UM-8251

Ranger 2 USBL
User Manual

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Document Information

Table 1 Document information

Document Title—Ranger 2 User Manual		
Document Reference	**ISSUE**	**ISSUE DATE**
UM–8251-A0	A - Rev 0	6-Jan-2011
UM-8251-A1	A - Rev 1	05-Sep-2011
UM-8251-A2	A - Rev 2	23-Dec-2011
UM-8251-A3	A - Rev 3	27-Jun-2012
UM-8251-A4	A - Rev 4	31-Oct-2013
UM-8251-A5	A - Rev 5	25-May-2014

Table 2 Document history

Issue	Rev	Date	Comments	Section	Page
A	0	6-Jan-2011	First issue	All	All
A	1	05-Sep-2011	Updates for software version 3.01	All	All
A	2	23-Dec-2011	Update Lodestar configuration details. Update Figure 12 Update cable drawings		
A	3	27-Jun-2012	General updates	All	All
A	4	31-Oct-2013	General updates	All	All
A	5	25-May-2014	Updates for V4.01	All	All

Glossary

The table below lists and defines the abbreviations used in this manual.

Table 3 Abbreviations

Abbreviation	Meaning
AHRS	attitude and heading reference system
BOP	blow-out preventer
CIS	Common Interrogate Signal
CRP	common reference point (see page 12)
CRS	Common Reply Signal
DB or DBV	Amplitude (dB)
DGPS	Differential Global Positioning System
DP	dynamic positioning (see page 13)
GPS	Global Positioning System (see page 13)
IIS	Individual Interrogate Signal
IL	Interference Level
INS	inertial navigation system
IRS	Individual Reply Signal
LBL	long baseline (see page 14)
NSH	Navigation Sensor Hub
ROV	remotely operated vehicle (see page 15)
Rx	Receive
SBL	short baseline (see page 15)
SN or SNR	Signal to Noise Ratio
TAT	A beacon's Turn Around Time
TOD	Time of Day
Tx	Transmit
UID	A beacon's Unique Identification
USBL	ultra-short baseline (see page 16)
VRU	vertical reference unit (see page 16)
XC	Cross-Correlation (signal quality)

This section includes two glossaries of terms:

- ❑ user operator terms (see Table 4 below).
- ❑ signal processing and communication terms (see Table 5 on page 16)

Table 4 User operator terms

Term	Definition
acoustic beacon	An instrument that emits acoustic signals. It is used to mark a point on the sea-bed or is fixed to a mobile (see page 14) target so that the target can be tracked or positioned in space. The major types of beacon are described in this glossary, but some beacons can be configured as several or any of the types. The major beacon types are: • transponder beacon (see page 15) • responder beacon (see page 15) • pinger beacon (see page 14)

Table 4 User operator terms (Continued)

Term	Definition
acoustic signal	A message carried by sound pressure waves through the water. In the Sonardyne case, the message has finite length in time.
common reference point	The location on a body from which all offset distances are measured. This point has the x, y, z co-ordinates 0, 0, 0 in the body's co-ordinate reference frame.
COMPATT	COMPuting And Telemetry Transponder (see acoustic "intelligent transponder beacon" on page 14). A range of COMPATTs is available from Sonardyne to perform a variety of tasks.
co-ordinate frame	A system that is used to define the position of a body in space. The system used is a right- handed Rectangular Cartesian co-ordinate system in three dimensions, where the three axes used are orthogonal. See Appendix B beginning on page 113 for a detailed description of the co-ordinate frames referred to in this manual. Co-ordinate frames are also called 'reference frames'.
database	A body of data stored in a computer memory or on magnetic disk media.
DP (dynamic positioning)	A system that automatically maintains a vessel on a constant heading and in a fixed position in an inertial frame or with respect to a mobile target. It avoids the need to anchor a vessel and provides greater flexibility in operation. Normally such a system uses a number of position inputs such as GPS (see page 13) receivers, taut wire sensors, LBL (see page 14), SBL (see page 15) or USBL (see page 16) acoustic positioning sensors, wind speed indicators and so on. The system controls thrusters on the vessel to maintain position and attitude in yaw.
DP reference	The acoustic positioning system reports the position of a reference point on the seabed, or that of a mobile target in the vessel's frame, or that of a stabilised vessel's frame regardless of what else the system is doing. This is to maintain compatibility with earlier systems and to provide a standard interface regardless of the type of system used (LBL, SBL, USBL, LSBL, L/USBL) and the manner in which it is being used (for example LSBL in SBL or LBL mode).
DP Telegram	The Telegram an acoustic positioning system sends to a DP system over a serial interface.
dual-redundant L/USBL system	Two complete sets of L/USBL equipment working in tandem on a master/slave basis. The two sub-systems are cross-linked in such a way that, in the event of a failure of any major element, system operation continues without the need for operator intervention. From the operator's point of view, operation of the dual-redundant version is essentially identical to that of the standard version.
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 at P and the plane of the spheroidal equator. • Longitude is defined as the angle between the meridian plane through P and the arbitrarily defined zero meridian plane or the 'Greenwich' plane. (See Geodesy, fourth edition, Bomford, Oxford, sections 2.03 and 4.10(d) for more precise definitions.) Note: This co-ordinate system is not the same as the astronomical co-ordinate system.
GPS (Global Positioning System)	A multi-user, 24-hour, worldwide radio navigation system using the NAVSTAR constellation of satellites. GPS receivers are capable of tracking and decoding data from the satellites and using it to compute the position and velocity of a vehicle. The L/USBL system uses the WGS 84 Geodetic Co-ordinate system.
GPS attitude sensor	A system based on a GPS 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.

Table 4 User operator terms (Continued)

Term	Definition
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.
inclinometer	An analogue device, usually fitted into a COMPATT (see page 13), which measures the angle of the transponder in which it is mounted with respect to the local vertical. These are generally less accurate than a dedicated vertical reference unit (VRU).
intelligent transponder beacon	A particular type of transponder beacon that is managed by a micro-controller. It is commonly referred to as a COMPATT (see page 13). It can decode acoustic telemetered commands from a transceiver and can send telemetered data to the transceiver. It can measure the distance between itself and other transponder beacons and can then telemeter the data to a transceiver. Usually the instrument is capable of measuring its depth and the temperature of the water, and can be commanded to telemeter its own internal state back to the surface. It can also be used to measure a variety of underwater parameters and telemeter these back to the surface. It is used, for example, as an intelligent angle-measuring device in a Riser Angle Monitoring System (see page 15). Very often is fitted with a release mechanism enabling it to be returned, on command, back to the surface at the end of a mission (or if battery power is low). The intelligent beacon can be developed to the state where it becomes a remotely operated transceiver.
L/USBL system	A hybrid of an LBL and a USBL system. It uses USBL equipment in an LBL configuration.
long baseline (LBL) system	A system where there are two or more (typically four) transponders 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. It takes its name from the 'baselines' joining each Transponder. It is sometimes referred to as a range-range system.
LSBL system	A hybrid version of an LBL system and an SBL system.
mobile	A body that is free to move relative to the seabed through the space between the sea surface and the seabed.
monitor / keypad	An instrument that contains a colour graphics display monitor and has a keypad in close proximity suitable for operator input to the system. Sonardyne systems are designed for rack mounting.
Navigation Sensor Hub (NSH)	An instrument that: • provides communication interfaces to connect to gyro, VRU, GPS, transceiver • provides power to transceiver • timestamps all messages
navigation processor	A rack-mounted set of chassis equipment that: • Acts as the system controller. • Accepts operator input from the keypad. • Generates the display signals for the monitor. • Processes data from the transceiver into a form suitable for display to the operator and output to a DP system. • Interfaces to various 'attitude' sensors and other navigation systems.
pinger beacon	A particular type of beacon that emits signals regularly without an interrogating signal. A Synchronous pinger is one that can be synchronised to an external master signal. A Precision pinger is one with an accurate internal time standard.

Table 4 User operator terms (Continued)

Term	Definition
RAMS (riser angle monitoring system) or marine riser angle monitoring system (MRAMS)	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 (see page 13), 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.
reference frame	See “reference frame” on page 15.
responder beacon	A particular type of beacon that emits an acoustic signal in response to an electrical signal carried to it by cable.
ROV (remotely operated vehicle)	A vehicle controlled and powered over a cable connection so that it can travel in the space between the sea surface and the seabed.
seabed	The surface of the earth covered by water or sea. The seabed is considered stationary.
short baseline (SBL) 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.
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.
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.
target	Object to be tracked by an acoustic system.
transceiver	An instrument that can generate electrical signals suitable for conversion to acoustic signals by a transducer. It can detect received signals and extract information from them. Some transceivers can measure the time it takes a signal to travel from a transducer to a transponder and return. Some can encode and send data in a message and extract digital data from a message (a process called Acoustic Telemetry).
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 a complete instrument that contains pre-amplifiers, matching networks and so on.
transponder beacon	A particular type of beacon that emits an acoustic signal when it detects an interrogating acoustic signal.

Table 4 User operator terms (Continued)

Term	Definition
true north	The direction of the shortest line that can be drawn, across the surface of the earth, from the observer to the North Pole.
ultra-short baseline (USBL) system	A system similar in principle 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 be equivalent to the SBL system.
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. Normally the co-ordinates are called eastings and northings, which are equivalent to x and y respectively. The UTM system is a worldwide system. Each projection covers 6 degrees of longitude with the central meridian at 3, 9 degrees etc. east of Greenwich and from 84 degrees north to 80 degrees south. The scale factor on a central meridian is 0.9996 (with some exceptions). The projection is orthomorphic, which means that at a point the scale in all directions is the same and there is no local distortion. However it should be noted that the scale factor changes with distance from the central meridian. For points away from the central meridian grid north and true north diverge. The difference is called the convergence, and is positive when grid north is east of true north. Usually, the point where the central meridian meets the spheroid equator is given a false easting of 500000 m. Many countries' mapping systems are based on the same system but use a particular reference spheroid, non-standard central meridians, scale factors and different false eastings and northings. The polar regions are covered by two Zenithal orthomorphic projections.
vessel	A body floating in the sea with at least part of it penetrating the surface. It is free to move and rotate relative to the seabed.
VRG (vertical reference gyroscope)	A gyroscopically stabilised VRU.
VRU (vertical reference unit)	An instrument that measures the instantaneous roll and pitch of a vessel.

The table below lists and describes the signal processing and communication terms used in this manual.

Table 5 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.

Table 5 Signal processing and communication terms (Continued)

Term	Definition
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).
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.
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.

1 Safety

In this chapter...

This chapter contains the following sections:

1.1 Introduction

Before you perform any activity that involves the system described in this User Manual, you should read and understand the information supplied in the separate Safety Manual and all Warnings and Cautions below .

Sonardyne recommends that all personnel who install, operate or maintain this system should comply with the Health and Safety Regulations applicable to the vessel and to the region where the system is used.

Operators and service personnel must make themselves familiar with the normal operating and safety procedures for use with Subsea Equipment. They must also consult the user documentation supplied with the system to identify the meaning of any warning, caution or hazard label or marking on the equipment. The user documentation explains what action to take to ensure the safety of personnel and to protect the system and peripheral equipment from damage.

You will impair the ability of the system to perform safely if you use any part of the system improperly. Always install, operate and maintain the system according to the instructions supplied by the manufacturer.

The owner and the operator of the system are entirely responsible for the safety of any installation that incorporates this equipment.

1.2 Procedures

Read and understand all of the following Warnings and Cautions before you perform any type of procedure involving the equipment.

Warnings

Warnings alert you to a danger to the health and safety of personnel. You MUST obey the instructions and precautions shown in Warning notices.

Heavy Equipment. The Type 8300 Series of transponders, when out of water, weigh between 22 kg and 35 kg (depending on type). You must use Manual Handling Equipment (MHE) to move this equipment. If there is no suitable MHE available, then you must conduct a manual handling assessment before carrying out manual lifting or handling. You must also wear Personal Protective Equipment (PPE) such as protective footwear and gloves before lifting the equipment.

Heavy Equipment. The Type 8142 transceivers, when out of water, weigh between 28 kg and 41 kg. You must use Manual Handling Equipment (MHE) to move this equipment. If there is no suitable MHE available, then you must conduct a manual handling assessment before carrying out manual lifting or handling. You must also wear Personal Protective Equipment (PPE) such as protective footwear and gloves before lifting the equipment.

Heavy Equipment. The Type 8084 GyroUSBL weighs between 51 kg and 64 kg in air. You must use Manual Handling Equipment (MHE) to move this equipment. If there is no suitable MHE available, then you must conduct a manual handling assessment before carrying out manual lifting or handling. You must also wear Personal Protective Equipment (PPE) such as protective footwear and gloves when moving the equipment.

Heavy Equipment. The Type 8084 GyroCompatt weighs 45 kg in air. You must use Manual Handling Equipment (MHE) to move this equipment. If there is no suitable MHE available, then you must conduct a manual handling assessment before carrying out manual lifting or handling. You must also wear Personal Protective Equipment (PPE) such as protective footwear and gloves when moving the equipment.

Heavy Equipment. The Type 8084 Lodestar AHRS and INS weighs between 13 kg and 39 kg in air. You must use Manual Handling Equipment (MHE) to move this equipment. If there is no suitable MHE available, then you must conduct a manual handling assessment before carrying out manual lifting or handling. You must also wear Personal Protective Equipment (PPE) such as protective footwear and gloves when moving the equipment.

Heavy Equipment. The Dunker 6, when out of water, weighs 24 kg. You must use Manual Handling Equipment (MHE) to move this equipment. If there is no suitable MHE available, then you must conduct a manual handling assessment before carrying out manual lifting or handling. You must also wear Personal Protective Equipment (PPE) such as protective footwear and gloves when lifting the equipment.

Heavy Equipment. The ROVNav 6 transceiver, when out of water, weighs 13 kg. You must use Manual Handling Equipment (MHE) to move this equipment. If there is no suitable MHE available, then you must conduct a manual handling assessment before carrying out manual lifting or handling. You must also wear Personal Protective Equipment (PPE) such as protective footwear and gloves when lifting the equipment. High Internal Pressures Risk. Due to the high internal pressure risk, dismantling sub-sea equipment must only be carried out by trained personnel.

Risk of impact injury. Do not stand in line with the end-cap when removing it from a transponder. Any internal pressure inside the transponder could rapidly force the end-cap from the transponder like a projectile, causing an impact injury to any person who stands in the way.

Risk of explosion. There is a risk of explosion if you use unauthorised battery packs inside transponders. Use only battery packs that are approved by the transponder manufacturer.

Risk of explosion. Use only Class D fire extinguishers on fires that involve Lithium or Lithium Ion battery packs. Do not use any other type of extinguisher.

Risk of crush injury. Do not place your hands near the Release Mechanism when it is operating. The release mechanism uses a high-pressure spring to open it, and this could trap your fingers.

Risk of crush injury. Do not stand below suspended equipment. You must wear Personal Protective Equipment such as safety boots and hard hat when lifting and handling the equipment.

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.

Cautions Cautions alert you to a risk of damage to equipment. You MUST obey the instructions and precautions shown in Caution notices.

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. Make sure that the Navigation Computer chassis and the Navigation Sensor Hub 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 Navigation Computer chassis and the Navigation Sensor Hub 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 Navigation Computer or the Navigation Sensor Hub, except for the external filters for the cooling fans. Do not attempt to open these items.

Risk of equipment Damage. You can cause damage 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.

Risk of loss of Data. It is strongly recommended that valuable user data and configuration files are regularly backed up to avoid loss of data.

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 installation manuals.

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.

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 H 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.

2 Introduction

In this chapter...

This chapter contains the following sections:

2.1 Overview of the Manual

About the manual

This is the User Manual for the Ranger 2 system developed by Sonardyne International Limited. It covers the following topics:

- A description of the system and its sub-systems
- Information to help you operate the system correctly for a setup, and to save the settings
- 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 dialogs 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

Readership

All users of the system should read this User Manual.

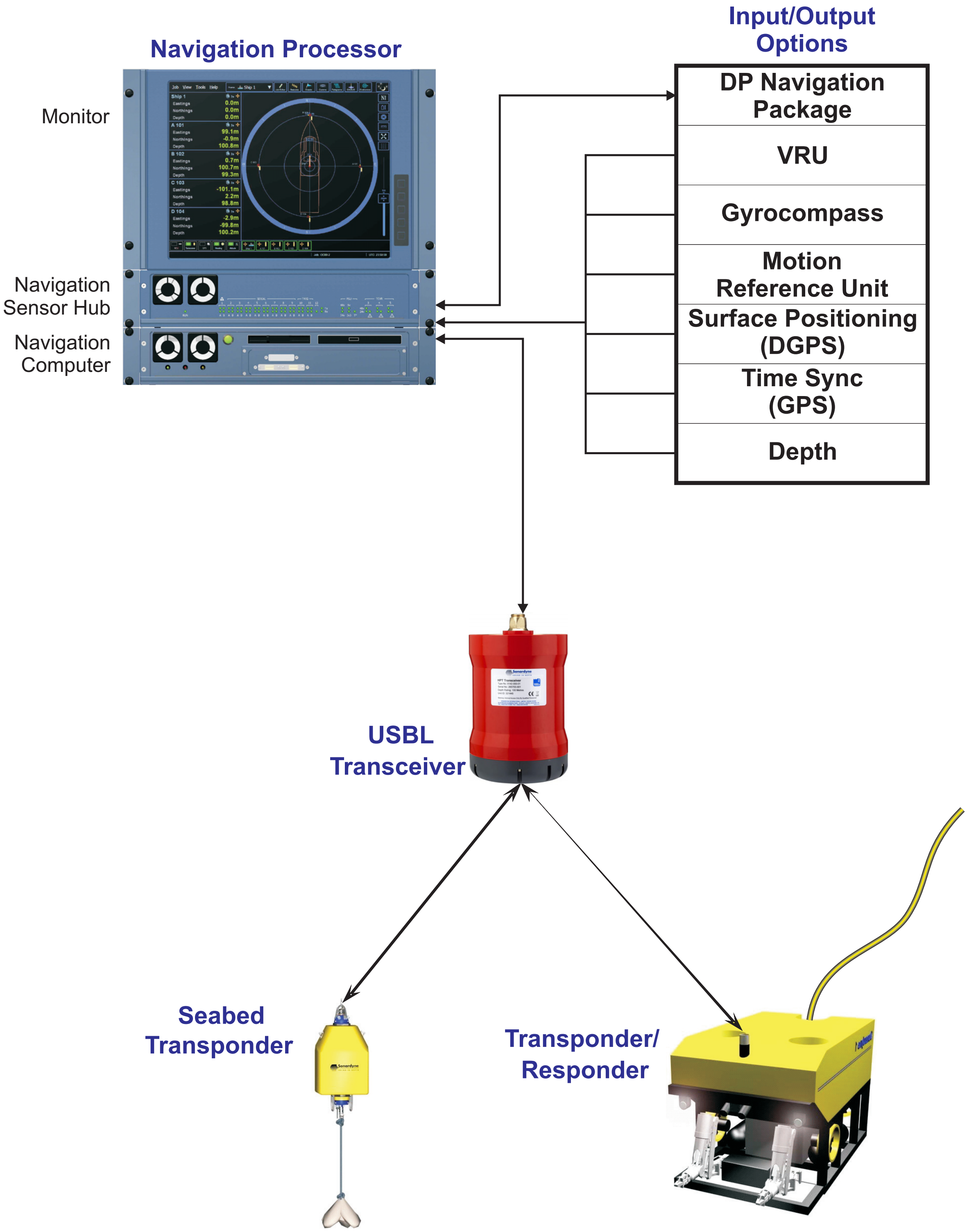
The information and procedures throughout this manual are based on Sonardyne’s considerable experience in the field and on safe practices developed for use in safety-critical operations. All engineers, even those already experienced in these operations, should read this manual and follow the procedures that it describes.

2.2 Overview of the System

Typical system

Figure 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 1 Typical Ranger 2 system



The architecture is highly scalable from a basic shallow water USBL system up to a complex deep water or high elevation USBL system.

Surface units

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

Navigation Processor

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.

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 transponder array.

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. Transponder 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, transponder or beacon for detailed information about the unit.

2.3 Navigation Processor

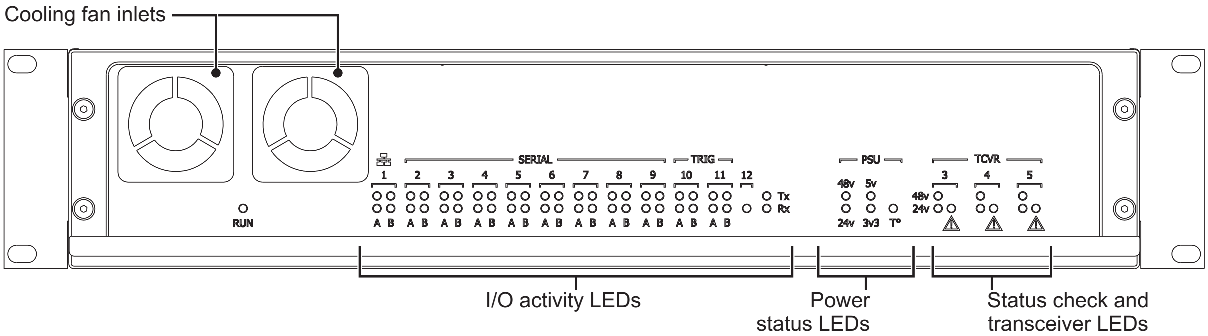
The Navigation Processor is the main control station for the complete system and includes:

- a Navigation Sensor Hub (NSH)
- a Navigation Computer, and
- a touchscreen monitor and keyboard unit.

Navigation Sensor Hub

The NSH provides the interface between acoustic instruments, external sub-systems and sensors, and the Navigation Computer on which the software operates.

Figure 2 Navigation sensor hub



The main functions of the NSH are to:

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

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.

Front panel features

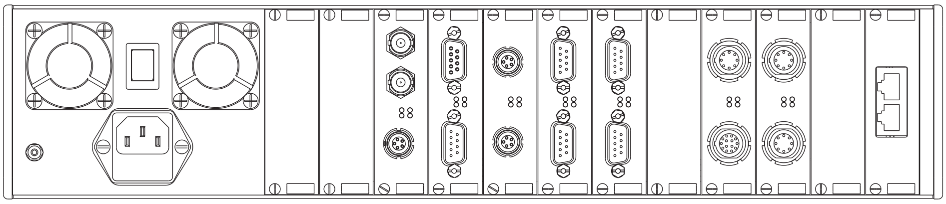
The front panel of the NSH, shown in Figure 2, includes the following features:

- Chassis fans for internal cooling.
- Reset button.

- Indicator LEDs:
  - 32 rear-card LEDs (16 each for Tx/Rx) to monitor all I/O activity through the rear-mounted interface cards.
  - Five green LEDs to confirm that the 24 V, 48 V power supply units (PSUs) are on, and that the 3.3 V and 5 V DC power supplies are available for use.
  - Three pairs of transceiver power-rail status LEDs (for slots 3 to 5) to confirm that 24 V, 48 V power rails are at the correct operating voltage and current.
  - Three transceiver output power fault LEDs (for slots 3 to 5).

Rear panel features

Figure 3 Navigation Sensor Hub rear panel features for a typical configuration



The rear panel of the NSH houses the following:

- Connectors (in Slot 1) for:
  - RJ-45 10/100Base–T Ethernet.
  - Interface card (in slot 2).
  - Serial interface reserved for NSH management.
- On/Off switch for the mains electrical power.
- IEC inlet socket for connection of mains electrical power in the range 100 V to 240 V 6.3 A, 50 to 60 Hz.
- Cooling fan for the electrical power supply.
- Transceiver communications and power output connector for 24 V and 48 V DC (Slots 3 to 5).
- Specific interface cards for transceivers and sensors (Slots 6 to 12).

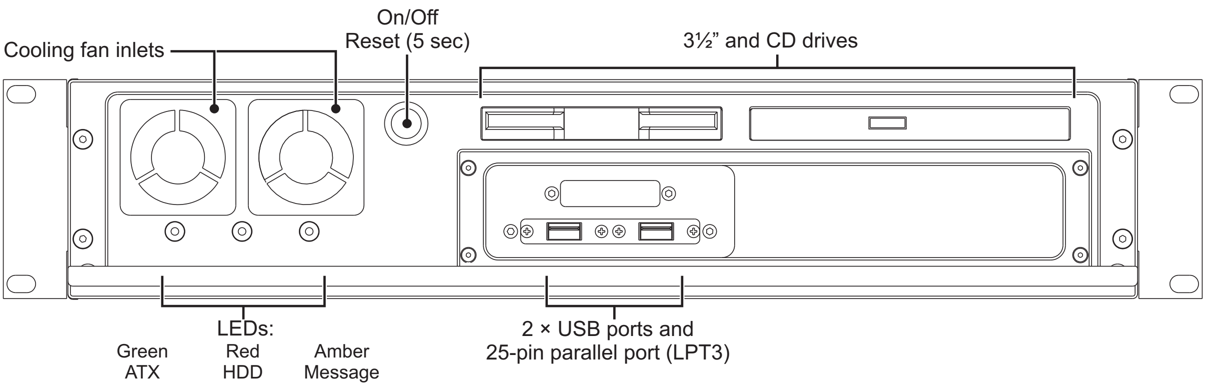
Navigation computer

The Navigation Computer is an industrial PC that has been purpose-built specifically for use with the Sonardyne Navigation Sensor Hub. It has been optimised to run Sonardyne's software application.

Note

The software is security protected and requires a valid dongle to be installed on the PC before you can use all the software features. In particular, you will NOT be able to use the system to track targets unless there is a valid dongle fitted. Contact Sonardyne if you require a dongle.

Figure 4 Navigation computer



Features The front-panel of the Navigation Computer, shown in Figure 4, has the following main features:

- CD–RW drive.
- 3½–inch removable disk drive.
- Connectors:
  - Two 4-pin USB 2.0 ports.

Note

Sonardyne navigation computers are normally fitted with an internal security key ("dongle"). If it must be external, Sonardyne recommends that you always connect a dongle to a USB port on the rear-panel of the Navigation Computer rather than to a USB port on the front-panel.

- A power and reset button to power-on the system. The button also acts as a system reset button if held pressed for five seconds.
- Three LED system status indicators:
  - A green system power LED that illuminates when the system power is ON, and extinguishes when system power is OFF. The LED flashes green when the system is in Sleep mode.
  - A red hard-disk LED illuminates when the hard disk drive (HDD) is actively reading or writing data.

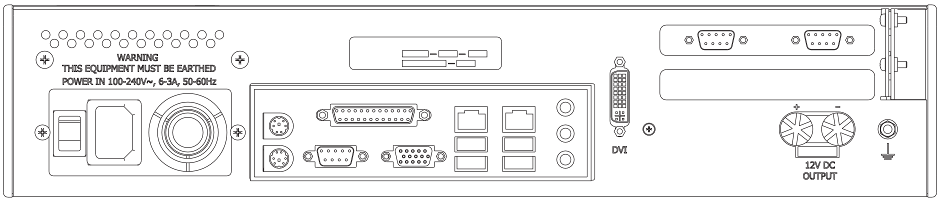
Risk of equipment Damage. You can cause damage to the hard disk or data corruption by switching off system power when the hard disk is reading or writing data. Do not switch off system power until after you have shut down the system correctly.

- The Microsoft® Original Equipment Manufacture (OEM) licence details affixed to the Navigation Computer's front-panel.

Note

This licence is not transferable to another computer.

Figure 5 Rear panel of the Navigation Computer



The rear-panel of the Navigation Computer, shown in Figure 5, has the following main features:

- Two PCI expansion card slots on a riser, of which one is free.
- Connectors:
  - Two PS/2 type 6-pin mini-DIN connectors — green for the mouse connector and purple for the keyboard connector.
  - One 9-pin D-type serial port — COM1. This is UART 16550 compatible.
  - Audio connectors — Line In, Line Out, and microphone.
  - Four 4-pin USB 2.0 ports.
  - RJ-45 connector for Ethernet LAN.
  - Digital Video Interface (DVI) port for an external monitor.
  - SVGA port

Note

Two SVGA monitors can be connected to the Navigation Computer and can be configured either as a single desktop display and repeater, or as two separate displays with the desktop extended across both.

  - Chassis ground.
- Rocker type ON/OFF power switch for electrical power.
- IEC inlet socket for connection of mains electrical power in the range 100 V to 240 V 6.3 A, 50 to 60 Hz.
- Cooling fan inlet for the electrical power supply.
- 12 V DC power output terminals to supply power for a flat screen monitor.

2.4 In-water Systems

The in-water systems include one or more transceivers and multiple transponders. The arrangement of these sub-systems is dependent on the installation requirements.

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, refer to the transceiver's user manual.

Transponder beacons

The transponders are a type of beacon. They 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 transponder 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.

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 transponder

2.5 Peripheral systems

Peripheral systems for use with the system can include:

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

Note

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

- ❑ a printer
- ❑ external mass storage

Note

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

DP navigation system

A dynamic positioning navigation system directs a DP 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 GPS 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 GPS-based reference.

Vertical reference unit

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

The system uses these measurements to compensate its position calculation for any changes in the vessel attitude and heave motion. 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.

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.

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
  - PRDID
  - PHOCT
- ❑ Position:
  - GPGGA
  - GPGLL
- ❑ Depth:
  - NMEA SDDPT
  - DBS
  - PSSIROV
  - SONDEP

- Time: • UTC
  • ZDA (with separate PPS signal)

Printer

The system can print logging and status information to an external printer for hard-copy storage and inclusion in an operation report. The Navigation Computer uses the Windows™ operating system, allowing the use of a very wide range of compatible printers.

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.

2.6 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 transponder receives the interrogation signal and transmits a response, if necessary.
3. The transceiver receives the transponder responses and measures the time interval between the interrogation signal and the individual transponder 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 transponder 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.

3 Common Procedures

In this chapter… This chapter contains the following sections:

3.1 Introduction

Chapter 4 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.

New setup There are a number of stages involved in creating a new configuration, and this chapter describes them all. 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, ROVs, structures and divers.
4. Add instruments to the mobile targets.
5. Configure the mobile and reference targets.

This chapter describes these common procedures.

Instruction format

To simplify the instructions included in this User Manual, where possible the procedures include example screen images with callout 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 dialogs or of the controls and features of the software. If you need detailed information about the software and its dialogs, refer to Appendix J.

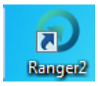
In common with many Windows-based applications, there are many valid methods that you can use to complete a command. For example there are buttons to click, and there are right-click context menus. This chapter explains the simplest method, and sometimes provides alternatives.

Delete an object

If necessary, to delete an object from the setup, right-click the object in the setup tree and select **Delete** from the context menu. Note that 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.

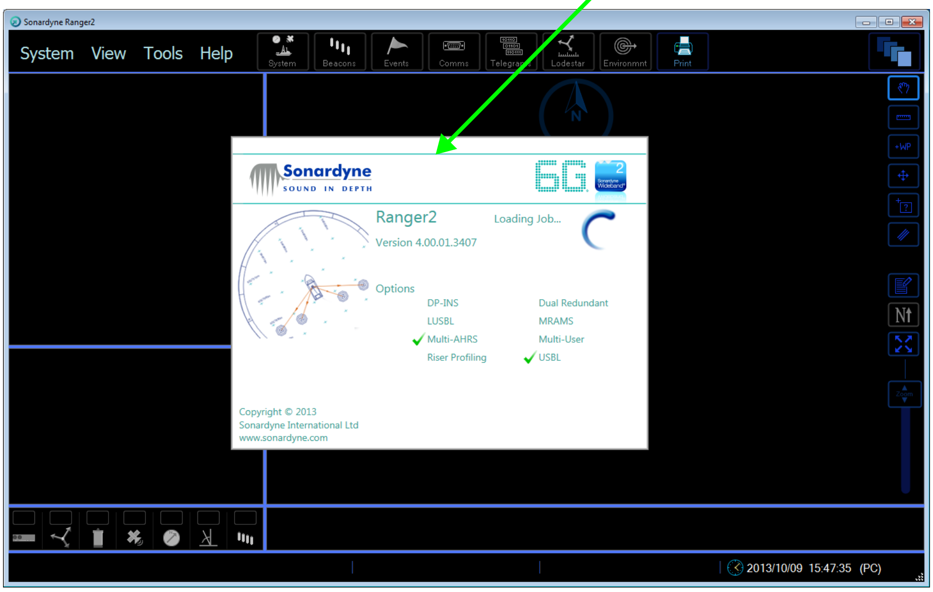
3.2 Start the Software

Follow the callout instructions below to start the software for the first time.



a. Double-click the icon on the computer's desktop to start the software.

The Ranger 2 Launcher screen is displayed with the splash to show initialization progress.



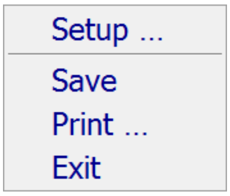
After initialisation has completed, Ranger 2 uses the setup that was active when you closed the program previously.

For a new software installation, Ranger 2 displays the **System Setup** dialog, which allows you to add objects to the initially empty setup.

b. Follow the instructions in section 3.3 "Initialisation" beginning on page 34 for instructions to use the **System Setup** window to edit the setup.

3.3 Initialisation

Select **System** > **Setup** to add instruments to a setup, as described in section 3.4.



3.4 How to Add Instruments to a Setup

This procedure explains how to add mobile objects and transceivers to a setup.

1. Choose **System** > **Setup…** to display the **System Setup** window.

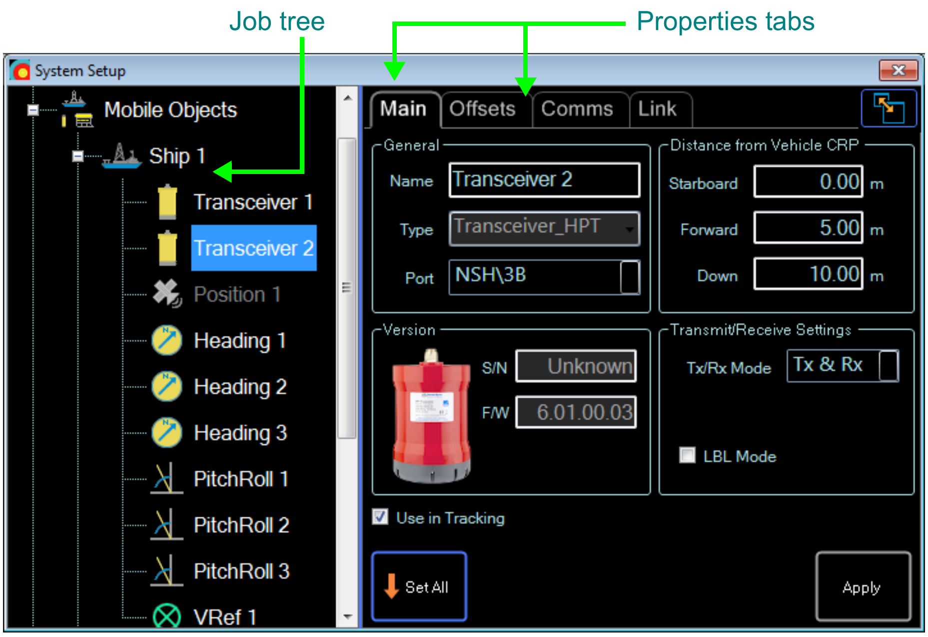
   Figure 6 shows an example of the **System Setup** window with the job tree, the object tabs and the properties tabs displayed.

   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.

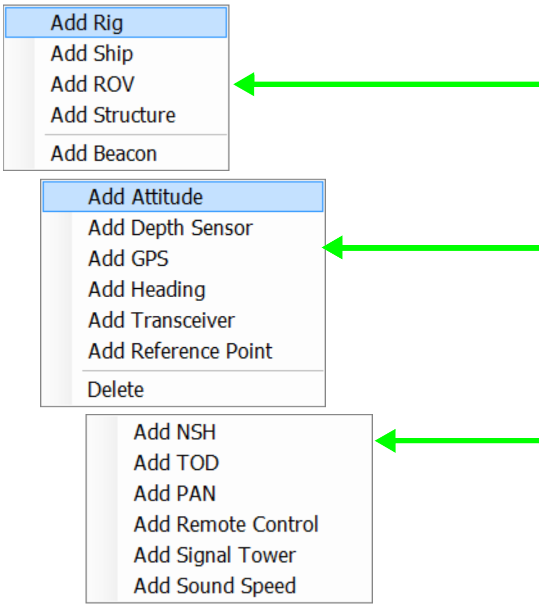
   The job tree groups objects so that ‘system’ devices such as the NSH, PAN, TOD remain together, and ‘ship’ devices such as gyros, VRUs and other mobile devices remain together.

   The example in Figure 6 includes several additional objects and instruments that have already been added to the setup.

Figure 6 Example System setup window



2. Follow the callout instructions below to add mobile objects to the setup. Use the scroll bar to see more objects that you can add.



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.

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 the System root in the job tree and select from the context menu.

d. 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

e. Confirm the object's properties are displayed.

For example:

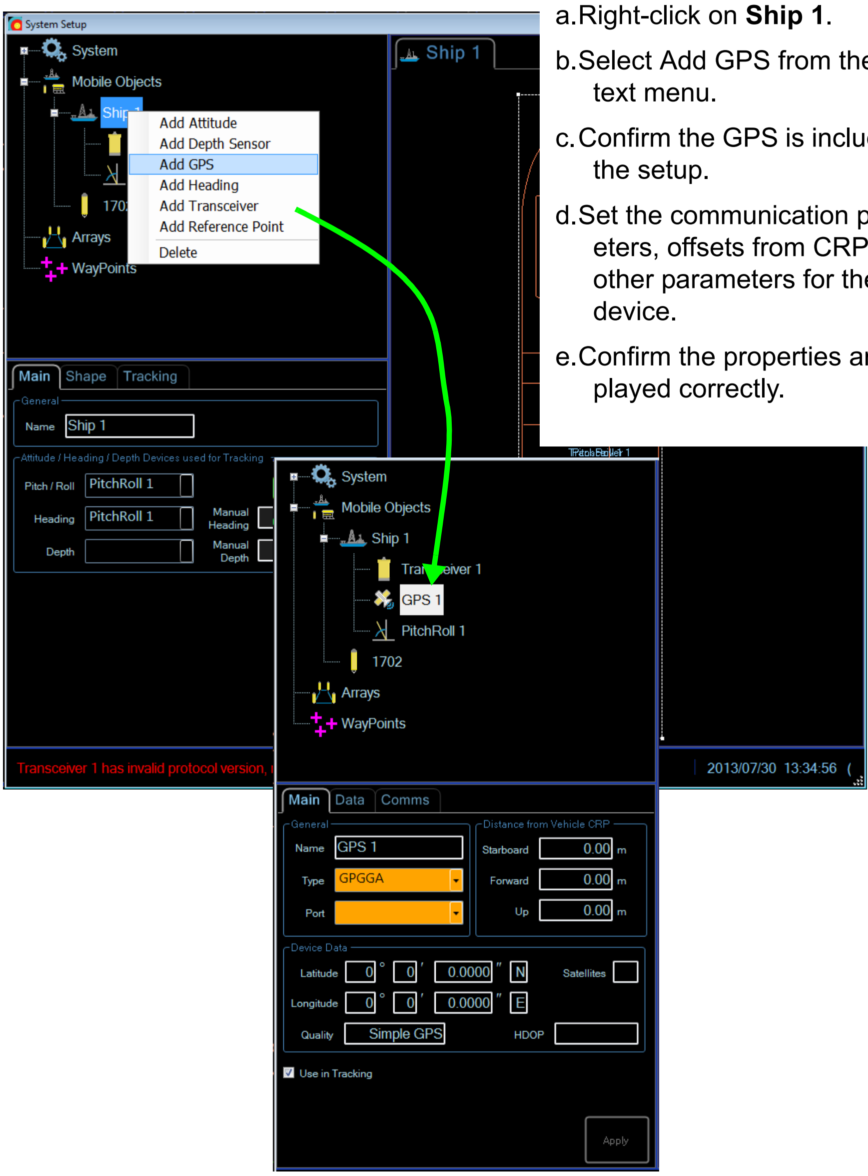
a. Right-click on **Ship 1**.

b. Select Add GPS from the context menu.

c. Confirm the GPS is included in the setup.

d. Set the communication parameters, offsets from CRP and other parameters for the device.

e. Confirm the properties are displayed correctly.



3. If necessary, use the properties tab to change the object's or the instrument's default name after you have added it.

4. Click **Apply** to apply and save any changes you make to the object's properties.

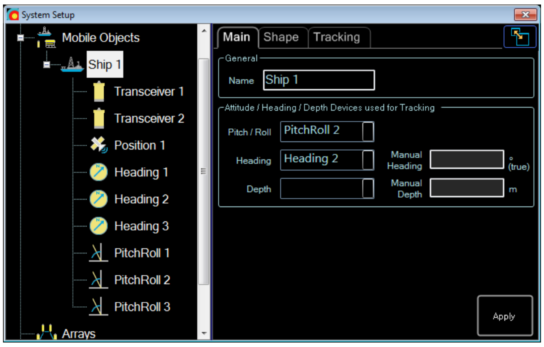
   Refer to sections 3.6 to 3.13 beginning on page 38 to configure the instruments that you add to the Mobile Objects.

5. Repeat step **1** to step **4** to add other Mobile Objects and Instruments as required for the current setup.

3.5 How to Configure the Vessel

This procedure explains how to configure a basic setup for the vessel by setting fields on the properties tab.

1. Choose **System > Setup…** to display the **System Setup** window and follow the callout instructions below.



a. Select the vessel in the job tree.

   The **Main** property tab is displayed for the selected vessel.

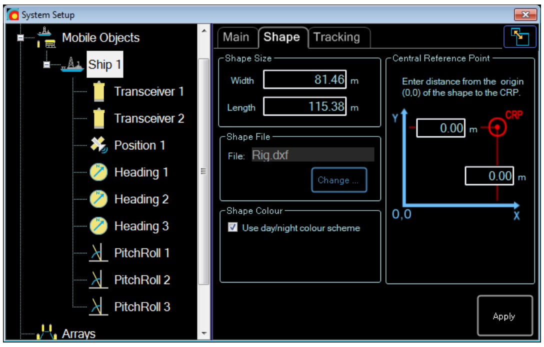
b. Enter a **Name** for the vessel, if necessary, or use the default name.

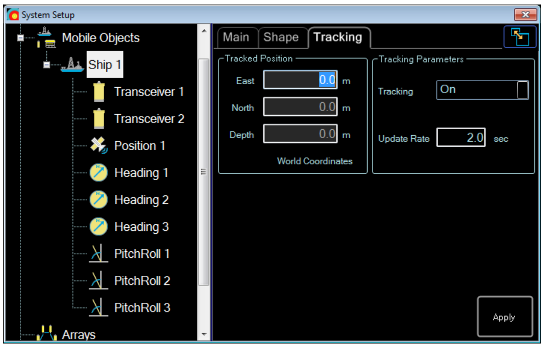
c. Select the preferred **Pitch/Roll** and **Heading** sensors to use on the vessel if there are multiple sensors.

d. Select **Manual Heading** and enter a fixed value if there is no heading sensor to use.

e. Select **Manual Depth** and enter a fixed value if required.

   Note: Manual depth is recommended only for high elevation angles, for example when using a long layback with a towfish. It is NOT recommended for conventional deep-water tracking.





f. Select the **Shape** tab. To change the vessel shape select **Change…** and pick from the list of available shapes. You can add a custom shape file in DXF or DWG format.

g. Set the vessel **Width** and **Length** as required.

h. Select the **Use Day/Night Colours** check box so that the software uses uniform colours that fade with the brightness setting.

i. Click **Apply**.

j. Select the **Tracking** tab, where you can set the vessel's acoustic position **Update** time.

3.6 How to Configure a Transceiver

1. Choose **System** > **Setup…** to display the **System Setup** window if it is not already displayed.

2. Select the transceiver in the job tree to display the **Main** tab and the current properties for the transceiver.

Main properties

3. Follow the callout instructions below to set the transceiver's main properties.

   a. (*Optional*) Type a name for the transceiver, or use the default.

   b. Select the type of transceiver used.

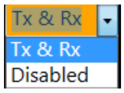
      If you have several transceivers connected to one comms port in a multi-drop configuration, you must enter a serial number manually.

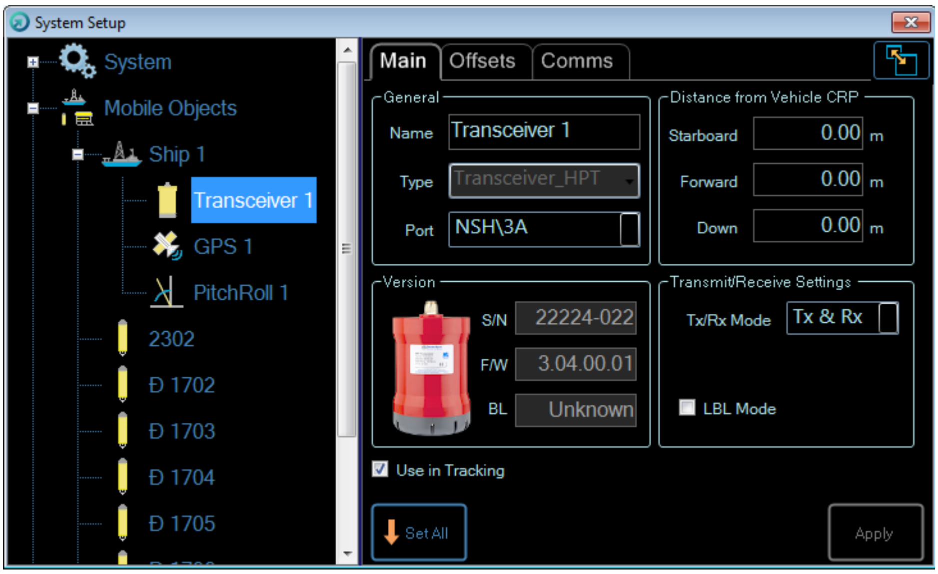
   c. Select the port used for transceiver communications.

   d. Enter the transceiver location with respect to the vehicle's CRP.

   e. Set the TxRx mode to **Tx & Rx** (the default) for normal operation, or **Disabled** if you want to disable the use of the transceiver in the system.

   f. For normal USBL operation, leave **LBL Mode** deselected.





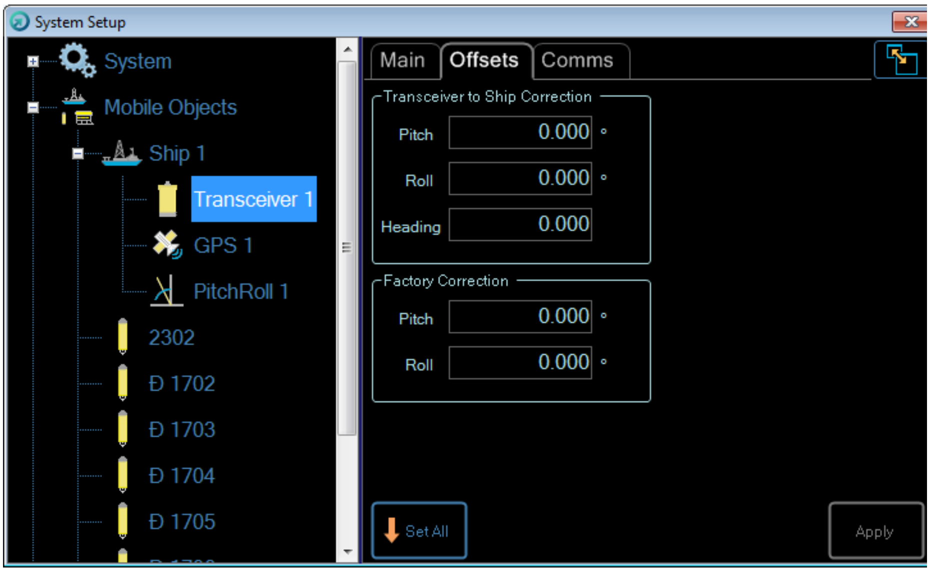
Offsets

4. Select the **Offsets** tab and follow the callout instructions below to set the transceiver properties.

   a. Enter the **Pitch**, **Roll** and **Heading** correction angles necessary to align the transceiver with the vehicle's reference frame.

   b. Enter the corrections measured by the factory for the transceiver's internal inclinometer.

   c. Click **Apply**.



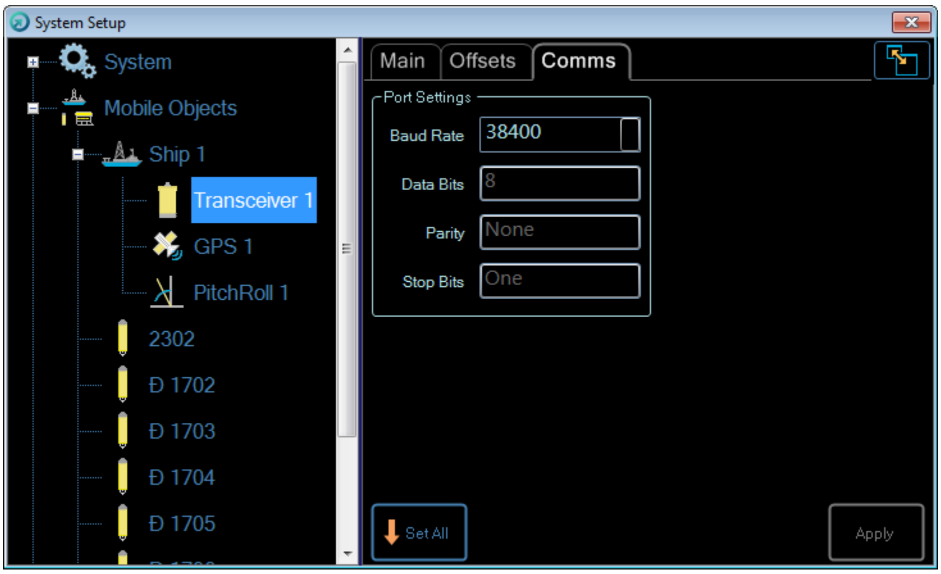
Comms

5. Select the **Comms** tab and follow the callout instructions below to set the transceiver properties:

   a. Select the **Baud Rate**, **Data Bits**, **Parity** and **Stop Bits** used for communication between the software and the transceiver.

   b. Click **Apply**.

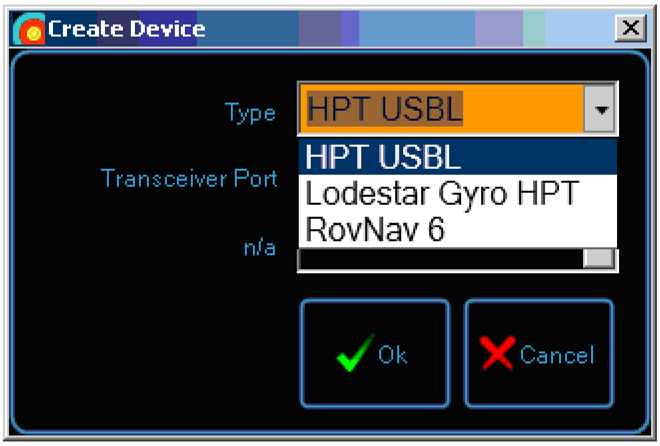
   c. Select the **Main** tab and confirm that the software has read the serial number and firmware version successfully.



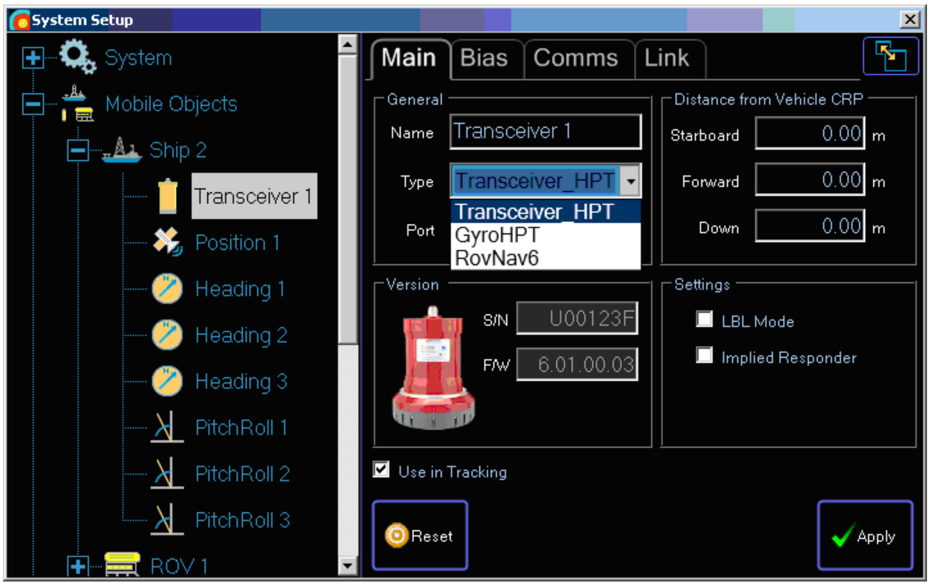
5G and 6G technologies

Note that 5G and 6G transceiver technologies cannot be mixed or changed.

Once the transceiver has been defined in a setup, only a 'type' of the same generation can be added, for example an HPT or a GyroHPT or a ROVNav 6 can be added to a setup already containing a 6G HPT:



After the transceiver has been defined in a setup, it can only be changed for a compatible type, for example a 6G HPT can be changed to a GyroHPT or a ROVNav 6.



3.7 How to Configure a Beacon – new method

Note

There are two methods available to configure a beacon. The new method described here supersedes the method described in section 3.8.

Beacons can be mobile or fixed targets, and you can change any beacon between these two types. The procedure for configuring a beacon is the same, whether it is mobile or fixed.

To add a beacon to the setup, use the **Beacons Table**, click the **Add** button and follow the instructions in the Wizard. See Appendix J.9 beginning on page 315 for details.

3.8 How to Configure a Beacon – old method

Note

The use of System Setup for beacon configuration is now superseded by the Beacons Table see Appendix J.9 beginning on page 315. The older method of configuring a beacon as described in this section is no longer recommended and is included for completeness only.

Beacons can be mobile or fixed targets, and you can change any beacon between these two types. The procedure for configuring a beacon is the same, whether it is mobile or fixed.

The exact beacon controls and properties vary depending on the beacon type. The following guidance relates mainly to current Sonardyne beacons – there will be slight differences in the controls for other beacon types.

Main properties

1. Choose **System** > **Setup…** to display the **System Setup** window if it is not already displayed.
2. Select the beacon in the job tree to display the beacon's **Main** properties tab.

3. Follow the callout instructions below to set the beacon's Main properties.

a. Select the beacon **Name**, **Address** and **Type**, and select which transceiver is used with this beacon.

   You must add a transceiver before you can configure this information.

b. Select the type of acoustic telemetry to be used for **Downlink** and **Uplink**. Lower speeds are more robust.

c. Select the beacon's **Interrogate** and **Reply** channels, and its Turn-Around Time (**TAT**).

d. Set the beacon's **Telemetry Power** and receive **Gain**.

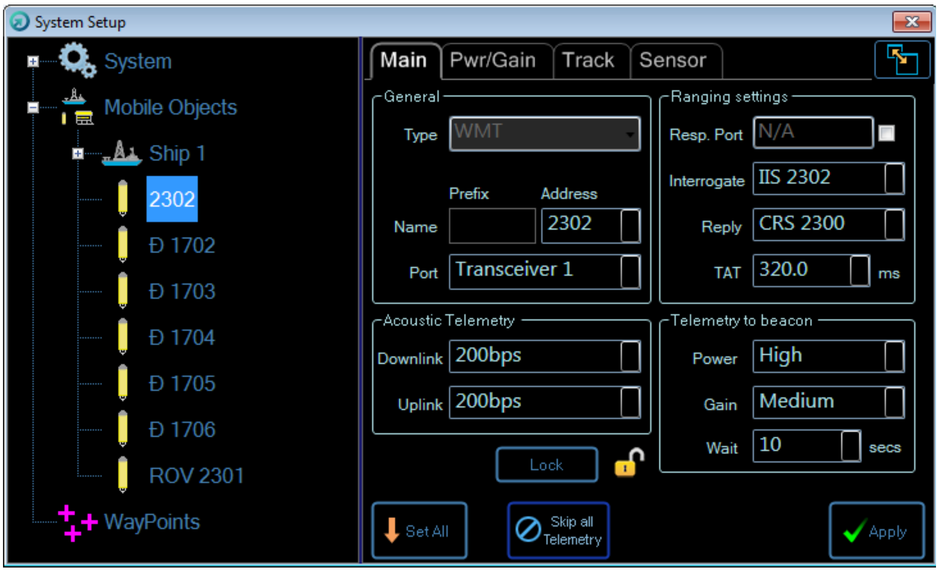
   Set these parameters according to local acoustic conditions. Refer to the beacon's manual for guidance.

e. Enter the number of seconds to **Wait** between updates.

f. Click **Apply** and confirm correct communication with the beacon.

g. **Set All** forces a full acoustic setup of the beacon according to the values you set.

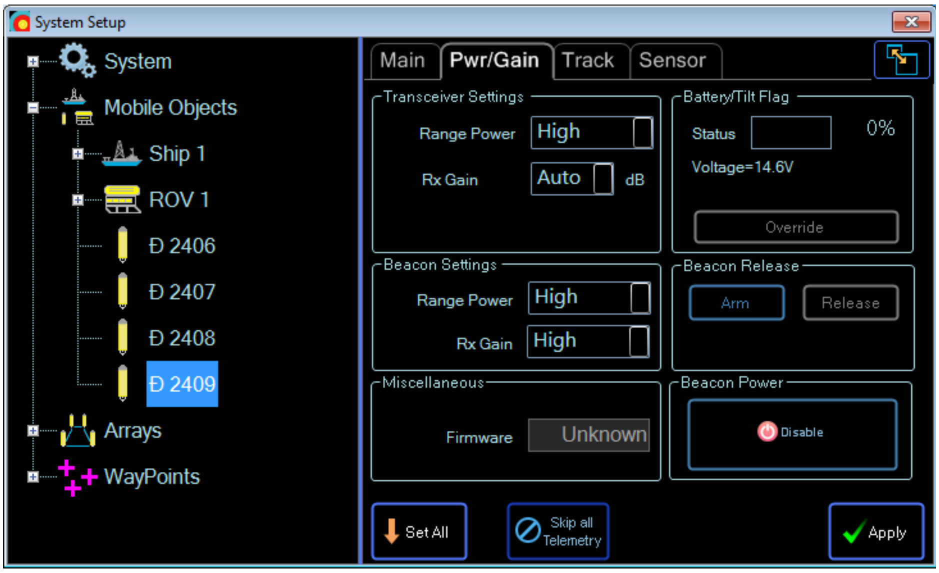
h. **Lock/Unlock** protects the setup for this beacon against accidental changes. The window is greyed out to show that the beacon is locked.



Power

4. Select the **Power/Gain** tab and follow the callout instructions below:
   a. Set the appropriate **Range Power** and **Rx Gain** in **Beacon Settings** for this beacon.

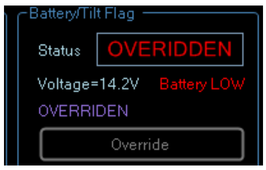
      Set these parameters according to local acoustic conditions. Refer to the beacon's manual for guidance.
   b. Set the appropriate **Range Power** and **Rx Gain** in **Transceiver Settings** for this beacon according to local acoustic conditions. Refer to the beacon's manual for guidance.
   c. Click **Apply** and wait for the software to finish the command sequence to the beacon.



Battery checks

Periodically, for example once each week, you should check the beacon's battery. To do this, double-click the **Status** bar to refresh the reading. Always change or recharge the battery in good time.

When the battery status is unacceptably LOW, a warning message is displayed in red. When this occurs, you should change or recharge the battery *as soon as possible*. If necessary, you can continue to operate in this condition by sending a manual battery **Override** command.



To trigger the beacon's release mechanism, click **Arm** and then click **Release**. Be sure to track the beacon as it rises to the surface, and be prepared to manoeuvre the vessel to avoid losing the beacon.

To preserve the battery when the beacon is not going to be in use for a while, click **Disable** and answer the 'Are you sure? dialog.

Track Select the **Track** tab to view the currently reported beacon position, or to set the desired **Update Period**.

You can set the period here, or you can set it in the Beacons table, described on page 356.

Note

If you have enabled Acoustic Synchronisation, you can only change the vehicle and beacon update periods to multiples of the acoustic window period. If a beacon is a reference beacon, then its update period is determined by the vehicle's update period.

Sensor

5. Select the **Sensor** tab and set the sensor configuration for use with this beacon.

Pulse Position Mode:

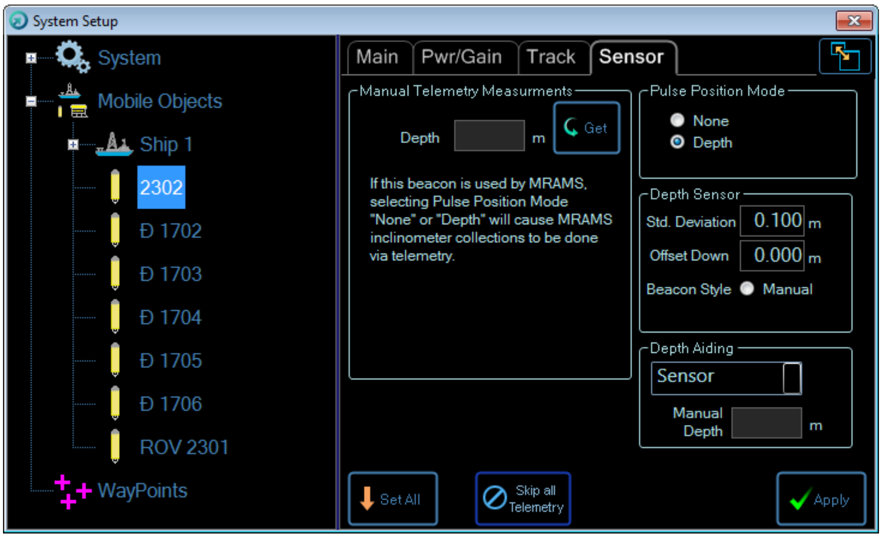
- ❑ Select **Depth** to enable Pulse Position Depth reporting on each ranging cycle—typically this is used to provide depth aiding for shallow water or long layback tracking.
- ❑ Select **Angle** to enable Pulse Position Angle reporting on each ranging cycle—typically this is used in MRAMS and Riser Profiling applications.

Depth Sensor:

Depth measurements can also be commanded by telemetry, by using the **Get** button.

Depth sensor **Std Deviation** – this is a value that represents the quality of the depth measurement from this beacon. Changing this value will affect the weighting of this measurement in the filter.

- ❑ Leave **Beacon Style** as **Standard** for most applications that have the beacon mounted vertically—the system sets the standard offset between the beacon's depth sensor and the acoustic transducer.
- ❑ Set **Beacon Style** to **Manual** and enter the measured offset for applications where the beacon is tilted. Note that positive offsets are down; negative offsets are up.



Depth Aiding:

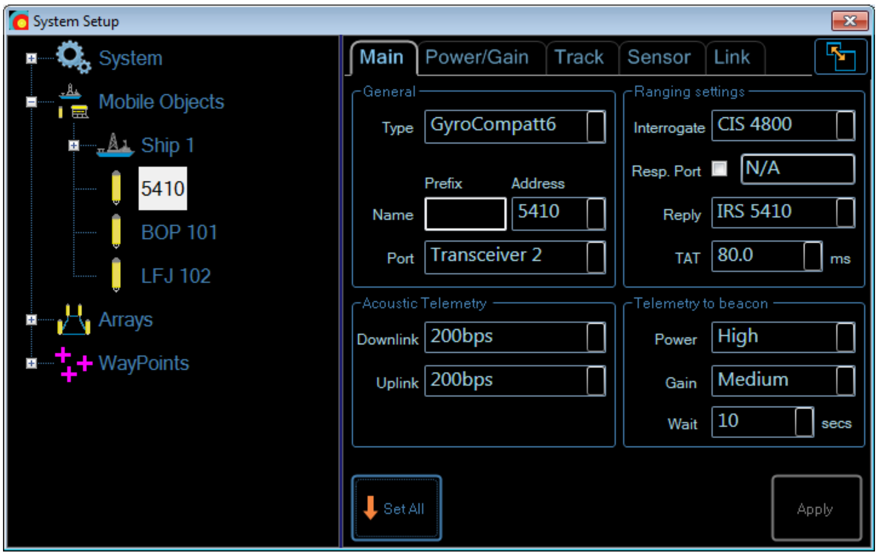
- ❑ Leave **Depth Aiding** set to **None** normally.
- ❑ Set **Depth Aiding** to **Sensor** to include the beacon's depth sensor reading as a factor in the tracking position.
- ❑ Set **Depth Aiding** to **Manual** to enter a fixed depth.

GyroCompatt Follow the steps below to add a GyroCompatt to the system.

Note

Note that this information applies to both GyroCompatt 5 and 6 variants.

1. Add a Beacon and select **GyroCompatt 5** or **6** in the **Type** field.

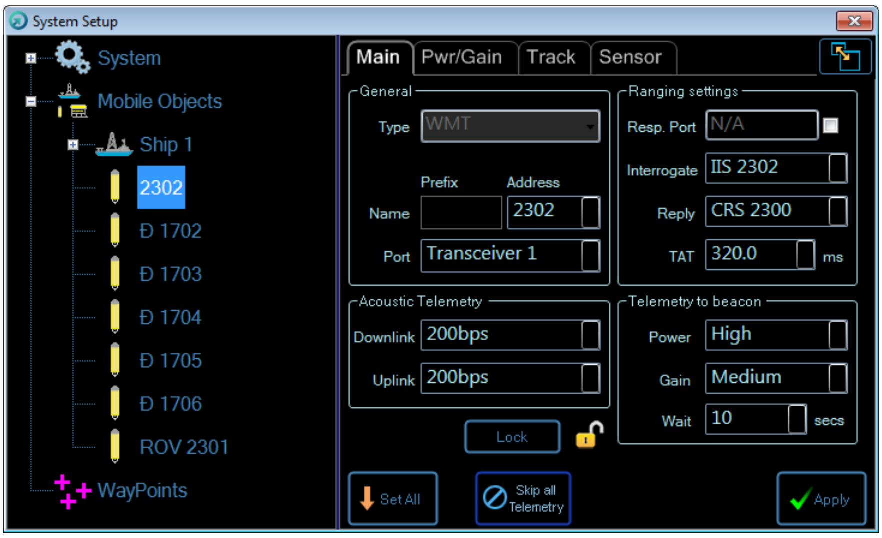


2. Set all standard acoustic and power settings as for a standard Compatt.

3. Click **Apply**.

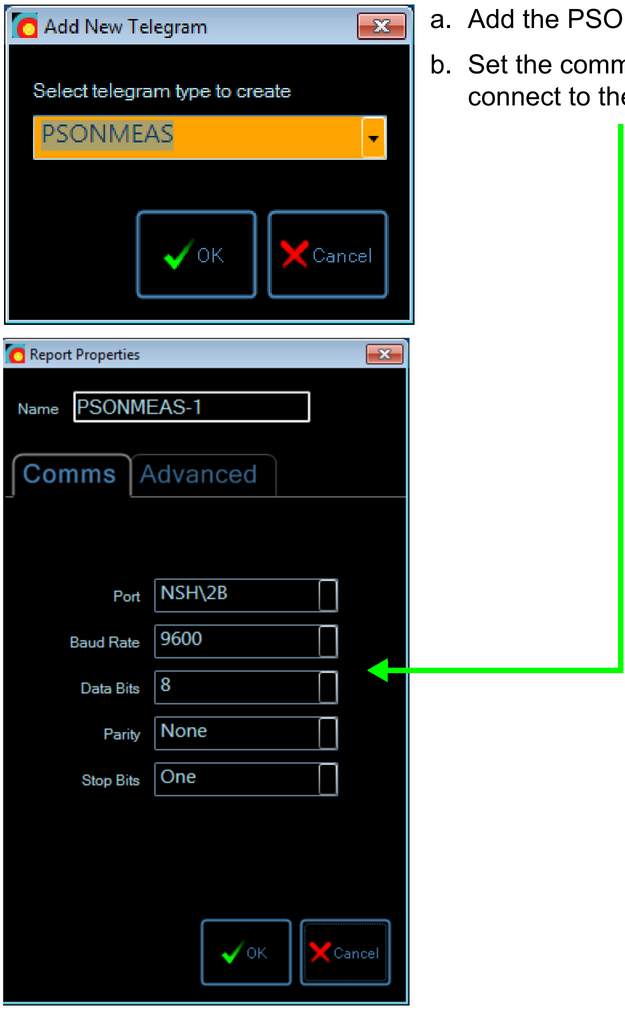
4. Select the **Sensor** tab and click **On** to enable the gyro.

