Sonardyne

UM-8142

User Manual for Type 8091, 8142, 8183 8212 & 8221 HPT Type 8182 & 8193 Modem 6 Transceiver

Issue C1

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Note

Email and telephone support is available during normal UK office hours (08:00 to 17:00).

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Amendment History

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

Issue	Revision	Date	Comments	Section	Page
A	0	20/10/2010	Initial Issue	All	All
B	0	12/05/2014	Complete reformat to comply with new branding. Reviewed and updated.	All	All
B	1	22/06/2016	Added Type 8221 & 8212 USBL transceiver. Installation and Deployment updated. General update.	All 4 All	All All All
B	2	29/04.2019	Lubricating procedure for connectors updated. Modem 6 Transceiver added. General update.	7.5.1 All All	44 All All
B	3	22/09/2020	Figures 3-10 & 3-11 updated. Weight specifications updated.	3 12	13, 14 65–69
C	1	17/06/2021	Caution and notes added relating to overheating of HPT2000 and 3000 in direct sunlight. Transceiver and cable drawings moved from Appendix A to Technical Specifications section. General update and formatted with new branding style.	2 5 6.3 12.2 & 12.3 All	12 48 51 79-89 All

Section 1 – Introduction

1.1 Purpose

This manual contains information for personnel involved in USBL system operations. It includes technical information to configure, operate and maintain USBL systems, and specific information concerning USBL products supplied by Sonardyne.

1.2 Scope

This manual describes the safe installation, operation and maintenance of HPT based USBL transceivers and associated equipment. The information and procedures within this manual are based on Sonardyne's experience and knowledge.

1.3 Related Publications

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

Table 1-1 Related Publications

Publication	Title
Safety Manual	*Operational and Safety Precautions*
UM-8300-099	*6G Terminal Lite User Manual*
UM-8250	*Marksman LUSBL and Ranger 2 Pro User Manual*
UM-8251	*Ranger 2 USBL User Manual*
UM-8295	*AMT Monitor V2 User Manual*
UM-8098	*User Manual for the Type 8098 Navigation Sensor Hub*
UM-8211	*User Manual for Type 8211 Ethernet Serial Hub*
IM-Modem 6	*Modem 6 Integration Manual*

1.4 Conventions

The following conventions are used in this manual.

Table 1-2 Conventions used in this Manual

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

Section 2 – Safety

2.1 Introduction

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

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

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

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

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

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

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

2.2 Safety Procedures

2.2.1 Warnings

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

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

⚠ **Hazardous Substance. Molykote 44 is a mild irritant. When lubricating connector faces, Personal Protective Equipment such as gloves and goggles must be worn.**

⚠ **Do not carry out maintenance on the transceiver if the housing is hot. Disconnect all power and wait for the housing to cool**

2.2.2 Cautions

⚠ Loss of connector Integrity. Do not over apply grease to the female connector. Grease build up will affect connector integrity.

⚠ Damage to transceiver. The weight of the mounting pole must not be supported by the transceiver front face.

⚠ Damage to protective coating. Do not use any abrasive brushes or sharp tools to clean the transponder and remove any marine growth, this will damage the protective coating and increase the risk of corrosion.

⚠ The weight of the deployment pole must not be supported by the transceiver front face.

⚠ If a Type 8212 (HPT 3000) or Type 8221 (HPT 2000) transceiver is left powered while exposed to direct sunlight in extreme temperatures, outside of the recommended operating temperatures of -5 to 40°C (23 to 104°F), then the transducer array could deform to the point where it allows water ingression.

Section 3 – Technical Description

3.1 Introduction

The Sonardyne Wideband ®2 6G® Series of Ultra-Short-BaseLine (USBL) High Performance Transceivers (HPT) are used as part of the USBL, Long-Ultra-Short BaseLine (LUSBL) Marine Riser Angle Monitoring System (MRAMS) and data retrieval systems.

The Wideband 2 technology uses a correlation reception technique with phase-encoded signals over a wide range of carrier frequencies. Signal coding allows for hundreds of channels enabling multiple users to work in the same area without interference.

This manual covers the USBL transceiver variants shown in *Table 3-1*.

Table 3-1 HPT & Modem 6 Variants

HPT Type	HPT Variant	Description	Connectivity	Reference
8221-000-01	HPT 2000	Short Range Array (HF)	Ethernet	*Figure 3-1*
8212-000-01	HPT 3000	Short Range Array (MF)	Ethernet	*Figure 3-2*
8142-000-01	HPT 5000	Standard Array	Serial	*Figure 3-3*
8142-000-31	HPT 5000	Standard Array 16-Way Connector	Serial/Ethernet	*Figure 3-3*
8142-000-11	HPT 5000T	Standard Array 30º Tilt	Serial	*Figure 3-6*
8182-000-01	Modem 6 Transceiver	Standard Array Modem Only	Serial	*Figure 3-3*
8091-000-10	iHPT 5000	Standard Array iUSBL	Serial	*Figure 3-8*
8142-000-02	HPT 7000	Large Array	Serial	*Figure 3-5*
8142-000-32	HPT 7000	Large Array 16-Way Connector	Serial/Ethernet	*Figure 3-5*
8142-000-12	HPT 7000T	Large Array 30º Tilt	Serial	*Figure 3-7*
8182-000-02	Modem 6	Large Array Modem Only	Serial	*Figure 3-5*
8183-000-01	HPT 7000L	Large Array LMF 14–19 kHz	Serial	*Figure 3-5*
8193-000-12	Modem 6	Large Array Modem Only LMF 14–19 kHz	Serial	*Figure 3-5*

3.2 Description

3.2.1 Type 8221-000-01

The type 8221-000-01 HPT 2000 6G USBL transceiver is a small, light, Ethernet interfaced HF band USBL with a short-range array optimised for shallow water and high elevation tracking in low noise environments up to 2000 m.

The HPT 2000 contains an internal attitude sensor and magnetic compass, mounted inside the head. It is important to note that this is a magnetic compass and therefore requires a Magnetic Offset deviation value to be entered between true north and magnetic north.

It is recommended to calibrate the internal compass when the HPT 2000 is first deployed; see *Section 4.2 "Type 8221/8212 Internal Compass Calibration"*.

Figure 3-1 Type 8221-000-01 HPT 2000

3.2.2 Type 8212-000-01

The type 8212-000-01 HPT 3000 6G USBL transceiver has the same specification as the HPT 2000 described above but operates in the MF band.

It is recommended to calibrate the internal compass when the HPT 3000 is first deployed; see *Section 4.2 "Type 8221/8212 Internal Compass Calibration"*.

Figure 3-2 Type 8212-000-01 HPT 3000

3.2.3 Type 8142-000-01, 8142-000-31, 8182-000-01

The Type 8142-000-01/31 HPT 5000 and 8182-000-01 Modem 6 USBL transceiver is the standard USBL system with a standard array used for navigation and data retrieval.

The HPT 5000 and Modem 6 variants are described in *Table 3-2*.

Table 3-2 HPT 5000 and Modem 6 Description

Type	Variant	Description
8142-000-01	HPT 5000	Allows both Ethernet and serial operation.
8142-000-31	HPT 5000	Allows both Ethernet and serial operation via a 16-way connector.
8182-000-01	Modem 6 Transceiver	Modem 6 operates as high data rate modem only, with almost the same functionality as Type 8142-000-01 series but does not present any bearing information. A Modem 6 Integration Manual *(IM-Modem 6*) is available for configuring the Modem 6 for operational use.

Figure 3-3 Type 8142-000-01 HPT 5000
Type 8142-000-31 HPT 5000 16-Way

Figure 3-4 Type 8182-000-01 Modem 6 Transceiver

3.2.4 Type 8142-000-02, 8142-000-32, 8182-000-02, 8183-000-01, 8193-000-12

The Type 8142-000-02/32, 8183-000-01 HPT7000 and 8182-000-02, 8193-000-12 Modem 6 USBL has a large array which has been optimised for deep water operations and delivers higher precision USBL measurements, required in deep water environments.

The HPT 7000 and Modem 6 variants are described in *Table 3-3*.

Table 3-3 HPT 7000 and Modem 6 Description

Type	Variant	Description
8142-000-02	HPT 7000	Allows both Ethernet and serial operation.
8142-000-32	HPT 7000	Allows both Ethernet and serial operation via a 16-way connector.
8183-000-01	HPT 7000L	Has the same functionality as the standard 8142-000-02 but uses the LMF operating band (14 to 19 kHz).
8182-000-02	Modem 6 Transceiver	Modem 6 operates as a high data rate modem only, with almost the same functionality as Type 8142-000-02 series but does not present any bearing information.
8193-000-12	Modem 6 Transceiver	Modem 6 has the same functionality as the 8182-000-02 modem but uses the LMF operating band (14 to 19 kHz).

Figure 3-5 Type 8142-000-02 HPT 7000
Type 8142-000-32 HPT 7000 16-Way
Type 8182-000-02 Modem 6 Transceiver
Type 8183-000-01 HPT 7000L LMF
Type 8193-000-12 Modem 6 Transceiver

3.2.5 Type 8142-000-11

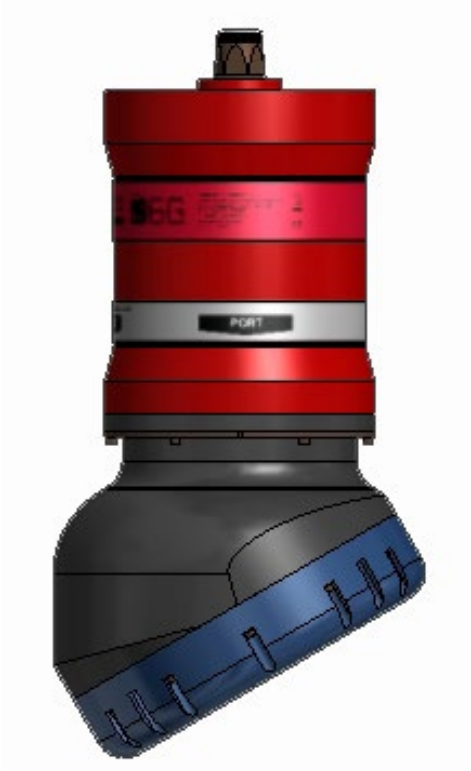
The type 8142-000-11 is a standard HPT 5000 6G USBL transceiver with a 30º tilted array.

Figure 3-6 Type 8142-000-11 HPT 5000T, 30º Tilted Array

3.2.6 Type 8142-000-12

The type 8142-000-12 is a standard HPT 7000 6G USBL transceiver with a 30º tilted array.

Figure 3-7 Type 8142-000-12 HPT 7000T, 30º Tilted Array



3.2.7 Type 8091-000-10 iHPT 5000

The type 8091-000-10 is a standard HPT 5000 6G USBL transceiver, depth rated to 4000 m for inverted applications.

Figure 3-8 Type 8091-000-10 HPT 5000, iUSBL

3.3 USBL Transceiver Operation

The USBL transceiver is a complete digital signal processor controlled acoustic interrogator / receiver operating on a command from the Data Fusion Engine (DFE). In other applications the USBL transceiver can passively monitor acoustic activity.

The main functions of the USBL transceivers are as follows:

- Interpretation of commands from the DFE
- Transmission of acoustic commands or transponder interrogation signals on any one of Sonardyne Wideband®2 signals
- Reception of transponder reply signals can be on any one of Sonardyne Wideband®2 signals
- Decoding acoustic telemetry
- Measurement of time and bearing (Type 8212 & 8142 only) in the received transponder reply
- Transmission of range, (bearing, Type 8212 & 8142 only) and telemetry data to the DFE

The electronic components are as follows:

- Voltage regulations circuits
- Analogue conditioning and digitisation
- Digital signal processing module
- Transmit circuit controlled by the processor
- Communications module providing RS485 and Ethernet communications

The transducer face contains an array of ceramic receiver and transmit elements. The elements are recessed into a high-grade plastic and encased in polyurethane to form a strong smooth acoustic interface to the water.

The electronics chassis is attached to a metal base plate of the transducer face assembly. A cylindrical housing slides over the electronics chassis to mate with the face of the metal base plate and is secured with six bolts. The housing is constructed in aluminium bronze to resist corrosion.

The processor within the USBL transceiver runs a program stored in firmware which controls all the functions of the unit.

An underwater connector is provided in the top of the housing for connection with the interface cable.

Nominally 48 V power is supplied to the unit using a single pair of conductors. Primary communications are achieved by half duplex RS485 link or Ethernet. Diagnostics and additional data channels are provided using a secondary half duplex RS485 link. A signal ground is provided to ensure reliable communications for both RS485 channels.

3.4 Typical Type 8221/8212 Mini-Ranger 2 System

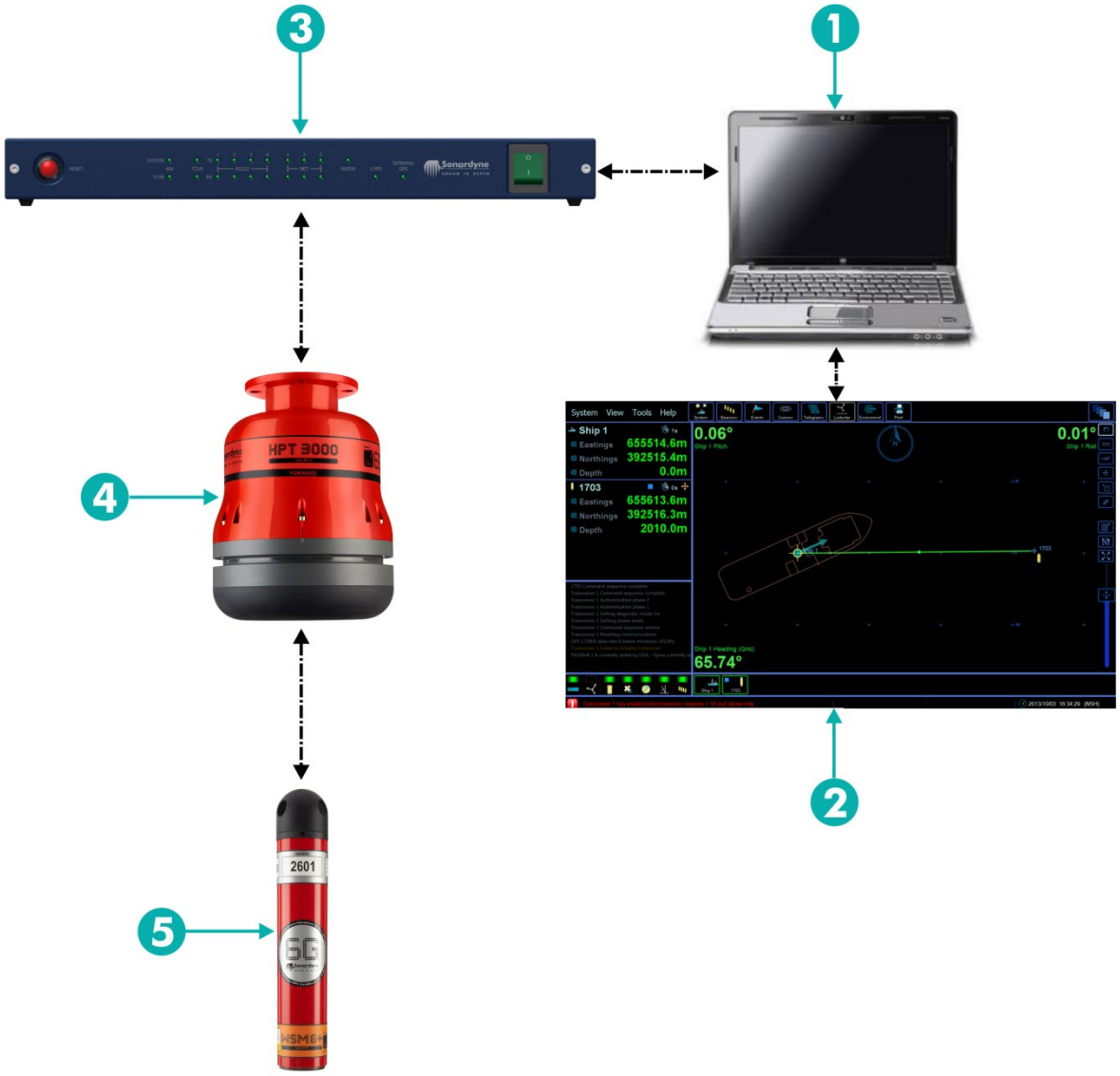
The Type 8221 HPT 2000 (HF)/8212 HPT 3000 (MF) USBL transceiver is intended to be used as part of the Mini-Ranger 2 system, typically consisting of:

- HPT 2000/3000 USBL Transceiver
- Ethernet Serial Hub (ESH)
- Mini-Ranger 2 Software
- PC with interface to Mini-Ranger 2 software using UDP
- WSM 6+ or other 6G beacon with MF system, or
- TZ/OBC or LRT beacon with HF system

3.4.1 Typical System Description

The HPT 2000 (HF)/HPT 3000 (MF) Mini-Ranger 2 system is configured using a pc with an Ethernet connection to the ESH; see *Figure 3-9*. The ESH provides power and communications to the HPT. The WSM 6+ would typically be mounted on a ROV or similar vehicle.

Figure 3-9 Typical Type 8221 HPT 2000 (HF)/8212 HPT 3000 (MF) USBL System



1. PC (not supplied)
2. Mini-Ranger 2 Software
3. ESH
4. HPT 2000/3000 USBL Transceiver
5. TZ/OBC, LRT, WSM 6+ or other beacon

3.5 Typical Type 8142 System

The equipment used in the Type 8142 USBL system typically consists of:

- USBL/LUSBL Transceiver
- Optional output to DP system
- AHRS
- Gyro Compass
- DGPS
- Monitor / Keypad unit
- Acoustic Transponder
- Acoustic Transceiver

3.5.1 Typical System Description

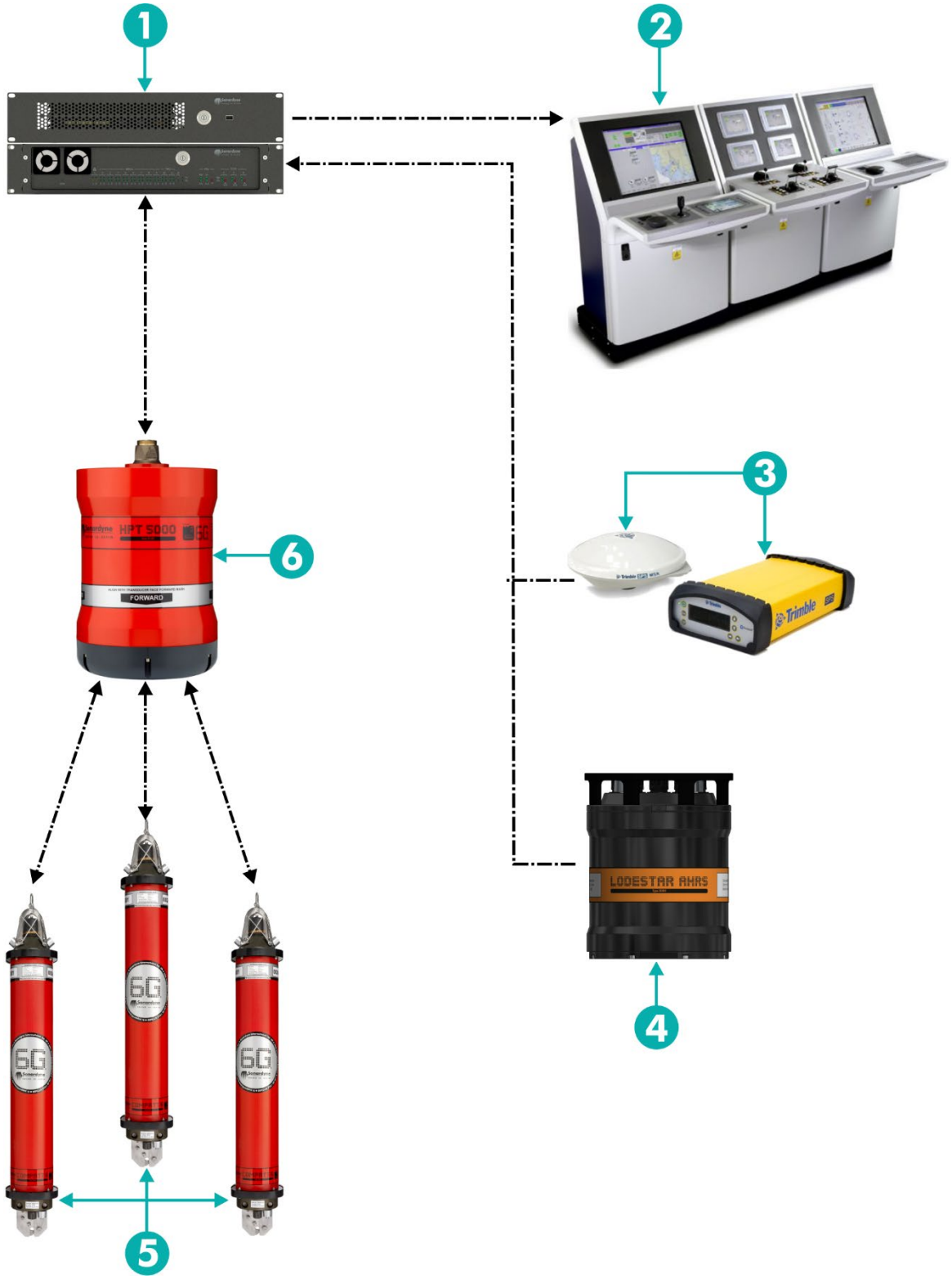
The system is controlled by the Data Fusion Engine (DFE). The operator uses the monitor/keypad unit to input data and run the Ranger 2 or Marksman software; see *Figure 3-10*. The processor commands the transceiver to send acoustic signals to the transponder(s) and then interprets the responses received by the transceiver.

The processor receives reference information from the Attitude and Heading Reference System (AHRS), Differential Global Positioning System (DGPS) and Gyro Compass and produces outputs to the DP system. The system measures the range and direction of a transponder relative to the known location and orientation of the transceiver housing.

The transponder range is calculated by measuring the elapsed time between the interrogation signal and the detection of the transponder reply.

The transponder bearing is calculated by using advanced signal processing on the received acoustic data on the multiple elements.

Figure 3-10 Typical Type 8142 USBL / LUSBL System



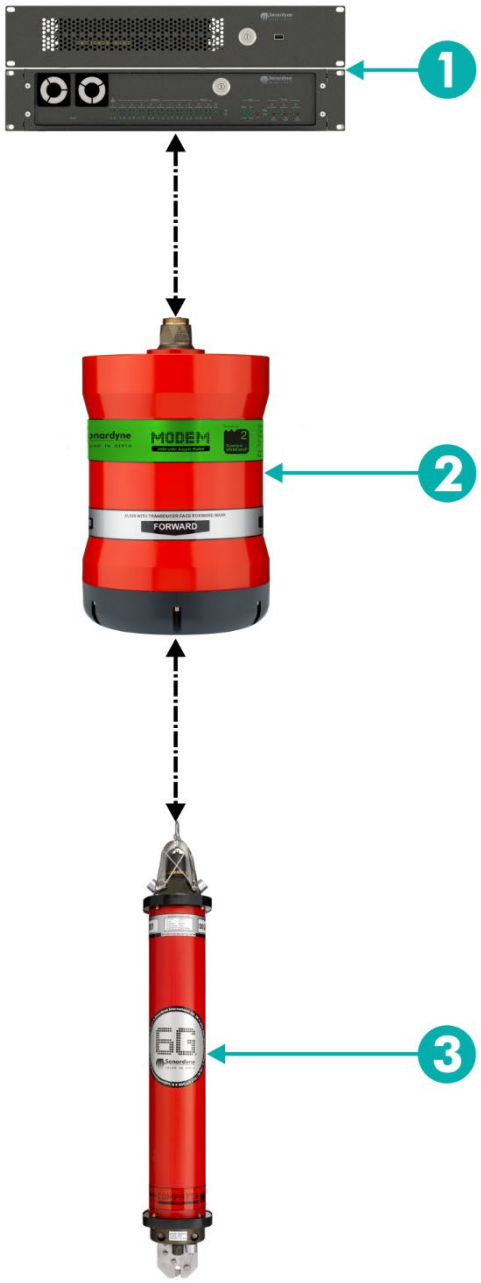
1. Marine Computer and NSH
2. Dynamic Positioning System
3. Differential Global Positioning System
4. Attitude and Heading Reference System (AHRS)
5. Acoustic Transponders
6. USBL/LUSBL Acoustic Transceiver

3.6 Typical Type 8182 Modem 6 Transceiver System

An example system using the Modem 6 Transceiver is shown in *Figure 3-11*. The top-side software used in the example below is "Monitor" and allows configuration of subsea transponders as well as uploading of data (see *UM-8295 "AMT Monitor V2 User Manual"*).

The Modem 6 Transceiver can be configured to act without top-side software; the modem protocol can be requested directly from Sonardyne.

Figure 3-11 Typical Type 8182 Modem 6 Transceiver System



1. Marine Computer and NSH
2. 8182 Modem 6 Transceiver
3. Acoustic Transponder

Section 4 – Installation and Deployment

4.1 Introduction

Before installing and deploying the USBL transceiver, ensure Section 2 – Safety is read and fully understood.

4.2 Type 8221/8212 Internal Compass Calibration

It is recommended to calibrate the internal compass when the Type 8221/8212 HPT 2000/3000 is first deployed. The magnetic compass can be calibrated from directly from the Mini-Ranger 2 software or using the Radian2 Tool.

To calibrate the internal magnetic compass using Mini-Ranger 2 software, see *UM-8245, "Mini-Ranger 2 USBL Manual".*

To configure the internal attitude sensor and calibrate the magnetic compass using the Radian2 tool, see *Appendix A – Radian 2* Tool.

Note

Magnetic Compasses are highly prone to interference and should not be relied on for precise survey work. It is recommended that a survey grade external heading device such as a Sonardyne Lodestar is used in the system for precise survey work.

4.3 Deployment Methods

The USBL transceiver can be deployed in a number of ways, depending on the type of vessel in use and the operational requirements. Sonardyne produces three systems for deploying USBL transceivers described in *Table 4-1*. Contact Sonardyne for more information on deployment systems.

Table 4-1 USBL Deployment Methods

Deployment Method	Description	Reference
Type 7950 Through-Hull	The Type 7950 consists of a hydraulically operated pole, a sealed bearing section and a sea chest service section with inspection door. The whole machine sits on a gate valve which in turn is mounted on the flange of a through-hull penetration pipe. The USBL transceiver is deployed by the hydraulic operation of the pole to the required depth and can be controlled locally or from a remote control panel.	See *Section 4.3.3*
Type 8097 Over-the-Side	The Type 8097 is a modular, transportable, over-the-side deployment pole, designed for vessels where through-hull deployment or through-tube options are not available or practical. Once deployed the pole is locked into place by a hydraulically operated mechanism that is welded to the vessel's hull.	See *Section 4.3.4*
Type 8169 Through-Tube	The Type 8169 is a modular, transportable, through-tube deployment, designed for vessels where through-hull deployment or over-the-side options are not available or practical. The pole is scalable to fit through an existing tube or a new tube installation. Once deployed the pole is held in place by a flange at the top of the tube and a hydraulically operated clamp mechanism near the bottom.	See *Section 4.3.5*

Deployment Method	Description	Reference
Non-Standard Deployment Pole	The transceiver can be fitted to a non-standard deployment pole using a purpose-designed flange adapter if necessary. Contact Sonardyne for details on installing USBL transceivers onto non-standard deployment poles. Sonardyne also offer a range of adaptors to fit other deployment poles.	See *Section 4.3.6*
HPT Dunker Kit	The HPT Dunker Kit is lowered into the water from the side of the vessel and is used to deploy the HPT in applications that only require telemetry and not positioning.	See *Section 4.3.7*

4.3.1 General Requirements

Depending on the deployment type, observe the following general requirements when you install the USBL transceiver:

- Ensure the method of deployment protects the sensitive acoustic transducer elements from damage at all times during installation, deployment, and demounting. A red sleeve is supplied fitted to the USBL transceiver to protect its transducer face during shipping. You MUST remove this protective sleeve before you deploy the USBL transceiver; the USBL transceiver will not perform correctly with this sleeve in place.
- Mount the USBL transceiver on a rigid pole 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 Induced Vibration (VIV) as the transducer's supporting pole moves through the water.
- Mount the USBL transceiver so that it is pointing vertically downwards, with the connector at the top and the black acoustic transducer at the bottom.
- Ensure the white forward-pointing direction arrow on the transducer is pointing forward on the vessel.
- For best results, if possible, deploy the USBL transceiver at least 2–3 metres below the lowest part of the vessel's hull.
- By increasing the separation distance between the transducer array and the hull in this way, you will reduce the risk of multipath reflections from the hull, reduce the amount of vessel noise received by the transducer, and reduce the chance of aerated water passing over the transducer's face.

Note

After installing the USBL transceiver, measure the vertical offset between the bottom face of the USBL transceiver and the vessel's waterline when the USBL transceiver is fully deployed (you will require this information later, to configure the USBL software).

- Deploy the transducer as far away as practical from any source of noise or bubbles, such as propellers, thrusters, moonpools, or other causes of aeration.
- Ensure the bottom face of the transducer is kept well clear of brackets, ropes, and other structures during deployment.
- To ensure correct 'wetting' of the transducer's polyurethane face, keep the USBL transceiver face clean and free from oil or grease.

4.3.2 Mounting Considerations

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

4.3.2.1 Attitude Measurement Errors

To achieve best USBL performance it is necessary to use a high accuracy attitude sensor so that the system can adjust the measured direction of arrival of the acoustic signal to compensate for the vessel's motion. If the attitude sensor is installed on the vessel, then it is particularly important to minimise movement of the USBL transceiver with respect to the vessel.

The importance of correct USBL transceiver deployment is greater if you intend to use external attitude measurement equipment, such as a Vertical Reference Unit, with the USBL System. These instruments measure the roll, pitch and heading angles of the object they are attached to, which is usually the vessel. However, if the USBL transceiver is mounted on a pole that is capable of moving significantly with respect to the vessel, then the attitude measurements will relate to the vessel, but not to the USBL transceiver with any accuracy.

Pole movements can arise from different causes: Small quick movements are usually caused by water flowing past the pole, giving rise to VIV, and larger, slow movements can arise as the vessel pitches and rolls. Both effects can be reduced by ensuring the pole is mounted rigidly on the vessel.

