Sonardyne

# UM-8190

# User Manual for Type 8190 Wideband Mini Transponder (and variants)

Issue C Rev 2

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**Note**

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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 Release | All | All |
| B | 0 | 08/02/2013 | OB9156 – updating of charging kit. Complete manual updated to bring in line with new branding | All | All |
| B | 1 | 04/10/2013 | Section 7.2 "Scheduled Maintenance and Recalibration" deleted<br>ECN12326 Raised: Section 12.9, Sensor specification updated | 7.2, 12.9 | 36, 68 |
| B | 2 | 11/01/2016 | OB11655 – Procedures for WTT replaced by 6G Terminal Lite<br>General update | All | All |
| B | 3 | 13/08/2019 | Modem 6 variant added<br>General update | All | All |
| C | 1 | 06/04/2023 | CPN 920-01023 and associated Programming Document 8190-014 removed (UM-8190 added to parts narrative)<br>Formatted with new branding style<br>General update | All | All |
| C | 2 | 13/06/2023 | 8244-3156 Mini-Dunker added | All | All |

# Section 1 – Introduction

## 1.1 Purpose

This user manual contains information for personnel involved in operations utilising the 8190 Wideband Mini Transponder and variants. It includes technical information for installation, operation and maintenance.

## 1.2 Scope

This user manual describes the safe installation, operation and maintenance of the 8190 Wideband Mini Transponder and variants. The information and procedures within this manual are based on Sonardyne's experience and knowledge.

## 1.3 Related publications

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

**Table 1-1 Related publications**

| Publication | Title |
|---|---|
| *Sonardyne Safety Manual* | *Operational and Safety Precautions* |
| *UM-8300-099* | *User Manual for 6G Terminal Lite* (included on the 6G Utilities Disc) |
| *UM-8250-8251* | *Marksman L/USBL, Ranger 2USBL/Survey/DP User Manual (included with Marksman/Ranger 2)* |
| *IM-Modem 6* | *Modem 6 Integration Manual* |

## 1.4 Conventions

The following conventions are used in this manual.

**Table 1-2 Conventions used in this manual**

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

# Section 2 – Safety

## 2.1 Introduction

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

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

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

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

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

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

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

## 2.2 Safety procedures

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

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

### 2.2.1 Warnings

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

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

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

⚠ **High internal pressure. Make sure the Pressure Relief Vent Valve is manually operated to release any internal pressure before attempting to dismantle the equipment.**

⚠ **High internal pressure. 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.**

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

**Electric shock risk. Some versions of the instrument are designed to be used with a Remote Transducer, driven at a high voltage via the endcap connection. Make sure the remote transducer is fully connected to the instrument housing before operating the equipment.**

**Make sure the work environment is well ventilated. Toxic gases may be released when operating the Pressure Relief Vent Valve.**

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

**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 injury. Do not stand in line with the endcap when removing from the transponder.**

**Do not fit unauthorised battery pack types into the transponder.**

**Risk of toxic gases. Make sure the work environment is well ventilated. Toxic gases may be released when operating the pressure relief vent valve.**

**Faulty battery pack. If a fault is suspected with the battery pack it must be investigated by qualified Sonardyne personnel and should not be deployed.**

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

### 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.**

**8244 Products: Risk of equipment damage. Avoid excessive testing of high-power acoustics in air, as this can cause additional heating and possible damage to the unit; run all in air testing at low or ultralow power levels. See *"Sonardyne Command Language PV1.04"* for detail on setting acoustic power levels.**

**8244 Products: Risk of equipment damage. Avoid high duty cycle, high power telemetry acoustics such as Telemetry Tracking, SMS, modem and 6G commands. Sustained high power activity can cause heating in the battery leading to battery protection circuitry turning off charging and reducing the effective output power; set telemetry power level (TPL) to low. See *"Sonardyne Command Language PV1.04"* for detail on setting acoustic power levels**

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

**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.**

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

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

⚠ **Equipment damage. A standard Subconn non-shorting blanking plug must be fitted when deployed if the connector on the unit is not being used.**

⚠ **Damage to external connector when submerged. The external connector must be covered while the transponder is submerged, either by the protective dummy plug (part no. 312-6874) or by the free plug of an external power cable.**

⚠ **Damage to connectors. The connectors must not be mated without lubrication as this will lead to delamination of the rubber from the connection pins and cause connector failure.**

⚠ **Damage to connectors. Do not over apply grease to the connector faces as a build-up of grease in the female connector will affect connector integrity.**

⚠ **Equipment damage. Failure to clean sand or silt from the connectors could result in the splaying of the female contact and damage to the O-ring seals.**

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

⚠ **The Dunker should be deployed over the side, well away from thrusters or propellers as there is the risk that the Dunker may be drawn in and damaged. It may be necessary to pull the Dunker out of the water when the vessel is manoeuvring.**

⚠ **Risk of Crush Injury. The Dunking Transceiver restraining cables must not be used if corroded or damaged as this could cause the Dunker to drop suddenly. Wear Personal Protective Equipment such as protective footwear and gloves.**

⚠ **Risk of Equipment Damage. Damaged or corroded restraining cables could fail causing the Dunker to drop from the attached cable causing damage to the equipment. Inspect the restraining cables for serviceability.**

⚠ **Risk of Impact Damage to Vessel and Equipment. Do not raise or lower the Dunker over the side of the vessel without assistance as impact could cause damage to the equipment and the vessel.**

# Section 3 – Technical description

## 3.1 Introduction

The Wideband Mini Transponder (WMT) is a 6G® Wideband®2 mini sized ranging and Ultra Short Base Line (USBL) transponder with Responder input primarily intended for installation on Remotely Operated Vehicles (ROVs) or other towed vessels where its main function is to position the ROV accurately and rapidly when used with a Sonardyne navigation system (e.g. Marksman or Ranger 2).

The navigation system can interrogate the WMT and detect its reply. Acoustic range-times and optionally bearing information can then be derived between the remote WMT and the transducer of the navigation system.

The WMT is seen as a direct replacement for Sonardyne's Wideband Sub-Mini transponder (WSM). The WSM can be interrogated by either a responder trigger sent down the ROV's umbilical or acoustically by a narrow band tone signal. In some situations, reverberation or multipath of the tone interrogation can cause interference problems.

The WMT supports full, two way Wideband 2 interrogation and reply signals which completely mitigate against the interference problems common to tone based signals. In addition, 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 instead of the usual twenty. Multiple users can therefore now work in the same area without interference.

The WMT can operate as a basic SIMRAD HPR400 transponder and supports a total of 56 possible two pulse interrogation channels (B12 to B87). This mode is configured and enabled/disabled under host control.

The WMT includes a responder trigger input and has an integrated rechargeable Li-ion battery pack that can be charged from the ROV's own power supply when deployed or, when out of the water, by an externally powered WMT charger available from Sonardyne. It also has a full RS232 serial communication interface through which the WMT's acoustic setup can be quickly configured. The WMT firmware can also be upgraded via this serial interface

The 8190/8244-3111/3112 series WMT incorporates a rotary On/Off switch in its connector endcap which disconnects the internal battery from the electronics when not in use which extends the battery life of the unit.

The 8190 series WMT can be used with other products from the 6G Wideband 2 range. For the latest range of Sonardyne 6G products visit the Sonardyne Website.

The 8244 variant is available as a Mini-Dunker to be used as a surface modem with an optional Serial Interface Unit (SIU), deck cable and bump guards.

## 3.2 Mechanical configuration

The following WMT configurations are available.

### 3.2.1 Type 8190

There are six variants of the type 8190 series of WMTs as follows:

- Type 8190-3111 MF Omni 3,000 m WMT.
- Type 8190-3112 MF Directional 3,000 m WMT.
- Type 8190-3161 MF Omni 3,000 m Remote WMT.
- Type 8190-3162 MF Directional 3,000 m Remote WMT.
- Type 8190-7212 MF Directional 7,000 m WMT.

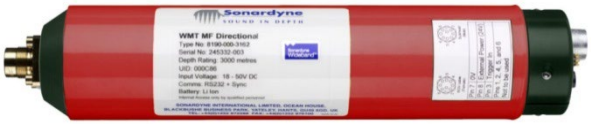
The remote versions of the WMT come with a remote transducer assembly available in various cable lengths and transducer orientations to suit the customer's requirements.

Each instrument is packed in a shipping case with a pair of Opening Tools and a CD containing software utilities.

**Figure 3-1 8190 MF Omni WMT**


**Figure 3-2 8190 MF Directional WMT**


**Figure 3-3 8190 MF Omni and Directional Remote WMTs**




### 3.2.2 Type 8244

There are three variants of the type 8244 Modem 6 series of WMTs.

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

- Type 8244-3111 MF Omni 3,000 m Modem 6 Mini
- Type 8244-3112 MF Directional 3,000 m Modem 6 Mini
- Type 8244-3151 MF Omni 3,000 m Modem 6 Mini-Dunker
- Type 8244-3155 LMF Omni 3,000 m Modem 6 Mini-Dunker
- Type 8244-3155 LMF Omni 3,000 m Modem 6 Mini-Dunker
- Type 8244-3156 LMF Omni 3,000 m Modem 6 Mini-Dunker

**Figure 3-4 8244 MF Omni Modem 6**

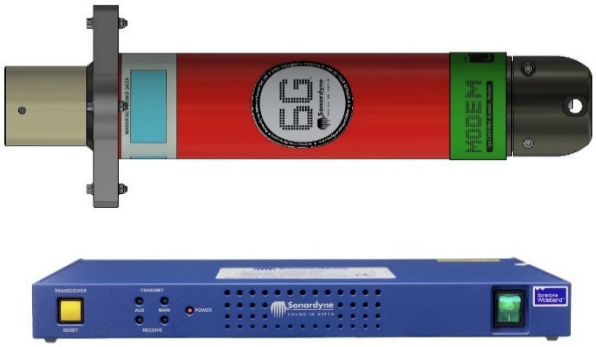
### 3.2.2.1 Type 8244-3111/3112

The Type 8244-3111/3112 Modem 6 Mini offers modem functionality only, suitable for transmission of data from a wide range of sensors including: current profilers, temperatures, depth and custom instrumentation.

### 3.2.2.2 Type 8244-3151/3155/3156 Mini-Dunker

The Type 8244-3151 Modem 6 Mini-Dunker offers modem functionality only, suitable for transmission of data from a surface vessel to a subsea Modem 6, used in conjunction with the Surface Interface Unit (SIU) and deck cable.

**Figure 3-5 Mini-Dunker Surface System Kit (cable not shown)**



For details of the surface system kit, see *Section 13.4 "Type 8244-3151/3155 Modem 6* Mini-Dunker*"*.

## 3.2.3 WMT features

| Feature | Description | |
|---|---|---|
| Depth Rating | 3,000 m (8190-3xxx)<br>3,000 m (8244-3xxx)<br>7,000 m (8190-7xxx) | |
| Input Operating Voltage | 24 or 48 V dc ±10% | |
| Serial Communications Interface | RS232 (Full duplex) | |
| | SYNC IN (software programmable) | |
| Supported Transponder Modes | Sonardyne WBv1 | C5 & GDT USBL compatible |
| | Sonardyne WBv2 | Standard 6G navigation |
| | Sonardyne WBv2+ | Advanced 6G navigation for harsh environments |
| | SIMRAD HPR400 | Channels B12 to B87 |
| Sensors | | |
| Pressure Sensors | Temperature compensated strain gauge | |
| Temperature Sensors | Platinum resistance thermometer | |
| Remote Transducer Ports | One (3-way Jupiter socket) | |
| Transducer Band | MF (20–34 kHz) | |
| Connector Type | Subconn (8-way male) power, comms and synch | |

| Feature | Description |
|---|---|
| Power Switch (8190/8244-3111/3112) | Rotary ON/OFF located in connector endcap |

### 3.2.4 WMT remote transducers

The following table provides information on the remote transducer options that can be fitted to the 8190-3161 and 8190-3162 Remote WMT types:

| Remote WMT | Remote transducer options |
|---|---|
| 8190-3161 MF Omni Remote | Cable length: 0.6 m, 1. 0 m, 2.0 m, 3.0 m |
| | Orientation: straight or right-angled |
| 8190-3162 MF Directional Remote | Cable length: 0.6 m, 1.0 m, 2.0 m, 3.0 m |
| | Orientation: right-angled |

## 3.3 Housing labelling

Waterproof labels on the housing uniquely identify the instrument as follows:

- SERIAL No 213245-006
- TYPE No 8XXX-XXXX
- Housing Limit 3,000 m max
- UNIT ID 00047D
- Address 2010 (factory default)

#### Serial number

The serial number identifies the transponder and should be quoted in all communications with Sonardyne International Ltd or their agents.

#### Type number

The following four digits indicate the depth rating, material, housing size and transducer type as indicated in the table below: e.g. 8190-3111.

- 8190 = WMT
- 3 = Depth rating 3,000 m
- 1 = Material Aluminium 6082
- 1 = Standard Housing
- 1 = Transducer Type MF Omni

**Table 3-1 Type number identification**

| | Depth Rating | Material | Housing | Transducer Type |
|---|---|---|---|---|
| 1 | 1,000 m | Aluminium 6082 | Standard | MF Omni |
| 2 | 2,000 m | Aluminium 7075 | Max | MF Dir – Type 1 |
| 3 | 3,000 m | S/Duplex | Mini | MF Dir – Type 2 |
| 4 | 4,000 m | Aluminium Bronze | Midi | MF Super Dir |
| 5 | 5,000 m | Titanium | Dunker | LMF Omni |
| 6 | 6,000 m | Stainless Steel | Remote | LMF Dir |
| 7 | 7,000 m | Composite | Sphere | LF Omni |
| 8 | | Glass | | EHF Omni |
| 9 | Special | Special | | |
| 0 | No Code | No Code | | |

### Transducer type

The transducer identifies the type of transducer beam-shape fitted to the transceiver. The types of transducer can be omni or directional

### Housing rating

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

### Unit ID

The UNIT ID box shows the unique identification number for the transceiver or transponder. The UNIT ID number is required to upgrade the functionality of the transceiver of transponder. The UNIT ID cannot be changed and is stored on the device.

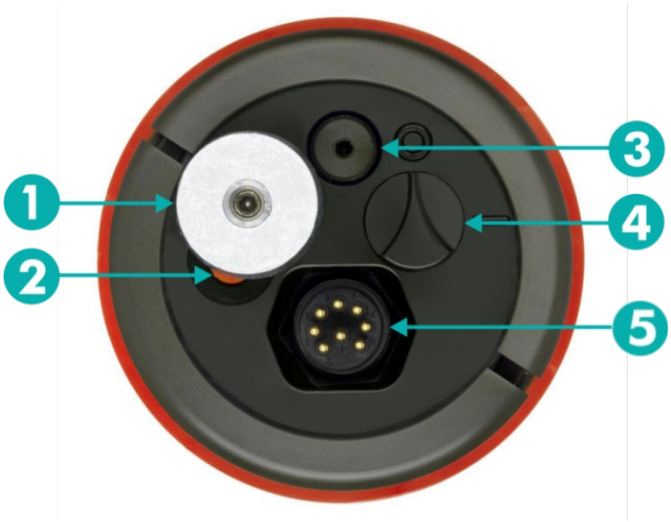
### Address

The address box contains the acoustic identity of the transceiver or transponder. The acoustic address is used by the transceiver to communicate with another transceiver or transponder. The first two digits of the address define the family group the last two digits of the address define the channel number. The acoustic address can be changed using a secure acoustic or serial command, which requires the UID of the instrument. It is important that the information on the address label is kept up to date.

## 3.4 Endcap

The connector endcap contains the sacrificial anode, connector, pressure relief vent valve and on/off switch.

**Figure 3-6 WMT connector endcap**




1. Sacrificial anode
2. Pressure sensor pPlug
3. Pressure relief vent valve
4. ON/OFF (**I**/**O**) rotary switch
5. 8-way connector MCBH8MAL for comms / charging*

*Refer to *Figure 3-7* for connector pin details.

### 3.4.1 Sacrificial anode

A sacrificial galvanic anode is installed to stop the metal of the instrument corroding.

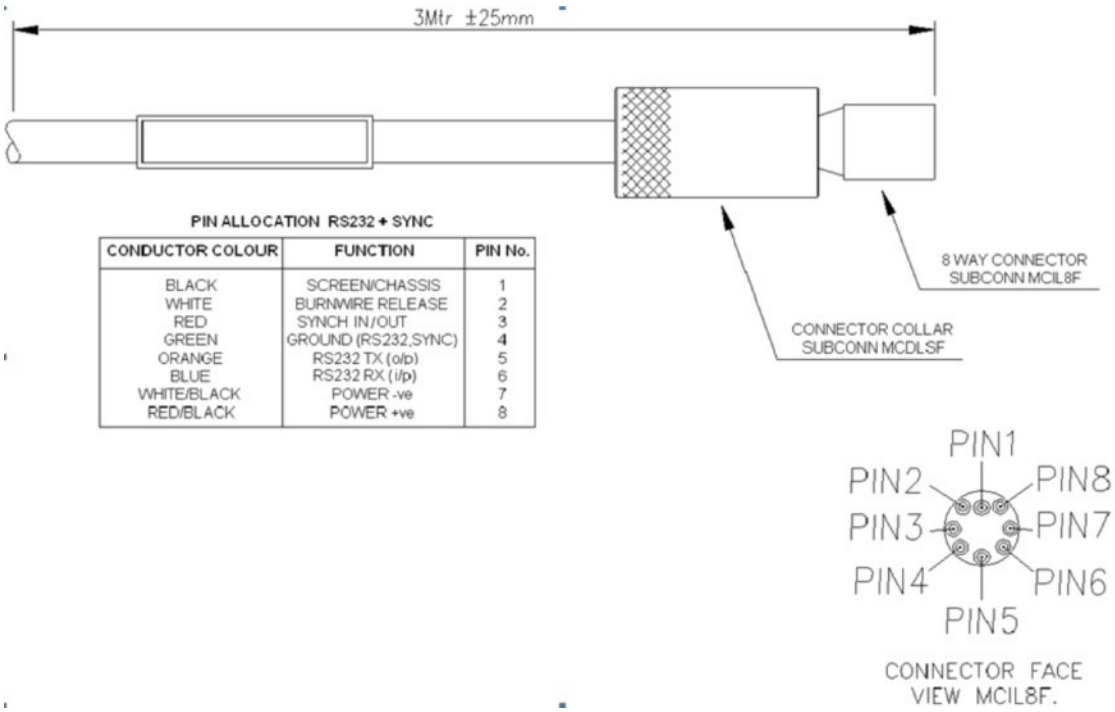
The anode is made from zinc that has a more "active" Voltage (more negative reduction potential/more positive electrochemical potential) than the metallic housing of the instrument. This means that the anode corrodes and not the instrument itself.

### 3.4.2 Connector

The endcap MCBH8MAL connector provides electrical connections for a responder trigger, an RS232 communications port and an external dc power input both to power the unit and charge the battery.

