KONGSBERG

Quick Start Guide for EM Portable Hydrographic System (PHS)

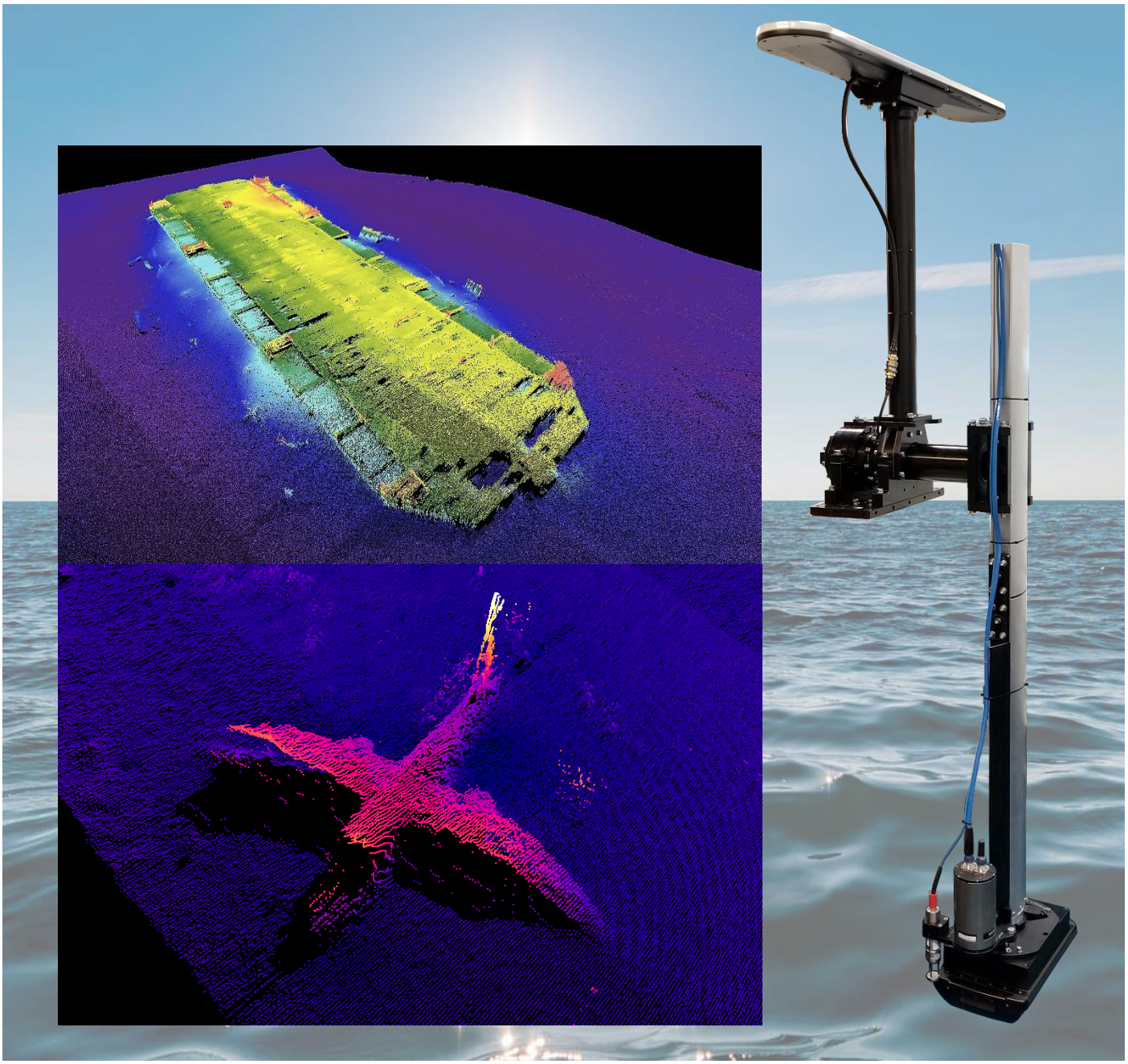


TABLE OF CONTENTS

About this Quick Setup Guide

The purpose of this manual is to provide the information, procedures and basic drawings required for the physical installation of the EM 2040 PHS (Portable Hydrographic System).

Target audience

The manual is intended for technical personnel. You are expected to have basic mechanical skills and familiarity with handling of sensitive electronic equipment. You must also be familiar with computer hardware, interface technology and installation of electronic and mechanical products.

We assume that you are familiar with the basic acoustic principles of sound in water. Familiarity with multibeam echo sounder and survey techniques are also recommended.

Introduction

The KONGSBERG EM 2040 PHS is designed for quick mobilization.

If this is your first time using the system, then follow the below instructions and by the end you should be ready to start a professional hydrographic survey in no time. Kongsberg Maritime recommends that you export Seapath and SIS parameters after setting everything up. Factory parameter settings is available on the USB stick that came with the system or can be obtained by contacting Customer support (km.hydrograhic.support@kongsberg.com).

System description

A standard KONGSBERG EM 2040 PHS consists of:

- EM 2040P Sonar Head
- EM Portable Processing Unit (PPU)
- Rugged or Semi-rugged laptop
- Seapath 130 antennae
- MRU in a subsea bottle
- Over the side sonar mount
- Interface cables

All of the above parts are powered from the PPU's internal power supply. An installation can include either an integrated SV Probe or a separately mounted SV Probe that interfaces to the Processing Unit or the Hydrographic Work Station respectively.

Key features of the EM 2040 PHS

• Frequency: 200-400 kHz

• Continuous Wave (CW)/FM (Frequency Modulated pulses

• ZDA/1PPS time synchronization

• Integrated GNSS signal and inertial measurement

• Real-time sound speed measurement at transducer

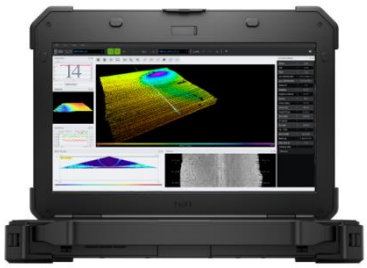
• IP67-rated splash-proof Portable Processing Unit (PPU)

• Repeatable deployment pole mount with safety breakaway

System units

The system has been set up before shipping, and to get the system started you need only plug in all the components and start the PU and laptop. However, as offsets may vary some with the type of sonar mount and vessel it's mounted on, it is important to make sure the offsets are correct and to do a patch test/calibration of the system.

Portable Hydrographic Workstation (HWS)



The portable Hydrographic Workstation (HWS) is the rugged or semi-rugged laptop that runs the main SIS acquisition software (Seafloor Information System), the Seapath 130 software as well as the SeaCast software for the surface sound velocity probe and the sound velocity profiler. The HWS is a vital part of the EM 2040 PHS Portable Hydrographic System (PHS). In this publication, the laptop is referred to as the Hydrographic Workstation (HWS).

The HWS communicates with the PPU (Portable Processing Unit) through a standard Ethernet cable.

EM Portable Processing Unit (PPU)

The Processing Unit is the central controlling device in the EM multibeam system. It is provided to process the signals to and from the transducer(s).

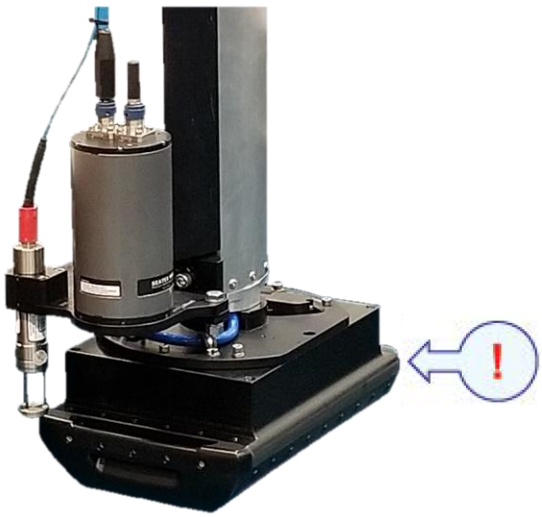
The Seapath 130 sensor unit, Motion Reference Unit (MRU), EM 2040P sonar head, and portable HWS all connect to the PPU.

An external power supply (24VDC Nominal) connects to the EM Portable Processing Unit (PPU), providing power to all system units. The Processing Unit also supplies 48 Vdc power to the transducer(s).

EM 2040P Sonar Head

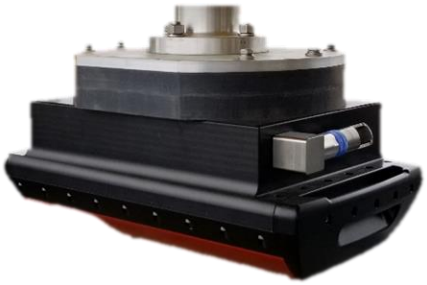
The EM 2040P transducer (!) has separate linear transducer arrays for transmit and receive in a Mills cross configuration. The transducer contains all analog electronics and digital control units with Ethernet interface to the Processing Unit. The transmitter is electronically steerable along-track while the receiver is steerable athwartships.

The EM 2040P can be delivered with an integrated AML SV probe or a separate SV Probe. In the EM 2040 PHS, the Sonar Head is attached to the bottom of the Pole Mount. The Sonar Head connects to the PPU through a head cable with an Ethernet data connection.



First generation sonar head

(Separate SV Probe)



Second generation sonar head
(Integrated SV Probe)

Rack mount traveling case

The PHS system can be delivered with a rack mount traveling case for the Processing unit and laptop. The traveling case is delivered with PU and a 3710 DGNSS receiver (optional) preconnected for a quick and easy setup. Simply remove the three lids on the unit, connect and start.

Features:

- Convenient plug and connector for 24VDC for the SV probe is integrated in the rack
- Single cable 110/230VAC connect in the back will provide the entire system with 110/230 VDC and 24VDC
- Room under the top lid for easy use and transport of the rugged HWS

Seapath 130 sensor unit

The sensor unit runs the navigation software. This software combines the GNSS signal and the inertial measurements to determine accurate position, heading, attitude and heave signal.

This software uses Kongsberg Seatex AS advanced true multi-reference algorithms for real-time parallel processing of all available correction signals.

The sensor unit includes the following:

- Two GNSS receivers and antennas
- Cable that connects to the EM 2040 Portable Processing Unit (PPU)
- Mounting bracket

Motion Reference Unit

The Motion Reference Unit (MRU) is specially designed for high precision motion measurements in marine applications. The MRU is mounted in a lightweight subsea bottle, rated 10 metres.

The MRU cable connects to the EM 2040 Portable Processing Unit (PPU) to integrate with Seapath 130 GNSS sensor.

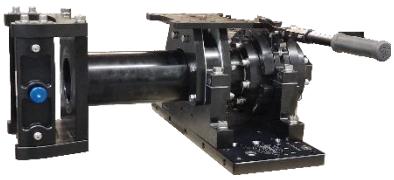
The Motion Reference Unit is very sensitive to impacts. Be careful not to drop the MRU. The electronics inside will be damaged and need to be returned to the manufacturer for repair.

Sound speed sensor

In order to ensure accurate measurements, a dedicated sound speed sensor is positioned close to the Sonar Head.
The Sound Speed Sensor (SV Probe) can be delivered integrated with the EM 2040P sonar head or separately.

Universal Sonar Mount - Pole Mount

The EM 2040 PHS Pole Mount provides precise and easy bolt on/off of flanges for all the sensors.

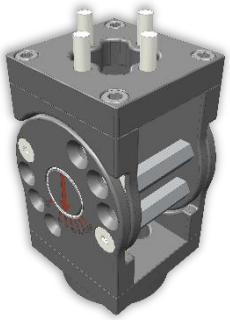


Key features of the Seapath 130 system:
• Adjustable and repeatable with no need to re-calibrate
• Quick to set up and easy to use
• Safe and audible release of sensor during collision or snag with submerged hazard
• Adjustable heading and depth with indexing

The Pole Mount parts include the following.
• The GPS Mast for mounting the Seapath 130 sensor unit.
• The Compact Mount for attaching to your gunwale.
• The Z Pole and EM 2040 PHS flange for mounting the Sonar Head, Motion Reference Unit, and sound speed sensor.
• The X Pole for connecting the Z Pole to the Compact Mount.

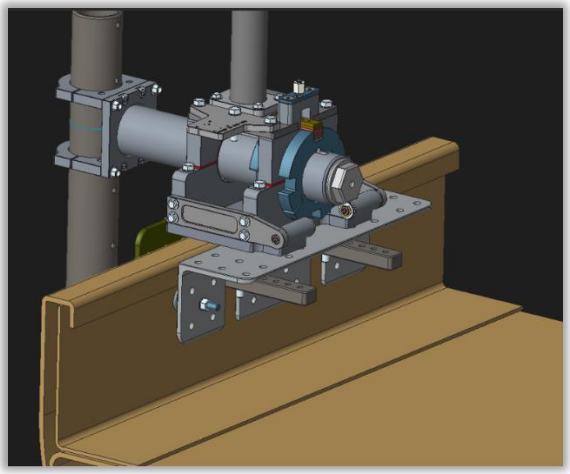
The USM Tilt Adapter option for the sonar head

The Tilt Adapter for the sonar head is an optional item available for purchase. It allows the sonar head to be tilted to port or starboard direction.



The Vessel of Opportunity kit (VOOP) option

The Vessel of Opportunity kit (VOOP) is also an optional item available for purchase. It allows the entire pole to be installed over board without the need to bolt the base of the pole mount to the vessel.



Multibeam system installation with USM pole

Transducer installation requires a detailed planning process and a level of experience and is also dependent of a variation of different parameters like the vessel's design and the installation approach. The transducer shape, the transducer size, the installation method and also customer requirements are important factors to pay attention to.

At all times it is strongly advised to use the official installation manuals of the USM Compact mounting pole.

Placement

The key to a successful installation with good system performance is to create an optimum acoustic environment for the transducers. This means an environment free from aerated water and air bubbles and also protected from different noise sources.

The best possible placement is over bow, ahead of all noise caused by the vessel. The further forward on the vessel you can place the pole the better.

Make sure that the antennae has a clear view to the sky. An extra length of antennae mast can be procured as an option.

Place the fixed plate on a rigid part of the vessel. Reinforce if necessary.

For VOOP installations tying down the installation to get rigidity can be an option.

Generally, installation must be in accordance with the type of survey you want to conduct. If you want a high quality survey at high speeds this requires a very rigid installation.

Generally, 7 knots of vessel speed is typical with an EM 2040 PHS before a bit of wobble is noticed through the pole. This is installation dependent, a very rigid installation will experience better performance.

Latest design of the Seapath MRU mounting flange allows for mounting the MRU both ways. It also has an improved assembly design that ensures repeatability in installation offsets.

The sonar head should be placed under the keel when the pole is down, in such a way the motion of vessel will never cause the sonar to come out of the water.

The depth of the pole can be adjusted using the ‘Index Marks’ on the pole that are separated every 10 cm.

Pitch installation angle should be around 0-2 degrees. Negative pitch should be avoided as negative water pressure may be a factor on the face of the sonar head (easier to get cavitation)

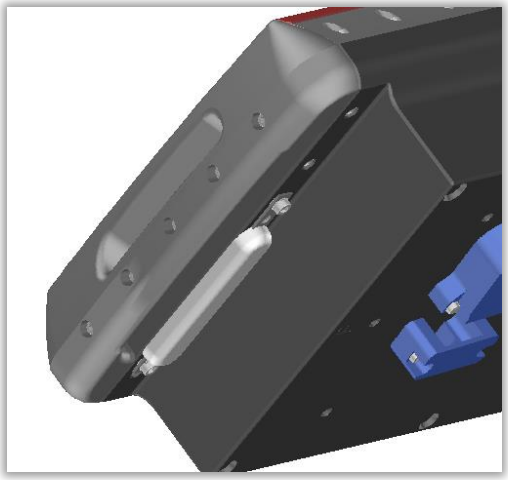
The yaw offset of the sonar head should not exceed +- 5 degrees of the vessel to avoid loss in coverage. The pole allows for yaw adjustments up to +-4 degrees. See the picture below on the right showing how the heading of the pole can be adjusted.

On the sonar head flange adapter there are several clamps that are well suited to run the cables for the SV probe and the sonar head. Also, when using the Tilt adapter, it's easy to get most cables through the pole. This is generally recommended if a tilt adapter is available.

With MRU mounted downwards the cable fits nicely into the trailing edge of the pole; see the picture below showing at the top part of the MRU mounting flange that allows to mount the MRU downwards. Also, note that the sonar head mounting flange has a fixture to install the SV probe next to the sonar head.

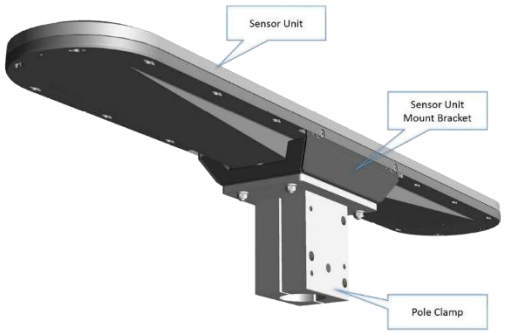
The Portable PU (PPU) should be placed in a well-ventilated area inside the vessel.

Electrical isolation is an integral part of the entire mounting pole to avoid corrosion on the systems attached. However, as the EM 2040P housing is of aluminium, regular inspection and preferably Zink anodes should be used.



Alternative mounting pole solution – Overside Mount

The Kongsberg's over-the-side mounting package is designed for installation on Vessel of Opportunity (VOOP) and it provides mounting arrangement for the sonar head, MRU/IMU (motion sensor), GNSS antennas, and SV Probe. It comes with Installation Manual and offset lookup table for easy, accurate and precise setup.



Key features of this mounting pole solution:
• Adjustable and repeatable with no need to re-calibrate
• Quick to set up and easy to use

The over-the-side mount consists of four main parts:
• Poles (shafts): three poles make a set. Each pole has a serial number and is identified to help you distinguish if it is the top, middle or bottom part. Note that you may only use the bottom, or the bottom and middle parts depending on the draft of your vessel.
• The boom mount plate: this part must be fixed to the vessel.
• Stabiliser: this ele1nent provides additional support between the vessel and the pole to which the mounting plate is attached.
• Two mounting plates for the peripheral sensors (GNSS Antennas, MRU, SV Probe and sonar head) that are attached to this assembly.

Please, refer to the Installation Manual document number 4561611 for details on the 'Overside Mount'.

Detailed XYZ offsets scenarios with the different pole mounts solutions

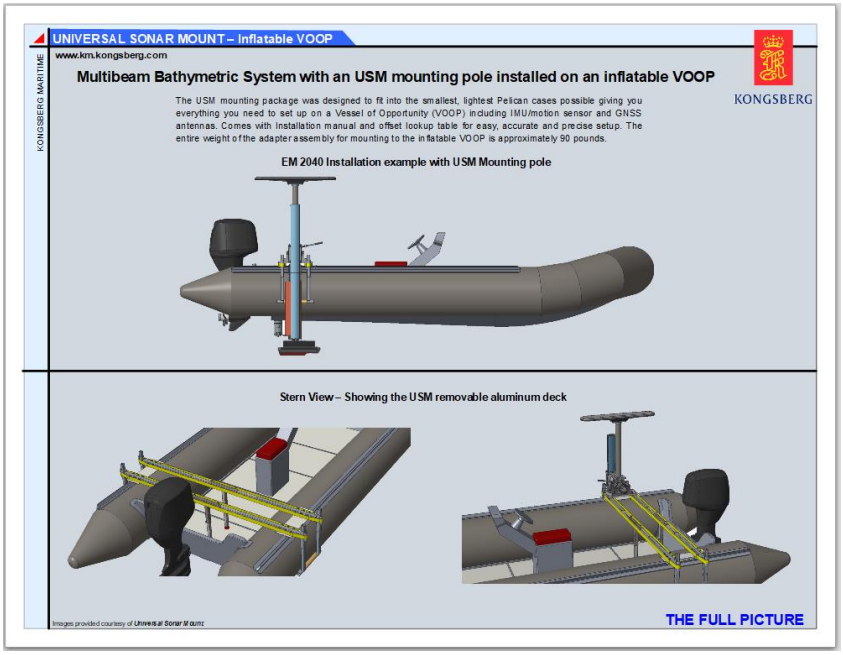
Please, refer to separate PDF document '**ANNEX 1**' for XYZ offsets scenarios with USM Mounting Pole solution.

Please, refer to separate PDF document '**ANNEX 2**' for XYZ offsets scenarios with KONGSBERG Mounting Pole solution.

USM mount option for Inflatable VOOP (Vessel of Opportunity)

The USM mounting package for a Vessel of Opportunity (VOOP) was designed to fit into the smallest, lightest Pelican cases possible giving you everything you need to set up including MRU/IMU (Motion Sensor) and GNSS antennas. The entire weight of the adapter assembly for mounting to the inflatable VOOP is approximately 90 pounds.

Please, refer to separate PDF document '**ANNEX 3**' for design details.



First time system setup

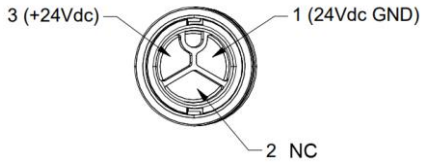
The system has been set up before shipping, and to get the system started you need only to plug in all the components and start the PPU and laptop. However, as offsets may vary with the type of sonar mount and the vessel it's mounted on, it is important to make sure the offsets are correct.

Interfacing cables into the PPU

Note: All connectors on PPU are BNC type. DO NOT pull the cable into the connector by twisting the BNC connector, but push the connector in before locking it by twisting the BNC connector.
Equipment cables only fit one place, so identifying what cable goes to what equipment should be easy.

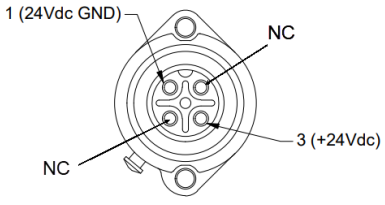
1. Connect EM 2040P **(E)** transducer head to PPU TRX_1 or TRX_2 connector
2. Connect Seapath antennae **(K)** to PPU Seapath Ant. Connector
3. Connect Subsea MRU **(L)** port A to PPU **(C)** Seapath MRU connector
4. Connect laptop to PPU **(C)** Workstation connector
5. Connect 24VDC (18-36v) to PPU **(C)** 18-36VDC Connector using the provided power cable.

