Seatex Seapath™ 200

Installation Manual

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Notice

- The contents of this manual is subject to change without notice.

- All efforts have been made to ensure the accuracy of the contents of this manual. However, should any errors be detected, Kongsberg Seatex AS would greatly appreciate being informed of them.

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Revision log

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	1	1998-05-04	Added to description of installing coax connector on superflex cable, new output data formats and some corrections.	FOS
	2	1998-12-14	Upgraded with new MRU mounting bracket and to correspond with Seapath version 1.02.03 and MRU version 2.53.	FOS
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	11	2006-05-11	Updated to correspond with latest PU hardware	FOS
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List of drawings

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31438-ma-010	HW platform, Enclosure dimensions	4	1
38120-md-007	Seapath 200, Antenna Holder	4	1
hs-003-a	MRU housing, External dimension	4	1
hs-016-b	MRU-M-MB3 bracket, Hydrographic version	1	1
hs-014-a	MRU junction box MRU-E-JB1, Layout and ext. dimensions	1	1
	M410-32 Processing Unit Connection Box	0	1
	M320-42 Cable, Processing Unit Aux-Serial, Analog Output	0	1

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1. INTRODUCTION

1.1 About this manual

This manual contains the information necessary to install the Seapath 200 on a ship. For all other product information, please consult the *User's Manual*, reference [3].

The Seapath 200 is a precise heading, attitude and position sensor based on a sophisticated combination of DGPS carrier phase measurements and inertial sensor technology. To achieve the specified accuracy of the product, the installation has to be properly done and the installation procedures in this manual have to be followed.

This manual is organised into the following chapters:

Chapter 1 **Introduction** - A brief presentation of the *Installation Manual* with references and abbreviations.

Chapter 2 **Specifications** - Describes the physical dimensions, required power, environmental and cable specifications.

Chapter 3 **Installation** - Presents procedures to be followed for a typical ship installation with recommendations on location of the different parts, mechanical and electrical installation, and how to set up and calibrate the product.

Chapter 4 **Installation Drawings** - Contains outline drawings showing the mechanical dimensions of the different parts of the Seapath 200.

In this manual the following notations are used:

CAUTION

Is used to make the user aware of procedures and operational practice which, if not followed, may result in degraded performance or damage to the equipment.

Note A note text has this format and is used to draw the user's attention to special features or behaviour of the equipment.

1.2 References

[1] *NMEA 0183 Standard for interfacing marine electronic devices*, Version 2.3
[2] *RTCM recommended standards for differential Navstar GPS service*, Version 2.2
[3] 38120-GM-001, *User's Manual, Seapath 200*, rev. 10

1.3 Definitions, abbreviations and acronyms

1.3.1 Definitions

alignment	Is the process of adjusting the current internal navigation frame (g, h or b-frame) in the instrument to the true external frame.
antenna bracket	Is the arrangement for mounting the GPS antennas.
antenna holder	Is the arrangement on board the vessel for mounting the antenna bracket to.
attitude	The orientation relative to the vertical axis of a vehicle. Heading is not included. If heading is included the word orientation for the vehicle is used.
heading	The direction of the main axis (bow direction) of the vehicle as opposed to course, which is the direction of motion of the vehicle. Yaw angle as defined here is the same as heading.
heave	The vertical dynamic motion of a vehicle and defined positive down. Heave position and velocity are dynamic motion variables with a certain lower cutoff frequency.
host system	In this manual defined as Navigation computers, Dynamic Positioning Systems, etc., receiving data from Seapath.
pitch	A rotation about the pitch axis is positive when the bow moves up. Normally pitch means the dynamic pitch angle motion.
roll	A rotation about the roll axis is positive when starboard side of the vehicle moves down. Normally roll means the dynamic roll angle motion.
starboard	When looking in the bow direction of a vehicle this is the right hand side of the vehicle.
yaw	A rotation about the vertical axis is positive when turning Eastward (Clockwise) when the vehicle cruises in North direction. Normally yaw means the dynamic yaw motion.

1.3.2 Abbreviations and acronyms

b-frame	Body frame. An orthogonal frame fixed to the MRU housing or to the vehicle where the MRU is fixed.
CEP	Circular Error Probability.
CG	Centre of gravity. The mass centre of a vessel. This is normally the location with least linear acceleration, and hence the best location for measurements of roll and pitch.
EMI	Electromagnetic interference.
g-frame	Geographic frame. An orthogonal frame having axes pointing North, East, and Down at the current location of the vehicle.
GPS Time	The time in the GPS system. The GPS time is within UTC time ±180 nsec (95 per cent) plus leap seconds.
IMU	Inertial Measurement Unit. A system consisting of gyros and accelerometers.
LGND	Logic Ground.
MP	Measurement Point.
MRU 5	Motion Reference Unit, model 5. This is the IMU within the Seapath measuring dynamic linear motion and attitude.
NMEA	National Marine Electronics Association. NMEA 0183 is a standard for interchange of information between navigation equipment.
P-axis	This axis is fixed in the vehicle, and points in the starboard direction horizontally when the roll angle is zero. Positive rotation about this axis is bow of the vehicle up.
PGND	Power Ground.
PPM	Parts per million.
1PPS	One Pulse Per Second.
RFI	Radio Frequency Interference.
RMS	Root Mean Square.
R-axis	This axis is fixed in the vehicle, and points in the forward direction horizontally when the pitch angle is zero. Positive rotation about this axis is starboard side of the vehicle down.
SBAS	Satellite Based Augmentation System
SCC	Seapath Control Centre is special software used to set configuration parameters in Seapath. The software runs under Microsoft Windows version 95, 98, NT 4.0 or compatible on a PC.
UTC	Universal Time Co-ordinated. This is the official time in the world and has replaced GMT (Greenwich Mean Time) as the official time.
Y-axis	This axis is fixed in the vehicle and points in the downward direction when the vehicle is aligned horizontally. Positive rotation about this axis is turning the bow of the vehicle to starboard.

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2. SPECIFICATIONS

2.1 Physical dimensions

Processing Unit
Width: .... 482 mm (19-inch rack)
Height: .... 132 mm (3 U)
Depth: .... 430 mm
Weight: .... 12 kg
Colour: .... Front anodised black

Connection Box, M410-32
Length: .... 114 mm
Width: .... 89 mm
Height: .... 55 mm
Weight: .... 0.3 kg
Colour: .... Grey

Video Display Unit, 15" LCD (Philips 150S4FB)
Width: .... 343 mm
Height: .... 310 mm
Depth: .... 170 mm
Weight: .... 3.7 kg
Colour: .... Black

MRU 5
Height: .... 204 mm
Diameter: .... 105 mm
Weight: .... 2.5 kg
Colour: .... Blue

MRU Mounting Bracket, MRU-M-MB3
Length: .... 265 mm
Width: .... 119 mm
Height: .... 119 mm
Weight: .... 1.6 kg
Colour: .... Black
Material: .... POM-H

MRU Junction Box, MRU-E-JB1
Length: .... 226 mm
Width: .... 126 mm
Height: .... 90 mm
Weight: .... 2.0 kg
Colour: .... Black

Antenna Bracket
Length.......... 2560 mm
Height:.......... 40 mm
Width:.......... 75 mm
Weight for the 2.5-metre aluminium version .... 6.6 kg
Colour:.......... Grey RAL 7035

2.2 Power

Processing Unit
Voltage: .... 85 to 135 and 180 to 265V AC
Power consumption:.......... 100 W (max.)
Batteries: .... None, connection to UPS recommended

Video Display Unit, 15" LCD (Philips 150S4FB)
Voltage: .... 100 to 240V AC (50/60 Hz)
Power consumption:.......... 23 W (typical)

2.3 Environmental specification

Processing Unit
Enclosure material:.......... Aluminium
Enclosure protection: IP-30
Operating temperature range:.......... 0 to +55ºC
Operating humidity: .... 20 to 80% relative
Storage temperature range: ....-20 to +60ºC
Storage humidity: .... Less than 55%
Vibration testing according to:.......... EN 60945

Connection Box, M410-32
Material: .... Aluminium
Enclosure protection: IP-20

Video Display Unit, 15" LCD (Philips 150S4FB)
Operating temperature range:.......... 5 to +40ºC
Relative humidity:.......... 20 to 80%

MRU 5
Enclosure material:.......... Anodised aluminium
Enclosure protection: IP-66
Operating temperature range:..........-5 to +55ºC
Operating humidity (max.):.......... 100%
Storage temperature range: ....-20 to +70ºC
Storage humidity (max.):.......... 100%
Max. allowed vibration operational (10-2000 Hz continuous): .... 0.5 m/s^2

Max. allowed vibration non-operational (0-2000 Hz continuous):................................. 20 m/s^2
Max. shock non-operational (10 ms peak):.. 1000 m/s^2

MRU Junction Box, MRU-E-JB1
Material: ....Aluminium
Enclosure protection: IP-65

GPS Antennas (L1)
Enclosure material:...Weatherable Polymer
Operating temperature range:..-40 to +70ºC
Operating humidity (max.):.. 100%

2.4 Cable

Cable MRU-E-CS1
Type:..................................... Heavy Duty Screened, Habia Aquatherm RTFR 14x2x0.25 mm^2
Length: .... 3 m
Diameter:.. 13.5 mm
Flame retardation: ....IEC 332-1
Insulation:...ETFE
Screen:.. Cu-braid

Processing Unit to MRU Junction Box Cable
Type:.. LAMAC 4x2x0.5 mm^2
Maximum length: .... 100 m
Diameter:.. 10 mm
Flame retardation: ....IEC 332-3/A

The GPS Antenna Cables (Coax)
Type:... NK ½"-Superflex 50 BHF
Attenuation:... 14 dB/100 m (at 1.6 GHz)
Maximum length (each cable):.. 100 m
Diameter:.. 13.2 mm
Minimum bend radius: .... 32 mm
Flame retardation: ....CATV, UL1581, IEC 332-3, IEEE383
Coax connectors:..Huber+Suhner 11 N-50-9-9

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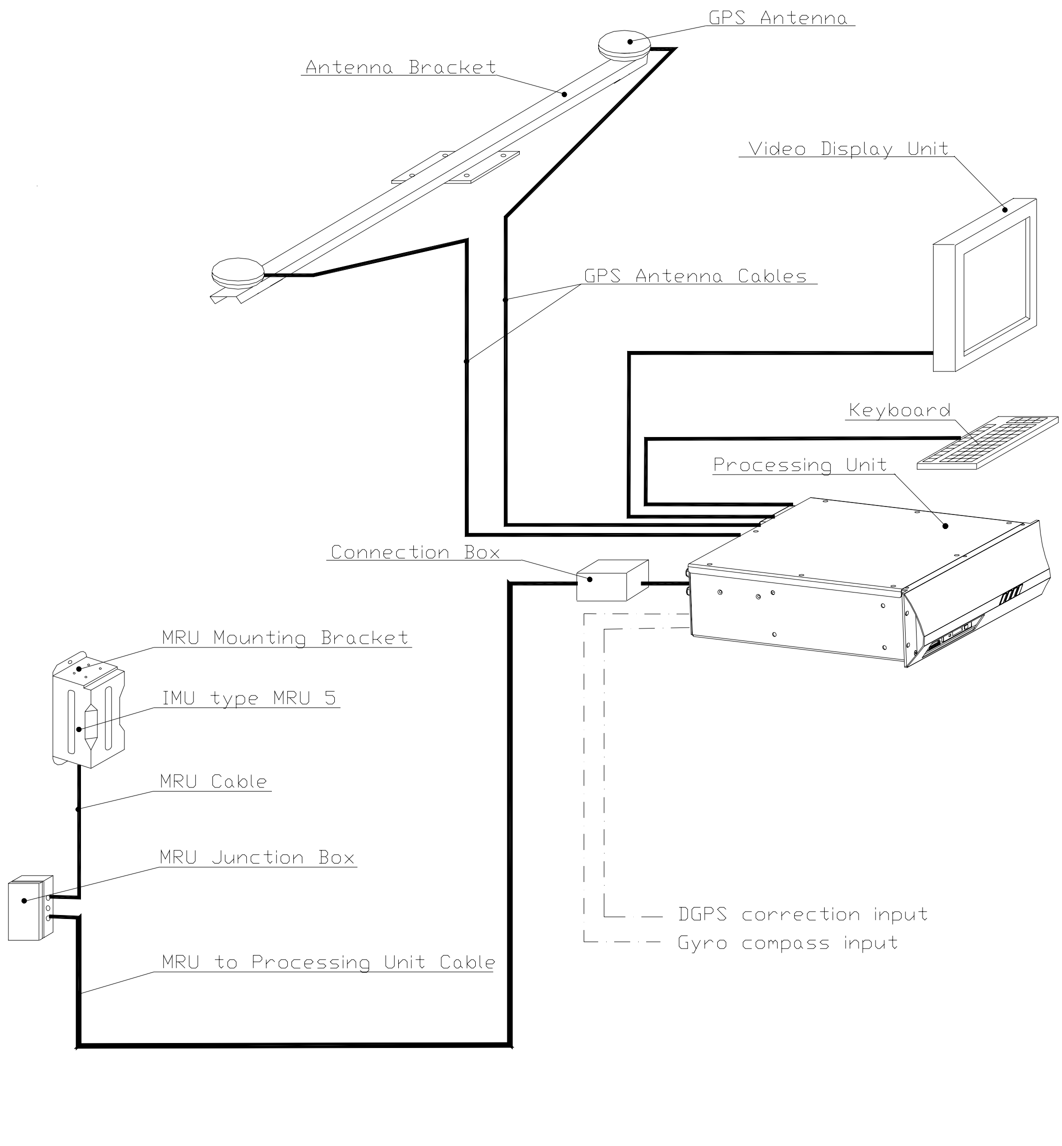
3. INSTALLATION

3.1 General information

This chapter describes a typical ship installation of the Seapath system. The standard system is supplied with the following parts:

- The Processing Unit.
- The Processing Unit connection box with 1.5-metre cable.
- Video Display Unit and standard keyboard.
- The MRU 5 unit.
- The MRU mounting bracket, MRU-M-MB3.
- Junction box, MRU-E-JB1, with three metres MRU-E-CS1 cable.
- Two GPS antennas.
- A 2.5-metre aluminium Antenna Bracket.
- Setup software, power cable, a null-modem configuration cable and documentation.



In addition to the above delivered parts, the following is needed:

- GPS antenna cables and the cable between the Processing Unit and the MRU junction box.
- A 19-inch rack for mounting of the Processing Unit.
- Gyro compass data on a serial line (recommended).
- DGPS corrections on one or more serial lines for improved position accuracy (recommended).
- Additional cables for input of Gyro compass data and DGPS corrections, and for output lines to external equipment.
- Devices for reference measurements of roll, pitch and heading (for calibration).
- An external IBM-compatible PC with MS-Windows for setup and calibration.

General arrangement drawings of the ship should be acquired to simplify determination of offsets between the GPS antennas, the MRU and the ship's centre of gravity (CG). Locations for the various parts of the system must be decided, and mounting arrangement for the Antenna Bracket and sufficient lengths of cable made available.

For external interfaces, electrical characteristics and data formats must be decided, and the necessary cables and connectors made available. Power supply for the Processing Unit and an external computer for setup and calibration are also needed.

An external heading reference, for example a surveyed quay is required for heading calibration. For some applications, pitch and roll reference for calibration is also needed.

The MRU unit is shipped in a specially designed transportation container. Keep the MRU within the container until everything is ready for installing the unit in the mounting bracket.

Note After the installation, please save the transportation container. The MRU must be shipped in this container for service or repair to maintain the warranty.

3.2 Logistics

Safety: General safety guidelines to be followed when working in mast and on deck.

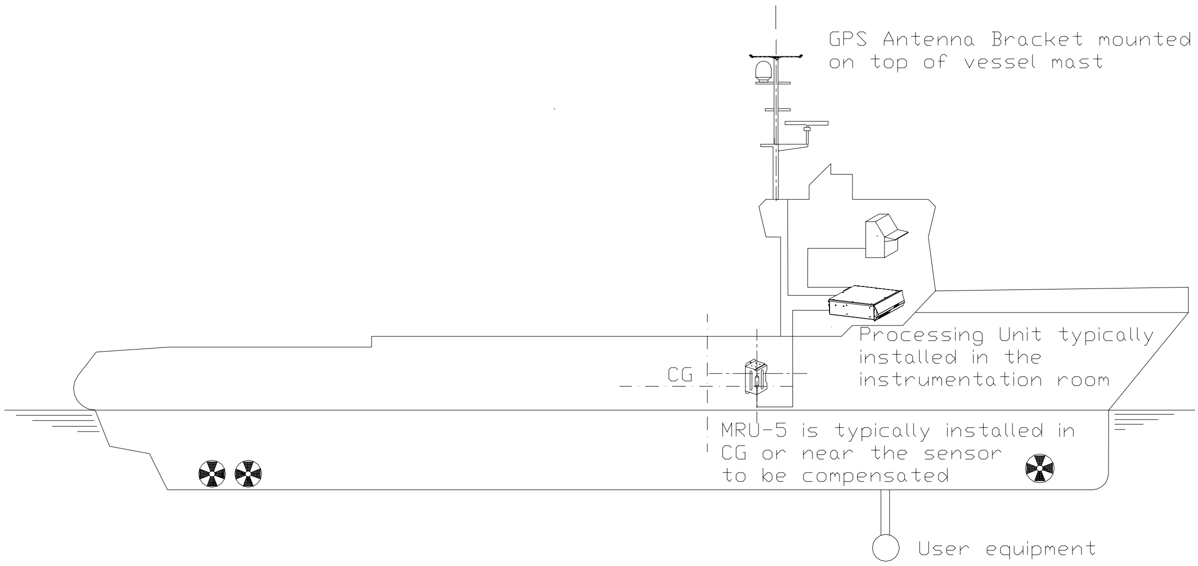
Personnel qualifications: Trained electrical workers.

Minimum number of personnel: 2, especially when mounting the Antenna Bracket to the Holder.

Ship location: The GPS antennas have to be mounted such that blocking of the GPS signal is avoided. The MRU 5 unit is preferably mounted low in the ship or close to the system to be compensated. The Processing Unit can be mounted on the bridge or in the instrument room.

Special tools required: A PC with Microsoft Windows 95, 98, NT version 4.0 or compatible.

3.3 Location of the system parts



The following sections contain hints regarding mounting of the various system parts:

3.3.1 The GPS antennas

For the GPS antennas, consider the following:

- The space above the antennas has to be free of obstructions of any kind. The antenna should be protected from direct illumination of radar beams and other transmitting antennas such as Inmarsat antennas. Seapath is more sensitive for blocking and reflections (multipath) of GPS signals than GPS sensors that only utilises pseudo-range data. This since Seapath also utilises carrier phase measurements for heading determination, and both GPS antennas need to see at least two common satellites at the same time.

CAUTION

The GPS antennas have to be mounted in a way that avoids blocking of the GPS signal.

- In order to reduce problems due to multipath effects the GPS antennas have to be mounted above the nearest deck at a height which is equal to the width of this deck or more.

- The Antenna Bracket has to be mounted in such a way that torsion movement relative to the ship's hull is kept at an absolute minimum.

Note If the Antenna Bracket supplied by Seatex is not used, it is important that the antennas are rigidly mounted so that the distance between the antennas does not change due to vibrations or accidental dislocation.

- The maximum length for each of the antenna coaxial cables is 100 metres for the cable type normally delivered with the system (1/2" Superflex). If longer cables are needed, a low noise signal amplifier (LNA) should be fitted.

3.3.2 The MRU 5

For the MRU 5, consider the following:

- The unit is designed for installation in an indoor environment and for operation within its temperature range.

- The unit is to be mounted close to the user equipment of which it is supposed to measure the motion. This is to avoid errors in alignment with the user equipment and to eliminate errors due to ship hull torsion.

- If the system is not allocated to measure motion of a particular user equipment, mount the MRU as close to the ship's centre of gravity (CG) as possible. This to ensure best roll and pitch measurements. If it is not possible to mount the MRU close to CG, try to mount it along the longitudinal axis of the ship and as close to the CG as possible. Avoid mounting the MRU high up or out to the side of the ship.

Be aware of:

- **Vibrations**. Direct mounting onto the main hull structure is preferable.

Note The worst mounting positions are thin walls that may come in resonance with vibrations driven by machinery, propellers, pumps or motors. Avoid mounting the MRU close to hydraulic pumps and valves where there are high frequency vibrations.

- **Temperature changes**. For safe mounting of the MRU, place the unit in a location where the temperature is low and where changes in temperature are slow. A location directly on the hull far away from the heat of the machinery, heaters and air conditioning systems is preferable.

- **Corrosion problems**. Place the MRU in a location where no direct splashing seawater is present.

3.3.3 The Processing Unit

For location of the Processing Unit, consider the following:

- The unit is designed for indoor installation and should not be exposed to heavy vibrations, transformers or similar.

- The unit should be mounted in a damped 19-inch rack to be in accordance with the environmental standard IEC945/EN600945.
- It is recommended that ventilation or air conditioning is provided in order to keep the ambient operating temperature around +20°C. The best location is typically in the instrument room or on the bridge mounted into a 19-inch rack with good ventilation.
- It is recommended that the area around the unit is kept free from dust and static electricity.
- The air inlet and outlet on the unit must not be blocked. The unit has an internal fan and requires free airflow from the rear and out to the sides of the unit.
- All connections to the unit are on the rear side and available space for cable connections and service must be provided.

3.3.4 The Video Display Unit

For location of the table mounted Video Display Unit, consider the following:

- The unit is designed for installation in an indoor environment and for operation within the temperature range. The best location is typically on a table in the instrument room or on the bridge mounted close to the Processing Unit.
- It is recommended that the area around the unit is kept free from dust and static electricity.

3.4 Procedures

3.4.1 Mechanical installation

The mechanical installation consists of:

- Making a holder for the Antenna Bracket and having it fastened in a suitable location in a mast.
- Mounting the Antenna Bracket with the GPS antennas on a holder in the mast.
- Mounting the MRU bracket and the MRU near the user equipment for which attitude data is wanted, or near the vessel's centre of gravity.
- Mounting the Processing Unit in a rack in the instrument room or bridge.
- Mounting the VDU close to the Processing Unit.

The installation procedure described below assumes that the Antenna Bracket delivered by Seatex is used and that a holder for this Antenna Bracket is prepared in accordance with the antenna holder drawing in chapter 4.

3.4.1.1 Installation procedure

The mechanical installation of the various parts is performed in the following steps:

1. First the user has to make a holder for the Antenna Bracket (the holder is not part of the Seapath delivery) and have it properly fastened to the mast in the preferred orientation (horizontal or vertical). When the Antenna Bracket is mounted vertically, the drawings in Figure 2, Figure 3 and Figure 4 are not correct.

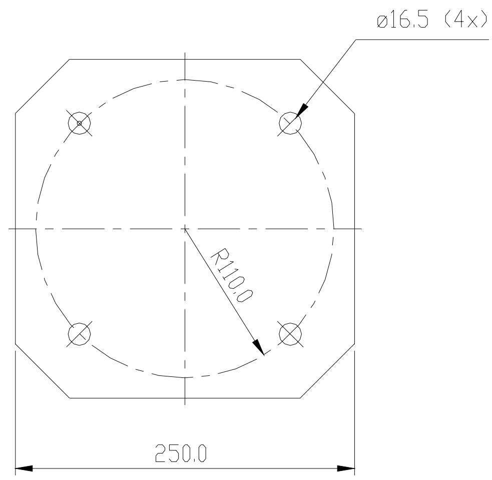


Figure 1 Dimensional drawing for the antenna holder

2. Bring the Antenna Bracket, the two GPS antennas and the antenna cables as close as possible to the location of the antenna holder. While both the GPS antennas and the Antenna Bracket are down on deck, mount the GPS antennas on the Bracket with both antennas oriented in the same direction. Depending on antenna type, labelling on the antenna housing (arrow or text) or connector location is used to determine direction. Figure 2 shows the antennas oriented with connectors pointing in the same direction. The antennas are not marked, and are interchangeable but called no. 1 or 2 for reference. The normal orientation of the Antenna Bracket is along ship with antenna no. 1 aft. It can, however, be mounted in any orientation, provided it is approximately horizontal.

Note Both GPS antennas have to be mounted on the Bracket oriented in the same direction, otherwise the system will have degraded heading performance.

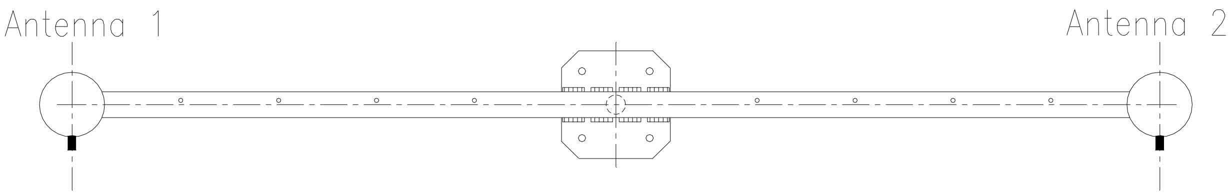


Figure 2 Top view of the Antenna Bracket

The screws for mounting the GPS antennas to the Bracket must be secured with washers.

3. Connect the antenna cables to both GPS antennas. The connection between the antenna and the antenna cable should be sealed against water penetration, preferably by using waterproof self-vulcanising tape. The GPS antenna cables are then strapped inside the Antenna Bracket as shown in Figure 4.

4. Lift the Antenna Bracket in the preferred direction on the holder.

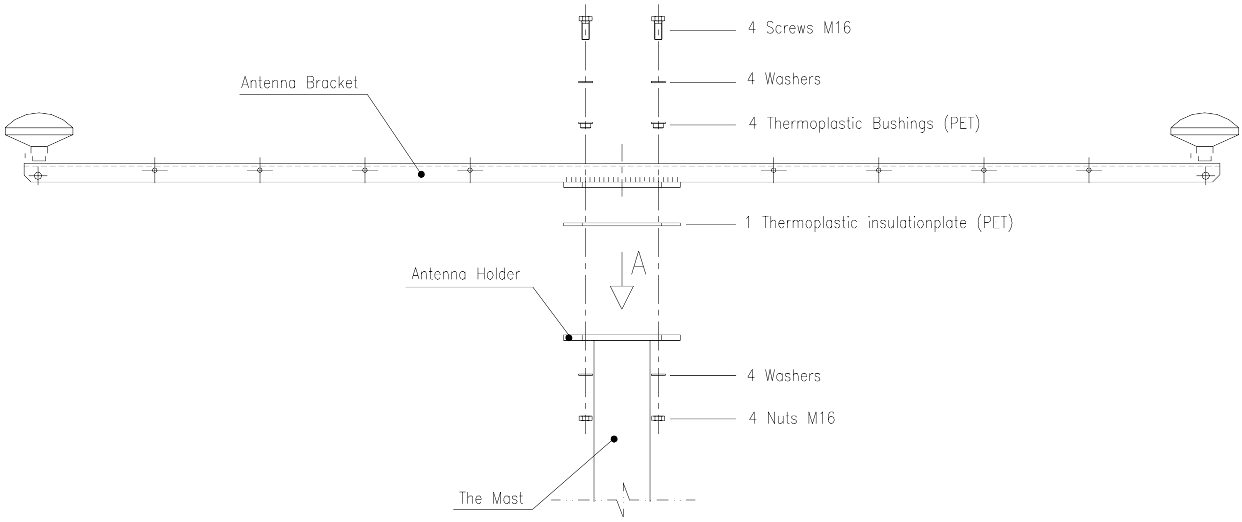


Figure 3 The different components for mounting of the Antenna Bracket

Ensure that the delivered insulation plate is used between the Antenna Bracket and the holder, and that the four bushings are placed in the mounting holes before the screws are entered. The nuts should be secured with washers or by utilising self-locking nuts.

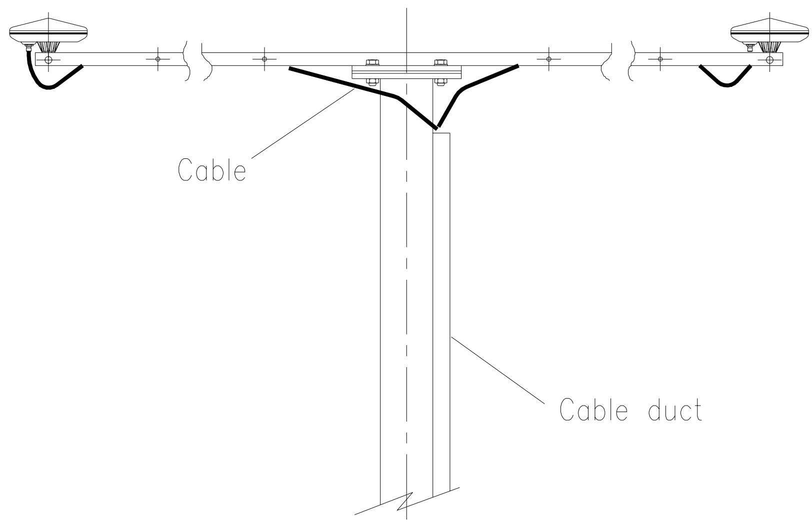


Figure 4 Side view of the GPS antenna installation

5. When the best mounting location for the MRU has been identified, place the MRU mounting bracket in the preferred orientation and make screw holes in the foundation. If the orientation of the bracket can be freely selected, mount the bracket on the longitudinal

or transversal bulkheads of the ship with the opening pointing downward, as shown in Figure 5. This will ensure easy and accurate orientation of the MRU according to the longitudinal axis. Reserve sufficient space below the bracket to allow insertion of the MRU from below.

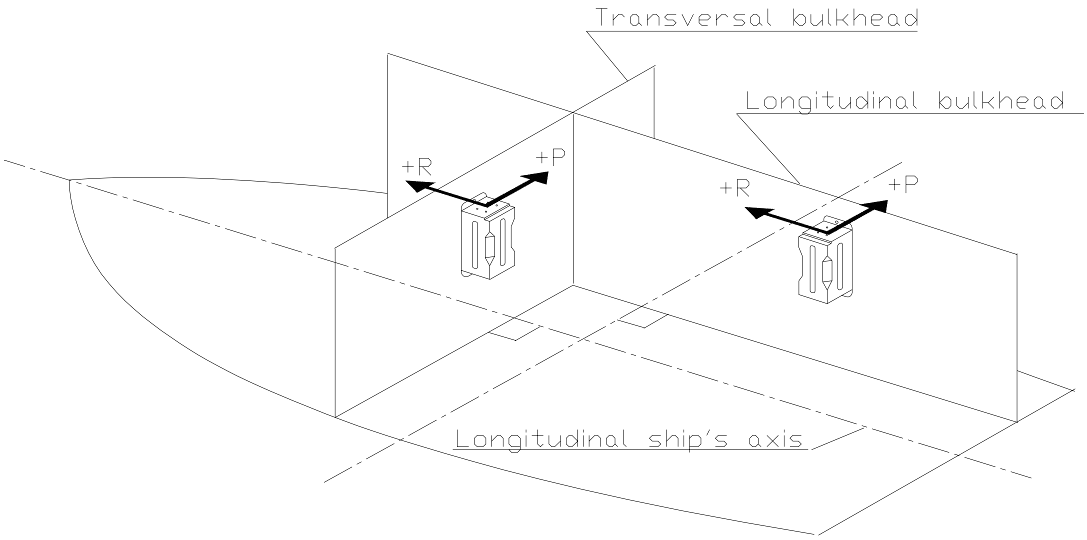


Figure 5 Recommended orientation of the MRU mounting bracket

6. Mount the MRU bracket on the wall, preferably with the opening pointing down, as shown in Figure 6. Mark and drill a M6 hole for the top screw (1) and enter the screw without tightening it completely. Align the bracket vertically using its own weight or by aligning it in relation to the wall. Drill two holes for the lower screws (2) and insert and securely tighten all three screws, using washers or self-locking nuts.

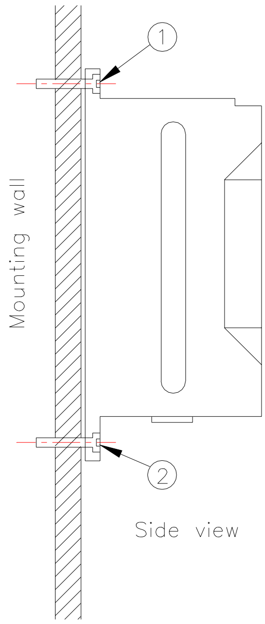


Figure 6 Wall mounting of bracket with MRU connector pointing down

7. Insert the MRU into the bracket. In order to achieve the orientation as shown in Figure 5, the MRU must be rotated in the bracket. Apply Loctite 242 glue or equivalent on the four MRU screws (3).

Note The MRU R+ arrow must always point in the bow direction unless the default mounting orientation of the unit is modified in the MRU configuration.

8. Apply the sticker (4) onto the bracket according to the actual mounting direction of the MRU, as shown in Figure 7. In this way, the actual mounting direction is identified in case the unit is to be exchanged or removed temporarily.

