(Position dilution of precision)
5. **x.x**: HDOP(Horizontal dilution of precision)
6. **x.x**: VDOP(Vertical dilution of precision)
7. ***hh**: Checksum

NMEA GST

The NMEA GST sentence transfers pseudo-range error statistics.

The sentence is as specified in NMEA standard 0183, version 3.0.

Format

```
$--GST,hhmmss.ss,x.x,x.x,x.x,x.x,x.x,x.x,x.x*hh
```

Description

1. **hhmmss.ss**: UTC of position (Hours, minutes and seconds)
2. **x.x**: RMS value of the standard deviation of the range inputs to the navigation process
3. **x.x**: Standard deviation of semi-major axis of error ellipse (Metres)
4. **x.x**: Standard deviation of semi-minor axis of error ellipse (Metres)
5. **x.x**: Orientation of semi-major axis of error ellipse (Degrees from true north)
6. **x.x**: Standard deviation of latitude error (Metres)
7. **x.x**: Standard deviation of longitude error (Metres)
8. **x.x**: Standard deviation of altitude error (Metres)

9. ***hh**: Checksum

NMEA GSV

The NMEA GSV sentence transfers the number of satellites in view (SV), satellite identification numbers, elevation, azimuth and signal–noise ratio (SNR) value. Four satellites maximum per transmission. Additional satellite data sent in second or third message.

The sentence is as specified in NMEA standard 0183, version 3.0.

Format

```
$--GSV,x,x,xx,xx,xx,xxx,xx,.....,xx,xx,xxx,xx*hh
```

Description

1. **x**: Total number of messages, 1 - 9
2. **x**: Message number, 1 - 9
3. **xx**: Total number of satellites in view
4. **xx**: Satellite identification number

   Satellite numbers 1 - 32 for GPS satellites

   Satellite numbers 33 - 64 for WAAS satellites

   Satellite numbers 65 - 96 for GLONASS satellites
5. **xx**: Elevation in degrees, 90° maximum
6. **xxx**: Azimuth in degrees, True, 000 - 359
7. **xx**: SNR, 00 - 99 dB-Hz, null when not tracking
8. **.....,xx,xx,xxx,xx**: A variable number of “Satellite identification number, Elevation, Azimuth, SNR” sets, maximum four sets per message.
9. ***hh**: Checksum

NMEA HDT

The NMEA HDT sentence contains the actual vessel heading in degrees true produced by any device or system producing true heading.

Note:

This is a deprecated sentence which has been replaced by THS.

Format

```
$--HDT,x.x,T*hh<CR><LF>
```

Description

1. **x.x**: Heading, degrees true.
2. **T**: Heading, degrees true.
3. ***hh**: Checksum

NMEA RMC

The NMEA RMC datagram transfers the time, date, position, course and speed data from a global navigation satellite system (GNSS) receiver.

Format

```
$--RMC,hhmmss.ss,A,llll.ll,a,yyyyy.yy,a,x.x,x.x,xxxxxx,x.x,a,a*hh
```

Description

1. **hhmmss.ss**:
2. Coordinated Universal Time (UTC) of the current position **A**: Status

   A = The data are valid.

   V = Navigation receiver warning.
3. **llll.ll,a**: Latitude North/South
4. **yyyyy.yy,a**: Longitude East/West
5. **x.x**: Speed over ground (knots)
6. **x.x**: Course over ground (Degrees (True))
7. **xxxxxx**: Date: ddmmyy
8. **x.x,a**: Magnetic variation, East/West (Degrees)

   E = Easterly variation, subtracts from True course

   W = Westerly variation, adds to True course

9. **a**:

   Mode indicator A = Autonomous mode

   D = Differential mode

   E = Estimated (dead reckoning) mode

   M = Mode indicator mode

   S = Simulator mode

   N = The data are not valid.

10. ***hh**: Checksum

NMEA ROT

The NMEA ROT sentence contains rate of turn and direction of turn information.

Format

```
$--ROT,x.x,A*hh<CR><LF>
```

Description

1. **x.x**: Rate of turn, °/min, "-" = bow turns to port.
2. **A**: Status.

   A = Data valid.

   V = Data invalid.

3. ***hh**: Checksum

NMEA VBW

The NMEA VBW datagram contains water- and ground-referenced vessel speed data.

Format

```
$--VBW,x.x,x.x,A,x.x,x.x,A,x.x,A,x.x,A*hh<CR><LF>
```

Description

1. **x.x**: Speed relative to water (knots)

2. **x.x**: Speed relative to water (knots)
3. **A**: Status, Speed relative to water,

   A = The data are valid.
4. **x.x**: Speed relative to ground, Longitudinal (knots)
5. **x.x**: Speed relative to ground, Transverse (knots)
6. **A**: Status, Speed relative to ground

   A = The data are valid.
7. **x.x**: Speed relative to water, Stern, Transverse (knots)
8. **A**: Status, Speed relative to water, Stern

   A = The data are valid.
9. **x.x**: Stern, Transverse (knots)
10. **A**: Status, Speed relative to ground, Stern

    A = The data are valid.

    V = The data are not valid.
11. ***hh**: Checksum

Note:

Transverse speed: " – " = port. Longitudinal speed: " – " = astern.

NMEA THS

The NMEA THS sentence contains the actual vessel heading in degrees true produced by any device or system producing true heading.

This sentence includes a "mode indicator" field providing critical safety related information about the heading data.

Note:

This sentence replaces the HDT sentence.

Format

```
$--THS,x.x,a*hh<CR><LF>
```

Description

1. **x.x**: Heading, degrees true.
2. **T**: Mode indicator. This field should not be null.

   A = Autonomous

   E = Estimated (dead reckoning)

   M = Manual input

   S = Simulator mode

   V = Data not valid (including standby)
3. ***hh**: Checksum

NMEA VER

The NMEA VER sentence provides identification and version information about a device. This sentence is produced as a reply to a query sentence.

The sentence is as specified in NMEA standard 0183, version 4.0.

Format

```
$--VER,x,x,aa,c--c,c--c,c--c,c--c,c--c,c--c,x*hh
```

Description

1. **x**: Total number of sentences needed, 1 - 9
2. **x**: Sentence number, 1 - 9
3. **aa**: Device type
4. **c--c**: Vendor identification
5. **c--c**: Unique identifier. Max 15 characters.
6. **c--c**: Manufacturer serial number. Max. 32 characters.
7. **c--c**: Model code (product code). Max. 32 characters.
8. **c--c**: Software revision. Max. 32 characters.
9. **c--c**: Hardware revision. Max. 32 characters.
10. **x**: Sequential message identifier. Message identification number from 0 - 9.
11. ***hh**

    : Checksum

NMEA VTG

The NMEA VTG sentence transfers the actual course and speed relative to the ground.

The sentence is as specified in NMEA standard 0183, version 3.0.

Format

```
$--VTG,x.x,T,x.x,M,x.x,N,x.x,K,a*hh
```

Description

1. **x.x**: Course over ground, Degrees (True)
2. **T**: Course over ground, marker
3. **x.x**: Course over ground, Degrees (Magnetic)
4. **M**: Course over ground, marker
5. **x.x**: Speed over ground, knots
6. **N**: Speed over ground, knots
7. **x.x**: Speed over ground, km/h
8. **K**: Speed over ground, km/h
9. **a**: Mode indicator. This shall not be a null field.

   A = Autonomous

   D = Differential

   N = The data are not valid.
10. ***hh**: Checksum

NMEA ZDA

The NMEA ZDA sentence contains the universal time code (UTC), day, month, year and local time zone.

The sentence is as specified in NMEA standard 0183, version 3.0.

Format

```
$--ZDA,hhmmss.ss,xx,xx,xxxx,xx,xx*hh
```

Description

1. **hhmmss.ss**: UTC of position (Hours, minutes and seconds)
2. **xx**: Day UTC, 01 - 31
3. **xx**: Month UTC, 01 - 12
4. **xxxx**: Year UTC
5. **xx**: Local time zone, 00 - ±13 hrs
6. **xx**: Local time zone, minutes, 00 – +59
7. ***hh**: Checksum

PSXN20

The proprietary PSXN20 NMEA sentence contains quality indicators for roll, pitch, heading and position.

The sentence destination is positioning reference systems.

The sentence is based on NMEA sentence format.

Format

```
$PSXN,20,x,x,x,x*hh<CR><LF>
```

Description

1. **$**: Start character.
2. **PSXN**: Seatex ID.
3. **Message number**: 20.
4. **x**: horiz-qual - Horizontal position and velocity quality.

   0 = Normal

   1 = Reduced performance

   2 = Invalid data
5. **x**: hgt-qual - Height and vertical velocity quality.

   0 = Normal

   1 = Reduced performance

   2 = Invalid data
6. **x**: head-qual - Heading quality.

0 = Normal

1 = Reduced performance

2 = Invalid data

7. **x**: rp-qual - Roll and pitch quality.

   0 = Normal

   1 = Reduced performance

   2 = Invalid data

8. ***hh**: Checksum.
9. **<CR><LF>**: End of sentence.

PSXN21

The proprietary PSXN21 NMEA sentence contains system restart status.

The sentence is based on NMEA sentence format.

Format

```
$PSXN,21,x*hh<CR><LF>
```

Description

1. **$**: Start character.
2. **PSXN**: Seatex ID.
3. **Message number**: 21.
4. **x**: Event code.

   1 = System restart

5. ***hh**: Checksum.
6. **<CR><LF>**: End of sentence.

PSXN22

The proprietary PSXN22 NMEA sentence contains calibration values for input gyro compass.

The sentence destination is positioning reference systems.

The sentence is based on NMEA sentence format.

Format

```
$PSXN,22,d.dd,d.dd*hh<CR><LF>
```

Description

1. **$**: Start character.
2. **PSXN**: Seatex ID.
3. **Message number**: 22.
4. **d.dd**: gyro-calib - Gyro calibration value since system start-up in degrees.
5. **d.dd**: gyro-offs - Short-term gyro offset in degrees.
6. ***hh**: Checksum.
7. **<CR><LF>**: End of sentence.

PSXN23

The proprietary PSXN23 NMEA sentence contains attitude and heave data calculated in the Seapath system.

The sentence destination is PRS monitoring systems.

The sentence is based on NMEA sentence format.

Format

```
$PSXN,23,x.x,x.x,x.x,x.x*hh<CR><LF>
```

Description

1. **$**: Start character.
2. **PSXN**: Seatex ID.
3. **Message number**: 23
4. **x.x**: Roll in degrees. Positive with port side up.
5. **x.x**: Pitch in degrees. Positive with bow up.
6. **x.x**: Heading, degrees true.
7. **x.x**: Heave [m]. Positive down.

8. ***hh**: Checksum (delimiter and field).
9. **<CR><LF>**: End of sentence.

PSXN24

The proprietary PSXN43 NMEA sentence contains angular and vertical velocities calculated in the Seapath system.

The sentence destination is PRS monitoring systems.

The sentence is based on NMEA sentence format.

Format

```
$PSXN,24,x.x,x.x,x.x,x.x*hh<CR><LF>
```

Description

1. **$**: Start character.
2. **PSXN**: Seatex ID.
3. **Message number**: 24
4. **x.x**: Roll rate in degrees per second. Positive with port side up.
5. **x.x**: Pitch rate in degrees per second. Positive with bow up.
6. **x.x**: Yaw rate in degrees per second. Positive clockwise.
7. **x.x**: Vertical velocity [m/s]. Positive down.
8. ***hh**: Checksum (delimiter and field).
9. **<CR><LF>**: End of sentence.

Seapath Binary 26

This binary format consists of a fixed-length message using 1, 2 and 4–byte signal and unsigned integers. The signed integers are represented as two-complement numbers. For the multi-byte elements, the most significant byte is transmitted first. The total number of bytes is 52.

