

UM-8250/UM-8251

Marksman L/USBL, Ranger 2 USBL/Survey/DP
V6.04 User Manual

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Amendment History

The amendment history records all amendments and additions made to this manual.

Issue	Revision	Date	Comments	Section	Page
A	1	13-10-2010	Revised to support Marksman Ver 2	All	All
A	2	19-12-2010	Added support for DP INS application	Ch 4 App G	All P209 to end
A	3	19-08-2011	Updated throughout for v 3.01	All	All
A	4	16-12-2011	Update Lodestar configuration details Update Figure 12 Update Figures 58 to 60 Add dual-redundant system wiring diagram	2.13 4.2 App G 6.4	All P 98 App G P117
A	5	15-06-2012	Add details for Ranger 2 Pro	All	All
A	6	13-10-2013	Updated throughout	All	All
A	7	11-05-2014	Revised throughout	All	All
B	1	01-02-2015	Updated for V4.02 Revised throughout	All	All
B	2	24-09-2015	Updated for V4.03 Revised throughout	All	All
B	3	01-02-2016	Updated for V4.04 Revised throughout	All	All
B	4	10-07-2016	Updated for V4.05 Revised throughout	All	All
B	5	06-11-2017	Updated for V4.06 Revised throughout	All	All
C	1	23-08-2018	Updated for V6.00 Revised throughout	All	All
C	2	25-10-2019	Updated for V6.01 Revised throughout	All	All
C	3	01-09-2020	Updated for V6.03 Revised throughout	All	All
C	4	01-11-2020	Updated for V6.03.02 Revised throughout	All	All
D	1	27-07-2022	Updated for V6.04 Now incorporates UM-8251 Ranger 2 USBL specific content Formatted with new branding	All	All

Section 1 – Introduction

1.1 Scope of this Manual

This manual refers to the Marksman, Ranger 2 USBL/Survey/DP system, manufactured by Sonardyne International Limited. It provides important information about the system, and offers advice on how to use the system safely and effectively.

Sonardyne International Limited operates a series of training courses that explain the theory and practice of the system.

1.2 Purpose of this Manual

This manual contains information for anyone involved with installing, using or maintaining the system. It includes technical and user information to deliver the best performance from the system.

Anyone using this system must ensure they read and understand the relevant parts of this manual.

This manual may be printed in part or whole by the user but cannot be copied or changed. Copyright of this manual remains with Sonardyne International Limited at all times.

1.3 Related Publications

The following publications can be referred to in conjunction with this manual.

Table 1–1 Related Publications

Publication	Title
<i>Sonardyne Safety Manual</i>	<i>Operational and Safety Precautions</i>
<i>QSG-SC-8251</i>	<i>Quick Start Guide, Ranger 2 System Configuration</i>
<i>QSG-SC-8250</i>	<i>Quick Start Guide, MRAMS</i>
<i>UM-8026-MC</i>	<i>User Manual for the Type 8026 Marine Computer</i> (supplied with the Marine Computer)
<i>UM-8098</i>	<i>User Manual for Navigation Sensor Hub</i> (supplied with the NSH)
<i>UM-8142</i>	<i>User Manual for the HPT</i> (supplied with the HPT)
<i>UM-7950</i>	<i>User Manual for Through-Hull Transceiver Deployment Machine</i>
<i>UM-8300-099</i>	<i>User Manual for 6G Terminal Lite</i>

1.4 Conventions

The following conventions are used in this manual.

Table 1–2 Conventions used in this Manual

Format	Conventions
Boldface Type	User Input, Menu Options, Keys, e.g. Click OK
<i>Italic Type</i>	References to Figures, Tables, Sections and other internal/external source
Arrow (>)	Selection of an additional menu item e.g. File > Save

Section 2 – Safety

2.1 Introduction

Before any activity is carried out on this system, it is recommended that the included Safety Manual and all warnings and cautions in this manual are read and understood.

It is recommended the operator complies with the Health and Safety Regulations applicable to the vessel and the region before operating this equipment.

Operators and service personnel must be familiar with the normal operating and safety procedures for subsea equipment.

Documentation must be consulted whenever a  or  warning symbol is found on the equipment, in order to determine the nature of the potential hazard and any actions which must be taken.

If any additional equipment is used, any warnings and cautions in the equipment user manual must be read and fully understood and the equipment must only be used as specified by the manufacturer.

The safety of any system incorporating this equipment is the responsibility of the assembler of the system.

2.2 Safety Procedures

Warning and Caution terms used in this manual are described below:

- Warning: indicates potential for property damage, personal injury or death.
- Caution: indicates potential for damage to hardware, malfunction or loss of data.

2.2.1 Warnings

 **Personal protection.** Appropriate protective equipment such as protective footwear, hard hat and gloves must be worn when handling or carrying out any procedures involving Sonardyne and other equipment.

 **Heavy Equipment.** Many Sonardyne products and equipment types, such as transponders, transceivers, cable drums etc. require Manual Handling Equipment (MHE) for lifting due to their heavy weight. If MHE is not available, it is the responsibility of the operator to perform a manual handling risk assessment prior to carrying out manual lifting/handling. Refer to the individual equipment documentation for weight specifications.

 **Risk of impact injury.** Do not stand in line with the end-cap when removing from beacon. Any internal pressure could rapidly force the end-cap from the beacon like a projectile.

 **Risk of crush injury.** Do not stand underneath suspended equipment.

 **Risk of crush injury.** Do not place hands near a Release Mechanism when in operation. The mechanism is opened with a high pressure spring which could trap fingers.

 **Risk of crush injury.** A Gyro USBL must only be lifted by the lifting eyes supplied with the equipment.

 **Risk of crush injury.** The Dunker 6 restraining cables must not be used if corroded or damaged as this could cause the Dunker 6 to drop suddenly.

 **Risk of burns.** If the battery pack has been exposed to flooding, corrosive liquids may be present. Personal protective equipment, such as gloves and goggles, must be worn to handle the battery

pack.

 **Risk of burns.** Do not carry out maintenance on a transceiver if the housing is hot. Lower the transceiver into cold water and wait for the housing to cool. Wear Personal Protective Equipment such as gloves.

 **Risk of Asphyxiation.** Only trained personnel must be allowed to work in confined spaces in general and in the sea-chest in particular. Make sure there is always an adequate supply of fresh air available inside the confined space.

 **Molykote 44 is a mild irritant.** When lubricating the connector faces, personal protective equipment such as gloves and goggles must be worn.

 **Risk of fire.** Make sure the power rating of any cables used is not exceeded.

 **Risk of Electric shock.** Do not push metal objects into the computer openings and keep metal objects away from connectors as this may result in short circuits, fire or electric shock.

2.2.2 Cautions

 **Compass safe distance.** The NSH and connecting cables should not be mounted within 5 metres of a navigational compass.

 **Installation Recommendation.** It is recommended that hardware installations are located at least 10 metres from any VHF radio antennae operating in the 156-165 MHz band.

 **Installation Recommendation.** This equipment is intended to be used (and draw its power) within the Bridge and deck zone of the ship. The BS IEC 60533 -1999 standard, Electrical & Electronic Installations in Ships, makes certain recommendation [see emission limits Table 3] to help aid protection in this specific zone. It requests that an inline RFI filter is to be installed in the power supply circuit between this zone and all other general power distribution zones. This filter is to be capable of achieving a decoupling of about 30 dB in the frequency range of 10 kHz to 30 MHz. This is the normal, anticipated practice and is stated here to secure EMC installation integrity.

 **Installation Recommendation.** It is advisable to use a power outlet with a surge protector fitted. Preferably the Marine Computer and NSH should be supplied with power from an Uninterruptible Power Supply (UPS) to prevent vessel power interruptions affecting the operation.

 **Loss of Data Risk.** Damage can occur to the hard disk or data corruption by switching off system power when the hard disk is reading or writing data. Do not switch off system power until after you have shut down the system correctly.

 **Network connection failure.** Connection of the Marine Computer and NSH to anything other than a closed private network or approved Sonardyne devices is at the risk of the operator. Sonardyne International Limited accepts no responsibility for network connections and configurations.

 **Risk of equipment damage.** All instruments must be maintained according to their individual operating manuals. Failure to follow recommended procedures could result in instrument failure, and loss of system integrity.

 **Risk of equipment damage.** When the Marine Computer is operating in critical vessel operations, external devices must not be connected/disconnected and the front panel must be kept in the upright closed position. The USB ports and SATA drive can be sensitive to Electrostatic Discharge (ESD) under certain conditions which could result in the computer malfunctioning.

 **Risk of equipment damage.** Make sure that the Marine Computer chassis and the NSH chassis are correctly installed in a rack or a console, and are provided with adequate fixings and support to avoid

damage from vibration.

 **Risk of equipment damage.** Make sure the Marine Computer chassis and the NSH chassis receive an adequate cool air supply to avoid damage caused by overheating.

 **Risk of equipment damage.** There are no user-serviceable parts inside the Marine Computer or the NSH, except for the external filters for the cooling fans. Do not attempt to open these items.

 **Risk of equipment damage.** Make sure the Marine Computer and NSH have an earth lead connected to the chassis earth at the rear of the computer when rack mounted.

 **Risk of equipment damage.** Do not operate the Marine Computer and NSH with any of the ventilation openings blocked or covered.

 **Risk of damaging connectors.** Do not move the Marine Computer or NSH with cables connected.

 **Risk of equipment malfunction.** This product makes use of Microsoft Windows which is not intended for use in any system where failure or fault of any kind of the Product could reasonably be seen to lead to death or serious bodily injury of any person, or to severe physical or environmental damage ("High Risk Use"). High Risk Use is **STRICTLY PROHIBITED**.

 **Risk of equipment malfunction.** For DP applications, the owner and operator must ensure that the DP control system accepts the position estimate and quality factors published by the system in the output telegram, and that it uses the quality factors to weight the estimate appropriately. Failure to do so can result in loss of system integrity. Refer to *Appendix E* for descriptions of the output telegram formats.

 **Risk of equipment malfunction.** When a vessel is used for critical operations such as drilling, work over operations where attached to a live well, or diver operations, it is recommended that:

- for LUSBL mode, five or more transponders should be deployed.
- for DP-INS mode, three or more transponders should be deployed.

Loss of system integrity can occur if you use fewer than the recommended minimum number of beacons.

 **Risk of equipment malfunction.** Do not operate multiple beacons on the same address in the water at the same time. The address must be unique to any one beacon operating in the same acoustic area.

 **Risk of equipment malfunction.** Minimise any sources of high-level acoustic noise in the MF band. Examples of such noise sources include ROVs, vessel thrusters, and other vessels using acoustic positioning. High noise levels can disrupt the acoustic measurements and lead to loss of system integrity.

 **Risk of equipment malfunction.** Do not ignore a system alarm because this can lead to incorrect operation. Investigate the cause of any system alarms, and make appropriate corrections for them.

 **Risk of equipment malfunction.** Review the system event log periodically (particularly the Warnings and Alarms categories). Investigate any unexplained events, particularly repeated warnings, and make any appropriate corrections.

 **Risk of equipment malfunction.** Mandatory software and firmware update notices must be applied as soon as practically possible.

 **Risk of equipment malfunction.** It is recommended that hull gate valves are exercised at least once a month to prevent build-up of marine growth, etc. that could cause the mechanism to seize. A failed gate-valve prevents maintenance of the USBL transceiver being carried out.

 **Risk of equipment malfunction.** Before carrying out hull gate valve maintenance, please deselect the PME from DP system and turn off vessel tracking. After the maintenance, restart tracking, reset

the Lodestar (if fitted), allow tracking to stabilise and reselect the PME in the DP system.



Risk of equipment damage. Acoustic transceivers and Lodestar units contain delicate transducers and motion sensing elements. Take care to protect this equipment during and after installation by following all the instructions in the user manual.



Risk of equipment damage. To avoid galvanic corrosion of the USBL transceiver housing, make sure it is electrically isolated from surrounding metalwork by following all the instructions in the installation manual.



The Deployment Machine and gate valve software control must only be configured once the Deployment Machine has been set to work by a suitably qualified person. Failure to do so may result in equipment and/or vessel damage.

Section 3 – System Overview

3.1 Introduction

This is the user manual for the Marksman, Ranger 2 USBL/Survey/DP systems developed by Sonardyne International Limited. The following topics are covered:

- A description of the system.
- Information to help you operate and setup the system correctly.
- A description of the software.
- Instructions to help you calibrate the system.
- Instructions to complete all the procedures you are likely to need during an operation.
- Information to help you recognise a possible fault condition and to help you solve it.

The manual also includes additional background information that you can refer to if necessary. This additional information is included in a series of appendix chapters:

- Instructions on how to use the electronic version of this manual and how to find the information you need quickly.
- A brief explanation of how the acoustic navigation system works.
- General guidance to help engineers install the system's hardware and software .
- Detailed descriptions of the individual dialog boxes included in the software.
- Information about the various error messages and alarms that you might experience when you are using the system.
- Additional reference information, including a glossary of terms used.

The software images shown in this manual are captured using Marksman software unless the item is specific to Ranger 2. The small identification logo in the top left of the window identifies the software type.

Note

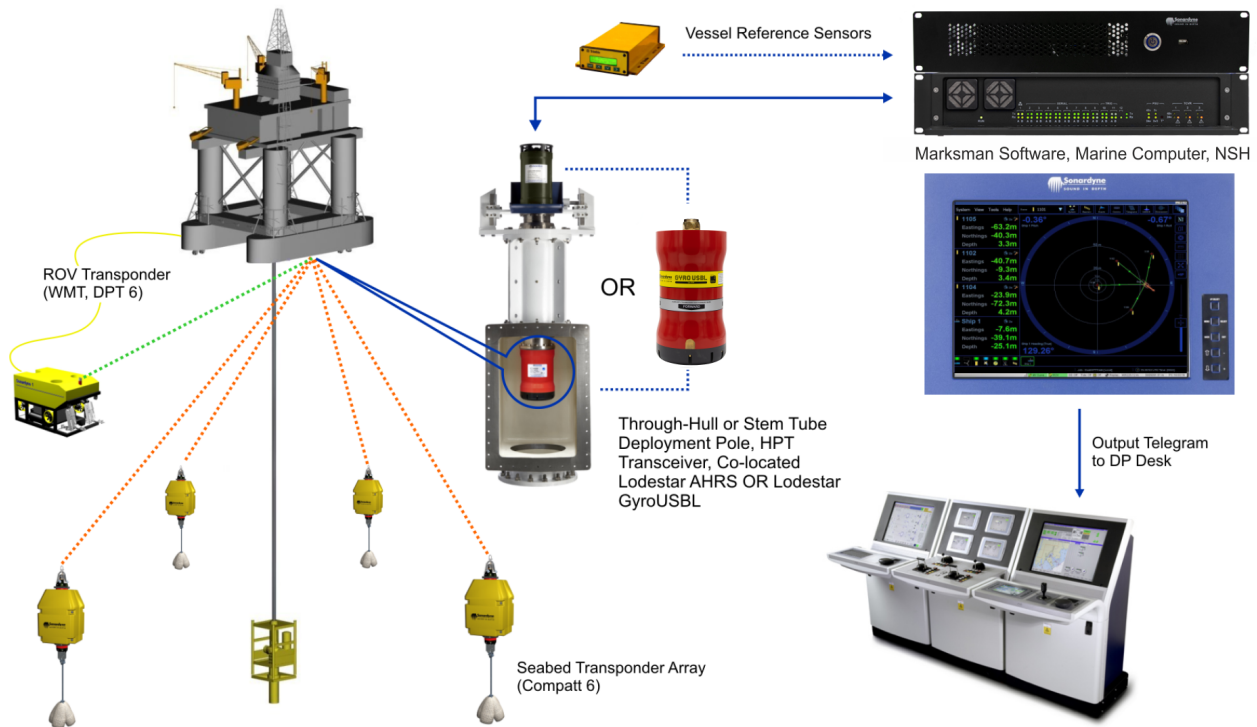


Some features shown here may not be available, depending on the exact product and options purchased.

3.2 Typical System

Figure 3–1 shows an example of a typical system. It consists of sub-systems installed on the surface vessel and sub-systems deployed in the water.

Figure 3-1 Typical Marksman, Ranger 2 USBL/Survey/DP System



The architecture is highly scalable from a basic shallow water USBL system up to a highly redundant deep water DP reference system.

3.2.1 Surface Units

The surface installation provides a human interface for the system, and allows peripheral devices to be used with the system.

The Navigation Processor includes single or dual monitors (optionally with touch screen capability), a keyboard, and a mouse or other pointing device.

The system can also integrate into an active bridge console if the vessel has this facility.

Sonardyne has developed the software that runs on the Navigation Processor especially for this system. It allows you to:

- configure the overall installation
- set up the system for each operation, and to save the set-up details
- change the set-up during an operation if necessary
- operate the system
- display the positioning information
- identify and react to any errors and alarm messages that occur
- set up interfaces between the system and peripheral devices such as a printer, vertical reference unit, gyrocompass, and dynamic positioning navigation system

Each of these tasks is described within this manual.

3.2.2 In-Water Units

The in-water units are the acoustic transceivers and acoustic beacons.

The acoustic transceivers communicate with an array of reference transponders that are either tethered on the seabed or are mounted on mobile platforms operating in the area.

Accurate measurements of the time taken for each of the transponders to respond to a signal from the transceiver allows the system to compute its relative position with respect to the beacon array.

3.2.2.1 Control

The transceivers are connected to the Navigation Processor and are controlled by it according to the instructions defined by the system set up.

The transponders use battery packs to provide operating power for extended in-water deployments. Each of the transponders can be set up before being deployed in the water. Beacon set-up parameters include their listening and response channels within their operating band; their individual address details; their response turn-around time (TAT); their listening sensitivity and their transmit power. After deployment, these parameters can be changed remotely through a secure acoustic link from the Navigation Processor.

Note



Refer to the manual supplied with the transceiver or beacon for detailed information about the unit.

3.2.2.2 Operating Range

The system's operating range depends on several factors, including:

- the frequency used for acoustic transmissions
- local water temperature and salinity profiles
- receiver sensitivity and transmission power settings for the transceiver and beacon
- vessel noise

3.3 Transceivers

Under software control, the transceivers emit acoustic interrogation or command signals into the water, and receive acoustic responses from the transponders. They then communicate these responses to the software for display and logging.

The system can use a range of alternative transceiver types supplied by Sonardyne International Limited. This User Manual includes generic information about the transceiver only. For specific technical information about a Sonardyne transceiver type for use with the system, see the transceiver's user manual.

See *Appendix G "Acoustic Positioning Methods"* for an explanation of the method that the system uses to calculate position information.

3.4 Beacons

Beacons (or transponders) listen for acoustic signals from the transceivers, and respond with a reply when required.

Several beacons can be assigned the same interrogation signal, often called a 'common interrogation' signal. They each reply on their 'individual reply' signal.

Depending on the nature of the interrogating signal, a beacon can either respond to a signal addressed to it individually, or can respond to a common interrogation signal that produces a response from all

transponders in the system. See *Appendix G "Acoustic Positioning Methods"* for an explanation of these operating modes.

3.5 Navigation Processor

The Navigation Processor is the main control station for the complete system and includes:

- A Navigation Sensor Hub (NSH)
- A Marine Computer
- A monitor and keyboard unit

3.5.1 Navigation Sensor Hub

The Type 8098 Navigation Sensor Hub (NSH) provides the interface between acoustic instruments, external sub-systems and sensors, and the Marine Computer on which the software operates.

The main functions of the NSH are to:

- Provide power and an RS232, RS485 serial communications interface for ship-borne acoustic transceivers, gyros, GNSS receivers, VRUs, and so on
- Provide responder beacon triggers
- Provide external trigger capture, such as a 1PPS signal from GNSS
- Attach an accurate time-stamp to data arriving from external sources such as Vertical Reference Units (VRUs), gyrocompasses and GNSS receivers.

3.5.1.1 NSH Options

Sonardyne offers a range of hardware interface cards for use with the NSH, to allow the specific system to be used with a wide range of Sonardyne transceivers and external Instruments and sensors. These plug-in cards allow the NSH to support acoustic operations from the very simple to the more complex.

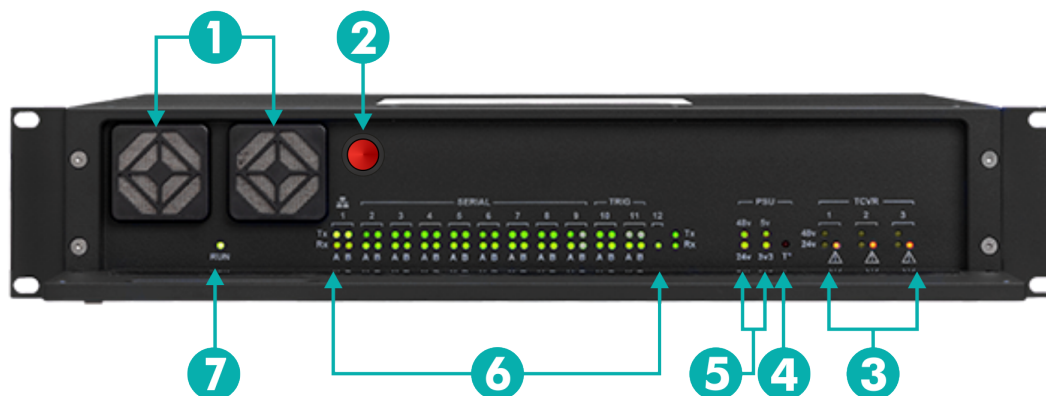
It is possible to add and configure a second NSH to the setup. This option requires an Ethernet address, a port number and a subnet mask to be set.

3.5.1.2 Front Features of the NSH

The front features of the NSH, shown in *Figure 3-2*, are as follows:

- Controller chassis fans
- Power/Reset Button
- Transceiver supply status
- PSU over temperature
- PSU status 48 V, 3.3 V, 5 V, PSU
- Tx / Rx rear card LEDs to monitor all I/O activity through the rear mounted interface cards
- Processor activity LED

Figure 3-2 Navigation Sensor Hub Front View



Item	Description	Item	Description
1	Fan Filters	5	PSU Status
2	Power/Reset Button ¹	6	I/O Activity LEDs
3	Transceiver Supply Status	7	Processor Activity LED
4	PSU Temp		

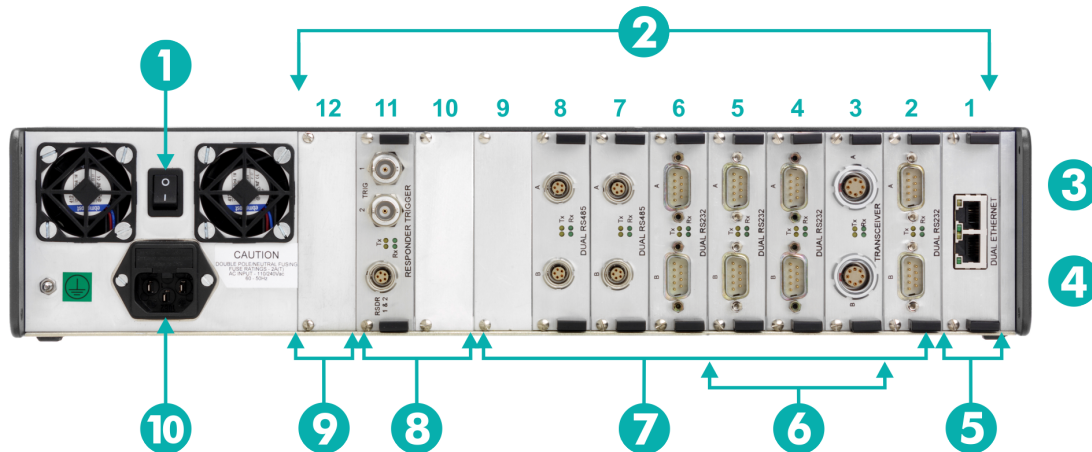
3.5.1.3 Rear Features of the NSH

The rear features of the NSH, shown in *Figure 3-3* are as follows:

- Power ON/OFF Switch.
- Card slot 1 – Dual RJ-45 connector for 10/100 BASE-T Ethernet.
- Card slot 2A is normally reserved for NSH management.
- Card slots 3 -9 – Dual Serial (Dual RS232, Dual RS485). Note: slots 3 - 5 Transceiver Power Out ports (or Dual Serial)
- Card slots 10 & 11 – Trigger Respond cards only.
- Card slot 12 – reserved.
- IEC Power Connector Socket 115/230 Vac, 6-3 A, 60/50 Hz.

¹Type 8098-000-01: Reset function only

Figure 3–3 Navigation Sensor Hub Rear View



Item	Description	Item	Description
1	Power ON/OFF	6	24 V / 48 V Transceiver
2	Card Slots (1 to 12)	7	Serial Ports
3	Port A	8	Trigger Responder
4	Port B	9	Reserved
5	RJ45 Ethernet	10	IEC Socket 115/230 Vac

For more information on the NSH, see *UM-8098 User Manual for the Navigation Sensor Hub*.

3.5.2 Marine Computer

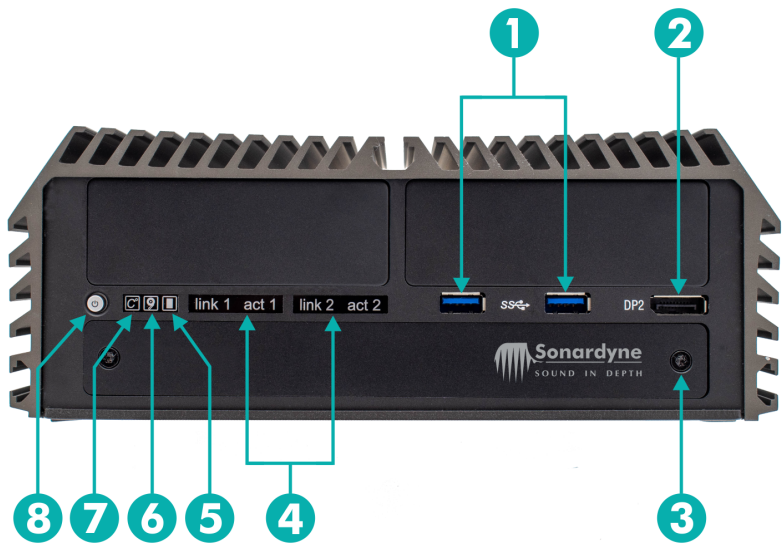
The Type 8026 Marine Computer is a versatile industrial specification, fanless embedded computer with a modern CPU architecture. It is designed for general marine purposes on the bridge, control rooms and other demanding environments. It is also used in conjunction with the Navigation Sensor Hub (NSH) and Ethernet Sensor Hub (ESH). It has been optimised to run Sonardyne's family of LBL and USBL navigational and positioning software applications.

3.5.2.1 Front Features of the Marine Computer

The front features of the Marine Computer, shown in *Figure 3–4*, are as follows:

- USB 3.1 ports x2.
- A removable front panel for fitting an additional SSD and replacing the CMOS battery.
- Display port.

Figure 3–4 Marine Computer Front View



Item	Description	Item	Description
1	USB 3.1 ports x2	5	Digital I/O LED
2	Display Port	6	HDD LED
3	Front Panel Access Screw x2	7	Temperature LED
4	Ethernet LED Indicators	8	Power On/Off

3.5.2.2 Rear Features of the Marine Computer

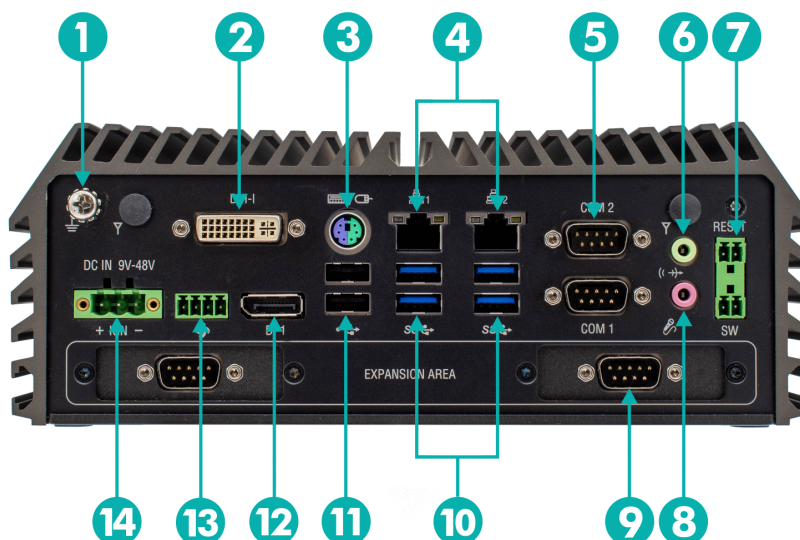
The rear features of the Marine Computer, shown in *Figure 3–5*, are as follows

- DVI-I and display ports.
- 4 x USB 3.0, 2 x USB 2.0.
- 4 x RS232/422/485 serial ports (with auto flow control).
- 2 x 1 Gbps Ethernet

Note

 Sonardyne navigation systems are normally fitted with a USB security key. Sonardyne recommends that you always connect the security key to a USB port on the rear panel of the Marine Computer rather than to a USB port on the front panel.

Figure 3-5 Marine Computer Rear View



Item	Description	Item	Description
1	Earth Connection	8	Microphone In
2	DVI-I Connector	9	Serial Com Port x2
3	PS/2 Connector	10	USB 3.0 Port x4
4	LAN Connector x2	11	USB 2.0 Port x4
5	Serial Com Port x2	12	Display Port
6	Line In	13	External Fan Power
7	Remote Power Reset & On/Off	14	DC In 9-48 V

Note

 **Dual screen capabilities are available by using any combination of the DVI or Display ports. It is recommended that the additionally supplied DVI to VGA connector is used for connection to the video monitor. Use of the DVI or display ports can increase the EMC radiation levels conflicting marginally with the EN 60945 pass levels. These very stringent levels make it highly unlikely that any interference will be caused by other equipment, but should the DVI connection be used it is the responsibility of the system integrator to check there is no practical EMC interference to, or by, the Sonardyne Equipment caused by use of this interface.**

3.5.3 Front Features of the Shelf Mounted Marine Computer

The front features of the Marine Computer when mounted in a shelf rack include:

- On/off switch
- USB 3.1 port

Figure 3–6 Marine Computer Shelf Mounted Front View



Item	Description
1	Power On/Off
2	USB 3.1 Port
3	Rack Fixing Holes x4

For more information on the Marine Computer, see *UM-8026-MC User Manual for the Type 8026 Marine Computer*.

3.6 Peripheral Systems

Peripheral systems for use with the system can include:

- a dynamic positioning (DP) navigation system.
- a GNSS.
- a vertical reference unit.
- a gyrocompass.
- an Attitude and Heading Reference System (AHRS).

Notes

 **The Lodestar™ system supplied by Sonardyne International Limited provides the features of a vertical reference unit and a gyrocompass combined within a single unit.**

 **Refer to the technical documentation provided by the equipment manufacturer for installation and operating instructions for the peripheral devices you use with your system.**

3.6.1 DP Navigation System

A dynamic positioning (DP) navigation system directs a vessel's thrusters to hold the vessel on station, combating the influence of currents, wind and wave effects.

This system communicates with the DP control system, and supplies information about the vessel's position in real time with respect to reference points in the water. The DP system then uses this information as a reference, and issues thruster commands to maintain the correct position with respect to that reference.

This method of operation has advantages over using GNSS as the position reference, because the reference points in the water can be attached to moving targets. This makes it possible for the DP system to maintain station with respect to the moving target, which would not be possible when using a GNSS-based reference.

3.6.2 Vertical Reference Unit

A vertical reference unit (VRU) measures the roll and pitch angles of the vessel on which it is installed under the influence of waves and swell.

The system uses these measurements to compensate its position calculation for any changes in the vessel attitude. If this information were not available to the software, errors could be present in the position calculations, and these would become greater with increasing angles of roll and pitch.

The Sonardyne Lodestar™ Attitude and Heading Reference System (AHRS) is a vertical reference unit that provides accurate measurements of roll, pitch and heave. Lodestar™ is also an accurate gyrocompass and provides measurements of the vessel's true heading.

3.6.3 Gyrocompass

A gyrocompass provides accurate heading information for use by the software. The system uses these measurements in its position calculations.

The Sonardyne Lodestar™ AHRS fills the combined role of gyrocompass and VRU (see above).

Note



Contact Sonardyne International Limited for information about the Lodestar™ AHRS.

3.6.4 Data Formats

The software can accept the following range of data formats from external equipment:

- Heading inputs:
 - NMEA 0183 HDT
 - SG Brown ASCII or binary
 - Robertson SKR82
- Attitude:
 - SON2 (preferred Lodestar format)
 - TSS1
 - TSS2
 - TSS3
 - EM1000
 - EM3000
 - JAVAD
 - PRDID
 - PHOCT
 - STD1
 - PASHR
 - PSXN
- Position:
 - GPGGA
 - GPGLL

- NMEA SSB
- Depth:
 - NMEA SDDPT
 - DBS
 - PSSIROV
 - SONDEP
 - DigiQuartz
 - Midas SVX2
- Time:
 - UTC
 - ZDA (with separate PPS signal)

3.6.5 External Mass Storage

The Navigation Processor continually logs data to the internal hard disk drive. However, it is good practice to use an additional external storage resource to provide a secure backup location for important configuration and archive data.

3.7 Typical Navigation Cycle

In a typical navigation cycle:

1. The software commands the transceivers to transmit an interrogation signal. If a system has multiple transceivers, they are each used to interrogate the beacons in sequence. All transceivers receive the reply signals.
2. Each beacon receives the interrogation signal and transmits a response, if necessary.
3. The transceiver receives the beacon responses and measures the time interval between the interrogation signal and the individual beacon responses.
4. The transceiver communicates these interval measurements to the software, which also receives information from the vertical reference unit and gyrocompass.
5. The software computes the position of each beacon relative to the transceivers and, if required, reports this information to a separate DP navigation system or survey computer.
6. The sequence continues automatically under software control.

Section 4 – Common Procedures

4.1 Introduction

Section 6 "*Application Procedures*" describes the specific procedures for a range of applications. However, before you can start to use these applications it is necessary to have a suitable setup already configured in the software. You can use a setup that you have used before and saved, or you can create a completely new setup to be used for the current operation.

4.1.1 New Setup

This section describe show to create a new setup. The common sequence to follow is:

1. Start the software.
2. Initialise the software using the current setup.
3. Add mobile objects such as ships, rigs, ROVs, USVs, structures and divers.
4. Add instruments to the mobile targets.
5. Configure the mobile and reference targets.

This chapter describes these common procedures.

4.1.2 Instruction Format

To simplify the instructions included in this User Manual, where possible the procedures include example screen images with instructions. Perform the actions in the order indicated.

These procedures include only the instructions you need to complete the task — they do not include detailed descriptions of the dialog boxes or of the controls and features of the software. If you need detailed information about the software and its dialog boxes, see *Appendix A "User Interface"*.

In common with many Windows-based applications, there are many valid methods that you can use to complete a command. For example there are buttons to click, and there are right-click context menus. This chapter explains the simplest method, and sometimes provides alternatives.

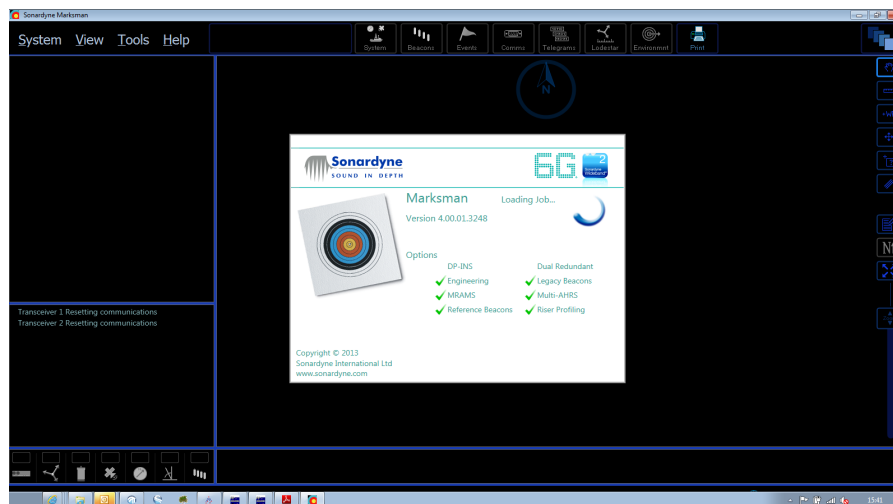
4.2 Starting the Software

Starting the software for the first time.

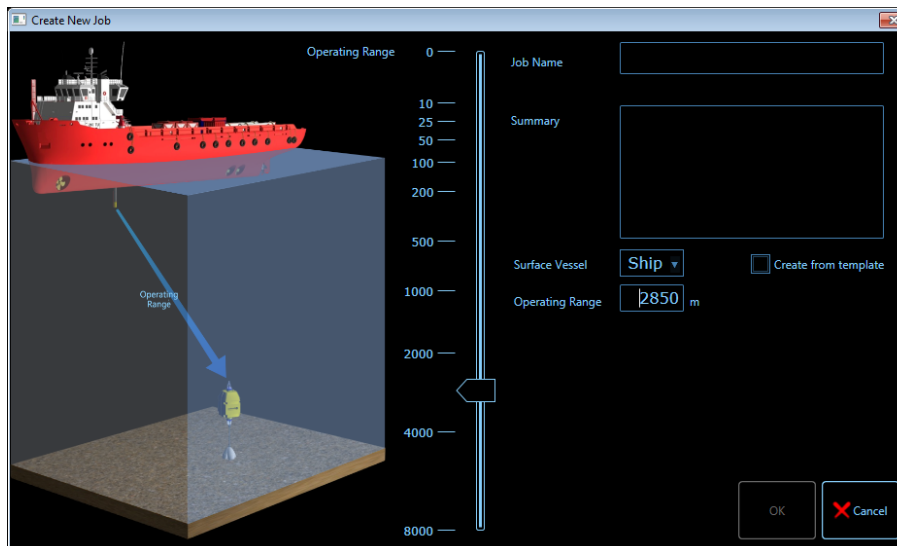
1. Double-click the icon on the desktop to start the software.



2. The software starts with the splash to show initialisation progress.



3. Wait for the **Create New Job** dialog box to be displayed.



Note



The New Setup window is displayed during software start-up only if there is no existing setup. If setup files already exist on the computer, the software opens at the main screen for the setup that was most recently in use.

4. Type a name for the new setup.
5. Type a summary description for the setup, if required. This information helps you to identify the setup later.

6. Select either **Ship**, **Rig** or **USV** to define the initial surface vessel.
7. Use the slider to select the expected maximum acoustic range.
8. Select the check box if you want to create the new setup from the template.
9. Click **OK** to display the **System Setup** window.
10. Follow the instructions in *Section 4.3 "Initialisation"* to use the **System Setup** window to edit the setup.

4.3 Initialisation

There are three options available to you when you start the software:

- You can open an existing setup and use it with or without changes.
- You can create a new job setup.
- You can open a previous setup, edit it for use in a different operation, and save it under a new name.

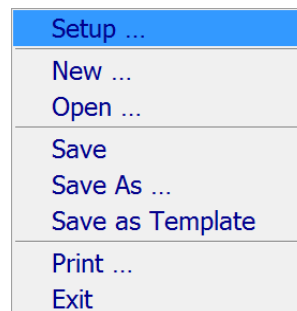
After you create a new setup, you can save it as a template. When you next create a new setup, you can then choose to base it on the template, so that you avoid having to re-enter all the details. Typically, the template includes information about the ship, the gyrocompass, the GNSS, the VRU and the transceiver.

The method that you use for initialisation depends on circumstances. This section explains how to use all the options that are accessible through the **System** menu on the main screen.

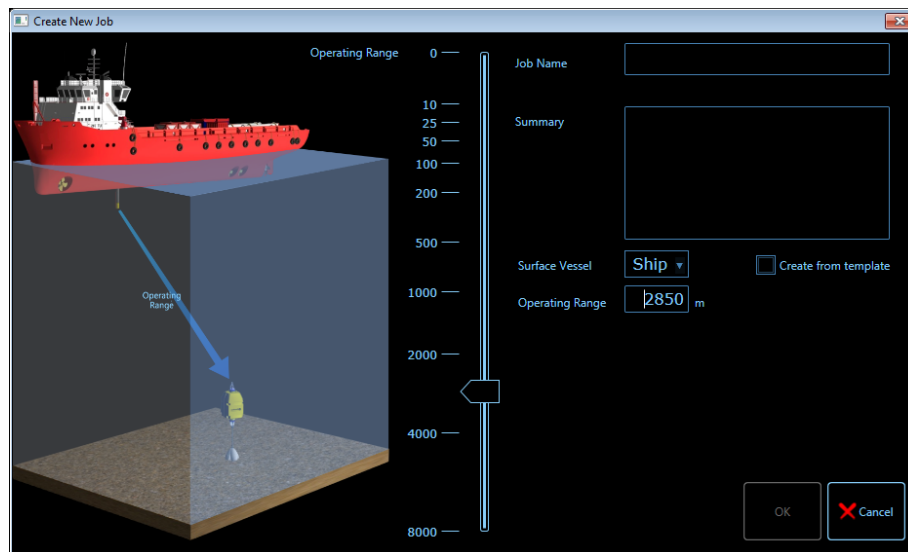
4.3.1 Creating a New Setup

Follow the instructions below to create a new setup from a fresh starting point.

1. Click **System > New** from the menu bar to display the **New Job** dialog box.



2. Type a name for the new setup.

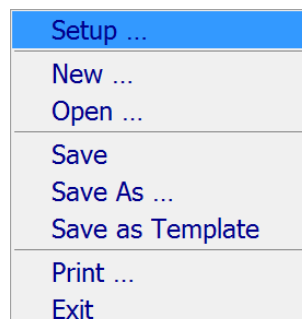


3. Type a summary description for the setup, if required.
4. This information helps you to identify the setup later.
5. Select either **Ship**, **Rig** or **USV** to define the initial surface vessel.
6. Use the slider to select the expected maximum acoustic range.
7. Select the check box if you want to create the new setup from the template.
8. Click **OK** to display the **System Setup** window.
9. Refer to *Section 4.4 "Adding Objects "* to use the System Setup window to edit the setup.
10. By default, the software starts each session by using the same settings that it was using when the program closed previously.

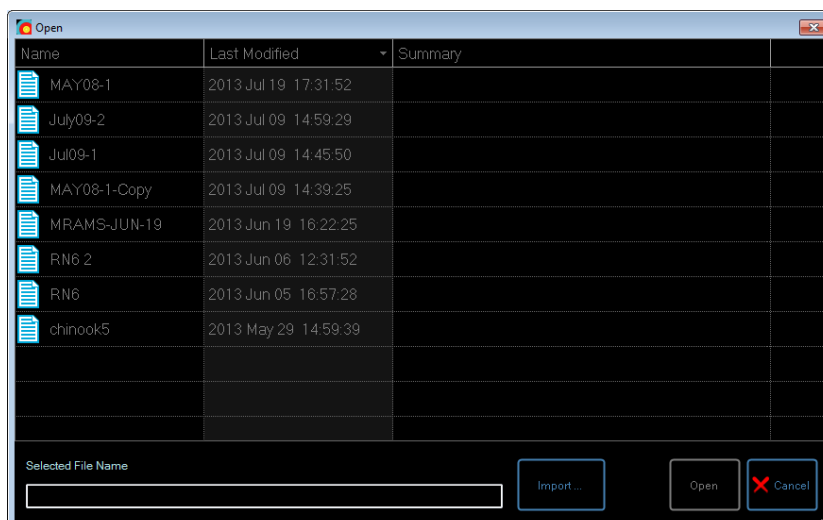
4.3.2 Opening a Previous Setup

Follow the instructions below to open a setup that already exists on the computer.

1. From the menu bar click **System > Open** to display the **Open** dialog box.
2. Click **Setup**.



- The **Name** and **Summary** fields show the setup details.



- Click **Open**.

The software loads the setup and displays the main screen. You can use the setup without making changes to it, or you can edit the setup as described in *Section 4.4 "Adding Objects"*.

4.4 Adding Objects

A mobile object can be added in one of two ways:

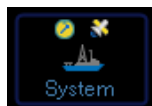
- Clicking the **System > Setup** or the **System** shortcut button to open the **System Setup** window or,
- Clicking the **Ports** and **Beacons** shortcut buttons to open the **Communications Port Table** and **Beacons Table** windows.

Both methods achieve the same outcome and are described in *Section 4.4.1*, *Section 4.4.2* and *Section 4.4.4*

4.4.1 Adding Objects from the System Setup Window

4.4.1.1 Adding Instruments

- Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.

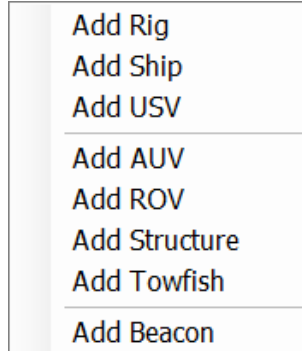


For a new setup, the **System Setup** window includes only the surface vessel that you defined when you created the setup. This is selected by default in the job tree, with the properties tabs showing the current properties for the object.

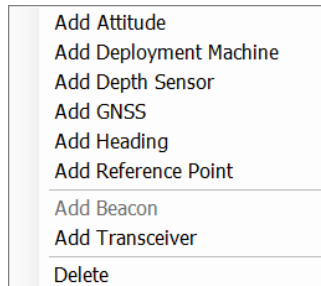
The job tree groups objects so that 'system' devices such as the NSH, PAN, TOD remain together, and 'ship' devices such as gyros, VRUs and other mobile devices remain together.

- a. To add a Mobile Object to the setup, right-click the **Mobile Objects** root in the job tree and select from the context menu.

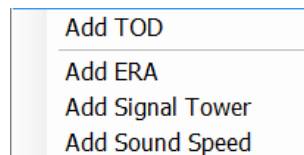
If you select **Add Beacon**, the Add Beacon wizard runs to guide you (see *Section 4.4.4* for a description of the beacon wizard).



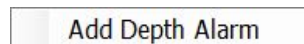
- b. To add an instrument or an object to a vessel or ROV, right-click the vessel or ROV and select from the context menu.



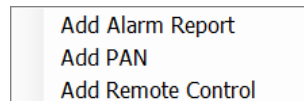
- c. To add a system object to the setup, right-click **System** in the job tree and select from the context menu.



- d. To add a Depth Alarm to the setup, right-click **Depth Alarms** in the job tree and select from the context menu.



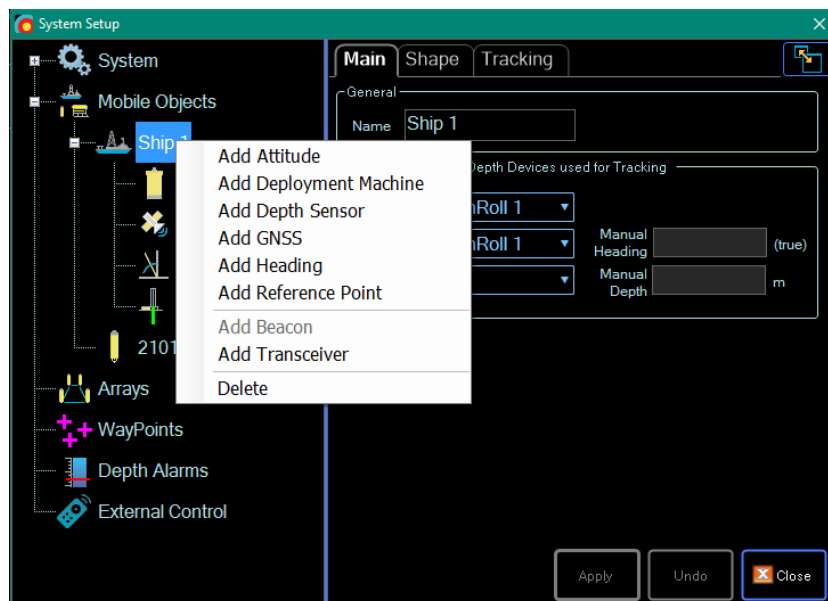
- e. To add an external control interface to the setup, right-click **External Control** in the job tree and select from the context menu.



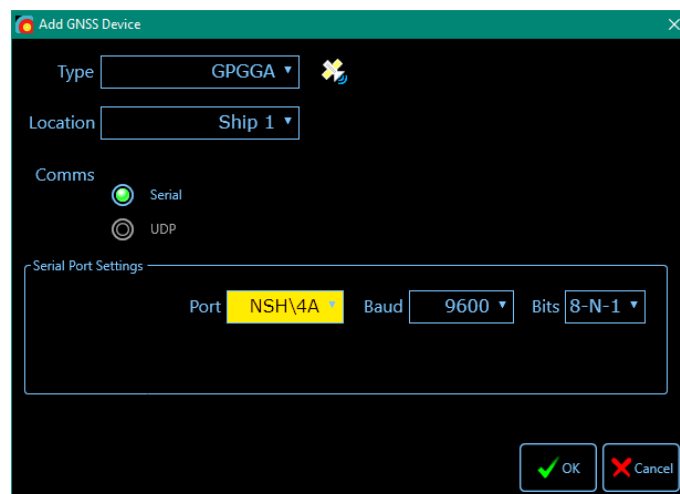
- f. Confirm the new object is included in the setup:
- A mobile object (for example an ROV) appears as a new branch in the job tree
 - An instrument (for example a satellite navigation system) appears as a sub-entry under its associated Mobile Object in the job tree
 - A system object appears under the system branch of the job tree
- g. Confirm the object's properties are displayed.

For example, to add a GNSS:

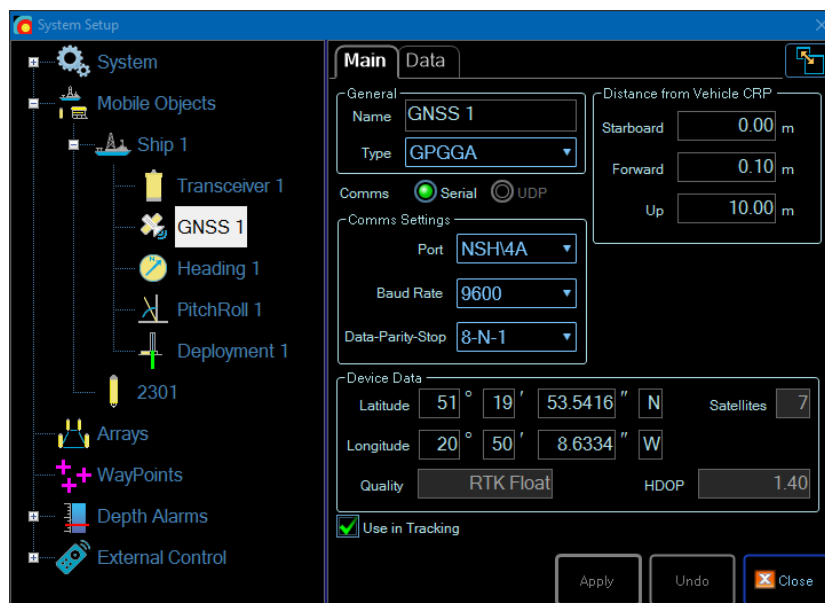
1. Right-click on the vessel (**Ship 1**) and select **Add GNSS**.



2. Select the **Type** and **Port** from the drop-down list.
3. Select the correct **Baud Rate** from the drop-down list e.g. **9600** and then click **OK**.



- The **Longitude** and **Latitude** data will be automatically updated.



- Add the **Starboard**, **Forward** and **Up** offsets for the GNSS antenna relative to the CRP and then click **Apply**.

Refer to *Section 4.7* through to *Section 4.15* to configure the other instruments.

- Repeat steps 1 to 3 to add other Mobile Objects and Instruments as required.

4.4.2 Adding Instruments using the Ports Table

- Click the **Ports** shortcut button to open the **Communications Port Table** window.

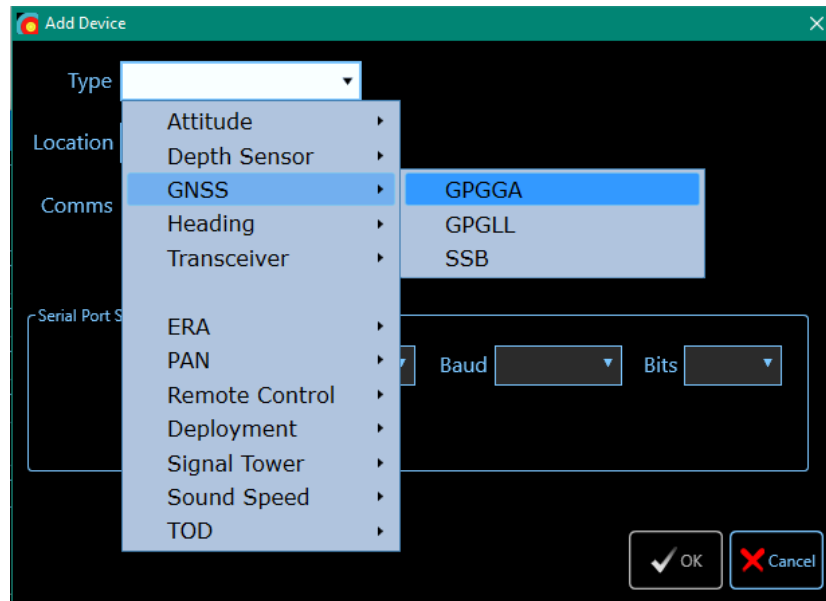


- To add a new instrument, click **Add**.

Select	View	Comms	Edit	Port	Baud	Device Name	Protocol	Location	Data
☐				NSH\3A	38400	Transceiver 1	6G Protocol	Ship 1	<U001240, BR: EVT1, SQ0, U0
☐				NSH\4A	9600	GNSS 1	\$GPGGA	Ship 1	\$GPGGA, 162511.216, 5119.83840, N, 00050.14140, W, 5.07, 2
☐				NSH\5B	115200	PitchRoll 1	:SON2	Ship 1	:162511240 000254 000482 046690 000g
☐				NSH\7A	9600	Heading 1	\$HEHDT	Ship 1	\$HEHDT, 46.7, T*30

At the bottom of the window, there is a 'Data Legend' section with 'Receive' (green square) and 'Transmit' (red square) indicators, and buttons for '+ Add', '- Delete', 'Apply Changes', 'Undo Changes', 'Print', and 'Close'.

3. Enter the **Type**, **Comms**, **Port** and **Location** settings (further configuration is available after clicking **OK**).



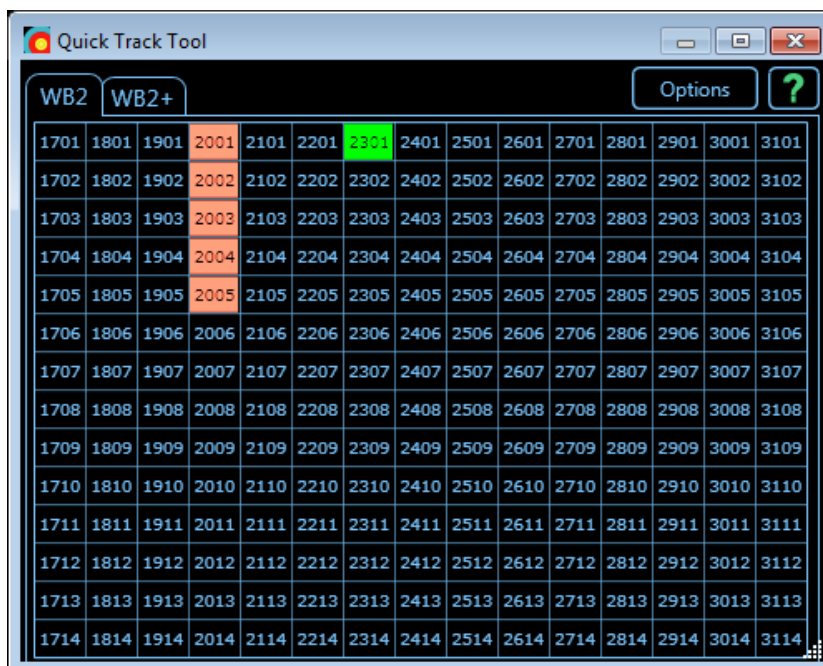
4.4.3 Adding Beacons using the Quick Track Tool

For simple jobs requiring a small number of 6G or PGT beacons, it will be easier and faster to add beacons to the job using the Quick Track tool. Quick Track uses the unique IIS interrogate signal for a 6G beacon.

For jobs with many beacons or where complex acoustic scheduling is required, it is recommended to add beacons to the job using the Beacons Table described in *Section 4.4.4*.

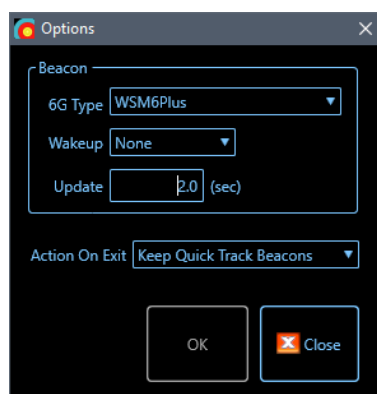
1. Click **Tools > Quick Track** or the **Q-Track** shortcut button.
2. Click the required address(es) on the **Quick Track** tool (clicking the same address again stops that beacon tracking and removes it from the job).
3. A 6G beacon with that address is added to the job and immediately begins to track (see **Options** below for beacon type).
4. An active Quick Track beacon is shown in green (beacon addresses already allocated are shown in pink).

5. A beacon output telegram is enabled (if there is a telegram setup).



The screenshot shows the 'Quick Track Tool' window. It has a title bar with standard Windows window controls. Below the title bar, there are two tabs: 'WB2' and 'WB2+'. To the right of the tabs is an 'Options' button and a green question mark icon. The main area of the window is a large grid of 14 columns and 20 rows of numbers. The columns are labeled from 1701 to 3101 in increments of 10. The rows are labeled from 1701 to 1714. The grid contains a sequence of numbers, likely representing beacon IDs or coordinates. The cell containing '2301' is highlighted in green.

6. Click **Options** on the **Quick Track** tool to configure the default **Beacon** type, **Wakeup** tone and **Update** rate; see *Section A.10.6 "Quick Track"* for more details.

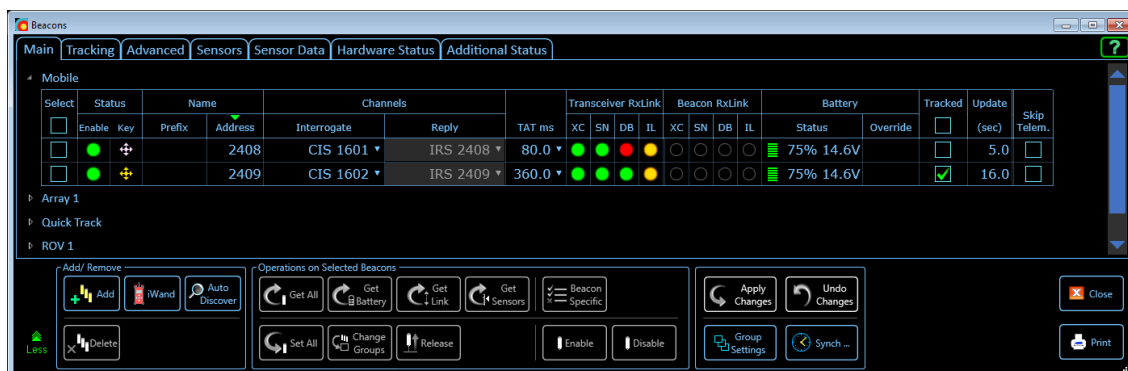


4.4.4 Adding Beacons using the Beacons Table

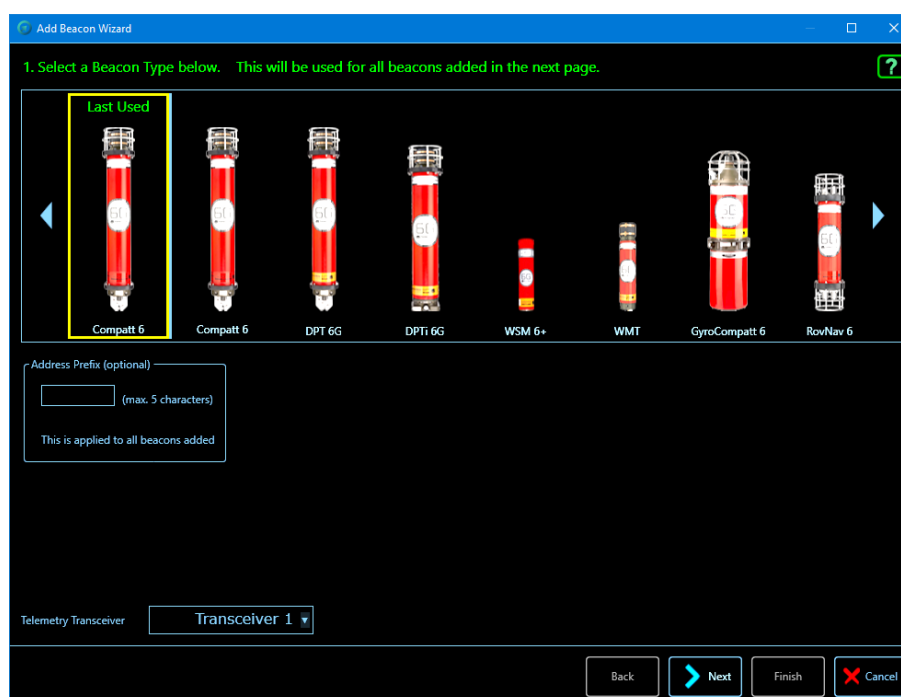
1. Click the **Beacons** shortcut button at the top of the main window to open the **Beacons Table** window.



- Click **Add** to start the **Add Beacon Wizard**. A list of all configured beacons and their status can be viewed in this window.



- The **Add Beacon Wizard** will start allowing one or more beacons to be configured.



- The beacon(s) can be configured using the wizard and Beacons Table.

4.5 Deleting Objects

To delete an object from the setup, right-click the object in the setup tree and select **Delete** from the context menu.

To delete a port or beacon, select the port or beacon in the Port or Beacons Table and click the **Delete** button.

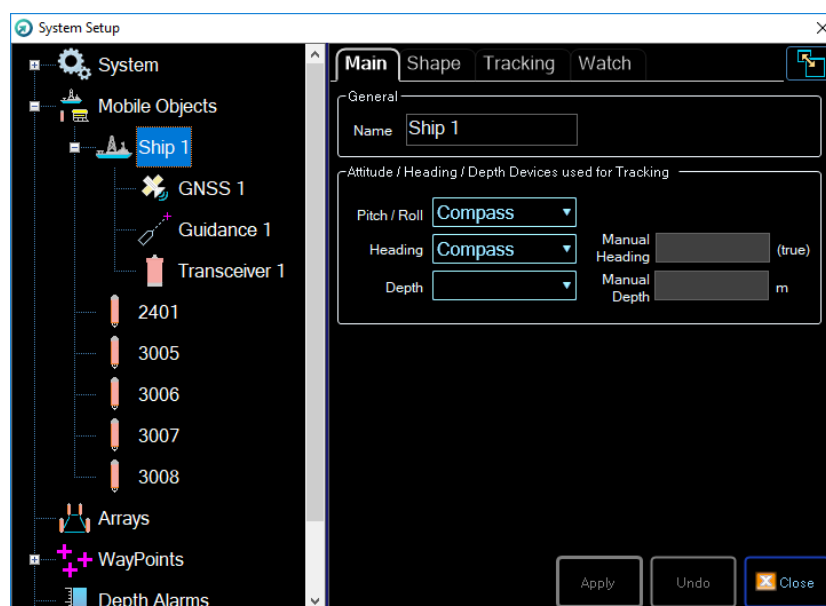
Note

 The software does not have an 'undo' feature — you cannot reverse a deletion. To re-insert a target that you have deleted accidentally you must insert and configure a new target.

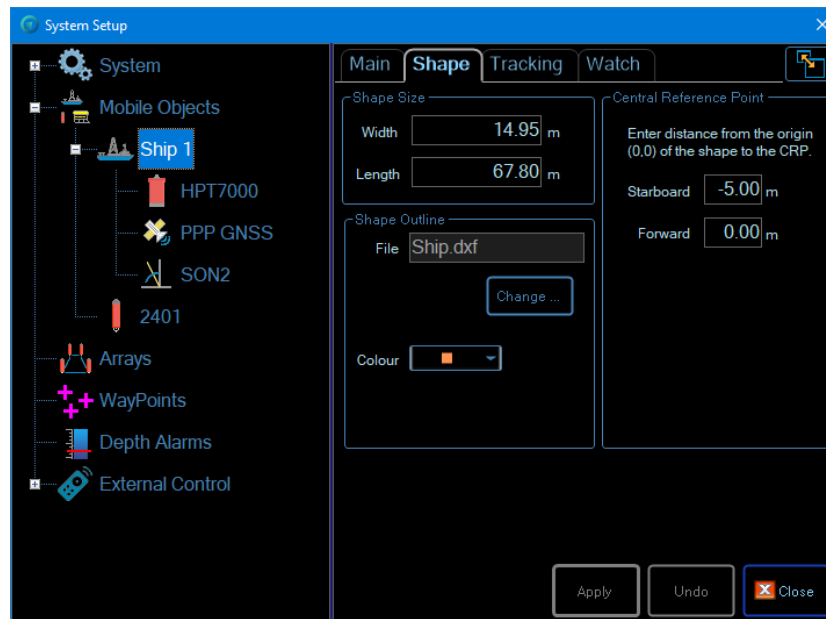
4.6 Configuring the Vessel

This procedure explains how to configure a basic setup for the vessel.

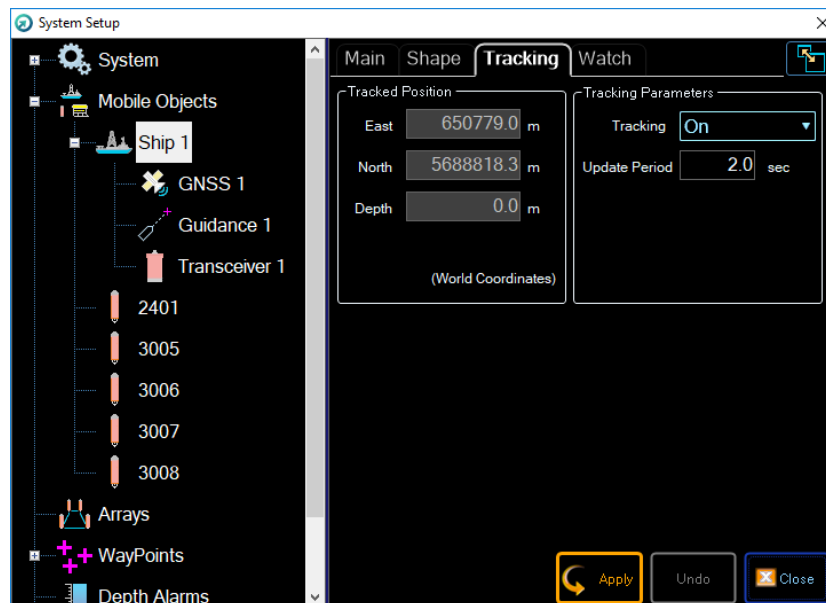
1. Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
2. Select the vessel in the job tree.
3. Enter a **Name** for the vessel, if necessary, or use the default name.
4. Select the preferred **Pitch/Roll** and **Heading** sensors to use on the vessel if there are multiple sensors.
5. Select **Manual Heading** and enter a fixed value if there is no heading sensor to use.
6. Select **Manual Depth** and enter a fixed value if it is necessary to constrain the computed vessel depth.



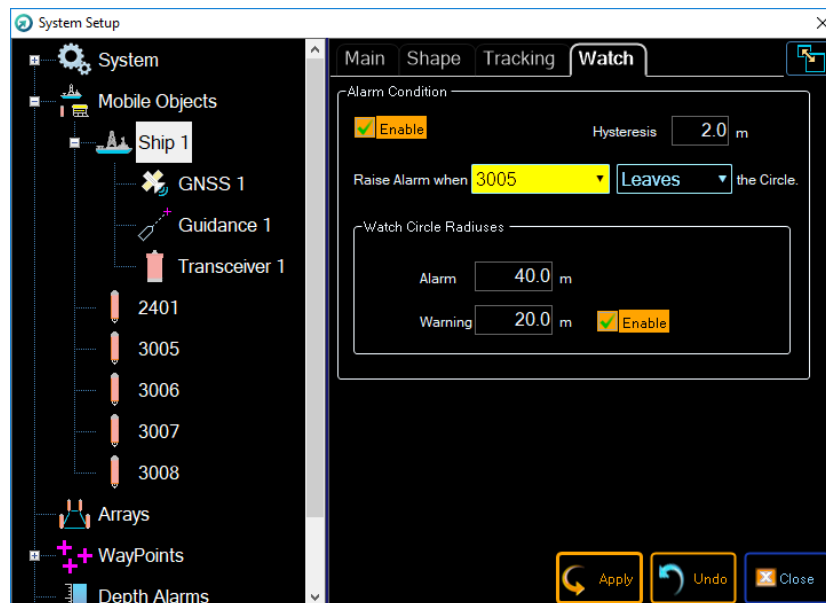
7. Select the **Shape** tab.
8. To change the vessel shape click **Change** and pick from the list of available shapes. You can add a custom shape file in DXF format (ensure the DXF file complies with the following rules):
 - a. contents must be exploded into polylines, (all splines and curves; ellipses should become polylines).
 - b. all visible layers must be collapsed to a single layer.
 - c. all hidden layers must be removed (document markups).
 - d. shape orientation must be bow up.
 - e. the (0,0) point of the shape must be at the centre of the shape (default).



9. Enter the vessel **Width** and **Length** as required.
10. If required, the central reference point can be adjusted from the origin of the graphical shape by entering a **Starboard** and **Forward** value in the **Central Reference Point**.
11. Select the **Colour** from the drop-down list for uniform colours that fade with the brightness setting.
12. Click **Apply**.
13. Select the **Tracking** tab, where the vessel's acoustic position **Update** time can be set.



14. Select the **Watch** tab, where warnings and alarms can be configured when the vessel approaches a beacon's position.



4.7 Configuring a Transceiver

1. Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
2. Select the transceiver in the job tree .
3. Type a **Name** for the transceiver, or use the default.
4. If you have several transceivers connected to one comms port in a multi-drop configuration, you must enter a serial number manually.
5. Select the **Port**, **Baud Rate** and **Data-Parity-Stop** to match the communication parameters used by the Transceiver if required.
6. Enter the **Starboard**, **Forward** and **Down** offsets with respect to the vehicle's CRP.
7. Select the Tx/Rx mode to **Tx & Rx** (the default) for normal operation, **Rx** for receive only, or **Disabled** to disable the use of the transceiver in the system.

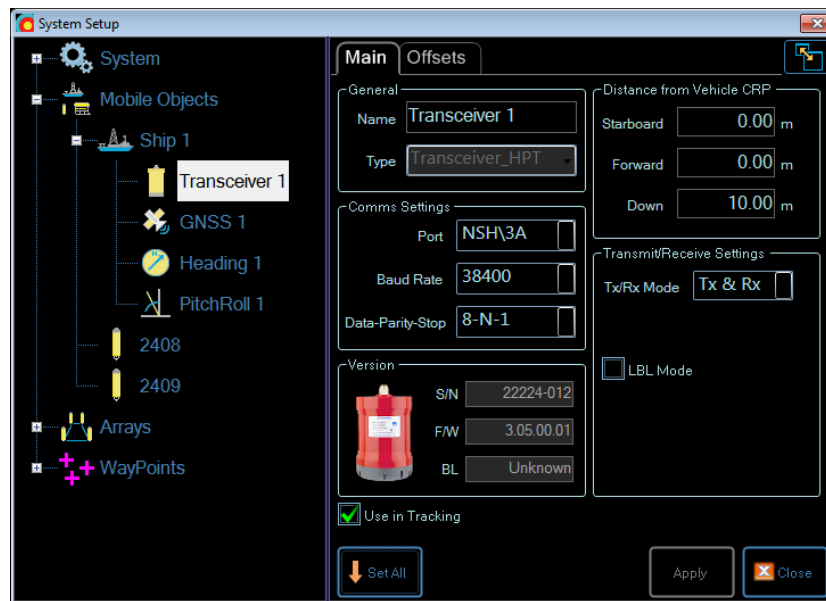
Note



The TxRx mode should only be used in special cases, e.g. a multi-transceiver setup with only one Lodestar INS fitted. In this case, it is necessary to ensure that the augmented primary (INS) transceiver is always measuring the direct range so that the Lodestar receives aiding data from every update. The secondary transceivers need to be configured to Rx only. If you try to track transponders with all transceivers set to Rx only, then the system will override this setting as it has to use something for the Tx function.

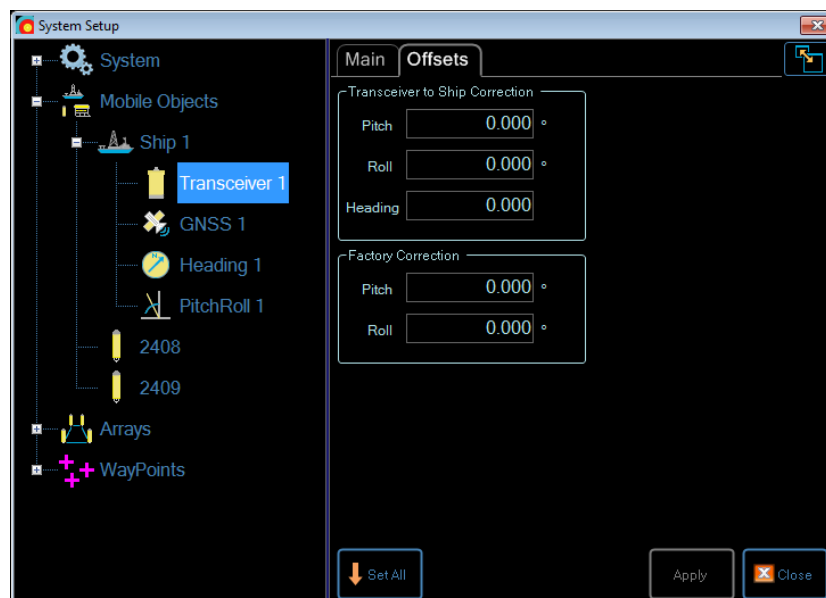
8. For normal USBL operation, leave **LBL Mode** deselected. This property should be selected only for special cases, such as for the second transceiver in a dual-transceiver LUSBL setup.

9. Click **Apply**.



4.7.1 Offsets

1. Select the **Offsets** tab and enter the **Pitch**, **Roll** and **Heading** correction angles necessary to align the transceiver with the vehicle's reference frame.
2. Enter the corrections measured by the factory for the transceiver's internal inclinometer.
3. Click **Apply**.



4.8 Configuring a Sonardyne Deployment Machine

CAUTION

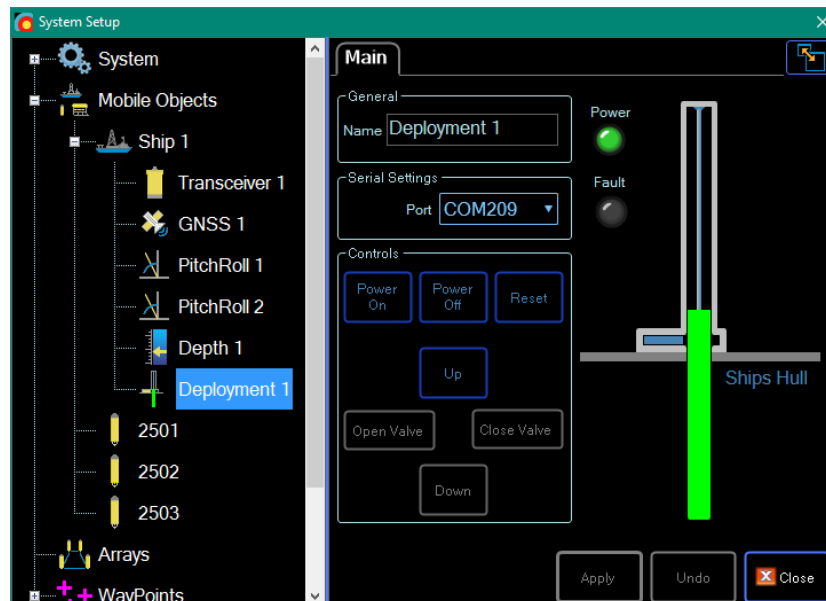
 The Sonardyne Deployment Machine and gate valve software control must only be configured once the Deployment Machine has been set to work by a suitably qualified person. Failure to do so may result in equipment and/or vessel damage.

1. Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
2. Select **Deployment Machine** in the job tree.
3. Enter a **Name**, if required.
4. Select the **Port**.

Note



The Deployment Machine uses fixed port settings with no alternative choice available.



5. Click **Apply**.

4.8.1 Operating the Deployment Machine

The animated graphic (right hand side) displays the current status of the gate valve and Deployment Machine.

The **Power** LED indicates the Deployment Machine's power status.

The **Fault** LED indicates the Deployment Machine's fault status. The Deployment Machine faults if the oil level exceeds 70°C or the oil level drops below the required level. The Deployment machine and gate valve will not operate if there is a fault in the system. (see *UM-7950 User Manual for Through-Hull Transceiver Deployment Machine* for more information).

Once a fault has been rectified, click **Reset** to clear the fault condition.

To operate the Deployment Machine:

1. Click **Power On** and **Power Off** to power the Deployment Machine on or off.
2. Click and hold **Open Valve** or **Close Valve** to open or close the gate valve (the gate valve will not close if the deployment pole is deployed).
3. Click and hold **Up** or **Down** to raise or lower the Deployment Machine (the deployment pole will not deploy if the gate valve is closed).

Note



A warning is given if attempting to sail with the Deployment Machine in the Down position, or when operating the transceiver with the Deployment Machine in the Up position.

4.9 Configuring a Beacon

To add a beacon to the setup, right-click **Mobile Objects** and select **Beacon** or click the **Beacons** shortcut button and click **Add** in the **Beacons Table** and follow the instructions in the Wizard (see *Section 5.2 "Add Beacon Wizard "* for details)

4.9.1 Adding a Gyro Compatt

Follow the steps below to add a Gyro Compatt to the system. Refer to *Section 5.1.10 "Additional Status Tab"* and *Section 5.1.19 "Beacon Specific Properties Dialog Box"*.

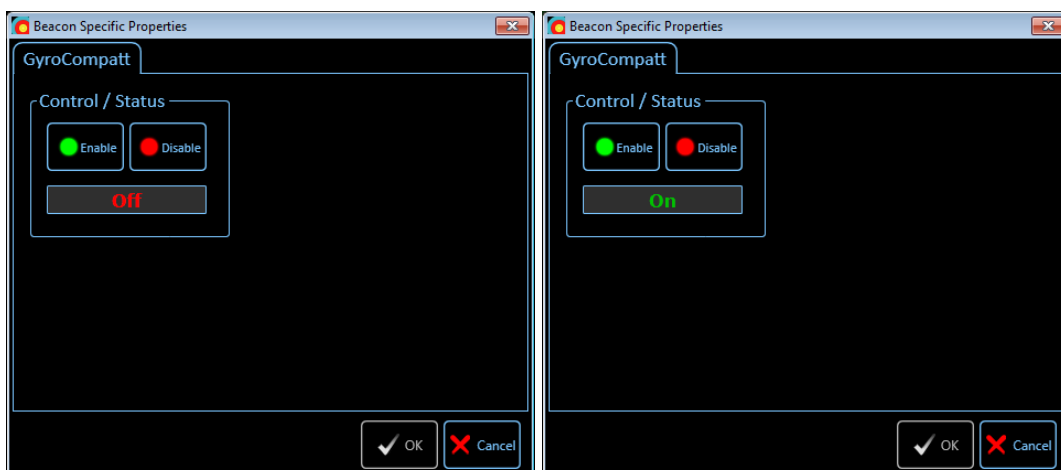
1. Use the **Add Beacon Wizard** (see *Section 5.2 "Add Beacon Wizard "*) to add a Gyro Compatt 5 or 6.
2. In the Beacons Table, set all standard acoustic and power settings as for a standard Compatt and click **Apply Changes**.



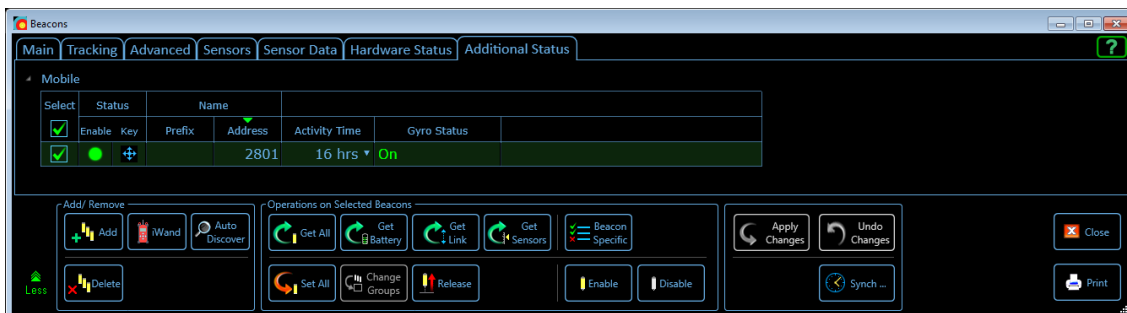
3. Select the Gyro Compatt and click the **Beacon Specific** button.



4. Click **Enable** to enable the Gyro Compatt. This command sends the telemetry to switch on the gyro and to start collecting measurements. At first, the **Control/Status** shows **Off** (in red text), but after the gyro boots up, the **Control/Status** shows **Unsettled** (in amber text). After the gyro has settled, the Control/Status shows **On** (in green text).



- The Beacons Table **Additional Status** tab also shows the Gyro Compatt status. The Gyro Compatt is ready to send data when it shows **On**.



4.9.1.1 Adding a PSONMEAS Report

- Add a PSONMEAS report (see Section 4.23.1 "Configuring an Output Telegram").



- Set the telegram to **Enable** for the Gyro Compatt in the telegram editor.

Note

 The editor only provides the option to enable or disable this telegram.

Example output string format:

\$PSONMEAS,124752.49,INCINT,5410,,44.91,8.130,-7.840*5D

- Use the Beacon Sensor Monitoring tool (see Section 10 "Beacon Sensor Monitoring Tool ") to enable sensor data collection from the Gyro Compatt. Results are displayed in graphical and tabular form in the monitoring tool, as well as being output by PSONMEAS report to an external system.

4.10 Array Beacons and Array Calibration

By default, the software classes a beacon as a mobile beacon when you first add it to the setup. In this condition, the transceiver tracks the beacon's relative position by using acoustic navigation techniques. If the setup includes satellite navigation, gyrocompass and attitude instruments, the software can determine the beacon's position in real-world co-ordinates.

If the application requires one or more beacons to be set at fixed positions on the seabed or on a fixed sub-sea structure, it is possible to calibrate the beacon positions and then add them to the array. The software considers beacons in an array to have fixed positions, and displays the vessel or other mobile target positions as being relative to the reference beacon.

Note

 **It is important to check that you have set-up the beacons correctly, and that you have captured the beacon settings in the setup before you deploy the beacons. Track the beacons continuously after release, and manoeuvre the vessel in a way to allow a successful recovery.**

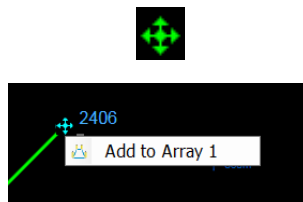
Deploy all the beacons to be included in the array and wait until they settle at the locations fixed for them.

Beacons can be added to an array and calibrated in one of two ways described in *Section 4.10.1* and *Section 4.10.2*. The first method involves right-clicking the individual beacon symbol, this can be useful for calibrating a single beacon.

The second method is preferred and involves clicking the **Beacons** shortcut button and calibrating beacons in the Beacons Table.

4.10.1 Adding and Calibrating Beacons from the Beacon Symbol on the Chart

1. Right-click the beacon symbol that identifies the CRP on the beacon and select **Add to Array**.

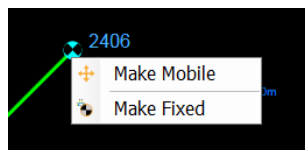


2. The beacon is added to the array in the calibrating state, and the software begins to refine the beacon's position.
3. Repeat step a for each of the beacons in the array.
4. Select which frame to use for the display. The options depend on the mobile targets and arrays in the setup.



5. Wait for approximately one hour to achieve optimal accuracy in the beacon's position.

- Right-click the beacon again and select **Make Fixed**.



- Repeat the previous step for each of the beacons in the array.
- The position of the beacon is fixed and the position of the surface vessel is shown relative to it.

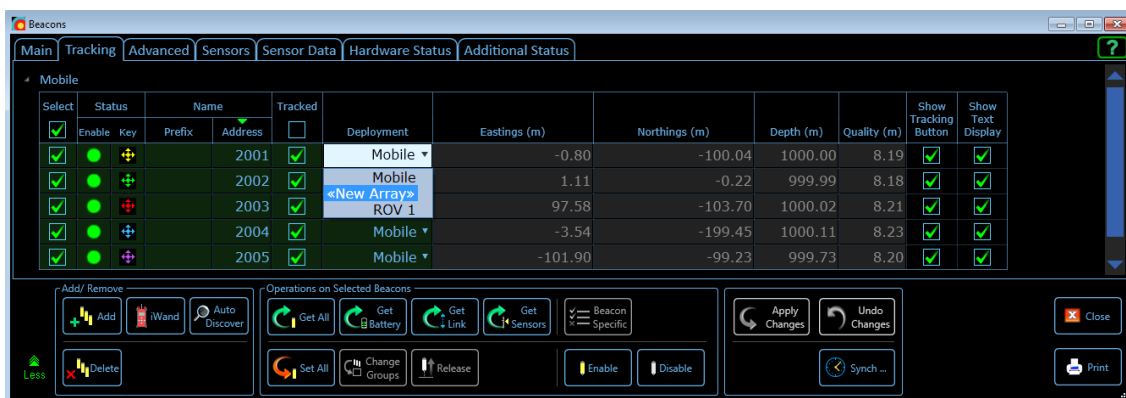
4.10.2 Adding and Calibrating Beacons from the Beacons Table

This is the preferred method of adding and calibrating beacons.

- Click the **Beacons** shortcut button.



- On the Beacons Table **Tracking** tab, select the the beacons to be added to the array and then select **New Array** on the **Deployment** column.



- The selected beacons will display **New Array** on the Deployment column.

Mobile						
Select	Status		Name		Tracked	Deployment
	Enable	Key	Prefix	Address		
☒	☒			2001	☒	«New Array»
☒	☒			2002	☒	«New Array»
☒	☒			2003	☒	«New Array»
☒	☒			2004	☒	«New Array»
☒	☒			2005	☒	«New Array»

- Click **Apply Changes** to begin the array calibration.

Note

It is recommended to allow the calibration to run for one hour (or until the desired precision is reached and the Quality figure has stopped decreasing) until the beacons have completed calibrating. A graph showing the calibration status can be displayed from **Tools>Advanced>Graphs** and selecting **Arrays**, see **A.10.12.12 "Graphs" in Section A.10.12.**

Array 1						
Select	Status		Name		Tracked	Deployment
	Enable	Key	Prefix	Address		
☐				2001	☒	Calibrating ▾
☐				2002	☒	Calibrating ▾
☐				2003	☒	Calibrating ▾
☐				2004	☒	Calibrating ▾
☐				2005	☒	Calibrating ▾

5. After the beacons have calibrated, select **Fixed** on the **Deployment** column.

Array 1						
Select	Status		Name		Tracked	Deployment
	Enable	Key	Prefix	Address		
☒				2001	☒	Calibrating ▾
☒				2002	☒	Calibrating ▾
☒				2003	☒	Fixed ▾
☒				2004	☒	Calibrating ▾
☒				2005	☒	Calibrating ▾

6. Click **Apply Changes** to save the array settings.

Array 1						
Select	Status		Name		Tracked	Deployment
	Enable	Key	Prefix	Address		
☐				2001	☒	Fixed ▾
☐				2002	☒	Fixed ▾
☐				2003	☒	Fixed ▾
☐				2004	☒	Fixed ▾
☐				2005	☒	Fixed ▾

Note



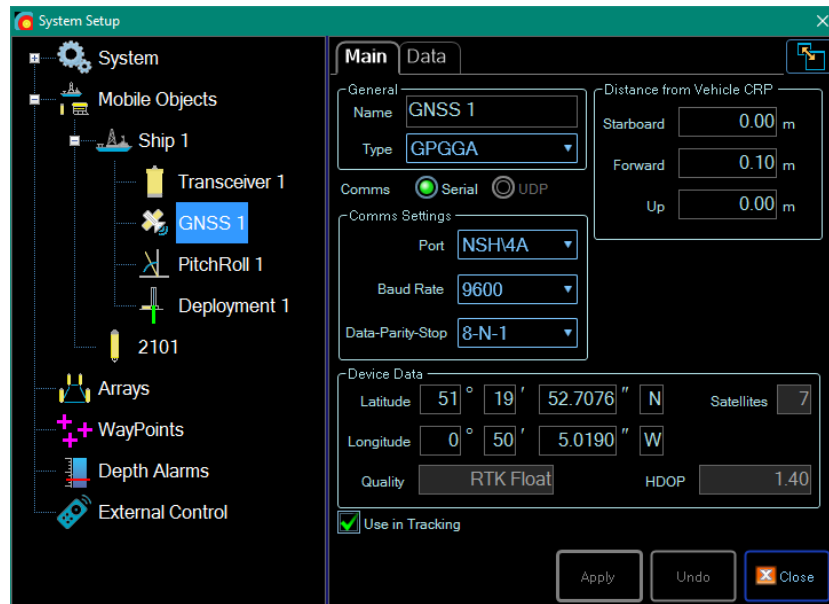
When the array is Fixed, GNSS is turned off automatically and navigation data is displayed in green text. If GNSS is turned on, positions are displayed with an underscore.

7. To remove a beacon from the array, select the beacon and then select **Mobile** on the **Deployment** column.

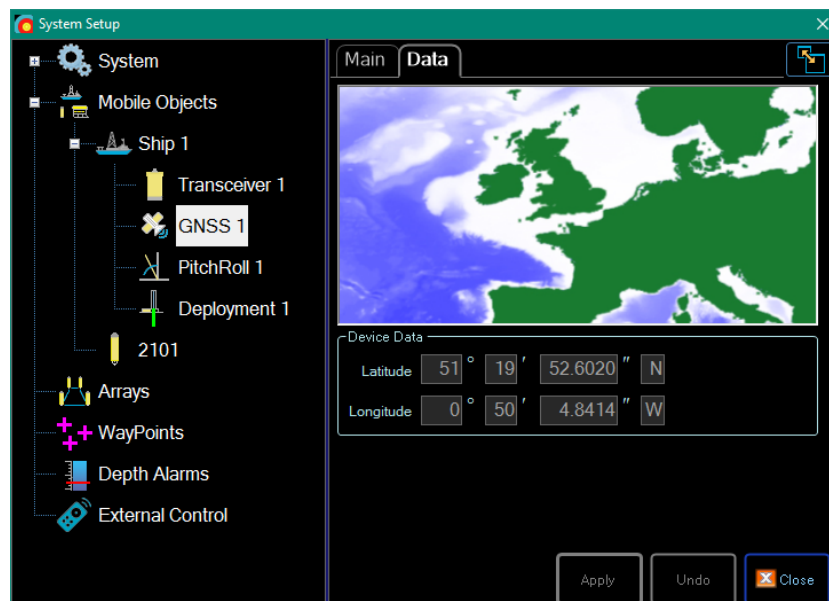
4.11 Configuring a GNSS

1. Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
2. Select the GNSS in the job tree .
3. Select the type of GNSS data string supplied by the receiver.
4. Select the **Port**, **Baud Rate** and **Data-Parity-Stop** to match the communication parameters used by the GNSS if required.
5. Enter the location of the GNSS antenna relative to the vehicle's CRP.
6. Click **Apply**.

7. Select the **Use in Tracking** check box.



8. Select the **Data** tab.
9. Confirm the position is displayed as a flashing red circle and cross on the map, with **Longitude** and **Latitude** data.

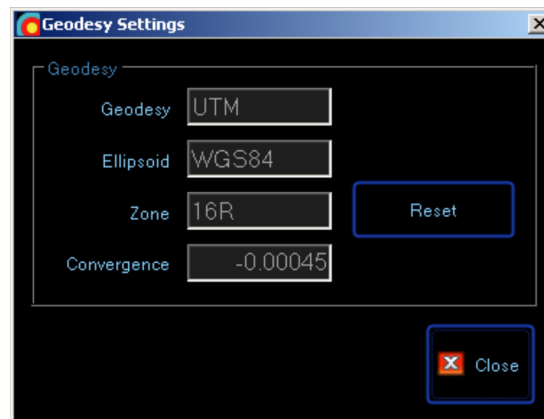


4.12 Geodesy Tool

The geodesy tool provides a visual indication of:

- The current geodetic projection
- The ellipsoid
- The zone
- The convergence

These four fields are read-only.



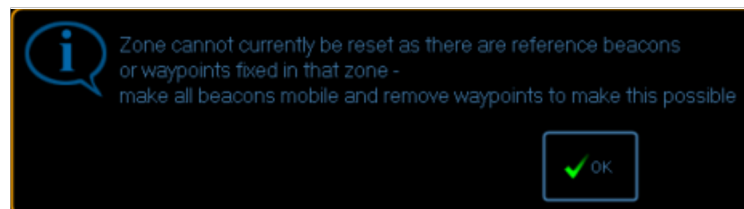
4.12.1 UTM Zone Reset

When the vessel moves across a UTM zone boundary to a new location, the software raises a zone alarm to warn of the increasing convergence error.

In order to avoid tracking discontinuity, the system does not automatically change zones. Click the zone **Reset** button to set the UTM zone for the new location.

Note

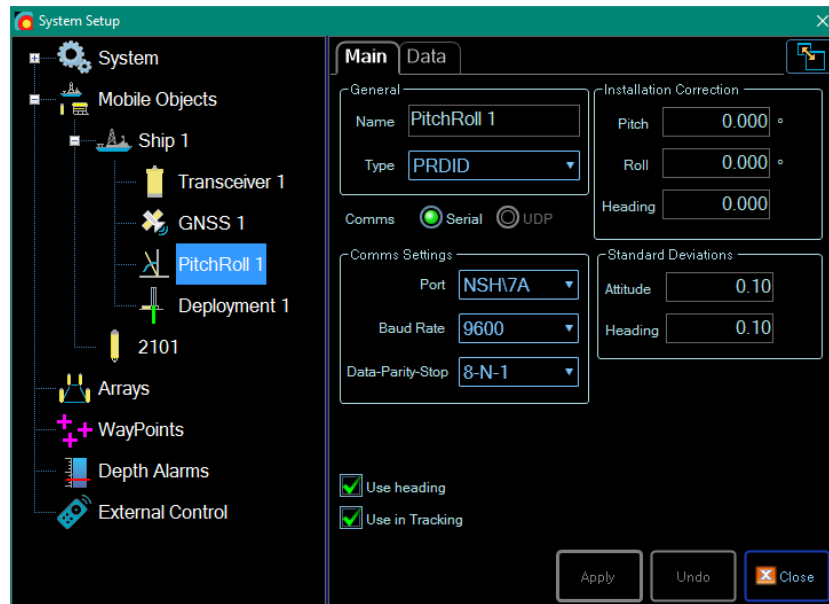
 **You must delete any waypoints or fixed references for the old UTM zone/location before the reset can be completed successfully.**



4.13 Configuring a Vertical Reference Unit (VRU)

1. Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
2. Select the VRU in the job tree.
3. Select the **Port**, **Baud Rate** and **Data-Parity-Stop** to match the communication parameters used by the VRU, if required.
4. Enter the **Pitch**, **Roll** and **Heading** correction angles necessary to align the VRU reference frame with the vessel's reference frame.
5. Select the **Use in Tracking** check box.
6. Normally, leave the Use heading check box selected, unless you know the heading is uncalibrated or unavailable.

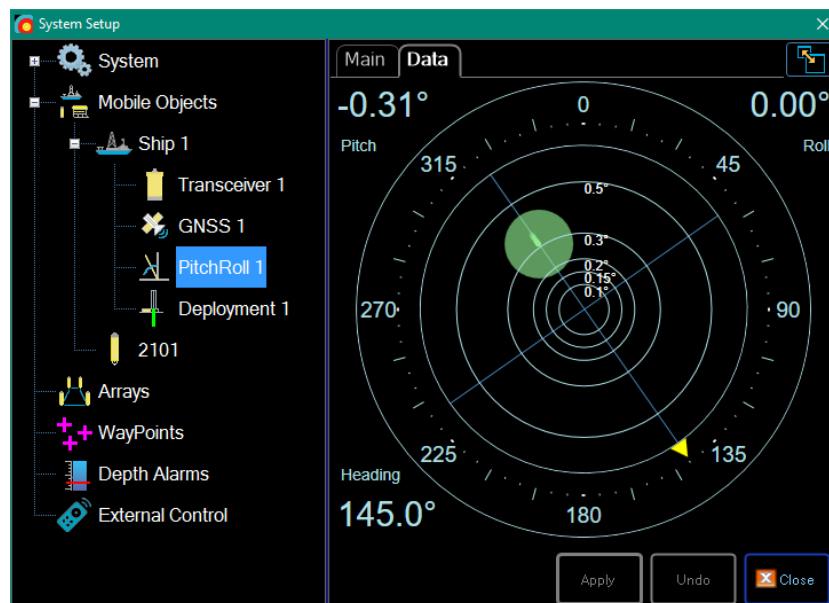
- Click **Apply**.



Note

 The Standard Deviation value is an important quality assessment on this and on the Gyrocompass settings, see *Section 4.15 "Configuring a Gyrocompass"*. The software uses this information to rank multiple instruments of the same type so that instruments providing a higher quality solution (that is, with a lower standard deviation) are more highly weighted.

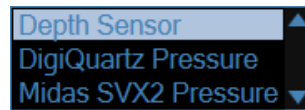
- Select the **Data** tab and confirm the VRU's measurements of **Pitch** and **Roll** are displayed.



4.14 Configuring a Depth Device

- Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
- Select the **Depth** device in the job tree.
- Select the name, if required.

4. Select the sensor type from the **Type** drop-down list.



5. For pressure devices (DigiQuartz and Midas SVX2), select the pressure Units, and whether Atmospheric Pressure compensation is required or not.

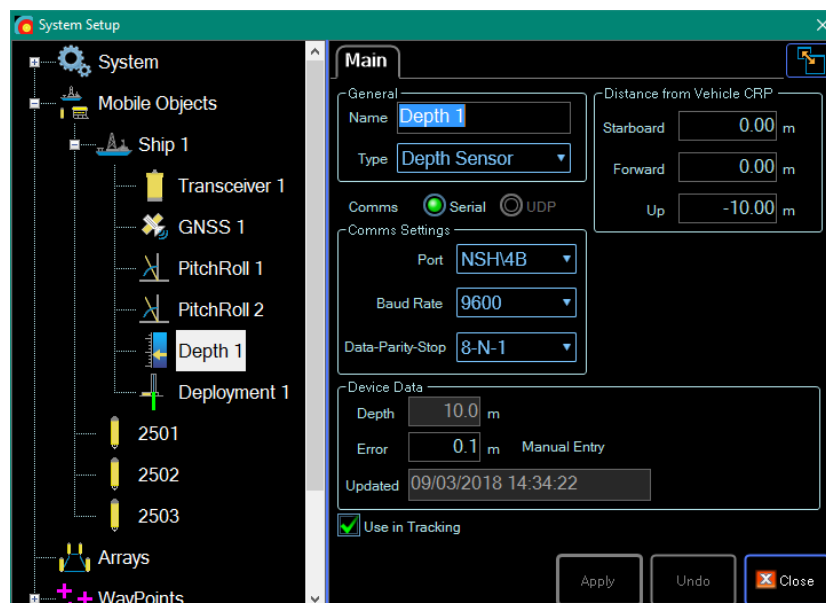
Note

 The generic 'Depth Sensor' type supports four standard depth string types automatically with no user intervention:

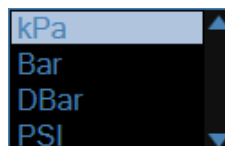
- Perry Slingsby depth – \$PSSIROV
- Sonardyne proprietary depth – \$SONDEP
- NMEA depth – \$SDDPT
- Seaeye depth – \$DBS

(units of depth in all string types are metres)

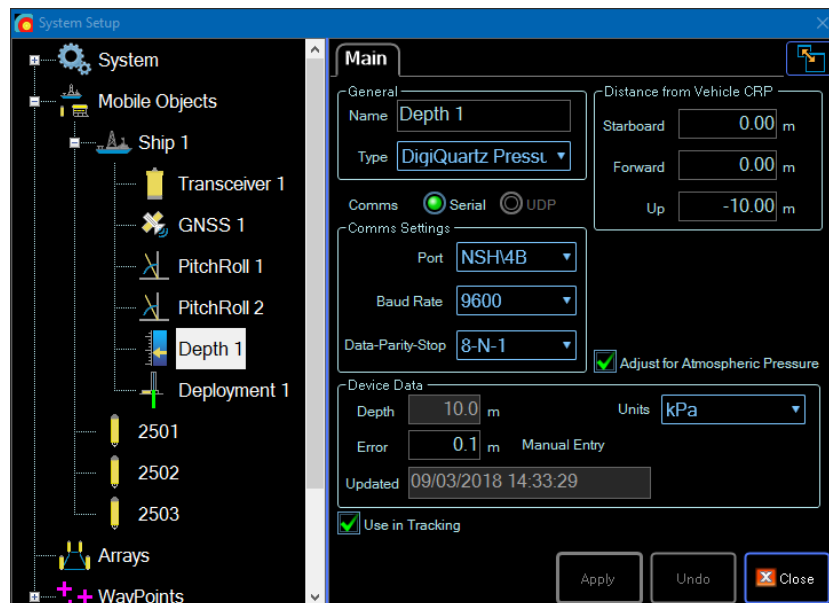
6. Select the **Port**, **Baud Rate** and **Data-Parity-Stop** to match the communication parameters used by the Depth device if required.
7. Enter the **Starboard**, **Forward** and **Up** offsets with respect to the vehicle's CRP.



8. For pressure sensor devices only, select the **Units** of pressure to match the sensor.



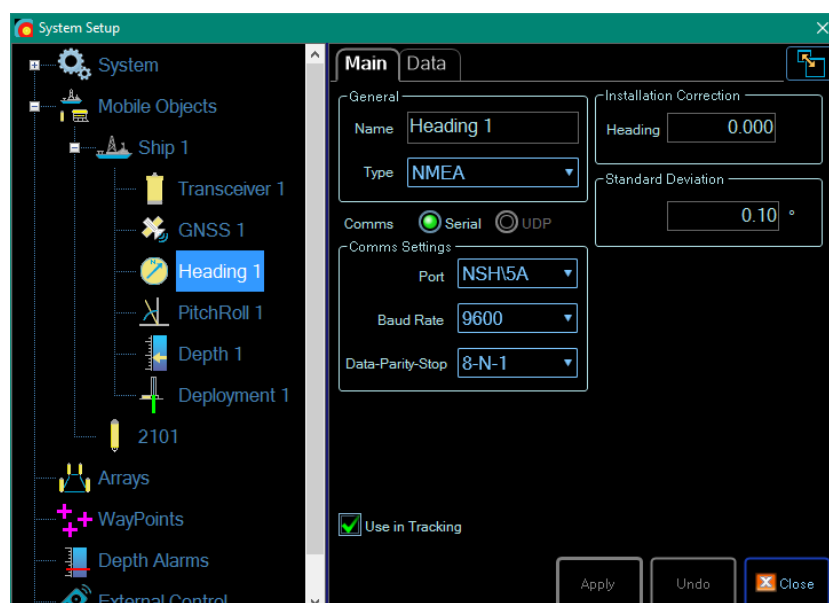
- For pressure sensor devices only, select **Adjust for Atmospheric Pressure**, if required.



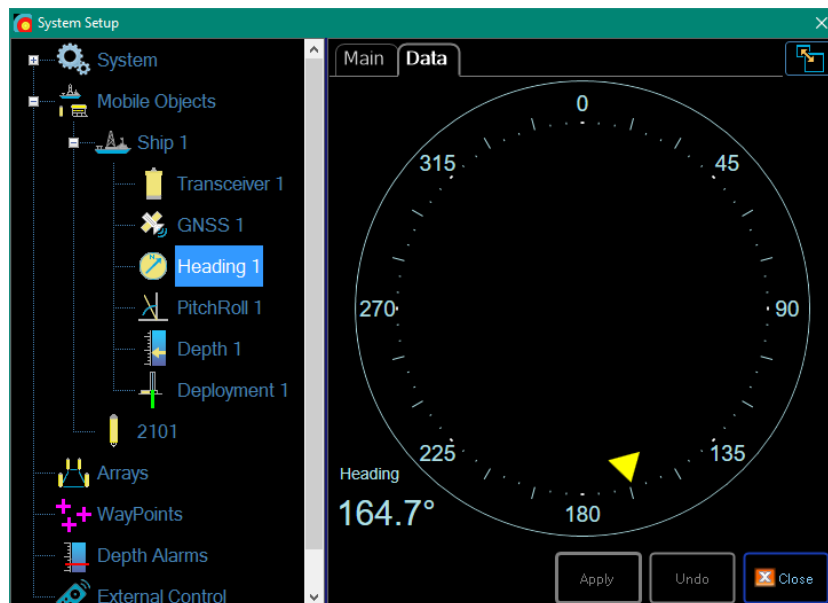
- Click **Apply**.

4.15 Configuring a Gyrocompass

- Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
- Select the Gyrocompass in the job tree.
- Select the **Port**, **Baud Rate** and **Data-Parity-Stop** to match the communication parameters used by the Gyrocompass if required..
- Enter the **Heading Correction** angle necessary to align the gyrocompass reference frame with the vessel's reference frame.
- Select the **Use in Tracking** check box.
- Click **Apply**.



7. Select the **Data** tab and confirm the heading is displayed.

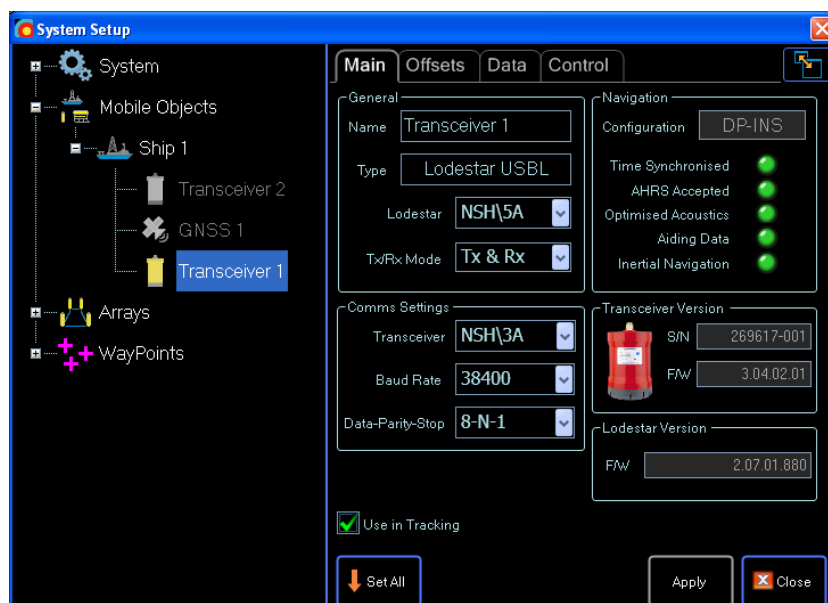


4.16 Configuring a Lodestar Gyro USBL Device

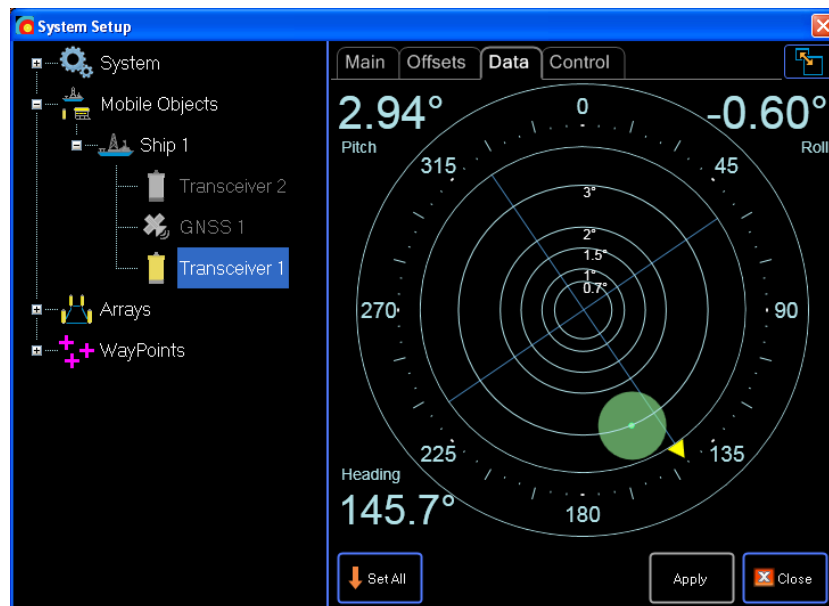
The Lodestar Gyro USBL device is available in 5-element and 7-element versions. Refer to the detail drawings in *Section C.5.7 "Gyro USBL "*.

The configuration procedure is the same for both types and is similar to adding a standard transceiver.

1. Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
2. Select the Gyro USBL (Transceiver) in the job tree .
3. Select the Lodestar **Port** and **Tx/Rx** Mode.
4. Select the transceiver **Port**, **Baud Rate** and **Data-Parity-Stop** to match the transceiver communication parameters used by the Gyro USBL if required.
5. Select the **Use in Tracking** check box.
6. Click **Apply**.



7. Select the **Data** tab and confirm the attitude measurements are displayed.

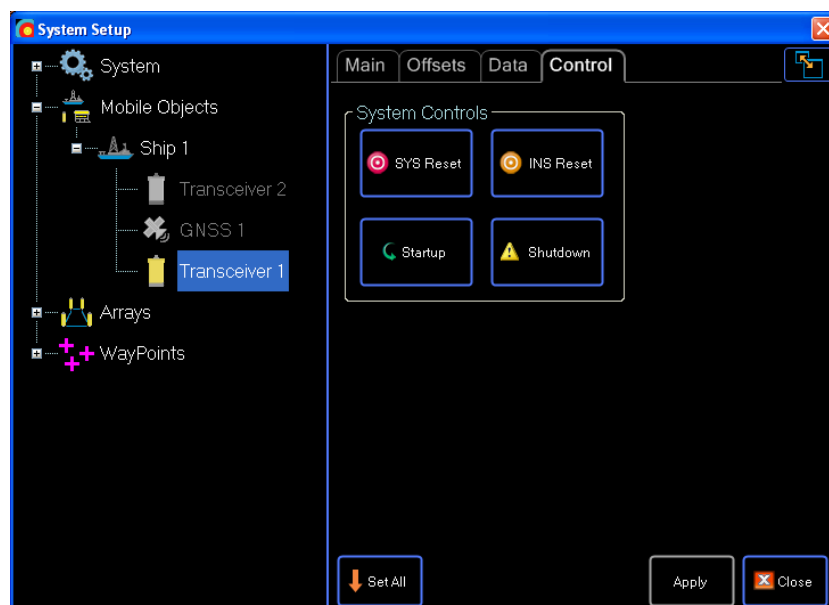


8. If necessary, select the **Control** tab to reset or shut down Lodestar.

CAUTION



Risk of equipment malfunction. Only qualified and experienced users should use the Control tab.

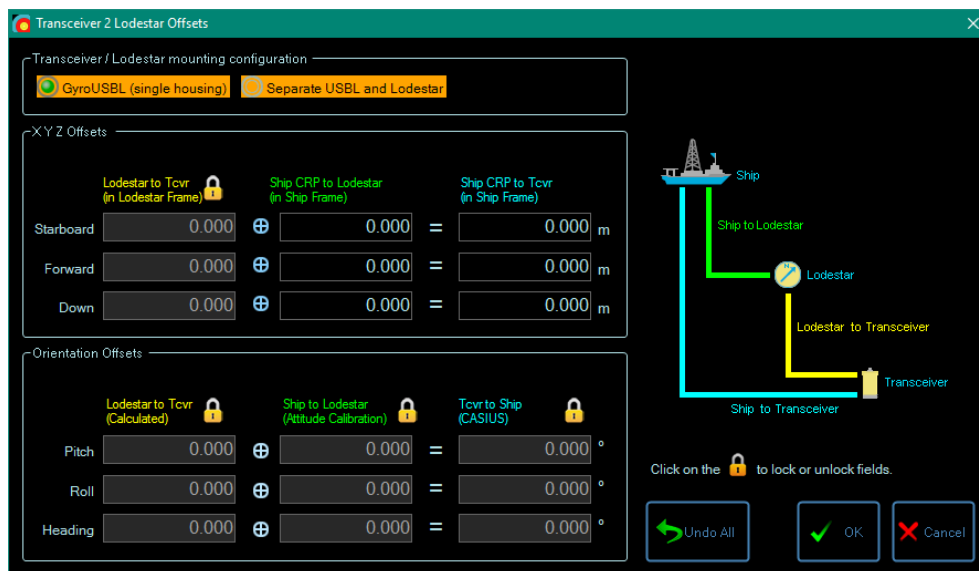
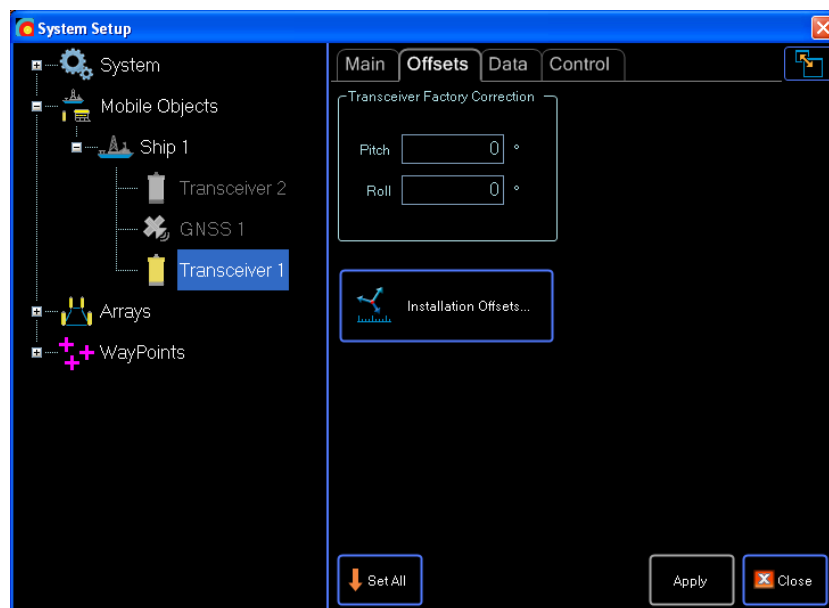


9. Select the **Offsets** tab and click **Installation Offsets** to enter the offset distances between the Lodestar INS and the vehicle. The misalignment angles are computed automatically using the Attitude/Heading Calibration tool and the CASIUS tool (see *Section 7 "Optimised USBL and DP INS"* for details).

CAUTION



Risk of equipment malfunction. Only qualified and experienced users should use the Offsets tab.



4.16.1 Overview of the Offsets Form

This procedure is intended to deal with DP-INS/Optimised USBL using Gyro USBL or where a Lodestar and USBL transceiver are rigidly coupled together but might not be perfectly aligned to the vessel reference frame.

The columns identified by small padlock symbols are not usually intended to be edited directly; they are either completed automatically by the system, or they would normally be constant values. However, you can click on the padlock symbol to edit the associated value if necessary.

The diagram on the right of the **Installation Offsets** window illustrates the relationship between the offsets that the dialog box displays in each column. Entering data in any two columns allows the system to complete the third so that all of the values are consistent.

The encircled cross symbol between the columns in the **Orientation Data** region of the dialog box indicates that these columns are combined together, but are not simply added to each other. They are rotations in three dimensions, and so do not simply add — the transformations **Lodestar to Transceiver**, and **Ship to Lodestar** are combined (similar to adding) together to make a single **Transceiver to Ship** correction.

4.16.1.1 XYZ Offsets

Transceiver/Lodestar mounting configuration

First, select either **Gyro USBL (single housing)** or **Separate USBL and Lodestar**. This is important as the tool makes different assumptions based on this setting.

The **XYZ Offsets** pane displays the transceiver lever arms. Enter the offsets between the Lodestar and the transceiver (or the Ship CRP-to-Lodestar) in one column, and the transceiver-to-ship offsets as normal (established from accurate drawings or from CASIUS). The system then computes the Lodestar-to-ship (or Lodestar-to-transceiver) offset to fit. The important point is that the system keeps the Lodestar-to-transceiver offsets constant because they are rigidly connected, and the housing does not change its physical dimensions if the system is moved to another vessel).

Updating either the Lodestar-to-ship, or the transceiver-to-ship offsets causes an update in the other so as to keep all the offsets consistent, leaving the Lodestar-to-transceiver offsets unchanged.

4.16.1.2 Orientation Offsets

The **Orientation Offsets** region at the bottom of the dialog box operates in a similar way to the XYZ offsets. However, Sonardyne strongly recommends that you allow the system to change these values.

The first step is to use the AHRS alignment tool (**Tools>Advanced>Attitude/Heading Calibration**) with the ship's sensors set as reference sensors to estimate the alignment of the Lodestar to the ship. This sets the **Ship-to-Lodestar** column in the offsets dialog box automatically.

When first commissioning a Gyro USBL it is necessary to use CASIUS to calibrate the alignment of the transceiver to the vessel using the CASIUS tool (**Tools>CASIUS**). When you then apply the CASIUS corrections, it sets the values in the **Transceiver-to-ship** column, and the system automatically completes the **Lodestar-to-transceiver** column. Given that the transceiver and Lodestar are rigidly coupled together, then this result should be constant.

When you raise and lower the pole, or if you move the system between vessels, no further CASIUS is required — you can re-align the AHRS corrections to the ship, and the **Transceiver-to-Ship** corrections will be updated to be consistent, leaving the **Lodestar-to-Transceiver** values unchanged.

4.16.1.3 Template

Sonardyne recommends that you save the configuration as a template after you have set the offset values for a Marksman, Ranger 2 USBL/Survey/DP system. This precaution makes sure all future jobs inherit the offsets.

4.17 Configuring System Devices

Devices are grouped under **System** and **External Control** in the job tree.

Note

 To configure an "External Control" device, see [Section 4.18 "Configuring External Control Devices"](#).

- The Network Sensor Hub (NSH)
- The Time of Day (TOD)
- The Electronic Riser Angle (ERA)
- The Signal Tower device
- The Sound Speed sensor

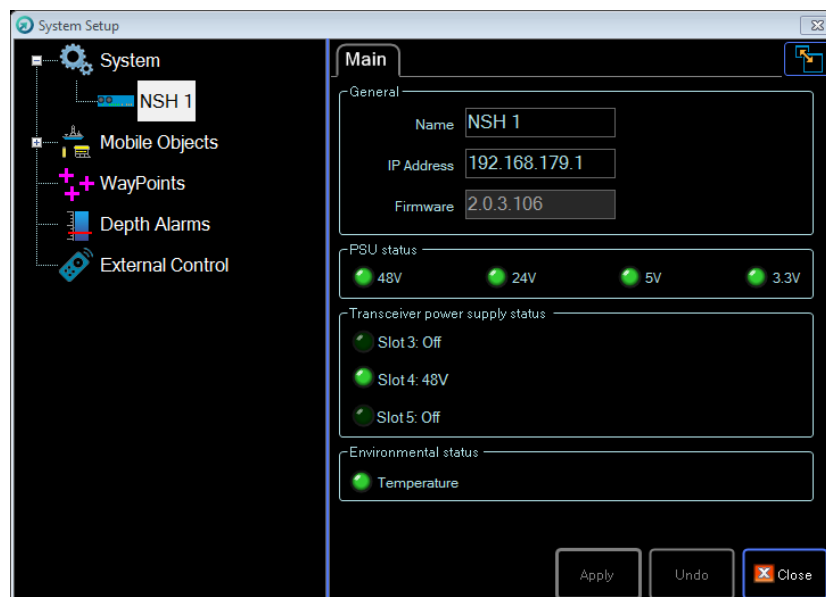
System devices are displayed in the job tree under **System**.

1. Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
2. Right-click **System** and select the device to add.

Add NSH
Add TOD
Add ERA
Add Signal Tower
Add Sound Speed

4.17.1 Network Sensor Hub (NSH)

1. Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
2. Select the NSH in the job tree.
3. Enter a **Name** for the NSH, if necessary.
4. Enter the **IP Address** to connect the NSH to the Computer (default is 192.168.179.1).
5. Click **Apply**.



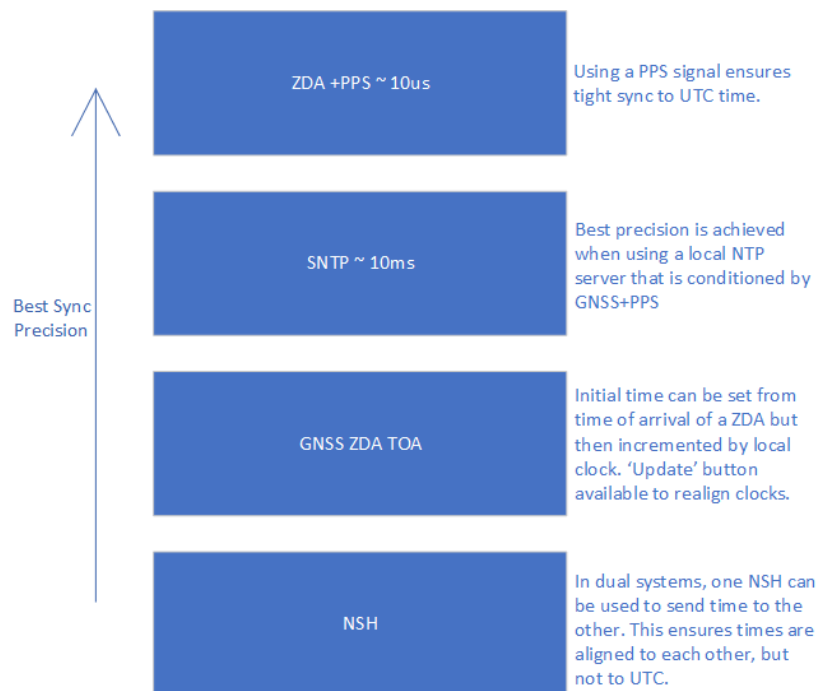
The software indicates a connection to the NSH by displaying a firmware version.

Status is indicated by green or red LEDs for:

- The various internal power supplies.
- The powered slots 3, 4, 5 dedicated to transceivers and Lodestars.
- The internal temperature.

4.17.2 Time of Day (TOD)

The TOD device allows the software to precisely synchronise the NSH clock with an external time source, typically provided by a GNSS set. UTC and ZDA time strings are supported. The precision of each type of time source is indicated in the following figure:



See *Appendix K "Time System"* for a description of the software time system.

1. Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
2. Select the TOD in the job tree.
3. Enter a **Name** and **Type**, if necessary.
 - UTC for standard time input from GNSS set.
 - Receive_NSH_Time to receive time from another NSH.
 - Send_NSH_Time to send time to another NSH.
 - SNTP for UTC from an NTP server.

Note



Connecting to an external NTP server requires connecting the system to a vessel network. This could create a security risk. Ensure that vessel IT policy is followed and appropriate anti-virus and anti-malware is installed and kept up to date.

4. Select the **Port**, **Baud Rate** and **Data-Parity-Stop** to match the communication parameters if required (refer to the TOD documentation if necessary).