   This command sends the telemetry to switch on the gyro and to start collecting measurements. At first, the Status field shows Off (in red text), but after the gyro boots up, the Status field shows Unsettled (in amber text). After the gyro has settled, the Status field shows On (in green text) and the Sensor tab shoes a set of sensor readings, for example:



Add a PSONMEAS report

Refer to section 3.18 beginning on page 72 for instructions to add an output telegram, and follow the callout instructions below:



a. Add the PSONMEAS telegram.

b. Set the communication parameters and connect to the port.

5. Set the telegram to **Enable** for the GyroCompatt on the telegram editor. Note that the editor provides the option only to enable or disable this telegram.

   Example output string format:

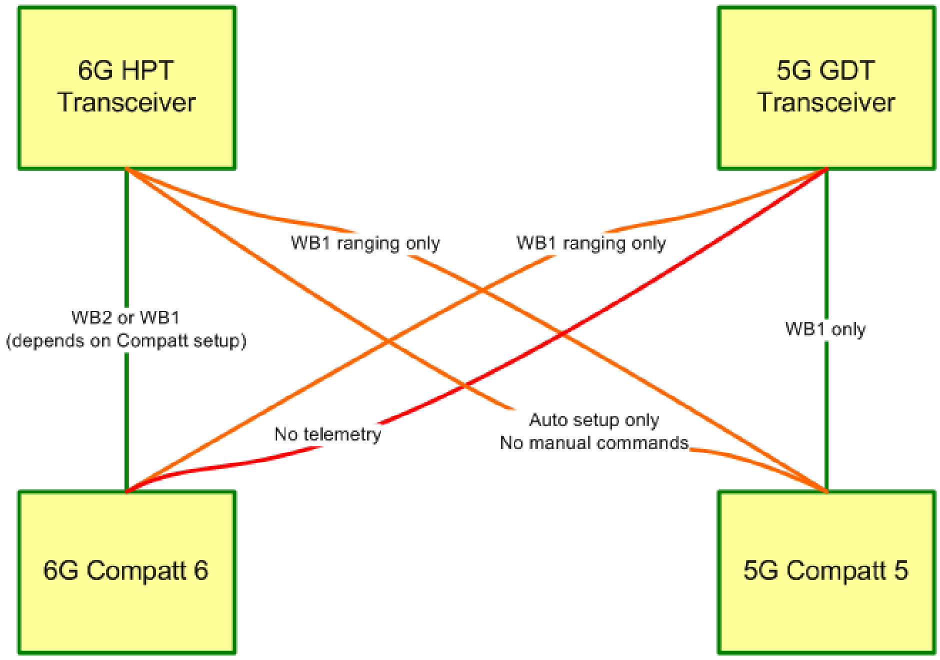
   $PSONMEAS,124752.49,INCINT,5410,,44.91,8.130,-7.840*5D

Mixed 5G and 6G Jobs

There are certain rules you must follow when you run a Job that uses a mixture of fifth and sixth generation transceivers and beacons:

- HPT (6G) with Compatt 6 gives full functionality (using Wideband1 and Wideband2).
- GDT (5G) with Compatt 5 gives full functionality (using Wideband1 only).
- HPT with Compatt 5 – Wideband1 ranging only (not Wideband2). Automatic set-up of the beacons only, with no tone or PP telemetry, and no manual commands.
- GDT with Compatt 6 – Wideband1 ranging is OK (not Wideband2), but NO TELEMETRY is possible.

Figure 7 Mixed 5G and 6G jobs



3.9 How to Configure GPS

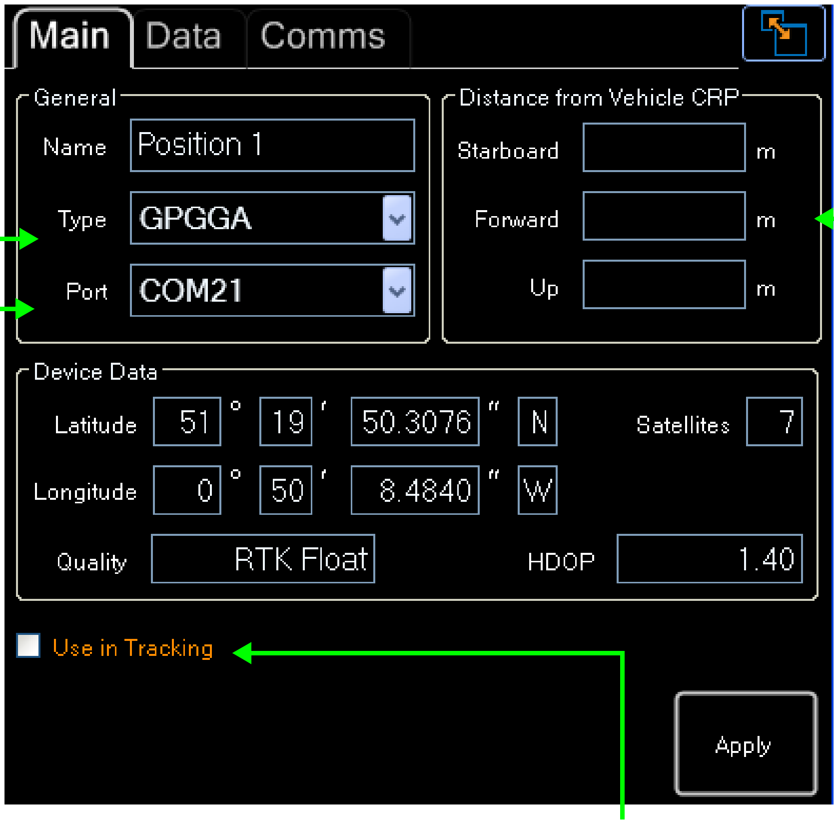
Main properties

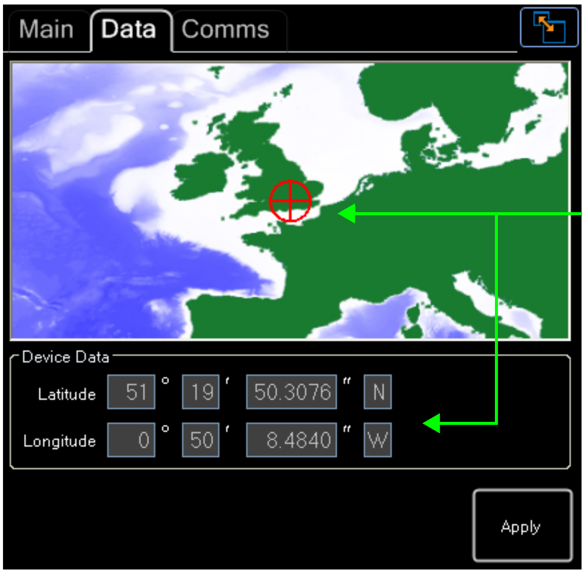
1. Choose **System** > **Setup…** to display the **System Setup** window if it is not already displayed.

2. Select the GPS in the setup.

3. Select the **Main** tab to display the GPS Main properties and follow the callout instructions below:

   a. Select the type of GPS data string supplied by the receiver.
   b. Select the port used for GPS communications.
   c. Enter the location of the GPS antenna relative to the vehicle's CRP.
   d. Click **Apply**.





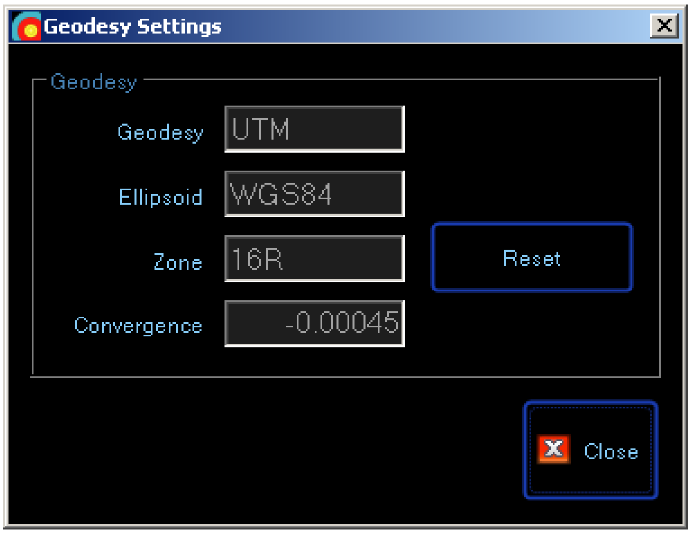
   e. Select the **Use in Tracking** check box.
   f. Select the **Map** tab.
   g. Confirm the position is displayed as a flashing red circle and cross on the map, with details in the **Longitude** and **Latitude** fields.

   If necessary, select the **Comms** tab and set the communication parameters used by the GPS receiver.

3.10 Geodesy tool

Overview

Figure 8 Geodesy Settings window



The geodesy tool provides a visual indication of:

- ❑ the current geodetic projection
- ❑ the ellipsoid
- ❑ the zone
- ❑ the convergence

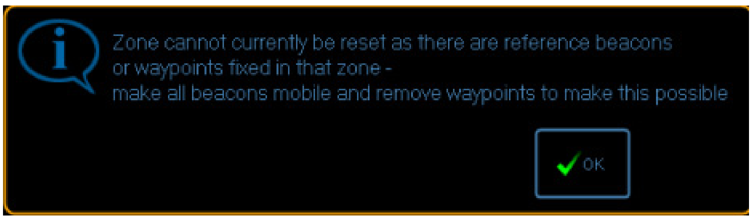
These fields are read-only.

UTM Zone reset

Occasionally, for example 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. Use the **Zone Reset** button in this case to set the UTM zone for the new location.

Note

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



3.11 How to Configure a VRU

Note

It is possible to include more than one VRU in a setup. The first VRU is used to perform position calculations, and this VRU should therefore be the one that provides the best performance.

Main properties

1. Choose **System** > **Setup…** to display the **System Setup** window if it is not already displayed.

2. Select the VRU in the job tree to display the **Main** properties tab for the sensor and follow the callout instructions below:

   a. Select the type of data string supplied by the VRU.

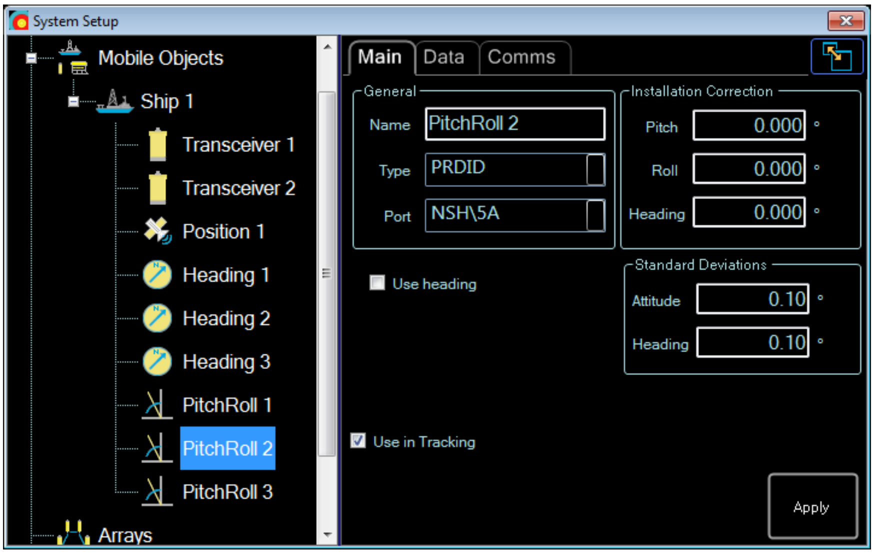
   b. Select the port used to receive VRU communications.

   c. Enter the **Pitch**, **Roll** and **Heading** correction angles necessary to align the VRU reference frame with the vessel's reference frame.

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

   e. Normally, leave the **Use heading** check box selected, unless you know the heading is uncalibrated or unavailable.

   f. Click **Apply**.



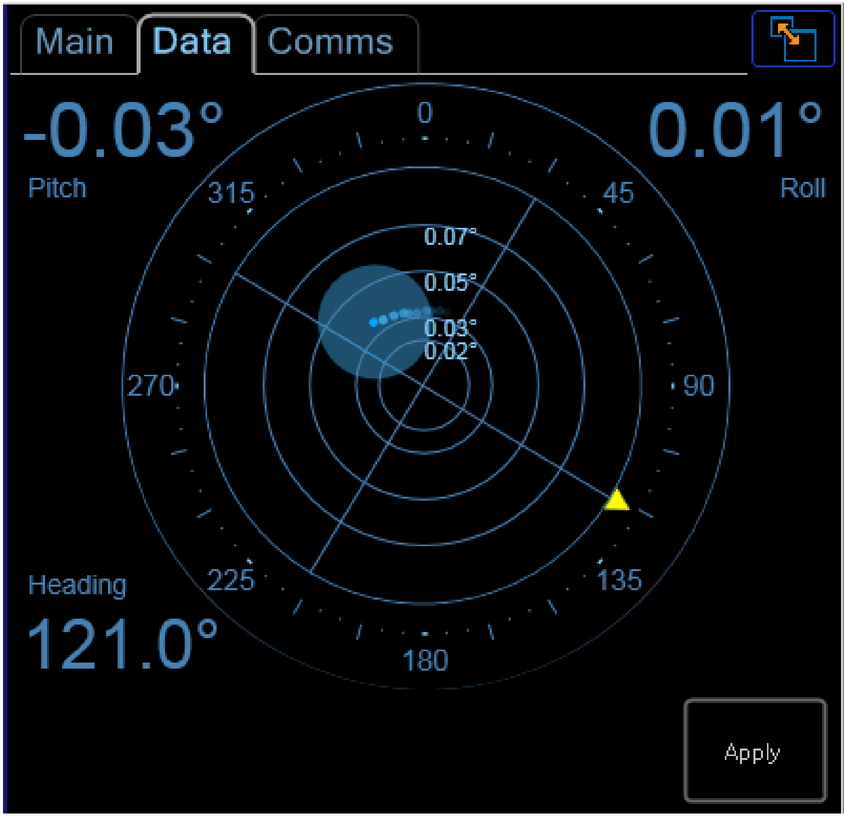
   Note that the Standard Deviation value is an important quality assessment on this and on the Gyrocompass settings (section 3.13). The software uses this information to rank multiple instruments of the same type so that instruments providing a higher quality solution (that is, with a lower standard deviation) are more highly weighted.

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

   If necessary, select the **Comms** tab and set the Baud Rate, Data Bits, Parity and Stop Bits to match the communication parameters used by the VRU.

Data tab

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

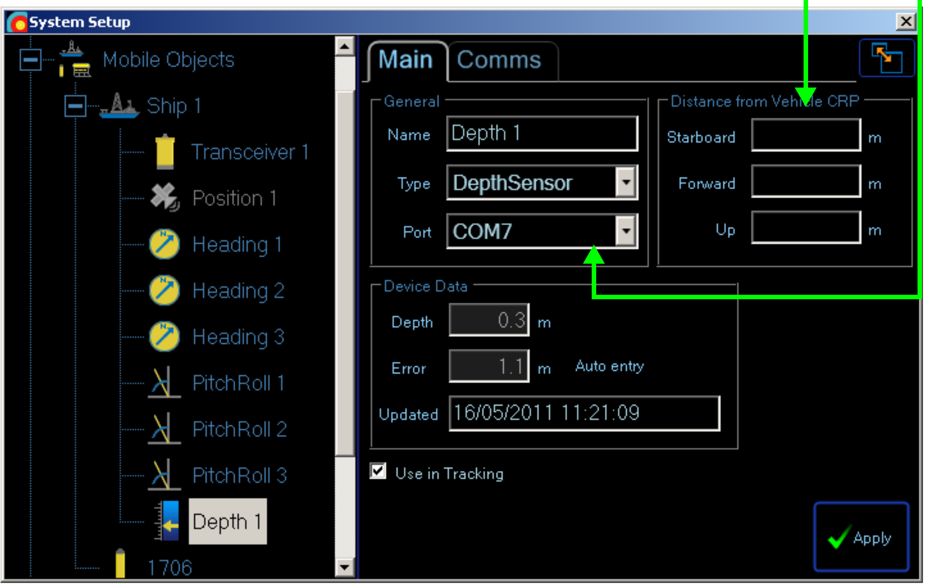


4. If necessary, select the **Comms** tab and set the Baud Rate, Data Bits, Parity and Stop Bits to match the communication parameters used by the VRU.

3.12 How to Configure a Depth Device

1. Choose **System** > **Setup…** to display the **System Setup** window if it is not already displayed.

2. Select the Depth device in the job tree to display the **Main** properties tab for the sensor and follow the callout instructions below:
   a. Select the port used for communication.
   b. Enter the location relative to the vehicle's CRP.
   c. Click **Apply**.



   d. Confirm the depth value is being updated in the **Device Data** fields.
   e. If necessary, select the Comms tab and set the communication parameters used by the depth instrument.

Depth Device Formats

The Depth device supports four standard 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.

3.13 How to Configure a Gyrocompass

Main properties

1. Choose **System** > **Setup…** to display the **System Setup** window if it is not already displayed.

2. Select the gyrocompass in the job tree to display the **Main** properties tab for the gyrocompass, and follow the callout instructions below:

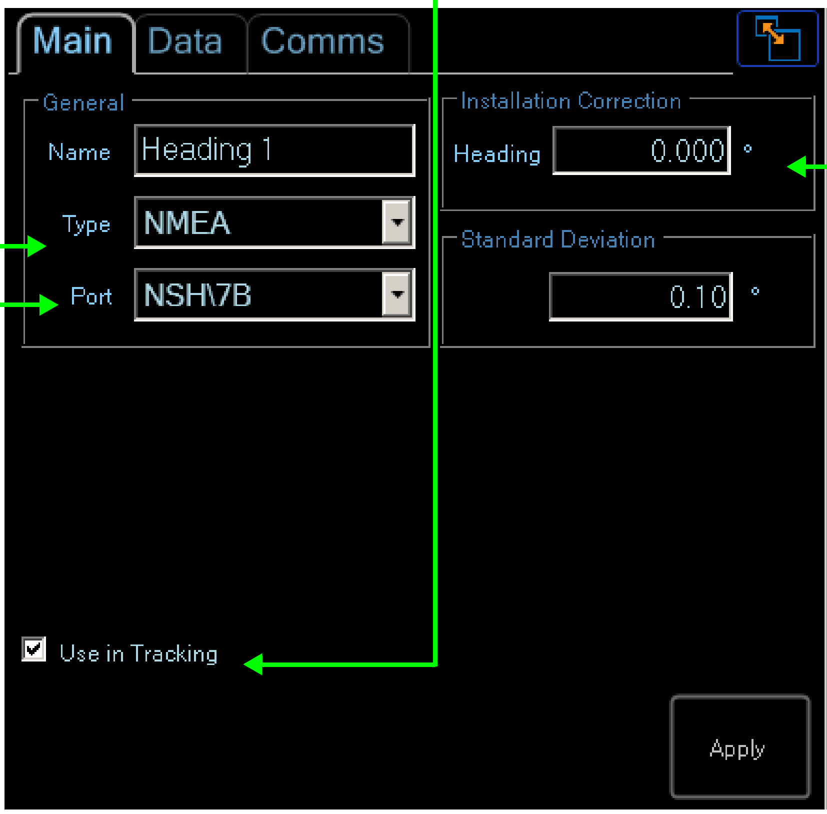
   a. Select the type of data string supplied by the gyrocompass.

   b. Select the port used to receive gyrocompass communications.

   c. Enter the Heading correction angle necessary to align the gyrocompass reference frame with the vessel's reference frame.

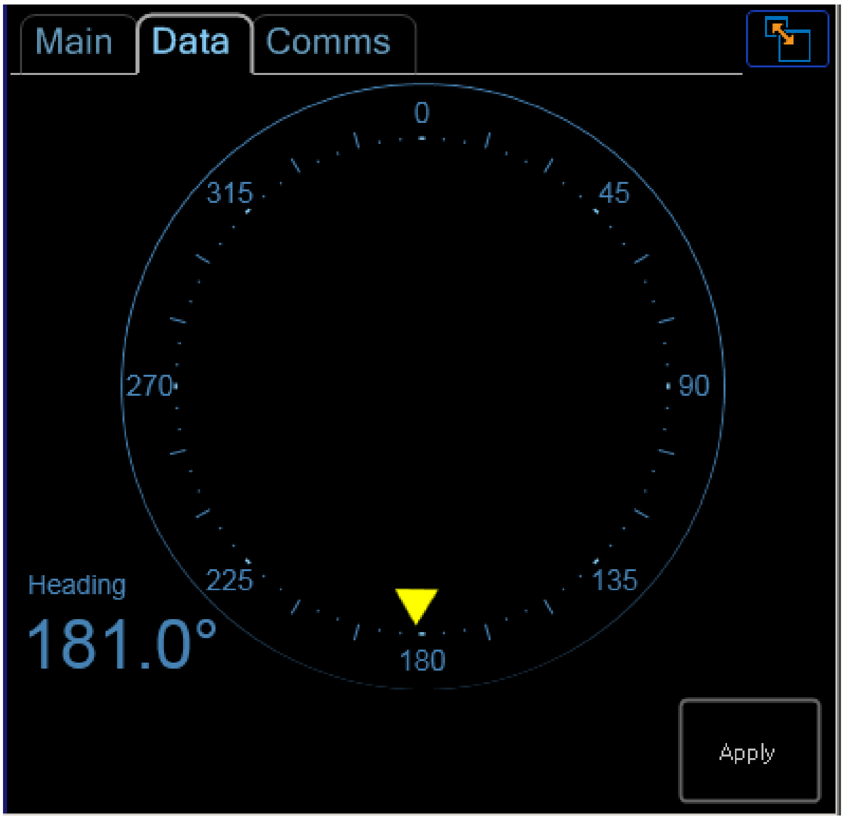
   d. Select the **Use in Tracking** check box.

   e. Click **Apply**.



Data tab

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



4. If necessary, select the **Comms** tab and set the Baud Rate, Data Bits, Parity and Stop Bits to match the communication parameters used by the gyro.

3.14 How to Configure a Lodestar GyroUSBL Device

The Lodestar GyroUSBL device is available in 5-element and 7-element versions. See the detail drawings in “GyroUSBL” on page 141.

The configuration procedure is the same for both types.

Main properties

1. Choose **System** > **Setup...** to display the **System Setup** window if it is not already displayed.

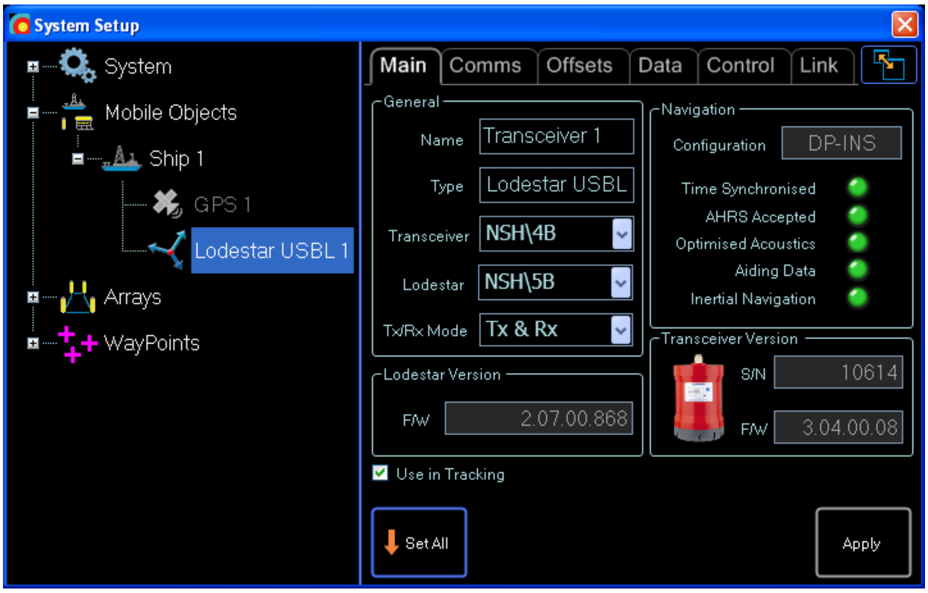
2. Select Lodestar USBL in the job tree to display its **Main** properties tab, and follow the callout instructions below:

   a. Type a name for the Lodestar, if necessary.

   b. Enter the Transceiver and Lodestar connections to use.

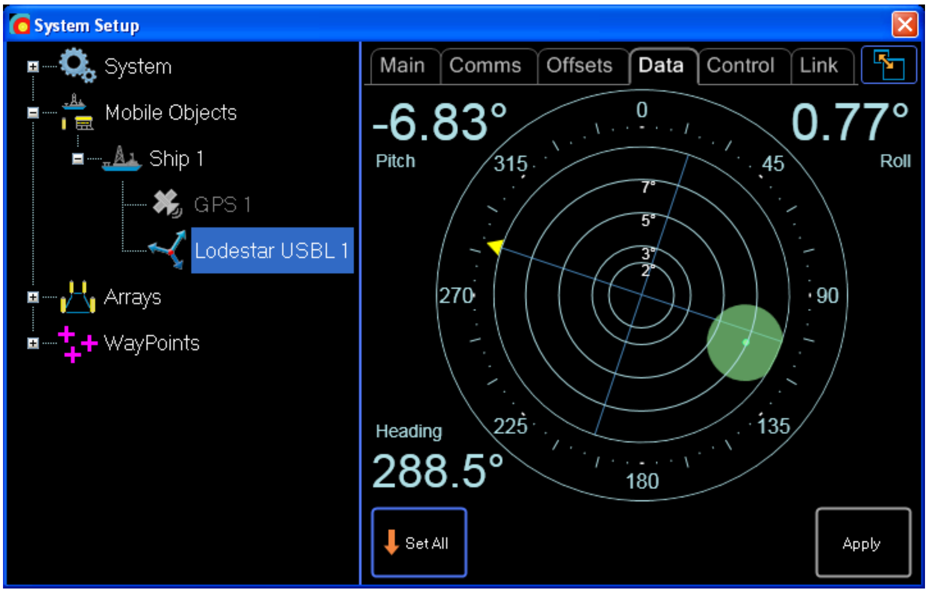
   c. Select the **Use in Tracking** check box.

   d. Click **Apply**.



Data tab

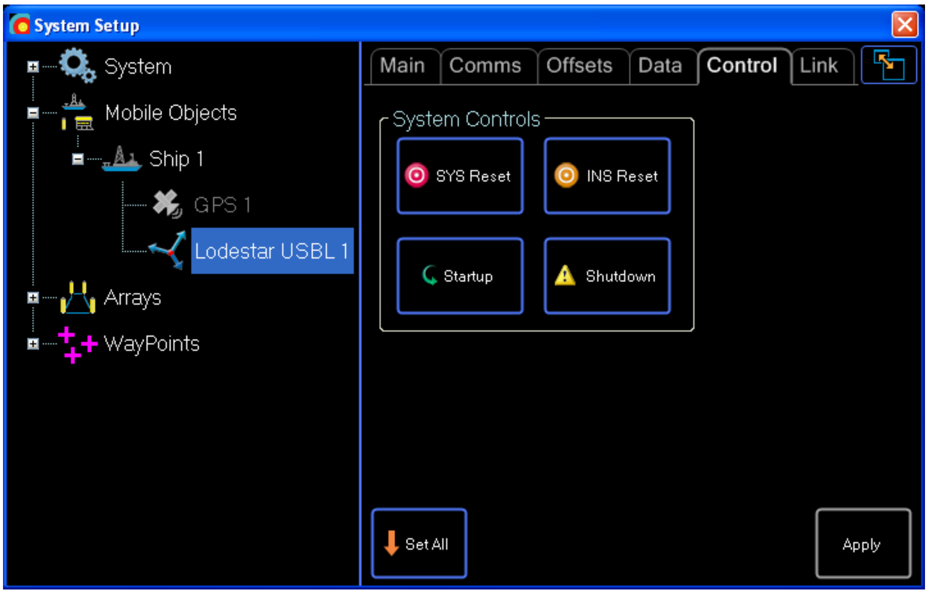
3. Select the **Data** tab and confirm the attitude measurements are displayed.



Control tab

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

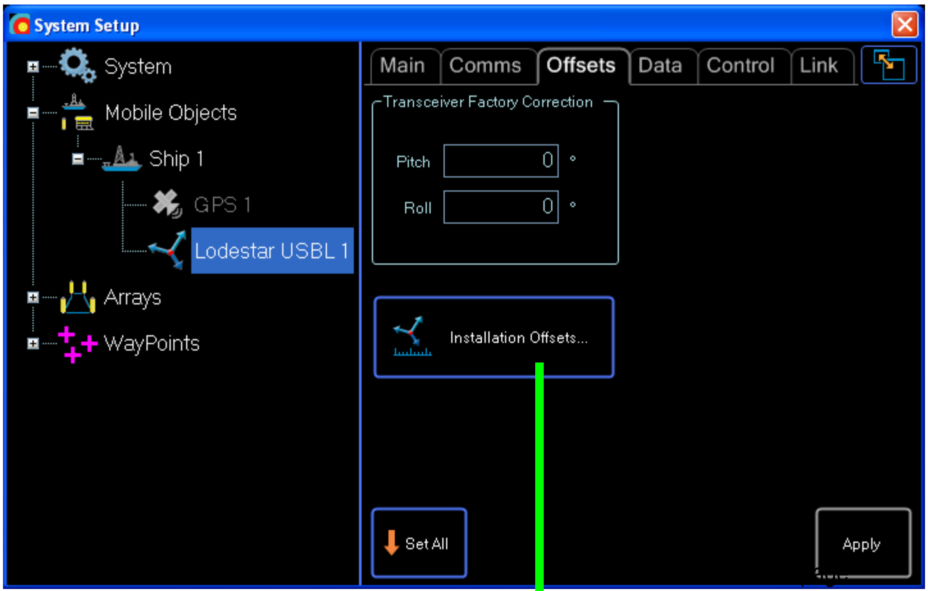
Risk of equipment malfunction. Only qualified and experienced users should use the **Control** tab.



Offsets tab

5. Select the **Offsets** tab and click **Installation Offsets…** to enter the offset distances between the Lodestar and the vehicle. The misalignment angles are computed automatically using the Attitude/Heading Calibration tool and the CASIUS tool. Refer to Chapter 5 for details.

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



is shown below

Overview

This procedure is intended to deal with Optimised USBL using GyroUSBL 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** page illustrates the relationship between the offsets that the page 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 page 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.

XYZ Offsets

The **XYZ Offsets** region at the top of the page displays the 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.

Orientation Offsets

The **Orientation Offsets** region at the bottom of the page operates in a similar way to the orientation 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 page automatically.

When first commissioning a GyroUSBL 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 LS 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.

Template

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

3.15 How to Configure System Devices

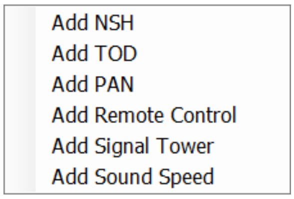
System devices are:

- ❑ the Network Sensor Hub (NSH).
- ❑ the Time of Day (TOD) source.
- ❑ the PAN device.
- ❑ the Remote Control device.
- ❑ the Sound Speed Sensor.

These devices are all grouped in the job tree under System.

1. Choose **System** > **Setup…** to display the **System Setup** window if it is not already displayed.

2. Right-click on **System** and select the preferred device type.



Network Sensor Hub (NSH)

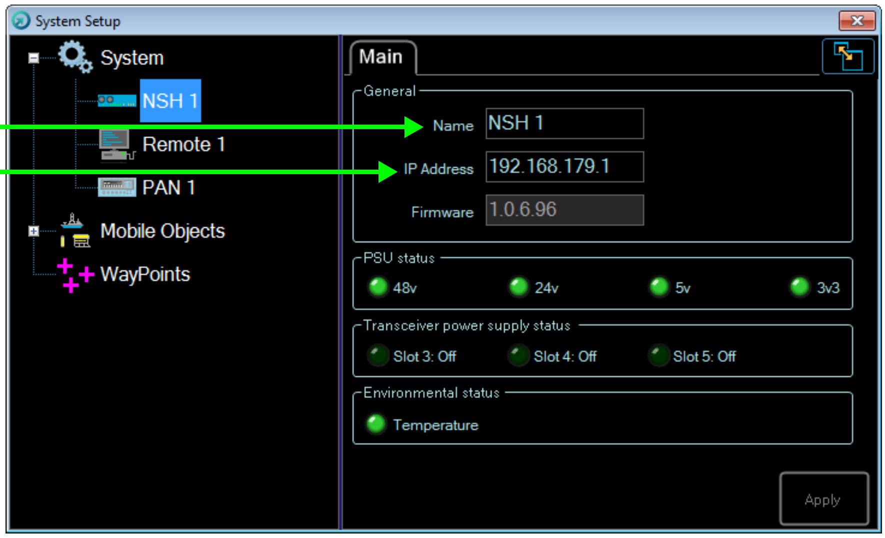
To configure the NSH main properties:

1. Choose **System** > **Setup...** to display the **System Setup** window if it is not already displayed.

2. Select the Navigation Sensor Hub (NSH) in the job tree to display its **Main** properties tab, and follow the callout instructions below:

   a. Type a name for the NSH, if necessary.

   b. Enter the connection details to use for communications between the PC and the NSH.



   c. Click **Apply**.

   The software indicates a good 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.

Time of Day (TOD) Source

The TOD device allows the software to precisely synchronise the NSH clock with an external time source, typically provided by a GPS set. UTC and ZDA time strings are supported. Refer to Appendix L beginning on page 379 for a description of the software time system.

Main properties

1. Choose **System** > **Setup...** to display the **System Setup** window if it is not already displayed, and add a Time of Day (TOD) if one is not already present.

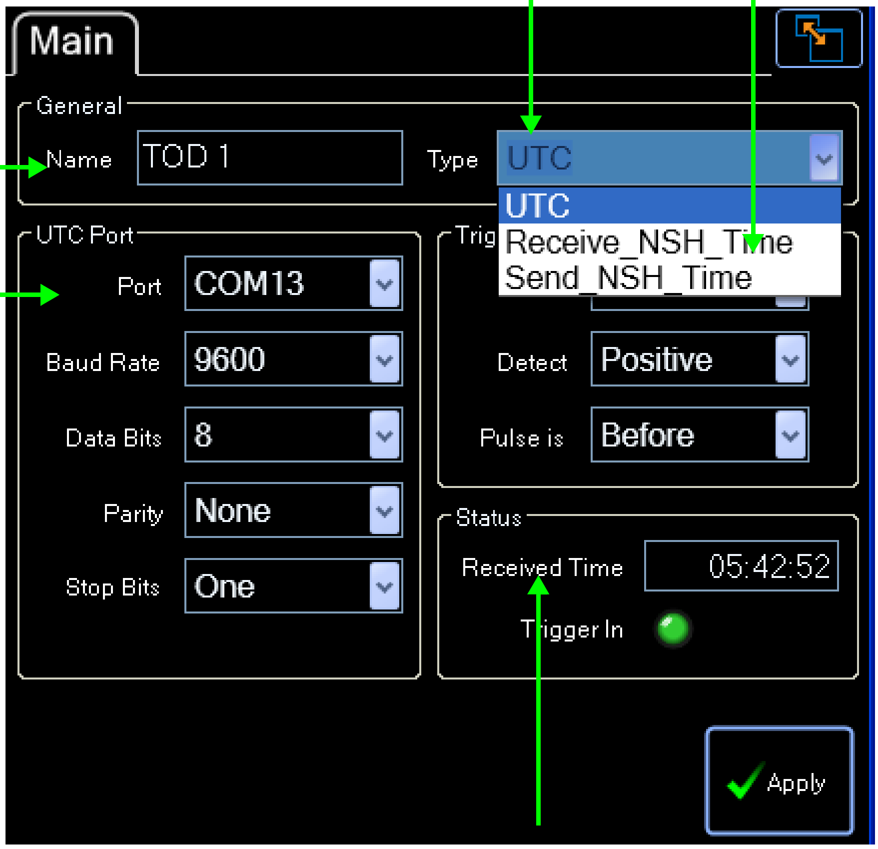
2. Select the Time of Day (TOD) source in the job tree to display its **Main** properties tab, and follow the callout instructions below:

a. Enter a name for and the TOD source, if necessary.

b. Enter the communication details to use for connection between the NSH and the TOD source.

c. Enter the NSH trigger port and the PPS triggering details for the TOD source. Refer to the TOD source documentation if necessary.

d. Select Type:
• UTC for standard time input from GPS set
• Receive_NSH_Time to receive time from another NSH
• Send_NSH_Time to send time to another NSH



e. Confirm the time details are shown correctly, and that the **Trigger In** indicator is flashing.

Note that there is no **Received Time** or **Trigger In** indicator when the TOD device is configured to **Send_NSH_Time**.

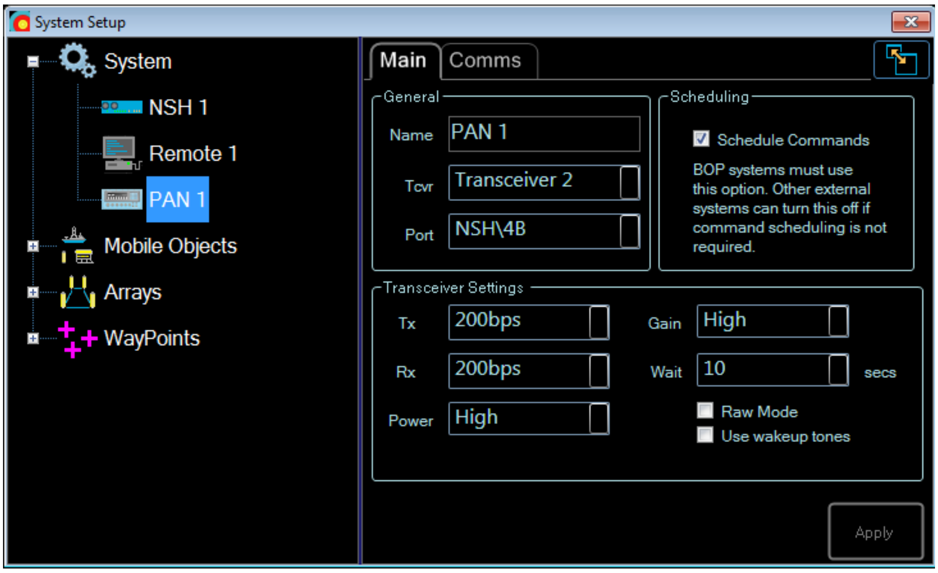
PAN To configure the PAN main properties:

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. Add **PAN**.

2. Select the PAN surface acoustic transceiver in the job tree to display its **Main** properties tab, and follow the callout instructions below:
   a. Enter a name for the PAN device, if necessary.
   b. Select the Transceiver to use.
   c. Enter the communication port to use for connection between the external client computer and the PAN device.
   d. Select the Transceiver settings for telemetry scheme, transmit power, receive gain, and wait time to be used.
   e. Select the **Raw Mode** check box if the external client application needs to take full control of the Transceiver.
   f. Select the **Use wakeup tones** check box if dealing with Sonardyne Compatt beacons with long activity timeouts.
   g. For use with Sonardyne integrated BOP control systems, select the **Schedule Commands** check box, otherwise leave it deselected.
   h. Click **Apply**.
   i. Use the **Comms Viewer** to confirm the PAN communications are correctly sent and received.
   j. If necessary, select the PAN Comms tab and set the communication parameters as required.



Remote Control Interface The Remote Control interface allows an External System to control and monitor the system. Typical uses for the Remote Control interface include:

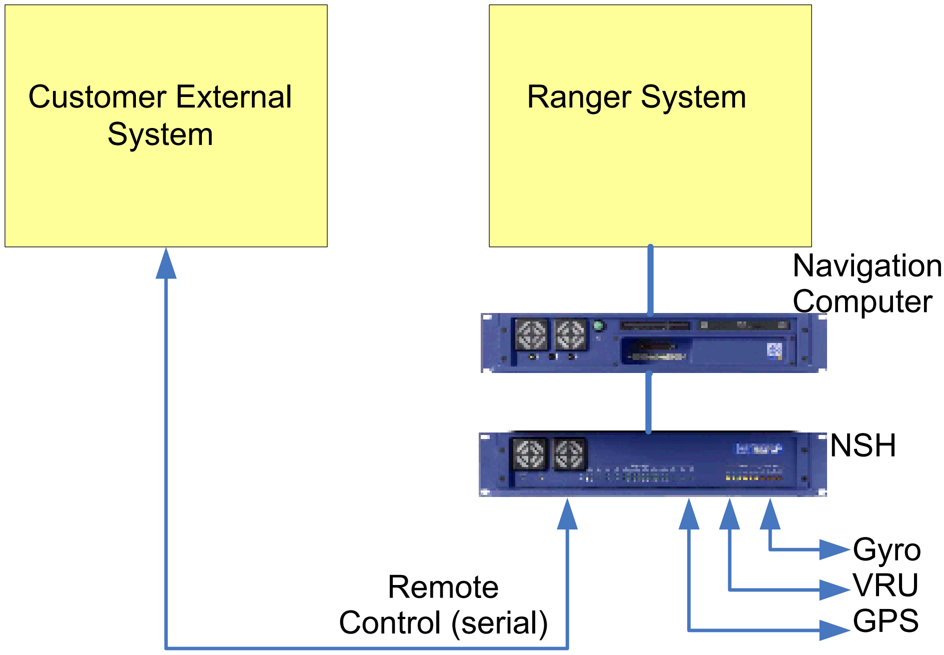
- ❑ Starting or stopping acoustic tracking.
- ❑ Interrogating the system status.
- ❑ Controlling depth aiding.

Hardware interface

The remote control link consists of either:

- ❑ an RS232 or RS485 connection from an external system to either the Navigation Computer or to its attached NSH, or
- ❑ a UDP connection through Ethernet to the Navigation Computer's second port.

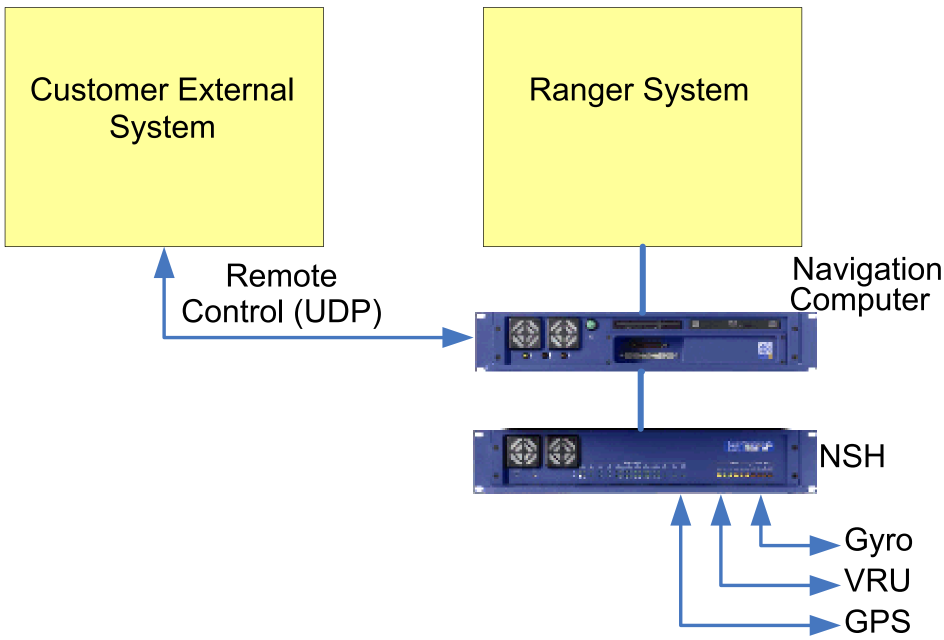
Figure 9 Remote control interface – by serial port



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 10 Remote control interface – by UDP (Ethernet) port



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.

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.

Operation

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

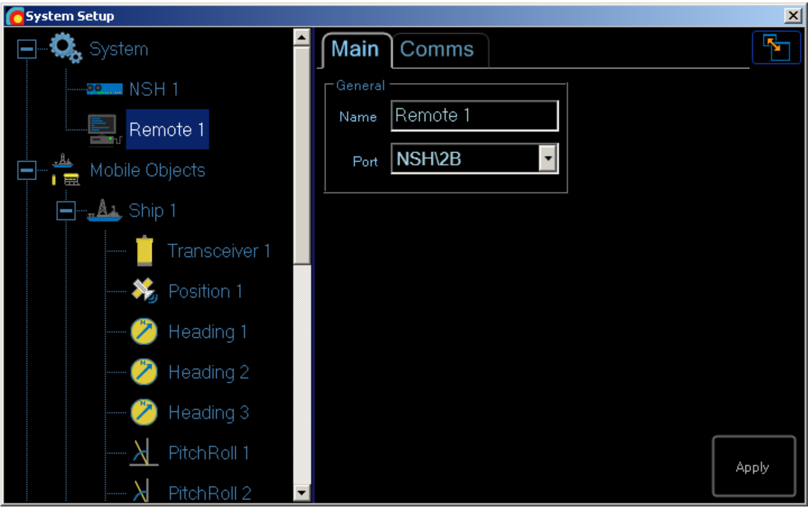
FOR SERIAL CONNECTIONS:

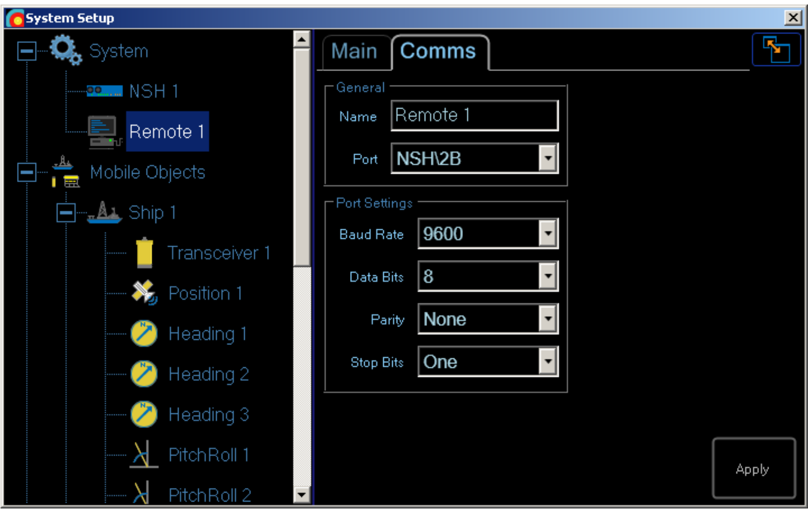
1. Connect an available NSH RS232 or RS485 port (as appropriate) to the external system

2. Use the **System Setup** tool, right-click on the **System** branch of the job tree and select **Add Remote Control**.

3. Set the NSH port to the chosen port and click **Apply**.

4. Select the **Comms** tab and set the Baud rate and other parameters.





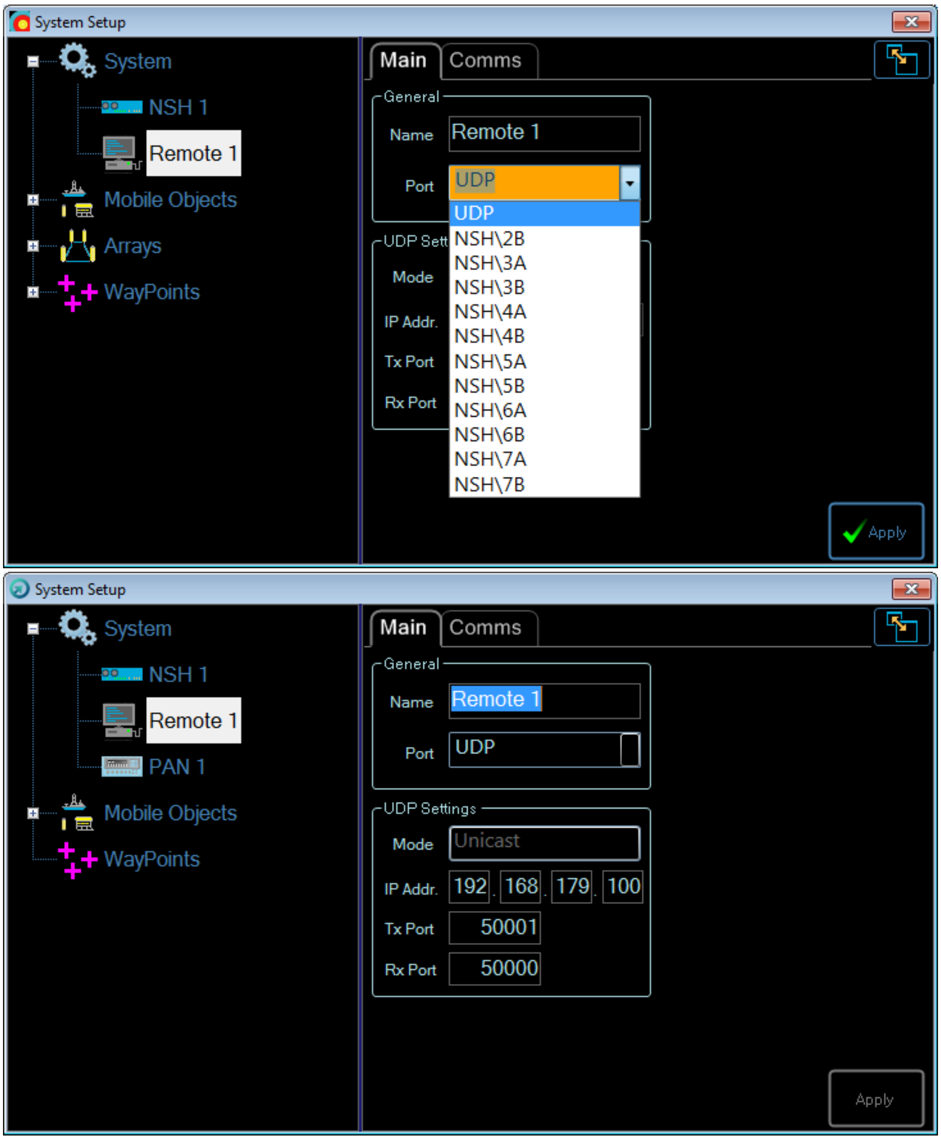
FOR ETHERNET CLIENTS:

1. Connect the external system to the Navigation Computer's second port.

2. Set the **IP Address**, **Tx Port** and **Rx Port** as required to suit the network.

Note

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



FOR ALL CONNECTIONS:

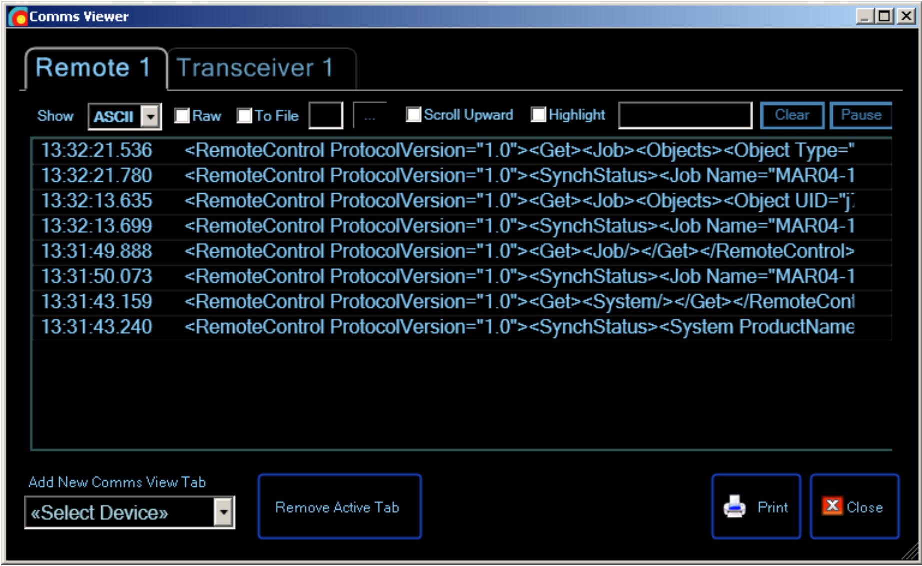
Run the external system's client software and establish communications.

Note

Use the Comms Viewer to view and debug the Remote Control commands and responses:

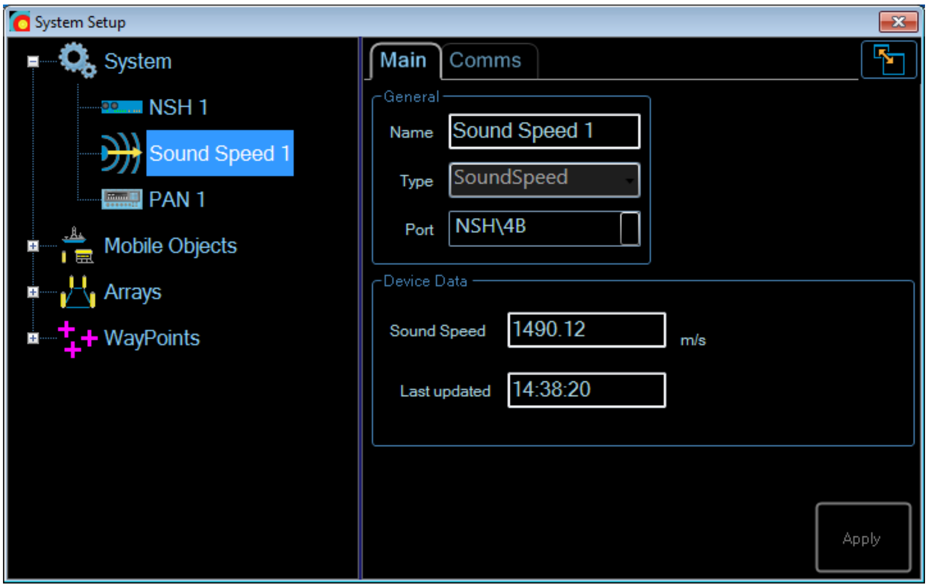
- To get started, use the Sonardyne sample Remote Control application from a Windows PC to prove the basic setup.

Figure 11 Comms Viewer window for the Remote Interface



Sound speed sensor

1. Add **Sound Speed**.
2. Select the **Port** for the device and click **Apply**.
3. Confirm the sound speed value updates in the **Sound Speed** field.
4. If necessary, select the **Comms** tab and set the communication parameters used by the sound speed instrument.



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.

3.16 How to Configure a Waypoint

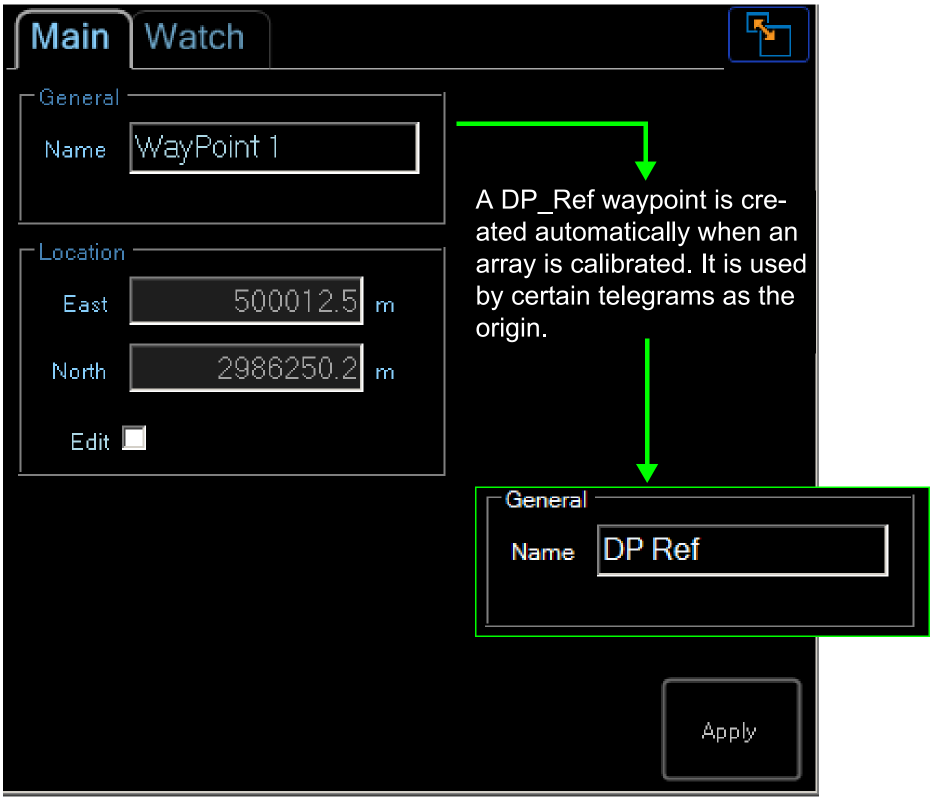
With the system in tracking mode, click the **Add WayPoint to Chart** button on the main screen. Move the cursor on the chart, and click at the location for the new waypoint.

Note

The software must be tracking with GPS before you can add a waypoint.

Waypoint Main properties

The **Main** properties tab shows the current position of the waypoint and allows you to edit the position by changing the Easting and Northing values.

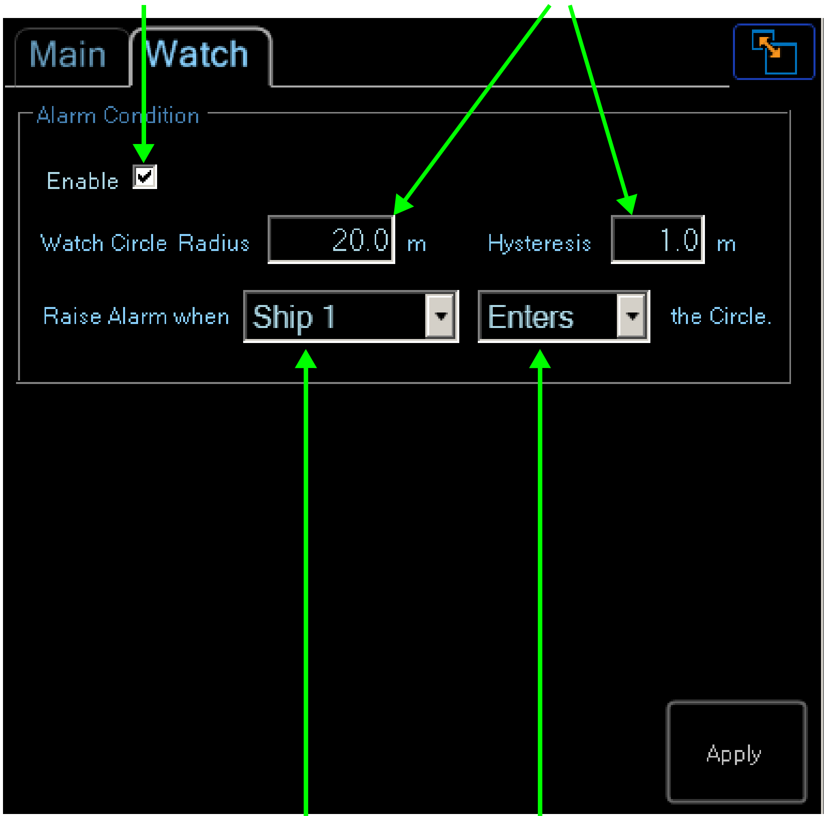


Watch circle

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.

Select the check box to enable the watch circle for the selected waypoint.

Set the radius and hysteresis for the watch circle



Select which target will raise the alarm, and select whether the alarm occurs when that target enters or leaves the watch circle

3.17 How to Configure the Sound Speed

Procedure

1. Choose **Tools > Environmental** to display the **Environmental Settings** dialog and follow the callout instructions below.

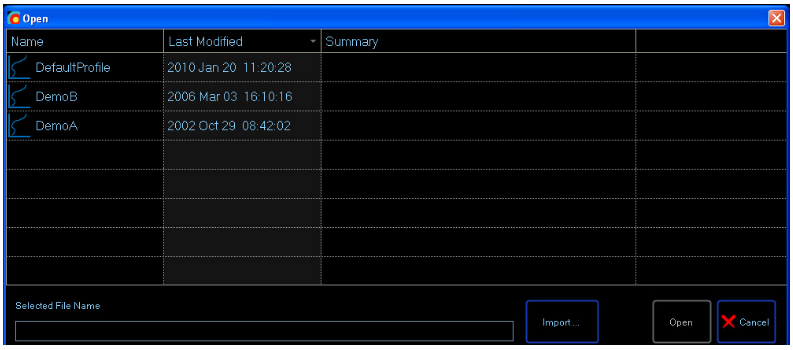
   a. Do one of the following:

   - ❑ Select the Sound Speed Profile option, click **Load…** and follow the instructions below from step **2**, **OR**
   - ❑ Select the option to set and use the mean and surface sound speed values that you enter, **OR**
   - ❑ Select the Sound Speed Sensor (if fitted).

   Note: The **Maximum Range** and **Latitude** settings on this dialog is not connected with sound speed.

   - ❑ **Maximum Range** is the maximum range from which the system can accept acoustic signals.
   - ❑ **Latitude** is the approximate current latitude, used for pressure sensor-to-depth calculations. This can be set automatically if a GPS sensor is available. Select the **GPS** check box to use this option.

2. Click **Load…** on the **Environmental Settings** dialog and select the correct profile from those displayed.



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

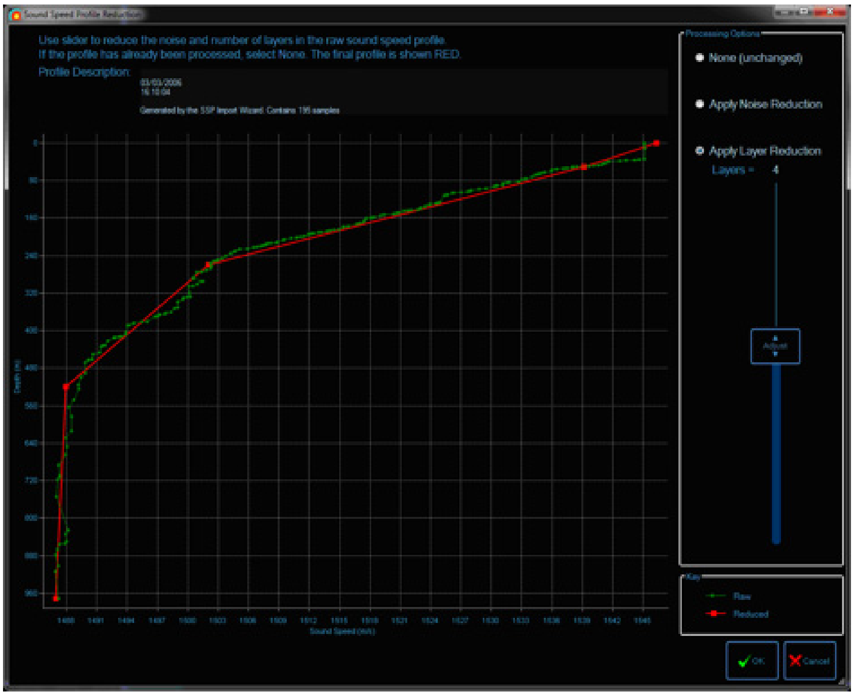
DepthValue	SpeedValue	SalinityValue	TemperatureValue
DepthValue	SpeedValue	SalinityValue	TemperatureValue
DepthValue	SpeedValue	SalinityValue	TemperatureValue

…

3. After you select the profile you wish to load, 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:

(i). 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).

(ii). 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.

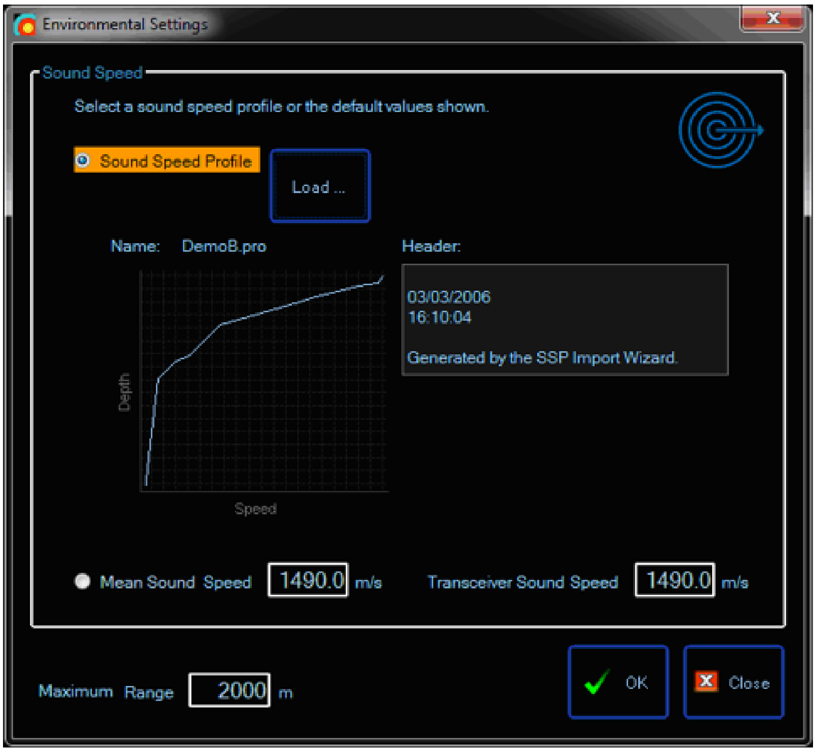
Use this option if you want to retain all the points in the original data, but want to eliminate noisy outliers.

(iii). 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 return to the **Environmental Settings** dialog.



The **Sound Speed Profile** button will have been highlighted in orange and the thumbnail graph updated.

Note

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

3.18 How to Configure 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 6 lists the available telegram types, and gives basic choices of trackable targets, reference frames, and so on.