Format

Element	Scaling	Format	Bytes	Value
Header		Unsigned	1	AA Hex
Header		Unsigned	1	53 Hex
Time, seconds	seconds	Integer	4	
Time, fraction of second	0.0001 second	Unsigned	2	0 - 9999
Latitude	2^{30} = 90 degrees	Integer	4	-2^{30} - 2^{30}
Longitude	2^{30} = 90 degrees	Integer	4	-2^{31} - 2^{31}
Height	centimetres	Integer	4	
Heave real-time	centimetres	Integer	2	
North velocity	centimetres/ second	Integer	2	
East velocity	centimetres/ second	Integer	2	
Down velocity	centimetres/ second	Integer	2	
Roll	2^{14} = 90 degrees	Integer	2	-2^{15} - 2^{15}
Pitch	2^{14} = 90 degrees	Integer	2	-2^{15} - 2^{15}
Heading	2^{14} = 90 degrees	Unsigned	2	0 - 2^{16}
Roll rate	2^{14} = 90 degrees/ second	Integer	2	-2^{15} - 2^{15}
Pitch rate	2^{14} = 90 degrees/ second	Integer	2	-2^{15} - 2^{15}
Yaw rate	2^{14} = 90 degrees/ second	Integer	2	-2^{15} - 2^{15}
Delayed heave time, seconds	seconds	Integer	4	
Delayed heave time, fraction of second	0.0001 second	Unsigned	2	0 - 9999
Heave, delayed	centimetres	Integer	2	
Status word		Bit-fields	2	
Checksum		Unsigned	2	

Description

Checksum is calculated as a 16-bit Block Cyclic Redundancy Check of all bytes between, but not including the Header and Checksum fields. The CRC algorithm is described in

a separate section. Time is divided in an integer seconds part and a fractional second part. The integer seconds part of time is counted from 1970-01-01 UTC time, ignoring leap seconds.

Latitude is positive north of the Equator. Longitude is positive east of Greenwich. Height is above the ellipsoid. Heave is positive down. Roll is positive with port side up. Pitch is positive with bow up.

The status word consists of 16 single bit flags numbered from 0 to 15, where 0 is the least significant bit.

A 1 value (true) means:

Bit no.	Interpretation
0	Reduced horizontal position and velocity performance
1	Invalid horizontal position and velocity data
2	Reduced heave and vertical velocity performance
3	Invalid heave and vertical velocity data
4	Reduced roll and pitch performance
5	Invalid roll and pitch data
6	Reduced heading performance
7	Invalid heading data
8	Invalid delayed heave data

The remaining bits in the status word are reserved for future expansion.

Simrad EM 3000

The Simrad EM 3000 is a proprietary datagram format created by Simrad for use with digital motion sensors. It holds roll, pitch, heave and heading information. The datagram contains a 10-byte message.

Format

Data description	Example	Format	Valid range
Sync byte 1 / Sensor status **[1]**	90h to Afh = sensor status	1U	00h, 90h to Afh
Sync byte 2	Always 90h	1U	144
Roll LSB **[2]**		1U	
Roll MSB **[2]**		1U	

Data description	Example	Format	Valid range
Pitch LSB **[2]**		1U	
Pitch MSB **[2]**		1U	
Heave LSB **[2]**		1U	
Heave MSB **[2]**		1U	
Heading LSB **[2]**		1U	
Heading MSB **[2]**		1U	

Description

LSB = least significant byte

MSB = most significant byte.

1. **Sync byte 1 / Sensor status**
   - **00h**: This value is sync byte 1.
   - **90h**: This value indicates valid measurements with full accuracy.
   - Any value from **91h** to **99h** indicates valid data with reduced accuracy (decreasing accuracy with increasing number).
   - Any value from **9Ah** to **9Fh** indicates non-valid data but normal operation (for example configuration or calibration mode).
   - Any value from **A0h** to **AFh** indicates a sensor error status.
2. **All data are in 2's complement binary.**

   Resolution is 0.01 degrees for roll, pitch and heading, and 1 cm for heave.
   - Roll is positive with port side up with valid range ±179.99 degrees.
   - Pitch is positive with bow up with valid range ±179.99 degrees.
   - Heave is positive up with valid range ±9.99 m.
   - Heading is positive clockwise with valid range 0 to 359.99 degrees.

   If a value is outside the valid range, it is assumed to be non-valid, and rejected.

   Note:

   Heave is logged as positive downwards (the sign is changed) including roll and pitch induced lever arm translation to the transmit transducer.

You can define how roll is assumed to be measured, either with respect to the horizontal plane (the *Hippy 120* or *TSS* convention), or to the plane tilted by the given pitch angle (i.e. as a rotation angle around the pitch tilted forward pointing x-axis).

The latter convention (called *Tate-Bryant* in the POS/MVdocumentation) is used inside the system in all data displays and in the logged data. A transformation is applied if the roll is given with respect to the horizontal.

Note:

This format was originally designed for use with the early multibeam echo sounders manufactured by Kongsberg Discovery. In the original version of the format (Simrad EM 1000), the first synchronisation byte was always assumed to be zero. The sensor manufacturers were then requested to include sensor status in the format using the first synchronisation byte for this purpose.

KM Binary datagram format

KM Binary is a proprietary datagram format created by Kongsberg Discovery for general use.

Format

Data description	Unit of measurement	Format	No. of bytes
Start ID	#KMB	char	4U
Datagram length		uint16	2U
Datagram version (=1)		uint16	2U
UTC seconds	s	uint32	4U
UTC nanoseconds	ns	uint32	4U
Status		uint32	4U
Latitude	deg	double	8F
Longitude	deg	double	8F
Ellipsoid height	m	float	4F
Roll	deg	float	4F
Pitch	deg	float	4F
Heading	deg	float	4F
Heave	m	float	4F
Roll rate	deg/s	float	4F
Pitch rate	deg/s	float	4F
Yaw rate	deg/s	float	4F
North velocity	m/s	float	4F

Data description	Unit of measurement	Format	No. of bytes
East velocity	m/s	float	4F
Down velocity	m/s	float	4F
Latitude error	m	float	4F
Longitude error	m	float	4F
Height error	m	float	4F
Roll error	deg	float	4F
Pitch error	deg	float	4F
Heading error	deg	float	4F
Heave error	m	float	4F
North acceleration	m/s^2	float	4F
East acceleration	m/s^2	float	4F
Down acceleration	m/s^2	float	4F
Delayed heave:			
UTC seconds	s	uint32	4U
UTC nanosecond	ns	uint32	4U
Delayed heave	m	float	4F

Description

Data format	Little endian (the least significant byte is transmitted first). Float is according to IEEE - 754.
Datagram length	The total number of bytes in the datagram
Datagram version	The version is incremented if the datagram format is changed.
Timestamp format	Epoch 1970-01-01 UTC time
Position and height	At user-defined sensor reference point. Position in decimal degrees. • Latitude: Negative on Southern hemisphere • Longitude: Negative on Western hemisphere • Height: Positive above ellipsoid
Positive roll	Port side up
Positive pitch	Bow up
Positive heave	Downwards, at user-defined sensor reference point
	True north
Error fields	Sensor data quality: RMS-1= not implemented

Status

One bit per status info, 1= active

Bit	
	Invalid data:
0	Horizontal position and velocity
1	Roll and pitch
2	
3	Heave and vertical velocity
4	Acceleration
5	Delayed heave
Reduced performance:	
16	Horizontal position and velocity
17	Roll and pitch
18	
19	Heave and vertical velocity
20	Acceleration
21	Delayed heave

Calibration format 7

The Calibration format 7 is used when calibrating the GNSS antenna installation. The format is a columnar ASCII text format.

Format

Element	Columns	Scaling	Decimals	Value
Time	1 - 7	seconds	1	0.0 - 86399.9
Heading	10 - 15	degrees	2	0.00 - 359.99
Gyro heading	18 - 23	degrees	2	0.00 - 359.99
Baseline	26 - 31	metres	3	
Height	34 - 38	metres	2	
Term	39 - 40			CR-LF

Description

Each record consists of numbers on ASCII format separated by spaces and terminated by carriage return and linefeed (values 10 and 13). Leading spaces are used, so the numbers are separated by two or more spaces, and spaces may occur before the first number on the record.

Time is counted since last midnight UTC time. Heading is true heading from the GNSS phase measurement, which is not the same as the heading output on the other formats. Gyro heading is from an external gyro, 0.00 if no gyro is connected. Baseline is the slant range between the antenna centres from the GNSS phase measurement. Height is the height difference between the antennas from the GNSS phase measurement. Height is positive if antenna 1 is above antenna 2.

The data are intended for calibration of the antenna installation, so no data are output unless the GNSS phase measurements are valid.

Echo sounder format 9

The Echo sounder 9 format is used when connecting Simrad EA500 and other echo sounders. The format is a proprietary ASCII text format with fixed-length records.

Format

Element	Columns	Scaling	Format
Header	1 - 7		:000000
Heave	9 - 13	1 cm	sdddd
Warning	14		space or "?"
Roll	15 - 19	0.01 degree	sdddd
Pitch	21 - 25	0.01 degree	sdddd
Term	26 - 27		CR-LF

Description

Heave is positive up. Roll is positive with the port side up.

Pitch is positive with the bow up. The zeroes in the header occupy the columns used for acceleration when this format is output from other systems. Seapath does not output acceleration.

"s" is the sign character, space if positive and "-" if negative. "dddd" is a decimal number with leading zeroes where appropriate.

The warning character is space if data are normal, "?" if data are invalid or they are of reduced quality.

Columns between elements are filled with spaces.

The definition of the attitude angles in this format is different from the Euler angles definition used elsewhere. The difference appears in the roll angle, where:

$roll_{echo\text{-}sounder}$=arcsin[sin($roll_{Euler}$)*cos($pitch_{Euler}$)]

Echo sounder format 18, TSS1

The Echo sounder 18, TSS1, format is used when connecting Seapath to Seabeam and other echo sounders The format is a proprietary ASCII text format with fixed-length records.

Format

Element	Columns	Scaling	Format
Header	1 - 7		:000000
Heave	9 - 13	1 cm	sdddd
Warning	14		"F" or "f"
Roll	15 - 19	0.01 degree	sdddd
Pitch	21 - 25	0.01 degree	sdddd
Term	26 - 27		CR-LF

Description

Heave is positive up. Roll is positive with the port side up. Pitch is positive with the bow up.

The zeroes in the header occupy the columns used for acceleration when this format is output from other systems. Seapath does not output acceleration.

"s" is the sign character, space if positive and "-" if negative. "dddd" is a decimal number with leading zeroes where appropriate.

The warning character is "F" if data are normal, "f" if data are invalid or they are of reduced quality.

Columns between elements are filled with spaces.

The definition of the attitude angles in this format is different from the Euler angles definition used elsewhere. The difference appears in the roll angle, where:

$roll_{echo\text{-}sounder}$=arcsin[sin($roll_{Euler}$)*cos($pitch_{Euler}$)]

RDI ADCP

The RDI format is used when connecting RDI ADCP equipment. The format is a proprietary ASCII text format.

Format

```
$PRDID,sddd.dd,sddd.dd,ddd,dd,<CR><LF>
```

Description

- **sddd.dd**: pitch - Pitch, degrees. s is the sign character, "+" or "-". ddd.dd is a decimal number with leading zeroes where appropriate. Positive with the bow up.
- **sddd.dd**: roll - Roll, degrees. s is the sign character, "+" or "-". ddd.dd is a decimal number with leading zeroes where appropriate. Positive with the port side up.
- **ddd.dd**: head - Heading, degrees true, with leading zeroes where appropriate.
- **<CR><LF>**: term - End of sentence (2 bytes, values 13 and 10).

1PPS, NMEA ZDA format 13

This 1PPS time tag message is output once per second, approximately 0.5 seconds before the time pulse. The 1PPS, NMEA ZDA format 13 contains the UTC time when the message is output. The next time pulse appears at the first integer second after the time in the message. The format is ASCII text using the ZDA message.

Format

```
$INZDA,hhmmss.ss,x,x,yyyy,,*hh<CR><LF>
```

Description

- **hhmmss.ss**: UTC time. hh = hours (00 - 23), mm = minutes (00 - 59), ss.ss = seconds (00.00 - 59.99)
- **x**: Day of month (01 - 31)
- **x**: Month of year (01 - 12)
- **yyyy**:Year

- **hh**: Checksum
- **<CR><LF>**: End of sentence (2 bytes, values 13 and 10).

This format is recommended used together with 1PPS signal output on the 1PPS terminal at the rear of the Processing Unit. This since the message is output synchronised with the 1PPS signal and is easier/faster to decode than the standard NMEA output with a number of NMEA messages included.

