SeaRAY Quick Start Guide

Contents

1 Hardware Installation

1.1 Introduction

SeaRAY sonars are highly-versatile, portable, high-resolution multibeam echosounders which are extremely simple to install and operate. The SeaRAY system contains a tightly integrated GNSS/INS subsystem to provide a complete hydrographic survey solution from one integrated system.

1.2 System Inspection

Unpack the system and inspect all cables and connectors for damage, dirt or moisture. Inspect the sonar for damage, especially around the transducers, for cuts or gouges. Never support the sonar by the sound speed probe or strictly by the projector, and do not allow the wet-end to rest on the polyurethane as this may scratch or wear this sensitive area.

1.3 Power Requirements

SeaRAY sonars require clean power for proper operation. As most vessels utilize an inverter for this purpose, it is important that it be **a true sine wave inverter**. A modified sine wave inverter may cause unexpected behavior, even when using the included power brick. In general, inexpensive inverters are likely modified sine wave. Use high quality inverters for providing power to the SeaRAY sonar. If dirty power is assumed, connect the system directly to a 12-24VDC battery and test.

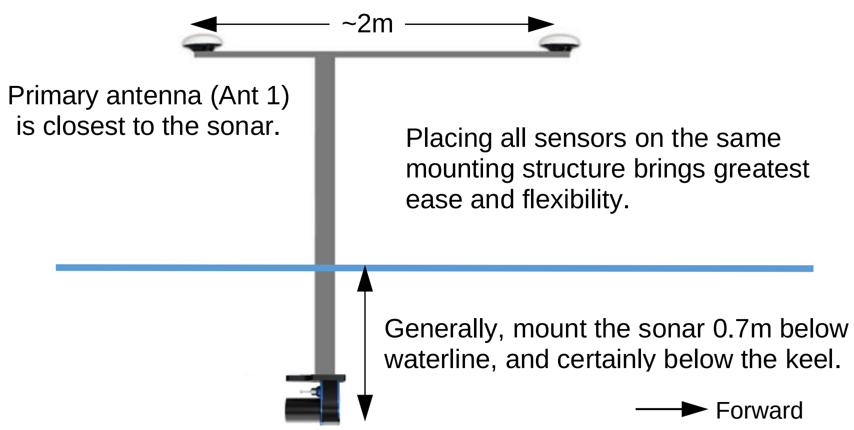
Power can also be provided directly from a 12V deep cycle battery. The maximum power consumption is 70W for the SeaRAY.

1.4 Wet-End Components

1.4.1 Mounting Location

Ideally, all survey sensors (sonar, IMU and GNSS antennas) should be mounted on the same pole to minimize offsets and errors caused by independent movement between sensors. All sensors should be fixed and rigid with respect to each other.

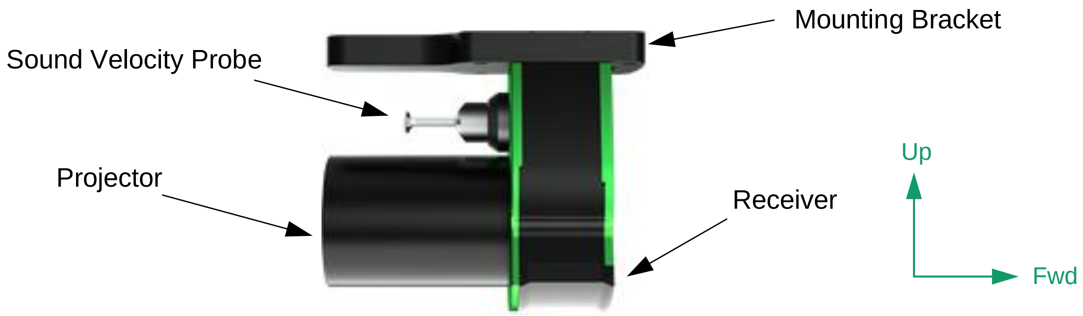
Install the sonar with the projector facing aft and the curved receiver array facing forward. It should be installed below the lowest part of the vessel to provide sufficient acoustic clearance for optimal performance, and ideally at least 0.7m below waterline to avoid bubbles and turbulence at the surface which can impact acoustic performance.



1.4.2 Sensor Mounting

Use at least 4 bolts (2 forward and 2 aft) made of high-quality stainless steel to mount the sonar wet end. Use a lock washer and/or an anaerobic thread adhesive such as Loctite 242 Blue to prevent loosening of sonar during long deployments.

When securing the sonar cable, push the connector while screwing the collar in place and wiggle it gently to ensure a robust connection. The sonar cable should never be connected or disconnected underwater. Ensure all connector pins and sockets are clean and dry. Always use the supplied connector caps on wet-end, cables and topside. Use a synthetic O-ring lubricant on connector O-rings that are in good condition.

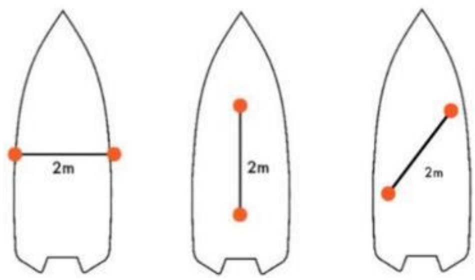


The mounting pole must be hollow and should be centered over the sonar connector, which exits through the top of the bracket. When a mounting pole is used, the cable must be routed inside the pole, and the minimum diameter of the pole must be 5.8cm.

1.5 GNSS Antennas

The SeaRAY includes integrated GNSS/INS subsystems, which comprises 2 Trimble 540AP antennas and an IMU integrated in the sonar head. The antennas must have a clear view of the sky to the horizon so that every satellite may be continuously tracked without obstruction. The mounting locations should be free from vibration and rigid with respect to each other and the IMU.

Trimble 540AP Antenna
L1 Phase: 58mm from base



The Primary Antenna (Ant 1) should be nearest to the sonar so that offset measurement errors are minimized. The Secondary Antenna (Ant 2) should be a fixed distance from the Primary Antenna. It is recommended that the antennas be at least 2m apart for optimal performance. The antennas should be positioned parallel to the water surface to within 2-3cm.

While the antennas may be oriented in any direction horizontally, it is good practice to orient them to be parallel or perpendicular to the vessel centerline. Screw the antennas onto 5/8” UNC threads.

1.6 Dry-End Components

The dry end consists of a single topside unit which distributes power and data. The sonar and GNSS antennas should be connected to this unit. Take care not to bend the pins on the connectors.

Connector	Description
Sonar	18-pin interface to sonar and IMU
Ant 1	Primary GNSS antenna
Ant 2	Secondary GNSS antenna
COM (Serial)	GNSS corrections input (RTK/DGNSS)
PPS	1PPS output for external sensor (not typically used)
Ethernet	For communication between topside PC and sonar
10-28 VDC	Input DC voltage

1.6.1 LED Status Indicators

Indicator	Pattern	Description
Sonar LED	Steady Green Blinking Green (1Hz) Blinking Green (ISO 1Hz) Blinking Green (5Hz) Off	Sonar Pinging Sonar Stand By Sonar Booting Sonar Over Current Failure Sonar Off
PPS LED	Blinking Orange (1Hz) Blinking Orange (5Hz) Steady Orange Off	Sync/Timing OK No Sync, NMEA Missing No Sync, PPS Missing No Sync, NMEA and PPS Missing
Aux In/Out LED	Off	Not currently in use
Power On/Off LED	Steady Green Blinking Green (5Hz) Off	Input Voltage OK Input Voltage <10v or >28V No Input Voltage
ETH	Blinking Green Off	INS established valid Ethernet connection No INS Ethernet connection
Msg	Blinking Green Off	INS receiving RTK corrections No RTK corrections
SV	Blinking Green Off	INS detecting satellite vehicles No satellite vehicles detected

2 Software Setup

2.1 SeaRAY GUI Installation

The GUI executable file installs the SeaRAY Graphical User Interface (GUI). It is recommended to disable the Windows Firewall, or add a port exception, to allow communication with the SeaRAY integrated INS.

2.1.1 PC System Requirements

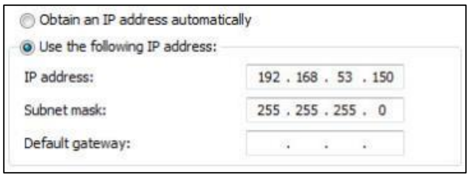
The minimum system requirements are shown below. Note that these may change depending on the acquisition software used.

