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WINGHEAD X · WBMS X · WINGHEAD

User and Technical Manual

TN-240293-7

February 2026

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About This Manual

This manual provides installation, configuration, integration, operation, and maintenance guidance for NORBIT WINGHEAD X, WBMS X, and WINGHEAD multibeam sonar systems.

It applies to both integrated and non-integrated configurations, including single and dual head setups. The manual covers mechanical installation, electrical interfacing, software configuration, data acquisition, troubleshooting, and system maintenance.

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Firmware Version: 5.7.34

Reference Documentation

The supporting documents listed below can be found on the USB memory stick delivered with the system. They can also be requested from NORBIT Support.

TN-210082 - WINGHEAD Interface Description
TN-190018 - Tilted Sonar Head Offsets
TN-190041 - ROV/ASV/USV Integration

Contact Information

NORBIT Subsea AS
Stiklestadveien 1
7041 Trondheim
Norway

Phone: +47 739 82 569
Support: https://norbit.com/subsea/support/
Email: subsea_support@norbit.com
Web: https://norbit.com/subsea/

Covered Models

This manual applies to the following systems:

WINGHEAD X, WBMS X
WINGHEAD B41, B43, B44 Deep Sea
WINGHEAD i77h, i79h
WINGHEAD B51S, B51S LR
WINGHEAD i80S, i80S Apogee, i80S LR

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Glossary of Terms, Abbreviations & Acronyms

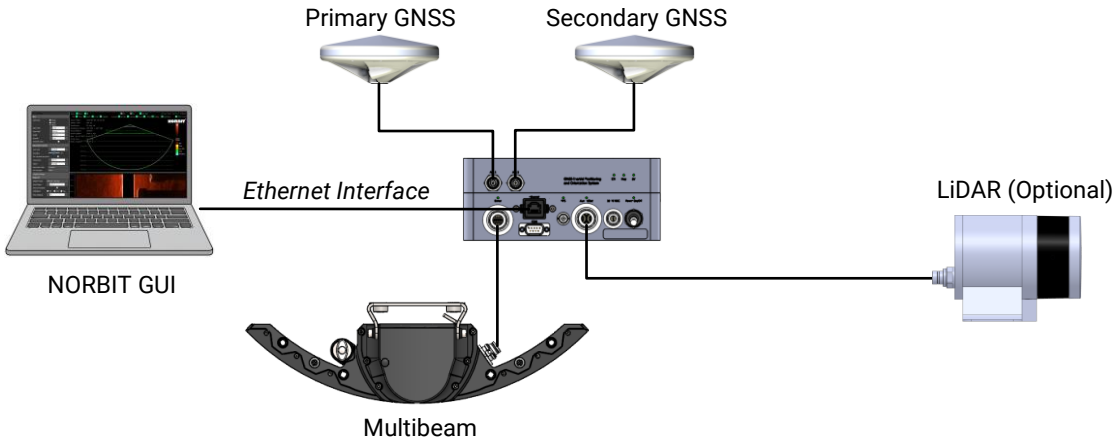
AP+	Latest Generation Applanix GNSS/INS Subsystem
ASV	Autonomous Surface Vehicle
AUV	Autonomous Underwater Vehicle
Aux	Auxiliary
Bandwidth	Range of frequency sweep
BNC	Bayonet Neill-Concelman (connector)
BSO	Backscattering Strength Output
C/A	Coarse Acquisition
CMR	Compact Measurement Record (a GNSS correction format from Trimble)
CoR	Centre of Rotation (or Centre of Gravity)
CW	Continuous Wave (single frequency)
EA	Equal Angle beam distribution
ED	Equal Distance beam distribution
FM	Frequency Modulation (swept frequency)
FPGA	Field-Programmable Gate Array
DGNSS	Differential Global Navigation Satellite System
GND	Ground
GNSS	Global Navigation Satellite System
GPS	US Global Positioning Satellites (often describes all GNSS)
GUI	Graphical User Interface
IMU	Inertial Measurement Unit
INS	Inertial Navigation System
iSIU	Integrated SIU
LED	Light Emitting Diode
N/C	No Connection
NMEA	National Marine Electronics Association
NTP	Network Time Protocol
NTRIP	Networked Transport of RTCM via Internet Protocol
PPK	Post Processed Kinematic
PPS	Pulse Per Second
ROV	Remotely Operated Vehicle
RTCM	Radio Technical Commission for Maritime Services
RTK	Real Time Kinematic
Rx	Receive
SBAS	Satellite Based Augmentation System
SBG	SBG Systems GNSS/INS Subsystem
SIU	Sonar Interface Unit
SNR	Signal to Noise Ratio
SONAR	Sound Navigation and Ranging
STX	Steerable Transmission
SV	Space Vehicle (GNSS/INS) or Sound Velocity
SVP	Sound Velocity Probe
SVT	Sound Velocity and Temperature
TTL	Transistor-Transistor Logic
Tx	Transmit
USV	Unmanned Surface Vehicle
VDC	Volts – Direct Current

1 Introduction

NORBIT sonars are compact, high resolution, wide-swath multibeam systems with receiver beam widths down to 0.5° at 400 kHz (WINGHEAD X) and 0.9° (WBMS X). With a dry weight less than 4.5kg and low power consumption, the systems can be deployed on a wide range of survey platforms.

NORBIT's sonar technology is unique to the industry as the first platform designed as a cylindrical array wideband system with frequency modulated (FM) transmission, forming 256, 512 or 1024 beams over a user-selectable 5° to 210° swath, providing accurate and repeatable bottom detections. All bathymetry processing and time-stamping occur inside the sonar head. A single cable powers and connects the sonar to a small Sonar Interface Unit (SIU), which connects to a data acquisition PC via a single Ethernet cable.

Through tightly integrated GNSS/INS options, integrated surface-sound-speed measurement, and a single-cable architecture, NORBIT systems minimise installation effort and reduce overall system complexity.



1.1 Product Overview

NORBIT sonars are available as standalone sonar systems or with tightly integrated GNSS/INS solutions. The latest X series shares a unified platform, offering adaptable systems with a standard core configuration and optional licensed features that can be enabled as needed to expand capability.

NORBIT WINGHEAD® X

NORBIT WBMS X

Built on a modular platform, the X sonars offer ultimate flexibility and can be customised for any operational environment.

0.5 x 0.9^0 at 400kHz
0.3 x 0.5^0 at 700kHz
1.0 x 1.8^0 at 200kHz (LR)

0.9 x 0.9^0 at 400kHz
0.5 x 0.5^0 at 700kHz

NORBIT WINGHEAD®

Ultra High-Resolution Curved Array Bathymetry Systems

0.5 x 0.9^0 at 400kHz
0.3 x 0.5^0 at 700kHz
1.0 x 1.8^0 at 200kHz (LR)

The table below provides an overview of the products and their key specifications. Note that some features are license-controlled (see Appendix B1).

Product	Nominal Frequency	Beam Width Across x Along	INS Options	Depth Rating	Dual Swath	Stabilisation
The X Series						
WINGHEAD X	400kHz	0.5 x 0.9^0	◆ ◇	100m	✓	Roll, Pitch, Yaw
WINGHEAD X LR	200kHz 400kHz	1.0 x 1.8^0 0.5 x 0.9^0	◆ ◇	100m	✓	Roll, Pitch, Yaw
WBMS X	400kHz	0.9 x 0.9^0	◆ ▲ △ ●	100m	✓	Roll, Pitch, Yaw
WINGHEAD Series						
WINGHEAD B41	400kHz	0.5 x 0.9^0	-	100m	✗	Roll
WINGHEAD B43	400kHz	0.5 x 0.9^0	-	1500m	✗	Roll
WINGHEAD B44 Deep Sea	400kHz	0.5 x 0.9^0	-	4500m	✗	Roll
WINGHEAD i77h/i79h	400kHz	0.5 x 0.9^0	◆ ◇	100m	✗	Roll
WINGHEAD B51S	400kHz	0.5 x 0.9^0	-	100m	✓	Roll, Pitch, Yaw
WINGHEAD B51S LR	200kHz 400kHz	1.0 x 1.8^0 0.5 x 0.9^0	-	100m	✓	Roll, Pitch, Yaw
WINGHEAD i80S	400kHz	0.5 x 0.9^0	◆ ◇	50m	✓	Roll, Pitch, Yaw
WINGHEAD i80S LR	200kHz 400kHz	1.0 x 1.8^0 0.5 x 0.9^0	◆	100m	✓	Roll, Pitch, Yaw

◆ Applanix OceanMaster ◇ SBG Apogee ▲ Applanix WaveMaster △ SBG Ekinox ● Applanix SurfMaster

1.2 Advantages of NORBIT Technology

1.2.1 Advantages of the Cylindrical Array

- Unlike a flat array, bottom detections from a cylindrical array are much less susceptible to surface sound speed errors.
- Due to proprietary progressive beamforming techniques supported only by cylindrical arrays, NORBIT sonars form narrower beams than flat arrays, resulting in superior bathymetry quality.
- At all frequencies, NORBIT sonars provide increased swath coverage with a smaller beam footprint for a fixed aperture.
- The cylindrical array of the NORBIT sonars can cover a full 210°. Flat array systems would lose data fidelity at much lower swath angles (±80°) and would necessitate mounting two or three sonars at angles to achieve higher swath coverage.
- The cylindrical array's hydrodynamic profile enables faster transit, reduced vibration, and lighter mounting hardware. Sturdier mounts, like hull mounts, support transit speeds >20 knots.

1.2.2 Advantages of the Integrated INS

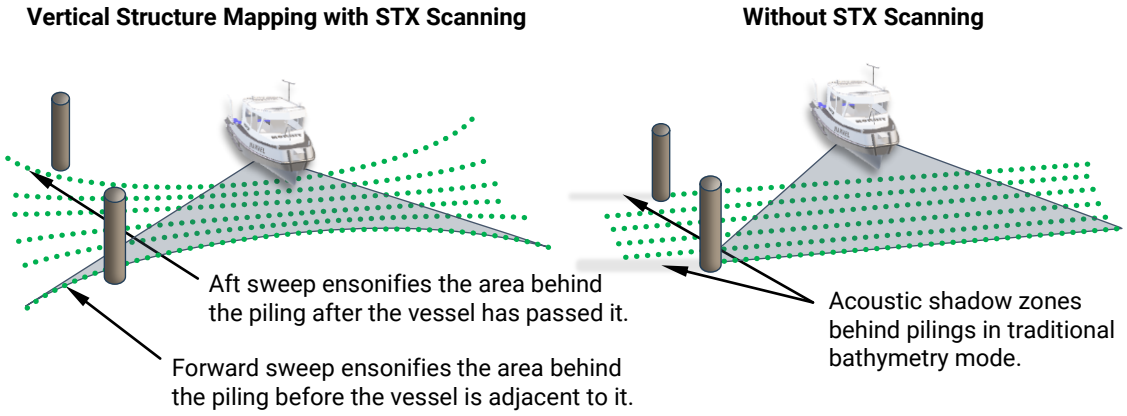
Factory integration of critical sensors provides several benefits. Offsets between the sonar and inertial navigation system are fixed and predefined within the system setup. The user need only measure the offset to the bottom of the primary GNSS antenna.

Cabling and software integration between the sonar, positioning, heading, attitude and sound speed probe is handled internally. The onboard surveyor need only connect the wet end to the topside via a single cable and then connect the primary and secondary GNSS cables (which are each labelled on both ends of the cable to remove installation uncertainty).

1.2.3 Advantages of Steerable Transmission

NORBIT sonars offer steerable transmission functionality, which brings several new license-controlled features to the user (see Appendix B1). Dual Swath enables higher sounding density, or increased survey speed, by transmitting multiple pings simultaneously, while pitch and yaw stabilisation provides uniform sounding density by actively steering the transmit beam to compensate for vessel motion.

In addition, the STX scanning feature enables the transmit beam to be directed ±10° in a scanning pattern. This feature allows the system to ensonify areas that traditional modes cannot reach, most notably behind vertical structures such as pilings. STX scanning can also capture additional details on complex features, such as shipwrecks, during a single pass. It can be enabled at any time and works by defining a step size, where each step angle occurs with each ping. The duration of a full scan depends on the current ping rate – for example, at 20Hz ping rate with a step size of 20, one complete scan takes 1 second.



STX scanning supports additional applications such as obstacle avoidance, dredge monitoring, and cable lay operations. The sonar can be mounted in any orientation to change the scanning pattern. For example, rotating the sonar 90° in heading, combined with an upward tilt, allows the sonar to scan a ±10° sector ahead of the vessel.

The special STX 360 configuration integrates the scanning sonar with a rotator to provide 360° real-time coverage from a static platform. This provides rapid and efficient dredge monitoring compared to conventional methods, since no vessel sailing is required.

1.3 System Specifications

While continual improvements are being implemented, specifications may change. To obtain the most current specification sheets please visit https://www.norbit.com/subsea/

1.4 Export, Shipping Weight & Dimensions

Each standard NORBIT system is shipped in a single, lightweight Pelican case that meets airline baggage guidelines. Refer to the NORBIT website for shipping weights and dimensions.

- **Airline Checked Luggage:** Although the rugged freight case includes dense foam shock absorption, handle it with care and ensure it has a prominent airline "Fragile" label.
- **Airline Carry-On Baggage:** The sonar case may be hand-carried onto many airplanes, but it is often required to remove the sonar from the case for x-ray security screening.

1.4.1 ITAR Restrictions

All systems are free of Canadian and EU export controls. NORBIT recommends DHL as a preferred shipper when shipping internationally. All shipping documents from the USA should quote:

- ECCN **7A994** classification number for all integrated systems (containing an integrated GNSS/INS) e.g. WINGHEAD i77h, iWBMS X, etc.
- ECCN **6A991** classification number for all non-integrated systems (i.e. not containing an integrated GNSS/INS) e.g. WBMS X, WINGHEAD B41, etc.

1.5 Technical Support

NORBIT offers global technical support. Please refer to section 7 before contacting NORBIT Support. To raise a request, register an account at the NORBIT helpdesk, select "Technical Support" and complete the form including the following details:

- Your name, organisation and system details (model, serial number and software versions).
- A detailed problem description, with photos or screenshots where relevant.
- Error messages, system logs (see section 4.8.6.4) and relevant INS logs where applicable (found at: *C:\Users\<user>\Norbit\WBMS*)

Data samples if relevant. Raw data recordings from the GUI should include water column data (ensure that WC Resolution is set under Backscatter Controls and displayed on the wedge.)

If replying via email, include the unique ID (NSS-XXXXX) in the email subject. When emailing NORBIT Support directly, a ticket and account will automatically be generated for you. To access the ticket, select the "Forgot your password" link to reset your password.

NORBIT Subsea AS
Stiklestadveien 1
7041 Trondheim
Norway

Support: https://norbit.com/subsea/support/
Email: subsea_support@norbit.com
Phone (GMT): +47 739 82 569 (For urgent enquiries)
Phone (US Time): +1 929 2667 248
Phone (APAC): +65 6349 2251

1.6 End-of-Life Management & Recycling Information

Electronic products must not be disposed of in regular household waste. To ensure environmentally compliant end-of-life management, you can return the product to a certified waste facility for proper handling or return it to NORBIT for appropriate disposal. Contact NORBIT Support for detailed instructions or assistance with returning your product.

2 Hardware Installation

Refer to Appendix C for the hardware dimension drawings. NORBIT can provide 3D models of the transducers, in the STEP file format, to support your installation plan.

CAUTION: Though many cables and connectors appear similar across different models, they are not cross-compatible. For reliable operation and to maintain warranty coverage, use only the original cable parts supplied with your system.

NOTE: For subsea ROV/AUV and USV installations, please consult TN-190041 for detailed technical guidance as well as critical safety notices. This document can be obtained from NORBIT Support.

2.1 Power Requirements

NORBIT sonars require clean, continuous power for reliable operation. Please refer to the requirements below for AC and DC power options and refer to the datasheets on the NORBIT website for power consumption values.

2.1.1 AC Power

Most vessels use an inverter to provide continuous power. It is important that the inverter is **a true sine wave inverter**. A modified sine wave inverter may cause unexpected behaviour, even when using the included power brick (PN 23008). Use **high-quality inverters** to provide power.

In general, inexpensive inverters produce a modified sine wave. “Dirty” power may cause data loss, system reboots, or electronic damage. To confirm whether the inverter is the source of the problem, the system can be powered directly from a 12-24 VDC battery. An oscilloscope can also be used to observe the quality of the AC supply.

2.1.2 DC Power

Power may also be supplied directly from a deep-cycle battery using the included pigtail connected to the SIU power port (12-24 VDC input). Thick wires should be used, minimising connection points to avoid voltage drop. If operating from a 12 V supply, using 2 batteries in series is recommended to reduce the impact of voltage drop. Voltage spikes exceeding 29V may damage the system.

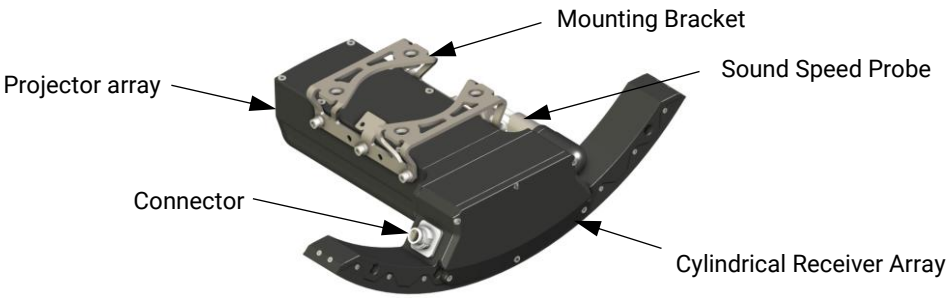
2.2 Wet-End Overview

CAUTION: When handling the unit, do **NOT** lift, carry, or support it strictly by the sound speed probe or the projector alone. These components are not designed to bear the weight of the system. Always support the unit by its main housing.

CAUTION: Ensure the wet-end connection is fully sealed. Inspect the O-ring, replace if needed, and apply a thin coat of synthetic grease (e.g. Molykote 55) to the O-ring. Hand-tighten the connector until firmly seated. If the threads stick, use a **VERY** thin coat of grease on the threads, but **NOT** the connector pins.

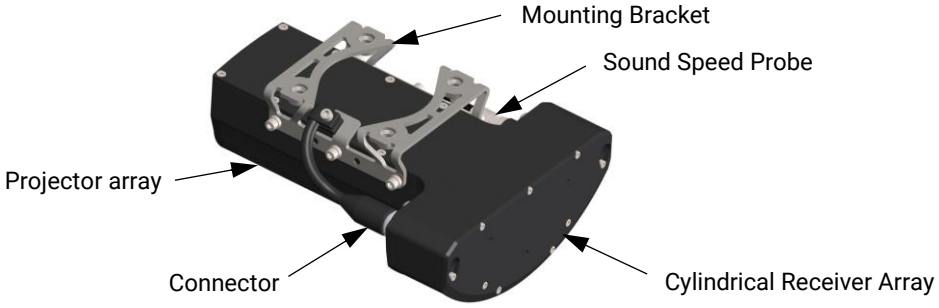
2.2.1 WINGHEAD X

The WINGHEAD X is offered in various configurations to accommodate different frequency and INS requirements, while using the same underlying hardware platform. With 0.5^0 receiver beam width resolution, it offers flexible configuration options and can be upgraded with software features such as pitch stabilisation, yaw stabilisation, and dual swath. It uses a field-swappable SV sensor, and integrated models contain an IMU housed inside the projector.



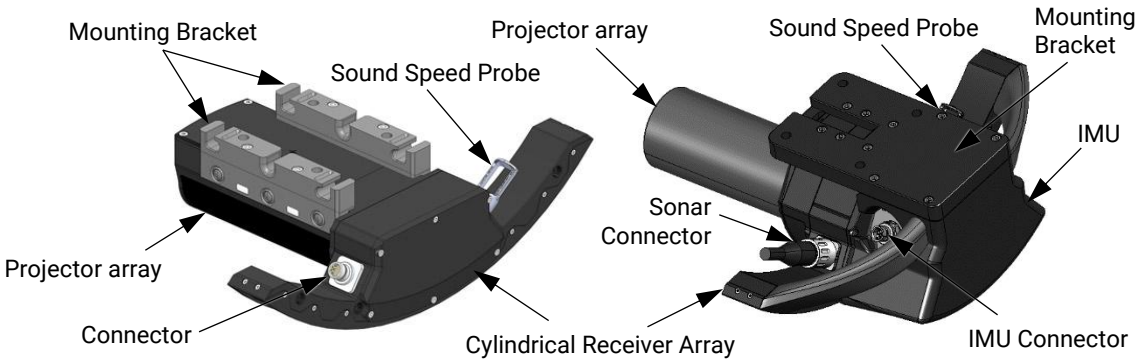
2.2.2 WBMS X

The WBMS X is built on the same concept as the WINGHEAD X (see section 2.2.1), offering the same features and flexibility, but with a more compact receiver array, giving 0.9^0 resolution. It uses a removable, field-swappable SV sensor, and integrated models contain an IMU housed inside the projector.



2.2.3 WINGHEAD

Other WINGHEAD models are offered in various hardware configurations. Integrated models contain an IMU housed inside the projector, or inside the front enclosure depending on the model. Typically, the SV sensor is tightly integrated and cannot be removed. A detachable SV option is also available (see Appendix B3).



WINGHEAD i77h *WINGHEAD i80S*

2.3 Dry-End Overview

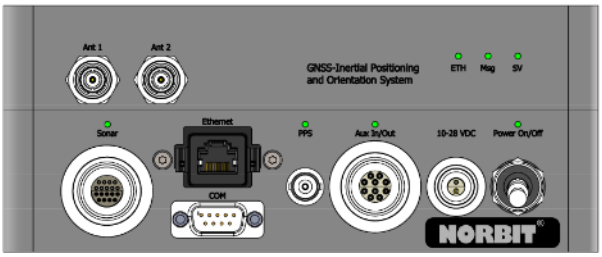
All NORBIT systems include a compact topside Sonar Interface Unit (SIU) which distributes power, time information and data between the sonar wet-end and the survey acquisition system. This environmentally sealed fan-less topside is dust-proof and splash resistant.

The SIU will shut down automatically at 70°C to prevent damage to electronics due to overheating. Refer to Appendix D7 for the connector pinouts.

CAUTION: The COM (DB9) and PPS connections on the SIU are not rated for voltages higher than 5V. Exceeding this limit could damage the system. Check all potential connections for unexpected voltages. Ensure there is no significant potential difference between the inputs/outputs of other sensors.

CAUTION: When operating in open environments, all connection ports on the SIU should be tightly sealed either with the NORBIT supplied cables or, if the port is unused, with the port covers provided with the system.

2.3.1 Integrated Sonar Interface Unit (iSIU)



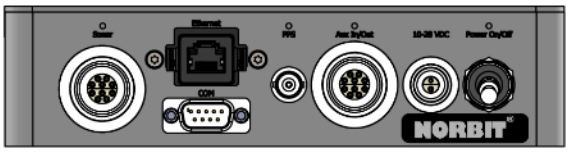
GNSS/INS Options: PN 29093: Applanix AP+ | PN 29060: Applanix AP | PN 29088: SBG

Connector	Description
Sonar	18-pin interface to sonar and integrated IMU
Ant 1	Primary GNSS antenna
Ant 2	Secondary GNSS antenna
COM (Serial)	GNSS corrections input (RTK/DGNSS) and GNSS/INS NMEA output. The optional split-serial upgrade allows GNSS/INS ASCII/binary data output for up to 3 serial connections (see Appendix B2)
PPS	1PPS output for external sensor (not typically used)
Ethernet	For communication between topside PC and sonar (SAMTEC Part No. RCE-01-G-05.00-D)
Aux In/Out	10-pin interface for communication with auxiliary devices (iLiDAR) and Trigger In/Out. Refer to section 2.3.3 for more details.
10-28 VDC	Input DC voltage. Refer to section 2.1 for power requirements.

Notes:

i. The INS LEDs at the top of the SIU vary by model. Refer to section 2.3.4.
ii. Refer to Appendix D7 for the connector pinouts.

2.3.2 Sonar Interface Unit (SIU)



PN 29064

Connector	Description
Sonar	10-pin interface to sonar
COM (Serial)	NMEA ZDA timing input
PPS	1PPS input for timing
Ethernet	For communication between topside PC and sonar (SAMTEC Part No. RCE-01-G-05.00-D)
Aux In/Out	Trigger In/Out. Refer to section 2.3.3 for more details.
10-28 VDC	Input DC voltage. Refer to section 2.1 for power requirements.

Notes:

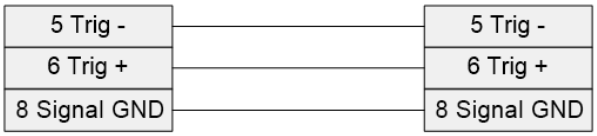
i. This model can also be combined with PN 29093 / 29060 / 29088 for dual head configurations. Refer to section 2.8 for more details.
ii. Refer to Appendix D7 for the connector pinouts.

2.3.3 Aux In/Out Port & Triggering

The Aux port provides trigger in/out functionality and, on integrated models, can interface with the NORBIT iLiDAR for simultaneous multibeam and topographic data collection. For detailed pin descriptions, see Appendix D7.

Pins 5 and 6 can be used to trigger to or from an external sensor, such as a sidescan sonar or DVL, to prevent interference. The trigger output operates as RS-422, while the trigger input is both TTL 5V and RS-422 compatible, except in models equipped with the 18-pin 318E sonar bulkhead connector, where the input is RS-422 only (see Appendix D6). The IRIG-B time output is TTL.

The trigger uses RS-422 in half-duplex mode, allowing the same pair to receive or transmit synchronisation depending on the designation. For synchronisation with another NORBIT sonar, connect pins 5 and 6 pin-to-pin with the corresponding unit's SIU Aux port. NORBIT cable PN 33249 can be used to achieve this connection.



Notes:

iii. The output trigger is sent 3300µs before the centre of the following transmit pulse.
iv. The default delay from the incoming trigger is 3300µs to the centre of the next transmit pulse.
v. A trigger cable solution (PN 33403, standard length 1m) is available, which converts the RS-422 trigger output from the SIU to a 5V TTL output on a BNC cable. For more information, contact NORBIT Support.

2.3.4 LED Status Indicators

Indicator	SIU Part Numbers	Pattern	Description
Sonar	29064, 29093, 29060, 29088	Green Off	Sonar On Sonar Off
PPS	29064, 29093, 29060, 29088	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	29064, 29093, 29060, 29088	Off	Not in use (always off)
Power On/Off	29064, 29093, 29060, 29088	Steady Green Blinking Green (5Hz) Off	Input Voltage OK Input Voltage <10v or >28V No Input Voltage
ETH	29060, 29088	Blinking Green Off	Valid INS Ethernet connection No INS Ethernet connection
INS	29060, 29088	Blinking Green Off	INS receiving RTK corrections No RTK corrections
GNSS	29093	Blinking Green Off	INS Power OK No INS Power
SV	29093, 29060, 29088	Blinking Green Off	INS detecting satellite vehicles No satellite vehicles detected

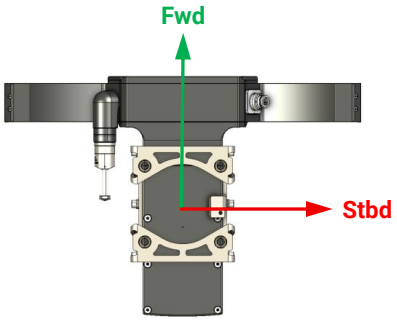
2.4 Sensor Installation

CAUTION: The cables are **NOT** wet-mateable. Only connect cables to the connectors when dry. Use compressed air to ensure that they are clean and dry, and **DO NOT** apply grease to the connector pins.

2.4.1 Sonar Orientation

Mount the sonar with the projector pointing aft so that the receiver operates in the quietest, least turbulent water for optimal SNR. Align the sonar with the keel or centreline, keeping it parallel to the water surface, ideally within 0.5°.

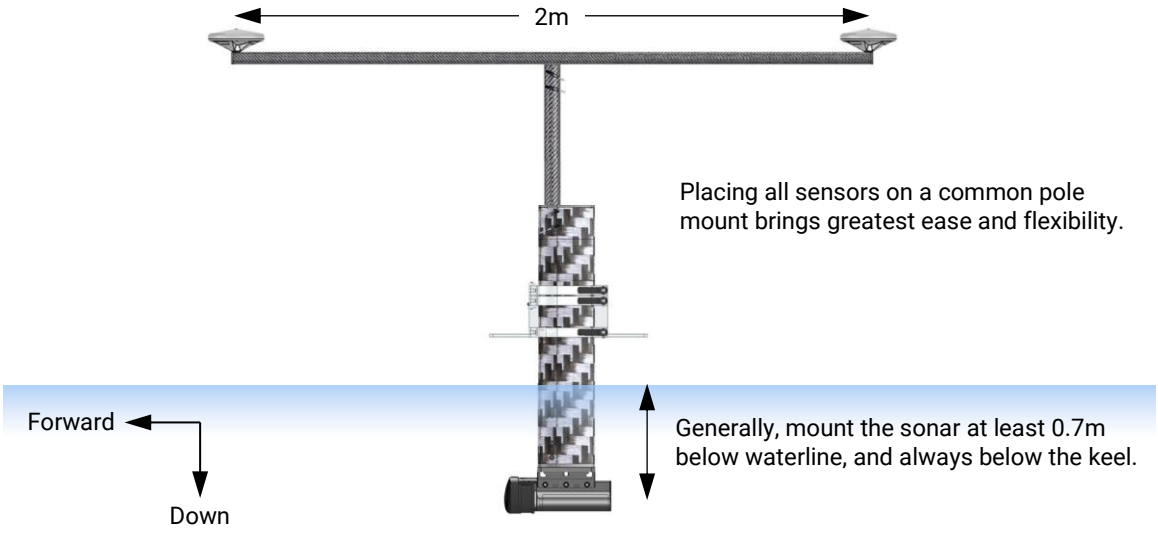
NORBIT sonars have been tested at a transit speed of 20 knots without damage. When not surveying, keep the sonar out of the water during transit to protect it from physical damage.



2.4.2 Sonar Draft

Vessel draft has a direct impact on multibeam range performance. A deeper draft places the sonar further below the surface, where the water column is more stable and less aerated, and ensures that the sonar is not subjected to reflections from the hull or water surface.

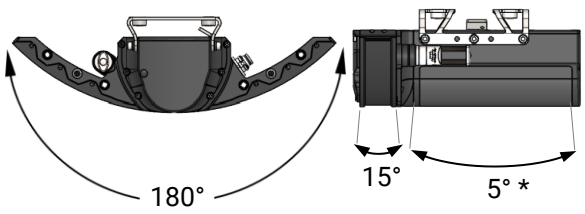
Increased draft is always beneficial and should be considered an advantage when evaluating expected range. The sonar should always be clear of the lowest part of the hull. It is critical that the sound speed sensor has a clean, bubble-free path.



2.4.3 Acoustic Clearance Zones

Keep the area around the sonar clear and unmasked to minimise acoustic reflections and blocking in both the across-track and along-track directions.

To achieve 210° across-track coverage (e.g. for lock surveys), the receiver requires 210° clearance. While this is not always possible on pole mounts, the sonar should be level with the keel as a minimum for full coverage on both sides. For standard seabed surveys, 180° clearance is sufficient. The **minimum** clearances are shown below:



* 30° for WINGHEAD X, WBMS X and WINGHEAD B51S/i80S models

To take advantage of the ability to measure above horizontal, the clearance angle should be extended up to above the required field of view.

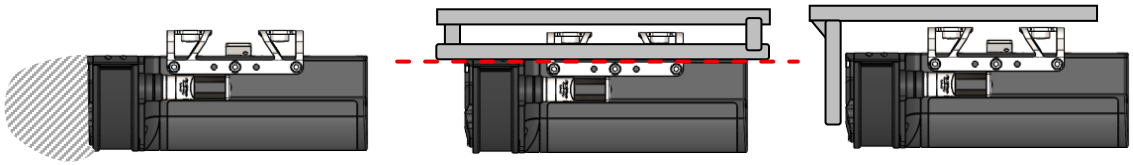
For subsea (ROV/AUV) or other complex mounts, achieving the minimum along-track clearance for the projector may not always be possible. Objects within the minimum angle can cause reflections or echoes, especially acoustically bright surfaces, therefore the widest possible along-track clearance should be sought.

2.4.4 Sonar Protection

If the vessel is operating in shallow waters, and there is danger of collision with objects, protection should be considered. The sonar could be protected by a larger fairing which extends slightly below the front of the sonar for additional protection.

A bullbar or cage assembly could also be placed around the sonar. The height of the bar should not be lower than the edges of the receiver array to maintain the necessary acoustic clearance. The cage must be **absolutely rigid** with respect to the sonar and must not generate excessive drag. If vibration is induced, it can negatively impact the integrated INS performance.

An alternative option is to add one or more knives protruding down in front of the sonar. However, knives can introduce turbulence which affects acoustic performance, so it should not have a large cross section, and the number of knives should be kept to a minimum, e.g. 1 or 2.



Extended Fairing Example | Cage Assembly | Knives

2.4.5 Sonar Mounting Instructions

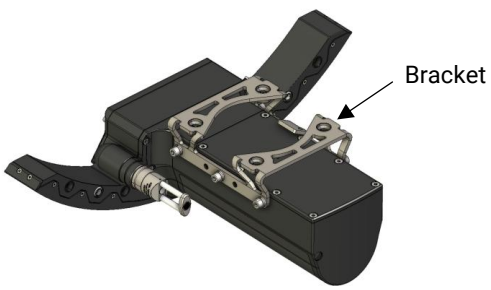
NORBIT sonars are supplied with one of several mounting bracket configurations, depending on the system type. While each bracket has a unique design, all brackets feature the same bolt hole pattern. For details on which bracket is supplied with each model, refer to Appendix C.

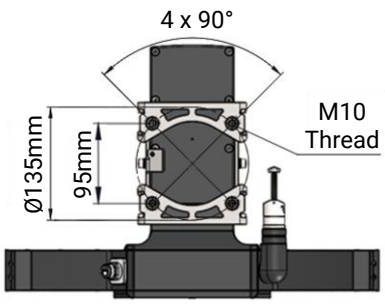
Each system is supplied with 4 M10x20, M10x30 and M10x40 bolts to accommodate most installations. Use high quality stainless-steel bolts to prevent corrosion, especially in saltwater. For long term mounting, use Loctite 242 Blue (do **NOT** use anything stronger) to prevent loosening during long deployments. Mounting poles require a minimum internal diameter of **5.8cm** for connector clearance.

2.4.5.1 Bracket Type A

This bracket is delivered with WINGHEAD X and WBMS X models, and generally all newer WINGHEAD models. The Long Range (LR) variant is wider at the bottom to fit the wider projector. Use 4x M10 stainless steel bolts and spring washers, inserting the bolts through the top of the bracket into the threaded holes, ensuring they do **NOT** protrude into the projector.

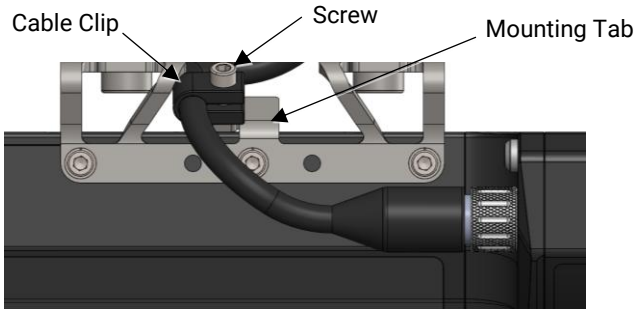
- **Torque limit:** Tighten the M10 bolts by hand using a calibrated torque wrench, **NOT** exceeding 25 Nm. Avoid using power tools.
- **Thread preparation:** NORBIT recommends applying anti-seize compound to all stainless-steel threads (e.g. Loctite 8009 or equivalent).





Ensure that the cable is routed through the designated cutout in the mounting bracket closest to the sonar connector. This routing secures the cable in a stable position, preventing unnecessary movement during operation.

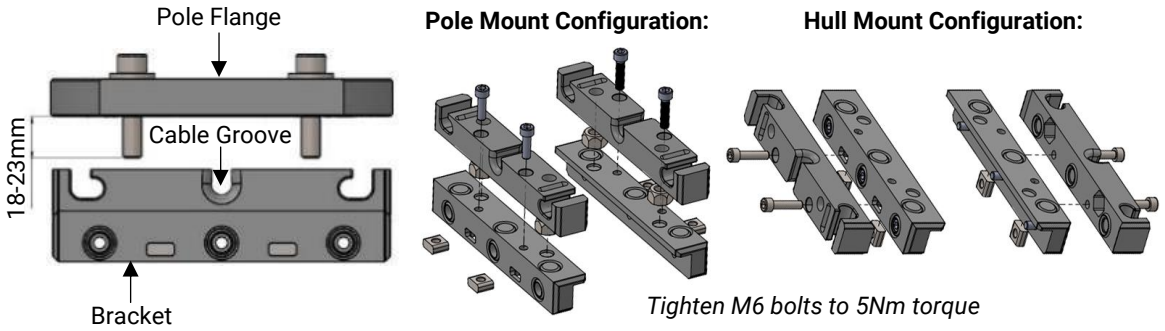
The bracket includes a mounting tab for securing a cable clip that supports the sonar cable. Attach the clip to the tab using the supplied screw to keep the cable firmly in place. Both the cable clip and screw are included in the accessories box, along with a spare.

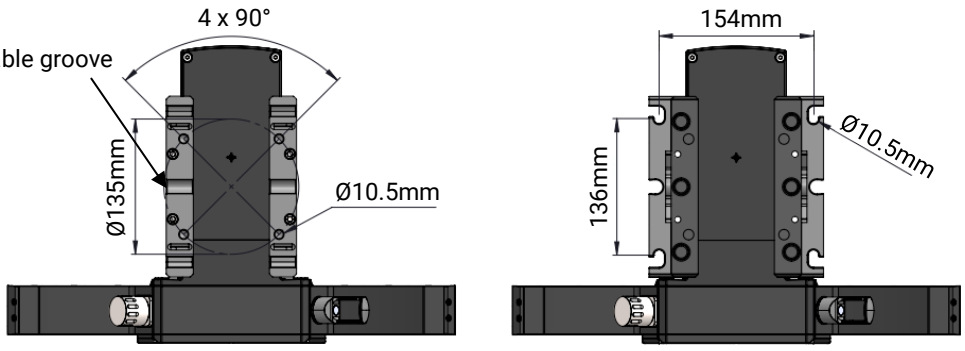


2.4.5.2 Bracket Type B

This configuration includes 2 brackets attached to each side of the projector array, oriented vertically, by default, for pole mount installations. The hole pattern is identical to Bracket Type A.

Secure the sonar with 4x M10 bolts, inserted from the top of the brackets into the lock nut inserts, securing the cable in the groove. The bolts should be 18-23mm longer than the mounting flange thickness. The brackets can also be oriented in the horizontal direction for hull mount installations (see section 2.4.7), except for WINGHEAD B44 models, using up to 6 bolts.





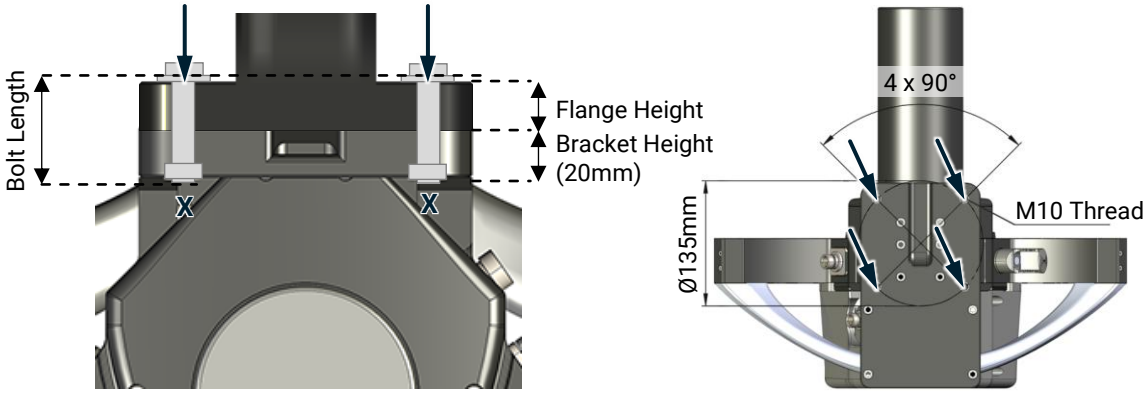
2.4.5.3 Bracket Type C

This bracket is used for WINGHEAD B51S and i80S models containing sonar **PN 24115**. The hole pattern matches Bracket Types A and B, and two length variants are available:

- Standalone models (e.g. WINGHEAD B51S): 130 x 130 mm
- Integrated models (e.g. WINGHEAD i80S): 130 x 223 mm (extended at the front for IMU support)

Secure the sonar using 4x M10 bolts inserted from the top of the bracket into the captive Nyloc nuts. The bolts should not protrude more than 5mm below the mount to ensure that they do not touch the material of the sonar body. For permanent installations, additional support must be added at the rear of the sonar to support the weight of the projector.

The correct shank length should be the height of the bracket (20mm), plus the mounting flange height and washer thickness. If the bolt is longer than required, use extra washers to adjust the length. When the NORBIT PORTUS pole is used, use M10x40mm bolts (20mm + 20mm + 1-2mm).



CAUTION: Secure the cables to prevent vibration and damage, using steel flatbar or rodding for routing, plus hosepipe (or similar) for sheathing. Use Jubilee clips or band-it to secure. If securing the cable directly with metal clips, add protection, such as rubber or hosepipe, between the clips to prevent cuts.

2.4.6 Cable Routing

Take care when routing and handling sensor cables and refer to section 2.4.5 for specific guidance on each bracket configuration. In general, be sure to:

- Minimise bends, and avoid kinks, twists, or stretching.
- Avoid pinching the cables in windows, doors, and other equipment.
- Secure the cables to prevent movement and reduce wear on the sheath.
- Keep long cables away from power sources and avoid tight coiling to prevent electrical interference.

For pole mount installations, it is best practice to route the sonar cable through the mounting pole to protect it from vibration, knocks or flotsam.

When connecting the cables, ensure the connectors are clean, dry, and properly aligned. Protect any exposed cable sections using a chafing guard (e.g. a short section of hose pipe) where necessary.

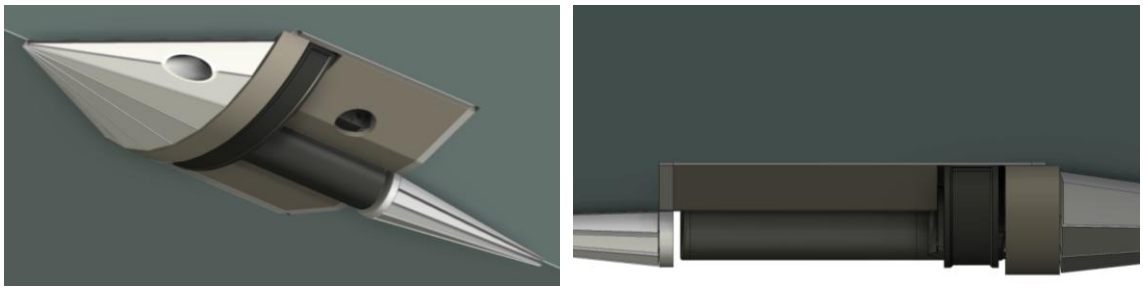
2.4.7 Hull Mounted Systems

NORBIT sonars can also be permanently hull-mounted to a vessel for operations that do not require the system to be portable.