1PPS, Trimble format 14

This 1PPS time tag message is output once per second, approximately 0.5 seconds before the time pulse. The message contains the UTC time of the next time pulse. The message format is fixed length ASCII text.

Format

Element	Columns	Format
Header	1 -3	UTC
Date	5 - 12	yy.mo.da
Time	14 - 21	hh:mm:ss
Fix type	23	digit or "?"
No. of satellites	24	digit or "?"
Term	25 - 26	CR-LF

Description

"yy.mo.da" is year (00 - 99), month of year (01 - 12) and day of month (01 - 31). "hh:mm:ss" is hours (00 - 23), minutes (00 - 59) and seconds (00 - 59). Fix type is "5" for 3D fix with accurate time, "?" for no fix (time from receiver clock). No. of satellites is"1" - "8" for 1 - 8 satellites tracked, "9" for 9 or more satellites tracked, "?" for no fix (time from receiver clock).

Columns between elements are filled with spaces.

PFreeHeave

The PfreeHeave® format is used to improve the accuracy on the real-time heave.

Format

Element	Scaling	Format	Bytes	Value
Header		Unsigned	1	AA Hex
Header		Unsigned	1	52 Hex
Time, seconds	Seconds	Integer	4	
Time, fraction of second	0.0001 second		2	0 - 9999
Heave	Centimetres	Integer	2	
Status word		Bit-fields	1	
Checksum		Unsigned	2	

Description

The PFreeHeave® format consists of a fixed-length message using 1-, 2- and 4-byte signed and unsigned integers. The signed integers are represented as two-complement numbers. For the multi-byte elements, the most significant byte is transmitted first. The total number of bytes is 13.

The PFreeHeave output is delayed by a few minutes due to processing. The time fields contain time of validity for the data.

Checksum is calculated as a 16-bit Block Cyclic Redundancy Check (CRC) of all bytes between, but not including the Header and Checksum fields. Time is divided in an integer seconds part and a fractional second part. The integer seconds part of time is counted from 1970-01-01 UTC time, ignoring leap seconds.

Heave is positive down. The status field is zero if heave is valid, non-zero if heave is invalid.

Related references

Cyclic redundancy check (CRC) algorithm, page 203

RTCM format 80

This format is used to output raw GNSS data for post processing of the position. All data are output in the GNSS antenna only and applies for both antennas.

This protocol is based on the RTCM Standard 10403.2, *Differential GNSS services*, version 3 with Amendments 1 and 2. Refer to this standard for a description of the output properties.

Cyclic redundancy check (CRC) algorithm

The 16-bit Block Cyclic Redundancy Check (CRC) algorithm is used to calculate the checksum in some formats. The algorithm is described in C and Fortran source code.

C code

```
#define POLY 0x8408
unsigned short blkcrc(
   unsigned char *bufptr,        /* message buffer */
   unsigned long len             /* number of bytes */
   )
{
   unsigned char i;
   unsigned short data;
   unsigned short crc = 0xffff;

   if (len == 0L) {
      return ~crc;
   }

 do {
      for (i=0, data = (unsigned short) (0xff & *bufptr++);
           i < 8;
           i++, data >>= 1) {
         if ((crc & 0x0001) ^ (data & 0x0001)) {
            crc = (crc >> 1) ^ POLY;
         } else {
            crc >>= 1;
         }
      }
   } while (--len);

   crc = ~crc;
   data = crc;
   crc = (crc << 8) | ((data >> 8) & 0xff);

   return crc;
}
```

Fortran code

```
SUBROUTINE blkcrc(inbuffer, len, crc)

INTEGER*2 len, i , bit
INTEGER*4 crc, data, poly
CHARACTER inbuffer*(*)

poly = 16#8408
crc  = 16#FFFF
data = 0

IF (len.EQ.0) THEN
    crc = 0
    RETURN
END IF

DO i = 1, len
    data = ICHAR(inbuffer(i:i))
    DO bit = 1, 8
        data = IAND(data,16#FF)
        IF (IAND(crc,16#01).EQ.(IAND(data,16#01))) THEN
            crc = ISHL(crc,-1)
        ELSE
            crc = ISHL(crc,-1)
            crc = IEOR(crc, poly)
        END IF
        data = ISHL(data,-1)
    END DO
END DO

data = IEOR(crc,16#FFFF)
crc = IOR(ISHL(data,8),IAND(ISHL(data,-8),16#FF))

END
```

Related references

PFreeHeave, page 201

Functions and dialog boxes

Topics

NAV Engine Configuration

Topics

Vessel Geometry page

Here you can set the vessel dimensions and reference points for the vessel on which the Seapath system is installed as well as defining the origin of the vessel coordinate system.

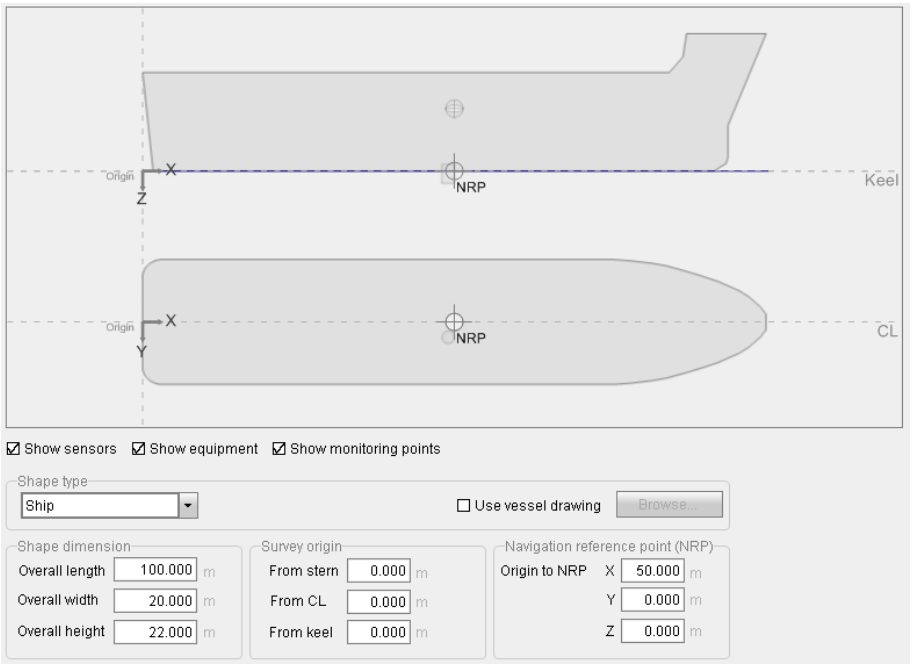
Prerequisites

The navigation reference points you type here must be measured or defined before you start the configuration process.

How to open

Select the **System** menu > **NAV Engine** > **Standard** > **Vessel** > **Geometry**.

Example



Description

The pre-defined scalable vessel shape types rarely represent the actual outline of your vessel. In order to configure the accurate location of the various sensors, equipment and monitoring points on your vessel, you can load a separate vessel model from file. Select **Use vessel drawing** and browse for your specific vessel model file.

Details

Show sensors, **Show equipment**, **Show monitoring points**

These items are displayed in the vessel illustration when you select the boxes.

Shape type

It defines the shape of the vessel which hosts the system. You can select between Ship, Rig, Jackup (3 leg) and Jackup (4 leg). These are all scaled according to the dimensions given in the **Shape dimension** section.

Use vessel drawing

The general shape outline can be overridden by an actual shape defined in a drawing file. Supported file extensions are **Vessel models(*.svm)**, **Vessel vector images (*.svi)** and **Old vessel images (*.txt)**. This file can be created or edited in a text editor. When a valid drawing file has been loaded, the dimensions are defined by the loaded shape and the **Shape dimension** parameters are locked.

Shape dimensions

It holds parameters for the overall length of the vessel from stern to bow, the overall width of the vessel and the overall height, which is the distance from the highest point of the vessel to the keel.

Survey origin

All point locations in the configuration refer to the origin. The location of the origin is defined using the distance from stern, centre line (CL) and keel. The location of origin is often referred to as the common reference point (CRP) in survey reports. The distance from stern is the distance from the aft point of the ship to origin along the X axis. The distance from CL is the distance from the vessel's centre line, positive towards starboard. The distance from keel is the distance from the keel, positive downwards.

Navigation reference point (NRP)

The Navigation Reference Point location (NRP) is the reference point for all measurements in the system. The recommended NRP is near the centre of gravity (CG), but it can be freely chosen. It is always defined related to the origin.

Related tasks

Setting vessel dimensions and reference points, page 101
Importing vessel shape from file, page 134

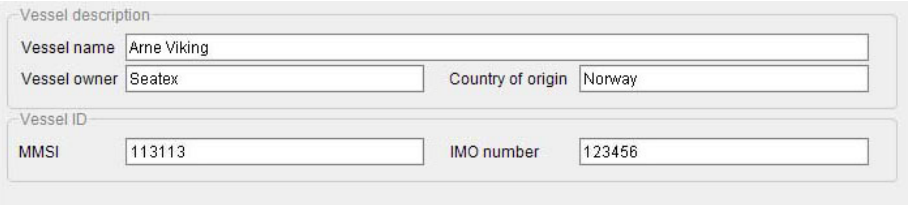
Vessel Description page

The vessel **Description** parameters allow you to enter information about the vessel which is needed for identification purposes.

How to open

Select the **System** menu > **NAV Engine** > **Standard** > **Sensors** > **GNSS** > **Geometry**.

Example



Details

Vessel name

This is the name of the vessel.

Vessel owner

This is the owner of the vessel.

Country of origin

This is the country in which the vessel is registered.

MMSI

This is the nine-digit Maritime Mobile Service Identity (MMSI) number which uniquely identifies your vessel.

IMO number

This is the International Maritime Organization (IMO) number which uniquely identifies your vessel.

Related tasks

Entering vessel identification parameters, page 134

Sensors GNSS Geometry page

Here you can enter the coordinates for the antenna location(s) on-board your vessel. The GNSS antennas are located inside the Sensor Unit.

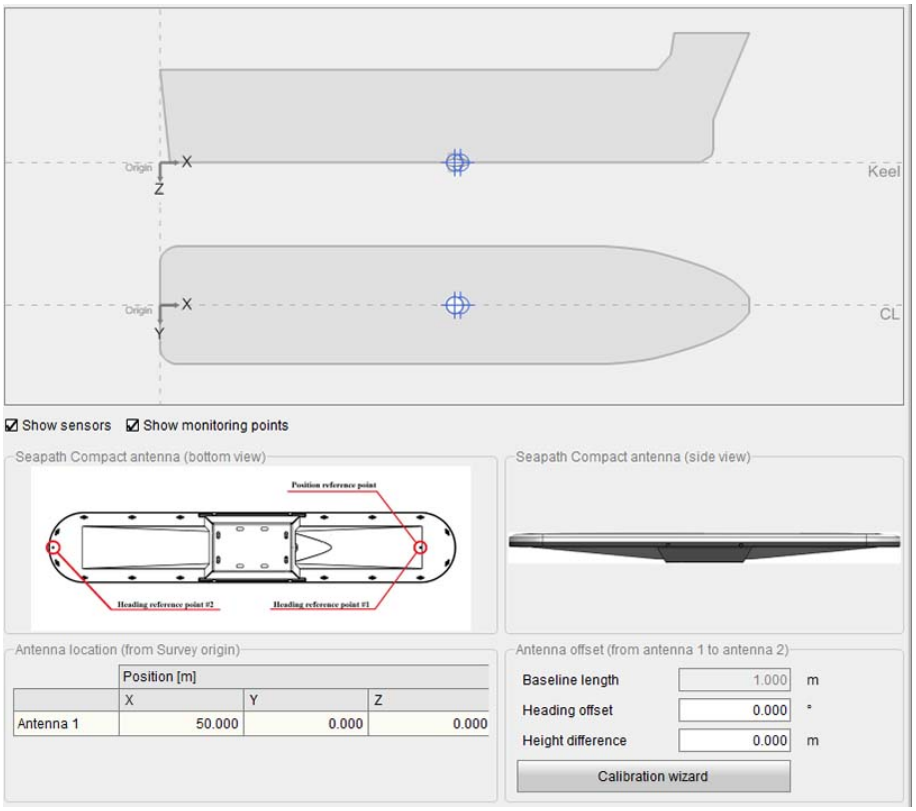
Prerequisites

The distance vector from the origin to the GNSS antenna has to be measured before you can enter the parameters into the configuration.