Hardware	Requirements
Operating System	Windows 10 Pro (Recommended) / Windows 8.1 (Fully Updated) / Windows 7 or Vista (Unsupported) * / Windows XP (Untested)
Processor	2GHz or more
Memory	4GB or more
Display Resolution	1400x900 or higher Lower resolution can be used but it is not optimal. It will not impair data acquisition.
Graphics Card	Integrated graphics are sufficient for running the GUI. A dedicated graphics card is required for running data acquisition or processing software.
Network Speed	100Mbit Ethernet
Storage	GUI operation only: <1GB; Full system with logging: >100GB

2.2 Network Configuration

SeaRAY sonars connect to the acquisition computer via standard Ethernet protocol. The computer network adaptor must be configured to the same subnet.

To configure the computer IP address, navigate to the network adaptor properties in Windows control panel and change the **TCP/IPv4** settings. The last 3 digits of the IP address must not conflict with the address of the sonar or integrated INS.



The SeaRAY integrated INS is pre-configured with an IP address of **192.168.53.100**. The IP address of the sonar is always **192.168.53.XX**, where XX represents the last two digits of the sonar serial number. A subnet mask of **255.255.255.0** should be used. Seafloor Systems recommends setting the IP address of the acquisition computer to **192.168.53.150**.

2.3 Connect to Sonar

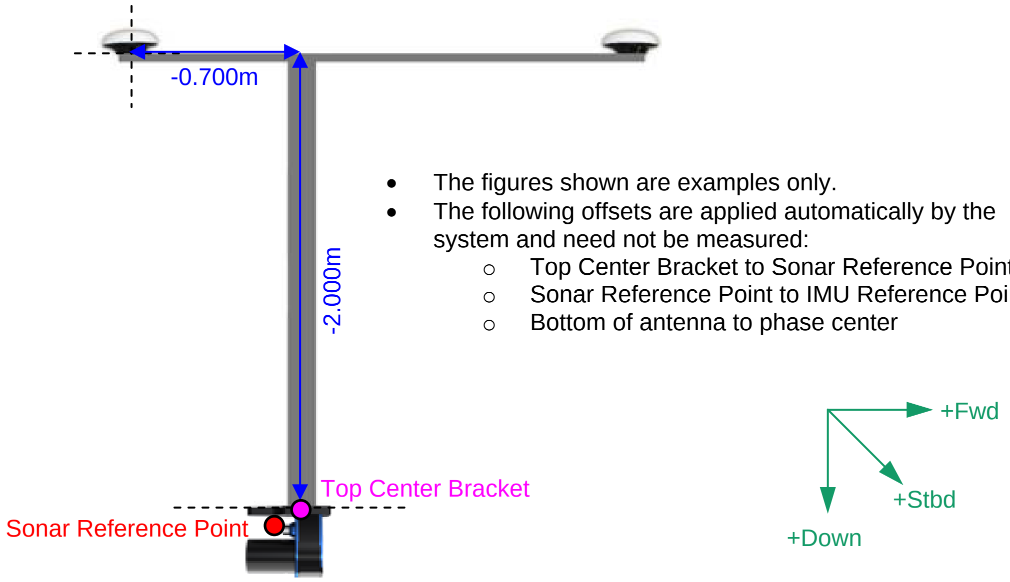
Upon launching the GUI, the **Connection Dialog** is displayed. If a sonar is powered on and active on the network, a green light is displayed. A red light indicates that the sonar is offline.

Select the sonar to highlight the row and click **Connect**. After the first successful connection is established, all subsequent connections to the sonar are automatic.

2.4 INS Setup for SeaRAY

2.4.1 Measuring Offsets

With all sensors installed, carefully measure from the top center of the sonar bracket to the bottom of the primary antenna (Ant 1) along all 3 axes, as defined by the sonar housing. Note that the sign convention is +Forward, +Starboard and +Down, therefore the vertical offset should always be a negative value.



- The figures shown are examples only.
- The following offsets are applied automatically by the system and need not be measured:
  - Top Center Bracket to Sonar Reference Point
  - Sonar Reference Point to IMU Reference Point
  - Bottom of antenna to phase center

2.4.2 Setup Wizard

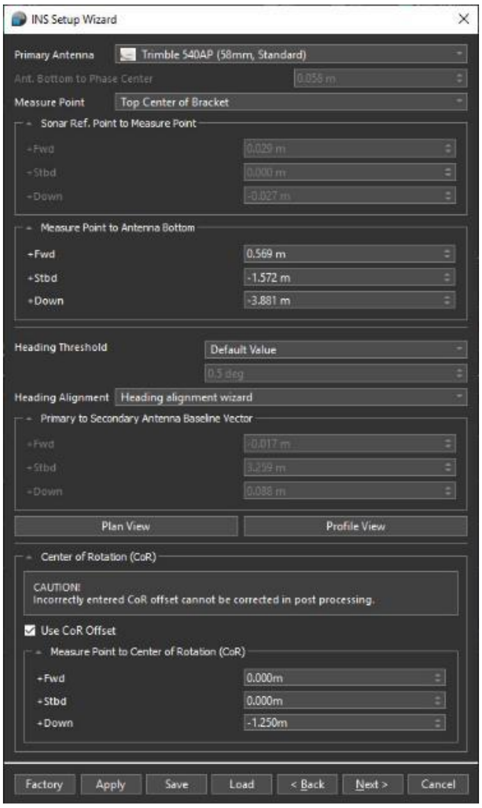
Run the setup wizard in the GUI to configure the integrated GNSS/INS subsystems. It is advised that, prior to each new installation, the factory default settings are restored. Open the **INS Setup Wizard** and select **Factory**. Note, this only resets the INS configuration and has no impact on the sonar configuration or GUI display preferences. Seafloor Systems recommends reviewing all inputs prior to each survey, even if the installation has not changed.

RTK positioning is **STRONGLY** recommended for optimal system performance. With no corrections configured, the GNSS subsystem works in standalone (Coarse Acquisition) mode with ~5m positioning accuracy. DGNSS corrections provide decimeter accuracy, while RTK provides centimeter accuracy.

2.4.2.1 IMU Offset & Mounting Angles

The first page of the setup wizard shows the sonar model in the **System** selection and the relevant offsets and mounting angles. The model is automatically detected and there is nothing to change here.

2.4.2.2 Antenna Offsets



Select the **Primary Antenna** model, which in most cases will be **Trimble 540AP**, to ensure that the correct phase center offset is applied.

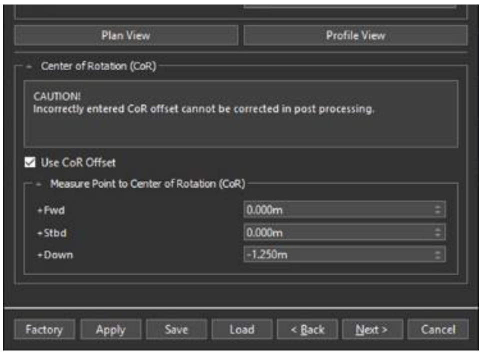
Select the **Measure Point** to define a convenient reference point from which to measure the primary antenna offset. **Top Center of Bracket** should normally be selected. A **Custom** point may also be defined.

Carefully measure the distance from **Measure Point to Antenna Bottom** and enter the correct values, bearing in mind the sign convention (positive down).

Users can specify the **Heading Threshold** for the heading alignment procedure which follows later. The **Default Value** (3.0º) should be used. Every time a heading alignment is performed, a patch test should be performed afterwards.

For **Heading Alignment** method, select **Heading Alignment Wizard** to populate the fields in **Primary to Secondary Antenna Baseline Vector** with zeros initially. Correct values are displayed after the alignment is complete (described in section 2.4.3). If the antenna baseline vector is already known, i.e. if it was measured using land survey techniques, the results can be entered by selecting **Custom**.

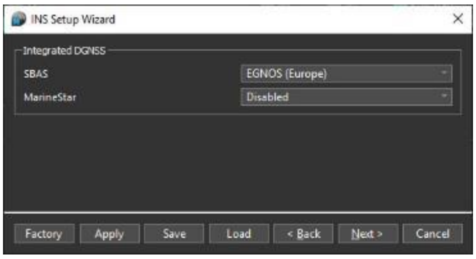
2.4.2.3 Center of Rotation Offset



The vessel **Center of Rotation** (CoR) offset should be entered relative to the **Measure Point**. Note that the center of rotation is more of an area rather than a well-defined point on the vessel, therefore an approximation will suffice. Select **Use CoR Offset** and enter the measured values under **Measure Point to Center of Rotation (CoR).**

The CoR, for most commercial vessels, is documented in the vessel design plans. For other vessels, it must be estimated. The location can be hard to determine, as it may change over time depending on fuel stowage and distribution of personnel body weight. Generally, choose a location that is about 3/4 distance from bow to stern, centered on the keel, and located at approximately water level.