Pin	Color	Con. Use
1	Black	24Vdc GND
2	Green	Chassy GND
3	White	+ 24Vdc



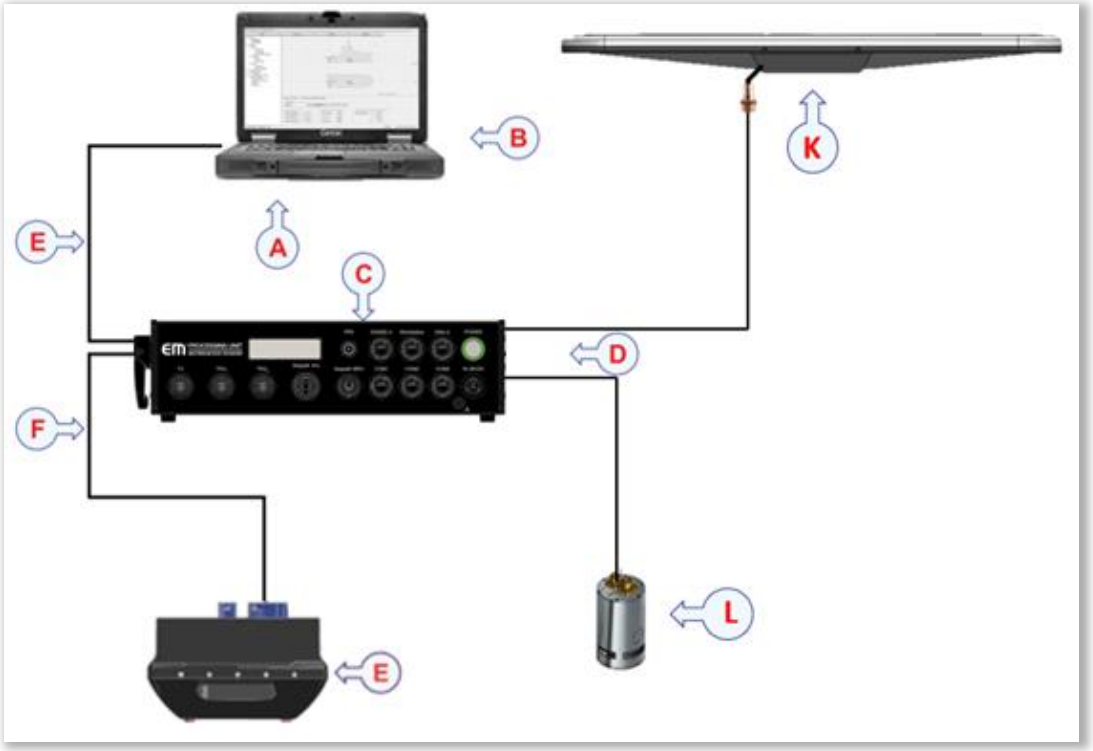
Optional but recommended inputs:

6. Connect SV probe serial port to laptop **(A)** serial COM port or to Processing Unit COM port **(E).** You can power the SV probe from the rack mount traveling case using the integrated 24VDC receptacle and the connector that came with your system.



7. Connect position aiding system (RTK or DGNSS corrections service) to PPU **(C)** DGNSS connector using the DGNSS marked cable that came with the system.

System diagrams



A. Hydrographic Work Station (Rugged/Semi Rugged)

B. Interfaces:
   - Sound speed sensor
   - Tide
   - Centre depth output

C. Portable Processing Unit (PPU)

D. Processing Unit interfaces:
   - Secondary Positioning systems
   - Secondary Attitude (roll, pitch and heave)
   - Secondary Velocity
   - Secondary Heading
   - Secondary Clock

   Processing Unit special interfaces:

   - Clock synchronization (1PPS) (Cannot be used if Seapath 130 is connected)

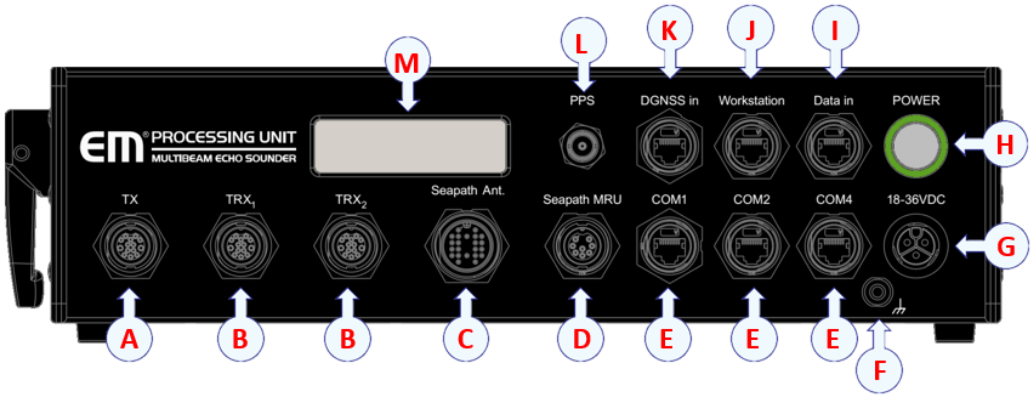
E. Transducer

F. Transducer Cable

K. Seapath 130 Antennae

   Provides system with:
   - Position
   - Attitude (roll, pitch and heave)
   - Velocity
   - Heading
   - Clock
   - Clock synchronization (1PPS)
   - Any network output that Seapath supports (RTCM, IMU, etc.)

L. Seapath MRU in Subsea flask



A. Transceiver Transducer cable input
B. Receiver Transducer cable input and Transceiver/Receive Transducer cable input (EM 2040C and EM 2040P)
C. Seapath 130 Antenna interface cable input
D. Seapath 130 MRU interface cable input
E. PU Serial Com ports (COM3 available from Seapath)
F. Ground connector
G. 18-36Vdc power input socket (24VDC Nominal)
H. Power on/off button. Correct direct current polarity indicated by green led.
I. External data input over Ethernet incl. Attitude velocity.
J. Hydrographic Work Station input
K. Input for GNSS corrections
L. 1PPS input (if Seapath 130 system not connected)
M. Processing Unit display

A. Kongsberg EM Portable Processing Unit
B. Kongsberg Seatex 3710 DGNSS correctional services receiver
C. 24VDC output for Sound Velocity Probe

Powering up the system

Once everything is connected you can power up the PPU by pressing the Power on button.

Green light: power on
Red light: wrong polarity
Blinking Green light: Not enough power available.

The PPU display will let you know when the unit is ready.

First time starting SIS and Seapath HMI

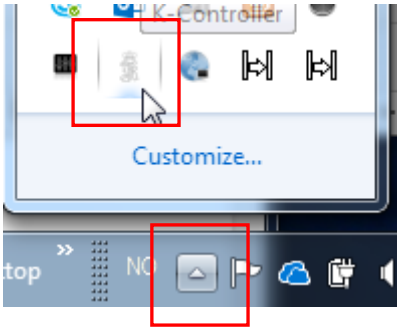
SIS and Seapath should have been set up prior to your first time setup, but as mentioned you do need to set or check the offsets of the system. Before moving on, ensure that the PPU display shows "**Unit Ready**" and that the expected number of RX and TX is listed there.

Seapath HMI
Open the Seapath HMI software by clicking the icon on the desktop. Note that it may take some time before everything is green as the system needs to align.

Seafloor Information System (SIS 5.x.x)

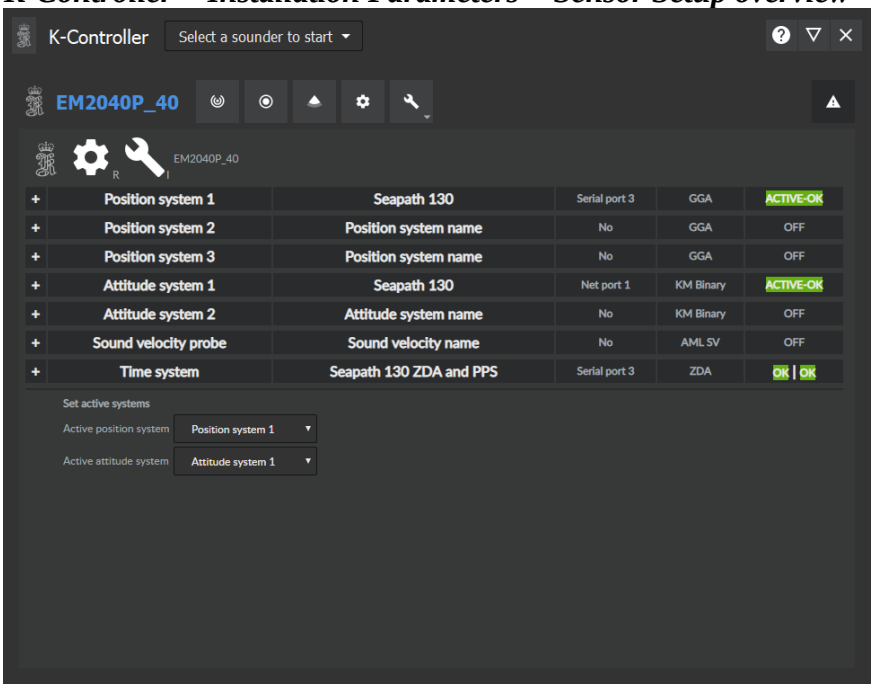
K-Controller runs as a separate program, or as an integrated part of SIS 5. Both software can be accessed from the Windows Start menu. If SIS5 software is started; the K-Controller module will also start automatically.

1. To open K-Controller; double-click the ***K-Controller*** icon on the Computer desktop to start the program.

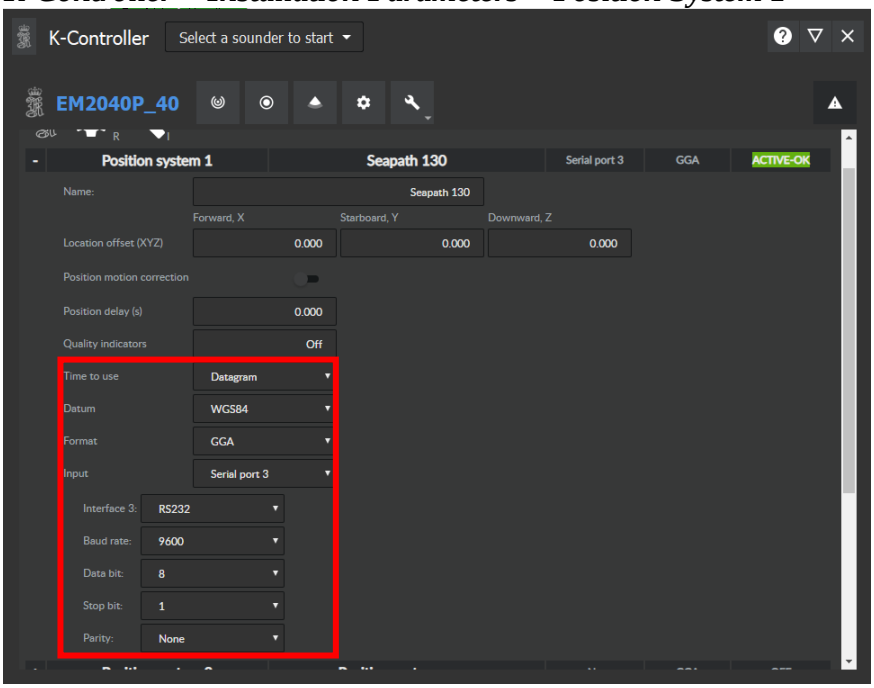


2. Let the system find all components.
3. Select the echo sounder from the list in ***Select a sounder*** to start.
4. Click *the* ***Installation parameters*** function  , then select ***Input Setup***. Check and set all *Installation Parameters* as per the following screen captures:

K-Controller > Installation Parameters > Sensor Setup overview

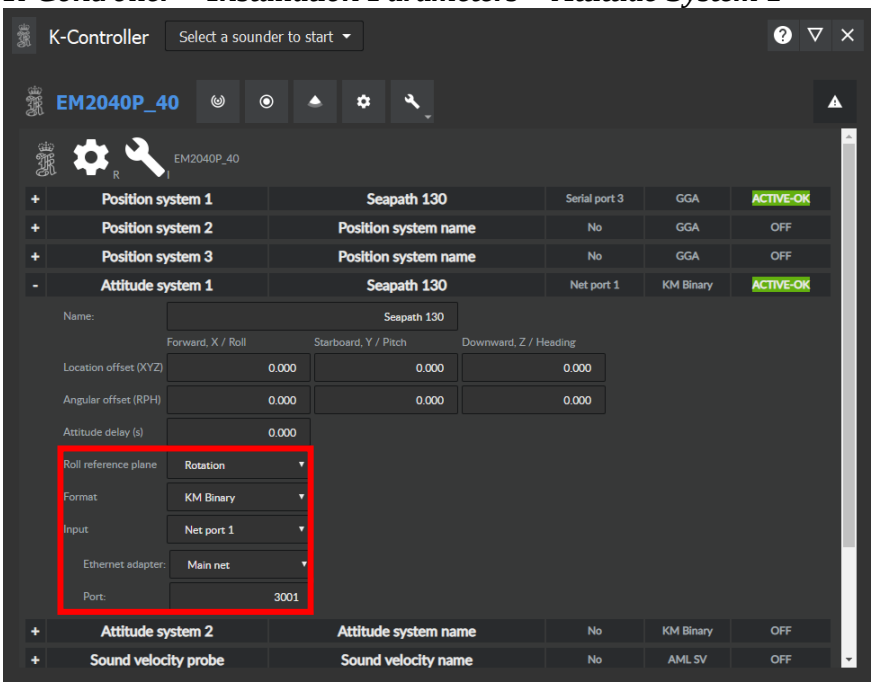


K-Controller > Installation Parameters > Position System 1



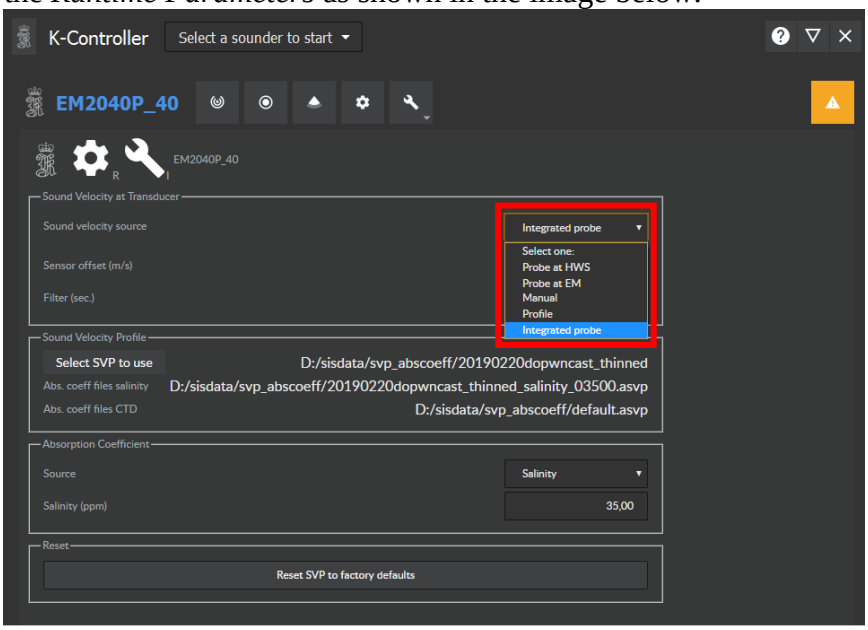
IMPORTANT: There is no need to enter the XYZ offsets for the Seapath 130 antenna as they have already been setup in the Seapath software.

K-Controller > Installation Parameters > Attitude System 1



IMPORTANT: There is no need to enter the XYZ offsets for the MRU as they have already been setup in the Seapath software.

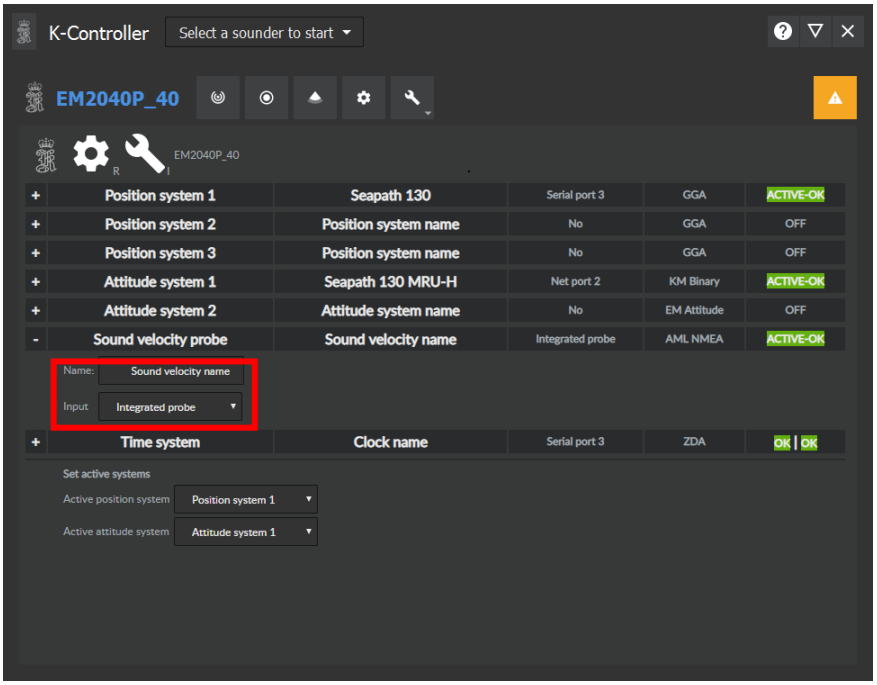
K-Controller > Installation Parameters > Sound Velocity Probe
In order to setup the options in the *Installations Parameters* for the SV Probe at the transducer head, the correct *Sound Velocity Source* needs to be selected in the *Runtime Parameters* as shown in the image below.



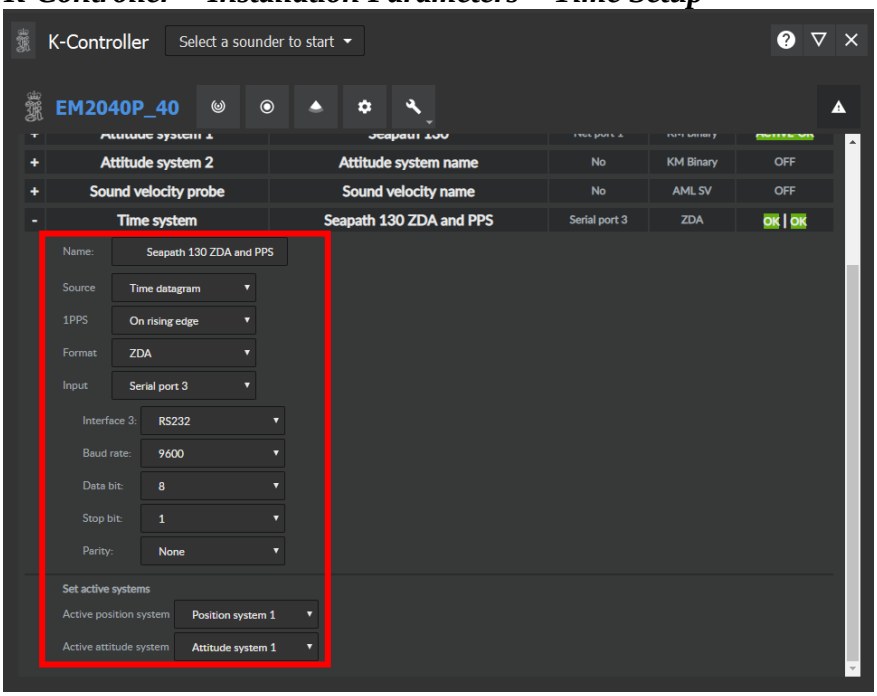
This is the menu where you select to use the integrated SV probe, NOT the installation menu

Select ***Integrated Probe*** if your sonar head comes with an integrated AML SV Probe. If not, select ***Probe at HWS***, or ***Probe at EM***. With this last option the user can connect the SV Probe to COM 1, 2 or 4 on the Processing Unit (PPU or Slim PU). ***Probe at EM*** is the recommended default option when using an external (not integrated) SV Probe.

Next, go back to ***K-Controller > Installation Parameters > Sound Velocity Probe*** and configure the COM port settings for the relevant SV Probe connected to your HWS (Hydrographic Workstation/PC/Laptop).



K-Controller > Installation Parameters > Time Setup

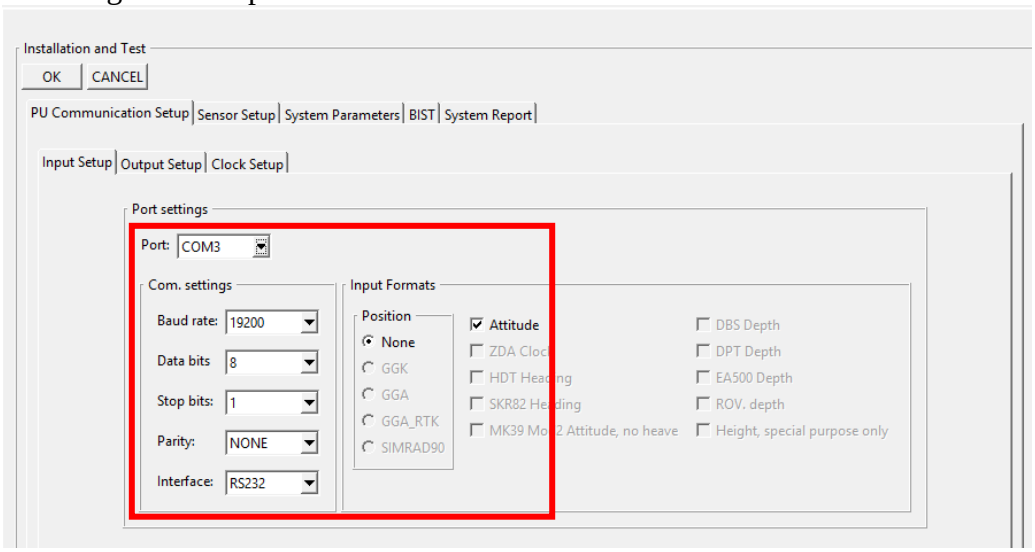


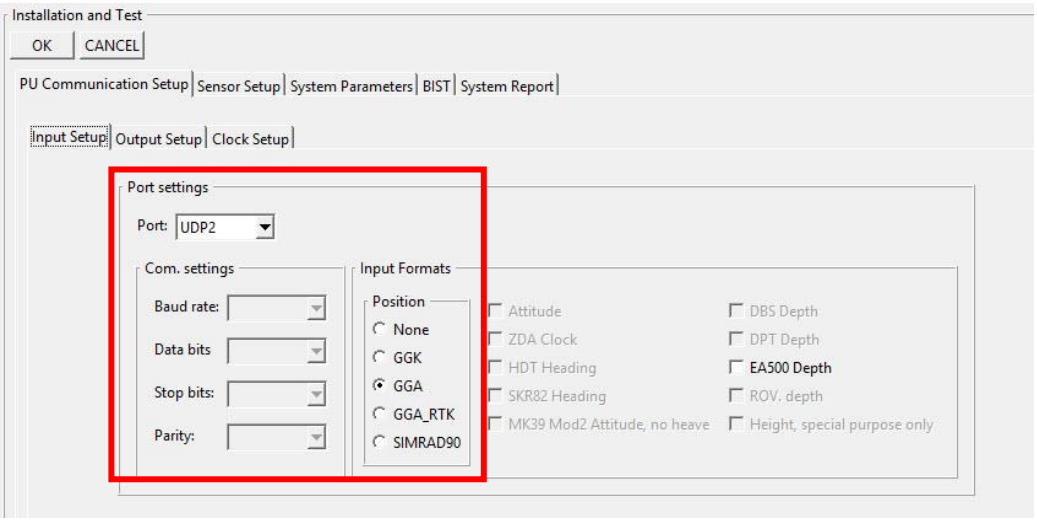
You are now ready to define a new survey and start pinging.