In some cases it is possible to mount the attitude measurement instrument on top of the pole so that it always measures the attitude of the USBL transceiver, even if the pole moves relative to the vessel.

4.3.2.2 Galvanic Isolation

The USBL transceiver housing is made of aluminium bronze. The most common material used for the tube, pole and mounting frame is mild steel.

It is good practice to isolate the USBL transceiver and the mounting arrangement electrically so as to reduce the effects of galvanic corrosion on the housing.

Sonardyne provide an isolation adapter within the installation kit. On no account should the aluminium bronze be in contact with a material more noble than itself (electro-chemically) — because galvanic corrosion will result.

Note

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

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

4.3.3 Through-Hull Mounting (Type 7950 Deployment Machine)

The Type 7950 is a through-hull deployment method using a gate-valve and sea chest assembly that can accommodate the USBL transceiver. Above the sea chest is a deployment machine that hydraulically raises and lowers the USBL transceiver to the optimal depth.

Figure 4-1 Through-Hull Mounting (Type 7950 Deployment Machine)

4.3.4 Over-the-Side (Type 8097)

The Type 8097 is a modular, transportable, over-the-side pole. The USBL transceiver is attached to a pole or frame designed so that USBL transceiver alignment can be maintained or re-established on subsequent deployments.

The pole or frame should be aligned vertically with respect to the vessel as far as is possible and, ideally, should be adequately braced against the hull to limit movement during operation.

Long poles can be susceptible to VIV. Various methods can be used to reduce the effects of this type of vibration. Contact Sonardyne for more information.

Figure 4-2 Over-the-Side (Type 8097)

4.3.5 Through-Tube Mounting (Type 8169)

The Type 8169 is a modular, transportable, through-tube deployment. The pole is scalable to fit through an existing tube or a new tube installation.

In this arrangement the pole should be stiff, rigidly mounted and long enough to locate the USBL transceiver at least 1.5 metres below the lowest point on the hull (2–3 metres is recommended for best results). The mounting arrangement used must minimise any movement of the USBL transceiver with respect to the vessel and ensure optimal tracking accuracy.

Figure 4-3 Through-Tube Mounting (Type 8169)

4.3.6 Non-Standard Deployment Pole

Sonardyne offer a range of adaptors to fit other deployment pole types. Contact Sonardyne for details on how to install the USBL transceiver on non-standard deployment poles.

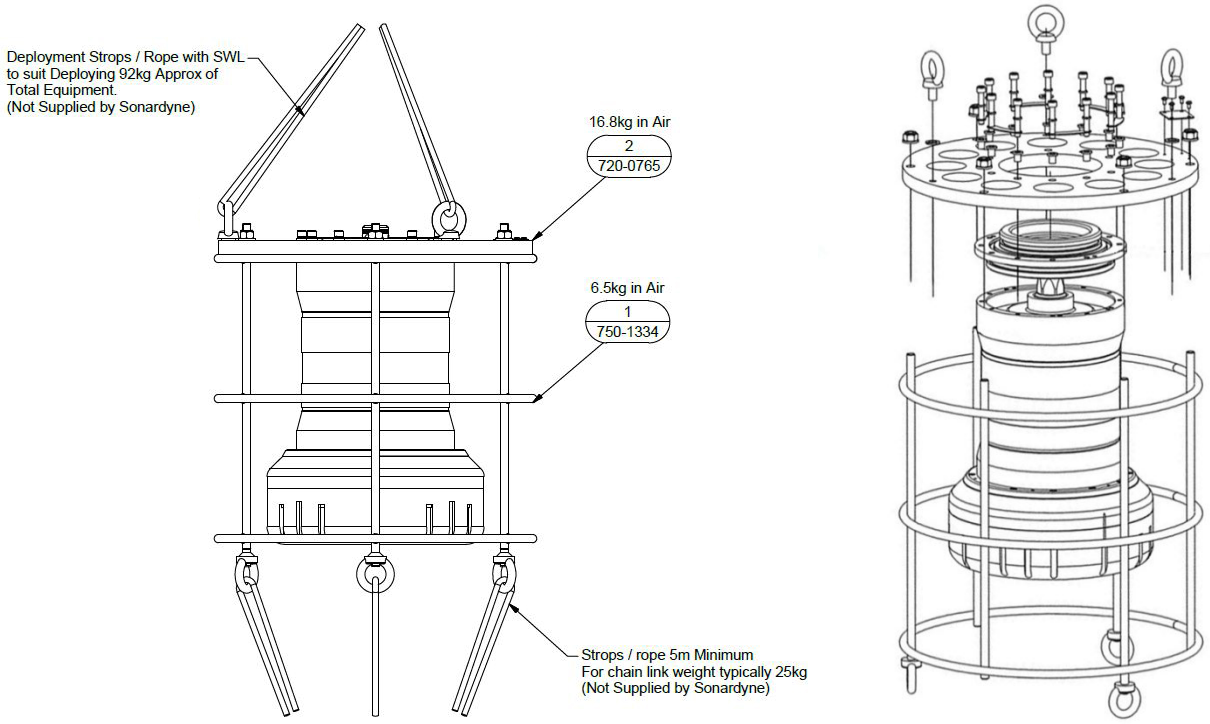
4.3.7 HPT Dunker Kit

The HPT Dunker Kit (641-3612) can be used to assist in the lowering of the HPT into the water from the side of the vessel. This is suitable for applications that only require telemetry and not positioning; see *Figure 4-4*.

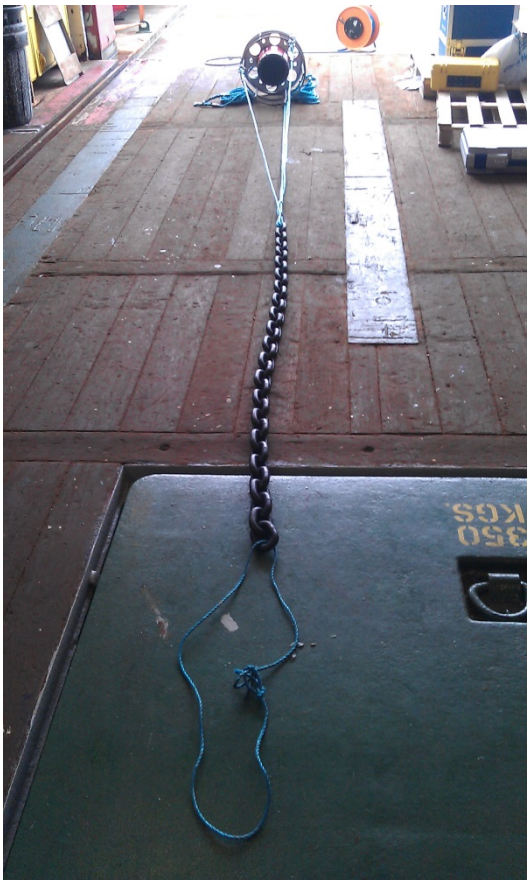
A weight (not supplied) can be attached to the bottom of the cage via ropes (also not supplied) to stabilise the HPT Dunker whilst in the water and prevent it from oscillating. The weight should be at least 10 m from the HPT Dunker.

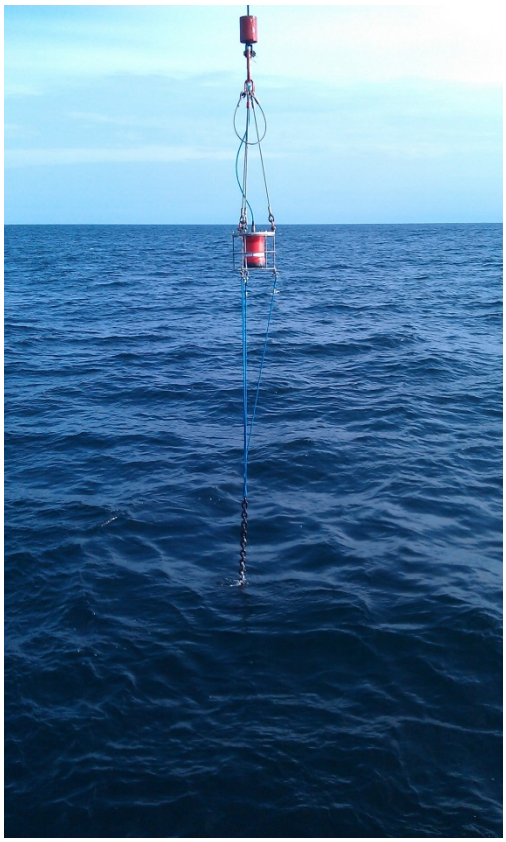
The HPT Dunker should be lowered to about 20 m below the vessel for optimum operation, water depth permitting. The deeper the HPT is lowered, the further it is from any surface noise sources such as machinery and the sea surface, and hence the signal to noise ratio at the HPT will be improved. In an ideal setup, the receiving transponder will be directly under the dunker assembly. In shallow water, it is more important to maintain line of sight to the transponder and minimise the grazing angle, and so the deployment depth can be reduced. Application-specific data retrieval software can then be used to command the HPT to perform telemetry uploads from the transponder.

Figure 4-4 HPT Dunker Kit



The HPT Dunker kit is typically deployed as shown in the photographic examples below.





4.4 USBL Transceiver Mounting Methods

4.4.1 Type 8221/8212

The Type 8221/8212 USBL Transceiver can be mounted and deployed using a number of deployment poles and methods. The bolt hole arrangement allows the transceiver to be installed on an ANSI 2" Nominal Bore (NB) Class 150 flanged pole as shown in *Figure 4-5.*

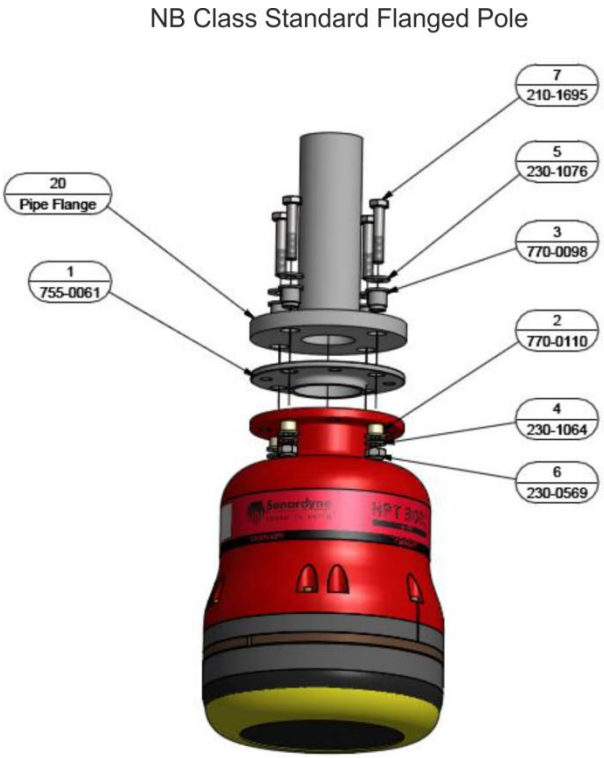
This transceiver can also be mounted and deployed using the mounting methods as shown in *Figure* 4-6 (in order of the most commonly used mounting method, from left to right).

4.4.1.1 NB Class 150 Standard Flanged Pole

The primary method of mounting the Type 8221/8212 USBL Transceiver is on the end of an ANSI 2" NB Class 150 standard flanged pole. The transceiver mounting face uses two sets of mounting holes, 11 mm and 16 mm diameter, equally spaced on a 121 mm Pitch Circle Diameter (PCD).

A HPT 3000 Isolation Kit (part number 650-0143) must be used to isolate the USBL transceiver from the pole. The kit contains fixings, O-rings and an isolation flange.

Figure 4-5 Type 8221/8212 NB Class Standard Pole Mounting



PARTS LIST			
ITEM	QTY	PART NO	DESCRIPTION
1	1	755-0061	8212-026 - Isolation flange
2	4	770-0110	M10 Nylon Insulating bush
3	4	770-0098	8212-027 - Flange bush
4	4	230-1064	Washer M10 Plain A4 S/S
6	4	230-0569	Nut M10 Nyloc A4 S/S
20	1	Pipe Flange	2" NB Class 150 Flange
5	4	230-1076	Washer M10 S-S Large form C BS4320
7	4	210-1695	Bolt Hex S,S M10x55 A4-70

4.4.1.2 Non-Standard Flanged Pole

The type 8221/8212 USBL Transceiver can be mounted to any non-standard flanged pole with the use of an adaptor flange. When the HPT 3000 Isolation Kit (part number 650-0143) is used, the flange must have mounting holes either 11 mm or 16 mm in diameter, equally spaced on a 121 mm Pitch Circle Diameter (PCD).

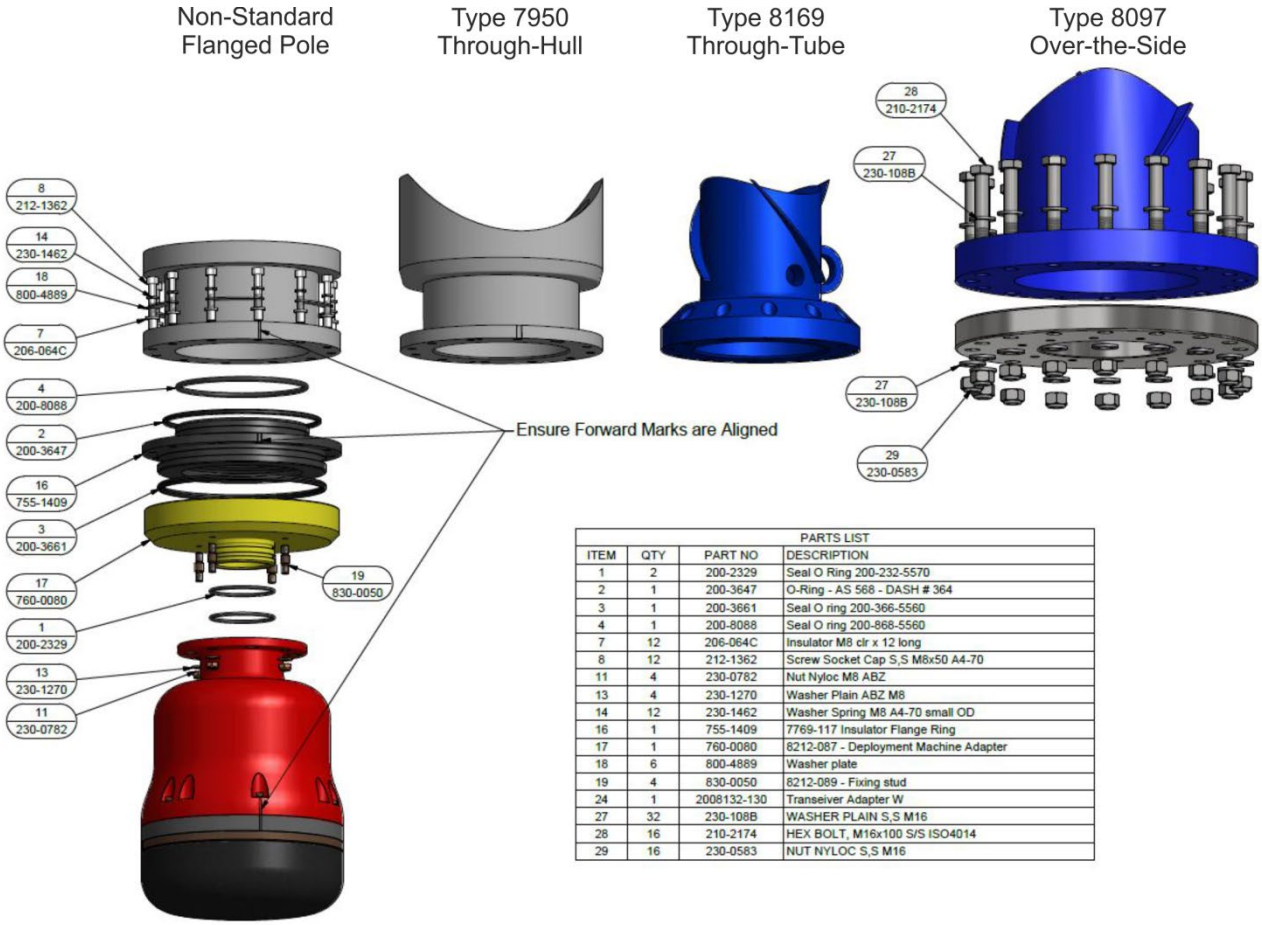
When installing the transceiver using the Deployment Pole Mounting Kit (part number 650-0154) the flange must have mounting holes 10.5 mm in diameter equally spaced on a 210 mm PCD.

4.4.1.3 Type 7950 Through-Hull, Type 8169 Through-Tube, Type 8097 Over-the-Side

The Type 8221/8212 USBL Transceiver has been designed to be mounted to a Sonardyne supplied Type 7950 through-hull Deployment Machine, Type 8169 Through-Tube deployment pole and Type 8097 and Over-the-Side deployment Pole.

A Deployment Pole Mounting Kit (part number 650-0154) must be used to isolate the USBL transceiver from the pole. The kit contains fixings, O-rings and an isolation flange.

Figure 4-6 Type 8221/8212 Standard Mounting Methods



PARTS LIST			
ITEM	QTY	PART NO	DESCRIPTION
1	2	200-2329	Seal O Ring 200-232-5570
2	1	200-3647	O-Ring - AS 568 - DASH # 364
3	1	200-3661	Seal O ring 200-366-5560
4	1	200-8088	Seal O ring 200-868-5560
7	12	206-064C	Insulator M8 clr x 12 long
8	12	212-1362	Screw Socket Cap S,S M8x50 A4-70
11	4	230-0782	Nut Nyloc M8 ABZ
13	4	230-1270	Washer Plain ABZ M8
14	12	230-1462	Washer Spring M8 A4-70 small OD
16	1	755-1409	7769-117 Insulator Flange Ring
17	1	760-0080	8212-087 - Deployment Machine Adapter
18	6	800-4889	Washer plate
19	4	830-0050	8212-089 - Fixing stud
24	1	2008132-130	Transeiver Adapter W
27	32	230-108B	WASHER PLAIN S,S M16
28	16	210-2174	HEX BOLT, M16x100 S/S ISO4014
29	16	230-0583	NUT NYLOC S,S M16

See *Section 4.4.2* for more information on the Type 7950 Through-Hull, Type 8097 Over-the-Side, Type 8169 Through-Tube and Non-Standard Flanged Pole.

4.4.2 Type 8142/8182 and Variants

The Type 8142/8182 (and variants) USBL Transceiver can be mounted and deployed using a number of deployment poles and methods as shown in *Figure 4-7* (in order of the most commonly used mounting method, from left to right).

4.4.2.1 Type 7950 Through-Hull Deployment Machine

The Type 8142/8182 (and variants) USBL Transceiver has been designed to be mounted to a Sonardyne supplied Type 7950 through-hull Deployment Machine.

A 6G Transceiver Installation Kit (part number 641-0197) must be used when installing this transceiver on a Deployment Machine. The kit contains fixings, O-rings and an isolation flange.

The integrity of the Deployment Machine must be maintained by using the supplied O-rings to ensure a water-tight seal is maintained between the transceiver and the Deployment Machine pole.

4.4.2.2 Type 8097 Over-The-Side Deployment Pole

The Type 8097 Over-the-Side Deployment Pole is supplied with a transceiver mounting flange. The Type 8142/8182 (and variants) must be mounted using the 6G Transceiver Installation Kit (part number 641-0197). When assembled, the transceiver and adaptor flange are bolted directly to the lower flange of the arm assembly using 16 x M16 bolts, nuts and washers.

4.4.2.3 Type 8169 Through-Tube Deployment Pole

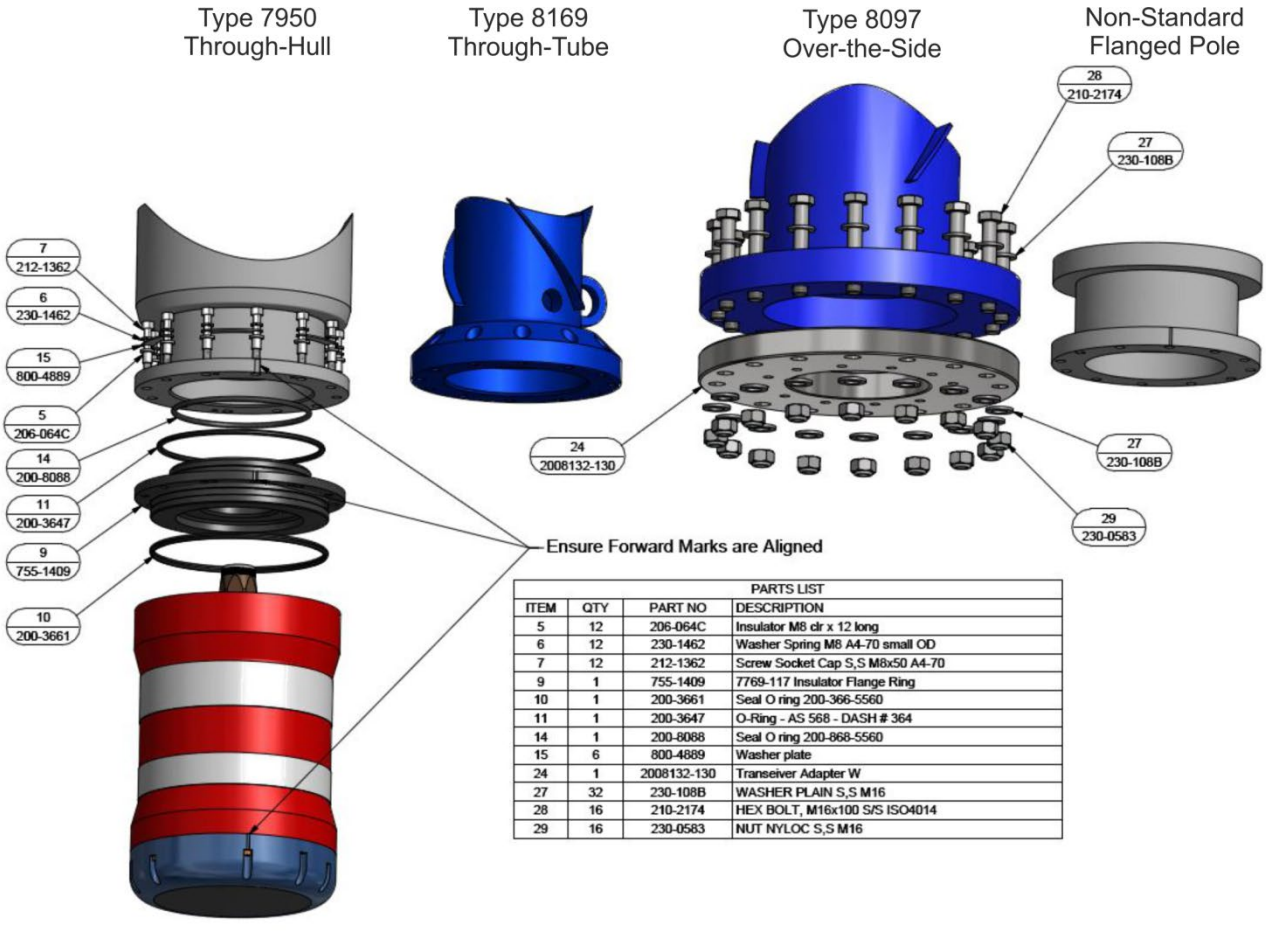
A 6G Transceiver Installation Kit (part number 641-0197) must be used when installing the transceiver on a Through-Tube deployment pole. The kit contains fixings, O-rings and an isolation flange.

4.4.2.4 Non-Standard Flanged Pole

The type 8142/8182 (and variants) USBL Transceiver can be mounted to any non-standard flanged pole with the use of an adaptor flange. The adaptor flange must have 10.5 mm diameter equally spaced on a 210 mm PCD. The flange must have an internal diameter of 155 mm.

A 6G Transceiver Installation Kit (part number 641-0197) must be used when installing the transceiver on a non-standard pole. The kit contains fixings, O-rings and an isolation flange.

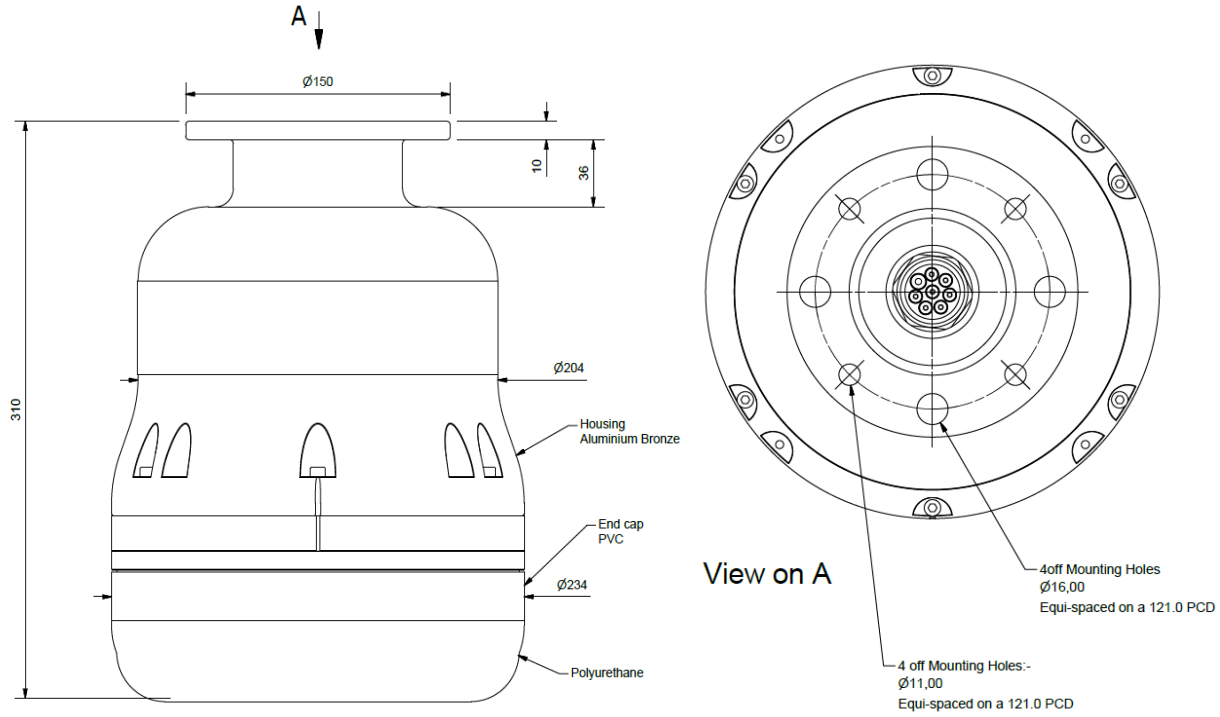
Figure 4-7 Type 8142/8182 Standard Mounting Methods



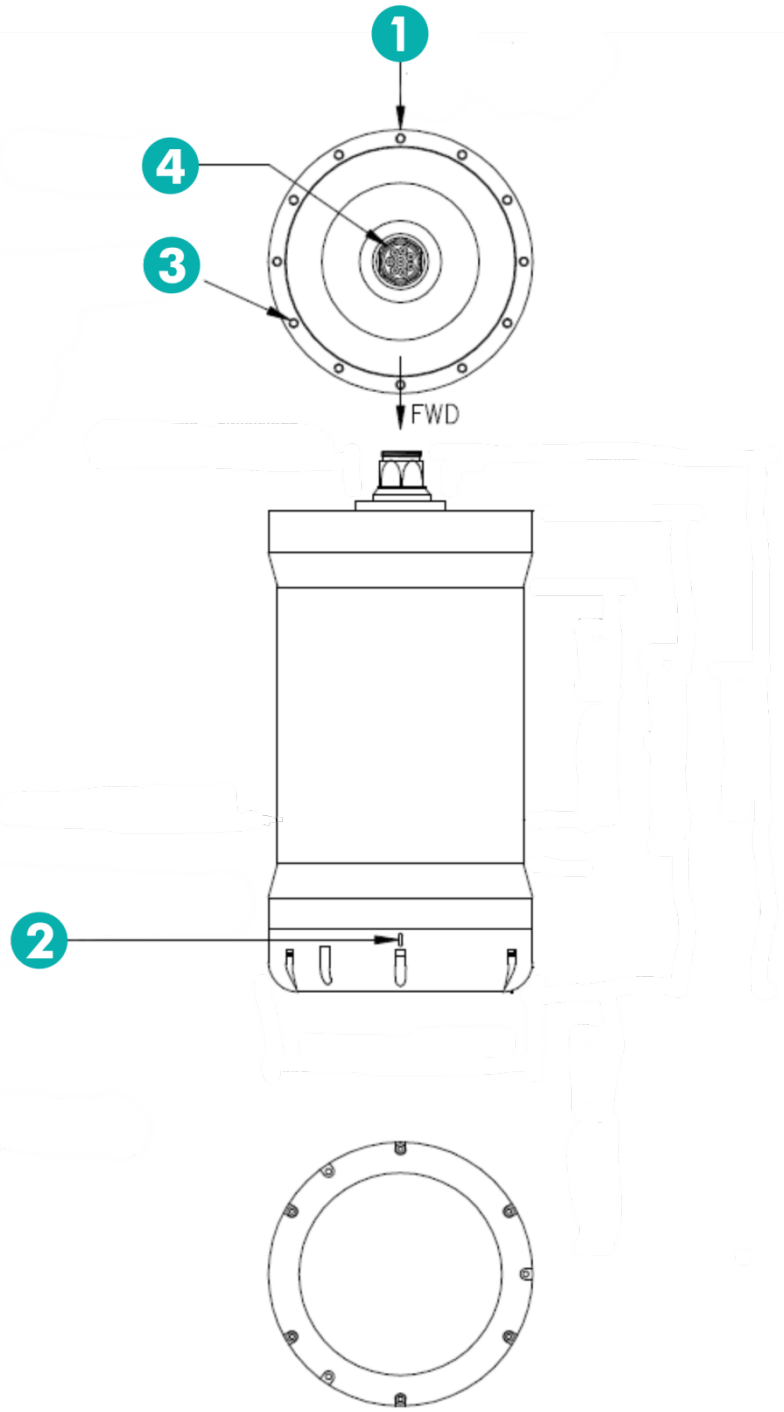
PARTS LIST			
ITEM	QTY	PART NO	DESCRIPTION
5	12	206-064C	Insulator M8 clr x 12 long
6	12	230-1462	Washer Spring M8 A4-70 small OD
7	12	212-1362	Screw Socket Cap S,S M8x50 A4-70
9	1	755-1409	7769-117 Insulator Flange Ring
10	1	200-3661	Seal O ring 200-366-5560
11	1	200-3647	O-Ring - AS 568 - DASH # 364
14	1	200-8088	Seal O ring 200-868-5560
15	6	800-4889	Washer plate
24	1	2008132-130	Transeiver Adapter W
27	32	230-108B	WASHER PLAIN S,S M16
28	16	210-2174	HEX BOLT, M16x100 S/S ISO4014
29	16	230-0583	NUT NYLOC S,S M16

4.4.3 USBL Transceiver Bolt Hole Pattern

4.4.3.1 Type 8221/8212



4.4.3.2 Type 8142/8182 and Variants



Item	Description
1	Parallel with Lubber Line
2	Forward Direction Identification Mark
3	12 Holes, M8 x 1.25 mm Pitch 20.3 mm (0.8") Deep Equally Spaced on 210 mm (8.27") Dia. 6 Holes Only Used for Mounting
4	Cable Connector AGP-2708-F

4.4.4 Alignment Criteria

When mounting the USBL transceiver, ensure that the mounting arrangement has some mechanical means to maintain alignment between the USBL transceiver's centre line and the vessel's centre line. Adapters supplied as an option by Sonardyne have provision for two dowel pins to meet this requirement.