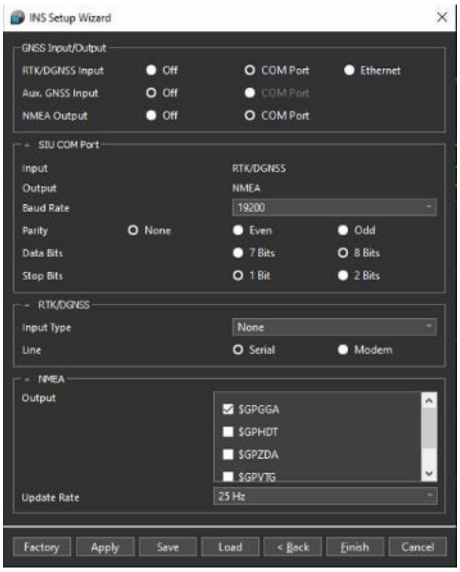
2.4.2.4 Integrated DGNSS



The **Integrated GNSS** settings are used to specify the desired satellite GNSS correction service. Satellite Based Augmentation Service (**SBAS**) may be configured here. This is a correction source that is regional and free.

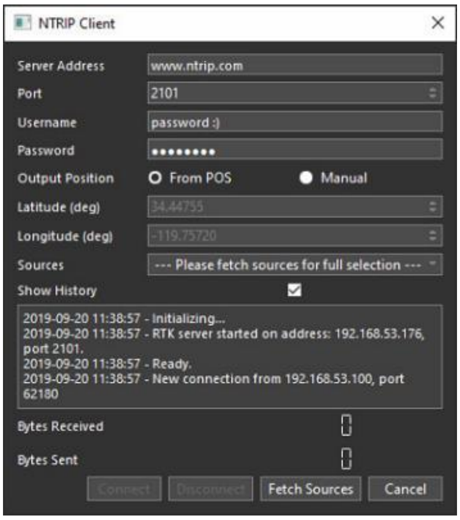
Alternatively, **Marinestar**, a paid subscription service providing decimeter accuracy, may be configured.

2.4.2.5 RTK/Aux GNSS Input & NTRIP Client



RTK corrections may be transmitted to the vessel from a land base station (via radio) and interfaced to the system via the serial COM port on the SIU. The radio on the vessel must therefore have a serial output, containing **only** the correction message. The incoming radio baud rate must match the selection in the setup wizard.

Select the correct RTK **Input Type** (**CMR**, **CMR+**, **RTCM**, etc.) as well as the input **Line**, either **Serial** or **Modem**. Please note that if an input type other than **None** is selected, the INS only uses GPS satellites, so it will likely result in fewer satellite vehicles being detected. Selecting **None** enables the INS to use additional satellites from other constellations such as GLONASS.

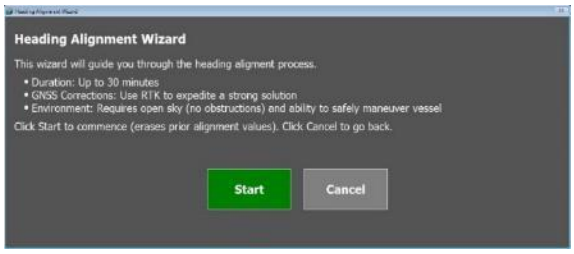


To enable RTK corrections via NTRIP, select **Ethernet** as the **RTK/DGNSS Input**. Select **NTRIP Client** and enter the login details. Select **Fetch Sources** and select the source from the dropdown menu. Click **Connect**.

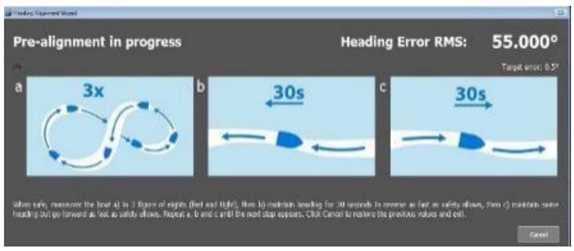
Click **Finish** to complete the setup wizard. If **Heading Alignment Wizard** was selected in section 2.4.2.2, finishing the setup wizard automatically starts the alignment wizard. If performing a heading alignment calibration is not possible at this time, you may select **Cancel**, with no loss of input values, and perform the calibration later.

2.4.3 Heading Alignment Wizard

A heading alignment must be performed when the SeaRAY sonar is first installed, or when one of the INS sensors (IMU or GNSS antennas) is moved. The heading alignment determines the vector offset from primary antenna to secondary antenna, and in doing so ensures proper alignment of the IMU with the GNSS antenna pair. RTK positioning must be used when performing a heading alignment, otherwise the primary-secondary antenna vector should be measured by hand and applied as a custom offset.

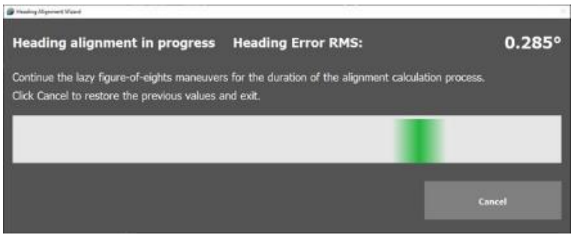


Step 1. Press **Start** to begin the calibration. RTK positioning must be used, and antennas must have a clear sky view, away from tall structures that impede GNSS performance. The installation must be completely rigid and free from vibration. The primary antenna offset must be accurately measured and applied during the INS setup stage described in the preceding section.

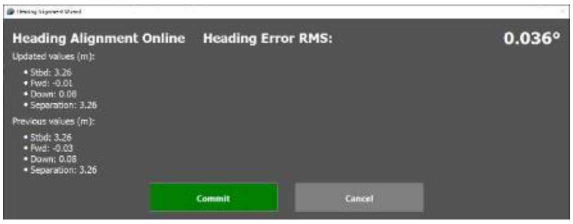


Step 2. Follow the recommended maneuvers during the pre-alignment stage and observe the display as the **Heading Error RMS** decreases from its initial value of 55°. Once the value drops below the defined threshold (**Target Error**) and stabilizes, the heading alignment begins. Continue to maneuver the vessel until this occurs.

Step 3. Follow the instructions and continue to perform figure-of-eight maneuvers while the heading alignment is in progress. The overall time to complete the calibration depends on the size of the vessel and the speed at which the maneuvers are performed, as well as positioning quality.



The computed results are unique to each installation. If the primary to secondary antenna baseline was manually measured beforehand, the calculated results should be similar. Select **Commit** to save the results. Seafloor Systems recommends performing a patch test after the heading alignment.



3 Sonar Reference Point

The **Sonar Reference Point** is where all sonar and navigation data are valid upon export. All sensors in the acquisition and processing software must have the same offset to this location.

The **Top Center of Bracket** is merely a convenient point from which to measure the primary GNSS antenna offset.

Sonar Ref. Point to Top Center of Bracket	
+Fwd	0.103 m
+Stbd	0.000 m
+Down	-0.024 m

Refer to Appendix A3 for the offsets drawing.

4 Sonar Operation

4.1 Sonar Wedge

The sonar is operated using the SeaRAY Graphical User Interface (GUI). It shows the sonar wedge at the center of the display, containing a single ping of data from a thin slice of the water column. The wedge comprises 256 overlapping beams, which each contains a depth sounding.

4.1.1 Upper GUI Status Indicators

The ***Sonar*** indicators shows the streaming status of various data types as requested by the acquisition software. If the sidescan (**SS)** indicator is red, it indicates that the signal is saturated.

The ***INS*** indicators relate to the function and health of the integrated INS. Mouseover the indicators to display additional information such as current position, attitude and accuracy.

The **Logging** indicator shows when raw INS data is recording. The GUI automatically logs INS data when the GUI is launched. This can be used for POSPac processing or for applying True Heave data. The log folder path is displayed by hovering over the indicator, and the path may be changed by selecting **Advanced** > **Options** > **Paths**.