How to open

Select the **System** menu > **NAV Engine** > **Standard** > **Sensors** > **GNSS** > **Geometry**.

Example



Details

Show sensors, Show monitoring points

These items are displayed in the vessel illustration when you select the boxes.

Antenna location (from Survey origin)

Position: X, Y, Z. This is the surveyed antenna co-ordinates.

Antenna offset from antenna 1 to antenna 2

The **Baseline length** is the distance between the antennas. The **Heading offset** is the angle between the antennas The **Height difference** is the difference in height between the antennas.

If you change the **Antenna location** parameters, the **Antenna offset** parameters will change as well.

Calibration Wizard

The **Calibration wizard** will help you to calculate the offset (length, heading and height) from antenna 1 to antenna 2.

Related tasks

Entering antenna location parameters, page 104
Using Calibration Wizard to determine antenna parameters, page 106

Sensors MRU Geometry page

Here you can enter the physical location, as well as the mounting angels, for the Inertial Measurement Unit (IMU) on your vessel. The location is relative to origin. The IMU is either an MGC (Motion Sensor and Gyro Compass) or an MRU (Motion Reference Unit).

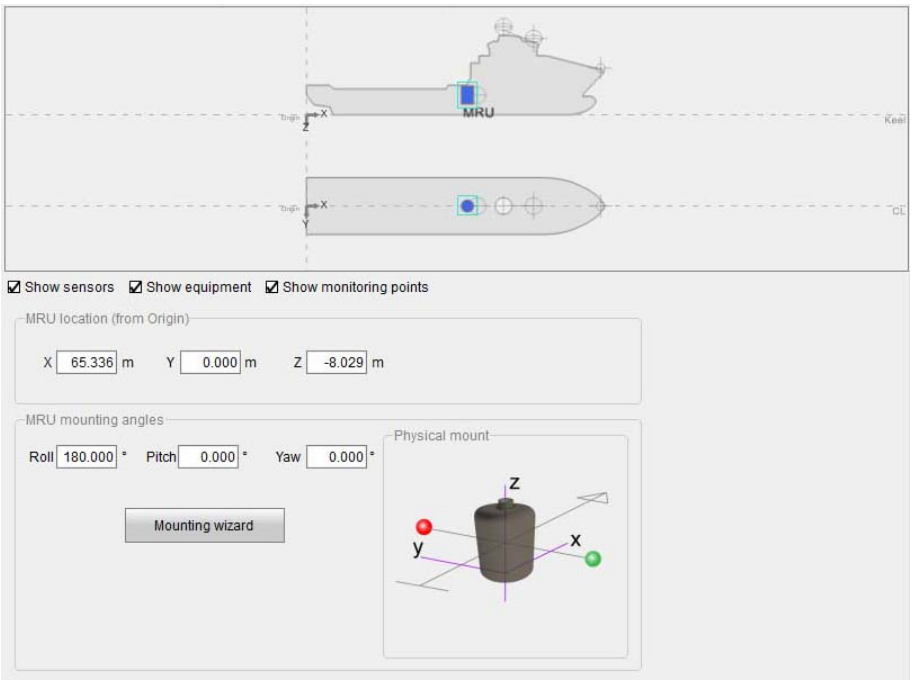
Prerequisites

For accurate location of the MRU (Motion Reference Unit) a survey has to be carried out.

How to open

Select the **System** menu > **NAV Engine** > **Standard** > **Sensors** > **MRU** > **Geometry**.

Example



Details

Show sensors, Show equipment, Show monitoring points

These items are displayed in the vessel illustration when you select the boxes.

Sensor location (from origin)

This ist he position of the MRU in X, Y, Z coordinates in metres from Origin. The sensor unit (IMU) location has to be measured. The default position of the IMU is in the vessel Origin.

IMU interface

Select the Inertial Measurement Unit connected to this product. 5th generation MRU or MGC.

Mounting angles

This is the mounting angles of the Inertial Measurement Unit in degrees for roll, pitch and yaw. The Mounting Wizard is a helpful tool to obtain the correct roll and pitch compensation.

`Mounting wizard` button

Select this button and the Mounting wizard will assist you with the determination of the MGC mounting angles.

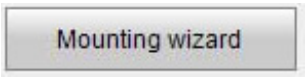
Related tasks

Setting MRU location and mounting angles, page 111

Setting miniMRU location and mounting angles, page 119

Sensors MRU Geometry - Mounting Wizard

Use the Mounting Wizard to determine the roll, pitch and yaw mounting angles in degrees for the MRU.



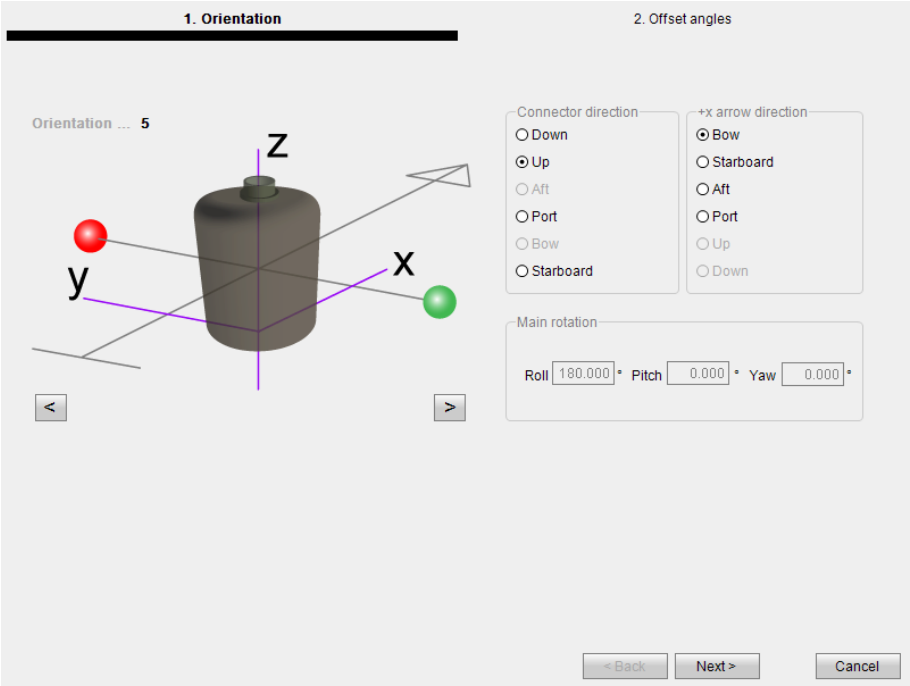
Prerequisites

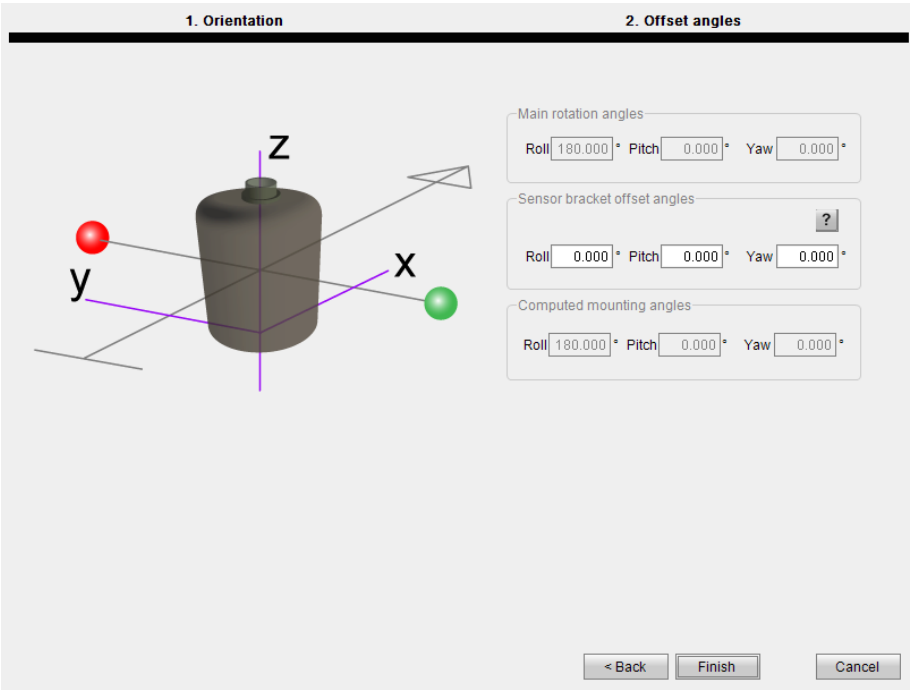
The MRU mounting bracket offset angles have to be available from a survey report or through other methods with similar accuracy.

How to open

Select the `Mounting Wizard` button in the **Sensors MRU Geometry** page.

Example



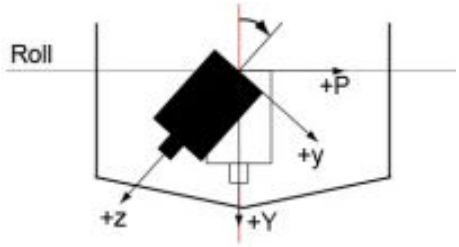


Description

The `Mounting Wizard` will help you to determine the offset angles of the sensor unit mounting bracket. The mounting bracket offset angles which have to be entered are roll, pitch and yaw.

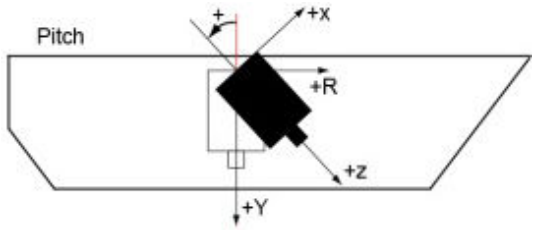
Roll offset angle

The angle between the ship's Y-axis and the projection of the unit's z-axis in the ship’s PY-plane. Positive roll offset angle if the bracket tilts to starboard.



Pitch offset angle

The angle between the ship’s Y-axis and the projection of the unit's z-axis in the ship’s RY-plane. Positive pitch offset angle if the bracket tilts to stern.



Yaw offset angle

The angle between the ship’s R-axis and the projection of the unit's x-axis in the ship’s RP-plane. Positive yaw offset angle if the bracket is rotated clockwise.

Details

Connector direction

This is the direction in which the connector on the sensor unit points. The selections are Down, Up, Aft, Port, Bow or Starboard.

+x arrow direction

This is the direction in which the +x arrow on the sensor unit points. The selections are Bow, Starboard, Aft, Port, Up or Down.

Main rotation/Main rotation angles

This is the designated installation orientation of the MGC/MRU in the vessel, as indicated by **Connector direction** and **+ arrow direction**. These angles are multiples of 90 degrees.

Sensor bracket offset angles

This is the surveyed offset angles from the designated installation orientation.

Computed mounting angles

This is the actual installation orientation of the MGC/MRU in the vessel, computed from the main rotation and sensor bracket offset angles.

Related tasks

Using Mounting Wizard to determine MRU mounting angles, page 112
Using Mounting Wizard to determine miniMRU mounting angles, page 121

Sensors MGC Geometry page

Here you can enter the physical location, as well as the mounting angels, for the Inertial Measurement Unit (IMU) on your vessel. The location is relative to origin. The IMU is either an MGC (Motion Sensor and Gyro Compass) or an MRU (Motion Reference Unit).