Table 6 Position output telegrams

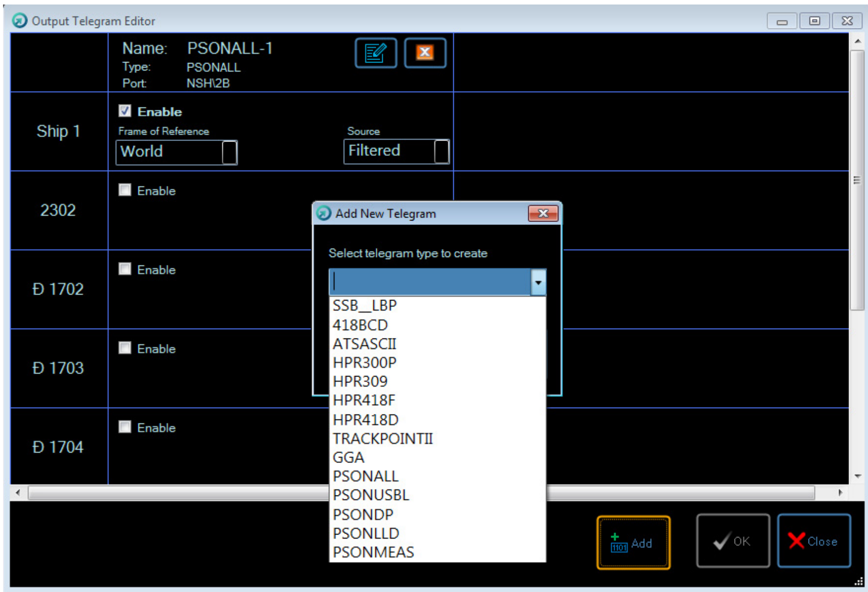
<table>
<tr><th rowspan="2">Telegram</th><th rowspan="2">Object</th><th rowspan="2">Valid Indexes</th><th rowspan="2">DR support</th><th rowspan="2">Simulation Flag support</th><th colspan="3">Telegram Output with respect to the CRP of:</th><th rowspan="2">Default Comms Settings</th><th rowspan="2">Supports user-assignable Mobile / Fixe Transponder Flag</th><th rowspan="2">Comments</th></tr>
<tr><th>Valid Frames of Reference</th><th>Valid Frame of Ref Orientations</th><th>Valid Data Sources</th></tr>
<tr><td rowspan="2">HPR 309</td><td>Transponder</td><td>1-16</td><td rowspan="2">STATUS (byte 17) BIT1=0 for MASTER else BIT1=1</td><td rowspan="2">Yes</td><td rowspan="2">SHIP/RIG</td><td rowspan="2">NorthUp
BowUp</td><td rowspan="2">Filtered
Raw</td><td rowspan="2">2400
7-O-2</td><td>Yes</td><td>All positions are sent in ship reference frame. Telegram supports north, or bows up. Can include MRAMS data in telegram.</td></tr>
<tr><td>Vehicle</td><td>1-16</td><td>No</td><td>Vessel position is sent by reporting position of DP_REF waypoint with respect to the ship.</td></tr>
<tr><td rowspan="3">HPR 400 (418D,F)</td><td>Transponder</td><td>B0 1-99
(see comment)</td><td rowspan="3">No</td><td rowspan="3">Yes</td><td>SHIP/RIG</td><td>NorthUp
BowUp</td><td rowspan="3">Filtered
Raw</td><td rowspan="3">9600
8-N-1</td><td>Yes</td><td>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.</td></tr>
<tr><td rowspan="2">Vehicle</td><td rowspan="2">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</td><td>WORLD</td><td>N/A</td><td rowspan="2">No</td><td rowspan="2"></td></tr>
<tr><td>BEACON WAYPOINT</td><td>NorthUp</td></tr>
<tr><td rowspan="2">HPR BCD (418)</td><td>Transponder</td><td>B0 1-99
(see comment)</td><td rowspan="2">STATUS1 (byte2) BIT5=0 and STATUS2 (byte3) BIT7=0 for MASTER else STATUS1 BIT5=1 and STATUS2 BIT7=1</td><td rowspan="2">Yes</td><td>SHIP/RIG</td><td>BowUp</td><td rowspan="2">Filtered
Raw</td><td rowspan="2">9600
8-N-1</td><td>Yes</td><td>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.</td></tr>
<tr><td>Vehicle</td><td>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)</td><td>BEACON WAYPOINT</td><td>NorthUp</td><td>No</td><td>Kongsberg apply an offset of 300 in the sequence telegram to indicate LBL vehicle positions.</td></tr>
<tr><td rowspan="4">NMEA</td><td rowspan="2">Transponder (SSB)</td><td rowspan="2">B01 to B99</td><td rowspan="4">No</td><td rowspan="4">Yes</td><td>WORLD</td><td>N/A</td><td rowspan="4">Filtered
Raw</td><td rowspan="4">4800
8-N-1</td><td rowspan="2">No</td><td rowspan="2">Can carry MRAMS data.</td></tr>
<tr><td>SHIP/RIG</td><td>NorthUp
BowUp</td></tr>
<tr><td rowspan="2">Vehicle (LBP)</td><td rowspan="2">Ve or R1 to R4</td><td>WORLD</td><td>N/A</td><td rowspan="2">No</td><td rowspan="2">-</td></tr>
<tr><td>BEACON WAYPOINT</td><td>NorthUp</td></tr>
</table>

Table 6 Position output telegrams (Continued)

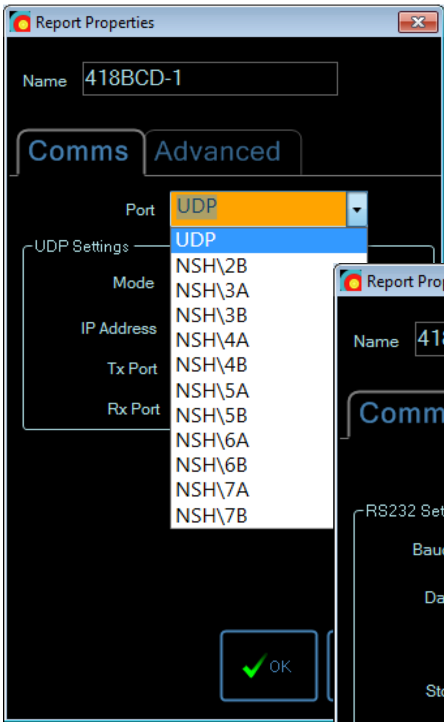
Telegram	Object	Valid Indexes	DR support	Simulation Flag support	Telegram Output with respect to the CRP of:			Default Comms Settings	Supports user-assignable Mobile / Fixe Transponder Flag	Comments
					Valid Frames of Reference	Valid Frame of Ref Orientations	Valid Data Sources			
ATS ASCII	Transponder	1 to 10	No	No	SHIP/RIG	BowUp	Filtered Raw	9600 8-N-1	No	-
	Vehicle	0 = The Vehicle			WORLD	N/A			No	-
					BEACON WAYPOINT	NorthUp				
GGA	Transponder	0-255	No	No	WORLD	N/A	Filtered Raw INS	4800 8-N-1	No	WGS 84 latitude and longitude coordinates
	Vehicle	0-255			WORLD	N/A			No	WGS 84 latitude and longitude coordinates
HPR 300P	Transponder	1 to 99	No	Implied	SHIP/RIG	NorthUp BowUp	Filtered Raw	4800 7-O-2	No	Very rarely used.
	Vehicle	-	-	-	-	-	-		-	Not supported
Trackpoint II	Transponder	1 to 9. 0 is Simulating	No	Yes	SHIP/RIG	NorthUp BowUp	Filtered Raw	9600 8-N-1	No	Very rarely used.
	Vehicle	-	-	-	-	-	-		-	Not supported
PSONALL	Transponder	Uses name of vehicle / offset (or some other meaningful string)	No	No	WORLD	N/A	Filtered Raw INS	9600 8-N-1	No	-
					BEACON WAYPOINT	NorthUp				
					SHIP/RIG	NorthUp BowUp				
	Vehicle	Uses name of vehicle / offset (or some other meaningful string)			WORLD	N/A			No	-
					BEACON WAYPOINT	NorthUp				
PSONUSBL	Transponder	1 to 999	No	No	SHIP/RIG	NorthUp BowUp	Filtered Raw INS	9600 8-N-1	No	-
	Vehicle	-	-	-	-	-	-	-	-	Not supported
PSONDP	Transponder	-	-	-	-	-	-	-	-	Not supported
	Vehicle	1 to 9	Yes	Yes	WORLD	N/A	Filtered Raw INS	9600 8-N-1	No	(WGS 84 latitude and longitude coordinates)

Configuration

1. Open the **Output Telegrams Editor** and follow the steps below to configure a telegram.
   a. Click **Add**.
   b. Select the telegram type from the list.
   c. Click **OK**.

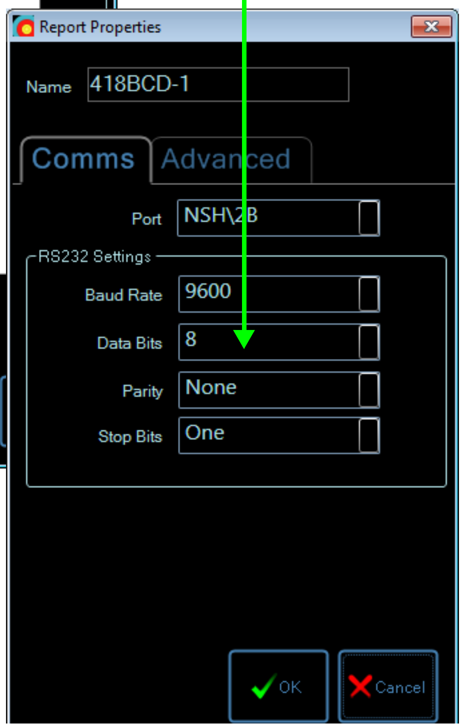


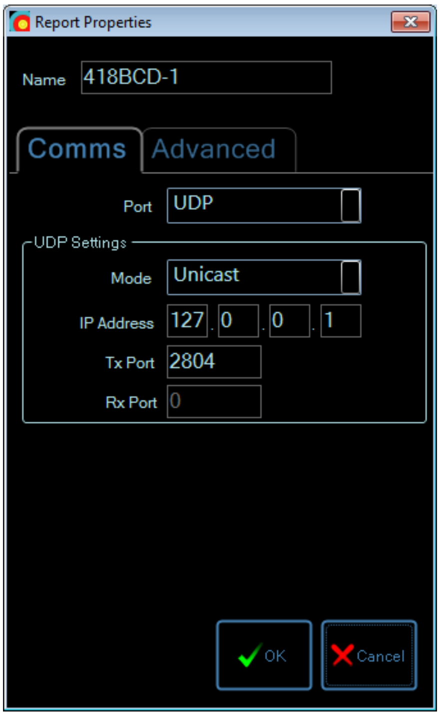
2. Follow the steps below to configure the telegram.



   a. Select the **Communications** tab to set the correct communication parameters.

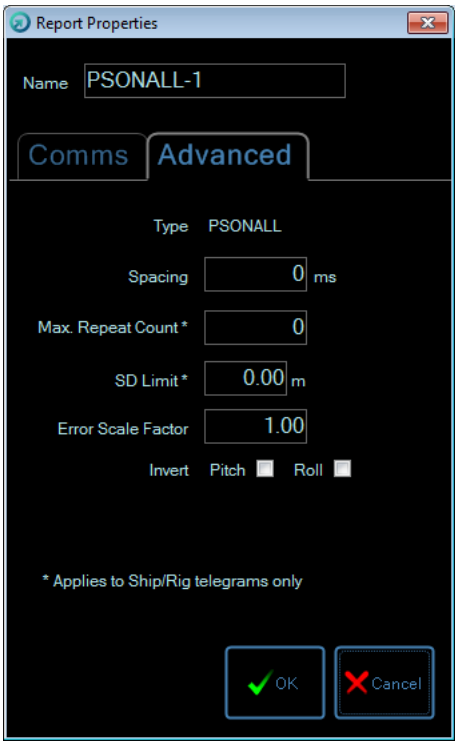
   For a serial connection select the **Serial** port from the drop-down **Port** list and then set the appropriate comms parameters.





For a UDP connection, select **UDP** from the drop-down **Port** list and then set:

- ❑ the Mode: Unicast, Multicast, or Broadcast.
- ❑ the IP address.
- ❑ the Tx and Rx ports.



b. For DP use select the **Advanced** tab and set the following as required:

- ❑ **Spacing**: this is 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.

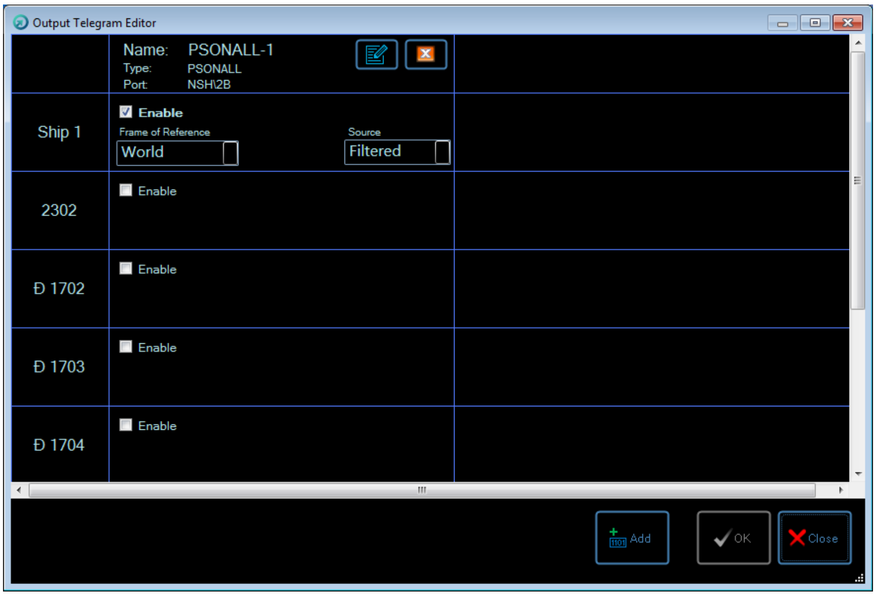
  Some older systems might require a gap between other telegrams to allow processing one telegram before the next arrives. Set this parameter in accordance with the requirements of the system receiving the data.

- ❑ **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.

3.



c. Set the following as required (with reference to Table 6):

- ❑ Ship or specific beacons (as position feeds are required)
- ❑ Reference frame
- ❑ DP index
- ❑ Filtered, raw or INS
- ❑ 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.

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

3.19 How to view 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:

- ❑ on Windows XP:

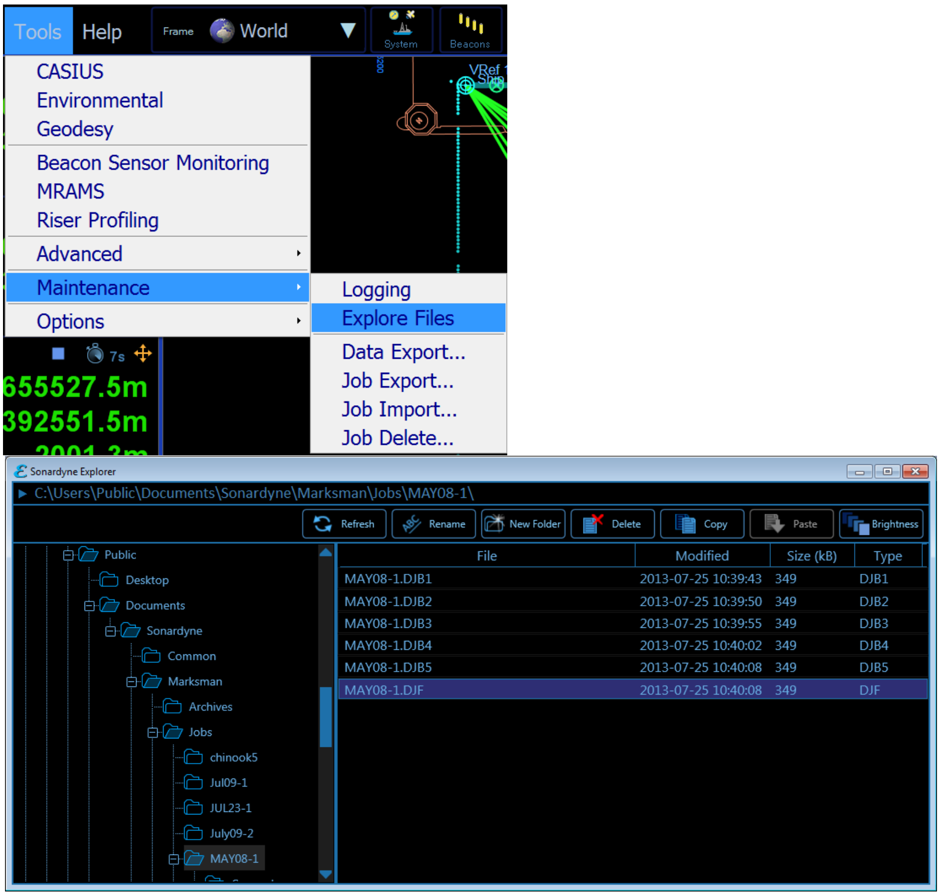
  C:\Documents and Settings\All Users\Documents\Sonardyne\Ranger 2\Jobs\

- ❑ on Windows 7:

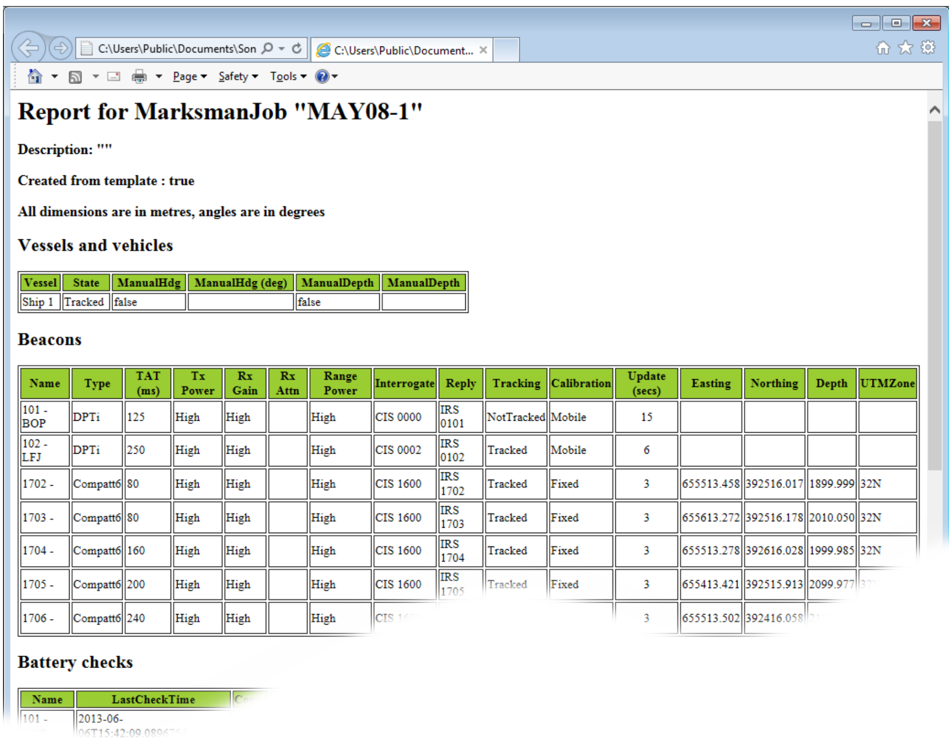
  C:\Users\Public\Documents\Sonardyne\Ranger 2\Jobs\

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

To view a setup (job) file in user-friendly style, use Windows Explorer or the built-in application to navigate to the setup file:



Double-click on the setup .DJF file of interest to launch a simplified view in the default browser. For example:



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 Application Procedures

In this chapter...

This chapter contains the following sections:

4.1 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. Chapter 3 explains and describes these common set-up tasks.

Read Chapter 3 carefully, and make sure you perform ALL the necessary setup tasks **before** you begin to use any of the procedures described in this chapter.

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 dialogs you are using in the software, please refer to Appendix J.

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.
- ❑ The alignment of **each** USBL transceiver has been properly calibrated to the attitude and heading sensors (refer to Appendix D.5 beginning on page 123 for calibration checks).

If any of these prerequisites is not true, resolve it now.

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 dialogs and using the fields and controls on those dialogs.

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

Note

Depending on the way your Navigation 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.

4.2 USBL mobile beacon tracking

Application summary

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

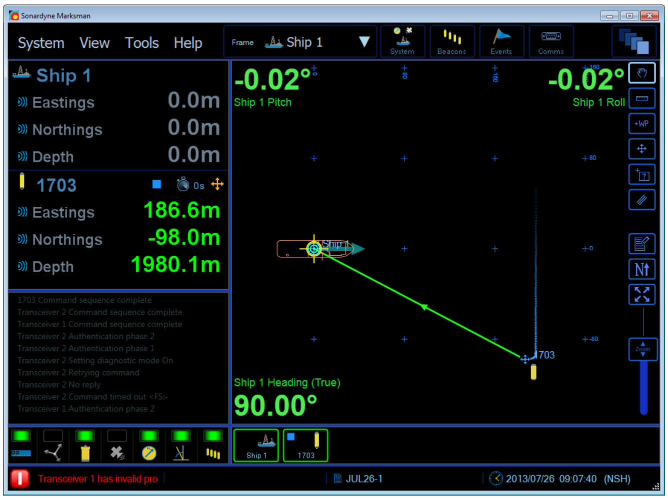
Navigation set-up

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

1. If there is no template, choose **System > Setup…** to display the **System Setup** window and refer to Chapter 3 to add the instruments used in the setup.

Navigate

2. Select the main screen and follow the callout instructions below.



a. Select the Ship frame for vessel-relative tracking.

b. Click to enable the Instruments on the ship for use in tracking.

c. Click to enable beacon tracking.

d. 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 GPS input and shows the beacon position relative to the vessel.

Note

Note that 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.

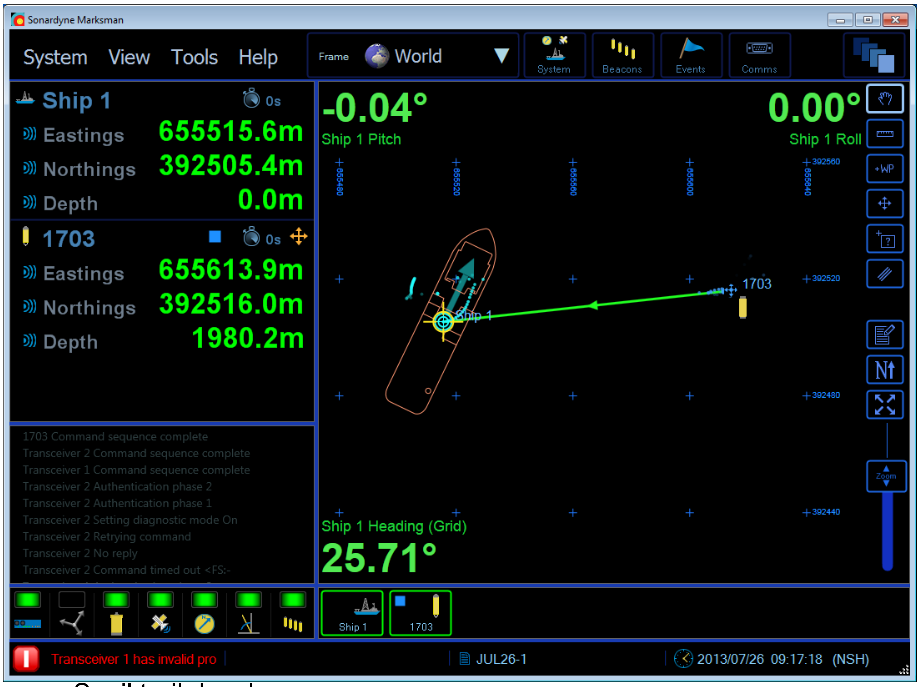
Refer to the description of the main screen in Appendix J.1 beginning on page 259 to set the options for north/bow up, centring or pinning an object on the chart, measuring distances on the chart, zooming the chart, and switching between day and night mode.

GPS input

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

When the system receives input from a GPS receiver, the display shows the vessel and beacon positions using real-world co-ordinates, for example:

In this example, the frame is set to World



Snail trail develops over time

In this operating mode, the tracked targets show a ‘snail trail’ to indicate a history of the target position over the previous 16 updates. This trail fades with time so that the display does not become cluttered.

4.3 ROV tracking

Application summary

You can use the system 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 transponder. To avoid this being a problem, it is recommended to configure beacons on ROVs as responders, and to trigger them electrically.

4.4 Towfish tracking

Application summary

You can use the system 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 GPS 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 GPS to track the vessel allows the system to compensate the towfish measurements for the true velocity of the beacon through the water.

4.5 Simple DP

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.

4.6 Optimised USBL

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 GyroUSBL integrates a USBL transceiver together with a Lodestar AHRS for near-perfect alignment and time-synchronisation.

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

See Chapter 5 "Optimised USBL" for details.

4.7 Multiple systems tracking independently

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 transponder 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 transponder 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 GPS receivers, so there is no connection between the systems. However, it is possible for the systems to share the same GPS, or to use one system to set the time for 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.

Set-up

1. Add a Time of Day (TOD) device to each system that is to be synchronised. See section 3.15 "How to Configure System Devices" beginning on page 64 for instructions 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 "Acoustic Synchronization" on page 328 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 transponder (usually more than 0.4 s).

4.8 Specialist tracking applications

Multiple systems tracking independently

When a vessel has more than one acoustic system running, it is useful to synchronise them so that one system does not transmit signals while another system is attempting to receive.

This is achieved in Sonardyne systems by synchronising timing between the systems using the Acoustic Synchronisation tool. The systems are then set to track at the same rate, but with individual offset times from each other.

The systems generally synchronise independently to UTC time from GPS receivers, so that there is no connection between the systems. However, it is possible to use one system to set the time to the other.

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 it can be restored.

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.

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.

5 Optimised USBL

In this chapter… This chapter contains the following sections:

5.1 Introduction

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

5.2 Installation and Set-up

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 Navigation PC over Ethernet. Make sure there is an Ethernet cable connected between the correct ports on the rear of the Nav PC and the NSH (see section E.3 “Hardware Installation” beginning on page 126 for more details).

- ❑ **GPS**

  A GPS receiver provides position information that is used to calibrate the transponder on the seabed and latitude compensates the Lodestar AHRS. The GPS 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 GPS receiver should be connected to an NSH trigger input.

Installations with separate USBL Transceiver and Lodestar units

Figure 12 Optimised USBL system with separate Lodestar / Tcvr

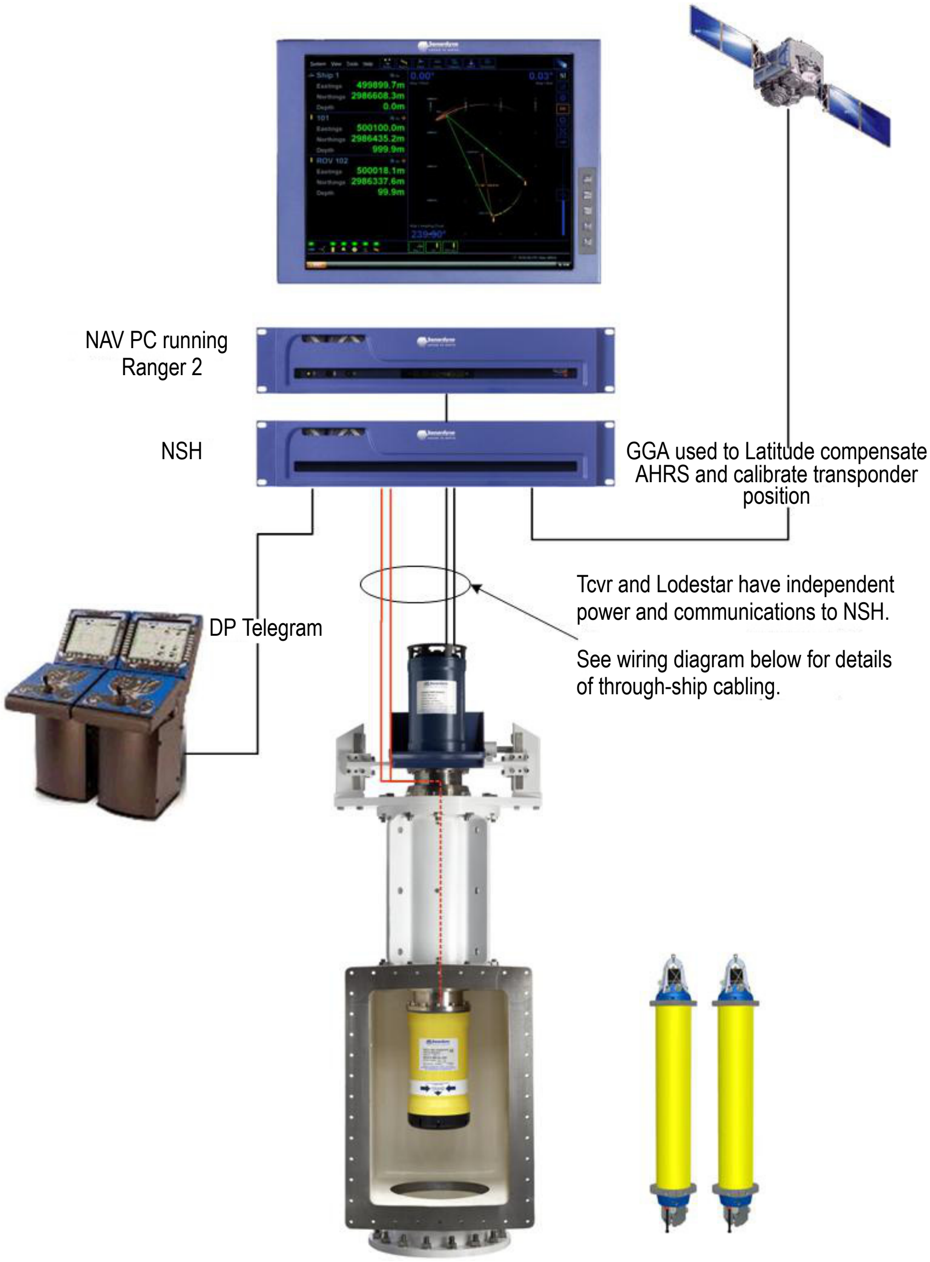


Figure 13 Detail of Lodestar and bracket mounted on a carriage

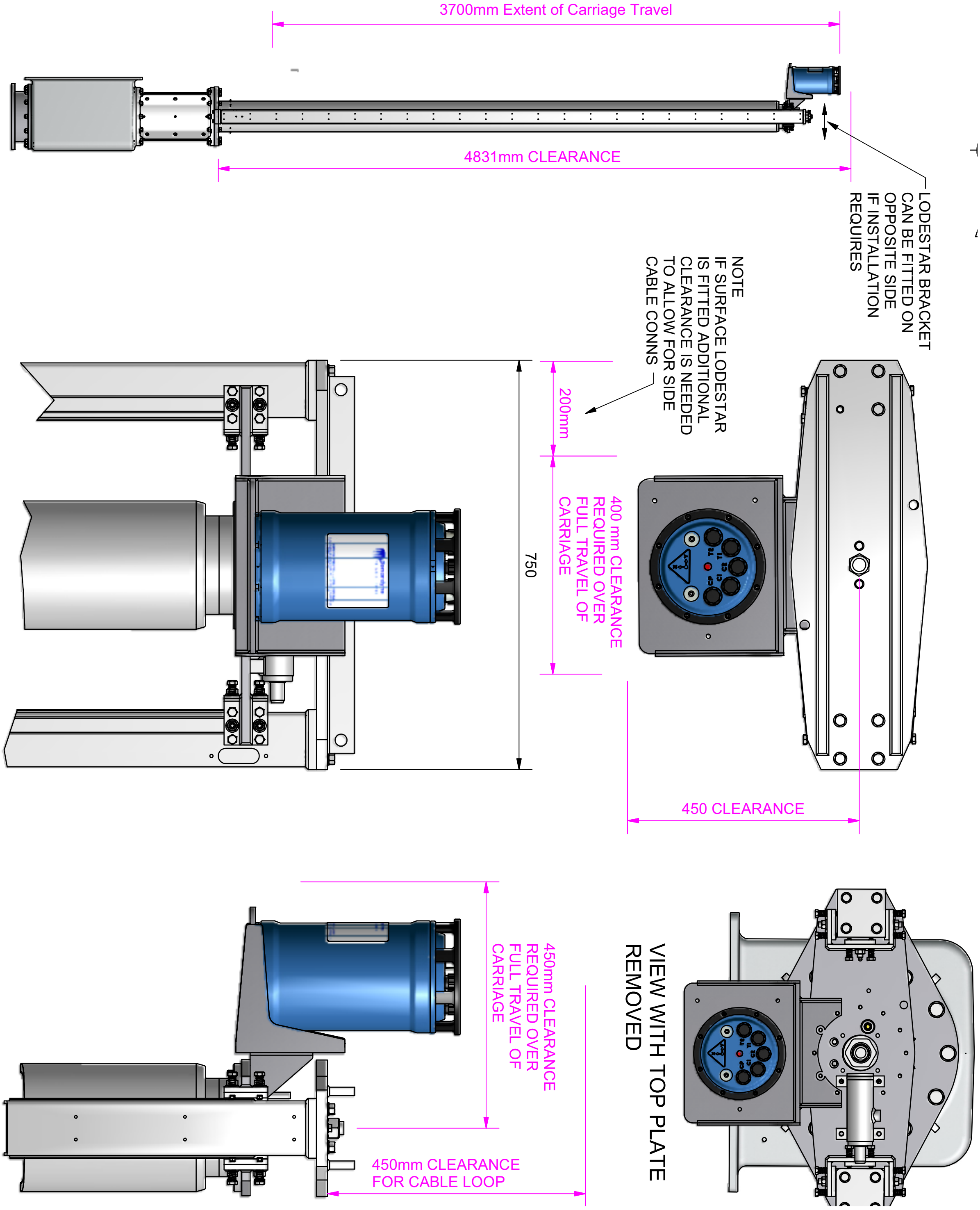
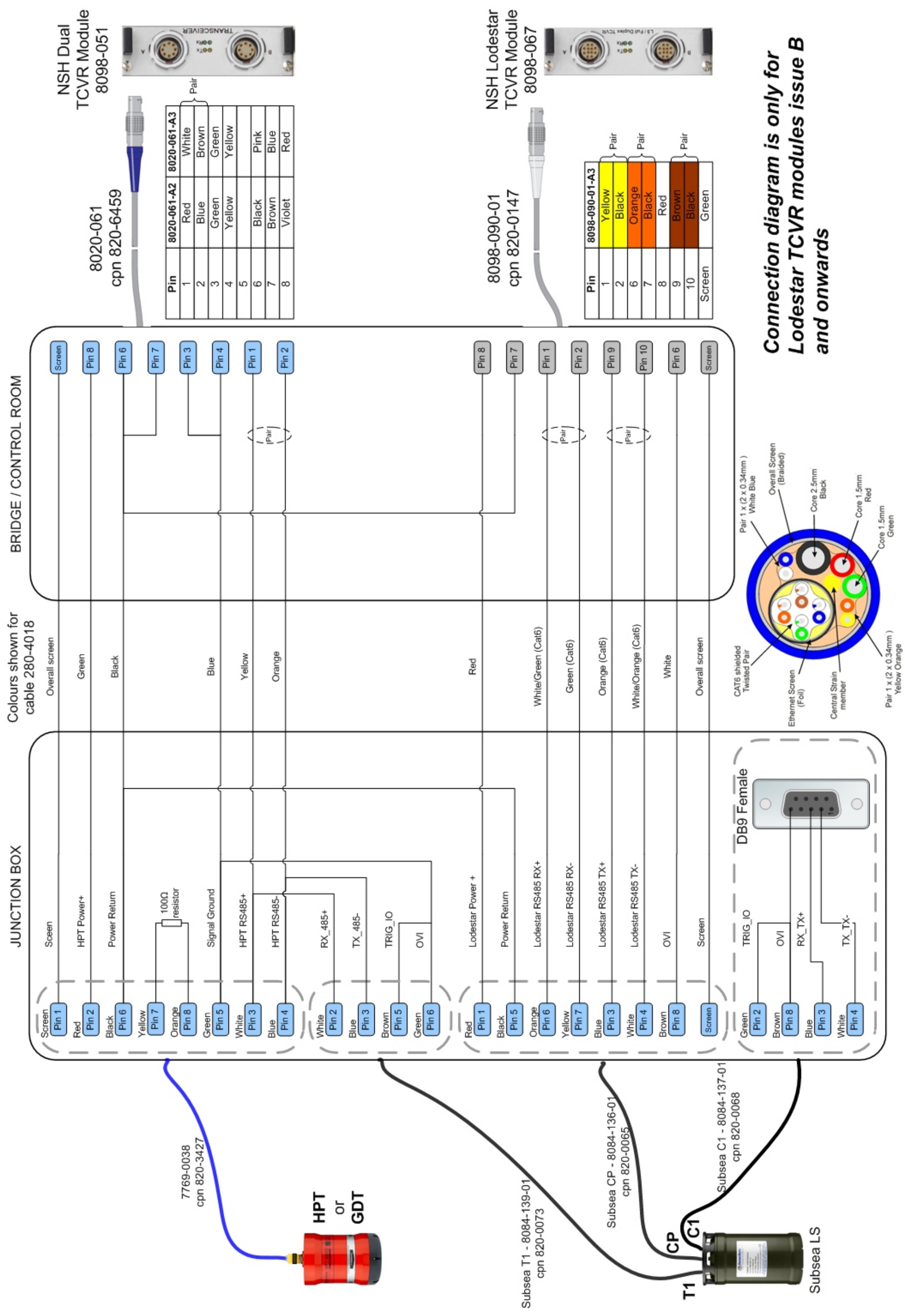


Figure 14 Separate Lodestar / Tcvr wiring diagram



A GDT or HPT 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 F beginning on page 152). 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 system. Lodestar does not send any commands to the transceiver.

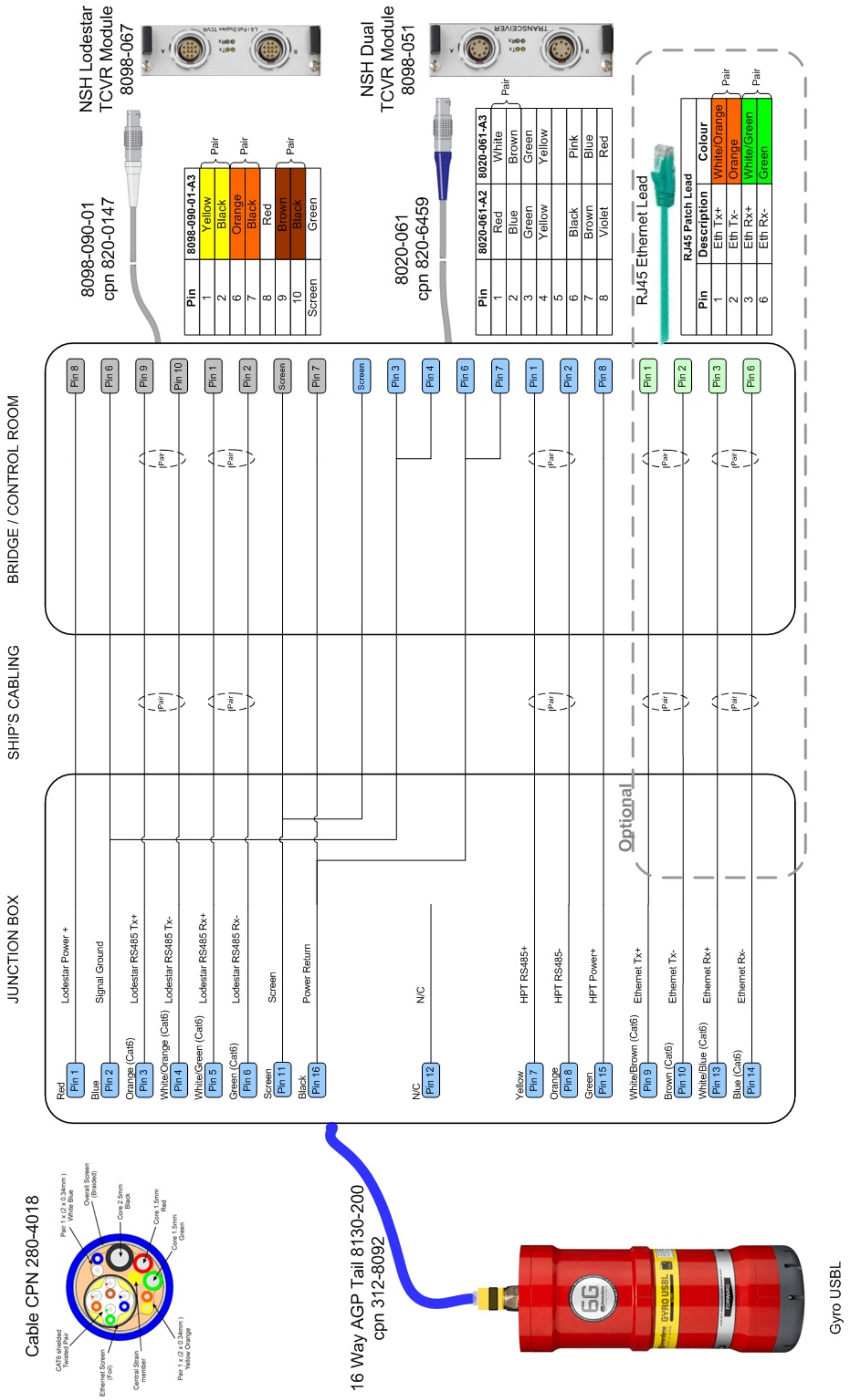
Also note the ‘Cable Detect’ connections that can be seen at the NSH tails on the bridge. These links are very important because they activate RS485 termination. Without termination the RS485 comms will present problems.

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 Appendix F.3 for drawings of cables used in Lodestar installations.

Installations with combined Lodestar GyroUSBL 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 GyroUSBL cable wired as shown in Figure 15.

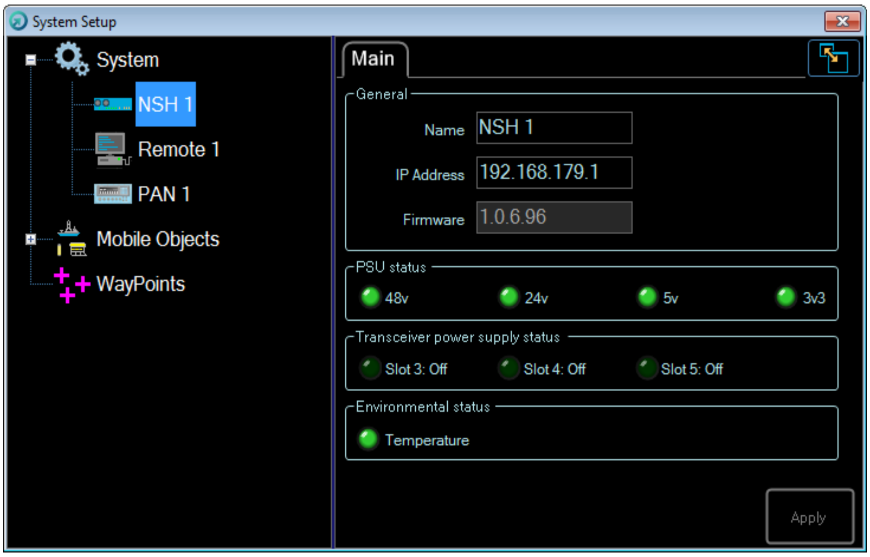
Figure 15 Gyro USBL wiring diagram



5.3 Software Setup

Create the Job and Add the NSH

1. Open the System Setup tool Right-click on the **System** branch of the tree and add an NSH. The software attempts to connect by using the default NSH IP address. If the connection is successful, the **System Setup** dialog shows the Firmware version of the NSH.



2. Right-click on the **System** branch of the setup tree and add a TOD device.

3. Set the **UTC Port** and the **Baud Rate** to match the GPS port.

4. Set the **Trigger** port to the appropriate NSH port for the 1PPS signal.

5. Configure the **Detect** field to match the GPS receiver. Positive means the PPS is valid on the rising edge of the trigger; Negative means the PPS is valid on the falling edge of the trigger.

6. Set the **Pulse is** field correctly.

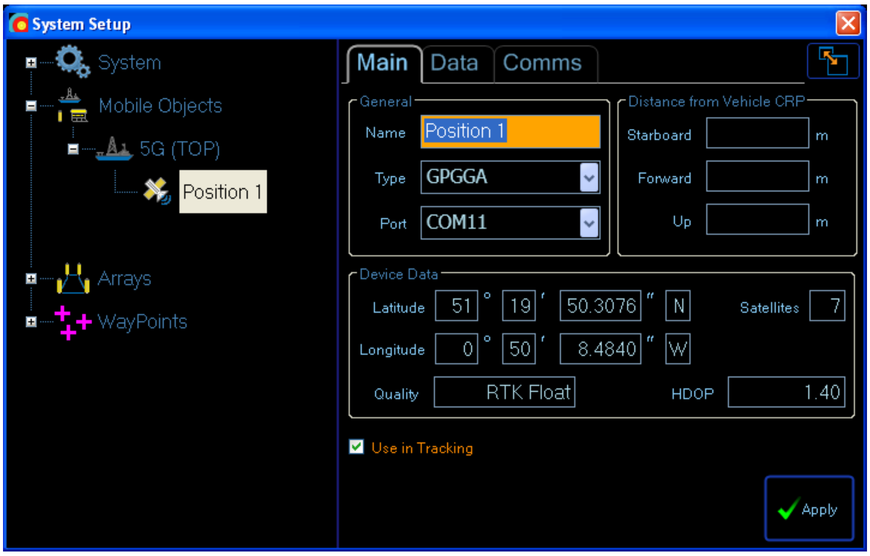
The **Pulse is** field is very important to the correct operation of the system. It determines whether the PPS arrives before or after the TOD serial string

- After means that the PPS arrives after the TOD message
- Before means that the PPS arrives before the TOD message.

7. Click **Apply** after all fields have been configured and check that the trigger LED flashes once per second and the **Received Time** field shows the decoded TOD data.

Add the GPS

8. Right-click on the Ship and add a GPS device.

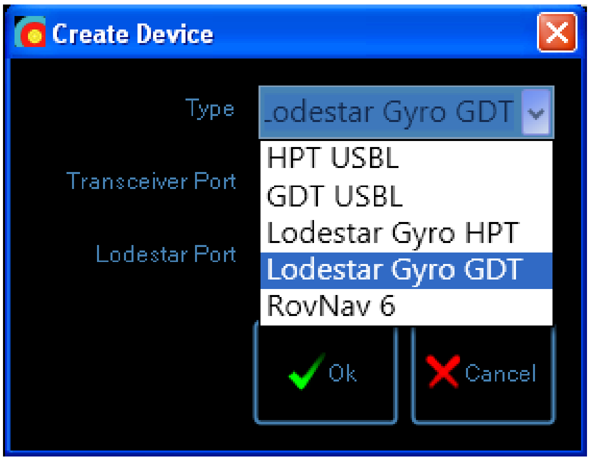


9. Set the comms port for the GPS device to the appropriate NSH port.
10. Configure the baud rate and check that valid position information is being received.
11. Enter the correct **Starboard**, **Forward** and **Up** offsets.
12. Check the TOD sync by confirming the time of arrival of UTC messages matches the time in the GPS data string.

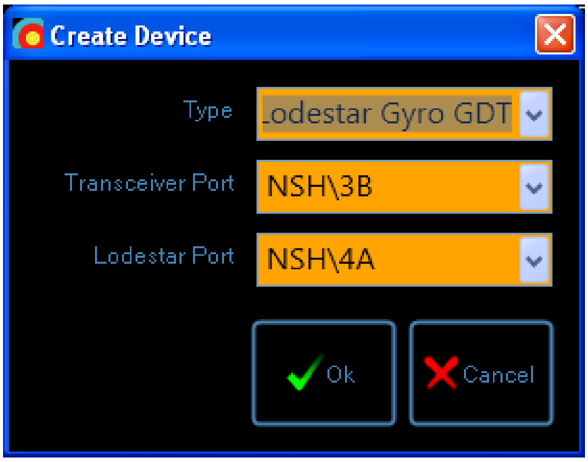
Add a combined Lodestar and USBL transceiver device

13. Right-click on the Ship and add a Transceiver device.

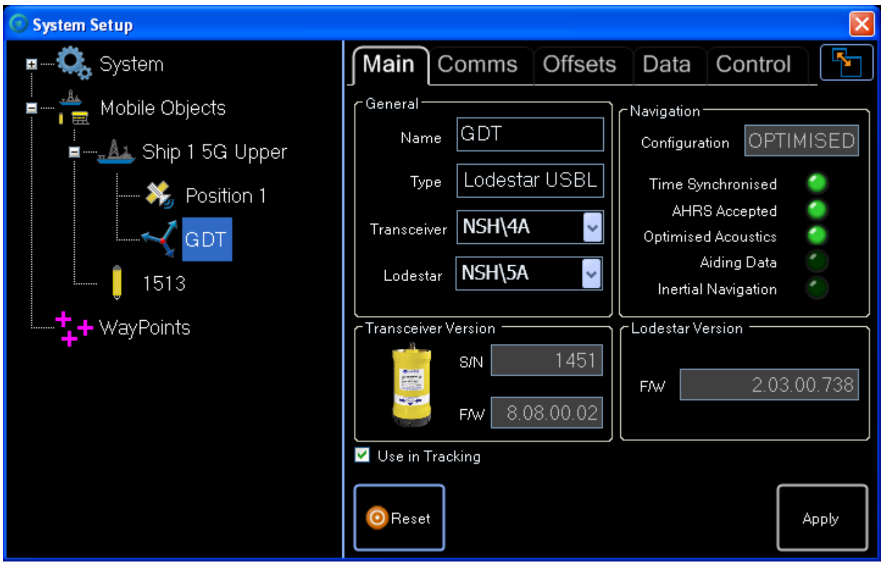
- Use a **Lodestar Gyro HPT** device type for either:
  - a Lodestar GyroUSBL, *or*
  - a separate Lodestar and HPT transceiver
- Use a **Lodestar Gyro GDT** device type when you are using a separate Lodestar and GDT USBL



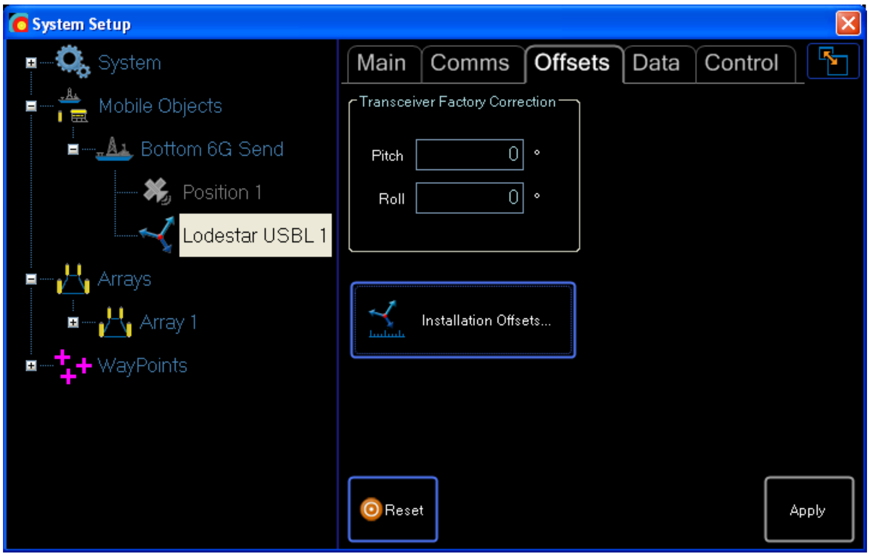
Select the correct NSH ports for the Lodestar and Transceiver connections.



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.



14. Select the **Offsets** tab.



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

16. If a surveyed ship's gyro and VRU are available, calibrate the Lodestar to these sensors using the Attitude and Heading Calibration Tools (see page 279). Use of this tool configures the **Pitch**, **Roll**, **Heading** offsets for the Ship to Lodestar.

17. Configure **Starboard**, **Forward** and **Down** offsets for the CRP to Transceiver using measured or surveyed values.

18. 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 GyroUSBL, or on the transceiver pole, or on the bridge.

19. Calibrate the **Pitch**, **Roll**, **Heading** for the Transceiver to Ship using the CASIUS Calibration Tool (see page 273).

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

5.4 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 optimised USBL 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.

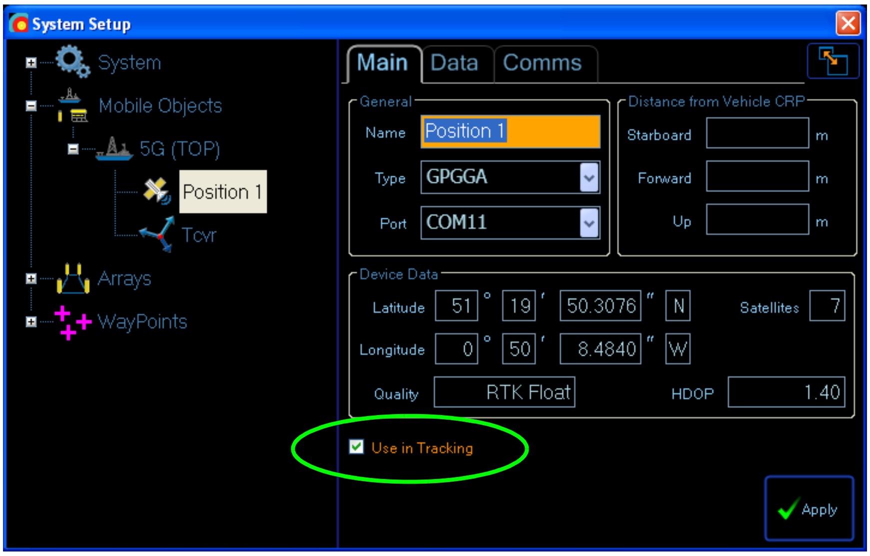
Procedure

1. Arrive at Location.

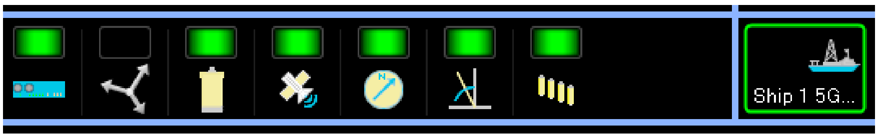
2. Lower the transceiver deployment pole fully when the vessel speed is within limits.

3. Switch on the Navigation PC and the NSH. The system is usually configured to start automatically. However, if it does not, double-click on the software icon on the Navigation PC's desktop.

4. Open the GPS System Setup dialog and select the **Use in Tracking** check box.



5. Check that the NSH, Transceiver, GPS, Heading and VRU status indicators are all solid green as shown in the example below. This might take a minute.



6. Open the Geodesy page (**Tools>Geodesy**) and click the Reset button to update the current operating UTM zone.

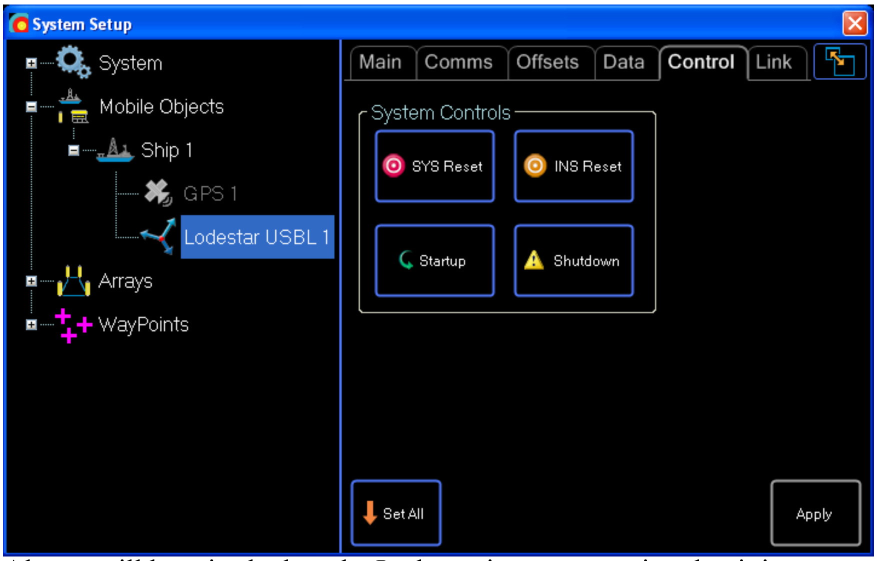
Reset the Lodestar

7. Open **System Setup** and select the **Lodestar Tcvr** device.

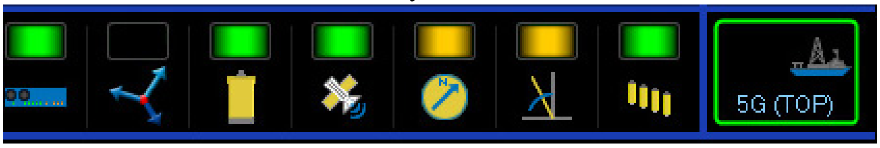
8. Select the **Control** tab, click the **System Reset** button and then confirm.

Note

Note that 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.



9. Deploy the beacons.

Note

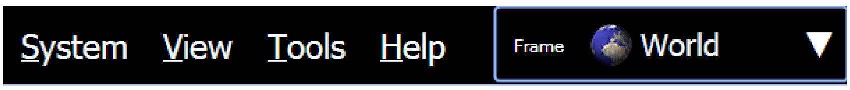
Do not proceed further until the alarm warning that Lodestar attitude is not settled has cleared.

10. Check the Lodestar and Transceiver Installation Offsets are still correct, as described in step **15** on page 97.

11. If necessary, add the Beacons to the system. If they are already in the system then ensure they are 'mobile' in the beacons table, for example:

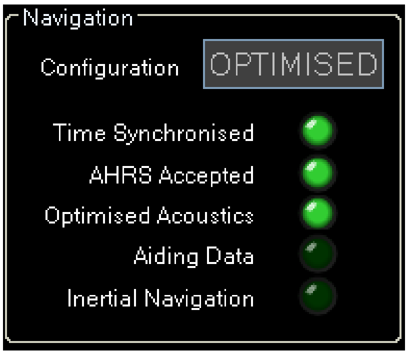
12. Start tracking the Beacons.

13. Change the **Reference Frame** combo box at the top of the Ranger 2 screen to **World Frame**.



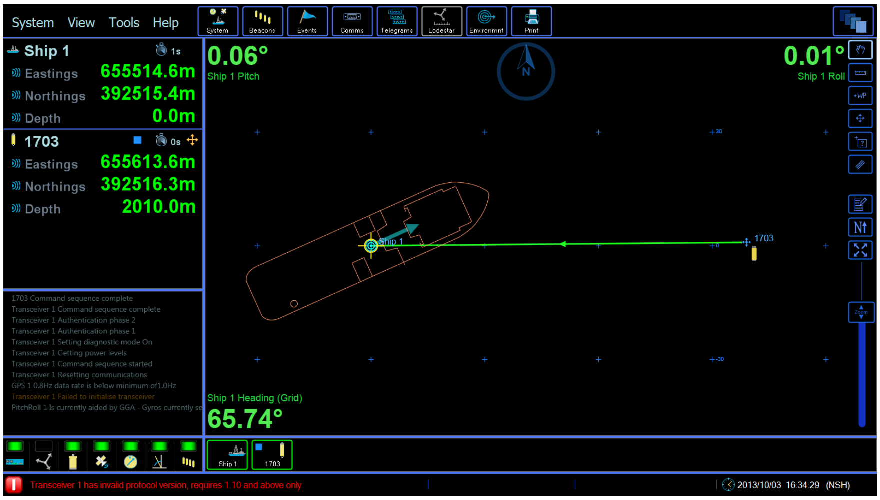
14. Check that the Beacon positions are stable and that the system is displaying UTM coordinates for the Vessel and for the Beacons.

15. Status LEDs:

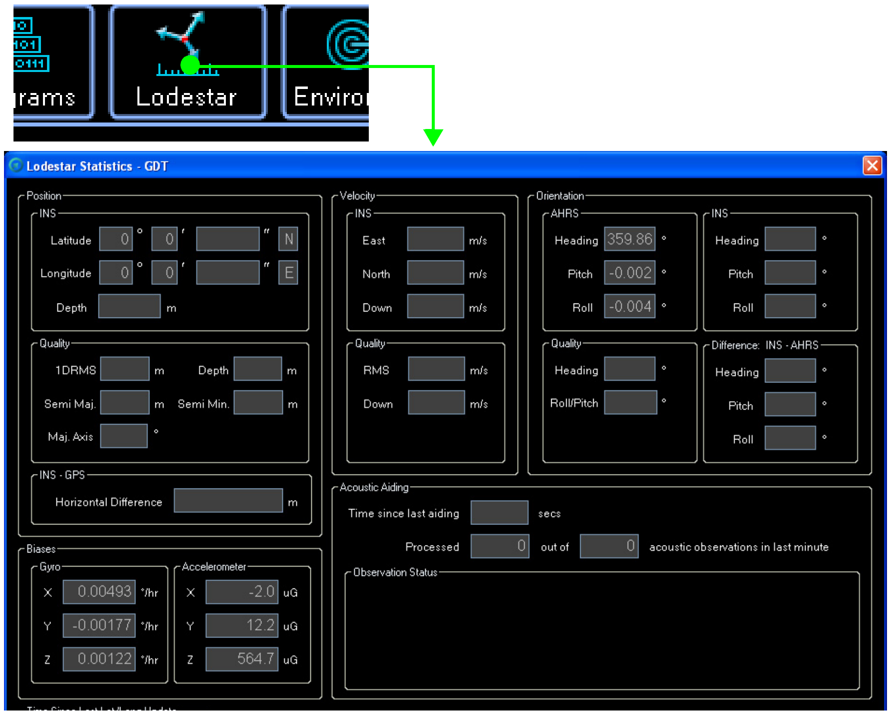


- **Time Synchronised** – Lodestar and system clocks are in sync
- **AHRS accepted** – the system is getting AHRS data with good timestamps from Lodestar
- **Optimised Acoustics** – automatically illuminates when Lodestar reports that it is correctly detecting transceiver comms and is able to publish attitude values time-synchronised with the acoustics.
- **Aiding Data** – the Lodestar is accepting acoustic aiding.
- **Inertial Navigation** – does not illuminate (INS is available only with the Ranger 2 Pro system).

16. The vessel and mobile position will be displayed on the main screen.



17. Select the Lodestar button to check the correct operation of the Lodestar AHRS:



18. Enable the Ship and select Lodestar output.

5.5 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 page and click the time sync button under 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 through this page.

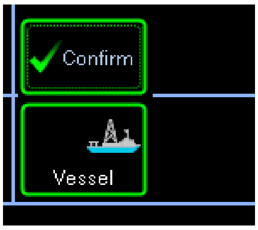
5.6 Suggested procedure – Leaving a Location

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

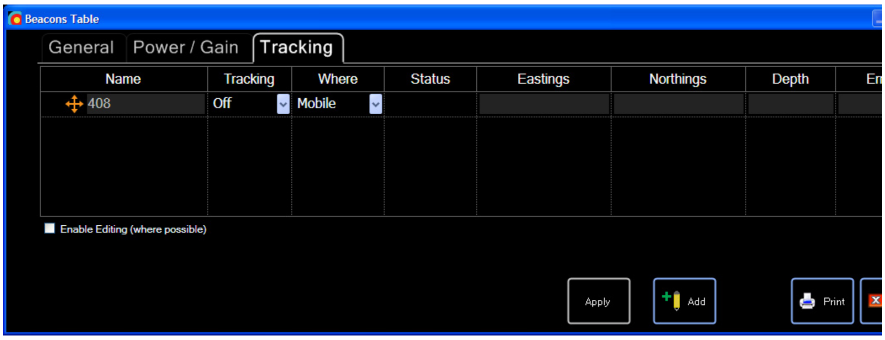
1. De-select from the DP Desk (if used).

   Make sure the DP desk is not using the optimised USBL position as a reference.

2. Click the **Vessel** tracking button and then click **Confirm** to stop acoustic positioning.



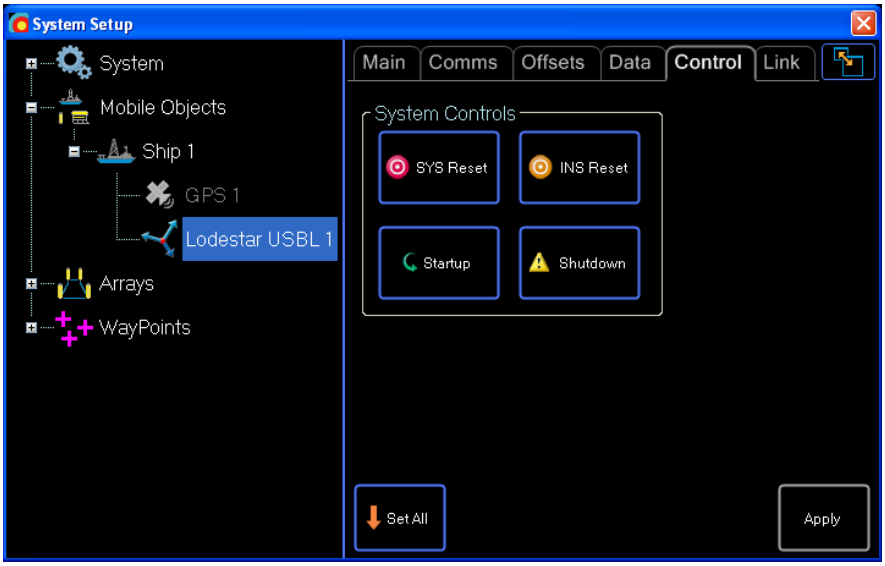
3. Open the Beacons table and change all Beacons from Array to Mobile.



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 Tcvr 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.

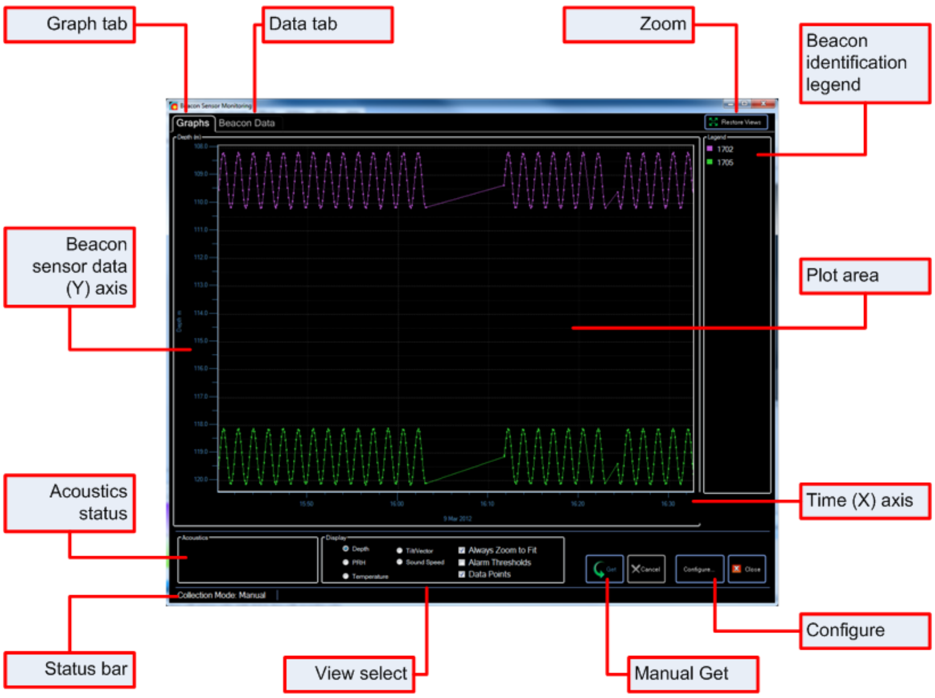
6 Beacon Sensor Monitoring Tool

In this chapter… This chapter contains the following sections:

This appendix describes the Beacon Sensor Monitoring tool that is integrated into the Ranger 2 system.