The **Status** indicator provides the current solution status (FIXED RTK, Pri. DGNSS, etc.) as well as the status of the current corrector stream.

INS Status	Navigator Description
DR (Dead Reckoning)	No GNSS input is available; navigation is using only the IMU data
RTCM DGNSS	Tightly coupled using raw observables plus corrections (RTCM 1 or 9)
CODE DGNSS	Tightly coupled using raw observables plus corrections (RTCM 18 and 19, CMR, CMR+)
FLOAT RTK	Tightly coupled using raw observables plus corrections (RTCM 18 and 19, CMR, CMR+)
FIXED RTK	Same as Float RTK but better accuracy
Pri. C/A	Closely coupled using primary GNSS position data in C/A mode
Pri. DGNSS	Closely coupled using primary GNSS position data in DGNSS mode
Pri. P Code	Closely coupled using primary GNSS position data in P-CODE mode
Pri. RTK	Closely coupled using primary GNSS position data in RTK mode
Aux. DGNSS	Loosely coupled using auxiliary GNSS position data in DGNSS mode
Aux. P Code	Loosely coupled using auxiliary GNSS position data in P-CODE mode
Aux. Float RTK	Loosely coupled using auxiliary GNSS position data in Float RTK mode
Aux. WL RTK	Loosely coupled using auxiliary GNSS position data in Wide Lane RTK mode
Aux. NL RTK	Loosely coupled using auxiliary GNSS position data in Narrow Lane RTK mode

4.1.2 Lower GUI Viewer Bar

By default, the sonar starts pinging once connected to the GUI. The Play /Stop button is used to start/stop pinging. Pinging should be stopped when the GUI is running with the sonar out of water, to prevent electronics from overheating. Selecting activates raw data recording, and the recording path is shown on the display when recording is active.

Users may also set the **Side Scan Length** and adjust display **Brightness**. The **Brightness** control bar only adjusts the wedge intensity displayed on the GUI; it does **not** affect the raw data signal. This can be used to effectively increase the illumination of received acoustic data. Applying too much brightness will saturate the image of the more reflective areas of the acoustic display, while applying too little results in a very dark image.

The **Zoom** tool opens an adjustable pop-up window on the sonar wedge. The window can be dragged to any part of the wedge to magnify any segment of the swath.

Hide/unhides the sonar settings menu. The user still has control of the gates, and therefore the sonar range, by clicking/dragging the gates interactively on the wedge.

4.2 Sonar Settings Menus

4.2.1 View

Function	Description
Gate Mode	Allows for selection of manual gates by upper and lower depth (**Depth** mode), by upper and lower range (**Range** mode) or by upper depth and lower range (**Mixed** mode). **Depth** gates are suitable for most environments. **Range** gates are ideal for shallow water bank to bank surveys, or when changing the **Direction**. A bottom search is performed between the **Upper Gate** and **Lower Gate** independently for each beam. When **Depth** mode is active, changing the **Direction**, or operating with a physically tilted head may drastically reduce the ping rate. To avoid this, select **Range** or **Mixed** mode.
Upper Gate	Sets the upper limit (minimum depth) for bottom detections. Change values by entering a number and press Enter, by using up/down arrows next to the corresponding control bar, or by interactively clicking and dragging the gate to the desired depth on the wedge. For most surveys the minimum should be at least 1m to avoid false detections at the surface.
Lower Gate	Maximum depth for calculating bottom detections. For optimal swath coverage, the gate should be set such that the seabed profile is lower than the two widest parts of the wedge. Change values by entering a number and press Enter, by using up/down arrows next to the corresponding control bar, or by interactively clicking and dragging the gate to the desired depth on the wedge.
Swath	User-defined total angular swath coverage. For typical harbor dredge surveys, this value is normally set to 130°
Automatic Zoom	Makes the active portion of the wedge full screen. This ensures that detections are clearly visible on the display, even when the range is very high.

4.2.2 Tx Pulse Settings

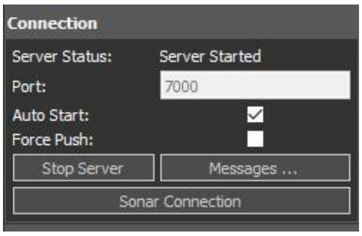
Function	Description
Frequency	Sets the center frequency of the transmitted pulse. SeaRAY sonars are optimized for a center frequency of 400kHz. For a given depth, higher frequencies theoretically have higher bottom detection resolution, but also higher signal attenuation, especially in the presence of sediments. For most applications, Seafloor Systems recommends using 400kHz.
Ping Rate	Sets the rate at which acoustic pulses are transmitted. Certain factors such as depth will limit the maximum achievable ping rate. For instance, in deeper water, lower ping rates should be expected since signal travel time and path length from projector to seabed, and then back to receiver, are longer.

4.2.3 Advanced

Function	Description
Sound Speed	Controls how the surface sound speed is applied. If **Auto Sound Speed** is selected (recommended) the sonar uses values from the integrated SVP. If this sound speed probe fails, users can disable the auto option and manually input the speed, based on a sound speed profiler for example. An incorrect surface sound speed will irreparably compromise data quality. Minimum value is 1300m/s, maximum is 1700m/s. When **Auto Sound Speed** is deselected, the last value at the head is used to populate the SV value. Please note that this range reflects default hardware capabilities.
Auto Sound Speed	If this option is selected the speed of sound is read from the probe at the sonar head. This is recommended unless the probe is damaged, out of calibration or there are too many bubbles affecting the data quality, e.g. when surveying in rapids or surf-zone. If necessary, this option may be deselected, and the value set manually. If the sonar is powered on and out of the water, or there are excessive bubbles, the GUI displays a warning that the sonar is "Out of water". If the sonar is pinging out of water, it automatically takes measures to prevent damage due to overheating. If the sonar temperature exceeds 65°C it will shut down automatically as a safety precaution.
Roll Stabilization	Allows for a wider swath width in more dynamic sea states. Roll stabilization compensates up to ±10º of roll. Note that this is unrelated to roll compensation for georeferencing, which is handled separately.
Beam Distribution	Several modes are available: • **Equiangular 256**: The angular swath coverage is divided equally by 256 (the total number of beams) to determine angular beam spacing. Use to increase resolution around the nadir zone. • **Equidistant 256**: The maximum chord distance of the swath is divided by 256 to determine the linear beam spacing. Use to increase resolution at outer swath edges. Do not switch while logging data.

4.2.4 Connection

SeaRAY sonars operate in a native data format. To ensure compatibility with other data acquisition and processing software, the system includes a proxy that translates native SeaRAY sonar data to the well-known s7k data format. The proxy is therefore run from the GUI and is initiated automatically. The connection can be reset should a conflict arise. If necessary, to avoid conflict with other sensors, the **Port** number can also be changed.



⚠ **NOTE: Enable Force Push for PDS and EIVA Acquisition**

To receive sonar and INS data into PDS or EIVA, the **Force Push** option must be selected.

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5 Basic Acquisition Software Setup

5.1 Offsets

By default, integrated SeaRAY systems output all sonar and navigation data at the Sonar Reference Point (refer to section 3 for more details). Therefore, each device in the acquisition software requires the same offset to this location, i.e. the offset from the acquisition software reference point (e.g. vessel center of gravity) to the Sonar Reference Point.

If the Sonar Reference Point location is chosen as the acquisition software reference point, no further offsets are required. However, in HYPACK it is always recommended to apply offsets relative to the vessel center of gravity, and note that the vertical offset is the same for all systems and should be measured from the waterline to the Sonar Reference Point.

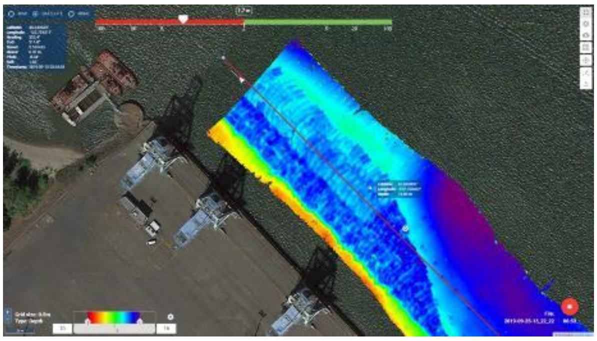
Seafloor Systems recommends consulting the respective manuals of your chosen acquisition software for full setup guidance, as this section outlines the basic project setup steps only.

