

UM-8300-Compatt 6

User Manual for Type 8300 Compatt 6 (and Variants)

Issue C1

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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	30/09/2010	First Issue	All	All
A	1	30/11/2010	Minor Changes	All	-
A	2	07/12/2010	Removed Section 4.2 – changing the inclinometer scaling range as this no longer applies for 6th Generation Transponders. Other minor typographical changes.	4.2	-
A	3	17/01/2011	Improved drawing resolution and details in Section 15. Section 4.1 inclinometer endcap drawing and mounting instructions clarified.	4.1, 15	-
A	4	21/01/2011	Improved the wording consistency.	2	-
B	0	18/02/2013	Reformatted the manual. Improved overall construction and consistency. Include new 6G Terminal Lite Software.	All	All
B	1	19/08/2013	ECN12238 Stock code for PCBs in recommended spares listing changed.	12	111
			Section 6.3 External Connector Pin-Out.	6.3	29
B	2	25/10/2016	OB11543/11657 Maintenance Section updated.	7	All
			Storage details added.	7.5	24
			References to iWAND added.	8	All
			References to battery disconnect fob added.	All	All
			Outline Drawings updated.	13.13	88–110
B	3	24/04/2019	Sections re-organised and general update.	All	All
			General update	All	All
C	1	11/05/2022	Maintenance <i>Table 8–2</i> updated for Type 8302 PIES.	8	page 32
			Formatted with new branding.	All	All

Section 1 – Introduction

1.1 Scope of this Manual

This User Manual describes the safe installation, operation and maintenance of the Type 8300 (and variants) wideband transponder. The information and procedures within this manual are based on Sonardyne's experience and knowledge.

1.2 Purpose of this Manual

This user manual contains information for anyone involved with installing, operating and maintaining the Type 8300 (and variants) wideband transponder.

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

To ensure the safety of the installer and operator is maintained it is important that all warnings and cautions in *Section 2 "Safety"* of this manual and in any related manuals are read and fully understood.

1.3 Related Publications

To ensure the equipment is operated safely, a Sonardyne Safety Manual is supplied with this user manual. It is important that the Sonardyne Safety Manual is read and fully understood before proceeding with any activity on the equipment.

Table 1–1 Related Publications

Publication	Title
<i>Sonardyne Safety Manual</i>	<i>Operational and Safety Precautions</i>
<i>UM-8300-099</i>	<i>User Manual for 6G Terminal Lite (included on the 6G Utilities media)</i>
<i>UM-8315</i>	<i>User Manual for the Type 8315 iWAND (included with the iWAND)</i>
<i>IM-Modem 6</i>	<i>Modem 6 Integration Manual</i>

1.4 Conventions

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
<i>Italic Type</i>	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

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

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

2.2.1 Warnings

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

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

 Electric shock. Electric shock hazard risk is present when dismantling or assembling the equipment. High voltages are present inside the transponder. Dismantling or assembling the equipment must only be carried out by trained personnel.

 High Internal Pressures Risk. Due to the high internal pressure risk, dismantling the sub-sea equipment must only be carried out by trained personnel.

 High Internal Pressures Risk. Make sure the pressure relief vent valve is manually operated to release any internal pressure before attempting to dismantle the equipment.

 Risk of toxic gases and corrosive liquids. Do not stand in direct line with the end of the transponder when operating the pressure relief vent valve. Sudden release of high pressure gases could cause injury to personnel. Wear Personal Protective Equipment such as goggles when operating the pressure relief vent valve.

 Risk of impact injury. Do not stand in line with the endcap when removing from the transponder. Any internal pressure could rapidly force the endcap from the transponder like a projectile.

 Risk of impact injury. Do not remove the endcap if there are any gaps between endcap and housing body.

 Risk of impact injury. Do not continue to remove the endcap if any movement is felt during removal of the clamp rings.

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

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

 Risk of Explosion. Do not fit unauthorised battery pack types into the transponder.

 Risk of Explosion. For lithium and lithium Ion battery packs, Class D fire extinguishers should be used. Do not use any other type of extinguisher.

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

2.2.2 Cautions

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

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

 Battery Power Failure. Do not charge the battery packs in any way not outlined in this manual. Failure to follow instructions may result in a loss of battery pack life or damage to the battery packs.

 Dispose of batteries in accordance with local health and safety and environmental regulations.

 Loss of Current Protection. Do not allow the transponder to be cooled or heated during the charging process as the over current protection component characteristics may change adversely.

 Damage to Sealing. Make sure the O-ring seals do not become damaged during removal of the endcaps.

 Damage to Connectors. Failure to clean sand or silt correctly could result in damage to the connectors and O-ring seals.

 Multiple beacon address conflict. Do not operate multiple beacons on the same Quickset Wideband settings in the water at the same time. The address must be unique to any one beacon operating in the same acoustic area.

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

 Equipment Damage. Only use the authorised battery packs in the transponder. Failure to use the correct batteries could cause damage to the equipment.

 Protective coating failure. 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.

2.2.3 Handling Procedures for CMOS Devices and Circuit Boards

Complementary Metal Oxide Semi-Conductor (CMOS) devices have diode input protection against adverse electrical environments such as electrostatic discharge.

Severe electrical transient voltages can be generated during handling.

Static voltages generated by a person walking across a common waxed floor have been measured in the 4 to 15 kilovolt range. These static high voltages are potentially dangerous when discharged into a CMOS electronic device, due to the energy stored in the capacity (~ 300 pF) of the human body at these voltage levels.

Present CMOS gate protection structures can generally protect against over-voltages. This is usually sufficient except in the severe cases.

All CMOS devices should be stored and transported in materials that are anti-static. CMOS devices must not be inserted into conventional plastic "snow", Styrofoam or plastic trays, but should be left in their original container until ready for use.

Operators must comply with safety precautions.

Completed assemblies should be placed in anti-static containers before being moved to stations.

All low impedance equipment (pulse generators, etc.) should be connected to CMOS inputs only after the CMOS is powered up. This type of equipment should be disconnected before power is turned off.

A circuit board containing CMOS devices is an extension of the device and the same handling precautions apply. Unprotected handling of any board containing edge connectors wired directly to CMOS device inputs can cause damage.

Do not insert or remove CMOS devices from their original or test sockets with power applied. Check all power supplies to be used for testing CMOS devices to ensure there are no voltage transients present.

All CMOS devices should be placed on a grounded bench surface and operators should ground themselves prior to handling devices, since a person can be statically charged with respect to the bench surface. Wrist straps in contact with skin are strongly recommended.

Nylon or other static generating materials should not come in contact with CMOS circuits.

When lead straightening or hand soldering is necessary, provide ground straps for the apparatus used and ensure the soldering irons are grounded.

Section 3 – Technical Description

3.1 Introduction

The Type 8300 (and variants) series Wideband®2 Transponders are designed for positioning, data telemetry, data logging functions and remote monitoring of subsea instrumentation.

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.

The 8300 (and variants) series Wideband®2 transponders can be fully integrated with other Sonardyne products from the 6G® range.

This manual covers the following Wideband®2 Transponders:

- Type 8300 – Compatt 6 Transponder, including:
 - Standard length
 - Mini
 - Midi
 - Maxi
- Variants, including:
 - Type 8301 – Dynamic Positioning Transponder 6 (DPT 6)
 - Type 8302 – Pressure Inverted Echo Sounder (PIES)
 - Type 8305 – Autonomous Monitoring Transponder 6 (AMT)
 - Type 8307 – Modem
 - Type 8308 – Sensor Logging Transponder (SLT)

3.2 Compatt 6 Series (Type 8300)

The Compatt 6 transponder is designed specifically for full Long Baseline (LBL) subsea deployments. The standard transducer housing is hard anodised aluminium but it is also available in aluminium bronze and super duplex stainless steel as well as standard, mini, midi and maxi lengths, depending on the operational requirements.

The Compatt 6 has a depth rating of 3,000 to 7,000 metres and is available as an omni-directional and directional transducer. The transponders are available with different sensor options and release mechanisms. The Compatt 6 is identified by a red coloured housing label.

3.2.1 Compatt 6

The Compatt 6 is approximately 1035 mm overall length (depending on transducer type and sensor options) with a hard anodised pressure housing approximately 135 mm diameter, protected by a red sleeve. The sensor endcap can contain a stainless steel release mechanism for releasing an anchor weight. The Compatt 6 can be fitted with either a lithium or alkaline battery.

Figure 3–1 Compatt 6 Transponder – Omni-Directional



Figure 3–2 Compatt 6 Transponder – Directional



3.2.2 Midi Compatt 6

The Midi is approximately 784 mm overall length (depending on transducer type and sensor options). The hard-anodised pressure housing is approximately 135 mm diameter. The lithium battery has approximately 30% of the capacity of the standard lithium battery with the same functionality.

Figure 3–3 Midi Compatt 6



3.2.3 Mini Compatt 6

The Mini is approximately 570 mm overall length (depending on transducer type) and is basically the same as the Midi Compatt 6 but without any sensor options. The hard-anodised pressure housing is approximately 135 mm diameter. The lithium battery has approximately 30% of the capacity of the standard lithium battery with the same functionality.

Figure 3–4 Mini Compatt 6

3.2.4 Maxi Compatt 6

The Maxi is approximately 1604 mm overall length (depending on transducer type and sensor options) and is designed for long life and/or high intensity applications. The hard-anodised pressure housing is approximately 135 mm diameter. The lithium battery has twice the capacity of the standard lithium battery with the same functionality.

Figure 3–5 Maxi Compatt 6

3.3 Type 8300 Variants

Many of the Type 8300 variants shown below are also available in mini, midi and maxi lengths.

3.3.1 Dynamic Positioning Transponder 6 (Type 8301)

The Dynamic Positioning Transponder 6 (DPT 6) is a USBL focused beacon designed specifically for dynamic positioning applications where structure tracking and baseline measurements are not required. The transducer is available as an omni-directional and directional, with a depth rating of 3000 and 5000 metres. The transponder's pressure housing is hard anodised and protected by a red sleeve. The sensor endcap can contain a stainless steel release mechanism for releasing an anchor weight. The DPT 6 is identified by an orange coloured housing label.

Figure 3–6 Dynamic Positioning Transponder 6 Transponder

3.3.2 Pressure Inverted Echo Sounder (Type 8302)

The Pressure Inverted Echo Sounder (PIES) is a long-life sensor logging node that measures the average sound velocity through a column of water from the seabed to the sea surface. The transducer is LMF directional, with a depth rating of 3000 and 6000 metres. The transponder's pressure housing is hard anodised and protected by a red sleeve. The sensor endcap can contain a stainless steel release mechanism for releasing an anchor weight. The PIES is identified by a blue coloured housing label.

Figure 3–7 Pressure Inverted Echo Sounder Transponder

3.3.3 Autonomous Monitoring Transponder (Type 8305)

The Autonomous Monitoring Transponder (AMT) has the same capabilities as the Compatt 6 with additional capabilities to periodically log sensor readings and make acoustic baseline measurements. The AMT has a depth rating of 3000 metres and is available as an omni-directional and directional transducer. The transponder's pressure housing is hard anodised and protected by a red sleeve. The sensor endcap can contain a stainless steel release mechanism for releasing an anchor weight. The AMT is identified by a yellow coloured housing label.

Figure 3–8 Autonomous Monitoring Transponder

3.3.4 Modem 6 Transponder (Type 8307)

The Modem 6 Transponder has the same capabilities and mechanical specification as the Compatt 6 but operates as a modem only. The Modem is identified by a green coloured label.

A Modem 6 Integration Manual (IM-Modem 6) is available for configuring the Modem 6 for operational use.



3.3.5 Sensor Logging Transponder (Type 8308)

The Sensor Logging Transponder (SLT) has the same capabilities as the Compatt 6 with additional capabilities of autonomously acquiring sensor data without surface control. The SLT has a depth rating of 3000 metres and is available as an omni-directional and directional transducer. The transponder's pressure housing is hard anodised and protected by a red sleeve. The sensor endcap can contain a stainless steel release mechanism for releasing an anchor weight. The SLT is identified by a blue coloured housing label.

Figure 3–9 Sensor Logging Transponder



3.4 Housing Labelling

Waterproof coloured labels on the housing uniquely identify the instrument as shown in the following 8300-3111 example:

3.4.1 Top Label

- Serial No:213245-006
- Config:3111
- Transducer:MF Omni
- Housing Rating:3000 m
- Unit ID:0047D
- Address:2010

3.4.2 Bottom Label

- Variant: COMPATT 6
- Type No: Type 8300

3.4.2.1 Serial No

Identifies the transponder and should be quoted in all communications with Sonardyne International Ltd or their agents.

3.4.2.2 Type and Config

The Type Number is a four digit number beginning with an '8' e.g. 8300 – Compatt 6 and 8305 – AMT. The following four digits indicate the depth rating, material housing size and transducer type as indicated in the table below: e.g. 8300-3111 – Standard MF Omni Compatt 6. *Table 3-1* shows the configuration matrix.

- 8300 = Compatt 6
- 3 = Depth Rating: 3000 m
- 1 = Material: Aluminium 6082
- 1 = Housing: Standard
- 1 = Transducer Type: MF Omni

Table 3-1 Type Number Identification

	Depth Rating	Material	Housing	Transducer Type
1	1000 m	Aluminium 6082	Standard	MF Omni
2	2000 m	Aluminium 7075	Max	MF Dir – Type 1
3	3000 m	S/Duplex	Mini	MF Dir – Type 2
4	4000 m	Aluminium Bronze	Midi	MF Super Dir
5	5000 m	Titanium	Dunker	LMF Omni
6	6000 m	Stainless Steel	Remote	LMF Dir
7	7000 m	Composite	Sphere	LF Omni
8		Glass		EHF Omni
9	Special	Special		
0	No Code	No Code		

3.4.2.3 Transducer

The transducer type; MF/LMF omni-directional or MF/LMF directional.

3.4.2.4 Housing Rating

This is the nominal pressure rating of the transponder housing. The sensor endcap may be rated less than the housing limit. Check the endcap label and use the lower figure.

3.4.2.5 Unit ID

The Unit ID box shows the unique identification number for the transponder. The Unit ID number is required to upgrade the software to aid the functionality of the transponder. The Unit ID cannot be changed and is stored on the CPU/Motherboard.

3.4.2.6 Address

The Address Box contains the acoustic command identity of the transponder. The acoustic address is used by the transceiver to communicate with the transponder. The first two digits of the address define the code or family group, the last two digits of the address define the channel number. It is recommended that the information on the address label is kept up to date.

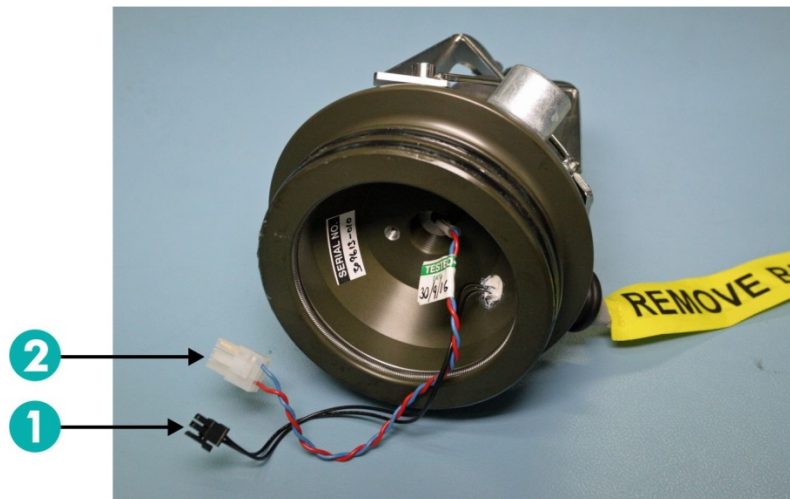
Table 3–2 Address Range

Address Range	Signal Type	Purpose
0101–1514	Wideband®1	Limited backward compatibility with 5G Wideband Transponders and GDT USBL
1701–3114	Wideband®2 standard	Standard Navigation 6G
5001–6314	Wideband®2 advanced	Advanced navigation and telemetry for harsh environments that are particularly noisy and/or reverberant.

3.5 Endcaps

3.5.1 Transducer Endcap

The transducer endcap can be removed by a qualified person in order to replace the internal battery. The internal battery disconnect fob switch connector **1** (if fitted) and transducer connector **2** must be disconnected from the main board when removing the endcap; see Section *Section 8.8.2 "Disconnecting and Replacing the Battery"*.

Figure 3–10 Transducer Endcap Internal Connectors

3.5.2 Sensor Endcap

The sensor endcap is an inter-changeable Data Acquisition Sub-Assembly (DAS), and has its own label, serial number and configuration number.

Figure 3–11 Example of a Sensor Endcap



The configuration (Config) lists the sensors and features fitted to the endcap, selected from the following list:

- R = Release Mechanism
- T = Temperature Sensor
- P = Strain Gauge Pressure Sensor
- HP = Hi-Precision Strain Gauge Pressure Sensor
- Q = Digiquartz® Pressure Sensor
- S = Sound Speed Sensor
- I = High Accuracy Dual-Axis Inclinator

Two examples of endcap labels are shown below:

Serial No. XXXXXX-XXX Config: T Q I Depth Sensor Cal: 2050 m
--

Temperature (PRT), 2000 m Digiquartz® Pressure Sensor, Inclinator

Serial No. XXXXXX-XXX Config: R T P S Depth Sensor Cal: 3000 m
--

Release, Temperature (PRT), 3000 m Strain Gauge Pressure Sensor, Sound Speed Sensor

The depth is a full scale rating of the pressure sensor fitted.

Note



Digiquartz ® sensors can be damaged if over pressurised by a range of 20%

The high accuracy inclinometers fitted have a range of $\pm 90^\circ$.

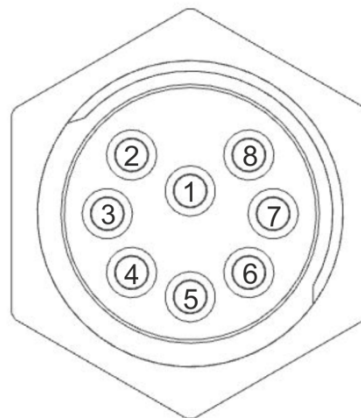
All transponder sensor endcaps have a low accuracy inclinometer fitted as standard.

Endcaps supporting external sensors, which require non-standard modifications to the DAS, PCB, wiring or firmware, are marked with an additional label.

3.6 Connector

The SubConn MCBH8F external connector is located on the sensor endcap. The connector pin details are shown in *Figure 3–12*

Figure 3–12 Subconn MCBH8F Connector



Subconn MCBH8F

Pin	Details	Description
1	RS232 In	HOST
2	GND	Power and Comms Ground
3	RS232 Out	HOST
4	Power In	8 V–18 V, Quiescent Power only (Not Acoustic Transmission) 18 V–24 V, Quiescent and Ping Power (Not Telemetry)
5	Power Out	12 V Regulated or V Batt
6	Sync	Responder Input (see <i>Section 6.2.1 "Responder Mode"</i>)
7	RS232 Out	DAS
8	RS232 In	DAS

3.7 Battery

3.7.1 Battery Type

The Compatt 6 uses either alkaline or lithium batteries depending on the type and application.

The battery voltage and remaining capacity (%) can be checked using 6G Terminal Lite software or an iWAND hand held test unit; see *Section 8.8 "Battery Maintenance"*.

3.7.2 Battery Disconnect Fob

The battery disconnect fob (if fitted) is located on the transducer endcap and uses an internal magnetic switch to disconnect the internal battery when the fob is connected.

When not in use the battery disconnect fob should always be connected to disconnect and conserve the battery.

Note

 Older transducers without a battery disconnect fob should have their battery internally disconnected for transportation and storage (of more than one month) as described in *Section 8.8.2 "Disconnecting and Replacing the Battery"*.

Figure 3–13 Battery Disconnect Fob



3.7.3 Battery Replacement

The battery can be replaced by removing the transducer endcap, disconnecting and removing the old battery and fitting a new one; see *Section 8.8 "Battery Maintenance"*.

CAUTION

 **Dispose of batteries in accordance with local health and safety and environmental regulations.**

3.7.3.1 Handling of Used Batteries

Batteries should not be discharged below their end point voltage. To do so can lead to internal corrosion and leakage of electrolyte in certain types of sulphur dioxide cells. Although there is very little gas to cause a pressure rise under these conditions, the electrolyte leakage will cause severe corrosion.

The remaining life of a battery depends on both time and, for a transponder, the number of times it has been interrogated. Normally transponders keep their own record of battery usage, but a separate record of time elapsed whilst battery is installed and connected, plus estimates of the number of interrogations should be kept.

Section 4 – Installation

4.1 Introduction

Before installing the equipment, ensure *Section 2 "Safety"* is read and fully understood.

4.2 Pre-Use Checks

The best positioning accuracies are achieved when the array transponders are held in a rigid support structure. Care should be taken to avoid metal to metal contact with the structure, as accelerated corrosion of the transponder may result. The integral tilt switch can be used to indicate whether a frame has fallen over.

Before installing the equipment it is advised to visually inspect the equipment for any signs of damage, e.g. corrosion, dents, bent protective guard or damage to the release mechanism (if fitted).

Note



Remove the battery disconnect fob (if fitted) to enable the transponder.

It is recommended a full functional test of the equipment is carried out to ensure the transponder is fully serviceable and to check the battery has sufficient charge to carry out its full term of operations. For instructions on functionally testing the transponder, see *Section 9 "Functional Test"*.

4.2.1 Check the Pressure Relief Vent Valve

Before using the transponder it is recommended the pressure relief vent valve is inspected to ensure it is flush with the endcap. If the pressure relief vent valve is found not to be flush it indicates a build-up of internal pressure. See *Section 8.7.1 "Operating the Pressure Relief Vent Valve"* to release the internal pressure.

4.2.2 Floatation

No floatation accessories are provided with the transponder. The Compatt 6 weighs approximately 15 kg in water, therefore buoyancy must be added for operations that require a net upthrust.

Glass spheres or syntactic foam with a suitable depth rating can be used and must be able to give a net up-thrust of 3 kilograms or more, allowing for the weight of the shackle and strop. Syntactic foam floats are usually in the form of "collars" which clamp around the pressure housing. Glass spheres or other floats should be attached to the top guard by a rope long enough to minimise "shadowing" of the transducer. Sonardyne supply a range of suitable floatation collars of different depth ratings.

Max Unit only: fit the floatation collar mid-way along the tube. This will allow the transducer to remain in the water when the unit is at the surface.

When possible, make sure the label with the acoustic command address and the Unit ID number are clearly visible with the floatation fitted.

4.2.3 Anchor Weights

To take the transponder to the seabed and hold it there an anchor weight is required for each deployment. A minimum of four times the net transponder/float buoyancy is recommended. As the anchor weight will be left on site after recovery of the transponder, Sonardyne International Ltd recommend "bio-degradable" anchor weights which take the form of gravel inside a double or triple skin of hessian sacks.

4.2.4 Strops

The suspension rope or strop between the anchor weight and the shackle in the release mechanism should be long enough to allow 'line of sight' between the transponders in the array, and any topographical features in between. The minimum strop length should be 1.5 metres to ensure the momentum of the falling transponder does not carry it down onto the weight when the weight reaches the seabed, and possibly damaging the release. Allowance should also be made for any currents which may deflect the transponder from floating straight above the anchor weight.

If a wire strop is used, particular attention should be paid to the materials used. Electrolytic action between dissimilar metals could result in the strop breaking and the transponder drifting away.

The eye of the wire strop must be electrically insulated from the release mechanism to minimise corrosion.

4.2.5 Mounting Guidelines for Endcaps with an Inclinometer

The following guidelines should be followed for mounting transponders with inclinometers.

Note

 **Inaccurate Equipment Operation. Realignment of the inclinometer orientation when re-installing the unit, following removal, is important. Small tilt angle differences can be zeroed out when the system is calibrated during lowering, however incorrect orientation will result in the system giving an incorrect Course to Steer.**

- a. **Orientation** – It is important to install the unit on a structure with a known orientation. The flat bottom endcap has a label next to a vertical groove which reads BOW/Forward. This must be facing North.
- b. **Levelness** – Although the inclinometers will be calibrated for levelness during structure lowering care should be taken to ensure it is mounted as near to vertical as practical. The sensors have a $\pm 90^\circ$ range.
- c. **Isolation** – To minimise corrosion of the aluminium pressure housing, contact with structure metalwork should be avoided at all costs. Clamps around the tube should only be in contact with the housing sleeve. The flat bottom face should be insulated with an insulating material such as neoprene or nylatron.
- d. **Acoustic masking** – The position on the structure should be such that the transducer is well away from reflecting surfaces above it, especially flat areas.
- e. **Installation mounting kit** – An inclinometer installation mounting kit, CPN 650-2559; see *Figure 4-1*.
- f. **Stab mounting kit** – A stab mounting kit (641-0434) with 0° 90° 180° 270° directional control can be used to mount a Compatt 6 ensuring repeatability when required; see *Figure 4-2*.
- g. **Endcap mounting** – To mount the bottom endcap onto an adaptor plate, a custom mounting plate must be used. The plate must contain two dowels to give a datum line to which the endcap can be abutted to. The plate is mounted using four bolts; see *Figure 4-3*. An electrical isolation layer between the mounting plate and the endcap should offer corrosion protection.

Note

 **The locking sleeve on the endcap connector protrudes from the port side face of the endcap.**

- h. DPT base mounting bracket – For Riser monitoring (620-7168); the transponder is held by one or two clamp rings around the tube which are stood off the Riser by approximately one metre. The stand-off arms must be detachable to allow the Riser through the drill floor. A bucket could equally be used to hold the transponder on the end of the arm(s).

Figure 4–1 Example of Inclinator Mounting Kit

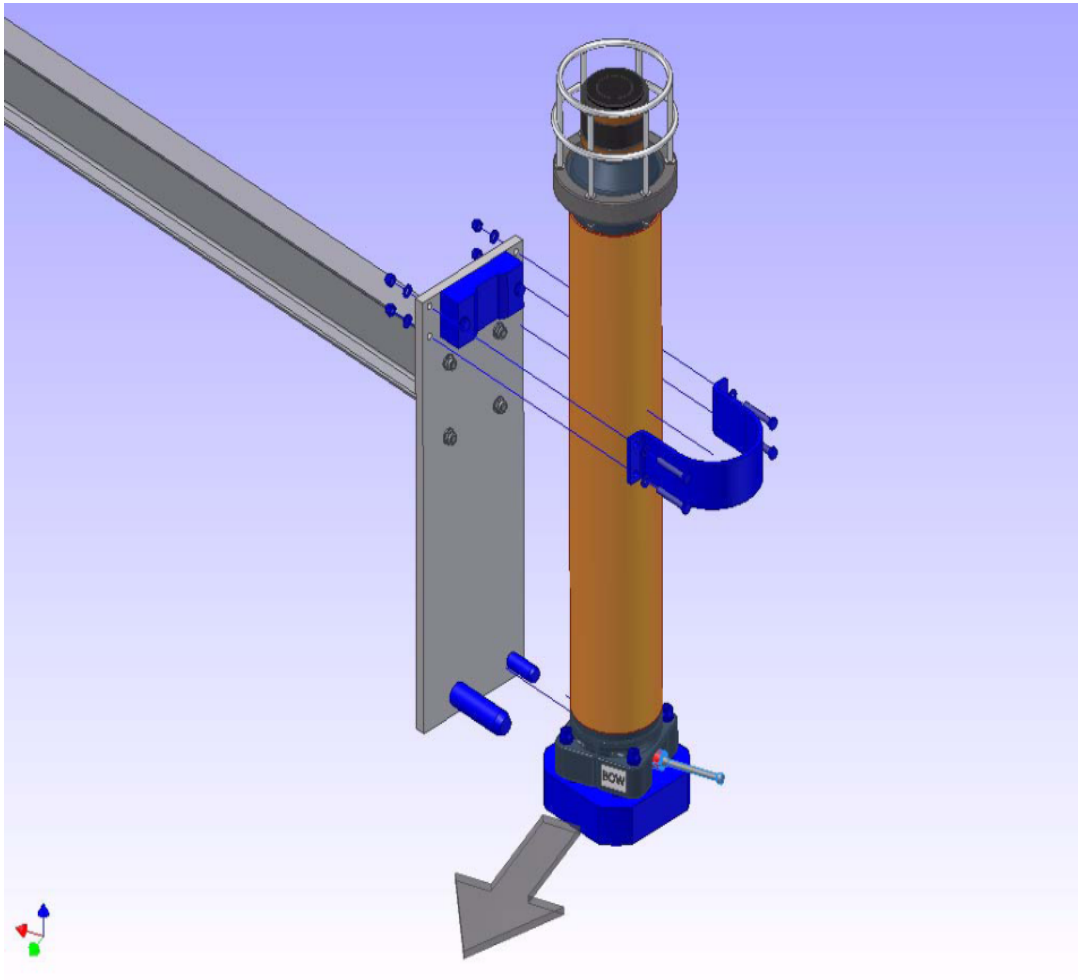


Figure 4-2 Example of Stab Mounting Kit

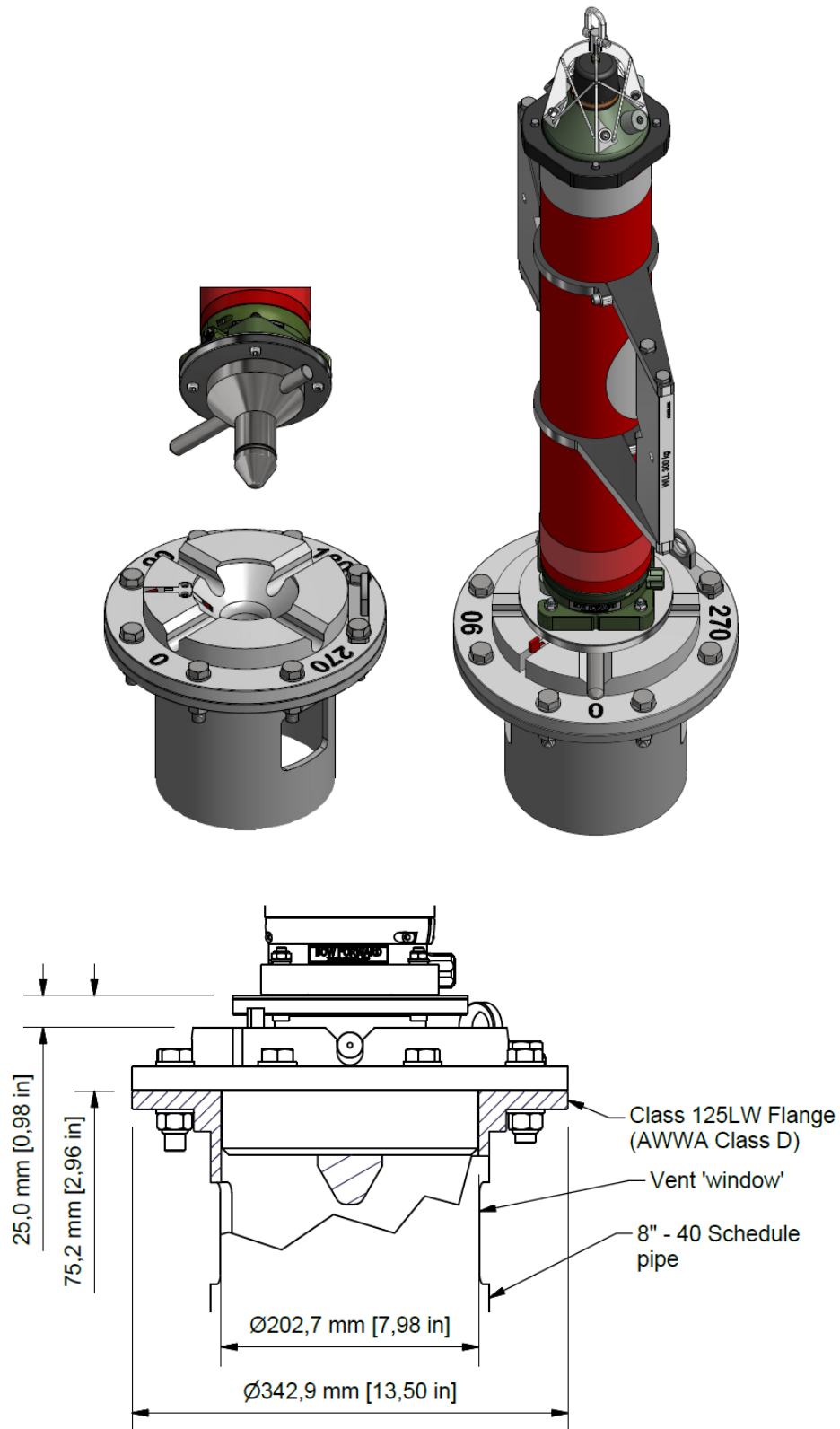
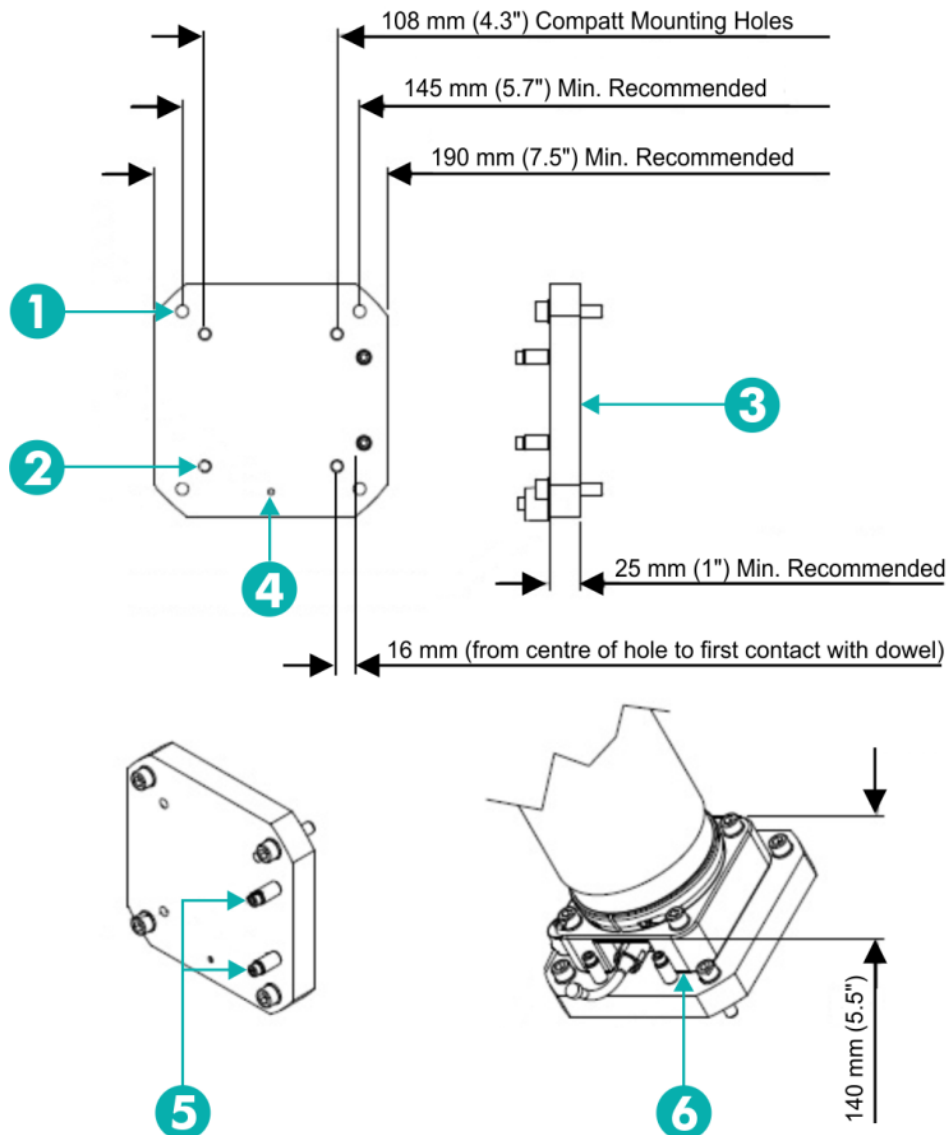


Figure 4–3 Recommended Specification for Inclinometer Endcap Mounting Plate



- | | |
|--|--|
| <p>1 4 x Plate Mounting Holes (M10 Min. Bolt Size).</p> <p>2 4 x Compatt 6 M8 Threaded Mounting Holes</p> <p>3 Recommended Plate Material: Anodised Aluminium</p> | <p>4 Ident Align with Endcap Notch</p> <p>5 2 x Dowels (Dowels must be positioned so first contact is 16 mm from Compatt 6 Mounting Hole Centre)</p> <p>6 Compatt 6 Endcap Shown Abutted against Dowels</p> |
|--|--|

Section 5 – Deployment

5.1 Introduction

Before deploying the equipment, ensure *Section 2 "Safety"* is read and fully understood.

