

USER MANUAL 8270-000

Wideband Sub-Mini Transponder / Responder (WSM6) Type 8270 Directional and Type 8271 Omni-Directional

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Head Office

Sonardyne International Limited
Blackbushe Business Park
Yateley, Hampshire
GU46 6GD United Kingdom

T. +44 (0) 1252 872288
F. +44 (0) 1252 876100
E. support@sonardyne.com
W. www.sonardyne.com

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Blackbushe Business Park
Yateley
Hampshire
GU46 6GD
England

Telephone: +44 (0) 1252 872288

Fax: +44 (0) 1252 876100

Email: support@sonardyne.com

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SECTION 1 – INTRODUCTION

1. Introduction

This User Manual describes the safe installation and operation of the Wideband Sub-Mini 6 (WSM6) Transponder / Responder. The information and procedures within this manual are based on Sonardyne's experience and knowledge.

To make sure the safety of the installer and operator is maintained it is important that all Warnings, Cautions and Safety Section in this manual, and the Warnings, Cautions and Safety Section of any additional manuals are read and understood.

1.1 Related Publications

To make sure the system is operated safely, a Safety Manual is supplied with this User Manual. It is important the Safety Manual is read and understood before proceeding with any activity on the equipment.

The related publications are:

Table 1-1 – Related Publications

Publication	Title
Safety Manual	Safety Manual

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SECTION 2 – SAFETY

2. Introduction

Before any activity is carried out on this WSM6 system, it is recommended that included Safety Manual and all Warnings and Cautions in this manual are read and understood.

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

Operators and service personnel must be familiar with the normal operating and safety procedures for Subsea Equipment.

Documentation must be consulted whenever a 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 the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

2.1 Procedures

Before carrying out any procedure on the WSM6 make sure all the following Warnings and Cautions are read and understood.

WARNINGS

 **High pressure risk when dismantling the equipment. Dismantling the Sub-Sea equipment must only be carried out by trained personnel.**

 **Electric shock hazard risk is present when dismantling the equipment. High voltages are present inside the WSM6. Dismantling the equipment must only be carried out by trained personnel.**

 **Do not stand in direct line with the end of the WSM6 when operating the Pressure Relief Vent Valve. Sudden release of high pressure gases from the WSM6 could cause injury to personnel. Wear Personal Protective Equipment such as goggles when operating the Pressure Relief Vent Valve.**

 **Make sure the work environment is well ventilated. Toxic gases may be released from the WSM6 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 stand directly inline with the WSM6 connector end-cap when operating the Pressure Relief Vent Valve. Toxic gases or corrosive liquids may be forcibly expelled due to serious battery failure.**

CAUTIONS

-  Do not charge the battery packs in any way other than is outlined in this manual. Failure to follow instructions may result in a loss of battery pack life or damage the battery pack.
 -  Do not allow the WSM6 transponder to be cooled or heated during the charging process as the over-current protection component characteristics may change adversely.
 -  Do not fast charge/discharge the WSM6 battery pack other than when using the Type 7972-000-0 WSM6 comms/charger and WSM6 charger PSU.
 -  Do not repeatedly connect the Fast Charger to the transponder when the battery is fully charged.
 -  Do not damage the WSM6 housing when attempting to remove the retaining rod. Damage to the protective coating will result in corrosion.
 -  When extracting the connector end-cap from the main housing do not twist as this will prevent the end-cap from being removed.
 -  Make sure the 'O' ring seals do not become damaged during the extraction process
 -  The Subconn and Micro-Subconn connectors must not be mated without lubrication as this will lead to delamination of the rubber from the connection pins and connector failure.
 -  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.
 -  Do not over apply grease to the connector faces as a build up of grease in the female connector will affect connector integrity.
 -  Do not operate multiple beacons on the same Quickset Wideband settings in the water at the same time. The address must be unique to any on e beacon operating in the same acoustic area.
 -  To avoid damage to the circuitry during testing, make sure the ON/OFF switch on the end-cap is set to OFF and only set to ON for the duration of the test.
-

SECTION 3 – TECHNICAL DESCRIPTION

3. Introduction

The Wideband Sub-Mini 6 (WSM6) transponder/responder is designed for use with Sonardyne Wideband Navigation Systems, SIMRAD “HPR” and Sonardyne LUSBL families of range-bearing acoustic navigation systems, including the High Frequency Scout system. By means of the supplied PC software “WSM Terminal”, it may be configured to any interrogation and reply setting, and its command address can also be changed easily.

Despite its high power output and its small size and weight, it has an operating life (at 1 pulse/second) of up to 20 hours when powered from the Nickel Metal Hydride rechargeable battery pack. A typical application is for marking a small ROV. Alternatively, the WSM6 can be powered by an external DC supply for continuous operation as a Transponder or Responder.

In addition to these features, the WSM6 can be fitted with a depth sensor option to report the depth by sending dual, time-coded reply pulses to each interrogation.

3.1 Description

Two types of WSM6 are available. Type 8270 – Directional (**Figure 3-1**) has a maximum operating depth rated for 4000m, but this may be limited by the full scale depth of the pressure sensor. Type 8271 – Omni-Directional (**Figure 3-3**) has an operating depth rated at 1000m.

Figure 3-1 – Type 8270 Directional Wideband Sub-Mini 6G®



Figure 3-2 – Type 8270 Directional Wideband Sub-Mini 6G® Outline Drawing

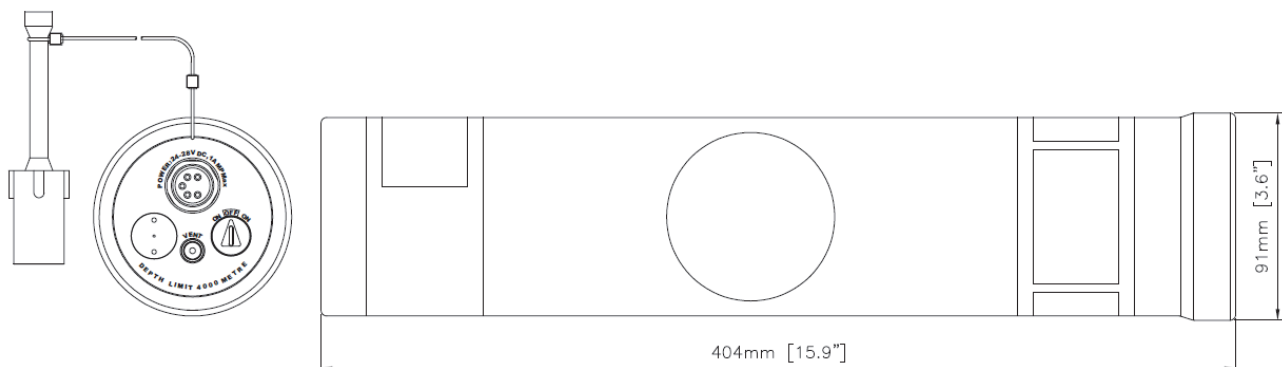
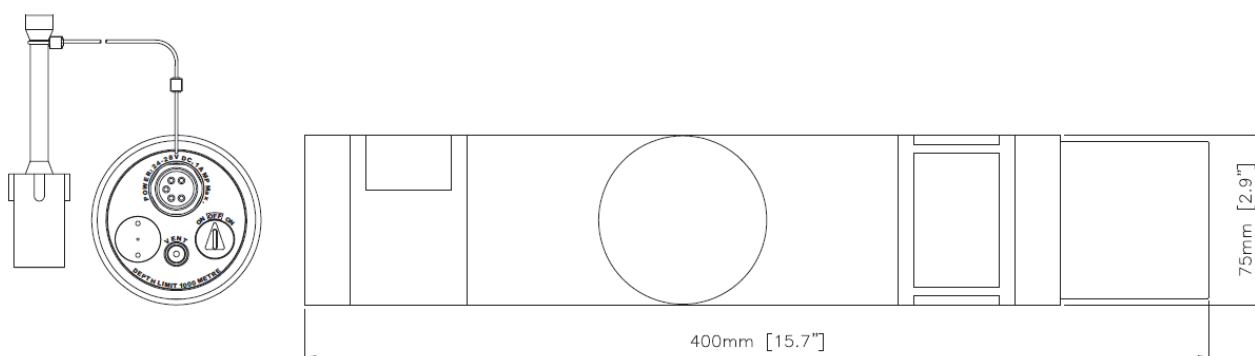


Figure 3-3 – Type 8271 Omni-Directional Wideband Sub-Mini 6G®



Figure 3-4 – Type 8271 Omni Directional Wideband Sub-Mini 6G® Outline Drawing



The connector end-cap shields the electrical charging socket and **ON/OFF** switch (refer to **Figure 3-5** and **Figure 3-6**). When not in use, the unit should be switched **OFF** to preserve battery charge. It should be noted, however, that Nickel Metal Hydride batteries do self-discharge over a number of weeks so the WSM6 should always be fully charged before use.

Figure 3-5 – Type 8270 Directional Wideband Sub-Mini 6G® End-Cap



Figure 3-6 – Type 8271 Omni Directional Wideband Sub-Mini 6G® End-cap

The connector on the end-cap, is a special Subconn Micro Connector (MCBH5M Type) (**Figure 3-7**) and operates with a standard in-line connector MCIL5F. It allows for a responder electrical trigger, RS232 communications to configure the unit, a battery charging input and a separate external dc power input.

Variations on the standard Type 8270 and 8271 are available. The Type 8270-000-07 WSM6 has a specific 8-pin connector (refer to **Section 3.5.2 - 8270-000-07 WSM6**), with the pin-out compatible with the Compatt 5 wiring; the Type 8270-000-11 WSM6 (refer to **Section 3.5.1 - 8270-000-11 WSM6**) has a specific 5-pin female connector.

A standard Subconn non-shorting blanking plug should be fitted when deployed if the connector on the unit is not being used.

Unless the unit is damaged or fails to function correctly after charging, there is no requirement to open the pressure housing. If access to the electronics or battery is required, this must be carried out by **qualified maintenance personnel**.

The WSM6 is designed to be operated in both transponder and responder modes. An electrical trigger input pin is provided on the external connector to enable operation in responder mode.

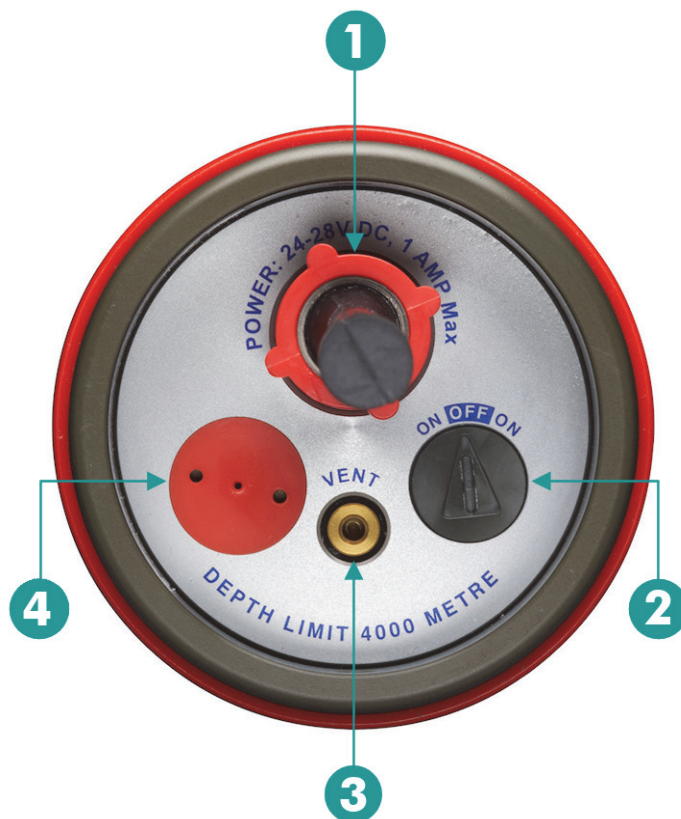
The main housing label contains the unit serial number which should be quoted in all correspondence with Sonardyne.

The acoustic command address and the interrogation channel are given on a separate housing label. These can be changed by software, via the RS232 link.

All HPR-300 channels, 01 to 09 plus 11, 22, 33, 44 and 55, are available, as well as all the HPR-400 channels. All Sonardyne navigation channels are also supported including the new wideband reply signals. A full table of frequencies for each valid navigation channel is given in **Appendix B - Frequency Tables**.

Acoustic commands are available to enable and disable the transponder and to switch on the depth reply.

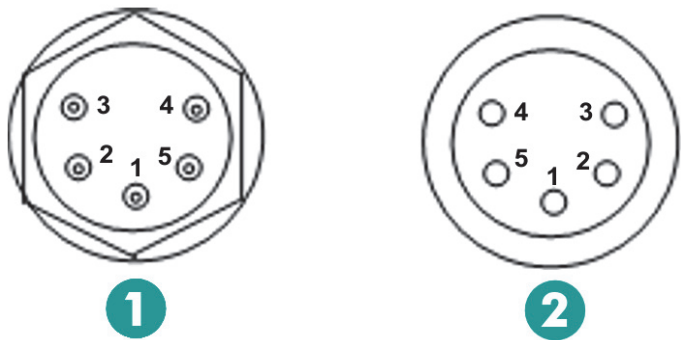
Figure 3-7 – Connector End-cap



- 1 5 way connector MCBH5M for Comms / charging
- 2 **ON/OFF** rotary switch

- 3 Pressure Relief Vent Valve
- 4 Depth Sensor cover plug

Figure 3-8 – Connector Pin numbering



1 Bulkhead male 2 Cable female

Pin number	Function	Colour
1	Trigger In / Comms In	Black
2	0V	White
3	Fast Charge / Comms out	Red
4	External Power 24V and trickle charge	Green
5	Not used	Orange

Refer to **Section 3.5.1 – 8270-000-11 WSM6**, and **Section 3.5.2 – 8270-000-07 WSM6** for wiring configurations for variant transponders.

3.2 WSM6

Sonardyne's WSM6 offers wideband navigation replies which are capable of significant improvements in ranging accuracy and repeatability, especially in responder mode. It also retains compatibility with existing "HPR" and LUSBL range-bearing acoustic navigation systems. The acoustic signal level transmitted by the Type 8270 is strongest on axis and useful over a 90 degree cone. It is usually mounted with the transducer pointing upwards - typically for marking small ROV's.

In circumstances where orientation in the general direction of the ship cannot be guaranteed, such as for longer ranges in shallow water, the omni-directional response of the Type 8271 Omni-directional Transponder is recommended. The Type 8271 has the same functionality as the 8270 Directional unit, but is generally only depth rated to 1000m where as the Directional unit is generally rated to 4000m, and has a lower transmit acoustic source level on axis but a wider omni-directional beam-pattern ($\pm 120^\circ$).

The WSM6 offers the following benefits to the user:

- High capacity Nickel Metal Hydride Rechargeable battery with 20 hour operating life at 1 pulse/second and rapid-charge capability by external connector.
- All "HPR-300" and "HPR-400" channels are supported.
- Sonardyne tone channels are available using shorter pulses, thus giving extended battery life.
- All Sonardyne wideband reply signals are supported giving better range accuracy and repeatability.
- External connector for "Responder" mode trigger, external power supply, charger and communications interface.
- Type 8270 in general has a 4000 metre depth rating.
- Type 8271 in general has a 1000 metre depth rating (dependent on depth sensor where fitted).
- Depth sensor option (no sensor on 8270 versions 8270-000-01, 8070-000-08 and 8271 versions 8271-000-01 and 8271-000-02).
- **ON/OFF** feature via external switch.
- Acoustic commands to enable and disable the transponder and to enable the Depth Data reply.
- Easy-to-use configuration software "WSM Terminal".