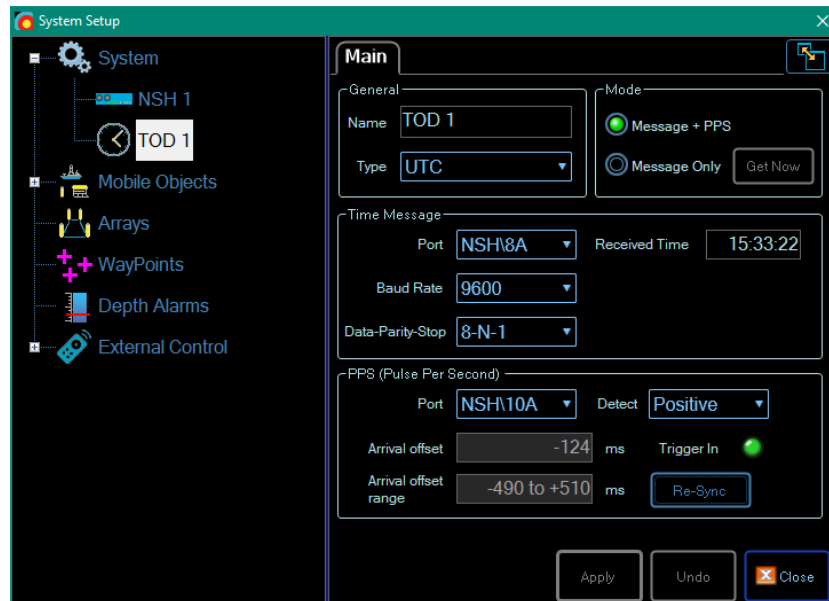
Note



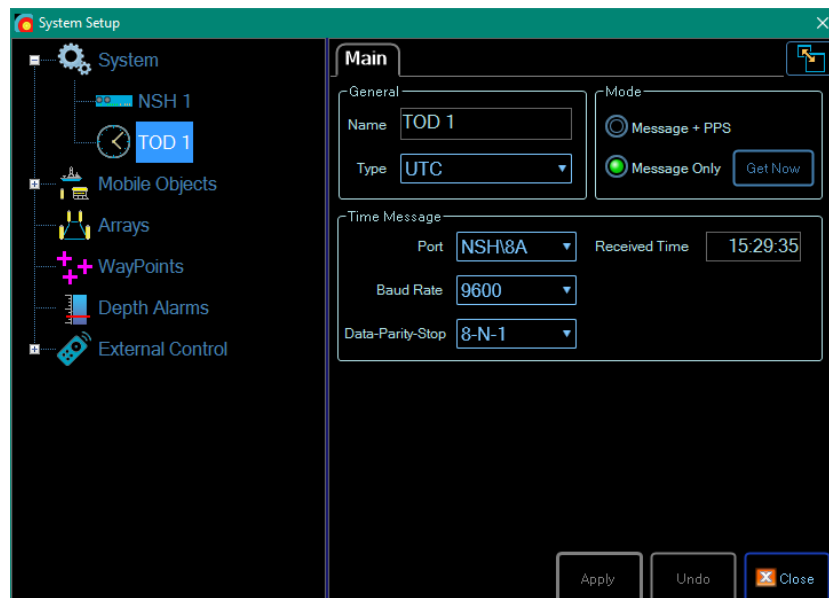
For accurate time synchronisation, a PPS signal is required. If no PPS is available, SNTP can be used, or the NSH clock can be set using just a ZDA/UTC string.

5. If a PPS input is available, continue below; if a PPS input is not available skip to *Step 6*.
 - a. Set the Mode to Message + PPS, and select the **PPS (Pulse per Second) Port** and edge **Detect** polarity.
 - b. Click **Apply**.
 - c. Confirm the **Received Time** is updating correctly, and that the **Trigger In** LED is flashing (refer to the time source documentation if necessary).

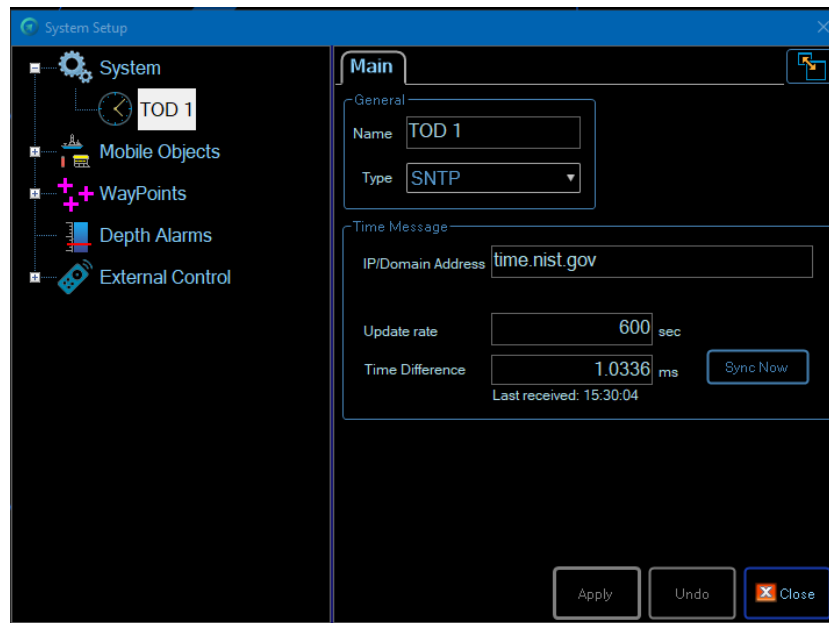
- d. Click **Re-Sync** to centre the **Arrival offset range** around the most recent **Arrival offset** value.



6. If a PPS input is not available:
 - a. Select the **Mode** to **Message Only**.
 - b. Click **Apply**.
 - c. Confirm the **Received Time** is updating correctly (refer to the time source documentation if necessary).
 - d. Click **Get Now** to force the system to re-read the time now in the ZDA/UTC string.



7. When using SNTP:
 - a. Enter the IP, or domain address of an NTP server (e.g. time.nist.gov) and then click **OK**.
 - b. On the properties page, enter the required **Update Rate** (setting the rate to 0s turns off automatic updates, and time is only synchronised when the **Sync Now** is clicked).
 - c. Click **Sync Now** until the **Time Difference** between updates is small.

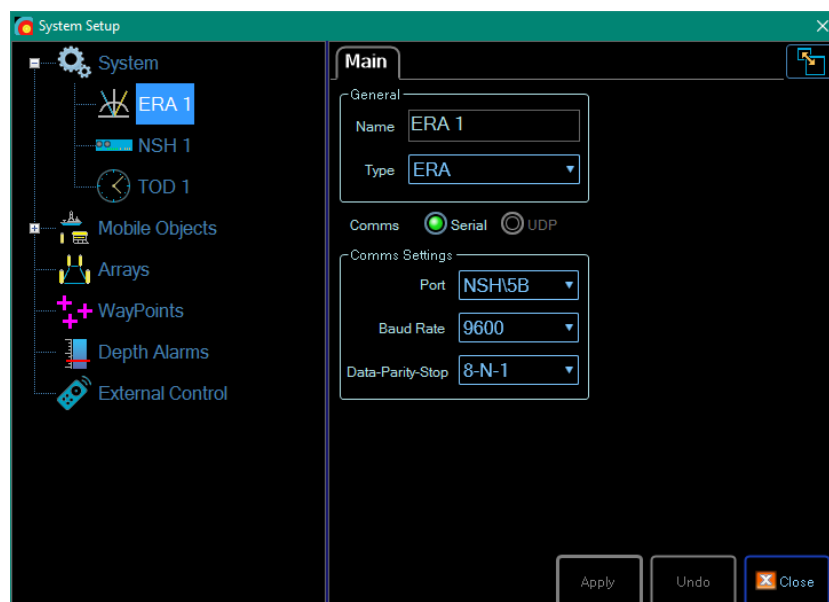


Note

 There is no Received Time or Trigger In indicator when the TOD device is configured to Send_NSH_Time.

4.17.3 Electronic Riser Angle (ERA)

1. Click **System** to expand the list and select or the **System** shortcut button to open the **System Setup** window.
2. Select the ERA in the job tree.
3. Enter a **Name** for the ERA, if necessary.
4. Select the **Port**, **Baud Rate** and **Data-Parity-Stop** to match the communication parameters if required.
5. Click **Apply**.



Note

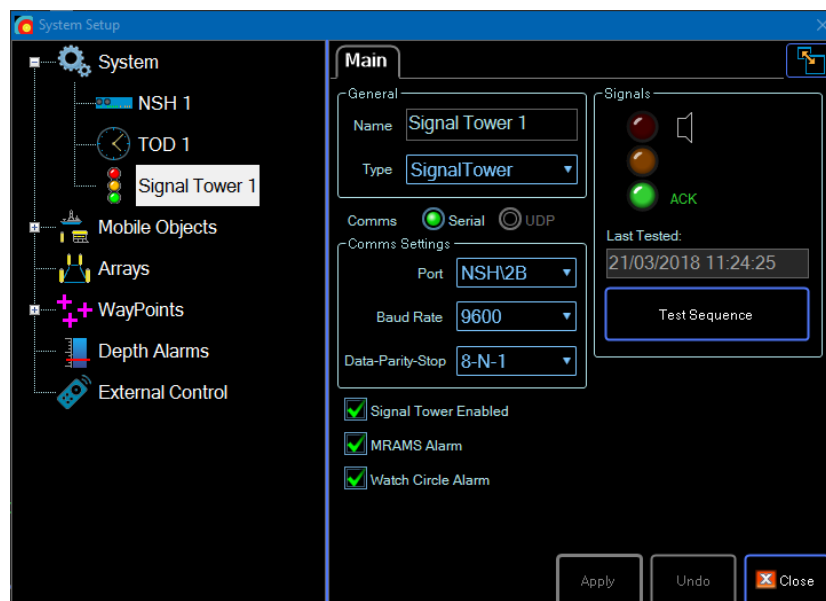


Standard strings are supported.

See Section 8.3 "Electrical Riser Angle (ERA) Monitoring" for more information.

4.17.4 Signal Tower

1. Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
2. Right-click **System** and select **Add Signal Tower**.
3. Enter a **Name**.
4. Select the **Port**, **Baud Rate** and **Data-Parity-Stop** to match the communication parameters if required.
5. Select the **MRAMS Alarm** to drive the signal tower from the MRAMS system status.
6. Select the **Watch-circle Alarm** to drive the signal tower from the watch-circle status.
7. Click **Apply**.



4.17.4.1 Operating the Signal Tower

- If an MRAMS **Warning** alarm occurs, the signal tower indicates this by turning on its amber light.
- If an MRAMS **Critical** alarm occurs, the signal tower indicates this by turning on its red light and sounding its alarm.

The signal tower status is also indicated on the Signal Tower user interface.

The signal tower also works with **Watch Circle** alarms. Watch circles can be configured on the **Way Points** region of the **System Setup** dialog box after one has been set on the main navigation chart. If a Watch Circle alarm occurs, the signal tower indicates this by turning on its red light and sounding its alarm.

Test sequence

Click the **Test Sequence** button to run a sequence of lights on the signal tower. This test exercises all the different states that the signal tower can show. After you have started the test sequence, the

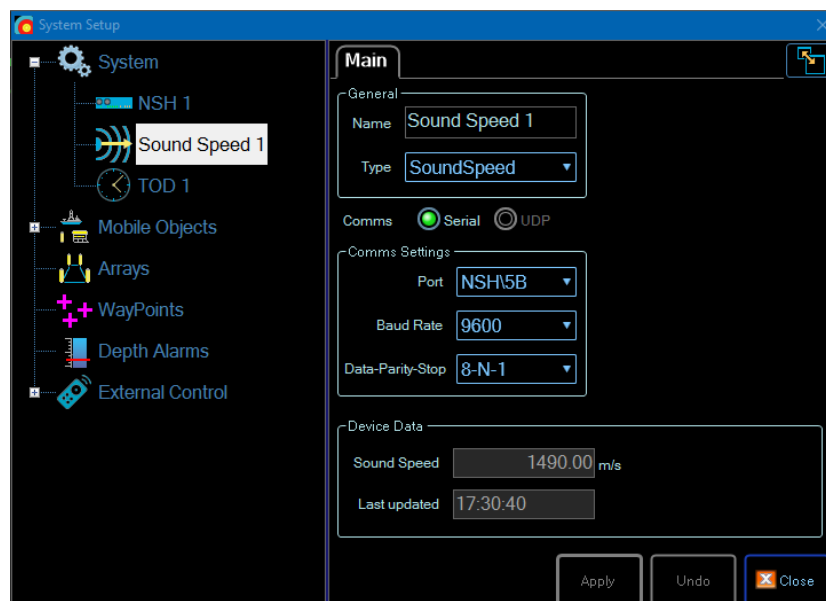
system records the date and the time of the test, and displays that information on the configuration dialog box.

Note

After you have initiated a test sequence, any new MRAMS alarms that occur will be ignored and not represented on the signal tower until the test sequence completes. See Section 8 "Riser Angle Monitoring" for information about MRAMS.

4.17.5 Sound Speed Sensor

1. Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
2. Right-click **System** and select **Add Sound Speed**.
3. Enter a **Name**.
4. Select the **Port**, **Baud Rate** and **Data-Parity-Stop** to match the communication parameters if required.
5. Click **Apply**.



4.17.5.1 Sound Speed Device Formats

The sound speed device supports two standard string types automatically, requiring no user intervention to select the correct type:

- **Valeport** – Valeport proprietary sound speed string.
- **\$PSONSS** – Sonardyne proprietary sound speed string.

4.18 Configuring External Control Devices

Note

To configure a System device, see Section 4.17 "Configuring System Devices".

External Control devices are displayed in the job tree under **External Control**.

- The Alarm Report
- The PAN device

- The Remote Control device

1. Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
2. Right-click **External Control** and select the device to add.

Add Alarm Report
Add PAN
Add Remote Control

4.18.1 NMEA Alarm Report

The Alarm Report device allows a remote system, e.g. HMI, to display active alarms and to send alarm acknowledgements according to the NMEA-0183 standard.

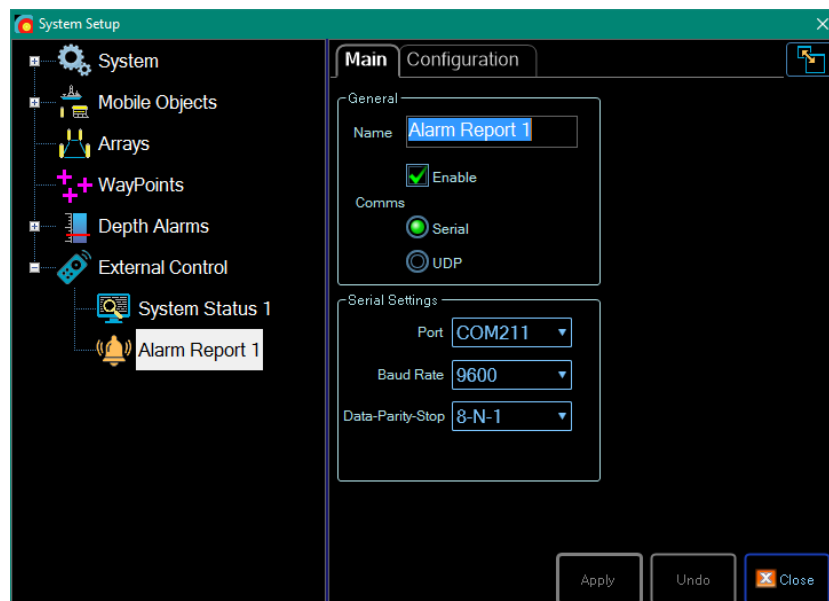
1. Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
2. Select **Alarm Report** in the job tree.
3. Enter the **Name** for the Alarm Report.
4. Depending on the connection type, select either **Serial** or **UDP**.

Note

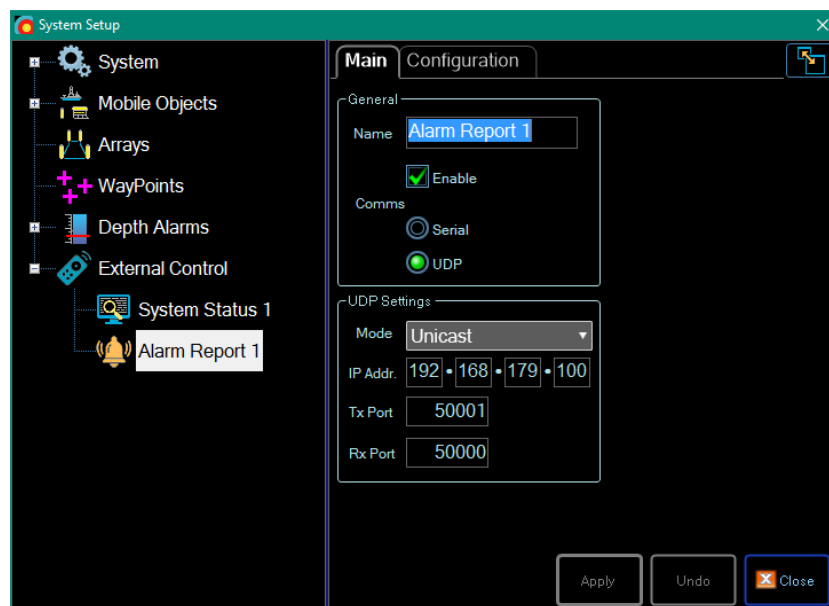


Only UDP Unicast mode is currently supported

- a. For a Serial connection: select the **Port**, **Baud Rate** and **Data-Parity-Stop** to match the communication parameters.



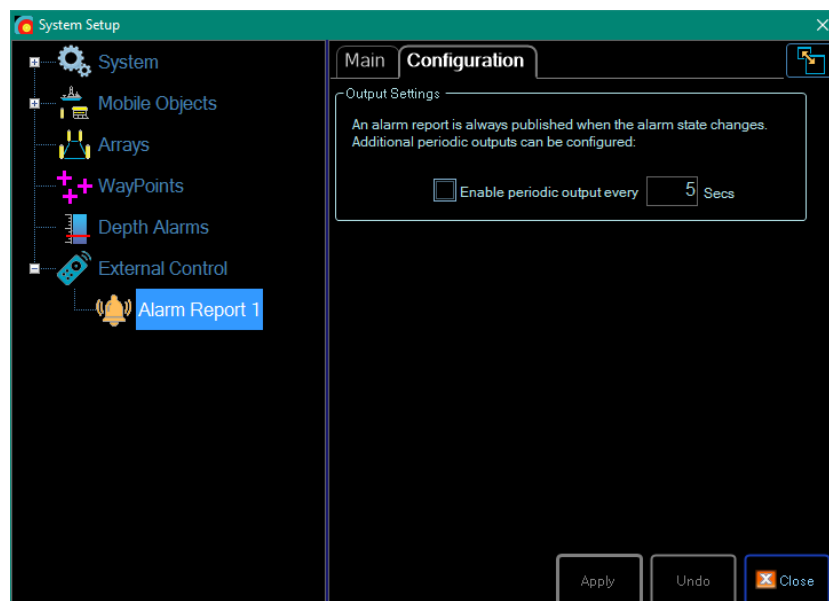
- b. For a UDP connection: select the **Mode**, enter the **IP Address**, **Tx Port** and **Rx Port**.



5. Click **Apply**.

4.18.1.1 Configuring the Alarm Report

Select **Enable Periodic Output** and set the required update period, if required. If this is left unselected, alarm messages are only sent on state changes.



4.18.1.2 Operating the Alarm Report

Once the Alarm Report device is added, for each new alarm the system automatically sends an ALR alarm state message to the defined port, in addition to alerting the user through the main user interface. To acknowledge the alarm, the external system sends an ACK message into the define port or the user can respond through the Alarm Viewer in the usual way. The alarm is only cleared when the cause of the cause of the alarm condition is removed.

The ALR and ACK strings follow the NMEA format shown below.

ALR - Set Alarm State

Local alarm condition and status. This sentence is used to report an alarm condition on a device and its current state of acknowledgement.

`$--ALR,hhmmss.ss,xxx,A,A,c--c*hh<cr><lf>`

Table 4–1 ALR - Set Alarm State Formatting

Field	Description
<code>\$--ALR,hhmmss.ss</code>	Time of alarm condition change, UTC
<code>xxx</code>	Unique alarm number (identifier) at alarm source
<code>A</code>	Alarm condition A = threshold exceeded V = not exceeded
<code>A</code>	Alarm's acknowledge state A = acknowledged V = unacknowledged
<code>c--c</code>	Alarm's description text
<code>*hh</code>	Terminator and checksum
<code><cr><lf></code>	Return plus linefeed

ACK - Acknowledge Alarm

Acknowledge device alarm. This sentence is used to acknowledge an alarm condition reported by a device.

`$--ACK,xxx*hh<cr><lf>`

Table 4–2 ACK - Acknowledge Alarm Formatting

Field	Description
<code>xxx</code>	Unique alarm number (identifier) at alarm source
<code>*hh</code>	Terminator and checksum
<code><cr><lf></code>	Return plus linefeed

For example, the system sends the active alarm state:

`$SNALR,095021.71,006,A,V,System is operating outside of its UTM Zone*6A`

The remote system acknowledges the alarm:

`$SNACK,006*4E`

The system now sends alarm acknowledged state:

`$SNALR,095031.62,006,A,A,System is operating outside of its UTM Zone*7E`

The cause of the alarm is removed, and the system now sends alarm cleared state:

`$SNALR,095041.72,006,V,A,System is operating outside of its UTM Zone*6F`

4.18.2 Programmable Acoustic Navigator (PAN)

Note

 A PAN port allows an external system direct access to a Sonardyne transceiver. This feature is reserved for Sonardyne approved products only because unexpected behaviour can result.

1. Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
2. Select the PAN in the job tree.
3. Enter a **Name** for the PAN, if necessary and then select the **Tcvr** transceiver.
4. Depending on the connection type, select either **Serial** or **UDP**.
 - a. For a **Serial** connection : select the **Port**, **Baud Rate** and **Data-Parity-Stop** to match the communication parameters.
 - b. For a **UDP** connection: select the **Mode**, enter the **IP Address**, **Tx Port** and **Rx Port**.

Note

 Only UDP Unicast mode is currently supported.

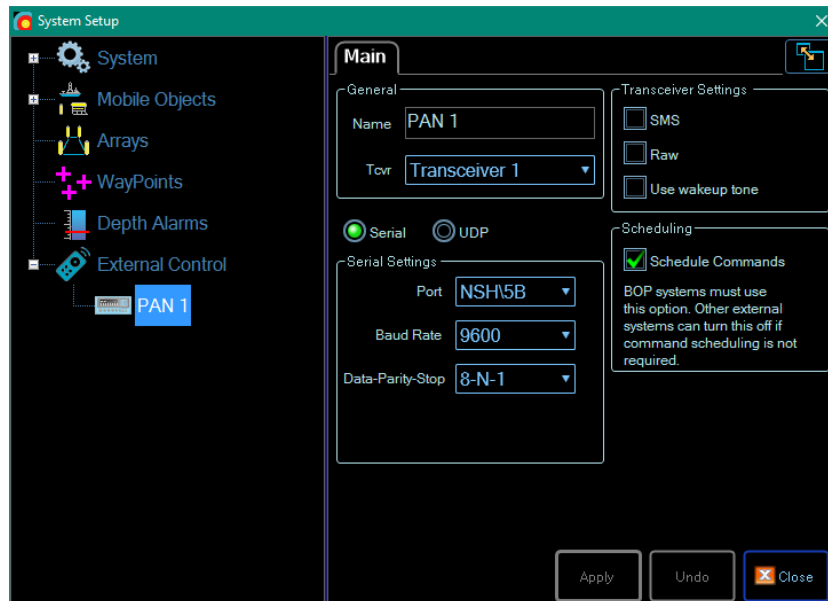
5. Select **SMS** to have incoming SMS messages routed to the PAN port. This is particularly used for AUV Telemetry tracking combined with asynchronous SMS data transfer.

Note

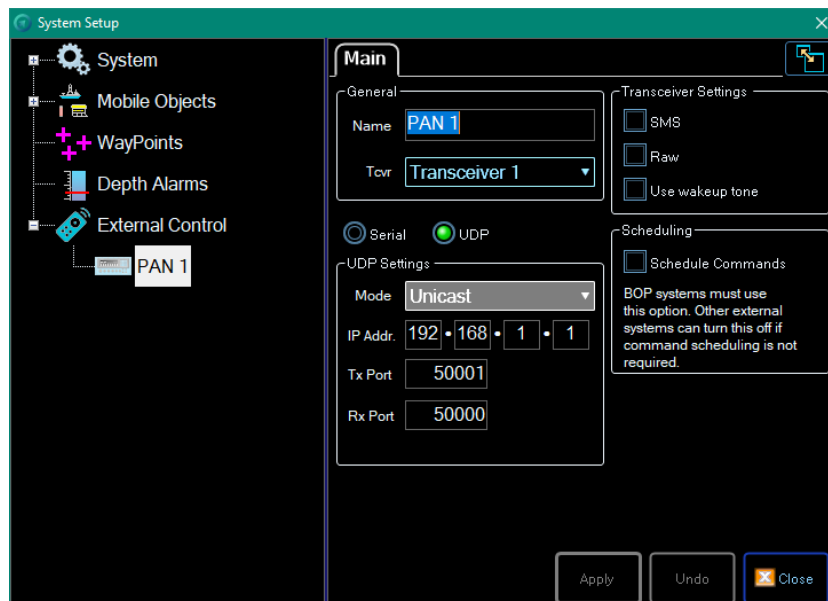
 When using an HPT transceiver with Sonardyne integrated BOP control systems, the **Raw Mode** check box must be selected.

6. Select **Raw** if the external client needs to take full control of the transceiver, or leave blank for the system to use default transceiver Power, Gain, Tx/Rx Telemetry and Wakeups, as defined in **Tools > Options > General, Acoustic** tab.
7. Select the **Use wakeup tone** if using Sonardyne Compatt beacons that have long activity timeouts.
8. Select **Schedule Commands** if using with a Sonardyne integrated BOP system, otherwise leave deselected.
9. Click **Apply**.
10. Use the **Comms Viewer** to confirm the PAN communications are correctly sent and received.

Serial Connection



UDP Connection



4.18.3 Remote Control Interface

The Remote Control interface becomes available when the optional 'Robotics pack' has been purchased. It allows an External System to control and monitor the system. Typical uses for the Remote Control interface include:

- Adding and deleting beacons.
- Starting or stopping acoustic tracking.
- Setting the sound speed.
- Interrogating the system status.
- Controlling depth aiding.

Note

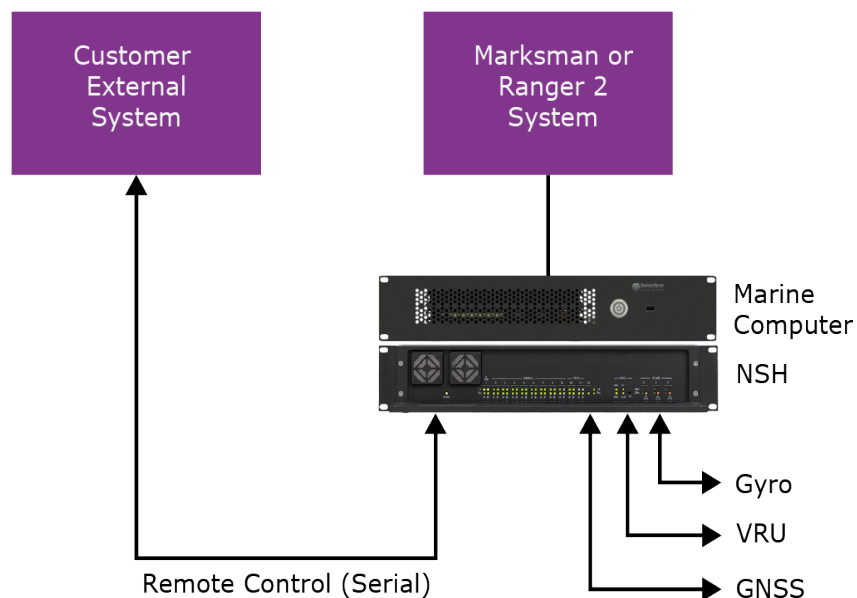
 Sonardyne cannot be held responsible for the operation or debugging of any external system, and can only offer limited support for the use of the Remote Control feature.

4.18.3.1 Hardware Interface

The remote control link consists of either:

- a serial connection from an external system to either the Marine Computer or to its attached NSH, or
- a UDP connection through Ethernet to the Marine Computer's second port.

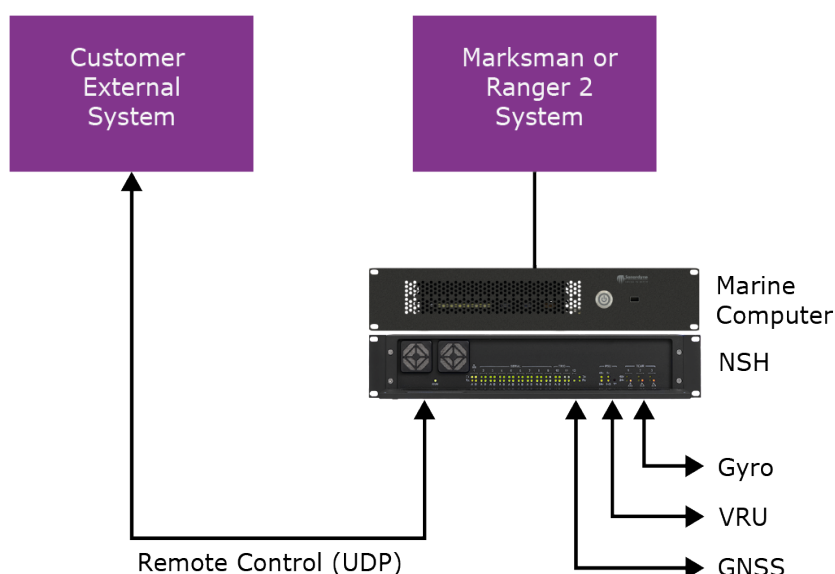
Figure 4–1 Remote Control Interface – by Serial Port



RS485 permits higher baud rates over longer distances than RS232; hence the choice between these two protocols may depend on system deployment.

The external system is connected to the NSH using an NSH RS485 or RS232 interface card.

Figure 4–2 Remote Control Interface – by UDP (Ethernet) Port



4.18.3.2 Software Protocol

All commands to and responses from the external system are encoded using standard XML. This enables a robust interface to which future commands and features can easily be added without affecting previous versions of the protocol.

4.18.3.3 Client Software

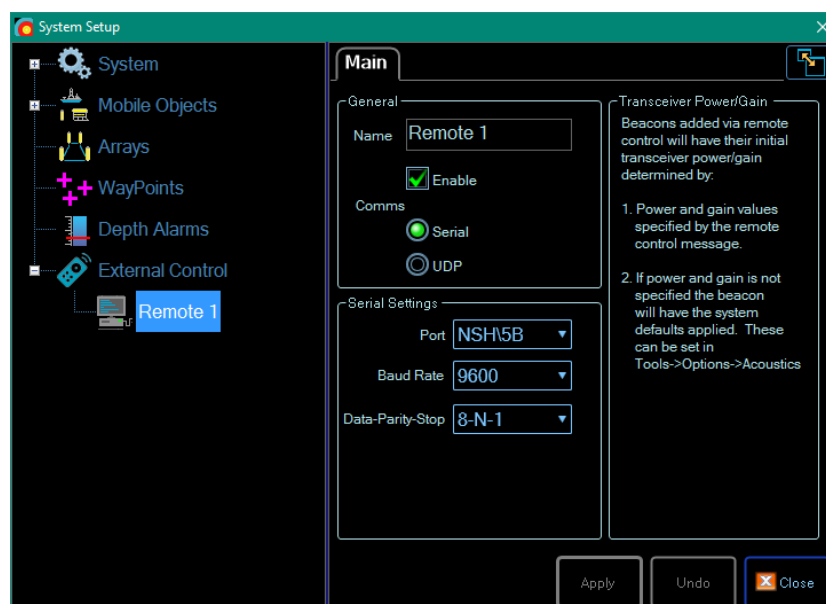
Client software can be written in any programming language and run on any operating system capable of sending and receiving XML via a serial port. A full Remote Control interface specification and sample C# .NET code is available on request from Sonardyne Support.

4.18.3.4 Operating the Remote Control Interface

A Remote Control interface can be added to a system, just like any other device.

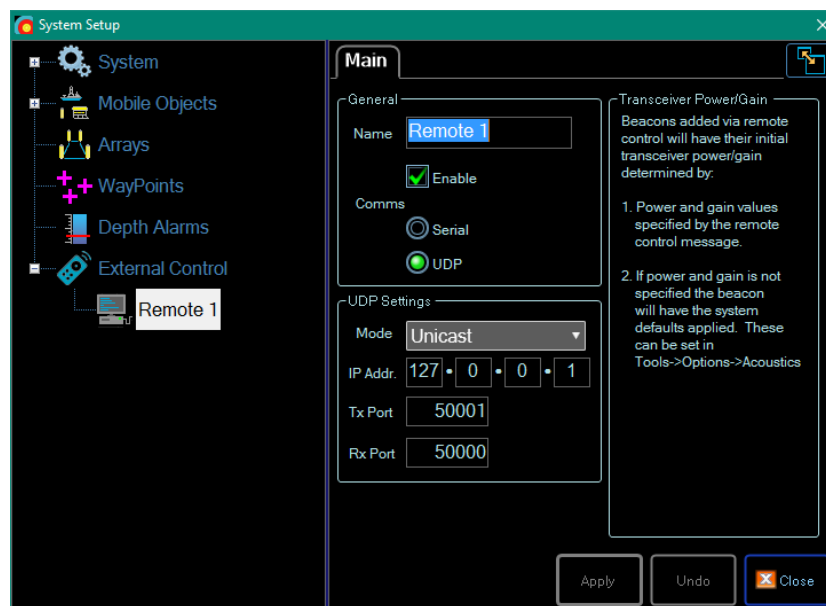
For serial connections:

1. Connect an available NSH serial port to the external system.
2. Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
3. Right-click **System** and select **Add Remote Control**.
4. Enter a **Name** and select **Serial**.
5. Select the **Port**, **Baud Rate** and **Data-Parity-Stop** to match the communication parameters if required.
6. Click **Apply**.



For UDP Ethernet clients:

1. Connect the external system to the Marine Computer's second port.
2. Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
3. Right-click **System** and select **Add Remote Control**.
4. Enter a **Name** and select **UDP**.
5. Enter the **IP Address**, **Tx Port** and **Rx Port**.
6. Click **Apply**.



Notes

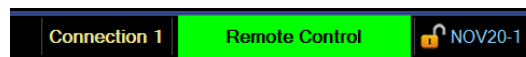
Do not attempt to share the private network that connects the Marine Computer to the NSH with external systems. System malfunction is likely to occur if you do this.

Firewall settings may need to be adjusted to enable UDP comms.

For all connections:

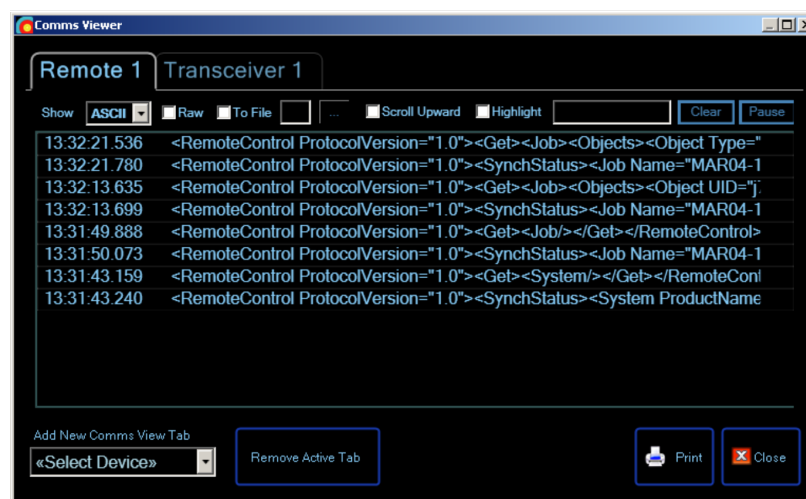
Run the external system's client software and establish communications.

Select the **Enable** check box and tick to enable or untick to disable the Remote Control. When Remote Control is enabled, an indicator appears at the bottom of the user interface.



Note

Use the Comms Viewer to view and debug the Remote Control commands and responses: To get started, use the Sonardyne sample Remote Control application from a Windows PC to prove the basic setup.



4.19 Configuring a Waypoint

With an active GNSS in the system, click the **Add WayPoint** button on the main window. Move the cursor on the chart and then click at the location for the new waypoint.



4.19.1 Waypoint Main Tab

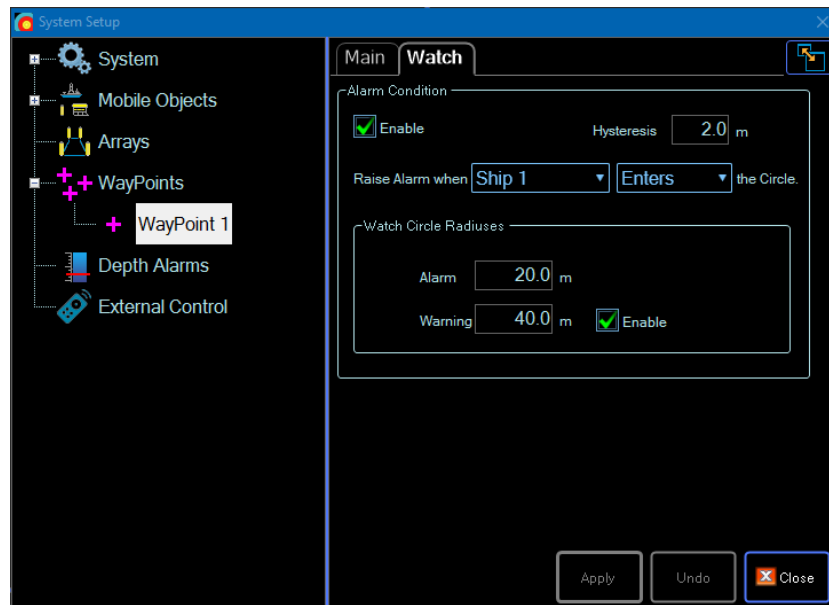
From the **System Setup** window, select the required waypoint. The **Main** tab shows the current position of the waypoint and allows you to edit the position by changing the Easting and Northing values.

A DP_Ref waypoint is created automatically when an array is calibrated. It is used by certain telegrams as the origin.

4.19.2 Watch Circle

A watch zone is an optional guard zone centred on a waypoint. The **Watch Circle** tab allows you to set the parameters for the guard zone.

1. Select the **Enable** check box to enable the watch circle alarm for the selected waypoint.
2. Select the **Warning Enable** check box if a warning circle is required.
3. In the **Watch Circle Radiuses** box Set the radius for the alarm and warning watch circles.
4. In the **Hysteresis**¹ box set the hysteresis for the watch circle.
5. In the **Raise Alarm when** and **the Circle** drop-down lists select which target will raise the alarm, and whether the alarm occurs when the target **Enters** or **Leaves** the watch circle.



¹ Hysteresis is used to prevent false watch-circle alarms when the target vessel or object is positioned near the edge of the circle. Some trial and error may be required in choosing the best value to suit the conditions.

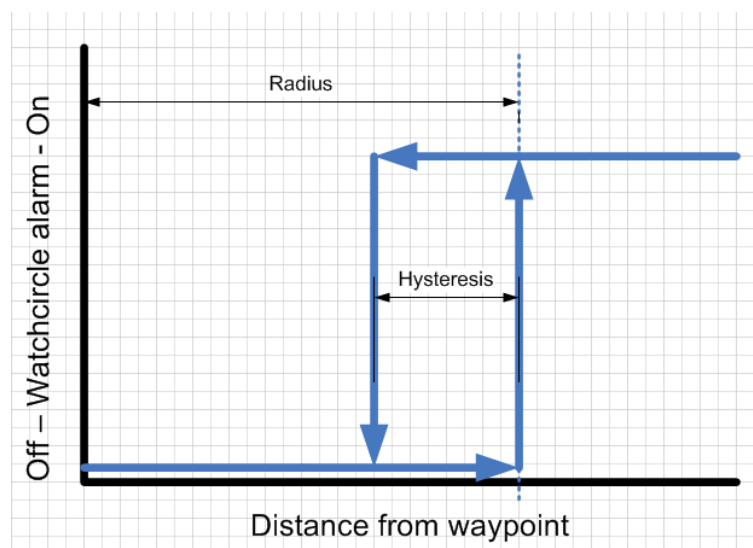
For **leaving the circle** type alarms:

- alarm is raised when the target position $>$ radius
- alarm is cleared when the target position $<$ radius - hysteresis

For **entering the circle** type alarms:

- alarm is raised when the target position $<$ radius
- alarm is cleared when the target position $>$ radius + hysteresis

Figure 4–3 Effect of Hysteresis on the Watch-Circle Alarm



4.19.3 Importing Waypoints

While tracking is active, **Tool > Waypoints** is greyed out to prevent critical changes taking place that could affect the system outputs.

To import a file containing multiple waypoints:

1. Ensure that tracking is not active by clicking vessel tracking off.
2. Click **Tools > Waypoints > Import**.
3. Navigate to and select the Sonardyne NAV, or CSV file.

The NAV file contains one line per waypoint. Each line is made up of:

Name,WAYPOINT,Easting,Northing,Depth.

Note



The file must be named with the file extension .NAV

The CSV file contains one title row:

Location Name,EPG Code,Geodetic latitude,Geodetic longitude,Depth

followed by one line per waypoint. Each line is made up of a name, followed by an EPSG code that must be set to 4326 to indicate that the co-ordinates are in World Geodetic System 1984 and the co-ordinate itself.

Note



The file must be named with the file extension .CSV

4.19.4 Exporting Waypoints

While tracking is active, **Tool > Waypoints** is greyed out to prevent critical changes taking place that could affect the system outputs.

To export a file containing multiple waypoints:

1. Ensure that tracking is not active by clicking **Vessel Tracking Off**.
2. Click **Tools > Waypoints > Export**.
3. Navigate to the required destination and select the CSV, or NAV file.

Note



The CSV file is compatible with Sonardyne's Fusion 2 software.

4.19.5 Removing All Waypoints

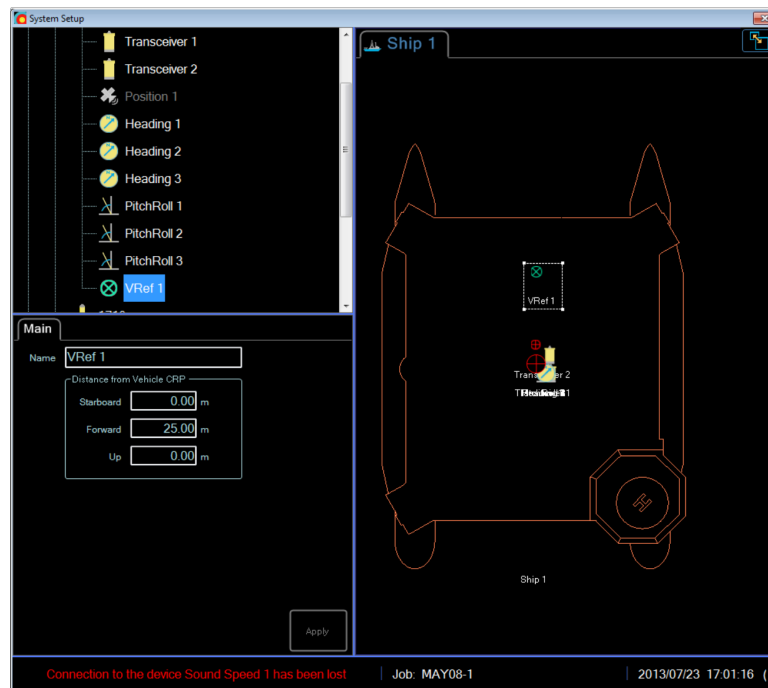
To remove all waypoints:

1. Ensure that tracking is not active by clicking vessel tracking off, and then select the menu option **Tools > Waypoints > Remove All** (a confirmation will be displayed). Note that the **DP Ref** waypoint will not be affected.
2. Ensure that none of the waypoints are being used as the reference for any required chart measurements, or telegrams, and then click **Yes**.

4.20 Adding a Vessel Reference Point

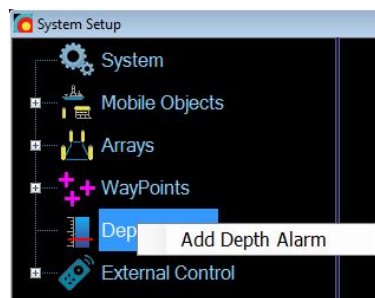
1. Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
2. Select the Vessel Reference Point in the setup.
3. Enter the location of the Reference Point relative to the vessel's CRP.

- The Reference Point will display on the vessel's shape, both in the System Setup vessel shape view and on the main navigation chart.



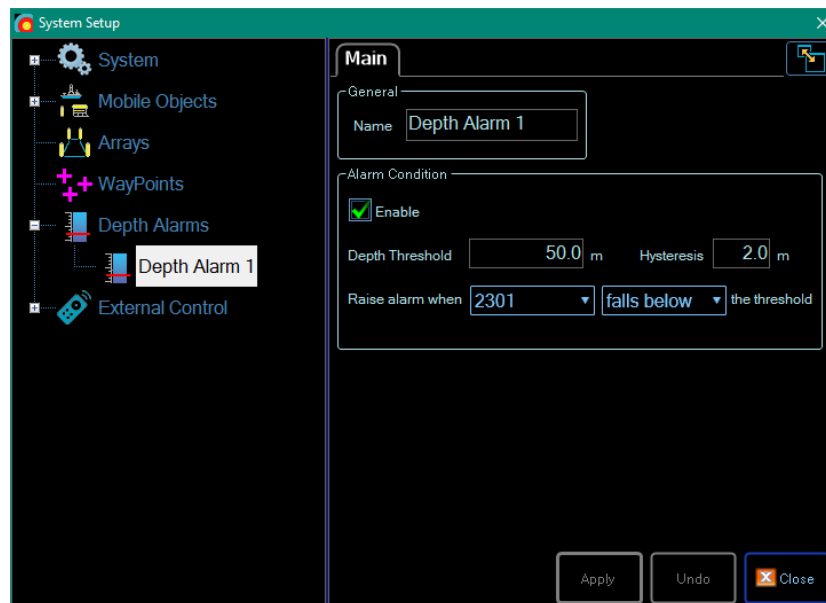
4.21 Configuring a Depth Alarm

- Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
- Right-click **Depth Alarms** in the setup tree, and select **Add Depth Alarm**.



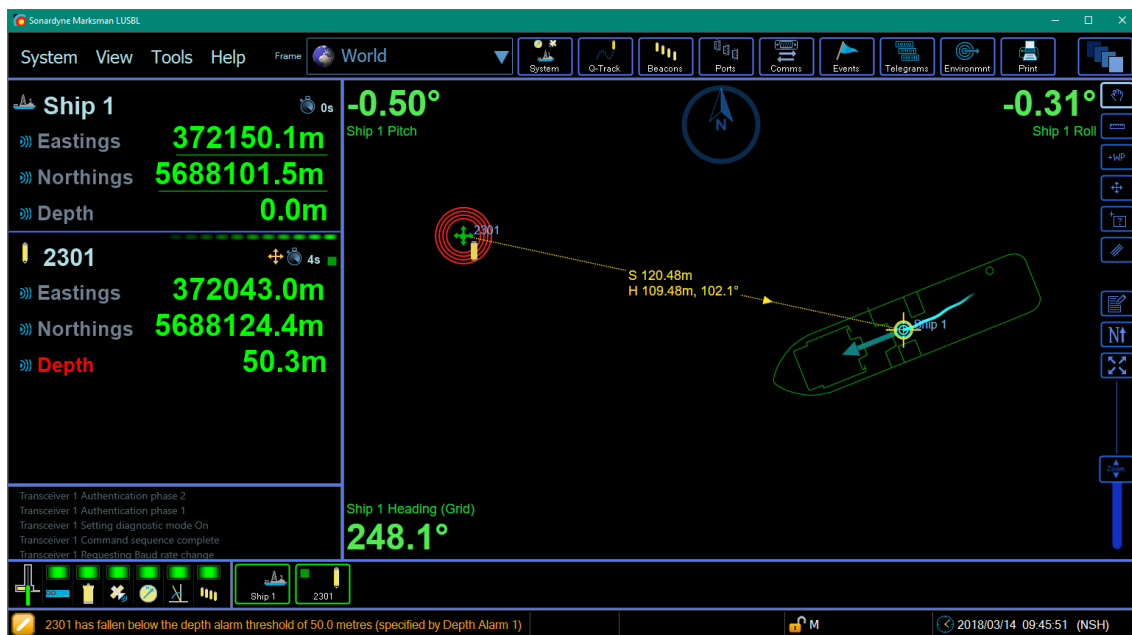
- Select the required object from the **Raise alarm when** drop-down list.
- Select **falls above** or **falls below** from the **threshold** drop-down list.

- Enter the required **Depth Threshold** and **Hysteresis** values; see *Hysteresis* on page 61.



4.21.1 Operating a Depth Alarm

If the depth alarm is triggered, a system alarm is raised but also the object's depth reading is flashed in red and a flashing red highlight is drawn around the object on the main chart.

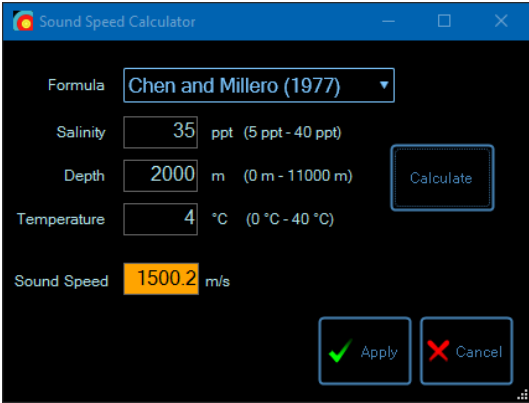


4.22 Environmental Settings

4.22.1 Configuring the Sound Speed

- Click **Tools > Environmental** to display the **Environmental Settings** dialog box.
- Perform one of the following three options:
 - Select **Sound Speed Profile**, and either click **Load** or **Estimated Profile** and then skip to *Step 3*, or

- If the salinity, depth and temperature are known, select **Fixed Values** and click the **Sound Speed Calculator**  to calculate and then enter the **Mean** and **Transceiver** (surface) sound speed values as follows:
 - Select the **Formula** (Chen and Millero, Del Grosso, Mackenzie or Medwin).
 - Enter the **Salinity**, **Depth** and **Temperature**.
 - Click **Calculate** to see the calculated **Sound Speed**.
 - Click **Apply** to automatically enter the calculated figures.



Sound Speed Calculator

Formula: **Chen and Millero (1977)**

Salinity: **35** ppt (5 ppt - 40 ppt)

Depth: **2000** m (0 m - 11000 m)

Temperature: **4** °C (0 °C - 40 °C)

Sound Speed: **1500.2** m/s

Calculate

Apply **Cancel**

or,

- Select **Sound Speed Sensor** (if fitted).



Environmental Settings

Sound Speed

Select one of the following methods to determine sound speed.

☐ Fixed Values

Mean Ranging Sound Speed: **1490.0** m/s

Transceiver Sound Speed: **1490.0** m/s

☒ Sound Speed Profile

Load ... **Estimated Profile**

Sound speed profile taken from location:
Latitude: 51.330376
Longitude: -20.834318
Profile taken at: 13/03/2018 16:03:47
Max depth: 3900 m
Mean Sound Speed: 1501.1 m/s

☐ Sound Speed Sensor

N/A

Pressure to Depth

Atmospheric Pressure: **100.00** kPa

Latitude: **51.33**° ☒ Use GNSS

Operating Range: **2500** m

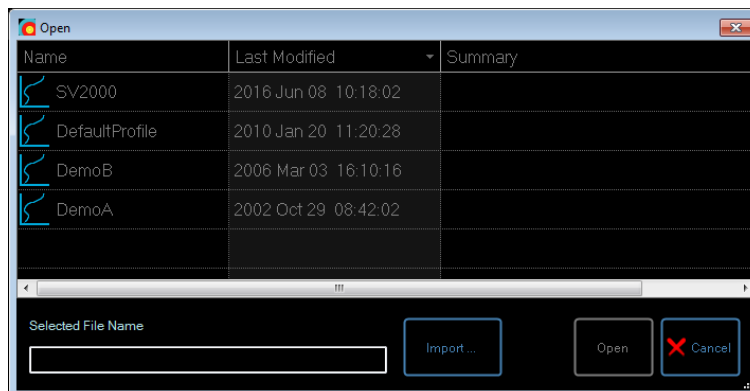
OK **Cancel**

3. Perform one of the following:

Either click **Load** and select a profile.

Note

 If a sound speed profile has not been previously loaded, selecting the "Sound Speed Profile" option will open the profiles window without having to click "Load".



If the profile you need is not included in the displayed list, click **Import**, navigate to the location of a different saved profile, and import it into the list.

The profile (.PRO) file is a plain text file with the following format:

Title

Date

Time

ProbeType

Comments

DepthValue SpeedValue SalinityValue TemperatureValue1

DepthValue SpeedValue SalinityValue TemperatureValue2

DepthValue SpeedValue SalinityValue TemperatureValue3

...

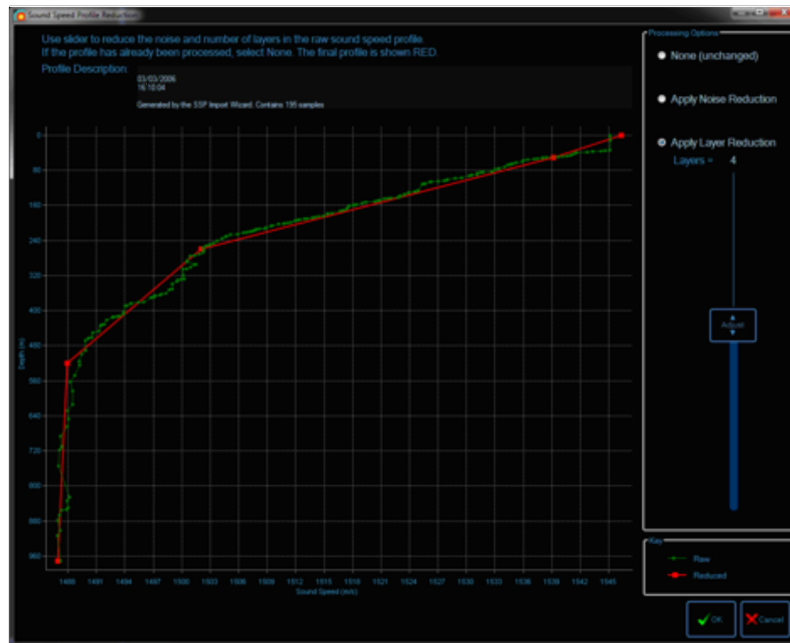
or,

Click **Estimated Profile** to load an estimated profile to suit the location and time of year.

4. After the profile is selected, the software displays the Sound Speed Layer Reduction tool.

This tool gives you the option to eliminate any noise in the data, and also to reduce the number of profile points for the software to process.

For example, selecting the **DemoB.pro** file results in the following:



The green points show the original raw data in the **DemoB.pro** file.

There are three options shown in the right hand panel:

1. **No changes**

This option allows you to import the raw (green) SSP data unchanged.

Use this option if the data has already been simplified (for example, by an external program).

2. **Apply Noise Reduction**

This option performs a fixed noise reduction algorithm on the raw SSP data. It should not change the number of points in the profile. The filtered points are shown in red.

Use this option if you want to retain all the points in the original data, but want to eliminate noisy outliers.

3. Apply Layer Reduction

This option allows you to interactively simplify the SSP data so that there are fewer points in the resulting profile. It also effectively reduces noise.

When you select this option, a vertical slider appears in the right hand panel. Move the slider up and down to change the number of layers (points) that the simplified profile will have (shown in red). The final position chosen will depend on the original data, but should have approximately 10 layers to give a reasonable fit.

Click **OK** to accept the option you have chosen and then return to the **Environmental Settings** dialog box.

Note



The changes will not be applied until you click the **OK** button on the **Environmental Settings** dialog box.

4.22.2 Optimising Pressure to Depth Measurements

Atmospheric Pressure is used to compensate pressure measurements when converting pressure to depth. The default value is equivalent to 1 atmosphere.

Latitude is the approximate current latitude and is also used in the pressure sensor-to-depth calculations. This can be set automatically if a GNSS sensor is available. Select the **GNSS** check box to use this option.

4.22.3 Setting the Maximum Operating Range

Maximum Range is the maximum range from which the system can accept acoustic signals before it times out waiting for acoustic replies. Best practice is to set this to a value just larger than the expected maximum range for the job, in order to achieve the best system performance.

Note



The maximum allowed range is determined by the Product type, as defined in the Security Key.

4.23 Configuring Output Telegrams

There are three main groups of users of output telegrams:

- DP systems
- Survey systems
- Miscellaneous other tools

The software supports several telegram types, but in practice the choice of telegram is usually governed by the third-party equipment that is to receive the telegram – the choices are often limited. Please consult the third-party equipment's user manual and/or the manufacturer's support group if in any doubt.

Table 4-3 lists the available telegram types, and gives basic choices of trackable targets, reference frames, etc.

Notes

 By default vehicle positions are flagged as invalid when GNSS is active. This is intended to prevent GNSS data accidentally being routed through the Marksman system. This behaviour can be overridden. Contact Sonardyne Support for details.

 Measurement telegrams PSONEAS and PSNMRAMS are also available (see *Appendix E "Output Telegram Formats and Interfaces"* for details).

Table 4–3 Position Out Telegrams

Telegram	Object	Valid Indices	Sim Flag Supp	Telegram Output with respect to the CRP of:		Supports User Assignments Mobile / Fixed Transponder Flag	Comments
				Valid Frames of Ref	Valid Frames of Orient		
HPR 309	Trans	1-16	Yes	SHIP/RIG/ROV	NorthUp BowUp	Yes	All positions are sent in ship reference frame. Telegram supports north, or bows up. Can include MRAMS data in telegram
	Vehicle	1-16				No	Vessel position is sent by reporting position of DP_REF waypoint with respect to the ship.
HPR 400 (481D, F)	Trans	B0 1-99 (see comment)	Yes	SHIP/RIG/ROV	NorthUp BowUp	Yes	Kongsberg apply an offset to the index number to indicate the frequency band. For MF, 100 is automatically added, and so B01-B87 are reported as indices 101 to 187 in the telegram. Can include MRAMS data in the telegram.
	Vehicle	0 = Vessel 1-16 = ROV1 to ROV16 17 = Position of Relay 1 18 = Position of Relay 1 19 = Position of Relay 1 20 = Position of Relay 1	Yes	WORLD	N/A	No	
				BEACON WAYPOINT	NorthUp		
HPR BCD (418)	Trans	B0 1-99 (see comment)	Yes	SHIP/RIG/ROV	BowUp	Yes	Kongsberg apply an offset to the index number to indicate the frequency band. For MF, 100 is automatically added, and so B01-B87 are reported as indices 101 to 187 in the telegram. Can include MRAMS data in the telegram.
	Vehicle	0 = Vessel 1-16 = ROV1 to ROV16 17 = Position of Relay 1 18 = Position of Relay 1 19 = Position of Relay 1 20 = Position of Relay 1 (see comment)		BEACON WAYPOINT	NorthUp	No	Kongsberg apply an offset of 300 in the sequence telegram to indicate LBL vehicle positions.

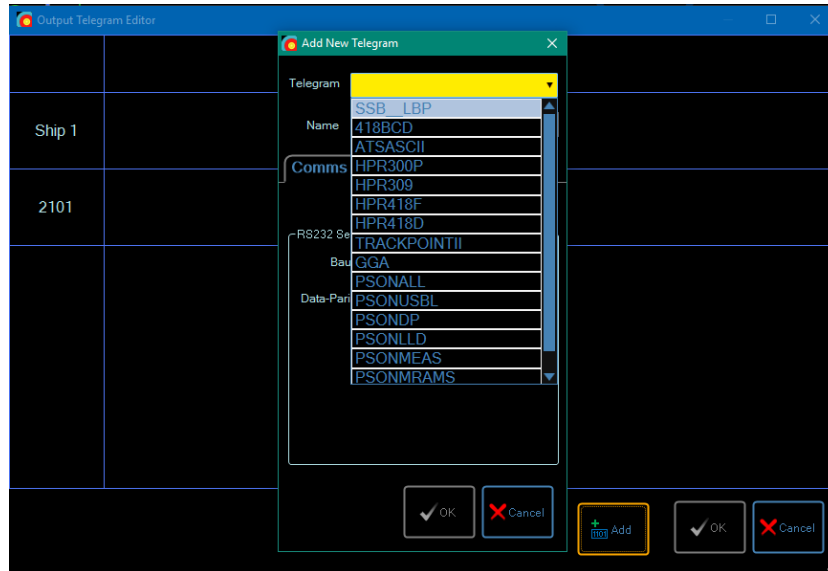
Table 4–3 Position Out Telegrams (continued)

Telegram	Object	Valid Indices	Sim Flag Supp	Telegram Output with respect to the CRP of:		Supports User Assignments Mobile / Fixed Transponder Flag	Comments
				Valid Frames of Ref	Valid Frames of Orient		
NMEA	Trans (SSB)	B01 to B99	Yes	WORLD	N/A	No	Can Carry MRAMS data.
				SHIP	NorthUp BowUp		
	Vehicle (LBP)	Ve or R1 to R4		WORLD	N/A	No	-
				BEACON WAYPOINT	NorthUp		
ATS ASCII	Trans	1 to 10	No	SHIP/RIG/ROV	BowUp	No	-
	Vehicle	0 = The Vehicle		WORLD	N/A	No	-
				BEACON WAYPOINT	NorthUp		
GGA	Trans	0-255	No	WORLD	N/A	No	WGS 8 4 latitude and longitude co-ordinates
	Vehicle	0-255		WORLD	N/A	No	WGS 84 latitude and longitude co-ordinates
HPR 300P	Trans	1 to 99	Implied	SHIP/RIG/ROV	NorthUp BowUp	No	Very rarely used
	Vehicle	-	-	-	-	-	Not supported
Track-point II	Trans	1 to 9.0 is simulating	Yes	SHIP/RIG/ROV	NorthUp BowUp	No	Very rarely used
	Vehicle	-	-	-	-	-	Not supported
PSON ALL	Trans	Uses name of vehicle / offset (or some other meaningful string)	No	WORLD	N/A	No	-
				WAYPOINT	NorhUp		
				SHIP/RIG/ROV	NorthUp BowUp		
	Vehicle	Uses name of vehicle / offset (or some other meaningful string)		WORLD	N/A	No	-
				BEACON WAYPOINT	NorthUp		
				SHIP/RIG/ROV	NorthUp		
PSON USBL	Trans	1 to 999	No	SHIP/RIG/ROV	NorthUp BowUp	No	-
	Vehicle	-	-	-	-	-	Not supported
PSON DP	Trans	-	-	-	-	-	Not supported
	Vehicle	1 to 9	Yes	WORLD	N/A	No	WGS 84 latitude and longitude co-ordinates
PSON LLD	Trans or Vehicle	Object Name	No	WORLD	N/A	No	WGS 84 latitude and longitude co-ordinates

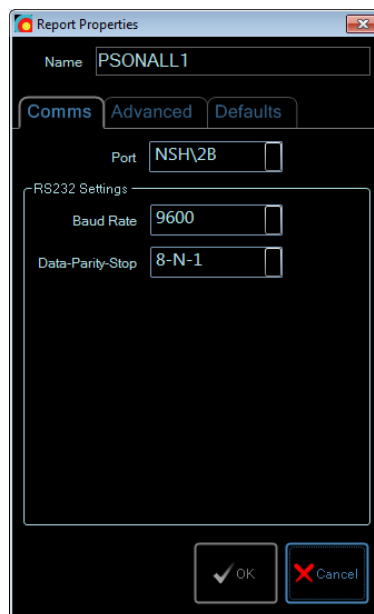
4.23.1 Configuring an Output Telegram

Open the Output Telegrams Editor and follow the steps below to configure a telegram.

1. Click **Add**.
2. Select the telegram type from the list.
3. Click **OK**.



4. Select the **Communications** tab.
5. For a serial connection select the **Port**, **Baud Rate** and **Data-Parity-Stop** and click **OK**.



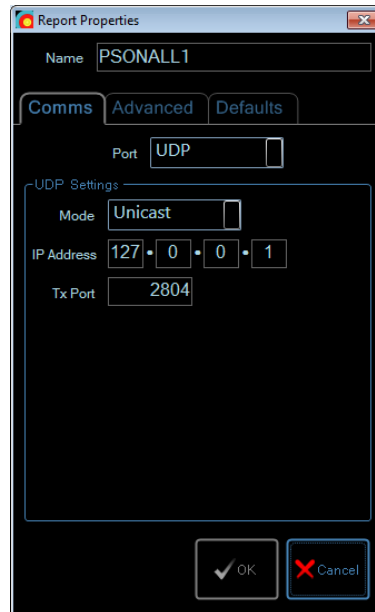
6. For a UDP connection, select **UDP** from the **Port** drop-down and then select:
 - The **Mode**: Unicast, Multicast, or Broadcast.
 - The **IP Address**.
 - The **Tx Port** and **Rx Port**.

7. Click **OK**.

Note

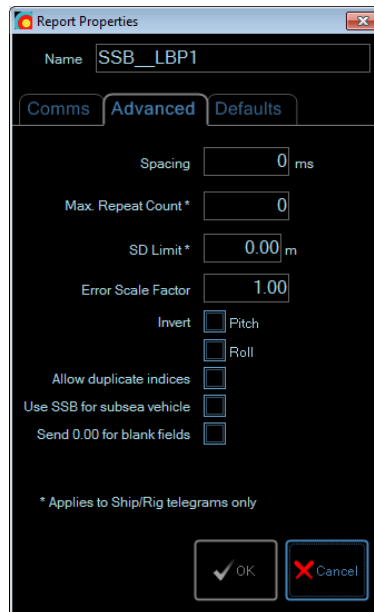


Firewall settings may need to be adjusted to allow UDP comms.



8. Select the **Advanced** tab and set the following as required:
- For DP Use:
 - **Spacing**: The time between telegrams. Normally this parameter should be left at the zero, except in the case of the HPR418D and HPR418F telegrams, which are binary telegrams without unique terminators. The specified gap between these telegrams is 40 ms. Some older systems might require a gap between other telegrams to allow processing one telegram before the next arrives. Set this parameter in accordance with the requirements of the system receiving the data.
 - **Max Repeat Count**: The number of times a telegram can be re-sent. By default this field is set to zero to disable any repeating of telegrams. However, it might be necessary to enable data repetition in some cases. This field limits the number of times a given telegram will be repeated.
 - **SD Limit**: The system will not send a telegram for a position estimate where the predicted error ellipse is larger than this value. The default is zero, which disables this check. Set a non-zero value to enable the limit. This feature is useful for inertial telegrams to prevent free inertial data being delivered beyond a chosen confidence limit.
 - **Error Scale Factor**: This value scales-up or scales-down the error ellipse radius as required. Leave the scale factor at its default value of 1.0 except where it must be adjusted to suit a specific DP system. The valid range is 0.1 to 10.0.
 - **Invert Pitch**: inverts the sign of the reported Pitch.
 - **Invert Roll** : inverts the sign of the reported Roll.
 - **Allow Duplicate Indices** : allows the user to select the same telegram index
 - **Use SSB for subsea vehicle** : enables an NMEA SSB telegram rather than an LBP to be sent for a subsea vehicle.

- **Send 0.00 for blank fields** : sends 0.00 for fields that would normally be sent as empty fields in a telegram string. (Some applications do not accept nulls)



The screenshot shows the 'Report Properties' dialog box with the 'Advanced' tab selected. The 'Name' field contains 'SSB_LBP1'. The 'Comms' tab is also visible. The 'Advanced' tab contains the following settings:

- Spacing: 0 ms
- Max. Repeat Count*: 0
- SD Limit*: 0.00 m
- Error Scale Factor: 1.00
- Invert: ☐ Pitch, ☐ Roll
- Allow duplicate indices: ☐
- Use SSB for subsea vehicle: ☐
- Send 0.00 for blank fields: ☐

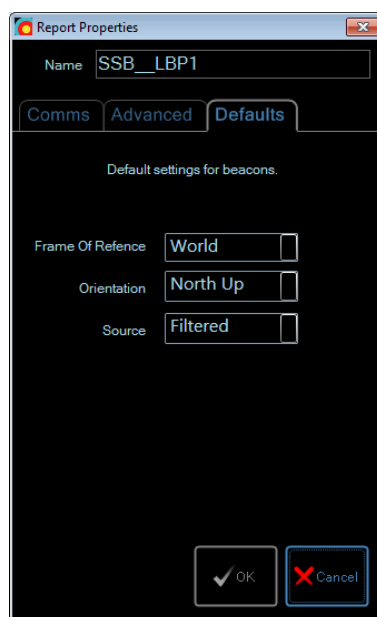
* Applies to Ship/Rig telegrams only

Buttons: OK, Cancel

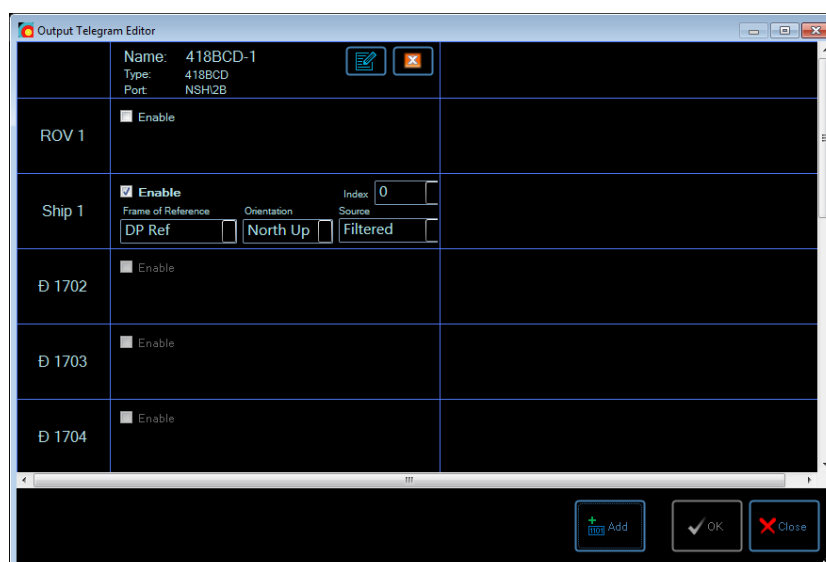
9. Select the **Defaults** tab to set the telegram parameters when beacons are added using the Add Beacon wizard, Quick Track or Remote Control.

Set the following as required:

- **Reference frame**: Position is sent with respect to the DP Ref waypoint, the Ship, a subsea vehicle such as ROV, or Structure.
- **Orientation**: Coordinates sent: North or Bow up.
- **Source**: Filtered, Raw, INS or SPRINT.
 - **Filtered**: Uses a Kalman filter to identify and exclude outliers (default).
 - **Raw**: Uses a least squares to estimate new position (Note: does not estimate velocity, and so computed position is not compensated for movement during the time that the acoustic signals were in the water).
 - **INS**: Uses the DP-INS solution (only available for the vessel).
 - **SPRINT**: Use when interfacing with SPRINT systems to supply position valid at the time that the beacon is interrogated, rather than at the time that the reply signal arrives at the vessel.



10. Set the following as required (with reference to *Table 4-3*).



Ship or specific beacons (as position feeds are required).

- Reference frame: Position is sent with respect to a waypoint, the Ship, or a subsea vehicle such as ROV, or Structure.
- Telegram index.
- Source: Filtered, Raw, INS or SPRINT; for a description, see *Source: Filtered, Raw, INS or SPRINT*. on the previous page
- Orientation: North or Bow up.

If necessary, you can set up more than one output telegram. Use the Comms viewer to check the output telegram.

To delete a telegram, click the red X button in the top right of that telegram's window.

4.23.2 Operating an Output Telegram

No user intervention is necessary. Output telegrams are generated as soon as the position data is available.

4.23.3 Vehicle Guidance Reports

A guidance report can be added to a vehicle, providing guidance from the current vehicle position to a destination waypoint. Distances are computed along the great circle path (rather than the rhumb line). Details of the reports are provided in *Appendix E "Output Telegram Formats and Interfaces"*.

The following sections describe the reports and how to create them.

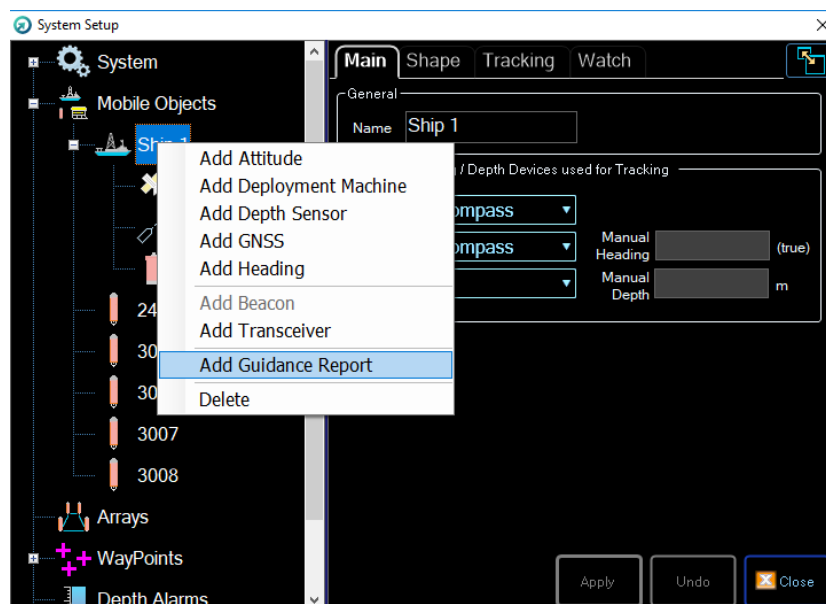
4.23.3.1 NMEA RMB Report

This is an NMEA-0183 report providing the 'Recommended Minimum Navigation' information. It provides cross track error from the path between the origin and destination waypoints, the direction to steer, and distance to destination.

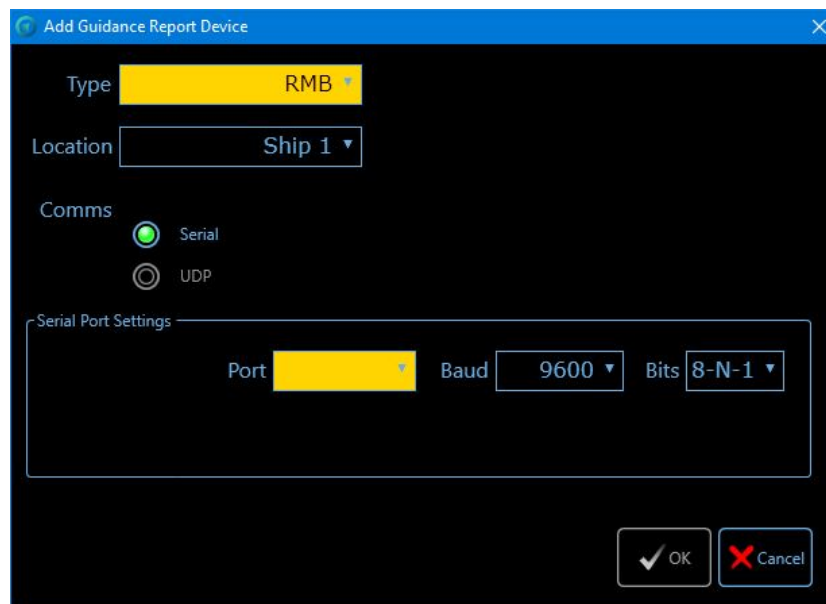
To create the report:

Set up the required origin and destination waypoints in the usual way; see *Section 4.19 "Configuring a Waypoint"*.

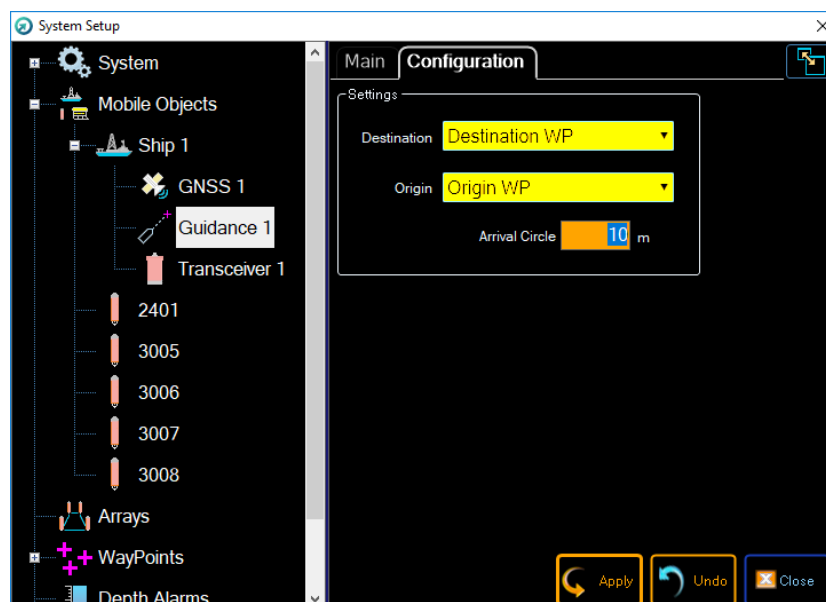
1. Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
2. Right-click **Ship** and select **Add Guidance Report**.



3. Select **RMB** as the **Type**.
4. Select the required **Port** in the **Serial Port Settings** and then click **OK**.



5. After the report has been added, select the **Configuration** tab, and set the **Destination** and **Origin** waypoints.
6. Set the **Arrival Circle** to the required precision to judge arrival at the destination waypoint and then click **Apply**.



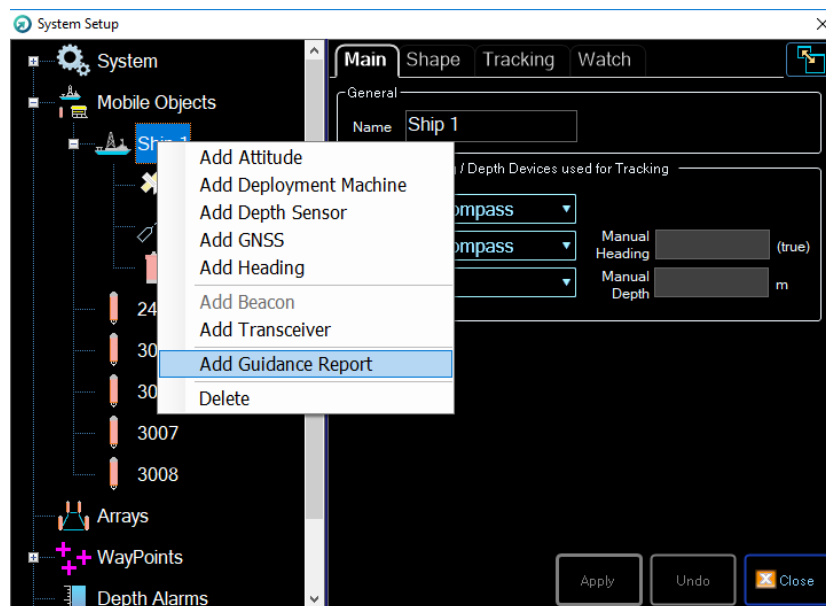
4.23.3.2 NMEA BWC Report

This is a NMEA-0183 report providing the 'Bearing and distance to Waypoint (great Circle)' information. It provides bearing, and distance along the great circle path between the current vessel position and the destination waypoint.

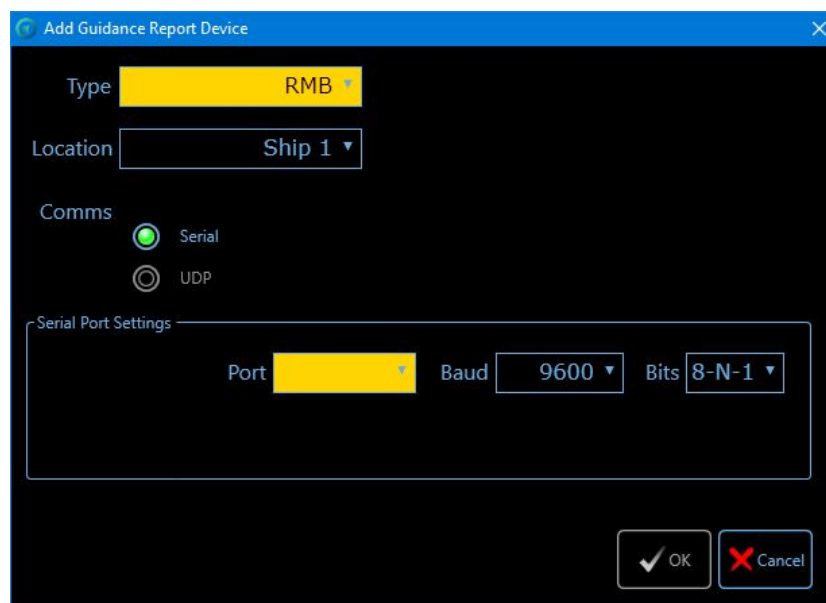
To create the report:

1. Set up the required origin and destination waypoints in the usual way; see *Section 4.19 "Configuring a Waypoint"*.

2. Click **System > Setup** or the **System** shortcut button to open the **System Setup** window.
3. Right-click **Ship** and select **Add Guidance Report**.



4. Select **BWC** as the **Type**.
5. Select the required **Port** in the **Serial Port Settings** and then click **OK**.



6. After the report has been added, select the **Configuration** tab, set the **Destination** waypoints and then click **Apply**.

4.24 Viewing Setup Files Offline

The software saves each setup in an XML-format setup (job) file with the filename extension .DJF. Each file is stored in its own folder.

The path to the jobs folder is:

C:\Users\Public\Documents\Sonardyne\Marksman\Jobs\

An XSL stylesheet called **Denovo.xsl** is installed automatically in the Jobs folder.

This simplified view of the system setup allows the user to perform important tasks, for example:

- View all the installation offsets for ship's instruments, transceivers, and so on.
- Check beacon settings.
- View battery check data.
- View beacon array positions.
- View waypoint locations.
- Check software and firmware versions.

4.25 Sending Log files to Sonardyne Support

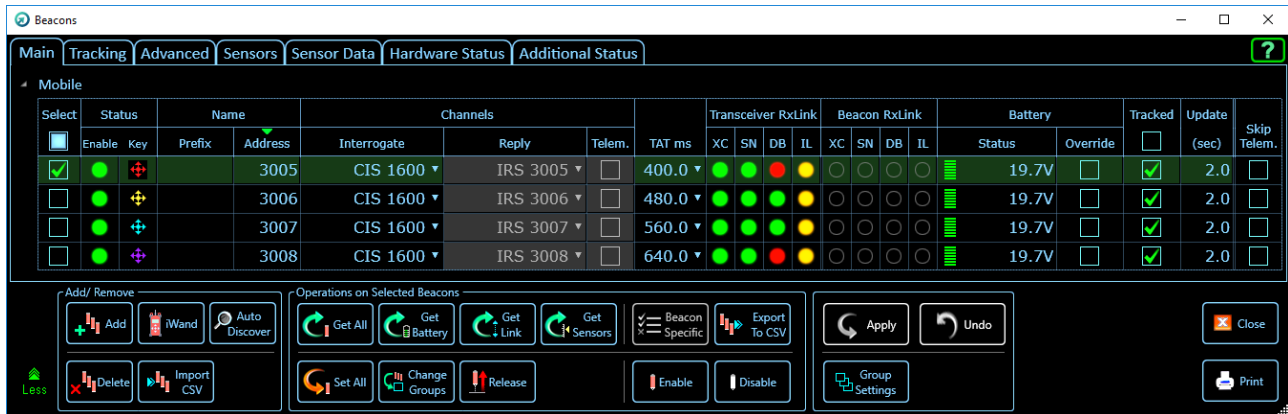
In the event of an error or system malfunction, system configuration data and log files can be appended into a compressed zip file and sent to Sonardyne Support for evaluation.

Click **Help>Sonardyne Support** to use the Sonardyne Support tool; see *Section A.11 "Help Menu"*.

Section 5 – Beacons

5.1 Beacons Table

The Beacons Table brings the management of all the beacons in the system together in one integrated tool. It contains six tabs: Main, Tracking, Advanced, Sensors, Hardware Status and Additional Status.



Note

The beacons shown in the following examples are for illustration purposes only; the exact types and features available depend on the product type.

5.1.1 Common to all Tabs

Table 5–1 Beacon Controls Common to all Tabs

Item	Function	Control Type
Select	Selects a beacon row	
Status/Enable	Current Beacon 'enabled' state.	(green circle = enabled)
Status/Key	Graphic symbol / colour used on chart to represent the beacon.	= mobile = reference = calibrating (The colour is unique for each beacon. The symbol rotates constantly.)
Name/Prefix	Beacon Name Prefix	Text Edit Box (Maximum 5 characters.)
Name/Address	Beacon Address	Text Label

5.1.2 Main Tab

The **Main** tab, shown below, displays the most important details about each of the beacons included in the setup, including its Name, Address, Interrogate and Reply, TAT, Acoustic Link Status, Battery status and Update period.

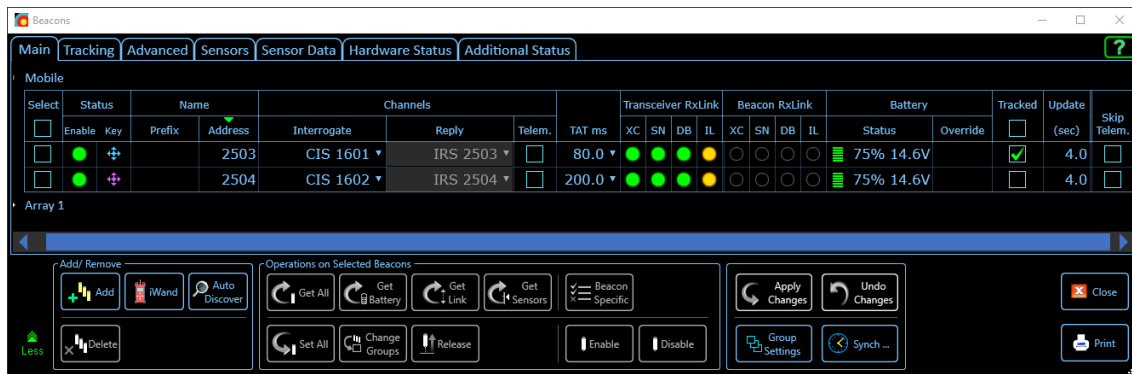


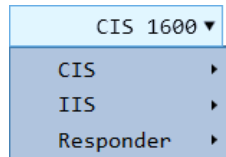
Table 5–2 Beacons Table - Main Tab Description

Item	Function	Control type
Channels/ Interrogate	Interrogate channel	Drop-down List
Channels/Reply	Reply channel	Drop-down List
Telem	Enables Telemetry Tracking	
TAT ms	Turn Around Time (ms)	Drop-down List
Transceiver RxLink	Transceiver Rx Link diagnostics	Note that this will be disabled if no tracking has been done on the beacon. Tool tips over each LED to show description, values and the most recent update time, for example: Beacon 3003 Cross-Correlation = 99% Advice: Decrease the Transceiver gain. Last Updated: 2021/12/15 12:00:20
Beacon RxLink	Beacon Rx Link diagnostics	Note that this will be disabled if the beacon does not support ALS, or no Get Link has been done on the beacon. Tool tips over each LED to show description, values and the most recent update time, for example: Beacon 3003 Signal to Noise Ratio = 27.00dB Advice: Decrease the Beacon gain. Last Updated: 2021/12/15 12:08:38
Battery/Status	Battery charge state – a Low battery status can be temporarily overridden	
Tracked	Tracking controls	
Update (sec)	Tracking update rate	Numeric edit box (single decimal)
Skip Telem	Skip sending telemetry for any commands to this beacon	

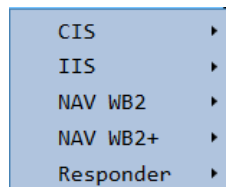
5.1.3 Interrogate and Reply

Depending on the beacon type, clicking on the **Interrogate** drop-down list presents the following menus:

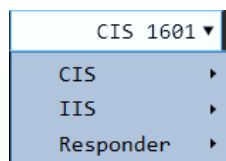
- For 6G beacons with functionality level that excludes multi-user NAV Channels: **CIS**, **IIS** and **Responder**.



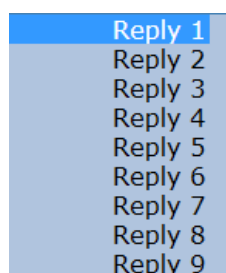
- For 6G beacons with functionality level that includes multi-user NAV channels: **CIS**, **IIS**, **NAV WB2**, **NAV WB2+** and **Responder**.



- For SST 6 nodal beacons, only the Unique Interrogation Signal (UIS) is currently offered.
- For AvTrak 6: **CIS**, **IIS** and **Responder**.



- For OBC/LRT beacons, the interrogate signal is fixed according to the address, but the reply channel can be selected.



5.1.4 Interpreting Link Status Information

The Link Status information from a transceiver or beacon provides four data values that can be useful in determining the status of the acoustic channel. These values are:

- Cross-Correlation (XC)
- Signal-to-Noise Ratio (SNR)
- Amplitude (dBV)
- Interference Level (IFL)

Several of these parameters are linked together. For example, changing the receiver gain (LG) may improve the XC and SNR in cases where the acoustic signal is saturating the receiver.

Wherever possible, it is important to ensure that the system is not saturating. This can be done by adjusting the LG parameter in the CS command to bring the DBV level to within the 'good' range indicated in the table below.

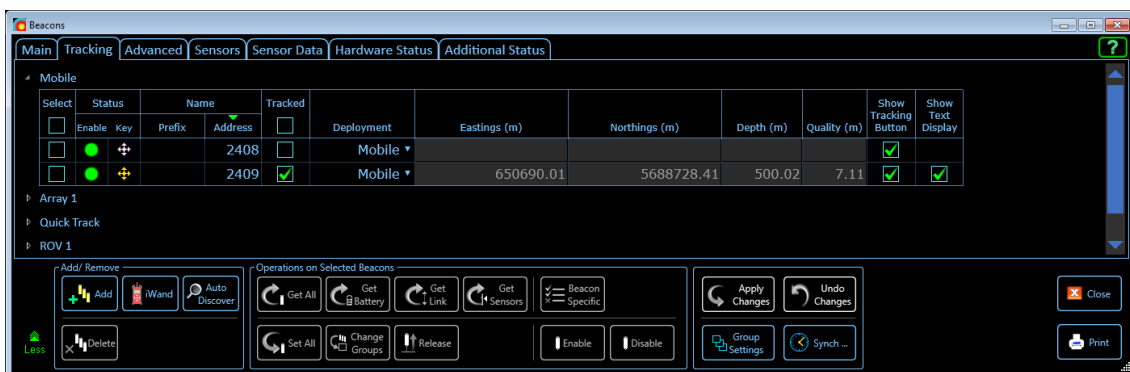
The table below shows a 'traffic light' interpretation and bounds for each of the parameters. The aim is to have all of the parameters within the 'Good' or 'Okay' bounds. Mainly this can be achieved by adjusting the gain of the instrument under test conditions.

Table 5-3 Parameter Bounds for Link Status Information

Parameter	Good	Okay	Difficult	Description
XC WBv1 WBv2 WBv2+	>70 >60 >50	>55 >50 >40	<55 <50 <40	The XC parameter shows how well the received signal matches a replica held inside the instrument. This value will be reduced by a strong multipath environment, for example in shallow water. There is no direct way of improving this figure, except environmentally, but ensure the other parameters are within their "Good" operation ranges.
DBV	-3 to -26	>-36 & >-3	<-6 or >=0	If the signal is either too large (>-3 dB) or too small (<-36) then the system is not optimal. If the dBV value is greater than -3 dB then reduce the gain (increase attenuation). The opposite is true of a signal below -36 dB.
SNR	>12	>6	<6	Signal to noise ratio, the higher the better. Ensure that the system is not saturating (DBV) as this will degrade the SNR. Increase the beacon power level to increase SNR, as long as the DBV value shows the system is not saturating.
IFL	<20	<40	>40	Interference level, maximum correlation level prior to detection. Mainly this will not affect the system performance, but if very high means the likelihood is there are other signals in the water column.

5.1.5 Tracking Tab

The **Tracking** tab, shown below, displays the major tracking parameters, including Deployment, Easting, Northing and Depth positions.



You can use the **Tracking** tab to switch Tracking on or off for one or more beacons, and to select whether or not to show each Tracking button and position display on the main window.

Table 5–4 Beacons Table – Tracking Tab Description

Item	Function	Control Type
Tracked	Controls tracking	
Deployment	Where the beacon is currently situated or attached.	 Drop-down List [Mobile, Calibrating, Array and Named Subsea Vehicle]
Eastings (m)	Easting (local or world)	Numeric Label (2 decimals)
Northings (m)	Northing (local or world)	Numeric Label (2 decimals)
Depth (m)	Depth	Numeric Label (2 decimals)
Quality (m)	Tracker Quality	Numeric Label (2 decimals)
Show Tracking Button	If this is a Mobile beacon this field is visible. Allows control over the visibility of the Tracking button for this beacon on the Main UI.	
Show Text Display	If this is a Mobile or Calibrating (not Fixed) beacon this field is visible. Allows control over the visibility of the Position Text Block for this beacon on the Main UI.	

5.1.6 Advanced Tab

The **Advanced** tab includes beacon parameters that should rarely need to be adjusted, including: Power, Gain and Telemetry scheme for one or more beacons.

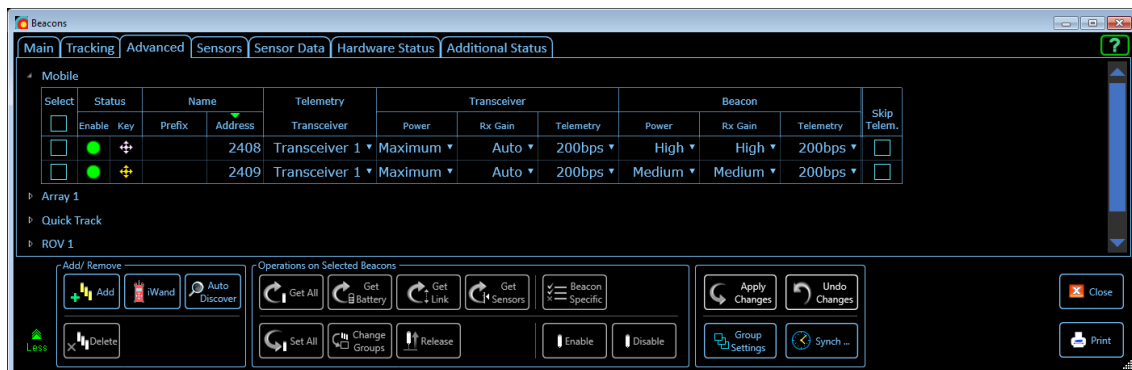


Table 5–5 Beacons Table – Advanced Tab Description

Item	Function	Control Type
Telemetry Transceiver	Transceiver assigned for performing telemetry to this beacon (if applicable)	 Drop-down List
Transceiver/Power	Transceiver Tx Power	 Drop-down List
Transceiver/Rx Gain	Transceiver Rx Gain	 Drop-down List
Transceiver/Telemetry	Transceiver Telemetry Scheme	 Drop-down List

Table 5–5 Beacons Table – Advanced Tab Description (continued)

Item	Function	Control Type
Beacon/ Power	Beacon Tx Power	 Drop-down List
Beacon/ Rx Gain	Beacon Rx Gain	 Drop-down List
Beacon/ Telemetry	Beacon Telemetry Scheme	
Skip Telem.	Skip sending telemetry for any commands to this beacon.	

5.1.7 Sensors Tab

The Sensors tab displays the sensor parameters of each beacon, including Pulse Position mode (depth or attitude), depth sensor style/offset/aiding mode. The Sensors tab is used to configure the depth and attitude sensors for one or more beacons.



Note

 Some 6G+ beacons support delivering depth using Wideband 3 telemetry when they are interrogated. Other beacons support delivering sensor data by Pulse Position Telemetry.

Table 5–6 Beacons Table – Sensors Tab Description

Item	Function	Control Type
Collection Mode	Collection Mode to be used during ranging cycles. Select Depth or Angle from the Collection Mode drop-down list if sensor measurements are to be integrated into ranging cycles.	 Drop-down List [None, Depth, Angle]
Depth Sensor/Beacon Style	Depth Sensor offset style – allows offset to be adjusted for tilted beacons	 Drop-down List [Manual, Standard]
Depth Sensor/Std. Dev.	Standard Deviation (quality) of depth sensor	Numeric Label (3 decimals)
Depth Sensor/Offset Down	Depth Sensor Offset to acoustic transducer	Numeric Label (3 decimals)

Table 5–6 Beacons Table – Sensors Tab Description (continued)

Item	Function	Control Type
Depth Sensor/Depth Aiding	Selects the type of depth aiding to be used when tracking this beacon. When set to Manual, the Manual Depth field (below) is visible	 Drop-down List [Manual, Sensor, None]
Depth Sensor/Manual Depth	Manual depth value editable by the user when the Depth Aiding field is set to Manual	Numeric Label (1 decimal)

5.1.8 Sensor DataTab

The Sensor Data tab displays the sensor values retrieved from each selected beacon when the **Get Sensors** button is clicked (see *Section 5.1.15 "Beacon Operations"*).

Note



This feature is only offered for Sonardyne beacons that are configured for telemetry.

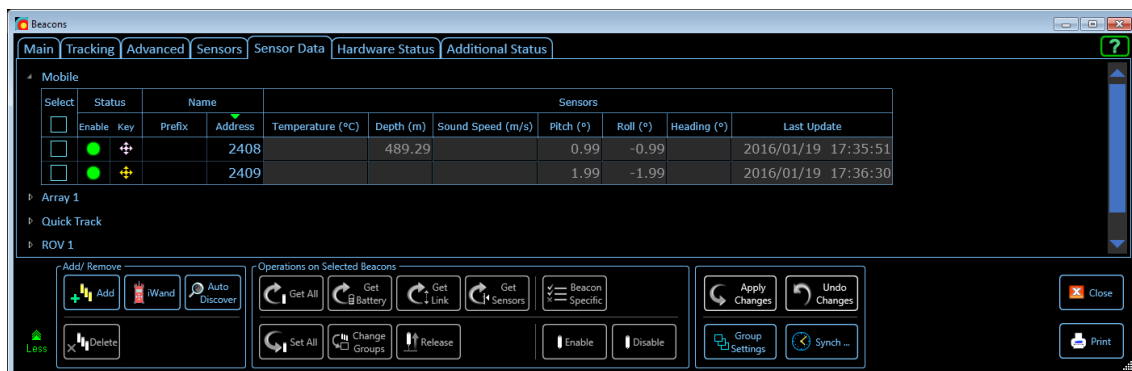


Table 5–7 Beacons Table – Sensor Data Tab Description

Item	Function	Control Type
Temperature	Temperature sensor value	Numeric label (2 decimals)
Depth	Depth sensor value	Numeric label (2 decimals)
Sound Speed	Sound Speed sensor value	Numeric label (2 decimals)
Pitch	Pitch sensor value	Numeric label (2 decimals)
Roll	Roll sensor value	Numeric label (2 decimals)
Heading	Heading sensor value	Numeric label (2 decimals)
Last Update	Date-time of last successful sensor data retrieval	Date-time label

5.1.9 Hardware Status Tab

The Hardware Status tab displays the fixed parameters of each beacon, including: UID, Firmware version and Transducer type.

If a beacon does not support telemetry, most fields are blank.

If a beacon supports telemetry but has not yet been involved in a telemetry transfer, fields might show 'Unknown'.

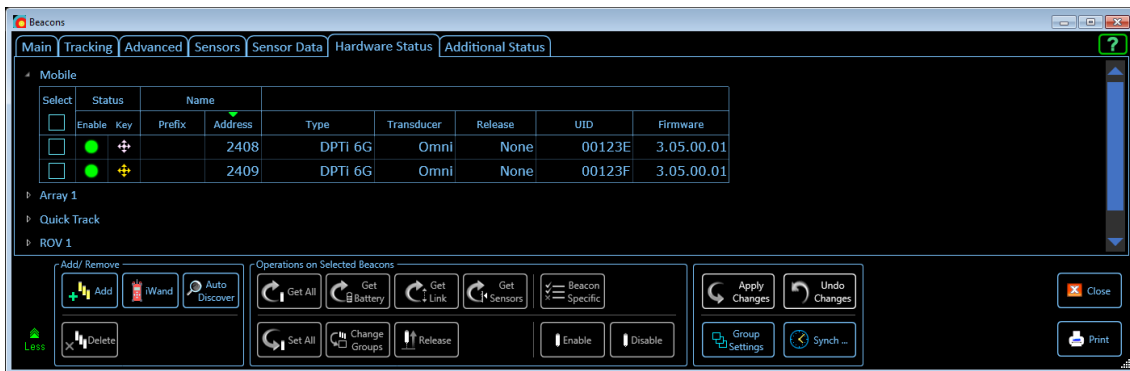


Table 5–8 Beacons Table – Hardware Status Tab Description

Item	Function	Control Type
Type	Beacon type name (e.g. Compatt 6)	Static Label
Transducer	Transducer type (Omni or Directional)	Static label
Release	Acoustic release type	Static Label
UID	Beacon UID	Static Label
Firmware	Firmware version	Static Label

5.1.10 Additional Status Tab

The Additional Status tab displays the additional parameters specific to certain types of beacon, e.g. Activity Time and Gyro Compatt status.

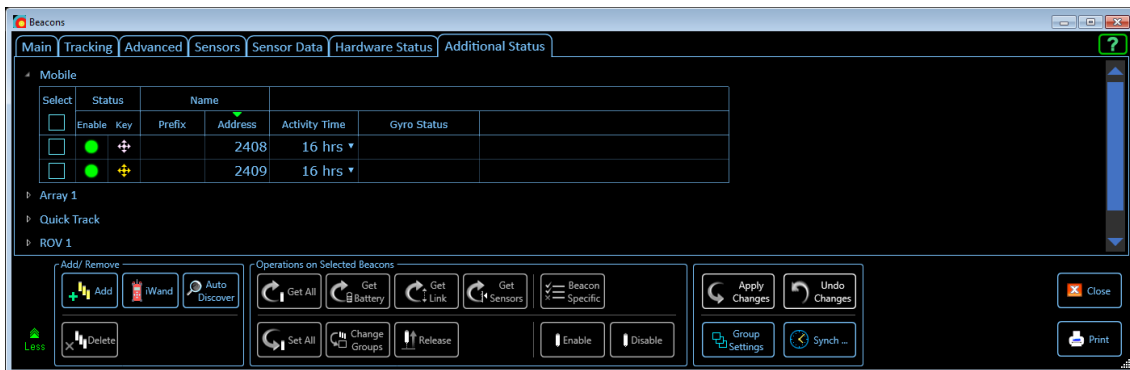


Table 5–9 Beacons Table – Additional Status Tab Description

Item	Function	Control Type
Activity Time	Allows selection of the desired stay-awaketime of the beacon	 Drop-down List Range from 2 Secs to 32 days or Always on
Status	Shows the current status of the Lodestar Gyro. Applicable only when the beacon is a Gyro Compatt	Static Label: On, Off, UnSettled

5.1.11 Common Commands

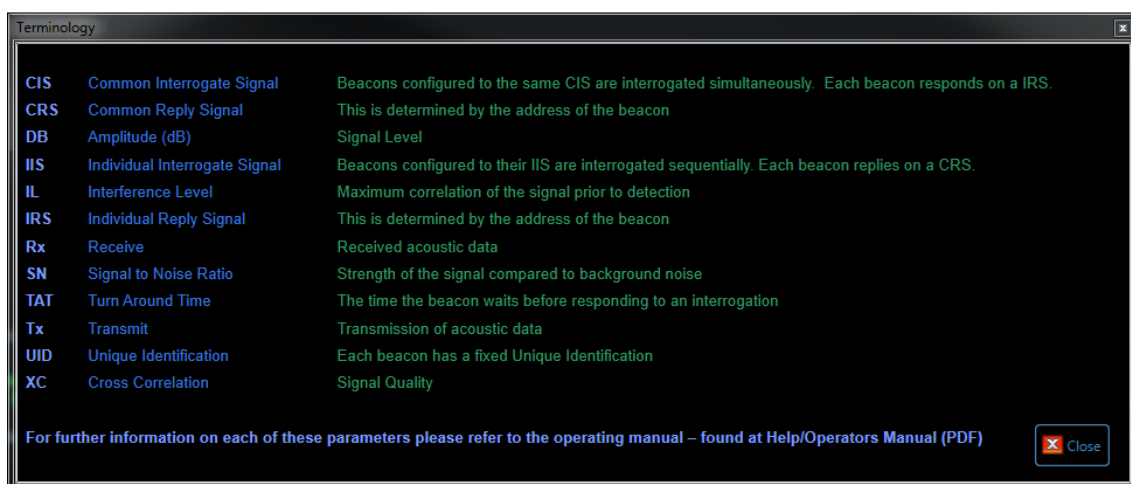
Clicking the  button at bottom left exposes the second row of buttons along the bottom of the window as shown below.



Clicking the  button at bottom left hides the second row of buttons along the bottom of the window.



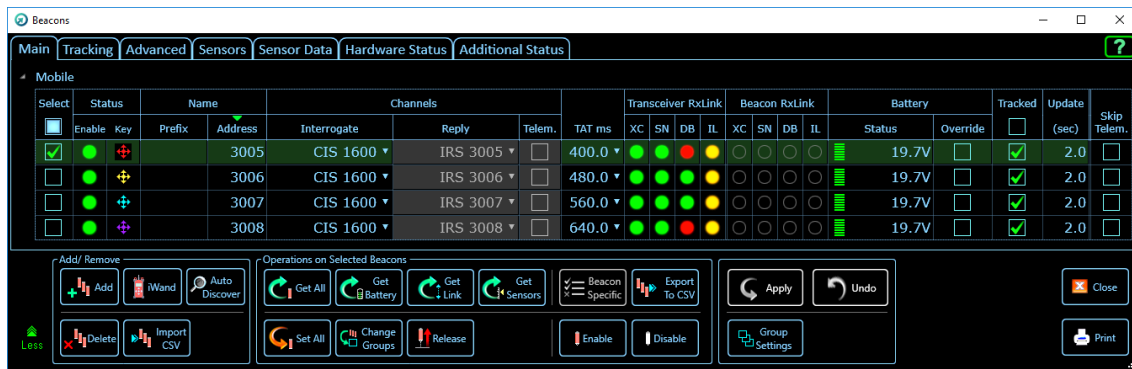
- Clicking **Add** launches the Add Beacon Wizard; see *Section 5.2 "Add Beacon Wizard "*.
- Clicking **iWAND** launches the iWAND tool; see *Section 5.4 "iWAND Tool "*.
- Clicking **Auto Discover** launches the Beacon Discovery Tool; see *Section 5.5 "Beacon Discovery Tool"*.
- Clicking **Import CSV** launches the file explorer to select the appropriate CSV file; see *Section 5.6 "Beacon Import/Export"*.
- Clicking **Group Settings** allows you to set special behaviour for a beacon group.
- Clicking **Sync** launches the **Acoustic Time Synchronisation** window.
- Clicking **Print** launches the Windows Print dialog box. This is a standard system dialog box that allows you capture and print out the Beacons Window.
- Clicking  shows the Beacon Terminology help window.



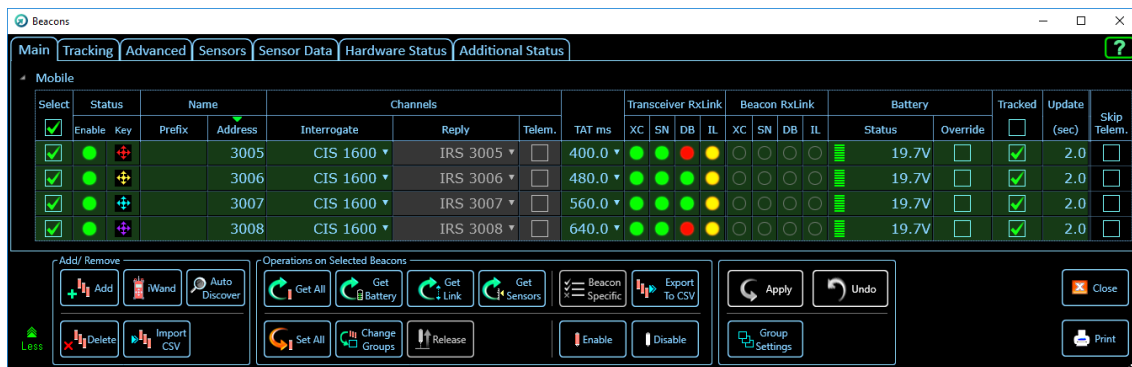
- Clicking on **Close** closes the window.

5.1.12 Beacon Selection

The **Select** column in each tab contains a check box to select beacons. When selected the entire row is highlighted in dark green, except for disabled fields which are shown greyed out. Using this method to select any beacon in any tab automatically results in the beacon being selected in all other tabs (see below).



The uppermost check box toggles all rows to be selected/cleared in all tabs (see below).



When at least one beacon is selected by its selection check box, the following buttons are enabled on the button panel, otherwise they are disabled:

- Get All
- Get Battery
- Get Link
- Get Sensors
- Beacon Specific
- Export To CSV
- Set All
- Change Groups
- Release
- Enable
- Disable
- Delete
- Import CSV



Depending on what beacon(s) have been selected, the following action occurs when a specific operation button is pressed:

1. If all selected beacons are capable of the operation, the operation is performed. A confirmation dialog box may be displayed if the operation makes fundamental changes to beacons.
2. If some selected beacons are capable of the operation and others are not, the operation is performed on those that support the operation. The user is not informed that some of the beacons were not capable. A confirmation dialog box may be displayed if the operation makes fundamental changes to beacons that support the operation.
3. If all selected beacons are NOT capable of the operation, the operation is NOT performed. A dialog box is displayed to explicitly tell the user that nothing happens.
4. If all selected beacons allow telemetry but have their **Skip Telemetry** check box selected, a dialog box is displayed to inform that no telemetry will occur (that is, the change will be a local UI change only).

5.1.15.1 Beacon Buttons

- **Get All.** This sends commands via telemetry to request all configuration data from all selected beacons to populate appropriate columns across all tabs of the Beacons Table.
- **Get Battery.** This requests battery status from all selected beacons and populates the Battery Status column appropriately.
- **Get Link.** This requests ALS link status from all selected beacons and populates the **Beacon RxLink** column appropriately. 'Traffic lights' are shown:

Transceiver RxLink				Beacon RxLink			
XC	SN	DB	IL	XC	SN	DB	IL

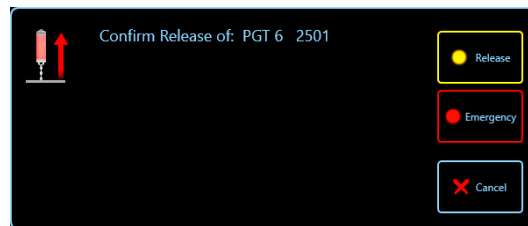
Hover the mouse cursor over each LED to reveal a tooltip giving values and last update time, for example:

Beacon 2005
 Interference Level = 25%
 Last Updated: 2014/11/28 14:18:23

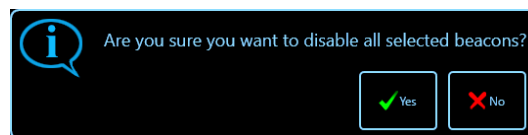
- **Get Sensors.** This sends commands via telemetry to request all sensor data from all selected beacons and populates the Sensor Data columns appropriately.
- **Beacon Specific.** Clicking on this button launches the **Beacon Specific Properties** dialog box; see *Section 5.1.19*.
- **Export To CSV.** This allows configuration of one of more beacons to be saved to a CSV file; see *Section 5.6 "Beacon Import/Export"*.
- **Set All.** This sets all fields across all tabs to all selected beacons, some of which may require telemetry.
- **Change Groups.** This launches the **Change Groups** dialog box; see *Section 5.1.17*.
- **Release.** If more than one beacon is selected, a dialog box is display to tell the user that only one beacon can be released at a time. If only one beacon is selected, a second release confirmation window is shown:



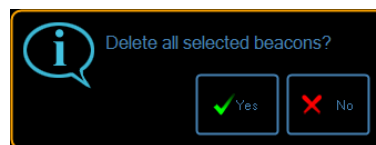
For beacons that require emergency release, the following window is shown instead:



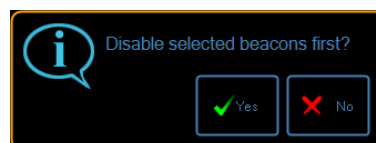
- **Enable.** This enables all selected beacons. The user must confirm the action. The green LED shows the beacon is enabled, the red LED shows that the beacon is disabled .
- **Disable.** This disables all selected beacons. The user must confirm the action.



- **Delete.** This deletes all selected beacons from the system setup. A confirmation dialog box is displayed as follows:



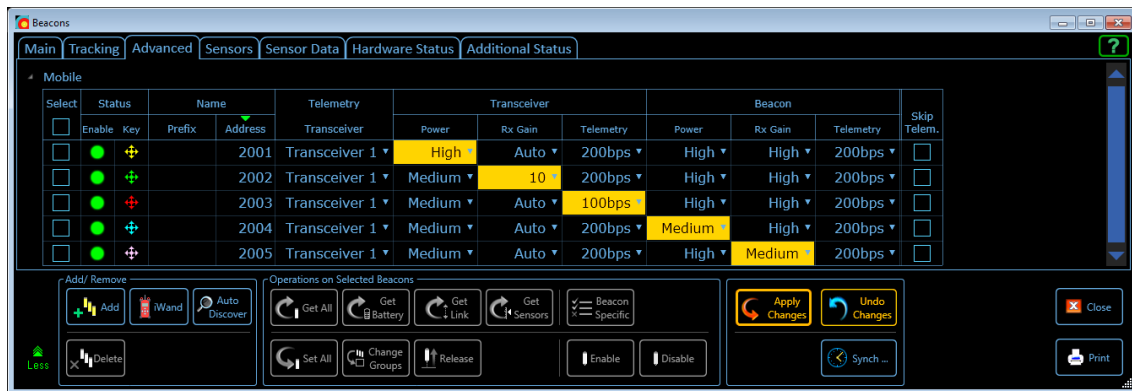
If at least one of the beacons to be deleted supports telemetry, then the following dialog box is shown.



- **Import CSV.** This allows configuration of one or more beacons to be imported from a CSV file; see *Section 5.6 "Beacon Import/Export"*.

5.1.15.2 Changing Field Values

If you edit one or more fields in the Beacons Table across one or more tabs, the background colour of the edited fields changes to orange and the **Apply Changes** and **Undo Changes** buttons are enabled (see below).



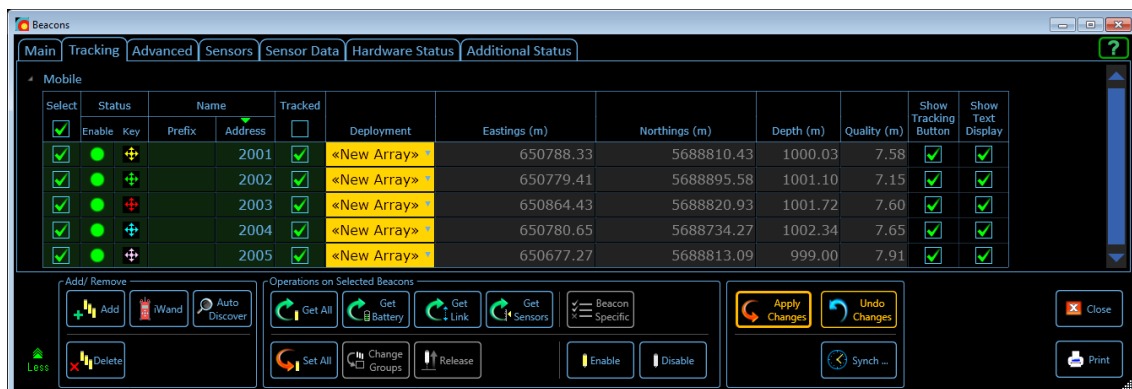
- Click the **Undo Changes** button to revert all modified (orange) fields to their original values. The **Apply Changes** and **Undo Changes** buttons become disabled and all the orange field backgrounds revert to black.
- Click the **Apply Changes** button to apply all modified (orange) fields to their respective beacons. The **Apply Changes** and **Undo Changes** buttons become disabled, the table reflects the changes, and the orange backgrounds revert to black.

When applying changes, if the **Skip Telemetry** check box is selected for a beacon that is to be updated, then the physical beacon is not updated. Only the software representation of the beacon is changed.

5.1.16 Bulk Changes

The following example of the bulk change feature shows the Deployment for selected Mobile beacons changed to **New Array**.

- On the **Tracking** tab, select the check box for the appropriate beacons.
- Change the **Deployment** of the selected beacons to **New Array**.



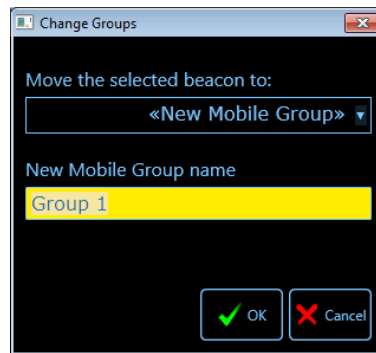
- Click **Apply Changes**.

Note

 Bulk editing is only available on certain table fields.

5.1.17 Change Groups Dialog Box

Clicking on the Change Groups button launches the Change Groups dialog box as shown below.



If the **Tools>Options>General** dialog box **User Defined Beacon Groups** check box is selected, the **Change Groups** dialog box allows selected beacons to be moved from any of the following source groups:

- Mobile
- Existing User Defined Mobile
- Discovered
- iWAND
- Remote Control

to one of the following destination groups:

- Mobile
- Existing User Defined Mobile
- « New Mobile Group»

If the **Tools>Options>General** dialog box **User Defined Beacon Groups** check box is not selected, the **Change Groups** dialog box only allows selected beacons to be moved from the following predefined mobile groups:

- Discovered
- iWAND
- Remote Control

back to:

- Mobile

If the **Tools>Options>General** dialog box **User Defined Beacon Groups** check box is unselected, all User Defined Beacon groups are automatically removed from the job. Any beacons contained within them are automatically moved to the predefined Mobile group. An appropriate popup message will warn that this will happen.

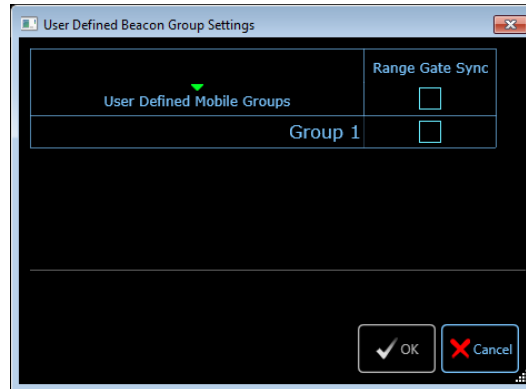
Note

 **New user defined mobile group names should be prevented from conflicting with any of the predefined group names, existing user defined mobile group names, Mobile, Array or Subsea vehicle names.**

Clicking **OK** on the dialog box applies all orange (modified) values; clicking **Cancel** closes the dialog box with no changes being applied.

5.1.18 User Defined Beacon Group Settings Dialog Box

Clicking on the **Group Settings** button launches the **User Defined Beacon Group Settings** dialog box. This shows a table of all currently user-defined mobile groups.



The names of all user-defined mobile groups are editable, and the text changes to orange when modified.

Note

 **User defined mobile group names should be prevented from conflicting with any of the pre-defined group names, existing user defined mobile group names, Mobile, Array or Subsea vehicle names.**

Each user-defined mobile group row in the table has a check box called **Range Gate Sync** (see above) to allow/disallow all of the beacons contained in the group from sharing the same approximate range gate during tracking. By default the check box is clear.

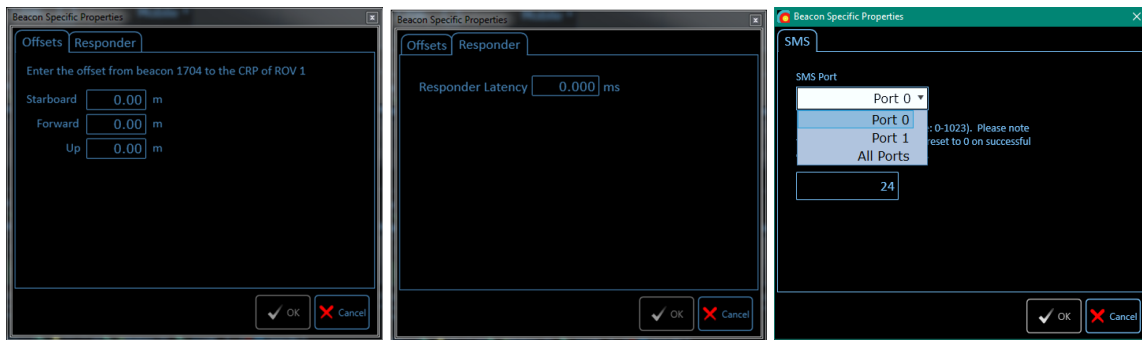
Clicking **OK** on the dialog box applies all orange (modified) fields in the table, clicking **Cancel** closes the dialog box with no changes being applied.

5.1.19 Beacon Specific Properties Dialog Box

Clicking on the **Beacon Specific** button launches the **Beacon Specific Properties** dialog box (shown below) for editing special parameters that are rarely used and very specific to certain types of beacon. The following beacon types are examples that require this feature:

- Gyro Compatt (5 & 6).
Requires enable / disable buttons for the Gyro, and also display current status of the Gyro.
- Any beacon attached to a subsea vehicle (e.g. ROV).
Requires Starboard, Forward and Up numeric fields to define the offset of the beacon to the CRP of the vehicle.
- Beacon using Responder Trigger
Requires a numeric field to define Responder latency (ms).
- Beacon using Telemetry Tracking, e.g. AvTrak 6
Offers user control of SMS port and spare SMS bits when using Telemetry Tracking.

Since a beacon can fall into one or more of the above categories, the dialog box provides tabs for each of the beacon type specific features above. Tabs that do not apply are hidden.

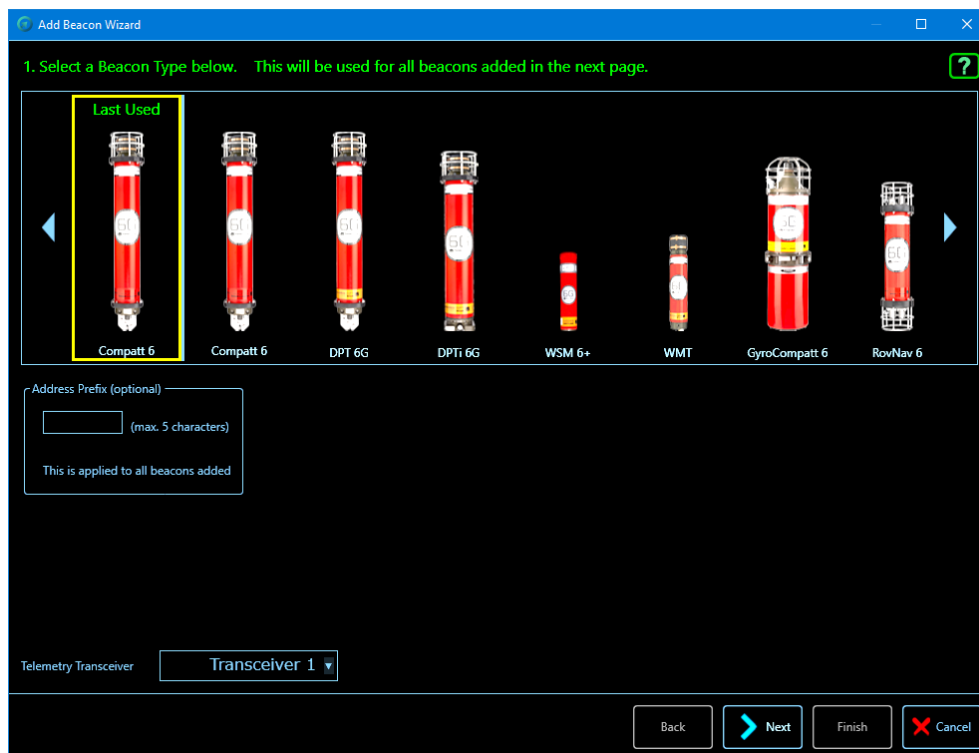


5.2 Add Beacon Wizard

5.2.1 Beacon Type

Click the **Add** button on the **Beacons** window to display the **Add Beacon Wizard**. This wizard allows you to add multiple beacons of the same type to the current setup.

The **Cancel** button at bottom right is always enabled. This allows you to cancel the add beacon operation and return to the main **Beacons** window.



The first window of the wizard, shown above, allows you to select:

- **Beacon Type** - You can scroll the beacon type selector left and right with the mouse, and click on a beacon to select it. Note that the list of beacons available is determined by the settings in the security key.
- **Beacon Address Prefix** is an optional user-defined three-character prefix for naming the beacon. This applies to all beacons added.
- **Telemetry Transceiver** allows the user to choose which telemetry transceiver to use for all beacons being added.