5.2 Data Collection Tool (DCT)

DCT is a web-based survey acquisition utility aimed to simplify standard bathymetry survey operations. A grid can be displayed on any computer or mobile device allowing quick estimation of survey coverage and data quality in real-time. Unlike other data acquisition packages, DCT requires no setup or offsets. By default, all data is output with WGS84 coordinates and depth below sonar.

The basic setup steps are outlined below. Refer to the dedicated DCT manual for more detailed operational guidance.

Step 1. Download Tiles
Background tiles from OSM and Google Maps can be optionally downloaded and saved at the office prior to commencing the survey. This is useful when an Internet connection is not available onboard.



Step 2. Start DCT
Start the application from the desktop shortcut icon using Google Chrome or Mozilla Firefox. DCT can be accessed from the same PC as the SeaRAY GUI, or remotely from anywhere in the world via tablets, office computers, etc. if they are on the same network.

Step 3. Data Acquisition
Press the record button to start and stop data logging. This commands the SeaRAY GUI to start logging s7k files, and a real time grid is displayed. Recorded files contain the complete survey solution (depth, position and attitude data, including delayed heave). Line plans may also be generated, and a left/right helmsman indicator is displayed.

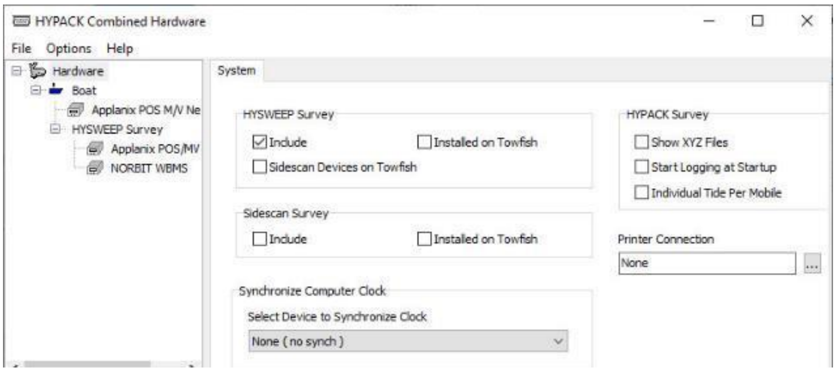
Step 4. Data Processing
The acquired s7k files should be processed using your software of choice (e.g. HYPACK, Qimera, CARIS, etc.). Here, patch test results and sound velocity profiles are applied, and the geodetic setup is defined.

5.3 HYPACK

For more comprehensive guidance, refer to the HYPACK manuals. With integrated SeaRAY sonars, all systems (navigation, attitude and multibeam) should have the same offset applied, as measured from the vessel center of gravity to the Sonar Reference Point. Note that the vertical offset is measured from waterline. The HYPACK sign convention uses **+Forward**, **+Starboard**, and **+Down.**

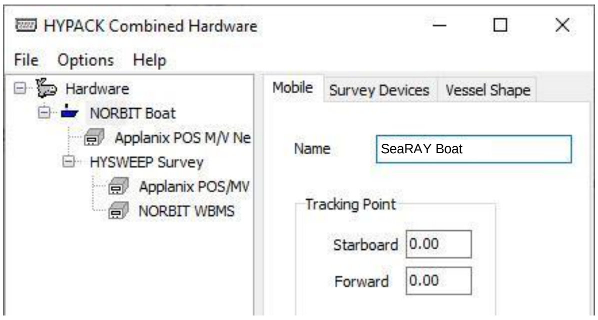
Step 1. Enable HYSWEEP Survey

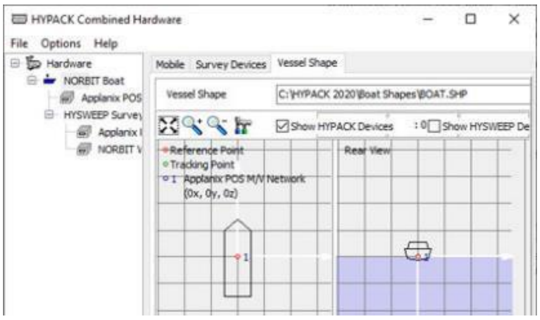
Check **Include** under HYSWEEP Survey. This allows devices to be added for multibeam surveys.



Step 2. Define Boat

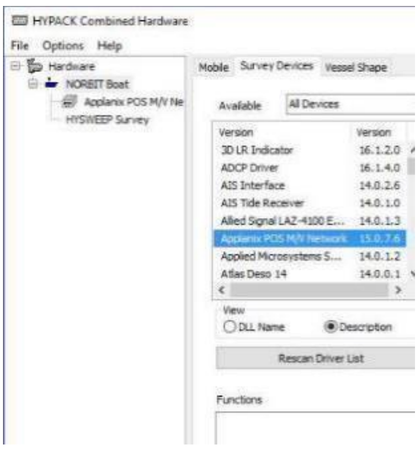
Select **Boat** and give it a name. For more intuitive visualization, add a tracking point, preferably to the Sonar Reference Point (for standard installations). Edit Vessel Shape as appropriate.

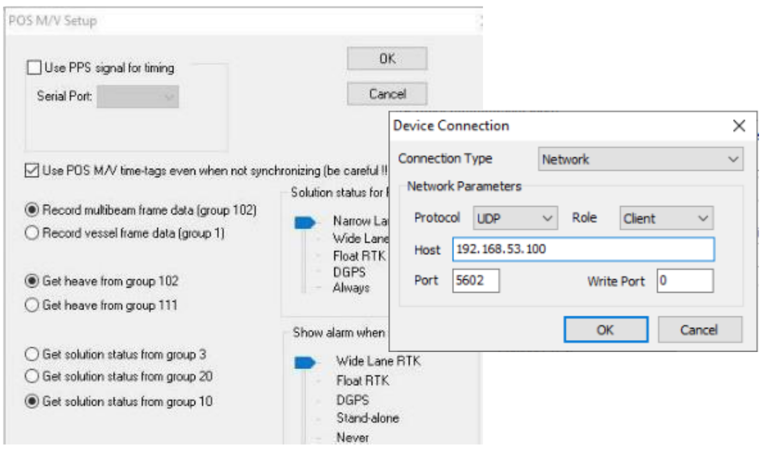




Step 3. Configure Position and Heading Device

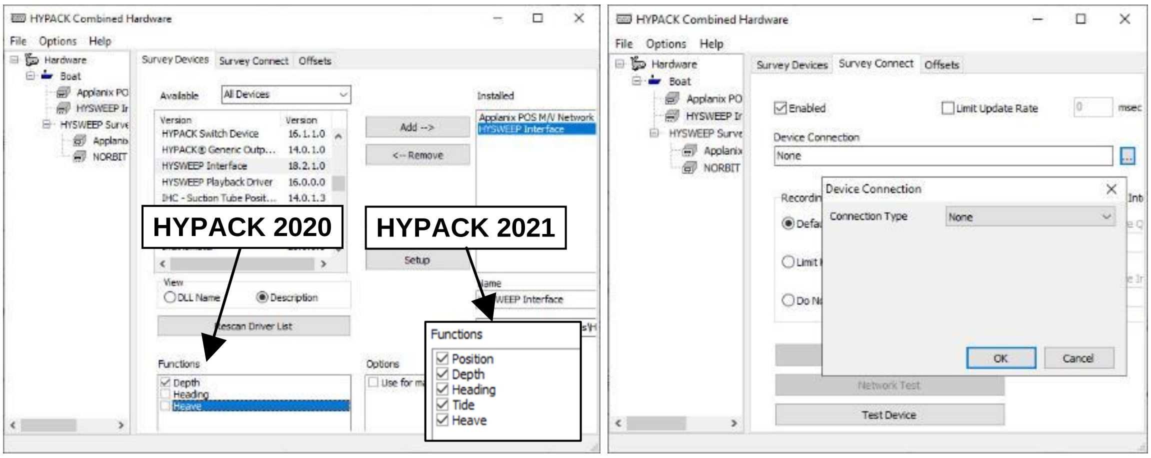
If using **HYPACK 2020 or earlier**, add the Applanix POS M/V Network device and configure it as shown below. If using **HYPACK 2021**, ignore this step and move onto the next.