The connector wiring details are shown in *Figure 3-7*.

**Figure 3-7 Connector wiring details**




PIN ALLOCATION RS232 + SYNC

| CONDUCTOR COLOUR | FUNCTION | PIN No. |
|---|---|---|
| BLACK | SCREEN/CHASSIS | 1 |
| WHITE | BURNWIRE RELEASE | 2 |
| RED | SYNCH IN/OUT | 3 |
| GREEN | GROUND (RS232,SYNC) | 4 |
| ORANGE | RS232 TX (o/p) | 5 |
| BLUE | RS232 RX (i/p) | 6 |
| WHITE/BLACK | POWER -ve | 7 |
| RED/BLACK | POWER +ve | 8 |

### 3.4.3 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.

If there is any reason to suspect there may still be pressure inside the instrument, the pressure relief vent valve should be operated. The pressure relief vent valve should always be operated before performing any maintenance work; refer to *Section 8.6 "Pressure relief vent valve".*

### 3.4.4 On/off switch

When not in use, the WMT should be switched to the **O** (OFF) position to preserve battery charge.

## 3.5 External power

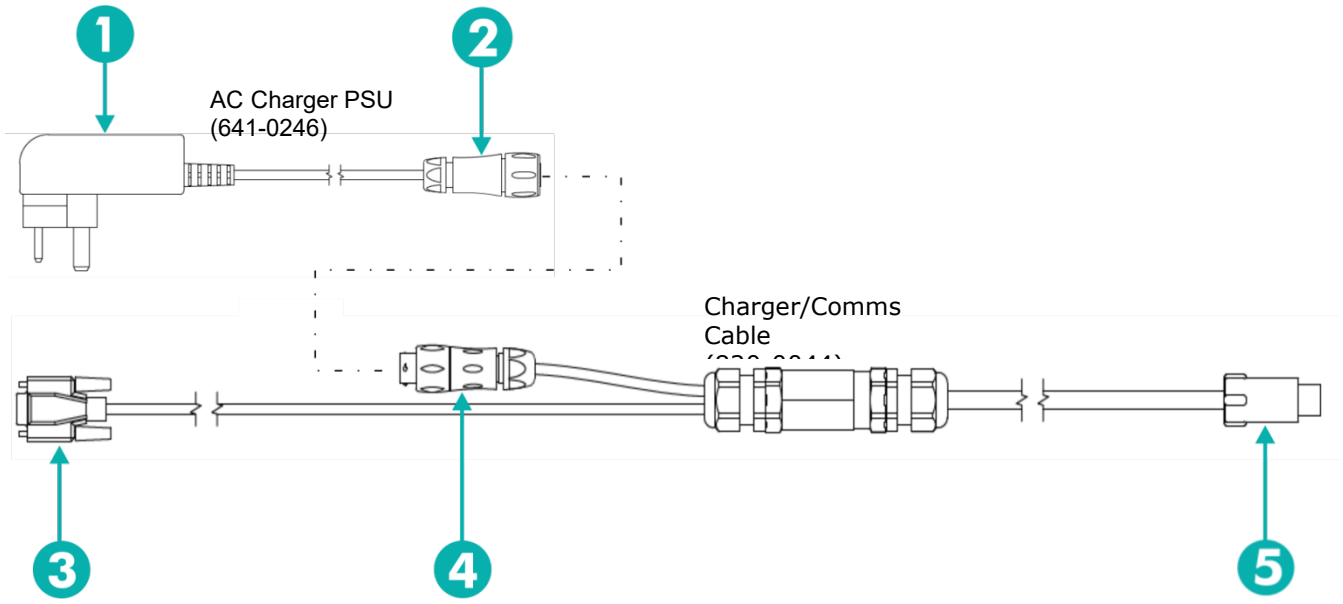
The WMT can either be powered externally using a 24 or 48 V dc supply or internally from the rechargeable lithium-ion (li-ion) battery pack. The external power supply also charges the internal li-ion battery.

## 3.6 Battery and charger

The li-ion battery pack (641-3370) can be charged using an external power supply (see *Section 3.6 "Battery and charger"*) or by using the Sonardyne charger kit (650-0043, see *Figure 3-8*). The charger kit consists of the AC charger PSU and charger/ comms cable. The charger/comms kit can be used as a comms cable only or together with the AC charger PSU as a comms and charger.

For a description on charging the battery, refer to *Section 8.7.2 "Charging the Battery".*

**Figure 3-8 650-0043 charger/comms kit**




1. ac charger PSU (including USA and Euro adaptors)
2. Charging adaptor
3. RS232 connector
4. Charging adaptor
5. Instrument connector

### 3.6.1 Battery life

The li-ion battery pack is capable of over 300 full charge-discharge cycles. The battery is prevented from deep discharge by firmware (auto off when battery voltage is low) and by the cell manufacturers monitoring circuit. The service life of the battery should exceed seven years if stored correctly; see *Section 7.2 "Storage"*.

The operating life of a fully charged battery can be extended by:

- Using the lowest transmit power conditions will allow.
- Using a slower update rate
- Using the acoustic command to disable the transponder when not in use on the seabed.
- Setting the ON/OFF switch to **O** (OFF) when not used for extended periods. This physically disconnects the internal battery pack from the electronics.

To check the state of the battery, refer to *Section 4.2.2 "Checking and connecting the battery"*.

### 3.6.2 Battery replacement

To replace the battery pack, refer to Section *8.9 "Battery pack replacement"*.

### 3.6.3 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.

## 3.7 Modes of operation

The WMT is capable of multiple simultaneous modes of operation:

- Sonardyne Wideband 2 Transponder Mode.
- SIMRAD HPR400 Transponder Mode.
- Sleep Mode.

The simultaneous modes of operation use multi-threaded programming techniques within the WMT. This does not overcome problems of simultaneous acoustics and the unit will not be able to receive incoming acoustics when it is transmitting because of a previous interrogation. Simultaneous transmissions from unrelated events are not possible.

### 3.7.1 Sonardyne Wideband 2 transponder (Type 8190 only)

In this mode the unit behaves as a basic Wideband ® 2 transponder by listening for its IIS signal and replying with its CRS signal. This mode of operation makes the unit compatible with all Sonardyne Wideband ® 2 transceivers.

A WMT in sleep mode can be woken up by using a Sonardyne wideband interrogation preceded by a suitable wakeup pulse.

### 3.7.2 SIMRAD HPR400 compatible transponder (Type 8190 only)

In this mode the unit operates as a basic Simrad HPR400 transponder and supports a total of 56 possible two pulse interrogation channels (B12 to B87). This mode can be configured and enabled/disabled either acoustically or serially.

If the WMT is not interrogated, by either HPR400 or Sonardyne Wideband ® 2, for a period exceeding its stay awake time the instrument will go into sleep mode.

The WMT unit cannot be woken up from sleep mode by a HPR400 interrogation. It must be woken up using a Sonardyne wideband interrogation preceded by a suitable wakeup pulse.

**Note**

**If HPR support is enabled using the 6G Setup tab in 6G Terminal Lite the stay awake time is automatically set to permanetly On.**

### 3.7.3 Sleep mode

In this mode the WMT enters a low power state. Sleep mode is activated by a set period of inactivity, which is set using a parameter in the Configuration Status (CS) command. Sleep mode is automatically over-ridden when the unit senses serial activity or receives a valid wideband acoustic interrogation preceded by a wakeup signal.

The WMT unit cannot be woken up from sleep mode by an HPR400 interrogation.

## 3.8 Serial interface

The WMT can be configured and tested prior to deployment via the RS232 link from a PC running Sonardyne 6G Terminal Lite software.

### 3.8.1 Hardware reset facility

The WMT has a built-in power reset circuit and an internal watchdog reset circuit. The unit also has a facility that allows the unit to be reset via the external serial comms interface. Asserting a break pulse of duration greater than 20 ms on the serial input line will force the WMT CPU to perform a coherent hard reset/restart on release of this break signal.

This break signal may be applied at any time while the unit is powered up.

After hardware reset the WMT firmware is reloaded from system Flash memory and restarted. This reset-start-up sequence takes approximately 5 seconds to complete.

The WMT outputs the following PORT: text string to confirm completion of hardware reset sequence and indicates the current port settings. This start-up PORT string is always output at 9600 baud the content will depend on the stored settings.

An example of a PORT text string is as follows:

>PORT:1010,P0;BR9600;CF0,P1;BR9600;CF1\r\n

P0;BR9600;CF0 indicates that the primary port (P0) will be configured for Baud Rate 9600 and it is configured as a command port (CF0).

Once this PORT message has been output the WMT is ready to receive serial commands and acoustic interrogations.

### 3.8.2 Watchdog function

The WMT has a watchdog timer that resets the unit every watchdog period. The watchdog timer has a period of approximately 17½ minutes. User configured system settings are retained through watchdog resets and operation of the watchdog reset will be invisible to the user with only the occasional missed interrogation. If during a watchdog reset the WMT unit fails to warm start correctly, it will automatically cold start and output the standard serial wake-up message. The configuration will be reloaded from non-volatile memory (EEPROM).

## 3.9 System configuration

The preferred method of configuring the WMT is via a serial link connected to a PC running 6G Terminal Lite software. Limited configuration can also be performed using an iWand hand held test unit.

### 3.9.1 6G Terminal Lite

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

### 3.9.2 iWand handheld test unit (Type 8190 only)

Type 8315 iWand handheld test unit. Refer to *UM-8315 "User Manual for the Type 8315 iWand"*.

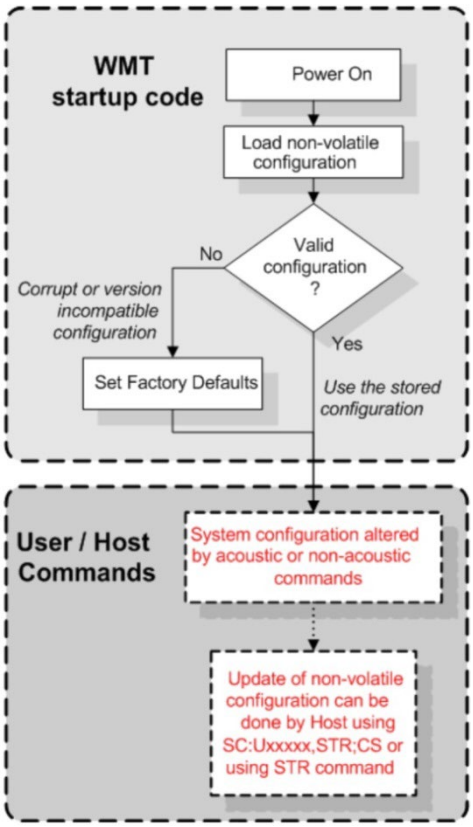
### 3.9.3 Restoring factory system configuration

Most configuration parameters are fixed in firmware, but some may be reassigned new values using manual commands in 6G Terminal Lite. The system configuration is loaded from non-volatile memory (EEPROM) at power-up. The factory default configuration can be set by using the RSFD command. The non-volatile system configuration can be saved by using the store command STR,SC:Uxxxx, STR;CS or by setting a new device address using SC:Uxxxx, Address.

All settings will be retained even after power cycling. Settings are automatically stored when they are set through the 6G Setup Tab of 6G Terminal Lite.

Refer to *Figure 3-9* for the start-up sequence and recommended user/host configuration.

**Figure 3-9 Startup sequence**



# Section 4 – Installation

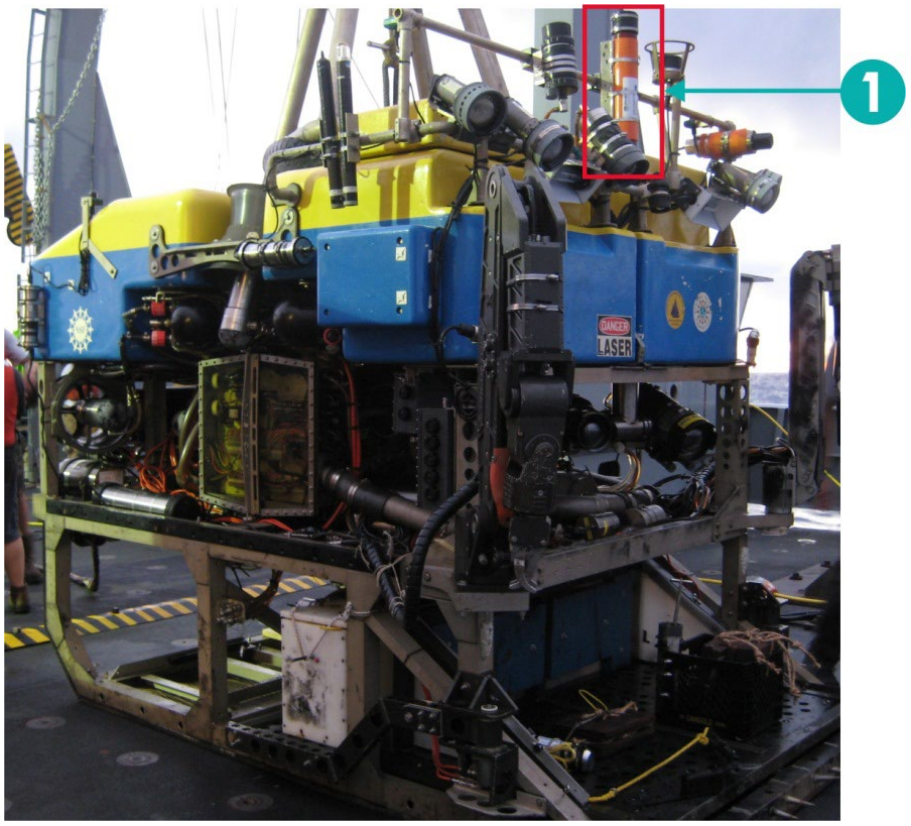
## 4.1 Introduction

The Wideband Mini Transponder (WMT) is a mini sized ranging and telemetry Ultra Short Base Line (USBL) transponder primarily intended for installation on Remotely Operated Vehicles (ROVs) or other towed vessels.

## 4.2 Installation of a WMT onto an ROV

The primary purpose of installing a WMT onto a ROV is for the WMT to respond to USBL interrogations from the surface vessel, thereby enabling it to compute the ROVs position relative to the surface vessel. For this reason, the position of the transducer on the hull of the ROV is important, see *Figure 4-1* for an example installation position.

**Figure 4-1 Installation of a WMT onto an ROV**




1 WMT installed with transducer above hull of the ROV

When mounted on an ROV the WMT can be powered by the ROV and serial communications multiplexed up the ROV umbilical.

If the WMT is to operate in a standalone transponder mode, i.e. no serial communication, and powered from its own internal battery pack a dummy blanking plug must be fitted to the endcap connector in the WMT.

In either configuration the power switch in the endcap must be set to the ON position prior to deployment.

Clamps must be designed to hold the WMT electronics pressure housing in place within the body of the ROV and, if required, the remote transducer.

The housing surface is hard anodised for protection but all impacts should be avoided as impact damage will cause corrosion to start.

The WMT must be acoustically and electrically isolated from the ROV body (high frequency vibration can have harmonics in the Medium Frequency (MF) band which can affect the acoustic operation). For this reason, it is recommended the pressure housing is clamped within the ROV body using sheet rubber.

The cable between the Remote WMT and the Remote Transducer can vary in length from 0.6 to 3.0 metres long and should be carefully tied in place.

Do not allow any cables to vibrate on the outside of the hull where flow may make the cable strum and fatigue.

The power/comms cable and remote transducer cables are flexible, but the bend radius should not be too tight. Do not kink the cables.

Cut the power/comms cable to length and mould a connector to the end appropriate for the given installation. Refer to *Figure 3-7* for the wiring details.

**Note**

**If responder mode is required, the responder trigger signal should be connected to SYNC IN (Pin 3) relative to Ground (pin 4).**

### 4.2.1 Transducer location on an ROV

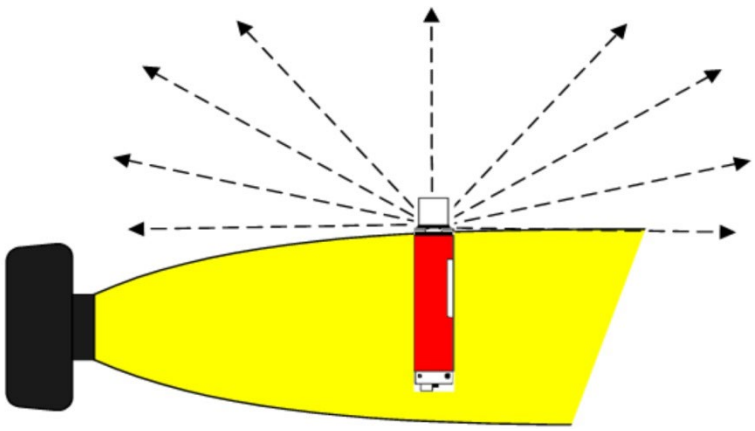
When installing a WMT onto ROV, the transducer of the WMT must be mounted outside of the hull profile of the ROV. The position chosen must give a line-of-sight 'view' to the tracking transceiver.

Transducers should be mounted with their axis vertical unless a directional transducer is mounted forward looking.

Some materials are described as acoustically transparent but this only applies in practice to acoustic rays perpendicular to the material surface. When the ray deviates from the perpendicular the hull can affect the beam pattern of the transducer.

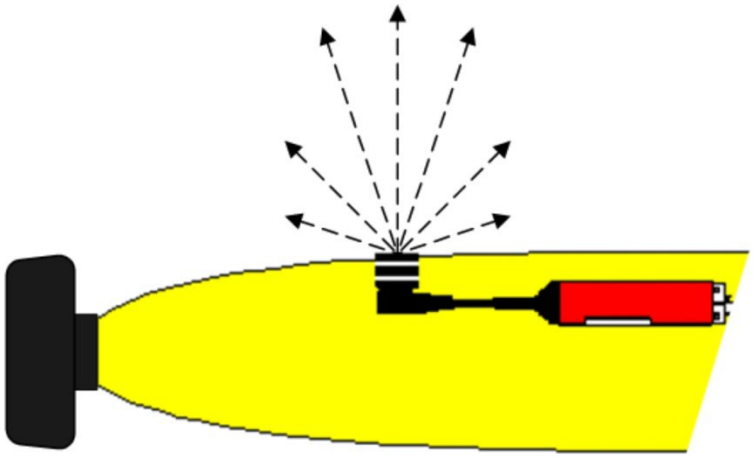
The Omni-directional transducer should be mounted with the acoustic transducer outside the profile of the ROV.

**Figure 4-2 Omni-directional transducer**



The directional transducer can be mounted flush with the hulls surface.

