

Quick Start Guide for EM Portable Hydrographic System (PHS)

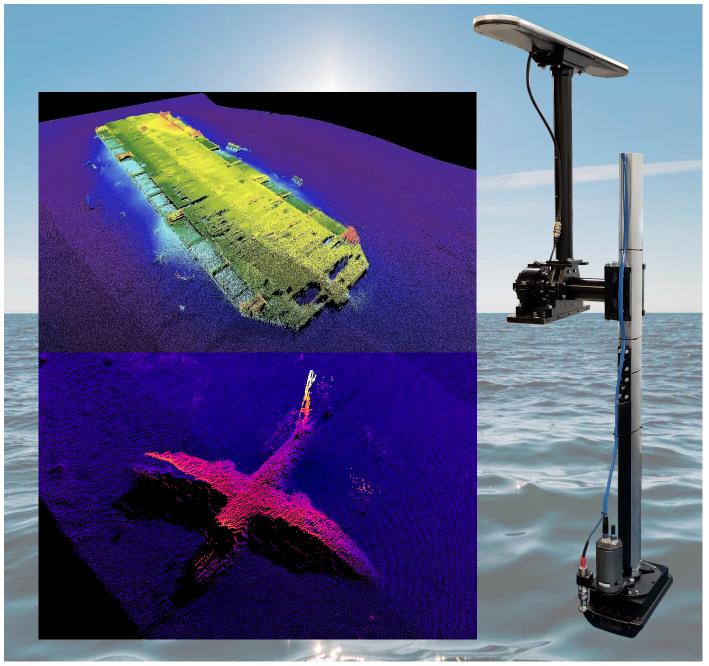


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About this Quick Setup Guide

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.



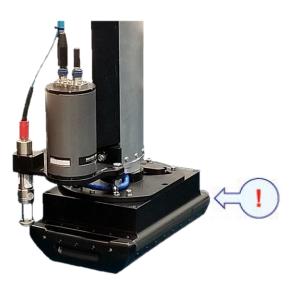


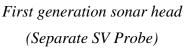
An external power supply (24VDC Nominal) connects to the EM Portable Processing Unit (PPU), providing power to all system units. The Processing Unit also supplies 48 Vdc power to the transducer(s).

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.







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
- \bullet 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.







The Course

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.

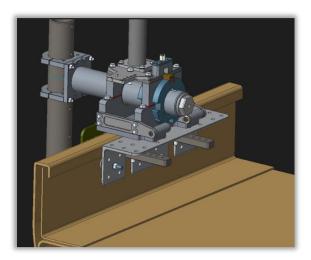
The USM Tilt Adapter option for the sonar head

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.





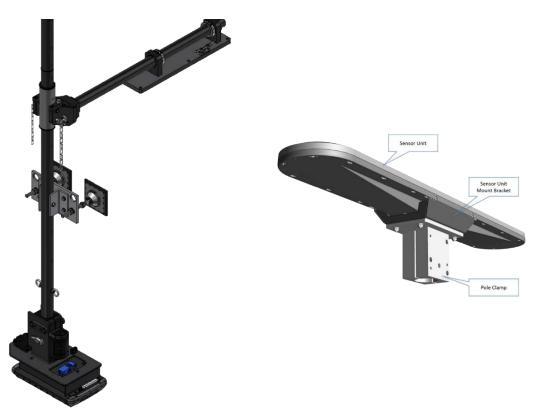
The Portable PU (PPU) should be placed in a well-ventilated area inside the vessel.

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.



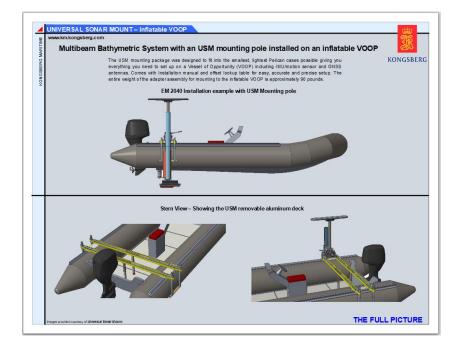
Please, refer to separate PDF document 'ANNEX 2' for XYZ offsets scenarios with KONGSBERG Mounting Pole solution.



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.

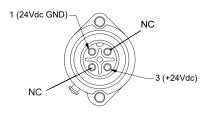
- 1. Connect EM 2040P (E) transducer head to PPU TRX₁ or TRX₂ connector
- 2. Connect Seapath antennae (K) to PPU Seapath Ant. Connector
- 3. Connect Subsea MRU (L) port A to PPU (C) Seapath MRU connector
- 4. Connect laptop to PPU (C) Workstation connector
- 5. Connect 24VDC (18-36v) to PPU (C) 18-36VDC Connector using the provided power cable.

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



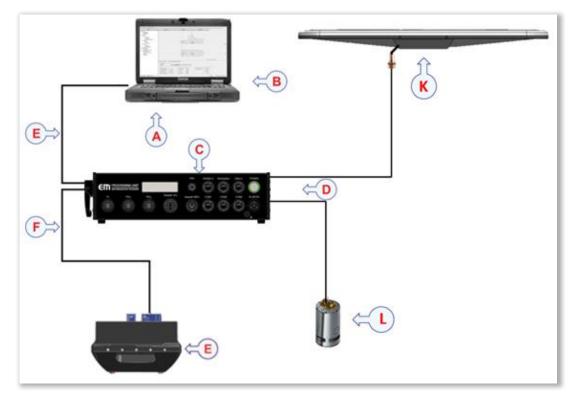
Optional but recommended inputs:

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.



 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

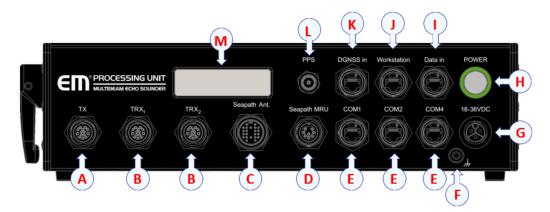


- A. Hydrographic Work Station (Rugged/Semi Rugged)
- B. Interfaces:
 - Sound speed sensor
 - Tide
 - Centre depth output
- C. Portable Processing Unit (PPU)
- D. Processing Unit interfaces:
 - Secondary Positioning systems
 - Secondary Attitude (roll, pitch and heave)
 - Secondary Velocity
 - Secondary 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.

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- 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 **(b)**, then select **Input Setup**. Check and set all **Installation Parameters** as per the following screen captures:

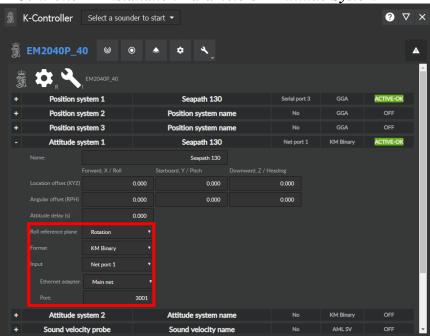
K-Controller > In	istallation 1 arameters >	Sensor .	setup o	verview
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+ Position system 1	Seapath 130	Serial port 3	GGA	ACTIVE-OK
+ Position system 2	Position system name	No	GGA	OFF
+ Position system 3	Position system name	No	GGA	OFF
+ Attitude system 1	Seapath 130	Net port 1	KM Binary	ACTIVE-OK
+ Attitude system 2	Attitude system name	No	KM Binary	OFF
+ Sound velocity probe	Sound velocity name	No	AML SV	OFF
+ Time system	Seapath 130 ZDA and PPS	Serial port 3	ZDA	
	system 1 🔹			

K-Controller > Installation Parameters > Sensor Setup overview

K-Controlle	r Se	lect a sou	nder	to start					? (?)	7
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	9600									
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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.