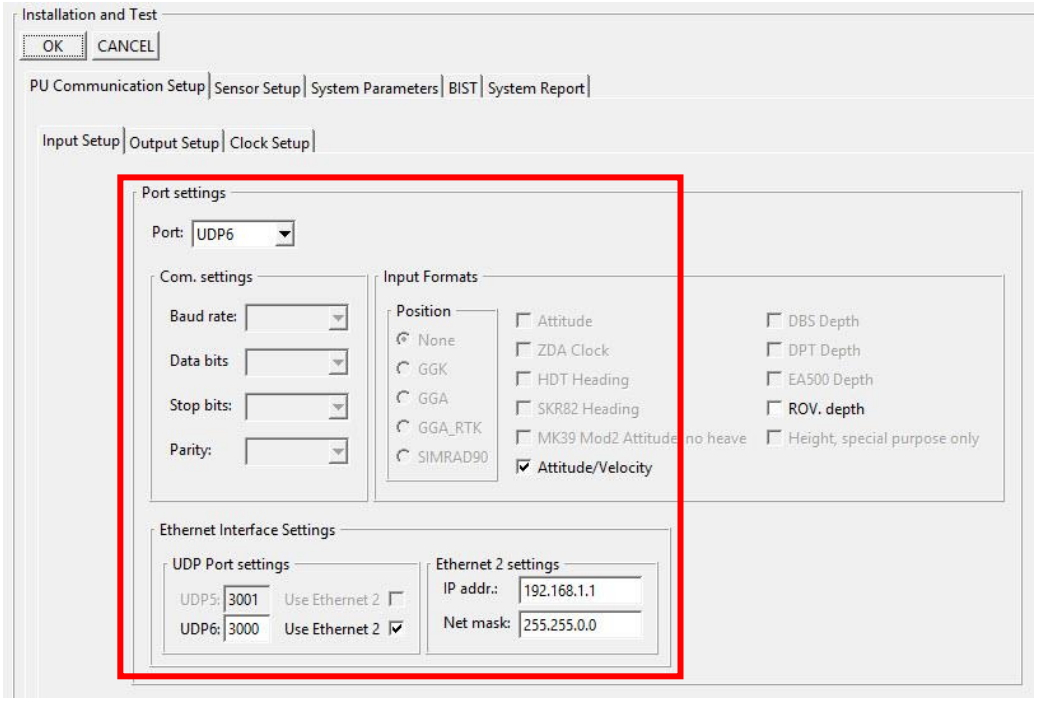
Seafloor Information System (SIS 4.x.x)

Open the SIS software by clicking the icon on the desktop.

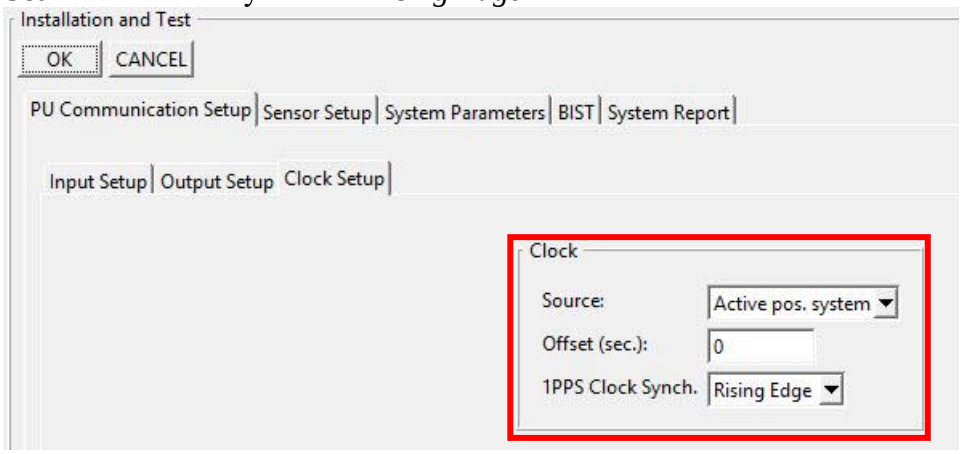
1. Start the sonar by selecting the sonar in the centre top window with text ***Not started***
2. Click ***View - Tear off - Installation parameters – PU Communication Setup***, then select ***Input Setup***. Check and set all ***COM3***, ***UDP2*** and ***UDP6*** as per the following screen captures:



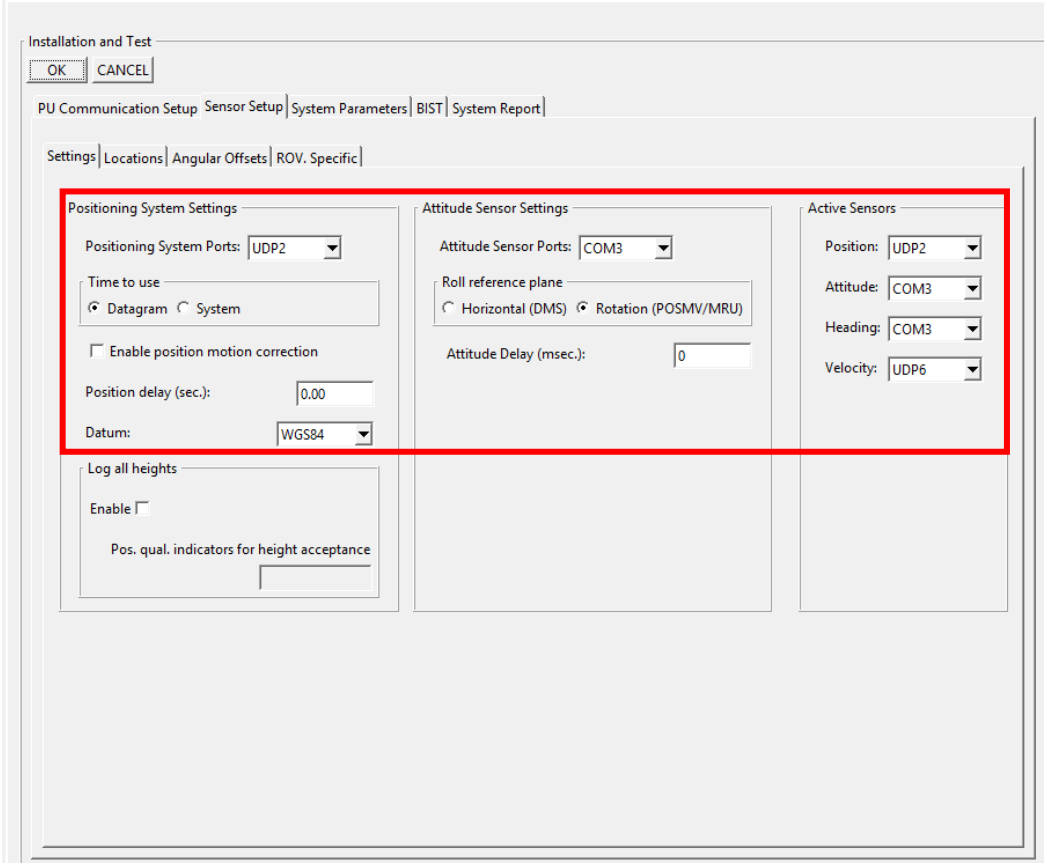




3. Click ***View - Tear off - Installation parameters – PU Communication Setup***, then select ***Clock Setup***.
   Set 'Source' to '*Active pos. system*'
   Set '1PPS Clock Synch' to '*Rising Edge*'

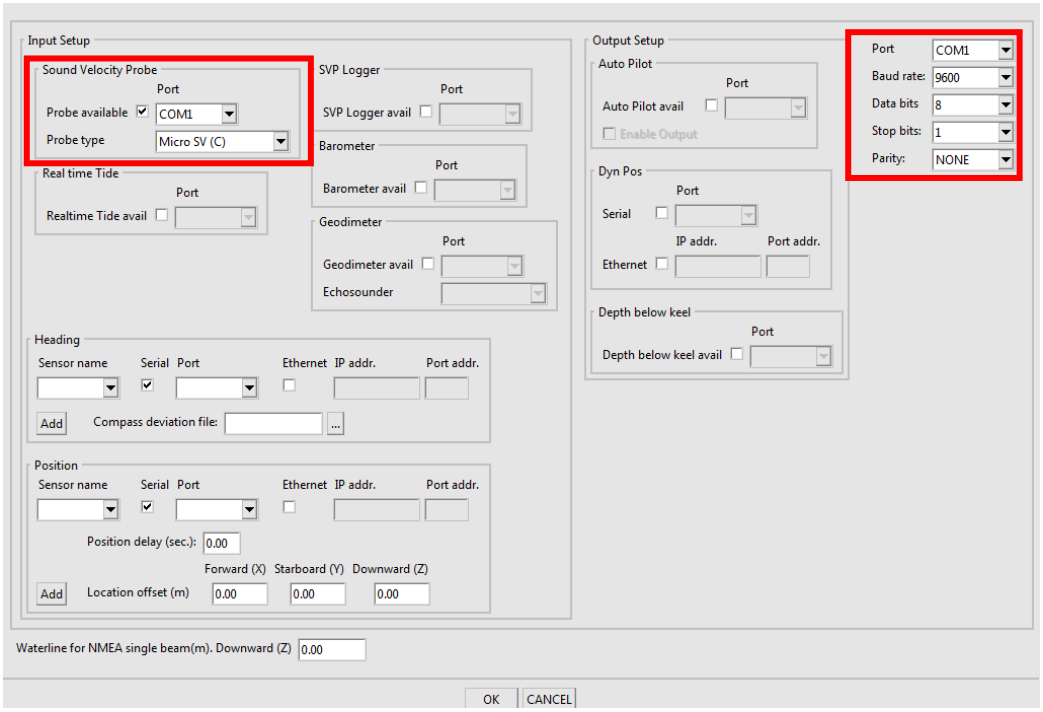


4. Click ***View - Tear off - Installation parameters – Sensor Setup***, then select ***Settings***. Check and set all parameters as per the following screen capture:

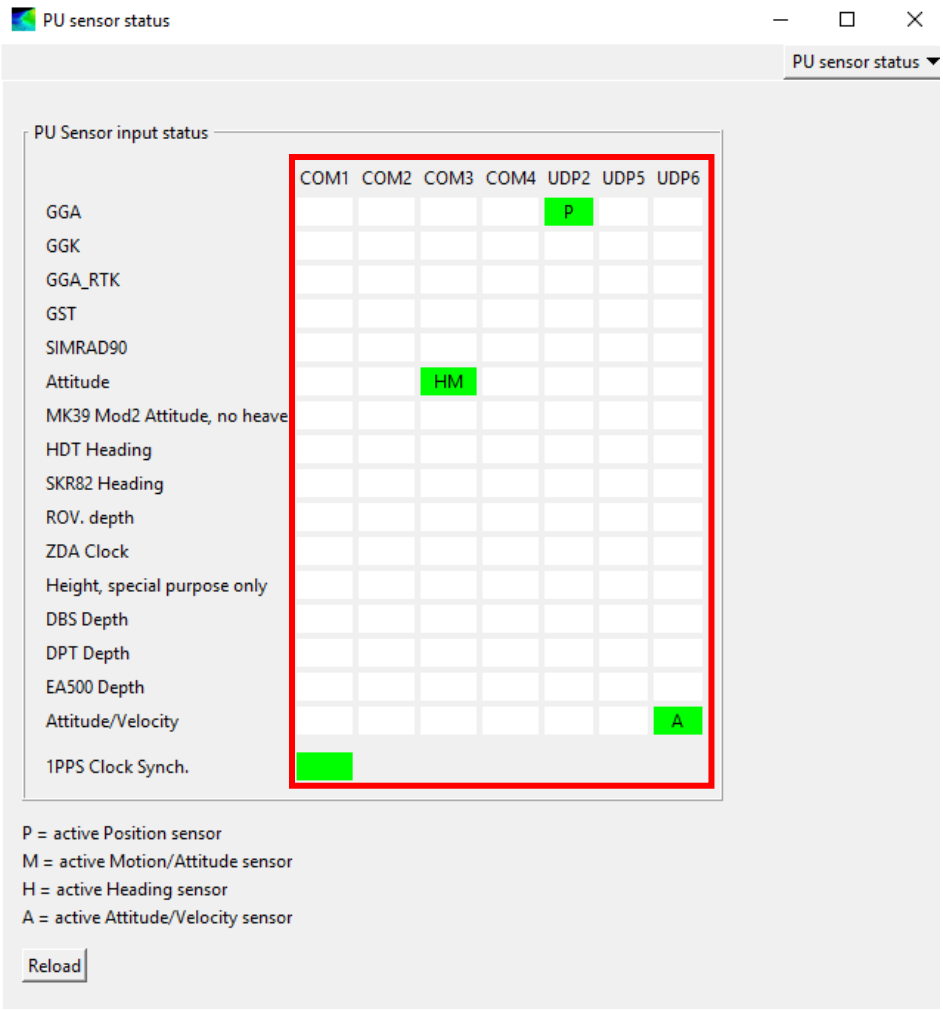


Note that '***Time to use***' has to be set to '***Datagram***'

5. Click ***Tools - External Sensors***. Proceed to configure the SV Probe connected to the Hydrographic Workstation (HWS) accordingly - whether AML, Valeport or any other brand with a datagram type supported in SIS.



6. Click ***View - Tear off - PU Sensor Status***. Should look as below



Note: Time sync is done via ***Active positioning system***, therefore '*ZDA Clock*' is not needed.

7. Click ***View - Tear off*** and ***Installation parameters***. Click the ***BIST*** tab and ***RUN ALL BIST***. Results should be all green

You are now ready to define a new survey and start pinging.

Configuring the offsets/inputs/outputs in Seapath 130

The position sensor offsets should be defined from the ***Survey Origin*** (same as NRP in our case) to the position reference point on the primary Seapath antennae. The motion sensor offsets should be defined from the ***Survey Origin*** (same as NRP in our case) to the MRU.

If you have purchased a complete system with a pole and all necessary adapter plates, a drawing with all relevant offsets should be available in your documentation. ***Survey Origin*** should be clearly marked on the system but may use different wording.

For larger systems, the reference point is typically a point easily identifiable on the vessel near to centre vessel.

1. Click the ***System*** button, then ***Change System Mode*** and select ***Configuration***. Password is "**stx**"
2. Click the ***System*** button, then ***Nav Engine*** and select ***Standard***
3. On the left side menu options, go to ***Sensors – GNSS – Geometry*** in the navigation tree. Enter antennae offsets Forward(X), Starboard(Y) and Downward (Z) as well as antennae heading and height difference between antennae Heading reference point 1 and 2 (pitch offset). Use the ***Calibration Wizard*** to set heading offset and height difference
4. On the left side menu options, go to ***Sensors – MRU – Geometry*** in the navigation tree. Enter MRU offsets Forward(X), Starboard(Y) and Downward (Z) as well as Mounting angles. Use the ***Mounting Wizard***.
5. Click the ***Apply*** button

Seapath sensors geometry setup

The following parameters can be set in the ***Standard*** configuration of the *Nav Engine*:

• Vessel geometry and description

• Sensor data, including:

– GNSS geometry, processing and attitude processing

– DGNSS, SBAS, XP/G2 and RTK

– MRU geometry and heave configuration

• Monitoring points geometry

• Communication interface, including:

– Input/Output;

– Serial port extender

– Network and Data pool

These parameters are described in detail in the Seapath manuals.

Vessel Geometry

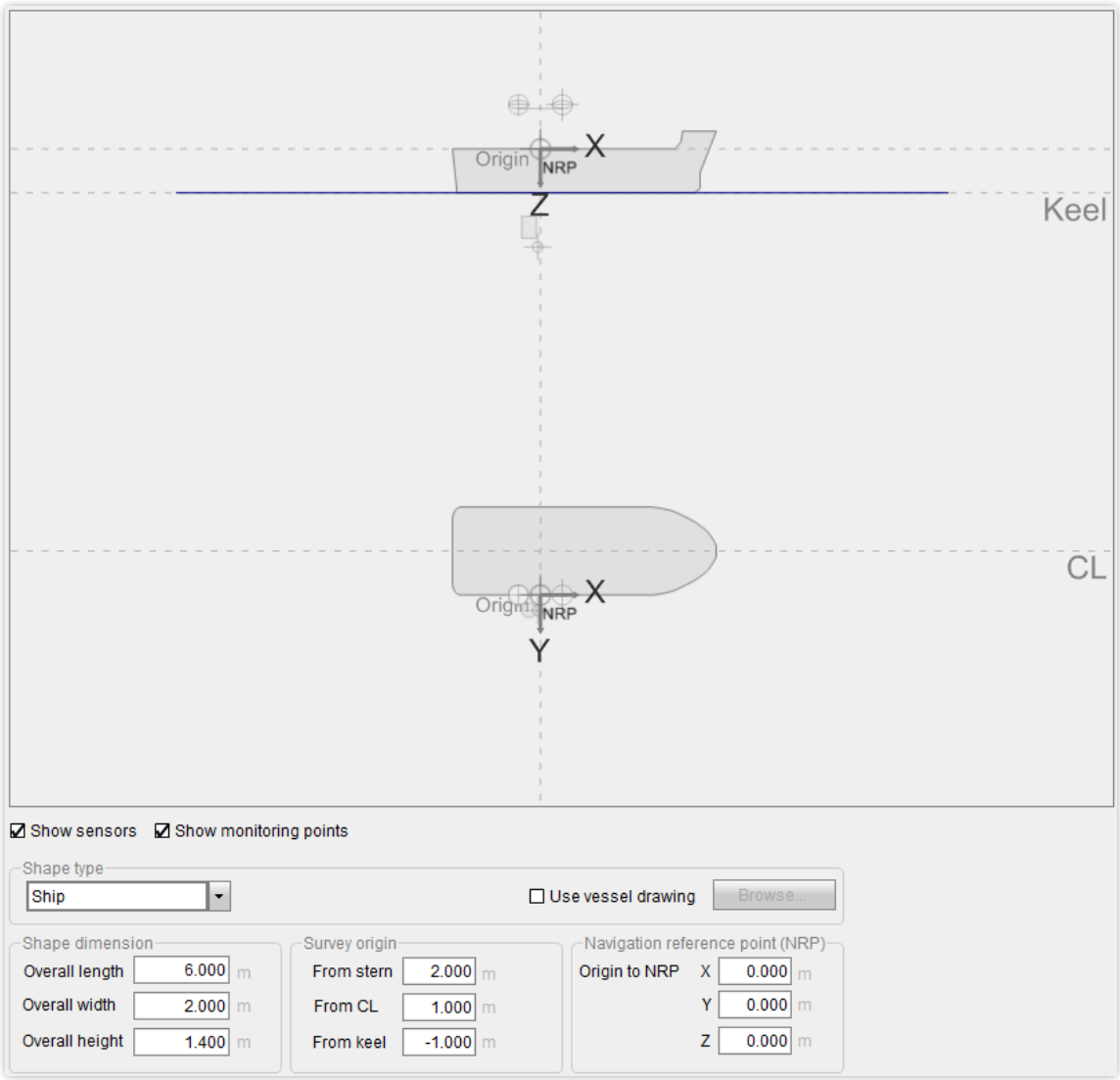
Select ***Vessel → Geometry.***

In the ***Vessel Geometry*** view, information needed to specify correct location of various sensors, equipment and monitoring points on a vessel is entered. The drawing is correctly scaled based on the vessel dimensions to ensure correct indication of the various points.

The unit of the entered coordinates is either [m] or [ft].