**Figure 4-3 Directional transducer**



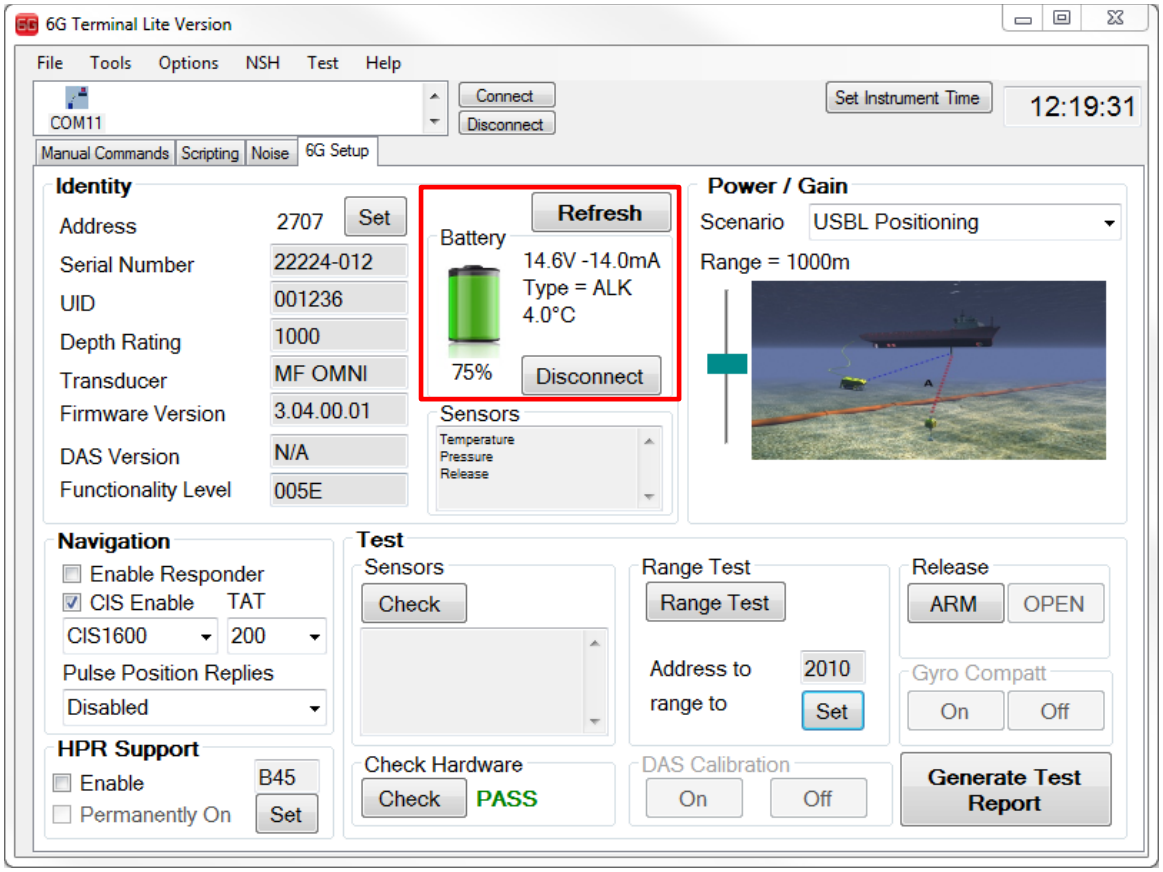
### 4.2.2 Checking and connecting the battery

Although the WMT has an on/off switch, the battery can also be electronically disconnected. To check the status of the battery and to make sure it is electronically connected:

1. Using the 820-0044 charger/comms interface, connect the WMT to a PC.
2. Double click the **6G Terminal Lite** icon to start 6G Terminal Lite.


3. The battery status is displayed on the **6G Setup** tab (click refresh is necessary).

4. If the battery is disconnected, click the **Connect** button (if the battery is connected the button will display **Disconnect**).




5. For more information Refer to *6G Terminal Lite, Section "Connecting".*

# Section 5 – Deployment

## 5.1 Introduction

## 5.2 Pre-Deployment checks

1. Inspect the WMT for any signs of mishandling, external damage or leakages.
2. Check the pressure relief vent valve is flush with the face of the endcap; refer to *Section 8.6 "Pressure relief vent valve"*.
3. Ensure the power switch on the endcap is fully rotated to the **I** (ON) position.
4. Configure the WMT (if required); refer to *Section 5.3 "Configuration"*.
5. Ensure either the external power/comms cable is connected to the endcap or that a dummy blanking plug is fitted to the endcap connector.

## 5.3 Configuration

Carry out the following procedures to configure the WMT ready for deployment.

1. Remove the dummy blanking connector from the WMT endcap.
2. Connect the WMT to the PC using the charger/comms cable; see *Figure 3-8.*
3. Set the power switch on the WMT endcap to the **I** (ON) position.
4. Open 6G Terminal Lite and check the battery level is sufficient for the application; refer to *Section 4.2.2 "Checking and connecting the battery"*.
5. Make sure the Unique Identity (UID) and address are correct.

**Note**

**The UID should match the UID printed on the WMT housing label.**

6. Check all the displayed settings are correct.

### 5.3.1 6G test report

6G Terminal Lite can generate a pdf test report to show the following data:

- Date/Scenario
- Hardware/Range/Sensor/Release Tests, confirmation of which tests were performed and the end results; PASS/FAIL
- Unit Status
- Settings
- Battery Status
- Hardware Identification

To generate a test report click **Generate Test Report** on the 6G Setup tab.

An example test report is shown in *Figure 9-3*.

## 5.4 Mini-Dunker deployment

The Mini-Dunker should be deployed as follows:

**CAUTION**

**The Dunker should be deployed over the side, well away from thrusters or propellers as there is the risk that the Dunker may be drawn in and damaged. It may be necessary to pull the Dunker out of the water when the vessel is manoeuvring.**

1. Connect the Dunker to the supplied cable and secure the locking sleeve.
2. Attach two of the supplied shackles on the Mini-Dunker endcap; fit the plastic isolation washers through the holes in the Mini-Dunker endcap first to prevent galvanic corrosion.
3. Attach one end of the wire strops to the shackles on the Mini-Dunker endcap and the other to the eyes in the steel strain relief arm moulded into the cable using the remaining shackles.
4. Tie off the cable to the vessel, to avoid it being pulled overboard.
5. Deploy the Mini-Dunker over the side until it is at least two metres below the hull.

# Section 6 – Operation

## 6.1 Operating instructions

### 6.1.1 Type 8190

The 8190 Wideband Mini Transponder is monitored and controlled by the Marksman/Ranger 2 software.

For operating instructions refer to the following user manuals:

- *UM-8250 "Marksman and Ranger 2 User Manual".*
- *UM-8250 "Ranger 2 User Manual"*.

### 6.1.2 Type 8244 Modem 6

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

**CAUTION**

**Risk of equipment damage. Avoid excessive testing of high-power acoustics in air, as this can cause additional heating and possible damage to the unit; run all in air testing at low or ultralow power levels. See *"Sonardyne Command Language PV1.04"* for detail on setting acoustic power levels.**

**Risk of equipment damage. Avoid high duty cycle, high power telemetry acoustics such as Telemetry Tracking, SMS, modem and 6G commands. Sustained high power activity can cause heating in the battery leading to battery protection circuitry turning off charging and reducing the effective output power; set TPL to low. See *"Sonardyne Command Language PV1.04"* for detail on setting acoustic power levels.**

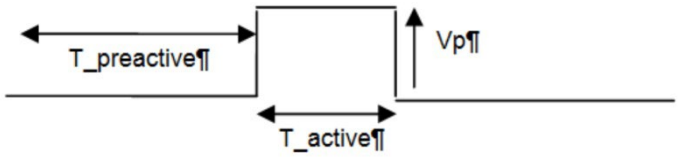
## 6.2 Bi-directional sync function

All WMT variants have a bidirectional sync line which can operate as both an input and an output. Whether the sync is enabled or disabled for input or output can be controlled serially or acoustically.

### 6.2.1 Sync input (Responder Mode)

As an input, the sync line is used to drive the transponder as a responder which can be particularly useful if the WMT is to mounted on a very noisy vehicle and operating at depth.

**Figure 6-1 Sync input illustration**




| Symbol | Description | Min | Max |
|---|---|---|---|
| T_preactive | Time that sync input is required to remain low prior to a rising edge to begin sync pulse validation | 200us | Infinite |
| T_active | Time that sync input remains high for a valid sync pulse to be recognised | 100us | Infinite |

| Symbol | Description | Min | Max |
|---|---|---|---|
| Vp | Sync input voltage | 4.5 V | 30 V |

If the minimum value for T_preactive is not met, then no amount of high state on the Sync In line will generate a sync in event. Similarly, if the minimum value for T_active is not met then no sync in event will be generated.

Responder mode can be activated by enabling it using 6G Terminal Lite; **6G Setup** tab, **Navigation**).

#### 6.2.1.1 Sync output

As an output the sync line can be made to generate a positive going pulse output at a prescribed time after the receipt of an acoustic detection.

The pulse is a positive going, ~14 Volts, output that drives for 1 millisecond exactly 80 milliseconds after a wideband navigation acoustic detection (either an individual or a common interrogation if common interrogation is enabled for the transponder).

### 6.2.2 Hardware reset facility

The WMT has a built-in power reset circuit together with an internal watchdog reset circuit. The unit is also provided with a facility for an external system to reset it. Asserting a break pulse for a duration greater than 20 milliseconds on the serial input line will force the WMT CPU to perform a coherent hard reset/restart on release of this break signal.

This break signal may be applied at any time while the unit is powered up.

After the hardware reset the WMT firmware is reloaded from system Flash memory and restarted. This reset/start-up sequence takes approximately 5 seconds to complete.

The WMT outputs the following **PORT:** text string to confirm completion of the Hardware reset sequence and indicates the current port settings.

This start-up PORT string is always output at 9600 baud the content will be dependent on stored settings, an example follows:

>PORT:1010,P0;BR9600;CF0,P1;BR9600;CF1\r\n

P0;BR9600;CF0 indicates that the primary port (P0) will be configured for **B**aud **R**ate 9600 and it is configured as a command port (CF0).

### 6.2.3 Operational check out

Many functions of the WMT can be tested via the RS232 link including features not available via acoustic commands.

Functional testing can be performed using 6G Terminal Lite; refer to *Section 9 – "Functional testing"*.

**Note**

**Some versions of the WMT are designed to be used with a Remote Transducer, driven at a high voltage via the endcap connection. Make sure the remote transducer is fully connected to the WMT housing before operating the equipment.**

# Section 7 – Retrieval and storage

## 7.1 Retrieval

1. Rotate the **ON/OFF** switch to **O** (OFF).
2. Clean the WMT; refer to *Section 8.2 "Cleaning".*
3. Inspect the WMT; refer to *Section 8.3 "Inspection".*
4. Check and recharge the battery (if required); refer to *Section 8.7.2 "Charging the Battery".*

## 7.2 Storage

On completion of all checks in the previous section the WMT can be placed in storage as described below. Refer to *Table 7-1* for the recommended storage conditions.

1. Store the WMT 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 note below) |
| Relative Humidity | 20 to 80% (non-condensing) |

**Note**

**To prolong the long term battery life it is recommended to store the unit within a 30 (±15)% state of charge and at a temperatures not exceeding 30°C.**

# Section 8 – Maintenance and monitoring

## 8.1 Dismantling

Dismantling of the WMT should only be carried out by Sonardyne qualified personnel. However, the transducer endcap can be removed to replace the battery as described in *Section 8.9 "Battery pack replacement".*

## 8.2 Cleaning

**Note**

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

1. Rotate the **ON/OFF** switch to **O** (OFF).
2. Thoroughly wash the instrument in warm clean fresh water to remove accumulations of salt, sand/silt and marine growth, paying particular attention to the ON/OFF switch and electrical connectors.
3. Dry the instrument with a clean lint free cloth.
4. Replace any attached dummy plus/protective caps.

## 8.3 Inspection

Inspect the WMT for the following:

1. Inspect the pressure relief vent valve; refer to *Section 8.6 "Pressure relief vent valve".*
2. Inspect the anodised surface of the housing for any signs of damage or corrosion. When at full working depth, the transponder housing is at risk of failure if damage or corrosion is not repaired.
3. Check the security of the connector by fitting the locking sleeve from the mating half of the connector, and check for movement. Any movement will require attention and the connector to be secured.
4. Inspect the connector contacts for signs of corrosion.
5. Inspect all cables and connections for signs of abrasion, cracks or splits.
6. Inspect the clamp ring bolts for signs of corrosion.
7. Inspect the rubber boot on the transducer for signs of splitting.
8. Check there is sufficient zinc remaining on the sacrificial anodes and replace if necessary.
9. Inspect the jointing faces of the endcaps and the main housings. Signs of corrosion indicate leakage of water into the transponder.

## 8.4 Lubrication

### 8.4.1 Subconn and Micro-Subconn connectors

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

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

The following lubricants are recommended for maintenance of the instrument.

**Table 8-1 Lubricants**

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

### 8.4.2 Lubricating endcap O-rings

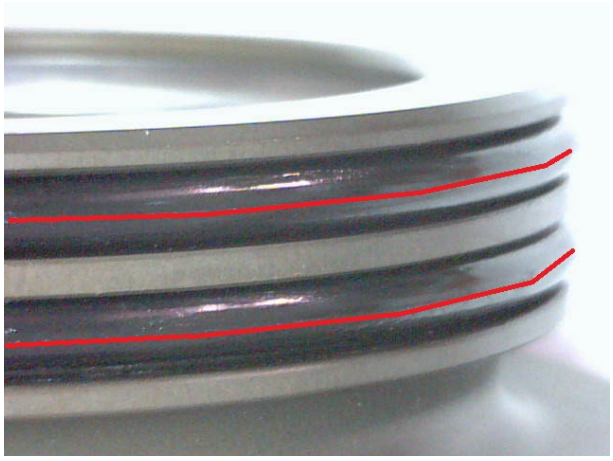
Endcap O-rings should always be inspected and lubricated before fitting the endcap.

**Note**

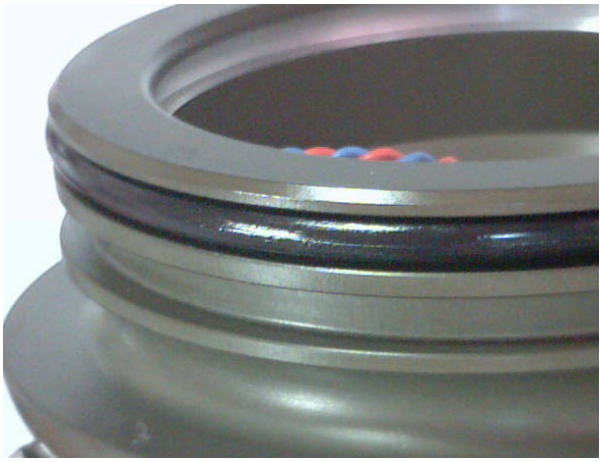
**Ensure the area you are working in is clean and dust free.**

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 Vaseline to the O-ring mating surface (the housing bore).

**Note**

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

## 8.5 Scheduled maintenance and recalibration

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

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

**Table 8-2 Scheduled maintenance and recalibration timetable**

| Maintenance schedule | | |
|---|---|---|
| **Sensor Type** | **1 Year** | **2 Years** |
| Pressure Sensor (strain gauge); see *Section 8.5.1* | X | |
| Temperature, PRT | | X |

### 8.5.1 Pressure sensor oil top-up

The pressure sensor port 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 face of the pressure sensor and corrode it.

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

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 Pressure relief vent valve

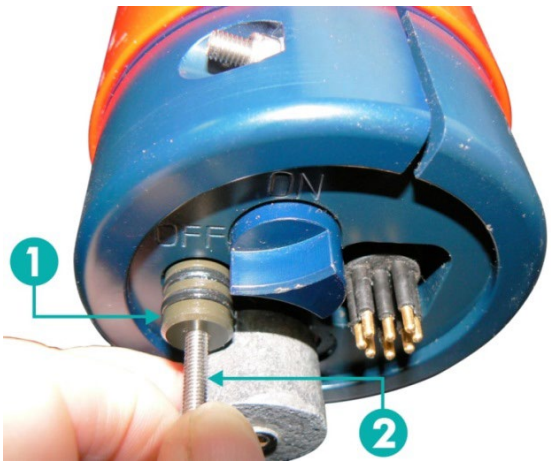
The pressure relief vent valve should be flush with the endcap face. If the pressure relief vent valve is not flush it should be operated to check for and release any internal pressure.

### 8.6.1 Operating the pressure relief vent valve

**Note**

**Refer to *Warnings* in *Section 2 – Safety "High internal pressure", Risk of toxic gases, Faulty Battery Pack*".**

**Figure 8-1 Operating the pressure relief vent valve**




1 Pressure relief vent valve 2 M4 bolt

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.

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

## 8.7 Battery maintenance

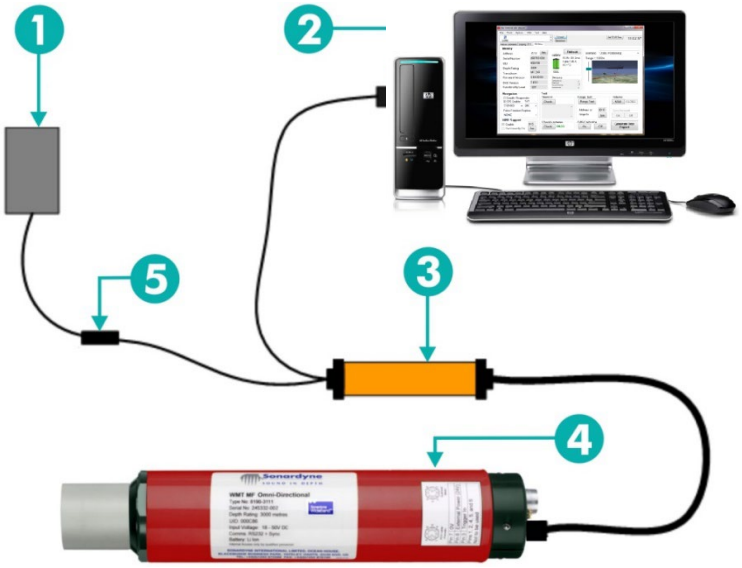
### 8.7.1 Electronically connecting and disconnecting the battery

To electronically connect or disconnect the battery, refer to *Section 4.2.2 "Checking and connecting the battery"*.

### 8.7.2 Charging the Battery

1. To recharge the WMT battery, use the WMT charger kit (650-0043) and connect to the WMT as shown in *Figure 8-2.*
2. Rotate the **ON/OFF** switch to the **I** (ON) position to turn the WMT on.
3. Connect the AC Charger PSU ❶.
4. An orange LED will illuminate within the body of the Charger & Comms Cable ❸ to confirm power is being supplied by the Sonardyne Charger Unit.
5. The WMT can be left connected to the charger and it will trickle charge the battery as required (electronics within the internal battery pack monitors and controls the charging of the battery).
6. The battery status can be monitored in 6G Terminal Lite; refer to *Section 4.2.2 "Checking and connecting the battery"*.