2.4.7.1 Mechanical Guidelines

Although every vessel is different, as a general guideline, the sonar should be installed around one-third of the vessel length from the bow, where water flow is more stable. The mounting arrangement must ensure the sonar has an unobstructed view of the seafloor while remaining protected within the vessel's hull profile. It must be carefully designed to prevent bubble formation, ensuring clean water flow over the sound velocity sensor.

> ⚠ **CAUTION:** On permanent hull-mount installations, it is essential to support the weight of the projector. This should be considered during the installation design phase.



Hull mounted WINGHEAD sonar installation on a large ocean-going vessel

Hull mounted WINGHEAD sonar installation on the DriX Unmanned Surface Vessel (USV)

To enquire about NORBIT's hull-mounted design and installation service, contact NORBIT Support.

2.4.7.2 Antifouling Considerations

Antifouling protection is mandatory for permanent installations. Extended submersion exposes the sonar to biofouling, particularly in warm or saline water. Even thin layers of growth can:

- Attenuate acoustic signals
- Reduce detection range and data quality
- Increase maintenance frequency and downtime

NORBIT offers factory-applied antifouling solutions which are tested for acoustic compatibility with the sonar. The installation design should also minimise marine growth on nearby structures and metalwork, which can otherwise become sites of heavy fouling.

2.4.8 GNSS Antenna Installation

2.4.8.1 Antenna Models

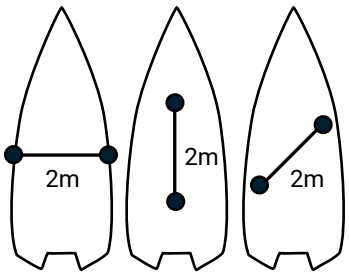
As standard, integrated NORBIT systems are supplied with 2 Trimble 540AP GNSS antennas for Applanix systems, and 2 VeroStar VSP6037L antennas for SBG systems. Only supported antenna models should be used.

The antennas are mounted by screwing onto 5/8" UNC threads. The recommended maximum cable length is 30m to avoid signal degradation. For longer cable runs, LMR-600-specification cables are recommended.

Supported Antennas for Applanix Systems				SBG Systems
				
Trimble 540AP	Trimble 382AP	Trimble GA830	Trimble Zephyr 3 Rugged	VeroStar VSP6037L
L1 Phase Centre Offset (measured up from bottom of antenna)				
58mm	66mm	88mm	58.9mm (bottom of antenna) 84.3mm (bottom of bracket)	48.82mm

2.4.8.2 Antenna Placement

- Mount the Primary Antenna (**Antenna 1**) closest to the IMU to minimise offset errors.
- Mount the Secondary Antenna (**Antenna 2**) a fixed distance from Antenna 1, with **2m** separation recommended.
- Both antennas must be free from vibration and rigid with respect to each other and the IMU.
- Ensure that both antennas have an unobstructed sky view for continuous satellite tracking.
- Install both antennas parallel to the water surface (±3cm).
- While the antennas can be oriented in any horizontal direction, it is good practice to align them parallel or perpendicular to the vessel centreline.



> **NOTE:** While antenna separations greater than the recommended distance of 2m can improve heading accuracy, it increases the risk of independent movement between the antennas which degrades the performance.

2.4.8.3 Avoiding Interference

- The antennas should be mounted away from adjacent reflective surfaces such as masts, bulkheads, and other metal structures.
- Keep the antennas clear of transmitting antennas of any frequency (e.g. VHF/UHF radios, radar, satellite or cellular communication equipment).

2.5 Detached IMU

If the IMU must be installed separately from the sonar on the vessel, NORBIT offers the IMUd option (Appendix C7), supplied in a box-shaped housing with a 50m depth rating, which is compatible with all integrated models. A **Custom** IMU Ref. Point offset is required in the INS Setup Wizard (see section 4.6.1.2).

Operating the system in a detached configuration typically requires a split cable if the IMUd is installed ≤5m from the sonar, or an additional SIU and cable when the separation is ≥5m. The full interfacing requirements are described in technical note TN-230138.

2.6 Time Synchronisation

Only standalone NORBIT sonars require a PPS & NMEA $GPZDA hardware input, as integrated systems receive timing from the internal GNSS card. Refer to section 4.8.5 for details on configuring the timing method in the sonar Web UI.

The system supports baud rates from 4800 to 115200 and can maintain sync with other NMEA messages output on the same port as the ZDA+PPS. The input baud rate is auto-detected on startup, therefore if the baud rate is changed, the SIU must be rebooted. Ensure that the baud rate is sufficient for all strings.

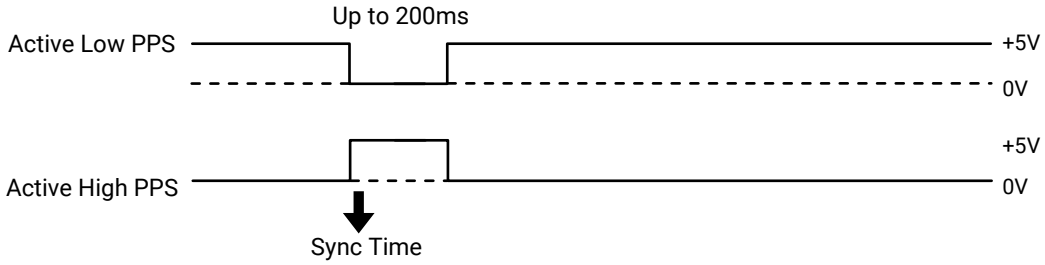
CAUTION: The integrated versions of the SIU **output** PPS pulses on the PPS port. It is **NOT** an input. Attaching an active PPS cable to this port will damage the internal electronics and void the warranty.

The PPS can be input in two ways:

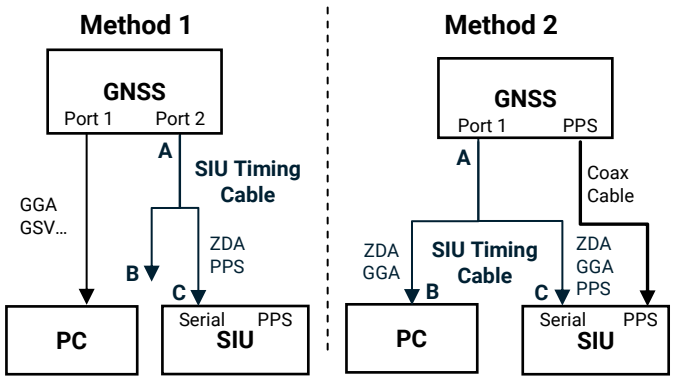
- To the BNC “PPS” connector on the non-integrated SIU
- To the Serial “COM” DB9 connector on the non-integrated SIU (pin 9 for pulse & pin 5 for ground)

The PPS signal can be either active low or active high. The SIU synchronises to the falling edge of an active low signal, or the rising edge of an active high signal. The voltage on the PPS should not exceed 5V.

The SIU should receive a PPS TTL input at 3.3V (5V tolerant). The SIU can autodetect a negative or positive PPS input and has ±15kV ESD protection, ±60V fault protection. Integrated GNSS/INS NORBIT systems can output a (positive or negative configurable) PPS TTL signal at 5V. However, it is **NOT** fault protected and is rated for a maximum absolute voltage of 6V.



The included DB9 timing cable should be used to interface a GNSS for timing. It splits the signal so that both the survey computer and SIU can be connected to the same GNSS port.

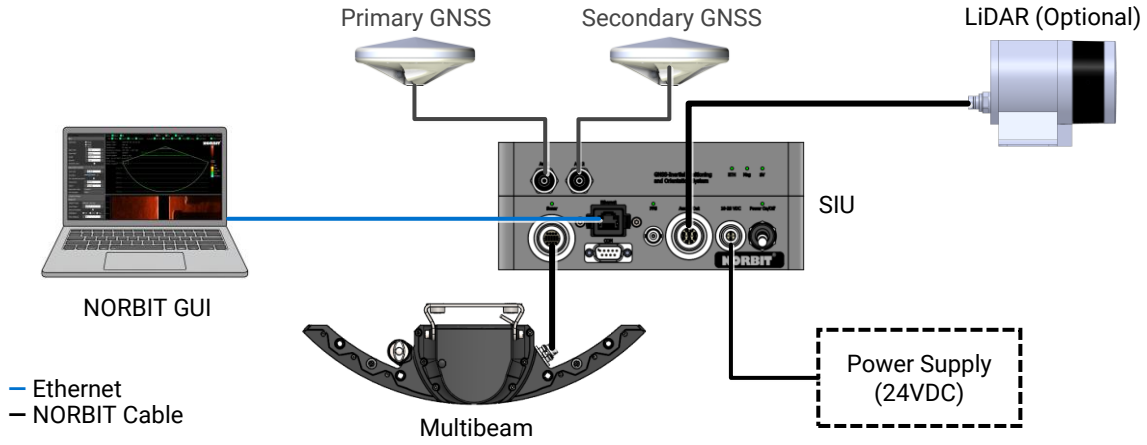


Timing Cable Pinouts			
A	**B**	**C**	**Description**
1	1	1	N/C
2	2	2	Transmit Data (from GNSS)
3	3		Receive Data (to GNSS)
4	-	-	N/C
5	5	5	Ground
6	-	-	N/C
7	-	-	N/C
8	-	-	N/C
9	-	9	PPS (from GNSS)

2.7 Single Head System Interfacing Diagrams

2.7.1 Integrated Systems

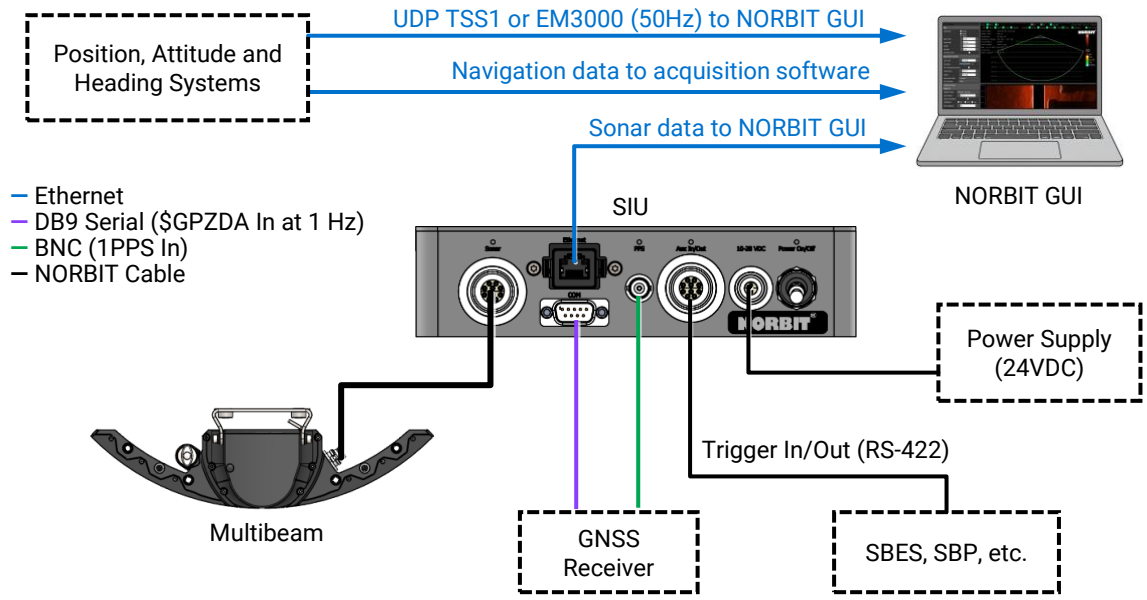
For systems that include integrated GNSS/INS components, the requirements for sonar time synchronisation are handled internally, eliminating the need for any external hardware timing inputs.



2.7.2 Non-Integrated Systems

Consult the manuals of your chosen ancillary sensors for details on configuring the required outputs for the sonar. While the precise configuration may differ based on the sensors employed, the essential requirements on the sonar side remain consistent:

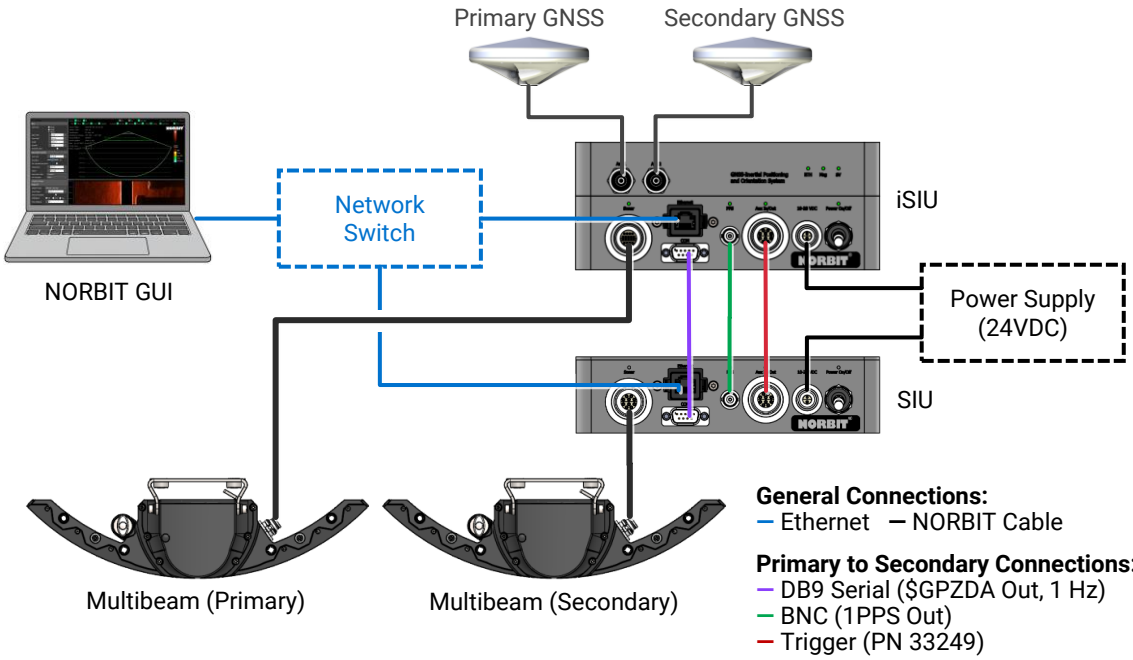
- The sonar requires NMEA $GPZDA (at 1Hz update rate) and 1PPS inputs from a GNSS receiver for sonar time synchronisation (see section 2.6).
- For active roll stabilisation (and pitch and yaw, on supported models), motion data should be interfaced to the PC or laptop which runs the NORBIT GUI. The accepted formats are TSS1 and EM3000, and high update rates of at least 50Hz are recommended (see section 4.6.8).
- If the PC or laptop does not have multiple network ports, a network switch should be used. Otherwise, the sonar Ethernet cable can be connected directly to the PC.



2.8 Dual Head System Interfacing Diagrams

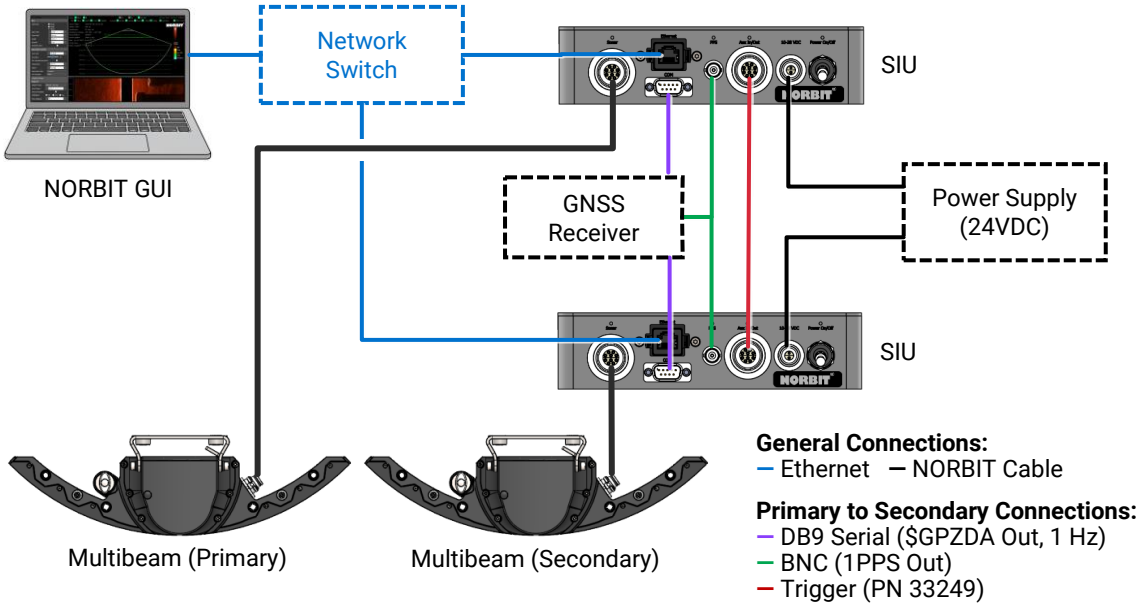
Compatible cables are required based on both the topside connector (18-pin or 10-pin) and wet-end connector type (see Appendix D). The trigger cable (PN 33249) is required for synchronisation purposes. For more details on dual head operation, refer to Appendix A2.

2.8.1 Integrated Systems



Although not standard, it is also possible to run integrated systems using 2 iSIU with a similar interfacing scheme. The secondary system must have at least 1 GNSS antenna connected for timing purposes, and **the IP address of the secondary INS must be changed** to avoid INS network conflicts.

2.8.2 Non-Integrated Systems



3 Reference Points

3.1 Sonar Reference Point

The Sonar Reference Point is where all sonar data (and INS data, for integrated systems) is valid upon output. The relevant offsets are shown in Appendix C, referenced from the Top Centre of Bracket, as well as the bottom edge of the receiver and back edge of the projector, for convenience, when the standard mounting bracket is not used.

For integrated systems, all sensors in the data acquisition and processing software must have the same offset applied to the sonar reference point. It is defined as follows:

Axis	Location
Fore-Aft	At the centre of the projector array.
Port-Starboard	At the centre of the cylindrical receiver array.
Up-Down	A vertical offset referenced from the bottom edge of the cylindrical receiver array.

3.2 IMU Reference Point

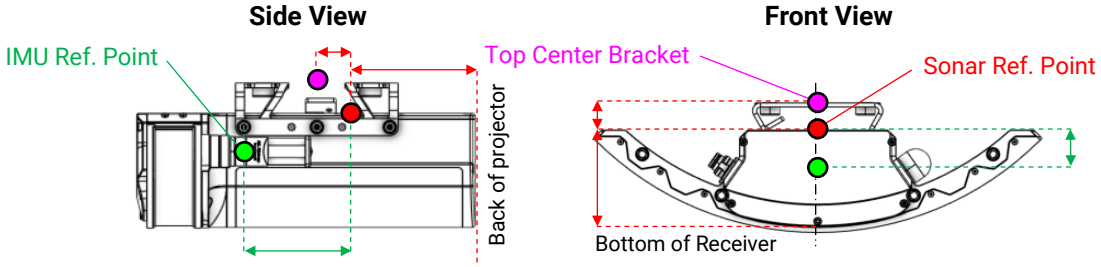
For systems with integrated GNSS/INS subsystems, the relevant sonar and IMU offsets are detected automatically in the INS Setup Wizard. The output is automatically corrected to the Sonar Reference Point. Therefore, knowledge of the IMU Reference Point is generally not required. For reference only, the IMU offsets and mounting angles are summarised in Appendix F.

When the sonar and IMU are rotated, the offsets and angles must be adjusted accordingly. Consult the technical note TN-190018 for details. Contact NORBIT Support if you require this document.

3.3 Overview of Reference Points

A visual overview of the reference points is provided below. Note that the Top Centre of Bracket is merely a convenient control point ("Measure Point") from which to measure the primary GNSS antenna for integrated systems, however no data output is valid at this location. The Top Centre of Bracket is defined as the centre of the mounting holes on the sonar bracket flange.

For dual head setups, it is more convenient, and practical, to define the Measure Point as the Top Centre of Dual Head Bracket.



Example illustration showing the reference points of a typical integrated NORBIT sonar. Refer to Appendix C and Appendix F for the relevant offsets for each model.

4 System Operation

The system is setup and controlled using the NORBIT Graphical User Interface. The GUI can also be controlled in headless/passive mode, as described in section 4.5.

Multiple PCs can monitor the GUI, but only one can control the sonar. When using a network switch, each PC must have a unique IP address in the same range (see section 4.2). The data acquisition software must connect to the local IP address of the PC running the GUI.

> ⚠ **CAUTION:** The integrated INS will not communicate correctly with the GUI if Windows Firewall blocks the required ports. Disable Windows Firewall or add a port exception as described in section 7.2.

4.1 System Requirements

Since all processing occurs inside the sonar head, the GUI can run on the same PC as the data acquisition software. Refer to your manual of your chosen software for recommended requirements.

The GUI itself has minimal requirements. NORBIT recommends PC or laptop with Windows 11, 2GHz+ processor, and ≥8GB of memory. Integrated motherboard graphics are sufficient for the GUI, but dedicated graphics are recommended for 3D data acquisition software displays. The recommended display resolution is 1400x900 or higher.

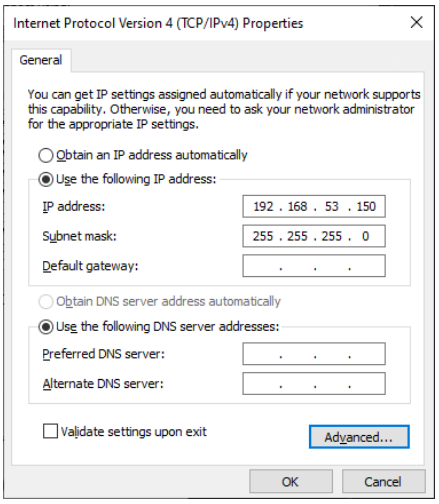
4.2 Network Configuration

NORBIT sonars connect to the acquisition computer via a standard Ethernet interface. The PC network adapter must be configured on the same static IP range.

> ⚠ **CAUTION:** Changing the IP address of the integrated INS from the factory configuration (192.168.53.100 for Applanix, or 192.168.53.103 for SBG) will disable INS functionality within the GUI.

To configure the IP address in Windows 11:

1. Go to **Settings > Network & Internet > Advanced Network Settings**, then expand the relevant adapter.
2. Select **Edit** next to **More Adapter Options**.
3. Open the **Internet Protocol Version 4 (TCP/IPv4)** properties.



The recommended IP address is **192.168.53.150** / subnet mask **255.255.255.0**. It is essential to avoid conflicts with:

- Sonar: 192.168.53.XX (XX = last two digits of serial no.)
- Applanix GNSS/INS: 192.168.53.100
- SBG INS: 192.168.53.103 / SBG GNSS: 192.168.53.104

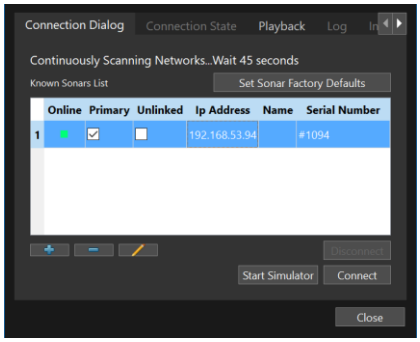
The IP address of the sonar unit itself should only be changed if absolutely required (see section 7.4).

CAUTION: Do **NOT** connect multiple network cards to the same static IP range, as doing so may cause duplication of navigation data, resulting in sonar data artifacts. The subnet mask does not matter.

NOTE: Make sure that DHCP servers are not running on the same network as the sonar. This causes automatic IP address assignment during bootup. If this occurs, power off the SIU, assign a static IP address, and power cycle.

4.3 Sonar Connection

After starting the GUI, the **Connection Dialog** opens automatically. A green indicator shows an active sonar on the network, while red indicates offline status. Highlight the sonar and click **Connect**. After the first successful connection, all subsequent connections are automatic.



To connect two sonars in dual head mode, set the left sonar as the **Primary** sonar, highlight **both** sonars, and click **Connect**. For more details, see Appendix A2.

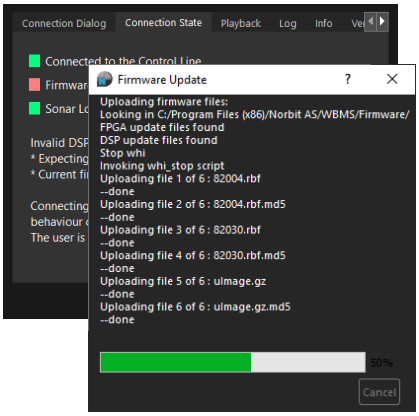
After connecting, the GUI automatically verifies firmware compatibility (see section 4.4). For a full description of the Connection Dialog, refer to section 4.8.6.1.

CAUTION: Whenever firmware is updated or a new GUI is installed, users are strongly advised to select **Set Sonar Factory Defaults** on the Connection dialog afterwards.

4.4 Firmware Update

4.4.1 Standard Procedure

When a firmware mismatch is detected, click **Perform Update** and follow the instructions. It is unsafe to turn off power to the sonar once the upgrade process has started.



When the upgrade is complete, power cycle the sonar and select **Set Sonar Factory Defaults** on the Connection dialog.

For WINGHEAD B51S and i80S models, containing sonar part number 24115, firmware updates must be applied through the sonar Web UI as described in section 4.4.2.

4.4.2 WINGHEAD B51S, i80S & i80S Apogee Models

Step 1. With the sonar powered on, open a web browser, and go to: http://192.168.53.XX:8080 (where XX is the last 2 digits of the sonar serial number).

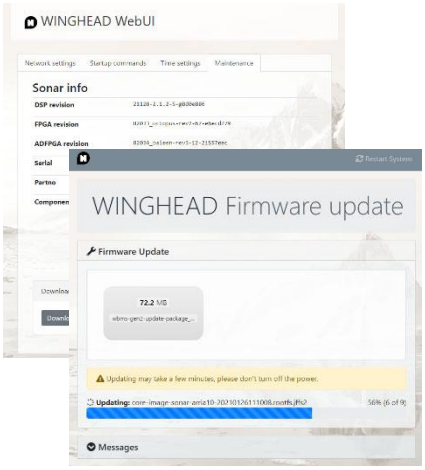
Step 2. Go to the **Maintenance** tab and click **Reboot** in the "Reboot to firmware upgrade mode" box.

Step 3. Click **OK** when prompted.

Step 4. The update file is located inside the GUI installation folder, in the Firmware subfolder: *C:\Program Files (x86)\Norbit AS\WBMS\Firmware\wh-fw.swu*

Step 5. Drag and drop the *.swu file into the Firmware Update box. The update will begin automatically.

Step 6. Do **NOT** turn off the sonar during the update. Upon completion, power cycle the system and select **Set Sonar Factory Defaults** on the GUI Connection dialog.



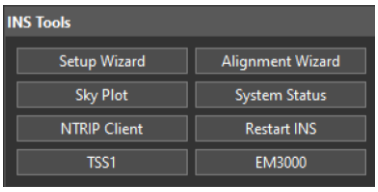
4.5 Operation Without the GUI

Some setups, such as those on AUVs, may require operation without the active use of the NORBIT GUI. For this purpose, the system can be configured to operate in **Passive** or **Headless** modes. These modes are not intended to be used where several observers are required, as it substantially increases sonar bandwidth and may cause data loss.

For details on how to configure the sonar in these modes, refer to the ROV/AUV/USV Integration Manual, TN-190041. Additionally, users have the option to interface with the sonar at a script level by sending direct commands (ref. TN-210082); however, this approach should only be used if passive and headless modes are not viable.

4.6 INS Tools

The NORBIT GUI contains integrated INS functionality for systems which contain integrated GNSS/INS subsystems, allowing the sonar and INS to be setup and controlled from the same user interface. For users with standalone systems, most settings under the **INS Tools** are intentionally disabled.



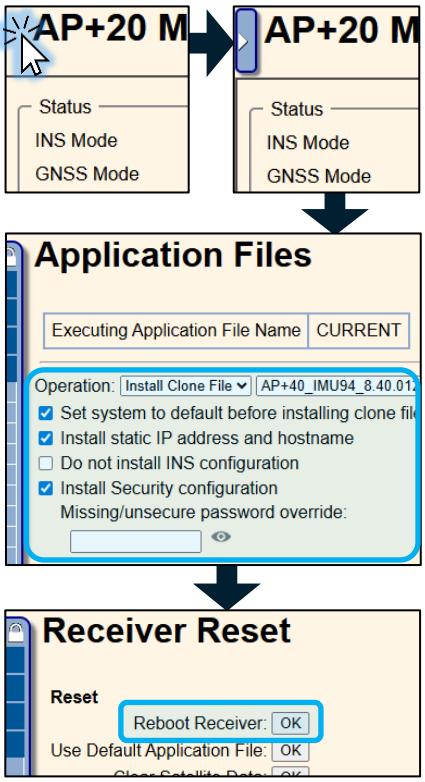
4.6.1 INS Setup Wizard

4.6.1.1 Factory Settings

To restore the factory settings, open the **INS Setup Wizard** and select **Factory**. This only resets the INS configuration and does not impact the sonar configuration or GUI display preferences.

CAUTION: Offsets are stored on the operator PC. If the PC is changed, the displayed **Measure Point to Antenna Bottom** offset is from the Sonar Reference Point to the antenna phase centre. This does not affect operation unless the configuration is re-saved. Review all inputs prior to each survey.

For Applanix AP+ models, the factory settings are restored using the Web UI:



Step 1. Open the AP+ Web UI (http://192.168.53.100)

Step 2. If the left menu is not visible (AP+ firmware ≥8.44), **triple-click** in the empty area at the top-left of the Web UI to unlock the advanced menu

Step 3. Go to **Receiver Configuration > Application Files**

Step 4. If the AP+ firmware was recently updated, obtain the relevant clone file from NORBIT Support and upload it by selecting **Operation: Upload Clone File**

Step 5. Select **Operation: Install Clone File** and select the file (*.xml) from the drop-down menu.

Step 6. Ensure that the following selections are made:

☑ Set system to default before installing clone file
☑ Install static IP address and hostname
☒ Do not install INS configuration
☑ Install Security configuration
Missing/unsecure password override:
(leave blank)

Step 7. Click **OK** and wait for the clone file to install.

Step 8. Navigate to **Receiver Configuration > Reset**

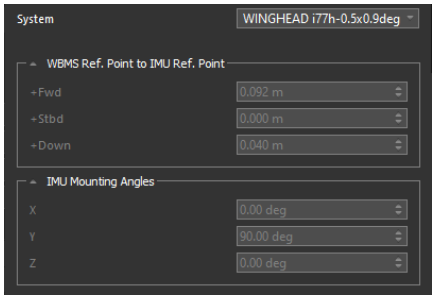
Step 9. Next to **Reboot Receiver**, click **OK**

Step 10. The factory reset procedure resets the IMU mounting angles to zero, which are invalid for most installations. To restore the correct angles, run the INS Setup Wizard in the GUI.

CAUTION: Installing a clone file via the right-menu in AP+ firmware ≥8.44 (instead of the advanced menu as described above) will prompt for credentials (username: **applanix**, password: **password**). Do **NOT** change any other AP+ Web UI settings as this may affect communication with the NORBIT GUI.

4.6.1.2 IMU Offset & Mounting Angles

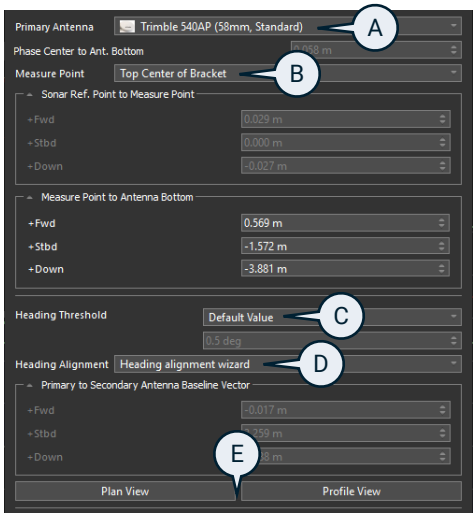
The first page of the setup wizard shows the sonar model in the **System** selection, along with the relevant offsets and mounting angles. The model is automatically detected, and for most users there is nothing to change here.



Select **Custom** for installations where the IMU is physically separated from the sonar using the IMUd option (see section 2.4.8.1 and Appendix C7). Most models contain tightly integrated IMUs which cannot be removed.

NOTE: The IMU mounting angles and offsets must be adjusted when the sonar is tilted, which is typical for dual head installations. For further information, refer to the technical note TN-190018 and Appendix A2.

4.6.1.3 Antenna Offsets



A. Choose the Antenna Model

- Typically **Trimble 540AP** (Applanix models) or **VeroStar VSP6037L** (SBG models).
- This ensures that the correct phase centre offset is applied (see section 2.4.8)

B. Define the Measure Point

- Choose a convenient point from which to measure the primary antenna offset. **Top Centre of Bracket** is recommended.
- For dual head, a **Custom** point using the top centre of the dual head bracket is more practical.
- Measure the distance from **Measure Point to Antenna Bottom** and enter the values, noting the sign convention (positive down).

C. Set Heading Threshold

- For Applanix models, set the **Heading Threshold** for the alignment (see section 4.6.2).
- The **Default Value** is suitable in most cases.
- If the vessel cannot manoeuvre aggressively, select **Custom** and increase it in 0.5^0 steps.

D. Heading Alignment Method

- If the primary to secondary antenna offset is already known (i.e. measured using land survey techniques), enter it using the **Custom** option. This is strongly recommended for installations on large vessels.
- If the antenna vector is unknown, select **Heading Alignment Wizard** and the alignment procedure will commence after completing the INS Setup Wizard (see section 4.6.2).

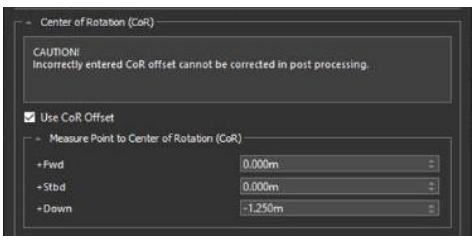
E. Visual Check

- **Plan View** and **Profile View** displays the antenna positions with respect to the Sonar Reference Point, which can be used for visual verification.

NOTE: The Measure Point to Antenna Bottom offset is corrected to the **Sonar Reference Point** upon transfer to the INS, therefore the displayed offset may differ from that reported in POSPac, POSView, Qinertia, etc.

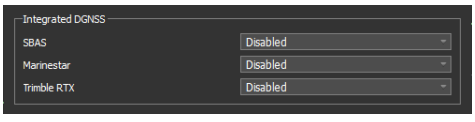
4.6.1.4 Centre of Rotation Offset

Enter the **Centre of Rotation** offset relative to the **Measure Point** to improve heave accuracy. It is an area rather than a precise point, which varies with fuel stowage and weight distribution, so an approximation is sufficient. It is generally 3/4 distance from bow to stern, centred on the keel, and near the waterline.

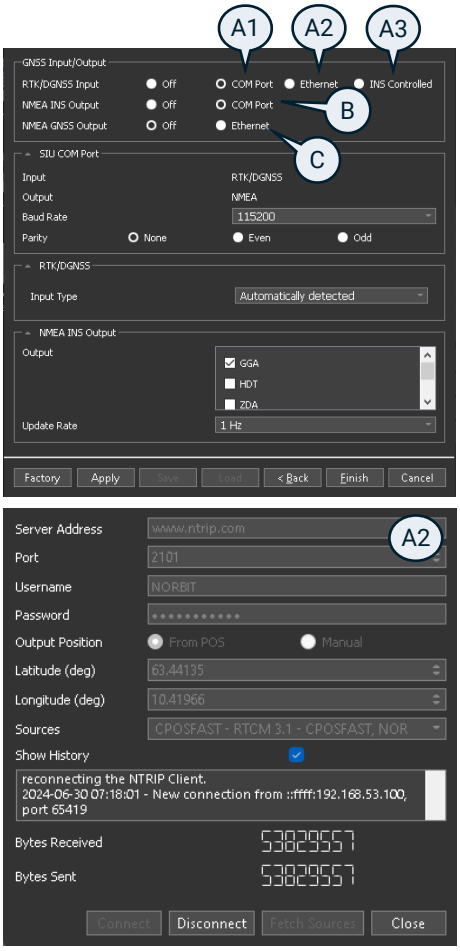


4.6.1.5 Integrated DGNSS

Satellite-based GNSS correction services include free regional SBAS services, and paid subscription services such as **Marinestar** or **Trimble RTX** (see sections 4.6.6 and 4.6.7).



4.6.1.6 Inputs/Outputs & RTK Corrections



A. Configure Real Time Kinematic (RTK) Input

Option 1: Corrections via radio

i. Ensure the vessel's radio has a serial output, containing **ONLY** the correction message.
ii. Connect the serial cable to the SIU COM port.
iii. Select **COM Port** as the **RTK/DGNSS Input** type and set the baud rate to match the radio.
iv. Select the correction format (e.g. **CMR+**, **RTCM 3.x**), noting that some models auto-detect it.

Option 2: Corrections via NTRIP (Internet Required)

i. Select **Ethernet** as the **RTK/DGNSS Input**.
ii. Enter the credentials in the **NTRIP Client**.
iii. Click **Fetch Sources**.
iv. Select the source and click **Connect**.

Option 3: Corrections via external software

i. Selecting **INS Controlled** allows the RTK input to be controlled by external software solutions.
ii. The GUI does not adjust any input settings.

B. Configure NMEA INS Output (Optional)

i. Select **COM Port** as the **NMEA INS Output**.
ii. Select the desired **NMEA** output messages.
iii. When receiving radio corrections, disable this output or separate the data input/output lines to prevent the modem from receiving NMEA data.

C. Configure NMEA GNSS Output (Optional)

It is also possible to output raw **NMEA GNSS** data over Ethernet on supported models:

i. Select **Ethernet** as the **NMEA GNSS Output**.
ii. Select the desired **NMEA** output messages.
iii. The raw GNSS data (**NOT** the inertial solution) is output at the specified reference point (ARP or APC) over **TCP** port **50100** and can be used for navigation quality control checks.

Although not recommended due to its inherent limitations, some models support **Aux. GNSS Input:**

i. Select **COM Port** as the **Aux. GNSS Input**.
ii. Enter the offset to the antenna phase centre from the **Sonar Reference Point**.
iii. The INS compares its own solution quality against the auxiliary solution and uses the best.
iv. The input must include NMEA GGA, and optionally GSV, GSA and GST at 1Hz update rate.

NOTE: For RTCMv3 corrections, NORBIT recommends sending either MSM7 messages (1077, 1087, 1097, 1107, 1117, 1127 & 1137) plus legacy messages 1006 & 1033 from the base station, or MSM4 messages (1074, 1084, 1094 & 1124) plus 1006 & 1033. Do **NOT** mix MSM4 and MSM7.

NOTE: For legacy Applanix models in Tightly Coupled modes, selecting the correction format **None** (not recommended) enables non-GPS constellations in Closely Coupled modes, however not all data feeds the Kalman Filter.

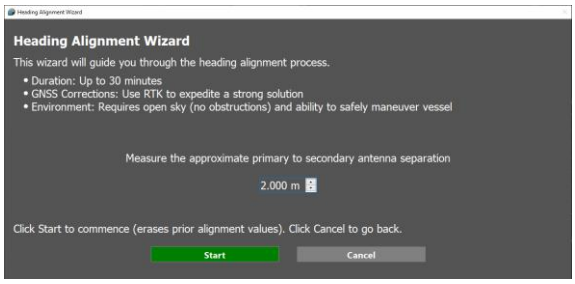
4.6.2 Heading Alignment Wizard

If the primary to secondary antenna offset was not applied in section 4.6.1.3, a heading alignment must be performed when the system is first installed, or each time one of the INS sensors (IMU or GNSS antennas) is moved. GNSS corrections are essential, and RTK is strongly recommended.

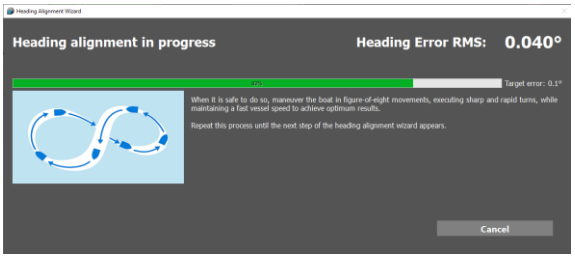
NOTE: The procedure varies depending on the integrated GNSS/INS model and the instructions are displayed on the alignment wizard. Note that, for AP+ models, T04 logging stops and restarts multiple times throughout the process.

Step 1. For AP+ models, enter the approximate antenna separation, and for SBG models, enter a first guess within ±0.1m accuracy to aid the alignment. Press **Start** to begin the process.

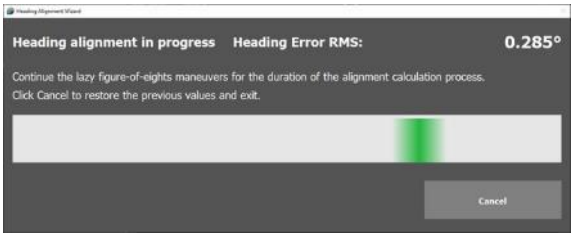
Ensure that the antennas have a clear view of the sky, away from tall structures that impede GNSS performance. The installation must be rigid and vibration-free, and the primary antenna offset must be accurately applied as described in the previous sections.



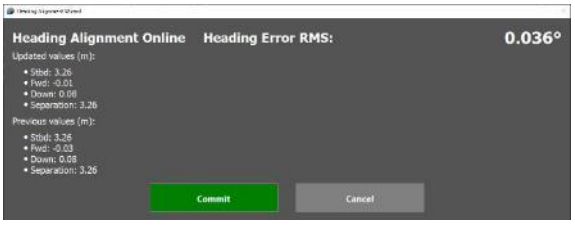
Step 2. Follow the recommended manoeuvres during the pre-alignment. The **Heading Error RMS** drops from 55° and the alignment begins once it falls below the defined **Target Error** and stabilises. Continue the manoeuvres until this occurs. The alignment is iterative for AP+ models, and it is normal for the RMS to jump to 40° between iterations.



Step 3. Follow the instructions and continue the figure-of-eight manoeuvres. The completion time depends on the size of the vessel and the speed at which the manoeuvres are performed, as well as positioning quality. If the alignment is slow or fails to complete, ensure that both antennas are securely mounted and free from vibration.