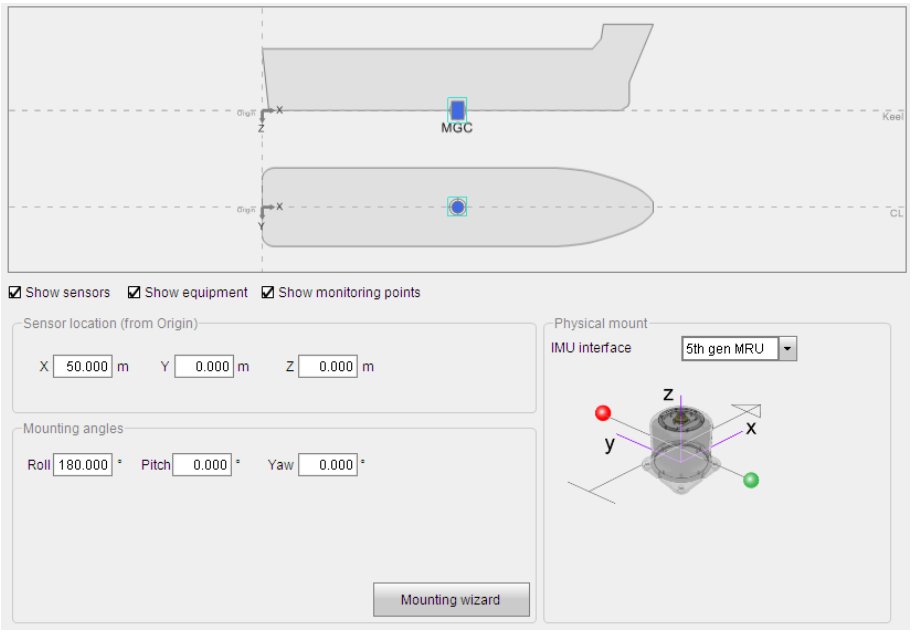
Prerequisites

For accurate location of the MGC (Motion Sensor and Gyro Compass) a survey has to be carried out.

How to open

Select the **System** menu > **NAV Engine** > **Standard** > **Sensors** > **MGC** > **Geometry**.

Example



Details

Show sensors, Show equipment, Show monitoring points

These items are displayed in the vessel illustration when you select the boxes.

Sensor location (from origin)

This is the position of the MGC in X, Y, Z coordinates in metres from Origin. The sensor unit (IMU) location has to be measured. The default position of the IMU is in the vessel Origin.

IMU interface

Select the Inertial Measurement Unit connected to this product.

Mounting angles

This is the mounting angles of the Inertial Measurement Unit in degrees for roll, pitch and yaw. The Mounting Wizard is a helpful tool to obtain the correct roll and pitch compensation.

`Mounting wizard` button

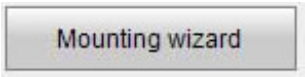
Select this button and the Mounting wizard will assist you with the determination of the MGC mounting angles.

Related tasks

Setting MGC location and mounting angles, page 115

Sensors MGC Geometry - Mounting Wizard

Use the Mounting Wizard to determine the roll, pitch and yaw mounting angles in degrees for the MRU.



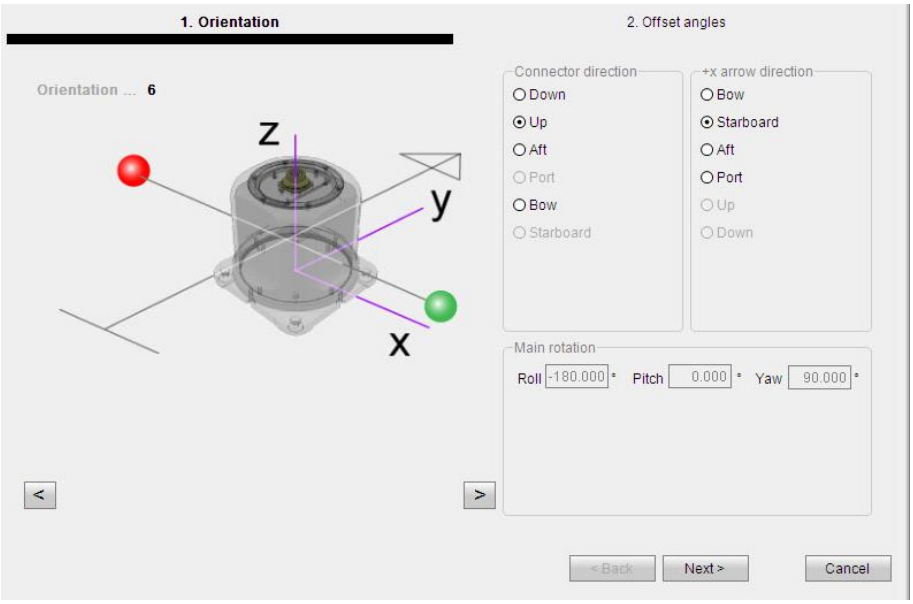
Prerequisites

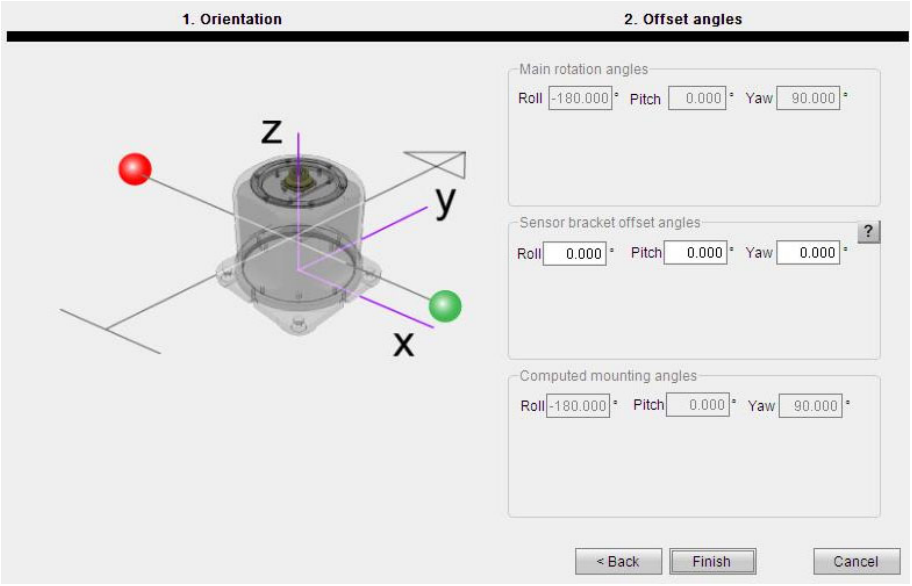
The MGC offset angles have to be available from a survey report or through other methods with similar accuracy.

How to open

Select the `Mounting Wizard` button in the **Sensors MGC Geometry** page.

Example



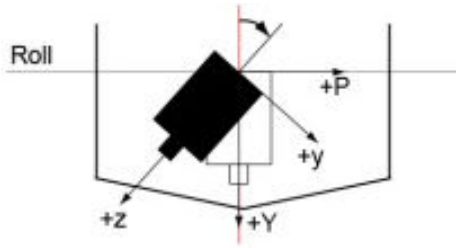


Description

The `Mounting Wizard` will help you to determine the offset angles of the sensor unit mounting bracket. The mounting bracket offset angles which have to be entered are roll, pitch and yaw.

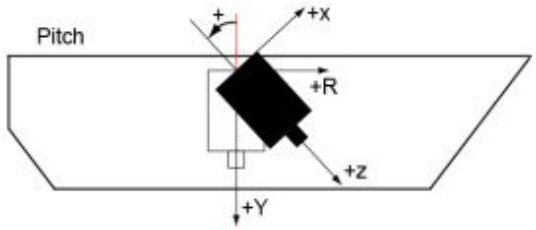
Roll offset angle

The angle between the ship's Y-axis and the projection of the unit's z-axis in the ship’s PY-plane. Positive roll offset angle if the bracket tilts to starboard.



Pitch offset angle

The angle between the ship's Y-axis and the projection of the unit's z-axis in the ship's RY-plane. Positive pitch offset angle if the bracket tilts to stern.



Yaw offset angle

The angle between the ship's R-axis and the projection of the unit's x-axis in the ship's RP-plane. Positive yaw offset angle if the bracket is rotated clockwise.

Details

Connector direction

This is the direction in which the connector on the sensor unit points. The selections are Down, Up, Aft, Port, Bow or Starboard.

+x arrow direction

This is the direction in which the +x arrow on the sensor unit points. The selections are Bow, Starboard, Aft, Port, Up or Down.

Main rotation/Main rotation angles

This is the designated installation orientation of the MGC/MRU in the vessel, as indicated by **Connector direction** and **+ arrow direction**. These angles are multiples of 90 degrees.

Sensor bracket offset angles

This is the surveyed offset angles from the designated installation orientation.

Computed mounting angles

This is the actual installation orientation of the MGC/MRU in the vessel, computed from the main rotation and sensor bracket offset angles.

Related tasks

Using Mounting Wizard to determine MGC mounting angles, page 117

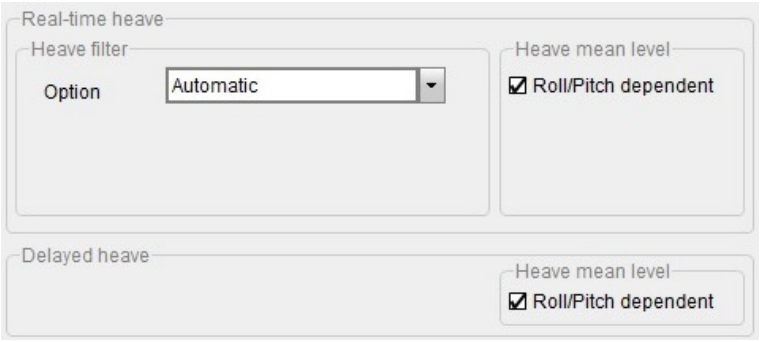
Sensors MRU/MGC Heave config page

The **Heave config** parameters allow you to tune the heave parameters to the vessel motion characteristics for the actual weather conditions. This is important when using real-time heave measurements in order to achieve optimum heave performance.

How to open

Select the **System** menu > **NAV Engine** > **Standard** > **Sensors** > **MGC/MRU** > **Heave config**.

Example



Description

You can select the heave filter options from the **Options** list. In the list you can select between four different heave filter modes: *Hydrographic survey*, *Automatic*, *GNSS aided* and *General purpose*.

It you select other options than Automatic, you must enter an expected heave period.

Details

Hydrographic survey

Select **Hydrographic survey** when the heave phase and amplitude have to be output correctly in real time. This mode is typically selected when the heave output signal from the system is to be used for heave compensation of echo sounders and offshore crane systems.

Automatic

Select **Automatic** when the vessel is operating in various sea states or when the average heave period is unknown. The *Automatic* filter mode estimates the average heave period and automatically sets the filter period in real time during operation. The Automatic filter mode uses the Hydrographic survey filter structure.

GNSS aided

Select **GNSS aided** when RTK DGNSS corrections are available or the GNSS velocity measurements are accurate. In this mode the heave and height measurements are determined by blending vertical acceleration and GNSS height measurements

in a Kalman filter. This combination makes it possible to measure wave slopes and the tide in real time with high precision ideal for hydrographic work. The height measurements are provided with centimeter accuracy and independent of wave frequency. If RTK is not available, the algorithm will use the GNSS velocity measurements for aiding the heave. If GNSS velocities are not available, the Automatic algorithm is used.

General purpose

Select **General purpose** when the heave phase is of no importance. This mode is typically selected when the system is to be used for measuring the heave height and period on oceanographic buoys.

Period

An expected average heave period has to be set to the heave filter unless the automatic mode is chosen. The settling time for the heave measurements from power-on or after a turn will be about 10 times the selected period, T_0.

Roll/Pitch dependent

Select the **Roll/Pitch dependent** check box to enable whether the heave mean level should be dependent on the roll and pitch measurements or not. When enabled, the heave position in the monitoring points (MP) has now longer zero mean level, instead its value depends on the vessel tilt at any time. This option is useful especially in applications where the distance between the MP and the sea level is to be determined, like in echo sounder installations with depth changes due to changes in vessel trim and list. If not enabled, the heave will always have zero mean level. There are separate selections for the real-time heave and the delayed heave (PFreeHeave).

Related tasks

Selecting heave filter options, page 124

Monitoring points Geometry page

Here you can define the locations on the vessel for which you want the system to calculate the position.