**Figure 8-2 Battery charging connections**



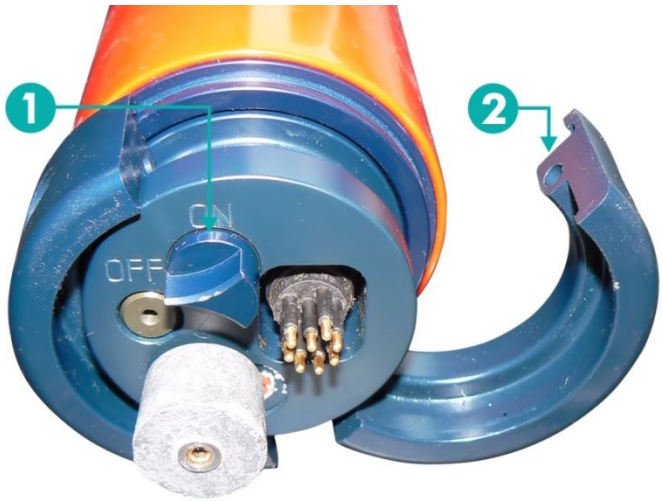

❶ ac charger PSU 641-0246
❷ RS232 port
❸ Charger & comms cable 820-0044
❹ WMT
❺ Inline 3-way plug to socket connection

7. Rotate the **ON/OFF** switch to the **O** (OFF) position to turn the WMT off.
8. Remove the Type 820-0044 Charger & Comms cable from the WMT connector.
9. Make sure the dummy blanking connector is replaced and secure.

## 8.8 Transducer endcap

### 8.8.1 Transducer endcap removal

1. Rotate the **ON/OFF** switch to the **O** (OFF) position to turn the WMT off.
2. Clean the WMT; refer to *Section 8.2* "Cleaning".
3. Operate the pressure relief vent valve; refer to *Section 8.6 "Pressure relief vent valve".*
4. Refer to the figure below and use an Allen Key to remove the two M5 socket head cap screws and nuts retaining the clamp rings.
5. Lever out the clamp rings using the tapered end of the opening tools.
6. Keep the four nylon isolation washers.
7. Remove any dirt, silt or water from the clamp seating.

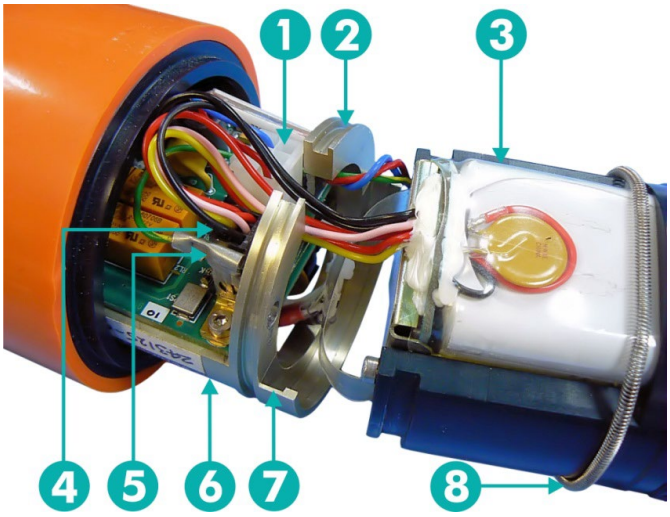



1 On/off switch 2 Clamp rings

8. Push the endcap into the pressure housing.

9. The transducer endcap will be pushed out of the pressure housing and expose the O-ring seals.
10. Remove any accumulation of silt and water.
11. Clean the O-ring seals or replace if necessary.

12. Continue to push the endcap into the housing until the transducer endcap connections are exposed.
13. Refer to the figure below and lift the spring gasket ❽ from its locating groove ❷ and position over the battery pack ❸.
14. Lift the transducer endcap out of its locating groove ❼ in the main chassis ❻.
15. Disconnect the battery connector ❹.
16. Disconnect the transducer connector ❶.
17. Disconnect the earth lead ❺.




| | | | |
|---|---|---|---|
| ❶ | Transducer connector | ❺ | Earth lead |
| ❷ | Locating groove | ❻ | Main chassis |
| ❸ | Battery | ❼ | Transponder locating groove |
| ❹ | Battery connection | ❽ | Spring gasket |

18. Remove the transducer endcap and store in a suitable container in a clean, dry area.

### 8.8.2 Transducer endcap fitment

1. Inspect the pressure housing for any signs of damage.
2. Inspect the pressure housing grooves and make sure they are clean.
3. Ensure the spring gasket is clean. Replace if necessary.
4. Ensure the O-ring seals are clean and serviceable. Replace if necessary.
5. Ensure easy access to the connection points on the main chassis are available.
6. Ensure the grey bump guard collar is correctly positioned on the transducer endcap. This is not fitted to the type 8190-3122 MF Directional WMT.
7. Position the transducer endcap next to the end of the main chassis.
8. Connect the earth lead.
9. Connect the transducer connector.
10. Connect the battery connector.

11. Lubricate the O-rings; refer to *Section 8.4.2 "Lubricating endcap O-rings"*.
12. Position the transducer endcap into the locating groove at the end of the main chassis.
13. Put the spring gasket into the locating groove.
14. Push the transducer endcap into the pressure housing until correctly seated.
15. Position the clamps in the grooves in the endcap. Make sure the gap between the ends of each clamp is equal.
16. Use an Allen Key, the two M5 socket head cap screws, the two nuts, four nylon isolation washers, and the two clamp rings to secure the endcap.
17. Tighten the clamps evenly but make sure a 2–3 mm gap is available between the ends of both clamps.

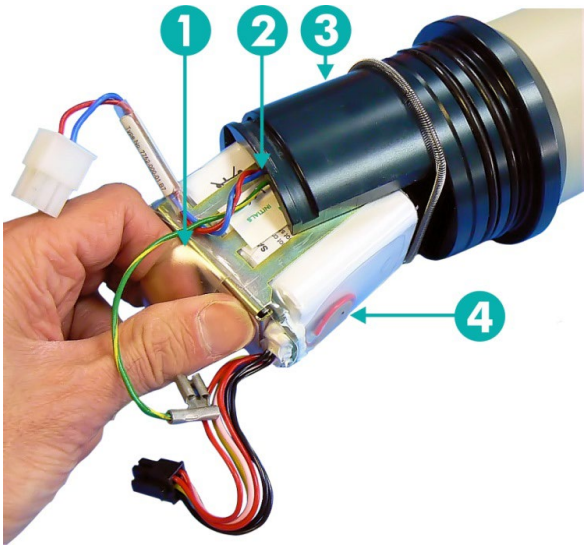
## 8.9 Battery pack replacement

### 8.9.1 Battery pack removal

1. Remove the transducer endcap; refer to *Section 8.8.1 "Transducer endcap removal".*
2. Pull the clear plastic strap to remove the battery pack from the transducer endcap.

**Note**

**The mechanical fitting of a battery to an MF Directional transducer endcap and remote WMT endcap are the same.**




1. Clear plastic strap
2. Transducer wiring
3. Transducer endcap
4. Battery pack

### 8.9.2 Battery pack fitment

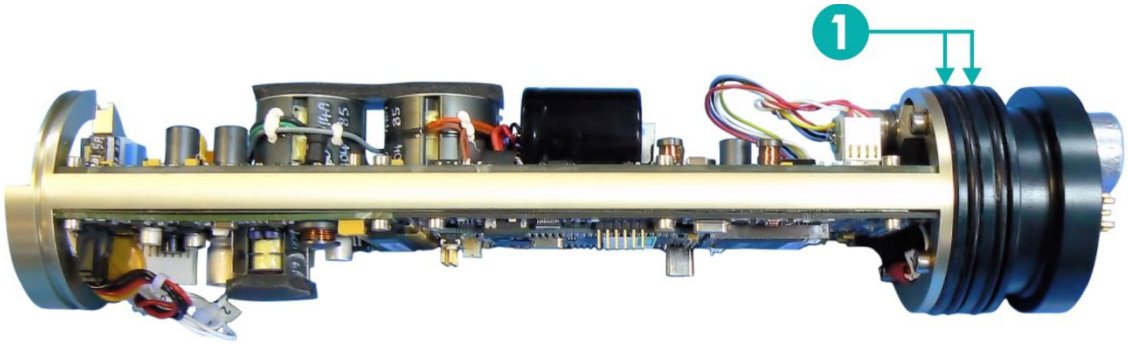
1. Push the battery pack into the transducer endcap. Make sure the transducer wiring is routed out through the gap between the side of the battery pack and the transducer endcap until the pack is firmly located.

2. Fit the transducer endcap; refer to *Section 8.8.2 "Transducer endcap fitment".*

## 8.10 Chassis assembly replacement

### 8.10.1 Chassis assembly removal

1. Remove the transducer endcap; refer to *Section 8.8.1 "Transducer endcap removal"*.
2. With the transducer endcap removed, the chassis can be carefully pushed back through the pressure housing and removed.
3. Place the chassis on a dry clean surface.
4. Check the O-rings and replace if necessary.




1 O-rings

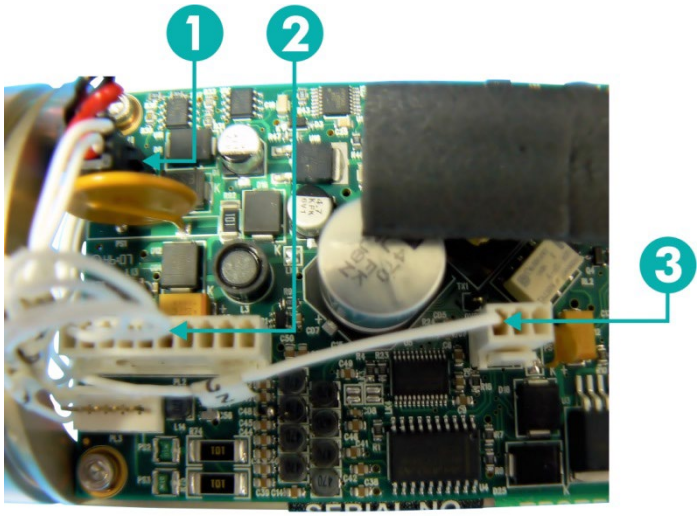
### 8.10.2 Chassis assembly fitment

1. Inspect the pressure housing for any signs of damage.
2. Inspect the pressure housing grooves and make sure they are clean.
3. Make sure the spring gasket is clean – replace if necessary.
4. Make sure the O-ring seals are clean and serviceable. Replace if necessary.
5. Lubricate the O-rings; refer to *Section 8.4.2 "Lubricating endcap O-rings"*.
6. Support the chassis and insert into the pressure housing. Take care not to damage the electronics.
7. Fit the transducer endcap; refer to *Section 8.8.2 "Transducer endcap fitment".*

## 8.11 Interface circuit board replacement

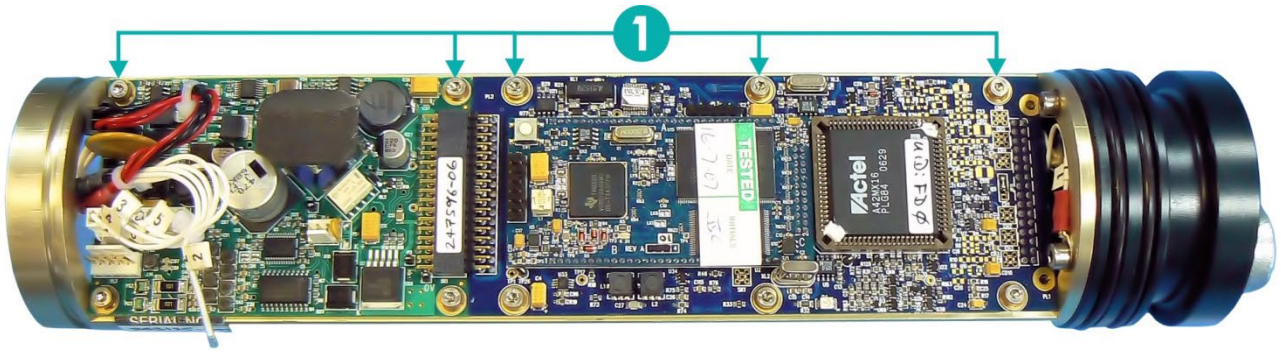
### 8.11.1 Interface circuit board removal

1. Remove the chassis assembly from the pressure housing; refer to *Section 8.10.1 "Chassis assembly removal".*
2. On the Interface Circuit Board, disconnect the Power Supply ❶, Sync/Release ❸ and Comms ❷ connections.




❶ Power supply
❸ Sync/release
❷ Comms connection

3. Using an allen key, remove the screws and washers ❶ securing the circuit board to the chassis assembly.




❶ Screws and Washers

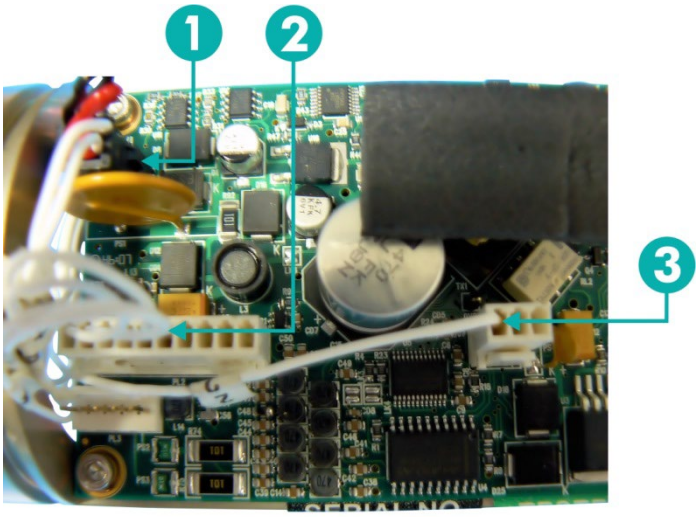
4. Carefully lift the interface circuit board away from the chassis.

### 8.11.2 Interface circuit board fitment

**Note**

**The end of the motherboard furthest away from the interface board must stay in contact with the chassis assembly at all times.**

1. Lift the mother board so the interface board can be connected to the mother board.
2. Place the interface board and the motherboard on to the chassis.
3. Use an Allen key to secure the interface and mother board to the chassis using the ten anchor screws and washers. Make sure the interface and motherboard do not twist during tightening.
4. Connect the power supply, Sync/Release, and comms connections.




1. Power supply
2. Comms connection
3. Sync/release

5. Refit the chassis; refer to *Section 8.10.2 "Chassis assembly fitment".*

# Section 9 – Functional testing

## 9.1 Introduction

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

Clean the WMT; refer *Section 8.2 "Cleaning"*.

To ensure the WMT functions correctly functional testing can be carried out. Many functions can be tested via the RS232 serial link using 6G Terminal Lite.

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

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

**CAUTION**

**8244 Products: Risk of equipment damage. Avoid excessive testing of high-power acoustics in air, as this can cause additional heating and possible damage to the unit; run all in air testing at low or ultralow power levels. See *"Sonardyne Command Language PV1.04"* for detail on setting acoustic power levels.**

**8244 Products: Risk of equipment damage. Avoid high duty cycle, high power telemetry acoustics such as Telemetry Tracking, SMS, modem and 6G commands. Sustained high power activity can cause heating in the battery leading to battery protection circuitry turning off charging and reducing the effective output power; set TPL to low. See *"Sonardyne Command Language PV1.04"* for detail on setting acoustic power levels.**

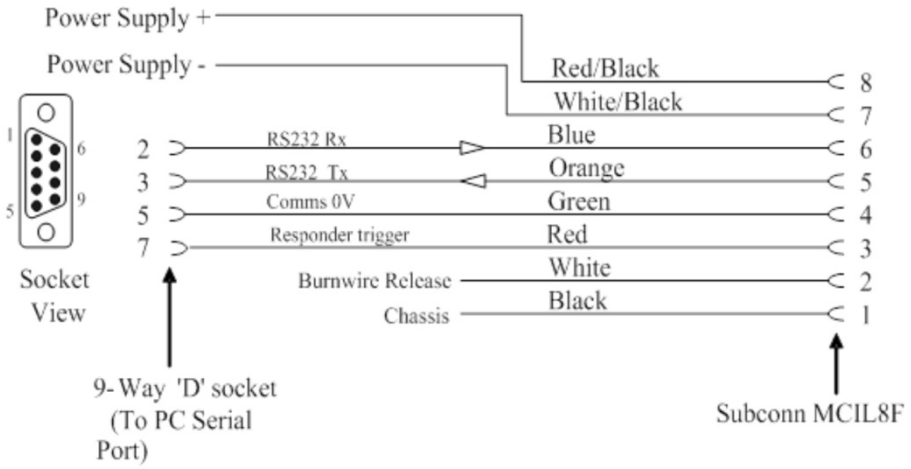
## 9.2 Test equipment

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

**Table 9-1 Test equipment**

| Description | Drawing No | CPN |
|---|---|---|
| PC with spare comm port | N/A | |
| 6G Utilities media | 8300-102 | 920-2000 |
| A spare Sonardyne 6G Wideband transponder or transceiver. | | |
| Either: | | |
| Charging Kit (comprises of 820-0044 and 641-0246 below) | N/A | 650-0043 |
| Charger & comms cable | 8190-090 | 820-0044 |
| ac charger PSU | 8190-006-01 | 641-0246 |
| or: | | |
| PSU: 24V dc output @ 500 mA (preferably with built in Ammeter) | N/A | |
| Test cable | N/A | |

**Figure 9-1 Test cable wiring**

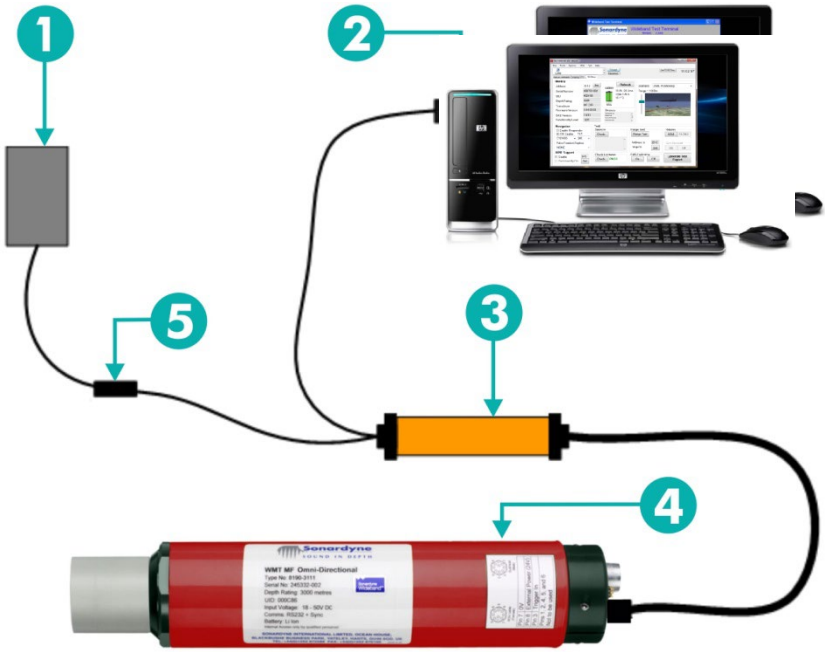



## 9.3 Operational testing

The following test procedures are described using 6G Terminal Lite.