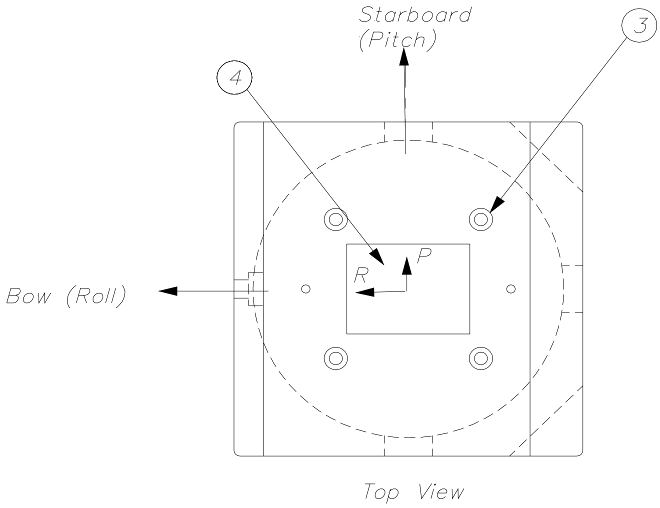


Figure 7 Sticker (4) shall indicate actual mounting orientation of MRU within bracket

Note If the MRU is mounted correctly in the bracket, the +R arrow on the top of the MRU will point in the bow direction of the ship and the same direction as the R-axis of the sticker. If uncertain whether the MRU R-axis is pointing in the bow direction, look under the MRU and check that the +R arrow label is pointing in the bow direction. Precise MRU orientation is important to ensure that high quality and accurate measurements are available to the host system.

9. Mount the junction box on the wall in a suitable location within the length of the 3-metre MRU-E-CS1 cable, as shown in Figure 8. The screws for mounting the junction box should be secured with washers or self-locking nuts.

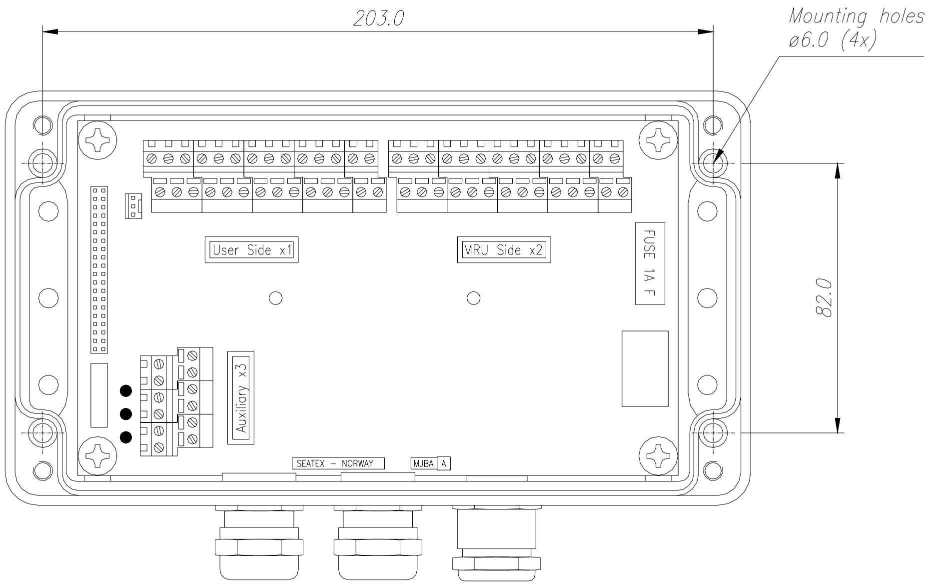


Figure 8 Junction box mounting

10. Mount the Processing Unit within a standard 19-inch rack in a preferred location. The Processing Unit has to be fastened both in front and rear of the rack. Minimum 10 cm free space is needed behind the module for connecting cables.

11. Mount the connection box (part no. M410-32) on a suitable location within the length of its 1.5-metre cable to the 15 pin MRU port on the Processing Unit, as shown in Figure 9. The two screws for mounting the connection box should be secured with washers or self-locking nuts.

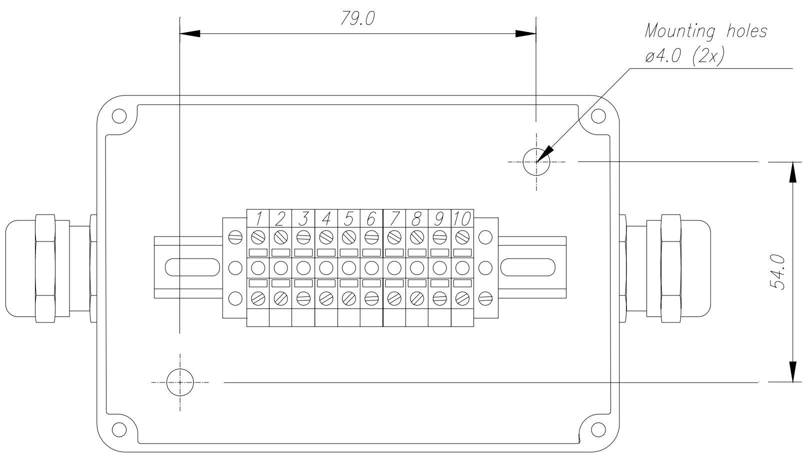


Figure 9 Connection box mounting

3.4.2 Electrical installation

The electrical installation consists of:

- Connecting two cables between the GPS antennas and the Processing Unit.
- Connecting a cable between the MRU junction box and the Processing Unit by using a direct cable or with the connection box in between.
- Connecting cables with output data between the Processing Unit and external equipment (optional).
- Connecting a cable with analog output signals between the Processing Unit and external equipment (optional).
- Connecting the Video Display Unit and the keyboard to the Processing Unit (optional).
- Supplying 110/230V AC power to the Processing Unit and the Video Display Unit.
- Connecting a cable with gyro data to the Processing Unit (optional).
- Connecting cables with DGPS corrections to the Processing Unit (optional).
- Connecting a cable with data output on the Ethernet between the Ethernet connector at the rear of the Processing Unit and external equipment (optional).
- Connecting a cable with 1PPS output signal between the between the PPS connector at the rear of the Processing Unit and external equipment (optional).

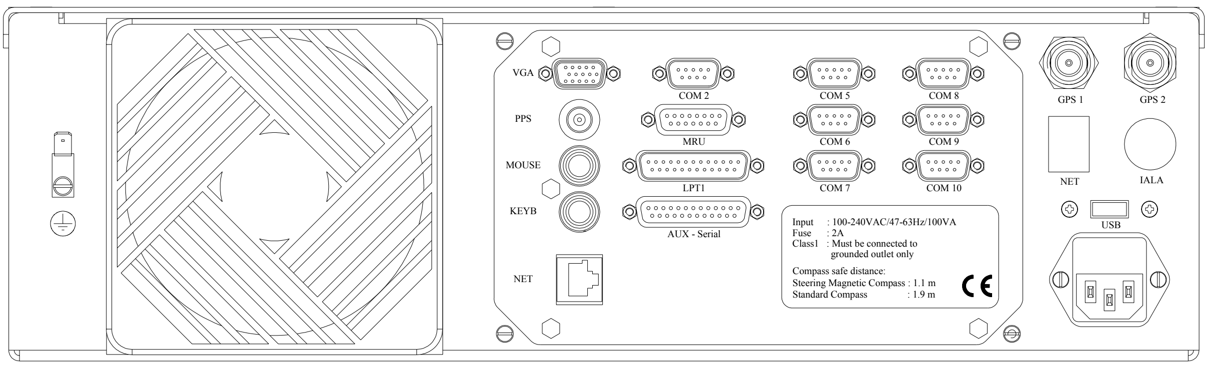


Figure 10 Rear panel of the Processing Unit

If the antenna cables are not delivered by Seatex, make sure that the cables meet the following electrical specifications:

Insertion loss (max.)	15 dB (at 1.6 GHz)
Characteristic impedance	50 ohm (nominal)
DC resistance (max.)	0.5 ohm ground braid and centre conductor

The antenna connectors on the Processing Unit and the GPS antennas are N-type female.

3.4.2.1 MRU to Processing Unit cable wiring

The MRU can be connected to the Processing Unit in the following three ways:

- A cable with the MRU connector in one end and a DB-15 male connector for the Processing Unit in the other end.
- A cable that is terminated in the MRU junction box in one end and with a DB-15 male connector for the Processing Unit in the other end.
- A cable that is terminated in the MRU junction box in one end and terminated in the Processing Unit connection box in the other end.

For the first two alternatives the cable wiring is as follows:

Processing Unit Pin no.	Signal	Pair no. Colour	MRU junct. box Pin no.	MRU connector Pin no.
1		screen	chassis (x3 side)	A
7	PGND	1 blue	2 (x1 side)	B
14	+24 V	1 white	1 (x1 side)	R
2	TX+	2 white	3 (x1 side)	C
9	TX-	2 blue	4 (x1 side)	T
3	RX+	3 white	5 (x1 side)	S
10	RX-	3 blue	6 (x1 side)	P
11	XIN	4 white	23 (x1 side)	U
5	LGND	4 blue	24 (x1 side)	a

For the last alternative with termination in the MRU junction box in one end and termination in the Processing Unit connection box in the other end, the cable wiring is as follows:

Processing Unit Pin no.	Signal	Pair no. Colour	PU connection box Pin no.	MRU junct. box Pin no.
1		screen	9	chassis (x3 side)
7	PGND	1 blue	2	2 (x1 side)
14	+24 V	1 red	1	1 (x1 side)
2	TX+	2 yellow	3	3 (x1 side)
9	TX-	2 green	4	4 (x1 side)
3	RX+	3 pink	5	5 (x1 side)
10	RX-	3 grey	6	6 (x1 side)
11	XIN	4 brown	7	23 (x1 side)
5	LGND	4 white	8	24 (x1 side)

The MRU is supplied with 24 VDC power from the MRU port on the Processing Unit.

Note The shield around each pair in the cable has to be individually isolated in the DB-15 connector. The outer shield is connected to pin 1 (screen) in this connector, which is an open end (not connected to earth). In the MRU junction box both the shield around each pair and the outer shield are terminated in pin 1 (chassis) on the x3 side.

Note It is important to insert a wire between pin 24 (LGND) and pin 27 (Shutoff) on the user side (x1) in the MRU junction box in order to establish RS-422 communication between the MRU and the Processing Unit. Otherwise it will be no communication between these two components.

3.4.2.2 External input and output serial lines

Seapath communicates with external equipment through RS-232 and RS-422 serial lines. It is recommended to input one or more differential GPS correction signals to Seapath and optionally heading from a gyro compass or similar device. Output data are position, velocity and attitude to navigation computers, dynamic positioning systems etc., hereafter called *host* systems. No hardware or software handshake is used on the serial lines.

The configuration of serial lines and their default settings are:

Line	Type	Data
com5	RS-232 or 422 (default 232)	User configurable input or output (default output data to host)
com6	RS-232 or 422 (default 232)	User configurable input or output (default output data to host)
com7	RS-232 or 422 (default 232)	User configurable input or output (default output data to host)
com8	RS-232 or 422 (default 232)	User configurable input or output (default output data to host)
com9	RS-232 or 422 (default 232)	User configurable input or output (default gyro compass input)
com10	RS-232 or 422 (default 232)	User configurable input or output (default DGPS corrections input)

All communication ports are set default to RS-232 communication when delivered from Seatex. In the SCC software the user can select which type of communication (RS-232 or 422) to be used on each port. See section **Properties** in Chapter 8.4.5.3 for details on selection between RS-232 and 422 communication in the SCC software.

To ensure a best possible position solution from Seapath based on the available differential GPS correction in the area of operation, up to four lines are available for differential GPS corrections. If more than one line is needed, lines used for output data or external heading in the default configuration must be used.

The connectors on the Processing Unit for the serial lines are of DB-9 male type. Pin layout:

RS-232	
Pin no.	**Signal**
1	N/C
2	RXD
3	TXD
4	N/C
5	REF
6	N/C
7	RTS
8	CTS
9	N/C

RS-422	
Pin no.	**Signal**
1	N/C
2	RX+
3	TX+
4	N/C
5	REF
6	N/C
7	TX-
8	RX-
9	N/C

Optional

The comports available on AUX - Serial connector may be used if more serial input or output lines than those described above (Com 5 to 10) are required. The AUX-Serial port makes it possible to increase the number of communication ports. On the 25-pin DSub male connector, six comports are available. These ports are default RS-232 serial lines. The pin layout is described below.

Pin no.	Signal	Line	Description
1	GND		
14	RX	Com4	RS-232, not galvanically isolated
2	TX		
15	GND		
3	RX	Com14	RS-232, not galvanically isolated
16	TX		
18	GND		
6	RX	Com15	RS-232, not galvanically isolated
19	TX		
7	GND		
20	RX	Com16	RS-232, not galvanically isolated
8	TX		
21	GND		
9	RX	Com17	RS-232, not galvanically isolated
22	TX		
10	GND		
23	RX	Com18	RS-232, not galvanically isolated
11	TX		

Note The AUX - Serial ports are limited in use since these ports are not galvanically isolated. They can only be used to distribute signals to/from other systems mounted in the same rack and uses the same power reference, unless addtional electronic equipment providing isolation is connected in between.

In order to galvanically isolate these lines and maybe convert them to RS-422, the Kongsberg Seatex product HMS 100 Converter Box (part no. M410-30) can be used. However, for the Seapath product we recommend that the product Seatex EXT 6 unit (part no. M320-41) is used for this purpose. The Seatex EXT 6 unit is a 1 U rack module including isolation and conversion to RS-422 on all the AUX - Serial comports.

3.4.2.3 Ethernet connection

The Seapath has the possibility to output data on up to eight individually configurable network ports. The output format, update rate and user measurement point are configured for each port by the SCC configuration software. For the network the IP address and mask have to be specified. The output data are sent out as an UDP (User Datagram Protocol) diagram. The datagrams (UDPs) that are output simultaneously (same time stamp) are sent out in one common data package. When a data package is received at the host computer, all data (UDPs) for that sample are received.

To connect Seapath to a network hub, you must use straight-through twisted pair (TP) cable with RJ45 connectors. Cables can be shielded (screened) or unshielded. However, shielded is recommended used. The maximum length of the cable that can be used is 100 metres (328 ft). A straight-through cable is one where the pins of one connector are connected to the same pins of the other connector. In special instances, a crossover cable instead of straight-through is needed, like connecting a Seapath Processing Unit and an HMS 100 Computing Unit together.

Below is the pin wiring for the different TP cables:

Straight-through			
Signal	**Pin no.**	**Pin no.**	**Signal**
TX+	1	1	TX+
TX-	2	2	TX-
RX+	3	3	RX+
RX-	6	6	RX-

Crossover			
Signal	**Pin no.**	**Pin no.**	**Signal**
TX+	1	3	RX+
TX-	2	6	RX-
RX+	3	1	TX+
RX-	6	2	TX-

The pins 4, 5, 7 and 8 are not used.

3.4.2.4 1PPS signal connection

A 1 pulse-per-second (1PPS) signal synchronised with GPS time is available from the BNC connector at the rear of the Processing Unit. This 1PPS signal originates from the GPS receiver within the Processing Unit. The 1PPS signal is buffered and fed to the BNC connector. The high level is at +5V (unloaded) and +3.8V (at 50 Ohm load). The low level is at 0V. The 1PPS signal is active high and has a pulse width of 10 ms. The 1PPS is generated exactly once every second with its rising edge synchronised to GPS time.

Synchronised with this signal it is possible to output 1PPS time tag messages from Seapath. These messages are the 1PPS NMEA ZDA (format no. 13) or the Trimble compatible message (format no. 14). For description of the format for these messages see "Appendix B - Output Protocols From Seapath".

3.4.2.5 Analog output

Three analog output channels are available from the AUX – Serial port at the rear of the Processing Unit. The variables available for analog output are roll, pitch, heave and Datawell Hippy compatible roll and pitch signals. The selection of variable and channel properties is performed in the SCC configuration software, see chapter 8.4.5.4 for details.

The pin wiring for the analog output part of the AUX – Serial port is as follows:

AUX – Serial port		
Pin no.	**Signal**	**Description**
24	AGND	Common ground for all analog signals
12	+AOUT-1	Analog output signal for channel no. 1
25	+AOUT-2	Analog output signal for channel no. 2
13	+AOUT-3	Analog output signal for channel no. 3

Note The other pins on the AUX - Serial port must not to be connected to anything. They have to be open.

Optionally, a DB-25 connector for the AUX - Serial port with the analog output signal connected can be delivered. This cable has a 3-metre cable length with the DB-25 connector in one end and is open in the other. The cable part number is M320-42 and a wiring drawing is shown in chapter 4.

3.4.2.6 Installation procedure

CAUTION

Attach the antenna cables to the GPS antennas on the Bracket before attaching the antenna cables to the Processing Unit. If the antenna cables are attached to the Processing Unit, do not attach the antenna cables to the GPS antennas with the Processing Unit powered on. If the antenna cables are short-circuited with power on, the GPS receivers within the Processing Unit will be damaged.

1. Connect the two GPS antenna cables to the connector 1 (for GPS antenna 1) and connector 2 (for GPS antenna 2) at the rear of the Processing Unit. See chapter 7 on how to install the coax connector on the Superflex antenna cable.

Note The GPS antenna cables must be as straight as possible. Do not crush or crimp the cable with tie-downs as this will affect the electrical properties of the cables.

2. Enter the cable from the MRU port at the rear of the Processing Unit or from its connection box (part no. M410-32) through one of the free nipples on the junction box. Ensure that the cable shield is in contact with the nipple for grounding before the cable is fastened to the box. Use the required number of clips to fasten the cable to the wall.

   Insert each of the MRU to Processing Unit cable wires into the correct terminal on the user side (x1) and all cable shields to pin 1 (chassis) on the auxiliary contact side (x3) within the box. Ensure that the shield around each pair is individually isolated in the DB-15 connector in the other end and that only the outer shield is connected to pin 1 in this connector.

   Insert an isolated wire between pin 24 (LGND) and pin 27 (Shutoff) on the user side (x1) in the junction box. By connecting these two pins together the communication with the MRU will switch from RS-232 to RS-422.

Note It is important to insert a wire between pin 24 (LGND) and pin 27 (Shutoff) on the user side (x1) in the MRU junction box in order to establish RS-422 communication between the MRU and the Processing Unit. Otherwise it will be no communication between these two components.

Note The Junction Box housing is grounded to earth through the screws for mounting the box to the wall or floor. Please note that if the foundation on which the junction box is mounted is NOT connected to earth, one of the junction box mounting screws has to be connected to earth by connecting a wire from the screw to an object that is connected to earth.

|----------------------------User side x1----------------------------|

pin	signal	description
1	PWRIN+	power +
2	PWRIN-	power gnd
3	TX+	from MRU
4	TX-	-"-
5	RX+	to MRU
6	RX-	-"-

pin	signal	description
23	XIN	to MRU
24	LGND	gnd ref.aux.+dig
27	SHUTOFF	of MRU

3. Connect the cables for output data from Seapath to external equipment to the ports com5, 6, 7 or com8 for RS-232 or 422 communication (RS-232 is the default setting), analog output signals on the AUX – Serial port or the Ethernet connection. If additional serial ports are required the ports com13to com16 available on the "AUX - Serial" port can be used, see chapter 3.4.3.3 for instructions.

4. Connect the 110/230V AC ship's power supply to the Seapath power connector at the rear of the Processing Unit.

5. Connect the cable from the Video Display Unit and the keyboard to the corresponding connectors at the rear of the Processing Unit.

6. Connect the Video Display Unit to 110/230V AC ship's power.

7. If available, connect the cables with the DGPS corrections to port com10 and the external gyro compass signal to com9 at the rear of the Processing Unit. Optionally, additional DGPS correction signals can be connected to the free communication ports in the range 5 to 9 instead of output lines and gyro input.

8. When all cables are connected, power on the Processing Unit. The four LED indicators located behind the door on the front panel of the Processing Unit should then start to shine red. The LED1 light diode in the MRU junction box should then shine green indicating that the MRU receives power. A yellow light in LED2 indicates that digital data are sent from the MRU on TX+.

9. If the lights in the LED1 and 2 in the MRU junction box are shining, the installation is now completed and you can continue to set up the configuration parameters.

3.4.3 Setup of configuration parameters

Setup consists of:

- Installing the setup software SCC on an external PC.
- Entering lever arm vectors and mounting angles for the MRU and the GPS antennas.
- Entering input and output data interface.

The setup parameters are entered into the Seapath Processing Unit by utilising the configuration software SCC. The SCC software is described in "Appendix D - Seapath configuration software, SCC".

Always fill in the setup parameters for the specific installation in the Seapath Installation Worksheet before entering the setup software. Fill in the parameters directly in the worksheet found in the "Appendix A - Installation worksheet" in the manual. In this way, the parameters for the actual installation will be easier to find when requested later.

3.4.3.1 Lever arm vector determinations

The following lever arm vectors have to be determined and input to the configuration software SCC:

- The vector from the centre of gravity to the GPS antenna no. 1.
- The vector from the centre of gravity to the MRU location.
- The vectors from the centre of gravity with up to maximum four measurement points.

All these vectors have to be measured or calculated based upon drawings or previously measured points. These vectors are to be measured within an accuracy of 0.5 metres or better. Positive vector orientation for these parameters is X - positive forwards, Y - positive towards starboard, Z - positive downwards with the centre of gravity as the origin.

Note If data shall be valid for centre of gravity, it is not necessary to define a zero measurement point vector since the data is default output in CG. The antenna and MRU vector have to be measured in any case.

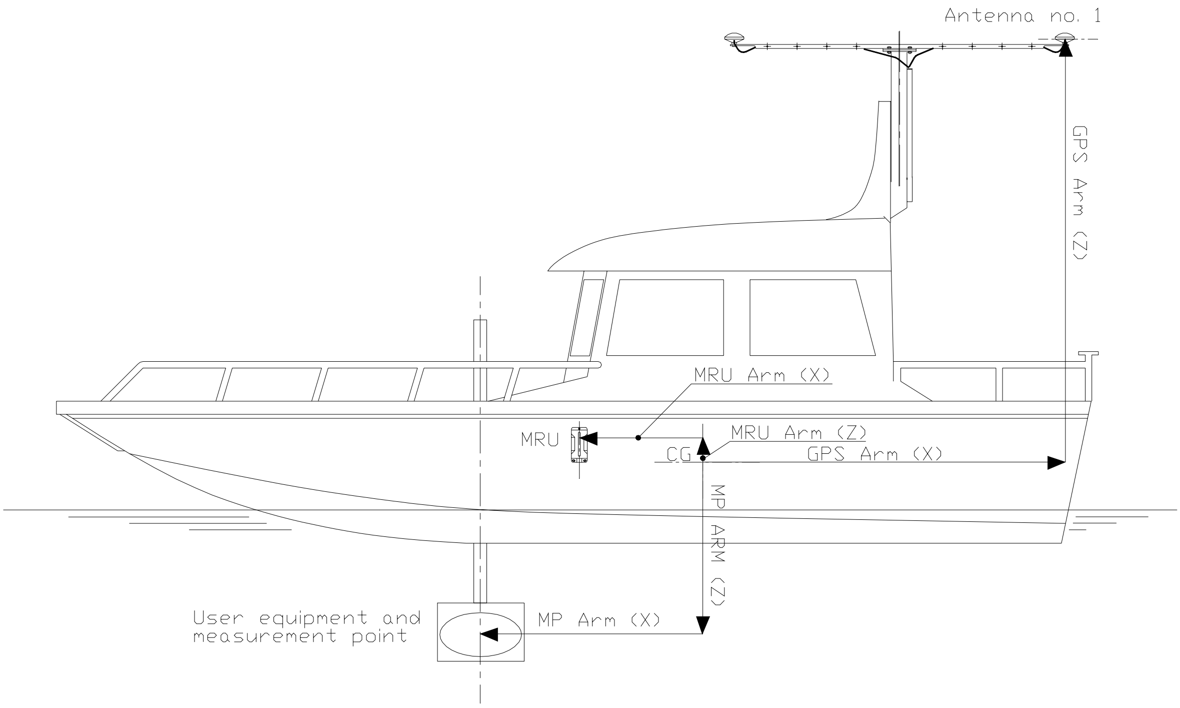


Figure 11 The offset vectors between the different components

3.4.3.2 Input data

The Processing Unit has up to five ports for input of data. The following data can be input to the system:

- DGPS corrections. These corrections are normally input through com10. The data format must conform to [2] "6 of 8" or "8 of 8" format. If additional lines are needed, use spare lines in the range com5 to com9. Make sure that the same line is not specified for two purposes. Optionally, the additional input lines on the AUX - Serial port can be used.

- Heading data from an external source, for example a gyro compass, as backup to improve reliability. Heading is normally input through the port com9. The data format must conform to an [1] HDT message or a supported proprietary format.

If DGPS correction data from more than one reference station are available on the links, Seapath combines data from up to six reference stations to obtain the best solution. If data from more than six stations are available, the six nearest stations are used. If required, see the description in the *User's Manual* [3] chapter five, "Operating Instructions" on how to override the automatic selection of the six nearest stations.

3.4.3.3 Serial data output

Data can be output on up to eight individually configurable serial lines (com5 to com20). For a more detailed description of the different output formats available, see "Appendix B - Output Protocols From Seapath".

The logical host channels for output of data are numbered from 1 to 8. Each channel is output to a serial line. The default configuration is:

Channel no.	Line	Type
Host Out #1	com5	RS-232
Host Out #2	com6	RS-232
Host Out #3	com7	RS-232
Host Out #4	com8	RS-232
Host Out #5	com13	RS-232, not isolated
Host Out #6	com14	RS-232, not isolated
Host Out #7	com15	RS-232, not isolated
Host Out #8	com16	RS-232, not isolated

The mapping between channel numbers and lines is configurable in the property setup string for each channel, but only one channel can be output to each line. If high data rates are used (less than 0.1 second between messages), the lowest channel numbers should be used for the highest data rates.

The points on the vessel where the output positions and velocities shall be valid (measurement points) must be defined. If points different from centre of gravity shall be used, the offsets from centre of gravity to these points have to be specified in the **Measurement Points \ Geometry** window in SCC. A maximum of four points can be defined. Each point can be used for one or more channels.

For NMEA messages, full conformance to the standard requires RS-422, 4800 baud, 8 data bits, no parity, one stop bit and at least 1 second between messages. For binary messages, 8 data bits must always be used.

Baud rate and interval between messages must be selected in such a way that the serial line has sufficient capacity. The minimum baud rate is approximately 15 times the number of bytes transmitted per second. If the binary message, which is 52 bytes long, is transmitted with a 0.02 second (50 Hz) interval, the minimum baud rate is:

$$\frac{15 \cdot 52}{0.02} = 39000 \approx 38400$$

A baud rate of at least 38400 should be used in this case.

3.4.3.4 Setup procedure

The following procedure is used to configure the Processing Unit on-line:

1. Install the SCC software on an external PC if not already done. See "Appendix D - Seapath configuration software, SCC" on how to install the software.

2. Power up the Seapath unit if not already running. Connect a null-modem cable or the delivered interconnection cable from a free serial port on an external PC to the front panel connector on the Processing Unit. Start the SCC program and click on the **Connect** button in the **Seapath** start-up window.

3. When contact with the Seapath is established, edit the Seapath parameters according to the completed Installation Worksheet. Finally, select **Parameter Management \ Download** in the folder list in order to download the entered configuration parameters to the Seapath unit. For more description of each of the configuration parameter selections, see "Appendix D - Seapath configuration software, SCC".

3.4.4 Calibration

The system has to be calibrated on board the vessel after installation. A typical calibration consists of:

- Calibrating the direction of GPS antennas against an external reference. Type of reference must be decided according to the required accuracy.
- Calibrate the MRU axes measured by the MRU against an external reference. Decision on whether MRU calibration is needed and type of reference is based on the type of system the Seapath is interfaced to and the accuracy required.

3.4.4.1 Calibration of the GPS antenna installation

For the GPS antenna installation the following calibration parameters have to be determined:

- **Baseline Length**. The baseline length between the two antennas is measured in metres. The length can be selected in the range 0.2 to 6.0 metres.
- **Heading Offset**. The direction of the GPS antennas relative to the vessel's longitudinal axis is measured in degrees.
- **Height Difference**. The height difference between the two antennas is measured in metres.

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.

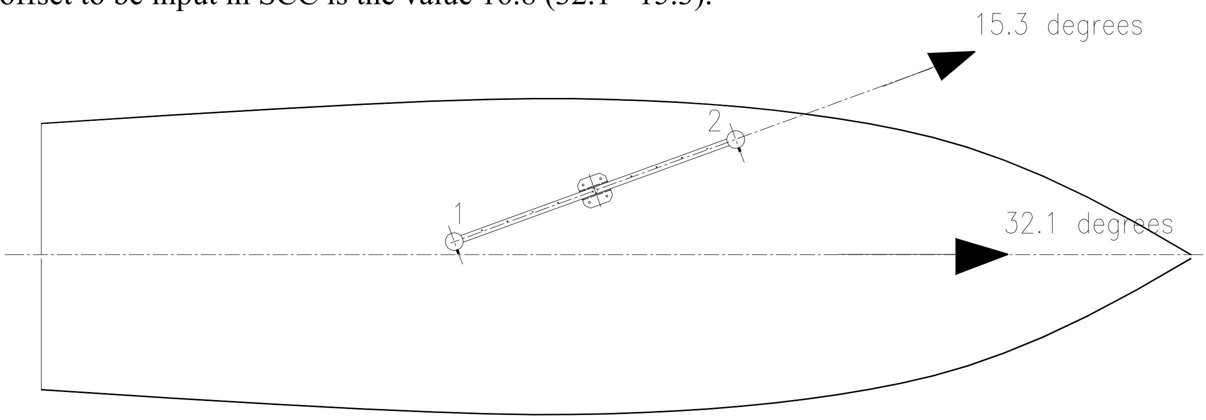
The long calibration time is necessary in order to cancel out errors in the Seapath measurements caused by multipath effects, which may be particularly pronounced in the static conditions of a harbour area.

Before calibration, measure the baseline length between the GPS antennas to within a tolerance of one centimetre or better. If the standard antenna bracket is used, the baseline is 2.500 metres. Enter the measured baseline length into the Processing Unit by using the SCC software.

The observations from each of the two different systems are then averaged and the offset between the two systems (reference minus Seapath reading) is the Seapath heading offset. If heading offset was not entered as zero in the SCC software on beforehand, the calibration value should be added to the existing offset value.
The baseline length and height difference should be determined within an accuracy of 10 centimetres in height difference and 1 mm in baseline length. These values should be entered into the Seapath through the SCC software. By using the calibration wizard in the SCC software the baseline length and height difference are calculated automatically.

Example:

If the heading measured by the reference system is found to be 32.1 degrees and the Seapath heading after the calibration has been determined to be 15.3 degrees, the Seapath heading offset to be input in SCC is the value 16.8 (32.1 - 15.3).



3.4.4.2 Typical calibration procedure

This is an example on how to perform a GPS antenna calibration. Proceed as follows:

1. Start up the SCC software and establish contact with the Processing Unit. When contact is established, enter the Configuration Folder List, select **Sensor \ GPS \ Antenna Configuration**.

2. Before editing parameter values belonging to a connected Seapath, it is recommended to first perform an upload from the Seapath. See chapter 8.4.6.2, "Upload".

3. In the **GPS Antenna Configuration** window, input the Baseline Length 2.5 metres if the standard Antenna Bracket is used, otherwise this length has to be measured manually with 1 cm accuracy and this value entered. For the Heading Offset input an approximate value or input zero if you are uncertain. For the Height Difference input an approximate value. Then click on the **Calibration Wizard** button to prepare the calibration.

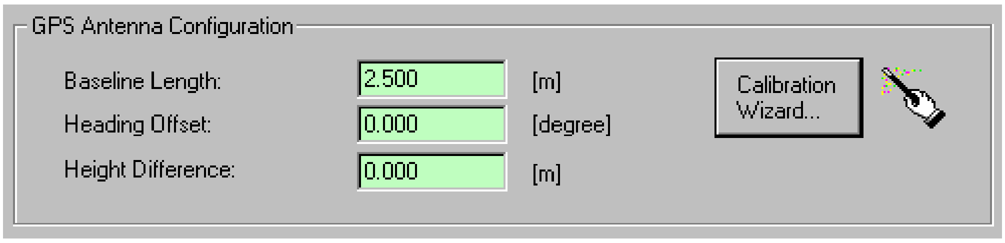


Figure 12 GPS Antenna Configuration

4. In the **GPS Antenna Calibration Wizard - Page 1** step 1, check that the baseline length has been entered correctly.

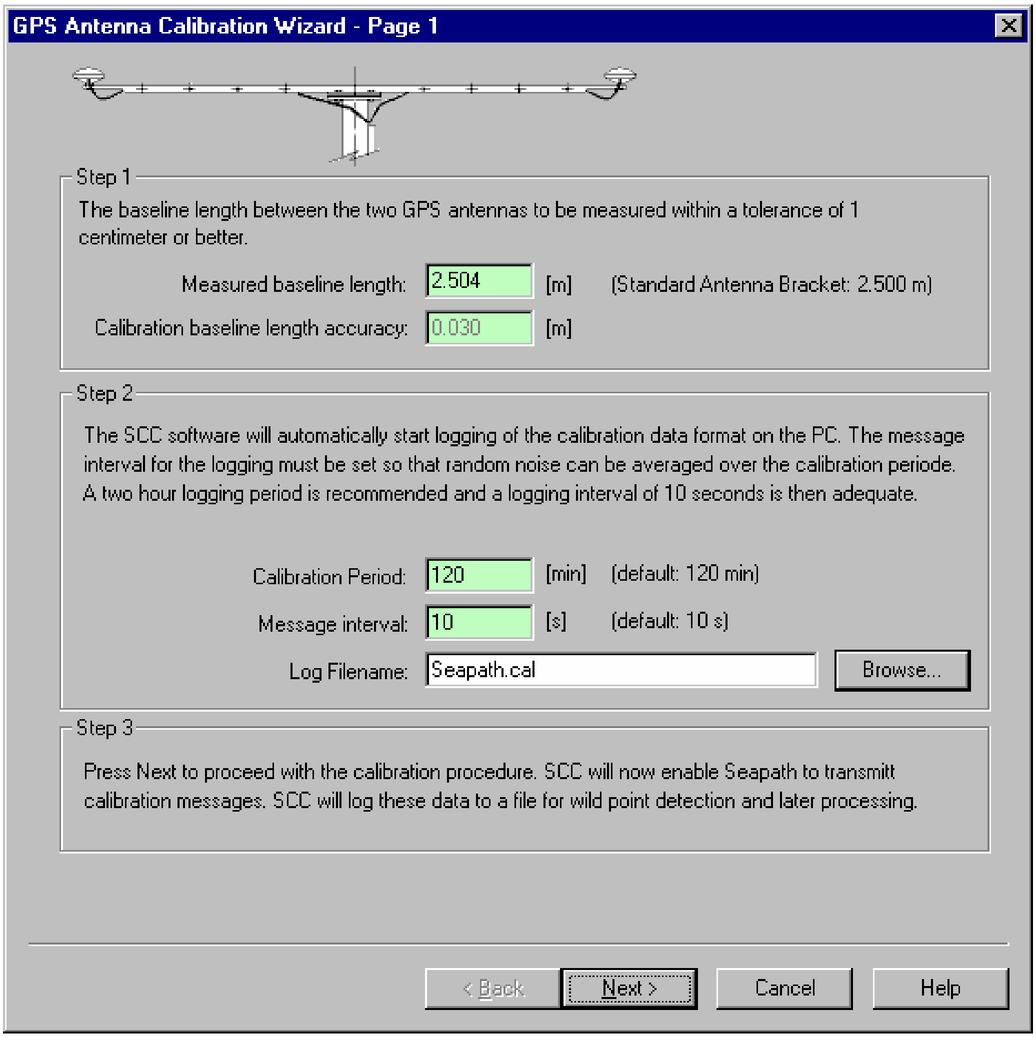


Figure 13 Page 1 of GPS Antenna Calibration

5. In step 2 input 120 minutes (two hours) as the calibration period and the logging interval as 10 seconds. Log the calibration data to the file "Seapath.cal" on a preferred folder on the PC.