Figure 3-9 – Type 8271-000-07 1000m rated Omni-Directional WSM6 with connector for remote Transducer

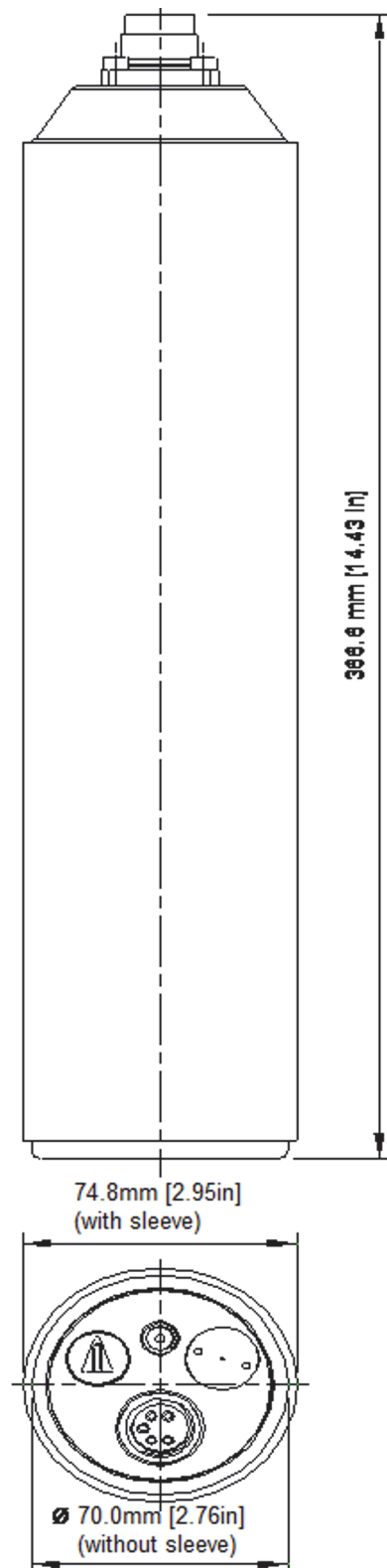
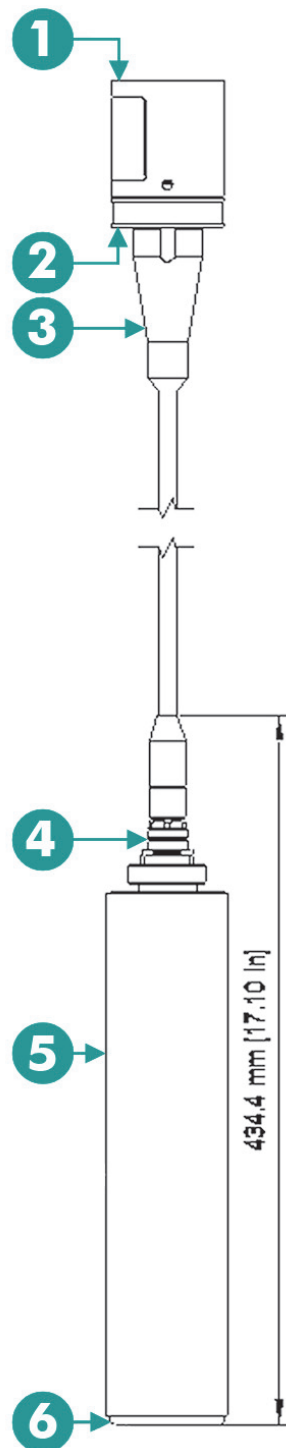


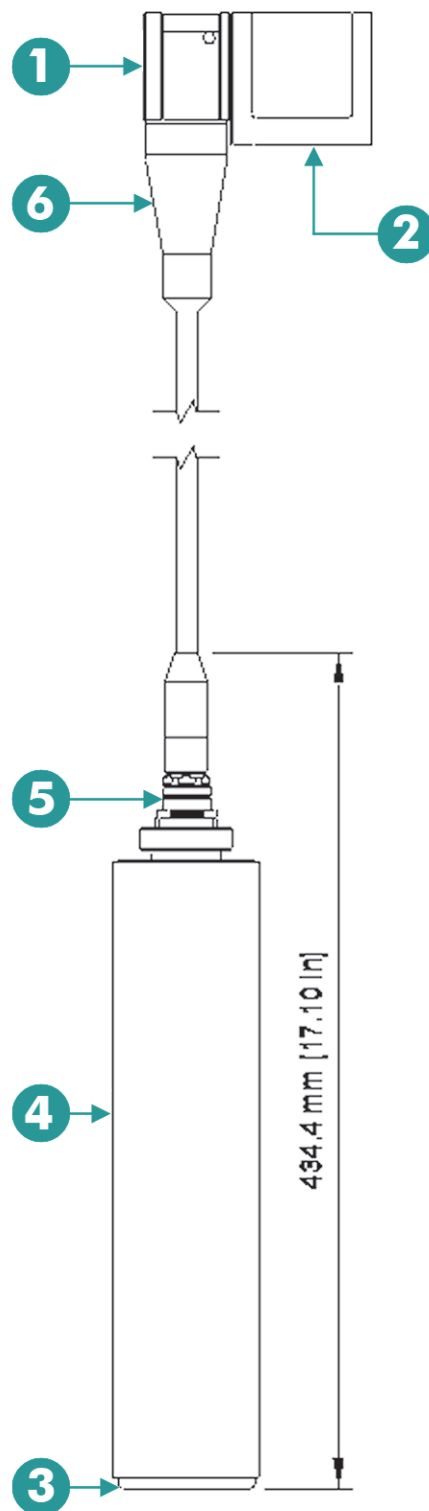
Figure 3-10 – Type 8271-000-07 – 1000M rated Omni-Directional WSM6 with straight remote Transducer



- 1 Transducer base PVC
- 2 Guard polypropylene
- 3 End-cap and housing anodised aluminium alloy

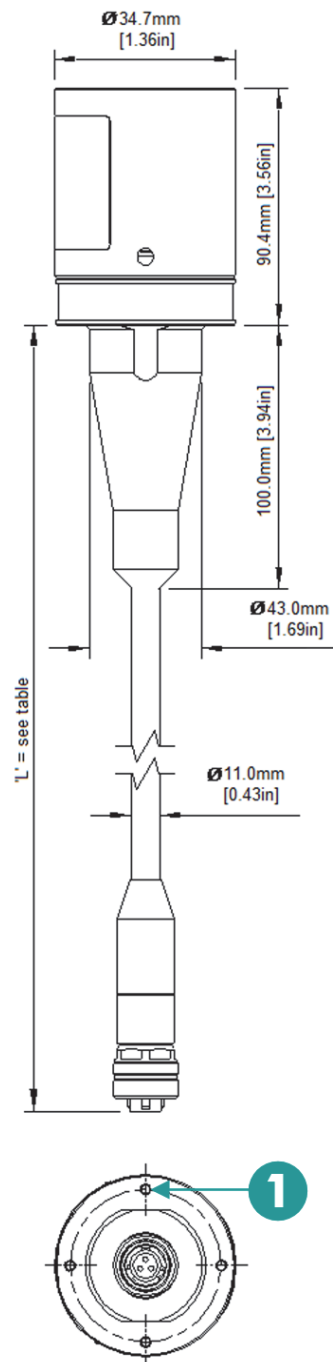
- 4 Unit covered with PVC sleeve
- 5 Connector aluminium bronze
- 6 Moulding polyurethane

Figure 3-11 – Type 8271-000-07 – 1000M Rated Omni-Directional WSM6 with right-angle remote Transducer



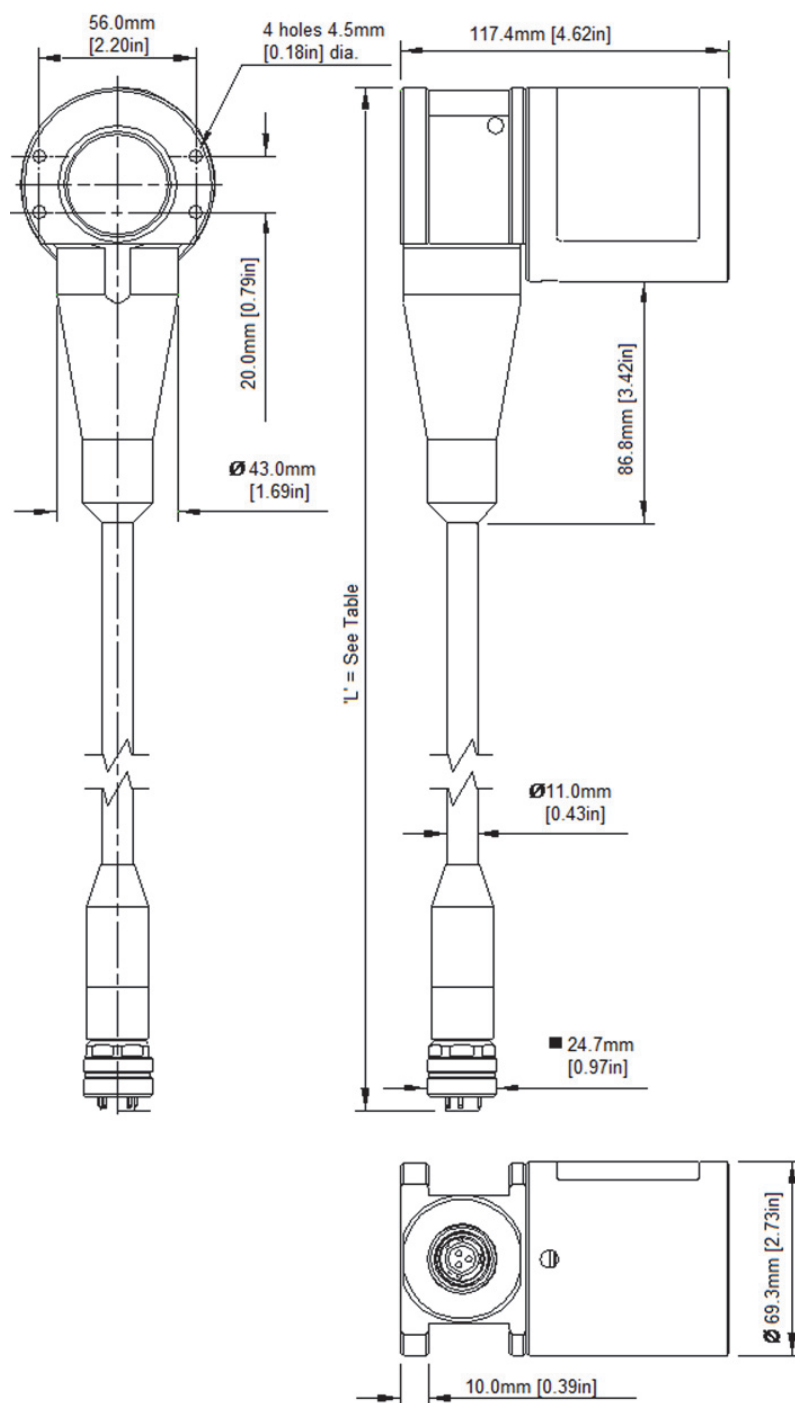
- 1 Transducer base PVC
- 2 Guard polypropylene
- 3 End-cap and housing anodised aluminium alloy

- 4 Unit covered with PVC sleeve
- 5 Connector aluminium bronze
- 6 Moulding polyurethane

Figure 3-12 – Type 8065-120-XM 1000m rated straight remote Transducer

- 1 4 holes M4 x15 deep, equi-spaced on a 58.0mm [2.28in] PCD (stainless steel inserts)

Tail Table (length L)	
0.6m	[2ft]
1.0m	[3ft]
2.0m	[6ft]
3.0m	[10ft]

Figure 3-13 – Type 8065-121-XM 1000m rated right-angle remote Transducer**Tail Table (length L)**

0.6m [2ft]
1.0m [3ft]
2.0m [6ft]
3.0m [10ft]

3.3 Configuration

The WSM6 is available in two different types; the 8270 Directional and the 8271 Omni-Directional. Configurations depend on the requirements.

Table 3-1 – Type 8270 WSM6 Configuration Table

Type Number	Transducer	Depth Rating	Depth Sensor	Note
8270-000-01	Directional	4000m	No	
8270-000-03	Directional	4000m	4000m	
8270-000-07	Directional	4000m	4000m	Female 8-way connector wired as Compatt 5
8270-000-08	Directional	4000m	No	External release voltage out
8270-000-11	Directional	4000m	4000m	Female 5-way connector

Table 3-2 – Type 8271 WSM6 Configuration Table

Type Number	Transducer	Depth Rating	Depth Sensor	Note
8271-000-01	Omni-Directional	1000m	No	
8271-000-02	Omni-Directional	4000m	No	Special order
8271-000-03	Omni-Directional	1000m	1000m	
8271-000-07	Omni-Directional	1000m	1000m	Remote Transducer

3.4 Battery Charging Description

The WSM6 is fitted with a 2000mAh Nickel Metal Hydride battery pack, which must only be charged with the Sonardyne Type 7972-000-04 comms/charger unit and matching charger PSU. Earlier types of transponder have different battery pack capacity, different rating A.C. power packs and different versions of charger, which are NOT compatible with the WSM6.

A flat battery will charge for approximately 4 to 6 hours at the full rate of 500mA, during which the red Fast Charge LED will illuminate. The charging current is applied to pin 3 of the external connector (zero volts is pin 2). This charge time is considerably longer than the one-hour charge of the SSM. This is due to the use of higher capacity NiMH cells in the WSM6, which cannot be charged at such a high rate as the lower capacity cells in the SSM.

The charging current is controlled by electronics inside the transponder. When the battery reaches a full charge the charging current is switched off, and the Fast Charge LED will switch off. However, the charger also permanently supplies External Power to the unit (28V, 85mA on pin 4) which will trickle charge the unit, and the yellow Trickle charge LED will illuminate. It is safe to leave the trickle charge connected indefinitely.

Special care must be taken if the battery has been allowed to become deeply discharged. In this state it is possible for some cells to drop to near-zero voltage or even reverse the voltage on their terminals. The WSM6 should always be switched off when not in use to minimise the chance of entering this deep discharge state.

Once a cell has become deeply discharged, its capacity is reduced. This has the effect of unbalancing the pack and therefore reduces the pack capacity. Usually the pack can be recovered by following the procedure below. If not, then recovery can only be achieved by removing the pack and subjecting it to several slow (200 mA) charge/discharge cycles. Even then the full capacity may not be recovered.

Charging a pack which has suffered deep discharge can result in some gas being discharged by the affected cells. If the pressure relief vent is found to be proud of its normal position, this may be an indication that one or more cells have gassed and the appropriate action should be taken to recover the battery pack as described above.

A Pressure Relief Vent Valve is provided to make sure there is no build-up of gas inside the transponder caused by the charging process. The battery manufacturer recommends the batteries are charged in an open environment. However, they also specify that no gas is vented by the batteries, providing the recommended charging procedures are followed. The WSM6 includes special circuitry to monitor the battery pack during charging. This safety feature makes sure the battery cannot be overcharged in normal use. For this reason it is not deemed necessary to remove the Pressure Relief Vent Valve during charging of a fully operational instrument.

Should there be any reason to suspect that there is pressure inside the unit, or that the charging circuitry may be faulty, it is recommended the Pressure Relief Vent Valve is extracted prior to charging. Use an M3 bolt to give purchase and carefully withdraw the vent plug.

Keep well clear of the transponder end-cap while withdrawing the vent and do not stand in line with the transponder axis. Toxic gasses or corrosive liquids may be forcibly expelled in the event of serious battery failure. There is a retaining device to prevent loss of the plug and later instruments are fitted with a spring to re-seal the vent once pressure has been released. Take care to avoid dirt contaminating the 'O' ring seals on the plug or entering the hole in the end-cap.