1. To test the WMT, use the WMT charger kit (650-0043) and connect to the WMT as shown in *Figure 9-2.*
2. Rotate the **ON/OFF** switch to the **I** (ON) position to turn the WMT on.

**Figure 9-2 WMT functional testing connections**




1. ac charger PSU 641-0246
2. RS232 port
3. Charger & comms cable 820-0044
4. WMT
5. Inline 3-way plug to socket connection

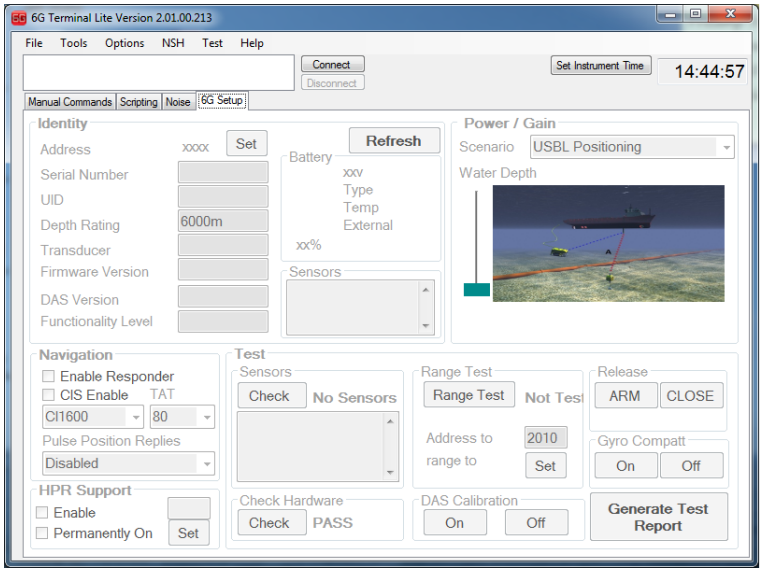
### 9.3.1 Checking the Wideband acoustics

The following procedure describes acoustic checks using 6G Terminal Lite.

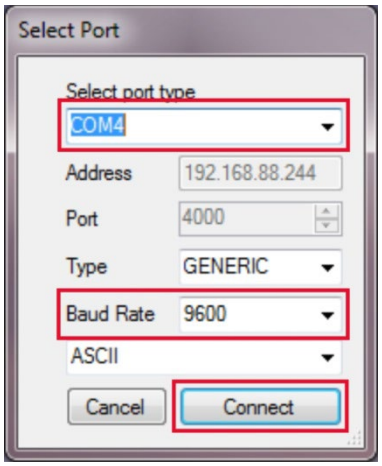
To carry out a check of the Wideband Acoustics of the transponders, it will also be necessary to enter the address of an acoustically paired device (if one is attached).

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

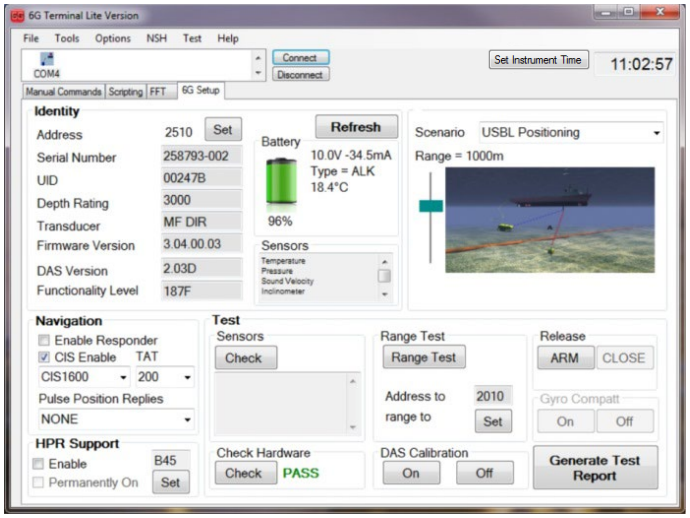

2. The 6G Terminal Lite dialog box will open on the **6G Setup** tab.




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



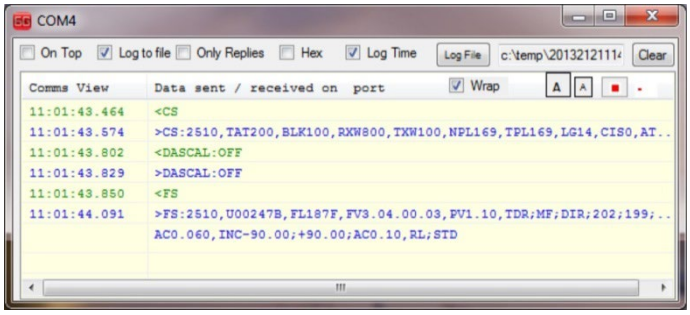
5. The **6G Setup** tab displays information on the connected transponder including address, serial number, depth rating and battery status.



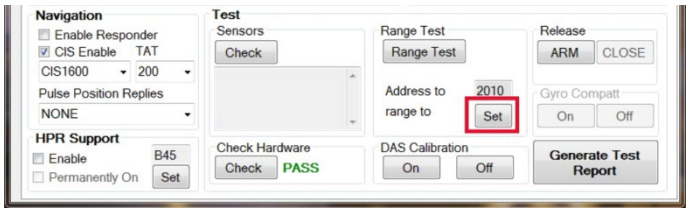

6. In the COMMS window, the green text indicates the commands sent from the software to the transponder; the blue text is the transponders response.

**Note**

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




7. To enter the address of the acoustically paired device, if one is attached, click **Set** on the **Range Test** section of the 6G Setup tab.

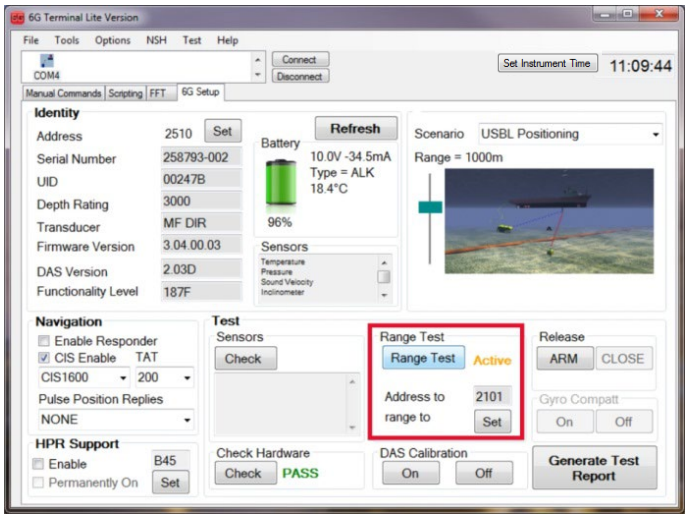



8. An **Address Selector** window will open listing all available addresses for Wideband 2. Select the address for the attached device and then click **OK**.

**Note**

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

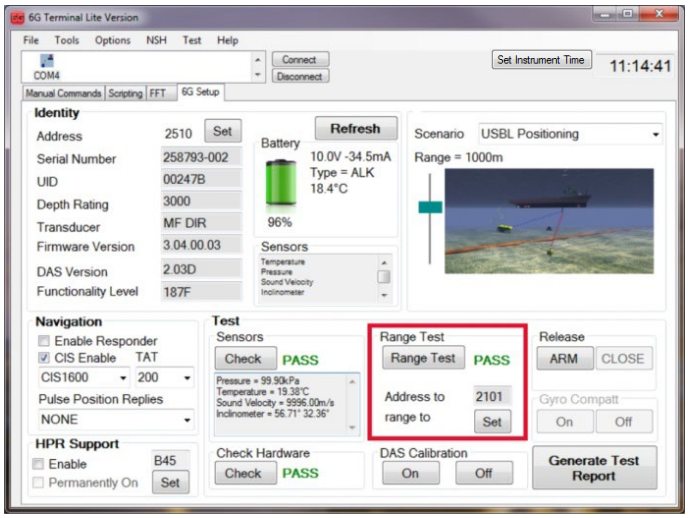

9. The 6G Setup tab will open with the selected address in the Range Test **Address to** window. Click **Range Test** to begin the acoustic check.
10. During the test **Active** will appear next to the **Range Test** button to indicate the test is in progress.



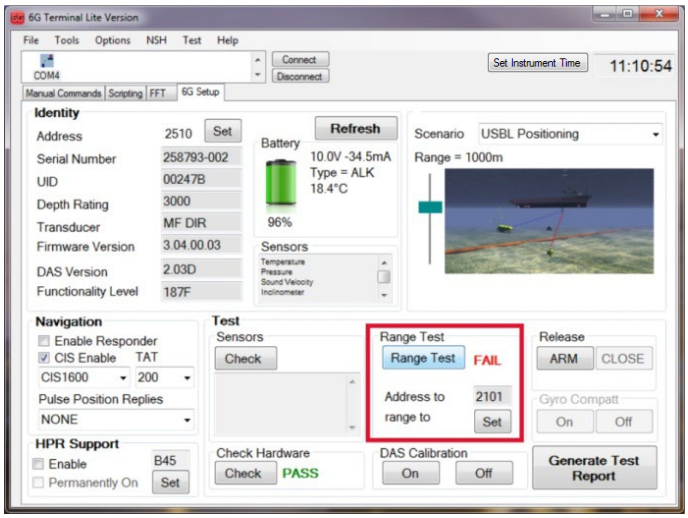

**Note**

**The Range Test function sends the interrogation pulse using the wakeup signal defined in Options->Preferences. Check that this is correct for the instrument being ranged to.**

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




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




13. 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.
14. The acoustic checks are now complete.

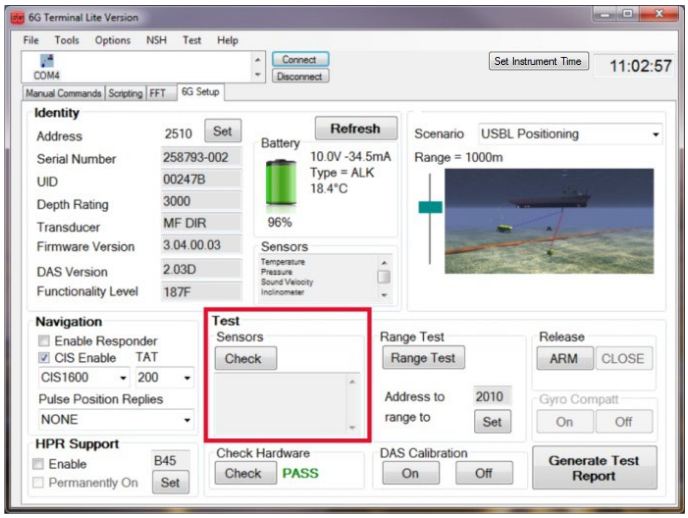
### 9.3.2 Checking the sensor measurements (Type 8190 only)

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

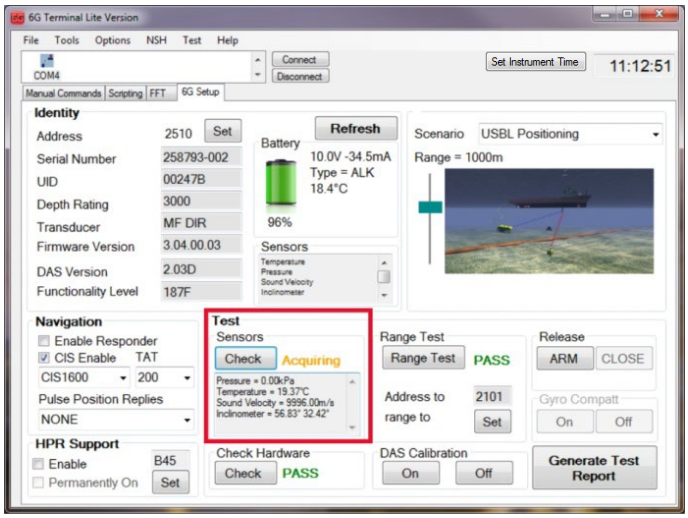
**Note**

**The same checks can also be performed using the iWand hand held test unit; refer to *UM-8315 "User Manual for the Type 8315 iWand", Section "View Sensors"*.**

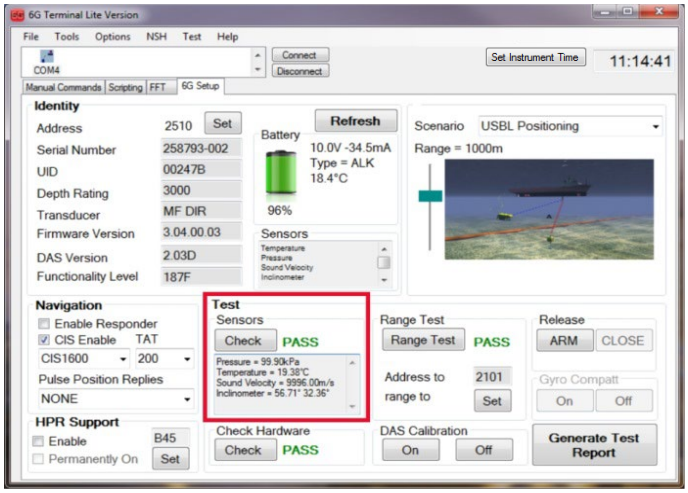
1. On the **6G Setup** tab, click **Test Sensors Check** to perform a test of all sensors installed in the transponder.




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.

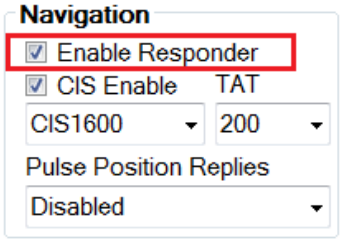



**Note**

**The Inclination values refer to the roll then pitch in degrees.**

### 9.3.3 Enabling responder operation (Type 8190 only)

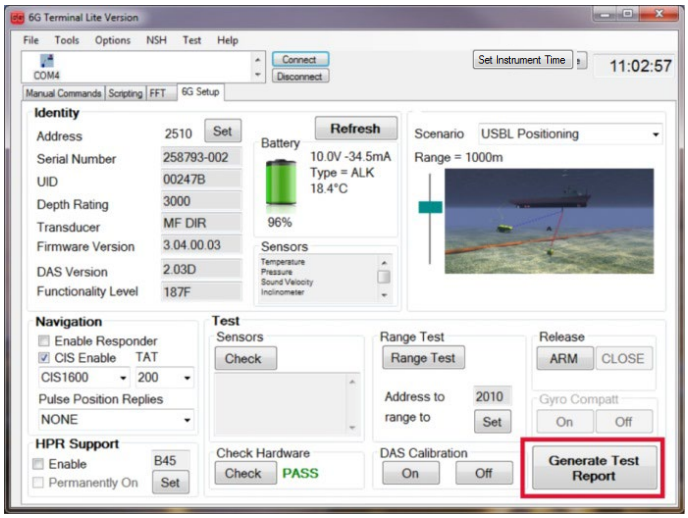
To enable Responder mode, select **Enable Responder** check box on the **Navigation** pane.



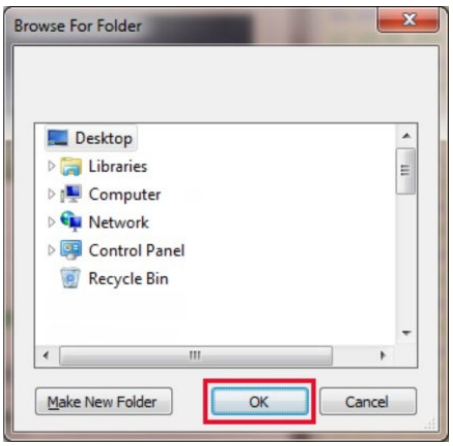

### 9.3.4 Creating a test report

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

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

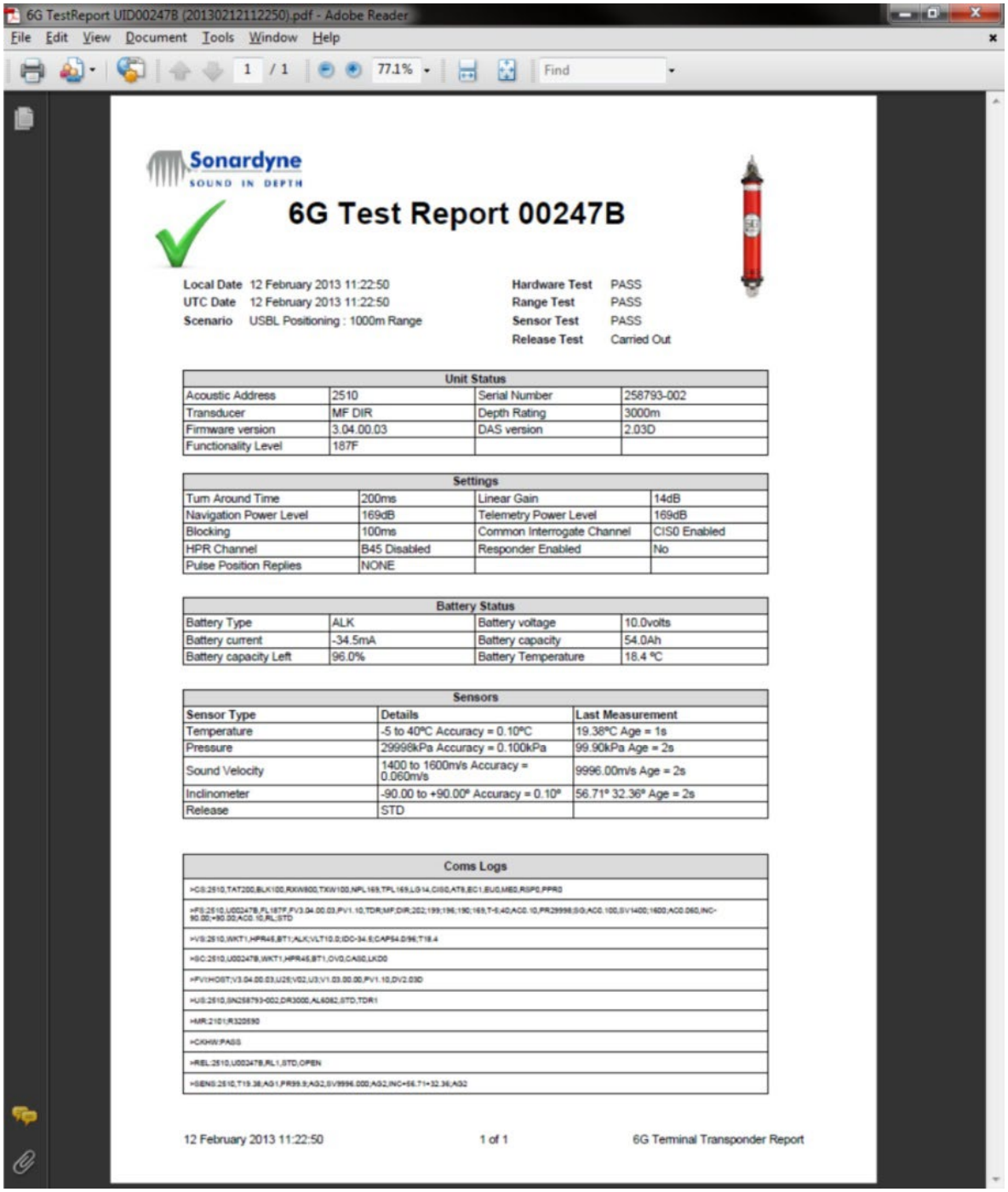


2. A file location window will open to save the new Test Report pdf in the selected folder.




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 9-3 Transponder test report pdf**