- Enter the vessel size

- Enter the placement on the pole System Centre on the vessel Survey origin. Origin to NRP stays 0,0,0

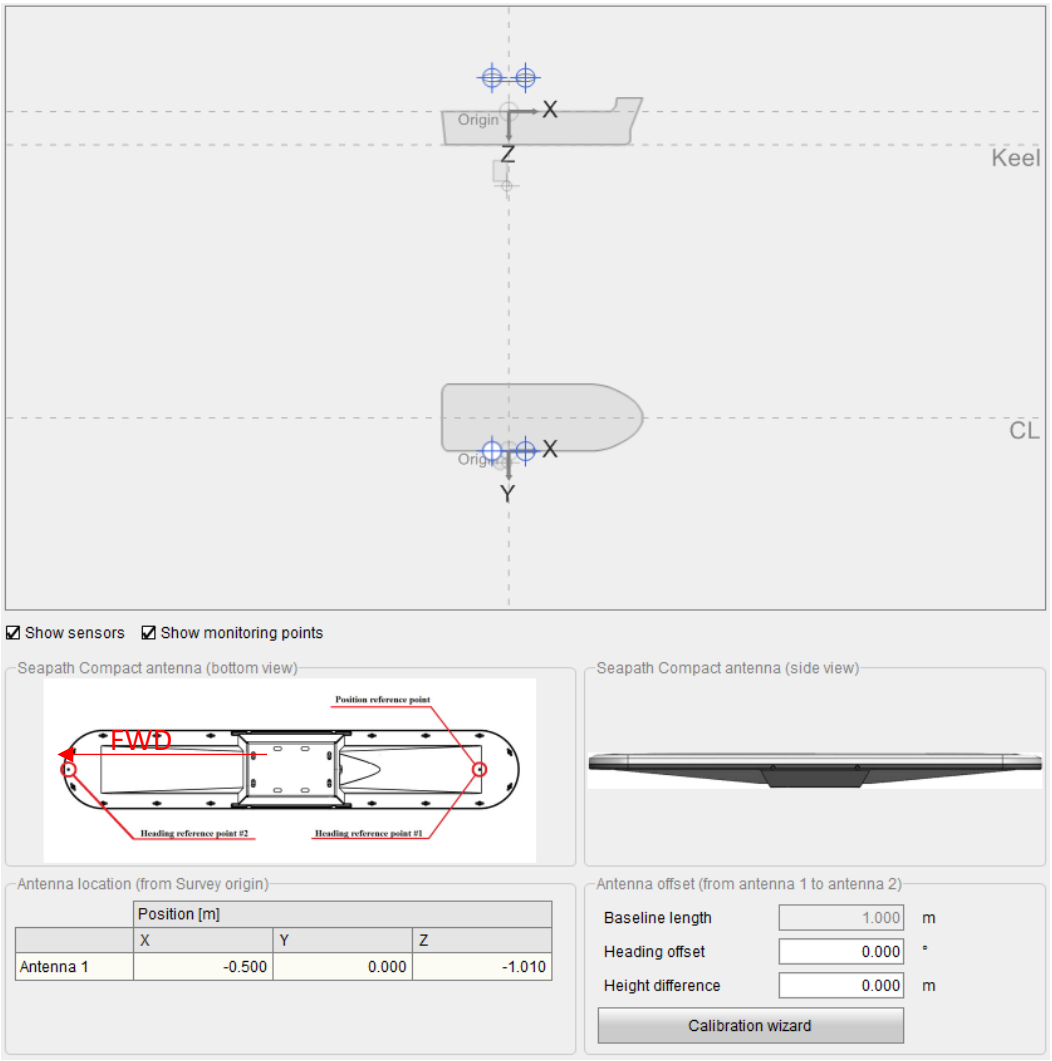


GNSS Geometry

Select ***Sensors→ GNSS → Geometry.***

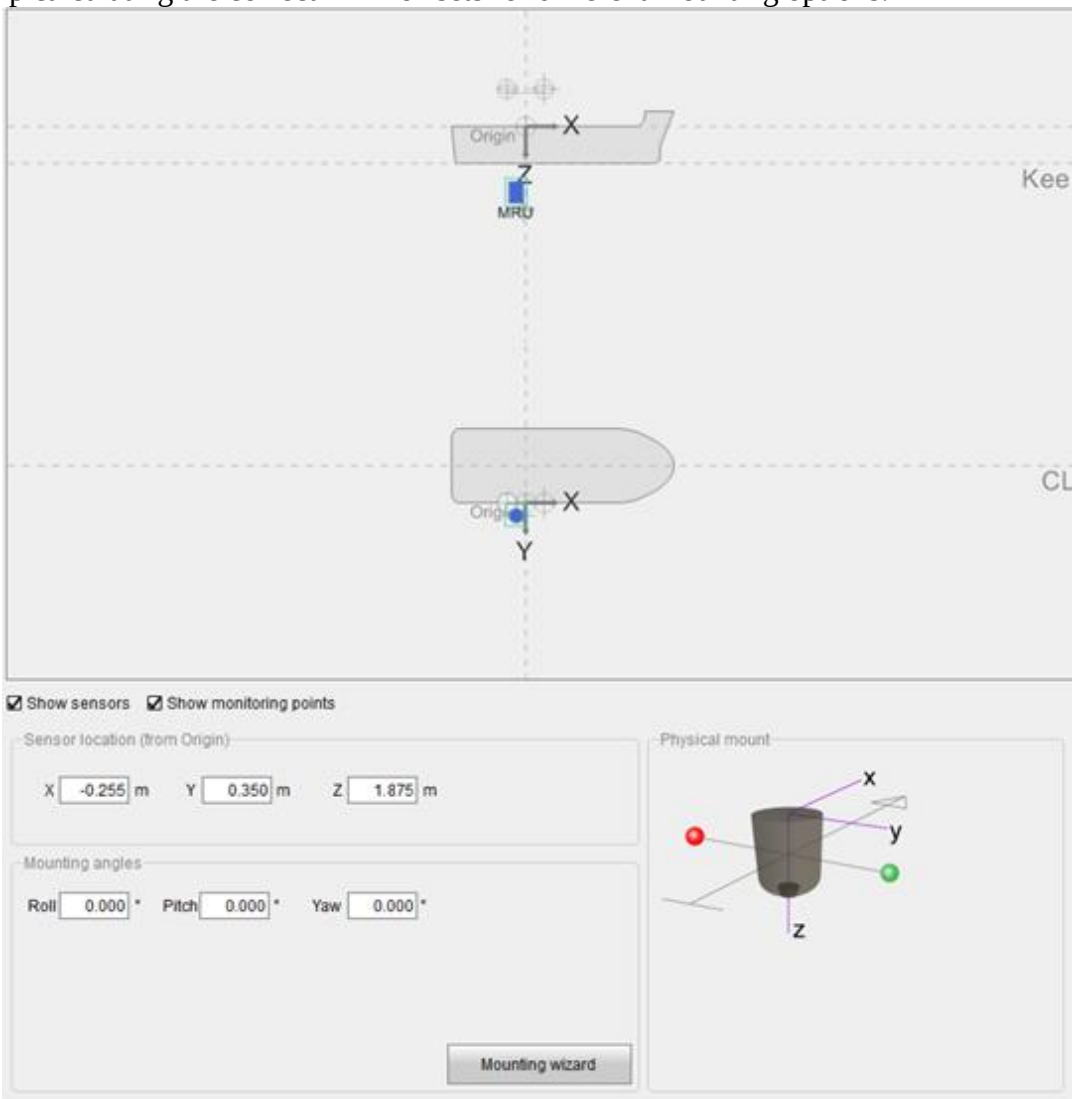
The lever arm vector from the NRP to GNSS Antenna 1 has to be measured or calculated based upon drawings or previously measured points, and entered into the software.

This is the location of the antennas on the mounting pole with respect to the NRP. Preferably the antenna should be installed in the aft-forward direction, with the position reference point at the aft antenna. In this scenario, the antenna offsets are: ***X = -0.50m, Y = ±0.000m*** and ***Z= -1.01m*** (as defined in the screen capture below). If the antennas are placed across the vessel with the antenna reference pointing to port side then the offsets are: ***X = 0.00m, Y = ±0.500m*** and ***Z= -1.01m***. If you have a second antenna mast the Z offset becomes: ***Z= -1.935m***



MRU Geometry

Select ***MRU → Geometry.***
The lever arm vector from the NRP to the MRU location has to be measured or calculated based upon drawings or previously measured points, and entered into the software. This is the location of the MRU on the mounting pole with respect to the NRP. The MRU can be placed with its default orientation with the cable connector UP; or DOWN. We recommend the UP orientation as this provides a better cable installation. Remember to change the sign of the Y axis to negative if the pole is mounted on the port side of the vessel.
The Z component depends on what indexing mark is being used of the Z-pole. In this example the deepest index mark is selected. Enter the MRU offsets as ***X = -0.255m***, ***Y = +0.350m*** and ***Z= +1.875m*** *(cable facing up) or* ***Z= +1.785m*** *(cable facing down).*
Other index marks can be found on the pole offset drawing (a separate document associated with this Quick Start Guide). Also, Kongsberg provides an Excel Sheet to help calculating the correct XYZ offsets for different mounting options.



Below is an example of the Kongsberg's Excel Sheet provided with the system.

KONGSBERG

INPUT	
EM Type	EM 2040P
Mounting side	Starboard
Antenna mounting	Along ship
Amount of GPS poles	One
MRU placement	On pole
MRU mounting	Cable Up
Index Setting (from top)	1
Tilt Adapter Mounted	No
Tilt Adapter Angle	0°
USM Yaw	0°
USM Pitch	0°
USM Y offset (cm, positive outboard)	0

SIS Offset results

EM 2040P					
Forward (X)	Starboard (Y)	Down (Z)	Roll	Pitch	Heading
-0.06	0.350	2.230	0°	0°	0°
Waterline					
Measure System center to waterline and enter into SIS. Positive down value.					

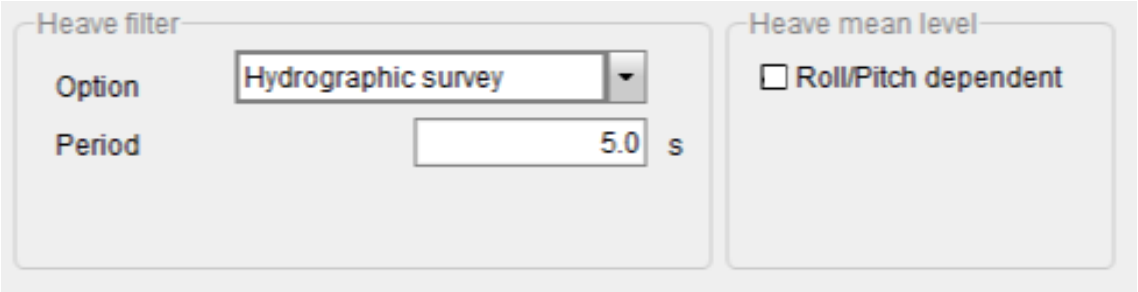
Seapath offset results

EM 2040 Monitoring point					
Forward (X)	Starboard (Y)	Down (Z)			
-0.06	0.350	2.230			
GNSS Geometry					
Forward (X)	Starboard (Y)	Down (Z)			Heading
-0.5	0	-1.01			0°
MRU Geometry					
Forward (X)	Starboard (Y)	Down (Z)	Roll	Pitch	Heading
-0.255	0.35	1.875	180°	0°	0°

MRU Heave Filter

Select ***MRU → Heave Filter.***

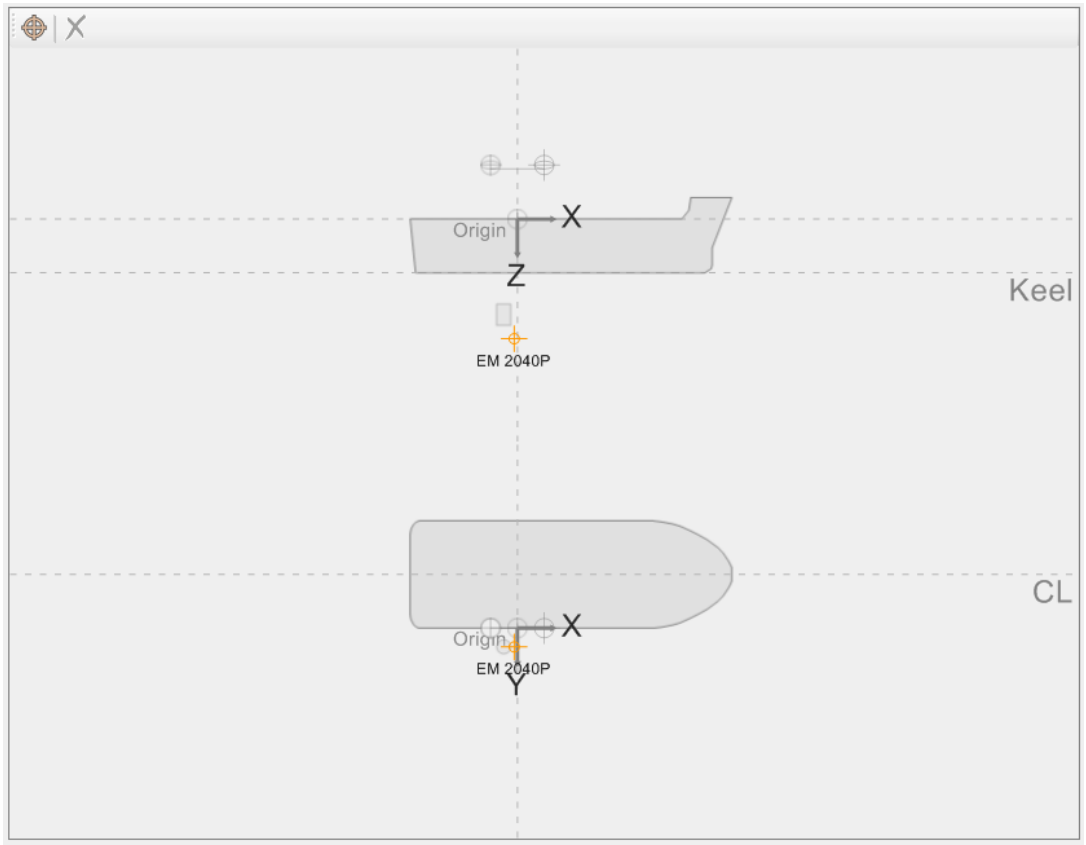
The **Heave filter** is to be set at 5s for smaller vessels. For the '*Heave mean level'* configuration uncheck the option '*Roll/Pitch dependent*'. Please, refer to Seapath Operator Manual for details on how to set the *Heave Filter* for different navigation conditions or consult with Seatex customer support.



Monitoring Point – EM 2040P Geometry

Select ***Monitoring Points → Geometry.***
The lever arm vector from the NRP to the EM 2040P location has to be measured or calculated based upon drawings or previously measured points and entered into the software. This is the location of the EM 2040P center geometry on the mounting pole with respect to the NRP. The EM 2040P offsets are entered as a Monitoring Point, and should be the preferred Reference Point for Delayed Heave data logging.

Enter EM 2040P offsets as ***X = -0.06m***, ***Y = +0.350m*** and ***Z= +2.43m***.



☑ Show sensors

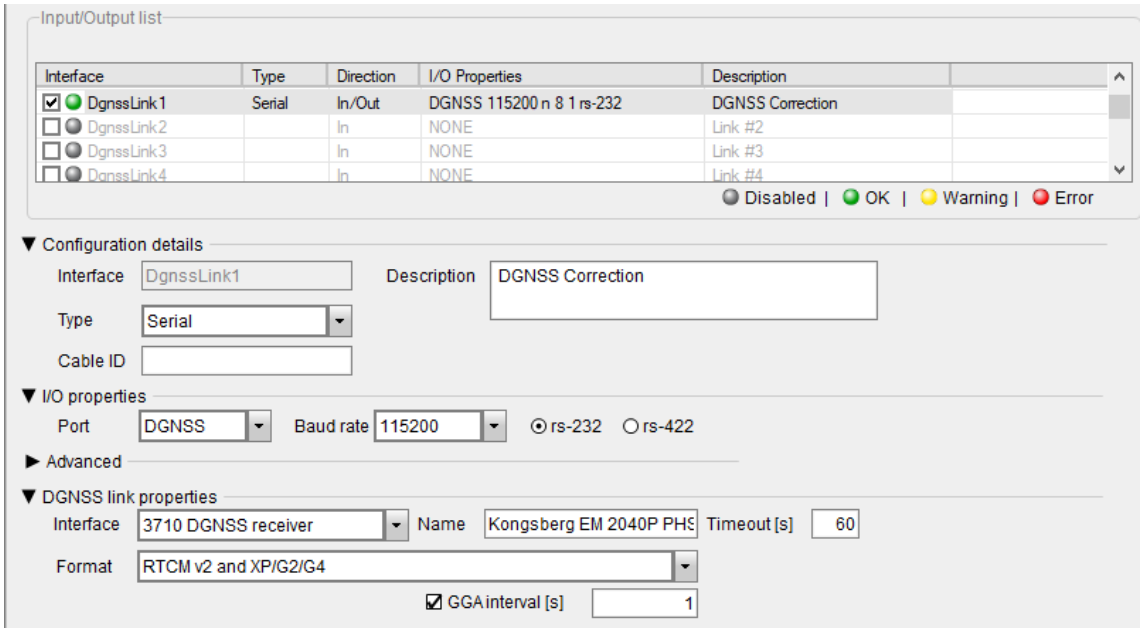
		Position [m]		
ID	Name	X	Y	Z
1	EM 2040P	-0.060	0.350	2.430

Monitoring points are entered relative to Origin

Seapath *Input/Output* generic setup

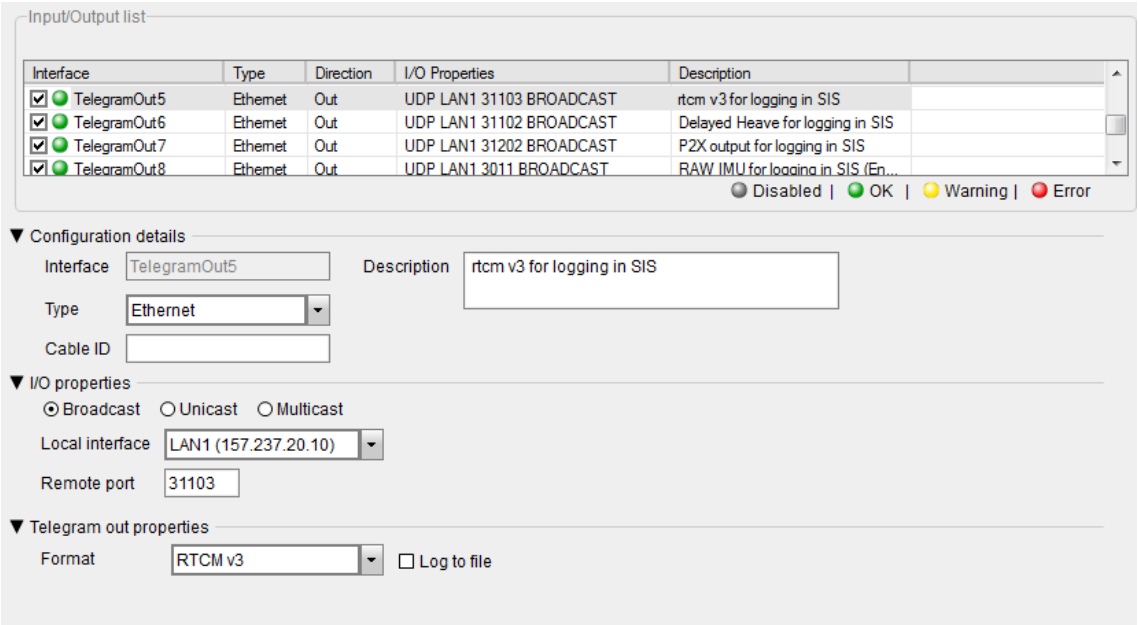
Select ***Communication Interface → Input/Output.***

DGNSS setup
Click on ***DgnssLink1***; configure as follows. The DGNSS Serial port as well as some generic outputs are always the same regardless of the version of software package used. DGNSS Serial to be set up to receive standard RTK over RS232.



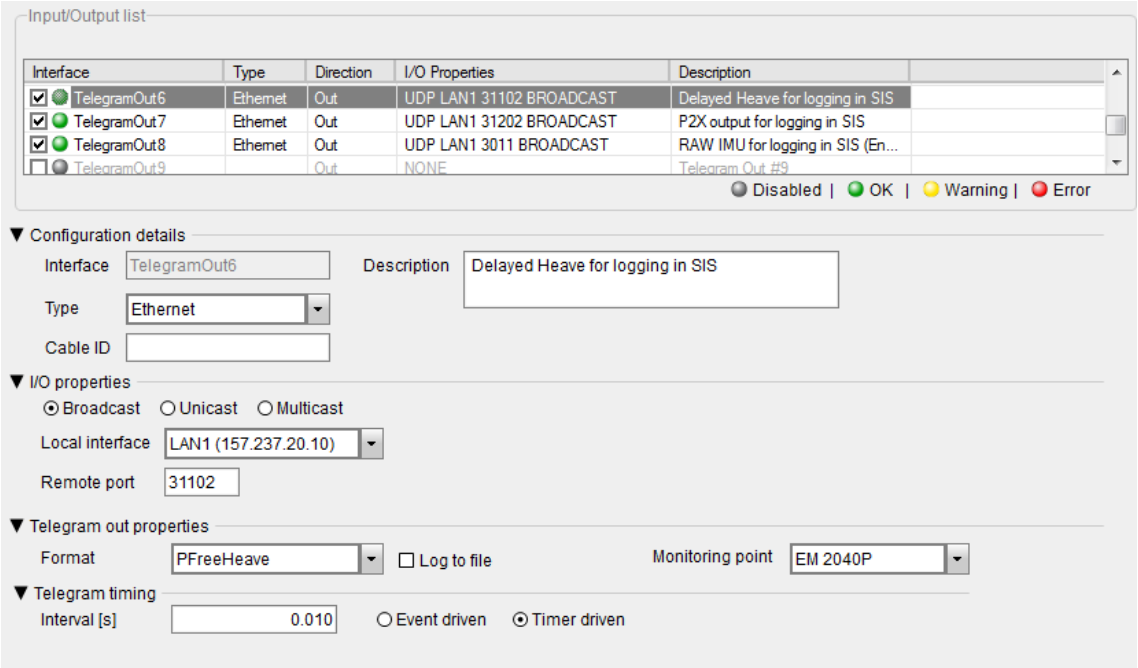
RTCM Data Output (For Logging in SIS)

Click on ***TelegramOut5***; configure as follows. Select to output *Delayed Heave* over UDP port 31103. Logging RTCM allows for a lot of positioning post-processing options (PPP and PPK). It is recommended to log this output in SIS if you are not using a correctional service to improve your position. RTCM data can be logged in SIS or Seapath.



Delayed Heave

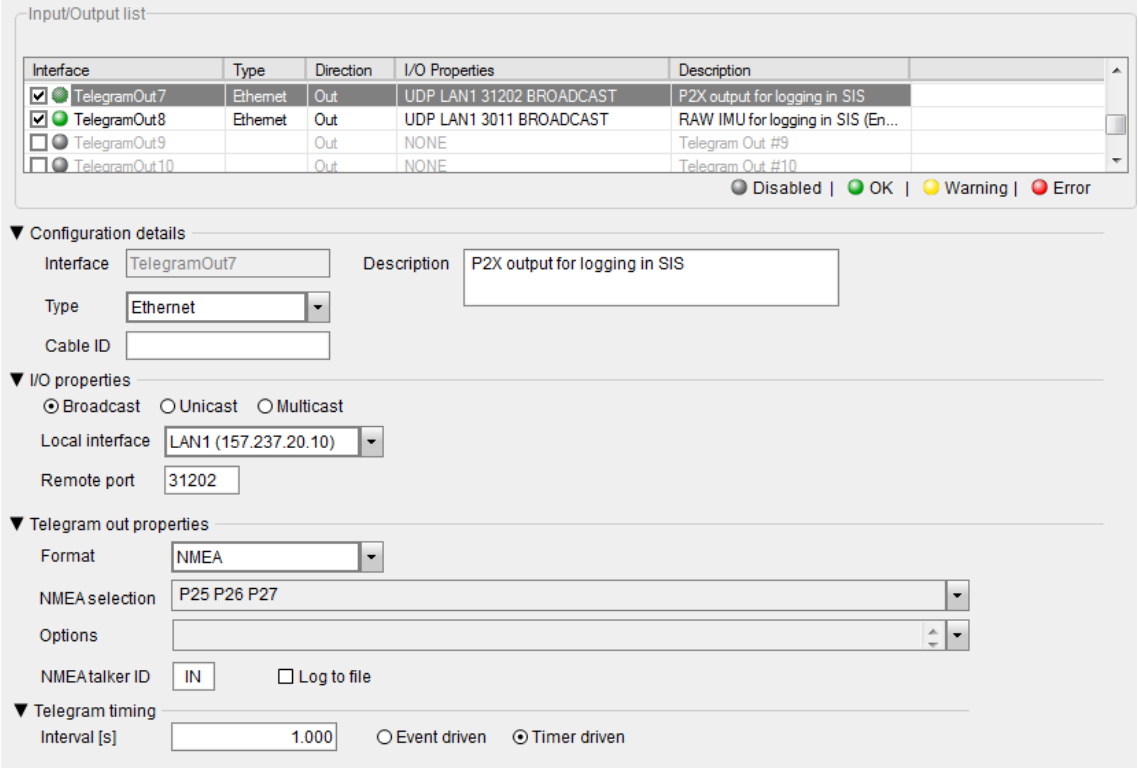
Click on ***TelegramOut6***; configure as follows. Select to output *Delayed Heave* over UDP port 31102 @ 100 Hz. Can be logged in SIS or Seapath. It is important to reference the *Delayed Heave* (PFREEHEAVE) to the sonar head when using SIS 4.x.x as this will ease the workflow during data post-processing for many customers.