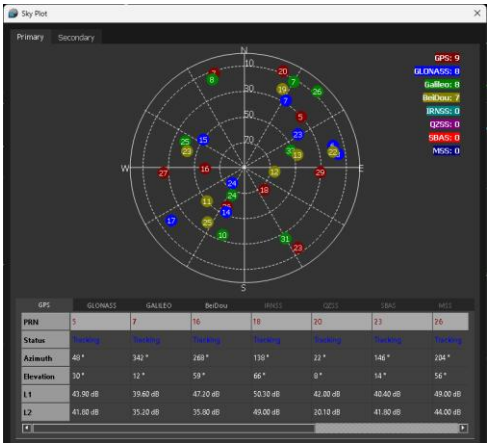


Step 4. The computed results are unique to each installation. If the primary to secondary antenna offset was measured beforehand, the calculated results should be similar. Click **Commit** to save the results. NORBIT recommends performing a patch test after the heading alignment.



4.6.3 Sky Plot

The **Sky Plot** displays the currently tracked GNSS satellites for each constellation:



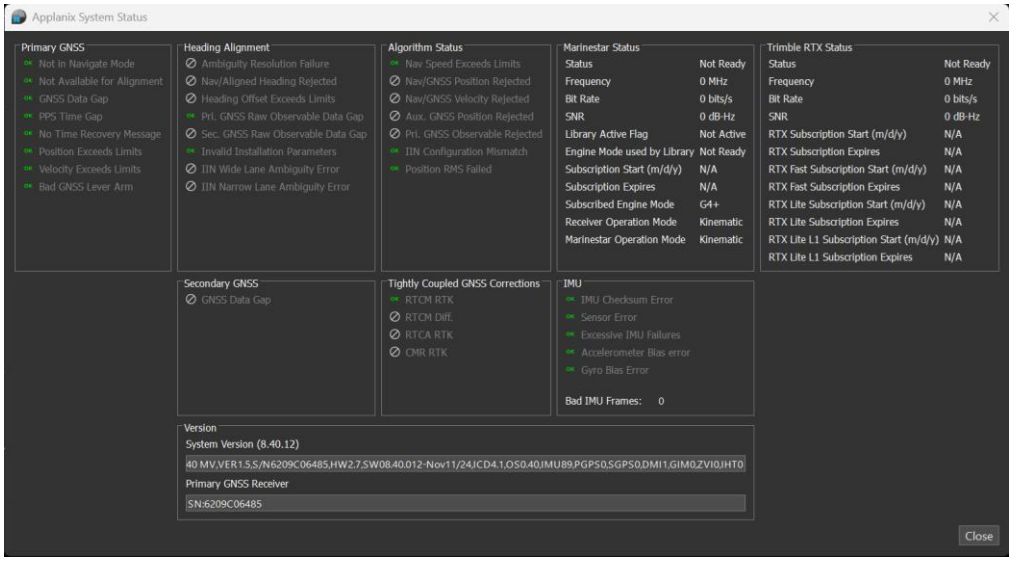
4.6.4 System Status

The **System Status** dialog reports any fault conditions that may occur during operation.

- Check this display if the **Faults** indicator on the GUI status bar appears red.
- Some items may appear red intermittently during operation (see section 7.2).
- The displayed items vary by INS model, so the display may differ from the example below.

The **Version** information block at the bottom shows:

- INS hardware, software, and firmware versions.
- **Marinestar** and **Trimble RTX** subscription expiry dates (MM/DD/YYYY).
- Trimble RTX is only supported on Applanix models, and for SBG models, the Marinestar details are reported on the Septentrio Web UI (see section 4.6.6).

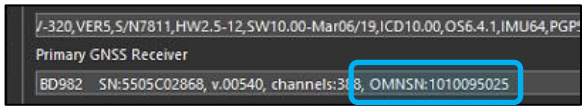


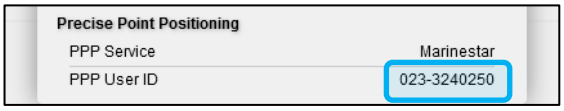
4.6.5 Restart INS

This **Restart INS** option resets the Kalman filter, prompting the IMU to restart its levelling routine. Note that the navigation output stops temporarily while this process is underway. It takes a short time for the system to reinitialise and resume the normal operation mode.

4.6.6 Marinestar Activation

Step 1. Obtain the **OMNSN** ID (Applanix models: **INS Tools** > **System Status**) or **PPP User ID** (SBG models: http://192.168.53.103 > **Information > Firmware & GNSS > Internal GNSS > Show Details**).





Step 2. Request your subscription from Fugro, noting that Applanix AP+ models are compatible **only** with the G4+ service. In your request, provide the OMNSN ID or PPP User ID from the previous step.

Step 3. Schedule a time with Fugro to activate the subscription, ensuring that the system is powered on and tracking satellites (see next step) when the activation code is transmitted over-the-air.

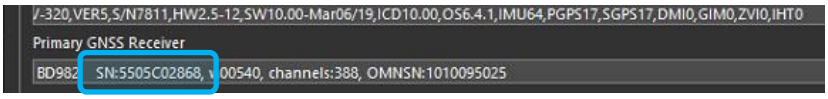
Step 4. For Applanix models, enable **Marinestar** in the **INS Setup Wizard** (see 4.6.1.5). Usually, **Auto** mode is sufficient, however a specific mode and frequency can be set using **Custom**. For SBG models, activate the service on the Septentrio Web UI (http://192.168.53.104) under **Fugro Marinestar > Settings > Satellite Beam Selection Mode**.

Step 5. Inform Fugro when the system is ready and wait for the activation code to be sent. The SNR must be >35dB-Hz. It may take 30-45 minutes after the code is sent for the subscription to activate.

Step 6. On Applanix models, check **INS Tools > System Status** for an updated expiration date to confirm a valid subscription. On SBG models, the expiration is reported on the Septentrio Web UI. Hover over the INS **Status** LED in the NORBIT GUI to see **Pri. Marinestar…** (or similar) status reported.

4.6.7 Trimble RTX Activation

Step 1. Trimble RTX is a paid-subscription service that is only available on Applanix models. Select **INS Tools** > **System Status** to obtain the **Primary GNSS Receiver** serial number:



Step 2. Schedule a time for activation, ensuring the system is powered on and tracking the appropriate satellite when the activation is transmitted over-the-air.

Step 3. Enable **Trimble RTX** in the **INS Setup Wizard**, as described in section 4.6.1.5. A firmware update may be required if the option is not available (contact NORBIT Support and include a screenshot of the **System Status** to confirm eligibility). In most cases, **Auto** mode is sufficient, however a specific satellite, frequency, and bitrate can also be set using **Custom**. The SNR must be >35dB-Hz.

Step 4. Inform Trimble when the system is ready and wait for the activation code to be sent. The activation will be transmitted over-the-air (OTA) every 10 minutes for up to 1 hour.

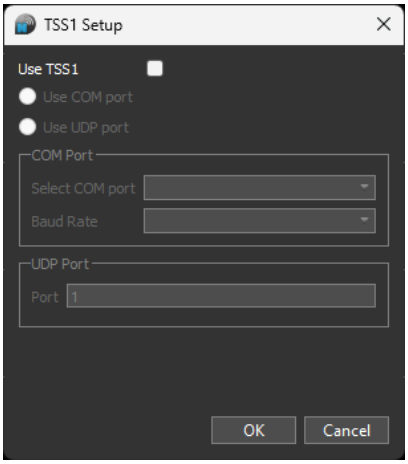
Step 5. For high/low latitudes with insufficient geostationary elevation, the NTRIP option may be used. An Internet connection and a valid subscription are required. Use the **NTRIP Client** under **INS Tools**, with the server address **www.trimblertx.net** and port **2101**. No username or password is needed.

Step 6. Confirm that the subscription is valid by observing the **System Status** window. You should expect to see the status **Tracking**, as well as an updated expiration date. The INS status will report **Trimble RTX** when the mouse is hovered over the INS **Status** LED indicator.

ⓘ **NOTE:** If OTA activation fails, the subscription code can be applied manually. On AP+ models, use the Web UI (http://192.168.53.100 on the **Receiver Options** page**)**, and on legacy models use POSView (**Tools > Send receiver option key**). Power cycle the system after applying the Option Code.

4.6.8 External TSS1 or EM3000 Input for Roll/Pitch/Yaw Stabilisation

For non-integrated sonars, the NORBIT GUI can receive motion data from an external motion sensor for roll stabilisation and, for supported models, pitch and yaw stabilisation.



Accepted Formats:

- TSS1 (Convention: Port Up+, Bow Up+)
- EM3000 (Convention: Port Up+, Bow Up+, Clockwise+)

Note: EM3000 Includes heading, required for yaw stabilisation.

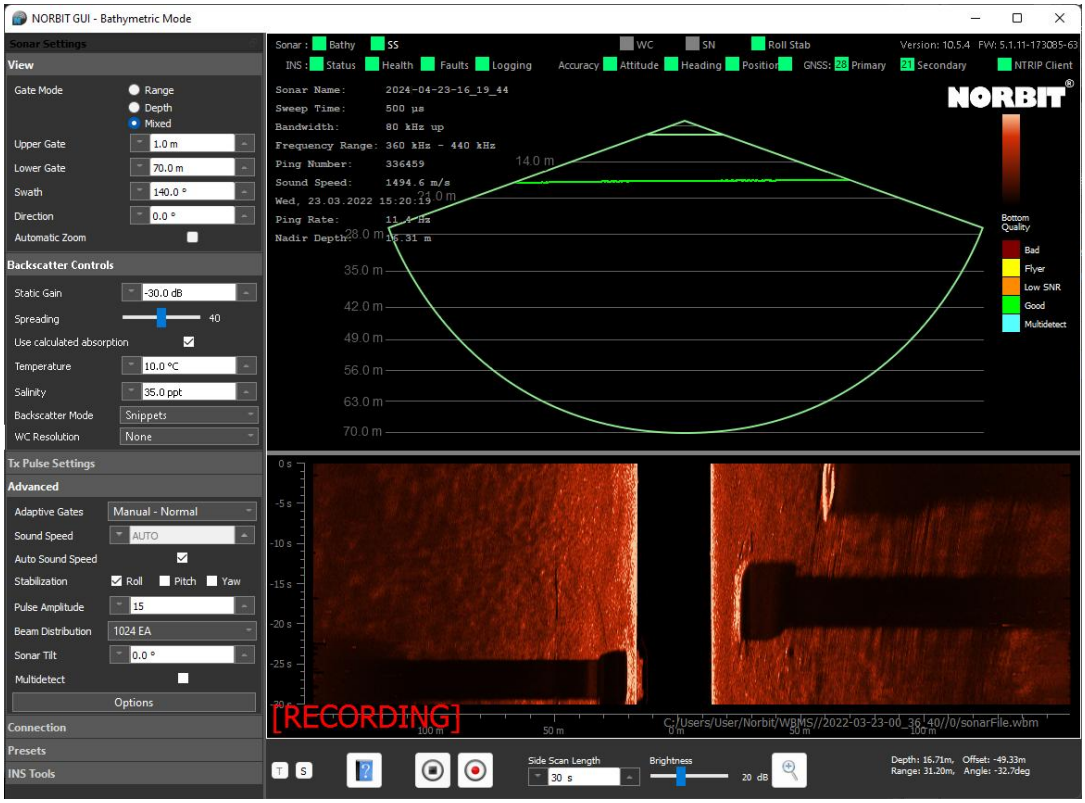
Interfacing Requirements:

- The message string must be sent to the PC running the NORBIT GUI, via COM Port or UDP protocol.
- The **Use TSS1** or **Use EM3000** checkbox must be enabled, along with the relevant communication parameters.
- ≥50Hz update rates are recommended. The minimum baud rate for a 50Hz update rate is 19200. The baud rate must match the output from the motion sensor.

4.7 Sonar Wedge Display

The sonar wedge shows a single ping of data from a thin slice of the water column. Up to 1024 overlapping beams are displayed, each producing a depth sounding.

- The wedge is used to monitor data quality and swath coverage.
- Current settings and statistics, such as frequency, sound speed, date, time, and ping number, are shown next to the wedge.
- Software and firmware versions are displayed at the top right corner.
- In dual head mode, two swaths are displayed, with the left sonar labelled primary and the right sonar labelled secondary (see Appendix A2).



Each bottom detection point is assigned a quality flag based on the signal brightness and proximity to adjacent detections. These points are flagged, but not deleted, and can be filtered during post-processing.

When the Multidetect option is enabled (see section 4.8.5), additional detections are flagged accordingly.

Quality (Flag)	Description
Bad (0)	Low SNR, Low Collinearity
Flyer (1)	High SNR, Low Collinearity
Low SNR (2)	Low SNR, High Collinearity
Good (3)	High SNR, High Collinearity
Multidetect (4)	Additional Detections

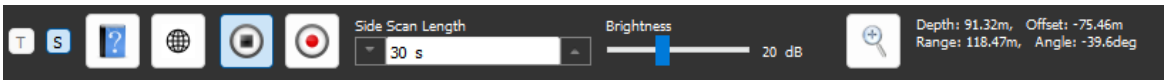
4.7.1 Status Indicators

	LED Indicator	Description
Sonar	Bathy	Bathymetry data streaming status (TCP/IP subscription)
	SS WC SN	Sidescan (SS), water column (WC), and snippets (SN) data streaming status (TCP/IP subscription). The indicators turn red when the backscatter signal is saturated (see section 4.7.3)
	Roll / Pitch / Yaw Stab	Active motion stabilisation status (see section 4.8.5)
INS	Status	Navigation solution mode (e.g. FIXED RTK) and corrector stream status
	Health	INS initialisation/alignment status
	Faults	INS diagnostics status (see section 4.6.4)
	Logging	INS raw observables recording status. Recording starts automatically, and hovering displays the file path. For AP+ models, delayed heave cannot be extracted from the T04 logs and must be recorded in the data acquisition software (see section 5)
	Attitude Heading Position	Position, attitude and heading solution (latitude, longitude, roll, pitch, and heading), plus associated accuracy metrics when hovered.
	Primary / Secondary	Tracked satellites on the GNSS antennas (see section 4.6.3)
	NTRIP Client	NTRIP Client status (see section 4.6.1.6)

	INS Status	Description
RTK	FIXED RTK	Tightly coupled using raw observables + corrections (RTCM 18 & 19, CMR, CMR+)
	Pri. Fixed RTK	Closely coupled using primary GNSS position data in RTK mode.
	FLOAT RTK	Same as FIXED RTK but with reduced accuracy.
PPP	Trimble RTX	Satellite-based corrections using Trimble's Real-Time eXtended (RTX) technology.
	Pri. Marinestar	Satellite-based corrections using Fugro's Marinestar service.
DGNSS	RTCM DGNSS	Tightly coupled using raw observables + corrections (RTCM 1 or 9)
	CODE DGNSS	Tightly coupled using raw observables + corrections (RTCM 18 & 19, CMR, CMR+)
	Pri. DGNSS	Closely coupled using primary GNSS position data in DGNSS mode.
Auxiliary	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.
	Aux. DGNSS	Loosely coupled using auxiliary GNSS position data in DGNSS mode.
	Aux. Float RTK	Loosely coupled using auxiliary GNSS position data in Float RTK mode.
Other	C/A	Closely coupled using primary GNSS position data in C/A mode.
	DR	No GNSS input is available; navigation is using only the IMU data.

NOTE: T04 data, recorded with Applanix AP+ models, is logged in GPS time instead of UTC time. As a result, POSPac users **MUST** export the PPK navigation solution using the **Custom Smoothed BET UTC** format.

4.7.2 Viewer Bar



T	Displays a time trace for each beam when water column is active. Select the active beam using the slider bar at the bottom. Left-click and drag to zoom in, and right-click to reset.
S	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.
	Opens the sonar user manual in PDF format.
	Opens a real-time 3D point cloud display in a web browser on port 41800 (e.g. http://127.0.0.1:41800)
	Starts sonar pinging. Pinging starts automatically when the GUI is connected to the sonar.
	Stops sonar pinging. Pinging should be stopped when the GUI is running with the sonar out of water to prevent the electronics from overheating.
	Activates raw data recording, which is described fully in section 4.9.1. Recorded data can be replayed at any time, even during live operation (see section 4.8.6.3).
	Opens an adjustable zoom 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.

Side Scan Length controls the duration of the backscatter waterfall display (30s default), while **Brightness** (20 dB default) controls the visual intensity of imagery data, for display purposes only.

4.7.3 Backscatter Optimisation

Tuning the display **Brightness** (on the lower GUI bar) and **Gamma Correction** (under **Advanced > Options**) is only for visual purposes and does not affect the raw data. In contrast, TVG settings directly influence the backscatter data output, as detailed in section 4.8.3.

Step 1. From the factory sonar settings, do not adjust **Brightness**. Use the default value of 20dB.
Step 2. Under **Backscatter Controls**, set the **WC Resolution**, and select the **Backscatter Mode**.
Step 3. Enable **Use calculated absorption**. Set the correct **Temperature** and **Salinity** for the environment.
Step 4. Adjust **Static Gain** until the backscatter image appears unsaturated.
Step 5. Make minor adjustments to **Spreading** to maintain a display with equal intensity across the seafloor.
Step 6. Adjust **Brightness** on the display control bar if desired (for visual purposes only).
Step 7. Ensure the **SS**, **SN** and **WC** indicators remain green, as saturated imagery will not be salvageable.

Saturation occurs when backscatter image details are permanently lost, and the raw data shows uniform intensity values. If an image appears too bright or saturated but adjusting the **Brightness** restores details, it means the observed saturation is only visual and is not present in the raw data.

4.8 Sonar Settings

4.8.1 Recommended Settings

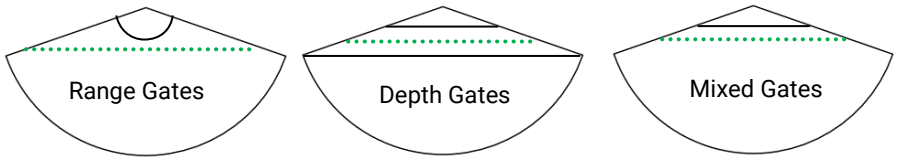
As a starting point, the following settings are recommended for shallow water bathymetric surveys:

- ✓ Use **Mixed** gates and set the **Upper Gate** to at least 1m.
- ✓ Enable **Adaptive Ping Rate** and set the **Lower Gate** beyond the expected maximum depth, e.g. at 20m depth, set the Lower Gate to 200m in Range/Mixed modes, or 100m in Depth mode.
- ✓ With **Adaptive Ping Rate** enabled, setting the **Lower Gate** beyond the maximum depth ensures fast ping rates, regardless of the Lower Gate (range) setting. This makes the sonar effectively "hands-off" by removing the need for constant gate adjustments as the depth changes.
- ✓ Enable **Automatic Zoom** to keep the active portion of the wedge visible on the display.
- ✓ Enable **Auto** under Tx Pulse Settings.
- ✓ Set the **Swath** angle to 120-140°. Monitor the quality of the outer beams and adjust accordingly.
- ✓ Set **Adaptive Gates** to Normal and choose the desired **Beam Distribution** mode.
- ✓ Ensure that the correct **Temperature** and **Salinity** for the current environment are set.
- ✓ Enable **Roll Stabilisation** (along with Pitch and Yaw Stabilisation on supported models) to provide even sounding coverage in dynamic sea states.

4.8.2 View

View settings control the size of the swath and range over which the sonar will search for bottom detections. The sonar range (i.e. how far the sonar listens for a return signal) is a function of the **Lower Gate**, **Swath** angle, and swath pointing **Direction**, and must be greater than the expected maximum depth.

As well as controlling range, the gates also serve as a noise filter by forcing bottom detections between the upper and lower gates.

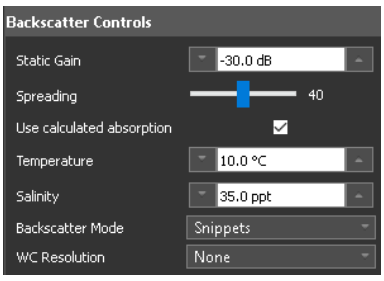
Setting	Description
Gate Mode	Gates set the range of the sonar, as well as forcing bottom detections between the **Upper Gate** and **Lower Gate**, acting as a noise filter. There are 3 options: • **Range**: The upper gate is radial, and the lower gate is the outer edge of the swath. Ideal for shallow water bank to bank surveys, or when changing the **Direction** to survey vertical structures up to waterline. • **Depth:** The upper and lower gates represent fixed depths, with the lower gate attached to the two corners of the wedge. Suitable for most environments. • **Mixed (Recommended):** A combination of the previous two modes, with the upper gate a fixed depth and the lower gate attached to the lower edge of the swath. Useful for surveys with rapid depth changes because the lower gate does not require as much attention from the operator.  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 for bottom detections. Adjust by typing a number and pressing Enter, by clicking the up/down arrow buttons, or by clicking/dragging the gate on the wedge interactively. A minimum of at least 1m is recommended to avoid false surface detections. **Minimum Value:** 0.2m **Maximum Value:** 599m
Lower Gate	Sets the maximum depth (or range) limit for bottom detections. It should be adjusted so that the seabed is above the two corners of the wedge. Adjust by typing a number and pressing Enter, by clicking the up/down arrow buttons, or by clicking/dragging the gate on the wedge interactively. **Minimum Value:** 0.3m **Maximum Value:** 600m
Swath	Sets the total angular swath coverage. For typical harbour surveys, this is normally set to 120-150°. Reducing the angle compresses the beams into a smaller sector, increasing the overlap between adjacent beams. In dual head mode, this setting defines the total coverage for both sonars combined and automatically allocates the required coverage to each head. **Minimum Value:** 5° **Maximum Value:** 210°
Wedge Overlap	Defines the percentage overlap between the primary and secondary sonar wedges when configured in dual head mode. With 100% overlap, both wedges fully cover the same area of the seafloor, providing double sounding density when the two sonars are mounted with zero rotation. If the overlap is <100%, the system automatically adjusts the Direction for each sonar to achieve the requested overlap (the Direction setting is therefore greyed out).
Direction	Sets the direction of the swath pointing angle. Useful when surveying slopes, shoreline, or mapping vertical structures. 0° places the swath symmetrically around nadir. To maximise ping rate while using this feature, it is recommended that **Range** mode is activated.
Automatic Zoom	Makes the active portion of the wedge full screen (for display purposes only). This ensures that detections are clearly visible on the display, even when the range is very long. This is most effective when using **Adaptive Ping Rate** with a large lower depth or range gate.

NOTE: In **Equidistant** mode, the swath angle cannot be increased such that any part of the swath exceeds an 80° pointing angle, i.e. 10^0 from horizontal (so, a 160° swath with 0° rotation or a 120° swath pointed 20° is the maximum.)

4.8.3 Backscatter Controls

Backscatter Controls change the data dynamics and apply gain to fit in the dynamic range of the output data format (s7k). The sonar hardware has a limited time varied gain (TVG) which operates up to around 30m. Thereafter, TVG yields a constant level. This may be a problem for some processing software when creating seamless mosaics. The GUI removes this native TVG and applies the user specified TVG defined by:

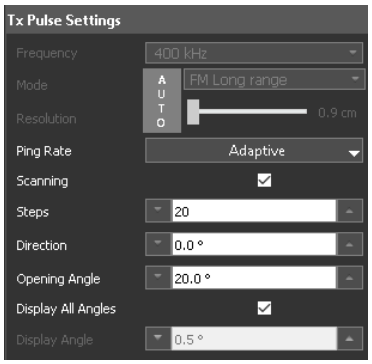


$$TVG = Spreading*Log_{10}(R) + 2*Absorption*R/1000 + Gain$$

This TVG curve is a standard continuous function to allow the signal to fit in the data format range and prevent signal saturation. This digital gain is applied to all imagery output (backscatter and water column) but has **NO** impact on bathymetry data. Refer to section 4.7.3 for tuning recommendations.

Setting	Description
Static Gain	Sets a fixed gain value that is used together with **Spreading** and **Absorption** to form the TVG curve. A setting of -30dB is suitable in most cases. Adjust the setting if the sonar signal becomes saturated, in which case the **SS/WC/SN** LED indicators appear red (see section 4.7.1). This setting is recalculated automatically when the **Spreading** or **Absorption** settings are adjusted.
Spreading	Sets the spreading component of the TVG calculation. Spreading loss is a geometrical phenomenon in which signal intensity is reduced with increasing range, as wave fronts are spread over a larger area.
Absorption	Sets the absorption component of the TVG calculation, accounting for transmission loss caused by conversion of acoustic energy into heat, which depends on the environment. When **Use calculated absorption** is enabled, **Temperature** and **Salinity** must be set, which, alongside the centre frequency and sonar-measured nadir depth, are used to determine the correct absorption. The sonar incorporates safeguards to prevent rapidly fluctuating depth values impacting the calculation. When Dual Swath or Yaw Stabilisation are enabled, the absorption value is computed individually for each centre frequency.
Backscatter Mode	Sets the backscatter mode to **Side Scan**, **Snippets**, **Snippet/Scan** or **None**. When backscatter data is requested from external data acquisition software (via TCP/IP subscription), the backscatter mode selection is automatically configured and greyed out. If side scan data is requested by the acquisition software when **Snippet/Scan** mode is selected, **Snippets-Sidescan** is generated so that (unlike regular side scan) a correctly positioned side scan can be derived from snippets. For optimal backscatter results, ensure that **Scanning** is disabled under **Tx Pulse Settings**. If the goal is to classify bottom types, collection of Snippets will be most helpful. Otherwise, snippets should be deactivated to conserve disk space and computational resources.
WC Resolution	Sets the resolution of water column data and displays it on the wedge. Note that if the resolution is set to **None**, water column data will **NOT** be recorded to raw *.wbm/*.s7k files. It is advised to keep the resolution low when computational resources are scarce.

4.8.4 Tx Pulse Settings

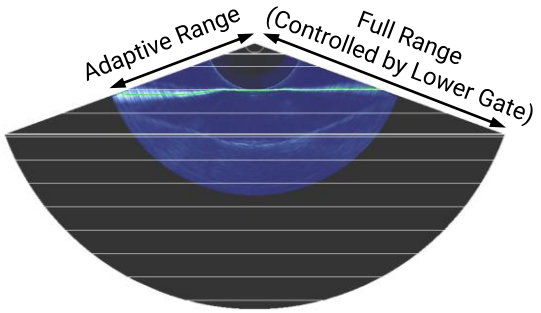


Tx Pulse Settings control the characteristics of the acoustic transmission, which impacts data quality, resolution, ping rate, and range performance. For most survey applications, the default settings are suitable.

When the STX scanning feature is licensed on supported models, this menu displays additional options to control the scanning mode. Refer to section 1.2.3 for more information.

Setting	Description
Frequency	Sets the centre frequency of the transmit pulse. Higher frequencies provide better resolution for a given depth, but also greater signal attenuation, especially in the presence of sediments. For most applications, use a frequency close to the design frequency, e.g. 400kHz for standard systems. Selecting a predefined frequency from the dropdown is recommended. At higher frequencies (e.g. 550kHz or 700kHz), the acoustic beam characteristics change in ways that affect outer-beam performance, particularly in complex environments. It is advisable to reduce the swath angle when working significantly above the system's design frequency. Additionally, higher frequencies are not advised for physically rotated installations.

Mode	Sets the sweep time of the signal transmission, which impacts range performance and ping rate. Shorter pulses allow faster ping rates in shallow water. The available selections are: • **FM Long Range** (recommended for most applications) • **FM Short Range** (for surveys in shallow water) • **FM Extended Range** (for maximum range in deep waters) • **CW** (legacy option, not recommended) The selection can be adjusted to control the range performance, where **FM Extended Range** applies the longest sweep time to maximise range. Note that using shorter pulses (e.g. **FM Short Range**) increases the effective ping rate in shallow water. For **CW** mode (not recommended) sweep time controls the range resolution and increases range performance at the expense of bottom detection quality. In **FM** modes (recommended), sweep time has no impact on range resolution.
Resolution	Sets the acoustic range resolution by controlling the pulse bandwidth. For FM modes, resolution is calculated as c/(2*Bandwidth), where c is the speed of sound. When maximum resolution (0.9cm) is set, 80kHz bandwidth is applied. Therefore, with a centre frequency of 400kHz, the transmission sweeps from 360-440kHz. Moving the slider to the right enhances range performance in deep water by reducing bandwidth, but it generally should not exceed 8cm (9kHz bandwidth) to ensure high data quality. In **CW** mode, the frequency transmission is constant. However, the system performs optimally in **FM** modes, yielding highest resolution regardless of depth. In dual head configurations, setting the centre Frequency automatically applies bandwidth above and below this value to prevent frequency overlap and crosstalk between sonars. A minimum range Resolution of approximately 1.1cm, with corresponding bandwidth, is used with 400kHz frequency in FM Short Range mode. When longer sweep times are used, the applied bandwidth is reduced accordingly to minimise range resolution.
AUTO	Adjusts **Mode**, **Resolution**, **Frequency** and **Pulse Amplitude** for best performance in nearly all survey conditions. For backscatter surveys, unless very high ping rates are desired in shallow water, disable **Auto** and use **FM Long Range** with **0.9cm Resolution** to ensure full processing of the backscatter signal. The system will otherwise switch between short and long pulses, which some processing software is unable to compensate for.
Ping Rate	Sets the rate at which acoustic pulses are transmitted, which, together with vessel speed, impacts along-track sounding density. Certain factors such as depth and sweep time (**Mode**) will limit the maximum achievable ping rate. In deeper water, lower ping rates should be expected since the signal travel times are longer. • **Adaptive (Recommended):** The system searches for the greatest bottom detection range over a certain number of pings and revises the transmission timing to match this. This ensures that the system always pings at the maximum rate, regardless of where the **Lower Gate** (range) is set. Ideal for high resolution data over rapidly changing bottoms or surveys that do not allow for full-time, hands-on operators.

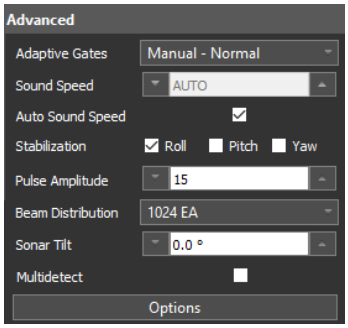


	• **Full Range:** The ping rate is based on the total effective range as defined by the **Swath** angle, swath **Direction** and **Lower Gate**. The rate is a function of the two-way travel-time of the signal from the projector to the bottom and back again, plus a small duration for ping processing and capacitor charge. • **Fixed:** The ping rate will not exceed the fixed value, even when the range makes it theoretically possible to do so. The maximum rate is based on the range as determined by the **Lower Gate**. Useful for reducing data volumes when operating at very short ranges (e.g. low altitude ROV surveys), as the system will attempt to ping as fast as possible up to the user defined threshold or the sonar range. • **External:** Each ping is triggered externally and only happens if the sonar is 'ready' when the signal arrives, e.g. if the sonar cannot ping faster than 10Hz due to range limitations, but the external signal is 12Hz, every other event will be skipped resulting in a 6Hz ping rate per every other signal. The external signal polarity is configurable. The minimum delay from the transmit signal to the centre of the transmit pulse is 500µs (half the transmit pulse buffer plus additional). An adjustable trigger delay is possible with millisecond resolution.
Scanning	Directs the sonar to sweep an along-track angular sector defined by the **Opening Angle**. If disabled, the sonar is directed to ping in one direction only, effectively behaving as a conventional multibeam sonar. It is **NOT** advised to perform an entire survey with scanning enabled. Use scanning only when attempting to further develop areas of interest.
Steps	The number of steps corresponds to the number of slices, or pings, in each defined along-track sector. For most applications, use a step size equal to, or less than, 20. This is configurable only if **Scanning** is enabled and the **Opening Angle** is set to a non-zero value. If the number of **Steps** is 20, and the **Opening Angle** is 20°, and the sonar ping rate is 20Hz, it will take exactly 1 second for the sonar to scan the 20° sector.
Direction	Defines the angular direction forming the centre of the along-track sector, e.g. for a **Direction** of 5° and **Opening Angle** of 10°, the STX sonar will scan across a sector from 0° to 10°.
Opening Angle	Defines the angular sector through which the transmit beam is steered. Steering is limited to ±10°, and as the angular **Direction** increases by 1°, the maximum **Opening Angle** decreases by 2°. If the **Direction** is 0°, the maximum **Opening Angle** is 20°.
Display all Angles	When enabled, all angles in the sector being scanned by the STX scanning mode are displayed. When disabled, the GUI will display only the angle defined in **Display Angle**.
Display Angle	The user may define a single angle within the sector to show on the display. If **Display all Angles** is enabled, this setting is greyed out.

ⓘ **NOTE:** High quality sonar data requires excellent Signal to Noise Ratio (SNR) and suitable TX settings to maximise swath width. For most conditions (temperature and salinity dependent) use **FM Long Range** mode with **0.9cm** resolution. In deeper waters, if the useable swath width narrows, gradually move the **Resolution** slider to the right. When in doubt, use **Auto.**

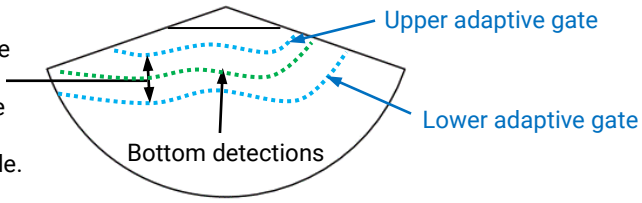
ⓘ **NOTE:** To obtain optimal backscatter results for bottom classification surveys using Snippets, disable **Auto** and set **Mode** and **Resolution** manually. Changing these settings during a survey may degrade data quality as the processing software is unable to compensate for variable pulse characteristics. When faster ping rates are required, use **FM Short Range**.

4.8.5 Advanced



Advanced settings allow the user to further customise the sonar configuration. The presented options depend on the sonar model, as some features are hardware limited, while some features are license controlled (see Appendix B1).

Pitch and yaw stabilisation are only available on NORBIT sonars with steerable transmission functionality. When Multidetect is enabled, additional options are shown to control the detection sensitivity and output settings.

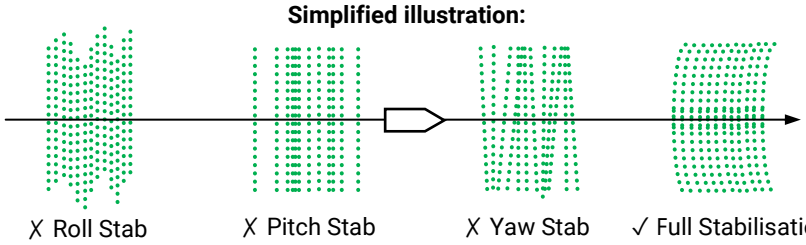
Setting	Description
Adaptive Gates	**Adaptive Gates** automatically track and follow the shape of the seafloor and are used to improve detection quality, working in conjunction with the fixed upper/lower gates. Note that they are **NOT** visible on the display. In areas with steep gradients or rapidly changing seabed, select **Wide** or **Off**. If the gates are too wide (or off), false detections may occur due to noise, second returns or marine life. The following applications are well suited for the corresponding settings: • Dredging Surveys: **Normal** Adaptive Gates • Engineering Surveys: **Normal** or **Wide** Adaptive Gates • General Bathy Surveys >40m: **Narrow** Adaptive Gates • General Bathy Surveys <40m: **Normal** Adaptive Gates • Wreck or Complex Structure Surveys: **Wide** Adaptive Gates or **Off** Bottom detections are forced within the adaptive window. The size can be set to normal, narrow or wide.  In some sea states, the gates may need to be set wider to avoid clipping data during large roll events. It is advisable to use adaptive gates in nearly all environments.
Sound Speed	Controls how the surface sound speed is applied for beam steering computations. If **Auto Sound Speed** is enabled (recommended) the sonar uses values from the integrated SV sensor. An incorrect surface sound speed will irreparably compromise data quality. The input range is 1300m/s to 1700m/s, which reflects default hardware capabilities. For marine conditions requiring a larger range, other models of the sound speed probe are available. When **Auto Sound Speed** is disabled, the last value at the head is used.
Auto Sound Speed	When this option is enabled, the speed of sound is taken from the probe at the sonar head. This is recommended unless the probe is damaged or there are too many bubbles affecting data quality, e.g. when surveying in rapids or surf-zone. If the sonar is powered on and out of water, or excessive bubbles are present, the GUI displays a warning that the sonar is “Out of water” and the sonar will stop pinging after a short period of time to prevent damage due to overheating. If the sonar temperature exceeds 65°C it will shut down automatically as a safety precaution.

Stabilisation

Motion stabilisation is used to increase survey efficiency, and is unrelated to motion compensation for georeferencing purposes, which is handled separately. Note that some options are licence-controlled.

- **Roll:** Allows for a wider swath width in more dynamic sea states. Roll stabilisation compensates up to ±10º of roll.
- **Pitch:** Allows the transmit beam to be compensated for up to ±10º of vessel pitch motion, providing more even along-track sounding coverage.
- **Yaw:** Provides evenly distributed along-track soundings, and prevents gaps in coverage, by compensating for changes in vessel heading (up to ±10º). To avoid gaps between sectors, there is a small overlap in the nadir region.

Simplified illustration:



Pulse Amplitude

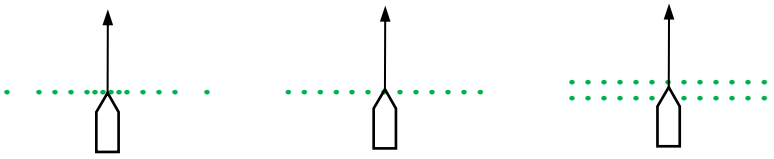
Sets the transmission power. In highly reflective areas (e.g. lock chambers) it may be necessary to slightly reduce the pulse amplitude to reduce acoustic reflections and noise. Otherwise, it is best to leave it set to 15. Note that this option is disabled when **Auto** Mode/Resolution is enabled (recommended).

Beam Distribution

Several options are available providing both Equiangular (EA) and Equidistant (ED) beam spacing. Do not switch modes while logging data, as there is a short 1 second lag when switching modes. Note that some options are licence-controlled.

- **1024/512/256 EA**: The angular swath coverage is divided equally by 1024, 512 or 256 (the total number of beams) to determine the angular beam spacing. Use this mode to increase resolution around the nadir zone.
- **1024/512/256 ED**: The beams are distributed across the swath so that the footprints have the same distance between them. The angular spacing varies across the swath. Use to increase resolution at the outer swath edges.
- **Dual Swath 2048 EA/ED**: Use this mode to increase along-track sounding density, or increase survey speed, by transmitting multiple pings simultaneously. It generates 2x1024 soundings per ping, offset by ±1°. The benefits are most evident in deeper waters; at very short ranges, the benefits are minimal. Note that the selectable frequency is restricted to specific optimised frequencies.

Simplified illustration:



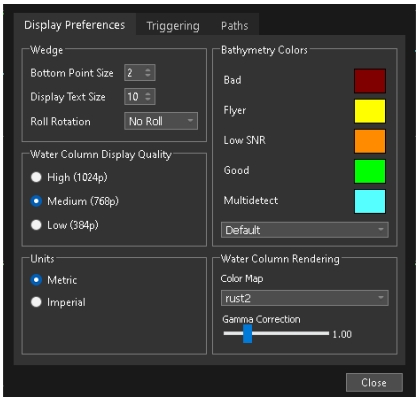
Displayed Swath

Controls which frequency is displayed on the sonar wedge when the Dual Swath beam distribution option is enabled.

Sonar Tilt

Specifies the tilting angle in special mounting configurations, such as dual head, when the sonar is mounted at an angle. It allows the user to normalise the display, otherwise a flat seafloor will appear to be sloping. In dual head mode, the Sonar Tilt automatically sets the secondary sonar to the opposite tilt of the primary. Note that additional considerations are required when the integrated IMU is tilted, which are detailed in technical note TN-190018.

Multidetect	Record up to 3 detections per beam, with one additional detection above and below the primary bottom detection. The upper/lower gates control which part of the water column is considered for additional detections. Multidetect operates outside the **Adaptive Gates**, which also controls the proximity of the additional detections to the seabed: **Narrow** gates keep them closer, while **Wide** gates allow them to be further away. Multidetect should not be enabled for the entire duration of the survey, as it may increase false detections and require additional data cleaning. Use it only to further develop areas of interest.
Multidetect Sensitivity	Adjusting the slider increases or decreases the sensitivity of the multi-detection algorithm to qualify the water column as a potential extra detection.
Multidetect in S7k Output	Select whether to output an additional detection above (**Upper**) and/or below (**Lower**) the bottom detection in s7k files generated by the GUI.
Options → Display Preferences	**Bottom Point Size:** Changes the point size on the wedge. Adjustable from 1-10. **Display Text Size:** Changes the text size on the wedge area. Adjustable from 1-12. **Roll Rotation:** Viewing options to show the roll stabilised wedge. **Water Column Data Image Quality:** Sets the resolution of the water column display. This does not affect output resolution. To ensure system resources are kept to a minimum for low-grade field laptops, run with medium or low graphics selected. **Units:** Selects the display units in the GUI to be shown as either metric or imperial. **Bathymetry Colours:** Adjusts the colour palette of bottom detection quality flags. **Colour Map:** Offers different colour settings for visualising the swath intensity data. **Gamma Correction:** Changes the visual contrast of the wedge intensity data. Setting the gamma too low will mute the intensity in the wedge display to nearly all off (black). Setting gamma too high will fuse the darkest areas with the brightest areas. A value of 2 is often the best.
Options → Triggering	The timing scheme is controlled in the Web UI at *http://192.168.53.XX:8080*, where XX is the last 2 digits of the sonar serial number. For most installations, **1PPS+ZDA** should be selected, in which case the GNSS signal provides the time stamp and associated 1PPS signal to the sonar. For installations where the SIU topside is not providing timing (e.g., ROV installations), an **NTP+PPS** timing solution is recommended: • A 1PPS pulse should be delivered to the sonar head via a zero-latency input on the TIME signal pair. • The 1PPS is validated against NTP time from a server on the sonar subnet, which must align with the 1PPS event within 100ms; otherwise, it will be rejected. • When the time is rejected, an error will appear in the Web UI Diagnostics tab, with the sonar wedge time turning red. • Pulses with a time difference >10ms, due to noise on the 1PPS line, will be ignored, and missing consecutive 1PPS pulses will trigger an error, also turning the time red.



- If a 1PPS signal is unavailable, time can be set using the **NTP Only** option with reduced accuracy, which may be suitable for platforms with low dynamics. This option requires that the NTP server is at a low STRATUM (<2) value and not too far away in the network (public servers are usually not good enough).

More advanced users can use an external signal to trigger the sonar. The **External Trigger** polarity can be set to **Rising Edge** or **Falling Edge**.

> **CAUTION:** Triggering via the BNC connector on the SIU is **NOT** possible. This is only for 1PPS Out (integrated models) or 1PPS In (non-integrated models). Inputting a voltage to the BNC of an integrated SIU can damage the internal electronics.

Options → Paths

Recording Area

Sets the recording folder location for native NORBIT (*.wbm), INS (*.000 or *.T04), s7k (*.s7k) and XYZ (*.xyz) data files.

Note that the GUI must be restarted when the recording path is changed.

> **NOTE:** T04 data, recorded with Applanix AP+ models, is logged in GPS time instead of UTC time. As a result, POSPac users **MUST** export the PPK navigation solution using the **Custom Smoothed BET UTC** format.