6G TestReport UID00247B (20130212112250).pdf - Adobe Reader

File Edit View Document Tools Window Help

Sonardyne
SOUND IN DEPTH

# 6G Test Report 00247B

Local Date 12 February 2013 11:22:50
UTC Date 12 February 2013 11:22:50
Scenario USBL Positioning : 1000m Range

Hardware Test PASS
Range Test PASS
Sensor Test PASS
Release Test Carried Out

| Unit Status | | | |
|---|---|---|---|
| Acoustic Address | 2510 | Serial Number | 258793-002 |
| Transducer | MF DIR | Depth Rating | 3000m |
| Firmware version | 3.04.00.03 | DAS version | 2.03D |
| Functionality Level | 187F | | |

| Settings | | | |
|---|---|---|---|
| Turn Around Time | 200ms | Linear Gain | 14dB |
| Navigation Power Level | 169dB | Telemetry Power Level | 169dB |
| Blocking | 100ms | Common Interrogate Channel | CIS0 Enabled |
| HPR Channel | B45 Disabled | Responder Enabled | No |
| Pulse Position Replies | NONE | | |

| Battery Status | | | |
|---|---|---|---|
| Battery Type | ALK | Battery voltage | 10.0volts |
| Battery current | -34.5mA | Battery capacity | 54.0Ah |
| Battery capacity Left | 96.0% | Battery Temperature | 18.4 °C |

| Sensors | | |
|---|---|---|
| Sensor Type | Details | Last Measurement |
| Temperature | -5 to 40°C Accuracy = 0.10°C | 19.38°C Age = 1s |
| Pressure | 29998kPa Accuracy = 0.100kPa | 99.90kPa Age = 2s |
| Sound Velocity | 1400 to 1600m/s Accuracy = 0.060m/s | 9996.00m/s Age = 2s |
| Inclinometer | -90.00 to +90.00° Accuracy = 0.10° | 56.71° 32.36° Age = 2s |
| Release | STD | |

| Coms Logs |
|---|
| >CS:2510,TAT200,BLK100,RXW800,TXW100,NPL169,TPL169,LG14,CIS0,AT8,EC1,EU0,MB2,RSP0,PPR0 |
| >PS:2510,U00247B,FL187F,FV3.04.00.03,PV1.10,TDR;MF,DIR,202;199;196;190;169,T-5;40,AC0.10,PR29998,S0;AC0.100,S1V1400;1600,AC0.060,INC-90.00,+90.00,AC0.10,RL;STD |
| >VS:2510,WKT1,HPR45,BT1;ALK,VLT10.0,IDC-34.5,CAP54.0/96,T18.4 |
| >SC:2510,U00247B,WKT1,HPR45,BT1,OV0,CAS0,LKD0 |
| >FV:HOST;V3.04.00.03,U25;V02,U3;V1.03.00.00,PV1.10,DV2.03D |
| >US:2510,SN258793-002,DR3000,AL4082,STD,TDR1 |
| >MR:2101;R320590 |
| >CKHW:PASS |
| >REL:2510,U00247B,RL1,STD,OPEN |
| >SENS:2510,T19.38;AG1,PR99.9;AG2,SV9996.000;AG2,INC+56.71+32.36;AG2 |

12 February 2013 11:22:50 1 of 1 6G Terminal Transponder Report

4. On completion of the review, the 6G Terminal Lite software can be closed.

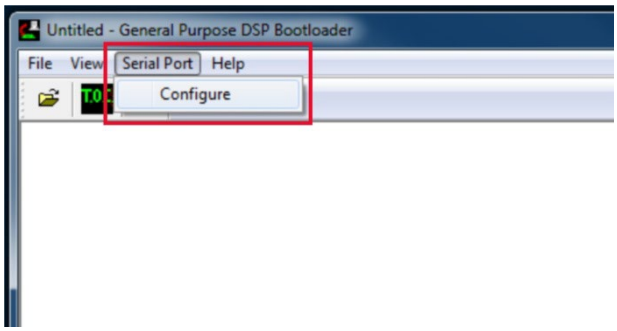
# Section 10 – Firmware update

The latest firmware will be displayed on the Sonardyne Support page on the Sonardyne website. Contact Sonardyne Support to obtain the updated firmware files.

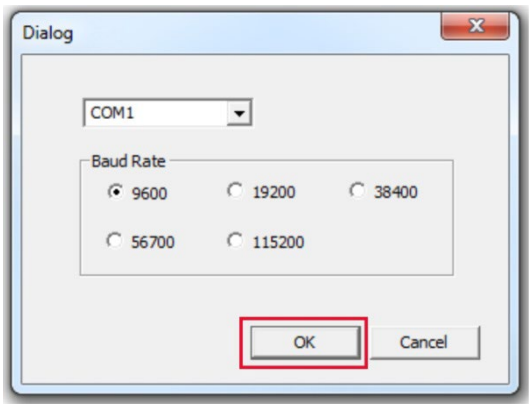
## 10.1 Firmware update procedure

1. Using the WMT charger kit (650-0043), connect to the WMT as shown in *Figure 9-2.*
2. Rotate the **ON/OFF** switch to the **I** (ON) position.
3. On the PC, double-click the *GP Bootloader.exe* icon to open the program.

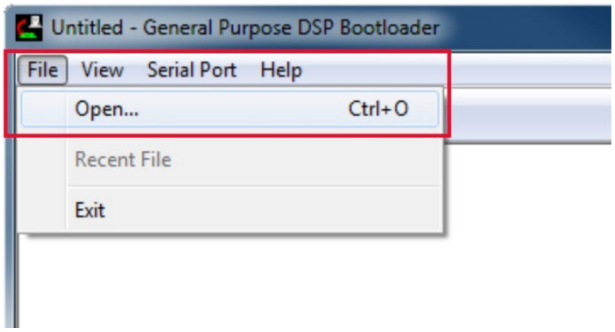

4. On the toolbar menu, select **Serial Port** and then click **Configure**.



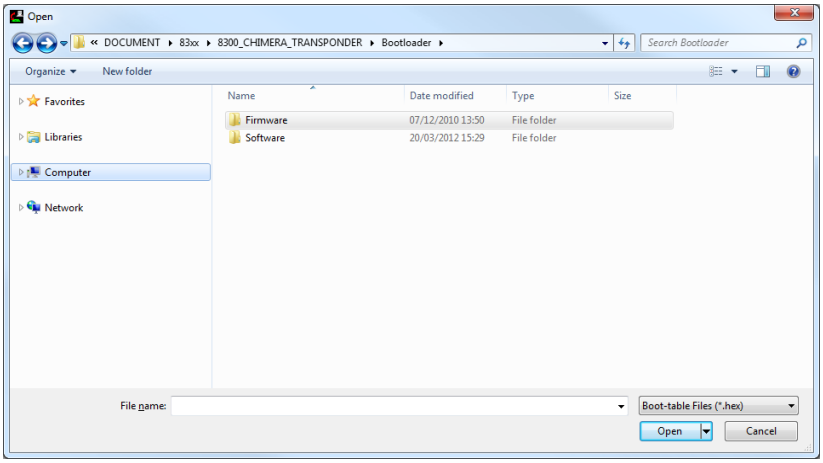

5. On the **Dialog** window select the correct **COM** port and **Baud Rate** (**38400**, **56700** or **115200**) and then click **OK**.



6. The Dialog window will close. On the main window click **File** >**Open**.

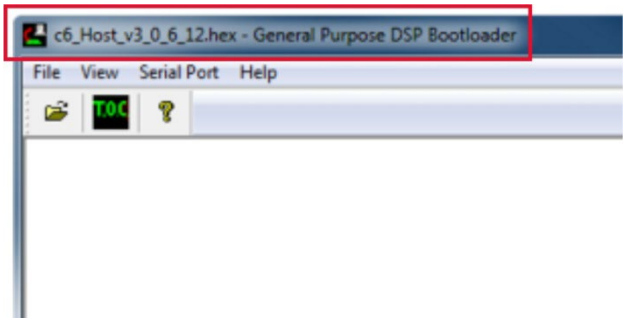



7. Browse to and select new firmware and then click **Open**.

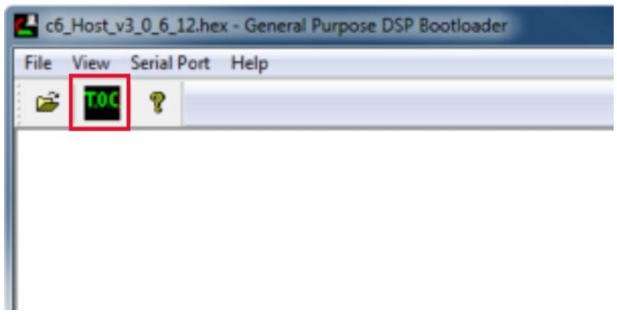



**Note**

**After the new firmware has been selected it will appear in the Bootloader homepage title bar.**




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



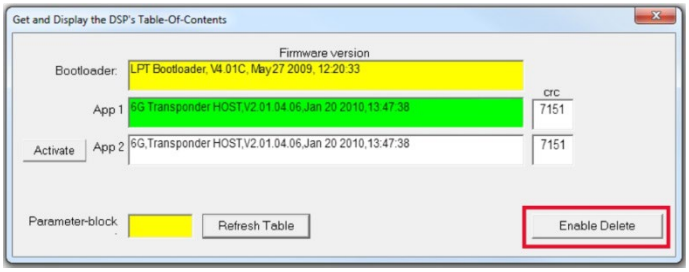
9. If a connection is not made successfully, an error message will appear on the Bootloader window.


10. Check all cables are connected correctly to the PC.
11. Go to the **Device Manager** facility on the PC and check the correct Comms Port has been selected for the CPU cable.
12. Click **Refresh Table** after checking the connections.
13. If all connections are correct, the window will refresh.

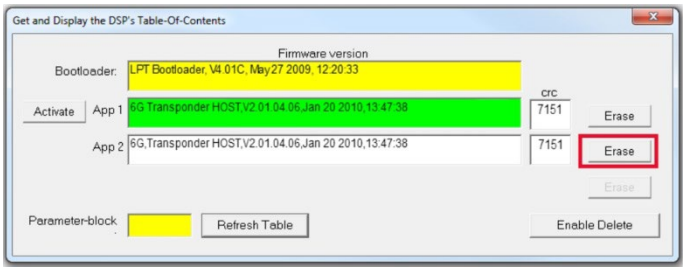
**Note**

**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.**

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

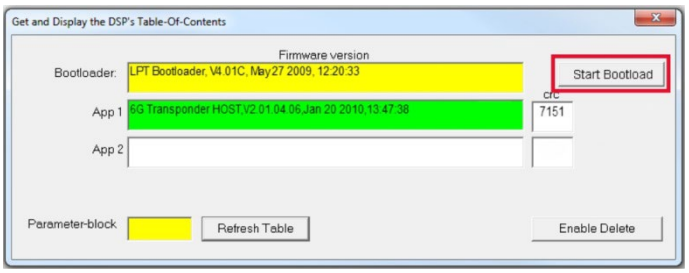



15. Clicking **Enable Delete** will allow **Erase** buttons to appear at the end of each installed firmware. Selecting one of the **Erase** buttons will remove that firmware.

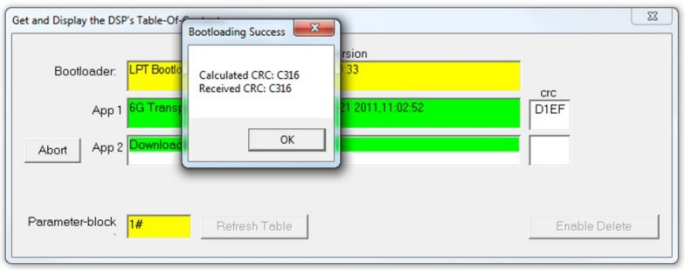



16. After an old firmware version has been erased, the **Start Bootload** button will appear.

17. Click **Start Bootload** to start uploading the new firmware




18. After **Start Bootload** is selected, a percentage uploading bar will scroll across the App location.
19. After the upload has completed a **Bootloading Success** window will appear.




20. Click **OK** to confirm the installation is a success.
21. The new uploaded program will appear in the selected App Window.
22. Close the **Get and Display the DSP's Table of Content** window.
23. To confirm the new firmware, on the main Bootloader screen, click on the **TOC** and the new firmware should be displayed highlighted in green.
24. Close all windows.

# Section 11 – Fault diagnosis

## 11.1 Introduction

In the event the WMT does not operate, refer to the following Fault-Finding tables to identify the fault, the possible cause and the action to take.

## 11.2 Fault types

### 11.2.1 Transponder does not reply to interrogations or command

| Fault | Possible cause | Action |
|---|---|---|
| Transponder does not reply to interrogation or commands | WMT endcap switch in the 'OFF' position | Rotate the WMT endcap switch to the 'ON' position |
| | Connection to Remote Transducer not made or loose | Check all connections on the surface transceiver and WMT remote transducer |
| | Incorrect transponder address set in the surface transceiver | Check address and reset to 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 International Ltd |
| | Surface thermocline refracting reply signals | Lower transducer below thermocline. |
| | Noise level at surface transducer to 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 |
| | Transponder gain setting has been set too Low | Wait 3 minutes with no interrogations, and then set command to increase the transponder gain |
| | Other acoustic systems maybe operating in the same frequency band | Check for signals validating by using the noise command on the surface transceiver |

### 11.2.2 Transponder replies to commands, but not to interrogations

| 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 |
| | Transponder may have been moved from original position | |

### 11.2.3 Transponder replies to command, but telemetry errors are detected

| Fault | Possible cause | Action |
|---|---|---|
| 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 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 |
| | | Set the transponder to high power telemetry transmission using the SPL and TPL parameters 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, the following must be provided:

- The part number of the component or item
- The drawing number (if known)
- The description

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

## 12.2 Recommended spares

### 12.2.1 Batteries

| Part No. | Dwg No | Description | Qty |
|---|---|---|---|
| 641-3370 | 8065-002-01 | Lithium-Ion Battery Pack | 1 |
| 650-0043 | n/a | WMT Charger Kit (consists of 820-0044 and 641-0246 below) | 1 |
| 820-0044 | 8190-090 | Charger/Comms WMT cable | 1 |
| 641-0246 | 8190-006 | AC Charger PSU | 1 |

### 12.2.2 Cables and accessories

| Part No. | Dwg No | Description | Qty |
|---|---|---|---|
| 317-2896 | n/a | Subconn MCIL8F Cable Tail 0.5 m (without locking collar) | 1 |
| 317-2963 | n/a | Subconn MCIL8F Cable Tail 5 m (without locking collar) | 1 |
| 820-5801 | n/a | Subconn MCIL8F Cable Tail 3 m (with locking collar) | 1 |
| 312-6924 | n/a | Subconn MCDC8F Dummy | 1 |
| 317-2672 | n/a | Subconn Locking Collar MCDLSF | 1 |

### 12.2.3 Miscellaneous parts

| Part No. | Dwg No | Description | Qty |
|---|---|---|---|
| 641-3332 | 8000-905-A2 | Sonardyne Opening Tool | 2 |
| 650-0017 | 8065-126-A1 | Ring Clamp kit<br>(incl. screws, washers, bushes, anode) | 1 |
| 201-5012 | n/a | Spring Earthing EMI | 1 |
| 212-0867 | n/a | Screw Clamp | 2 |
| 730-4592 | n/a | Isolator Nylon | 4 |
| 230-0535 | n/a | Nut Nyloc | 2 |

| Part No. | Dwg No | Description | Qty |
|---|---|---|---|
| 860-0725 | n/a | Anode Zinc | 1 |
| 230-104A | n/a | Anode washer | 1 |
| 212-5246 | n/a | Stud Anode Mounting | 1 |
| 200-2302 | n/a | Seal O-ring (Housing endcaps) | 4 |
| 200-012C | n/a | Seal O-ring (Pressure relief valve) | 2 |
| 830-0343 | n/a | Dust cover Pressure port | 1 |
| 650-0125 | N/A | Pressure Port Oil Top-up Kit | 1 |

### 12.2.4 Remote transducers (Type 8190 only)

| Part No. | Dwg No | Description | Qty |
|---|---|---|---|
| 620-0034 | 8065-121-A3 | Remote MF Omni Transducer Right Angled, 3.0 m | 1 |
| 620-0056 | 8065-121-A3 | Remote MF Omni Transducer Right Angled, 2.0 m | 1 |
| 620-0055 | 8065-121-A3 | Remote MF Omni Transducer Right Angled, 1.0 m | 1 |
| 620-0045 | 8065-121-A3 | Remote MF Omni Transducer Right Angled, 0.6 m | 1 |
| 620-0033 | 8065-120-A3 | Remote MF Omni Transducer straight, 3.0 m | 1 |
| 620-0054 | 8065-120-A3 | Remote MF Omni Transducer straight, 2.0 m | 1 |
| 620-0053 | 8065-120-A3 | Remote MF Omni Transducer straight, 1.0 m | 1 |
| 620-0052 | 8065-120-A3 | Remote MF Omni Transducer straight, 0.6 m | 1 |
| 641-0032 | 8140-008-A2 | Remote MF Directional Transducer Right Angled, 3.0 m | 1 |
| 641-0107 | 8140-008-A2 | Remote MF Directional Transducer Right Angled, 2.0 m | 1 |
| 641-0108 | 8140-008-A2 | Remote MF Directional Transducer Right Angled, 1.0 m | 1 |
| 641-0109 | 8140-008-A2 | Remote MF Directional Transducer Right Angled, 0.6 m | 1 |

### 12.2.5 Type 8244-3151 Mini-Dunker Surface Kit

| Part No. | Description | Qty |
|---|---|---|
| 620-7079 | Surface Interface Unit (SIU) | 1 |
| 820-0384 | Deck Cable (20 m) | 1 |

# Section 13 – Technical specifications

## 13.1 Type 8190-3111/3112/7212

| Feature | | Type 8190-3111 | Type 8190-3112 | Type 8190-7212 |
|---|---|---|---|---|
| Depth rating | | 3,000 m | 3,000 m | 7,000 m |
| Operating frequency | | MF (20–34 kHz) | MF (20–34 kHz) | MF (20–34 kHz) |
| Transducer beam shape | | Omni-directional | Directional | Directional |
| Source level (re 1 µPa @ 1 m) | High power | 187 dB | 193 dB | 199 dB |
| | Low power | 181 dB | 187 dB | 193 dB |
| Tone equivalent energy (TEE)[1] WBv2+ | High power | 193 dB | 199 dB | 205 dB |
| | Low power | 187 dB | 193 dB | 199 dB |
| Range precision | | Better than 15 mm | Better than 15 mm | Better than 15 mm |
| Depth sensor | | ± 0.5% full scale | ± 0.5% full scale | ± 0.5% full scale |
| Communications interface | | RS232 (9,600–115,200 baud) | | |
| External supply voltage | | 24 or 48 V dc (± 10%) | 24 or 48 V dc (± 10%) | 24 or 48 V dc (± 10%) |
| External power | Sleep | ~650 mW | ~650 mW | ~650 mW |
| | Wideband listening | ~1 W | ~1 W | ~1 W |
| | Battery charging | 6 W | 6 W | 6 W |
| | Peak (during transmission) | <50 W | <50 W | <50 W |
| External power switch | | Yes | Yes | No |
| Battery life (Li-ion 15 V) | Listening | 30 days | 30 days | 30 days |
| | Continuous 5 seconds interrogation | Approx. 6 days at low power | | |
| Mechanical construction | | Anodised aluminium alloy and plastics | | |
| Operating temperature | | -5 to 40°C | -5 to 40°C | -5 to 40°C |
| Storage temperature | | -20 to 55°C | -20 to 55°C | -20 to 55°C |
| Dimensions (diameter x length) | | 94 x 501 mm | 94 x 512 mm | 98 x 512 mm |
| Weights in air/water[2] | | 5.1/2.2 kg | 7.0/3.5 kg | 7.0/3.5 kg |
| Options | | Remote, cable connected transducer (see separate datasheet). | | None |

[1] WBv2+ signals are 4x the duration of Sonardyne tone signals (WBv1 & WBv2 are 2x). The TEE figure shows the operational performance when comparing Wideband and tone systems.
[2] Estimated Weights.