Configuration Parameters and vectors for the GNSS antennas, monitoring points and MRU (P2X output for logging in SIS)

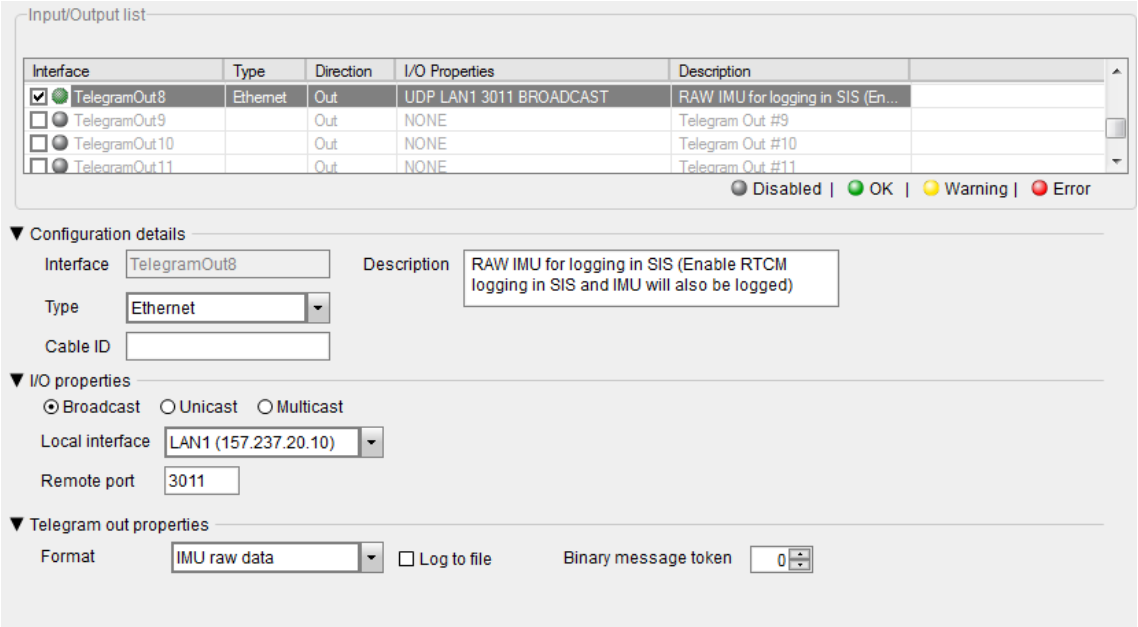
It is also possible to output and log configuration parameters and vectors for the GNSS antennas, monitoring points and MRU. These configuration parameters are available through the proprietary NMEA formats P25, P26 and P27.

Click on ***TelegramOut7***; configure as follows. Logging P2X creates a new file every time you change offsets or other installation settings in the Seapath; handy for post processing purposes. P2X data can be logged in SIS or Seapath.



Raw IMU Data Output (For logging in SIS)

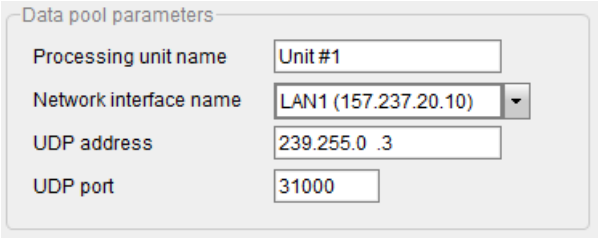
Click on ***TelegramOut8***; configure as follows. Logging Raw IMU data allows for post-processing of IMU data (smoothing and other options). Raw IMU data can be logged in SIS or Seapath.



Seapath Communication Interface setup

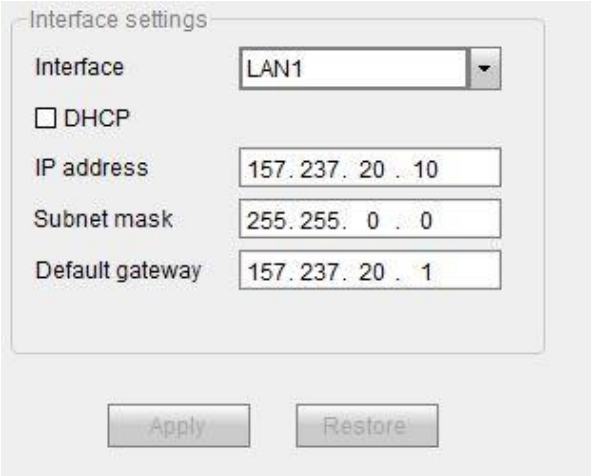
Select ***Communication Interface → Serial port extender.***

Make sure the Data pool parameters are defined as follows.



Select ***Network***

Make sure the network *Interface Settings* are defined as follows.



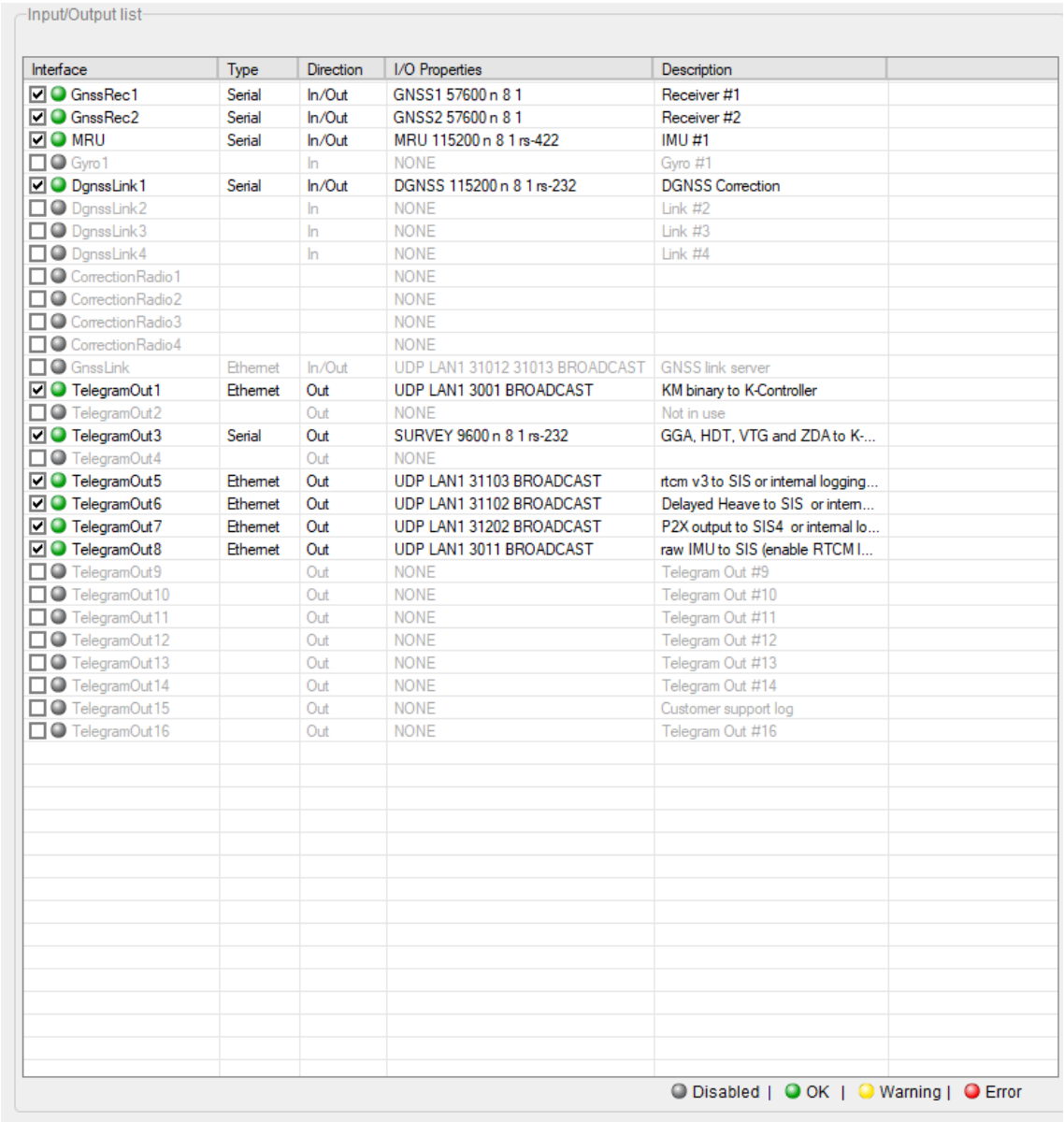
Note: the Seapath will reset everything upon restart if the *Default Gateway* is not in the same IP range as the *IP address*.

The EM Multibeam system is configured to work in the 157.237.xx.xx IP range (domain). As everything is connected through the same LAN, and the Seapath HMI needs to reach the Seapath PU through that same network, the Seapath also needs to be configured in this IP range. The above settings should be applied for the Seapath unit to work seamlessly with the Portable Processing Unit (PPU).

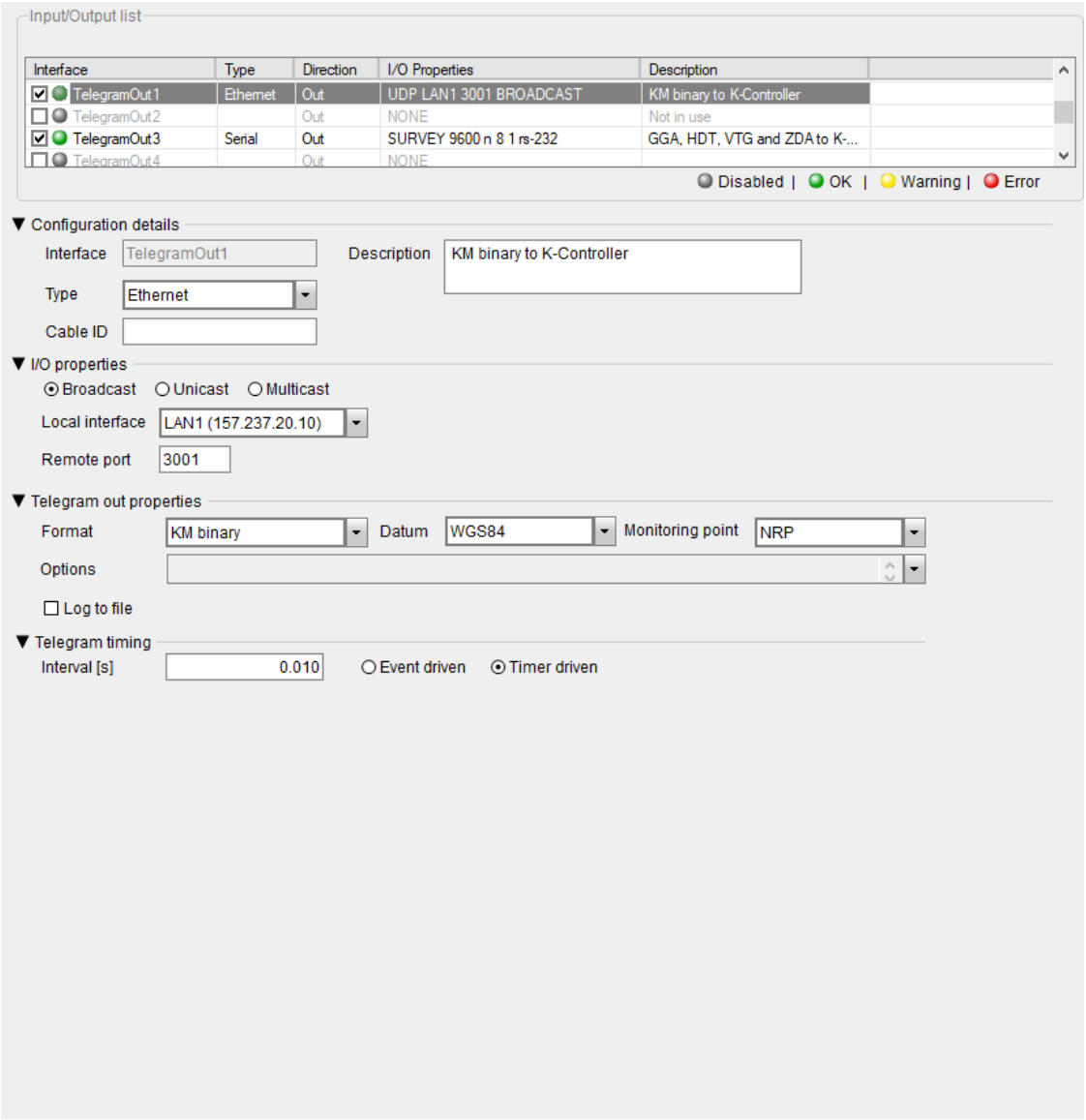
Seapath setup for K-Controller users (SIS5)

The following screen capture from the *Seapath Nav Engine* shows a summary and description of all inputs and outputs in Seapath for K-Controller users.

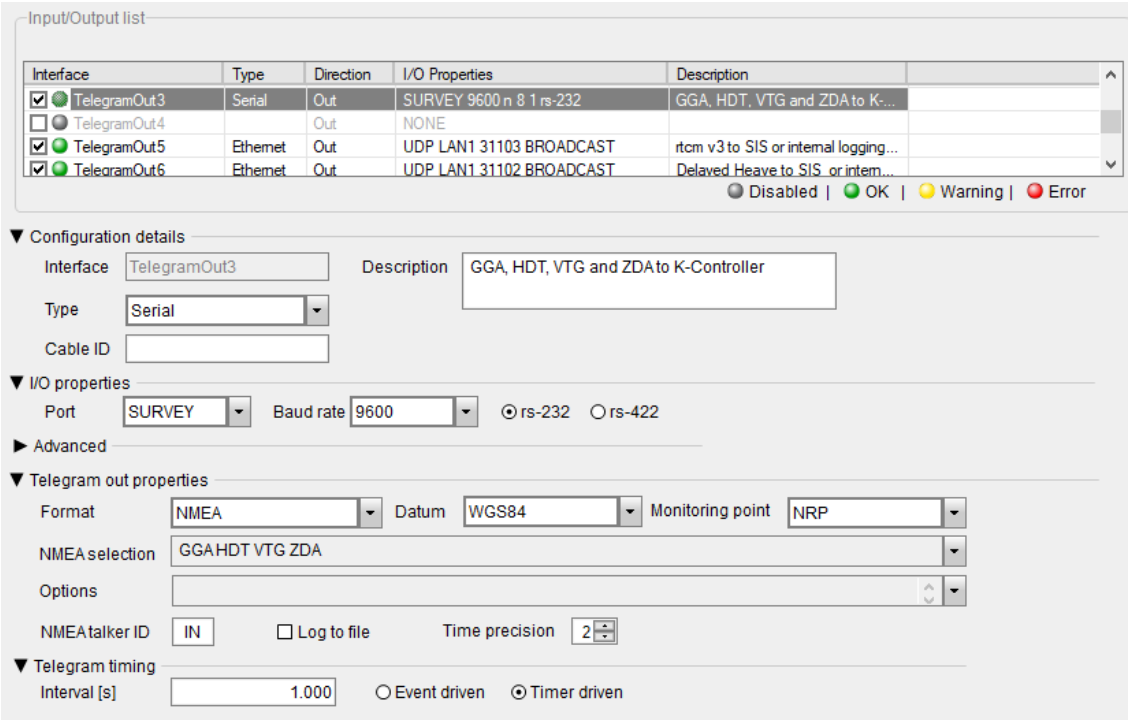
Because K-Controller allows us to receive all available data from Seapath over ethernet, a different setup is preferred.



TelegramOut1 supplies the system with motion and attitude velocity as well as time and date. Broadcasted as ***KM Binary*** over Ethernet at 100 Hz.

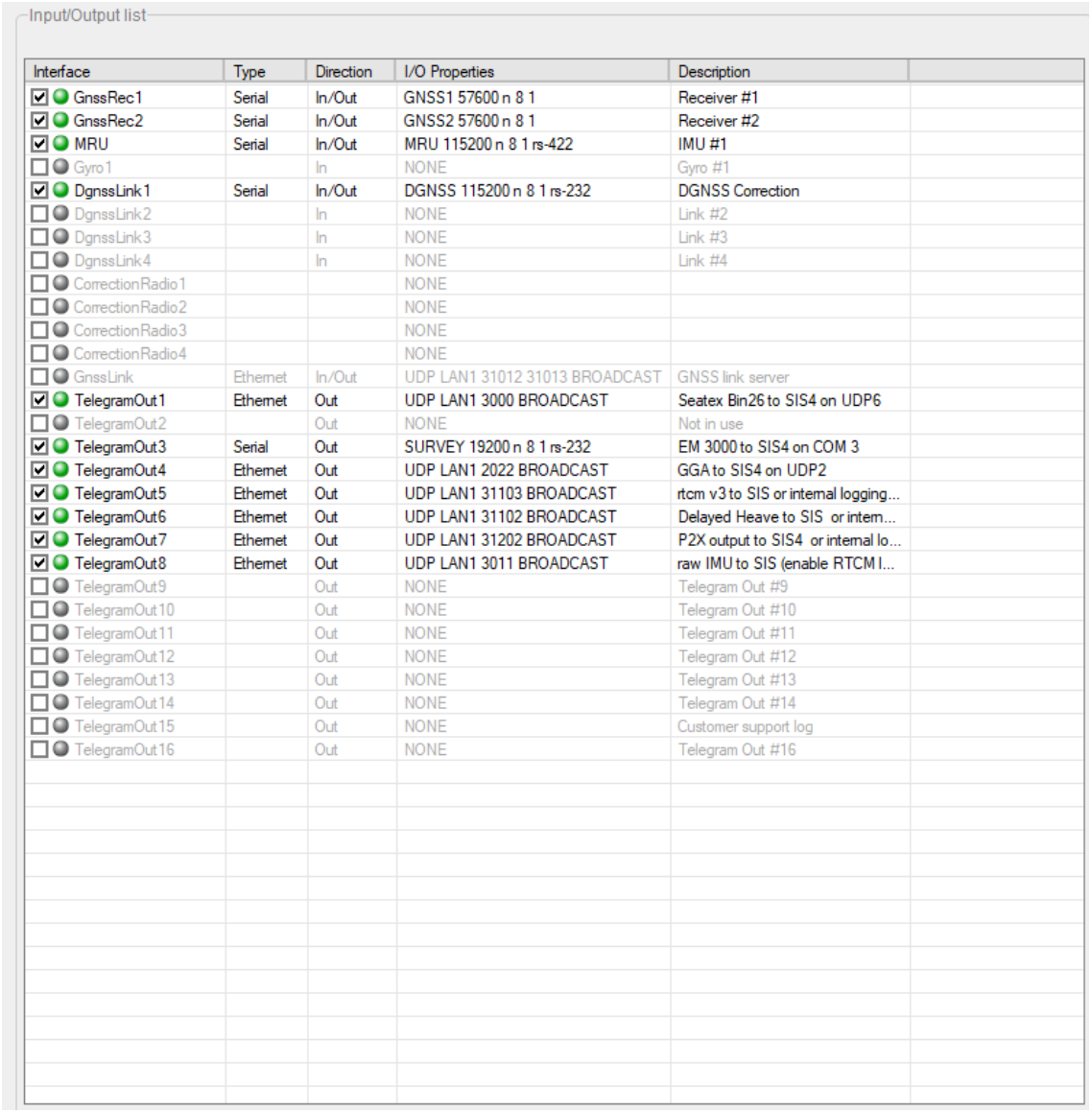


TelegramOut3 supplies the system with ***NMEA GGA, HDT, VTG*** and ***ZDA***.
Broadcasted as ***SURVEY*** Serial 9600/8/N/1 at 1 Hz.



Seapath setup for SIS 4.x.x users

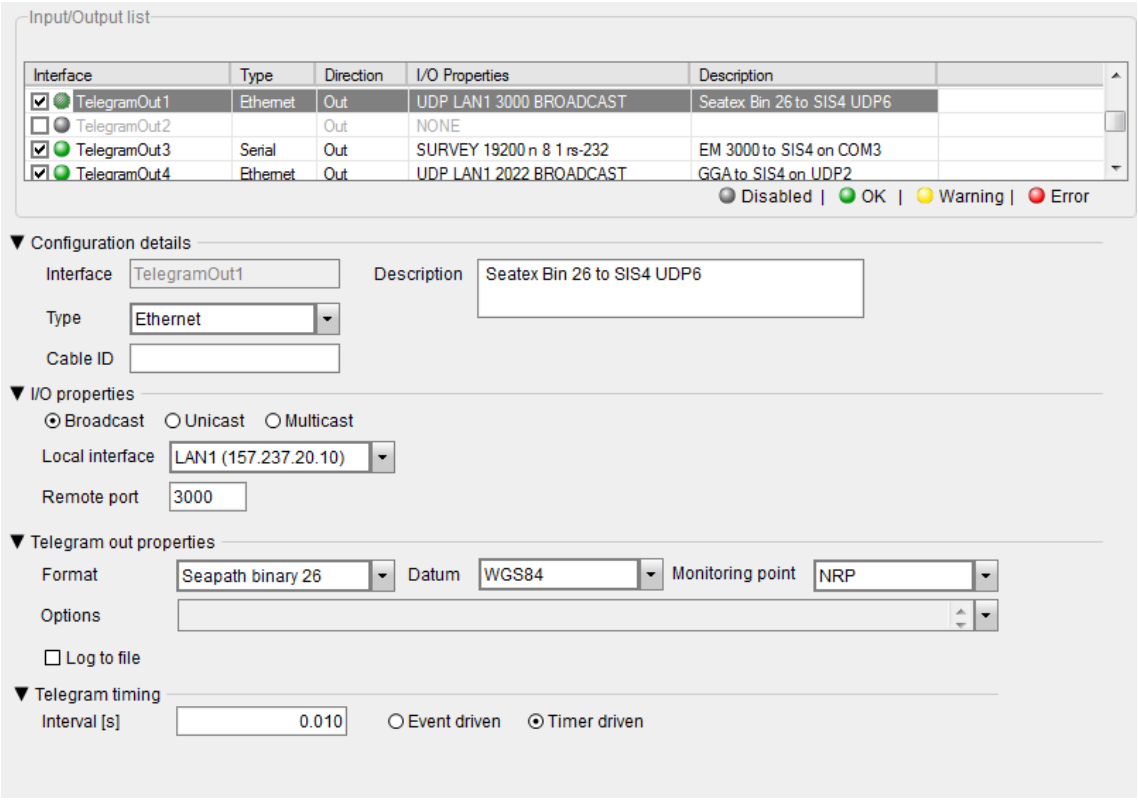
The following screen capture from the *Seapath Nav Engine* shows a summary and description of all inputs and outputs in Seapath for SIS 4.x.x users.