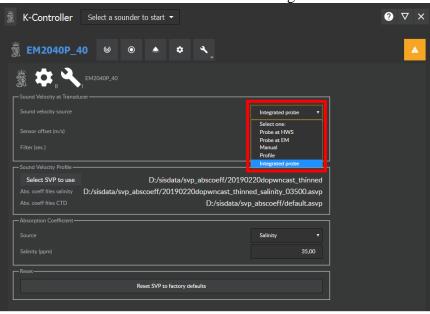


K-Controller > Installation Parameters > Attitude System 1

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 Select a sounder	er to start 🔻			? ⊽ ×
∰ EM2040P_40 ⊌ ⊙	· · · ·			
За страна и стран				
+ Position system 1	Seapath 130	Serial port 3	GGA	ACTIVE-OK
+ Position system 2	Position system name	No	GGA	OFF
+ Position system 3	Position system name	No	GGA	OFF
+ Attitude system 1	Seapath 130 MRU-H	Net port 2	KM Binary	ACTIVE-OK
+ Attitude system 2	Attitude system name	No	EM Attitude	OFF
- Sound velocity probe	Sound velocity name	Integrated probe	AML NMEA	ACTIVE-OK
Name: Sound velocity name Input Integrated probe				
+ Time system	Clock name	Serial port 3	ZDA	OK OK
K-Controller > Insta		s > Time S	etup	9 ⊽ ×
 K-Controller Select a sound EM2040P_40 () 	er to start 👻			A
 K-Controller Select a sound EM2040P_40 (a) FM2040P_40 (b) 	er to start 👻	THE POIL &	1111 LATINI Y	
 K-Controller Select a sound EM2040P_40 FULLIANCE System 1 Attitude system 2 	er to start -			OFF
 K-Controller Select a sound EM2040P_40 (a) FM2040P_40 (b) 	er to start 👻	THUS DOLS & NO	KM Binary	
 K-Controller Select a sound EM2040P_40 EM2040P_40 Culture system 1 Attitude system 2 Attitude system 1 Attitude system 1 Time system Time system Time datagram IPPS On rising edge IPPS On rising edge Ipput Serial port 3 Interface 3 R5232 Baud rate: 9600 Data bit: 8 Stop bit: 	Attitude system name Sound velocity name Seapath 130 ZDA and PPS	No No	KM Binary AML SV	OFF OFF

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:

K CANCEL Communication Setup Sensor Setup System Pa	arameters BIST Sy	stem Report	
put Setup Output Setup Clock Setup			
Port settings			
Com. settings	Input Formats —		
Baud rate: 19200 💌	Position	🔽 Attitude	🗖 DBS Depth
Data bits 8	None GGK	☑ ZDA Clock ☑ HDT Heading	DPT Depth EA500 Depth
Stop bits: 1	C GGA	🗖 SKR82 Heading	🗖 ROV. depth
Parity: NONE	C GGA_RTK C SIMRAD90	MK39 Mo 2 Attitude, no heave	Height, special purpose only
Interface: RS232 🔻			

CANCEL				
nmunication Setu	Sensor Setup	System Parameters BIST	System Report	
Setup Output Se	up Clock Setup]		
			-	
Port sett	ings			
Port:	UDP2 🔻			
r Com.	settings	Input Formats	r <u>et</u>	
		Position		
Bau	d rate:		T Attitude	🗖 DBS Depth
Data	bits	C GGK	ZDA Clock	DPT Depth
			☐ HDT Heading	F EA500 Depth
Stop	bits:		SKR82 Heading	🔽 ROV. depth
Pari	v:		WIK39 Wod2 Attitude, no neave	
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Port settings Port: UDP6 💌			
Com. settings			
Baud rate: Data bits Stop bits: Parity:	Position C None C GGK C GGA C GGA_RTK C SIMRAD90	 ☐ Attitude ☐ ZDA Clock ☐ HDT Heading ☐ SKR82 Heading ☐ MK39 Mod2 Attitude no heave ☑ Attitude/Velocity 	DBS Depth DPT Depth EA500 Depth ROV. depth Height, special purpose only

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*'

rs BIST System Rep	port
Clock	
Source:	Active pos. system 💌
Offset (sec.): 1PPS Clock Synch.	0 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:

ositioning System Settings Positioning System Ports: UDP2 Time to use C Datagram C System	Attitude Sensor Ports: COM3	Active Sensors Position: UDP2 Attitude: COM3 Heading: COM3
Enable position motion correction Position delay (sec.): Datum: WGS84 Cog all heights	Attitude Delay (msec.): 0	Velocity: UDP6
Enable 🗖 Pos. qual. indicators for height acceptance		

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.

Input Setup		Output Setup	Port COM1 🔻			
Sound Velocity Probe	SVP Logger	Auto Pilot				
Port	Port	Port				
Probe available 🗹 COM1 👻	SVP Logger avail 🗌 🚽	Auto Pilot avail	Data bits 8 💌			
Probe type Micro SV (C)	Barometer	🗖 Enable Output	Stop bits: 1			
Real time Tide	Port	Dyn Pos	Parity: NONE 💌			
Port	Barometer avail	Port				
Realtime Tide avail		Serial 🔲 🚽				
	Geodimeter	IP addr. Port addr.				
	Geodimeter avail	Ethernet				
	Echosounder					
		Depth below keel				
r Heading		Port				
	rnet IP addr. Port addr.	Depth below keel avail 🗌 📃				
Add Compass deviation file:						
Position Sensor name Serial Port Ethe	rnet IP addr. Port addr.					
Position delay (sec.): 0.00						
Forward (X) Starbo	ard (Y) Downward (Z)					
Add Location offset (m) 0.00 0.0	0.00					
aterline for NMEA single beam(m). Downward (Z) 0.00						
	OK CANCEL	1				

PU sensor status									_		×
									PU	sensor st	atus 🔻
									_		
PU Sensor input status								-1			
	COM1	COM2	СОМЗ	COM4		UDP5	UDP6				
GGA					Р						
GGK											
GGA_RTK							_				
GST											
SIMRAD90											
Attitude			HM								
MK39 Mod2 Attitude, no heave											
HDT Heading											
SKR82 Heading											
ROV. depth											
ZDA Clock											
Height, special purpose only											
DBS Depth											
DPT Depth											
EA500 Depth											
Attitude/Velocity							А				
1PPS Clock Synch.											
P = active Position sensor											
M = active Motion/Attitude senso	r										
H = active Heading sensor											
A = active Attitude/Velocity sensor											
Reload											

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
- 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

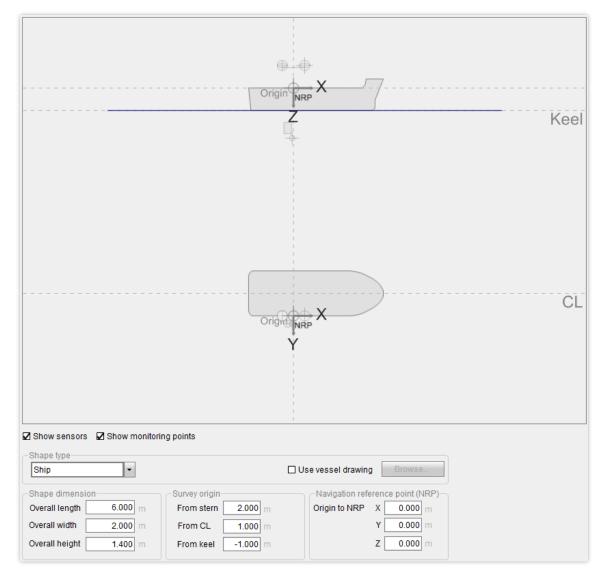
Select *Vessel* → *Geometry*.