6.1 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:

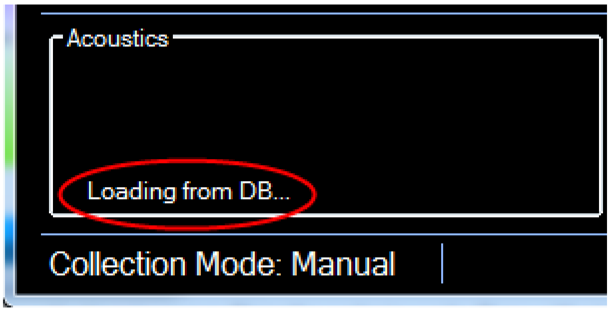
- ❑ Depth
- ❑ Pitch/Roll/Heading
- ❑ Temperature
- ❑ Tilt/Vector

- ❑ 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.

6.2 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:

- ❑ HPT or GDT 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

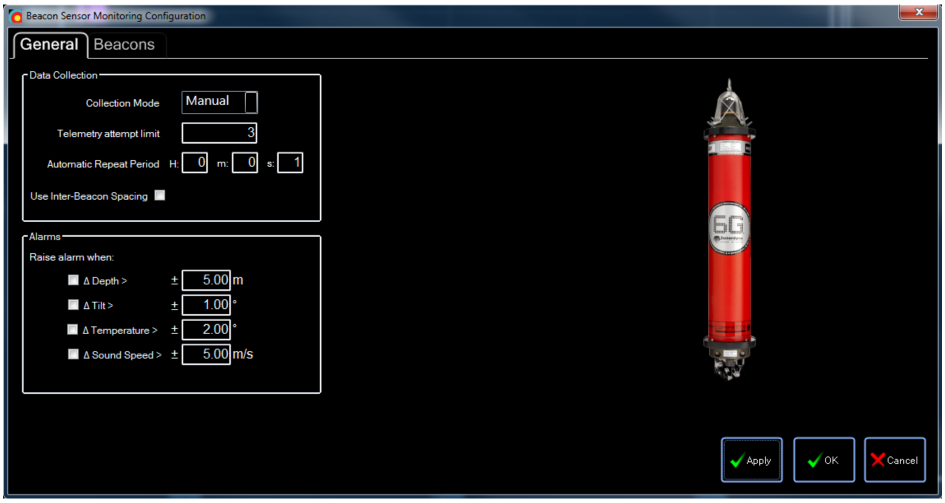
When each beacon is initialised, its sensor capabilities (Depth, Inclination, Heading, Temperature and Sound Speed) are automatically detected for use by the Beacon Sensor Monitoring tool.

6.3 Configuration

To use the Beacon Sensor Monitoring display, choose **Tools > Beacon Sensor Monitoring** from the main menu. At this point the Graphical display might or might not be empty, depending on whether or not there is historical data to be retrieved.

Note that the Collection Mode in the status bar is initially OFF.

Click **Configure…** on the Beacon Sensor Monitoring main window to display the Configuration window. The **General** tab of this window is shown below.



6.4 Setting the Collection Mode

The collection mode determines when to collect sensor data from all the beacons.

- **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, where **Monitor** is checked on the **Beacons** tab) only when the **Get** button (on the main 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 **Monitor** is checked 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 not selected, 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 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 deselected.

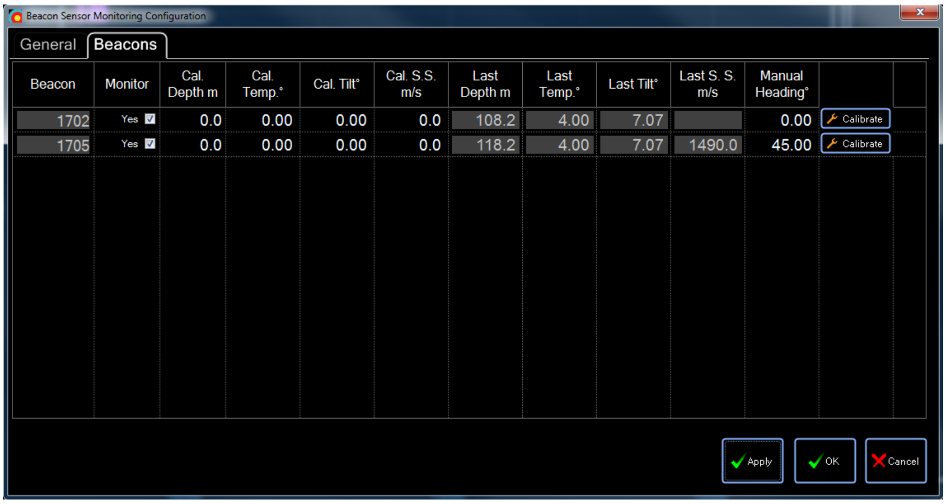
Note that, in auto mode, beacon sensor monitoring runs even when the Beacon Sensor Monitoring Tool window is not open.

Set the **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.

Set the **Alarm Thresholds** for depth, tilt, sound speed and temperature delta. If an alarm is required when any beacon's depth, tilt, sound speed or temperature change by more than a pre-set delta threshold, select the **Raise Alarm When** check box and set the delta value.

6.5 Setting the Beacons to be monitored

Click on 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. Set the **Monitor** check box to 'yes' to monitor a beacon.

Click on **Calibrate** to set the reference depth, temperature, tilt and sound speed values for each beacon. This calibrated value is then used with the delta alarm threshold set on the **General** 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 that 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 GyroCompatt, because its heading value is read from the device and there is no need to rotate the pitch and roll values.

Click **Apply** to accept changes in the configuration.

Click **OK** to close the window.

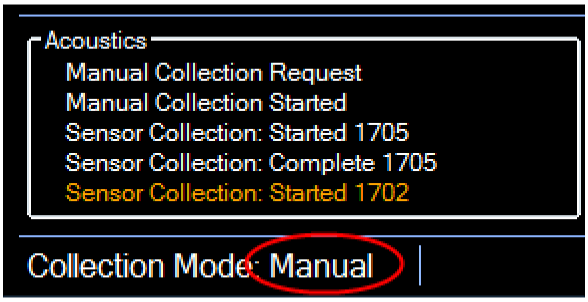
The Beacon Sensor Monitoring tool is now configured to use.

6.6 Operation

Manual Data Collection Mode

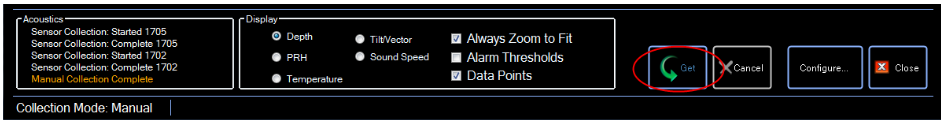
The current collection mode is always displayed in the status bar.

If the Beacon Sensor Monitoring tool is configured for Manual Collection, the **Get** button is displayed on the main window. Click the **Get** button 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 small Acoustics status window, for example:



You can click the **Cancel** button at any time to abort the operation.

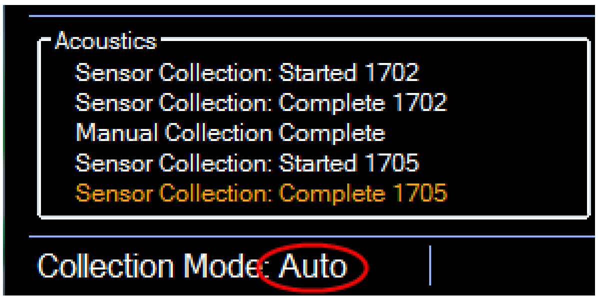
When the collection cycle is complete the status shows **Manual Collection Complete**, for example:



Automatic Collection mode

The current collection mode is always displayed in the status bar.

If the Beacon Sensor Monitoring tool is configured for Automatic Collection, 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 window shows current activity, for example:



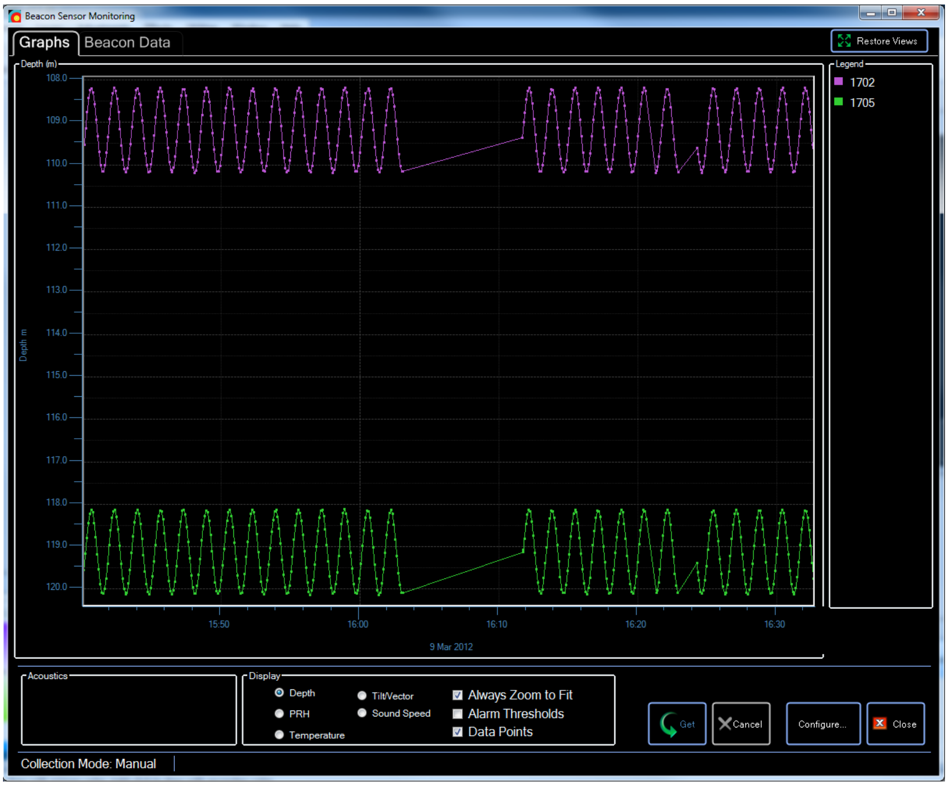
6.7 Beacon Sensor Monitoring tool displays

The Beacon Sensor Monitoring tool's main display has 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.

Graphs tab

During data collection, the graphical display updates.



View Selection

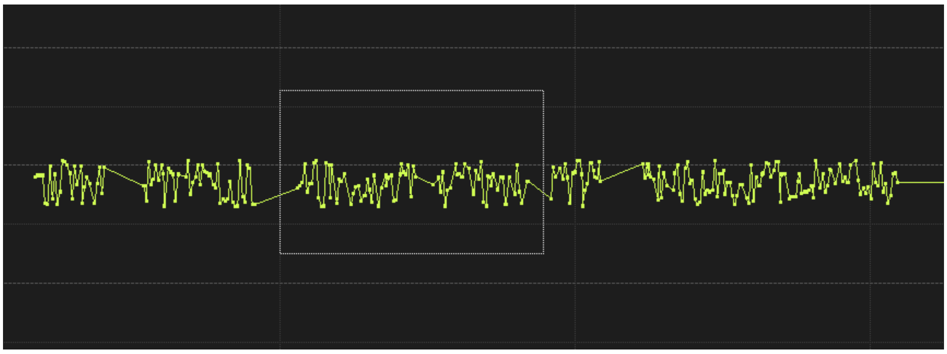
There are five different graphical views that can be selected using the buttons below the graph. The available choice is among the following:

- ❑ 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.

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 checked by default. If this check box is not selected, the graph snaps to the latest point that has been plotted.

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 the **Restore Views** button at the top right of the display to restore the graph view to its original state.

Beacon Data tab

Select the **Beacon Data** tab to see a table of the latest beacon data values. None of the fields can be edited.

The **Beacon Data** table has 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

  $$\text{Tilt}=\sqrt{(\text{Pitch}^2 + \text{Roll}^2)}$$

- **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.

A Using this Manual

In this chapter... This chapter contains the following sections:

A.1 Purpose

This User Manual is for use with the Ranger 2 systems 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.

Electronic manual

This manual is supplied electronically as a PDF file. You can navigate the manual easily by clicking on hyperlinks. You can search the manual for words, optionally using advanced features such as ‘word stemming’ and ‘sounds like’ available in Adobe® Acrobat® Reader. The manual also includes a more conventional table of contents.

If required, you can print any part of this manual. However, you cannot select, copy, or change any part of it. Copyright in this manual remains with Sonardyne International Limited at all times.

Who should read this manual

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

Anyone who uses the system should make sure they read the relevant parts of this manual.

Updates to the manual

If necessary, contact Sonardyne International Limited to check whether you have the latest revision of this manual, or to request printed copies. The document reference number for this manual is **UM-8251** and this is issue **A Rev 5**.

A.2 Navigating the manual

The electronic version of this manual is a PDF file read using Adobe® Acrobat® Reader. Acrobat Reader provides a number of features to help you navigate through the manual, and to find the information you are looking for efficiently.

Note

You will not be able to use the electronic version of this manual unless the computer on which it is installed has the Adobe Acrobat Reader software installed. Visit the Adobe website **www.adobe.com** to download the Adobe Reader software if necessary.

Navigation in Reader

If necessary, refer to the on-line Help installed with Acrobat Reader for instructions to navigate through the manual. You can use the controls in Reader to move to the beginning or to the end of the manual, or to move forwards and backwards by a single page. You can also navigate directly to a specific page number or chapter heading.

Links

Throughout the manual you will find cross-references that refer to section or sub-section titles, page numbers, figures or tables. For example, "see section A.2 "Navigating the manual" beginning on page 111." These are hyperlinks. When you hover the mouse pointer over them in Reader, the cursor changes to a pointing finger. Click on the link to jump to the relevant location in the manual.

The "Contents", "Figures" and "tables" sections all include hyperlinks to the locations listed. Click on the listed page number to make the jump.

Click on the **Previous View** or the **Next View** buttons to go backwards or forwards through the sequence of pages you have already viewed.

Note

If you cannot see the navigation buttons in your installation of Acrobat Reader, set Reader to show the Page Navigation toolbar.

Slider control

You can click and drag the 'thumb' button on the vertical slider at the right-hand side of the display to move forwards and backwards through the pages.

Search

Acrobat Reader includes a powerful facility to find specific words in the text. Click the **Search** button and then type the word that you need to find. The software will then display the first occurrence of that word after the current location.

Hold the **[Ctrl]** key and press **[G]** to find the next and subsequent occurrences of the search word.

Printing

You can print part or all of the manual if you wish. To do this, choose **File > Print** from the Acrobat menu bar.

Note

If necessary, refer to the on-line help for Adobe Acrobat Reader for full instructions to use Reader's navigation and search controls.

B Frames of Reference

In this chapter… This chapter contains the following sections:

B.1 Introduction

When studying the relative positions and movements between two of 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 we can consider them as being the same.

This appendix explains each of the reference frames (also called co-ordinate frames) mentioned in this manual.

B.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).

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.

B.3 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.

B.4 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

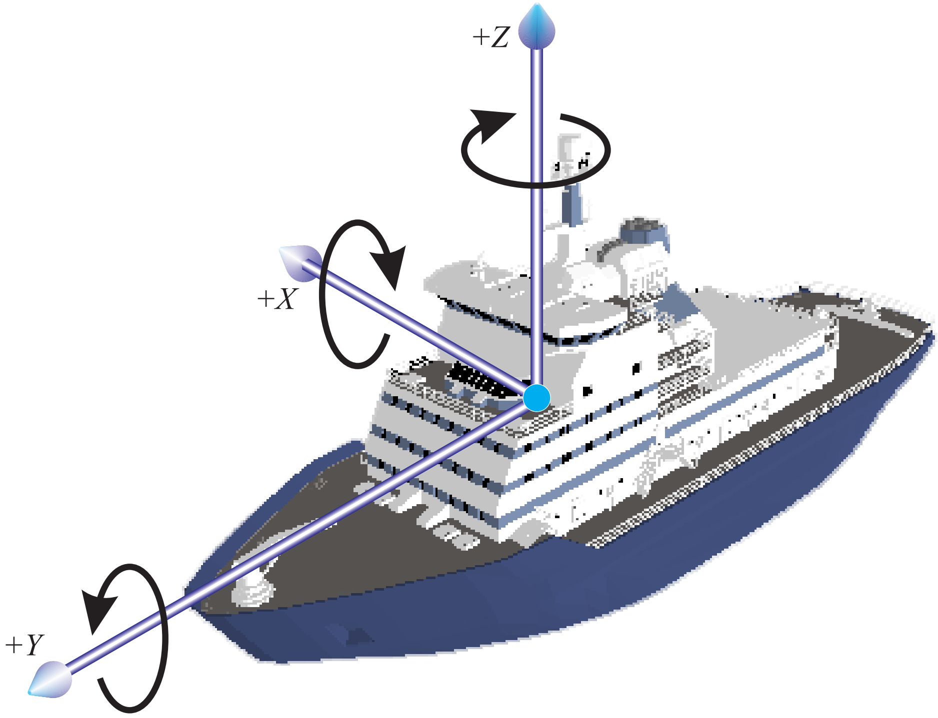
In this explanation the term 'vessel body frame' could refer equally to a surface vessel, an ROV, or any other body.

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.

Figure 16 shows the convention used by Sonardyne to define the vessel body frame.

Figure 16 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 Yaw rotation the Y axis rotates towards the current +X direction.
- 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.

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.

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).

B.5 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.

B.6 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 GPS, 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 GPS antenna.

C System Calibration

In this chapter...

This chapter contains the following sections:

C.1 Introduction

This chapter 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.

C.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.

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:

$$\text{range} = \frac{\text{elapsed time} \times \text{sound velocity}}{2}$$

Note

The divide-by-two element of this calculation allows for the two-way acoustic path—from the interrogating transceiver to the transponder 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. However, in some cases the **Sound Velocity at Seabed** value is more important. The application procedures described in Chapter 4 explain which of the sound velocity measurements is more important in each case.

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.

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.

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.

C.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 transceivers' frames of reference and the VRU's frame of reference.

C.4 Simple Array Calibration

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.

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.

D CASIUS Data Collection Methods

In this chapter... This chapter contains the following sections:

Note

See “CASIUS” on page 273 for information about the software interface for CASIUS.

D.1 Manoeuvring Guidelines

There is 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 the water depth at the beacon position, or a maximum of 500 metres from the beacon’s position, which ever 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.

D.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 17 below, pausing at each of the cardinal points and also directly above the beacon.

Note

CASIUS data is collected while stationary

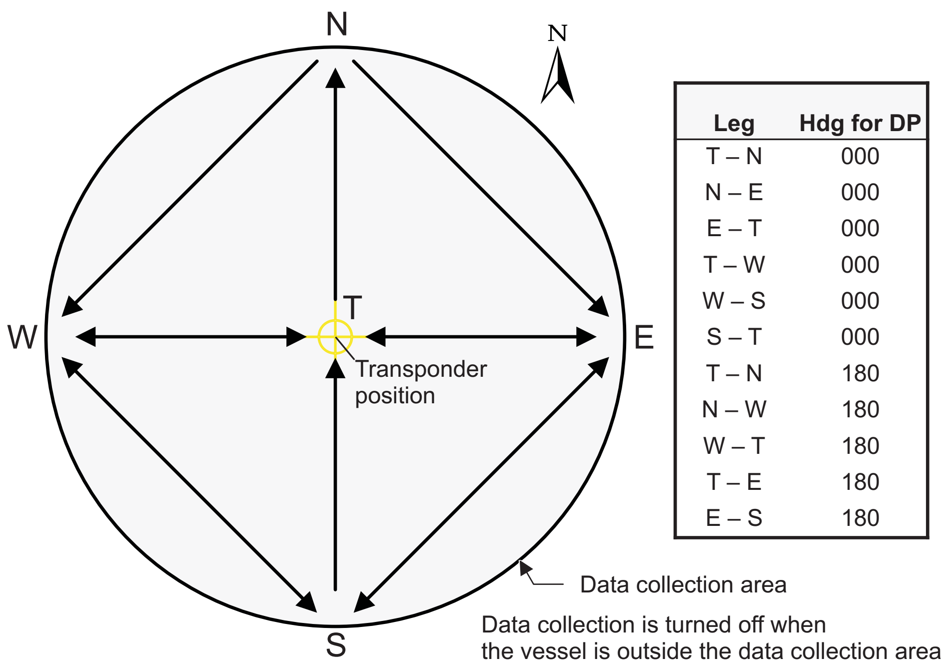
Sonardyne suggests that you collect an equal amount of data at each cardinal point to avoid skewing the data.

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 half 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 17 Manoeuvring pattern for a DP vessel



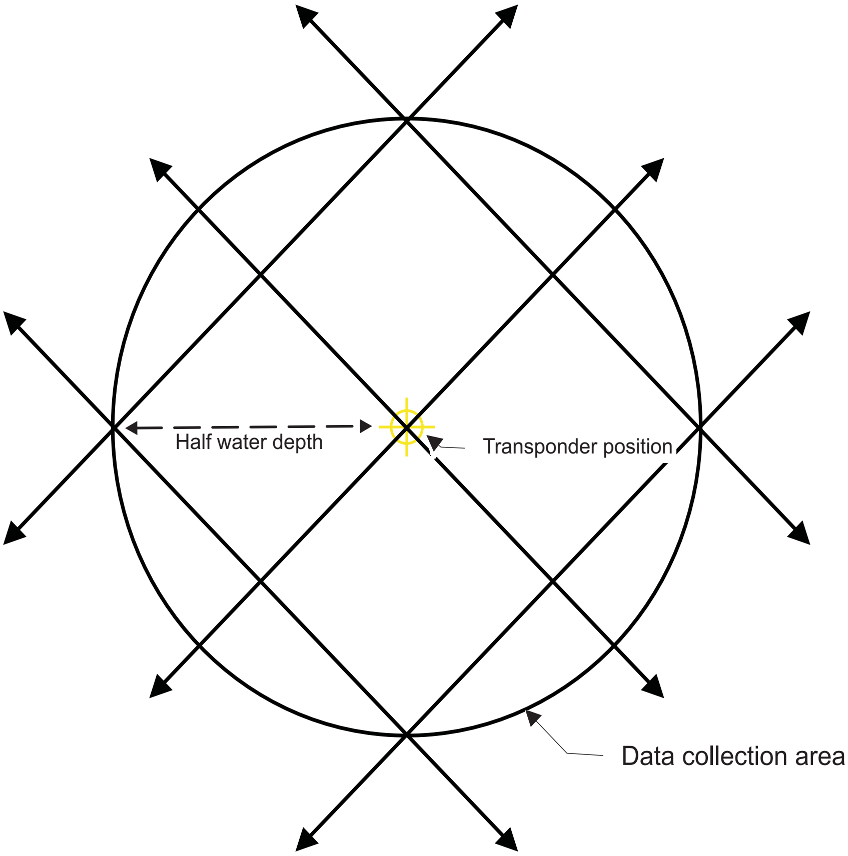
Leg	Hdg for DP
T – N	000
N – E	000
E – T	000
T – W	000
W – S	000
S – T	000
T – N	180
N – W	180
W – T	180
T – E	180
E – S	180

D.3 Data Collection – Constantly Moving Vessel

This data collection method is very similar to the one outlined in section D.2 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 18.

Figure 18 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).

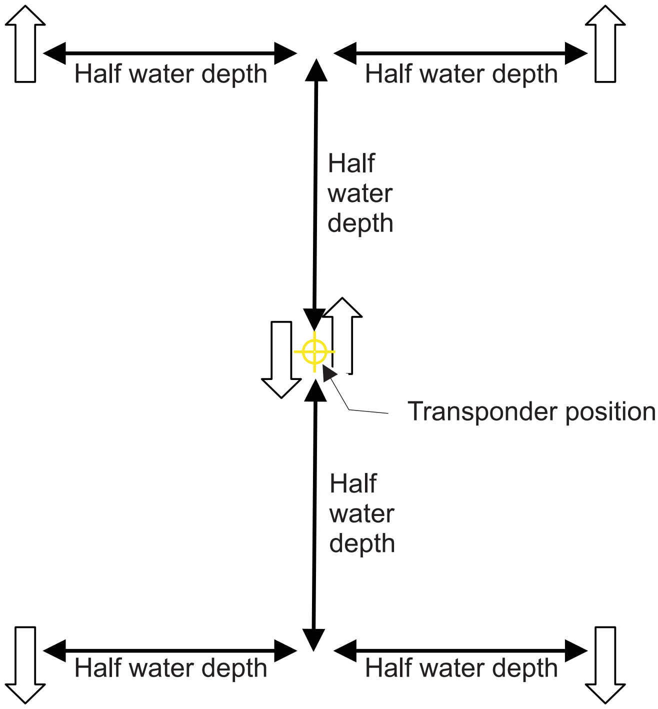
The vessel should reduce speed while passing over the beacon, to acquire more readings there. The vessel's speed should be maintained at the outer ends of the run lines.

D.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 19 shows a suggested data collection pattern and the heading of the vessel at each position, (assuming the transceiver is tilted backwards).

Figure 19 Manoeuvring pattern – Tilted transceiver



D.5 USBL transceiver alignment calibration check

After you have applied the alignment corrections you should perform more manoeuvres to confirm the correct operation of the system. Commonly these manoeuvres involve using the same seabed beacon used for the CASIUS calibration, but they can be repeated using any seabed beacon to verify that the alignment corrections are still valid at any time.

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 page.
- ❑ the GPS is enabled for use in tracking.
- ❑ the alignment corrections from the CASIUS are correctly entered in the USBL transceiver's offsets page.

- ❑ the correct average through-water sound speed is set, or a current sound speed profile has been imported into the system.

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. Allow the beacon to track as a mobile for several minutes, and then place a waypoint as near as possible to the centre of the cloud of positions.

   If this beacon has just been used for the CASIUS calibration, then the position of the waypoint can be edited in the system setup tree to match the box-in co-ordinate of the beacon, otherwise, the position derived directly over the beacon can be used.

3. Rotate the vessel slowly around the beacon, attempting to keep the transceiver as near as possible over the top of the beacon.

   As a percentage of water depth, the computed position of the beacon should not deviate from the waypoint by more than the 1 Drms ‘After CASIUS (% depth)’ figure given in the CASIUS report.

4. Starting with the transceiver as close as possible over the top of the beacon, move the vessel by a distance of twice the water depth, or 1000 metres (whichever is less) away from the beacon. The beacon should not deviate significantly from the waypoint position.

If the system passes both of these checks, this confirms that the USBL transceiver is correctly aligned to the selected attitude and heading sensors.

If the system has other sensors interfaced, Sonardyne recommends that you align them to the sensors used in the CASIUS calibration by using the tool provided in the **Tools** menu.

E Installation

In this chapter… This chapter contains the following sections:

E.1 Introduction

Note

The software is supplied under licence for use with Ranger 2 systemS only. This software is the intellectual property of Sonardyne International Limited and is subject to the usual copyright restrictions.

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.

These installation instructions are included in the manual to allow you to re-install the software if necessary, or to upgrade the software to a later release.

Click **Help** > **About** in the menu bar to see information about the version number of the installed software. Contact Sonardyne for upgrade details.

E.2 System Installation

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 Navigation 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.

Navigation Processor

Navigation Processor is the term used to describe the top-side equipment comprising the following units:

- The Navigation Sensor Hub (NSH).
- The Navigation 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 re-installation of the supplied software version is required for any reason. If it becomes necessary to install or upgrade the software, refer to section E.7 beginning on page 146 for more information.

E.3 Hardware Installation

To install the hardware you must install the Navigation Computer and the NSH, and you must then interconnect them using the supplied cables.

Before you begin

Take the following steps before you begin to install the hardware of the Navigation Processor:

- ❑ Identify a suitable location for the Navigation Computer and the NSH where they can be installed near to each other.

Risk of equipment malfunction. It is recommended that hardware installations are located at least 20 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.

Risk of equipment malfunction or damage. 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.

What you will need

You will need the following items and tools to complete the installation:

- ❑ Two AC power cables.

  These are for connection to the rear panels of the NSH and the Navigation 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.

- An Ethernet cable to provide an interface between the Navigation Computer and the NSH.
- An 8-pin Lemo-to-48V cable to provide an interface between the transceiver and the NSH. See Figure 33 on page 157.
- A yellow primary security key that indicates it is a system software security key – see “Security keys” on page 146 for more information. The system will not operate without this key.

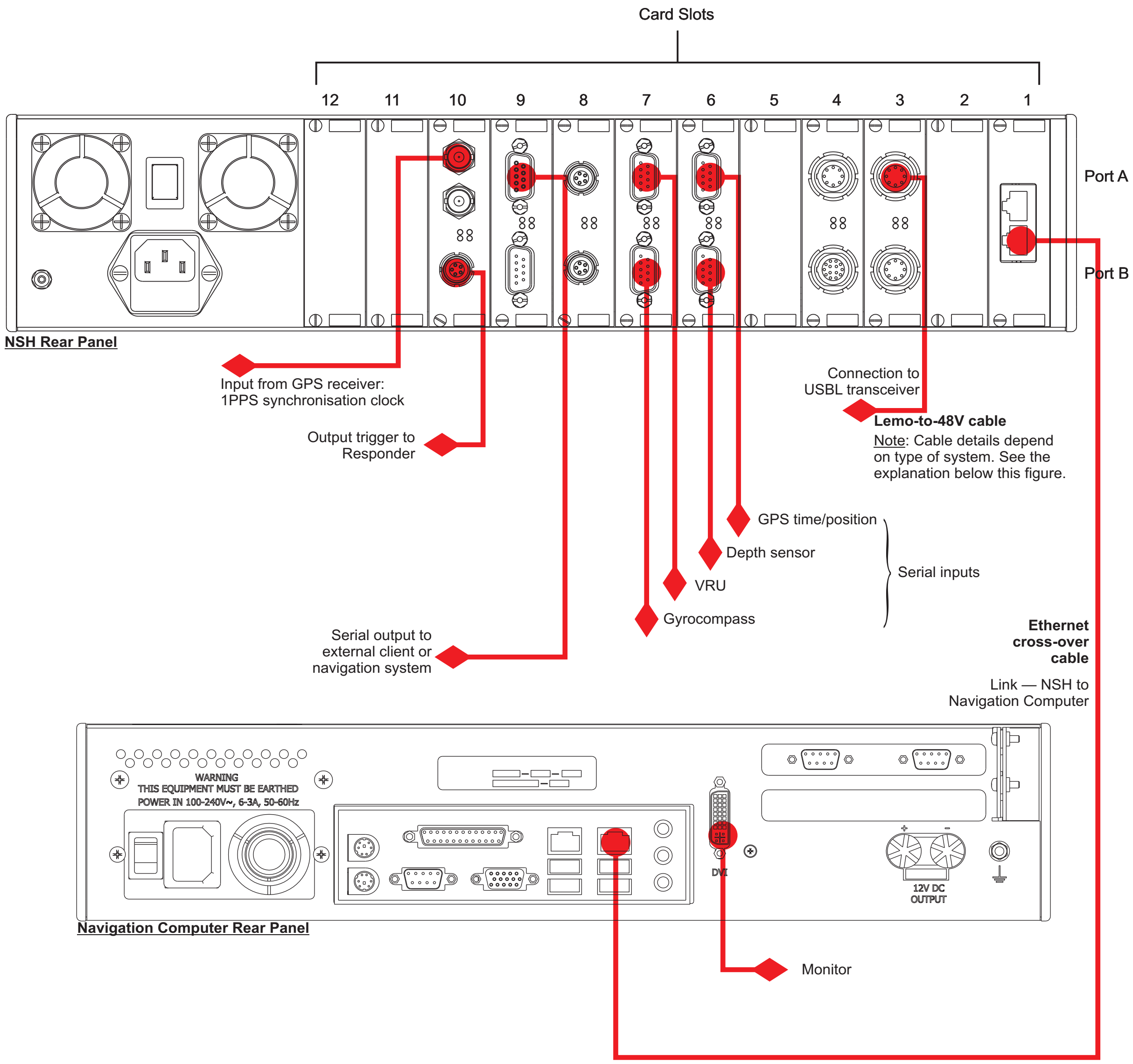
Installation

Follow the steps below to install the NSH and the Navigation Computer.

1. Make sure the power switches on the rear panels of both units are set to their OFF positions.
2. Secure the NSH and the Navigation Computer at the locations you have selected for them.
3. Make connections to the NSH as required within your system. Refer to Figure 20 below for guidance.

   Note that this figure 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. Refer to “NSH Interface card details” on page 130 for instructions to install additional interface cards.

Figure 20 Typical interconnections - NSH and Navigation Computer



Note

Details for the 8-way transceiver cable from slot 3 on the Navigation Computer 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.

See the cable drawings in Appendix F beginning on page 152.

- ❑ 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 Navigation Computer to the lower Ethernet port (Port B) in slot 1 at the rear panel of the NSH. This cable can be connected either way around.

- ❑ Connect the Lemo end of the supplied 8-pin Lemo-to-48V cable to Port A in slots 3, 4 or 5 on the rear panel of the NSH.

Note

It is possible to fit 48V 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 Lemo-to-48V cable to the USBL transceiver.
- ❑ Make whichever optional connections as are required within your system as follows:
  - ❑ Connect serial inputs from a GPS 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 navigation 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 GPS receiver to the top input trigger port (Port A) 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.
  - ❑ Connect an output trigger cable from the NSH to a Responder beacon, if you are using one, from the bottom port (Port B) on the Responder/Trigger interface card located 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. The yellow ‘primary’ security key (dongle) is normally installed by Sonardyne inside the Navigation Computer. If the dongle is supplied loose with the software, plug it into a suitable USB port at the rear of the Navigation Computer. Refer to page 146 for an explanation of the security key.
6. Connect the keyboard and mouse supplied by Sonardyne to either of the USB ports on the Navigation Computer’s front panel. Alternatively, make this connection to either of the USB ports on the Navigation Computer’s rear panel.
7. Connect the display monitor, if one has been supplied by Sonardyne, to the SVGA port on the Navigation Computer’s rear panel. The Navigation Computer can support a second external monitor. If necessary, connect a second monitor to the DVI port on the Navigation Computer’s rear panel using a DVI-to-SVGA adapter supplied by Sonardyne. Note that the minimum screen resolution is 1280 x 1024 pixels.
8. Set the power switches on the rear panels of the NSH and the Navigation Computer to ON. It does not matter which of the units is switched on first.

9. 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/Reset** button on the Navigation Computer's front panel to start the Navigation Computer.

11. On the Navigation Computer check the following:

    - The green **System Power** LED should light up to show that the system is receiving power.

    - The red **HDD** LED should light up to show that the Navigation Computer is reading the hard disk and is booting.

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.

NSH Interface card details

The NSH can be configured with various interface cards depending on the sensor inputs required for the installation. Table 7 lists and describes the interface cards for use in the NSH.

Table 7 Interface cards

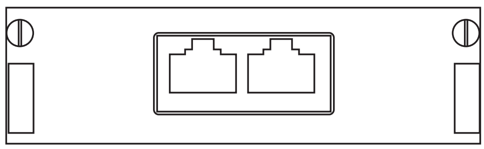
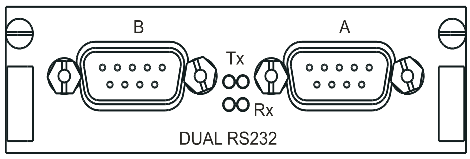
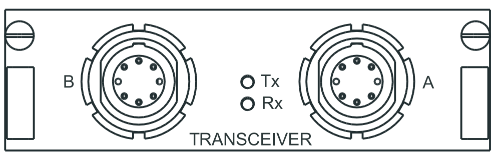
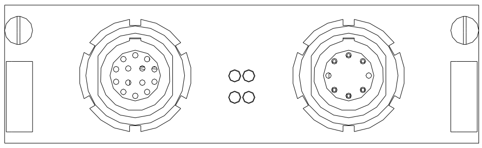
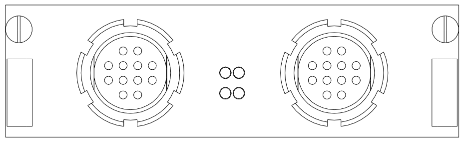
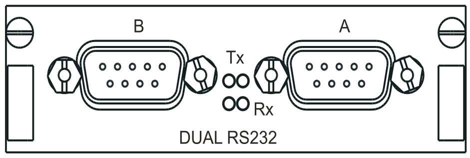
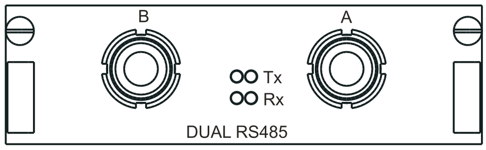
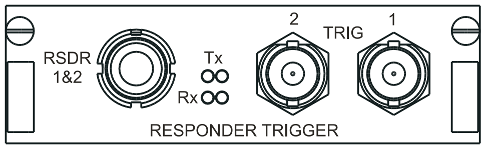
Slot	Notes	Part Number and Interface Card	
1	Link Port: • Ethernet link to Navigation Computer	CPN 631-7691 	Drg 8098-050
2	Reserved for Link/Management Ports: • RS232 link to Navigation Computer • RS232 link for initial NSH setup using HyperTerminal	CPN 631-8074 	Drg 8098-053
3, 4, 5	RS485 communications and 24V or 48V power for the following transceivers: • USBL • ROVNav	CPN 631-7658 	Drg 8098-051

Table 7 Interface cards (Continued)

Slot	Notes	Part Number and Interface Card
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 Drg 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 Drg 8098-067  NSH LODESTAR TCVR MODULE
6, 7, 8, 9 *3, 4, 5	RS232 communications with: • ROVNav • Serial gyrocompass • GPS • Serial VRU	CPN 631-8074 Drg 8098-053 
6, 7, 8, 9 *3, 4, 5	RS485 communications with: • ROVNav • Serial gyrocompass • GPS • Serial VRU	CPN 631-8073 Drg 8098-057 
10, 11	Two responder outputs and two BNC inputs for external triggers, such as 1 PPS from a GPS 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 F.

Interface card installation

Refer to Table 7 to identify which slots on the NSH's rear panel support which types of interface card.

Before you begin to add or remove interface cards in the NSH, power-off the NSH and disconnect it from the electrical power supply

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.

Network connection

The Navigation Computer is supplied with an RJ–45 Ethernet LAN connection port. Any network configuration settings within the Windows XP Operating System are at the risk of the operator. Sonardyne International Limited accepts no responsibility for network connections and configurations.

E.4 USBL Transceiver Installation

The USBL transceiver can be deployed in a number of ways, depending on the type of vessel in use and on operational requirements.

Risk of equipment damage. 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.

General requirements

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 transceiver to protect its transducer face during shipping. You MUST remove this protective sleeve before you deploy the transceiver; the transceiver will not perform correctly with this sleeve in place.
- Mount the transceiver on a rigid pole, supported so as to minimise vibration and reduce free movement of the transducer with respect to the vessel.

The main sources of vibration that could affect the transducer are; normal operation of the vessel's machinery; and vortex-shedding as the transducer's supporting pole moves through the water.

- ❑ Mount the transceiver so that it is pointing vertically downwards, with the connector at the top and the black acoustic transducer at the bottom.
- ❑ Ensure the white forward-pointing direction arrow on the transducer is pointing forward on the vessel.
- ❑ For best results, if possible deploy the transceiver at least 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 you have installed the transceiver, measure the vertical offset between the bottom face of the transceiver and the vessel's waterline when the 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, 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 transceiver face clean and free from oil or grease.

Pole mounting

The design of any deployment mechanism should ensure that all unwanted movements of the transceiver with respect to the vessel are minimised.

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 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 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 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 vortex shedding, and larger, slow movements can arise as the vessel rolls or under the influence of tidal changes. 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 transceiver, even if the pole moves relative to the vessel.

Over-the-side deployment

If you intend to use an over-the-side deployment, attach the transceiver to a pole or frame designed so that 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 vortex induced vibration. Various methods can be used to reduce the effects of this type of vibration. Contact Sonardyne for further advice in this area.

Through-hull mounting

The recommended way to mount a USBL transceiver is on a pole through the vessel’s hull.

In this arrangement the pole should be stiff, rigidly mounted and long enough to locate the transceiver at least 1 metre below the lowest point on the hull. The mounting arrangement used must minimise any movement of the transceiver with respect to the vessel, and ensure optimal tracking accuracy.

For the ‘standard’ transceiver, this mounting arrangement requires a vertical tube of at least 254 mm or 10 inches internal diameter to be let into the ship.

For the ‘Big Head’ transceiver the vertical tube should be at least 350 mm or 14 inches internal diameter.

Galvanic isolation

The 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 transceiver and the mounting arrangement both electrically and acoustically 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.

Risk of equipment damage. To avoid galvanic corrosion of the aluminium bronze transceiver housing, never allow the housing to remain in contact with a material more electro-chemically noble than itself.

Note

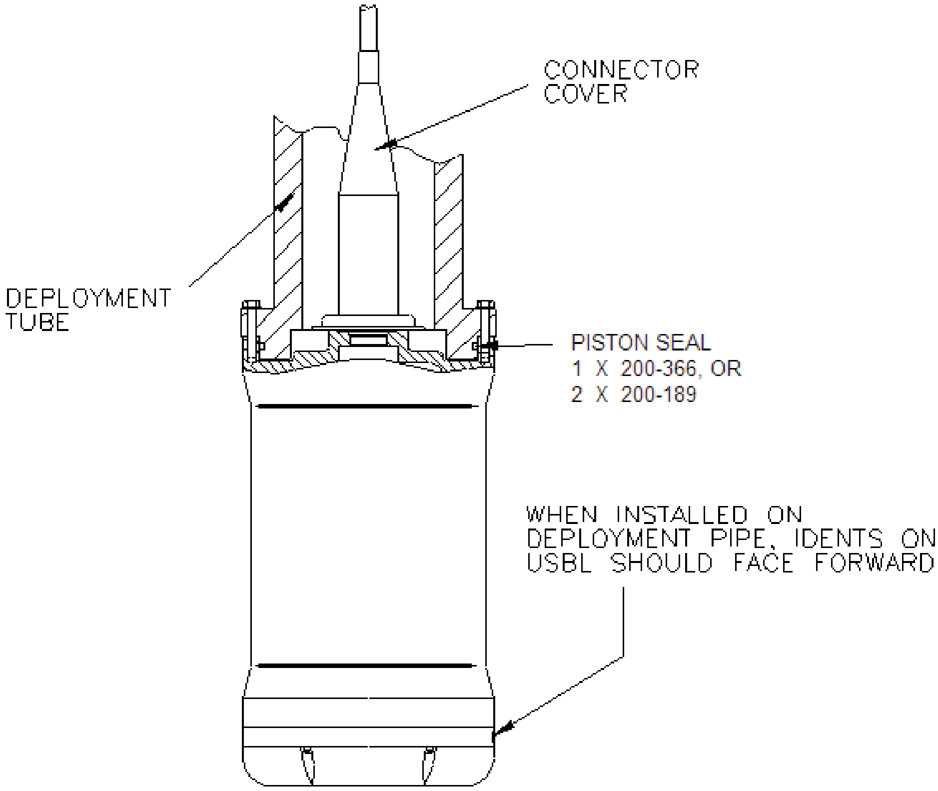
Before you mount the transceiver, always record the information detailed on the label on the outside of its housing. This information includes its serial number, the device serial number, and factory offsets for the internal inclinometer sensors.

Mounting considerations

The most common through-hull deployment method is the use of a gate-valve and sea chest assembly that can accommodate the transceiver. Above this sea chest is a deployment machine capable of raising and lowering the transceiver and stem.

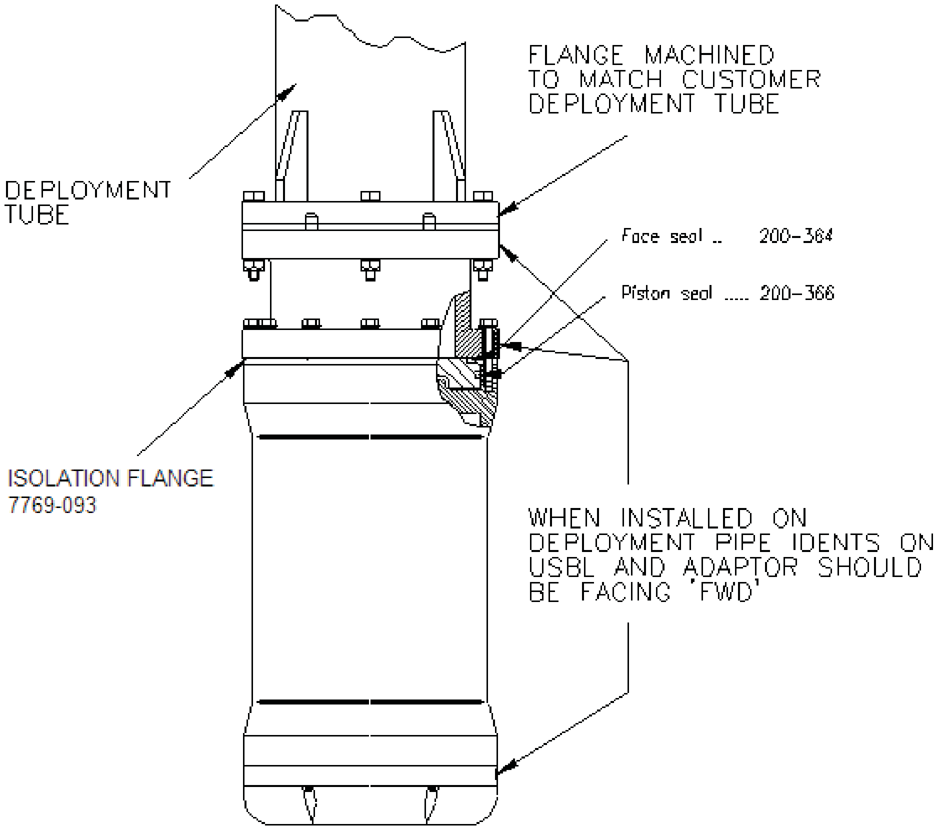
The USBL transceiver has been designed to fit to a type 7950 Sonardyne-supplied deployment machine, or to fit directly onto a fixed-head HPR deployment pole as shown in Figure 21.

Figure 21 Transceiver mounting — Arrangement 1



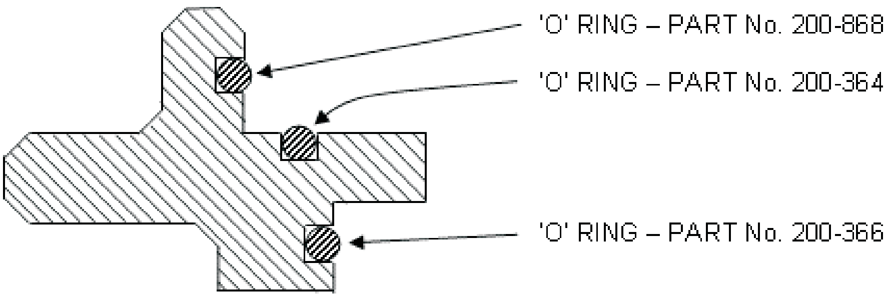
A second popular mounting arrangement is to mount the transceiver on the end of a flanged pole, using a purpose-designed flange adapter if necessary, as shown in the example in Figure 22. In this second arrangement, the pole will normally have a number of flanges, each of which has a compliant outer edge that contacts the inside wall of the deployment tube.

Figure 22 Transceiver mounting — Arrangement 2



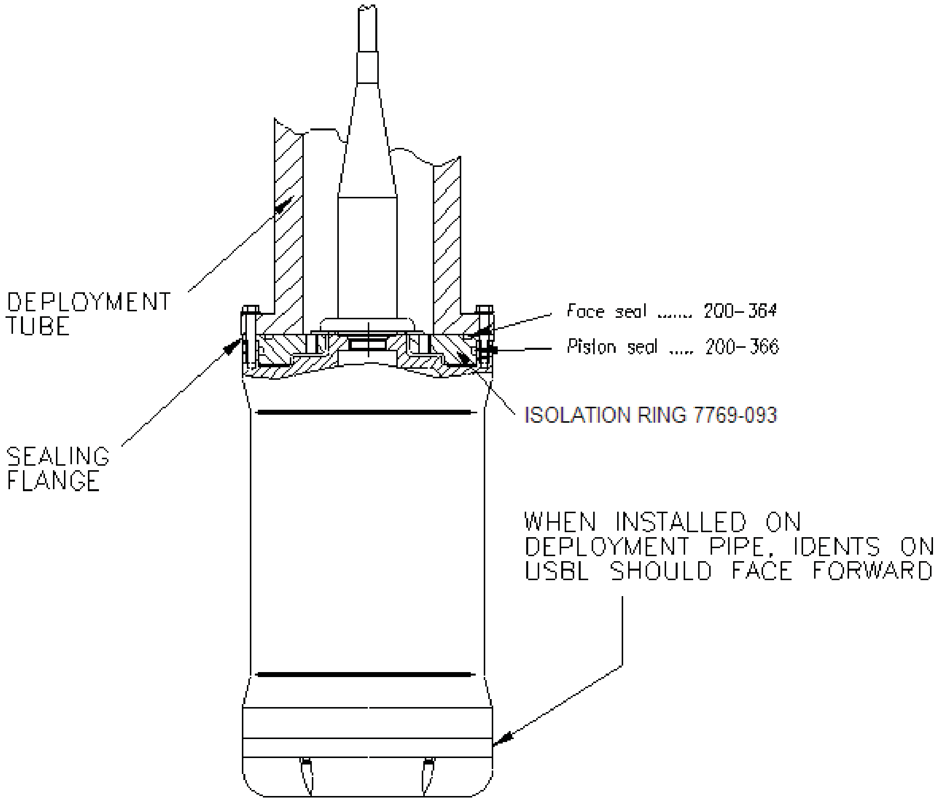
An alternative isolation flange is also available for Sonardyne-supplied deployment machines, as shown in Figure 23.

Figure 23 Alternative isolation flange



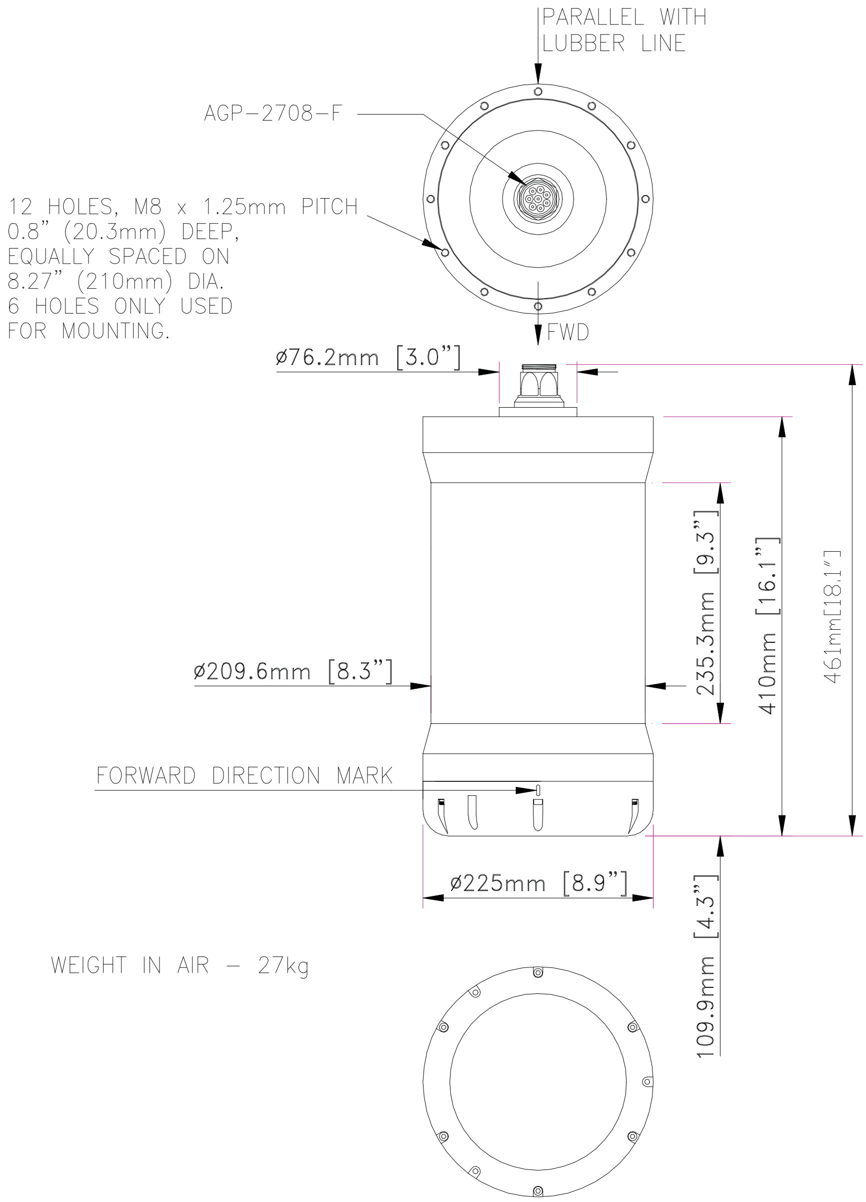
If the mounting flange already has the correct fixing holes, the transceiver can be bolted on without need of an adapter ring, as shown in Figure 24. Note, however, that you MUST use an isolation flange in this arrangement if there is any possibility of galvanic corrosion occurring.

Figure 24 Transceiver mounting — Arrangement 3



Transceiver bolt holes

Figure 25 Transceiver bolt hole pattern



Alignment criteria

When mounting the transceiver you should ensure that the mounting arrangement has some mechanical means to maintain alignment between the 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 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.

Transceiver connection

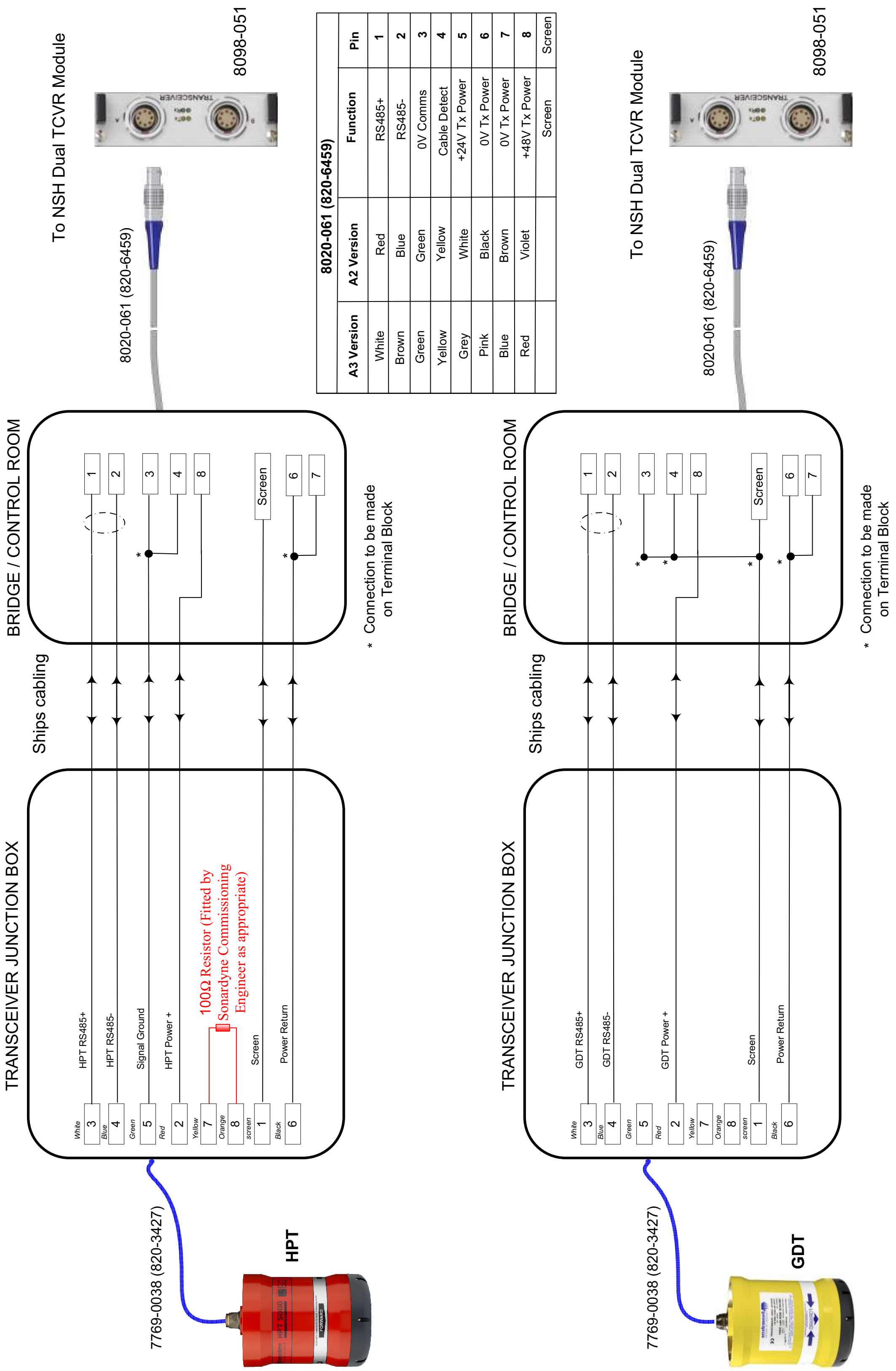
Connection between the transceiver and the NSH rear panel is through the Lemo-to-48V cable supplied with the system. Connect the Lemo end of this cable to the top port (Port A) on the transceiver card in the NSH. Refer to Appendix E.3 beginning on page 126 for more information.

System calibration

You must perform a complete system calibration (CASIUS) when you deploy any transceiver for the first time in its mounting arrangement. Refer to Chapter C beginning on page 117 for more information about the CASIUS calibration procedure.

USBL transceiver installation

Figure 26 HPT – GDT transceiver wiring



8020-061 (820-6459)

A3 Version	A2 Version	Function	Pin
White	Red	RS485+	1
Brown	Blue	RS485-	2
Green	Green	0V Comms	3
Yellow	Yellow	Cable Detect	4
Grey	White	+24V Tx Power	5
Pink	Black	0V Tx Power	6
Blue	Brown	0V Tx Power	7
Red	Violet	+48V Tx Power	8
		Screen	Screen

GyroUSBL Figure 27 5-element Lodestar GyroUSBL

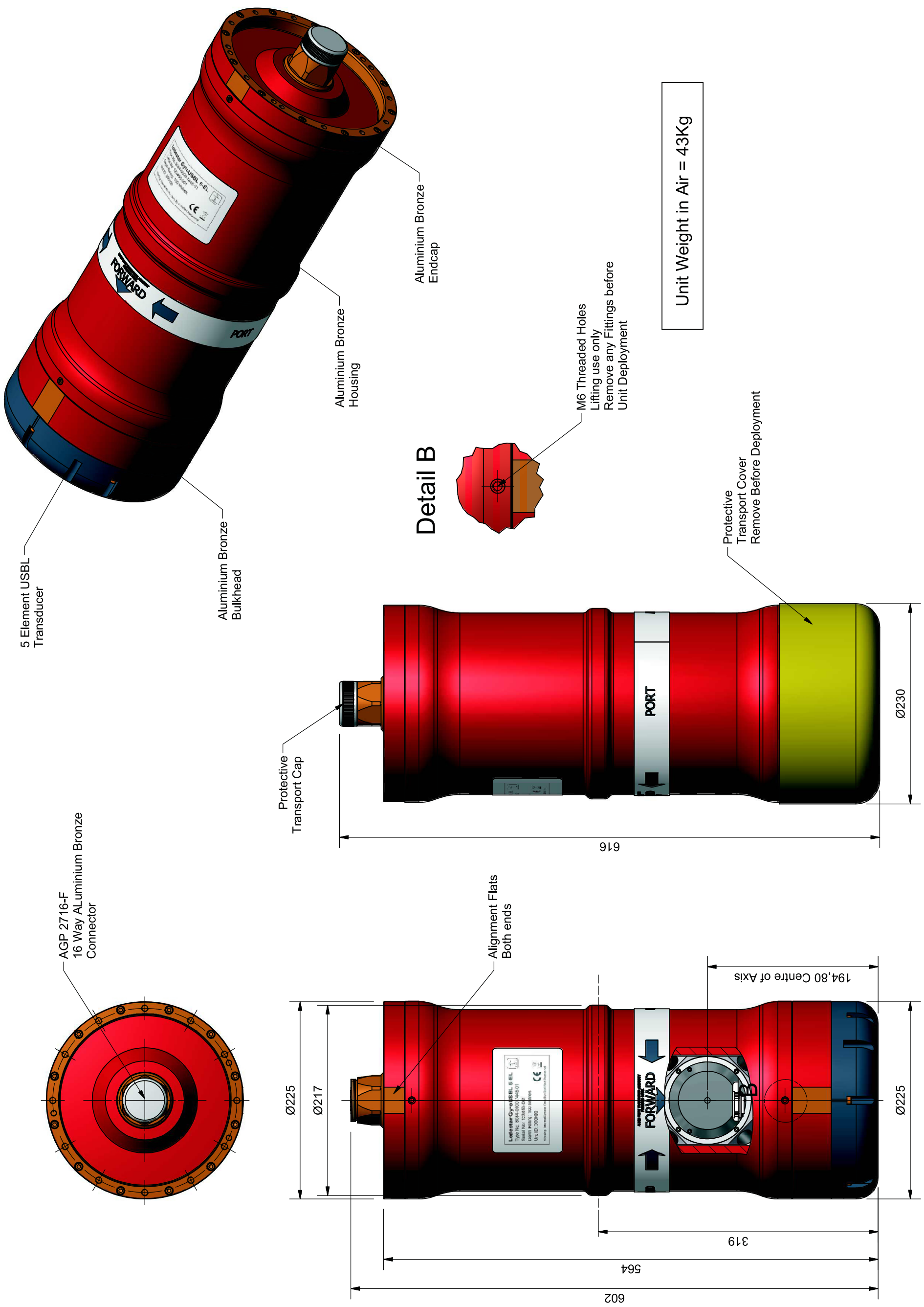
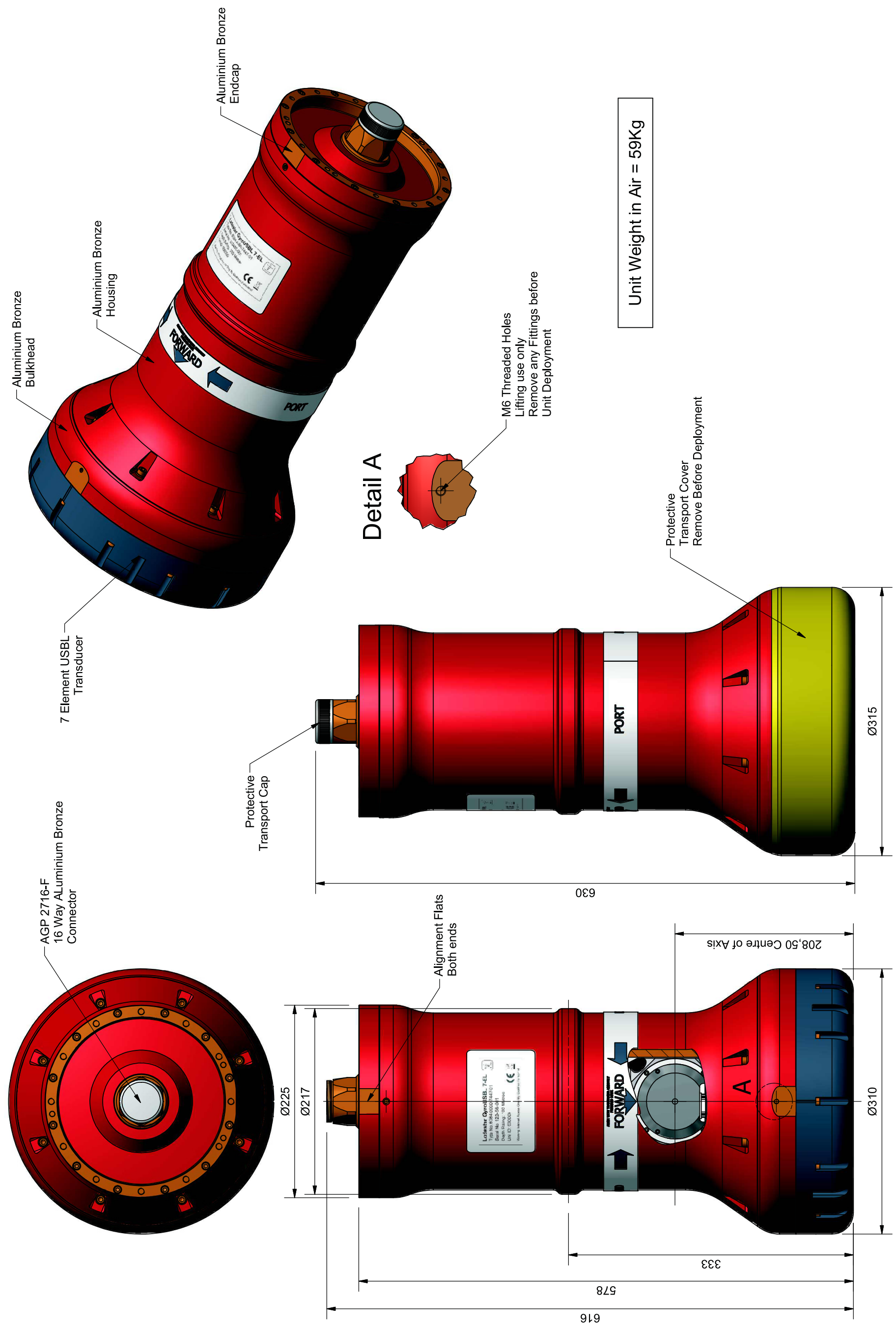


Figure 28 7-element Lodestar GyroUSBL device



E.5 External sensors

You should give careful consideration to the selection and installation of external sensors such as a Vertical Reference Unit (VRU), gyrocompass and GPS 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. Refer to Appendix E.3 beginning on page 126 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.

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 GPS 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.

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 0.05° 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 accuracy 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.

GPS receiver system

- ❑ Mount the GPS 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 GPS 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 GPS antenna and the USBL transceiver. You will require these measurements later to configure the USBL software.
- ❑ If possible, supply measurements from the GPS receiver directly to the USBL software so as to minimise any position latency inherent with computer-based GPS solutions.
- ❑ Because the quality of the GPS solution has a direct effect on the quality of any real-world positions determined by the USBL, you should use only differential GPS (DGPS) or carrier-phase based (such as Real-Time Kinematic — RTK) corrected GPS inputs.

E.6 NSH Firmware Installation

Upgrade

You must have the appropriate ***.mot** file available for the firmware upgrade saved on the PC that you use to perform the upgrade. Contact Sonardyne for advice if necessary.

Follow the steps below to upgrade the firmware:

1. Use HyperTerminal or another suitable terminal emulation program to connect to the TCP/IP management port.

Note

The management port is normally configured as port 4000.