6. Before pressing **Next** and start logging of Seapath GPS, it is recommended to start recording data of the vessel reference heading on another PC or by manual readings. When logging of the reference heading has started, click **Next** in order to proceed to page 2.

7. The progress of the calibration process is then shown on the screen with a graphical presentation of the measured data for the Seapath heading, the gyro compass (if connected), the antenna baseline length and the height difference.

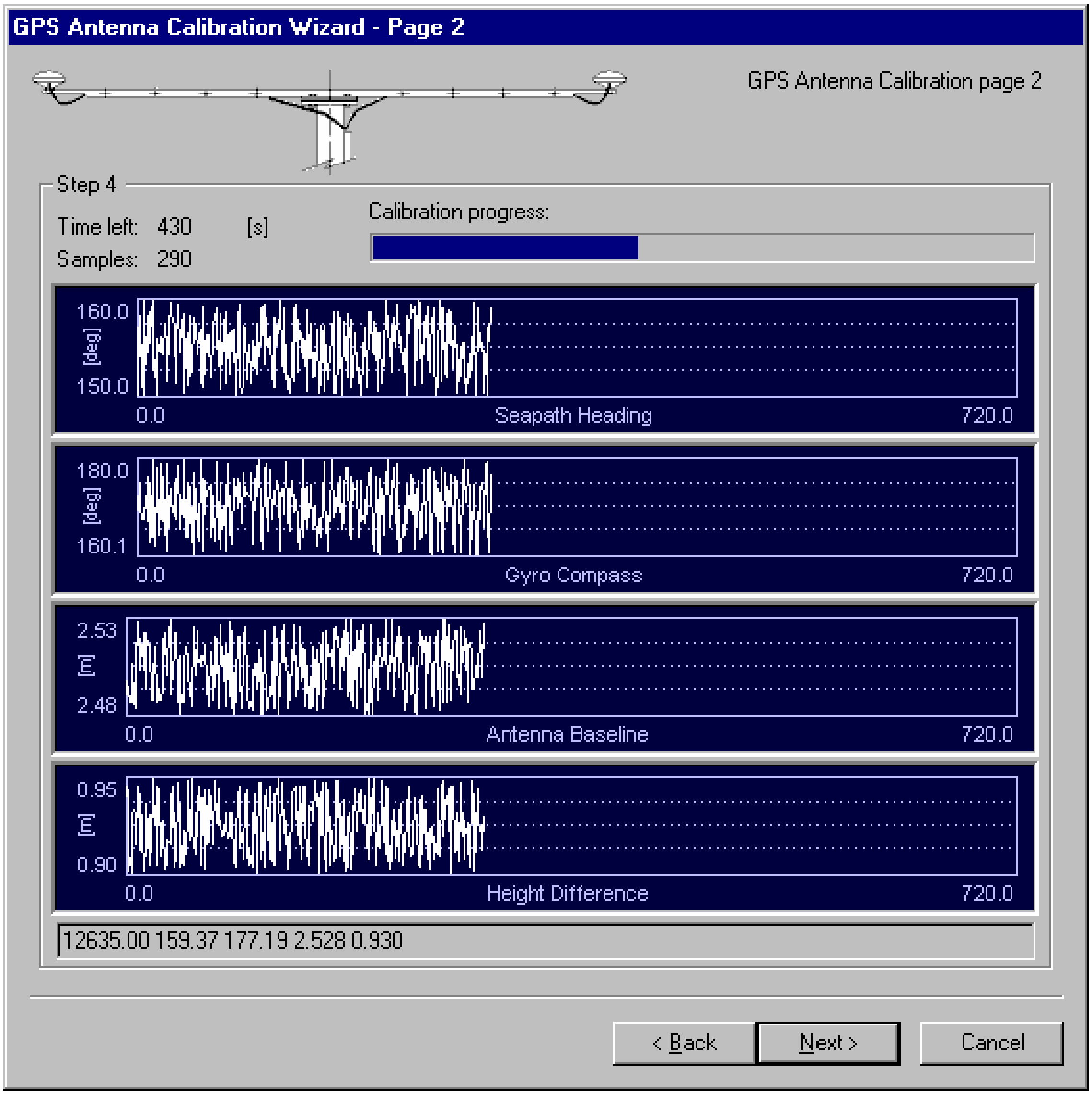


Figure 14 Page 2 of GPS Antenna Calibration

8. Click **Next** to proceed to page 3 for information about the calibration result.

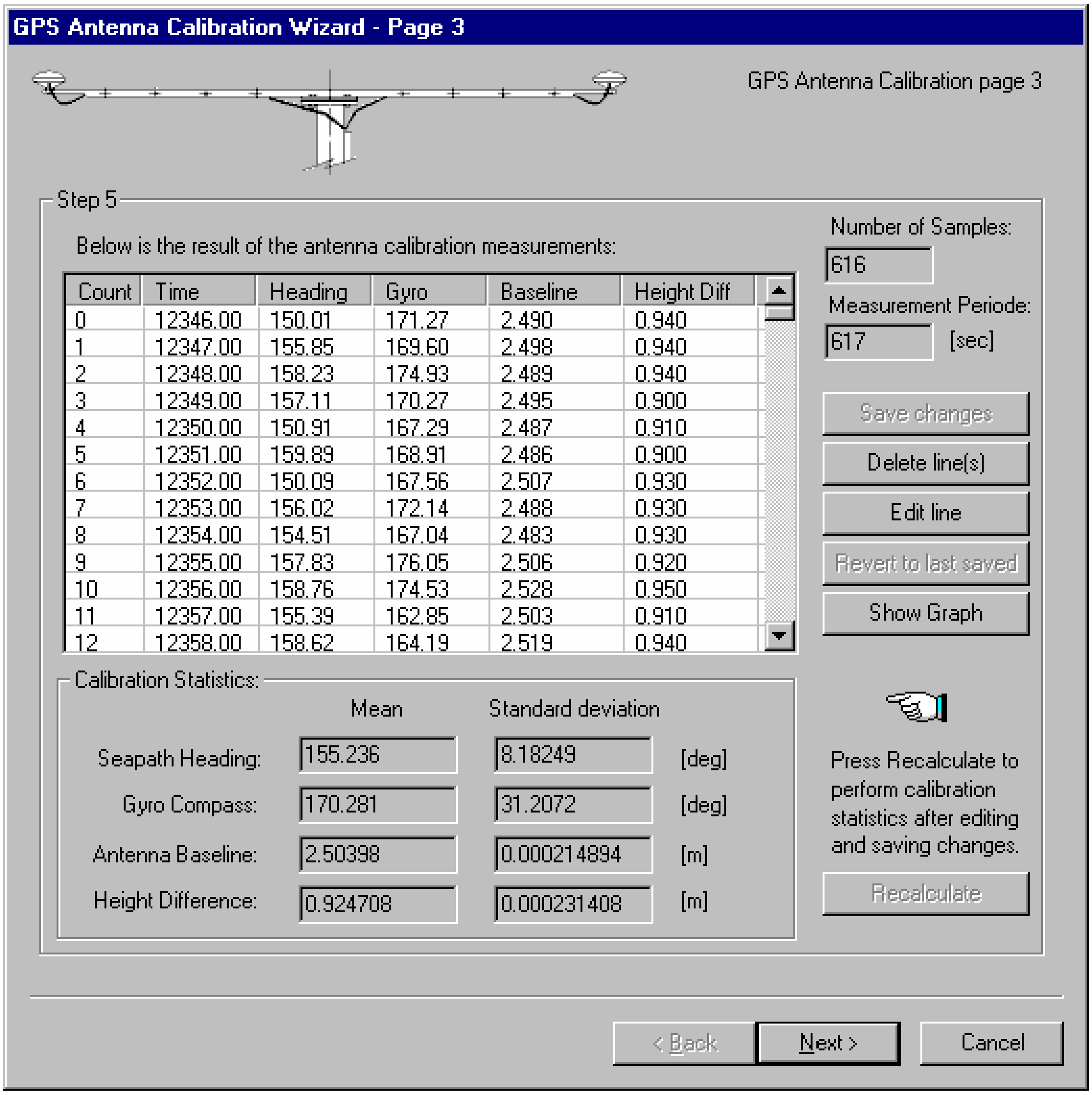


Figure 15 Page 3 of GPS Antenna Configuration

9. Inspect the logged calibration data (in the file "Seapath.cal"**)** for any wild points by selecting the command **Show Graph**. Correct the wild points found or delete the whole line(s) and perform a recalculation of the calibration data.

10. When the Seapath calibration result has been found acceptable, click **Next** to proceed to page 4. Input the mean value for the vessel heading reference, in this example logged on a separate PC and found to be 7.83 degrees, and click on **Compute** in order to calculate the heading offset.

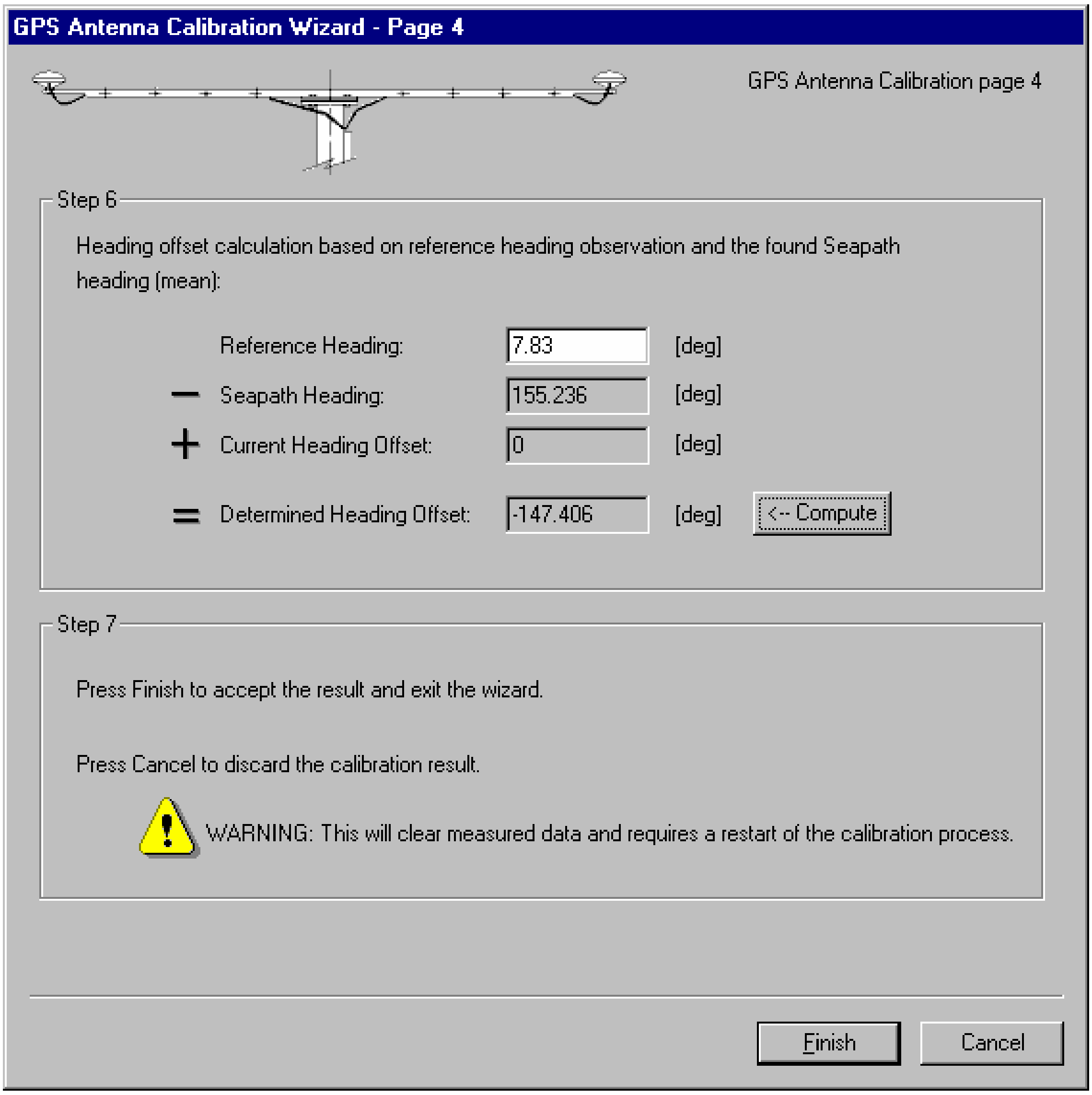


Figure 16 Page 4 of GPS Antenna Configuration

11. Click **Finish** to accept the result and exit the antenna calibration wizard.

3.4.4.3 Calibration of MRU axis

The MRU axes must be calibrated to the vessel axes after the mechanical installation. To achieve the specified roll and pitch accuracy, the offset angles between the MRU axes and the vessel axes have to be calculated to an accuracy better than 0.5 degrees. These offset angles are input to the Seapath configuration as mounting angles. For multibeam echo sounder applications an accuracy better than 0.1 degrees is required to ensure satisfactory performance.

A typical calibration consists of calibrating the MRU axes to an external reference. Type of reference must be determined according to the required accuracy.

The reference for roll and pitch calibration must be carefully selected depending on the intended application. It may be the hull, or a sensor like a multibeam echo sounder or a USBL acoustic system. Some sensors have internal calibration routines, and accurate calibration of the MRU is not required. In "Appendix D - Seapath configuration software, SCC" a procedure for automatic setup of MRU mounting angles is described.

An accurate alignment of the MRU +R arrow with respect to the vessels longitudinal axis (yaw orientation) is of crucial importance. If not properly aligned, the performance of the roll and pitch measurements from MRU will be degraded. The easiest way to ensure a correct yaw orientation of the MRU is to mount the unit on the vessel's longitudinal or transversal bulkheads. Figure 17 illustrates that a misalignment of 1 degree of the MRU in yaw will result in a roll error of ±0.09 degrees if the vessel is pitching ±5 degrees. To calibrate the misalignment of the MRU axis to an accuracy of 0.5 degrees is not an easy task and requires use of an accurate external reference.

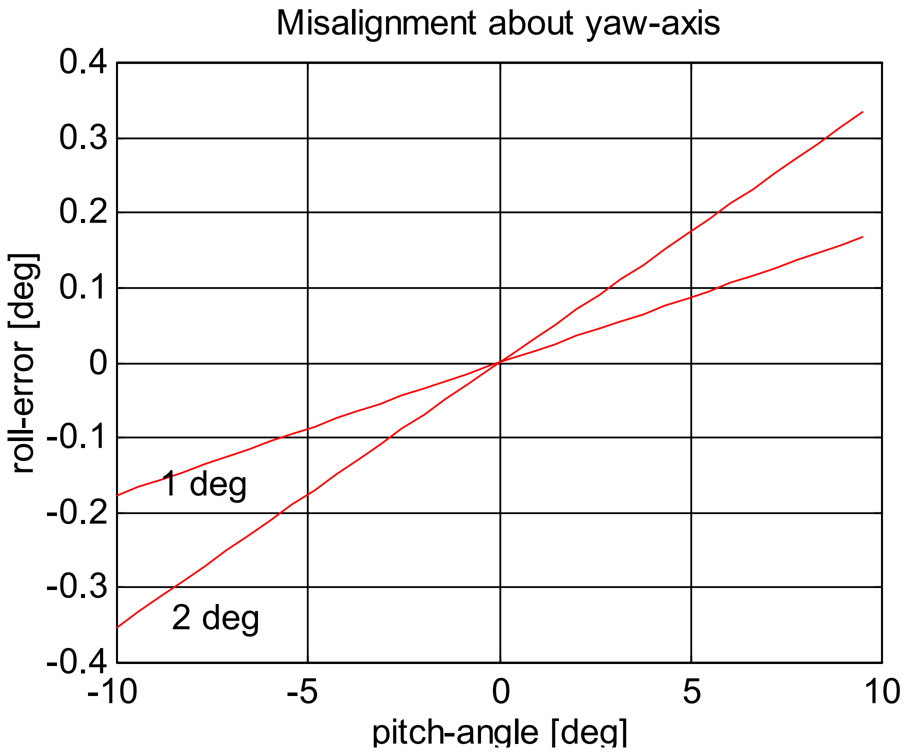
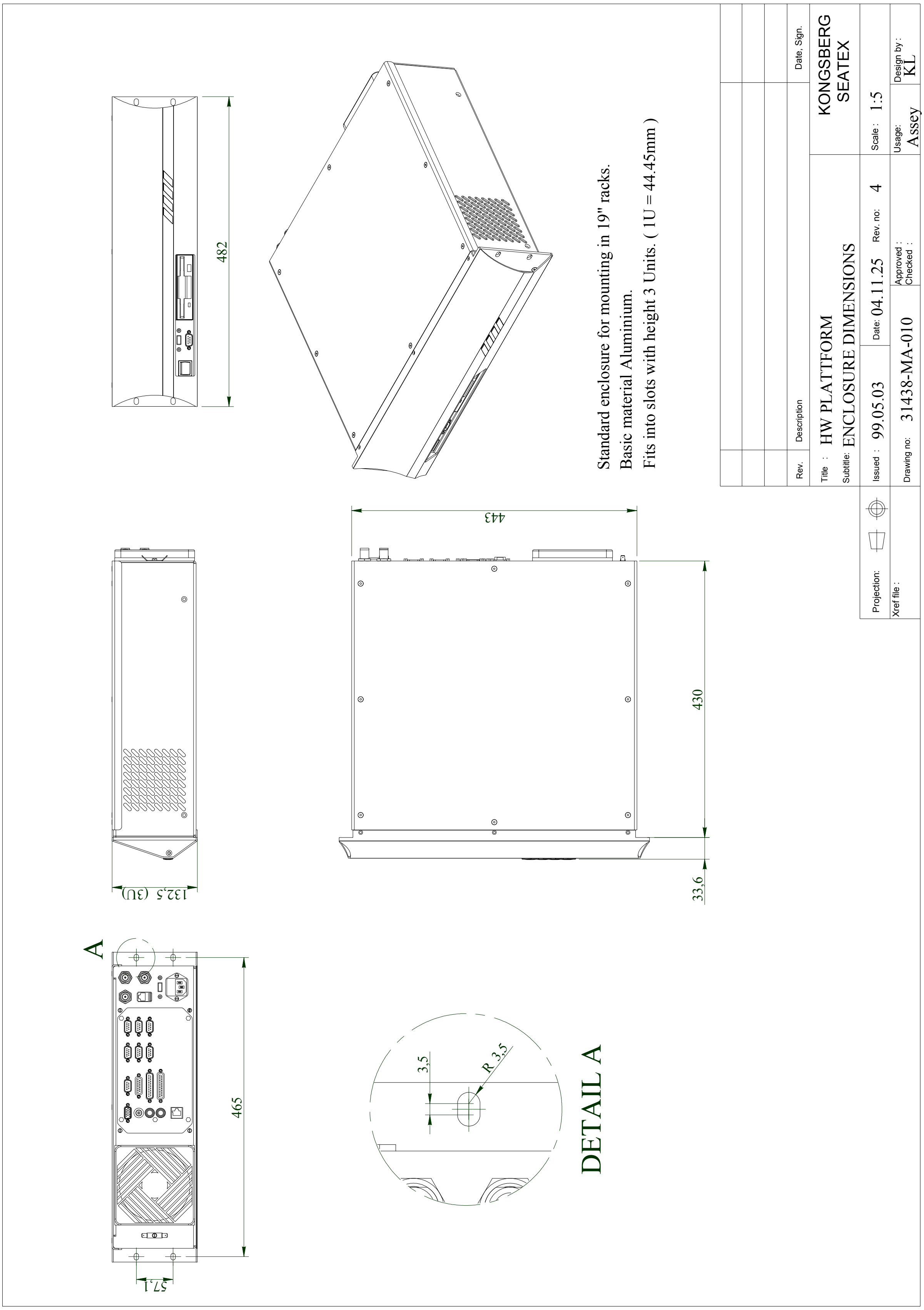
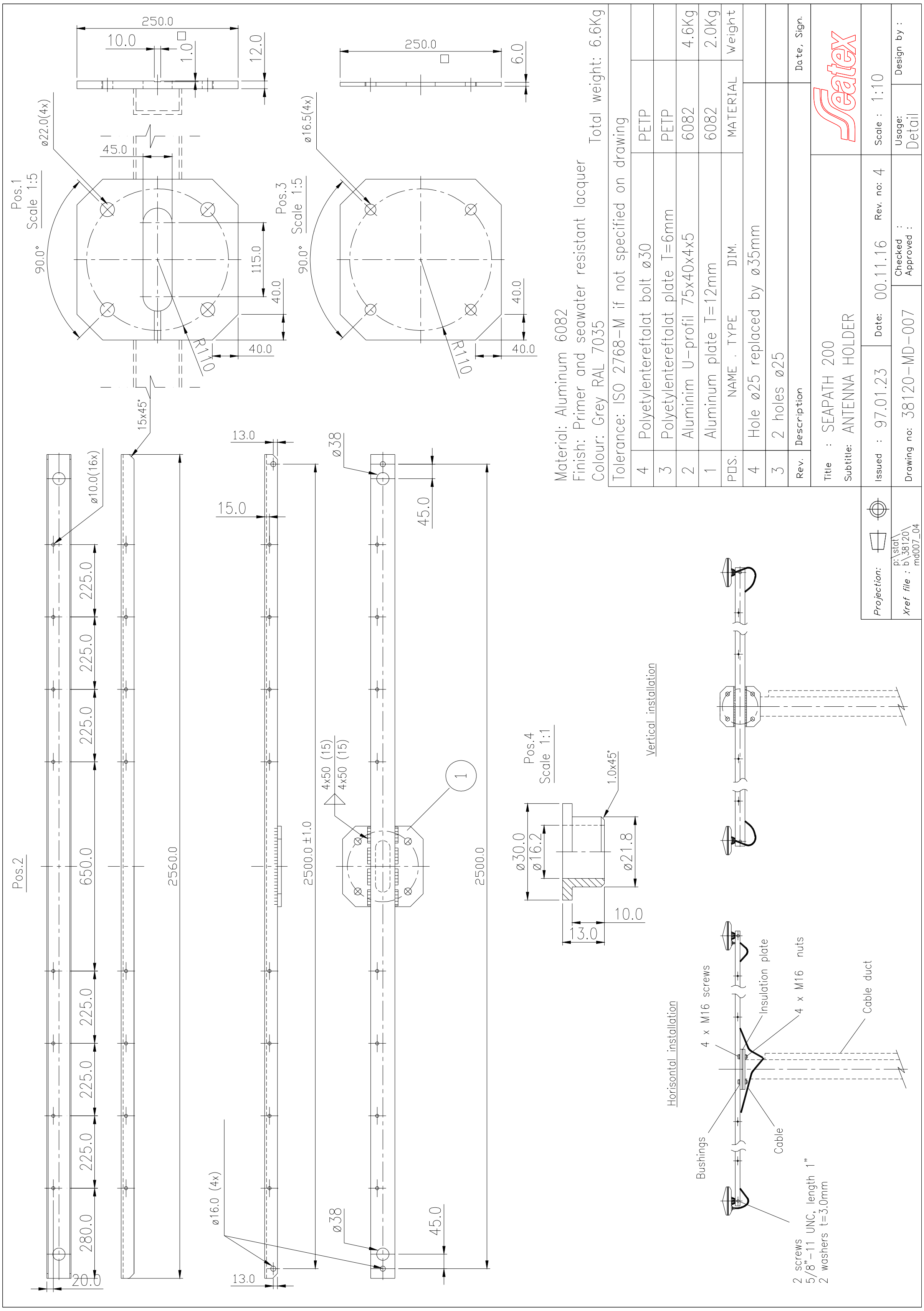


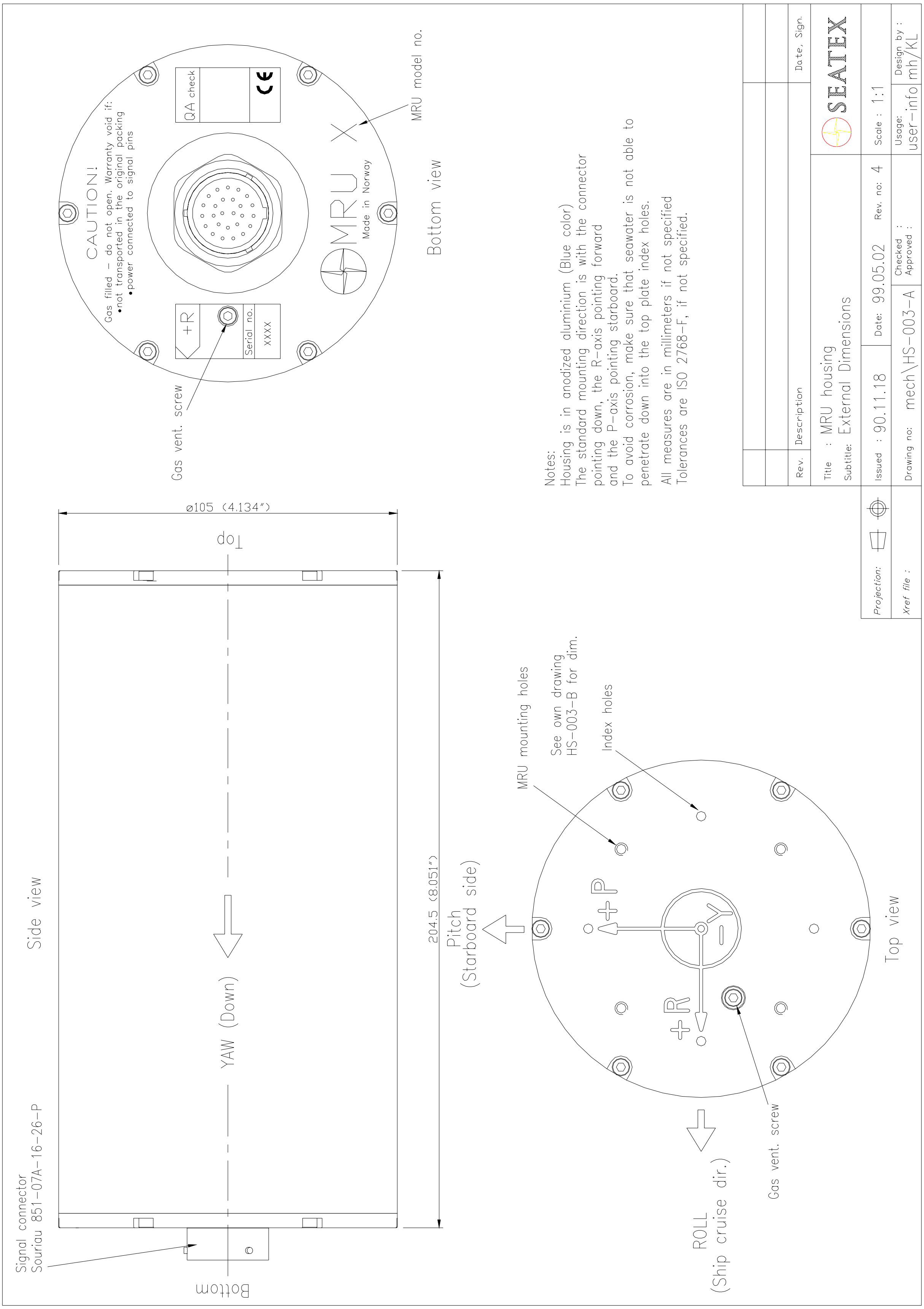
Figure 17 Value of roll-error as function of vessel pitch angle as parameter and 1° and 2° yaw misalignments

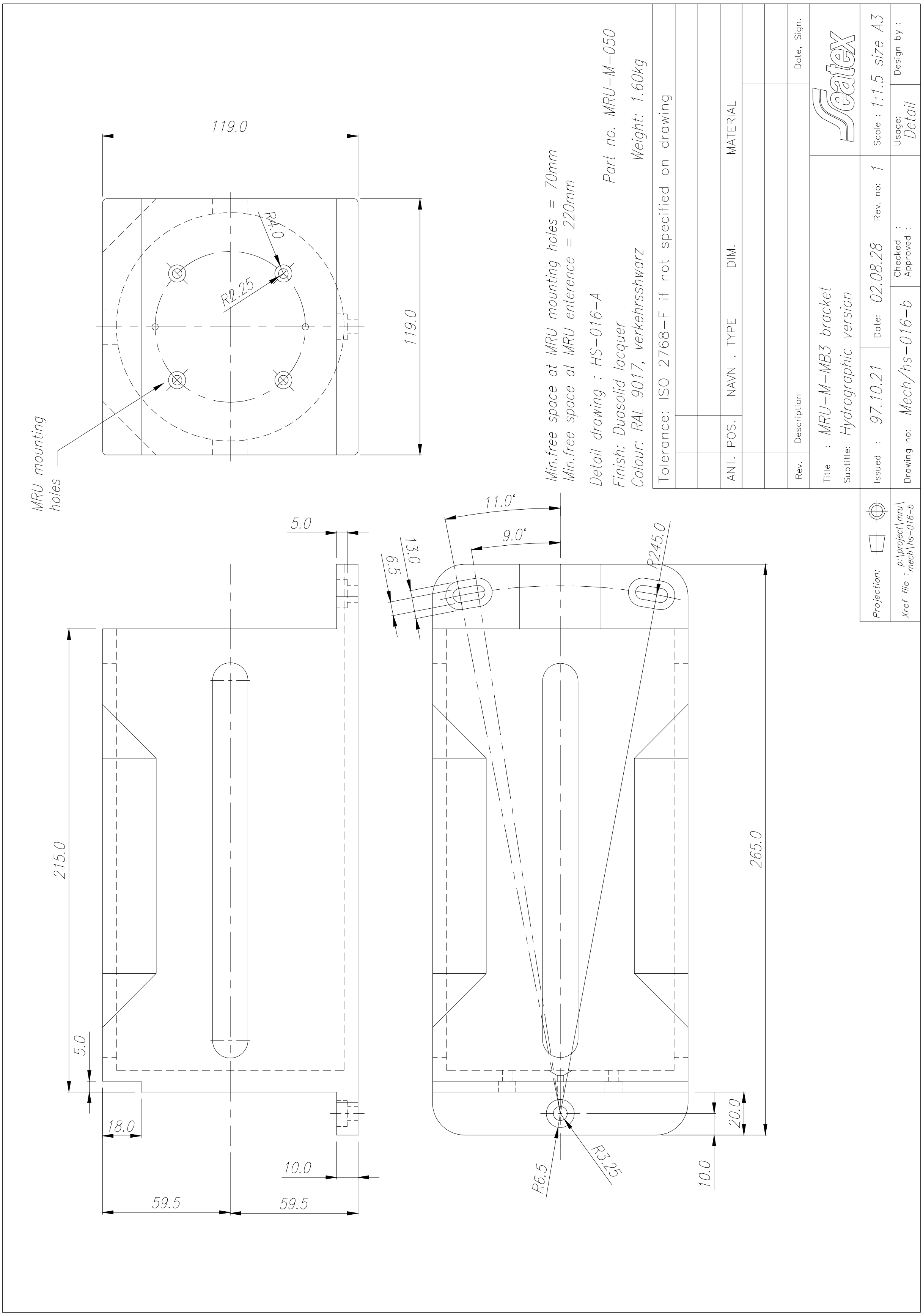
4. INSTALLATION DRAWINGS

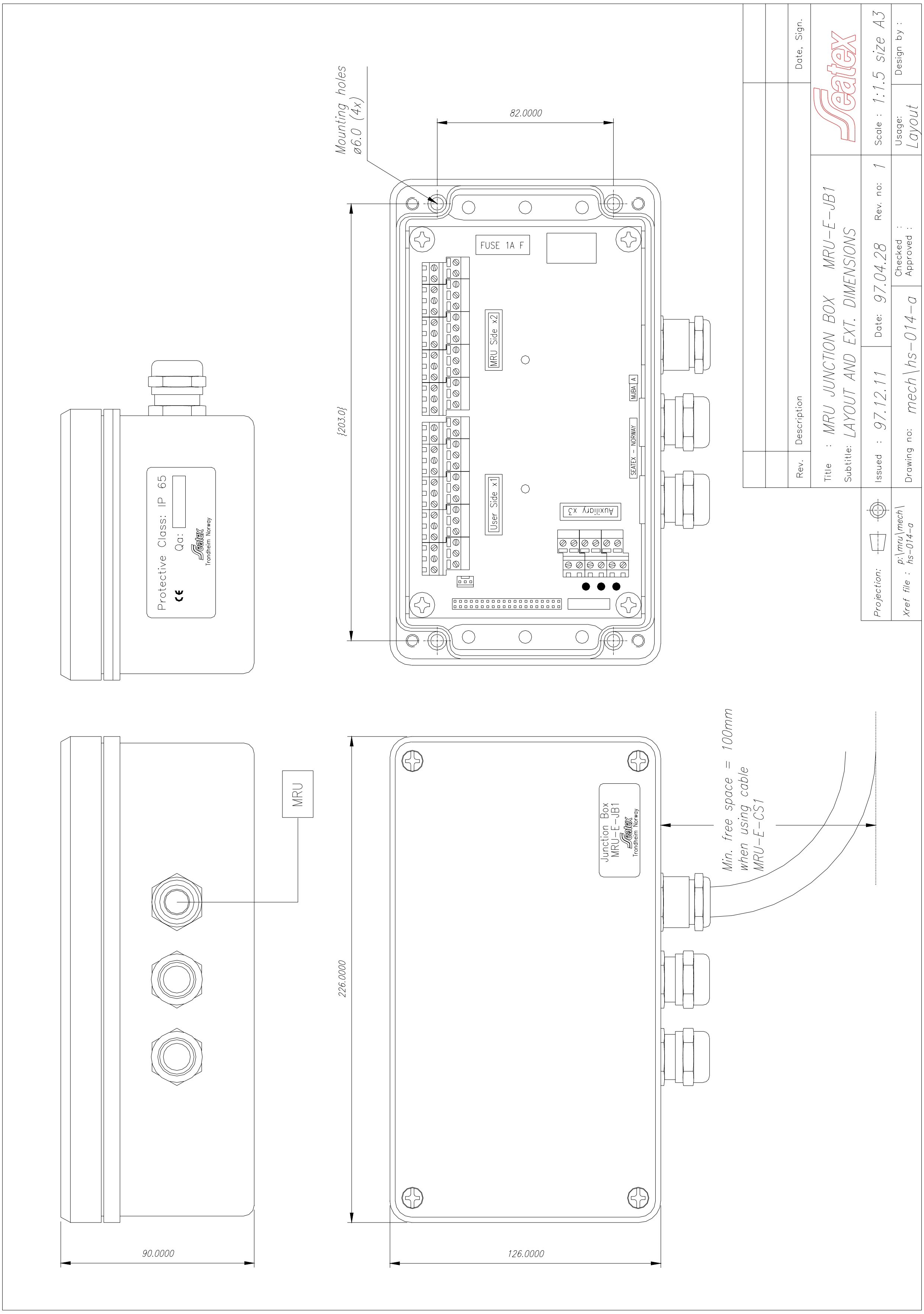
This chapter contains the outline drawings showing the mechanical dimensions of the Processing Unit, the GPS Antenna Bracket and Holder, the MRU 5 and its mounting bracket, and the MRU junction box.