Accurate horizontal and vertical alignment between the USBL transceiver and the vessel is not critical. However, it is important that the deployed alignment angles are repeatable to a much greater precision than the measurement sensors in use so as to avoid the need to recalibrate the deployed angles every time the pole is retracted and redeployed.

4.4.5 USBL Transceiver Connection

Connection between the USBL transceiver and the Navigation Sensor Hub (NSH) rear panel is through the Lemo-to-48 V cable supplied with the system. Connect the Lemo end of this cable to the top port (Port A) on the USBL transceiver card in the NSH. See *UM-8098 "User Manual for the NSH"* for more information.

4.4.6 System Calibration

You must perform a complete system calibration (CASIUS) when you deploy any USBL transceiver for the first time in its mounting arrangement. See "*System Calibration*" in the *UM-8245 "Mini-Ranger 2"*, *UM-8250 "Marksman"* or *UM-8251 "Ranger 2"* user manual (depending on the application being used) for more information about the CASIUS calibration procedure.

4.5 USBL Transceiver Installation

4.5.1 Sea-Chest Installation

For a through-hull installation; ensure gate valve is closed and the sea chest has been drained prior to removing the sea chest door; see *Figure 4-8*.

Figure 4-8 Sea Chest with Door Removed

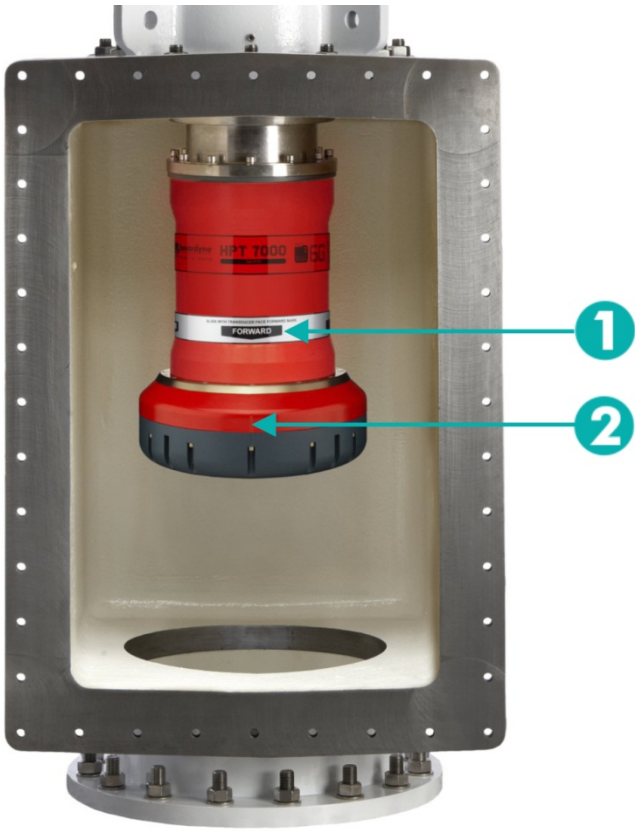
4.5.2 USBL Transceiver Orientation

The USBL transceiver should be installed vertically, with the **Forward** direction label and machined groove pointing forwards; see *Figure 4-9.*

Note

In the absence of the Forward direction label use the machined groove as a reference.

Figure 4-9 Forward Direction Marks



1 Forward Direction Label 2 Machined Groove

4.5.3 Mounting the USBL Transceiver

The USBL transceiver is mounted on a ship as follows:

1. Remove the USBL transceiver from its transit container.
2. Remove the bolts securing the protection ring (store the ring and bolts).
3. Remove the plastic blank from the connector cap (store the blank).
4. Position the USBL transceiver onto an applicable surface ready for connection to the pole.

5. Fit O-ring seals to the insulator flange ring (refer to the installation kit instructions).

1. O-Ring Groove (CPN 200-8088)
2. O-Ring Groove (CPN 200-3661)
3. O-Ring Groove (CPN 200-3647)

6. Lubricate the O-rings with petroleum jelly; see *Section 7.5.2 "Adaptor Flange O-Ring Seals".*
7. Ensure the flange on the USBL transceiver is clean and grease free.
8. Fit the isolation flange ring to the USBL transceiver and line up the mounting holes.
9. Either lower from the top, or using a draw cord, pull the USBL transceiver cable through the centre of the pole; see *Figure 4-10.*

Figure 4-10 USBL Transceiver Cable Location

10. Fit the USBL transceiver cable to the USBL transceiver. A master pin makes sure the plug is located correctly.
11. Hand-tighten the locking sleeve on the USBL transceiver cable.
12. Install applicable lifting equipment to the pole.
13. The crane should slowly lift the equipment until the weight of the pole registers on the crane instrumentation.

CAUTION

The weight of the deployment pole must not be supported by the USBL transceiver front face.

14. Lower the pole into position over the USBL transceiver.
15. Lift the USBL transceiver up to the pole.

Note

Alignment should be maintained to within one degree.

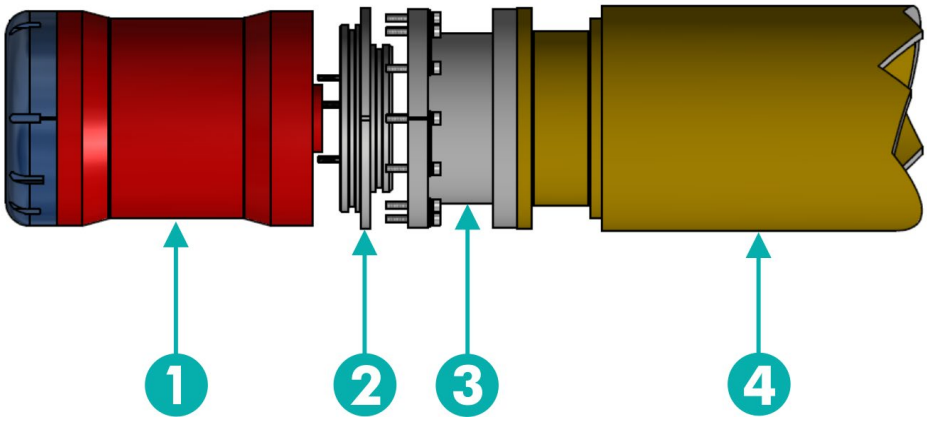
16. Bolt the USBL transceiver to the mounting flange/adaptor on the pole using the bolts, insulation washers, dual washers and spring washers from the installation kit; see *Figure 4-11* (refer to the instructions in the installation kit).

Notes

The isolation flange ring must be used when mounting a USBL transceiver to a pole or adaptor flange of dissimilar metal to the transceiver.

The mounting flange adaptor type is dependent on individual installation. Sonardyne manufactured poles do not require an adaptor.

Figure 4-11 USBL Transceiver to Pole Connection



1 USBL Transceiver
2 Isolation Flange Ring
3 Mounting Flange Adaptor
4 Pole

17. Tighten the fixing bolts in a diagonal sequence with an Allen key to approximately 5 Nm.
18. Remove the protective cover from the USBL transceiver before deployment.
19. The pole should not change its vertical alignment with respect to the ship by more than 0.5 degrees.

4.6 USBL Transceiver Interconnections

4.6.1 Interconnection Cables

Table 4-2 lists the USBL transceiver interconnection cables available. Cables are also available in different lengths (refer to the Drawing No.).

Table 4-2 Cable Types for USBL Transceiver Interconnections

USBL Transceiver	CPN	Drawing No.	Description	Reference
Type 8221/8212	820-6793	8024-044*	Amphenol to AGP Cable Assembly (30 m)	*Section 12.3.1*
Type 8221/8212	820-0331	8212-061*	Amphenol to AGP Cable Assembly (30 m)	*Section 12.3.2*
Type 8142/8182/ Variants	820-3427	7769-038	8-Way AGP Tail (30 m)	*Section 12.3.3*
	312-8092	8130-200	16-Way AGP Tail (30 m)	*Section 12.3.4*
	820-3650	7784-159	5-Way Lemo I/O Tail (5 m)	*Section 12.3.5*
	820-6459	8020-061	8-Way Lemo NSH Tail (5 m)	*Section 12.3.6*

*There are currently two alternatives of cable for this transceiver

4.6.2 Type 8221/8212

The Type 8221/8212 USBL Transceiver interconnections are shown below.

Figure 4-12 Type 8221/8212 USBL Transceiver Interconnections

1. CPN 820-6793 (30 m) Cable Assembly (see the following note and *Section 12.3.1*, or
   CPN 820-0331 (30 m) Cable Assembly (see *Section 12.3.2)*
2. ESH

Note

For Type 8221/8212 the "Function" differs on the wiring connection table shown for CPN 820-6793 in *Section 12.3.1.* The wirng connection table shown in *Table 4-3* replaces the wiring connection table shown in *Section 12.3.1 "8024-044/820-6793 Amphenol to AGP Cable Assembly".*

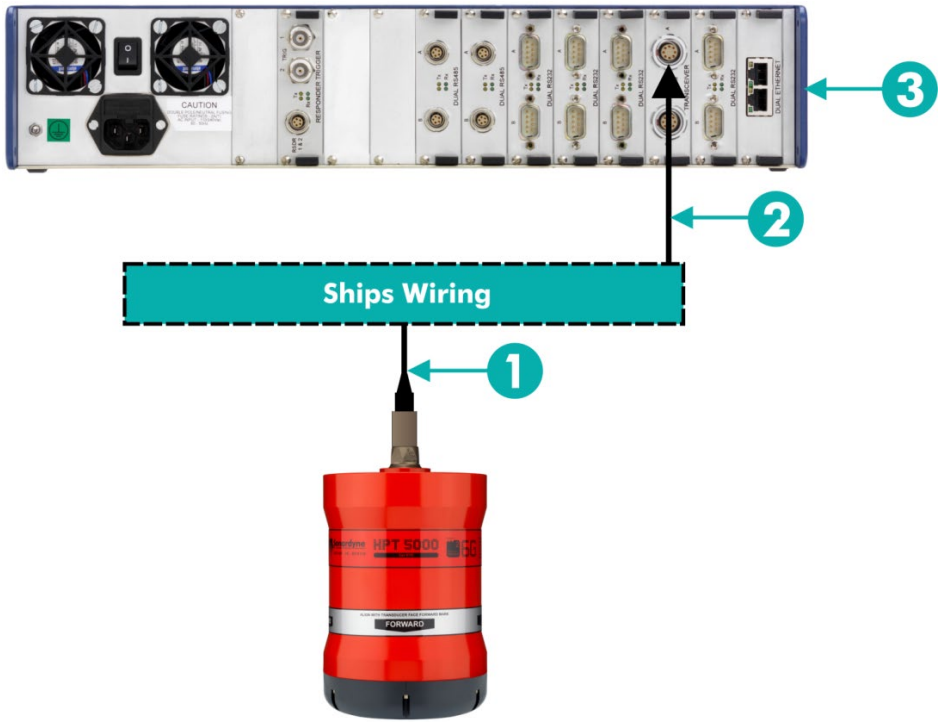
Table 4-3 Type 8221/8212 Wiring Connections

Amphenol Pin Number	Cable Core Colour	AGP Pin Number	Function
F Earth Ring	Screen and Drains	1	Screen
J	Red	2	Power +
K	White	3	Ethernet Tx Data +
L	Blue	4	Ethernet Tx Data -
G	Green	5	Trigger
M	Black	6	Ground and Power Return
A	Orange	7	Ethernet Rx Data +
B	Yellow	8	Ethernet Rx Data -
H	Brown	No Connection	N/A

4.6.3 Type 8142/8182

The Type 8142/8182/Variant USBL transceiver interconnections are shown below.

Figure 4-13 USBL Transceiver Interconnections – Command port only



1. CPN 820-3427 (30 m) See *Note 1*
   (8-Way AGP Transceiver Connector and Tail)
2. CPN 820-6459
   (Lemo NSH Connector)
3. NSH

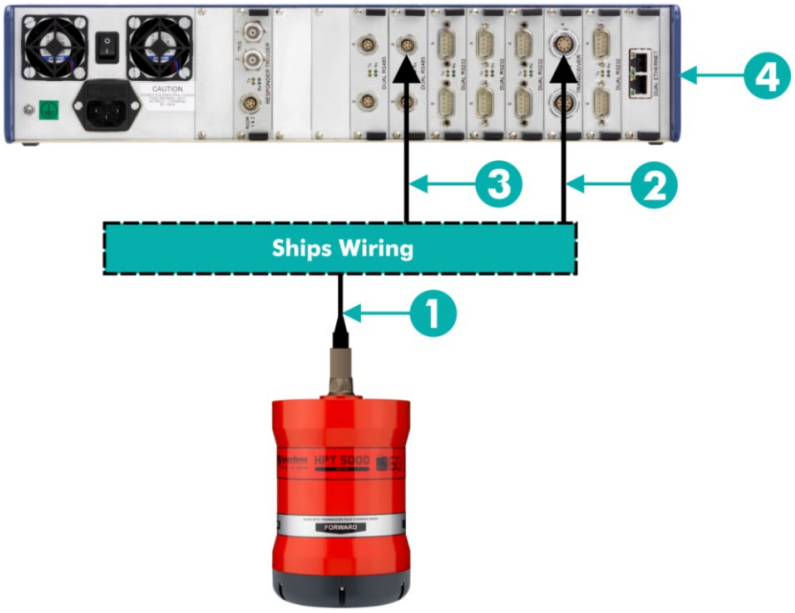
Table 4-4 USBL Transceiver Interconnections – Command Port Only

Function	Lemo NSH Connector CPN 820-6459 issue A3a and Above	Ships Wiring (details can be added for reference by operator)	AGP Transceiver Connector CPN 820-3427
TCVR_+48 V (Pin 8)	Red		Red
TCVR_RTN Pins 6 & 7)	Pink and Blue Joined		Black
RS485+ (Pin 1)	White		White
RS485- (Pin 2)	Brown		Blue
Signal Gnd (Pins & 4)	Green and Yellow Joined		Green
Screen	Screen		Screen

Note 1

For type 8142-000-31 and 8142-000-32 USBL transceivers:
1 CPN 312-8092 16-Way AGP USBL Transceiver Connector.
See *Figure 4-18* for AGP USBL transceiver connector colours.

Figure 4-14 USBL Transceiver Interconnections – Command and Data Port (Modem or Special Applications)



1. CPN 820-3427 (30 m) See *Note 2* (8-Way AGP Transceiver Connector)
2. CPN 820-6459 (Lemo NSH Connector)
3. CPN 820-3650 (Lemo IO Connector)
4. NSH

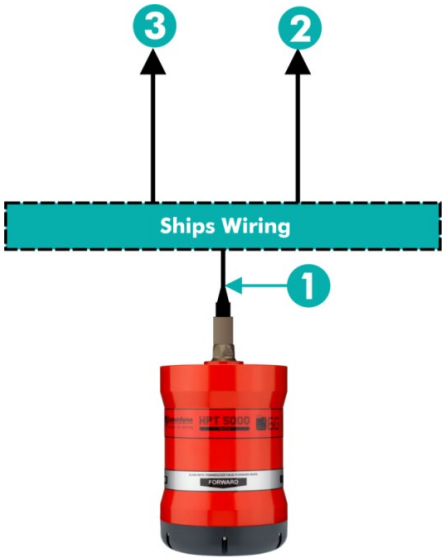
Table 4-5 USBL Transceiver Interconnections – Command and Data Port

Function	Lemo NSH Connector CPN 820-6459	Ships Wiring (details can be added for reference by operator)	AGP USBL Transceiver Connector CPN 820-3427
TCVR_+48 V (Pin 8)	Red		Red
TCVR_RTN (Pins 6 & 7)	Pink & Blue Joined		Black
RS485+ (Pin 1)	White		White
RS485- (Pin 2)	Brown		Blue
Signal GND (Pins 3 & 4)	Green and Yellow Joined		Green*
Screen	Screen		Screen
	Lemo NSH IO connector CPN 820-3650		
RS485+	Red and Blue		Orange
RS485-	Green and Black		Yellow
Signal GND	Yellow		Green* (same as above)

Note 2

For type 8142-000-31 and 8142-000-32 USBL transceivers:
1 CPN 312-8092 16-Way AGP USBL Transceiver Connector.
See *Figure 4-18* for AGP USBL transceiver connector colours.

Figure 4-15 USBL Transceiver Interconnections RS232 Configuration – Command and Data (Modem or Special Applications)



1. CPN 820-3427 (30 m) See *Note 3* (8-Way AGP Transceiver Connector)
2. Users Data Port Connection
3. Users Command Port and Power Connection

Table 4-6 USBL Transceiver Interconnections RS232 Configuration – Command and Data

Function	Command Port Connection, and Power	Ships Wiring (details can be added for reference by operator)	AGP USBL Transceiver connector CPN 820-3427
TCVR_+48 V (Pin 8)			Red
TCVR_RTN (Pins 6 & 7)			Black
RS232 RX (wrt transceiver – Pin 1)			White
RS232 TX (wrt transceiver – Pin 2)			Blue
Signal GND (Pins 3 & 4)			Green*
Screen	Screen		Screen
	Data port connection		
RS232 RX (wrt transceiver – Pin 1)			Orange
RS232 TX (wrt transceiver – Pin 2)			Yellow
Signal GND			Green* (same as above)

Note 3

For type 8142-000-31 and 8142-000-32 transceivers:
1 CPN 312-8092 16-Way AGP Transceiver Connector.
See *Figure 4-18* for AGP USBL transceiver connector colours.

Figure 4-16 Ethernet Configuration – 8-Way AGP Connector – DWG 7769-038

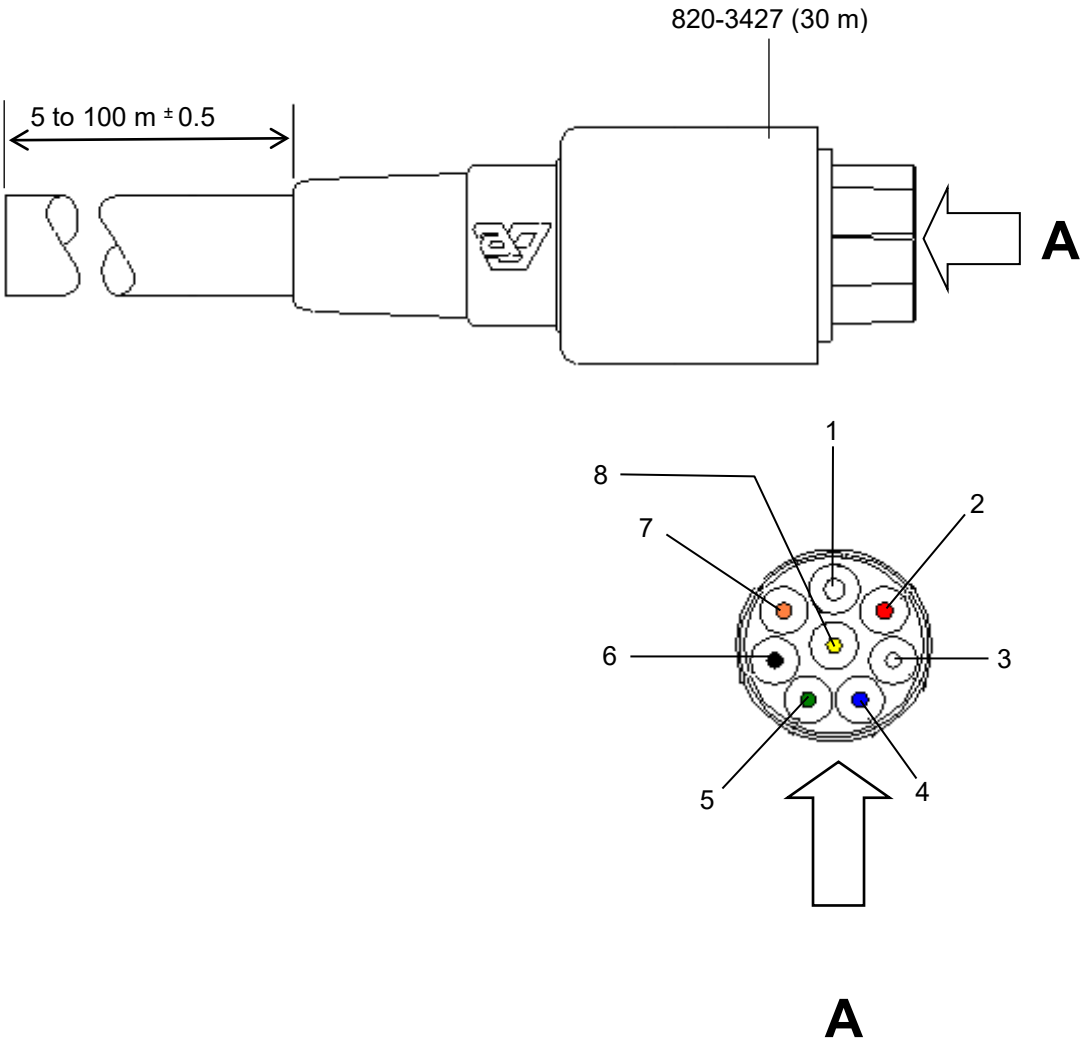


Table 4-7 Ethernet Configuration – 8-Way AGP Connector – DWG 7769-038

Connector Pin	Cable Colour	Function
1	Screen	Screen
2	Red	Power +
3	White	Ethernet Tx Data +
4	Blue	Ethernet Tx Data -
5	Green	Trigger
6	Black	Ground and Power Return
7	Orange	Ethernet Rx Data +
8	Yellow	Ethernet Rx Data -

Figure 4-17 RS 485 Configuration – 8-Way AGP Connector – DWG 7769-038

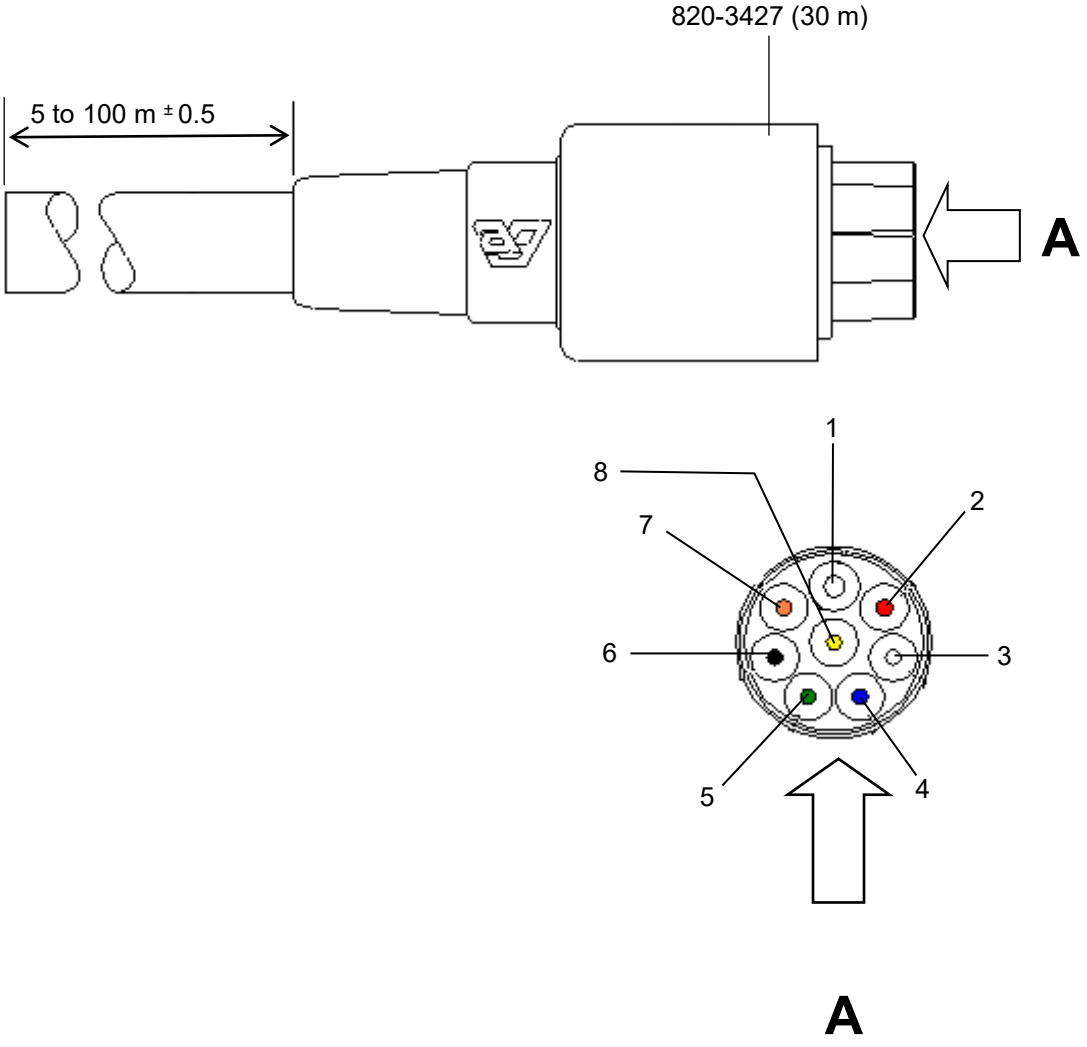


Table 4-8 RS 485 Configuration – 8-Way AGP Connector – DWG 7769-038

Connector Pin	Cable Colour	Function
1	Screen	Screen
2	Red	Power +
3	White	CHAN 0 RS 485+
4	Blue	CHAN 0 RS 485-
5	Green	Signal GND
6	Black	Power Return
7	Orange	CHAN 1 RS485
8	Yellow	CHAN 1 RS 485-

Figure 4-18 RS 485 Configuration – 16-Way AGP Connector – DWG 8130-200

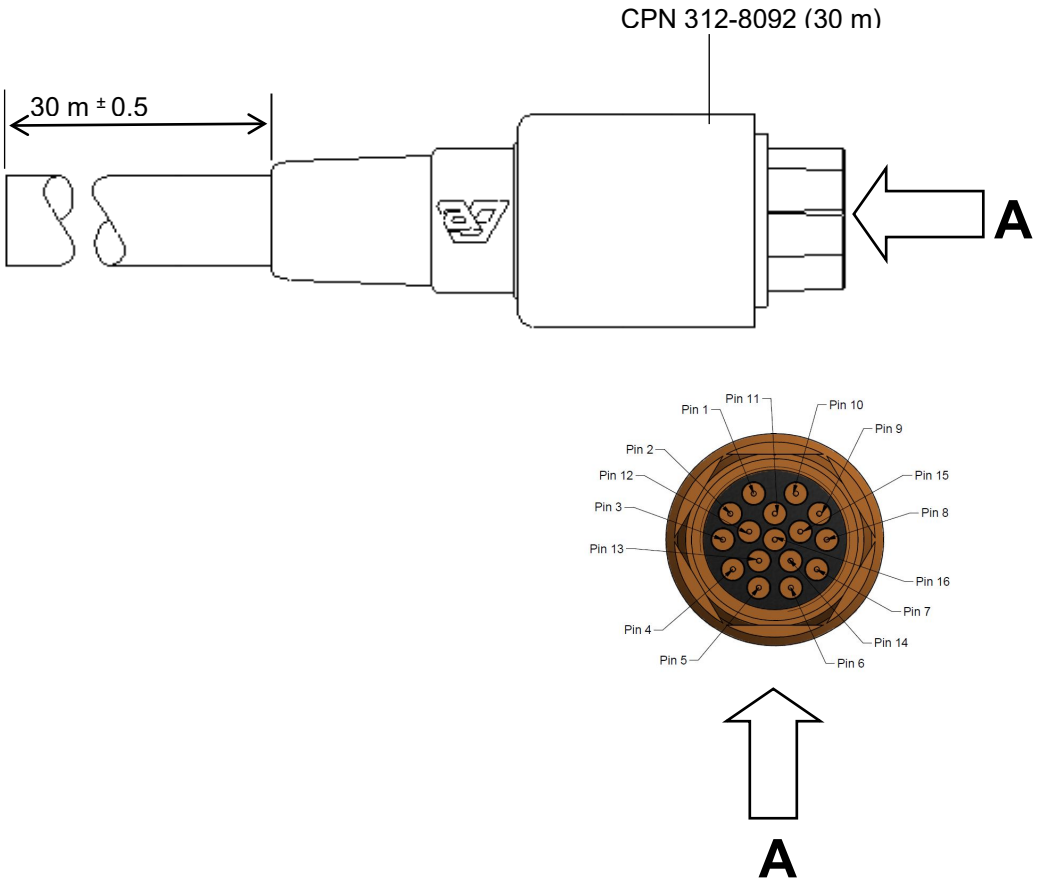


Table 4-9 RS 485 Configuration – 16-Way AGP Connector – DWG 8130-200

Connector Pin	Cable Colour	Function
1	Red	Trigger Output
2	Blue	COM GND
3	Orange (Cat6)	HPT CH1_TX+
4	White/Orange (Cat6)	HPT CH1_TX-
5	White/Green (Cat6)	HPT CH1_RX+
6	Green (Cat6)	HPT CH1_RX-
7	Yellow	HPT CH0_TX/RX+
8	Orange	HPT CH0_TX/RX-
9	White/Brown (Cat6)	ETH TX+
10	Brown (Cat6)	ETH TX-
11	–	Shield
12	White	Trigger Input
13	White/Blue (Cat6)	ETH RX+
14	Blue (Cat6)	ETH RX-
15	Green	HPT Power +
16	Black	HPT Power RTN

Section 5 – Operation

Before operating the USBL transceiver, ensure Section 2 – Safety is read and fully understood.