3.4.1 Fast Charging

The Fast Charge feature is controlled by electronics inside the transponder which monitors the voltage and temperature of the battery pack to decide when to stop charging. The parameters are first monitored some six minutes after connection so connecting the fast charger to a fully charged battery will allow the full charging current to flow for that length of time.

Repeatedly connecting the fast charger to a fully charged (or near fully charged) battery will reduce the life of the battery and may cause damage.

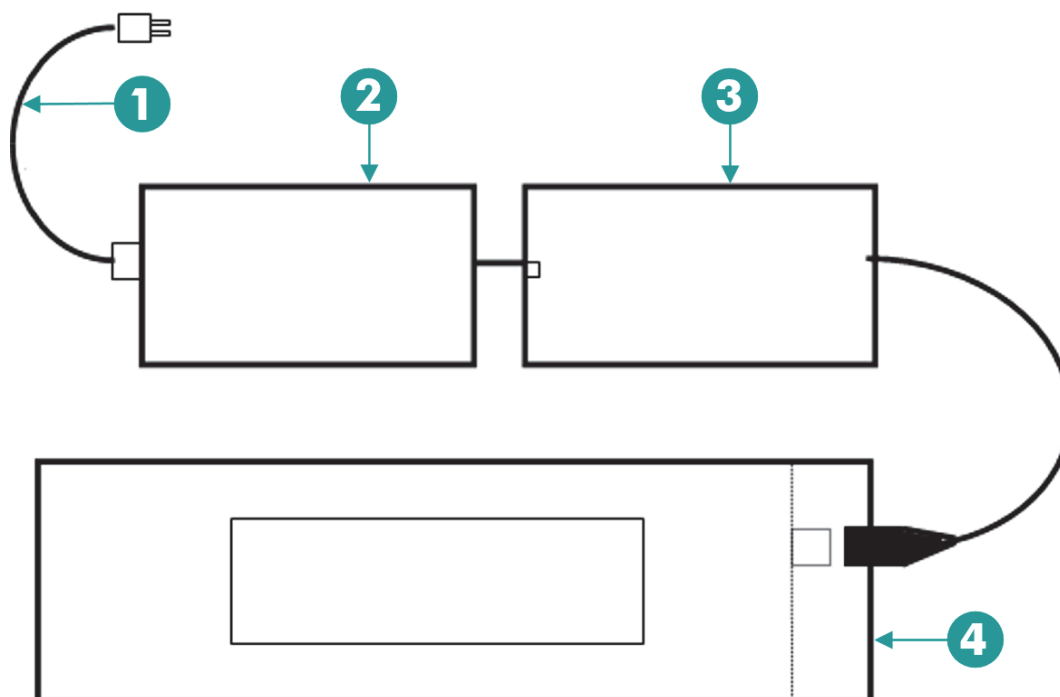
The charge control chip, within the transponder, will cut off charge current if:

- The rate of change of voltage with time indicates the pack is approaching full charge
- The temperature of the pack rises outside limits (10-40 °C)
- A time limit is exceeded (in the WSM6 case this is 6 hours)

The current during fast charging is limited by the WSM6 PSU, not by the WSM6 charger/comms unit. The WSM6 has a 2000 mAh battery but charging is only recommended at 500 mA. Faster charging is likely to affect the number of charge cycles that a pack will achieve in its lifetime.

If, in an emergency, it is necessary to charge the WSM6 by means other than the Type 7972-000-04 dedicated comms/charger unit, then the charge supply should be 24 V at 500 mA **constant current** for 4 hours maximum. Note that the charging time must be reduced if the battery pack has been charged recently. The charging current should be applied to pin 3 of the external connector with the return (zero volts) connected to pin 2.

Figure 3-14 – Charger Connections



- 1 AC cable option part numbers: UK 272-0345; US 272-036C; Euro 272-0352
2 WSM6 Charger PSU

- 3 WSM6 Charger/Comms
4 WSM6

Various components inside the transponder are designed to limit damage due to misconnection of the external signals. However, some damage to the electronic components may result. Under no circumstances should mains AC power be applied to the transponder.

3.4.2 Compatibility with SSM Chargers

The current during fast charging is limited by the WSM PSU, not by the WSM charger/comms unit. It is not recommended that the incorrect charger combination is used. However, if it is, it has been shown that there are no safety implications, but charging will not be complete.

The Type 7970 and 7973 SSM use a 1300 mAh battery which can be fast charged at 1.3 A. A fast charge time limit is set to 60 minutes.

If a WSM charger is used to charge a SSM, the current will only be 500 mA and the SSM will cut off fast charge after 1 hour, so full charge will not be attained if the SSM was more than one third below full capacity.

If a SSM charger is used to charge a WSM6, the current will be higher than recommended. Depending on ambient temperature, the charging process may be curtailed early if the pack temperature rises above limit. Repeated excessive fast charging will affect the capacity of the battery pack and the number of charge cycles it will support in its lifetime.

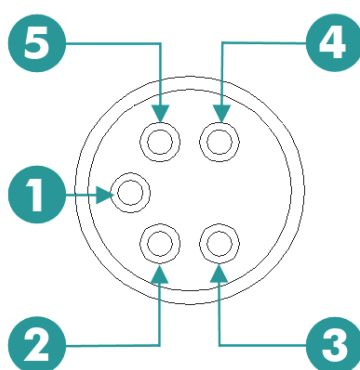
3.5 Variants

3.5.1 8270-000-11 WSM6

The 8270-000-11 is a special version of the WSM6 which uses a 5-pin Subconn female bulkhead connector. The performance and behaviour is exactly the same as the 5-pin 8270-000-01 4000m Directional WSM6.

A male-to-male adaptor cable (part number 8070-053-01) is supplied to permit the standard charger and accessories to be used.

Figure 3-15 – 8270-000-11 connector pin-out



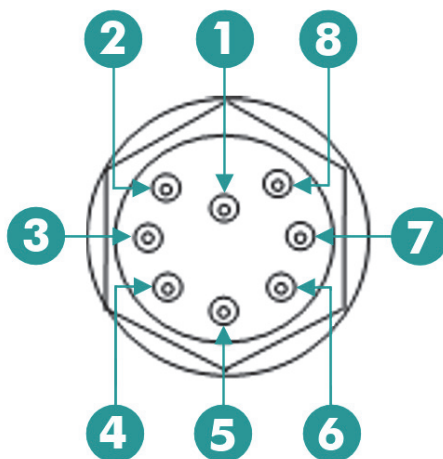
Pin Number	Function	Colour
1	Trigger In / RS232 from PC	Black
2	0V	White
3	Fast Charger / RS232 to PC	Red
4	External Power 24V and trickle charge	Green
5	Not used	Blue

3.5.2 8270-000-07 WSM6

The 8270-000-07 is a special version of the WSM6 and uses an 8-pin Subconn female bulkhead connector. The performance and behaviour is exactly the same as the 5-pin 8271-000-01 Omni-Directional 1000m WSM6.

The pin out is compatible with the Compatt 5 wiring.

Figure 3-16 – 8270-000-07 connector pin-out



Pin Number	Function	Colour	Connection
1	RS232 from PC	Black	Comms in
2	0V	White	0V Common
3	RS232 to PC / Fast Charge	Red	Comms Out/Fast Charge
4	External Power 24V and trickle charge	Green	External 28V dc power
5	Not used	Orange	Not connected
6	Trigger In	Blue	Trigger In
7	Not Used	Wh/Blk	Not connected
8	Not Used	Red/Blk	Not connected

Spares and accessories are available for the Type 8270-000-07 – Wideband Sub-Mini 6 Directional 4000m, (refer to **Section 10 - Type 8270-000-07 Wideband Sub-Mini 6G Directional 4000m 8-pin**) and for the Type 8270-000-11 – Wideband Sub-Mini 6 Directional 4000m (refer to **Section 10 – Spares Type 8270-000-11 – Wideband Sub-Mini Directional 6G 4000m, 5-pin Female**).

SECTION 4 – INSTALLATION

4. Pre-Use Checks

Before installation, checks are carried out to make sure the WSM6 is serviceable and ready for use. These checks are:

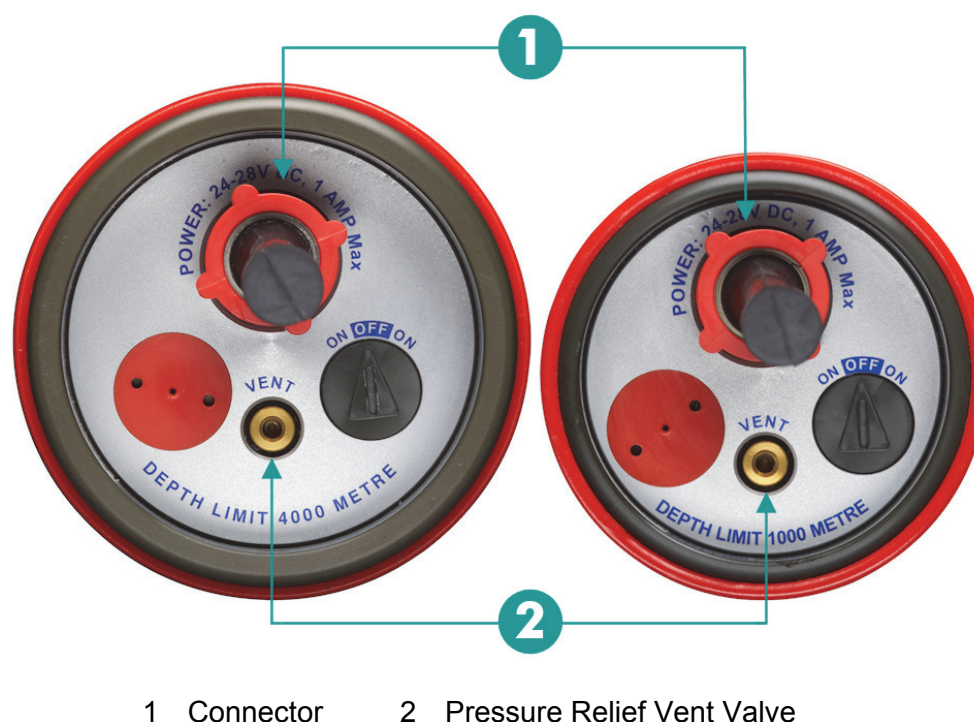
- Check the Pressure Relief Vent Valve (refer to **Section 4.1**)
- Charge the Battery (refer to **Section 4.2**)

4.1 Check the Pressure Relief Vent Valve

A Pressure Relief Vent Valve is provided to reduce the build up of gas inside the WSM6 caused by the battery charging process.

Check the Pressure Relief Vent Valve is flush with the end-cap. If the Pressure Relief Vent Valve is not flush it could indicate a pressure build-up during previous operations due to a fault developing in the battery pack.

Figure 4-1 – WSM6 Pressure Relief Vent Valve and Connector location



The unit must be investigated by a qualified service engineer and should not be deployed. It is recommended the Pressure Relief Vent Valve is extracted prior to charging the battery.

To operate the vent valve:

WARNINGS

 **Do not stand directly inline with the WSM6 end-cap. Toxic gases or corrosive liquids may be forcibly expelled due to serious battery failure.**

1. Screw an M4 bolt into the Pressure Relief Vent Valve.
2. Slowly pull the M3 bolt to withdraw the vent valve.

4.2 Charge the Battery

The standard WSM6 is fitted with Nickel Metal Hydride rechargeable battery. The Type 7972-000-04 Charger will charge the batteries in approximately 4 hours.

The WSM6 includes special circuitry to monitor the battery pack during charging. This safety feature makes sure the battery cannot be over-charged in normal use.

The WSM6 should always be switched off when not in use to minimise entering into a deep discharge state. In this state it is possible for some cells to drop to near zero voltage or even reverse the voltage of their terminals.

There are four states of charge for the battery, each requiring different charging methods.

For a battery that is partially discharged proceed with the charging instructions in this section. For any other charge condition of the battery refer to **Section 6.3 - WSM6 Battery Charging Procedure**.

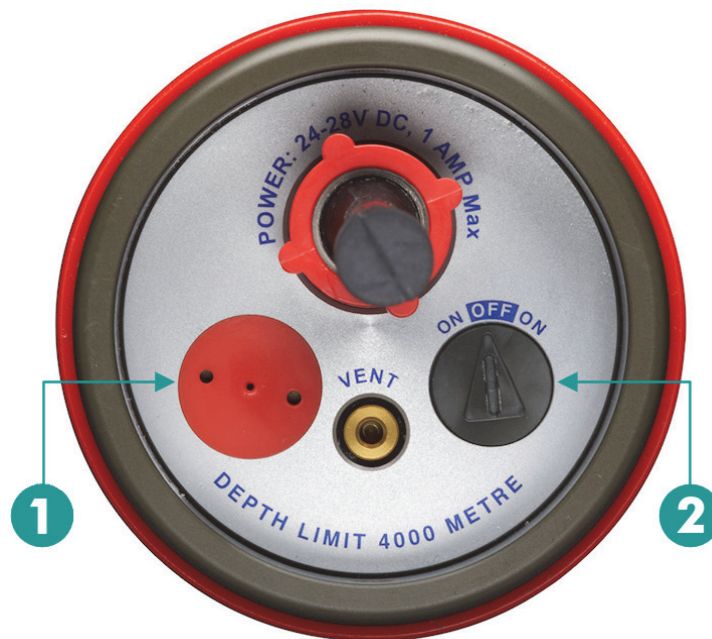
To charge the battery:

CAUTION

 **The WSM6 battery pack must only be charged using the Sonardyne Type 7972-000-04 comms/charger unit and matching charger PSU.**

1. Operate the Pressure Relief Vent Valve – refer to **Section 4.1 - Check the Pressure Relief Vent Valve**.
2. Check the ambient temperature is between 10 and 40°C. The battery will not accept charge outside these limits.
3. Check the WSM6 ON/OFF switch is set to OFF (refer to **Figure 4-2**, item 2)
4. Unscrew and remove the protective cap from the Connector End-Cap connection point.
5. Connect the Type 7972-000-04 WSM6 comms/charger to the WSM charger PSU using a 2.1mm power socket. The PSU accepts a standard IEC power lead.

Figure 4-2 – WSM6 ON/OFF switch



1 Depth Sensor 2 ON/OFF Switch

CAUTION

Do not allow the WSM6 to be cooled or heated during the charging process.

6. Observe the initial 10 minutes of charging operation to determine the state of charge of the battery. If necessary refer to **Section 6.3 - WSM6 Battery Charging Procedure**.
 7. If the battery is partially discharged, the red and yellow LEDs will both flash for about 2-3 minutes. The red Fast Charge LED will then come on for up to 6 hours.
 8. When the battery reaches full charge, the red Fast Charge Led will go out and the yellow Trickle Charge LED will illuminate. The trickle charge may be left connected.
 9. To finish the charge process, remove the AC power from the Charger.
 10. Check the pressure relief vent valve is flush with the housing.
-

CAUTIONS

Do not switch on the WSM6 until at least 10 minutes has lapsed following disconnection of the WSM6 Charger PSU.



Do not reconnect AC power until the battery has been used or left standing for at least 24 hours.



Do not reconnect the Fast Charger to the WSM6 if the battery is fully charged.

11. The WSM6 is now ready to be used.

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SECTION 5 – OPERATION

5. Operational Modes

The Wideband Sub-Mini 6 (WSM6) is capable of two modes of operation, and may be powered either internally or externally:

- **Transponder Mode** – triggered (interrogated) by an acoustic signal
- **Responder Mode** – triggered by an electrical signal via the external connector

The Responder Mode is recommended for the following operational scenarios:

- On acoustically noisy ROV's
- Whenever an electrical trigger signal is available via an umbilical from the ship's HPR or LUSBL unit.
- When tracking from a USBL at $< 20^\circ$ from the horizon

The normal operational state is achieved with the appropriate channel selected via RS232 and the ON/OFF switch operated on the connector end-cap.