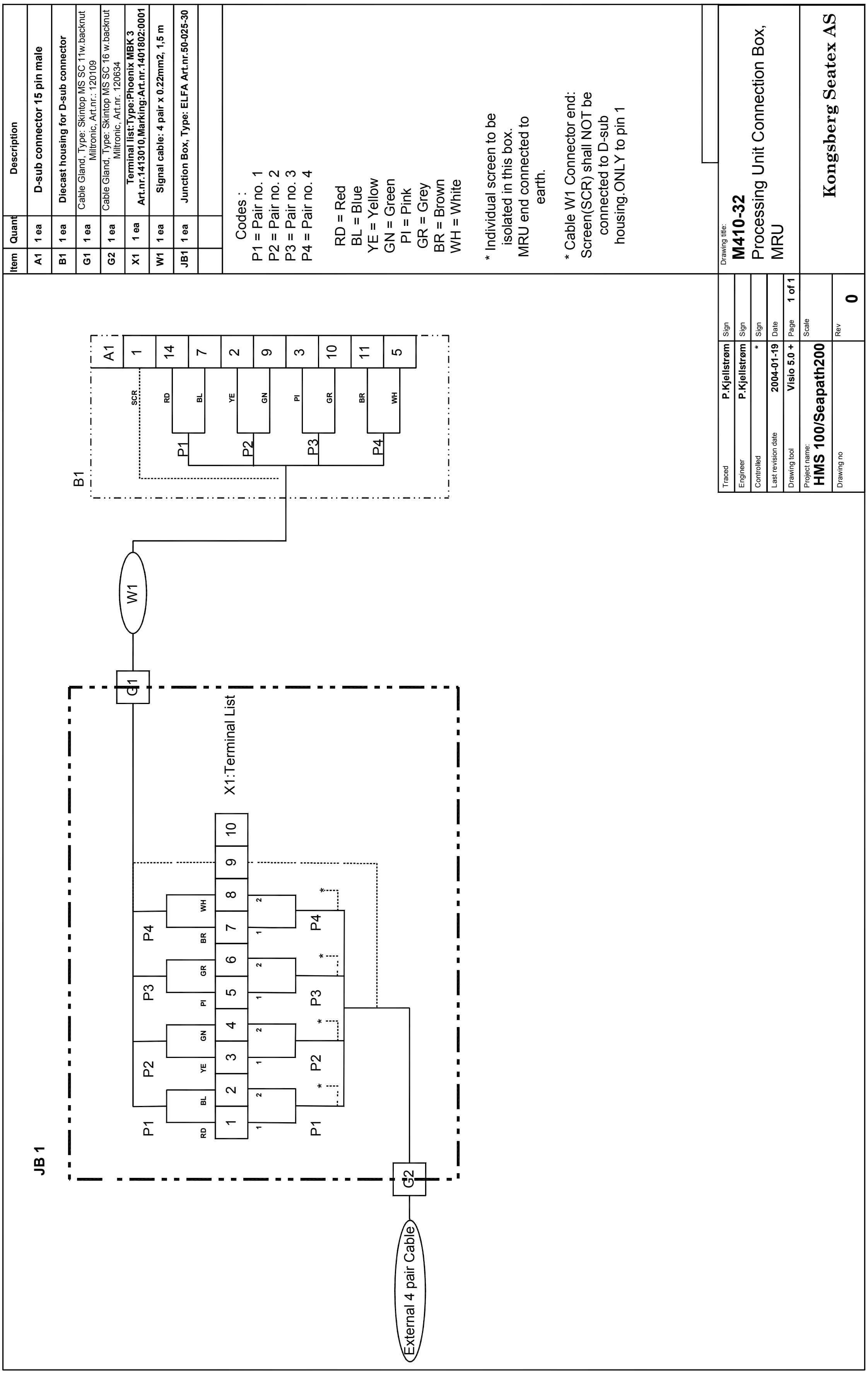

Standard enclosure for mounting in 19" racks.
Basic material Aluminium.
Fits into slots with height 3 Units. (1U = 44.45mm)
482
443
430
33,6
132,5 (3U)
465
57,1
A
DETAIL A
3,5
R 3,5
Rev.
Description
Date, Sign.
KONGSBERG SEATEX
Title : HW PLATTFORM
Subtitle: ENCLOSURE DIMENSIONS
Projection:
Issued : 99.05.03
Date: 04.11.25
Rev. no: 4
Scale : 1:5
Xref file :
Drawing no: 31438-MA-010
Approved : Checked :
Usage: Assey
Design by : KL

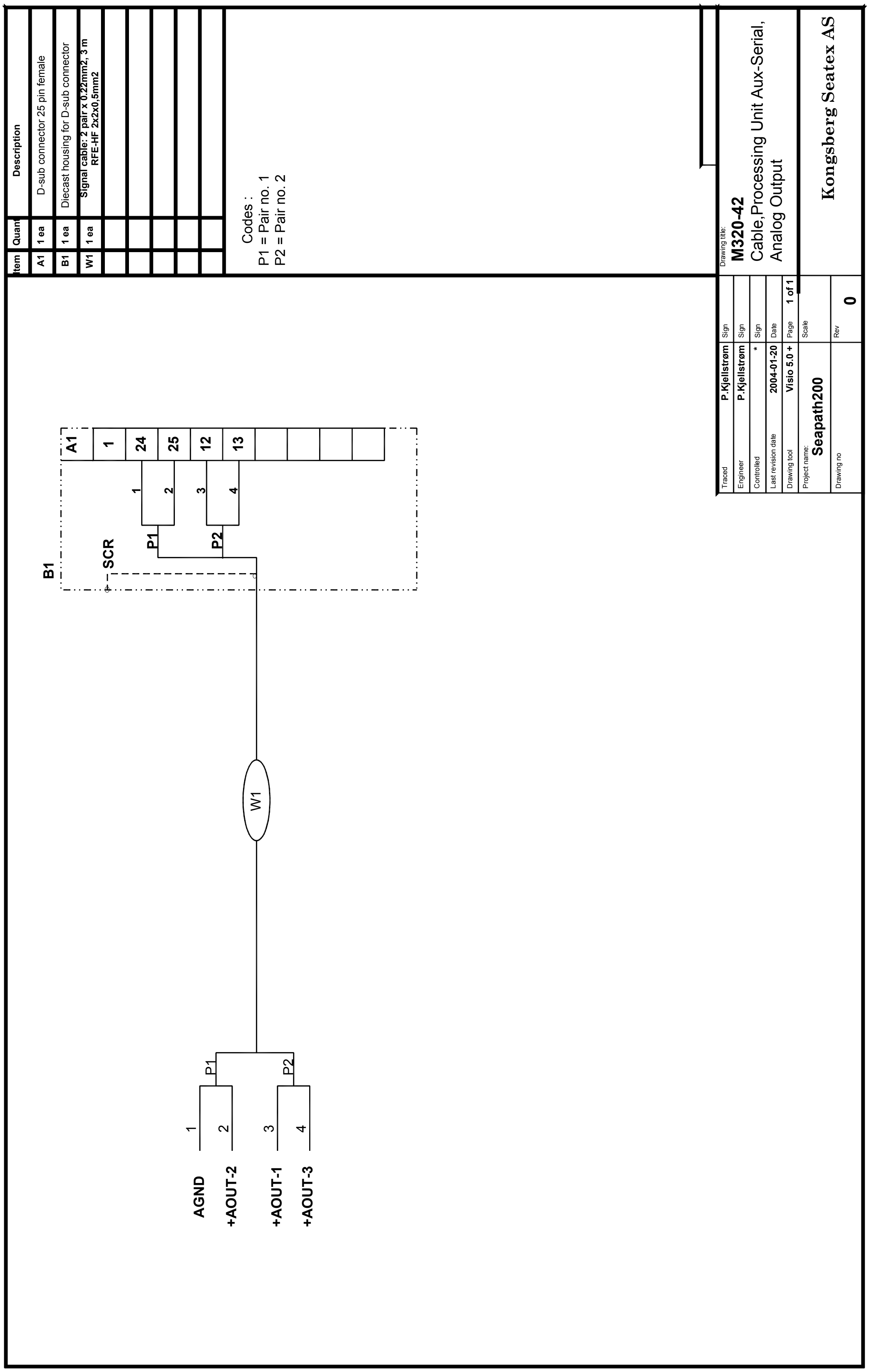

Material: Aluminum 6082
Finish: Primer and seawater resistant lacquer
Colour: Grey RAL 7035
Tolerance: ISO 2768-M if not specified on drawing
Total weight: 6.6Kg
4 Polyetylentereftalat bolt ø30 PETP
3 Polyetylentereftalat plate T=6mm PETP
2 Aluminim U-profil 75x40x4x5 6082 4.6Kg
1 Aluminum plate T=12mm 6082 2.0Kg
POS. NAME . TYPE DIM. MATERIAL Weight
4 Hole ø25 replaced by ø35mm
3 2 holes ø25
Rev. Description Date, Sign.
Title : SEAPATH 200
Subtitle: ANTENNA HOLDER
Issued : 97.01.23 Date: 00.11.16 Rev. no: 4 Scale : 1:10
Drawing no: 38120-MD-007
Checked : Approved :
Usage: Detail
Design by :
Projection:
Xref file : p:\stat\b\38120\md007_04
Seatex
Pos.1 Scale 1:5
Pos.2
Pos.3 Scale 1:5
Pos.4 Scale 1:1
Vertical installation
Horisontal installation
4 x M16 screws
Insulation plate
4 x M16 nuts
Cable duct
Bushings
Cable
2 screws 5/8"-11 UNC, length 1"
2 washers t=3.0mm


CAUTION!
Gas filled – do not open. Warranty void if:
•not transported in the original packing
•power connected to signal pins
QA check
CE
+R
Serial no.
XXXX
MRU
Made in Norway
X
MRU model no.
Gas vent. screw
Bottom view
Notes:
Housing is in anodized aluminium (Blue color)
The standard mounting direction is with the connector pointing down, the R-axis pointing forward and the P-axis pointing starboard.
To avoid corrosion, make sure that seawater is not able to penetrate down into the top plate index holes.
All measures are in millimeters if not specified
Tolerances are ISO 2768-F, if not specified.
Rev.
Description
Date, Sign.
SEATEX
Title : MRU housing
Subtitle: External Dimensions
Issued : 90.11.18
Date: 99.05.02
Rev. no: 4
Scale : 1:1
Drawing no: mech\HS-003-A
Checked :
Approved :
Usage: user-info
Design by : mh/KL
Projection:
Xref file :
ø105 (4.134")
Top
Side view
YAW (Down)
204.5 (8.051")
Signal connector
Souriau 851-07A-16-26-P
Bottom
Pitch
(Starboard side)
MRU mounting holes
See own drawing
HS-003-B for dim.
Index holes
+P
+R
Y
Top view
Gas vent. screw
ROLL
(Ship cruise dir.)


Min.free space at MRU mounting holes = 70mm
Min.free space at MRU enterence = 220mm
Detail drawing : HS-016-A
Finish: Duasolid lacquer
Colour: RAL 9017, verkehrsshwarz
Part no. MRU-M-050
Weight: 1.60kg
Tolerance: ISO 2768-F if not specfied on drawing
MRU mounting holes
119.0
119.0
R4.0
R2.25
11.0°
9.0°
5.0
13.0
6.5
R245.0
215.0
265.0
5.0
18.0
10.0
59.5
59.5
20.0
10.0
R6.5
R3.25
ANT.
POS.
NAVN . TYPE
DIM.
MATERIAL
Rev.
Description
Date, Sign.
Title : MRU-M-MB3 bracket
Subtitle: Hydrographic version
Issued : 97.10.21
Date: 02.08.28
Rev. no: 1
Scale : 1:1.5 size A3
Drawing no: Mech/hs-016-b
Checked :
Approved :
Usage: Detail
Design by :
Projection:
Xref file : p:\project\mru\mech\hs-016-b


Mounting holes ø6.0 (4x)
82.0000
{203.0}
FUSE 1A F
MRU Side x2
User Side x1
Auxiliary x3
Protective Class: IP 65
Qa:
Seatex Trondheim Norway
MRU
226.0000
90.0000
126.0000
Junction Box MRU-E-JB1
Min. free space = 100mm when using cable MRU-E-CS1
Rev.
Description
Date, Sign.
Title : MRU JUNCTION BOX MRU-E-JB1
Subtitle: LAYOUT AND EXT. DIMENSIONS
Issued : 97.12.11
Date: 97.04.28
Rev. no: 1
Scale : 1:1.5 size A3
Drawing no: mech\hs-014-a
Checked :
Approved :
Usage: Layout
Design by :
Projection:
Xref file : p:\mru\mech\hs-014-a


Item Quant Description
A1 1 ea D-sub connector 15 pin male
B1 1 ea Diecast housing for D-sub connector
G1 1 ea Cable Gland, Type: Skintop MS SC 11w.backnut Miltronic, Art.nr.: 120109
G2 1 ea Cable Gland, Type: Skintop MS SC 16 w.backnut Miltronic, Art.nr. 120634
X1 1 ea Terminal list:Type:Phoenix MBK 3 Art.nr.1413010,Marking:Art.nr.1401802:0001
W1 1 ea Signal cable: 4 pair x 0.22mm2, 1,5 m
JB1 1 ea Junction Box, Type: ELFA Art.nr.50-025-30
Codes :
P1 = Pair no. 1
P2 = Pair no. 2
P3 = Pair no. 3
P4 = Pair no. 4
RD = Red
BL = Blue
YE = Yellow
GN = Green
PI = Pink
GR = Grey
BR = Brown
WH = White
* Individual screen to be isolated in this box. MRU end connected to earth.
* Cable W1 Connector end: Screen(SCR) shall NOT be connected to D-sub housing.ONLY to pin 1
A1
B1
SCR
RD BL YE GN PI GR BR WH
P1 P2 P3 P4
1 14 7 2 9 3 10 11 5
W1
G1
G2
JB 1
X1:Terminal List
1 2 3 4 5 6 7 8 9 10
External 4 pair Cable
Traced P.Kjellstrøm Sign
Engineer P.Kjellstrøm Sign
Controlled * Sign
Last revision date 2004-01-19 Date
Drawing tool Visio 5.0 + Page 1 of 1
Project name: HMS 100/Seapath200 Scale
Drawing no Rev 0
Drawing title: M410-32
Processing Unit Connection Box, MRU
Kongsberg Seatex AS


Item
Quant
Description
A1
1 ea
D-sub connector 25 pin female
B1
1 ea
Diecast housing for D-sub connector
W1
1 ea
Signal cable: 2 pair x 0.22mm2, 3 m RFE-HF 2x2x0,5mm2
Codes :
P1 = Pair no. 1
P2 = Pair no. 2
A1
1
24
25
12
13
B1
SCR
P1
P2
W1
AGND
+AOUT-2
+AOUT-1
+AOUT-3
Traced
P.Kjellstrøm
Engineer
P.Kjellstrøm
Controlled
*
Last revision date
2004-01-20
Drawing tool
Visio 5.0 +
Page
1 of 1
Project name:
Seapath200
Scale
Drawing no
Rev
0
Drawing title:
M320-42
Cable,Processing Unit Aux-Serial, Analog Output
Kongsberg Seatex AS

5. APPENDIX A - INSTALLATION WORKSHEET

Vessel			
Seapath serial no.		MRU serial no.	
Place		Date	
Installed by		Signature	

Vessel Geometry		
Vessel Dimension:		
Length [m]	Width [m]	Height [m]
Centre of Gravity (CG) Location:		
From CG to AP (Aft Point) [m] (positive forward of CG)	From CG to CL (Centre Line) [m] (positive to starboard of CG)	From CG to the Keel [m] (positive below CG)

Vessel Description		
Vessel Data:		
Vessel Type and Name	Vessel Owner	Country of Origin
Management:		
Manager	Phone Number	
Seapath:		
Seapath Owner	Seapath Manager	

GPS Antenna Geometry		
Antenna Lever Arm from CG to Antenna #1:		
X[m] (positive forward of CG)	Y[m] (positive to starboard of CG)	Z[m] (positive below CG)

GPS Antenna Processing Settings		
Height Aiding and SV Masking:		
Aid Mode (default = Off)	Aided Height [m] (default = 0)	Elevation Mask [deg] (default = 10)
Range Rate Corrections (default = enabled)	Use Geo Range (default = disabled)	RTK Search Mode (default = Normal)

GPS Reference Stations		
Only Stations:	Force Stations:	Ignore Stations:

SBAS Common Settings	
SBAS Enable:	
Automatic mode (default = disabled)	GEO SV's to track
SBAS Decode:	
Decode any satellite (default = disabled)	Decode following SVs
Enable SBAS WASS Testmode (default = disabled)	

GPS Antenna Configuration		
Baseline length (standard 2.500) [m]	Heading offset (Reference - Seapath reading) [deg]	Height difference (standard 0.00) [m]

GPS Antenna Attitude Processing Settings	
Max Pitch and Roll Angles [deg] (default = 15)	Max Average Pitch and Roll Angles [deg] (default = 7)

MRU Geometry		
MRU Lever Arm: From CG to MRU		
X[m] (positive forward of CG)	Y[m] (positive to starboard of CG)	Z[m] (positive below CG)
MRU Mounting Angles used:		
Roll [deg]	Pitch [deg]	Yaw [deg]

MRU Heave Configuration		
Filter Mode	Average period [s]	Damping

Measurement Points (0 - 4, CG not counted)					
Offset from CG to each measurement point					
Point no.	Active	X (positive if MP forward of CG) [m]	Y (positive if MP starboard of CG) [m]	Z (positive if MP below CG) [m]	Name of MP
1	☐				
2	☐				
3	☐				
4	☐				

Data Interface - Common Host Settings	
NMEA Identification (2 characters)	Binary Message Token (0 – 255)

Data Interface - Common Network Settings			
IP Network Address	IP Network Mask	NMEA Identification (2 characters)	Binary Message Token (0 – 255)
FTP Server Password			

Data Interface – Input Configuration							
Device	Line (com)	Electric 232/422	Baud rate	Parity (standard n)	Data bits (st.. 8)	Stop bits (st. 1)	Format
Gyro							
DGPS Link #1							
DGPS Link #2							
DGPS Link #3							
DGPS Link #4							
OpCom (default Com1)							

Data Interface – Digital RS-232/422 Output Configuration										
Device	Line (com)	Electric 232/422	Baud rate	Parity (st. n)	Data bits (st. 8)	Stop bits (st.1)	MP# (0=CG)	Int [s]	Op. (0)	Format
Host Out #1										
Host Out #2										
Host Out #3										
Host Out #4										
Host Out #5										
Host Out #6										
Host Out #7										
Host Out #8										

Data Interface – Digital Network Output Configuration					
Device	Port	MP# (0=CG)	Int [s]	Option (st. 0)	Format
Network Out #1					
Network Out #2					
Network Out #3					
Network Out #4					
Network Out #5					
Network Out #6					
Network Out #7					
Network Out #8					

Data Interface – Analog Output Configuration				
Device	Gain [V/Physical Unit]	Offset [Physical Unit]	MP# (0=CG)	Format
Analog Out #0				
Analog Out #1				
Analog Out #2				

Blank page

6. APPENDIX B - OUTPUT PROTOCOLS FROM SEAPATH

The available output data formats are as follows:

Name	Format no.	Description
NMEA	1	NMEA and proprietary messages
Simrad EM1000/950	2	Simrad EM1000 and 950 binary format
Seapath binary fmt3	3	Seapath binary format 3
Simrad EM3000/Hipap	6	Simrad EM3000, 300 and Hipap compatible
Calibration	7	Calibration format for GPS antennas
Echo Sounder fmt9	9	Echo sounder format
RDI ADCP	10	RDI ADCP format, PRDID
Seapath binary 11 fmt11	11	Seapath binary format 11
Lehmkuhl gyro repeater	12	Lehmkuhl gyro repeater format
1PPS NMEA ZDA	13	1PPS time tag, NMEA ZDA message
1PPS Trimble	14	1PPS time tag, Trimble compatible message
Atlas Fansweep	16	Atlas Fansweep format
Echo Sounder fmt18	18	Echo sounder format, TSS1 compatible
Submetrix	19	Submetrix format

6.1 NMEA format

The NMEA format is an ASCII text format using the ZDA, GGA, GLL, VTG, HDT, GST, GSA and GRS messages defined in [1] and the proprietary PSXN,20, PSXN,21, PSXN,22 and PSXN,23 messages conforming to the same specification.

Format:

$INZDA,*time***,***day***,***month***,***year***,,****csum term*
$INGGA,*time***,***lat***,**{**N**|**S**}**,***long***,**{**E**|**W**}**,***gga-qual***,***nsat***,***hdop***,***height***,M,,M,***age***,***stn*******csum term*
$INGLL,*lat***,**{**N**|**S**}**,***long***,**{**E**|**W**}**,***time***,***gll-qual***,***mode*******csum term*
$INVTG,*course***,T,,M,***speed***,N,,K,***mode*******csum term*
$INHDT,*head***,T****csum term*
$INGST,*time***,,***semi-maj***,***semi-min***,***ell-orient***,***sd-lat***,***sd-long***,***sd-height*******csum term*
$INGSA,*gsa-mode***,***gsa-status***,***id***,***id***,***id***,***id***,***id***,***id***,***id***,***id***,***id***,***id***,***id***,***id***,***pdop***,***hdop***,***vdop*******csum term*
$INGRS,*time***,1,***res***,***res***,***res***,***res***,***res***,***res***,***res***,***res***,***res***,***res***,***res***,***res*******csum term*
$PSXN,20,*horiz-qual***,***hgt-qual***,***head-qual***,***rp-qual*******csum term*
$PSXN,22,*gyro-calib***,***gyro-offs*******csum term*
$PSXN,23,*roll***,***pitch***,***head***,***heave*******csum term*
$PSXN,24,*roll-rate***,***pitch-rate***,***yaw-rate***,***vertical-vel*******csum term*

$PSXN,21,*event*******csum term*

Explanation:

time	UTC time on format hhmmss.ss where hh is hours (00 - 23), mm is minutes (00 - 59) and ss.ss is seconds (00.00 - 59.99).
day	Day of month (01 - 31).
month	Month of year (01 - 12).
year	Year on format yyyy.
lat	Latitude on format ddmm.mmmmmm where dd is degrees (00 - 90) and mm.mmmmmm is minutes (00.000000 - 59.999999).
long	Longitude on format dddmm.mmmmmm where ddd is degrees (000 - 180) and mm.mmmmmm is minutes (00.000000 - 59.999999).
gga-qual	GPS quality indicator: 0 = invalid position, 1 = GPS SPS used, 2 = DGPS used, 3 = GPS PPS used, 4 = GPS RTK used, 5 = GPS float RTK used, 6 = dead reckoning.
nsat	Number of satellites in use (00 - 99).
hdop	HDOP on format x.x.
height	Height above ellipsoid in metres on format m.mm.
age	Age of DGPS corrections in seconds on format s.s.
stn	DGPS reference station ID (0000 - 1023).
gll-qual	Geographic position quality: A = valid, (D)GPS used (normal or reduced performance), V = dead reckoning or invalid position.
mode	Positioning mode: A = GPS used, D = DGPS used, E = dead reckoning, N = invalid position/velocity.
course	Course over ground, degrees true on format d.dd (0.00 - 359.99).
speed	Speed over ground, knots on format k.k.
head	Heading, degrees true on format d.dd (0.00 - 359.99).
semi-maj	Standard deviation of the semi-major axis of the position error ellipse in metres on format m.mm.
semi-min	Standard deviation of the semi-minor axis of the position error ellipse in metres on format m.mm.
ell-orient	Orientation of the semi-major axis of the position error ellipse in degrees (0 - 180).
sd-lat	Standard deviation of latitude error in metres on format m.mm.
sd-long	Standard deviation of longitude error in metres on format m.mm.
sd-height	Standard deviation of height error in metres on format m.mm.
gsa-mode	GPS position mode setting: A = height aiding enabled, M = 3D only.
gsa-status	GPS position mode used: 1 = no GPS position, 2 = height aided (3 satellites), 3 = 3D.
id	Satellite ID number, PRN (01 – 32).
pdop	PDOP on format x.x
vdop	VDOP on format x.x.
res	GPS range residual in metres on format m.m (no fraction if the value is greater than 99.9 metres).
horiz-qual	Horizontal position and velocity quality: 0 = normal, 1 = reduced performance, 2 = invalid data.
hgt-qual	Height and vertical velocity quality: 0 = normal, 1 = reduced performance, 2 = invalid data.
head-qual	Heading quality: 0 = normal, 1 = reduced performance, 2 = invalid data.
rp-qual	Roll and pitch quality: 0 = normal, 1 = reduced performance, 2 = invalid data.

gyro-calib	Gyro calibration value since system start-up in degrees on format d.dd.
gyro-offs	Short-term gyro offset in degrees on format d.dd.
roll	Roll in degrees on format d.dd. Positive with port side up.
pitch	Pitch in degrees on format d.dd. Positive with bow up.
heave	Heave in metres on format d.dd. Positive down.
roll-rate	Roll rate in degrees per second on format d.dd. Positive when port side is moving upwards.
pitch-rate	Pitch rate in degrees per second on format d.dd. Positive when bow is moving upwards.
yaw-rate	Yaw rate in degrees per second on format d.dd. Positive when bow is moving towards starboard.
vertical-vel	Vertical velocity in metres per second on format d.dd. Positive when moving downwards.
event	Event code: 1 = system restart.
csum	Checksum (exclusive or) of all characters between, but not including, the preceding **$** and *****, hexadecimal (00 - FF).
term	CR-LF (2 bytes, values 13 and 10).

The ZDA, GGA, GLL, VTG, HDT, GST, GSA, GRS, PSXN,20, PSXN,22 and PSXN,23 messages are output regularly at an adjustable rate. If gyro calibration data are not being calculated, the PSXN,22 message is not output. The PSXN,21 message is output once when an event occurs.

A sub-set of the available NMEA messages can be configured individually for each serial line.

6.2 Binary format 3

The binary format consists of a fixed-length message using single-byte unsigned, 4-byte two-complement integer and 4-byte IEEE floating point data elements. For the multi-byte elements, the most significant byte is transmitted first.

Format:

Element	Scaling	Format	Bytes	Value
Header		ASCII	1	ASCII "q"
Length		Unsigned	1	49
Token		Unsigned	1	0 - 255
Time	nanoseconds	Integer	4	0 - 999999999
Latitude	2^{30} = 90 degrees	Integer	4	-2^{30} - 2^{30}
Longitude	2^{30} = 90 degrees	Integer	4	-2^{31} - 2^{31}
Height	metres	Float	4	
Heave	metres	Float	4	
North velocity	metres/second	Float	4	
East velocity	metres/second	Float	4	
Down velocity	metres/second	Float	4	

Element	Scaling	Format	Bytes	Value
Roll	radians	Float	4	
Pitch	radians	Float	4	
Heading	radians	Float	4	0 - 2 pi
Status word		Bit-fields	4	
Checksum		Unsigned	1	0 - 255

Length is number of bytes between, but not including, the Length and Checksum fields. Checksum is calculated modulo 256 of all bytes between, but not including, the Length and Checksum fields. The contents of the Token field is adjustable. 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 32 single bit flags numbered from 0 to 31, 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.

The remaining bits in the status word are reserved for future expansion.

6.3 Binary format, Simrad EM1000/950 compatible

The Simrad EM1000 format consists of a fixed-length message using single-byte unsigned, 2-byte unsigned and 2-byte two-complement integer data elements. For the 2-byte elements, the least significant byte is transmitted first.

Format:

Element	Scaling	Format	Bytes	Value
Header		Unsigned	1	00 Hex
Header		Unsigned	1	90 Hex
Roll	0.01 degrees	Integer	2	-17999 to 17999
Pitch	0.01 degrees	Integer	2	-17999 to 17999
Heave	1 cm	Integer	2	-999 to 999
Heading	0.01 degrees	Unsigned	2	0 to 35999

Roll is positive with port side up. Pitch is positive with bow up. Heave is positive up. Invalid data are indicated by values outside the specified ranges.
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

$$roll_{EM1000} = \arcsin\left[\sin(roll_{Euler}) \cdot \cos(pitch_{Euler})\right]$$

6.4 Binary format, Simrad EM3000, EM300 and HiPap compatible

The Simrad EM3000 format consists of a fixed-length message using single-byte unsigned, 2-byte unsigned and 2-byte two-complement integer data elements. For the 2-byte elements, the least significant byte is transmitted first.

Format:

Element	Scaling	Format	Bytes	Value
Status byte		Unsigned	1	
Header		Unsigned	1	90 Hex
Roll	0.01 degrees	Integer	2	-17999 to 17999
Pitch	0.01 degrees	Integer	2	-17999 to 17999
Heave	1 cm	Integer	2	-999 to 999
Heading	0.01 degrees	Unsigned	2	0 to 35999

Roll is positive with port side up. Pitch is positive with bow up. Heave is positive up.

The status byte can have the following values:

Value	Interpretation
90 Hex	Normal.
91 Hex	Reduced performance.
A0 Hex	Invalid data.

Invalid data are also indicated by values outside the specified ranges. When the status is A0, the values which are within specified ranges can be assumed to have valid, but reduced quality.

6.5 Calibration format

The calibration format is a columnar ASCII text format for use when calibrating the GPS antenna installation.

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

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 GPS 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 GPS phase measurement. Height is the height difference between the antennas from the GPS 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 GPS phase measurements are valid.

6.6 Echo sounder format 9

The echo sounder format is a proprietary ASCII text format with fixed-length records used when connecting Simrad EA500 and other echo sounders.

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

Heave is positive up. Roll is positive with port side up. Pitch is positive with 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 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

$$roll_{echo-sounder} = \arcsin\left[\sin(roll_{Euler}) \cdot \cos(pitch_{Euler})\right]$$

6.7 RDI ADCP format

The RDI format is a proprietary ASCII text format used when connecting RDI ADCP equipment.