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

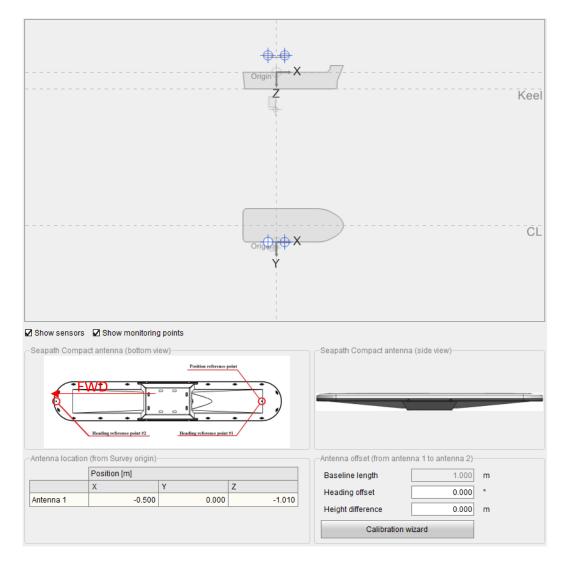


GNSS Geometry

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, $Y = \pm 0.000m$ 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, $Y = \pm 0.500m$ and Z = -1.01m. If you have a second antenna mast the Z offset becomes: Z = -1.935m

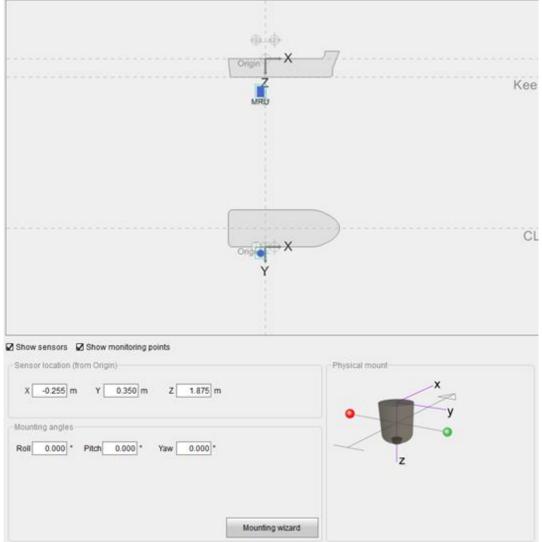


MRU Geometry

Select $MRU \rightarrow Geometry$.

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.

	BERG						USM
INPUT			S	SIS Offset results			
EM Type	EM 2040P	EM 2040P					
Mounting side	Starboard	Forward (X)	Starboard (Y)	Down (Z)	Roll	Pitch	Heading
Antenna mounting	Along ship	-0.06	0.350	2.230	0°	0°	0°
Amount of GPS poles	One	Waterline					
MRU placement	On pole	Measure System ce	nter to waterline and e	nter into SIS. Positive	down value		
MRU mounting	Cable Up						
Index Setting (from top)	1		Sea	path offset results			
Tilt Adapter Mounted	No	EM 2040 Monitorin	ng point				
Tilt Adapter Angle	0°	Forward (X)	Starboard (Y)	Down (Z)			
USM Yaw	0°	-0.06	0.350	2.230			
USM Pitch	0°	GNSS Geometry					
USM Y offset (cm, positive outboard)	0	Forward (X)	Starboard (Y)	Down (Z)			Heading
		-0.5		-1.01			0°
		MRU Geometry					
		Forward (X)	Starboard (Y)	Down (Z)	Roll	Pitch	Heading

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.

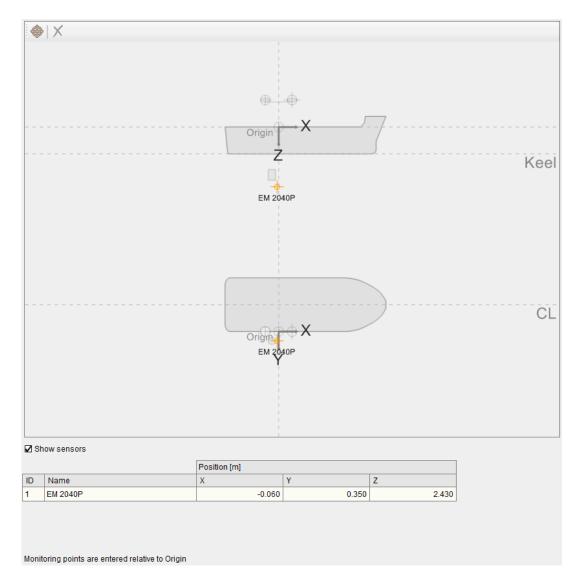
Heave filter-			Heave mean level
Option	Hydrographic survey	-	Roll/Pitch dependent
Period		5.0 s	

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.



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.

Interface	Туре	Direction	I/O Properties	Description	
🗹 🎱 DgnssLink 1	Serial	In/Out	DGNSS 115200 n 8 1 rs-232	DGNSS Correction	
🗌 🔘 DgnssLink2		In	NONE	Link #2	
🗌 🔘 DgnssLink3		In	NONE	Link #3	
DanssLink4		In	NONE	Link #4	
				🔘 Disabled 🕒 OK 🍚 Wa	arning 🥥 Error
Configuration details Interface DgnssL Type Serial Cable ID	ink1	De	scription DGNSS Correction		
Interface DgnssL Type Serial				-422	
Interface DgnssL Type Serial Cable ID		•		-422	
Interface DgnssL Type Serial Cable ID I/O properties Port DGNSS Advanced	■ Ba	•		422	
Interface DgnssL Type Serial Cable ID	■ Ba	aud rate 115			

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.

Interface	Туре	Direction	I/O Properties	Description	
🗹 🥥 TelegramOut5	Ethemet	Out	UDP LAN1 31103 BROADCAST	rtcm v3 for logging in SIS	
🗹 🥥 TelegramOut6	Ethemet	Out	UDP LAN1 31102 BROADCAST	Delayed Heave for logging in SIS	
🗹 🥥 TelegramOut 7	Ethemet	Out	UDP LAN1 31202 BROADCAST	P2X output for logging in SIS	
🗸 🔍 TelearamOut8	Ethemet	Out	UDP LAN1 3011 BROADCAST	RAW IMU for logging in SIS (En	
				isabled 🥥 OK	💛 Warning 🥥 Error
Configuration details					
-	0.45				
Interface Telegran	IOUI5	Des	scription rtcm v3 for logging in SIS	i l	
Type Ethernet		*			
Luidinde					
Cable ID					
I/O properties					
	icast O Mult	Icast			
Broadcast OU	-				
⊙Broadcast OU	icast O Mult 1 (157.237.20.				
	1 (157.237.20.				
Broadcast O Un Local interface	1 (157.237.20.				
Broadcast O Un Local interface	11 (157.237.20. 03				

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.

terface	Type D	irection	I/O Properties	Description	
TelegramOut6	Ethernet 0	ut	UDP LAN1 31102 BROADCAST	Delayed Heave for logging in SIS	
] 🥥 TelegramOut 7	Ethemet 0	ut	UDP LAN1 31202 BROADCAST	P2X output for logging in SIS	
TelegramOut8	Ethernet 0		UDP LAN1 3011 BROADCAST	RAW IMU for logging in SIS (En	
CelearamOut9	0	ut	NONE	Telegram Out #9	
				Ulsabled UK	🥥 Warning 🥥 Erro
onfiguration details					
-	10	1	minitian Delaward Hanna faala ania		
Interface TelegramOu	10	Des	cription Delayed Heave for logging	g in 515	
Type Ethernet	•	1			
		1			
Cable ID					
O properties					
⊙ Broadcast O Unica	st O Multica	ist			
Local interface	157.237.20.10				
		<i>,</i>			
Remote port 31102					
elegram out properties	Heave	•	□ Log to file M	onitoring point EM 2040P	

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.

TelegramOut 7 Ethemet TelegramOut 8 Ethemet TelegramOut 9	Out	LIDD LANT 21202 DDO ADCACT		
TelegramOut9		UDP LAN1 31202 BROADCAST	P2X output for logging in SIS	
	Out	UDP LAN1 3011 BROADCAST	RAW IMU for logging in SIS (En	
	Out	NONE	Telegram Out #9	
TeleoramOut10	Out	NONE	Telearam Out #10	
			🔘 Disabled 🥥 OK 🍚 V	varning UErro
Configuration details				
Interface TelegramOut7	De	scription P2X output for logging	in SIS	
Type Ethernet	-	L		
Cable ID				
O properties				
● Broadcast ○ Unicast ○ M	ulticast			
Local interface LAN1 (157.237.	20.10) 💌			
Remote port 31202				
elegram out properties				
Format NMEA	-			
NMEA selection P25 P26 P27				•
				=
Options			* *	-
NMEAtalker ID IN	Log to file			
Telegram timing	1.000	Event driven • Timer driven		

Raw IMU Data Output (For logging in SIS)

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

Interface	Туре	Direction	I/O Properties	Description	
🗹 🥥 TelegramOu	.t8 Ethernet	Out	UDP LAN1 3011 BROADCAS	T RAW IMU for logging in SIS (En.	
🔲 🔘 TelegramOu	ıt9	Out	NONE	Telegram Out #9	
🗌 🔘 TelegramOu		Out	NONE	Telegram Out #10	
TelearamOu	#11	Out	NONE	Telegram Out #11	
				🔘 Disabled 🕒 Ok	K 🥥 Warning 🥥 Erro
Configuration d	ataila				
Interface Te	legramOut8	De		ging in SIS (Enable RTCM	
Type Et	hernet	-	logging in SiS an	d IMU will also be logged)	
iype Et	liemet				
Cable ID					
I/O properties	O Unicast O M	lulticast			
I/O properties –	O Unicast O M				
I/O properties					
I/O properties	LAN1 (157.237.				
I/O properties –					
I/O properties — ⊙ Broadcast Local interface	LAN1 (157.237.				