   The NSH should produce a command prompt:

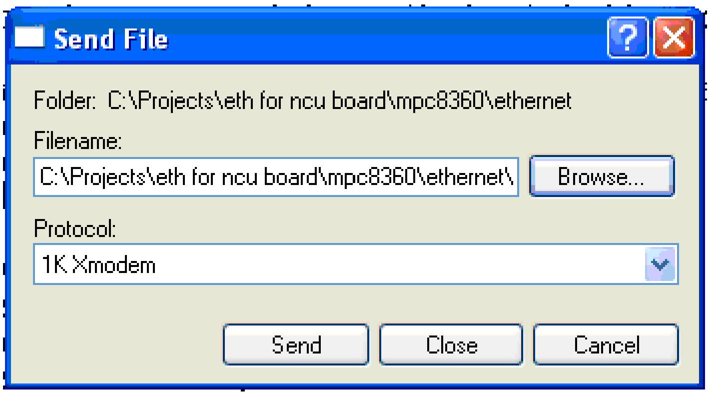
   NSH>

2. Type the following command at the command prompt:

   Software load

3. Choose **Transfer > Send File…** in HyperTerminal.
4. Browse to and select the ***.mot** file to be transferred.

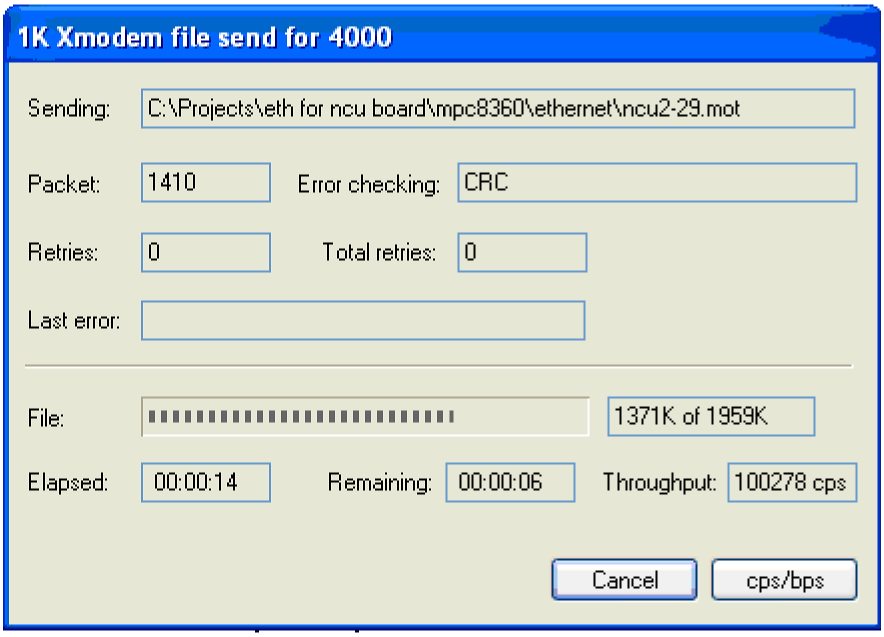
5. Select **1K Xmodem** in the **Protocol** drop-down list, and click **Send**.



Note

The NSH may send a series of 'C' characters. This is not a fault condition – it is part of the transfer protocol that confirms the receiving equipment is ready to receive data.

HyperTerminal transfers the firmware upgrade file to the NSH. This process should take approximately 20 seconds to complete.



Note

The loader may time-out if you take too long to find the file to transfer. If this occurs, start the procedure again. HyperTerminal starts in the same folder that was in use when it closed previously, which means that the file to transfer should be easy to select on the second attempt.

6. After the transfer has completed successfully, click **Disconnect** on HyperTerminal to restart the instrument.

   The new application firmware should start after approximately 10 seconds.

View stored applications

Follow the steps below to view stored applications:

1. Use HyperTerminal to connect to the instrument, as described in step **1** on page 144.

2. Type the following command at the command prompt:

   Software status

   The NSH responds with the current software status, for example:

   ***+ NSH Oct 23 2008 0.1.0.29....... CRC = ok**
   NSH Oct 22 2008 0.1.0.27....... CRC = ok

   These two lines show details of the firmware that is currently loaded into the instrument.

Note

The line that has the asterisk * at the beginning indicates the firmware that is running currently.

The line that the plus sign + in it, which is usually the same line that has the asterisk * at the beginning, indicates which default application is loaded on start up.

Firmware roll-back

There may sometimes be a need to roll back to the previous version of the firmware. Follow the steps below to do this:

1. Use HyperTerminal to connect to the instrument, as described in step **1** on page 144.

2. Type the following command at the command prompt:

   Software switch

   After a short delay the default application is switched.

3. Type the following command at the command prompt to confirm that the default application is switched:

   Software status

   The NSH responds with the current software status, for example:

   *** NSH Oct 23 2008 0.1.0.29....... CRC = ok**
   + NSH Oct 22 2008 0.1.0.27....... CRC = ok

   In this example, the + symbol has moved to the other line.

4. Disconnect from the instrument.

5. Wait approximately 10 seconds and then reconnect to the instrument.

   The previous version of the firmware should now be running.

E.7 Software Installation

Security keys

Sonardyne supplies a security key with the system, which allows the software to run.

❑ The yellow key is the 'primary' key, which you should always use with the system.

Note

For a Sonardyne-supplied system, the yellow security key is fitted inside the Navigation Computer to prevent loss, accidental damage, or tampering.

- The red key is the ‘Emergency’ key and is supplied in a sealed plastic bag.

  In an emergency, the red USB security key can be fitted to either of the two USB ports on the Navigation Computer’s front panel.

Remove the Emergency security key from its sealed plastic bag only if you need to use it.
Use the Emergency key in place of the Primary key only if the Primary key fails, expires, or is damaged or lost.

After you have used the Emergency key for the first time, it is valid for only 10 days.

Contact Sonardyne International Limited immediately if you have to use the Emergency key.

To avoid possible damage to the Navigation Computer or corruption of the computer’s software, never attach any security key for another application to the Navigation Computer.

Never attach more than one of the security keys to the Navigation Computer at the same time.

The supplied security keys will be either of two types:

- 25-pin parallel-port style.

  If your system has a 25-pin parallel-port style of security key, you must attach it to the parallel port on the rear-panel of the Navigation Computer.

- USB key.

  If your system uses a USB security key, attach it to either of the two USB ports on the Navigation Computer’s front panel.

Installation procedure

Follow the steps below to install the software.

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.

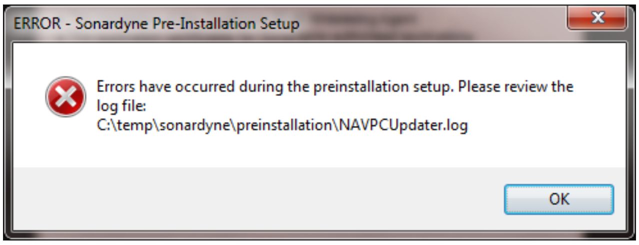
For Sonardyne Navigation Computer installations

1. If the Norton Anti-virus software is still installed, use the Control Panel’s **Add or Remove Programs** facility to uninstall the Norton software.

2. Load the software installation DVD into the PC's DVD drive, and use Windows Explorer to navigate to the DVD 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.



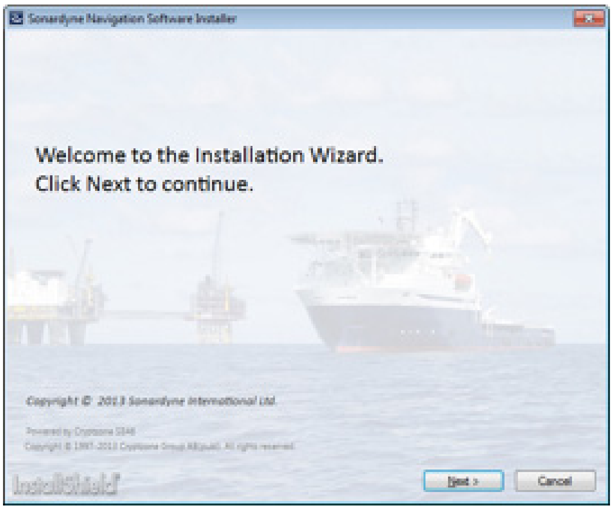
Non-Sonardyne computer installations

1. Load the software installation DVD into the PC's DVD drive.

2. Use Windows Explorer to navigate to the DVD and run the setup executable file.

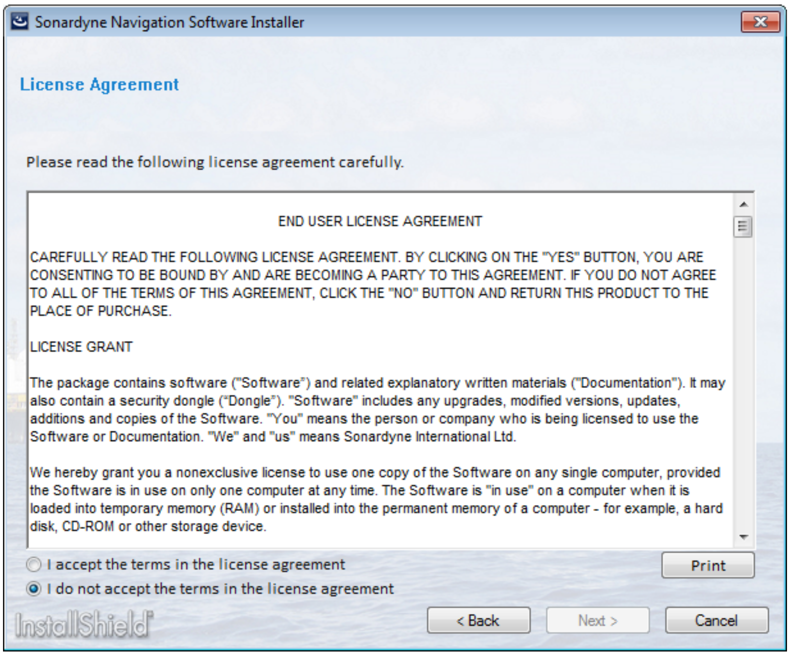
For all computer types

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.

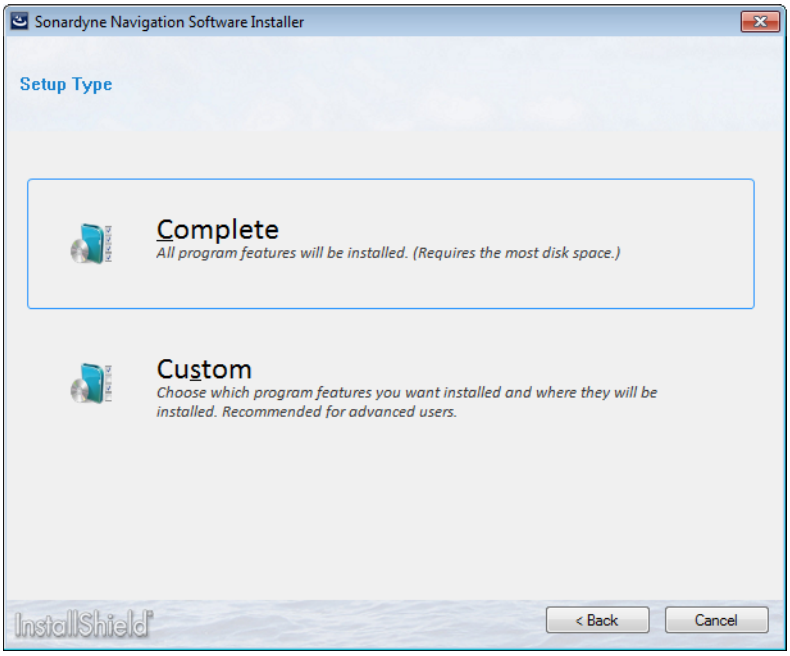
5. Read the licence agreement under which the software is supplied, and click **Yes** to accept the agreement.



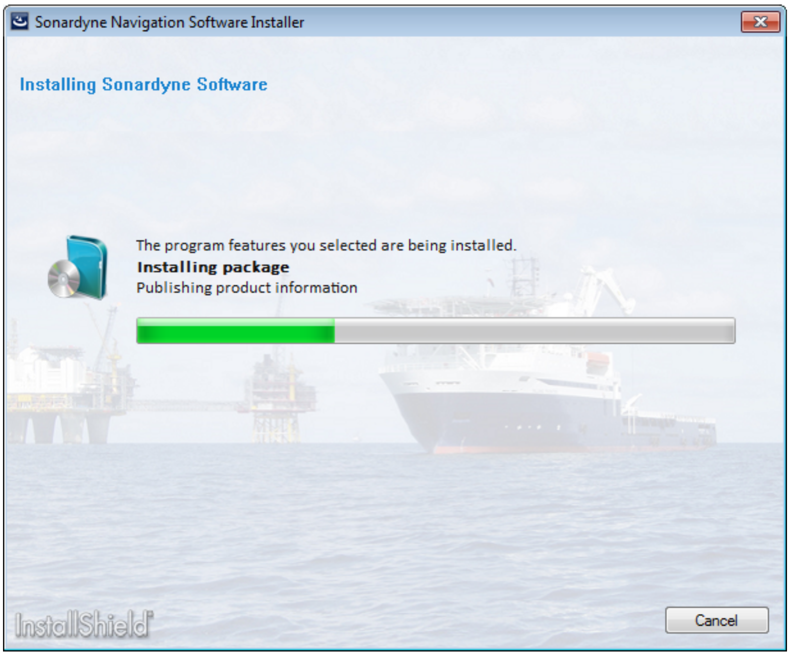
Note that you can print the licence agreement from this dialog.

6. Select either:

- **Complete** for a complete, regular installation, OR
- **Custom** to override the default contents for the installation.



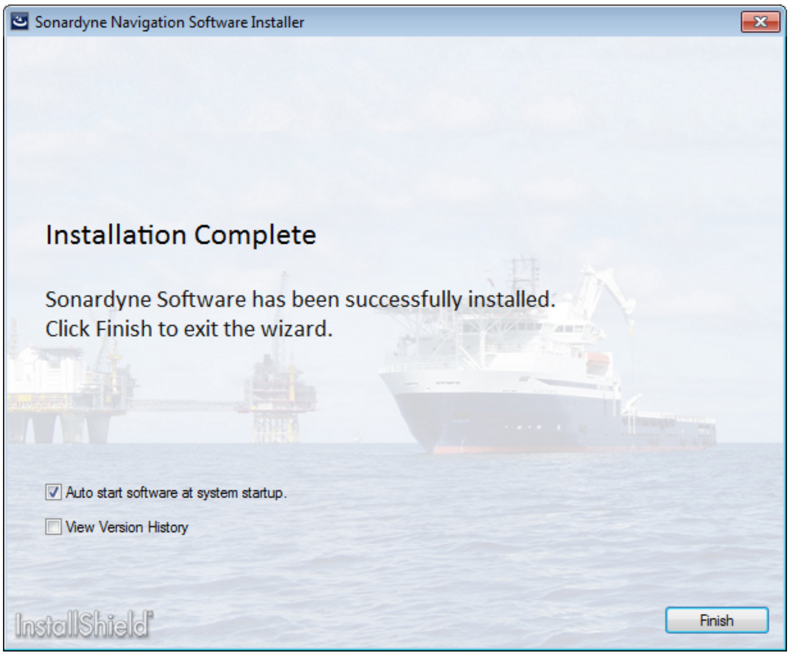
7. Click **Next** to begin the installation process. A progress bar indicates the installation progress.



8. The final dialog allows you to:

- select whether to start the software automatically when the system starts, and
- read the software release notes.

Select the options you want to use and click Finish to complete the installation.



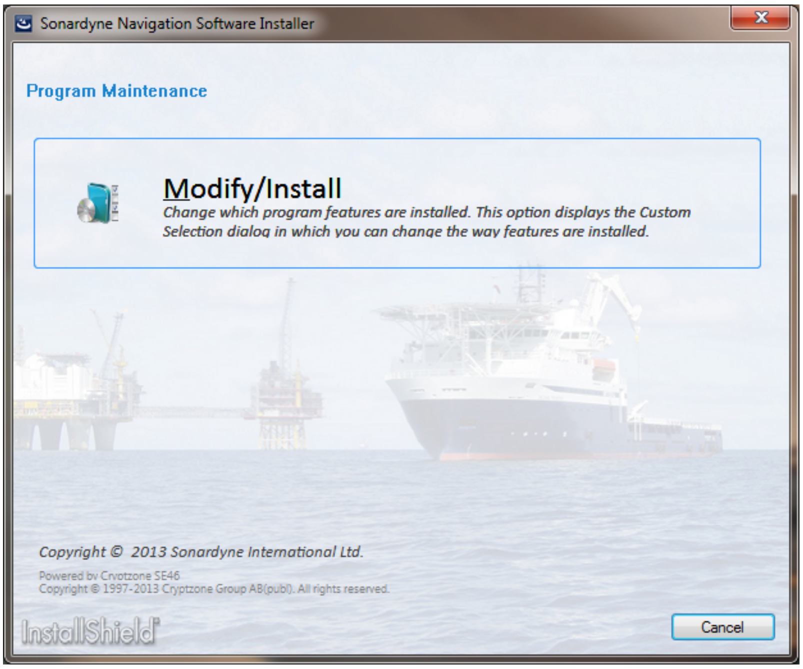
Maintenance procedure

At any time, run the setup executable on the installation DVD to perform maintenance procedures.

1. Load the software installation DVD into the PC's DVD drive.

2. Use Windows Explorer to navigate to the DVD and run the setup executable file.

3. Select **Modify/Install** to install alternative or custom software components, depending on the security key options available.



F Interface Cables

In this chapter… This chapter contains the following sections:

F.1 Serial Interfaces

Serial interfaces to the NSH are either RS232 or RS422 (RS485).

The configuration of the modules in the NSH will define what connections are available. Refer to Figure 20 on page 128 for a typical system configuration. Sonardyne supplies appropriate serial cables with each system.

Modules are available to connect to synchro gyros and analogue VRUs. These are not supplied as standard—you must order them from Sonardyne with the appropriate modules if you need them.

F.2 Cable Diagrams

Table 8 List of cable diagrams

CPN	Type	Notes
820-0118	NSH Dual redundant transceiver cable assembly	
820-6608	RS232 serial data cable to open flylead	
820-6459	8-pin Lemo to open flylead	Transceiver interface cable
820-3349	Responder cable	
820-6484	8-pin Lemo to 48V USBL	Digital USBL transceivers only
820-3427	Transceiver cable	
820-3650	Serial I/O cable	

Figure 29 NSH Dual redundant transceiver cable assembly – CPN 820-0118

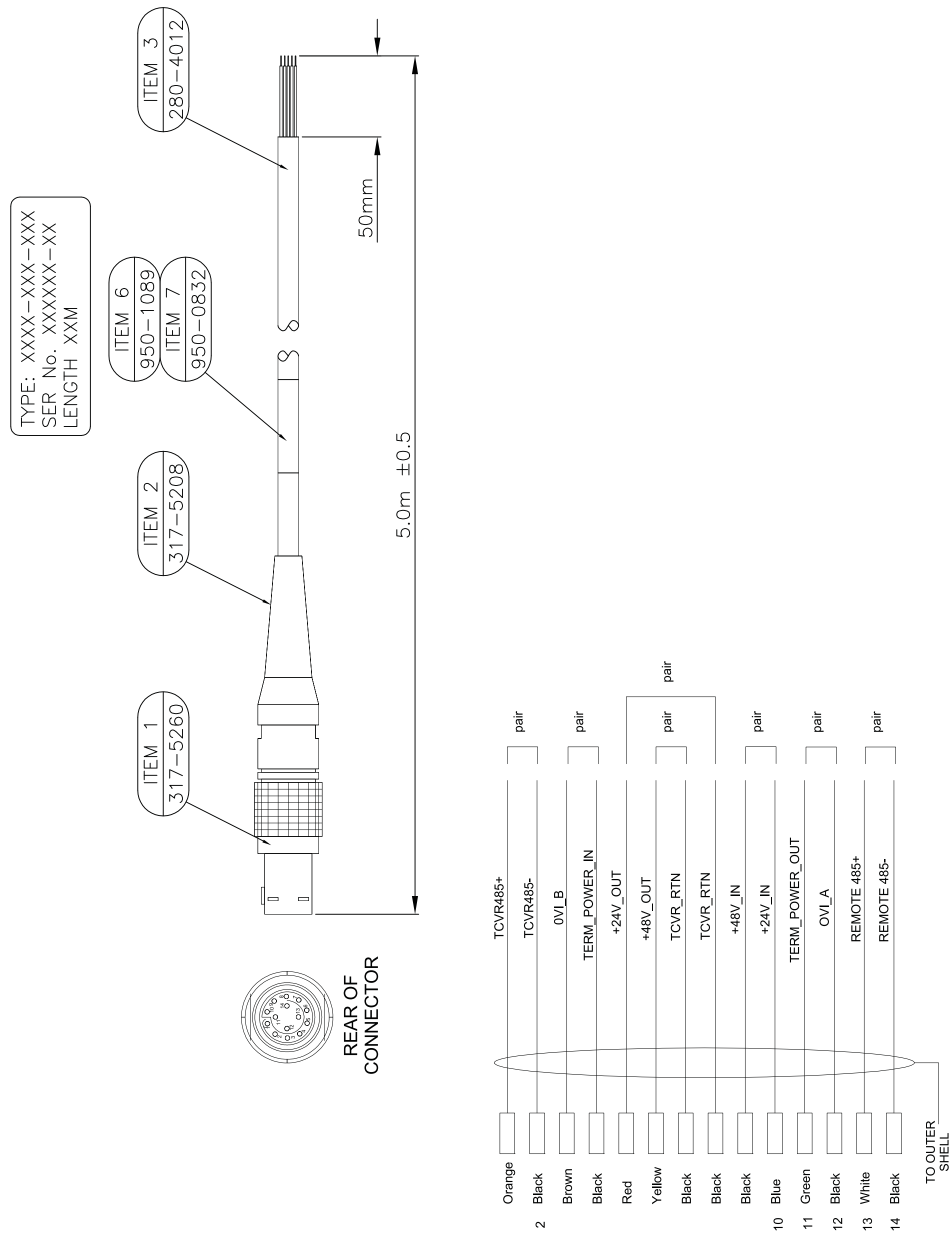


Figure 30 RS232 Serial Data Cable to Flylead – CPN 820-6608

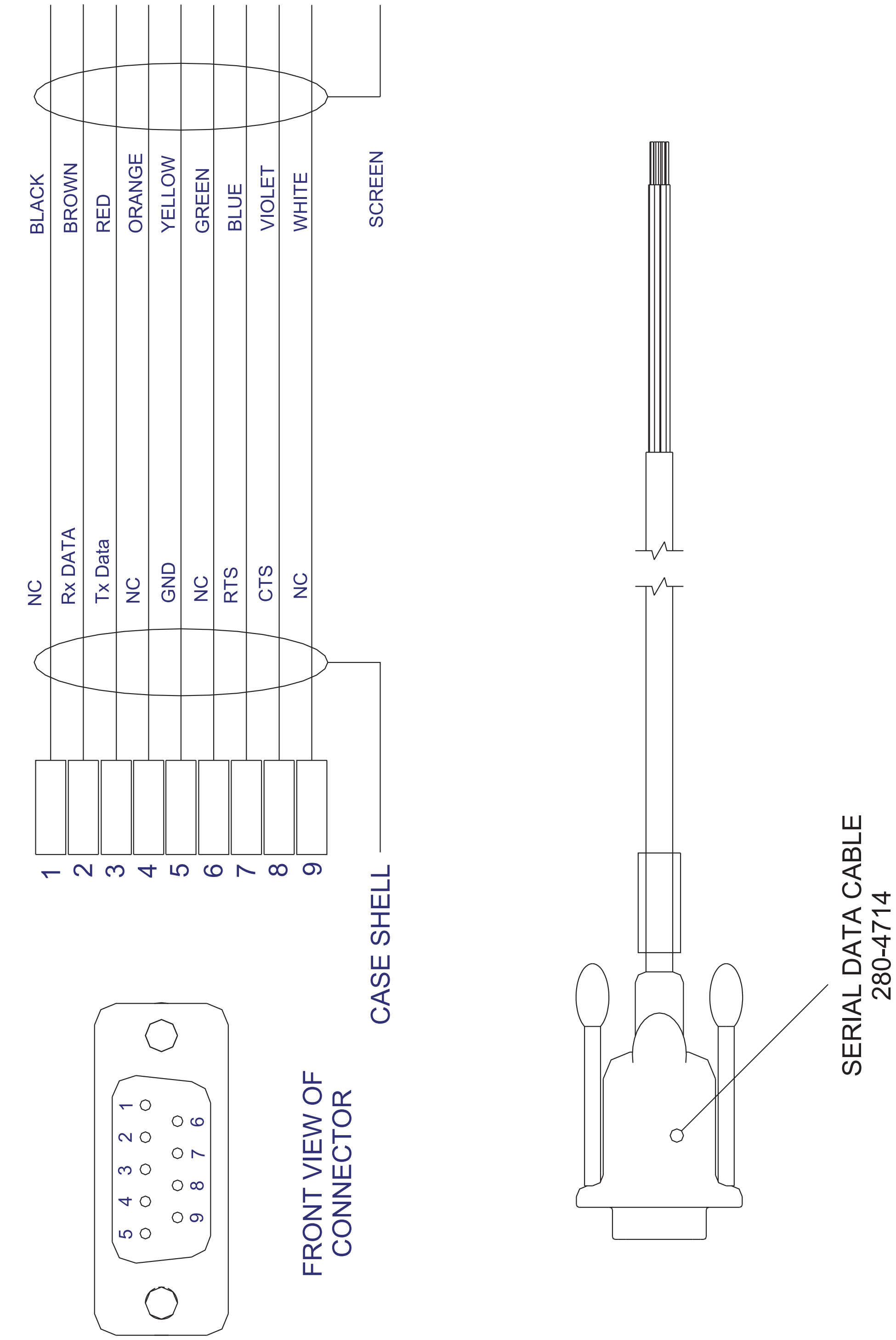


Figure 31 8-Pin Lemo to Flylead – CPN 820-6459

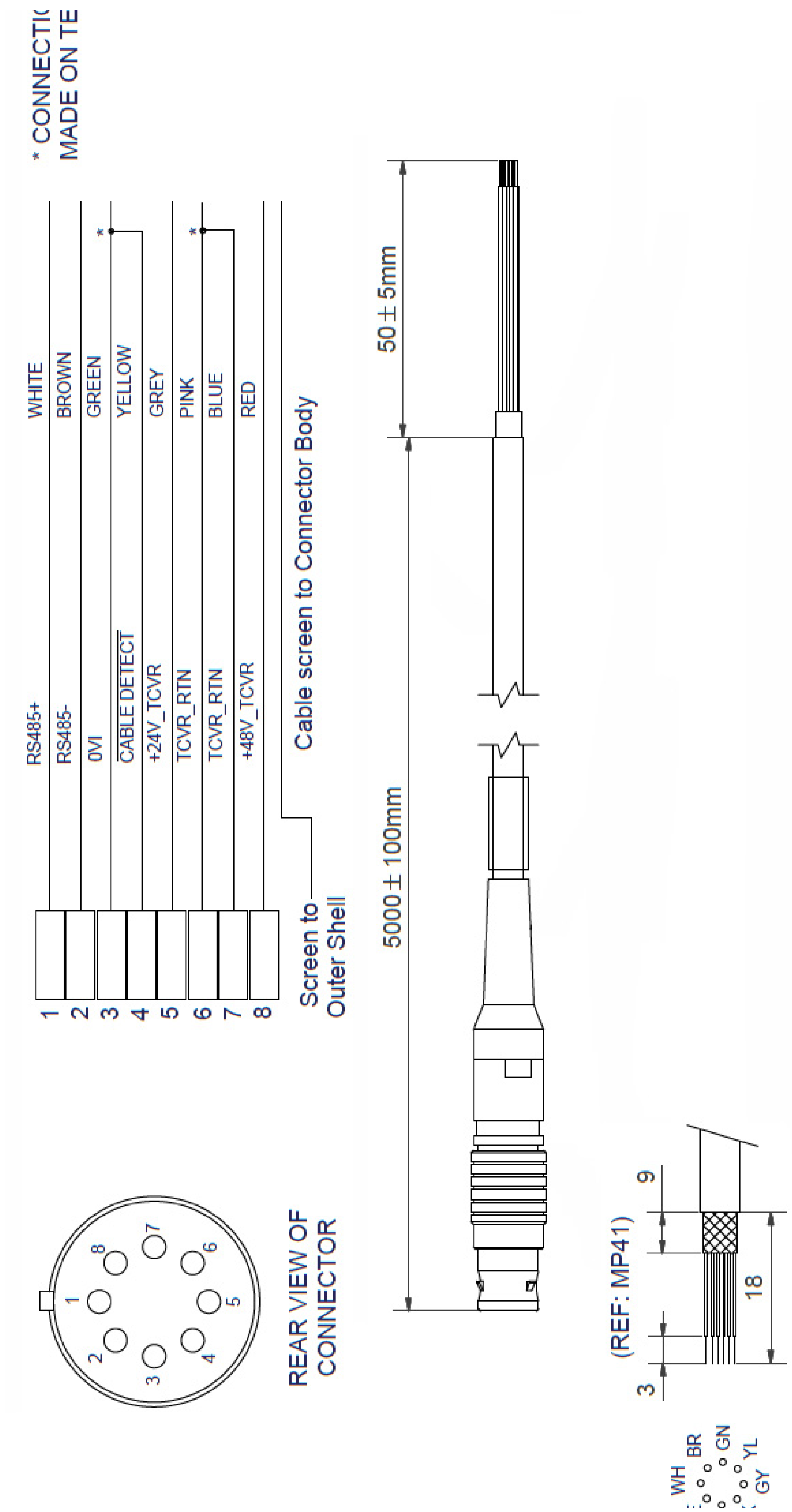
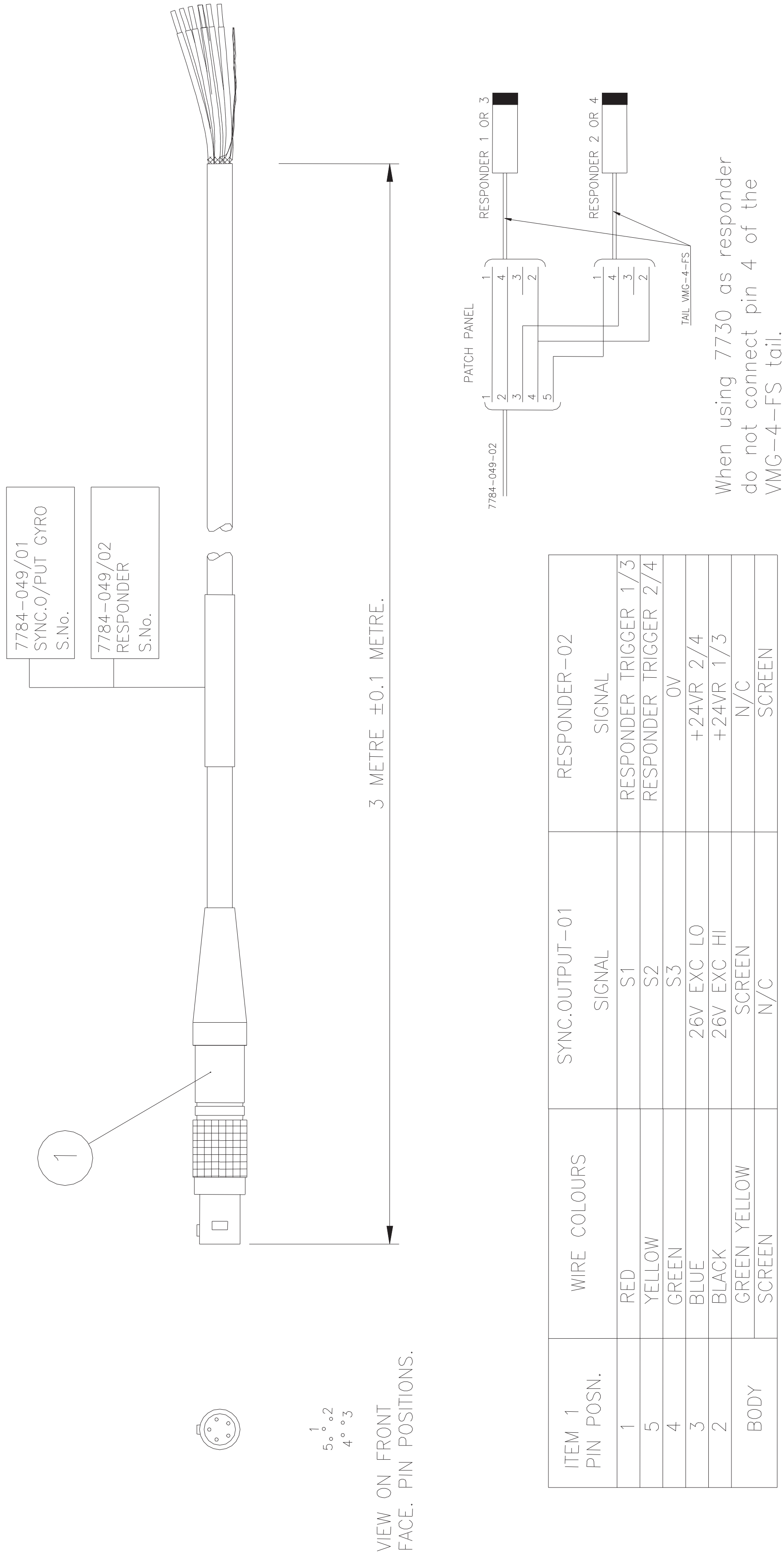


Figure 32 Responder Cable – CPN 820-3349



ITEM 1 PIN POSN.	WIRE COLOURS	SYNC.OUTPUT-01 SIGNAL	RESPONDER-02 SIGNAL
1	RED	S1	RESPONDER TRIGGER 1/3
5	YELLOW	S2	RESPONDER TRIGGER 2/4
4	GREEN	S3	0V
3	BLUE	26V EXC LO	+24VR 2/4
2	BLACK	26V EXC HI	+24VR 1/3
BODY	GREEN YELLOW SCREEN	SCREEN	N/C
	SCREEN	N/C	SCREEN

Figure 33 8-Pin Lemo to 48V USBL Transceiver – CPN 820-6484

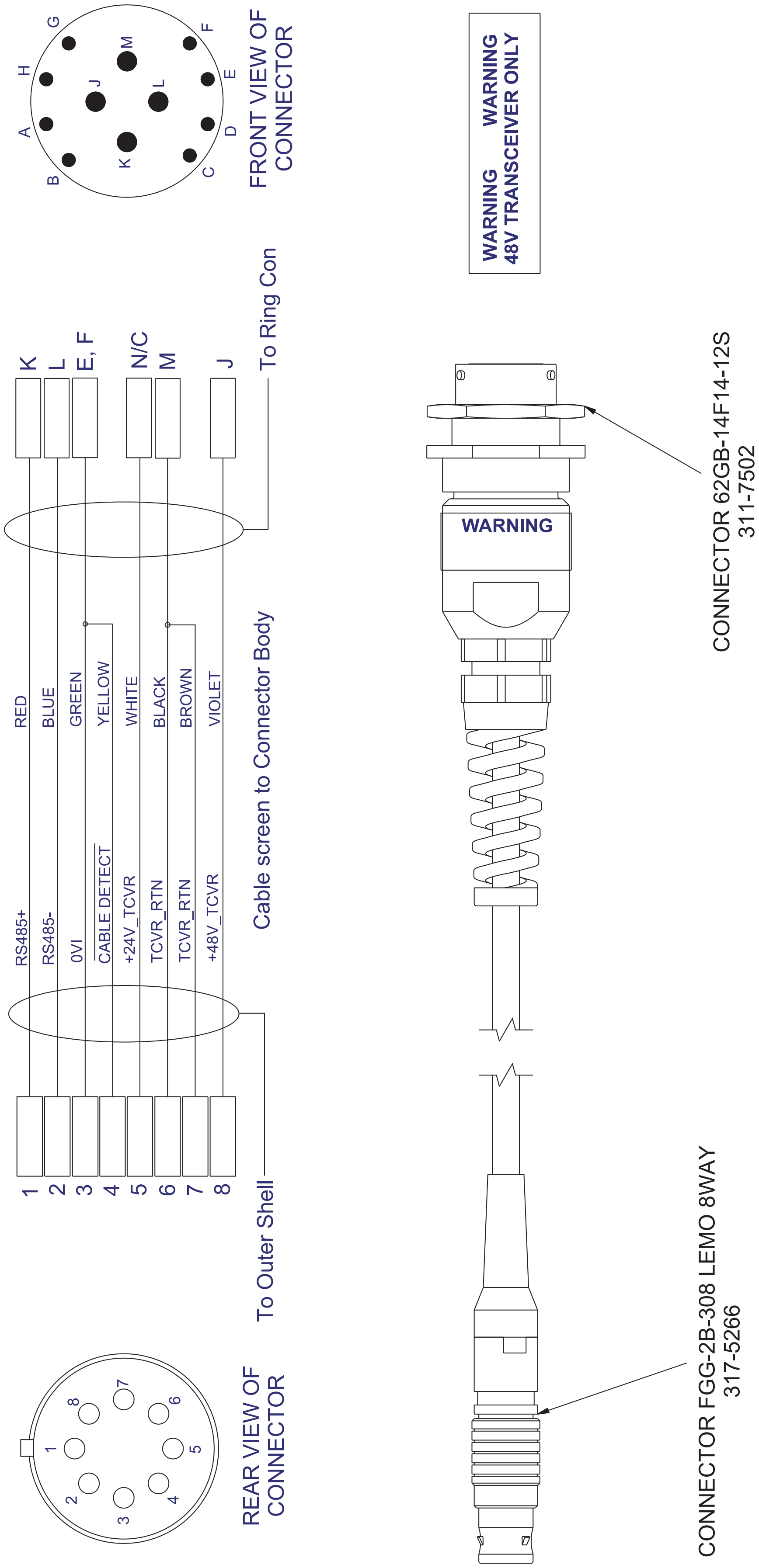
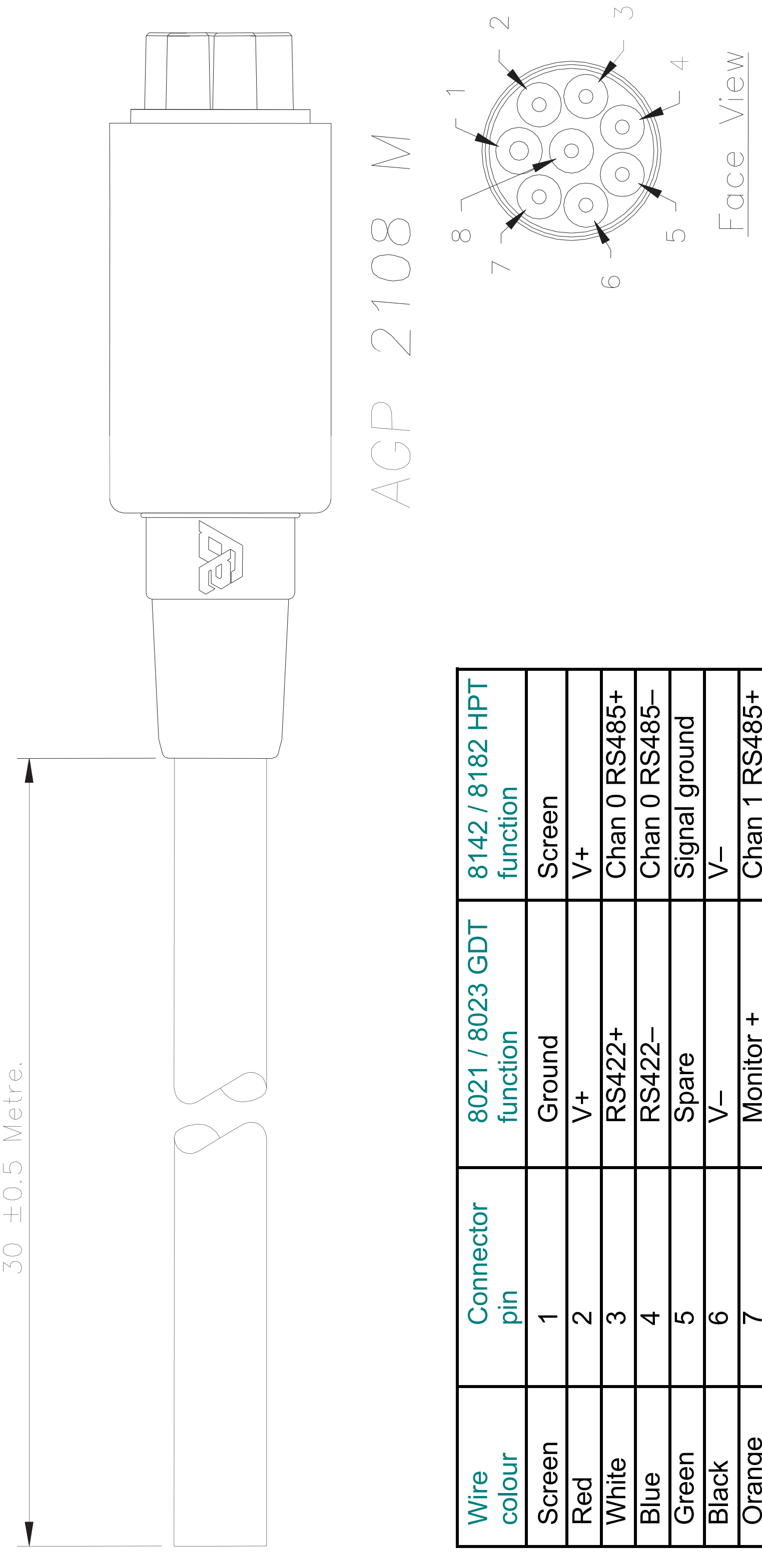
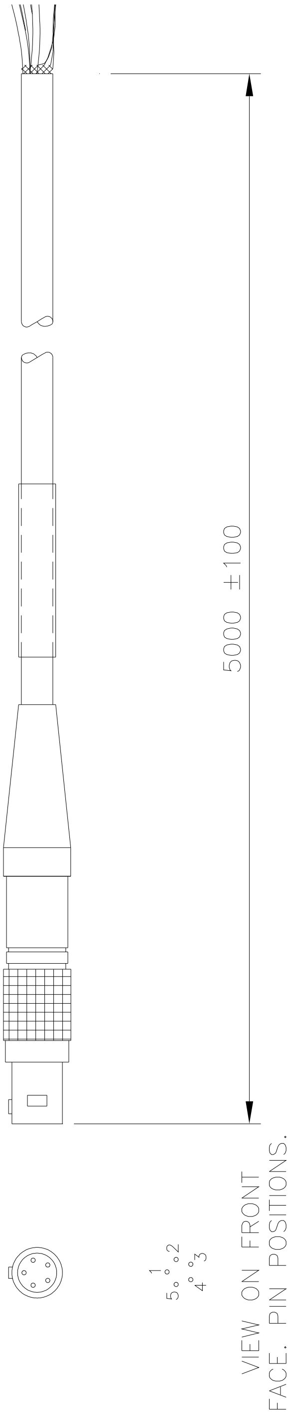


Figure 34 Transceiver Cable – CPN 820-3427



Wire colour	Connector pin	8021 / 8023 GDT function	8142 / 8182 HPT function
Screen	1	Ground	Screen
Red	2	V+	V+
White	3	RS422+	Chan 0 RS485+
Blue	4	RS422–	Chan 0 RS485–
Green	5	Spare	Signal ground
Black	6	V–	V–
Orange	7	Monitor +	Chan 1 RS485+
Yellow	8	Monitor –	Chan 1 RS485–

Figure 35 Serial I/O cable – CPN 820-3650



ITEM 1 PIN POSN.	WIRE COLOUR ISSUE B3 & EARLIER	WIRE COLOUR ISSUE B4 & LATER	Serial I/O RS422 SIGNAL
1	RED	WHITE	TX+
2	BLACK	BROWN	TX−
3	BLUE	GREEN	RX+
4	GREEN	YELLOW	RX−
5	YELLOW	GREY	0V1
BODY	SCREEN	SCREEN	SCREEN

CUT BACK WHITE CORE TO END OF OUTER SHEATH TO ISOLATE BOTH ENDS.

F.3 Cable Diagrams for Lodestar applications

Table 9 List of cable diagrams for Lodestar applications

CPN	Type
820-0065	Subsea Lodestar console cable assembly – 8084-136-01
820-0068	Subsea Lodestar Comms C1 cable assembly – 8084-137-01
820-0071	Subsea Lodestar Comms Ethernet tail cable assembly – 8084-138-01
820-0073	Subsea Lodestar transceiver tail cable assembly – 8084-139-01
820-0147	NSH Lodestar tail cable – 8098-090-01
820-6873	Gyro USBL mobile system cable – 8130-170-01
820-6882	Gyro USBL mobile system cable – 8130-175-01
Refer to table in drawing	Gyro USBL tail cable – 8130-200-A1

Figure 36 Subsea Lodestar console cable assembly – 8084-136-01

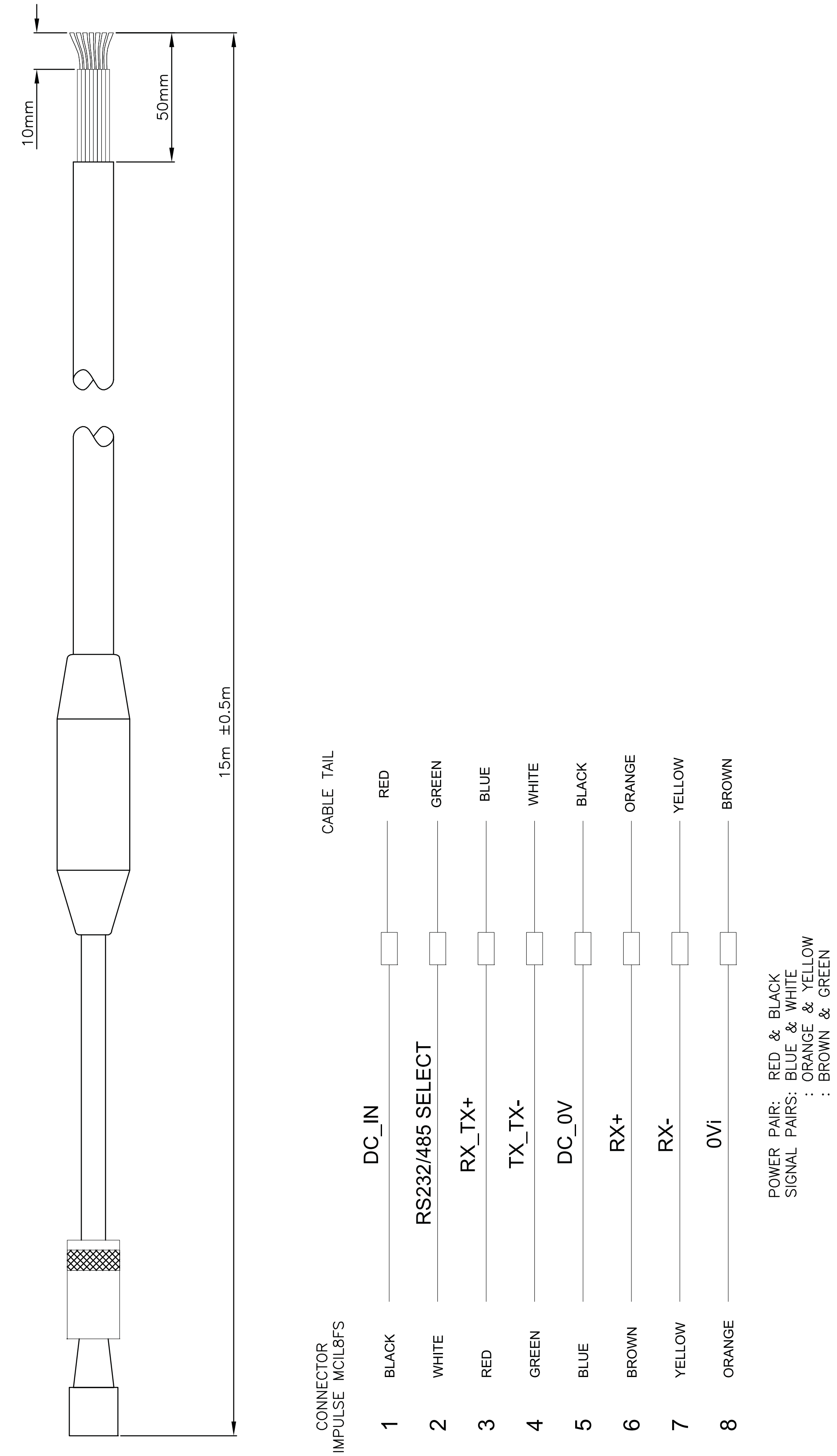


Figure 37 Subsea Lodestar Comms C1 cable assembly – 8084-137-01

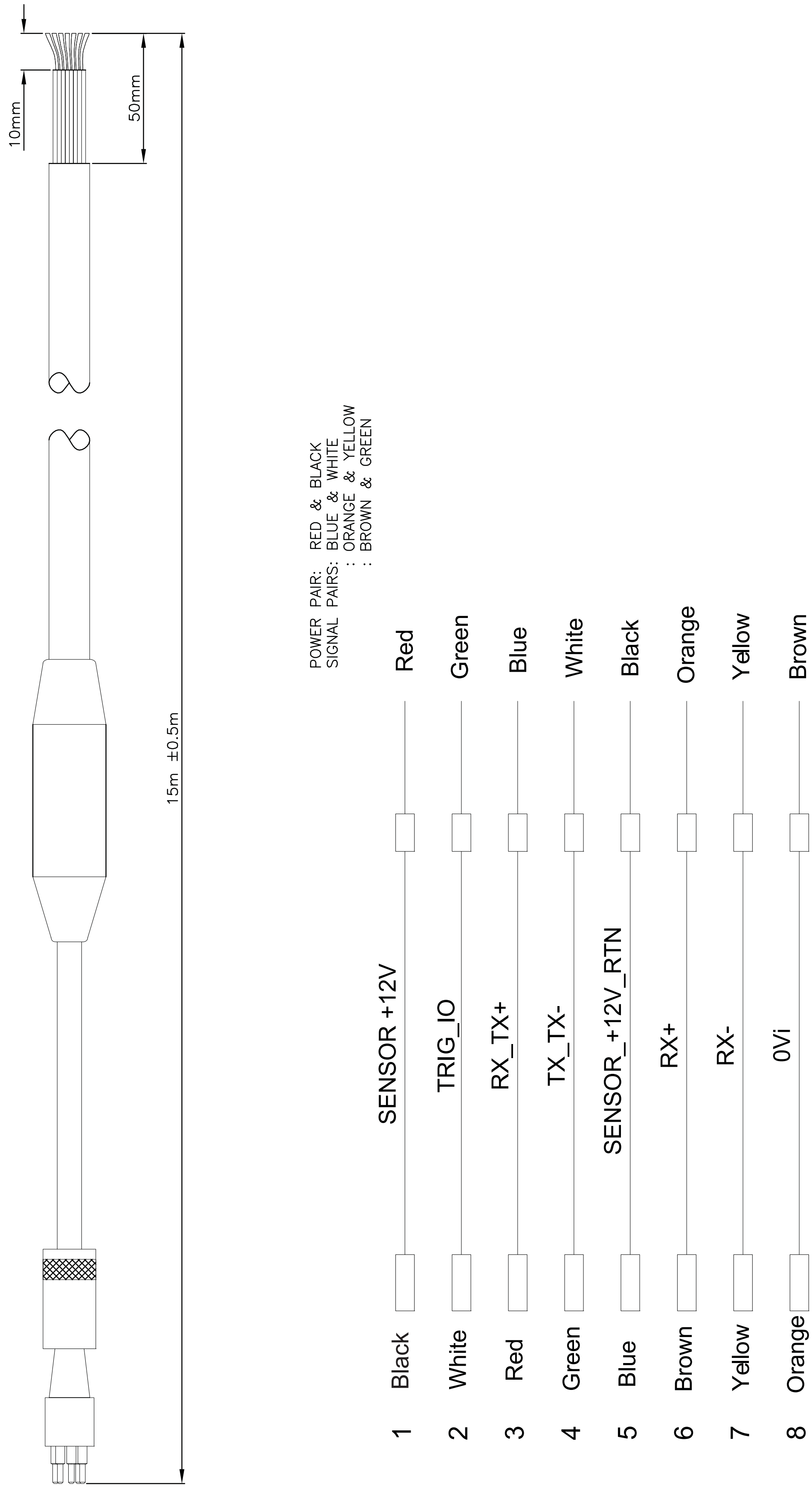
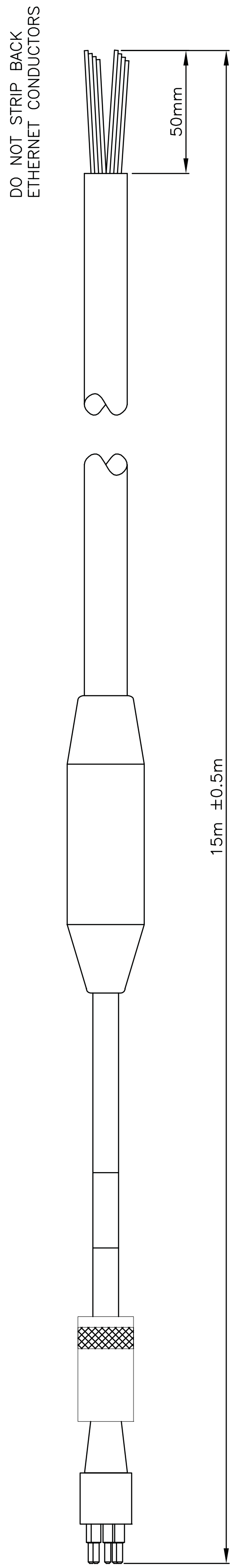


Figure 38 Subsea Lodestar Comms Ethernet tail cable assembly – 8084-138-01



POWER CONDUCTORS: RED, BLACK, GREEN, GREY & BLUE

SIGNAL PAIRS: BLUE & WHITE/BLUE
: ORANGE & WHITE/ORANGE
: BROWN & WHITE/BROWN
: GREEN & WHITE/GREEN

WIRING TABLE

IMPULSE CONNECTOR (ITEM 1)	DESCRIPTION	CABLE (ITEM 3)
1	SPARE 1	BROWN (22 AWG)
2	TRIG_IO	BLUE (16 AWG)
3	Ethernet TD+	WHITE/GREEN (22 AWG)
4	Ethernet TD-	GREEN (22 AWG)
5	SPARE 2	WHITE/BROWN (22 AWG)
6	Ethernet RD+	WHITE/ORANGE (22 AWG)
7	Ethernet RD-	ORANGE (22 AWG)
8	0Vi	BLACK (16 AWG)

Figure 39 Subsea Lodestar Comms Ethernet cable assembly – 8084-138-04

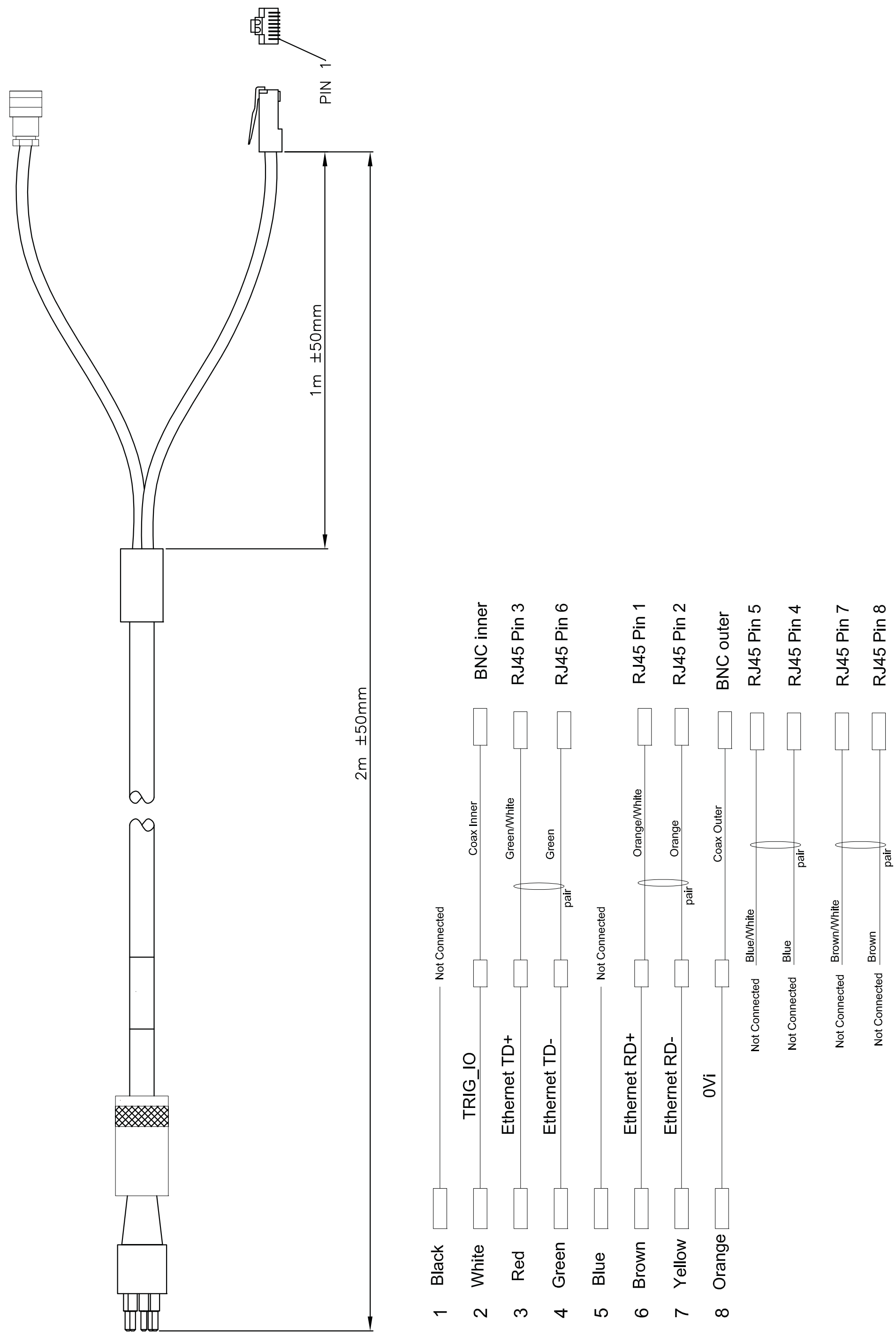


Figure 40 Subsea Lodestar transceiver tail cable assembly – 8084-139-01

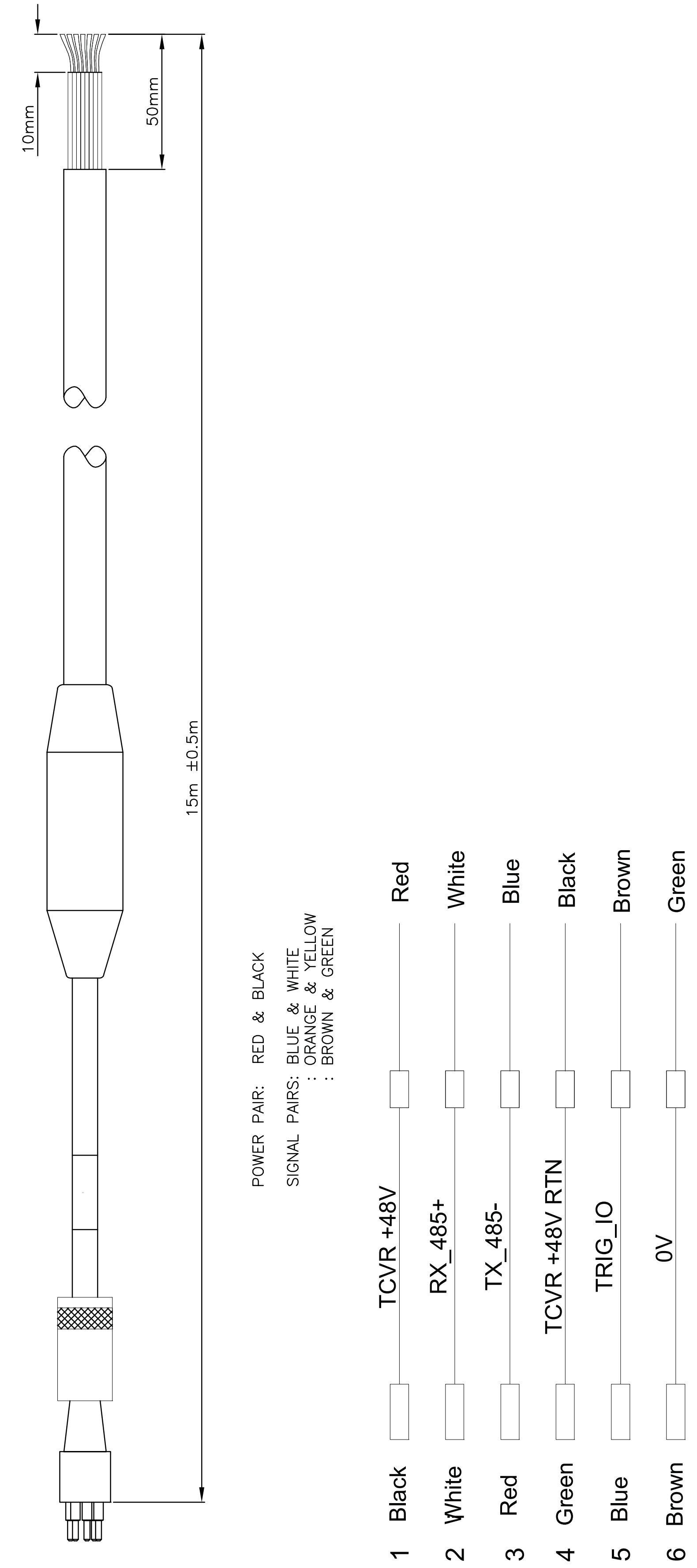


Figure 41 NSH Lodestar tail cable – 8098-090-01

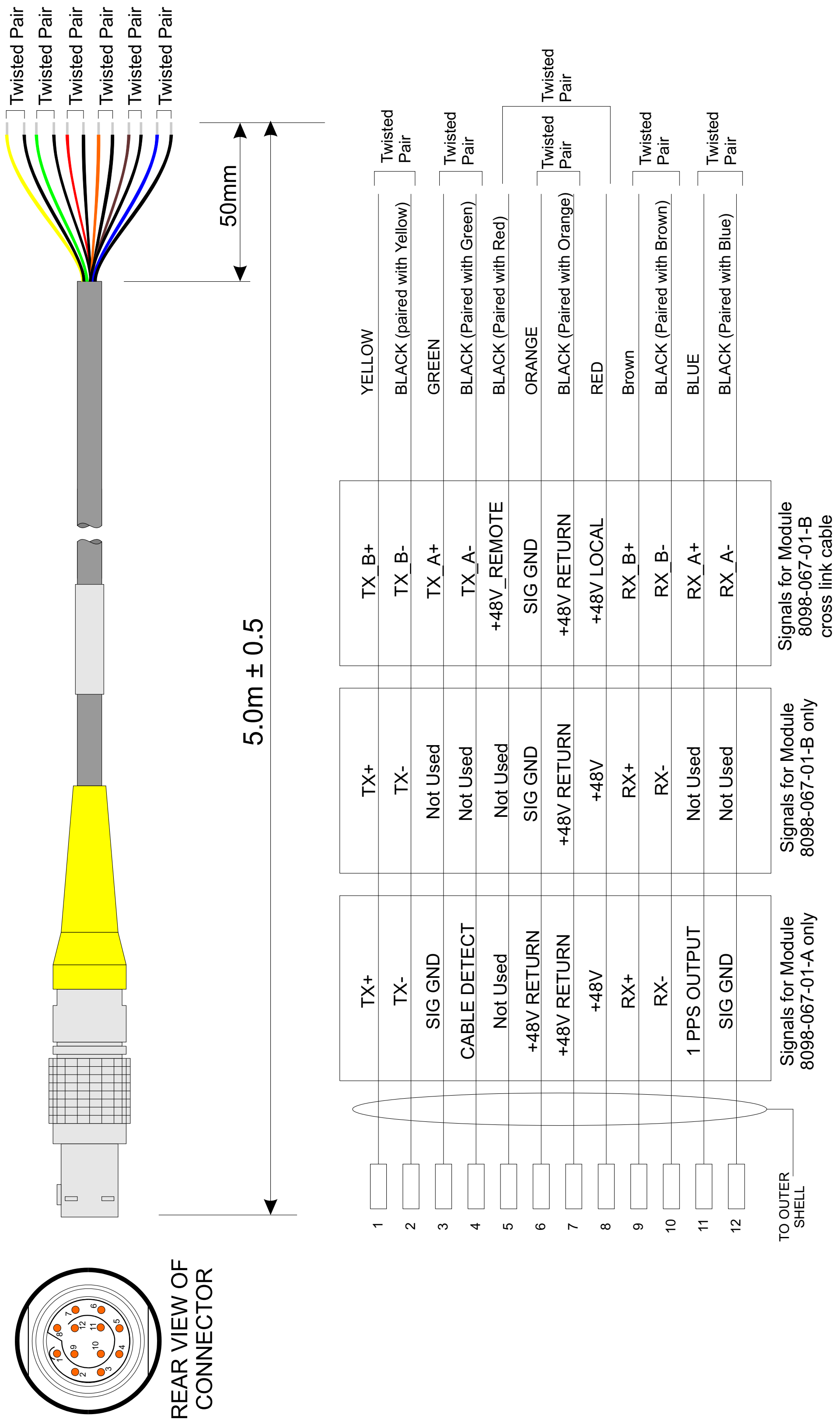
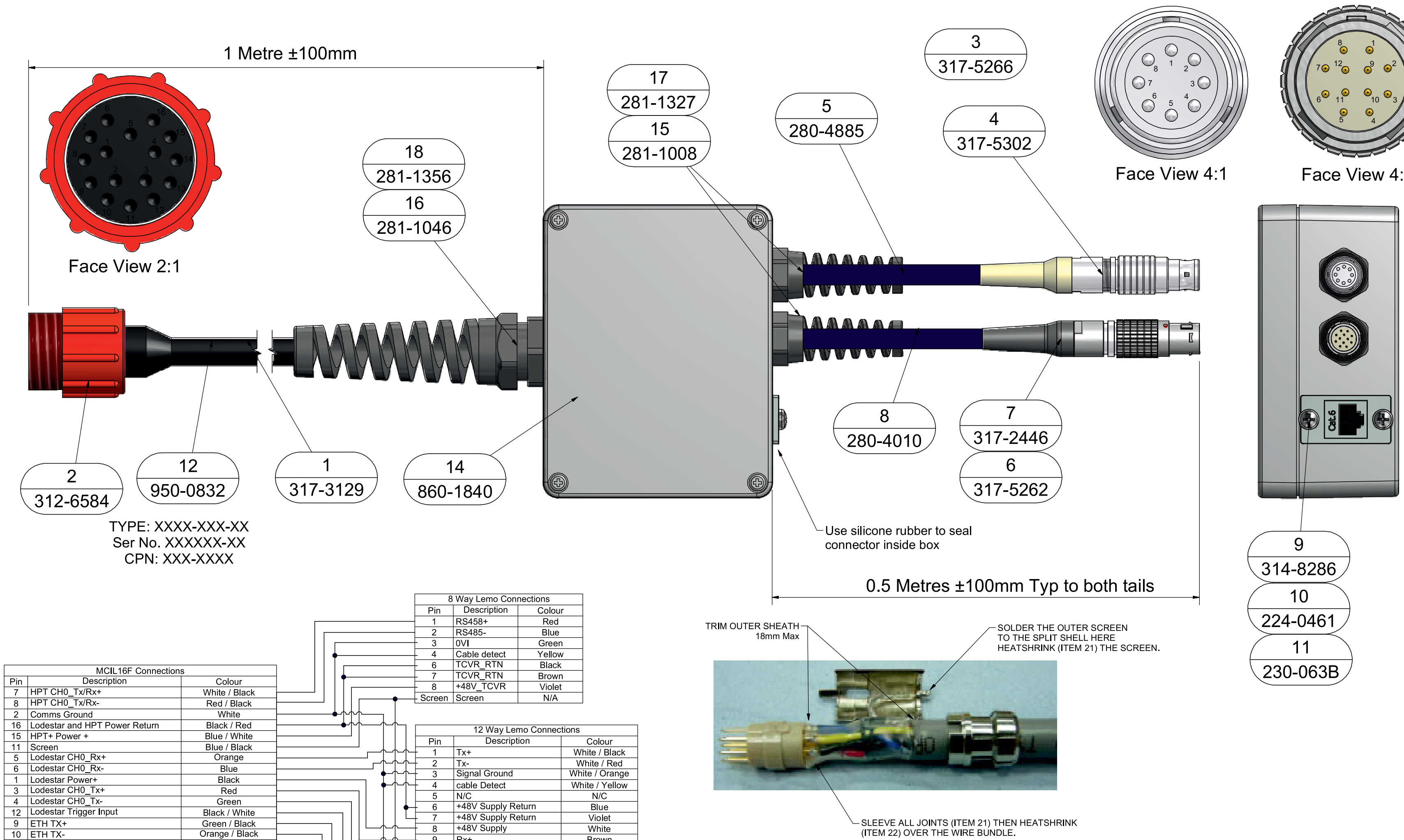


Figure 42 Gyro USBL mobile system cable – 8130-170-01



MCIL16F Connections

Pin	Description	Colour
7	HPT CH0_Tx/Rx+	White / Black
8	HPT CH0_Tx/Rx-	Red / Black
2	Comms Ground	White
16	Lodestar and HPT Power Return	Black / Red
15	HPT+ Power +	Blue / White
11	Screen	Blue / Black
5	Lodestar CH0_Rx+	Orange
6	Lodestar CH0_Rx-	Blue
1	Lodestar Power+	Black
3	Lodestar CH0_Tx+	Red
4	Lodestar CH0_Tx-	Green
12	Lodestar Trigger Input	Black / White
9	ETH TX+	Green / Black
10	ETH TX-	Orange / Black
13	ETH RX+	Red / White
14	ETH RX-	Green / White

8 Way Lemo Connections

Pin	Description	Colour
1	RS458+	Red
2	RS485-	Blue
3	0VI	Green
4	Cable detect	Yellow
6	TCVR_RTN	Black
7	TCVR_RTN	Brown
8	+48V_TCVR	Violet
Screen	Screen	N/A

12 Way Lemo Connections

Pin	Description	Colour
1	Tx+	White / Black
2	Tx-	White / Red
3	Signal Ground	White / Orange
4	cable Detect	White / Yellow
5	N/C	N/C
6	+48V Supply Return	Blue
7	+48V Supply Return	Violet
8	+48V Supply	White
9	Rx+	Brown
10	Rx-	Red
11	1PPS Input to Lodestar	Orange
12	Signal Ground	Black
Screen	Screen	N/A

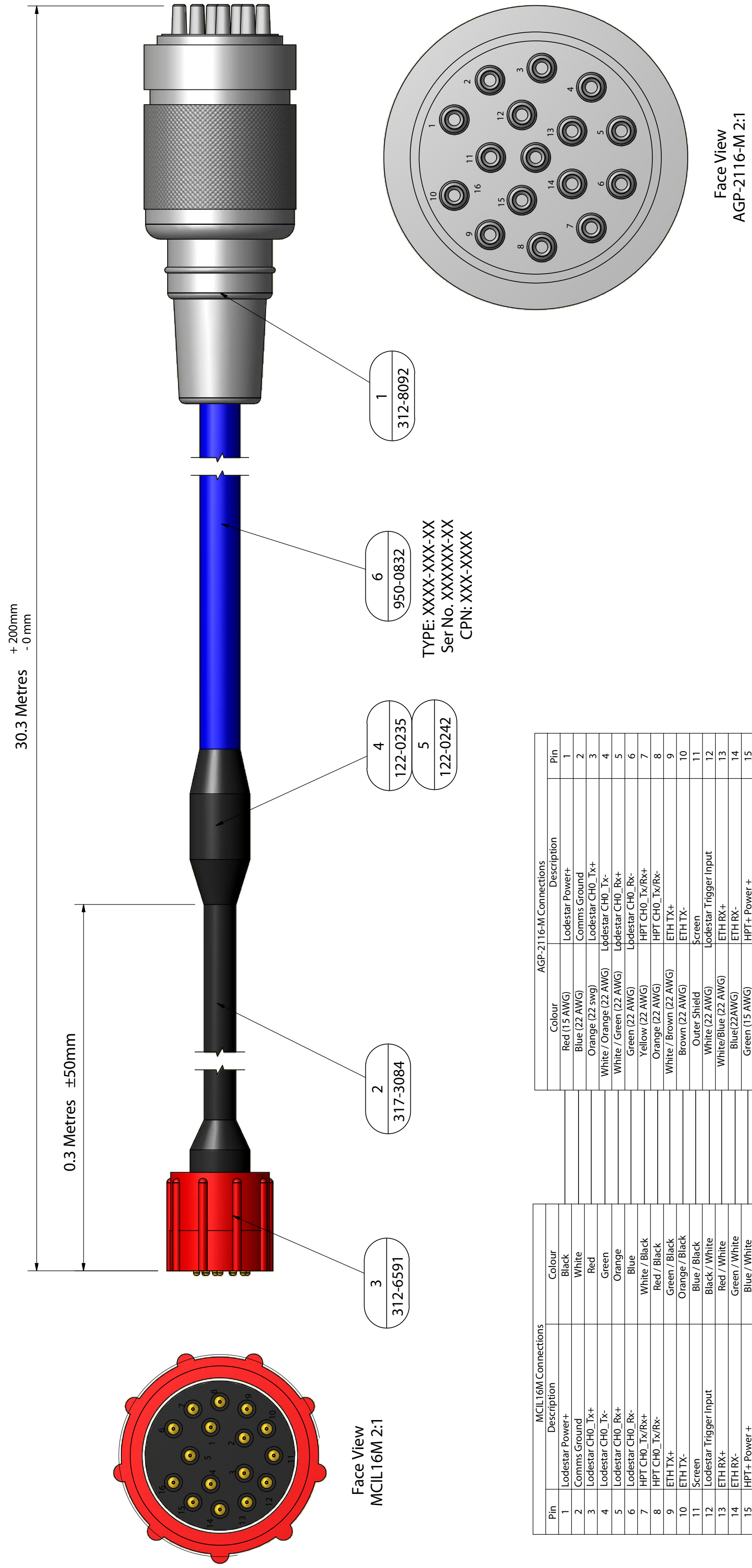
RJ45 Patch lead

Pin	Description	Colour
1	ETH TX+	White/Orange
2	ETH TX-	Orange
3	ETH RX+	White/Green
6	ETH RX-	Green

Assembly notes.
1, Cut one end off patch cable, Item 20.
Wire with inline joints to Item 1 as per wiring table.
Plug RJ45 patch cable into coupler plug Item 9 inside box.