Click **Next** to proceed to the Beacon Address window. The **Next** button is enabled only after you have selected a beacon type.

The **Finish** and **Back** button on the wizard are always disabled on this first window.

5.2.2 Beacon Address



The Beacon Address selection window allows you to choose the beacon address.

Addresses are shown as a table with tabs:

- Each tab presents addresses for a specific address band.
 - WB1 for Sonardyne Wideband 1
 - WB2 for Sonardyne Wideband 2
 - WB2+ for Sonardyne Wideband 2+
 - Nodal for Sonardyne nodal
 - OBC/LRT for Sonardyne OBC
- Depending on the beacon type selected, more than one tab may be accessible because some beacons support multiple band types.
- Pre-existing beacon addresses are permanently highlighted in pink.
- Addresses reserved for pulse position mode of pre-existing beacons are permanently highlighted in light brown as shown in the example above. One extra cell is used for pulse-position depth; two extra cells are used for pulse-position angle.
- Select new beacon addresses within the active tab by clicking on the address cells of the beacons you wish to add. The cell changes to green when selected.
- Clicking on a selected (green) cell deselects it.

- Certain address ranges are not recommended for new jobs (e.g. WB2 1801...1814, 1901...1914 and 3101...3114). These address cells are shown with a dark red background with an appropriate key that warns the user of their use.

Final beacon settings are carried out within the Beacons Table and using the Beacon Specific Properties dialog box.

It is not possible to select pre-existing address cells (beacon addresses or pulse position mode cells). If the tab is changed and new cells are selected, the selected cells on the previous tab become deselected.

Three radio buttons are provided at the bottom of the window to specify what should happen after the beacons are created:

1. **Get None** – Don't do any telemetry to the beacon after creation.

On returning to the Beacons Table, all fields will show normal colour (not amber).

2. **Get Beacon Identity** (default selection) – If the beacon supports telemetry, obtain the identity of the beacon after creation.
 - a. For Sonardyne 6G beacons the transceiver sends an FS command (and possibly a SUB command) to the physical beacon.
 - b. All fields that have not been updated by the above commands show a User Modified state (AMBER).
 3. **Get All Beacon Parameters** – If the beacon supports telemetry, retrieve all beacon parameters from the physical beacon and update all relevant fields in the table.
 - a. For Sonardyne 6G this results in FS, VS, CS commands being sent.
 - b. All fields are updated in the table, so all cells for the created beacons should be in normal state (not AMBER).
- The **Clear** button clears all selected cells.
 - The **Back** button on the wizard is always enabled, so you can go back to the previous window and edit its contents.
 - When the **Finish** button is clicked, the beacon(s) is created according to the settings provided, and the Wizard closes.

Refer to the Frequency Chart (see *Figure 5-1*) for guidance on optimising USBL accuracy vs. range and avoidance of other acoustic systems operating in the vicinity.

Figure 5-1 Sonardyne Frequency Chart



5.3 Optimum Choice of Wideband Signals for USBL

Note

 This section is not relevant for the Type 8221 (HF) transceiver.

5.3.1 Overview

In Sonardyne Wideband systems, the carrier frequency of coded reply signals is linked to the beacon address. Choosing the most appropriate address to use for USBL tracking is always a compromise between competing factors. The most important factor is to ensure that there is good signal compared to the noise (SNR), but the frequency of the Wideband carrier is also important to get the best performance. In general, higher frequencies provide both better precision, and accuracy; however, higher frequencies also suffer greater absorption, and therefore reduced SNR.

5.3.2 Wideband Choices

Wideband2 signals, which are available in all 6G instruments, should be used unless there are specific operating circumstances that require another option. In situations where there is likely to be significant reverberation, high noise or at extremely long range, then Wideband2+ may be useful (Wideband2+ signals have twice the duration of a Wideband2 signal, and so use twice the battery power). Wideband1 signals should only be used for compatibility with 5G systems. When adding a new beacon in Marksman, Ranger 2 USBL/Survey/DP the address selector lays out beacon addresses that use the same carrier frequency in columns.

A range of addresses at the top and bottom of the band that are not generally recommended for use are shaded in red below.

WB1WB2WB2+

Wideband 2 is the default for 6th Generation (6G) instruments

1701	1801	1901	2001	2101	2201	2301	2401	2501	2601	2701	2801	2901	3001	3101
1702	1802	1902	2002	2102	2202	2302	2402	2502	2602	2702	2802	2902	3002	3102
1703	1803	1903	2003	2103	2203	2303	2403	2503	2603	2703	2803	2903	3003	3103
1704	1804	1904	2004	2104	2204	2304	2404	2504	2604	2704	2804	2904	3004	3104
1705	1805	1905	2005	2105	2205	2305	2405	2505	2605	2705	2805	2905	3005	3105
1706	1806	1906	2006	2106	2206	2306	2406	2506	2606	2706	2806	2906	3006	3106
1707	1807	1907	2007	2107	2207	2307	2407	2507	2607	2707	2807	2907	3007	3107
1708	1808	1908	2008	2108	2208	2308	2408	2508	2608	2708	2808	2908	3008	3108
1709	1809	1909	2009	2109	2209	2309	2409	2509	2609	2709	2809	2909	3009	3109
1710	1810	1910	2010	2110	2210	2310	2410	2510	2610	2710	2810	2910	3010	3110
1711	1811	1911	2011	2111	2211	2311	2411	2511	2611	2711	2811	2911	3011	3111
1712	1812	1912	2012	2112	2212	2312	2412	2512	2612	2712	2812	2912	3012	3112
1713	1813	1913	2013	2113	2213	2313	2413	2513	2613	2713	2813	2913	3013	3113
1714	1814	1914	2014	2114	2214	2314	2414	2514	2614	2714	2814	2914	3014	3114

(19kHz)

← Longer Range

High Elev. USBL

USBL → (33kHz)

5.3.3 Address Choices

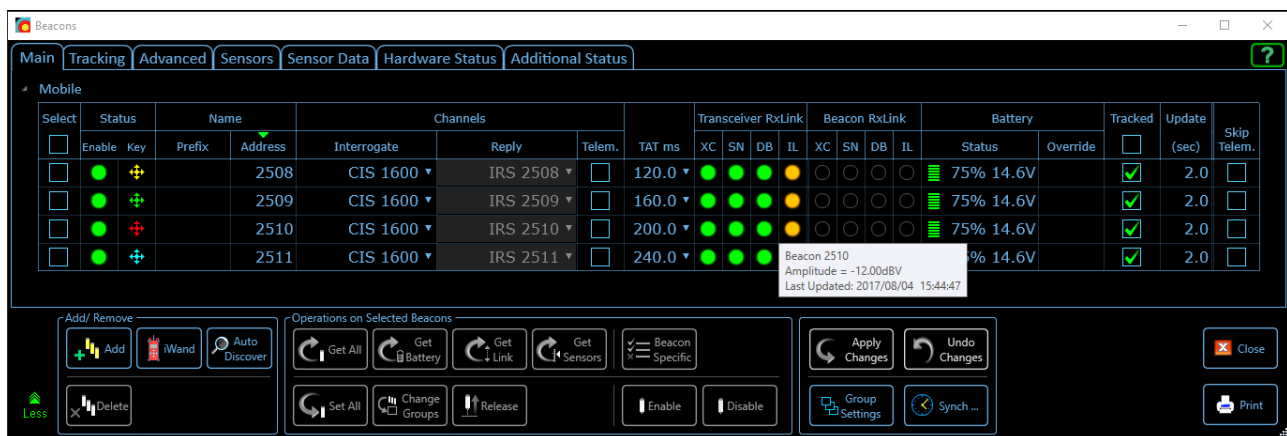
It can be difficult to predict what the SNR is going to be before deploying a beacon, and currently Marksman, Ranger 2 USBL/Survey/DP does not provide an automatic way to reconfigure a beacon's address after it has been deployed, and so it is sometimes necessary to select an address that will give best performance based on the application, and the expected operating depth. As a general rule, high elevation tracking applications (such as towfish tracking) ought to use addresses in the range 20xx-24xx, and USBL applications tracking beacons mostly below the vessel should aim to use addresses between 27xx and 30xx. Omni-directional beacons should provide sufficient signal level to

use Wideband address families with higher frequency carriers to operating depths of 1500 m or more, and directional beacons track up to 2500 m. If the expected operating depth is more than these limits, then lower address families may give better SNR. Refer to individual beacon operating manual for instructions on how to change the address.

5.3.4 Diagnostics

The Beacons Table in Marksman, Ranger 2 USBL/Survey/DP provides useful received signal diagnostic 'traffic light' indicators from the transceiver on every update, and from the beacon on request (select the check box on the left of a row, and click **Get Link**). The traffic light indicators include the amplitude (DB), and SNR (SN) of signals being received from each beacon. Green is good, amber is okay, but red indicates that performance may be difficult. By hovering the cursor over the traffic light indicators, a readout popup shows the current levels (see below).

Assuming that the received signal level is not saturating the USBL transceiver's receiver (check DB light is not red), SNR can be improved by increasing the output power of the beacon. If the transceiver's DB light is red, which indicates that the receiver is being saturated, check the transceiver gain, and consider reducing it to avoid saturation. It is possible to tune the transceiver power, and beacon gain in the same way – adjust beacon gain and transceiver output power so that the DB light is not red, and the SNR is good.



5.4 iWAND Tool

Note

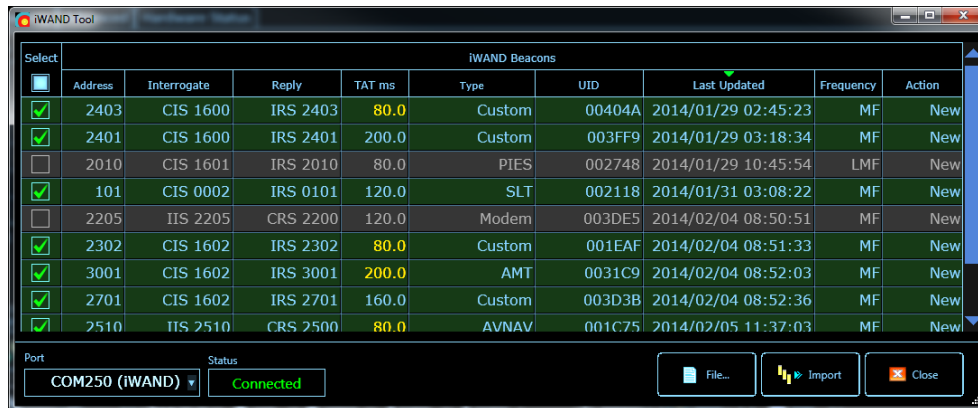
 This section is not relevant for the Type 8221 (HF) transceiver.

Clicking the **iWAND** button on the **Beacons** window launches the **iWAND Tool** as shown below. This tool allows multiple beacon data to be imported into the current setup.



If no iWAND is connected the **Port status** field shows **Connecting**.

When an iWAND is connected through RS232 or USB to the Marine Computer, the **Port** field automatically updates, and after a short time shows the status **Connected**. The available beacons for import are listed in the table, for example as shown below.



Select	Address	Interrogate	Reply	TAT ms	Type	UID	Last Updated	Frequency	Action
☒	2403	CIS 1600	IRS 2403	80.0	Custom	00404A	2014/01/29 02:45:23	MF	New
☒	2401	CIS 1600	IRS 2401	200.0	Custom	003FF9	2014/01/29 03:18:34	MF	New
☐	2010	CIS 1601	IRS 2010	80.0	PIES	002748	2014/01/29 10:45:54	LMF	New
☒	101	CIS 0002	IRS 0101	120.0	SLT	002118	2014/01/31 03:08:22	MF	New
☐	2205	IIS 2205	CRS 2200	120.0	Modem	003DE5	2014/02/04 08:50:51	MF	New
☒	2302	CIS 1602	IRS 2302	80.0	Custom	001EAF	2014/02/04 08:51:33	MF	New
☒	3001	CIS 1602	IRS 3001	200.0	AMT	0031C9	2014/02/04 08:52:03	MF	New
☒	2701	CIS 1602	IRS 2701	160.0	Custom	003D3B	2014/02/04 08:52:36	MF	New
☒	2510	IIS 2510	CRS 2500	80.0	AVNAV	001C75	2014/02/05 11:37:03	MF	New

Port: COM250 (iWAND) Status: Connected

File... Import Close

If there are conflicting beacon addresses or TATs in the imported data, a warning message is shown:

If there are conflicting beacon Addresses in the imported data, the relevant row(s) are enabled but the **Select** check box is only selected for one of the conflicting addresses (see **2101** below). The remaining conflicting addresses are highlighted in red. A tooltip indicates the problem if the mouse cursor is hovered over it.

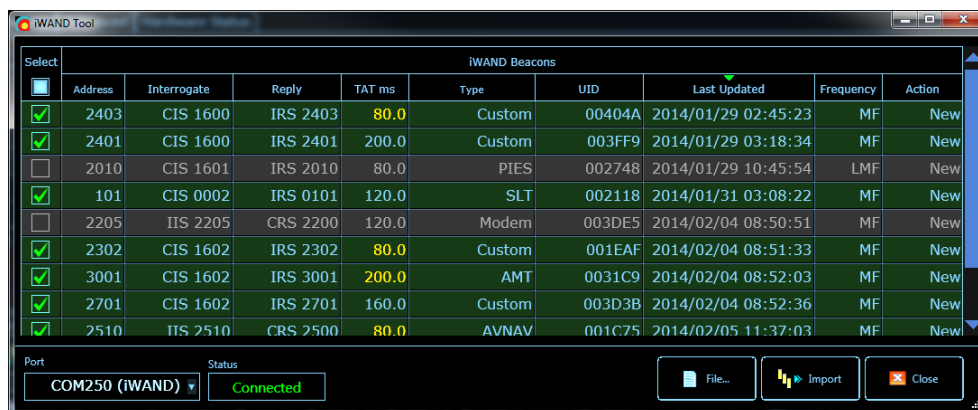


Select	Address	Interrogate	Reply	TAT ms	Type	UID	Last Updated	Frequency	Action
☒	2301	CIS 1601	IRS 2301	80.0	Custom	003D3B	2013/11/01 01:47:04	MF	New
☐	2101	CIS 1601	IRS 2101	120.0	Compatt 6	003DE5	2013/11/05 01:47:11	MF	New
☒	2101	CIS 1600	IRS 2101	80.0	Custom	003C44	2013/11/07 01:57:16	MF	New

Port: COM1 Status:

File... Import Close

If there are conflicting TATs in the imported data, the relevant rows(s) are enabled. The conflicting TAT is highlighted in orange (see below). A tooltip indicates the problem if the mouse cursor is hovered over the relevant row.



Select	Address	Interrogate	Reply	TAT ms	Type	UID	Last Updated	Frequency	Action
☒	2403	CIS 1600	IRS 2403	80.0	Custom	00404A	2014/01/29 02:45:23	MF	New
☒	2401	CIS 1600	IRS 2401	200.0	Custom	003FF9	2014/01/29 03:18:34	MF	New
☐	2010	CIS 1601	IRS 2010	80.0	PIES	002748	2014/01/29 10:45:54	LMF	New
☒	101	CIS 0002	IRS 0101	120.0	SLT	002118	2014/01/31 03:08:22	MF	New
☐	2205	IIS 2205	CRS 2200	120.0	Modem	003DE5	2014/02/04 08:50:51	MF	New
☒	2302	CIS 1602	IRS 2302	80.0	Custom	001EAF	2014/02/04 08:51:33	MF	New
☒	3001	CIS 1602	IRS 3001	200.0	AMT	0031C9	2014/02/04 08:52:03	MF	New
☒	2701	CIS 1602	IRS 2701	160.0	Custom	003D3B	2014/02/04 08:52:36	MF	New
☒	2510	IIS 2510	CRS 2500	80.0	AVNAV	001C75	2014/02/05 11:37:03	MF	New

Port: COM250 (iWAND) Status: Connected

File... Import Close

Beacons that are not supported, or are not enabled in the security key, are disabled (greyed out) in the table as shown above. It is not possible to Select these beacons for import.

All other supported, non-conflicting beacons have their **Select** check box automatically selected as shown above. You can use the **Select** column to select/clear beacons for import.

You can click on the header area of any column to sort the whole table by the data in that column. The sorted column is indicated by a green chevron in the column header. Clicking on the green chevron toggles the sort order.

Clicking the **Import** button imports all beacons that have their **Select** check box selected. The **iWAND Tool** closes and the **Beacons** window updates with the new beacons that have been imported.

When a beacon is created by using iWAND Import, only key beacon settings are specified by the iWAND. The rest are defined by system defaults. Specifically, the telemetry transceiver defaults to the first available 6G transceiver that is in the setup.

Clicking the **File** button launches a dialog box that allows you to select an iWAND data file (XML). When this is done, data from the file appears in the table in exactly the same way as if it came from the iWAND itself (see previous figures).

Click the **Close** button at any time closes the **iWAND Tool** and returns control to the **Beacons** window.

The prefix for all imported iWAND beacons in the Beacons Window defaults to:

iW.

You can edit this prefix if necessary.

5.5 Beacon Discovery Tool

Note



This section is not relevant for the Type 8221 (HF) transceiver.

Clicking on the **Auto Discover** button on the **Beacons** window launches the **Beacon Discovery Tool** window. This allows the acoustic discovery of any Sonardyne 6G beacon within the current Environmental Operating Range of a selected transceiver.

On launch, all controls are enabled (buttons/ combo boxes, and so on), except for the **Identify** and **Import** buttons.



Click **Transceiver** and select the preferred transceiver to use for the discovery. Only 6G transceivers are listed, and the first available one is automatically selected as default.

Click on the **Signal Set** control and choose the -Sonardyne signal set to use when discovering beacons. The default signal set is Wideband 2.

The workflow order is:

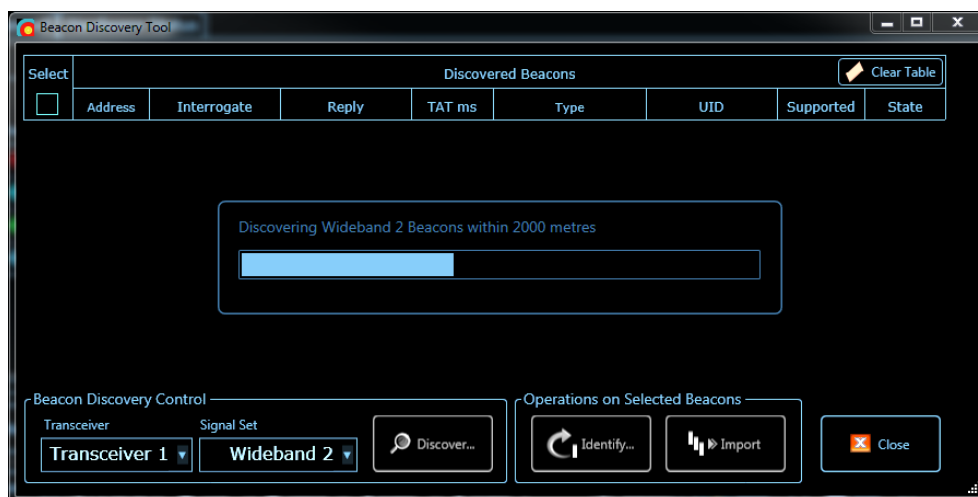
1. Discover the beacon(s).
2. Identify the beacon(s).
3. Import the beacon(s) to the setup.

These are described in detail in the next sections.

Clicking the **Close** button when the tool is not busy performing a Discover or Identify operation causes the window to close. Control is then returned to the **Beacons** window.

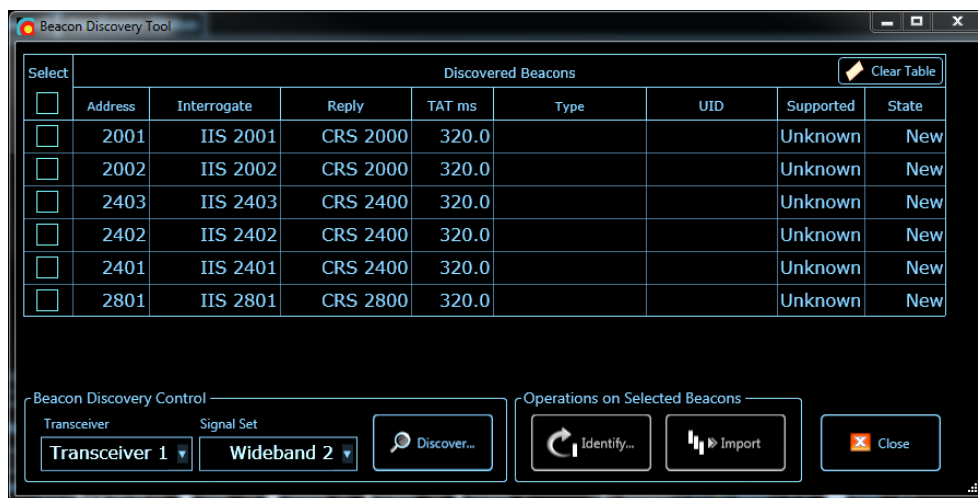
5.5.1 Beacon Discovery Operation

Click **Discover** to start the beacon discovery process using the selected transceiver and the selected signal set. A dialog box shows a progress bar and **Cancel** button (see below). The discovery process uses the **Max Operating Range** value as defined in the Environmental settings.



When the beacon discovery progress bar reaches the end, the progress window closes, and the **Discovered Beacons** table updates with all 6G beacons discovered during that cycle (see below).

Repeated clicking of the **Discover** button merges any newly found beacons with results of those discovered on previous tries. That is, discovery is cumulative over successive discovery cycles.



Newly discovered beacons that already exist in the setup are shown as completely greyed out rows in the table (see above). Additionally:

- The **Select** field is disabled. No operations can be performed on existing beacons.
- The **Address** field is the discovered address.
- The **State** field shows **Exists**.
- The Supported field shows **Yes**.
- All other fields are filled in (as in the main **Beacons** window).

Newly discovered beacons that do not yet exist in the setup are shown with the row not greyed out (see above). Additionally:

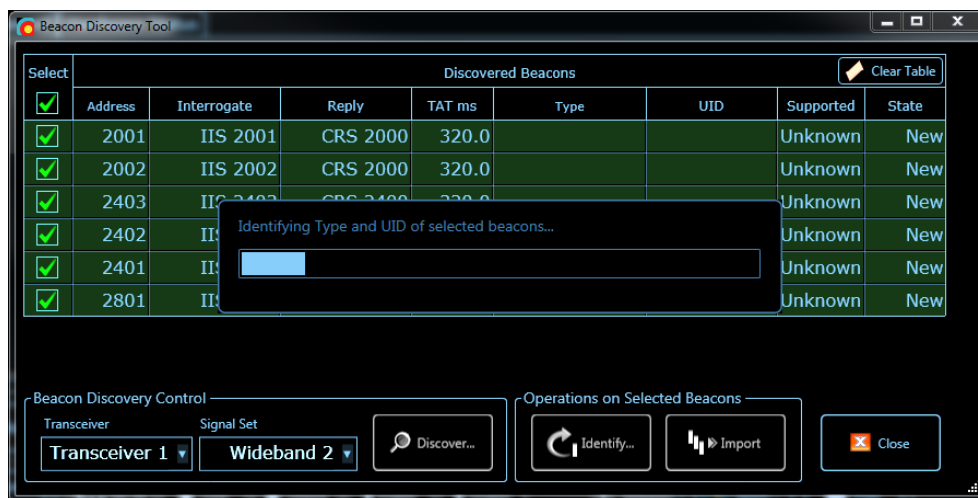
- The **Select** field is enabled, so that Identify and Import operations can be performed.
- The **Address** field is the discovered address.
- The **State** field shows **New**.
- The **Supported** field shows **Unknown**.
- The **Interrogate*** field shows an IIS signal for the discovered address.
- The **Reply*** field shows a CRS signal for the discovered address.
- The **TAT ms*** field shows 320 because of the IIS
- The **Type** field is empty at this stage
- **The** UID field is empty at this stage

* The **Interrogate**, **Reply**, and **TAT ms** fields default to IIS/CRS values to avoid the need to send any telemetry to the beacons in order to start tracking immediately.

Clicking the **Clear Table** button clears all data from the **Discovered Beacons** table.

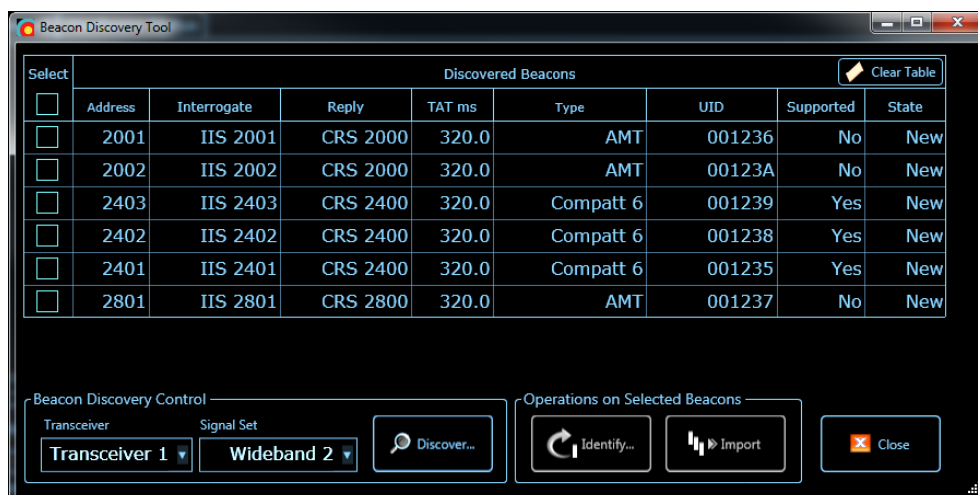
5.5.2 Beacon Identification.

You may optionally select specific beacons, and click the **Identify** button. A dialog box shows a progress bar and **Cancel** button (see below). This causes an FS telemetry command to be sent sequentially to each selected beacon that has a current Supported status of Unknown. Note that if the Supported status is Yes/No, then it implies that the beacon has already been identified (no need to repeat). The reply from the FS is used to update the Type and UID columns of the respective beacons in table.



When the progress bar reaches the end, the progress dialog box closes and the **Discovered Beacons** table updates with the **Type** and **UID** fields filled in for all beacons that were selected. The **Supported** field updates to:

1. **Yes** if the beacon is supported (as shown below).
2. **No** if it is not supported (as shown below).



If an error occurs in identifying any beacon, the **Type** and **UID** fields remain blank, and the **Supported** field remain **Unknown**.

5.5.3 Beacon Import

Beacon import is possible on any selected beacon in the **Discovered Beacons** table, regardless of whether or not the **Identify** process has been done.

Note

 **Beacons whose State is set to Exists, are not selectable, and so are not importable.**

Certain assumptions are made when importing a beacon, depending on whether **Identify** has been performed and whether the identified beacon is **Supported** by the application. These are as follows:

- If the **Identify** process has not been performed on a beacon, then it is always imported as a generic **Compatt 6**. A warning message is displayed to indicate this.

- If the **Identify** process has been performed on a beacon, but its type is not supported, then it is always be imported as a generic **Compatt 6**. A warning message is displayed to indicate this.
- If the **Identify** process has been performed on a beacon, and its type is supported, then it is always imported as the type indicated without any message to the user.
- If a mixture of **Identified** / **Non-Identified** / **Supported** / **Unsupported** beacons are selected for import, a message is displayed to indicate that at least one beacon will be imported as a **Compatt 6** for the appropriate reason.

After the Import has completed, the **Beacon Discovery Tool** window closes and the imported beacons are shown in the **Mobiles** section of the **Beacons** window.

The prefix for all discovered beacons in the **Beacons** window defaults to the **D** character. You can edit this subsequently if necessary.

All imported beacons have their Skip Telemetry check box clear in the **Beacons** window.

5.6 Beacon Import/Export

Importing and Exporting beacons is a useful way of maintaining an inventory of beacons, and their current state, as well as moving beacons between systems.

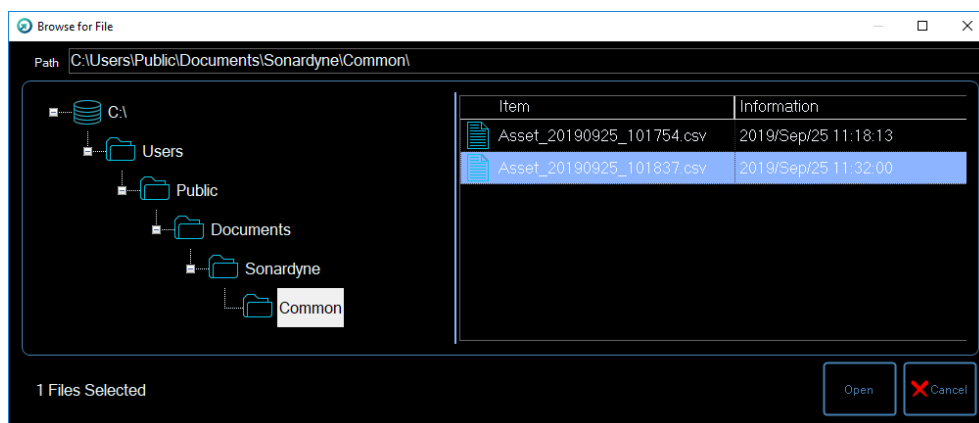
Note

 **The import/Export CSV format is compatible with Sonardyne's Fusion 2 software, and so can be used for moving assets between systems.**

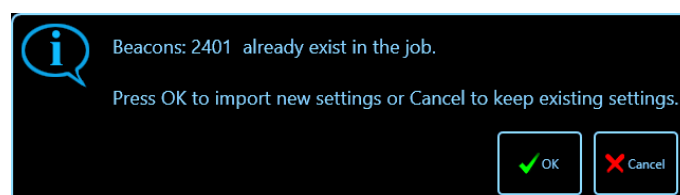
5.6.1 Importing Beacons

To import beacons to the current job:

1. Click **Import CSV** and select the file to import.



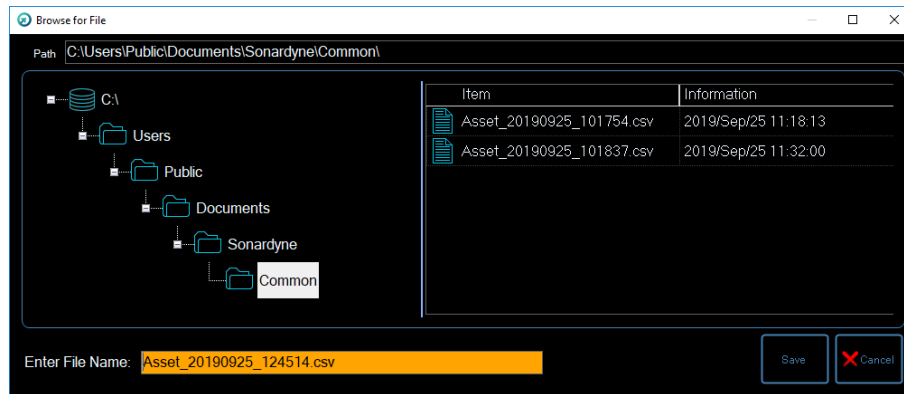
2. Click **Open** to automatically add the beacons in the CSV to the job.
3. A warning prompt is given prior to overwriting existing beacons that already exist in the job.



5.6.2 Exporting Beacons

To export beacons from the current job:

1. Select the required beacon in the **Beacons Table**, and then click **Export To CSV**.
2. Enter a filename and then click **Save** to save the file to the default folder.

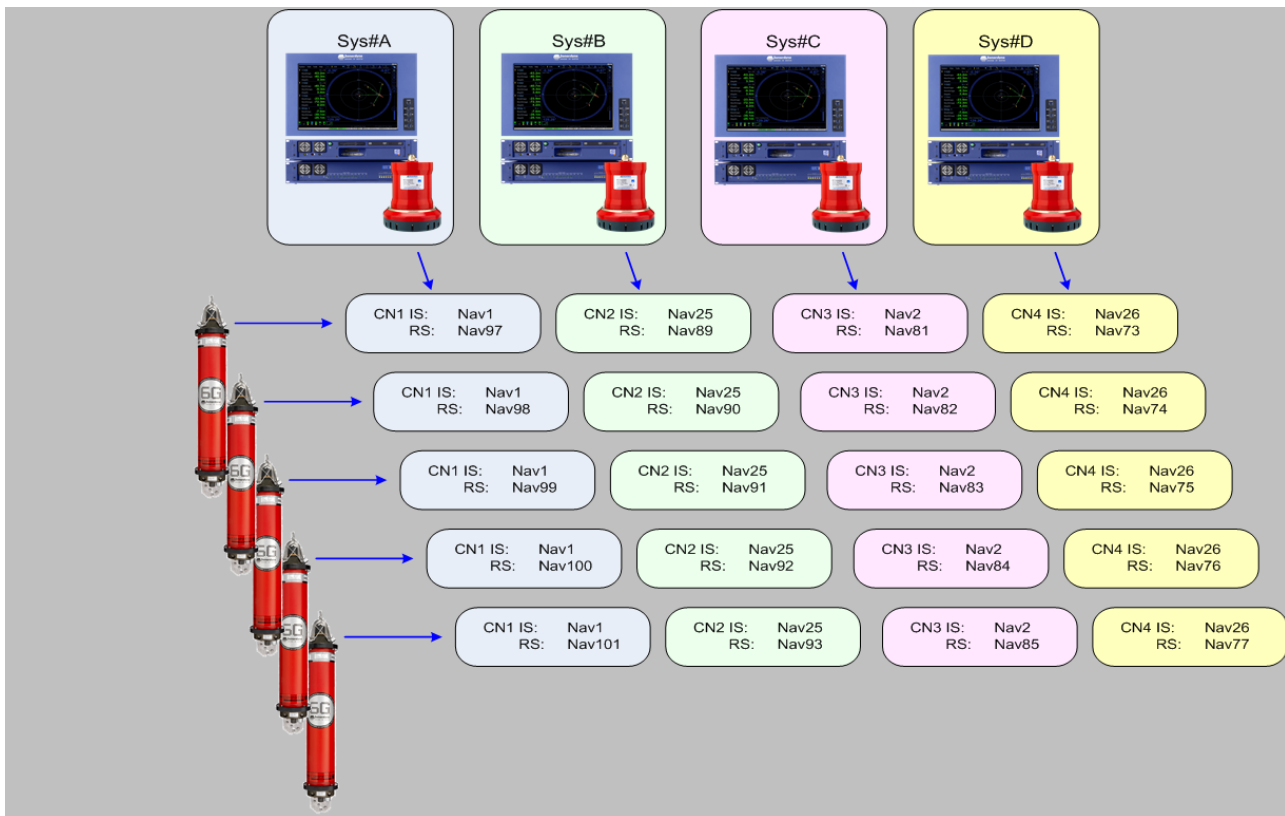


5.7 Multi-User Shared Arrays and Advanced Navigation Setup

5.7.1 Overview

Normally, beacons can be shared between multiple LUSBL or LUSBL aided DP-INS systems using timing windows to interleave interrogations. 6G Multi-User mode adds the ability to separate the operation of the systems in signal space, thus reducing the need for accurate timing, and removing the possibility of one system detecting the reply signals from the other.

Each 6G Compatt in an LUSBL array can support up to 4 independent connections in addition to its normal individual (IIS) and common (CIS) interrogation modes. These connections can be visualised as 'virtual beacons' that can be assigned to independent systems, and can be interrogated asynchronously to each other. The systems can be installed on one or more vessels. Each system uses its own unique interrogation and reply signals to avoid interference.

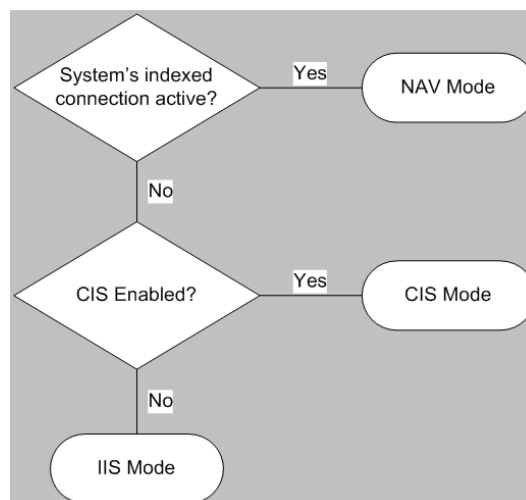


Note

Multi-User mode has to be enabled in the 6G Compatt and the security key. It is not available in previous generation beacons.

Adding and configuring 6G Multi-User beacons is largely unchanged for the user. The 6G multi-user mode uses a set of WB2 and WB2+ NAV signals (called NAV WB2 and NAV WB2+) for acoustic interrogation and replies, and these work in the same way that the system already deals with IIS and CIS beacon modes.

When requesting a beacon's status, the decision about which mode the system defaults to is as follows:



Note



A 6G Compatt's CIS channel is still a available even while the NAV channels are active.

5.7.1.1 Wideband 2

For Wideband 2, the list of interrogation signals in NAV mode is:

- NAV1
- NAV25
- NAV2
- NAV26
- NAV3
- NAV27
- NAV4
- NAV28
- Advanced

If the user chooses Wideband2 signals, then the choice of reply signals is also Wideband2. The indices in the first row of the table below are the default interrogation signals. The default choice of reply signals are the set of signals in the same column as the selected interrogation signal.

LO			HI		28	4	27	3	26	2	25	1
1	9	17	25	33	41	49	57	65	73	81	89	97
2	10	18	26	34	42	50	58	66	74	82	90	98
3	11	19	27	35	43	51	59	67	75	83	91	99
4	12	20	28	36	44	52	60	68	76	84	92	100
5	13	21	29	37	45	53	61	69	77	85	93	101
6	14	22	30	38	46	54	62	70	78	86	94	102
7	15	23	31	39	47	55	63	71	79	87	95	103
8	16	24	32	40	48	56	64	72	80	88	96	104

5.7.1.2 Wideband 2+

For Wideband 2+, the list of interrogation signals in NAV mode is:

- NAV129
- NAV153
- NAV130
- NAV154
- NAV131
- NAV155
- NAV132
- NAV156
- Advanced

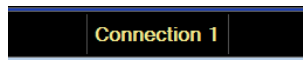
If the user chooses Wideband2+ signals, then the choice of reply signals is also Wideband2+. The indices in the first row of the table are the default interrogation signals. The default choice of reply signals is the set of signals in the same column as the selected interrogation signal.

				156	132	155	131	154	130	153	129	
129	137	145	153	161	169	177	185	193	201	209	217	225
	138	146	154	162	170	178	186	194	202	210	218	226
	139	147	155	163	171	179	187	195	203	211	219	227
	140	148	156	164	172	180	188	196	204	212	220	228
	141	149	157	165	173	181	189	197	205	213	221	229
	142	150	158	166	174	182	190	198	206	214	222	230
	143	151	159	167	175	183	191	199	207	215	223	231
	144	152	160	168	176	184	192	200	208	216	224	232

Note

 **Wideband 2+ are double length signals and hence use twice the battery power. Wideband2+ should be reserved for special applications, particularly reverberant environments.**

Each system is manually configured with a connection index that is unique to that system. This is the index of the connection that this system uses in all shared multi-user beacons. The index is set-up at commissioning time, and is clearly visible in the status bar at the bottom of the main UI.



The system supports creating, editing and deleting the connection that is allocated to it, but cannot interfere with any other system's connection (but the system does not block manual commands, or commands from the PAN port that modify connections).

The system supports:

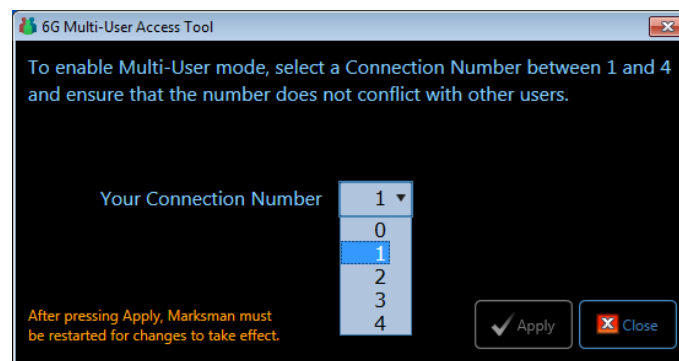
- Configuration of the subscription connections on deck via iWAND.
- Getting the current status of the beacons acoustically.
- Setting up the connections acoustically.

5.7.2 Shared Array/Multi-User Setup

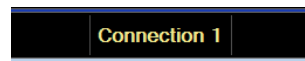
5.7.2.1 First time Connection

Each system using a shared array of multi-user 6G Compatt beacons needs a unique connection number to be setup.

1. From the Windows **Start** menu, run the **6G Multi-User Access Tool**.



2. Select the next free number in the range 1-4 from the **Your Connection Number** drop-down list. This is used to access the allocated connection on all shared multi-user 6G Compatts.
3. Click **Apply** and then **Close** to complete the connection setup.
4. Start the Marksman/Ranger 2 system software – the assigned connection number appears in the status bar at the bottom of the userinterface.



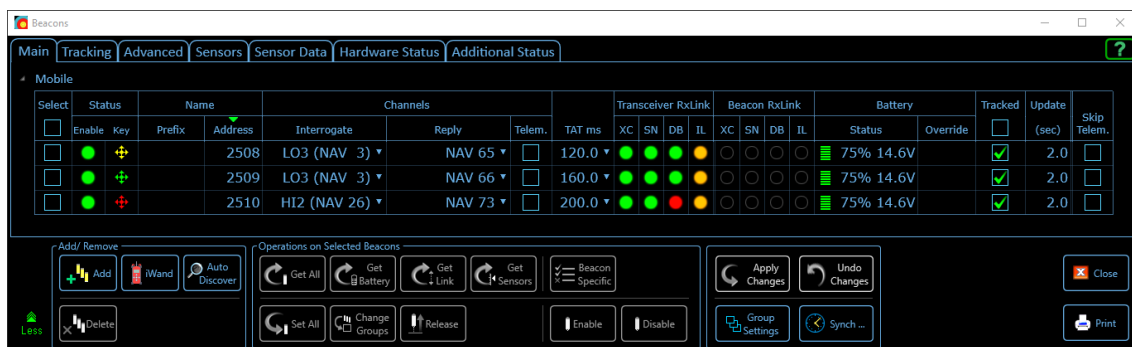
5.7.2.2 Adding and Configuring Multi-User Beacons

Refer to *Section 5.2 "Add Beacon Wizard "* to add the Compatts.

5.7.3 Advanced Navigation Mode Setup

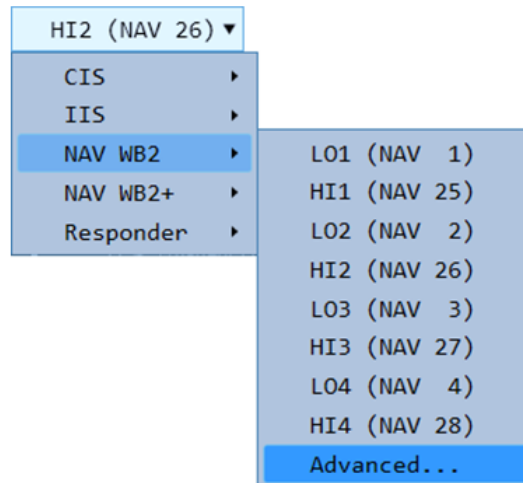
Sonardyne 6G Compatt beacons can support a multi-user mode where a single beacon can operate in up to 4 different systems. Alternatively, the 4 connections on a Compatt 6 can be configured for more complex operations in Advanced mode, where the user is free to choose the Interrogate and Reply signals from the full set of available Navigation signals.

In the following example assume that 3 beacons have been added to the job, all of which use multi-user (NAV) interrogate/reply channels, as shown below.

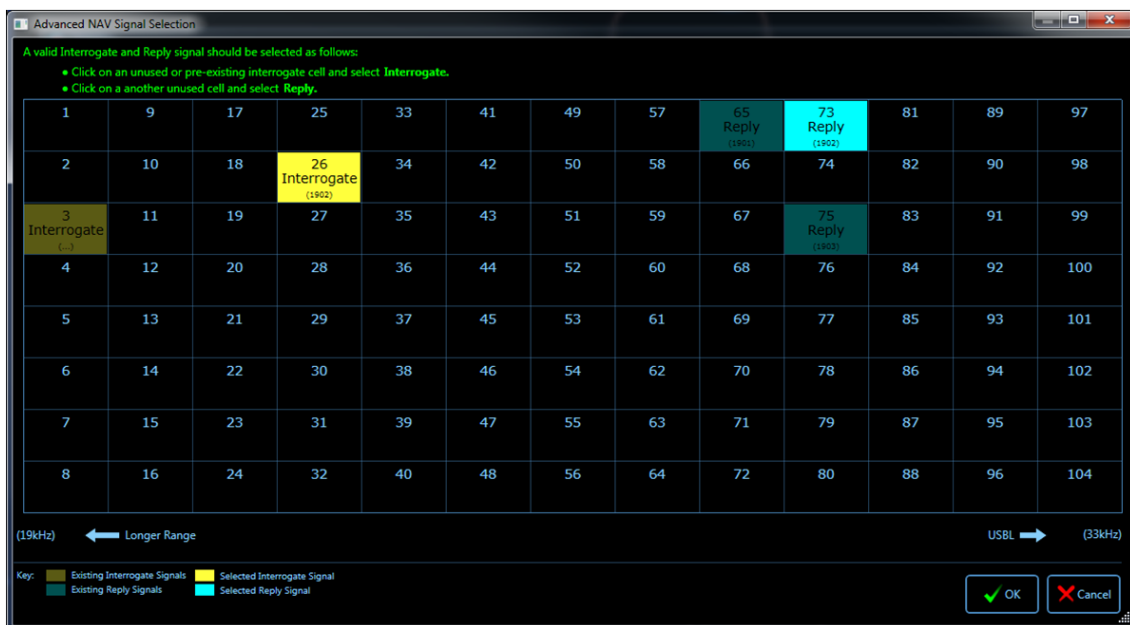


5.7.3.1 Wideband 2

Click **HI2 (NAV 26)** and select **Advanced**:



The **Advanced NAV Signal Selection** dialog box opens in Wideband 2 mode, as shown below:



The grid shows all NAV signal numbers for Wideband2 [1...104] in the row/column order as laid out above.

The grid shows existing beacon NAV Interrogate signal cells coloured dark yellow. The word **Interrogate** together with the beacon address using that signal are also shown in the cell. If more than one beacon is using an existing interrogate cell, the beacon address is shown as: "...".

The grid shows existing beacon NAV Reply signal cells coloured dark cyan. The word **Reply** together with the beacon address using that signal is also be shown in the cell.

The grid shows the current beacon's selected NAV interrogate signal coloured bright yellow. If the current beacon is not using any Wideband 2 NAV signals, then the grid does not show any bright yellow cell. The word Interrogate together with the beacon Address using that signal is also shown in the cell. If more than one beacon is using an existing interrogate cell, the beacon address is shown as: "...".

The grid shows the current beacon's selected NAV reply signal coloured bright cyan. If the current beacon is not using any Wideband 2 NAV signals, then the grid does not show any bright cyan cell. The word **Reply** together with the beacon address using that signal is also shown in the cell.

A NAV Interrogate signal can be selected by clicking on any pre-existing OR unused cell and selecting Interrogate from the drop-down list.

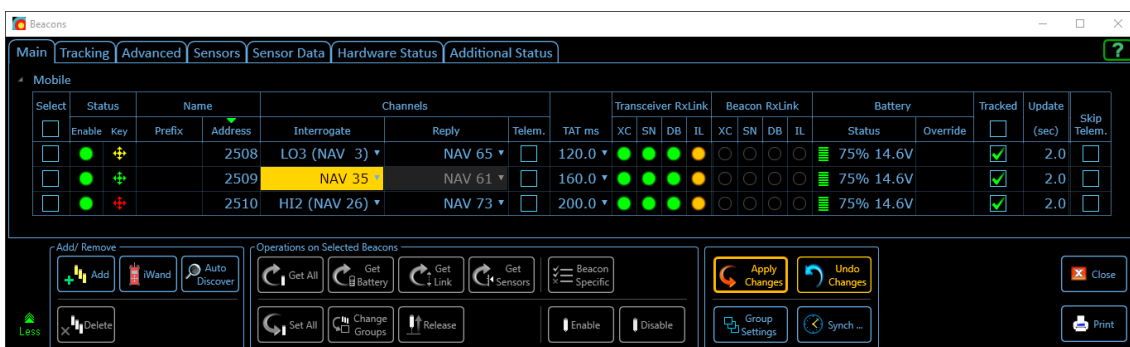
A NAV Reply signal can be selected by clicking on any unused cell and selecting **Reply** from the drop-down list. Existing Reply signal numbers can not be used.



The **Cancel** button is always enabled. Clicking **Cancel** closes the dialog and returns control to the Beacons Table, without any changes being made.

The **OK** button is only enabled if both an **Interrogate** (bright yellow) and **Reply** (bright cyan) have been selected.

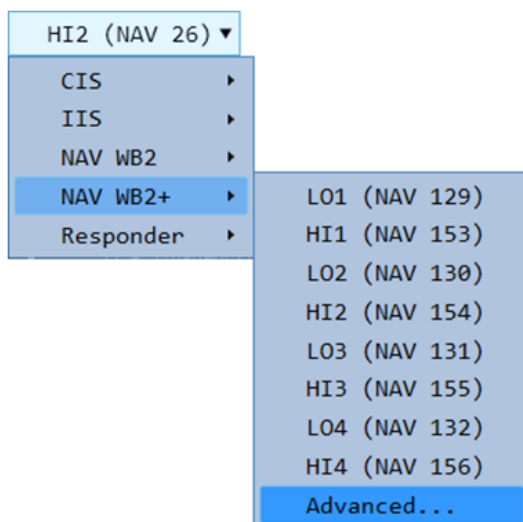
Clicking **OK** closes the dialog box and returns control to the Beacons Table, with the Interrogate and Reply boxes changing to amber colour according to the selections made in the advanced dialog box. See the following examples.



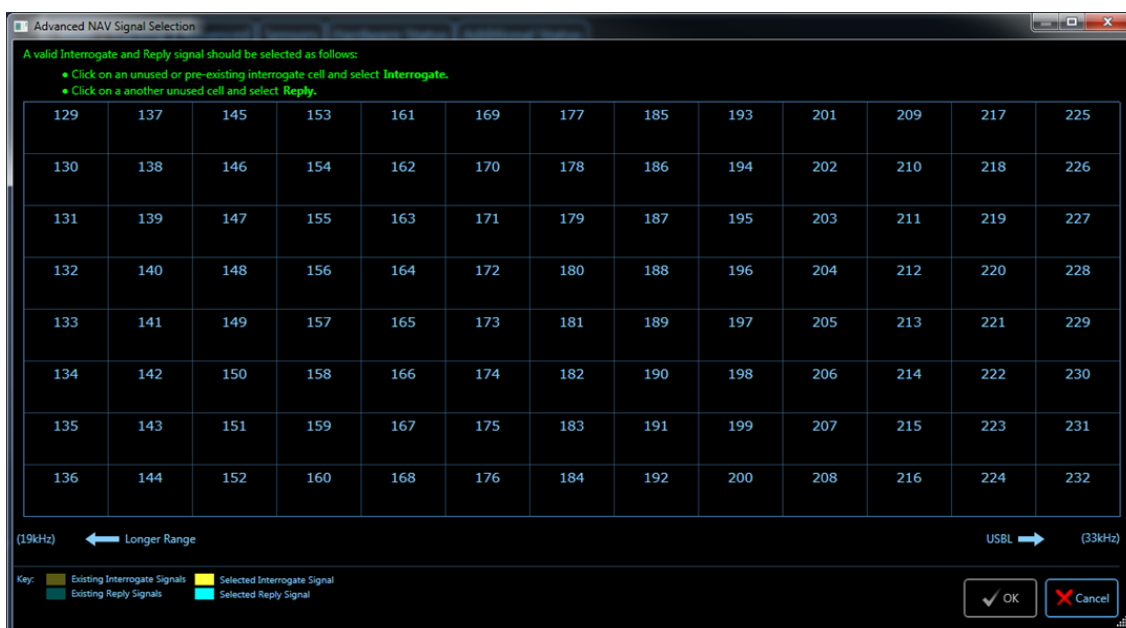
Clicking the amber **Apply** button confirms the changes to the beacon.

5.7.3.2 Wideband 2+

Click **HI2 (NAV 26)** and select **Advanced**:



The **Advanced NAV Signal Selection** dialog box opens in Wideband 2 mode, as shown below:



The grid shows all NAV signal numbers for Wideband 2+ [129...232] in the row/column order.

Section 6 – Application Procedures

6.1 Introduction

This chapter includes a series of procedures for performing common acoustic positioning tasks with the system. Each procedure in this chapter includes the instructions you need to set up the system and to perform the specific procedure.

Note



There are certain set-up tasks that are common to many of the procedures included in this chapter. Section 4 "Common Procedures" explains and describes these common set-up tasks.

The software is able to manage communications between multiple transceivers and multiple target objects. This gives much improved operational flexibility when the system is being used in a complex configuration. Some of the procedures described in this chapter take advantage of this flexibility.

For simplicity, the descriptions in this chapter are limited to include only the information needed to perform each procedure. If you require more information about the software dialog boxes, see *Appendix A "User Interface"*.

6.1.1 Before you begin

All the procedures in this chapter assume that:

- the system has been installed correctly
- you are starting each of these applications with a new setup that contains no targets or Instruments
- you have made a written record of the addresses for each of the beacons to be used in the setup, and
- you have arrived on station and deployed all the transceivers, transponders, and targets required for the application.

If any of these prerequisites is not true it should be resolved.

All these procedures also assume that the system operator is familiar with the rules and methods for selecting menu items, moving the cursor around the dialog boxes and is familiar with the options and controls on the dialog boxes.

Switch on the system and wait until the main window is displayed.

Note



Depending on the way your Marine Computer has been configured and which software version you are running, the software may appear slightly different when you use it. However, the controls will function as described in this manual.

6.2 USBL Mobile Beacon Tracking

6.2.1 Application Summary

In this scenario a USBL system is required simply to report the position of a mobile beacon (typically installed on an ROV). Position is reported in terms of eastings, northings and depth with respect to the vessel datum. If GNSS position and gyrocompass heading reports are available to the system, the positions of both the vessel datum and of the mobile beacon are reported in absolute co-ordinates.

The output can be made available to a dynamic positioning system and to a survey package.

There are two types of beacon available in the system:

- **Transponder** — the mobile beacon is completely remote. It is interrogated acoustically and replies acoustically.
- **Responder** — the beacon is triggered by an electronic interrogation through a hard-wired link or umbilical, and replies acoustically.

6.2.2 Navigation Set-up

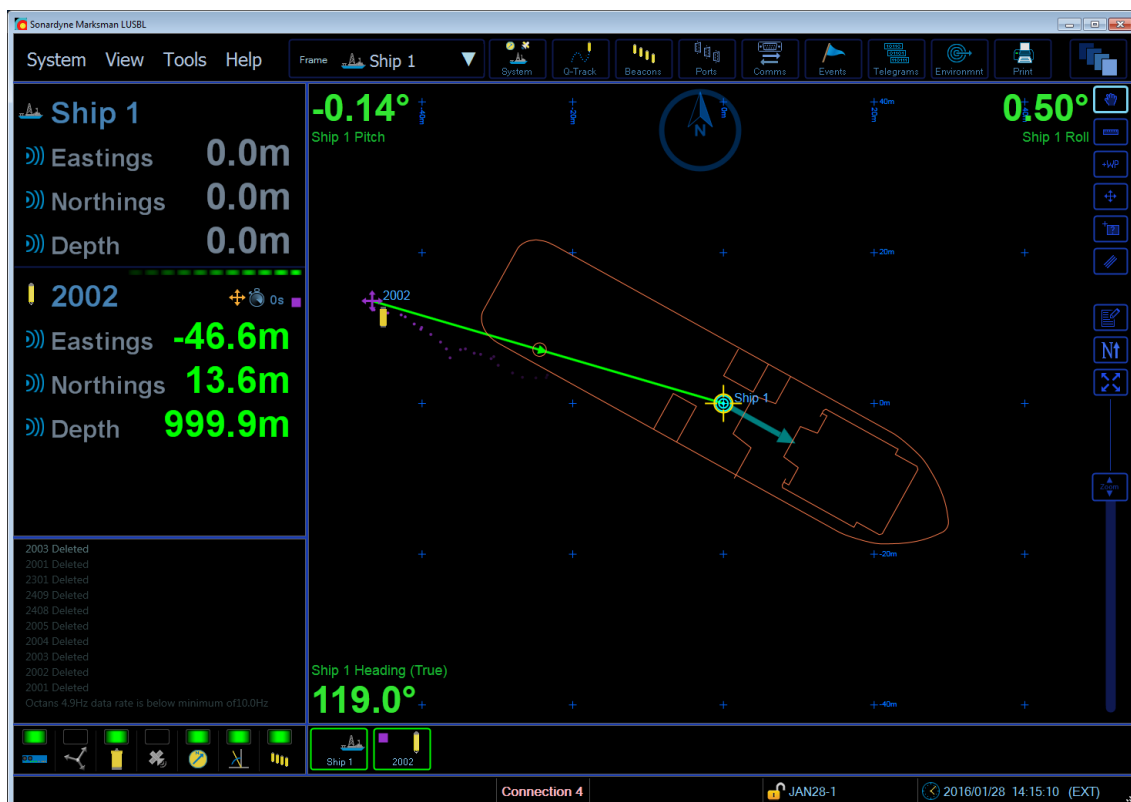
If a template exists, use it to create the setup.

If there is no template, select **System > Setup** to display the **System Setup** window and refer to *Section 4 "Common Procedures"* to add the instruments used in the setup.

6.2.3 Navigate

Select the main screen and follow the callout instructions below.

1. Select the Ship frame for vessel-relative tracking.
2. Enable the Instruments on the ship for use in tracking.
3. Click to enable beacon tracking.
4. Wait for a short time while a series of measurement cycles complete and the vessel and beacon positions are displayed. In this example the system has no GNSS input and shows the beacon position relative to the vessel.



Note

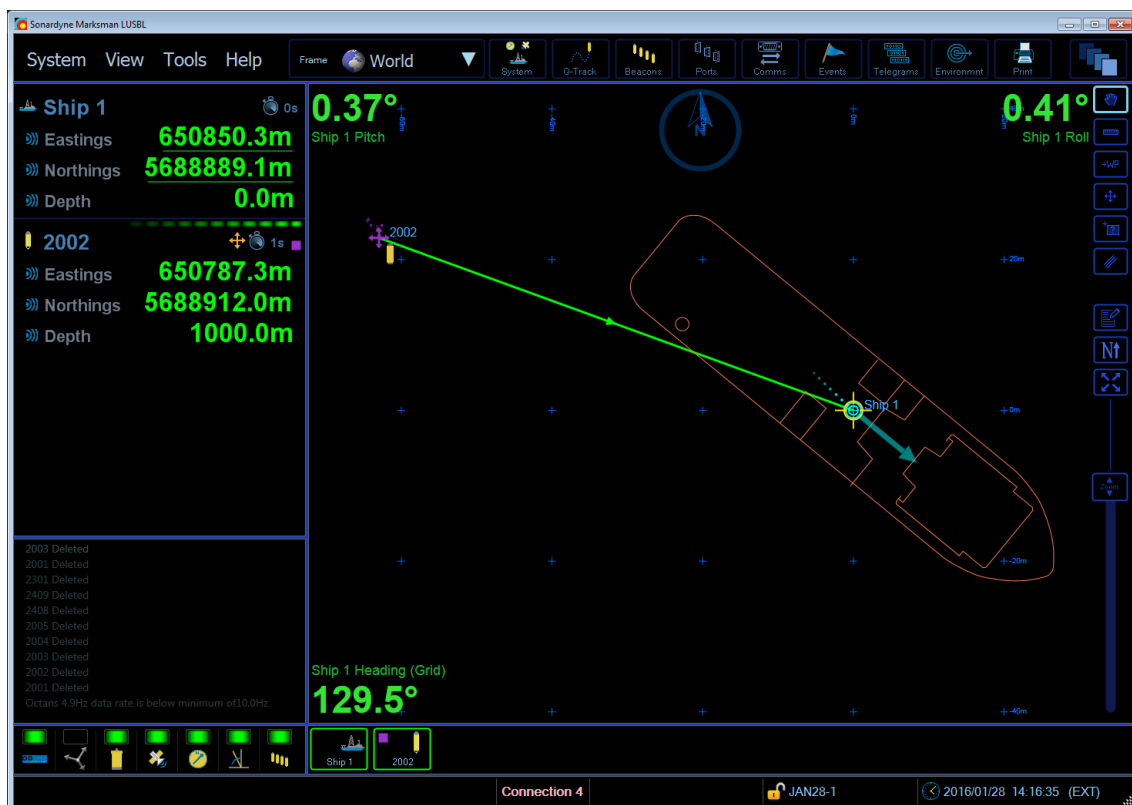
 The intermittent radial line from the vessel to the beacon that represents the measurement cycle is green when range measurements are successful, and red when range measurements are in error. Also note that the position information shown is in green figures when the measurements are fresh, but decay towards orange figures if the measurements are not updated.

Refer to the description of the main window in *Appendix A "User Interface"* to set the options for north/bow up, centring or pinning an object on the chart, measuring distances on the chart, zooming the chart, and switching between day and night mode.

6.2.4 GNSS Input

The example shown above uses input from a gyrocompass but not from a GNSS system, and provides only basic tracking information for the beacon relative to the vessel's datum. You can add a GNSS Instrument to the setup to provide more detailed position reports.

When the system receives input from a GNSS receiver, the display shows the vessel and beacon positions using real-world co-ordinates, for example in the following screen the frame is set to World.



In this operating mode, the tracked targets show a 'snail trail' to indicate a history of the target position over the previous updates; see **Position History Length** in the **Chart Properties** (Section A.3.1 "Chart Properties"). This trail fades with time so that the display does not become cluttered.

6.3 ROV Tracking

6.3.1 Application Summary

The system can be used to position an ROV with respect to the vessel.

When tracking an ROV it is important to consider the following carefully:

- Where is the beacon positioned on the vehicle, and how is it configured?
- The beacon needs to be positioned such that it has a clear line of sight to the USBL so that the signals do not become shielded when the ROV manoeuvres.

- It is common for ROVs to produce noise that can prevent a beacon from being interrogated as a beacon. To avoid this being a problem, it is recommended to configure beacons on ROVs as responders, and to trigger them electrically.

6.3.2 Simple ROV Tracking

The simplest mechanism to view the position of an ROV is to track and display the position of a beacon mounted on the ROV. This mechanism allows the approximate position of the ROV to be followed so that the ROV can be guided to the required location.

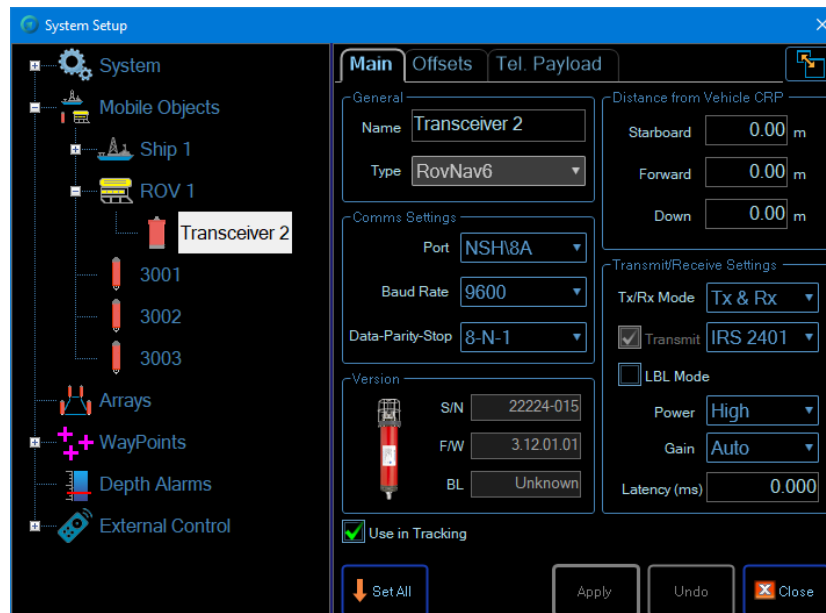
6.3.3 ROV Vehicle Tracking

Some Marksman, Ranger 2 USBL/Survey/DP product variants support tracking the position and heading of the ROV as a vehicle. This allows the ROV to be tracked more precisely. The offsets of the beacon with respect to the required CRP can be entered, and an AHRS used to correct the acoustic position of the beacon to the CRP. Optionally, a depth sensor can be attached to the vehicle, and provide a more precise estimate of depth.

6.3.4 ROV Vehicle Tracking by RovNav.

On occasion, where an ROV already has a ROVNav 6 installed for LBL operations, it can be serially attached to the Ranger 2 system and used as a responder. This is sometimes referred to as 'implied responder' mode and allows:

- The required signal to be used for ranging to be configured.
- The power level of the RovNav to be configured.
- Any latency through the ROV MUX to be corrected for using the 'Latency' box.
- Marksman, Ranger 2 USBL/Survey/DP cannot use the ROVNav as an LBL transceiver for tracking within an array.



6.4 AUV Tracking (requires 'Robotics pack' option)

In this application, an AvTrak 6 or other SMS capable beacon is mounted on an AUV with one of its serial ports connected to the AUV control system. The transceiver sends SMS messages to the AvTrak

6, and computes its USBL position from the acknowledgment. The computed position is then sent to the AvTrak 6 as the payload of the next SMS message.

Note

 **Contact Sonardyne Customer Support for detailed guidance on the AvTrak 6 position message string format.**

This technique can be used to either track an individual AUV using an IIS interrogation, or groups of AUVs using multiple beacons on the same CIS.

If multiple different interrogation signals are enabled in SMS telemetry mode, the system will schedule the interrogations in a round robin fashion.

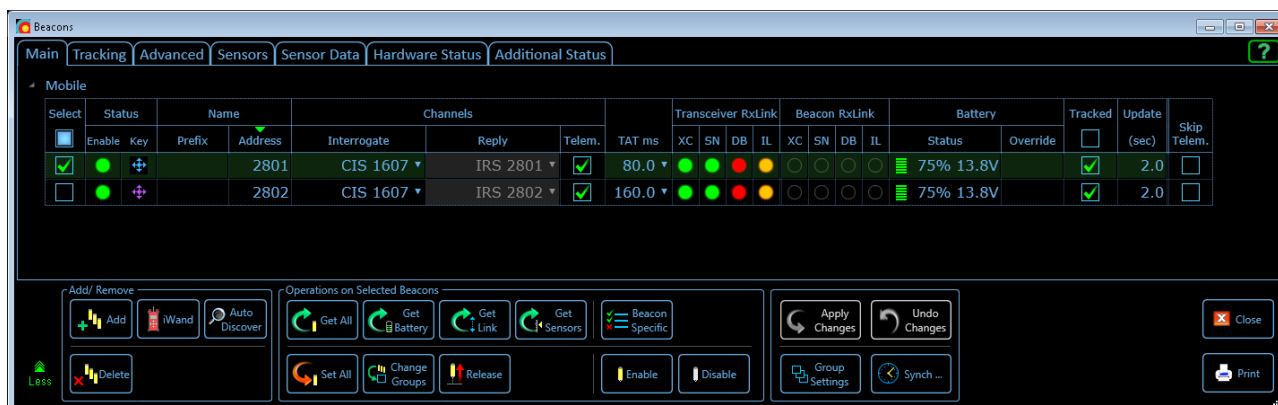
Note

 **This technique uses telemetry for tracking, and is exclusive of normal ranging. When one, or more AvTrak 6s are put into Telemetry tracking mode, tracking of all other beacons is automatically turned off.**

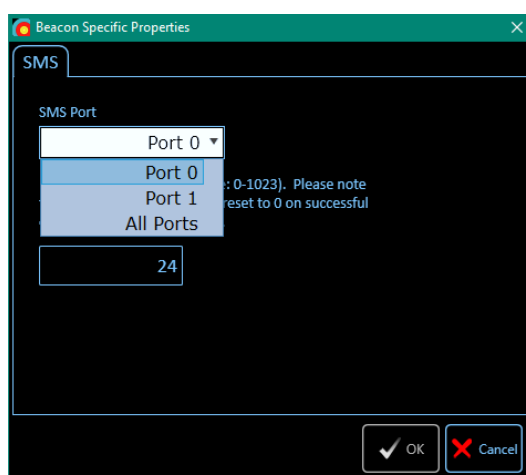
1. Select the AvTrak 6 and choose whether individual interrogation (IIS) or common interrogation (CIS) is required; see *Section 5 "Beacons"*
2. Select the **Telem** checkbox to enable the Telemetry tracking mode.

Channels			TAT ms
Interrogate	Reply	Telem.	
CIS 1607 ▾	IRS 2401 ▾	☒	120.0 ▾
CIS 1607 ▾	IRS 2705 ▾	☒	240.0 ▾
CIS ▶	CIS 1600		
IIS ▶	CIS 1601		
Responder ▶	CIS 1602		
	CIS 1603		
	CIS 1604		
	CIS 1605		
	CIS 1606		
	CIS 1607		
	CIS 1608		
	CIS 1609		
	CIS 1610		
	CIS 1611		
	CIS 1612		
	CIS 1613		
	CIS 1614		

- To set up a serial connection to the AUV, select the checkbox of the AUV's AvTrak 6 and click the **Beacon Specific** button.



- Select the AvTrak 6 serial port on the drop-down list.

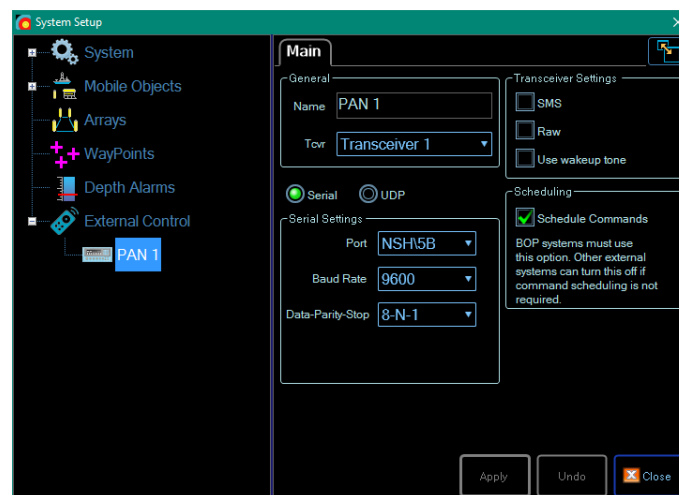


Note

The spare three digits on this dialog box can be set, and will be encoded into the following SMS messages sent to the beacon. They can be used by an external system to send command numbers or status requests to the vehicle.

If the AUV control system needs to send occasional status messages, it can send these to the AvTrak 6 as SMS messages, which will be sent as the acknowledgement to the next incoming position message from the surface.

If a PAN port is added to the system, and **SMS** is selected, then the SMS messages received from the AvTrak6 will be routed out of that port. In the same way, SMS commands can be sent into the PAN port and these will be interleaved with the normal SMS traffic.



Since this tracking technique uses telemetry messages for tracking, it is important to optimise the telemetry settings for best performance. In particular, it is recommended that the fastest reliable transmit speed is used (see **Tools > Options** and select the **Acoustics** tab for default settings).

6.5 Towfish Tracking

6.5.1 Application Summary

The system can be used to position a towfish while a vessel is towing it.

Towfish are commonly tracked at high elevations. This can make the signals difficult to detect, and make the estimated depth less precise.

The following recommendations apply when using this application:

- Use depth aiding in this application. Sonardyne beacons can be configured to report depth using a second reply signal, or a manual depth can be used.
- For very long layback tracking, it is sometimes necessary fit an adaptor flange to a standard transceiver so that it angles the transceiver face towards the target. Although this technique can be helpful in increasing the signal level received from the beacon when tracking a target directly astern of the vessel, it can also result in the introduction of additional noise from the vessel, and so limit the transceiver's ability to track targets.
- Use GNSS input. Generally a towfish is towed a fixed distance behind the vessel, and so does not appear to move very much with respect to the vessel. Using GNSS to track the vessel allows the system to compensate the towfish measurements for the true velocity of the beacon through the water.

6.6 Simple DP

6.6.1 Application Summary

In shallow water, a simple mobile beacon can be enabled and used for DP to help control the position of the vessel. The safe working depth for using a simple USBL mobile beacon for DP purposes depends on the quality of the attitude and heading sensors. With Sonardyne's Lodestar it is possible to use a simple USBL mobile beacon for DP in depths up to 1000 metres. Generally, more than one beacon should be used so that the DPS can maintain control, even if data from one beacon is lost.

Many DP systems require that a flag is set in the telegram that confirms that the beacon is stationary on the seabed. Use the Output Telegram Editor to set the mobility field to 'Fixed' for a beacon that is on the seabed if required by the DPS.

6.7 Optimised USBL

6.7.1 Application Summary

In deep water, or for long-range tracking, it is important to use a high-quality AHRS to achieve good accuracy and stability. Sonardyne's Lodestar Gyro USBL integrates a USBL transceiver together with a Lodestar AHRS for near-perfect alignment and time-synchronisation.

Operation of a Lodestar Gyro USBL-based system is the same as for a standard USBL system.

See *Section 7 "Optimised USBL and DP INS"* for details.

6.8 LUSBL Tracking for DP

6.8.1 Application Summary

When the system is required to estimate the position of the vessel relative to more than one beacon on the seabed, the transponders can be added to an array. Sonardyne recommends laying a **minimum** array of five beacons, to ensure that the integrity of the position estimate of the vessel does not become degraded if measurements from one or more of the beacons in the array are missed.

The **array beacons** can either be calibrated with respect to each other, or calibrated with respect to the GNSS. The system can then use the measurements from all of the **beacons** in the resulting array to estimate the position of the vessel. This position is considerably more stable than the position of USBL mobile beacons and can be used as an input to DP to full ocean water depth.

When using GNSS, all beacons added to the array are calibrated with respect to the GNSS.

CAUTION



Take care to ensure that the GNSS is disabled in the system after the calibration completes, so that the resulting position estimate is derived purely from the acoustic measurements.

When not using GNSS, the position of the first beacon added to an array is held fixed, and the positions of subsequent beacons added to the array are then calibrated with respect to the first beacon.

6.8.2 General Navigation Set-up

1. If a template exists, use it to create the setup.

If there is no template, select **System > Setup** to display the **System Setup** window and refer to *Section 4 "Common Procedures"* to add the instruments used in the setup.

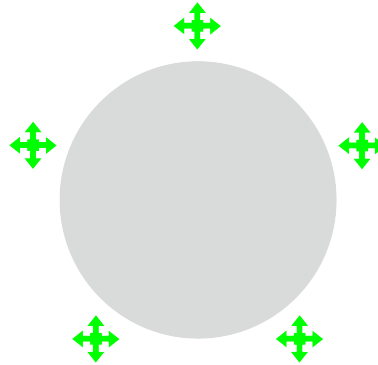
2. Add the beacons to the setup and begin to track them.

6.8.2.1 Deployment

1. Continue to track the beacons as mobiles while the ROV places them in a suitable position.

The usual beacon arrangement is a five-pointed star (pentagon) such as the example pattern shown below. The main operating area is inside the pentagon.

Figure 6–1 Example 5-Beam Array Deployment Pattern



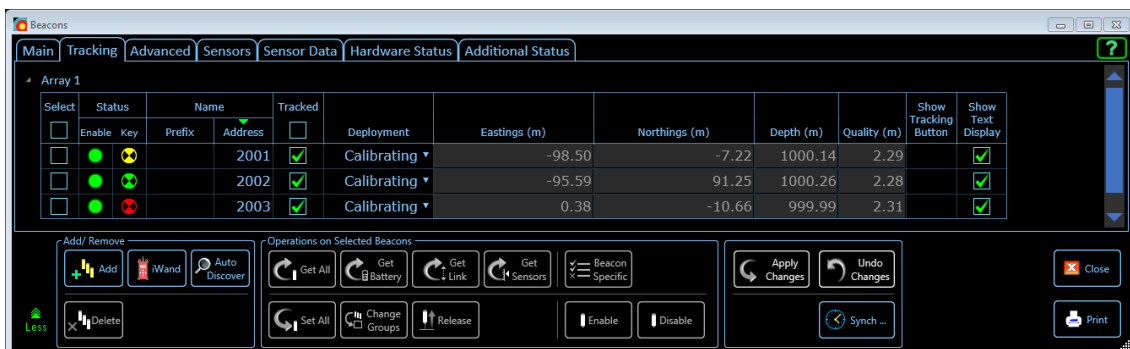
2. When the beacons are all deployed, confirm that they are all tracking correctly and are stable as mobiles.

Note

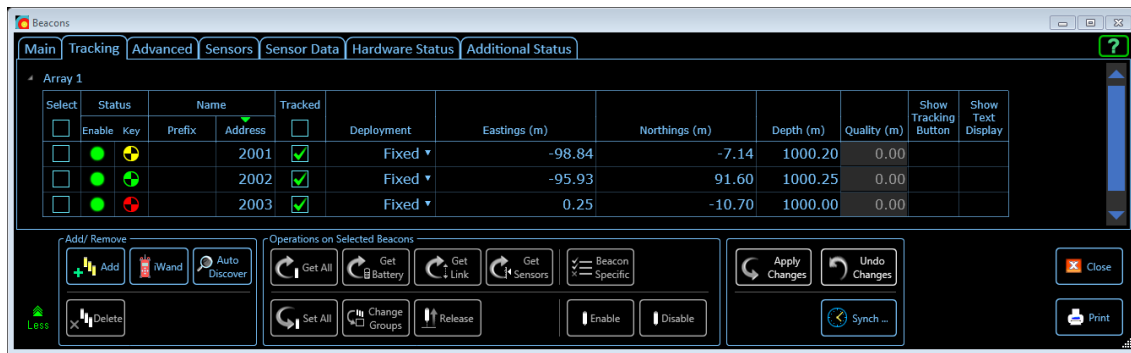
 If the transceiver has been moved or re-installed, or if the VRU or gyrocompass has changed, then you must run a CASIUS calibration using one of the beacons (with the beacon set as a mobile). See Appendix I "CASIUS Data Collection Methods" for an explanation of the CASIUS calibration process.

6.8.2.2 Beacon Calibration

1. Open the Beacons Table and change the INS Beacons from **Mobile** to **Array**. This will begin the process of calibrating their position.



2. Allow the calibration to run for a minimum of one hour (or until the desired precision is reached and the Quality figure has stopped decreasing).
3. Open the Beacons Table and change the INS Beacons from **Calibrating** to **Fixed**.



6.9 DP INS

DP INS is very similar to 'LUSBL tracking for DP', but with the addition of a Lodestar INS for faster position update and superior ride-through during acoustic drop-outs. The number of beacons in the array can also be reduced to three.

6.9.1 Setup

The setup uses a Lodestar GyroUSBL instead of the regular transceiver.

6.9.2 Deployment and Calibration

Deployment and calibration are as for a 'LUSBL for DP' (see *Section 7 "Optimised USBL and DP INS"* for details).

6.10 Multiple Systems Tracking Independently

6.10.1 Application Summary

A vessel can operate with more than one acoustic system, and they can share sensors, and transponders without necessarily impacting on their independence. Each system tracks using measurements made only on that system, and so the solution produced by one system has no influence on the solution produced by the other(s).

When sharing transponders in an array, the failure of a single beacon could reduce the robustness of all systems. Therefore, it is recommended that the minimum number of transponders in the array should increase from 5 to at least 6, so that a single beacon failure does not result in all systems that share the array operating below Sonardyne's minimum recommended array size.

To avoid one system transmitting signals while another system is attempting to receive it is useful to synchronise them. This is achieved in Sonardyne systems by synchronising timing between the systems using the Acoustic Synchronisation tool. The systems are set to track at the same rate, but with individual offset times to separate their signals from each other.

The systems generally synchronise independently to UTC time from independent GNSS receivers, so there is no connection between the systems. However, it is possible for the systems to share the same GNSS, or to use one system to set the time from one to the other. Although it may be simpler to use one system to send the time to the others, it does have the weakness that the sending system does not know whether it is synchronised to the remote systems, and so cannot raise an alarm if it is no longer receiving time; however, each of the receiving systems would raise alarms if the sending system stopped transmitting.

The NSH has an extremely good clock, and so after the offset to UTC has been measured, the systems can continue to run independently of the UTC time source for many days without losing synchronisation. If a system loses the UTC source, an alarm is raised so that the operator is aware, and so that the UTC source can be restored.

6.10.2 Set-up

1. Add a Time of Day (TOD) device to each system that is to be synchronised. See *Section 4.17 "Configuring System Devices"* for instructions on how to do this.
2. Select the required **Window** and **Offset** for each system to ensure adequate separation of interrogate and reply signals.

Note that a system does not have to use every interrogation window that is allocated to it, and so it is possible to configure the Window on all systems, but choose to track a particular target on one system at any multiple of the Window width that is less than 30 s. For example, if the selected window width was 5 s, an operator may wish to track an MRAMS beacon at a 15 s rate. This is achieved by changing the update period of the MRAMS beacon. The UI will automatically snap to the nearest multiple of the Window. See *A.10.12.11 "Acoustic Synchronization" in Appendix A "User Interface"* for more information.

3. If a BOP interface is required, ensure that the **Schedule Commands** option is ticked on the **Main** tab of the PAN device that the BOP connects to.
4. If sharing transponders in the array, and using the same interrogation signal in more than one system, it is necessary to ensure that the offset between the systems is longer than the blocking period set in the beacon (usually more than 0.4 s).

6.11 Specialist Tracking Applications

6.11.1 iUSBL

In this application the iUSBL transceiver is installed on a subsea vehicle, such as a towfish, and is usually mounted horizontally looking backwards to track beacons mounted on streamers towed behind the towfish.

It is difficult to run a procedure such as CASIUS to estimate the alignment between the USBL transceiver and the attitude sensors in this application, and so typically the iUSBL transceiver is mounted on a plate with a Sonardyne Lodestar that has been carefully calibrated using a CMM or equivalent machine to measure the alignment of the USBL to the Lodestar axes.

6.11.2 Follow Sub

This is an application where an ROV might be carrying out a pipeline survey or similar exercise. A beacon is mounted on the vehicle, and enabled into the DPS as the sole reference. The DPS attempts to maintain a constant offset between the vessel position and the beacon on the ROV, and so as the ROV flies down the pipeline the vessel follows.

Some DPS installations require that the beacon telegram flags that the beacon is stationary before they will allow the telegram to be selected for positioning. If this is the case it is necessary to set that beacon's mobility to 'Fixed' in the telegram properties.

6.12 Diver Tracking

For high-elevation diver tracking, it is recommended to use depth aiding by WB3 Depth mode on the beacon.

6.13 OBC Tracking

In this application, TZ/OBC beacons are deployed attached to seismic cables and are tracked to the seabed by the USBL system. The USBL system is typically driven remotely by an external navigation package such as Sonardyne Hydropos through the remote control interface.

1. Setup the 'Remote Control Device' to connect to Hydropos (or equivalent); see *Section 4.18.3 "Remote Control Interface "*.
2. Setup the required position output telegram to report beacon positions to Hydropos (or equivalent); see *Section 4.23 "Configuring Output Telegrams"*.
3. Hydropos adds beacons, starts tracking, stops tracking and deletes beacons through the remote control.
4. While Remote Control is active, the user interface is locked to prevent accidental operation.

Section 7 – Optimised USBL and DP INS

7.1 Introduction

This section describes how to set up and operate a system for DP INS or Optimised USBL operation. It is valid for systems version 3.01 and later.

Note



The hardware and software are exactly the same for Optimised USBL and DP INS systems. In fact, a DP INS system is an Optimised USBL system where the Lodestar has been enabled to allow inertial positioning.

7.2 Installation and Set-up

7.2.1 Hardware Connections

The following devices must be interfaced to the system.

- NSH

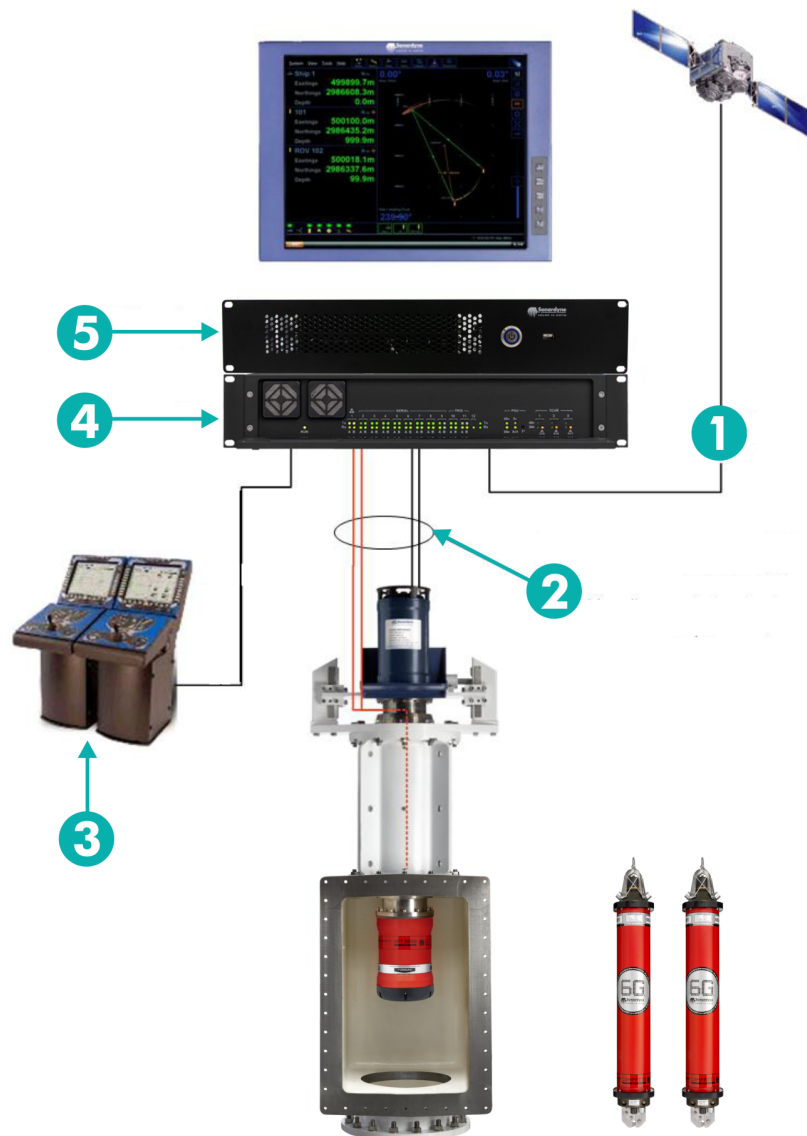
The NSH provides power and communications to the Lodestar and transceiver, and communicates with the Marine Computer over Ethernet. Make sure there is an Ethernet cable connected between the correct ports on the rear of the Marine Computer and the NSH (see *Section C.3 "Hardware Installation (Rack Mount)"*).

- GNSS

A GNSS receiver provides position information that is used to calibrate the beacon on the seabed and latitude compensates the Lodestar AHRS. The GNSS receiver output should be connected to an NSH serial port, and should include GGA and VTG telegrams. If desired, the UTC time and PPS can also be interfaced. The 1PPS signal from the GNSS receiver should be connected to an NSH trigger input.

7.2.2 Installations with Separate USBL Transceiver and Lodestar Units

Figure 7–1 DP INS / Optimised USBL System with Separate Lodestar / Tcvr



Item	Description
1	GGA used to latitude compensate AHRS and calibrate beacon position
2	Tcvr and Lodestar have independent power and communications to NSH. Refer to wiring diagram for details of through-ship cabling
3	DP Telegram
4	NSH
5	Marine Computer

Figure 7-2 Detail of Lodestar and Bracket Mounted on a Carriage

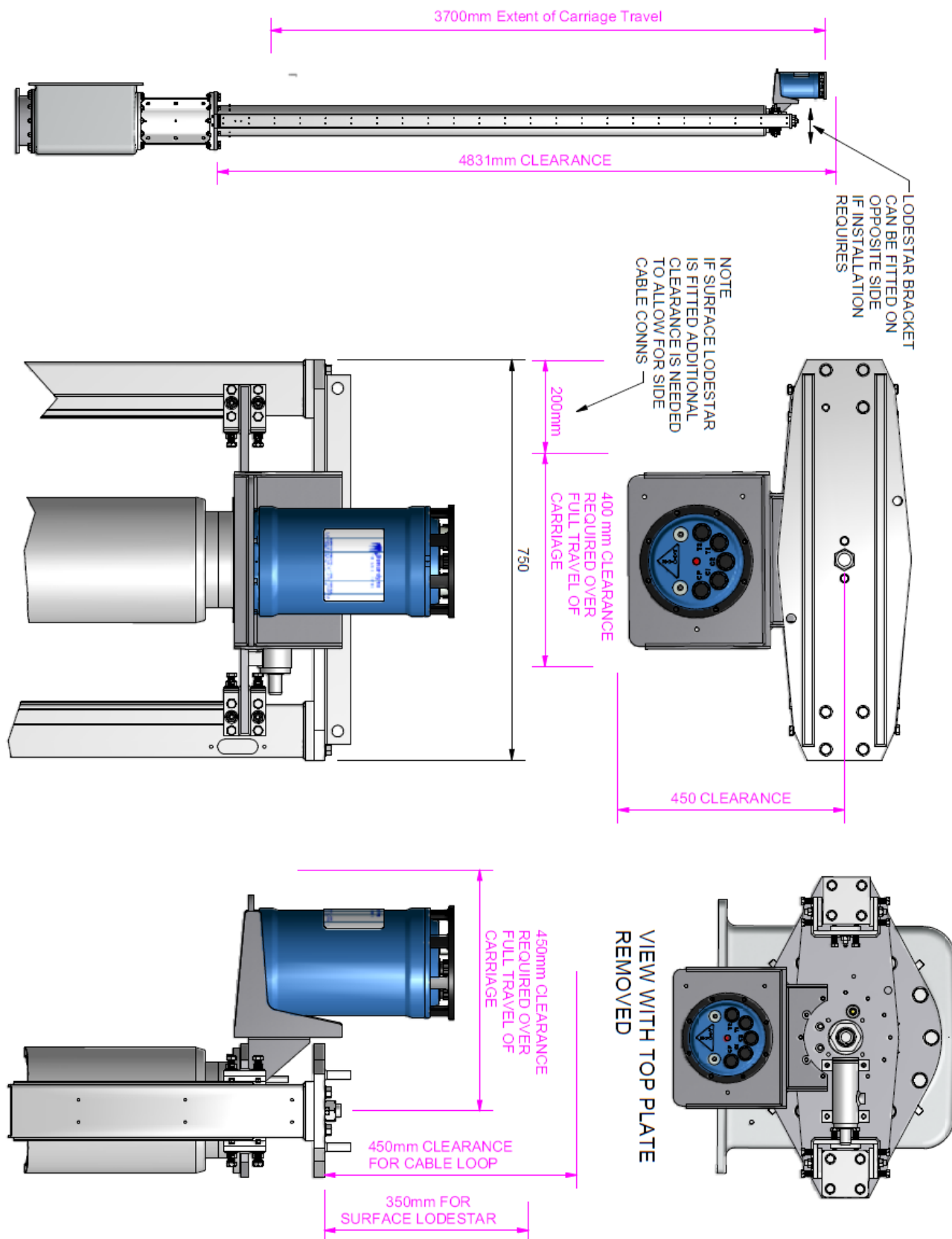
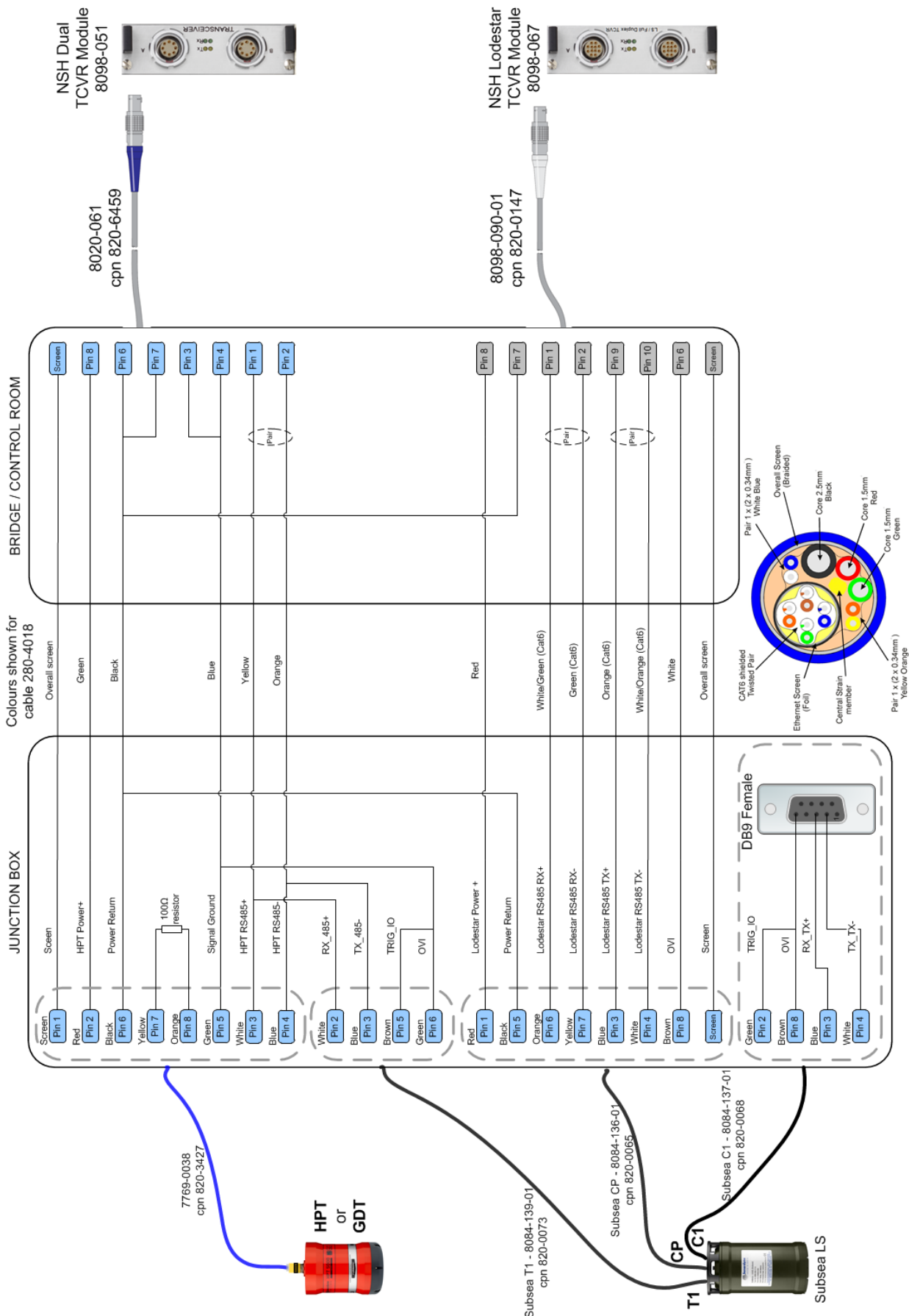


Figure 7-3 Separate Lodestar / Tcwr Wiring Diagram



The transceiver should be connected directly to an NSH Transceiver card in the usual way, and the Lodestar to an NSH Lodestar card. The NSH Lodestar card provides 48 V power and full duplex RS485 comms (see *Appendix D "Interface Cables"*). The transceiver card supplies 48 V and half-duplex RS485 comms. Note that the transceiver comms is split in the junction box and sent across to the Lodestar so that it can listen to the commands being sent by the Marksman system. Lodestar does not send any commands to the transceiver.

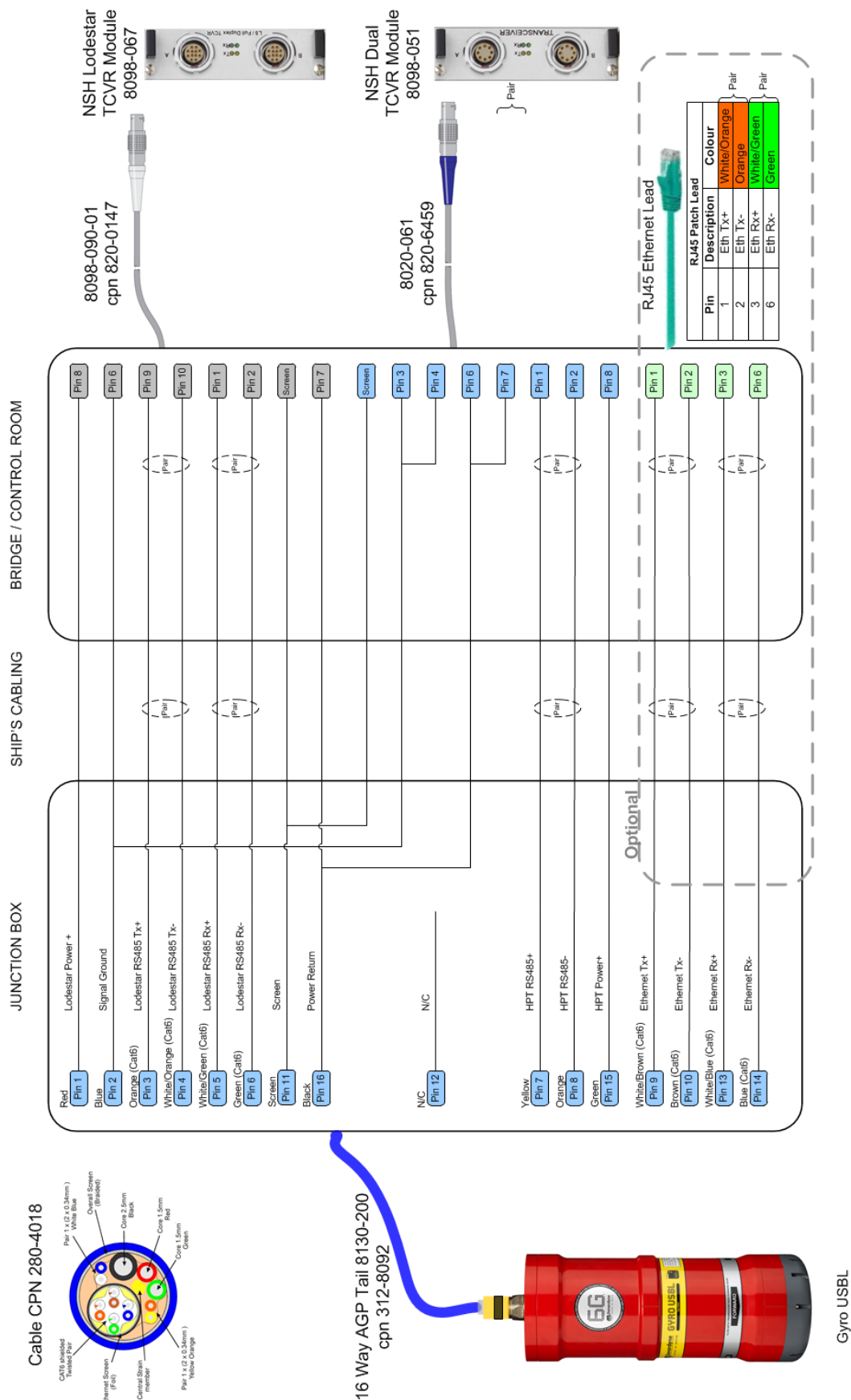
Also note the 'Cable Detect' connections that can be seen at the NSH tails on the bridge. These links are very important because they activate RS485 termination. Without termination the RS485 comms will present problems.

The through-ship cabling should be suitable for the application: Comms wires carry RS485 comms at 115200 baud or less. The power wires carry 48 V at 25 W to each device. Sonardyne suggests using two Cat6 cables for RS485 comms, where one cable is for the Lodestar and the other for the Transceiver. Additionally, two suitable pairs of copper conductors are required to power the Lodestar and Transceiver independently. See *Section D.3 "Cable Diagrams for DP INS/Optimised Applications"* for drawings of cables used in DP INS installations.

7.2.3 Installations with Combined Lodestar Gyro USBL Unit

A Gyro USBL unit is available that houses both a Lodestar and an HPT USBL transceiver. It requires the use of a 16-way Gyro USBL cable wired as shown in *Figure 7-4*.

Figure 7–4 Gyro USBL Wiring Diagram

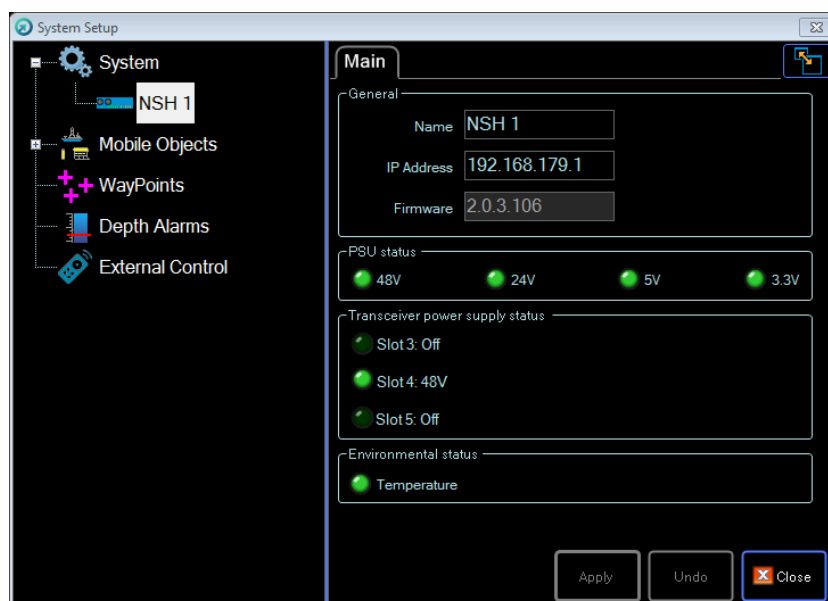


7.3 Software Setup

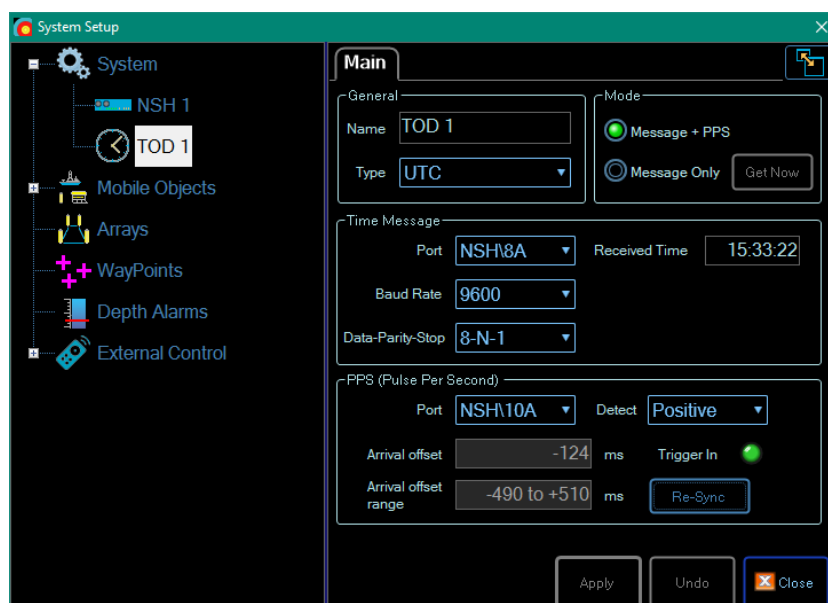
Click **System > New** to create a new job. Some systems will have been configured with template jobs, which means that new jobs have certain default instruments in them. If the template job is correctly configured for DP INS then no further setup should be necessary and you can proceed straight to the operational procedure.

7.3.1 Create the Job and Add the NSH

1. Click **System > Setup** or the **System** button to open the **System Setup** window.
2. Right-click on **System** and select **NSH**.
3. The software attempts to connect by using the default NSH IP address (192.168.179.1). If the connection is successful, the **System Setup** dialog box shows the Firmware version of the NSH.



4. Right-click **System** and select **Add TOD**.



5. Select the **Time Message Port** and the **Baud Rate** to match the GNSS port.
6. Select the **PPS (Pulse per Second) Port** to the appropriate NSH port for the 1PPS signal.

- Click **Apply** and check that the trigger LED flashes once per second and the **Received Time** field shows the decoded TOD data.
- Check the ZDA/UTC to PPS **Arrival offset value** is within the defined **Arrival offset range** (if necessary, refer to the documentation for time source).

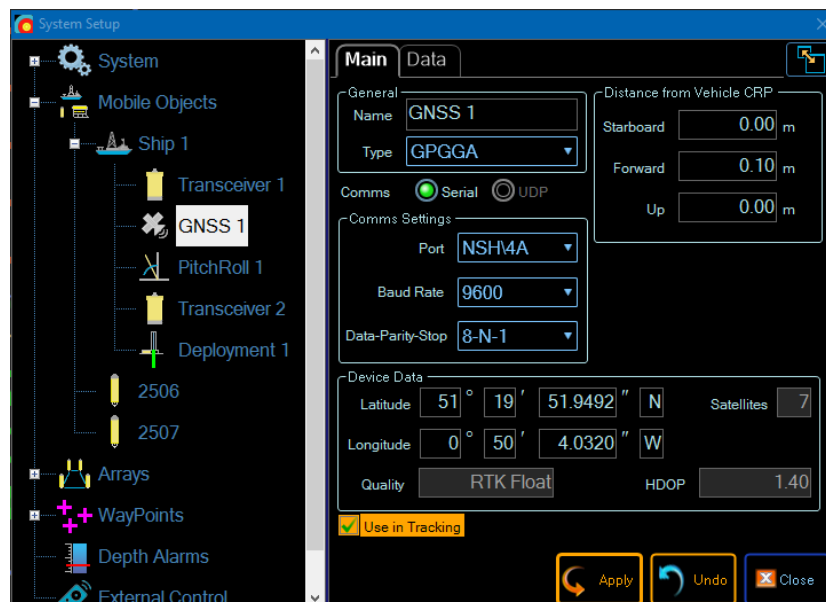
Note



See Section 4.17.2 "Time of Day (TOD)" for more information.

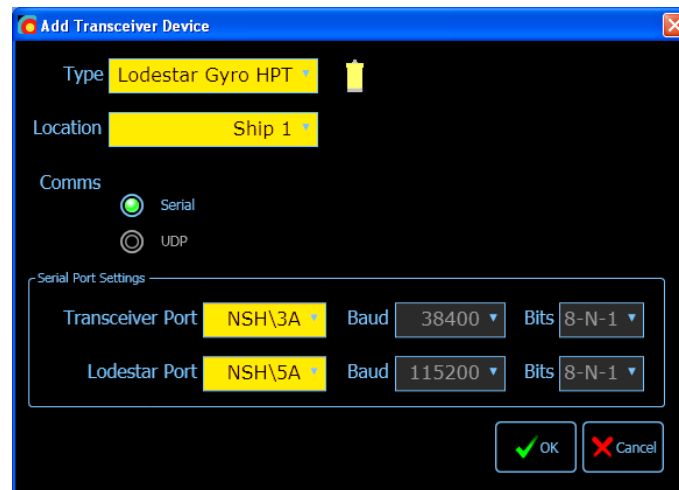
7.3.2 Add the GNSS

- Click **System > Setup** or the **System** button to open the **System Setup** window.
- Right-click the vessel and select **Add GNSS**.
- Select the **Port**, **Baud Rate** and **Data-Parity-Stop** to match the communication parameters used by the GNSS.
- Enter the **Starboard**, **Forward** and **Up** offsets.
- Click **Apply**.



7.3.3 Add a Combined Lodestar and USBL Transceiver Device

- Right-click the vessel and select **Add Transceiver**.
- Select a **Lodestar Gyro HPT** device type for either:
 - a Lodestar Gyro USBL, or
 - a separate Lodestar INS and HPT transceiver.
- Select the **Port**, **Baud Rate** and **Data-Parity-Stop** to match the communication parameters used by the Lodestar and transceiver.

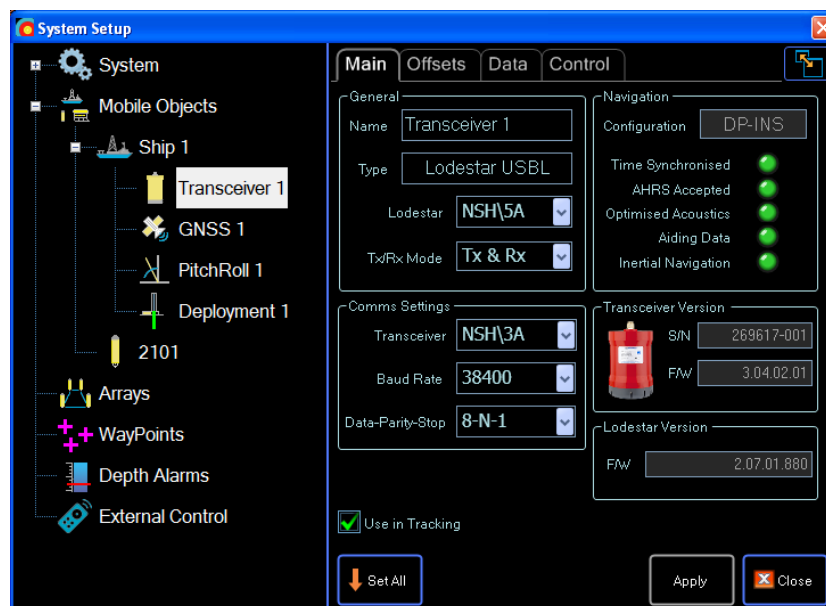


4. After a short delay the display should report the Lodestar serial number and firmware version, although the LEDs shown below will not show green yet. The system auto-detects the Transceiver type. After a short delay the display should report the Transceiver serial number and firmware version.

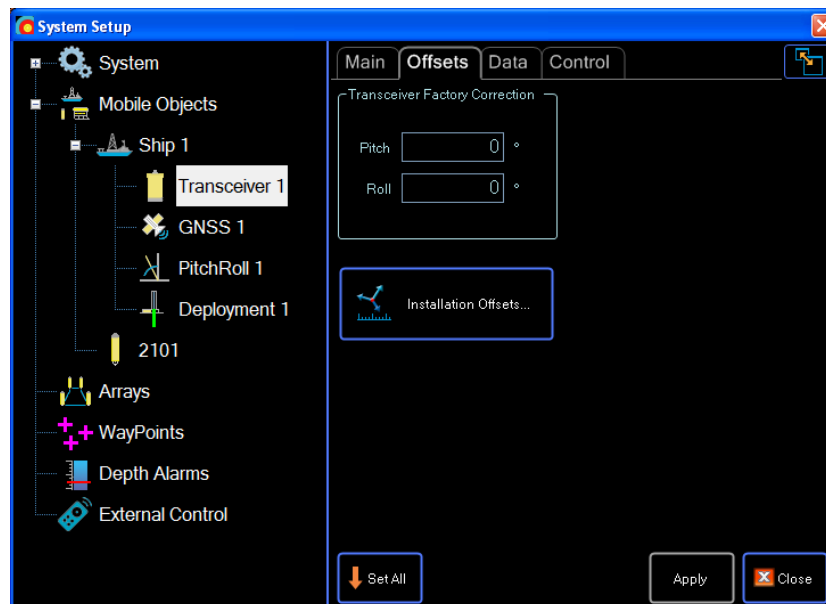
Note



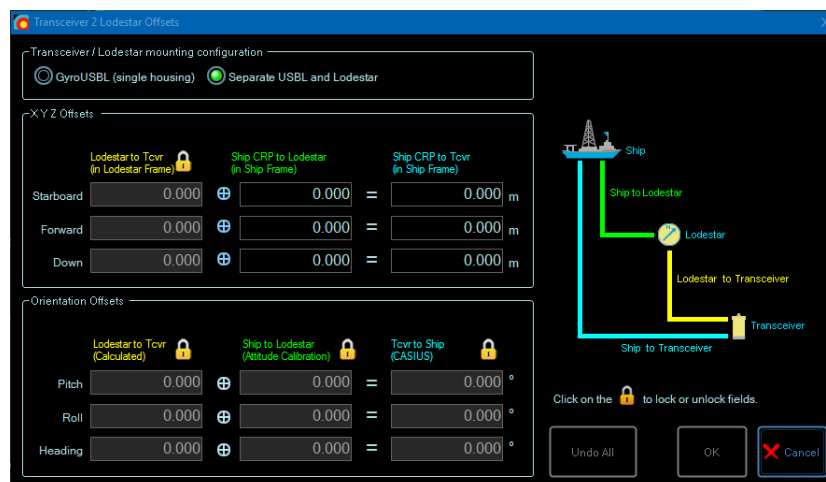
DP-INS functionality (shown below) is not applicable to Ranger 2 USBL.



5. Select the **Offsets** tab.



6. Click the **Installation Offsets** button and check all the various offsets are set correctly.



7. If a surveyed ship's gyro and VRU are available, calibrate the Lodestar to these sensors using the Attitude and Heading Calibration Tools (see A.10.12.2 "Attitude and Heading Calibration" in Appendix A "User Interface". Use of this tool configures the **Pitch, Roll, Heading** offsets for the Ship to Lodestar.
8. Configure **Starboard, Forward** and **Down** offsets for the CRP to Transceiver using measured or surveyed values.
9. Configure Starboard, Forward and Down offsets for the Lodestar to Transceiver or CRP to Lodestar using measured values, depending on whether the Lodestar is mounted in a Gyro USBL, or on the transceiver pole, or on the bridge.
10. Calibrate the **Pitch, Roll, Heading** for the Transceiver to Ship using the CASIUS Calibration Tool (see Section A.10.3 "CASIUS").

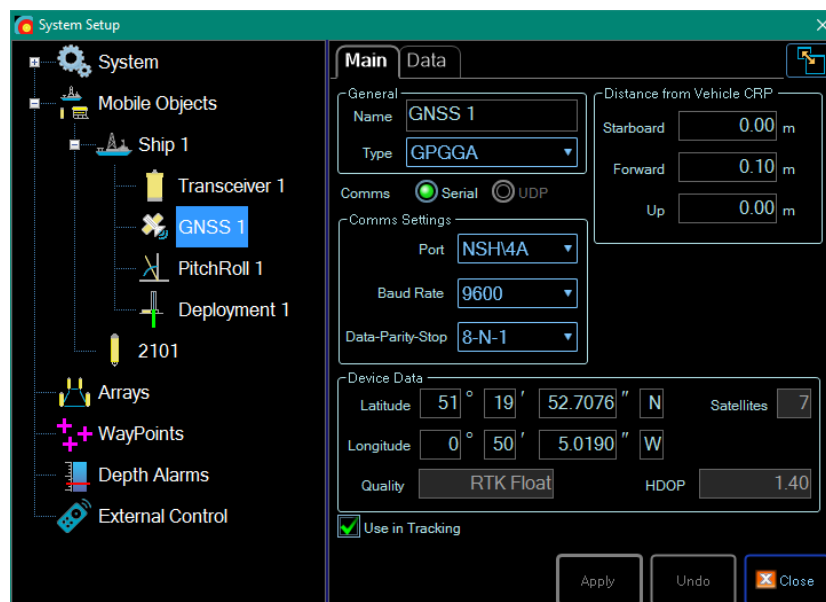
It should now be possible to follow the procedure for arriving at location.

7.4 Suggested Procedure – Arriving on Location

The following is a suggested operational procedure that is suitable for use when arriving on location at a site where DP INS is to be used as a PME. What follows assumes that the system has a job with all necessary hardware connected and interfaced to the system.

7.4.1 Procedure

1. Arrive at Location.
2. Lower the transceiver deployment pole fully when the vessel speed is within limits.
3. Switch on the Marine Computer and the NSH. The system is usually configured to start automatically. However, if it does not, double-click on the software icon on the Marine Computer's desktop.
4. Click **System > Setup** or the **System** button to open the **System Setup** window.
5. Select **GNSS** and select the **Use in Tracking** check box.



6. Check that the NSH, INS, Transceiver, GNSS, Heading and VRU status indicators are all solid green as shown in the example below.



7. Open the Geodesy dialog box (**Tools>Geodesy**) and click **Reset** to update the current operating UTM zone.

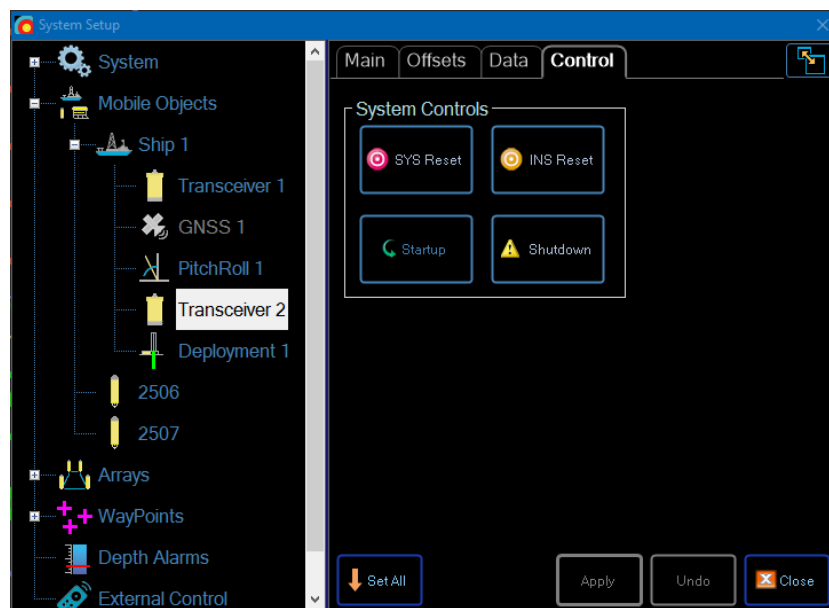
7.4.2 Reset the Lodestar

1. Open **System Setup** and select the **Lodestar Tcwr** device.
2. Select the **Control** tab, click the **System Reset** button and then confirm.

Note



This will restart the Lodestar, making it unavailable for 15 minutes while it settles.



Alarms will be raised when the Lodestar is reset, warning that it is not ready for use. Heading and Attitude indicators will flash orange during this time. These will clear automatically when Lodestar has settled.

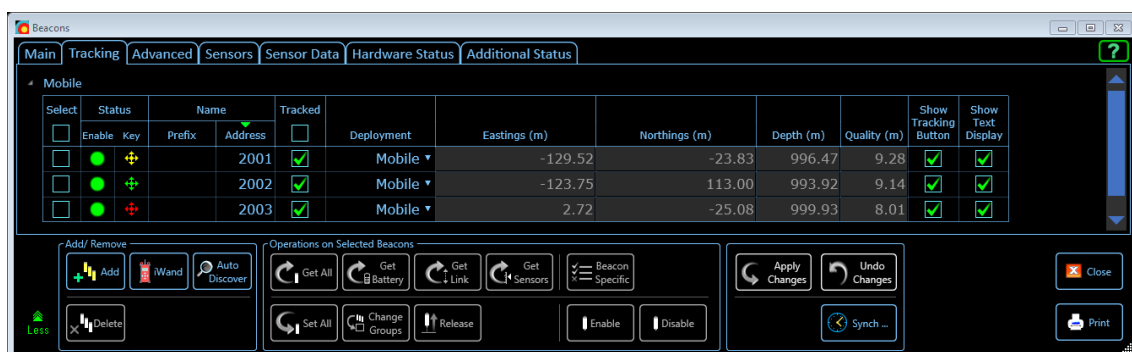
3. Deploy the INS beacons. If the seabed Beacons are not already deployed then have them placed on the seabed. The deployment pattern is determined by the number of Beacons.

Note

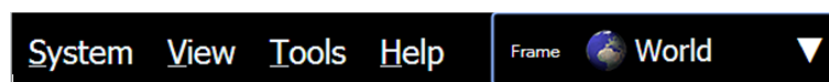


Do not proceed further until the alarm warning that Lodestar attitude is not settled has cleared.

4. Check the Lodestar and Transceiver Installation Offsets are still correct, as described in step 5 in *Section 7.3.3 "Add a Combined Lodestar and USBL Transceiver Device"*
5. If necessary, add the INS Beacons to the system. If they are already in the system then ensure they are 'mobile' in the Beacons Table, for example:



6. Start tracking the INS Beacons.
7. Change the **Reference Frame** drop-down list at the top of the Marksman screen to **World Frame**.



8. Check that the INS Beacon positions are stable and that the system is displaying UTM coordinates for the Vessel and for the Beacons.

7.4.2.1 INS Beacon Position Calibration

Refer to *Section 6.8.2 6.8.2.2 "Beacon Calibration"*.

7.4.2.2 De-select GNSS For Use In Tracking

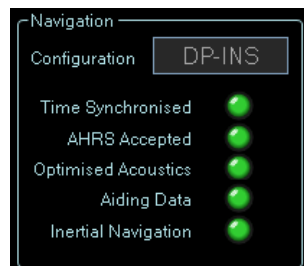
1. Open **System Setup** and select the GNSS device.
2. Clear the **Use in Tracking** check box (note the GNSS status LED now shows blue):



3. Wait for the INS position to establish.

When the Beacons are changed to be 'fixed' the system automatically begins to send acoustic aiding data to the Lodestar unit.

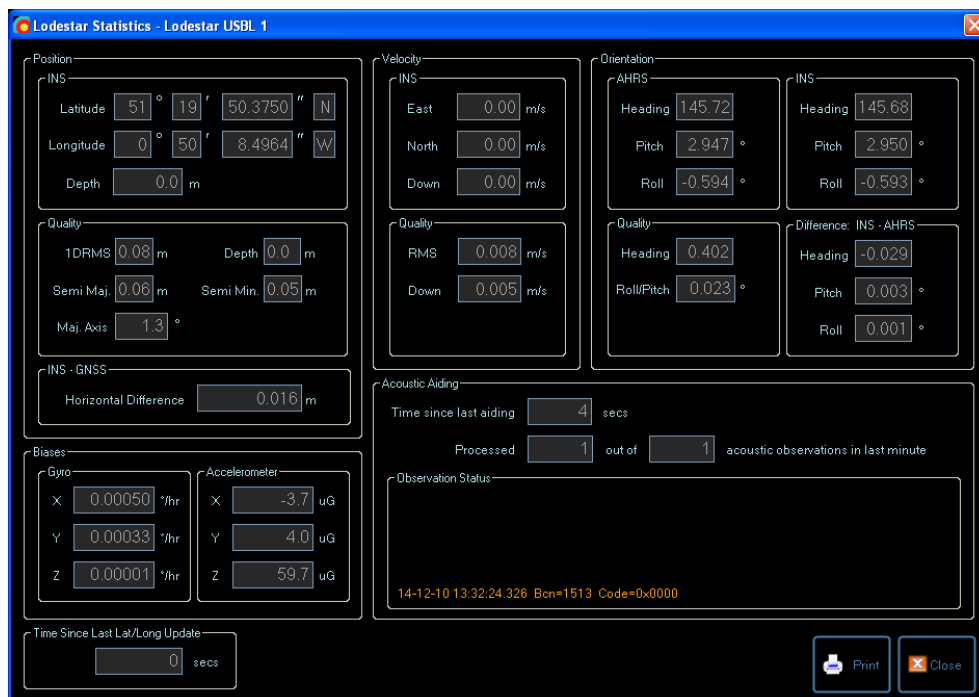
4. Status LEDs in System Setup Lodestar should show:
 - **Time Synchronised** – Lodestar and system clocks are in sync.
 - **AHRS accepted** – the system is getting AHRS data with good time-stamps from Lodestar.
 - **Optimised Acoustics** – automatically illuminates when Lodestar reports that it is correctly detecting transceiver comms and is able to publish attitude values time-synchronised with the acoustics.
 - **Aiding Data** – the Lodestar is accepting acoustic aiding.
 - **Inertial Navigation** – illuminates when the Lodestar INS has settled, is receiving acoustic position aiding, and is publishing inertial positions.



5. The vessel INS position will be displayed on the main window in blue.



6. Select **Lodestar** from the **View** menu to check the correct operation of the Lodestar AHRS and INS.

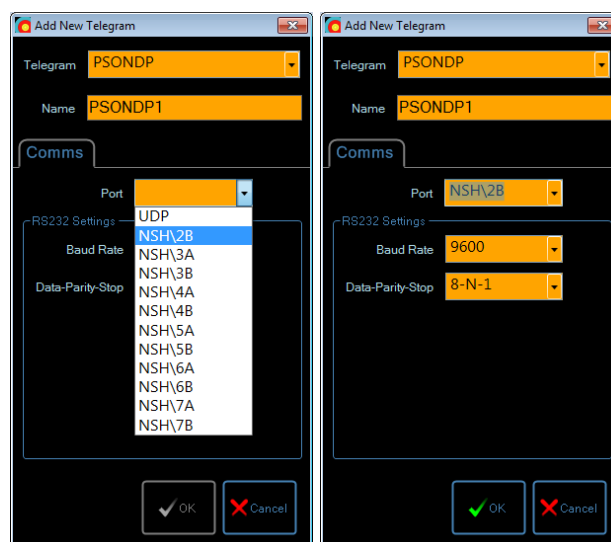


7. Select INS Position in the DP Desk.
8. When DP-INS is tracking well, add a DP telegram to publish the vessel position to the DP desk.