Seapath Communication Interface setup

Select *Communication Interface* \rightarrow *Serial port extender*.

Make sure the Data pool parameters are defined as follows.

Data pool parameters	
Processing unit name	Unit #1
Network interface name	LAN1 (157.237.20.10) 💌
UDP address	239.255.0 .3
UDP port	31000

Select Network

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

P address	157.237.20.10
Subnet mask	255.255.0.0
Default gateway	157.237.20.1

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.

Image: Constant of the server of the servere of the server of the server of the server of the ser	GnssRec1	Туре	Direction	I/O Properties	Description	
▼ MRU Serial in/Out MRU 115200 n 8 1 rs-422 IMU #1 ● Gyro 1 in NONE Gyro #1 ♥ DgnssLink1 Serial In/Out DGNSS 115200 n 8 1 rs-232 DGNSS Correction ● DgnssLink2 in NONE Link #2 DGNSS Correction ● DgnssLink3 in NONE Link #3 ● DgnssLink4 in NONE Link #4 ● CorrectionRadio1 NONE NONE ● CorrectionRadio2 NONE NONE ● CorrectionRadio3 NONE NONE ● CorrectionRadio4 NONE NONE ● CorrectionRadio4 NONE NONE ● CorrectionRadio3 NONE NONE ● CorrectionRadio4 NONE NONE ● TelegramOut1 Ethemet Out UDP LAN1 31012 31013 BROADCAST KM binary to K-Controller ● TelegramOut3 Serial Out NONE Notin use Out NONE ● TelegramOut5 Ethemet Out UDP LAN1 3103 BROADCAST tram v3 to SIS or internal logging ♥ TelegramOut5 Ethemet Out </td <td></td> <td>Serial</td> <td>In/Out</td> <td>GNSS1 57600 n 8 1</td> <td>Receiver #1</td> <td></td>		Serial	In/Out	GNSS1 57600 n 8 1	Receiver #1	
In NONE Gyro #1 Image: Construction of the second of the sec	GnssRec2	Serial	In/Out	GNSS2 57600 n 8 1	Receiver #2	
Y DgnssLink1 Serial In/Out DGNSS 115200 n 8 1 rs-232 DGNSS Correction Im DgnssLink3 In NONE Link #3 Im DgnssLink4 In NONE Link #4 Im NONE Link #4 In/Out Link #4 Im NONE Link #4 In/Out In/Out Im NONE In/Out NONE In/Out In/Out Im CorrectionRadio2 NONE In/Out In/O	MRU	Serial	In/Out	MRU 115200 n 8 1 rs-422	IMU #1	
□ DgnssLink2 In NONE Link #2 □ DgnssLink3 In NONE Link #3 □ DgnssLink4 In NONE Link #4 □ CorrectionRadio1 NONE Link #4 □ CorrectionRadio2 NONE In □ CorrectionRadio3 NONE In □ TelegramOut1 Ethernet Out UDP LAN1 3010 BROADCAST KM binay to K-Controller □ TelegramOut2 Out NONE Not in use In □ TelegramOut3 Serial Out SURVEY 9600 n 8 1 rs-232 GGA, HDT, VTG and ZDA to K □ TelegramOut4 Out NONE International logging International logging ☑ TelegramOut5 Ethernet Out UDP LAN1 31102 BROADCAST Pelayed Heave to SIS or intern ☑ TelegramOut6 Etherm	Gyro 1		In	NONE	Gyro #1	
□ DgnssLink3 in NONE Link #3 □ DgnssLink4 in NONE Link #4 □ CorrectionRadio1 NONE Link #4 □ CorrectionRadio2 NONE Image: CorrectionRadio3 NONE □ CorrectionRadio3 NONE Image: CorrectionRadio3 NONE □ CorrectionRadio4 NONE Image: CorrectionRadio4 Image: CorrectionRadio4 □ CorrectionRadio3 NONE Image: CorrectionRadio4 Image: CorrectionRadio4 □ CorrectionRadio4 NONE Image: CorrectionRadio4 Image: CorrectionRadio4 □ CorrectionRadio4 NONE Image: CorrectionRadio4 Image: CorrectionRadio4 □ TelegramOut1 Ethemet Out UDP LAN1 31012 31013 BROADCAST GNSS link server □ TelegramOut3 Serial Out SURVEY 9600 n 8 1 rs-232 GGA, HDT, VTG and ZDA to K □ TelegramOut4 Out NONE Intern v3 to SIS or Internal logging □ TelegramOut5 Ethemet Out UDP LAN1 31103 BROADCAST Delayed Heave to SIS or Internal. □ TelegramOut6 Ethemet Out UDP LAN1 31202 BROADCAST Delayed Heave to SIS or Internal. <		Serial	In/Out	DGNSS 115200 n 8 1 rs-232		
□ DgnssLink3 In NONE Link #3 □ DgnssLink4 In NONE Link #4 □ CorrectionRadio1 NONE In □ CorrectionRadio2 NONE In □ CorrectionRadio3 NONE In □ CorrectionRadio3 NONE In □ CorrectionRadio3 NONE In □ CorrectionRadio4 NONE In □ TelegramOut1 Ethemet Out UDP LAN1 3001 BROADCAST KM binary to K-Controller □ TelegramOut3 Serial Out SURVEY 9600 n 8 1 rs-232 GGA, HDT, VTG and ZDA to K □ TelegramOut4 Out NONE Inter v3 to SIS or internal logging □ TelegramOut5 Ethemet Out UDP LAN1 31103 BROADCAST Delayed Heave to SIS or internal □ TelegramOut6 Eth	DanssLink2		In	NONE	Link #2	
□ DgnssLink4 In NONE Link #4 □ CorrectionRadio1 NONE Image: Strategy and Strategy anu			In	NONE	Link #3	
□ CorrectionRadio1 NONE □ CorrectionRadio2 NONE □ CorrectionRadio3 NONE □ CorrectionRadio4 NONE □ TelegramOut1 Ethernet □ TelegramOut2 Out □ TelegramOut3 Serial □ TelegramOut4 Out □ TelegramOut5 Ethernet □ TelegramOut5 Ethernet □ TelegramOut6 Ethernet □ TelegramOut7 Ethernet □ TelegramOut8 Ethernet □ TelegramOut8 Ethernet □ TelegramOut8 Ethernet □ TelegramOut9 Out UDP LAN1 3102 BROADCAST □ TelegramOut8 Ethernet Out UDP LAN1 31102 BROADCAST □ TelegramOut7 Ethernet Out UDP LAN1 31102 BROADCAST □ TelegramOut8 Ethernet Out UDP LAN1 31102 BROADCAST P2X outpu			In	NONE	Link #4	
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CorrectionRadio4 NONE GnssLink Ethernet In/Out UDP LAN1 31012 31013 BROADCAST GNSS link server TelegramOut1 Ethernet Out UDP LAN1 3001 BROADCAST KM binary to K-Controller TelegramOut2 Out NONE Not in use TelegramOut3 Serial Out SURVEY 9600 n 8 1 rs-232 GGA, HDT, VTG and ZDA to K TelegramOut4 Out NONE Mone TelegramOut5 Ethernet Out UDP LAN1 31103 BROADCAST rcm v3 to SIS or internal logging TelegramOut6 Ethernet Out UDP LAN1 31102 BROADCAST Delayed Heave to SIS or internal logging TelegramOut7 Ethernet Out UDP LAN1 31102 BROADCAST Delayed Heave to SIS or internal lo TelegramOut7 Ethernet Out UDP LAN1 3102 BROADCAST P2X output to SIS (enable RTCM1 TelegramOut7 Ethernet Out UDP LAN1 3101 BROADCAST raw IMU to SIS (enable RTCM1 TelegramOut8 Ethernet Out UDP LAN1 3101 BROADCAST raw IMU to SIS (enable RTCM1 TelegramOut9 Out NONE TelegramOut #10 Out NONE	-					
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Image: Constraint of the system Out SURVEY 9600 n 8 1 rs-232 GGA, HDT, VTG and ZDA to K Image: Constraint of the system Out NONE NONE Image: Constraint of the system Out UDP LAN1 31103 BROADCAST rtcm v3 to SIS or internal logging Image: Constraint of the system Out UDP LAN1 31102 BROADCAST Delayed Heave to SIS or internal. Image: Constraint of the system Out UDP LAN1 31202 BROADCAST Delayed Heave to SIS or internal. Image: Constraint of the system Out UDP LAN1 31202 BROADCAST P2X output to SIS4 or internal lo Image: Constraint of the system Out UDP LAN1 31202 BROADCAST P2X output to SIS4 or internal lo Image: Constraint of the system Out UDP LAN1 31102 BROADCAST raw IMU to SIS (enable RTCM I Image: Constraint of the system Out NONE Telegram Out #9 Image: Constraint of the system Out NONE Telegram Out #10 Image: Constraint of the system Out NONE Telegram Out #11 Image: Constraint of the system Out NONE Telegram Out #12 Image: Constraint of the system Out NONE Telegram Out #13			Out	NONE		
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Image: Constraint of the system Out UDP LAN1 3011 BROADCAST raw IMU to SIS (enable RTCM I Image: Constraint of the system Out NONE Telegram Out #9 Image: Constraint of the system Out NONE Telegram Out #10 Image: Constraint of the system Out NONE Telegram Out #10 Image: Constraint of the system Out NONE Telegram Out #11 Image: Constraint of the system Out NONE Telegram Out #12 Image: Constraint of the system Out NONE Telegram Out #13 Image: Constraint of the system Out NONE Telegram Out #14 Image: Constraint of the system Out NONE Telegram Out #14 Image: Constraint of the system Out NONE Telegram Out #14 Image: Constraint of the system Out NONE Customer support log						
Image: Constraint of the system Out NONE Telegram Out #9 Image: Constraint of the system Out NONE Telegram Out #10 Image: Constraint of the system Out NONE Telegram Out #10 Image: Constraint of the system Out NONE Telegram Out #11 Image: Constraint of the system Out NONE Telegram Out #12 Image: Constraint of the system Out NONE Telegram Out #13 Image: Constraint of the system Out NONE Telegram Out #14 Image: Constraint of the system Out NONE Telegram Out #14 Image: Constraint of the system Out NONE Customer support log						
TelegramOut 10 Out NONE Telegram Out #10 TelegramOut 11 Out NONE Telegram Out #11 TelegramOut 12 Out NONE Telegram Out #12 TelegramOut 13 Out NONE Telegram Out #13 TelegramOut 14 Out NONE Telegram Out #14 TelegramOut 15 Out NONE Telegram Out #14	-					
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 Telegram Out #14			Out	NONE	2	
TelegramOut 12 Out NONE Telegram Out #12 TelegramOut 13 Out NONE Telegram Out #13 TelegramOut 14 Out NONE Telegram Out #14 TelegramOut 15 Out NONE Telegram Out #14				NONE	-	
Out NONE Telegram Out #13 TelegramOut 14 Out NONE Telegram Out #14 TelegramOut 15 Out NONE Customer support log					_	
Ott NONE Telegram Out #14 TelegramOut 15 Out NONE Customer support log					-	
TelegramOut 15 Out NONE Customer support log					-	
					-	
Instant Instant Instant Instant						
					lologian eatinto	