2, Insulate all wire joints with suitable heatshrink.

Figure 43 Gyro USBL mobile system cable – 8130-175-01



MCIL16M Connections		
Pin	Description	Colour
1	Lodestar Power+	Black
2	Comms Ground	White
3	Lodestar CH0_Tx+	Red
4	Lodestar CH0_Tx-	Green
5	Lodestar CH0_Rx+	Orange
6	Lodestar CH0_Rx-	Blue
7	HPT CH0_Tx/Rx+	White / Black
8	HPT CH0_Tx/Rx-	Red / Black
9	ETH TX+	Green / Black
10	ETH TX-	Orange / Black
11	Screen	Blue / Black
12	Lodestar Trigger Input	Black / White
13	ETH RX+	Red / White
14	ETH RX-	Green / White
15	HPT+ Power +	Blue / White
16	Lodestar and HPT Power Return	Black / Red

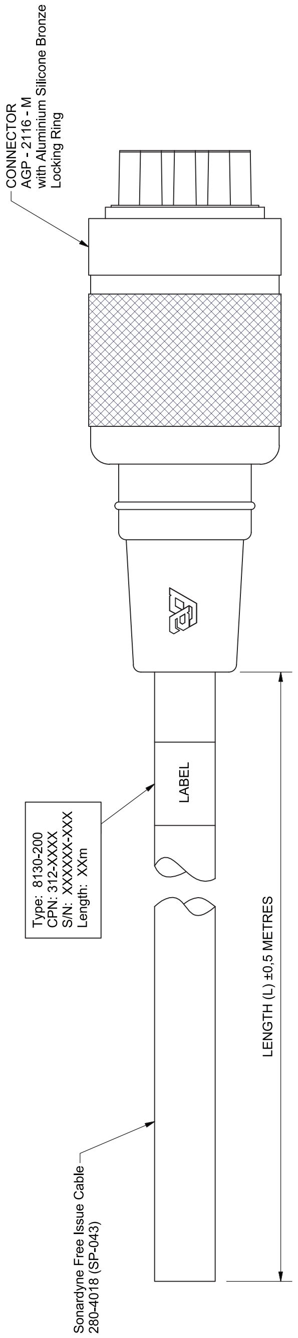
AGP-2116-M Connections		
Colour	Description	Pin
Red (15 AWG)	Lodestar Power+	1
Blue (22 AWG)	Comms Ground	2
Orange (22 swg)	Lodestar CH0_Tx+	3
White / Orange (22 AWG)	Lodestar CH0_Tx-	4
White / Green (22 AWG)	Lodestar CH0_Rx+	5
Green (22 AWG)	Lodestar CH0_Rx-	6
Yellow (22 AWG)	HPT CH0_Tx/Rx+	7
Orange (22 AWG)	HPT CH0_Tx/Rx-	8
White / Brown (22 AWG)	ETH TX+	9
Brown (22 AWG)	ETH TX-	10
Outer Shield	Screen	11
White (22 AWG)	Lodestar Trigger Input	12
White/Blue (22 AWG)	ETH RX+	13
Blue(22AWG)	ETH RX-	14
Green (15 AWG)	HPT+ Power +	15
Black (13 AWG)	Lodestar and HPT Power Return	16

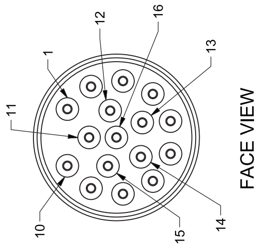
Insulate all Unused Cores

Notes:

1. It is critical that the "twisted pairs" are twisted all the way up to the connector pin. The rate & direction of twist must be maintained.
2. All connections to be isolated with heatshrink.
3. Do not connect the shield on the twisted pairs. Isolate using heatshrink.
4. Connect the outer tinned copper braid to Pin 11.

Figure 44 Gyro USBL tail cable – 8130-200-A1





LENGTH TABLE

Cable Length (L)	CPN
5 metres	312-8091
30 metres	312-8092
50 metres	312-8093
100 metres	312-8094
200 metres	312-8095

Notes:

1. It is critical that the "twisted pairs" are twisted all the way up to the connector pin. The rate & direction of twist must be maintained.
2. All connections to be isulated with heatshrink.
3. Do not connect the shield on the twisted pairs. Isolate using heatshrink.
4. Connect the outer tinned copper braid to Pin 11.

WIRING TABLE

AGP-2116-M	WIRE	TWISTED PAIRS	
1	RED (15 AWG)		
2	BLUE (22 AWG)	5	
3	ORANGE (22 AWG)	2	CAT6 CORES
4	WHITE/ORANGE (22 AWG)	2	
5	WHITE/GREEN (22 AWG)	3	
6	GREEN (22 AWG)	3	
13	WHITE/BLUE (22 AWG)	1	
14	BLUE (22 AWG)	1	
9	WHITE/BROWN (22 AWG)	4	
10	BROWN (22 AWG)	4	
11	OUTER SHIELD		
12	WHITE (22 AWG)	5	
7	YELLOW (22 AWG)	6	
8	ORANGE (22 AWG)	6	
15	GREEN (15 AWG)		
16	BLACK (13 AWG)		

G Remote Control Interface

In this chapter… This chapter contains the following sections:

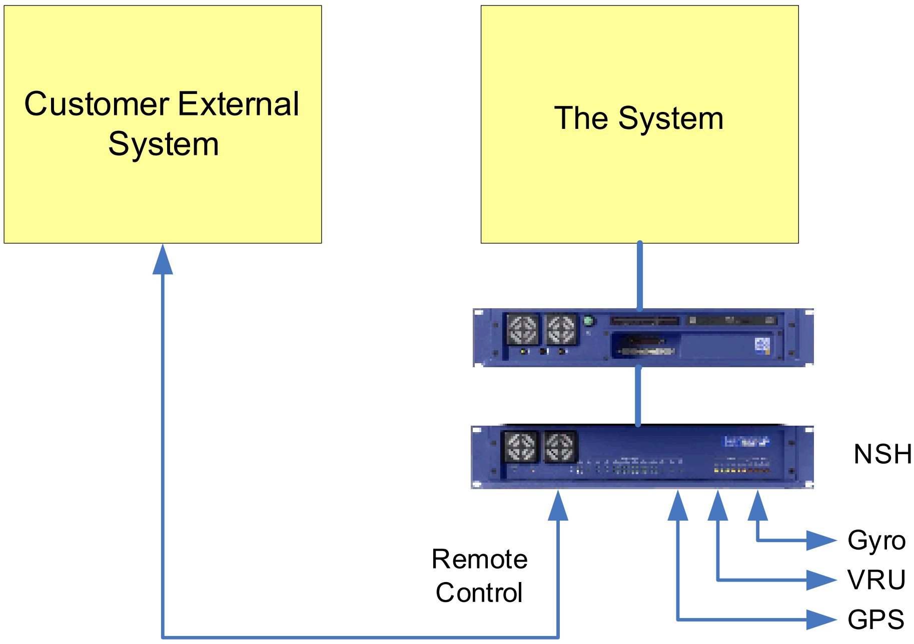
This appendix describes the Remote Control interface, which allows an External System to control and monitor a system. Typical uses for the Remote Control interface include:

- ❑ Starting or stopping acoustic tracking
- ❑ Interrogating the system status
- ❑ Controlling depth aiding

G.1 Hardware interface

The remote control link consists of an RS232 or RS485 connection from an external system to either the NAV PC or to its attached NSH. (Ethernet is not currently supported).

Figure 45 Remote control interface



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.

G.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.

G.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.

Note

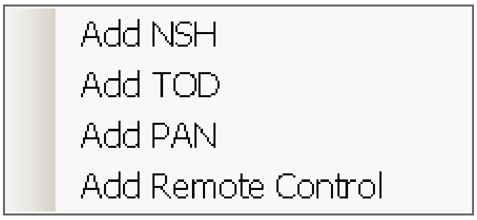
Sonardyne cannot be held responsible for the operation or debugging of any external system, and can only offer limited support for the use of the Remote Control feature.

G.4 Operation

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

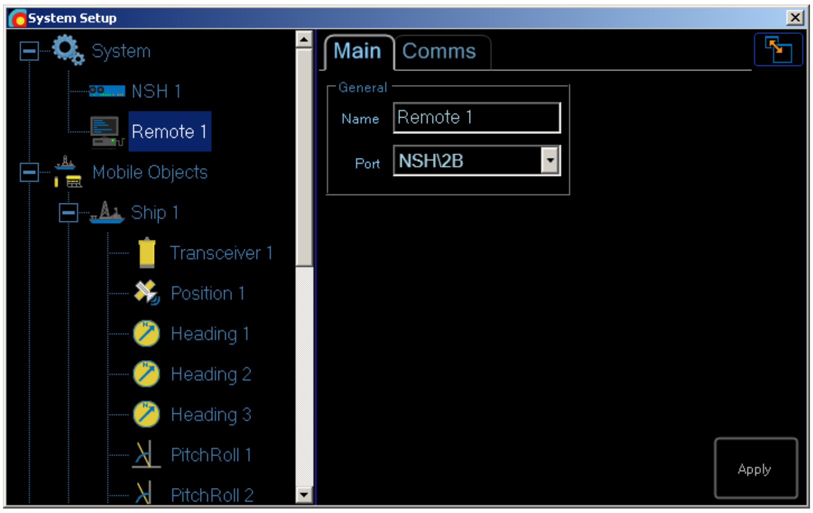
1. Connect an available NSH RS232 or RS485 port (as appropriate) to the external system

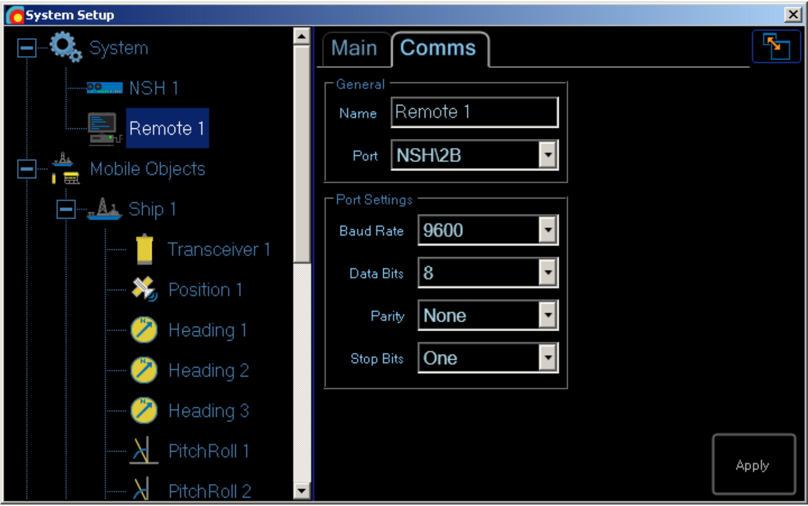
2. Use the **System Setup** tool, right-click on the **System** branch of the job tree and select **Add Remote Control**:



3. Set the NSH port to the chosen port and click **Apply**.

4. Select the **Comms** tab and set the Baud rate and other parameters.





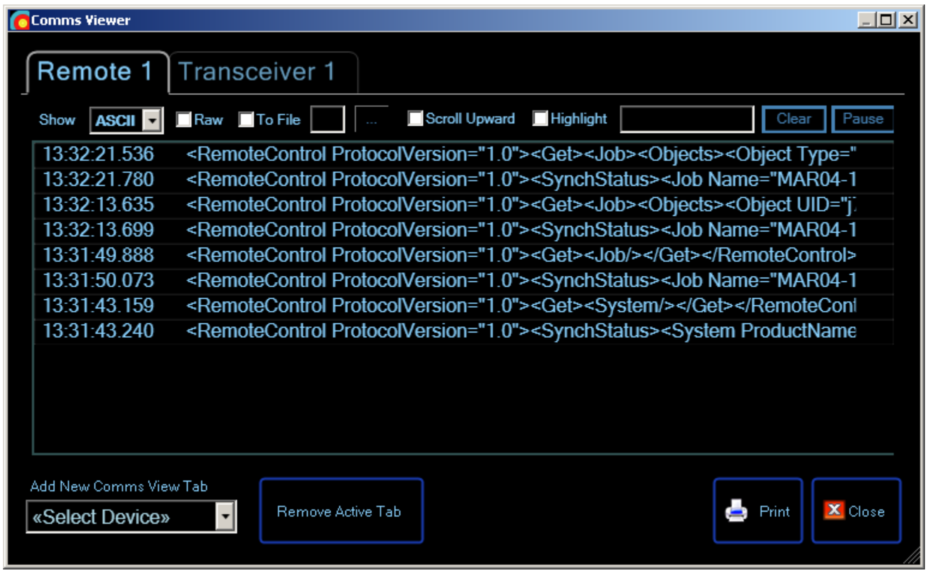
5. Run the external system's client software and establish communications.

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.

Figure 46 Comms Viewer window for the Remote Interface

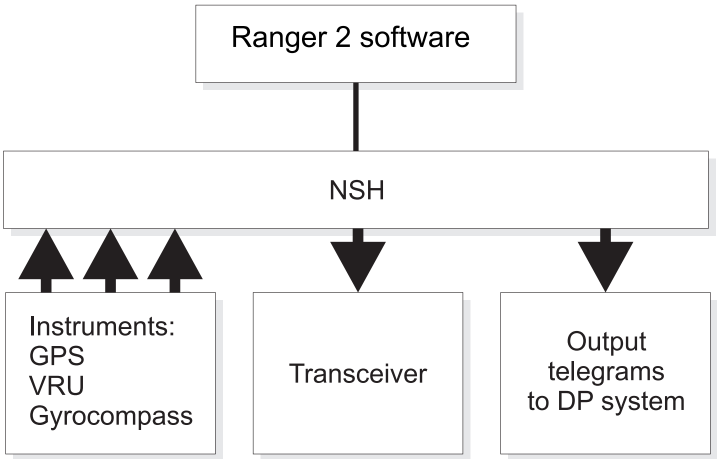


H Output Telegram Formats and Interfaces

In this chapter... This chapter contains the following sections:

H.1 Introduction

Figure 47 Interface block diagram



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 H.2 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.

Risk of equipment malfunction. For DP applications, whoever installs the system must make sure 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.

H.2 HPR 309

Description

The HPR 309 Telegram is the output telegram from the HPR 309 DP.

Format

Table 10 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
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

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.

Definition of field names:

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.

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, 12bit, 2’s complement.
- Resolution = 360.0 / 4096 degrees. (= 0.0878906 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.

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, 12bit, 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.

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.

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.

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. (= 0.125m).
- 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.

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. (= 0.125m).

- 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.

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. (= 0.125m).
- 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.

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.

Time Out

Bit 1 is set when the riser angle data is not valid.

Transponders in sequence

These are flags to indicate which transponders are being used.

Table 11 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).

Not Used (Tracking TD Angle)

Zero.

Not Used (Test)

Zero.

Transponder Type

0 = Standard transponder.

6 = Differential angles from Riser Angle Monitoring System (MRAMS).

Transponder Specification

Flags.

- Bit 0: Set for a mobile transponder, Cleared for a reference transponder.
- Bits 1 to 5: Unused, all cleared.

Not Used (Transducers)

Zero.

Not Used (Transducer Status)

Zero.

Kalman Filter Window

This is the horizontal position quality, rounded to the nearest metre.

Checksum

This is the result of performing an exclusive-OR on all bytes in the telegram up to but not including this byte.

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.

H.3 HPR 418 – Message 1 (USBL/SSBL)

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 12 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
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

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.

Definition of field names

Start character

This is a single byte start character 55 hex.

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.

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.

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.

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.

Operation_mode — A single byte containing the operation mode of the transceiver.

- ❑ 00 = standard navigation mode
- ❑ 01 = simulated position test mode. (Training)

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

Tp_type

- ❑ 000 = transponder
- ❑ 003 = transponder with Riser Angle Monitoring System (MRAMS)

Tp_operation — A single byte defining the operation mode of the transponder:

- ❑ 000 = fixed standard transponder
- ❑ 001 = mobile standard transponder

Pos_data_form — A single byte defining the position co-ordinate format:

- ❑ Bit 0 = 0 vessel oriented, Cartesian
- ❑ Bit 0 = 1 North oriented, Cartesian

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)

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.

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.

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.

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.

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.

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.

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.

P_course
A value in REAL format.

The vessel's course at the time of transponder position measurement; 0 to 360 degrees.

P_roll
A value in REAL format.

The vessel's roll at the time of transponder position measurement +/–180 degrees.

P_pitch
A value in REAL format.

The vessel's pitch at the time of transponder position measurement +/–180 degrees.

Td_beam A single byte defining the transducer beam.

- 0 = wide
- 1 = narrow.

Td_type Defines the transducer type.

Sonardyne uses value 0 (30kHz wide beam only).

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.

Diagnostic Sonardyne do not use this field because it is specific to Simrad hardware. The value is always 0 (no errors).

Stand_dev A value in REAL format.

This is the horizontal position quality in metres.

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.

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.

Stop character This is a single byte stop character AA hex.

H.4 HPR 418 – Message 2 (LBL/LUSBL)

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 Table 13 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 13 Format: Message 2 LBL Vessel Position Data

Field	Byte	Byte Offset
Start character	1	0
Block length	2	1
Message type	1	3
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

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

Definition of field names

Start character This is a single byte start character 55 hex.

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.

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.

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.

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.

Time_header (7) — Defines the clock when the position is valid.

Table 14 describes the format of the time_header.

Table 14 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

Interrogation_age — Time interval since the previous interrogation of the array. The time resolution is 1ms.

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.

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.

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.

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.

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.

Hor_err_ellipse_direction	Each LBL position measurement has a likelihood ellipse associated with it. It is based on 1δ 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.
Hor_err_ellipse_major	The major axis of the likelihood ellipse in metres. A value in REAL format.
Hor_err_ellipse_minor	The minor axis of the likelihood ellipse in metres. A value in REAL format.
Z_standard_deviation	The standard deviation (δ) of the depth in metres.
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.
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
P_course	A value in REAL format. The vessel's course at the time of transponder position measurement; 0 to 359.9°.
P_roll	A value in REAL format. The vessel's roll at the time of transponder position measurement ±180°.
P_pitch	A value in REAL format.

The vessel's pitch at the time of transponder position measurement ±180°.

Diagnostic

Sonardyne do not use this field because it is specific to Simrad hardware. It is always set to zero to indicate no errors.

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.

Stop character

This is a single byte stop character AA hex.

H.5 HPR 418 BCD – Message 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.

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 indictor 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 15 Field description of the HPR418BCD telegram

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
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

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

Definition of field names

SOT (Start of Telegram)

This is a single byte start character DF hex.

Head Byte

This byte indicates the message type and is always 01 hex for a transponder message type 1.

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. 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

Transponder Type

A single byte defining the transponder type.

- 00 = standard transponder
- 03 = Riser Angle Monitoring System (MRAMS) transponder

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.

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.
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.
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.
Heading	Two bytes used for the vessel heading. The LSB is 1/10th of a degree.
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.
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.
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.
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.
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.
Checksum	The result of performing an exclusive OR on all bytes in the telegram up to but not including this byte.

EOR (End of Record) This byte marks the end of a telegram. It is always FF.

H.6 HPR 418 BCD – Message 2

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.

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 indictor 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 16 Format: Message 2 Vessel LBL Position Data

Field	Byte	Sample BCD Data
SOT (Start of Telegram)	1	DF
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

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

Definition of field names

SOT (Start of Telegram)

This is a single byte start character DF hex.

Head Byte

This byte indicates the message type and is always 02 hex for an object message type 2.

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 - Tcvr 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

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

Transponder Array

Sonardyne fix this byte to 01 hex.

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.
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.
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.
Heading	Two bytes used for the vessel heading. The LSB is 1/10th of a degree.
Not Used	Three bytes filled with 00 hex.
Horizontal Error Ellipse Direction	Each position measurement has a likelihood ellipse associated with it. It is based on 1δ 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.
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
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
Checksum	The result of performing an exclusive OR on all bytes in the telegram up to but not including this byte.
EOR	This byte marks the end of a telegram. It is always FF.

H.7 NMEA 0183 – SSB (USBL/SSBL Position)

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 17 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
First_add_value	,x.x	,-12.3
Second_add_value	,x.x	,-14.0
Checksum	*hh	*hh
Termination	CRLF	CRLF

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

Definition of field names

Start_character

The single ASCII character <$>.

Address

The ASCII character string <PSIMSSB> to indicate that the telegram is a Simrad SSBL message.

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 <,>.

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>

Status

This will always show OK because this telegram is sent only if the status is OK.

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).

Coordinate_system

A single ASCII character preceded by a comma <,a>

C = Cartesian co-ordinates, U = UTM, R = Radians.

Orientation

A single ASCII character preceded by a comma <,a>

H = Vessel head up, or N = North up.

SW_filter

A single ASCII character preceded by a comma <,a>

F = filtered, or M = measured.

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 18.

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 18.

Table 18 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 (degrees)	Longitude (degrees)

Additional_info

A single ASCII character preceded by a comma <,a>

I = inclinometer, T = time, D = depth and N = none <,N>.

First_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:

- 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.

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.

Checksum

The result of performing an exclusive OR on all bytes in the telegram up to but not including this byte.

Termination

The ASCII for Carriage Return followed by Line Feed are sent <CRLF>.

H.8 NMEA 0183 – LBP (LBL / LUBSL Position)

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.

Table 19 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

Table 19 Field description of the LBP telegram (Continued)

Field	Data Format	Sample Data
Checksum	*hh	*hh
Termination	CRLF	CRLF

Definition of field names

Type

Ve = vessel.

R1 to R4 = ROV 1 to ROV 4.

Status

The Status field is A when the measurements are OK. The possible statuses are as shown below:

- A OK
- ??? Simulating or error condition

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.

The **Coordinate_system** field should be used to decode the X_ and Y_coordinate fields as shown in the table below.

Table 20 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.

H.9 PSONALL – Sonardyne general position report

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.

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.yy,
DDDD.dd,HHH.hh,CCC.cc,T,PP.PP,RR.RR,VVV.vv,AAA.AA,BBB.BB*hhCRLF

Field descriptions

Table 21Field description for the PSONALL telegram

Field	Description
$PSONALL	Header to identify the telegram.
Name	The name of the vehicle the string relates to.

Table 21Field description for the PSONALL telegram (Continued)

Field	Description
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.
CCC.cc	Course made good (CMG).
T	Heading type: • G = grid • T = True • M = Magnetic
PP.PP	Vehicle Pitch.
RR.RR	Vehicle Roll.
VVV.vv	Velocity.
AAA.AA	Position accuracy (95%).
BBB.BB	Depth accuracy.
*hh	Checksum.
CRLF	Termination characters, carriage return plus linefeed.

Checksum

The Checksum value is the resultant XOR of all characters in the report string, excluding the CRLF termination characters.

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>

H.10 PSONUSBL – Sonardyne USBL report

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.

Format

The PSONUSBL telegram format shown below consists of a single string, separated across two lines here for clarity

$PSONUSBL,HHMMSS.ss,ddd,C,saaaa.aa,sbbbb.bb,dddd.dd,spp.pp,srr.rr,hhh.hh,
qq.q*hhCRLF

Field descriptions

Table 22Field 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)

Table 22Field description for the PSONUSBL telegram (Continued)

Field	Description
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).
CRLF	Termination characters - carriage return, line feed.

Example $PSONUSBL,123456.12,101,H,-1234.56,-1234.56,1234.56,-12.34, -12.34,123.45,12.3*70

H.11 PSONDP – Sonardyne DP Report

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.

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,,,*hhCRLF

Table 23 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.
c---c,	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)
x.xx,	Position accuracy error ellipse major axis (metres). See Note 3

Table 23 Field description for the PSONDP reports

Field	Description
x.xx,	Position accuracy error ellipse minor axis (metres). See Note 3
xxx.xx,	Position accuracy error ellipse direction (True - degrees). See Note 3
x.xx,	Depth below sea surface (metres), see Note 4
x.xx,	Speed over ground (m/s).
xxx.x,	Course over ground (True - degrees). 0.0-359.9
x.xx,	Speed over ground accuracy error ellipse major axis (m/s). See Note 3
x.xx,	Speed over ground accuracy error ellipse minor axis (m/s). See Note 3
xxx.xx,	Speed over ground accuracy error ellipse direction (True - degrees). See Note 3
x.xxx,	Pitch (degrees). Bow up: positive. See Note 5
x.xxx,	Roll (degrees). Port up: positive.
xxx.xxx,	Heading (True - degrees). 0.0 - 359.999
x.xx,	Heading accuracy (Standard deviation - degrees)
c-c,	Aiding: N:None,U:USBL,L:LBL,G:GPS,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
CRLF	Terminator, return plus linefeed

Notes

1. The system time for which the data is valid. If the system is connected to a GPS time source this will be UTC time.

2. Latitude and longitude values are always displayed in the degrees, minutes, decimal minutes (DDDMM.mmmmmm) 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.

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.

Example

$PSONDP,123456.43,0010,M,2,5020.234502,N,12345.324576,E,12.34,12.34,123.45,1234.56,12.34,359.9,0.45,0.23,123.45,-12.345,-12.345,359.999,1.23,UP,N,,,*2E

H.12 NMEA 0183 GGA

Description

The NMEA GGA telegram is a simulation of a standard NMEA GGA string and is used to show fix-related data for a GPS receiver.

You should use this sentence only where the receiving installation does not support a more suitable sentence.

Format

The NMEA GGA telegram format shown below consists of a single string, separated across two lines here for clarity.

$GPGGA,HHMMSS.ss,DDMM.mmmmmm,N,DDDMM.mmmmmm,
E,2,12,A.AA,Z.ZZ, M,0.0,M,0.0,0000*hhCRLF

Field description

Table 24Field description for the NMEA GGA telegram

Field	Description
$GPGGA,	Header to identify the report (fixed).
HHMMSS.ss,	The valid time of the position.
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).
2,12,	Fixed values.
A.AA,	Accuracy (semi-major axis). See Note 3.
Z.ZZ,	Height, see Note 4.
M,0.0,M,0.0,0000	Fixed values.
*hh	Checksum. See Note 5.
CRLF	Termination characters, carriage return plus linefeed.

Notes

1. Latitude and longitude values are always displayed in the DDDMM.mmmmmm 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.

2. The accuracy value is the semi-major axis value for the vehicle. It is always displayed in metres and is fixed to two DPs.

3. The height value is always displayed in metres and fixed to 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.

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 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>.

Example

$GPGGA,123456.43,5020.234502,N,134.324576,E,2,12,6.7,
–56.78,M,0.0,M,0.0,0000*hh

H.13 ATS ASCII

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

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 Xddd.d Y:ddd.d D:
ddd.d P:d.d R:d.d H:ddd.d E:d<LF><CR>

Table 25 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 join 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

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

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>

H.14 Trackpoint II

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.

Format

Table 26 Field descriptions 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.

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

Example 1 15:53:53 12 104.9 141.1 97.9 -26.0 98.2 0<CR><LF>

H.15 HPR 300P

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.

Format

Table 27 Field descriptions 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
dddd.d	Vessel course 0-359.9 (degrees)	14-19
c	Space	20
dddd.d	X Coordinate in metres.	21-26

Table 27 Field descriptions for the HPR 300P telegram

Field	Description	Position
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
c	Carriage return	66
c	Line feed	67

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

Example 33 1 W OK 0 18.9 40.5 30.0 0.1 NRY 0.0 0.0<CR><LF>

H.16 PSONMEAS – Sonardyne measurements report

Description This report is a custom sentence for outputting measurement data from peripheral sensors.

Format $PSONMEAS,hhmmss.ss,I,A,B,X.X,Y.Y,Z.Z*hh

Table 28 Field descriptions for the PSONMEAS format

Field	Description
$PSONMEAS	Header
hhmmss.ss	Valid time of the position
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
<CRLF>	Terminator - carriage return line feed

Definition of field names

Information source: INCINT for Inclinometer with Heading
INCEXT for Inclinometer without Heading

DEPTH for depth sensor
TEMP for temperature sensor
RNG for range measurement

Table 29 PSONMEAS format Data field 1, Data field 2, Data field 3

	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

H.17 PSONLLD - Lat, Long, Depth

Description This report is a custom sentence for outputting latitude, longitude and depth information.

Format $PSONLLD,hhmmss.sss,id,status,lat,long,depth,hor_err_major,hor_err_minor, hor_error_dir,depth_error,optional_spec,opt1,opt2,op3*hh<CR><LF>

Table 30 Field descriptions for the PSONLLD format

Field	Description
$PSONLLD	Header
hhmmss.sss	Time of validity
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

I Alarms and Events

In this chapter...

This chapter contains the following sections:

I.1 Alarms

System manager

Table 31 Alarm details - System manager component

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 System-Manager. 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

Table 31 Alarm details - System manager component (Continued)

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**

Table 31 Alarm details - System manager component (Continued)

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."

Table 31 Alarm details - System manager component (Continued)

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"

Device Manager

Table 32 Alarm details - Device manager component

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 NSH. 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"

Table 32 Alarm details - Device manager component (Continued)

Description:	"GPS HDOP value indicates very bad positioning - please check GPS 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 GPS aiding"
Description:	"To get best performance from an attitude sensor it needs GPS aiding so that it can separate movement from roll and pitch. Please add GPS 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"

Table 32 Alarm details - Device manager component (Continued)

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 GPS fix quality is unsuitable for navigation"
Description:	"The GPS device is reporting the fix quality is unsuitable for navigation please check GPS 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"

Table 32 Alarm details - Device manager component (Continued)

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."

Table 32 Alarm details - Device manager component (Continued)

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"

Table 32 Alarm details - Device manager component (Continued)

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:	**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"

Table 32 Alarm details - Device manager component (Continued)

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."

Table 32 Alarm details - Device manager component (Continued)

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"

Table 32 Alarm details - Device manager component (Continued)

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**

Table 32 Alarm details - Device manager component (Continued)

Default Severity:	Critical
Summary:	"0 has invalid protocol version, requires 1.10 and above only"
Description:	"Transceiver requires protocol version 1.10 and above - 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:	**2566**
Default Severity:	0
Summary:	"Vessel depth bias exceeded threshold"
Description:	"INS vessel depth bias can be reduced by either recalibrating the reference beacon array, or adjusting the mean sound speed."
Solution URL:	"SolutionsSolution 2566.htm"

Scheduler

Table 33 Alarm details -Scheduler component

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."

Table 33 Alarm details -Scheduler component (Continued)

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:	**3007**
Default Severity:	High
Summary:	"System time synchronising"

Table 33 Alarm details -Scheduler component (Continued)

Description:	"The systems internal time is still synchronising. If this alarm persists check the connection between the navigation PC and the NSH."
Solution URL:	"SolutionsSolution 3007.htm"

Tracker

Table 34 Alarm details - Logger component

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"

Table 34 Alarm details - Logger component (Continued)

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 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"

Table 34 Alarm details - Logger component (Continued)

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:	**4013**
Default Severity:	High
Summary:	"Attitude telemetry from Beacon 0 was not received"
Description:	"The system has requested attitude data from Beacon 0 but no reply was received or the reply was corrupted."
Solution URL:	"SolutionsSolution 4013.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"

Table 34 Alarm details - Logger component (Continued)

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

Table 34 Alarm details - Logger component (Continued)

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 GPS available for latitude"
Description:	"Pressure to Depth: The option "Use GPS" in the Toolwindow requires an operational GPS in the job."
Solution URL:	"SolutionsSolution 4026.htm"

Logger

Table 35 Alarm details - Housekeeping component

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"

Table 35 Alarm details - Housekeeping component (Continued)

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."

Table 35 Alarm details - Housekeeping component (Continued)

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"

MainUI 6000+

Table 36 Alarm details - MainUI

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"

Application Main

Table 37 Alarm details - ApplicationMain

ID:	7000
Default Severity:	Critical
Summary:	"Unable to start the ApplicationMain system"
Description:	"An unknown failure occured at time 0, when trying to start the ApplicationMain System. Please verify that the application was installed correcly using the installer, and if not please re-install the Software."
Solution URL:	"SolutionsSolution 7000.htm"

Table 37 Alarm details - ApplicationMain (Continued)

ID:	7001
Default Severity:	Critical
Summary:	"Unable to stop the ApplicationMain system"
Description:	"An unknown failure occured at time 0, when trying to stop the ApplicationMain System. Please verify that the application was installed correcly using the installer, and if not please re-install the Software."
Solution URL:	"SolutionsSolution 7001.htm"

MainUI 8000+

Table 38 Alarm details - Remote Control

ID:	8000
Default Severity:	Critical
Summary:	"Unable to start the Remote Control system"
Description:	"An unknown failure occured at time 0, when trying to start the Remote Control System. Please verify that the application was installed correcly 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 occured at time 0, when trying to stop the Remote Control System. Please verify that the application was installed correcly using the installer, and if not please re-install the Software."
Solution URL:	"SolutionsSolution 8001.htm"

I.2 Events

System Manager

Table 39 Event details - SystemManager component

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."

Table 39 Event details - SystemManager component (Continued)

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."

Table 39 Event details - SystemManager component (Continued)

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

Table 39 Event details - SystemManager component (Continued)

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"

Device Manager

Table 40 Event details - DeviceManager

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 of1Hz."
Show In MiniView:	"True"
ID:	**20004**
Type:	DebugTrace
Msg:	"0 Initialisation ok"
ID:	**20005**
Type:	SystemWarning

Table 40 Event details - DeviceManager (Continued)

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

Table 40 Event details - DeviceManager (Continued)

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"

Table 40 Event details - DeviceManager (Continued)

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

Table 40 Event details - DeviceManager (Continued)

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"

Table 40 Event details - DeviceManager (Continued)

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

Table 40 Event details - DeviceManager (Continued)

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"

Table 40 Event details - DeviceManager (Continued)

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:	**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

Table 40 Event details - DeviceManager (Continued)

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"

Table 40 Event details - DeviceManager (Continued)

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"

Table 40 Event details - DeviceManager (Continued)

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**

Table 40 Event details - DeviceManager (Continued)

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"

Table 40 Event details - DeviceManager (Continued)

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

Table 40 Event details - DeviceManager (Continued)

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"

Table 40 Event details - DeviceManager (Continued)

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"

Table 40 Event details - DeviceManager (Continued)

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:	**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."
ID:	**27010**
Type:	SystemWarning
Msg:	"0 Lodestar is rejecting acoustics."
ID:	**27011**
Type:	SystemWarning
Msg:	"0 Lodestar QJSum limit exceeded."

Table 40 Event details - DeviceManager (Continued)

ID:	**27012**
Type:	SystemWarning
Msg:	"0 Lodestar minimum SNR limit not achieved."
ID:	**27013**
Type:	SystemWarning
Msg:	"0 Lodestar minimum signal level not achieved."
ID:	**27014**
Type:	SystemWarning
Msg:	"0 Lodestar was provided invalid Jx/Jy values."
ID:	**27015**
Type:	SystemWarning
Msg:	"0 Lodestar failed Kalman filter Sigma test."
ID:	**27016**
Type:	SystemWarning
Msg:	"0 Lodestar did not pass observation to Kalman filter"
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:	**28000**
Type:	DebugTrace
Msg:	"DeviceManager requesting Job Save."

Scheduler

Table 41 Event details - Scheduler component

ID:	**30000**
Type:	SystemWarning

Table 41 Event details - Scheduler component (Continued)

Msg:	"Failed to measure range between 0 and 1"
Show In MiniView:	"True"
ID:	**30001**
Type:	DebugTrace
Msg:	"Scheduler aborted acoustic cycle (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**

Table 41 Event details - Scheduler component (Continued)

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"

Tracker

Table 42 Event details - Tracker component

ID:	**40000**
Type:	DebugTrace
Msg:	"Tracker failed to solve - Kalman Filter:0"
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"
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"

Table 42 Event details - Tracker component (Continued)

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"
Show In MiniView:	"True"
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

Table 42 Event details - Tracker component (Continued)

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."

Logger

Table 43 Event details - Logger component

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

Table 43 Event details - Logger component (Continued)

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"

Table 43 Event details - Logger component (Continued)

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 thresh-old"
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 thresh-old"
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**

Table 43 Event details - Logger component (Continued)

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

Table 43 Event details - Logger component (Continued)

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."

Table 43 Event details - Logger component (Continued)

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**

Table 43 Event details - Logger component (Continued)

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) unexpectably 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."

Table 43 Event details - Logger component (Continued)

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."

MainUI

Table 44 Event details - MainUI component

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" [Machine=4 User=5] "
ID:	**60003**
Type:	UserTransaction
Msg:	""0" Object="1" Value="2" [Machine=3 User=4] "
ID:	**60004**
Type:	UserTransaction
Msg:	""0" Object="1" [Machine=2 User=3] "

Table 44 Event details - MainUI component (Continued)

ID:	60005
Type:	UserTransaction
Msg:	""0" [Machine=1 User=2] "

ApplicationMain

Table 45 Event details - ApplicationMain component

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"

MainUI

Table 46 Event details - Remote Control component

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"

Table 47 Event details - Remote Control component (Continued)

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"

J Software Screens and Dialogs

In this chapter… This chapter contains the following sections:

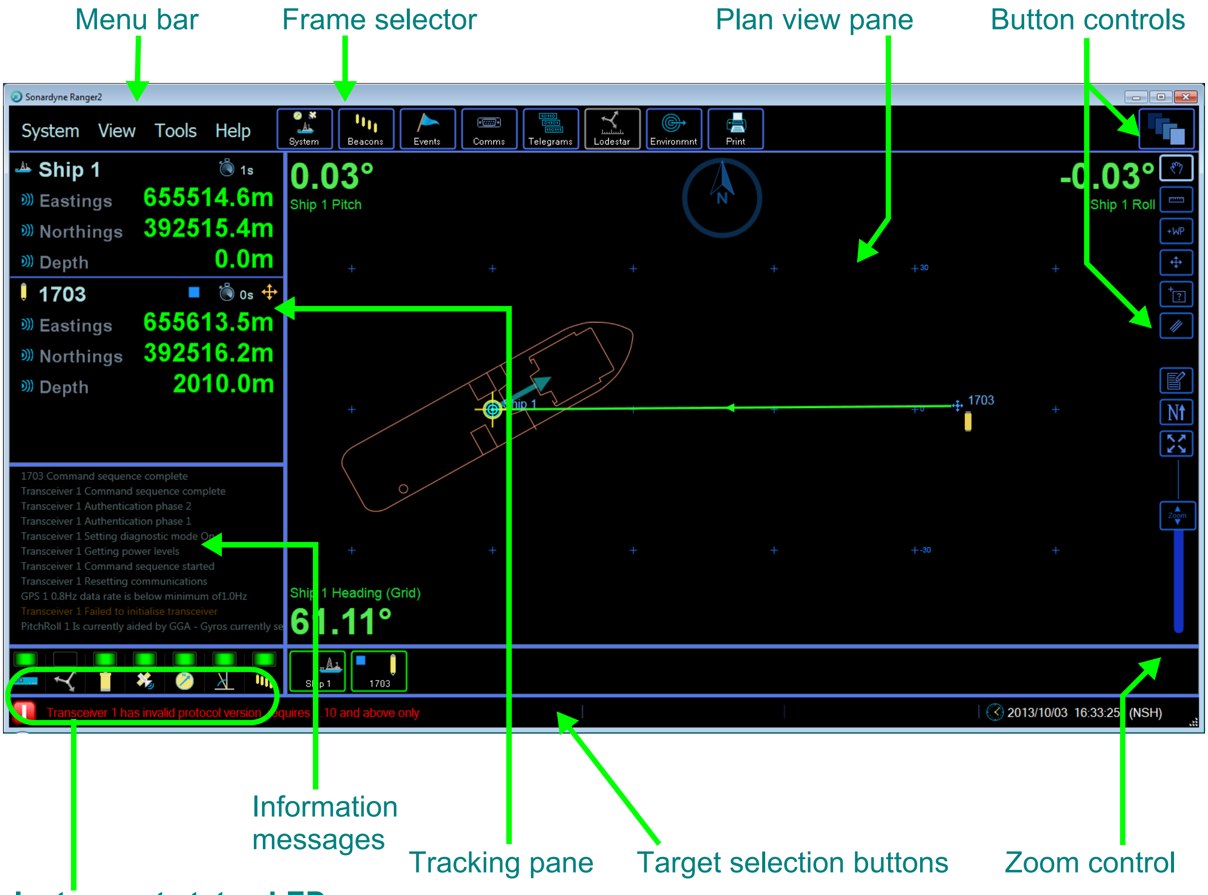
J.1 Main Screen

Note

The software dialogs and screens are all resizeable.

The main screen, shown as an example in Figure 48, is the first screen to display when you start the software. The screen shows the most recent setup used, or is empty for a new installation.

Figure 48 Main screen of the software



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.

Note: Double-click on an LED to jump to the setup for that sensor.

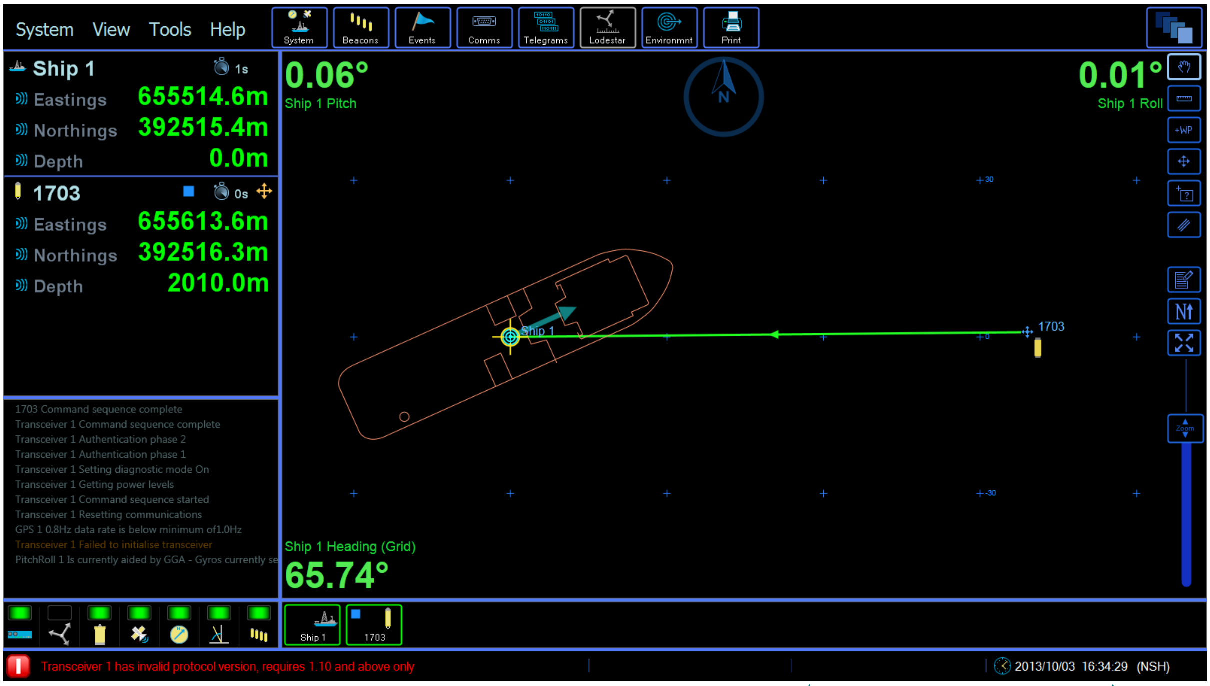
The status bar at the bottom of the main screen shows the name of the current setup, and the current time and its source (either UTC or PC). See Appendix L beginning on page 328 for information about timekeeping.

The status bar also shows information about the most recent alarm condition, with the alarm icon flashing. See “Alarms” on page 269 for a detailed description of the alarm window.

There is an option to display the main screen of the software in full-screen mode. See “Options” on page 298 for instructions to set this option. Figure 49 shows an example of the main screen in frameless mode.

The menu system (shown in Figure 50) provides access to all the features needed to use the software.

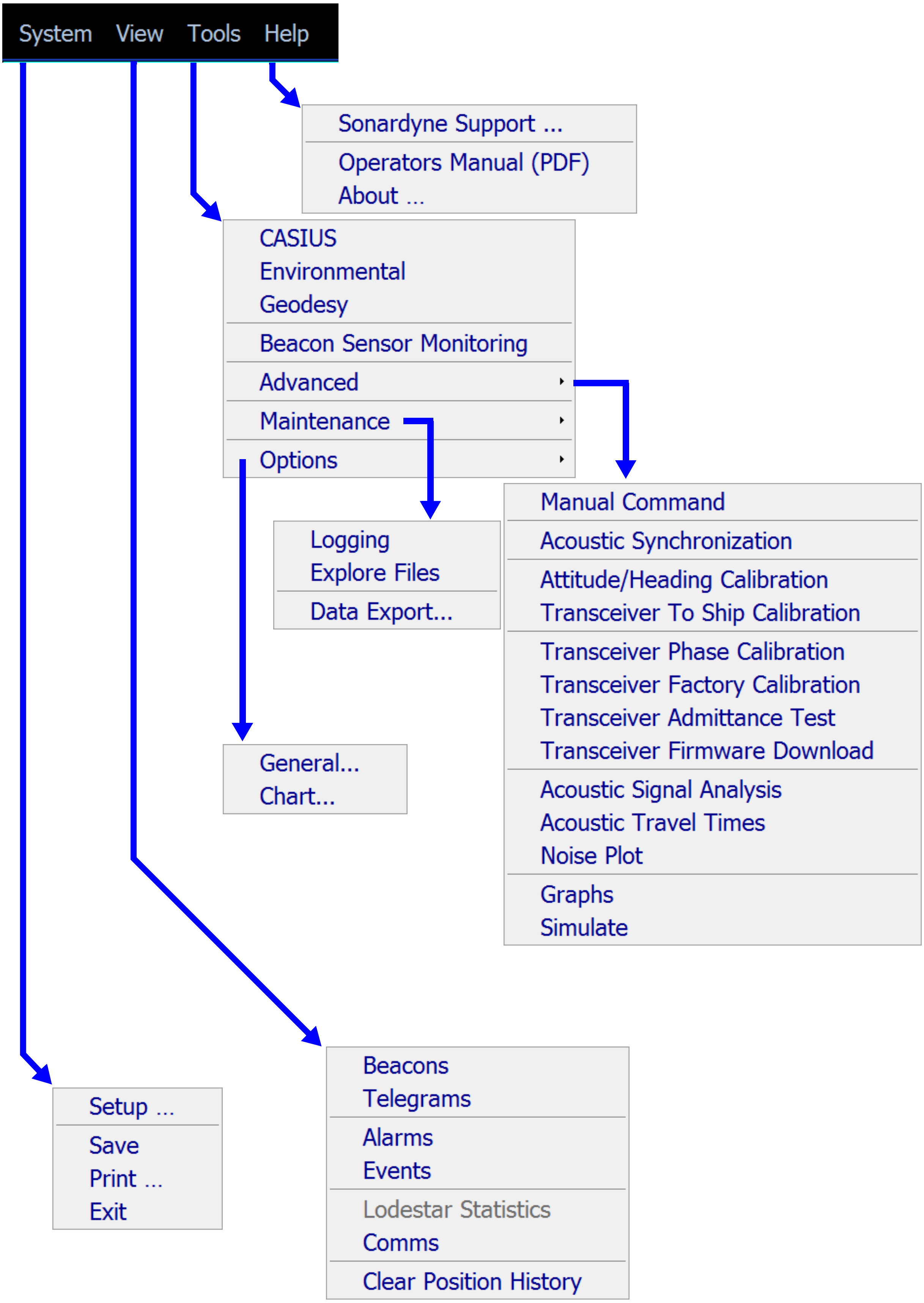
Figure 49 Main screen when using the full-screen option



Name of current setup

Current time

Figure 50 Menu system



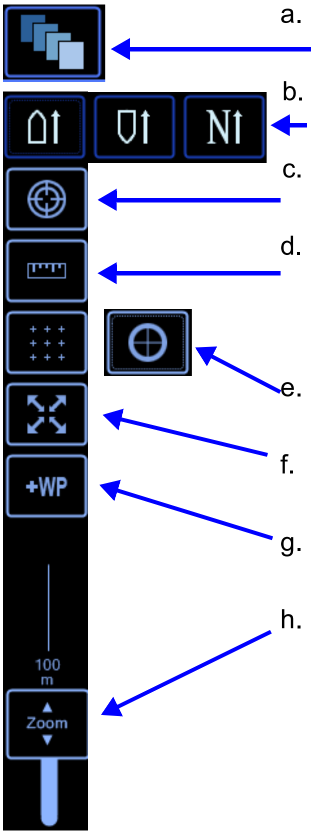
Note: For clarity, all the menu entries are shown. During operation, some menu entries will not be available, and will be greyed out.

J.2 Button Controls

The User Interface style and user controls for the main plan view chart vary depending on the version of Windows operating system that the system uses.

Windows XP

The button controls on the main screen set how the main screen displays navigation information. They change their appearance when selected, as shown in the examples below.



a. Cycle the main screen display through four levels of brightness.

b. Select north-up, ship's head up or ship's head down mode for the main display.

c. Centre the display on a target. Click on the target to set it at the centre of the main display.

d. Measure distance tool. Click a starting point and move the mouse to a second point. A circle is drawn on the screen showing the range and bearing to the second point.

e. Toggle the main display between a radar-style view or a Cartesian grid view.

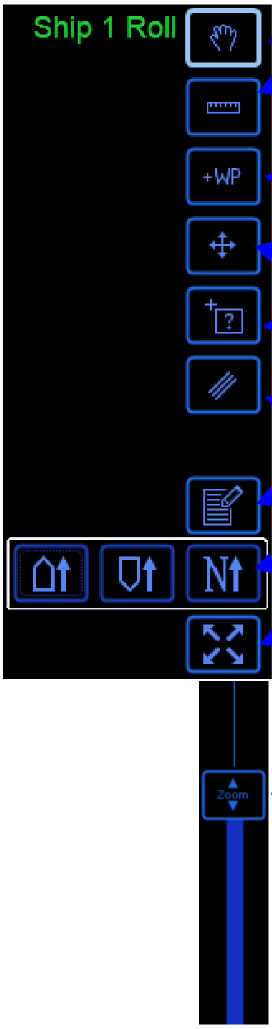
f. Click to set the chart scale automatically to include all active targets.

g. Click to add a waypoint to the chart at the current location.

h. Click and drag the slider control to set the zoom level of the main display.

Windows 7

The button controls on the main screen set how the main screen displays navigation information. They change their appearance when selected, as shown in the examples below.



a. Cycle the main screen display through four levels of brightness.
b. Chart pan mode - drag the chart with the mouse.
c. Measure distance tool. Click a starting point and move the mouse to a second point. A circle is drawn on the screen showing the range and bearing to the second point.
d. Click to add a waypoint to the chart at the current location.
e. Move waypoint – click and drag with the mouse.
f. Show mouse position coordinates.
g. Create run lines – click and drag from a beacon or waypoint to position (see the information about Chart Options in section J.4 for run-line choices).
h. View navigation chart options.
i. Select north-up, ship’s head up, or ship’s head down mode for the main display.
j. Click to set the chart scale automatically to include all active targets.
k. Click and drag the slider control to set the zoom level of the main display.

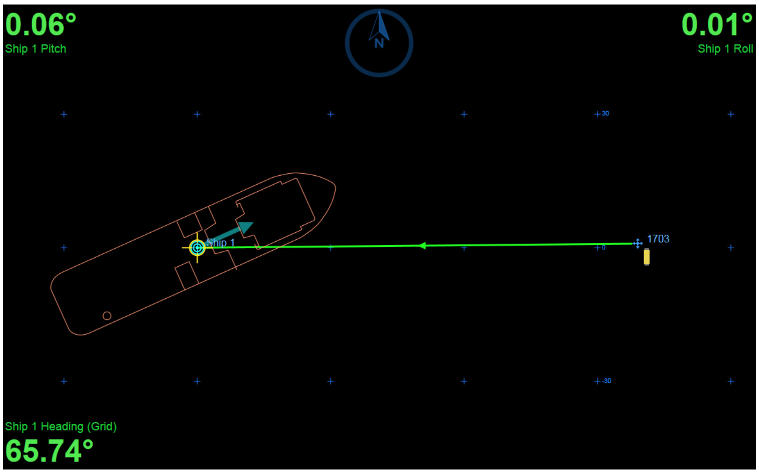
J.3 Target Selection Buttons

The target selection buttons allow you to select the targets to be tracked and displayed by the main display. The buttons available depend on the targets in the current setup.

The buttons have green borders for targets that are being tracked, or blue borders if the target is not being tracked. Click the button to toggle the tracking status.

J.4 Plan View Pane

The plan view pane displays a graphical representation of the relative positions of all items in the setup.



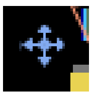
You can use the Chart Controls and the Chart Options to:

- ❑ 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.

'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.

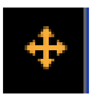
Mobile beacons are shown using the icon:



Mobile

J.5 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 icon used is:

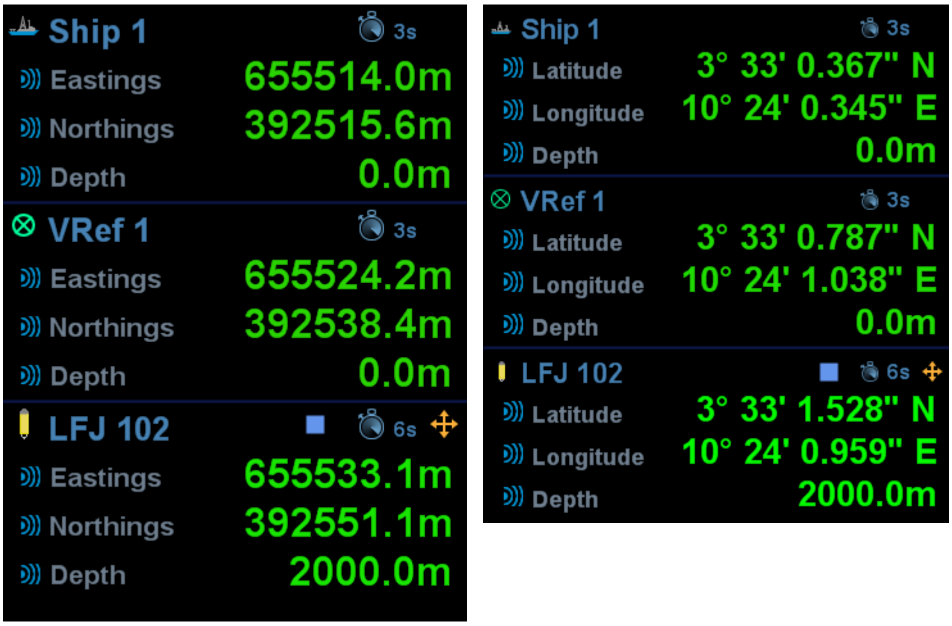


Mobile beacon

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

Figure 51 Position Display Format setting examples



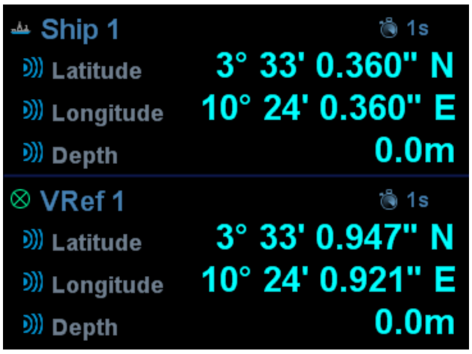
UTM example   Latitude/longitude example

Positions shown are relative to the transceiver if there is no GPS data available to the software. If the software receives GPS 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 dongle fitted.

GPS-based positions are shown in blue cyan colour to distinguish them from acoustically-derived positions.

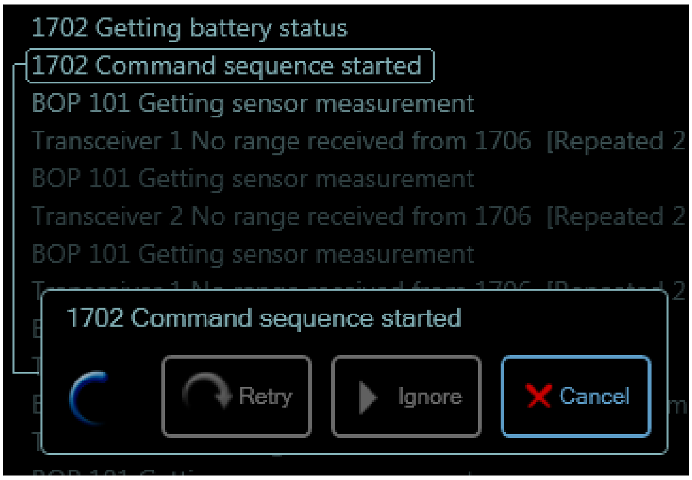


Note

Vessel GPS position is automatically displayed when acoustic tracking is stopped, assuming GPS is available.

J.6 Message Pane

The Message Pane displays information about what the system is doing. Each message fades out as it ages.



Double-click anywhere on the Message Pane to launch the Events Viewer, which shows a more detailed view of the message system.

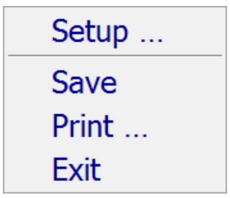
When a command sequence starts, **Retry**, **Ignore** and **Cancel** buttons are overlaid on the Message Pane. These buttons allow you to interact with the command sequence:

- 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 transponder might not be set up ready for use.

J.7 System Menu



The **System** menu gives access to all the system-related functions of the software.

Setup Launches the **System Setup** window so that you can edit the settings for the current setup.

- **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.

J.8 View Menu

The dialogs that are accessible through the View menu display important information about the system and its operating parameters.

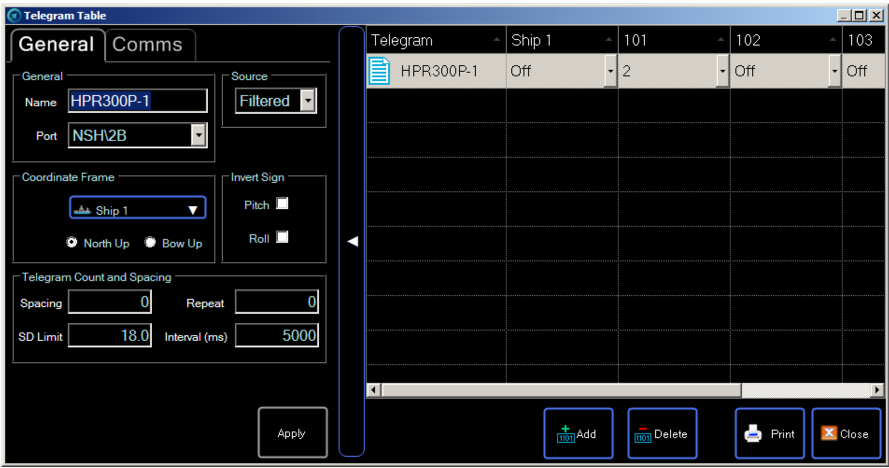
Beacons

For a detailed description of the Beacons options, see Appendix K ”Beacons” beginning on page 304.

Telegrams

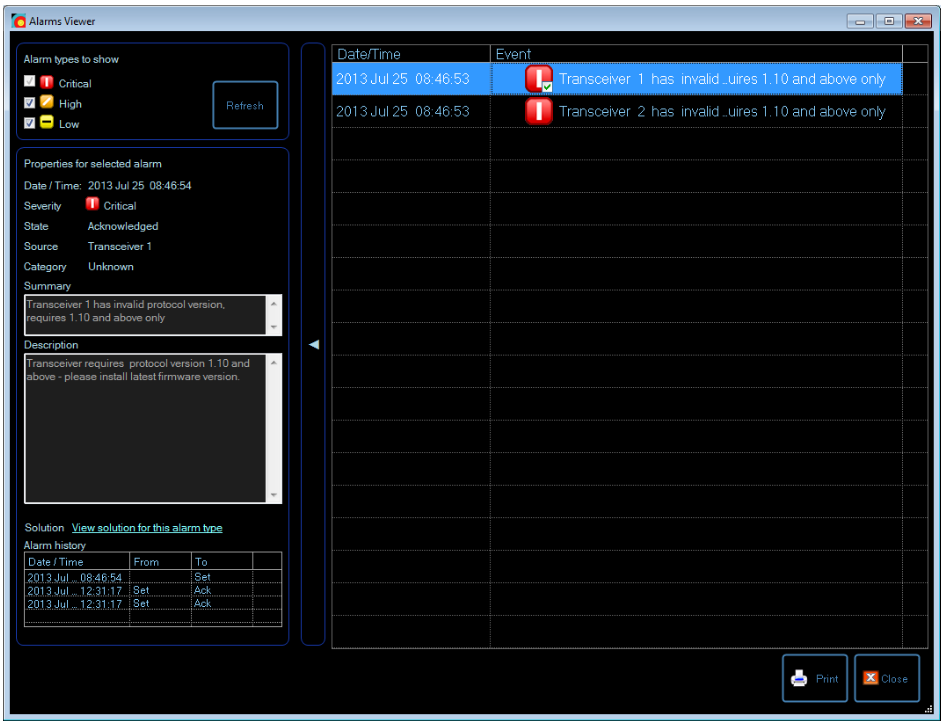
The **Telegram Table** shows the current settings for Telegrams sent to the vessel’s DP system, and allows you to edit and add Telegrams. See section 3.18 “How to Configure Output Telegrams” beginning on page 72 for a description of the **Telegram Table**, and for instructions to use it.