9. Click **Telegrams**.

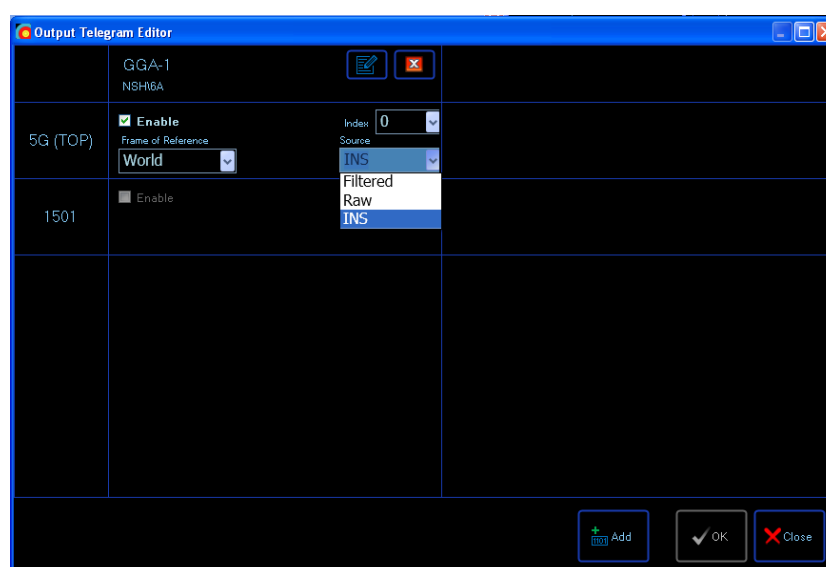


10. Click **Add**.



Note

 Sonardyne's recommended DP telegram type is the \$PSONDP (described in *Section E.11 "PSONDP - Sonardyne DP Report"*), which carries enhanced INS quality data. However, in cases where this is not accepted, choose a suitable alternative. Set up the comms as required by the DP desk, but note that the INS position is published at approximately 5 Hz, so a fast baud rate may be necessary.



It is now possible to select the vessel INS position for use in the DP desk. Use the Comms Viewer to monitor the telegram output if diagnostics are required. Make sure the **Source** is set to **INS** for

the inertial position. Selecting **Filtered** or **Raw** will case the acoustic position to be sent instead of inertial.

7.5 Simultaneous Operations

When running simultaneous operations with a second USBL system on board it might be necessary to enable time synchronization. To enable time synchronization:

1. Select the beacon dialog box and click **Time Sync** on the main tab.
2. Select the **Enable Acoustic Time Synchronization** check box.
3. Ensure the Survey system is set up with a 5 second window and a 2.5 second offset. Ensure the bridge system is set up with a 5 second window and a 0 second offset.

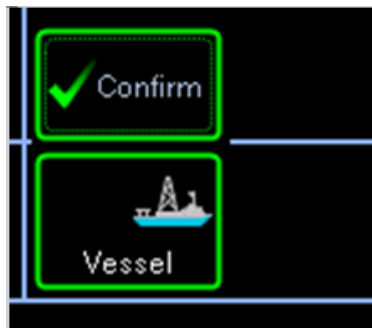
Note

 **This will make all update rates five seconds. You will no longer be able to change the update rate without changing the Acoustic Window on this dialog box.**

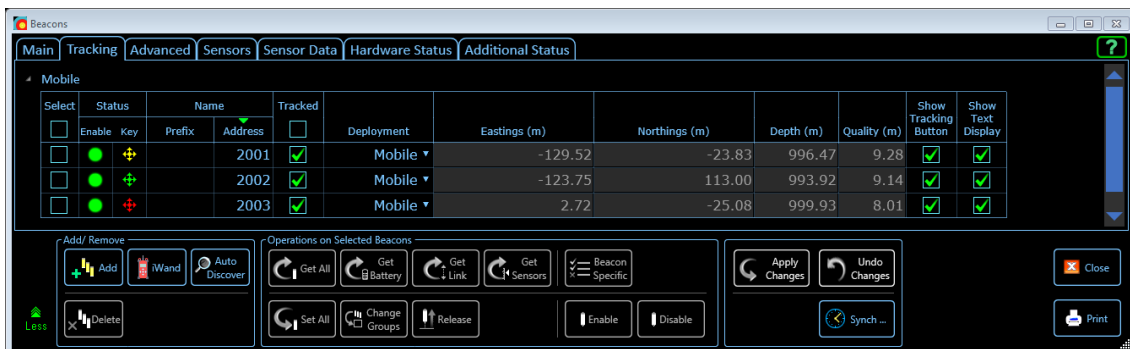
7.6 Suggested Procedure – Leaving a Location

The following is a suggested operational procedure that is suitable for use when leaving a location where DP INS has been deployed.

1. De-select INS from the DP Desk.
Make sure the DP desk is not using the INS position as a reference.
2. Click the **Vessel** tracking button and then click **Confirm** to stop acoustic positioning.

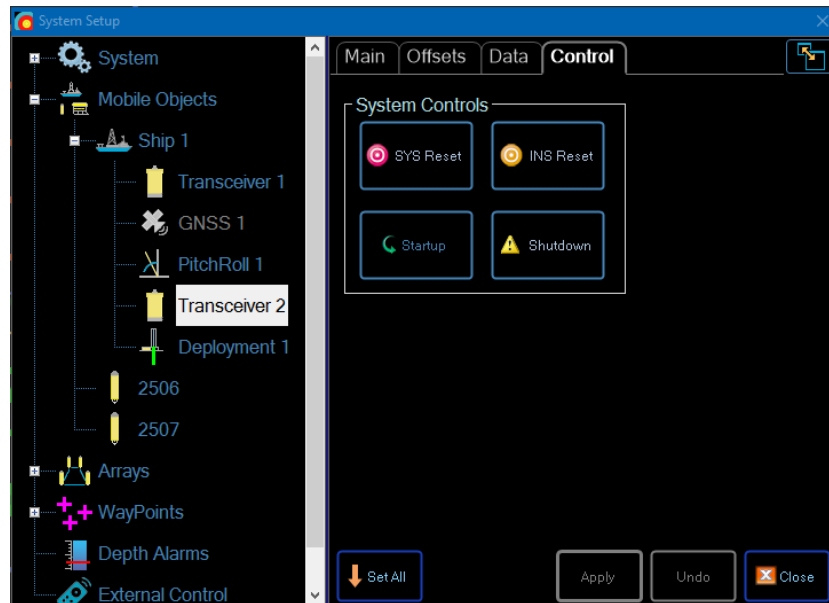


3. Open the Beacons Table and change all INS Beacons from **Array** to **Mobile**.



4. Release the beacons or retrieve them using the ROV.
Beacons can now be tracked as mobile targets as they float to the surface if desired.

5. Open System Setup and select the Tcwr device. Select the Control tab and click the button to 'Shutdown' Lodestar.



6. Confirm the shutdown request.
7. Raise the Transceiver Deployment Pole fully before beginning a transit.
Make sure the transceiver deployment pole is fully raised before beginning a transit.

Section 8 – Riser Angle Monitoring

8.1 Introduction

This section describes Marine Riser Angle Monitoring System (MRAMS) and Electrical Riser Angle (ERA) system software utilities that support monitoring of the relative attitude of a Riser and a Blow Out Preventer (BOP) during drilling operations. When correctly configured, the systems calculate the angular difference between these two elements and display a course to steer that minimises the stress at the joint between the riser and the BOP.

In order to use the MRAMS option it is necessary to have two Sonardyne DPTi transponders: one attached to the Riser and the other attached to the BOP. Both transponders should have a clear line of sight to the transceiver on the surface, and both must be aligned to the forward mark on the BOP.

Note



If the two transponders are not correctly aligned to the forward mark of the BOP then the course to steer indicated by the system will be incorrect.

The MRAMS software display can also be used in conjunction with a **Signal Tower** warning system, where the MRAMS alarms are represented visually and audibly on the signal tower. To use this feature, the signal tower must first be added as a device (see *Section 4.17.4 "Signal Tower"*).

8.2 Marine Riser Angle Monitoring System (MRAMS)

Add the BOP and Riser transponders to the system by using the same method as used for other beacons (see *Section 4 "Common Procedures"*). Confirm that the system can track these beacons before you continue.

For both the BOP and the riser transponders, select either **Pulse Position Angle** or **Telemetry** as the data collection method. Telemetry is usually the appropriate setting to use for the BOP because its attitude changes very slowly.

Note



Telemetry data collection is normally used when the update rate of a beacon's pitch and roll data is slower than one minute. If Pulse Position data collection is used then pitch and roll measurements are collected every time the beacon is positioned by the USBL system. In this mode the data collection rate is determined by the Update Rate in the beacon properties or Beacons table.

8.2.1 MRAMS Software Configuration

1. Select **Tools > Riser Angle Monitoring** to display the **Riser Angle Monitoring (MRAMS)** dialog box.
2. Drag the **Riser Angle Monitoring** dialog box to the second screen and maximise it.
3. Click **Configure** on the **Riser Angle Monitoring** dialog box to display the **MRAMS Configuration** dialog box.

Figure 8–1 MRAMS Configuration Dialog Box

The screenshot shows the MRAMS Configuration dialog box with the following settings:

- General:**
 - ☒ Enable MRAMS
 - ☒ Raise Warning Alarm when: $|BOP^* - LFJ^*| > 0.5^\circ$
 - ☒ Raise Critical Alarm when: $|BOP^* - LFJ^*| > 1.0^\circ$
- BOP:**
 - Beacon: 2401
 - Collection Mode: Telemetry
 - Update Period: 1800 Secs
 - Heading: 0.000
 - Calibration Offsets:
 - Pitch: 0.210°
 - Roll: 0.050°
 - Use Last Reading button
- LFJ:**
 - Beacon: 2403
 - Collection Mode: Pulse Position Ranging
 - Update Period: 2 Secs
 - Calibration Offsets:
 - Pitch: -0.110°
 - Roll: -0.110°
 - Use Last Reading button

Note: Go to the System Editor / Beacon Sensor Page to change MRAMS collection parameters.

Buttons: Calibrate Using New Data, OK, Cancel

4. Select the beacon that is assigned to the BOP from the **Beacon** drop-down list in the **BOP** frame.
5. Select the beacon that is assigned to the Riser from the Beacon drop-down list in the **LFJ** frame.
6. Set the required update rates for the BOP and the Riser transponders (if using telemetry).

Note

If using the Pulse Position Angle method, set the update period in the same way as for any other mobile beacon (see Section 4 "Common Procedures").

7. Set the initial BOP heading.
8. Leave **Pitch** and **Roll** offsets at zero.
9. If it is necessary to generate alarms when the difference between the BOP attitude and the Riser attitude exceeds defined limits:
 - Select the **Warning Alarm** check box and enter an angular alarm limit in degrees.
 - Select the **Critical Alarm** check box and enter an angular alarm limit in degrees.
10. Select the **Enable MRAMS** check box to enable the automatic MRAMS function.
11. Click OK to accept changes and close the **MRAMS Configuration** dialog box.

8.2.2 MRAMS Calibration

To calibrate the BOP and Riser attitudes, the BOP should be suspended in the water under the vessel at a depth where there is a clear line of sight between the transceiver and the transponders.

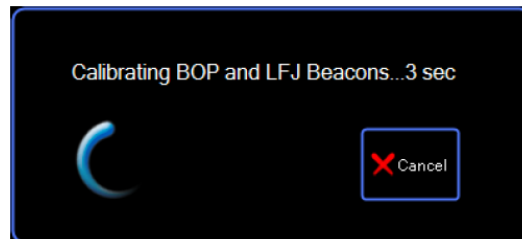
Note

The automatic MRAMS function must be switched off.

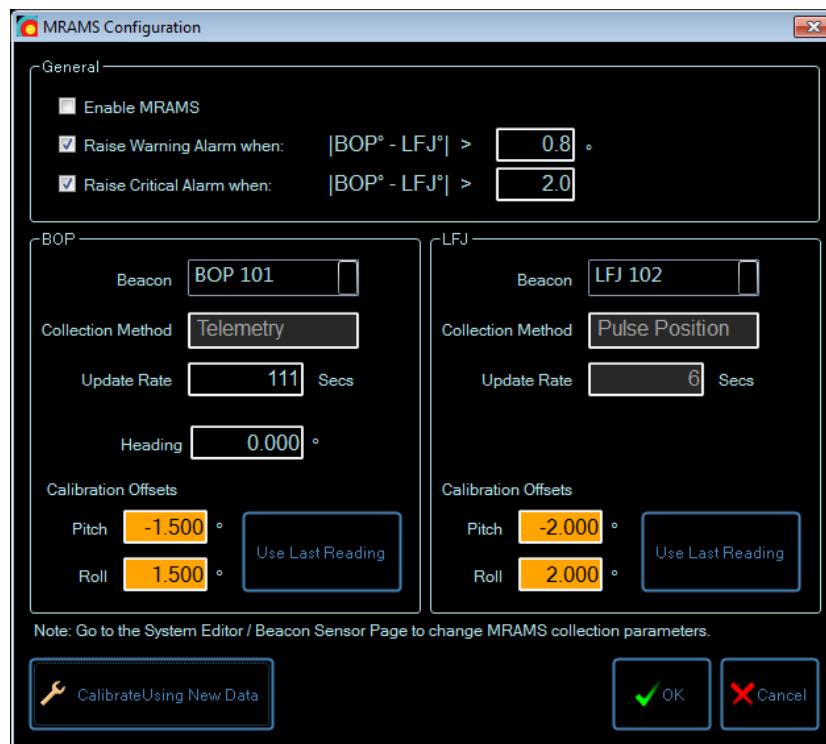
The system may then be calibrated as follows:

1. Click **Configure** on the **Riser Angle Monitoring** dialog box to display the **MRAMS Configuration** dialog box.
2. If the **Enable MRAMS** check box is selected, clear it and then click **OK**.
3. The dialog box then closes; click **Configure** again to reopen it.
4. Click **Calibrate** to begin measuring the BOP and Riser angles.

The following window is displayed while this measurement continues:



When the measurement completes, the software displays the results on the MRAMS Configuration dialog box, for example:



The Pitch and Roll offsets for the BOP and the Riser will now have been updated to give measured angles of 0 degrees.

5. Click **OK** to accept the new offsets.

8.2.2.1 BOP Heading

The BOP can now be lowered to the seabed and connected to the well head. After the BOP is connected it is necessary to enter the BOP heading into the Heading field so that it can correctly calculate the 'course to steer' for the vessel.

CAUTION

 **Risk of equipment malfunction.** Failure to enter the correct heading of the BOP after it is latched on the seabed will cause the system to report an incorrect course to steer to minimise the differential angle.

Set the BOP heading as follows:

1. Click **Configure** on the **Riser Angle Monitoring** dialog box to display the **MRAMS Configuration** dialog box.
2. Type the heading of the BOP into the **BOP Heading** field.
3. Click **OK** to close the **MRAMS Configuration** dialog box.

8.2.3 MRAMS Output Telegram

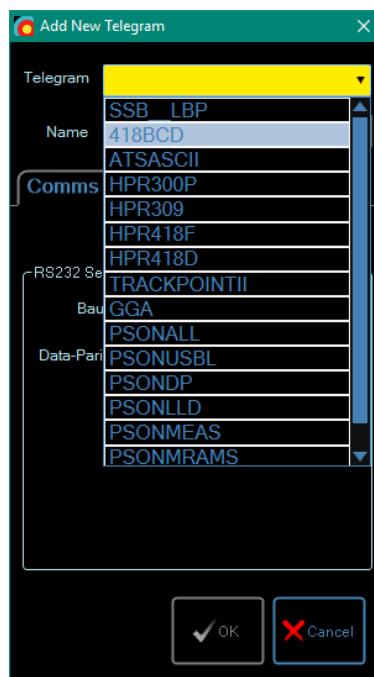
A DP telegram carrying MRAMS data can be added. The usual choice of HPR309, 418 or 418BCD or SSB depends on the DPS configuration, but note that these telegrams require the LFJ beacon to be tracked in Pulse Position Angle mode.

The Sonardyne PSONMRAMS telegram can also be used. This has the advantage that it does not need the system to be tracking a beacon.

1. Click on the **Telegrams** button.



2. Click **Add** and then select the chosen telegram type.



- Set up the communications port.

Add New Telegram

Telegram: 418BCD

Name: 418BCD1

Comms

Port: NSH\28

RS232 Settings

Baud Rate: 9600

Data-Parity-Stop: 8-N-1

OK Cancel

- Enable the Riser beacon only and click **OK**.

Output Telegram Editor

Name: 418BCD-1
Type: 418BCD
Port: NSH\28

Name	Type	Port	Enable
Ship 1			☐ Enable
1702			☐ Enable
1703			☐ Enable
1704			☐ Enable
1705			☐ Enable
1706			☐ Enable
BOP 101			☐ Enable
LFJ 102			☒ Enable

LFJ 102 details:

Mobility: Auto Index: 101

Frame of Reference: Ship 1 Orientation: Bow Up Source: Filtered

Add OK Close

The output telegram will now carry the MRAMS differential pitch and roll data each time the Riser position updates.

See *Section 4.23 "Configuring Output Telegrams"*s for more details on Telegram setup.

8.2.4 MRAMS Operation

8.2.4.1 Controlling Data Collection

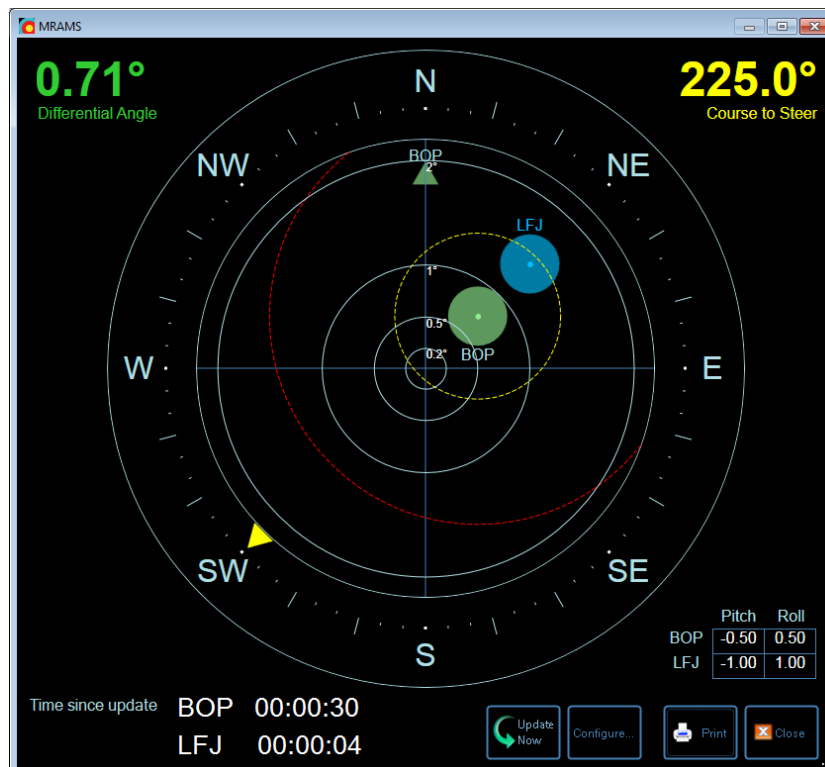
If the data collection technique is set to Telemetry then data is collected whenever the MRAMS function is enabled. In this mode it is not necessary to track the beacon in order to collect and display attitude data.

If the data collection technique is set to **Pulse Position Ranging** then data is collected whenever the beacon is being tracked and the automatic MRAMS function is enabled. If the beacon is not being tracked then a warning is displayed in the **Riser Angle Monitoring** dialog box.

You can manually request a reading from the beacon using telemetry by clicking the **Update Now** button on the main MRAMS window.

8.2.4.2 The MRAMS Display

Figure 8–2 Riser Angle Monitoring Display



The Bubble Gauge in the centre of the screen shows the angles of the BOP and of the Riser, with a blue arrow to indicate the BOP heading as entered in the **MRAMS Configuration** dialog box. The dotted red and yellow circles at the centre of the screen show the **Warning** and **Critical** alarm limits. The small yellow arrow and the yellow data field at the top right-hand corner of the screen indicate the course to steer.

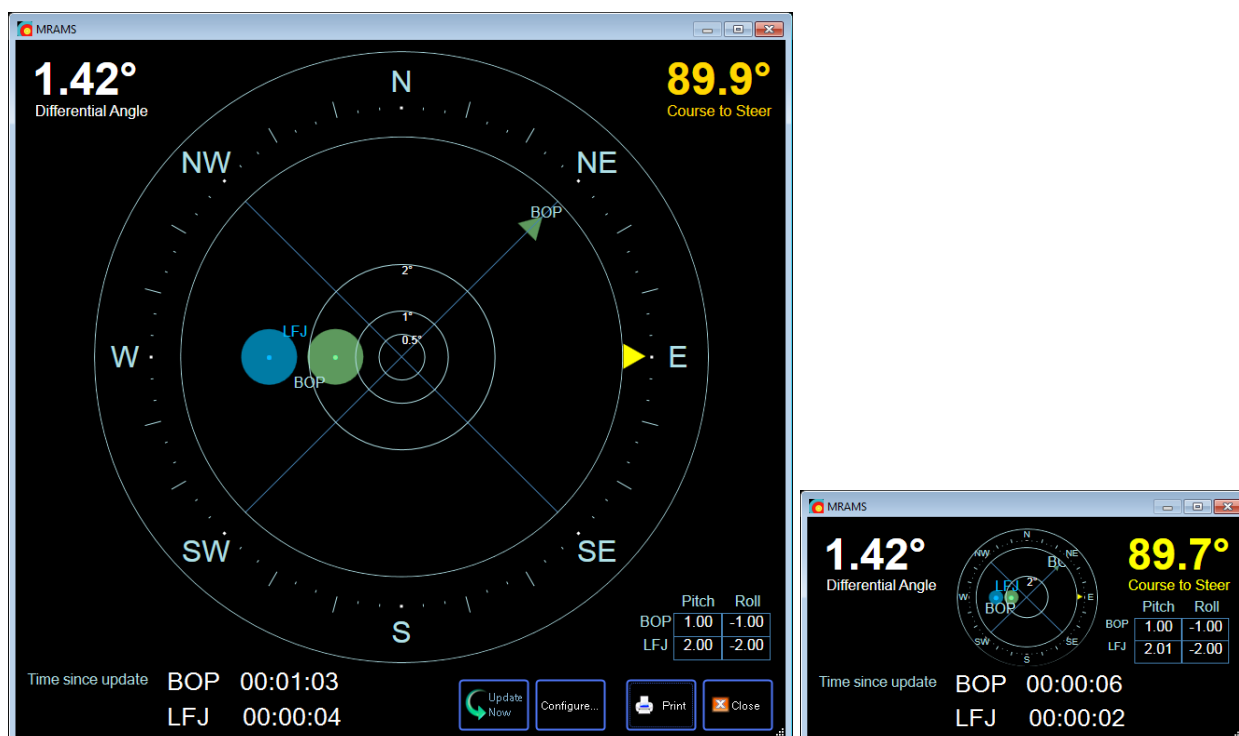
The top left-hand field indicates the differential angle between the BOP and the Riser.

The bottom right-hand field indicates the pitch and roll of both the BOP and the Riser.

8.2.4.3 The MRAMS Reduced Display

Where screen space is limited, the MRAMS display window can be resized (using standard Windows techniques of dragging a corner) to a very small display. The key parameters are maintained using a large font that can be read from a distance.

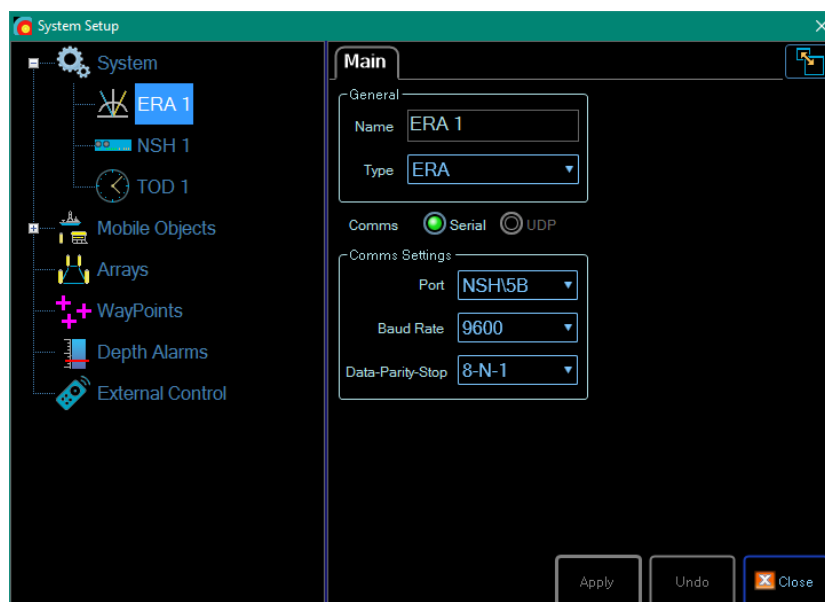
All other functions, such as alarms, remain the same.



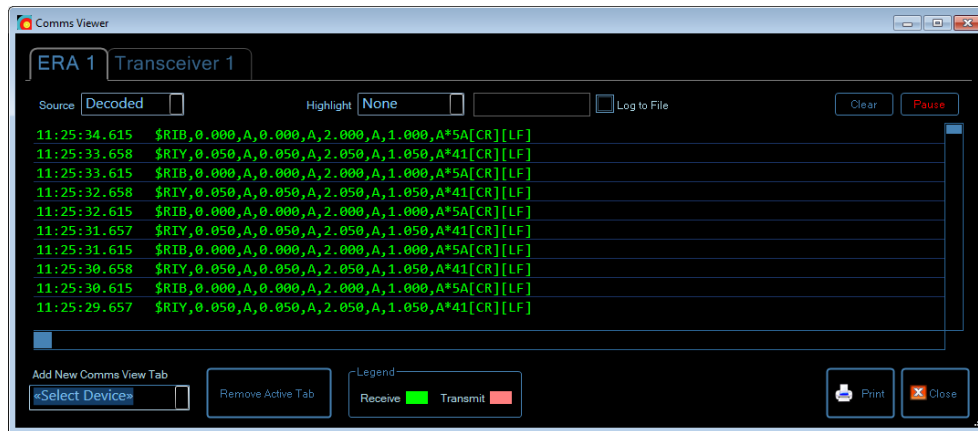
8.3 Electrical Riser Angle (ERA) Monitoring

8.3.1 ERA Software Configuration

1. Add an ERA device to the system setup as described in *Section 4.4 "Adding Objects "* and *Section 4.17.3 "Electronic Riser Angle (ERA)"*.



2. Check that comms from both **Blue** and **Yellow** ERA sensors is being received correctly using the Comms Viewer.



8.3.2 ERA Operation

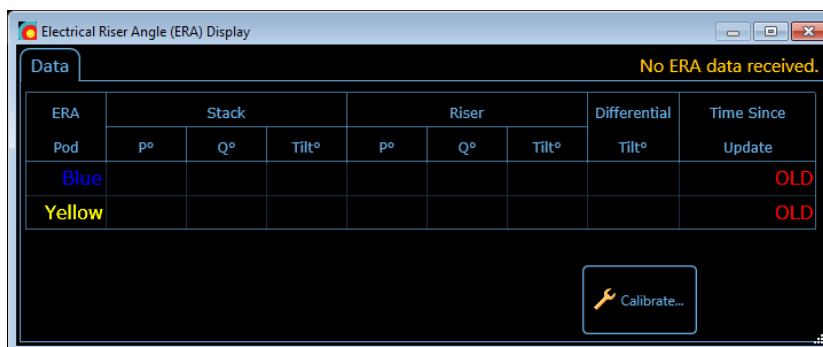
Once an ERA device is added to the system setup, the ERA display can be viewed at any time from the **Tools** menu.

The ERA display shows:

- the Blue P and Q angles and the calculated tilt for the BOP Stack
- the Blue P and Q angles and the calculated tilt for the BOP Riser
- the Blue differential tilt
- the Blue time since last update
- the Yellow P and Q angles and the calculated tilt for the BOP Stack
- the Yellow P and Q angles and the calculated tilt for the BOP Riser
- the Yellow differential tilt
- the Yellow time since last update

ERA Pod	Stack			Riser			Differential	Time Since Update
	P°	Q°	Tilt°	P°	Q°	Tilt°	Tilt°	
Blue	1.03	1.93	2.19	0.03	-0.07	0.08	2.24	00:00:01
Yellow	1.08	1.98	2.26	0.08	-0.02	0.08	2.24	00:00:01

If ERA comms is lost or corrupted, a warning is displayed as shown below.



8.3.3 ERA Calibration

To calibrate the ERA, click **Calibrate**.

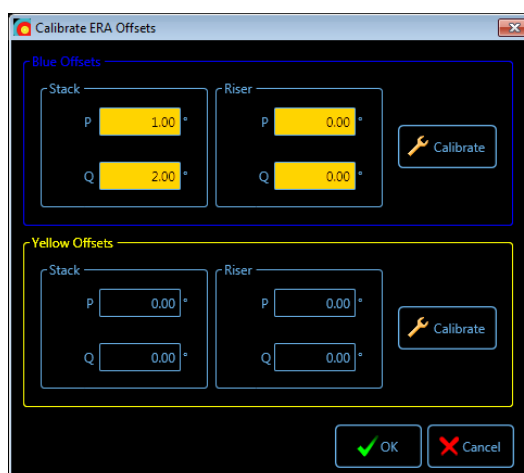
Note

 **When calibrating the ERA, ensure that the stack is in a vertical rest position.**

There are two calibration methods available.

Either:

1. Enter the **P** and **Q** values for **Stack** and **Riser** manually, or,
2. Click both **Calibrate** buttons for the system to take an average of numerous readings.



Section 9 – Riser Profile System

9.1 Introduction

This section describes the Riser Profiling System (RPS) that is integrated into the software.

In order to use the RPS, a set of Compatt 6 beacons must first be attached along the length of the riser at regular intervals. Typically this involves ten beacons spaced 200 to 300 metres apart.

The RPS gathers the following information about the condition of the riser at each beacon location:

- Depth
- Riser pitch / roll inclination
- Temperature
- Water current direction and speed (but only if the beacon has an Aqua-Dopp™ current meter fitted)

The RPS requests this information via acoustic telemetry either on demand, or automatically at predefined intervals.

9.2 Assumptions

The RPS assumes that a job has already been created that is suitable for the installation configuration you are using. Therefore you must have: the following

- An HPT Transceiver attached to the surface vessel and configured for use.
- All required Compatt 6 beacons added to the job as **Mobile Objects**. These must correspond to the beacons that are physically fitted to the riser. Note that, when each beacon is initialized, its sensing capabilities (Depth, Inclination, Temperature and Water Current) are automatically detected for use by the RPS.

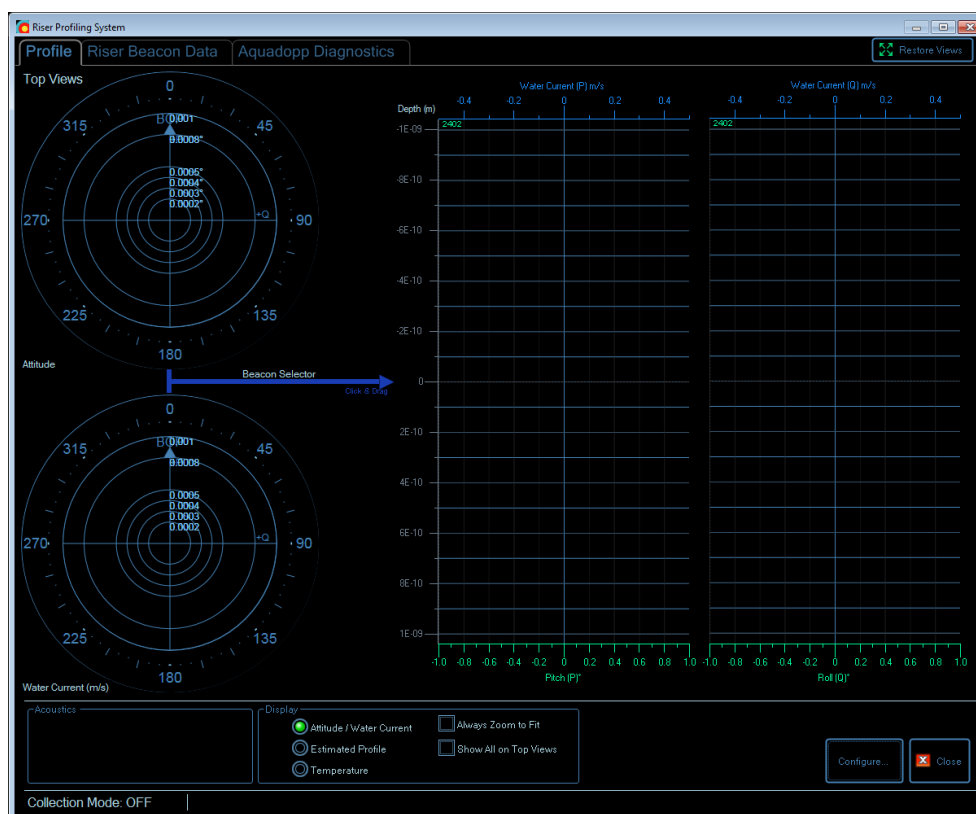
9.3 Configuration

To start RPS, click **Tools > Riser Profiling** from the main menu. The graphical display will be empty as shown below.

Note



The Collection Mode in the bottom status bar is initially OFF.



Click **Configure** on the **Riser Profiling System** window to display the **Riser Profile Configuration** window (shown below).

The **Beacons** tab shows all Compatt 6 type beacons that are available for use in RPS. By default, each beacon is not assigned for use in RPS (the **Use As** column shows **None** in all entries).

Beacons							
Beacon	Use As	Manual Depth	Depth (m)	* Heading Offset*	Pitch Offset*	Roll Offset*	
101	None	☐			0.0	0.0	
102	None	☐			0.0	0.0	
103	None	☐			0.0	0.0	
104	None	☐			0.0	0.0	
105	None	☐			0.0	0.0	
106	None	☐			0.0	0.0	
107	None	☐			0.0	0.0	
108	None	☐			0.0	0.0	
109	None	☐			0.0	0.0	
110	None	☐			0.0	0.0	

* Relative to Riser Heading

Sort

OK Cancel

Select **Riser** on each **Use As** drop-down list and then enter a default **Heading Offset** value of **0.0**.

Beacon	Use As	Manual Depth	Depth (m)	* Heading Offset*	Pitch Offset*	Roll Offset*
101	Riser	☐		0.0	0.0	0.0
102	Riser	☐		0.0	0.0	0.0
103	Riser	☐		0.0	0.0	0.0
104	Riser	☐		0.0	0.0	0.0
105	Riser	☐		0.0	0.0	0.0
106	Riser	☐		0.0	0.0	0.0
107	Riser	☐		0.0	0.0	0.0
108	Riser	☐		0.0	0.0	0.0
109	Riser	☐		0.0	0.0	0.0
110	Riser	☐		0.0	0.0	0.0

* Relative to Riser Heading

Sort OK Cancel

During normal operation of the RPS, each beacon's depth is retrieved automatically via acoustic telemetry.

It is possible that telemetry may fail from one or more beacons, resulting in an invalid depth entry for it.

To work around this problem, the RPS Configuration window allows manual entry of depth.

To enter a manual depth for a beacon, select the **Manual Depth** check box and then enter the depth in metres in the corresponding **Manual Depth (m)** box, for example:

Beacon	Use As	Manual Depth	Depth (m)	* Heading Offset*	Pitch Offset*	Roll Offset*
104	Riser	☒	403.0	0.0	0.0	0.0

Next, click on the **Riser** tab.

Riser Profile Configuration

Beacons **Riser** Advanced

Data Collection

Collection Mode: OFF

Beacon Retry Limit: 3

Automatic Repeat Period: 2 hrs

Use Inter-Beacon Spacing: ☒ 10 mins

BOP Heading

Absolute Heading: 0 °

Riser to BOP Heading Offset

Heading Offset: 0 °

Alarms

☐ Raise Alarm when: |Riser Angle°| > 0.6 °

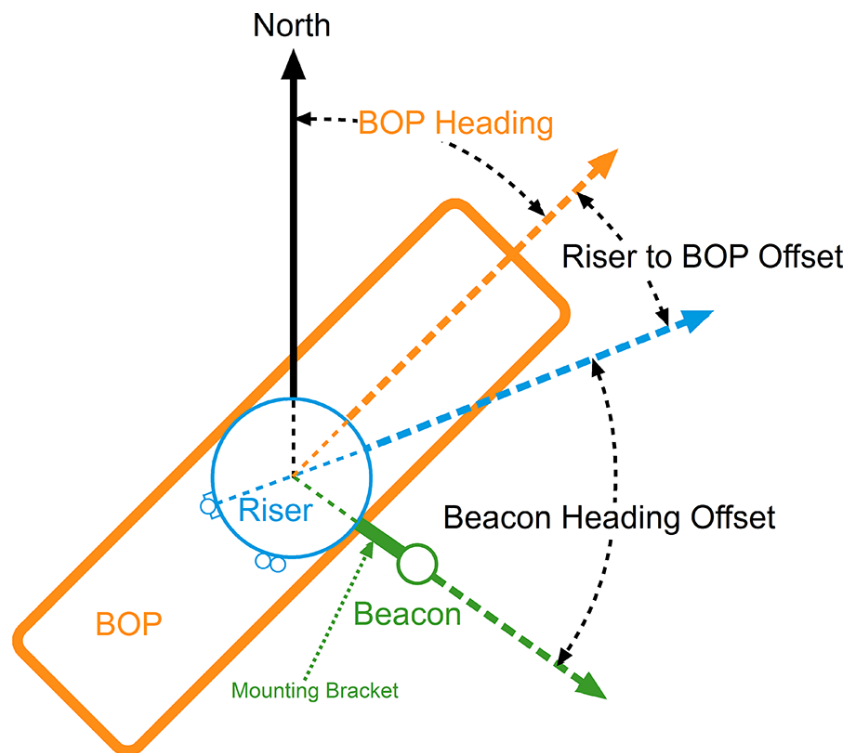
OK Cancel

Before you modify any fields, obtain the following information from external sources (for example, via external measurements or mechanical drawings):

- BOP Heading
- Riser to BOP Heading Offset
- Beacon Heading Offsets

Figure 9–1 shows the physical relationship of these values.

Figure 9–1 Relationship between BOP and Beacon Parameters



Enter the relevant values into the **BOP Heading** and **Riser to BOP Heading Offset** panes on the **Riser** tab.

The beacon **Heading Offsets** must be entered individually for each beacon.

To do this, click the **Beacons** tab and enter the values for each beacon **Heading Offset** (where 0.0 exists as a default). Note that these values are relative to the Riser Heading as shown above, not the BOP Heading.

9.3.1 Setting the Collection Mode

The Collection Mode determines when to collect the data from all the riser beacons.

Click **Configure** on the **Riser Profiling System** window to display the **Riser Profile Configuration** window.

Data Collection

- **OFF**: The RPS will not perform any data collection.
- **Manual**: The RPS will collect data from the riser beacons only when **Manually Get Data** on the **Riser Profiling System** window is clicked. Note that this button is visible only when **Manual** mode is selected. In this mode, the data collection will proceed as fast as possible with no delay between each beacon.

- **Auto:** The RPS will automatically collect data from all configured riser beacons (that is, when **Use As** is set to **Riser** on the **Beacons** tab). Collection occurs on a periodic basis using the time periods and spacings specified below:
 - **Automatic Repeat Period:** This is the time period for a full riser beacon measurement cycle. All riser beacon data will be collected and updated at this rate.
 - **Use Inter-Beacon Spacing** check box: When selected, this feature helps minimize the impact of the acoustic telemetry on any acoustic tracking that may be occurring at the same time.
 - If this check box is cleared, then the RPS will collect all riser beacon data as quickly as possible, with no delay between each beacon.
 - If this check box is selected then the **Use Inter-Beacon Spacing** drop-down list will be visible. This allows you to select the delay between each beacon command during the data collection cycle.

If Marksman is not required to perform any acoustic tracking, leave this check box clear.

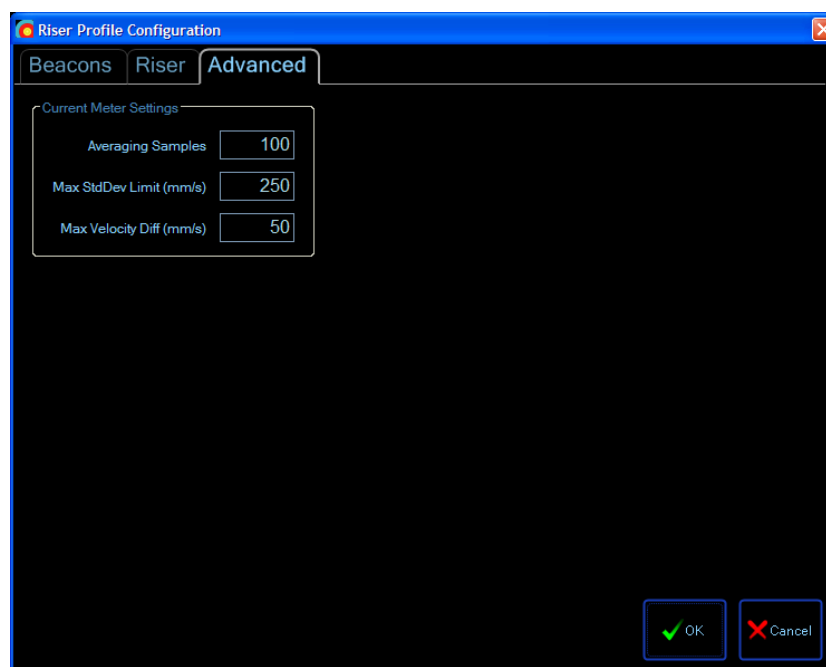
- **Telemetry Attempt Limit:** If a beacon fails to respond to acoustic telemetry requests, then the RPS system will retry this number of times before abandoning it for the current measurement cycle. The default value of 3 should be good enough for most circumstances.

Alarm Thresholds

An alarm can be set to show when any riser beacon's inclination exceeds a pre-set threshold.

To set an alarm, select the **Raise Alarm When** check box and enter the **Riser Angle°** alarm threshold.

Click the **Advanced tab** on the **Riser Profile Configuration** window.



This tab allows advanced configuration of some AquaDopp™ Current Meter settings. These should be left at their default values unless specific advice is given to change them.

Click **OK** to close the **Riser Profile Configuration** window.

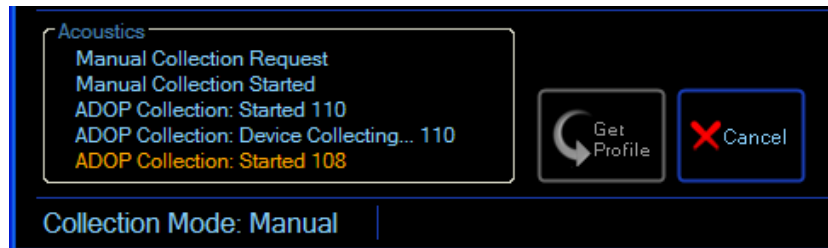
The RPS is now configured for use.

9.4 Operation

9.4.1 Manual Data Collection Mode

If the **Collection Mode** is configured for **Manual** collection (see *Section 9.3.1*), the **Manually Get Data** button is displayed on the bottom of the **Riser Profiling System** window.

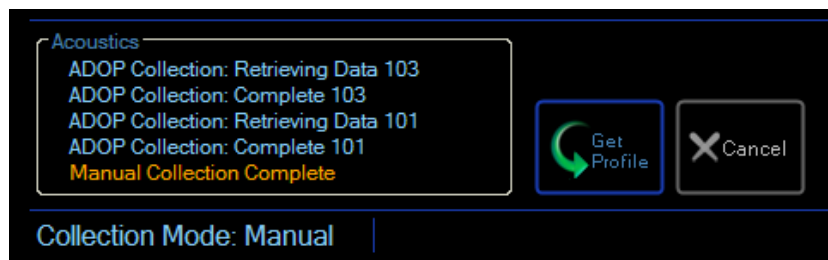
Click **Manually Get Data** to retrieve the latest data from all riser beacons. Data will be retrieved as quickly as possible. The current state of collection is shown in the small Acoustics status window, for example:



Note

 You can click the **Cancel** button at any time to abort the operation

When the collection cycle is complete the **Acoustics** status pane shows **Manual Collection Complete**.

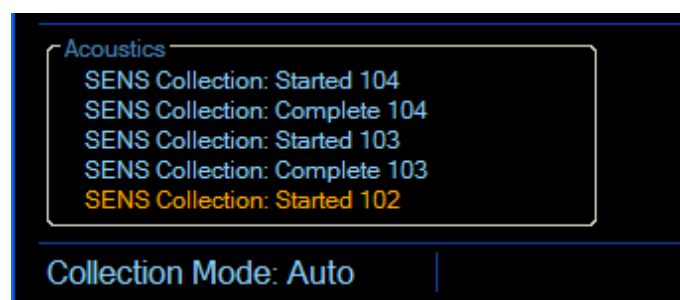


Note

 The current collection mode is always displayed in the status bar.

9.4.2 Automatic Collection Mode

If the **Collection Mode** is configured for **Automatic** collection (see *Section 9.3.1*), the tool periodically triggers a collection of all the riser beacon data at the intervals specified in the configuration settings. As the collection cycle progresses, the **Acoustics** status pane shows current activity.

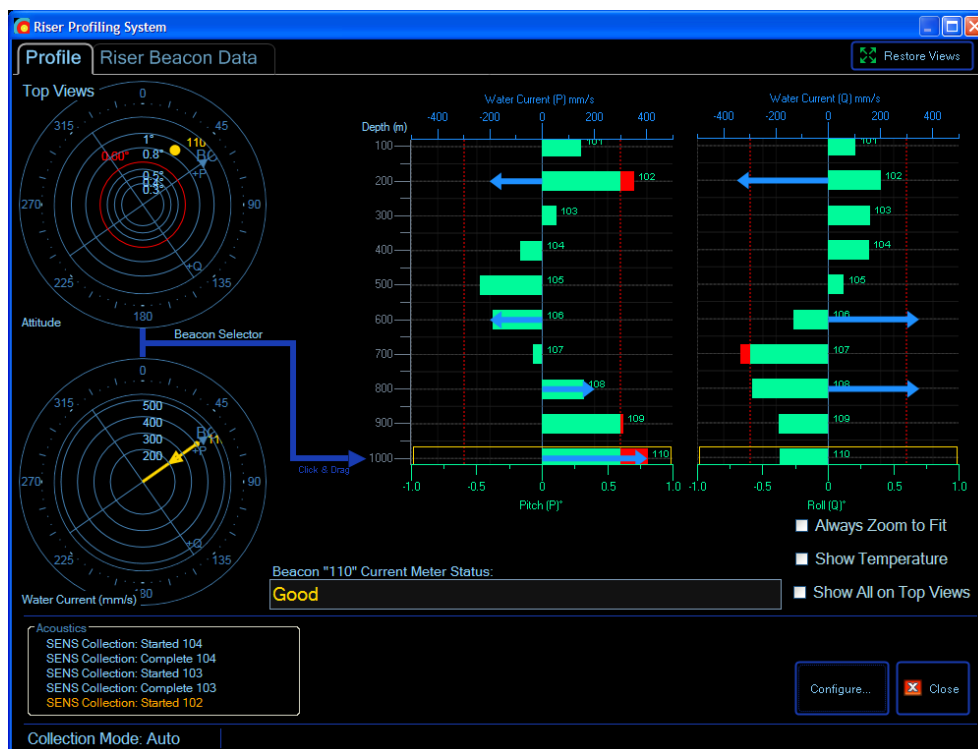


9.5 Riser Profiling System Displays

The RPS main display has two tabs. The **Profile** tab shows a graphical representation of the riser beacon data; the **Riser Beacon Data** tab shows a tabular view containing the actual values retrieved for each beacon.

9.5.1 Profile Tab

During collection the graphical display updates.



9.5.1.1 Side Views

The main centre and right regions of this window show side-view graphs of Inclination/Water Current against Depth.

Each green bar represents the Pitch and Roll for the named beacon at that depth along the P and Q axes respectively.

Note that the P axis is in the direction of the BOP Heading. The Q axis is at 90 degrees clockwise to it (looking down from above).

The bottom green axes show the roll and pitch scales in degrees.

The alarm thresholds (if enabled) are shown as red vertical dotted lines on the graph. If the roll or pitch for a given beacon exceeds the alarm threshold then the bar indicates the excessive roll or pitch by a red colour (see the examples shown above).

The light blue arrows on the same graph indicate the water current magnitudes along the P and Q axes for each beacon that has a current meter fitted. Note that in the example above, AquaDopp™ water current meters have been fitted only to the even-numbered beacons, hence there are only five beacons providing water current measurements.

The blue axes at the top of the graph show the water current scale in mm/s.

9.5.1.2 Modifying the View or Scales

All Water Current and Pitch/Roll scales support user interaction. Left click on a scale and drag to pan the scale and its data. Right click and drag on a scale to change the scaling (zoom factor) for that scale and its data.

You can also zoom in to a specific area of the graph by left clicking and dragging a rectangle around the area you wish to zoom.

To show all side view data fully zoomed to fit, select the **Always Zoom to Fit** check box.

To restore these graphs to their original state, click **Restore Views** at top right of the display.

9.5.1.3 Top Views

The left of the display shows two circular top-down views of the riser. Pitch and Roll is shown at top left; Water Current is shown at bottom left. The perimeter scale of each view shows heading (°), with North topmost at 0. The P and Q axes (mentioned earlier) are shown with the BOP heading aligned to +P.

The riser inclination alarm threshold (if enabled) is shown on the Pitch/Roll view as a red dotted circle.

Both top views auto-scale to fit the data that they display. There is no manual way of changing these scales.

By default only the data for a selected beacon on the side view is shown. On the Pitch/Roll view the beacon's attitude is shown as a single yellow point (labelled with the beacon name). On the Water Current view the current is shown as a yellow arrowed line indicating the direction and speed of the current.

9.5.1.4 Beacon Selection

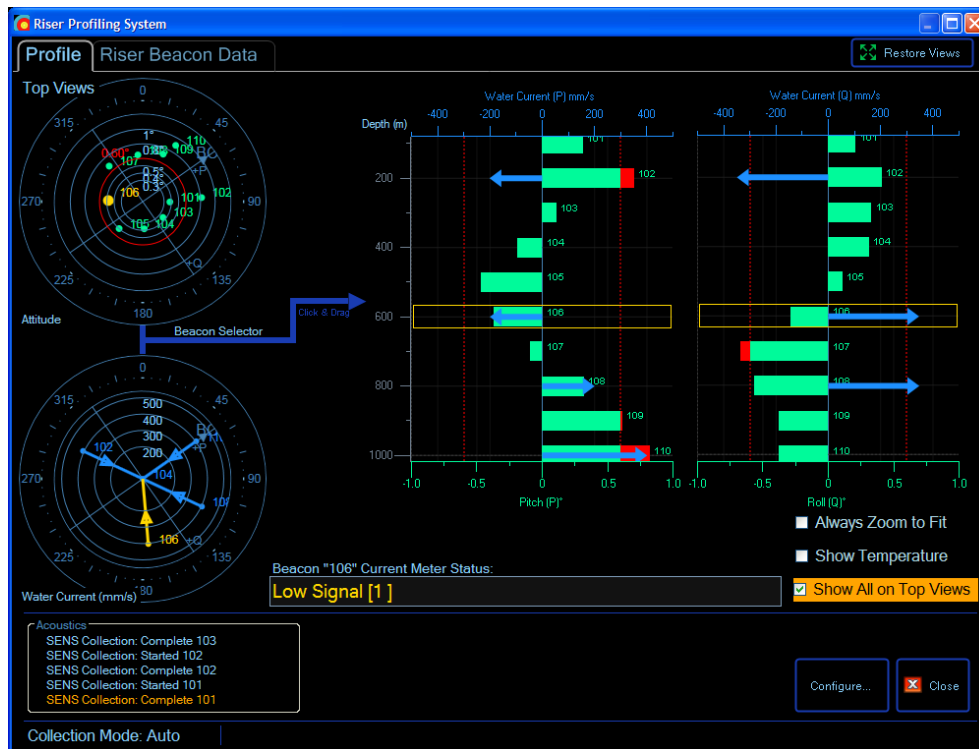
To show different beacon data on the top views, the selected beacon must be changed.

Beacon selection is performed by clicking and dragging the blue **Beacon Selector** arrow up or down beside the **Depth** axis. As the selector is moved, the nearest beacon to the selector arrow is selected (indicated by two yellow rectangles). Both top views update with the selected beacon's data. The selected beacon's Current Meter Status (if available) is also updated (at the bottom centre of the display).

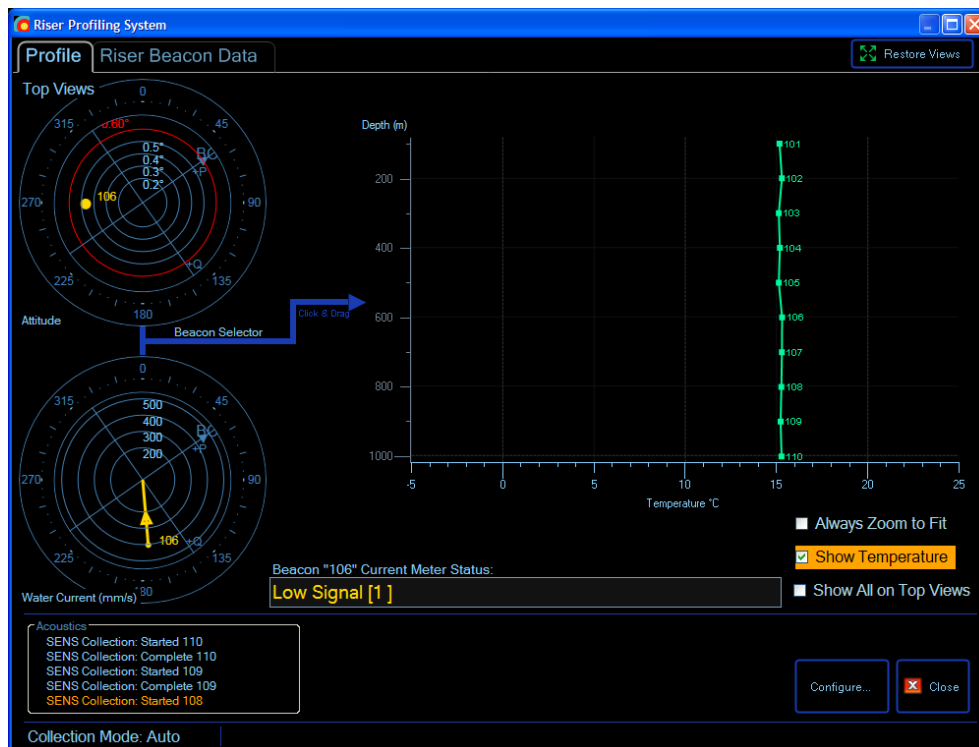
Note that all selected beacon data is indicated in yellow.

9.5.1.5 Other Display Options

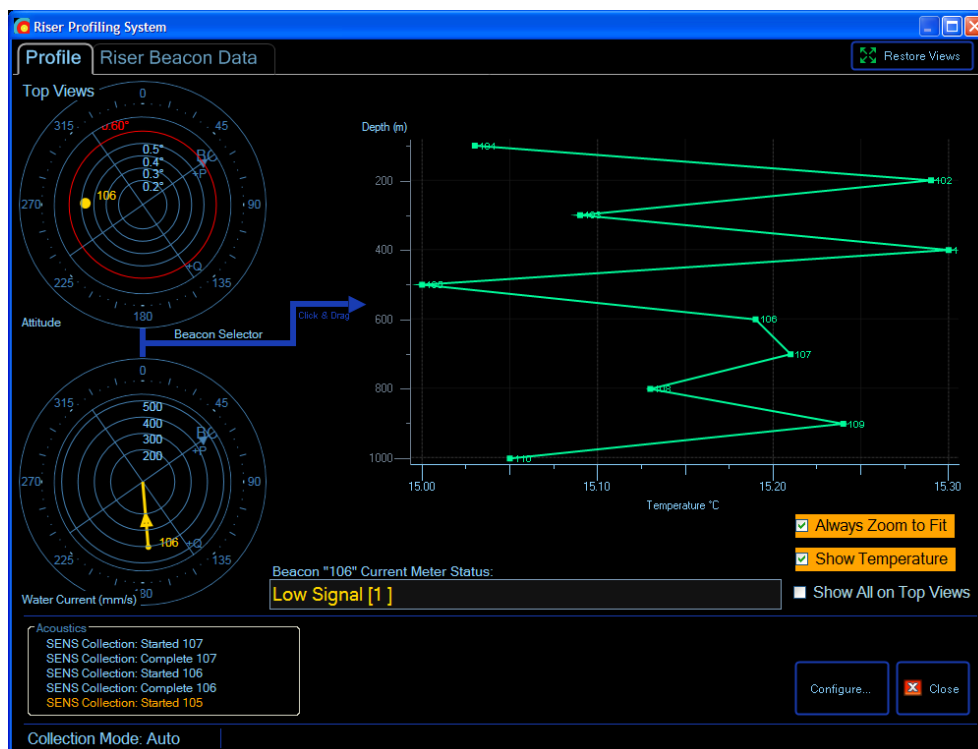
To show all beacon data on the top views, select the **Show All on Top Views** check box at the bottom right. This may be useful, depending on whether there is much overlap between the beacon data. An example is shown below.



To show a graph of Temperature against Depth, select the **Show Temperature** check box. An example is shown below.



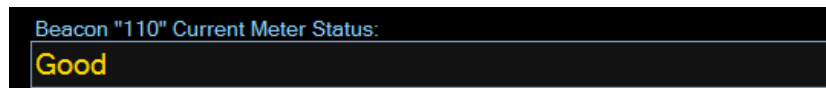
Selecting the **Always Zoom to Fit** check box automatically expands this to show more detail.



To restore, either clear the **Always Zoom to Fit** check box or click **Restore Views** at the top right.

9.5.1.6 Beacon Current Meter Status Field

As mentioned earlier the **Selected Beacon's Current Meter Status** is always indicated in the status window, for example:



The full range of status texts and their meaning are as follows:

- **Not Installed** – An AquaDopp current meter is not fitted to this riser beacon.
- **Bad Turbulence** – The water current values could not be determined because of severe turbulence around the beacon.
- **Low Signal** – One or more of the sensors on the current meter experienced a low return signal, which may reduce reliability of the result.
- **Velocity Outlier** – One or more of the sensors on the current meter detected a water velocity that was outside the expected range.
- **High SD** – One or more of the sensors on the current meter experienced a high standard deviation of velocity readings.
- **Minor Turbulence** – The water current values were calculated using a reduced set of sensor data, resulting in lower confidence in the result.
- **Good** – The current meter produced a very reliable result with no detected turbulence.

9.5.2 Riser Beacon Data Tab

Select the **Riser Beacon Data** tab. A table of all beacon data values is shown.

This display is useful for inspecting individual values or the age of the retrieved data. None of the fields can be edited.

Beacon	Depth m	* Heading Offset*	Pitch (P)°	Roll (Q)°	Tilt°	Temp °C	Current mm/s	Current Hdg°	Age hh:mm:ss
101	100.2	0.0	0.31	0.22	0.38	15.2			00:06:34
102	200.1	0.0	0.71	0.43	0.83	15.2	404.0	240.0	00:06:22
103	300.0	0.0	0.11	0.30	0.32	15.2			00:06:38
104	400.1	0.0	-0.17	0.31	0.35	15.2	401.3	300.0	00:06:24
105	500.1	0.0	-0.47	0.11	0.48	15.1			00:06:42
106	600.1	0.0	-0.37	-0.29	0.47	15.2	401.0	120.1	00:06:26
107	700.3	0.0	-0.09	-0.67	0.68	15.2			00:06:46
108	800.2	0.0	0.32	-0.57	0.65	15.2	401.0	60.1	00:06:29
109	900.1	0.0	0.60	-0.36	0.70	15.2			00:06:51
110	1000.2	0.0	0.81	-0.39	0.90	15.1	401.0	359.9	00:06:31

* Relative to Riser Heading

Acoustics
 ADOP Collection: Retrieving Data 104
 ADOP Collection: Complete 104
 ADOP Collection: Retrieving Data 102
 ADOP Collection: Complete 102
 Manual Collection Complete

Collection Mode: Manual

Get Profile Cancel Configure... Close

The columns are as follows:

- **Beacon** – Shows the beacon name.
- **Depth** – Shows the last retrieved depth in metres of each beacon. If the RPS Configuration window specified any Manual Depths, then those manual depths are shown here as well.
- **Heading Offset** – Shows the Heading Offset specified in the RPS Configuration as a read-only field.
- **Pitch (P) °** and **Roll (Q) °** – Show the latest inclinometer values of each beacon, rotated to the P and Q axis frame.
- **Tilt°** – This shows the maximum inclination due to Pitch(P) and Roll(Q) experienced by the beacon. This is typically along an axis between P and Q.
- **Temp °C** – Shows the last retrieved temperature of each beacon.
- **Current mm/s** – Shows the latest water current speed in mm/s flowing past the AquaDopp attached to the beacon. This field is blank if no current meter is fitted.
- **Current Hdg°** – Shows the latest water current heading (relative to north). This field is blank if no current meter is fitted.
- **Age** – Shows the age of the data obtained for each beacon. Format is: Hours:Minutes:Seconds.

9.6 Automatic Logging of Processed Data

All raw Riser Profiling System sensor data from all deployed riser beacons is automatically logged to the Marksman database. This raw data is processed before being shown on the Riser Profiling System displays.

In addition to the raw data, Marksman also automatically logs the processed version of the data to a separate set of CSV files (which are not connected with the main database).

9.6.1 RPS Log File Management

All data from the RPS system is logged to a long-running rolling set of CSV files.

- One RPS log file will contain up to seven days' worth of logged records.
- After seven days of logging, a new log file will be created to capture data for the next seven days, and so on.
- Log files will accumulate like this until 365 days have elapsed since the first log file was created.
- After 52 files have been logged, the oldest log file (containing data from the first seven days of data) will be deleted, before a new one is created. Therefore, only the most recent 365 days' worth of data is kept.
- Log files are named using the following format:

RPS_YYYYMMDD_HHMMSS.csv

Where:

- YYMMDD is the date
- HHMMSS is the time that the log file was CREATED (not last saved).

Example: RPS_20120709_133917.csv

- Log files are stored in the following folder:

C:\Documents and Settings\All Users\Documents\Sonardyne\
Marksman\Jobs\ **<JobName>** \RPSLogs

9.6.2 RPS Log File Format

Each record in the log file consists of either a **BeaconSensor** record or a **WaterCurrent** record using the comma-separated values described below.

9.6.2.1 BeaconSensor

BeaconSensor Record format (field numbers 1...15).

1. Date/Time of Sensor measurement (UTC) [= Sonardyne QPC time].
2. Record Type = **BeaconSensor**
3. Beacon Name and Address from which the measurement originated.
4. Beacon Depth (metres) – as measured by the beacon, including any depth offset.
5. Raw Pitch (P)° – as seen by the beacon inclinometer. It is used to calculate a corrected value of pitch.
6. Raw Roll (Q)° – as seen by the beacon inclinometer. It is used to calculate a corrected value of roll
7. Corrected Pitch (P)° – computed pitch as seen on the P axis (see the RPS specification).
8. Corrected Roll (Q)° – computed roll as seen on the Q axis (see the RPS specification).
9. Tilt° – computed from corrected pitch and roll.
10. Temperature ° – as measured on the beacon.
11. Pitch Correction° – used to calculate corrected values.

12. Roll Correction[°] – used to calculate corrected values.
13. BOP Absolute Heading[°] – used to calculate corrected values.
14. Riser to BOP Heading Offset[°] – used to calculate corrected values.
15. Heading Offset relative to Riser[°] – used to calculate corrected values.

9.6.2.2 WaterCurrent

WaterCurrent Record format (field numbers 1...19).

1. Date/Time of Sensor measurement (UTC) [= Sonardyne QPC time]
2. Record Type = **WaterCurrent**.
3. Beacon Name and Address from which the measurement originated.
4. Beacon Depth (metres) – as measured by the beacon, including any depth offset.
5. Raw Beam 1 Velocity (mm/s).
6. Raw Beam 1 Velocity Standard Deviation (mm/s).
7. Raw Beam 1 Amplitude (0..255).
8. Raw Beam 2 Velocity (mm/s).
9. Raw Beam 2 Velocity Standard Deviation (mm/s).
10. Raw Beam 2 Amplitude (0..255).
11. Raw Beam 3 Velocity (mm/s).
12. Raw Beam 3 Velocity Standard Deviation (mm/s).
13. Raw Beam 3 Amplitude (0..255).
14. Computed Water Current Speed (mm/s).
15. Computed Water Current Heading [°] relative to BOP.
16. Water Current Measurement Status value (enumerated).
17. BOP Absolute Heading[°] – used to calculate corrected values.
18. Riser to BOP Heading Offset[°] – used to calculate corrected values.
19. Heading Offset relative to Riser[°] – used to calculate corrected values.

Example output

2012/07/09 13:39:52,**BeaconSensor**,1703,199.2,0.40,-0.30,-0.26,
0.43,0.50,4.0,0.00, 0.00,45.0,22.0,180.0

2012/07/09 13:39:54,**BeaconSensor**,1702,99.2,0.20,0.10,0.22,0.02,0.22,4.0,0.00,
0.00,45.0,22.0,0.0

2012/07/09 13:40:00,**WaterCurrent**,1704,299.2,-401.0,100.0,128,-201.0,
100.0,128, -200.0,100.0,128,401.0,21.9,Good,45.0,22.0,0.0

2012/07/09 13:40:03,**WaterCurrent**,1703,199.2,-345.0,100.0,128,-346.0,
100.0,128, 1.0,100.0,128,399.0,171.9,Good,45.0,22.0,180.0

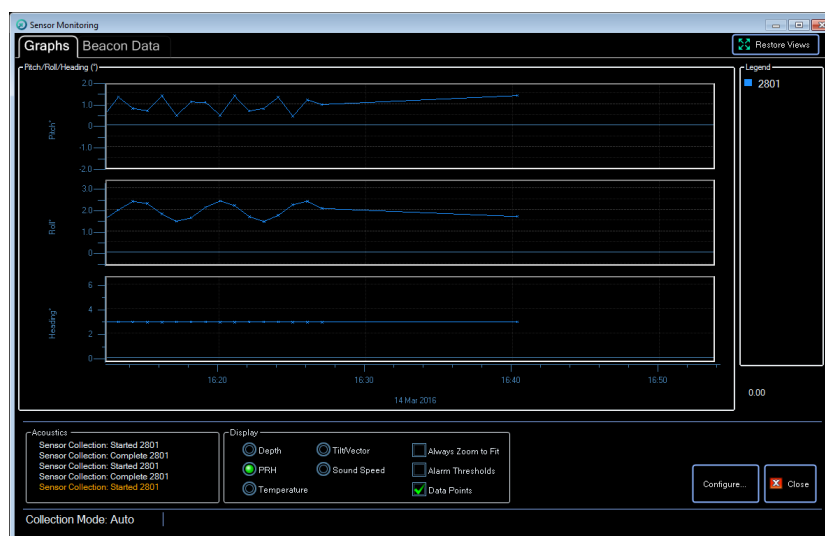
Section 10 – Beacon Sensor Monitoring Tool

10.1 Introduction

This section describes the Beacon Sensor Monitoring tool that is integrated into the Marksman, Ranger 2 USBL/Survey/DP system.

10.2 Overview

The Beacon Sensor Monitoring Tool allows automatic or manual sensor data collection from one or more Compatts, together with historic and real-time visualisation. Optionally, alarms can be raised if sensor values move outside preset limits.



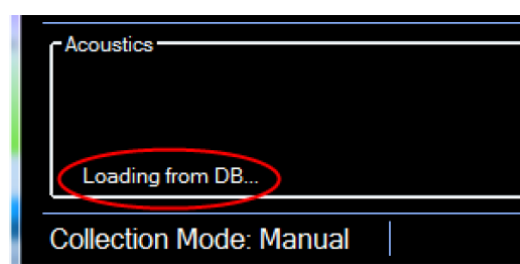
The Beacon Sensor Monitoring tool can gather and display the following sensor data from each Compatt, depending on which sensors are fitted:

- Depth
- Pitch/Roll/Heading
- Temperature
- Tilt/Vector
- Sound Speed

All data is collected by using acoustic telemetry.

The Beacons Sensor Monitoring tool also displays historical data for each beacon. Note, however, that it might take the tool a few moments to retrieve this data.

While historic data is being retrieved, the message **Loading from DB** is displayed in the acoustics status window in the bottom left hand corner of the main window:



After the data retrieval completes, the historical data is plotted and the **Loading from DB** message disappears.

10.3 Assumptions

The Beacon Sensor Monitoring tool assumes that a job has already been created and this matches all the equipment in use. The job must contain:

- An HPT Transceiver attached to the surface vessel and configured for use.
- Compatt 6 and/or Compatt 5 beacons added to the job as Mobile Beacons. These must correspond to the beacons that are physically deployed.

Note

 When each beacon is initialised, its sensor capabilities (Depth, Inclination, Heading, Temperature and Sound Speed) are automatically detected for use by the Beacon Sensor Monitoring tool.

10.4 Configuration

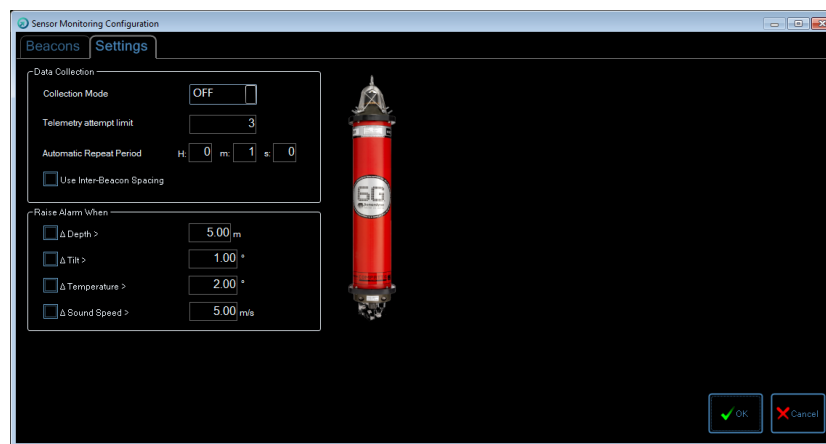
To start Beacon Sensor Monitoring, click **Tools > Sensor Monitoring** from the main menu. At this point the Sensor Monitoring display might or might not be empty, depending on whether or not there is historical data to be retrieved.



10.4.1 Setting the Collection Mode

The collection mode determines when to collect sensor data from all the beacons.

Click **Configure** on the **Sensor Monitoring** window to display the **Sensor Monitoring Configuration** window (the **Settings** tab of this window is shown below).



Note



The Collection Mode in the bottom status bar is initially OFF.

Data Collection

- **OFF:** The Beacon Sensor Monitoring tool does not perform any data collection.
- **Manual:** The Beacon Sensor Monitoring tool collects data from the configured beacons (that is, when **Monitor** is selected on the **Beacons** tab) only when the **Manually Get Data** button on the **Sensor Monitoring** window is clicked.

Note that the **Get** button is visible only when manual mode is selected. In this mode, the data collection proceeds as quickly as possible with no delay between each beacon

- **Auto:** The Beacon Sensor Monitoring tool automatically collects data from all configured beacons (that is, where the **Monitor** check box is selected on the **Beacons** tab). Collection cycles occur periodically using the time periods and spacing specified below:
 - **Automatic Repeat Period:** This is the time period for a full collection cycle. All beacon data is collected and updated at this rate.
 - **Use Inter-Beacon Spacing** check box: When selected, this feature helps minimise the impact of the acoustic telemetry on any acoustic tracking that might be occurring at the same time.
 - If this check box is clear, the Beacon Sensor Monitoring tool collects all beacon data as quickly as possible, with no delay between each beacon.
 - If this check box is selected then the **Use Inter-Beacon Spacing** numeric boxes are visible. Enter the delay between each beacon command during the data collection cycle.

If the system is not required to perform any acoustic tracking, leave this check box clear.

Note



In auto mode, beacon sensor monitoring runs even when the Beacon Sensor Monitoring Tool window is not open.

- **Telemetry Attempt Limit:** If a beacon fails to respond to acoustic telemetry requests, then the Beacon Sensor Monitoring tool retries a number of times set by this limit before abandoning it for the current measurement cycle. The default value of 3 should be satisfactory for most circumstances.

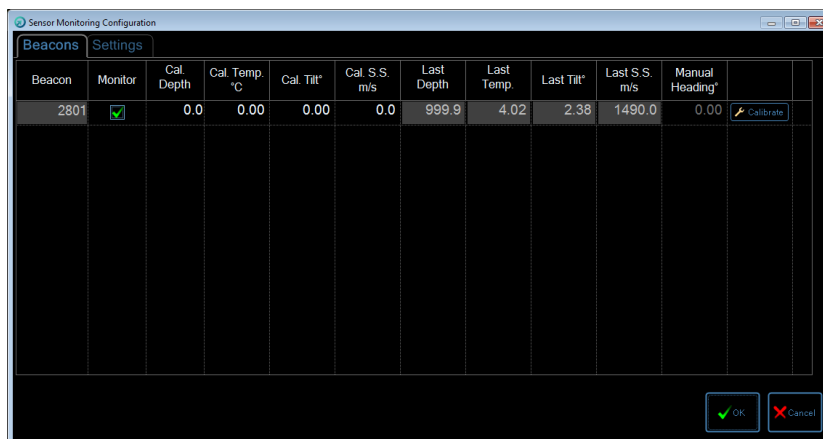
Alarm Thresholds

An alarm can be set to show when any beacon's depth, tilt, sound speed or temperature change by more than a pre-set delta from the calibrated value.

To set an alarm, type the threshold values in the **ΔDepth**, **ΔTilt**, **ΔTemperature** and **ΔSound Speed** boxes and then select the check box.

10.4.2 Setting the Beacons to be Monitored

Click the **Beacons** tab on the configuration window.



The **Beacons** tab shows all Compatt 6 and Compatt 5 type beacons that are available for use in Beacon Sensor Monitoring. Select the **Monitor** check box to monitor a beacon.

Click **Calibrate** to set the calibrated **Cal. Depth** (depth), **Cal Temp °C** (temperature), **Cal. Tilt°** (tilt) and **Cal. S.S. m/s** (sound speed) values for each beacon. This calibrated value is then used with the delta alarm threshold set on the **Settings** tab to set the alarm boundary values. For example, if the calibrated depth is 100 m and the depth alarm threshold is ± 2.00 m, then an alarm is displayed if the beacons depth is less than 98 m or greater than 102 m.

Note

 **The software only retrieves the data from the sensors fitted to the beacon.**

The **Manual Heading** column is used to set a heading offset. This is used to ensure the pitch and roll values are rotated correctly if the beacon is to be installed at a specific heading offset. This is set to a default of 0 degrees.

Note

 **It is not possible to set a Manual Heading if the beacon has a Pitch Roll Heading device attached, for example a Gyro Compatt, because its heading value is read from the device and there is no need to rotate the pitch and roll values.**

Click **OK** to accept changes in the configuration and close the window.

The Beacon Sensor Monitoring tool is now configured to use.

10.5 Operation

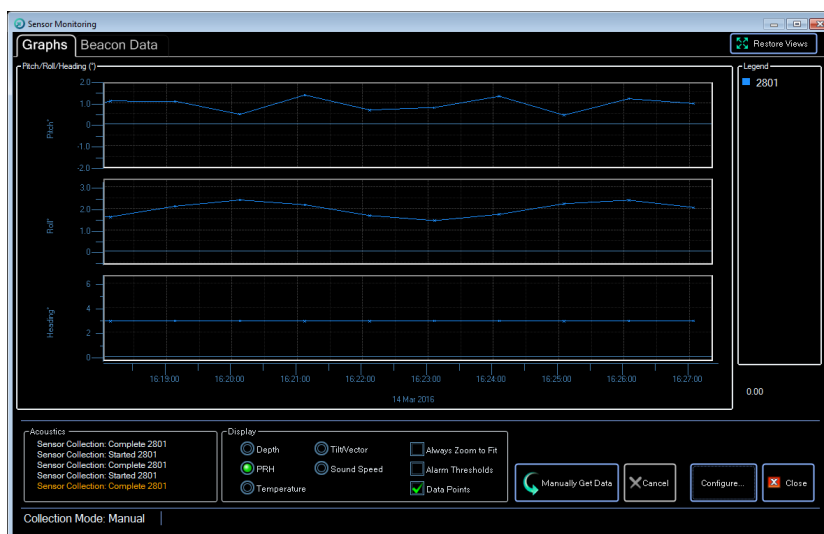
The current collection mode is always displayed in the status bar at the bottom of the **Sensor Monitoring** window.

10.5.1 Manual Data Collection Mode

If **Collection Mode** is configured for **Manual** collection (see *Section 10.4.1* the **Manually Get Data** button is displayed on the bottom of the **Sensor Monitoring** window.



Click **Manually Get Data** to retrieve the latest data from all riser beacons. In this case, data is retrieved as quickly as possible. The current state of collection is shown on the **Acoustics** status pane.



Note

 You can click the **Cancel** button at any time to abort the operation

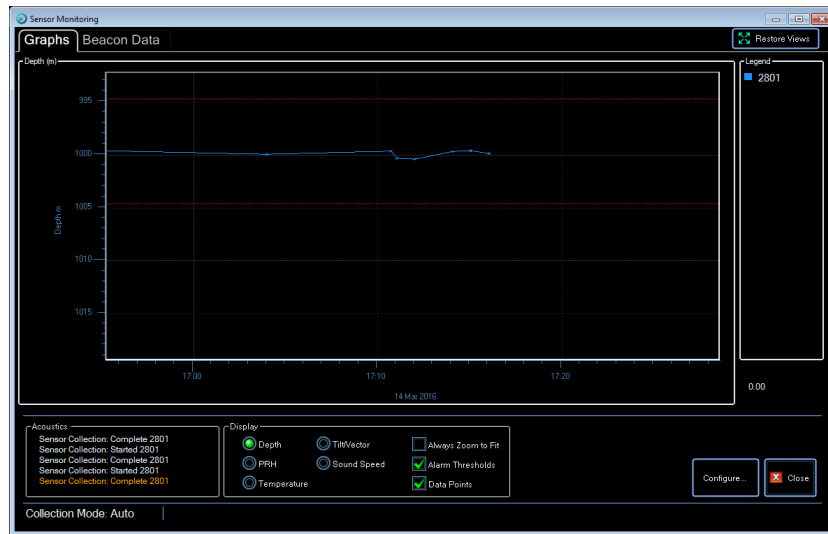
When the collection cycle is complete the **Acoustics** status pane shows **Manual Collection Complete**.

Beacon	Depth (m)	Pitch (P)°	Roll (Q)°	Tilt°	Heading°	Temp (°C)	S.S. (m/s)	Sensor Age (hh:mm:ss)	Get
2801	1000.0	1.26	2.00	2.36	3.00	4.01	1490.0	00:01:02	

10.5.2 Automatic Collection mode

If the **Collection Mode** is configured for **Automatic** collection (see *Section 10.4.1*), the tool periodically triggers a collection of all the beacon data at the intervals specified in the configuration

settings. As the collection cycle progresses, the **Acoustics** status pane shows current activity.



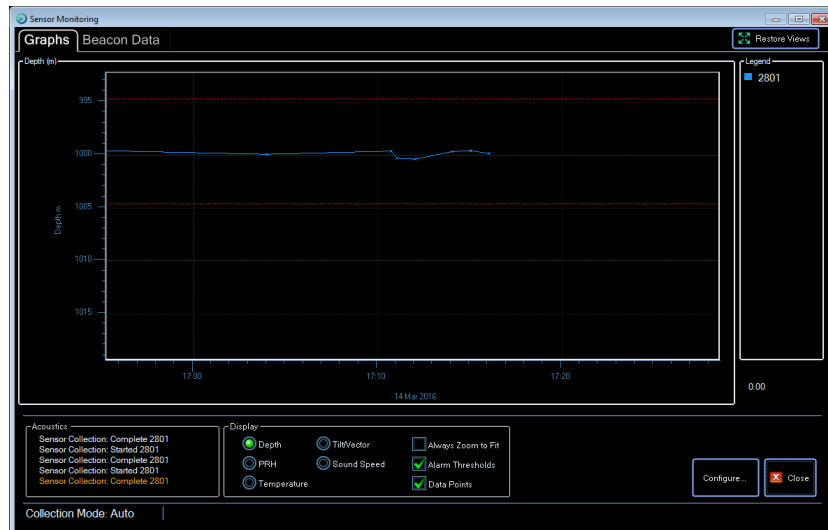
10.6 Beacon Sensor Monitoring Tool Displays

The Beacon Sensor Monitoring tool contains two tabs:

- The **Graphs** tab shows graphical time-series plots of the beacon sensor data.
- The **Beacon Data** tab shows a tabular view containing the last values retrieved for each beacon.

10.6.1 Graphs Tab

During data collection, the graphical display updates.



10.6.1.1 View Selection

There are five different graphical views that can be selected using the buttons below the graph. The available choice is among the following:

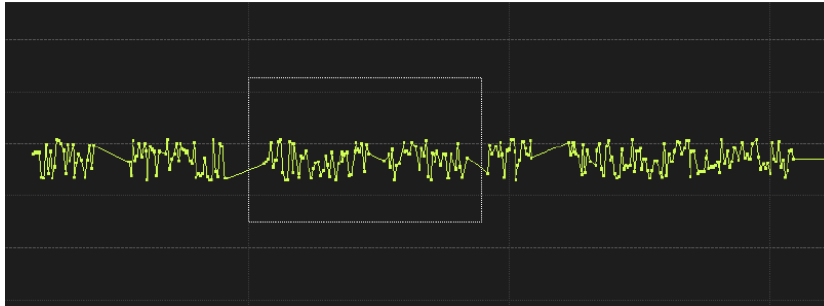
- Depth
- Pitch/Roll/Heading
- Temperature

- Tilt/Vector
- Sound Speed.

The legend on the right-hand side allows identification of the data by a unique colour for each beacon.

10.6.1.2 Pan and Zoom Controls

Both the X and the Y axes support user interaction. Left-click on an axis and drag it to pan the view. Right-click on an axis and drag it to change the view scaling (zoom factor).

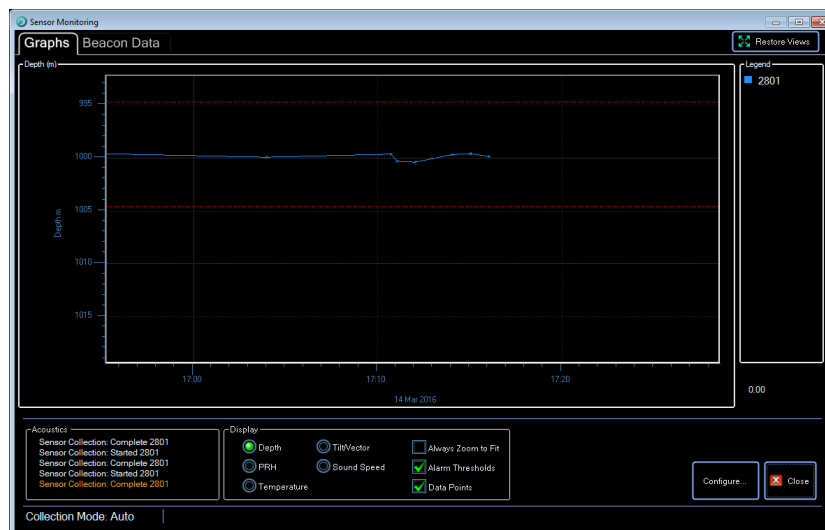


You can zoom a specific area of the graph by left-clicking and dragging a rectangle around the area to zoom.

Select the **Always Zoom to Fit** check box to automatically zoom the view to fit all the data. This option is selected by default. If this check box is clear, the graph snaps to the latest point that has been plotted.

10.6.1.3 Other Controls

Alarm Thresholds is used to switch on a visual representation of the alarm levels for each beacon. These are shown as broken red lines above and below the calibrated value. If you need to see the alarm threshold for an individual beacon, hold down the Ctrl key and left-click on the graph to cycle through for each beacon.



Data Points simply turns on and off the data point markers on the graph.

Click **Restore Views** at the top right of the display to restore the graph view to its original state.

10.6.2 Beacon Data Tab

Select the **Beacon Data** tab to see a table of the latest beacon data values.

Note

 None of the fields can be edited.



Beacon	Depth m	Pitch (P) °	Roll (Q) °	Tilt °	Heading °	Temp. °C	S.S. m/s	Sensor Age hh:mm:ss	
2801	999.9	1.06	2.13	2.38	3.00	4.02	1490.0	00:10:30	Get

Acoustics

- Sensor Collection: Complete 2801
- Sensor Collection: Started 2801
- Sensor Collection: Complete 2801
- Sensor Collection: Started 2801
- Sensor Collection: Complete 2801

Collection Mode: Manual

Manually Get Data Cancel Configure... Close

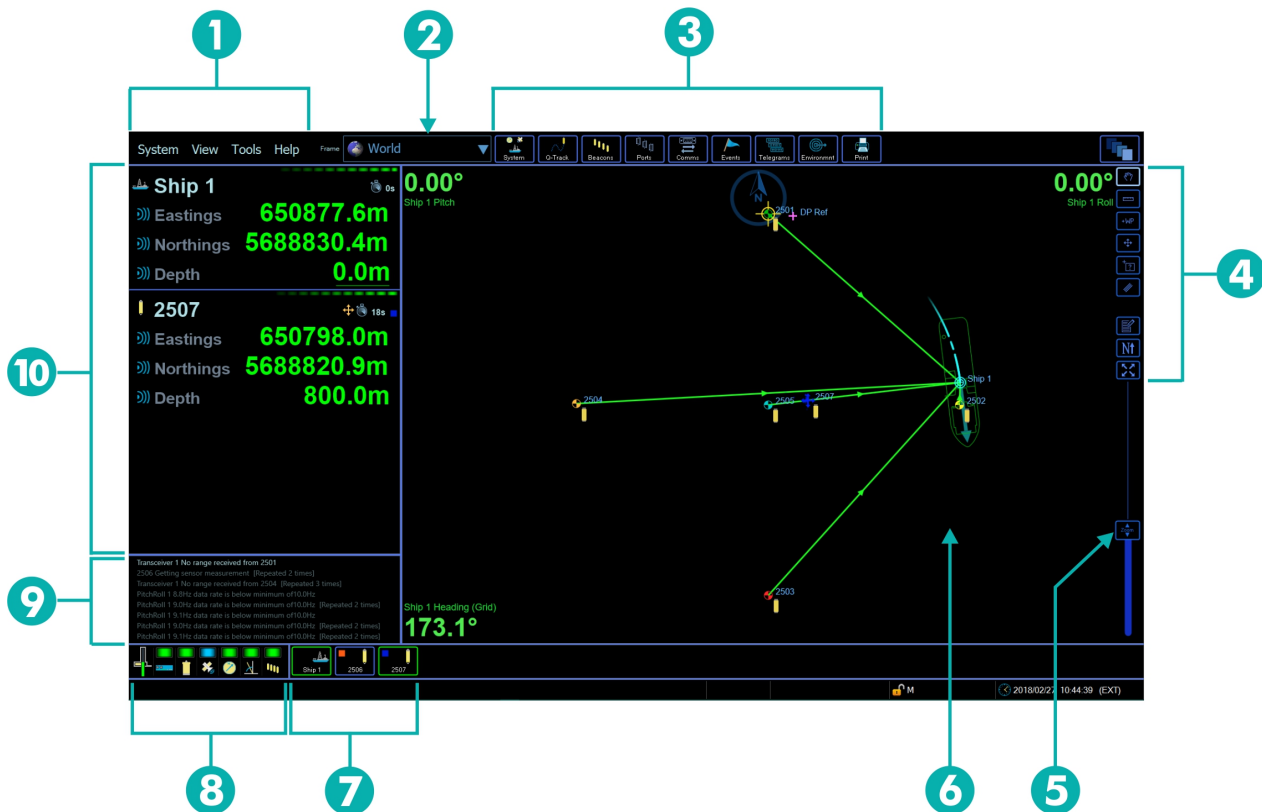
The **Beacon Data** tab contains the following columns:

- **Beacon:** Shows each beacon name.
- **Depth:** Shows the last retrieved depth in metres.
- **Pitch (P) °** and **Roll (Q) °:** Shows the latest inclinometer values.
- **Tilt°:** This shows the combined pitch and roll calculated using the formula: $Tilt = \sqrt{Pitch^2 + Roll^2}$.
- **Heading°:** This shows the last retrieved heading.
- **Temp°:** This shows the last retrieved temperature.
- **Sound Speed m/s:** This shows the last retrieved sound speed.
- **Age:** Shows the age of the data obtained for each beacon, in Hours:Minutes:Seconds format.

Appendix A – User Interface

A.1 Marksman, Ranger 2 USBL/Survey/DP Main Window

This section references and describes the Marksman, Ranger 2 USBL/Survey/DP user interface.

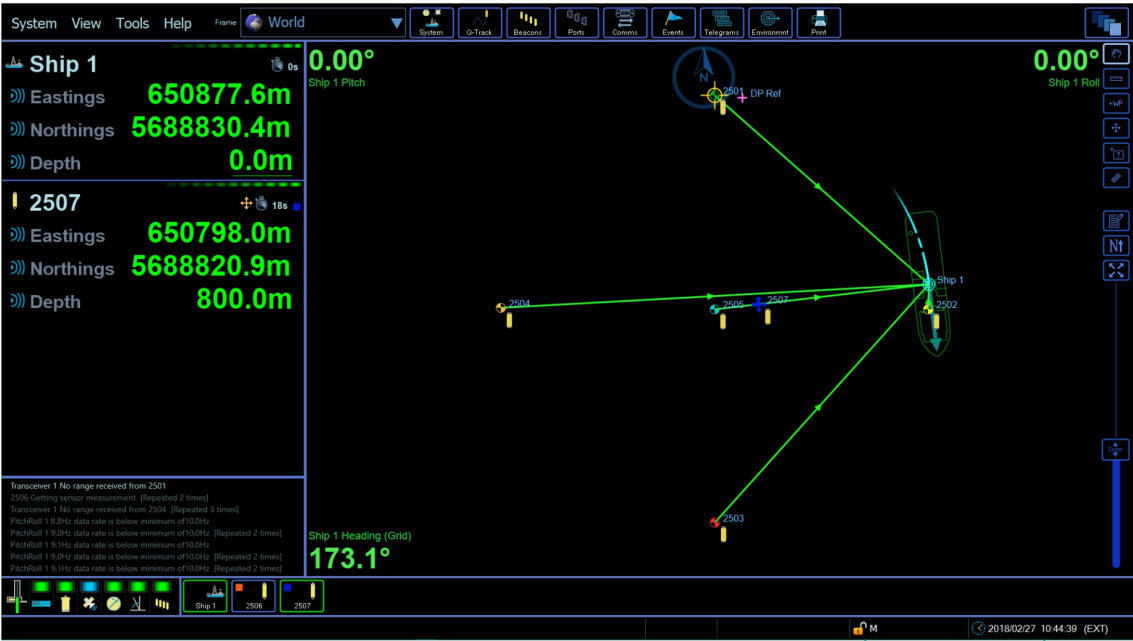


Item	Description
1	Menu Bar
2	Frame Selector
3	Shortcut Buttons
4	Button Controls
5	Zoom Control
6	Navigation Chart
7	Target Selection Buttons
8	Instrument Status LEDs: - Green: All sensors are operating correctly - Blue: At least one sensor is not being used in tracking - Amber: At least one sensor is non-operational - Red: All sensors are non-operational - Deployment Machine; Green: operating correctly; red: fault Note: Double-click an LED to jump to the setup for that sensor.
9	Information Messages
10	Tracking Pane

The status bar at the bottom of the Marksman, Ranger 2 USBL/Survey/DP main window shows the name of the current setup, and the current time and its source (either UTC or PC). Refer to *Section A.9.4 "Alarms"* for information about timekeeping.

The status bar also shows information about the most recent active alarm condition, with the alarm icon flashing. Refer to *Section A.9.4 "Alarms"* for a detailed description of the alarm window.

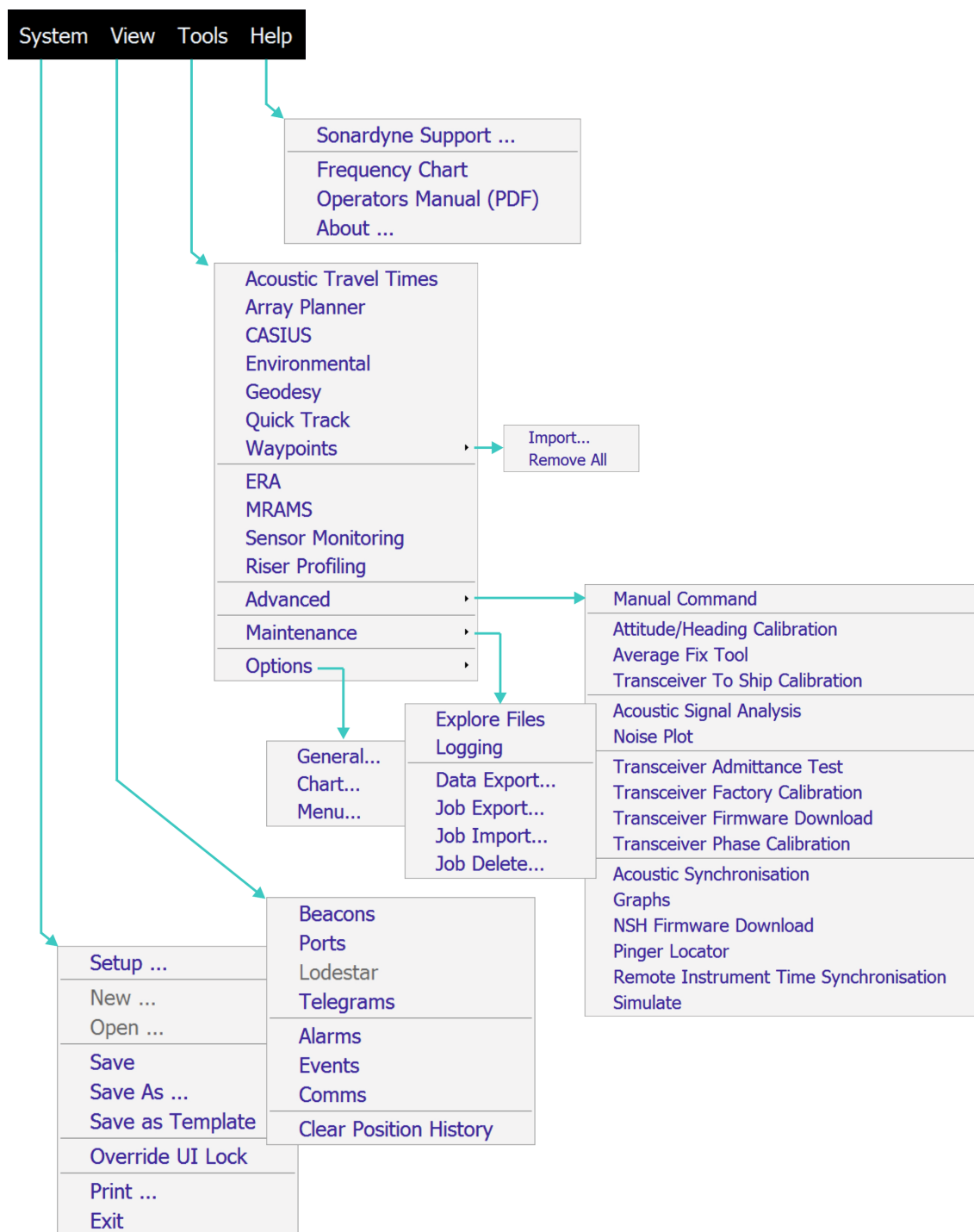
There is an option to display the main window of the software in full-screen mode. Refer to *Section A.10.14 "Options"* for instructions to set this option. The figure below shows an example of the main screen in frameless mode.



Item	Description
1	Current Time
2	Name of Current Setup

The menu system (shown below) provides access to all the features needed to use the software.

Figure A–1 Menu System

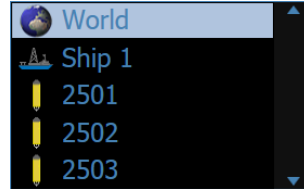


Note

 For clarity, all the menu entries are shown. During operation, some menu entries will not be available and will be greyed out.

A.2 Frame Selector

The frame selector allows you to set the reference frame used to display positions on the main window.



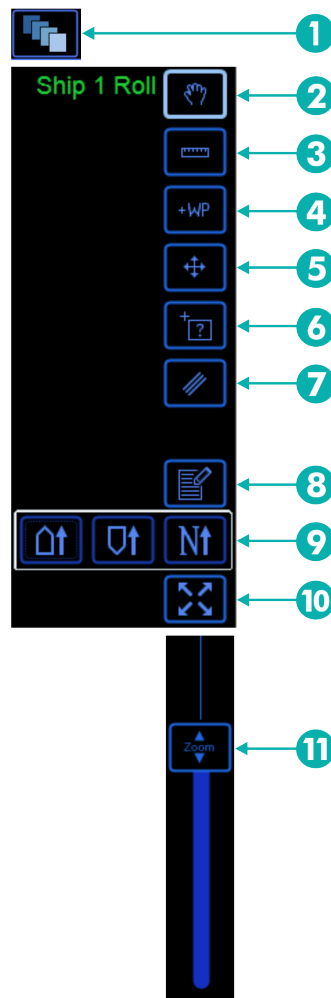
The options available depend on the mobile targets, waypoints and arrays in the setup. To view coordinates with respect to a seated feature such as wellhead, add a waypoint and select it as the frame of reference.

Note

 The chart grid control is purely a cartesian view and always shows grid coordinates when World frame is selected - it does not show latitude/longitude. Target positions can be viewed in latitude and longitude or UTM grid in the Tracking Pane.

A.3 Button Controls

The button controls on the main window control how the chart displays navigation information. They change their appearance when selected, as shown in the examples below:



Item	Description
1	Cycle the display through four levels of brightness.
2	Chart pan mode - drag the chart with the mouse.
3	Measure distance tool. Click a starting point and move the mouse to a second point. A circle is drawn on the screen showing the horizontal and slant range and bearing to the second point.
4	Click to add a waypoint to the chart at the current location.
5	Move waypoint – click and drag with the mouse.
6	Show mouse position coordinates.
7	Create run lines – click and drag from a beacon or waypoint to position; see the information about Chart Properties in <i>Section A.5 "Navigation Chart Pane"</i> for Run Line choices.
8	Navigation Chart Properties; see <i>Section A.3.1 "Chart Properties"</i> .
9	Select north-up, ship's head up, or ship's head down mode for the main display.
10	Click to set the chart scale automatically to include all active targets.
11	Click and drag the slider control to set the zoom level of the main display.

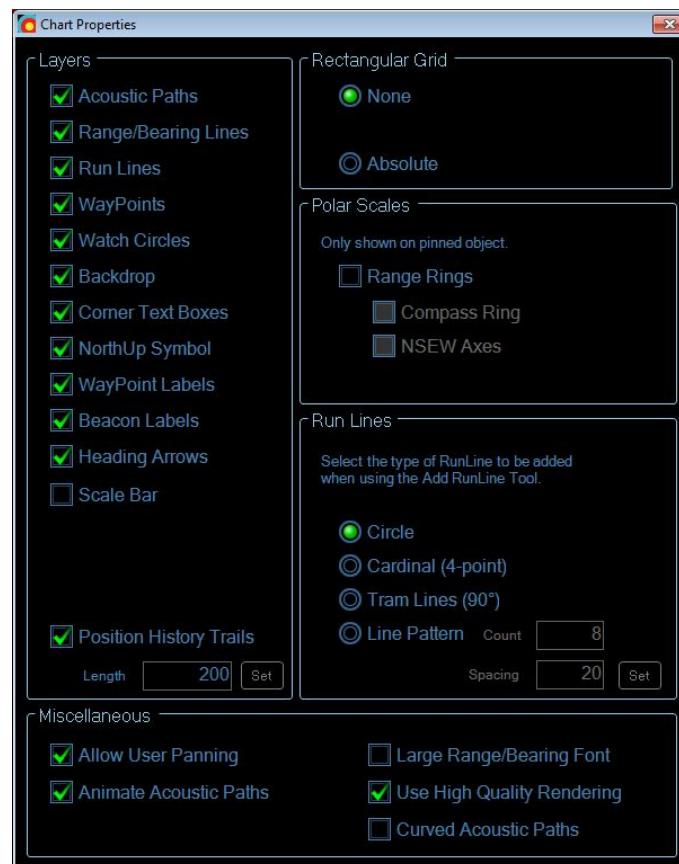
A.3.1 Chart Properties

The **Chart Properties** are shown below.

Note



Properties shown below are dependent on the software options purchased.



A.4 Target Selection Buttons

The target selection buttons allow you to select the targets to be tracked and displayed. The buttons available depend on the targets in the current setup.



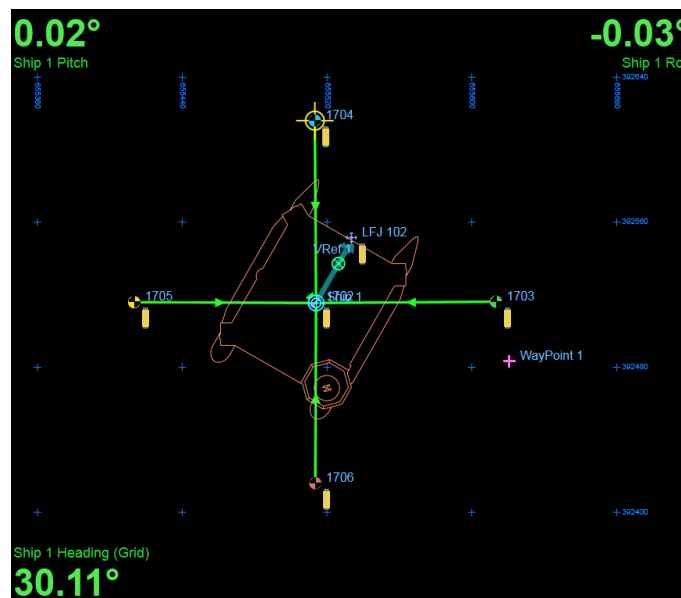
The buttons show green borders for targets that are being tracked, or blue borders if the target is not being tracked. The button can be clicked to toggle the tracking status.

Note

 Buttons and positions are not shown for LUSBL Array Beacons because these are 'owned' by the vessel using them for positioning and should not be interfered with. Beacon positions and tracking status are available through the System Setup and Beacons Table if required.

A.5 Navigation Chart Pane

The navigation chart pane displays a graphical representation of the relative positions of all items in the setup.



You can use the Chart Controls and the Chart Properties to:

- toggle the display between the Cartesian grid (shown here) and the Radar view.
- zoom the display
- pan the display
- pin a particular target
- measure distances between items
- add Run Lines
- add Waypoints
- Configure Position History Trails

'Range' lines indicate each active acoustic ranging to each tracked target. Range lines are green when tracking is successful.

The current ship's Pitch, Roll and Heading are displayed in the corners of the pane.

Mobile, calibrating and fixed beacons are shown using different icons:



Mobile



Calibrating (rotating symbol)



Fixed

A.6 Tracking Pane

The tracking pane lists all the tracked targets and shows information about their status and position. As the position data ages, the display colour fades from green through to brown or red. The icons used are:



Mobile beacon



Calibrating beacon

Depending on the **Position Display Format** setting defined in **Tools > Options**, positions of the tracking pane can be show using any of the following formats:

- UTM grid with 1 decimal point precision
- Latitude/longitude degrees to 7 decimal points
- Latitude/longitude minutes to 5 decimal points
- Latitude/longitude seconds to 3 decimal points
- Horizontal Range and Bearing

See *Section A.10.14 "Options"* for details of how to choose the display format.

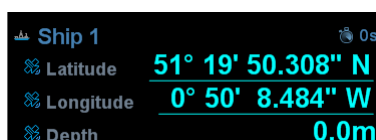
Ship 1 1s Eastings 650779.0m Northings 5688818.4m Depth 0.0m	Ship 1 0s Latitude 51° 19' 50.308" N Longitude 0° 50' 8.484" W Depth 0.0m	Ship 1 H. Range 0.0m Bearing n/a Depth 0.0m
2001 2s Eastings 650778.3m Northings 5688817.7m Depth 1000.0m	2001 1s Latitude 51° 19' 50.296" N Longitude 0° 50' 8.541" W Depth 1000.0m	2001 0s H. Range 153.8m Bearing 329.9° Depth 99.8m
2002 2s Eastings 650781.9m Northings 5688918.4m Depth 1000.0m	2002 1s Latitude 51° 19' 53.328" N Longitude 0° 50' 8.422" W Depth 1000.6m	2002 1s H. Range 99.7m Bearing 15.9° Depth 100.3m

Positions shown are relative to the transceiver if there is no GNSS data available to the software. If the software receives GNSS information, positions shown can be in real-world co-ordinates.

For each entry in the tracking pane, there is a target selection button that allows you to toggle tracking on or off for the associated target.

Note that tracking is disabled in the software unless there is a valid security key fitted.

When acoustic tracking is not active, INS positions or GNSS-based positions are shown in blue cyan colour to distinguish them from acoustically-derived positions.



Note

 **Vessel GNSS position is automatically displayed when acoustic tracking is stopped, assuming GNSS is available.**

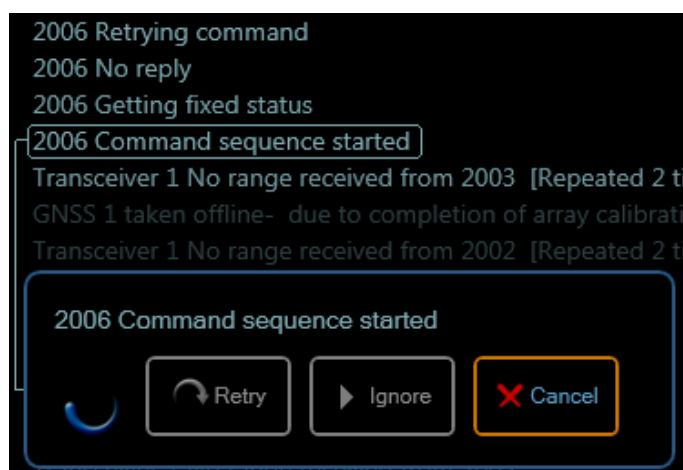
When a position is 'aided' by GNSS or depth sensor, it is displayed with an underscore. In this example, the Ship Easting and Northing were calculated using GNSS input, and the beacon 2001 depth was calculated using the beacon's depth sensor.

A series of moving dashes above the position indicates the status of the acoustic cycle.



A.7 Message Pane

The Message Pane displays information about what the system is doing. Each message fades out over time.



Double-click anywhere on the Message Pane to launch the Events Viewer, which shows a more detailed view of the message system.

When a command sequence starts, **Retry**, **Ignore** and **Cancel** buttons are overlaid on the Message Pane. These buttons allow you to interact with the command sequence:

- Click **Retry** to retry a failed command.
- Click **Ignore** to ignore a failed command.
- Click **Cancel** to cancel a failed or running command.

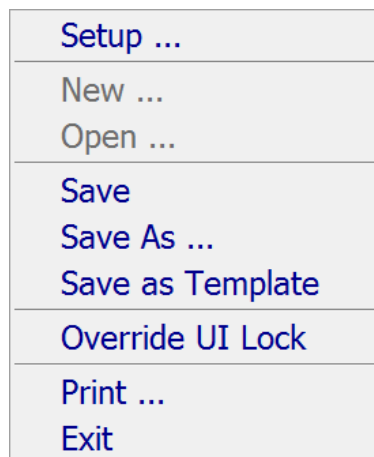
Note



Cancelling a running command might leave a part of the system in an unknown state. For example, a beacon might not be set up ready for use.

A.8 System Menu

The **System** menu gives access to all the system-related functions of the software.



A.8.1 Setup

Launches the **System Setup** window so that you can edit the settings for the current setup.

A.8.2 New

You can create a new setup either from:

- a blank template, or
- a template that you create and save.

A.8.3 Open

You can open a setup file that already exists.

The ability to save and open setup files means that you can break and then continue an operation without the need to re-enter all the setup details.

Setup files use a version of the XML file format, which can be read by any text editor program.

A.8.4 Save options

The three **Save** options are:

- **Save** — Saves the current setup under its current name. If you have not already supplied a name for the setup, you are prompted for one.
- **Save As** — Saves the current setup under a different name. This allows you to create a new setup based on the current setup.

This is a useful option to use if you want to create only a single new setup from the current one.

- **Save as Template** — Saves the current setup as an XML template file so that you can use it as the basis for future new setups.

A.8.5 Override UI Lock

Allows temporary override of job protection, see *Section B.1 "UI Lock"*.

A.8.6 Print

Prints the screen or saves the screenshot to a file.

A.9 View Menu

The dialog boxes that are accessible through the View menu display important information about the system and its operating parameters.

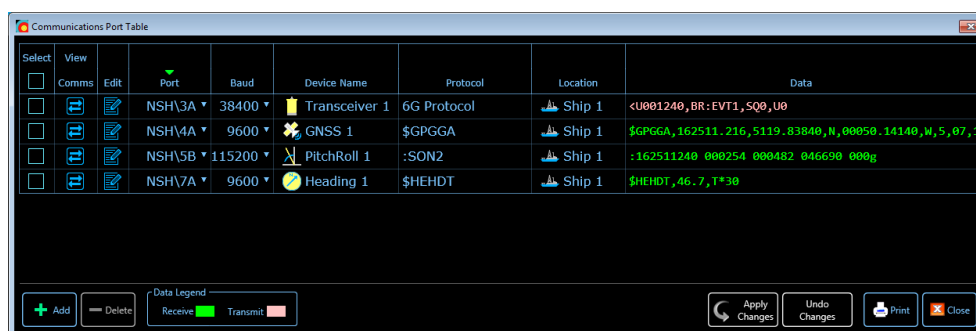


A.9.1 Beacons

For a detailed description of the Beacons options, see *Section 5 "Beacons"*.

A.9.2 Ports

The **Communications Port Table** lists all comms ports currently in use, allows editing of the port settings and gives a quick view of the live comms.



- Click **Add** to add a new device; see the **Add Device** dialog box below.
- Clicking **Print** launches the Windows Print dialog box. This allows the capture and print out the Communications Port Table.
- Clicking **Close** closes the Communications Port Table.

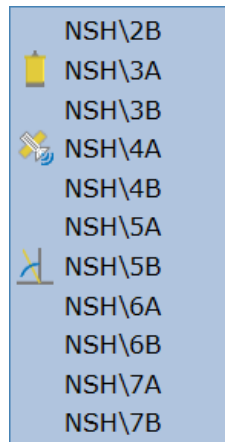
The columns within the Communications Port Table are described in the following table.

Description	Function	UI Control Type
Select	Selects a beacon row for a subsequent operation	
View Comms	Open the Comms Viewer with the tab for this device. If tab doesn't exist, open a new tab	
Edit	Opens the appropriate editor for the device. Responder Beacons open the Beacons Table, Reports open Output Telegram editor, all other devices open the System Editor	
Port	Serial port assigned to this device/ output telegram. Populated with NSH\xxx and/or COMxxx	 Drop-down list
Baud	Baud Rate of port (110 to 115200)	 Drop-down list
Device Name	Name of device/output telegram	Static label field with device type icon on LHS
Protocol	Serial Comms Protocol used for device/output telegram. Responder Beacons shall show "Responder Beacon" in this field	Static label field indicating device or telegram protocol
Location	Where the device is located. (Ship, ROV, Structure, System, Mobile). Output Telegrams show "System"	Static label field with location type icon on LHS
Data	Last decoded data to/from the device/output telegram. Outgoing data shown in different colour to incoming	Static label field

Note that the Serial port selection is restricted for the following device types:

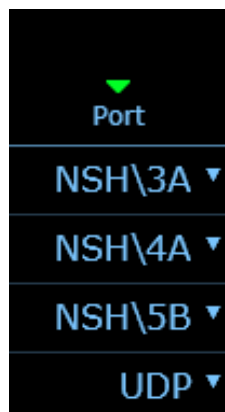
- Responder Beacons – Only dedicated NSH ports can be used for trigger ports, although conventional COM ports CTS line can be used for some system configurations.
- Time of Day – Only dedicated NSH ports can be used for PPS ports.
- If UDP is selected as a port for a device type, then the UDP settings are only accessible within the System Setup. The port column (as shown above for the Remote Control device) will simply show "UDP".

The serial port drop-down list shows a device type icon beside each port that is already in use (as shown below):



A.9.2.1 Sorting the Table

To sort a table column (that contains sortable data), clicking on a column header will toggle the green chevron (as shown below) to sort ascending or descending. Only one column is sortable at a time.



A.9.2.2 Delete

When at least one table row is selected via its check box, the **Delete** button is enabled, except when:

- One of the selected items is a Responder Beacon. It is only possible to create/edit/delete any beacon via the Beacons Window.
- One of the selected items is an Output Telegram. It is only possible to create/edit/delete any output telegram via the Output Telegram Editor.

When the Delete button is enabled, clicking on it deletes all selected devices. Confirmation is required when more than one device is being deleted.

A.9.2.3 Add Device Dialog Box

Clicking **Add** opens the **Add Device** dialog box. This dialog box is shown whenever a serial communication device is to be created, excluding the addition of beacons and output telegrams as they have their own more sophisticated editors.

Any device type, location and port can be added, as shown below:

Type

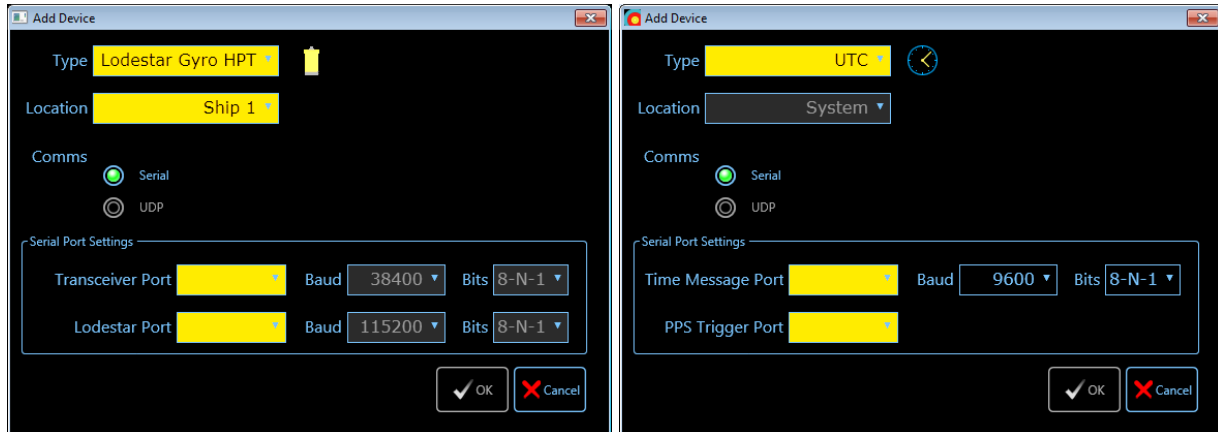
The following devices can be added:

For example, selecting **GNSS > GPGGA** populates the dialog box as follows:

If the selected **Type** is any of:

- Lodestar Gyro HPT
- TOD device (any subtype)

then the dialog box displays a second set of comms port boxes, as shown in the examples below.



Location

The **Location** drop-down list allows selection of where the device is located.

- If the selected device type is an Attitude, Depth Sensor, GNSS, Heading or Transceiver, then the drop-down list displays all Vehicles in the job.
- If the selected device type is a TOD, PAN, ERA, Remote Control, Signal Tower, Sound Speed then the drop-down list only displays System. No vehicles are offered.

Serial Port Settings

The **Serial Port Settings** consists of primary (and optional secondary) serial port controls, consisting of:

- **Port** – A drop-down list that allows selection of the serial communications port to which the device is connected.
- **Baud** – A drop-down list that allows selection of the port baud rate. In the case of devices that only use CTS or Trigger functionality, this will be disabled.
- **Bits** – A drop-down list that allows selection of Data-Parity-Stop bits. In the case of devices that only use CTS or Trigger functionality, this will be disabled.

By default, the following Data-Parity-Stop combinations are enumerated in the drop-down list:

- 8-N-1
- 8-N-2
- 7-O-2

Where:

E = Even parity

N = No parity

O = Odd parity

UDP Settings

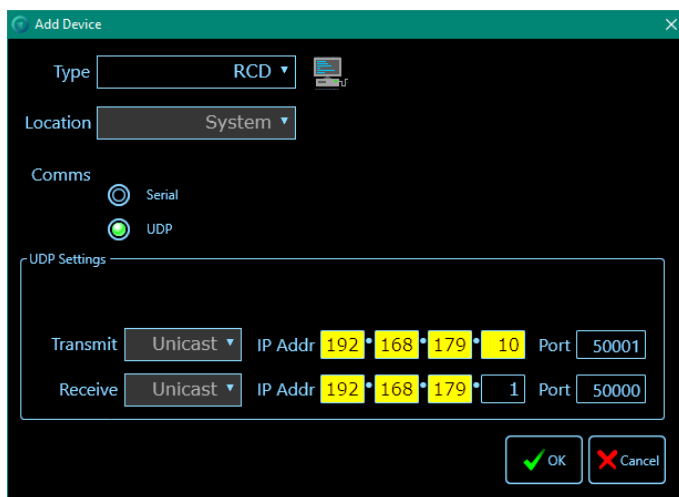
Note

 This option is currently only available for devices which are not time-sensitive, e.g. Remote Control, or which carry strings with a time-of-validity, e.g. GPGGA.

If the **UDP** radio button is selected, the normal Serial Settings group box is hidden and the **UDP Settings** group box is shown.

The **UDP Settings** group box contains controls to specify UDP parameters, as follows:

- **Mode** – Set to Unicast, Multicast or Broadcast.
- **IP Address** – Specifies the source/destination IP address of the UDP comms.
- **Tx Port** – Specifies the source/destination Port number for UDP Transmit comms.
- **Rx Port** – Specifies the destination Port number for UDP Receive comms.

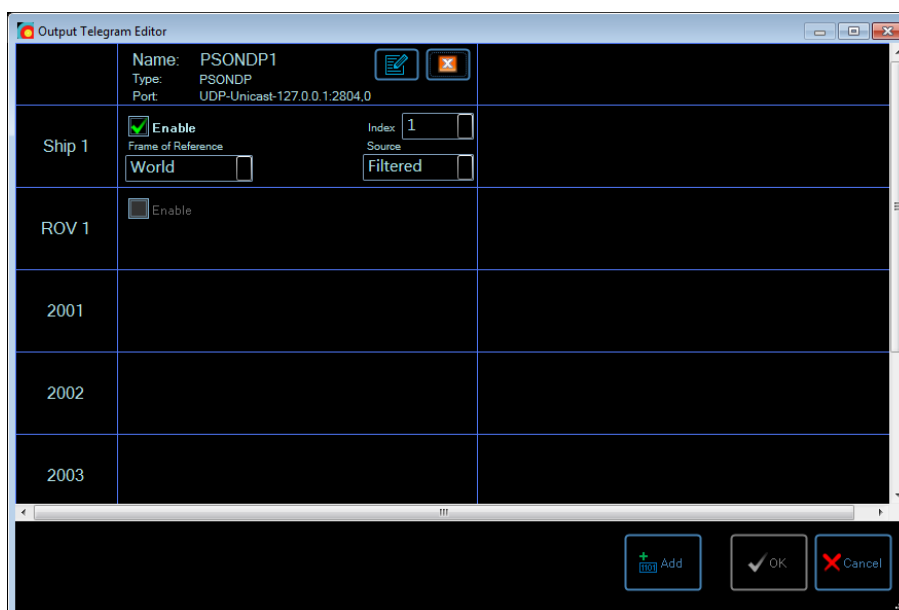


The screenshot shows the 'Add Device' dialog box with the following settings:

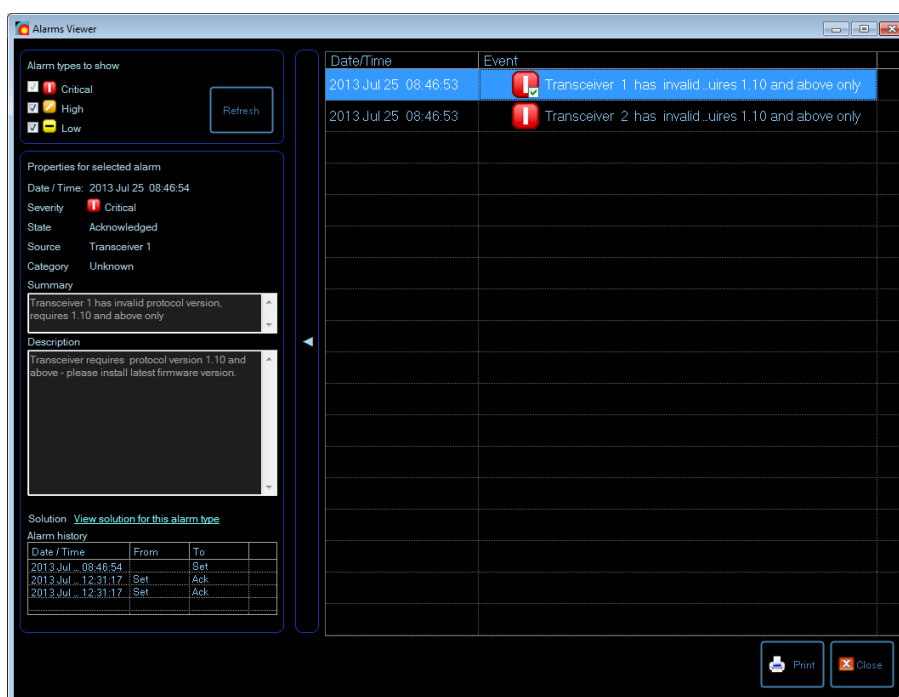
- Type:** RCD
- Location:** System
- Comms:** UDP (selected)
- UDP Settings:**
 - Transmit:** Unicast, IP Addr: 192.168.179.10, Port: 50001
 - Receive:** Unicast, IP Addr: 192.168.179.1, Port: 50000
- Buttons:** OK (green checkmark), Cancel (red X)

A.9.3 Telegrams

The **Telegram Table** shows the current settings for Telegrams sent to the vessel's DP system or survey system, and allows you to edit and add Telegrams. See *Section 4.23 "Configuring Output Telegrams"* for a description of the **Telegram Table**, and for instructions on how to use it.

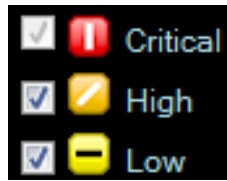


A.9.4 Alarms



There are three main panes of the **Alarms Viewer**:

- **Alarm list** – a list of all the current alarms, showing details of the date and time when each alarm occurred and details of the event that caused the alarm condition. Clicking on an alarm in the list acknowledges the alarm, and temporarily silences the alarm sounder.
- **Alarm properties** – detailed properties about the alarm selected in the alarm list.
This pane includes a **View solution for the alarm type** link, which opens a file containing user guidance in a browser window. These HTML files can be modified locally, if required.
- **Alarm category** – alarm categories (**Low**, **High** and **Critical**) indicate the priority, and are used for sorting the list into priority order.



See for a list and description of the alarms.

The **Print** button allows you to send the alarm list view to the default printer. You can hide or display the **Alarm properties** and **Alarm category** panes by clicking a control, which provides more space to display the alarm list.

System alarms can be in one of the following states:

Clear (no alarm)



Set, unacknowledged (a fault exists, the user has not acknowledged)



Set, acknowledged (a fault exists, the user has acknowledged)

When an alarm is set, a Summary of the alarm condition is displayed at the bottom-left of the main screen, a flashing red Alarm button is displayed at the bottom-right of the main screen, and a siren audio output starts.