Deployment of a transponder can take many forms. The following sections detail common deployment methods.

5.2 Lifting

The shackle on the transducer guard can be used to lift the transponder.

Lifting eyes on the floatation collar can be used (if fitted).

5.3 Deployment from Ship

5.3.1 Recommended Method

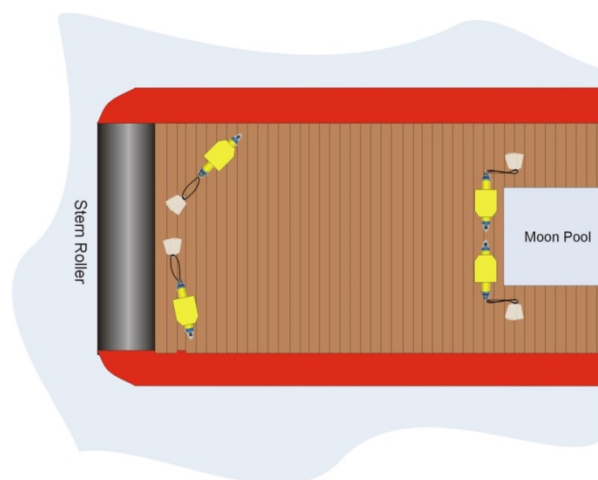
1. The recommended method of deploying a transponder from a surface vessel is as follows:
2. Thread a loop of rope through an eye in the anchor weight. Make fast one end of the rope. Take the strain on the free end.
3. Lower the transponder and float to the water so they stream behind the ship as it approaches the drop position.
4. Lower the weight to the water line, allowing the rope to slip through the eye.
5. When on location let go of the free end of the rope. The weight will sink immediately, pulling the transponder with it.
6. Recover the free end of the rope.

5.3.2 Additional Deployment methods

5.3.2.1 Roll the Transponder off the Deck

Roll the transponder off the deck and the weights will follow.

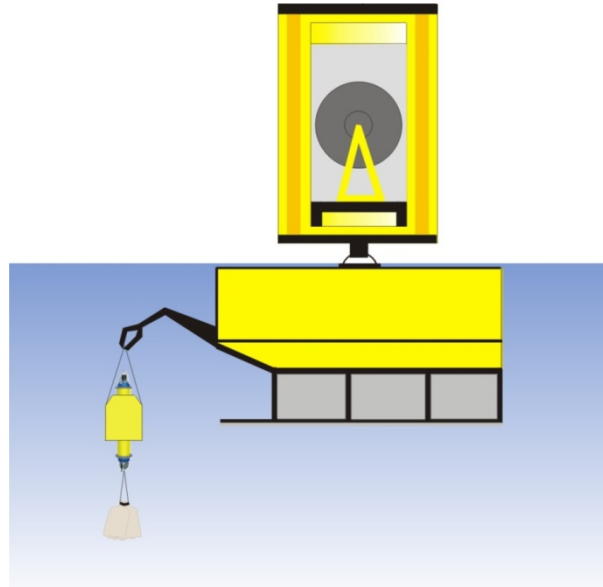
Figure 5–1 Rolling the Transponder off the Deck



5.3.2.2 Lowered by Vessel Crane or A-Frame – Single Transponder Installation

The ROV grabs a one metre loop of rope attached to the top guard or the float.

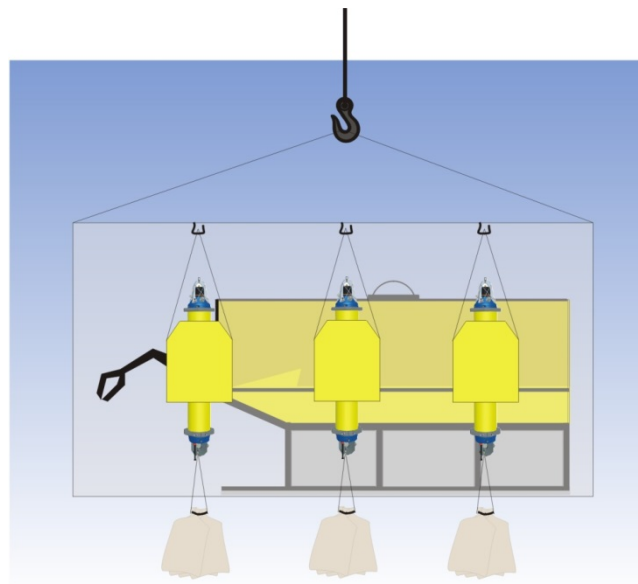
Figure 5-2 Lowered by Vessel Crane or A-Frame – Single Transponder Installation



5.3.2.3 Lowered by Vessel Crane or A-Frame – Multiple Transponder Installation

The ROV grabs a one metre loop of rope attached to the top guard or the float.

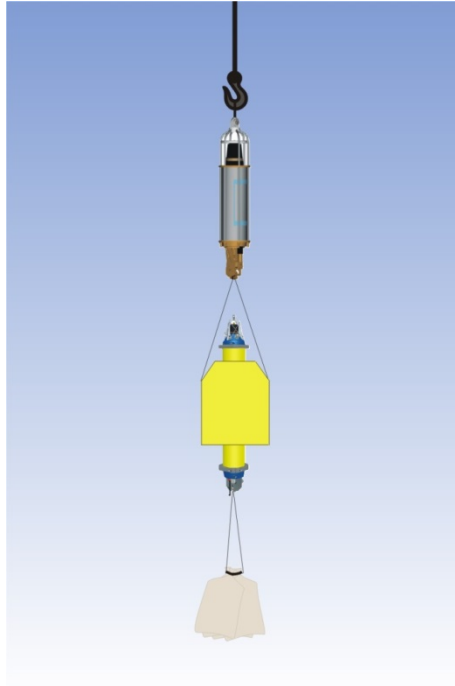
Figure 5-3 Lowered by Vessel Crane or A-Frame – Multiple Transponder Installation



5.3.2.4 Acoustic Release used as Crane Hook

An acoustic release is used as a crane hook. Typically the release will need to be 15–20 metres under water for a survey boat and 35–50 metres for a semi-sub.

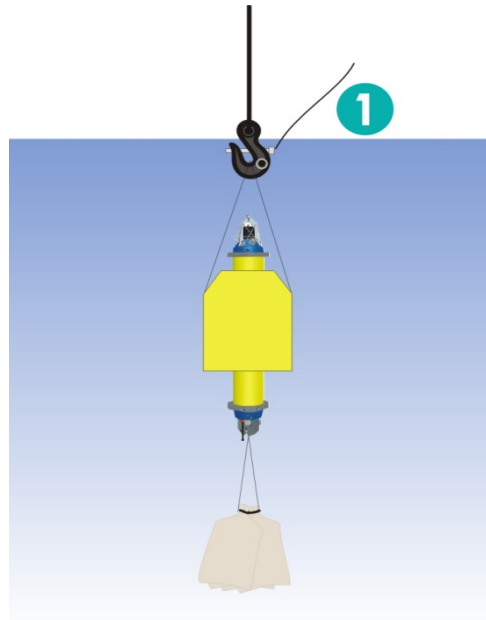
Figure 5–4 Acoustic Release used as a Crane Hook



5.3.2.5 Slip Hook with Integral Swivel

Slip hook with integral swivel and D shackle to transponder to be released.

Figure 5–5 Slip Hook with Integral Swivel

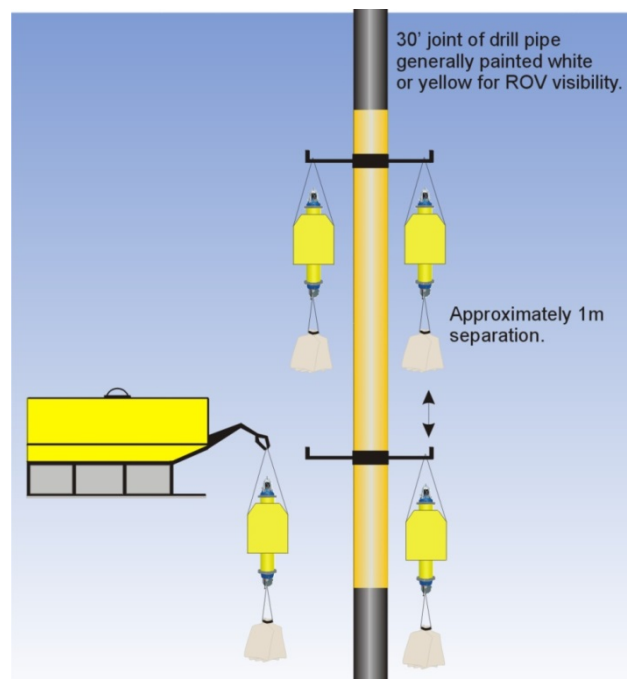


1 Release Control Line

5.3.2.6 ROV grabs One metre Loop of Rope

The ROV grabs a one metre loop of rope attached to the top guard or float.

Figure 5–6 ROV grabs one metre loop of Rope



Section 6 – Operation

6.1 Introduction

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

6.2 Operational Modes

The transponder is activated by removing the battery disconnect fob (if fitted).

When the transponders have been installed, they are monitored and controlled by the software system.

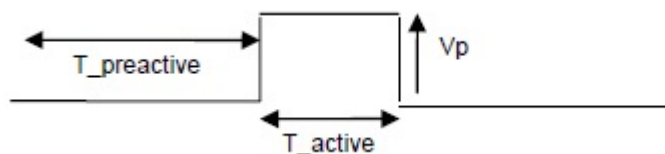
6.2.1 Responder Mode

All transponders have a bi-directional sync line which can be operated as a responder input. Enabling or disabling responder mode can be controlled serially or acoustically.

6.2.1.1 Responder Input

The sync line, when used as an electrical input, can provide responder functionality (the transponder replies acoustically after an electrical trigger pulse instead of an acoustic interrogation). This mode of operation can be useful if the transponder is to be mounted on a very noisy vehicle and is operating at high depths or a long slant range.

Figure 6–1 Responder Input



Symbol	Description	Min	Max
$T_{preactive}$	Time that Sync Input is required to remain high prior to a falling edge to begin sync pulse validation	200 us	Infinite
T_{active}	Time that Sync Input remains low before a valid sync pulse to be recognised	100 us	Infinite
V_p	Sync Input voltage	4.5 V	24 V

If the minimum value for $T_{preactive}$ is not met then no amount of low state on the Sync Input line will generate a sync event. Similarly if the minimum value for T_{active} is not met then no sync event will be generated. Operating as a responder, the transponder will fire a reply acoustic transmission timed from the rising edge of the sync input pulse (the turn-around-time TAT begins at the rising edge of the trigger pulse).

6.2.2 Operating Notes for External Power Out

All transponders can be configured serially or acoustically to allow three external power options; power out disabled, power out enabled at regulated 12 Volts dc or power out enabled at the battery voltage. The maximum rating for the external power out supply is 3 Watts.

See Section 3.6 "Connector" for the external connector pin details.

6.2.3 Modem 6

For Operating instructions, refer to the Modem 6 Integration Manual (*IM-Modem 6*), together with the appropriate user manual for the system in use.

6.2.4 Operating Notes for Inclinometer Variants

The standard transponders can be fitted with an endcap containing dual axis inclinometers as an option. This version of the bottom endcap will be non-release.

The range of the sensors fitted is $\pm 90^\circ$, but when the transponder passes 90° in pitch or roll the sensor output will show a reducing angle, as the sensor is a sine law device.

The output of the cross axis sensor may report an inverted angle. There is no indication of either of these occurrences in the output from the transponder. The tilt sensor will not help as it indicates that the transponder is either upright or inverted within a 45° cone.

The inclinometers orientation is marked on the bottom endcap by a groove running up the edge of the endcap, indicating the bow or forward face and a BOW/Forward label is fitted adjacent to the groove.

The Sonardyne polarity follows a standard Cartesian format:

Bow Up = Pitch +ve

Port Up = Roll +ve

Section 7 – Retrieval and Storage

7.1 Introduction

Before retrieving the equipment, ensure *Section 2 "Safety"* is read and fully understood.

7.2 Retrieval Planning

It is advised that a retrieval procedure is formulated and understood by all involved before attempting to retrieve any equipment.

Note

 **Retrieval using ROV manipulators or grappling with boat hooks can result in major damage to the transducer.**

A dedicated loop of rope fitted to the transducer guard shackle or floatation will reduce the risk of damage to the equipment during recovery.

For ROV handling, add a metal ring to this rope loop. The rope loop must sufficiently long enough to allow the ring to fall below the acoustic transducer.

Note

 **The floatation bump-stop ring must not be used to lift more than the transponder and float collar.**

A transponder floating to the surface can be tracked during its ascent by ranging to it, or by making repeated depth readings.

7.3 Retrieval from the Water

When a transponder reaches the surface, it will float approximately horizontal, depending on the float collar fitted.

Note

 **The transducer guard must not be used to hook the transponder, this will result in damage to the transducer.**

A boat hook can be used to hook:

- A rope loop attached to the transducer Guard Shackle
- A rope loop attached to the floatation bump stop
- A lifting point fitted to the floatation collar
- The release guard if fitted

The transducer guard must not be used to hook the transponder, this can result in damage to the transducer.

If recovered into a small boat, the transponder should be lifted on board the mother vessel using a crane attached to the lifting shackle or the lifting point on the float.

7.4 After Retrieval

- Disconnect the battery by inserting the battery disconnect fob.
 - Clean the instrument; see *Section 8.3 "Cleaning"*.
 - Inspect the instrument; see *Section 8.4 "Inspection"*
-

- Lubricate the connectors; see *Section 8.5 "Lubrication"*.
- Check and replace the battery if required; see *Section 8.8.1 "Checking the Battery Condition"*.

7.5 Storage

On completion of all procedures in the previous section the instrument can be placed in storage as described below. See *Table 7-1 "Storage Conditions"* for the recommended storage conditions.

1. Store the instrument in its transit case.
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 7-1 Storage Conditions

Item	Specification
Storage Temperature	-20 to 55°C (see notes below)
Relative Humidity	20 to 80% (non-condensing)

Notes

 To prolong the life of the batteries it is not recommended to exceed a storage temperature range of 0 to 30°C.

 Transponders without a battery disconnect fob should have their battery internally disconnected for transportation and storage (of more than one month) as described in *Section 8.8.2 "Disconnecting and Replacing the Battery"*.

Section 8 – Maintenance

8.1 Introduction

Before any maintenance activity is carried out on the equipment, ensure *Section 2 "Safety"* is read and fully understood.

8.2 Retrieval from the Water

See *Section 7 "Retrieval and Storage"*.

8.3 Cleaning

Clean the transponder as follows:

1. Thoroughly wash the transponder in warm clean fresh water to remove accumulations of salt, sand or silt and marine growth, paying particular attention to the electrical connectors.

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.

2. If a sound speed sensor is fitted, clean the transducer and reflector faces with warm clean fresh water.
3. Remove any attached cabling or dummy plugs/protective caps and wash the external socket.
4. Dry the instrument and any attached cabling with a clean lint free cloth.
5. Replace any dummy plugs/protective caps.

8.4 Inspection

Regularly inspect the instrument for the following:

1. Inspect the Pressure Relief Vent Valve; *Section 4.2.1 "Check the Pressure Relief Vent Valve"*.
2. Inspect the housing for signs of corrosion or damage. When in full working depth, the housing is at risk of failure if corrosion or damage is present. If any corrosion is found it can be treated as described in *Section 8.12 "Corrosion Removal"*.
3. Inspect the connectors and cables for signs of abrasion, damage or corrosion.
4. 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.
5. Inspect the jointing faces of the endcaps and the main housings. Signs of corrosion indicate leakage of water into the transponder.
6. Check the guard for distortion.
7. Check there is sufficient zinc remaining on the anodes, replace if necessary.
8. Inspect the rubber boot on the transducer for signs of splitting.
9. Check the brass filling screw is in place.
10. Inspect the connector contacts for signs of corrosion.

11. Inspect the clamp ring bolts for signs of corrosion.
12. Check the plastic clamp ring insulators are in place.

8.5 Lubrication

The following lubricants are recommended for maintaining the Compatt 6.

Table 8–1 Lubricants

Assembly	Lubricants
Subconn and Micro-Subconn connectors	Molykote 44 Medium
O-ring seals	Petroleum Jelly

8.5.1 Subconn Connectors

Note

 **Follow the connector manufacturer's recommended procedure for installing, inspecting, cleaning and lubricating the connectors.**

The connectors should be cleaned and lubricated using the manufacturer's recommended lubricant "Molykote 44 Medium" before each mating.

CAUTION

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

1. Make sure the connectors are clean and dry.
2. Clean using a spray based contact cleaner (isopropyl alcohol).
3. Lubricate the connectors as follows:
 - a. Apply a layer of grease to the female connector corresponding to a minimum 1/10th of socket depth.
 - b. The inner edge of all sockets should be completely covered, and a thin layer of grease left visible on the face of the connector.
 - c. After greasing, fully mate the male and female connector to optimise distribution of the grease on pins and in sockets.
 - d. Confirm that the grease has been sufficiently applied by de-mating and checking that grease is present on every male pin.
 - e. Re-mate the connectors.

8.5.2 Endcap O-Rings

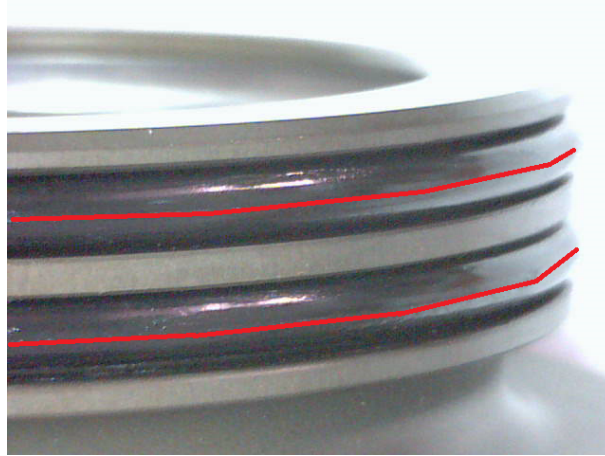
Endcap O-rings should always be inspected and lubricated before fitting the endcap.

Note

 **Ensure the area you are working in is clean and dust free.**

1. Check the O-rings for cuts and nicks and replace if damaged.
2. Avoid forcing O-rings over threads, sharp corners or other sharp objects (if necessary mask any areas to protect the O-ring during fitting).

3. Using a clean finger (not a brush), smear a light film of Vaseline all over the surface of the O-ring only (do not smear Vaseline into the endcap grooves).
4. Fit the O-ring onto the endcap, ensuring that the O-ring is not twisted (the moulding line on the O-ring, must be straight).



5. Always fit the outermost O-ring first, then roll the second O-ring over the first O-ring (this minimises the risk of damaging the innermost O-ring).



6. Before assembly, apply a light even film of petroleum jelly to the O-ring mating surface (the housing bore).

Note



There should be no visible lumps of petroleum jelly on the O-ring or the mating bore.

8.6 Scheduled Maintenance and Recalibration

To ensure the transponder provides long and effective service, it is important to carry out scheduled maintenance and recalibration processes.

Table 8–2 identifies the scheduled maintenance and the frequency of the activity.

Table 8–2 Maintenance and Recalibration Schedule

Applicable To	Sensor Type	1 Year	2 Years	3 Years
Type 8300 and all variants	Pressure Sensor (strain gauge) see Section 8.6.1 "Pressure Sensor Oil Top-Up"	X		
Type 8300 and all variants excluding Type 8302 PIES	Pressure Sensor (Digiquartz®); see Sections 8.6.1 "Pressure Sensor Oil Top-Up" and 8.6.2 "Depth Sensor (Digiquartz®) Recalibration".	X		
Type 8302 PIES Only ¹	Pressure Sensor (Digiquartz®); see Sections 8.6.1 "Pressure Sensor Oil Top-Up" and 8.6.2 "Depth Sensor (Digiquartz®) Recalibration".	X Oil Top-Up		X Recalibration
Type 8300 and all variants	Inclinometer (precision)		X	
	Inclinometer (MEMS)		X	
	Temperature, PRT		X	
	Sound Speed ²	X		

8.6.1 Pressure Sensor Oil Top-Up

The pressure sensor port (located on the face of the sensor endcap) contains high viscosity silicone oil behind the red plug. The oil can seep out over time and must be replenished; otherwise sea water may eventually make contact with the stainless steel pipework of the pressure sensor and corrode it.

A top-up kit is available for this operation, part number 650-0125.

To top up the oil:

1. Place the release endcap upside down.
2. Remove the red pressure port plug using a flat-bladed screwdriver.
3. Fill the syringe with the silicone oil and apply into the pressure port.
Note: the oil will flow best if it is at room temperature.
4. Leave the oil to stand for at least 4 hours to allow any air bubbles to slowly float up out of the oil.
5. Screw the red pressure port plug back in.

To stop the oil from seeping out while in storage, an adhesive label may be fitted over the port. This must be removed before deployment, or if accurate pressure readings are needed.

8.6.2 Depth Sensor (Digiquartz®) Recalibration

The Digiquartz® depth sensor is very fragile and has a limited over-range capability. Endcaps that contain these sensors are supplied with a sheet of calibration coefficients that are needed to convert the measurements made by the Compatt 6 into an absolute pressure reading.

¹Based on field data and intended use for Type 8302 PIES.

²Sound Speed sensor is not recalibrated but is verified against a reference sensor.

The manufacturer, Paroscientific Inc. do not provide any method to calibrate the sensor other than removing small offset errors. This is achieved by recalculating the coefficients C1 and T1.

Under normal conditions a zero adjustment calibration will correct for normal component ageing. This should be checked annually. A zero offset can be trimmed by re-computing the coefficients supplied with the sensor (contact Sonardyne Support for details).

Consequently, the only calibration undertaken at Sonardyne involves a single point calibration at atmospheric pressure, to a limit of 0.01%, using a calibrated barometer to measure the atmospheric pressure to an accuracy greater than 0.01% FSD.

Further testing is then carried out at nominal 20% steps of the sensor's pressure range, to ensure the sensor functions correctly over the full range. In order to confirm the calibration to the full accuracy of the sensor, a pressure source with an accuracy of an order of magnitude better than the accuracy of the sensor would be required; such equipment is not commercially available. As these tests are to prove functionality, a suitable test limit is used for this phase of the testing.

8.7 Pressure Relief Vent Valve

A pressure relief vent valve is fitted to automatically release any build-up of pressure inside the instrument during deployment. This could be caused by water ingress during deployment and/or the degassing of a battery.

The pressure relief vent valve should be flush with the endcap face. If the pressure relief vent valve is not flush it should be operated to check for and release any internal pressure.

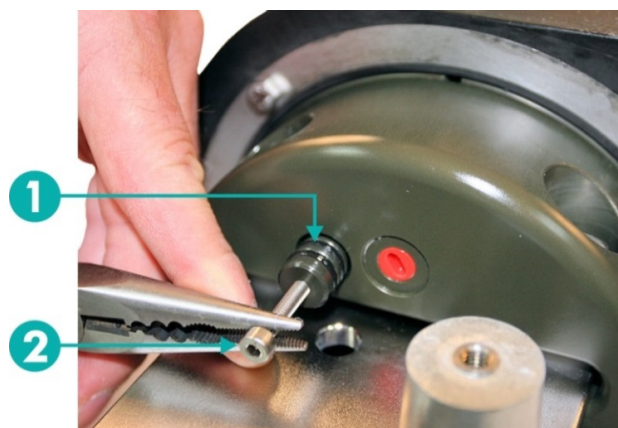
The pressure relief vent valve should always be operated before performing any maintenance work.

8.7.1 Operating the Pressure Relief Vent Valve

WARNINGS

 **Due to the high internal pressure risk, dismantling the sub-sea equipment must only be carried out by trained personnel.**

 **Do not stand in direct line with the end of the transponder when operating the pressure relief vent valve. Sudden release of high pressure gases could cause injury to personnel. Wear Personal Protective Equipment such as goggles when operating the pressure relief vent valve.**



1 Pressure Relief Vent Valve **2** M4 bolt (not supplied)

To operate the pressure relief vent valve:

1. Screw an M4 bolt into the pressure relief vent valve.
2. Slowly pull the M4 bolt to withdraw the vent valve and wait for any internal pressure to be released.

Notes

If the pressure relief vent valve is difficult to pull out, a pair of long nosed pliers can be used to assist.



The pressure relief vent valve has an internal retaining screw preventing it from being fully pulled out of the endcap.

3. With the pressure relief vent valve pulled out inspect the O-rings for any signs of damage.
4. If necessary, lubricate the O-rings using petroleum jelly.
5. The valve should retract back into place; remove the M4 bolt and check the valve is flush with the endcap face.

8.8 Battery Maintenance

8.8.1 Checking the Battery Condition

Check the battery using either 6G Terminal Lite software or an iWAND acoustic transponder.

The battery voltage must be above 11 V and have enough capacity for the next deployment.

If the battery needs replacing see *Section 8.8.2 "Disconnecting and Replacing the Battery"*.

8.8.1.1 Checking the Battery using 6G Terminal Lite

To check the battery using 6G Terminal Lite, see *UM-8300-099 "User Manual for 6G Terminal Lite"*, *Section "6G Setup tab"*.

8.8.1.2 Checking the Battery using an iWAND

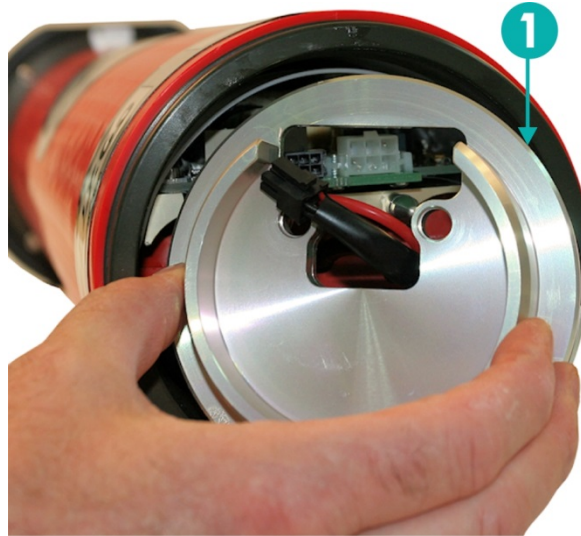
To check the battery using an iWAND acoustic transponder; see *UM-8315 "User Manual for the Type 8315 iWAND"*, *Section "Quick Check > Battery Status"*.

8.8.2 Disconnecting and Replacing the Battery

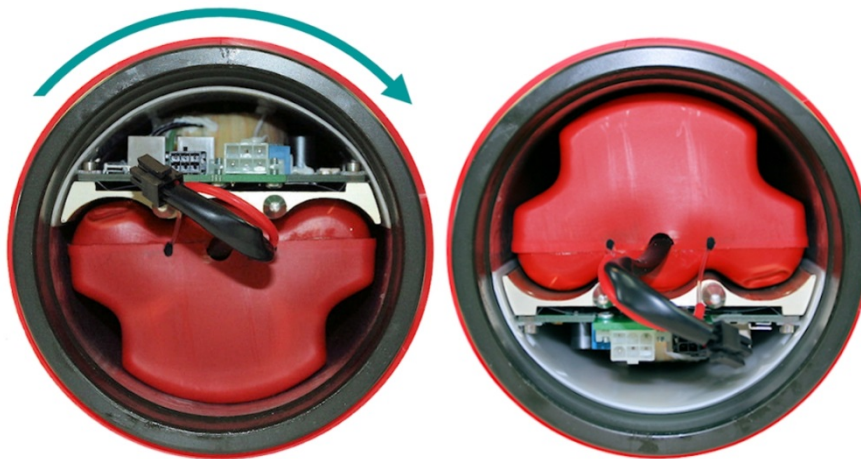
1. Ensure the transponder has been cleaned with clean fresh water and any marine growth removed; see *Section 8.3 "Cleaning"*.
2. Position the transponder on a clean dry bench.
3. Operate the pressure relief vent valve to release any internal pressure; see *Section 8.7.1 "Operating the Pressure Relief Vent Valve"*.
4. Remove the transducer endcap and disconnect the black battery connector – for a directional transducer endcap see *Section 8.9.1 "Directional Transducer Endcap Removal"*; for an omni-directional transducer endcap see *Section 8.10.1 "Omni-Directional Transducer Endcap Removal"*.

8.8.2.1 Battery Removal

1. With the transducer endcap removed and cables disconnected, pull out the top bulkhead **1**.



2. Rotate the housing so the battery is located uppermost in the housing.



3. Using the drawstring **1** attached to the battery pack, slowly pull and support the battery pack out of the transponder.



8.8.2.2 Battery Fitment

Before fitting a new battery pack ensure there are no obstructions inside the pressure housing.

1. Ensure the replacement battery is the correct type and check for any leakages or damage.
2. Position the transponder on a clean dry bench.

Note



The battery pack should be able to slide smoothly inside the transponder housing. If any resistance is felt, remove the battery and inspect the transponder housing.

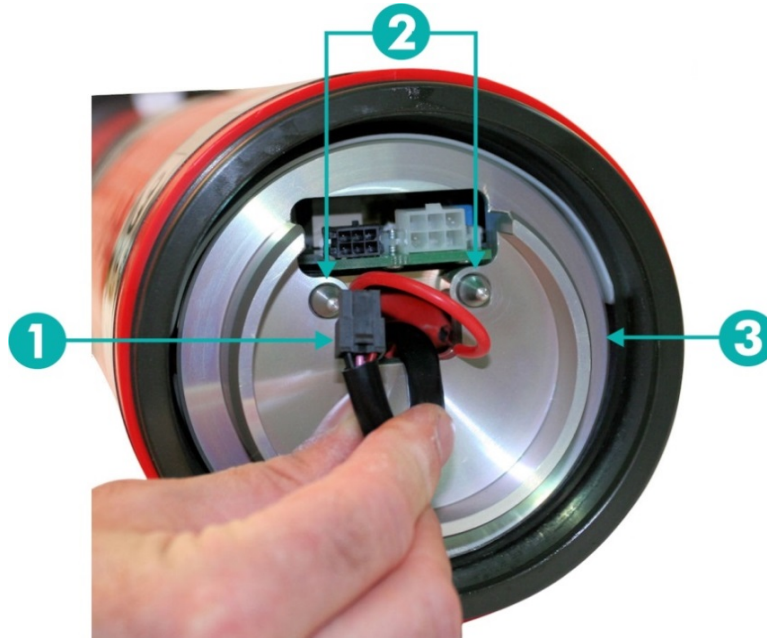
3. With the battery connector **2** facing outwards, support the battery pack **1** and slide into the transponder housing.



4. Position the bulkhead plate **3** so the machined rim is outer most. Feed the battery connector lead **1** through the bulkhead plate; see *Figure 8-1*

5. Position the bulkhead plate **3** over the two locating pins **2** and firmly push into position.
6. Connect the black battery connector lead **1** to the connector and ensure the locking mechanism engages.

Figure 8–1 Fitting the Bulkhead Plate



7. Inspect the transducer endcap for any signs of damage, pay particular attention to the O-ring seals and groove; see *Figure 8–2*.

Figure 8–2 Inspecting the Transducer Endcap



8. Inspect the O-rings and replace if necessary.
9. Lubricate the O-rings; see *Section 8.5.2 "Endcap O-Rings"*.
10. Position the transducer endcap next to the transponder housing.

11. For fitment instructions of the directional transducer endcap, see *Section 8.9.2 "Fitment of the Directional Transducer Endcap"*; for fitment instructions of the omni-directional transducer endcap, see *Section 8.10.2 "Fitment of the Omni-Directional Transducer Endcap"*.

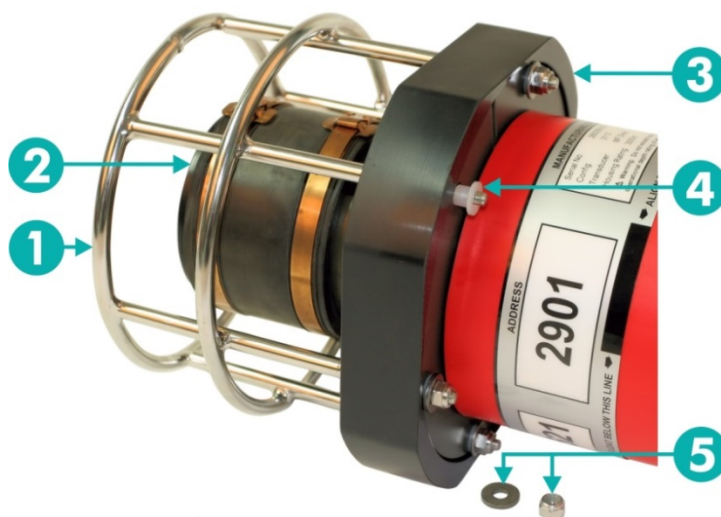
8.9 Removal and Fitment of a Directional Transducer Endcap

If the transponder is configured with a directional transducer endcap the removal and fitment procedures will differ to that of the omni-directional transducer.

8.9.1 Directional Transducer Endcap Removal

1. Ensure the transponder has been cleaned with clean fresh water and any marine growth removed; see *Section 8.3 "Cleaning"*.
2. Operate the pressure relief vent valve to release any internal pressure; see *Section 8.7.1 "Operating the Pressure Relief Vent Valve"*.
3. Undo, remove and retain the six nuts, washers **5** and white nylon spacers **4** from the end of the guard **1** protecting the transducer **2**; see *Figure 8-3*.

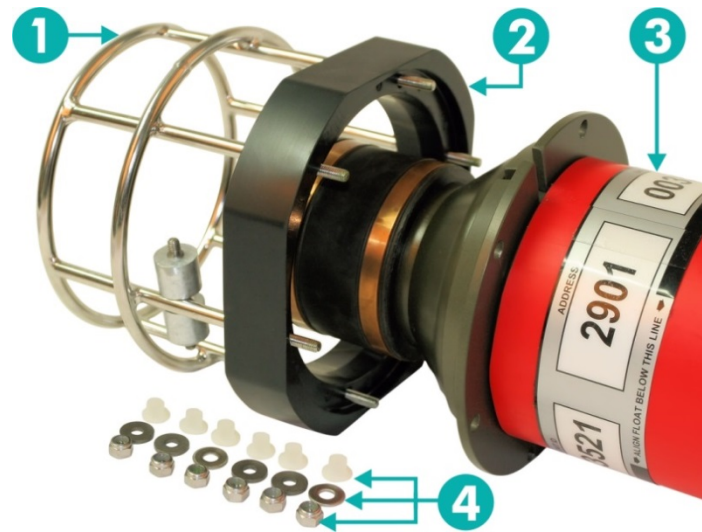
Figure 8-3 Removing the Protective Guard



- | | |
|---------------------------|---------------------------|
| 1 Guard | 4 Nylon Spacer |
| 2 Transducer | 5 Washers and Nuts |
| 3 Rubber Bump Stop | |

4. Lift the end of the transponder housing a small amount to allow the protective guard **1** and bump stop **2** to be removed from the clamp rings **3**; see *Figure 8-4*.

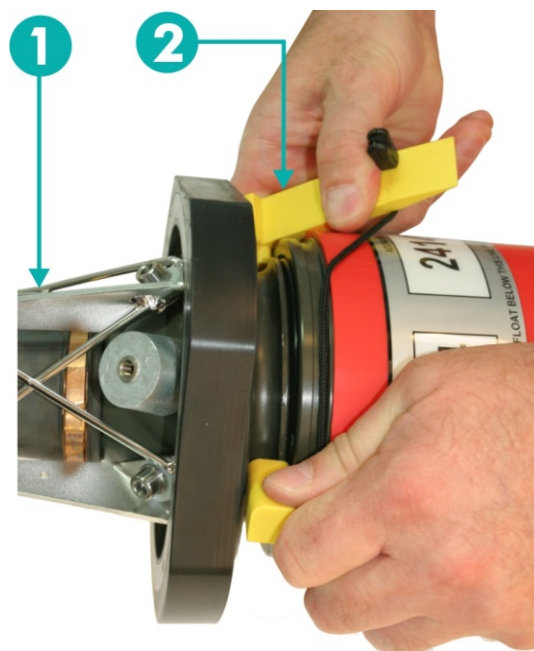
Figure 8-4 Removing the Guard and Bump Stop



- | | |
|-------------|-----------------------------------|
| 1 Guard | 3 Clamp Rings |
| 2 Bump Stop | 4 Nuts, Washers and Nylon Spacers |

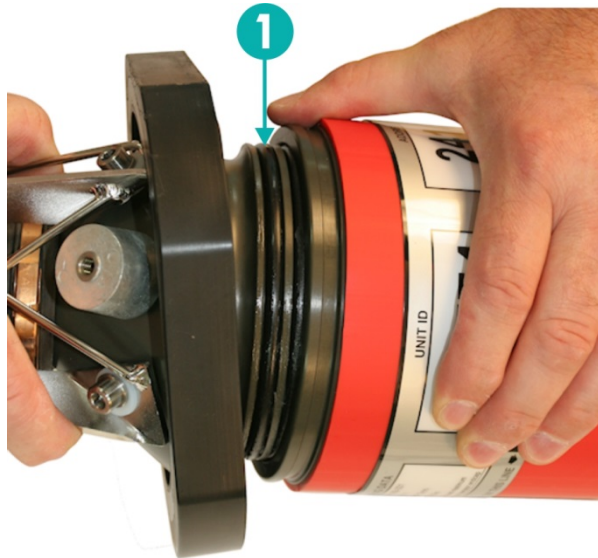
5. With the guard and bump stop removed, remove the clamp rings.
6. Remove any dirt, silt or water that may have accumulated around the endcap.
7. Using the Opening tools, lever the transducer endcap from the housing until the O-ring seals are exposed; see *Figure 8-5*.