CAUTION

If a Type 8212 (HPT 3000) or Type 8221 (HPT 2000) transceiver is left powered while exposed to direct sunlight in extreme temperatures, outside of the recommended operating temperatures of -5 to 40°C (23 to 104°F), then the transducer array could deform to the point where it allows water ingression.

5.1 Operating Instructions

5.1.1 Types 8091, 8212, 8221, 8142, 8183

For Operating instructions refer to the appropriate user manual for the system in use (see *Table 1-1*).

Note

If Type 8212 and 8221 transceivers are to be left exposed to direct sunlight, while not immersed in water, in temperatures above 40°C, then the power to the unit MUST be switched off. This removes additional internal temperature rise from the electronics. This includes units that are mounted on over the side deployment system as well as on deck.

Sonardyne recommend that transceivers which could be exposed to direct sunlight in high temperature environments should be protected by a white / light coloured covering as well as being powered off when not in use.

5.1.2 Type 8182, 8193

Refer to the Modem 6 Integration Manual (*IM-Modem 6*), together with the appropriate user manual for the system in use (see *Table 1-1*).

5.2 End of Operations

When operations are complete the USBL transceiver can be retrieved from the water; see *Section 6 – Retrieval and Storage.*

Section 6 – Retrieval and Storage

Before retrieving the USBL transceiver, ensure Section 2 – Safety is read and fully understood.

6.1 Retrieving USBL Transceiver from Through-Deck Deployment Pole or Over-the-Side Mount

1. Install applicable lifting equipment to the deployment pole.
2. The crane should slowly lift the lifting equipment until the weight of the pole registers on the crane instrumentation.
3. Lift the deployment pole out of the deck tube.

4. Place protective foam matting or suitable material on the surface that the USBL transceiver is to be placed onto.

5. Position and lower the USBL transceiver for removal from the deployment pole.

CAUTION

The weight of the deployment pole must not be supported by the USBL transceiver front face.

6. Using an Allen key, remove the bolts, insulation washers, dual washers and spring washers securing the USBL transceiver to the deployment pole.
7. Discard the spring washers.
8. If the USBL transceiver will not separate from the pole, gently tap around the pole with a hide face hammer so the USBL transceiver gently drops onto the protective surface.
9. The crane should slowly lift the deployment pole.
10. Disconnect the USBL transceiver cable from the USBL transceiver.
11. Blank the connection with the connector cap.
12. Remove the USBL transceiver cable from the deployment pole.
13. Remove and store the pole to the applicable storage area.
14. Remove applicable lifting equipment from the deployment pole.

6.2 Cleaning and Maintenance

On retrieval from the water, the following procedures must be carried out before the USBL transceiver is stored.

1. Clean the USBL transceiver; see Section *7.3 "Cleaning"*.
2. Inspect the USBL transceiver; see *Section 7.4 "Inspection"*.
3. Lubricate the connector; see *Section 7.5.1 "Connector Maintenance and Lubrication".*

6.3 Storage

On completion of all procedures in the previous section the USBL transceiver can be placed in storage as described below. See *Table 6-1* for the recommended storage conditions.

1. Store the transceiver in its transit case.

Note

Care should be taken if the unit is stored in a metal shipping container which is exposed to direct sunlight in high temperature environments. The temperature inside these containers can easily increase beyond the recommended storage temperature even if the measured external air temperature is within the stated limits.

2. Equipment must be kept in a dry, non-condensing atmosphere (20% to 80% humidity), free from corrosive agents and isolated from sources of vibration.
3. The packaging should be stored on solid, level and damp-proof floors. It must not be stored directly on damp or dirt floors or areas prone to flooding. In this case suitable shelving raised off the floor should be used.
4. It is recommended to visually inspect the equipment at least annually.
5. When equipment is taken from low temperature storage for immediate use its temperature should be raised to normal operating temperature before use.

Table 6-1 Storage Conditions

Item	Specification
Storage Temperature	-20 to 45°C
Relative Humidity	20 to 80% (non-condensing)

Section 7 – Maintenance

Before any maintenance activity is carried out, ensure Section 2 – Safety is read and fully understood.

7.1 Dismantling

Dismantling of the USBL transceiver must only be carried out by Sonardyne qualified personnel.

7.2 Retrieval from the Water

See *Section 6 – Retrieval and Storage*.

7.3 Cleaning

Note

Do not use any abrasive brushes or sharp tools to remove marine growth when cleaning the instrument as this will damage the protective coating and increase the risk of corrosion.

1. Thoroughly wash the USBL transceiver in warm clean fresh water to remove accumulations of salt, sand or silt, paying particular attention to electrical connectors.
2. Remove any attached cabling or dummy plugs and wash the external socket.
3. Dry the USBL transceiver and any attached cabling with a clean lint free cloth.
4. Replace any dummy plugs and protective caps.
5. Clean the inside of the protective boot and place onto the USBL transceiver.

7.4 Inspection

Inspect the USBL transceiver for the following:

1. Inspect the housing for signs of corrosion or damage. If any corrosion is found, see *Section 7.6 "Corrosion Removal"*.
2. Inspect the connectors and cables for signs of abrasion, damage or corrosion.
3. Check the security of the connector by fitting the locking sleeve from the mating half of the connector, and check for movement. Any movement will require attention and the connector to be secured.

7.5 Scheduled Maintenance

To ensure the USBL transceivers provide long and effective service, it is important to carry out scheduled maintenance and recalibration processes.

The following table identifies the scheduled maintenance and the frequency of the activity.

Table 7-1 Scheduled Maintenance and Recalibration Timetable

Task	Occurrence
Clean and Lubricate Connectors (see *Section 7.5.1*)	Prior to each mating
Clean USBL Transceiver Face (see *Section 7.5.3*)	6 months
Run Bench Test (see *Section 8.4.1*)	12 months

7.5.1 Connector Maintenance and Lubrication

The connectors should be cleaned and lubricated using the manufacturer's recommended lubricant "3M Silicon Spray, ECG RX2200 or Dow Corning DC200" on a regular basis.

1. Ensure the connectors are clean and dry.
2. Clean using a spray-based contact cleaner (isopropyl alcohol).
3. Lubricate the connector mating surface using 3M Silicon Spray, ECG RX2200 or Dow Corning DC200.

CAUTION

⚠ **Do not use WD40, CRC, DC111 or any other solvents or heavy silicon greases**

4. Lubricate only the threaded portion of the stainless-steel locking rings using a light machine oil or dielectric anti-seize.

7.5.2 Adaptor Flange O-Ring Seals

1. Ensure the adaptor flange and the O-rings are clean and dry.
2. Inspect the O-rings for imperfections or damage.
3. Apply a sparing amount of Petroleum Jelly to the O-rings before fitting.

7.5.3 Cleaning the USBL Transceiver Face

The USBL transceiver array face should be regularly cleaned to allow the transceiver array to function correctly; see *Section 7.5.3.1 "Routine Cleaning"* below.

After continued use, hard and soft biofouling can cause degradation in positioning performance, as it will alter the way in which acoustic waves propagate across the face of the array. Hard biofoul can imbed in the array changing the physical properties of the array and soft biofoul can trap air close to the array face, both impacting the acoustic signal. Paint contamination of the front face of the array could cause significant life reduction due to incompatibility between the chemical composition of the paint and the array face material. In both cases it is recommended to remove the unwanted materials as quickly as possible; see *Section 7.5.3.2 "Removing Marine Growth and Overspray of Anti-Fouling Coatings"* below.

Typical Biofouling

Paint Overspray

7.5.3.1 Routine Cleaning

On a six month cycle (or more frequent If needed) the following steps should be followed to maximise the operational life of the USBL transceiver.

1. Wash the transceiver array face in fresh clean water using a soft non-abrasive cloth.
2. Rinse the transceiver face with fresh clean water.
3. Dry the transceiver face using a non-abrasive towel.
4. USBL transceivers deployed using a sea chest: if oil or grease is found in the sea chest, it must be removed using a degreaser.

Note

After cleaning, prior to immersion it is recommended that a wetting agent be applied to the face of the transceiver, such as a weak solution of washing up liquid and fresh water.

7.5.3.2 Removing Marine Growth and Overspray of Anti-Fouling Coatings

On a six-month cycle (or more frequent depending on the operating conditions) the following steps should be followed to maximise the operational life of the USBL transceiver.

1. Wash down the transceiver and array face with clean water and remove any loose biofouling or debris using a soft non-abrasive cloth.
2. Use a soft plastic scraper to remove stubbornly attached marine life such as barnacles, keeping the motion of the scraper flat across the surface (the array face does not have to be perfectly smooth when the process is finished).
3. Leave small pieces of very well attached biofouling in-situ (e.g. the rim of a limpet shell) and so avoid the risk of damaging the transceiver array.
4. Lightly sand the transceiver array using abrasive paper (such as 240 grit wet & dry) with lots of clean water to remove the final signs of biofouling or paint coating.

Note

Ensure the sanding is even and uniform across the whole face of the transceiver array.

5. Lightly wipe the transceiver array using an alcohol wipe to remove any final oil or grease residues.

6. Carefully examine the transceiver face for damage, such as small cracks which typically occur around the edges of where barnacles had been attached. If there are any defects deeper than 1 mm or you have any doubt about damage to the face, send a photograph to Sonardyne support for further advice.

Note

After cleaning, prior to immersion it is recommended that a wetting agent be applied to the face of the transceiver, such as a weak solution of washing up liquid and fresh water.

7.6 Corrosion Removal

Cases of slight corrosion found on the USBL transceiver housing can be treated effectively as described below.

1. Ensure the instrument is thoroughly clean and dry.
2. Clean the corroded area with a degreaser.
3. Treat the corroded area with Alocrom for approximately two minutes, or until the aluminium changes colour to golden brown.
4. Wash off with clean fresh water and dry thoroughly.
5. Ensure the corroded area is completely dry then cover the exposed metal with 2-part epoxy.

Section 8 – Functional Testing

8.1 Introduction

To ensure the USBL transceiver functions correctly the following functional tests can be carried out:

- Serial connection from NSH to USBL transceiver (Type 8142/8182 and variants)
- Connection from ESH to USBL transceiver (Type 8212/8221)
- NPT Bench and test tank

8.2 Test Equipment

8.2.1 6G Terminal Lite

6G Terminal Lite software is supplied on the 6G Utilities CD. See *UM-8300-099-User Manual for 6G Terminal Lite*.

8.2.2 Type 8221/8212 USBL Transceiver

Testing of the transceiver can be carried out with an ESH using 6G Terminal Lite; see *Section 8.2.1 "6G Terminal Lite"*. The ESH will power the USBL transceiver if connected.

8.2.3 Type 8142/8182 USBL Transceiver

Testing of the USBL transceiver can be carried out with an NSH using 6G Terminal Lite; see *Section 8.2.1 "6G Terminal Lite".* The NSH will power the USBL transceiver if connected.

8.3 Connecting to the USBL Transceiver

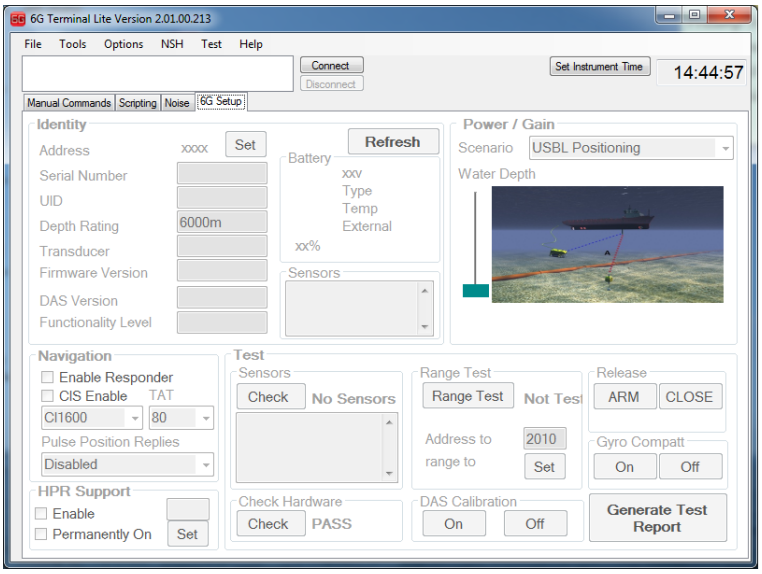
Depending on the USBL transceiver type, either a serial or socket (Ethernet) connection must be established for testing using 6G Terminal Lite.

- Type 8221/8212 USBL transceivers connect to the PC/ESH using a socket connection
- Type 8142-000-31/32 USBL transceivers connect to the NSH using a socket or serial connection
- All other Type USBL transceivers connect to the NSH using a serial connection

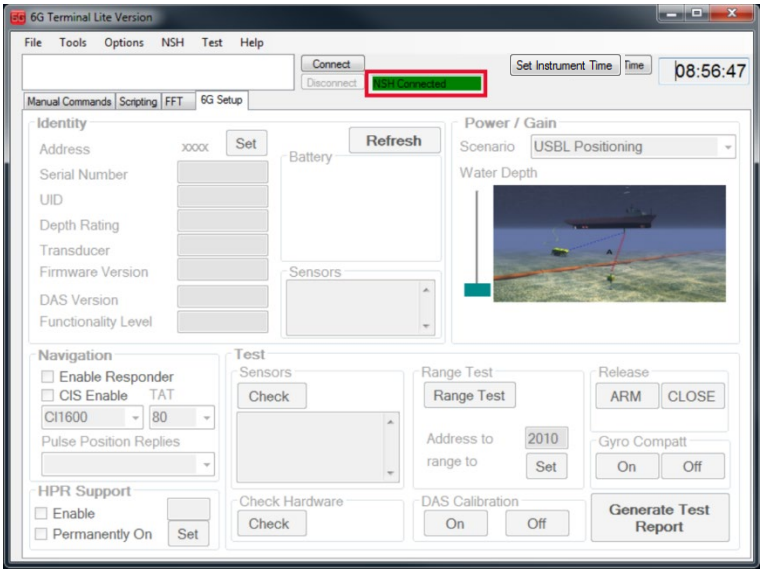
To connect to the USBL transceiver:

1. Double-click the **6G Terminal Lite** desktop icon to start the software.

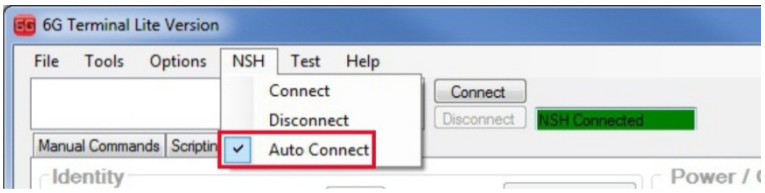
2. The 6G Terminal Lite dialog box will open on the **6G Setup** tab.



3. If connecting through an NSH follow steps *4* to *7* otherwise go to step *8*.
4. The 6G Terminal Lite software should automatically connect to the NSH. Connection will be indicated by **NSH Connected** displayed green.

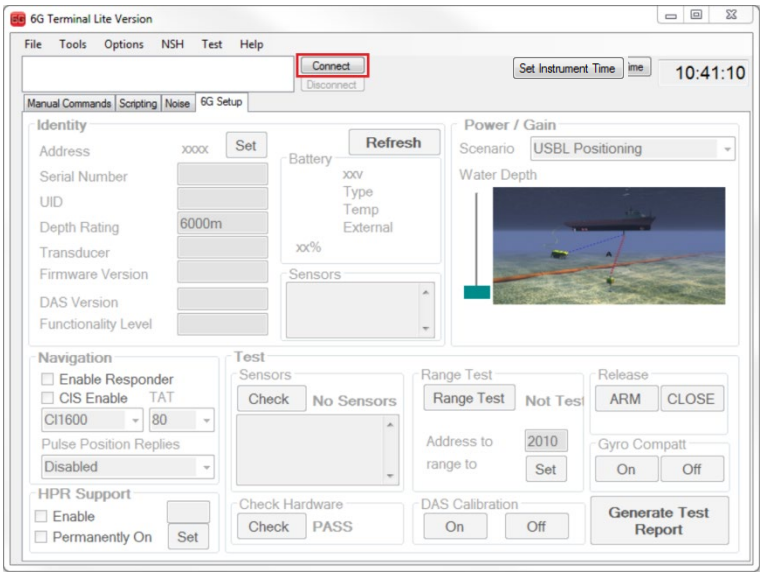


5. If the green **NSH Connected** indication does not appear, the NSH has not automatically connected (if the NSH has not automatically connected follow step *6* otherwise go to step *8*).
6. To connect to the NSH, click **NSH**, and then check the **Auto Connect** check box.

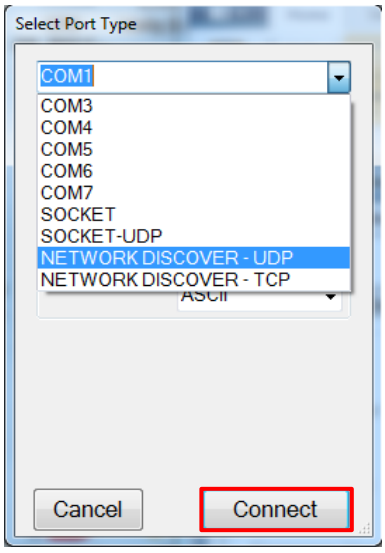


7. Wait until the green **NSH Connected** indication appears (this may take up to 20 seconds). If the **NSH Connected** label does not appear check the NSH connection and confirm it is switched on.

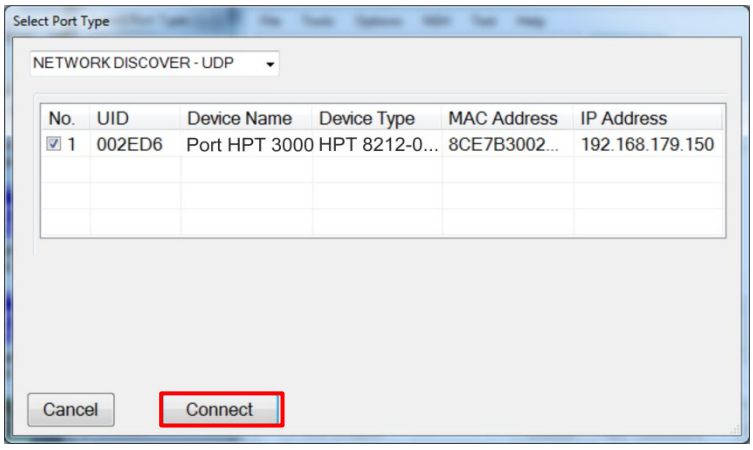
8. Click **Connect**.



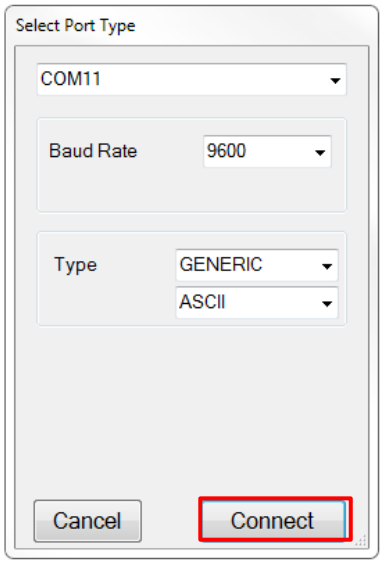
9. If connecting to an Ethernet based instrument such as the HPT 3000 follow steps *10* to *12* otherwise skip to step *13*.
10. On the drop-down list Select **NETWORK DISCOVER – UDP** and then click **Connect.**



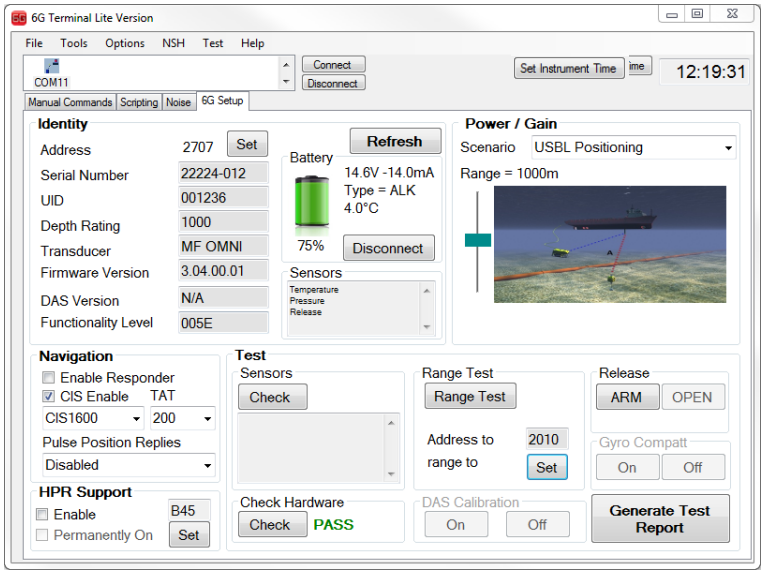
11. The device connected to the Ethernet port will be discovered as shown below:



12. Click **Connect** to connect to the device and skip to step *15* (if the device is not shown then ensure the Ethernet socket on the PC being used is set to the same subnet mask. Also ensure firewall settings are not restricting network connection to the device).
13. On the **Select port type** drop-down list, select the computer connection port.
14. On the **Baud Rate** drop-down list select the baud rate and then click **Connect**.



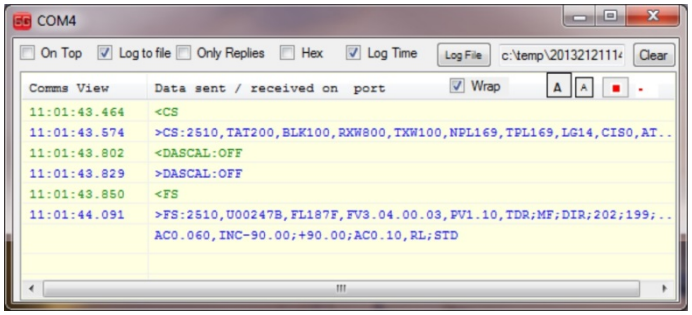
15. The **6G Setup** tab displays information on the connected USBL transponder including address, serial number, depth rating and battery status.



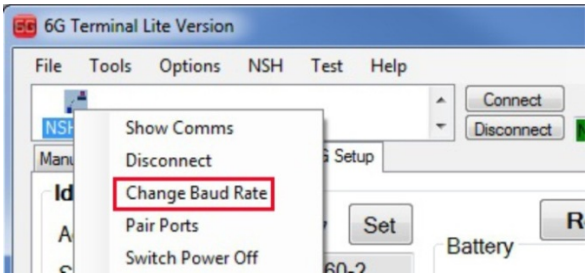
16. A COM log window will also open. The green writing indicates the commands sent from the software to the transponder, the blue writing is the transponders response.

Note

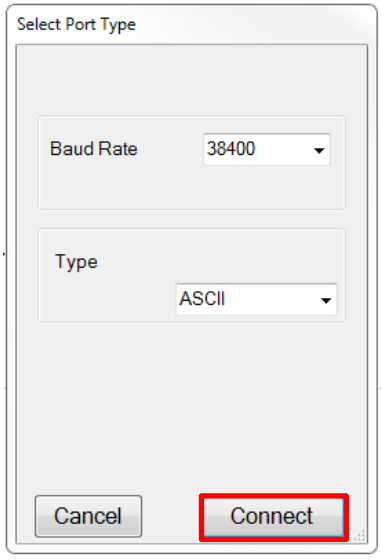
This window automatically logs all communications when open and should be left open to ensure communications are logged for diagnostic purposes.



17. If the information fails to display it may be because the baud rate is incorrect.
18. Double-click the connection port icon on the 6G Terminal Lite dialog box and select **Change Baud Rate**.



19. On the **Baud Rate** drop-down list select **the correct baud rate**.
20. Click **Connect** to accept the baud rate and return to the main **6G Terminal Lite** dialog box.



21. Click **Refresh** to get the settings again at the revised baud rate.

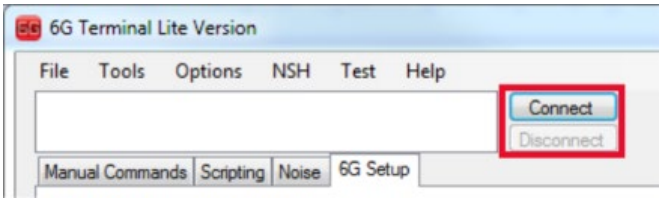
8.3.1.1 No Communication between the PC and the USBL Transceiver

If the 6G Terminal Lite window does not populate or if no communication between the PC and the USBL transceiver appears in the communication window it may be necessary to check the network IP address.

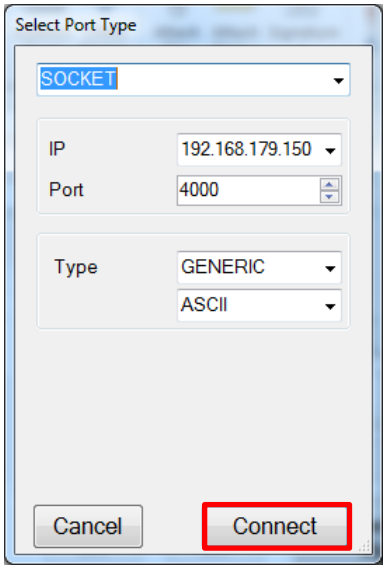
Note

The Ethernet adaptor must be on the same subnet as the USBL transceiver: 192.168.179.x (where x is any number between 1–255 except 50, 51, 80, 150 & 200 as these are used by other Sonardyne instruments).

1. On the **6G Terminal Lite** dialog box, click **Disconnect** and then click **Connect**.



2. On the **Address** drop-down list confirm the correct IP address and then click **Connect**.



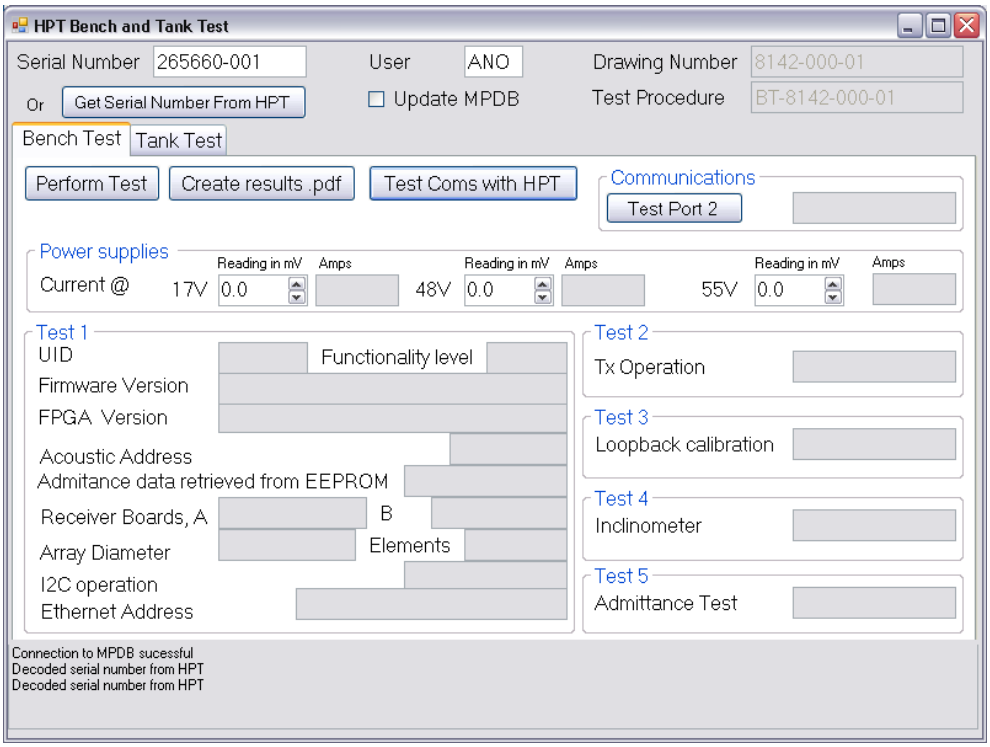
3. The **6G Terminal Lite** dialog box will populate and communication between the PC and the USBL transceiver appears in the communications window.
4. Proceed to *Section 8.4 "Testing"*.

8.4 Testing

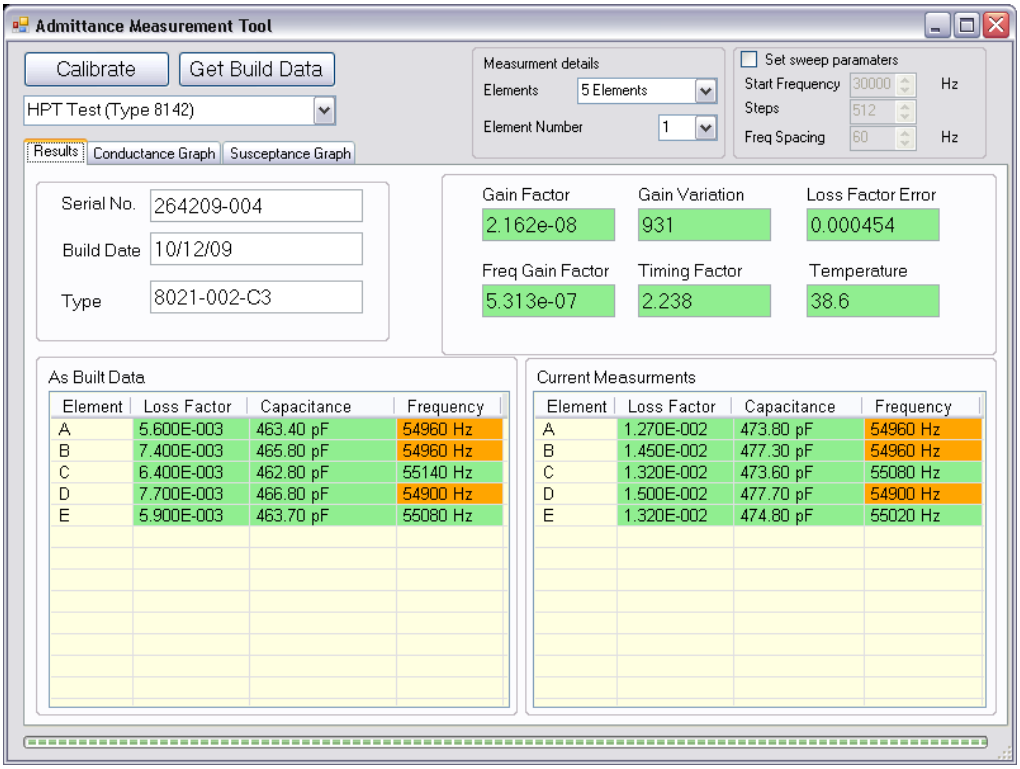
8.4.1 HPT Bench and Tank Test

1. On the **6G Terminal Lite** menu click **Test** > **Bench Test**.
2. The **HPT Bench and Tank Test** dialog box will open.
3. Uncheck the **Update MPDB** check box.
4. Click **Get Serial Number From HPT**. The serial number will be displayed in the **Serial Number** field.