For each serial input device or output port required top side the LCH can provide a variety of configurable serial settings such as:

- Baud rates from 50 to 921,600
- RS-232, RS-422, RS-485 Half Duplex or RS-485 Full Duplex
- Data bits, Stop bits, parity, flow control and FIFO

5.1 Transponder Mode

The Transponder Mode is interrogated by an acoustic input. If there is not external power connection, the connector must be fitted with the dummy plug to protect the connector pins and switched to **ON**.

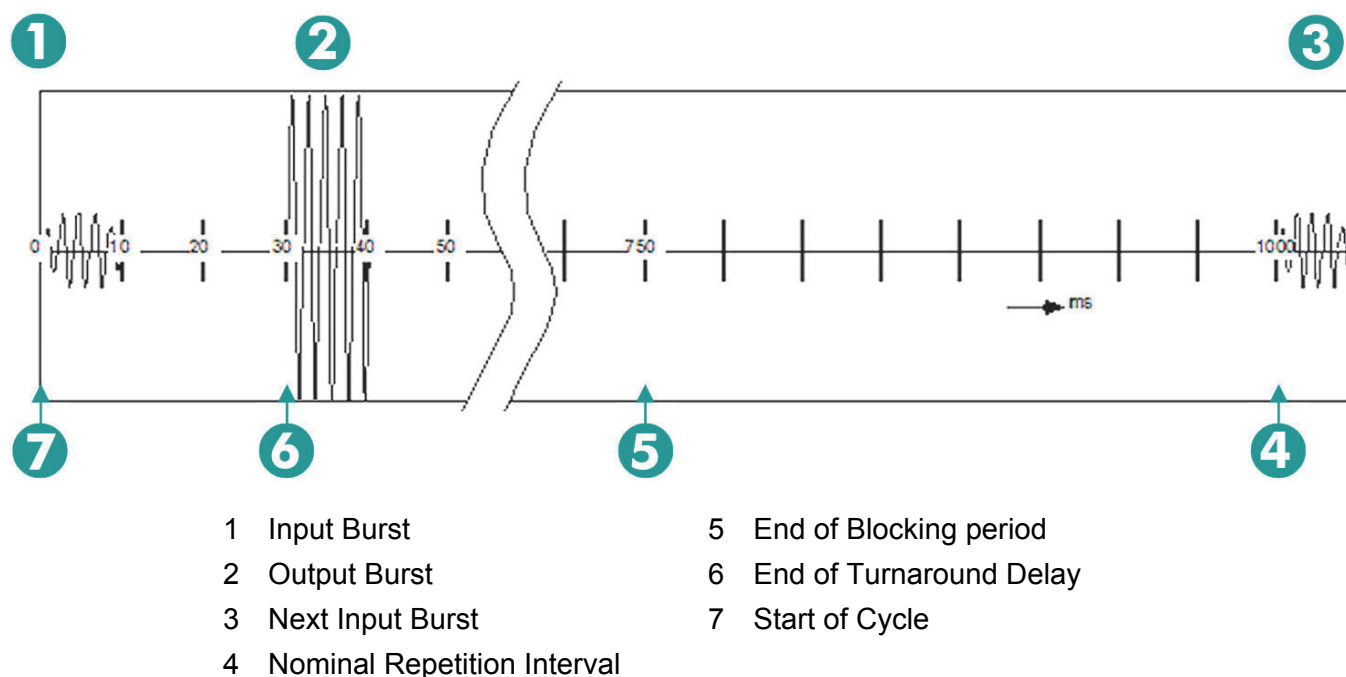
When set to HPR series 300 channel, the transponder will respond 30 milliseconds after recognising an incoming acoustic burst of the selected frequency and of sufficient magnitude/duration. If the ambient noise level is too great for the interrogation signals to be heard, the WSM6 may not reply to interrogations or may reply erratically.

In Sonardyne Tone configuration, a single interrogation tone pulse will trigger a tone reply after the selected 'Turn around Time'.

In Sonardyne Wideband configuration, a single interrogation tone pulse will trigger a wideband reply after the selected 'Turn around Time'.

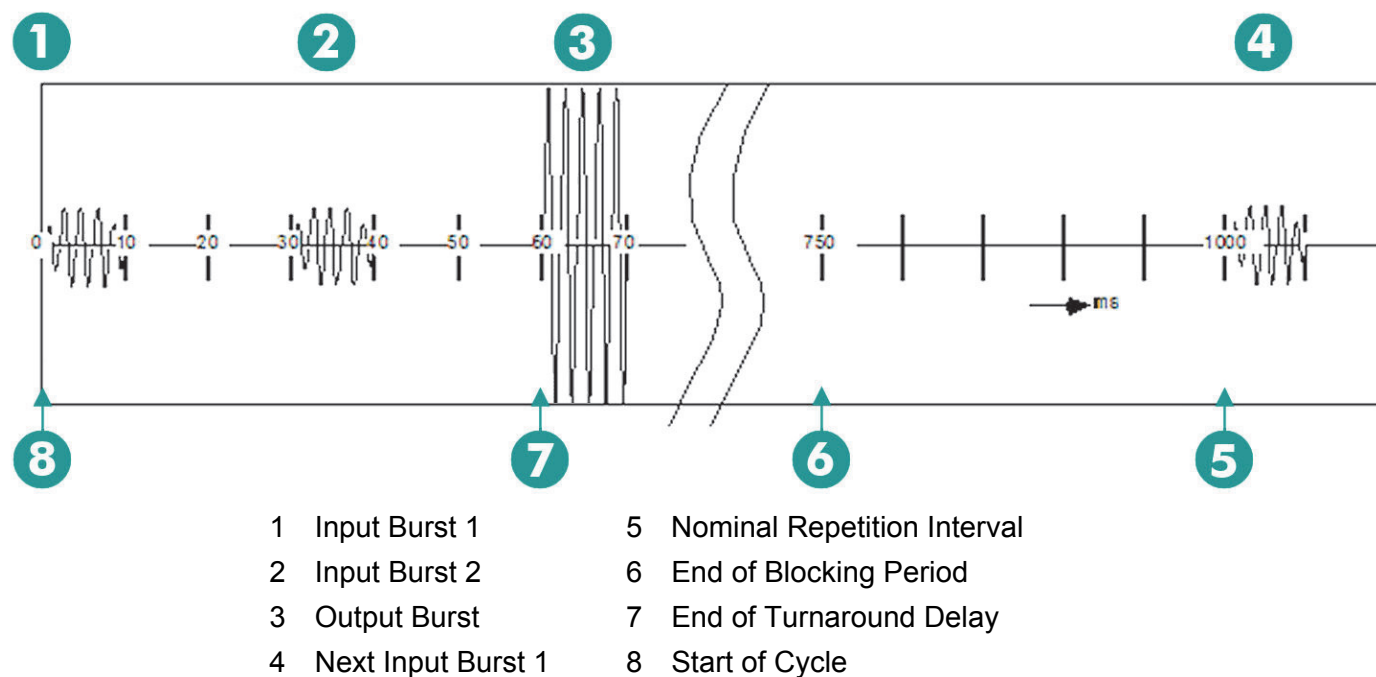
HPR Series 300 systems send a single interrogation signal.

Figure 5-1 – Overall Acoustic Sequence HPR – 300 Series Channels



HPR Series 400 systems use a coded sequence of two interrogation pulses, separated in time by 30 ms. The reply pulse starts 60 ms from the start of the first interrogation pulse.

Figure 5-2 – Overall Acoustic Sequence HPR – 400 Series Channels

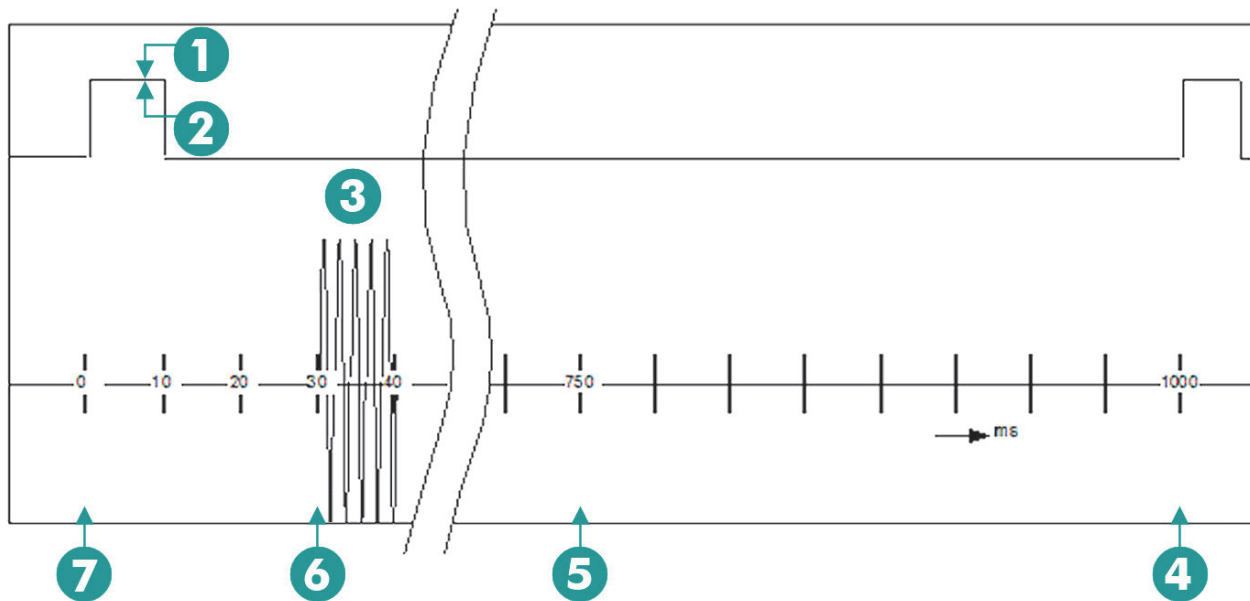


5.2 Responder Mode

In this mode, the transponder is triggered to transmit on the configured reply signal by an electrical trigger signal applied to the external connector. Following the reply, the transponder will be inhibited from responding to acoustic interrogations for the blocking period, after which it will respond to either acoustic or electrical triggers.

The trigger pulse waveform is a positive going pulse with a pulse width between 3 and 25 ms and voltage levels between 4 V minimum and 24 V.

Figure 5-3 – HPR Responder Sequence



- | | |
|-------------------------------|------------------------------------|
| 1 3ms minimum width | 5 End of Blocking Period (nominal) |
| 2 +4V minimum trigger | 6 End of Turnaround Delay |
| 3 Output Burst | 7 Start of Cycle |
| 4 Nominal Repetition Interval | |

5.3 Preparing the WSM6 for Service

5.3.1 Check the Pressure Relief Vent Valve

Check the Pressure Relief Vent Valve is flush with the end-cap. If not, it could indicate a pressure build-up during previous operations due to a fault developing in the battery pack. The unit should be investigated by qualified service personnel and should not be deployed.

5.3.2 Charge the Battery

The WSM6 transponder is fitted with **Nickel Metal Hydride** batteries. The Type 7972-000-04 Charger charges the battery in approximately 4 hours. Refer to **Section 6.3 - WSM6 Battery Charging Procedure** for full details of the charging procedure and important safety.

CAUTIONS



Wait at least 10 minutes before switching the unit on.



Do not re-connect AC power until the battery has been used or left standing for at least 24 hours.

Remove the AC power from the Charger to terminate the charging process.

5.3.3 Set the Interrogation Channel and Command Address

Switch the WSM6 **ON** by rotating the **ON/OFF** switch on the connector end-cap. **Do not force the switch to rotate.**

The **Interrogate** and **Reply** signals are set via the serial comms link, as is the acoustic command address. Connect the Charger / comms Interface to a PC and run the **WSM Terminal** test program (refer to **Section 7.3- WSM Terminal Test Software**).

It is advisable to mark the command Address and Interrogation channel on the outside of the unit if either is changed from the factory set values.

5.3.4 Transmission Power Level

The transmitter power level is factory set to High Power.

Two levels are available, selected via the **WSM Terminal Software** package (refer to **Section 7.3- WSM Terminal Test Software**). High power will normally be selected when operating using ROV power. If a long duration operation is required while running on internal battery power, the low power setting may be selected, providing the unit is not operating at the limit of the range capability. In shallow or enclosed water operations low power may be an advantage to reduce acoustic reverberation.

5.3.5 Receiver Gain Level

The receiver gain is factory set to High Gain.

Two levels are available, selected via the WSM Terminal software, refer to **Section 7.3- WSM Terminal Test Software**. High gain will normally be selected when operating at long range. Low gain is recommended when operating at relatively short range, or as a transponder in a high noise-level environment.

5.3.6 Enable Depth Telemetry

Check and record the Firmware Version fitted and check the Depth Telemetry facility is enabled or disabled as required. Note the depth sensor is an option, and may not be fitted.

If changing the Depth **ON/OFF** status, the transponder must be switched **OFF** and **ON** again for the change to take place. Alternatively, wait up to 2 minutes for the Watchdog Interrupt to apply the new depth status.

The **WSM Terminal** software, described in **Section 7.3- WSM Terminal Test Software**, allows the operator to change the scaling of the depth telemetry transmissions, but non-standard scaling must be supported by the whole system.

The default settings are:

- HPR-300 channels: 0.5 ms / m
- HPR-400 channels: 1.0 ms / m (indicated as Gain = 0.3)

5.3.7 Location on ROV

The unit should be positioned in an upright attitude, with the transducer end-cap uppermost, pointing towards the sea surface. If clamped to a metal structure, rubber should be used to isolate the transponder from the structure both electrically (to prevent corrosion) and mechanically (to damp conducted acoustic noise). Pin-out of the transponder connector is shown in **Figure 3-8 – Connector Pin numbering**.

The WSM6 has a red plastic sleeve around the transponder to provide both electrical and some mechanical isolation.

As the Type 8270 transducer has a Directional beam pattern, it can be located with the face of the transducer flush or slightly below the level of the ROV's syntactic foam buoyancy. This will serve to protect the transponder in the event of accidental collisions during ROV operations.

The Type 8271 transducer has an Omni Directional beam pattern, therefore it must be located with the transducer above the level of the ROV's syntactic foam buoyancy.

5.3.8 Switch ON and Electrical Connections

Make sure the transponder is switched **ON**.

The external connector **must be covered** while the transponder is submerged, either by the protective dummy plug (part no. 641-2141) or by the free plug of an external power cable (see below).

If the unit is to operate in "Responder" mode or with external power, a 5-pin free socket with appropriate wiring (e.g. 5m tail, Part No. 820-5163, see **Figure 3-8**) must be mated with the external connector. The **TRIGGER** pin and **COMMON** must be connected via an umbilical to the **HPR** or **USBL** system on the vessel

5.3.9 Test the Transponder

Test the transponder by interrogating with a test unit such as the Sonardyne ANT (Acoustic Navigation Tester) as described in **Section 7.10 - Programming the Acoustic Navigation Tester (ANT)**. When operating with external power, also test the emergency transponder mode by switching off the external supply, if possible. The transponder should revert to its internal battery supply and should continue to reply to interrogations or to electrical Responder trigger signals.

If the unit has been set up for Wideband replies, then only a suitable Wideband Interrogator can be used to fully test the WSM6. Refer to **Section 5.3.13**.

NOTE



Wideband operation uses exactly the same hardware circuitry as tone operation, so if a unit has been checked out to work on an HPR400 channel, it will have validated the performance of the hardware.