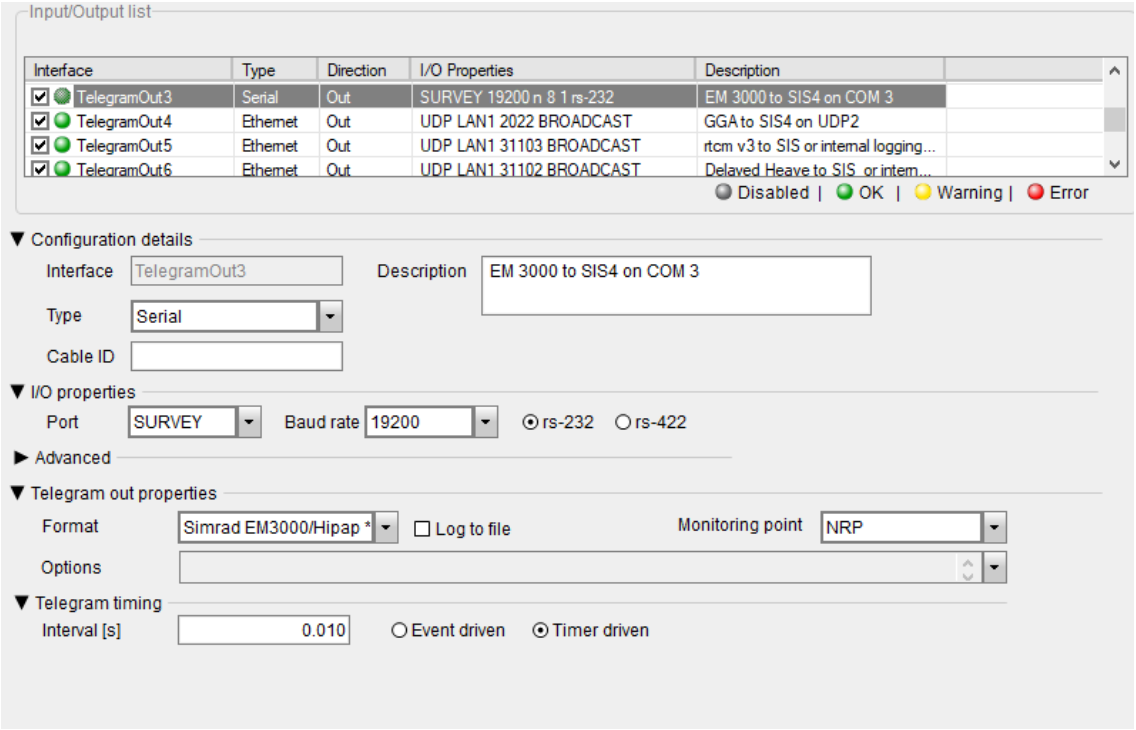
Input/Output list

Interface	Type	Direction	I/O Properties	Description
GnssRec1	Serial	In/Out	GNSS1 57600 n 8 1	Receiver #1
GnssRec2	Serial	In/Out	GNSS2 57600 n 8 1	Receiver #2
MRU	Serial	In/Out	MRU 115200 n 8 1 rs-422	IMU #1
Gyro1		In	NONE	Gyro #1
DgnssLink1	Serial	In/Out	DGNSS 115200 n 8 1 rs-232	DGNSS Correction
DgnssLink2		In	NONE	Link #2
DgnssLink3		In	NONE	Link #3
DgnssLink4		In	NONE	Link #4
CorrectionRadio1			NONE	
CorrectionRadio2			NONE	
CorrectionRadio3			NONE	
CorrectionRadio4			NONE	
GnssLink	Ethernet	In/Out	UDP LAN1 31012 31013 BROADCAST	GNSS link server
TelegramOut1	Ethernet	Out	UDP LAN1 3000 BROADCAST	Seatex Bin26 to SIS4 on UDP6
TelegramOut2		Out	NONE	Not in use
TelegramOut3	Serial	Out	SURVEY 19200 n 8 1 rs-232	EM 3000 to SIS4 on COM 3
TelegramOut4	Ethernet	Out	UDP LAN1 2022 BROADCAST	GGA to SIS4 on UDP2
TelegramOut5	Ethernet	Out	UDP LAN1 31103 BROADCAST	rtcm v3 to SIS or internal logging...
TelegramOut6	Ethernet	Out	UDP LAN1 31102 BROADCAST	Delayed Heave to SIS or intern...
TelegramOut7	Ethernet	Out	UDP LAN1 31202 BROADCAST	P2X output to SIS4 or internal lo...
TelegramOut8	Ethernet	Out	UDP LAN1 3011 BROADCAST	raw IMU to SIS (enable RTCM I...
TelegramOut9		Out	NONE	Telegram Out #9
TelegramOut10		Out	NONE	Telegram Out #10
TelegramOut11		Out	NONE	Telegram Out #11
TelegramOut12		Out	NONE	Telegram Out #12
TelegramOut13		Out	NONE	Telegram Out #13
TelegramOut14		Out	NONE	Telegram Out #14
TelegramOut15		Out	NONE	Customer support log
TelegramOut16		Out	NONE	Telegram Out #16

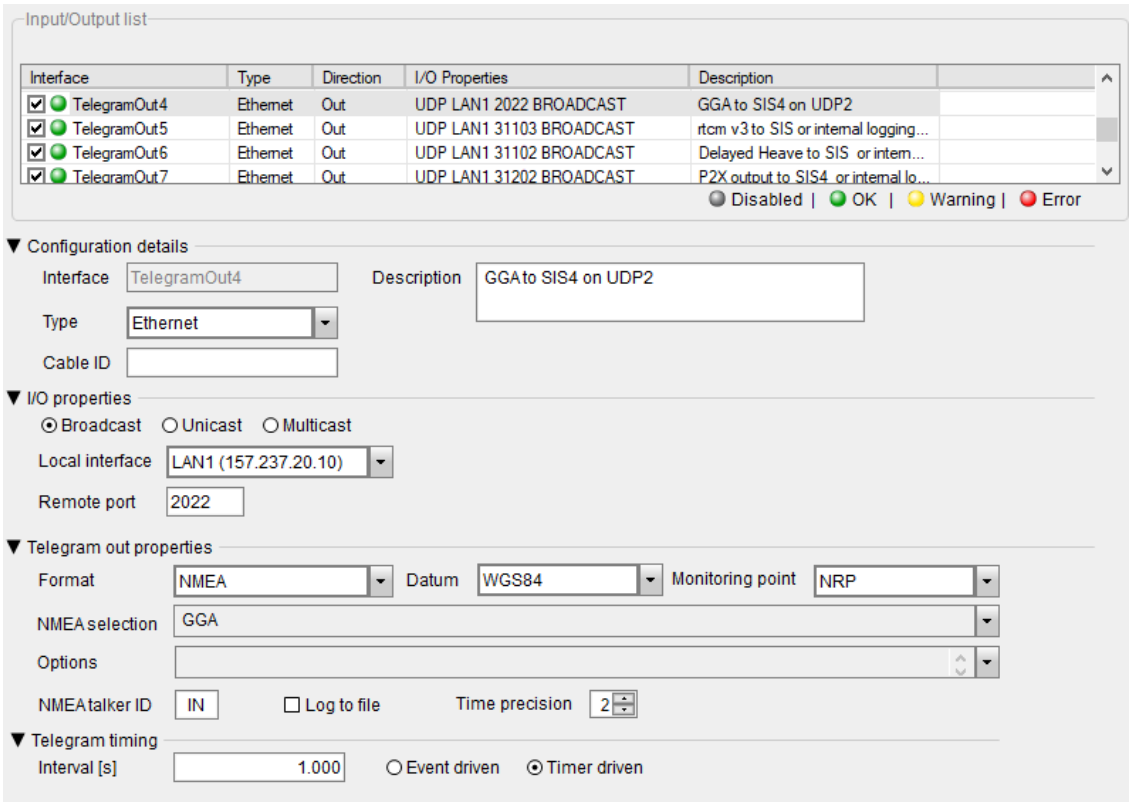
TelegramOut1 supplies the system with Attitude velocity corrections. Broadcasted as '*Seatex Binary 26'* over Ethernet at 100 Hz.



TelegramOut3 supplies system with motion. Broadcasted as ***EM 3000*** datagram over ***SURVEY*** serial 19200/N/8/1 at 100 Hz.



TelegramOut4 supplies system with NMEA GGA. Broadcasted as ***NMEA GGA*** over Ethernet at 1 Hz.

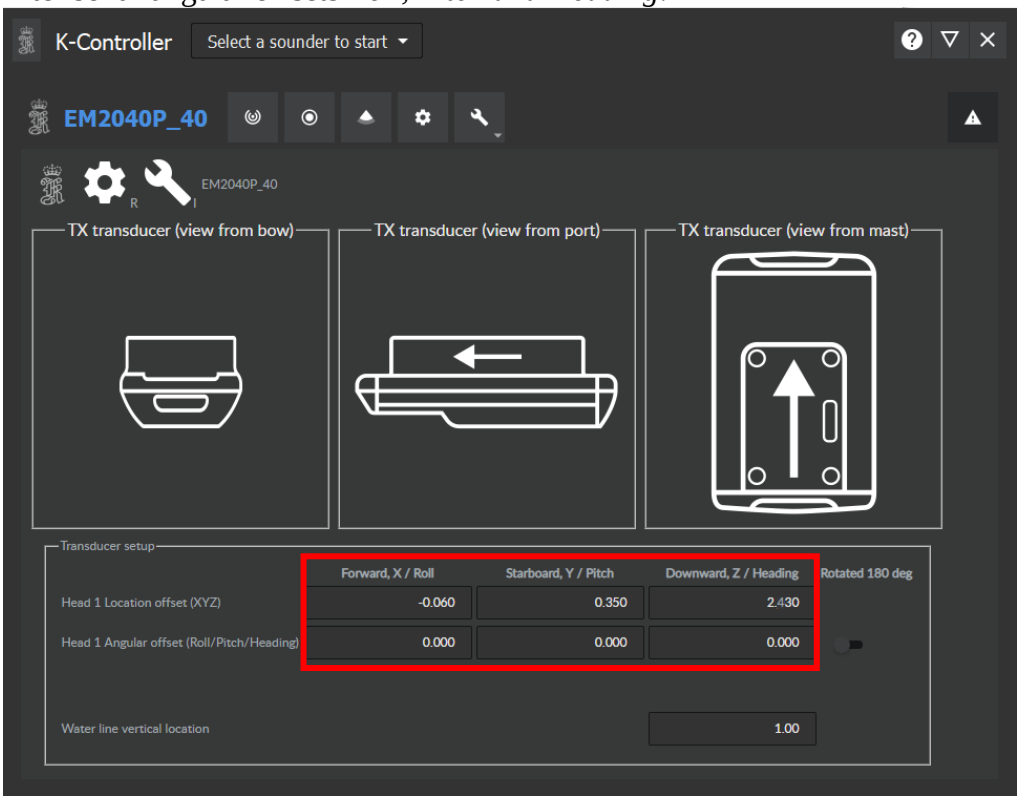


Remember to set time as '***Active Positioning System***' in SIS 4.x.x

Setting transducer offsets in K-Controller (SIS 5.x.x)

The only offsets that should be set in SIS5 is the location of the sonar and angular offsets, all referenced to ***Survey Origin*** as seen in the Seapath offset settings. Position and attitude offsets should already be referenced to ***Survey Origin*** and so we leave those alone and make modifications only to sonar head.

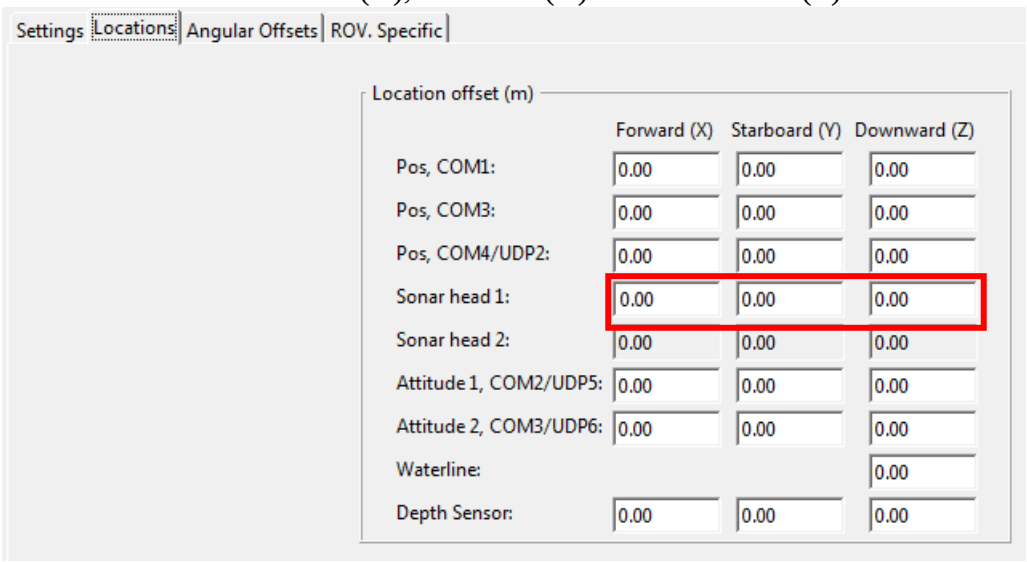
1. Click *the* ***Installation parameters*** function  , then select ***Transducer Setup***.
   Enter sonar offsets *Forward(X), Starboard(Y) and Downward (Z).*
   Enter sonar angular offsets *Roll, Pitch and Heading*.



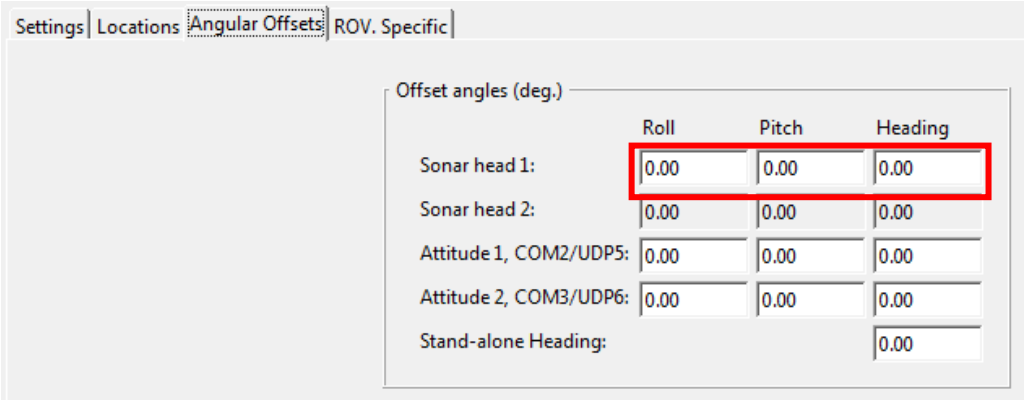
Setting transducer offsets in SIS 4.x.x

The only offsets that should be set in SIS is the location of the sonar and angular offsets, all referenced to ***Survey Origin*** as seen in the Seapath offset settings. Position and attitude offsets should already be referenced to ***Survey Origin*** and so we leave those alone and make modifications only to sonar head

1. Click ***View – Tear off*** – ***Installation parameters*** in SIS upper left corner
2. Click the ***Sensor setup*** tab and then the ***Locations*** subtab
3. Enter sonar offsets Forward(X), Starboard(Y) and Downward (Z)