Save s7k in the same folder as WBM
When this option is deselected, it is possible to define a separate logging folder for s7k files. Otherwise, s7k and WBM files will be recorded to the same folder.

Save XYZ file
Enabling this option generates a raw XYZ point cloud file, together with the WBM and s7k recordings, for easy loading into CloudCompare or similar tools for quick visualisation.

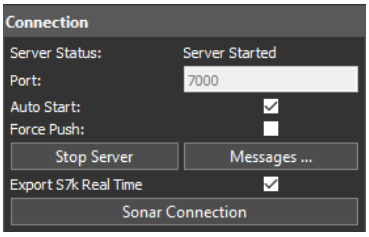
Save GNSS/INS Raw Observables to local PC storage
Enables INS Ethernet data logging (*.000 format, or *.T04 format for AP+ models) for post-processing and/or delayed heave extraction. This option should always be enabled, even when not post-processing INS data, as it is also useful for troubleshooting purposes.

Additionally, INS data is logged by default to the internal 4GB (or 10GB on select models) storage in the SIU. When the storage is full, the oldest recordings are automatically overwritten. Recordings can be retrieved using an FTP client (e.g. FileZilla).

- ***Systems with Applanix (Legacy) GNSS/INS Subsystem:***
  Host: 192.168.53.100 **Username:** guest **Password:** applanix
  Note that for later models, delivered after 2020, the password is **PSWXXXXX**, where XXXXX is the Applanix serial number found on the **INS Tools > System Status** dialog, for example PSW12345.
- ***Systems with Applanix AP+ GNSS/INS Subsystem:***
  Host: 192.168.53.100 **Username:** Not required **Password:** Not required
- ***Systems with SBG GNSS/INS Subsystem:***
  Host: 192.168.53.103 **Username:** Not required **Password:** Not required

4.8.6 Connection

NORBIT sonars use a native data format. To ensure compatibility with data acquisition and processing software packages, a proxy, which runs automatically, translates this data to the well-known s7k data format.



If required, the connection can be reset, and the **Port** number can be changed to avoid conflicts with other sensors.

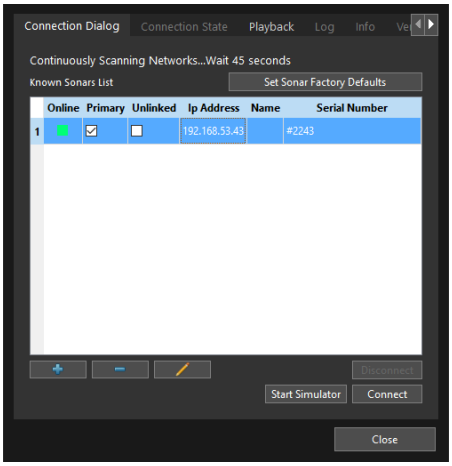
In dual head configurations, the configured **Port** number applies only to the primary sonar, and the secondary port is one number greater. For example, if the **Port** is set to **17000**, the secondary sonar will be port **17001**. Qinsy users should avoid port 7001, as it is occupied by the Qinsy dongle.

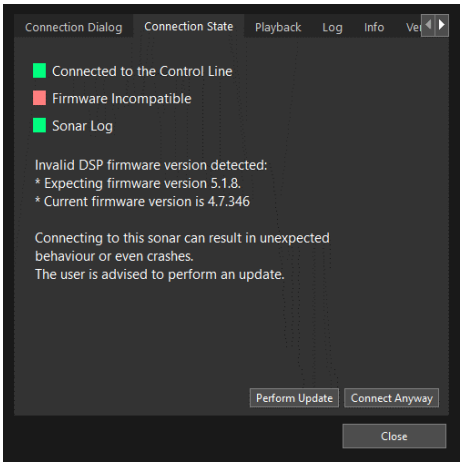
NOTE: To receive sonar and INS data into PDS and NaviScan, the **Force Push** option must be enabled. This option forces the output of 7k records without a TCP/IP subscription.

4.8.6.1 Connection Dialog & Connection State

Select **Sonar Connection** to open the **Connection Dialog**:

- Selecting **Set Sonar Factory Defaults** resets the sonar configuration but does not reset the integrated INS. When this option is selected, raw GNSS/INS logging briefly terminates.
- **Connection State** contains basic information about the current connection status. If any indicators are red, action is required by the user. The example presented below shows that the sonar is not loaded with the firmware expected by the GUI (see section 4.4).
- To disconnect the sonar, select the sonar on the **Known Sonars List**, and select **Disconnect**.





The **Primary** and **Unlinked** options relate to dual head operation:

- The **Primary** selection determines which sonar is primary and secondary. This should be the sonar installed on the left (port) side.
- By default, all setting changes apply to both systems, while the **Unlinked** option *(not recommended)* allows dual head sonars to be operated independently.
- Refer to Appendix A2 for more details on dual head operation.

4.8.6.2 Sonar Simulator

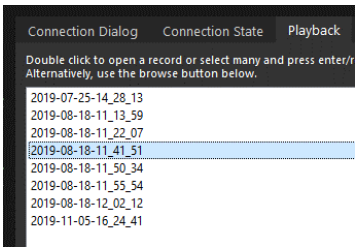
The simulator is started via the Connection Dialog. The **Start Simulator** button is hidden by default and can be enabled by adding the following lines to this file: *C:\Program Files (x86)\Norbit AS\WBMS\config\factory_wbmsgui.ini*

```
[Gui]
show_simulator_button=true
```

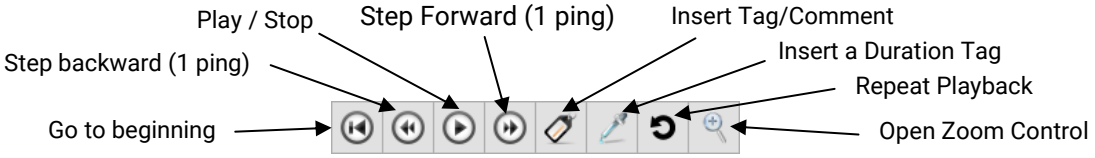
Click **Start Simulator**, highlight the bathy simulator on the sonar list, and click **Connect**, ignoring any firmware compatibility warnings. Simulated data can be used for testing and training purposes. It does not output sound velocity or navigation data and is therefore not time stamped.

4.8.6.3 Playback

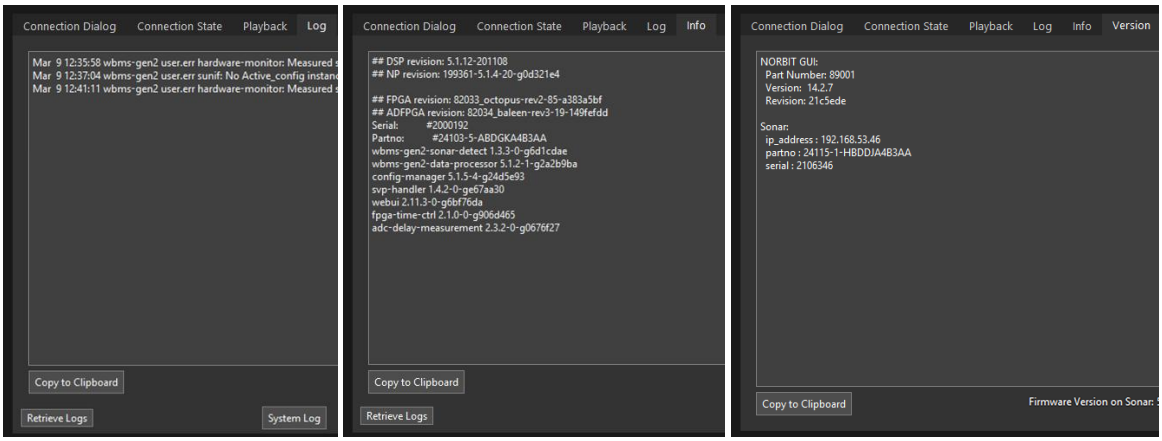
The **Playback** tab displays all detected recordings. To open a recording, double-click the file name. To browse to another folder, select **Browse**. Recordings are saved by default to: *C:\Users\<user>\NORBIT\WBMS*



- Only bathymetry and water column data are shown.
- The window can be resized by dragging the central divider.
- **Settings** and **Controls** are found on the left, including the **Sonar Orientation**.
- To export the current ping, or a series of pings, use **Export Current Ping** or **Export**.
- Additional options (s7k export, video export, etc.) are available on the left menu.
- The playback controls are displayed at the bottom:

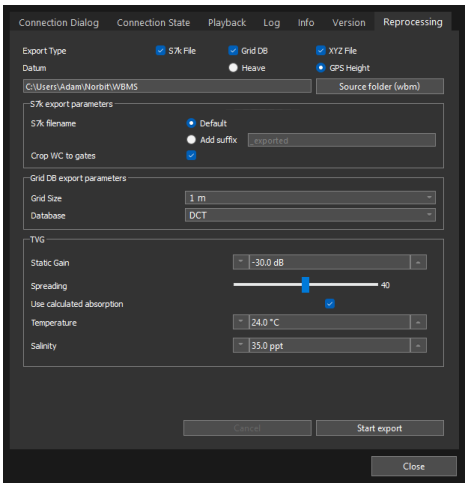


4.8.6.4 Log, Info & Version



- **Log**: Displays system hardware events. Clicking **System Log** at the bottom shows a log of commands sent to the sonar by the GUI, which are also stored in this folder on the GUI PC: *C:\Users\<user>\AppData\Roaming\Norbit\Logs*
- **Info**: Displays serial numbers, part numbers and revision numbers.
- **Version**: Displays the current NORBIT GUI version and sonar IP address.

4.8.6.5 Reprocessing

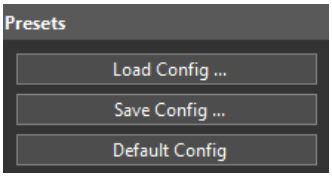


The **Reprocessing** tab allows users to regenerate the following data products from raw WBM recordings:

- **s7k Files** – This option can be used to generate new s7k files (*.s7k) with adjusted TVG parameters for backscatter data when the real time acquisition settings were not ideal (see section 4.8.3).
- **Grid DB** – This option allows a database grid to be exported for display in DCT or NORdredge. The **Database** type and **Grid Size** can be set.
- **XYZ Files** – This option creates XYZ point cloud files (*.xyz), when this option was disabled in real time, for easy loading into CloudCompare or similar tools for quick visualisation of the data.

Select the required export formats, choose the vertical datum (**Heave** or **GPS Height**), specify the source folder containing the WBM files, and click **Start export** to begin the batch reprocessing. Note that the vertical datum is only applicable for Grid DB and XYZ File outputs.

4.8.7 Presets



Users can save preferred sonar configurations using **Save Config** and apply them using **Load Config**. Presets include all sonar settings (frequency, swath angle, etc.) and display preferences and can be transferred between computers. The presets are stored at: *%appdata%\NORBIT\PredefinedSonarSettings*

4.9 Data Formats, Recording & Output

4.9.1 Raw Data Recording

Bathymetry data with the full INS solution (for integrated systems), including delayed heave data, can be recorded in the native NORBIT format with extension *.wbm. Additionally, s7k files are exported automatically. The s7k format has a publicly available data format definition (DFD).

4.9.1.1 Recording Directory & Naming

- Default recording directory: *C:\Users\<user>\NORBIT\WBMS*
- Each session is saved in a folder named: **YYYY-MM-DD-HH_MM_SS**
- s7k files are split automatically into 1GB segments with numerical suffixes, e.g. *YYYYMMDD_HHMMSS_1.s7k*, *YYYYMMDD_HHMMSS_2.s7k*, etc.
- The logging directory can be customised (see section 4.8.5).

4.9.1.2 Recorded Data Types

The recorded data types are determined by the **Backscatter Controls** settings:

- **Backscatter Mode** determines the backscatter imagery type. This does not affect TCP/IP subscription outputs to the data acquisition software (see section 4.9.2).
- **WC Resolution** determines whether compressed water column is recorded.

Backscatter Mode	WC Resolution	Recorded Data Types (WBM)		Recorded Data Types (s7k)	
None	None	✓ Bathymetry	✗ Side scan	✓ 7027	✗ 7007
		✗ Water Column	✗ Snippets	✗ 7042	✗ 7028
None	Highest-Lowest	✓ Bathymetry	✗ Side scan	✓ 7027	✗ 7007
		✓ Water Column	✗ Snippets	✓ 7042	✗ 7028
Side scan	Highest-Lowest	✓ Bathymetry	✓ Side scan	✓ 7027	✓ 7007
		✓ Water Column	✗ Snippets	✓ 7042	✗ 7028
Snippets	Highest-Lowest	✓ Bathymetry	✗ Side scan	✓ 7027	✗ 7007
		✓ Water Column	✓ Snippets	✓ 7042	✓ 7028[ii]
Snippets/scan	Highest-Lowest	✓ Bathymetry	✓ Side scan	✓ 7027	✓ 7007
		✓ Water Column	✓ Snippets	✓ 7042	✓ 7028[ii]

Notes:

i. For systems which support GNSS/INS integration in the GUI, the 7k navigation records (Position: 1003, Roll/Pitch/Heave: 1012, Heading: 1013, Navigation: 1015, and Attitude: 1016) are also recorded. For systems equipped with a NORBIT Rotator, record 1017 is also supported.

ii. When the Backscattering Strength Output option is licensed, record 7058 is recorded in addition to 7028. See Appendix B4 for more details.

iii. Acquisition software data subscriptions override selections made in the GUI. Therefore, if side scan data is requested by the acquisition software, side scan data is recorded in the raw data files.

iv. Bathy intensity values at the bottom detection point are recorded automatically in the bathymetry data packets. It can be used to provide coarse backscatter, separately from side scan and snippets outputs.

v. The position output for integrated systems uses the real time navigation datum. By default, this is WGS84, but changes if the RTK corrections use another datum (e.g. RTK with NAD83 outputs NAD83).

4.9.2 Data Output via Network Subscription

The adjacent table lists the current s7k records output by the Proxy Server in the NORBIT GUI, which are available for data streaming via the TCP/IP subscription model (record 7500 with ID 1051). All subscriptions can be ended with record 7500, ID 1052.

For systems which support GNSS/INS integration in the NORBIT GUI, the relevant s7k navigation records (1003, 1012, 1013, 1015 and 1016) are also available for subscription.

Supported single request records (via record 7500 with ID 1050): 7001

Successful requests are replied with record 7501 (ACK) while unsuccessful requests return record 7502 (NACK). This is based on the DFD version 2.43.

Record	Description
7000	Sonar settings
7004	Beam Geometry
7006	Bathymetry data (obsolete)
7007	Side scan data
7027	Bathymetry data (and intensity)
7028	Snippets data
7042	Compressed water column data
7058	Snippet Backscattering Strength (See Appendix B4)
1003	Position
1012	Roll/Pitch/Heave
1013	Heading
1015	Navigation
1016	Attitude
1017	Pan/Tilt (Rotator)
7500	7k remote control with ID 1051
7501	7k remote control acknowledge
7502	7k remote control not acknowledge

4.9.3 Data Rates

The estimated data rates for a single head system are given below. When water column (WC) data is recorded, it is assumed that **Medium** resolution is selected.

Raw files are recorded in the native NORBIT data format (.wbm) and are simultaneously exported to the s7k format, as detailed in section 4.9.1.

	Data Types					Data Rate by Ping Rate (Mbps)							
						50Hz		25Hz		10Hz		5Hz	
	Bathy	INS	SS	SN	WC	WBM	s7k	WBM	s7k	WBM	s7k	WBM	s7k
1024 Beams	✓	✗	✗	✗	✗	19.27	16.78	10.17	8.52	4.25	3.41	2.48	1.70
	✓	✓	✗	✗	✗	25.16	16.80	16.10	8.63	10.23	3.59	8.45	1.88
	✓	✓	✓	✗	✗	26.20	17.85	18.33	10.78	11.18	4.45	9.05	2.36
	✓	✓	✗	✓	✗	35.26	37.36	23.47	31.54	13.50	13.81	10.32	7.05
	✓	✓	✗	✗	✓	27.53	25.65	18.92	20.17	13.05	14.20	11.27	12.45
512 Beams	✓	✗	✗	✗	✗	19.73	8.54	10.17	4.31	4.30	1.72	2.48	0.86
	✓	✓	✗	✗	✗	25.15	8.62	16.10	4.45	10.23	1.90	8.46	1.04
	✓	✓	✓	✗	✗	26.25	9.56	18.37	6.61	11.18	2.77	9.04	1.52
	✓	✓	✗	✓	✗	35.26	18.92	23.47	15.94	13.50	7.00	10.32	3.61
	✓	✓	✗	✗	✓	27.53	12.41	18.92	10.21	13.05	7.23	11.27	6.33

INS log files for integrated models, containing raw GNSS/INS observables, are recorded at a rate of 2MB per minute for models which support the *.000 format. For AP+ models which use the *.T04 format, file sizes are significantly smaller due to compression, with a typical rate of 0.8MB per minute.

5 Data Acquisition

Integrated NORBIT systems output sonar and navigation data at the Sonar Reference Point (see section 3). Each device in the acquisition software requires the same offset to this location, i.e. the offset measured from the reference point defined in the acquisition software (e.g. vessel centre of gravity) to the Sonar Reference Point. If the optional iLiDAR is installed, its output is valid at the iLiDAR reference point.

> **NOTE:** NORBIT recommends consulting the respective manuals of your chosen data acquisition software, as this section only describes the basic setup steps required for the most common software packages.

If the reference point in the acquisition software is the same as the Sonar Reference Point, only the draft offset is required for the simplest setup. HYPACK users are advised that all offsets should be referenced from the vessel centre of gravity, and the vertical offset should be the same for all drivers, measured from the waterline to the Sonar Reference Point.

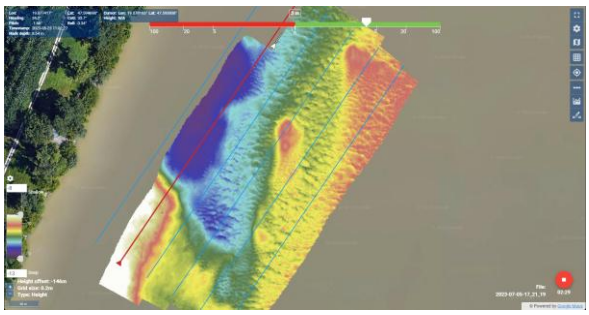
5.1 NORBIT Data Collection Tool (DCT)

DCT is a web-based survey acquisition utility, developed by NORBIT, 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.

DCT reports horizontal coordinates in the real time navigation datum, together with depths when the **GPS Height** vertical datum option is selected. By default, the reported positions and depths are referenced to the WGS84 ellipsoid, however when GNSS corrections are interfaced, the datum may change. For example, when RTK corrections are used with NAD83, the DCT output is NAD83. DCT does not change the datum or apply transformations. Refer to the dedicated DCT manual for full operational guidance.

Step 1. **Download Tiles**
Background tiles 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 NORBIT GUI, or remotely from anywhere in the world providing the device is on the same network.



Step 3. **Data Recording**
Press the record button to start/stop data logging. This commands the NORBIT 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.

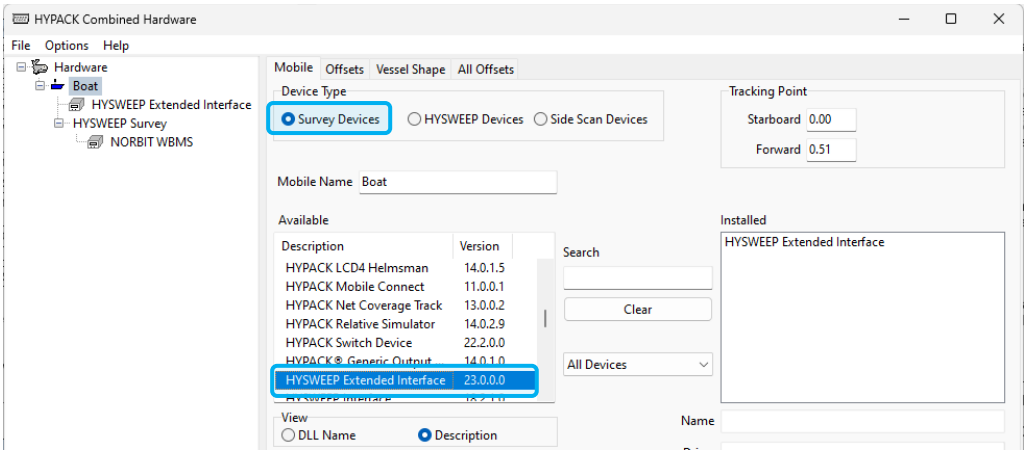
Step 4. **Data Processing**
The recorded s7k files should be processed using your software of choice (e.g. HYPACK, Qimera, CARIS, etc.). Here, patch test results and sound velocity profiles can be applied or refined, and the geodetic setup is defined.

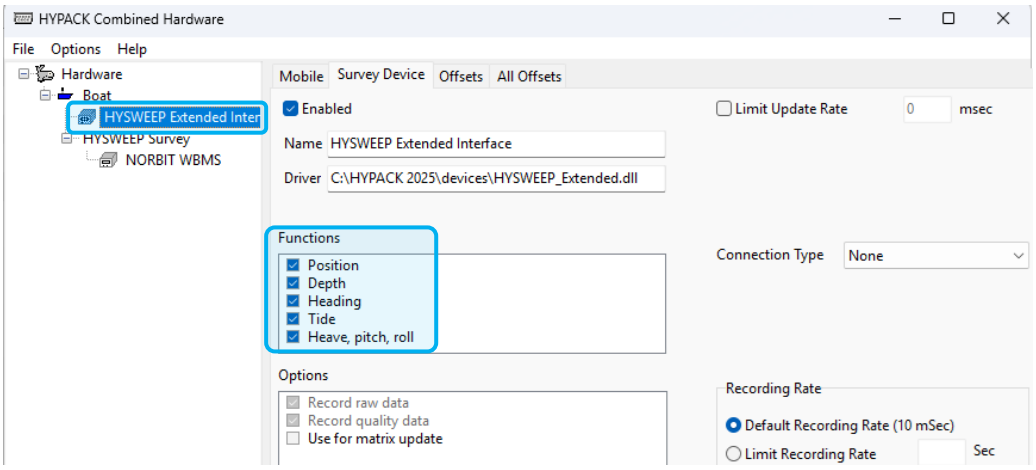
5.2 HYPACK

Refer to the HYPACK manual for comprehensive guidance and note that the setup described below is based on HYPACK 2025. With integrated NORBIT sonars, all systems (navigation, attitude and multibeam) should have the same offset applied, as measured from the vessel centre of gravity to the Sonar Reference Point, while the vertical offset should be measured from the waterline. The HYPACK sign convention uses **+Forward**, **+Starboard**, and **+Down.**

Step 1. **Configure HYSWEEP Extended Interface**

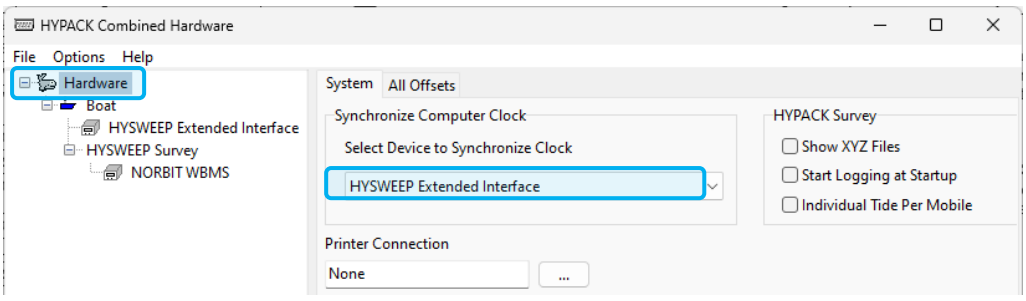
Add HYSWEEP Extended Interface from the Survey Devices list and enable all the function checkboxes (Position, Depth, Heading, Tide and Heave/Pitch/Roll).





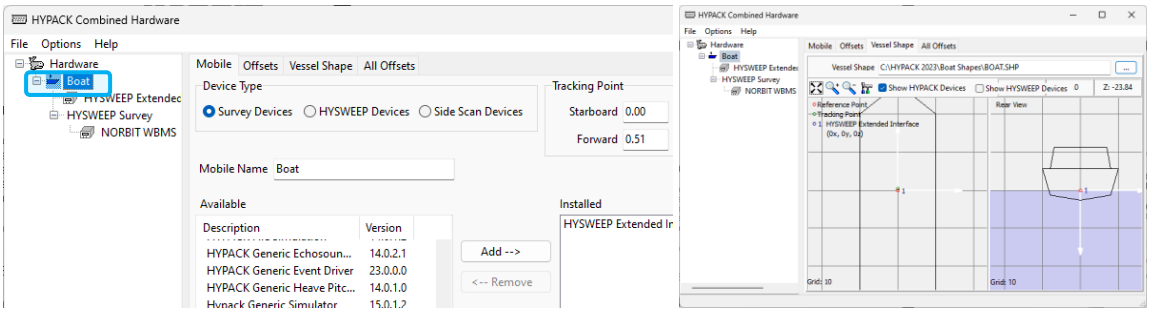
Step 2. **Configure Clock Synchronization**

Select Hardware on the left pane and then, on the System tab, select HYSWEEP Extended Interface as the device to synchronize the computer clock.



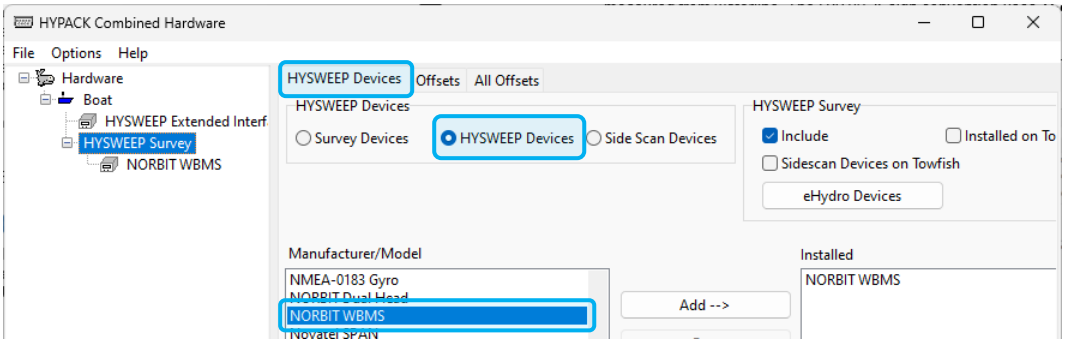
Step 3. **Define Boat**

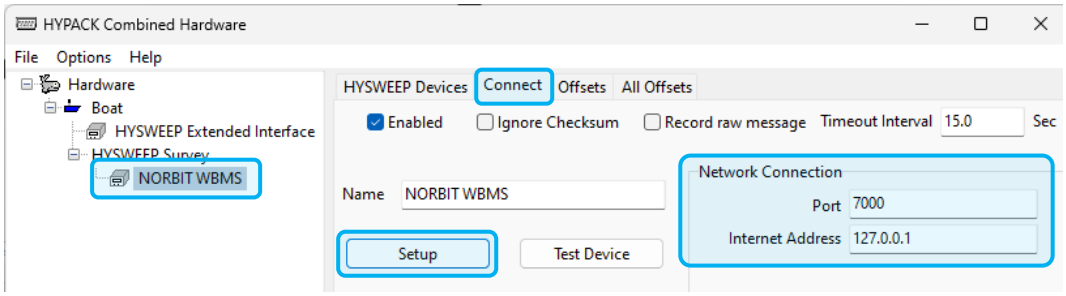
Select **Boat** and assign a name. For more intuitive visualisation, add a tracking point, preferably to the Sonar Reference Point (for standard installations). Edit the Vessel Shape as appropriate.



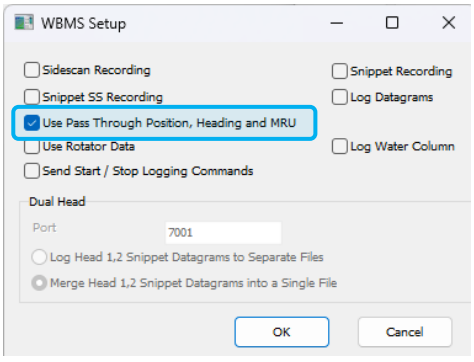
Step 4. **Configure Multibeam Device**

Select HYSWEEP Devices and add NORBIT WBMS from the list. On the Connect tab, the **Internet Address** should be set as the IP address of the PC running the NORBIT GUI.





On the Setup dialog, 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 or SBG Network devices that were required in previous versions of HYPACK.



Optionally, select **Sidescan Recording** (for recording Sidescan data), **Snippet SS Recording** (for Snippets-Sidescan), or **Snippet Recording** (for Snippets). If Snippets is requested, users must also select **Log Datagrams**.

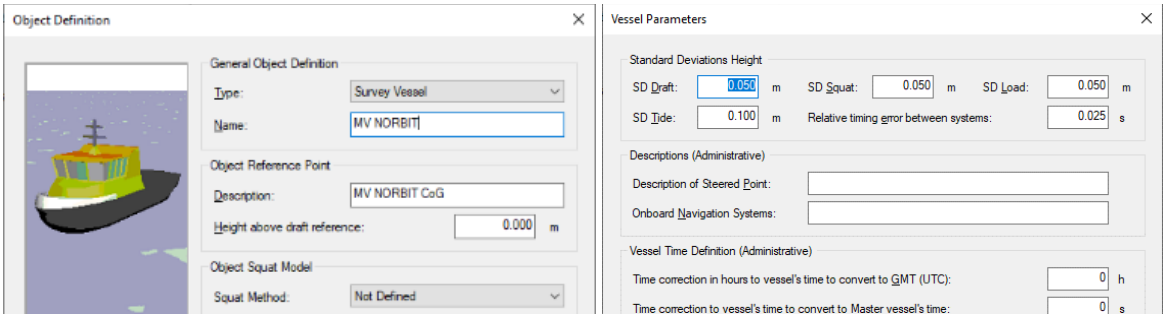
Note that bathymetry data automatically includes bathy intensity values at the bottom detection point, which provides coarse backscatter.

5.3 Qinsy

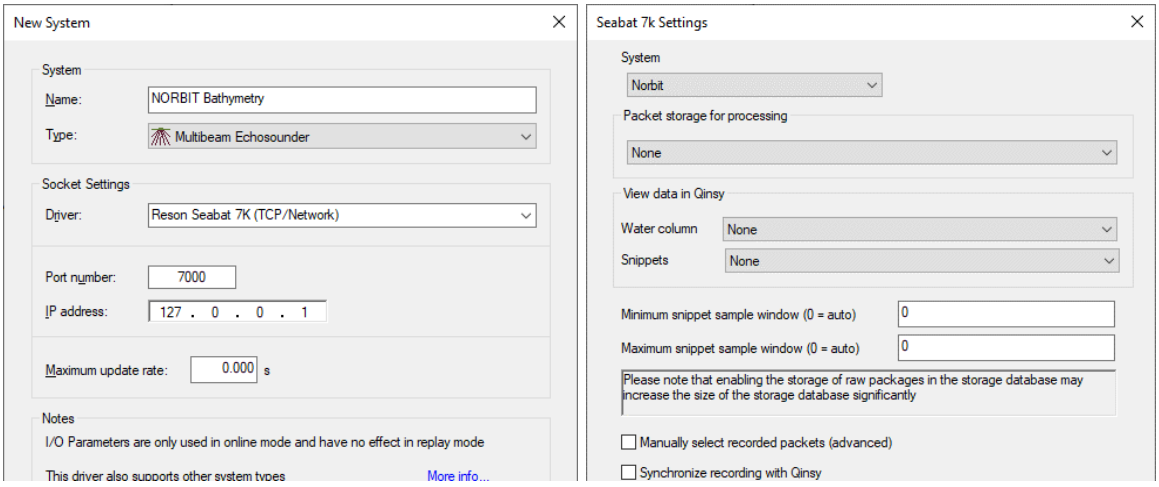
The described configuration of Qinsy v9 assumes that the INS reference is collocated with the Sonar Reference Point. The Qinsy sign convention uses **X+ Starboard**, **Y+ Forward** and **Z+ Up**.

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 centre of gravity)

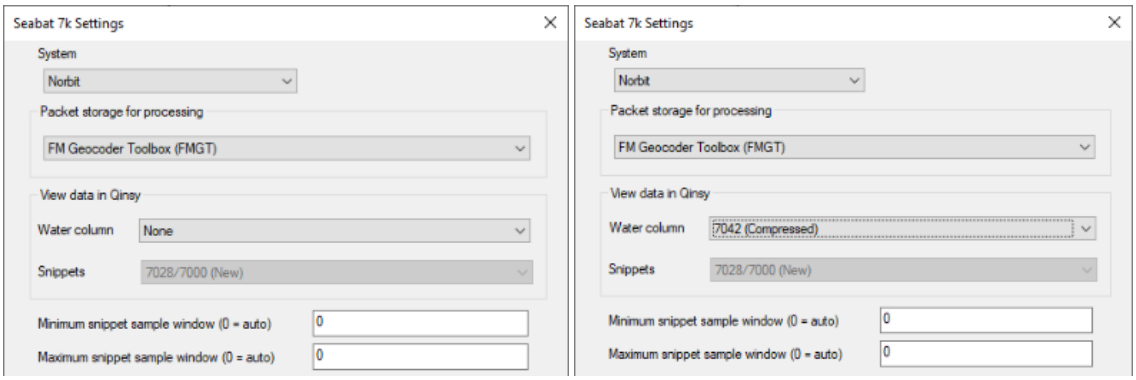


Step 3. **Add Multibeam System**
Specify a system name, e.g. NORBIT, and select **Multibeam Echosounder** as the type**.** Select the **Reson SeaBat 7k (TCP/Network)** driver, use port **7000** and IP address **127.0.0.1** (unless the GUI is installed on a different PC, in which case use the local network address).



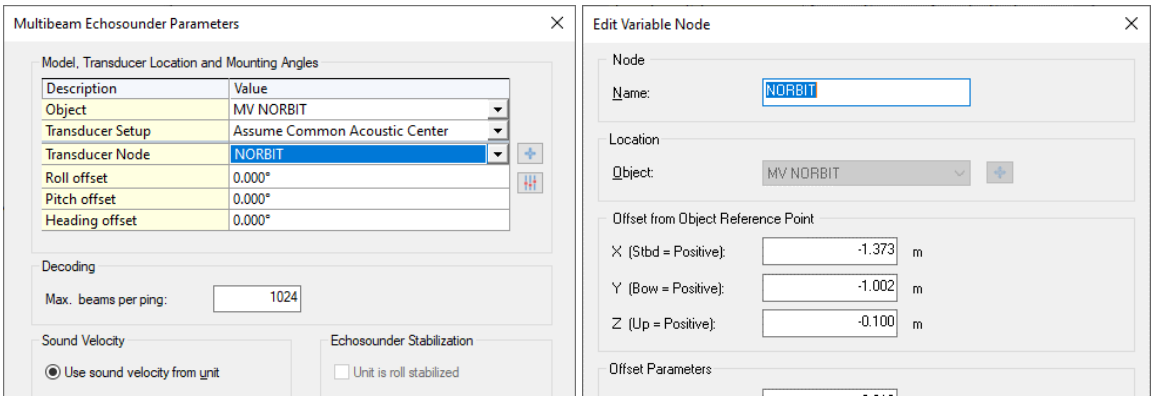
Under Raw Data Recording, for standard bathymetric data collection select the **NORBIT** System and **None** for Packet Storage, Water Column and Snippets.

Step 4. **Configure Snippets and/or Water Column Recording (Optional)**
To collect water column, select the 7042 (Compressed) option. To collect snippets without water column, configure the system as shown below (left); or for snippets and water column (right)



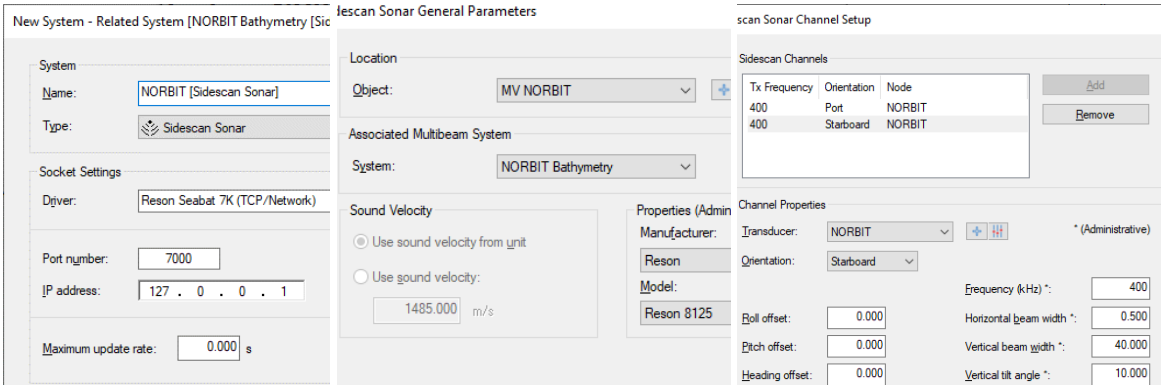
Step 5. **Enter Offset to Sonar Reference Point**

In Multibeam Echosounder Parameters, click the **+** button to generate a node. Patch test values (roll, pitch and heading) should be entered if known. Enter 1024 under max beams per ping. Use the default echosounder accuracy and correction values. The offsets shown are an example only.



Step 6. **Add Side Scan System (Optional)**

To add side scan, a port and starboard channel should be added, and the frequency should also be specified. Items marked with an asterisk (*) will not impact the data and are only for record keeping.



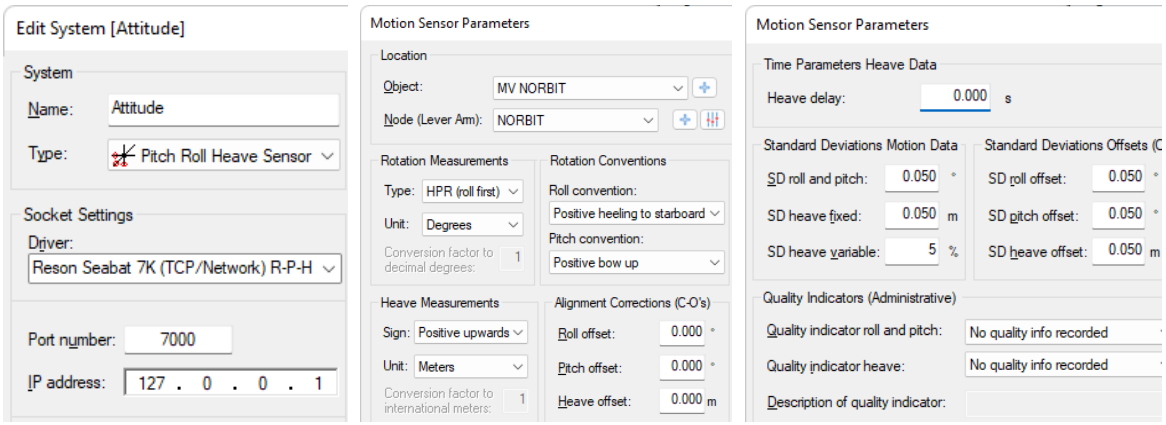
Step 7. **Add Delayed Heave System**

To record delayed heave, add the **Network - POS MV V5 (Binary Group 111 - True Heave)** system (for Applanix models) using port **5602**, or the **Network (UDP) - SBG Systems Delayed Heave UTC** option (for SBG models) using port **1234**, found under the **Miscellaneous System** category.

Delayed heave is logged to a .bin / .txt file in the **Import** directory of the project and can be applied in post-processing to replace real time heave. Delayed heave is more accurate and is logged with a 3-minute delay. This means that Qinsy must remain open for 3 minutes at the end of the survey.

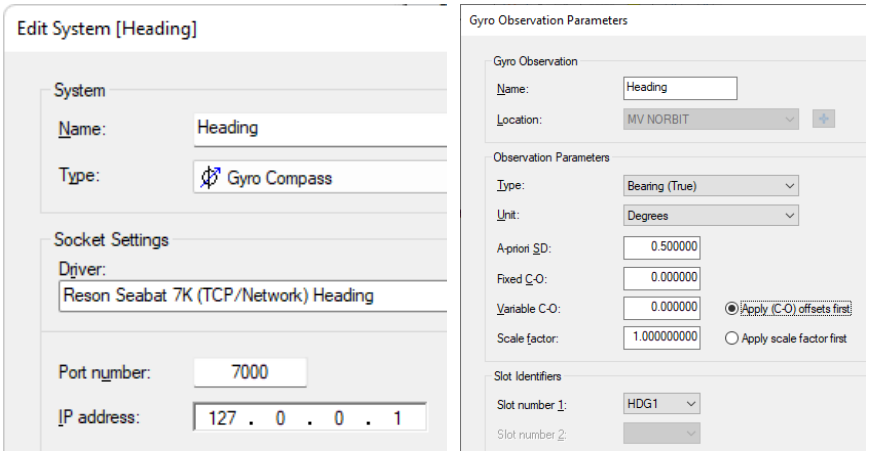
Step 8. **Add Pitch/Roll/Heave System**

From the Database Setup window, add a new Pitch/Roll/Heave sensor, using the **Reson SeaBat 7k (TCP/Network) R-P-H** driver and the same port number and IP address as in the previous steps.



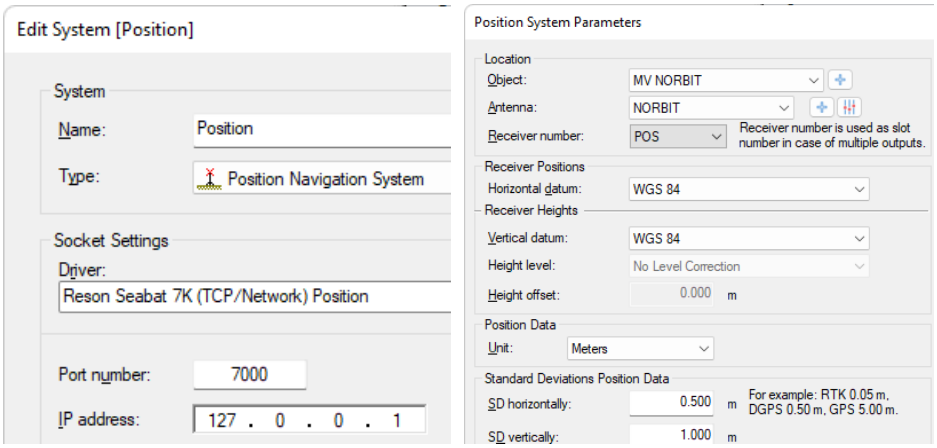
Step 9. **Add Gyro Compass System**

Repeat the previous step to add a new system, but this time select Gyro Compass. The latest versions of Qinsy allow users to specify the slot number. If you see this option, select HDG1.