5.3.10 After Use

After in-water operations, the unit should be thoroughly soaked in warm fresh water, to dissolve salt and wash off sand or silt, especially around the ON/OFF switch and the external connector. The cable or dummy plug can be removed to wash the external socket. When dry, lubricate the connector with a light coating of lubricant refer to **Section 6.6 - Lubrication**.

Switch **OFF** before charging or storing.

If the unit is believed to be serviceable, it should not require any attention apart from charging and washing, and should therefore not be dismantled.

5.3.11 Acoustic Command Functions

The 'Command' concept refers to the remote control of the operating modes of a transponder by coded acoustic signals, generally transmitted from a Sonardyne transceiver operated from a surface vessel. The basic applications are to '**ENABLE**' and '**DISABLE**' the transponder. The essential requirement is high security with a very low probability of false actuation. The traditional technique is a pulse position code using three tone bursts of different frequencies. The three pulses uniquely define the address of the commanded WSM6, and the command function to be executed. The command address of the unit is a three or four digit number that is set using the test software and a serial link cable. Refer to **Section 7.4.2 - General Status**

The first two digits of the address are known as the command code. The preferred range is 33 to 47.

The Wideband Sub-Mini can accept acoustic commands from the following transceivers:-

- 7663 MF LCU with firmware 4.00 or greater,
- 7574 MF Directional LCU with firmware 4.00 or greater
- 8010 MF RovNav 5 with firmware V7.0 or greater
- 8021/3 Digital USBL with firmware V7.0 or greater

The Wideband Sub-Mini can accept acoustic commands from the following test units:-

- 7343 ANT with firmware V2.25 or greater,
- 8063 Deck test Unit (DTU).

The Wideband Sub-Mini cannot accept acoustic commands from the following transceivers unless the first two digits of the address are changed to be in the range 01 to 15:-

- Type 7145 PAN transceivers.
- Type 7807 MF Mk4RovNav
- Type 7842 MF Mini RovNav
- Type 7769 analogue USBL

The WSM can be set by acoustic command into one of three separate reply modes.

- Interrogation replies **ENABLED** - command “**PEN**” - each valid interrogation results in a single pulse reply as configured by the **WSM Terminal** PC software.
- Interrogation Depth replies **ENABLED** - Command “**PDE**” - each valid interrogation results in a two pulse reply as configured by the **WSM Terminal** PC software. The second pulse carries the encoded depth information.
- Interrogation replies **DISABLED** - Command “**PDS**” - unit will not reply to any interrogations.

WSM command	Equivalent Compatt or ANT command	Command function
PEN	EN	Enable
PDE	TC	Depth Enable
PDS	DS	Disable

5.3.12 Interrogators

Various transceiver units are capable of interrogating WSM6s, including all HPR 300, 400 and HiPAP® systems. Only Sonardyne MF transceiver systems can be used to send acoustic commands to WSMs. Only Sonardyne Digital USBL or RovNav 5 transceivers can be used with wideband reply signals from the WSM.

A Sonardyne Type 7343 Acoustic Navigation Test unit (ANT) can be used to interrogate WSM6s and also send commands, but is only designed for pre-deployment testing and fault diagnosis. To command a WSM6, the ANT firmware must be V2.25 or later. To interrogate a unit the command HInn is used where nn is the HPR300 or HPR400 channel number.

The 7574 MF Directional LCU and 7663 MF Omni-directional LCU may be used to command the unit and as a range-only interrogator provided the unit channel is set to a HPR300 channel. Interrogate command HInn where nn is 1 – 9 for HPR 1 – 9 and 10 for Square(11), 11 for Circle(22), 12 for Delta(33), 13 for X(44) and 14 for Y(55).

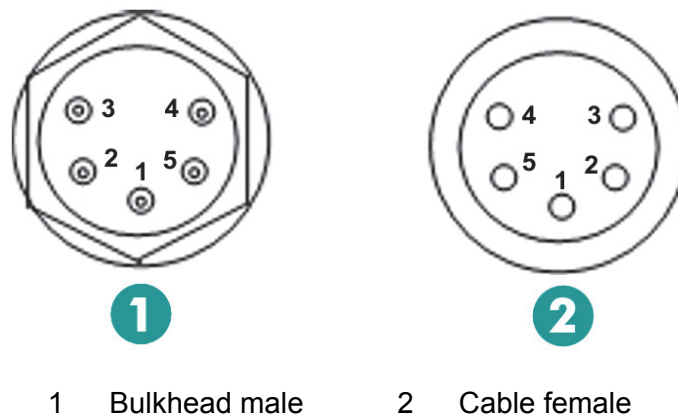
5.3.13 Wideband Interrogators

A Type 8010 MF RovNav 5 may be used to command and interrogate the unit, including wideband ranging. The RovNav 5 must be fitted with firmware V8.0 or greater to use Wideband ranging.

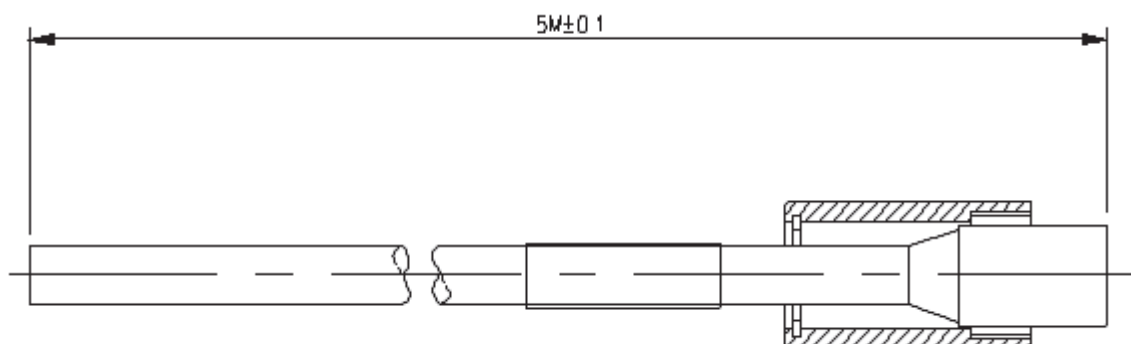
A Type 8021 or 8023 Digital USBL/LUSBL system has HPR 300 and HPR 400 navigation processing capability and therefore provides range and direction to the unit as well as being able to command the unit. The Digital USBL/LUSBL must be fitted with firmware V8.0 or greater to use wideband ranging.

Each Individual wideband reply (IRS) generated when the high order address codes are used (for improved command security) maps to the same IRS when the low order address codes are used. The high order codes are incremented on the lower order codes by 32, e.g code 1 maps to code 33 thus address 101 uses the same IRS address 3301, hence over-layed IRS's must be avoided.

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Figure 5-4 – Connector Pin-Out and Mating Tail

Pin number	Function	Colour
1	Trigger In / Comms In	Black
2	0V	White
3	Fast Charge / Comms out	Red
4	External Power 24V and trickle charge	Green
5	Not used	Orange

Figure 5-5 – Mating In-line female connector (Part No. 820-5163)

Refer to **Section 3.5.1– 8270-000-11 WSM6**, and **Section 3.5.2 – 8270-000-07 WSM6** for wiring configurations for variant transponders.

5.4 Wideband Sub-Mini 6 – Pre-Deployment Checklist

Table 5-1 – Wideband Sub-Mini 6 – Pre-Deployment Checklist

Type Number:	807...	Serial Number:	
Channel:	Address:	Firmware Version:	
Date:		Tested By:	

	Test	Tick / Comment
5.3.1	Check the Pressure Relief Vent Valve	
5.3.2	Charge the Battery	
5.3.3	Set the Interrogation Channel and Command Address	
5.3.4	Transmission Power Level (Hi / Lo)	
5.3.5	Receiver Gain Level (Hi / Lo)	
5.3.6	Enable Depth Telemetry (On / Off)	
5.3.7	Location on ROV	
5.3.8	Switch ON and Electrical Connections	
5.3.9	Test the Transponder	
	Test on battery power: Responder Operation	
	Test on external power: Responder Operation	

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SECTION 6 – MAINTENANCE & MONITORING

6. Maintenance

Before any maintenance activity is carried out make sure all warnings and cautions in **Section 2 – Safety** are read, and the Safety Manual is fully read and understood.

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

6.1 General Maintenance

On retrieval of the WSM6, from operations, it must be switched off at the **ON/OFF** switch. It must then be thoroughly soaked in fresh warm water to remove all accumulations of salt, sand and silt. Once clean, the WSM6 must be thoroughly dried with a lint free cloth and inspected for any external damage. When completely dry, the connector can be lubricated, refer to **Section 6.6** for details on the lubrication process.

Before any maintenance activity or storing the WSM6 must be recharged, refer to **Section 6.3** for the **WSM6 Battery Charging Procedure**.

6.2 Inspection

Before any maintenance activity is carried out on the WSM6 make sure all Warnings, Cautions, **Section 2– Safety** and the Safety Manual are read and fully understood.

Inspect the WSM6 for the following:

1. Inspect the Pressure Relief Vent Valve. If it is proud of the end-cap surface it is possible the battery has developed a fault, or has been damaged by water ingress causing the production of gas inside the transponder.
2. Inspect the anodised surface of the housing for signs of corrosion or damage. When in full working depth, the transponder housing is at risk of failure if corrosion or damage is not removed or the housing replaced.
3. Inspect the connectors for signs of damage or corrosion.
4. Check the security of the connector by fitting the locking sleeve from the mating half of the connector, and check for movement. Any movement will require attention and the connector to be secured.
5. Inspect the jointing faces of the end-caps and the main housings. Signs of corrosion indicate leakage of water into the transponder.

6.3 WSM6 Battery Charging Procedure

1. Check the temperature is between 10 and 40 degrees Celsius. The battery will not accept charge outside these limits.
2. Check the transponder **ON/OFF** switch is set to **OFF**.

3. Connect the Type 7972-000-04 WSM comms/charger to the WSM6 charger PSU via a 2.1mm power socket. The PSU accepts a standard IEC power lead, and UK, US and European plugs are supplied with new product.
4. It is important to observe the charger during the first 10 minutes of operation, as the method depends on the state of charge of the battery.
 - a. If the battery is partially discharged, the red and yellow LEDs will both flash for about 2-3 minutes, then just the red Fast charge LED will come on, for up to 6 hours.
 - b. If the battery is already fully charged, the yellow Trickle charge LED will come on for a few seconds, go off, then the red fast charge LED will come on for up to one hour. Finally the red LED will go out and the yellow trickle charge LED will come on again.
 - c. If the battery is fully discharged, the red and yellow LEDs will both flash for about 6 minutes, then just the yellow Trickle LED will stay on. Leave on Trickle charge for about 5 minutes, then disconnect, leave for another 5 minutes, then restart. The red Fast charge LED should now come on, as in the partially discharged case.
 - d. If the battery is deeply discharged, the red and yellow LEDs will both flash for about 6 minutes, then just the yellow Trickle LED will stay on. Leave on Trickle charge for about 20 minutes, then disconnect the charger, wait another 5 minutes, then restart. This time the red and yellow LEDs will both flash for about 2-3 minutes, then just the red Fast charge LED will stay on for about 6 hours.
5. When the battery reaches full charge, the red Fast Charge LED will go out and the yellow Trickle Charge LED will illuminate. The trickle charge may be left connected indefinitely.
6. Remove the AC power from the Charger to terminate the charging process. **Wait at least 10 minutes before switching the unit on.**
7. Do not re-connect AC power until the battery has been used or left standing for at least 24 hours.
8. Check that the pressure relief vent is fully home (Red version is sub flush, Gold version is flush with the end-cap face).

6.4 Corrosion removal

Cases of slight corrosion found on the transponder housing can be treated effectively. Before proceeding make sure the WSM6 is thoroughly clean and dry.

1. Clean the corroded area with a degreaser.
2. Treat with Alocrom for 2 minutes, or until the aluminium goes golden brown.
3. Wash off with clean fresh water and dry thoroughly.
4. Make sure the area is completely dry then cover the exposed metal with 2 part epoxy.

6.5 Dismantling

WARNINGS

 High voltages are present inside the WSM6, make sure the WSM6 is switched OFF. Only trained personnel should carry out any maintenance activity.

 High pressure hazard risk when dismantling sub-sea equipment. Only trained personnel should dismantle this equipment.

 Do not stand in direct line with the end of the WSM6 when operating the Pressure Relief Vent Valve. Sudden release of high pressure gases from the WSM6 could cause injury to personnel. Wear Personal Protective Equipment such as goggles when operating the Pressure Relief Vent Valve.

 Make sure the work environment is well ventilated. Toxic gases may be released from the WSM6 when operating the Pressure Relief Vent Valve.

Dismantling of the WSM6 must only be carried out by trained maintenance personnel.

1. Make sure the WSM6 **ON/OFF** switch is in the **OFF** position.
 2. Make sure no cables are connected to the WSM6.
 3. Check the Pressure Relief Vent Valve is not proud of the end-cap surface.
 4. Remove the plastic sleeve from the WSM6 housing. If it is necessary – but not recommended - to cut the sleeve, take great care not to damage the housing.
-

NOTE

 Liquid detergent may be used as a lubricant to assist in removal of the sleeve.

5. Inspect the end-cap and housing for signs of a gap. This could indicate possible internal pressure build up.
 6. Screw an M4 bolt into the tapped hole of the Pressure Relief Vent Valve.
-

WARNING

 Do not stand directly inline with the WSM6 connector end-cap when operating the Pressure Relief Vent Valve. Toxic gases or corrosive liquids may be forcibly expelled due to serious battery failure.

7. Standing to the side of the WSM6, carefully pull out the Pressure Relief Vent Valve from the WSM6.

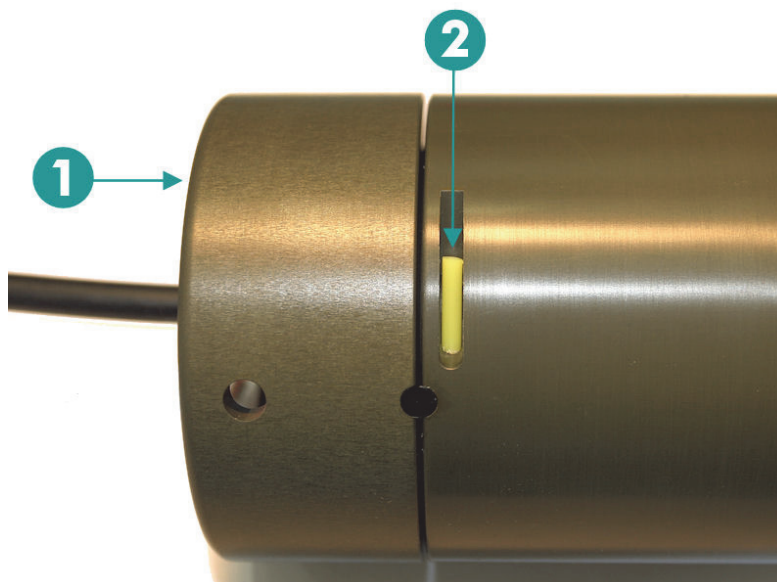
NOTES

 Pull the Pressure Relief Vent Valve until two 'O' rings are visible. A retaining device prevents the valve from being fully detached.

 The Pressure Relief Vent Valve is spring loaded and will return to the closed position if released.

8. Two 'O' rings should be visible when the vent valve is fully withdrawn.
9. Inspect the 'O' rings for cleanliness and serviceability.
10. Using a tapered plastic tie-wrap (or similar), remove the retraining rod (**Figure 6-1**), used to retain the end-cap, by inserting under the retaining rod and lifting it clear of the groove.

Figure 6-1 – Retaining Rod



1 Connector End-Cap 2 Retaining Rod

CAUTION

 Do not damage the WSM6 housing when attempting to remove the retaining rod. Damage to the protective coating will result in corrosion.