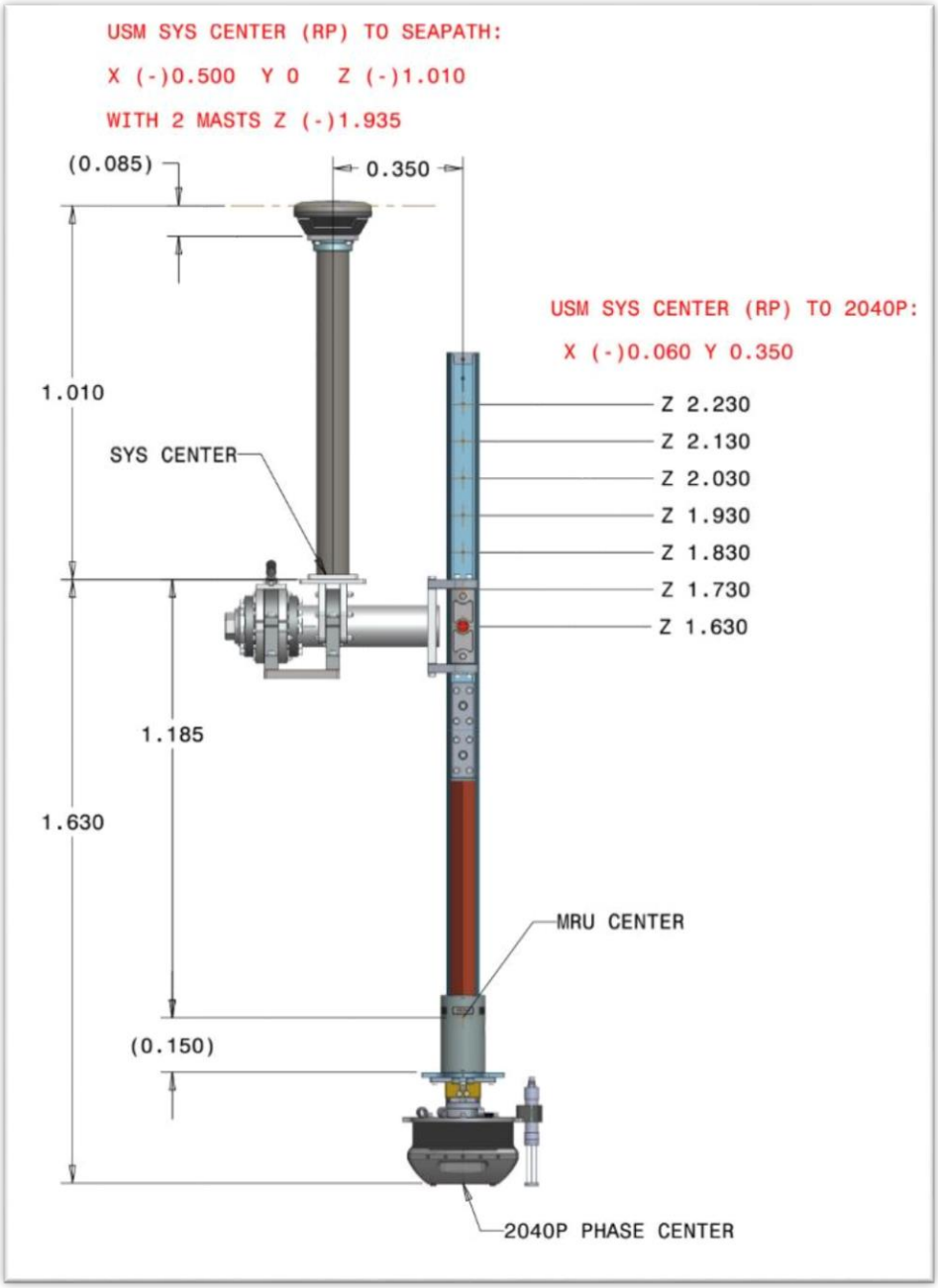


4. Click the ***Angular Offsets*** subtab
5. Enter sonar angular offsets Roll, Pitch and Heading.



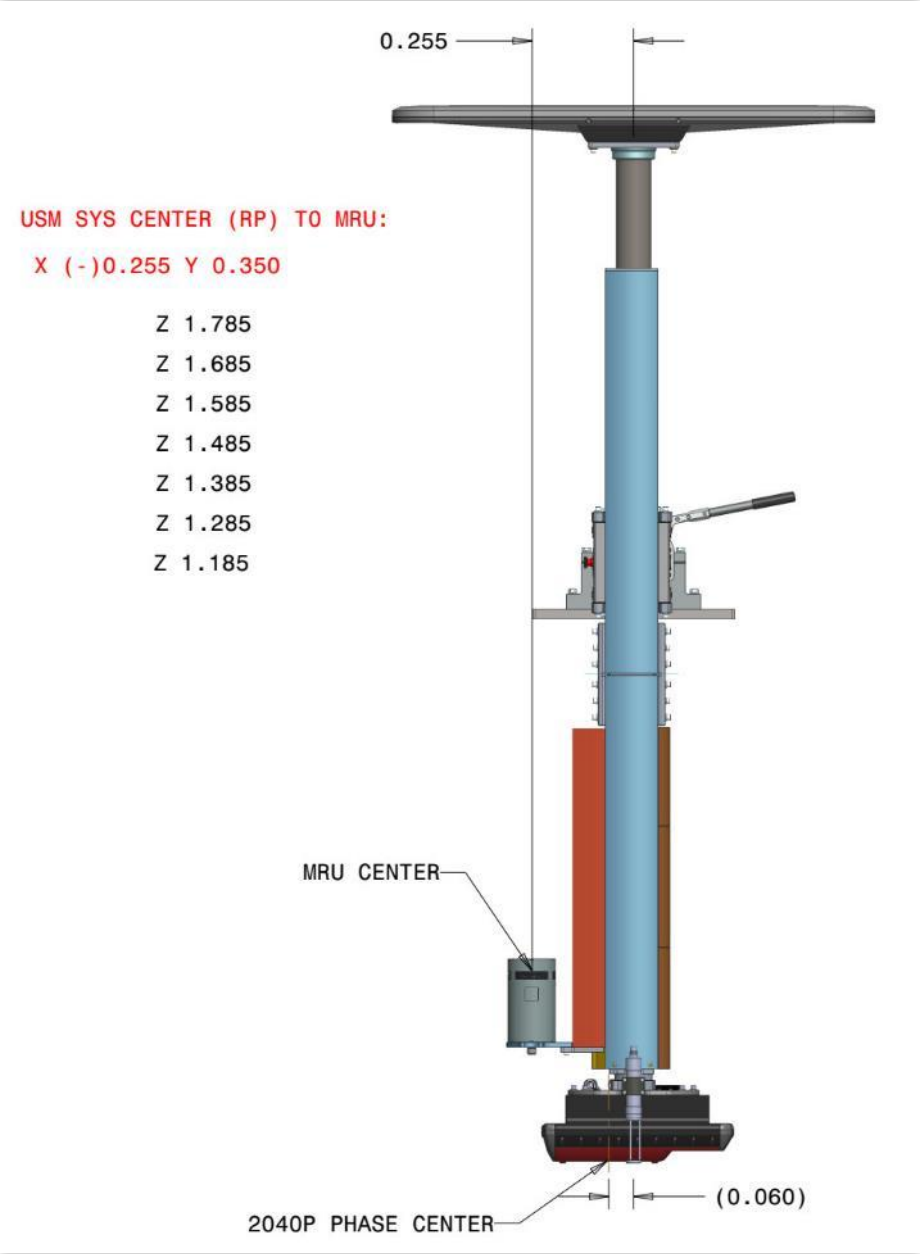
System Drawings

EM 2040 PHS – MRU at the bottom, MRU cable facing down - Rear view



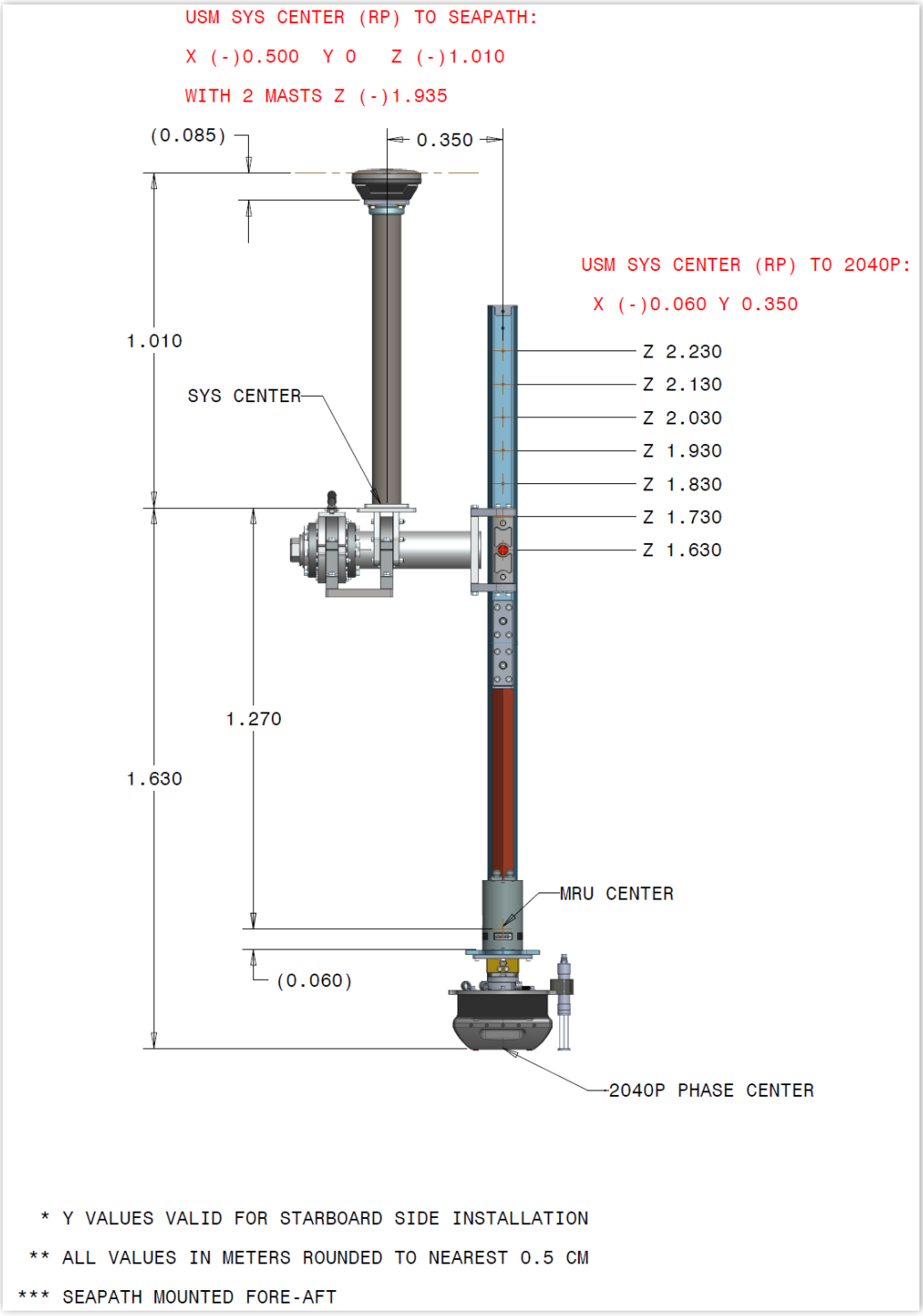
Please, also refer to '**ANNEX 1**' document for more details.

EM 2040 PHS – MRU at the bottom, MRU cable facing down - Side view



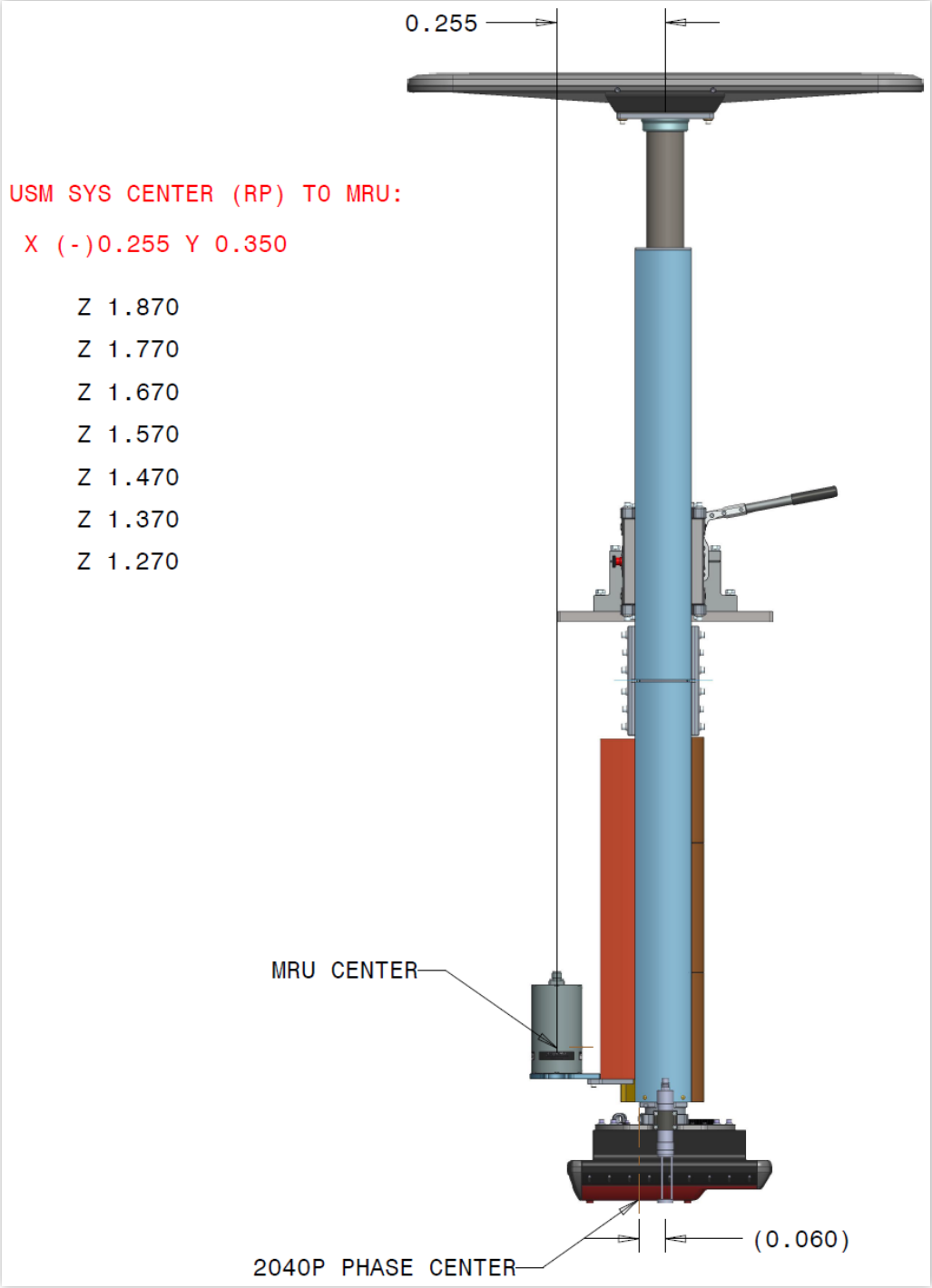
Please, also refer to '**ANNEX 1**' document for more details.

EM 2040 PHS – MRU at the bottom, MRU cable facing up - Rear view



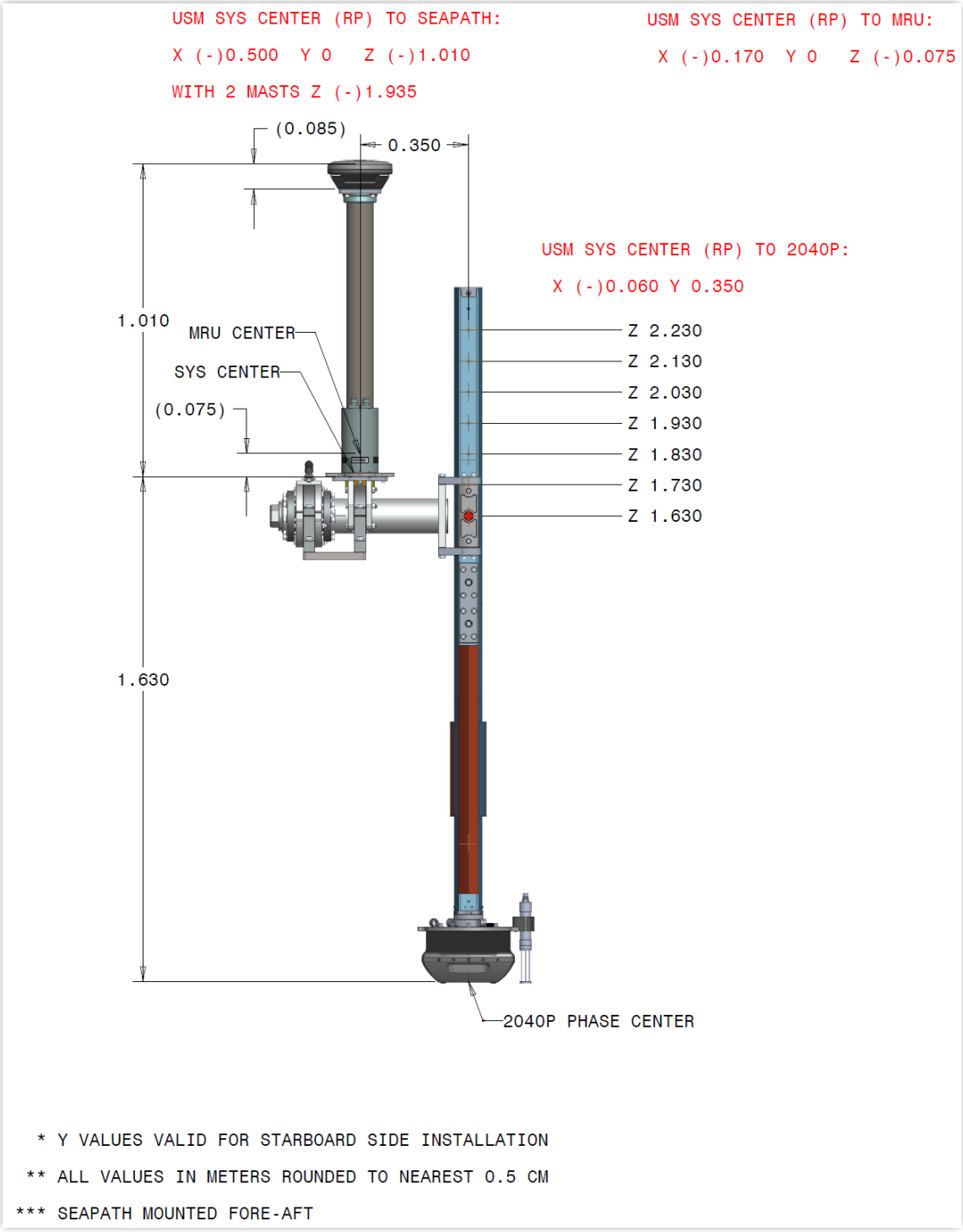
Please, also refer to '**ANNEX 1**' document for more details.

EM 2040 PHS – MRU at the bottom, MRU cable facing up - Side view



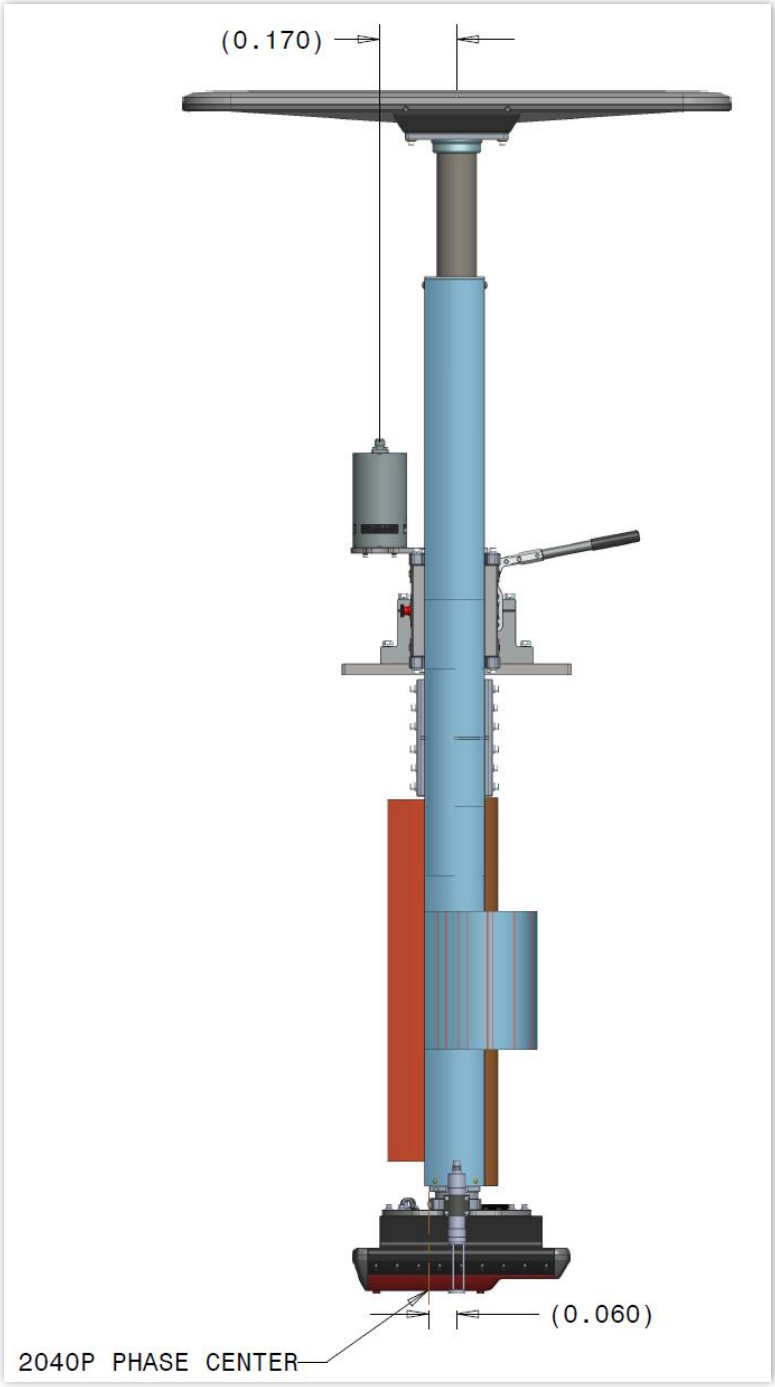
Please, also refer to '**ANNEX 1**' document for more details.

EM 2040 PHS – MRU at the topside, MRU cable facing up - Rear view



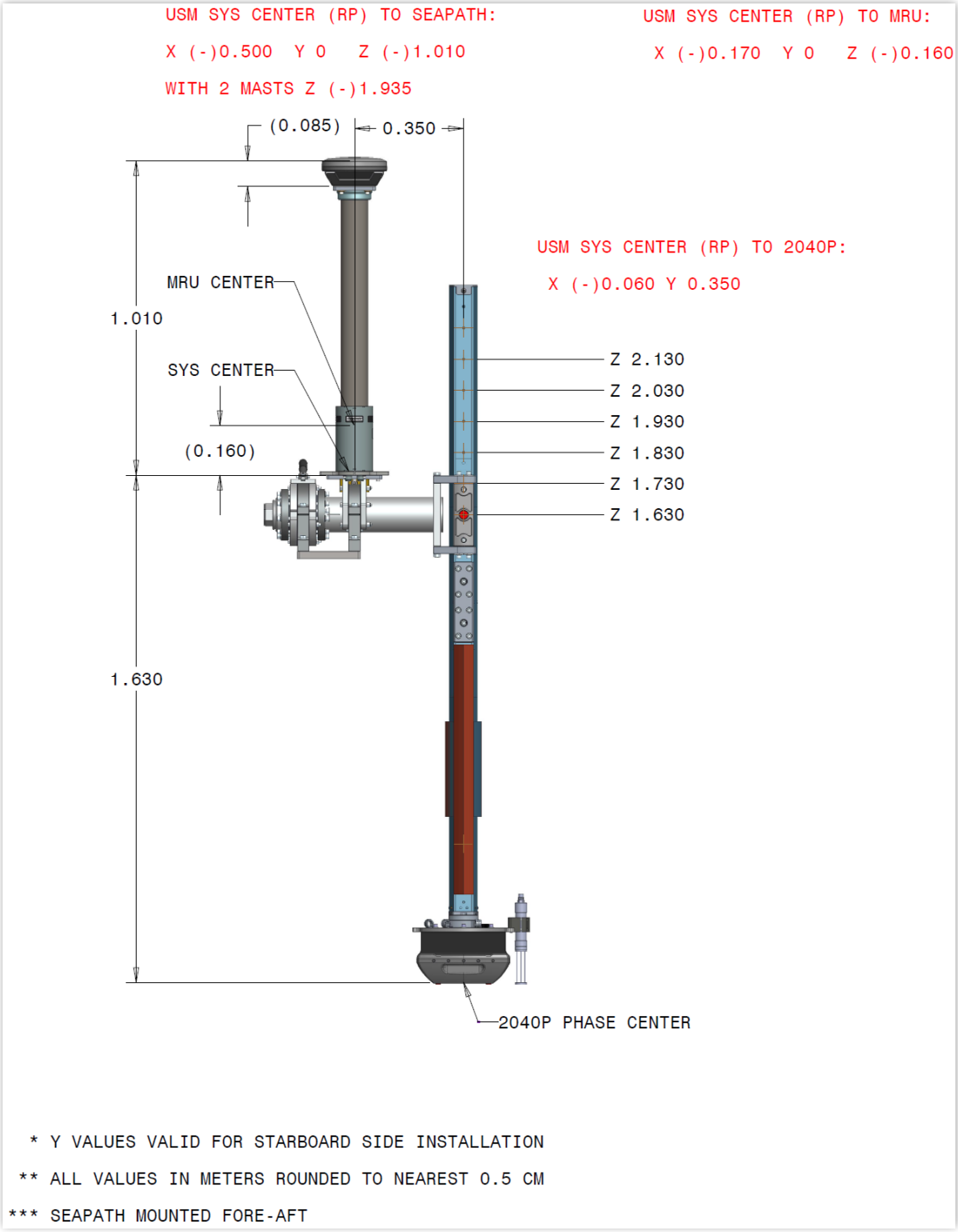
Please, also refer to '**ANNEX 1**' document for more details.

EM 2040 PHS – MRU at the topside, MRU cable facing up - Side view



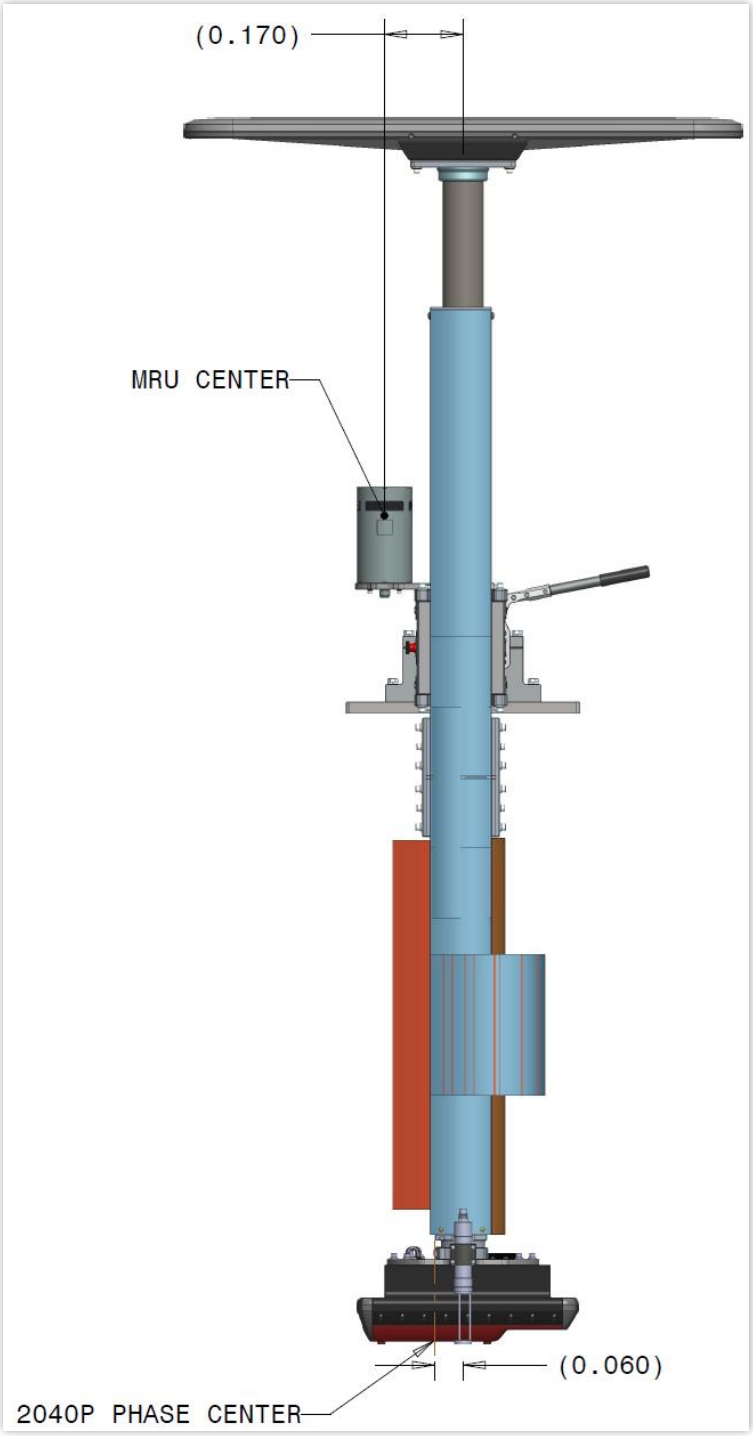
Please, also refer to '**ANNEX 1**' document for more details.