When the user acknowledges an alarm, the audio (siren) output is silenced for a short period, but this will resume if the fault is not cleared.

An alarm can be cleared only by clearing the cause of the fault. See the alarm description and solution for help on this. When an alarm is cleared, the audio output is silenced, and the alarm text and red button are removed.

Alarm suppression – repeated nuisance alarms can be suppressed if absolutely necessary by making a system configuration change. An example of where this may be permissible is for a GNSS HDOP alarm triggered whenever the GNSS antenna's view of the sky is obscured. Please contact Sonardyne Support for guidance.

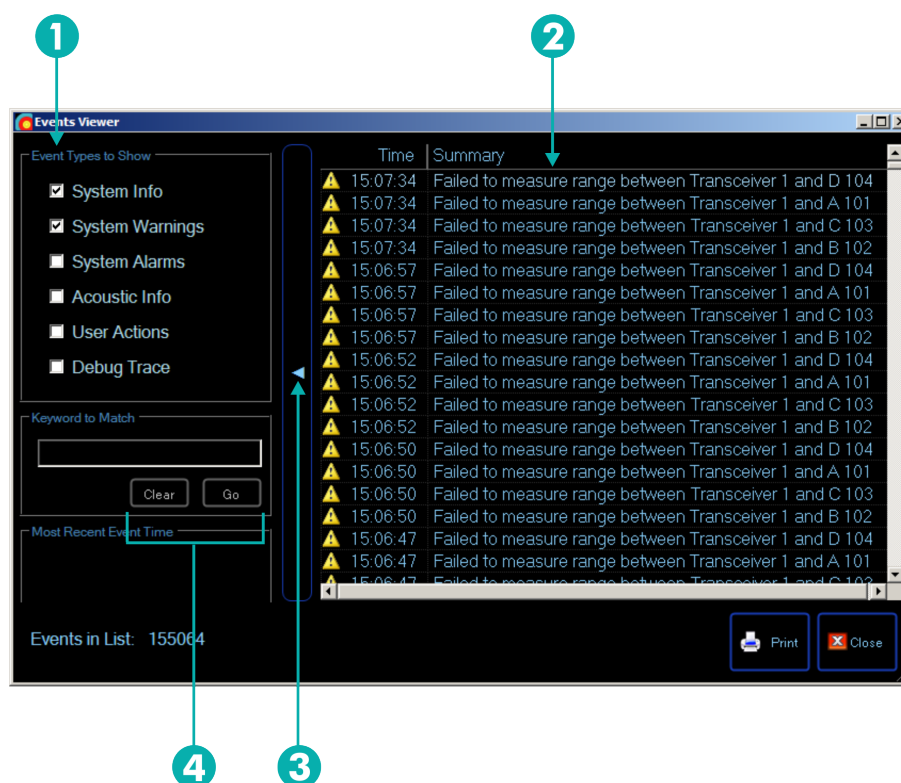
Note



Do not ignore a system alarm as this can lead to incorrect operation.

All alarm state changes and user actions are logged to the system event log for later review.

A.9.5 Events



Item	Description
1	Event Category Filter
2	Event List
3	Display/Hide Pane
4	Event Search Buttons

The main features of the **Events Viewer** are:

- **Event list** – a list of all events, showing details of the date and time when each event occurred and details of the event.
- **Event category** – select the event categories to display in the event list, and you can filter the list to include only events that occurred during a defined interval.

The **Events Viewer** also allows you to search for particular events, print the event list, and close the **Events Viewer**.

You can hide or display the **Event category** panes by clicking a control, which provides more space to display the event list.

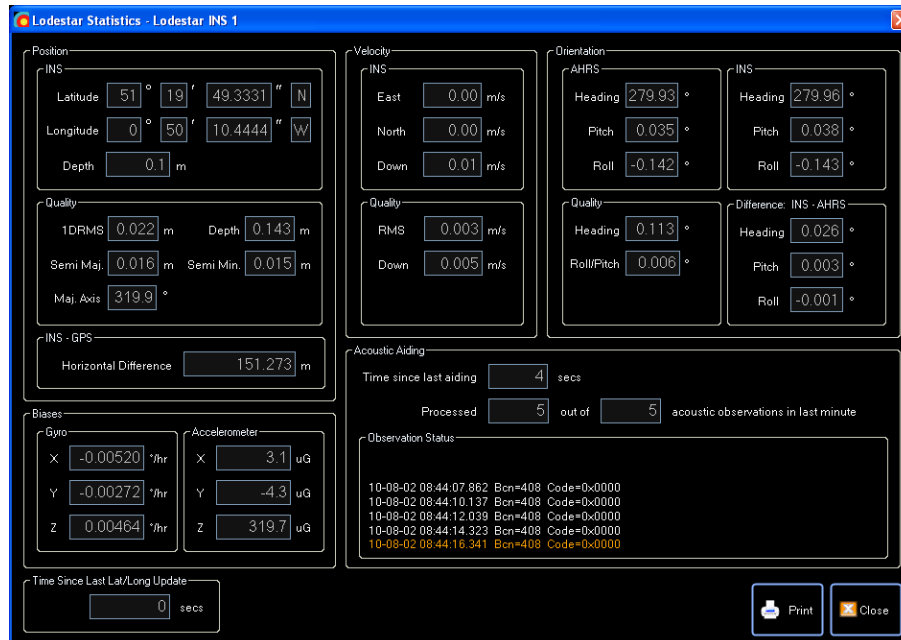
See for a list and description of the events.

Note

 The system event log should be periodically reviewed (particularly the Warnings and Alarms categories). Unexplained events, particularly repeated warnings, should be investigated, and the cause understood and corrected.

A.9.6 Lodestar Statistics

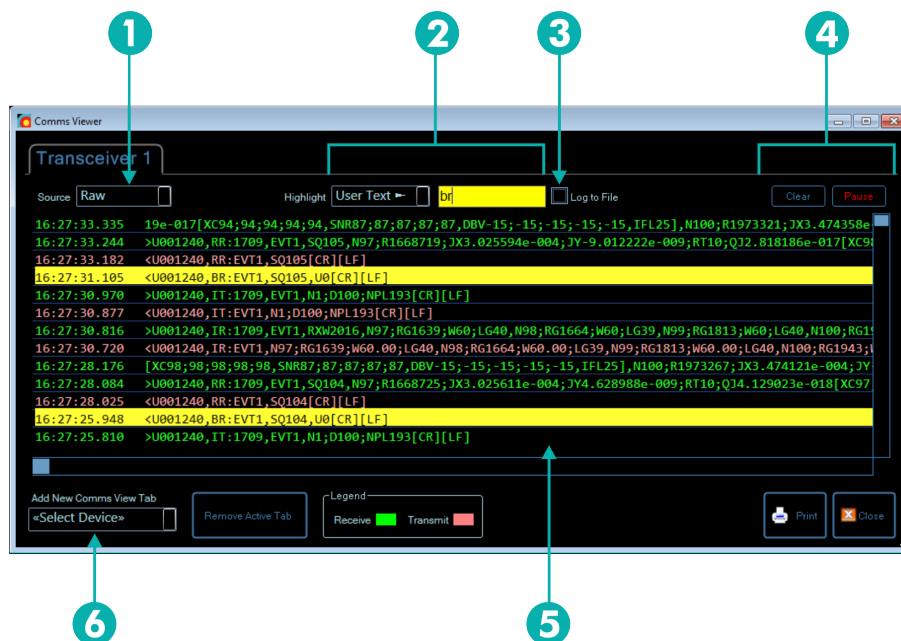
This menu option is greyed out unless the system is receiving data from a Sonardyne Lodestar INS. The statistics displayed include all current inertial measurements, and an indication of their quality and age.



A.9.7 Comms

The **Comms Viewer** shows communications between the system and the various Instruments in the setup. You can select any device in the current setup and add a tab to display its communications.

- Output strings are shown in pink.
- Input strings are shown in green.



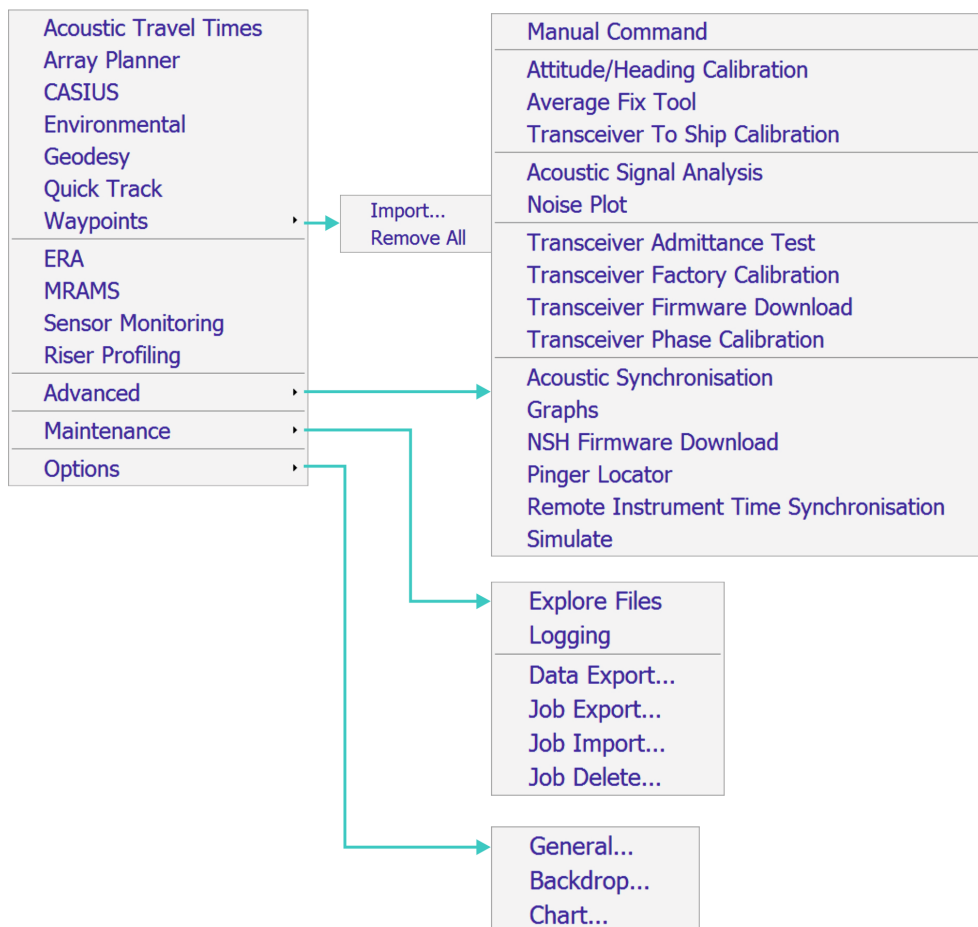
Item	Description
1	If necessary, change the communication Source to display: - Raw for text with control characters - Decoded for normal text - Observation for additional diagnostics (where available)
2	If necessary, select Highlight/User Text and enter text in the adjacent box. The system identifies any string in the communications that includes this text and highlights the string in yellow.
3	If necessary select the Log to File check box and identify the location and name of a file on the computer where the software can store the communications as a text file.
4	Use the Clear and Pause buttons to control the flow of data strings.
5	Review the communications.
6	Select a device in the current setup. A tab is added for the device you select. If necessary, click Remove Active Tab to remove a selected tab from the Comms Viewer.

A.9.8 Clear Position History

Clears the Position History Trails from the chart.

A.10 Tools Menu

The **Tools** menu includes a set of software tools that help you to optimise the performance of the system. The following sections describe the dialog boxes accessible through this menu.



The image above shows the **Tools menu, with the Advanced, Maintenance and Options** sub-menus detailed.

Some options on the Advanced sub-menu may be greyed out, depending on the system's tracking status.

A.10.1 Acoustic Travel Times

The Acoustic Travel Times tool display shows the two-way acoustic travel times for each beacon in the setup plotted against time. Overlapping travel times can make it difficult for the transceiver to separate the responses from individual beacons, leading to longer intervals between updates.

This tool ensures reply signals from beacons on the same interrogation signal do not overlap. If they do, you should adjust the beacon turnaround time (TAT) to separate the travel times.

Note

 **Pulse-position mode beacons supply a double pulse reply (for depth) or triple pulse reply (for pitch and roll).**

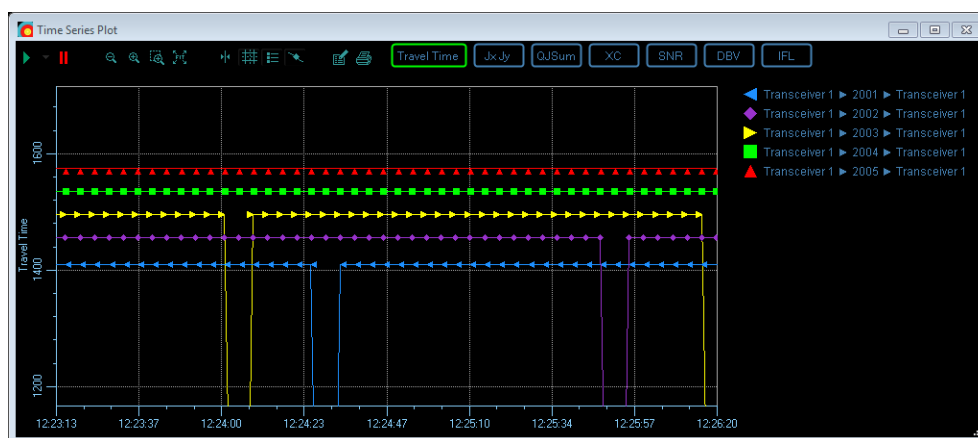
The following acoustic diagnostic types can be displayed by clicking on the buttons listed below:

- Travel Time
- Jx Jy
- QJSum
- XC
- SNR
- DBV
- IFL

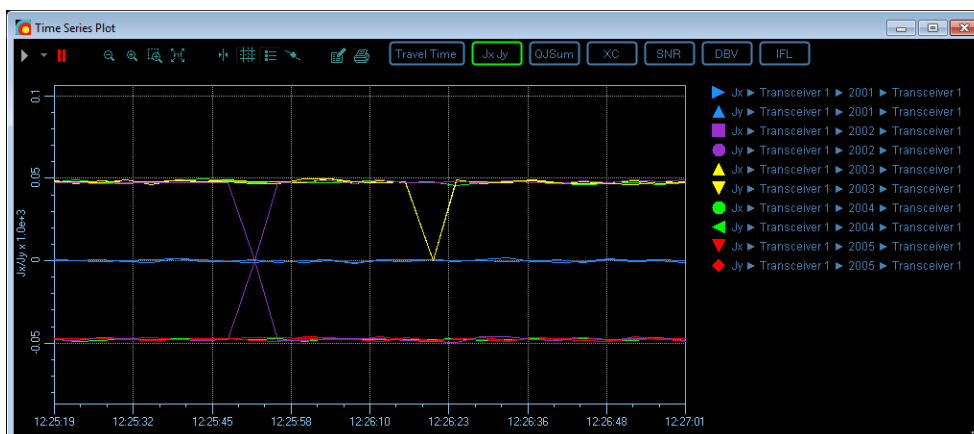
An example of each graph type is shown below.

A.10.1.1 Travel Time

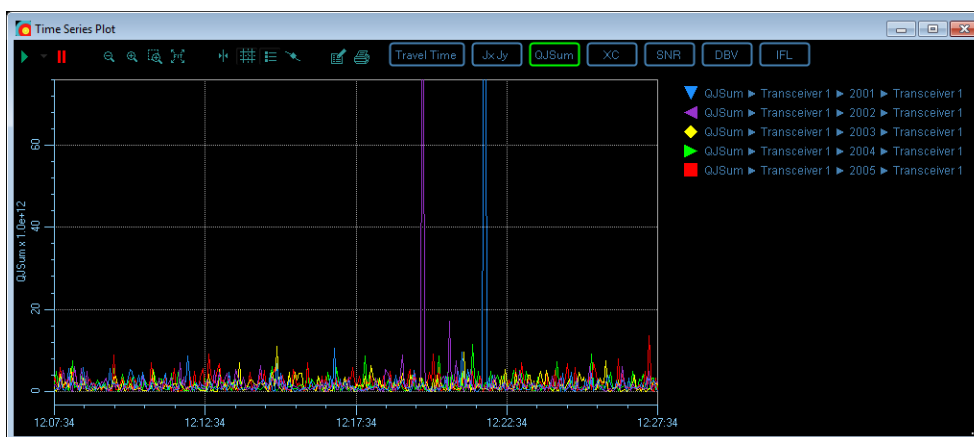
The Travel Time graph below shows an example of an acoustic travel times display. In this example, the travel times for 2003 (yellow) and 2004 (green) are too close together, so one of the beacon TAT values requires adjustment.



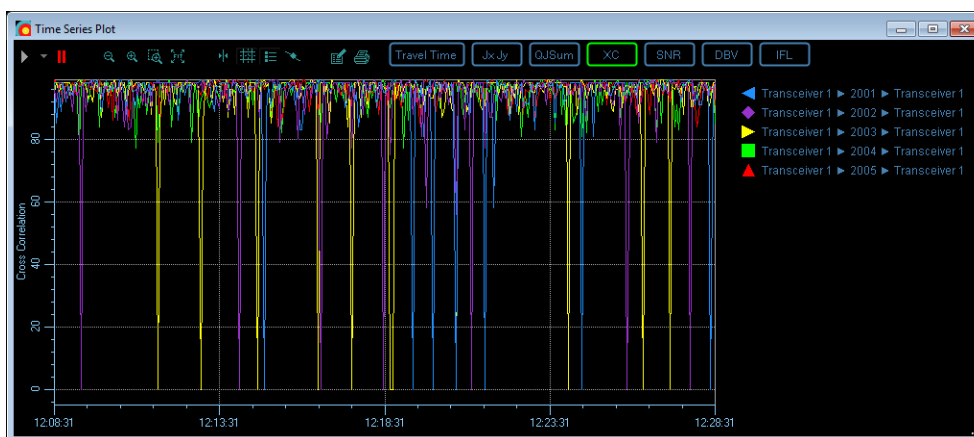
A.10.1.2 Jx Jy



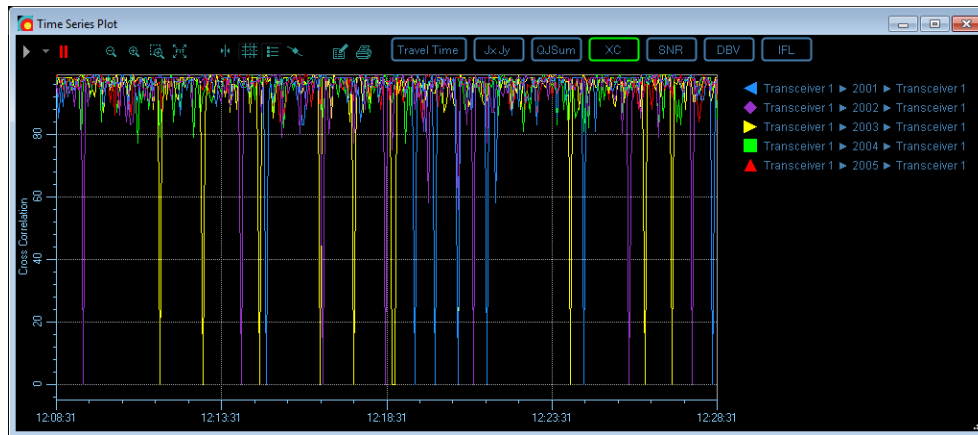
A.10.1.3 QJSum



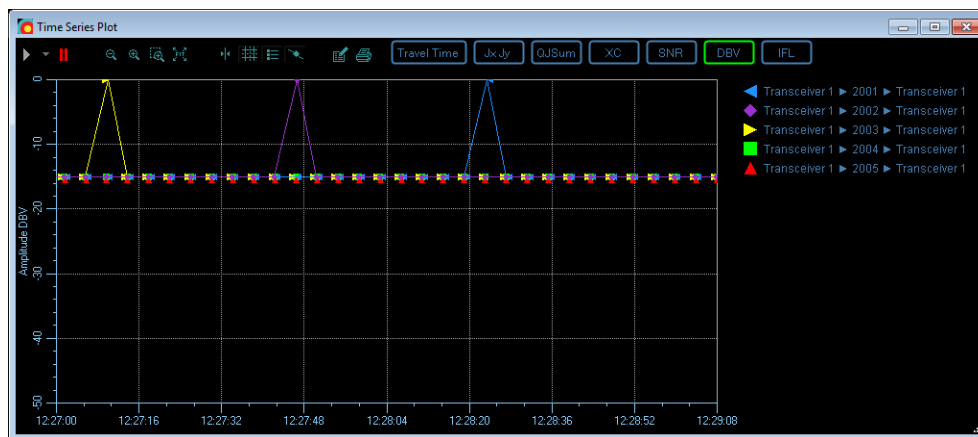
A.10.1.4 XC



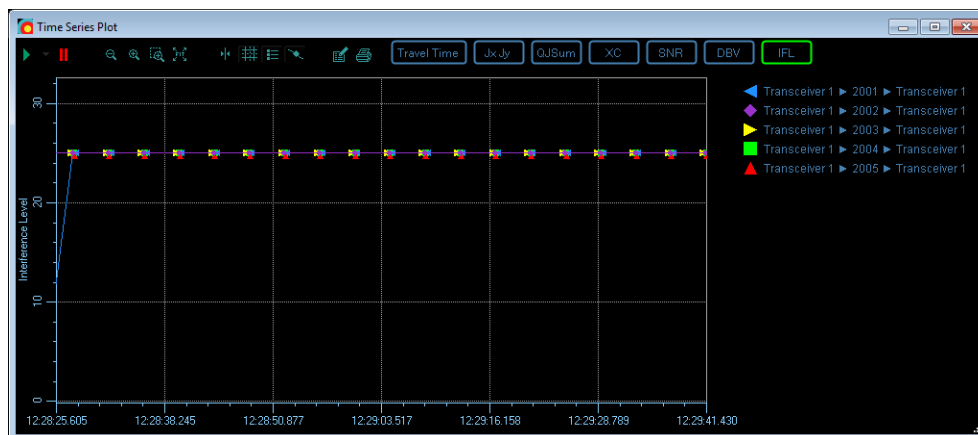
A.10.1.5 SNR



A.10.1.6 DBV



A.10.1.7 IFL



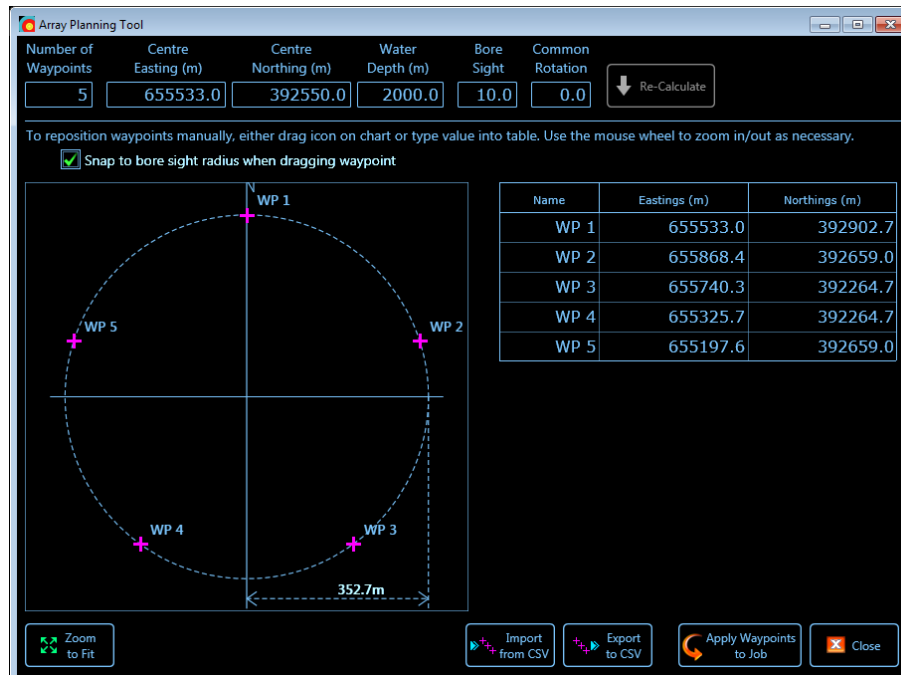
A.10.2 Array Planner

The **Array Planning Tool** is launched from the **Tools/Array Planner** menu.

Note

 **World Frame must be selected in the Frame selector at the top of the main window. This means you should either have GNSS enabled or calibrated array reference beacons in world frame.**

The **Array Planning Tool** is designed to allow you to define a pattern of seabed waypoints where array beacons will be deployed - typically using a tracked ROV.



The tool shows a 2D graphical view centred on the transceiver, a waypoint position table and some edit boxes to control how waypoints are deployed.

The deployment pattern is circular, with the radius defined by the editable **Water Depth** and the **Bore Sight** angle of the transceiver. The centre of the circle is defined by the editable **Eastings** and **Northings** values.

The user can define the **Number of Waypoints** (equally spaced) to be distributed around the circle, and an overall **Common rotation** angle to be applied to all waypoints relative to the centre.

After any of these parameters are adjusted the user must click the **Re-Calculate** button to update the chart and the waypoint/position table.

You may also manually adjust the position of any waypoint by:

1. Dragging a waypoint on the graphical view.

Note that if the **Snap to bore sight radius** check box is selected, the waypoint will tend to follow the circle. Otherwise it can be moved completely freeform. In either case, the table position values will update as the waypoint is dragged. Clicking the **Zoom-to-fit** button will fit all waypoints within the graphical view.

2. Typing exact Easting and Northing values into the table. After the values are entered (carriage return), the graphical view will update to show the new position.

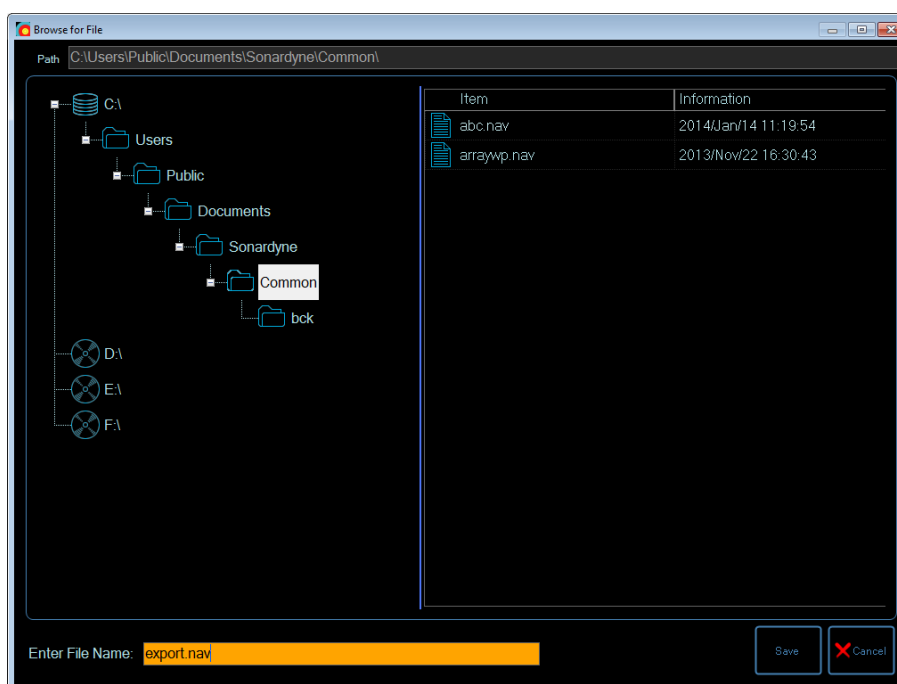
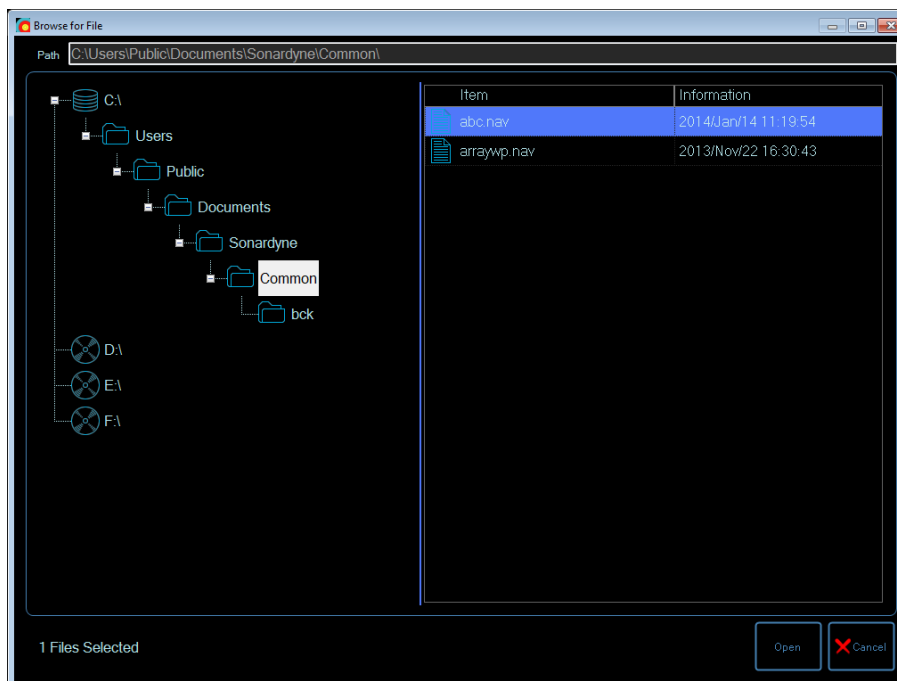
After the waypoint plan completes, clicking **Apply Waypoints to Job** will create the waypoints on the main chart (and in the job). Any pre-existing waypoints in the job with the same name will be overwritten with the new waypoint positions. The new waypoints will appear on the chart at the specified locations.

A.10.2.1 Import and Export

The waypoint pattern information can be **Imported** or **Exported** from/to a NAV file using the corresponding buttons, followed by **Save** or **Open**.

Note

 A maximum of 10 waypoints can be imported using this method. To import a larger number of waypoints, see *Section A.10.7 "Waypoints"*



The file format used is CSV, but the file extension is NAV. The NAV file format is the same used by Fusion LBL 6G. The following is an example NAV file defining the position of three waypoints:

// Fusion 6G Navigation File - version 1.00

//

WP1,WAYPOINT,500010,6000010,0.000,,0,50.000,0.000,Waypoint,16711935,50.000,50.000,
WP2,WAYPOINT,500020,6000020,0.000,,0,50.000,0.000,Waypoint,16711935,50.000,50.000,

WP2,WAYPOINT,500000,6000010,0.000,,0,50.000,0.000,Waypoint,16711935,50.000,50.000,

A.10.3 CASIUS

The CASIUS tool menu contains two tabs:

- CASIUS **Data Collection**
- CASIUS **Data Export**

CASIUS is an acronym that stands for Calibration of Attitude Sensors In the USBL System manufactured by Sonardyne International Limited.

By manoeuvring near a stationary beacon deployed on the seabed and recording DGPS positions and acoustic positions relative to the beacon, you can use CASIUS to compute:

- The precise position and depth of the beacon.
- The mean sound speed through the water column.
- USBL transceiver offsets from the GNSS antenna.
- Pitch, roll and alignment corrections to correct for the misalignment of the attitude and heading sensor (AHRS) and gyrocompass with respect to the USBL transceiver.

In general, pitch and roll alignment errors have a greater effect on beacons directly under a vessel (especially in deep water), and heading errors will have a greater effect at horizontal offsets from a beacon.

The correction values for pitch, roll and heading that you obtain by performing a CASIUS calibration help you to achieve significantly better results when you are positioning acoustic beacons. You should check the calibration regularly during each operation, so that you can detect any long-term drift in gyrocompass and AHRS sensors, and apply appropriate corrections; see *Section I.5 "USBL Transceiver Alignment Calibration Check"*.

See *Appendix I "CASIUS Data Collection Methods"* for instructions to perform a CASIUS calibration using this tool.

Before starting a CASIUS data collection run:

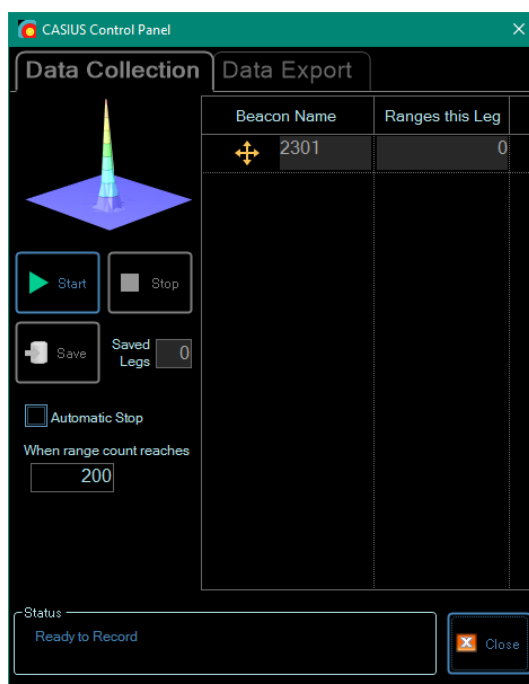
- Ensure that tracking of the CASIUS beacon is reliable and stable.
- Ensure the sound speed has been set correctly.
- Ensure a high quality GNSS position is available and enabled. The status field should say **Ready to record**.

Select the **CASIUS Data Collection** tab. If you prefer to use auto mode, click **Automatic stop** and set the number of ranges required. Otherwise, data collection will continue until stopped manually.

Procedure:

1. Click **Start** to begin data collection.
2. Click **Stop** when the required number of ranges has been acquired if in manual mode.
3. Click **Save** to store the collected data set.

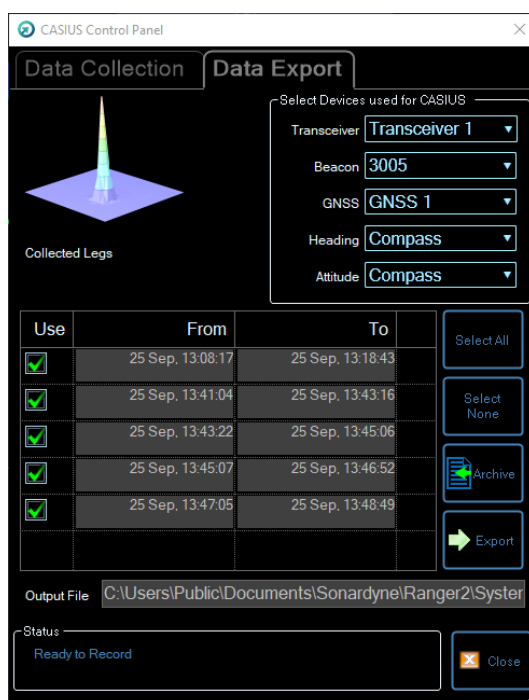
Repeat *Steps 1 to 3* above for each leg of the CASIUS data collection.



When data has been successfully collected for all CASIUS legs, select the **Data Export** tab.

Select the transceiver, beacon, GNSS, heading and attitude sensor to be used for the CASIUS calibration from the drop-down lists, then select the data sets for CASIUS processing by selecting the **Use** check boxes.

Click **Export** to process the CASIUS data.



Clicking **Archive** generates an archive of the data collected during the selected CASIUS legs. This can be useful for analysis and support.

A.10.4 Environmental

The Environmental Settings dialog box allows you to set the default sound speed, and to import a sound speed profile, if one is available for the operating area. This is one of the system's common operating procedures and is described fully in *Section 4.22 "Environmental Settings"*.

A.10.5 Geodesy

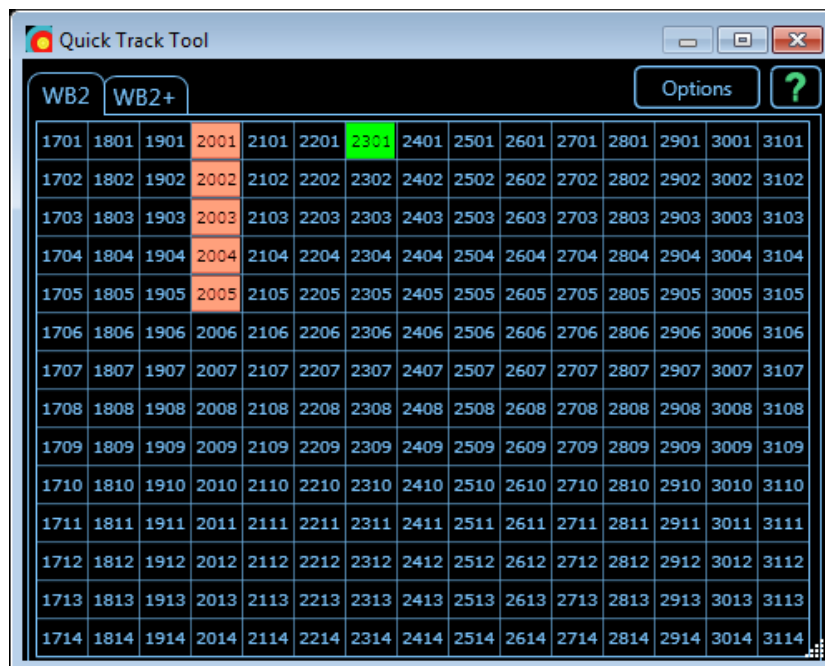
See *Section 4.12 "Geodesy Tool"*.

A.10.6 Quick Track

The Quick Track tool is used for simple jobs requiring a small number of 6G or PGT beacons. Quick Track tool. Quick Track uses the unique IIS interrogate signal for a 6G beacon.

Clicking on the beacon address in the Quick Track tool :

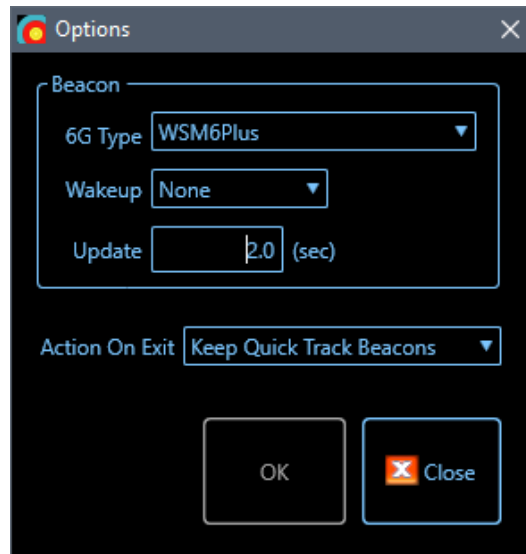
- Adds a 6G beacon with that address to the setup.
- Starts the beacon tracking.
- Enables a beacon output telegram (if there is a telegram setup).
- Clicking the address again stops that beacon tracking and removes it from the setup.
- An active Quick Track beacon is shown in green. Other beacon addresses already allocated are shown in pink.



The Quick Track defaults can be configured by clicking the **Options** button.

- **6G Type** – Defines the type of beacon to be added to the setup (choices offered depend on the product and security key settings).
- **Wakeup** – Selects whether to use a wakeup tone – this depends on the beacon configuration.
- **Update Rate** – Defines the acoustic update time.
- **Action on Exit** – Determines what happens to Quick Track beacons when the tool is closed.
 - Remain as Quick Track beacons
 - Convert to permanent beacons

- Remove beacons



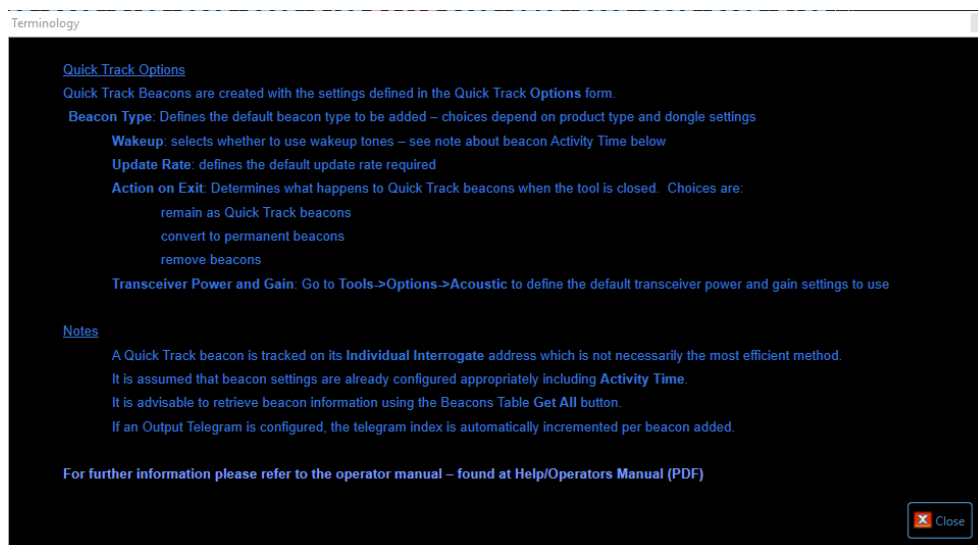
Note



Default Transceiver power and gain are defined in Tools/Options/Acoustics.



Guidance notes are displayed by clicking on the Quick Track Tool.

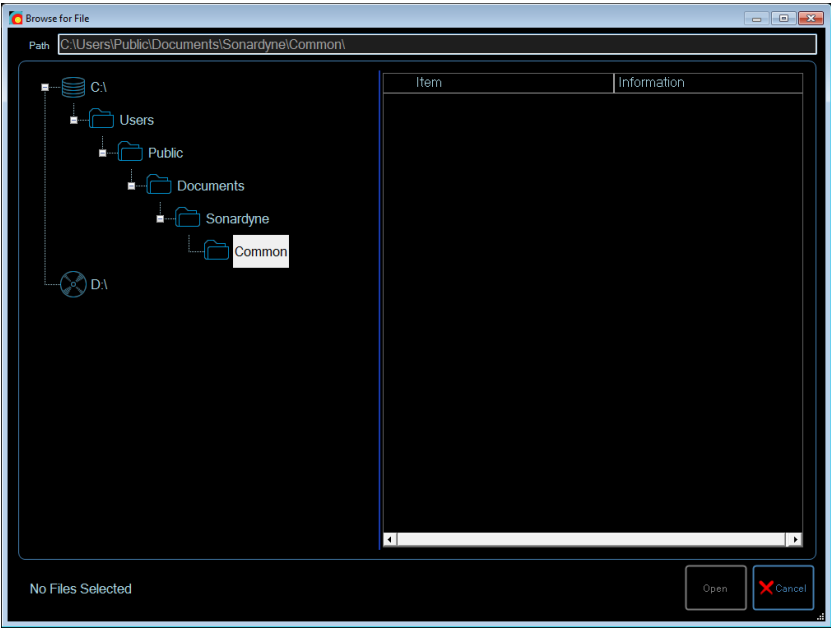


A.10.7 Waypoints

A.10.7.1 Import

To import a large number of waypoints, select **Tools > Waypoints > Import** to open the waypoints import window. Navigate to and select the NAV file containing the range of waypoints and then click **Open**.

Import supports importing of waypoints from standard .NAV files. See A.10.2.1 "Import and Export" in Section A.10.2 for a description of the .NAV filr format.



A.10.7.2 Remove All

Select **Tools > Remove All** to delete all the waypoints in the job. Click **Yes** to confirm .

A.10.8 ERA

See *Section 8 "Riser Angle Monitoring"* for a description of the Riser Angle Monitoring feature.

Select **Tools > ERA** to display ERA measurements.

Click **Calibrate** to enter the Stack and Riser offsets.

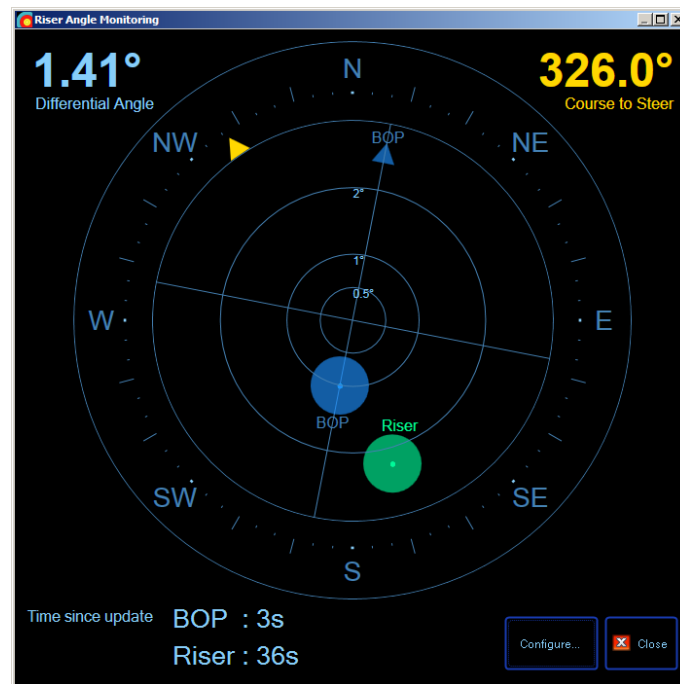
Electrical Riser Angle (ERA) Display								
Data								
ERA	Stack			Riser			Differential	Time Since
Pod	p°	Q°	Tilt°	p°	Q°	Tilt°	Tilt°	Update
Blue	1.03	1.93	2.19	0.03	-0.07	0.08	2.24	00:00:01
Yellow	1.08	1.98	2.26	0.08	-0.02	0.08	2.24	00:00:01

Calibrate...

A.10.9 MRAMS

See *Section 8 "Riser Angle Monitoring"* for a description of the Riser Angle Monitoring feature.

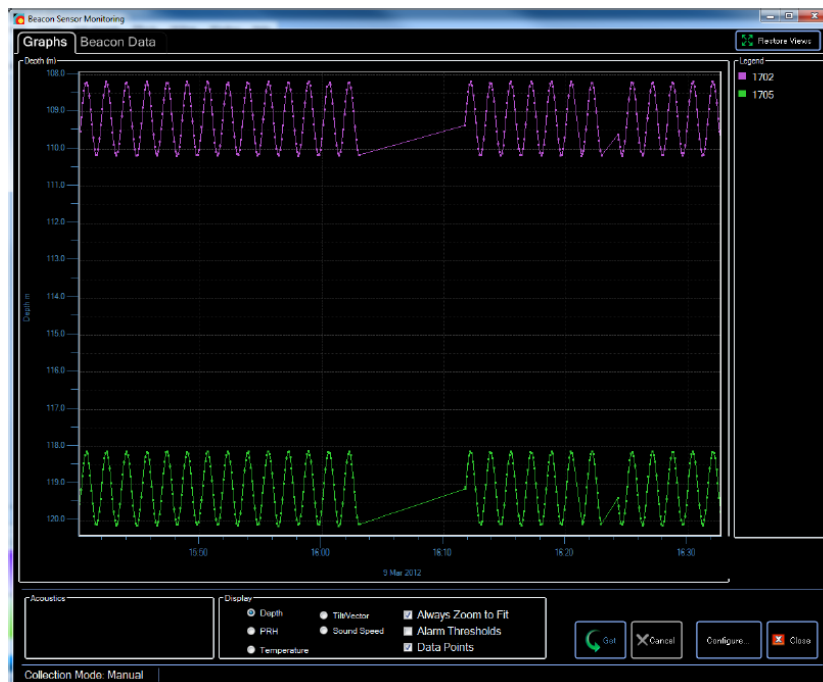
Select **Tools > MRAMS** to display MRAMS measurements.



A.10.10 Sensor Monitoring

See Section 10 "Beacon Sensor Monitoring Tool " for a description of the Sensor Monitoring feature.

Select **Tools** > **Sensor Monitoring** to display the Sensor Monitoring window.



A.10.11 Riser Profiling

See Section 9 "Riser Profile System"

Select **Tools** > **Riser Profiling** to display the Riser Profiling window.



A.10.12 Advanced

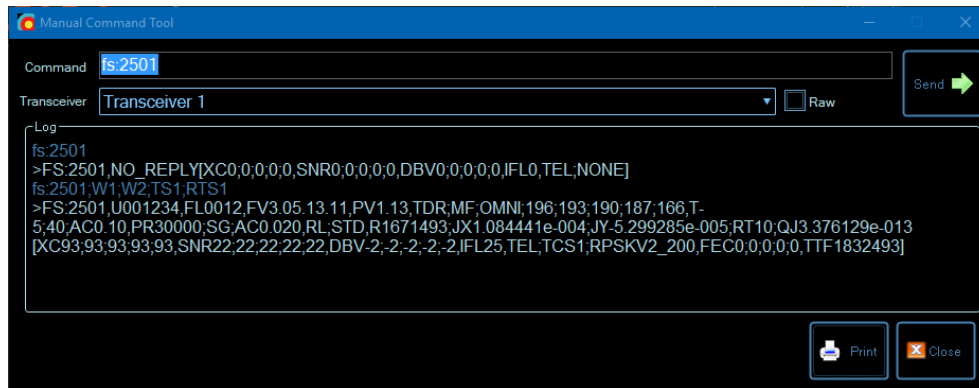
The **Advanced** menu provides the following features:

- Manual Command
- Attitude and Heading Calibration
- Average Fix Tool
- Transceiver To Ship Calibration
- Acoustic Signal Analysis
- Noise Plot
- Transceiver Admittance Test
- Transceiver Factory Calibration
- Transceiver Firmware Download
- Transceiver Phase Calibration
- Acoustic Synchronization
- Graphs
- NSH Firmware Download
- Pinger Locator
- Remote Instrument Time Synchronisation
- Simulate

Note

 When tracking, only the Manual Command, Acoustic Synchronization and the Acoustic Signal Analysis options are available on the Advanced menu.

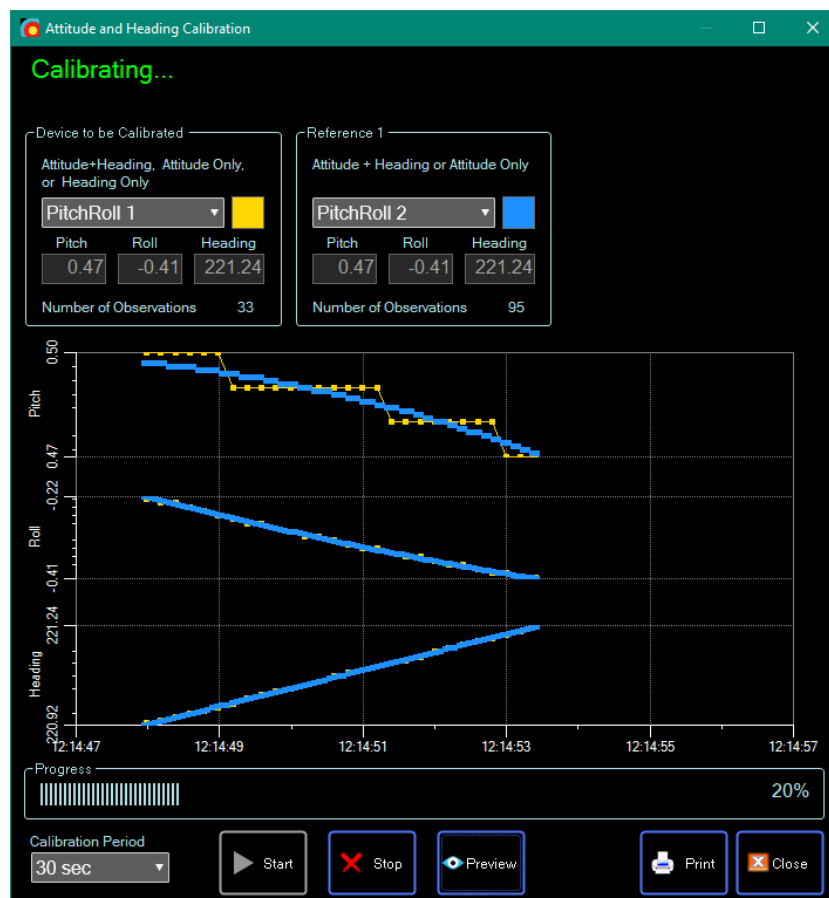
A.10.12.1 Manual Command



The **Manual Command Tool** allows you to type and send it to a selected transceiver. The centre pane displays communications with the selected transceiver as the command is issued and the replies received.

Select **Raw** to force commands to be sent 'as-is', or leave blank for the system to use default transceiver Power, Gain, Tx/Rx Telemetry and Wakeups, as defined in *Section A.10 "Tools Menu"* *Section A.10.14A.10.14.4 "Acoustic Tab"*.

A.10.12.2 Attitude and Heading Calibration

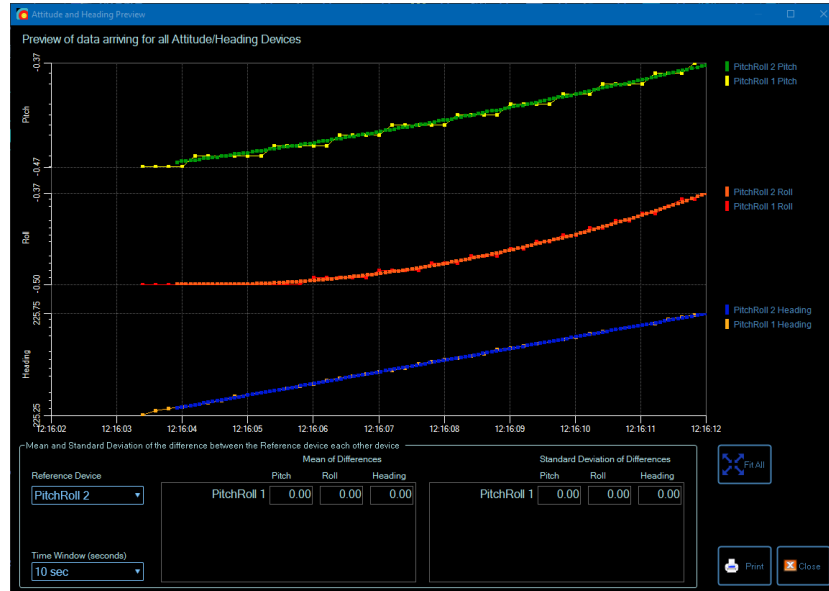


This tool allows you to calibrate a gyro or AHRS device against a 'reference' device (shown as **Device to be Calibrated** and **Reference 1** above).

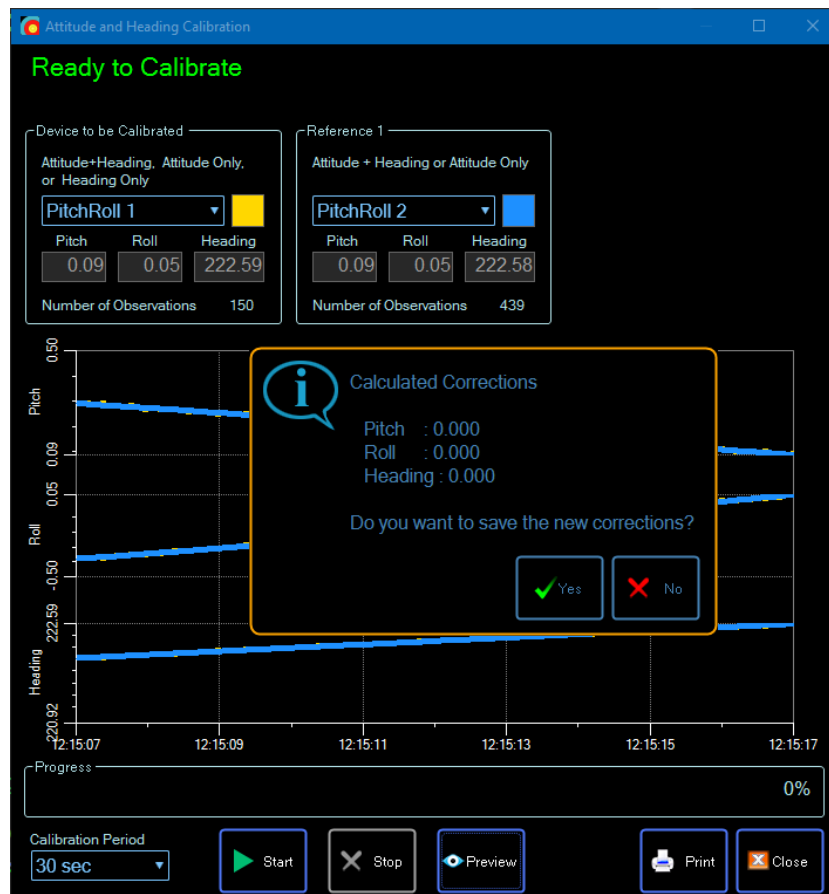
The charts show the measurements of Pitch, Roll and Heading for the data sources, using the colours shown in the top control groups to identify them.

Buttons at the bottom of the tool dialog box allow you to **Start** and **Stop** the calibration.

The **Preview** button allows attitude and heading inputs to be compared. The running Mean and Standard Deviation for Heading, Pitch and Roll are shown for the Time Window selected.



At the end of the calibration an option allows you to apply the calculated offsets to the device.

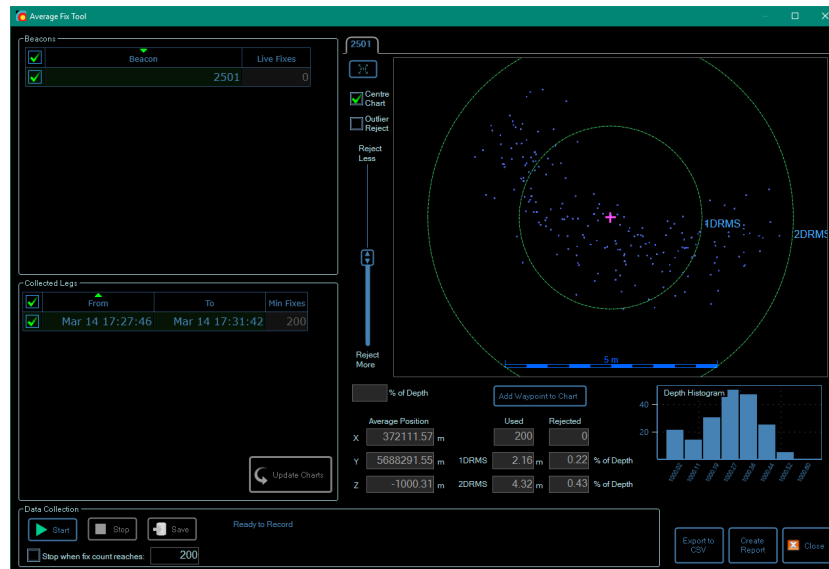


A.10.12.3 Average Fix Tool

The Average Fix tool is used to calculate an average of a set of positions for one or more beacons, together with statistics that indicate the quality of the position fix.

Note

 The tool can also be used as a pre- or post-CASIUS calibration check; see *Section I.5 "USBL Transceiver Alignment Calibration Check"*.



The tool includes:

- **Beacons** available for tracking, with ability to select beacons of interest (top-left pane)
- **Collected Legs**, with **From** and **To** times and number of **Min Fixes** (left middle pane)
- Position chart showing the cloud of collected position fixes for each beacon, together with **1DRMS** and **2DRMS** range rings and dimension scale (top right pane). The chart can be zoomed using the mouse wheel, or use the auto-zoom control 
- **Outlier Reject** slide control (centre pane)
- Summary statistical data for each beacon's **Average Position (X,Y,Z, 1DRMS, 2DRMS, Used and Rejected counts)**, and **Depth Histogram** (bottom right pane)
- **Data Collection** to **Record, Stop, and Save** (bottom left pane)

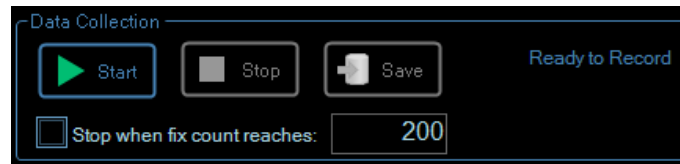
Operating the Average Fix Tool

1. Ensure that the beacon(s) are tracking reliably before starting (correct any tracking problems).
2. Select the beacons of interest from the **Beacons** list.
3. Carry out vessel manoeuvres while collecting data; for each manoeuvre,
 - a. Click **Start** to start collecting data
 - b. Click **Stop** when sufficient data has been collected

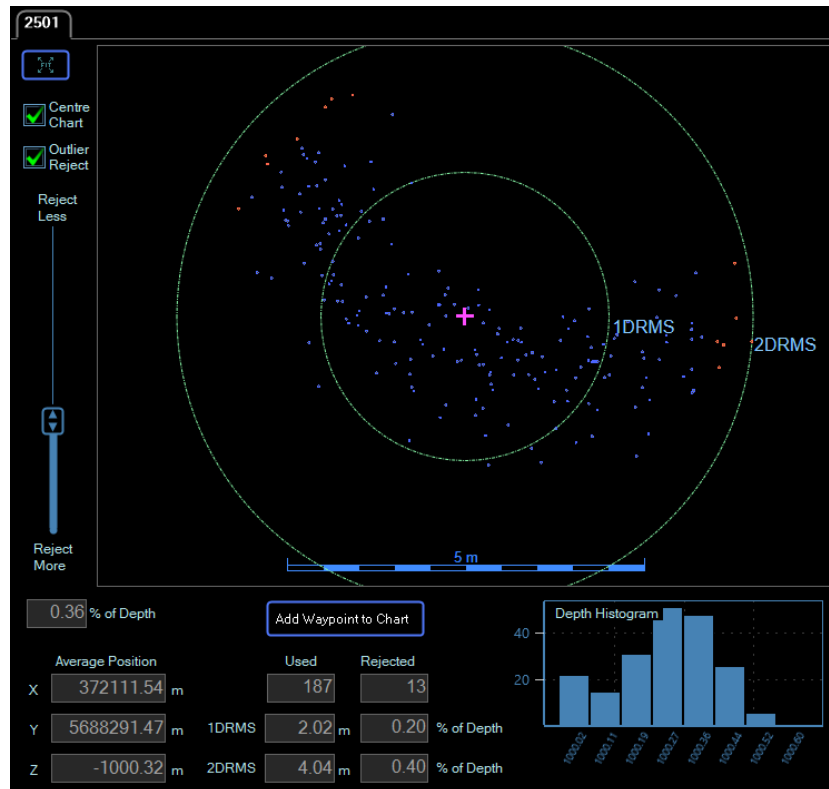
Note

 Select "Stop when fix count reaches" feature to stop automatically at any chosen fix count value.

- c. Click **Save** to save the data.



4. Review the summary statistical data for each beacon (if necessary, use **Outlier Reject** to reject obvious outliers).



5. Click **Add Waypoint to Chart** to drop a waypoint at the beacon's average position onto the main system chart.
6. Select **Export to CSV** to export the collected data to a CSV file for further processing.
7. Select **Create Report** to create a PDF report.

Average Fix Report



Vessel(s): Ship 1

Date/Time (UTC): 2018-03-15 16:52:22

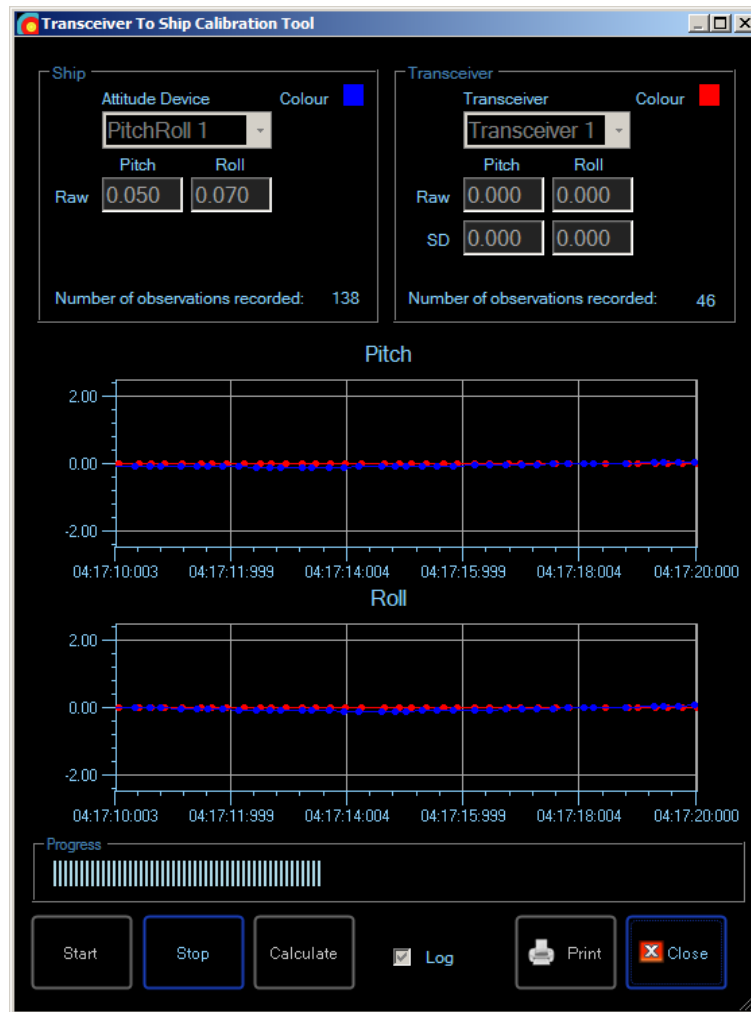
Results:

Beacon	Eastings	Northings	Depth	Use/Reject	1DRMS	2DRMS
2501	372111.54m	5688291.47m	-1000.32m	187 / 13	2.02m/0.20%D	4.04m/0.40%D

Selected Fix Point Legs:

From	To	Minimum Fixes
Mar 14 17:27:46	Mar 14 17:31:42	200

A.10.12.4 Transceiver To Ship Calibration



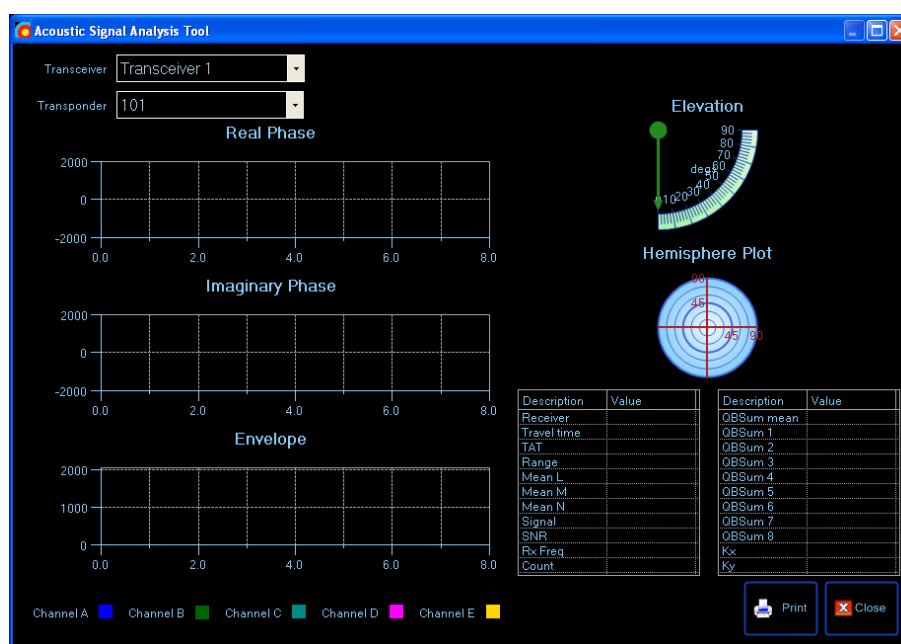
The two control groups **Ship** and **Transceiver** show real-time data for the AHRS Instrument and for the transceiver's internal inclinometer. They also show the correction necessary to align the inclinometer and AHRS measurements, and the standard deviation (SD) error in the inclinometer measurements.

Two charts show the measurements of Pitch and Roll for the two data sources, using the colours set in the top control groups to identify them.

A series of buttons at the bottom of the tool dialog box allow you to control the calibration and to log and print the results.

A.10.12.5 Acoustic Signal Analysis

The Acoustic Signal Analysis Tool allows you to assess the condition of the acoustic signal. This tool provides a large amount of detailed information that you can use to diagnose acoustic problems that may affect system performance.



The **Real Phase** and **Imaginary Phase** graphs show the phase of the signal received on each of the transceiver's receiving transducers relative to a local reference signal generated within the transceiver.

- **Real Phase** represents the component of received signal that is in phase with the reference signal.
- **Imaginary Phase** represents the component of the received signal that is in quadrature with the reference signal.

This is information about the difference in received signal phase between the five transducers, and the graphs show information from each of the transducer channels as a different colour.

Each line in the graph includes eight points, to represent the eight samples taken of the acoustic pulse. They rise in amplitude as the signal strength rises.

The graph's horizontal axis is the time into the received pulse, in milliseconds, over which the eight samples are taken.

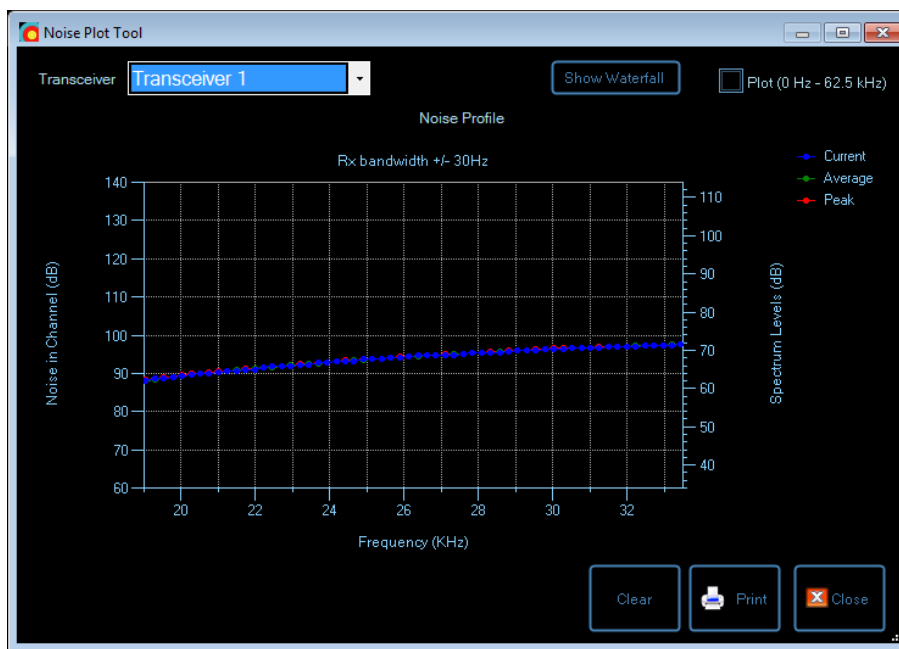
The **Envelope** graph displays the absolute magnitude of the acoustic signal as seen at each of the five transducers. The absolute magnitude is:

$$\text{Magnitude} = \sqrt{(\text{real}^2 + \text{imaginary}^2)}$$

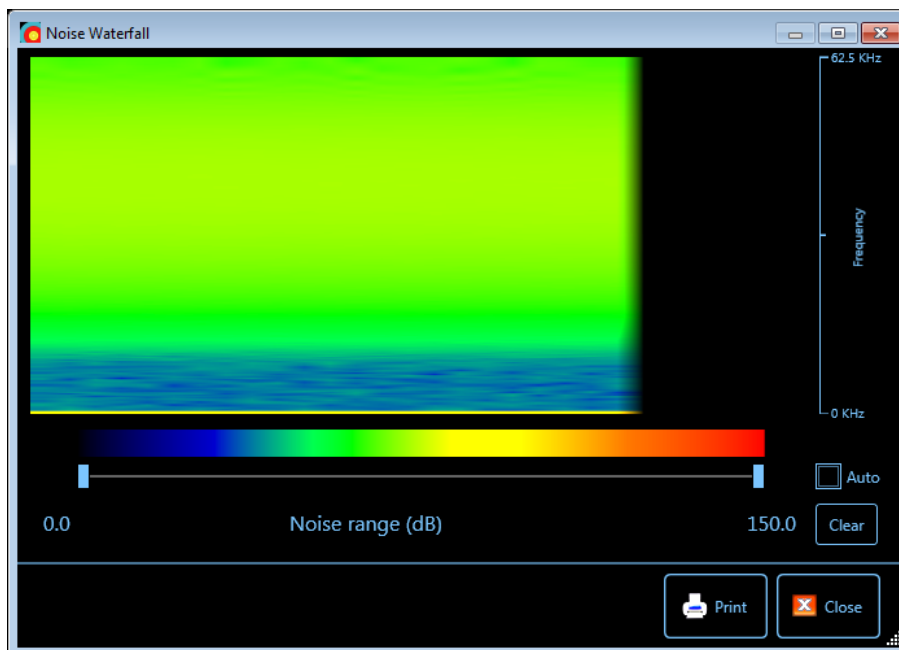
The **Envelope** graph also includes five lines, with one for each transducer. However, because they are all of the same magnitude, the graph shows them superimposed on top of each other. This is normal—the signal magnitude should always be the same at all five transducers.

A.10.12.6 Noise Plot

The noise plot tool is a fault finding tool that you can use to analyse the amount of background noise to which the transceiver is exposed. You can use it to take various noise profiles of the vessel under different operating configurations — for example with thrusters on and off; with the echo-sounder on and off. These profiles will give you an good idea of the power and gain settings to use; the maximum range you will achieve; and the power setting required in the beacon.



Click **Show Waterfall** to display a waterfall plot.



A.10.12.7 Transceiver Admittance Test

This procedure performs a transceiver admittance test and health check.

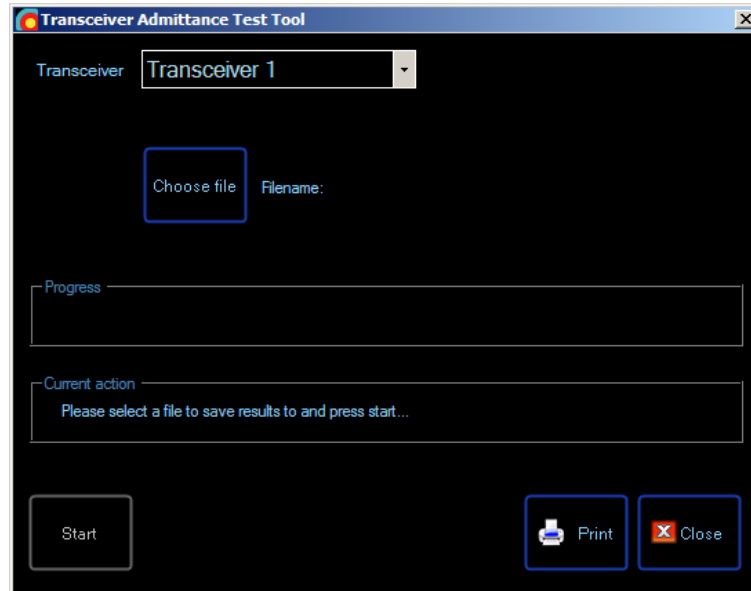
The health check works only on transceivers that have a device serial number that is higher than 1560, because these units were fitted with all the necessary components when shipped as new. It may be possible that older transceivers could have had both an array and a pre-amp upgrade performed at some time, in which case this health check will work.

On completion of the check, a CSV file is created. You should send this file to Sonardyne for analysis.

Note

 **You can perform these operations only if tracking is off-line.**

1. Make certain the transceiver is connected and is working correctly. Use System Setup to do this.
2. Select **Tools > Advanced > Transceiver Admittance Test** to display the Transceiver Admittance Test Tool.



3. Select the correct **Transceiver** and click **Choose file** to select the folder and file name for the output CSV file.
4. Click **Start** to begin the check.
A progress bar shows progress as the test is performed and data collected.
5. When the test finishes, send the CSV file to Sonardyne for analysis (email address: **usbl.support@sonardyne.com**).

A.10.12.8 Transceiver Factory Calibration

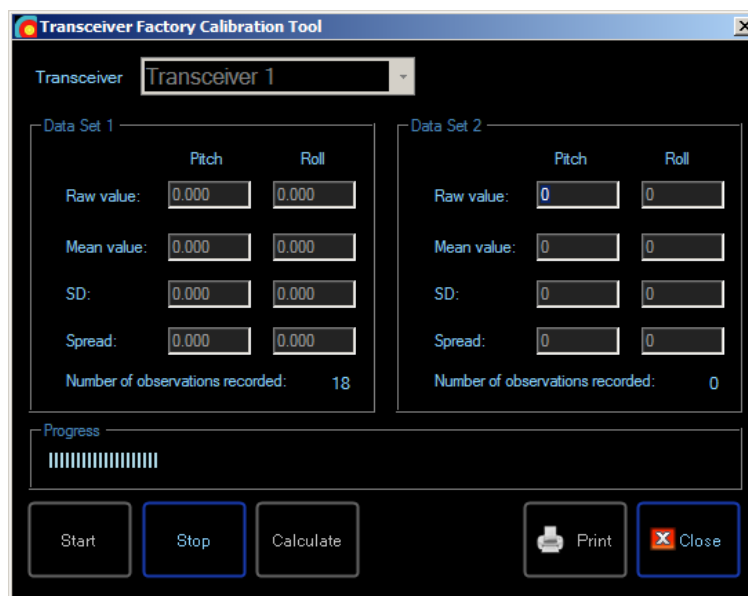
The **Transceiver Factory Calibration Tool** performs a coarse calibration on the internal roll and pitch sensors.

Place the transceiver on a flat and level surface and display the Transceiver Factory Calibration Tool and follow the instructions below.

1. Click **Start**.

The transceiver takes and stores a series of measurements from the internal roll and pitch sensors.

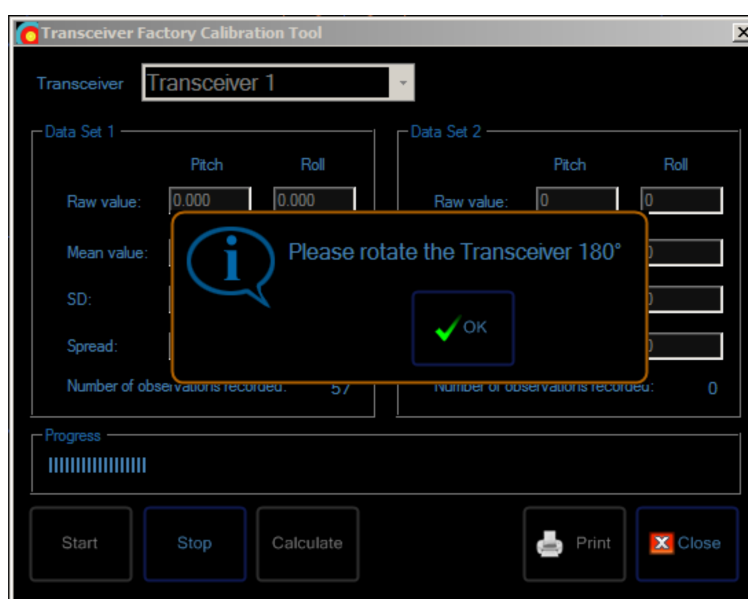
2. Turn the transceiver through 180° when prompted.



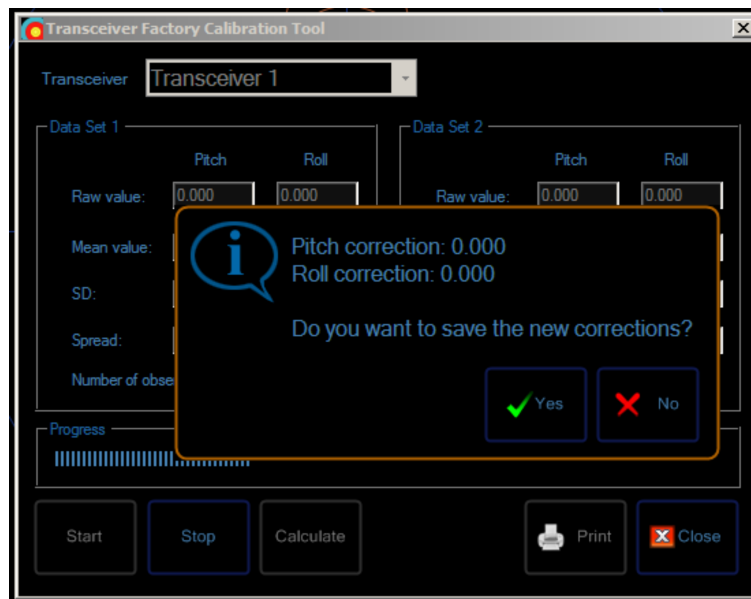
3. Click **OK**.

The transceiver takes another series of measurements from the internal roll and pitch sensors. A progress bar shows progress of the calibration.

On completion of the measurements, the calibration details are displayed.



- Click **Yes** to save the results of the sensor calibration, or click **No** to discard the results.



Note

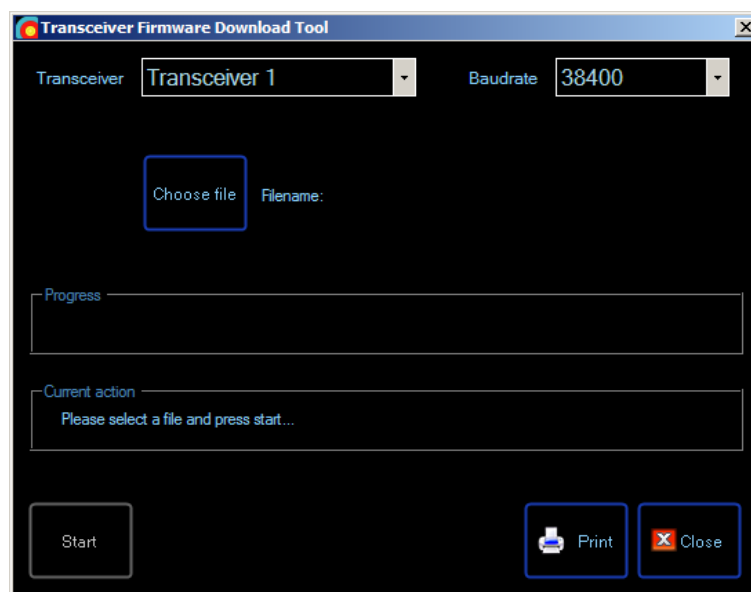
 You can choose to export the results of the internal sensor calibration (see *Section A.10.13.3 "Data Export"*).

A.10.12.9 Transceiver Firmware Download

Note

 You can perform these operations only if tracking is off-line.

- Make certain the transceiver is connected to an NSH transceiver port and the NSH is networked into the Marine Computer correctly.
- Add a transceiver device to the system setup of the correct type, and confirm that communications to the transceiver is working correctly
- Select **Tools > Advanced > Transceiver Firmware Download** to display the Transceiver Firmware Download Tool.



- Select the correct **Transceiver** and then set the **Baudrate** to use for the firmware download.

Note

 **Higher baudrates will allow a faster download. However, you should consider that vessel's wiring can sometimes cause communication errors at higher baudrates.**

- Click **Choose file** and select the file to download.
- Click **Start** to begin the download.

A progress bar shows the download progress. The download will take approximately 15 minutes at 38400 baud, and proportionately longer at lower baudrates.

Notes

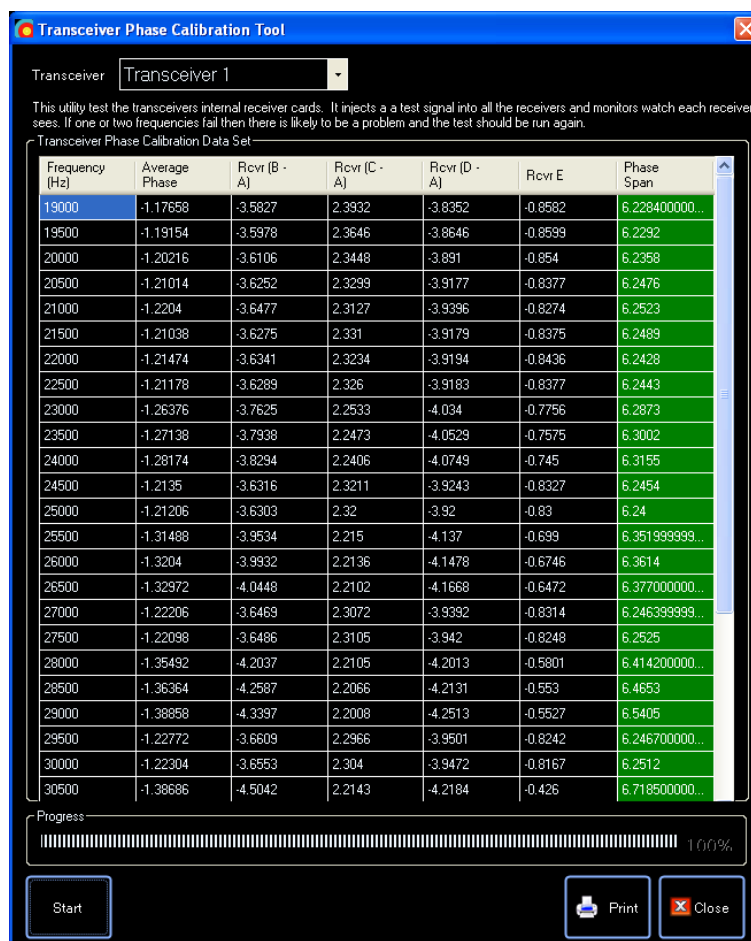
 **If the download fails, try again using a lower baudrate. Avoid using the PC for other purposes while the download progresses.**

- Return to the System Setup for the transceiver and click **Set All**.
- Confirm the firmware version is now set to the new version you have downloaded.

A.10.12.10 Transceiver Phase Calibration

The Transceiver Phase Calibration test tool is available only when all beacons are offline and set to not tracking.

To perform a transceiver phase calibration test select **Tools > Advanced > Transceiver Phase Calibration** from the menu.



This tool tests the transceiver's internal receivers by injecting a test signal across a range of frequencies, and measuring the differences (using receiver A as the reference). The results are shown with a colour coding:

- red indicates a large difference (typically more than 8 degrees).
- green indicates a small differences.

If only one or two frequencies fail, it is unlikely that there is a problem because the test can be disturbed by external noise. In this case, repeat the test to try to gain a successful result.

The system runs this calibration test automatically at 15 minute intervals, and sends warning messages if a problem is detected. You should use this tool if you suspect there is something wrong with the transceiver.

A.10.12.11 Acoustic Synchronization

The Acoustic Synchronization tool allows you to synchronize all the acoustic signals transmitted by the system to reduce or avoid interference with other acoustic systems operating on the vessel.

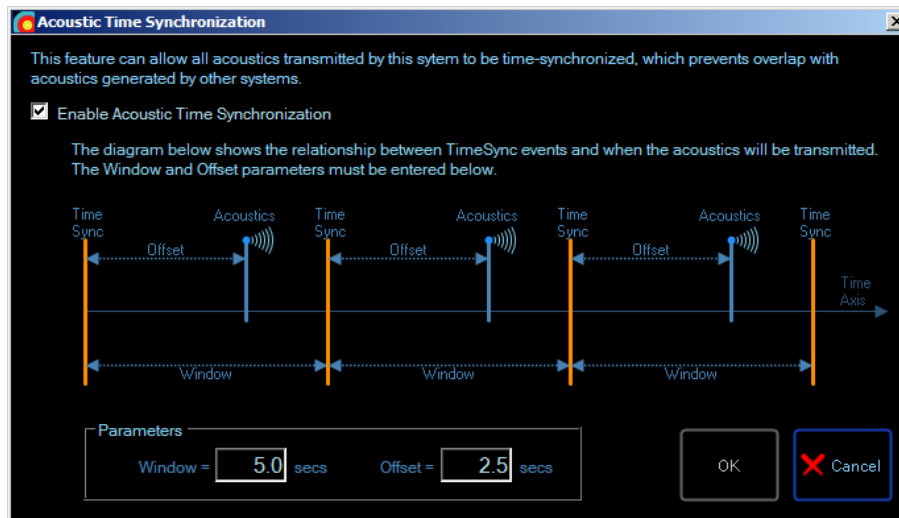
The **Window** parameter sets the interrogation rate to be used on this system. Generally, all synchronised systems should use the same **Window** width. The **Offset** parameter allows control of where one system transmits with respect to the others so that signals do not collide in the water. There are several strategies that can be used to select the most appropriate **Window** and **Offset** times to use. The most appropriate strategy depends on the application, and the requirements of the operator. The three main strategies are:

1. Keep the interrogation signals from all systems close together, leaving a large space until the reply signals arrive. In deep water, setting the **Window** on all systems to 5 s, and staggering the **Offset** by 0.2 s or 0.5 s can work well. This is a straightforward, low risk approach. In some applications it is preferred to have data from the independent systems spread out in time as evenly as possible.
2. Estimate how long an acoustic cycle will take, and set the **Window** to at least twice this time, and the **Offset** equal to half of the chosen **Window** width. In 1500 m of water, signals take approximately 1 s to arrive at the seabed, and 1 s to return. Add to this the longest turn around time, and the estimated cycle time might be around 3 s. Setting the **Window** to 6 s on both systems in a dual independent system, and **Offsetting** the second system by 3 s would ensure reliable performance, and that there is an acoustic position available every 3 s.
3. Use an offline planning tool to tune TATs, and **Offsets** to achieve fast, interleaved updates.

Sonardyne support can provide further guidance on particular tracking scenarios if required.

Select the **Enable Acoustic Time Synchronization** check box to enable this feature.

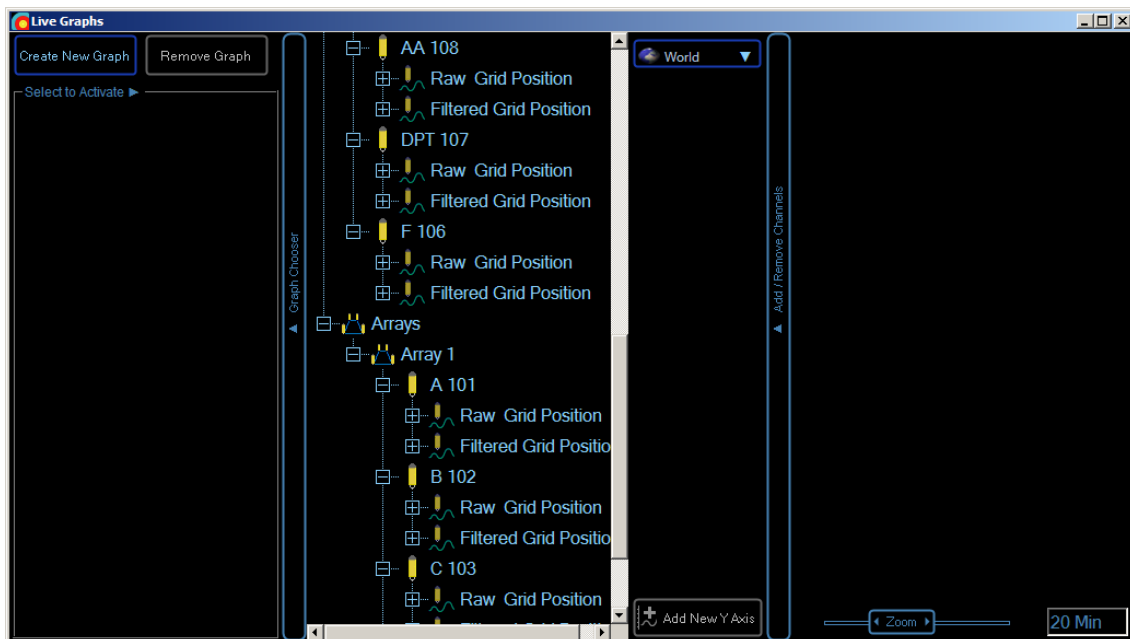
Enter the **Window** time and the **Offset** time to use for synchronization and click **OK**.



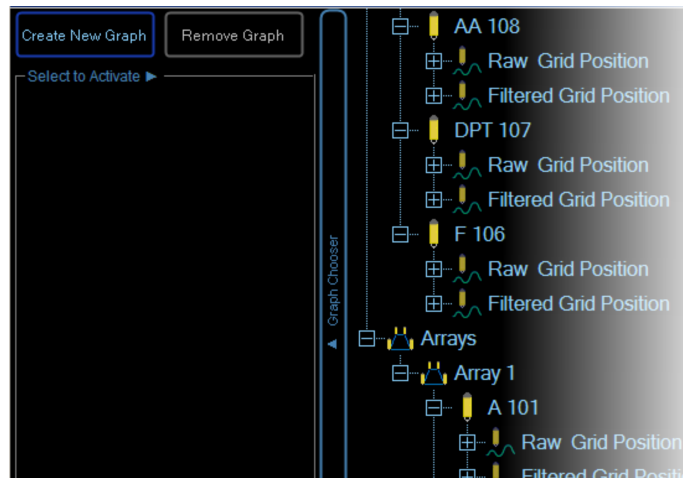
A.10.12.12 Graphs

The software allows you to create live graphs that show the measurements made by objects in the setup. You can select the instrument to use as the data source for a graph, and then you can select the measurements to use for the graph.

1. Select **Tools >Advanced>Graphs** to display the **Live Graphs** window.



2. Click **Create New Graph**.

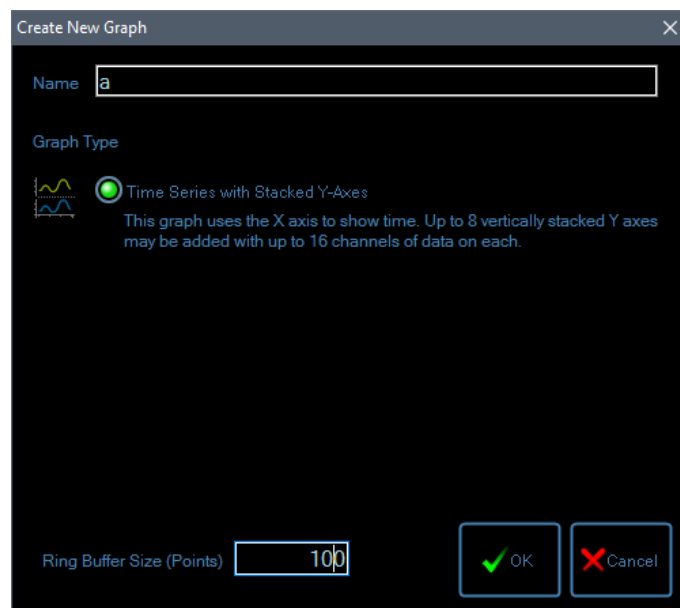


3. Enter a name for the new graph and the size of the graph's Ring Buffer.

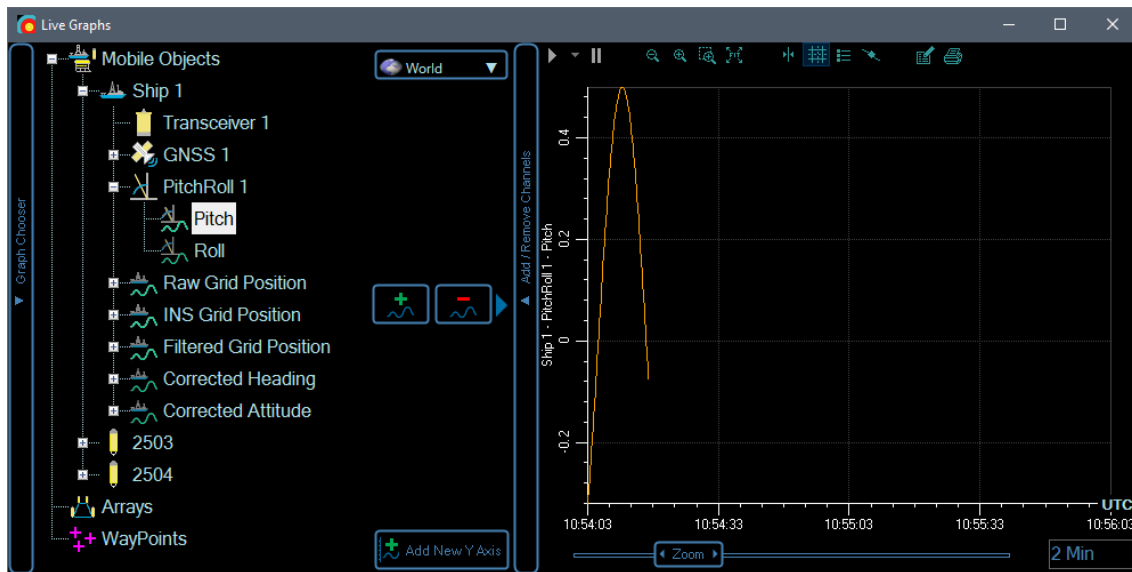
Note



Large ring buffers can appear to make the user interface unresponsive.



4. Select an instrument in the object tree whose measurements you want to use for the graph.
5. Either:
 - a. Click **Add New Y Axis**, or
 - b. Click the **+** button to add an existing Y axis.



Graph Controls:



The graph controls, shown above, are from left to right:

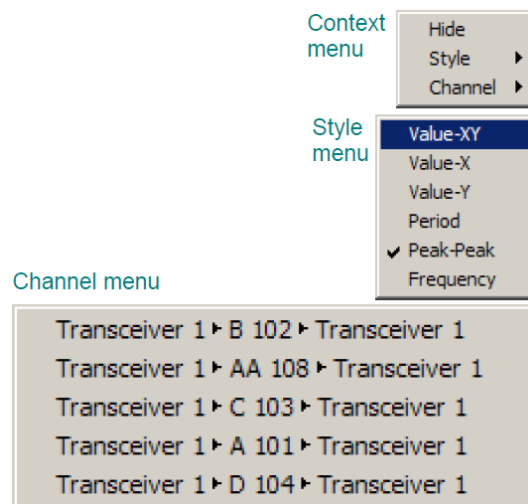
- Play/Resume the plot
- Pause the plot
- Zoom Out
- Zoom In
- Zoom Area
- Zoom to Fit
- Cursor On/Off
- Grid Lines On/Off
- Legend On/Off
- Markers On/Off
- Edit Properties (for advanced users only)
- Print

Cursor:

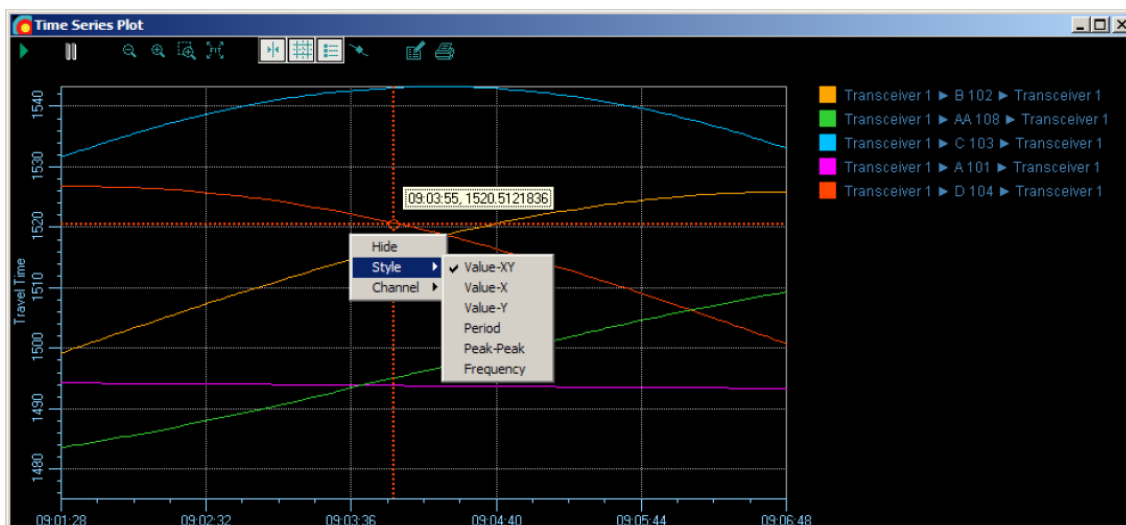
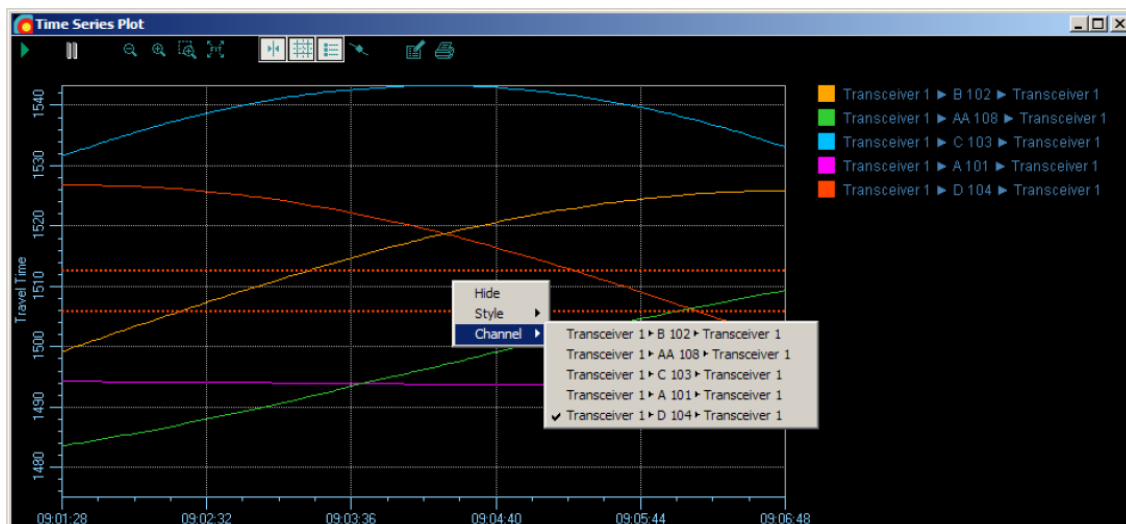
Use the **Cursor On/Off** toolbar button to enable the cursor. Right-click the cursor lines to see the cursor context menu.

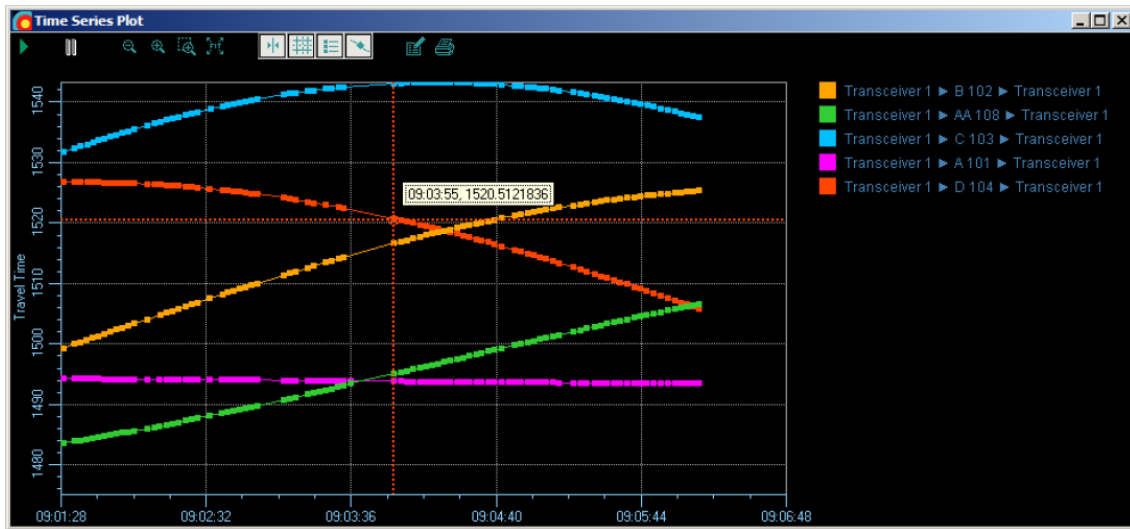
The Style menu allows selection of the type of cursor read-out.

The Channel menu allows selection of the channel to associate with the cursor. Note that the cursor's colour changes to match the selected channel.



shows an example where the acoustic travel times display has been set up with the cursor on channel D104, and the display uses the Value-XY style.





A.10.12.13 NSH Firmware Download

Sonardyne recommends that you use the NSH firmware version appropriate to the system software version; this firmware file is found on the system software release CD/DVD. The NSH firmware is stored in a *.nsh file.

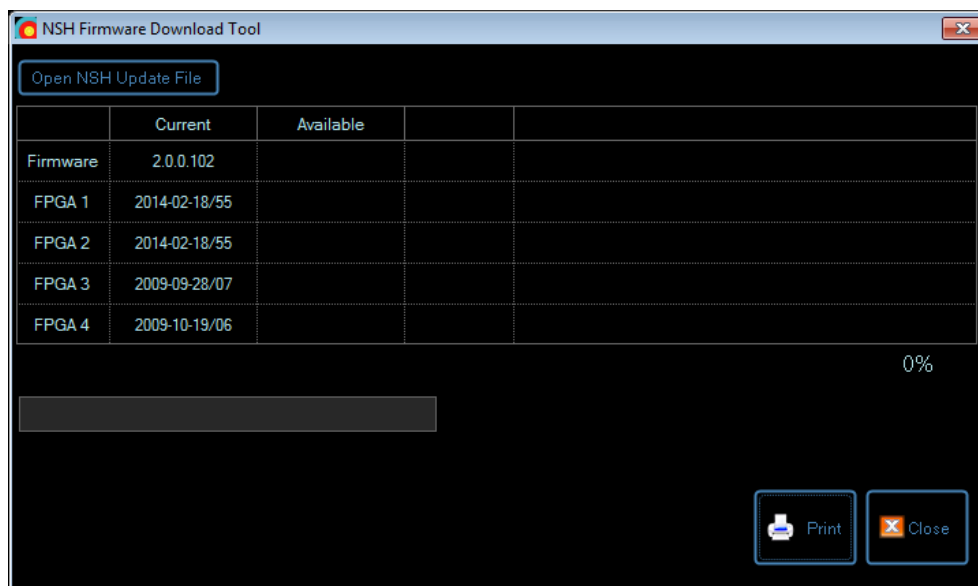
Alternatively, obtain the latest recommended version of firmware from Sonardyne International Limited.

Note



You can only perform these operations if tracking is off-line.

1. Save the .nsh file to the C: drive of the computer that you use to run the software.
2. Make certain the NSH is networked into the Marine Computer correctly.
3. Add an NSH device to the system setup, and confirm that communications to the NSH is working correctly.
4. Click **Tools > Advanced > Transceiver Firmware Download** to display the Transceiver Firmware Download Tool.



5. Click **Open NSH Update File** and select the file to download (the Current and Available firmware file versions are displayed).
6. Confirm that the Available firmware version is newer than the Current firmware version and then click **Download**.
7. A progress bar indicates the status of the firmware download and **Download Complete** is displayed after the installation has completed.
8. Confirm the new firmware version is now installed.

A.10.12.14 Pinger Locator

The Pinger Locator tool provides the ability to detect acoustic Underwater Locator Beacons (ULBs) and display the estimated range and direction. Most ULBs transmit a 10 ms pulse once per second at 37.5 kHz $\pm$ 1 kHz.

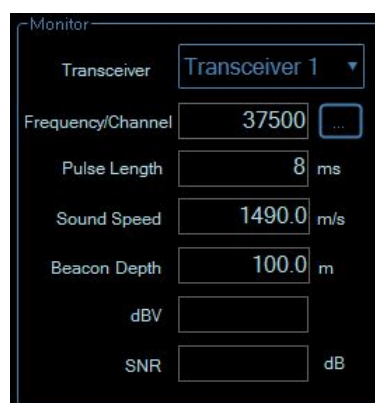


Operating the Pinger Locator

Note

 **All normal USBL tracking must be stopped before starting pinger tracking.**

1. In the **Monitor** pane, enter the **Frequency/Channel** of the ULB or,



- Click ... and select the appropriate beacon type (**AODC** is the default beacon, which also responds on 37.5 kHz).

Monitor

Transceiver: Transceiver 1

Frequency/Channel: AODC A

Pulse Length: 8 ms

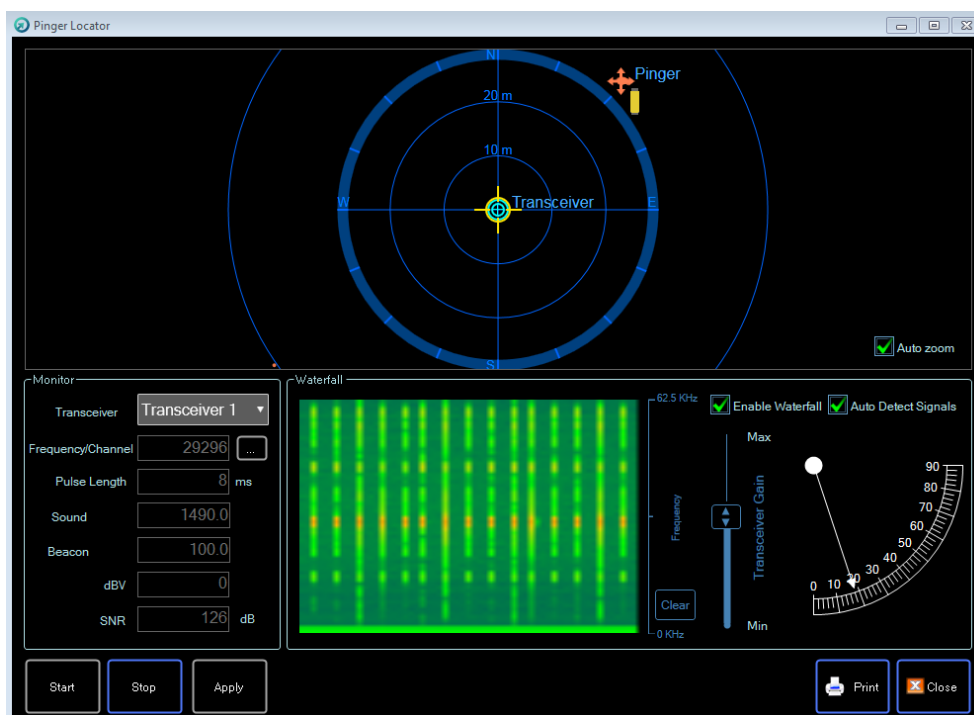
Sound Speed: 1490.0 m/s

Beacon Depth: 100.0 m

dBV:

SNR: dB

- Enter the ULB's transmit **Pulse Length**, the estimated average **Sound Speed** for the location, and the estimated **Depth**.
- Click **Start** to change the transceiver to pinger receive mode.
- When an acoustic ping in the selected frequency band is received, the Pinger Locator plots the elevation angle of the incoming signal (bottom right), and the beacon's estimated range and direction on the top of the chart.



- The **dBV** and **SNR** values give an indication of signal strength and signal-to-noise ratio.
- Use the **Transceiver Gain** slider control to adjust for best dBV and SNR—the gain should be as high as possible without introducing significant false detection (sometimes, it can be helpful to reduce the **Pulse Width** to improve the probability of signal detection, but this comes at the cost of increased false detection).
- Select **Enable Waterfall** to display the moving acoustic noise plot (high background noise will tend to mask the pinger's signal and reduce the SNR value).

9. Select **Auto Detect Signals** to receive a prompt if a significant signal is found in another part of the band (this could be just noise, so the **Transceiver Gain** may need to be reduced to minimise false-triggering).
10. Select **Auto Zoom** on the chart to switch between manual-zoom (mouse wheel) and auto-zoom.
11. Click **Stop** to return the transceiver to normal USBL mode.

A.10.12.15 Remote Instrument Synchronisation

The Remote Instrument Synchronisation tool provides the ability to time-synchronise acoustic beacons to UTC time, for example where an accurately time-stamped data log is required. This is not required for normal USBL tracking operations.

Select the **Select** checkbox for beacons to be time synced.

Remote Time Synchronisation

Synchronisable Beacons

Select	Name		Transceiver to Beacon Time Offsets		Beacon to Transceiver Time Offsets		Last Updated (UTC)	Doppler Compensation
	Prefix	Address	Previous (s)	Current (s)	Previous (s)	Current (s)		
☐		2503						☒
☐		2504						☒

Buttons: Set, Get, Print, Close

Note



It recommended to keep the Doppler Compensation checkbox selected.

Click **Get** to read the beacon time offsets. The **Transceiver to Beacon** and **Beacon to Transceiver Time Offsets** are displayed in the **Current(s)** columns, together with the time stamp in the **Last Updated (UTC)** column.

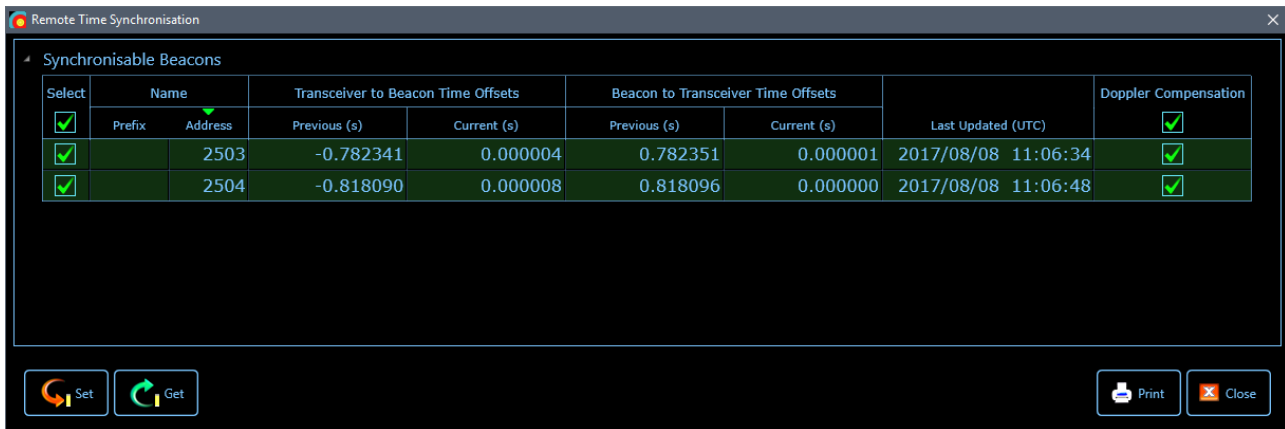
Remote Time Synchronisation

Synchronisable Beacons

Select	Name		Transceiver to Beacon Time Offsets		Beacon to Transceiver Time Offsets		Last Updated (UTC)	Doppler Compensation
	Prefix	Address	Previous (s)	Current (s)	Previous (s)	Current (s)		
☒		2503		-0.787382		0.787390	2017/08/08 11:05:49	☒
☒		2504		-0.813856		0.813859	2017/08/08 11:05:56	☒

Buttons: Set, Get, Print, Close

Click **Set** to synchronise the beacon time clocks to the transceiver time clock (each beacon may take a few seconds to synchronise).

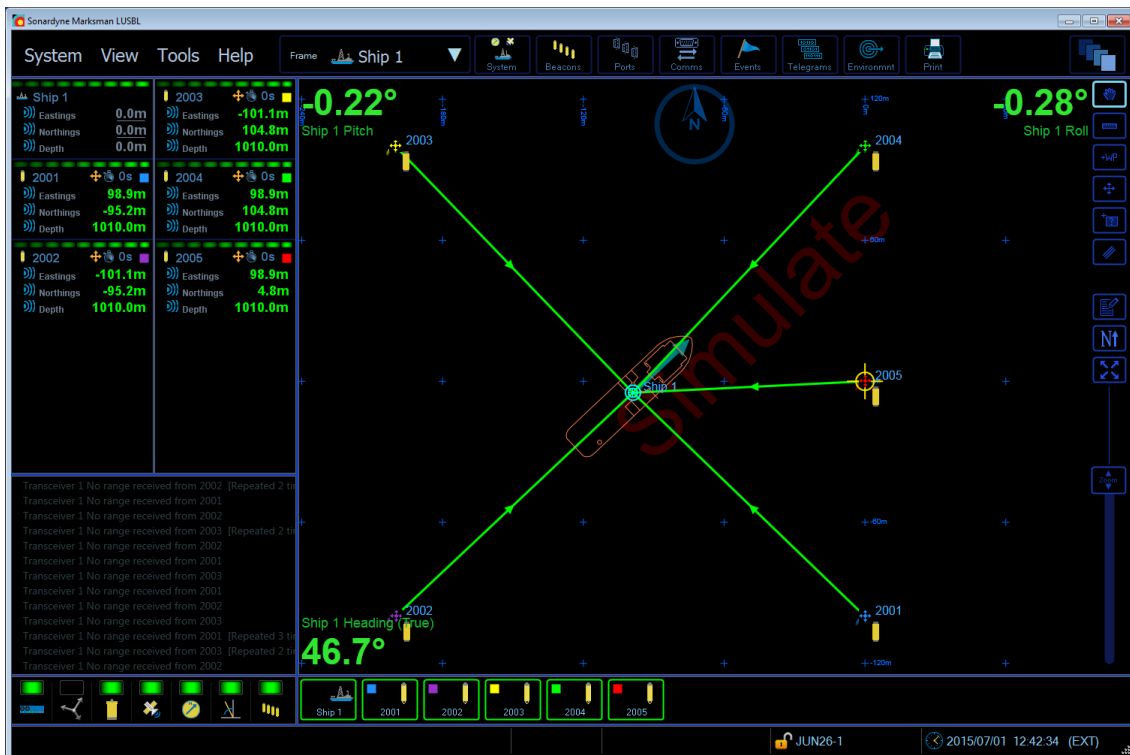


A.10.12.16 Simulate

The built-in simulation mode is mainly used for generating DP test telegrams. For a more sophisticated simulation tool, use a product such as SonSim available from Sonardyne.

Guidance notes

- It is necessary for the transceiver to be on and working. The Scheduler is not given transceivers, and therefore cannot simulate positions, unless the transceivers are operational.
- Regardless of the configuration, only the first transceiver is simulated.
- Beacons remain in their simulated positions regardless of pitch, roll and heading changes.
- At least one beacon must be defined, but does not need to be present. Each beacon is given a simulated position.
- Simulated positions are relative to the transceiver, not to the CRP.
- The current simulated positions are:
 - (100, 100, 1000));
 - (100, -100, 1000));
 - (-100, 100, 1000));
 - (-100, -100, 1000));
 - (100, 0, 1000));
 - (0, 100, 1000));
 - (0, -100, 1000));
 - (-100, 0, 1000));
- There is currently no user interface that allows configuration of the simulated positions.
- All beacons are updated at the update rate of the fastest.



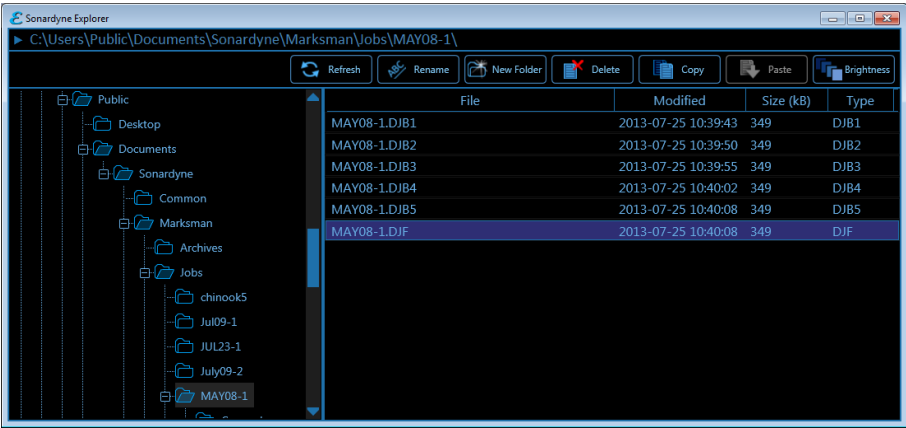
A.10.13 Maintenance

The Maintenance menu allows you to manage data logging, to explore the files, and to import or export set-up files.

A.10.13.1 Explore Files

The software's file explorer quickly navigates the user to the most commonly used system folders. Using this Explorer, the user can:

- **Copy** and **Paste** files between the system folders and removable backup media, such as USB memory sticks.
- **Rename** file, such as exported data files. Note that this option must not be used to rename Marksman system files otherwise unexpected behaviour might occur.
- **Delete** files.
- Create **New Folders**.
- **Refresh** the file list.
- Change the viewer **Brightness**.



A.10.13.2 Logging

The log file system is managed automatically by the software, but the **Logging** user interface allows you to make manual changes, if necessary.

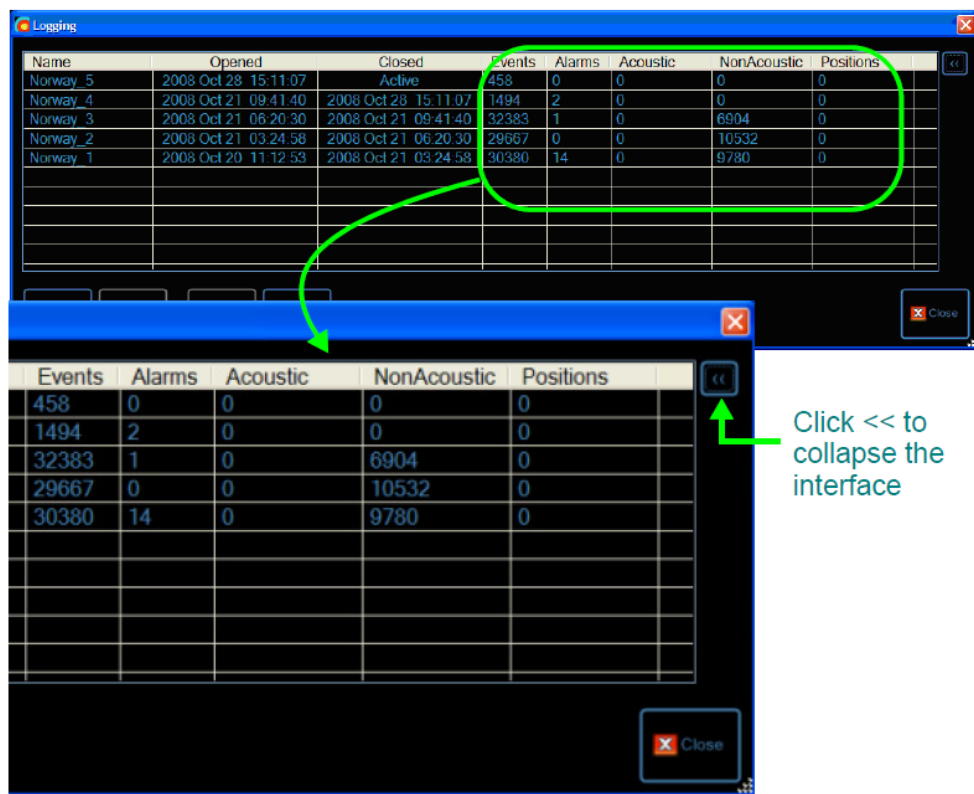
Figure A-2 Logging User Interface



Click >> to expand the interface

The Logging user interface (UI) is shown in *Figure A-2*. It shows a list of the log files, together with details of the dates and times when the files were opened and closed, or their current status. Normally, log files are created and purged entirely automatically without user intervention. Occasionally, operator assistance may be required, but this should be done under the guidance of Sonardyne Support.

Click the >> button (near the top right-hand corner) to expand the interface to show more information about each file, for example:

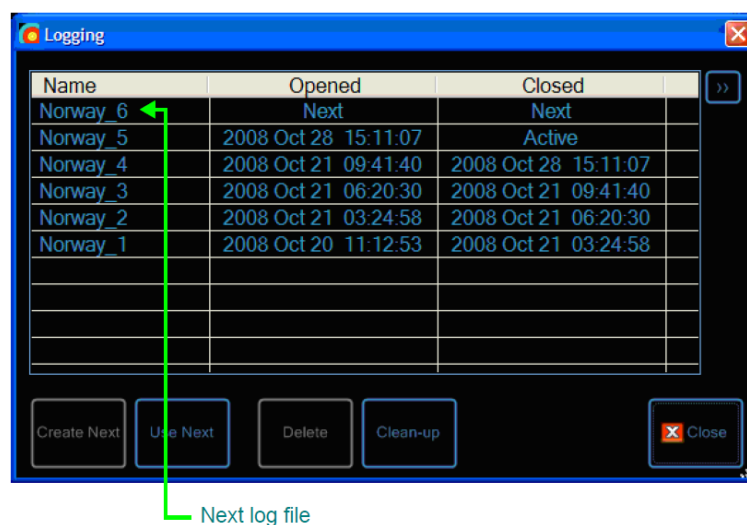


The Logging interface allows the following operations:

- Create Next
- Use Next
- Delete
- Clean-up

Create Next

The **Create Next** button is enabled if there is no 'next' log file already available. Click the **Create Next** button to create the next log file to which the system logs data. The application takes several seconds to create the next log file, after which the display updates, for example:



The status indicator **Next** in the **Opened** and **Closed** columns for the **Norway 6** entry shows that this is the next log file to be ready for use by the system to log data. However, in this example the active file is still **Norway 5**.