11. Using a tool with a narrow rounded end, push on the other end of the retaining rod to slide it clear of the groove.
12. When possible pull the retaining rod with a pair of pliers clear of the WSM6.
13. Inspect the retaining rod and discard if damaged.

CAUTION

When extracting the connector end-cap from the main housing do not twist as this will prevent the end-cap from being removed.



Make sure the 'O' ring seals do not become damaged during the extraction process.

14. Carefully extract the connector end-cap by gently levering to and fro from the main housing.
-

NOTE

The Opening Tool (Part No. 810-1262) can be used to assist in extracting the connector end-cap.

15. When the end-cap has been fully extracted it is retained by a ribbon cable connector and internal nylon retaining cord.
16. Disconnect the ribbon cable from the connector end-cap by releasing the side clips and gently pulling the cable connector off the socket.
17. The nylon retaining cord is attached to an end-cap locating pillar. Unscrew the pillar to release the cord and free the end-cap from the main housing.
18. The end-cap at the other end of the WSM6 can now be removed from the housing using the same process for the connector end-cap.
19. Clean all sealing surfaces and inspect for damage. Damage to the sealing surface will allow water to ingress inside the housing. Any damaged component must be replaced.
20. Remove the end-cap from the other end of the housing, using the same process for the connector end-cap.
21. Lay the internal assembly down on a clean surface with the battery pack downwards. Set the housing to one side.
22. Clean the grease from all sealing surfaces and examine the sealing surfaces on the internal bore of the housing. If there is any sign of significant damage to these sealing surfaces, then the housing should be replaced before the unit is re-assembled.
23. If the transponder has been opened to refit a loose end cap connector, proceed to **Section 6.5.3 - End-cap connector tightening procedure**, and then re-assemble the transponder.
24. Remove the two M4 bolts that fix the electronics chassis to the transducer end-cap.
25. Remove the 3-pin Molex connector close to the transducer end of the chassis.
26. Carefully separate the electronic chassis and the transducer end-cap. The tuning coil is fitted to the end of the chassis and fits into a recess in the transducer end-cap. It is recommended that replacement of the transducer or the coil assembly is carried out at Sonardyne premises.

6.5.1 Removal of the battery pack

It may be necessary to remove the battery pack following fault diagnosis. After disassembling the WSM6 proceed as follows:

1. The battery pack may be removed by undoing the screw into the battery pack release clamp (at the connector end-cap end of the assembly).
2. Lever the retaining tab of the battery connector on the Rx/Tx PCB gently to one side and pull the connector out.
3. To release the battery it may be necessary also to cut through the small fillet of silicon rubber which helps to retain the battery pack in position.

6.5.2 Removal of CPU Boards

It may be necessary to remove a CPU board following fault diagnosis. Following disassembly of the WSM6 and removal of the battery pack, proceed as follows:

1. The upper CPU board may be removed by unscrewing the two grey fixing screws holding the upper board to the lower board and prising the board away from the two connectors.
2. The lower board may be removed by disconnecting the transducer and unscrewing the six fixing screws holding the lower board to the chassis.
3. The 2 flying leads to the tuning coil must be de-soldered to finally remove the board.

6.5.3 End-cap connector tightening procedure

Use the following procedure to tighten the end-cap connector. To assist in this process the following tools are recommended:

Torque wrench. (Suitable for applying 5 Nm - 3.7lbf-ft.)

22mm Socket. (with long internal clearance, more than 36mm)

17mm Open ended Spanner.

1. Dismantle the transponder as detailed in **Section 6.5 - Dismantling**
2. Place the socket over the external part of the connector, the long internal clearance is required to avoid damage to the pins. Make sure the socket is well seated on the hexagonal part of the connector.
3. Place the open-ended spanner over the internal locking nut to prevent it from rotating.
4. If the connector wires have already started to become twisted, loosen the locknut slightly and rotate the connector so as to untwist the wires. Tighten the locknut to moderate tightness without rotating the connector. If connector wires are found to be damaged, replace connector. Refer to **Section 10 – Spares** for parts list.
5. Connect the torque wrench to the socket and tighten the socket to a torque setting of 5 Nm (44.3 lbf-in. or 3.7 lbf-ft.)

6.6 Lubrication

6.6.1 Lubrication of Subconn and Micro-Subconn Connectors

Before proceeding with any maintenance activity, make sure all Warnings and Cautions, the **Section 2 – Safety** and the Safety Manual are read and fully understood.

WARNING

 The lubricant used can cause slight irritation through prolonged usage. When applying the lubricant to the connector face make sure Personal Protective Equipment such as gloves are worn.

CAUTIONS

 The Subconn and Micro-Subconn connectors must not be mated without lubrication as this will lead to delamination of the rubber from the connection pins and connector failure.

 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.

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

1. Make sure the connectors are clean and dry. Accumulation of sand or silt must be removed with clean fresh water, and dried thoroughly.
2. Using the manufacturer's recommended lubricant – Molykote 44 Medium – apply a sparing amount across the connector face using a clean finger. This will allow a small amount of grease to enter the connector as the faces are mated.

6.7 Assembly Procedure

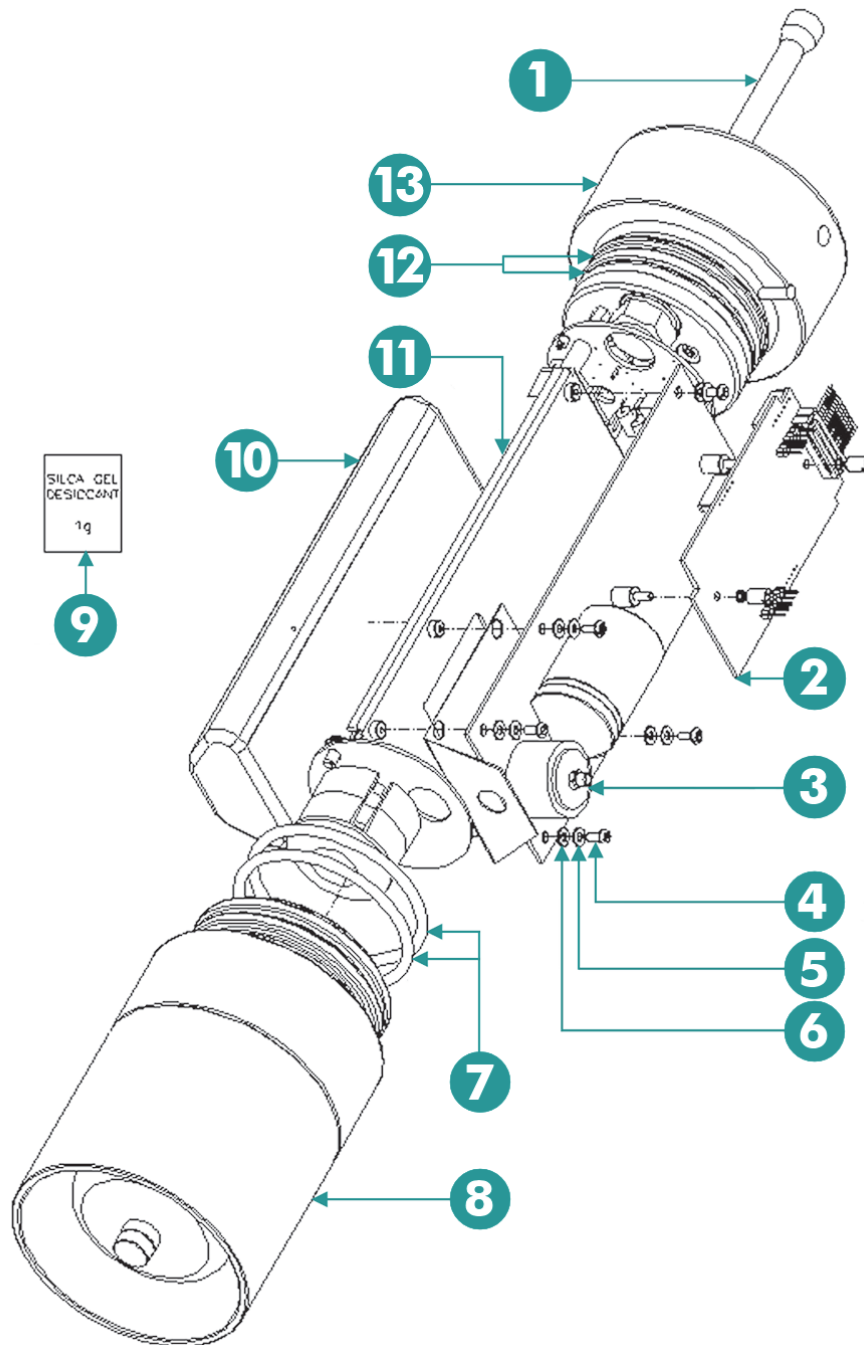
Before proceeding with the assembly, make sure the Warnings and Cautions in the **Section 2 – Safety**, and the Safety Manual are read and understood,

To assembly the transponder, following maintenance, proceed as follows:

1. Remove the 'O'-rings from the end-caps and clean with a dry lint free cloth.
2. Inspect the 'O'-rings for signs of damage, replace if necessary.
3. Lubricate the 'O'-rings with petroleum jelly.
4. Refit the 'O'-rings into the grooves.
5. Make sure no cable or blanking plug is connected to the external connector.
6. Reconnect the battery plug to the CPU PCB.

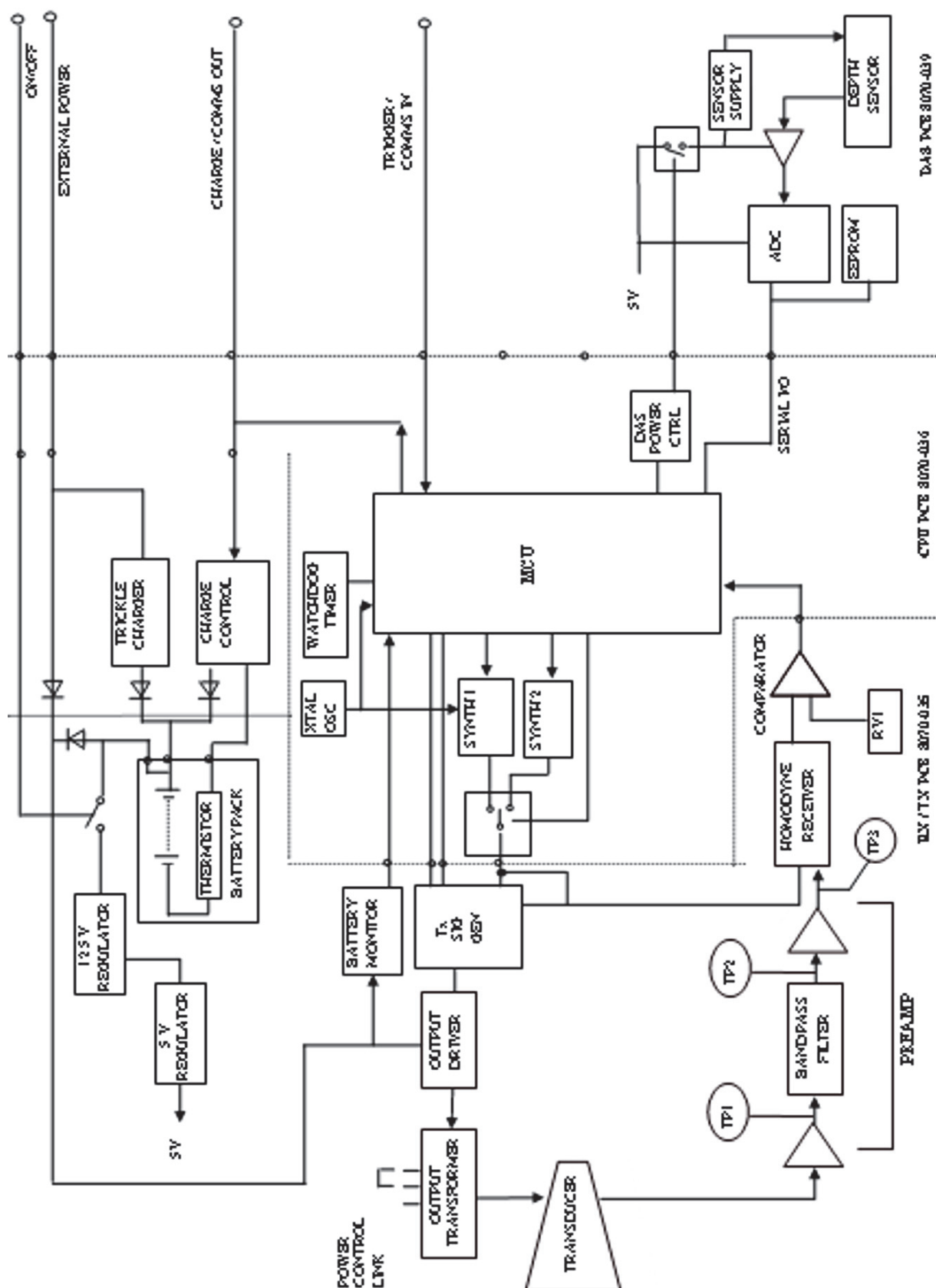
7. Fit a fresh silica gel bag.
8. Insert the transducer / chassis assembly into the housing.
9. Make sure the transducer end-cap and housing are assembled correctly and insert the flexible plastic retaining rod to secure.
10. Screw the pin on the end of the nylon retaining cord to the stud on the connector end-cap, forming the second locating pin.
11. Connect the ribbon cable to the connector end-cap PCB.
12. Position the connector end-cap to the housing and align the notches in the end-cap with the housing. As the end-cap is inserted into the housing, the ribbon cable should fold down neatly without needing any special action.
13. Insert the flexible plastic retaining rod to secure the connector end-cap to the housing.
14. Unless the battery is to be charged immediately, remove the protective tape from the Pressure Relief Vent Valve.
15. Clean the lightly lubricate the 'O'-rings.
16. Make sure the Pressure Relief Vent Valve seats flush with the connector end-cap.
17. Fit the red plastic sleeve over the whole unit.
18. Make sure the connectors are lubricated, refer to **Section 6.6 - Lubrication**
19. Carry out a functional test, refer to **Section 7 – WSM6 Functional Test**.

Figure 6-2 – Type 8270 / 8271 Wideband Sub-Mini 6 Assembly



- | | | |
|-----------------------|-------------------------|--------------------------|
| 1 Dummy plug | 6 M2.5 fibre washer | 11 Chassis |
| 2 CPU PCB assembly | 7 Double seal 'O' rings | 12 Double seal 'O' rings |
| 3 TX/RX assembly | 8 Transducer end-cap | 13 Connector end-cap |
| 4 M2.5 x 6 MSZP screw | 9 Silca gel desiccant | |
| 5 M2.5 crinkle washer | 10 Battery | |

Figure 6-3 – Circuit Block Diagram



SECTION 7 – WSM6 FUNCTIONAL TEST

7. WSM6 Functional Test

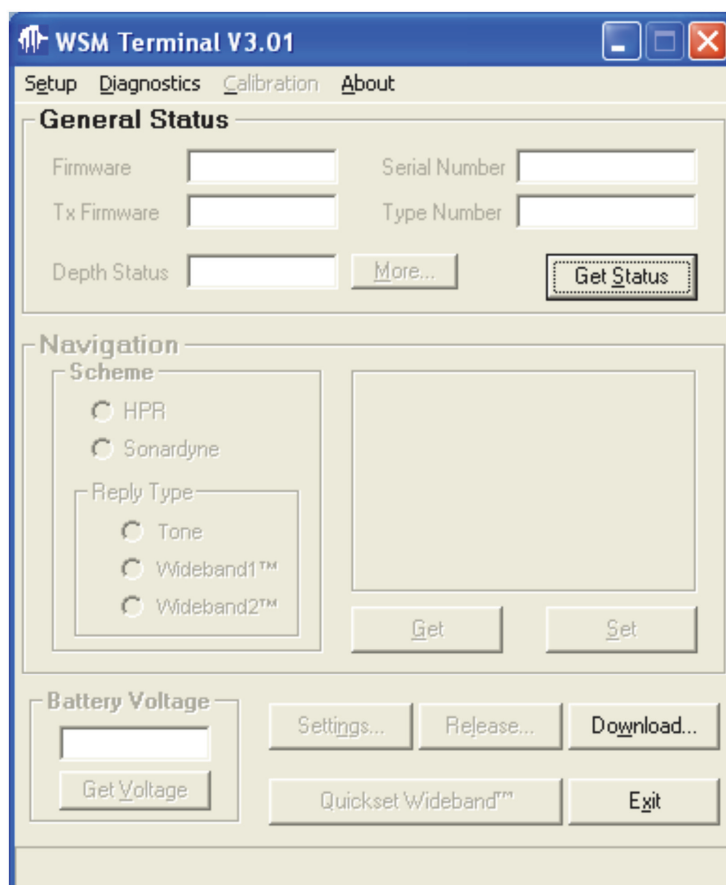
Carry out the following tests to check the full electronic functionality of the WSM6.