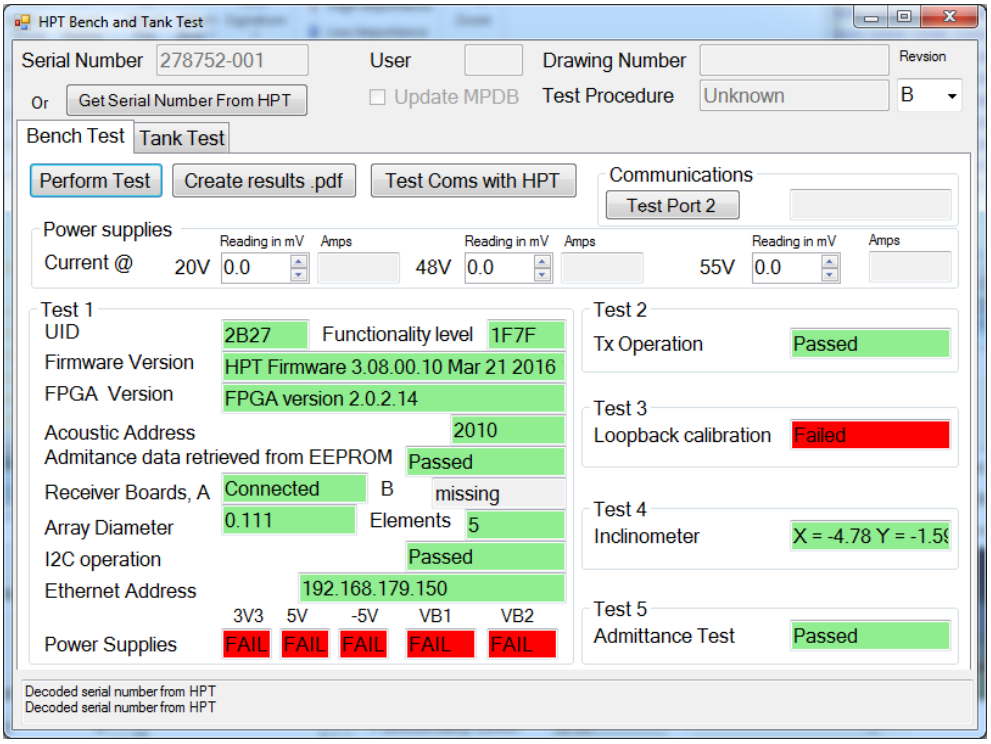
5. Click Perform Test.



6. An admittance test is performed on the unit. Admittance test windows will appear on the screen during the test. The results will be marked red, orange or green.



7. If any results appear marked red, click **NO** when prompted for a "successful test". The test result window below indicates a system with a failed power supply.



8. When the test is complete click **Create results pdf**.

Note

The tests 1.01 through 1.03 are not run during this procedure, and do not qualify as a failure of the unit.

HPT Bench test report

Test Procedure: BT-8142-000-01 **Drawing Number:** 8142-000-01
Serial number: 265660-001 **Operator:** ANO

Test Results

Test 1 Results			
1.01	17V Supply Current	Current not measured	FAILED
1.02	48V Supply Current	Current not measured	FAILED
1.03	55V Supply Current	Current not measured	FAILED
1.1	UID of device	26C5	PASS
1.2	Firmware version	TYPE-8142-01 3.00.01.11 Sep 10 2010 12:23:28	PASS
1.3	CPU FPGA version	FPGA version 2.0.2.5	PASS
1.3a	Acoustic Address	5602	PASS
1.4	Admitance data retrieved from EEPROM	Passed	PASS
1.5	Rx board A	Connected	PASS
1.6	Rx board B	missing	PASS
1.8	Array diameter	0.111	PASS
1.9	Number of elements	5	PASS
1.10	I2C operation	Passed	PASS
1.11	Ethernet IP address	0	FAILED
1.12	Functionality level	849	PASS

Test 2 Results			
2.0	Transmit operation	Passed	PASS

Test 3 Results			
3.0	Loopback calibration	Passed @38.00 degrees	PASS

Test 4 Results			
4.0	Inclinometer operation	X = 0.00 Y = 0.30	PASS

Test 5 Results			
5.0	Admitance Test	Passed	PASS

24 September 2010 14:53:58 1 of 2 HPT Bench Test Results

9. If the test is unsuccessful the test results should be sent to Sonardyne Support.

Section 9 – Firmware Update

9.1 Introduction

The USBL transceiver can be updated by installing new versions of the firmware. The Sonardyne Support Team will inform customers of any required firmware updates.

The USBL transceiver can accept firmware updates via connections made to the ESH/NSH. The firmware can be updated in two ways:

- Using 6G Terminal Lite software
- Using Marksman and Ranger 2/Mini-Ranger 2 software

The two procedures are described in *Sections 9.3* and *9.4*.

9.2 Connecting to the USBL Transceiver

See *Section 8.3 "Connecting to the USBL Transceiver"*.

9.3 Updating USBL Transceiver Firmware using 6G Terminal Lite

9.3.1 Prerequisites

Before updating the firmware, ensure the following is available:

- The new firmware file
- A 6G Terminal Lite software installation

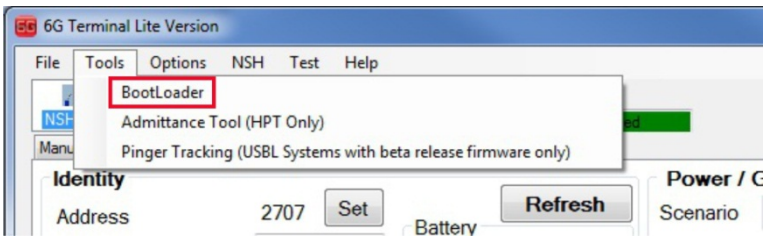
9.3.2 Updating the Firmware

Notes

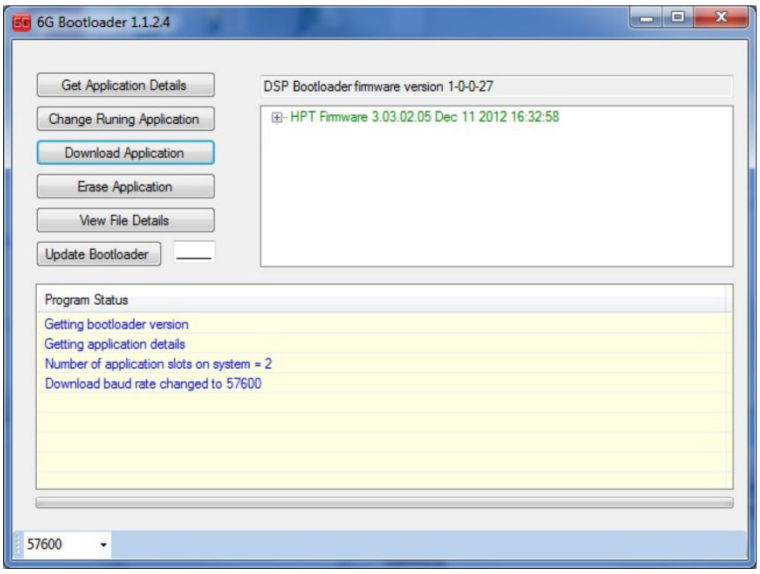
If using Ethernet device discovery (e.g when connecting to HPT 3000) and the unit cannot be discovered, the instrument cannot be upgraded until the connection issue is resolved.

If communications do not appear in this window the 6G bootloader can still be started (see the following step).

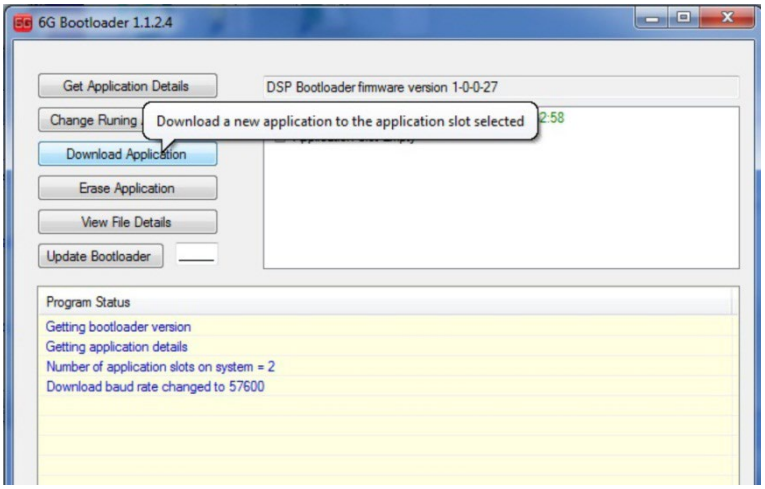
1. On the **6G Terminal Lite** dialog box, click **Tools > Bootloader**.



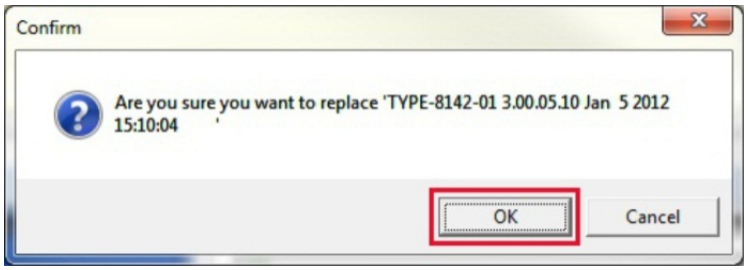
2. The **6G Bootloader** window displays the current firmware installed in the USBL transceiver.



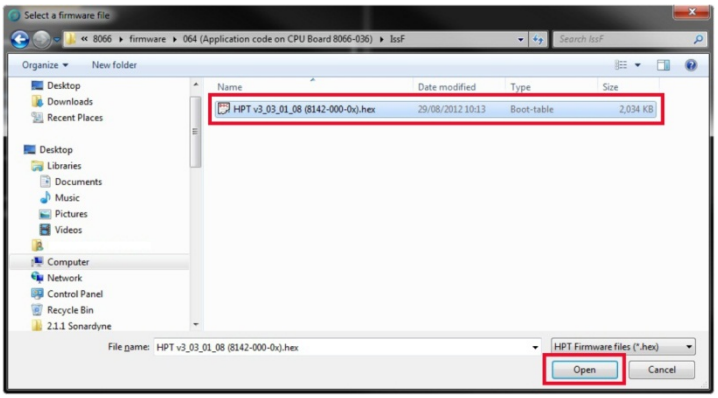
3. Click *Download Application*.



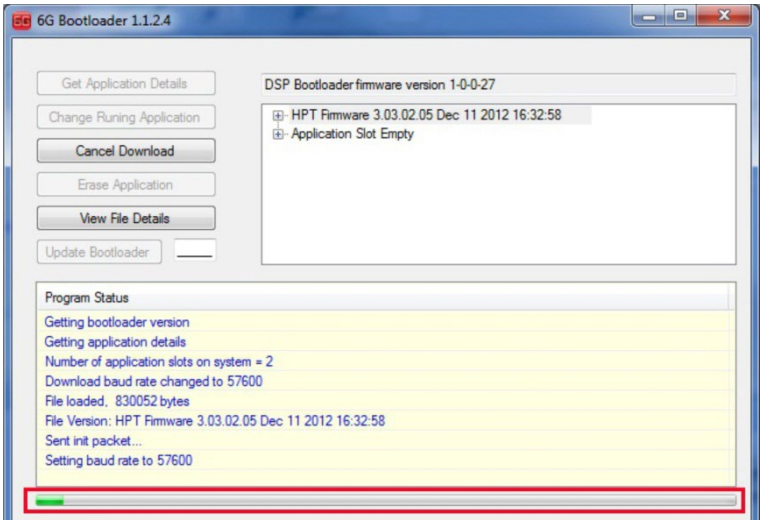
4. A warning dialog box will appear to confirm that the firmware will be replaced; to proceed, click **OK**.



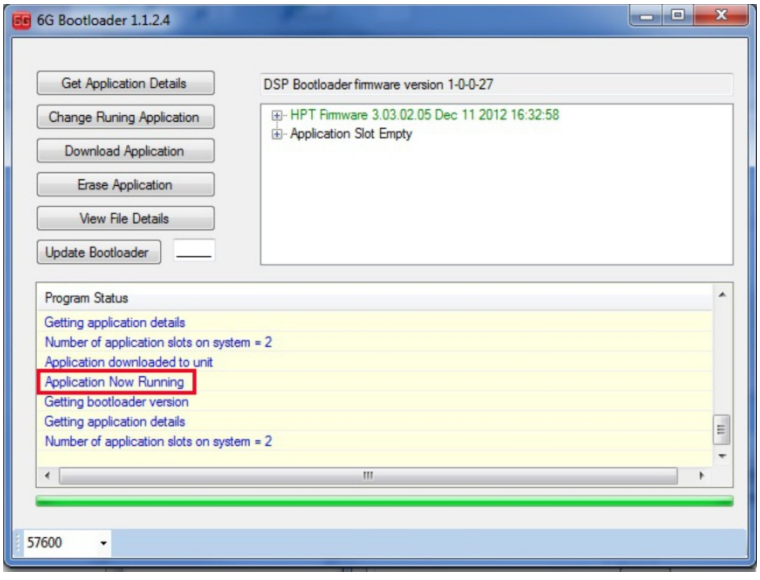
5. On the **Select a firmware file** dialog box, navigate to and select the new firmware file and then click **Open**.



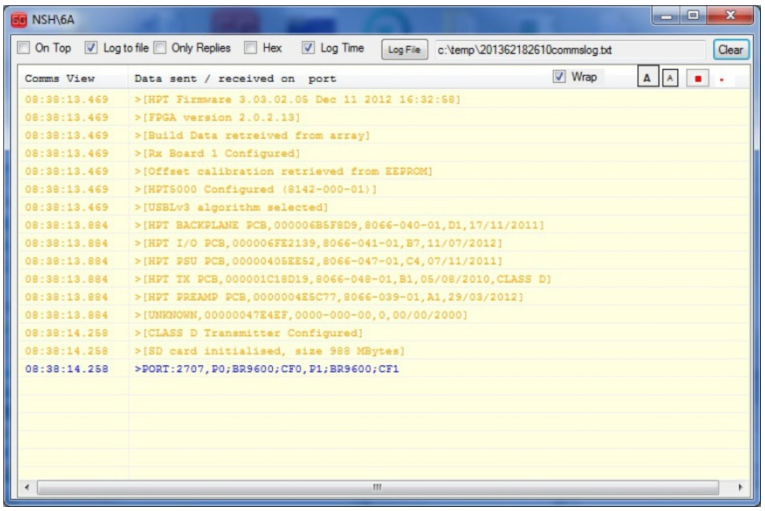
6. The **Select a firmware file** dialog box will close.
7. The **6G Bootloader** dialog box displays the progress of the firmware installation.



8. The firmware installation will be complete when the progress bar is completely green and **Application Now Running** appears in the **Progress Status** list.



9. Close the **6G Bootloader** dialog box and return to the **6G Terminal Lite** dialog box.
10. After a short pause, communication between the USBL transceiver and the NSH will begin (this can be viewed in the communications window).



11. Communication indicates the firmware upload has been successful.

9.4 Updating USBL Transceiver Firmware using Marksman/Ranger 2/Mini-Ranger 2

9.4.1 Prerequisites

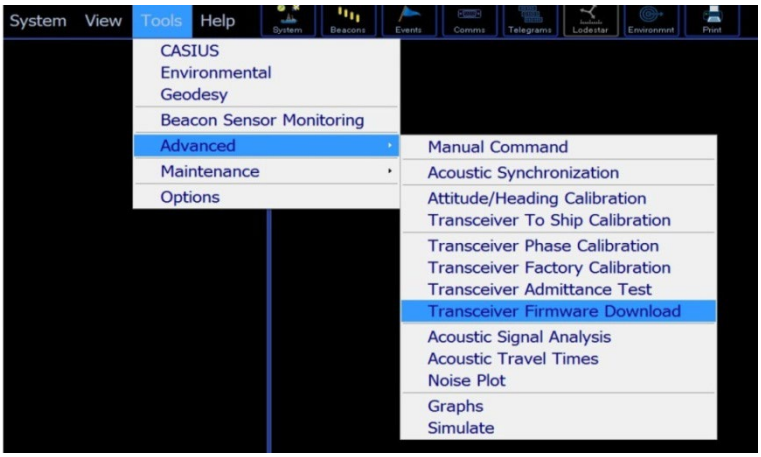
Before updating the firmware, ensure the following are available:

- The new firmware file
- A Marksman/Ranger 2/Mini-Ranger 2 Software Installation

9.4.2 Updating the Firmware

Ensure the Marksman, Ranger 2 or Mini-Ranger 2 software is started.

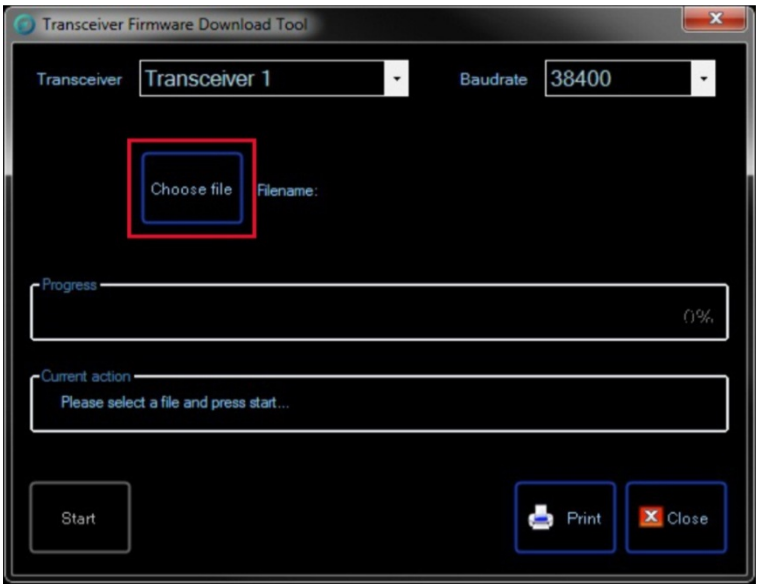
1. On the **Tools** menu, click >**Advanced**>**Transceiver Firmware Download**.



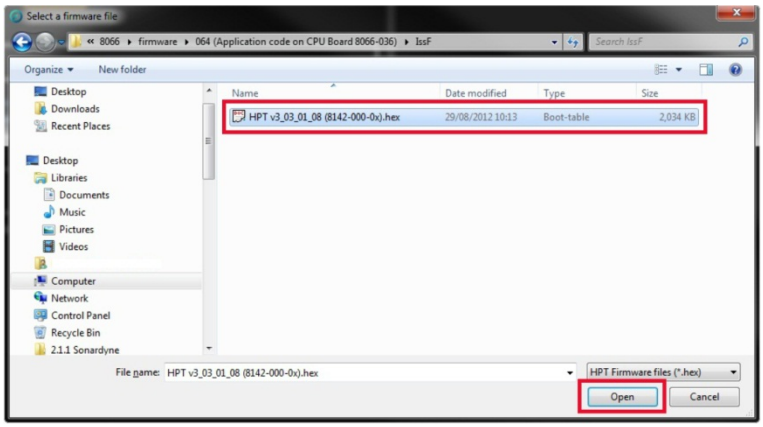
2. On the **Transceiver Firmware Download Tool** dialog box, select the current USBL transceiver and baud rate from the **Transceiver** and **Baud rate** drop-down lists and then click **Choose file.**

Note

If performing a default update, the USBL transceiver and baud rate need to be changed.

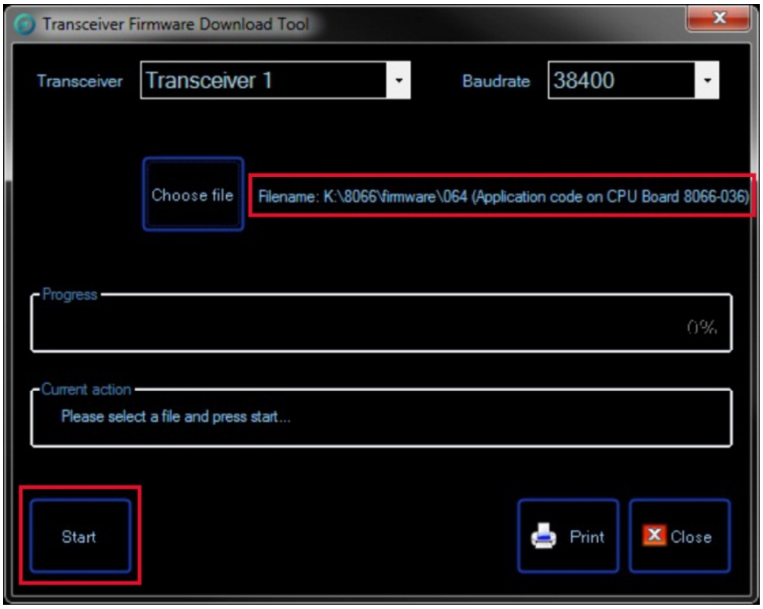


3. On the **Select a firmware file** dialog box, navigate to and select the new firmware file and then click **Open**.



4. The **Select a firmware file** dialog box will close.

5. On the **Transceiver Firmware Download Tool** dialog box, the firmware location will be displayed. Click **Start** to begin the download.



6. A **Progress** bar displays the rate of download.
7. Once the download has completed, the **Transceiver Firmware Download Tool** can be closed.
8. If the USBL transceiver doesn't re-connect this could indicate the firmware update was unsuccessful; see *Section 10 – Fault Diagnosis.*

Section 10 – Fault Diagnosis

10.1 Introduction

If the USBL transceiver system fails to operate refer to the following fault diagnosis to determine the possible cause and the action to take. If the USBL transceiver fails to operate following referral to the fault diagnosis, contact Sonardyne Support.

10.1.1 No Communication from the USBL Transceiver

Use the following fault diagnosis table to help diagnose the fault (see *Section 4.6* for interconnection details).

Table 10-1 Fault Diagnosis Table

Fault	Possible Cause	Action
No communication from the USBL Transceiver	Wiring connections	Check all LEDs on the Navigation Sensor Hub to confirm power is available to the USBL transceiver (if power is available, refer to AGP Connector).
	No power	Check all USBL transceiver connections (see *Section 4.6 "USBL Transceiver* Interconnections*".*
		Ensure the Marksman software is running correctly on the attached PC and the USBL transceiver has been added to the correct port.
		Ensure the power supply is available and connected securely.
	AGP Connector	Unplug the AGP connector and check the 48 V pin outs of the AGP connector (see *Section 12 – "Technical Specifications"*).
	Continuity of RS485 Connection	To check RS485 connection: turn off power to the system and unplug the topside wiring. Connect RS485 pins 3 and 4 together. Use a multi-meter to check continuity of the RS485 + / RS485 – on the amphenol connector. If no fault is found the wiring is correct (see *Section 12 – "Technical Specifications"*).
		Check the polarity of the RS485 wiring. It is not easy to check the polarity of the RS485 connection apart from checking the wiring carefully against the wiring diagram. If needed a separate RS485 to RS232 converter can be used topside, then 6G Terminal can be used to connect directly to the serial port to ensure correct operation.
	Ethernet Adaptor Subnet (for Ethernet connected USBL transceiver)	Check that the Ethernet adaptor is on the same subnet as the USBL transceiver: 192.168.179.x (where x is any number between 1–255 except 50, 51, 80, 150 & 200 as these are used by other Sonardyne instruments).

Section 11 – Spares

11.1 Introduction

When ordering spare parts, please provide:

1. The part number
2. The drawing number (if known)
3. A description

Enquiries about, or orders for spare parts should be directed to your local Sonardyne office or agent. Local agents contact details can be viewed at www.sonardyne.com and contact details are shown at the end of this manual:

11.2 Recommended Spares

The following is a list of available spares.

11.2.1 USBL Transceiver Type 8221/8212

CPN	Drawing No	Description	Qty
650-0143	8212-007	HPT 3000 Isolation Kit	1
650-0154	8212-006	Deployment Pole Mounting Kit	1
755-0061	8212-026	HPT 3000 Isolation Flange	1
760-0080	8212-087	Deployment Machine Adaptor	1

11.2.2 USBL Transceiver Type 8142 and 8182

CPN	Drawing No	Description	Qty
650-0154	8212-006	Deployment Pole Mounting Kit	1
641-0697	7769-063	Transceiver Installation Kit (USBL)	1
640-6792	7769-063	Transceiver Installation Kit (USBL)	1
This above kit contains the following parts:			
206-064C		Insulation Bush 015-0986 M8.0 Nylon	12
230-1462		Washer Spring S/S M8 Din 7980 small O/D	12
212-1362		Screw Socket Cap S/S M8 X 50	12
755-1409	7769-117-B	Insulator Flange Ring	1
200-3661	200-366-5570	Seal 'O' Ring	1
200-3647	200-364-5570	Seal 'O' Ring	1
820-4808	7009-304-A3	Test Cable Assy	1
200-8088	200-868-5570	Seal 'O' Ring	1
800-4889	7769-118-A	Washer Plate	6
212-133B		Screw Socket Cap S/S M8 X 30	6
200-1896	1895:30-043	Seal 'O' Ring Nit	2
200-4399	200-439-5570	Seal 'O' Ring	1

11.2.3 Assemblies

CPN	Drawing No	Description	Qty
620-7181	8142-000-01	Transceiver Assembly	1
641-2020	8021-002-01	Transducer Assembly	1
620-7230	8142-000-02	Transceiver Assembly	1

11.2.4 Cables

CPN	Drawing No.	Description	Qty
820-8793	8024-044	Amphenol to AGP Cable Assembly (30 m)	1
820-3427	7769-038	8-Way AGP Tail (30 m) Subsea	1
312-8092	8130-200	16-Way AGP Tail (30 m) Subsea	1
820-3650	7784-159	5-Way Lemo I/O Tail (5 m) Topside	1
820-6459	8020-061	8-Way Lemo NSH Tail (5 m) Topside	1

Section 12 – Technical Specifications

12.1 Specifications

12.1.1 8221-000-01 USBL Transceiver

Feature		Type 8221
Operational Frequency		HF (34–50 kHz)
Transceiver Performance	Operating Range	500 m
	Acoustic Coverage	Full 180°
	Range Precision	Better than 15 mm
	Positioning Repeatability External MRU	All transceivers tested to better than 0.2% of slant range 1 Drms / 0.14% 1 Sigma
	Positioning Repeatability Internal Xsens Pitch and Roll	All transceivers tested to better than 1.3% of slant range 1 Drms / 0.9% 1 Sigma
Source Level (dB re 1 µPa @ 1 m)		194 dB
Electrical		48 V dc (±10%), typical 15 W, maximum 120 W
Communication		Ethernet 100 Mbps
Operating Temperature		-5 to 40°C
Storage Temperature		-20 to 45°C
Mechanical Construction		Aluminium bronze
Dimensions (Height x Diameter)		310 x 234 mm
Weight in Air/Water		19.4/9.5 kg

12.1.2 8212-000-01 USBL Transceiver

Feature		Type 8212
Operational Frequency		MF (19–34 kHz)
Transceiver Performance	Operating Range	Restricted to 995 m with Mini Ranger 2 system (4000 m with extended range version)
	Acoustic Cover	Full 180°
	Range Precision	Better than 15 mm
	Positioning Repeatability External MRU	All transceivers tested to better than 0.2% of slant range 1 Drms / 0.14% 1 Sigma
	Positioning Repeatability Internal Xsens Pitch and Roll	All transceivers tested to better than 1.3% of slant range 1 Drms / 0.9% 1 Sigma
Transmit Source Level (dB re 1 µPa @ 1 m)		194 dB
Tone Equivalent Energy (TEE)[1]		200 dB (3 JA)
Electrical		48 V dc (±10%), typical 15 W, maximum 120 W
Communication		Ethernet 100 Mbps
Operating Temperature		-5 to 40°C
Storage Temperature		-20 to 45°C
Mechanical Construction		Aluminium bronze
Dimensions (Height x Diameter)		310 x 234 mm
Weight in Air/Water		19.4/9.5 kg

[1] WBv2+ signals are 4x the duration of Sonardyne tone signals (WBv1 & WBv2 are 2x). The TEE figure shows the operational performance when comparing wideband and tone systems.
Detection performance is directly related to the signal energy (Joules (Watt seconds)) and not power. WBv2+ signals are longer in duration (greater energy) than WBv1 and Tone, therefore the detection performance is the same or improved for low transmit source levels.