Format: **$PRDID,***pitch***,***roll***,***head term*

Explanation:

pitch Pitch, degrees on format sddd.dd. s is the sign character, "+" or "-". ddd.dd is a decimal number with leading zeroes where appropriate. Positive with bow up.
roll Roll, degrees on format sddd.dd. s is the sign character, "+" or "-". ddd.dd is a decimal number with leading zeroes where appropriate. Positive with port side up.
head Heading, degrees true on format ddd.dd, with leading zeroes where appropriate.
term CR-LF (2 bytes, values 13 and 10).

6.8 Binary format 11

The binary 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 42.

Format:

Element	Scaling	Format	Bytes	Value
Header		ASCII	1	ASCII "q"
Time, seconds	seconds	Integer	4	
Time, fraction of second	0.01 second	Unsigned	1	0 - 99
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	

Element	Scaling	Format	Bytes	Value
Heave	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}
Status word		Bit-fields	2	
Checksum		Unsigned	2	

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.

The remaining bits in the status word are reserved for future expansion.

6.9 Lehmkuhl gyro repeater format

The Lehmkuhl gyro repeater format is used when outputting heading from Seapath to Lehmkuhl gyro repeaters. The message is similar to the HDT message output in the standard NMEA format from Seapath. The main differences are lower resolution and no checksum.

When heading is output to devices, which are compliant to the NMEA specification [1], it is recommended to use the standard NMEA format and not the Lehmkuhl format.

6.10 1PPS time tag, NMEA ZDA message

The 1PPS time tag message is output once per second, approximately 0.5 seconds before the time pulse. The message format is ASCII text using the ZDA message defined in [1]. The message 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.

Format: **$INZDA,***time***,***day***,***month***,***year***,,****csum term*

Explanation:

time	UTC time on format hhmmss.ss where hh is hours (00 - 23), mm is minutes (00 - 59) and ss.ss is seconds (00.00 - 59.99).
day	Day of month (01 - 31).
month	Month of year (01 - 12).
year	Year on format yyyy.
csum	Checksum (exclusive or) of all characters between, but not including, the preceding **$** and *****, hexadecimal (00 - FF).
term	CR-LF (two bytes, values 13 and 10).

This format is recommended used together with 1PPS signal output on the BNC connector 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.

6.11 1PPS time tag, Trimble compatible

The 1PPS time tag message is output once per second, approximately 0.5 seconds before the time pulse. The message format is fixed length ASCII text. The message contains the UTC time of the next time pulse.

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

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.

6.12 Atlas Fansweep format

The Atlas format is a proprietary binary format used for outputting data to Atlas Fansweep echo sounders. It consists of a fixed-length message using single-byte and 2-byte two-complement integer data elements. For the 2-byte elements, most significant byte is transmitted first.

Format:

Element	Scaling	Format	Bytes	Value
Start byte		Integer	1	10 Hex
Roll	2^{14} = 90 degrees	Integer	2	
Pitch	2^{14} = 90 degrees	Integer	2	
Heave	millimetres	Integer	2	
Status byte		Integer	1	
Stop byte		Integer	1	10 Hex

Roll is positive with port side up. Pitch is positive with bow up. Heave is positive up.

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

$$roll_{Atlas} = \arcsin\left[\sin(roll_{Euler}) \cdot \cos(pitch_{Euler})\right]$$

The status byte can have the following values:

Value	Interpretation
6	Normal.
7	Reduced performance or invalid data.

6.13 Echo sounder format 18

The echo sounder format is a proprietary ASCII text format with fixed-length records used when connecting Seabeam and other echo sounders.

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

Heave is positive up. Roll is positive with port side up. Pitch is positive with 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 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

$$roll_{echo-sounder} = \arcsin\left[\sin(roll_{Euler}) \cdot \cos(pitch_{Euler})\right]$$

6.14 Submetrix format

The Submetrix format is a proprietary binary format used for outputting data to Submetrix equipment. It consists of a fixed-length message using single-byte and 2-byte unsigned integer data elements. For the 2-byte elements, the most significant byte is transmitted first.

Format:

Element	Bytes	Max. value	Min. value
Start byte	1		
Status byte	1		
Unused	2		
Heading	2	360 deg	0 deg
Roll	2	π rad	-π rad
Pitch	2	π rad	-π rad
Heading	2	360 deg	0 deg
Roll rate	2	5 rad/s	-5 rad/s
Yaw rate	2	5 rad/s	-5 rad/s
Heave	2	1000 m	-50 m
Vertical velocity	2	10 m/s	-10 m/s
Unused	5		
Checksum	1		

The scale of the unsigned integers is such that the minimum value is output as 0 and the maximum value is output as 65535 (FFFF Hex).

Roll is positive with port side up. Pitch is positive with bow up. Heave and vertical velocity are positive down.

The start byte is ASCII ":". Unused elements are output as 0. The checksum byte is calculated as a sum modulo 256 of all bytes transmitted excluding the checksum byte.
The status byte indicates the heave, roll/pitch and heading status using the following ASCII values:

Value	Heave	Roll/pitch	Heading
"A"	N	N	N
"B"	R	N	N
"C"	N	R	N
"D'	N	N	R
"E"	R	R	N
"F"	R	N	R
"G"	N	R	R
"H"	R	R	R
"b"	I	NR	NR
"c"	NR	I	NR
"d"	NR	NR	I
"e"	I	I	NR
"f"	I	NR	I
"g"	NR	I	I
"h"	I	I	I

The codes are:

N: Normal.
R: Reduced accuracy.
I: Invalid.
NR: Normal or reduced accuracy.

6.15 Cyclic redundancy check algorithm

The 16-bit Block Cyclic Redundancy Check algorithm used to calculate the checksum in some formats is described in C and Fortran source code below.

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;
}
```

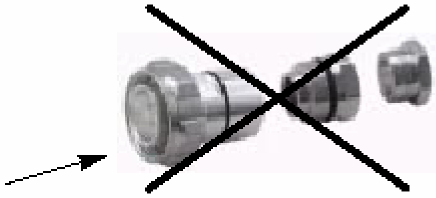
Fortran code:

```
      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
```

7. APPENDIX C - INSTALLATION OF COAX CONNECTORS ON SUPERFLEX CABLE

This is the assembly instruction for the Huber+Suhner connectors 11 716-50-9-9, 11 N-50-9-9, 21 716-50-9-9 and 21 N-50-9-9. This connector consists of one part.



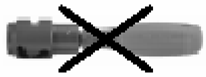
Do not open!
Bitte nicht öffnen!
No abrir por favor!

mit / with / con 

Required Tools: Stripping Tool 74 Z-0-9-15 (see also 27345), Spanners AF 21 and 22 mm, Metal Saw, Knife, Abrasive Paper 320.

Benötigte Hilfsmittel: *Abisolierwerkzeug 74 Z-0-9-15 (siehe auch 27345), Gabelschlüssel 21 und 22 mm, Metall-Säge, Messer, Schleifpapier 320.*

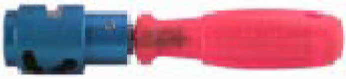
Herramientas requeridas: Fresador especial 74 Z-0-9-15 véanse también 27345) , llaves de horquilla de 21 y 22 mm, sierra para metal, cuchilla, papel de lija 320.

ohne / without / sin 

Required Tools: Spanners AF 21 and 22 mm, Metal Saw, Knife, Measure, Abrasive Paper 320, File.

Benötigte Hilfsmittel: *Gabelschlüssel 21 und 22 mm, Metall Säge, Messer, Massstab, Schleifpapier, Feile.*

Herramientas requeridas: Llaves de horquilla de 21 y 22 mm, sierra para metal, cuchilla, regla graduada, papel de lija 320, lima.

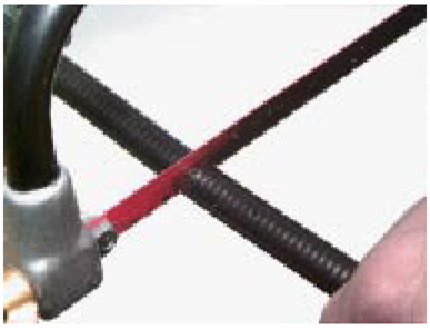
with / mit / con 

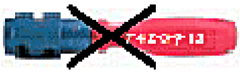
BACK TO MAIN MENU

1. Cut the cable off square (perpendicular to the cable axis).

   Das Kabel rechtwinklig absägen.

   Cortar el cable en ángulo recto.



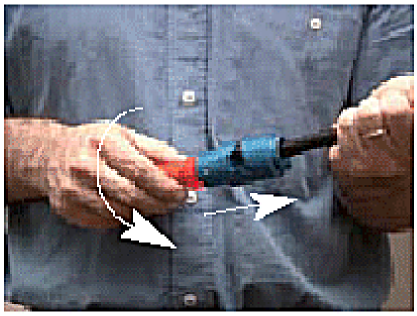
without / *ohne* / sin 

⇒ see page/ *siehe Seite* /véase página 4

2. Strip the cable with the stripping tool 74 Z-0-9-15 as far as the stop.

   Kabel mit Abisolierwerkzeug 74 Z-0-9-15 bis zum Anschlag abisolieren.

   Aislar el cable con el fresador 74 Z-0-9-15 hasta el tope.



3. Deburr outer conductor carefully.

   Aussenleiter sorgfältig entgraten.

   Eliminar cuidadosamente las asperezas del conductor exterior.

IMPORTANT! ***WICHTIG!*** **IMPORTANTE!**

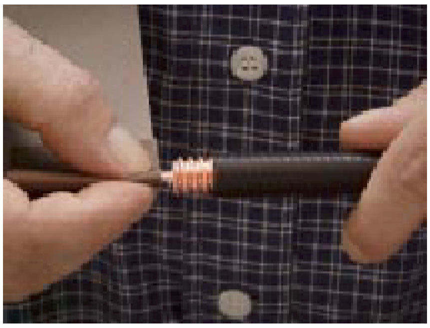
DAMAGED THREAD!
BESCHÄDIGTES GEWINDE!
ROSCA ESTROPEZADA!

GOOD!
RICHTIG!
CORRECTO!

4. Clean the centre conductor carefully with abrasive paper.

Innenleiter mit Schleifpapier gut reinigen.

Limpiar cuidadosamente el conductor interior con el papel de lija.



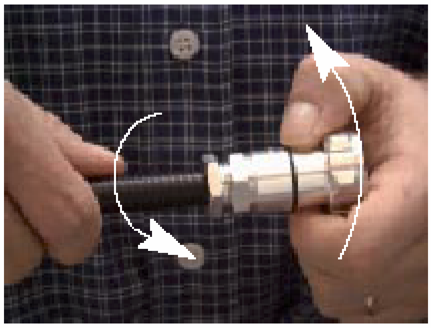
with / mit / con 

BACK TO MAIN MENU

5. Screw the connector on the cable as far as the stop.

Verbinder bis zum Anschlag auf das Kabel schrauben.

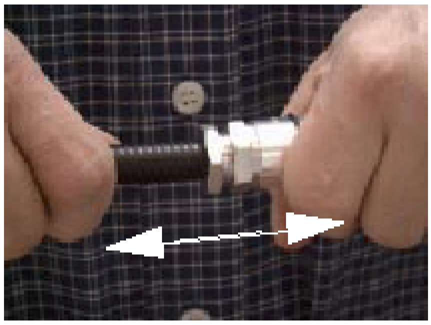
Atornillar el conector en el cable hasta el tope.



6. Check connector seat by pulling the cable which should not be pulled out of the connector.

Zur Kontrolle am Kabel ziehen; dabei darf sich das Kabel nicht herausziehen lassen.

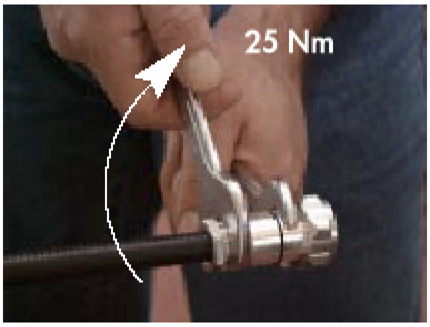
Controlar si el cable está fijo, tirandolo. Este no debe salir del conector.



7. Tighten connector head and cable entry with approx. 25 Nm. **Rotate the cable entry only.**

Verbinderkopf und Kabeleinführung mit ca. 25 Nm zusammenschrauben. ***Nur die Kabeleinführung drehen.***

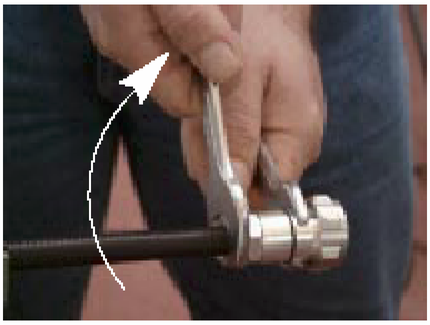
Montar la cabeza del conector y la entrada del cable con aproximadamente 25 Nm **girando la guía del cable.**



8. Tighten the back nut of the cable entry as far as the stop.

Die hintere Mutter der Kabeleinführung bis zum Anschlag anziehen.

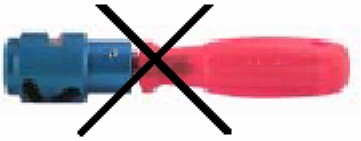
Apretar la tuerca posterior de la guía del cable hasta el tope.



9. **Optional:** Cover the mated connector pair with a cold shrink sleeve (e.g. 74 Z-0-0-337).

Optional: *Verbinderpaar mit Kaltschrumpfschlauch (z.B. 74 Z-0-0-337) zusätzlich abdichten.*

Opcional: Proteger el conector utilizando un tubo exterior colocado en frío (p.ej. 74 Z-0-0-337).

without / ohne / sin 

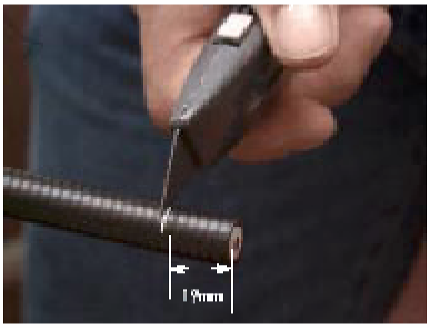
BACK TO MAIN MENU

2.

Cut back the cable jacket about 19 mm (*0.75 in.*).

Kabelmantel 19 mm zurückschneiden.

Cortar y separar 19 mm del revestimiento exterior.

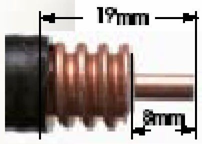


3.

Cut back the outer conductor 8 mm (*0.31 in.*) **Do not damage the centre conductor.**

Aussenleiter 8 mm zurückschneiden. ***Innenleiter darf nicht beschädigt werden.***

Cortar 8 mm del conductor exterior. **No dañar el conductor interior!**

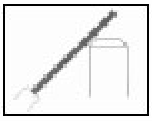


4.

Chamfer centre conductor.

Innenleiter anfasen.

Dar forma cónica al conductor interior.



5.

Follow with step 3 on page 2

Fahren Sie mit Schritt 3, Seite 2 weiter

Continue con paso no. 3, página 2

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8. APPENDIX D - SEAPATH CONFIGURATION SOFTWARE, SCC

The **SCC** (**Seapath Control Centre**) program is used to set configuration parameters in Seapath. It runs under Microsoft Windows 98, NT 4.0, Me, 2000 and XP or compatible operational systems except Japanese and Chinese versions of Windows. The SCC communicates with Seapath through a serial line.

8.1 Software installation

Follow the procedure below to install the SCC software on the external PC:

1. Insert SCC CD-ROM into the CD or DVD drive on the local PC.

2. From the **Start** menu select **Settings**. Then select **Control Panel** and **Install program**. Follow the instructions on the screen in order to complete the installation of the "SCCSetup.exe" program.

3. When the installation of files is finished, the window shown in Figure 18 appears. Choose to restart the computer now or later. Click **Finish** and the setup is complete. Remove the diskette.

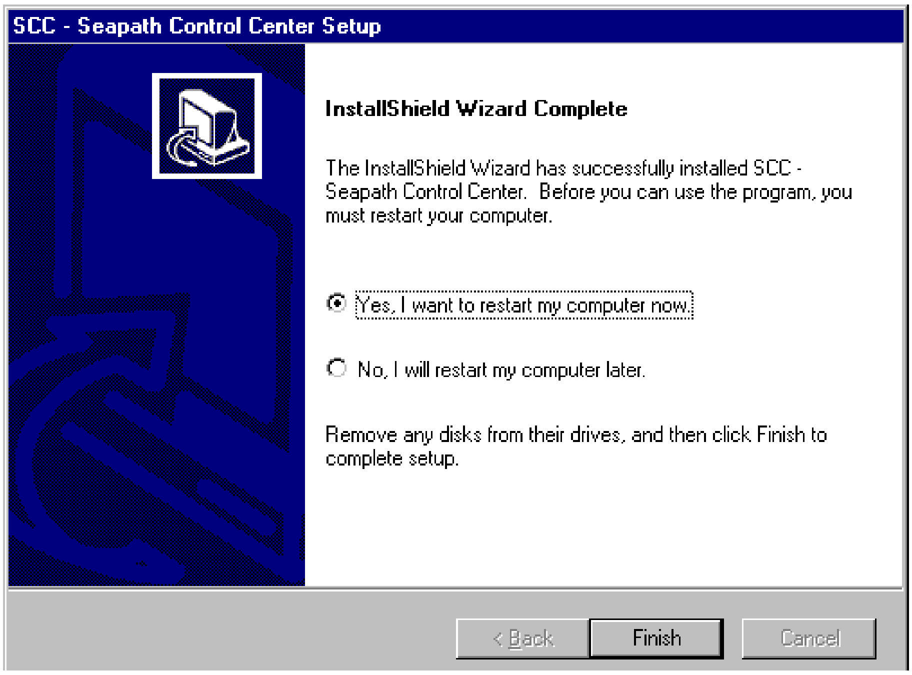


Figure 18 Installation Complete

8.2 How to get started

8.2.1 Starting the program

Power up Seapath if not already running. Connect a null-modem cable from a free serial port on the PC (com1: or com2:) to the front panel connector on Seapath. A null-modem cable is delivered with Seapath.

Start Microsoft Windows. Start SCC by double-clicking on the **SCC** icon. The **Seapath** SCC start window shows the software version, and a rotating Kongsberg Seatex AS logo indicates a running application. To continue, click one of three buttons:

1. **Connect**. System tries to establish communication with Seapath. If connection fails, Figure 23 is shown.

2. **Offline**. System opens for preparation of setting parameters in local SCC computer.

3. **Exit**. Application is closed.

Figure 19 SCC Start Window

If option 2 (**Offline**) is selected, the dialogue box shown in Figure 20 appears. Tick off for **Open existing Seapath parameter file** or **Create a Seapath demo parameter file,** and choose type of Seapath. Click **OK**.

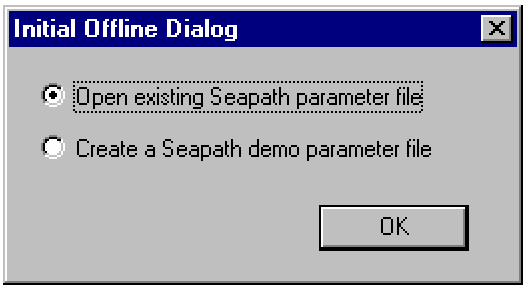


Figure 20 Initial Offline Dialog

If option **Open existing Seapath parameter file** is selected, the window **Select file to load parameters from** appears. Select the parameter file to be edited and click **Open**. The main window, **Seapath Control Centre** appears, see Figure 21. This main window also appears if the option **Create a Seapath demo parameter file**, is chosen.

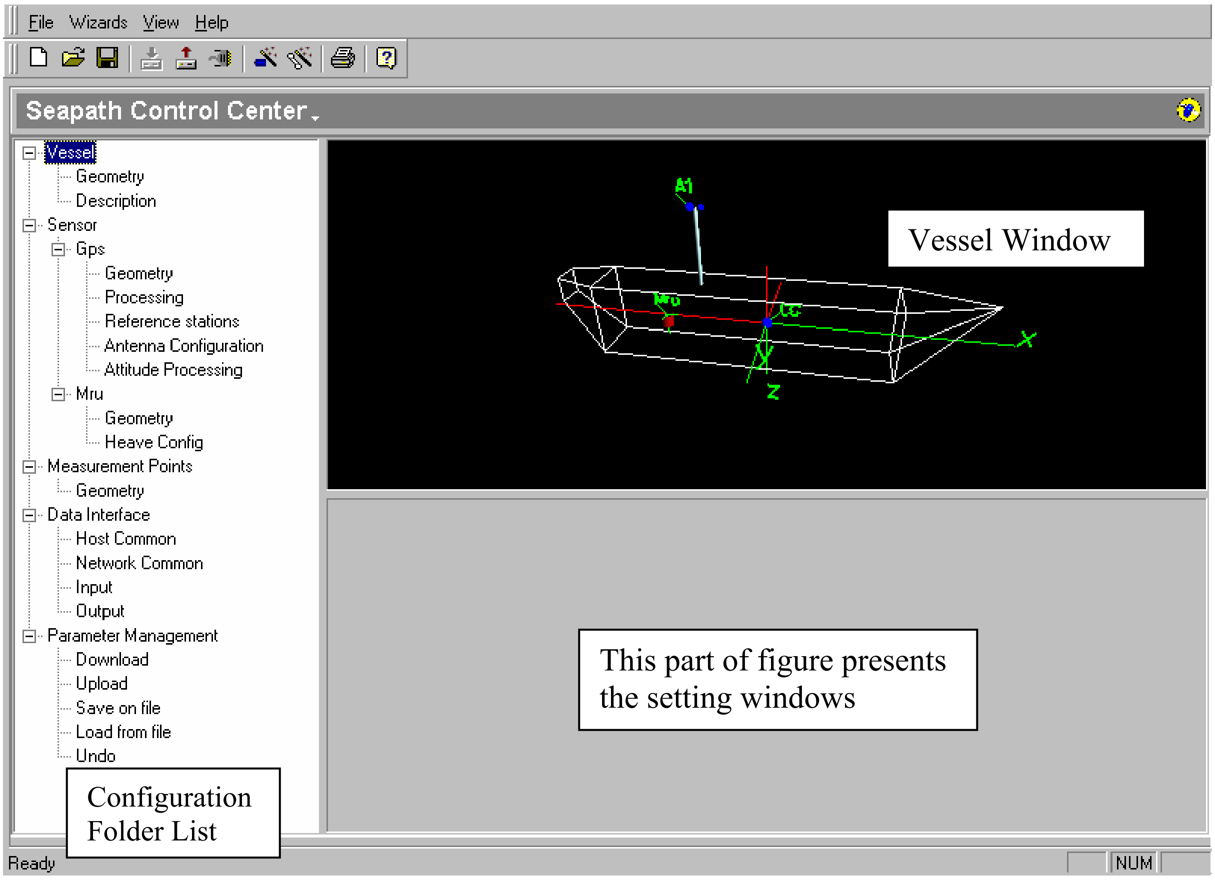


Figure 21 Seapath Control Centre, Main Window

8.2.2 Setting the serial port parameters

Click the **SCC-Seapath Port Configuration** button, or pull down the **Options File** menu and select the **SCC to Seapath Communication / Port Configuration** option. The dialogue box for communication setup appears (Figure 22), select connector and baud rate. The baud rate must correspond to the baud rate setting in Seapath, unless the communication goes through modems or other equipment, which change the baud rate. Default baud rate is 9600. Normally, only the connector selection has to be changed.

Click **OK**. The settings are saved and will remain unchanged until reconfigured.

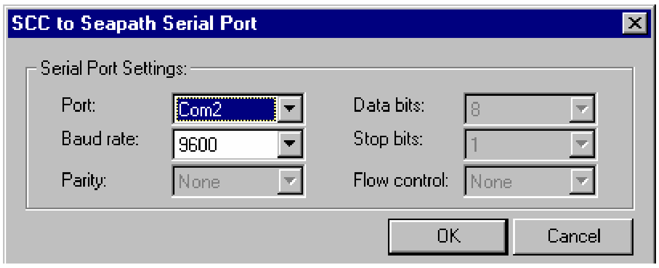


Figure 22 Communication Setup

8.2.3 Establishing connection

Click the **Connect to Seapath** button, or pull down the **File** menu and select the **SCC to Seapath Communication / Connect**. The **Connect to Seapath Status** window becomes active, if communication is OK, Figure 24 is shown. If the Seapath type and version is correct, accept by clicking **OK**.

If the connection is not in order, a "Found no Seapath at this comm. port" message will appear after a few seconds. The two buttons **Retry connection** and **Go Offline** are highlighted, choose **Go Offline** in order to close the connection attempt. Check that Seapath has power on, that the connection cable is plugged into the correct connectors and that the correct baud rate has been selected. When connection is checked and corrected, try to establish connection again.

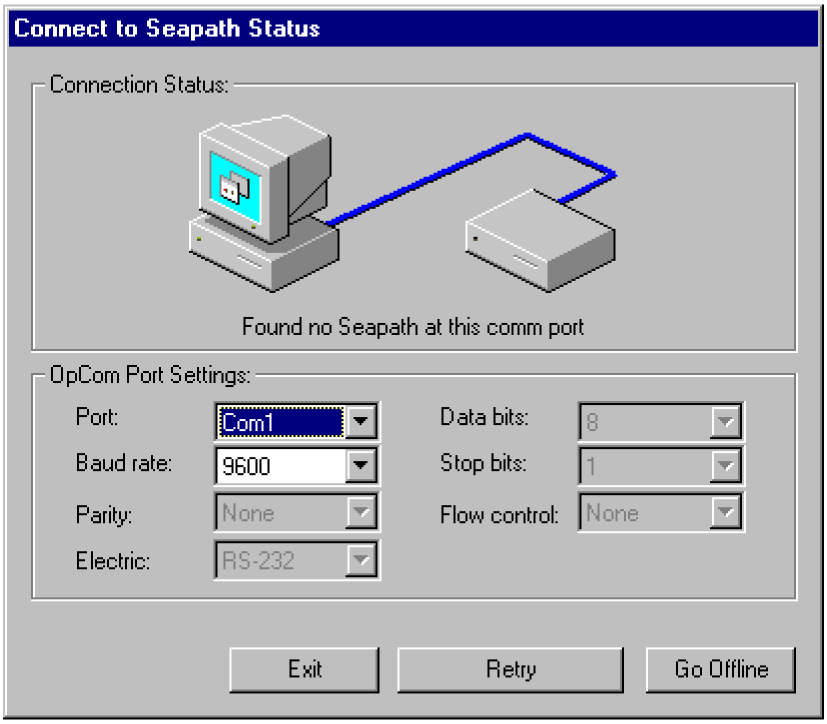


Figure 23 Connect Status

Figure 24 Connected to Seapath

Note Before editing parameter values belonging to a connected Seapath, it is recommended to perform an Upload from the Seapath first. See chapter 8.4.6.2, "Upload".

8.3 General user interface

8.3.1 File menu

In the **File** menu following options are available:

- **Open Configuration.** (See description in chapter 8.4.6.4, "Load from file")
- **Save Configuration.** (See chapter 8.4.6.3, "Save on file")
- **Save Configuration. As** (See chapter 8.4.6.3, "Save on file")
- **SCC to Seapath Communication**
    - **Connect** (Connects SCC to Seapath)
    - **Disconnect** (Disconnects SCC from Seapath)
    - **Port Configuration** (See chapter 8.2.2, "Setting the serial port parameters")
    - **Demo** (See chapter 8.3.1.1)
- **Print Configuration** (Self-explanatory)
- **Print Preview** (Self-explanatory)
- **Print Setup** (Self-explanatory)
- **Recent File** (Self-explanatory)
- **Exit** (See chapter 8.3.1.2)

8.3.1.1 Demo

Click on the **Demo** option and the system enters parameter examples into the different settings, making it possible to play with the application in offline mode.

8.3.1.2 Exit

To close down the application, pull down the **File** menu and click the **Exit** option. The connection to Seapath is shut down and the SCC program terminates. If parameters have been edited but not sent back to Seapath, the editing will be lost.

8.3.2 Wizards menu

Pull down **Wizards** menu. Two options are available:

- MRU configuration.
- GPS Antenna Calibration.

Click on the **MRU configuration** option or click on the tool button **MRU Configuration Wizard,** to activate the **MRU Axis Orientation** window. The configuration setting is described in chapter 8.4.3.1, "MRU geometry".

Click on the **GPS Antenna Calibration** option or click on the tool button **GPS Antenna Calibration Wizard**, to activate the **GPS Antenna Calibration Wizard** window. The Calibration settings are described in chapter 8.4.2.5, "GPS antenna configuration".

8.3.3 View menu

Pull down the **View** menu. Tick off to view the wanted options:

✓ **Toolbar** (See detailed information in chapter 8.3.5)
✓ **Status Bar** (Bottom line).
✓ **SCC Mode Select Bar**. (See Figure 25 Setup icons)
✓ **Advanced Options** (For use by service personnel only, password required)

Tick off to view the **SCC Mode Select Bar** and the **Setup** window below appears.

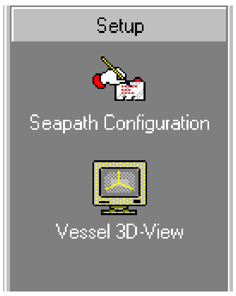


Figure 25 Setup icons

Click the **Seapath Configuration** icon to activate the Seapath configuration folder list.
Click the **Vessel 3D-View** button to expand the "vessel" part of the configuration window to maximum size.

8.3.4 Help menu

Pull down the **Help** menu. Click on the **About SCC** option and the **About SCC** window below appears. A scroll window contains information about Company, software version and the software application.

Figure 26 About SCC

8.3.5 Tool buttons

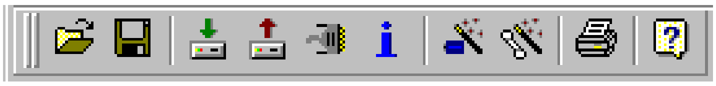


Figure 27 Tool Buttons

Description of tool buttons (from left to right):

- Open Configuration (Self-explanatory)
- Save Configuration (Self-explanatory)
- Connect to Seapath (Establishes data communication from SCC to Seapath)
- Disconnect from Seapath (Disconnects data communication between SCC and Seapath)
- SCC-Seapath Port Configuration (See chapter 8.2.2, "Setting the serial port parameters")
- MRU Configuration Wizard (See chapter 8.4.3.1, "MRU geometry")
- GPS Antenna Calibration Wizard (See chapter 8.4.2.5, "GPS antenna configuration")
- Print Configuration (Not yet implemented)
- About (See chapter 8.3.4 for details)

8.3.6 Seapath Control Centre button

The **Seapath Control Centre▾** button is located below the other tool buttons. Click on the button to see the folder list below.

Figure 28 Keep Folder List Open

Click the push pin in the upper right corner of the folder list to place this folder on the left side of the configuration folder. To remove the folder list and return to the original main window, click the **X** button in the upper right corner.

Figure 29 Close Folder List

Click the **Vessel 3D-View** button to show an expanded "vessel window". The "vessel window" will cover the whole screen like the figure below (here shown in Ghost mode). Click the **Vessel 3D-View** button and then click the line **Seapath Configuration** to return to the main window.

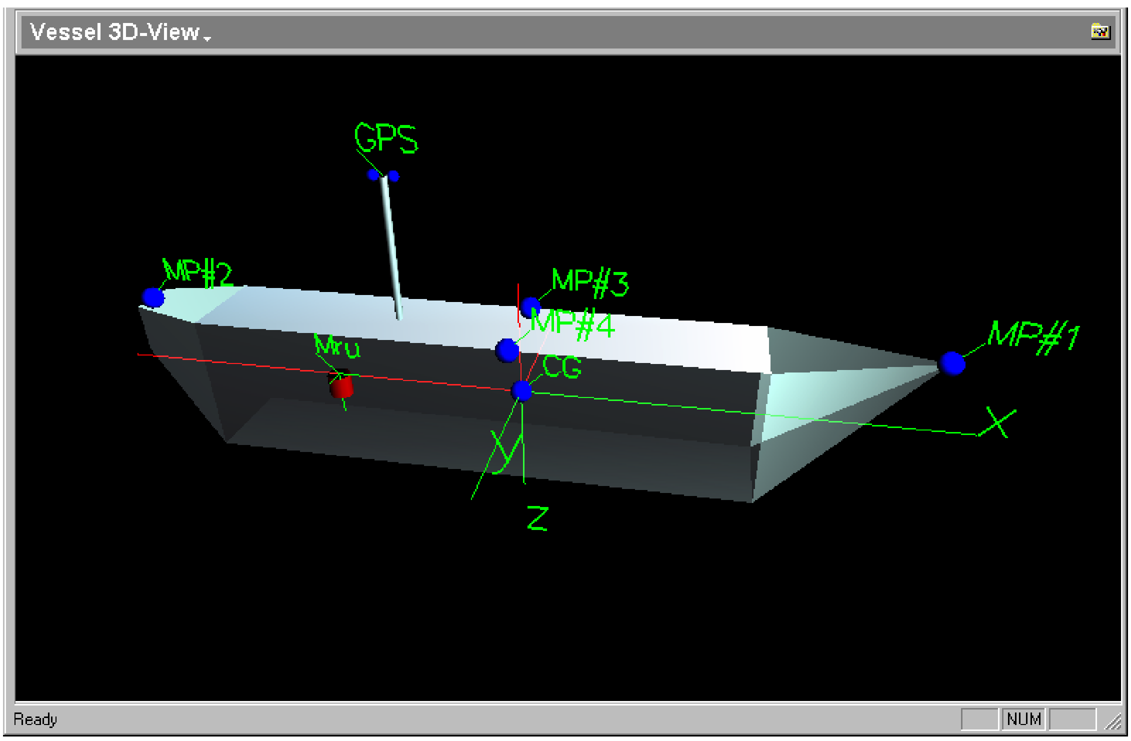


Figure 30 Vessel 3D-View, Ghost mode

Right click in the window to activate menu for alternative view settings. Alternative to Ghost mode is Wireframe.

8.3.7 Mouse operation

The mouse operations for the 3D-View and the "vessel window" are as follows:

- Point and left click with the mouse pointer in the upper right "vessel window", and the mouse arrow changes into a rotation symbol. The "vessel model" can then be rotated in all directions.
- Press SHIFT and simultaneously point and left click with the mouse pointer in the upper right "vessel window", and the mouse arrow changes into a zoom symbol. The "vessel model" can then be zoomed both out and in.
- Press CTRL and simultaneously point and left click with the mouse pointer in the upper right "vessel window", and the mouse arrow changes into a move symbol. The "vessel model" can then be moved around within the window.
- Point and right click with the mouse pointer in the upper right "vessel window", and a drop down menu with the below options appears. The options are self-explanatory. Tick off for wanted features.

Reset Viewpoint
Ghost Vessel
4Wireframe Vessel
Vessel Properties (NA)
Light properties (NA)
Show lights
Show OGL Axis
4Show Vessel Axis
Change FOV mode
Change Background Colour
Camera Properties

Figure 31 Vessel Drop Down Menu

8.4 Editing parameter values

When contact with the Seapath Processing Unit is established parameter values are loaded from Seapath into the local memory in the SCC computer where they can be inspected and modified. After editing, the parameters are sent back to Seapath. No changes are effective until the parameters are sent.

In the main window, Figure 21, the different parameter groups to be edited is shown. Editing of the parameter values are done by pointing to the parameter name in the Configuration Folder List and clicking the left mouse button. The Configuration Folder List contains following parameter groups:

- The Vessel group contains settings for Vessel Geometry and Description.
- The GPS and MRU groups contain sensor parameters to be edited when installing and calibrating Seapath.
- The Measurement Points group contains information on up to maximum four Measurement Points.
- The Data Interface contains in/out parameters to be edited when defining communication with external systems.
- The Parameter Management group contains user features for loading and saving.

Note For this new version of the SCC software, the sensor parameters for the MRU are to be set from this software only.

Note Remember that the editing is done locally in SCC and has no immediate effect until the changes are downloaded to Seapath.

8.4.1 Vessel settings

8.4.1.1 Vessel geometry

In this folder the dimensions of the vessel and the location of the centre of gravity are entered. These inputs will influence the displayed location of the GPS antenna, the MRU and the Measurement Points in the "vessel window" and these values should therefore be as accurate as possible. Proceed as follows:

- In the Configuration Folder List, select **Vessel \ Geometry**.

- Set Vessel Dimension and Centre of Gravity Location. Look at the sketch of the vessel co-ordinate system in the menu in order to enter correct signs on the distance to CG.

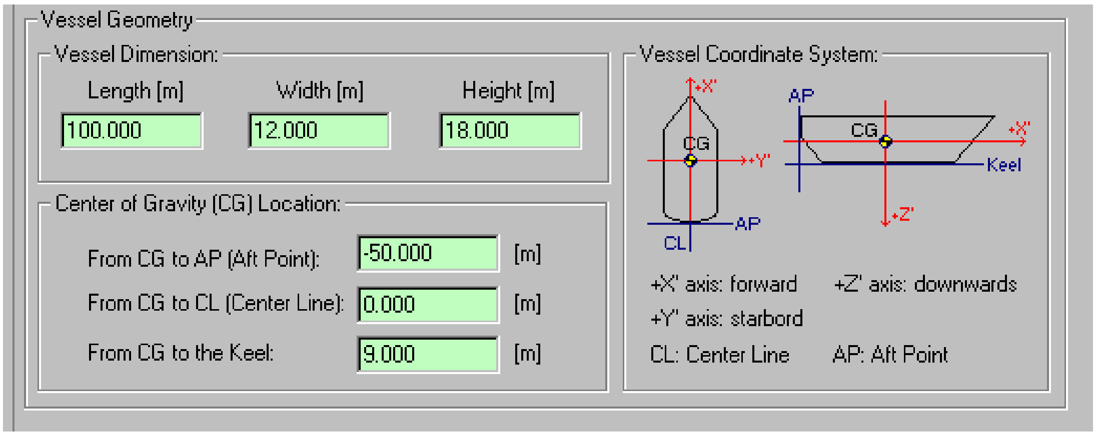


Figure 32 Vessel Geometry

8.4.1.2 Vessel description

In this folder vessel data for the specific Seapath configuration file are entered. This information is helpful to identify the correct configuration file at a later stage. Proceed as follows:

- In the Configuration Folder List, select **Vessel \ Description**.
- Set general vessel data and management information.

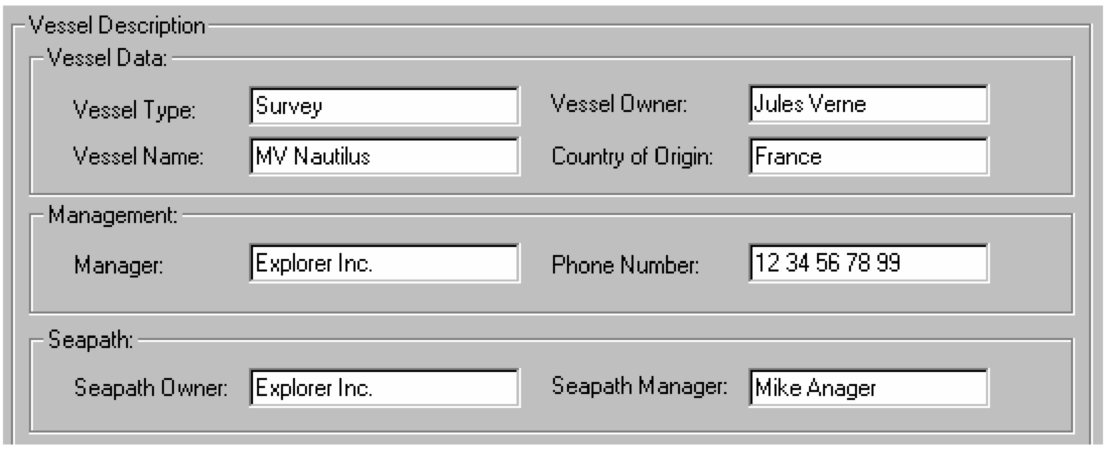


Figure 33 Vessel Description

8.4.2 GPS sensor settings

8.4.2.1 GPS geometry

The lever arm vector from the centre of gravity to GPS antenna no. 1 has to be measured or calculated based upon drawings or previously measured points, and entered into the software. The antenna cable connected to ANT.1 at the back of the Processing Unit will be GPS antenna no. 1 in the installation. This vector is to be measured within an accuracy of 0.5 metres. Proceed as follows:

- In the Configuration Folder List, select **Sensor \ GPS \ Geometry**.

- Set the Antenna Lever Arm for the GPS antenna which is defined to be antenna no. 1, normally the antenna closest to the aft of the vessel. Look at the sketch of the antenna geometry in the menu in order to enter correct signs on the co-ordinates. Check also that the antenna has been located on the expected spot in the "vessel window". If not, check the signs and the co-ordinates input for GPS antenna no. 1, the vessel dimension and the entered location of CG.