## 13.2 Type 8190-3161/3162 MF Omni Remote, MF Directional Remote Unit

| Parameter | Specification |
|---|---|
| Diameter (Body) | 94 mm (3.7 in) |
| Overall length | 467 mm (18.4 in) |
| Weight in air | 4.8 kg (10.7 lbs.) |
| Weight in water | 2.1 kg (4.6lbs.) |
| Max Operating Depth | 3,000 m |

## 13.3 Type 8244-3111/3112 Modem 6

| Feature | | Type 8244-3111 | Type 8244-3112 |
|---|---|---|---|
| Depth rating | | 3,000 m | 3,000 m |
| Operating frequency | | MF (20–34 kHz) | MF (20–34 kHz) |
| Transducer beam shape | | Omni-directional | Directional |
| Source level (re 1 µPa @ 1 m) | High power | 187 dB | 193 dB |
| | Low power | 181 dB | 187 dB |
| Tone equivalent energy (TEE)[3] WBv2+ | High power | 193 dB | 199 dB |
| | Low power | 187 dB | 193 dB |
| Communications interface | | RS232 (2,400–115,200 baud) | |
| Operating voltage | | 24 or 48 V dc (± 10%) | 24 or 48 V dc (± 10%) |
| External power consumption | Sleep | ~650 mW | ~650 mW |
| | Wideband listening | ~1 W | ~1 W |
| | Battery charging | 6 W | 6 W |
| | Peak (transmission) | <50 W | <50 W |
| External power switch | | Yes | Yes |
| Battery life (li-ion 15 V) (listening) | | 30 days | 30 days |
| Operating temperature | | -5 to 40°C | -5 to 40°C |
| Storage temperature | | -20 to 55°C | -20 to 55°C |
| Mechanical construction | | Anodised aluminium alloy and plastics | |
| Dimensions (length x diameter) | | 501 x 94 mm | 512 x 97 mm |
| Weights in air/water[4] | | 5.1/2.2 kg | 7.0/3.5 kg |

[3] WBv2+ signals are 4x the duration of Sonardyne tone signals (WBv1 & WBv2 are 2x). The TEE figure shows the operational performance when comparing Wideband and tone systems.
[4] Estimated weights.

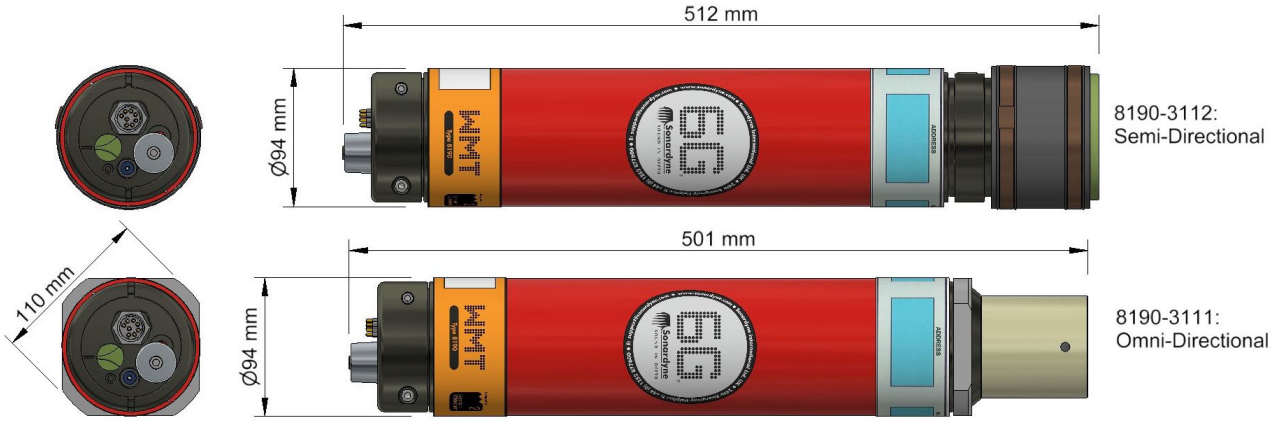
## 13.4 Type 8244-3151/3155/3156 Modem 6 Mini-Dunker

| Feature | | Type 8244-3151 | Type 8244-3155 | Type 8244-3156 |
|---|---|---|---|---|
| Depth rating | | 3,000 m | 3,000 m | 3,000 m |
| Operating frequency | | MF (20–34 kHz) | LMF (14–19 kHz) | LMF (14–19 kHz) |
| Transducer beam shape | | Omni-directional | Omni-directional | Directional |
| Source level (re 1 µPa @ 1 m) | High power | 187 dB | 190 dB | 196 dB |
| | Low power | 181 dB | 187 dB | 190 dB |
| Tone equivalent energy (TEE)[5] WBv2+ | High power | 193 dB | 196 dB | 202 dB |
| | Low power | 187 dB | 193 dB | 196 dB |
| Serial communications | | Primary and secondary port: RS485 (half-duplex) SIU input: RS232 | | |
| Modem 6 Mini-Dunker operating voltage | | 24 or 48 V dc (± 10%) – supplied by the SIU | | |
| SIU operating voltage | | 90–260 V ac, 50/60 Hz, 200 VA max – power out 48 V dc, 2.0 A maximum | | |
| External power consumption | Sleep | ~650 mW | ~650 mW | ~650 mW |
| | Wideband listening | ~1 W | ~1 W | ~1 W |
| | Battery charging | 6 W | 6 W | 6 W |
| | Peak (transmission) | <50 W | <50 W | <50 W |
| External power switch | | Yes | Yes | Yes |
| Battery life (li-ion 15 V) (listening) | | 30 days | 30 days | 30 days |
| Operating temperature | | -5 to 40°C | -5 to 40°C | -5 to 40°C |
| Storage temperature | | -20 to 55°C | -20 to 55°C | -20 to 55°C |
| Mechanical construction | | Anodised aluminium alloy and plastics | | |
| Dimensions (length x diameter) | | 518 x 94 mm | 604 x 94 mm | 605 x 94 mm |
| Bump guard diameter | | 178 mm | 200 mm | 183 mm |
| Weights in air/water[6] | | 5.1/2.2 kg | 7.0/3.5 kg | 7.0/3.5 kg |
| Surface System Kit | | 602-0123 | 602-0129 | 602-0150 |
| Mini-Dunker | | 8244-3151 | 8244-3155 | 8244-3156 |
| Surface Interface Unit (SIU) | | 620-7079 | 620-7079 | 620-7079 |
| Deck cable (20 m) | | 820-0384 | 820-0384 | 820-0384 |

[5] WBv2+ signals are 4x the duration of Sonardyne tone signals (WBv1 & WBv2 are 2x). The TEE figure shows the operational performance when comparing wideband and tone systems.
[6] Estimated weights.

## 13.5 Technical Drawings

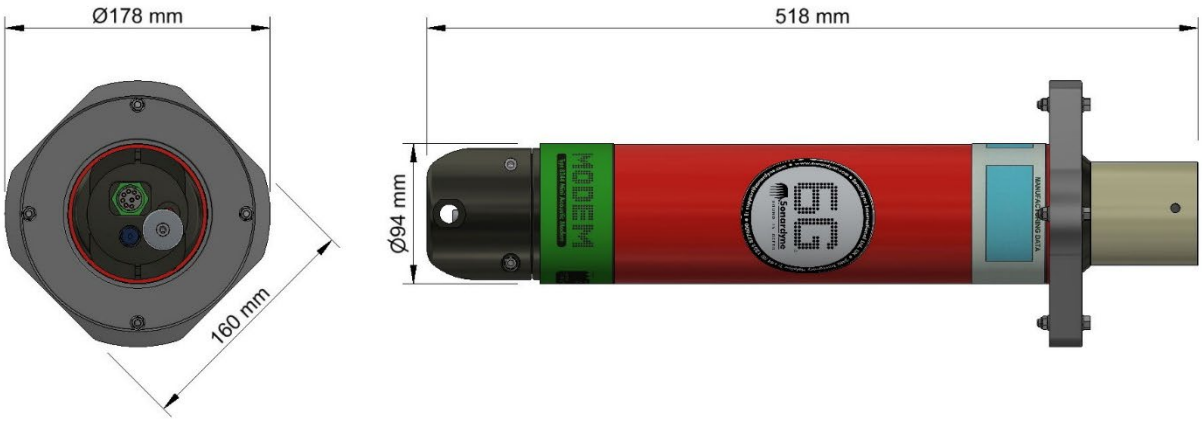
### 13.5.1 Type 8190-3111 omni-directional and Type 8190-3112 directional



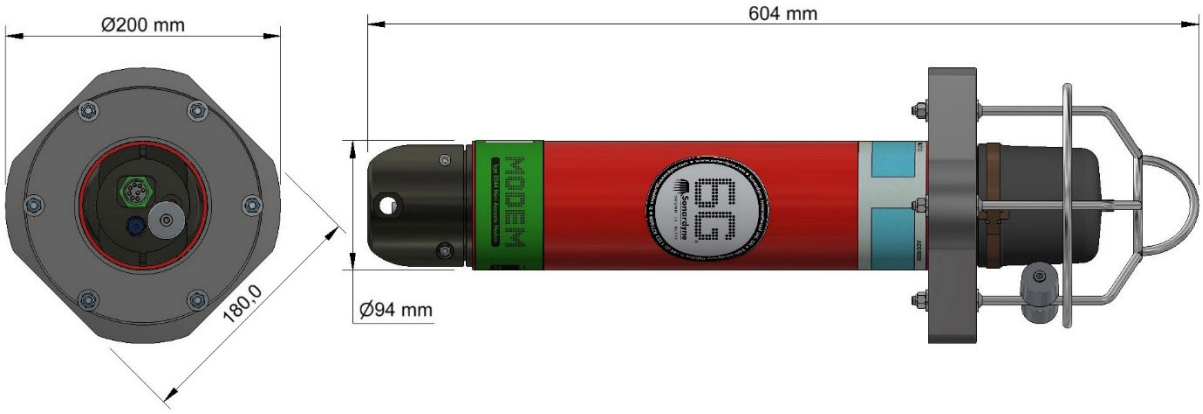

### 13.5.2 Type 8244-3111 MF omni-directional Modem 6


### 13.5.3 Type 8244-3112 directional Modem 6


### 13.5.4 Type 8244-3151 MF omni-directional Modem 6 Mini-Dunker



### 13.5.5 Type 8244-3155 LMF omni-directional Modem 6 Mini-Dunker



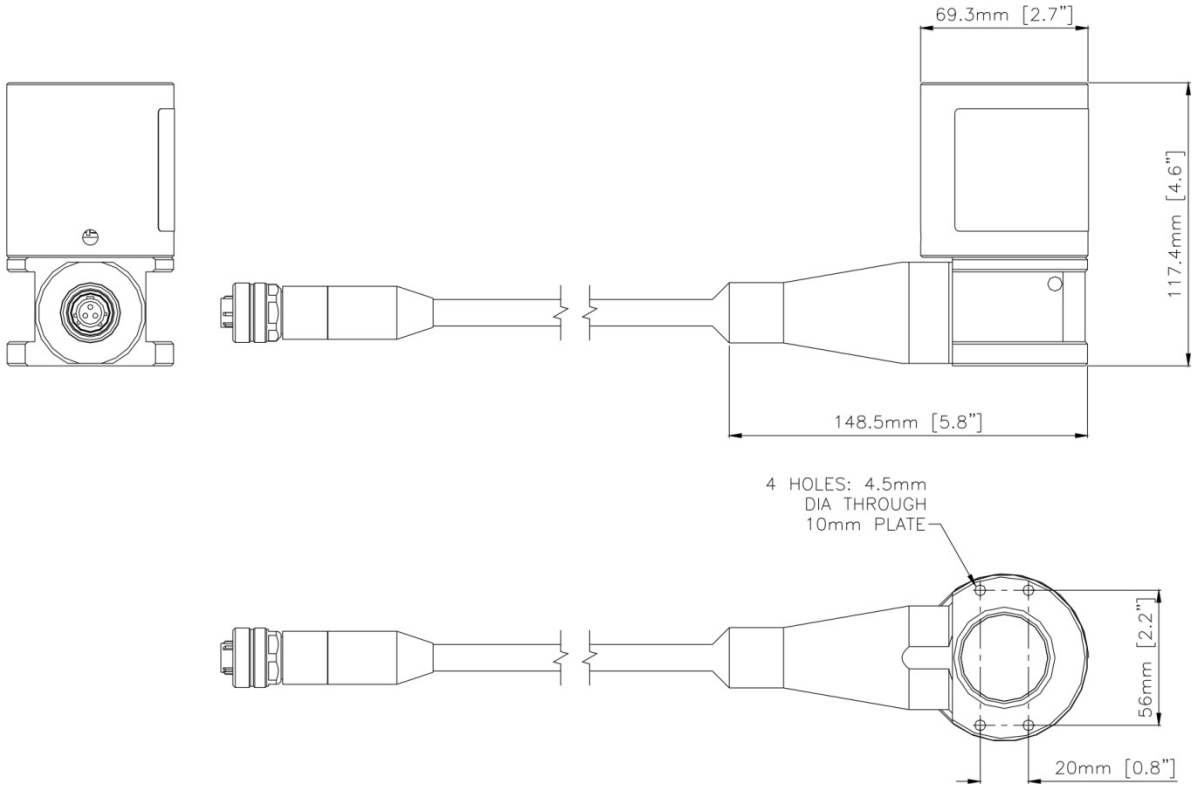

### 13.5.6 Type 8244-3156 LMF directional Modem 6 Mini-Dunker


### 13.5.7 Remote MF Omni Straight Transducer

**Figure 13-1 Remote MF Omni Straight Transducer**

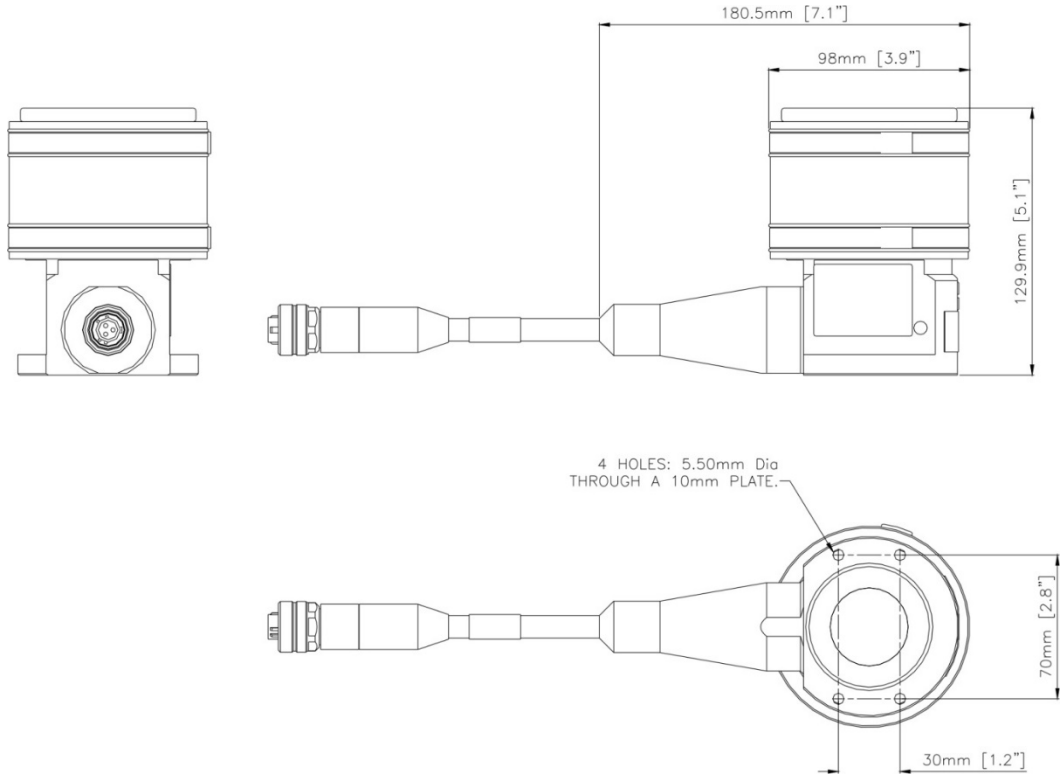
### 13.5.8 Remote MF Omni Right Angle Transducer