12.1.3 8142-000-01, 8142-000-31 & 8142-000-11 USBL Transceivers

Feature		Type 8142-01
Operational Frequency		MF (19–34 kHz)
Transceiver Performance	Operating Range	Up to 7,000 m
	Acoustic Coverage	Up to ± 90°
	Range Precision	Better than 15 mm
	Positioning Repeatability	All transceivers tested to better than 0.1% of slant range 1 Drms
Transmit Source Level (dB re 1 µPa @ 1 m)		200 dB
Tone Equivalent Energy (TEE)[2]		206 dB (13 JA)
Electrical		48 V dc (±10%), Typical 15 W, Max 120 W
Communication		RS485, baud rate switchable, ethernet 100 Mbps
Operating Temperature		-5 to 40°C
Storage Temperature		-20 to 45°C
Mechanical Construction		Aluminium bronze
Dimensions; Length x Diameter		322 x 225 mm
Weight in Air/Water		26.7/15.3 kg
Options		Tilted array adaptor

[2] WBv2+ signals are 4x the duration of Sonardyne tone signals (WBv1 & WBv2 are 2x). The TEE figure shows the operational performance when comparing wideband and tone systems.
Detection performance is directly related to the signal energy (Joules (Watt seconds)) and not power. WBv2+ signals are longer in duration (greater energy) than WBv1 and Tone, therefore the detection performance is the same or improved for low transmit source levels.

12.1.4 8142-000-02, 8142-000-32 & 8142-000-12 USBL Transceivers

Feature		Type 8142-02 (Deepwater optimised unit)
		MF (19–34 kHz)
Transceiver Performance	Operating Range	Up to 7,000 m
	Acoustic Coverage	Up to ± 90º Optimised for deep water (depending on frequency of operation)
	Range Precision	Better than 15 mm
	Positioning Repeatability	All transceivers tested to better than 0.07% of slant range 1 Drms
Transmit Source Level (dB re 1 µPa @ 1 m)		200 dB
Tone Equivalent Energy (TEE)[3]		206 dB (13 JA)
Electrical		48 V dc (±10%), Typical 15 W, Max 120 W
Communication		RS485, baud rate switchable, ethernet 100 Mbps
Operating Temperature		-5 to 40°C
Storage Temperature		-20 to 45°C
Mechanical Construction		Aluminium bronze
Dimensions; Length x Diameter		391 x 310 mm
Weight in Air/Water		46.9/29.0 kg
Options		Tilted array adaptor

[3] WBv2+ signals are 4x the duration of Sonardyne tone signals (WBv1 & WBv2 are 2x). The TEE figure shows the operational performance when comparing wideband and tone systems.
Detection performance is directly related to the signal energy (Joules (Watt seconds)) and not power. WBv2+ signals are longer in duration (greater energy) than WBv1 and Tone, therefore the detection performance is the same or improved for low transmit source levels.

12.1.5 8182-000-01 & 8193-000-12 Modem 6 Transceivers

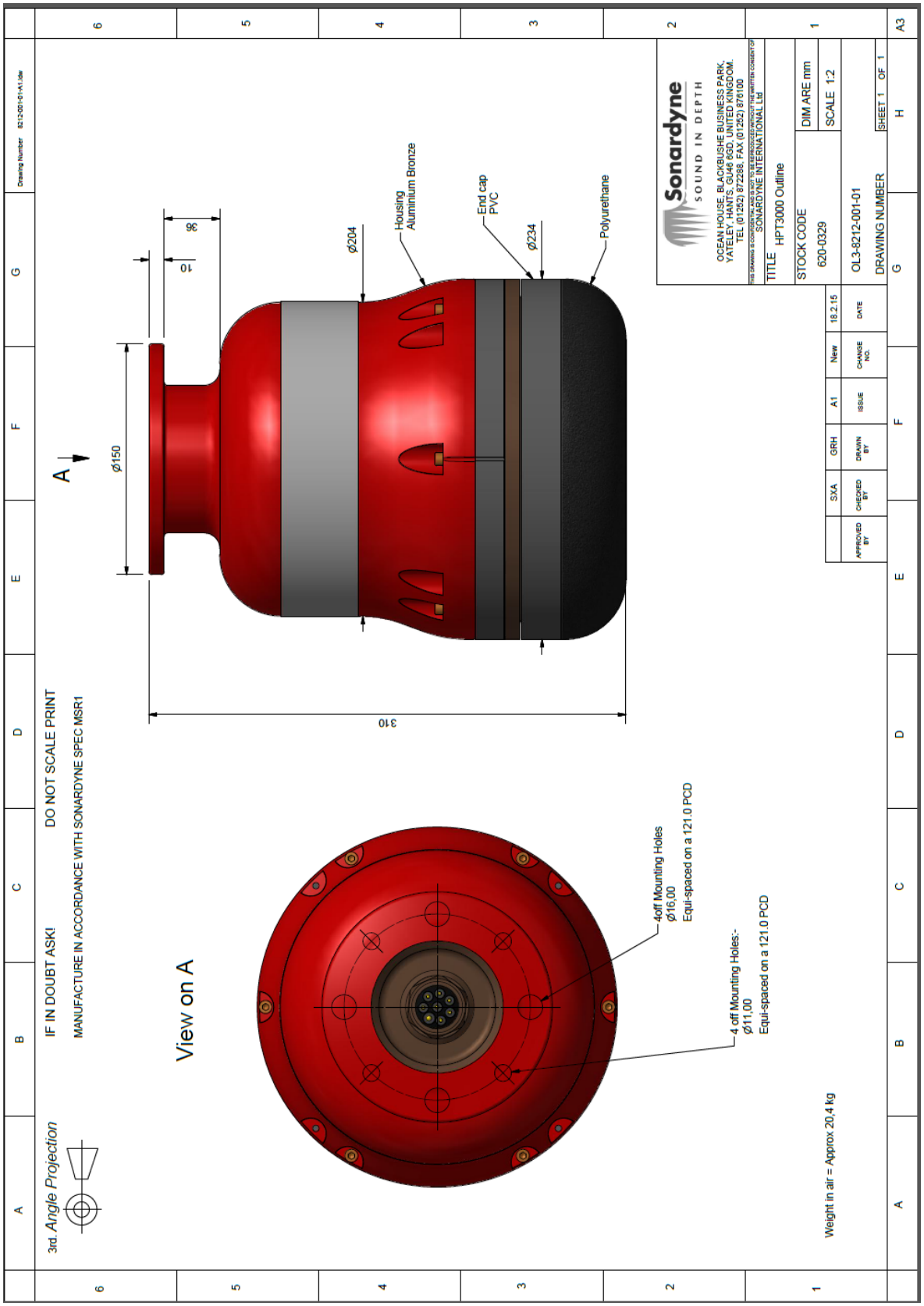
Feature	Type 8182-01	Type 8193-12
Operating Frequency	MF (21–32.5 kHz)	LMF (14–19 kHz)
Operating Range	Up to 7,000 m	Up to 12,000 m
Acoustic Coverage	Up to ± 90º	Up to ± 90º optimised for deepwater (depending on frequency of operation)
Transmit Source Level (dB re 1 µPa @ 1 m)	200 dB	200 dB
Tone Equivalent Energy (TEE)[4]	206 dB (13 JA)	206 dB (13 JA)
Transceiver 6 Operating Voltage	48 V dc (±10%), typical 15 W, max 120 W – supplied by the SIU	
SIU Operating Voltage	90–260 V ac, 50/60 Hz, 200 VA max	
Serial Communication	Primary and secondary port: RS485 (half-duplex) SIU input: RS232	Primary and secondary port: RS485 (half-duplex) SIU input: RS232
Operating Temperature	-5 to 40°C	-5 to 40°C
Storage Temperature	-20 to 45°C	-20 to 45°C
Mechanical Construction	Aluminium bronze	Aluminium bronze
Dimensions (Height x Diameter)	370 x 225 mm	439 x 310 mm
Weight in Air /Water[5]	28/15 kg	41/20 kg
Surface System Kit	Sonardyne Part Number	
Surface Interface Unit (SIU)	620-7079	
Cable Drum (100 m)	641-3614	
Deck Cable (5 m)	820-0127	
Dunker Cage	641-3612	

[4] WBv2+ signals are 4x the duration of Sonardyne tone signals (WBv1 & WBv2 are 2x). The TEE figure shows the operational performance when comparing wideband and tone systems.
Detection performance is directly related to the signal energy (Joules (Watt seconds)) and not power. WBv2+ signals are longer in duration (greater energy) than WBv1 and Tone, therefore the detection performance is the same or improved for low transmit source levels.

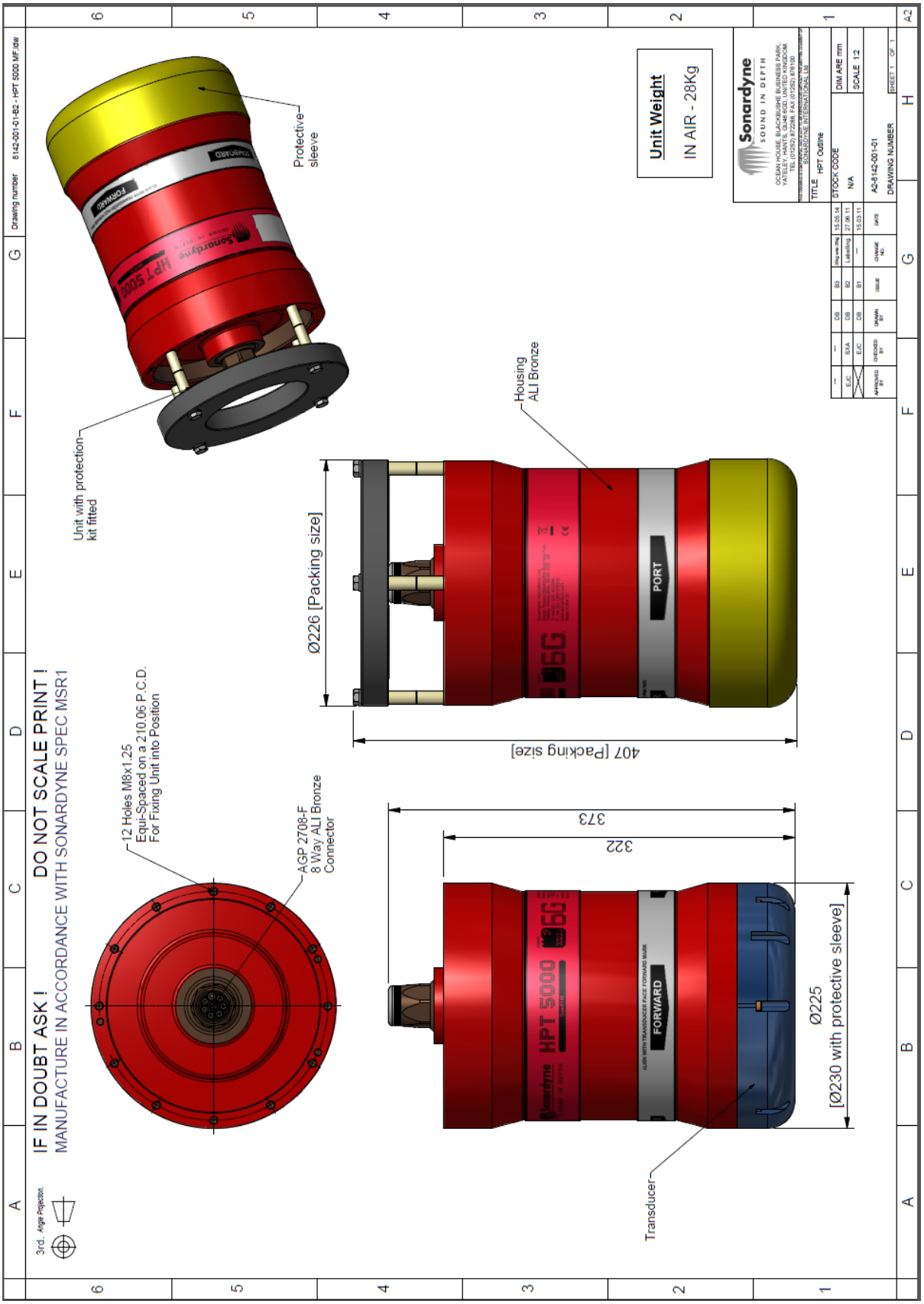
[5] Estimated Weights.

12.2 Transceiver Drawings

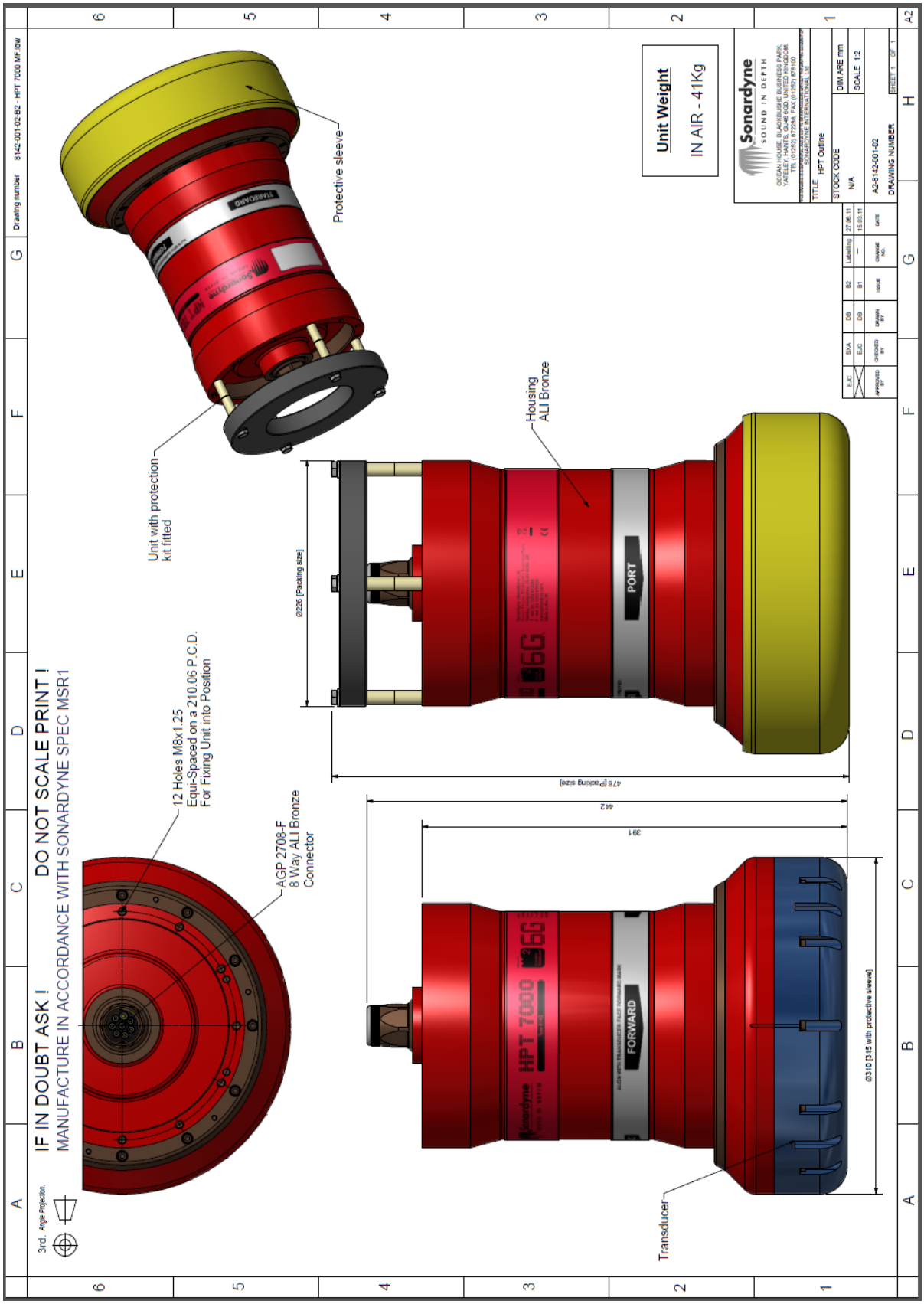
12.2.1 8221/8212-000-01 HPT 2000/3000 Dimensions



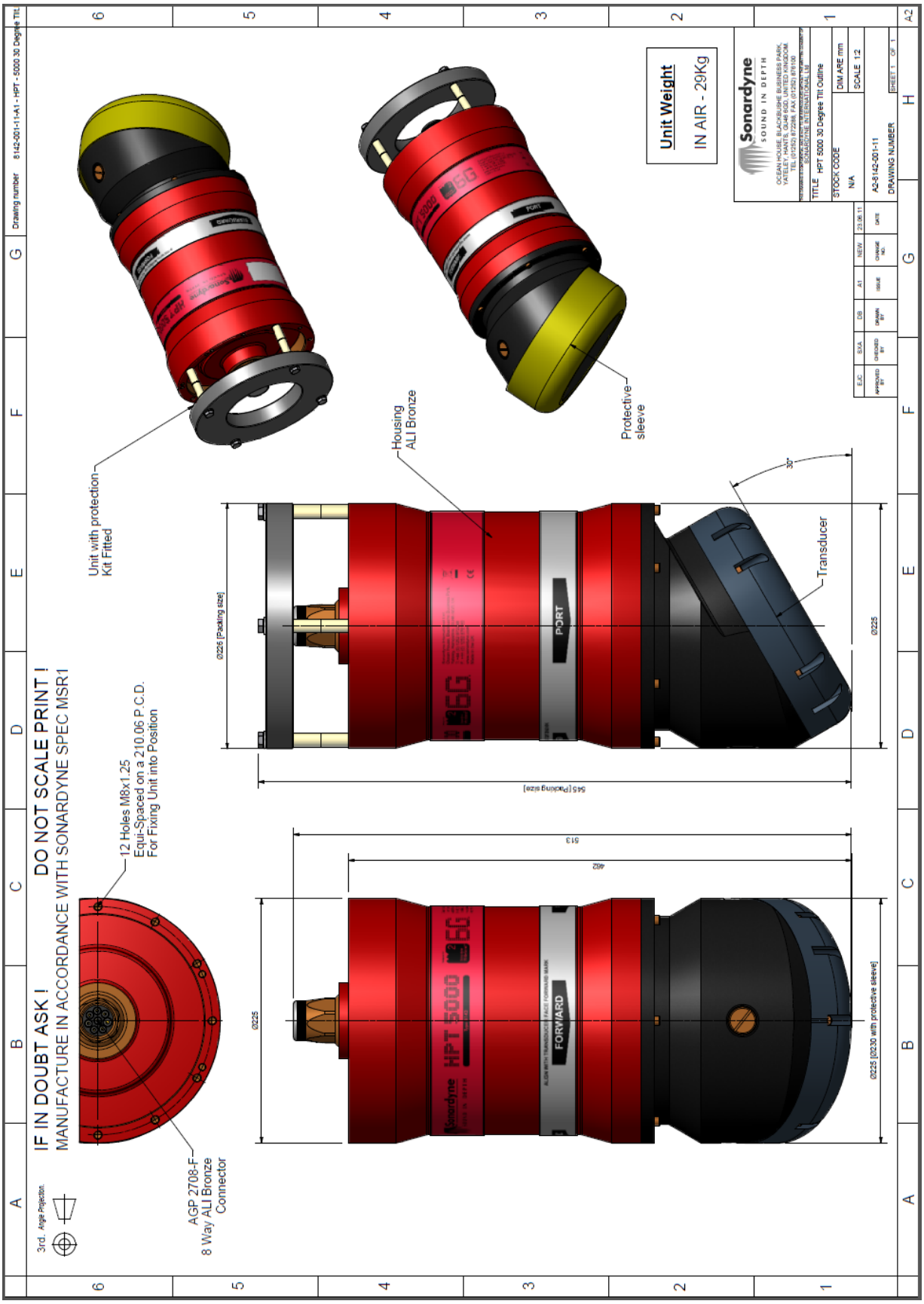
12.2.2 8142-000-01, 8142-000-31, 8182-000-01 HPT 5000 Dimensions



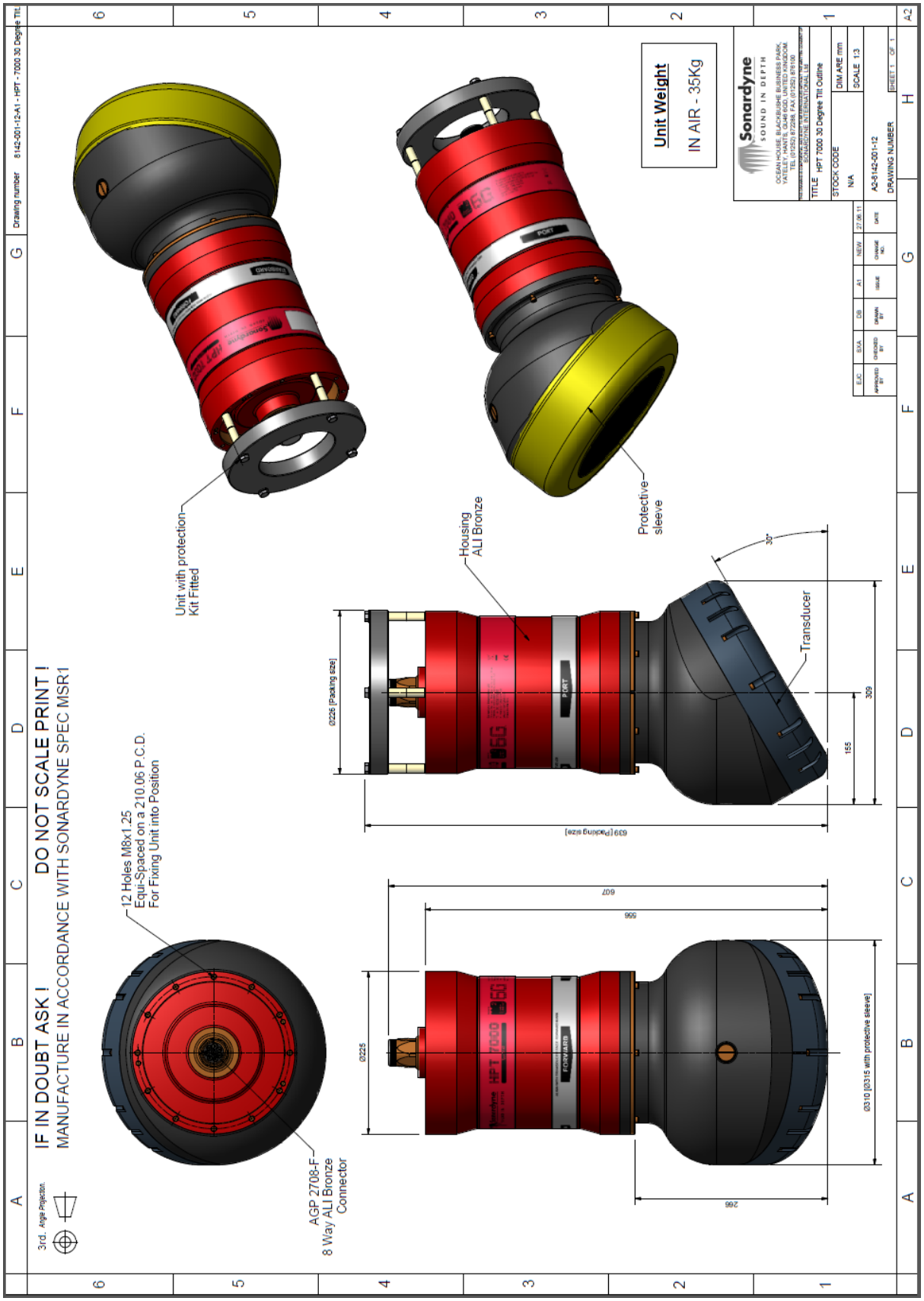
12.2.3 8142-000-02, 8142-000-32, 8182-000-02 HPT 7000 Dimensions



12.2.4 8142-000-11 HPT 5000 Dimensions



12.2.5 8142-000-12 HPT 7000 Dimensions

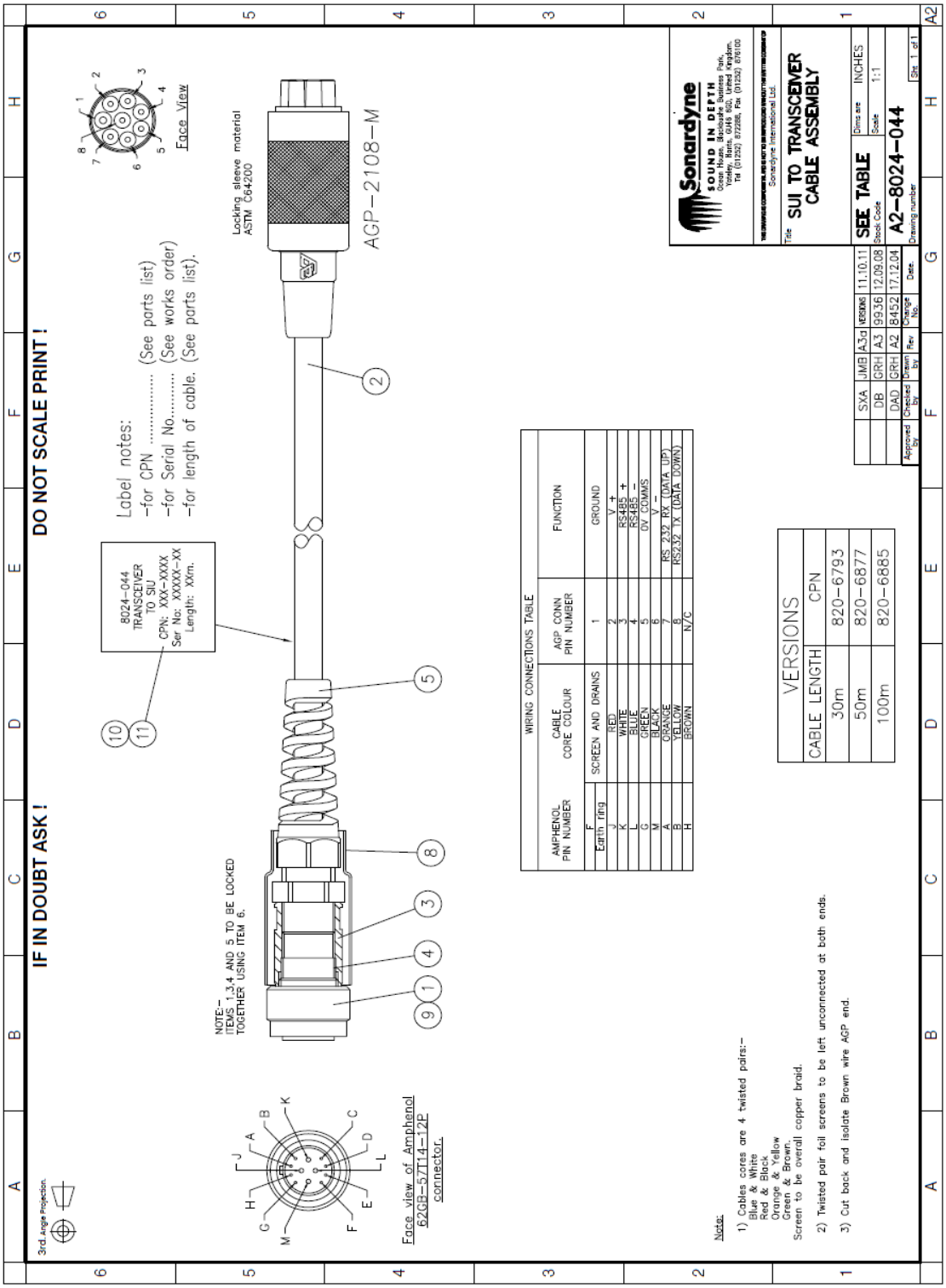


12.3 Transceiver Cable Drawings

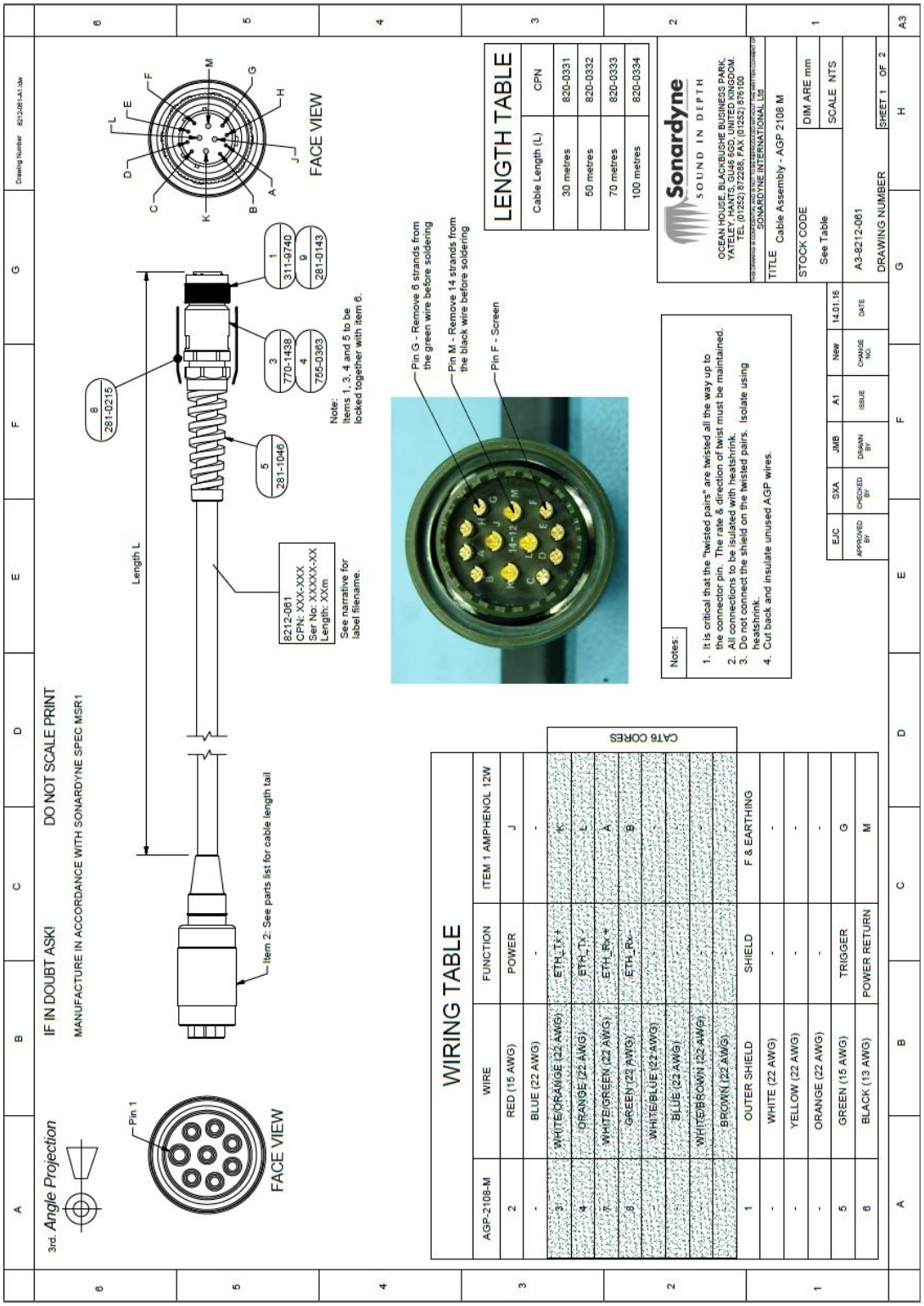
12.3.1 8024-044/820-6793 Amphenol to AGP Cable Assembly

Note

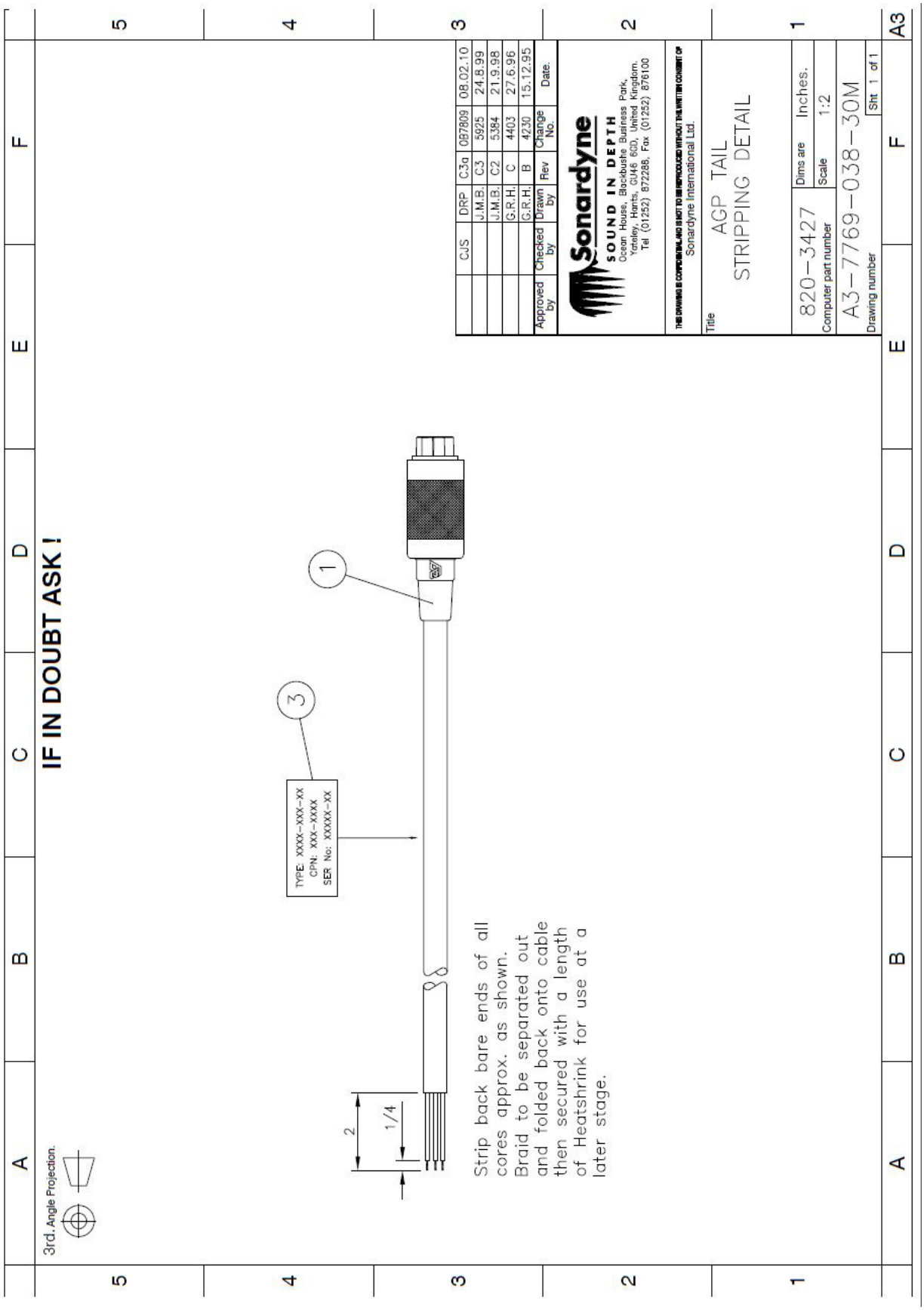
For Type 8221/8212 wiring "Function" see the wiring connections table shown in *Table 4-3*.