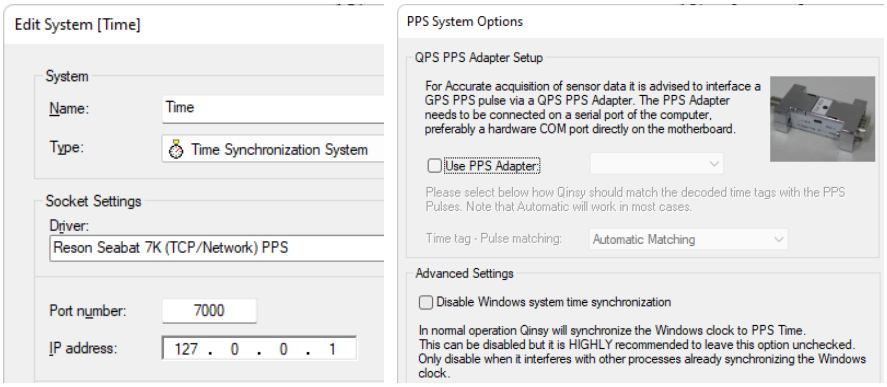
Step 10. **Add Position Navigation System**

Repeat the previous step to add a new Position Navigation System. The datums will depend on the project specifications. For older versions of Qinsy, the receiver number should be 0. For newer versions, the slot options POS and NAV are available, and either can be used.



Step 11. Add Time Synchronisation System

Add a time synchronisation system, as per below. No PPS adapter is necessary.



Step 12. Configure Qinsy Online Filters

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

Item	Min	Max
☐ Depth outside	1.00	400.00
☑ Range outside	0.50	500.00
☐ Sector outside	-75.00	75.00
☑ Brightness test fails		
☑ Colinearity test fails		

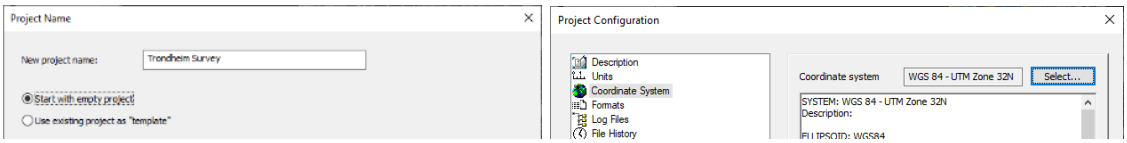
> ⚠ **NOTE:** Red time synchronisation alerts in Qinsy Online are generally not a concern, as all data is time stamped at source. These alerts can safely be ignored.

5.4 PDS

Force Push must be enabled in the **Connection** menu to receive data in PDS (see section 4.8.6). The PDS sign convention uses **Y+ Forward**, **X+ Starboard**, and **Z+ Up**. For integrated Applanix systems, the Ethernet output groups required by PDS are automatically configured on the NORBIT system, thus no action is required.

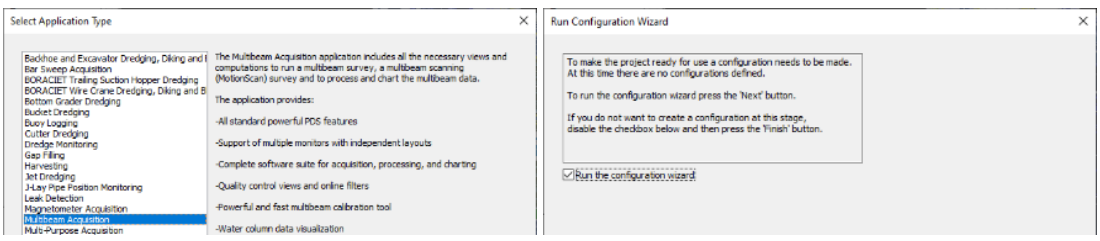
Step 1. Create New Project and Setup Geodesy

Create a new project in PDS Control Centre via **File** > **New Project**. Specify a name for the project, and on the next page select a coordinate system from the geodatabase or define a new coordinate system according to the survey requirements.



Step 2. Select Application Type and Run Configuration Wizard

Select **Multibeam Acquisition** as the application type. Click **Next** and run the configuration wizard.



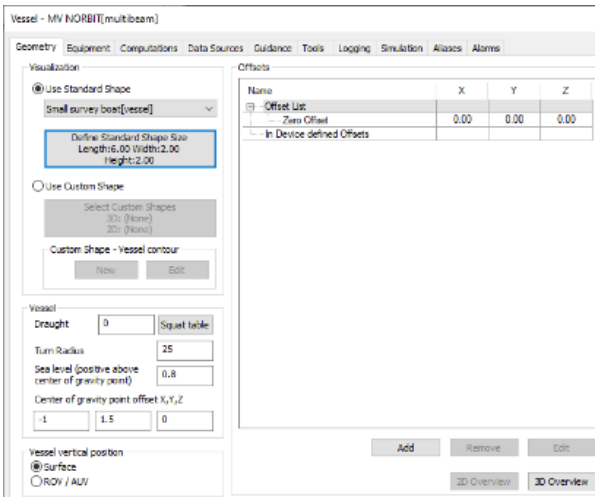
Step 3. Add New Vessel

Specify a name for the configuration (e.g. “Survey Vessel Pole Mount”) and on the next page add a Local vessel which will contain all relevant drivers and offsets.

Step 4. Enter Offsets

On the Geometry tab, define the shape of the vessel (only for display) and enter the Centre of Gravity offset measured from the Sonar Reference Point. Leave the CoG Z field zero to keep the setup simple, as the Sea Level offset is defined in relation to the CoG. Then enter the Sea Level offset relative to the Sonar Reference Point as a positive value.

If the optional iLiDAR is installed, add its offset to the list. This is the measured offset from Sonar Reference Point to iLiDAR Reference Point.



Step 5. Add Essential Devices

Devices for each data type are added on the Equipment list. On the left side, select the Group and select the driver to add. As a minimum, the following drivers are required:

For systems with integrated Applanix GNSS/INS…			
Group	**Driver**	**I/O Port**	**Offset**
Positioning system Geogs	PosMV all coupled modes- ethernet msg 3+10+12+20+102+104[pos]	UDP 5602	Zero Offset
Compass	PosMV ethernet 3+102+104[hdg]	UDP 5602	Zero Offset
VRU	PosMV ethernet 3+102+104[vru]	UDP 5602	Zero Offset
Multibeam	NORBIT using RESON 7k protocol (1) [mbs]	127.0.0.1, TCP 7000	Zero Offset

For systems with integrated SBG GNSS/INS…			
Group	**Driver**	**I/O Port**	**Offset**
Positioning system Geogs	SBG Systems 08[pos]	UDP 1234	Zero Offset
Compass	SBG Systems 06[hdg]	UDP 1234	Zero Offset
VRU	SBG Systems 06[vru]	UDP 1234	Zero Offset
Heave	SBG Systems 09[heave]	UDP 1234	Zero Offset
Multibeam	NORBIT using RESON 7k protocol (1) [mbs]	127.0.0.1, TCP 7000	Zero Offset

Note: It is assumed that the NORBIT GUI and PDS are installed on the same PC, therefore 127.0.0.1 is configured for the multibeam driver. Otherwise, the local network IP address of the GUI PC must be entered.

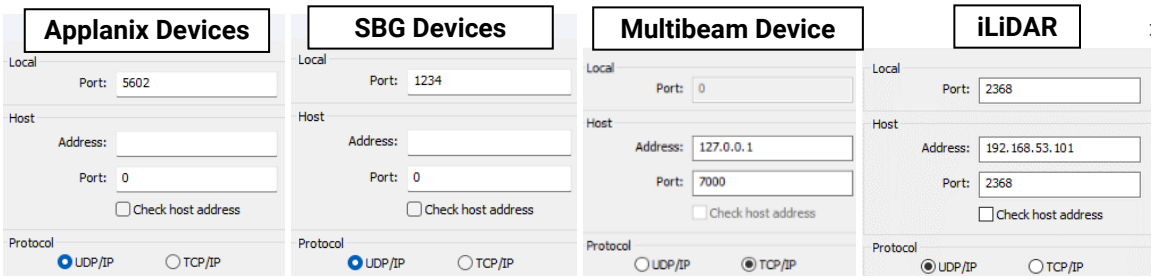
Step 6. Add Optional Devices

Optional drivers may be added for snippets, side scan, delayed heave, or LiDAR data:

Group	Driver	I/O Port	Offset
Snippets	NORBIT using RESON 7k protocol (1) [snp]	127.0.0.1, TCP 7000	Zero Offset
Sidescan Sonar	NORBIT using RESON-7k protocol (1) [sss]	127.0.0.1, TCP 7000	Zero Offset
Heave *(Applanix)*	PosMV ethernet 3+111[heave]	UDP 5602	Zero Offset
Heave *(SBG)*	SBG Systems Delayed 32	UDP 1234	Zero Offset
Laser Scan	Velodyne LiDAR VLP-16[laser-scan]	UDP 2368	iLiDAR

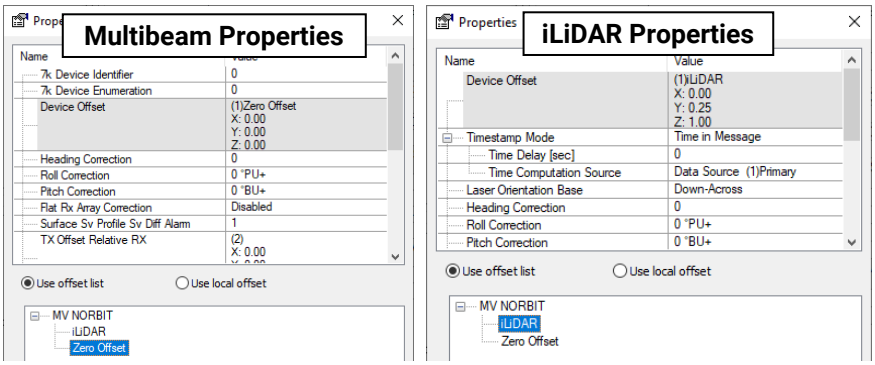
Step 7. Configure I/O Ports

Select each device on the Equipment list and click I/O Port to configure the interfacing parameters, as per the tables in the previous sections. Configure the IP addresses and port numbers correctly based on whether the system contains an integrated Applanix or SBG GNSS/INS.



Step 8. Configure Device Properties and Apply Offsets

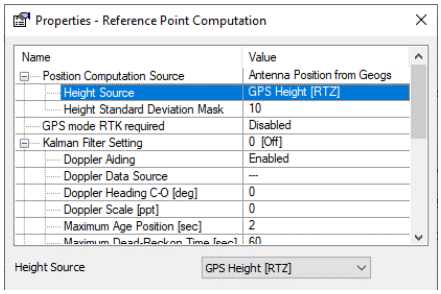
For each device on the Equipment list, click Edit to open the Device Properties. Here you must select the offsets to apply, as defined previously on the Geometry setup. Recall that all applied offsets should be zero, except the optional iLiDAR. The patch test values, if known, may be entered in the device properties for the multibeam and optional iLiDAR.



Step 9. Configure Optional LiDAR Properties

If the optional iLiDAR is installed, the orientation base must be set in device properties. This should be set to **Down-Across** assuming the scanner is installed in the standard configuration with connector aft. Refer to the PDS manual for more details.

Step 10. Configure Height Source

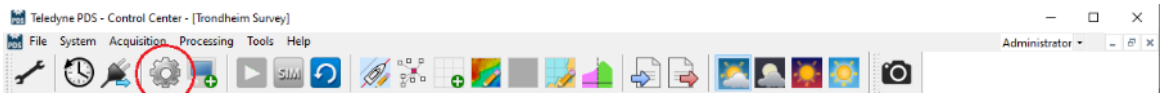


Select **Reference Point Computation** under the positioning device and double click, or press Edit. The height source can be set to **GPS Height [RTZ]** if RTK positioning is available, otherwise, set this to **None**.

Height Standard Deviation Mask is a user-defined quality threshold for utilising RTK heights in the depth calculation. By default, it is set to 0.1m, which means that the GPS Height source will only be applied if the altitude quality reported by the sensor is <0.1m.

Step 11. Complete the Wizard

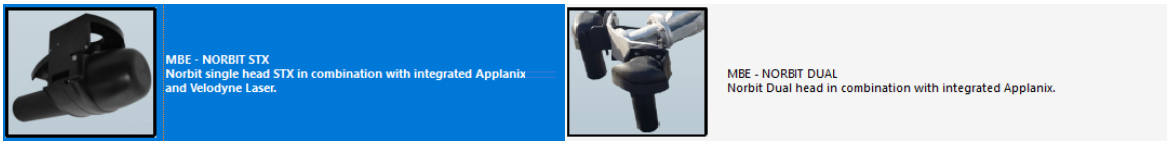
Now the essential steps are complete. The next pages of the wizard contain optional setup steps, details of which are available in the PDS manual. Finish the wizard to return to PDS Control Centre. To return to these settings and modify the vessel configuration, click the gear icon on the toolbar.



5.5 BeamworX

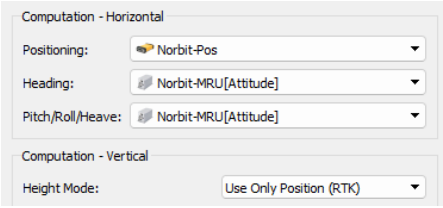
This section explains how to configure NavAQ for data collection with integrated NORBIT systems. Refer to the BeamworX manual for comprehensive guidance.

Step 1. **Create Survey Configuration**
In NavAQ, select **File > New Survey Config**, and select the **NORBIT STX** template for single head, or **NORBIT DUAL** for dual head. This adds the required devices for NORBIT integrated systems.

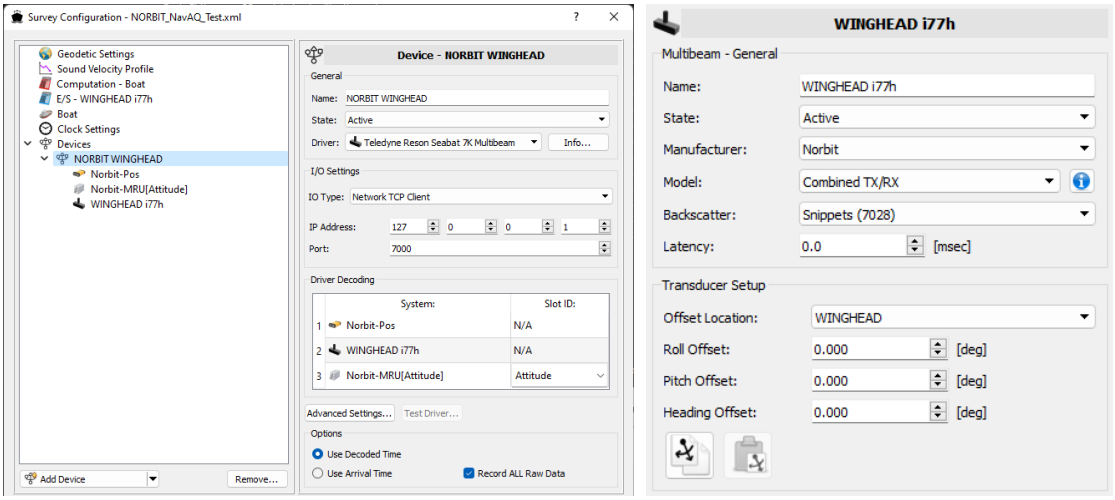


Step 2. **Remove Redundant Devices**
If the iLiDAR is not used, this device can be removed. BeamworX can retrieve INS data directly from the 7k record stream for integrated NORBIT systems, therefore the **Applanix POS MV** devices can be removed. Alternatively, the **Norbit-Pos** and **Norbit-MRU[Attitude]** devices can be removed.

Step 3. **Configure Computation Settings**
Under computation settings, select which devices to use for Positioning, Heading, and Pitch/Roll/Heave based on the devices that were added in the previous steps. The Height Mode can also be configured here.



Step 4. **Configure Device Settings**
Configure the IP Address and Port settings for each device. When the Applanix device is added (i.e. when not using INS data from the 7k data stream), it should interface to UDP port **5602**. The multibeam device interfaces to the IP address of the GUI PC (typically **127.0.0.1**) on TCP port **7000**.



Step 5. **Configure Offsets**
For systems which support pitch or yaw stabilisation, BeamworX recommends defining **Separate TX/RX** offset locations to increase the accuracy of the footprint calculation. Otherwise, the **Combined TX/RX** model should be selected for the multibeam device.

Step 6. **Configure Backscatter**
To collected snippets backscatter data, select the **Snippets (7028)** backscatter option in the multibeam device settings. The **Per Beam Intensity** option can also be used, to record single intensity values at the bottom detection point (a form of coarse backscatter).

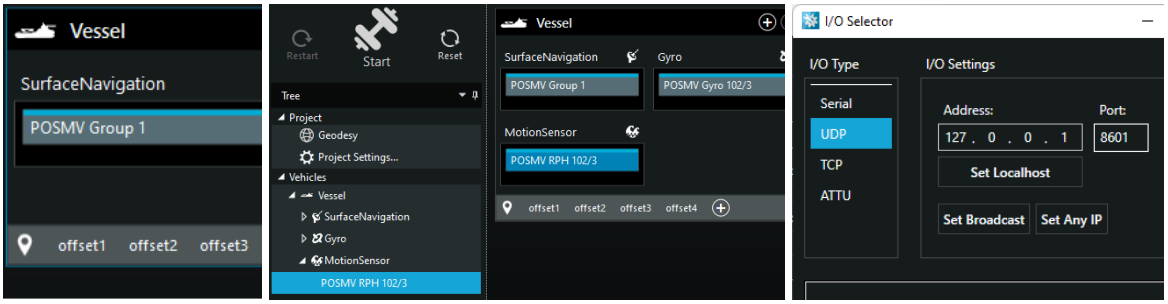
5.6 NaviSuite

This section describes a typical setup for NaviPac and NaviScan using a NORBIT system with integrated Applanix GNSS/INS. It may be necessary to enable **Force Push**, as described in section 4.8.6, to receive data into NaviScan. The sign convention uses **X+ Starboard**, **Y+ Forward**, and **Z+ Up.** Refer to the NaviSuite software guides for comprehensive guidance.

5.6.1 NaviPac

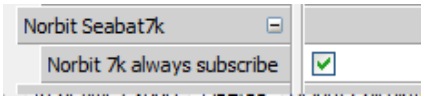
Step 1. **Configure POSMV IF Module**
The POSMV IF Module is required to send Applanix UDP data to NaviPac and NaviScan:
https://eiva.freshdesk.com/support/solutions/articles/43000565394-navipac-posmv-if-module

Step 2. **Add Surface Navigation, Gyro and Motion Instruments**
Add a Surface Navigation instrument to the vessel. Select **POSMV Group 1** from the list and use IP address **127.0.0.1** with the correct UDP port as set in POSMV IF. Repeat this step for Gyro and Motion, using **POSMV Gyro 102/3** and **POSMV RPH 102/3**, respectively.

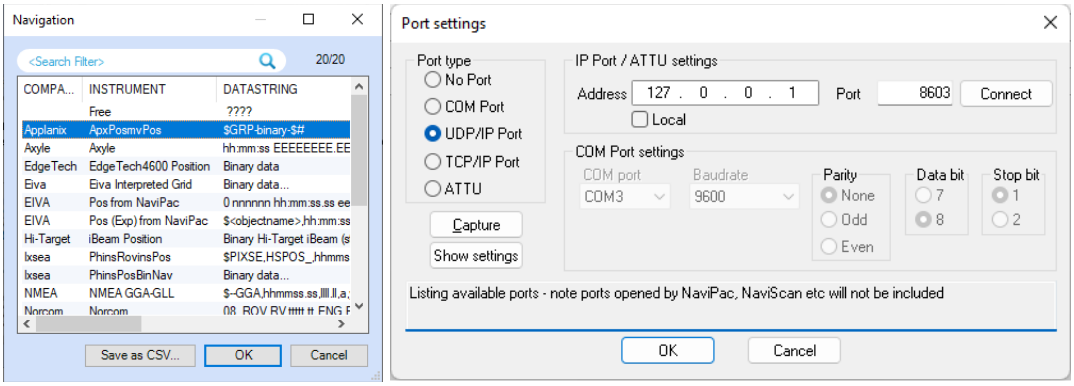


5.6.2 NaviScan Config

Step 3. **Enable Automatic Packet Subscription**
In **Options > Global Parameters > MBE/SS**, enable the *Norbit 7k always subscribe* option. NaviScan will then automatically subscribe for packets when the connection port differs from 7000.

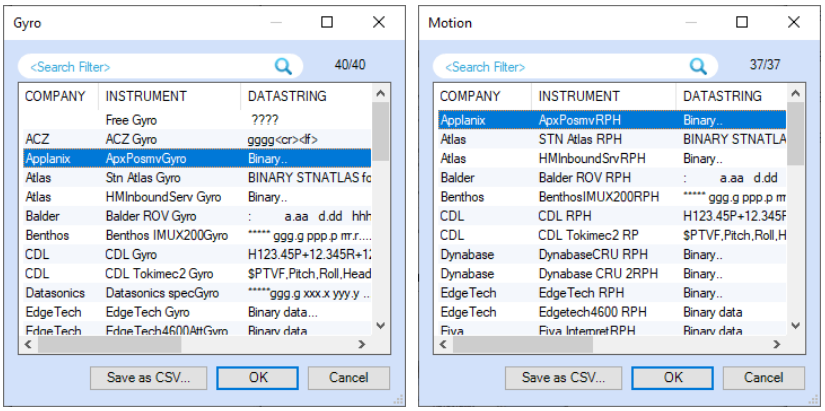


Step 4. **Add Navigation Sensor**
Begin by adding the navigation sensor. Go to **Equipment > Add Sensor** and select the **Applanix** option. For port settings, enter the IP address **127.0.0.1** (if NaviPac and NaviScan are installed on the same PC), and the UDP/IP Port as defined in POSMV IF.



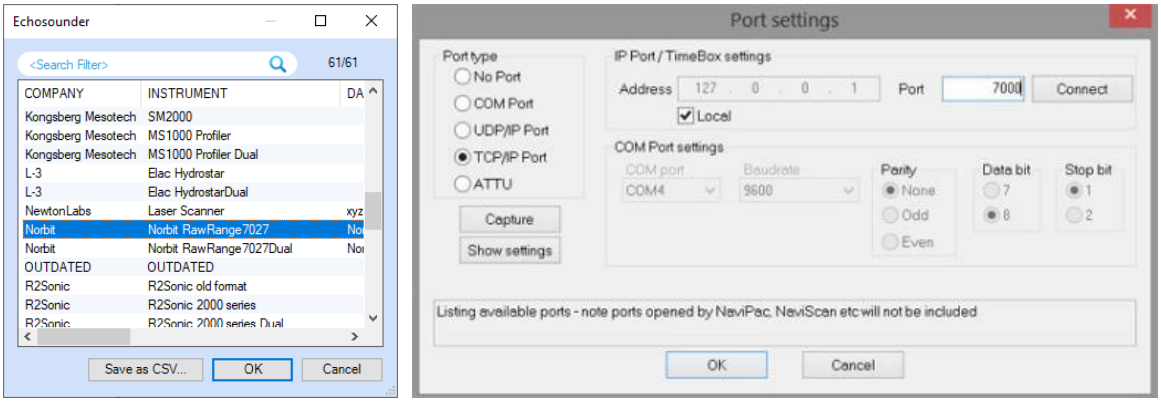
Step 5. **Add Gyro Sensor and Motion Sensor**

Repeat the previous step to add the Gyro sensor and Motion sensor. Select the Applanix options and configure the network settings as per the previous step, noting that the UDP port for each sensor depends on the POSMV IF configuration.



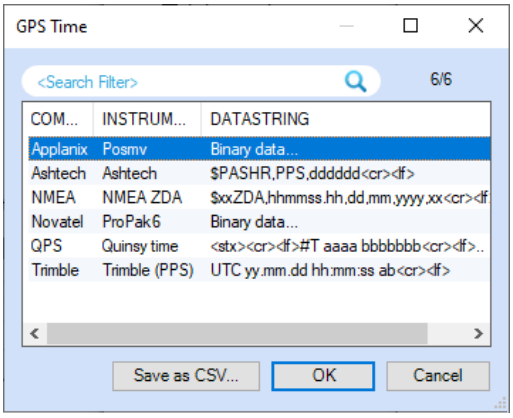
Step 6. **Add Echosounder**

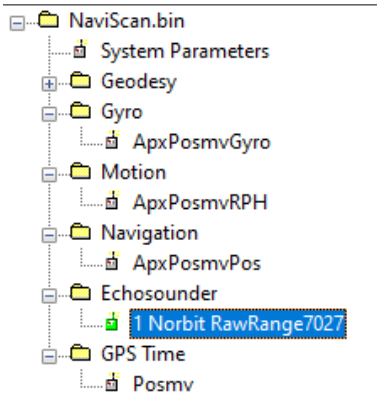
Add an Echosounder, selecting the **Norbit RawRange 7027** option. In port settings, select **TCP/IP Port**, enable **Local** if the NORBIT GUI and NaviScan are installed on the same PC, and use port **7000** (unless configured otherwise in the NORBIT GUI). For dual head operations, select the **Norbit RawRange 7027 Dual** option.



Step 7. **Time Synchronisation**

If NaviPac and NaviScan are on the same computer, Ethernet timing can be used for time synchronisation. Add a GPS Time sensor and select the Applanix option, using the same port settings as the other Applanix sensors. The final NaviScan project tree is shown below.

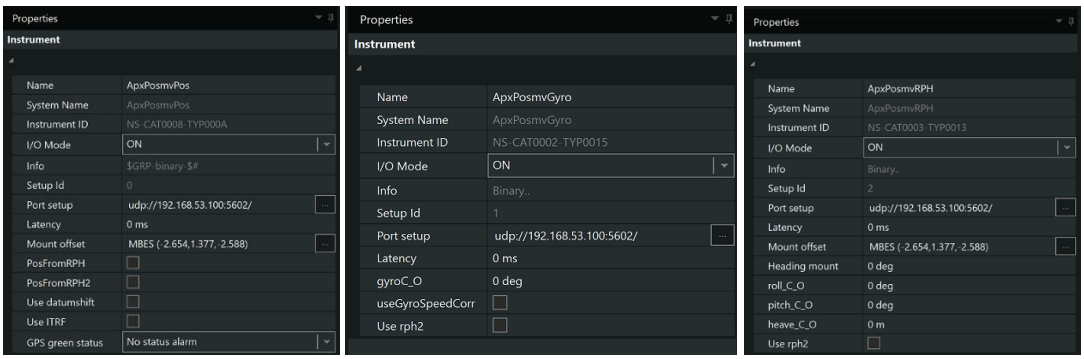




5.6.3 NaviSuite Kuda Core

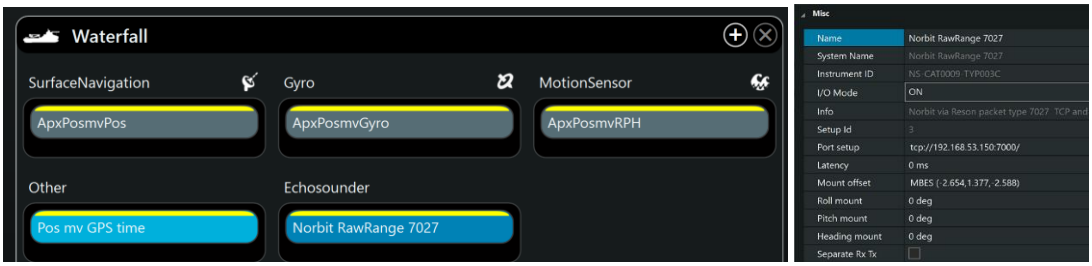
This section describes a typical setup using a NORBIT system with integrated Applanix GNSS/INS. Kuda Core is an entry-level software variant that simplifies the setup by combining the functions of NaviPac and NaviScan into a single interface. Note that POSMV IF is not required with Kuda Core.

Step 1. **Add Surface Navigation, Gyro and Motion Instruments**
Add a Surface Navigation instrument to the vessel and select the **ApxPosmvPos** option. Configure the port to **192.168.53.100** on **UDP 5602**. Repeat this step for Gyro and Motion, selecting the **ApxPosmvGyro** and **ApxPosmvRPH** options, respectively.



Step 2. **Add Time Synchronisation Instrument**
Repeat the above step to add a time synchronisation instrument. From the **Other** category, select the **Pos mv GPS time** option, and use the same Port setup as the previous instruments.

Step 3. **Add Echosounder**
Add an Echosounder, selecting the **Norbit RawRange 7027** option. Configure the port to localhost (**127.0.0.1**) if the GUI and NaviSuite are installed on the same PC, on **TCP** port **7000** (unless configured otherwise in the NORBIT GUI). If the GUI and NaviSuite are installed on different PCs, the IP address should be configured to the address of the GUI PC. For dual head operations, select the **Norbit RawRange 7027 Dual** option. Snippets and/or sidescan instruments can also optionally be added from the **Sidescan** category, using the same port settings as the Echosounder.



Step 4. **Enable Automatic Packet Subscription**
In **Project Settings > Instrument Extra**, enable the *Norbit 7k always subscribe* option. The software will then automatically subscribe for packets when the connection port differs from 7000. The port is set to 7000 by default in the NORBIT GUI but can be changed to any number by the user.

6 Maintenance

6.1 Caring for Your Investment

6.1.1 Handling & Shipping

- Handle the sonar with care and use "Fragile" labels for shipping. Ensure it is properly supported and avoid lifting or carrying the sonar by the sound speed probe or projector.
- Do **NOT** allow the sonar to rest on the polyurethane, and place sturdy padding (foam) under the sonar when mounting to prevent scratches.
- The Inertial Measurement Unit (IMU) on integrated models contains sensitive solid-state accelerometers and gyros. Rough handling can damage these components.
- For standalone WINGHEAD X or WBMS X sonars, if shipping in a non-foam cut case, remove the SV sensor and replace it with the dust cap. When removing the sensor, orient the sonar so that the SV socket faces horizontally to prevent water on the wet sensor from entering the socket. Ensure the socket is completely dry before re-attaching the sensor.
- Some WINGHEAD models contain sound speed probes which are tightly integrated and **NOT** field-swappable. These probes cannot be removed and attempting to do so will damage the system. For information on the field-swappable option, refer to Appendix B3.

6.1.2 Operational Use

- Do **NOT** operate the sonar in air for extended periods, as this may cause overheating and permanent damage. The sonar must be fully submerged in water during normal operation. Functional checks performed in-air must be brief, with Pulse Amplitude set to 0.
- Keep the sonar out of prolonged direct sunlight to protect the polyurethane coating on the transducers from UV damage, which can cause brittleness and cracking formations. When pole-mounted systems are recovered, the sonar should be covered with a protective bag or similar.
- To protect the system electronics, always turn off the power before disconnecting or swapping cables. Do **NOT** connect or disconnect cables when the system is powered on.

6.1.3 Submersion Guidelines

- The SIU has an IP67 ingress protection rating. This rating is intended to provide protection against accidental exposure only and does not imply suitability for intentional or prolonged submersion. It also assumes that all connectors are properly sealed with cables or dust caps. If the SIU is exposed to salt water, it must be promptly cleaned and dried thoroughly.
- Extended submersion risks biofouling (especially in warm salty water) or subjection to stray electric currents. NORBIT offers titanium housing, additional anodes (for aluminium models) and factory applied antifouling coating that is tested against acoustical losses.

6.1.4 Post-Use Cleaning

- Clean the sonar with mild, non-abrasive soap, fresh water, and a soft brush. Do **NOT** use a pressure washer. Rinse and dry the sonar thoroughly after use, especially in saltwater. For models with aluminium housing, handle the anodised housing carefully to prevent scratches.
- For instructions on removing marine growth, refer to section 6.2.

6.1.5 Antifouling

- When the system is coated with NORBIT's approved ClearSignal antifouling coating, handle it with extra care to preserve its effectiveness. After retrieval, wipe the sonar with a clean towel to remove any dirt or grime.
- For instructions on removing marine growth from antifouled systems, refer to section 6.2.2.

6.2 Marine Growth Removal

6.2.1 Standard Procedure

Remove the sonar from the vessel and secure dust resistant caps on the bulkhead and cable.
Remove as much fouling from the sonar as possible by hand.
Fill a large bucket with clean fresh water.
With the bulkhead cap tightened, submerge the sonar for 2 hours to soften the marine growth.
Remove and scrub the sonar using fresh water and a soft, non-abrasive tool (e.g. plastic scraper).
Repeat the soaking process, if necessary, until all biofouling has been removed from the system.
Allow the system to dry fully prior to storage.

CAUTION: Do **NOT** use pressure washers to clean the sonar, as it may damage the sensitive arrays. Only scrub the sonar using super-fine, non-metallic abrasive pads, such as 3M™ Scotch-Brite™ Light Cleansing Hand Pad 7445, or soft plastic or wooden scrapers. Do **NOT** use metal tools or sharp objects.

6.2.2 Systems Coated with ClearSignal Antifouling

Remove the sonar from the vessel and secure dust resistant caps on the bulkhead and cable.
Avoid using highly abrasive and chemical cleaning methods.
Clean the sonar using a wet kitchen-type sponge, using the soft or abrasive side of the sponge.
Use generous amounts of water to wash away the removed fouling.
Soapy water can be used for cleaning and will aid in the removal of biofouling.
Allow the system to dry fully prior to storage.

6.3 Maintenance Schedule

6.3.1 Before Each Survey

Component	Inspection	Additional Notes
Receiver Array	Inspect the polyurethane for any gouges, nicks or separation from the housing. Ensure the array face is smooth and uniform.	Water intrusion can cause damage and lead to costly repairs. Store the sonar away from direct sunlight.
Projector Array	Inspect the projector array for any gouges or nicks and check the attachment area where the projector connects to the sonar housing. The surface should be smooth and uniform.	Water intrusion can cause damage and lead to costly repairs. Store the sonar away from direct sunlight.
O-Rings on Wet-End Cable Connections	Check the O-rings for damage and any particulates that could interfere with their operation. Keep the O-rings lightly lubricated with silicone grease that is at least 90% pure. **DO NOT** apply grease to the connector pins.	If a spare O-ring is missing, borrow one from the cable wet-end protective cap and contact NORBIT Support for replacements.
Sound Speed Probe	For sonar models containing a field-swappable probe (e.g. WINGHEAD X and WBMS X), unscrew the probe and inspect the connector for corrosion.	SV probes on some WINGHEAD models are tightly integrated and can **NOT** be removed, and attempting to do so will damage the system. A detachable SVP

	When removing the sensor, orient the sonar so that the SV socket faces horizontally to prevent water on the wet sensor from entering the socket. Ensure the socket is completely dry before re-attaching the sensor. Ensure the O-ring is in good condition before reinstalling the sensor tightly, then compare the SV value with the SV profiler at the same depth. The difference should not exceed 1m/s.	option is available for such models (see Appendix B3). Incorrect or missing sound speed data causes beam steering errors and affects outer swath performance. Calibrate the probe every 24 months.
Sonar Housing	Inspect the housing for scratches and corrosion. Ensure the anode is in good condition for aluminium models.	Small scratches compromise the galvanic barrier of the aluminium housing.
Sonar Connector	Check for debris and clean with compressed air. Ensure the cable connector is dry and clean and use a protective cap when the connector is not in use.	The sonar connection is not wet-mateable. Do not disconnect or connect the sonar when it is submerged or in wet areas.
Sonar Cable	Clean the connectors with compressed air, and ensure the cable is smooth and free from kinks and tears. Check the pins are shiny and straight. Inspect the O-rings for wear and replace if needed. Apply a small amount of silicone lubricant.	A bad connection or damaged cable will corrupt survey data. Handle the cable with care (do not stand on it).
Sonar Mounting Bolts	Verify that the threads on plastic sleeves are intact and not de-threaded. Long-term vibration can loosen bolts, which may compromise data quality or result in wet-end loss.	Use only stainless-steel bolts and washers. Apply Loctite 242 Blue, lock washers and/or nylon nuts to secure the bolts.
Mounting Bracket	Ensure all hardware on the mounting bracket is tight. Be cautious when checking the mounting screws for the sonar, as over-tightening can damage the connections.	The bracket is robust and provides electrical isolation from the vessel.
Firmware & GUI Versions	Ensure that both the firmware and GUI versions are up to date and match each other. For integrated systems, this may involve an annual maintenance cost for the INS component.	Contact NORBIT Support for further details.

6.3.2 After Each Survey

Component	Inspection	Additional Notes
Complete Kit	Perform all inspections from the previous section.	Store the system in a dry location at room temperature.
Wet-End	Rinse the wet end with fresh water and clean off marine growth with a soft rag. Remove barnacles carefully to avoid pitting or nicking the polyurethane. Send photos of any damage to the anodised aluminium or polyurethane to NORBIT Support. Allow the kit to dry before storing, and store with the lid open once back at the office.	When not in use, secure the sonar cable with the included protective caps. Adjust the length by grabbing one of the collars and pulling on the cable.

6.3.3 Monthly

Component	Inspection	Additional Notes
Complete Kit	Perform all inspections from the previous sections.	Ensures readiness for the next survey.
Sound Speed Probe	Compare the surface sound speed probe with another sensor. If the difference exceeds 1m/s under similar conditions, identify the faulty sensor and return it for calibration.	The surface sound speed sensor should provide reliable data for a 24-month period.

6.3.4 Annually

Component	Inspection	Additional Notes
Complete Kit	Perform all inspections from the previous sections. NORBIT offers factory or on-site system health checks. The factory health check is recommended every two years for a full system inspection and performance scan, while the on-site check is more limited.	The factory service includes surface sound speed calibration. Contact NORBIT Support to schedule a factory health check. It is the responsibility of the user to schedule the service.

6.4 PORTUS Pole Tool Bag Contents

Item	Qty A*	Qty B*
Tool Pouch	1	1
Safety Line (5m)	1	1
Gear Ties	4	4
Silver Permanent Marker	1	1
5/8” 0.12” Rubber Washer	2	0
5/8” ASME B18.21.1 Exter. Tooth Lock Washer	2	0
GNSS End Caps 20149P017-4	2	0
M6 x 12mm DIN580 Eye Bolt	2	2
M8 x 80mm Ball Lock	2	2
M8 x 60mm Ball Lock	2	2
M6 x 39mm Ball Lock	2	2
M8 x 90mm DIN912 A4 Cap head Screw	2	1
M8 x 30mm DIN931 A4 Hexagon Bolt	4	4
M8 x 30mm DIN912 A4 Cap Head Screw	4	4
M8 From A DIN123 Flat Washers	12	10
M8 DIN985 A4 Nylon Locking Nuts	10	9
M8 DIN127B A2 Spring Washer (short term use only)	6	6
M8 DIN315AF Wing Nut (short term use only)	6	6
M6 x 25mm DIN7991 A2 Socket Screw	2	2
M8 x 30mm GN927.5-82 Levers	0	2

*A: When purchased with PORTUS Pole
*B: When purchased as standalone tool bag

7 Troubleshooting

7.1 Sonar

Problem	Solution
System does not behave as expected	• Select **Set Sonar Factory Defaults** (see section 4.8.6.1). • Obtain the latest GUI installer from NORBIT Support.
Firmware compatibility warning	• Ensure that the latest GUI is installed, and if required, update the sonar firmware as described in section 4.4.
No sonar connection	• Check and secure all cables. If the wet-end connection is loose, remove the connection, clean the threads at both the male and female fittings, then apply a very small amount of (approved) O-ring grease and re-tighten. • Reboot the PC, wait 30 seconds, then power-cycle the system. • Check for IP address conflicts. The PC network adapter should be configured to 192.168.53.XXX (where XXX is **NOT** in the 100-110 range, nor equal to the last 2 digits of the sonar serial number). See section 4.2. • Bypass network switches and connect the SIU directly to the PC. • In Windows Command Prompt, type `ping 192.168.53.XX` (where XX is the last 2 digits of the sonar serial number) to verify network connectivity. • Allow GUI and BathyProxy in Windows Firewall.
Power-up failure or power loss during operation	• Check the power supply voltage with a voltmeter. See section 2.1. • Inspect the battery/inverter for failure and replace if necessary. • If the supply voltage is outside the permitted range, the SIU Power LED blinks at 5Hz. Verify the power input using a known-good, stable power source.
Display freezes or data packets dropped	• The sonar output stops when the SV probe is detected 'Out of water'. This is a protection measure to prevent damage to the electronics. • Check Windows Task Manager for excessive network bandwidth usage. • Replace the network cable or switch where applicable. • Update the computer network adapter driver. • Select **Set Sonar Factory Defaults** (see section 4.8.6.1).
Data quality issues (e.g. motion artefacts)	• Ensure that the installation is completely rigid and free from vibrations. • Ensure that there is no independent movement between the GNSS antennas and review the antenna separation distance (2m is recommended). • Review offsets and positioning quality. RTK corrections are recommended. • Verify that the primary GNSS antenna is connected to the Ant 1 SIU socket. • Check the sonar head for marine biofouling (see section 6.2). • Check for acoustic interference from other sensors, bubbles, or machinery. • Ensure that multiple network cards (e.g. Wi-Fi and wired) are **NOT** on the same static IP range. This causes duplication of navigation data. • For standalone systems, ensure the same PPS signal edge is used by both the SIU and the third-party GNSS/INS supplying the timing signal. • See section 7.3 for guidance on maximising data quality.
Invalid sonar date/time (red) when using IRIG-B (ZDA and 1PPS) timing	• Inspect the pins on the cable and SIU. If a pin is bent, **VERY** gently bend it back, being careful to avoid further damage. Proceed at your own risk. • In **INS Tools > Sky Plot**, check that GNSS satellites are detected. • Check that the PPS LED on the SIU blinks at 1Hz (see section 2.3.4). • Perform a factory reset of the integrated INS (see section 4.6.1.1). • For Applanix models, verify that COM2 is configured to output $GPZDA at 1Hz, 115200 baud, in the AP+ Web UI, or COM4 at 9600 baud in POSView (legacy models). For SBG models, Port D is configured in a similar manner. • For subsea ROV/AUV installations, NTP+PPS timing is recommended. Consult TN-190041 for full guidance on the timing requirements.
"Sonar timing incorrect" error	• This may happen if the integrated INS boots-up slower than the sonar. Acknowledge the error and continue to monitor it. • If the timing is incorrect, the date/time in the GUI appears red.