7.1 Serial Communications with PC software

Use the following procedure to test the Serial Communications of the WSM6.

1. Use the charger/comms interface, connect the WSM6 to a PC.
2. Run the WSM Terminal Software.
3. Switch the transponder **ON** by rotating the end-cap **ON/OFF** switch.
4. Select Get Status on the WSM Terminal Software. Refer to **Figure 7-1**.

Figure 7-1 – WSM Terminal Software Get Status



5. Check the transponder returns data by populating the General Status screen. This test checks the basic operation of the microprocessor and associated crystals.

NOTE

If the depth sensor is enabled, then occasionally the comms may drop out. To clear go to Setup, Serial port settings and increase the Serial Communications Wait and Delay between commands timings to 2 and 2.5 seconds

7.2 Transponder Test

Use the following procedure to test the Transponder.

1. Connect the ANT TDR output to the transducer end cap using the Test Transducer (or coupling loop).
2. Programme the ANT in accordance with
3. Enter channel number 21 (HII21) to select the HPR400 channel.
4. The ANT will generate the two-pulse interrogation used in the HPR400 Scheme.

7.3 WSM Terminal Test Software

7.3.1 Introduction

Sonardyne Int Ltd provides software to assist with Configuration, Test and Calibration checks of the following transponders:

- Type 8270 WSM6 (Directional) Transponder
- Type 8271 WSM6 (Omni-Directional) Transponder
- Type 8070 WSM (Directional) Transponder
- Type 8071 WSM (Omni-Directional) Transponder
- Type 7970 Super Sub-Mini (Directional) Transponder
- Type 7973 Super Sub-Mini (Omni-Directional) Transponder
- Type 7971 PGT (Omni-Directional) Transponder
- Type 7977 PGT (Directional) Transponder
- Type 7978 PGT (Super-Directional) Transponder

NOTE

Some features of the WSM Terminal are only applicable to older units and are therefore greyed out or absent when a WSM is detected.

The program is stored on a CD labelled “WSM Utilities” supplied with the unit, or can be downloaded from the Sonardyne Int Ltd website: - www.sonardyne.com

Using the software implies acceptance of Sonardyne’s standard software licence agreement. A copy is included at the end of this section.

The program will run under Windows 95 or later. This description applies to WSM Terminal V3.01.03, © Sonardyne Int Ltd.

7.3.2 Software Installation

Use the following instructions to install the test software onto the user computer.

1. Insert the CD "WSM Utilities".
2. Access My Computer or Windows Explorer.
3. Access the drive containing the software.
4. Run **Setup.exe** and follow the installation instructions.

7.3.3 Electrical Connections

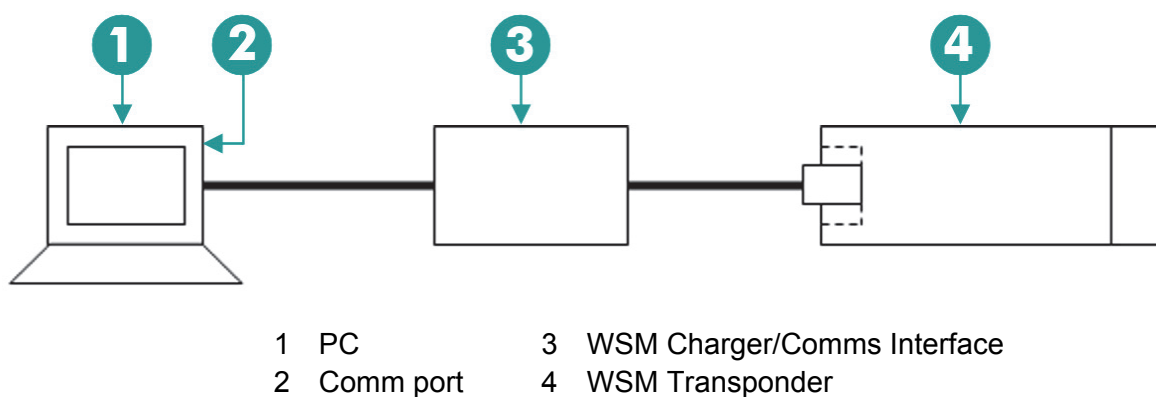
Connect the PC to the Transponder as follows:

CAUTION

 **Make sure the WSM Charger PSU is NOT connected to the Charge/Comms Interface, as this will inhibit the communication link.**

Connect the PC to the Transponder via the Type 7972-000-04 WSM Charger/Comms interface (a simple PC to Transponder comms cable is also available (part no. 820-6586)).

Figure 7-2 – Transponder connection configuration for software installation



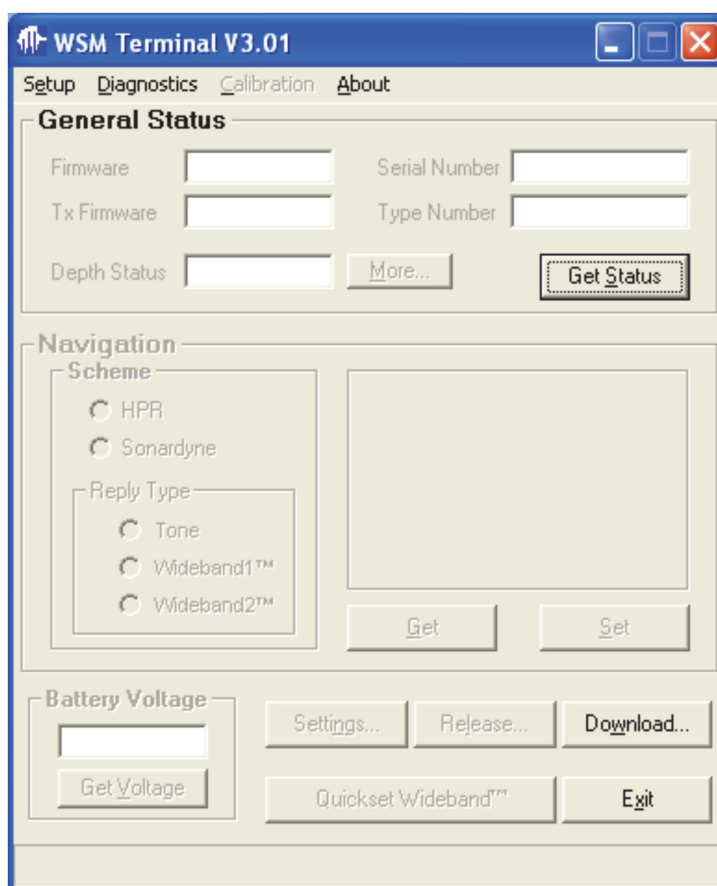
7.4 Software Operation

7.4.1 Software Setup procedure

Use the following procedure to safely use the WSM Terminal software.

1. If the default setup locations are accepted during installation, then the program can be run from the Start button. Follow: **All Programs > Sonardyne > WSM Terminal V3.01.05**.
2. The WSM Terminal – General Status main screen will appear.

Figure 7-3 – Software operation

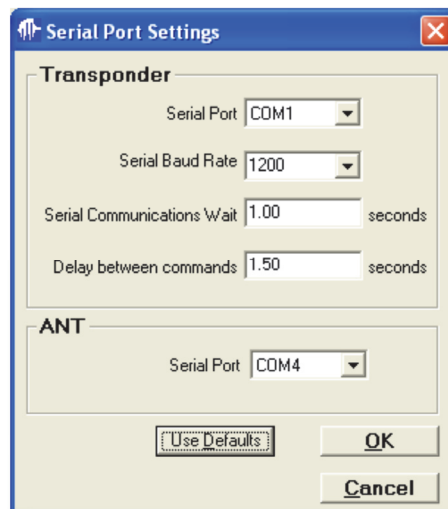


7.4.1.1 Serial port settings

To set the serial port settings, proceed as follows, refer to **Figure 7-4**:

1. Select **Setup** from the main toolbar, then select **Serial Port Settings**.
2. In the **Serial Port Settings** window select the correct **Coms** port from the **Serial Port** drop down menu list.

Figure 7-4 – Serial Port Settings



3. Make sure the Serial Baud rate is set to 1200 for normal operation.
4. Set the Serial Communications Wait time to the maximum time allowed for the Transponder to reply to an RS232 command (e.g. 1 second).
5. Set the Delay between commands time to provide a delay between adjacent commands.

NOTE



If reliability problems are experienced with the serial communication, increase the Delay between commands time to 2.5s. Once changed the setting will be retained by the computer.

6. If the ANT serial port is not being used, set the port to **Not Used**.

NOTE



The ANT serial port is only used for diagnostic checks.



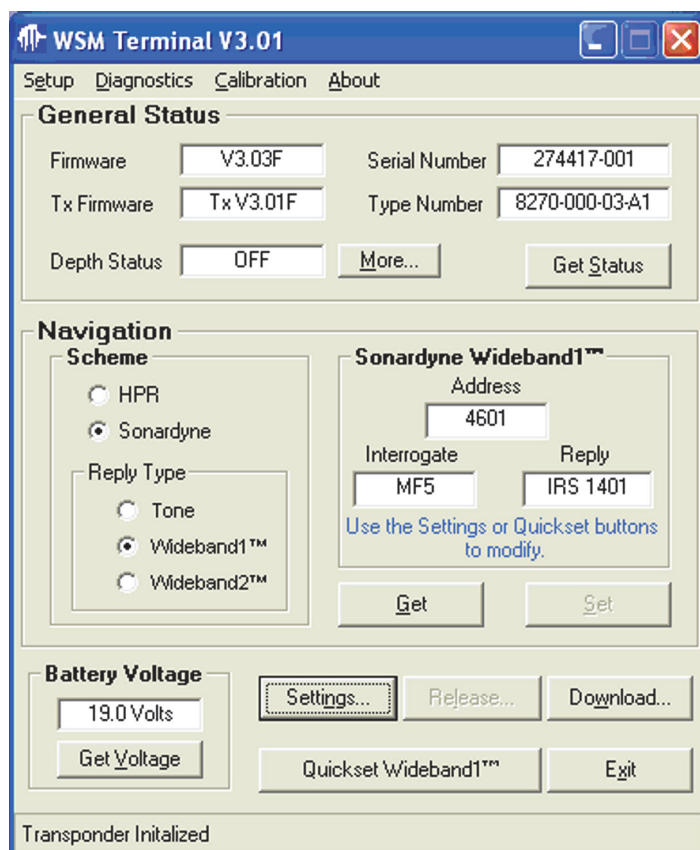
If the depth sensor is set to ON, communications with the unit is improved if the 'Serial Communications Wait' is set to 2 seconds and the 'Delay between commands' set to 2.5 seconds.

7. Once all settings have been entered click on **OK** to return to the main screen. Entered settings will be saved.

7.4.2 General Status

1. On the **WSM Terminal** main screen select the **Get Status** button to populate the screen with the current configuration of the connected Transponder.

Figure 7-5 – Get Status current configuration



2. If there is no RS232 communication with the Transponder, check the following:
 - The WSM6 is switched on
 - The Serial port settings are correct, refer to **Section 7.4.1.1 – Serial port settings** cable connections are clean and secure.
 - Check the WSM battery is charged (refer to **Section 6.3 – WSM6 Battery Charging Procedure**)
3. If a successful reply is obtained, all boxes will be populated. **Table 7-1 – WSM Terminal General Status Meanings**, details all the boxes and their meanings
4. In the Nav Scheme selection, choose between HPR or Sonardyne.
5. In the Reply Type selection, choose between Tone and Wideband.
6. With the Nav Scheme set to Sonardyne, and the Reply Type set to Wideband® 1, the current Interrogate Channel, command Address and Wideband Individual Reply Signal (IRS) Reply will be displayed.

Table 7-1 – WSM Terminal General Status Meanings

Table Reference	Definition
Firmware	This is the firmware version installed in the Transponder. Firmware upgrades can be installed via WSM Terminal.
Tx Firmware	This is the transmission signal synthesiser.
Depth Status	This can be Not Fitted , On or Off . If set to On , every interrogation will have 2 reply signals from the WSM, with the time between them being proportional to the depth sensor reading.
Serial Number	This is the unique factory serial number allocated to the Transponder and should be referred to in any communications with Sonardyne regarding the unit.
Type Number	This is the Sonardyne drawing number. The build state is indicated by the last letter and digit.
Interrogate and Reply	Dependent on the Nav Scheme and Reply Type currently selected and may not be displayed.
Address	This is the acoustic command address used to control the WSM. NOTE  It is important the command address is unique to the beacon and does not conflict with other Sonardyne beacons operating in the vicinity.
Nav Scheme Reply Type	The WSM6 is compatible with Sonardyne Wideband® 1 and Wideband® 2, Sonardyne Tone and Simrad HPR systems, but only one can be selected at any one time.

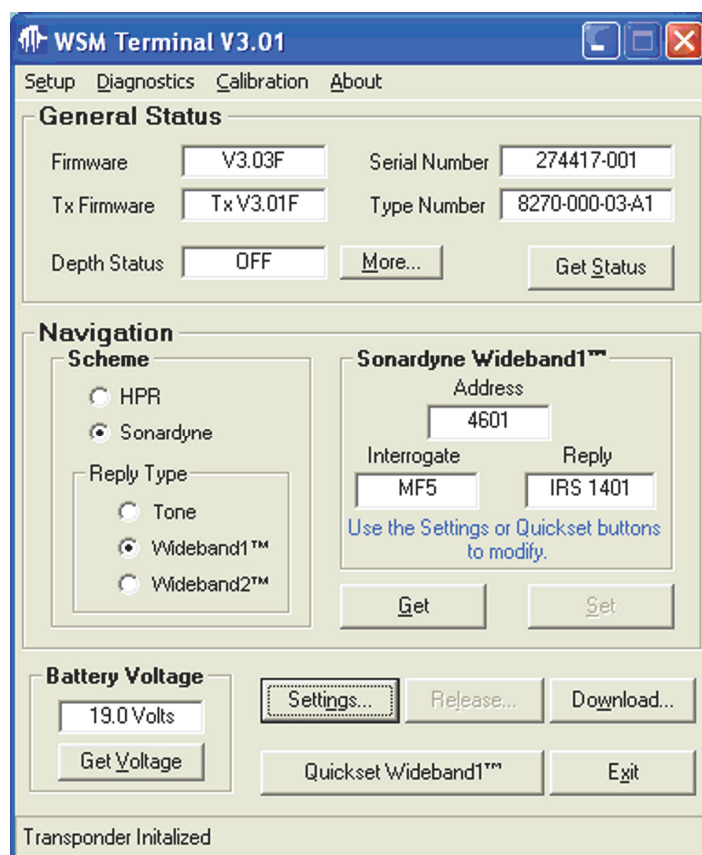
7.4.3 NAV Scheme

The WSM6 is compatible with Sonardyne Wideband® 1 and Wideband® 2, Sonardyne Tone and Simrad HPR systems, but only one can be selected at any one time.