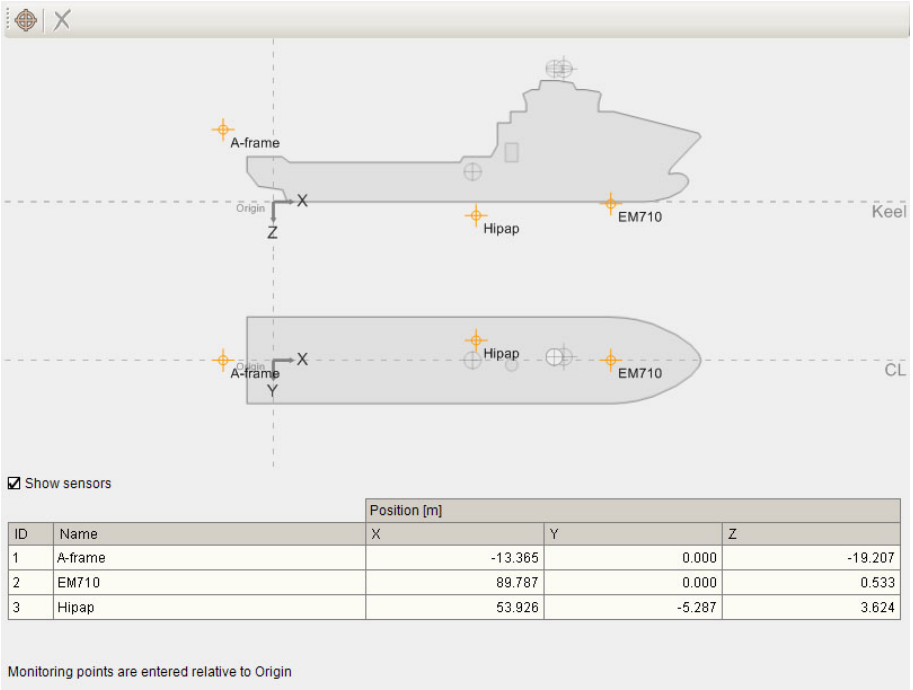
Prerequisites

To get exact coordinates from origin to each monitoring point, each monitoring point has to be measured or calculated based upon drawings or previously measured points.

How to open

Select the **System** menu > **NAV Engine** > **Standard** > **Monitoring points** > **Geometry**.

Example



		Position [m]		
ID	Name	X	Y	Z
1	A-frame	-13.365	0.000	-19.207
2	EM710	89.787	0.000	0.533
3	Hipap	53.926	-5.287	3.624

Monitoring points are entered relative to Origin

Description

The toolbar at the top contains two icons. One for adding a monitoring point,  , and one for deleting a monitoring point,  .

The monitoring points are entered relative to Origin.

Details

Show sensors, Show equipment

These items are displayed in the vessel illustration when you select the boxes.

ID

This is the ID number for the given monitoring point.

Name

This is the name you give the monitoring point.

Position: X, Y, Z

These are the surveyed co-ordinates in metres for the various monitoring points.

Related tasks

Setting monitoring points, page 125

Communication interface - Input/Output

Here you can set the parameters for communication with external equipment.

How to open

Select the **System** menu > **NAV Engine** > **Standard** > **Communication interface** > **Input/Output**.

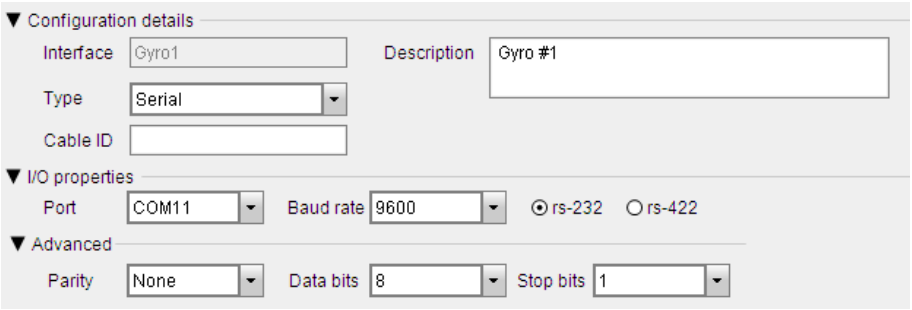
Communication interface - Serial or Ethernet

When you have selected an interface in the **Input/Output list**, you must select which type of communication you want for that interface. You can select between serial or Ethernet communication.

How to open

Select the **System** menu > **NAV Engine** > **Standard** > **Communication interface** > **Input/Output**.

Example



Description

When you select a communication interface from the **Input/Output** list, various parameters will appear at the lower part of the page, depending on your choice of interface. Some of these parameters are common for all interfaces.

The Serial interface allows you to decide how the Processing Unit shall communicate with and interface to other equipment.

The Ethernet interface allows you to decide how the Processing Unit shall communicate via the internet protocol (IP) network.

Configuration details

Interface

This is the interface you have selected from the **Input/Output list**.

Description

Here you can type an informative text about the interface you have selected.

Type

Here you can select which type of communication you want for your interface. You can select between communication via **Serial** line or **Ethernet**.

The selection you make here, will affect the parameters which appear under **I/O properties**.

Cable ID

Here you can type a short identification text for the cable connected to the Processing Unit. The **Cable ID** box is optional. It is intended for installation documentation.

I/O properties - Serial interface

Port

Select which port to use for the serial communication. The serial port number corresponds with the number on the Processing Unit.

Baud rate

Select which baud rate to use for the serial communication.

RS-232/RS-422

Select if you want to use RS-232 or RS-422 for the electrical interface. This selection depends on the **Port** you selected.

Advanced

Under **Advanced** you are able to modify the parity, stop bits and data bits. These parameters should be left unchanged. If these parameters are to be modified, they should only be modified by skilled personnel.

I/O properties - Ethernet interface - Broadcast

Broadcasting is a method of transferring a message to all recipients simultaneously.

Local interface

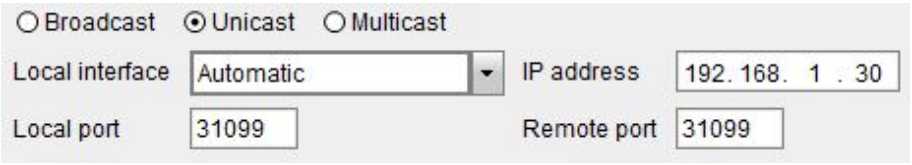
This is the LAN port on the Processing Unit.

Port

This is one of the LAN ports on the Processing Unit.

I/O Properties - Ethernet interface - Unicast

Unicast transmission is the sending of messages to a single network destination identified by a unique address.



Local interface

Select which local interface you want to use from the list.

IP address

This is the target IP address, to which the unit is receiving or sending.

Local port

When receiving, this is the port on which the unit listens.

Remote port

When transmitting, this is the port to which the unit sends.

Note:

It is recommended to use the same port number for both Local and Remote ports.

I/O Properties - Ethernet interface - Multicast

Multicast (one-to-many or many-to-many distribution) is group communication where information is addressed to a group of destination computers simultaneously.

Local interface

This is the LAN port on the Processing Unit.

IP address

This is the multicast group address. Recommended range: 239.255.000.000 to 239.255.255.255.

Remote port

When transmitting, this is the port to which the unit sends.

Communication interface - TelegramOut interface page

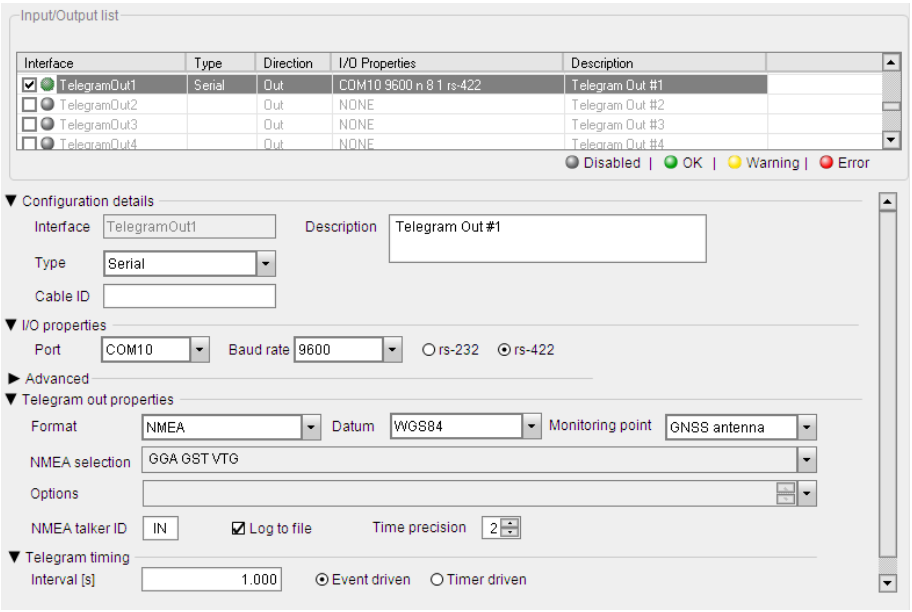
Here you can enable and set up data messages which are transmitted to external equipment.

How to open

Select the **System** menu > **NAV Engine** > **Standard** > **Communication interface** > **Input/Output**.

Select the **TelegramOut** interface in the **Input/Output list**.

Example



Telegram out properties

Details

Format

This is the format of the output telegram.

Datum

The datum selection is only valid if the datum on the corrections input to the product are in WGS84 or no corrections are input. If the corrections input are in another datum than WGS84, you must select WGS84. The datum of the output will then be on the same datum as the datum on the corrections input to the product. The other choices can only be used when the system navigates in WGS84 datum.

Monitoring point

This is a point on the vessel for which you want the position measurements to be output.

NMEA selection

The NMEA selection option is activated if the **Format** is selected as NMEA. Select between a number of NMEA telegrams.

Note:

To output $DPGGA sentence, enable GGA and select the Use DQI(0-9) as GGA quality indicator option.

Options

The contents of some of the available NMEA telegrams can be modified according to options listed in the **Options** list. This is for example useful when interfacing to older equipment.

NMEA talker ID

The talker ID of NMEA messages sent from this output. The default value is IN for systems with an Intertial Measurement Unit (IMU) connected. The default value is GP for systems without an IMU connected.

Log to file

This option logs the measurements to file internally in the Seapath system.

Time precision

This is the number of decimals in the time field in NMEA telegrams which contain time information.

Telegram timing properties

Details

Interval

This is the interval between each sample. It can be selected in the range 0.005 to 3000 seconds.

Event driven

The output of data is driven by receipt of IMU (Inertial Measurement Unit) data to the Processing Unit. **Event driven** data is valid for the point in time the sensors within the IMU are sampled. The option is recommended used when transmission in real time is not required.

Timer driven

When using timer driven output the data will be output in real time. (0 ms delay.) **Timer driven** output is recommended used when the data is preferred in real-time. For example when the system which receives the data time-stamp these data when receiving them.

Related tasks

Setting up the Telegram out interface, page 129

Communication interface - DgnssLink interface page

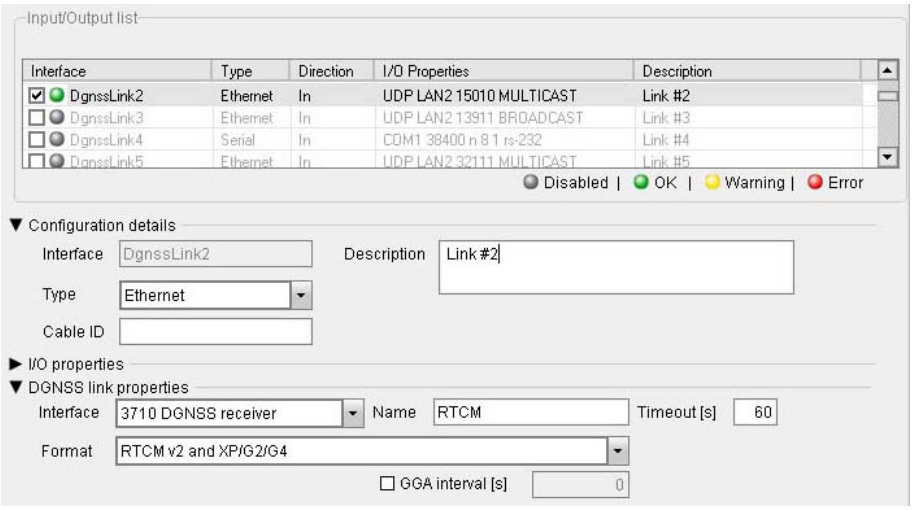
Here you can set up the system to receive various kinds of corrections which will improve the position accuracy.

How to open

Select the **System** menu > **NAV Engine** > **Standard** > **Communication interface** > **Input/Output**.