Figure 8-5 Removing Transducer Housing using the Opening Tools (Omni-Directional shown for Reference)



8. Using a lint free cloth, clean around the O-ring seals; see *Figure 8-6*.

Figure 8-6 Cleaning the O-ring Seals (Omni-Directional shown for Reference)

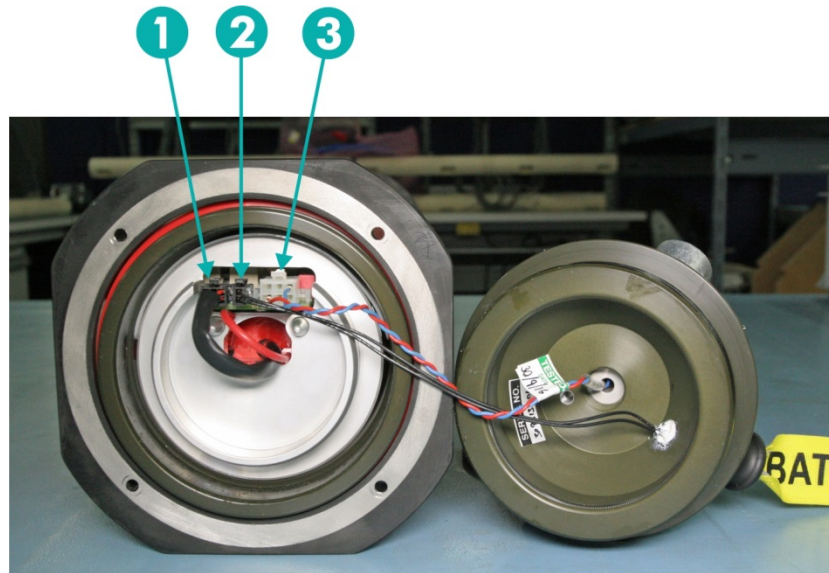


Note



Remove the transducer endcap slowly to prevent the cables becoming detached.

9. Pull the transducer endcap slowly from the transponder body. Take care not to pull too hard or suddenly resulting in the cables becoming detached from the housing.
10. Disconnect the battery **1**, battery disconnect fob **2** (if fitted) and transducer **3** cable connectors by pressing in the connector locking pin and pulling out.



8.9.2 Fitment of the Directional Transducer Endcap

1. Inspect the transducer endcap for any signs of damage, pay particular attention to the O-ring seals and groove.
2. Inspect the O-rings and replace if necessary.

3. Lubricate the O-rings; see *Section 8.5.2 "Endcap O-Rings"*.
4. Position the transducer endcap next to the transponder housing.
5. Connect the white transducer endcap cable to the white connection block.
6. Connect the battery disconnect fob connector (if fitted) to the black connection block.
7. Connect the battery connector to the black connection block.
8. Slowly rotate the transducer to coil the cable inside the bulkhead plate; push the transducer into the housing taking care not to trap the cable.

Note

Observe the position of the transducer cable, ensure the cable does not become trapped when inserting the transducer.

9. Position the clamp rings in the grooves on the endcap.
10. Position the guard with the bump stop over the transducer.
11. Rotate the clamp rings **2**, if necessary, to align the holes with the screw ends of the guard **1**; see *Figure 8-7*.

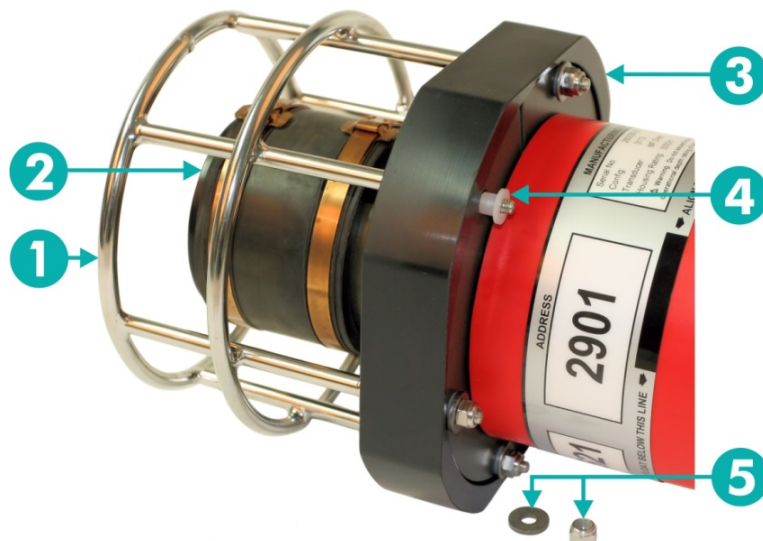
Figure 8-7 Refitting the Guard and Bump Stop



12. Lift the end of the transponder enough to locate the guard screws through the holes in the clamp rings.

13. Secure the Bump Stop and Guard in place with the six nylon spacers, washers and nuts; see *Figure 8–8*.

Figure 8–8 Securing the Bump Stop and Guard



- | | |
|--------------------|--------------------|
| 1 Guard | 4 Nylon Spacer |
| 2 Transducer | 5 Washers and Nuts |
| 3 Rubber Bump Stop | |

14. The transponder is now ready to be tested for operation; see *Section 9 "Functional Test"*.

8.10 Removal and Fitment of Omni-Directional Transducer Endcap

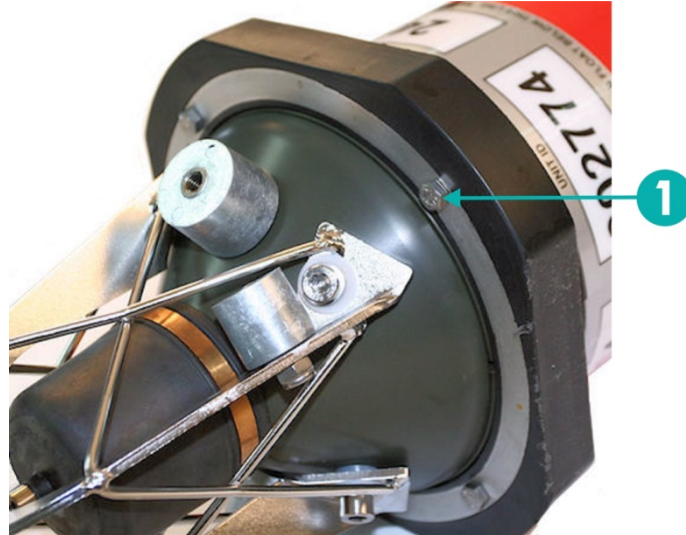
If the transponder is configured with an omni-directional transducer endcap the removal and fitment procedures will differ to that of the directional transducer.

8.10.1 Omni-Directional Transducer Endcap Removal

1. Ensure the transponder has been cleaned with clean fresh water and any marine growth removed; see *Section 8.3 "Cleaning"*.
2. Operate the pressure relief vent valve to release any internal pressure; see *Section 8.7.1 "Operating the Pressure Relief Vent Valve"*.

3. Undo and remove the nuts, washers and bolts ❶ securing the clamp rings and transducer to the housing see *Figure 8-9*.

Figure 8-9 Removing the Clamp Rings



4. Push the rubber bump stop ❷ free from the clamp rings ❶ and housing; use the tapered end of the Opening Tools to assist if necessary; see *Figure 8-10*.
5. With the Rubber Bump Stop ❷ free, remove the clamp rings ❶.

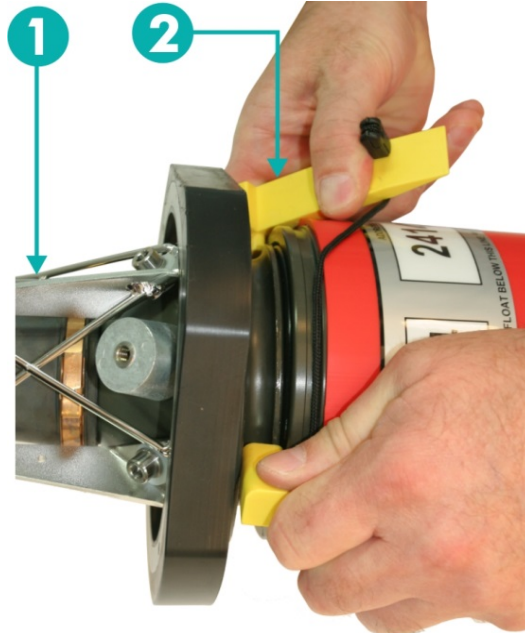
Figure 8-10 Removing the Rubber Bump Stop



6. Remove any dirt, silt or water that may have accumulated around the endcap.

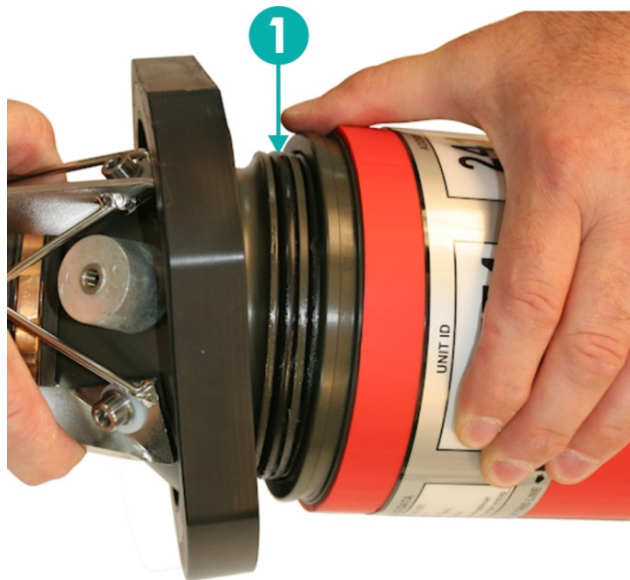
7. Using the Opening Tools **2**, lever the transducer endcap **1** from the housing until the O-ring seals are exposed; see *Figure 8-11*.

Figure 8-11 Removing Transducer Housing using the Opening Tools



8. Using a lint free cloth, clean around the O-ring seals **1**; see *Figure 8-12*.

Figure 8-12 Cleaning the O-ring Seals



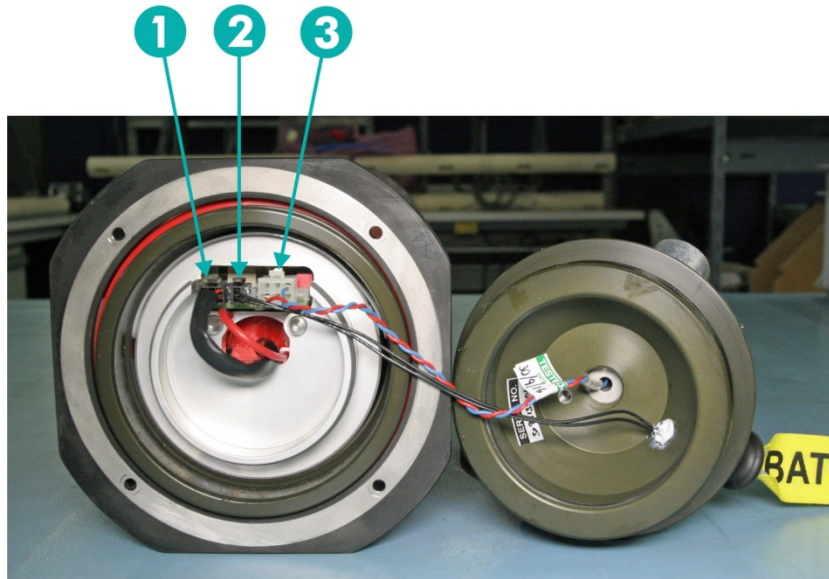
Note



Remove the transducer endcap slowly to prevent the cables becoming detached.

9. Pull the transducer endcap slowly from the transponder body. Take care not to pull too hard or suddenly resulting in the cables becoming detached from the housing.

10. Disconnect the battery **1**, battery disconnect fob **2** (if fitted) and transducer **3** cable connectors by pressing in the connector locking pin and pulling out.



8.10.2 Fitment of the Omni-Directional Transducer Endcap

1. Inspect the transducer endcap for any signs of damage, pay particular attention to the O-ring seals and groove.
2. Inspect the O-rings and replace if necessary.
3. Lubricate the O-rings; see *Section 8.5.2 "Endcap O-Rings"*.
4. Position the transducer endcap next to the transponder housing.
5. Connect the white transducer endcap cable to the white connection block.
6. Connect the battery disconnect fob connector (if fitted) to the black connection block.
7. Connect the battery connector to the black connection block.

Note

Observe the position of the transducer cable, ensure the cable does not become trapped when inserting the transducer.

8. Slowly rotate the transducer to coil the cable inside the bulkhead plate; push the transducer into the housing taking care not to trap the cable.
9. Position the clamp rings **1** in the grooves on the endcap; see *Figure 8-13*.
10. Slide the rubber bumper stop **2** over the endcap and align with the holes in the clamp rings.

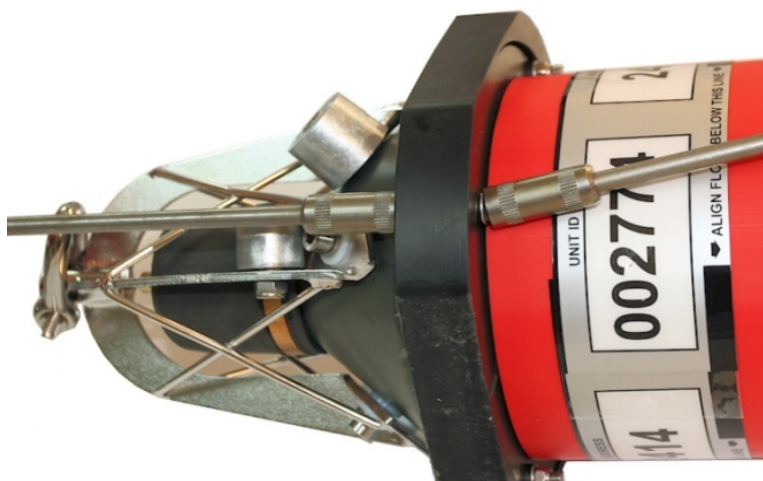
11. Secure the clamp rings **1** to the bumper stop **2** using the bolts, washers and nuts.

Figure 8–13 Fitting Clamp Rings and Bumper Stop



12. Tighten the nuts and bolts.

Figure 8–14 Securing Bump Stop to Clamp Rings



8.11 Removal and Fitment of the Sensor Endcap

8.11.1 Sensor Endcap Removal

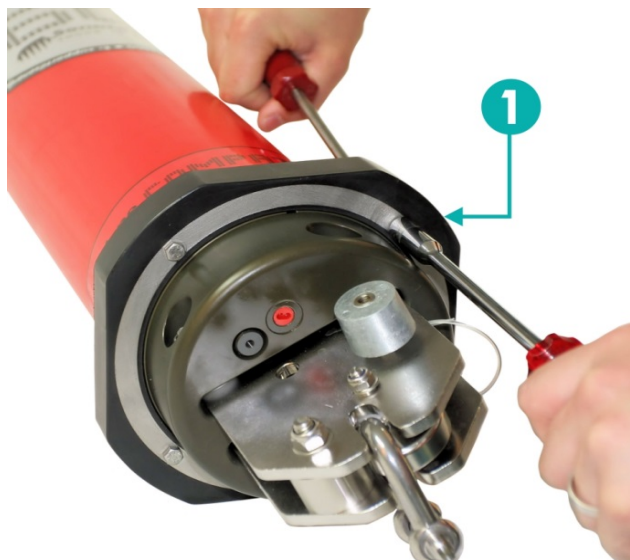
Note



Removal of the sensor endcap must only be carried out by Sonardyne trained personnel.

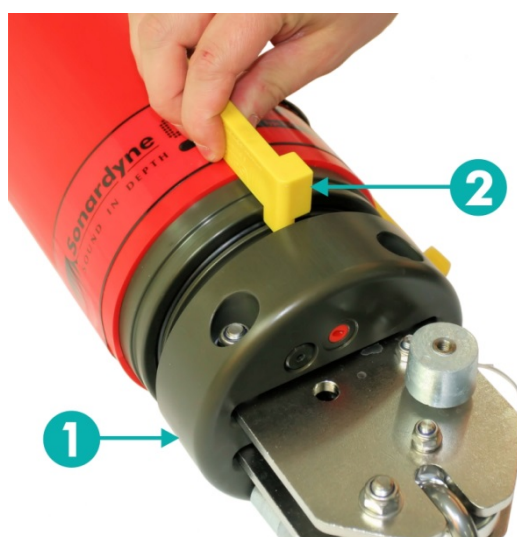
1. Ensure the transponder has been cleaned with clean fresh water and any marine growth removed; see *Section 8.3 "Cleaning"*.
2. Operate the pressure relief vent valve to release any internal pressure; see *Section 8.7.1 "Operating the Pressure Relief Vent Valve"*.
3. Remove the transducer endcap – for a directional transducer endcap see *Section 8.9.1 "Directional Transducer Endcap Removal"*; for an omni-directional transducer endcap see *Section 8.10.1 "Omni-Directional Transducer Endcap Removal"*.
4. Remove the battery; see *Section 8.8.2 "Disconnecting and Replacing the Battery"*.

5. Undo and remove the nuts, washers and bolts securing the clamp rings and bump stop **1** from the sensor endcap.



6. Push the rubber bump stop free from the clamp rings and housing (use the tapered end of the Opening Tools to assist if necessary).
7. With the Rubber Bump Stop free, remove the clamp rings.
8. Remove any dirt, silt or water that may have accumulated around the sensor endcap.
9. Using the Opening Tools **2** to assist to lever the sensor endcap **1** from the housing until the O-rings are exposed.

Figure 8-15 Figure 0-13 Remove the Sensor Endcap



10. Using the lint free cloth, clean around the O-ring seals.
11. Remove the Sensor Endcap; slowly pull the sensor endcap **1** from the transponder housing; see *Figure 8-16*.

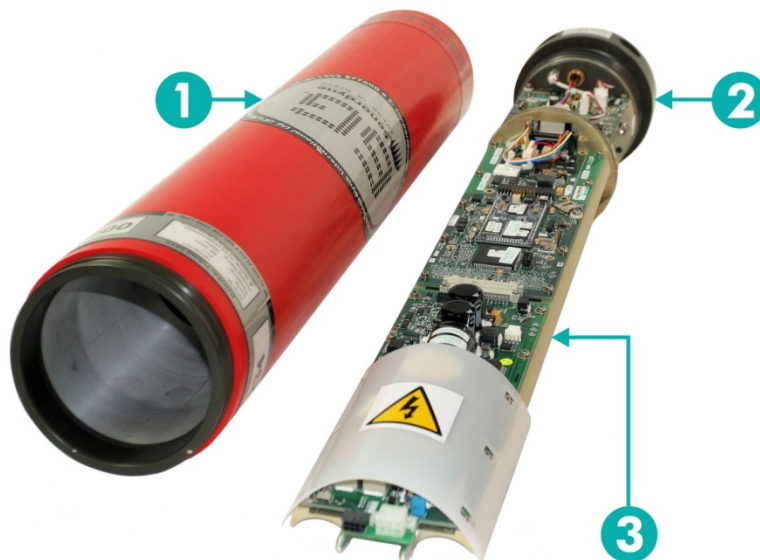
12. Inspect the condition of the O-ring **2** seals; replace if necessary.

Figure 8-16 Removing the Sensor Endcap



13. While pulling off the sensor endcap, support the chassis without touching the printed circuit boards.
14. Place the chassis on a clean dry surface; see *Figure 8-17*.

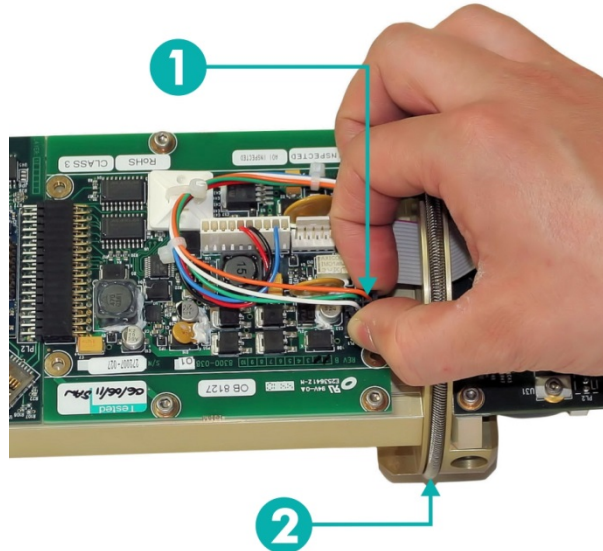
Figure 8-17 Sensor Endcap and Chassis



- | | |
|------------------------------|------------------|
| 1 Transponder Housing | 3 Chassis |
| 2 Sensor Endcap | |

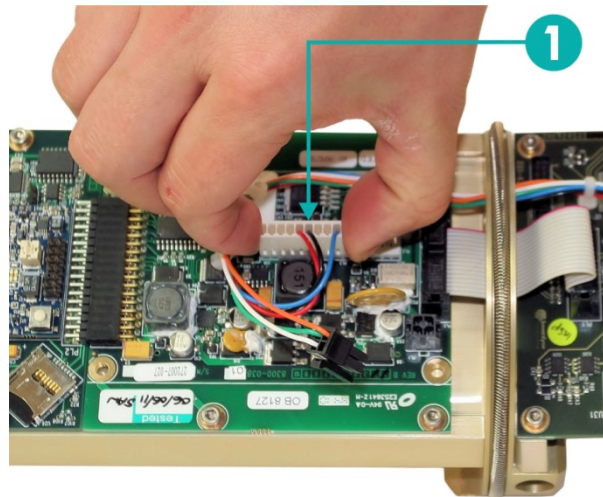
15. Inspect the spring gaskets **2** for signs of damage. Replace if necessary; see *Figure 8-18*.
16. Disconnect the PL1 connection **1** from the Interface PCB Assembly.

Figure 8-18 Disconnecting PL1 Connection from the Interface PCB Assembly



17. Disconnect the PL2 connection **1** from the Interface PCB Assembly.

Figure 8-19 Disconnecting PL2 Connection from the Interface PCB Assembly

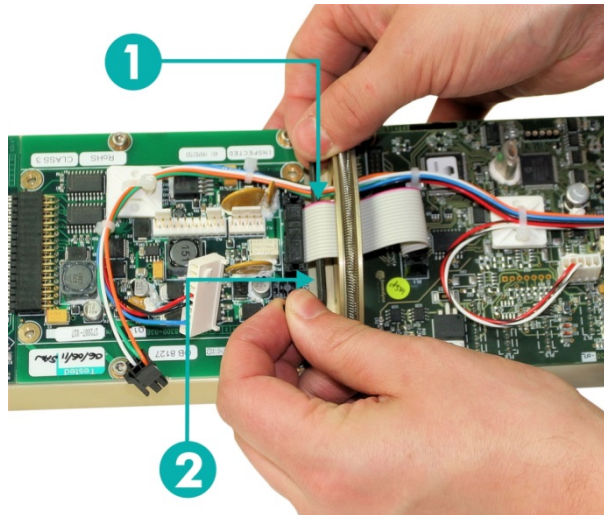


18. Disconnect the Ribbon Cable ① from the connection point on the Interface PCB Assembly.

Note

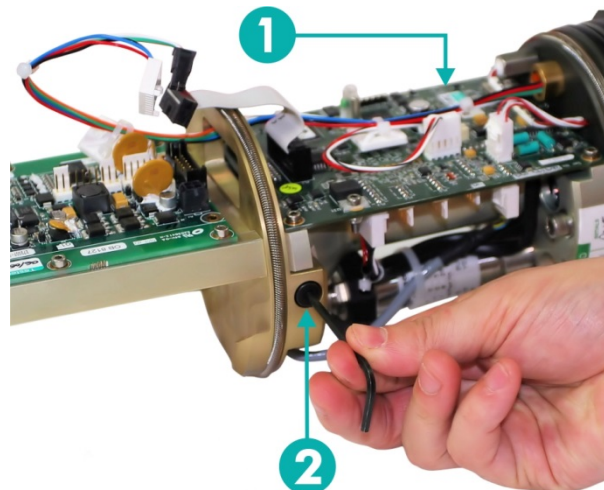
 An Allen key ② can be used to assist in lifting the ribbon cable connection from its location point.

Figure 8–20 Disconnecting the Ribbon Cable from the Interface PCB Assembly



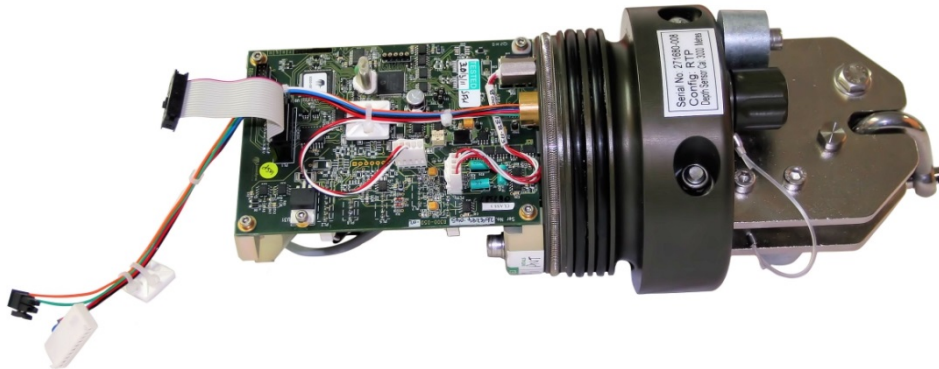
19. Use an Allen Key to undo the 2 x retaining screws ② from the sensor endcap ① to the main chassis.

Figure 8–21 Disconnecting the Sensor Endcap from the Main Chassis



20. Carefully feed all cables through the hole in the end of the chassis.

21. The Sensor endcap is now disconnected from the main chassis and can be replaced if necessary.



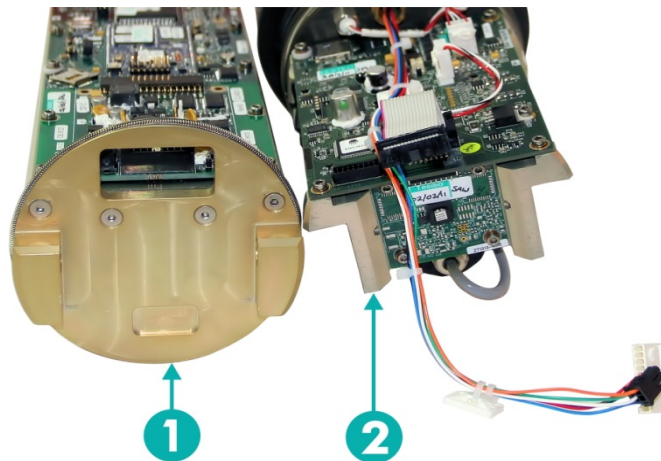
8.11.2 Sensor Endcap Fitment

Note



Fitting of the sensor endcap must only be carried out by Sonardyne trained personnel.

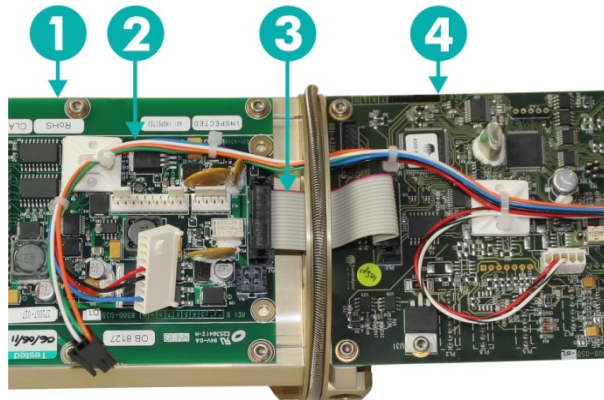
1. Before fitting a new sensor endcap, inspect the main chassis and sensor endcap mating faces for any signs of damage.



- 1 Chassis mating face 2 sensor endcap mating face

2. Position the sensor endcap so it abuts the main chassis; see *Figure 8-22*.
3. Feed the wiring and ribbon cable through the cut out in the main chassis.

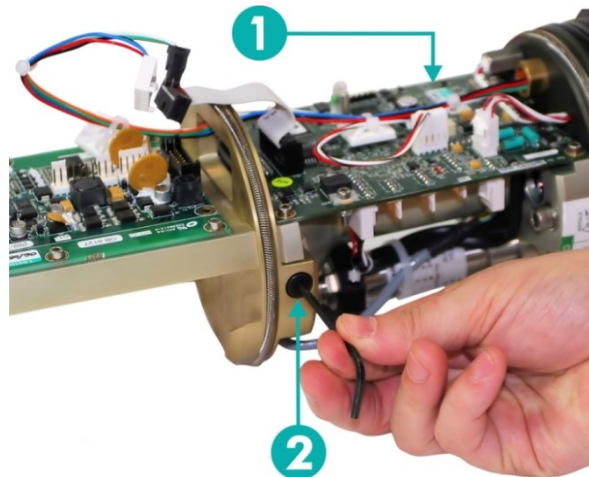
Figure 8-22 Abutting Chassis and Sensor Endcap



- | | |
|----------------|-----------------|
| 1 Main Chassis | 3 Ribbon Cable |
| 2 Wiring loom | 4 Sensor Endcap |

4. Using an Allen Key, secure the sensor endcap 1 to the Chassis using the 2 x retaining screws 2.

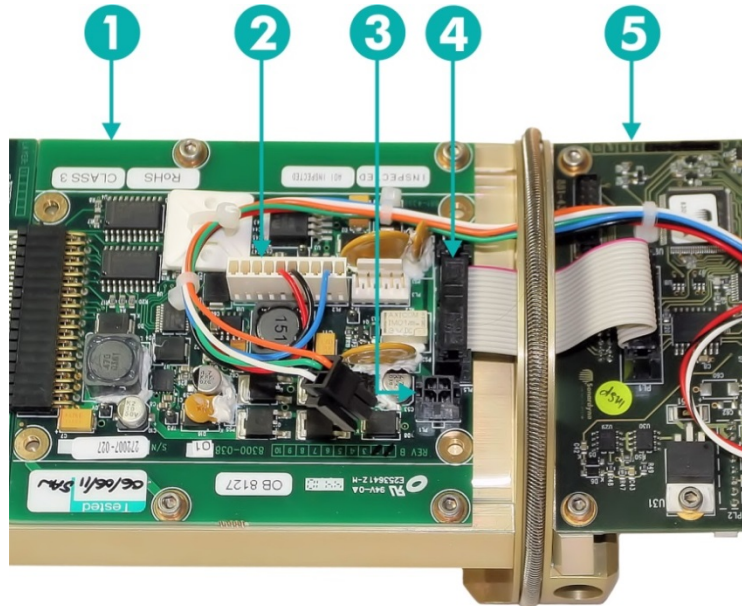
Figure 8-23 Securing the Sensor Endcap to the Chassis



1. Connect the ribbon cable to the black connection block 4 on the Interface PCB Assembly; see *Figure 8-24*.
2. Connect the white block connection to the PL2 connection point 2 on the Interface PCB Assembly.

3. Connect the black block connection to the PL1 connection point ³ on the Interface PCB Assembly.

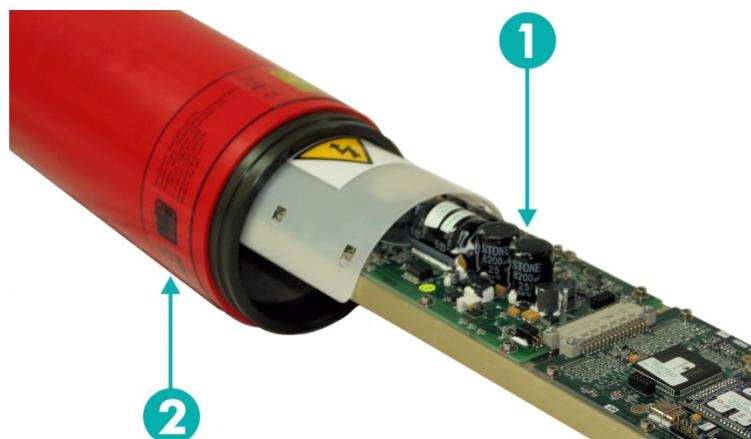
Figure 8-24 Interface PCB Connections



- | | |
|-------------------------------------|--|
| ¹ Interface PCB Assembly | ⁴ Ribbon Cable connection point |
| ² PL2 Connection point | ⁵ Sensor Endcap |
| ³ PL1 Connection point | |

4. Support the chassis ¹ and insert into the housing; check the direction of housing labels ² to ensure the chassis is inserted to the bottom of the housing.

Figure 8-25 Inserting the Chassis into the Housing



5. Lubricate the 2 x O-rings **2** on the Sensor Endcap **1**; see



6. Push the sensor endcap fully into the housing.

Note

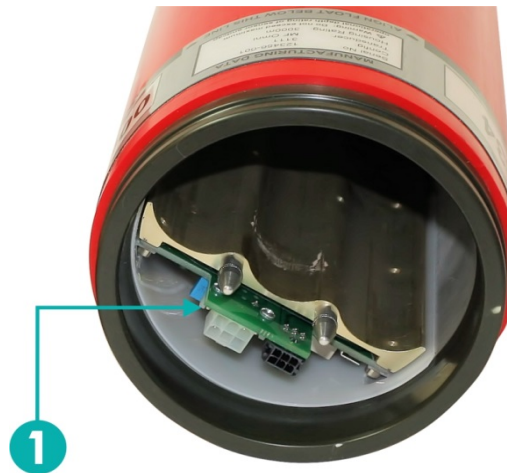
 **If any resistance is felt, pull out the sensor endcap and Chassis fully and inspect the housing for any obstructions.**

7. Position the clamp rings in the grooves on the sensor endcap.
8. Slide the rubber bumper stop over the sensor endcap and align the holes in the clamp rings.
9. Secure the clamp rings to the bumper stop **1** using the bolts, washers and nuts.



10. Tighten the nuts and bolts.

11. Viewing the housing from the other end, rotate the transponder housing so the circuitry **1** is at the bottom of the housing.



12. Check inside the housing for any signs of obstruction.

Note



The battery pack should be able to slide smoothly inside the transponder housing. If any resistance is felt remove the battery and inspect the transponder housing.

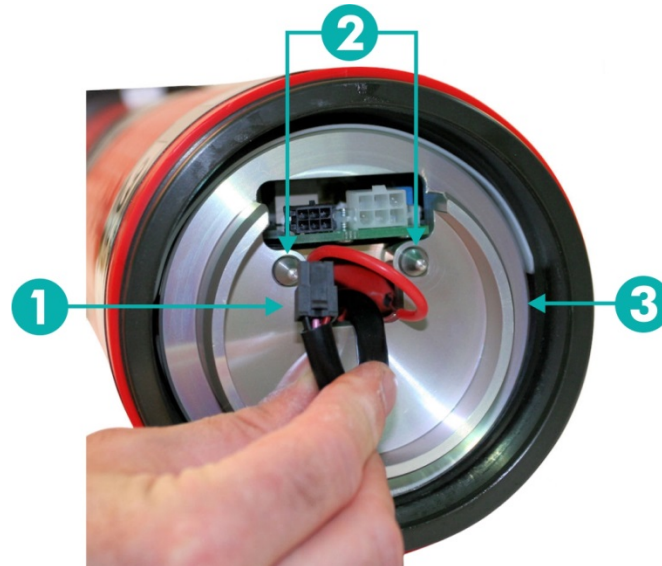
13. Support the battery pack and slide into the transponder housing.