After you create the next log file as described, the **Create Next** buttons is disabled and the **Use Next** button is enabled.

Use Next

The **Use Next** button is enabled only if there is a 'next' log file available for use.

Click the **Use Next** button to stop logging to the log file that is currently active, and start logging to the next log file. The Opened and Closed fields are updated, for example:



The **Use Next** button is disabled, and the **Create Next** button is enabled, ready for you to create the next log file.

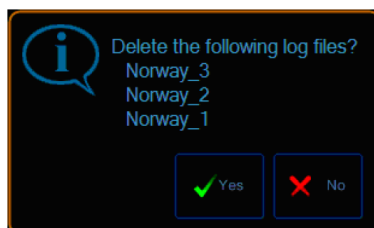
Delete

This option allows you to delete a continuous sequence of one or more log files, always beginning from the oldest log file in the list and ending at the log file you select. The **Delete** button is enabled only when you select a file in the list.

To delete a selection of files, click the most recent file that you want to delete, and click **Delete** to delete the selected file and all log files in the list that are older than the selected file, for example:



The software displays a prompt for confirmation, for example:



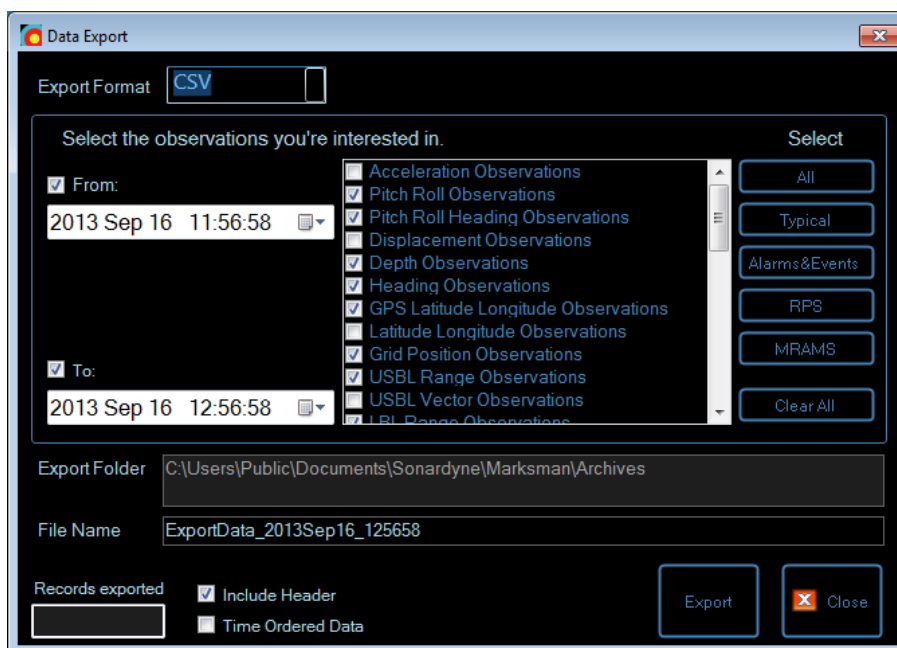
Click **Yes** to confirm the deletion. The interface is then updated to show the new list of log files, and the **Delete** button is disabled, for example:



Clean-up

The Clean-up button starts a house-keeping session that deletes any old log files as specified in the **House Keeping** section of the Options – Logging tab.

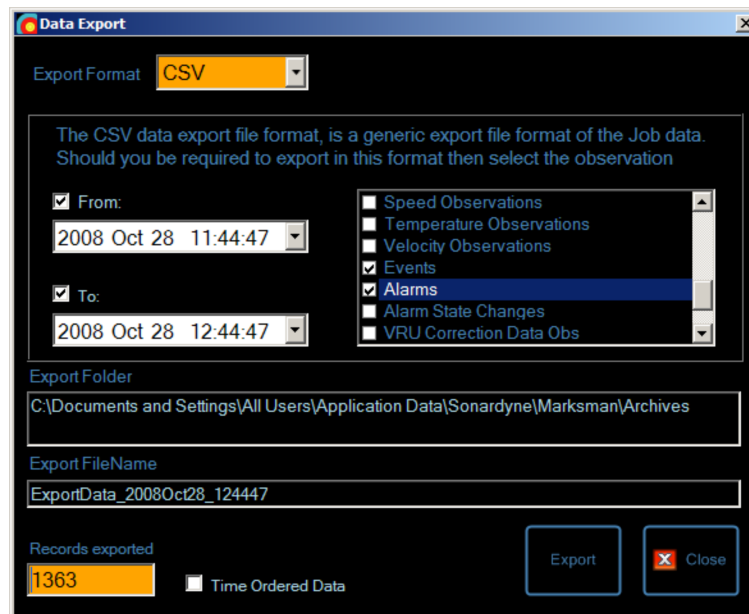
A.10.13.3 Data Export



The data export mode uses **CSV**, which you select through the **Export Format** control on the dialog box.

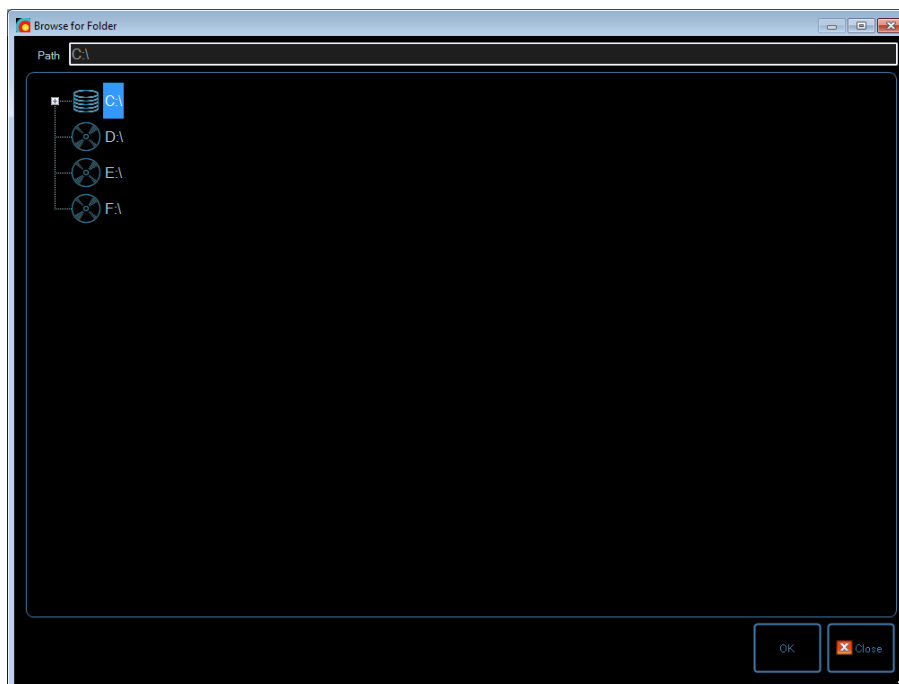
The CSV export mode is a general purpose exporter.

1. Select **CSV** in the **Export Format** control.
2. Set the **From** and the **To** dates between which to export observations.
 - To select all observations after a particular date, set the **From** date and then clear the check box for the **To** date.
 - To select all observations before a particular date, set the **To** date and then clear the check box for the **From** date.
3. Select the observations to include in the export.
4. Click **Export**.



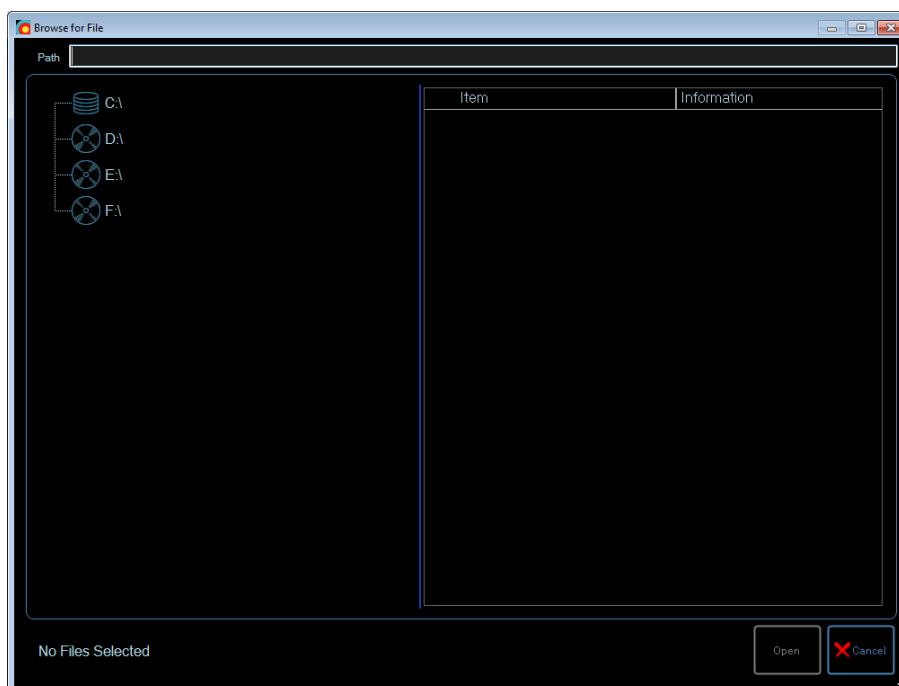
A.10.13.4 Job Export

This option allows you to export the current setup or a job to another system. Use the export dialog box to select a folder or removable device to receive the copied setup file.



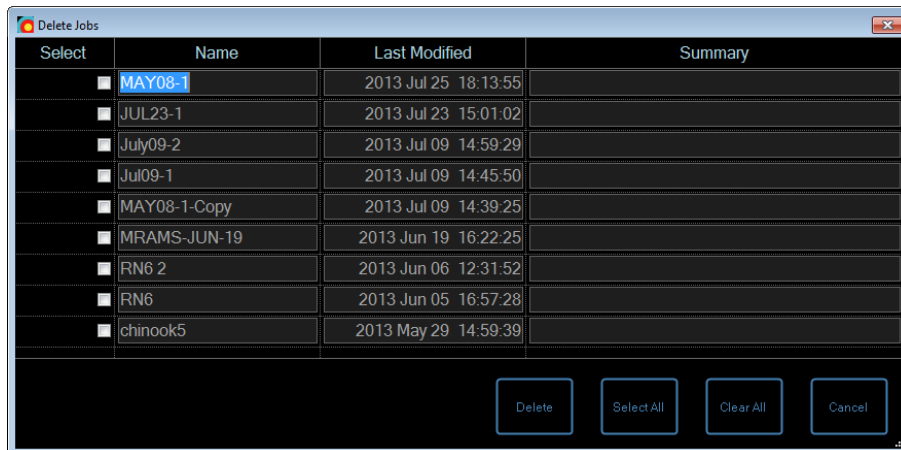
A.10.13.5 Job Import

This option allows you to import a setup or job from another system. Use the dialog box to navigate to a folder or removable drive containing the setup file (.DJF) to be imported.



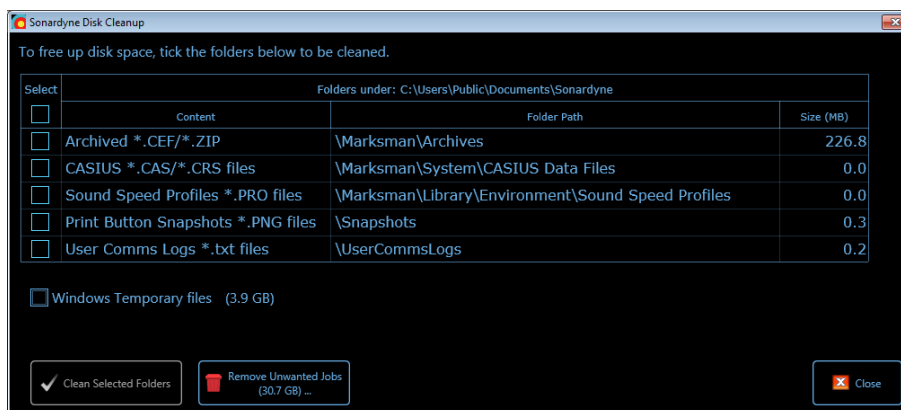
Select the jobs to be deleted, and click **Delete**. A dialog box allows you to confirm the action before the delete occurs.

Select all and **Clear all** allow you to select all the files for deletion, or to select none of the files.



A.10.13.6 Disk Cleanup

This option allows selected folders to be "cleaned", removing the contents from the hard drive to free up space on your PC.



The following folders and their associated file types can be cleaned:

- \Marksman\Archives (Archived .CEF/.ZIP files)
- \Marksman\System\CASIUS Data Files (.CAS,/.CRS files)
- \Marksman\Library\Environment\Sound Speed Profiles (.PRO files)
- \Snapshots (.PNG files)
- \UserCommsLogs (.txt files)

Select the content you want to delete or select the top check box to select all and then click **Clean Selected Folders**.

Windows temporary files can be "cleaned" by selecting **Windows Temporary files** and then clicking **Clean Selected Folders**.

Deleting Jobs



To delete unwanted saved jobs, click **Remove Unwanted Jobs**, select the job to be deleted and then click **Delete**. A dialog box allows you to confirm the action before the delete occurs.

The Remove Unwanted Jobs button displays the file size of all saved jobs.

Note



Take care not to unintentionally select and delete the current job.

A.10.14 Options

The **Options** menu contains the **General**, **Chart** and **Menu** items.

A.10.14.1 Options > General (Options)

The **General(Options)** dialog box contains the **General**, **Logging** and **Acoustic** tabs.

A.10.14.2 General Tab

Main chart options:

- Select **Show raw acoustic positions** to see the unfiltered position points.
- Select **Show...the following vessel** to choose the primary vessel for the display chart.

Position Display Formats

- Select **World Frame** to choose **UTM** or **Latitude/Longitude**
- Select **Relative Frame** to choose **East/North/Depth** or **Range/Bearing/Depth**

INS Tracking Options

- Select **Show Error Ellipse** with **Scale Factor** to display an error ellipse with a defined multiplication factor scale.

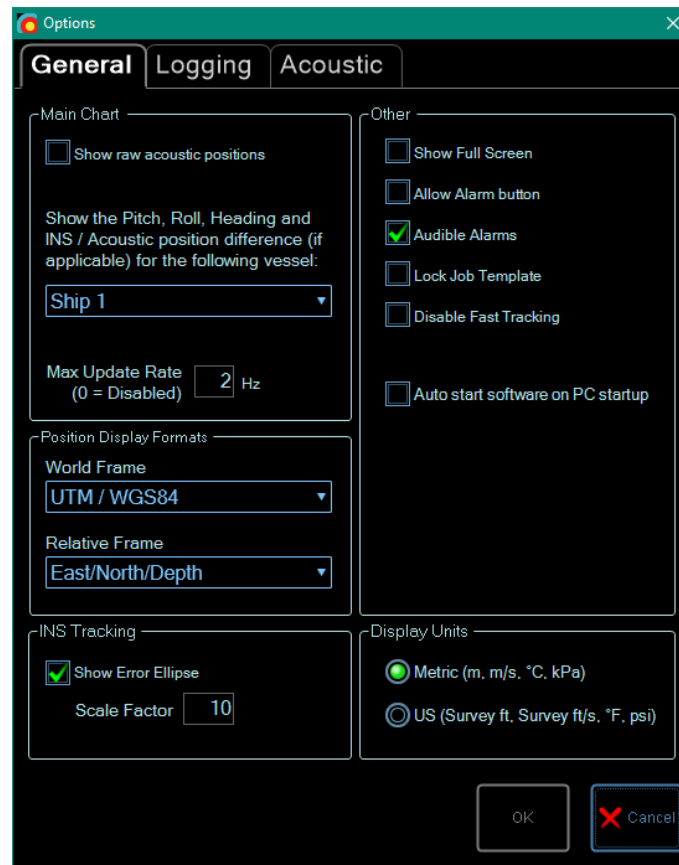
Other Options

- Select **Show Full Screen** to remove the Windows title bar.
- Select **Allow Alarm Button** to display the on-screen alarm button.
- Select **Audible Alarms** to enable the alarm audio output.
- Select **Lock Job Template** to protect the job template containing the installation data.
- Select **Disable Fast Tracking** to stop interleaved ranging cycles (ping stacking); the system will send a command and wait for a response before sending another.
- Select **Auto start software on PC startup** to automatically start the software when the PC starts.

Display Units

Select Metric to display all measurements in SI units.

Select US to display in US survey feet, degrees Fahrenheit, and so on.



A.10.14.3 Logging Tab

Normally, you should leave the data logging options in their default settings. Refer to Sonardyne for advice before changing settings.

To keep logged data for:

- 1 week – set **Housekeeping Offline** to 168 with **Change Log File** at 1 hour.
- 1 month – set **Housekeeping Offline** to 720 with **Change Log File** at 1 hour.

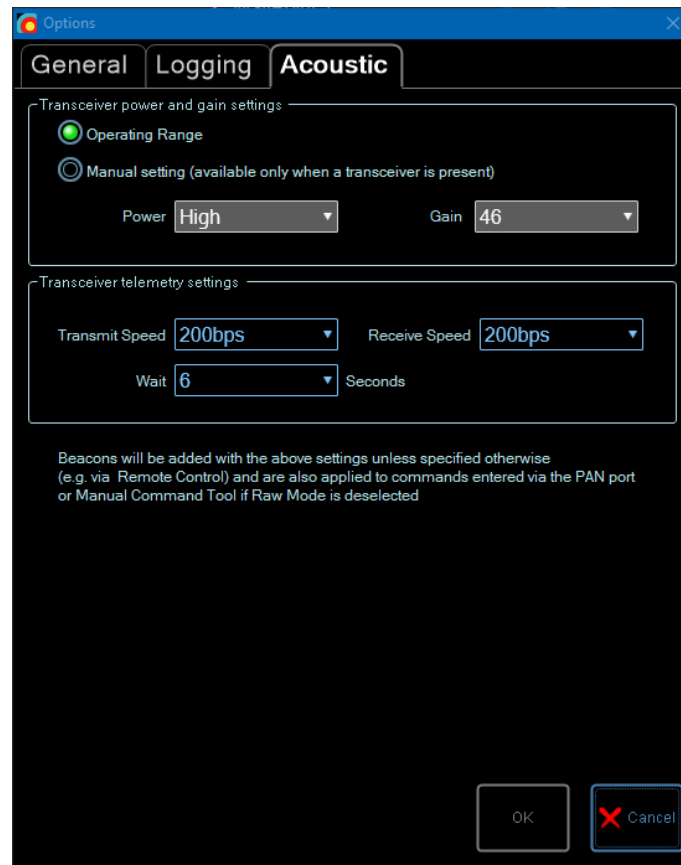


A.10.14.4 Acoustic Tab

Transceiver Power/Gain

When using Beacons Table Add Beacon, QuickTrack, 6G Discovery or Remote Control, beacons are added with default transceiver power and gain levels, unless specified otherwise.

1. Select **Operating Range** to have the system select the best power and gain according to the maximum range set, or
2. Select **Manual setting** to set the power and gain with specific values.
3. Set the default **Transmit Speed**, **Receive Speed** and **Wait time** for robust telemetry, according to the vessel conditions and requirements of the job.



A.10.14.5 Options > Backdrop

A chart backdrop may be used to reference the positions of vessels or beacons to seabed assets or topography.

Backdrop image files must be of type DXF. Ensure that the following actions are applied and confirmed for DXF files:

- contents must be exploded into polylines, (all splines and curves; ellipses should become polylines).
- all visible layers must be collapsed to a single layer.
- all hidden layers must be removed (document markups).
- shape orientation must be bow up.
- the (0,0) point of the shape must be at the centre of the shape (default).

Select the appropriate backdrop from the named list and click **Apply**. Select **None** to work without a backdrop.

Multiple backdrop files may be **Imported** and stored on the system.

The DXF backdrop should normally have its Easting/Northing origin already defined, but an **Offset** may be applied if necessary.



A.10.14.6 Options > Chart

See Section A.3.1 "Chart Properties".

A.10.14.7 Options > Menu

The Menu dialog box allows you to customise the Main UI menu. Clicking a menu item allows you to show or hide that item in the Main UI. If the menu has a corresponding toolbar button then it will also be shown/hidden as appropriate.

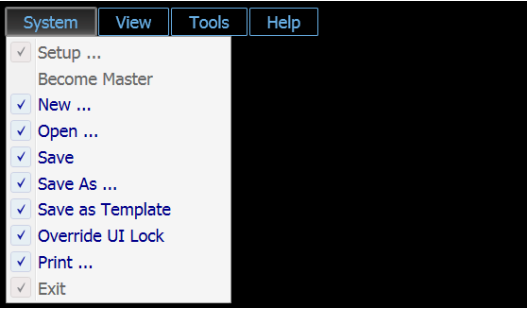


The four menu items are shown expanded below.

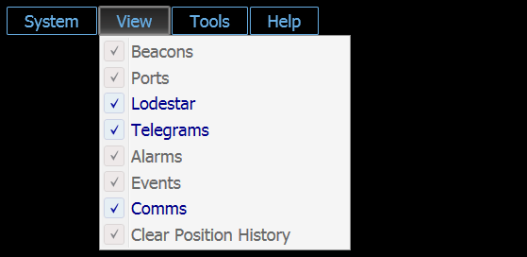
Note

 **Menu items displayed below are dependent on the product and options purchased.**

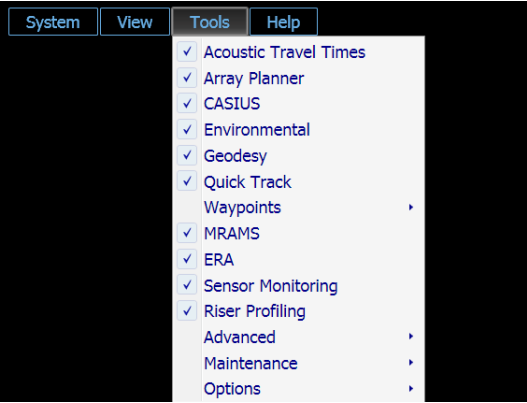
A.10.14.8 System



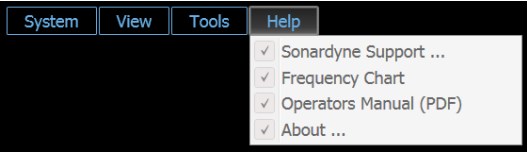
A.10.14.9 View



A.10.14.10 Tools



A.10.14.11 Help



Note

 When a system is upgraded to include new features, the new menu items must first be enabled (selected) in this menu to enable them to appear in the Main UI.

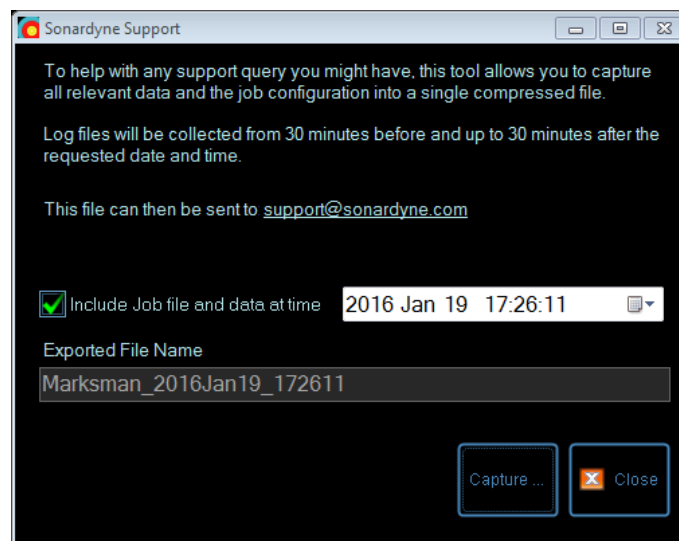
A.11 Help Menu

The **Help** menu options are described below:

A.11.1 Sonardyne Support

This option allows you to export relevant data and configuration to a compressed file, so that you can send the file (.CEF extension) to Sonardyne as part of a support request.

1. Select the date and time the event occurred and then click **Capture...**
2. Browse to the desired folder for the output file and then click **OK**.
3. A support log file will be created containing logged data from 30 minutes before to 30 minutes after the target time. The support log file can be sent to Sonardyne Support for analysis.



A.11.2 Frequency Chart

The frequency chart can be referred to for guidance on optimising USBL accuracy vs. range and avoidance of other acoustic systems operating in the vicinity (see *Figure 5-1 "Sonardyne Frequency Chart"*).

A.11.3 Operators Manual

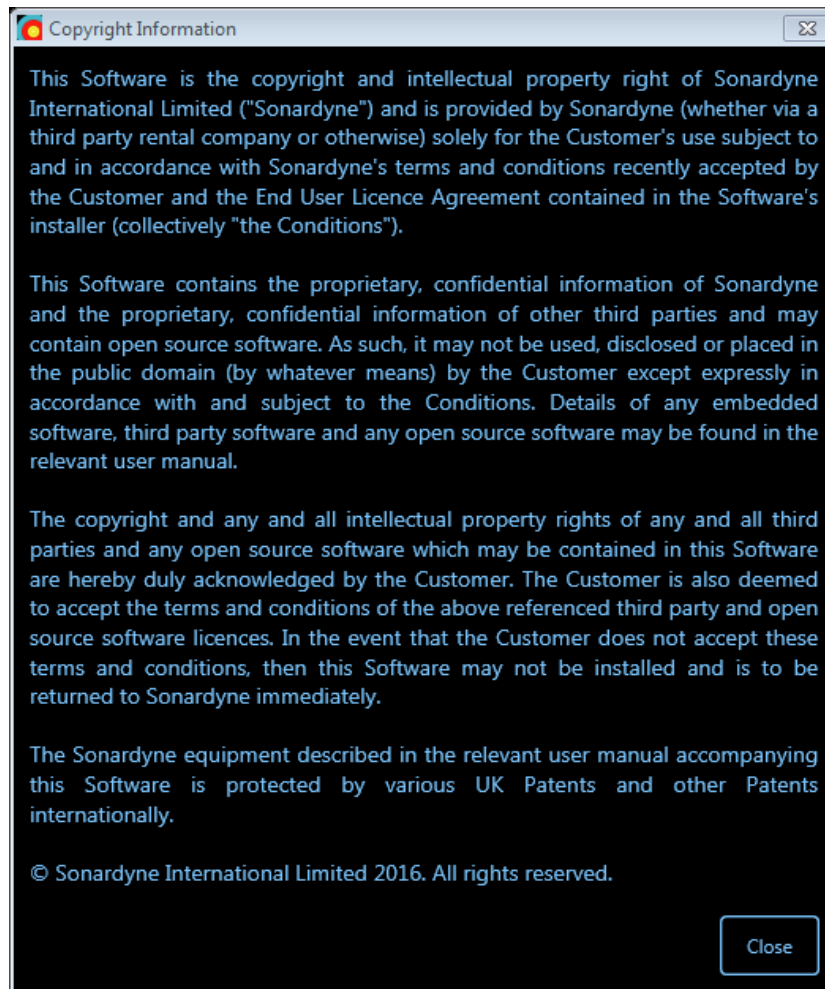
This option opens the User Manual (this manual) so that you can refer to it easily.

A.11.4 About

This option displays information about the system options which the security key has enabled, the primary software version number and the copyright statement. A detailed copyright notice is also provided.

If you experience a problem with the software, make a note of the version number on this dialog and supply this information to Sonardyne International Limited when you report the problem.

Contact Sonardyne International Limited for advice and information about updates to the software.



Appendix B – System Integrity

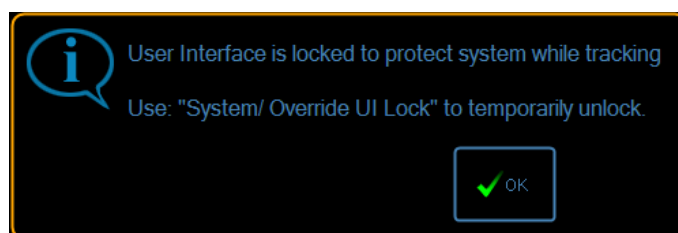
B.1 UI Lock

B.1.1 Overview

A system setup can be locked to prevent accidental changes being applied. Depending on the product and the settings in the security key, a User Interface Lock may be provided. If **Override UI Lock** is present in the **System** menu, this feature is enabled as shown below.



When UI lock is enabled, any user changes to the setup while the system is tracking are blocked, and the following warning is displayed:



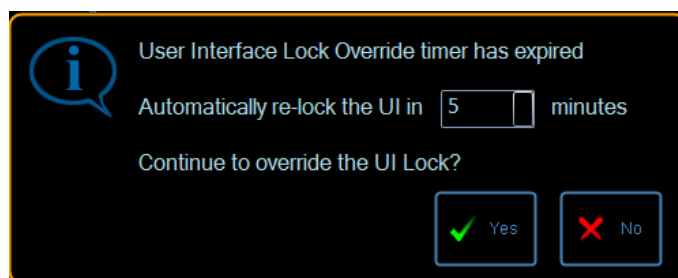
Note

 This feature replaces the previous Beacons Table locking scheme.

B.1.2 Override UI Lock

If a change in the setup has to be made while tracking, the UI lock can be temporarily unlocked for 1, 5 or 10 minutes. To override the UI lock:

1. Select **Override UI Lock** in the **System** menu.
2. Select the **Automatically re-lock the UI** time period from the drop-down list.
3. Click **Yes** to override the UI lock or **No** to cancel.



B.2 Sonardyne Resource Monitor

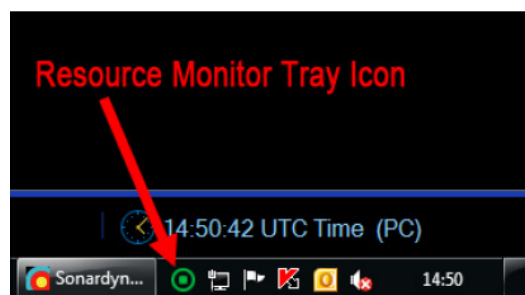
B.2.1 Overview

To help protect the system integrity, the system includes a system Resource Monitor which continually checks for correct operation. If it notices a trend that might lead to degraded operation, it issues warnings, and restarts the system if necessary.

B.2.2 General Operation

When the system starts , it automatically starts a background process called **_SN_ResourceMonitor.exe**.

This process continuously monitors and logs the system resources used (typically Memory, Handles, Threads and CPU usage). The Resource Monitor is visible in the Windows System Tray as shown below.



The Resource Monitor is controlled by a file that specifies the resources and processes to monitor, together with as some resource trip thresholds. There is a warning and severe trip threshold for each resource type:

1. **Warning.**

If the Resource Monitor detects any processes resources are beyond a warning threshold, it displays the following:



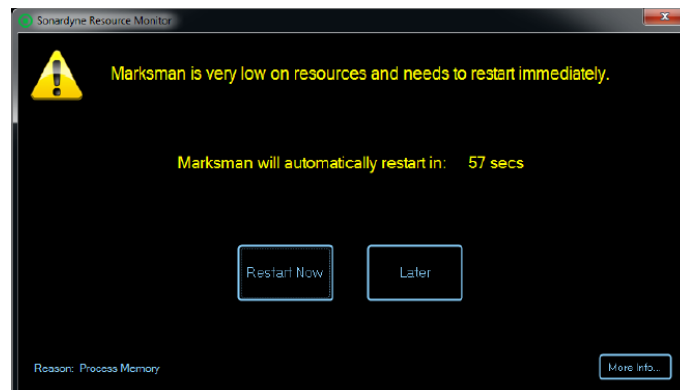
This it means that the system is using resources well above its normal levels. The system will probably still continue to run, but might encounter problems later on.

The user may either click:

- **Restart Now** – the system will completely restart.
- **Later** – the system will continue. If the resource issue has not disappeared, then the above dialog will return after a specified time (default = 60 seconds).

2. **Severe.**

If the Resource Monitor detects any process's resources are beyond a severe threshold, it displays the following, and sounds an alarm.



In this case the system is almost certainly not functioning correctly because resources are running extremely low.

This dialog box shows a restart counter, which starts at 60 seconds. If the timer expires, it behaves as if you clicked the **Restart Now** button (that is, it triggers a full system restart).

If you click the **Later** button, then the timer is cancelled and the system is allowed to continue. If the resource issue has not disappeared, then the above dialog will return after a specified time (default = 60 seconds).

In addition to resource threshold checking, the Resource Monitor also periodically logs the resource usage of all system processes to a file (typically every minute). The logged data can subsequently be examined if necessary using the Perflog Viewer tool.

B.2.3 Resource Monitor Warning Actions

In normal operation, Resource Monitor warnings should never be seen. However, if this happens:

1. Click on **More Info** on the Warning dialog and take a note of the text.
 - If other applications are running on the same computer, it is quite likely that these are causing the problem. Shut down any unauthorised applications.
 - Check whether the resource warning occurs for a particular user operation. Running several complex commands together may lead to low resources.
2. Get a CEF file using the **Help>Sonardyne Support** tool.
3. Report the problem and send the CEF to Sonardyne Support.

Appendix C – Installation

C.1 Introduction

Note

 This software is supplied under licence for use with Marksman, Ranger 2 USBL/Survey/DP systems only. This software is the intellectual property of Sonardyne International Limited and is subject to the usual copyright restrictions.

When Sonardyne supplies the computer, Sonardyne installs the latest released version of the software on the Navigation Processor before shipment of a system. It is not necessary to install the software on the system before you begin to use the system.

The software installation instructions allow you to re-install the software if necessary, or to upgrade the software to a later release.

When the software is running, Click **Help > About** in the menu bar to see information about the version number of the installed software. Contact Sonardyne for upgrade details.

C.2 System Installation

Note

 Risk of equipment malfunction or interference with other systems. This system has been carefully designed to comply with the relevant Electro-Magnetic Compatibility (EMC) standards for marine use. In order to maintain EMC compliance, the system must be installed according to the Sonardyne User Manual and only Sonardyne approved parts may be used. Use of unapproved parts, such as unscreened cables, may put EMC compliance at risk. Please contact Sonardyne Support for further guidance.

This section is concerned with all aspects of installing the hardware of a typical system. Sonardyne ships the system with the most recent released version of the software already installed on the Marine Computer.

Inevitably, because of the nature of applications that use L/USBL systems, each installation is likely to be unique and characterised by its own specific set of difficulties and special requirements. The guidance included here can therefore only be of a general nature.

If necessary, contact Sonardyne for advice if your specific installation configuration raises some special obstacles to achieving a successful deployment.

C.2.1 Hardware Requirements

Marksman/Ranger 2 recommended computer hardware specifications are shown below.

Item	Minimum Specification	Recommended Specification
CPU	i5 2.8 GHz	i7 2.8 GHz
Memory (RAM)	8 GB	8 GB
Hard Drive	240 GB SSD or Hard Disk Drive	500 GB SSD
Graphics	32-bit colour, Direct-X V10 or later	32-bit colour, Direct-X V10 or later
Monitor Resolution	1280 x 1024	1920 x 1080
USB Ports	4	4
Operating System	Windows® 10 Professional x64	Windows® 10 Professional x64

C.2.2 Navigation Processor

Navigation Processor is the term used to describe the top-side equipment comprising the following units:

- The Navigation Sensor Hub (NSH)
- The Marine Computer
- The LCD touchscreen
- A combined mini-keyboard and touchpad

In practice, it is usually necessary to consider only the hardware installation requirements. Software installation is necessary only if a later revision of that software has been supplied by Sonardyne, or if reinstallation of the supplied software version is required for any reason. If it becomes necessary to install or upgrade the software, see *Section C.8 "Software Installation"* for more information.

C.3 Hardware Installation (Rack Mount)

To install the hardware you must first install the Marine Computer and the NSH and interconnect them using the supplied cables.

C.3.1 Before you Begin

Take the following steps before you begin to install the hardware of the Navigation Processor:

- Identify a suitable location for the Marine Computer and the NSH where they can be installed near to each other.

Note



It is recommended that hardware installations are located at least 10 metres from any VHF radio antennas operating in the 156–165 MHz band.

- Ensure the installed location provides good ventilation for both units.
- For a fixed installation, you should ideally used a 19-inch rack.
- For transportable installations, select a location for both units on a secure desk or bench that allows convenient connection of power and data cables without causing a hazard or obstruction to users or to other personnel in the area.
- Ensure the installation location does not subject either of the units to extremes of vibration, temperature or humidity.
- Secure both units against movements of the vessel.
- Ensure there is a convenient ac power outlet near to the installed location, and sufficient space at the back of both units to allow easy access for connection of the power and signal cables and to operate the main power switches on the backs of both units.

Note



It is recommended that ac power feeds are clean and stable, and are suitable for use with IT equipment. If in doubt, then an external surge suppressor conforming to UL1449 (or equivalent) must be installed.

C.3.2 What you will Need

You will need (as a minimum) the following items and tools to complete the installation:

- IEC power cables (ideally locking) for connection to the rear panels of the NSH and the Marine Computer. The cables are supplied as standard with a 3-pin UK-style fused electrical plug and are also available with either a Euro or a US mains electrical adaptor if requested.
- A monitor cable to connect the monitor to the Marine Computer.
- An Ethernet cable to provide an interface between the Marine Computer and the NSH.
- A USBL transceiver cable to provide an interface between the transceiver and the NSH (see *Figure D-4 "USBL Transceiver Cable – CPN 820-6484/DWG 8020-069"*).
- A yellow primary USB security key; see *Section C.8.1 "Security Keys"* for more information. The system will not operate without this key.

C.3.3 Installation

Follow the steps below to install the NSH and the Marine Computer.

Note

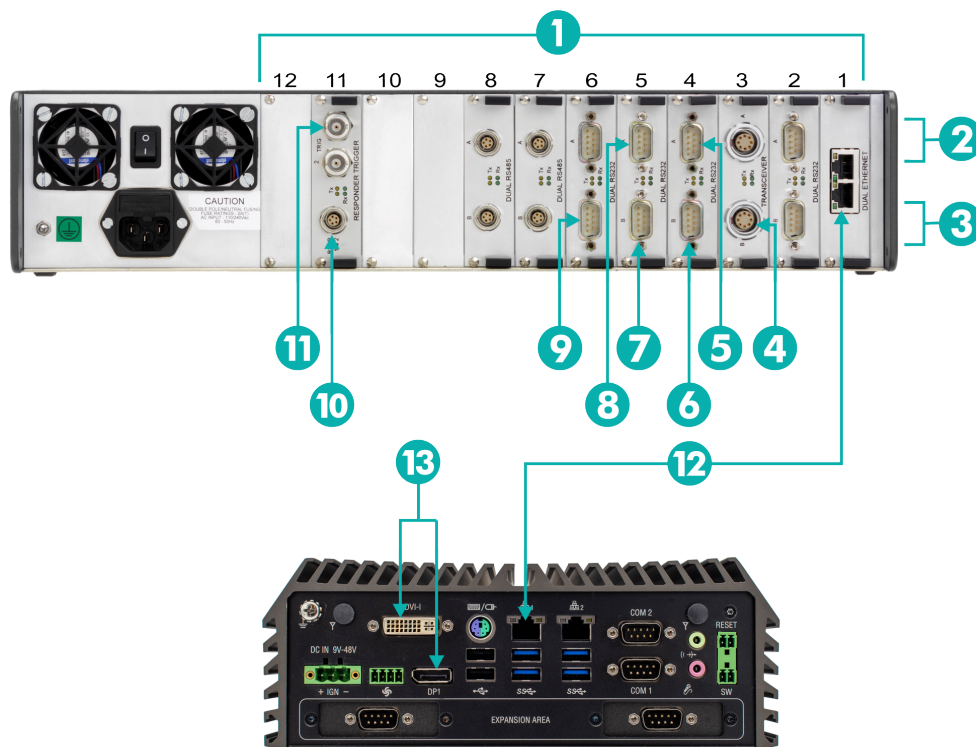
If the Marine Computer is replacing a previously installed Navigation Computer, the security key must first be removed from inside of the Navigation Computer; see *Appendix M*.

1. Ensure the power to both units is turned off.
2. Secure the NSH and the Marine Computer at the locations you have selected for them.
3. Make the connections to the NSH as required within your system; see *Figure C-1* below.

Note

Figure C-1 does not show the power connections to both units. The NSH rear panel arrangement and serial connections required within your installation may be different from those shown. See *Section C.3.4 "NSH Interface Card Details"* for instructions to install additional interface cards.

Figure C-1 Typical Interconnections - NSH and Marine Computer



Item	Description
1	Card Slots
2	Port A
3	Port B
4	Connector to USBL Transceiver. Cable details depend on type of system (see the note below).
5	Serial Input: GNSS Time/Position
6	Serial Input: Depth Sensor
7	Serial Input: VRU
8	Serial Input: Gyrocompass
9	Serial Output: External Client or Navigation System
10	Output Trigger to Responder
11	Input from GNSS Receiver: 1 PPS Synchronisation Clock.
12	Ethernet Cross-over Cable: NSH to Marine Computer
13	Monitor (DVI-I/Display Port)

Note

 **Details for the transceiver cable from slot 3 on the NSH depend on whether the system is portable or rack-mounted:**

- **If the system is portable, the cable will be terminated with a suitable connector to be attached to the main cable from the USBL transceiver.**
- **If the system is rack-mounted, the cable will have open tails for connection to the vessel's junction box or a terminal strip in the rack.**

Refer to the cable drawings in *Appendix D "Interface Cables"*.

- Connect the two IEC connectors on the supplied ac power cables to the IEC electrical power inlets on the rear panels of both units.
- Connect the mains electrical plug on each power cable to a convenient electrical supply outlet.
- Connect the supplied Ethernet cable from a network connector on the Marine Computer to the lower Ethernet port (Port B) in slot 1 at the rear panel of the NSH; see *Figure C-1*. This cable can be connected either way around.
- Connect the Lemo end of the supplied USBL transceiver cable to Port A in slots 3, 4 or 5 on the rear panel of the NSH; see *Figure C-1*.

Note

 **It is possible to fit 48 V transceiver interface cards in any of the slots 3 to 5 on the NSH. The NSH can support a maximum of six USBL transceivers.**

- Connect the other end of the USBL transceiver cable to the USBL transceiver.
- Make whichever optional connections as are required within your system as follows:
 - Connect serial inputs from a GNSS receiver, a gyrocompass and a Vertical Reference Unit as required to any of the serial ports on the NSH.
 - Connect serial outputs from the system, supplying information such as position reports for external client or Marine Computer systems as required, to any of the serial ports on the NSH.

- Connect an external time synchronising signal, such as a 1PPS (pulse per second) clock from a GNSS receiver to either of the top input trigger ports on the Responder/Trigger interface card located in slots 10 or 11 on the NSH.
 - Connect the corresponding serial time message to one of the serial ports located on the NSH.
 - If you are using Responder beacon(s), connect an output trigger cable from the bottom port of an NSH Responder/Trigger interface card to up to 2 Responder triggers.
Responder/Trigger cards can be installed in slots 10 or 11 on the NSH.
4. Make a written note of which input/output device is connected to which port (A or B) on each interface card installed in the NSH.
 5. Insert the yellow 'primary' security key into a USB port on the rear of the Marine Computer; see *Figure 3-5*.

Notes



Sonardyne recommends that you always connect the security key to a USB port on the rear panel of the Marine Computer rather than to a USB port on the front panel.

6. Connect the keyboard and mouse supplied by Sonardyne to a suitable USB port on the Marine Computer.
 7. Connect the display monitor(s), to a DVI/Display port on the rear of the Marine Computer; see *Figure 3-5*.
-

Note



Dual screen capabilities are available by using any combination of the DVI or Display ports. It is recommended that the additionally supplied DVI to VGA connector is used for connection to the video monitor. Use of the DVI or display ports can increase the EMC radiation levels conflicting marginally with the EN 60945 pass levels. These very stringent levels make it highly unlikely that any interference will be caused by other equipment, but should the DVI connection be used it is the responsibility of the system integrator to check there is no practical EMC interference to, or by, the Sonardyne Equipment caused by use of this interface..

- Press the **Power/Reset** button to turn on the NSH (ensure the power switch on the rear panel of the NSH is ON). It does not matter which of the units is switched on first.
 - On the NSH check the following:
 - The three green indicator LEDs on the front panel should light up to show that the unit is receiving power and the 3.3 V and 5 V supplies are operating.
 - The three power-rail status LEDs should light up to show that the transceiver power supplies are at the correct operating voltage.
10. Press the **Power** button on the Marine Computer's front panel to start the Marine Computer and check the **HDD** LED is on.
 12. Check that the software starts automatically. If the software does not start automatically, use the mouse to double-click the software icon on the desktop.
 13. While the software is starting, check that all the LEDs on the NSH front panel are flashing at the same time to indicate that the software has established communications with the NSH.

C.3.4 NSH Interface Card Details

The NSH can be configured with various interface cards depending on the sensor inputs required for the installation. *Table C-1* lists and describes the interface cards for use in the NSH.

Table C-1 Interface Cards

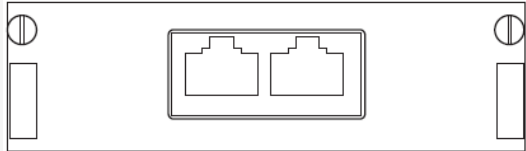
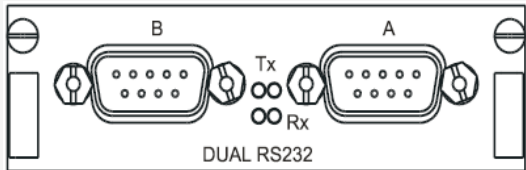
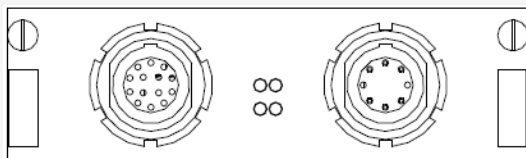
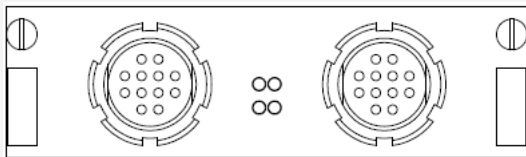
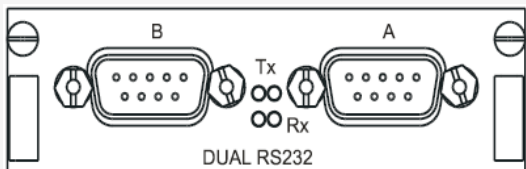
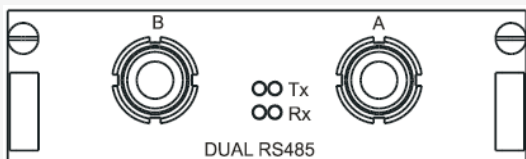
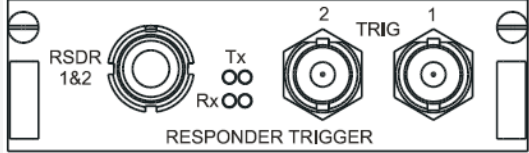
Slot	Notes	Part Number and Interface Card
1	Link Port: - Ethernet link to Computer.	CPN 631-7691/DWG 8098-050 
2	Reserved for Link/Management Ports: - RS232 link to Computer. - RS232 link for initial NSH setup using HyperTerminal.	CPN 631-8074/DWG 8098-053 
3, 4, 5	RS485 communications and 24V or 48V power for the following transceivers: - USBL - ROVNav	CPN 631-8165/DWG 8098-051 
3, 4, 5	RS485 communications and 24 V or 48 V power for a USBL transceiver, together with comms and power cross-link connection to other redundant system.	CPN 631-7624/DWG 8098-052  DUAL REDUNDANT TCVR MODULE
3, 4, 5	RS485 communications and 48 V power for Lodestar AHRS / INS, together with comms cross-link connection to associated co-located transceiver.	CPN 631-7977/DWG 8098-067  NSH LODESTAR TCVR MODULE
6, 7, 8, 9 *3, 4, 5	RS232 communications with: ROVNav Serial Gyrocompass GNSS Serial VRU	CPN 631-8074/DWG 8098-053 
6, 7, 8, 9 *3, 4, 5	RS485 communications with: ROVNav Serial gyrocompass GNSS Serial VRU	CPN 631-8073/DWG 8098-057 

Table C–1 Interface Cards (continued)

Slot	Notes	Part Number and Interface Card
10, 11	Two responder outputs and two BNC inputs for external triggers, such as 1 PPS from a GNSS receiver.	CPN 631–7623/Drg 8098–059 
12	Reserved for use by Sonardyne.	

Note

 **Pin-outs, wiring and connector specifications for cable connections to the interface cards are detailed in *Appendix D "Interface Cables"*.**

C.3.5 Interface Card Installation

Refer to *Table C–1* to identify which slots on the NSH's rear panel support which types of interface card.

Note

 **Before you begin to add or remove interface cards in the NSH, power-off the NSH and disconnect it from the electrical power supply.**

C.3.5.1 Installation and Removal Procedure

Follow the steps below to install or remove an interface card. To substitute one card for another already fitted to the NSH, follow the steps to remove an existing interface card and then install the new card in its place.

1. Power-off the NSH and disconnect it from the mains electrical supply.
2. Remove the NSH from its installed location, if necessary, to gain easy access to the unit's rear panel.
3. Either:
 - Identify the location to be used for the additional interface card, or
 - Identify the interface card you intend to remove from the NSH.
4. Use a medium flat-headed screwdriver either to release the blanking plate or to release the interface card.
5. Either:
 - Fit the new interface card into the slot vacated by the blanking plate, or
 - Withdraw the interface card from the NSH's rear panel.
6. Fit and tighten the two screws removed in step 4 to either:
 - Secure the new interface card into the NSH's rear panel, or
 - Fit and secure a blanking plate to the slot vacated by the removed interface card.
7. Return the NSH to its proper installed location.
8. Re-connect the NSH to the electrical power supply and power it on.

9. Conduct tests to ensure the NSH is operating correctly following the alterations made to the system.

C.3.6 Network Settings

Notes

 **All network settings must be chosen to suit the other network devices and connection to existing networks must be performed in consultation with local IT staff.**

The Sonardyne instrument network used for connection to NSH, transceiver, Lodestar and other devices, must be kept private to guarantee performance and reliability.

Public network connections for Remote Control, Output Telegrams, PAN, etc should be routed via a separate sub-net (to the 2nd network port if using a Sonardyne Computer).

C.3.6.1 IP Address

An IP address is a unique numeric label assigned to each device in a computer network that uses the Internet Protocol for communication. It is defined as a 32-bit number in Internet Protocol Version 4 (IPv4) and is usually written in a human-readable notation, e.g. the NSH default address is 192.168.179.1 and the default PC IP address is 192.168.179.100 (only static/fixed IP addresses are supported).

C.3.6.2 Port

A port is associated with an IP address and the protocol type of the communication and is defined as a 16-bit number, e.g. NSH default port is 4000.

C.4 USBL Transceiver Installation and Deployment

Note

 **USBL transceivers contain delicate transducers and motion sensing elements. Take care to protect the transceiver during and after installation by following all the instructions in this section.**

C.4.1 Deployment Methods

The USBL transceiver can be deployed in a number of ways, depending on the type of vessel in use and the operational requirements. Sonardyne produces several systems for deploying USBL transceivers described in *Table C-2*. Contact Sonardyne for more information on deployment systems.

Table C-2 USBL Deployment Methods

Deployment Method	Description	Reference
Type 7950 Through-Hull	The Type 7950 consists of a hydraulically operated pole, a sealed bearing section and a sea chest service section with inspection door. The whole machine sits on a gate valve which in turn is mounted on the flange of a through-hull penetration pipe. The USBL transceiver is deployed by the hydraulic operation of the pole to the required depth and can be controlled locally or from a remote control panel.	See <i>Section C.4.4</i>

Table C–2 USBL Deployment Methods (continued)

Deployment Method	Description	Reference
Type 8097 Over-the-Side	The Type 8097 is a modular, transportable, over-the-side deployment pole, designed for vessels where through-hull deployment or through-tube options are not available or practical. Once deployed the pole is locked into place by a hydraulically operated mechanism that is welded to the vessel's hull.	See <i>Section C.4.5</i>
Type 8169 Through-Tube	The Type 8169 is a modular, transportable, through-tube deployment, designed for vessels where through-hull deployment or over-the-side options are not available or practical. The pole is scalable to fit through an existing tube or a new tube installation. Once deployed the pole is held in place by a flange at the top of the tube and a hydraulically operated clamp mechanism near the bottom.	See <i>Section C.4.6</i>
Non-Standard Deployment Pole	The transceiver can be fitted to a non-standard deployment pole using a purpose-designed flange adapter if necessary. Contact Sonardyne for details on installing USBL transceivers onto non-standard deployment poles. Sonardyne also offer a range of adaptors to fit other deployment poles.	See <i>Section C.4.7</i>
HPT Dunker Kit	The HPT Dunker Kit is lowered into the water from the side of the vessel and is used to deploy the HPT in applications that only require telemetry and not positioning.	See <i>Section C.4.8</i>

C.4.2 General Requirements

Depending on the deployment type, observe the following general requirements when you install the USBL transceiver:

- Ensure the method of deployment protects the sensitive acoustic transducer elements from damage at all times during installation, deployment, and demounting. A red sleeve is supplied fitted to the USBL transceiver to protect its transducer face during shipping. You **MUST** remove this protective sleeve before you deploy the USBL transceiver; the USBL transceiver will not perform correctly with this sleeve in place.

The main sources of vibration that could affect the transducer are; normal operation of the vessel's machinery; and Vortex Induced Vibration (VIV) as the transducer's supporting pole moves through the water.

- Mount the USBL transceiver on a rigid pole to minimise vibration and reduce free movement of the transducer with respect to the vessel.
- Mount the USBL transceiver so that it is pointing vertically downwards, with the connector at the top and the black acoustic transducer at the bottom.
- Ensure the forward-pointing direction arrow on the transducer is pointing forward on the vessel.
- For best results, if possible deploy the USBL transceiver at least 2–3 metres below the lowest part of the vessel's hull.

By increasing the separation distance between the transducer array and the hull in this way, you will reduce the risk of multipath reflections from the hull, reduce the amount of vessel noise received by the transducer, and reduce the chance of aerated water passing over the transducer's face.

Note



After installing the USBL transceiver, measure the vertical offset between the bottom face of the USBL transceiver and the vessel's waterline when the USBL transceiver is fully deployed. You will require this information later, to configure the USBL software.

- Deploy the transducer as far away as practical from any source of noise or bubbles, such as propellers, thrusters, moonpools, or other causes of aeration.
- Ensure the bottom face of the transducer is kept well clear of brackets, ropes, and other structures during deployment.
- To ensure correct 'wetting' of the transducer's polyurethane face, keep the USBL transceiver face clean and free from oil or grease.

C.4.3 Deployment Considerations

The design of any deployment mechanism should ensure that all unwanted movements of the USBL transceiver with respect to the vessel are minimised.

C.4.3.1 Attitude Measurement Errors

To achieve best USBL performance it is necessary to use a high accuracy attitude sensor so that the system can adjust the measured direction of arrival of the acoustic signal to compensate for the vessel's motion. If the attitude sensor is installed on the vessel, then it is particularly important to minimise movement of the USBL transceiver with respect to the vessel.

The importance of correct USBL transceiver deployment is greater if you intend to use external attitude measurement equipment, such as a Vertical Reference Unit, with the USBL System. These instruments measure the roll, pitch and heading angles of the object they are attached to, which is usually the vessel. However, if the USBL transceiver is mounted on a pole that is capable of moving significantly with respect to the vessel, then the attitude measurements will relate to the vessel, but not to the USBL transceiver with any accuracy.

Pole movements can arise from different causes: Small quick movements are usually caused by water flowing past the pole, giving rise to VIV, and larger, slow movements can arise as the vessel pitches and rolls. Both effects can be reduced by ensuring the pole is mounted rigidly on the vessel.

In some cases it is possible to mount the attitude measurement instrument on top of the pole so that it always measures the attitude of the USBL transceiver, even if the pole moves relative to the vessel.

C.4.3.2 Galvanic Isolation

The USBL transceiver housing is made of aluminium bronze. The most common material used for the tube, pole and mounting frame is mild steel.

It is good practice to isolate the USBL transceiver and the mounting arrangement electrically so as to reduce the effects of galvanic corrosion on the housing.

Sonardyne provide an isolation adapter within the installation kit. On no account should the aluminium bronze be in contact with a material more noble than itself (electro-chemically) — because galvanic corrosion will result.

Note



To avoid galvanic corrosion of the aluminium bronze USBL transceiver housing, never allow the housing to remain in contact with a material more electro-chemically noble than itself.

Before you mount the USBL transceiver, always record the information detailed on the label on the outside of its housing. This information includes its serial number, the device serial number, and factory offsets for the internal inclinometer sensors.

C.4.4 Through-Hull Mounting (Type 7950 Deployment Machine)

The Type 7950 is a through-hull deployment method using a gate-valve and sea chest assembly that can accommodate the USBL transceiver. Above the sea chest is a deployment machine that hydraulically raises and lowers the USBL transceiver to the optimal depth.

Figure C-2 Through-Hull Mounting (Type 7950 Deployment Machine)



C.4.5 Over-the-Side (Type 8097)

The Type 8097 is a modular, transportable, over-the-side pole. The USBL transceiver is attached to a pole or frame designed so that USBL transceiver alignment can be maintained or re-established on subsequent deployments.

The pole or frame should be aligned vertically with respect to the vessel as far as is possible and, ideally, should be adequately braced against the hull to limit movement during operation.

Long poles can be susceptible to VIV. Various methods can be used to reduce the effects of this type of vibration. Contact Sonardyne for more information.

Figure C-3 Over-the-Side (Type 8097)



C.4.6 Through-Tube Mounting (Type 8169)

The Type 8169 is a modular, transportable, through-tube deployment. The pole is scalable to fit through an existing tube or a new tube installation.

In this arrangement the pole should be stiff, rigidly mounted and long enough to locate the USBL transceiver at least 1.5 metres below the lowest point on the hull (2–3 metres is recommended for best results). The mounting arrangement used must minimise any movement of the USBL transceiver with respect to the vessel, and ensure optimal tracking accuracy.

Figure C-4 Through-Tube Mounting (Type 8169)



C.4.7 Non-Standard Deployment Pole

Sonardyne offer a range of adaptors to fit other deployment pole types. Contact Sonardyne for details on how to install the USBL transceiver on non-standard deployment poles.

C.4.8 HPT Dunker Kit

Note

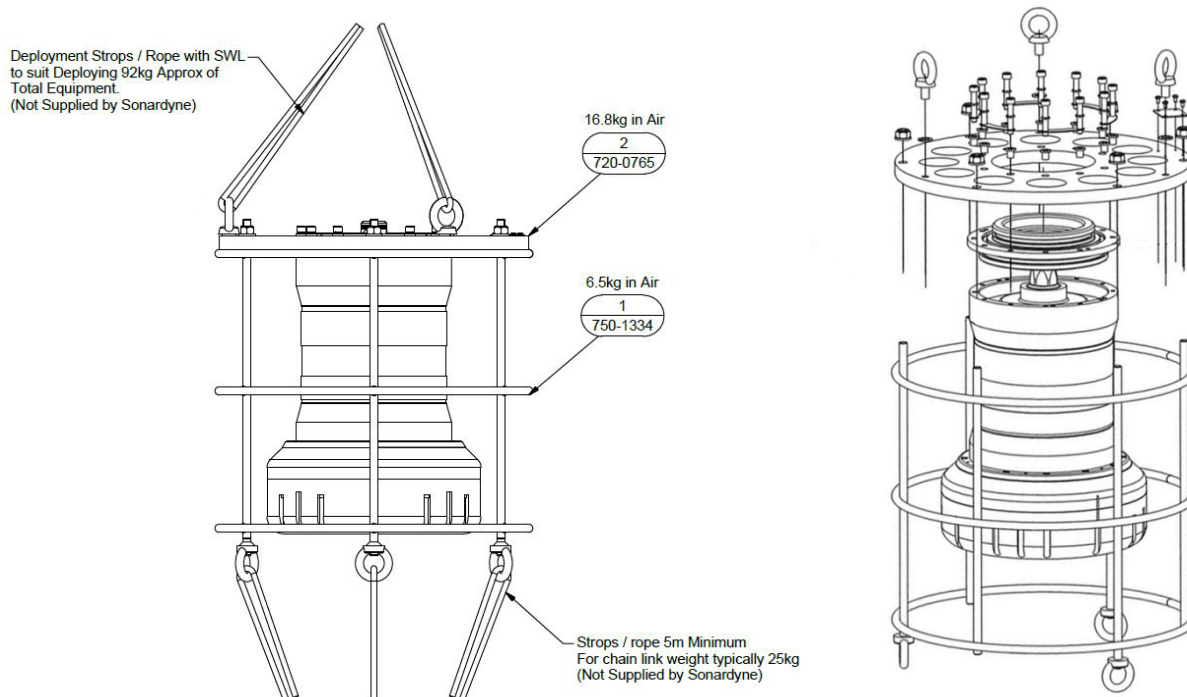
 **The HPT Dunker Kit is used for applications that only require telemetry and not positioning.**

The HPT Dunker Kit (641-3612) can be used to assist in the lowering of the HPT into the water from the side of the vessel; see *Figure C-5*.

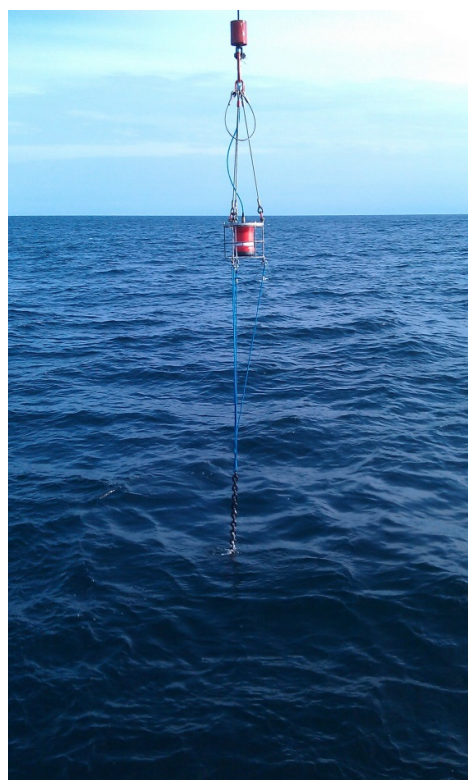
A weight (not supplied) can be attached to the bottom of the cage via ropes (also not supplied) to stabilise the HPT Dunker whilst in the water and prevent it from oscillating. The weight should be at least 10 m from the HPT Dunker.

The HPT Dunker should be lowered to about 20 m below the vessel for optimum operation, water depth permitting. The deeper the HPT is lowered, the further it is from any surface noise sources such as machinery and the sea surface, and hence the signal to noise ratio at the HPT will be improved. In an ideal setup, the receiving beacon will be directly under the dunker assembly. In shallow water, it is more important to maintain line of sight to the beacon and minimise the grazing angle, and so the deployment depth can be reduced. Application-specific data retrieval software can then be used to command the HPT to perform telemetry uploads from the beacon.

Figure C-5 HPT Dunker Kit



The HPT Dunker kit is typically deployed as shown in the photographic examples below.



C.5 USBL Transceiver Mounting Methods

C.5.1 Type 8142/8182 and Variants

The Type 8142/8182 (and variants) USBL Transceiver can be mounted and deployed using a number of deployment poles and methods as shown in *Figure C-6* (in order of the most commonly used mounting method, from left to right).

C.5.1.1 Type 7950 Through-Hull Deployment Machine

The Type 8142/8182 (and variants) USBL Transceiver has been designed to be mounted to a Sonardyne supplied Type 7950 through-hull Deployment Machine.

A 6G Transceiver Installation Kit (part number 641-0197) must be used when installing this transceiver on a Deployment Machine. The kit contains fixings, O-rings and an isolation flange.

The integrity of the Deployment Machine must be maintained by using the supplied O-rings to ensure a water-tight seal is maintained between the transceiver and the Deployment Machine pole.

C.5.1.2 Type 8097 Over-The-Side Deployment Pole

The Type 8097 Over-the-Side Deployment Pole is supplied with a transceiver mounting flange. The Type 8142/8182 (and variants) must be mounted using the 6G Transceiver Installation Kit (part number 641-0197). When assembled, the transceiver and adaptor flange are bolted directly to the lower flange of the arm assembly using 16 x M16 bolts, nuts and washers.

C.5.1.3 Type 8169 Through-Tube Deployment Pole

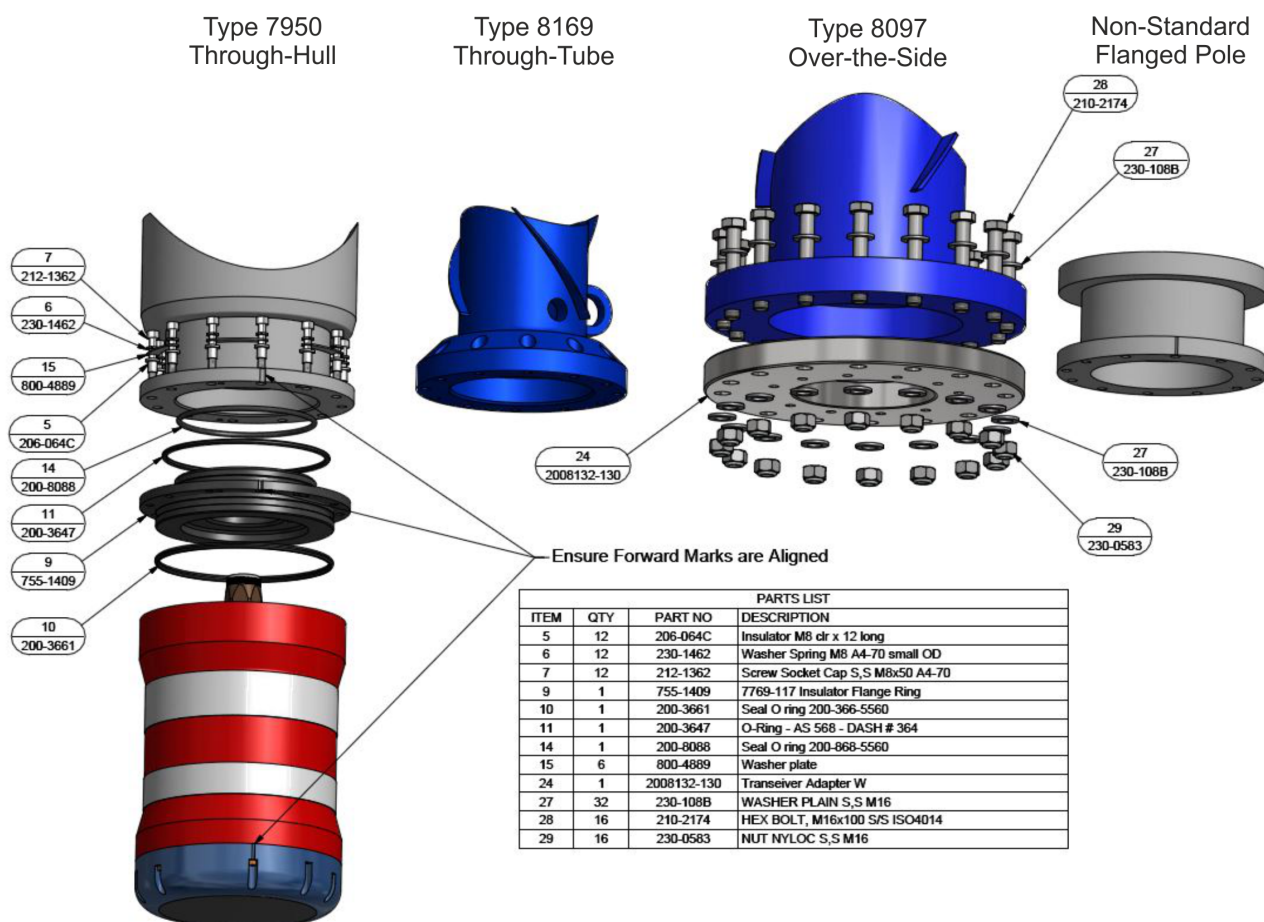
A 6G Transceiver Installation Kit (part number 641-0197) must be used when installing the transceiver on a Through-Tube deployment pole. The kit contains fixings, O-rings and an isolation flange.

C.5.1.4 Non-Standard Flanged Pole

The type 8142/8182 (and variants) USBL Transceiver can be mounted to any non-standard flanged pole with the use of an adaptor flange. The adaptor flange must have 10.5 mm diameter equally spaced on a 210 mm PCD. The flange must have an internal diameter of 155 mm.

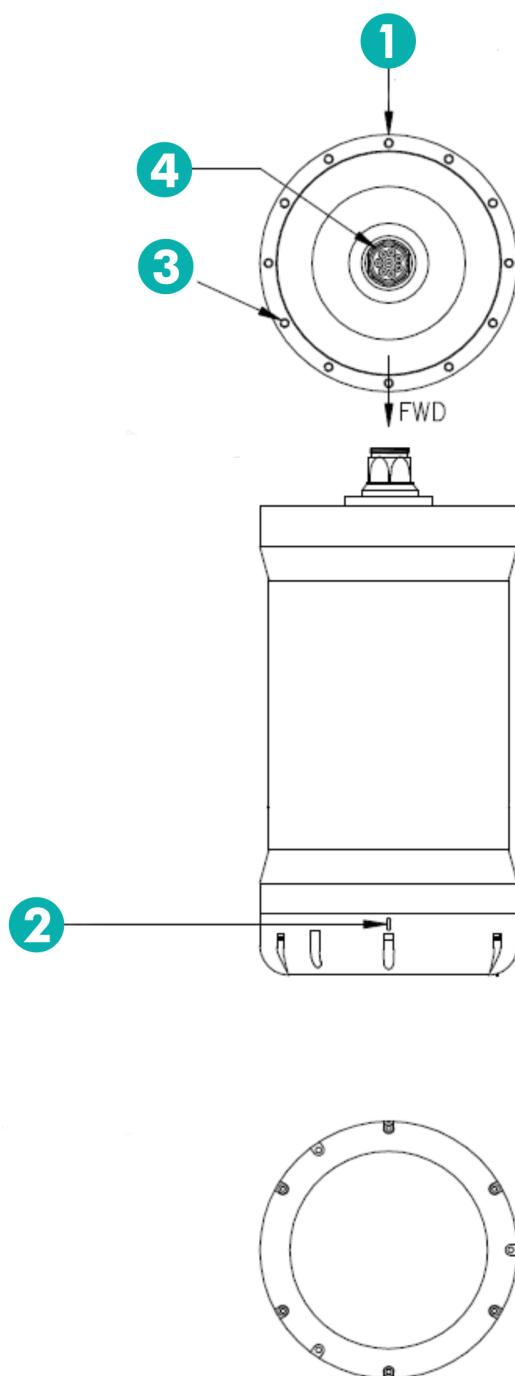
A 6G Transceiver Installation Kit (part number 641-0197) must be used when installing the transceiver on a non-standard pole. The kit contains fixings, O-rings and an isolation flange.

Figure C-6 Type 8142/8182 Standard Mounting Methods



C.5.2 USBL Transceiver Bolt Hole Pattern

C.5.2.1 Type 8142/8182 and Variants



Item	Description
1	Parallel with Lubber Line
2	Forward Direction Identification Mark

Item	Description
3	12 Holes, M8 x 1.25 mm Pitch 20.3 mm (0.8") Deep Equally Spaced on 210 mm (8.27") Dia. 6 Holes Only Used for Mounting
4	Cable Connector AGP-2708-F

C.5.3 Alignment Criteria

When mounting the USBL transceiver, ensure that the mounting arrangement has some mechanical means to maintain alignment between the USBL transceiver's centre line and the vessel's centre line. Adapters supplied as an option by Sonardyne have provision for two dowel pins to meet this requirement.

Accurate horizontal and vertical alignment between the USBL transceiver and the vessel is not critical. However, it is important that the deployed alignment angles are repeatable to a much greater precision than the measurement sensors in use so as to avoid the need to recalibrate the deployed angles every time the pole is retracted and redeployed.

C.5.4 USBL Transceiver Connection

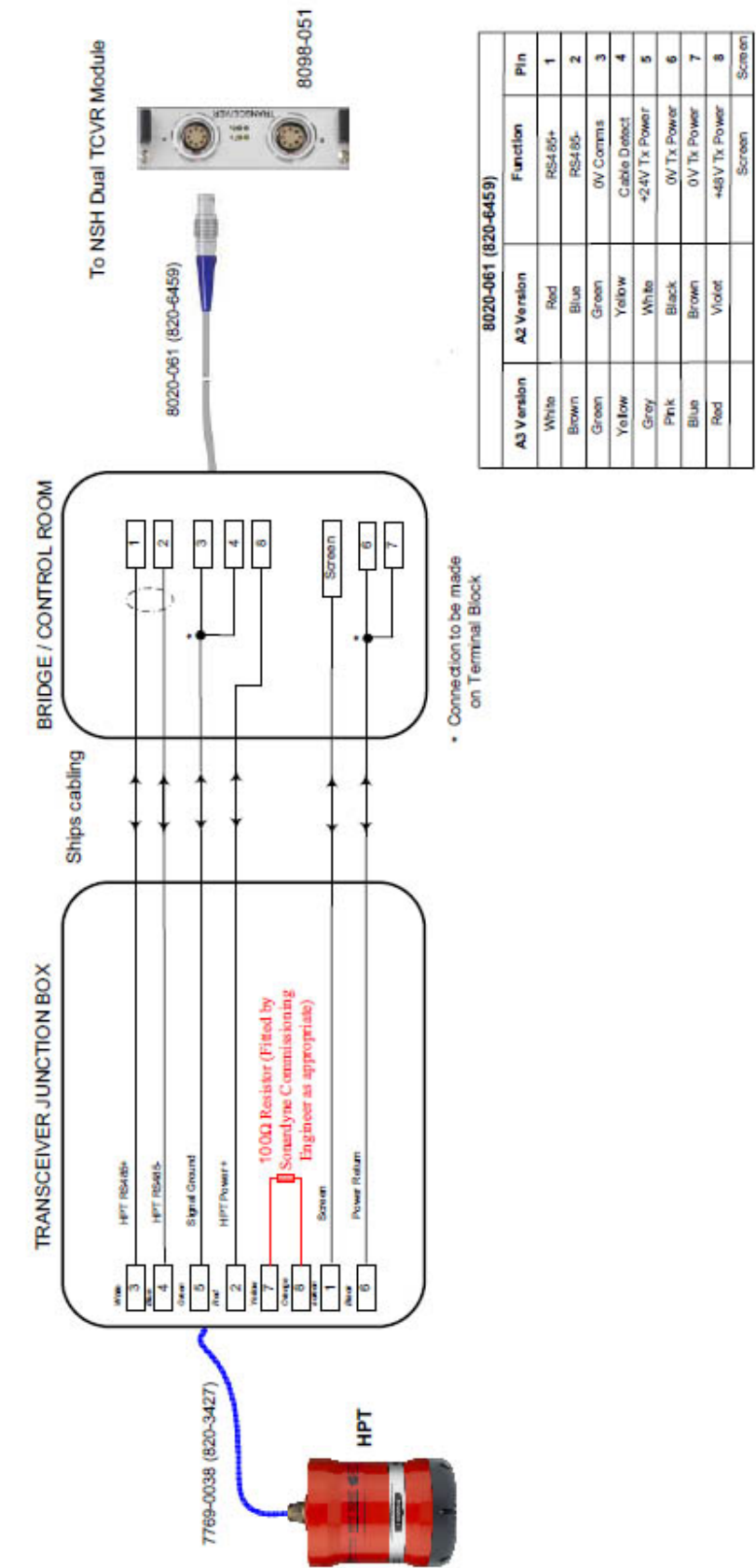
Connection between the USBL transceiver and the Navigation Sensor Hub (NSH) rear panel is through the Lemo-to-48 V cable supplied with the system. Connect the Lemo end of this cable to the top port (Port A) on the USBL transceiver card in the NSH. See *UM-8098 "User Manual for the NSH"* for more information.

C.5.5 System Calibration

You must perform a complete system calibration (CASIUS) when you deploy any transceiver for the first time in its mounting arrangement. See *Appendix H "System Calibration"* for more information about the CASIUS calibration procedure.

C.5.6 Installation

Figure C-7 HPT Transceiver Wiring



C.5.7 Gyro USBL

Figure C-8 Gyro USBL 5000

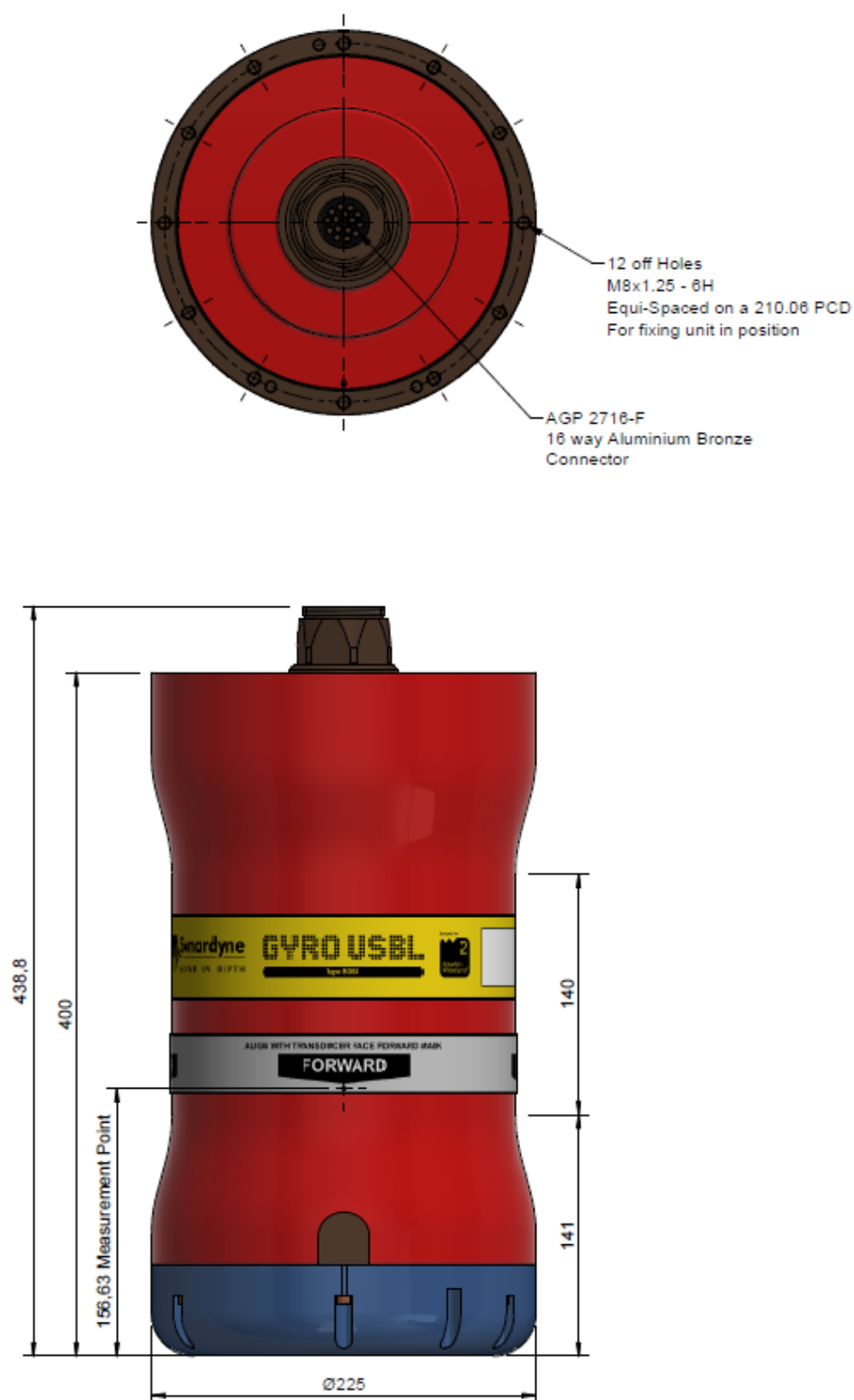
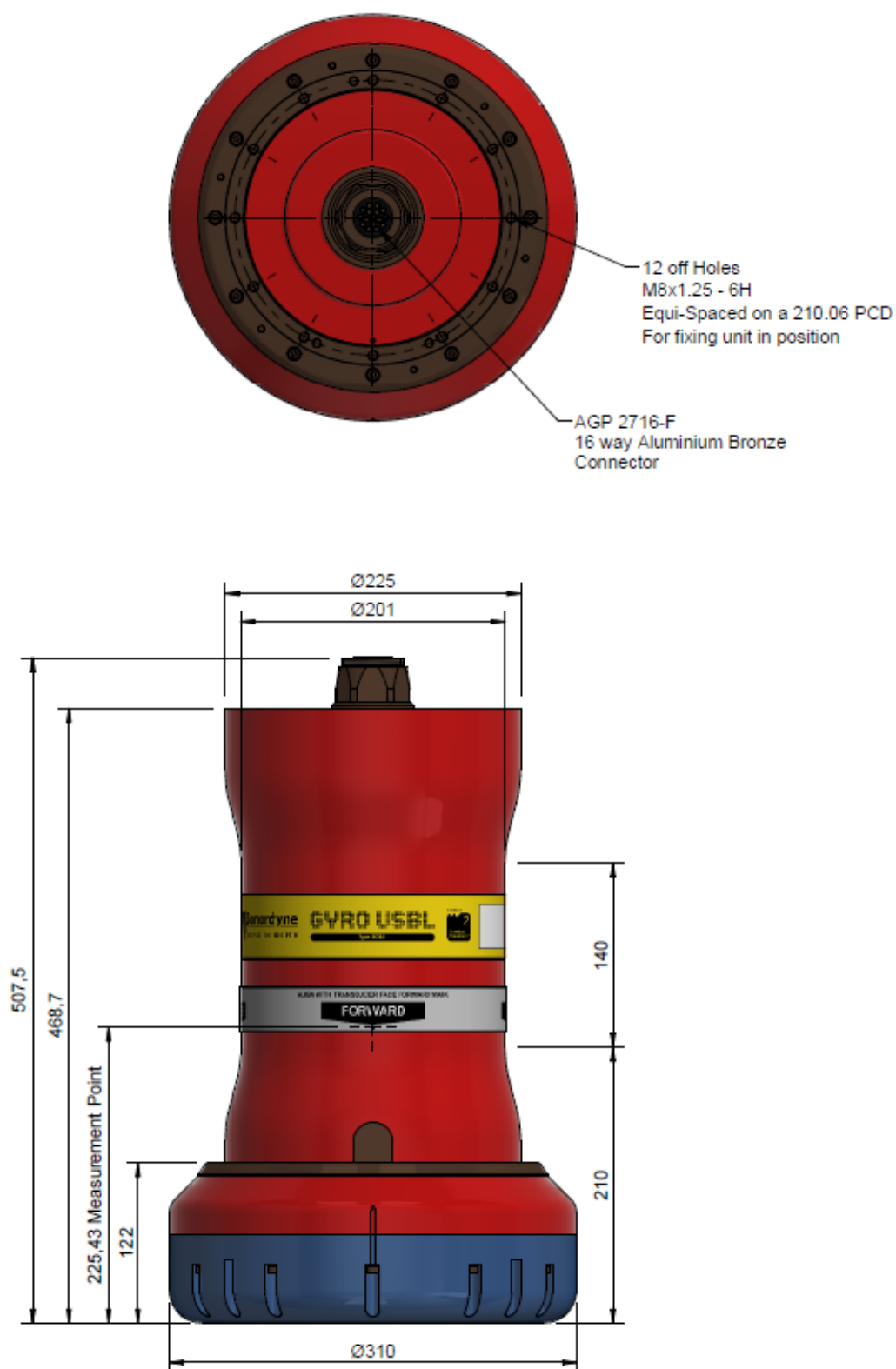


Figure C-9 Gyro USBL 7000



C.6 External Sensors

You should give careful consideration to the selection and installation of external sensors such as a Vertical Reference Unit (VRU), gyrocompass and GNSS antenna. In particular, the installation and calibration of the VRU and the gyrocompass will have a direct impact on the overall position measurement accuracy of the USBL.

Connections between external sensors and the USBL System are through serial ports on interface cards located on the NSH rear panel. See *Section C.3 "Hardware Installation (Rack Mount)"* for more information.

The guidelines below will help you to establish the best installation location for the external sensors. However, you should also refer to the installation instructions supplied by the manufacturer of the external sensors for detailed installation instructions.

C.6.1 VRU

- Use a survey quality VRU providing dynamic roll and pitch measurement accuracy better than 0.05° for deep water operations.
- Ensure the VRU is fastened securely to prevent any movement with respect to the vessel or the USBL transceiver.
- Align the VRU to be parallel with the vessel's centre line by following the manufacturer's installation instructions.
- Install the VRU on the vessel's centre line if possible.
- If you have to install the VRU away from the vessel's centre line, measure and enter the relevant lever arm offsets into the VRU's configuration, as detailed in the manufacturer's instructions.
- Install the VRU as close as possible to the vessel's centre of gravity (CoG), or as close as possible to the USBL transceiver.
- Ensure the VRU configuration provides a serial output of the vessel's roll and pitch angles to the highest accuracy available and at the highest possible baud rate to minimise the effects of data latency.
- Ideally the measurement accuracy should be 0.01°, and the output rate should be at least 10 Hz.
- Some VRUs allow aiding input of speed and course made good (CMG) from external equipment such as a GNSS receiver. This enhancement improves the accuracy of VRU measurements in dynamic environments, and should be used if it is available.
- Complete all the manufacturer's recommended installation and calibration procedures.

Note



Sonardyne recommends that any manufacturer-recommended installation offsets should be entered into the VRU's configuration software, not into the USBL software.

- Ensure the conventions used for pitch and roll output from the VRU are the same as those used in the USBL software, because some VRU manufacturers use a different convention.

C.6.2 Gyrocompass

- For survey and towfish tracking operations in particular, it is essential to use a survey-quality gyrocompass that provides heading measurements with an accuracy of 0.1° or better.

- Ensure the gyrocompass is configured to output serial heading data to the highest accuracy available and at the highest possible baud rate to minimise the effects of data latency. Ideally the measurement precision should be 0.01° or better, and the output rate should be at least 5 Hz.
- Align the gyrocompass to be parallel with the vessel's centre line.
- Perform a gyrocompass calibration BEFORE you perform a calibration of the USBL System to measure any alignment offsets that may exist between the gyrocompass mounting arrangements and the vessel's centre line. Any offsets measured should be entered into the USBL software.
- Make regular and frequent checks of the gyrocompass against any other gyrocompass systems installed on the vessel, to detect and correct any long-term drift.

C.6.3 GNSS System

- Mount the GNSS antenna so that it has a clear and unobstructed view of the sky.
- For short-term operations where an over-the-side pole is used to mount the USBL transceiver, consider mounting the GNSS antenna over the top of the pole to minimise any effects arising from antenna offsets.
- Accurately measure and record the X, Y and Z offset distances between the GNSS antenna and the USBL transceiver. You will require these measurements later to configure the USBL software.
- If possible, supply measurements from the GNSS receiver directly to the USBL software so as to minimise any position latency inherent with computer-based GNSS solutions.
- Because the quality of the GNSS solution has a direct effect on the quality of any real-world positions determined by the USBL, you should use only differential GNSS (DGNSS) or carrier-phase based (such as Real-Time Kinematic — RTK) corrected GNSS inputs.

C.7 NSH Firmware Upgrade

See the NSH User Manual *UM-8098* for instructions on upgrading the NSH firmware.

C.8 Software Installation

C.8.1 Security Keys

Sonardyne supplies a USB security key with the system that allows the software to run.

Insert the USB security key into an available USB port on the rear of the Marine Computer.

Note

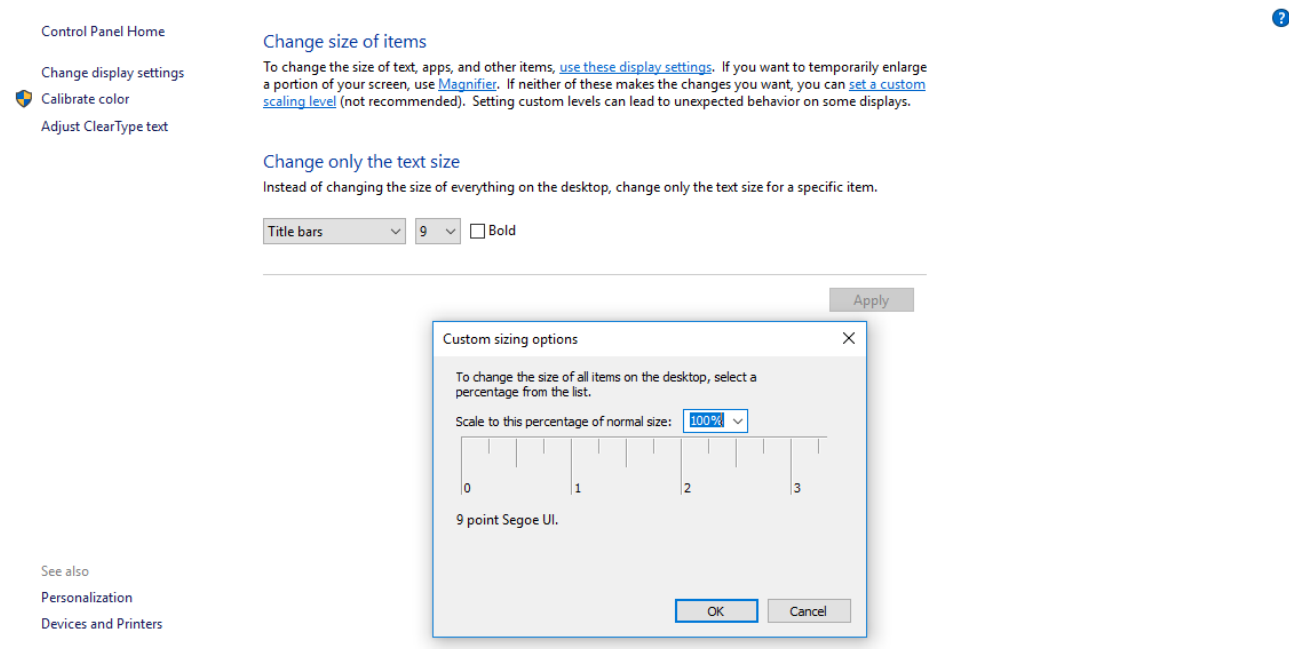


To avoid possible damage to the Marine Computer or corruption of the computer's software, never attach any security key for another application to the Marine Computer. Never attach more than one of the security keys to the Marine Computer at the same time.

C.8.2 Font Scale

Notes

 **This Software is designed to display using an operating system text size of 100%. In Windows 10 this can be set as follows: Control Panel > Display > Set a Custom Scaling Level > 100%.**



C.8.3 Software Installations

Note

 **If you are upgrading an existing software installation, use the Add or Remove Programs facility accessible through the Windows Control Panel to remove the previous software version first.**

To install the software:

1. For installations using media including a USB memory stick:
 - Insert the USB media into an available USB port and use Windows Explorer to navigate to the drive and run the setup executable file; skip to *Step 3*.

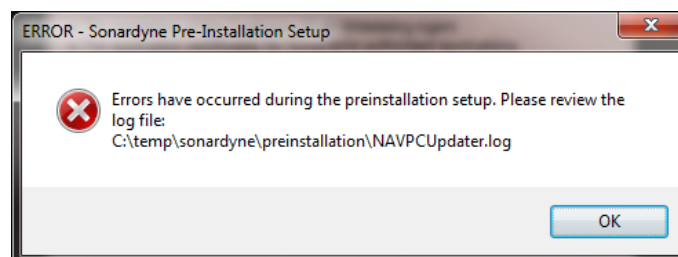
2. For FTP users:

- Download the ISO image, right-click on the ISO image file to mount it, and use Windows Explorer to navigate to the drive and run the setup executable file.

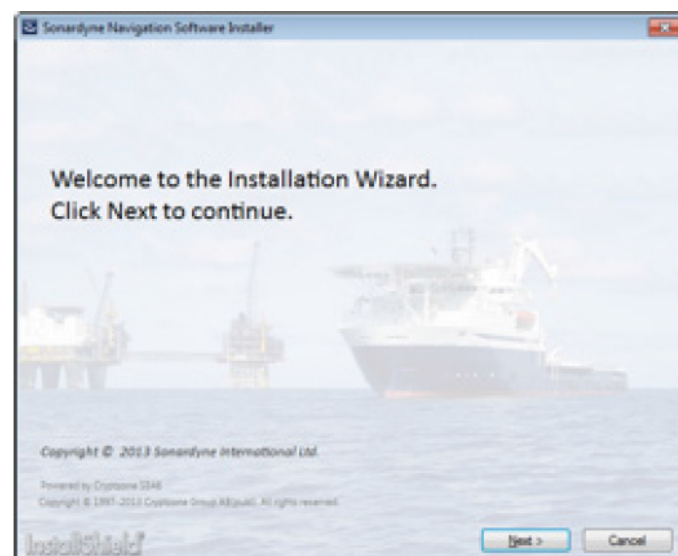


The pre-installation housekeeping might require you to reboot the computer one or more times before it completes. This is normal, and the installation will continue after housekeeping completes and you log on as Administrator following a reboot.

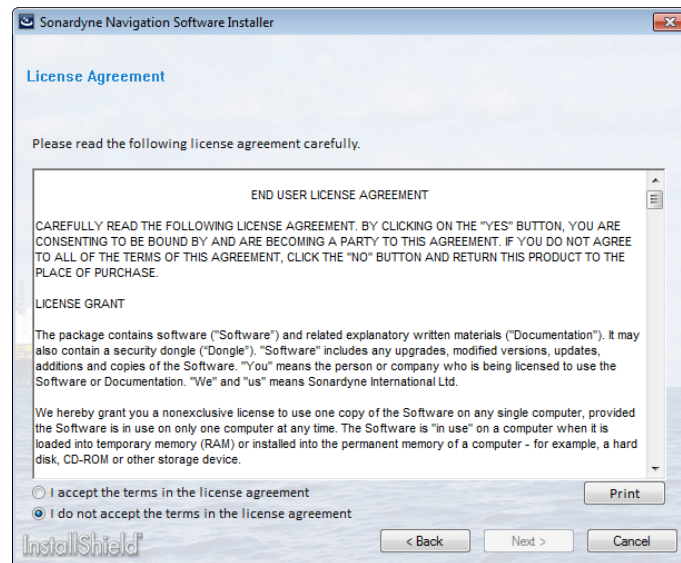
The software alerts you if an error occurred during the pre-installation setup. If necessary, contact Sonardyne support for further assistance.



3. Wait for the wizard to unpack the files needed for the installation and to display the installation welcome screen.



4. Click **Next** to start the installation.
5. Read the licence agreement under which the software is supplied, and click **Yes** to accept the agreement.

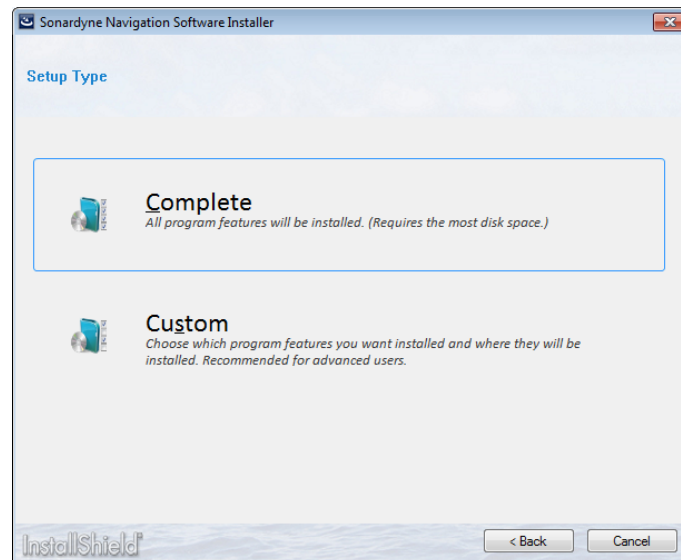


Note

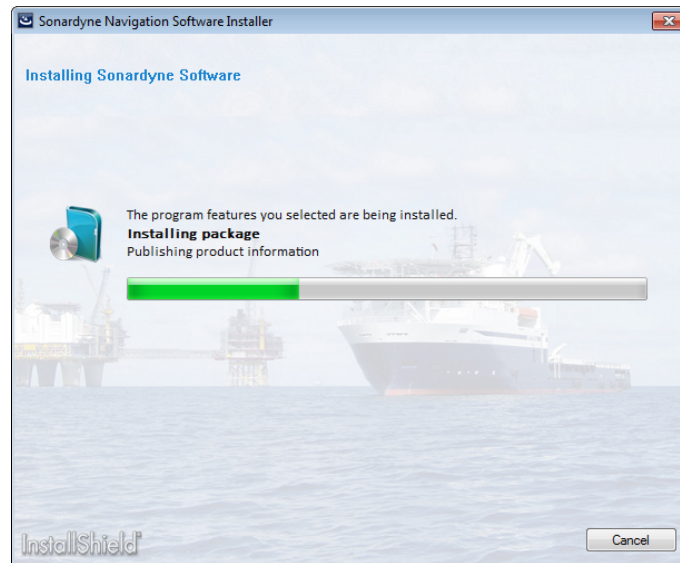


The licence agreement can be printed by clicking "Print".

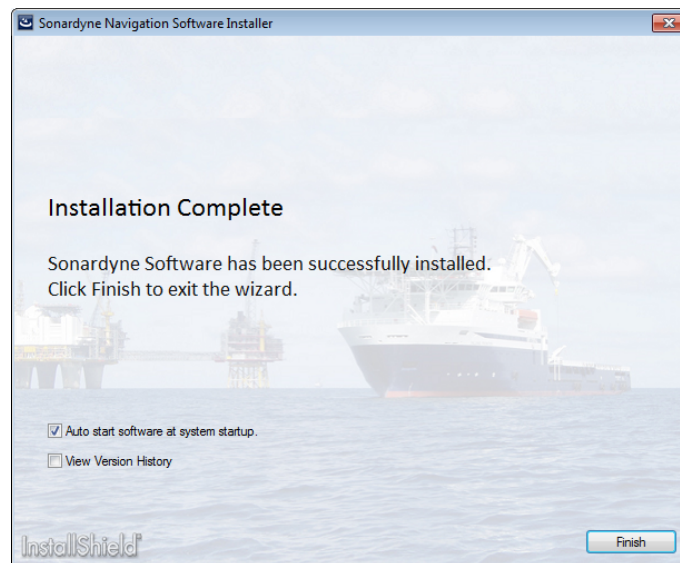
6. Select either:
 - **Complete** for a complete, regular installation, or
 - **Custom** to override the default contents for the installation.



7. Click **Next** to begin the installation process. A progress bar indicates the installation progress.



8. The final dialog allows you to:
- select whether to start the software automatically when the system starts, and
 - read the software release notes.
9. Select the options you want to use and click **Finish** to complete the installation.



Appendix D – Interface Cables

D.1 Serial Interfaces

Serial interfaces to the NSH are either RS232 or RS485.

The configuration of the interface cards in the NSH will define what connections are available. See *Figure C–1* in *Appendix C "Installation"* for a typical system configuration. Sonardyne supplies appropriate serial cables with each system.

D.2 Cable Diagrams

Note



The following cable diagrams are for guidance only and are subject to change without notice.

Table D–1 Cable Diagrams

CPN	Drawing No.	Type	Notes
820-6608	8020-060	RS232 Serial Data Cable to Open Flylead	
820-6459	8020-061	NSH Transceiver Cable	
820-3349	8020-069	Responder cable	
820-6484	7784-049-02	USBL Transceiver Cable	Digital USBL Transceivers Only
820-3427	7769-038	Transceiver Cable	Wiring information is dependant on the instrument type. Refer to the instrument manual for wiring information
820-3650	7784-159	Serial I/O Cable	

Figure D-1 RS232 Serial Data Cable to Flylead – CPN 820-6608/DWG 8020-060

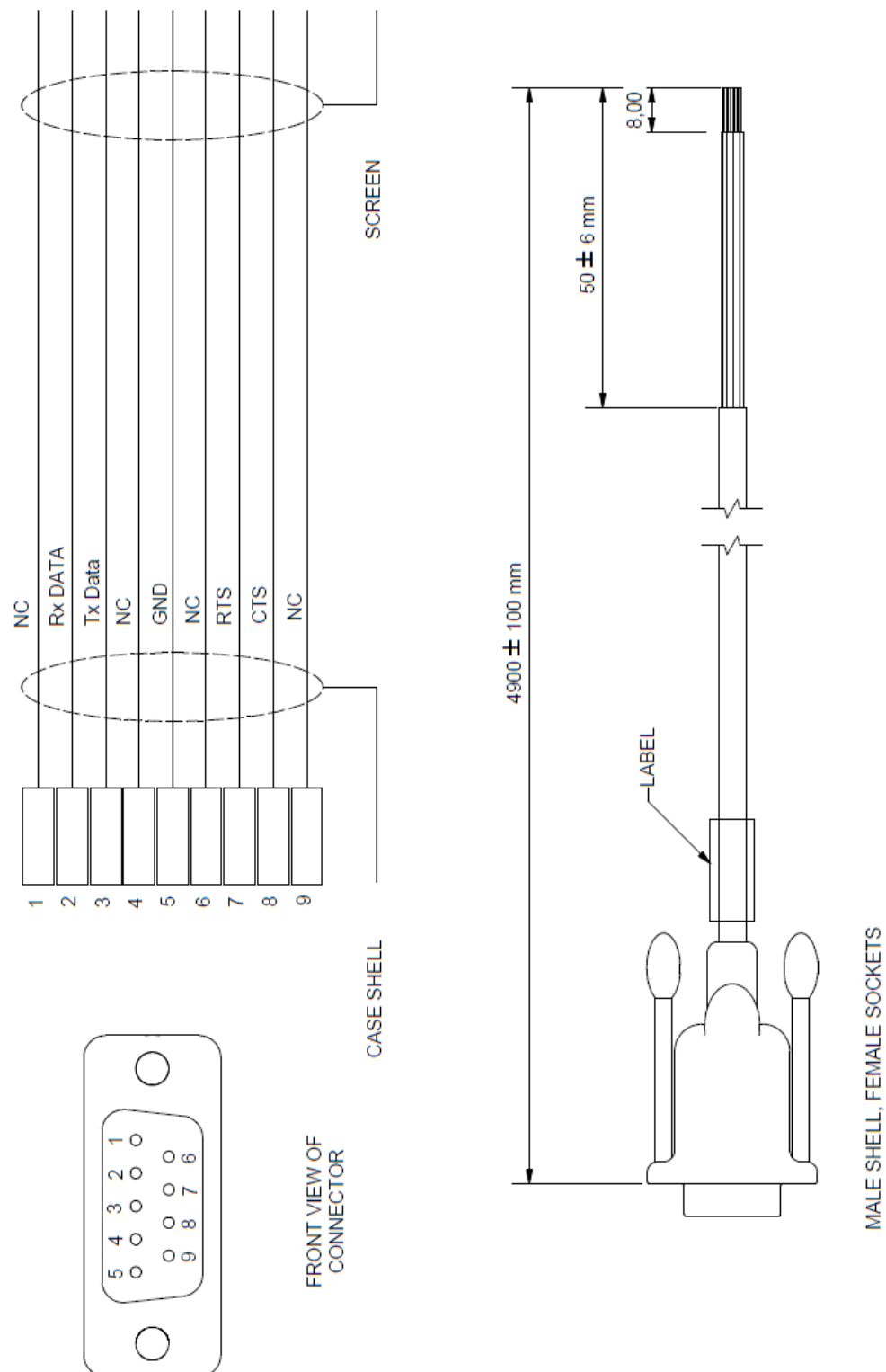
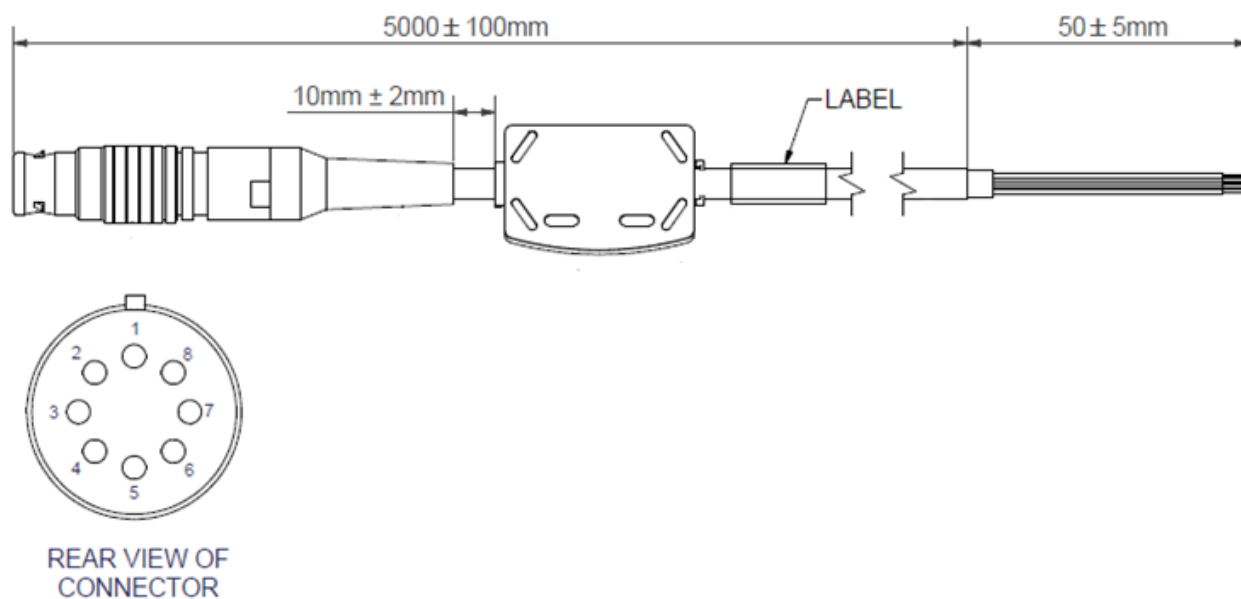
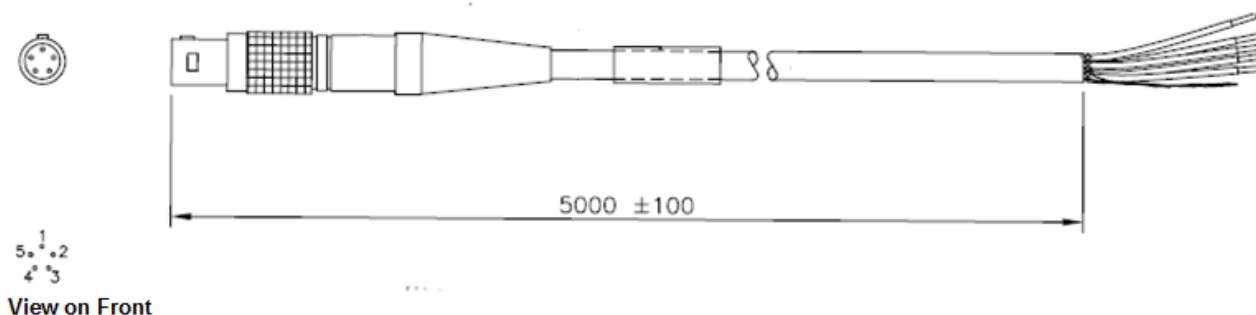


Figure D-2 NSH Transceiver Cable – CPN 820-6459/DWG 8020-061



Pin No.	Wire Colour (Issue A2 and Earlier)	Wire Colour (Issue A3 and Later)	Wire Colour (Issue A5 and Later)		Serial I/O RS422 Signal
1	Red	White	Red	Pair	RS485+
2	Blue	Brown	Black		RS485-
3	Green	Green	Black	Pair	0 VI
4	Yellow	Yellow	White		Cable Detect
5	White	Grey	Green	Pair	+24 V TCVR
6	Black	Pink	Black		TCVR RTN
7	Brown	Blue	Black	Pair	TCVR RTN
8	Violet	Red	Blue		+48 V TCVR
Body	Screen	Screen	Screen		Screen

Figure D-3 Responder Cable – CPN 820-3349/DWG 7784-049-02



Pin No.	Wire Colour (Issue D3 and Earlier)	Wire Colour (Issue E1)	Responder – 02 Signal
1	Red	Red	Responder Trigger 1/3
2	Black	Black	+24 VR 1/3
3	Blue	Brown	+24 VR 2/4
4	Green	Green	0 V
5	Yellow	Yellow	Responder Trigger 2/4
Body	Screen	Screen	Screen

Figure D-4 USBL Transceiver Cable – CPN 820-6484/DWG 8020-069

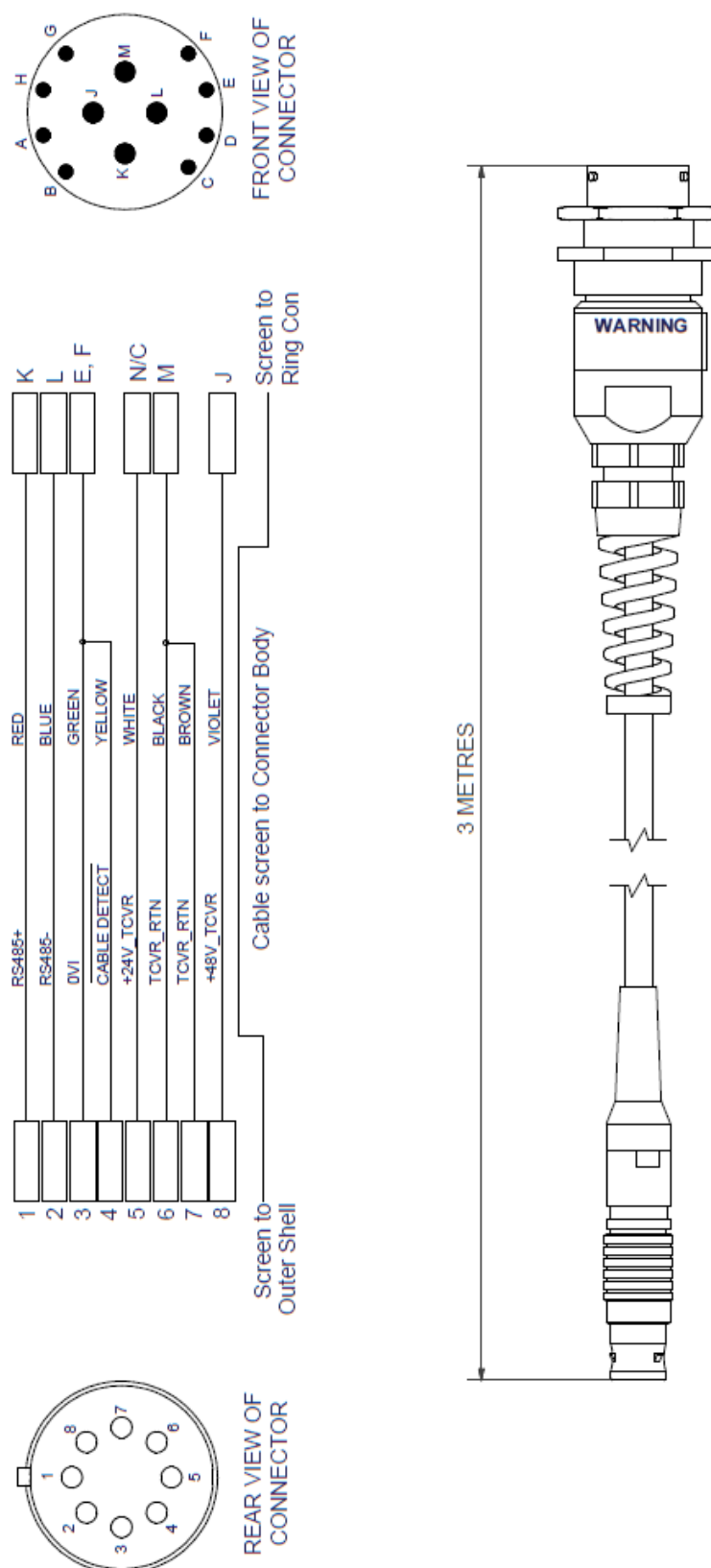
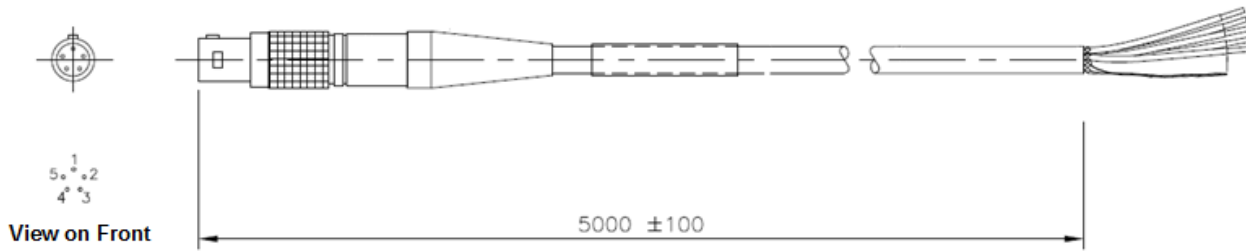


Figure D-5 Transceiver Cable – CPN 820-3427/DWG 7769-038



Note
 **Wiring information is dependent on the instrument type. Refer to the instrument manual for wiring information.**

Figure D–6 Serial I/O Cable – CPN 820-3650/DWG 7784-159



Pin No.	Wire Colour (Issue B3 and Earlier)	Wire Colour (Issue B4)	Wire Colour (Issue C1)	Serial I/O RS422 Signal	Serial I/O RS232 Signal
1	Red	White	Red	TX+	RTS Out
2	Black	Brown	Black	TX-	Data Out
3	Blue	Green	Green	RX+	CTS In
4	Green	Yellow	Black	RX-	Data In
5	Yellow	Grey	White	0 V	0 V
Body	Screen	Screen	Screen	Screen	Screen

D.3 Cable Diagrams for DP INS/Optimised Applications

Notes

- The following cable diagrams are for guidance only and are subject to change without notice.
- INS is available when using an INS enabled Lodestar, and seabed reference beacons have been calibrated.