Figure 52 Example telegrams table



Alarms

Figure 53 Alarms viewer



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 Appendix I.1 beginning on page 205 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.

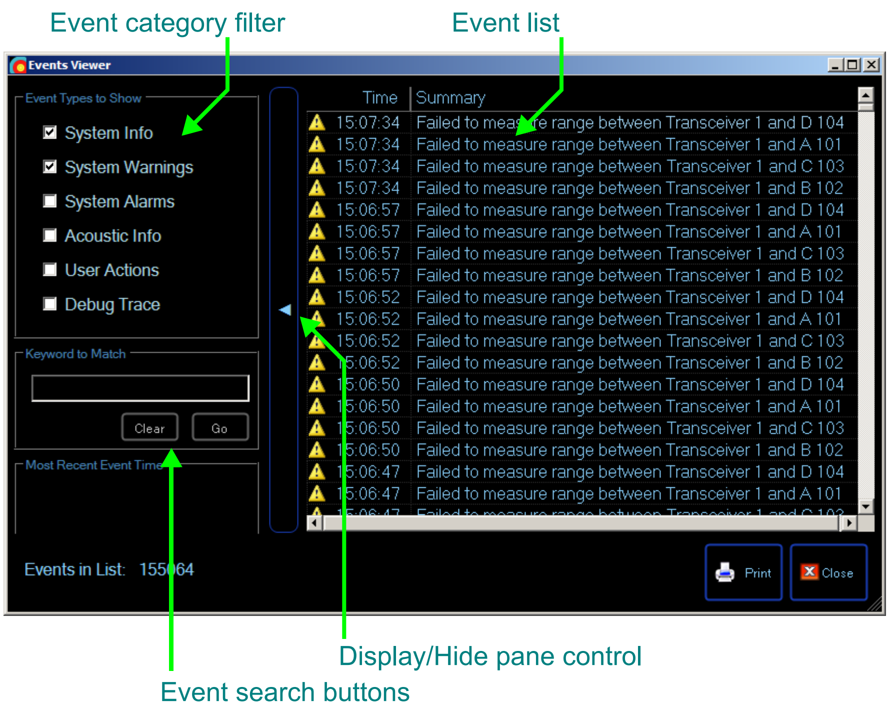
An alarm can be cleared only by clearing the cause of the fault. See the alarm description and solution for help on this. When an alarm is cleared, the audio output is silenced, and the alarm text and red button are removed.

Risk of equipment malfunction. Do not ignore a system alarm because this can lead to incorrect operation.

All alarm state changes and user actions are logged to the system event log for later review.

Events

Figure 54 Events viewer



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 Appendix I.2 beginning on page 226 for a list and description of the events.

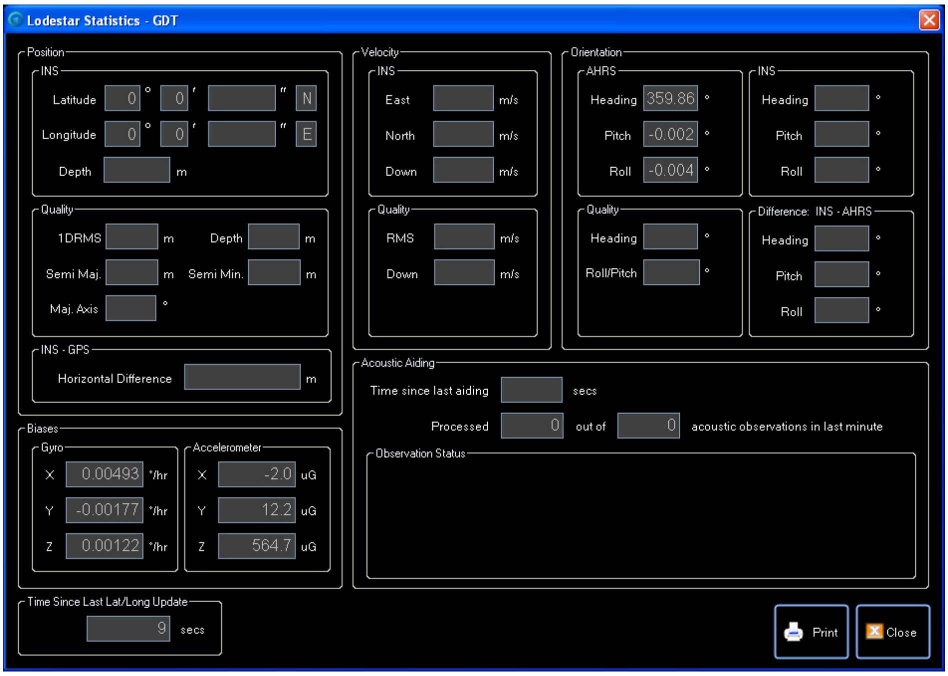
Risk of equipment malfunction. The system event log should be periodically reviewed (particularly the Warnings and Alarms categories). Unexplained events, particularly repeated warnings, should be investigated, and the cause understood and corrected

Lodestar statistics

This menu option is greyed out unless the system is receiving data from a Sonardyne Lodestar.

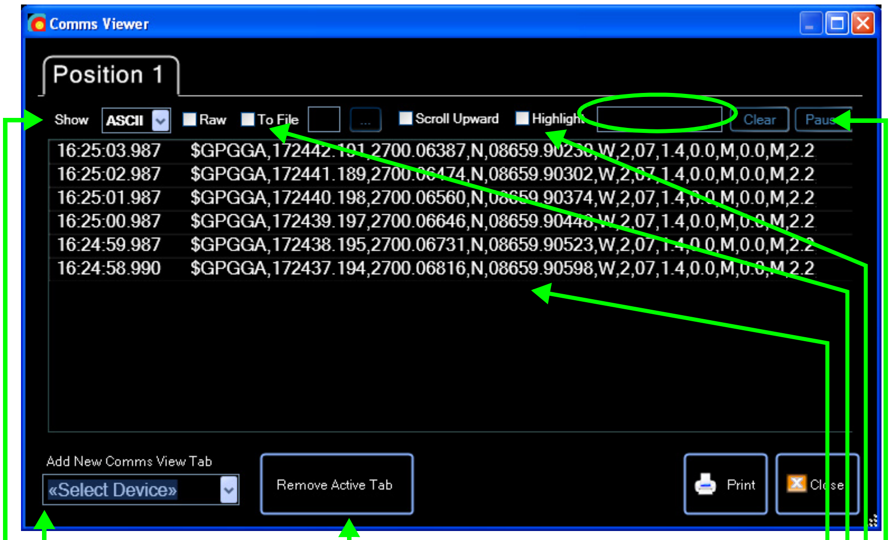
The statistics displayed include all current inertial measurements, and an indication of their quality and age.

Figure 55 Lodestar statistics



Comms

Figure 56 Comms viewer



a. 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.

b. Review the communications in the main pane of the window.

c. If necessary select the **To File** check box and identify the location and name of a file on the PC where the software can store the communications as a text file.

d. If necessary, select the **Highlight** check box and enter text in the adjacent field. The system identifies any string in the communications that includes this text and highlights the string in yellow.

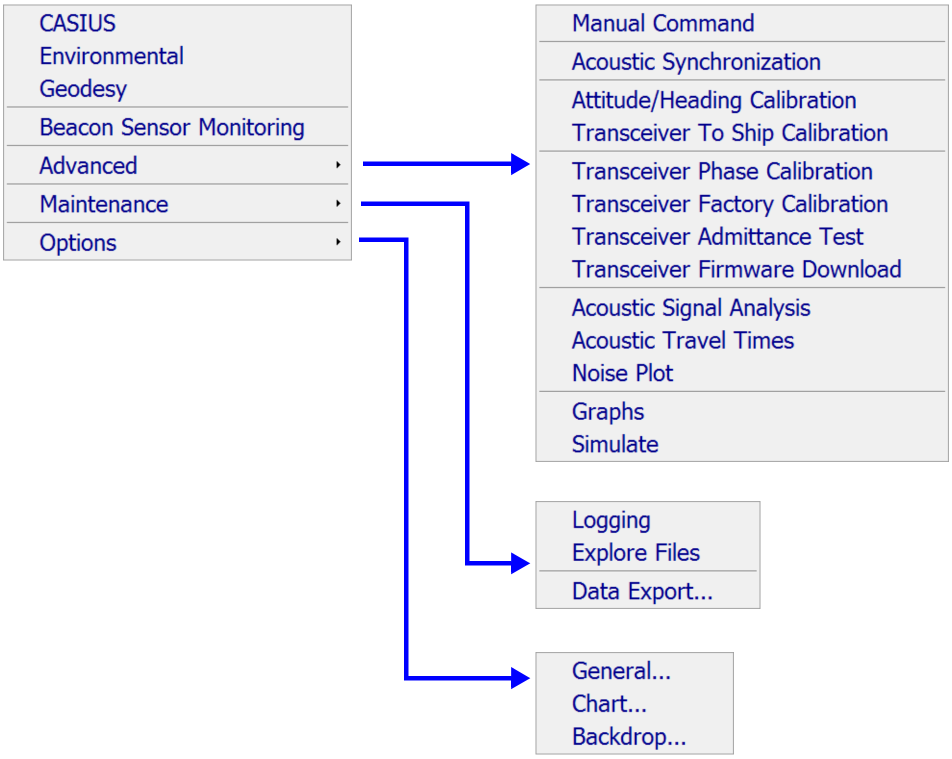
e. If necessary, change the communication string format to display Hex, Ascii or Obs.

f. Use the **Clear** and **Pause** buttons to control the flow of data strings.

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.

J.9 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 dialogs accessible through this menu.



The image on the left shows the **Tools** menu, with the **Advanced** and the **Maintenance** sub-menus detailed.

Some options on the Advanced sub-menu may be greyed out, depending on the system's tracking status.

CASIUS The CASIUS tool menu displays the CASIUS Control Panel, which has two tabs:

- ❑ CASIUS Data Collection tab
- ❑ CASIUS Data Export tab

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 GPS 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 perform such a calibration regularly during each operation, so that you can detect any long-term drift in gyrocompass and AHRS sensors, and apply appropriate corrections.

Refer to Appendix D ”CASIUS Data Collection Methods” beginning on page 120 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**.

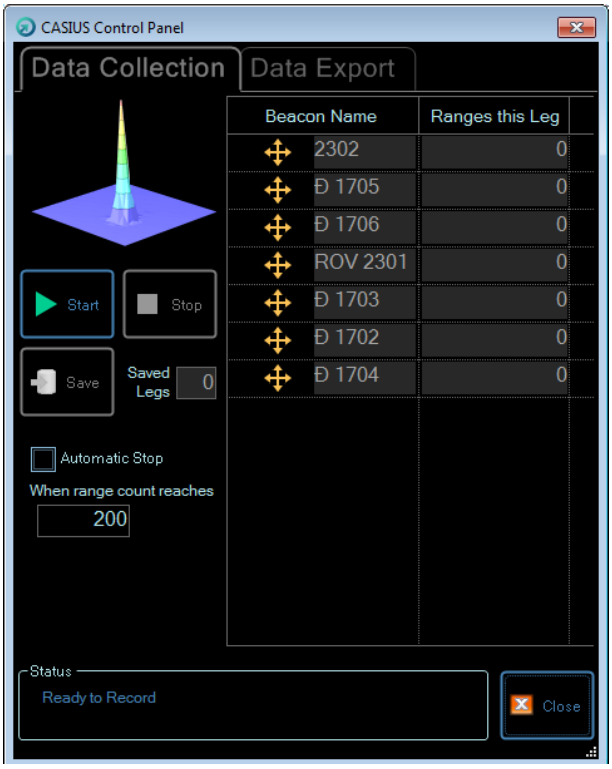
Select the **CASIUS Data Collection** tab. If you prefer to use auto mode, click **Automatic stop** and set the number of ranges required. Otherwise, data collection will continue until stopped manually.

Procedure:

1. Click the **Start** button 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 for each leg of the CASIUS data collection.

Figure 57 CASIUS Data Collection tab

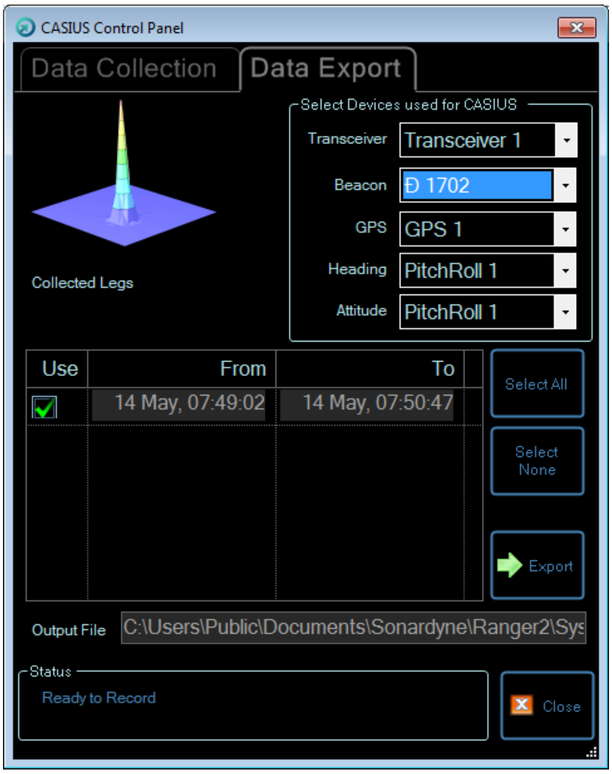


When data has been successfully collected for all CASIUS legs, select the **Data Export** tab.

Select the transceiver, beacon, GPS, 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 clicking on the **Use** check boxes.

Click **Export** to process the CASIUS data.

Figure 58 CASIUS Data Export tab



Environmental

The **Environmental Settings** dialog 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 3.17 beginning on page 69.

Geodesy

Refer to section 3.10 "Geodesy tool" beginning on page 50.

Tools / Advanced

The **Tools / Advanced** menu item provides the following features:

- ❑ Manual Command
- ❑ Acoustic Synchronization
- ❑ Attitude and Heading Calibration
- ❑ Transceiver To Ship Calibration
- ❑ Transceiver Phase Calibration
- ❑ Transceiver Factory Calibration
- ❑ Transceiver admittance test
- ❑ Transceiver firmware download
- ❑ Acoustic Signal Analysis
- ❑ Acoustic Travel Times
- ❑ Noise Plot
- ❑ Graphs

- ❑ Simulate

Note

Only the **Manual Command**, **Acoustic Synchronization** and the **Acoustic Signal Analysis** options are available on the Advanced menu if you are tracking.

Manual Command

Figure 59 Manual command tool

The **Manual Command Tool** allows you to type a command and send it to a selected transceiver. The centre pane shows communications with the selected transceiver as the command is issued and the replies received.

Optionally, you can also set the following parameters for the manual command:

- ❑ Tx, Rx telemetry schemes
- ❑ Telemetry power
- ❑ Receiver gain
- ❑ Telemetry wait time

Alternatively, the current default parameters can be used by selecting the **Use transceiver settings** check box.

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.

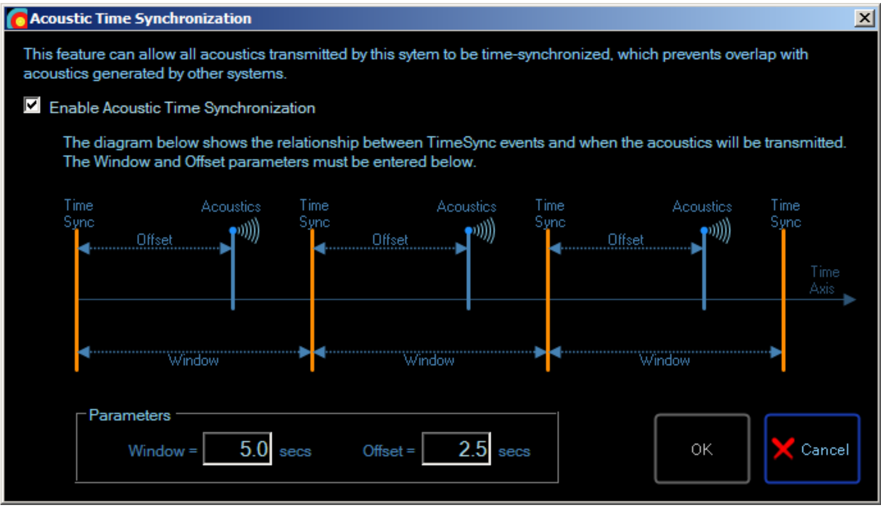
3. Use an offline planning tool to tune TATs, and **Offsets** to achieve fast, interleaved updates.

Sonardyne support can provide further guidance on particular tracking scenarios if required.

Select the **Enable Acoustic Time Synchronization** check box to enable this feature.

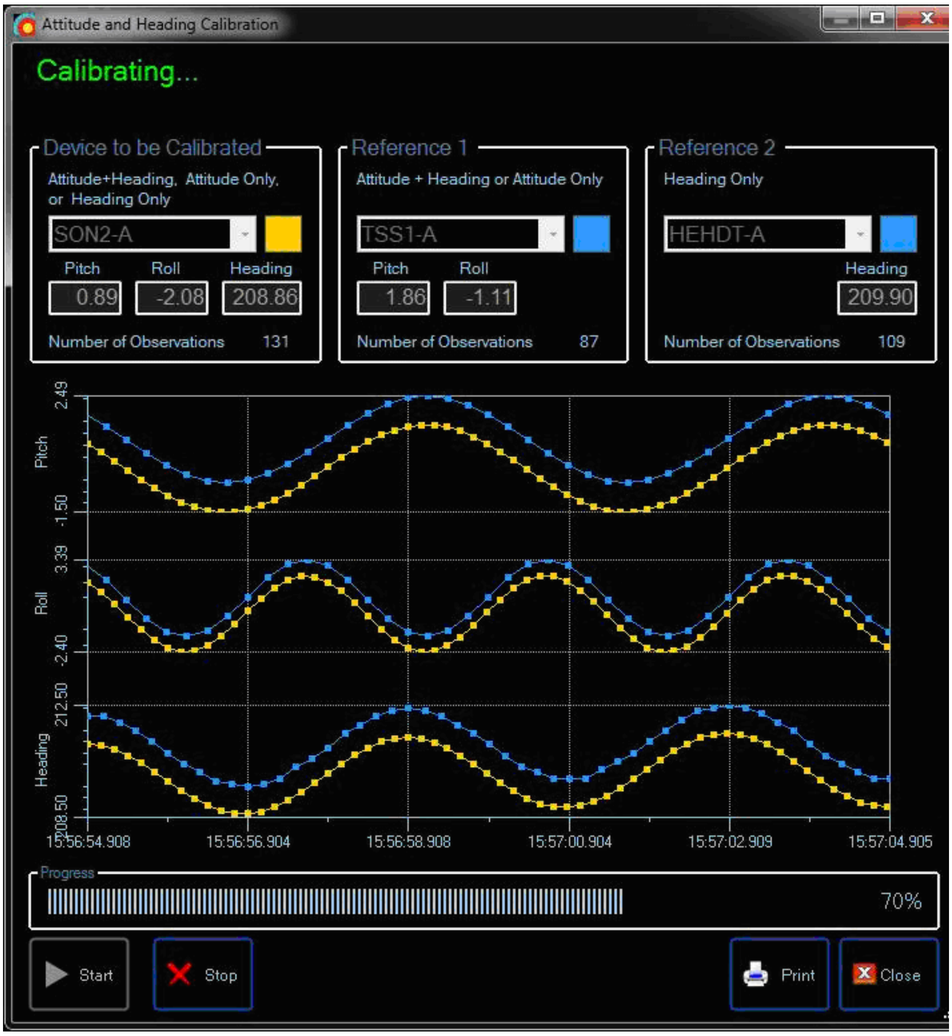
Enter the **Window** time and the **Offset** time to use for synchronization and click **OK**.

Figure 60 Acoustic synchronization tool



Attitude and Heading Calibration

Figure 61 Attitude and Heading calibration tool



This tool allows you to calibrate an AHRS device against either a single 'reference' AHRS, or two separate Attitude and Heading devices (shown as **Reference 1** and **Reference 2** in Figure 61). The tool automatically hides the **Reference 2** selection control if **Reference 1** provides all the required data.

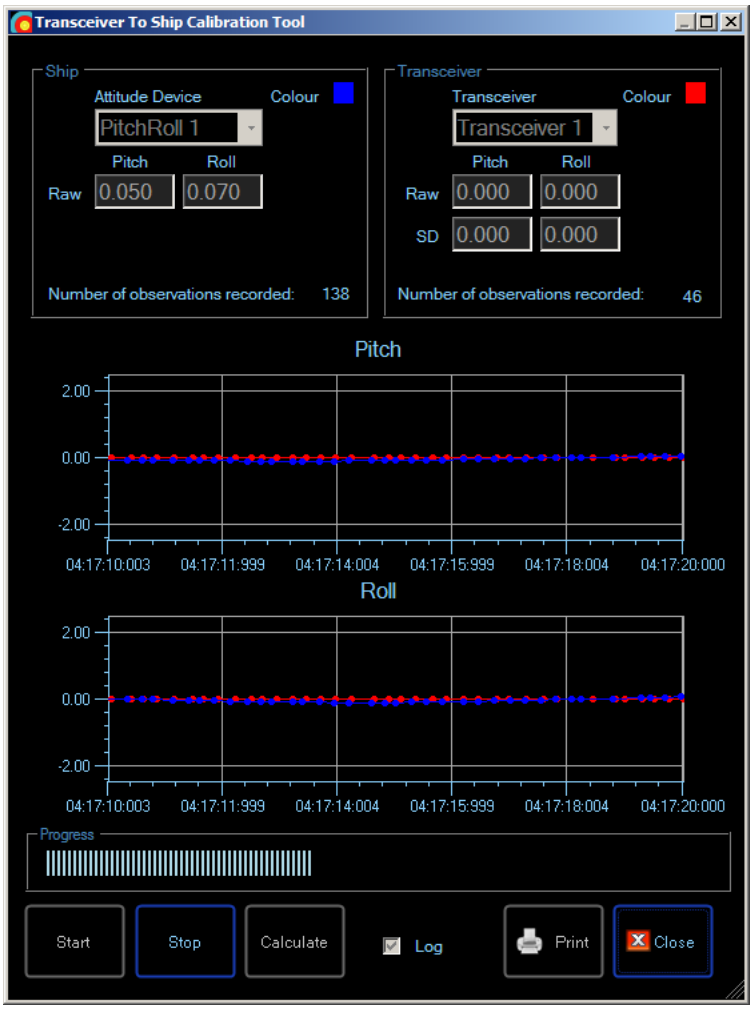
The charts show the measurements of Pitch, Roll and Heading for the data sources, using the colours shown in the top control groups to identify them.

Buttons at the bottom of the tool dialog allow you to start and stop the calibration.

At the end of the calibration you are given the option to apply the calculated offsets to the device

Transceiver To Ship Calibration

Figure 62 Transceiver to ship calibration tool



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.

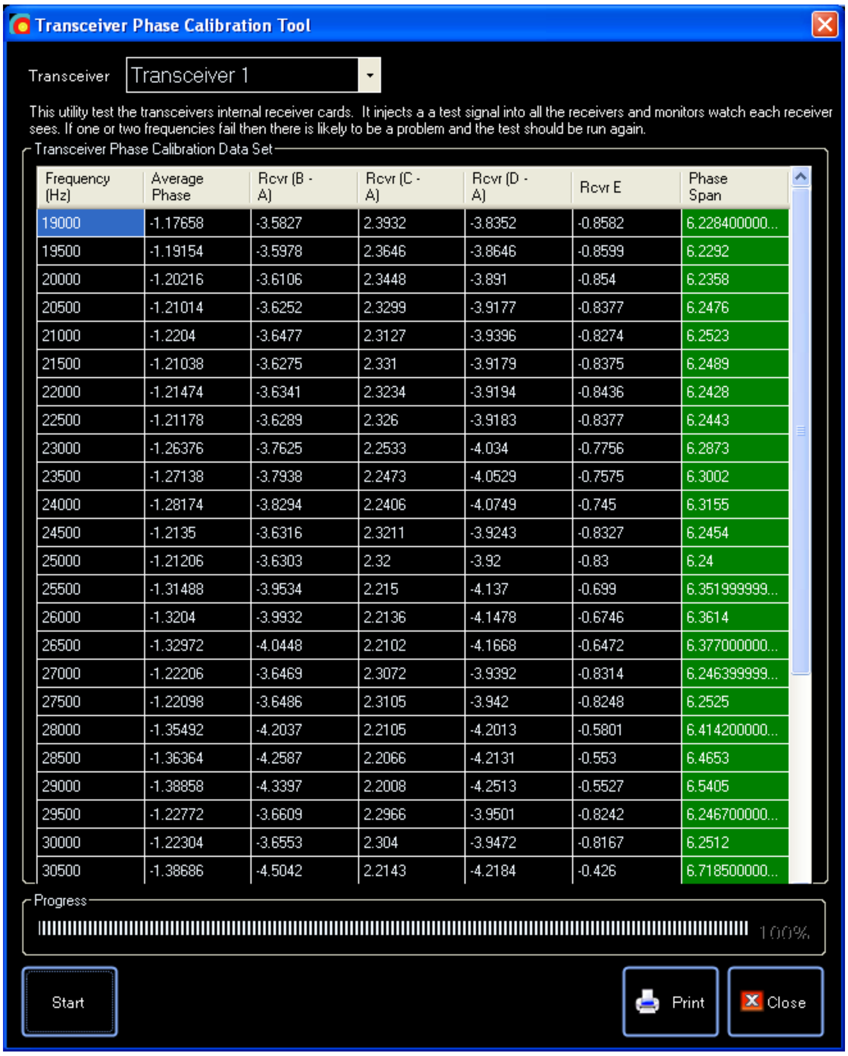
A series of buttons at the bottom of the tool dialog allow you to control the calibration and to log and print the results.

Transceiver Phase Calibration

The Transceiver Phase Calibration test tool is available only when all transponder beacons are offline and set to not tracking.

To perform a transceiver phase calibration test select **Tools > Advanced > Transceiver Phase Calibration …** from the menu.

Figure 63 Transceiver phase calibration tool



Frequency (Hz)	Average Phase	Rcvr (B - A)	Rcvr (C - A)	Rcvr (D - A)	Rcvr E	Phase Span
19000	-1.17658	-3.5827	2.3932	-3.8352	-0.8582	6.228400000...
19500	-1.19154	-3.5978	2.3646	-3.8646	-0.8599	6.2292
20000	-1.20216	-3.6106	2.3448	-3.891	-0.854	6.2358
20500	-1.21014	-3.6252	2.3299	-3.9177	-0.8377	6.2476
21000	-1.2204	-3.6477	2.3127	-3.9396	-0.8274	6.2523
21500	-1.21038	-3.6275	2.331	-3.9179	-0.8375	6.2489
22000	-1.21474	-3.6341	2.3234	-3.9194	-0.8436	6.2428
22500	-1.21178	-3.6289	2.326	-3.9183	-0.8377	6.2443
23000	-1.26376	-3.7625	2.2533	-4.034	-0.7756	6.2873
23500	-1.27138	-3.7938	2.2473	-4.0529	-0.7575	6.3002
24000	-1.28174	-3.8294	2.2406	-4.0749	-0.745	6.3155
24500	-1.2135	-3.6316	2.3211	-3.9243	-0.8327	6.2454
25000	-1.21206	-3.6303	2.32	-3.92	-0.83	6.24
25500	-1.31488	-3.9534	2.215	-4.137	-0.699	6.351999999...
26000	-1.3204	-3.9932	2.2136	-4.1478	-0.6746	6.3614
26500	-1.32972	-4.0448	2.2102	-4.1668	-0.6472	6.377000000...
27000	-1.22206	-3.6469	2.3072	-3.9392	-0.8314	6.246399999...
27500	-1.22098	-3.6486	2.3105	-3.942	-0.8248	6.2525
28000	-1.35492	-4.2037	2.2105	-4.2013	-0.5801	6.414200000...
28500	-1.36364	-4.2587	2.2066	-4.2131	-0.553	6.4653
29000	-1.38858	-4.3397	2.2008	-4.2513	-0.5527	6.5405
29500	-1.22772	-3.6609	2.2966	-3.9501	-0.8242	6.246700000...
30000	-1.22304	-3.6553	2.304	-3.9472	-0.8167	6.2512
30500	-1.38686	-4.5042	2.2143	-4.2184	-0.426	6.718500000...

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

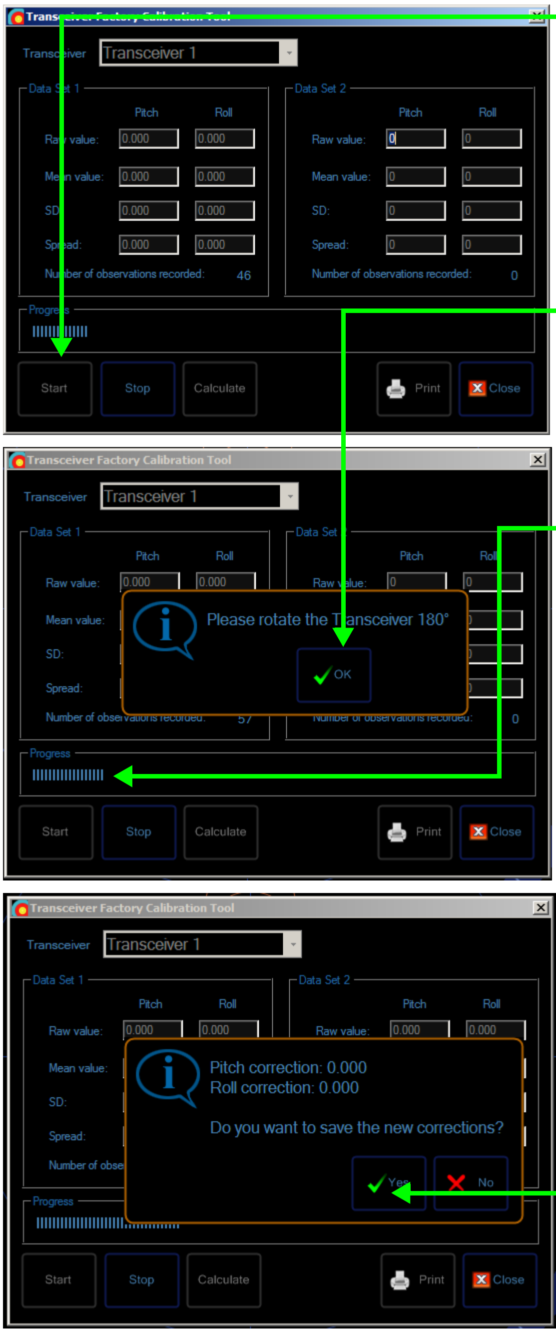
If only one or two frequencies fail, it is unlikely that there is a problem because the test can be disturbed by external noise. In this case, repeat the test to try to gain a successful result.

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.

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 callout instructions below.



a. Click **Start**.

The transceiver takes and stores a series of measurements from the internal roll and pitch sensors.

Turn the transceiver through 180° when prompted to do so.

b. 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.

c. Click **Yes** to save the results of the sensor calibration, or click **No** to discard the results.

Note that you can choose to export the results of the internal sensor calibration. See “Data Export” on page 296 for details.

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.

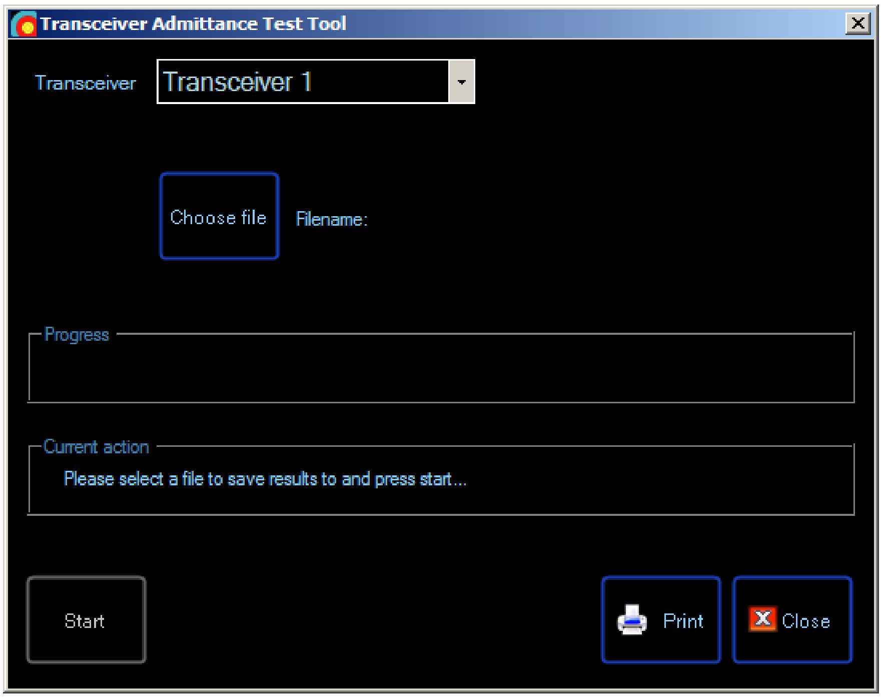
Note

You can perform these operations only if tracking is off-line.

1. Make certain the GDT 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.

Figure 64 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.

   The email address is **usbl.support@sonardyne.com**

Transceiver firmware download

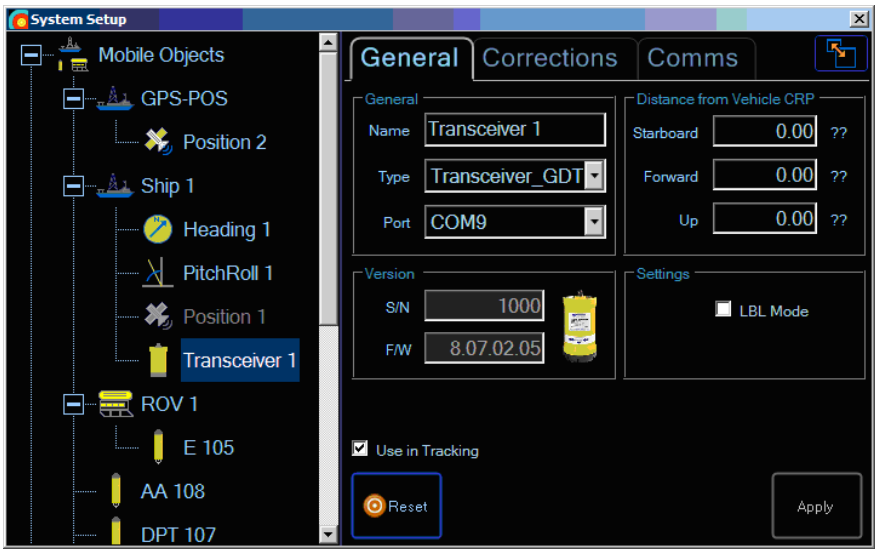
GDT firmware is stored in a ***.gdt** file. Sonardyne recommends that you obtain the latest version of firmware from Sonardyne International Limited and that you save it to the C: drive of the PC that you use to run the software.

Note

You can perform these operations only if tracking is off-line.

1. Make certain the GDT transceiver is connected to an NSH transceiver port and the NSH is networked into the Navigation Computer correctly.

2. Run the software and use System Setup to create a setup that includes the GDT transceiver, for example:



3. Set the correct NSH port, baud rate and other parameters, and click **Apply**.

4. Select **Tools > Advanced > Transceiver Firmware Download** to display the Transceiver Firmware Download Tool.

Figure 65 Transceiver firmware download tool

5. 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.

6. Click **Choose file** and select the **gdt** file to download.

7. 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.

Risk of equipment malfunction. Avoid using the PC for other purposes while the download progresses.

Note

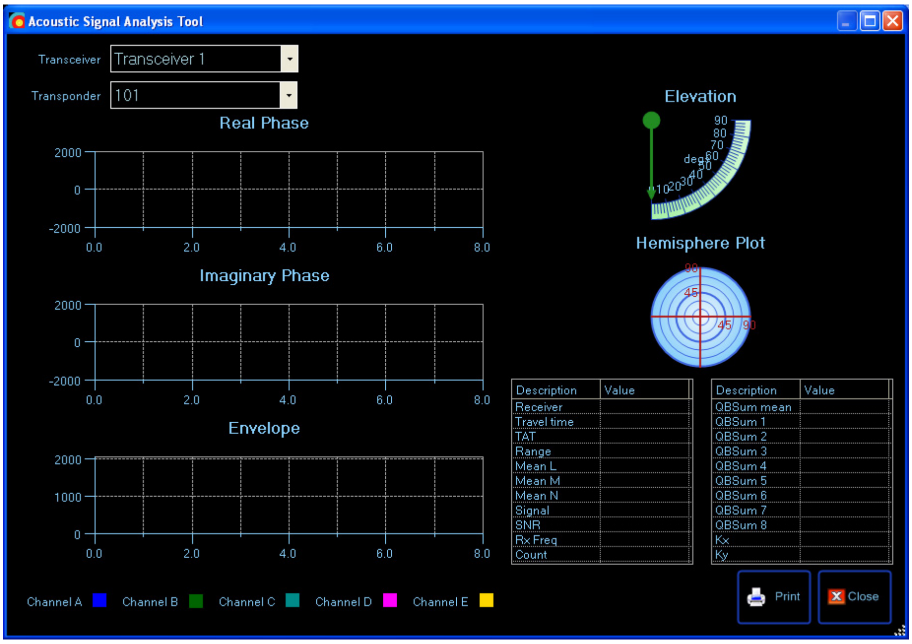
If the download fails, try again using a lower baudrate.

8. Return to the System Setup for the transceiver and click **Reset**.

9. Confirm the firmware version is now set to the new version you have downloaded.

Acoustic Signal Analysis

Figure 66 Acoustic signal analysis tool



The acoustic signal analysis tool allows you to assess the condition of the acoustic signal. This tool provides a 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.

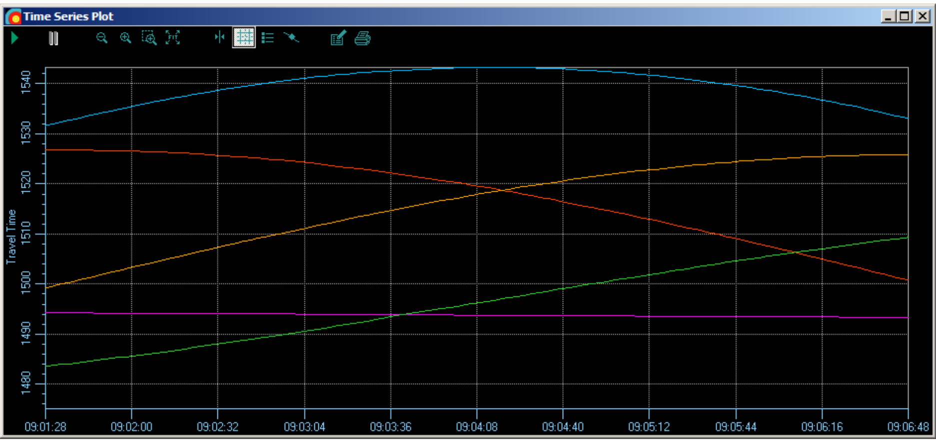
Acoustic Travel Times

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 is used to help ensure that travel times do not overlap. If they do, you should adjust the beacon turnaround time (TAT) to separate the travel times.

Figure 67 shows an example of an acoustic travel times display. In this example, the Y axis shows the two-way travel time (transceiver to beacon to transceiver), and the X axis shows time.

Figure 67 Example acoustic travel times display

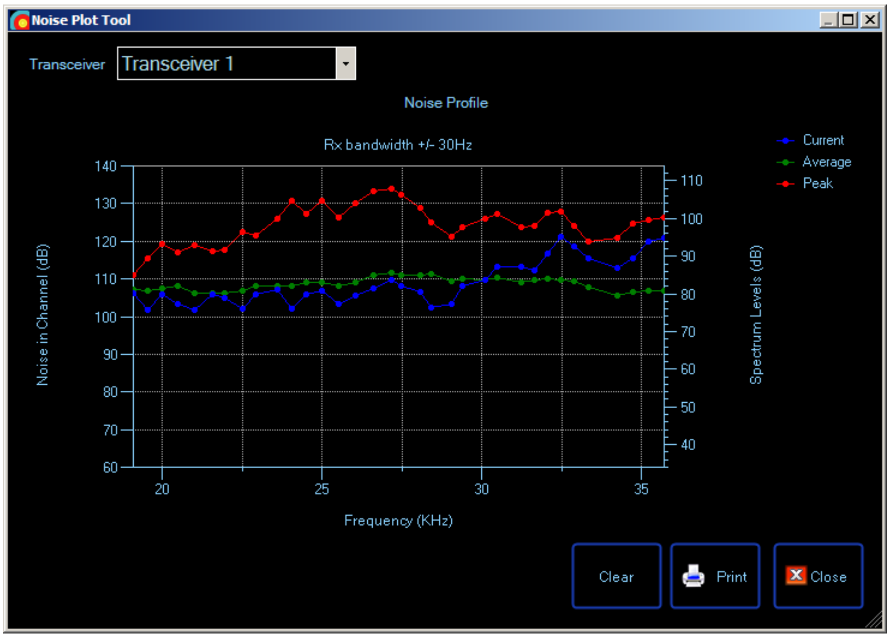


Note

The following explanation applies for travel time display and for the graphing tool.

Noise Plot

Figure 68 Noise plot tool



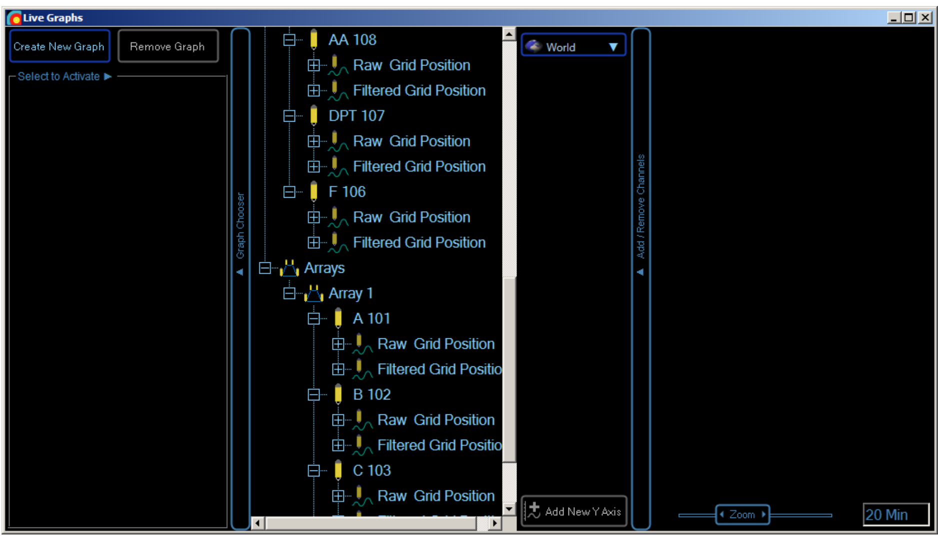
The noise plot tool is a fault finding tool that you can use to analyse the amount of background noise to which the transceiver is exposed. You can use it to take various noise profiles of the vessel under different operating configurations—for example with thrusters on and off; with the echo-sounder 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.

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.

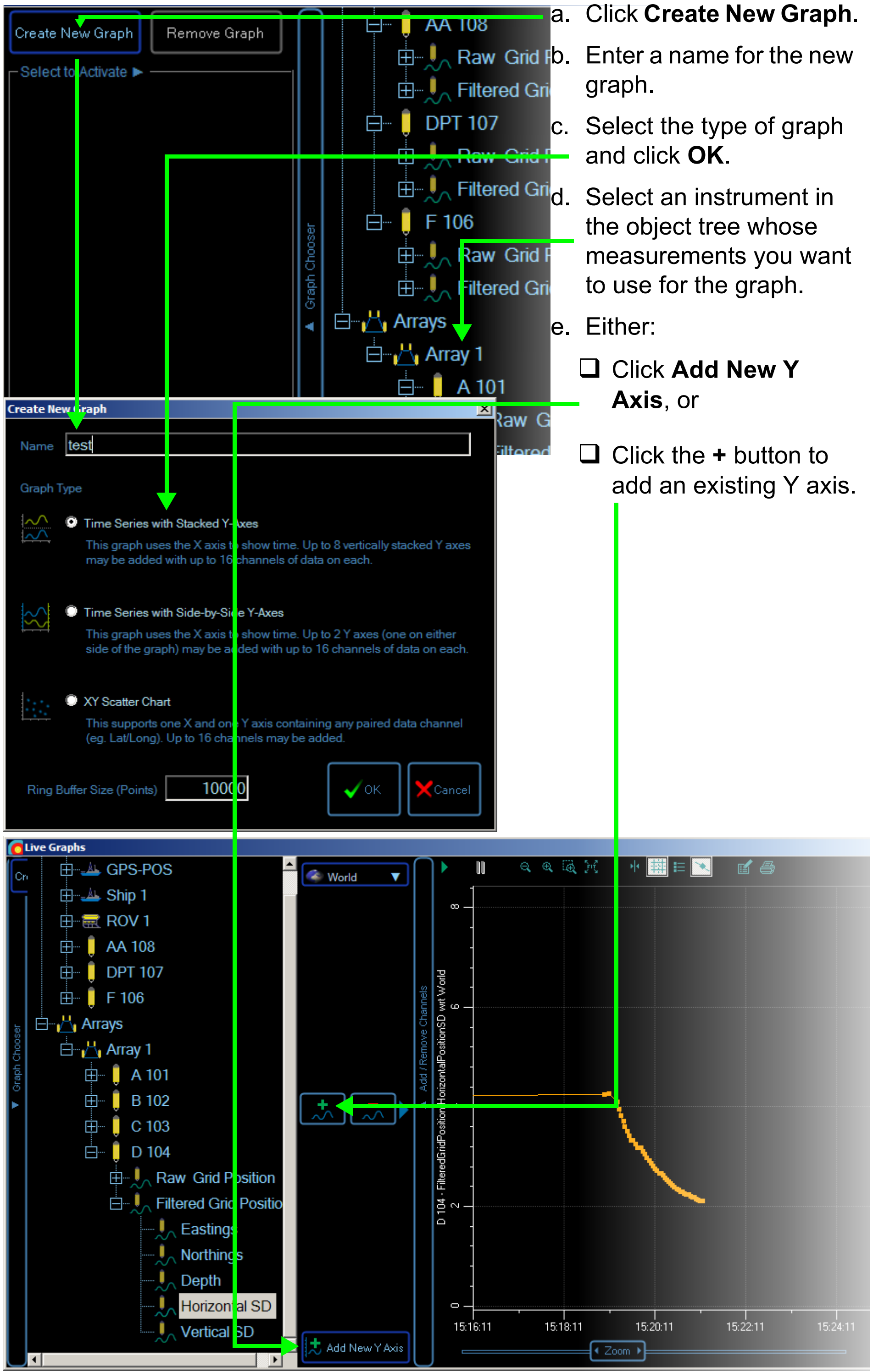
1. Select **Tools > Graphs** to display the **Live Graphs** window.

Figure 69 Live graphs window



Create a new graph

2. Follow the callout instructions below to create a new graph.



a. Click **Create New Graph**.

b. Enter a name for the new graph.

c. Select the type of graph and click **OK**.

d. Select an instrument in the object tree whose measurements you want to use for the graph.

e. Either:

- ❑ Click **Add New Y Axis**, or
- ❑ 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.

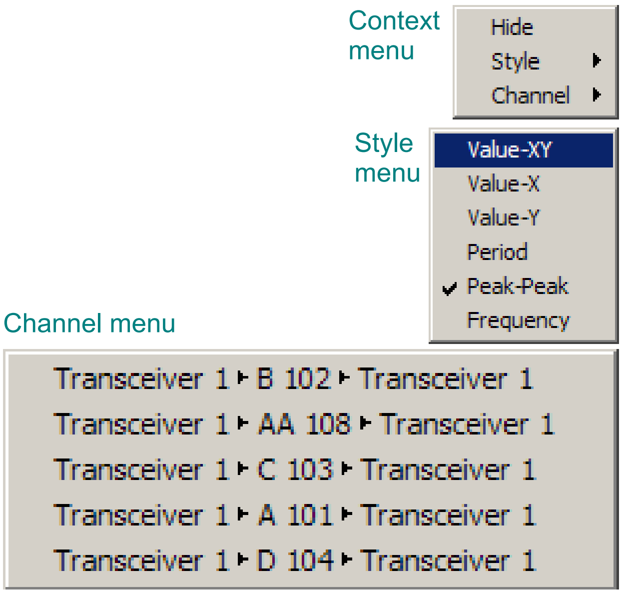
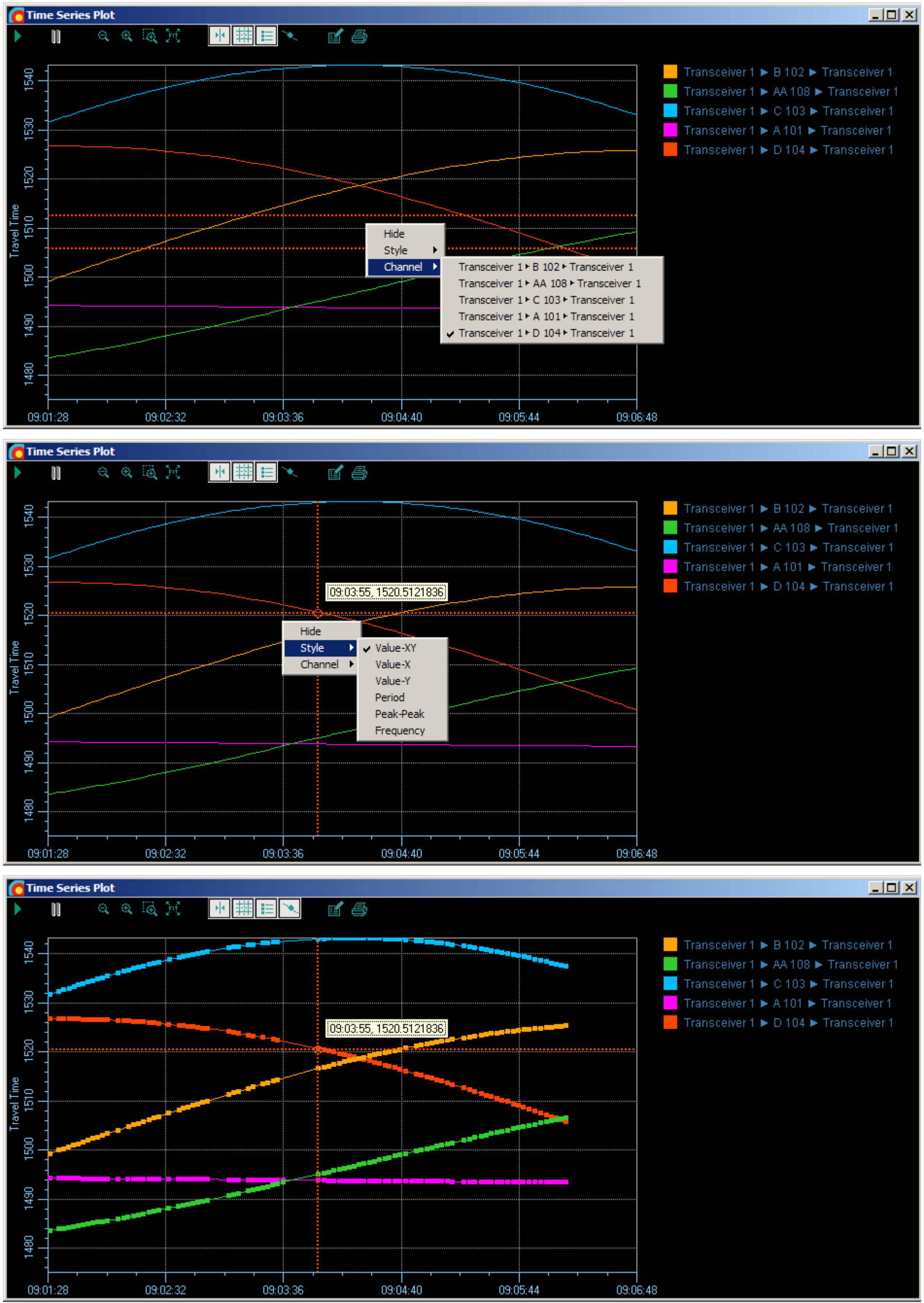


Figure 70 shows an example where the acoustic travel times display has been set up with the cursor on channel D104, and the display uses the Value-XY style.

Figure 70 Example showing Channel D104 using Value-XY style



Simulate

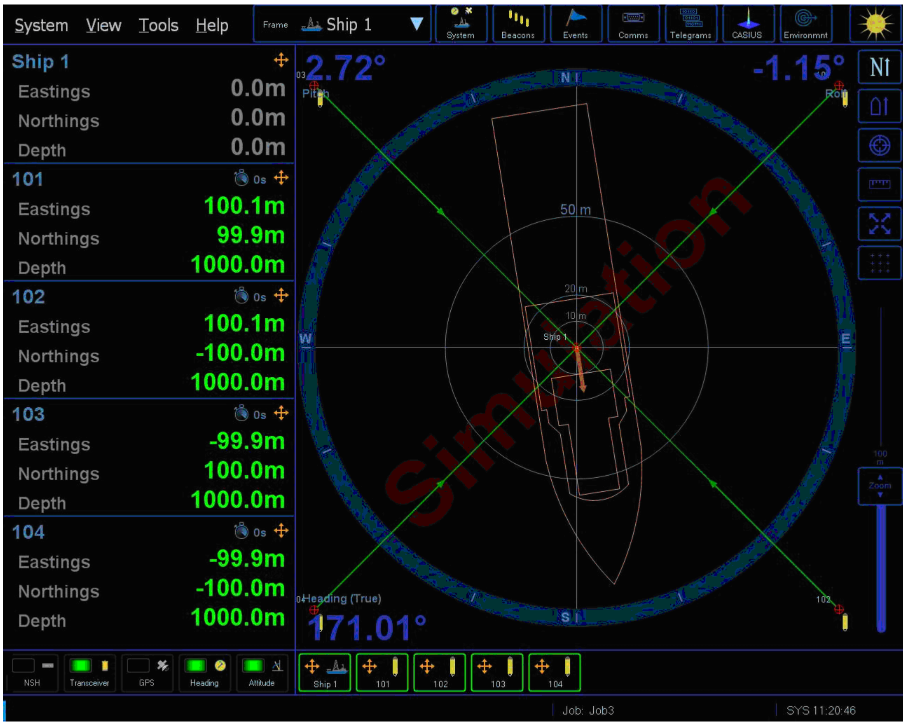
The built-in simulation mode is mainly used for generating DP test telegrams. For a more sophisticated simulation tool, use a product such as SonSim available from Sonardyne.

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.

Figure 71 Simulation mode



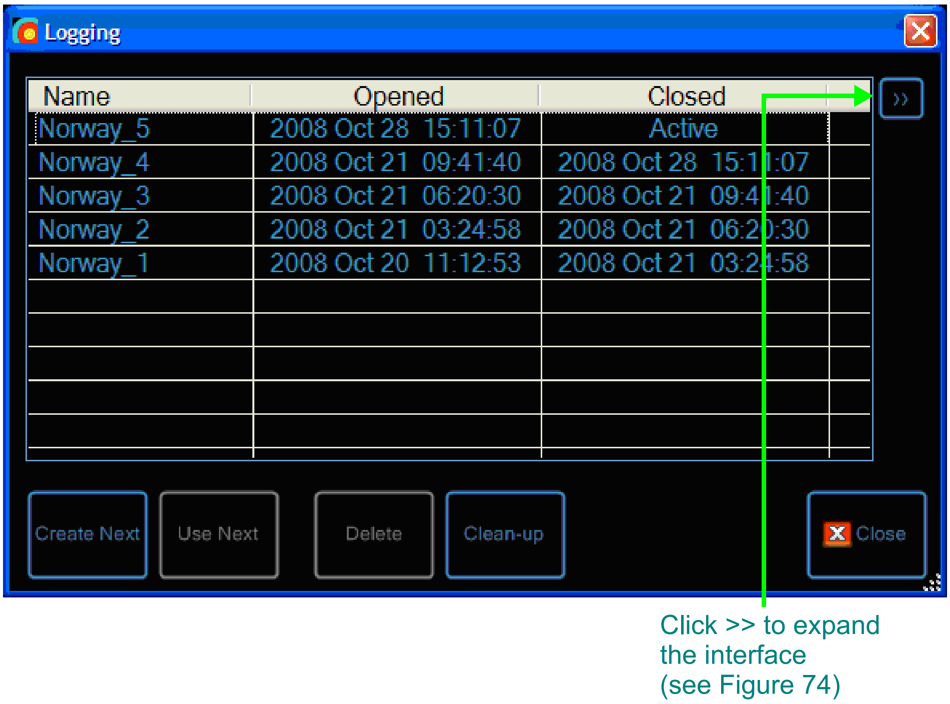
Maintenance

The Maintenance menu allows you to manage data logging, to explore the files, and to import or export set-up files.

Logging

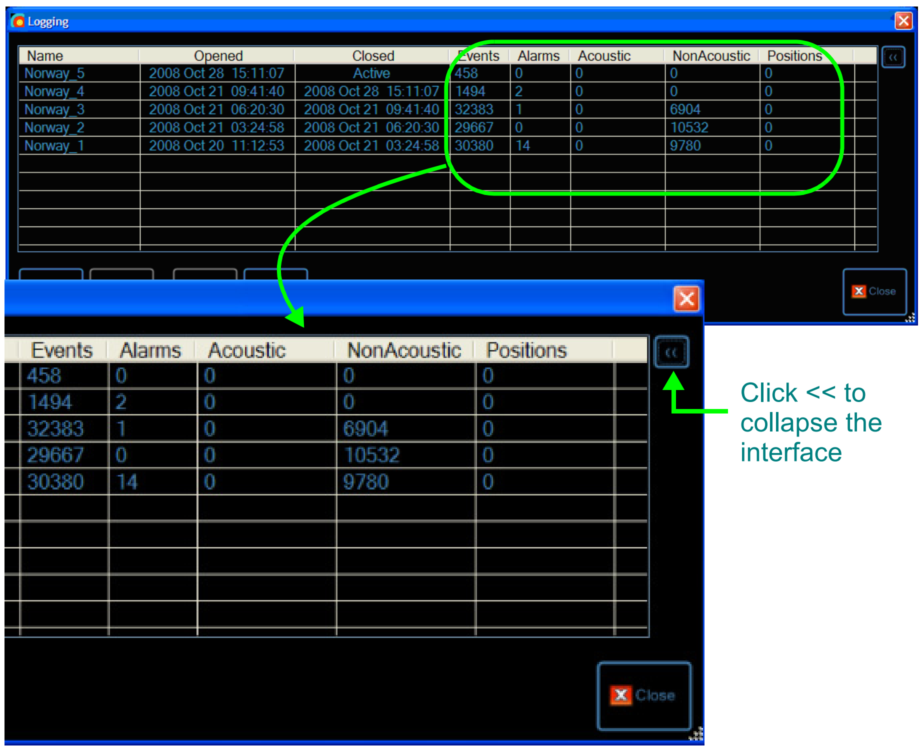
The log file system is managed automatically by the software, but the **Logging** user interface allows you to make manual changes, if necessary.

Figure 72 Logging user interface



The Logging user interface (UI) is shown in Figure 72. 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:

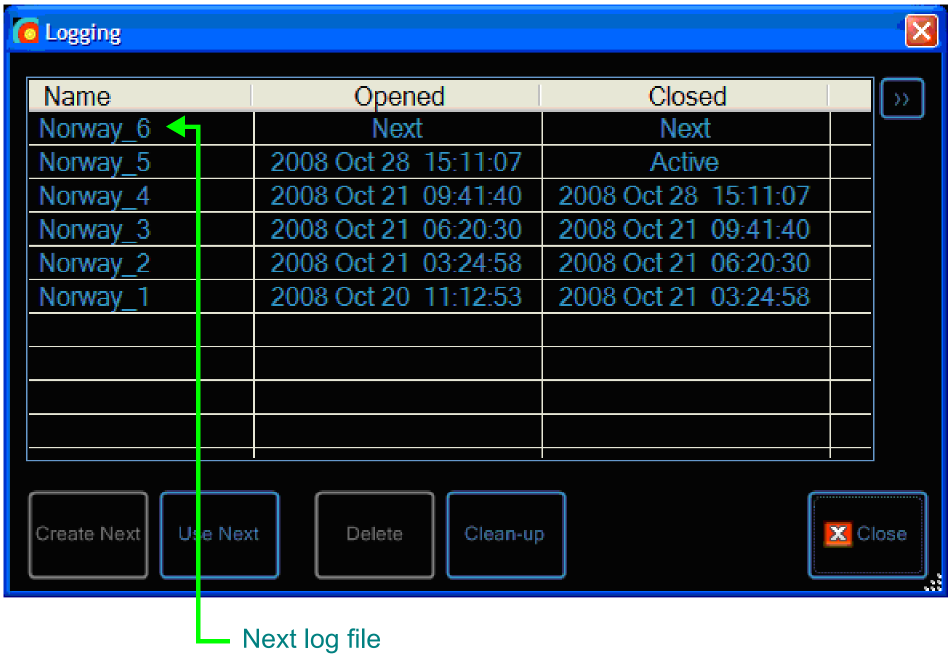


The Logging interface allows the following operations:

- ❑ 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:



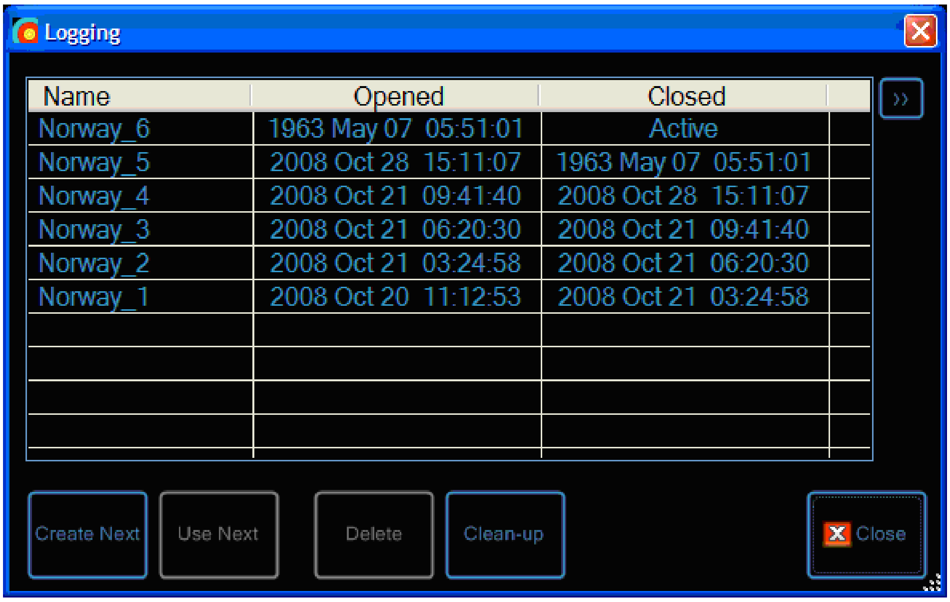
The status indicator **Next** in the **Opened** and **Closed** columns for the **Norway 6** entry shows that this is the next log file to be ready for use by the system to log data. However, in this example the active file is still **Norway 5**.

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:

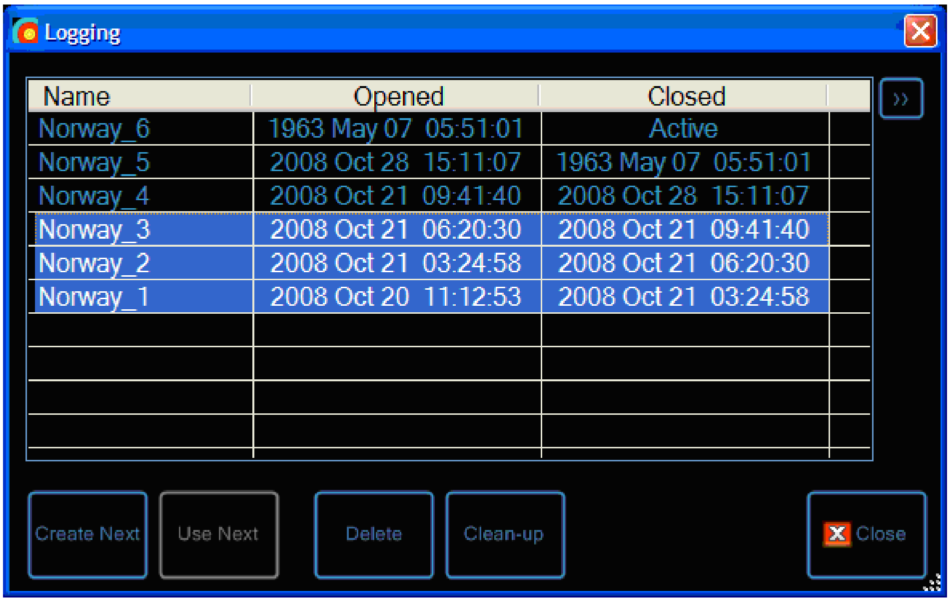


The **Use Next** button is disabled, and the **Create Next** button is enabled, ready for you to create the next log file.

Delete:

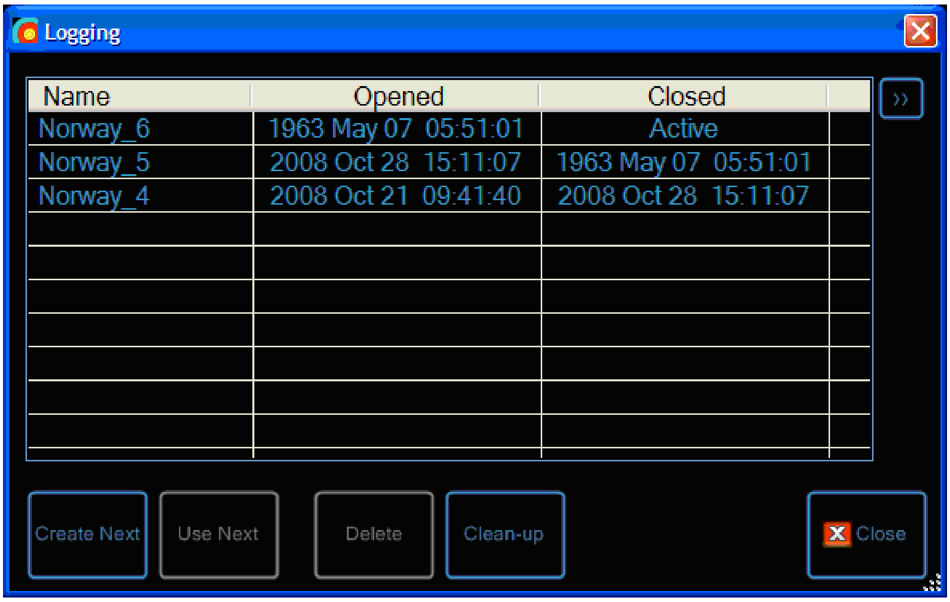
This option allows you to delete a continuous sequence of one or more log files, always beginning from the oldest log file in the list and ending at the log file you select. The **Delete** button is enabled only when you select a file in the list.