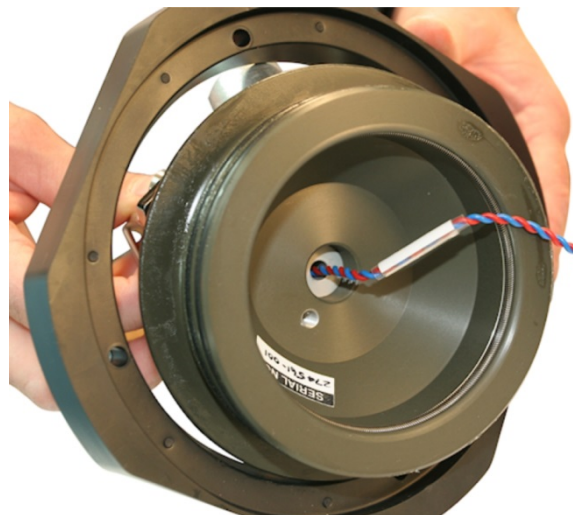
- 1** Battery pack **2** Battery Connection

14. Position the bulkhead plate **3** so the machined rim is outer most. Feed the battery connection lead **1** through the bulkhead plate **3**; see *Figure 8-26*.
15. Position the bulkhead plate **3** over the two locating pins **2** and firmly push into position.

Figure 8-26 Fitting the Bulkhead Plate over the Pins

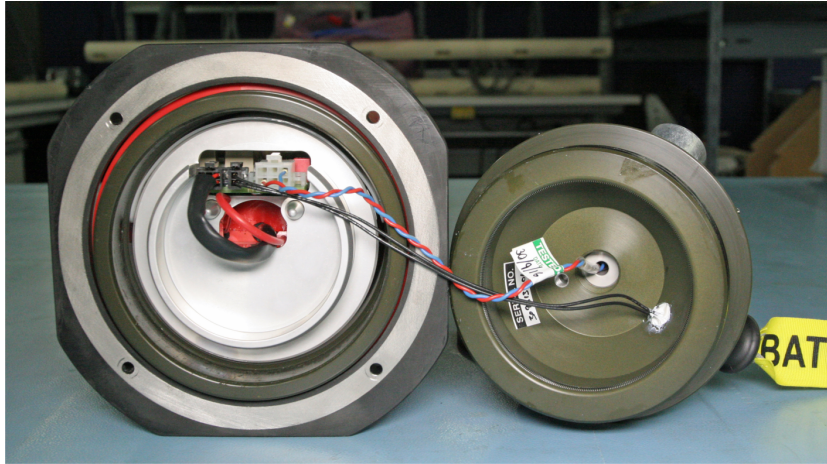


16. Inspect the transducer endcap for any signs of damage, paying particular attention to the O-ring seals and grooves.



17. Inspect the O-rings and replace if necessary.
18. Lubricate the O-rings; see *Section 8.5.2 "Endcap O-Rings"*.

19. Position the transducer endcap next to the transducer housing.



20. For fitment instructions of the directional transducer endcap, see *Section 8.9.2 "Fitment of the Directional Transducer Endcap"*; for fitment instructions of the omni-directional transducer endcap, see *Section 8.10.2 "Fitment of the Omni-Directional Transducer Endcap"*.

8.12 Corrosion Removal

Cases of slight corrosion found on the transponder 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 9 – Functional Test

9.1 Introduction

Before performing any functional testing on the equipment, ensure *Section 2 "Safety"* is read and fully understood.

Make sure the transponder has been cleaned; see *Section 8.3 "Cleaning"*.

Remove the battery disconnect fob (if fitted) to enable the transponder.

To make sure the Compatt 6 functions correctly functional testing can be carried out. Many functions can be tested via the RS232 serial link using 6G Terminal Lite software.

Functional testing can be carried out on all major sub-systems in the Compatt 6, these include:

- Acoustic Transducer
- Pre-amplifier
- Tone Receiver Circuitry
- Transmitter Synthesizer
- Wideband Receiver Circuitry
- Release Motor and Sensors

9.2 Test Equipment

The following equipment can be used to carry out functional testing of the transponders:

Table 9–1 Test Equipment

Description	Sonardyne Order Code
PC with RS232 COM Port	-
Power supply (24 VDC) @ 2 amp	-
6G® Utilities media; see <i>Section 9.2.1 "6G Terminal Lite "</i>	920-2000
Dual Serial Cable	820-6713
Compatt 6 to PC serial Cable	820-6570
iWAND hand held test device; see <i>Section 9.2.2 "iWAND Hand Test Device"</i>	8315-0002

9.2.1 6G Terminal Lite

6G Terminal Lite software is supplied on the 6G Utilities CD. See *UM-8300-099-User Manual for 6G Terminal Lite* (referred to as *6G Terminal Lite* in this manual).

9.2.2 iWAND Hand Test Device

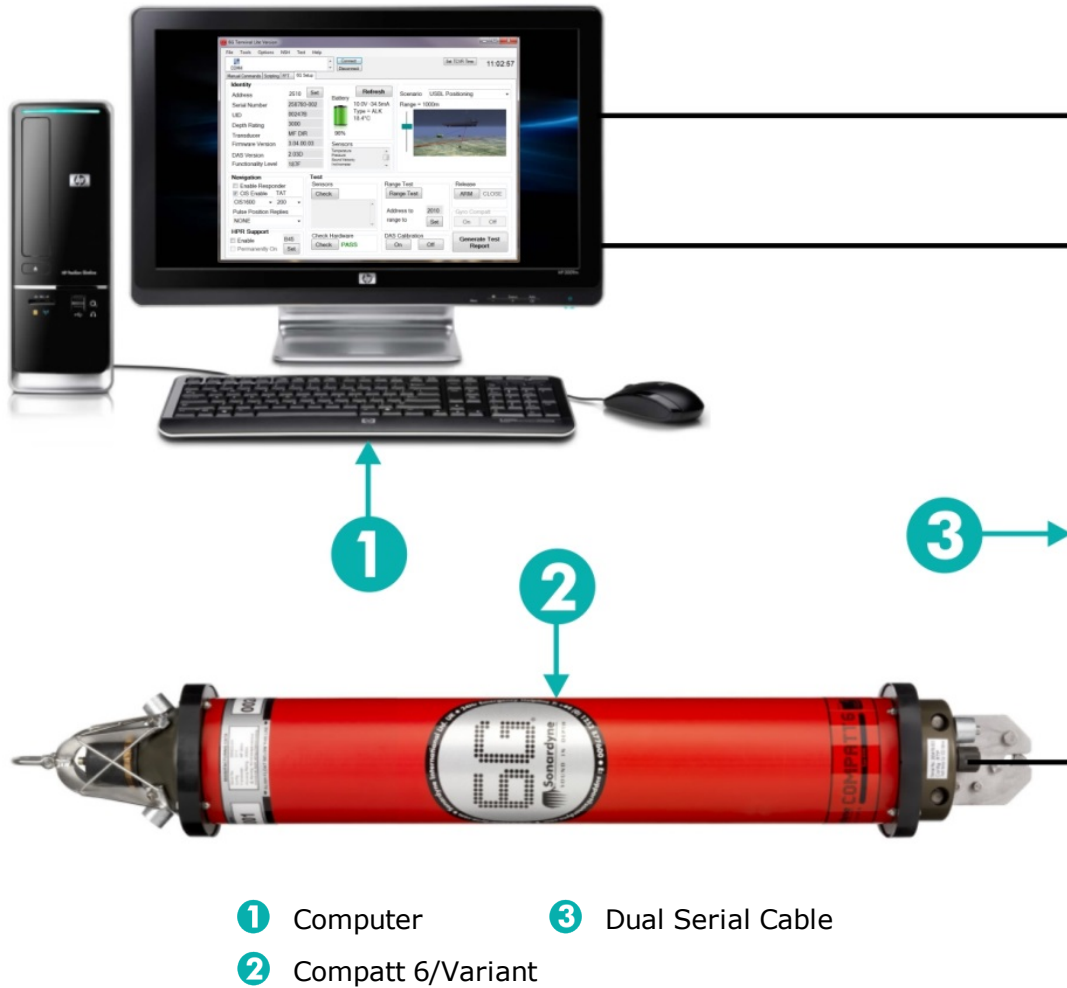
The Type 8315 iWAND is a hand-held acoustic transponder test and configuration device for use with Sonardyne's 6G product range.

9.3 Operational Testing

The following test procedures are described using 6G Terminal Lite. Many of the procedures can also be performed using the iWAND acoustic transponder; see *UM-8315 "User Manual for the Type 8315 iWAND"*.

To carry out operational testing of the Compatt 6 transponder, connect the Dual Serial Cable in as described in *Section 9.3.1 "Connecting the Dual Serial Cable"*.

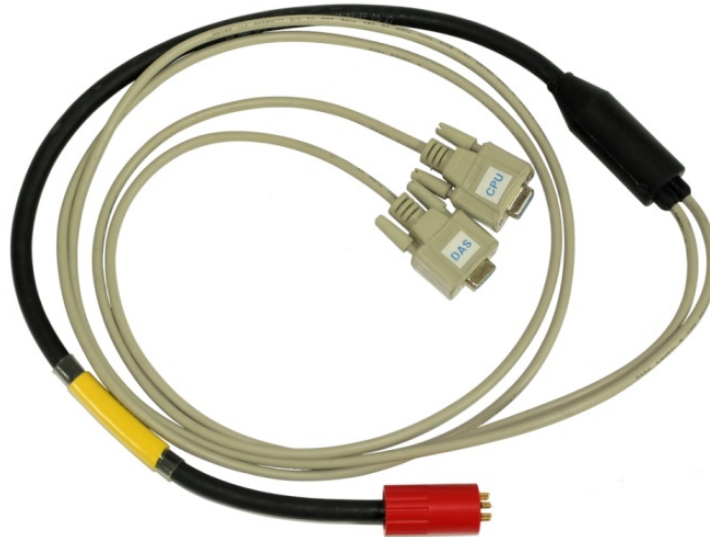
Figure 9–1 Compatt 6 Connected to the PC using the Dual Serial Cable



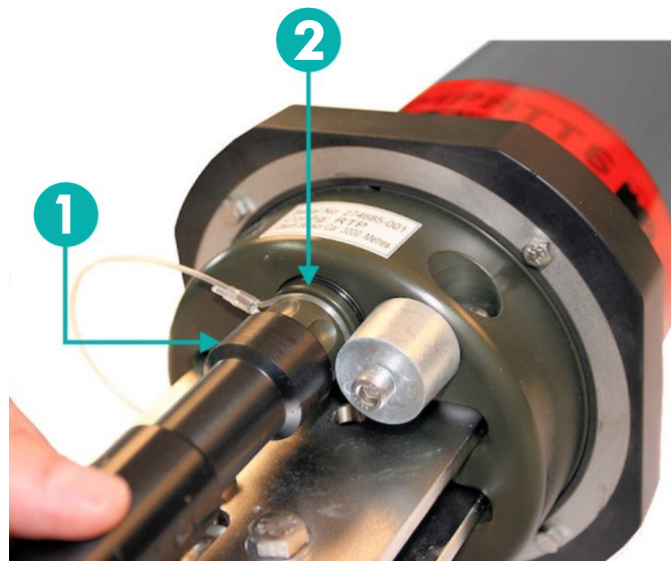
9.3.1 Connecting the Dual Serial Cable

1. Locate the round Dual Serial Cable connection point on the transponder.

Figure 9-2 Dual Serial Cable



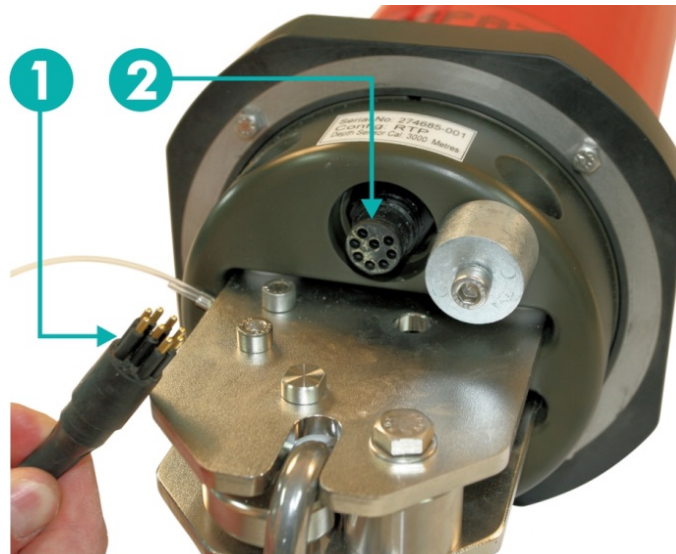
2. Using the Connector Cover Tool **1**, remove the protective connector cover **2**.



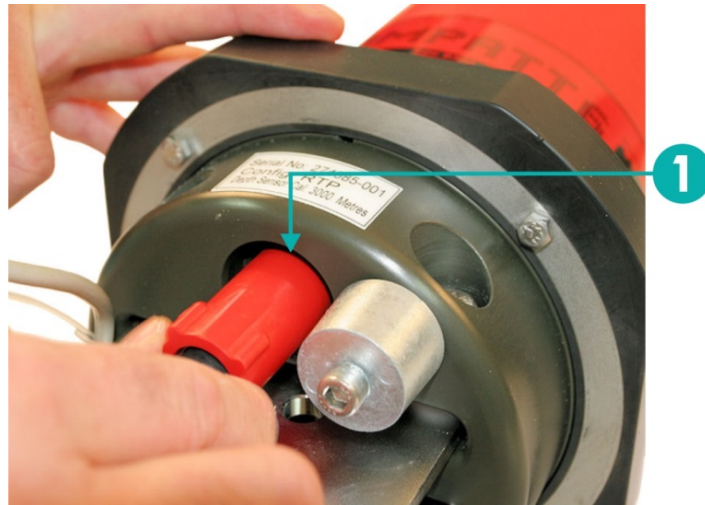
3. Check the connection points are free from dirt and obstruction.



4. Position the Dual Serial Cable **1** in the correct orientation and insert into the connector **2**.



5. Ensure the Dual Serial Cable is fully secured in place by screwing in the red protective cover **1** (clockwise).



6. The opposite end of the Dual Serial Cable has the CPU and DAS connectors for connecting to the PC COM ports.

9.3.2 Checking the Wideband Acoustics

The following procedure describes the acoustics check using 6G Terminal Lite.

Note

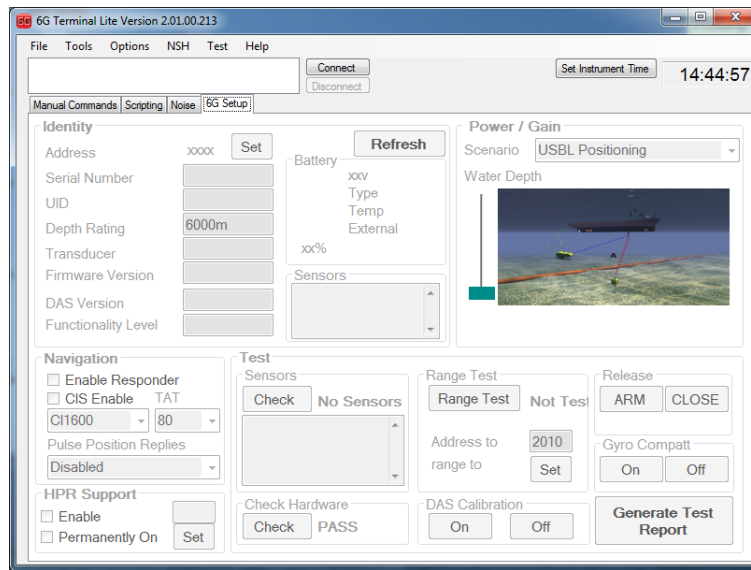
 The same checks can also be performed using the iWAND acoustic transponder; see *UM-8315 "User Manual for the Type 8315 iWAND", Section "Ping Check"*.

To carry out a check of the Wideband Acoustics of the transponders, it will also be necessary to enter the address of an acoustically paired device (if one is attached).

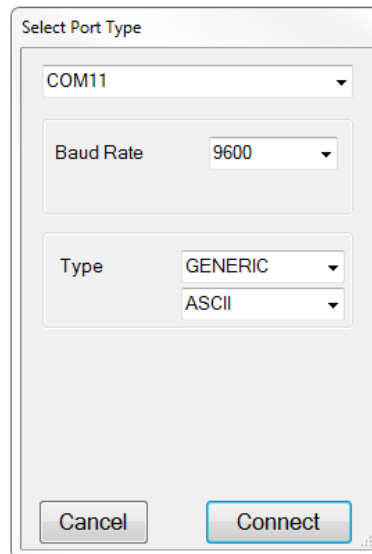
1. Double-click the **6G Terminal Lite** desktop icon to start the software.



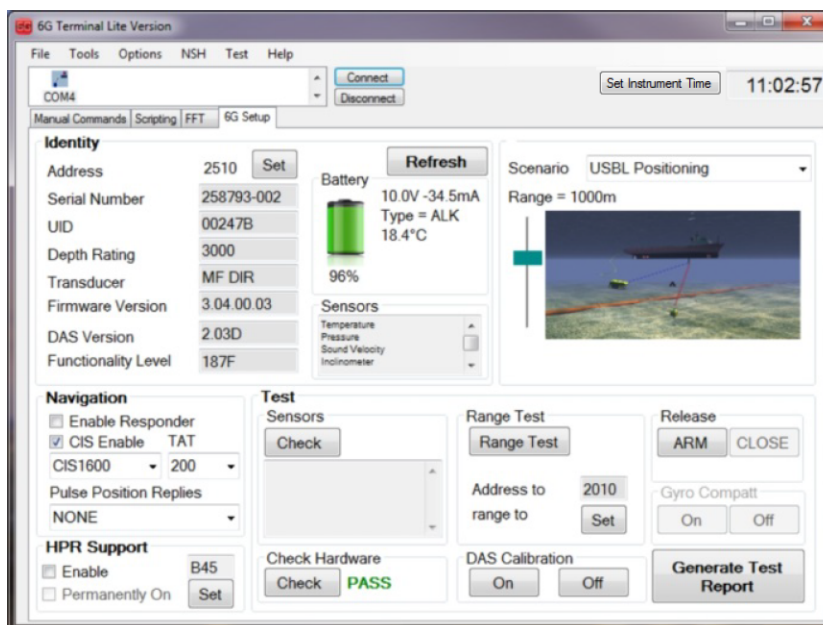
- The 6G Terminal Lite dialog box will open on the **6G Setup** tab.



- Click **Connect**.
- On the **Select port type** drop-down list, select the computer connection port.
- On the **Baud Rate** drop-down list select the baud rate and then click **Connect**.



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

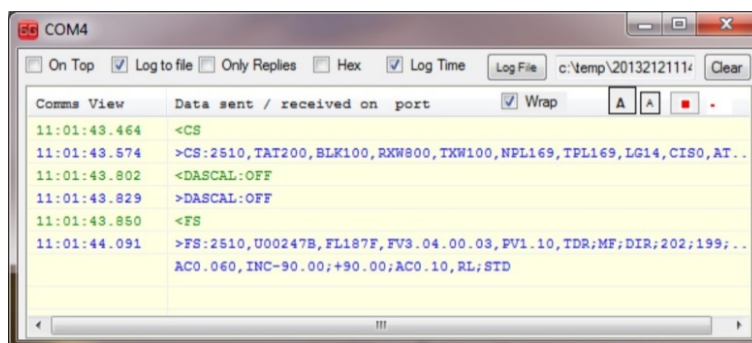


7. A COM log window will also open. The green writing indicates the commands sent from the software to the transponder, the blue writing is the transponders response.

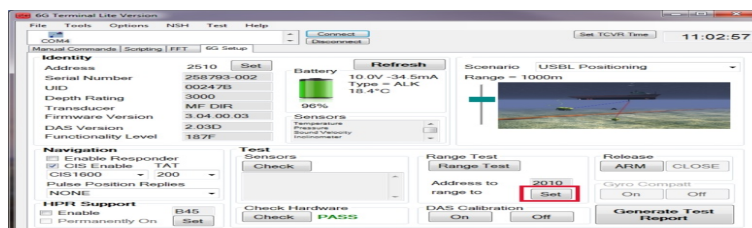
Note



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



8. To enter the address of the acoustically paired device, if one is attached, click **Set** on the **Range Test** pane.



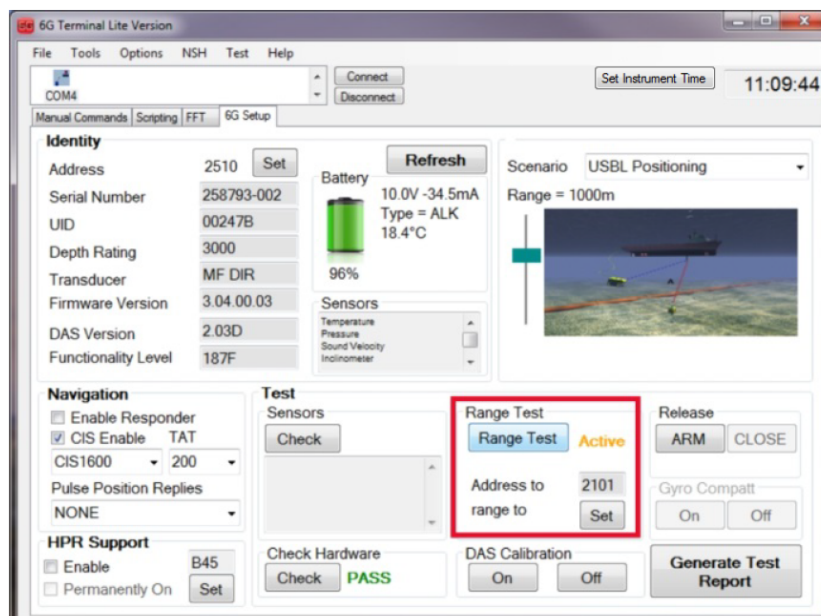
- An **Address Selector** window will open listing all available addresses for Wideband 2. Select the address for the attached device and then click **OK**.

Note

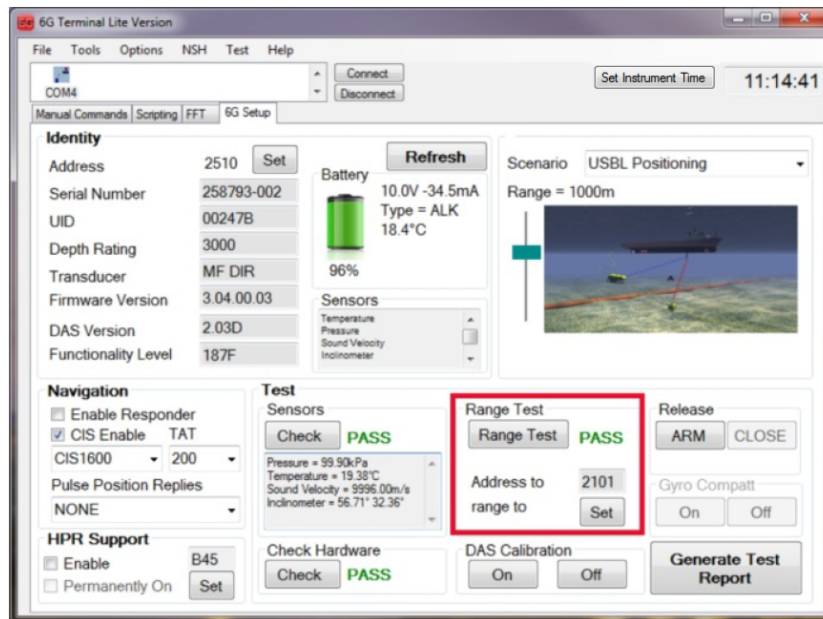
 **Tabs are also available to show addresses for Wideband 1 and Wideband 2+ systems.**



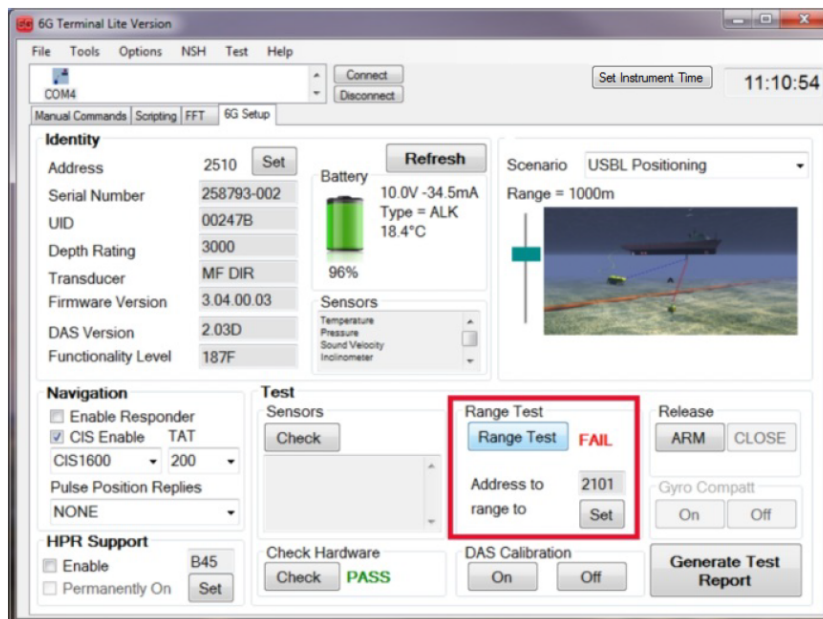
- The 6G Setup tab will open with the selected address in the Range Test **Address to** window. Click **Range Test** to begin the acoustic check.
- During the test, **Active** will appear next to the **Range Test** button to indicate the test is in progress.



12. If the Acoustic check is successful, **Pass** will appear next to the **Range Test** button.



13. If the Range Test is unsuccessful, **Fail** will appear next to the **Range Test** button.



14. If **Fail** appears next to the range test, move the transponder to a new location and repeat the range test. If the Range Test continues to fail contact Sonardyne Support.
15. The acoustic checks are now complete.

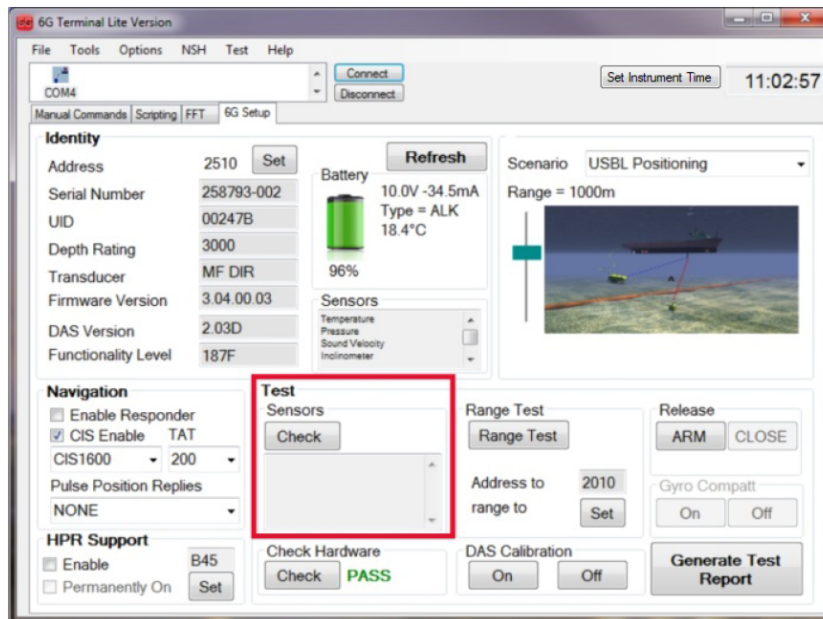
9.3.3 Checking the Sensor Measurements

The following procedure describes the sensor measurements check using 6G Terminal Lite.

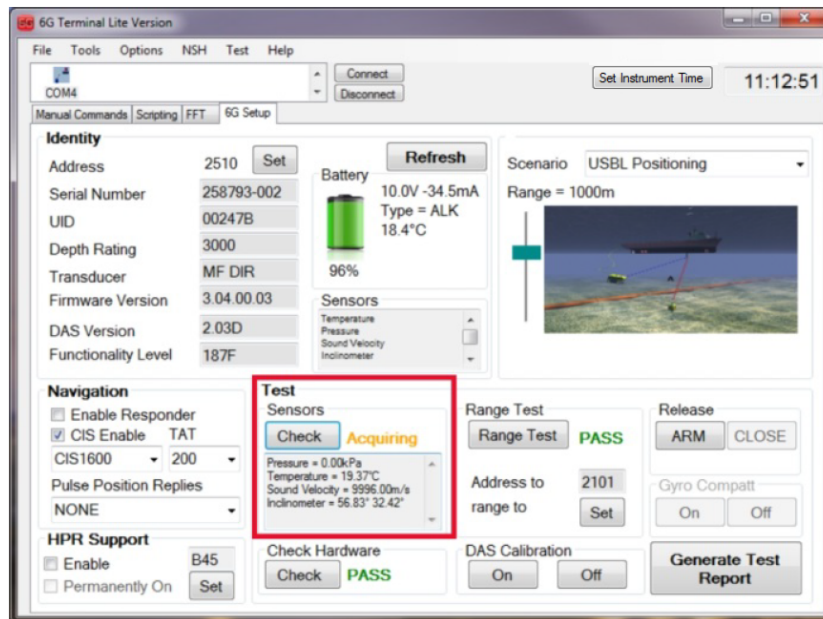
Note

 The same checks can also be performed using the iWAND acoustic transponder; see UM-8315 "User Manual for the Type 8315 iWAND", Section "View Sensors".

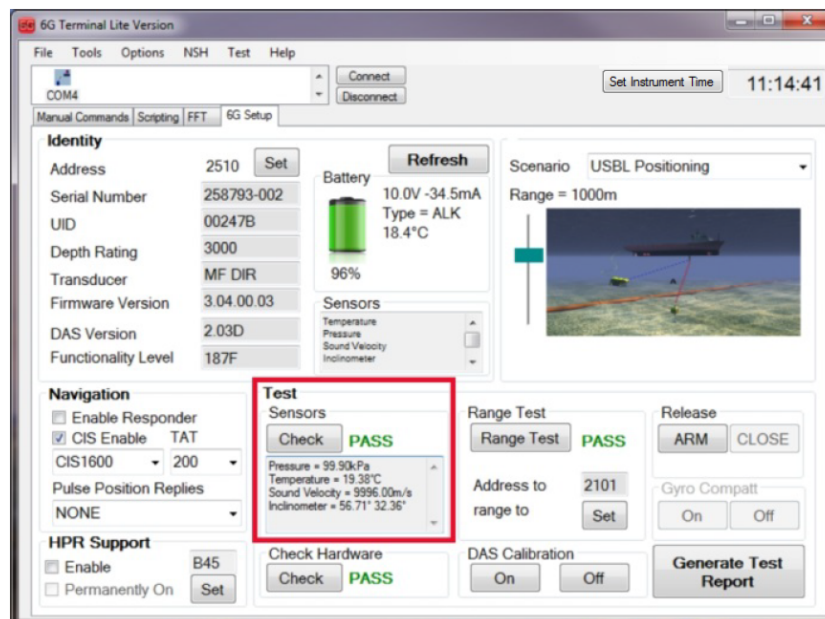
1. On the **6G Setup** tab, click **Test Sensors Check** to perform a test of all sensors installed in the transponder.



2. **Acquiring** appears next to the **Test Sensors Check** button to indicate the test is in operation.



3. **PASS** appears next to the **Test Sensors Check** button to indicate the test is successful. If the test is unsuccessful the word **FAIL** appears.



Note

 The Inclination values refer to the roll followed by pitch in degrees.

9.3.4 Checking the Release Mechanism

Before operating the release mechanism, ensure *Section 2 "Safety"* is read and fully understood. The following procedure describes the release mechanism check using 6G Terminal Lite.

Note

 These checks can also be performed using the iWAND acoustic transponder; see UM-8315 "User Manual for the Type 8315 iWAND", Section "Test Release".

1. Make sure the Dual Serial Cable is connected to the transponder; see *Section 9.3.1 "Connecting the Dual Serial Cable"*.
2. Check the position of the release mechanism **1**, to see if it is in the fully open position (*Figure 9-3*) or fully closed position (*Figure 9-4*).

Figure 9-3 Release Mechanism Fully Open

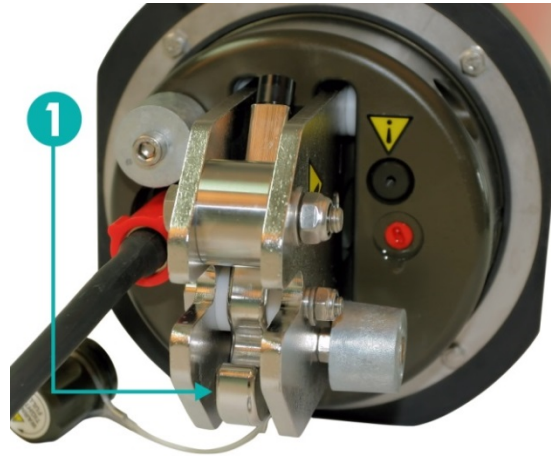
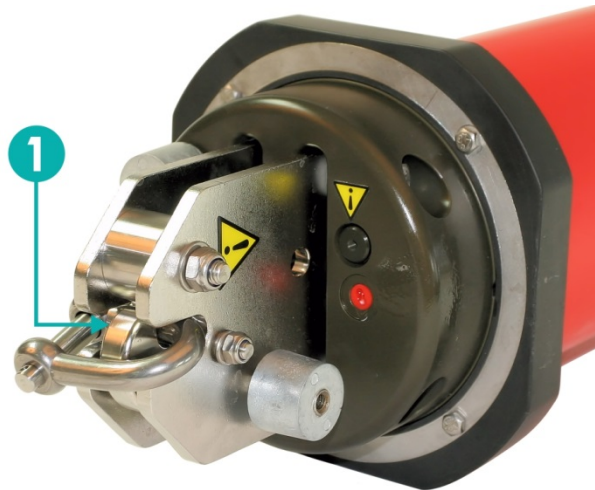
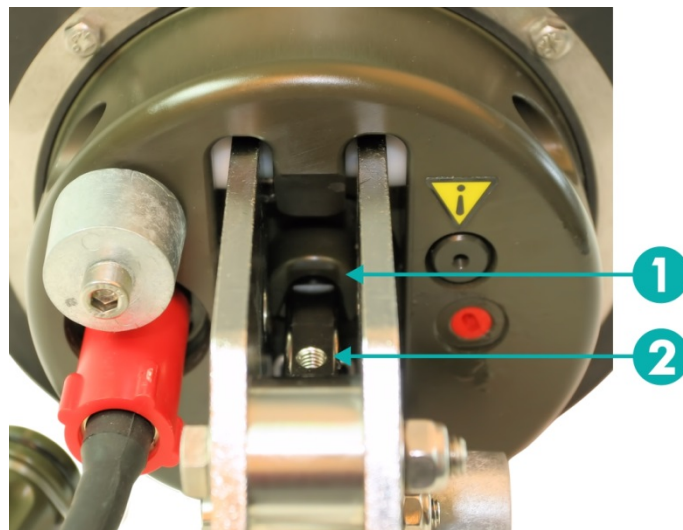


Figure 9-4 Release Mechanism Fully Closed



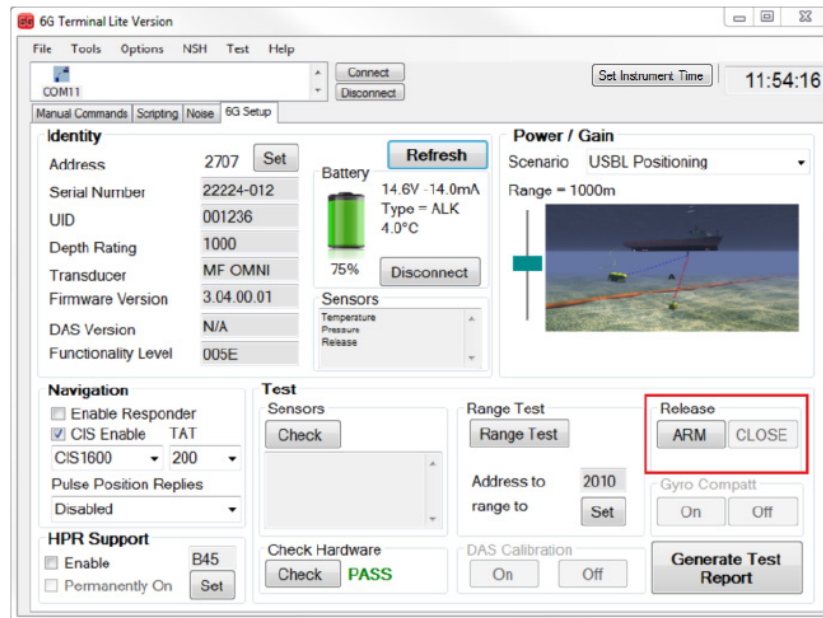
3. When closed the release mechanism ② is held in position by a rotating lock ①.