Table D–2 Cable Diagrams for DP INS/Optimised Applications

CPN	Drawing No.	Type
820-0065	8084-136-01	Subsea Lodestar Console Cable Assembly
820-0068	8084-137-01	Subsea Lodestar Comms C1 Cable Assembly
820-0071	8084-138-01	Subsea Lodestar Comms Ethernet Tail Cable Assembly
820-0072	8084-138-04	Subsea Lodestar Comms Ethernet Cable Assembly
820-0073	8084-139-01	Subsea Lodestar Transceiver Tail Cable Assembly
820-0147	8098-090-01	NSH Lodestar Tail Cable – 8098-090-01
820-6873	8130-170-01	Gyro USBL Mobile System Cable
820-6882	8130-175-01	Gyro USBL Mobile System Cable 30 m
820-6917	8130-175-01	Gyro USBL Mobile System Cable 50 m
820-6913	8130-175-01	Gyro USBL Mobile System Cable 100 m
312-8091	8130-200	Gyro USBL Tail Cable 5 m
312-8092	8130-200	Gyro USBL Tail Cable 30 m
312-8093	8130-200	Gyro USBL Tail Cable 50 m
312-8094	8130-200	Gyro USBL Tail Cable 100 m

Table D-2 Cable Diagrams for DP INS/Optimised Applications (continued)

CPN	Drawing No.	Type
312-8095	8130-200	Gyro USBL Tail Cable 200 m

Figure D-7 Subsea Lodestar Console Cable Assembly – CPN 820-0065

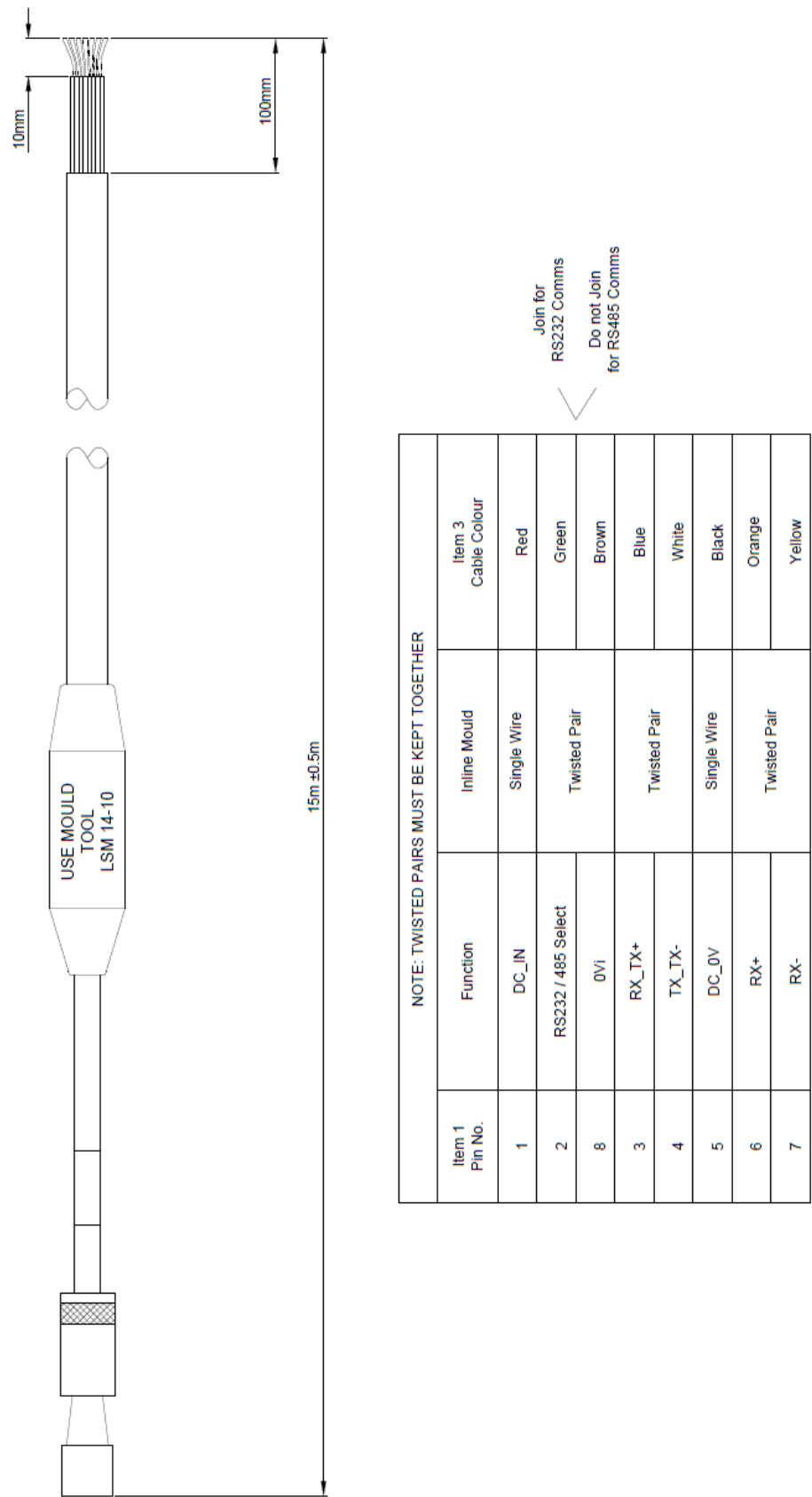
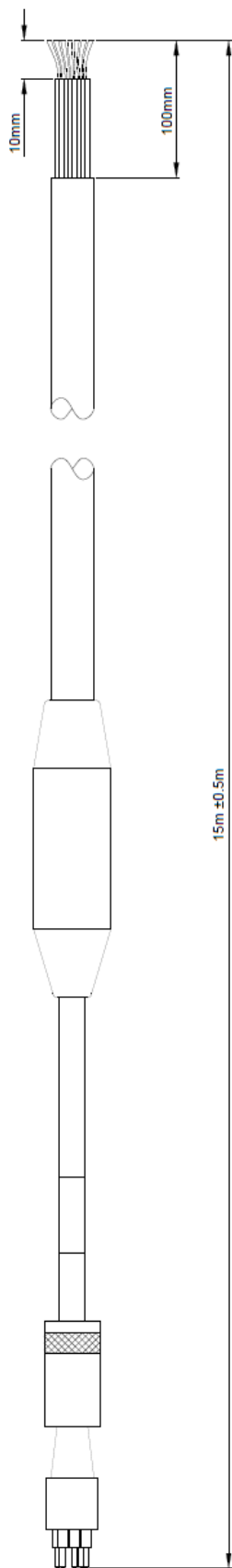


Figure D-8 Subsea Lodestar Comms C1 Cable Assembly – CPN 820-0068



Item 1 Pin No.	Function	Inline Mould	Item 3 Cable Colour
1	Not Used	Single Wire	Red
5	Not Used	Single Wire	Black
2	TRIG_IO	Twisted Pair	Green
8	0V <i>i</i>		Brown
3	RX_TX+	Twisted Pair	Blue
4	TX_TX-		White
6	RX+	Twisted Pair	Orange
7	RX-		Yellow

Figure D-9 Subsea Lodestar Comms Ethernet Tail Cable Assembly – CPN 820-0071

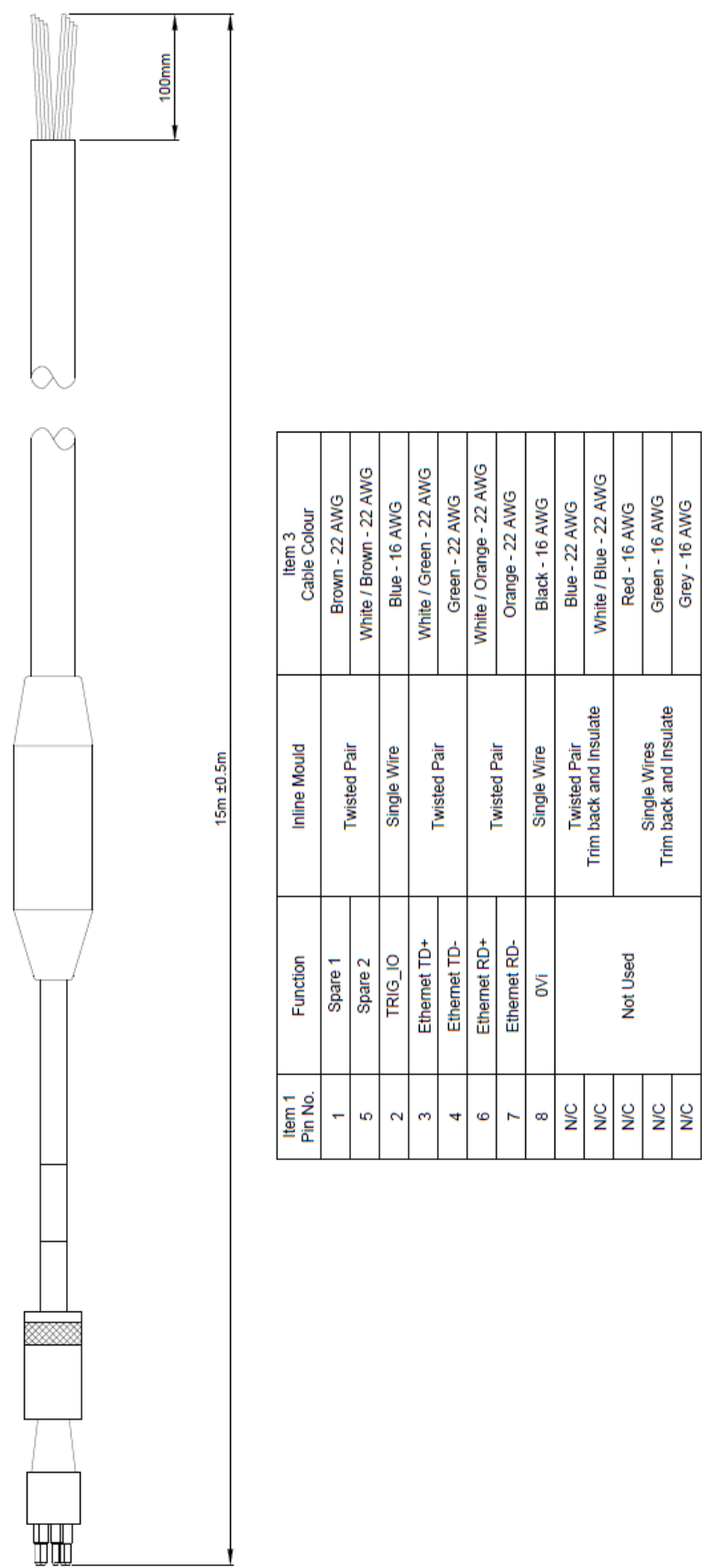
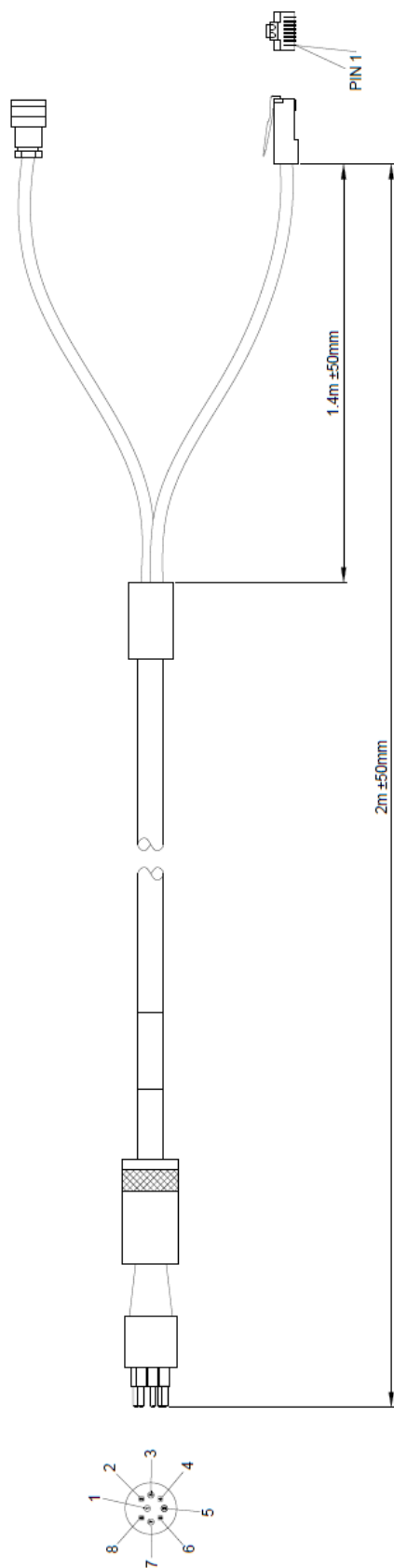
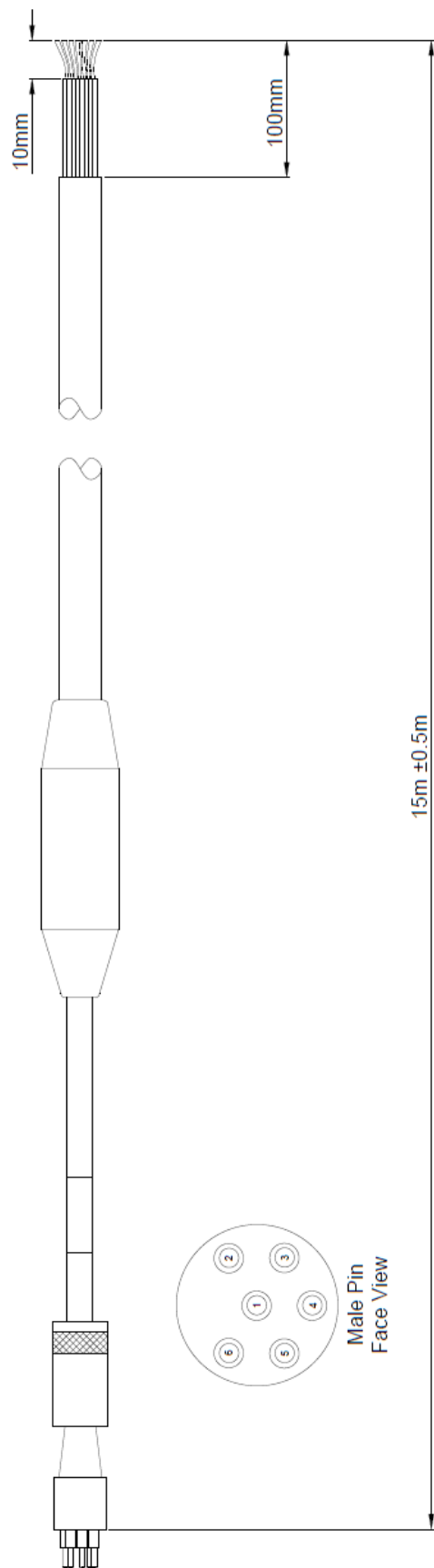


Figure D-10 Subsea Lodestar Comms Ethernet Cable Assembly – CPN 820-0072



Item 1 Pin No.	Function	Inline Splice	Connection
1	Not Used	N/C	Trim back and Insulate
2	TRIG_IO	Coax Inner	BNC Inner
3	Ethernet TD+	Twisted Pair	Item 4 Pin 3 - Green / White
4	Ethernet TD-	Twisted Pair	Item 4 Pin 6 - Green
5	Not Used	N/C	Trim back and Insulate
6	Ethernet RD+	Twisted Pair	Item 4 Pin 1 - Orange / White
7	Ethernet RD-	Twisted Pair	Item 4 Pin 2 - Orange
8	0V _i	Coax Outer	BNC Outer
			Item 4 Pin 5 - Blue / White
			Item 4 Pin 4 - Blue
			Item 4 Pin 7 - Brown / White
			Item 4 Pin 8 - Brown
Trim back and Insulate all unused wires			

Figure D-11 Subsea Lodestar Transceiver Tail Cable Assembly – CPN 820-0073



NOTE: TWISTED PAIRS MUST BE KEPT TOGETHER				
Item 1 Pin No.	Function	Inline Mould	Item 3 Cable Colour	
1	Not Used	Single Wire Trim back and Insulate	Red	
2	RX_485+	Twisted Pair	White	
3	TX_485-		Blue	
4	Not Used	Single Wire Trim back and Insulate	Black	
5	TRIG_IO	Twisted Pair	Brown	
6	0Vi		Green	
N/C	Not Used	Twisted Pair Trim back and Insulate	Orange	
N/C			Yellow	

Figure D-12 NSH Lodestar Tail Cable – CPN 820-0147

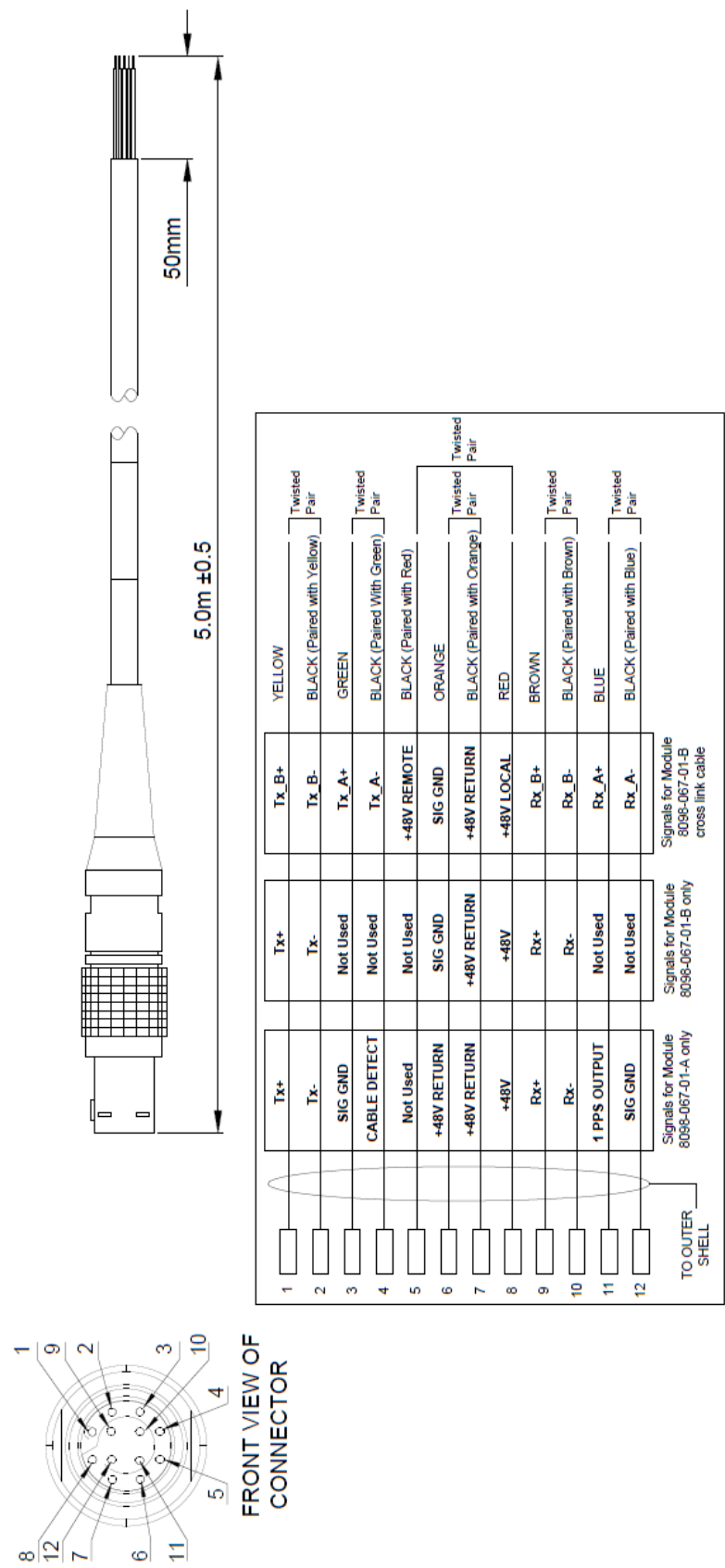


Figure D-13 Gyro USBL Mobile System Cable – CPN 820-6873

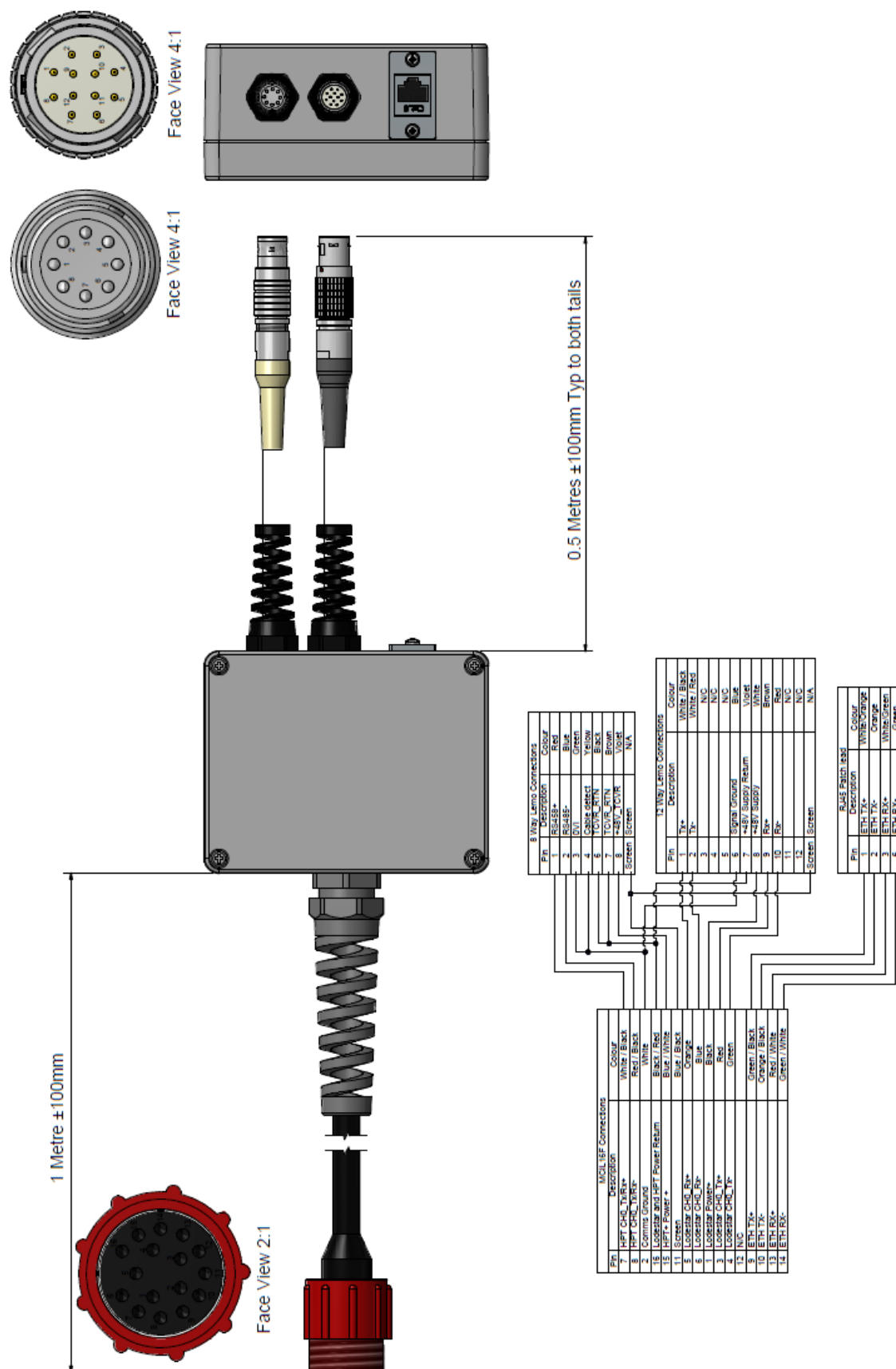


Figure D-14 Gyro USBL Mobile System Cable – CPN 820-6882, 820-6917, 820-6913

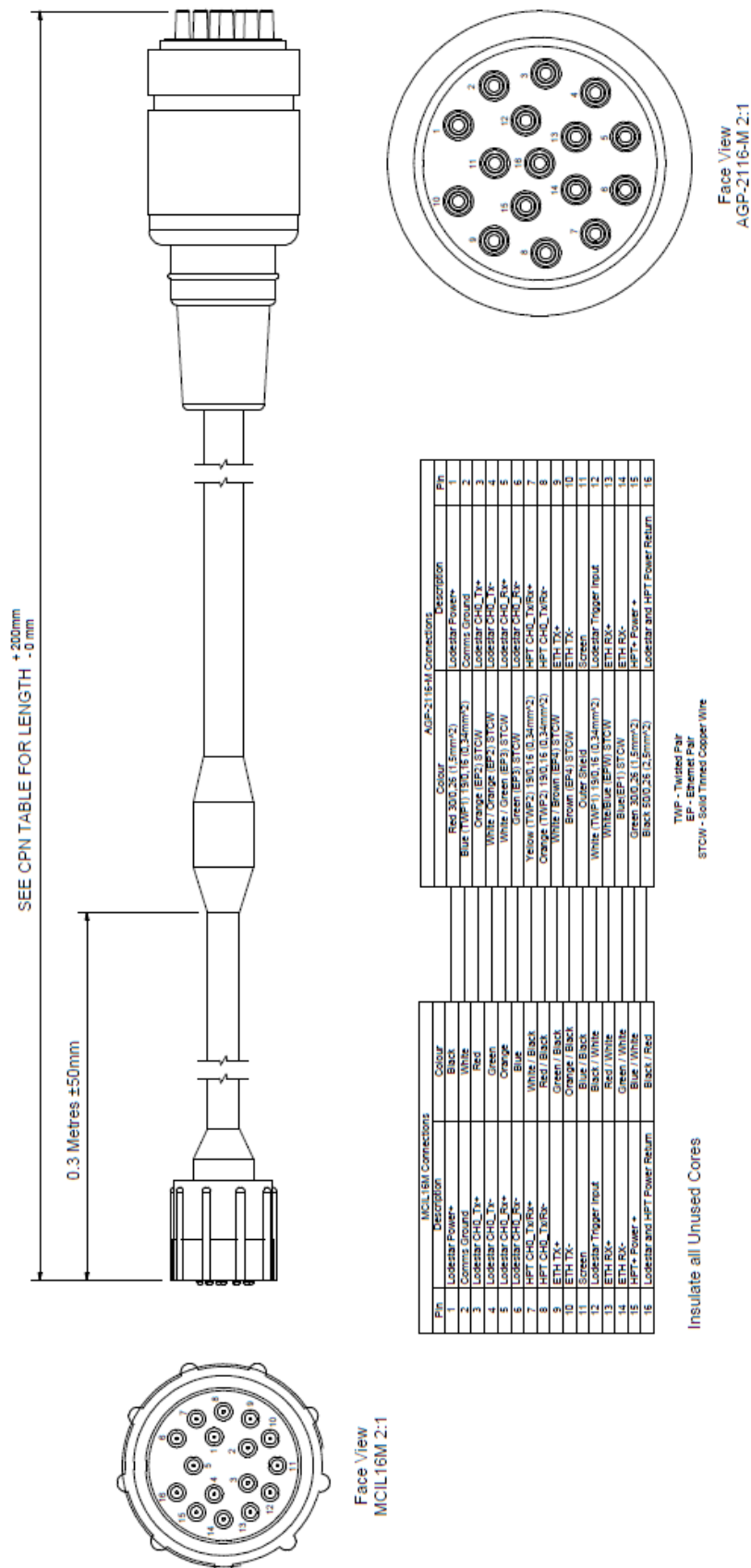
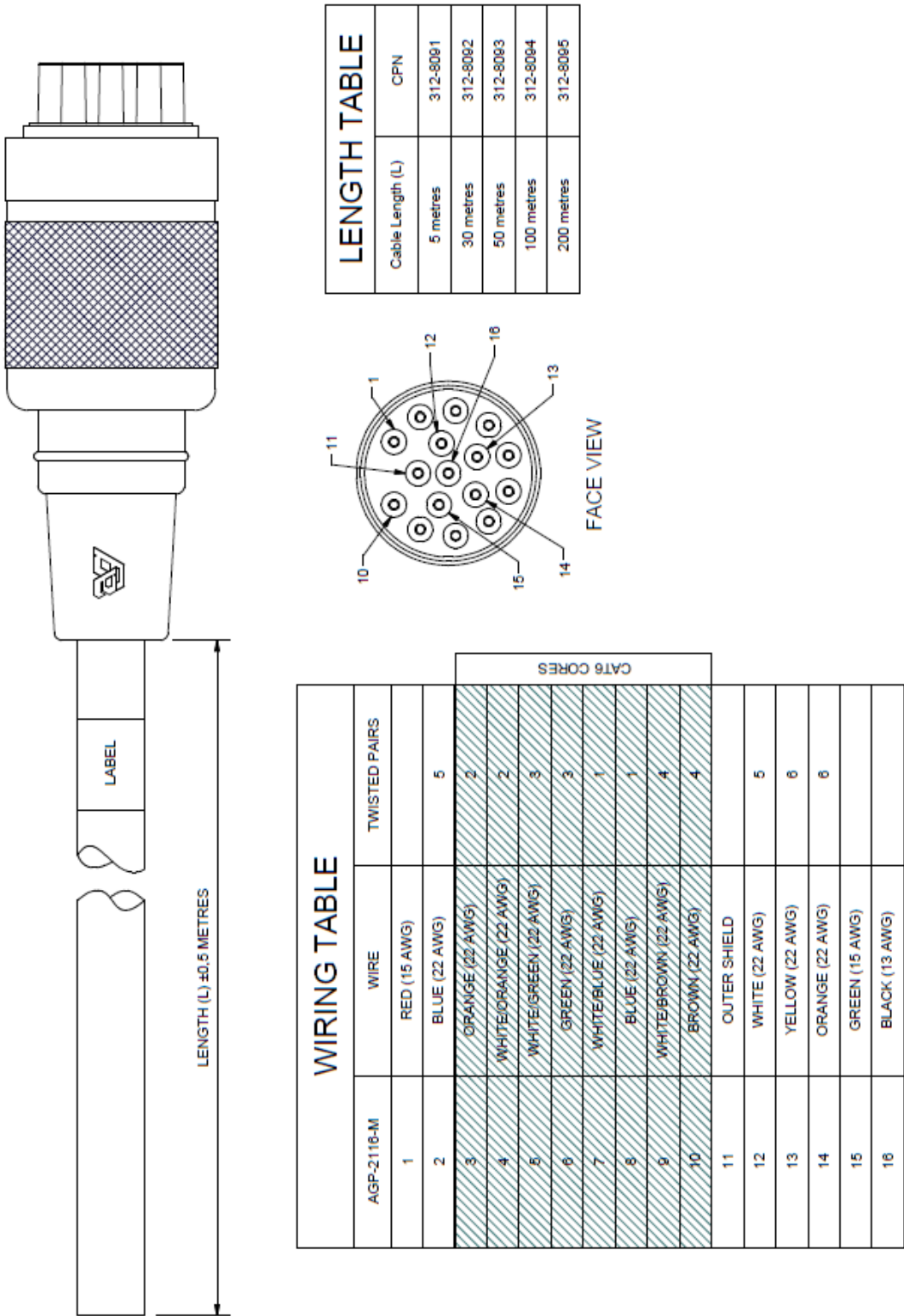


Figure D–15 Gyro USBL Tail Cable – CPN 312-8091 to 8095



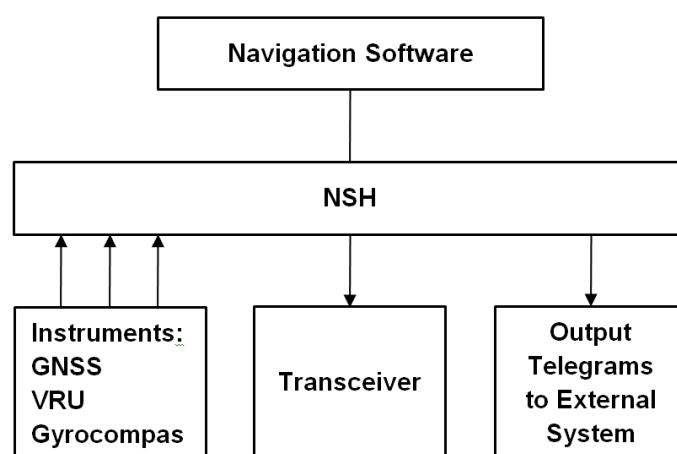
Appendix E – Output Telegram Formats and Interfaces

E.1 Introduction

Output Telegrams are used to send Reference Beacon or Mobile Vehicle position information to the Dynamic Positioning (DP) Desk or to the Navigation Package. *Table 4–3 "Position Out Telegrams"* lists the Output Telegrams supported by the system.

The HPR 309, HPR 418 BCD and HPR 418 F Output Telegrams are all industry standard formats used by DP vessels for the transfer of Hydro-acoustic Position Reference (HPR) beacon data.

Figure E–1 Interface Block Diagram



CAUTION

 **Risk of equipment malfunction. For DP applications, ensure that the DP Control System accepts the Position Estimate and Quality Factors published by the Acoustic Positioning Reference System in the Output Telegram, and that it weights the Estimate appropriately. Failure to do so can result in incorrect vessel positioning.**

E.2 HPR 309

E.2.1 Description

The HPR 309 Telegram is the output telegram from the HPR 309 DP.

E.2.2 Format

Table E–1 Field description of the HPR 309 Telegram

Field	Size (Bytes)	Byte Offset
Head	1	0
Roll	2	1
Pitch	2	3
Heading	2	5
Transponder Index	1	7
X Position	3	8
Y Position	3	11

Table E–1 Field description of the HPR 309 Telegram (continued)

Field	Size (Bytes)	Byte Offset
Z Position	3	14
Position Status	1	17
Time Out	1	18
Transponders in Sequence	3	19
Not Used (Tracking TD Angle)	2	22
Not Used (Test)	1	24
Transponder Type	1	25
Transponder Specification	1	26
Not Used (Transducers)	1	27
Not Used (Transducer Status)	1	28
Kalman Filter Window	1	29
Checksum	1	30
End of Telegram	1	31

E.2.2.1 Notes

- This telegram will be sent only if the status shows OK.
- The co-ordinate frame for vessel position is the sea-bed LBL array co-ordinate frame.
 - Positive X is North.
 - Positive Y is East.
- Bits 0 to 5 contain data.
- Bit 6 is only ever set on the last byte of the telegram.
- If there is a bit 7, it is zero.

E.2.3 Definition of Field Names:

E.2.3.1 Head

This is the telegram header that defines the mode of operation.

- Bit 0 is set for normal acoustic navigation.
- Bit 1 Test mode is set in DP_test mode and Simulate mode.
- Bit 2 is not supported by Sonardyne.
- Bit 3 is set if the Cartesian Y direction is North.

The bit is cleared if the Cartesian Y direction is the vessel forward direction (ship relative co-ordinates).

- Bit 4 is set if the data is smoothed by a filter.
- Bit 5 is set if the position reference point is the spare reference point.

E.2.3.2 Roll

This is the roll of the ship or the differential roll for a Riser Angle Monitoring System (MRAMS).

- Positive direction is port side up.
- Scaled integer, 12 bit, 2's complement.
- Resolution = $360.0 / 4096$ degrees. (= 0.0878906 degrees).
- Min = 800000 h = -2048 which relates to -180.0 degrees.
- 0 which relates to 0.0 degrees.
- Max = 7fffffh = 2047 which relates to (180 – resolution) degrees.

The first byte of this field in the telegram contains the six most significant bits, and the next byte contains the six least significant bits.

E.2.3.3 Pitch

This is the pitch of the ship or the differential pitch for a Riser Angle Monitoring System (MRAMS).

- Positive direction is bows up.
- Scaled integer, 12 bit, 2's complement.
- Resolution = $360.0 / 4096.0$ degrees
- Min = 800000h = -048 with relates to -180.0 degrees
- 0 which relates to 0.0 degrees.
- Max = 7fffffh = 2047 which relates to (180 – resolution) degrees.

The first byte of this field in the telegram contains the six most significant bits, and the next byte contains the six least significant bits.

E.2.3.4 Heading

- This is the vessel's heading.
- Positive direction is clockwise.
- Zero is north.
- Scaled integer, 12bit, 2's complement.
- Resolution = $360.0 / 4096.0$ degrees.
- Min = 800000h = -2048 which relates to -180.0 degrees.
- 0 which relates to 0.0 degrees.
- Max = 7fffffh = 2047 which relates to (180 – resolution) degrees.

The first byte of this field in the telegram contains the six most significant bits, and the next byte contains the six least significant bits.

E.2.3.5 Transponder Index

Zero means that the position is invalid. Otherwise, this field contains the index of the transponder.

- 1 to 9 = HPR Channels 1 to 9
- 10 to 14 = HPR Channels, □, △, ○, X, Y
- 15 to 63 = Undefined.

E.2.3.6 X Position

This is the X position of the transponder with respect to the vessel's datum.

- The positive direction is starboard.
- Valid when "transponder index" is not zero and when 'Status' is not zero.
- Scaled integer, 16-bit (sign-extended to 18 bits), 2's complement.
- Resolution = 8192.0 / 65536 metres. (= 0.125 m).
- Min = 8000h which relates to -4096.0 metres.
- 0 which relates to 0.0 degrees.
- Max = 7fffh which relates to (4096.0 – Resolution) metres.

The first byte of this field in the telegram contains the six most significant bits, the next byte contains bits 6 to 11 and the next byte contains the six least significant bits.

E.2.3.7 Y Position

This is the Y position of the transponder with respect to the vessel's datum.

- The positive direction is forwards.
- Valid when 'transponder index' is not zero and when 'Status' is not zero.
- Scaled integer, 16-bit (sign-extended to 18 bits), 2's complement.
- Resolution = 8192.0 / 65536 metres. (= 0.125 m).
- Min = 8000 h which relates to -4096.0 metres.
- 0 which relates to 0.0 degrees.
- Max = 7fffh which relates to (4096.0 – Resolution) metres.

The first byte of this field in the telegram contains the six most significant bits, the next byte contains bits 6 to 11 and the next byte contains the six least significant bits.

E.2.3.8 Z Position

This is the Z position of the transponder with respect to the vessel's datum.

- The positive direction is down.
- This is not depth. Depth is with respect to the surface of the water.
- Valid when 'transponder index' is not zero and when 'Status' is not zero.
- Scaled integer, 16-bit (sign-extended to 18 bits), 2's complement.
- Resolution = 8192.0 / 65536 metres. (= 0.125 m).
- Min = 8000 h which relates to -4096.0 metres.
- 0 which relates to 0.0 degrees.
- Max = 7fffh which relates to (4096.0 – Resolution) metres.

The first byte of this field in the telegram contains the six most significant bits, the next byte contains bits 6 to 11 and the next byte contains the six least significant bits.

E.2.3.9 Position Status

This telegram will be sent only if the status shows OK.

Flags:

- Bit 0 is set when the position data is invalid.
- Bit 1 is set when the telegram has come from a Slave on a Dual Redundant system.

- Bit 2 is not used.
- Bit 3 is set when the riser angle data is not valid.
- Bit 4 is not used.
- Bit 5 is not used.

Watchdog telegrams do not contain valid position data, and bit 0 is therefore set. The roll pitch and heading data is valid in a watchdog telegram.

E.2.3.10 Time Out

Bit 1 is set when the riser angle data is not valid. 0 = Standard Transponder.

E.2.3.11 Transponders in sequence

These are flags to indicate which transponders are being used.

Table E-2 HPR Channel Flags

	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1st byte	undefined	undefined	undefined	undefined	U	C
2nd byte	D	O	o	9	8	7
3rd byte	6	5	4	3	2	1

Bits are set for the transponders in use.

All other bits are cleared (including those whose meaning is undefined).

E.2.3.12 Not Used (Tracking TD Angle)

Zero.

E.2.3.13 Not Used (Test)

Zero.

E.2.3.14 Transponder Type

0 = Standard transponder.

6 = Differential angles from Riser Angle Monitoring System (MRAMS).

E.2.3.15 Transponder Specification

Flags.

Bit 0: Set for a mobile transponder, Cleared for a reference transponder.

Bits 1 to 5: Unused, all cleared.

E.2.3.16 Not Used (Transducers)

Zero.

E.2.3.17 Not Used (Transducer Status)

Zero.

E.2.3.18 Kalman Filter Window

This is the horizontal position quality, rounded to the nearest metre.

E.2.3.19 Checksum

This is the result of performing an exclusive-OR on all bytes in the telegram up to but not including this byte.

E.2.3.20 End of Telegram

This byte marks the end of a telegram. It is always 40h.

This byte is the only byte of the telegram with bit 6 set.

E.3 HPR 418 – Message 1 (USBL / SSBL)

E.3.1 Description

This sub-section describes the format and contents of the HPR 418 Rev. F Message 1 SSBL transponder position output telegram. REAL format and REAL_64 format as referred to in the 'Message Definition of Field Names' below are structured as follows:

- REAL = 32-bit floating point data
- REAL_64 = 64-bit floating point data

Both of these formats conform to IEEE standard 754. The 32-bit data uses the single precision data format; the 64-bit data uses the double precision format.

Table E–3 Field description of the HPR418 Telegram

Field	Byte	Byte Offset
Start character	1	0
Block length	2	1
Message type	1	3
Destination	1	4
Tp_index	2	5
Operation_mode	1	7
Sync_mode	1	8
Tp_type	1	9
TP_operation	1	10
Pos_data_form	1	11
Reply_status	1	12
Filt_X_pos	4	13
Filt_Y_pos	4	17
Filt_Z_pos	4	21
X_pos	4	25
Y_pos	4	29
Z_pos	4	33
Slant_range	4	37
P_course	4	41
P_roll	4	45
P_pitch	4	49

Table E-3 Field description of the HPR418 Telegram (continued)

Field	Byte	Byte Offset
Td_beam	1	53
Td_type	1	54
Td_num	2	55
Diagnostic	2	57
Stand_dev	4	59
Instr_data	4*n	63
Sumcheck	2	63+4*n
Stop character	1	64+4*n

E.3.1.1 Notes

The co-ordinate frame for SSBL transponder position data is relative to the vessel datum point.

- Positive Y is forward.
- Positive X is starboard.
- Positive Depth is down.

E.3.2 Definition of Field Names

E.3.2.1 Start Character

This is a single byte start character 55 hex.

E.3.2.2 Block length

A 2-byte block length number from 0 to 65536 defining the number of bytes after Destination field and before Sumcheck. It is 8 less than the message length.

In this case it is set to 3A hex plus the number of bytes of Instrument Data. There will usually be 0 bytes of Instrument Data. The number of Instrument Data bytes depends upon the type of transponder.

E.3.2.3 Message type

A single byte defining a number from 0 to 255 to indicate the type of message transmitted.

In this case it is 1.

E.3.2.4 Destination

A single byte number from 0 to 255 defining the device to which the message is transmitted.

This is not used by Sonardyne, but is set to 30 hex.

E.3.2.5 Tp_index

Two bytes defining the transponder channel.

On the -Sonardyne L/USBL it is possible to use a different Tp_index number from the acoustic channel in use. This is done to allow for the -Sonardyne Compatt transponders, which would not fit within the Simrad DP index system. An additional advantage is that, if a DP desk requires 418 telegrams and a survey desk requires 309 telegrams, by setting the index to a number between 1 and 16, both systems will work.

The selection of 9 as the Tp_index on the -Sonardyne L/USBL prior to V6.04 would cause 009 to be transmitted, which would be displayed as A09 on a DP desk. From V6.04 onwards, when index 9 is set, 109 is transmitted and the DP desk would display B09. The default value for DP_test is 1.

E.3.2.6 Operation_mode

A single byte containing the operation mode of the transceiver.

- 00 = standard navigation mode
- 01 = simulated position test mode. (Training)

E.3.2.7 Sync_mode

A single byte containing the synchronisation mode of the transceiver. It is not used. It is not used by -Sonardyne.

- 0 = no synchronisation

E.3.2.8 Tp_type

- 000 = transponder
- 003 = transponder with Riser Angle Monitoring System (MRAMS)

E.3.2.9 Tp_operation

A single byte defining the operation mode of the transponder:

- 000 = fixed standard transponder
- 001 = mobile standard transponder

E.3.2.10 Pos_data_form

A single byte defining the position co-ordinate format:

- Bit 0 = 0 vessel oriented, Cartesian
- Bit 0 = 1 North oriented, Cartesian

E.3.2.11 Reply_status

A single byte defining the transponder reply status:

- 000 = reply OK
- 001 = timeout 1 pulse (used as general data rejection status by -Sonardyne)

E.3.2.12 Filt_X_pos

A value in REAL format.

The filtered X – position co-ordinates of the transponder. Transponder's horizontal athwart ship distance from reference point in metres.

E.3.2.13 Filt_Y_pos

A value in REAL format.

The filtered Y – position co-ordinates of the transponder. Transponder's horizontal fore and aft ship distance from reference point in metres.

E.3.2.14 Filt_Z_pos (Depth)

A value in REAL format.

The filtered Z – position co-ordinates of the transponder. Transponder's vertical distance from reference point in metres.

E.3.2.15 X_pos

A value in REAL format.

The raw X – position co-ordinates of the transponder. Transponder's horizontal athwart ship distance from reference point in metres.

E.3.2.16 Y_pos

A value in REAL format.

The raw Y – position co-ordinates of the transponder. Transponder's horizontal fore and aft ship distance from reference point in metres.

E.3.2.17 Z_pos (Depth)

A value in REAL format.

The raw Z – position co-ordinates of the transponder. Transponder's vertical distance from reference point in metres.

E.3.2.18 Slant_range

A value in REAL format.

The direct raw slant range from the vessel's CRP to the transponder in metres.

Note



Simrad standard is from the Transducer to the Beacon. -Sonardyne deviate from this standard because the solution may be the result of measurements to more than one transducer.

E.3.2.19 P_course

A value in REAL format.

The vessel's course at the time of transponder position measurement; 0 to 360 degrees.

E.3.2.20 P_roll

A value in REAL format.

The vessel's roll at the time of transponder position measurement +/-180 degrees.

E.3.2.21 P_pitch

A value in REAL format.

The vessel's pitch at the time of transponder position measurement +/-180 degrees.

E.3.2.22 Td_beam

A single byte defining the transducer beam.

- 0 = wide
- 1 = narrow.

E.3.2.23 Td_type

Defines the transducer type.

Sonardyne uses value 0 (30kHz wide beam only).

E.3.2.24 Td_num

A 16-bit word that defines the transducer number.

Sonardyne do not differentiate between transducers and transceivers and always use the value 1. This is because all positions are reported relative to the CRP, and because the solution may be the result from more than one transducer.

E.3.2.25 Diagnostic

Sonardyne do not use this field because it is specific to Simrad hardware. The value is always 0 (no errors).

E.3.2.26 Stand_dev

A value in REAL format.

This is the horizontal position quality in metres.

E.3.2.27 Instr_data (*)

If Tp_type = 3 then 8 bytes of differential riser angle (MRAMS) data are added: 4 bytes of differential roll in REAL format, followed by 4 bytes of differential pitch in REAL format.

E.3.2.28 Sumcheck

Sumcheck of the contents of the entire telegram except for the sumcheck itself and the stop character. The sumcheck is a 16-bit integer calculated by normal byte + byte addition.

E.3.2.29 Stop character

This is a single byte stop character AA hex.

E.4 HPR 418 – Message 2 (LBL / LUSBL)

E.4.1 Description

This describes the format and contents of the HPR 418 Rev F Message 2 LBL vessel position output telegram.

The LBL position contains the vessel's position relative to the origin at the LBL transponder array, which is transmitted after each position calculation. If the transponder array is north-oriented, the co-ordinates are relative to true North, otherwise they are relative to local North.

REAL format and REAL_64 format as referred to in Format: Message 2 LBL Vessel Position Data below are structured as follows:

- REAL = 32-bit floating point data
- REAL_64 = 64-bit floating point data

Both of these formats conform to IEEE standard 754. The 32-bit data uses the single precision data format and the 64-bit data uses the double precision format.

Table E-4 Field Description of the HPR418 Telegram Message 2

Field	Byte	Byte Offset
Start character	1	0
Block length	2	1
Message type	1	3

Table E-4 Field Description of the HPR418 Telegram Message 2 (continued)

Field	Byte	Byte Offset
Destination	1	4
Sequence_number	2	5
Time_header (7)	7	7
Interrogation_age	2	14
Tp_array	1	16
Td_num	1	17
Pos_east	8	18
Pos_north	8	26
Depth	4	34
Hor_err_ellipse_direction	4	38
Hor_err_ellipse_major	4	42
Hor_err_ellipse_minor	4	46
Z_standard_deviation	4	50
Pos_type	1	54
Pos_status	1	55
P_course	4	56
P_roll	4	60
P_pitch	4	64
Diagnostic	2	68
Sumcheck	2	70
Stop character	1	72

E.4.2 Notes

- This telegram will be sent only if the status is OK.
- The co-ordinate frame for vessel position is the seabed LBL array co-ordinate frame.
 - Positive X is North
 - Positive Y is East

E.4.3 Definition of Field Names

E.4.3.1 Start character

This is a single byte start character 55 hex.

E.4.3.2 Block length

A 2-byte block length number from 0 to 65536 that defines the number of bytes after the Destination field and before Sumcheck. It is 8 less than the message length. In this case it is set to 36 hex.

E.4.3.3 Message type

A single byte defining a number from 0 to 255 to indicate the type of the message transmitted.

In this case it is 2.

E.4.3.4 Destination

A single byte number from 0 to 255 that defines the device to which the message is transmitted.

This is not used by -Sonardyne, but is set to 30 hex.

E.4.3.5 Sequence_number

This number is set to zero when navigation starts and is incremented for each LBL interrogation. The range is from 0 to 65535 and will wrap around to 0 when 65535 is reached.

E.4.3.6 Time_header (7)

Defines the clock when the position is valid.

Table E-5 describes the format of the time_header.

Table E-5 Time_header format

Block Content	Size	Index	Resolution	Range
Day	Byte	0	1 Day	1 to 31
Month	Byte	1	1 Month	1 to 12
Year	Byte	2	1 Year	0 to 99
Hours	Byte	3	1 Hour	0 to 23
Minutes	Byte	4	1 Minute	0 to 59
Seconds	Byte	5	1 Second	0 to 59
1/100th seconds	Byte	6	1/100th Second	0 to 99

E.4.3.7 Interrogation_age

Time interval since the previous interrogation of the array. The time resolution is 1ms.

E.4.3.8 Tp_array

A single byte that defines the number of the transponder array in use. Its value can be 0, 1, 2 or 3. - Sonardyne sets this to 0.

E.4.3.9 Td_num

A 16-bit word that defines the transducer number.

Sonardyne do not differentiate between transducers and transceivers and always use the value 1. This is because all positions are reported relative to the CRP, and because the solution may be the result from more than one transducer.

E.4.3.10 Pos_east

A value in REAL_64 format.

East co-ordinates in metres, with a positive value meaning East. Negative values indicate West.

The co-ordinates are either local co-ordinates or global UTM co-ordinates.

E.4.3.11 Pos_north

A value in REAL_64 format.

North co-ordinates in metres, with a positive value meaning North. Negative values indicate South.

The co-ordinates are either local co-ordinates or global UTM co-ordinates.

E.4.3.12 Depth

A value in REAL format.

The depth co-ordinate with a positive value meaning downwards.

For the vessel, the depth is the vertical distance from the sea level to the vessel's CRP. For ROVs and relay transponders, the depth is the depth below the sea surface of the transducer on the unit.

E.4.3.13 Hor_err_ellipse_ direction

Each LBL position measurement has a likelihood ellipse associated with it. It is based on 1 δ in each of the axes. The direction is the angle in degrees between the North axis and the major axis of the ellipse. It is a value in REAL format.

E.4.3.14 Hor_err_ellipse_ major

The major axis of the likelihood ellipse in metres. A value in REAL format.

E.4.3.15 Hor_err_ellipse_ minor

The minor axis of the likelihood ellipse in metres. A value in REAL format.

E.4.3.16 Z_standard_ deviation

The standard deviation (δ) of the depth in metres.

E.4.3.17 Pos_type

A single byte with value:

- 0 = Vessel position
- 1 = ROV 1 position
- 16 = ROV 16 position
- 17 = Relay 1 position
- 20 = Relay 4 position

Bit 7 acts as a switch for local co-ordinates or UTM co-ordinates:

- 0 = local
- 1 = UTM

Sonardyne currently only set this bit to zero. However, if large numbers appear in the **Pos_east** and **Pos_north** fields then they are very likely to be UTM values because local numbers tend to be less than 3000 m.

E.4.3.18 Pos_status

A single byte with value 0.

This variable tells the status of the position calculation. It will always show 0 to indicate the status of the position calculation, because the telegram will not be sent unless this status is OK.

- 0 = OK position

E.4.3.19 P_course

A value in REAL format.

The vessel's course at the time of transponder position measurement; 0 to 359.9°.

E.4.3.20 P_roll

A value in REAL format.

The vessel's roll at the time of transponder position measurement $\pm 180^\circ$.

E.4.3.21 P_pitch

A value in REAL format.

The vessel's pitch at the time of transponder position measurement $\pm 180^\circ$.

E.4.3.22 Diagnostic

Sonardyne do not use this field because it is specific to Simrad hardware. It is always set to zero to indicate no errors.

E.4.3.23 Sumcheck

Sumcheck of the contents of the entire telegram except for the sumcheck itself and the stop character. The sumcheck is a 16-bit integer calculated by normal byte + byte addition.

E.4.3.24 Stop character

This is a single byte stop character AA hex.

E.5 HPR 418 BCD – Message 1

E.5.1 Description

This sub-section describes the format and contents of the HPR 418 BCD Message 1 SSBL transponder position output telegram. This is a condensed 418 telegram form designed to fit within the length of a 309 telegram so as to overcome hardware buffer size constraints on older DP desks.

E.5.1.1 BCD

BCD stands for Binary Coded Decimal, and requires 4 bits (a 'nibble') to encode a single character.

In conventional BCD the values 0 to 9 inclusive are the only valid characters. However some of the bytes in the Simrad specification allow the use of alpha Hexadecimal (hex) characters A to F inclusive. The most common use among these is D, because it is used as a negative indicator in the most significant nibble of a 3-byte field.

The Start- and End-of-Message fields include fixed alpha hex values in both nibbles. The Status bytes, which are assembled bit-by-bit, can in some conditions also include alpha hex characters. The checksum byte is also likely to contain alpha hex characters.

Table E-6 Field Description of the HPR418BCD Telegram Message 1

Field	Byte	Sample BCD Data
SOT (Start of Telegram)	1	DF
Head Byte	2	01
Status Byte 1	3	01
Status Byte 2	4	00
Transponder Type	5	02

Table E-6 Field Description of the HPR418BCD Telegram Message 1 (continued)

Field	Byte	Sample BCD Data
Transponder Index	67	0133
X Position Raw	8910	001234
Y Position Raw	111213	D05678
Z Position Raw	141516	012345
Heading	1718	3599
Optional Data 1	192021	000003
Optional Data 2	222324	D00075
Horizontal Error Ellipse Direction	2526	0000
Horizontal Error Ellipse Major	2728	0000
Horizontal Error Ellipse Minor	2930	0000
Checksum	31	XX
EOR (End of Record)	32	FF

E.5.1.2 Notes

- The co-ordinate frame for SSBL transponder position data is relative to the vessel datum point.
 - Positive Y is forward
 - Positive X is Starboard
 - Positive Depth is down

E.5.2 Definition of Field Names

E.5.2.1 SOT (Start of Telegram)

This is a single byte start character DF hex.

E.5.2.2 Head Byte

This byte indicates the message type and is always 01 hex for a transponder message type 1.

E.5.2.3 Status Byte 1

- Bit 0 set = position measurement OK
- Bit 1 set = position is filtered
- Bit 2 not used by Sonardyne. Bit set to 0
- Bit 3 not used by Sonardyne. Bit set to 0
- Bit 4 not used by Sonardyne. Bit set to 0
- Bit 5 set = data from Slave system; clear = data from Master system
- Bit 6 set = BCD conversion error
- Bit 7 not used by Sonardyne. Bit set to 0

E.5.2.4 Status Byte 2

- Bits 0 to 1 = Transducer number. Not used by Sonardyne. Bits are set to 01 — Tdr 1
- Bits 2 to 3 = Transceiver number. Not used by Sonardyne. Bits are set to 01 — Tcvr 1

- Bit 4 set = Simulate mode
- Bit 5 set = Mobile transponder
- Bit 6 not used by Sonardyne. Bit set to 0
- Bit 7 set = data from Slave system; clear = data from Master system

E.5.2.5 Transponder Type

A single byte defining the transponder type.

- 00 = standard transponder
- 03 = Riser Angle Monitoring System (MRAMS) transponder

E.5.2.6 Transponder Index

Two bytes that define the transponder channel.

The software allows you to use a different TP_index number from the acoustic channel in use. This is done so as to cater for the Sonardyne COMPATT transponders, which would not fit within the Simrad DP index system. This also has another advantage in that if a DP desk requires 418BCD telegrams and a survey desk requires 309 telegrams, by setting the index to a number between 1 and 16, both systems will work.

The selection of 9 as the Tp_index on the -Sonardyne L/USBL prior to V6.04 would cause 00 09 hex to be transmitted, which would be displayed as A09 on a DP desk. From V6.04 onwards, when index 9 is set, 01 09 hex is transmitted and the DP desk would display B09. The default value for DP_test is index 1.

E.5.2.7 X Position Raw

Three bytes used for the beacon athwartship position.

The MSB is used for the sign and therefore the most significant nibble only returns 0 hex for positive or D hex for negative. The LSB is 1/10th of the unit.

E.5.2.8 Y Position Raw

Three bytes used for the beacon along-ship position.

The MSB is used for the sign and therefore the most significant nibble only returns 0 hex for positive or D hex for negative. The LSB is 1/10th of the unit.

E.5.2.9 Z Position Raw

Three bytes used for the beacon depth.

The MSB is used for the sign and therefore the most significant nibble only returns 0 hex for positive or D hex for negative. The LSB is 1/10th of the unit.

E.5.2.10 Heading

Two bytes used for the vessel heading.

The LSB is 1/10th of a degree.

E.5.2.11 Optional Data 1 (Vessel Roll)

Three bytes used for the vessel roll or differential roll for a Riser Angle Monitoring System (MRAMS).

The MSB is used for the sign and therefore the most significant nibble only returns 0 hex for positive or D hex for negative. The LSB is 1/10th of the unit.

E.5.2.12 Optional Data 2 (Vessel Pitch)

Three bytes used for the vessel pitch or differential pitch for a Riser Angle Monitoring System (MRAMS).

The MSB is used for the sign and therefore the most significant nibble only returns 0 hex for positive or D hex for negative. The LSB is 1/10th of the unit.

E.5.2.13 Horizontal Error Ellipse Direction

Each position measurement has a likelihood ellipse associated with it. It is based on 1 σ in each of the axes.

Two bytes are used to indicate the direction of the major axis in degrees between the North axis and the major axis of the ellipse. The LSB is 1/10th of the unit.

E.5.2.14 Horizontal Error Ellipse Major

Two bytes used to indicate the major axis of the likelihood ellipse in metres.

The LSB is 1/10th of the unit.

E.5.2.15 Horizontal Error Ellipse Minor

Two bytes used to indicate the minor axis of the likelihood ellipse in metres.

The LSB is 1/10th of the unit.

E.5.2.16 Checksum

The result of performing an exclusive OR on all bytes in the telegram up to but not including this byte. Bit 7 is always zero.

E.5.2.17 EOR (End of Record)

This byte marks the end of a telegram. It is always FF.

E.6 HPR 418 BCD – Message 2

E.6.1 Description

This sub-section describes the format and contents of the HPR 418 BCD Message 2 LBL position output telegram. This is a condensed 418 telegram form designed to fit within the length of a 309 telegram so as to overcome hardware buffer size constraints on older DP desks.

E.6.1.1 BCD

BCD stands for *Binary Coded Decimal* and requires 4 bits (a 'nibble') to encode a single character.

In conventional BCD the values 0 to 9 inclusive are the only valid characters. However some of the bytes in the Simrad specification allow the use of alpha Hexadecimal (hex) characters A to F inclusive. The most common use among these is D, because it is used as a negative indicator in the most significant nibble of a 3-byte field.

The Start- and End-of-Message fields include fixed alpha hex values in both nibbles. The Status bytes, which are assembled bit-by-bit, can in some conditions also include alpha hex characters. The checksum byte is also likely to contain alpha hex characters.

Table E-7 Field Description of the HPR418BCD Telegram Message 2

Field	Byte	Sample BCD Data
SOT (Start of Telegram)	1	DF

Table E-7 Field Description of the HPR418BCD Telegram Message 2 (continued)

Field	Byte	Sample BCD Data
Head Byte	2	02
Status Byte 1	3	01
Status Byte 2	4	00
Object Type	5	02
Transponder Array	6	01
X Position Raw	7891011	0000123456
Y Position Raw	1213141516	D000098765
Z Position Raw	171819	122345
Heading	2021	3599
Not Used	222324	000000
Horizontal Error Ellipse Direction	2526	0000
Horizontal Error Ellipse Major	2728	0000
Horizontal Error Ellipse Minor	2930	0000
Checksum	31	XX
EOR (End of Record)	32	FF

E.6.1.2 Notes

- This telegram will be sent only if the status is OK.
- The co-ordinate frame for vessel position is the sea-bed LBL array co-ordinate frame.
 - Positive X is North
 - Positive Y is East

E.6.2 Definition of Field Names

E.6.2.1 SOT (Start of Telegram)

This is a single byte start character DF hex.

E.6.2.2 Head Byte

This byte indicates the message type and is always 02 hex for an object message type 2.

E.6.2.3 Status Byte 1

- Bit 0 set = position measurement OK
- Bit 1 set = position is filtered
- Bit 2 not used by Sonardyne. Bit set to 0
- Bit 3 not used by Sonardyne. Bit set to 0
- Bit 4 not used by Sonardyne. Bit set to 0
- Bit 5 set = data from Slave system; clear = data from Master system
- Bit 6 set = BCD conversion error
- Bit 7 not used by Sonardyne. Bit set to 0

Status Byte 2

- Bits 0 to 1 = Transducer number. (not used by Sonardyne. Bit are set to 01 - Tdr 1)
- Bits 2 to 3 = Transceiver number. (not used by Sonardyne. Bit are set to 01 - Tcvt 1)
- Bit 4 set = Simulate mode.
- Bit 5 Not used by Sonardyne. Bit set to 0
- Bit 6 LBL co-ordinates in UTM
- Bit 7 set = data from Slave system; clear = data from Master system

E.6.2.4 Object Type

A single byte defining the object type.

- 00 = Vessel position
- 01 = ROV position
- 16 = ROV 16 position
- 17 = Relay 1 position
- 18 = Relay 2 position
- 19 = Relay 3 position
- 20 = Relay 4 position

E.6.2.5 Transponder Array

Sonardyne fix this byte to 01 hex.

E.6.2.6 X Position Raw

Five bytes used for the object position in Northings.

The MSB is used for the sign and therefore the most significant nibble only returns 0 hex for positive or D hex for negative. The LSB is 1/100th of the unit.

E.6.2.7 Y Position Raw

Five bytes used for the object position in Eastings.

The MSB is used for the sign and therefore the most significant nibble only returns 0 hex for positive or D hex for negative. The LSB is 1/100th of the unit.

E.6.2.8 Z Position Raw

Three bytes used for the beacon depth.

The MSB is used for the sign and therefore the most significant nibble only returns 0 hex for positive or D hex for negative. The LSB is 1/10th of the unit.

E.6.2.9 Heading

Two bytes used for the vessel heading. The LSB is 1/10th of a degree.

E.6.2.10 Not Used

Three bytes filled with 00 hex.

E.6.2.11 Horizontal Error Ellipse Direction

Each position measurement has a likelihood ellipse associated with it. It is based on 1 δ in each of the axes.

Two bytes are used to indicate the direction of the major axis in degrees between the North axis and the major axis of the ellipse. The LSB is 1/10th of the unit.

E.6.2.12 Horizontal Error Ellipse Major

Two bytes used to indicate the major axis of the likelihood ellipse in metres.

The LSB is 1/10th of the unit

E.6.2.13 Horizontal Error Ellipse Minor

Two bytes used to indicate the minor axis of the likelihood ellipse in metres.

The LSB is 1/10th of the unit.

E.6.2.14 Checksum

The result of performing an exclusive OR on all bytes in the telegram up to but not including this byte. Bit 7 is always zero.

E.6.2.15 EOR

This byte marks the end of a telegram. It is always FF.

E.7 NMEA 0183 SSB – (USBL / SSBL Position)

E.7.1 Description

The maximum length of the NMEA 0183 SSB Telegram is 82 characters, including the start character <\$> and the termination characters <CR> and <LF>. However the telegram will typically be less than this and will be of variable length, because leading zeros are suppressed.

Table E-8 Field Description of the SSBL Telegram

Field	Data Format	Sample Data
Start Character	\$	\$
Address	PSIMSSB	PSIMSSB
Time	,hhmmss.ss	,130700.43
Tp_code	,ann	,B22
Status	,a	,A (Always)
Error_code	,aaa	,
Coordinate_system	,a	,C
Orientation	,a	,H
SW_filter	,a	,M
X_coordinate	,x.x	,-100000.40
Y_coordinate	,x.x	,-100000.89
Depth	,x.x	,4329.10
Expected_accuracy	,x.x	,3.16
Additional_info	,a	,I

Table E–8 Field Description of the SSBL Telegram (continued)

Field	Data Format	Sample Data
First_add_value	,x.x	,-12.3
Second_add_value	,x.x	,-14.0
Checksum	*hh	*hh
Termination	<CR><LF>	<CR><LF>

E.7.1.1 Notes

- This telegram will be sent only if the status is OK.
- The co-ordinate frame for SSBL transponder position data is relative to the vessel datum point.
 - Positive Y is forward
 - Positive X is Starboard
 - Positive Depth is down

E.7.2 Definition of Field Names

E.7.2.1 Start_character

The single ASCII character <\$>.

E.7.2.2 Address

The ASCII character string <PSIMSSB> to indicate that the telegram is a Simrad SSBL message.

E.7.2.3 Time

The time at which the fix was valid.

An ASCII character string preceded by a comma, indicating the time in hh (hours) mm (minutes) ss (seconds). (decimal point) ss (hundredths of seconds)

<,hhmmss.ss>

Example: <,035623.19>

Alternatively the field may be left blank, for example <,>.

E.7.2.4 Tp_code

The index of the transponder used.

B01 to B99 = MF channels

Examples: B05, B55, B58

The format is three ASCII characters preceded by a comma <,ann>, for example <,B17>

E.7.2.5 Status

This will always show OK because this telegram is sent only if the status is OK.

E.7.2.6 Error_code

This is always blank because the telegram will not be sent if there is an error code (meaning that the status is not OK).

E.7.2.7 Coordinate_system

A single ASCII character preceded by a comma <,a>

C = Cartesian co-ordinates, U = UTM, R = Radians.

E.7.2.8 Orientation

A single ASCII character preceded by a comma <,a>

H = Vessel head up, or N = North up.

E.7.2.9 SW_filter

A single ASCII character preceded by a comma <,a>

F = filtered, or M = measured.

E.7.2.10 X_coordinate

When no position has been calculated the field will be empty and only the comma field separator will be sent <,>

When data is present the field takes the form <,xxx.xx>. It is of variable length with leading zeros suppressed (see *Table E-9 "Supported options for NMEA SSB Telegram"*).

E.7.2.11 Y_coordinate

When no position has been calculated the field will be empty and only the comma field separator will be sent <,>

When data is present the field takes the form <,xxx.xx>. It is of variable length with leading zeros suppressed (see *Table E-9 "Supported options for NMEA SSB Telegram"*).

Table E-9 Supported options for NMEA SSB Telegram

Coordinate system	Orientation	X_coordinate	Y_coordinate
C	H	Starboard	Forwards
C	N	North (m)	East (m)
U	N	Northings (m)	Eastings (m)
R	N	Latitude (radians)	Longitude (radians)

E.7.2.12 Additional_info

A single ASCII character preceded by a comma <,a>

I = inclinometer, T = time, D = depth and N = none <,N>

E.7.2.13 First_add_value

- When the **Additional_info** field is I then the field will represent differential roll for a Riser Angle Monitoring System (MRAMS).
- When the **Additional_info** field is T then the field will represent range time in seconds.
- When the **Additional_info** field is D then the field will represent measured depth in metres.

The data field takes the form <,xxx.xx>. It is of variable length with leading zeros suppressed.

E.7.2.14 Second_add_value

When the Additional_info field is N then this field will be empty and only the comma field separator will be sent <,>

When data is present its meaning is controlled by the Additional_info field. The only option supported by -Sonardyne is differential pitch for a Riser Angle Monitoring System (MRAMS).

The data field takes the form <,xxx.xx>. It is of variable length with leading zeros suppressed.

E.7.2.15 Checksum

The result of performing an exclusive OR on all bytes in the telegram up to but not including this byte. Bit 7 is always zero.

E.7.2.16 Termination

The ASCII for Carriage Return followed by Line Feed are sent <CR><LF>.

E.8 NMEA 0183 – LBP (LBL / LUBSL Position)

E.8.1 Description

The maximum length of the NMEA 0183 LBP Telegram is 82 characters, including the start character <\$> and the termination characters <CR> and <LF>. However, the telegram will typically be less than this and will be of variable length, because leading zeros are suppressed.

E.8.2 Field Description

Table E-10 Field Description of the LBP Telegram

Field	Data Format	Sample Data
Start_character	\$	\$
Address	PSIMLBP	PSIMLBP
Time	,hhmmss.ss	,130700.43
Tp_array	,c--c	,1
Type	,a_	,Ve
Status	,A	,A
Coordinates	,a_	,C
X_coordinate	,x.x	123.45
Y_coordinate	,x.x	678.90
Depth	,x.x	456.78
Major	,x.x	1.23
Minor	,x.x	1.32
Direction	,x.x	0.00
Res_rms	,x.x	0.97
Checksum	*hh	*hh
Termination	<CR><LF>	<CR><LF>

E.8.3 Definition of Field Names

E.8.3.1 Type

Ve = vessel.

R1 to R4 = ROV 1 to ROV 4.

E.8.3.2 Status

The Status field is A when the measurements are OK. The possible statuses are as shown below:

- A OK
- ??? Simulating or error condition

E.8.4 X_coordinate, Y_coordinate, Coordinate_system

The contents of the **X_coordinate** and the **Y_coordinate** fields are controlled by the settings in the **Configure** dialog box.

The **Coordinate_system** field should be used to decode the X_ and Y_coordinate fields as shown in *Table E-11*.

Table E-11 NMEA 0183 LBP Coordinate Fields

APOS Configure Setting	Coordinate system	X_coordinate	Y_coordinate
Cartesian N/E	C	North	East
UTM N/E	U	Northings	Eastings
Radians	R	Latitude	Longitude

Depth - the depth in meters

Major, Minor, Direction - the major axis, minor axis and direction of the error ellipse.

E.9 PSONALL – Sonardyne General Position Report

E.9.1 Description

The PSONALL telegram is an extended version of a standard PSONOG grid co-ordinate position telegram for use when transferring vehicle positions to client navigation systems. The included co-ordinates use the selected projection system defined in software.

E.9.2 Format

The PSONALL telegram format shown below consists of a single string, separated across two lines here for clarity.

\$PSONALL,Name,Offset,HHMMSS.ss,EEEEEEEE.ee,NNNNNNNN.nn,
DDDD.dd,HHH.hh,CCC.cc,T,PP.PP,RR.RR,VVV.vv,AAA.AA,BBB.BB*hh<CR><LF>

E.9.3 Field Descriptions

Table E-12 Field Description for the PSONALL Telegram

Field	Description
\$PSONALL	Header to identify the telegram.

Table E-12 Field Description for the PSONALL Telegram (continued)

Field	Description
Name	The name of the vehicle the string relates to.
Offset	Offset on vehicle the position relates to.
HHMMSS.ss	The valid time of the sentence.
EEEEEEEE.ee	Grid Easting.
NNNNNNNN.nn	Grid Northing.
DDDD.dd	Depth.
HHH.hh	Heading ¹
CCC.cc	Course made good (CMG) ¹
T	Heading type: G = grid T = True M = Magnetic
PP.PP	Vehicle Pitch ¹
RR.RR	Vehicle Roll ¹
VVV.vv	Velocity ¹
AAA.AA	Position accuracy (95%).
BBB.BB	Depth accuracy.
*hh	Checksum.
<CR><LF>	Termination characters, carriage return plus linefeed.

¹ Empty fields are null by default as shown above, or replaced with '0.00' values (see *Section 4.23 "Configuring Output Telegrams"*).

E.9.3.1 Checksum

The Checksum value is the resultant XOR of all characters in the report string, excluding the <CR><LF> termination characters.

E.9.3.2 Example

\$PSONALL,Rangeaster,Dunker,123443.56,419876.56,5567887.45,
6789.07,234.56,235.67,T,15.12,17.34,2.4,1.22,0.39*hh<CR><LF>

With null fields:

\$PSONALL,2404,Transducer,085741.262,650883.02,5688721.58,999.91,,,G,,,,7.858,0.806*05<CR><LF>

With 0.00 replacing null fields:

\$PSONALL,2404,Transducer,085227.318,650816.89,5688781.67,372.58,0.00,0.00,G,0.00,0.00,0.00,32
60605850.979,22753659635.223*2B<CR><LF>

E.10 PSONUSBL – Sonardyne USBL Report

E.10.1 Description

This sentence is intended to include all of the information necessary to provide USBL position and attitude/heading information to an external system.

Null fields with their delimiters can have the following appearance, depending on where they are located in the sentence: ",,","\",*"

The ASCII NULL character (HEX 00) shall not be used as the null field.

E.10.2 Format

The PSONUSBL telegram format shown below consists of a single string, separated across two lines here for clarity

\$PSONUSBL,HHMMSS.ss,ddd,C,aaaa.aa,bbbb.bb,dddd.dd,pp.pp,srr.rr,hhh.hh, qq.q*hh<CR><LF>

E.10.3 Field Description

Table E-13 Field Description for the PSONUSBL Telegram

Field	Description
\$PSONUSBL	Header to identify the telegram.
HHMMSS.ss	The valid time of the sentence.
ddd	Beacon index - the index of the beacon that the string relates to (valid range 1 to 999 with 0 not valid).
C	Co-ordinate frame orientation: H = vehicle head up N = North up
aaaa.aa	Vehicle-centred East or Starboard co-ordinate.
bbbb.bb	Vehicle-centred North or Forward co-ordinate.
dddd.dd	Depth.
pp.pp	Pitch.
rr.rr	Roll.
hhh.hh	Heading (true).
qq.q	1 sigma position accuracy (39.4 %).
*hh	ASCII Hex checksum (XOR of all characters between, but not including, the \$ and * characters).
<CR><LF>	Termination characters, carriage return, line feed.

E.10.4 Example

\$PSONUSBL,123456.12,101,H,-1234.56,-1234.56,1234.56,-12.34,
-12.34,123.45,12.3*70 <CR><LF>

E.11 PSONDP - Sonardyne DP Report

E.11.1 Description

This sentence includes all of the information necessary to provide position, velocity and attitude/heading information to a DPS. In addition to the positional information it also provides error metrics that allow the DPS to determine that the data is valid, and the correct weight to give to the data.

Null fields with their delimiters can have the following appearance depending on where they are located in the sentence: ",,","\",*"

The ASCII NULL character (HEX 00) shall not be used as the null field.

This telegram is subject to change, although additions will only be made immediately before the '*' that marks the beginning of the checksum.

E.11.2 Format

\$PSONDP,HHMMSS.ss,0000,M,Q,DDMM.mmmmmm,N,DDDMM.mmmmmm,E,A.aa,A.aa,AAA.aa,D.dd,
S.ss,C.c,A.aa,A.aa,AAA.aa,P.ppp,R.rrr,
HHH.hhh,A.aa,CCC,N,,,,*hh<CR><LF>

E.11.3 Field Description

Table E-14 Field Description for the PSONDP Reports

Field	Description
\$PSONDP	Header (fixed)
HHMMSS.ss	The valid time of the contents. See Note 1.
0000	Target ID.
M	Status: M:Master, S:Slave.
Q	Quality Indicator (0:No Data, 1:Degraded Data, 2:Full Accuracy.
DDMM.mmmmmm	Latitude. See Note 2.
N	Direction of latitude (N or S).
DDDMM.mmmmmm	Longitude. See Note 2.
E	Direction of longitude (E or W).
A.aa	Position accuracy error ellipse major axis (metres). See Note 3.
A.aa	Position accuracy error ellipse minor axis (metres). See Note 3.
AAA.aa	Position accuracy error ellipse direction (True - degrees). See Note 3.
D.dd	Depth below sea surface (metres), see Note 4.
S.ss	Speed over ground (m/s).
C.c	Course over ground (True - degrees). 0.0-359.9
A.aa	Speed over ground accuracy error ellipse major axis (m/s). See Note 3.
A.aa	Speed over ground accuracy error ellipse minor axis (m/s). See Note 3.
AAA.aa	Speed over ground accuracy error ellipse direction (True - degrees). See Note 3.
P.ppp	Pitch (degrees). Bow up: positive. See Note 5
R.rrr	Roll (degrees). Port up: positive.
HHH.hhh	Heading (True - degrees). 0.0 - 359.999
A.aa	Heading accuracy (Standard deviation - degrees)
CCC	Aiding: N:None,U:USBL,L:LBL,G:GNSS,D:DVL,P:Pressure. See Note 6.
A,x.xxx,x.xxx,x.xxx	Additional data: N: None. TBD See Note 7.
*hh	Checksum. See Note 8.
<CR><LF>	Terminator, return plus linefeed .

E.11.3.1 Notes

1. The DP-INS system time for which the data is valid. If the system is connected to a GNSS time source this will be UTC time.
2. Latitude and longitude values are always displayed in the degrees, minutes, decimal minutes (DDMM.mmmmm) format. All values are relative to the WGS-84 datum. Leading zeros are not required. Latitude range (DD) = 0 - 89, longitude range (DDD) = 0 - 179.
3. The accuracy values contain the length of the vehicle's error ellipse axes and direction of the major axis. Error ellipse values are always displayed to 2 DPs.
4. The depth value is always displayed in metres and fixed to 2 DPs. Negative depth indicates the target is above the water surface.
5. Pitch and roll angles are defined as the angle between the gravity vector and the deck plane in the direction of the roll and pitch axes of the vessel.
6. The Aiding source indicates what type of aiding data is currently in use.
7. Additional data is reserved to contain data received from the target instrument. Empty data slots will be left null when no data is present.
8. The checksum is the 8-bit exclusive OR (no start or stop bits) of all characters in the sentence, including "," delimiters, between but not including the "\$" and the "*" delimiters. The hexadecimal value of the most significant and least significant 4 bits of the result is converted to two ASCII characters (0-9, A-F) for transmission. The most significant character is transmitted first.

E.11.4 Modifications

The maximum number of characters in a normal NMEA sentence should be 82, consisting of a maximum of 79 characters between the starting "\$" and the terminating <CR><LF>. This telegram currently could be as long as 180 characters.

E.11.5 Example

```
$PSNDP,123456.43,0010,M,2,5020.234502,N,12345.324576,E,12.34,12.34,123.45,1234.56,12.34,35  
9.9,0.45,0.23,123.45,-12.345,-12.345,359.999,1.23,UP,N,,,*2E
```

E.12 NMEA 0183 GGA

E.12.1 Description

The NMEA GGA telegram is a simulation of a standard NMEA GGA string and is used to show fix-related data for a GNSS receiver.

You should use this sentence only where the receiving installation does not support a more suitable sentence.

E.12.2 Format

The NMEA GGA telegram format shown below consists of a single string, separated across two lines here for clarity.

```
$GPGGA,HHMMSS.ss,DDMM.mmmmm,N,DDMM.mmmmm,  
E,2,0,A,A,Z.ZZZ, M,0.0,M,0.0,0000*hh<CR><LF>
```

E.12.3 Field Description

Table E–15 Field Description for the NMEA GGA Telegram

Field	Description
\$GPGGA	Header to identify the report (fixed).
HHMMSS.ss	The valid time of the position.
DDMM.mmmmm	Latitude. See Note 1.
N	Direction of latitude (N or S).
DDDMM.mmmmm	Longitude. See Note 1.
E	Direction of longitude (E or W).
2	Quality. See Note 2.
0	Number of satellites (not used). See Note 3.
A.A	Accuracy (semi-major axis). See Note 4.
Z.ZZZ	Height. See Note 5.
M,0.0,M,0.0,0000	Fixed values.
*hh	Checksum. See Note 6.
<CR><LF>	Termination characters, carriage return, linefeed.

E.12.3.1 Notes

- Latitude and longitude values are always displayed in the DDDMM.mmmmm format.
All values are relative to the WGS84 datum. Leading zeros are not required. Latitude range (DD) = 0 to 89; Longitude range (DDD) = 0 to 179.
- Quality will be '2' or '0' (invalid).
- Number of satellites will always be '0'.
- The accuracy value is the semi-major axis value for the vehicle. It is always displayed in metres and is fixed to one DP.
- The height value is always displayed in metres and fixed to three DPs.
Because this string format has no concept of depth, depth values for the vehicle should be displayed as negative values so that, for example when depth = 56.7 m, depth is formatted as – 56.7.
- The checksum is the 8-bit exclusive OR (no start or stop bits) of all characters in the sentence, including "," delimiters, between but not including the "\$" and the "*" delimiters.
The hexadecimal value of the most significant and least significant 4 bits of the result is converted to two ASCII characters (0 to 9, A to F) for transmission. The most significant character is transmitted first.

The maximum number of characters in a sentence is 82, consisting of a maximum of 79 characters between the starting "\$" and the terminating <CR><LF>.

E.12.3.2 Example

```
$GPGGA,123456.43,5020.23450,N,134.32457,E,2,0,6.7,
-56.789,M,0.0,M,0.0,0,0000*hh
```

E.13 ATS ASCII

E.13.1 Description

The ATS ASCII Telegram is used by Nautronix ATS-S02 SO4 and S08 Systems. Each line of the data contains position data for one object terminated by a <LF> then <CR>

E.13.2 Format

The ATS ASCII format shown below consists of a single string, separated across two lines here for clarity.

dd mmm yy hh:mm:ss B:d X:ddd.d Y:ddd.d D:ddd.d P:d.d R:d.d H:ddd.d E:d A:ddd.d C:ddd.d
E:d<LF><CR>

E.13.3 Field Description

Table E-16 Field Description for the ATS ASCII Telegram

Field	Description
dd mmm yy hh:mm:ss	Date and time of receipt or the acoustic reply.
B:d	Beacon Index 0 = Ship, 1-10=beacons 1 to 10
X:ddd.d	X Coordinate in metres.
Y:ddd.d	Y Coordinate in meters.
D:ddd.d	Depth in metres.
P:d.d	Ships pitch in degrees. Positive pitch is bow up +/-9,9
R:d.d	Ships roll in degrees. Positive roll is port up +/-9,9
H:ddd.d	Ships heading relative to North in degrees 0-360
A:ddd.d	(Optional) Riser angle monitoring – Lower flex joint pitch in degrees.
C:ddd.d	(Optional) Riser angle monitoring – Lower flex joint roll in degrees.
E:d	Error code: bit 0 = simulating; bit 2 = position data is invalid.
<LF><CR>	Line feed, Carriage return.

E.13.3.1 Notes

- The co-ordinate frame for beacon position data is relative to the ship datum point.
 - Positive Y is forward
 - Positive X is starboard
 - Positive depth is down

E.13.3.2 Example

30 Sep 04 13:47:55 B:0 X:-84.2 Y:-11.6 D:31.0 P:0.0 R:0.0 H:189.1 E:0<LF><CR>

E.14 Trackpoint II

E.14.1 Description

The Trackpoint II Telegram is a fixed length 66 character ASCII based transponder position telegram. Each line of the data contains position data for one object terminated by a <CR> then <LF>.

E.14.2 Field Description

Table E-17 Field Description for the Trackpoint II Telegram

Field	Description
d	Index of the transponder.
hh:mm:ss	Time of receipt or the acoustic reply.
ddd	Ships heading relative to North in degrees 0-360
ddd.d	Bearing to target in degrees 0-360
d.d	Slant range to target in metres.
d.d	X Coordinate in metres.
d.d	Y Coordinate in meters.
d.d	Depth in metres.
d	Error code (0 indicates good position).
<CR>	Carriage return.
<LF>	Line feed.

E.14.2.1 Notes

- The co-ordinate frame for beacon position data is relative to the ship datum point.
 - Positive Y is forward
 - Positive X is starboard
 - Positive depth is down

E.14.2.2 Example

1 15:53:53 12 104.9 141.1 97.9 -26.0 98.2 0<CR><LF>

E.15 HPR 300P

E.15.1 Description

The HPR 300P Telegram is a 66 character ASCII based transponder position. Each line of the data contains position data for one object terminated by a <CR> then <LF>.

E.15.2 Field Description

Table E-18 Field Description for the HPR 300P Telegram

Field	Description	Position
dd	Index of the transponder.	1-2
c	Space.	3
d	Transducer number (Always 1).	4
cc	Spaces.	5-6
c	Beam used (Always W).	7
cc	Spaces.	8-9
ccc	Reply status. OK=Good position. NRY=No reply.	10-12
c	Space.	13

Table E–18 Field Description for the HPR 300P Telegram (continued)

Field	Description	Position
dddd.d	Vessel course 0-359.9 (degrees).	14-19
c	Space.	20
dddd.d	X Coordinate in metres.	21-26
c	Space.	27
dddd.d	Y Coordinate in meters.	28-33
c	Space.	34
dddd.d	Z Coordinate in metres or Depth.	35-40
c	Space.	41
ddd.d	QUA. Position quality.	42-46
cc	Spaces.	47-48
ccc	Riser angle status. Always NRY.	49-51
c	Space.	52
dddd.d	Riser X-angle or tilt with sign.	53-58
c	Space.	59
dddd.d	Riser Y-angle or azimuth with sign.	60-65
<CR>	Carriage return.	66
<LF>	Line feed.	67

E.15.2.1 Notes

- The co-ordinate frame for beacon position data is relative to the ship datum point.
 - Positive Y is forward
 - Positive X is starboard
 - Positive depth is down

E.15.2.2 Example

33 1 W OK 0 18.9 40.5 30.0 0.1 NRY 0.0 0.0<CR><LF>

E.16 PSONMEAS – Sonardyne Measurements Report

E.16.1 Description

This report is a custom sentence for outputting measurement data from peripheral sensors.

E.16.2 Format

\$PSONMEAS,hhmmss.ss,I,A,B,X.X,Y.Y,Z.Z*hh <CR><LF>

E.16.3 Field Description

Table E–19 Field Description for the PSONMEAS Format

Field	Description
\$PSONMEAS	Header.
hhmmss.ss	Valid time of the position.

Table E-19 Field Description for the PSONMEAS Format (continued)

Field	Description
I	Information source.
A	Name of Instrument Or Source.
B	Name sensor or Destination.
X.X	Data Field 1.
Y.Y	Data Field 2.
Z.Z	Data Field 3.
*hh	Check Sum.
<CR><LF>	Terminator - carriage return, line feed.

E.16.4 Definition of Field Names

E.16.4.1 Information Source

INCINT for Inclinator with Heading

INCEXT for Inclinator without Heading

DEPTH for depth sensor

TEMP for temperature sensor

RNG for range measurement

Table E-20 Format Data field 1, Data Field 2, Data Field 3 for PSONMEAS Format

	Data Field 1	Data Field 2	Data Field 3
INCINT	Grid Heading.	Roll	Pitch
INCEXT	0.00	Roll	Pitch
DEPTH	Depth.	0.00	0.00
TEMP	Temperature.	0.00	0.00
RNG	Distance in meters.	0.00	0.00

E.17 PSONLLD – Sonardyne Lat, Long, Depth Report

E.17.1 Description

This report is a custom sentence for outputting latitude, longitude and depth information.

E.17.2 Format

\$PSONLLD,hhmmss.sss,id,status,lat,long,depth,hor_err_major,hor_err_minor,
hor_error_dir,depth_error,optional_spec,opt1,opt2,opt3*hh<CR><LF>

E.17.3 Field Description

Table E-21 Field Description for the PSONLLD Format

Field	Description
\$PSONLLD	Header.
hhmmss.sss	Time of validity.

Table E–21 Field Description for the PSONLLD Format (continued)

Field	Description
id	id of tracked object; in the case of a beacon, the beacon's Address.
status	A = valid, V = invalid.
lat	Latitude in decimal degrees, +ve value indicates North, -ve value indicates South.
long	Longitude in decimal degrees, +ve value indicates East, -ve value indicates West.
depth	Depth in metres, with respect to the water surface. +ve = down.
hor_err_major	Horizontal error ellipse major axis in metres (1 S.D.).
hor_err_minor	Horizontal error ellipse minor axis in metres (1 S.D.).
hor_err_dir	Direction of Horizontal error ellipse major axis in decimal degrees relative to true North.
depth_error	Depth error in metres (1 S.D.).
optional_spec	Optional fields specifier, a code denoting what the optional fields contain or blank for no optional data.
opt1	Optional field 1.
opt2	Optional field 2.
opt3	Optional field 3.
*hh	NMEA style checksum.
<CR><LF>	Carriage return & line feed.

E.18 PSONMRAMS – Sonardyne MRAMS Report

E.18.1 Description

The PSONMRAMS telegram is used for the exclusive transport of MRAMS data. The system sends this telegram each time it successfully measures the attitude of the BOP or Riser beacon.

This telegram has been designed to be independent of any position information, allowing the acoustic system to be used for measurement of MRAMS data without the requirement to be performing USBL positioning at the same time.

The maximum length of the telegram is 82 characters, including the start character <\$> and the termination characters <CR> and <LF>. However, the telegram will typically be less than this and will be of variable length, because leading zeros are suppressed.

E.18.2 Format

\$PSONMRAMS,hhmmss.ss,x.xx,x.xx,x.xx,x.xx,x.xx,x.xx,x.xx,x.xx,xxx.xx*hh<CR><LF>

E.18.3 Field Description

Table E–22 Field Description for the NMEA PSONMRAMS Format

Field	Description
\$PSONMRAMS	Header (fixed).
hhmmss.sss	The valid time of the contents. See Note 1.
x.xx	BOP Pitch (degrees). See Note 2.
x.xx	BOP Roll (degrees). See Note 3.

Table E-22 Field Description for the NMEA PSNMRAMS Format (continued)

Field	Description
x.xx	BOP Age (seconds). See Note 4.
x.xx	Riser Pitch (degrees). See Note 5.
x.xx	Riser Roll (degrees). See Note 6.
x.xx	Riser Age (seconds). See Note 7.
x.xx	Differential Pitch (degrees). See Note 8.
x.xx	Differential Roll (degrees). See Note 9.
x.xx	Differential Tilt (degrees). See Note 10.
xxx.xx	Course to steer (degrees). See Note 11.
*hh	Checksum. See Note 12.
<CR><LF>	Termination.

E.18.3.1 Notes

1. The data in this telegram is only updated when pitch and roll is successfully received from either the BOP or Riser beacon. If the system is connected to a GNSS time source this will be UTC time.
2. BOP Pitch (degrees). The pitch angle of the BOP reported by the beacon attached to the BOP, corrected for any offsets. Sign convention: Bows up = +ve.
3. BOP Roll (degrees). The roll angle of the BOP reported by the beacon attached to the BOP, corrected for any offsets. Sign convention: Starboard down = +ve.
4. BOP Age (seconds). Riser and BOP data will be collected at different times although this telegram will be output when data is received from either. The BOP Age reports how old the BOP attitude is in seconds.
5. Riser Pitch (degrees) The pitch angle of the Riser reported by the beacon attached to the Riser, corrected for any offsets. Sign convention: Bows up = +ve.
6. Riser Roll (degrees). The roll angle of the Riser reported by the beacon attached to the Riser, corrected for any offsets. Sign convention: Starboard down = +ve.
7. Riser Age (seconds). Riser and BOP data will be collected at different times although this telegram will be output when data is received from either. The Riser Age reports how old the Riser attitude is in seconds.
8. Differential Pitch (degrees). The differential pitch angle of the BOP and Riser calculated from BOP and Riser Roll data. Sign convention: Bows up = +ve.
9. Differential Roll (degrees). The differential roll angle of the BOP and Riser calculated from BOP and Riser Roll data. Sign convention: Starboard down = +ve.
10. Differential Tilt (degrees) The included angle between the axis of the BOP stack and the Riser. Sign Convention: Zero represents Riser in line with BOP axis. All realistic angles will be positive.
11. Course to Steer (degrees). The true bearing of the course to be made good to minimise the differential tilt angle.
12. Checksum. The result of performing an exclusive OR on all bytes in the telegram up to but not including this byte.

E.18.3.2 Examples

\$PSONMRRAMS,164324.801,0.26,-1.25,0.00,-0.67,0.49,24.83,-0.93,1.74,1.97,241.88*61

\$PSONMRRAMS,164330.645,0.26,-1.25,5.89,-0.67,0.49,0.11,-0.93,1.74,1.97,241.88*53

\$PSONMRRAMS,164359.864,0.26,-1.25,0.00,-0.67,0.49,29.33,-0.93,1.74,1.97,241.88*6E

\$PSONMRRAMS,164405.707,0.26,-1.25,5.89,-0.67,0.49,0.11,-0.93,1.74,1.97,241.88*55

E.19 RMB Report

E.19.1 Description

This is a NMEA-0183 report providing the 'Recommended Minimum Navigation' information. It provides navigation information to get from the current position to the Destination waypoint.

E.19.2 Format

\$SNRMB,A,x.x,a,c c,c,llll.ll,a,yyyyy.yy,a,x.x,x.x,x.x,A,a*hh<CR><LF>

Table E-23 Field Description for the RMB Format

Field	Description
\$SNRMB,	Header (fixed).
A,	Data Status - A=data valid, V=invalid
x.x,	Cross-track error - distance from line between origin and destination waypoints (nautical miles). See Note 1.
a,	L = left, R = right
c--c,	Name of origin waypoint
c--c,	Name of destination waypoint
DDMM.mmmmm,	Latitude of destination waypoint. See Note 2.
N,	Direction of latitude (N or S)
DDDMM.mmmmm,	Longitude of destination waypoint. See Note 2.
E,	Direction of longitude (E or W)
x.x,	Range to destination, nautical miles. See Note 3.
x.x,	Bearing to destination, degrees (true)
x.x,	Destination closing velocity, knots
A,	Arrival status, A=arrival circle entered or perpendicular passed, V=not entered/-passed
a	Mode Indicator – Autonomous (fixed value)
*hh	Checksum. See Note 4.
<CR><LF>	Termination.

E.19.2.1 Notes

1. The cross-track error is limited to 9.99NM
2. Latitude and longitude values are always displayed in the DDDMM.mmmmm format. All values are relative to the WGS-84 datum. Latitude range (DD) = 0 – 89, longitude range (DDD) = 0 – 179.

3. The range to destination is a great circle distance limited to 999.9NM.
4. The checksum is the 8-bit exclusive OR (no start or stop bits) of all characters in the sentence, including “,” delimiters, between but not including the “\$” and the “*” delimiters. The hexadecimal value of the most significant and least significant 4 bits of the result is converted to two ASCII characters (0-9, A-F) for transmission. The most significant character is transmitted first.

E.19.2.2 Modifications:

The normal maximum number of characters in a sentence shall be 82, consisting of a maximum of 79 characters between the starting “\$” and the terminating <CR><LF>. This may be exceeded if names of waypoints are too long.

E.19.2.3 Example

\$SNRMB,A,0.0056,R,Origin WP,Destination WP,5119.84950,N,00050.16615,W,0.01905,305.7,0.000,V,A*38<CR><LF>

E.20 BWC Report

E.20.1 Description

This is a NMEA-0183 report providing the distance and bearing to a specified waypoint. The distance is computed along the great circle path from the current position rather than along the rhumb line.

E.20.2 Format

\$SNBWC,hhmmss.ss,llll.ll,a,yyyyy.yy,a,x.x,T,x.x,M,x.x,N,c,c,a*hh<CR><LF>

Table E-24 Field Description for the BWC Format

Field	Description
\$SNBWC,	Header (fixed).
A,	Data Status - A=data valid, V=invalid
hhmmss.ss,	The UTC valid time of the position
DDMM.mmmmm,	Latitude of destination waypoint. See Note 1.
N,	Direction of latitude (N or S)
DDDMM.mmmmm,	Longitude of destination waypoint. See Note 1.
E,	Direction of longitude (E or W)
x.x,	Bearing to destination, degrees (true)
T,	T=True
,	Bearing to destination, degrees (magnetic) – not used
,	M=Magnetic – not used
x.x,	Distance to destination
N,	N=nautical miles
c--c,	Name of destination waypoint
a	Mode Indicator – Autonomous (fixed value)
*hh	Checksum. See Note 2.
<CR><LF>	Termination.

E.20.2.1 Notes

1. Latitude and longitude values are always displayed in the DDDMM.mmmmm format. All values are relative to the WGS-84 datum. Latitude range (DD) = 0 – 89, longitude range (DDD) = 0 – 179.
2. The checksum is the 8-bit exclusive OR (no start or stop bits) of all characters in the sentence, including “,” delimiters, between but not including the “\$” and the “*” delimiters. The hexadecimal value of the most significant and least significant 4 bits of the result is converted to two ASCII characters (0-9, A-F) for transmission. The most significant character is transmitted first.

E.20.2.2 Modifications:

The normal maximum number of characters in a sentence shall be 82, consisting of a maximum of 79 characters between the starting “\$” and the terminating <CR><LF>. This may be exceeded if names of waypoints are too long.

E.20.2.3 Example

\$SNBWC,080737.22,5119.84950,N,00050.16615,W,305.7,T,,,0.01905,N,Destination WP,A*45<CR><LF>

Appendix F – Alarms and Events

F.1 Alarms

F.1.1 System Manager

ID:	1000
Default Severity:	Critical
Summary:	"Security key authentication failed"
Description:	"The system was unable to detect a valid security key. Please ensure that a valid security key is fitted."
Solution URL:	"SolutionsSolution 1000.htm"
ID:	1001
Default Severity:	Critical
Summary:	"Failed to start 0 component(s)"
Description:	"System component(s) 0 could not be started within a timeout period of 1 second."
Solution URL:	"SolutionsSolution 1001.htm"
ID:	1002
Default Severity:	Critical
Summary:	"Unable to stop the System Manager"
Description:	"An unknown failure occurred at time 0, when trying to stop the SystemManager. Please verify that the application was installed correctly using the installer, and if not please re-install the Software."
Solution URL:	"SolutionsSolution 1002.htm"
ID:	1003
Default Severity:	High
Summary:	"Job save failed. 0"
Description:	"The system was unable to save the job. It is advised that you restart the system. This will result in the last used job being reloaded."
Solution URL:	"SolutionsSolution 1003.htm"
ID:	1004
Default Severity:	High
Summary:	"Slave failure"
Description:	"Unable to communicate with the Slave system. Updates to the Slaves's job will not be possible."
Solution URL:	"SolutionsSolution 1004.htm"
ID:	1005
Default Severity:	High

Summary:	"Master failure - becoming Master"
Description:	"The Slave system is unable to detect the presence of a Master and will therefore take over as Master."
Solution URL:	"SolutionsSolution 1005.htm"
ID:	1006
Default Severity:	Critical
Summary:	"Attached security key has expired."
Description:	"The system was unable to detect a valid security key, as the security key found attached to the system has expired. Either ensure that a valid security key is fitted, or contact Support to remotely update the security key."
Solution URL:	"SolutionsSolution 1006.htm"
ID:	1007
Default Severity:	High
Summary:	"Attached security key has less than 0 time left"
Description:	"The system found a valid security key attached, however there is only 0 left before it expires. Ensure that a valid security key is available to replace it, or contact Support to remotely update the security key."
Solution URL:	"SolutionsSolution 1007.htm"
ID:	1008
Default Severity:	Critical
Summary:	"Attached security key has less than 0 time left"
Description:	"The system found a valid security key attached, however there is only 0 left before it expires. Ensure that a valid security key is available to replace it, or contact Support to remotely update the security key."
Solution URL:	"SolutionsSolution 1008.htm"
ID:	1009
Default Severity:	Critical
Summary:	"Transceiver cross link failed"
Description:	"This is a Dual Redundant system which requires a cross-link cable between the local and remote transceiver. The local transceiver has failed to detect comms activity on the remote transceiver."
Solution URL:	"SolutionsSolution 1009.htm"
ID:	1010
Default Severity:	High
Summary:	"Unable to function as Master. The NSH or its instruments have failed."
Description:	"If this system was functioning as Master when the problem occurred, an attempt will be made to pass control to the Slave."

Solution URL:	"SolutionsSolution 1010.htm"
ID:	1011
Default Severity:	Critical
Summary:	"Communication failure between Master and Slave"
Description:	"The Master and Slave NAV PCs are unable to communicate over the Ethernet cross-link. The other system may be not running, or the ethernet cross link may have failed. The Master will not be able to update the Slave's job until the connection is restored."
Solution URL:	"SolutionsSolution 1011.htm"
ID:	1012
Default Severity:	Low
Summary:	"Job Save unable to log the current job state."
Description:	"The problem reported is not a critical problem, and one which has only been seen rarely. Please get a system support (CEF) file and sent to support@sonardyne.com to help us track down and fix this issue. (Further Info to check: 0)"
Solution URL:	"SolutionsSolution 1012.htm"
ID:	1013
Default Severity:	Critical
Summary:	"Attached security key time is later then current time"
Description:	"The system was unable to detect a valid security key, as the security key found attached to the system has a time stamp later than the current time. Either ensure that a valid security key is fitted, or contact Support to remotely update the security key."
Solution URL:	"SolutionsSolution 1013.htm"
ID:	1014
Default Severity:	High
Summary:	"Attached security key has less than 1 day left"
Description:	"The system found a valid security key attached, however there is less than 1 day left before it expires. Ensure that a valid security key is available to replace it, or contact Support to remotely update the security key."
Solution URL:	"SolutionsSolution 1014.htm"
ID:	1015
Default Severity:	Critical
Summary:	"Attached security key has less than 1 hour left"
Description:	"The system found a valid security key attached, however there is less than 1hour left before it expires. Ensure that a valid security key is available to replace it, or contact Support to remotely update the security key."
Solution URL:	"SolutionsSolution 1015.htm"

ID:	1016
Default Severity:	Low
Summary:	"Attached security key has less than 0 time left"
Description:	"The system found a valid security key attached, however there is only 0 left before it expires. Ensure that a valid security key is available to replace it, or contact Support to remotely update the security key."
Solution URL:	"SolutionsSolution 1016.htm"
ID:	1017
Default Severity:	Low
Summary:	"Attached security key has less than 5 days left"
Description:	"The system found a valid security key attached, however there is less than 5 days left before it expires. Ensure that a valid security key is available to replace it, or contact Support to remotely update the security key."
Solution URL:	"SolutionsSolution 1017.htm"
ID:	1018
Default Severity:	Critical
Summary:	"Attached security key hasn't been activated"
Description:	"The system found a valid security key attached, however the time limited security key needs to be activated. To activate the dongle, restart the application, and when offered to activate the security key select yes."
Solution URL:	"SolutionsSolution 1018.htm"

F.1.2 Device Manager

ID:	2000
Default Severity:	Critical
Summary:	"Unable to start the DeviceManager system"
Description:	"An unknown failure occurred at time 0, when trying to start the DeviceManager System. Please verify that the application was installed correctly using the installer, and if not please re-install the Software."
Solution URL:	"SolutionsSolution 2000.htm"
ID:	2001
Default Severity:	Critical
Summary:	"Unable to stop the DeviceManager system"
Description:	"An unknown failure occurred at time 0, when trying to stop the DeviceManager System. Please verify that the application was installed correctly using the installer, and if not please re-install the Software."
Solution URL:	"SolutionsSolution 2001.htm"
ID:	2100

Default Severity:	Critical
Summary:	"Connection to the device 0 has been lost"
Description:	"No data has been received by the device. Please check port settings, cabling and hardware."
Solution URL:	"SolutionsSolution 2100.htm"
ID:	2101
Default Severity:	Critical
Summary:	"Connection to the device 0 has been lost"
Description:	"No data has been received by the device. Please check the IP Address and port setting, cabling and hardware."
Solution URL:	"SolutionsSolution 2101.htm"
ID:	2102
Default Severity:	Critical
Summary:	"HDOP value for positioning device 0 indicates very bad positioning"
Description:	"GNSS HDOP value indicates very bad positioning - please check GNSS equipment."
Solution URL:	"SolutionsSolution 2102.htm"
ID:	2103
Default Severity:	Critical
Summary:	"0 has invalid firmware, requires V8.01 and above only"
Description:	"Transceiver firmware requires V8.01 and above - please install latest firmware."
Solution URL:	"SolutionsSolution 2103.htm"
ID:	2104
Default Severity:	Critical
Summary:	"0 has invalid address, check firmware is installed"
Description:	"Transceiver address is invalid - please check valid firmware is installed."
Solution URL:	"SolutionsSolution 2104.htm"
ID:	2105
Default Severity:	Critical
Summary:	"Input to device 0 indicates lack of GNSS aiding"
Description:	"To get best performance from an attitude sensor it needs GNSS aiding so that it can separate movement from roll and pitch. Please add GNSS aiding to this device."
Solution URL:	"SolutionsSolution 2105.htm"
ID:	2106
Default Severity:	High
Summary:	"The Lodestar INS system is currently not time synchronised"

Description:	"Application should be time synchronised to allow the INS solution to function optimally."
Solution URL:	"SolutionsSolution 2106.htm"
ID:	2107
Default Severity:	Critical
Summary:	"NOT USED! Lodestar INS system failure"
Description:	"The Lodestar INS has indicated a system failure has occurred"
Solution URL:	"SolutionsSolution 2107.htm"
ID:	2108
Default Severity:	Critical
Summary:	"Phase calibration data span has exceeded 0 degrees"
Description:	"The transceiver has indicated that the phase calibration data span has exceeded 0 degrees. Span = 1. Please refer to the Transceiver Phase Calibration Tool for details concerning the exact receiver card(s) that failed."
Solution URL:	"SolutionsSolution 2108.htm"
ID:	2109
Default Severity:	Critical
Summary:	"Beacon 0 has an incompatible address"
Description:	"The system is configured to use pulse position angles, the address conflicts with this. Tracking will be impaired."
Solution URL:	"SolutionsSolution 2109.htm"
ID:	2110
Default Severity:	Critical
Summary:	"Telegram 0 stopped - error exceeds SD limit"
Description:	"Positions are not being sent because the SD of the position is beyond the configured limit. Raising the limit would allow the positions to be sent but the impact of low quality positions on the receiving system must first be considered."
Solution URL:	"SolutionsSolution 2110.htm"
ID:	2111
Default Severity:	Critical
Summary:	"The GNSS fix quality is unsuitable for navigation"
Description:	"The GNSS device is reporting the fix quality is unsuitable for navigation please check GNSS input."
Solution URL:	"SolutionsSolution 2111.htm"
ID:	2112
Default Severity:	Critical

Summary:	"The Lodestar is not receiving a 1 PPS Signal"
Description:	"The Lodestar is not receiving a 1 PPS Signal, please check cabling and configuration."
Solution URL:	"SolutionsSolution 2112.htm"
ID:	2113
Default Severity:	Critical
Summary:	"Attitude device is not yet settled"
Description:	"The attitude device is currently unsettled, tracking whilst the device is in this state may lead to undesirable results."
Solution URL:	"SolutionsSolution 2113.htm"
ID:	2114
Default Severity:	High
Summary:	"Gyro Compatt attitude device is settling"
Description:	"The Gyro Compatt is currently settling, attitude observation will not be used."
Solution URL:	"SolutionsSolution 2114.htm"
ID:	2115
Default Severity:	Critical
Summary:	"Gyro Compatt attitude device is switched OFF"
Description:	"The Gyro Compatt is currently switched OFF, attitude collection cannot proceed. Enable the gyro via the beacon property 'Sensors' page."
Solution URL:	"SolutionsSolution 2115.htm"
ID:	2116
Default Severity:	Critical
Summary:	"0 unaided for more than 30 seconds"
Description:	"No aiding data has been sent for more than 30 seconds."
Solution URL:	"SolutionsSolution 2116.htm"
ID:	2117
Default Severity:	Critical
Summary:	"0 rejecting aiding for more than 30 seconds"
Description:	"All aiding data has been rejected for more than 30 seconds."
Solution URL:	"SolutionsSolution 2117.htm"
ID:	2118
Default Severity:	Critical
Summary:	"Beacon 0 has been tilted more than 45 degrees. Maximum power will not be available."

Description:	"Ensure the beacon position is not tilted beyond 45 degrees if maximum power is required. If maximum power is required and it is necessary for operations to have the beacon tilted then the user will need to press the Override button - this will override the tilt flag and allow maximum power."
Solution URL:	"SolutionsSolution 2118.htm"
ID:	2119
Default Severity:	Critical
Summary:	"Beacon 0 is not set for navigation"
Description:	"The beacon navigation functionality is not enabled."
Solution URL:	"SolutionsSolution 2119.htm"
ID:	2120
Default Severity:	Critical
Summary:	"0 aiding data shows too few good acoustic samples."
Description:	"The acoustic observation data number of samples are below the minimum specified in the Lodestar configuration."
Solution URL:	"SolutionsSolution 2120.htm"
ID:	2121
Default Severity:	Critical
Summary:	"0 acoustic aiding limit exceeded."
Description:	"The acoustic observation data rejection value has exceeded the maximum specified in the Lodestar configuration."
Solution URL:	"SolutionsSolution 2121.htm"
ID:	2122
Default Severity:	Critical
Summary:	"0 acoustic quality (QJSum) limit exceeded."
Description:	"The acoustic observation quality indicator has exceeded the maximum specified in the Lodestar configuration."
Solution URL:	"SolutionsSolution 2122.htm"
ID:	2123
Default Severity:	Critical
Summary:	"0 acoustic signal to noise ratio exceeded."
Description:	"The acoustic observation signal to noise ratio has exceeded the maximum specified in the Lodestar configuration."
Solution URL:	"SolutionsSolution 2123.htm"
ID:	2124
Default Severity:	Critical

Summary:	"0 signal level limit exceeded."
Description:	"The acoustic observation signal level has exceeded the maximum specified in the Lodestar configuration."
Solution URL:	"SolutionsSolution 2124.htm"
ID:	2126
Default Severity:	Critical
Summary:	"0 age of beacon position information has exceeded 180 seconds."
Description:	"The lodestar has not received PSONBCN messages for more than 180 seconds."
Solution URL:	"SolutionsSolution 2126.htm"
ID:	2127
Default Severity:	Critical
Summary:	"0 age of lever arm information has exceeded 180 seconds."
Description:	"The lodestar has not received PSONLVR messages for more than 180 seconds."
Solution URL:	"SolutionsSolution 2127.htm"
ID:	2128
Default Severity:	Critical
Summary:	"0 maximum horizontal distance has been exceeded."
Description:	"The horizontal distance to transponder depth ratio as specified in the Lodestar configuration has been exceeded."
Solution URL:	"SolutionsSolution 2128.htm"
ID:	2129
Default Severity:	Critical
Summary:	"0 Kalman sigma test failed."
Description:	"the current acoustic observations are failing to pass the Lodestar kalman sigma test criteria."
Solution URL:	"SolutionsSolution 2129.htm"
ID:	2130
Default Severity:	Critical
Summary:	"0 Kalman filter is not using acoustic observations."
Description:	"The current acoustic observation are not being used be the Lodestar kalman filter."
Solution URL:	"SolutionsSolution 2130.htm"
ID:	2132
Default Severity:	Critical
Summary:	"Output Telegram 0 cannot sustain data rate"

Description:	"Output Telegram 0 cannot sustain the required data rate - Reduce the Telegram Spacing and increase the Baud Rate. Telegrams will be dropped until this is resolved"
Solution URL:	"SolutionsSolution 2132.htm"
ID:	2133
Default Severity:	High
Summary:	"External time synchronisation failed"
Description:	"NSH not externally time synchronised with the TOD. Please verify that you are correctly receiving the time of day telegrams in the comms viewer"
Solution URL:	"SolutionsSolution 2133.htm"
ID:	2134
Default Severity:	High
Summary:	"0 is reporting invalid blue data."
Description:	"The ERA device is reporting invalid data. Please check port settings, cabling and hardware."
Solution URL:	"SolutionsSolution 2134.htm"
ID:	2135
Default Severity:	High
Summary:	"0 is reporting invalid yellow data."
Description:	"The ERA device is reporting invalid data. Please check port settings, cabling and hardware."
Solution URL:	"SolutionsSolution 2135.htm"
ID:	2136
Default Severity:	High
Summary:	"0 - Time message is < 50ms from limits of the offset range"
Description:	"The TOD device is reporting that the time of day message is close to the limits of the range when it would fall into the next or previous second. Re-Sync the offset range from the TOD properties dialog"
Solution URL:	"SolutionsSolution 2136.htm"
ID:	2511
Default Severity:	Critical
Summary:	"0 position error greater than 5 metres"
Description:	"The position error being received has been greater than 5 metres for more than 5 seconds."
Solution URL:	"SolutionsSolution 2511.htm"
ID:	2512
Default Severity:	Critical
Summary:	"0 position accuracy out of bounds"

Description:	"Lodestar AINS expected position error has reached defined upper limit (1km) and has reset itself automatically to protect integrity of the inertial solution"
Solution URL:	"SolutionsSolution 2512.htm"
ID:	2513
Default Severity:	Critical
Summary:	"0 depth error greater than 5 metres"
Description:	"The depth error being received has been greater 5 meters for more than 5 seconds."
Solution URL:	"SolutionsSolution 2513.htm"
ID:	2514
Default Severity:	Critical
Summary:	"Lodestar hardware error"
Description:	"The Lodestar has detected an IMU hardware error causing operation to halt or navigation solution to become unreliable"
Solution URL:	"SolutionsSolution 2514.htm"
ID:	2515
Default Severity:	Critical
Summary:	"Lodestar is not initialised"
Description:	"Lodestar is uninitialised. Time to settle can be set using the GC SETTLE command."
Solution URL:	"SolutionsSolution 2515.htm"
ID:	2516
Default Severity:	Critical
Summary:	"Lodestar orientation error"
Description:	"No initial orientation - AHRS unsettled."
Solution URL:	"SolutionsSolution 2516.htm"
ID:	2517
Default Severity:	Critical
Summary:	"Lodestar position error"
Description:	"No initial position has been available for the last 3 seconds."
Solution URL:	"SolutionsSolution 2517.htm"
ID:	2518
Default Severity:	Critical
Summary:	"Lodestar horizontal position 1DRMS exceeds limit"
Description:	"Horizontal position 1DRMS > 1km for more than 5s - inertial solution will re-initialise."
Solution URL:	"SolutionsSolution 2518.htm"

ID:	2519
Default Severity:	Critical
Summary:	"Lodestar INS/AHRS heading error exceeds limit"
Description:	"INS and AHRS heading different by more than 2 degrees for more than 5 seconds."
Solution URL:	"SolutionsSolution 2519.htm"
ID:	2520
Default Severity:	Critical
Summary:	"Lodestar INS/AHRS attitude error exceeds limit"
Description:	"Lodestar INS and AHRS pitch and/or roll different by more than 0.2 degrees for more than 5 seconds."
Solution URL:	"SolutionsSolution 2520.htm"
ID:	2521
Default Severity:	Critical
Summary:	"Lodestar gyro error estimate exceeds limit"
Description:	"The AINS Kalman filter estimates gyro sensor errors. Estimate consistently exceeds 3 times its expected RMS value."
Solution URL:	"SolutionsSolution 2521.htm"
ID:	2522
Default Severity:	Critical
Summary:	"Lodestar accelerometer error estimate exceeds limit"
Description:	"The AINS Kalman filter estimates accelerometer sensor errors. Estimate consistently exceeds 3 times its expected RMS value."
Solution URL:	"SolutionsSolution 2522.htm"
ID:	2523
Default Severity:	Critical
Summary:	"Transceiver power output 1 problem"
Description:	"Transceiver power output 1 is not as set."
Solution URL:	"SolutionsSolution 2523.htm"
ID:	2524
Default Severity:	Critical
Summary:	"Transceiver power output 1 has tripped"
Description:	"Transceiver power output 1 has tripped."
Solution URL:	"SolutionsSolution 2524.htm"

ID:	2525
Default Severity:	Critical
Summary:	"Transceiver power output 2 problem"
Description:	"Transceiver power output 2 is not as set."
Solution URL:	"SolutionsSolution 2525.htm"
ID:	2526
Default Severity:	Critical
Summary:	"Transceiver power output 2 has tripped"
Description:	"Transceiver power output 2 has tripped."
Solution URL:	"SolutionsSolution 2526.htm"
ID:	2527
Default Severity:	Critical
Summary:	"The PSU on 0 has failed at 48v"
Description:	"The PSU on the NSH has failed for 48v. If possible try and use a different voltage."
Solution URL:	"SolutionsSolution 2527.htm"
ID:	2528
Default Severity:	Critical
Summary:	"The PSU on 0 has failed at 24v"
Description:	"The PSU on the NSH has failed for 24v. If possible try and use a different voltage."
Solution URL:	"SolutionsSolution 2528.htm"
ID:	2529
Default Severity:	Critical
Summary:	"The PSU on 0 has failed at 5v"
Description:	"The PSU on the NSH has failed for 5v. If possible try and use a different voltage."
Solution URL:	"SolutionsSolution 2529.htm"
ID:	2530
Default Severity:	Critical
Summary:	"The PSU on 0 has failed at 3v3"
Description:	"The PSU on the NSH has failed for 3v3. If possible try and use a different voltage."
Solution URL:	"SolutionsSolution 2530.htm"
ID:	2531
Default Severity:	Critical
Summary:	"0 has overheated"

Description:	"The NSH has overheated, please check the cooling fans and filters."
Solution URL:	"SolutionsSolution 2531.htm"
ID:	2533
Default Severity:	High
Summary:	"0"
Description:	"The received acoustic ranges are approaching the systems maximum range limit. Try increasing the range in the Environmental settings."
Solution URL:	"SolutionsSolution 2533.htm"
ID:	2534
Default Severity:	Critical
Summary:	"Invalid transceiver protocol version for this function, requires 0 and above"
Description:	"Transceiver requires protocol version - please install latest firmware version."
Solution URL:	"SolutionsSolution 2534.htm"
ID:	2535
Default Severity:	Critical
Summary:	"0 has invalid firmware, requires 1.0.6.91 and above only"
Description:	"NSH firmware requires 1.0.6.91 and above - please install latest firmware."
Solution URL:	"SolutionsSolution 2535.htm"
ID:	2536
Default Severity:	Critical
Summary:	"0 has failed to send power through transceiver card 3"
Description:	"The NSH has failed to power the transceiver in slot 3."
Solution URL:	"SolutionsSolution 2532.htm"
ID:	2537
Default Severity:	Critical
Summary:	"0 has failed to send power through transceiver card 4"
Description:	"The NSH has failed to power the transceiver in slot 4."
Solution URL:	"SolutionsSolution 2532.htm"
ID:	2538
Default Severity:	Critical
Summary:	"0 has failed to send power through transceiver card 5"
Description:	"The NSH has failed to power the transceiver in slot 5."
Solution URL:	"SolutionsSolution 2532.htm"

ID:	2540
Default Severity:	High
Summary:	"0 telegram time is ahead of the current UTC time by 1 seconds"
Description:	"The telegram time is ahead of the current UTC time"
Solution URL:	"SolutionsSolution 2540.htm"
ID:	2541
Default Severity:	High
Summary:	"0 telegram time is behind the current UTC time by 1 seconds"
Description:	"The telegram time is behind current UTC time"
Solution URL:	"SolutionsSolution 2541.htm"
ID:	2542
Default Severity:	High
Summary:	"0 data invalid - baseline status not fixed."
Description:	"The baseline fix flag in the telegram is set to 'not fixed'"
Solution URL:	"SolutionsSolution 2542.htm"
ID:	2543
Default Severity:	0
Summary:	"0 does not have navigation functionality"
Description:	"The trasceiver does not have the navigation flag set and cannot be used for navigation."
Solution URL:	"SolutionsSolution 2567.htm"
ID:	2544
Default Severity:	High
Summary:	"Ambiguous network configuration detected"
Description:	"The system found that more than one network adapter may be configured to the same IP address family as at least one Sonardyne product. Please ensure that only one network adapter is configured to each IP address family. 0."
Solution URL:	"SolutionsSolution 2544.htm"
ID:	2545
Default Severity:	Critical
Summary:	"0 oil level or temperature fault detected."
Description:	"A system fault has been detected on the device - Check oil level and temperature."
Solution URL:	"SolutionsSolution 2545.htm"
ID:	2546
Default Severity:	Critical

Summary:	"0 is in the down position and vessel speed has exceeded the safety threshold of 1 knots."
Description:	"A deployment machine is in the down position and the vessel is moving at a speed greater than the pole safety threshold. Reduce vessel speed or retract deployment pole immediately."
Solution URL:	"SolutionsSolution 2546.htm"
ID:	2547
Default Severity:	High
Summary:	"0 NMEA checksum failure."
Description:	"The instrument is indicating a NMEA checksum failure. Please check any communication settings and connections."
Solution URL:	"SolutionsSolution 2547.htm"
ID:	2566
Default Severity:	Low
Summary:	"Vessel depth bias exceeded threshold"
Description:	"INS vessel depth bias can be reduced by adjusting mean sound speed to bring vessel depth closer to 0.0, and failing that recalibrating the reference array may be necessary."
Solution URL:	"SolutionsSolution 2566.htm"

F.1.3 Scheduler

ID:	3000
Default Severity:	Critical
Summary:	"Unable to start the Scheduler system"
Description:	"An unknown failure occurred at time 0, when trying to start the Scheduler System. Please verify that the application was installed correctly using the installer, and if not please re-install the Software."
Solution URL:	"SolutionsSolution 3000.htm"
ID:	3001
Default Severity:	Critical
Summary:	"Unable to stop the Scheduler system"
Description:	"An unknown failure occurred at time 0, when trying to stop the Scheduler System. Please verify that the application was installed correctly using the installer, and if not please re-install the Software."
Solution URL:	"SolutionsSolution 3001.htm"
ID:	3002
Default Severity:	High
Summary:	"The system cannot track: No interrogating transceiver"
Description:	"Tracking is enabled, but the system cannot find a transceiver on an active vehicle that could be used to interrogate transponders from. Check a transceiver exists on an active vehicle, and that transceiver devices on active vehicles are working correctly."

Solution URL:	"SolutionsSolution 3002.htm"
ID:	3003
Default Severity:	High
Summary:	"The system cannot track: No receiving transceiver"
Description:	"Tracking is enabled, but the system cannot find a transceiver on an active vehicle that could be used to receive replies from beacons. Check a transceiver exists on an active vehicle, and that transceiver devices on active vehicles are working correctly."
Solution URL:	"SolutionsSolution 3003.htm"
ID:	3004
Default Severity:	High
Summary:	"The system cannot track: No beacons selected"
Description:	"Tracking is enabled, but the system cannot find a beacon to be tracked. Either enable a mobile beacon for tracking, or add one to the system."
Solution URL:	"SolutionsSolution 3004.htm"
ID:	3005
Default Severity:	High
Summary:	"Beacon 0 taken offline: No reply is being received"
Description:	"The system has not received a reply from Beacon 0 for some time. It has been taken offline to improve the update rate of other beacons."
Solution URL:	"SolutionsSolution 3005.htm"
ID:	3006
Default Severity:	High
Summary:	"DO NOT USE THIS ALARM"
Description:	"This alarm value has been previously used and subsequently renamed and should not be used again. The alarm solution file will not exist."
Solution URL:	"SolutionsSolution 3006.htm"
ID:	3007
Default Severity:	High
Summary:	"System time synchronising"
Description:	"The systems internal time is still synchronising. If this alarm persists check the connection between the navigation PC and the device."
Solution URL:	"SolutionsSolution 3007.htm"
ID:	3008
Default Severity:	High
Summary:	"Common Interrogate Replies for beacons 0 are too close together"

Description:	"Signals from beacons 0 on a Common Interrogate are less than 1ms apart. Check the Travel Time display to diagnose the problem, and then adjust the beacon Turn Around Times (TAT) to resolve the issue"
Solution URL:	"SolutionsSolution 3008.htm"
ID:	3009
Default Severity:	High
Summary:	"Beacons are selected for both Telemetry and Standard Ranging - Doing 0 ranging only"
Description:	"The current job has beacons selected for tracking using both telemetry interrogation and standard interrogation. It is not possible to run both types at the same time, please change the job configuration to avoid this, or deselect some of the beacons for tracking. Currently only the 0 tracking will be running."
Solution URL:	"SolutionsSolution 3009.htm"
ID:	3010
Default Severity:	High
Summary:	"No world referenced position is currently available to send for telemetry ranging due to no GNSS device being available"
Description:	"The system can't currently provide a position to send via telemetry, as there is no GNSS available in the system. Check you have a GNSS Device and that it is enabled for tracking"
Solution URL:	"SolutionsSolution 3010.htm"
ID:	3011
Default Severity:	0
Summary:	"Telemetry tracking is unavailable"
Description:	"Security key does not support telemetry tracking."
Solution URL:	"SolutionsSolution 3011.htm"
ID:	3012
Default Severity:	High
Summary:	"Vehicle 0 taken offline: No reply is being received from Beacon(s) 1"
Description:	"The system has not received a reply from Beacon(s) 0 for some time. Vehicle 1 has been taken offline to improve the update rate of other beacons."
Solution URL:	"SolutionsSolution 3012.htm"

F.1.4 Tracker

ID:	4000
Default Severity:	Critical
Summary:	"Unable to start the Tracker system"
Description:	"An unknown failure occurred at time 0, when trying to start the Tracker System. Please verify that the application was installed correctly using the installer, and if not please re-install the Software."

Solution URL:	"SolutionsSolution 4000.htm"
ID:	4001
Default Severity:	Critical
Summary:	"Unable to stop the Tracker system"
Description:	"An unknown failure occurred at time 0, when trying to stop the Tracker System. Please verify that the application was installed correctly using the installer, and if not please re-install the Software."
Solution URL:	"SolutionsSolution 4001.htm"
ID:	4002
Default Severity:	Critical
Summary:	"No Heading data for 0 - attempting to compute heading"
Description:	"0 has a USBL Transceiver but does not have any Heading Data - If there are reference beacons, the system will compute heading, but if not this will result in incorrect tracking. Solution: Add a Heading Device to this vehicle, or fix a Heading device which is not working. Alternatively select Manual Heading for this vehicle."
Solution URL:	"SolutionsSolution 4002.htm"
ID:	4003
Default Severity:	High
Summary:	"No Pitch/Roll data for 0 - using USBL internal sensors"
Description:	"0 has a USBL Transceiver but does not have any Pitch/Roll Data - USBL Transceiver internal sensors will be used - this could result in degraded tracking. Solution: Add a Pitch/Roll Device to this vehicle, or fix a Pitch/Roll device which is not working."
Solution URL:	"SolutionsSolution 4003.htm"
ID:	4004
Default Severity:	Low
Summary:	"System is operating outside of its UTM Zone"
Description:	"System is operating outside of its UTM Zone - please reset geodesy or shutdown and restart the system."
Solution URL:	"SolutionsSolution 4004.htm"
ID:	4005
Default Severity:	Low
Summary:	"Ranging target is more than 0% beyond max. sound speed profile depth"
Description:	"The System is trying to obtain the Sound Velocity for a depth which is more than 0% greater than the maximum depth in the currently loaded Sound Velocity Profile - load a new profile which covers a greater depth."
Solution URL:	"SolutionsSolution 4005.htm"

ID:	4006
Default Severity:	Low
Summary:	"No Heading data for 0 - using best alternative: 1"
Description:	"The selected Heading sensor for 0 is not available - best alternative device 1 is being used."
Solution URL:	"SolutionsSolution 4006.htm"
ID:	4007
Default Severity:	Low
Summary:	"No Pitch/Roll data for 0 - using best alternative: 1"
Description:	"The selected Pitch/Roll sensor for 0 is not available - best alternative device 1 is being used."
Solution URL:	"SolutionsSolution 4007.htm"
ID:	4008
Default Severity:	High
Summary:	"0 has 1 2's alarm watch circle"
Description:	" The target object 0 has 1 the watch circle surrounding 2 "
Solution URL:	"SolutionsSolution 4008.htm"
ID:	4009
Default Severity:	High
Summary:	"BOP to Riser angle has exceeded critical angle of 0. Its value is 1."
Description:	"BOP to Riser angle has exceeded the critical threshold of 0. Its value is 1."
Solution URL:	"SolutionsSolution 4009.htm"
ID:	4010
Default Severity:	High
Summary:	"0 does not support Wideband 2."
Description:	"0 does not support Wideband 2, support for this feature has been disabled. Any beacon with a Wideband 2 address will not be used for navigation."
Solution URL:	"SolutionsSolution 4010.htm"
ID:	4011
Default Severity:	High
Summary:	"MRAMS telemetry from Beacon 0 was not received"
Description:	"The system has requested the attitude of Beacon 0 but no reply was received or the reply was corrupted."
Solution URL:	"SolutionsSolution 4011.htm"
ID:	4012
Default Severity:	High

Summary:	"Riser Profiling telemetry from Beacon 0 was not received"
Description:	"The system has requested the Riser Profiling data from Beacon 0 but no reply was received or the reply was corrupted."
Solution URL:	"SolutionsSolution 4012.htm"
ID:	4014
Default Severity:	High
Summary:	"Riser angle at beacon 0 has exceeded 1"
Description:	"Riser angle at beacon 0 has exceeded the threshold of 1."
Solution URL:	"SolutionsSolution 4014.htm"
ID:	4015
Default Severity:	High
Summary:	"Beacon 0 has returned no data"
Description:	" Beacon 0 returned no data from at least 1 sensor."
Solution URL:	"SolutionsSolution 4015.htm"
ID:	4016
Default Severity:	High
Summary:	"0 does not support HPR 300 Channels."
Description:	"0 is a 6G device and does not support navigation using HPR300 channels, these beacons will be taken offline."
Solution URL:	"SolutionsSolution 4016.htm"
ID:	4017
Default Severity:	High
Summary:	"No Pitch/Roll data for 0 - using 0.0"
Description:	"0 has a USBL Transceiver but does not have any Pitch/Roll Data - 0.0 will be used - this could result in degraded tracking. Solution: Add a Pitch/Roll Device to this vehicle, or fix a Pitch/Roll device which is not working."
Solution URL:	"SolutionsSolution 4017.htm"
ID:	4018
Default Severity:	High
Summary:	"Beacon 0's tilt has exceeded the delta angle 1. It is currently 2"
Description:	"Beacon 0's tilt has exceeded the Beacon Sensor Monitoring delta angle of 1. It is currently 2"
Solution URL:	"SolutionsSolution 4018.htm"
ID:	4019
Default Severity:	High

Summary:	"Beacon 0's depth has exceeded the delta depth 1. It is currently 2"
Description:	"Beacon 0's depth has exceeded the Beacon Sensor Monitoring delta depth of 1. It is currently 2"
Solution URL:	"SolutionsSolution 4019.htm"
ID:	4020
Default Severity:	High
Summary:	"Beacon 0's temperature has exceeded the delta temperature 1. It is currently 2"
Description:	"Beacon 0's temperature has exceeded the Beacon Sensor Monitoring delta temperature of 1. It is currently 2"
Solution URL:	"SolutionsSolution 4020.htm"
ID:	4021
Default Severity:	High
Summary:	"Beacon 0's sound speed has exceeded the delta sound speed 1. It is currently 2"
Description:	"Beacon 0's speed has exceeded the Beacon Sensor Monitoring delta sound speed of 1. It is currently 2"
Solution URL:	"SolutionsSolution 4021.htm"
ID:	4022
Default Severity:	High
Summary:	"Beacon Sensor Monitoring telemetry from Beacon 0 was not received"
Description:	"The system has requested the Beacon Sensor Monitoring data from Beacon 0 but no reply was received or the reply was corrupted."
Solution URL:	"SolutionsSolution 4022.htm"
ID:	4024
Default Severity:	Low
Summary:	"No Heading data for 0 - using Computed Heading"
Description:	"0 has a USBL Transceiver but does not have any Heading Data - As there are 2 or more reference beacons, the Heading will be Computed"
Solution URL:	"SolutionsSolution 4024.htm"
ID:	4025
Default Severity:	High
Summary:	"BOP to Riser angle has exceeded warning angle of 0. Its value is 1."
Description:	"BOP to Riser angle has exceeded the warning threshold of 0. Its value is 1."
Solution URL:	"SolutionsSolution 4025.htm"
ID:	4026
Default Severity:	Low

Summary:	"Environmental settings: No GNSS available for latitude"
Description:	"Pressure to Depth: The option "Use GNSS" in the Toolwindow requires an operational GNSS in the job."
Solution URL:	"SolutionsSolution 4026.htm"
ID:	4027
Default Severity:	Low
Summary:	"GyroCompatt 0 is not enabled for Sensor Monitoring"
Description:	"GyroCompatt 0 is not enabled for Sensor Monitoring. Sensor measurements should be enabled as heading sensor observations are required for vehicle tracking."
Solution URL:	"SolutionsSolution 4027.htm"
ID:	4028
Default Severity:	High
Summary:	"0 has 1 2's Warning watch circle"
Description:	" The target object 0 has 1 the warning watch circle surrounding 2 "
Solution URL:	"SolutionsSolution 4028.htm"
ID:	4029
Default Severity:	High
Summary:	"0 frequency band 1 is incompatible current transceivers in use are 2"
Description:	"Transceiver 0 is using the 1 frequency band this has been disabled for tracking as it conflicts with the 2 frequency band currently in use"
Solution URL:	"SolutionsSolution 4029.htm"
ID:	4030
Default Severity:	High
Summary:	"0 1 the depth alarm threshold of 2 metres (specified by 3)"
Description:	" The target object 0 1 the depth alarm threshold of 2 metres (specified by 3)"
Solution URL:	"SolutionsSolution 4030.htm"
ID:	4031
Default Severity:	Critical
Summary:	"Unable to position in world reference frame"
Description:	"The system has automatically changed to a local frame of reference. The system has no observations that can provide a valid world position. Check that a GNSS position or reference array is available. Features reliant on world positions (e.g. output telegrams in world frame) will not function until a position is available."
Solution URL:	"SolutionsSolution 4031.htm"
ID:	4032

Default Severity:	High
Summary:	"Unable to track beacon 0 by telemetry tracking"
Description:	"Beacon 0 is unable to be positioned by telemetry tracking as the firmware is running a protocol version that is below the minimum version required to support this functionality. The firmware version must be running at least PV2.0 or greater to support telemetry tracking. The current firmware is running PV1"
Solution URL:	"SolutionsSolution 4032.htm"

F.1.5 Logger

ID:	5000
Default Severity:	Low
Summary:	"Available disk space is less than minimum threshold (0)"
Description:	"Monitored disk drive 0 has been detected at time 1, to have less space than the minimum threshold (2). It is recommended to perform any manual housekeeping activities on drive 0 to free any disk space."
Solution URL:	"SolutionsSolution 5000.htm"
ID:	5001
Default Severity:	High
Summary:	"Available disk space is less than warning threshold (0)"
Description:	"Monitored disk drive 0 has been detected at time 1, to have less space than the warning threshold (2). The system will attempt to perform adhoc automated housekeeping on drive 0, to free some disk space. Any additional housekeeping activities that can be performed on drive 0 to free any disk space are recommended."
Solution URL:	"SolutionsSolution 5001.htm"
ID:	5002
Default Severity:	Critical
Summary:	"Available disk space is less than critical threshold (0)"
Description:	"Monitored disk drive 0 has been detected at time 1, to have less space than the critical threshold (2). The system will attempt to perform adhoc automated housekeeping on drive 0, to free some disk space, however will no longer log any Data until this alarm has been cleared. Any additional housekeeping activities that can be performed on drive 0 to free any disk space are recommended."
Solution URL:	"SolutionsSolution 5002.htm"
ID:	5003
Default Severity:	Critical
Summary:	"Log File Update Failed"
Description:	"Error occurred updating current Active log file 0. It is recommended to save the job and then shutdown the system, and then restart. If the problem persists, then try creating a new job should resolve the issue."
Solution URL:	"SolutionsSolution 5003.htm"

ID:	5004
Default Severity:	Critical
Summary:	"Initialising Logger Failed"
Description:	"Error occurred initialising Logger using current Active log file 0. It is recommended to save the job and then shutdown the system, and then to restart the application. If the problem persists, then try recreating a new job should resolve the issue."
Solution URL:	"SolutionsSolution 5004.htm"
ID:	5005
Default Severity:	Critical
Summary:	"Log File Connection Failed"
Description:	"Error occurred connecting to current Active log file 0, using connection string 1. It is recommended that you verify that the Server name in the Options Logger setting is correct, and that SQL Server service is running. After making any changes shutdown the system, and then restart. If the problem persists, then try recreating a new job should resolve the issue."
Solution URL:	"SolutionsSolution 5005.htm"
ID:	5006
Default Severity:	Critical
Summary:	"Creating New Log Repository File Failed"
Description:	"Error occurred during creating new Log repository 0, using connection string 1. It is recommended that you use the Logging UI found under menus Tools->Maintenance, to create a new repository, and select to use this for logging."
Solution URL:	"SolutionsSolution 5006.htm"
ID:	5007
Default Severity:	Critical
Summary:	"Attempting to Log 0 with invalid SourceUID"
Description:	"Attempting to log 0 data with an unset SourceUID, which is invalid and will cause a batch update exception to occur. To prevent this exception, this value is being set to zero. This error should only be seen by development systems, and it's recommended that the developer logging this data needs to be informed, that the SourceUID value is set correctly."
Solution URL:	"SolutionsSolution 5007.htm"
ID:	5008
Default Severity:	High
Summary:	"0 Log File Batch Update Failed"
Description:	"Error occurred updating current Active log file 0, with invalid data in batch update of table 1. This will not prevent the system from tracking, however it is recommended that you export a Sonardyne support file, and send this to support@sonardyne.com."
Solution URL:	"SolutionsSolution 5008.htm"

ID:	5009
Default Severity:	High
Summary:	"0 Log data bounds check failed"
Description:	"Bounds checking error occurred with invalid data found for table 0, the variables failing bounds checking being 1. This will not prevent the system from tracking or logging, however it is recommended that you export a Sonardyne support file, and send this to support@sonardyne.com."
Solution URL:	"SolutionsSolution 5009.htm"
ID:	5010
Default Severity:	High
Summary:	"Job file Logging failed"
Description:	"A problem was experienced when the system attempted to log the Job file. Further information: 0. This may not prevent the system from tracking, however it is recommended that you export a Sonardyne support file, and send this to support@sonardyne.com should you be having a logging problem."
Solution URL:	"SolutionsSolution 5010.htm"
ID:	5011
Default Severity:	Critical
Summary:	"Stopped Logging Data"
Description:	"The system has stopped logging data, after passing the critical disk space threshold on the monitored disk drive 0. The system will no longer log any Data until this alarm has been cleared. Please perform manual housekeeping to free as much disk space on drive 0 as possible, including emptying the Recycle Bin, to increase the free disk space above the disk space thresholds."
Solution URL:	"SolutionsSolution 5011.htm"
ID:	5012
Default Severity:	Critical
Summary:	"Logging system failed to create buffer for 0 data"
Description:	"The Logging system was unable to to create a buffer, for the table 0, using the database 1. The system will no longer be able to log any data of this type, until this alarm has been cleared. Please use the Logging window, found in the menu Tools and Maintenance, to create and use a new log file. Should this fail then try to restart the system."
Solution URL:	"SolutionsSolution 5012.htm"

F.1.6 Main UI

ID:	6000
Default Severity:	Critical
Summary:	"Unable to start the MainUI system"

Description:	"An unknown failure occurred at time 0, when trying to start the MainUI System. Please verify that the application was installed correctly using the installer, and if not please re-install the Software."
Solution URL:	"SolutionsSolution 6000.htm"
ID:	6001
Default Severity:	Critical
Summary:	"Unable to stop the MainUI system"
Description:	"An unknown failure occurred at time 0, when trying to stop the MainUI System. Please verify that the application was installed correctly using the installer, and if not please re-install the Software."
Solution URL:	"SolutionsSolution 6001.htm"

F.1.7 Application Main

ID:	7000
Default Severity:	Critical
Summary:	"Unable to start the ApplicationMain system"
Description:	"An unknown failure occurred at time 0, when trying to start the ApplicationMain System. Please verify that the application was installed correctly using the installer, and if not please re-install the Software."
Solution URL:	"SolutionsSolution 7000.htm"
ID:	7001
Default Severity:	Critical
Summary:	"Unable to stop the ApplicationMain system"
Description:	"An unknown failure occurred at time 0, when trying to stop the ApplicationMain System. Please verify that the application was installed correctly using the installer, and if not please re-install the Software."
Solution URL:	"SolutionsSolution 7001.htm"

F.1.8 Main UI

ID:	8000
Default Severity:	Critical
Summary:	"Unable to start the Remote Control system"
Description:	"An unknown failure occurred at time 0, when trying to start the Remote Control System. Please verify that the application was installed correctly using the installer, and if not please re-install the Software."
Solution URL:	"SolutionsSolution 8000.htm"
ID:	8001
Default Severity:	Critical
Summary:	"Unable to stop the Remote Control system"

Description:	"An unknown failure occurred at time 0, when trying to stop the Remote Control System. Please verify that the application was installed correctly using the installer, and if not please re-install the Software."
Solution URL:	"SolutionsSolution 8001.htm"

F.2 Events

F.2.1 System Manager

ID:	10000
Type:	SystemInformation
Msg:	"All system components started."
Show In MiniView:	"True"
ID:	10001
Type:	DebugTrace
Msg:	"0 successfully started."
ID:	10002
Type:	SystemInformation
Msg:	"0 no longer available."
ID:	10003
Type:	UserTransaction
Msg:	"Last job not loaded because user held CONTROL+SHIFT keys down."
ID:	10004
Type:	UserTransaction
Msg:	"Job not automatically saved during shutdown because user held CONTROL+SHIFT keys down."
ID:	10005
Type:	SystemInformation
Msg:	"Automatically loaded last used job: 0"
ID:	10006
Type:	SystemWarning
Msg:	"Unable to save the job due to a problem in component: 0"
Show In MiniView:	"True"
ID:	10007

Type:	SystemWarning
Msg:	"Unable to access Security Key - Please restart system"
Show In MiniView:	"True"
ID:	10008
Type:	SystemInformation
Msg:	"Created new job 0 from current template"
ID:	10009
Type:	SystemInformation
Msg:	"Saved job template data"
ID:	10010
Type:	SystemInformation
Msg:	"Job 0 Closed"
ID:	10011
Type:	SystemInformation
Msg:	"Created new blank job 0"
ID:	10012
Type:	SystemInformation
Msg:	"Loaded Job 0 and updated with job template settings"
ID:	10013
Type:	SystemWarning
Msg:	"Job file : 0 is corrupted. No backup found."
Show In MiniView:	"True"
ID:	10014
Type:	SystemWarning
Msg:	"Job file : 0 is corrupted. The backup job was loaded instead."
Show In MiniView:	"True"
ID:	10015
Type:	SystemWarning
Msg:	"Job file : 0 is corrupted. No backup found."