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

	Ethemet Serial	Out Out Out Out Out	NONE	N1 3001 BROADCA: Y 9600 n 8 1 rs-232 KM binary to K-C		KM binary to K-C Not in use GGA, HDT, VTC Disa	G and ZD		⊖ Warning	Erro
TelegramOut3 TelegramOut3 TelegramOut4 Configuration details Interface TelegramO Type Ethernet Cable ID O properties		Out Out De	SURVE NONE		;ontroller	GGA, HDT, VTC			O Warning	Erro
TelegramOut4 Configuration details Interface TelegramO Type Ethernet Cable ID O properties		De	NONE		controller				O Warning	Erro
Configuration details Interface TelegramO Type Ethernet Cable ID O properties	ut1	De		KM binary to K-C	controller	Disa	abled	OK	⊖ Warning	Erro
Interface TelegramO Type Ethernet Cable ID Oproperties	ut1		escription	KM binary to K-C	ontroller	UIS	abled	UK	 warning (U Eno
Interface TelegramO Type Ethernet Cable ID Oproperties	ut1		escription	KM binary to K-C	ontroller					
Type Ethernet Cable ID Oproperties	ut1		escription	KM binary to K-C	controller					
Cable ID		•								
O properties										
Broadcast O Unic Control Contro Control Control Control Co										
Land Interference Landson	ast OMu		1							
	(157.237.2	0.10) 💌								
Remote port 3001										
elegram out properties										
Format KM b	inary	•	Datum	WGS84	- M	onitoring point	NRP		-	
Options									÷ -	
Log to file										
Felegram timing ———										
Interval [s]	(.010	O Event dri	iven 💿 Timer di	riven					

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

	Туре	Direction	I/O Properties	Description	
🗹 🥥 TelegramOut 3	Serial	Out	SURVEY 9600 n 8 1 rs-232	GGA, HDT, VTG and ZDA to K	
TelegramOut4		Out	NONE		
TelegramOut5	Ethernet	Out	UDP LAN1 31103 BROADCAST	rtcm v3 to SIS or internal logging	
TelegramOut6	Ethernet	Out	UDP LAN1 31102 BROADCAST	Delaved Heave to SIS or intem Disabled OK	
Configuration details -					
Interface Telegram	0.00	Dee	scription GGA, HDT, VTG and ZDA	to K Controllor	
Telegran	iouis	De:	scription GGA, HDT, VTG and 2DA	to K-Controller	
Type Serial		•			
Cable ID					
	▼ Bau	ud rate 9600	0 ▼ ⊙rs-232 Ors-422		
/O properties Port SURVEY	► Bau	ud rate 9600	0 ▼ ⊙rs-232 Ors-422		
/O properties Port SURVEY Advanced		ud rate 9600	0 ▼ ⊙rs-232 Ors-422		
I/O properties		ıd rate 9600	0 ▼ ⊙rs-232 Ors-422		
I/O properties Port SURVEY Advanced Telegram out propertie		ud rate 9600		Ionitoring point NRP	
VO properties Port SURVEY Advanced Telegram out propertie Format NI	s IEA	•			
VO properties Port SURVEY Advanced Telegram out propertie Format NV	s	•			•
VO properties Port SURVEY Advanced Telegram out propertie Format NI	s IEA	•			
/O properties Port SURVEY Advanced Felegram out propertie Format NM NMEA selection GC	s IEA GAHDT VTG Z	•			•

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.