Figure 9-5 Release Mechanism Rotating Lock

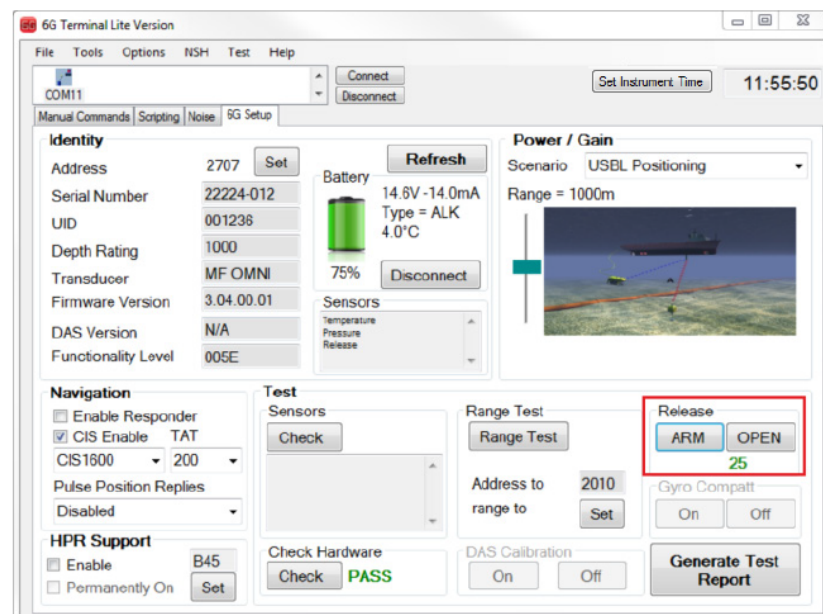


- A functional test of the release mechanism can be carried out using 6G Terminal Lite software on the **6G Setup** tab; see *Figure 9–6*.
- On the **6G Setup** tab, the greyed out button to the right of the **Release ARM** button indicates the next position of the release mechanism, for example, if the release mechanism is currently open the button shows **CLOSE**.

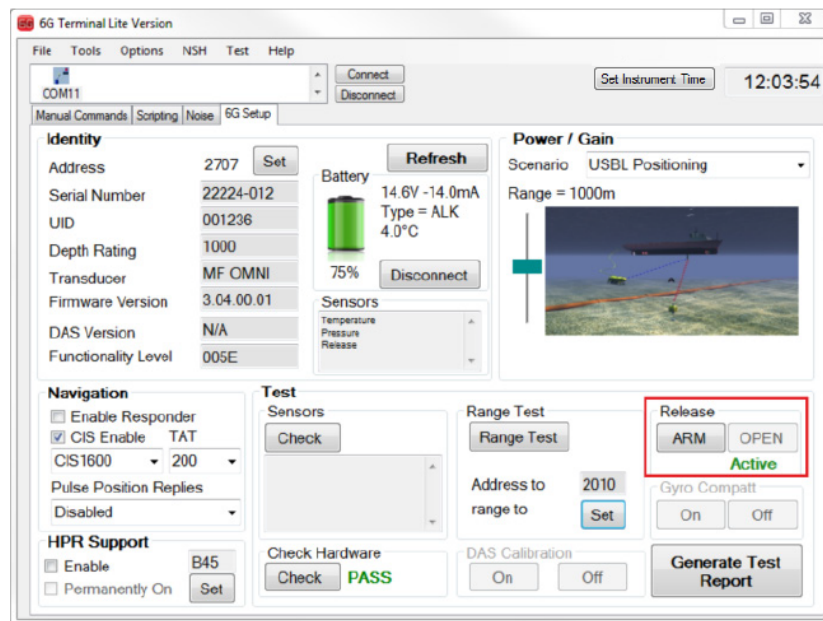
Figure 9–6 Release Test



- To operate the release mechanism, click **ARM**. The **OPEN/CLOSE** button will become active and a 30-second countdown timer will start counting down.

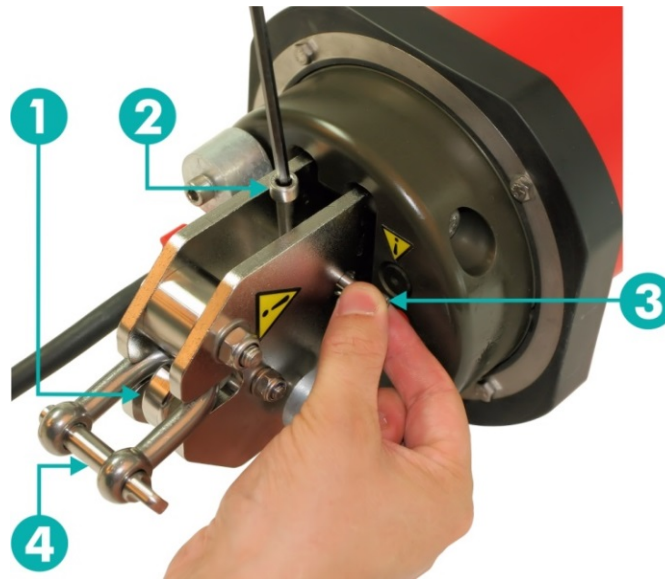


- Click the **OPEN** or **CLOSE** button before the 30-second countdown ends.



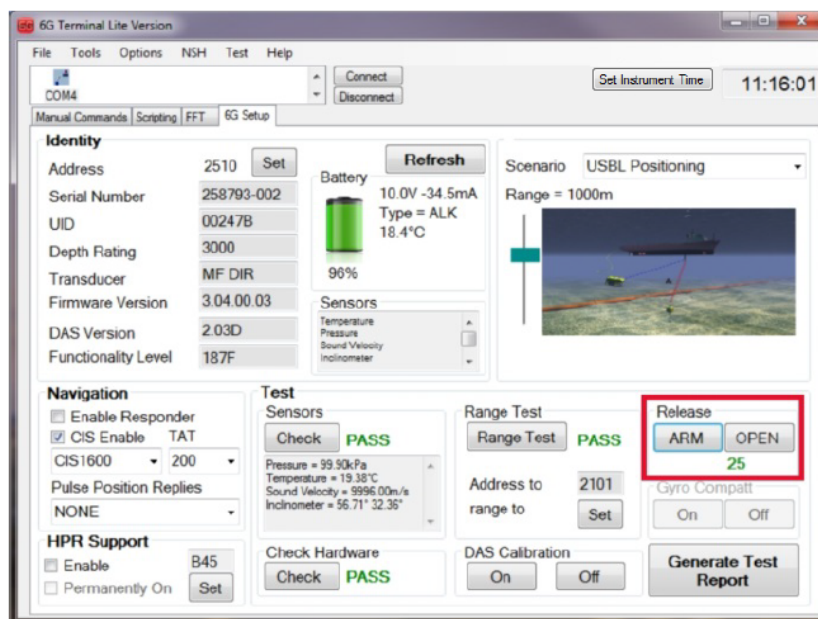
- After the **OPEN/CLOSE** button has been selected, it will return to a greyed out status and **Active** will appear to indicate the mechanism is moving.
- When the release mechanism movement has completed the **OPEN/CLOSE** button indicates the next position of the release mechanism.
- If the release is in the **Open** position, it will be necessary to manually position the release into the closed position.
- Screw a long screw **2** (either an M4 or M5 screw – not supplied by Sonardyne) into the release mechanism **1**; see *Figure 9–7*.
- Unscrew the pin **4** from the 'D' shackle pin. With the aid of a screwdriver, push the release mechanism into the closed position and insert the 'D' shackle pin **4** into the holes in the side of the mechanism **3** to hold the Release in the closed position.

Figure 9–7 Manually Closing the Release Mechanism



- 1 Release Mechanism
- 2 Screw
- 3 Mechanism Retaining Screw Hole
- 4 'D' Shackle Pin

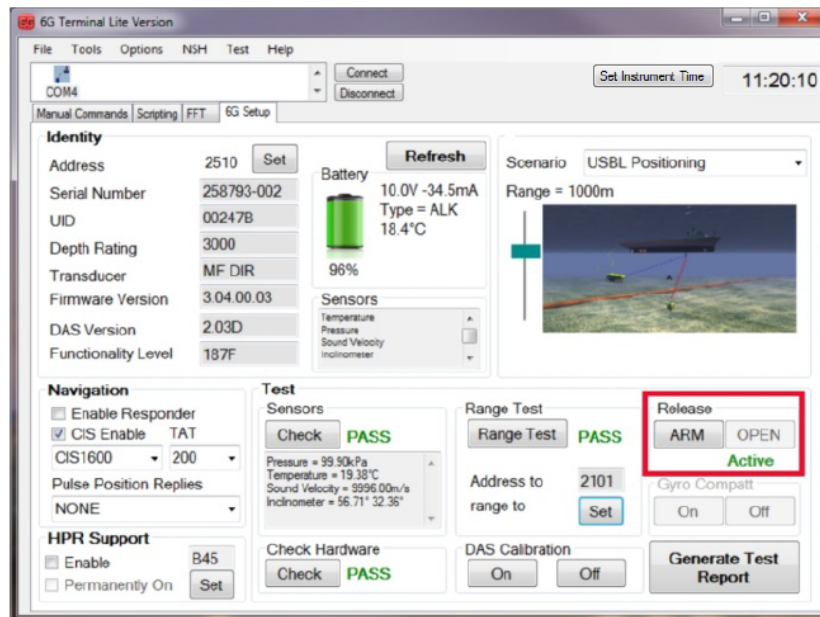
13. Click **ARM** to prepare the release mechanism to be operated.



14. As soon as **ARM** is clicked the **CLOSE** button becomes active and a 30 second countdown timer begins.

15. Click **CLOSE** before the 30 second countdown ends.

16. After **CLOSE** has been clicked, it will become greyed out and **Active** will appear to indicate the mechanism is moving.



17. When the release mechanism movement has completed, the **OPEN/CLOSE** button indicates the next position of the release mechanism.

Note



Deployment of the transponder with the 'D' shackle pin fitted to retain the release mechanism in the closed position will prevent the release mechanism from opening. This will result in the transponder being irretrievable from the seabed. Make sure the 'D' shackle pin is removed when the release mechanism locked is in the closed position.

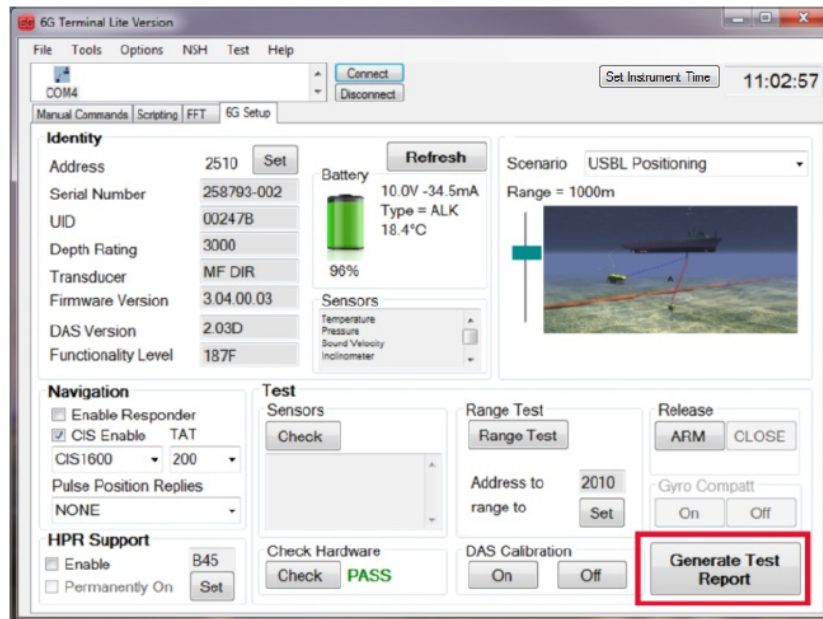
18. Remove the 'D' shackle pin from the retaining hole and refit to the 'D' shackle inserted through the release mechanism.

9.3.5 Creating a Test Report

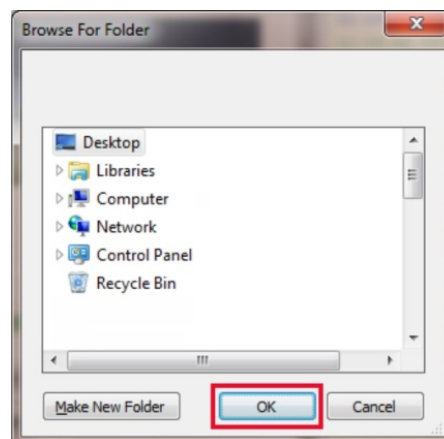
On completion of a functional testing of the transponder a test report can be created. The report will list all information provided on the 6G Setup tab of the 6G Terminal Lite software.

To generate a test report:

1. Click **Generate Test Report** on the 6G Setup tab.

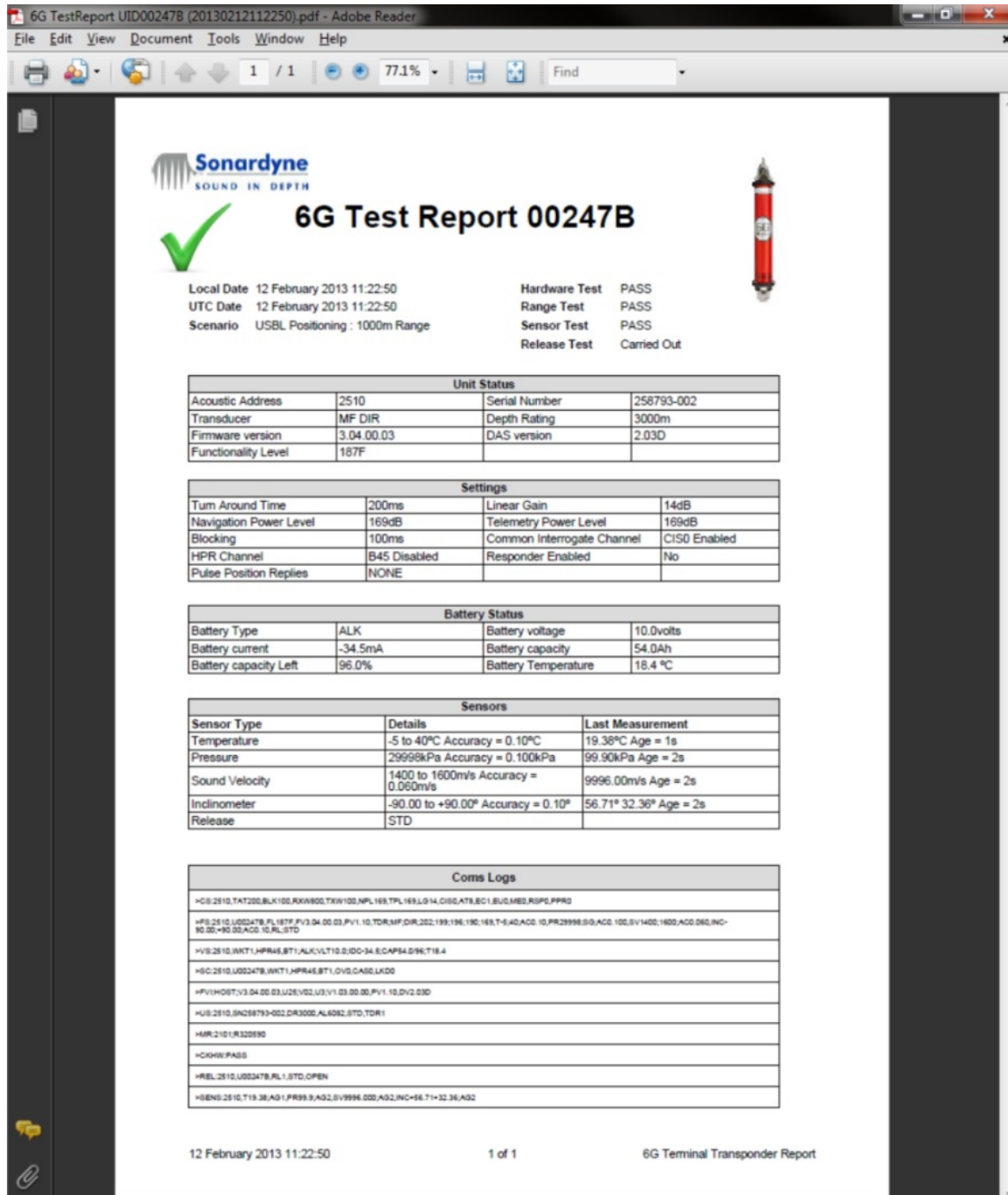


2. A file location window will open to save the created Test Report pdf in the selected folder.



3. A pdf test report will now be created and saved in the designated location. The report will list all information provided on the 6G Setup tab. A tick and pass will appear alongside all the tests to indicate the transponder has passed all the tests.

Figure 9–8 Transponder Test Report pdf



Section 10 – Firmware Update

10.1 Introduction

The latest firmware version is displayed on the Sonardyne website product support page. Contact Sonardyne Support to obtain the updated firmware files.

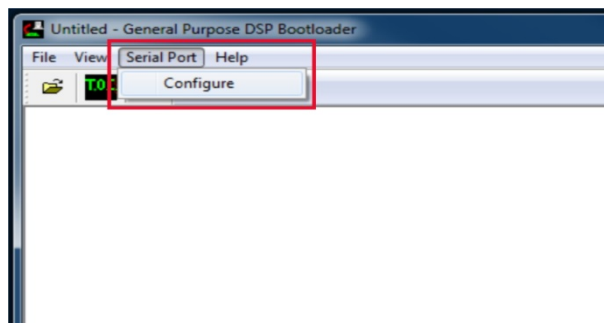
10.2 Firmware Update Procedure

To update the firmware:

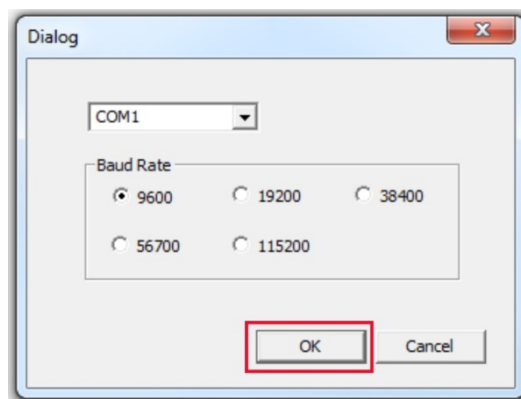
1. Make sure the Dual Serial Cable is connected to the connection point on the transponder; see *Section 9.3.1 "Connecting the Dual Serial Cable"*.
2. Connect the CPU connector to a COM port on the PC (make a note of which COM port is used).
3. On the PC, double-click the **GP Bootloader.exe** icon to open the program.



4. On the toolbar menu, select **Serial Port** and then click **Configure**.

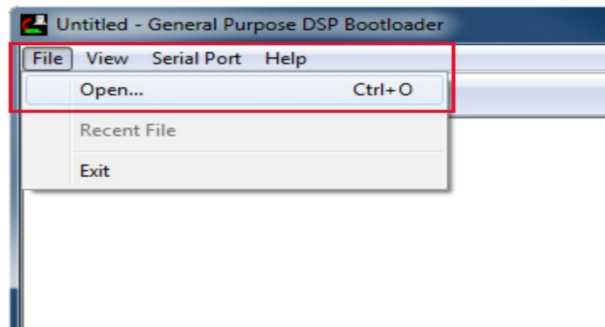


5. Select the correct **COM** port and **Baud Rate**¹ (**38400**, **56700** or **115200**) and then click **OK**.

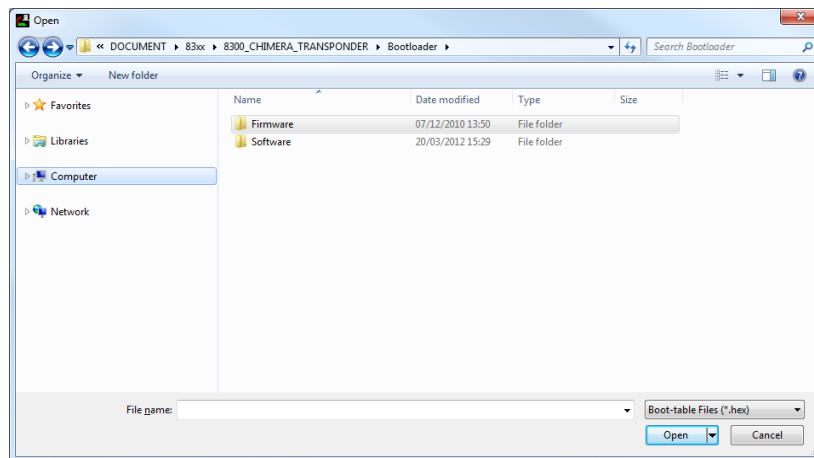


¹The baud rate selected is the transfer rate of the bootloader and doesn't need to match the configured baud rate of the instrument. Lower speeds are useful if using a longer cable. For the fastest operation, select 115200.

- On the Bootloader main window, click **File > Open**.



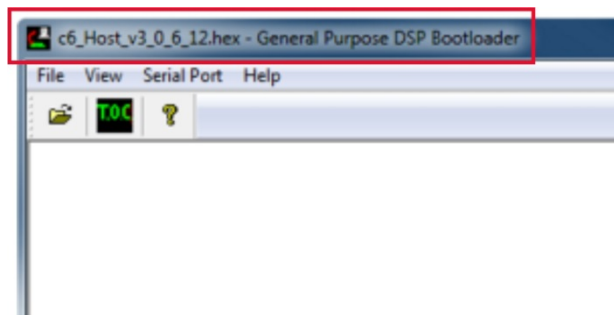
- Browse to and select new firmware and then click **Open**.



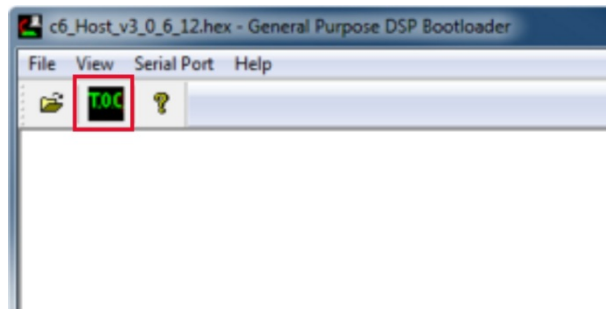
Note



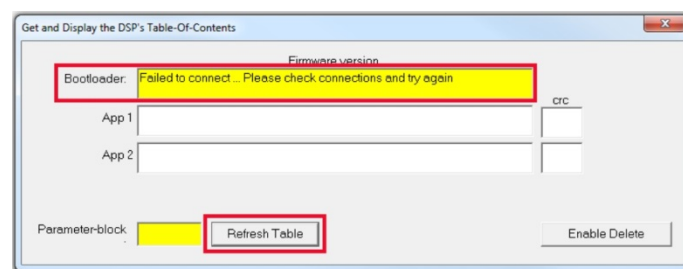
After the new firmware has been selected it will appear in the Bootloader home page title bar.



8. On the Bootloader main window, click **TOC**.



9. If the connection is not made successfully, an error message will appear on the Bootloader window.



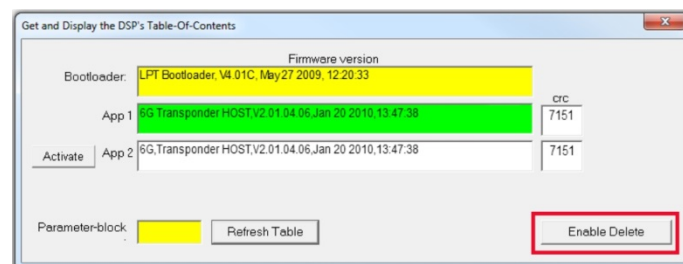
10. Check the following for an unsuccessful connection:
 - a. Check all cables are connected correctly to the PC.
 - b. Go to the **Device Manager** facility on the PC and check the correct COM Port has been selected for the CPU cable.
 - c. Click **Refresh Table** after checking the connections.
 - d. If all cable connections have been made successfully, the window will refresh.
 - e. Try a slower baud rate.

Note

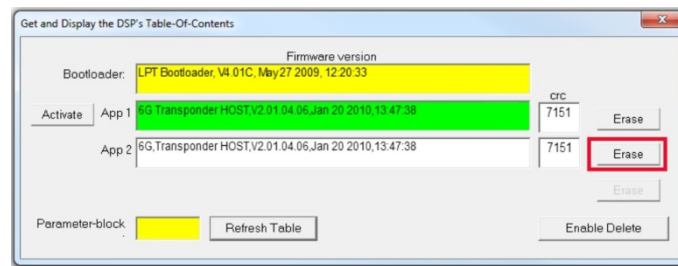


Two spaces are available on the hardware for firmware. If all spaces are full, then one must be deleted to accommodate the firmware upgrade. The green highlighted App indicates the currently active firmware.

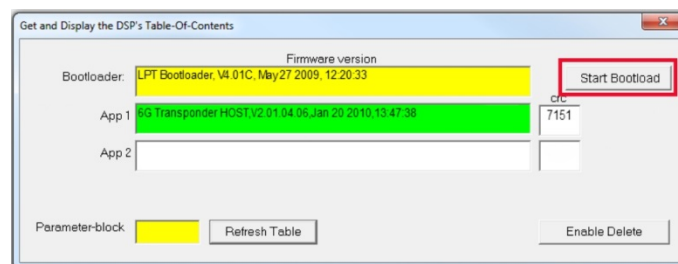
6. To erase an application, click **Enable Delete**.



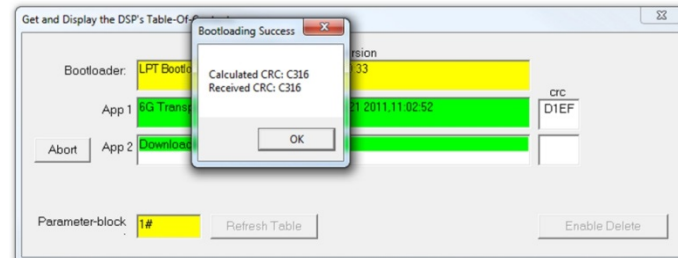
- Clicking **Enable Delete** will activate the **Erase** button to appear at the end of each installed firmware (clicking **Erase** will remove that firmware).



- Click **Start Bootload** to start uploading the new firmware



- After **Start Bootload** is selected, a percentage uploading bar will display the progress.
- After the upload has completed a **Bootloading Success** window will appear.



- Click **OK** to confirm the installation is a success.
- The new uploaded program will appear in the selected App Window.
- Close the **Get and Display the DSP's Table of Content** window.
- To confirm the new firmware is working, click on the TOC in the main Bootloader window; the new firmware is highlighted in green.

10.3 DAS Firmware Update

To update the DAS firmware:

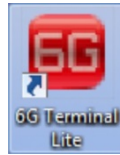
- Connect the Dual Serial Cable as described in *Section 9.3.1 "Connecting the Dual Serial Cable"*.
- Connect the CPU and the DAS connectors to the COM ports on the PC.

Note

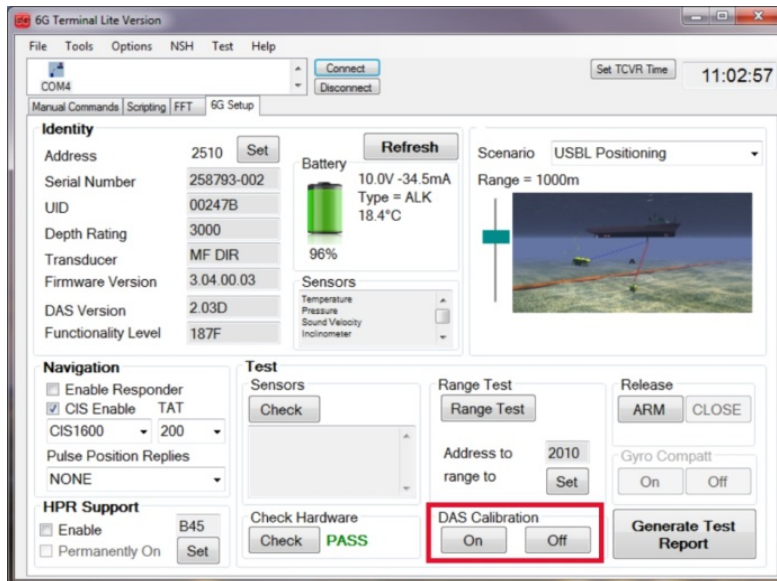


Make a note of which COM port each connector is connected to.

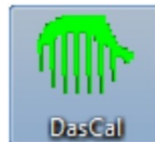
- Double click the **6G Terminal Lite** icon to open the software.



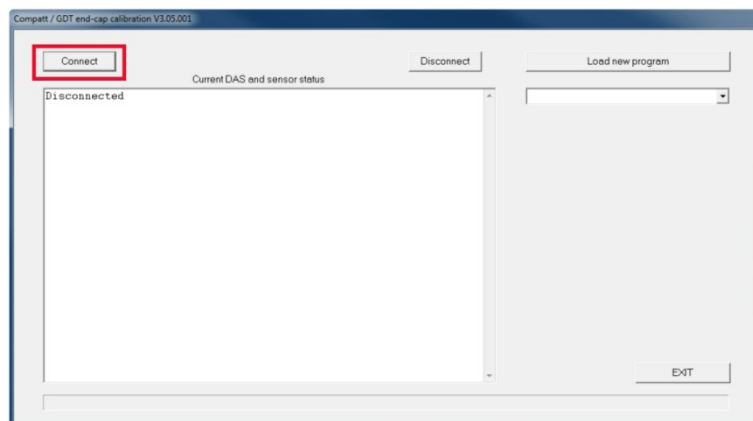
- Connect to the instrument as described in *Section 9.3.2 "Checking the Wideband Acoustics"*
- On the **6G Setup** tab, **DAS Calibration** pane, click **On** to upgrade the DAS firmware.



- Double-click the **DasCal** icon to open the DAS software.



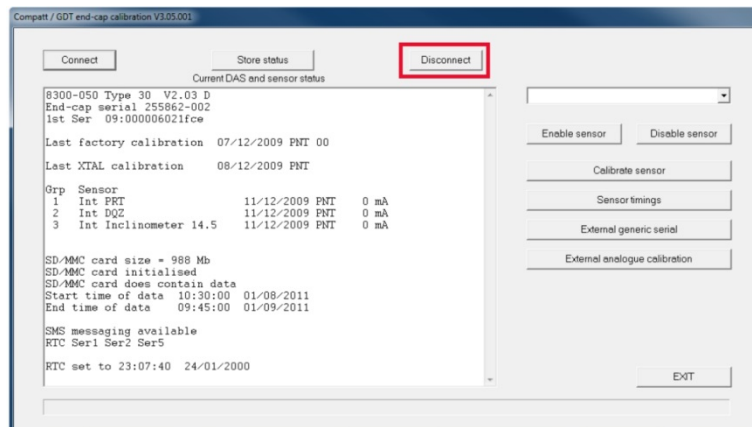
- On the DAS page click **Connect**.



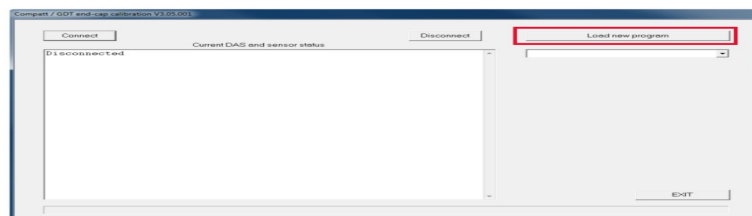
- On the **DAS Comms** window, select the correct COM port for the DAS connection from the drop-down list and then click **Select**.



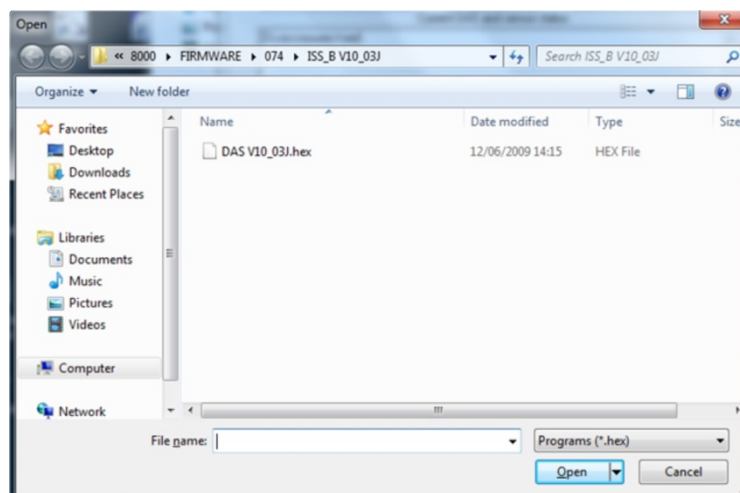
- When the DASCAL program opens click **Disconnect**.



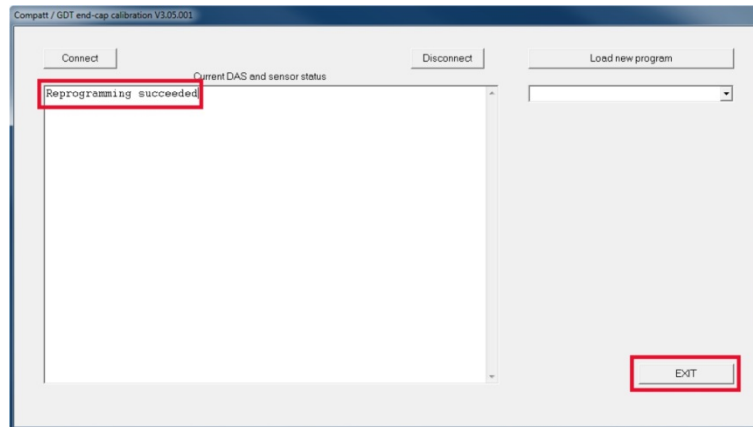
- Click **Load New Program** to load the new firmware.



- Navigate to the location of the new program and then click **Open**.



12. The firmware update will commence (this process will take approximately 4-5 minutes).
13. When the new firmware update has completed, a **Reprogramming Succeeded** notification will be displayed on the DAS home page window.
14. Click **Exit** and return to the 6G Terminal Lite software.

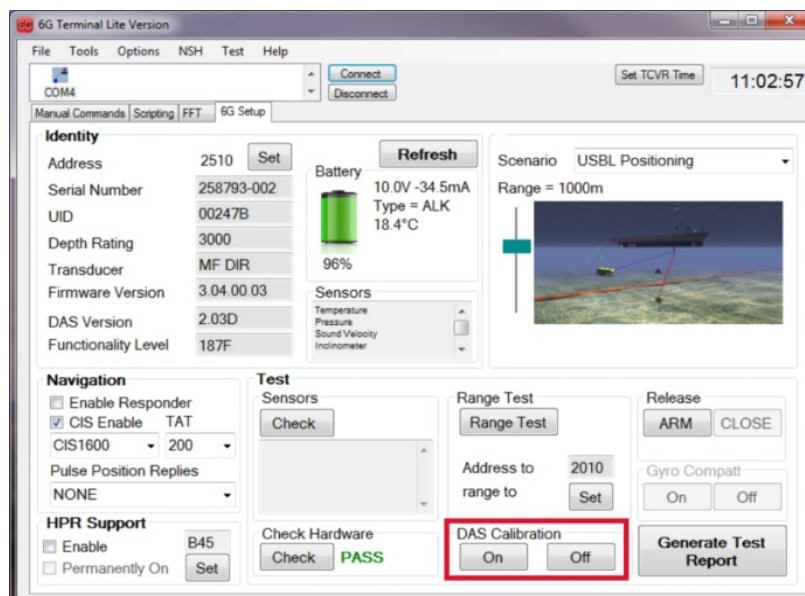


Note



If only one COM Port connection has been used, close the DAS program by selecting Exit Program, disconnect the DAS connection from the COM Port and replace it with the CPU connection on the Dual Serial Cable.

15. On the **6G Setup** tab, **DAS Calibration** pane, click **OFF**.



16. The 6G Terminal Lite software can now be closed.
17. After updating the DAS firmware, power cycle the transponder:
 - a. Transponders with a battery disconnect fob; connect the fob for >1 minute.
 - b. Transponders without a battery disconnect fob; disconnect the battery for >1 minute; see *Section 8.8.2 "Disconnecting and Replacing the Battery"*.