Show In MiniView:	"True"
ID:	10016
Type:	SystemWarning
Msg:	"Job file : 0 is corrupted. Replaced with backup job."
Show In MiniView:	"True"
ID:	10017
Type:	DebugTrace
Msg:	"Adhoc dongle check initiated"
ID:	10018
Type:	DebugTrace
Msg:	"Initiated adhoc dongle check - found a 0 dongle."
ID:	10019
Type:	DebugTrace
Msg:	"Periodic dongle check initiated"
ID:	10020
Type:	DebugTrace
Msg:	"Initiated periodic dongle check - found a 0 dongle"
ID:	10021
Type:	SystemInformation
Msg:	"Found uninitialised 0 1 security key has been activated."
ID:	10022
Type:	SystemInformation
Msg:	"User: 0 selected Become Master"
ID:	10023
Type:	SystemInformation
Msg:	"Received "Become Master" request from Slave system (0)."
Show In MiniView:	"True"
ID:	10024

Type:	SystemInformation
Msg:	"Remote System (0): Master-Slave state changed from 1 to 2."
Show In MiniView:	"True"
ID:	10025
Type:	SystemInformation
Msg:	"Local System (0) Master-Slave state changed from 1 to 2."
Show In MiniView:	"True"
ID:	10026
Type:	DebugTrace
Msg:	"Job Save failure, with exception: 0."
ID:	10027
Type:	DebugTrace
Msg:	"Failure to set security of Job file after save, with exception: 0."
ID:	10029
Type:	DebugTrace
Msg:	"Job Saved Successfully to 0"

F.2.2 Device Manager

ID:	20000
Type:	DebugTrace
Msg:	"0 Device UID:1 has been created ok"
ID:	20002
Type:	SystemWarning
Msg:	"0 2Hz data rate is below minimum of 1Hz."
Show In MiniView:	"True"
ID:	20004
Type:	DebugTrace
Msg:	"0 Initialisation ok"
ID:	20005
Type:	SystemWarning
Msg:	"0 Baud rate change failed"
Show In MiniView:	"True"

ID:	20006
Type:	SystemWarning
Msg:	"0 Calibration command failed"
Show In MiniView:	"True"
ID:	20007
Type:	DebugTrace
Msg:	"0 Calibration command ok for frequency 1Hz"
ID:	20009
Type:	DebugTrace
Msg:	"0 Attitude command failed"
Show In MiniView:	"True"
ID:	20010
Type:	DebugTrace
Msg:	"0 Noise monitor command failed"
Show In MiniView:	"True"
ID:	20011
Type:	DebugTrace
Msg:	"0 Unable to send command"
ID:	20012
Type:	DebugTrace
Msg:	"0 Not initialised. Unable to send command"
Show In MiniView:	"True"
ID:	20013
Type:	DebugTrace
Msg:	"0 Phase calibration out of range"
Show In MiniView:	"True"
ID:	20014
Type:	DebugTrace
Msg:	"0 Failed to send telemetry"
Show In MiniView:	"True"

ID:	20015
Type:	DebugTrace
Msg:	"0 Getting serial number"
Show In MiniView:	"True"
ID:	20016
Type:	DebugTrace
Msg:	"0 Setting address to 1 "
Show In MiniView:	"True"
ID:	20017
Type:	DebugTrace
Msg:	"0 Address command ok"
ID:	20018
Type:	DebugTrace
Msg:	"0 Address command failed"
Show In MiniView:	"True"
ID:	20019
Type:	DebugTrace
Msg:	"0 Authenticating"
ID:	20020
Type:	DebugTrace
Msg:	"0 Authentication ok"
ID:	20021
Type:	DebugTrace
Msg:	"0 Authentication failed"
Show In MiniView:	"True"
ID:	20022
Type:	DebugTrace
Msg:	"0 Setting Baud rate to 1 "
Show In MiniView:	"True"
ID:	20024
Type:	DebugTrace

Msg:	"0 Device has connected ok"
ID:	20025
Type:	SystemWarning
Msg:	"0 HDOP value of 1 indicates low quality"
Show In MiniView:	"True"
ID:	20026
Type:	SystemWarning
Msg:	"0 Quality indicator changed from: 1 to 2"
Show In MiniView:	"True"
ID:	20028
Type:	SystemWarning
Msg:	"0 Is currently aided by 1"
Show In MiniView:	"True"
ID:	20030
Type:	DebugTrace
Msg:	"0 Auto gain initialising to maximum."
ID:	20031
Type:	DebugTrace
Msg:	"0 Beacon 1 no signal, increasing gain to 2"
ID:	20032
Type:	DebugTrace
Msg:	"0 Beacon 1 signal 2dBV, auto setting gain to 3"
ID:	20033
Type:	DebugTrace
Msg:	"0 Cannot connect. No security key found."
Show In MiniView:	"True"
ID:	20034
Type:	AcousticInformation
Msg:	"0 [Signal Diags] Total RMS noise calculated at 1dB."
ID:	20036

Type:	DebugTrace
Msg:	"0 Status flag changed to 1"
ID:	20037
Type:	DebugTrace
Msg:	"0 Pre-emption time less than 50ms [Current = 1][Requested = 2]"
ID:	20038
Type:	DebugTrace
Msg:	"0 Pulse Position Pitch is 1 Roll is 2"
ID:	20039
Type:	DebugTrace
Msg:	"0 Phase calibration data span > 1 degrees."
Show In MiniView:	"True"
ID:	20040
Type:	DebugTrace
Msg:	"0 HPT Transceiver Baud rate change ok: 1 to 2."
ID:	20041
Type:	DebugTrace
Msg:	"0 HPT Transceiver Baud rate change failed: 1 to 2."
Show In MiniView:	"True"
ID:	20042
Type:	DebugTrace
Msg:	"0 Pulse Position depth calculated as 1m."
ID:	20043
Type:	DebugTrace
Msg:	"0 Pulse Position depth not received or negative."
Show In MiniView:	"True"
ID:	20044
Type:	DebugTrace
Msg:	"0 Broadcast event ID not found."
ID:	20045

Type:	DebugTrace
Msg:	"0 Range rejected RT value of 1 ` acceptance level of 2"
Show In MiniView:	"True"
ID:	20046
Type:	DebugTrace
Msg:	"0 Range is being set to invalid"
Show In MiniView:	"True"
ID:	20047
Type:	DebugTrace
Msg:	"0 Direction information set to invalid"
Show In MiniView:	"True"
ID:	20049
Type:	SystemInformation
Msg:	"0 Failed to get battery type"
Show In MiniView:	"True"
ID:	20050
Type:	DebugTrace
Msg:	"0 Cannot Transmit, must be a Slave"
ID:	20051
Type:	DebugTrace
Msg:	"0 DiagnosticCommand: 1"
ID:	20052
Type:	DebugTrace
Msg:	"0 Rx attenuation 1dB not supported. Maximum value is 2dB"
ID:	20053
Type:	DebugTrace
Msg:	"0 Range rejected 1 samples 2 or more required."
Show In MiniView:	"True"
ID:	20054
Type:	DebugTrace
Msg:	"0 Range set to invalid."

Show In MiniView:	"True"
ID:	20055
Type:	DebugTrace
Msg:	"0 Setting direction information to invalid."
ID:	20056
Type:	DebugTrace
Msg:	"0 MasterAcoustics : 1"
ID:	20057
Type:	DebugTrace
Msg:	"0 TransceiverLPT : 1"
ID:	20058
Type:	DebugTrace
Msg:	"0 Unknown HPT protocol version"
ID:	20059
Type:	DebugTrace
Msg:	"0 Range recovery failed"
Show In MiniView:	"True"
ID:	20060
Type:	DebugTrace
Msg:	"0 Range reply failed"
Show In MiniView:	"True"
ID:	20061
Type:	DebugTrace
Msg:	"0 Checksum failure on command 1"
Show In MiniView:	"True"
ID:	20063
Type:	DebugTrace
Msg:	"0 TransceiverGDT 1"
ID:	20064
Type:	DebugTrace

Msg:	"0 TransceiverHPT 1 "
ID:	20065
Type:	DebugTrace
Msg:	"0 Lodestar AHRS is settling"
Show In MiniView:	"True"
ID:	20066
Type:	DebugTrace
Msg:	"0 Lodestar AHRS is settled"
Show In MiniView:	"True"
ID:	20067
Type:	DebugTrace
Msg:	"0 1 command timed out "
Show In MiniView:	"True"
ID:	20068
Type:	DebugTrace
Msg:	"0 Command decode failure"
Show In MiniView:	"True"
ID:	20069
Type:	DebugTrace
Msg:	"0 No reply"
Show In MiniView:	"True"
ID:	20070
Type:	DebugTrace
Msg:	"0 Telemetry errors in 0"
Show In MiniView:	"True"
ID:	20071
Type:	DebugTrace
Msg:	"0 Not initialised!"
Show In MiniView:	"True"
ID:	20072
Type:	SystemInformation

Msg:	"0 Retrying command"
Show In MiniView:	"True"
ID:	20073
Type:	SystemInformation
Msg:	"0 is 1"
Show In MiniView:	"True"
ID:	20074
Type:	SystemInformation
Msg:	"0 Covert mode is 1"
Show In MiniView:	"True"
ID:	20075
Type:	SystemInformation
Msg:	"0 - Time taken to 1 2"
ID:	22527
Type:	SystemWarning
Msg:	"The PSU on 0 has failed at 48v 1"
ID:	22528
Type:	SystemWarning
Msg:	"The PSU on 0 has failed at 24v 1"
ID:	22529
Type:	SystemWarning
Msg:	"The PSU on 0 has failed at 5v 1"
ID:	22530
Type:	SystemWarning
Msg:	"The PSU on 0 has failed at 3v3 1"
ID:	22531
Type:	SystemWarning
Msg:	"0 has overheated 1"
ID:	22536
Type:	SystemWarning

Msg:	"0 has failed to send power through transceiver card 3 1"
ID:	22537
Type:	SystemWarning
Msg:	"0 has failed to send power through transceiver card 4 1"
ID:	22538
Type:	SystemWarning
Msg:	"0 has failed to send power through transceiver card 5 1"
ID:	24000
Type:	SystemInformation
Msg:	"0 1"
ID:	24001
Type:	SystemInformation
Msg:	"0 Setting individual interrogate mode"
Show In MiniView:	"True"
ID:	24002
Type:	SystemInformation
Msg:	"0 Setting TAT to 1:F1ms"
Show In MiniView:	"True"
ID:	24003
Type:	SystemInformation
Msg:	"0 Setting range power to 1"
Show In MiniView:	"True"
ID:	24004
Type:	SystemInformation
Msg:	"0 Setting receive gain to 1"
Show In MiniView:	"True"
ID:	24005
Type:	SystemInformation
Msg:	"0 Setting responder mode On"
Show In MiniView:	"True"

ID:	24006
Type:	SystemInformation
Msg:	"0 Setting responder mode Off"
Show In MiniView:	"True"
ID:	24007
Type:	SystemInformation
Msg:	"0 Setting Pulse Position Depth On"
Show In MiniView:	"True"
ID:	24008
Type:	SystemInformation
Msg:	"0 Setting Pulse Position Angles On"
Show In MiniView:	"True"
ID:	24009
Type:	SystemInformation
Msg:	"0 Setting Pulse Position mode Off"
Show In MiniView:	"True"
ID:	24010
Type:	SystemInformation
Msg:	"0 Setting telemetry wait to 1 seconds"
Show In MiniView:	"True"
ID:	24011
Type:	SystemInformation
Msg:	"0 Setting telemetry gain to 1"
Show In MiniView:	"True"
ID:	24012
Type:	SystemInformation
Msg:	"0 Setting telemetry power to 1"
Show In MiniView:	"True"
ID:	24013
Type:	SystemInformation
Msg:	"0 Getting battery status"
Show In MiniView:	"True"

ID:	24014
Type:	SystemInformation
Msg:	"0 Getting fixed status"
Show In MiniView:	"True"
ID:	24015
Type:	SystemInformation
Msg:	"0 Setting release mode"
Show In MiniView:	"True"
ID:	24016
Type:	SystemInformation
Msg:	"0 Getting depth "
Show In MiniView:	"True"
ID:	24017
Type:	SystemInformation
Msg:	"0 Getting sound speed "
Show In MiniView:	"True"
ID:	24018
Type:	SystemInformation
Msg:	"0 Getting temperature "
Show In MiniView:	"True"
ID:	24019
Type:	SystemInformation
Msg:	"0 Setting blocking period to 1ms"
Show In MiniView:	"True"
ID:	24020
Type:	SystemInformation
Msg:	"0 Disabling"
Show In MiniView:	"True"
ID:	24021
Type:	SystemInformation
Msg:	"0 Setting Common Interrogate mode"

Show In MiniView:	"True"
ID:	24022
Type:	SystemInformation
Msg:	"0 Setting TX telemetry to Fast"
Show In MiniView:	"True"
ID:	24023
Type:	SystemInformation
Msg:	"0 Setting TX telemetry to Normal"
Show In MiniView:	"True"
ID:	24024
Type:	SystemInformation
Msg:	"0 Setting TX telemetry to Slow"
Show In MiniView:	"True"
ID:	24025
Type:	SystemInformation
Msg:	"0 Setting TX telemetry to Wideband"
Show In MiniView:	"True"
ID:	24026
Type:	SystemInformation
Msg:	"0 Setting Individual Interrogate mode On"
Show In MiniView:	"True"
ID:	24027
Type:	SystemInformation
Msg:	"0 Setting HPR mode On"
Show In MiniView:	"True"
ID:	24028
Type:	SystemInformation
Msg:	"0 Setting wideband receiver On"
Show In MiniView:	"True"
ID:	24029
Type:	SystemInformation

Msg:	"0 Getting sensor measurement"
Show In MiniView:	"True"
ID:	24030
Type:	SystemInformation
Msg:	"0 Setting Individual Interrogate mode"
Show In MiniView:	"True"
ID:	24031
Type:	SystemInformation
Msg:	"0 Setting battery override"
Show In MiniView:	"True"
ID:	24032
Type:	SystemInformation
Msg:	"0 Resetting to defaults"
Show In MiniView:	"True"
ID:	24033
Type:	SystemInformation
Msg:	"0 Getting beacon configuration"
Show In MiniView:	"True"
ID:	24034
Type:	SystemInformation
Msg:	"0 Getting user defaults"
Show In MiniView:	"True"
ID:	24035
Type:	SystemInformation
Msg:	"0 Setting user defaults"
Show In MiniView:	"True"
ID:	24036
Type:	SystemInformation
Msg:	"0 Setting protocol reply format"
Show In MiniView:	"True"
ID:	24037

Type:	SystemInformation
Msg:	"0 Setting LBL wait to 1 seconds"
Show In MiniView:	"True"
ID:	24038
Type:	SystemInformation
Msg:	"0 Authentication phase 1"
Show In MiniView:	"True"
ID:	24039
Type:	SystemInformation
Msg:	"0 Authentication phase 2"
Show In MiniView:	"True"
ID:	24040
Type:	SystemInformation
Msg:	"0 Preparing navigation cycle"
Show In MiniView:	"True"
ID:	24041
Type:	SystemInformation
Msg:	"0 Starting navigation cycle"
Show In MiniView:	"True"
ID:	24042
Type:	SystemInformation
Msg:	"0 Setting TX telemetry to 1"
Show In MiniView:	"True"
ID:	24043
Type:	SystemInformation
Msg:	"0 Calibrating 1Hz"
Show In MiniView:	"True"
ID:	24044
Type:	SystemInformation
Msg:	"0 Getting firmware version"
Show In MiniView:	"True"

ID:	24045
Type:	SystemInformation
Msg:	"0 Setting RX config for event 1 "
Show In MiniView:	"True"
ID:	24046
Type:	SystemInformation
Msg:	"0 Setting TX config for event 1 "
Show In MiniView:	"True"
ID:	24047
Type:	SystemInformation
Msg:	"0 Setting diagnostic mode On"
Show In MiniView:	"True"
ID:	24048
Type:	SystemInformation
Msg:	"0 Setting diagnostic mode Off"
Show In MiniView:	"True"
ID:	24049
Type:	SystemInformation
Msg:	"0 Getting noise measurement"
Show In MiniView:	"True"
ID:	24050
Type:	SystemInformation
Msg:	"0 Setting TX telemetry to Pulse Position"
Show In MiniView:	"True"
ID:	24051
Type:	SystemInformation
Msg:	"0 Getting protocol version"
Show In MiniView:	"True"
ID:	24052
Type:	SystemInformation
Msg:	"0 Setting range reply mode to LBL"
Show In MiniView:	"True"

ID:	24053
Type:	SystemInformation
Msg:	"0 Setting range reply mode to USBL "
Show In MiniView:	"True"
ID:	24054
Type:	SystemInformation
Msg:	"0 Setting internal range calculation"
Show In MiniView:	"True"
ID:	24055
Type:	SystemInformation
Msg:	"0 Setting external range calculation"
Show In MiniView:	"True"
ID:	24056
Type:	SystemInformation
Msg:	"0 Reset communications link"
Show In MiniView:	"True"
ID:	24057
Type:	SystemInformation
Msg:	"0 Setting RX telemetry to 1 "
Show In MiniView:	"True"
ID:	24058
Type:	SystemInformation
Msg:	"0 Release 1 "
Show In MiniView:	"True"
ID:	24059
Type:	SystemInformation
Msg:	"0 Getting sensor measurement"
Show In MiniView:	"True"
ID:	24060
Type:	SystemInformation
Msg:	"0 Setting common interrogate mode on 1 "

Show In MiniView:	"True"
ID:	24061
Type:	SystemInformation
Msg:	"0 Release armed"
Show In MiniView:	"True"
ID:	24062
Type:	SystemInformation
Msg:	"0 Release activated"
Show In MiniView:	"True"
ID:	24063
Type:	SystemWarning
Msg:	"PTP offset of 0s has exceeded 1s limit"
Show In MiniView:	"True"
ID:	24064
Type:	SystemWarning
Msg:	"0 Discovering beacons"
Show In MiniView:	"True"
ID:	24065
Type:	SystemInformation
Msg:	"0 No release mechanism found!"
Show In MiniView:	"True"
ID:	24066
Type:	SystemInformation
Msg:	"0 Getting configuration"
Show In MiniView:	"True"
ID:	24067
Type:	SystemInformation
Msg:	"0 Getting subscription configuration"
Show In MiniView:	"True"
ID:	24068
Type:	SystemInformation

Msg:	"0 Setting subscription configuration "
Show In MiniView:	"True"
ID:	24069
Type:	SystemInformation
Msg:	"0 Setting interrogation to navigation channel 1 "
Show In MiniView:	"True"
ID:	24070
Type:	SystemInformation
Msg:	"0 Setting reply to navigation channel 1 "
Show In MiniView:	"True"
ID:	24071
Type:	SystemInformation
Msg:	"0 sending 1 to 2"
Show In MiniView:	"True"
ID:	24072
Type:	SystemInformation
Msg:	"0 receiving 1 from 2"
Show In MiniView:	"True"
ID:	24073
Type:	SystemWarning
Msg:	"0 Failed changing to 1 "
Show In MiniView:	"True"
ID:	24074
Type:	SystemInformation
Msg:	"0 Recovered reassigning beacons"
Show In MiniView:	"True"
ID:	24077
Type:	SystemWarning
Msg:	"0 NMEA Checksum error"
Show In MiniView:	"True"
ID:	25000

Type:	SystemInformation
Msg:	"0 1"
Show In MiniView:	"True"
ID:	25001
Type:	SystemWarning
Msg:	"0 1"
Show In MiniView:	"True"
ID:	27000
Type:	AcousticInformation
Msg:	"0 Starting acoustic event 1 at 2"
ID:	27008
Type:	AcousticInformation
Msg:	"0 Acoustic Diagnostics 1"
ID:	27009
Type:	SystemWarning
Msg:	"0 Lodestar sample count limit not achieved for beacon 1."
ID:	27010
Type:	SystemWarning
Msg:	"0 Lodestar is rejecting acoustics for beacon 1."
ID:	27011
Type:	SystemWarning
Msg:	"0 Lodestar QJSum limit exceeded for beacon 1."
ID:	27012
Type:	SystemWarning
Msg:	"0 Lodestar minimum SNR limit not achieved for beacon 1."
ID:	27013
Type:	SystemWarning
Msg:	"0 Lodestar minimum signal level not achieved for beacon 1."
ID:	27014
Type:	SystemWarning

Msg:	"0 Lodestar was provided invalid Jx/Jy values for beacon 1."
ID:	27015
Type:	SystemWarning
Msg:	"0 Lodestar failed Kalman filter Sigma test for beacon 1."
ID:	27016
Type:	SystemWarning
Msg:	"0 Lodestar did not pass observation to Kalman filter for beacon 1"
ID:	27017
Type:	SystemWarning
Msg:	"0 Resetting after 1 phase calibrations with span > 30 degrees."
Show In MiniView:	"True"
ID:	27018
Type:	SystemWarning
Msg:	"0 No range received from 1"
Show In MiniView:	"True"
ID:	27019
Type:	SystemWarning
Msg:	"0 Getting time"
Show In MiniView:	"True"
ID:	27020
Type:	SystemInformation
Msg:	"0 baseline status changed to 1"
Show In MiniView:	"True"
ID:	27021
Type:	SystemWarning
Msg:	"0 telegram received 1 seconds post UTC"
Show In MiniView:	"True"
ID:	28000
Type:	DebugTrace
Msg:	"DeviceManager requesting Job Save."

F.2.3 Scheduler

ID:	30000
Type:	SystemWarning
Msg:	"Failed to measure range between 0 and 1"
Show In MiniView:	"True"
ID:	30001
Type:	DebugTrace
Msg:	"Scheduler aborted acoustic cycle 0 (timed out on DeviceManager)"
ID:	30002
Type:	AcousticInformation
Msg:	"Valid Direct (0) TT:1 Kx:2 Ky:3 4 Signal"
ID:	30003
Type:	AcousticInformation
Msg:	"Invalid Direct (0) TT:1 Kx:2 Ky:3 4 Signal"
ID:	30004
Type:	AcousticInformation
Msg:	"Valid Indirect (0) TT:1 Kx:2 Ky:3 4 Signal"
ID:	30005
Type:	AcousticInformation
Msg:	"Invalid Indirect (0) TT:1 Kx:2 Ky:3 4 Signal"
ID:	30006
Type:	AcousticInformation
Msg:	"Invalid unknown (0) TT:1 Kx:2 Ky:3 4 Signal"
ID:	30007
Type:	SystemInformation
Msg:	"The scheduler is discarding the prediction to 0"
Show In MiniView:	"True"
ID:	30008
Type:	SystemWarning
Msg:	"There have been 0 consecutive no replies to Beacon 1."
Show In MiniView:	"True"

ID:	30009
Type:	SystemWarning
Msg:	"Simulation has started."
ID:	30010
Type:	SystemWarning
Msg:	"Simulation has ended."
ID:	30011
Type:	DebugTrace
Msg:	"Acoustic cycle complete."
ID:	30012
Type:	SystemInformation
Msg:	"Too many beacons are on Common Interrogate Signal 0"
Show In MiniView:	"True"

F.2.4 Tracker

ID:	40000
Type:	DebugTrace
Msg:	"Tracker failed to solve - Kalman Filter:0 1"
ID:	40001
Type:	DebugTrace
Msg:	"Kalman failed Chi-Squared Test - 0 : 1"
ID:	40002
Type:	DebugTrace
Msg:	"Tracker 0 Observation Rejected - Kalman Filter"
ID:	40003
Type:	DebugTrace
Msg:	"Tracker failed to solve - Least Squares Filter:0 1"
ID:	40004
Type:	SystemWarning
Msg:	"Range Rejected - Negative Range - 0"
Show In MiniView:	"True"

ID:	40005
Type:	DebugTrace
Msg:	"Least Squares failed to converge after 0 iterations"
ID:	40006
Type:	SystemInformation
Msg:	"Beacon 0 changed from 1 to 2"
ID:	40007
Type:	DebugTrace
Msg:	"Tracker Reseeded due to divergence - Kalman Filter:0 RF:1"
ID:	40008
Type:	DebugTrace
Msg:	"Tracker Reseeded due to Stability Period - Kalman Filter:0"
ID:	40009
Type:	DebugTrace
Msg:	"Tracker Reseeded due to Speed Threshold - Kalman Filter:0 RF:1"
ID:	40010
Type:	SystemWarning
Msg:	"Sensor Monitoring- No status received"
Show In MiniView:	"True"
ID:	40011
Type:	SystemWarning
Msg:	"Sensor Monitoring - Telemetry from beacon 0 to be retried."
Show In MiniView:	"True"
ID:	40012
Type:	SystemWarning
Msg:	"Sensor Monitoring - Sensor Error: 0 : 1 Observation Invalid or Old"
ID:	40013
Type:	AcousticInformation
Msg:	"Sensor Monitoring- Good Reply: 0"

ID:	40014
Type:	SystemWarning
Msg:	"Range Rejected - too few good samples - received: 0 good samples"
Show In MiniView:	"True"
ID:	40015
Type:	DebugTrace
Msg:	"Least Squares Reset - 0 Filter: 1"
ID:	40016
Type:	DebugTrace
Msg:	"0 Reseeded due to Unreasonable Values - 1 States:2"
ID:	40017
Type:	SystemWarning
Msg:	"0 taken offline, due to completion of array calibration"
Show In MiniView:	"True"
ID:	40018
Type:	DebugTrace
Msg:	"Tracker EnvironmentManager requesting Job Save."
ID:	40019
Type:	DebugTrace
Msg:	"Tracker ReferenceFrameManager requesting Job Save."
ID:	40020
Type:	SystemWarning
Msg:	"Output Telegram automatically disabled for 0. Beacon is fixed."
Show In MiniView:	"True"
ID:	40021
Type:	SystemWarning
Msg:	"Kalman forward prediction exceeds limit (0s)"
ID:	40022

Type:	SystemWarning
Msg:	"Jx, Jy and Jz appear to be inconsistent and have been discarded (0)"
ID:	40023
Type:	DebugTrace
Msg:	"Tracker Reseeded due to persistent rejection of observations - Kalman Filter:0 RF:1"

F.2.5 Logger

ID:	50000
Type:	DebugTrace
Msg:	"Logger successfully started monitoring disk drive 0"
ID:	50001
Type:	DebugTrace
Msg:	"Logger failed to start monitoring disk drive 0"
ID:	50002
Type:	DebugTrace
Msg:	"Logger successfully stopped monitoring disk drive 0"
ID:	50003
Type:	DebugTrace
Msg:	"Logger failed to stop monitoring disk drive 0"
ID:	50004
Type:	DebugTrace
Msg:	"Logger successfully started monitoring log repository 0"
ID:	50005
Type:	DebugTrace
Msg:	"Logger failed to start monitoring log repository 0"
ID:	50006
Type:	DebugTrace
Msg:	"Logger successfully stopped monitoring log repository 0"
ID:	50007
Type:	DebugTrace
Msg:	"Logger failed to stop monitoring log repository 0"

ID:	50008
Type:	DebugTrace
Msg:	"Logger created new log repository 0"
ID:	50009
Type:	DebugTrace
Msg:	"Logger failed to created new log repository"
ID:	50010
Type:	DebugTrace
Msg:	"Logger started using new log repository 0"
ID:	50011
Type:	DebugTrace
Msg:	"Logger failed to start using new log repository 0"
ID:	50012
Type:	DebugTrace
Msg:	"Critical House keeping session started on drive 0"
ID:	50013
Type:	SystemWarning
Msg:	"Critical House keeping session completed on drive 0"
ID:	50014
Type:	DebugTrace
Msg:	"Adhoc House keeping session started"
ID:	50015
Type:	DebugTrace
Msg:	"Adhoc House keeping session completed"
ID:	50016
Type:	DebugTrace
Msg:	"Warning House keeping session started on drive 0"
ID:	50017
Type:	SystemWarning
Msg:	"Warning House keeping session completed on drive 0"

ID:	50018
Type:	DebugTrace
Msg:	"Manual house keeping required on drive 0 (drives free space < Minimum disk space threshold)"
ID:	50019
Type:	DebugTrace
Msg:	"Free disk space on drive 0 is now greater than minimum disk space threshold"
ID:	50020
Type:	DebugTrace
Msg:	"House keeping required on drive 0 (drives free space < Warning disk space threshold)"
ID:	50021
Type:	DebugTrace
Msg:	"Free disk space on drive 0 is now greater than warning disk space threshold"
ID:	50022
Type:	DebugTrace
Msg:	"House keeping required on drive 0 (drives free space < Critical disk space threshold)"
ID:	50023
Type:	DebugTrace
Msg:	"Free disk space on drive 0 is now greater than critical disk space threshold"
ID:	50024
Type:	DebugTrace
Msg:	"Log file 0 is approaching enforced maximum size and is requesting a new log to be created."
ID:	50025
Type:	DebugTrace
Msg:	"Log file 0 has reached enforced maximum size and is requesting to switch to the new log file."
ID:	50026
Type:	DebugTrace
Msg:	"0 house keeping session has deleted 1 log files. (Deleted log files are 2)."
ID:	50027
Type:	DebugTrace

Msg:	"0 house keeping session has not offlined or deleted any log files."
ID:	50028
Type:	DebugTrace
Msg:	"Closing job file and detaching log repository files."
ID:	50029
Type:	SystemWarning
Msg:	"Job '0' has been modified with its log files folder setting being updated. This may occur if the job has been copied or moved."
ID:	50030
Type:	SystemWarning
Msg:	"Unable to find log files 0 and 1 in folder 2."
ID:	50031
Type:	DebugTrace
Msg:	"Logger compressed closed log repository 0."
ID:	50032
Type:	DebugTrace
Msg:	"Logger successfully cancelled thread '0'."
ID:	50033
Type:	DebugTrace
Msg:	"Logger failed to cancel thread '0' within specified time."
ID:	50034
Type:	SystemWarning
Msg:	"Casius export timed-out whilst retrieving data leg (0 to 1)."
ID:	50035
Type:	DebugTrace
Msg:	"Next Repository Log file 0 cannot be found attached to server 1 - switching to next log file has been delayed."
ID:	50036
Type:	SystemWarning
Msg:	"Unable to find log file 0 in folder 1."

ID:	50037
Type:	DebugTrace
Msg:	"Successfully deleted log file 0 in folder 1."
ID:	50038
Type:	DebugTrace
Msg:	"Unable to delete log file 0 in folder 1."
ID:	50039
Type:	DebugTrace
Msg:	"Starting to check for orphaned repositories left on the server."
ID:	50040
Type:	DebugTrace
Msg:	"Successfully detached orphaned repository 0 from server 1."
ID:	50041
Type:	DebugTrace
Msg:	"Unable to detach orphaned repository 0 from server 1."
ID:	50042
Type:	DebugTrace
Msg:	"Finished checking for orphaned repositories left on the server. (Removed 0 repositories)."
ID:	50043
Type:	DebugTrace
Msg:	"Timed 0 house keeping session started"
ID:	50044
Type:	DebugTrace
Msg:	"Timed 0 house keeping session completed"
ID:	50045
Type:	DebugTrace
Msg:	"No active data repository found in the job - logger will attempt to create it."
ID:	50046
Type:	DebugTrace
Msg:	"No active event repository found in the job therefore - logger will attempt to create it."

ID:	50047
Type:	DebugTrace
Msg:	"No active calibration event repository found in the job - logger will attempt to create it."
ID:	50048
Type:	DebugTrace
Msg:	"Active repository found using old schema (0) - a new repository will be created (1)."
ID:	50049
Type:	SystemWarning
Msg:	"The logger has encountered a possible corrupted job file which it will attempt to recover from."
ID:	50050
Type:	SystemWarning
Msg:	"Unable to attach static repository(s) (0) to Server (1). Verify server is running, repositories exist, and are not compressed."
ID:	50051
Type:	SystemWarning
Msg:	"Unable to attach active repository(s) (0) to Server (1). Verify server is running, repositories exist, and are not compressed."
ID:	50052
Type:	SystemWarning
Msg:	"Unable to find active repository (0) - requesting new repository to be created."
ID:	50053
Type:	DebugTrace
Msg:	"0 House keeping session has offlined 1 log files. (Offlined log files are 2)."
ID:	50054
Type:	DebugTrace
Msg:	"Successfully offlined log file 0 in folder 1."
ID:	50055
Type:	DebugTrace
Msg:	"Unable to offline log file 0 in folder 1."
ID:	50056

Type:	SystemWarning
Msg:	"Batched update of 0 data buffer failed, 1. To protect the system, buffered data has been deleted."
ID:	50057
Type:	DebugTrace
Msg:	"Successfully detached offlined log file 0 in folder 1."
ID:	50058
Type:	DebugTrace
Msg:	"Unable to detach offline log file 0 in folder 1."
ID:	50059
Type:	DebugTrace
Msg:	"0 House keeping session has detached 1 offline log files. (Detached offlined log files are 2)."
ID:	50060
Type:	DebugTrace
Msg:	"Offline repository(s) (0) unexpectedly found attached to Server (1). This may occur should a system be forcibly closed before a successful job save."
ID:	50061
Type:	DebugTrace
Msg:	"Exception caught in 0. Further Info: 1. Please check the debug event log for more information."
ID:	50062
Type:	DebugTrace
Msg:	"Asked to log an empty job file. Please check the debug event log for more information."
ID:	50063
Type:	DebugTrace
Msg:	"Logger Housekeeping requesting Job Save."
ID:	50064
Type:	DebugTrace
Msg:	"Logger Admin requesting Job Save post creating new 0 repository."
ID:	50065
Type:	DebugTrace

Msg:	"Logger Admin requesting Job Save post switching to use new repository."
ID:	50066
Type:	DebugTrace
Msg:	"Logger Admin requesting Job Save post deleting repository 0."
ID:	50067
Type:	DebugTrace
Msg:	"Logger Admin requesting Job Save post offlining repository 0."
ID:	50068
Type:	DebugTrace
Msg:	"Logger Admin requesting Job Save post job load."
ID:	50069
Type:	DebugTrace
Msg:	"Logger Admin requesting Job Save post New Job finished load."
ID:	50070
Type:	DebugTrace
Msg:	"Logger Admin requesting Job Save post Job SaveAs."
ID:	50071
Type:	SystemWarning
Msg:	"Logging stopped due to Critical Disk Space Threshold has being passed on disk 0."
ID:	50072
Type:	SystemInformation
Msg:	"Logging restarted due to Critical Disk Space Theshold being cleared on disk 0."
ID:	50073
Type:	SystemWarning
Msg:	"Cannot create new 0 log repository because Logging has stopped due to Critical Disk Space Threshold alarm."

F.2.6 Main UI

ID:	60000
Type:	SystemInformation
Msg:	"The MainUI system successfully started at time 0"

ID:	60001
Type:	SystemInformation
Msg:	"The MainUI system successfully stopped at time 0"
ID:	60002
Type:	UserTransaction
Msg:	""0" Object="1" OldValue="2" NewValue="3""
ID:	60003
Type:	UserTransaction
Msg:	""0" Object="1" Value="2""
ID:	60004
Type:	UserTransaction
Msg:	""0" Object="1""
ID:	60005
Type:	UserTransaction
Msg:	""0""

F.2.7 Application Main

ID:	70000
Type:	SystemInformation
Msg:	"The ApplicationMain system successfully started at time 0"
ID:	70001
Type:	SystemInformation
Msg:	"The ApplicationMain system successfully stopped at time 0"

F.2.8 Main UI

ID:	80000
Type:	SystemInformation
Msg:	"The Remote Control system successfully started at time 0"
ID:	80001
Type:	SystemInformation
Msg:	"The Remote Control system successfully stopped at time 0"
ID:	80002
Type:	UserTransaction

Msg:

"0"

Appendix G – Acoustic Positioning Methods

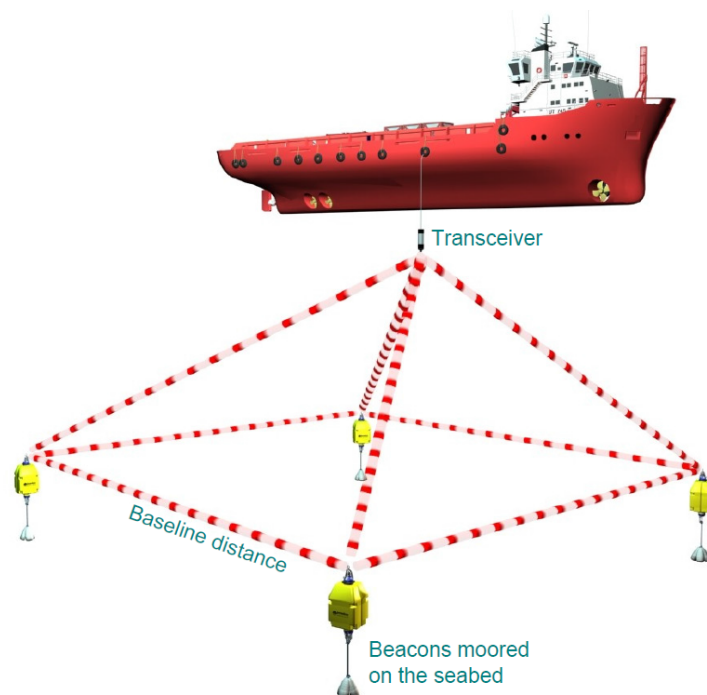
G.1 Long Baseline (LBL)

G.1.1 Hardware

A long baseline system has two parts or segments:

The first segment comprises a number of acoustic transponder beacons in an array moored in fixed positions on the seabed. The positions of the beacons are described in a co-ordinate frame fixed to the seabed. The straight-line distances between them form the 'baselines' used by the system.

Figure G-1 Typical LBL System



The second segment comprises an underwater acoustic transducer on a transceiver. The transceiver is usually installed on the vessel either in an over-the-side arrangement as shown in *Figure G-1*, or in a fixed through-the-hull arrangement. It can also be installed on a towfish if necessary.

G.1.2 Principles

The distance from the transducer to a transponder beacon can be measured by causing the transducer to transmit a short acoustic signal to which the transponder beacon responds.

The transceiver makes an accurate measurement of the interval between the instant when it transmits and the instant when it receives the transponder's response. Because the sound velocity in water is known at the location, it is possible to develop a good estimate of the range between the transceiver and the transponder beacon.

This measurement process is repeated for all the beacons in the array, and the position of the transceiver is then calculated or estimated relative to the array.

G.1.3 Beacon Numbers

In principle, navigation can be achieved using just two transponder beacons fixed to the seabed. However, with only two transponders, there would be ambiguity in the navigation solution because it

would not be possible to determine from the measurements which side of the baseline was the correct transceiver position.

Also, when using only two beacons, the depth of the transceiver (equivalent to the transceiver's 'height' above the beacons) must be assumed.

For these reasons, three beacons is the minimum that can be used to produce unambiguous results in three dimensions. The use of five beacons provides sufficient redundancy to allow erroneous measurements to be identified, and is useful for making checks on the quality of navigation.

G.1.4 Baseline Distance

The term 'long baseline' is used because, generally, the baseline distances are much greater for LBL than for short baseline (SBL), and it is certainly much longer than for ultra-short baseline (USBL).

The longer baselines used by LBL systems mean that LBL is more accurate than SBL and USBL. LBL also has the advantage of being able to position the vessel, or any other object, directly using a 'fixed' frame of reference. This removes most of the problems associated with vessel motion.

G.1.5 Calibration

It is necessary to calibrate the array of beacons on the seabed, and there are several techniques available for doing this. The most appropriate method to use depends on the specific requirements of the operation and on the available hardware.

With the continuing integration of LBL, SBL and USBL systems, intelligent transponder beacons that can measure baselines directly, and satellite navigation systems, the calibration of seabed arrays has become a quick and simple operation, completed automatically in some cases.

G.2 Short Baseline (SBL)

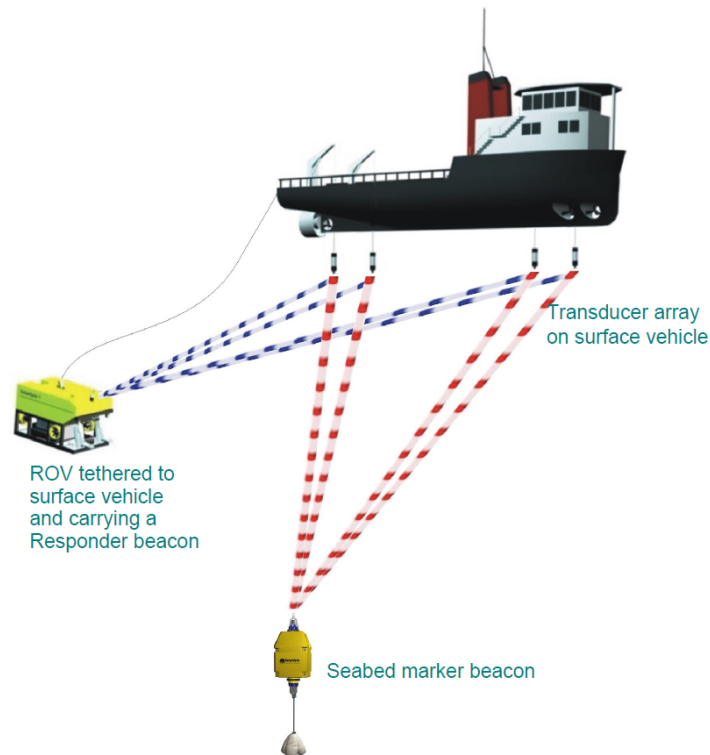
G.2.1 Hardware

Short baseline (SBL) acoustic position systems are usually fitted to a vessel such as a barge, a semi-submersible, or a large drilling vessel.

In an SBL system there are at least three, and typically four, acoustic transducers fitted in a triangular or rectangular array on the lower part of the vessel. The distances between transducers (the 'baselines') are made as large as practical on the vessel, and are typically at least 10 metres long.

The position of each transducer within a co-ordinate frame fixed to the vessel is determined by conventional survey techniques, or from the 'as built' survey of the vessel.

Figure G-2 Typical SBL System



G.2.2 Baseline Distances

The term 'short' is used as a comparison against long baseline techniques, where the baseline length usually exceeds 100 metres and can exceed 1000 metres.

If the distances from the transducers to an acoustic beacon are measured using the techniques described for LBL, then the beacon's position within the vessel's co-ordinate frame can be computed. Furthermore, if redundant measurements are made, a best estimated can be determined, which is statistically more accurate than the basic position calculation.

G.2.3 Principles

SBL systems transmit from one but receive on all transducers. The result is one distance (or range) measurement and a number of range (or time) differences.

With an SBL system the co-ordinate frame is fixed to the vessel, and is therefore subject to the rotational motions of roll, pitch and yaw. This apparent disadvantage can be overcome by using additional VRU and gyrocompass instruments, external to the SBL system, to supply measurements of roll, pitch and heading. The additional measurements allow the co-ordinates of the beacon to be transformed mathematically to remove the effects of these rotational motions.

If the requirement is to estimate the position of the vessel in some fixed or 'inertial' frame, such as one fixed to the seabed, then at least one beacon must be placed in a fixed position on the seabed and used as a reference point. This is the principle used for dynamic positioning vessels.

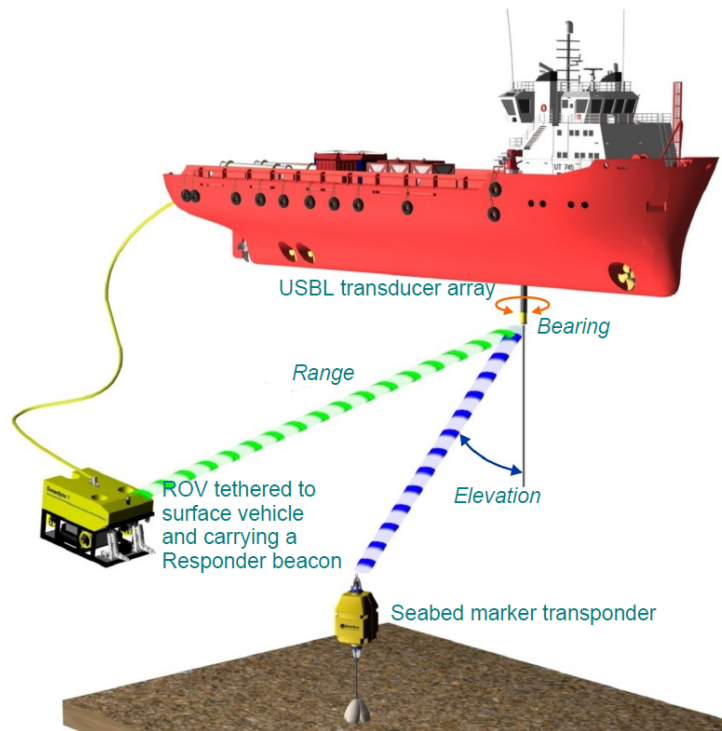
Figure G-2 shows an example of a system that has a transponder beacon fixed to the seabed and a responder beacon located on an ROV. In this case the system can calculate the position of the vessel and of the ROV within a reference frame fixed to the seabed.

G.3 Ultra-short Baseline (USBL)

G.3.1 Hardware

The principles of ultra-short baseline (USBL) position measurement are very similar to those of an SBL system already described. However, instead of the transducers being deployed at widely-spaced locations on the vessel, they are built into a single transceiver assembly.

Figure G-3 Typical USBL System



G.3.2 Principles

The distance or range measurement principles used in a USBL system are the same as those used for SBL, but the time differences between signal reception at the difference transducers are significantly less than for an SBL system.

Systems that use sinusoidal signals measure the time-phase of the signal received by each transducer element in the transceiver, and compare them with a reference signal generated in the receiver. These time-phase differences between transducer elements are computed by subtraction, and then the system is equivalent to an SBL system in the calculation of range and bearing.

Another practical difference is that the transducer elements of a USBL system are in a transceiver assembly that is installed at some convenient location in the vessel co-ordinate frame.

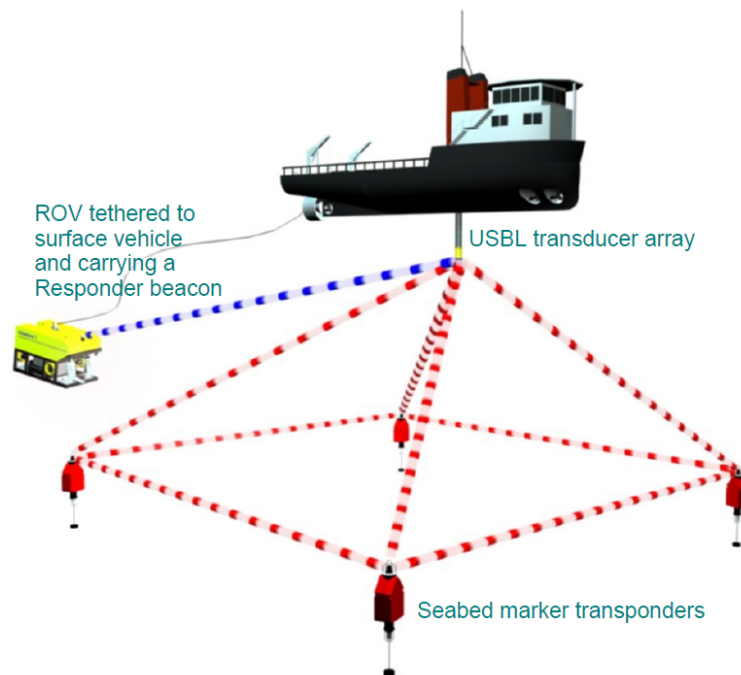
It is important to recognise that, whereas an SBL system calculates beacon positions in the vessel frame, a USBL system calculates beacon positions in a frame fixed to the transceiver assembly. To transform these positions into the vessel's co-ordinate frame requires the transceiver's attitude with respect to the vessel frame to be measured during installation.

G.4 Long / Ultra-short Baseline (L/USBL)

G.4.1 Hardware

The long / ultra-short baseline (L/USBL) system is a special case of the USBL system. It uses USBL hardware in a configuration similar to the one described for the LBL system.

Figure G-4 Typical L/USBL System



G.4.2 Principles

An L/USBL system follows the same methods for calculating range and bearing measurements as the basic USBL system. However, because there are more beacons deployed on the seabed, a considerable improvement in accuracy can be achieved by the L/USBL system.

G.4.2.1 Non-Critical Operations

If a basic L/USBL system is not to be used for highly accurate survey work, a system such as the one shown in *Figure G-4* above will perform a top-down calibration automatically as soon as it is placed in Navigation mode with the beacons declared as References.

This calibration technique, described in *Section H.4 "Simple Array Calibration"*, relies on multiple range and time-phase difference measurements between the USBL transducer and each transponder on the seabed in turn. Provided an accurate measurement of sound velocity is used, over a period of time the system calculates repeatable positions for the seabed array relative to the USBL transducer.

G.4.2.2 Critical Operations

If the L/USBL system is to be used for survey work where accuracy is critical, the seabed array must be calibrated separately or by using baseline measurements. If a DGPS input is available to the L/USBL system it is feasible to locate each beacon on the seabed directly in a geographical frame of reference to an accuracy determined by that of the DGPS measurements.

Similarly, if COMPATT beacons are used for the seabed array, the L/USBL system can command them to self-calibrate. Using COMPATT beacons has the additional advantage of giving the system

significantly more flexibility, in that they can be commanded to respond on any of a variety of frequencies and with any desired turn-around delay time. This means that a COMPATT version of the system becomes simpler and faster to set up and use.

G.5 Long-short USBL (LSUSBL)

G.5.1 Hardware

In a LSUSBL system, four or more transceivers are deployed below the vessel, and four or more beacons are deployed on the seabed.

G.5.2 Principles

LSUSBL mode is a combination of USBL, LBL and SBL modes. The reference array is interrogated from one transceiver, and the replies from all the beacons are collected at all the transceivers. All the resulting measurements are used to derive a single solution of the vessel's position.

This single solution comprises SBL, USBL and LBL components:

- Ranges to each beacon are collected at all the transceivers, giving an SBL component to the solution.
- The LBL component arises from the ranges three or more beacons having been collected.
- The USBL component arises from both range and direction calculations derived from the multiple transducers of a single transceiver.

LSUSBL uses the same equipment and configuration as LUSBL, but uses data from more transceivers. It is not specifically described in this manual. If operating in LSUSBL mode, use the description for L/USBL but enter the additional transceivers.

Appendix H – System Calibration

H.1 Introduction

This section explains how certain factors external to the system can have an impact on system performance.

By following appropriate calibration methods it is possible to take control of these external factors by quantifying their effects, and then compensating for them in software.

H.2 Sound Velocity

An accurate knowledge of sound velocity, and of the way that the sound velocity varies with water depth, are both very important factors in making an estimation of acoustic range underwater.

H.2.1 Background

The system estimates ranges from a knowledge of the elapsed time between the transmission of an interrogation signal and the reception of a reply. To convert this time measurement to a range estimate, the system requires an accurate knowledge of sound velocity:

$$\text{Range} = (\text{ElapsedTime} - \text{TurnAroundTime}) * \text{SoundVelocity} / 2$$

Note

 **The divide-by-two element of this calculation allows for the two-way acoustic path — from the interrogating transceiver to the beacon and then back to the transceiver again.**

Because of the linear relationship between sound velocity and estimated range, a 1% error in the measurement of sound velocity causes a 1% error in the range estimate.

For L/USBL applications, the **Through the Water Column** sound velocity value is usually the most important.

Note

 **Provided the sound velocity is set to the average sound velocity in water between the transceiver and the working depth, the USBL software compensates automatically for ray refraction.**

H.2.1.1 Checks on Sound Velocity

You should make regular checks on the sound velocity during an operation. The frequency with which you make these checks depends on circumstances. You should make the checks more frequently in areas where you suspect the temperature profile with depth may change significantly during the operation.

Update the software whenever you note any changes in the value of sound velocity. Depending on circumstances, these changes can occur over the course of a full day, or can occur more rapidly.

It is possible to make a simple check on the **Through the Water Column** sound velocity by observing the vessel's depth value shown on the **Chart** display. If this is not zero, then it is likely that the 'through water' sound velocity requires correction.

If there is no other method available to measure the sound velocity, it is possible to use the value of the vessel's apparent depth, indicated on the **Chart** display, together with a knowledge of the beacon's depth in water to calculate a new value for sound velocity as follows:

$$NSV = OSV \times \left[\frac{WD + SD}{WD} \right]$$

where:

NSV=new value for Through the Water Column sound velocity

OSV=old sound velocity value

WD=water depth to beacon

SD=apparent depth for the vessel

Save the new value for sound velocity and, having done this, check that the apparent depth of the vessel is now zero.

H.2.2 Measurement of Sound Velocity

You can use a sound velocity profiler to measure sound velocity directly. Alternatively, you can read the acoustic range from a beacon directly below the transceiver and compare the indicated value with the known water depth. Adjust the sound velocity value to make the two measurements equal.

There are a number of velocimeter instruments available for measuring the speed of sound directly. These devices use the 'sing-around' principle where high-frequency acoustic pulses emitted by a transducer reflect back from a target at a known distance from the transducer.

By knowing the round-trip distance and measuring the round-trip time to great accuracy, these devices are capable of delivering direct sound speed measurements to an accuracy of ± 0.1 m/s or better.

H.3 Transceiver Alignment Calibration

If absolute position accuracy is important (as distinct from good position repeatability), it is necessary to determine what corrections must be applied to the vessel's attitude sensors so that the system can calculate the correct L/USBL directions.

Note

 **The system uses measurements from an external vertical reference unit and gyrocompass to apply corrections to its directional and positional calculations. For these corrections to be accurate, the misalignment between the vessel's vertical reference unit (VRU) and the system's transceivers must be known.**

Before accurate and reliable measurements can be taken from the system it is important to measure and compensate for any misalignment that exists between the transceiver's frames of reference and the VRU's frame of reference.

H.4 Simple Array Calibration

H.4.1 Top-down Calibration

The USBL capability of the integrated system allows the position of each reference beacon to be determined relative to other beacons in the array by using a 'top-down' calibration technique, without the need to take baseline measurements between them.

In this method, the system measures the slant range and direction to each beacon from the vessel, and uses this information to determine the position of each reference beacon with respect to the vessel's L/USBL position.

The accuracy of this calibration is affected by random and systematic error sources, including the accuracy of transceiver measurement, errors in sound velocity measurement, and the accuracy of transceiver alignment with the vessel's VRU and gyrocompass.

The calibrated beacon positions produced by the top-down method are the best estimates in the presence of these errors. More importantly, it gives the positions of the reference beacons as seen by the USBL transceivers.

This array calibration method provides the most stable position for DP operations on deep-water drilling vessels, because it is used only to maintain a fixed position for the vessel, which means that the acoustic measurements do not change.

Typically, the top-down calibration technique takes approximately one hour to complete. It has the important advantage of providing an uninterrupted supply of acoustic position information to a vessel's DP system throughout the calibration. This can be from arrival on station and deployment of the first beacon, through the array calibration process, and then during the long-term maintenance of the array.

On vessels where there are multiple transceivers in use, all transceivers should be selected and configured for L/USBL operation during the top-down calibration process.

Because the integrated system supports operation in a WGS84 earth frame, the 'absolute' geodetic co-ordinates for each reference beacon can be determined in WGS84 UTM co-ordinates if necessary. Because this does not require measurement of the seabed baselines, it represents a significant advantage when working in areas where there is a rugged bottom topography.

H.4.2 DP-Ref Waypoint

Calibration creates a special waypoint called DP_Ref located at the origin of the array. Certain DP telegrams indicate vessel position relative to the DP_Ref location.

In common with all waypoints, DP_Ref has its own reference frame so that the system can display positions relative to DP_Ref.

Appendix I – CASIUS Data Collection Methods

Note



See Section A.10.3 "CASIUS" for information about the software interface for CASIUS.

I.1 Manoeuvring Guidelines

There are no specific manoeuvres required, but data collected should conform to the following guidelines:

- Some of the data must be taken with the vessel above or nearly above the beacon, so as to maximize the effects of any pitch and roll offsets.
- Some of the data must be taken with the vessel at some distance from the beacon so as to maximize the effects of any gyrocompass offset.
- Data must be taken at opposite headings so as to maximize information used to determine any antenna offsets.
- Ideally, data should be taken through the full range of azimuth directions.
- Data should be collected at a horizontal distance from the beacon that is no greater than one third the water depth at the beacon position, or a maximum of 500 metres from the beacon's position, whichever is the smaller.
- Ideally, the manoeuvres done while collecting data should reflect the way the vessel is used operationally.

If the vessel is expected to be largely stationary during operation then it should be stationary for each data collection phase. Similarly if the vessel is expected to be moving past the beacon operationally then the data should be collected while moving.

If the vessel is not capable of dynamic positioning, then it will be difficult to keep the vessel stationary, so the latter method will almost inevitably be used.

- Heading changes are known to cause some VRU units to misread. Refer to the VRU documentation for details of how long the VRU takes to settle down after various rates of turn.

Because of this effect, and because data is needed at more than one heading, the vessel manoeuvring may need to be broken up into a series of data collection passes or phases, each at a constant heading. A constant heading should be maintained for a short time prior to and during each pass.

- An important decision to be made is whether the data will be collected while moving or stationary. It is preferable to be stationary if possible as this minimises any DGPS lag problems. If the vessel has no DP capability then this will not be a realistic option and in this case data should be collected during a series of straight run lines over and to the side of the beacon.

I.2 Data Collection – DP Vessel

A dynamic positioning vessel is able to move in any direction while maintaining a constant heading. - Sonardyne suggests that you use the manoeuvring pattern shown in *Figure I-1* below, pausing at each of the cardinal points and also directly above the beacon.

Note



CASIUS data is collected while stationary.

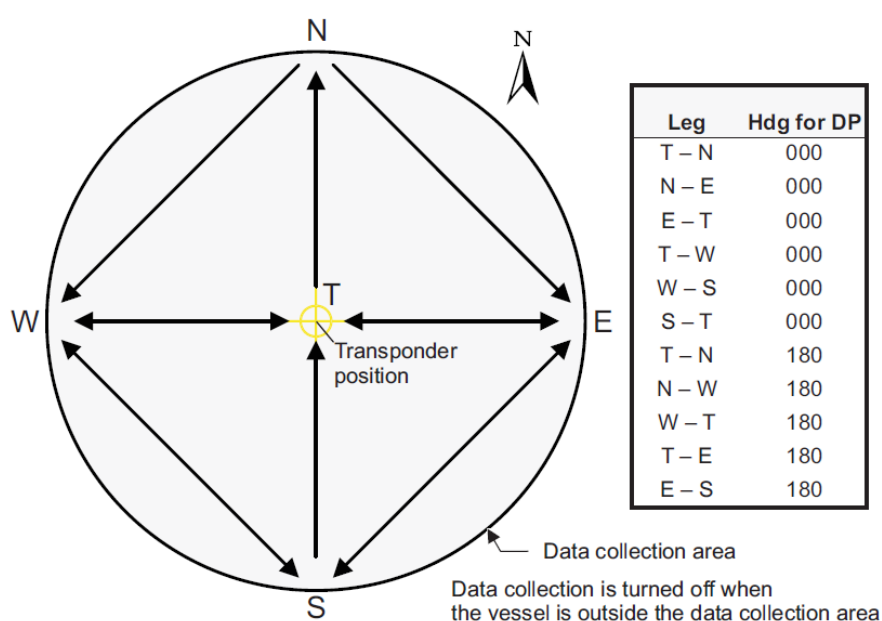
Sonardyne suggests that you collect an equal amount of data at each cardinal point to avoid skewing the data.

Note that a reciprocal heading is used for the second half of the data collection.

The radius of the circle centred on the beacon defines the data collection area. This would normally be equal to one third of the water depth at the beacon, or a maximum of 500 metres. The data collection points are then at 90 degrees to one another at equal distance from the beacon, as well as immediately above the beacon.

The pattern may be rotated in any direction to accommodate wind or currents.

Figure I-1 Manoeuvring Pattern for a DP Vessel

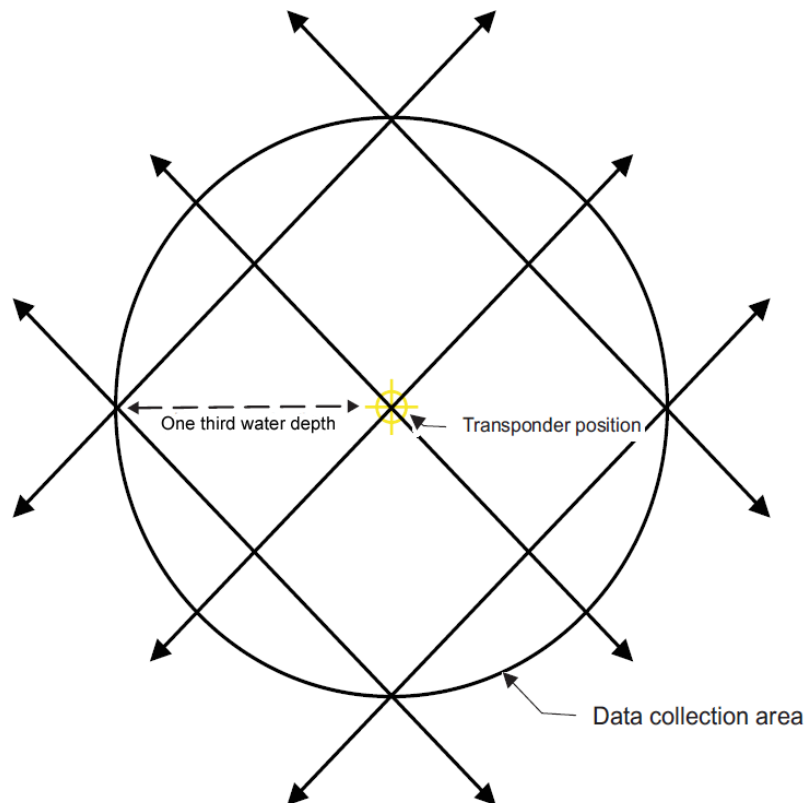


I.3 Data Collection – Constantly Moving Vessel

This data collection method is very similar to the one outlined in *Section I.2 "Data Collection – DP Vessel"* for stationary collection of data, except that the vessel is not expected to stop at the cardinal points to log the data but only to collect data on the transits between cardinal points whilst maintaining good heading.

This method requires the vessel to run 12 lines, with eight transits between adjacent cardinal points (in both directions). The pattern includes a run line in both directions passing directly over the beacon, as shown in *Figure I-2*.

Figure I-2 Manoeuvring Pattern – Constantly Moving Vessel



As before, the pattern can be rotated to allow for current and wind directions where required. The length of the run lines for data collection depend on the water depth as before for the stationary data collection example.

The radius of the circle centred on the beacon defines the data collection area. This would normally be equal to half of the water depth, or a maximum of 500 metres.

Sonardyne suggests that you extend these lines by an appropriated distance to ensure the vessel has a chance to stabilize its heading before beginning data collection within the area, as shown in the example.

To keep the lines straight in the data collection area, the vessel should move outside the data collection area before making a turn for the next run line. Also, the heading should be stable for a period before starting to collect data (the length of this period depends on the VRU's characteristics and on the rate of heading change prior to achieving a stable heading).

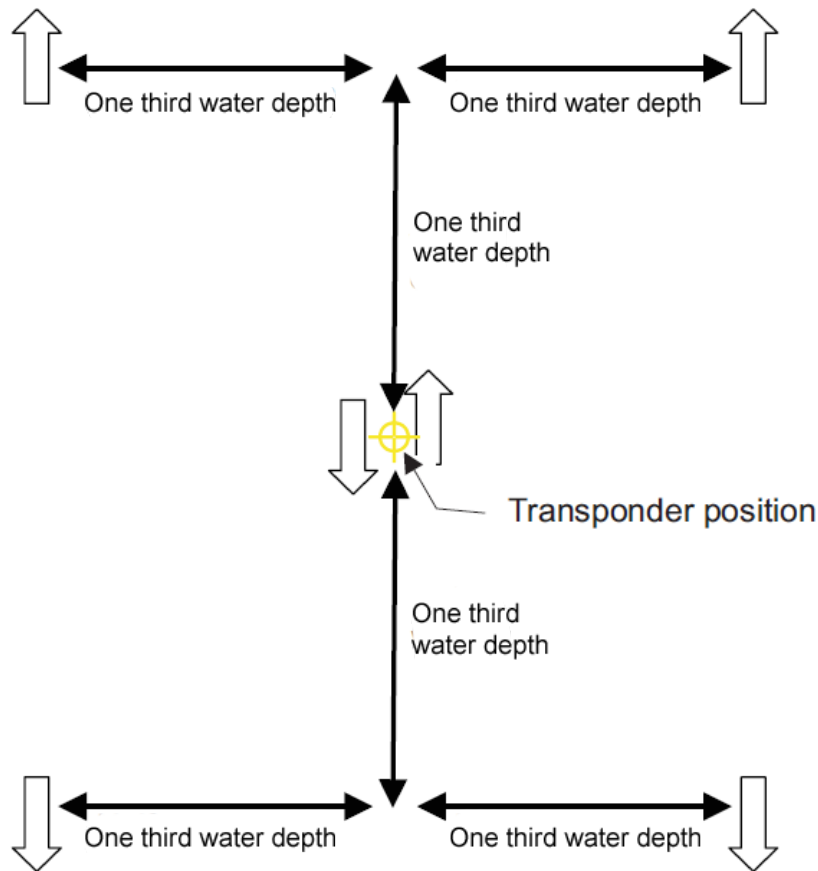
The vessel should reduce speed while passing over the beacon, to acquire more readings there. The vessel's speed should be maintained at the outer ends of the run lines.

I.4 Data Collection – DP Vessel with Tilted Transceiver

The data collection process is the same as for a non-tilted transceiver, except the points where the data is collected must be moved by 30° when collecting data with a tilted transceiver.

Figure I-3 shows a suggested data collection pattern and the heading of the vessel at each position, (assuming the transceiver is tilted backwards).

Figure I-3 Manoeuvring pattern – Tilted Transceiver



I.5 USBL Transceiver Alignment Calibration Check

An existing USBL CASIUS calibration can be quickly verified using the Average Fix tool, thus avoiding the need to spend valuable vessel time re-calibrating the system unnecessarily. The tool allows a report of current system settings and performance to be produced, which when compared to the result of the previous CASIUS calibration can be used to decide whether a new calibration is required.

This verification test can be performed using either the same seabed beacon used for the CASIUS calibration or any other convenient seabed beacon that can be tracked with good acoustic performance

I.5.1 Before You Begin

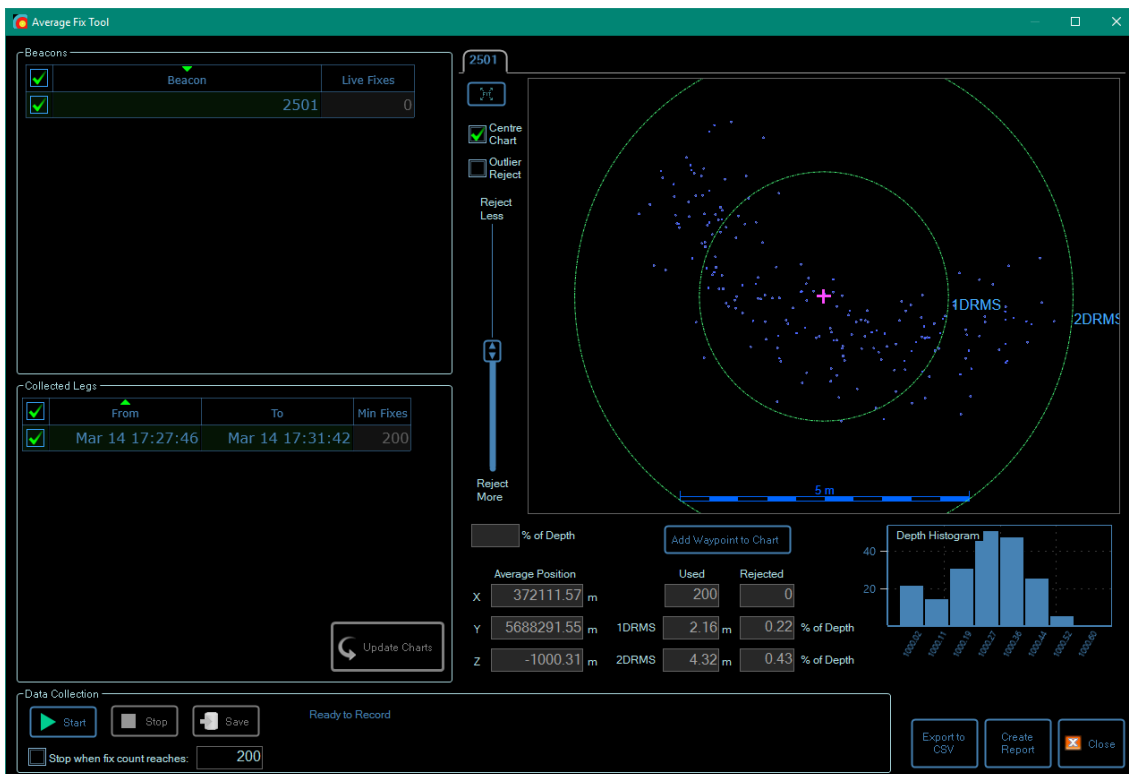
Check that:

- the VRU and heading sensors that were used in the CASIUS calibration are selected as the active sensors in the vessel properties dialog box
- the GNSS is enabled for use in tracking
- the alignment corrections from the CASIUS are correctly entered in the USBL transceiver's offsets dialog box
- the correct average through-water sound speed is set, or a current sound speed profile has been imported into the system
- If the system uses multiple heading and attitude sensors, Sonardyne recommends that you align them using the **AHRS Alignment** tool provided in the **Tools** menu

1.5.2 Alignment Check

1. Manoeuvre the vessel so that the USBL transceiver is as close as possible over the top of the nominated beacon on the seabed.
2. Ensure that the beacon is tracking reliably for several minutes (correct any tracking problems, if necessary).
3. Carry out vessel manoeuvres while collecting data (see *Step 4* below). Sonardyne recommends the following two manoeuvres as a minimum, but any manoeuvres are possible, depending on vessel capabilities and customer requirements.
 - a. Rotate the vessel slowly around the beacon, attempting to keep the transceiver as near as possible over the top of the beacon.
 - b. Starting with the transceiver as close as possible over the top of the beacon, move the vessel by a distance of one third the water depth, or 500 metres (whichever is less) away from the beacon.
4. For each manoeuvre, collect and save data using the **Average Fix Tool**:
 - a. Click **Start** to start collecting data.
 - b. Click **Stop** to stop collecting data.
 - c. Click **Save** to save the data.

The Average Fix Tool produces an estimate of the position of the beacon position with respect to the GNSS, and the position spread. The **Average Position** and the **1DRMS** values can be compared to those produced by the CASIUS calibration.



5. Click **Create Report** to generate a report that provides the installation settings that were used, and the achieved position performance.

This report can be either used as evidence of the performance of the system following a fresh calibration, or as evidence that the existing calibration achieves the required survey performance, and so a new calibration was not necessary.

Average Fix Report



Vessel(s): Ship 1

Date/Time (UTC): 2018-03-15 16:52:22

Results:

Beacon	Eastings	Northings	Depth	Use/Reject	1DRMS	2DRMS
2501	372111.54m	5688291.47m	-1000.32m	187 / 13	2.02m/0.20%D	4.04m/0.40%D

Selected Fix Point Legs:

From	To	Minimum Fixes
Mar 14 17:27:46	Mar 14 17:31:42	200

2018-03-15 16:52:22

1 of 2

Version 6.0.0.5773

Appendix J – Frames of Reference

J.1 Introduction

When studying the relative positions and movements between two or more bodies, it is important to set and follow rules that define the references to be used for the resulting measurements. In considering these relationships for the system there are several definitions that apply:

- geographical co-ordinate frame
- local grid co-ordinate frame
- vessel body frame
- VRU or attitude sensor body frame
- gyrocompass or heading sensor body frame, and
- body frames of the system's transceivers.

In a practical, well-surveyed navigation installation, the body frames of the vessel, the gyrocompass and the VRU will align with each other, and can be considered as being the same.

This appendix explains each of the reference frames (also called co-ordinate frames) mentioned in this manual.

J.2 Geographical (World) Co-ordinate Frame

The geographical co-ordinate frame is fixed with respect to the earth's surface and aligns with the north-south, east-west and up-down directions.

Absolute positions can be defined within this co-ordinate frame by using conventional latitude, longitude and depth notations. Positions can also be defined relative to another fixed location either in Cartesian co-ordinates (through eastings and northings) or in polar co-ordinates (as an offset distance, bearing and depth relative to the reference point).

J.3 Seabed Frame

A frame with its z axis vertical and stationary with respect to the seabed is known as a seabed frame or an inertial frame. Normally, and for convenience in this reference frame, the x,y plane where $z = 0$ is at or just below the lowest point on the seabed in the area. Positions above this plane have a positive z co-ordinate or height. Depth is considered as negative height and is measured from the sea-surface or from a height close to it.

J.4 Local Grid Co-ordinate Frame

A local grid co-ordinate frame is also fixed with respect to the earth's surface, but it does not need to align with it, and can have its origin at any convenient location.

Again, it is possible to express positions within the local frame by using Cartesian co-ordinates or polar co-ordinates, with respect to a fixed location within the frame.

When using this type of reference frame, it is necessary to define the frame's origin (co-ordinate 0, 0, 0) and its orientation with respect to the geographical co-ordinate frame before it is possible to translate positions measured in the local frame into geographical co-ordinates.

J.5 Vessel, VRU and Gyrocompass Body Frames

These reference frames are fixed relative to the body to which they refer. They move and rotate relative to the geographical co-ordinate frame as the body moves.

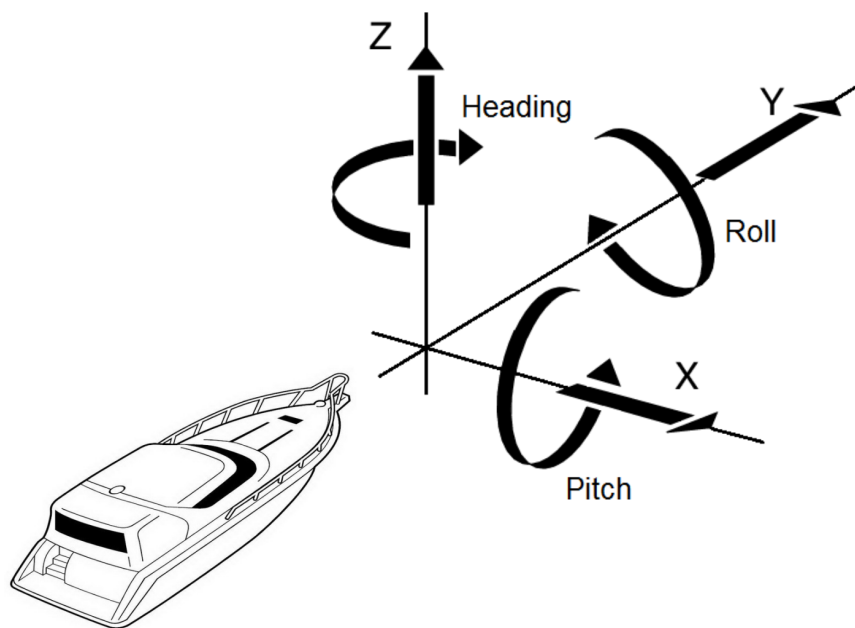
Note

 In this explanation the term 'vessel body frame' could refer equally to a surface vessel, an ROV, or any other body.

There are different conventions available to define the various body frames in use, and all are equally valid. Differences exist particularly among the manufactures of vertical reference units. These differences should have been addressed during installation so that they can be ignored for the purposes of normal system operation, but you should make yourself aware of the differences so that you can identify problems arising from incorrect corrections if they occur.

Also, during installation the various attitude and heading instruments should have been aligned with the vessel, so that their measurements are valid for the vessel and for all the various sensors installed on it. Residual misalignment between the instruments can usually be compensated for in software.

The figure below shows the convention used by Sonardyne to define the vessel body frame.



In this convention:

- The X axis aligns with the vessel's port-starboard direction, with positive co-ordinates being to starboard of the axis origin.
- The Y axis aligns with the vessel's fore-aft direction, with positive co-ordinates being forward of the axis origin.
- The Z axis aligns with the vessel's vertical, with positive co-ordinates being above the axis origin.
- Under positive Pitch rotation the Y axis rotates towards the current +Z direction.
- Under positive Roll rotation the Z axis rotates towards the current +X direction.
- Under positive Heading rotation the Y axis rotates towards the current +X direction.

J.5.1 Origins

The origin of a co-ordinate frame is the point where the X, Y and Z offsets are all zero (0, 0, 0).

The origin of the vessel frame is called the vessel's common reference point (CRP). The position of the vessel's CRP is arbitrary and can be at any convenient location on the vessel.

The origin of the vertical reference unit is usually at the centre of the internal inclinometer, at a location inside the VRU defined by the VRU manufacturer.

The origin of the gyrocompass is at the centre of the gyro, with the fore-aft direction defined by the compass lubber line.

J.5.2 Compensated frame

An RPH (Roll, Pitch and Heading) compensated vessel frame is a frame sharing the same origin as the vessel frame but with the z-axis vertical and the y-axis parallel with a meridian passing through the origin (points true north).

J.6 Transceiver Co-ordinate Frame

The system's transceiver co-ordinate frames follow the same convention described above for the vessel frame. The origin is at the centre of the transducer.

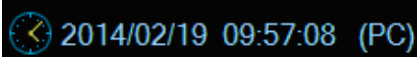
J.7 Corrections Between Co-ordinate Frames

Corrections between the transceiver and the vessel body frame are estimated by the CASIUS calibration tool. This tool uses simultaneous observations of position from GNSS, attitude from the VRU, and heading from the gyro, combined with acoustic observations from a beacon on the seabed, to estimate the alignment angles of the transceiver and its position relative to the GNSS antenna.

Appendix K – Time System

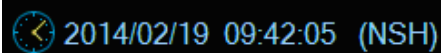
All Marksman, Ranger 2 USBL/Survey/DP time keeping and time stamping uses System (common) Time, which is the current best estimate of UTC time.

On start-up, system time is started from Windows time (which itself starts from the PC's real-time clock (RTC)), but the software always shows UTC, which is independent of the time zone. The software user interface shows PC at the bottom right-hand corner.



2014/02/19 09:57:08 (PC)

After an NSH is connected, the system synchronizes its machine time with the NSH clock, which is significantly more stable than the PC's clock. After this has occurred, the user interface shows NSH as the time source.



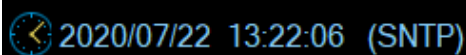
2014/02/19 09:42:05 (NSH)

Whenever time synchronization is really important, for example in multi-system operations, a TOD device is added to the system. This takes UTC or ZDA strings and a PPS signal from a GNSS into the NSH. This allows the NSH time to synchronize with UTC. The PPS signal flashes and the received time changes on the TOD device dialog. The user interface shows EXT as the time source.



2014/02/19 10:12:10 (EXT)

It is also possible to synchronise using an external NTP server. This will accurately track UTC and correct for drift of the Windows clock, but is less precise than using a GNSS PPS signal.



2020/07/22 13:22:06 (SNTP)

The UTC time can be resynced at any time by clicking **Sync Now** on the TOD device.

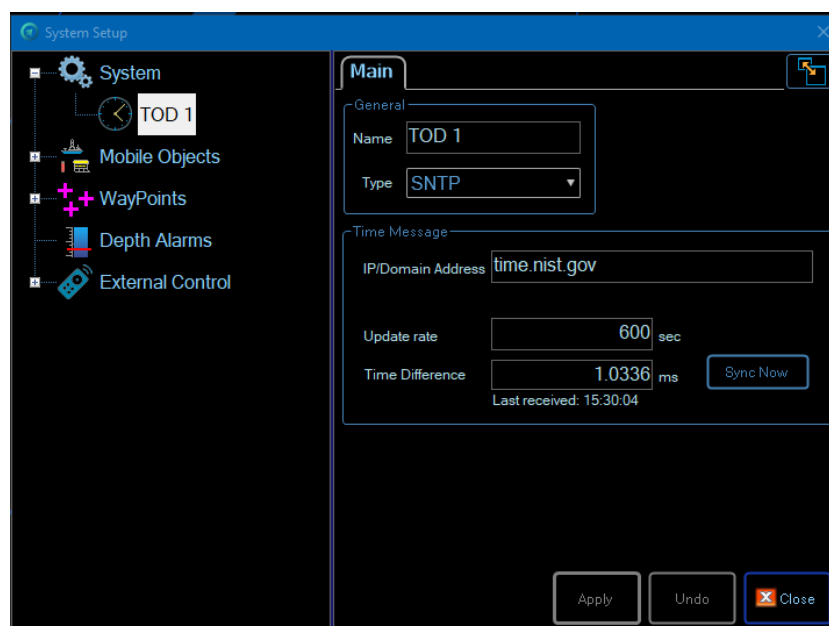
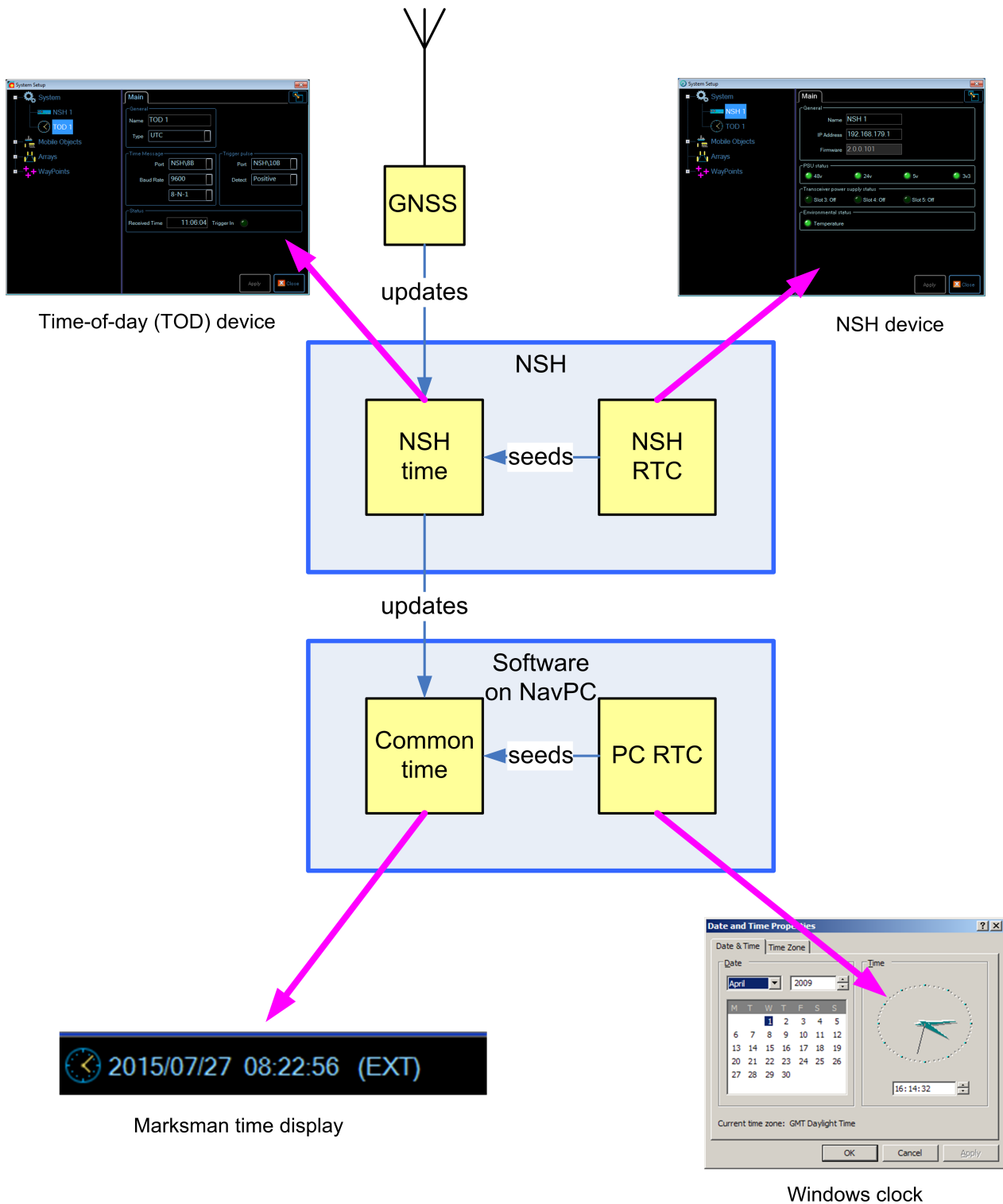


Figure K-1 Time System



Appendix L – 6G Command Configuration

The following acoustic commands can be used to change the configuration of Sonardyne 6G beacons using the manual command tool.

CAUTION



These parameters should be changed with caution as incorrect commands may limit or stop the beacon communicating.

L.1 Address change

The Secure Command (SC) can be used to change the address of the beacon to alter the frequency for the operating environment. To ensure changes are only made to one instrument at a time the Unique device ID (UID) must be entered as part of the command. The UID is displayed in the Beacons Table.

<SC:2014,U1ABC,AD2013

>SC:2401,U001ABC,WKT1,HPR45,OV0,CAS0,LKD0

Where:

2014 is the address of the beacon you wish to change

1ABC is the unique device ID

2013 is the address you want to change the beacon to.

Advised address range is:

WB2: 2001 -3014

WB2+: 5201 - 6214

L.2 HPR Address change

The secure command can also be used to change the HPR address on the beacon.

<SC:2014,U1ABC,HRP78

>SC:2401,U001ABC,WKT1,HPR78,OV0,CAS0,LKD0

Where:

2014 is the 6G address of the beacon you wish to change

1ABC is the unique device ID

78 is the new HPR address you want to change the beacon to.

Appendix M – Removing the Internal Security Key from a Navigation Computer

When replacing the Navigation Computer with a Marine Computer, the internal USB security key must first be removed from the Navigation Computer.

To remove the security key:

1. Turn off power to the Navigation Computer.
2. Remove the 13 M3x6 countersunk screws from the top lid.

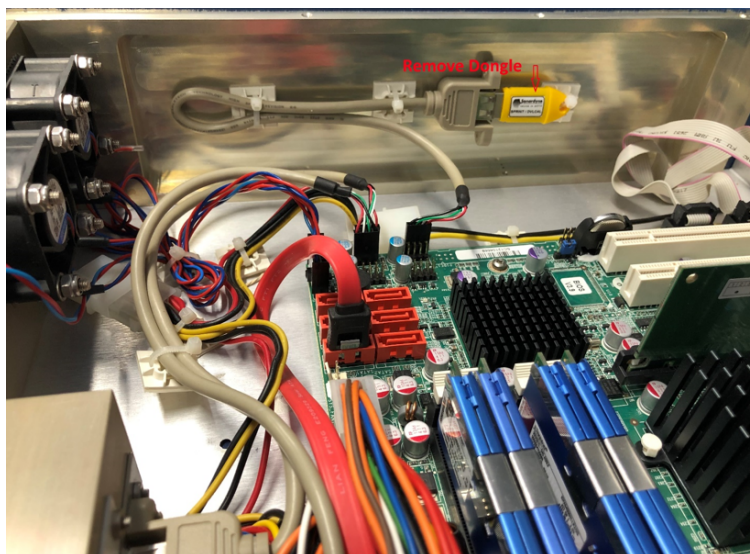


Note



Ensure ESD procedures are followed prior to opening the Navigation Computer top lid.

3. Remove the lid and then remove the security key from the USB connector on the side panel of the case.



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N.2.5 L.2.5 Open Hardware Monitor V0.8.0

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N.2.6 Open Hardware Monitor V0.8.0 WinRing0

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N.2.7 World Ocean Atlas

Contains World Ocean Atlas 2013 version 2 information.

<https://www.nodc.noaa.gov/about/disclaimer.html>

Definitions

The following tables are included in this section:

Table No	Title
Table 1	Sonardyne Abbreviations/Terms and Definitions
Table 2	Signal Processing and Communication Terms

Sonardyne Abbreviations, Terms and Definitions

Abbreviation/Term	Definition
1DRMS	Distance Root Mean Square (DRMS) is a single number that expresses 2D accuracy. 39.4% of fixes are expected to lie within 1DRMS of the true position
2DRMS	Distance Root Mean Square (DRMS) is a single number that expresses 2D accuracy. 98.2% of fixes are expected to lie within 2DRMS of the true position
6+	Sonardyne instruments that can use Wideband 3 enabling sensor data to be embedded in navigation range replies e.g. Compatt 6+
6G [®]	Sonardyne's sixth generation technology hardware platform
AAINS	Acoustically Aided Inertial Navigation System
Accelerometer	A sensor that measures changes in velocity (acceleration)
Acoustic Pinger	A specific type of "beacon" that emits signals regularly without an interrogating signal A Synchronous pinger can be synchronised to an external master signal A Precision pinger contains an accurate internal time standard
Acoustic Responder	A specific type of "beacon" that emits an acoustic signal in response to an electrical trigger signal carried to it by cable
Acoustic Signal	Sonardyne Wideband acoustic signals are discrete signals containing a carrier frequency encoded with identification information. Acoustic signals are used for purposes such as measuring the time of flight between acoustic instruments
Acoustic Synchronous Precision Pinger	See <i>Acoustic Pinger</i>
Acoustic Telemetry	An acoustic message containing data that is sent between acoustic instruments
Acoustic Transceiver	An instrument that emits and receives acoustic signals, and extracts information from them. Transceivers can measure the time it takes a signal to travel from its transducer to a transponder and return. Some can encode and send data in a message and extract digital data from a message (Acoustic Telemetry). Used on a surface vessel or to mark a point on the seabed, or fixed to a mobile vehicle for tracking or positioning
Acoustic Transducer	A device that converts electrical signals into acoustic signals and vice versa. A hydrophone is a device used to convert acoustic signals into electrical signals only Note: The term is often applied to describe a complete instrument that contains pre-amplifiers, matching networks etc.

Sonardyne Abbreviations, Terms and Definitions (continued)

Abbreviation/Term	Definition
Acoustic Transponder	A specific type of “beacon” that emits an acoustic signal when it detects an interrogating acoustic signal
Acoustic Transponder (Intelligent Transponder)	A transponder that is managed by a micro-controller. Examples include the COMPATT (COMPUTing And Telemetry Transponder) and the WMT (Wideband Mini Transponder). Depending on supported functionality it can: - decode acoustic telemetered commands from a transceiver and can send telemetered data to the transceiver - measure the distance between itself and other transponders and then telemeter the data to a transceiver - measure its depth and the temperature of water - measure a variety of underwater parameters and telemeter these back to the surface - be used, as an intelligent angle-measuring device, in a Riser Angle Monitoring System - be fitted with a release mechanism so it can return, on command, back to the surface e.g. if battery power is low
ACPI	Advanced Configuration and Power Interface Specification providing an open standard for device configuration and power management by the operating system
Addr	The address of a local or remote instrument
AHRS	Attitude and Heading Reference System An inertial sensor that provides outputs of heading, pitch and roll
ALS	Acoustic Link Status
AMS	Autonomous Monitoring System A completely autonomous system enabling a network of monitoring transponders to be deployed over a large area for long term (3 years+) monitoring
AMT	Autonomous Monitoring Transponder
ASV	Autonomous Surface Vehicle See <i>USV</i>
AUV	Autonomous Underwater Vehicle See <i>UUV</i>
AvTrak	Acoustic navigation and communications instrument designed to form part of an integrated AUV tracking and navigation system
Beacon	The term “beacon” is a generic term that covers “transponders”, “responders” and “pingers”. The term “beacon” is used in Sonardyne documentation and in subsea positioning literature when the specific type of beacon is not important See <i>Acoustic Transponder</i> , <i>Acoustic Responder</i> and <i>Acoustic Pinger</i>
BlueComm	A wireless, subsea high-speed optical communications system
BOP	Blowout Preventer A blowout preventer is a large, specialised valve or similar mechanical device, used to seal, control and monitor oil and gas wells to prevent blowout, the uncontrolled release of crude oil and/or natural gas from a well

Sonardyne Abbreviations, Terms and Definitions (continued)

Abbreviation/Term	Definition
Bore-sight	The axis about which the transducer maximum power gain is being directed
Box-in	A box-in calibration combines vehicle positions and acoustic ranges to compute the position of one or more reference locations in real-world co-ordinates
CASIUS	Calibration of Attitude Sensors in a USBL System CASIUS is the Sonardyne recommended USBL calibration tool for the determination of accurate transceiver offsets (X, Y and Z) in relation to the GPS antenna and the transceiver Pitch, Roll and Heading alignment errors. It also determines accurate 'through water' sound velocity calculation
CIS	Common Interrogation Signal Multiple transponders can be set to reply to a single common interrogation signal - this can increase the efficiency of tracking operations as it reduces the number of acoustic interrogations in the water. When transponders are set to respond to a common interrogate signal they will respond on their Individual Reply Signal
COMPATT	COMPUTing and Telemetry Transponder <i>See Acoustic Transponder (Intelligent Transponder)</i>
Control Hub	The Control Hub is integrated into the Micro-Range 2 portable topside case and performs a similar function to the ESH
Cordinate Frame	A reference system used to define the position of a body in space. Sonardyne use right- handed Rectangular Cartesian co-ordinate systems in three dimensions, where the three axes used are orthogonal. Co-ordinate frames are also called 'reference frames'
CPN	Computer Part Number
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check
CRP	Common Reference Point The origin of the vessel frame is called the vessel's CRP. The position of a vehicle's CRP is arbitrary and can be at any convenient location on the vehicle
CRS	Common Reply Signal A reply signal common to a complete family of addressed transponders
CS	Configuration Status
DAS	A micro-controlled data acquisition and logging sub-assembly located within a transponder
Database	An organised collection of data stored in a computer memory or other media
dB	Decibel A logarithmic unit used to express the ratio of one value of a physical property to another, and may be used to express a change in value or an absolute value
dBV	Decibels reference to Volt dBV specifies a relative voltage level without regard for impedance and is used to measure input and output levels for electronic audio equipment 1 V = 0 dBV

Sonardyne Abbreviations, Terms and Definitions (continued)

Abbreviation/Term	Definition
Depth Status	The transponder can be fitted with an optional depth sensor to send depth information at each interrogation
DFE	Data Fusion Engine Acts as the system controller, generates the display signals for the monitor, processes the data from the transceiver for the display to the operator and output to a DP system talks to various "attitude" sensors and other navigation systems
DGPS	Differential Global Positioning System A differential GPS receiver uses corrections from land based receivers to compensate the signals received from satellites with a view to increasing accuracy GPS is a specific type of GNSS; see <i>GNSS</i>
Directivity Index	The ratio of the radiation intensity in the direction of interest compared with an isotropic radiator
DNV	Det Norske Veritas International accredited registrar and classification society
DORT	Deep water Oceanographic Release Transponder
DP Reference	Dynamic Positioning Reference The acoustic positioning system reports changes in the vessel position so that the DPS can maintain position
DPS	Dynamic Positioning System Automatically maintains a vessel with a constant heading, and in a fixed position without an anchor and provides more flexibility in operation Normally such a system uses a number of position inputs such as GNSS receivers, taut wire sensors, LBL, SBL or USBL acoustic positioning sensors, wind speed indicators and so on. The system controls thrusters on the vessel to maintain position and attitude in yaw
DPT	Dynamic Positioning Transponder
DSP	Digital Signal Processing The representation of signals by a sequence of numbers or symbols and the processing of these signals. DSP includes subfields like: audio and speech signal processing, sonar and radar signal processing, sensor array processing
Dual-Independent LUSBL System	Two complete sets of LUSBL equipment working in independently. The two sub-systems are usually time synchronised to prevent interference. Each system independently estimates the position of the vessel so that the output of each system can be used in the DPS
Dunker 6	An LBL and telemetry transceiver specifically designed for vessel deployment. The super duplex stainless steel housing with shock and vibration isolated electronics makes for an extremely rugged dunking system
DVL	Doppler Velocity Log Uses acoustic measurements to capture bottom tracking velocity measurements and can be used to calculate distance travelled
Dynamic Positioning Message	DP Message The message an acoustic positioning system sends to a DP system

Sonardyne Abbreviations, Terms and Definitions (continued)

Abbreviation/Term	Definition
EHF	Extra-High Frequency (50–110 kHz)
EMC	Electro-Magnetic Compatibility A branch of electrical engineering concerned with the unintentional generation, propagation and reception of electromagnetic energy which may cause unwanted effects such as electromagnetic interference (EMI) or even physical damage in operational equipment
EMI	Electro-Magnetic Interference A disturbance generated by an external source that affects an electrical circuit by electromagnetic induction, electrostatic coupling, or conduction (definition from Wikipedia)
ESH	Ethernet Serial Hub The ESH is the interface between the in-water acoustic instruments, sensors and the computer that runs the acoustics positioning software
False Alarm	An invalid signal which has satisfied all of the detection criteria and the detection process incorrectly declares a valid signal
False Alarm Number	Predicts the average number of possible decisions between false alarms
False Alarm Probability	The resultant probability of all the false alert probabilities
False Alarm Rate	Predicts the number of false alarms what will occur in a specified time
False Alert	An invalid signal has satisfied one detection criteria and the detection process incorrectly declares a valid signal
False Alert Rate	Predicts the number of false alerts that will occur in a specified time
FEC	Forward Error Correction A technique used for correcting errors in data transmission over unreliable or noisy communication channels
FETCH	Fetch is a long-life subsea sensor logging node that enables data to be wirelessly extracted via its integrated high speed acoustic modem
Firmware	The firmware installed in an instrument Firmware updates can be installed via 6G Terminal
Flotation Collar	Allow transponders to be deployed, moored on the seabed and then recovered to the surface
FS	Fixed Status
FTAT	Fixed Turn Around Time (320 ms)
Fusion	Long BaseLine (LBL) acoustic positioning system. Provides the most accurate method for installing subsea structures, tracking ROVs and conducting acoustic metrology
GCS	Global Command Signal
Geodetic Co-ordinates	The earth is modelled by a reference spheroid (of which there is a large selection). The position of any point on or near the earth surface is defined by an angle of latitude and an angle of longitude. For a point on the spheroid P: - Latitude is defined as the angle between the normal plane at P and the plane of the earth's equator

Sonardyne Abbreviations, Terms and Definitions (continued)

Abbreviation/Term	Definition
	- Longitude is defined as the angles between the meridians plane through P and the defined zero meridian plane or "Greenwich" plane (see Geodesy, fourth edition, Bomford, Oxford, sections 2.03 and 4.10(d) for more precise definitions)
GNSS	Global Navigation Satellite System A multi-user, 24-hour, worldwide radio navigation system using a constellation of satellites. GNSS receivers are capable of tracking and decoding data from the satellites and using it to compute the position and velocity of a vehicle
GNSS attitude sensor	A system based on a GNSS receiver using three or more antennas with known baselines. It is able to compute the instantaneous attitude of a vessel about the roll, pitch and yaw axes
GPS	Global Positioning System GPS is a specific type of GNSS; see <i>GNSS</i>
Gyrocompass	A north-seeking gyroscope uses the properties of a gyroscope when its spin axis is maintained horizontal. The gyroscope senses the spin axis of the earth and will align itself with true north. Precision gyrocompasses, such as that in the Sonardyne Lodestar Attitude and Heading Reference System (AHRS) use ring laser gyros, which have no moving parts
Gyro Compatt 6+	Combines a Compatt 6+ transponder and a Lodestar Attitude and Heading Reference System (AHRS)/Inertial Navigation System (INS) in a single housing
Gyro iUSBL	Combines inverted HPT USBL transceiver and a Lodestar Attitude and Heading Reference System (AHRS)/Inertial Navigation System (INS) in a single housing, usually deployed for subsea operations
Gyro USBL	Combines HPT USBL transceiver and a Lodestar Attitude and Heading Reference System (AHRS)/Inertial Navigation System (INS) in a single housing
HF	High Frequency (34–40 kHz)
Homer-Pro	Diver held positioning and relocation instrument
HPR	Hydro acoustic Position Reference A system comprising both a transmitter (transducer) and a receiver (transponder). A signal (pulse) is sent from the transducer, and is aimed towards the seabed transponder. This pulse activates the transponder, which responds immediately to the vessel transducer. The transducer, with corresponding electronics, calculates an accurate position of the transponder relative to the vessel
HPT	High Performance Transceiver
HRP	Heading, Roll and Pitch A compensated vessel frame. This is a frame sharing the same origin as the vessel frame but with the z axis vertical and the y axis parallel with a meridian passing through the origin (points true north)
IEEE	Institute of Electrical and Electronic Engineers
IIS	Individual Interrogation Signal

Sonardyne Abbreviations, Terms and Definitions (continued)

Abbreviation/Term	Definition
	A signal used to uniquely address a transponder, based on the transponders acoustic address
IMU	Inertial Measurement Unit
Inclinometer	An analogue device, which measures the angle of the transponder.
INS	Inertial Navigation System A navigation aid that uses a computer, motion sensors and rotation sensors to continuously calculate the position, orientation and velocity of moving object without the need for external references
IOPG	International association of Oil and Gas Producers
iRelease	A hand held instrument that interacts with a Lightweight Command Unit (LCU) acoustic transceiver to acoustically release Oceanographic Release Transponders (ORTS)
IRS	Individual Reply Signal Signal used to uniquely identify a reply from a transponder
iWand	A hand held acoustic transponder test and configuration device for use with Sonardyne's 6G product range
Janus	Quality Control and post-processing INS software for SPRINT. A simple user interface allows quick and easy data editing, post-processing and data export to enhance real time navigation
Kalman Filter	An adaptive filter what provides optimum filtering of a signal that has been subjected to a non-stationary environment (i.e. when the data is significantly changing during the filter convergence time)
LBL	Long BaseLine A system where two or more transponders are on the seabed. The positions of the transponders are established by a calibration process in a seabed frame. The distances from a transducer to each transponder are measured using a transceiver. The position of the transducer can be computed in the seabed frame. The name comes from the "baselines" joining each transponder
LCH	Lodestar Communication Hub
LMF	Low-Medium Frequency (14–19 kHz)
Lodestar	Lodestar is a combined solid state Attitude and Heading Reference System (AHRS), which is upgradable to SPRINT Acoustically Aided Inertial Navigation System [AAINS]
Lodestar-Nav	Lodestar-Nav is an all-in-one subsea navigation instrument for underwater vehicles, combining AHRS and Syrinx Doppler Velocity Log (DVL) in a single housing
LUSBL	Long Ultra Short BaseLine A hybrid of an LBL and USBL system, utilising USBL equipment in an LBL configuration
Marksman	LUSBL dynamic positioning system. Primarily suited to deep water mobile drilling units, well intervention and heavy lift construction vessels, where the system calculates position relative to a seabed deployed transponder array

Sonardyne Abbreviations, Terms and Definitions (continued)

Abbreviation/Term	Definition
MEMS	Micro-Electro-Mechanical-Systems
MF	Medium Frequency (19–34 kHz)
Micro-Ranger 2	USBL subsea tracking and positioning system designed for inshore shallow water applications for tracking divers, remotely operated and autonomous underwater vehicles
Mini-Ranger 2	USBL subsea tracking and positioning system designed for inshore shallow water applications for tracking remotely operated and autonomous underwater vehicles
MIR	Measure Individual Range
MR	Measure Range (TCVR + NAV)
MRAMS	Marine Riser Angle Monitoring System Used for measuring the angle between the Blow-Out Preventer (BOP) on the seabed and the Riser
MRT	Micro-Ranger Transceiver
MSR	Measure Slant Range (TCVR + NAV)
MTBF	Mean Time Before Failure A measure of how reliable a hardware product or component is
Navigation Processor	Controls the system; processes data from the transceiver into a form suitable for display to the operator and output to a DP system and interfaces to various 'attitude' sensors and other navigation systems
NSH	Navigation Sensor Hub The NSH is the interface between the in-water acoustic instruments, sensors and the Navigation Computer that runs the acoustics positioning software
NTAT	Navigation Turn-Around Time (programmable 80 to 640 ms)
OEM	Original Equipment Manufacturer OEMs are manufacturers who resell another company's product under their own name and branding
ORT	Oceanographic Release Transponder
PAN	Programmable Acoustic Navigator Acoustic transceiver dedicated to the transmission and decoding of subsea acoustic signals
PCD	Pitch Circle Diameter The diameter of the circle which passes through the centre of all the studs, wheel bolts or wheel rim holes
Pinger	See <i>Acoustic Pinger</i>
POSD	Position Data
PSU	Power Supply Unit
RAMS/MRAMS	Riser Angle Monitoring System/Marine Riser Angle Monitoring System

Sonardyne Abbreviations, Terms and Definitions (continued)

Abbreviation /Term	Definition
	A system used for measuring the differential angle between a BOP (Blow-Out Preventer) on the seabed and the Riser, connecting the BOP to the rig. Comprises a COMPATT type Transponder, which is normally mounted rigidly to the BOP, and an external inclinometer unit normally mounted on the Riser and connected by cable to the COMPATT. On command, the system measures the angle of the BOP with respect to the local vertical and reports this back to the surface. It can then repeat this process for the Riser using the external inclinometer
Ranger 2	USBL subsea tracking and positioning system
REL	Release Command
Remote	Commands relating to a remote instrument that are communicated via an acoustic transmission
Responder Beacon	See <i>Acoustic Responder</i>
RLG	Ring Laser Gyroscope A sensor that measures rotation
ROV	Remotely Operated Vehicle A vehicle controlled and powered by a cable connection so it can travel between the sea surface and seabed
ROVNav 6+	Remotely Operated Vehicle Navigation 6 ROVNav 6+ is a 6G® Wideband®3 ranging LBL ROV Transceiver and telemetry transceiver specifically designed for installation on work class ROVs
RPSK	Robust Phase Shift Keying.
Rx	Receive
SBL	Short BaseLine System A system where three or more transducers are fixed to a vessel and connected to a single transceiver. The position of each transducer is measured and co-ordinated in the vessel frame. By measuring the time of arrival of the signal from a beacon at each transducer the position of the beacon in the vessel frame can be computed
SC	Secure Configuration
SDM	Structure Deflection Monitoring
SENS	Sensor Measurement
Serial Communications Wait	The maximum time allowed for the Transponder to reply to an RS232 command
SI	Simultaneous Interrogation
SLAM	Simultaneous Localisation and Mapping In robotic mapping and navigation, simultaneous localisation and mapping is the computational problem of constructing or updating a map of an unknown environment while simultaneously keeping track of an agent's location within it. While this initially appears to be a chicken-and-egg problem there are several algorithms known for solving it, at least approximately, in tractable time for certain environments
SLT	Sensor Logging Transponder
SMS	Sonardyne Messaging Service

Sonardyne Abbreviations, Terms and Definitions (continued)

Abbreviation / Term	Definition
	Short Message Service SMS (also called texting or text messaging). Messages or 'texts' are usually sent from one mobile phone to another
SNR	Signal to Noise Ratio This is the ratio of the signal power to noise power in unit bandwidth generally quoted in dB. Effective operation requires that the strength of a transmitted signal is sufficient to be detected above the noise level at the receiver
Sonardyne	Sonardyne International Limited and its affiliates
Sonardyne Wideband®2 (WB2)	6G® transponders and transceivers use Sonardyne Wideband® 2 ultra-wide bandwidth signals giving a faster and robust transmission of data, more precise ranging and mitigation from multipath in shallow water and amongst steel structures in deep water
Sonardyne Wideband®3 (WB3)	Telemetry protocol available with 6G "+" devices that enables sensor data to be embedded in navigation range replies
Sound Speed	If seawater is at a constant temperature, salinity and pressure the speed at which sound travels in seawater is constant. Sound speed can be derived from values of conductivity, temperature and depth, or it can be measured directly using time-of-flight instruments
Sound Speed Profile	At different depths the temperature, salinity and pressure vary, so the local sound speed varies. Depth cannot be measured directly. So pressure measurements are taken, and the depth calculated, using knowledge of density and local gravity. Derivation of density requires knowledge of temperature and salinity. Salinity cannot be measured directly but conductivity can be measured. A method of measuring the sound speed profile is from a profile of pressure, temperature and conductivity and a formula to compute depth and sound speed
Sound Velocity	The speed with which sound pressure waves propagate through water. Sound velocity varies with properties such as water temperature, salinity and pressure. This is a core parameter in the accurate operation of acoustic positioning systems
Sound Velocity Profile	Variations of sound velocity with water depth caused by varying temperature, salinity and pressure In practice the depth cannot be measured directly. Therefore pressure measurements are made, and depth computed, using a knowledge of density. Derivation of density requires a knowledge of temperature and salinity. Salinity is measured indirectly through a measurement of water conductivity. Therefore a popular method of measuring the sound velocity profile is from a profile of pressure, temperature and conductivity and the use of empirically derived formulae to compute depth and sound velocity Sound velocity can be measured directly using a dedicated and calibrated instrument called a sound velocimeter, although it is still necessary to have the relevant depth measurements available

Sonardyne Abbreviations, Terms and Definitions (continued)

Abbreviation /Term	Definition
Spread Spectrum	Spread-spectrum techniques are methods by which a signal (e.g. and electrical, electromagnetic, or acoustic signal) generated in a particular bandwidth is deliberately spread in the frequency domain, resulting in a signal with a wider bandwidth. These techniques are used for a variety of reasons, including the establishment of secure communications, increasing resistance to natural interference and jamming, to prevent detection, and to limit power flux density
SPRINT	Subsea Precision Reference Inertial Navigation An Acoustically aided inertial navigation system for subsea vehicles. The system extends the operating limits of USBL and improves the operational efficiency of LBL by using sparse arrays
SPRINT-Nav	Subsea Precision Reference Inertial Navigation Technology-Navigation SPRINT-Nav is an all-in-one subsea navigation instrument for underwater vehicles, combining Sonardyne's SPRINT INS sensor and a Syrinx Doppler Velocity Log (DVL) in a single housing
SSM	Super Sub-Mini Transponder (WSM predecessor)
Submersible	A vehicle that operates below the sea surface and can carry a pilot and other personnel in a one atmosphere environment. It carries a supply of air for life support, and power for propulsion and other demands. It is capable of operating autonomously away from its support vessel for a limited time
Syrinx DVL	Syrinx Doppler Velocity Log A Doppler Velocity Log (DVL) for surface and subsea vehicle navigation
Target	Object to be tracked by an acoustic system
TAT	Turn-Around Time; see <i>NTAT</i>
TCP	Transmission Control Protocol A connection-oriented, reliable protocol to exchange data between networked hosts (e.g. computers). TCP is used extensively by many applications available by internet, including the World Wide Web (WWW), E-mail, File Transfer Protocol, Secure Shell, peer-to-peer file sharing, and streaming media applications
TCVR	See <i>Acoustic Transceiver</i>
TPDR	See <i>Acoustic Transponder</i>
Transceiver	See <i>Acoustic Transceiver</i>
Transducer	See <i>Acoustic Transducer</i>
Transponder	See <i>Acoustic Transponder</i>
True North	The direction of the shortest line that can be drawn, across the surface of the earth, from the observer and the north pole
Tx	Transmit
UDP	User Datagram Protocol
UID	Unique ID Number Each product contains a unique 24 bit address electronically coded into the firmware. It is denoted by 6 hexadecimal characters
ULB	Underwater Locator Beacon

Sonardyne Abbreviations, Terms and Definitions (continued)

Abbreviation/Term	Definition
	A beacon that emits a "ping" to enable location such as an aircraft black box recorder (aircraft black box recorders normally operate on 37.5 kHz)
USBL	Ultra-Short BaseLine A system similar to an SBL system except the system uses three or more elements in a single transducer array. The measurements it makes are the differences in "time-phase" of the signals from each element. The co-ordinate frame is fixed to the transducer array which must be oriented in the vessel frame to the equivalent to the SBL
USV	Unmanned Surface Vehicle A vehicle that operates on the surface of the water without a human occupant Also referred to as an Autonomous Surface Vehicle (ASV)
UTC	Universal Time Co-ordinate The primary time standard by which the world regulates clocks and time. Closely related successor to Greenwich Mean Time (GMT)
UTM	Universal Transverse Mercator A projection system that is used to transform geodetic co-ordinates into an orthogonal two dimensional system suitable for representation on a plane such as a chart
UUV	Underwater Unmanned Vehicle A vehicle that operates under the surface of the water without a human occupant Also referred to as an Autonomous Underwater Vehicle (AUV)
VRG	Vertical Reference Gyroscope A gyroscopically stabilised VRU
VRU	Vertical Reference Unit Measures the instantaneous roll and pitch of a vessel. The origin of the VRU is usually at the centre of the internal inclinometer at a location inside the VRU defined by the VRU manufacturer
VS	Volatile Status
WDT	Watch Dog Timer count A watchdog timer is a piece of hardware that is used to detect any software anomalies and asserts a processors reset signal A watchdog timer, in general is a counter that counts down from some initial value, set by an embedded software, to zero. The counter's initial value is periodically restarted by the embedded software If the counter reaches zero before the software restarts it, the embedded software is presumed to be malfunctioning and the processor's reset signal is asserted
Wideband [®] 2 (WB2)	6G transponders and transceivers use Sonardyne Wideband 2 ultra-wide bandwidth signals giving a faster and robust transmission of data, more precise ranging and mitigation from multipath in shallow water and amongst steel structures in deep-water
Wideband [®] 3 (WB3)	Telemetry protocol available with 6G "+" devices that enables sensor data to be embedded in navigation range replies

Sonardyne Abbreviations, Terms and Definitions (continued)

Abbreviation/Term	Definition
WRT 6	Wideband Release Transponder 6
WSM	Wideband Sub-Mini Transponder
WSM 6+	Wideband Sub-Mini Transponder 6 Plus
Yaw (Heading)	Twisting or oscillation of a moving ship about a vertical axis

Signal Processing and Communication Terms

Term	Definition
Bore-Sight	The axis about which a transducer's maximum power gain is being directed.
Capture Area	The effective aperture size of the array. It is directly related to the array gain.
Carrier-to-Noise Density	The ratio of the signal power (C) to noise power (No) in unit bandwidth (C/No); generally quoted in dBHz.
Directivity Index	The ratio of the radiation intensity in the direction of interest compared with an isotropic radiator.
False Alarm	Occurs when an invalid signal has satisfied all of the detection criteria and the detection process incorrectly declares the presence of a valid signal.
False Alarm Number	Prediction of the average number of possible decisions between false alarms.
False Alarm Probability	The resultant probability of all the false alert probabilities.
False Alarm Rate	Prediction of the number of false alarms that will occur in a specified time.
False Alert	Occurs when an invalid signal has satisfied one detection criterion and the detection process incorrectly declares the presence of a valid signal.
False Alert Rate	Prediction of the number of false alerts that will occur in a specified time.
Front-to-Back Ratio (for a transducer)	The ratio of power transmitted in the forward hemisphere of the transducer's polar diagram to that transmitted in the reverse hemisphere of the polar diagram.
Kalman Filter	An adaptive filter that provides optimum filtering of a signal that has been subjected to a non-stationary environment (that is, when the data is changing significantly during the filter convergence time).
Least Squares (LSQ)	Used to generate a raw estimate of position based on a single set of measurements. The solution computed minimises the sum of the squares of the differences between the measurements and their estimates based on the solution. Each solution is independent of those that were computed from previous sets of measurements, and so is vulnerable to the effect of undetected errors in the current set of measurements.
Middleton Noise	This noise is impulsive in nature and is described by a Middleton probability density function. The three classes of noise description are A, B and C: Class A: Typically narrower spectrally than the receiver bandwidth in question and, as such, generates ignorable transients in the receiver's front end (initial linear stages) when source emission terminates. Class B: The bandwidth of the incoming noise is larger than that of the receiver's front end stages, so that transient effects occur both in the build up and in the decay; the latter predominates. To varying degrees, the receiver is 'shock excited', particularly for inputs of very short duration; the receiver is said to 'ring'. Class C: The sum of Class A and Class B interference.

Signal Processing and Communication Terms (continued)

Term	Definition
Rayleigh Fading Channel	The fading characteristics of the propagating channel are in accordance with a Rayleigh Probability Density function. Such a channel does not support constant signals. The phase of the signal is uniformly distributed between 0 and 2 radians.
Rayleigh Probability Density Function	A Rayleigh Probability Density function is the instantaneous vectorial addition of two independent zero mean-time variant Gaussian processes. The phase of the resultant vector is uniformly distributed between 0 and 2 radians.
Rician Fading Channel	The fading characteristics of the propagating channel are in accordance with a Rician Probability Density function. Such a channel does support a constant signal level. Associated with this signal is a non-coherent Gaussian signal of lower strength.
Rician Probability Density Function	A Rician Probability Density function is the instantaneous vectorial addition of two independent zero mean-time variant Gaussian processes where one of the designated signal vectors is not only consistently larger than the other but remains so during the observation time.
Translinear Mode	The system operates in linear mode for signals within specified dynamic range. Once the input signal level is larger than the upper limit set by the input dynamic range, hard limiting occurs.

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