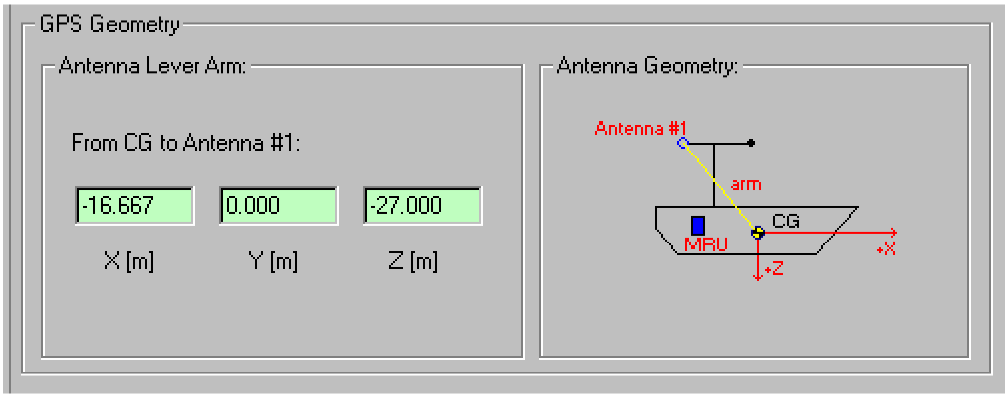


Figure 34 GPS Geometry

8.4.2.2 GPS processing

For operations with weak satellite geometry the position output can be made more accurate by using height aiding and low elevation mask. For normal operations the Height Aiding mode is set to "Off", but "Filter" is also recommended used. The elevation mask is set to 10 degrees as the default value and must not be changed by other than experts. For the Seapath 200 RTK version the search mode for the RTK solution has three selections: "Safe", "Normal" and "Fast". The default RTK search mode is "Normal". In order to change the default GPS processing settings, proceed as follows:

- In the Configuration Folder List, select **Sensor \ GPS \ Processing**.

- Set the Seapath in Height Aiding mode by pulling down the **Aid Mode** menu and change the selection from "Off", which is the default setting, to "Filter". The Aided Height is for the CG and measured above the ellipsoid. This height should be set when "Filter" is selected since the filter will start with the entered height value as the initial value.

- The SV Masking value can be changed from the default value 10 by entering an Elevation Mask value between 7 and 20 degrees. This value must not be changed by other than experts from the default value 10.

- Click on the checkbox **Enable Range Rate Corrections** to use the DGPS corrections in the GPS velocity calculations. The default setting is enabled on use of range rate corrections. Disabling range rate corrections will reduce velocity and attitude noise when receiving DGPS corrections from a reference station with a noisy range rate.

- Click on the checkbox **Use Geo Range in position solution** to enable Seapath to use the ranges from the Geo stationary satellites in the SBAS system like WAAS, EGNOS or MSAS. Be aware that the Geos are less accurate than the GPS ranges. Geo ranges should not be used without differential corrections, such as SBAS. The default setting is without use of Geo ranges.

- For the Seapath 200 RTK version the search mode for the RTK solution be changed from the default mode "Normal" to "Safe" or "Fast" by pulling down the **RTK Search Mode** menu. The "Safe" mode is recommended used under difficult conditions with much multipath or ionospheric activity and for long baselines. The "Fast" mode is used when a fast RTK solution is required. However, in this mode the probability for an incorrect solution from the system increases.

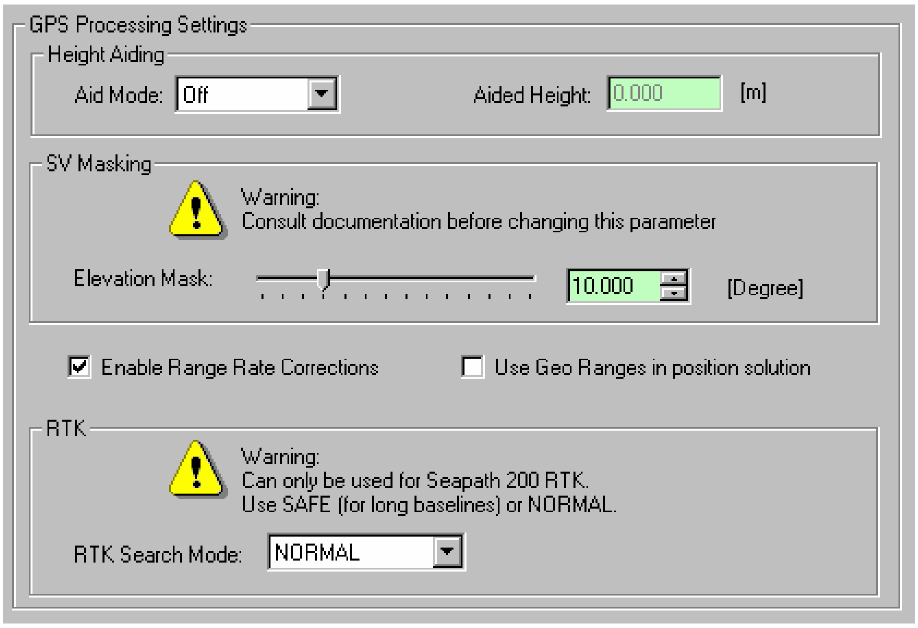


Figure 35 GPS Processing Settings

For more information on how to select the best values for GPS Processing, see the *User's Manual* [3] chapter 5, "Operating Instructions".

8.4.2.3 GPS reference stations

If data from more than one reference station are available on the DGPS correction links, Seapath combines data from up to six reference stations to obtain the best solution. The default configuration is to automatically use the six nearest stations available. The Seapath can be configured to ignore a number of stations or forced to use some selected stations in addition to the automatically selected stations, or disable the automatic selection by filling in a number of stations in the **Only Stations List**. In order to change the reference stations used in the solution proceed as follows:

- In the Configuration Folder List, select **Sensor \ GPS \ Reference Stations**.

- Select the Station ID and add or remove this station from one of the three station fields by selecting the Station List to be changed. Set the Age Limit for Differential Corrections.

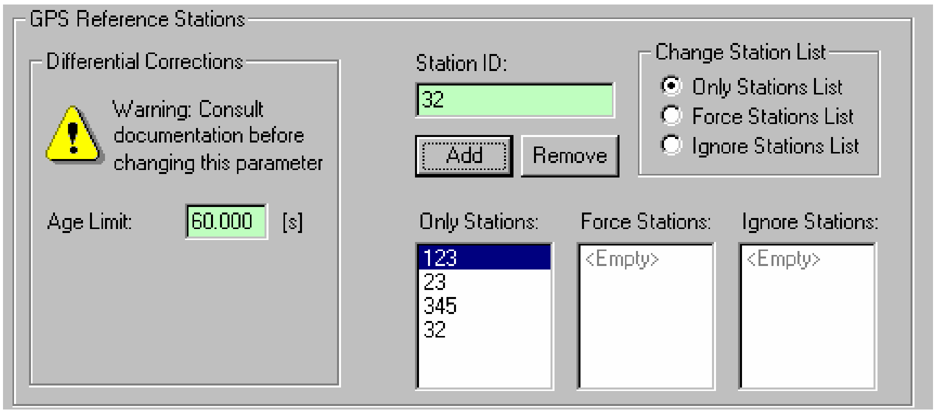


Figure 36 GPS Reference Stations

For more information whether to override the automatic selections or not, see the description in the *User's Manual* [3] chapter 5, "Operating Instructions".

8.4.2.4 SBAS common settings

The following configuration settings are available for SBAS:

- **SBAS Enable**. The preferred option is to manually select which two (or one) satellites to track. This forces Seapath to use only the satellites listed. However, automatic search for the Geo stationary satellites is available by clicking the checkbox **Automatic mode** to let the Seapath automatically search for the Geo stationary satellites, but this option is not recommended due to less control of the signals used. Use the **Add/Clear All** buttons to add or clear satellites from the list.

- **SBAS Decode**. It is recommended to force Seapath to use corrections only from the satellites listed instead of using the automatic decode mode. If more than one SBAS satellite is enabled in the **GEO SV' to track** above, it is recommended to choose which SBAS satellite to use for corrections. If two satellites are chosen, data from both satellites will be used to make the same set of SBAS corrections. Then it is very important that the satellites are from the same SBAS system and that they send exactly the same information. It is therefore recommended to set up Seapath to use corrections from only one satellite.

- **Enable SBAS WAAS Testmode**. During the test period of an SBAS system the system is not operational and the corrections are not guaranteed. Message type 0 is sent regularly as a warning and if message 0 appears it is not recommended to use information from this satellite. During normal performance the system will disregard corrections from this satellite. If **SBAS WAAS Testmode** is entered, this warning will be ignored and the corrections will be decoded. EGNOS and EGNOS Test Bed are not fully operational before the second half of year 2004. To be able to use corrections from these satellites you need to enable **SBAS WAAS Testmode**. WAAS is operational and the test mode should be disabled.

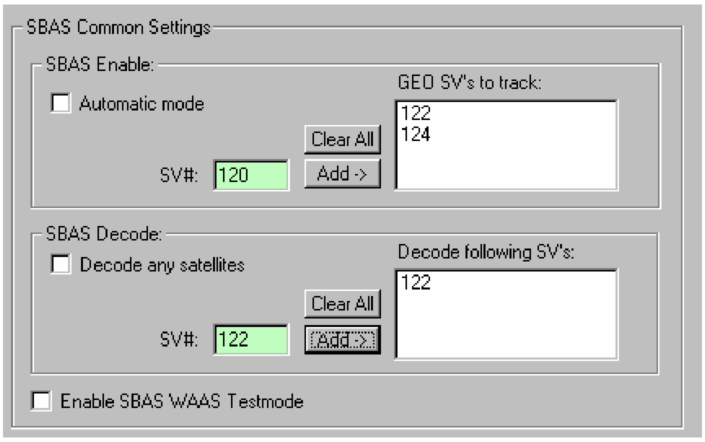


Figure 37 SBAS Common Settings for WAAS satellites

For more information on how to use SBAS corrections, see the description in the *User's Manual* [3] chapter 5, "Operating Instructions".

8.4.2.5 GPS antenna configuration

The heading of the GPS antenna baseline direction relative to the vessel's heading must be input to the software. At the same time, the baseline length and the antenna height difference should be determined. These values can either be calculated or input manually or determined automatically by selecting the **Calibration Wizard**. In order to determine the GPS Antenna configuration, proceed as follows:

- In the Configuration Folder List, select **Sensor \ GPS \ Antenna Configuration**.

- In the **GPS Antenna Configuration** window, input the baseline length 2.5 metres if the standard Antenna Bracket is used, otherwise this length has to be measured up manually and this value entered. For the heading offset and height difference input zero. Then click on the **Calibration Wizard** button to prepare the calibration. The Heading Offset and Height Difference is automatically updated trough the Calibration Wizard process.

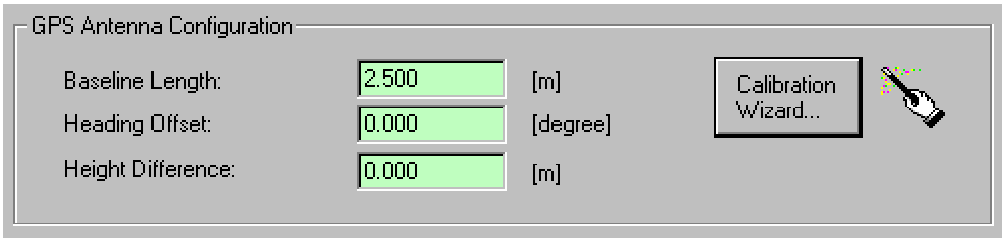


Figure 38 GPS Antenna Configuration

- Activate the **Calibration Wizard** button and page 1 of the GPS Antenna Calibration appears. Enter the baseline and calibration information asked for in step 1 and 2, and click **Next** in order to proceed to page 2. See chapter 3.4.4.2, "Typical calibration procedure" for a detailed example of antenna calibration.

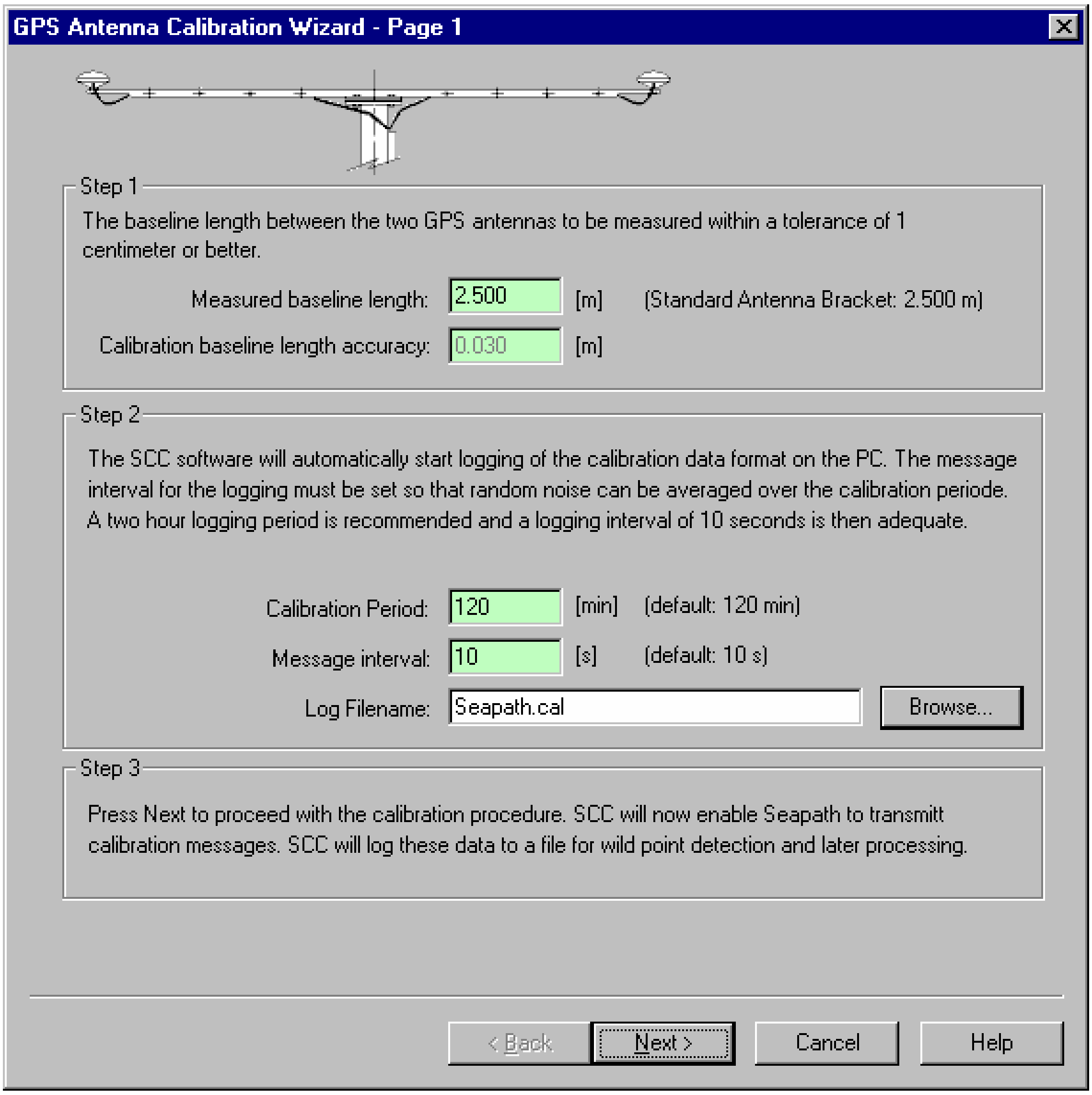


Figure 39 Page 1 of GPS Antenna Calibration

- Click **Next** in the **GPS Antenna Calibration page 1** and the **GPS Antenna Calibration page 2** appears and the calibration process starts automatically. Measurements for Seapath Heading, Gyro Compass, Antenna Baseline and Height Difference are shown in a graphical presentation in their respective diagram. The diagrams are auto scaled in order to show the total calibration period. A progress bar shows the calibration progress.

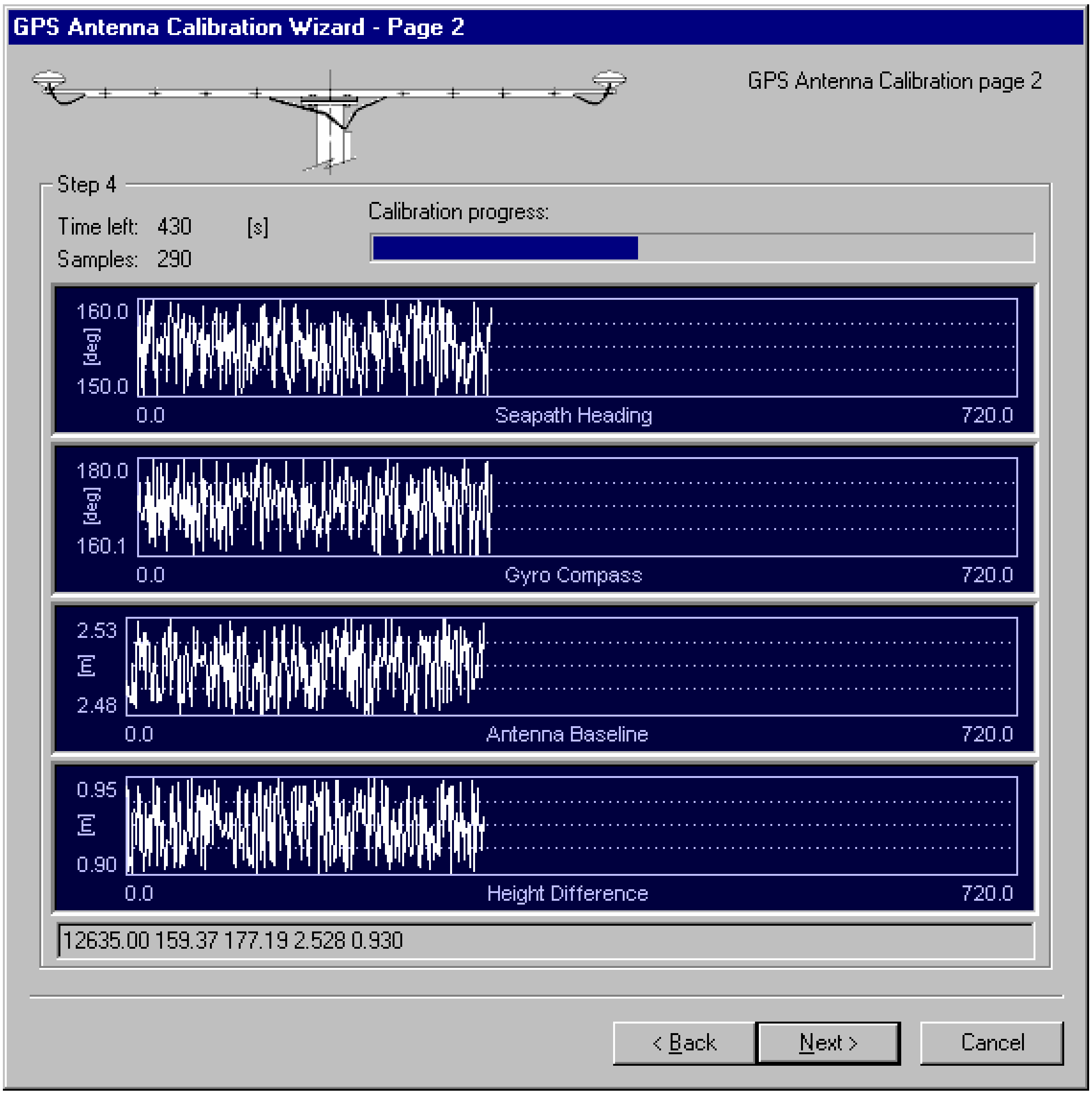


Figure 40 Page 2 of GPS Antenna Calibration

- Click the **Back** or **Cancel** button at any time if you want to stop the calibration process, see the window in Figure 42. Accept to stop the calibration by clicking **Yes** or click **No** to continue.

- Click **Next** during the calibration process will also bring up the stop window. If accepted, the calibration process will stop and the **GPS Antenna Calibration page 3** appears.

Figure 41 Stop Antenna Calibration

- Click **Next** after the calibration process has finished and the wizard continues to page 3.

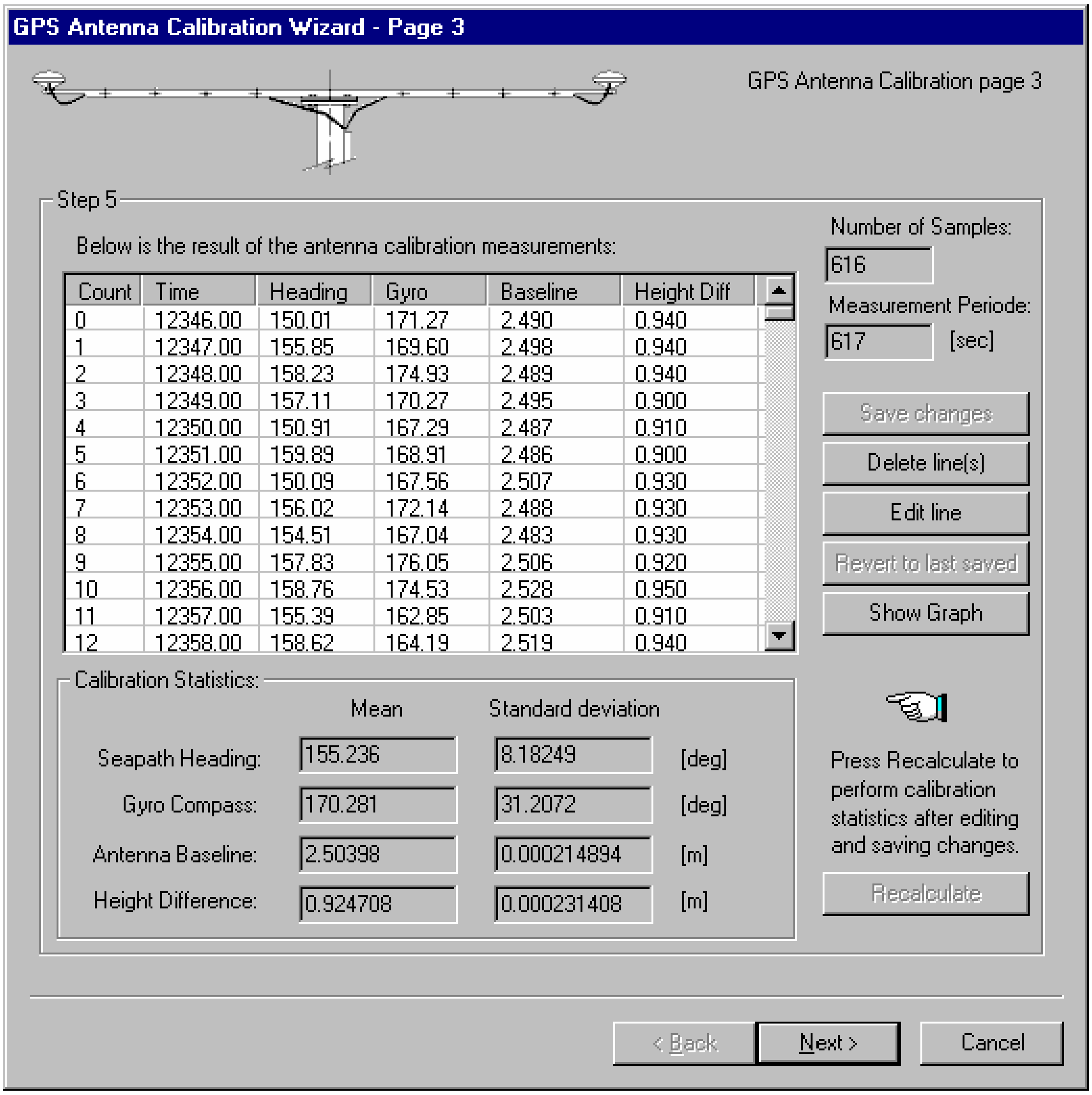


Figure 42 Page 3 of GPS Antenna Configuration

- **GPS Antenna Calibration page 3** contains information about the calibration measurements result. Here it is possible to edit or delete lines of measurements. Select a line by pointing on it. Click on the **Count** or **Time** cell, choose to edit or delete the line. Click on the **Edit line** button and the **Edit Calibration Data** dialogue box appears. This dialogue box also appears when clicking on one of the cells **Heading**, **Gyro**, **Baseline** or **Height Difference**. Change the wanted information; click the **Set** button, and the **Edit Calibration Data** dialogue box disappears.

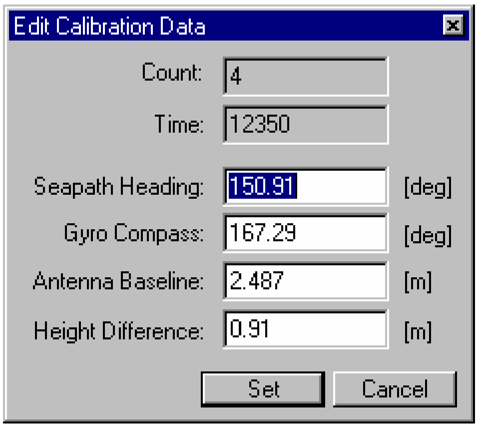


Figure 43 Edit Calibration Data

- Click **Save changes** in order to save the changes in the calibration file.
- Click **Recalculate** to update the calibration statistics including the changes. Only saved changes are included.
- Click **Show Graph** to see the updated graph.
- Click **Next** to proceed to page 4. In page 4 the vessel reference heading can be input. Click **Compute** in order to calculate the heading offset. Click **Finish** to accept the result and terminate the calibration.

Note If there are too many wild points and lines that need to be edited in the logged file, a new logging period of calibration data is recommended started. Then start from Step 2 again.

Note The new calibration data are only valid in the Seapath after download of parameters.

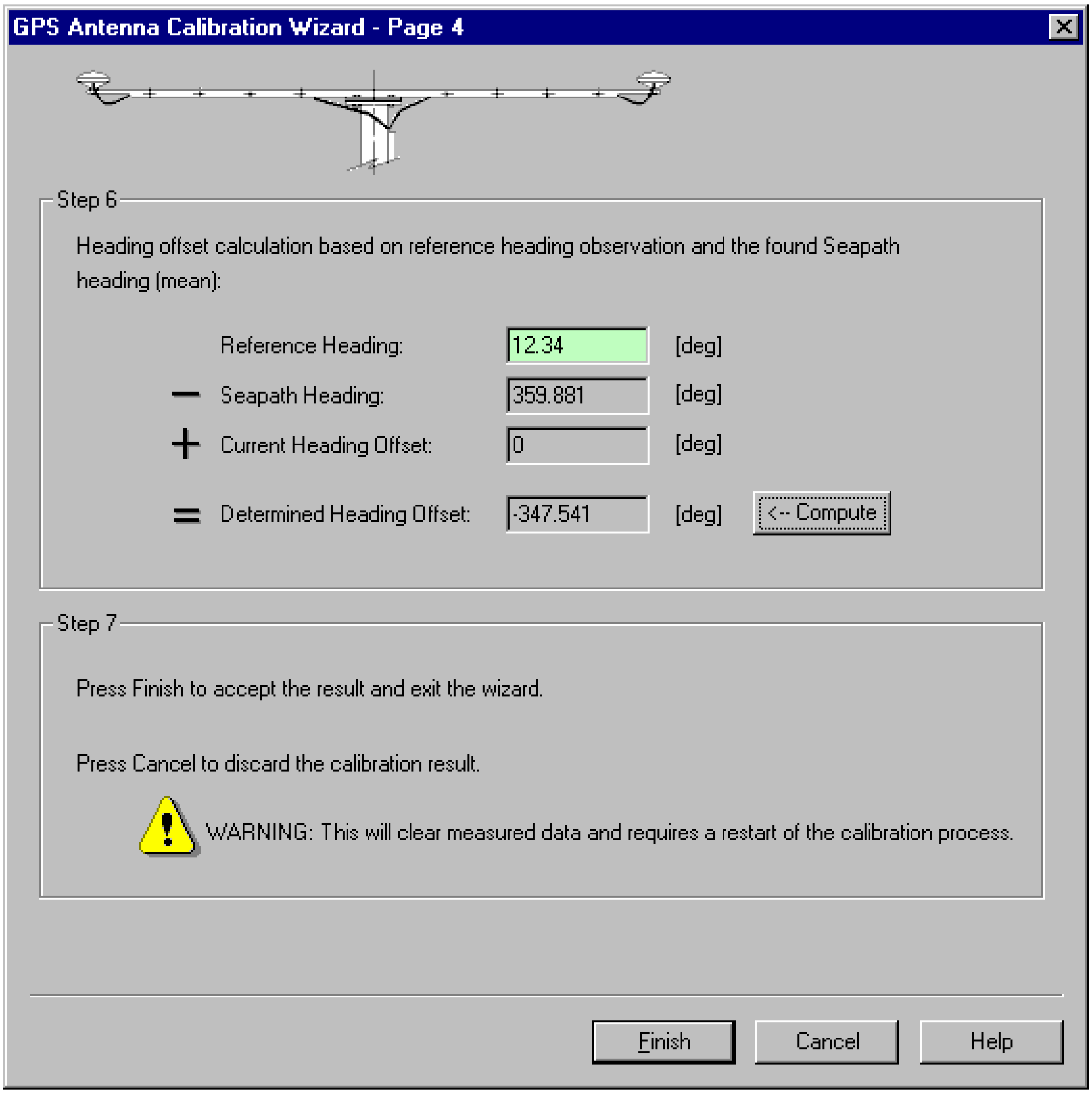


Figure 44 Page 4 of GPS Antenna Configuration

8.4.2.6 GPS attitude processing

In the Configuration Folder List, select **Sensor \ GPS \ Attitude Processing**. Enter the maximum values to be used for attitude processing.

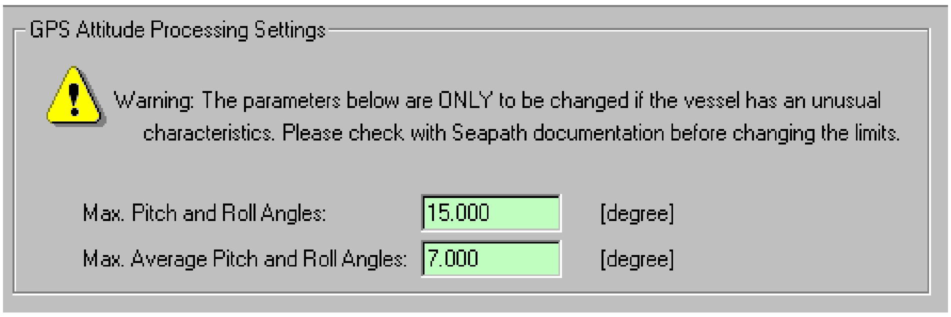


Figure 45 GPS Attitude Processing

8.4.3 MRU sensor settings

8.4.3.1 MRU geometry

The lever arm vector from the centre of gravity to the MRU location has to be measured or calculated based upon drawings or previously measured points, and entered into the software. This vector is to be measured with an accuracy of 0.5 metres. Proceed as follows to enter the MRU lever arm:

- In the Configuration Folder List, select **Sensor \ MRU \ Geometry.**

- Enter the settings for MRU Lever Arm. Look at the sketch of the MRU geometry on the screen in order to enter correct signs on the co-ordinates. Check also that the MRU has been located on the expected spot in the "vessel window". If not, check the signs and the co-ordinates input for the MRU, the vessel dimension and the entered location of CG.

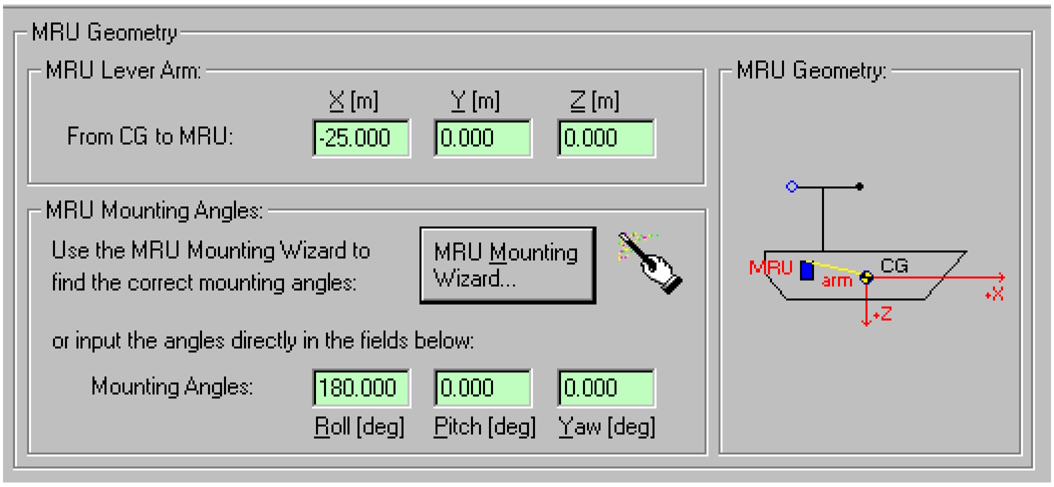


Figure 46 MRU Geometry

The MRU mounting angles can either be input manually or determined by use of the MRU Mounting Wizard. To use the MRU Mounting Wizard proceed as follows:

- Click the **MRU Mounting Wizard** button to get to Step 1 of the MRU axis orientation. Choose to continue with Manual or Automatic setup of mounting angles.

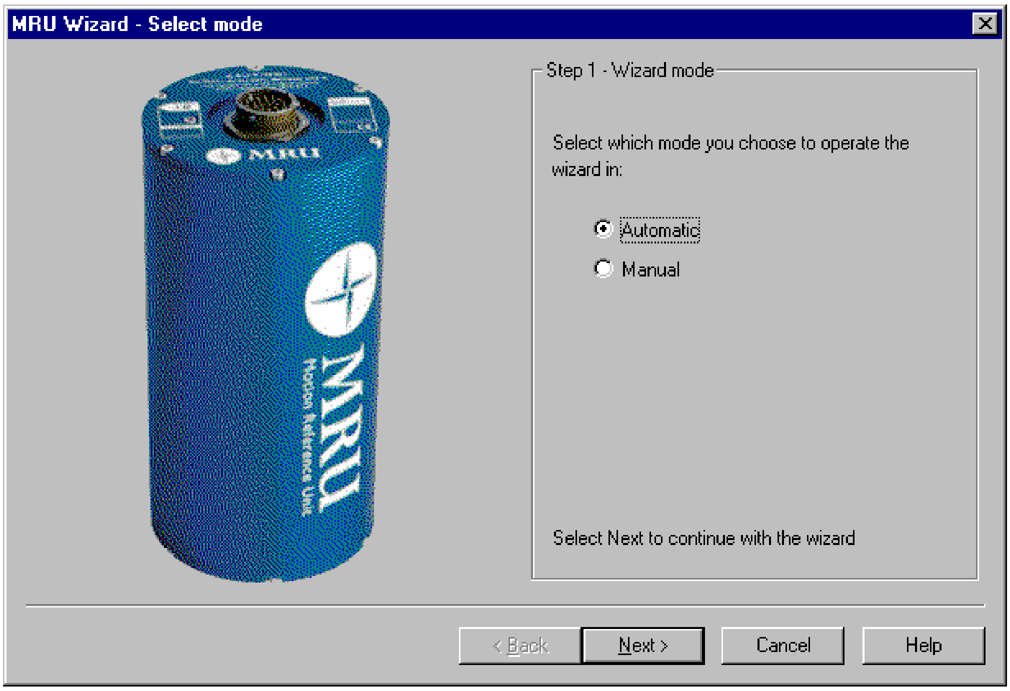


Figure 47   Step 1 of MRU Axis Orientation

Manual setup:

- Manual setup selected in Step 1. Click **Next** to go to the **Step 2 –Manual** window as shown in Figure 48. Click the **Previous** or **Next** buttons in the left part of the window to turn the MRU unit around in 90-degree steps, axis by axis. Click until the correct mounting orientation of the MRU has been found. The right part of the window is automatically updated with the actual main rotation of the MRU.

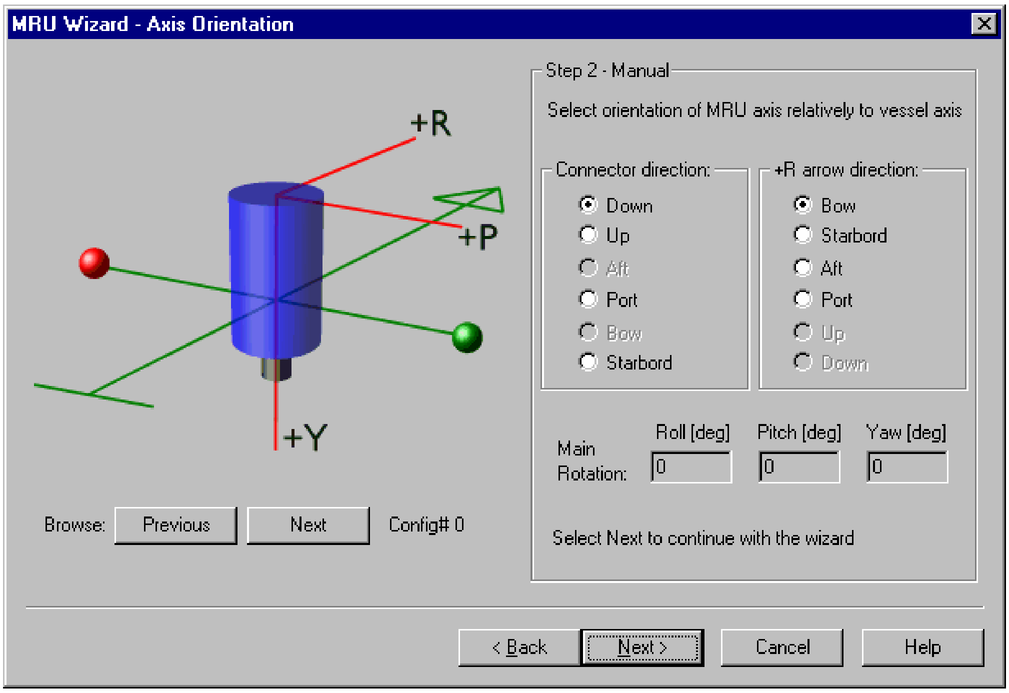


Figure 48   Step 2 of Manual MRU Axis Orientation

- Click the **Next** button in the lower right corner in order to proceed to **Step 3 - Manual**.

- At the top of the **Step 3-Manual** window the found main rotation angles for the MRU are displayed. Enter the offset angles for Roll, Pitch and Yaw from the main rotation angles. A positive offset angle rotation is:

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

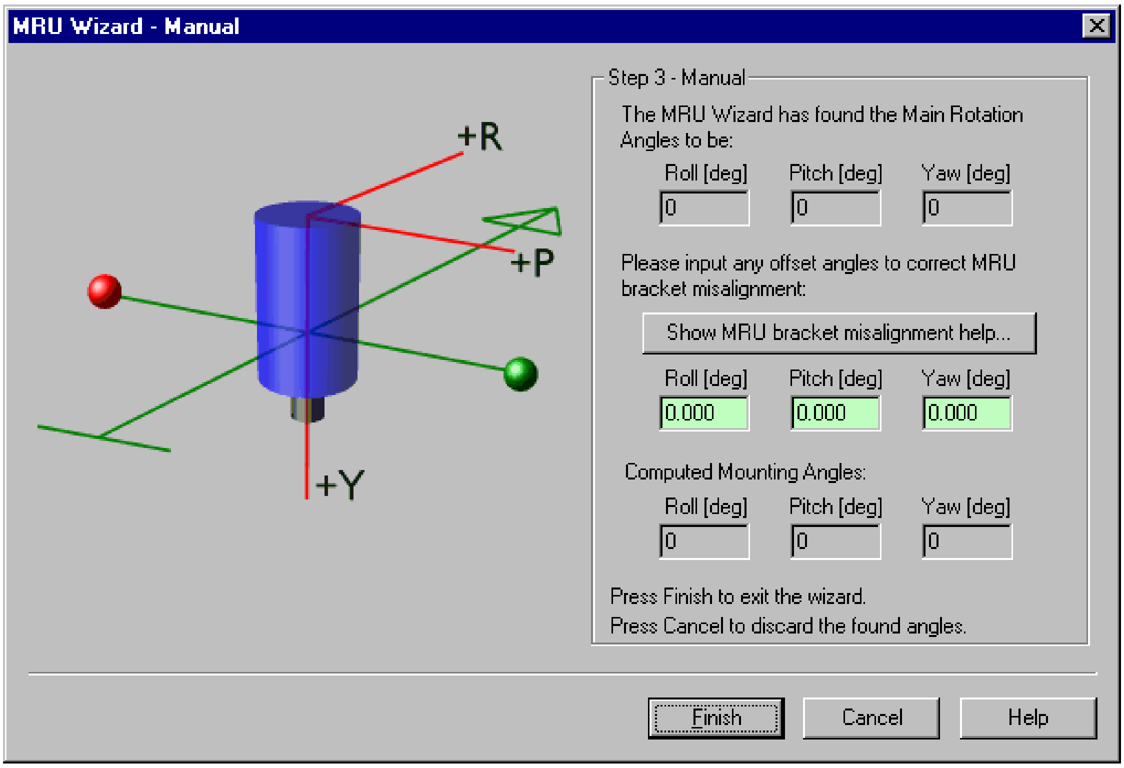


Figure 49 Step 3 of Manual MRU Axis Orientation

- To get more help on the sign of the offset angles, press the **Show MRU bracket misalignment help** button and the window in Figure 50 will appear.

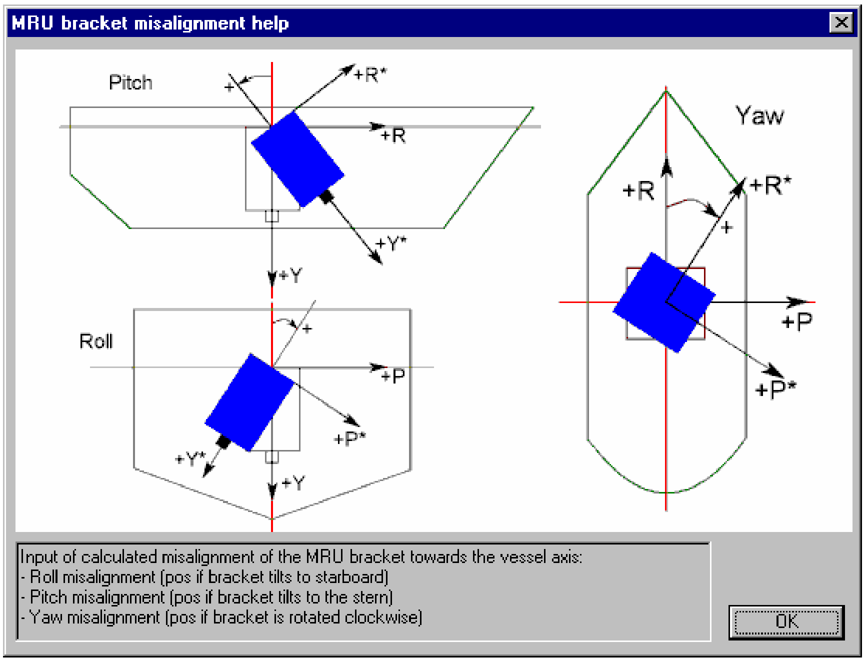


Figure 50 Positive offset angles rotations

- Click **Finish** to finish the manual setting of the MRU axis.

Note The new MRU mounting angles are only valid in the Seapath after download of parameters.

Automatic Setup:

- Automatic setup selected in Step 1. Click **Next** to go to the **Step 2 –Auto** window, as shown in Figure 51.

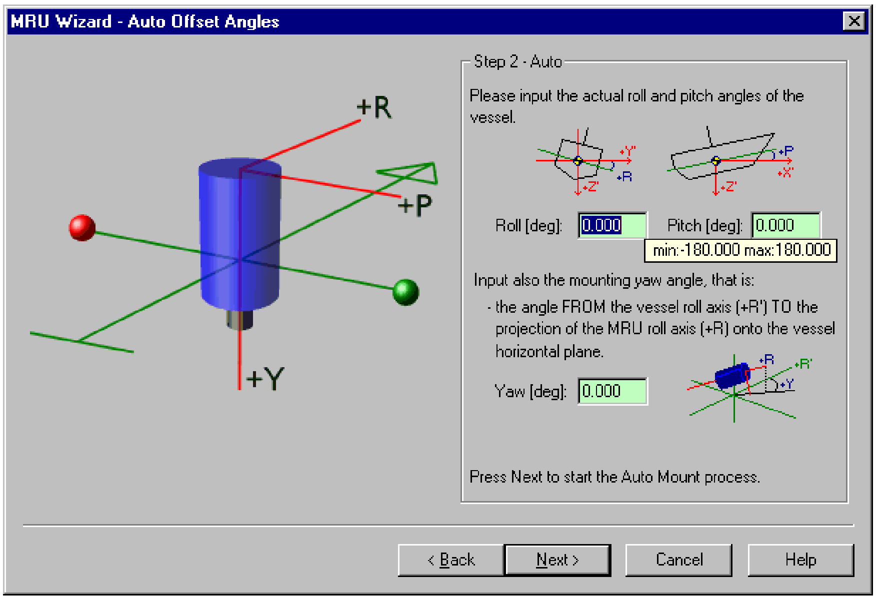


Figure 51 Step 2 of Auto MRU Axis Orientation

- First, input the actual roll and pitch angles of the vessel. A positive vessel angle is from the red to the green co-ordinate system or:
  - Positive pitch angle if the bow is up.
  - Positive roll angle if the starboard (right) side facing downward.
- Secondly, input the MRU mounting angle in yaw (positive clockwise). The yaw angle is found by projecting the MRU +R arrow to the horizontal plane. The yaw angle is then the angle between the longitudinal axis of the ship and the projected +R arrow in the horizontal plane. It is important that this angle is measured accurately and input correctly to avoid degradation in the performance of the roll and pitch measurements from the MRU.

Note Before starting the Auto Mount process, be sure that the ship motion has stabilised and that the harbour conditions are calm.

- Then click **Next** to start the Auto Mount process. The window in Figure 52 will appear, and the MRU offset angles are computed. A time-out bar shows the progress. When finished and the found mounting angles look OK, press **Finish**.

Note The new MRU mounting angles are only valid in the Seapath after download of parameters.

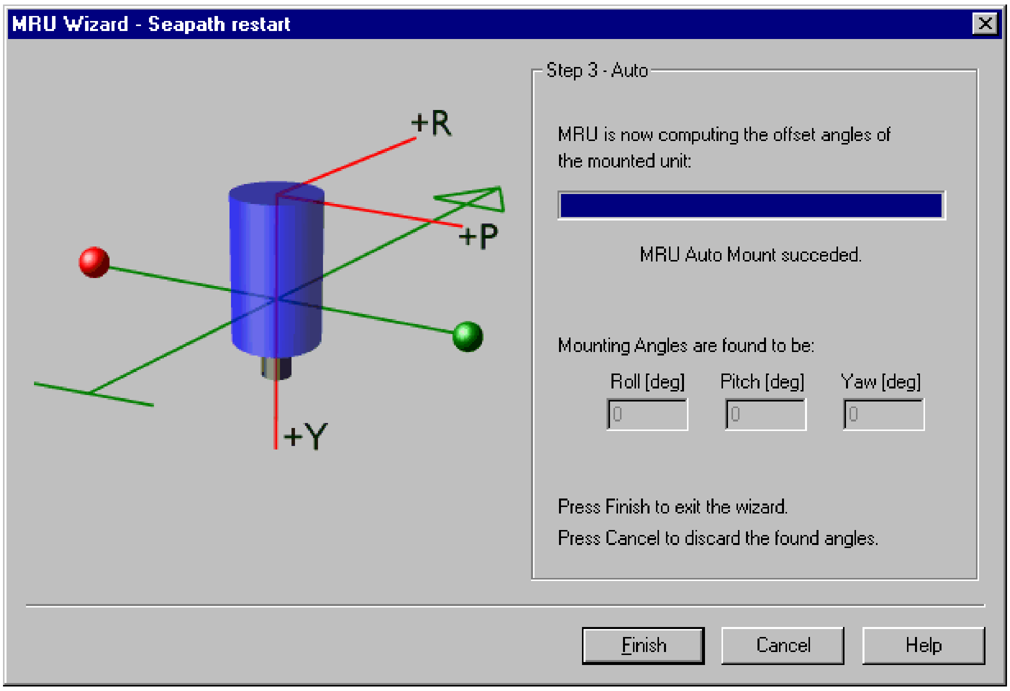


Figure 52 Step 3 of Auto MRU Axis Orientation

8.4.3.2 MRU heave configuration

When using Seapath for heave measurements, it is important to tune the heave parameters (heave period and damping) to the vessel size and the motion characteristics for the actual weather conditions. The default settings in the SCC software for filter mode heave period and damping, have to be tuned for the actual vessel and weather conditions in order to achieve optimum heave performance. Therefore, before a survey and/or during operation check the heave performance of the Seapath and tune the heave parameters until the best heave performance is achieved. An alternative is to select "Automatic" and let Seapath automatically choose the best settings. The following should be considered when selecting the different heave filter modes and parameters:

Filter mode:

- **Automatic**. To be selected when the vessel is operating in various sea states or when the average heave period is unknown.
- **General purpose**. Is selected when an optimal heave amplitude is to be measured and the heave phase is of no importance. This mode is typically selected when the Seapath is to be used for measuring the heave height and period on oceanographic buoys.
- **Hydrographic survey**. To be selected when the heave phase and amplitude have to be output correct in real time. This mode is typically selected when the heave output signal from the Seapath is to be used for heave compensation of echo sounders and offshore crane systems.
- **Integrated**. To be selected when RTK DGPS corrections are available. In this mode the heave and height measurements are determined by blending vertical acceleration and RTK 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 centimetre accuracy and independent of wave frequency. The average heave period and damping parameters must be input as backup values in case the RTK DGPS corrections drop out for a longer period. Then the Seapath automatically switches over to Hydrographic survey mode.

Period:

- An expected average heave period has to be set to the heave filter. This period can be determined by measuring the time between two wave-tops by a watch.
- The settling time for the heave measurements from power-on or after a turn will be about 10 times the selected period, T_o. By selecting an unnecessary long heave period the settling time will be slower than it has to. For vessels performing surveys with frequent turns, the period should be set as low as possible to minimise the heave settling time after turns.

Damping:

- The heave damping factor is usually set to 0.7. Only for special occasions should this parameter be changed. In operations with heave periods of more than 25 seconds, the damping factor should be reduced to 0.6 in order to achieve correct phase measurements. In operations with heave periods of less than 2 seconds, the damping factor should be increased to 0.8.

For more details on selection of heave filter mode and parameters, see the *User's Manual*. In order to select the heave configuration proceed as follows:

- In the Configuration Folder List, select **Sensor \ MRU \ Heave Config.**