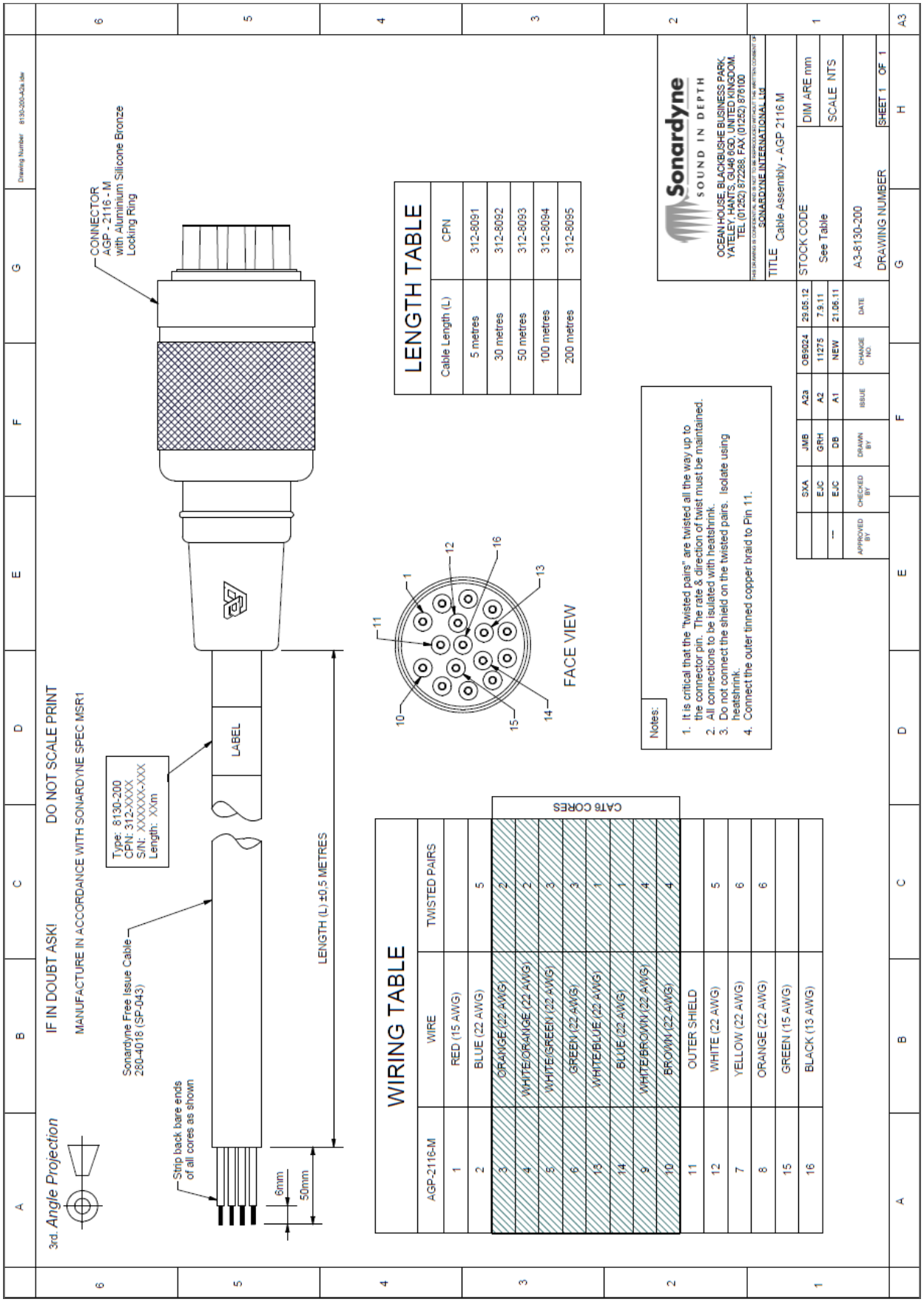
12.3.2 8212-061/820-0331 Amphenol to AGP Cable Assembly



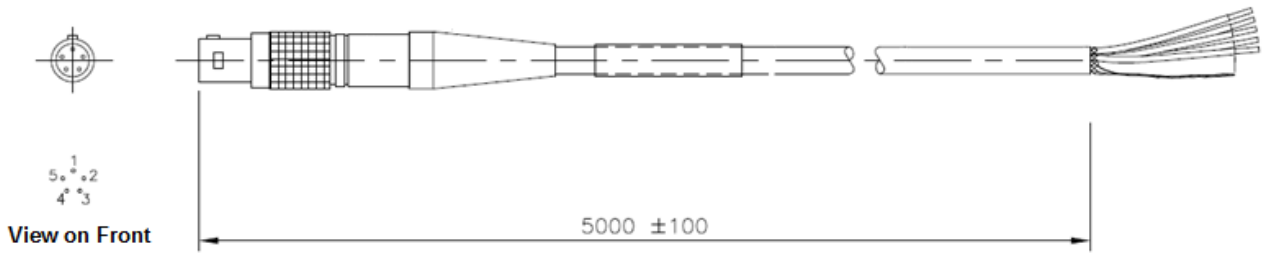
12.3.3 7769-038 8-Way AGP Tail



12.3.4 8130-200 16-Way AGP Tail

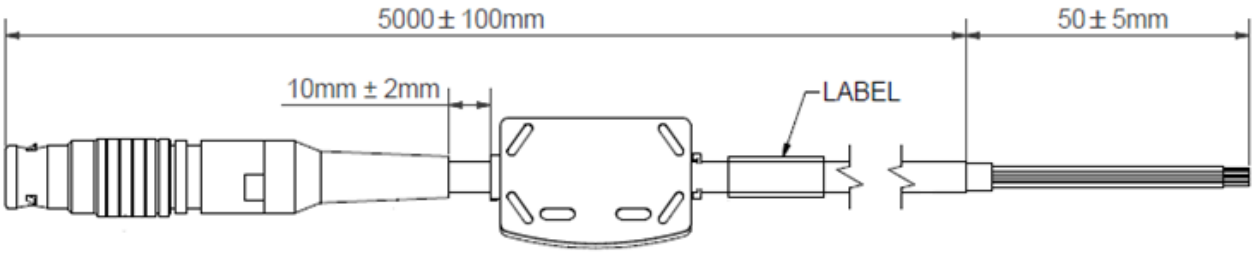


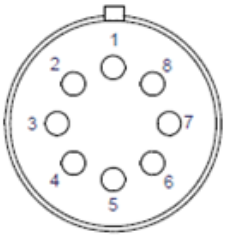
12.3.5 CPN 820-3650/DWG 7784-159 Serial Cable



Pin No.	Wire Colour (Issue B3 and Earlier)	Wire Colour (Issue B4)	Wire Colour (Issue C1)	Serial I/O RS422 Signal	Serial I/O RS232 Signal
1	Red	White	Red	TX+	RTS Out
2	Black	Brown	Black	TX-	Data Out
3	Blue	Green	Green	RX+	CTS In
4	Green	Yellow	Black	RX-	Data In
5	Yellow	Grey	White	0 VI	0 V
Body	Screen	Screen	Screen	Screen	Screen

12.3.6 CPN 820-6459/DWG 8020-061 8 Pin Lemo to Flylead





REAR VIEW OF CONNECTOR

Pin No.	Wire Colour (Issue A2 and Earlier)	Wire Colour (Issue A3 and Later)	Wire Colour (Issue A5)		Serial I/O RS422 Signal
1	Red	White	Red	Pair	RS485+
2	Blue	Brown	Black		RS485-
3	Green	Green	Black	Pair	0 Vl
4	Yellow	Yellow	White		Cable Detect
5	White	Grey	Green	Pair	+24 V TCVR
6	Black	Pink	Black		TCVR RTN
7	Brown	Blue	Black	Pair	TCVR RTN
8	Violet	Red	Blue		+48 V TCVR
Body	Screen	Screen	Screen		Screen

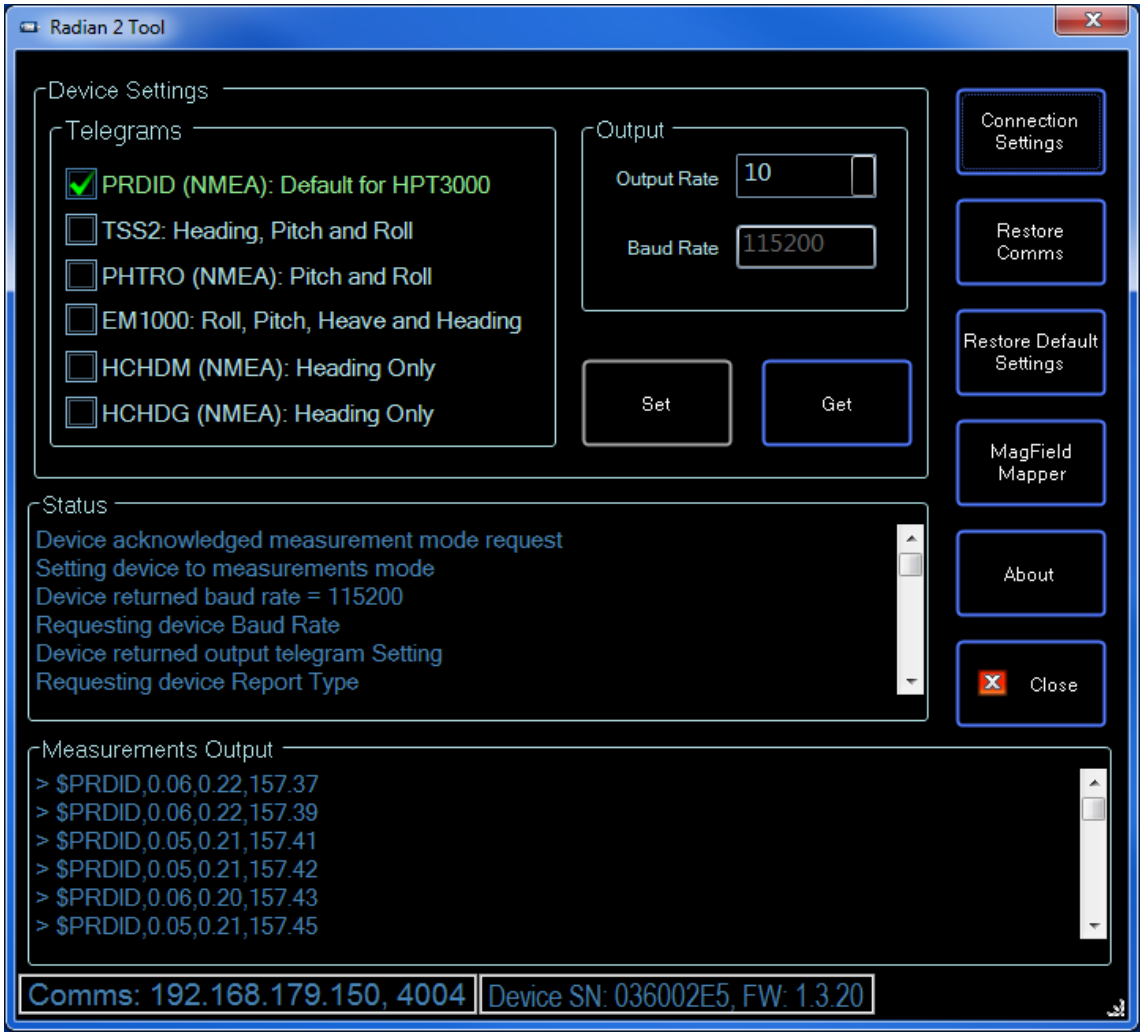
Appendix A – Radian 2 Tool

A.1 Introduction

The Sonardyne Radian 2 Tool can be used to calibrate the HPT 3000's internal attitude sensor and magnetic compass. The sensor is an Xsens MTi-30 magnetic compass which works by measuring the earth's magnetic field to determine the direction of north. A locally distorted (warped) magnetic field (caused by ferromagnetic materials in close proximity to the sensor) can result in an error in orientation that can be quite substantial. Further information on the Mti-30 sensor can be found at: www.Xsens.com.

A.2 Radian 2 Tool Description

1. Click **Start > All programs > Sonardyne > Ranger2 > Radian2Tool** to open the Radian 2 Tool.

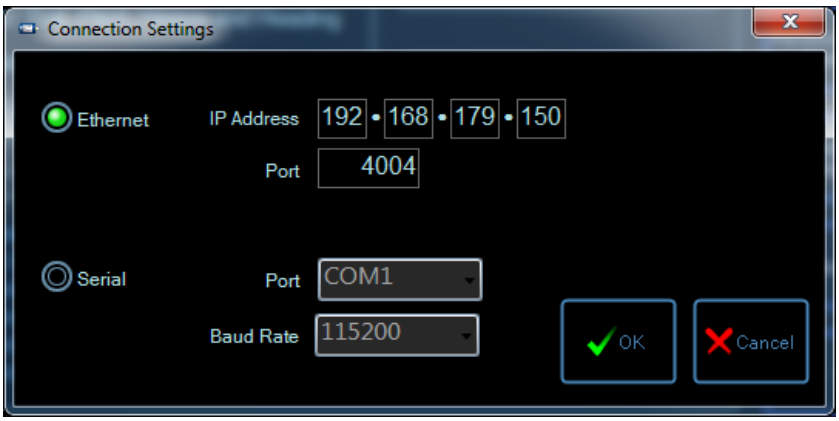


2. Click **Connection Settings** and select the **Ethernet** radio button.

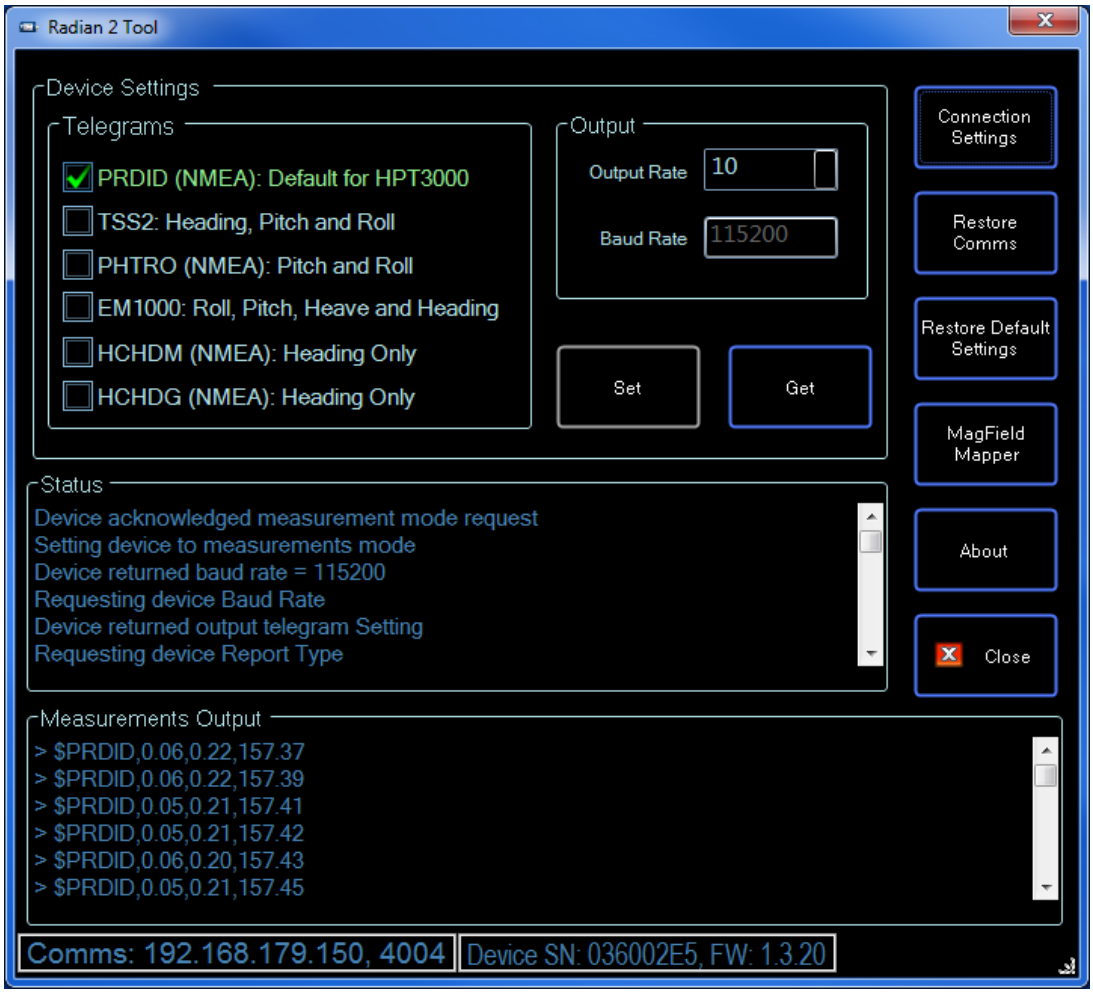
3. Type the **IP Address 192.168.179.150** and **Port 4004** and then click **OK**.

Note

When this is connected the attitude data will be unavailable in the Mini-Ranger 2 software.



The default settings are configured to work with an HPT 3000 system. If the parameters are not as displayed below then the internal sensor may not perform correctly when used in Mini-Ranger 2 software.



The table below describes the button functions on the main window.

Button	Function
	Opens the Connections Setting window.
	Sends a break over a serial line to reset the unit (this is not possible using an Ethernet connection).
	Restores the default settings on the sensor (PRDID (NMEA) telegram at an output rate of 10 hz).
	Opens the Magnetic Compass Calibration for calibrating the local magnetic field disturbances (*see Section A.3*).

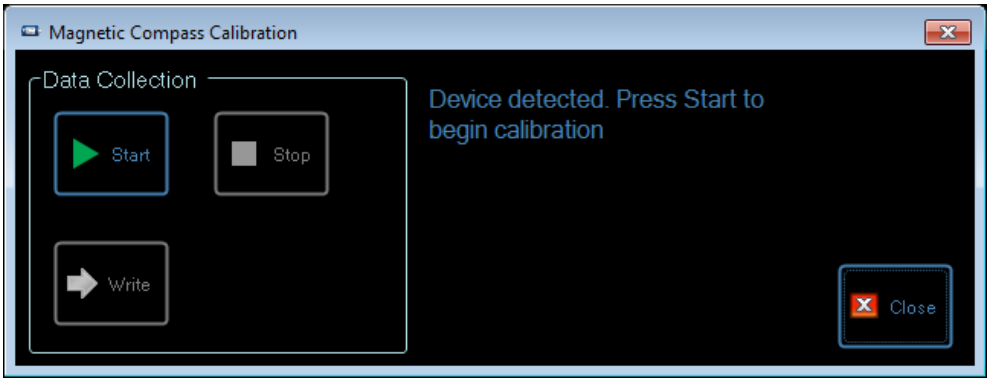
A.3 Magnetic Compass Calibration

The magnetic compass which works by measuring the earth's magnetic field to determine the direction of north. A locally distorted (warped) magnetic field (caused by ferromagnetic materials in close proximity to the sensor) can result in an error in orientation that can be quite substantial.

To correct for possible disturbances, it is necessary (when the HPT 3000 is first deployed) to run the following calibration procedure to correct for the disturbance to the magnetic field.

A.4 Calibration Procedure

Figure A-1 Magnetic Compass Calibration Tool

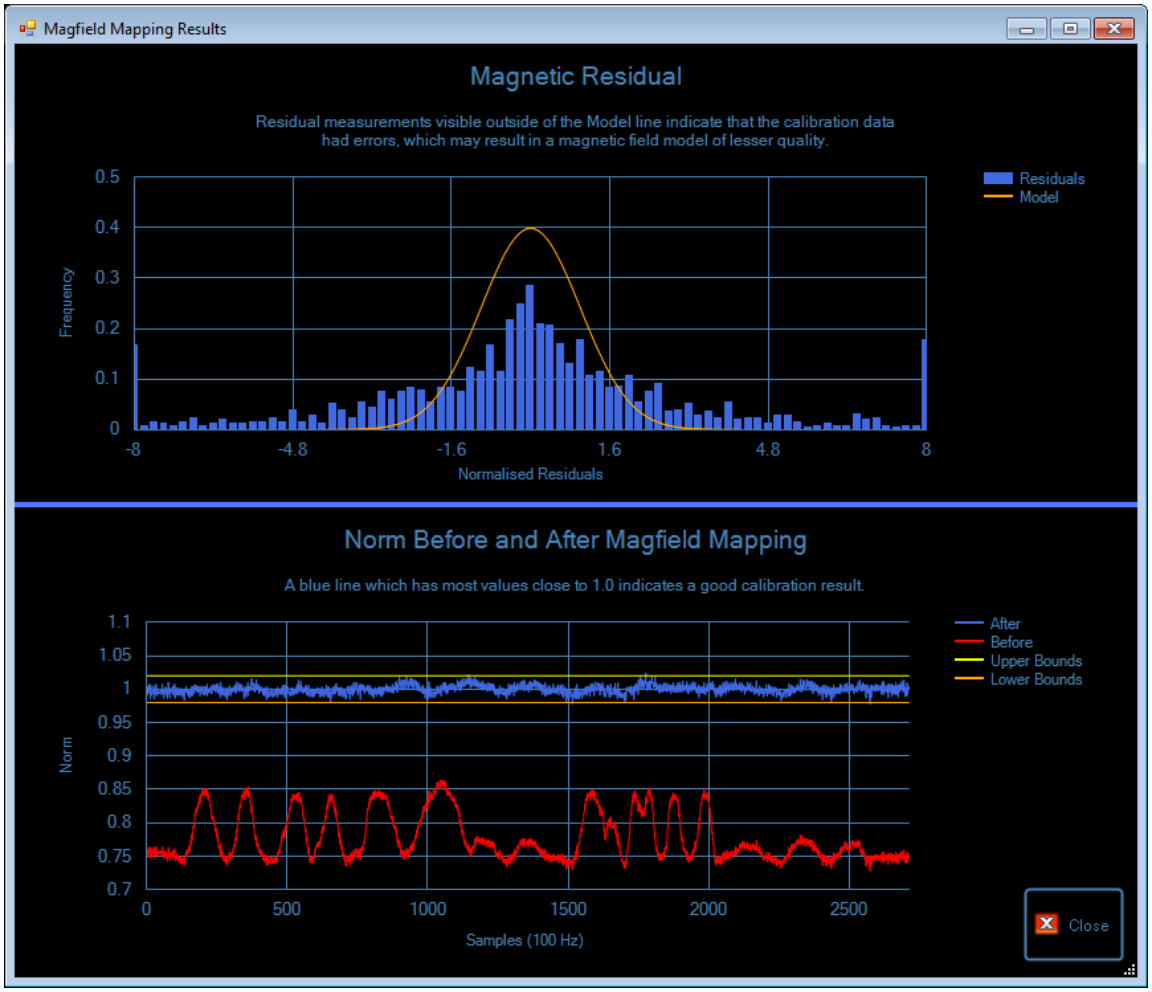


1. The device will switch to calibration mode and the tool will begin collecting data. Data collection should continue for at least two minutes, during which time, the vessel should be slowly rotated through 360 degrees.
2. Click **Stop** to end the measurement process and to start the data analysis procedure. If the tool is able to produce results from the collected data, the MagField Mapping Results form will be displayed as shown in *Figure A-2.*

A.5 Calibration Results

By examining of the graphs in *Figure A-2*, a judgement can be made as to the quality of the Magfield Mapping.

Figure A-2 Magfield Mapping Results



Appendix B – Deployment and Recovery Log Book

	Date	Time	Sea State	Name Sign/Print
Deployed				
Recovered				
Deployed				
Recovered				
Deployed				
Recovered				
Deployed				
Recovered				
Deployed				
Recovered				
Deployed				
Recovered				
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Deployed				
Recovered				
Deployed				
Recovered				

Appendix C – Repairs Log Book

Date	Time	Reason for Repair	Name Sign/Print

Appendix D – Servicing Log Book

Date	Time	Type of Servicing	Name Sign/Print

Appendix E – Sea State Table

Wave Height (metres)	Wave Height (feet)	Characteristics
0 m	0 ft	Calm (glassy)
0 to 0.1 m	0 to 0.3 ft	Calm (rippled)
0.1 to 0.5 m	0.3 to 2 ft	Smooth (wavelets)
0.5 to 1.25 m	2 to 4 ft	Slight
1.25 to 2.5 m	4 to 8 ft	Moderate
2.5 to 4 m	8 to 13 ft	Rough
4 to 6 m	13 to 20 ft	Very Rough
6 to 9 m	20 to 30 ft	High
9 to 14 m	30 to 46 ft	Very High
Over 14 m	Over 46 ft	Phenomenal

Appendix F – Acoustic Navigation Principles

F.1 Acoustic Processing Principles

The two tasks the USBL transceiver performs in the acoustic domain are as follows:

- Positioning
- Data Exchange

Although these functions may seem like separate tasks, precise positioning information is always available as a result of the data exchange.

F.1.1 Positioning

Positioning involves an acoustic cycle. The USBL transceiver sends a Sonardyne Wideband®2 signal to the transponder. This activates the transponder which sends back a Sonardyne Wideband®2 signal to the USBL transceiver. The USBL transceiver will process the information received from the transponder as follows:

- Range
- Azimuth
- Elevation

Other parameters which are available as a result of the processing are as follows:

- Signal strength
- Signal to Noise Ratio (SNR)
- Doppler
- Detailed channel estimate which allows multipath to be tracked

The DFE cycle goes through the stages that follow:

- The DFE commands the USBL transceiver to transmit an interrogation signal.
- The transponder replies are detected by the USBL transceiver which measures the elapsed time and bearing.
- The data is reported to the DFE; at the same time the DFE will have received the vessel's Heading, Roll and Pitch (HRP) data.
- The DFE computes the position of the transponders relative to the vessel and reports the data to the DP system.
- If heading data is present, the processor can compute the position of the vessel (in a North referenced grid) relative to the transponder fixed to the seabed.
- Without heading data, vessel position would only be known in terms of range, bearing and elevation from the transponder.