Section 11 – Fault Diagnosis

11.1 Introduction

The following section assists in diagnosis when the transponder fails to operate correctly. Each section identifies a fault, the possible cause and the recommended action to rectify the fault.

11.2 Fault Types

Fault	Possible Cause	Action
Transponder does not reply to interrogation or commands.	Transducer or transceiver connections not made or loose.	Check all connections on the surface transducer or transceiver.
	Incorrect transponder address set in the surface transceiver.	Check address and repeat with the correct address.
	Operating at long range.	Increase power to the surface transceiver.
	Ray-bending effects stopping the transponder from receiving.	Use software application RAY_TRACE available from Sonardyne Int Ltd.
	Surface thermocline refracting reply signals.	Lower transducer below thermocline.
	Noise level as surface transducer too high.	Lower the dunking transducer/transceiver or towfish and reduce the surface transceiver gain settings.
		Do a noise check using the applicable transceiver noise check command.
		Increase the transponder power level using the Navigation Power Level (NPL) in the Configuration Status (CS) Command.
	Transponder has low battery power.	Check log for battery output before deployment.
		Check battery levels since deployment.
	Surface currents maybe streaming the transducer away from transponder location.	Add 20 kg of ballast on a 1 m strop from the transducer guard.
	Other acoustic systems maybe operating in the same frequency band.	Check the signals for validating by using the noise command on the surface transceiver.

Fault	Possible Cause	Action
Transponder replies to commands, but not interrogations.	Transponder disabled.	Check by reading the transponder CS reply.
		EC1 indicates the transponder is enabled for CIS interrogations.
		EC0 indicates it is disabled.
	The incorrect CIS signal.	Check the transponder CS reply.
	Battery capacity is below 5%.	Check the capacity remaining as reported by the VS reply. Send a Secure Configuration (SC) command to override, release and recover the transponder. Replace the battery.
	Transponder may have been moved from original position.	Move the transponder.
Transponder replies to commands, but telemetry errors are detected.	Noise level at surface transducer too high.	Lower the dunking transducer / transceiver or towfish and reduce the surface transceiver gain.
		Do a noise check using the applicable transceiver noise check command.
		Set the transponder to high power telemetry transmission using the TPL parameter in the CS command.
	Other acoustic systems maybe operating in the same frequency band.	Check for signals validating by using the noise command on the surface transceiver.

Section 12 – Spares

12.1 Introduction

When ordering spare parts, please provide the part number (CPN) and a description.

Enquiries about, or orders for spare parts should be directed to your local Sonardyne office or agent. For addresses and contact details, see the back page of this manual or visit our website:

<https://www.sonardyne.com/get-in-touch/>.

12.2 Recommended Spares

The following is a list of common spare parts.

12.2.1 Batteries

Part Number	Drawing Number	Description	Quantity
*	8300-002	Alkaline Battery Pack (Standard unit)	1
	8300-006	Lithium Battery Pack (Standard unit)	1
	8300-004	Lithium Battery Pack (Midi and Mini unit)	1
	8300-006	Lithium Battery Pack (Maxi unit)	2

* Contact Sonardyne Sales for the latest part number.

12.2.2 Sonardyne Upgrades

Part Number	Drawing Number	Description	Quantity
650-0060	8300-000-3111	MF Omni C5 to C6 Upgrade Kit	1
650-0061	8300-000-3113	MF Directional C5 to C6 Upgrade Kit	1
650-0062	8300-000-3141	MF Omni C5 Midi to C6 Midi Upgrade Kit	1

12.2.3 Miscellaneous Parts

Part Number	Drawing Number	Description	Quantity
890-0026	8300-118	Compatt connector blanking socket	1
641-3332	8000-905	Compatt Opening Tool	1
650-2334	8000-007	Transducer Spares Kit, MF Omni (incl. O-rings)	1
750-1267-SP	8000-247	Transducer Guard Spares Kit	1
650-2531		Anode Kit – MF Omni TDR Endcap	1
650-2533		Anode Kit – Release Endcap	1
810-0010-SP	8300-024	Housing Sleeve Red, (for 3000 m tube)	1
200-3455		Main Housing O-rings, 100-345-5570	4
201-5140		Spring Gasket, 106LB-[MW]-4.005-2	2
650-0125		Pressure Port Oil Top-Up Kit	1
231-0035		Release Shackle 10 mm D, S/Duplex, Breaking load 800 kg	1
231-0145		Lifting Shackle 8 mm D, S/Duplex WLL 500 kg	1
925-0005		Silica Gel Bag – self indicating	4

12.2.4 Cables

Part Number	Drawing Number	Description	Quantity
820-6795	8000-075	SubConn 8 W mating connector kit including locking sleeve	1
820-6713	8000-157	PC to Compatt Dual Serial Cable	1
820-0038	8159-070	CPU to DAS Ribbon Cable (16 way x 60 mm)	1

Section 13 – Technical Specifications

Note

 Dimensions and weights are shown below for 3,000 m rated omni-directional with release endcap (release endcap is not available for Mini-Compatt 6). Weights and dimensions will vary according to transducer type and sensor endcap options; see Section 13.13 "Outline Drawings".

13.1 Mechanical – Compatt 6 Type 3111 with Release Endcap

Parameter	Specification
Diameter (main body)	133.5 ±2 mm (5.3 ±0.1 ins)
Overall Length	1034.3 mm (40.7 ins)
Weight in air (Alkaline battery)	23.8 kg (52.5 lb)
Weight in water (Alkaline battery)	11.8 kg (24.3 lb)
Weight in air (lithium battery)	22.3 kg (49.2 lb)
Weight in water (lithium battery)	8.4 kg (18.6 lb)
Max Operating Depth	3,000 m Limited by depth sensor (see endcap label)
Release Mechanism	Working Load Limit (WLL) 250 kg (551 lb)
Transducer Guard Shackle	Working Load Limit (WLL) 250 kg (551 lb)

13.2 Mechanical – Mini Compatt 6 Type 3131

Parameter	Specification
Diameter (main body)	133.5 ±2 mm (5.3 ±0.1 ins)
Overall Length	569 mm (22.4 ins)
Weight in air (Alkaline battery)	11.0 kg (24.2 lb)
Weight in water (Alkaline battery)	5.0 kg (11.0 lb)
Max Operating Depth	3,000 m Limited by depth sensor (see endcap label)
Transducer Guard Shackle	Working Load Limit (WLL) 250 kg (551 lb)

13.3 Mechanical – Midi Compatt 6 Type 3141 with Release Endcap

Parameter	Specification
Diameter (main body)	133.5 ±2 mm (5.3 ±0.1 ins)
Overall Length	784 mm (30.9 ins)
Weight in air (Alkaline battery)	14.0 kg (30.9 lb)
Weight in water (Alkaline battery)	5.7 kg (12.6 lb)
Max Operating Depth	3,000 m Limited by depth sensor (see endcap label)
Release Mechanism	Working Load Limit (WLL) 250 kg (551 lb)
Transducer Guard Shackle	Working Load Limit (WLL) 250 kg (551 lb)

13.4 Mechanical – Maxi Compatt 6 Type 3141 with Release Endcap

Parameter	Specification
Diameter (main body)	133.5 ±2 mm (5.3 ±0.1 ins)
Overall Length	1604 mm (63.2 ins)
Weight in air (lithium battery)	34.8 kg (76.7 lb)
Weight in water (lithium battery)	14.7 kg (32.4 lb)
Max Operating Depth	3,000 m Limited by depth sensor (see endcap label)
Release Mechanism	Working Load Limit (WLL) 250 kg (551 lb)
Transducer Guard Shackle	Working Load Limit (WLL) 250 kg (551 lb)

13.5 Battery Life

Battery Type	Capacity (Ah)	Start Life Voltage		Battery Limit Voltage	
Alkaline	54	15.5		11.3	
Lithium	100	14.5		13.0	
Transducer Type		Omni-Directional		Directional	
Battery Type		Alkaline	Lithium	Alkaline	Lithium
Listening only when disabled (days)		750	1388	750	1388

Figure 13–1 Estimated Battery Life (Alkaline)

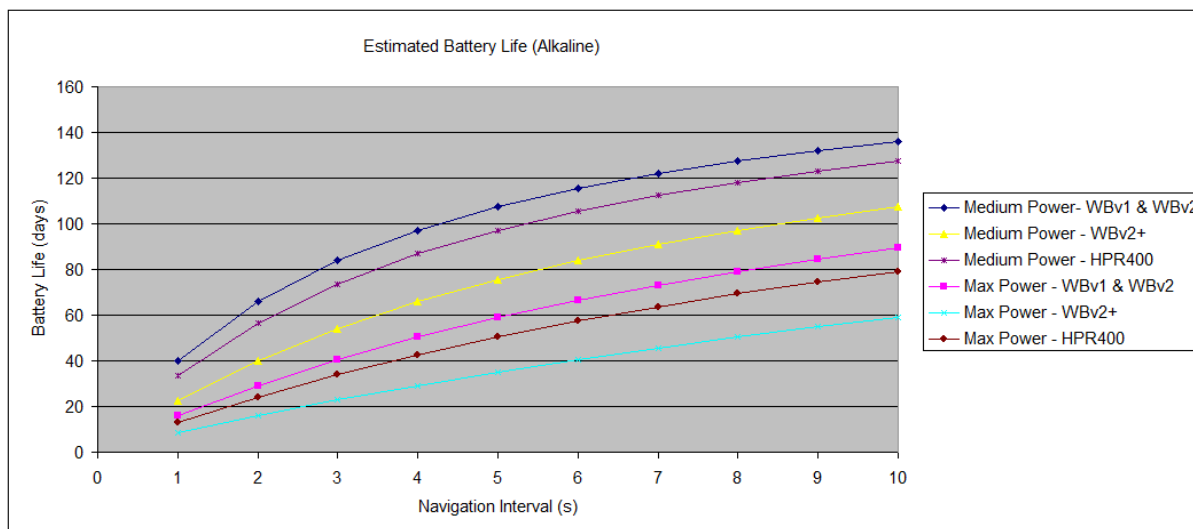
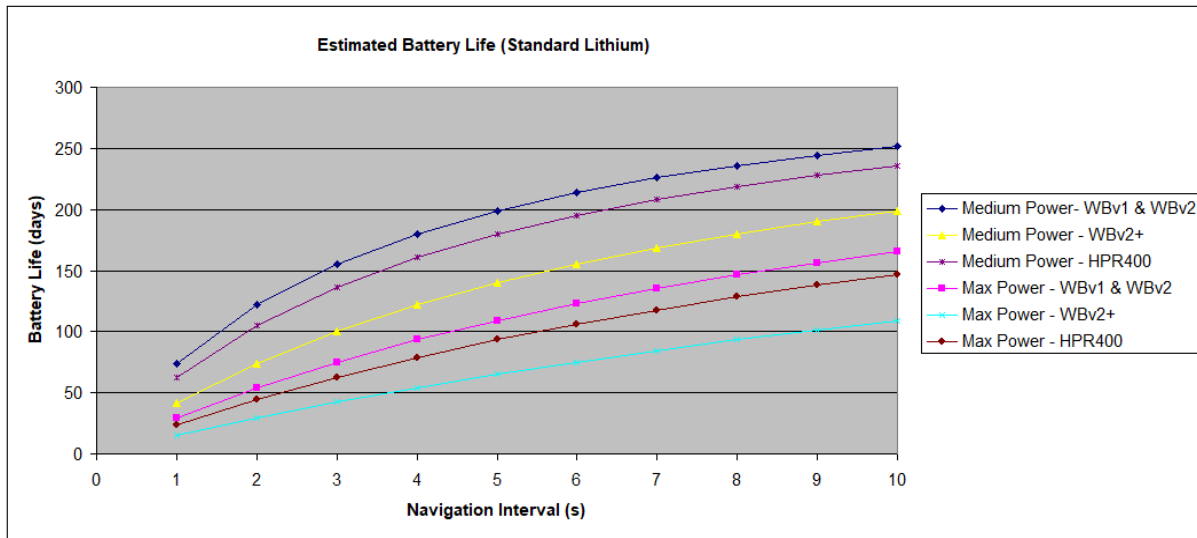


Figure 13–2 Estimated Battery Life (Standard Lithium)

13.6 6G Battery Life Estimator

To determine there is sufficient battery life for operational scenarios, the 6G Battery Life Estimator is available as a new Android Battery life Estimation App.

Figure 13–3 6G Battery Life Estimator App.

The app estimates the battery life of the 6G transponders for a pre-defined operational scenario allowing the operator to specify instrument type with navigation and telemetry settings. Based on the information entered the app will provide an estimate, measured in days, of the remaining battery life.

The app can be downloaded using the following QR code:

Figure 13–4 6G Battery Life Estimator App. QR Code

13.7 Communication Port

Type	RS232
Baud Rate (default)	Default 9600 baud (8 data bit, no parity, 1 bit stop) Configurable to 2400, 4800, 9600, 19200, 38400, 57600 and 115200 baud

13.8 Acoustic

Transducer Type	MF Omni-Directional	MF Directional	LMF Omni-Directional	LMF Directional
Transducer Beam Shape	Hemispherical ($\pm 80^\circ$ @ 35 kHz)	Directional ($\pm 25^\circ$ @ 35 kHz)	Hemispherical ($\pm 120^\circ$ @ 18 kHz)	Directional ($\pm 22^\circ$ @ 18 kHz)
Frequency Range	MF 19–34 kHz	MF 19–34 kHz	LMF 14–19 kHz	LMF 14–19 kHz
Acoustic Sensitivity (dB re 1 μ Pa)	<85	<85	<85	<85
Acoustic Transmit source level – 4 levels (dB re 1 μ Pa)	196/193/190/187	202/199/196/190	196/193/190/187	202/199/193/187
Pulse length, Wideband (ms)	8/16	8/16	8/16	8/16
Time resolution (μ s)	1	1	1	1

13.9 Environmental

Parameter	Specification
Temperature Operation	-5° to 40°C (23° to 104°F)
Temperature Storage	-20° to 55°C (-4° to 131°F)
Rated for Outdoor use	IP68

13.10 Sensors

Temperature Measurement	-5° to 40°C (23° to 104°F)
Resolution	0.01°C
Accuracy	$\pm 0.1^\circ\text{C}$ ($\pm 0.05^\circ\text{C}$ to special order)

Depth Measurement (Strain Gauge)					
Span (depth)	5000 m	3000 m	1000 m	500 m	300 m
Resolution	0.01 kPa	0.01 kPa	0.01 kPa	0.01 kPa	0.01 kPa
Accuracy	± 5.0 m	± 3.0 m	± 1.0 m	± 0.5 m	± 0.3 m

Depth Measurement (High Precision Strain Gauge)					
Span (depth)	5000 m	3000 m	1000 m	500 m	300 m

Depth Measurement (High Precision Strain Gauge)

Resolution	0.01 kPa	0.01 kPa	0.01 kPa	0.01 kPa	0.01 kPa
Accuracy	±0.5 m	±0.3 m	±0.1 m	±0.05 m	±0.03 m

Depth Measurement (Digiquartz® option)

Span (pressure psi)	0 – 6000 psi	0 – 3000 psi	0 – 2000 psi
Span (pressure kPa)	0 – 41370 kPa	0 – 20685 kPa	0 – 13790 kPa
Span (depth)	0 – 4100 m	0 – 2050 m	0 – 1360 m
Resolution	0.01 kPa	0.01 kPa	0.01 kPa
Accuracy	±0.42 m	±0.21 m	±0.14 m

Options I2 an I4 dual axis high accuracy. (Inclinometer I4 option is inverted for transponders mounted upside down)

Range	±90°		
Resolution	0.01° (over the range ±14.5°)	0.05° (over the range ±45°)	
Accuracy	±0.05° (over the range ±14.5°)	±0.2° (over the range ±45°)	

Tilt Switch

Internal 45° tilt switch indicates vertical position

Sound Sensor

Model	50 mm	100 mm
Resolution	0.01 m/s	0.01 m/s
Range	1400–1600 m/s	1400–1600 m/s
Accuracy	±0.06 m/s	±0.03 m/s

13.11 Responder Input Trigger (Sync Input)

Inactive State	Low
Ground Reference	Power Ground
Input Impedance	~47 kΩ
Trigger Pulse	Nominally positive pulse minimum 4.5 V, maximum 24 V. Leading edge triggered Responder mode is enabled by serial or acoustic command
Pulse Width	See <i>Section 6.2.1 "Responder Mode"</i>
Turn Around Delay	TAT reported by CS Command is used for IRS replies. HPR replies have a fixed TAT of 30 ms
Blocking Time	TAT + BLK as reported by CS Command

13.12 Nett Upthrust

Is the difference between the net buoyancy of the float and the total weight of an object, or objects, in water that it is supporting, e.g.

Nett Upthrust =

(Minimum net buoyancy of the Float) – (the weight of the instrument + inserts in water).

e.g. 30 kg – (11.2 + 0.5) kg = 17.3 kg net upthrust

13.13 Outline Drawings

Common Compatt 6 and variants outline drawings are shown below. For dimensions or information on configurations not shown below, contact Sonardyne Support.

13.13.1 3,000 m MF Omni-Directional Aluminium Housings

Note

 In the following product types, "x" denotes Compatt 6 variants, for example, standard Compatt 6: 8300, DPT: 8301, AMT: 8305 etc; see *Section 3.3 "Type 8300 Variants"*.

Figure 13–5 Type 830x-3111 (Standard Length 3,000 m MF Omni-Directional)

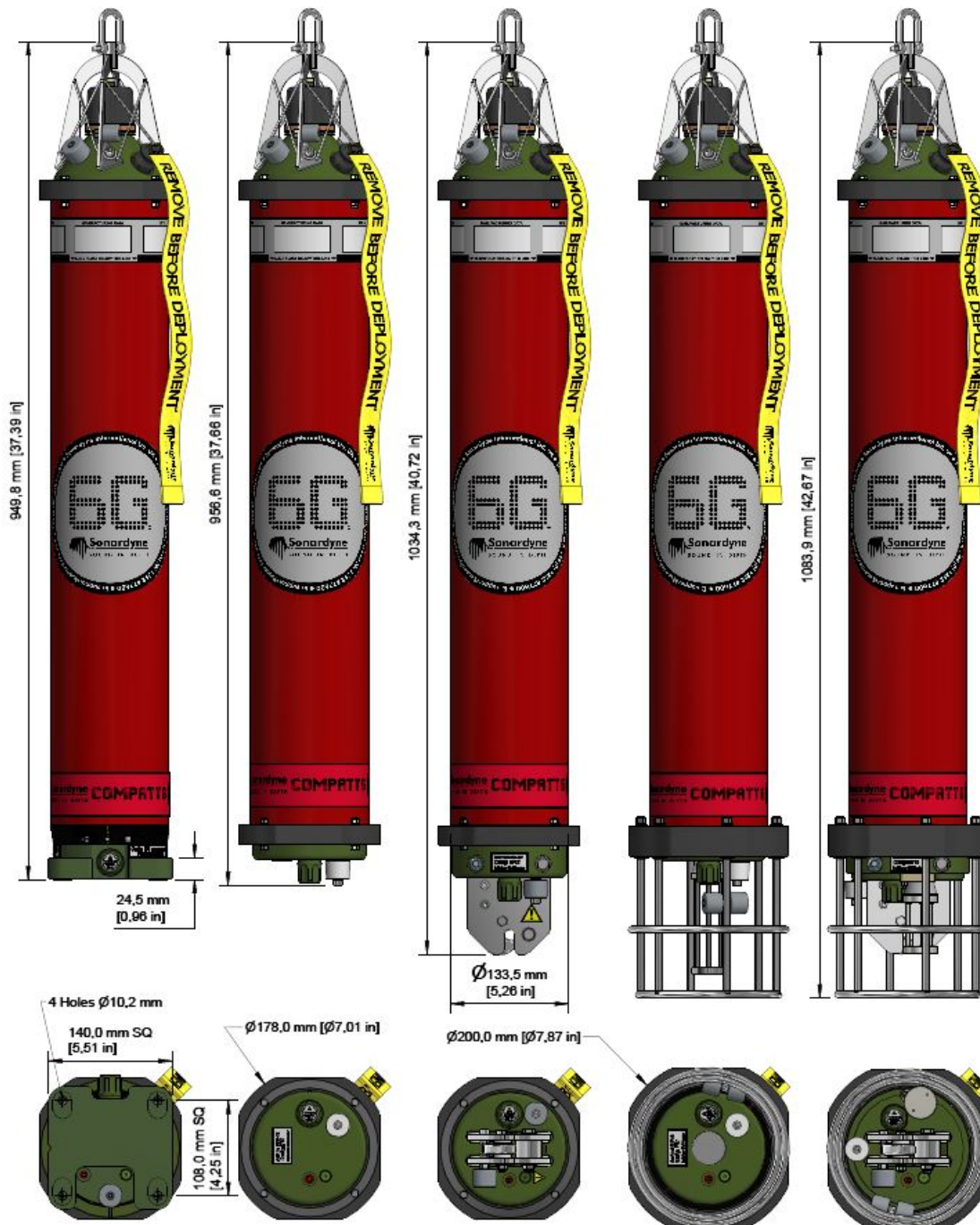


Figure 13-6 Type 830x-3121 (Maxi 3,000 m MF Omni-Directional)



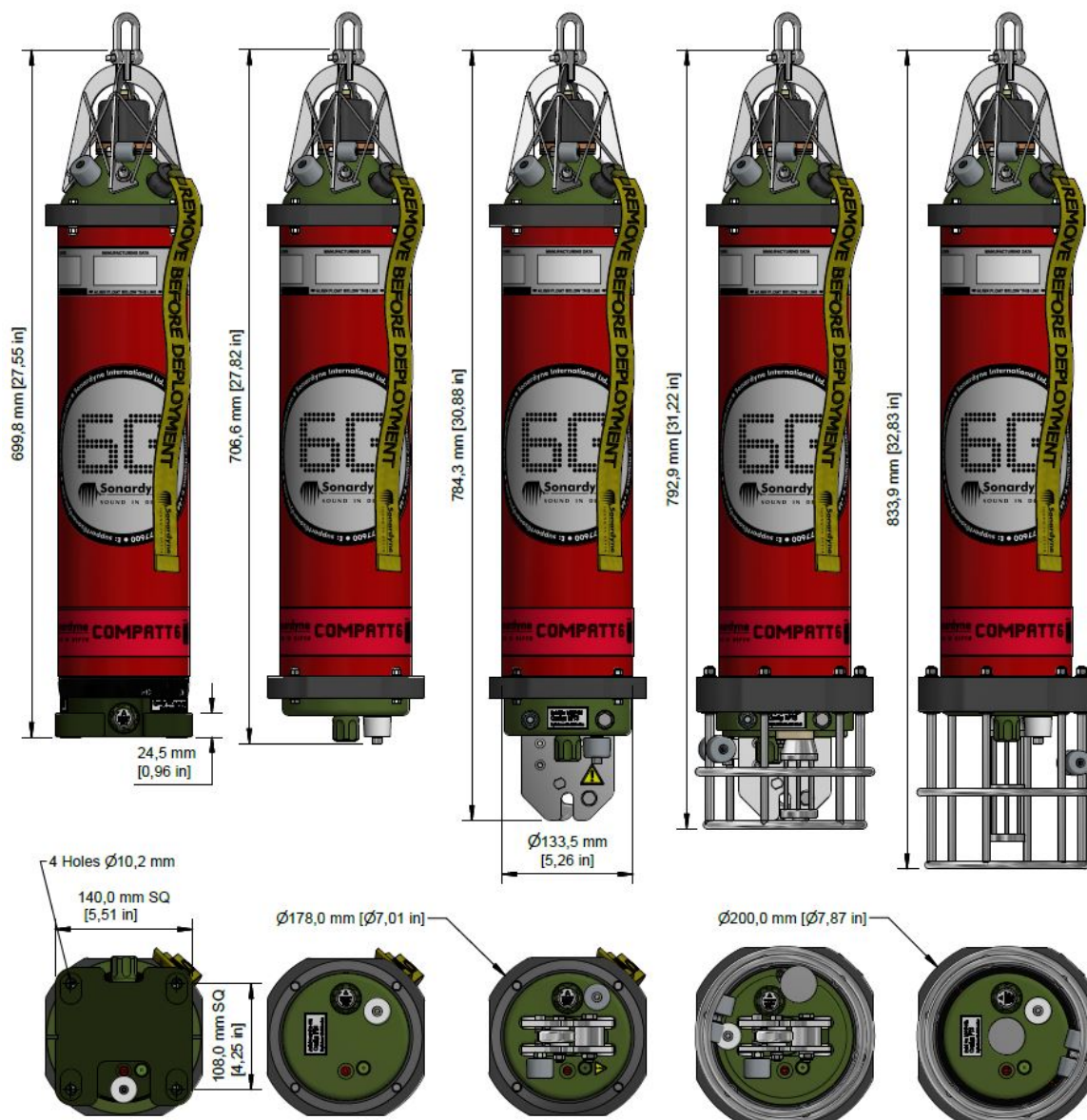
Figure 13–7 Type 830x-3131 (Mini 3,000 m MF Omni-Directional)



Note

 The Type 830x-4131 (Mini 4,000m MF Omni-Directional) has the same dimensions as above.

Figure 13–8 Type 830x-3141 (Midi 3,000 m MF Omni-Directional)



13.13.2 3,000 m MF Directional Aluminium Housings

Figure 13–9 Type 830x-3113 (Standard Length 3,000 m MF Directional)

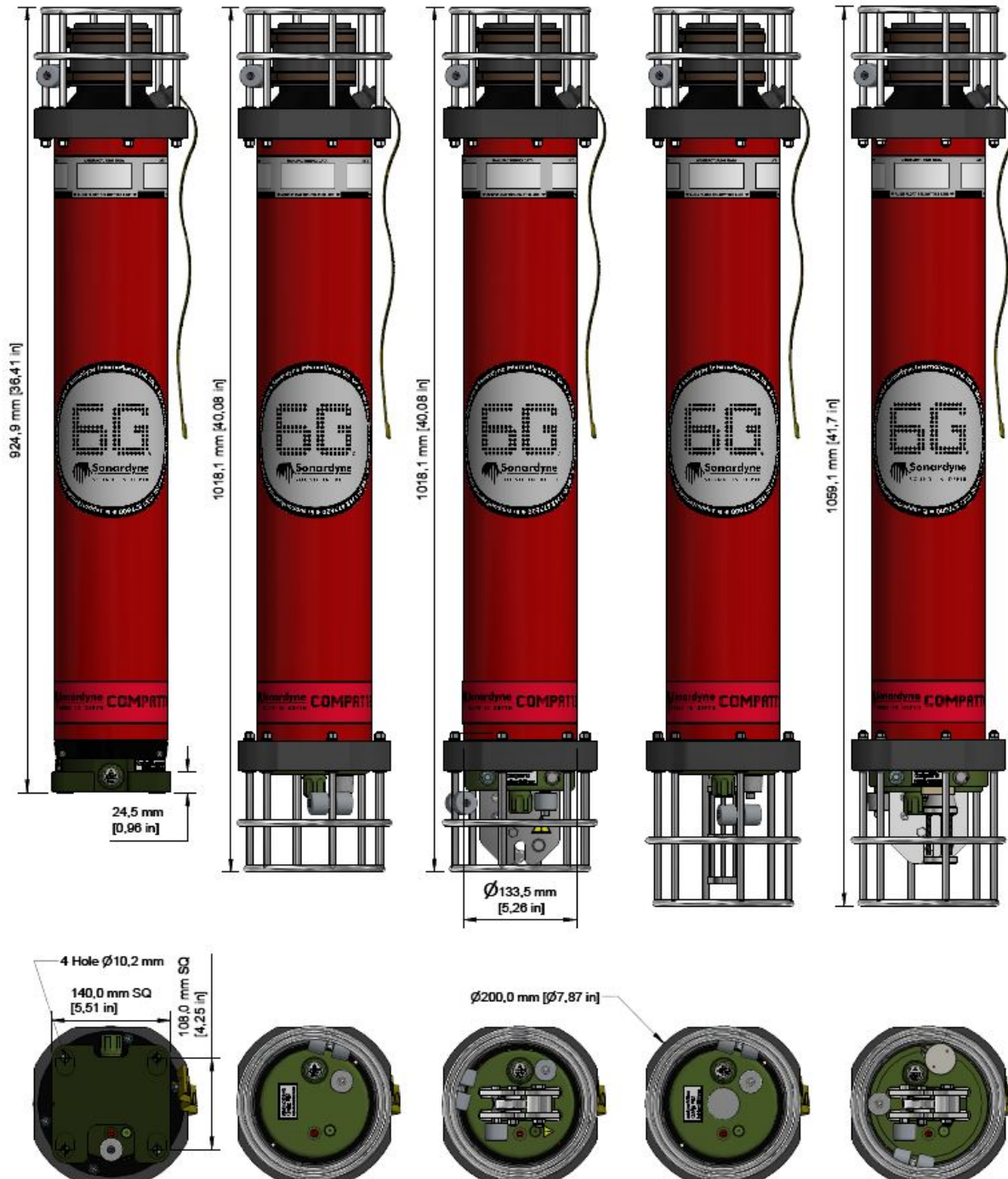


Figure 13–10 Type 830x-3123 (Maxi 3,000 m MF Directional)



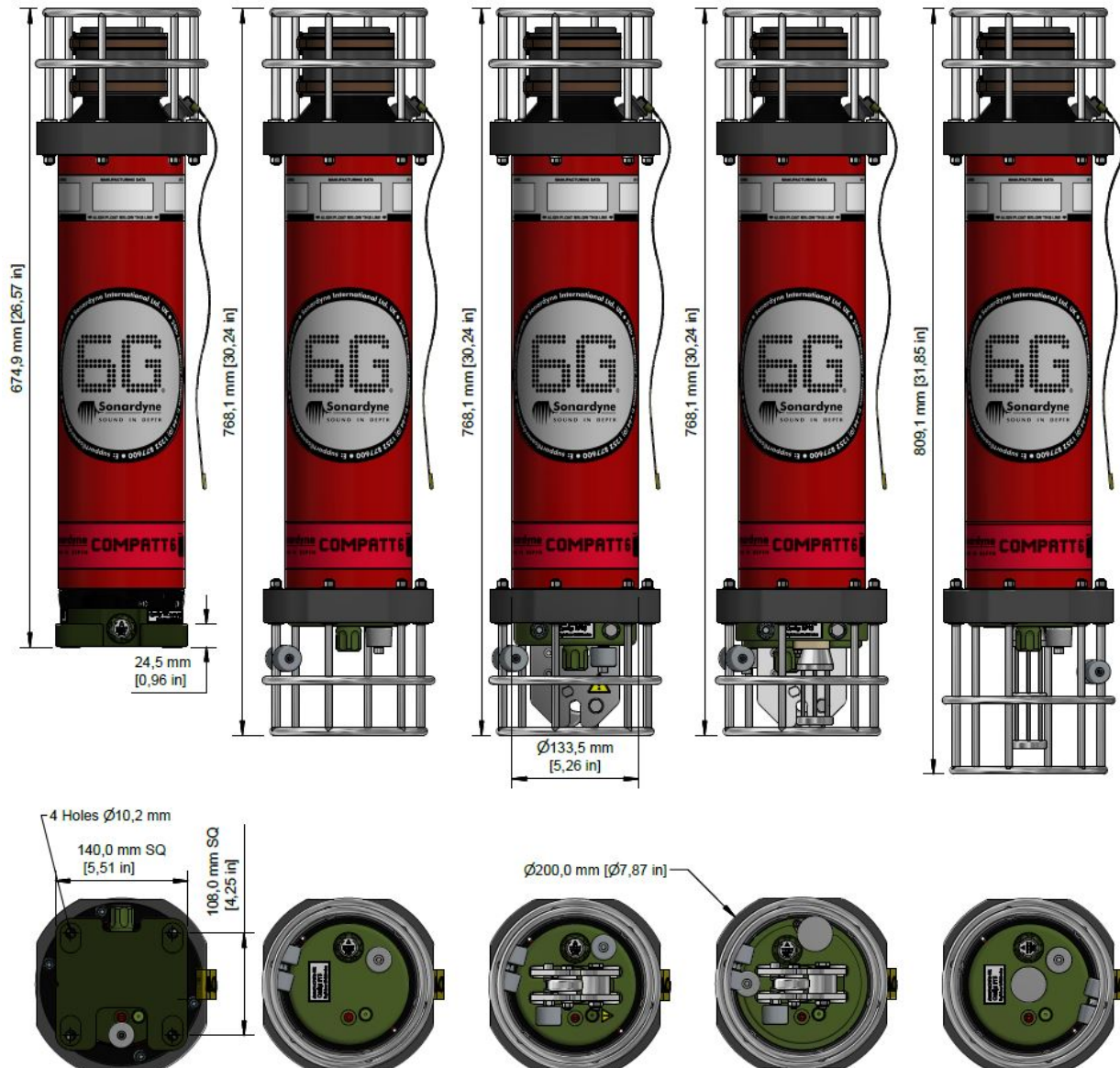
Figure 13–11 Type 830x-3133 (Mini 3,000 m MF Directional)



Note

 The Type 830x-4133 (Mini 4,000m MF Directional) has the same dimensions as above.