SV sensor reports 'Out of water' or incorrect values	• For models containing a field-replaceable SV sensor, verify and tighten the connection. On some models, the SV sensor is tightly integrated and **CANNOT** be unscrewed, and attempting to do so will damage the sensor. • Stop the vessel to allow air bubbles to dissipate. If required, adjust the mounting to reduce bubble formation. • Verify the raw SV sensor data in the Web UI Diagnostics page (http://192.168.53.XX:8080, where XX is the last 2 digits of the serial number). • Inspect the SV sensor for damage or marine growth.
Sounding gaps in data	• Adjust the **Adaptive Gates** to a wider setting. See section 4.8.5. • Ensure that the seabed is between the **Upper Gate** and **Lower Gate**.
False detections at nadir with 0m range	• Apply brightness and collinearity filters, and/or 0.5m minimum range filter in the data acquisition and processing software to remove false soundings.
Seabed not detected	• Move the **Upper Gate** closer to the expected bottom to bypass surface noise. • Ensure that the **Lower Gate** is beyond the expected maximum depth.
Stabilisation status (roll, pitch or yaw) is red	• For integrated systems, ensure the INS is detected by the GUI and reporting valid attitude data. If not, power cycle and review Windows Firewall settings. • For non-integrated systems, follow the instructions in section 4.6.8, and use a terminal emulator such as PuTTY to verify the TSS1/EM3000 data stream. Select "Serial" type connection, enter the port number and baud rate, and select Open to display the data stream.
Licensed features not available	• Ensure that the sonar GUI and firmware is up to date. • Follow the activation instructions described in Appendix B1.
Data not received in acquisition software	• Disable both Private and Guest or public firewalls. • Ensure the acquisition software has the correct IP address and ports. For sonar data, the acquisition software must connect to the IP address of the NORBIT GUI PC (usually 127.0.0.1) and not the IP address of the sonar itself. • Ensure that the GUI reports valid sonar timing.
Dual head secondary data not received in acquisition software	• Sentinel dongles (e.g. Qinsy license dongles) occupy port 7001, which is also the default port of the secondary sonar. • To avoid conflict, change the primary port number in the GUI **Connection** settings to 17000, for example (see section 4.8.6).
Data not received in PDS or EIVA NaviScan	• Ensure that **Force Push** is enabled under the **Connection** menu in the GUI (see section 4.8.6).
Backscatter mode is greyed out	• TCP/IP subscriptions from the data acquisition software (such as Qinsy or HYPACK) overrides the GUI selection. This is normal.
Cannot steer swath to waterline	• Ensure that Equiangular beam spacing is used. Detections in Equidistant modes are limited to 10° from horizontal.
Text in GUI appears condensed	• In Windows settings, go to **System > Display** and adjust the **Scale** setting. • Right-click the GUI desktop shortcut, open the Properties, and select **Change high DPI settings** on the Compatibility tab. Change the **High DPI scaling override** setting to **System**.
s7k file sizes are too large	• The file size limit can be controlled by editing this file: *C:\Program Files (x86)\Norbit AS\WBMS\config\factory_wbmsgui.ini* • In the `[S7kFiles]` section, `size_limit_MB` controls the maximum file size in megabytes, e.g. `size_limit_MB=1024` will split the s7k file every 1GB.

7.2 Integrated INS

Problem	Solution

INS not detected in the GUI	• Disable Windows Firewall, or allow GUI access and add a port exception:
	  ▪ Open legacy Windows Control Panel and go to **System and Security > Windows Defender Firewall**.
	  ▪ Choose **Advanced Settings** on the left menu. Create a new **Inbound Rule**, select **Port** and click **Next**.
	  ▪ Apply the rule to UDP port 5602 and click **Next**.
	  ▪ Select **Allow the connection** and click **Next**.
	  ▪ Apply the rule to **Domain, Private and Public**, and click **Next**.
	  ▪ Specify a rule name and **Finish** the wizard.
	• For SBG models, add exceptions for UDP port 1234, TCP ports 50000 and 50001.
	• For Applanix models, ensure that POSView is closed or in **Monitor** mode, then restart the NORBIT GUI.
	• In Windows Command Prompt, type `ping 192.168.53.100` (Applanix models) or `ping 192.168.53.103` (SBG models) to verify network connectivity.
	• Review the network configuration (section 4.2) and check for IP address conflicts. Change it to **192.168.53.150**, with subnet mask **255.255.255.0**.
	• Inspect all cables and connectors, ensuring that the connections are tight.
	• Low quality power supplies may cause this issue. Try an alternative power source.
	• Perform a factory reset of the integrated INS (see section 4.6.1.1).

GNSS data not received	• Check the antenna cables and ensure that all connections are secure. • Use only the antennas provided with the kit and ensure that they have a clear sky view with no obstructions. Unsupported antennas may not work.
INS Wizard fails to update	• The error *"Failed to connect to the POS MV Control port"* on Applanix models indicates that POSView is open and Connected. POSView is not required for integrated systems. At a minimum, it should be in **Monitor** mode during operation.
RTK corrections not received	• For serial RTK data, check the COM port settings and cable connections. Check the radio link and frequency, ensuring that the baud rates and corrector types match. • If required, use a Null Modem adapter on the serial connector to swap pins 2 and 3. • For serial RTK data, use a terminal emulator such as PuTTY to verify the data stream. Select "Serial" type connection, enter port number and baud rate of data source, and select Open to display data stream. • For NTRIP solutions, verify the credentials and check the Internet connection.

RTX/Marinestar corrections not received	• Ensure that Trimble RTX or Marinestar is enabled in the INS Setup Wizard (see section 4.6.1.5).
	• Ensure that the correct satellite frequency and bitrate are configured for your region.
	• Under **INS Tools > System Status**, verify that:
	  ▪ The subscription is active with a valid expiry date shown.
	  ▪ The **Status** in the **Marinestar Status** or **Trimble RTX Status** block is reported as *Tracking*.
	  ▪ The SNR is >35dB-Hz. If the SNR is ≤35dB-Hz, inspect the antenna cables and antenna placement, and ensure that there is no interference.
	• If the over-the-air (OTA) activation method failed, contact your service provider to re-send the activation, ensuring that the **Status** is *Tracking* during this period.
	• For Trimble RTX users, the activation code can also be applied manually to the GNSS receiver if the OTA method fails (see section 4.6.7).
	• For Marinestar users, check with your service provider that the correct subscription plan is activated, noting that Applanix AP+ models **only** support the G4+ service.

Heading alignment fails	• Ensure that RTK or PPP (Marinestar or Trimble RTX) corrections are received. • Ensure that the antennas are connected to the correct Ant 1/Ant 2 SIU sockets. • Verify the offsets and review the GNSS environment. • Ensure that the installation is completely rigid and free from vibrations.
Red Faults LED and System Status alerts	If any of the errors below are shown permanently, check the offsets and mounting angles, and check the raw GNSS data for cycle slips or interference.

	• **Accelerometer Bias or Gyro Bias:** May indicate that the IMU is outside specification limits and requires service. Can also be caused by incorrect offsets. • **Nav/Aligned Heading Rejected:** The vector between the antennas has not been accurately determined by the Kalman filter. May flicker red during normal operation. • **Pri. GNSS Observable Rejected:** Similar to the above. • **Invalid Installation Parameters:** Usually caused by incorrect offsets, incomplete heading alignment, or low satellites. If error persists, reboot system. • **Bad IMU Frames:** Should always be zero. If number is increasing, it could indicate a cable problem or electronics error.
INS Logging LED is red or orange	• Perform a factory reset of the integrated INS (see section 4.6.1.1). • Disable Windows Firewall. • Reboot PC.
SBG Web UI is unstable	• If the system includes the split serial upgrade and the Web UI is unstable, ensure that **ONLY** the split serial cable (PN 33209) is connected to the SIU COM port. Do not connect other cables directly to this port.

Recorded files (.000 or .T04) are too large	• The maximum file size of GNSS/INS raw observable files is controlled via the ini file: *C:\Users\<user>\AppData\Roaming\Norbit\wbmsgui.ini*
	• A new file is automatically generated when the specified file size limit is reached.
	• The limit can be changed under the `[ins_logging]` section, by specifying `logfile_max_size` in bytes. For example, to change the file size limit to 64MB, use `logfile_max_size=67108864` (i.e. 64 * 1024 * 1024)
	`[ins_logging]`
	`logfile_max_size=67108864`
	• If **Set Sonar Factory Defaults** is selected at any time, this modification is reset.

7.3 Data Quality Checklist

- ✓ ***Review Hardware Installation:*** Ensure that all sensors are fixed, rigid, and free from vibration. There must not be any independent movement of sensors.
- ✓ ***Primary Antenna Location:*** Ensure that the primary antenna is closest to the NORBIT system and connected to the correct SIU port (Ant 1).
- ✓ ***Offsets:*** Measure offsets correctly to the nearest 1cm or better, and check sign inputs.
- ✓ ***Sensor Alignment:*** Ensure that the integrated system is closely aligned with the vessel centreline. Agreement to within ±0.5° is ideal.
- ✓ ***Centre of Rotation:*** If the sonar and IMU are not mounted at the CoR, measure and apply this offset in the INS Setup Wizard to eliminate heave artefacts.
- ✓ ***GNSS Corrections:*** Only Narrow Lane RTK is suitable for RTK tides, requiring a base station with a baseline of <20km. Position errors increase with distance from the base station. DGNSS is accurate only to about 60cm horizontally. Ideally use a post-processed kinematic solution.
- ✓ ***Sound Speed:*** In many environments, sound speed varies more in the upper layer of the water column. Mounting the sonar lower helps to overcome errors related to unaccounted changes in sound velocity. Perform SV casts on a regular basis and compare them to the surface sound speed, ensuring that the difference does not exceed 1m/s.
- ✓ ***Patch Test:*** Review multibeam roll, pitch, and yaw misalignments. Repeat measurements as and when required. Generally, roll should not vary by more than ±0.02°, pitch by ±0.1° and heading by ±0.5°. Perform a patch test every time the sonar and IMU are moved.
- ✓ ***Swath Angle:*** Soundings are most accurate within ±70° from nadir (depth-dependent). Accuracy may extend beyond this where the beam footprint and incidence angle are small (e.g. looking up a steep slope). Soundings looking down-slope have larger footprints and higher incidence angles, so survey lines should generally be parallel to the bottom contour.

7.4 Change Sonar IP Address

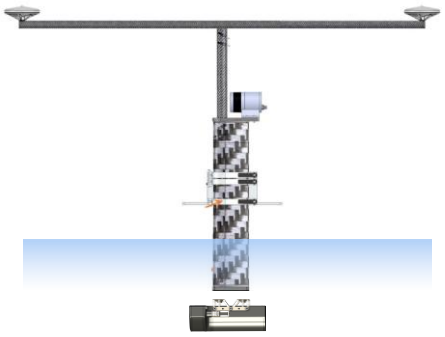
The sonar IP address can be changed on the **Network Settings** tab of the sonar Web UI: *http://<sonar-ip>:8080* (for example: http://192.168.53.51:8080)

CAUTION: Do **NOT** change the static IP range of WINGHEAD S-series sonars (e.g. i80S, B51S) with **PN 24115**. Only the last digit may be changed via the Web UI (i.e. 192.168.53.X). If an IP-range change is required, contact NORBIT Support for assistance.

Appendix A: Quick Start Guides

A1. Single Head Installation

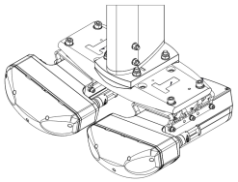
1. ***Unpack and Inspect:*** Unpack sonar system and inspect all cables and connectors for damage, dirt and moisture. Inspect the transducers for cuts or gouges (see section 6).
2. ***Sonar Installation:*** Mount the sonar parallel to the vessel keel with the projector pointing aft. Secure the bracket to the pole with at least 4 bolts, using lock-washers and/or Loctite 242, especially for longer deployments. Connect the wet-end cables prior to mounting (see section 2.4).
3. ***Antennas:*** For GNSS/INS integrated systems, mount the GNSS antennas with 5/8" threaded bolts. While not essential, it is helpful to align the GNSS antennas parallel or perpendicular to the vessel keel (see section 2.4.6). The antenna closest to the sonar is typically the primary. Connect the primary antenna to Ant 1 on the SIU, and the secondary antenna to Ant 2.



4. ***Cables:*** Run the cables from the sonar and antennas to the SIU. Avoid sharp bends and beware of chafing. Handle cables with care, as rough handling can bend, and damage, the connector pins. Do not run the cables next to high voltage lines and spread the cables out to avoid RF interference.
5. ***SIU & PC:*** Connect the SIU to the PC via Ethernet. Set the IP address of the PC to **192.168.53.XXX**, where XXX can be any number from 110 to 255, with subnet mask to **255.255.255.0** (see section 4.2).
6. ***RTK:*** If RTK positioning is used, configure it as required.
7. ***Offsets:*** For the default setup, measure the XYZ offsets from the Top Centre of Bracket to the bottom of the primary GNSS antenna.
8. ***Power:*** Ensure that the power source is clean and beware of batteries that are under powered, or cheap inverters. See section 2.1 for more details.
9. ***Software:*** Install the NORBIT GUI and disable Windows Firewall. Power on the SIU, launch the NORBIT GUI, and connect to the sonar via the **Connection Dialog**. Once connected, the GUI starts logging raw GNSS/INS observables automatically on integrated models.
10. ***INS Setup:*** Open the **INS Setup Wizard** under **INS Tools**. Follow the prompts and enter the measured offsets. For the antenna baseline vector, select **Alignment Wizard** to ensure that the heading alignment starts automatically once the INS Setup Wizard is completed (see section 4.6.1).
11. ***Acquisition:*** Set up your acquisition software of choice, e.g. DCT, HYPACK or Qinsy. Select the NORBIT driver (or Reson SeaBat 7125 network driver, if that is not available) and connect to the GUI IP address, which is typically **127.0.0.1**, on TCP port **7000** (see section 5).
12. ***Tides:*** Verify the INS system readiness by examining the RTK tide values for stability. As soon as the tide graph stabilises on a narrow value range, the system is ready for survey.
13. ***Bar Check:*** Run a bar check to validate the sonar draft.
14. ***Sound Speed:*** Verify the sound velocity reported by the sensor on the sonar by comparing it to another sensor, e.g. a sound velocity profiler.
15. ***Online Filters:*** In your acquisition software, enable online filters to remove low quality soundings. Enable the brightness and collinearity filters, and if using Qinsy, enable a 0.5m minimum range filter to remove the false trail of soundings at nadir (which are recorded with 0m range). Flagged soundings can be recovered in post-processing, if necessary.
16. ***Patch Test:*** Perform a patch test each time the sonar is installed or relocated.

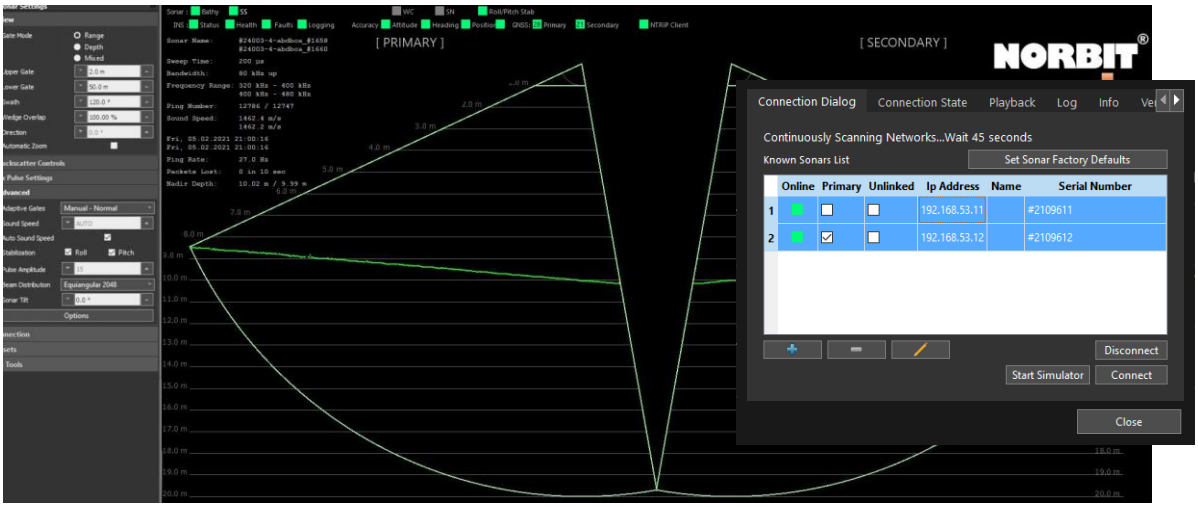
A2. Dual Head Installation

Dual Head WINGHEAD
(±10° Roll, ±1° Pitch)



Dual Head WBMS X
(±10° Roll)

1. ***Mounting:*** For the standard dual head brackets (Appendix E), mount each sonar using M10x40-A4 screws. In general, avoid exceeding ±10° physical rotation to prevent water surface reflections in the acoustic signal. Secure the bracket to the mounting platform using suitably sized M10 screws, using M10x60-A4 when mounting to a PORTUS pole.
2. **Cables:** Secure and connect the cables, as shown in section 2.8. Each sonar must be connected to a separate SIU.
3. ***Networking:*** Configure the IP address of the operator PC to **192.168.53.XXX** where XXX can be any number from 110 to 255, with subnet mask to 255.255.255.0, as described in section 4.2.
4. ***Connection:*** Power on the system and start the NORBIT GUI. On the **Connection Dialog**, highlight both online sonars on the **Known Sonars List**, set the left (port side) sonar as **Primary**, ensure the **Unlinked** boxes remain unchecked, and click **Connect** (see section 4.8.6.1).
5. ***INS Setup:*** For integrated models, complete the **INS Setup Wizard**, adjusting the offsets and IMU rotations accordingly if the integrated IMU is rotated. Refer to Appendix F for the standard dual head bracket offsets and consult technical note TN-190018 for custom arrangements.
6. ***Sonar Controls:*** The main display shows two swaths, with the primary sonar on the left. All setting changes apply to both systems, and note that when side scan is enabled, the display combines data from both sonars. The **Sonar Tilt** automatically sets the secondary sonar to the opposite tilt of the primary sonar. Note that in **Unlinked** mode *(not recommended)*, each sonar is controlled independently, allowing independent steering (**Direction**) control.
7. ***Wedge Overlap:*** The percentage overlap can be controlled in the GUI under the **View** menu. The **Sonar Tilt** setting (under **Advanced**) should also be set to match the physical rotation of the sonars.
8. ***Frequencies:*** When the centre **Frequency** is set under **Tx Pulse Settings**, the system automatically applies bandwidth above and below this value to prevent frequency overlap and crosstalk between sonars. A minimum range **Resolution** of approximately 1.1cm, with corresponding bandwidth, is used with 400kHz frequency in **FM Short Range** mode. When longer sweep times are used, the applied bandwidth is reduced accordingly to minimise range resolution (see section 4.8.4).
9. ***Port Numbers:*** In the data acquisition software, the default port numbers are **7000** for primary and **7001** for secondary. The secondary port is always one greater than the primary. Note that Sentinel dongles (e.g. those used by Qinsy) occupy port 7001, therefore the port in the GUI must be changed to avoid conflicts. For example, change the primary port to **17000** (see section 4.8.6).



Appendix B: Optional Features

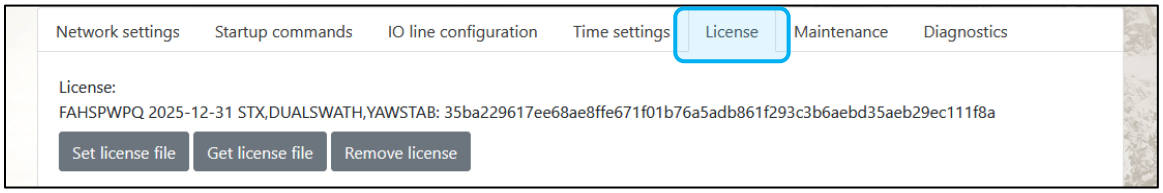
B1. License-Controlled Features

Feature	WINGHEAD X WBMS X	WINGHEAD B51S & i80S	All Other Models
Pitch Stabilisation Provides evenly distributed along-track sounding coverage by actively compensating up to ±10° of vessel pitch motion.	●	✓	○
Yaw Stabilisation Provides evenly distributed sounding coverage by actively compensating up to ±10° of vessel heading changes.	●	●	○
Dual Swath 2048 Beams Increase along-track coverage, or increase survey speed, with dual ping transmission (offset ±1°), producing 2x 1024 beams.	●	●	○
STX Scanning Directs the sonar to sweep the transmit beam along-track in a ±10° sector to increase survey coverage (see section 1.2.3).	●	●	○
Equidistant Beam Spacing Distributes the beams across the swath to maintain equal footprint spacing for consistent coverage.	●	✓	✓
512 Beams Increases the maximum number of beams to 512 per ping to improve across-track sounding density.	●	✓	✓
1024 Beams Increases the maximum number of beams to 1024 per ping to improve across-track sounding density.	●	✓	✓
Long Range[1] Allows longer transmit pulses to achieve extended range performance when operating at 200kHz frequency mode.	●	✓	○
Backscattering Strength Output (BSO) Provides absolute backscatter strength output, demonstrating how strong the bottom reflects transmitted signals.	●	●	●

✓ Standard ● Licensed ○ Not Supported

License Activation Procedure

1. Access the Sonar Web UI: http://192.168.53.XX:8080 (where XX is the last 2 digits of the serial number)
2. On the **License** tab, select **Set License File**
3. Select the ***.lic** file provided by NORBIT to activate the license, then restart the NORBIT GUI.



[1] Supported on WINGHEAD X Long Range, WINGHEAD B51S Long Range and WINGHEAD i80S Long Range models only.

B2. Additional SIU COM Ports

Integrated systems contain one SIU COM port for receiving GNSS corrections and/or GNSS/INS output to external systems. For additional ports, a split serial upgrade option is available, which includes the split cable **plus a factory SIU modification**. The cable connects to the SIU COM port and splits into 2 or 3 labelled connectors: COM1/A, COM2/B and COM3/C.

Integrated GNSS/INS	Cable Part Number	Configurable Ports
Applanix AP+	33424	COM1, COM3
Applanix (Legacy)	33209	COM1, COM2, COM3
SBG	33209	Port A, Port B, Port C

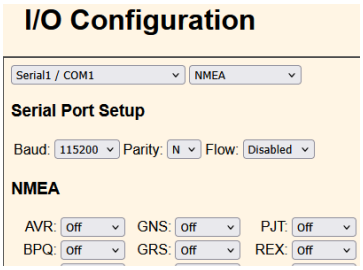
CAUTION: The serial split option includes an internal hardware modification, which means the SIU COM port is no longer a standard serial port. No cables, other than the split serial cable provided by NORBIT, should be connected.

Integrated Applanix AP+ Systems

Step 1. For AP+ systems, only one additional port (COM1) is configurable through the AP+ Web UI at: http://192.168.53.100

Step 2. Go to the **I/O Configuration** menu. The port configured on the last page of the INS Setup Wizard corresponds to COM3, therefore only **COM1** should be configured through the Web UI.

Step 3. Select the output type (NMEA or Binary), messages and baud rate, and click **OK**. COM2 must **NOT** be changed. If additional outputs are required, network outputs can be configured.



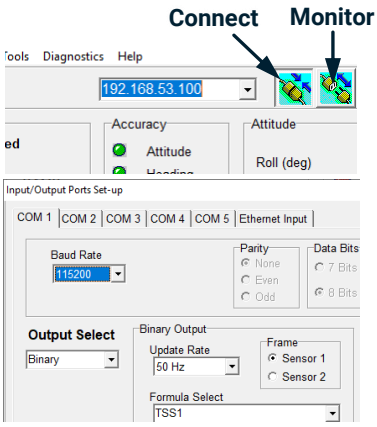
Integrated Applanix (Legacy) Systems

Step 1. Use the correct version of POSView that matches the INS firmware. Click **Connect** and go to **Settings > Input/Output Ports…**

Step 2. The port configured on the last page of the INS Setup Wizard corresponds to **COM3**, therefore COM3 can be configured in the GUI. For each additional port in POSView (**COM1** & **COM2**), select the output type (NMEA or Binary), output messages and baud rate.

Step 3. Click **Apply** and **Close**, then select **Settings > Save Settings**

Step 4. Click **Monitor**, or close POSView, to avoid conflicts with the NORBIT GUI. Note that COM4 must **NOT** be changed.

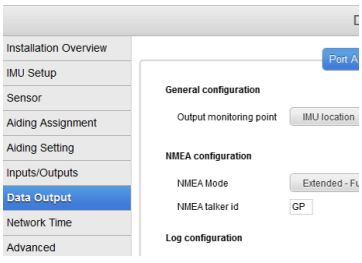


Integrated SBG Systems

Step 1. For systems equipped with SBG hardware, the additional ports are configured through the Web UI at: http://192.168.53.103

Step 2. Set the baud rate under **Inputs/Outputs > COM Ports**. The port configured on the last page of the INS Setup Wizard corresponds to Port C in the Web UI, therefore Port C can be configured via the GUI, and Ports A and B through the Web UI.

Step 3. Configure the outputs for Port A & B using the Web UI, under **Data Output > Port A/Port B**. Port D must **NOT** be changed.



B3. Detached SVP (SVPd)

The detached SVP option is available for WINGHEAD users that require an external, field-swappable, AML sound velocity sensor that can be removed underwater by divers. It is supported out of the box and there are no special software requirements.

Hardware Requirements

- WINGHEAD SVPd sonar variant, containing SVPd bulkhead connector.
- Optional mounting bracket (PN 35216)
- AML SV sensor which comprises:
  - SV sensor housing (PN 954147)
  - Swappable SVT sensor (PN 954145)
  - AML SV cable with 50cm length standard, 2m optional (PN 33300)

Connection Details

- The AML SVPd connects to the 10-pin connector on the sonar using cable PN 33300. The pinout details are provided below:

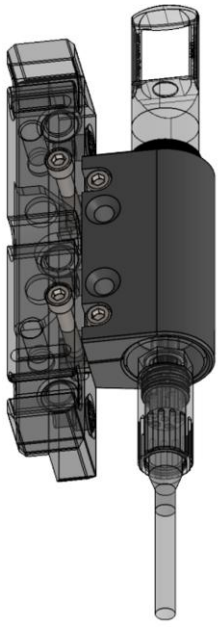
Probe	Sonar	Function
1	1	RS232 to Probe
2	5	Signal & PWR GND
3	6	12/24 vDC
4	2	RS232 from Probe

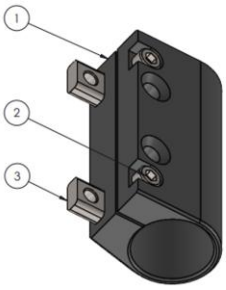
Supported Probes

- All AML SV sensors are supported, except for salinity sensors on the AML-1.

Mounting

- The sensor is mounted using the supplied bracket (PN 35216) that attaches to the standard WINGHEAD mounting bracket (PN 35150).
- The regular nuts on the bracket are swapped with extended nuts that allows the SVPd bracket to be attached. Note that the bracket is not compatible with WINGHEAD S-series models.





No.	Part Number	Description	Torque	Qty
1	451521	Clamp Bracket	5 Nm	1
2	DIN 912 M6x25 --- 25C	M6 Screws	-	2
3	451522	Extended Bracket Nut, M6	5 Nm	2

B4. Backscattering Strength Output

Backscattering Strength Output (BSO) is an optional upgrade that provides backscatter strength output, demonstrating how strong, in absolute form, the bottom reflects transmitted acoustic signals. It provides fully repeatable backscatter results, as well as compatibility with physical models.

Requirements

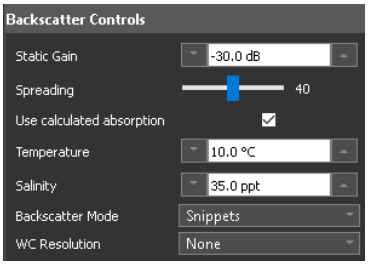
- The unit must be calibrated at NORBIT's production facility. Each calibration is unit-specific and cannot be shared with other sonars. It is not performed as standard with new systems.
- In addition to the calibration file, a valid BSO license is required (see Appendix B1).

Applying the Calibration

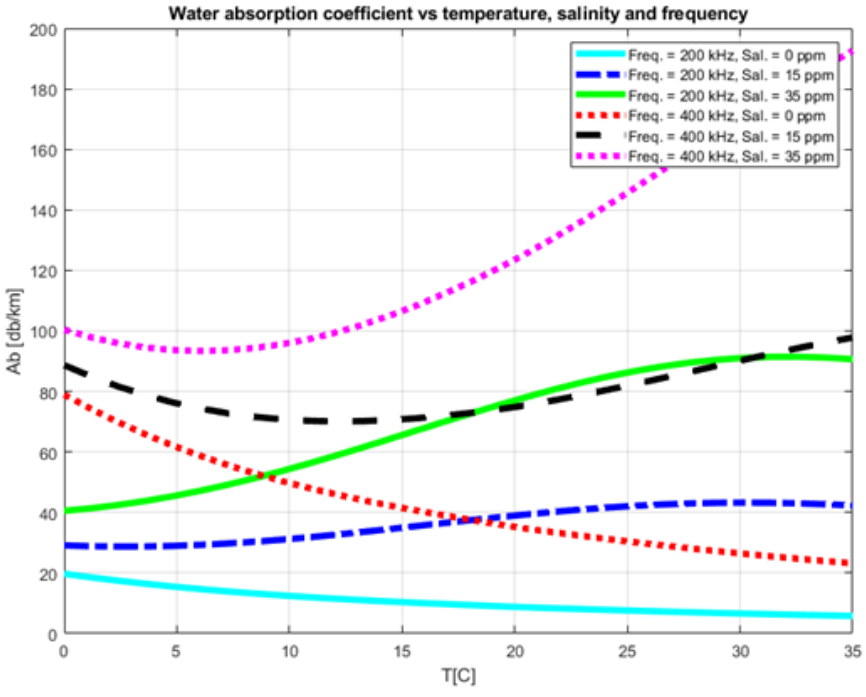
1. Copy the supplied XML calibration file from the USB stick to this directory on the GUI PC, ensuring that the filename is correct: *%appdata%\Norbit\CalibrationFiles**CalBSSdata.xml***
2. Apply the BSO license to the sonar using the procedure described in Appendix B1.
3. With both a valid license and BSO calibration file, the sonar can now generate 7k record 7058 containing backscattering strength snippet data.
4. The 7058 record is available for TCP subscription from the GUI and is also saved in the s7k files when raw data recording is activated in the GUI.

Sonar Settings

- Correct TVG settings under Backscatter Controls are essential:
  - **Static Gain:** Set to 0 by default
  - **Spreading:** Should be set to 40.
  - **Absorption:** Set to the correct physical value for the current environment.
- All applied TVG settings are reported in the s7k datagrams.
- If required, WBM files can be reprocessed with different TVG parameters and re-exported to s7k (see section 4.8.6.5).



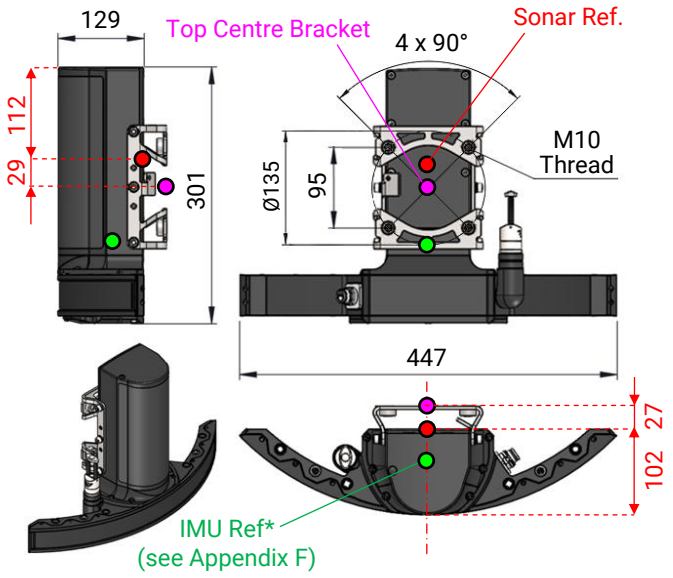
The graph below provides approximate values only. For accurate values, enable **Use calculated absorption**, or use this calculator: http://resource.npl.co.uk/acoustics/techguides/seaabsorption/



Appendix C: Hardware Dimensions & Offsets

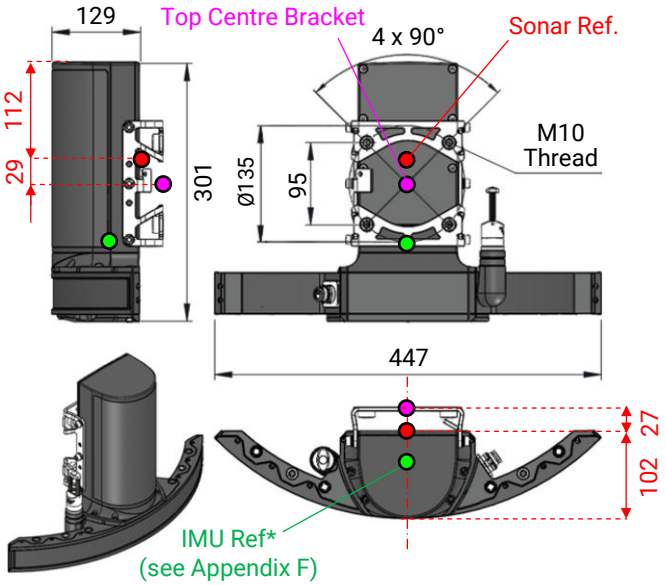
C1. WINGHEAD X (PN 24116/24119)

WINGHEAD X



Sonar PN: 24116
Weight: 6.9kg (air), 3.7kg (water)

WINGHEAD X Long Range

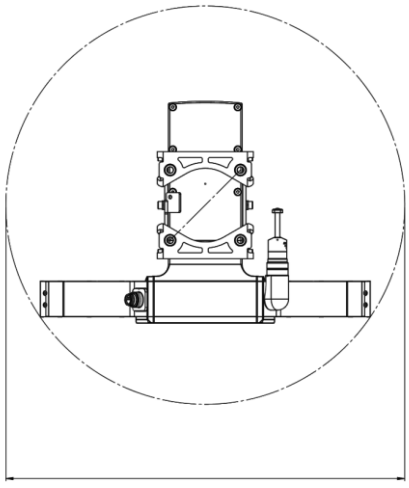


Sonar PN: 24119
Weight: 8.0kg (air), 4.2kg (water)

*Relevant for integrated models only.

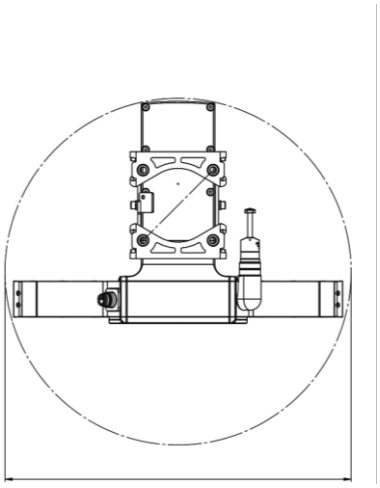
Moonpool Dimensions

Recommended minimum internal diameter with centre of sonar bracket in centre of moonpool.



Ø550

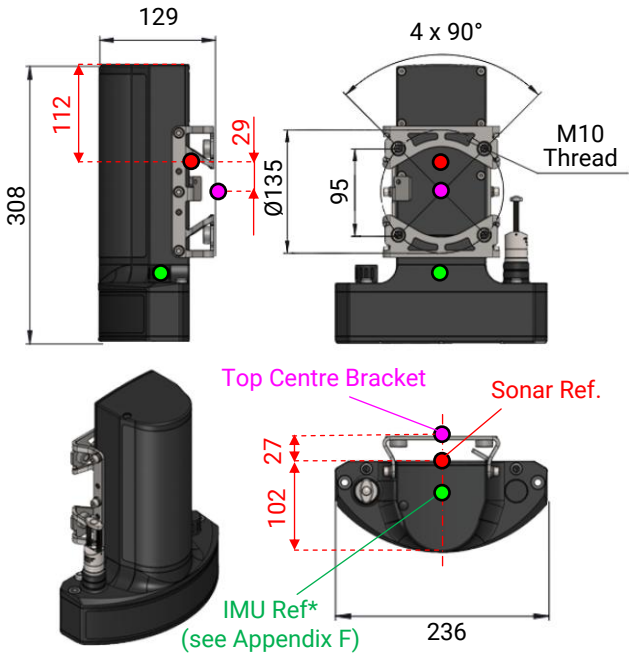
Recommended minimum internal diameter with sonar mounted off-centre in moonpool.



Ø470

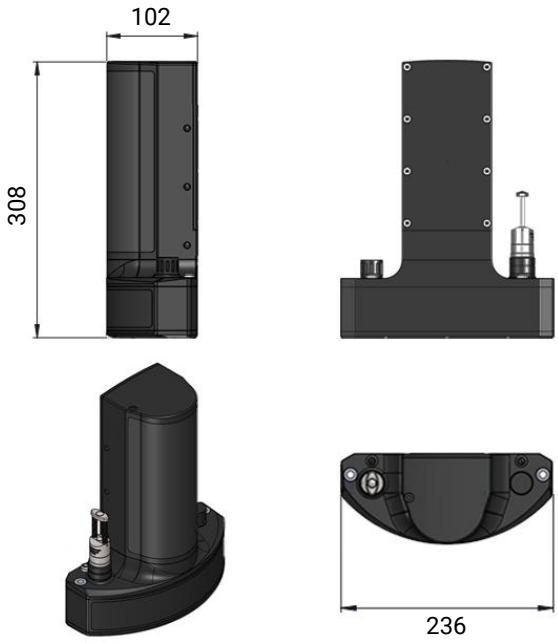
C2. WBMS X (PN 24216)

Including Mounting Bracket



*Relevant for integrated models only.

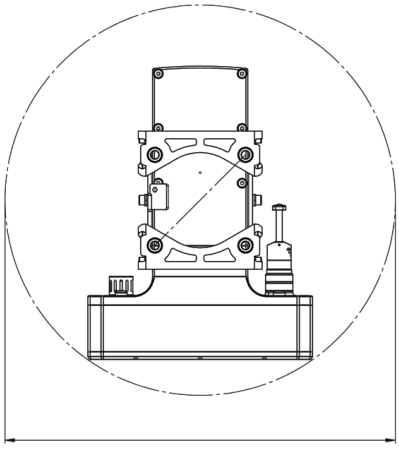
Excluding Mounting Bracket



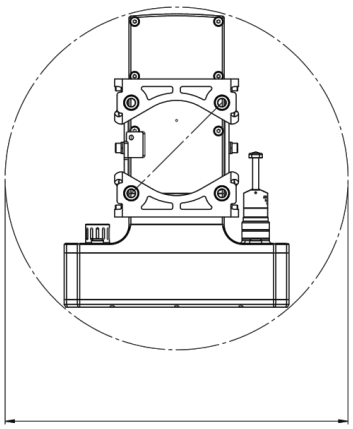
Weight	In Air	In Water
iWBMS Xh	6.7kg	3.3kg
iWBMS X	6.6kg	3.2kg
iWBMS Xe	6.5kg	3.1kg
iWBMS X Ekinox	6.5kg	3.1kg
WBMS X	6.2kg	2.8kg
Bracket	0.5kg	0.4kg

Moonpool Dimensions

Recommended minimum internal diameter with centre of sonar bracket in centre of moonpool.

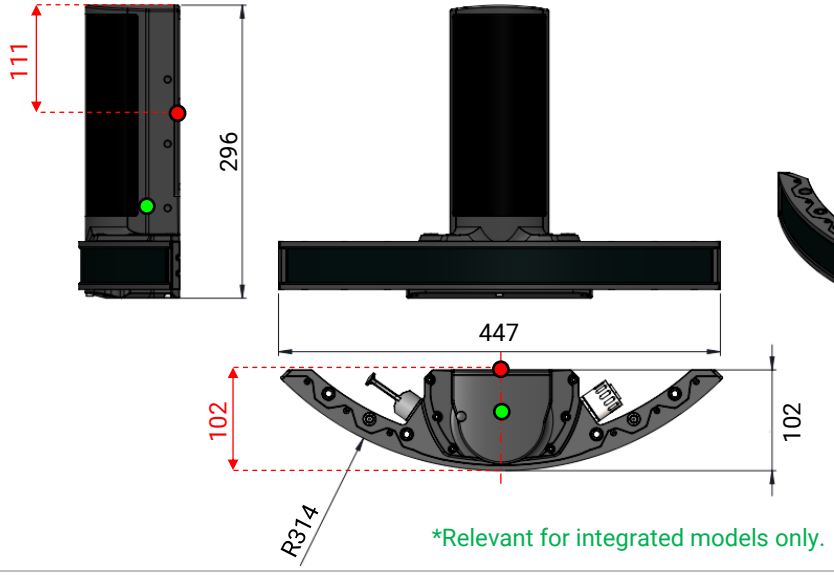


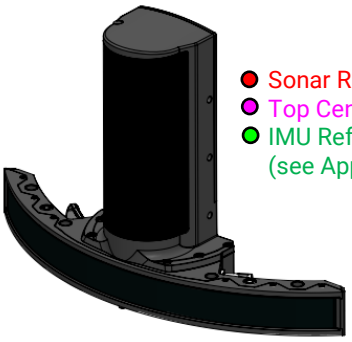
Recommended minimum internal diameter with sonar mounted off-centre in moonpool.



C3. WINGHEAD i77h / i79h / B41 / B43 (PN 24103)

Excluding Mounting Bracket



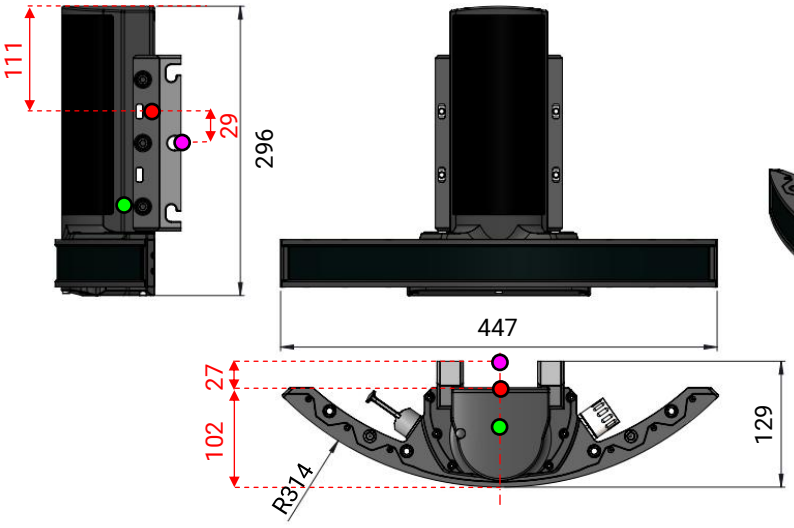


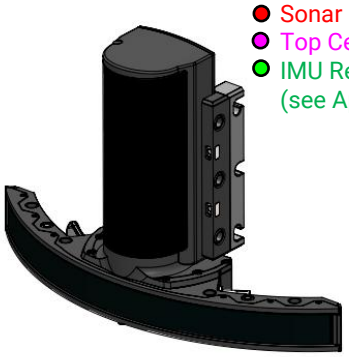
- Sonar Ref. Point
- Top Centre Bracket
- IMU Ref. Point* (see Appendix F)

Weight:
B41 : 6.6kg (air), 3.5kg (water)
B41 Titan : 9.0kg (air), 5.9kg (water)
B43 : 9.0kg (air), 5.9kg (water)
i77h : 6.9kg (air), 3.6kg (water)
i79h : 9.3kg (air), 6.2kg (water)

*Relevant for integrated models only.