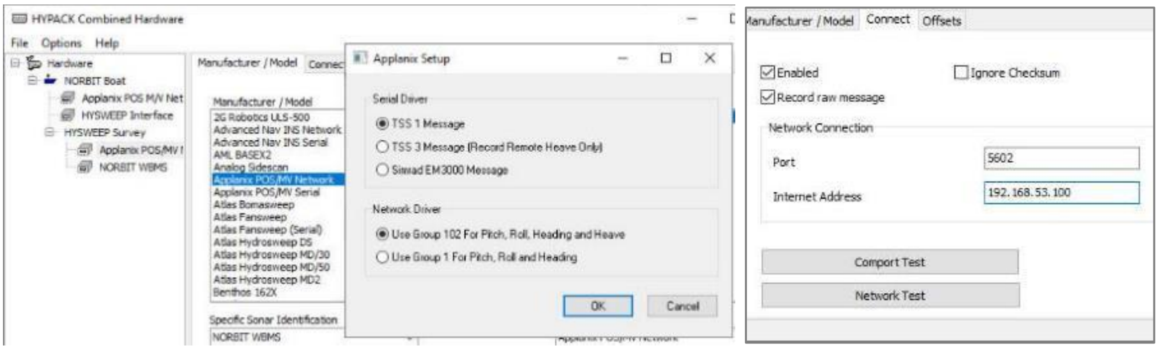
Step 4. Configure HYSWEEP Interface

For **HYPACK 2020 and earlier**, add the HYSWEEP Interface, checking only the *Depth* function. For **HYPACK 2021**, check all the function boxes (*Position*, *Depth*, *Heading*, *Tide* and *Heave*).



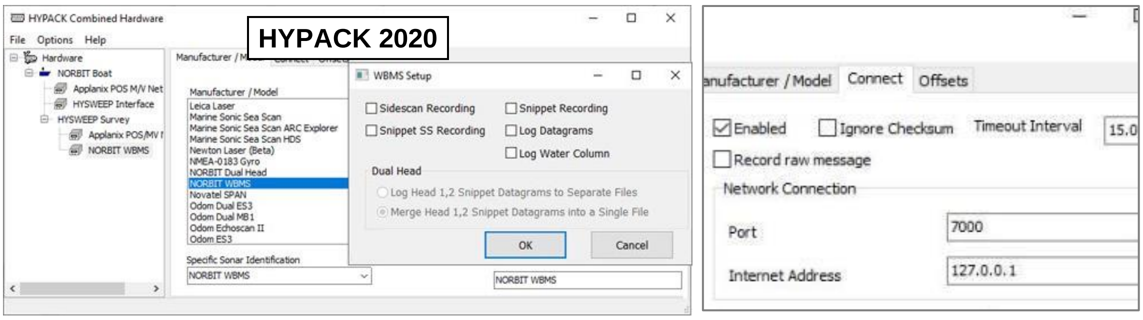
Step 5. Configure Motion Device

For **HYPACK 2020 and earlier,** under HYSWEEP Survey, add the Applanix POS/MV Network device and configure it as shown. For **HYPACK 2021**, ignore this step and move onto the next.

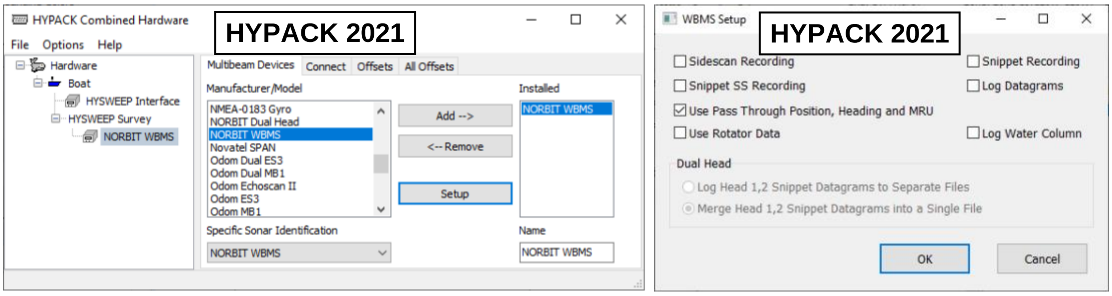


Step 6. Configure Multibeam Device

Under HYSWEEP Survey, select NORBIT WBMS. In the WBMS Setup window, select **Sidescan Recording** if sidescan data is also required. Note that bathymetry data automatically includes bathy intensity values at the bottom detection point, which provides coarse backscatter.



If using **HYPACK 2021**, enable the **Use Pass Through Position, Heading and MRU** option. This provides the navigation solution, simplifying the setup by removing the need for the Applanix POS/MV Network devices that were required in previous versions.



5.4 Qinsy

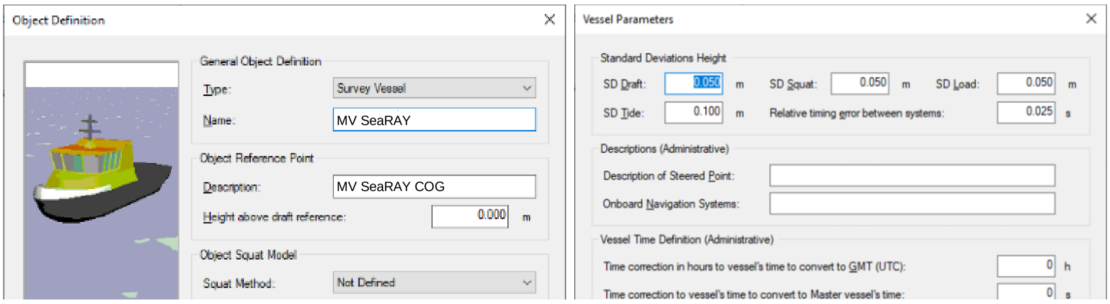
The following sections show recommended configurations of Qinsy v9 for all SeaRAY sonars. It assumes that the INS reference is collocated with the Sonar Reference Point. Note that the Qinsy sign convention uses **Y+ Forward**, **X+ Starboard**, and **Z+ Up**. Qinsy structures all data in a native database format. All data and hardware settings including offsets are saved to a database file.

Step 1. Configure Geodesy

Access the Geodetic Configuration from the Qinsy console and specify the relevant geodesy.

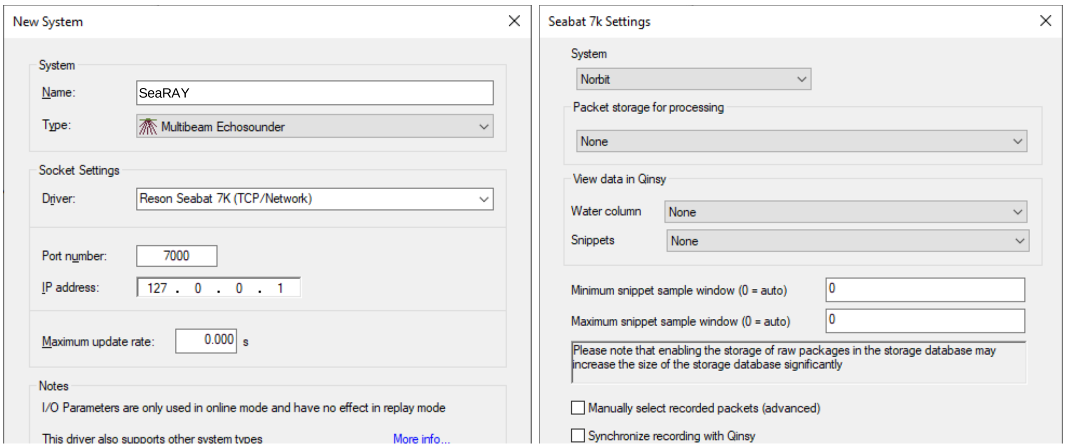
Step 2. Object Definition

From the Qinsy console, select **Setup** > **New Database** Specify the shape of the vessel and the reference point for Qinsy (e.g. vessel center of gravity)



Step 3. Add Multibeam System

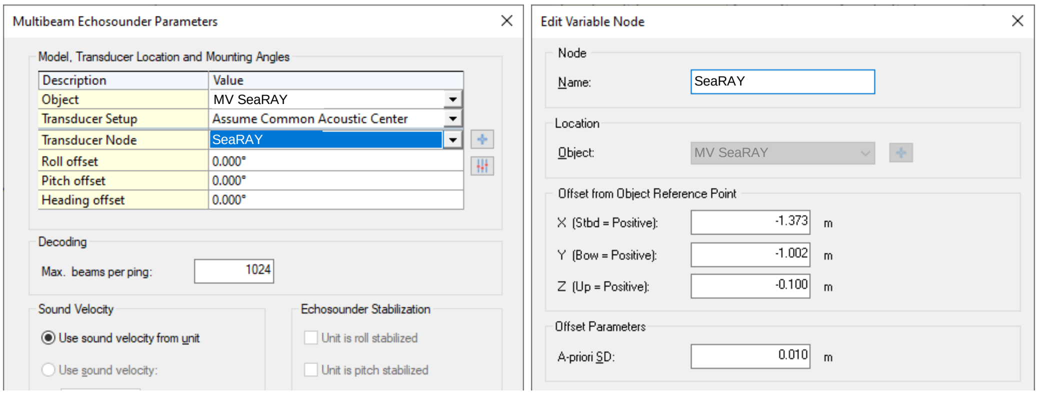
Specify a system name, e.g. SeaRAY, and select **Multibeam Echosounder** as the type**.** Select the **Reson SeaBat 7k (TCP/Network)** driver, use port **7000** and IP address **127.0.0.1**.