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 lit of log files, and the **Delete** button is disabled, for example:



Clean-up:

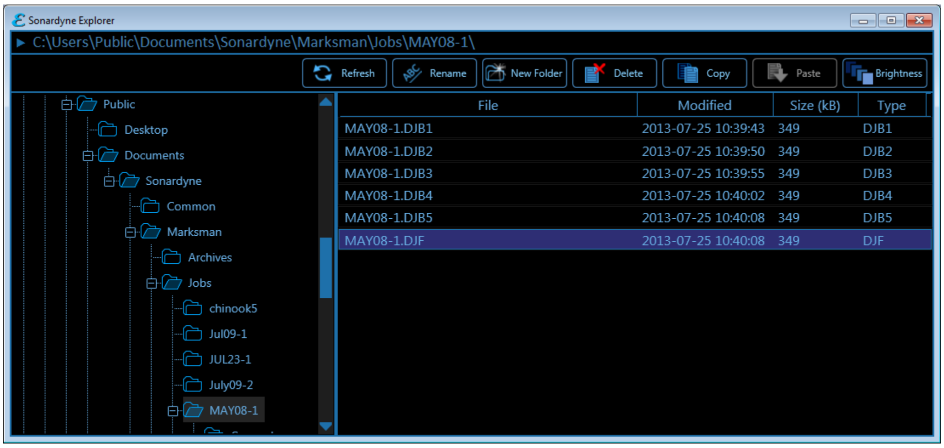
The Clean-up button starts a house-keeping session that deletes any old log files as specified in the **House Keeping** section of the **Options – Logging** tab (see Figure 75 on page 299).

Explore files

The software's file explorer quickly navigates the user to the most commonly used system folders. Using this Explorer, the user can:

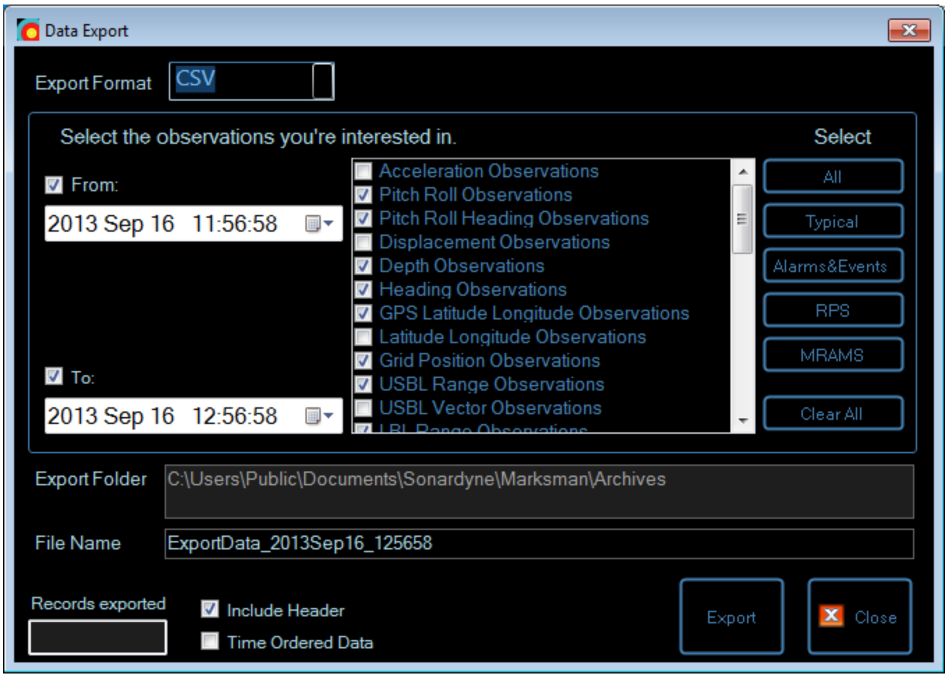
- **Copy** and **Paste** files between the system folders and removable backup media, such as USB memory sticks.
- **Rename** file, such as exported data files. Note that this option must not be used to rename system files otherwise unexpected behaviour might occur.
- **Delete** files.
- Create **New Folders**.
- **Refresh** the file list.

- ❑ Change the viewer **Brightness**.



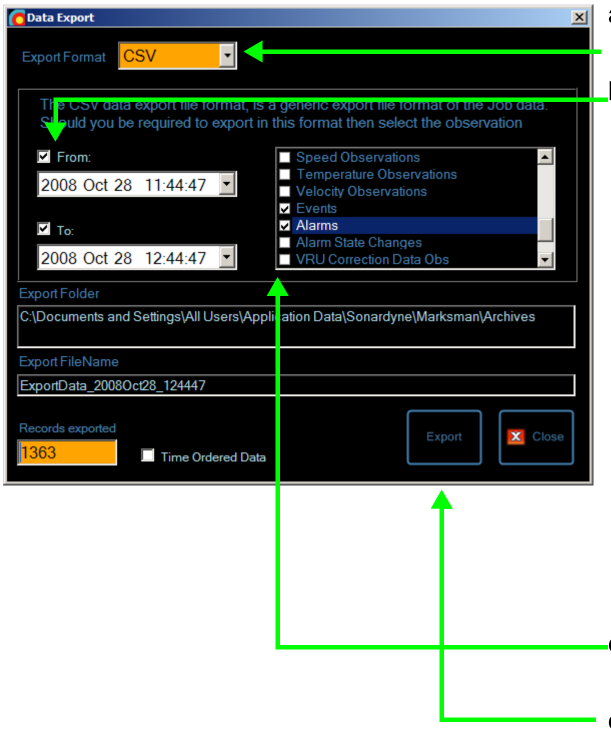
Data Export

Figure 73 Data export tool



The data export mode uses **CSV**, which you select through the **Export Format** control on the dialog.

The CSV export mode is a general purpose exporter.



a. Select **CSV** in the **Export Format** control.

b. Set the **From** and the **To** dates between which to export observations.

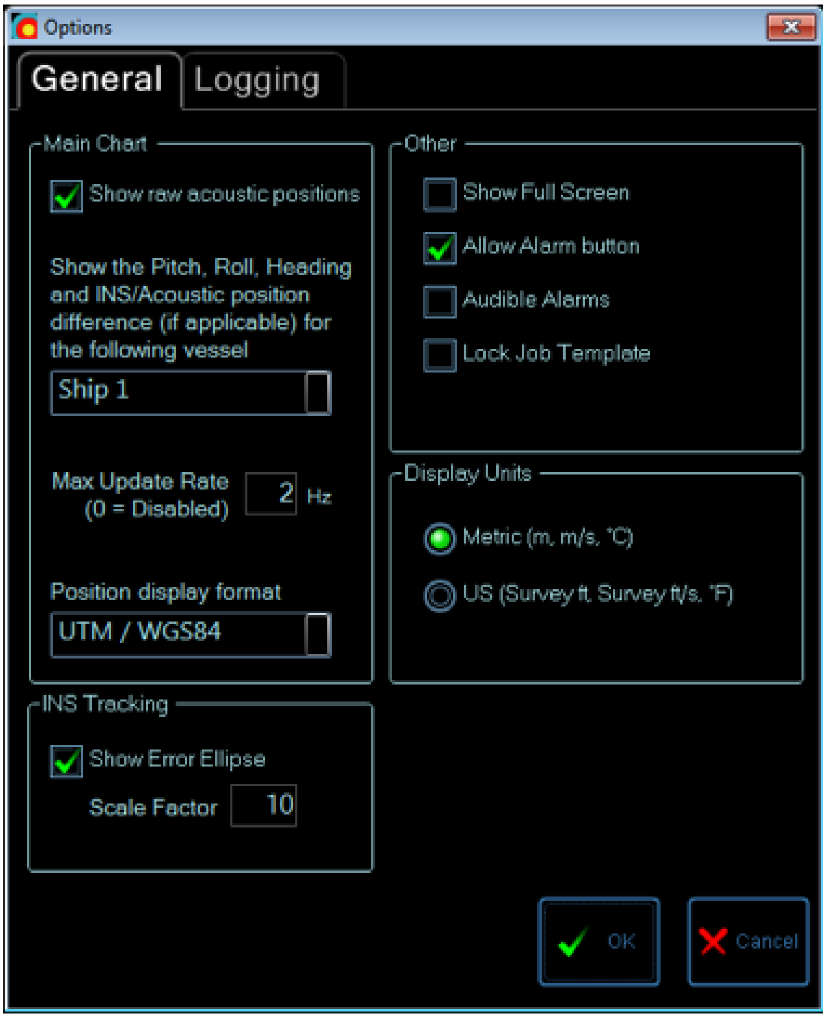
- ❑ To select all observations after a particular date, set the **From** date and then deselect the check box for the **To** date.
- ❑ To select all observations before a particular date, set the **To** date and then deselect the check box for the **From** date.

c. Select the observations to include in the export.

d. Click **Export**.

Options There are two tabs on the **Options** dialog.

Figure 74 Options – 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.
- Select **Position display format** to choose UTM or latitude/longitude display format.
- Select **INS Show Error Ellipse with Scale Factor** to display an error ellipse with a defined multiplication scale factor.

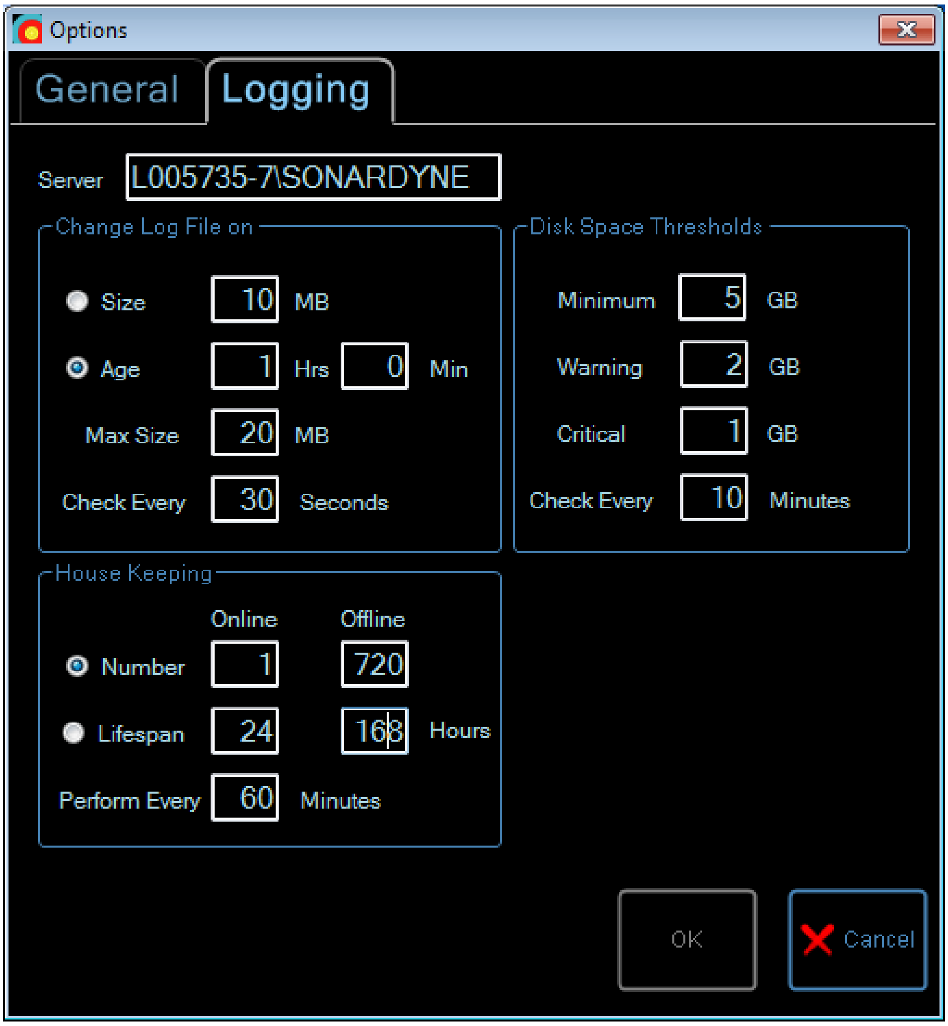
Other options

- 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.

Display units

- ❑ Select Metric to display all measurements in SI units.
- ❑ Select US to display in US survey feet, degrees Fahrenheit, and so on.

Figure 75 Options – Logging



Normally, you should leave the data logging options in their default settings. Please ask 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.

Options - Chart

On Windows XP-based systems, there are no chart options, other than those listed in the **General Options** dialog and the **Button Controls** described above.

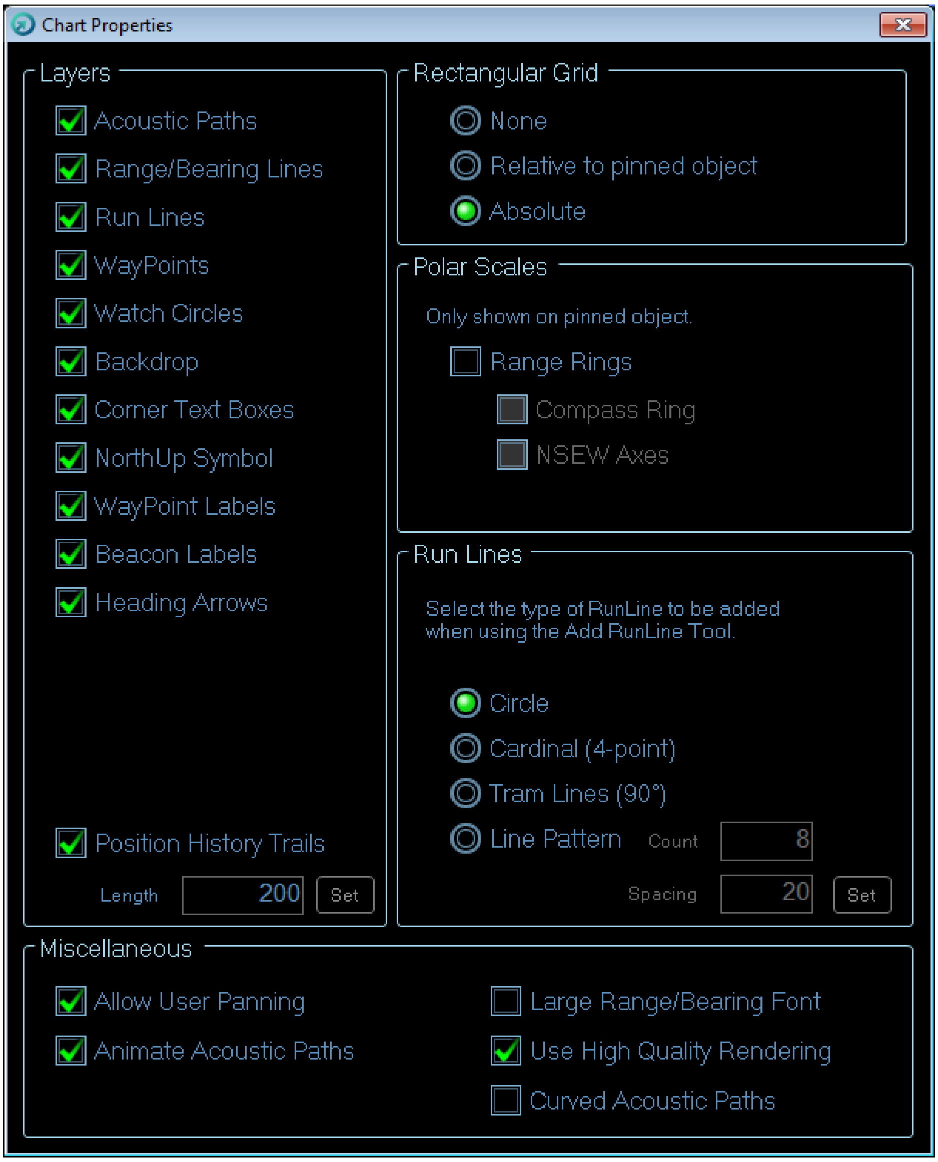
On Windows 7-based systems, the navigation chart in the **Plan View Pane** has a flexible set of user options available through the **Chart Options** dialog.

The user can select to view or hide each of the different object layers:

- a rectangular grid.
- a polar display with optional compass ring.
- run-lines settings for several different patterns.
- chart panning (dragging with the mouse).
- animation of acoustic range lines.
- range tool font size.

Selection of any of these properties takes immediate effect and the setting is saved automatically.

Figure 76 Chart options available in Windows 7-based systems



Options – Backdrop

A chart backdrop may be used to reference the positions of vessels or beacons to seabed assets or topography.

Note

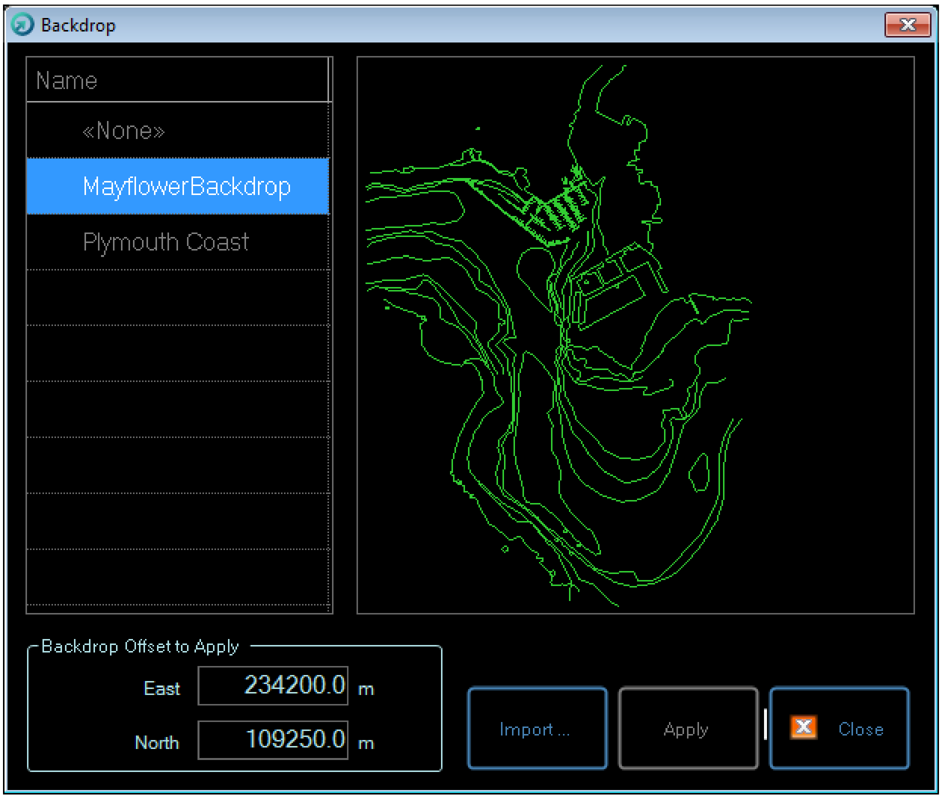
This optional feature is available only on Windows 7 (or later Windows versions).:

Backdrop image files must be of type DXF. 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.

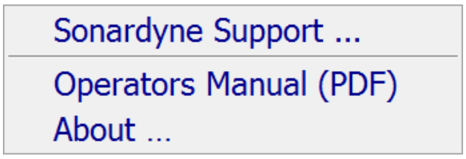
The DXF backdrop should normally have its Easting/Northing origin already defined, but an **Offset** may be applied if necessary.

Figure 77 Example of a chart backdrop



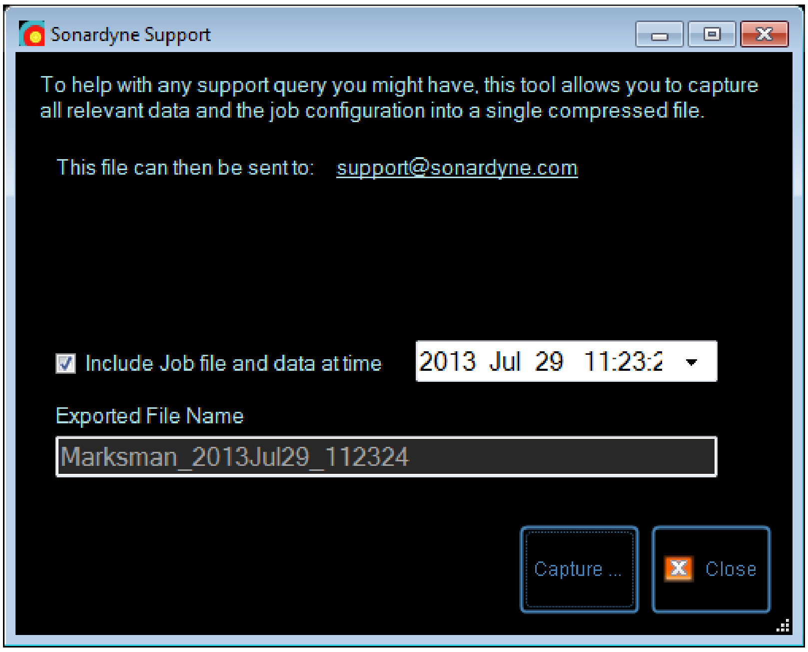
J.10 Help Menu

There are three options under the **Help** menu:



- **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.



- **Operators Manual (PDF)**

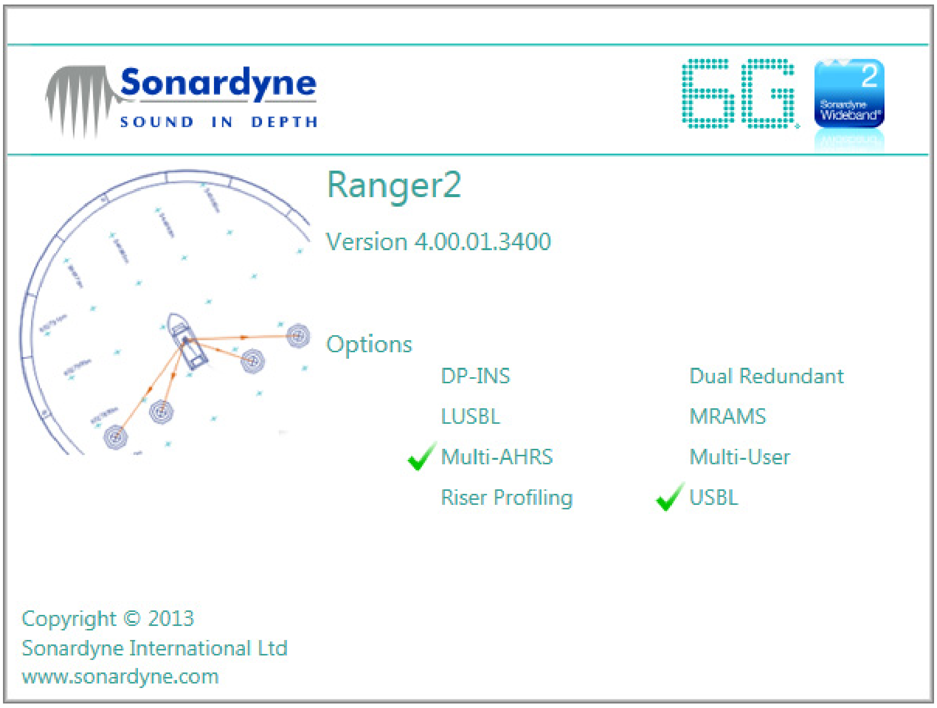
  This option opens the User Manual (this manual) so that you can refer to it easily.

- **About…**

  This option displays information about the system options which the security key (dongle) has enable, together with the primary software version number. 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.

Figure 78 About the software



K Beacons

In this chapter...

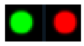
This chapter contains the following sections:

K.1 Beacons Table

The Beacons Table brings the management of all the beacons in the system together in one integrated tool. It includes four tabs to display the different kinds of information: Main, Tracking, Advanced, and Hardware Status.

Common to all tabs

Table 48 Beacon controls common to all tabs

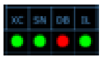
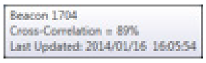
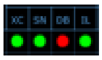
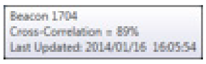
Column /Field Name	Function	Control Type
Select	Selects a beacon row	
Status/ Lock	Current Lock status as a padlock	
Status/ Enable	Current Beacon ‘enabled’ state.	 (green = enabled)
Status/ Key	Graphic symbol / colour used on chart to represent the beacon.	 = mobile  = reference  = calibrating (The colour is unique for each beacon. The symbol rotates constantly.)
Name/ Prefix	Beacon Name Prefix	Text Edit Box (Maximum 3 characters.)
Name/ Address	Beacon Address	Text Label

Main tab

The **Main** tab, shown in Figure 79, 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.

Figure 79 Beacons table – Main tab

Table 49 Beacons table – Main tab description

Column/Field name	Function	Control type
Channels/ Interrogate	Interrogate channel	Drop-down Combo box
Channels/ Reply	Reply channel	Drop-down Combo box
TAT ms	Turn Around Time (ms)	Drop-down Combo box
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 1704 Cross-Correlation = 89% Last Updated: 2014/01/16 16:05:54
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 1704 Cross-Correlation = 89% Last Updated: 2014/01/16 16:05:54
Battery Status	Battery charge state	 88% 14.5V  -- LOW --  Overridden
Track	Tracking controls	Drop-down Combo box (On/Off)
Update (sec)	Tracking update rate	Numeric edit box (single decimal)
Skip Telem	Skip sending telemetry for any commands to this beacon	

Interpreting Link Status information

The Link Status information from a transceiver or transponder 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.

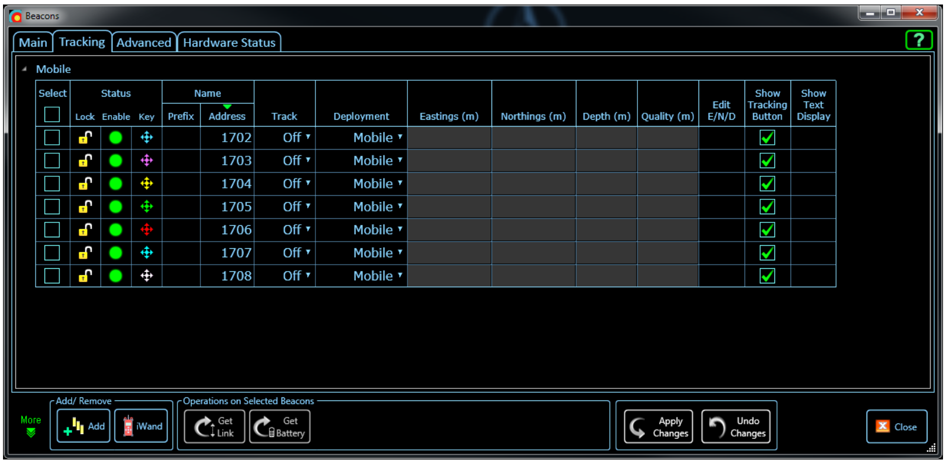
Table 50 Parameter bounds for link status information

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 transponder 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.

Tracking tab

The **Tracking** tab, shown in Figure 80, displays the major tracking parameters, including Deployment and Easting, Northing, Depth positions.

Figure 80 Beacons table – Tracking tab



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 screen.

Table 51 Beacons table – Tracking tab description

Column /Field Name	Function	Control Type
Tracking	Controls tracking	Drop down ComboBox [On/Off]
Deployment	Where the beacon is currently situated or attached.	Drop down ComboBox [Mobile, Fixed, Calibrating, Array and Named Subsea Vehicle]
Easting (m)	Easting (local or world)	Numeric Label (2 decimals)
Northing (m)	Northing (local or world)	Numeric Label (2 decimals)
Depth (m)	Depth	Numeric Label (2 decimals)
Quality (m)	Tracker Quality	Numeric Label (2 decimals)
Edit E/N/D	If this beacon is an array beacon, then this field will become visible. It allows the **Easting**, **Northing**, and **Depth** values above to be edited when the check box is checked.	
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.	

Advanced tab

The **Advanced** tab, shown in Figure 81, includes beacon parameters that should rarely need to be adjusted.

Figure 81 Beacons table – Advanced tab

Use the **Advanced** tab to adjust the Power, Gain and Telemetry scheme for one or more beacons.

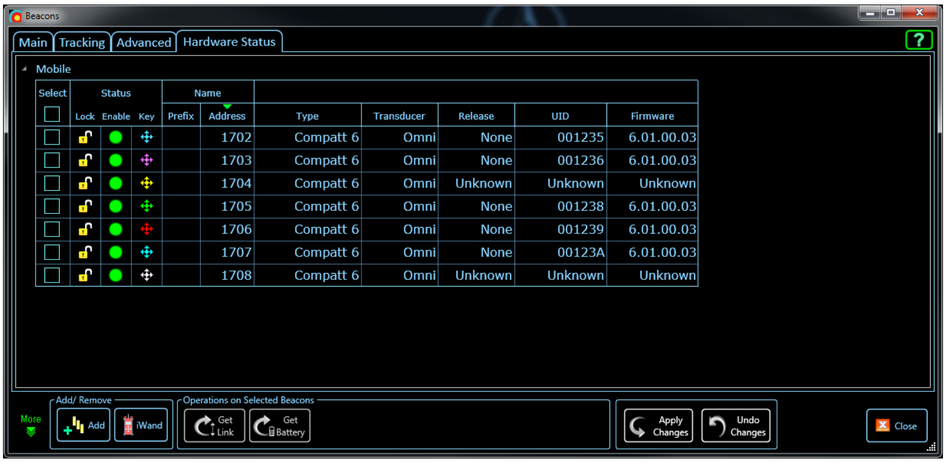
Table 52 Beacons table – Advanced tab description

Column /Field Name	Function	Control Type
Telemetry Transceiver	Transceiver assigned for performing telemetry to this beacon (if applicable)	Drop down ComboBox
Transceiver/ Power	Transceiver Tx Power	Drop down ComboBox
Transceiver/ Rx Gain	Transceiver Rx Gain	Drop down ComboBox
Transceiver? Telemetry	Transceiver Telemetry Scheme	Drop down ComboBox
Beacon/ Power	Beacon Tx Power	Drop down ComboBox
Beacon/ Rx Gain	Beacon Rx Gain	Drop down ComboBox
Beacon/ Telemetry	Beacon Telemetry Scheme	Drop down ComboBox
Skip Telem.	Skip sending telemetry for any commands to this beacon.	

Hardware Status tab

The Hardware Status tab, shown in Figure 82, displays the fixed parameters of each beacon, including UID, Firmware version and Transducer type.

Figure 82 Beacons table – Hardware Status tab



If a beacon does not support telemetry (or has an incompatible 5G/6G Transceiver) most fields are blank.

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

Table 53 Beacons table – Hardware Status tab description

Column /Field Name	Function	Control Type
Type	Beacon type name (e.g. Compatt 6)	Static Label
Transducer	Transducer type (Omni or Directional)	Static label
Release	Release type	Static Label
UID	Beacon UID	Static Label
Firmware	Firmware version	Static Label

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 on the **Add** button launches the Add Beacon Wizard (see Appendix K.2 beginning on page 315).

- ❑ Clicking on the **iWAND** button launches the iWAND tool (see Appendix K.3 beginning on page 321).

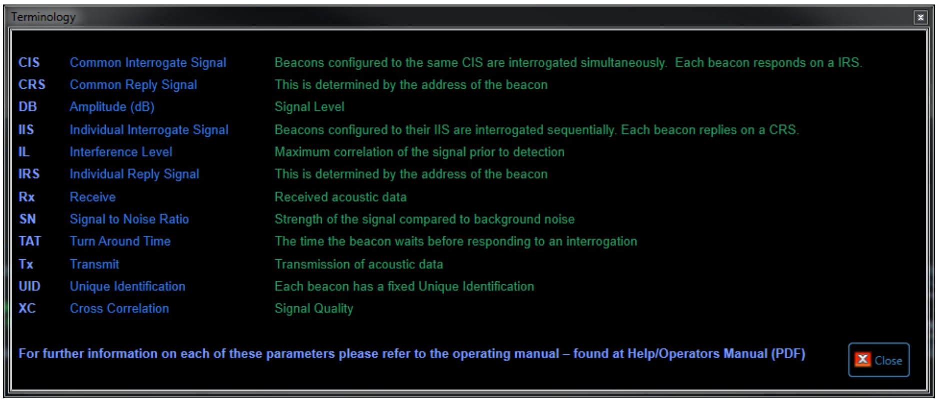
- Clicking on the **Sync…** button launches the **Acoustic Time Synchronisation** window (see Appendix J.9 beginning on page 273).

- Clicking on the **Print** button launches the Windows Print Dialog. This is a standard system dialog that allows you capture and print out the Beacons Window.

- Clicking on the **Auto Discover** button launches the Beacon Discovery Tool (see Appendix K.4 beginning on page 323).

- Clicking on the ? button shows the Beacon Terminology help window.

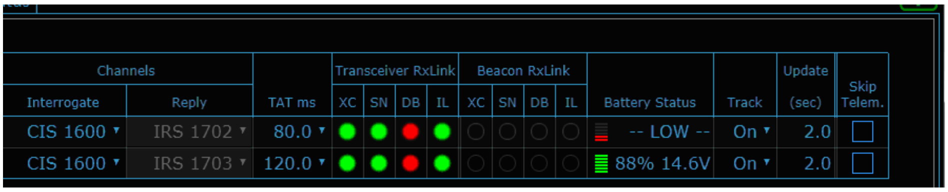
Figure 83 Beacons Terminology window



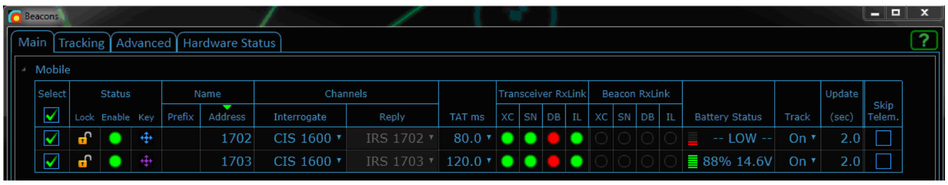
- Clicking on **Close** closes the window.

Beacon selection

The first column in all tables in all tabs is a Beacon **Select** column, consisting of a check box to select a row. When a beacon is 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.



There is a **Select All/None** check box in the header of each table's selection column. Toggling this selects All or None of the beacons in that table, across 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:

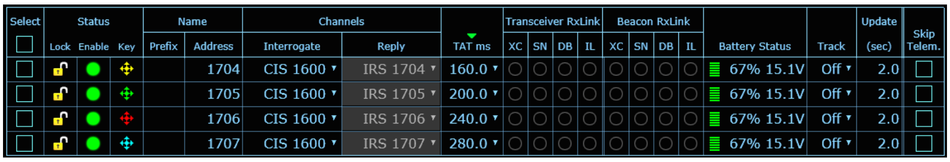
- Get Link

- Get Battery

- ❑ Set All
- ❑ Lock
- ❑ Unlock
- ❑ Enable
- ❑ Disable
- ❑ Release
- ❑ Delete

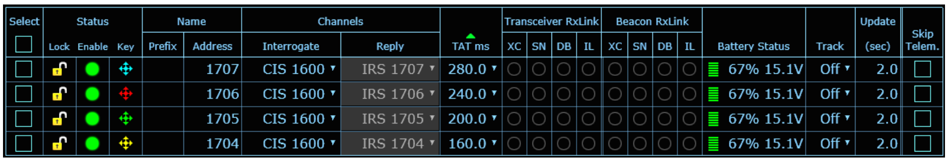
Sorting columns

Columns that have data that can be usefully sorted do allow sorting (see the examples below for where this feature can be used). To sort the columns, click on a column header that contains sortable data results so that a green chevron (as shown below) appears above the header text. Only one column is sortable at a time, but it is applied to all tables on all tabs (as applicable).



Select	Status			Name		Channels			Transceiver RxLink				Beacon RxLink						Update	Skip Telem.
	Lock	Enable	Key	Prefix	Address	Interrogate	Reply	TAT ms	XC	SN	DB	IL	XC	SN	DB	IL	Battery Status	Track	(sec)	
					1704	CIS 1600	IRS 1704	160.0									67% 15.1V	Off	2.0	
					1705	CIS 1600	IRS 1705	200.0									67% 15.1V	Off	2.0	
					1706	CIS 1600	IRS 1706	240.0									67% 15.1V	Off	2.0	
					1707	CIS 1600	IRS 1707	280.0									67% 15.1V	Off	2.0	

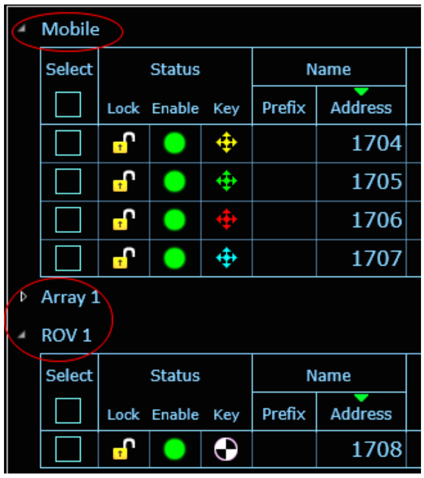
Clicking on the chevron reverses the sort order.



Select	Status			Name		Channels			Transceiver RxLink				Beacon RxLink						Update	Skip Telem.
	Lock	Enable	Key	Prefix	Address	Interrogate	Reply	TAT ms	XC	SN	DB	IL	XC	SN	DB	IL	Battery Status	Track	(sec)	
					1707	CIS 1600	IRS 1707	280.0									67% 15.1V	Off	2.0	
					1706	CIS 1600	IRS 1706	240.0									67% 15.1V	Off	2.0	
					1705	CIS 1600	IRS 1705	200.0									67% 15.1V	Off	2.0	
					1704	CIS 1600	IRS 1704	160.0									67% 15.1V	Off	2.0	

Beacon groups

All tabs show separate collapsible tables for Mobile, Array and ROV. Each table is independently collapsible by clicking on the chevron next to the table title, as shown here.



Beacon operations

Assuming at least one beacon has been selected in the table then these buttons are enabled:

- ❑ Get Link

- Get Battery
- Set All
- Lock
- Unlock
- Enable
- Disable
- Release
- Delete

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

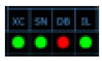
1. If all selected beacons are capable of the operation, the operation is performed. A confirmation dialog may be displayed if the operation makes fundamental changes to beacons.

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 may be displayed if the operation makes fundamental changes to beacons that support the operation.

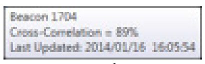
3. If all selected beacons are NOT capable of the operation, the operation is NOT performed. A dialog is displayed to explicitly tell the user that nothing happens.

4. If all selected beacons allow telemetry but have their **Skip Telemetry** check box checked, a dialog is displayed to explicitly tell the user that no telemetry will occur (that is, the change will be a local UI change only).

Get Link Button. This requests ALS link status from all selected beacons and populates the **Beacon RxLink** column appropriately. 'Traffic lights' are shown:



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



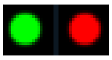
Get Battery Button. This requests battery status from all selected beacons and populates the **Battery Status** column appropriately.

Set All Button. This sets ALL fields across all tabs to all selected beacons, some of which may require telemetry.

Lock Button. This locks all selected beacons. The user must confirm the action. If a beacon does not support telemetry, then the beacon is locked in the UI only (greyed out row).

Unlock Button. This unlocks all selected beacons. The user must confirm the action. If a beacon does not support telemetry, then the beacon is unlocked in UI only.

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

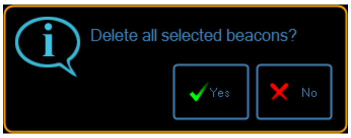


Disable Button. This disables all selected beacons. The user must confirm the action.

Release Button. If more than one beacon is selected, a dialog 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 dialog is shown:

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

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



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

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 the example below.

Figure 84 Beacons table showing edited fields

- ❑ 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 back-grounds revert to black.

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

Bulk changes

The following example explains and shows the bulk change feature. The example assumes we wish to change the Deployment of some Mobile beacons to 'New Array'.

1. Select the appropriate beacons by using the check box.
2. Change the Deployment of any one of the selected beacons to the desired value (New Array).

   All selected beacons change to the new Deployment value as shown below:

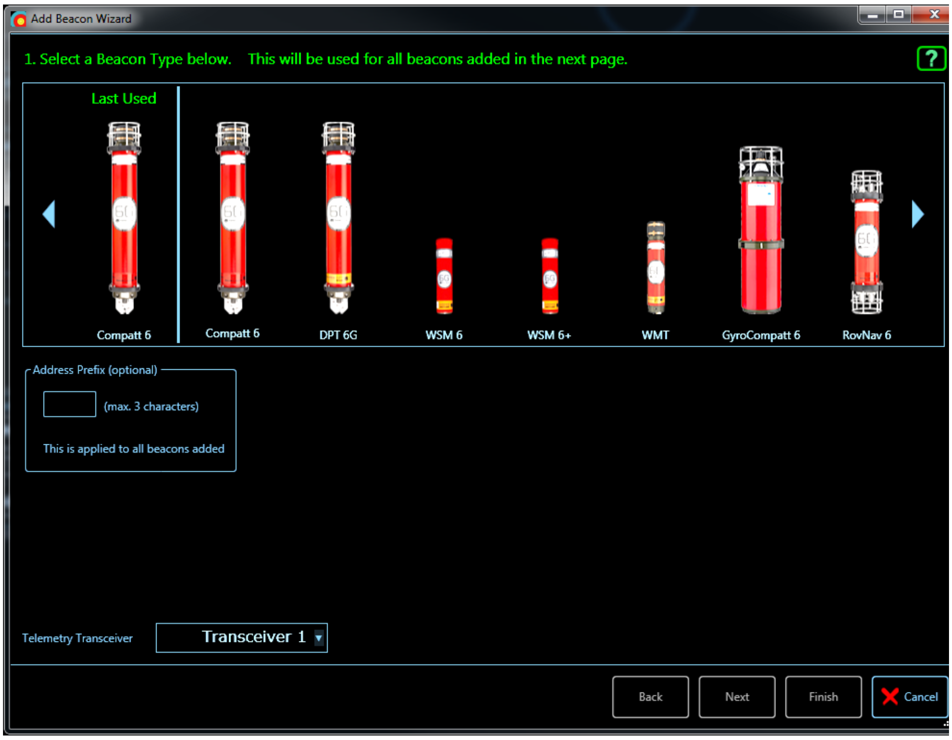
3. Click the **Apply Changes** button.

Note that bulk editing is only available on certain table fields.

K.2 Add Beacon Wizard

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.

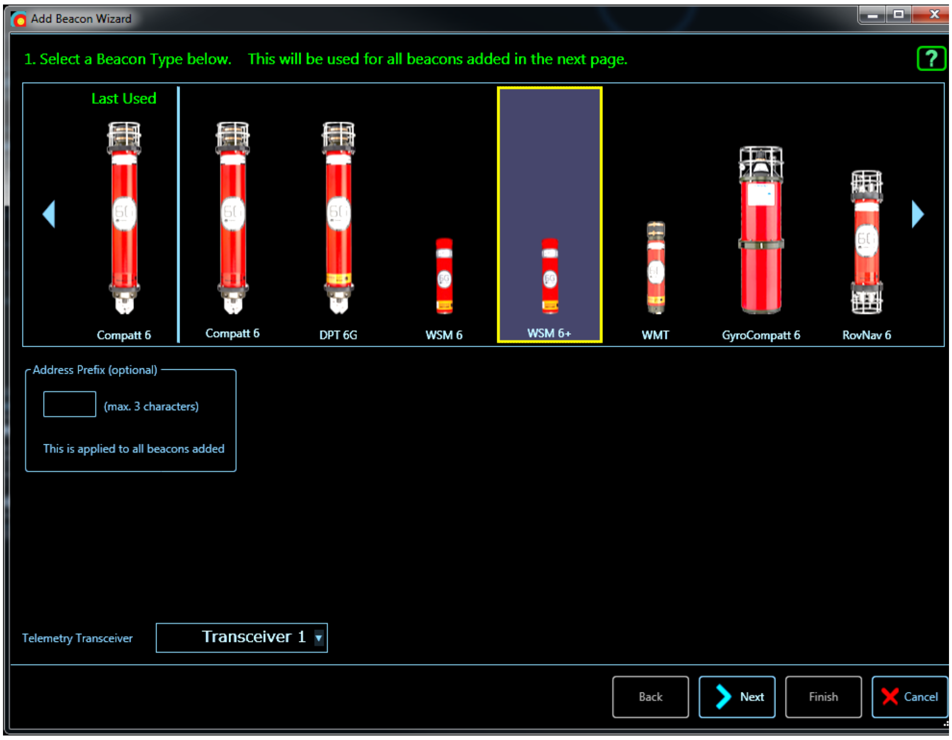
Figure 85 Add Beacon Wizard



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.

Beacon Type

Figure 86 Beacon type selection



The first page of the wizard, shown in Figure 85 and Figure 86, 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 (dongle).
- **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 page. 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 page.

Beacon Address

Figure 87 Beacon address selection

The Beacon Address selection page 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+.
  - QuickSet 1 or 2 for Sonardyne Quicksets.
  - HPR for Kongsberg HPR400.
- 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.

Because of options that must be selected on the final page, certain beacon types allow only one beacon (and therefore only one address) to be added at a time. These are:

- SST
- NanoResponder
- WSM
- WSM 6

In this case only one cell selection is allowed at any one time.

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.

The **Clear** button clears all selected cells.

Click **Next** to proceed to the Beacon Address page. The **Next** button is enabled only after you have selected at least one beacon address (shown using a green background).

The **Back** button on the wizard is always enabled, so you can go back to the previous page and edit is contents.

The **Finish** button on the wizard is always disabled on this page.

Beacon Scenario

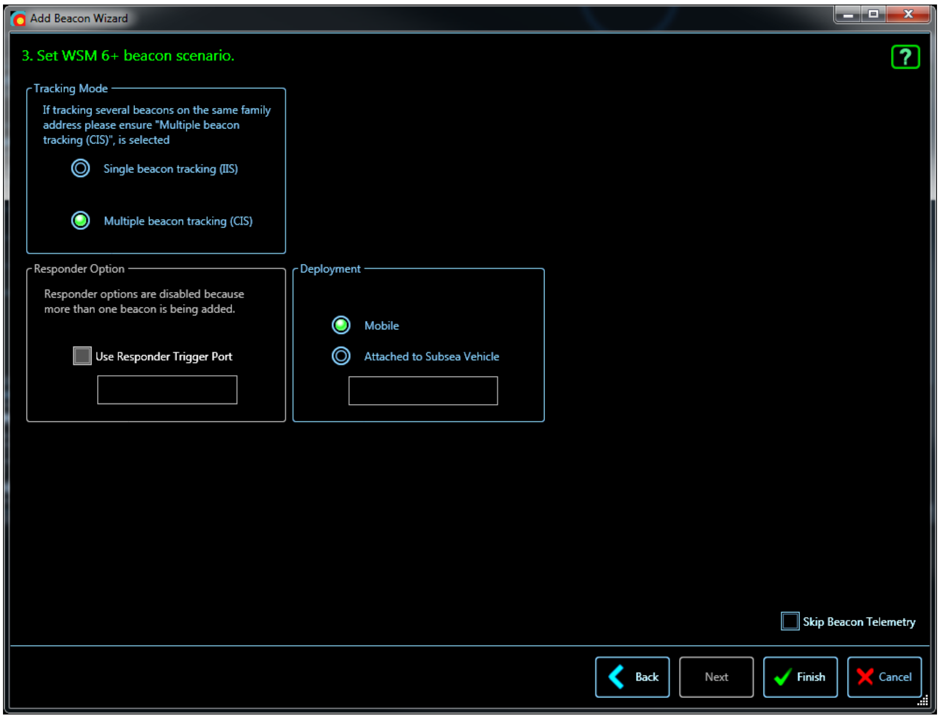
The Beacon Scenario selection page allows you to set various parameters that are specific to the beacon. There are four group boxes of settings (the top right one is hidden on the screen shot below because of the beacon type used).

The **Next** button is always greyed out.

The **Back** button on the wizard is always enabled, so you can go back to the previous page and edit is contents.

The **Finish** button on the wizard is enabled, but only if all mandatory settings (as are applicable) on this page for this beacon type have been set.

Figure 88 Beacon scenario selection

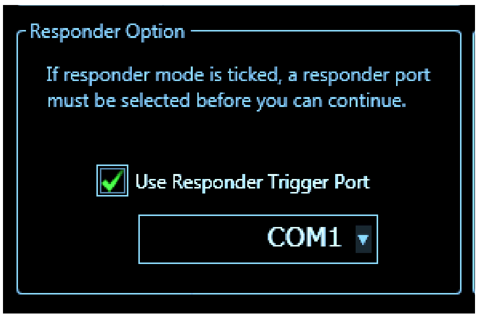


The **Tracking Mode** group box (top left) allows you to select individual or group interrogation, and is shown for all beacon types except the following:

NanoResponder	WSM6
AODC	AvTrack2
HPR	PGT
WSM	SST

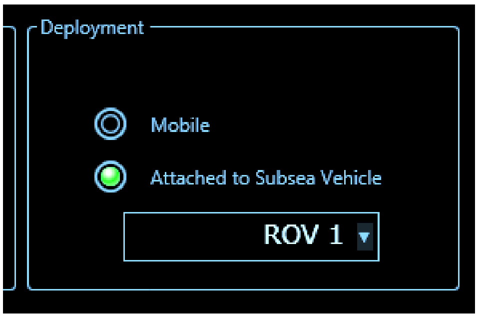
The **Responder Option** group box is always enabled for Responder beacons, and the **Use Responder Trigger Port** check box is force checked.

When the **Use Responder Trigger Port** check box is checked, the trigger port ComboBox is enabled. This shows a list of ports available to use (see below).



The **Deployment** group box is always enabled. This determines if the beacon is initially located as a Mobile or attached to a Subsea Vehicle. The default is always Mobile.

If the **Attached to Subsea Vehicle** option is checked, then the Subsea Vehicles combo box is enabled. If there is at least one subsea vehicle in the setup, this is shown in the combo box (see below).



The **Channels** group box (top right in screen shot below) is visible only if the beacon being added is:

- SST
- WSM / WSM6 without Quicksets

In the case of SST, the Channels group box shows the Reply Channel Combobox only (see below).

In the case of WSM / WSM6 (no quicksets), the Channels group box shows the Interrogate Channel Combobox only (see below).

The **Skip Beacon Telemetry** check box at bottom right on the page allows creation of the new beacon(s) without sending telemetry to the physical beacon when you click **Finish**.

Click **Finish** to create beacons according to the settings provided in this wizard and according to default values supplied by the Device Manager. The wizard then closes.

Note that if the **Skip Beacon Telemetry** check box is checked, the corresponding **Skip Telemetry** fields on the **Beacons** window are also checked for the beacon(s) added.

K.3 iWAND tool

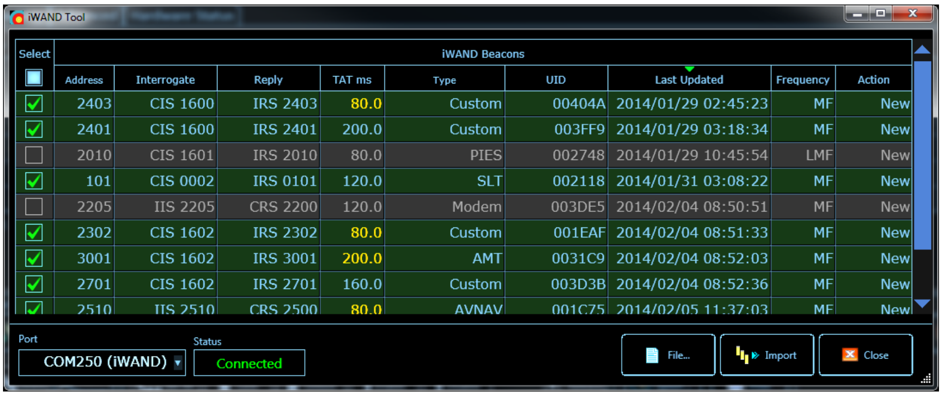
Clicking on the **iWAND** button on the **Beacons** window launches the **iWAND Tool** as shown below. This tool allows multiple beacon data to be imported into the current setup.

Figure 89 iWand tool

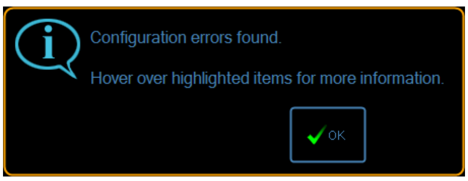
If no iWAND is connected the **Port status** field shows **Connecting**.

When an iWAND is connected through RS232 or USB to the Navigation 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.

Figure 90 iWand – Beacons available for import



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

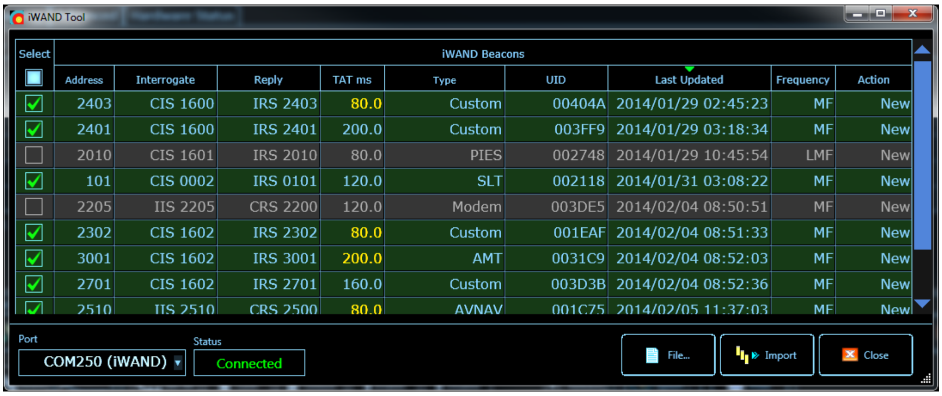


If there are conflicting beacon Addresses in the imported data, the relevant row(s) are enabled but the **Select** check box is only checked for one of the conflicting addresses (see **2101** in Figure 91). The remaining conflicting addresses are highlighted in red. A tooltip indicates the problem if the mouse cursor is hovered over it.

Figure 91 Conflicting beacon address

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.

Figure 92 Conflicting TATs



Beacons that are not supported, or are not enabled in the Security Key (dongle), 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 checked as shown above. You can use the **Select** column to check/ uncheck 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** field checked. 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 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 screen shots.

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:

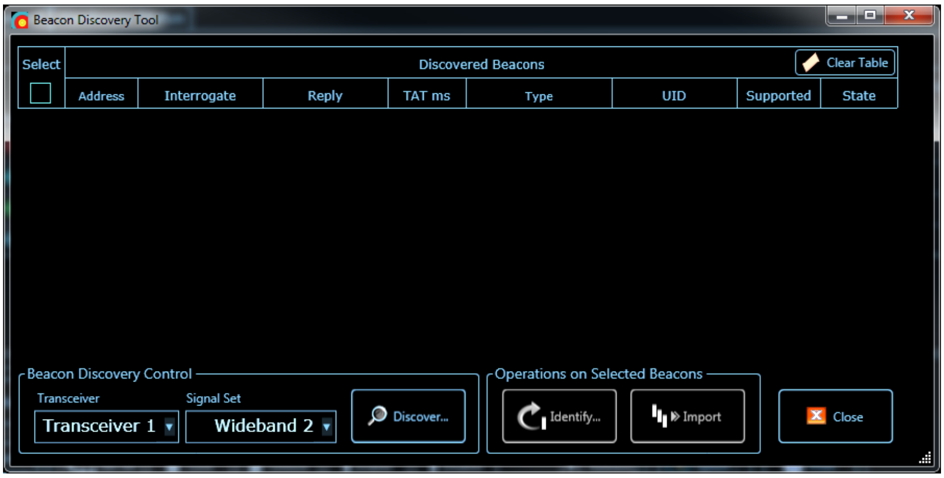
iW.

You can edit this prefix if necessary.

K.4 Beacon Discovery tool

Clicking on the **Auto Discover** button on the **Beacons** window launches the **Beacon Discovery Tool** window. This allows the acoustic discovery of any Sonardyne 5G and 6G beacons 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.

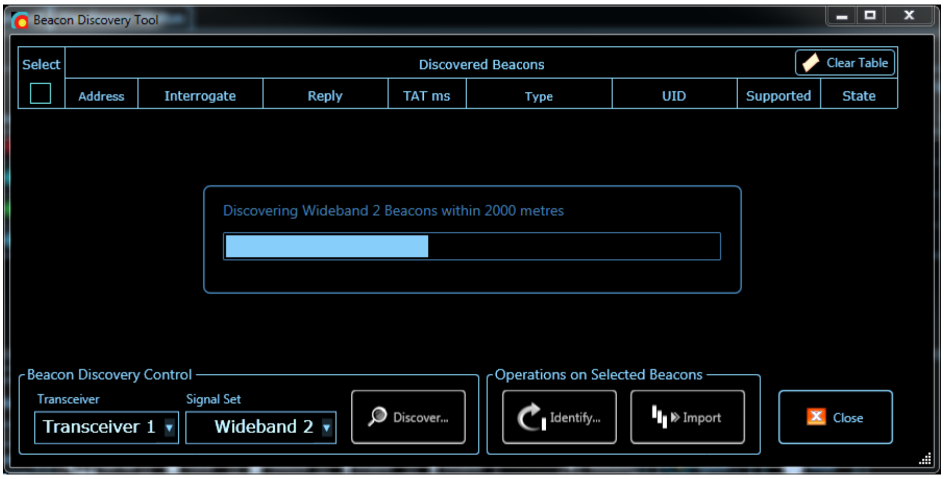
These are described in detail in the next sections.

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.

Beacon Discovery operation

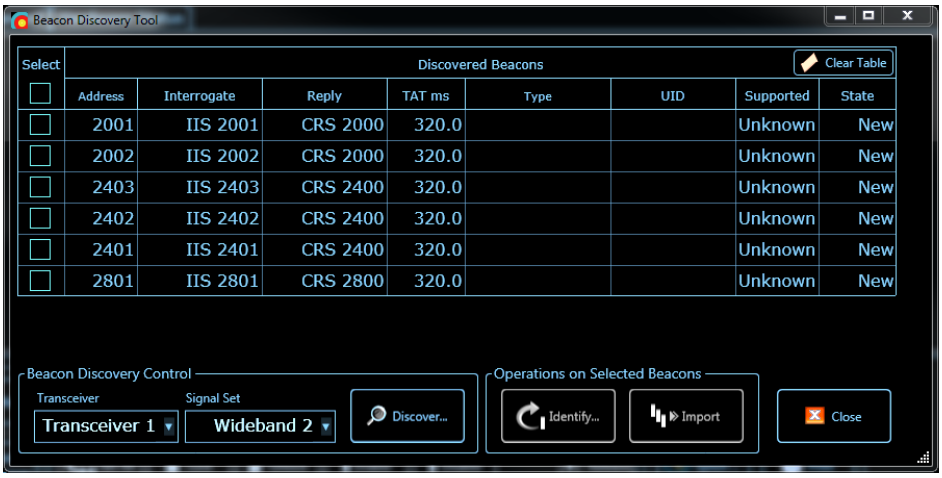
Click the **Discover…** button to start the beacon discovery process using the selected transceiver and the selected signal set. A dialog shows a progress bar and **Cancel** button (see below). The discovery process uses the **Max Operating Range** value as defined in the Environmental settings.

Figure 93 Beacon Discovery Tool



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 pressing 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.

Beacon Identification.

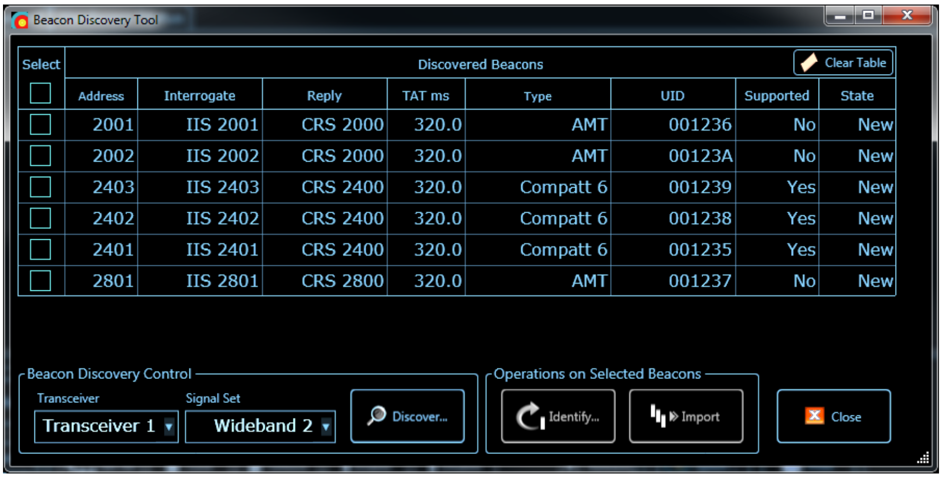
You may optionally select specific beacons, and press the **Identify…** button. A dialog shows a progress bar and **Cancel** button (see below). This causes an FS telemetry command to be sent sequentially to each selected beacon that has a current Supported status of Unknown. Note that if the Supported 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.

Figure 94 Beacon identification

When the progress bar reaches the end, the progress dialog 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:

- ❑ Yes if the beacon is supported.
- ❑ No if it is not supported.

See below.



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

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

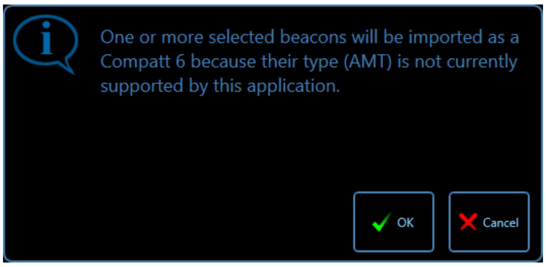
Certain assumptions are made when importing a beacon, depending on whether **Identify** has been performed and whether the identified beacon is **Supported** by the application. These are as follows:

- If the **Identify** process *has not been* performed on a beacon, then it is always imported as a generic **Compatt6**. 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 **Compatt6**. 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 **Compatt6** 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 special:

Ð character.

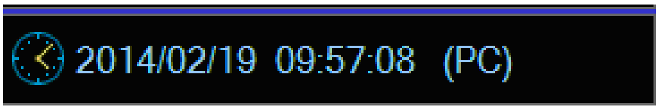
You can edit this subsequently if necessary.

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

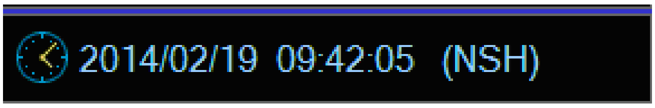
L Ranger 2 Time System

All Ranger 2 time keeping and time stamping uses System (Machine) Time.

On start-up, machine time is started from Windows time (which itself starts from the PC's real-time clock (RTC)), but always shows UTC, which is independent of the time zone. The Ranger 2 user interface shows **PC** at the bottom right-hand corner.



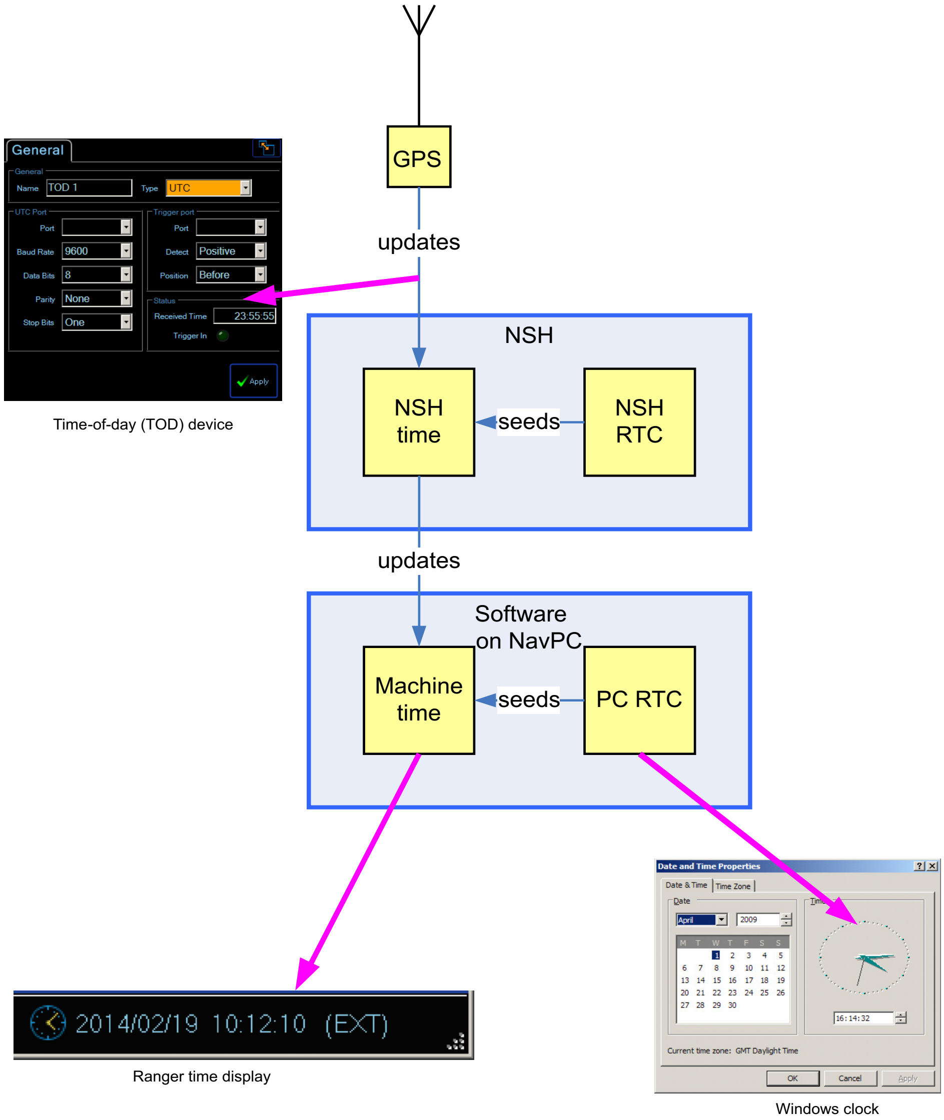
After an NSH is connected, Ranger 2 synchronizes its machine time with the NSH clock, which is significantly more stable than the PC's clock. After this has occurred, the Ranger 2 user interface shows **NSH** as the time source.



Whenever time synchronization is really important, for example in multi-system operations, a TOD device is added toe Ranger 2. This takes UTC or ZDA strings and a PPS signal from a GPS 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 Ranger 2 user interface shows **EXT** as the time source.

It is also possible to synchronize the NSH RTC to the external UTC feed by using the Sync button on the TOD device dialog.

Figure 95 Ranger 2 time system



Contacting the Sonardyne Support Team

24-hour Emergency Telephone Helpline: **+44 (0) 1252 877600**

The Sonardyne 24-hour helpline is answered during normal office hours (08:00 to 17:00 GMT) Outside of these hours, your call is automatically transferred to an agency, who will log the details of your emergency and alert the appropriate Sonardyne personnel.

Our aim is to ensure that emergency requests are dealt with immediately during office hours, and are responded to within 30 minutes at all other times.

Note

Please note that the helpline is for emergency use ONLY.

If you require NON-EMERGENCY product support, please contact your nearest Sonardyne office. Alternatively, contact the Sonardyne Head Office:

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