- Enter the settings for Filter Mode and Filter Parameters. The pull-down Filter Mode menu has the following options; Integrated, Automatic, Hydrographic survey or General purpose. In Integrated, Hydrographic survey and General purpose mode, the filter parameter for Period can be set to a value between 1 and 25 seconds, and the Damping value between 0.2 and 1.

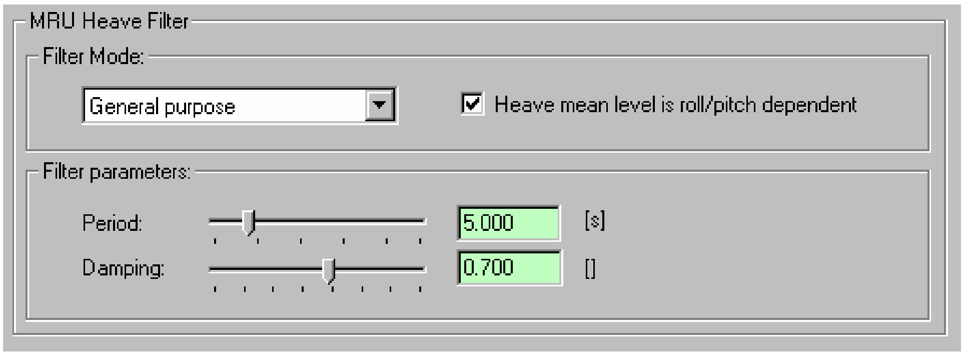


Figure 53 MRU Heave Filter

- Click on the checkbox "Heave mean level is roll/pitch dependent" to make the heave measurement dependent on the roll and pitch measurements. Then the heave position in the measurement 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 this mode is not selected, the heave will always have zero mean level.

8.4.4 Measurement points

8.4.4.1 Measurement points geometry

In Seapath up to four different measurement points for output data can be defined. The lever arm vector from the centre of gravity to each measurement point has to be measured or calculated based upon drawings or previously measured points, and entered into the software. These vectors are to be measured with an accuracy of 0.5 metres. Proceed as follows to enter the measurement point vectors:

- In the Configuration Folder List, select **Measurement Points \ Geometry.**

- Enter a vector and a name for each of the measurement points needed for the installation. Tick off the measurement points that should be active. Check that the measurement points have been located on the expected points in the "vessel window". If not, check the signs and the co-ordinates input for each measurement point, the vessel dimension and the entered location of CG.

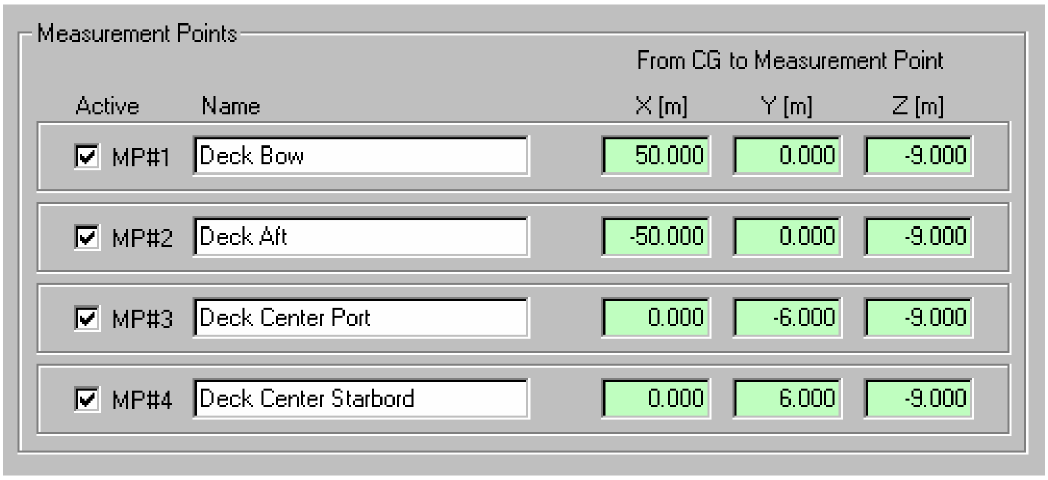


Figure 54 Measurement Points Geometry

Note If data shall be valid for centre of gravity, it is not necessary to define a zero vector since the data is default output in CG.

8.4.5 Data interface

8.4.5.1 Host common

For identification of the output protocols from Seapath on the serial lines, the following parameters can be set:

- **NMEA ID**. A two-letter talker identifier in NMEA messages as defined in [1]. Default is IN (Integrated Navigation).
- **Token**. Numerical token in binary messages. The token number is selected in the range 0 to 255.

Proceed as follows to set the common host parameters:

- In the Configuration Folder List, select **Data Interface \ Host Common.**
- In the **NMEA Identification** field, enter a two-character identification text.
- In the **Binary message token** field, enter a token number to be output in the Seapath binary formats.

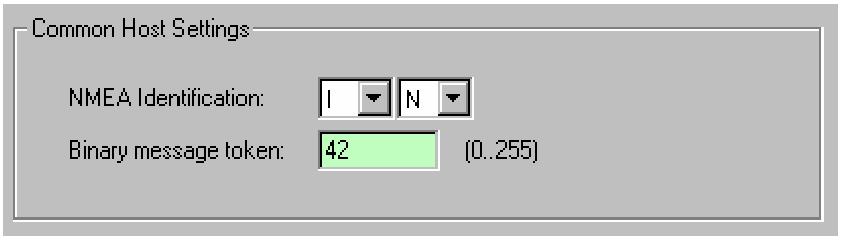


Figure 55 Common Host Settings

8.4.5.2 Network common

In order to output Seapath data on the Ethernet connector as an UDP (User Datagram Protocol) diagram the following parameters have to be set:

- The Internet protocol (IP) network address. Default is 192.168.1.10.
- The Internet protocol (IP) network mask. Default is 255. 255. 255. 0.
- The NMEA ID. A two-letter talker identifier in NMEA messages as defined in [1]. Default is IN (Integrated Navigation).
- A token number. Numerical token in binary messages. The token number is selected in the area 0 to 255.

Proceed as follows to set the common network parameters:

- In the Configuration Folder List, select **Data Interface \ Network Common.**

- In the **IP Network Address** field, enter the port ID.

- In the **IP Network Mask** field, input the mask.

- In the **FTP Server Password**, input wanted password to gain access to the FTP server. The default password is "seapath". This password is typically needed when transferring Seapath log files through the Ethernet to an external PC. Then the Seapath will ask for this password.

- In the **NMEA Identification** field, enter a two-character identification text.

- In the **Binary message token** field, enter a token number to be output in the Seapath binary formats.

Note Changes in the **IP Network Address** or **Mask** will only take effect after a restart of the Seapath system.

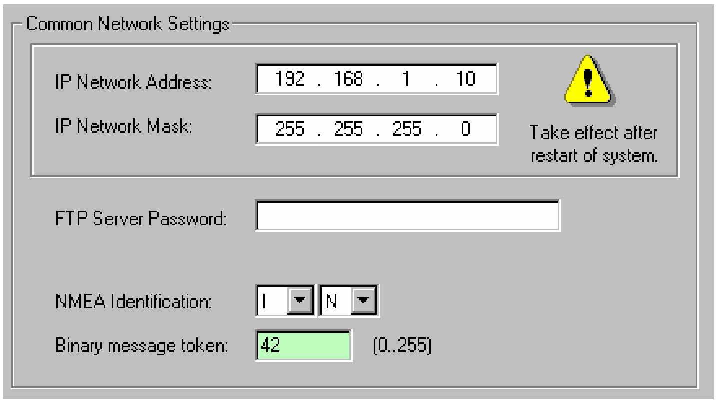


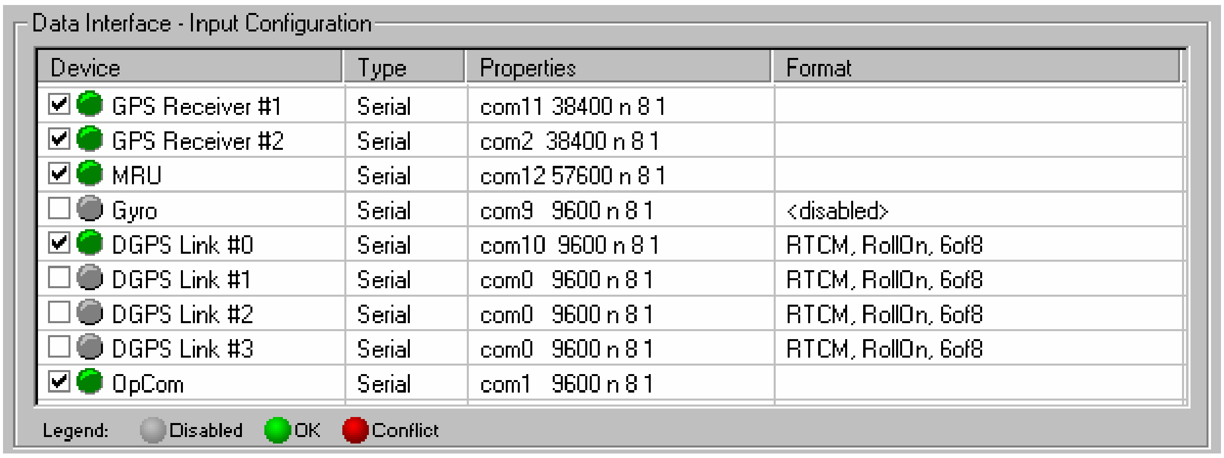
Figure 56 Common Network Settings

Check with the network administrator on board the vessel for the correct selection of network address and mask.

8.4.5.3 Input

In this folder list, all the input interface to the Seapath unit is selected. The following four devices can be input to the unit:

- The GPS antenna signals and the MRU communication. The settings for the interface with these devices are fixed in the system and cannot be changed by the user.
- External gyro input. Seapath can use heading data from an external source, for example a gyro compass, as backup to improve reliability. The properties and format of this signal are to be set by the user.
- Differential GPS corrections. DGPS corrections from up to four different data links can be input to Seapath. The properties and format for each of these links have to be set by the user.
- The SCC configuration port. The properties of the operational communication port (OpCom) for connecting an external PC for configuration of the Seapath unit with SCC can be set by the user. Default is com1 and normally this configuration shall not be changed.



Data Interface - Input Configuration

Device	Type	Properties	Format
GPS Receiver #1	Serial	com11 38400 n 8 1	
GPS Receiver #2	Serial	com2 38400 n 8 1	
MRU	Serial	com12 57600 n 8 1	
Gyro	Serial	com9 9600 n 8 1	<disabled>
DGPS Link #0	Serial	com10 9600 n 8 1	RTCM, RollOn, 6of8
DGPS Link #1	Serial	com0 9600 n 8 1	RTCM, RollOn, 6of8
DGPS Link #2	Serial	com0 9600 n 8 1	RTCM, RollOn, 6of8
DGPS Link #3	Serial	com0 9600 n 8 1	RTCM, RollOn, 6of8
OpCom	Serial	com1 9600 n 8 1	

Legend: Disabled OK Conflict

Figure 57 Data Interface - Input Configuration

To setup the input interface proceed as follows:

- In the Configuration Folder List, select **Data Interface \ Input.**

- Activate the device to be interfaced by clicking on the checkbox in front of the device name.

- The Property of the selected Device ("Gyro", "DGPS" and "OpCom") is set by clicking in the wanted **Properties** cell and the **Serial Port Settings** dialogue box below appears. Select the wanted settings and click **OK**. The wanted communication (RS-232 or RS-422) is selected in the **Electric** field. For com2 only RS-232 communication is available.

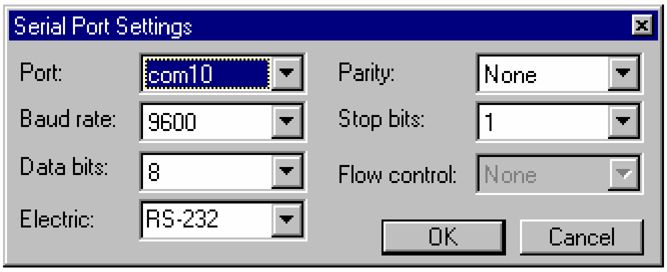


Figure 58 Serial Port Setting

- The Format settings can be changed for Device type "Gyro" and "DGPS". For Device type "DGPS", click in the wanted DGPS **Format** cell and the **Select Format** dialogue box below appears. Select "RTCM, RollOn, 6of8" or the "CMR" setting for the Trimble CMR format. Click **OK**, or if " RTCM, RollOn, 6of8" is selected, click on **RTCM Properties** button in order to change format on RTCM Decoding. The **RTCM Format Decoding** dialogue box below appears. Choose the wanted settings for Roll Bytes and Bits/Byte and click **OK**. The setting "MSB First (Roll ON)" and "6 of 8" are the most commonly used settings.

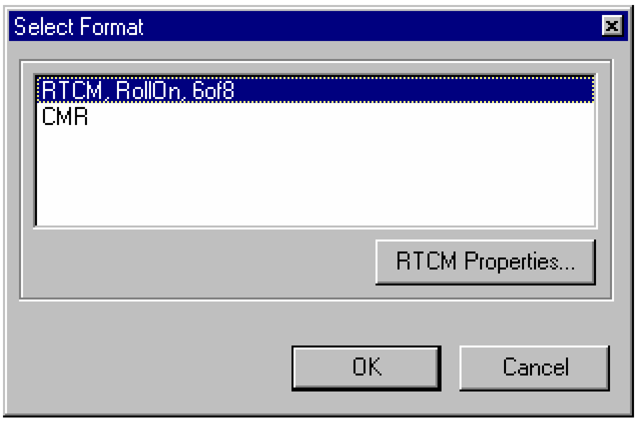


Figure 59 Format Setting

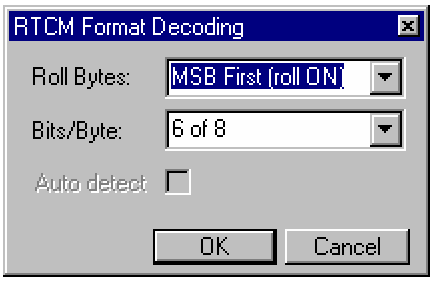


Figure 60 RTCM Format Decoding

The options for Roll Bytes are:	The options for Bits/Byte are:
MSB First (Roll ON)	6 of 8
LSB First (Roll OFF)	8 of 8

- To set the Format for Device type "Gyro", click in the gyro **Format** cell and the dialogue box below appears. Select "<Disabled>", "NMEA HDT" or "Robertson" format. Click **OK** and the selection is finished. The other selections are not recommended used.

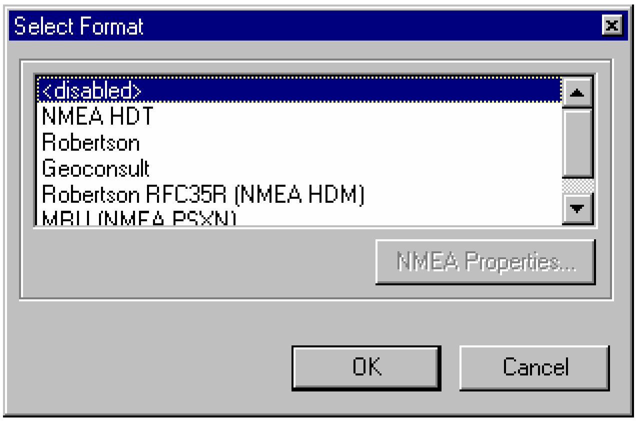
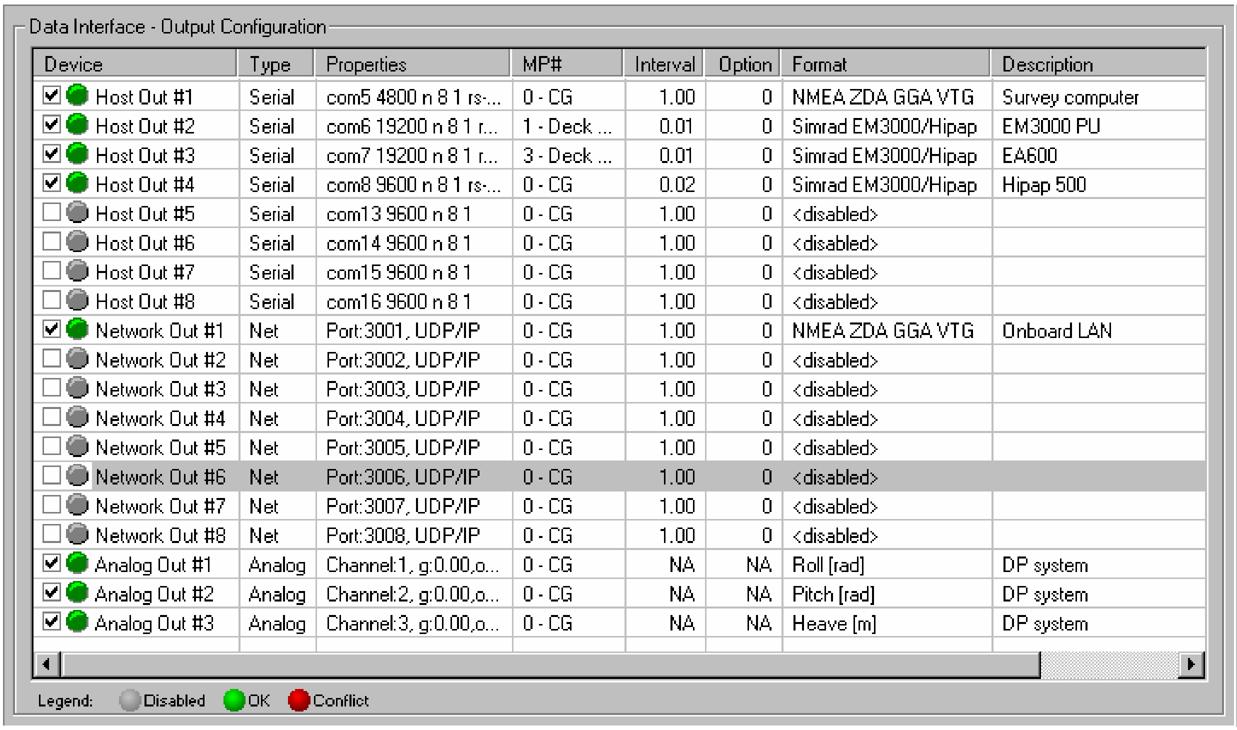


Figure 61 Formats available for device type Gyro

8.4.5.4 Output

In the Seapath the following three types of output devices are available:

- Serial host output ports.
- Network output ports (not available in Seapath 200 M).
- Three analog output channels (not available in Seapath 200 M).



Data Interface - Output Configuration

Device	Type	Properties	MP#	Interval	Option	Format	Description
☑ Host Out #1	Serial	com5 4800 n 8 1 rs-...	0 - CG	1.00	0	NMEA ZDA GGA VTG	Survey computer
☑ Host Out #2	Serial	com6 19200 n 8 1 r...	1 - Deck ...	0.01	0	Simrad EM3000/Hipap	EM3000 PU
☑ Host Out #3	Serial	com7 19200 n 8 1 r...	3 - Deck ...	0.01	0	Simrad EM3000/Hipap	EA600
☑ Host Out #4	Serial	com8 9600 n 8 1 rs-...	0 - CG	0.02	0	Simrad EM3000/Hipap	Hipap 500
☐ Host Out #5	Serial	com13 9600 n 8 1	0 - CG	1.00	0	<disabled>	
☐ Host Out #6	Serial	com14 9600 n 8 1	0 - CG	1.00	0	<disabled>	
☐ Host Out #7	Serial	com15 9600 n 8 1	0 - CG	1.00	0	<disabled>	
☐ Host Out #8	Serial	com16 9600 n 8 1	0 - CG	1.00	0	<disabled>	
☑ Network Out #1	Net	Port:3001, UDP/IP	0 - CG	1.00	0	NMEA ZDA GGA VTG	Onboard LAN
☐ Network Out #2	Net	Port:3002, UDP/IP	0 - CG	1.00	0	<disabled>	
☐ Network Out #3	Net	Port:3003, UDP/IP	0 - CG	1.00	0	<disabled>	
☐ Network Out #4	Net	Port:3004, UDP/IP	0 - CG	1.00	0	<disabled>	
☐ Network Out #5	Net	Port:3005, UDP/IP	0 - CG	1.00	0	<disabled>	
☐ Network Out #6	Net	Port:3006, UDP/IP	0 - CG	1.00	0	<disabled>	
☐ Network Out #7	Net	Port:3007, UDP/IP	0 - CG	1.00	0	<disabled>	
☐ Network Out #8	Net	Port:3008, UDP/IP	0 - CG	1.00	0	<disabled>	
☑ Analog Out #1	Analog	Channel:1, g:0.00,o...	0 - CG	NA	NA	Roll [rad]	DP system
☑ Analog Out #2	Analog	Channel:2, g:0.00,o...	0 - CG	NA	NA	Pitch [rad]	DP system
☑ Analog Out #3	Analog	Channel:3, g:0.00,o...	0 - CG	NA	NA	Heave [m]	DP system

Legend: Disabled OK Conflict

Figure 62 Data Interface - Output Configuration

In order to set up the different output devices, proceed as follows:

- In the Configuration Folder List, select **Data Interface \ Output.**
- Activate the device to be interfaced by clicking on the checkbox in front of the device name.
- The property of the selected Device are set by clicking in the wanted **Properties** cell belonging to the "Host Out" device, and the box shown in Figure 58 appears. Select the wanted settings and click **OK**. Click in the wanted **Properties** cell belonging to the "Network Out" device, and the **Network Settings** dialogue box below appears. Select the wanted Port Number and click **OK**. The default port number is recommended used unless it is in conflict with other equipment connected to the network.

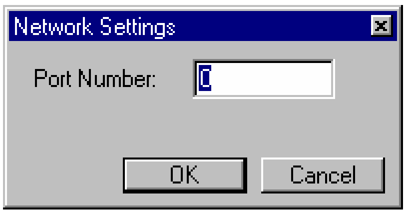


Figure 63 Network Settings

- Click in the wanted **Properties** cell belonging to the "Analog Out" device, and the **Analog Settings** dialogue box below appears. Enter the wanted settings and click **OK**.

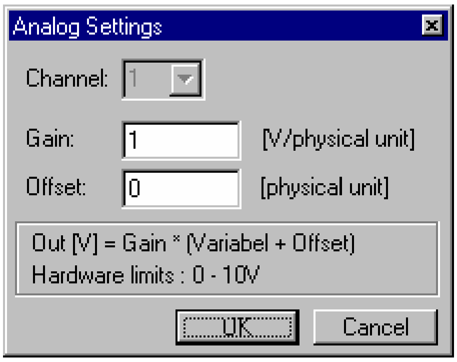


Figure 64 Analog Settings

- Click in the wanted **MP#** cell and the **Select Measurement Point** dialogue box below appears. Select the wanted Measurement Point and click **OK**.

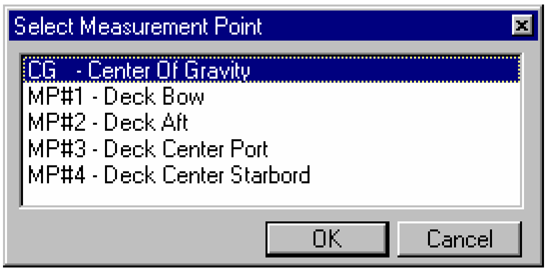


Figure 65 Measurement Point

- Click in the wanted **Interval** cell belonging to the "Host Out" or "Network Out", and the **Message Interval Settings** dialogue box below appears. Activate the pull-down menu and choose the wanted Interval. The optional intervals are fixed values between 0.01 and 300 seconds. When finished, click **OK**.

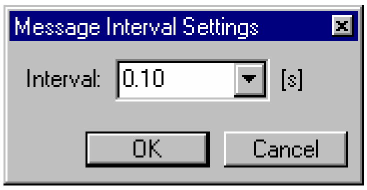


Figure 66 Message Interval Settings

- Click in the **Option** cell to select the NMEA messages standard and/or the characteristics of the roll and pitch angles. The following options are available:
  - *Option **0***. This is the default selection and will give NMEA output messages according to version 2.3.
  - *Option 2*. The selection **2** together with selection of NMEA messages will give messages as implemented in Seapath software version 2.00 or earlier. The NMEA messages will then be output in NMEA 0183 version 2.00 format.
  - *Option 4*. The selection **4** together with selection of NMEA VTG message will add "Speed through water" in a VHW message. This option is used to show travelled distance on a Simrad IS15 display.

- *Option* ***8***. The selection **8** together with selection of NMEA HDT message sets up the system not to output heading data if the heading accuracy gets reduced. This option is normally not used.
- *Option* ***16***. The selection **16** will give pure inertial determined roll and pitch angles not integrated with GPS. These roll and pitch angles are only recommended used for vessels not cruising, such as dynamic positioned vessels that receive noisy or bad GPS data.
- *Option* ***18*** *(option 16 + option 2)*. The selection **18** will give both NMEA messages implemented in Seapath software version 2.00 or earlier and pure inertial roll and pitch angles.

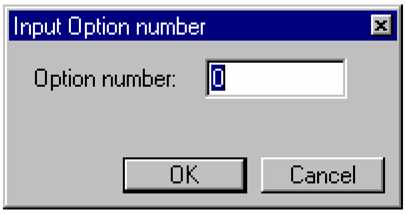


Figure 67 Selection of NMEA output standard

- Click in the wanted **Format** cell belonging to the "Host Out" or "Network Out" device, and the **Select Format** dialogue box below appears. Select the wanted format and click **OK**.

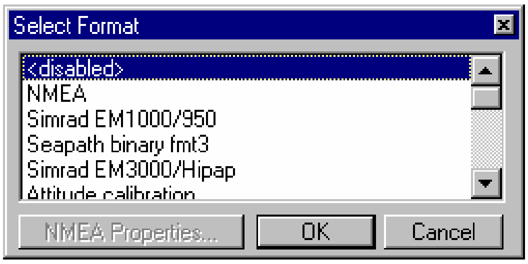


Figure 68 Format Settings

The options for Format settings are:

<Disabled>	NMEA
Simrad EM1000/950	Seapath binary fmt3
Simrad EM3000/Hipap	Calibration
Echo Sounder fmt9	Seapath binary fmt11
RDI ADCP	1PPS NMEA ZDA
Lehmkuhl gyro repeater	Atlas Fansweep
1PPS Trimble	Submetrix
Echo Sounder fmt18	<other>=0

- Click in the wanted **Format** cell belonging to an "Analog Out" device, and the dialogue box below appears. Select the wanted format and click **OK**.

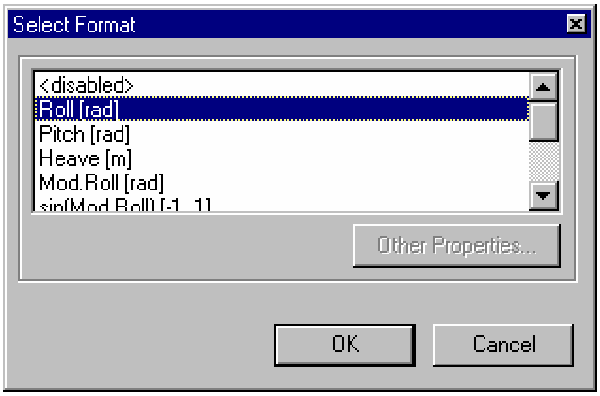


Figure 69 Analog Format Settings

The options for Analog Format settings are:

<Disabled>	Roll [rad]
Pitch [rad]	Heave [m]
Mod.Roll [rad]	sin(Mod.Roll) [-1 to 1]
sin(-Pitch) [-1 to 1]	Constant
Heave Velocity [m/s]	Roll, pure inertial [rad]
Pitch, pure inertial [rad]	Mod.Roll, pure inertial [rad]
sin(Mod.Roll), pure inertial [-1 to 1]	sin(-Pitch), pure inertial [-1 to 1]
other=0	

In order to output Datawell Hippy or Piro compatible analog signals, the following variables, gains and offsets must be selected:

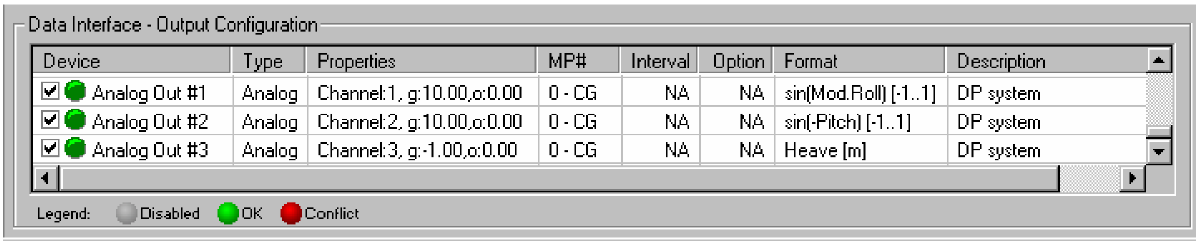


Figure 70 Datawell Hippy compatible analog output signals

Note Negative gain and the value 1 has to be used for "Heave" in order to make the variables positive according to the Datawell co-ordinate system. The variable "sin(Mod.Roll)" is to be selected for roll and "sin(-Pitch)" for pitch. Both variables to be selected with positive gain 10 in order to achieve analog Hippy roll and pitch output.

Note The pure inertial variables for roll and pitch are only recommended used for vessels not cruising, such as dynamic positioned vessels that receive noisy or bad GPS data. These roll and pitch angles are determined due to pure inertial measurements and are not integrated with GPS.

The analog format **Constant** can be selected to test one of the analog channels. When Constant is selected as analog format, the **Test Analog Channels** dialog shown in Figure 71 appears by clicking in the Properties field.

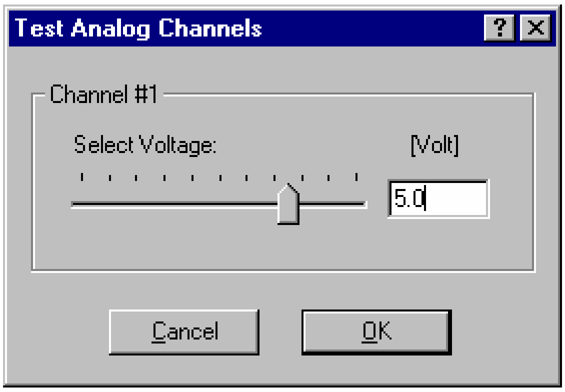


Figure 71 Input of test voltage for the selected analog channel

- In the **Description** column enter a text referring to which system the output line is connected. This helps finding the correct Seapath port to connect to which system.

8.4.6 Parameter management

8.4.6.1 Download

The edited parameters are applied by sending them to Seapath. In the Configuration Folder List, select **Parameter Management \ Download.** Click the button **Download Parameters to Seapath** to download. The values of the edited parameters are transferred. Progress bar indicates downloading progress.

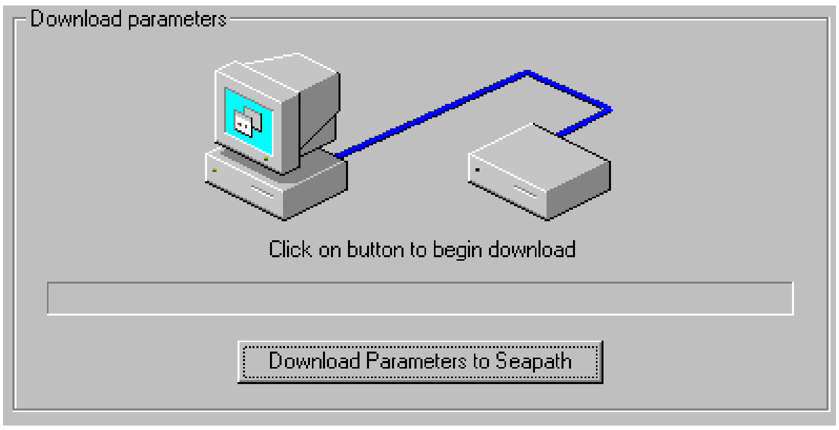


Figure 72 Download Parameters

8.4.6.2 Upload

In the Configuration Folder List, select **Parameter Management \ Upload.** Click the button **Upload Parameters from Seapath** to upload parameters from Seapath to the SCC computer. Progress bar indicates uploading progress.

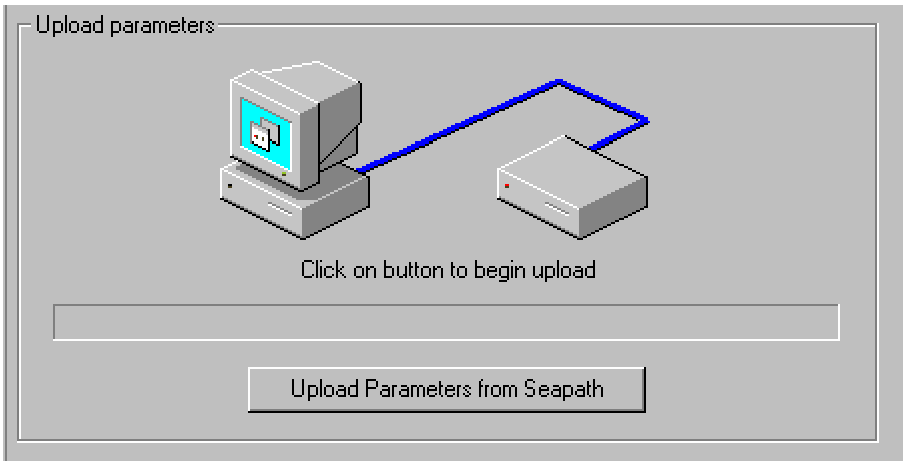


Figure 73 Upload Parameters

8.4.6.3 Save on file

Edited parameters can also be stored locally on disk in the SCC computer. In the Configuration Folder List, select **Parameter Management \ Save on file**, and the window below appears.

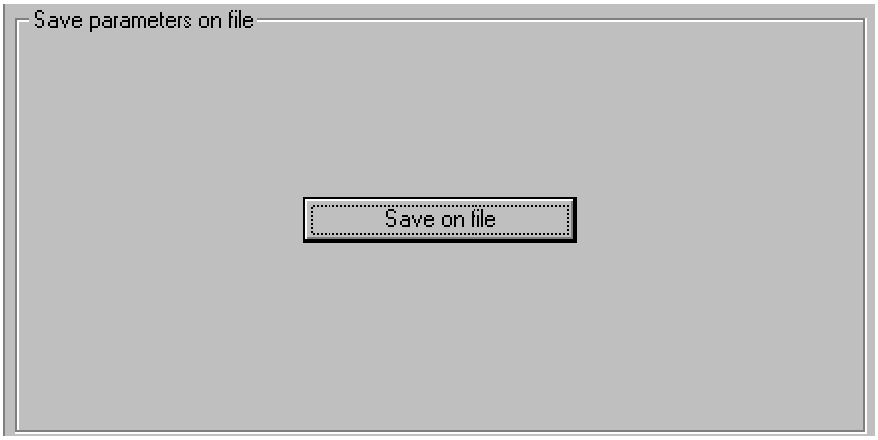


Figure 74 Save on file

Click the **Save on file** button, and the "standard save window" **Select file to save parameters on** appears. Choose wanted location and click **Save**.

8.4.6.4 Load from file

Seapath parameters stored on file in the SCC computer can be loaded back into the workspace area for further editing or/and downloaded to Seapath. In the Configuration Folder List, select **Parameter Management \ Load from file,** and the window below appears.

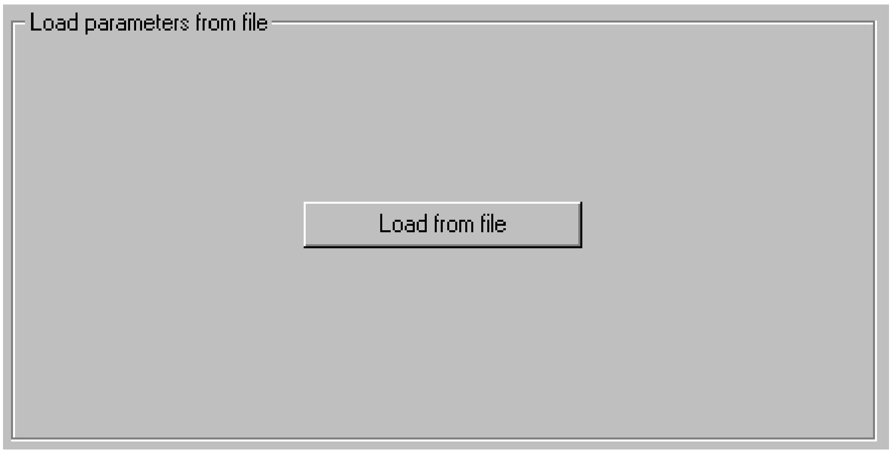


Figure 75 Load from file

Click the **Load from file** button, and the "standard open window" **Select file to open parameters from** appears. Choose wanted location and click **Open**.

8.4.6.5 Undo

If the editing of Seapath parameters for some reason fail, it is possible to overwrite the SCC workspace with the last saved parameters from Seapath at any time. In the Configuration Folder List, select **Parameter Management \ Undo** and the window below appears. Click **Undo** to get the last saved parameters.

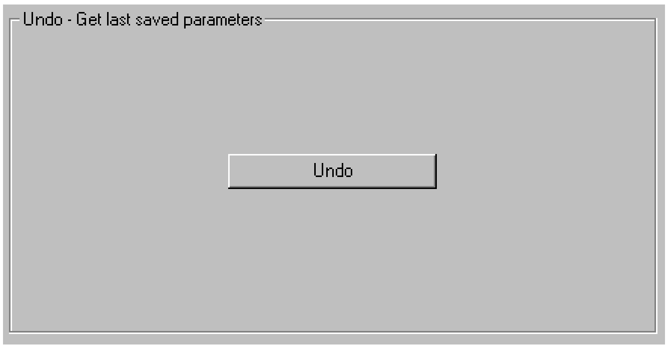


Figure 76 Undo

8.4.6.6 Generate report

A report with a list of all the configuration settings in the connected MRU or a configuration read from file is generated by clicking the **Generate configuration report** button as shown in Figure 77.

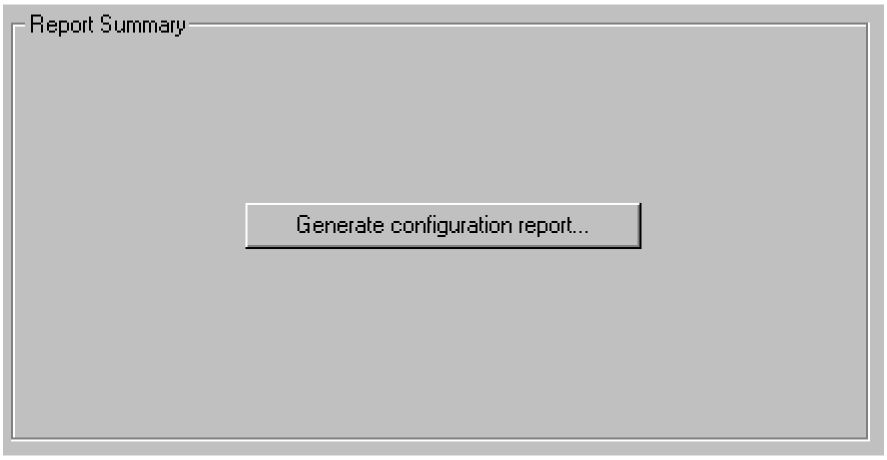


Figure 77 Generate configuration report

The MRU configuration report as shown in Figure 78 can be saved to file or printed out.

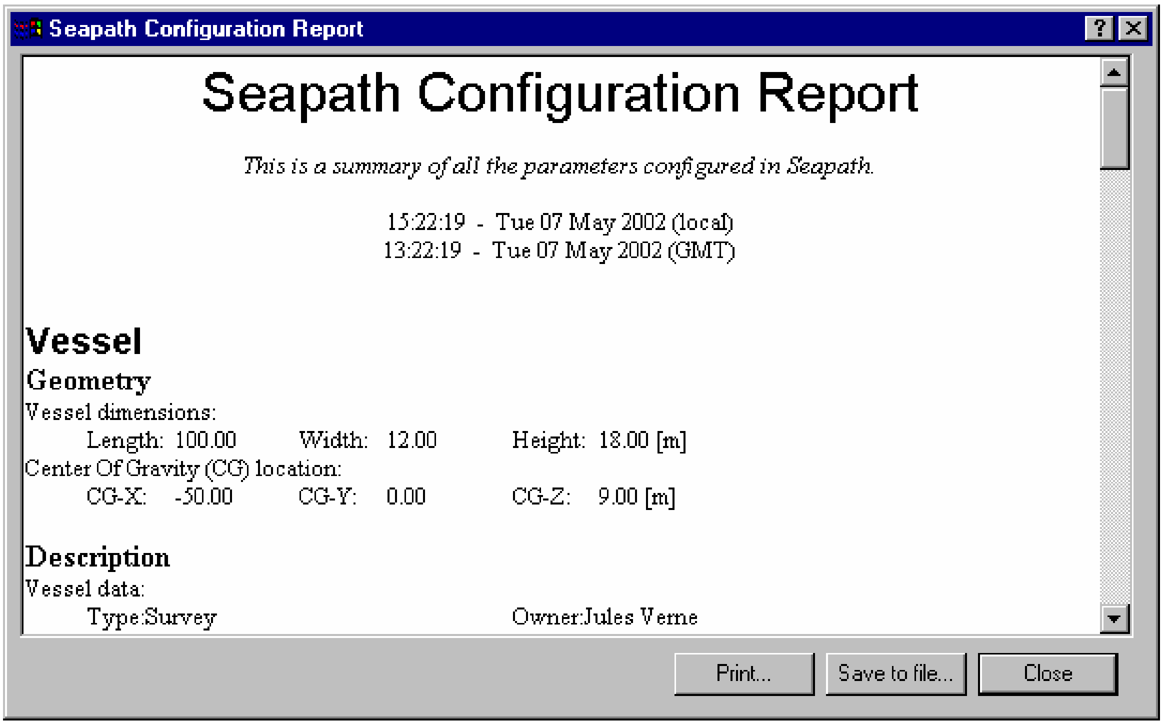


Figure 78 Configuration report

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