Under Raw Data Recording, for standard bathymetric data collection select the **NORBIT** System and **None** for Packet Storage, Water Column and Snippets.

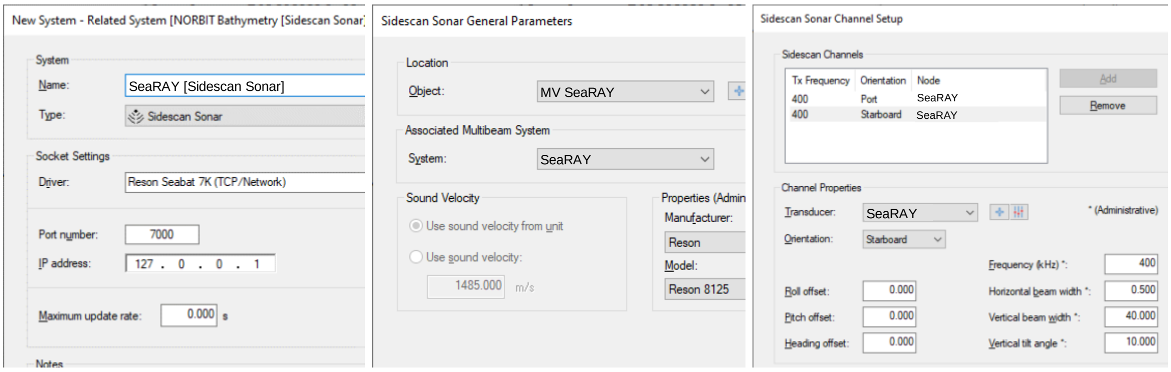
Step 4. Enter Offset to Sonar Reference Point

In Multibeam Echosounder Parameters, click the **+** button to create a node. Patch test values (roll, pitch and heading) may be entered if known. Enter 1024 under max beams per ping. Use the default echosounder accuracy and correction values. Click Finish.



Step 5. Add Side Scan System (Optional)

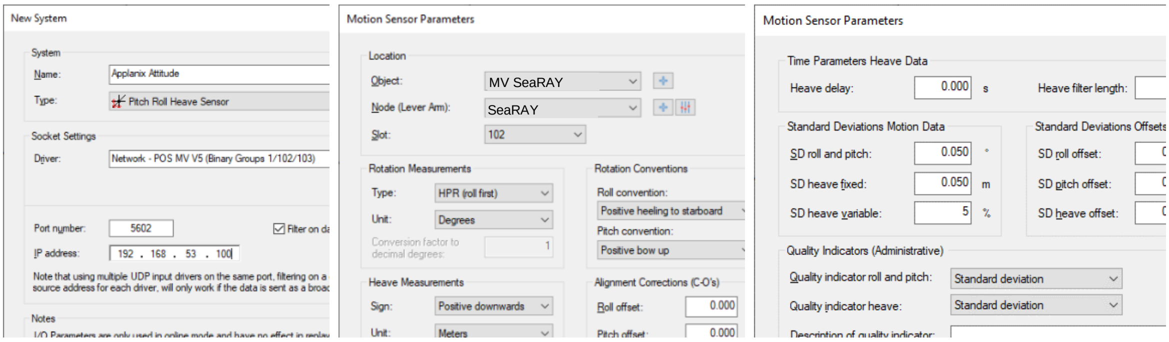
Related systems may now be added. To add side scan, a port and starboard channel should be added and the frequency should be specified. Items marked with an asterisk (*) will not impact the data and are only for record keeping. Click Finish when done.



Step 6. Add Pitch/Roll/Heave System

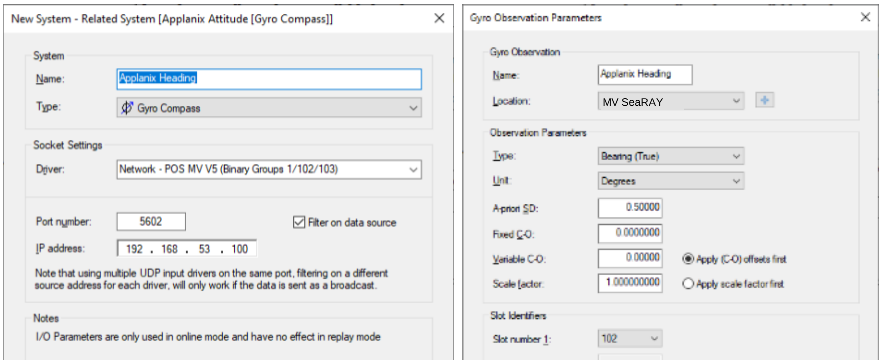
MV SeaRAY

From the Database Setup window, right-click System, click New System and add a Pitch/Roll/Heave sensor. Please note that for Applanix systems, the sign convention is positive downwards:



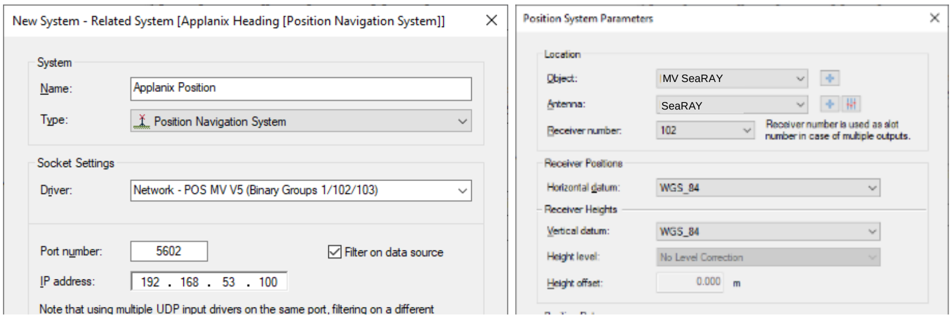
Step 7. Add Gyro Compass System

Repeat the previous step to add a new system, but this time add a Gyro Compass:



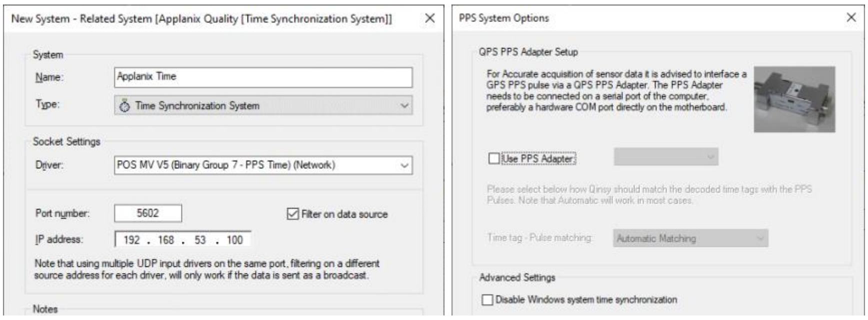
Step 8. Add Position Navigation System

Repeat the previous step to add a new system, but this time add a Position Navigation System. The Horizontal and Vertical datum will obviously depend on project specifications.



Step 9. Add Time Synchronization System

A time synchronization system must be added. Use binary group 7 without a PPS box.



Step 10. Configure Qinsy Online Filters

Seafloor Systems recommends adding a Range filter (minimum 0.5m) and Brightness/Collinearity filters. This is set under **Controller > Settings > Echosounder Settings** in Qinsy Online. It removes the false trail of soundings at nadir which have 0m range and quality flag zero.