Figure 13–12 Type 830x-3143 (Midi 3,000 m MF Directional)



13.13.3 3,000 m LMF Omni-Directional Aluminium Housings

Figure 13–13 Type 830x-3115 (Standard Length 3,000 m LMF Omni-Directional)

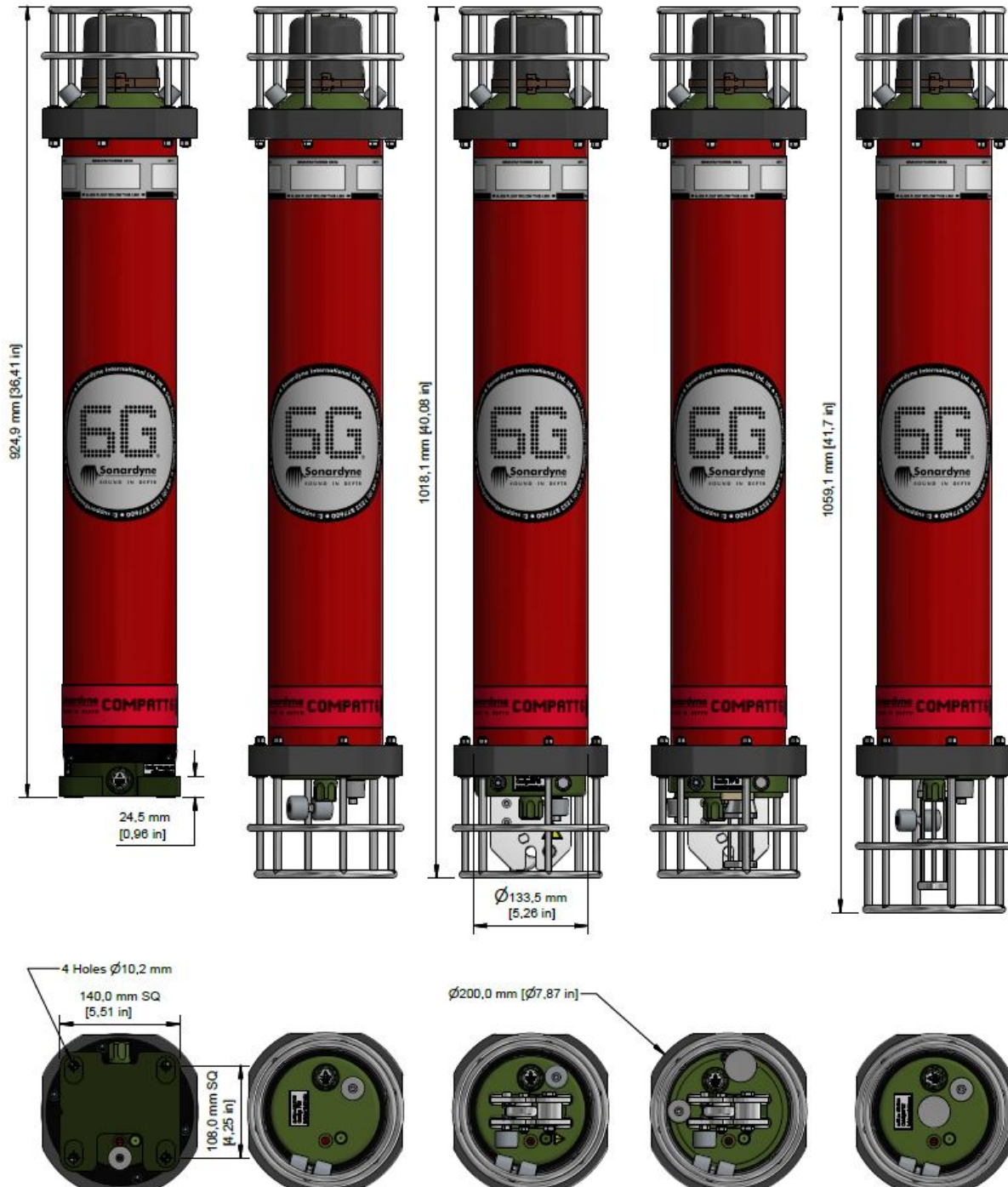


Figure 13–14 Type 830x-3125 (Maxi 3,000 m LMF Omni-Directional)

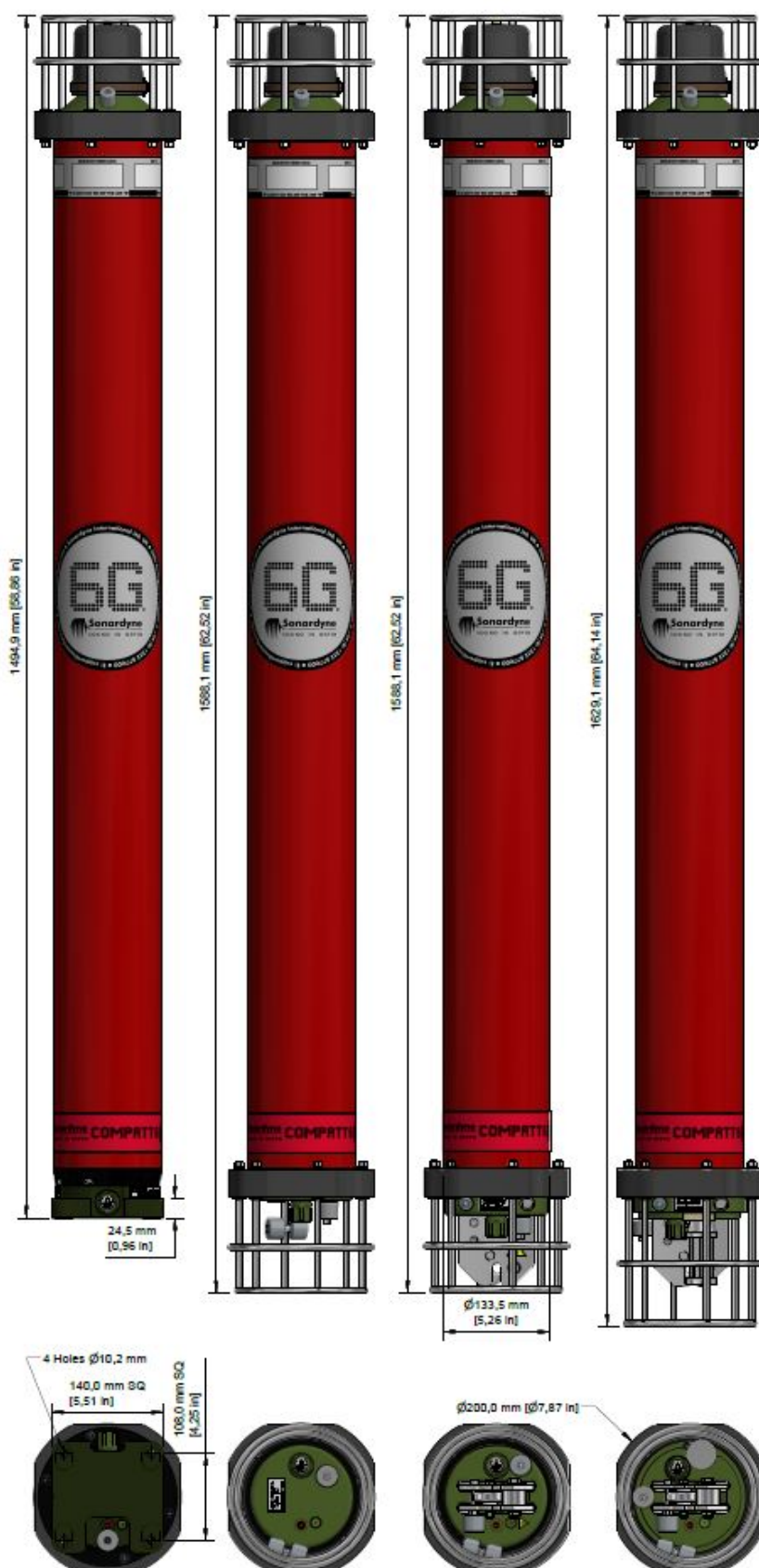
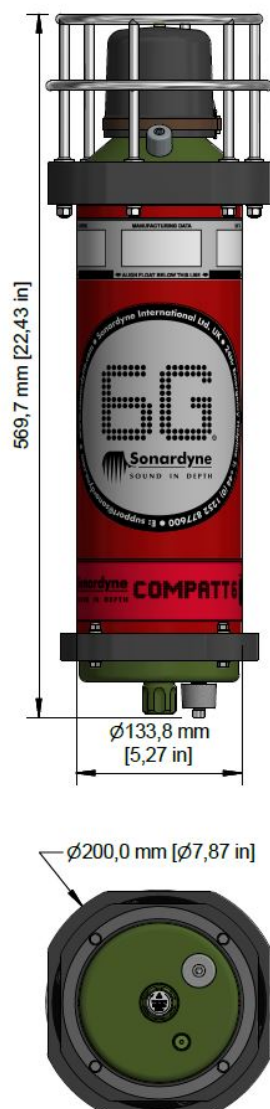


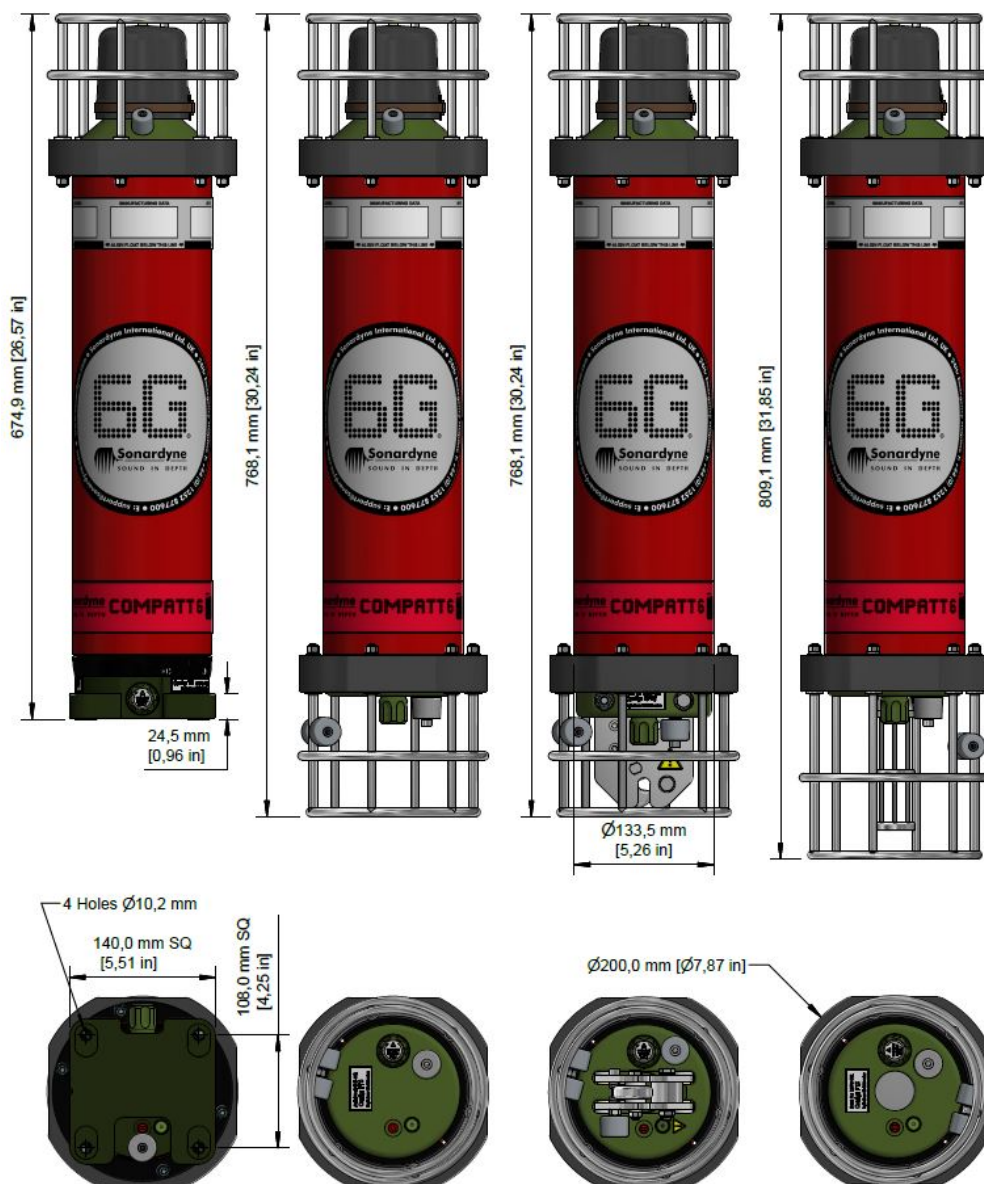
Figure 13–15 Type 830x-3135 (Mini 3,000 m LMF Omni-Directional)



Note

 The Type 830x-4135 (Mini 4,000m LMF Omni-Directional) has the same dimensions as above.

Figure 13–16 Type 830x-3145 (Midi 3,000 m LMF Omni-Directional)



13.13.4 3,000 m LMF Directional Aluminium Housings

Figure 13–17 Type 830x-3116 (Standard Length 3,000 m LMF Directional)

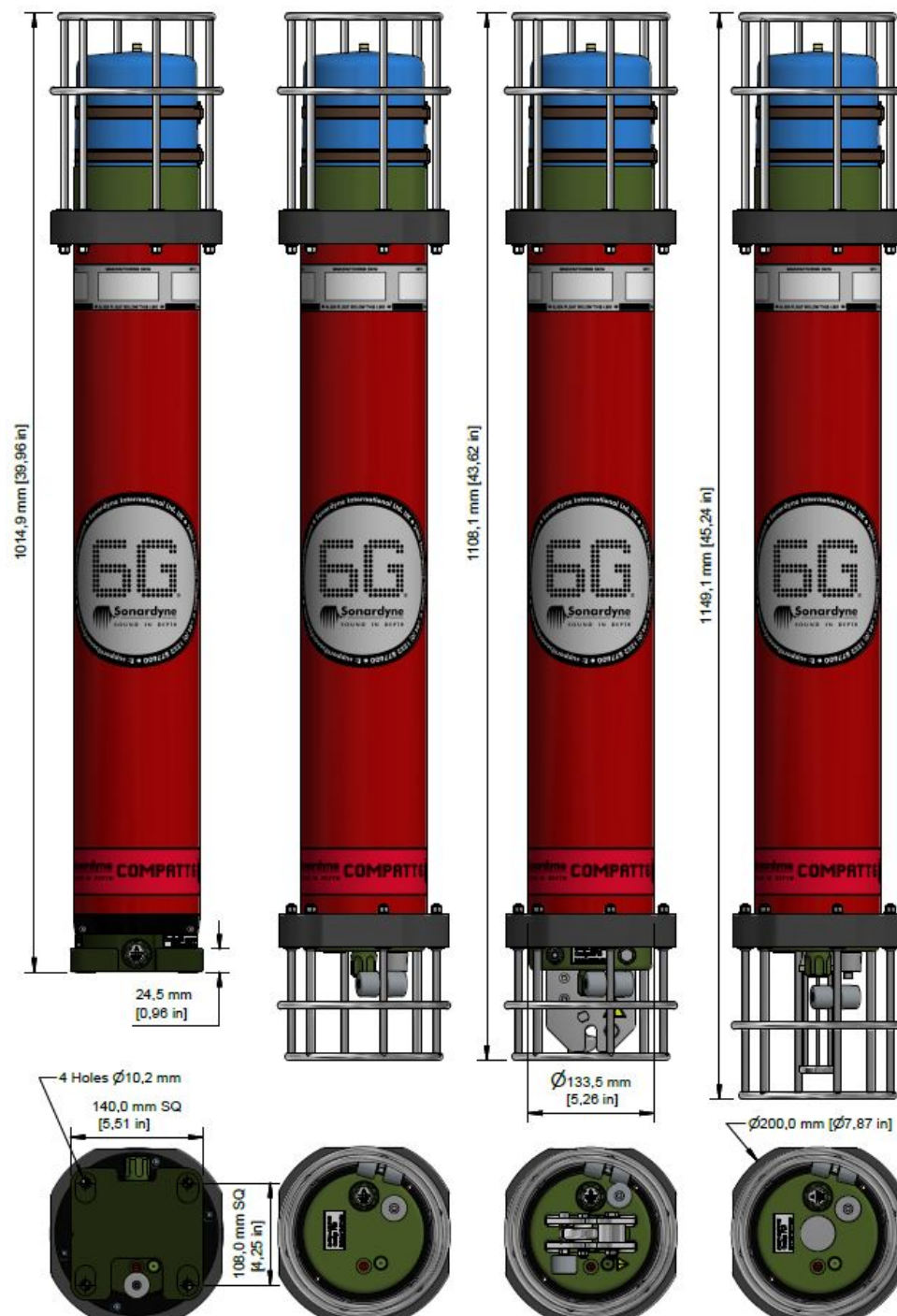


Figure 13–18 Type 830x-3126 (Maxi 3,000 m LMF Directional)

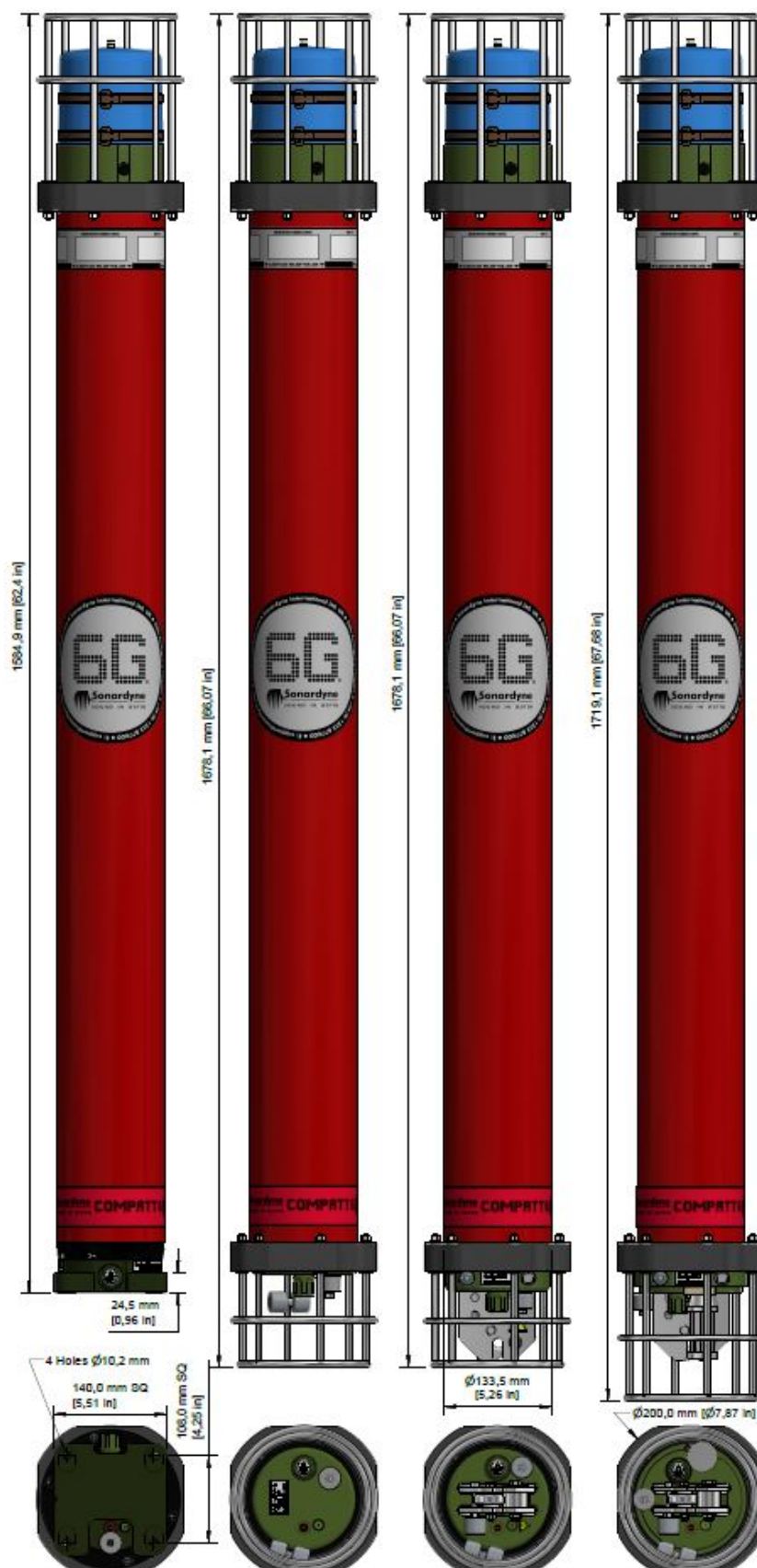
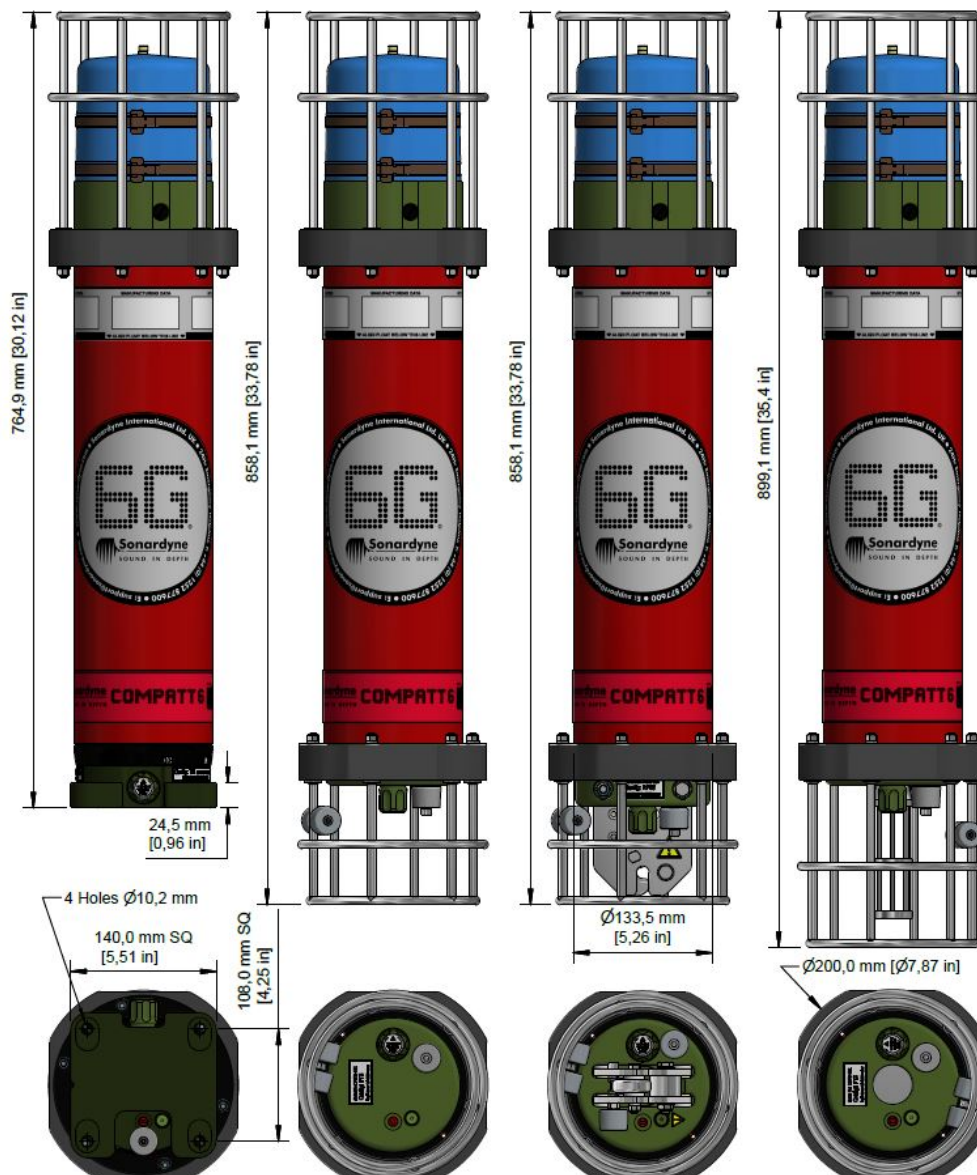


Figure 13–19 Type 830x-3146 (Midi 3,000 m LMF Directional)



13.13.5 3,000 m MF Omni-Directional Super Duplex Housings

Figure 13–20 Type 830x-3311 (Standard Length 3,000 m MF Omni-Directional)

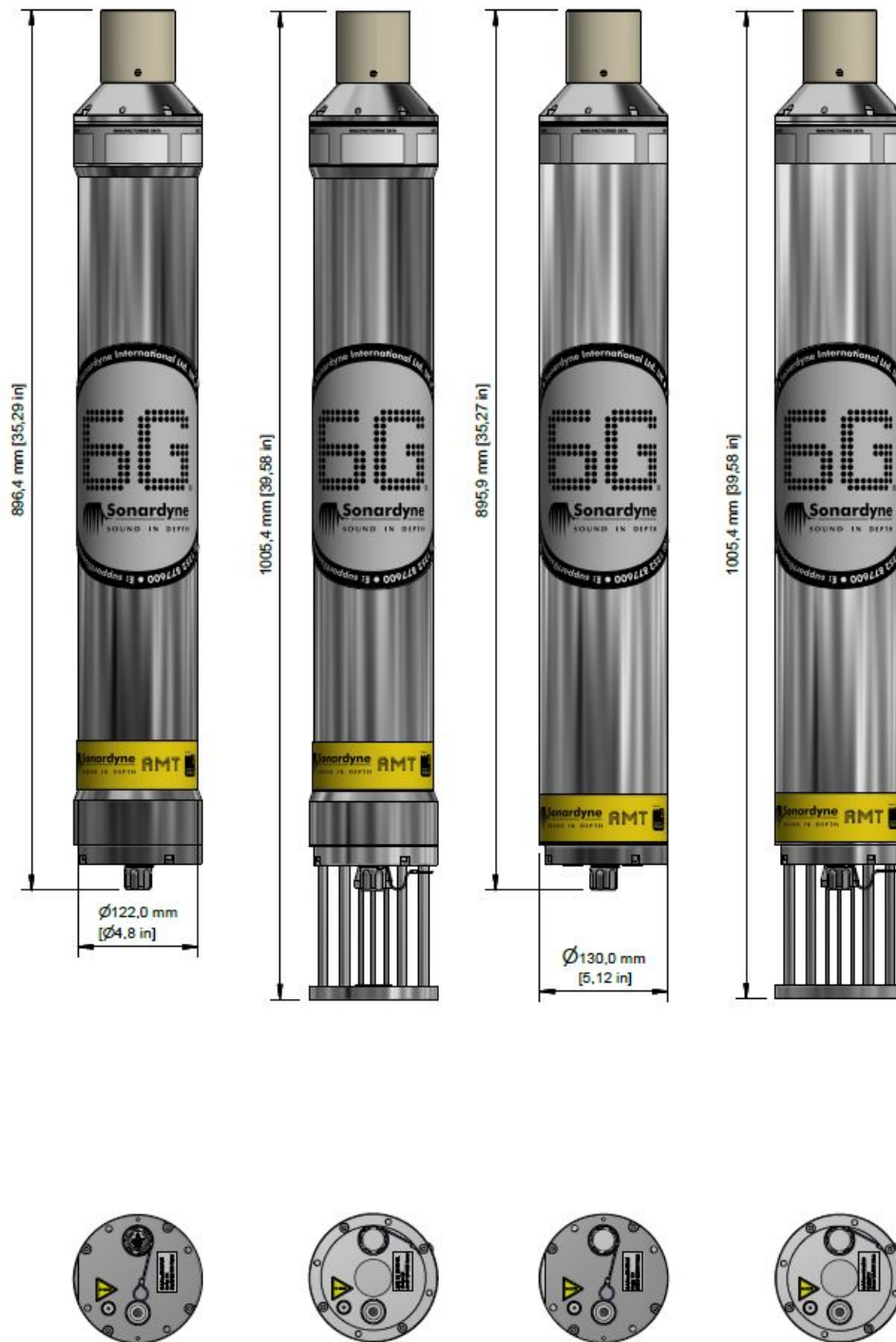
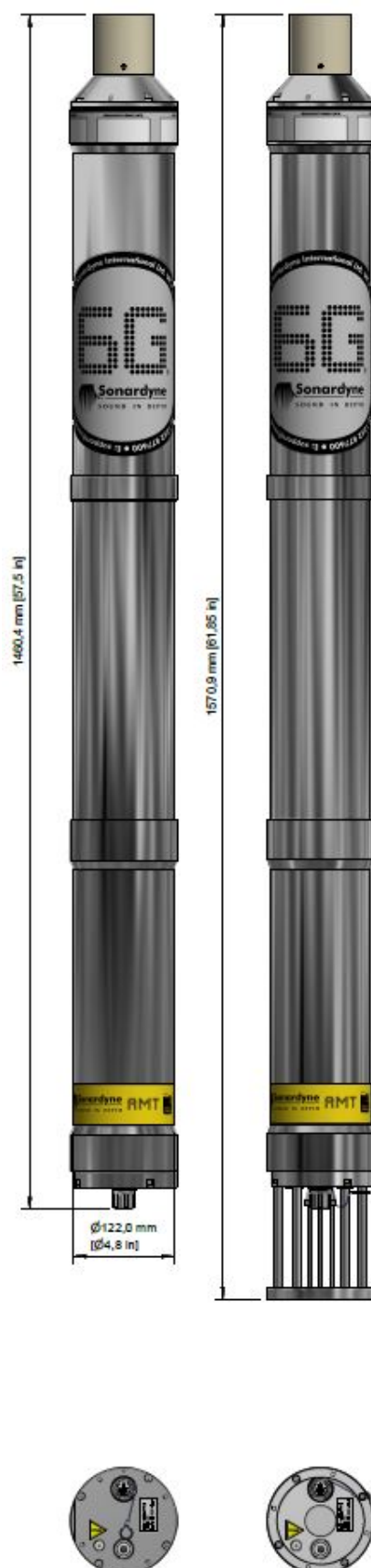


Figure 13-21 Type 830x-3321 (Maxi 3,000 m MF Omni-Directional)



13.13.6 3,000 m LMF Omni-Directional Super Duplex Housings

Figure 13–22 Type 830x-3315 (Standard Length 3,000 m LMF Omni-Directional)

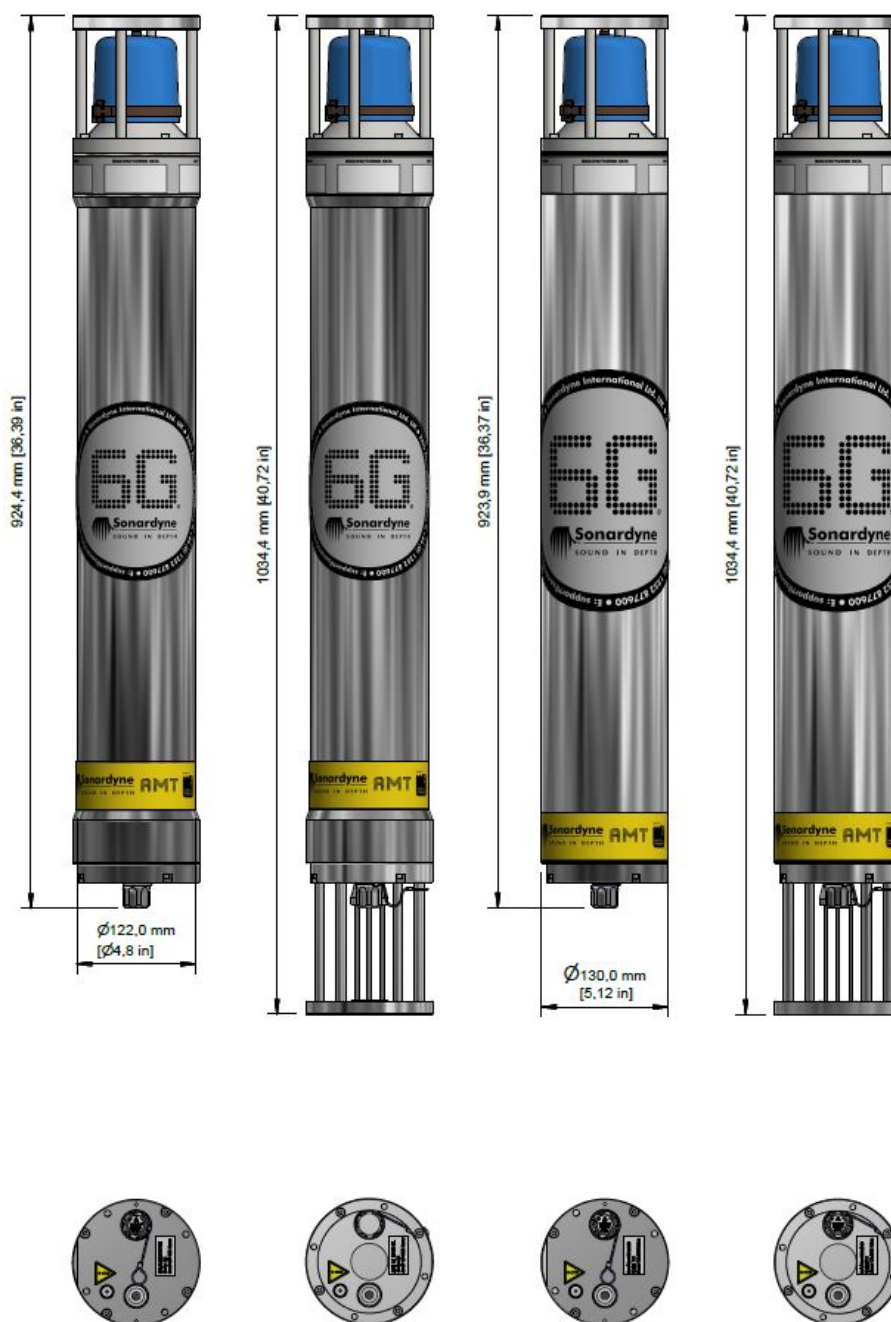
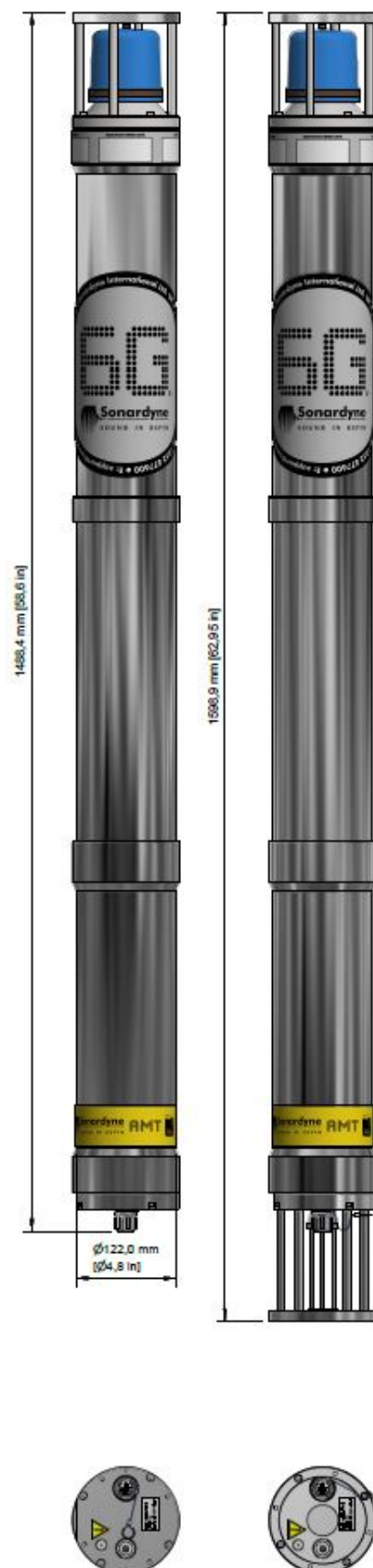


Figure 13–23 Type 830x-3325 (Maxi 3,000 m LMF Omni-Directional)



13.13.7 5,000 m MF Omni-Directional Aluminium Housings

Figure 13–24 Type 830x-5211 (Standard Length 5,000 m MF Omni-Directional)

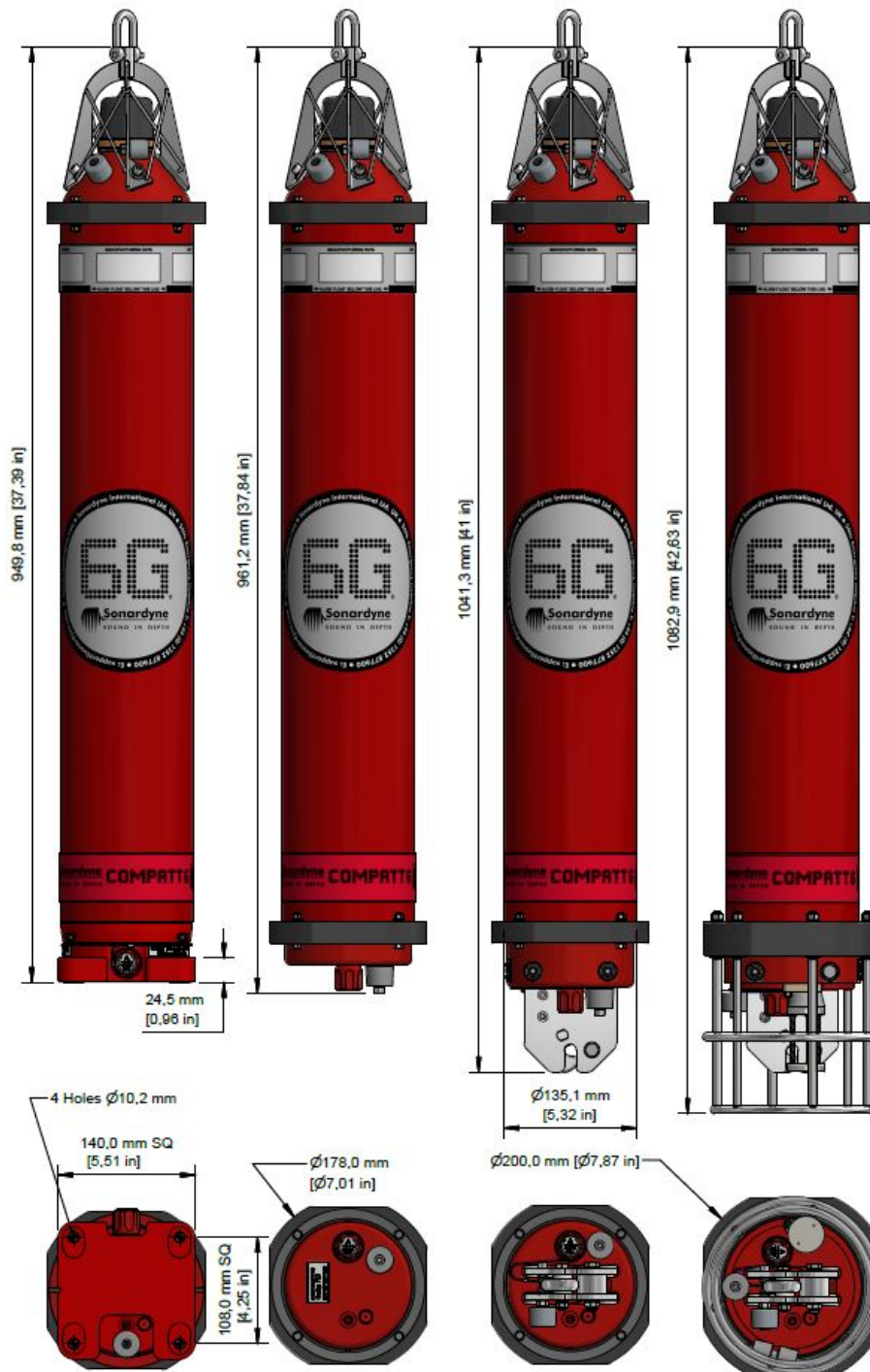


Figure 13–25 Type 830x-5221 (Maxi 5,000 m MF Omni-Directional)