GnssRec1	Туре	Direction	I/O Properties	Description	
	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	
Gyro 1		In	NONE	Gyro #1	
DgnssLink1	Serial	In/Out	DGNSS 115200 n 8 1 rs-232	DGNSS Correction	
DanssLink2		In	NONE	Link #2	
DgnssLink3		In	NONE	Link #3	
DgnssLink4		In	NONE	Link #4	
Correction Radio 1			NONE		
Correction Radio 2			NONE		
Correction Radio 3			NONE		
Correction Radio 4			NONE		
GnssLink	Ethernet	In/Out	UDP LAN1 31012 31013 BROADCAST	GNSS link server	
TelegramOut 1	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	
TelegramOut 10		Out	NONE	Telegram Out #10	
TelegramOut 11		Out	NONE	Telegram Out #11	
TelegramOut 12		Out	NONE	Telegram Out #12	
TelegramOut 13		Out	NONE	Telegram Out #13	
TelegramOut 14		Out	NONE	Telegram Out #14	
TelegramOut 15		Out	NONE	Customer support log	
TelegramOut 16		Out	NONE	Telegram Out #16	
• Pologramourro			110114	loogian oachto	

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

	Туре	Direction	I/O Properties	Description	
🖌 🔘 TelegramOut 1	Ethernet	Out	UDP LAN1 3000 BROADCAST	Seatex Bin 26 to SIS4 UDP6	
TelegramOut2		Out	NONE		
TelegramOut3		Out	SURVEY 19200 n 8 1 rs-232	EM 3000 to SIS4 on COM3	
1 🔵 TeleoramOut4	Ethemet	Out	UDP LAN1 2022 BROADCAST	GGA to SIS4 on UDP2	0
				🔘 Disabled 🕒 OK 🍛 Warning	Error
onfiguration details -					
Interface Telegram	Out1	Dec	cription Seatex Bin 26 to SIS4 UD	39	
Telegram	Juli	Des	Cipiton Sealex Bill 20 to 3134 OD	-0	
Type Ethernet		-			
		-			
Cable ID					
O properties					
⊙ Broadcast ○ Un	icast O Multi	cast			
Local interface	1 (157.237.20.1	10) 💌			
		10)			
Remote port 300	•				
Remote port 300					
elegram out propertie					
Felegram out propertie	s apath binary 26	•	Datum WGS84 💌 M	onitoring point NRP -	
elegram out propertie Format Se		•	Datum WGS84 • M		
elegram out propertie Format Se		•	Datum WGS84 • N		
elegram out propertie Format Se		•	Datum WGS84 • N		
elegram out propertie Format Sec Options		•	Datum WGS84 • N		

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

	Type Direct	tion I/O Properties	Description	
🖌 🎱 TelegramOut 3	Serial Out	SURVEY 19200 n 8 1 rs-2	32 EM 3000 to SIS4 on COM 3	3
🗹 🥥 TelegramOut4	Ethernet Out	UDP LAN1 2022 BROADC	CAST GGA to SIS4 on UDP2	
🗹 🥥 TelegramOut5	Ethernet Out	UDP LAN1 31103 BROAD	CAST rtcm v3 to SIS or internal log	gging
TelegramOut6	Ethernet Out	UDP LAN1 31102 BROAD	CAST Delaved Heave to SIS or in	ntem
			isabled 🥥 OK	🥥 Warning 🥥 Error
0 C				
Configuration details				
Interface Telegram	nOut3	Description EM 3000 to SI	S4 on COM 3	
Time				
Type Serial	•	<u> </u>		
Cable ID				
/O properties				
	Baud rate	19200 • @rs-232	0	
Port SURVEY	 Baud rate 	19200 • Ors-232	O rs-422	
Advanced				
Telegram out properti	es			
- · · -	mrad EM3000/Hipap	* Loa to file	Monitoring point NRP	
	mrad Em3000/Hipap			
Options				0 -
Options				
Telegram timing				

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

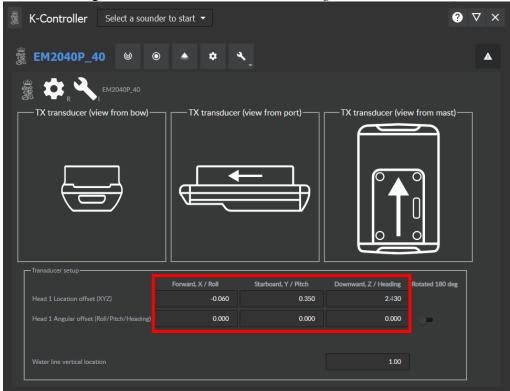
Interface	Туре	Direction	tion I/O Properties		Description		
🗹 🥥 TelegramOut4	Ethernet	Out	UDP LAN1 2022 BROADCAST		GGA to SIS4 on UDP2		
🗹 🥥 TelegramOut5	Ethemet Out UDP LAN1 31103 BROADCAS		N1 31103 BROADCAST	rtcm v3 to SIS or internal logging			
🗹 🎱 TelegramOut6	Ethernet	Out		N1 31102 BROADCAST	Delayed Heave to S		
TelegramOut7	Ethernet	Out	UDP LA	N1 31202 BROADCAST	P2X output to SIS4		
					Disabled) ок 🔾 и	Varning 🥥 Err
Configuration details							
Interface Telegran	nOut4	Des	scription	GGAto SIS4 on UDP2			
Type Ethernet							
		-					
Cable ID							
I/O properties							
no proportioo							
	nicast OMu	lticast					
⊙Broadcast OU	nicast OMu V1 (157.237.20						
⊙ Broadcast OU Local interface LA	11 (157.237.2						
⊙Broadcast OU	11 (157.237.2						
⊙ Broadcast O U Local interface LA	11 (157.237.20 2						
Broadcast OU Local interface LA Remote port 202 Telegram out properti	11 (157.237.20 2		Datum	WGS84	Monitoring point N	٦P	•
Broadcast OU Local interface LA Remote port 202 Telegram out propertir Format N	11 (157.237.20 2 95	0.10) 🔻	Datum	WGS84	Monitoring point NF	RP	•
Broadcast OU Local interface LA Remote port 202 Telegram out propertie Format NI	II (157.237.2) 2 95 IEA	0.10) 🔻	Datum	WGS84	Monitoring point N	₹₽	
Broadcast OU Local interface LA Remote port 202 Telegram out propertii Format NI NMEA selection G	II (157.237.2) 2 98 IEA GA	0.10) 🔻		WGS84	Monitoring point NF	₹P	•
Broadcast OU Local interface LAI Remote port 200 Telegram out propertie Format NI NMEA selection G Options	II (157.237.2) 2 98 IEA GA	0.10)			Monitoring point NF	₹P	•

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) Settings Locations Angular Offsets ROV. Specific

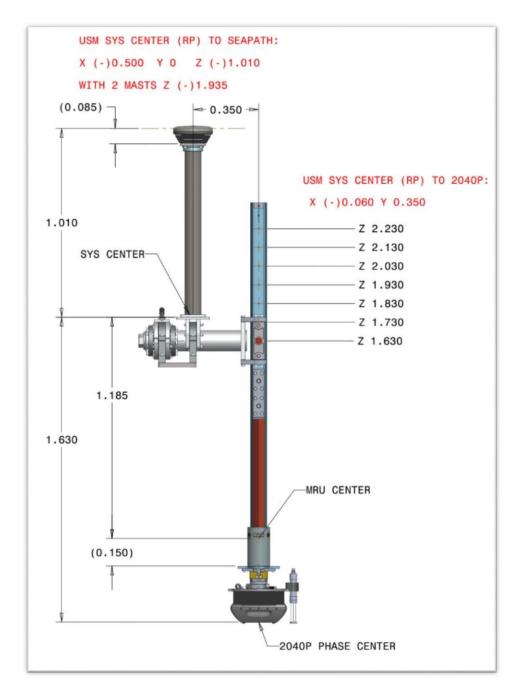
Location offset (m)			
	Forward (X)	Starboard (Y)	Downward (Z
Pos, COM1:	0.00	0.00	0.00
Pos, COM3:	0.00	0.00	0.00
Pos, COM4/UDP2:	0.00	0.00	0.00
Sonar head 1:	0.00	0.00	0.00
Sonar head 2:	0.00	0.00	0.00
Attitude 1, COM2/UDP5:	0.00	0.00	0.00
Attitude 2, COM3/UDP6:	0.00	0.00	0.00
Waterline:			0.00
Depth Sensor:	0.00	0.00	0.00

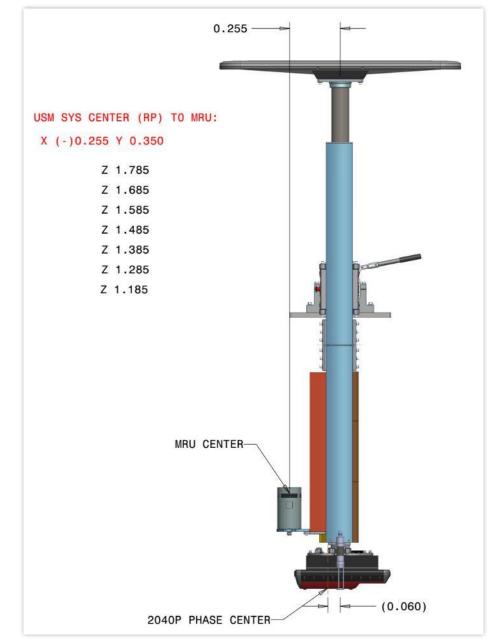
- 4. Click the *Angular Offsets* subtab
- 5. Enter sonar angular offsets Roll, Pitch and Heading.