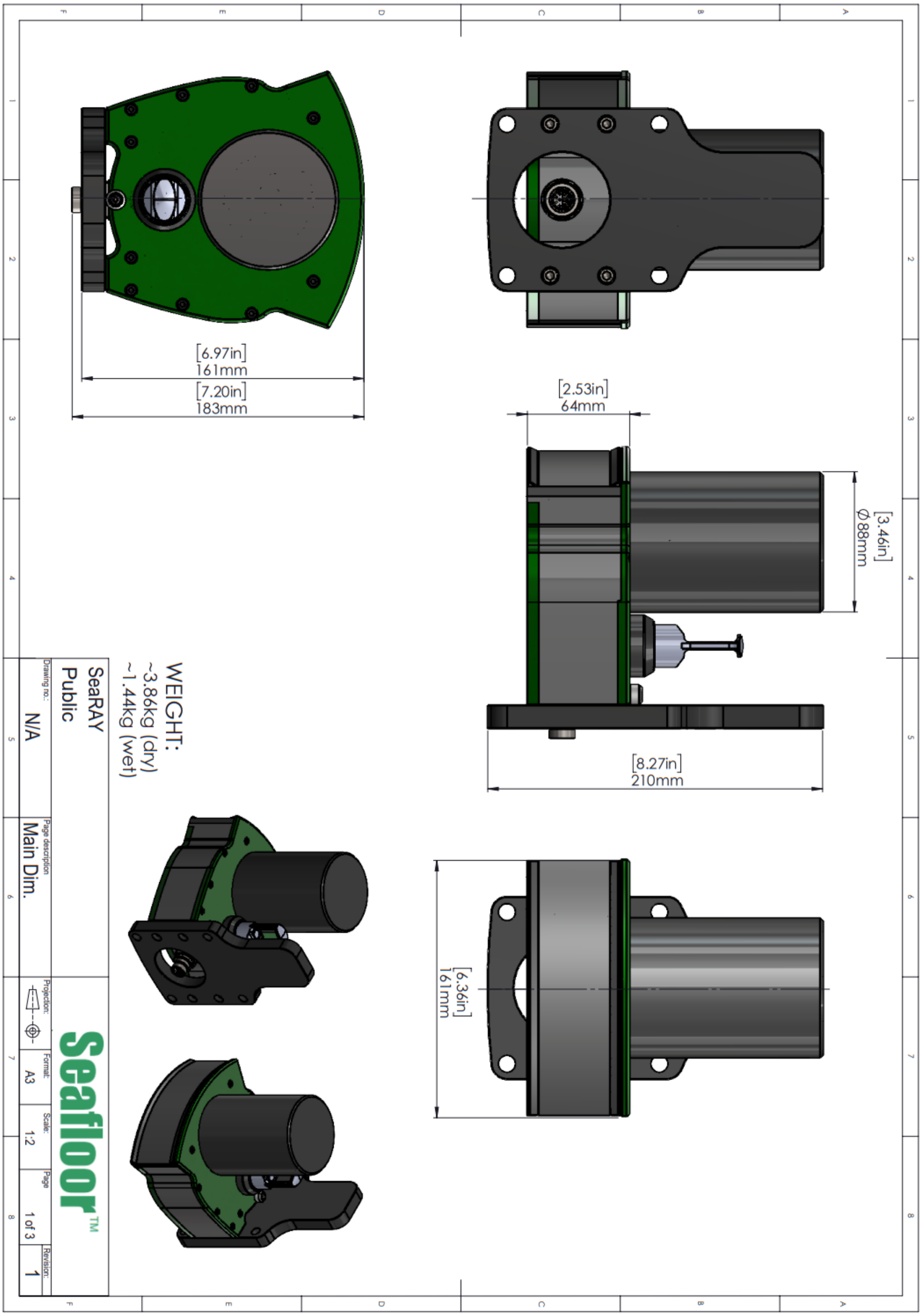
Item	Min	Max
☐ Depth outside	2.00	20.00
☑ Range outside	0.50	500.00
☐ Sector outside	-75.00	75.00
☐ Heave above		5.00
☐ TPE exceeds		
☑ Brightness test fails		
☑ Colinearity test fails		

NOTE: Time Synchronization Accuracy Alerts

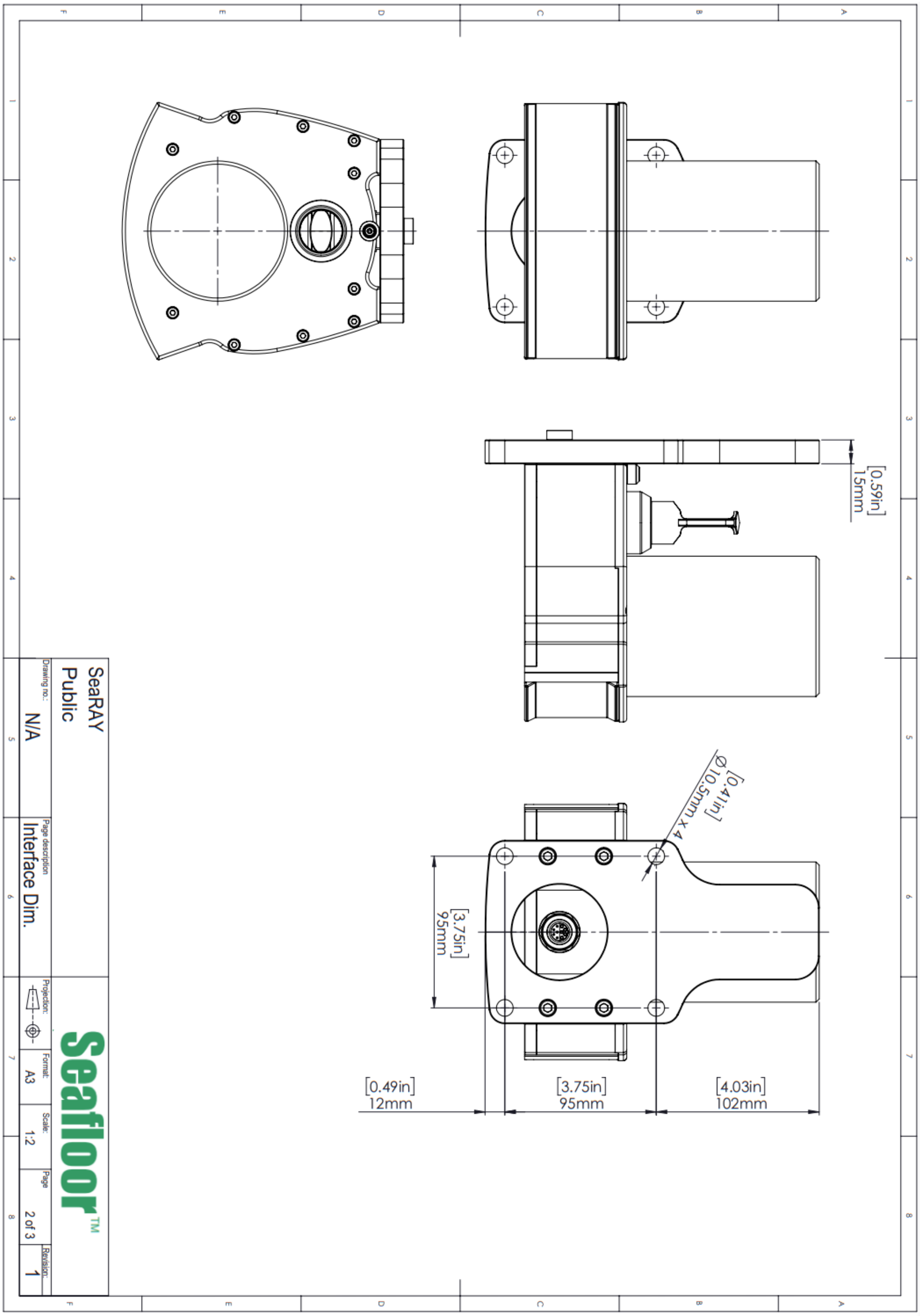
Red time synchronization alerts in Qinsy Online are generally not a concern, as all data is time stamped at source. This alert can safely be ignored.

Appendix A: Technical Drawings

A1. SeaRAY – Wet-End Dimensions



A2. SeaRAY – Mounting Hole Pattern



A3. SeaRAY – Offsets