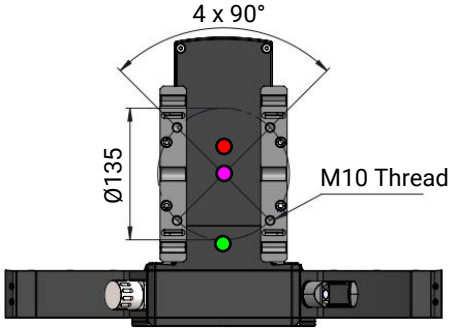
Including Mounting Bracket





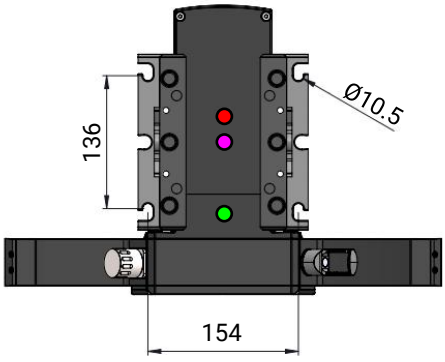
- Sonar Ref. Point
- Top Centre Bracket
- IMU Ref. Point* (see Appendix F)

Weight:
B41 : 8.1kg (air), 4.7kg (water)
B41 Titan : 10.5kg (air), 7.1kg (water)
B43 : 10.5kg (air), 7.1kg (water)
i77h : 8.4kg (air), 5.0kg (water)
i79h : 10.8kg (air), 7.4kg (water)

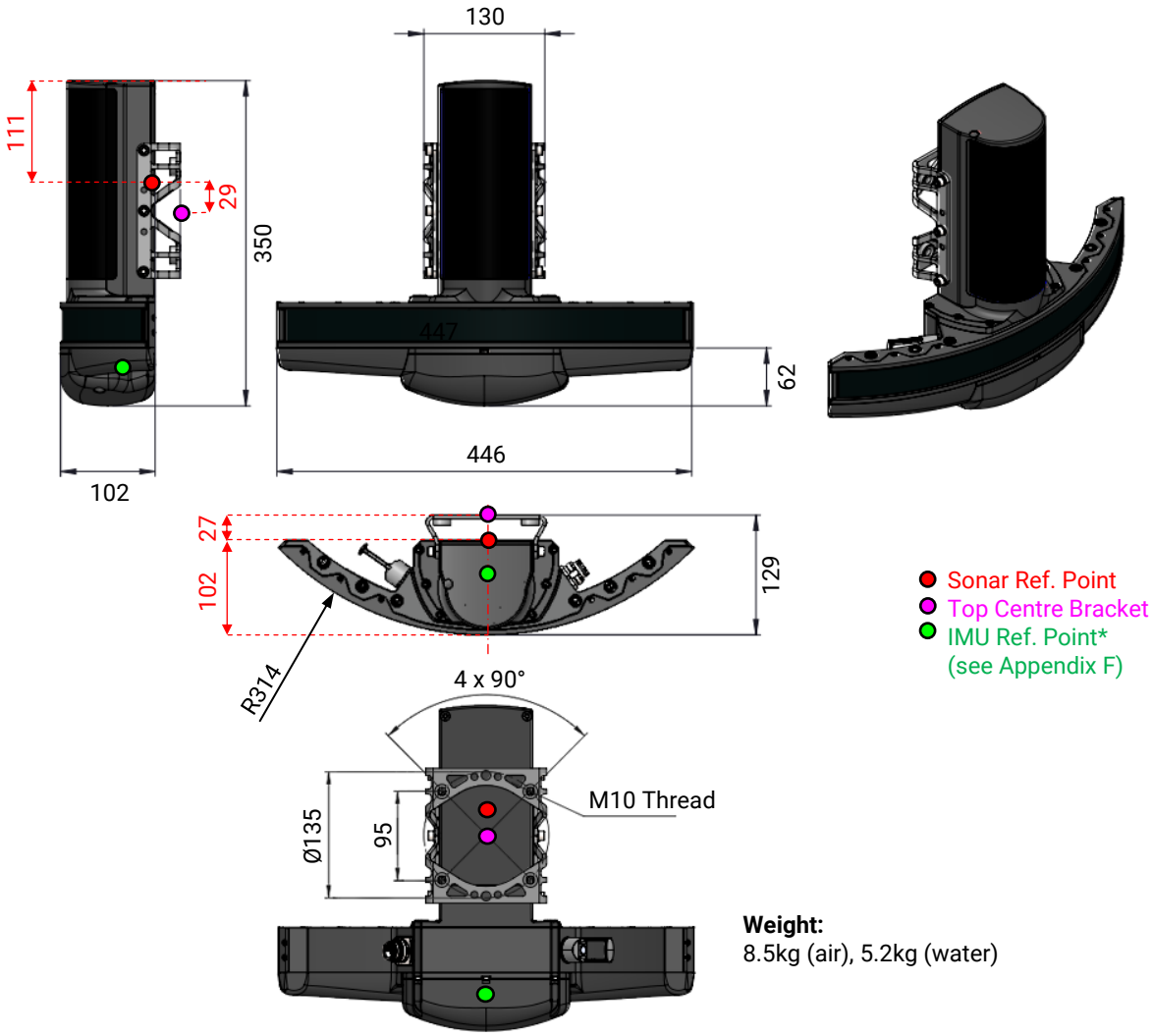


Bracket Mounting Pattern – Pole Mount

Bracket Mounting Pattern – Hull Mount



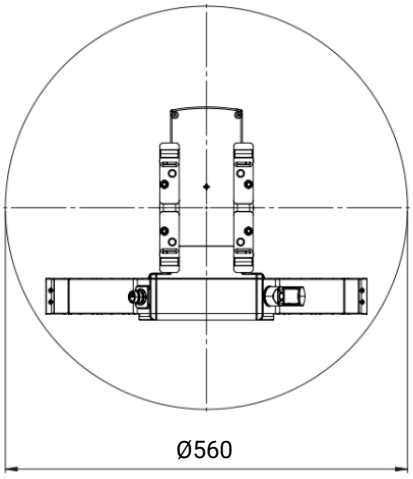
WINGHEAD i77h/i79h-Apogee



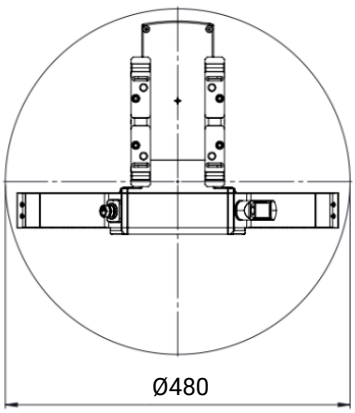
Weight:
8.5kg (air), 5.2kg (water)

Moonpool Dimensions

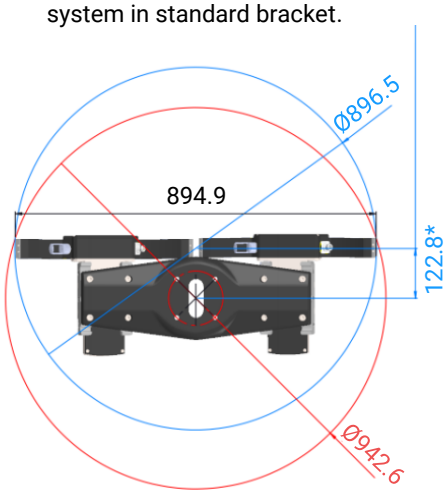
Recommended minimum internal diameter with centre of sonar bracket in centre of moonpool.



Recommended minimum internal diameter with sonar mounted off-centre in moonpool.



Recommended minimum internal diameter with dual head system in standard bracket.

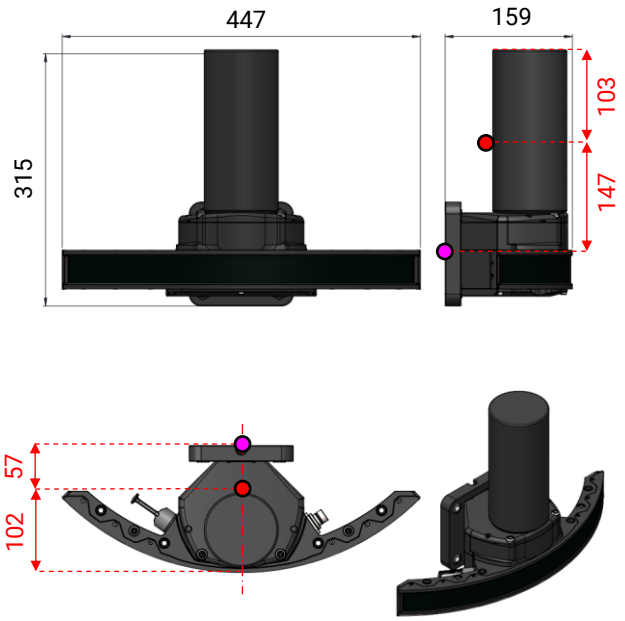


Also valid for WINGHEAD i77h/i79h-Apogee models.

Centre of sonar bracket off-centre of moonpool
Centre of sonar bracket in centre in moonpool
* Bracket centre to centre of moonpool

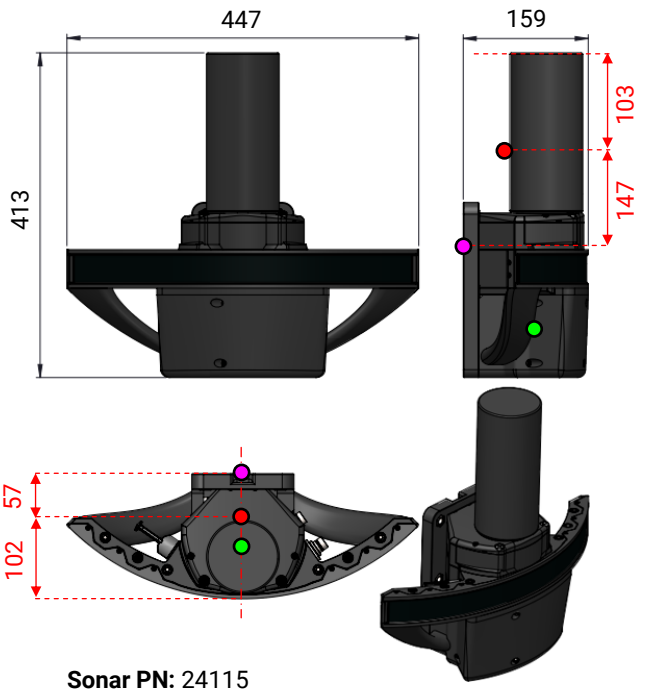
C4. WINGHEAD B51S / i80S / i80S LR (PN 24115/24119)

WINGHEAD B51S



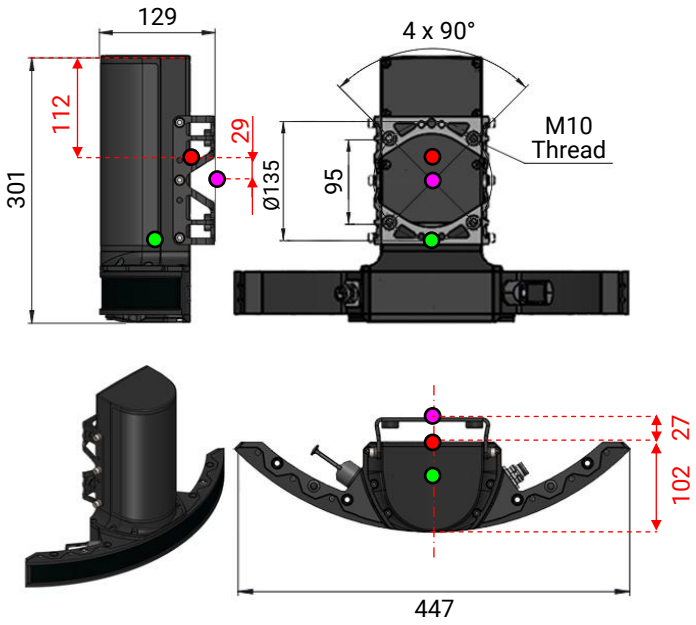
Sonar PN: 24115
Weight: 6.7kg (air), 3.0kg (water)

WINGHEAD i80S / WINGHEAD i80S-Apogee



Sonar PN: 24115
Weight: 11.0kg (air), 4.9kg (water)

WINGHEAD B51S/i80S Long Range



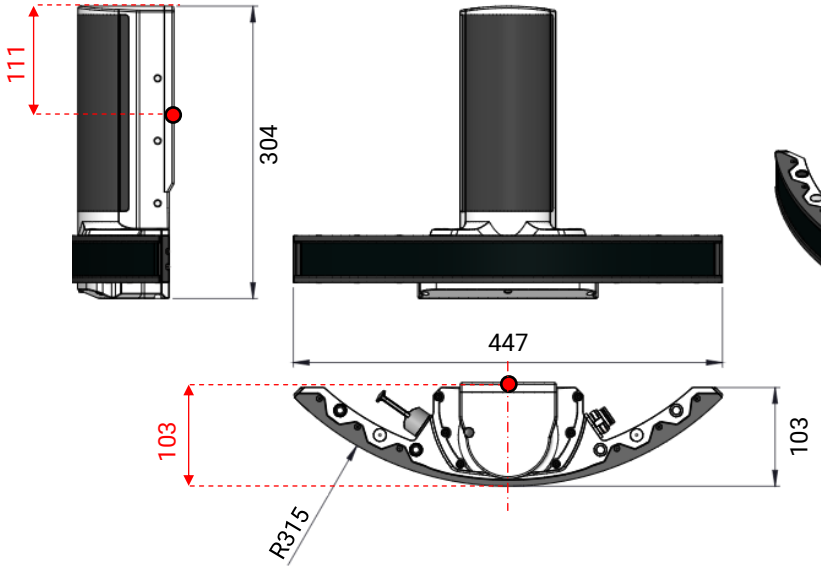
- Sonar Ref. Point
- Top Centre Bracket
- IMU Ref. Point* (see Appendix F)

*Relevant for integrated models only.

Sonar PN: 24119
Weight: 8.0kg (air), 4.2kg (water)

C5. WINGHEAD B44 Deep Sea (PN 24110)

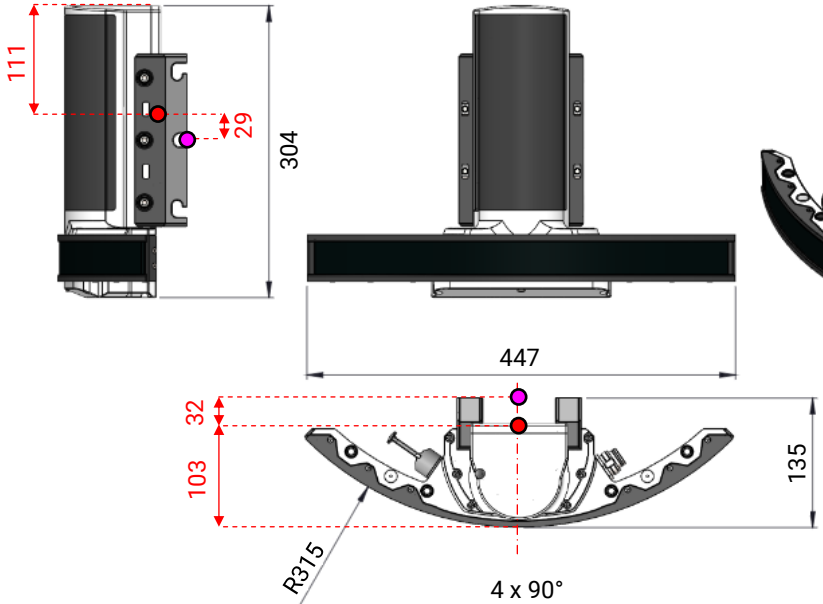
Excluding Mounting Bracket



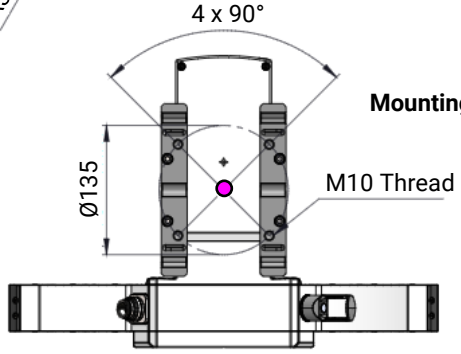
Weight:
B44 : 10.8kg (air), 7.1kg (water)

CAUTION: The vent screw beneath the sonar allows controlled pressure release after deep dives in case of suspected leaks. Do **NOT** tamper with it. Contact NORBIT Support for guidance if in doubt.

Including Mounting Bracket



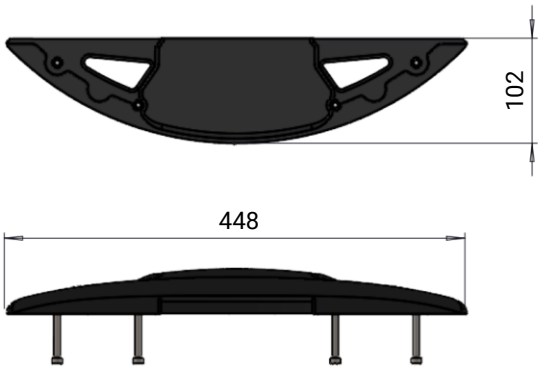
Weight:
B44 : 12.4kg (air), 8.5kg (water)

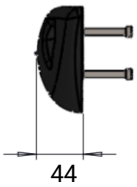


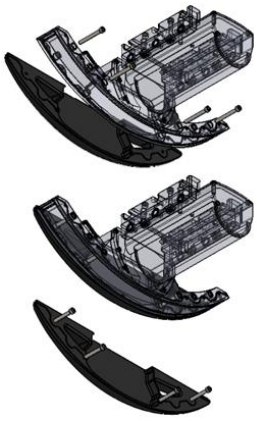
Mounting Hole Pattern

- Sonar Ref. Point
- Top Centre Bracket

C6. WINGHEAD Fairing (PN 35166)





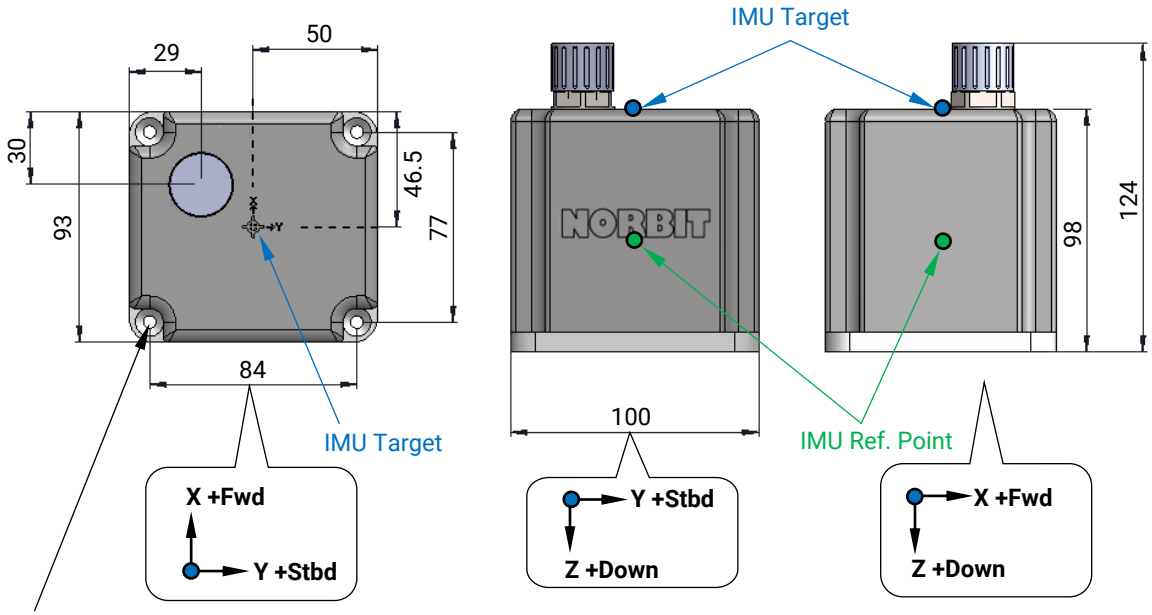


Weight: 0.9kg

Assembly Instructions:
1. Place fairing onto sonar.
2. Attach 4x M6x55mm screws through sonar.
3. Torque to 1Nm after all bolts are aligned.

Part No.	Description	Qty
451280	WINGHEAD Fairing Bumper	1
-	DIN 912 M6 x 55 – 24N	4

C7. IMU Detached (IMUd, PN 24036)



- For through-hole mounting, use M5 countersunk bolts.
- For direct attachment, use M6 bolts.

Note: The IMUd has a depth rating of 50m.

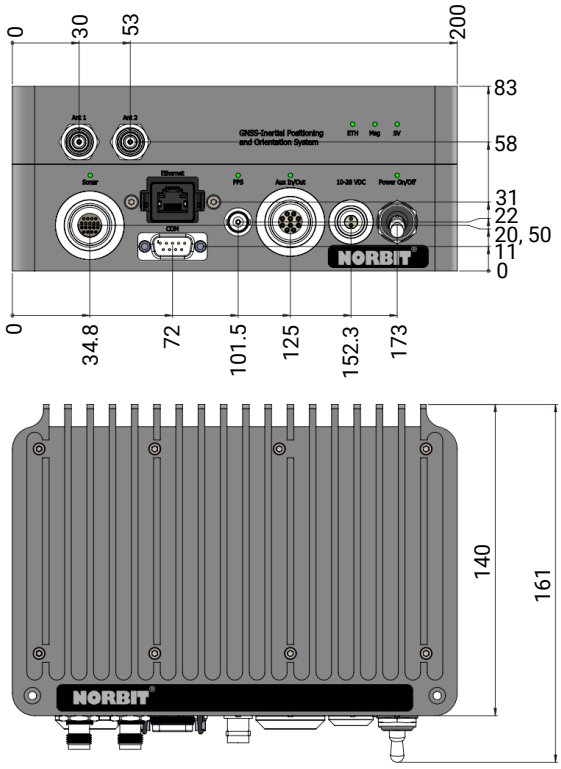
The IMU Reference Point is offset from the IMU Target marked on the top. The offsets and mounting angles are based on the default orientation (connector forward/port, X-axis forward, and Y-axis starboard).

IMU Type	Part No.	IMU Target to IMU Ref. Point			IMU Mounting Angles		
		X +Fwd	Y +Stbd	Z +Down	X	Y	Z
Type 82/89	24036-P2/P3	0.000 m	0.000 m	0.052 m	0.00°	0.00°	0.00°
Type 90	24036-P9	-0.005 m	0.000 m	0.075 m	0.00°	0.00°	90.00°
Type 94	24036-P4	-0.005 m	0.004 m	0.065 m	0.00°	0.00°	180.00°
Type 69	24036-P1	0.001 m	-0.015 m	0.076 m	0.00°	0.00°	-90.00°
Apogee	24036-PA	0.001 m	0.013 m	0.056 m	0.00°	-90.00°	0.00°
Ekinox	24036-PE	-0.002 m	-0.014 m	0.080 m	0.00°	0.00°	-90.00°

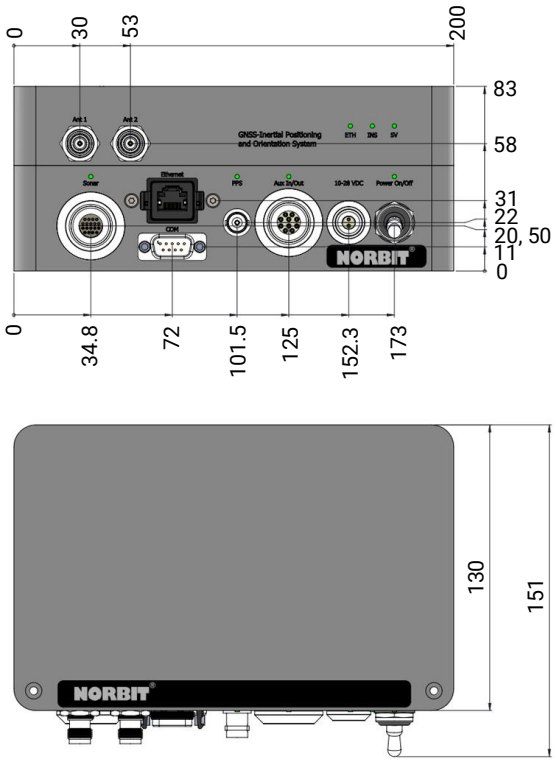
C8. Sonar Interface Unit

Integrated iSIU

PN 29093: Applanix AP+ | PN 29060: Applanix AP



PN 29088: SBG

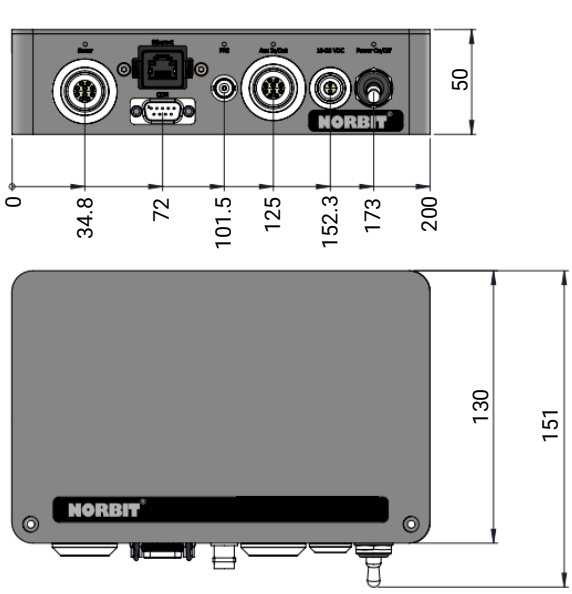


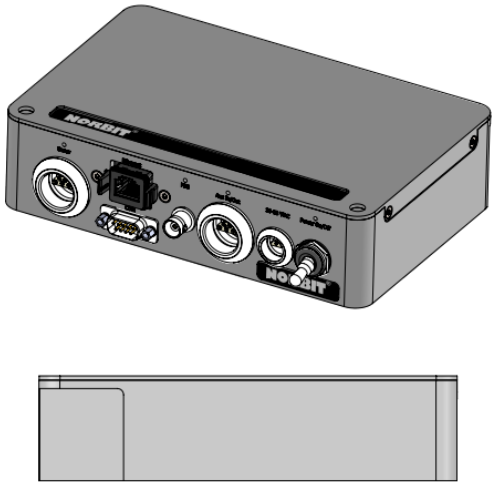
Weight: 2.3kg

Note: The INS LEDs at the top of the SIU vary by model. Refer to section 2.3.4.

Non-Integrated SIU

PN 29064





Weight: 1.5kg

Appendix D: Cables & Connectors

> ⚠ **CAUTION:** Several cable types appear visually similar but are not cross-compatible. Confirm the sonar connector type before connecting a cable and use only the original parts supplied with your system to ensure reliability and warranty coverage.

D1. Connector Identification

NORBIT sonars use 3 bulkhead connectors: 18-pin 318R, 18-pin 318E, and 24-pin. The connector type on your unit determines which cable and pinout information applies. Identify your connector visually using the images below.

318R Connector (18-pin)

Used on all WINGHEAD X and WBMS X models, and on most current WINGHEAD systems.

318E Connector (18-pin)

Still supported on several WINGHEAD models in the field.

24-pin Connector

Used on early revisions of depth-rated WINGHEAD models.

D2. Cable Options for 18-pin 318R Connector (Current Standard)

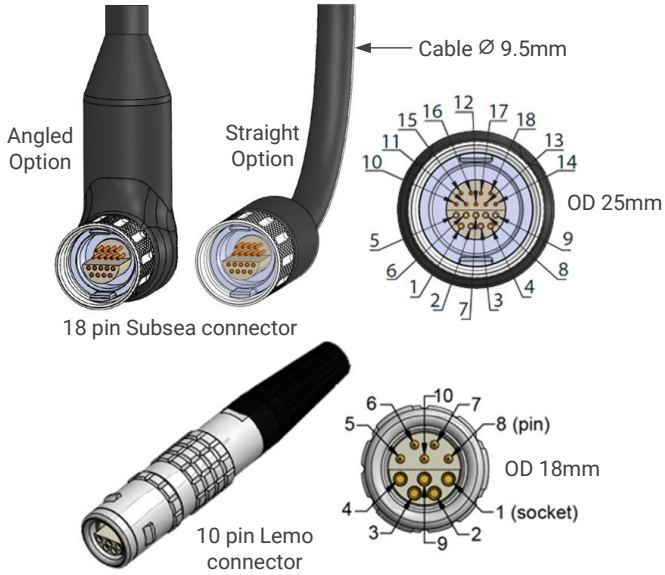
D2a. Integrated iSIU Cable (PN 33371)

Description: Connects the Integrated iSIU to sonars which contain the 18-pin 318R bulkhead connector.

Subsea (18-pin)	Topside (18-pin)	Function
1	3	PWR+
2	7	ETH1_A+
3	12	ETH1_A-
4	4	PWR+
5	5	IMU_A+
6	9	TIME+
7	14	TIME-
8	10	TIME_GND
9	18	IMU_C-
10	6	IMU_A-
11	11	Trigger_GND
12	16	TRIGGER-
13	15	TRIGGER+
14	17	IMU_C+
15	1	GND
16	8	ETH1_B+
17	13	ETH1_B-
18	2	GND

D2b. Non-Integrated SIU Cable (PN 33372)

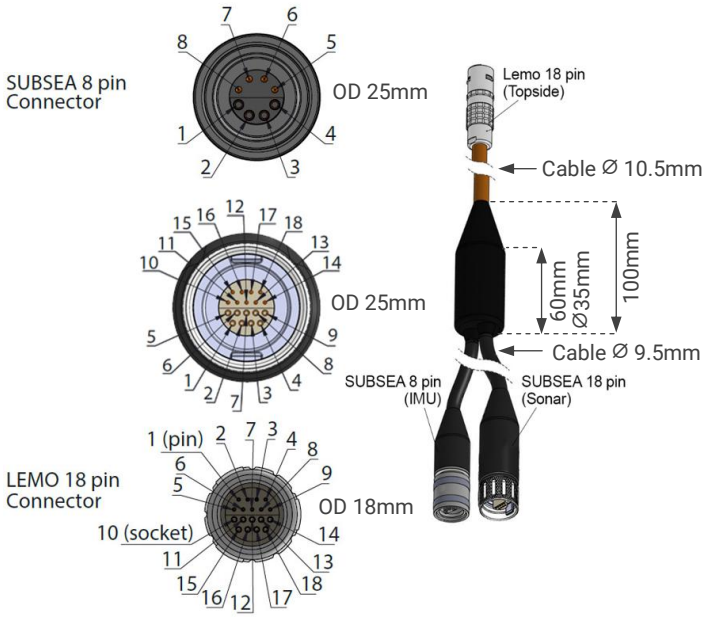
Description: Connects the Non-Integrated SIU to sonars which contain the 18-pin 318R bulkhead connector.



Subsea (18-pin)	Topside (10-pin)	Function
1	10	PWR+
2	1	ETH1_A+
3	2	ETH1_A-
4	10	PWR+
5	N/C	-
6	7	TIME+
7	8	TIME-
8	N/C	-
9	N/C	-
10	N/C	-
11	N/C	-
12	6	Trigger-
13	5	Trigger+
14	N/C	-
15	9	GND
16	3	ETH1_B+
17	4	ETH1_B-
18	9	GND

D2c. Integrated iSIU Split Cable (PN 33373)

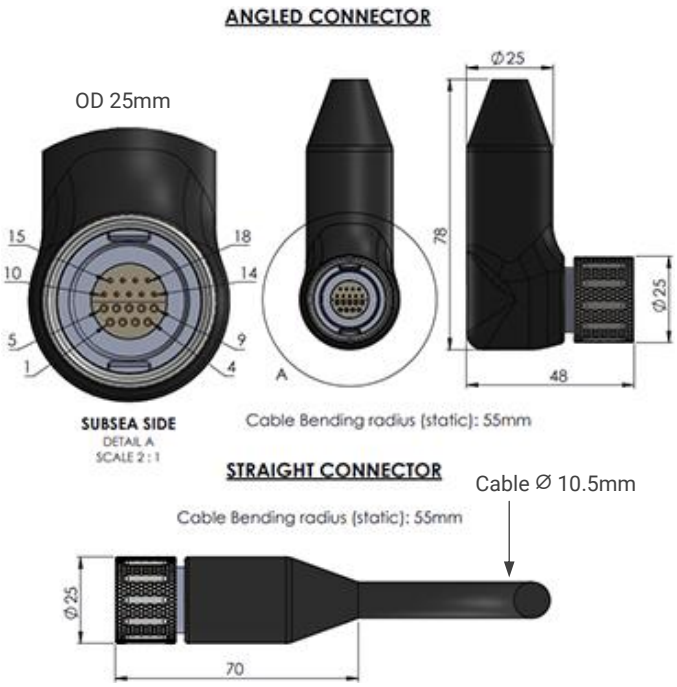
Description: Connects the Integrated iSIU to models which contain separate 8-Pin IMU (308E) and 18-pin sonar (318R) bulkhead connectors.



Topside (18-pin)	Subsea		Function
	18-pin	8-pin	
1	15	4	GND
2	18	4	GND
3	1	3	24 VDC
4	4	3	24 VDC
5	-	8	IMU COM1
6	-	7	IMU COM2
7	2	-	ETH1_A+
8	16	-	ETH1_B+
9	6	-	TIME+
10	-	6	IMU COM3
11	-	5	IMU COM4
12	3	-	ETH1_A-
13	17	-	ETH1_B-
14	7	-	TIME-
15	13	-	Trigger+
16	12	-	Trigger-
17	-	2	IMU COM8
18	-	1	IMU COM9

D2d. Subsea Sonar Interface Pigtail (PN 33370)

Description: ROV/AUV pigtail to interface with sonars which contain the 18-pin 318R bulkhead connector.

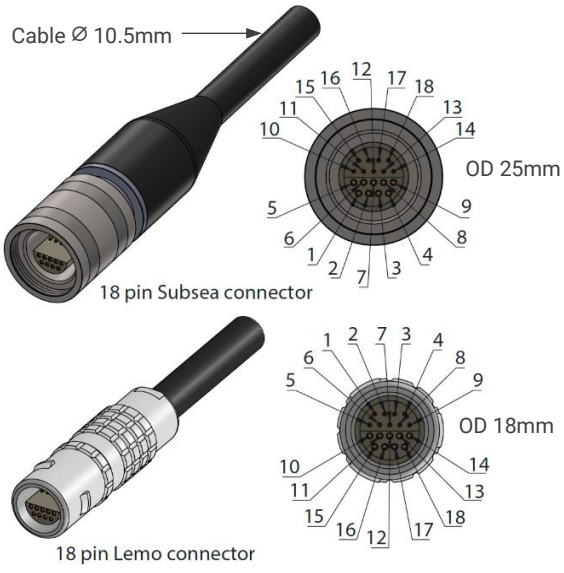


Pin	Function	Colour
1	PWR+	White
2	ETH1_A+	Black (red pair)
3	ETH1_A-	Red
4	PWR+	White
5	IMU_A+/ETH1_C+	Orange
6	TIME+	Brown
7	TIME-	Black (brown pair)
8	TIME_GND	Drain wire
9	IMU_C-/ETH1_D-	Black (green pair)
10	IMU_A-/ETH1_C-	Black (orange pair)
11	Trigger_GND	Drain wire
12	Trigger-	Black (white pair)
13	Trigger+	White
14	IMU_C+/ETH1_D+	Green
15	GND	Black
16	ETH1_B+	Blue
17	ETH1_B-	Black (blue pair)
18	GND	Black

D3. Cable Options for 18-pin 318E Connector (Legacy)

D3a. Integrated iSIU Cable (PN 33231)

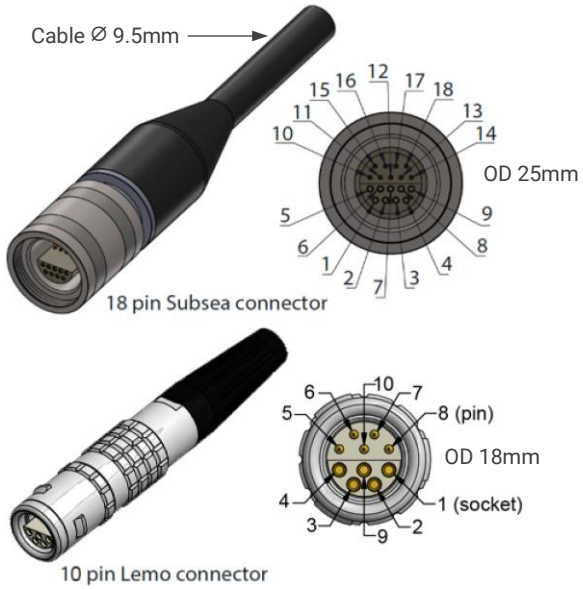
Description: Connects the Integrated iSIU to sonars which contain the 18-pin 318E bulkhead connector.



Subsea (18-pin)	Topside (18-pin)	Function
1	1	GND
2	2	GND
3	3	24 VDC
4	4	24 VDC
5	5	IMU COM1
6	6	IMU COM2
7	7	LAN, TX+
8	8	LAN, RX+
9	9	IRIG-B+
10	10	IMU COM3
11	11	IMU COM4
12	12	LAN, TX-
13	13	LAN, RX-
14	14	IRIG-B-
15	15	Trigger+
16	16	Trigger-
17	17	N/C
18	18	N/C

D3b. Non-Integrated SIU Cable (PN 33248)

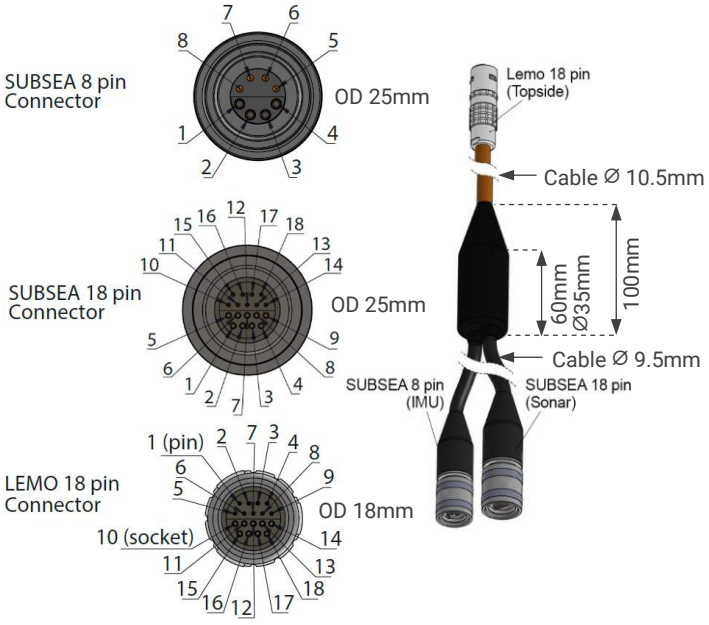
Description: Connects the Non-Integrated SIU to sonars which contain the 18-pin 318E bulkhead connector.



Subsea (18-pin)	Topside (10-pin)	Function
1	9	GND
2	9	GND
3	10	24 VDC
4	10	24 VDC
5	N/C	-
6	N/C	-
7	1	LAN, TX+
8	3	LAN, RX+
9	7	IRIG-B+
10	N/C	-
11	N/C	-
12	2	LAN, TX-
13	4	LAN, RX-
14	8	IRIG-B
15	5	Trigger+
16	6	Trigger-
17	N/C	-
18	N/C	-

D3c. Integrated iSIU Split Cable (PN 33273)

Description: Connects the Integrated iSIU to models which contain separate 8-Pin IMU (308E) and 18-pin sonar (318E) bulkhead connectors.



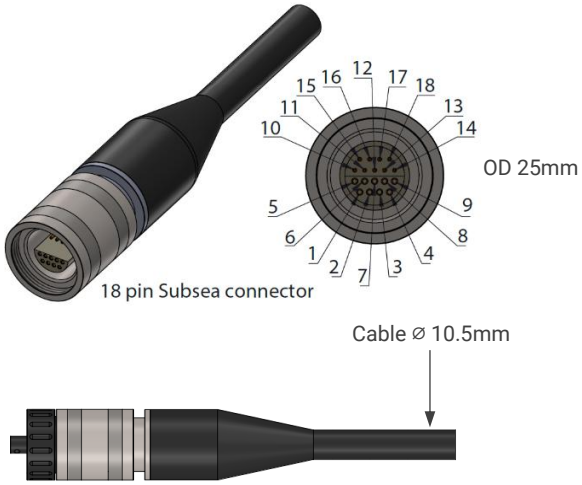
Topside (18-pin)	Subsea		Function
	18-pin	8-pin	
1	1	4	GND
2	2		GND
3	3	3	24 VDC
4	4	-	24 VDC
5	-	8	IMU COM1
6	-	7	IMU COM2
7	7	-	LAN, TX+
8	8	-	LAN, RX+
9	9	-	IRIG-B+
10	-	6	IMU COM3
11	-	5	IMU COM4
12	12	-	LAN, TX-
13	13	-	LAN, RX-
14	14	-	IRIG-B-
15	15	-	Trigger+
16	16	-	Trigger-
17	-	2	IMU COM8
18	-	1	IMU COM9

D3d. Subsea Sonar Interface Pigtail (PN 33272)

Description: ROV/AUV pigtail to interface with sonars which contain the 18-pin 318E bulkhead connector.

STRAIGHT CONNECTOR

Available in 2m and 8m lengths.



Pin	Function	Colour
1	GND	Black
2	GND	Black
3	24 VDC	White
4	24 VDC	White
5	N/C	-
6	N/C	-
7	LAN, TX+	White/Orange
8	LAN, RX+	White/Green
9	IRIG-B+	White/Blue
10	N/C	-
11	N/C	-
12	LAN, TX-	Orange
13	LAN, RX-	Green
14	IRIG-B-	Blue
15	Trigger+	White/Brown
16	Trigger-	Brown
17	N/C	-
18	N/C	-

D4. Cable Options for 24-pin Connector (Legacy)

D4a. Integrated iSIU Cable (PN 33228)

Description: Connects the Integrated iSIU to sonars which contain the 24-pin bulkhead connector.