Settings Locations Angular Offsets ROV.	Specific			
	Offset angles (deg.)		0 % 1	
		Roll	Pitch	Heading
	Sonar head 1:	0.00	0.00	0.00
	Sonar head 2:	0.00	0.00	0.00
	Attitude 1, COM2/UDP5:	0.00	0.00	0.00
	Attitude 2, COM3/UDP6:	0.00	0.00	0.00
	Stand-alone Heading:			0.00

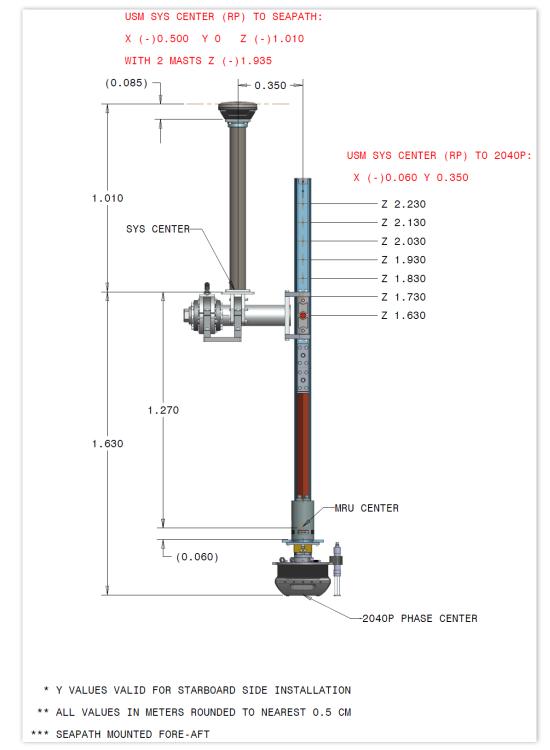
System Drawings

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



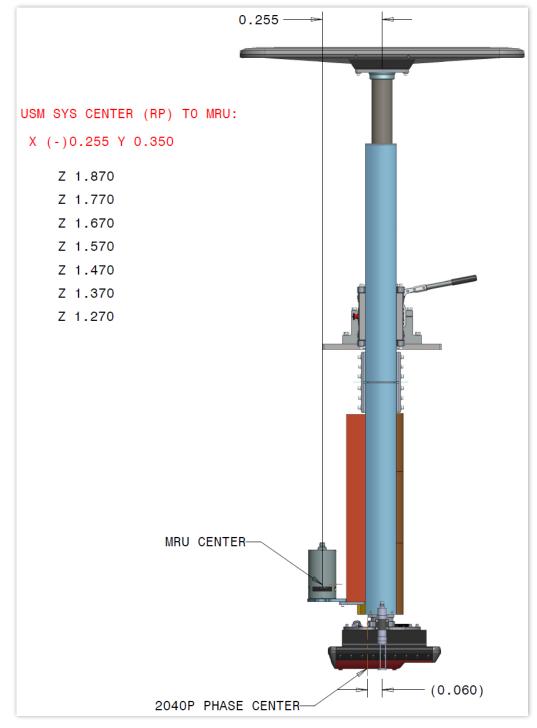


EM 2040 PHS – MRU at the bottom, MRU cable facing down - Side view



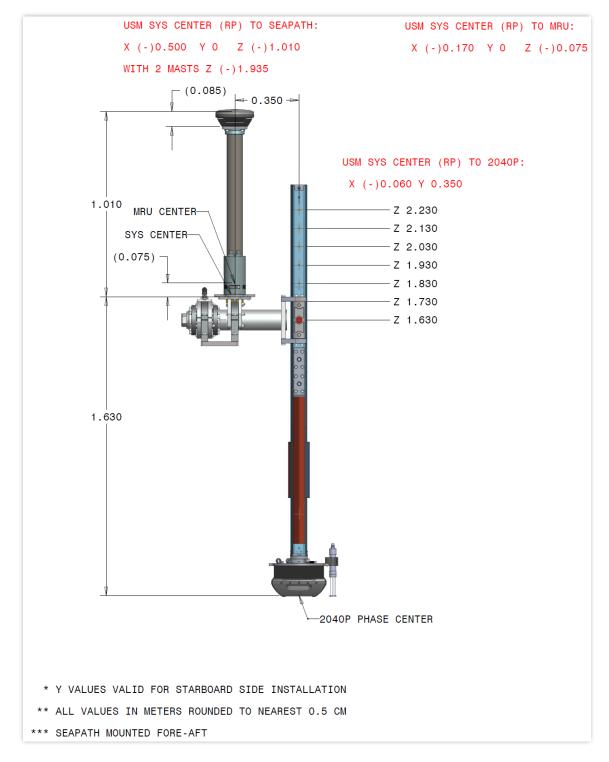
EM 2040 PHS – MRU at the bottom, MRU cable facing up - Rear view

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

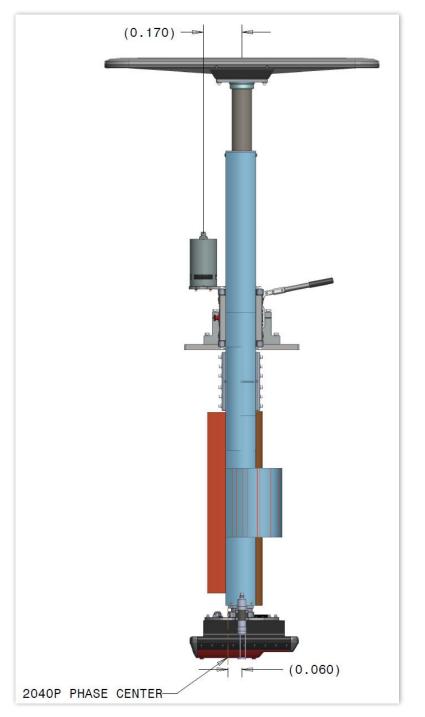


Please, also refer to 'ANNEX 1' document for more details.

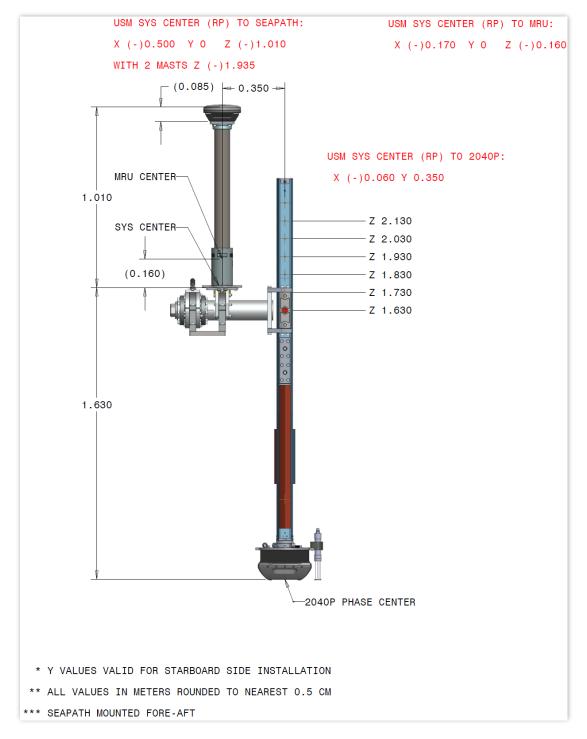
453991 / A / Page 56 of 69



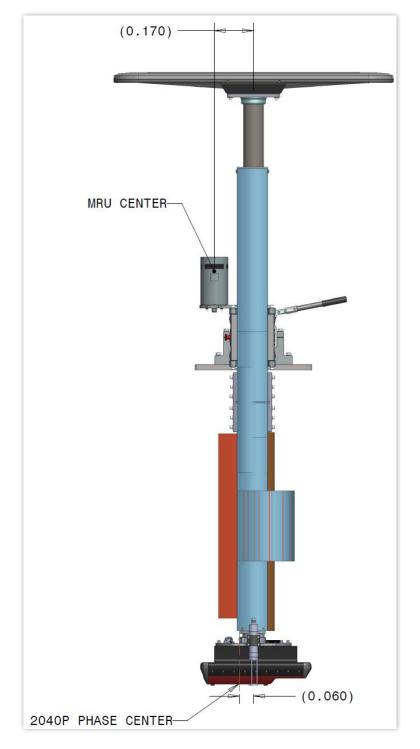
EM 2040 PHS – MRU at the topside, MRU cable facing up - Rear view