EM 2040 PHS – MRU at the topside, MRU cable facing down - Rear view



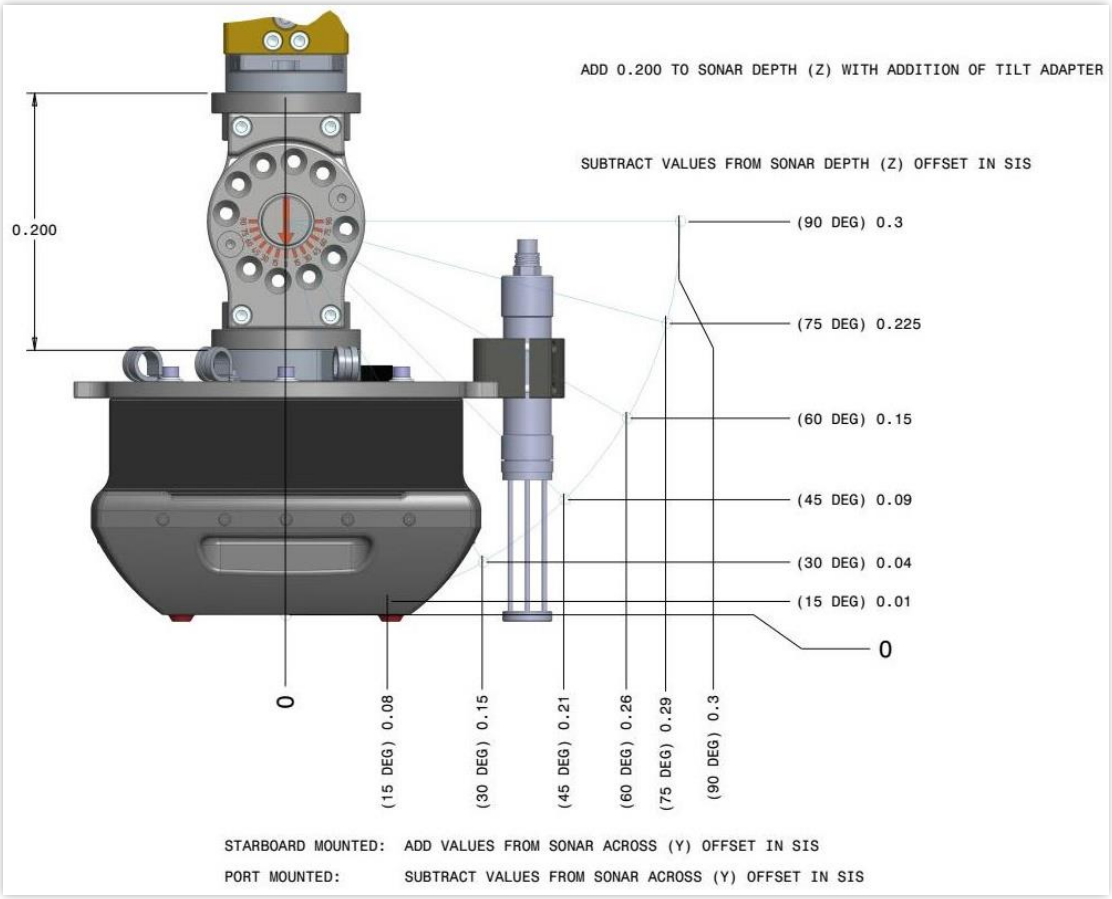
Please, also refer to '**ANNEX 1**' document for more details.

EM 2040 PHS – MRU at the topside, MRU cable facing down - Side view



Please, also refer to '**ANNEX 1**' document for more details.

EM 2040P PHS overview – Tilt Adapter

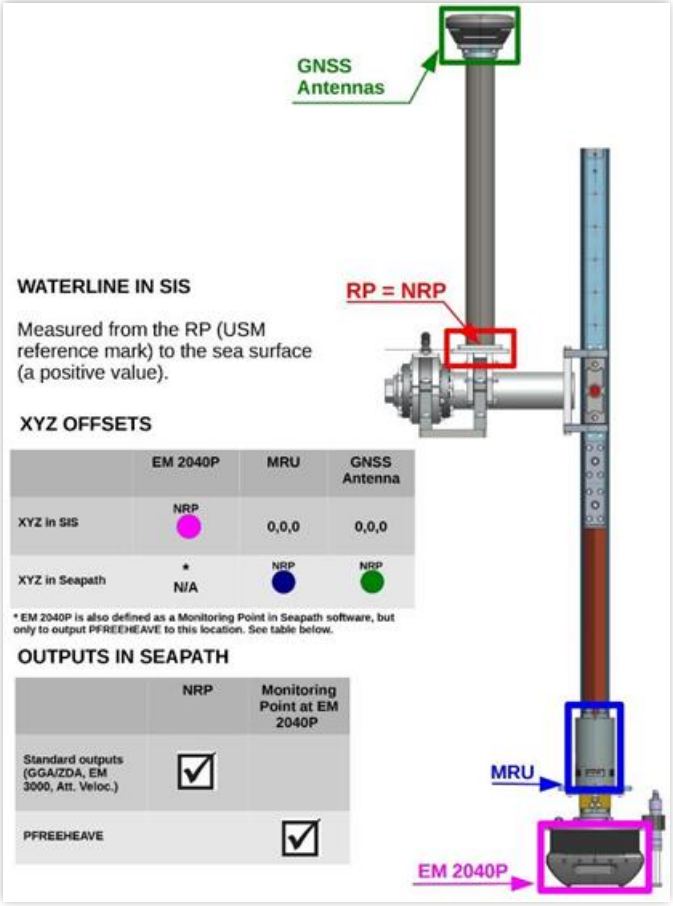


Please, also refer to '**ANNEX 1**' document for more details.

Different offsets scenarios for the EM 2040 PHS

Scenario No. 1 (RECOMMENDED and preconfigured state)

- All standard outputs to Navigation Reference Point (NRP) in Seapath
- Delayed Heave to EM 2040P.



Advantages:

- Logs delayed heave at sonar head (to be applied with post-processing software)
- Fairly easy to change offsets if tilting or changing height

Tilt change:

- Need to change Monitoring Point EM 2040P in Seapath HMI
- Need to change sensor location Y and Z offset in SIS or K-Controller

Pole index change:

- Need to change MRU geometry and monitoring point EM 2040P in Seapath

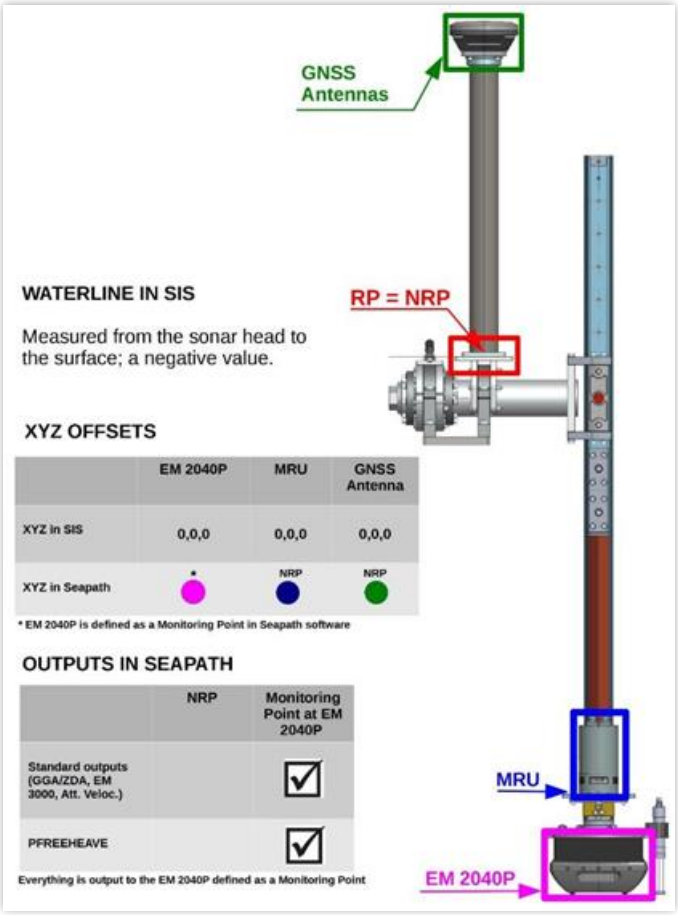
HMI

- Need to change sensor location Z offset in SIS or K-Controller

Please, also refer to '**ANNEX 1**' document for more details.

Scenario No. 2

- All standard outputs reference to the EM 2040P Sonar Head.



Advantages:

- Logs delayed heave at sonar head (to be applied with post-processing software)
- Logs all data to the same point

Disadvantages:

- This option creates the most changes to offsets when changing tilt or index setting

Tilt change:

- Need to change Monitoring point EM 2040P in Seapath HMI
  Need to change GNSS geometry in Seapath HMI
- Need to change MRU geometry in Seapath HMI
- Need to change waterline in SIS

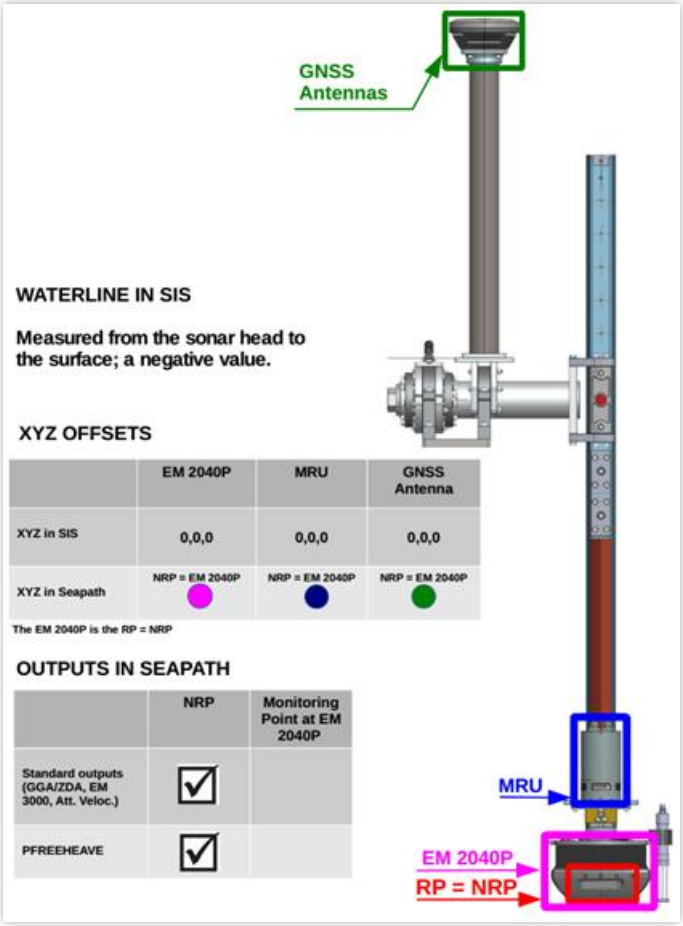
Pole index change:

- Need to change GNSS geometry in Seapath HMI
- Need to change waterline in SIS

Please, also refer to '**ANNEX 1**' document for more details.

Scenario No. 3

- EM 2040P is the Navigation Reference Point (NRP) for all offsets



Advantages:

- Logs delayed heave at sonar head (to be applied with post-processing software)
- Logs all data to the same point
- Only one reference point in the system

Disadvantages:

- More options for offsets

Tilt change:

- Need to change GNSS geometry in Seapath HMI
- Need to change MRU geometry in Seapath HMI
- Need to change waterline in SIS

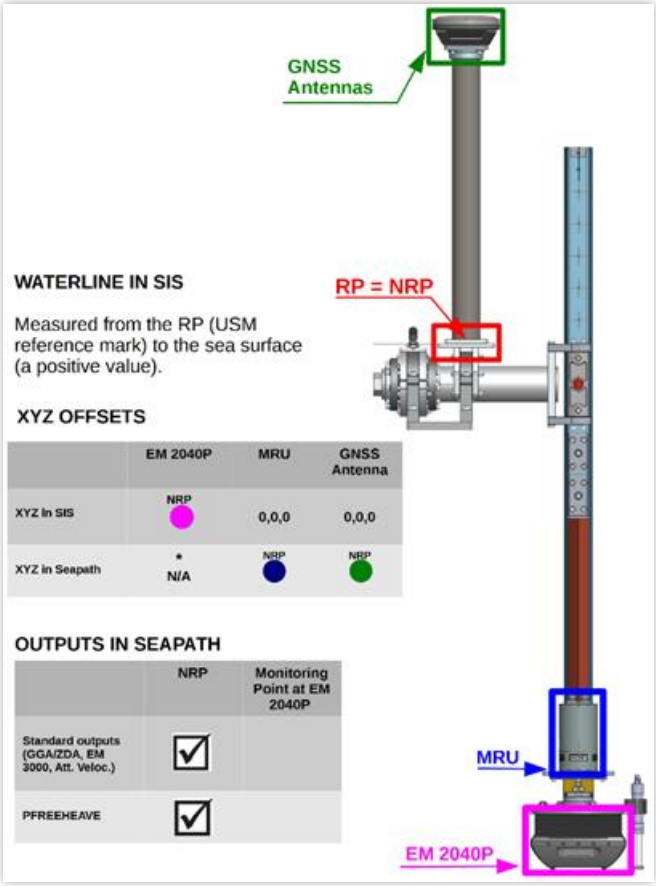
Pole index change:

- Need to change GNSS geometry in Seapath HMI
- Need to change waterline in SIS

Please, also refer to '**ANNEX 1**' document for more details.

Scenario No. 4

- All outputs referenced to Navigation Reference Point (NRP)



Advantages:

- Logs all data to the same point
- Has the least amount of changes to offsets when changing tilt or index setting

Disadvantages:

- Delayed heave is not referenced to sonar head, this is known to create problems for CARIS users

Tilt change:

- Need to change sensor location Y and Z offset in SIS or K-Controller

Pole index change:

- Need to change MRU geometry and monitoring point EM 2040P in Seapath HMI
- Need to change sensor location Z offset in SIS or K-Controller

Please, also refer to '**ANNEX 1**' document for more details.

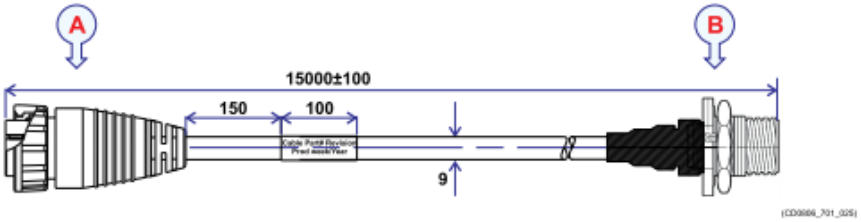
The interface cables for the Seapath 130

Seapath Antenna interface cable

A single cable from the Processing Unit to the Seapath 130 antennae.

Seapath antenna interface cable - with plug

The Portable Processing Unit can be connected to a Seapath 130 antenna with a dedicated cable. The cable is delivered with the Seapath 130 unit.



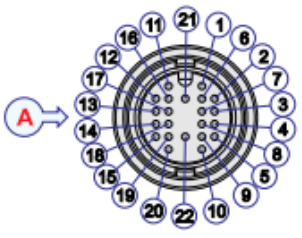
A			B	
22	18-36VDC FUSED	BLACK/WHITE	24 VDC	R
21	18-36VDC GND	BLACK	GND 24 VDC	B
19	ETH RX-	BROWN/WHITE	ETH RXD-	C
18	ETH RX+	BROWN	ETH RXD+	T
15	ETH TX-	RED/WHITE	ETH TXD-	S
14	ETH TX+	RED	ETH TXD+	P
16	DGNSS RTS/TXA	ORANGE/WHITE	DGNSS CTS/RXA	G
12	DGNSS TX/TXB	ORANGE	DGNSS RX/RXB	H
13	DGNSS CTS/RXA	YELLOW	DGNSS RTS/TXA	X
17	DGNSS RX/RXB	YELLOW/BLACK	DGNSS TX/TXB	A
11	DGNSS GND	GREEN/WHITE	DGNSS GND	J
9	SURVEY GND	GREEN	SURVEY GND	K
4	SURVEY RX	BLUE	SURVEY TX/TXB	c
5	SURVEY CTS	BLUE/WHITE	SURVEY RTS/TXA	M
10	PPS GND	PURPLE	1PPS GND	a
20	PPS +	PURPLE/WHITE	1PPS TXA	E
3	MRU RXA	GRAY/BLACK	MRU TXA	b
2	MRU RXB	GRAY	MRU TXB	F
7	MRU TXA	WHITE	MRU RXA	Z
8	MRU TXB	ORANGE/BLACK	MRU RXB	W
1	MRU LGND	PINK	MRU LGND	D
6	MRU PPS	RED/BLACK	MRU XIN (1PPS)	N

A *Local connection*

Amphenol LTW DU-22BFFA-SL7000

B *Connection to Seapath 130 antenna*

JVS07A1726SN



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

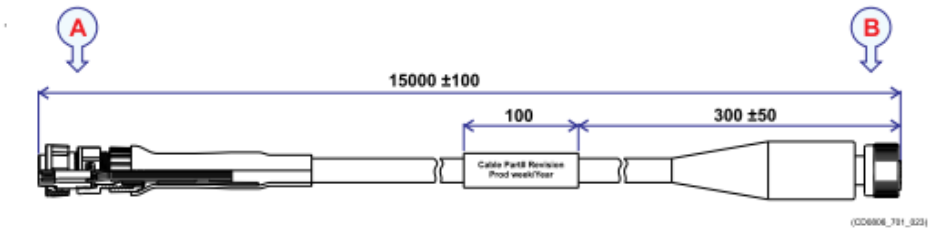
Relation between RS-232 and RS–422 pins

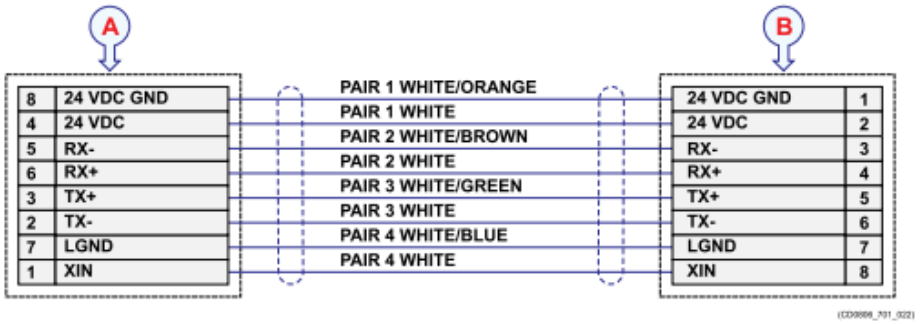
Seapath MRU interface cable

A single cable from The Processing Unit to the MRU.

Seapath MRU interface cable

The Portable Processing Unit can be connected to a Seapath Motion Reference Unit with a dedicated cable. The cable is delivered with the Seapath 130 system.



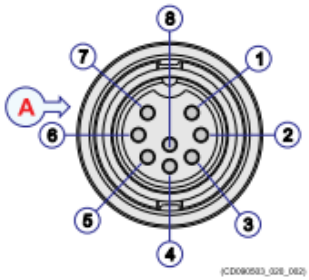


A *Local connection*

Amphenol LTW CD-08BFMA–LL7001

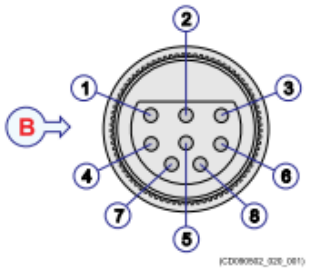
B *Connection Seapath MRU*

SEACON 5501–1508



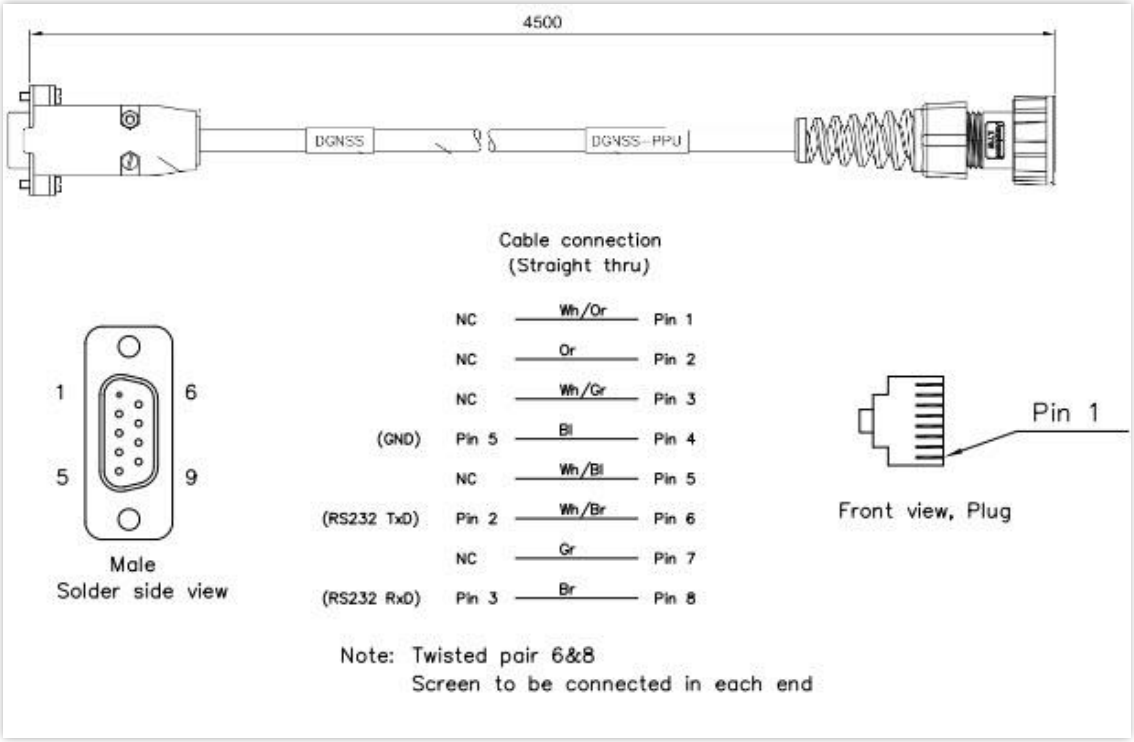
Cable specifications

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



Seapath DGNSS interface cable

RS232 interface cable from PPU to your correctional services receiver unit.



Annexes

EM 2040P PHS XYZ offsets considerations for USM pole

Please, refer to document ‘ANNEX 1_EM 2040P PHS on USM Mounting Pole_Drawings and XYZ Offsets’.

EM 2040P PHS XYZ offsets considerations for Kongsberg’s Overside pole

Please, refer to document ‘ANNEX 2_EM 2040P PHS on Geoacoustics Mounting Pole_Drawings and XYZ Offsets’

EM 2040P PHS mounting options for Inflatable VOOP

Please, refer to document ‘ANNEX 3_EM 2040P PHS on USM Mounting Pole for Inflatable VOOP installations’

EM 2040P Installation Manual

Please, refer to document number 417418ab

Seapath 130 Installation Manual

Please, refer to document number M340-63/7.0

Universal Sonar Mount installation manual

Please, refer to all relevant printed installation manuals from Universal Sonar Mount provided in the system’s delivery.

Multibeam survey planning, the key to success

Please, refer to EM Technical Note that covers several important topics to be considered during survey planning. Click on link below; or perform a web search on your web browser for the following: “*Multibeam survey planning, the key to success*”.

Web link:

https://www.kongsberg.com/globalassets/maritime/km-products/product-documents/multibeam-survey-planning---the-key-to-success