**Figure 13-2 Remote MF Omni Right Angle Transducer**



### 13.5.9 Remote MF Directional Transducer

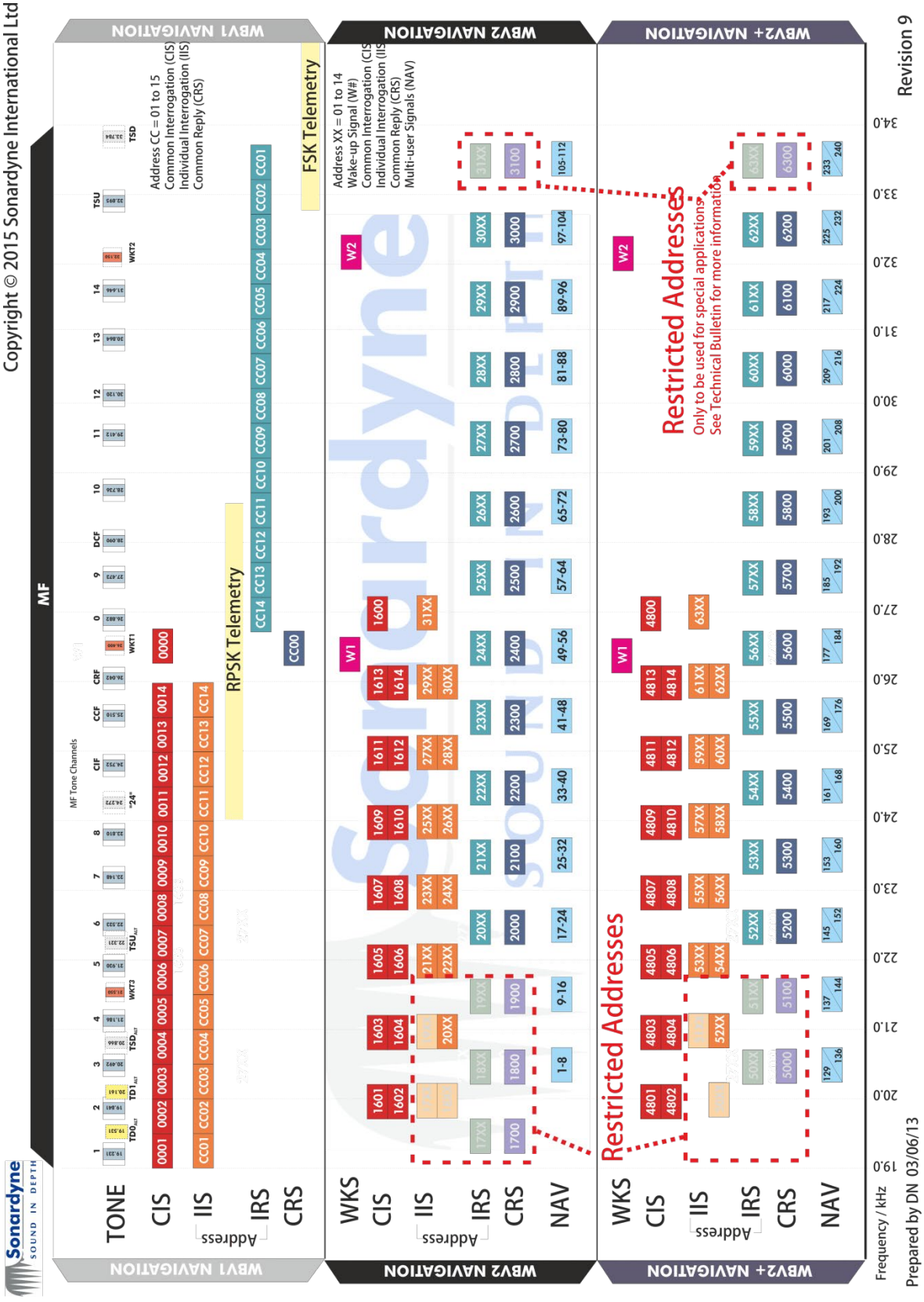
**Figure 13-3 Remote MF Directional Transducer dimensions**




| Remote transducer variations | |
|---|---|
| **Cable type** | **Transducer type** |
| WMT MF Omni 0.6 metres | Right angled |
| WMT MF Omni 1.0 metres | Right angled |
| WMT MF Omni 2.0 metres | Right angled |
| WMT MF Omni 3.0 metres | Right angled |

# Appendix A – Sonardyne Frequency Chart

The Sonardyne Frequency Chart can be used for guidance on optimising USBL accuracy vs. range and avoidance of other acoustic systems operating in the vicinity.



# Appendix B – Basic principles of transponder interrogation and reply

## B.1 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 of 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 'turnaround 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 the same length.

The equipment which sent out 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 follows:

- *Measures the total time delay = A*
- *Subtracts the turnaround delay = B*
- *This gives the true time delay = C*
- *Multiplies by the speed of sound in water = D*
- *This equals the two-way range = E.*

A – B = C

C x 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 original 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' this allows the reverberation to fade away before a transmission starts. The 'blocking period' prevents multiple replies from being transmitted in response to the reverberation.

The 6G Wideband 2 instruments are 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 or transceiver will reply on a Common Reply Signal (CRS) depending on the address family. This interrogation mode is used for baseline measurements between transponders, where only one transponder at a time will be replying. The turnaround time is fixed to 320 milliseconds.

The transponders or transceivers can also reply to a Common Interrogation Signal (CIS), its reply can be enabled or disabled via serial or 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 programmable turnaround time. There are different CIS signals (CIS0 to CIS14) these allow independent operation of several Long Base Line (LBL) navigation systems in the same area. The CIS used and the value of the turnaround time can be set by serial port or acoustic command.

To make sure of maximum 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 controllable period of inactivity. The transponder can be programmed with an inactivity time, the length of the inactivity time required depends on the task 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.

## B.2 Interrogators

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.

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

- *TYPE 8310 ROVNav6 is a navigation transceiver used for LBL array calibration, ROV navigation and data telemetry.*
- *TYPE 8142 HPT USBL transceiver with a multi-element array provide both range and bearing information. The transceiver is capable of receiver Sonardyne's high data rate (HDR) telemetry, 3kbps and 6kbps.*
- *TYPE 8220 AvTrak6, Versatile AUV transceiver with Omni-directional transducers and used for self navigation, tracking and acoustic telemetry.*
- *TYPE 8309 MF Dunker transceiver for deployment over the side of a surface vessel and used for command and control and data acquisition from subsea instruments.*

For testing and maintenance, the Type 8063 deck test unit can perform basic WBv1 interrogations acoustic check, but cannot command or configure the transponder. The transponder should be configured using the Sonardyne 6G Terminal Lite software and if required another 6G instrument can be used for a basic acoustic check.

## B.3 Command and telemetry functions

'Command' is the remote control of operating modes of a transponder by coded acoustic signals, transmitted from an acoustic transceiver. The basic commands are to enable and disable the transponder and to actuate the release mechanism. The first two commands allow or prevent interrogation replies to conserve the battery while the third will release the transponder from its anchor weight. The requirement is high security with a low probability of false actuation.

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. If a data acquisition command was sent the reply will include sensor readings for the internal temperature and pressure. These readings are shown by the surface transceiver in standard engineering units. Error detection and correction give the best acoustic reception reliability.

# Appendix C – Acoustic positioning methods

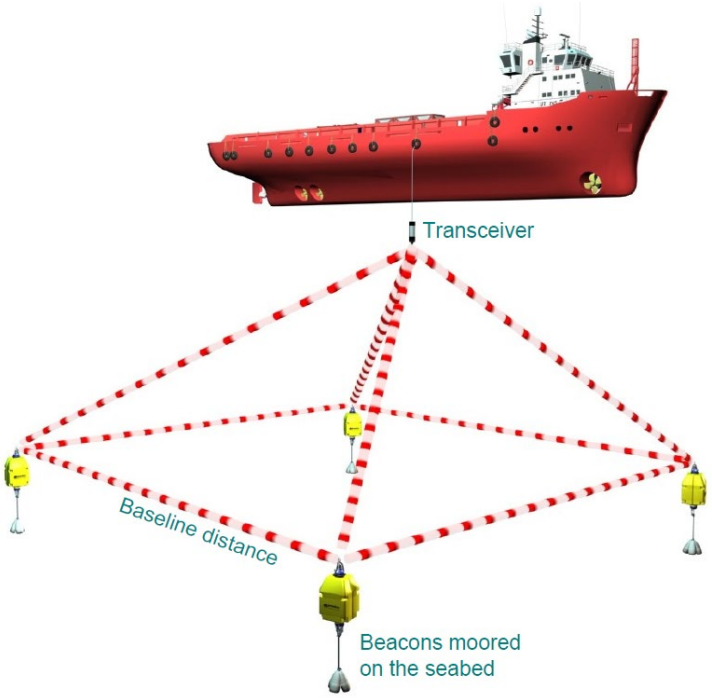
## C.1 Long Baseline (LBL)

### C.1.1 Hardware

A long baseline system has two parts or segments:

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

**Figure C-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 C-1*, or in a fixed through-the-hull arrangement. It can also be installed on a towfish, if necessary.

### C.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.

### C.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.

### C.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.

### C.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.

## C.2 Short Baseline (SBL)

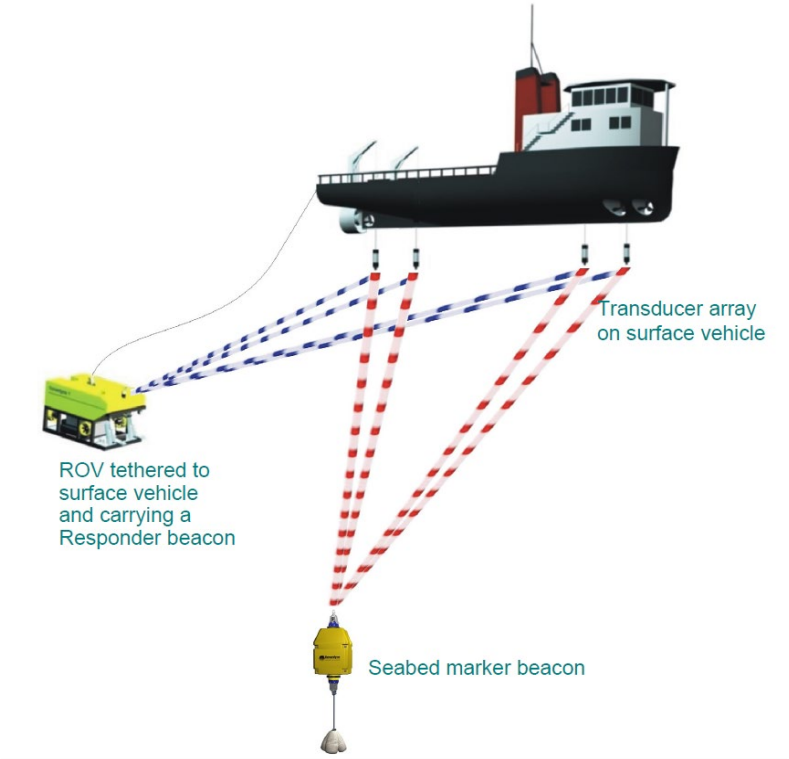
### C.2.1 Hardware

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 C-2 Typical SBL system**




## C.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 1,000 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.

## C.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 on 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.

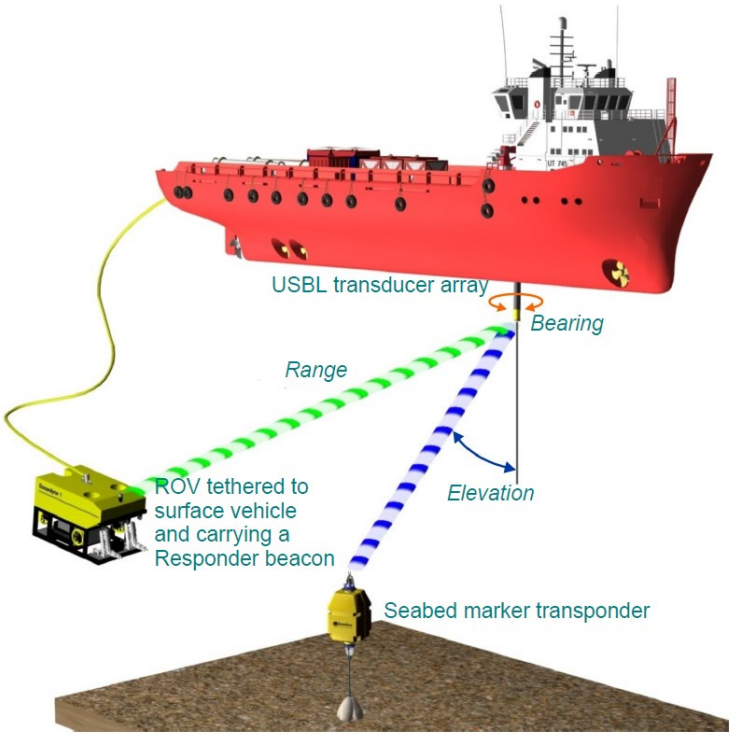
*Figure C-2* shows an example of a system that has a transponder beacon fixed to the seabed and a responder beacon located on an ROV. In this case the system can calculate the position of the vessel and of the ROV within a reference frame fixed to the seabed.

## C.3 Ultra-Short Baseline (USBL)

### C.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 C-3 Typical USBL system**




### C.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.

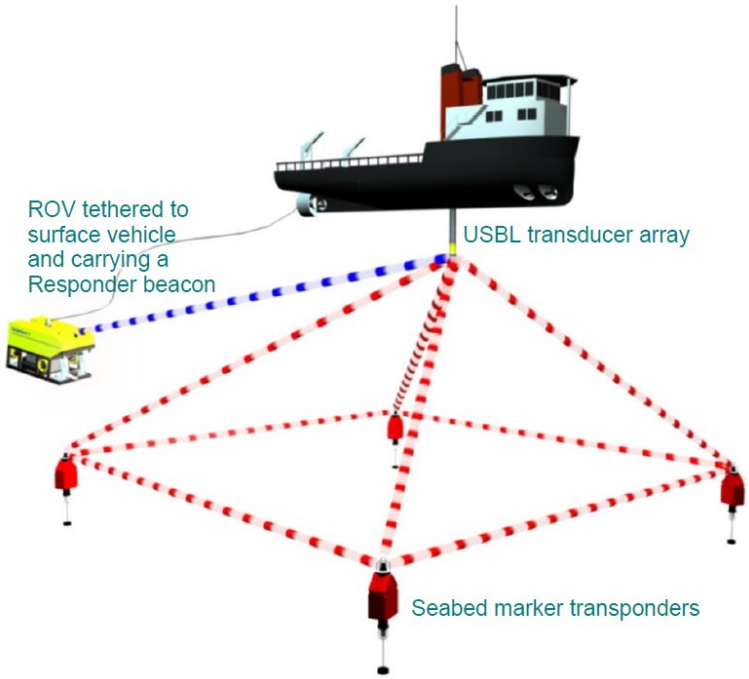
It is important to recognise that, whereas an SBL system calculates beacon positions in the vessel frame, a USBL system calculates beacon positions in a frame fixed to the transceiver assembly. To transform these positions into the vessel's co-ordinate frame requires the transceiver's attitude with respect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

# C.4 Long / Ultra-Short Baseline (L/USBL)

## C.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 C-4 Typical L/USBL system**




## C.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.

## C.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 C-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.

## C.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.

### C.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.

## C.5 Long-Short USBL (LSUSBL)

### C.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.

### C.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.

# Definitions

The following table lists abbreviations and terms used in this manual.

| Term | Definition |
|---|---|
| 6G® | Sonardyne's sixth generation technology hardware platform. |
| Acoustic Responder | An instrument that emits an acoustic signal in response to an electrical signal carried to it by cable. |
| Acoustic Signal | Information carried by sound pressure waves through water. The Sonardyne acoustic signal has a finite length. |
| Acoustic Synchronous / Precision Pinger | An instrument that emits signals regularly without an interrogating signal. A SYNCHRONOUS Pinger can be synchronised to an external master signal.<br>A PRECISION Pinger has an accurate internal time standard. |
| Acoustic Transceiver | An instrument that emits and receives acoustic signals, and extracts information from them. Transceivers can measure the time it takes a signal to travel from its transducer to a transponder and return. Some can encode and send data in a message and extract digital data from a message (Acoustic Telemetry). Used on a surface vessel or to mark a point on the seabed, or fixed to a mobile for tracking or positioning. |
| Acoustic Transducer | A device that converts electrical signals into acoustic signals and vice versa. |
| Acoustic Transponder | An instrument that emits an acoustic signal when it detects an interrogating acoustic signal. |
| Acoustic Transponder (Intelligent Transponder) | A type of transponder that is managed by a micro-controller. Examples include the COMPATT (COMPuting And Telemetry Transponder) and the WMT (Wideband Mini Transponder). Depending on supported functionality it can:<br>Decode acoustic telemetered commands from a transceiver and can send telemetered data to the transceiver. It can measure the distance between itself and other transponders and then telemeter the data to a transceiver. It can be capable of measuring its depth and the temperature of the water.<br>It can be used to measure a variety of underwater parameters and telemeter these back to the surface. It can be used, as an intelligent angle-measuring device, in a Riser Angle Monitoring System.<br>It can be fitted with a release mechanism so it can return, on command, back to the surface e.g. if battery power is low. |
| CMOS | Complementary Metal Oxide Silicon. A major integrated circuit technology based on combinations of p-channel and n-channel field effect transistors fabricated on the same silicon substrate. Especially attractive in low-power applications since the basic CMOS logic gate only consumes significant power during switching. |
| COMPATT | COMPuting and Telemetry Transponder (see Acoustic Intelligent Transponder) |
| Common Reply Signal (CRS) | A reply signal common to a complete family of addressed transponders. |
| Firmware | The firmware installed on the transponder. Firmware upgrades can be installed via WSM Terminal. The Tx firmware refers to the transmission signal synthesiser. |
| Differential Global Positioning System (DGPS) | A 24 hour, world-wide radio navigation system. GPS receivers track and decode the data from satellites and calculate the position and speed of a vehicle. |
| Dynamic Positioning reference (DP Reference) | Several position inputs e.g. GPS receivers, taut wire sensors, LBL, SBL or USBL acoustic positioning sensors, wind speed indicators etc. |

| Term | Definition |
|---|---|
| Dynamic Positioning System (DPS) | Automatically maintains a vessel with a constant heading, and in a fixed position without an anchor and provides more flexibility in operation. |
| Global Positioning System (GPS) | A multi-user, 24-hour, worldwide radio navigation system using the NAVSTAR constellation of satellites. GPS receivers are capable of tracking and decoding data from the satellites and using it to compute the position and velocity of a vehicle. |
| HPR | Hydro-acoustic Position Reference |
| Long BaseLine Positioning System (LBL) | A system where two or more transponders are on the seabed. The positions of the transponders are established by a calibration process in a seabed frame. The distances from a transducer to each transponder are measured using a transceiver. The position of the transducer can be computed in the seabed frame. The name comes from the "baselines" joining each transponder. |
| LUSBL | Long and Ultra Short Base-Line |
| PSU | Power Supply Unit |
| ROV | Remotely Operated Vehicle |
| 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. |
| 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. |

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