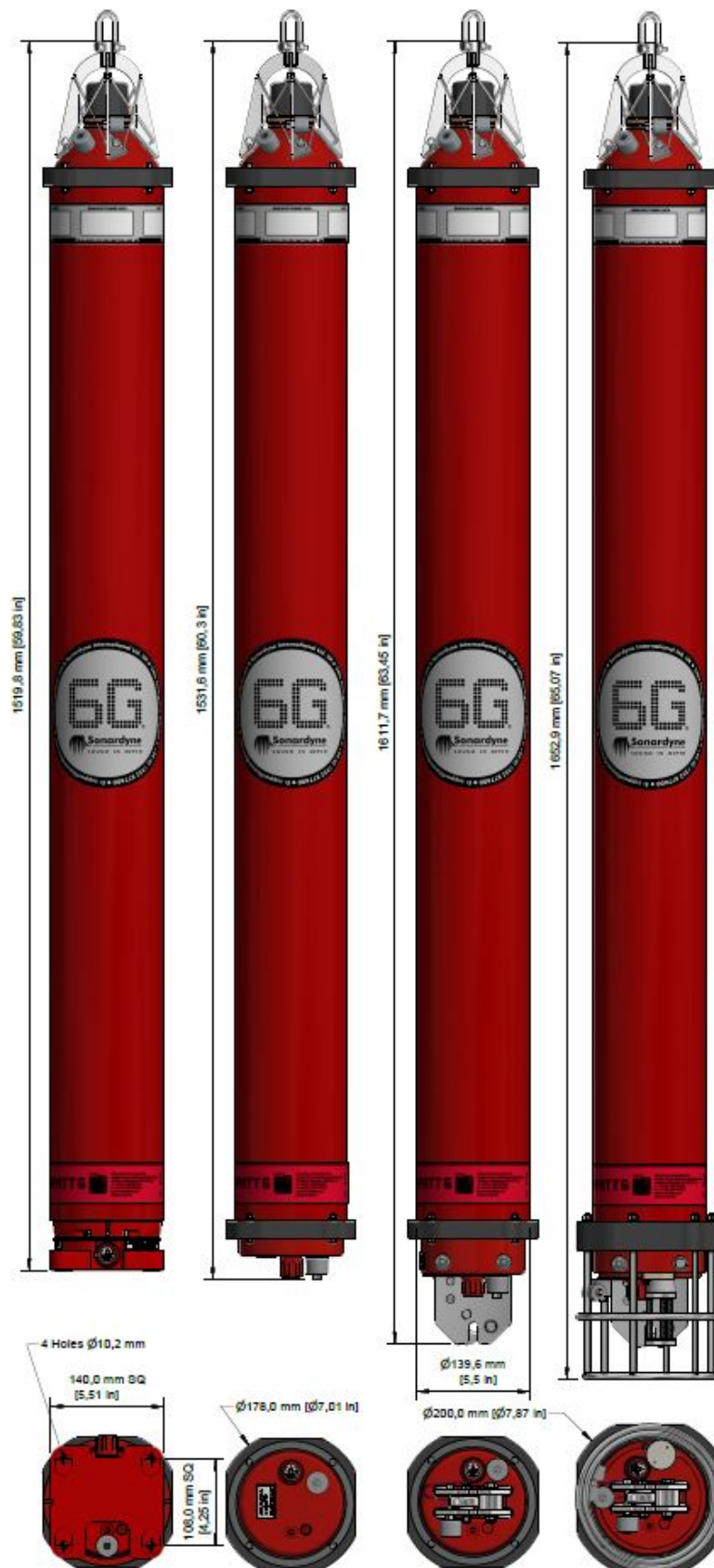
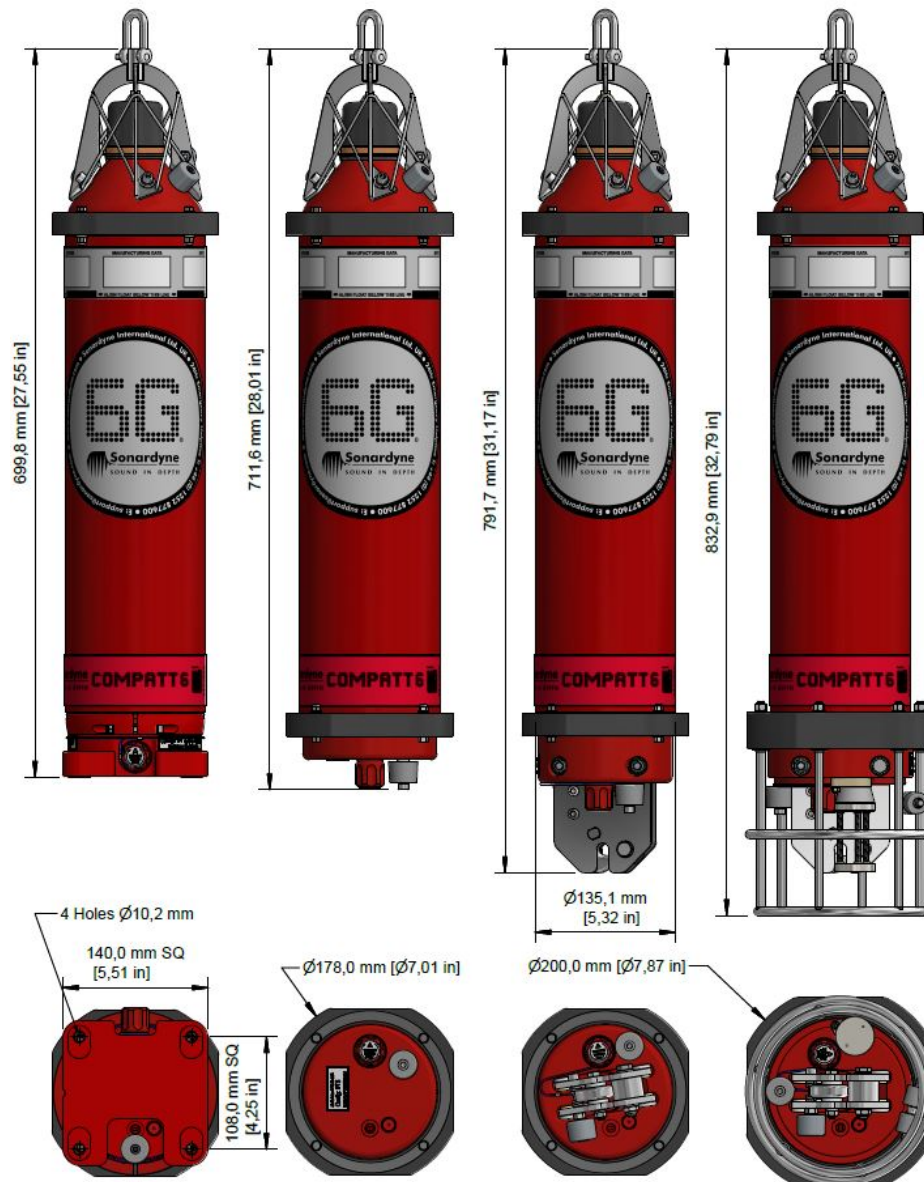


Figure 13-26 Type 830x-5241 (Midi 5,000 m MF Omni-Directional)



13.13.8 5,000 m MF Directional Aluminium Housings

Figure 13–27 Type 830x-5213 (Standard Length 5,000 m MF Directional)

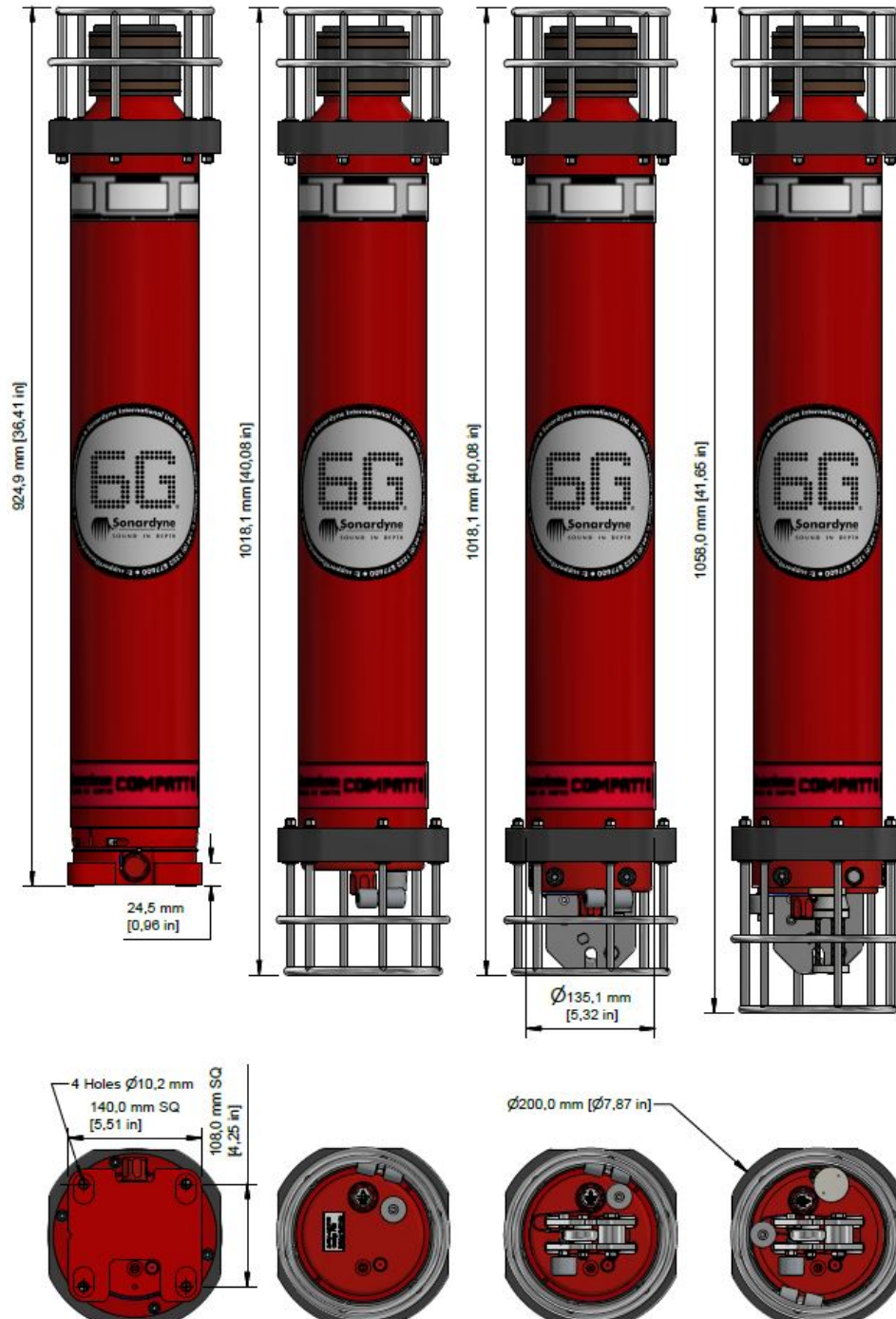
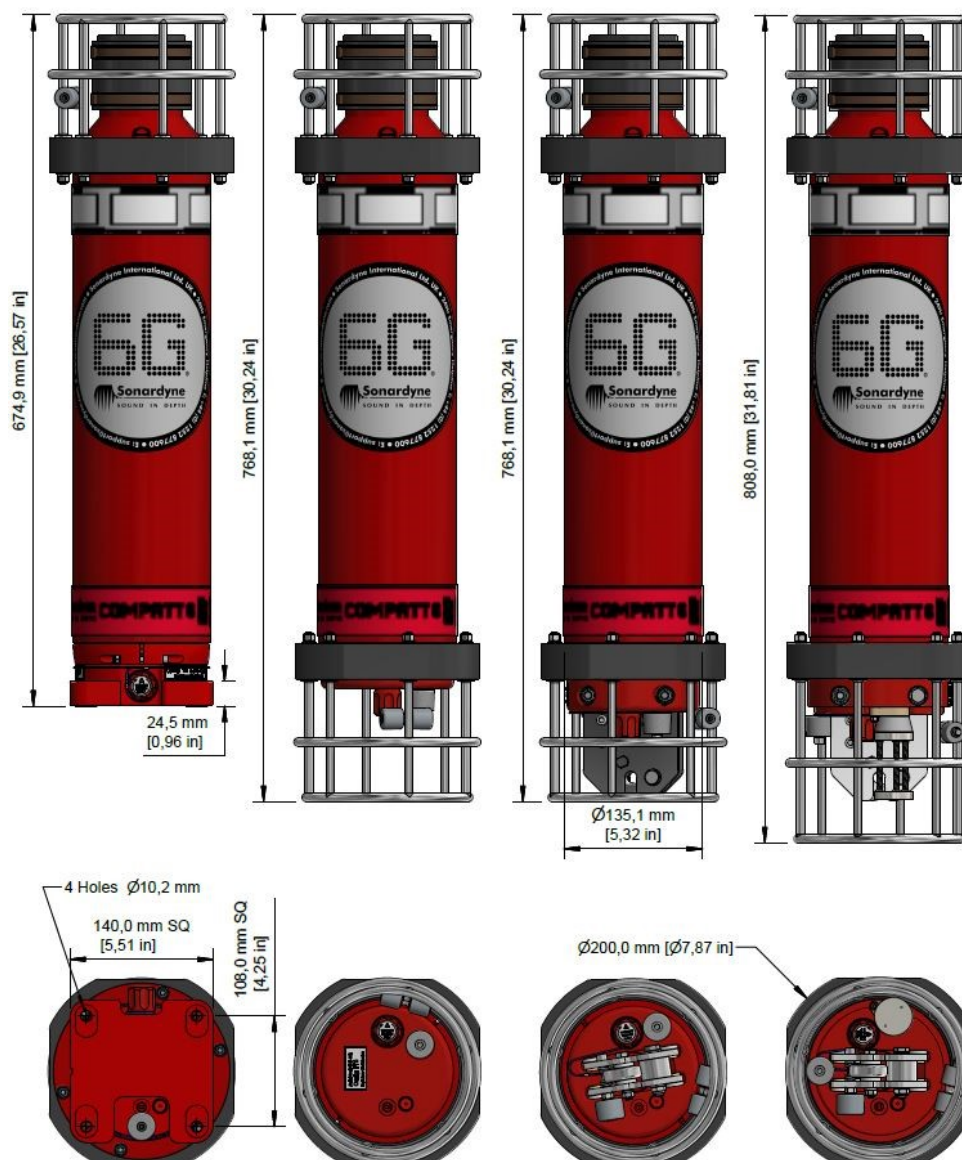


Figure 13–28 Type 830x-5223 (Maxi 5,000 m MF Directional)



Figure 13–29 Type 830x-5243 (Midi 5,000 m MF Directional)



Appendix A – Acoustic Positioning Methods

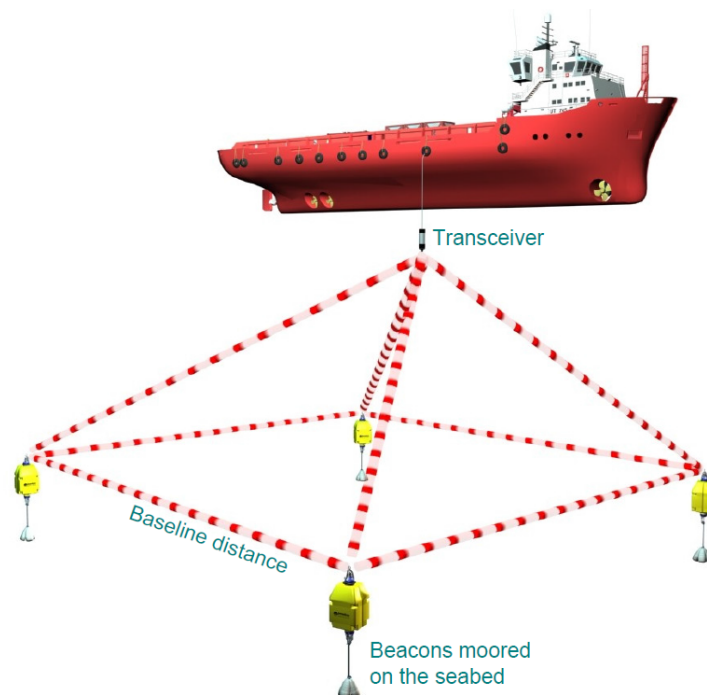
A.1 Long Baseline (LBL)

A.1.1 Hardware

A long baseline system has two parts or segments:

The first segment comprises of a number of acoustic transponder beacons in an array moored in fixed positions on the seabed. The positions of the beacons are described in a co-ordinate frame fixed to the seabed. The straight-line distances between them form the 'baselines' used by the system.

Figure A-1 Typical LBL System



The second segment comprises an underwater acoustic transducer on a transceiver. The transceiver is usually installed on the vessel either in an over-the-side arrangement as shown in *Figure A-1*, or in a fixed through-the-hull arrangement. It can also be installed on a towfish, if necessary.

A.1.2 Principles

The distance from the transducer to a transponder beacon can be measured by causing the transducer to transmit a short acoustic signal to which the transponder beacon responds.

The transceiver makes an accurate measurement of the interval between the instant when it transmits and the instant when it receives the transponder's response. Because the sound velocity in water is known at the location, it is possible to develop a good estimate of the range between the transceiver and the transponder beacon.

This measurement process is repeated for all the beacons in the array, and the position of the transceiver is then calculated or estimated relative to the array.

A.1.3 Beacon Numbers

In principle, navigation can be achieved using just two transponder beacons fixed to the seabed. However, with only two transponders, there would be ambiguity in the navigation solution because it would not be possible to determine from the measurements which side of the baseline was the correct transceiver position.

Also, when using only two beacons, the depth of the transceiver (equivalent to the transceiver's 'height' above the beacons) must be assumed.

For these reasons, three beacons is the minimum that can be used to produce unambiguous results in three dimensions. The use of five beacons provides sufficient redundancy to allow erroneous measurements to be identified, and is useful for making checks on the quality of navigation.

A.1.4 Baseline Distance

The term 'long baseline' is used because, generally, the baseline distances are much greater for LBL than for short baseline (SBL), and it is certainly much longer than for ultra-short baseline (USBL).

The longer baselines used by LBL systems mean that LBL is more accurate than SBL and USBL. LBL also has the advantage of being able to position the vessel, or any other object, directly using a 'fixed' frame of reference. This removes most of the problems associated with vessel motion.

A.1.5 Calibration

It is necessary to calibrate the array of beacons on the seabed, and there are several techniques available for doing this. The most appropriate method to use depends on the specific requirements of the operation and on the available hardware.

With the continuing integration of LBL, SBL and USBL systems, intelligent transponder beacons that can measure baselines directly, and satellite navigation systems, the calibration of seabed arrays has become a quick and simple operation, completed automatically in some cases.

A.2 Short Baseline (SBL)

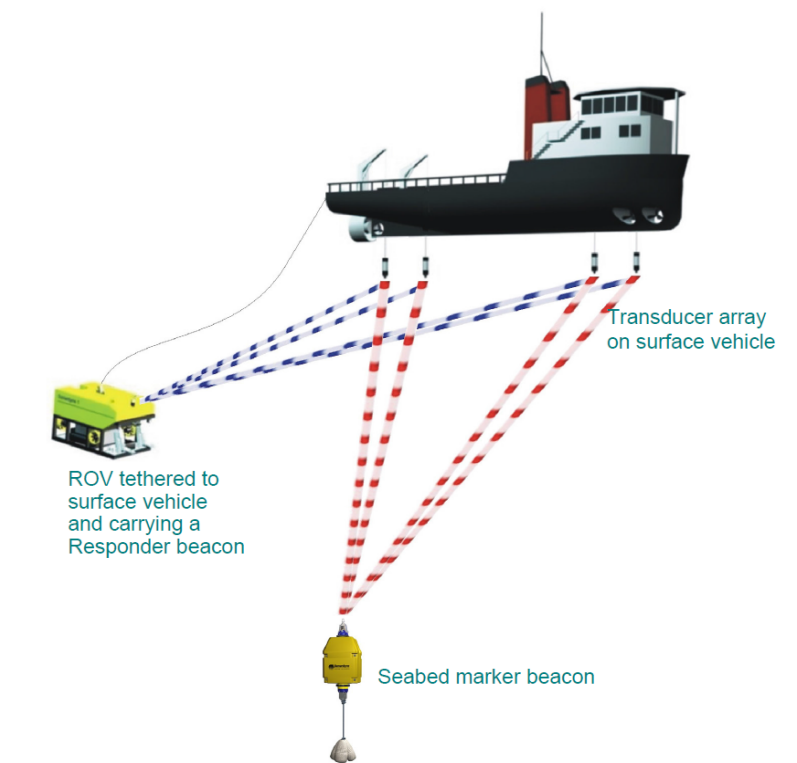
A.2.1 Hardware

Short baseline (SBL) acoustic position systems are usually fitted to a vessel such as a barge, a semi-submersible, or a large drilling vessel.

In an SBL system there are at least three, and typically four, acoustic transducers fitted in a triangular or rectangular array on the lower part of the vessel. The distances between transducers (the 'baselines') are made as large as practical on the vessel, and are typically at least 10 metres long.

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

Figure A-2 Typical SBL System



A.2.2 Baseline Distances

The term 'short' is used as a comparison against long baseline techniques, where the baseline length usually exceeds 100 metres and can exceed 1000 metres.

If the distances from the transducers to an acoustic beacon are measured using the techniques described for LBL, then the beacon's position within the vessel's co-ordinate frame can be computed. Furthermore, if redundant measurements are made, a best estimated can be determined, which is statistically more accurate than the basic position calculation.

A.2.3 Principles

SBL systems transmit from one but receive on all transducers. The result is one distance (or range) measurement and a number of range (or time) differences.

With an SBL system the co-ordinate frame is fixed to the vessel, and is therefore subject to the rotational motions of roll, pitch and yaw. This apparent disadvantage can be overcome by using additional VRU and gyrocompass instruments, external to the SBL system, to supply measurements of roll, pitch and heading. The additional measurements allow the co-ordinates of the beacon to be transformed mathematically to remove the effects of these rotational motions.

If the requirement is to estimate the position of the vessel in some fixed or 'inertial' frame, such as one fixed to the seabed, then at least one beacon must be placed in a fixed position on the seabed and used as a reference point. This is the principle used for dynamic positioning vessels.

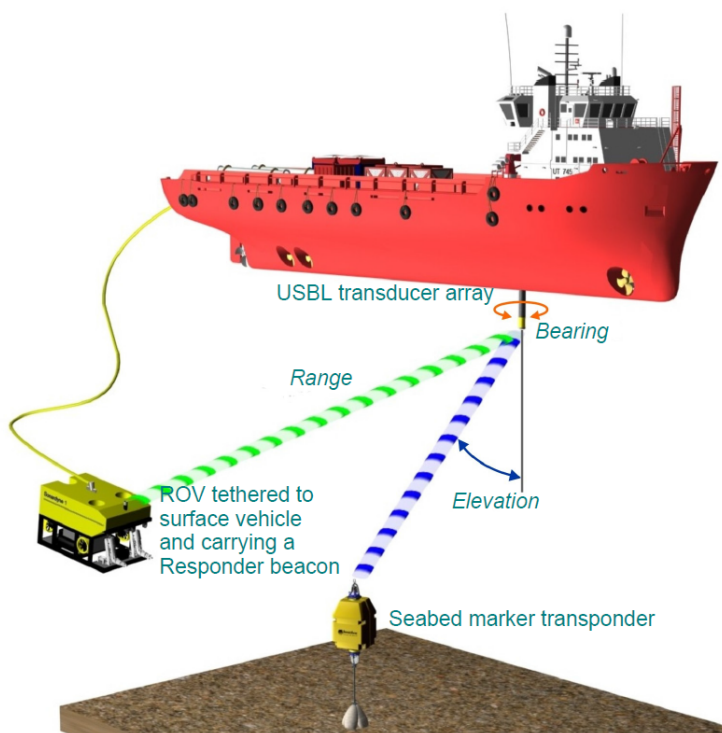
Figure A-2 shows an example of a system that has a transponder beacon fixed to the seabed and a responder beacon located on an ROV. In this case the system can calculate the position of the vessel and of the ROV within a reference frame fixed to the seabed.

A.3 Ultra-short Baseline (USBL)

A.3.1 Hardware

The principles of ultra-short baseline (USBL) position measurement are very similar to those of an SBL system already described. However, instead of the transducers being deployed at widely-spaced locations on the vessel, they are built into a single transceiver assembly.

Figure A-3 Typical USBL System



A.3.2 Principles

The distance or range measurement principles used in a USBL system are the same as those used for SBL, but the time differences between signal reception at the difference transducers are significantly less than for an SBL system.

Systems that use sinusoidal signals measure the time-phase of the signal received by each transducer element in the transceiver, and compare them with a reference signal generated in the receiver. These time-phase differences between transducer elements are computed by subtraction, and then the system is equivalent to an SBL system in the calculation of range and bearing.

Another practical difference is that the transducer elements of a USBL system are in a transceiver assembly that is installed at some convenient location in the vessel co-ordinate frame.

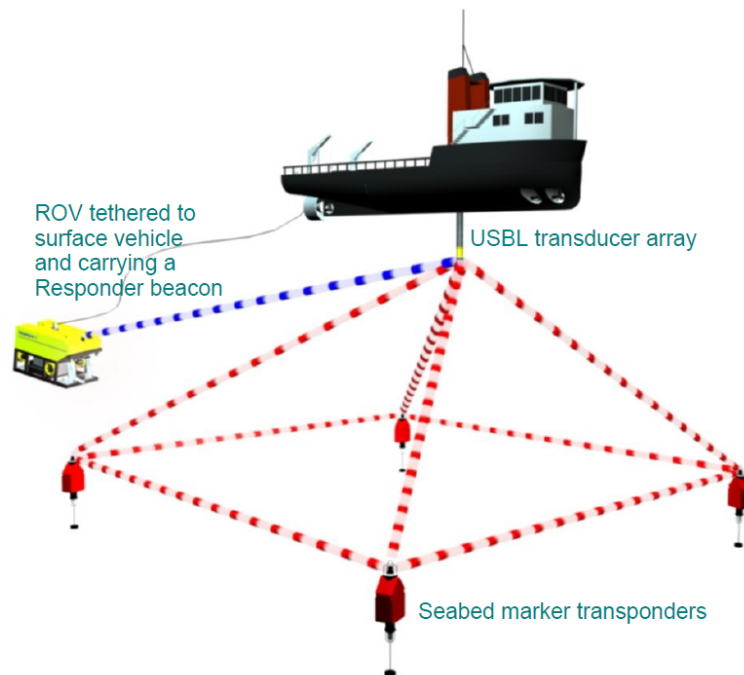
It is important to recognise that, whereas an SBL system calculates beacon positions in the vessel frame, a USBL system calculates beacon positions in a frame fixed to the transceiver assembly. To transform these positions into the vessel's co-ordinate frame requires the transceiver's attitude with respect to the vessel frame to be measured during installation.

A.4 Long / Ultra-short Baseline (L/USBL)

A.4.1 Hardware

The long / ultra-short baseline (L/USBL) system is a special case of the USBL system. It uses USBL hardware in a configuration similar to the one described for the LBL system.

Figure A-4 Typical L/USBL system



A.4.2 Principles

An L/USBL system follows the same methods for calculating range and bearing measurements as the basic USBL system. However, because there are more beacons deployed on the seabed, a considerable improvement in accuracy can be achieved by the L/USBL system.

A.4.3 Non-Critical Operations

If a basic L/USBL system is not to be used for highly accurate survey work, a system such as the one shown in *Figure A-4* will perform a top-down calibration automatically as soon as it is placed in Navigation mode with the beacons declared as References.

This calibration technique relies on multiple range and time-phase difference measurements between the USBL transducer and each transponder on the seabed in turn. Provided an accurate measurement of sound velocity is used, over a period of time the system calculates repeatable positions for the seabed array relative to the USBL transducer.

A.4.4 Critical Operations

If the L/USBL system is to be used for survey work where accuracy is critical, the seabed array must be calibrated separately or by using baseline measurements. If a DGPS input is available to the L/USBL system it is feasible to locate each beacon on the seabed directly in a geographical frame of reference to an accuracy determined by that of the DGPS measurements.

Similarly, if Compatt beacons are used for the seabed array, the L/USBL system can command them to self-calibrate. Using Compatt beacons has the additional advantage of giving the system significantly more flexibility, in that they can be commanded to respond on any of a variety of frequencies and with any desired turn-around delay time. This means that a Compatt version of the system becomes simpler and faster to set up and use.

A.4.5 Dual Operation

Two complete sets of L/USBL equipment can be operated in tandem to provide dual redundancy. When used in this way, the two systems are linked in such a way that, following failure of any major element, the system can continue to operate without the need for operator intervention. Operation of a dual-redundant system is identical to that of a standard version.

In dual redundancy, one system operates as the 'master' and the other operates as the 'slave'. The slave system monitors the functions and performance of the master and takes over system operations if it detects any failure.

A.5 Long-short USBL (LSUSBL)

A.5.1 Hardware

In a LSUSBL system, four or more transceivers are deployed below the vessel, and four or more beacons are deployed on the seabed.

A.5.2 Principles

LSUSBL mode is a combination of USBL, LBL and SBL modes. The reference array is interrogated from one transceiver, and the replies from all the beacons are collected at all the transceivers. All the resulting measurements are used to derive a single solution of the vessel's position.

This single solution comprises SBL, USBL and LBL components:

Ranges to each beacon are collected at all the transceivers, giving an SBL component to the solution.

The LBL component arises from the ranges three or more beacons having been collected.

The USBL component arises from both range and direction calculations derived from the multiple transducers of a single transceiver.

LSUSBL uses the same equipment and configuration as LUSBL but uses data from more transceivers. It is not specifically described in this manual. If operating in LSUSBL mode, use the description for L/USBL but enter the additional transceivers.

Appendix A – Basic Principles of Transponder Interrogation and Reply

The interrogation signal transmitted to a 6G® Wideband®2 Transponder is a phase-encoded acoustic signal. This signal is around 8 milliseconds in length. The acoustic transducer converts the acoustic signal into a low level alternating voltage. All ambient noise is converted into an electrical noise voltage covering a wide frequency range. The pre-amplifier in the transponder amplifies the combined signal and noise voltages, and filters to weaken frequencies outside the band used by the transponder channels. The receiver uses Digital Signal Processing (DSP) to detect the interrogation signal, even in the presence of other noise and signals.

After a specific time-interval known as the 'turn-around time' logic circuits in the transponder and transmitter generate a powerful acoustic reply. The reply is on a different channel to the interrogation signal, but is the same length.

The equipment sending the interrogation signal will detect the reply signal from the transponder. The delay in receiving the reply will allow the equipment to calculate the range (distance) to the transponder.

The equipment calculates the range as follow:

- Measures the total time delay = A
- Subtracts the turn-around delay = B
- This gives the true 'through water' time delay = C
- Multiplies by the speed of sound in water = D
- This equals the two way range = E

$$A - B = C$$

$$C \times D = E$$

Sound is reflected by the sea surface, seabed and other reflecting surfaces. This causes a received signal to appear much longer in duration than the other transmission. This extended signal has random phases and random decreasing amplitude. This sound reflection is known as reverberation. The transponder has a built in 'blocking period' which allows the reverberation to face away before a transmission starts. The 'blocking period' prevents multiple replies from being transmitted in response to the reverberation of the initial interrogation signal.

The 6G® Wideband®2 transponder is set to always receive its Individual Interrogation Signal (IIS) which is set by its acoustic address. The IIS can be followed by an acoustic command. If no command is present the transponder will reply on the Common Reply Signal (CRS). This interrogation mode is used for baseline measurements between transponders, where only one transponder at a time will be replying. The turn-around time in this fixed mode is 320 milliseconds.

The transponders can also reply to a Common Interrogation Signal (CIS), this reply can be enabled or disabled by acoustic command. If enabled, it will reply to the interrogation signal using its Individual Reply Signal (IRS), which is set by the acoustic address after the turn-around time. There are different CIS signals (CIS0 to CIS14) these allow independent operation of several Long Baseline (LBL) navigation systems in the same area. The CIS used and the value of the turn-around time can be set by serial port commands or acoustic telemetry commands.

To maximise battery life, the transponder goes into a sleep mode. To wake the transponder from this mode a wake up signal is sent before interrogation. The transceiver which generates the interrogation can be instructed to transmit a wake-up signal immediately before sending the interrogation signal.

When the transponder has replied to the interrogation signal it will return to sleep mode after a controlled period of inactivity. The transponder can be programmed with an activity time, the length of the inactivity time depends on how the transponder is being used. The activity time is restarted after each valid interrogation. If the transponder has not gone into its sleep mode a wake-up signal is not required.

A.1 Transceivers

Wideband transponders are being used for general acoustic navigation and special projects where the efficient command structure is required to save time during position and sensor measurement cycles.

Transceivers which are compatible with the new command structure are as follows:

- Type 8309Dunker 6 is an 'over-the-side' navigation transceiver used for LBL array calibration, ROV navigation and data telemetry.
- Type 8310ROVNav 6 is a vehicle mounted navigation transceiver used for LBL array calibration, ROV navigation and data telemetry.
- Type 8142HPT USBL transceiver with a multi-element array provides both range and bearing information. The transceiver is capable of receiving Sonardyne's high data rate (HDR) telemetry, supported rates including 3 kbps and 6 kbps
- Type 8220AvTrak 6 is versatile AUV transceiver with omni-directional or directional transducers used for self-navigation, tracking and acoustic telemetry.

For testing and maintenance, the Type 8063 Deck Test Unit can perform basic WBv1 interrogation acoustic checks, but cannot command or configure the transponder. The transponder should be configured using the 6G Terminal Lite and if required another 6G instrument can be used for a basic acoustic check.

A.2 Command and Telemetry Functions

'Command' is the remote control of operating modes of transponder by coded acoustic signals, transmitted from a surface vessel..

The Wideband transponders use Wideband digital telemetry to send commands and transmit data replies. This allows multiple parameters to be set in one command, giving a faster set-up than previous command systems. Wideband digital telemetry has error detection and correction to improve reliability and security.

When the command function has been executed by the transponder, a telemetry signal is transmitted to acknowledge the operation is complete.

Example commands include the ability to change power levels, gain and navigation turnaround time for the beacon; to collect sensor readings and / or baseline measurements or (when fitted) actuate a release drive. All acoustic commands are initiated from an acoustic transceiver which is in turn driven by bespoke Sonardyne software.

A.3 Communicating via RS232

The transponder can be configured and tested via the RS232 link from a PC running the Sonardyne software. An acoustic and serial protocol document that describes the acoustic and serial commands supported by each transponder is available on request from Sonardyne Support.

A.4 Acoustic Navigation System Principles

For a detailed description on acoustic navigation system principles, see *Appendix A "Acoustic Positioning Methods"*.

Definitions

Term	Definition
6+	Sonardyne instruments that can use Wideband 3 enabling sensor data to be embedded in navigation range replies e.g. Compatt 6+ 6+ instruments are also backward compatible with Wideband 2.
6G®	Sonardyne's sixth generation technology hardware platform.
Acoustic Signal	Information carried by sound pressure waves through water. The Sonardyne acoustic signal has a finite length.
Acoustic Responder	An instrument that emits an acoustic signal in response to an electrical signal carried to it by cable.
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.
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
Common Reply Signal (CRS)	A reply signal common to a complete family of addressed transponders.
CPU	Central Processing Unit
DAS	A micro-controlled data acquisition and logging sub-assembly located within a transponder.
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.
Firmware	The firmware installed on the transponder. Firmware updates can be installed via 6G Terminal Lite. The Tx firmware refers to the transmission signal synthesiser.
Long Base Line 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 Base-Line
PSU	Power Supply Unit
QR code	Quick Response Code. A matrix barcode of black modules arranged in a square grid on a white background.
ROV	Remotely Operated Vehicle

Term	Definition
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.
Sonardyne Wideband®3	Telemetry protocol available with 6G+ devices that enables sensor data to be embedded in navigation range replies.
Ultra-Short Base Line 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.
WLL	Working Load Limit. The Working Load Limit (WLL) is the maximum recommended working load. This is set as a maximum 25% of the Breaking Load and allows for factors such as corrosion, fatigue, shock loads, harmonic loads, manufacturing defects and material defects. This does not account for extreme offshore service conditions.

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