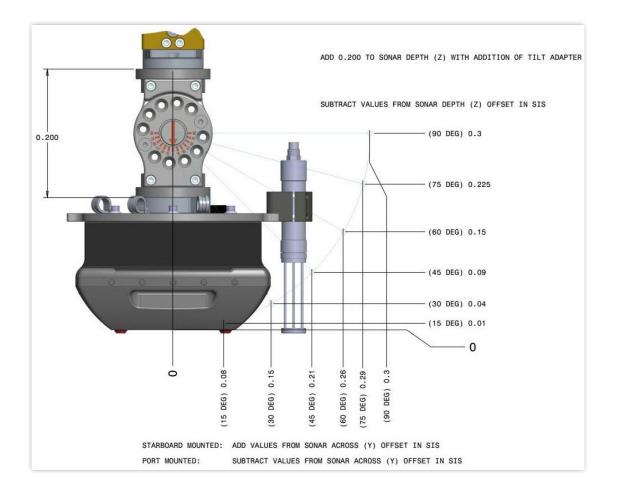
EM 2040 PHS – MRU at the topside, MRU cable facing up - Side view



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



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

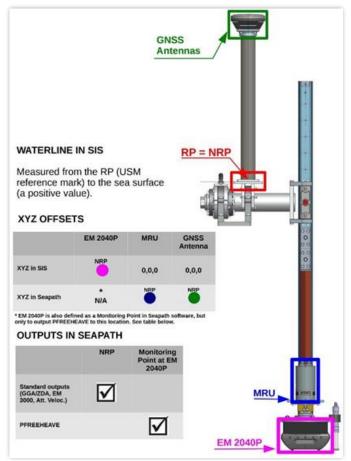


EM 2040P PHS overview – Tilt Adapter

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:

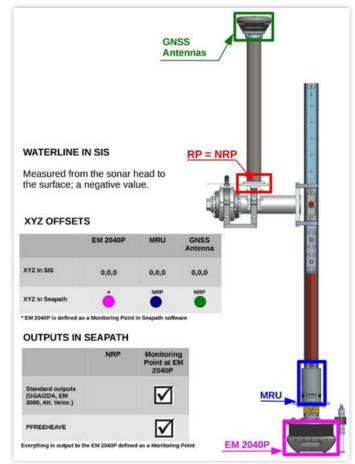
- Need to change Monitoring Point EM 2040P in Seapath HMI
- Need to change sensor location Y and Z offset in SIS or K-Controller

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

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:

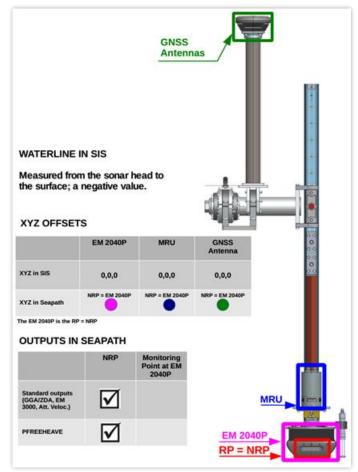
- Need to change Monitoring point EM 2040P in Seapath HMI Need to change GNSS geometry in Seapath HMI
- Need to change MRU geometry in Seapath HMI
- Need to change waterline in SIS

Pole index change:

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

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:

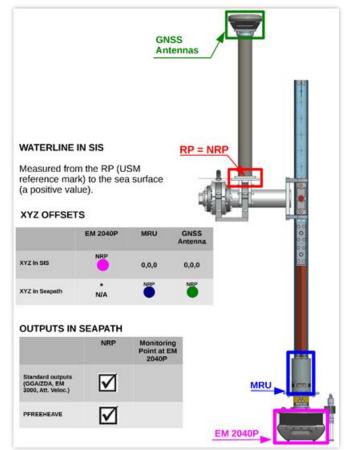
- Need to change GNSS geometry in Seapath HMI
- Need to change MRU geometry in Seapath HMI
- Need to change waterline in SIS

Pole index change:

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

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

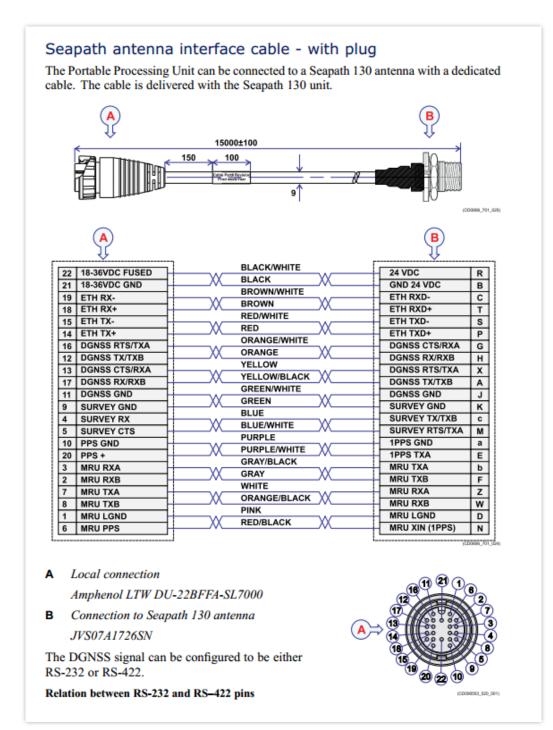
Pole index change:

- 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

The interface cables for the Seapath 130

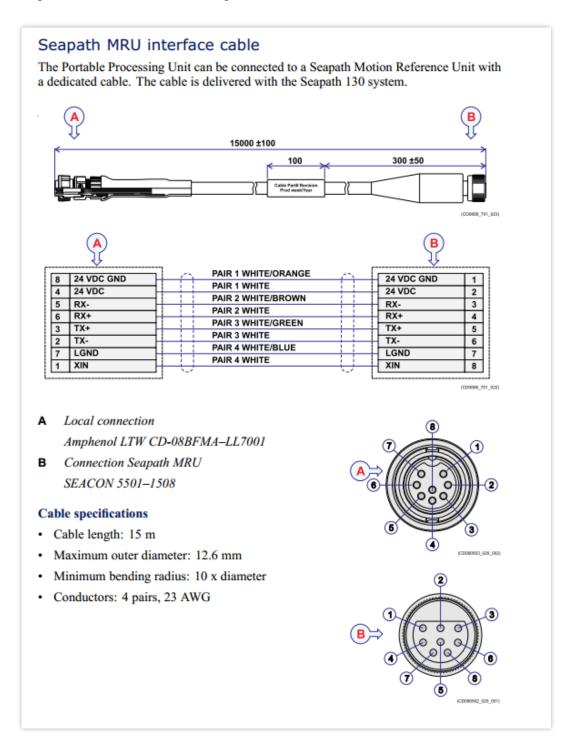
Seapath Antenna interface cable

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



Seapath MRU interface cable

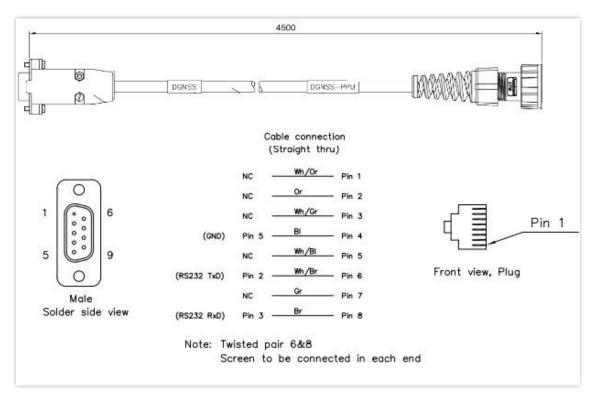
A single cable from The Processing Unit to the MRU.



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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/productdocuments/multibeam-survey-planning---the-key-to-success