Select the **DgnssLink** interface in the **Input/Output list**.

Example



Details

Interface

Select which external equipment you want to interface. Some configuration parameters are dependent on the interface selection.

Name

Type the name you want to give the DGNSS correction link.

Timeout

This is an age limit. If the age of the corrections exceeds this limit, the corrections are invalid.

Format

This is the format types which are supported by the system.

GGA interval

If this option is selected, the system sends GGA messages to the DGNSS receiver at specified intervals in seconds.

Related tasks

Setting up the DGNSS correction link parameters, page 131
Setting up NTRIP client, page 142

Communication interface - MGC interface page

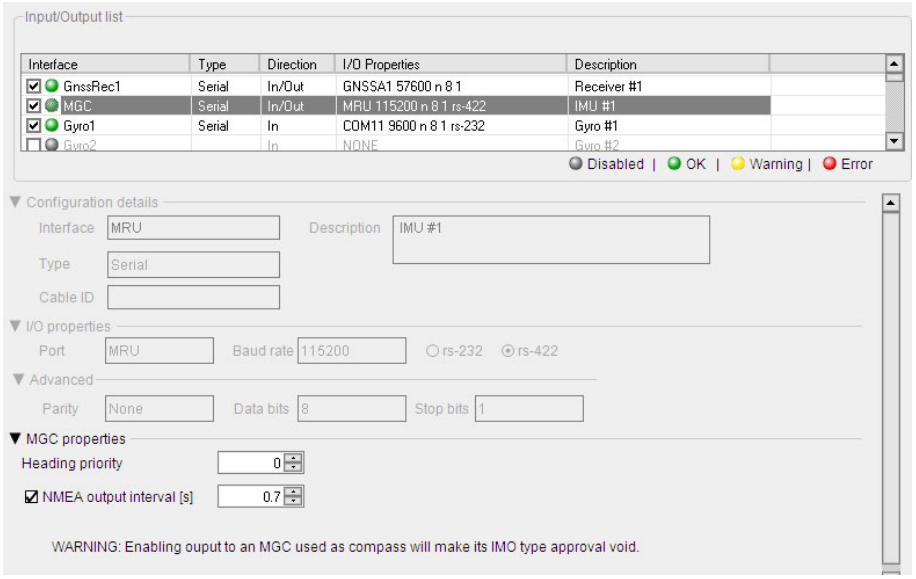
Here you can select which priority the MGC heading input shall have in the system if you have several heading sources in your system. You can also select interval for message output.

How to open

Select the **System** menu > **NAV Engine** > **Standard** > **Communication interface** > **Input/Output**.

Select the **MGC** interface in the **Input/Output list**.

Example



Description

WARNING:

Enabling output to an MGC used as compass will void the IMO type approval.

Details

Heading priority

Set priority for the heading input from the MGC in your system.

NMEA output interval

Enable output of NMEA GGA, VTG and ZDA messages to the MGC and at which interval the message shall be output.

Related tasks

Setting up the MGC as an inertial navigation system (INS), page 140

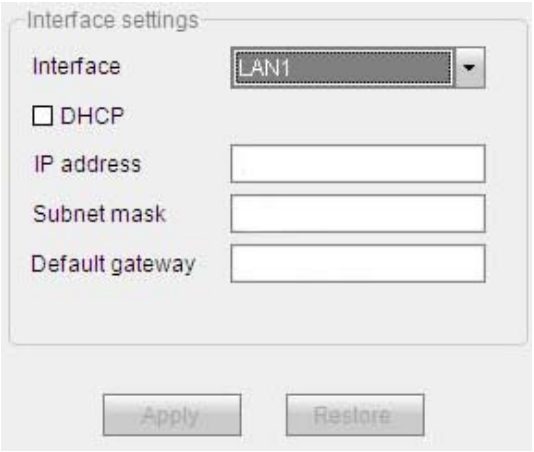
Network page

Here you can change the IP address for the Processing Unit.

How to open

Select the **System** menu > **NAV Engine** > **Standard** > **Network**.

Example



Details

Interface

This is the interface for which you want to change the IP address.

DHCP

Select this box if the IP address is given by a DHCP server. This selection will disable the rest of the parameters.

IP Address

This is the new IP address for the interface.

Subnet mask

This is the subnet mask for the interface.

Default gateway

This is the default gateway for the Processing Unit.

Note:

Only one default gateway can be set up.

Apply button

Select **Apply** to save the settings.

Restore button

If you select `Restore`, you will return to the previous interface settings.

Related tasks

Changing the Sensor Unit IP address, page 132

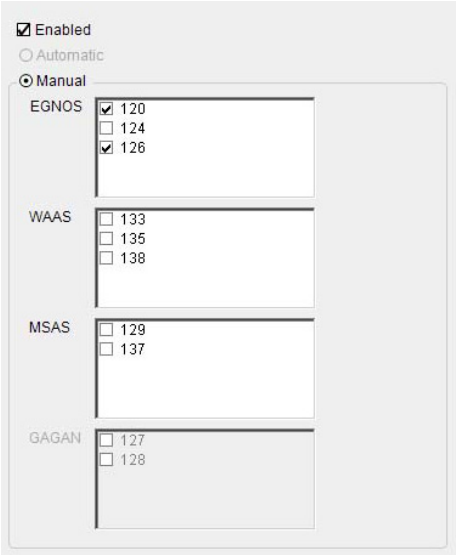
Sensors DGNSS SBAS page

The SBAS parameters enable the system to track SBAS satellites.

How to open

Select the **System** menu > **NAV Engine** > **Standard** > **Sensors** > **DGNSS** > **SBAS**.

Example



Details

Enable

Select this box if you want your system to track SBAS satellites.

Automatic

If you select **Automatic**, the GNSS receiver will select which SBAS satellites to track. This option may be unavailable for some systems.

Manual

Here you must select which SBAS satellites the system shall track. If two SBAS satellites are selected, the system will automatically use data from the best satellite. If only one SBAS satellite is selected, only correction data from this satellite will be used in the computations.

If no specific SBAS satellite is selected, the system will select and use data from the best of the available satellites.

If the selected satellite is not available, the system will not use the SBAS correction data in the computations.

Maximum two SBAS satellites can be tracket by the GNSS receiver.

Related tasks

Selecting SBAS satellites, page 137

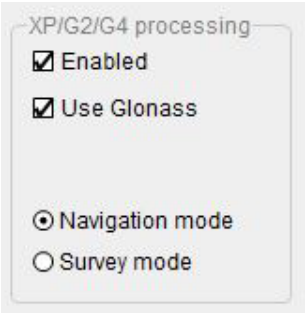
Sensors DGNSS XP/G2/G4 page

The **XP/G2/G4** parameter allows you to use high precision services to improve the accuracy of the GNSS signal. This will result in a more accurate position.

How to open

Select the **System** menu > **NAV Engine** > **Standard** > **Sensors** > **DGNSS** > **XP/G2/G4**.

Example



Details

Enabled

Select **Enabled** if you want to enable the use of high precision services in the position solution.

Use Glonass

Select **Use Glonass** if you want to enable the use of GLONASS corrections in the position solution.

Navigation mode

Select **Navigation mode** if you want more reliability on the position solution during difficult GNSS conditions.

Survey mode

Select **Survey mode** if you want continuous output of data even under difficult GNSS conditions and uncertainty on data quality.

Related tasks

Enabling Fugro high precision services, page 138

Communication interface - Gyro interface page

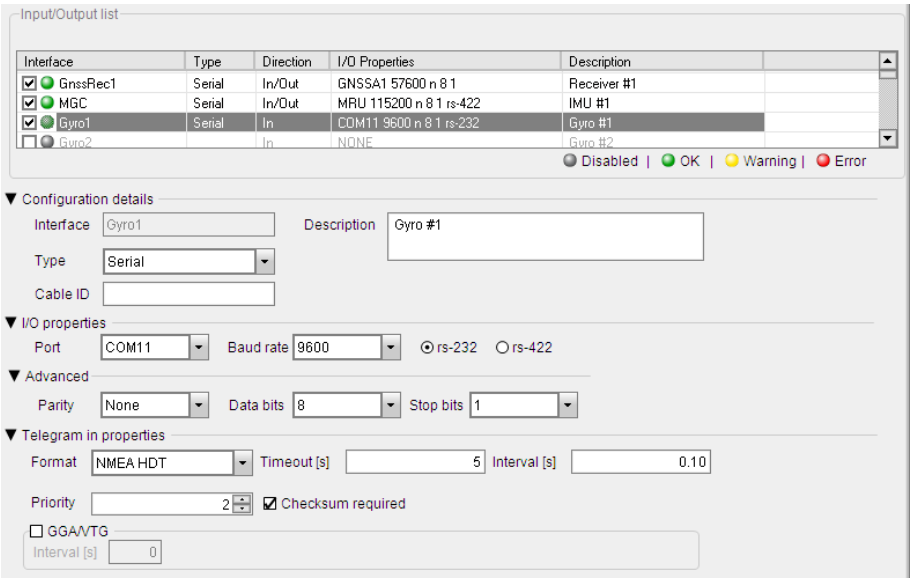
Here you can set up the system to receive heading input from a gyro compass or similar.

How to open

Select the **System** menu > **NAV Engine** > **Standard** > **Communication interface** > **Input/Output**.

Select **Gyro** in the **Input/Output list**.

Example



Description

Gyro interface is for external heading input to the system. External heading may be received on either serial line or Ethernet.

Details

Telegram in properties

Format

This is the format of the input telegram.

Timeout

This is an age limit. If the age of the heading message exceeds this limit, the heading message is invalid. [s].

Interval

This is the expected interval in seconds between incoming telegrams.This option can be configured.

Priority

This is the priority of the gyro interface. If more than one gyro interface is defined and available, one is selected for use, based on the specified priority.

Checksum required

This option enables or disables NMEA checksum requirement. The option is default set to **Enabled**. This is the recommended setting.

GGA/VTG

If this option is selected the system sends GGA and VTG messages to the gyro at specific intervals.

Related tasks

Selecting heading input format from a gyro compass, page 139

Operator software configuration

Topics

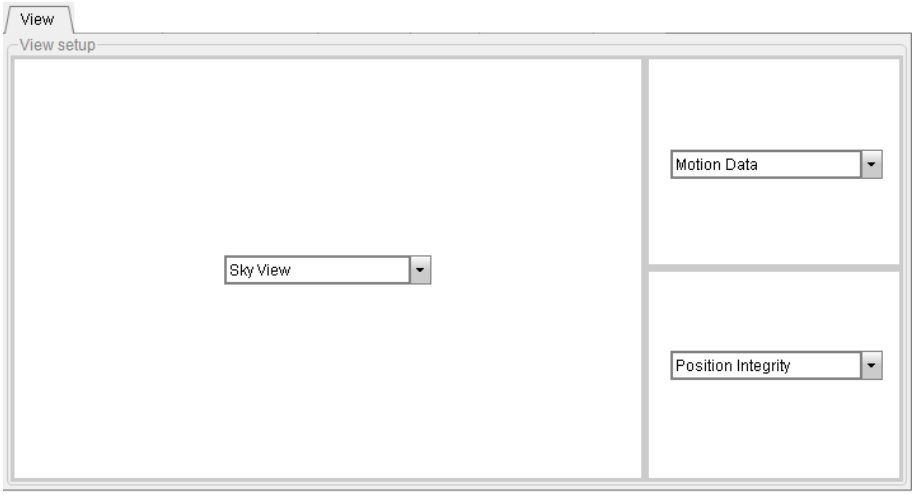
Operator software configuration - View page

Here you can select which view you want to appear where in the display when the HMI (Human Machine Interface) application starts.

How to open

Select the **System** menu > **Operator SW** > **View**.

Example



Description

The **View** page has the same layout as the views in the display. You can select which information you want to appear in the various views.

Two views cannot have the same contents. When one view is selected as contents in View 1, other contents will automatically be selected for View 2.