Subsea (24-pin)	Topside (18-pin)	Function
1	9	TIME+
2	14	TIME-
3	N/C	-
4	1	PWR-
5	13	ETH_B-
6	8	ETH_B+
7	2	PWR-
8	7	ETH_A+
9	5	IMU_A+
10	11	IMU_B-
11	17	IMU_C+
12	N/C	-
13	12	ETH_A-
14	6	IMU_A-
15	10	IMU_B+
16	18	IMU_C-
17	N/C	-
18	3	PWR+
19	N/C	-
20	N/C	-
21	4	PWR+
22	N/C	-
23	16	TRIG-
24	15	TRIG+

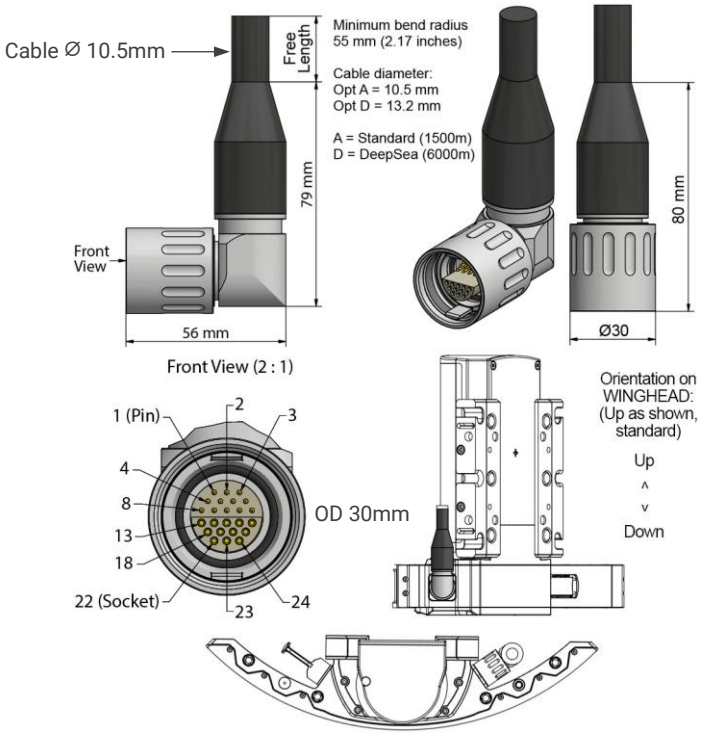
D4b. Non-Integrated SIU Cable (PN 33267)

Description: Connects the Non-Integrated SIU to sonars which contain the 24-pin bulkhead connector.

Subsea (24-pin)	Topside (10-pin)	Function
1	7	TIME+
2	8	TIME-
3	N/C	-
4	9	PWR-
5	4	ETH_B-
6	3	ETH_B+
7	9	PWR-
8	1	ETH_A+
9	N/C	-
10	N/C	-
11	N/C	-
12	N/C	-
13	2	ETH_A-
14	N/C	-
15	N/C	-
16	N/C	-
17	N/C	-
18	10	PWR+
19	N/C	-
20	N/C	-
21	10	PWR+
22	N/C	-
23	6	TRIG-
24	5	TRIG+

D4c. Subsea Sonar Interface Pigtail (PN 33256)

Description: ROV/AUV pigtail to interface with sonars which contain the 24-pin bulkhead connector.



Pin	Function	Comment
1	TIME+	TTL/RS422
2	TIME-	TTL/RS422
3	TIME_GND	TTL/RS422
4	PWR-	PWR GND
5	ETH_B-	1000BASE-T
6	ETH_B+	1000BASE-T
7	PWR-	PWR GND
8	ETH_A+	1000BASE-T
9	IMU_A+	RS422
10	IMU_B-	RS422
11	IMU_C+	RS422
12	ETH_C-	1000BASE-T
13	ETH_A-	1000BASE-T
14	IMU_A-	RS422
15	IMU_B+	RS422
16	IMU_C-	RS422
17	ETH_C+	1000BASE-T
18	PWR+	24-48VDC
19	ETH_D+	1000BASE-T
20	ETH_D-	1000BASE-T
21	PWR+	24-48VDC
22	TRIG_GND	TTL/RS422
23	TRIG-	TTL/RS422
24	TRIG+	TTL/RS422

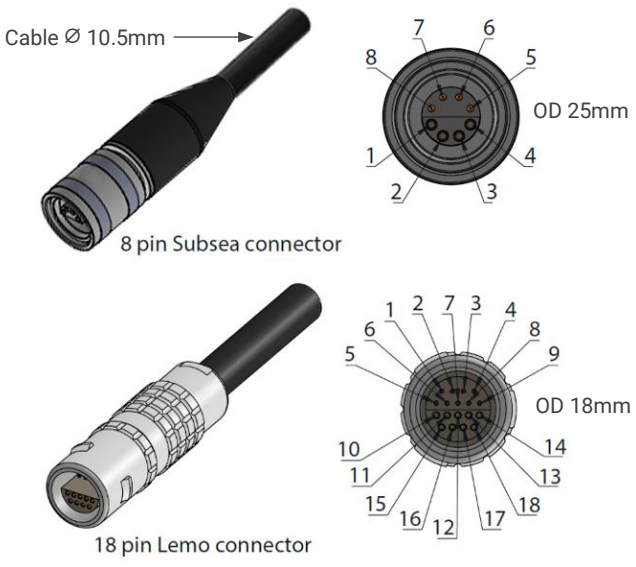
D4d. Subsea Sonar Interface Cable (PN 33264)

Description: ROV/AUV interface cable for vehicle integrators, with Titanium depth-rated connectors on both ends, for sonars which contain the 24-pin bulkhead connector.

Subsea (24-pin)	Topside (10-pin)	Function
1	7	TIME+
2	N/C	-
3	8	TIME_GND
4	9	PWR-
5	4	ETH_B-
6	3	ETH_B+
7	9	PWR-
8	1	ETH_A+
9	N/C	-
10	N/C	-
11	N/C	-
12	N/C	-
13	2	ETH_A-
14	N/C	-
15	N/C	-
16	N/C	-
17	N/C	-
18	10	PWR+
19	N/C	-
20	N/C	-
21	N/C	-
22	6	TRIG_GND
23	N/C	-
24	5	TRIG+

D5. IMU Detached (IMUd) Cable (PN 33172)

Description: Connects the Integrated iSIU (via the Sonar Port) to the IMUd (PN 24036) 8-Pin connector.

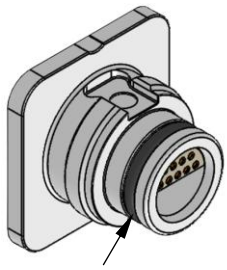


Topside (18-pin)	Subsea (8-pin)	Function
1	4	IMU GND
2	-	-
3	3	IMU 24 VDC
4	-	-
5	8	IMU COM1
6	7	IMU COM2
7	-	-
8	-	-
9	-	-
10	6	IMU COM3
11	5	IMU COM4
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	2	IMU COM8
18	1	IMU COM9

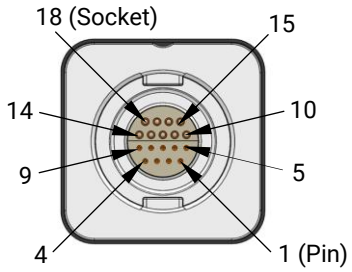
D6. Sonar Bulkhead Connectors & Pinouts

All connectors: 600 bar depth rating (mated), 300V contact rating, >5000 cycles endurance (IEC 60512-5 test 9a)

PN 33362/33360, 318R Connector (Current Standard)

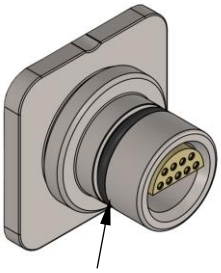


O-ring type: Parker 2-014
NBR 70 Ø12.42x1.78

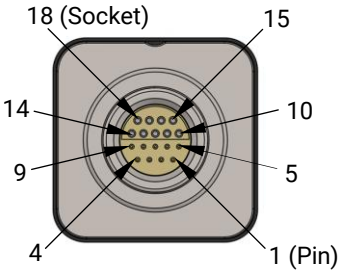


Pin	Function
1	PWR+
2	ETH1_A+
3	ETH1_A-
4	PWR+
5	IMU_A+/ETH1_C+
6	TIME+
7	TIME-
8	TIME_GND
9	IMU_C-/ETH1_D-
10	IMU_A-/ETH1_C-
11	Trigger_GND
12	Trigger-
13	Trigger+
14	IMU_C+/ETH1_D+
15	GND
16	ETH1_B+
17	ETH1_B-
18	GND

PN 33237, 318E Connector (Legacy)

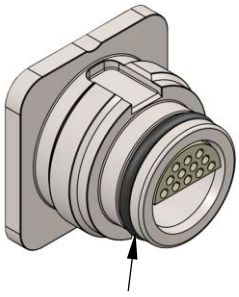


O-ring type: Parker 2-014
NBR 70 Ø12.42x1.78

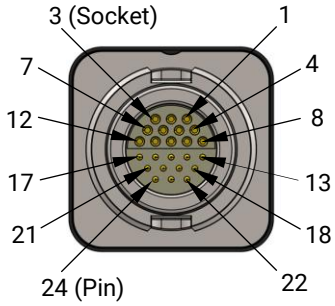


Pin	Function
1	GND
2	GND
3	24 VDC
4	24 VDC
5	IMU COM1
6	IMU COM2
7	LAN, TX+
8	LAN, RX+
9	IRIG-B+
10	IMU COM3
11	IMU COM4
12	LAN, TX-
13	LAN, RX-
14	IRIG-B-
15	Trigger+
16	Trigger-
17	IMU COM8
18	IMU COM9

PN 33227, 24-pin Connector (Legacy)



O-ring type: Parker 6-725
NBR 70 Ø16.56x1.78



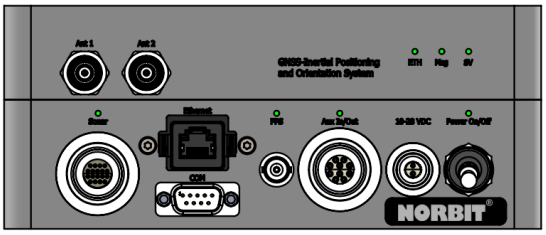
Note: Any NBR 70 ∅16.56 x 1.78mm O-ring can be used.

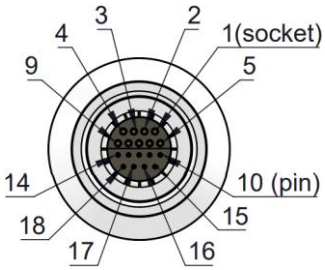
Pin	Function
1	TIME+
2	TIME-
3	TIME_GND
4	PWR-
5	ETH_B-
6	ETH_B+
7	PWR-
8	ETH_A+
9	IMU_A+
10	IMU_B-
11	IMU_C+
12	ETH_C-
13	ETH_A-
14	IMU_A-
15	IMU_B+
16	IMU_C-
17	ETH_C+
18	PWR+
19	ETH_D+
20	ETH_D-
21	PWR+
22	TRIG_GND
23	TRIG-
24	TRIG+

D7. Sonar Interface Unit Connectors & Pinouts

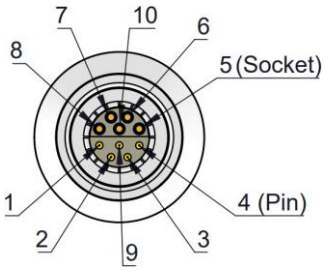
Integrated iSIU

PN 29093: Applanix AP+ | PN 29060: Applanix AP | PN 29088: SBG

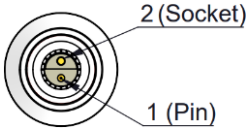




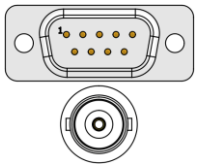
Sonar Socket	
Pin	**Function**
1	GND
2	GND
3	24 VDC
4	24 VDC
5	IMU COMM1
6	IMU COMM2
7	LAN, TX+
8	LAN, RX+
9	Time Out
10	IMU COMM3
11	IMU COMM4
12	LAN, TX-
13	LAN, RX-
14	Signal GND
15	Trig+ (RS422)
16	Trig- (RS422)
17	IMU COMM8
18	IMU COMM9



AUX Socket	
Pin	**Function**
1	LAN TX+
2	LAN TX -
3	LAN RX+
4	LAN RX-
5	Trig- (RS422)
6	Trig+ (RS422)
7	Time Out
8	Signal GND
9	PWR GND
10	PWR + 24 VDC



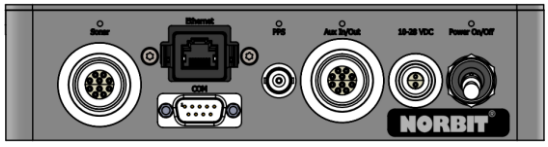
12-28 VDC Socket	
Pin	**Function**
1	PWR GND
2	PWR+12-28 VDC

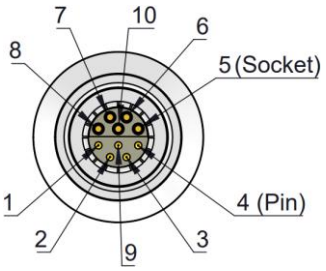


COM Socket / BNC	
Pin	**Function**
2	INS COM3 RX
3	INS COM3 TX
5	GND
9/BNC	PPS Out

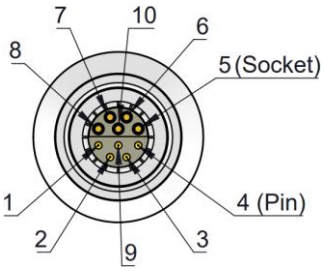
Non-Integrated SIU

PN 29064

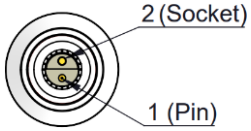




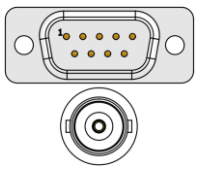
Sonar Socket	
Pin	**Function**
1	LAN TX+
2	LAN TX -
3	LAN RX+
4	LAN RX-
5	Trig+ (RS422)
6	Trig- (RS422)
7	Time Out
8	Signal GND
9	PWR GND
10	PWR + 24 VDC



AUX Socket	
Pin	**Function**
1	NC
2	NC
3	NC
4	NC
5	Trig- (RS422)
6	Trig+ (RS422)
7	NC
8	Signal GND
9	NC
10	NC



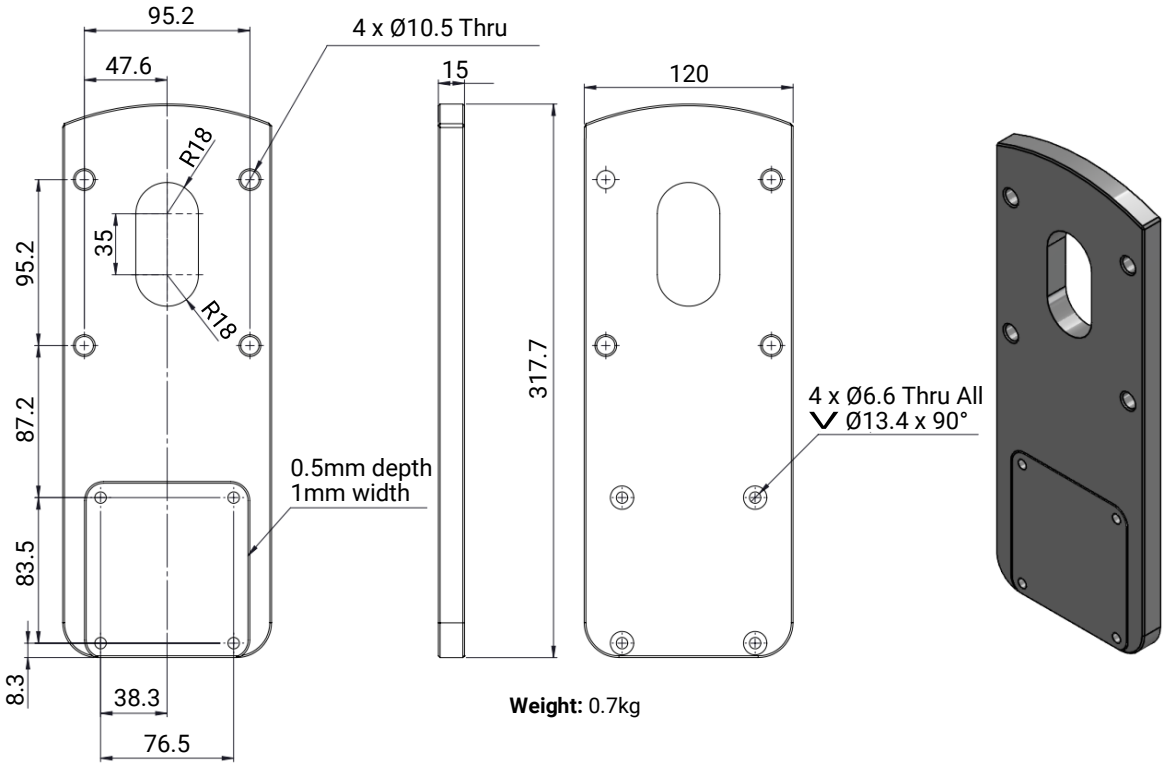
12-28 VDC Socket	
Pin	**Function**
1	PWR GND
2	PWR+12-28 VDC



COM Socket / BNC	
Pin	**Function**
2	ZDA In, RS232 RX
3	RS232 TX
5	GND
9/BNC	PPS In

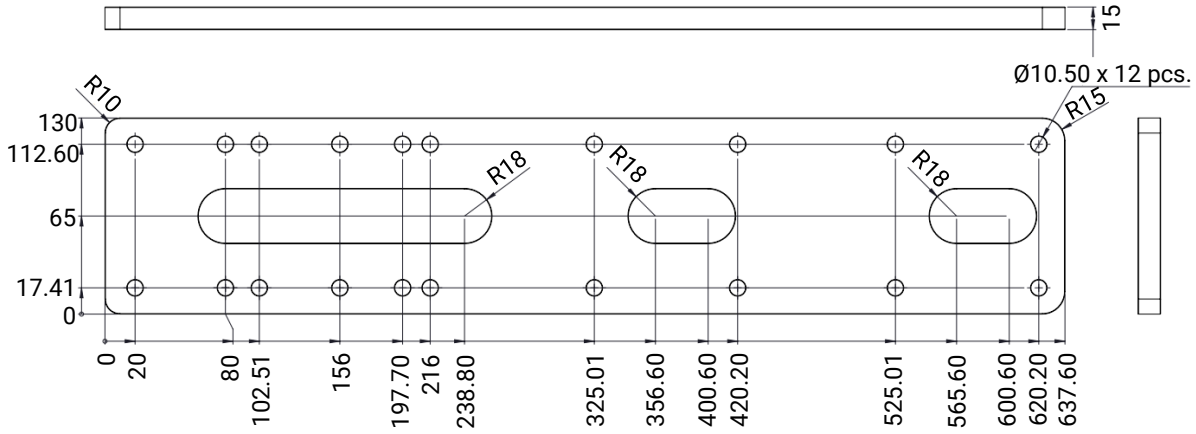
Appendix E: Mounting Hardware

E1. WINGHEAD Detached IMU (IMUd) Mounting Bracket (PN 451314)



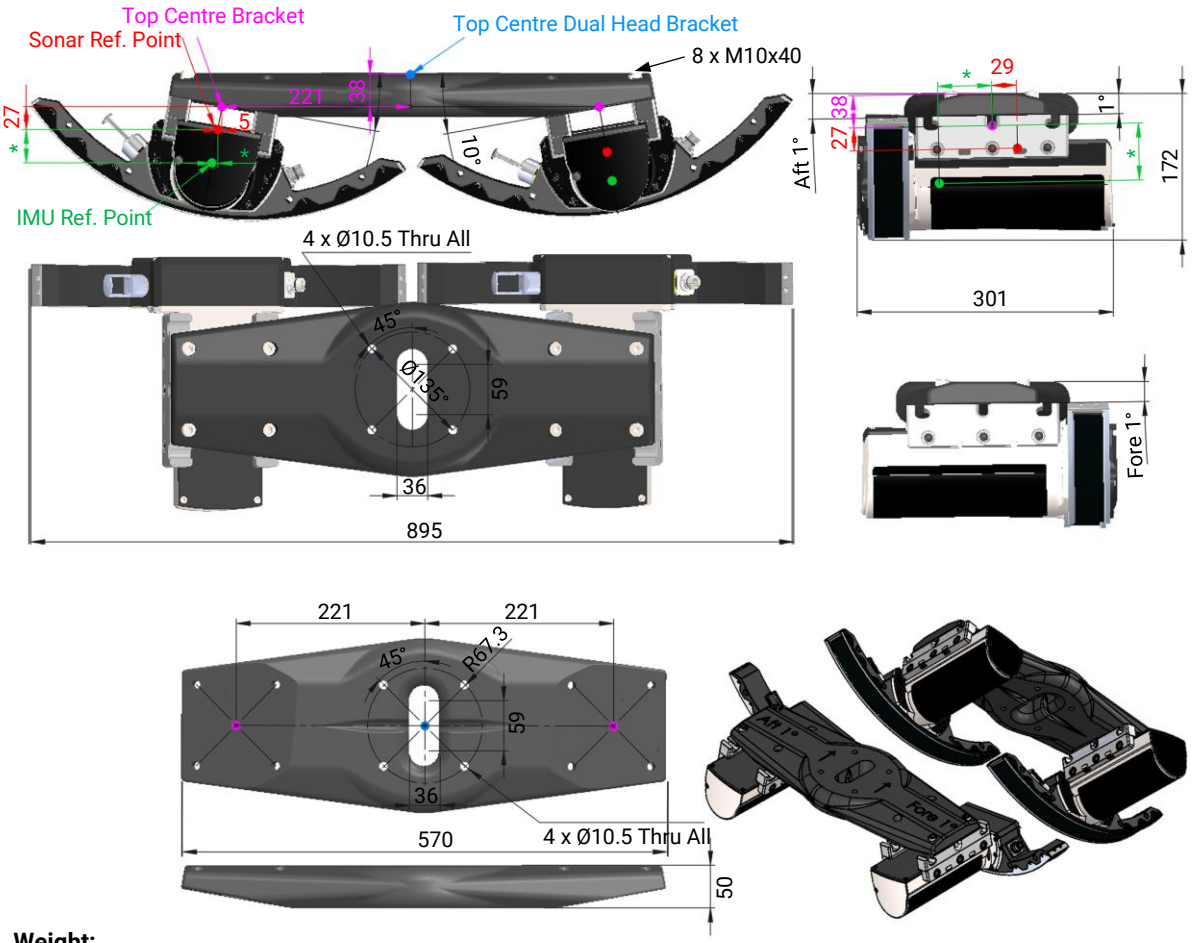
Weight: 0.7kg

E2. WINGHEAD Multi-Purpose Bracket (PN 451547)



Stainless steel bracket for dual head i80S/B51S in fore/aft configuration.

E3. Dual Head WINGHEAD Bracket (PN 35163)

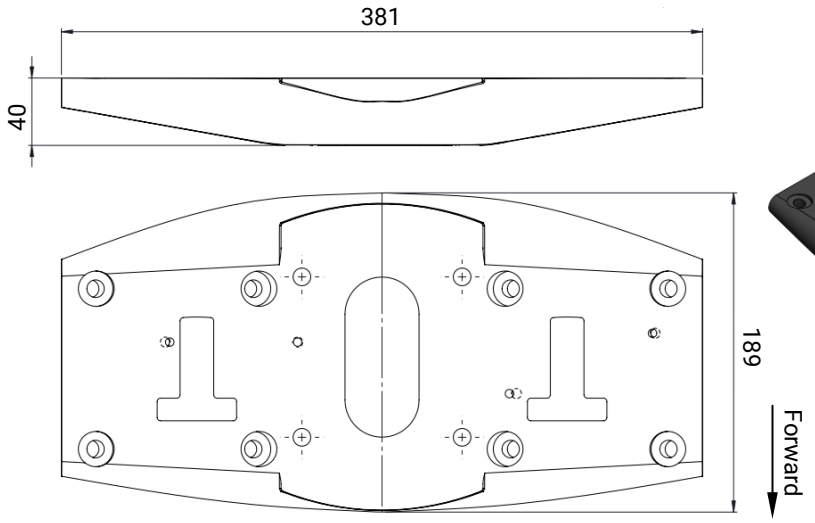


Weight:
i77h :19.9kg (air), 9.4kg (water)
B41 : 19.6kg (air), 8.8kg (water)

* IMU Ref. Point offset varies depending on the integrated IMU type. Refer to Appendix F.

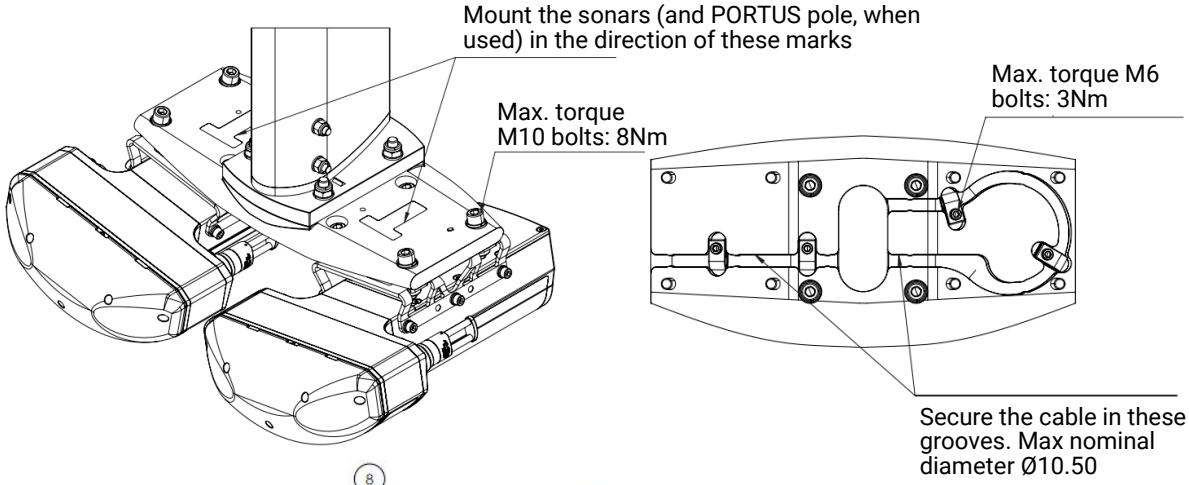
E4. Dual Head WBMS X Bracket (PN 452255)

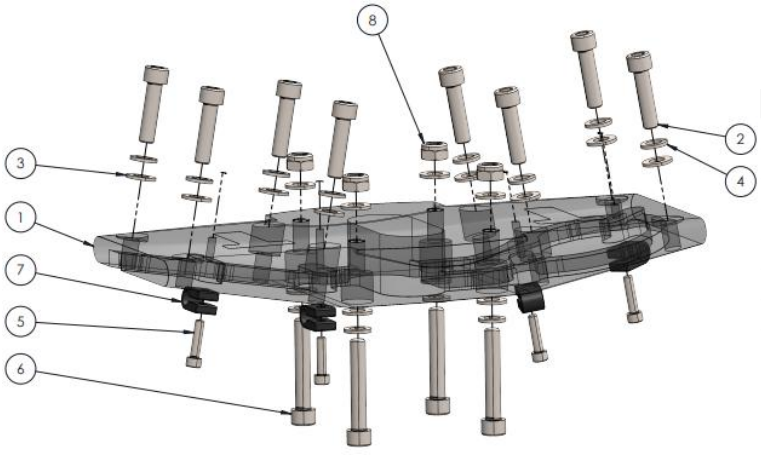
Dimensions



Refer to Appendix F2 for sonar offsets.

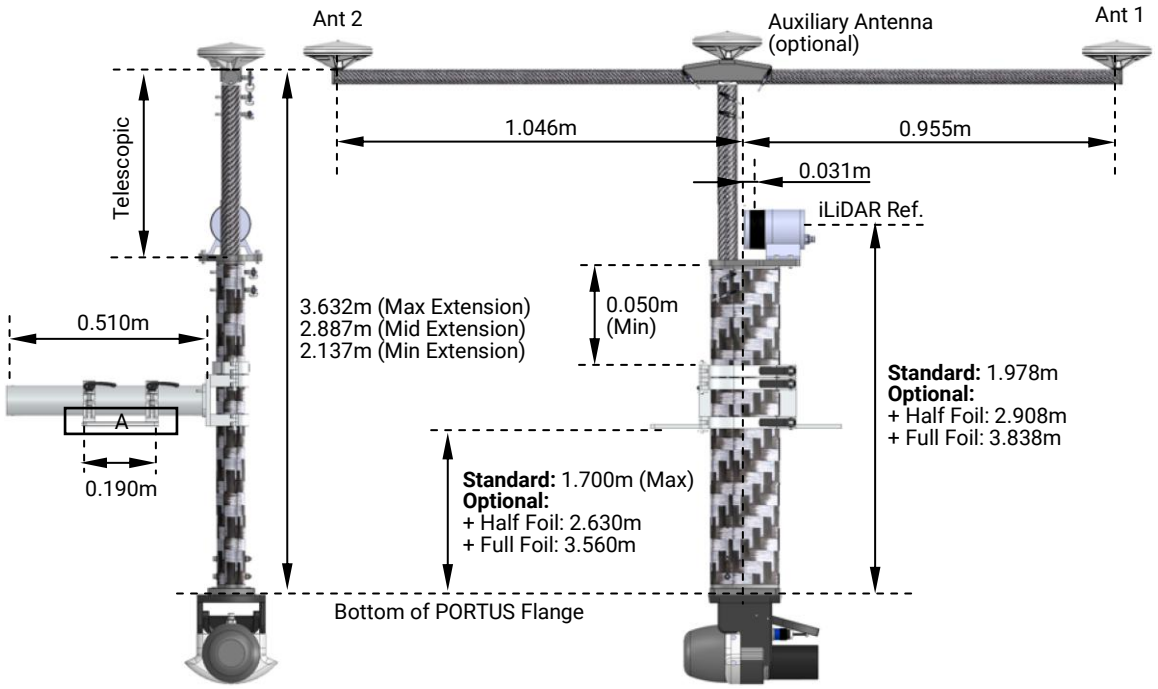
Mounting





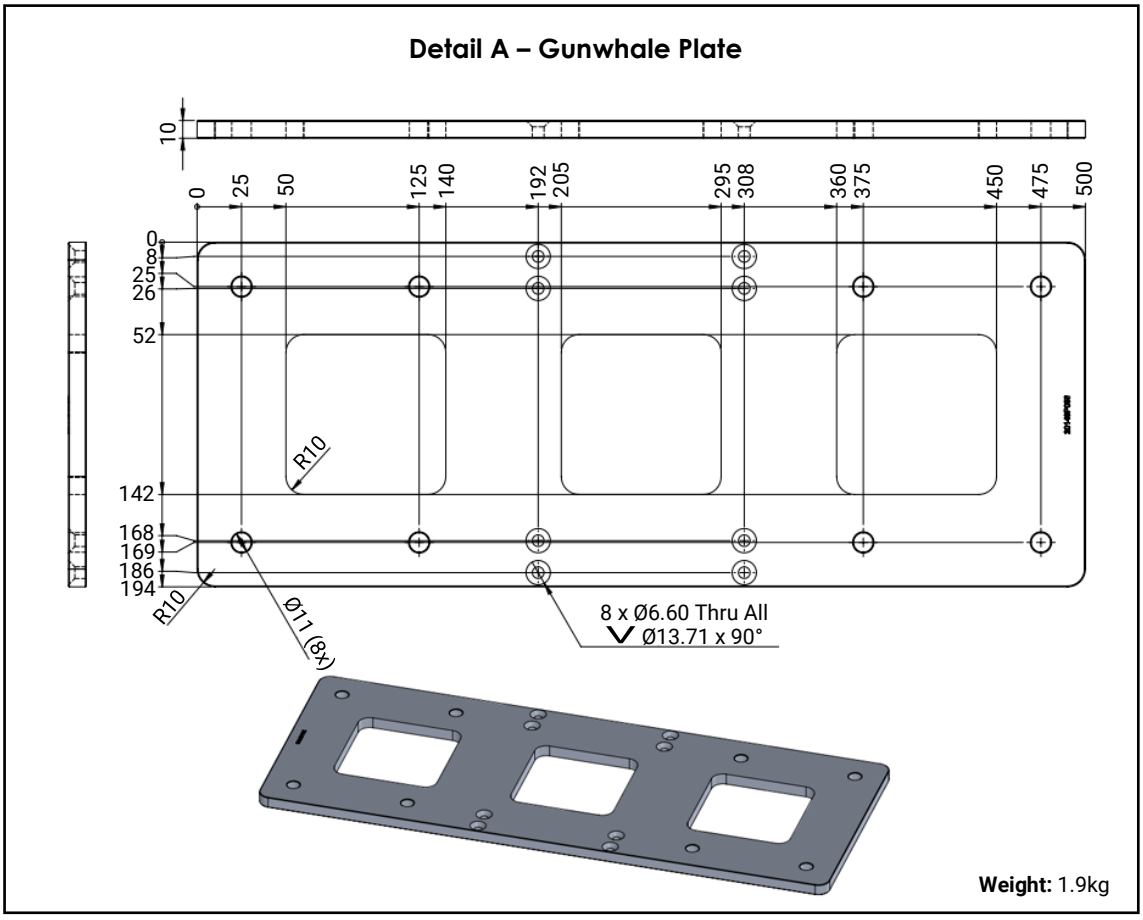
No.	Part	Qty
1	452255	1
2	Screw ISO4762 M10-40-A4	8
3	Washer DIN125 M10-A4	16
4	Washer DIN127 M10-A4	12
5	Screw ISO4762 M6-25-A4	4
6	Screw ISO4762 M10-60-A4	4
7	Propower cable cleat_NP0620	4
8	Nut DIN985 M10-A4	4

E5. NORBIT Carbon Fibre PORTUS Mounting Pole MKIII



Standard Foil Case Dimensions – with case and all hardware

Length: 200cm / 79” | Width: 33cm / 13” | Depth: 25cm / 10” | Total Weight: 27kg / 60lbs



Appendix F: IMU Mounting Angles & Offsets

NOTE: For systems with integrated GNSS/INS subsystems, the relevant offsets are automatically detected in the INS Setup Wizard. Therefore, knowledge of the IMU offset and internal mounting angles is not required. They are presented below for reference.

F1. WINGHEAD X

Single Head Configurations

Sonar Kit (Drawings: Appendix C)	IMU Type[1]	Sonar Ref to IMU Ref	IMU Angles	Sonar Ref to Top Centre of Bracket
WINGHEAD X	Applanix Type 94	**+Fwd:** 0.109 m **+Stbd:** 0.003 m **+Down:** 0.035 m	**X:** 90° **Y:** 0° **Z:** 90°	**+Fwd:** 0.029 m **+Stbd:** 0.000 m **+Down:** -0.027 m
	Applanix Type 89	**+Fwd:** 0.096 m **+Stbd:** 0.000 m **+Down:** 0.040 m	**X:** 0° **Y:** -90° **Z:** 180°	

Dual Head Configurations (Bracket PN 35163 with IMU installed on the port side)[2]

Sonar Kit (Drawings: Appendix C)	IMU Type[1]	Sonar Ref to IMU Ref	IMU Angles	Sonar Ref to Top Centre of Dual Head Bracket	Primary to Secondary Offset
WINGHEAD X	Applanix Type 94	**+Fwd:** 0.109 m **+Stbd:** -0.006 m **+Down:** 0.034 m	**X:** 89° **Y:** -10° **Z:** 90°	**+Fwd:** 0.029 m **+Stbd:** 0.226 m **+Down:** -0.064 m	**+Fwd:** 0.000 m **+Stbd:** 0.452 m **+Down:** 0.000 m
	Applanix Type 89	**+Fwd:** 0.096 m **+Stbd:** -0.007 m **+Down:** 0.039 m	**X:** 96° **Y:** -100° **Z:** 84°		

[1] Type 94/89 refers to the Applanix OceanMaster grade IMU (displayed under **INS Tools > System Status**).

[2] The dual head bracket (PN 35163) is shown in Appendix E3. For custom arrangements (e.g. different rotation angles, or IMU installed on the starboard side) please consult the technical note TN-190018. Contact NORBIT Support if you require this document.

F2. WBMS X

Single Head Configurations

Sonar Kit (Drawings: Appendix C)	IMU Type[1]	Sonar Ref to IMU Ref	IMU Angles	Sonar Ref. to Top Centre of Bracket
iWBMS Xh	Applanix Type 94	**+Fwd:** 0.109 m **+Stbd:** 0.003 m **+Down:** 0.035 m	**X:** 90° **Y:** 0° **Z:** 90°	**+Fwd:** 0.029 m **+Stbd:** 0.000 m **+Down:** -0.027 m
	Applanix Type 89	**+Fwd:** 0.096 m **+Stbd:** 0.000 m **+Down:** 0.040 m	**X:** 0° **Y:** -90° **Z:** 180°	
iWBMS X	Applanix Type 90	**+Fwd:** 0.119 m **+Stbd:** -0.012 m **+Down:** 0.035 m	**X:** 0° **Y:** -90° **Z:** 180°	
iWBMS Xe	Applanix Type 69	**+Fwd:** 0.123 m **+Stbd:** 0.000 m **+Down:** 0.041 m	**X:** 0° **Y:** -90° **Z:** 180°	
iWBMS X Ekinox	SBG Ekinox	**+Fwd:** 0.123 m **+Stbd:** 0.000 m **+Down:** 0.035 m	**X:** 0° **Y:** -90° **Z:** 180°	

Dual Head Configurations (Bracket PN 452255 with IMU installed on the port side)[2]

Sonar Kit (Drawings: Appendix C)	IMU Type[1]	Sonar Ref to IMU Ref	IMU Angles	Sonar Ref to Top Centre of Dual Head Bracket	Primary to Secondary Offset
iWBMS Xh	Applanix Type 94	**+Fwd:** 0.109 m **+Stbd:** -0.003 m **+Down:** 0.035 m	**X:** 90° **Y:** -10° **Z:** 90°	**+Fwd:** 0.029 m **+Stbd:** 0.131 m **+Down:** -0.055 m	**+Fwd:** 0.000 m **+Stbd:** 0.262 m **+Down:** 0.000 m
	Applanix Type 89	**+Fwd:** 0.096 m **+Stbd:** -0.007 m **+Down:** 0.039 m	**X:** 90° **Y:** -100° **Z:** 90°		
iWBMS X	Applanix Type 90	**+Fwd:** 0.119 m **+Stbd:** -0.018 m **+Down:** 0.032 m	**X:** 90° **Y:** -100° **Z:** 90°	**+Fwd:** 0.029 m **+Stbd:** 0.131 m **+Down:** -0.055 m	
iWBMS Xe	Applanix Type 69	**+Fwd:** 0.123 m **+Stbd:** -0.007 m **+Down:** 0.040 m	**X:** 90° **Y:** -100° **Z:** 90°	**+Fwd:** 0.029 m **+Stbd:** 0.131 m **+Down:** -0.055 m	
iWBMS X Ekinox	SBG Ekinox	**+Fwd:** 0.123 m **+Stbd:** -0.006 m **+Down:** 0.034 m	**X:** -90° **Y:** -10° **Z:** 90°	**+Fwd:** 0.029 m **+Stbd:** 0.131 m **+Down:** -0.055 m	

[1] Applanix OceanMaster: Type 94/89, WaveMaster: Type 90, SurfMaster: Type 69 (displayed under **INS Tools > System Status**).

[2] The dual head bracket (PN 452255) is shown in Appendix E4. For custom arrangements (e.g. different rotation angles, or IMU installed on the starboard side) please consult the technical note TN-190018. Contact NORBIT Support if you require this document.

F3. WINGHEAD

Single Head Configurations

Sonar Kit (Drawings: Appendix C)	IMU Type[1]	Sonar Ref to IMU Ref	IMU Angles	Sonar Ref to Top Centre of Bracket
WINGHEAD i77h & i79h	Applanix Type 94	**+Fwd:** 0.105 m **+Stbd:** 0.003 m **+Down:** 0.035 m	**X:** 90° **Y:** 0° **Z:** 90°	**+Fwd:** 0.029 m **+Stbd:** 0.000 m **+Down:** -0.027 m
	Applanix Type 89	**+Fwd:** 0.092 m **+Stbd:** 0.000 m **+Down:** 0.040 m	**X:** 0° **Y:** 90° **Z:** 0°	
	SBG Apogee	**+Fwd:** 0.204 m **+Stbd:** 0.005 m **+Down:** 0.034 m	**X:** -90° **Y:** 0° **Z:** 90°	
WINGHEAD i80S	Applanix Type 94	**+Fwd:** 0.253 m **+Stbd:** -0.011 m **+Down:** 0.028 m	**X:** 55° **Y:** 0° **Z:** 0°	**+Fwd:** 0.147 m **+Stbd:** 0.000 m **+Down:** -0.057 m
	Applanix Type 89	**+Fwd:** 0.248 m **+Stbd:** 0.002 m **+Down:** 0.024 m	**X:** -55° **Y:** 0° **Z:** 180°	
	SBG Apogee	**+Fwd:** 0.248 m **+Stbd:** -0.008 m **+Down:** 0.016 m	**X:** -90° **Y:** -35° **Z:** -90°	
WINGHEAD i80S LR	Applanix Type 94	**+Fwd:** 0.109 m **+Stbd:** 0.003 m **+Down:** 0.035 m	**X:** 90° **Y:** 0° **Z:** 90°	**+Fwd:** 0.029 m **+Stbd:** 0.000 m **+Down:** -0.027 m
	Applanix Type 89	**+Fwd:** 0.096 m **+Stbd:** 0.000 m **+Down:** 0.040 m	**X:** 0° **Y:** -90° **Z:** 180°	

Dual Head Configurations (Bracket PN 35163 with IMU installed on the port side)[2]

Sonar Kit (Drawings: Appendix C)	IMU Type[1]	Sonar Ref to IMU Ref	IMU Angles	Sonar Ref to Top Centre of Dual Head Bracket	Primary to Secondary Offset
WINGHEAD i77h & i79h	Applanix Type 94	**+Fwd:** 0.105 m **+Stbd:** -0.006 m **+Down:** 0.034 m	**X:** 89° **Y:** -10° **Z:** 90°	**+Fwd:** 0.029 m **+Stbd:** 0.226 m **+Down:** -0.064 m	**+Fwd:** 0.000 m **+Stbd:** 0.452 m **+Down:** 0.000 m
	Applanix Type 89	**+Fwd:** 0.092 m **+Stbd:** -0.007 m **+Down:** 0.039 m	**X:** 89° **Y:** 80° **Z:** 89°		
WINGHEAD i80S	Applanix Type 94	**+Fwd:** 0.253 m **+Stbd:** -0.005 m **+Down:** 0.028 m	**X:** 65° **Y:** -1° **Z:** 0°	**+Fwd:** 0.147 m **+Stbd:** 0.231 m **+Down:** -0.094 m	**+Fwd:** 0.000 m **+Stbd:** 0.462 m **+Down:** 0.000 m
	Applanix Type 89	**+Fwd:** 0.248 m **+Stbd:** -0.004 m **+Down:** 0.024 m	**X:** -65° **Y:** 1° **Z:** 180°		
WINGHEAD i80S LR	Applanix Type 94	**+Fwd:** 0.109 m **+Stbd:** -0.006 m **+Down:** 0.034 m	**X:** 89° **Y:** -10° **Z:** 90°	**+Fwd:** 0.029 m **+Stbd:** 0.226 m **+Down:** -0.064 m	**+Fwd:** 0.000 m **+Stbd:** 0.452 m **+Down:** 0.000 m
	Applanix Type 89	**+Fwd:** 0.096 m **+Stbd:** -0.007 m **+Down:** 0.039 m	**X:** 96° **Y:** -100° **Z:** 84°		

[1] Type 94/89 refers to the Applanix OceanMaster grade IMU (displayed under **INS Tools > System Status**).

[2] The dual head bracket (PN 35163) is shown in Appendix E3. For custom arrangements (e.g. different rotation angles, or IMU installed on the starboard side) please consult the technical note TN-190018. Contact NORBIT Support if you require this document.