Navigation cycles may contain multiple replies to allow many transponders to be tracked simultaneously.

F.1.2 Sonardyne Wideband® 2 Signals

There are more than 600 Sonardyne Wideband 2 signals. The different signals means the system can be adjusted to various environmental conditions e.g. deep or shallow water and allow accurate Doppler estimates of the target being tracked.

The latest processing techniques allow range accuracies of millimetres (excluding error contributions' from environmental effects).

Using the Sonardyne Wideband 2 signals the USBL transceiver will also provide a precise position estimate. This estimate is then passed to the surface controller as a direction cosine allowing an X, Y, Z position to be computed by the navigation controller.

F.1.3 Data Exchange

The acoustic data exchange between USBL transceiver and transponder is in the form of setting up the transponder. The acoustic data exchange is also used for data retrieval from the transponder. This could be a 'real time' retrieval of a sensor measurement or an upload of stored data.

The USBL transceiver has many options of acoustic telemetry. It ranges from a secure Spread Spectrum (SS) wideband telemetry at 100 bps to a High Data Rate (HDR) transmissions of 6000 bps (user data). The unit has many levels to allow the system to adapt to the most efficient and robust data exchange.

F.2 USBL

The USBL system can be used to track Remotely Operated Vehicle (ROV), Tow fish and divers relative to the vessel. It can also be used as a position sensor for a vessel during Dynamic Positioning (DP).

F.2.1 ROV/Tow Fish Tracking

A transponder is placed on an ROV, tow fish or diver as applicable. The USBL system will track the depth and bearing of the ROV, tow fish or diver relative to the vessel.

F.2.2 Dynamic Positioning

Dynamic Positioning (DP) control of a vessel removes the need to anchor the vessel. The DP system receives information from the DFE. The DFE receives information from the Attitude and Heading Reference System (AHRS), Gyro Compass and Digital Global Positioning System (DGPS). A DP vessel is fitted with a number of thrusters located in the hull, in addition to the main propellers. The thrusters and propellers are managed by the DP system to keep the vessel on a constant heading and in a constant position whatever the forces from wind, current and wave action.

For the DP application to function with USBL a reference transponder is placed on the seabed and the position of the transponder or array in the vessel frame is reported to the DP control system. This is done by using the repeating acoustic ranging cycles from the USBL transceiver.

Another method is to place a transponder on a ROV following a line feature such as a pipeline. The USBL/DP system will then control the vessel to follow the ROV. This can be referred to as "the dog on a lead" or "follow the sub" principle.

F.3 LUSBL

The USBL transceiver can be used in a LUSBL configuration to provide a higher degree of accuracy in DP applications.

F.3.1 Dynamic Positioning

For the DP application to function with LUSBL, an array of transponders is placed on the seabed and the position of the transponders or array in the vessel frame is reported to the DP control system. The USBL transceiver measures the range and bearing to multiple transponders in one ranging cycle and reports the results.

F.3.2 Underwater Positioning

The greater accuracy of the LUSBL system is required, when the position of an underwater structure needs to be known more accurately than can be achieved by any other method. By deploying more than one transponder, the LUSBL is able to use statistical filtering techniques to reduce the impact of system errors.

F.3.3 Marine Riser Angle Monitoring

Setup and control functions for a Marine Riser Angle Monitoring System (MRAMS) are built into the L/USBL system. The MRAMS alarm levels can be displayed on the L/USBL screen while in Navigation mode. The MRAMS constantly measures the angle between the Blow-Out Preventer (BOP) and the riser.

F.4 Long BaseLine Principles

A Long BaseLine (LBL) system has two parts or segments.

The first segment comprises a number of acoustic transponders moored in fixed locations on the seabed. The positions of the transponders are described in a co-ordinate frame fixed to the seabed. The distances between them form the “baselines” used by the system.

The second segment comprises an acoustic transducer on a USBL transceiver which is temporarily installed on the vessel, or on a Tow Fish. The distance from a transducer to a transponder can be measured by causing the transducer to transmit a short acoustic signal which the transponder detects and causes it to transmit an acoustic signal in response. The time from the transmission of the first signal to the reception of the second is measured. As sound travels through the water at a fixed speed, the distance between the transducer and the transponder can be estimated.

The process is repeated for the remaining transponders and the position of the vessel relative to the array of transponders is then calculated or estimated.

Navigation can be achieved using just two seabed transponders but in doing this there is a possible doubt as to which side of the baseline (a line drawn between the transponders) the vessel may be on, also the depth or height of the transducer has to be assumed.

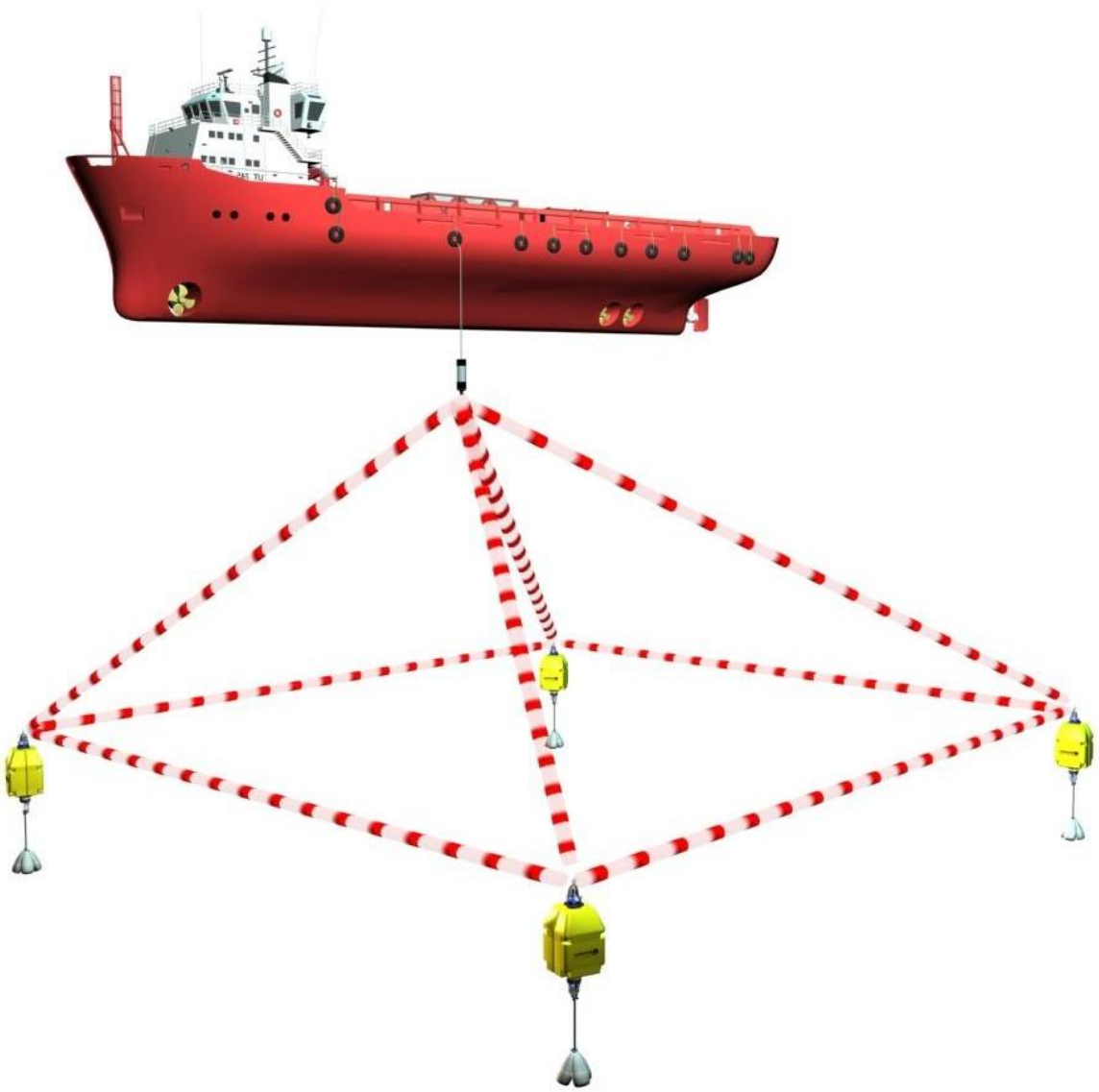
Three transponders is the minimum required for certain navigation in three dimensions. Four is the minimum number required for some degree of redundancy—which is useful for checks on the quality of navigation.

LBL baselines are much larger, so an LBL system is very accurate compared with the Short BaseLine (SBL) and Ultra-Short BaseLine (USBL) versions and also has the advantage of positioning the vessel (or any other object) directly in a "fixed" or an inertial frame. This removes most of the problems associated with vessel motion.

The array of seabed transponders needs to be calibrated and there are several techniques to do this. The applicable technique depends on the requirements of the task or job and the available hardware.

With the continuing integration of LBL, SBL and USBL systems, intelligent transponders (that measure baselines directly) and satellite navigation systems, the calibration of seabed arrays is becoming a quick and simple operation. The operator will be free to choose the techniques applicable to the task requirements.

Figure F-1 LBL System



F.5 Short BaseLine Principles

A Short BaseLine (SBL) system is can be fitted to a vessel such as a barge, semi-submersible or a large drilling vessel. A number of at least three or four acoustic transducers are fitted in a triangle or a square on the lower part of the vessel. The distance between the transducers is made as large as is practical, and it is this distance that is known as the baseline.

The position of each transducer within a co-ordinate frame fixed to the vessel is determined by conventional survey techniques or from the "as built" survey of the vessel.

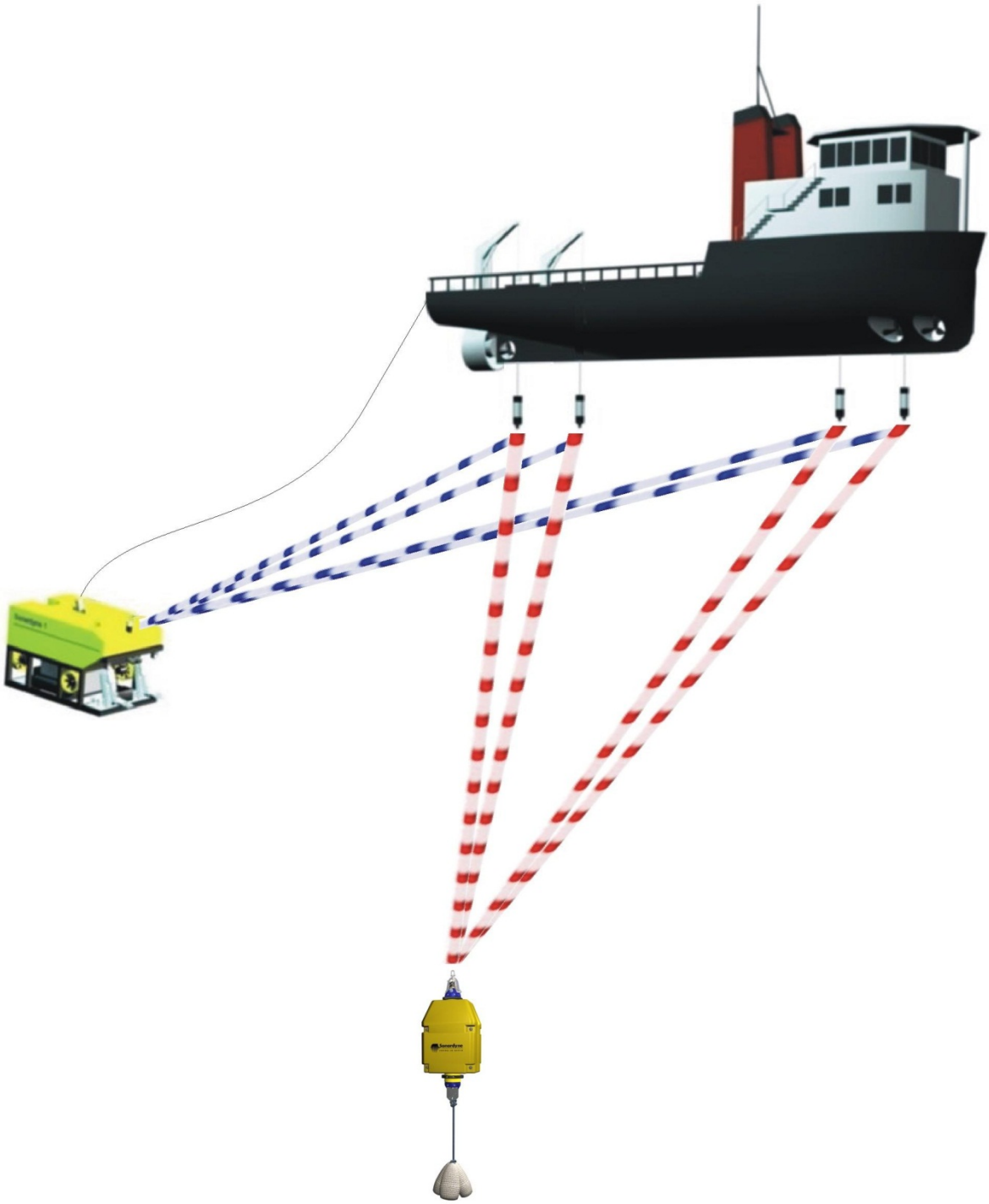
If the distance from the transducers to the transponders is measured as described for LBL, then the position of the transponders, within the vessel co-ordinate frame, can be computed. If redundant measurements are made, a best estimate can be determined which is, statistically, more likely to be more accurate than the basic position calculation.

It is impractical to transmit a signal from each SBL transducer in turn, so the systems that use transponders transmit from one transducer but receive simultaneously on all transducers. The result is one distance (or range) measurement and a number of range (or time) differences.

With an SBL system, the co-ordinate frame is fixed to the vessel. The vessel is subject to roll, pitch and yaw motion. This movement can be overcome by using additional equipment such as a Attitude and Heading Reference System (AHRS) to measure roll and pitch and a Gyro-compass to measure yaw. The co-ordinates of the transponders can then be calculated mathematically to remove the effect of the movement.

To estimate the position of the vessel in a "fixed" or "inertial" frame such as one fixed to the seabed. Then at least one transponder should be in a fixed position on the seabed and used as a reference point. This principle is used for Dynamic Positioning (DP) of vessels. If a transponder is fixed to the seabed and a responder located on a Remotely Operated Vehicle (ROV), the system will calculate the position of the vessel and the ROV in a seabed-fixed frame.

Figure F-2 SBL System



F.6 Ultra-Short BaseLine Principles

USBL transducers are all built into a single USBL transceiver assembly—or the array of transducers is replaced by an array of transducer elements in a single USBL transceiver assembly.

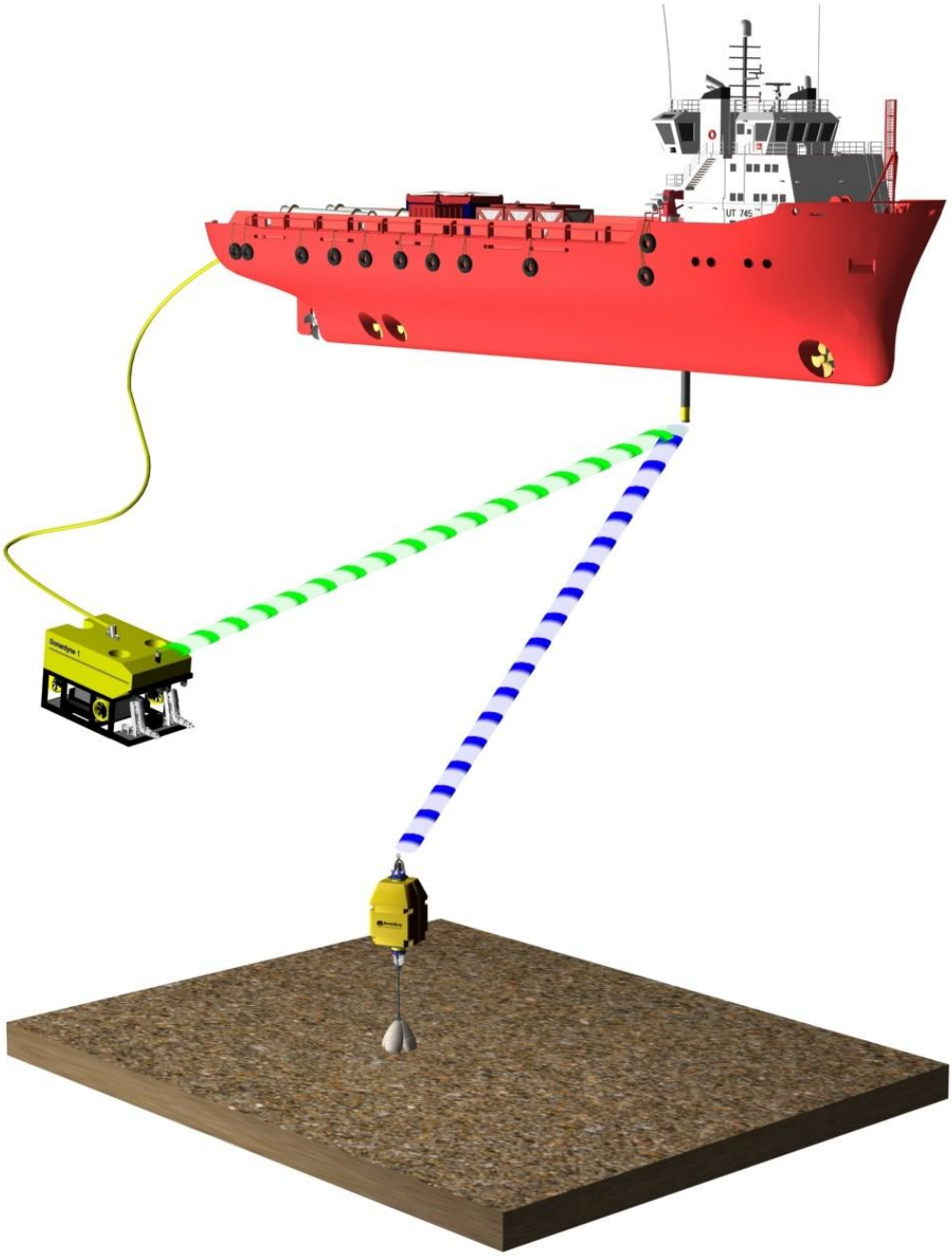
The distances or ranges are measured as they are in an SBL system, but the time differences are now much less. Systems using sinusoidal signals measure the "time phase" of the signal in each element with respect to a reference in the receiver. The "time phase differences" between transducer elements are computed by subtraction and then the system is equivalent to an SBL system.

Similar rules apply in that systems using three elements (or groups of elements) have the same restrictions as SBL systems with three transducers. USBL systems using four elements have the same restrictions as SBL systems using four transducers and so on.

Another restriction is that if an unambiguous position within a hemisphere is required and there are only three elements or element groups in use, then the element spacing must be less than one-half wavelength of the signal. Alternatively, a prior set of measurements must have been made with an element spacing of less than one-half wavelength.

Another difference is that the transducer elements are in a USBL transceiver assembly that is placed somewhere in the vessel frame. The attitude of the assembly in the vessel frame must be measured during installation. A USBL system positions a transponder in a frame fixed to the USBL transceiver assembly, not directly in a vessel-fixed frame as in the SBL case.

Figure F-3 USBL System



F.7 Long Ultra Short BaseLine Principles

The Long Ultra Short BaseLine (LUSBL) system is a variation of a USBL system. It uses USBL hardware in a configuration similar to the one described for the LBL system.

The range and bearing in a LUSBL system is measured as for a basic USBL system, but a larger number of transponders are deployed on the seabed, so a greater accuracy can be achieved.

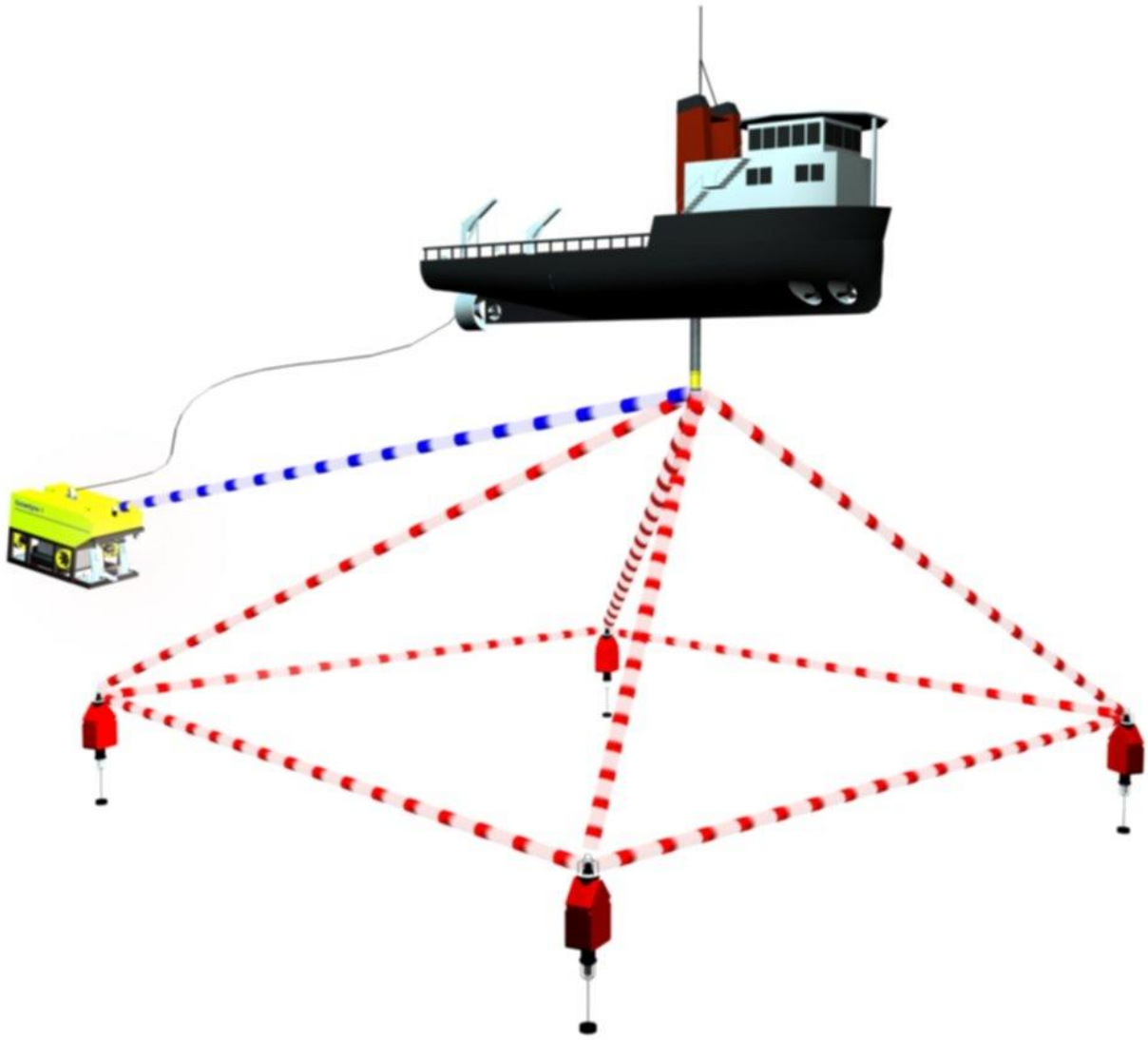
In a LUSBL system, the seabed array must be calibrated separately, and the baseline data entered manually into the LUSBL navigation processor. If a radio navigation input is available to the LUSBL system, it is possible to locate each seabed transponder directly in an earth-referenced frame to an accuracy determined by the accuracy of the radio navigation system. Using this method removes the need for the separate calibration of the seabed transponder array.

If transponders of the COMPATT type are used on the seabed, it is possible for the seabed array, under command from the LUSBL system, to be self-calibrating. Using COMPATT transponders has the advantage of giving the system more flexibility so they can be commanded to respond to a variety of frequencies and with any delay time. As an operator, the COMPATT version of the system is simpler and faster to set up and use.

Two complete sets of LUSBL equipment (navigation processor, monitor/keypad and transceiver) may operate in tandem to form a dual-redundant version of the system. The two sub-systems are cross-linked in the event of a failure of any major element. The system operation will continue without operator intervention. As an operator, the operation of the dual-redundant version is almost the same as a standard version.

In operation, one of the sub-systems operates as the “master system” and performs all normal system functions. The second sub-system monitors the function of the “master system” and will take over system operation if it detects that the “master system” is not functioning.

Figure F-4 LUSBL System



Definitions

Term	Definition
6G®	Sonardyne's sixth generation technology hardware platform.
Acoustic Responder	An instrument that emits an acoustic signal in response to an electrical signal carried to it by cable.
Acoustic Signal	Information carried by sound pressure waves through water. The Sonardyne acoustic signal has a finite length.
Acoustic Synchronous / Precision Pinger	An instrument that emits signals regularly without an interrogating signal. A SYNCHRONOUS Pinger can be synchronised to an external master signal. A PRECISION Pinger has an accurate internal time standard.
Acoustic Transceiver	An instrument that emits and receives acoustic signals and extracts information from them. Transceivers can measure the time it takes a signal to travel from its transducer to a transponder and return. Some can encode and send data in a message and extract digital data from a message (Acoustic Telemetry). Used on a surface vessel or to mark a point on the seabed, or fixed to a mobile for tracking or positioning.
Acoustic Transducer	A device that converts electrical signals into acoustic signals and vice versa.
Acoustic Transponder	An instrument that emits an acoustic signal when it detects an interrogating acoustic signal.
Acoustic Transponder (Intelligent Transponder)	A type of transponder that is managed by a micro-controller. Examples include the COMPATT (COMPuting And Telemetry Transponder) and the WMT (Wideband Mini Transponder). Depending on supported functionality it can: Decode acoustic telemetered commands from a transceiver and can send telemetered data to the transceiver. It can measure the distance between itself and other transponders and then telemeter the data to a transceiver. It can be capable of measuring its depth and the temperature of the water. It can be used to measure a variety of underwater parameters and telemeter these back to the surface. It can be used, as an intelligent angle-measuring device, in a Riser Angle Monitoring System. It can be fitted with a release mechanism so it can return, on command, back to the surface e.g. if battery power is low.
ANT	Acoustic Navigation Tester
ANT serial port	Used for diagnostic checks.
Attitude and Heading Reference System (AHRS)	An inertial sensor that provides outputs of heading, pitch and roll.
CIF	Common Interrogation Frequency
CMOS	Complementary Metal Oxide Silicon. A major integrated circuit technology based on combinations of p-channel and n-channel field effect transistors fabricated on the same silicon substrate. Especially attractive in low-power applications since the basic CMOS logic gate only consumes significant power during switching.
COMPATT	COMPuting and Telemetry Transponder (see Acoustic Intelligent Transponder)
Common Reply Signal (CRS)	A reply signal common to a complete family of addressed transponders.
CPN	Computer Part Number
CPU	Central Processing Unit
CRF	Common Reply Frequency

Term	Definition
DAS	A micro-controlled data acquisition and logging sub-assembly located within a transponder.
Data Fusion Engine (DFE)	Acts as the system controller, generates the display signals for the monitor, processes the data from the transceiver for the display to the operator and output to a DP system and talks to various "attitude" sensors and other navigation systems.
Delay between commands	Provides a delay between adjacent commands.
Depth Status	The transponder can be fitted with an optional depth sensor to send depth information at each interrogation.
Differential Global Positioning System (DGPS)	A 24 hour, world-wide radio navigation system. GPS receivers track and decode the data from satellites and calculate the position and speed of a vehicle.
Dynamic Positioning reference (DP Reference)	Several position inputs e.g. GPS receivers, taut wire sensors, LBL, SBL or USBL acoustic positioning sensors, wind speed indicators etc.
Dynamic Positioning System (DPS)	Automatically maintains a vessel with a constant heading, and in a fixed position without an anchor and provides more flexibility in operation.
Dynamic Positioning telegram (DP Telegram)	The report an acoustic positioning system sends to a DP system over a serial interface.
Digital Signal Processing (DSP)	The representation of signals by a sequence of numbers or symbols and the processing of these signals. DSP includes subfields like: audio and speech signal processing, sonar and radar signal processing, sensor array processing.
ESH	Ethernet Serial Hub
Firmware	The firmware installed on the transponder. Firmware updates can be installed via WSM Terminal. The Tx firmware refers to the transmission signal synthesiser.
Global Positioning System (GPS)	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.
HF	High Frequency
HPR	Hydro-acoustic Position Reference
HPT	High-Performance Transceiver
Inertial Navigation System (INS)	A navigation aid that uses a computer, motion sensors and rotation sensors to continuously calculate the position, orientation and velocity of a moving object without the need for external references.
Long BaseLine Positioning System (LBL)	A system where two or more transponders are on the seabed. The positions of the transponders are established by a calibration process in a seabed frame. The distances from a transducer to each transponder are measured using a transceiver. The position of the transducer can be computed in the seabed frame. The name comes from the "baselines" joining each transponder.
LUSBL	Long and Ultra Short BaseLine
MF	Medium Frequency
MRAMS	Marine Rise Angle Monitoring System
NSH	Navigation Sensor Hub
PCD	Pitch Circle Diameter

Term	Definition
PSU	Power Supply Unit
ROV	Remotely Operated Vehicle
Serial Communications Wait	The maximum time allowed for the Transponder to reply to an RS232 command.
Sonardyne	Sonardyne International Limited and its affiliates.
Sonardyne Wideband®2	6G® transponders and transceivers use Sonardyne Wideband® 2 ultra-wide bandwidth signals giving a faster and robust transmission of data, more precise ranging and mitigation from multipath in shallow water and amongst steel structures in deep-water.
SSM	Super Sub-Mini Transponder (WSM predecessor)
UDP	User Datagram Protocol
Ultra-Short BaseLine Positioning System (USBL\)	A system similar to an SBL system except the system uses three or more elements in a single transducer array. The measurements it makes are the differences in “time-phase” of the signals from each element. The co-ordinate frame is fixed to the transducer array which must be oriented in the vessel frame to be equivalent to the SBL.
VIV	Vortex Induced Vibration
VRU	Vertical Reference Unit
WSM	Wideband Sub-Mini Transponder

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