Related tasks

Selecting the position of views in the display, page 145

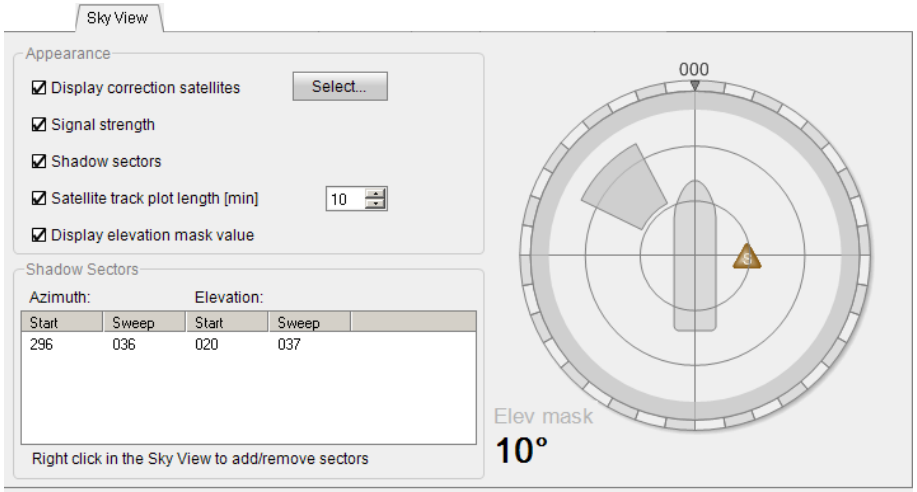
Operator software configuration - Sky view page

Here you can define the appearance of the *Sky View*.

How to open

Select the **System** menu > **Operator SW** > **Sky View**.

Example



Details

Display correction satellites

This option allows you to show correction satellites such as Inmarsat and Spotbeam in the Sky view. The satellite positions are predefined. You must enable the satellites which you want to appear in the Sky view where they are shown as brown triangles. Spotbeam satellites are marked with an S while Inmarsat satellites are marked with an I. When you hover the cursor over a correction satellite in the Sky view, a tooltip with satellite name, azimuth, elevation and position will appear.

Signal strength

This option allows you to display a signal bar under the satellites in the Sky view. The signal bar indicates the signal-to-noise ratio for the satellite, and the longer the bar, the stronger the signal.

Note:

*The **Signal strength (L2)** option is only available on dual frequency, single receiver systems.*

Shadow sectors

This option allows you to show the shadow sectors in the Sky view. You must add a shadow sector before you can display it in the Sky view. A shadow sector is just an indicator and does not influence the position solution in any way. The shadow sector refers to the vessel centre and will follow the vessel heading. Azimuth start describes the starting angle of the sector in degrees (0 to 360) related to North. Azimuth sweep describes the size in degrees. Elevation start describes the starting angle of the sector in degrees (0 to 90) where 0 degrees is the horizon and 90 degrees is straight above the antenna.

Satellite track plot length

This option assists in determining if a satellite is rising or falling in elevation. The **Satellite track plot length** option defines how long the length of the track plot should be. When you select this option, the track plot starts to increase. The maximum length of the track plot is 720 minutes.

Display elevation mask value

When you select **Display elevation mask value**, the configured elevation mask is indicated in the lower left corner of the Sky view.

Related tasks

Selecting the appearance of the Sky view, page 146

Operator software configuration - Position Integrity page

Under **Position Integrity** you can adjust the scaling of the Integrity view.

How to open

Select the **System** menu > **Operator SW** > **Position Integrity**.

Description

This is the estimated position error in North/South direction. The value is metres.

The error ellipse indicates a statistical error in the position solution. The smaller the ellipse, the more accurate and reliable position.

Details

Max ellipse EPE

Max ellipse EPE indicates the radius of the outer circle (grey area) in the Integrity view.

Ellipse diagram resolution

The **Ellipse diagram resolution** indicates the number of steps from the centre to the outer circle.

Related tasks

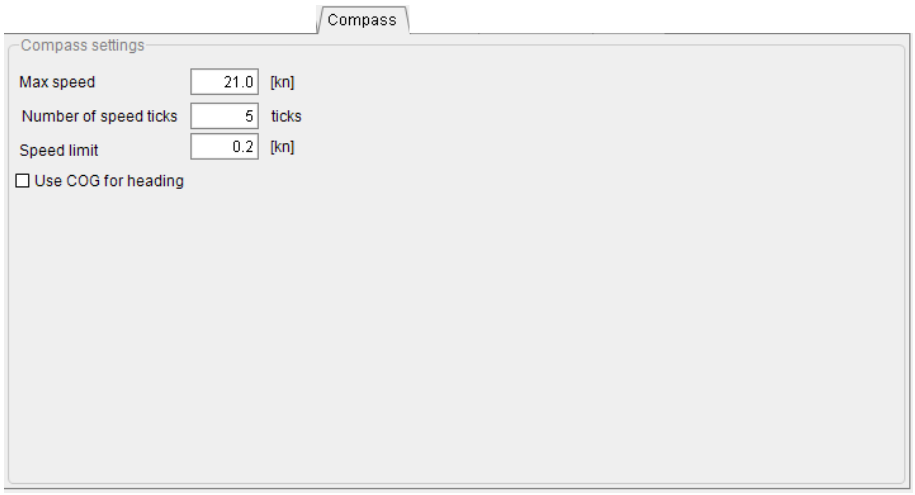
Adjusting the Integrity view, page 147

Operator software configuration - Compass page

The **Compass** page allows you to adjust the speed scaling of the Compass view.

How to open

Select the **System** menu > **Operator SW** > **Compass**.



Details

Max speed

This is the maximum vessel speed in knots.

Number of speed ticks

This is the resolution of the graphical presentation of the speed in the compass.

Speed limit

This is the lower speed limit in knots for when the COG (Course Over Ground) and SOG (Speed Over Ground) shall be displayed in the view.

Use COG for heading

Select this box if you do not have true heading.

Related tasks

Adjusting the Compass view, page 148

Operator software configuration - UTM page

This page allows you to control how UTM positions are treated by the application. UTM is the Universal Transverse Mercator coordinate system.

How to open

Select the **System** menu > **Operator SW** > **UTM**.

Example

Details

False Northing,

When you select **False Northing**, positions south of the equator will always be presented as positive in the Position data area in the display. A fixed offset of 10 000 000 m is added to the northing value to avoid negative coordinates in the southern hemisphere.

False Easting

When you select **False Easting**, a fixed offset of 500 000 m is added to the true easting value to avoid negative coordinates.

The UTM standard uses false northing and false easting, that is the coordinates are never negative.In case negative northing or easting is wanted, clear the **False Northing** check box.

Note:

*It is not possible to clear the **False Easting** check box.*

Zone options: **Auto**

When selecting **Auto** zone, the system zone is automatically calculated in accordance with the inserted coordinates.

Zone options: **Auto extended**

The UTM zone is automatically calculated by default. The **Auto extended zone** option is only applicable between 56 degrees to 64 degrees north and 3 degrees to 6 degrees east. The 32V zone is extended west to 3 degrees east, so when selecting the **Auto extended zone** in this area, zone 32V is used. When outside the current area and **Auto extended zone** is selected, the used zone is equal to the zone used when selecting **Auto** zone.

Zone options: **Manual**

Selecting **Manual** zone makes it possible to define which **Manual zone** and **Zone offset** to use. The **Zone offset** option allows a fixed offset to be applied to the longitudinal degrees. The UTM zone can be offset up to ±3 degrees. The zone offset is typically used where the maps used have an offset. The zone range is from 1 to 60.

Related tasks

Adjusting UTM presentation, page 149

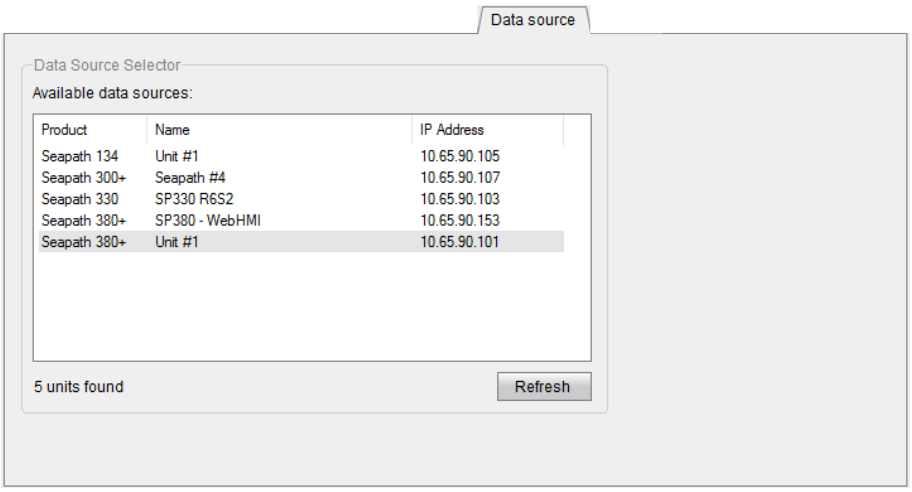
Operator software configuration - Data source page

This page allows you to select the data source from which the computer with the Seapath operator software installed on.

How to open

Select the **System** menu > **Operator SW** > **Data Source**.

Example



Details

Available data sources

This is a list of available Seapath sources in the system.

Refresh

Select **Refresh** to updated the list of available units. If the wanted data source is not displayed in the list, you can check the network connections and that all equipment is switched on.

Related tasks

Selecting the Seapath Operator software data source, page 149

Operator software configuration - Alarms page

Here you can define how to receive alarm messages.

How to open

Select the **System** menu > **Operator SW** > **Alarms**.

Example

Description

UDP Broadcast is the default (and recommended) setting. Defining a multicast address for alarm message distribution requires advanced network configuration skills.

Details

UDP Multicast

If the operator software configuration which is performed, is not in the same network as the Processing Unit, IP multicast is required. To enable multicast, select **UDP Multicast** and enter the multicast address to use for reception of alarms.

UDP Broadcast

Select this option if alarm messages are transmitted to all network units.

Related tasks

Selecting reception of alarm messages, page 150

Equipment handling

Topics

Taking delivery

When the equipment arrives at its destination:

- Perform an inspection immediately to register any damage that may have occurred in transit.
- If you find any damage, both the insurance company and the shipping agent must be informed immediately.

Unpacking and handling

Care should be taken when unpacking and handling the equipment. A visual inspection should be made to check that the equipment has not been damaged during shipment and that all components and parts are present according to the packing list.

The equipment contains delicate electronic components – handle with care and avoid shocks.

The equipment can be lifted by hand.

Storage

After the equipment in the boxes has been inspected and it has been verified that no damage has occurred, the equipment must be stored in its original packaging until the time of installation. The storage premises must be dry and well protected.

Verify that the location meets the environmental requirements defined for the equipment.

Inertial Measurement Unit transportation box

The unit is shipped in a specially designed transportation box. Keep the unit stored within the box until everything is ready for installation of the unit.

Note:

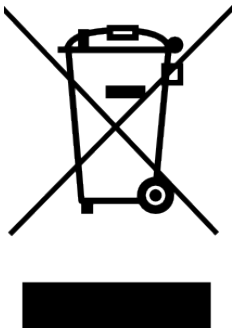
After the unit has been installed, please keep the transportation box. The unit must be shipped in this box for maintenance or repair in order to maintain the warranty.

Related references

Environmental specifications, page 163

Disposal

At the end of the product lifetime, all parts and products must be disposed of in an environmentally-friendly way.



All electrical and electronic parts and components must be disposed of separately from the municipal waste stream via designated collection facilities appointed by the government or local authorities. The correct disposal and separate collection of your old appliance will help prevent potential negative consequences for the environment and human health. This is a precondition for reuse and recycling of used electrical and electronic equipment. For more detailed information about disposal of your old appliance, please contact your local authorities or waste disposal service.

All disposal of mechanical, electromechanical, electronic and chemical waste - including all types of batteries - must take place according to national and international rules and regulations. Observe the relevant Waste Electrical and Electronic Equipment (WEEE) regulations.

The equipment can be returned to Kongsberg Discovery AS if there is no local WEEE collection. The equipment is marked with this waste pictogram.

Free and open source software

Topics

General information

Some of the software components in this product are free and open source software. These components are released under the licenses given here.

The source code for the relevant software components may be available upon request.

- **Company name**: Kongsberg Discovery AS
- **Address**: Havnegata 9, N-7010 Trondheim, Norway
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- **Telephone, global 24h support**:

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Americas: +15 04 303 5244

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- **Website**: http://www.kongsberg.com/discovery

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