7.4.3.1 Quickset Wideband® 1

With the **NAV Scheme** set to **Sonardyne**, and the **Reply Type** set to **Wideband 1®**, the current **Interrogation** channel, and the command **Address** (which defines the **Wideband Individual Reply Signal (IRS)**) is shown.

Figure 7-6 – Quickset Wideband setting



The **Interrogate** and **Reply** configuration can be changed by selecting **Settings** or **Quickset Wideband® 1**. This process can be used when setting up one or two Transponders in the water.

To change the Interrogate and Reply configuration proceed as follows:

CAUTION

Do not operate multiple beacons on the same Quickset Wideband® 1 settings in the water at the same time. The address must be unique to any on e beacon operating in the same acoustic area.

1. On the **WSM Terminal** home page, select **Quick Wideband® 1**.
2. Select one of the nine preset Wideband configurations by clicking on the button, then press **Set**.

Figure 7-7 – Quickset Wideband Configuration

General Settings

Quickset Wideband™

Click the required scheme, A1 to C3; Select Power & Gain.
Click Set to program the transponder.

A1	B1	C1
A2	B2	C2
A3	B3	C3

Same column e.g. B1+B2+B3 etc = Simultaneous mode.
Same interrogation cycle; Faster update rate.

Same row/diagonal e.g. A1+B1+C3 etc = Sequential.
Separate interrogation cycles;
Slower but separate update rates.

WARNING: C1, C2 or C3 may cause interference with BOP systems address x00.

Address	Interrogate	Reply
4703	MF9	IRS 1503
TAT	Power	Gain
375.0	Low	High

Get Set Cancel

Advanced

Exit

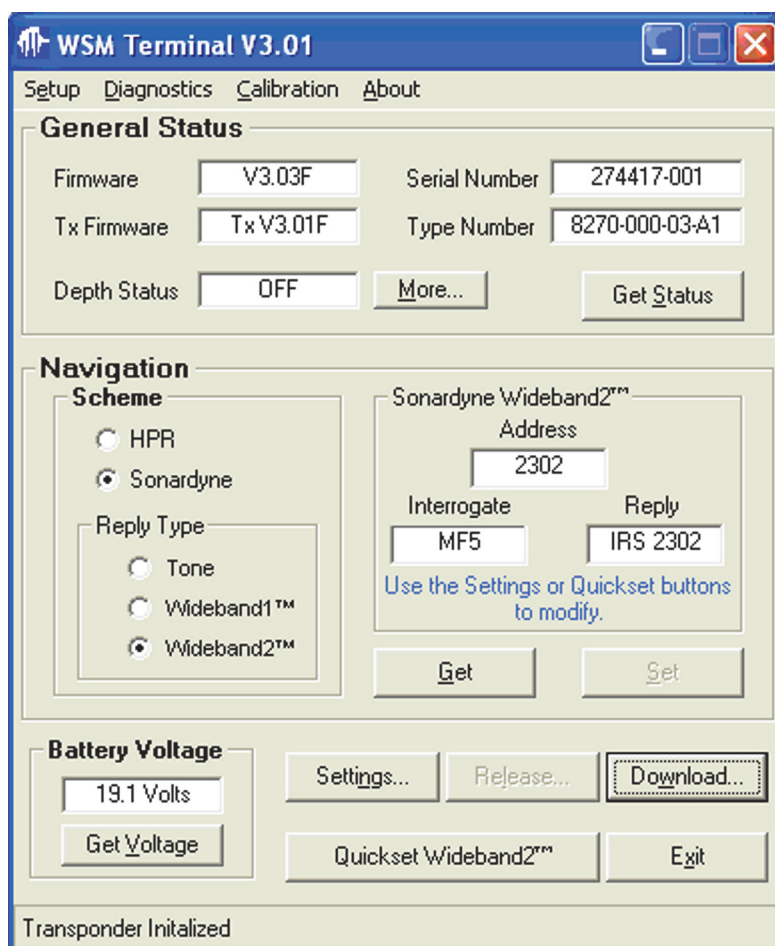
Transponder Initalized

3. If the unit is already in a **Quickset** configuration, one button will have font larger than the others.
4. Select the **Power** and **Gain** settings from the drop down menus.
5. The **Advanced** button allows users to select any available interrogate and reply signals, as well as other advanced features.
6. When the configuration is complete, select **Exit** to return to the main screen.

7.4.3.2 Quickset Wideband® 2

With the **NAV Scheme** set to **Sonardyne**, and the **Reply Type** can be set to **Wideband® 2**.

Figure 7-8 – Quickset Wideband® 2 setting



The **Interrogate** and **Reply** configuration can be changed by selecting **Settings** or **Quickset Wideband® 2**.

To change the Interrogate and Reply configuration proceed as follows:

CAUTION

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

1. On the **WSM Terminal** home page, select **Quick Wideband® 2**.
2. Select one of the nine preset **Quickset Wideband® 2** configurations by clicking on the button, then press **Set**.

Figure 7-9 – Quickset Wideband® 2 Configuration

General Settings

Quickset Wideband™

Click the required scheme, W1 to Z3; Select Power & Gain.
Click Set to program the transponder.

W1	X1	Y1	Z1
W2	X2	Y2	Z2
W3	X3	Y3	Z3

Same column e.g. Y1+Y2+Y3 etc = Simultaneous mode.
Same interrogation cycle;
Faster update rate.

Same row/diagonal e.g. W1+X2+Y3 etc = Sequential.
Separate interrogation cycles;
Slower but separate update rates.

Note: "W" column recommended for high elevation targets.

Address	Interrogate	Reply
2702	MF9	IRS 2702
TAT	Power	Gain
160.0	Low	High
Get	Set	Cancel

Advanced

Exit

Transponder Initialized

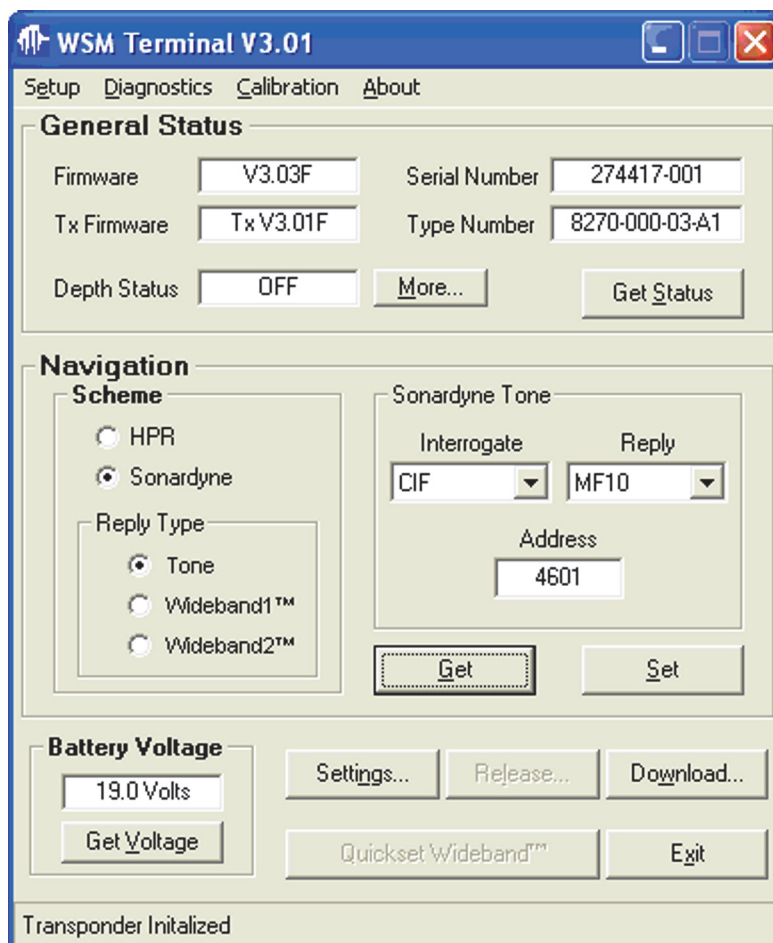
3. If the unit is already in a **Quickset Wideband** configuration, one button will have font larger than the others.
4. Select the **Power** and **Gain** settings from the drop down menus.
5. The **Advanced** button allows users to select any available interrogate and reply signals, as well as other advanced features.
6. When the configuration is complete, select **Exit** to return to the main screen.

7.4.3.3 Sonardyne Tone

With **NAV Scheme** set to **Sonardyne** and the **Reply Type** set to **Tone**, the **Interrogation** and **Reply** channels can be individually set to any Sonardyne **MF** channel using the drop down lists.

Select **Set** to program the new channels.

Figure 7-10 – Sonardyne Tone Setting



The acoustic transmission performance will only meet the specification if used in the range 26 – 32kHz i.e. if the reply channel is chosen from the list:

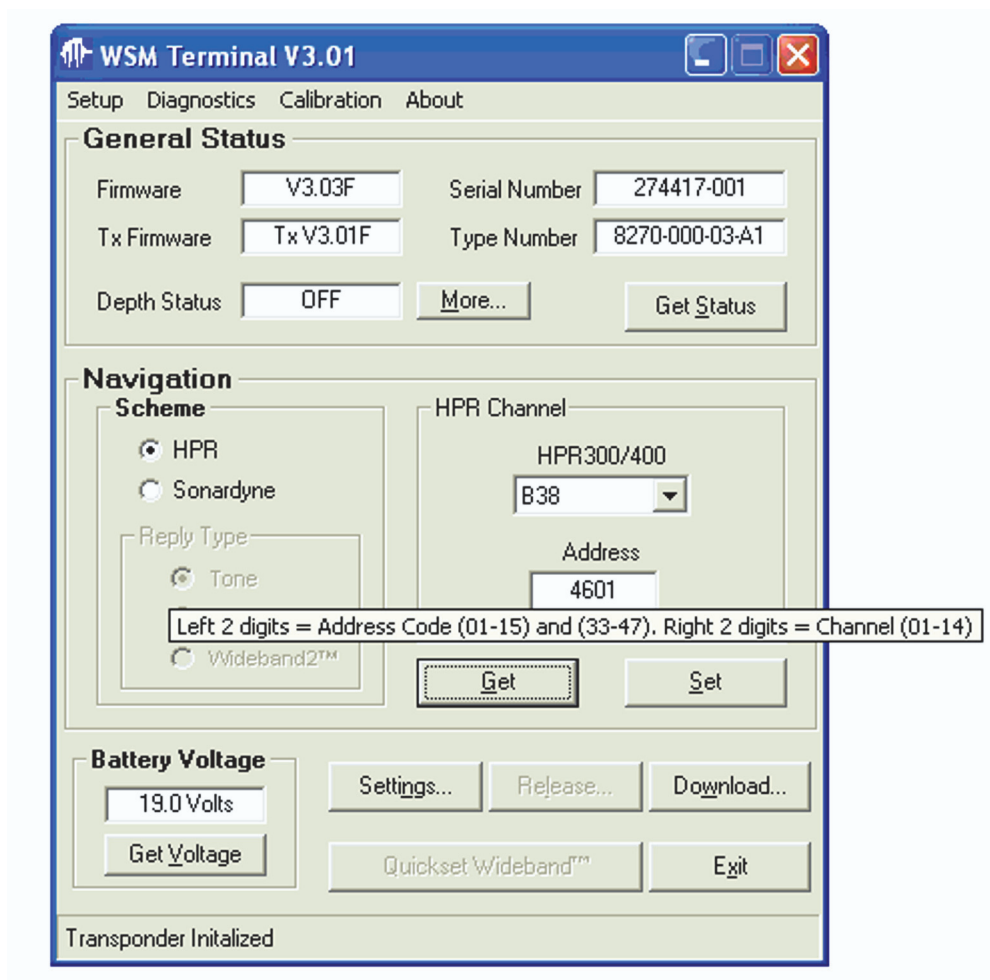
CRF, MF0, MF9, MF10, MF11, MF12, MF13, MF14

NOTE

 At the end of each drop down list, the emergency AODC channels are available. Note that operating on these frequencies will reduce the effective acoustic range of the unit.

If the mouse hovers over certain data boxes on the page, a prompt will appear displaying the legal ranges.

Figure 7-11 – Mouse prompt display

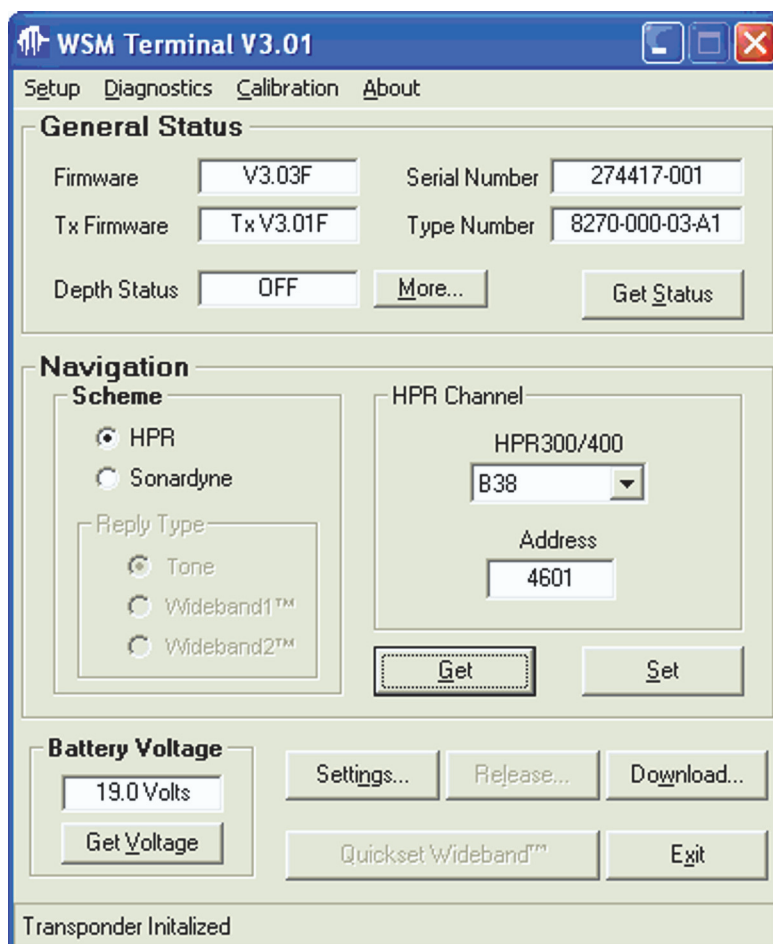


7.4.3.4 HPR

With the **NAV Scheme** set to **HPR**, the **HPR Channel** box will contain the beacon channel if configured for HPR300 or HPR400.

The **Interrogate** and **Reply** channels are a fixed pair in the **HPR** mode.

Figure 7-12 – HPR set up



To change the **HPR** proceed as follows:

1. Select a different channel from the **HPR300/400** drop down menu.
2. Click **Set**. The new channel will appear in the **HPR** box.
3. The acoustic command **Address** is in the lower box. The beacon can only be commanded by a Sonardyne Transceiver.

7.5 Battery Status

From the main menu, select Get Voltage to obtain a fresh voltage reading. For a Nickel Metal Hybride pack, the voltage is nominally 18.75V but may be as high as 21.5V immediately after a charge, falling to below 17.0V when nominally flat.

7.6 Depth Telemetry

The Transponder may be fitted with an optional Depth Sensor. If fitted, the end-cap will be identified as having the options C (connector) and D (depth). Transponders that are fitted with a Depth Sensor can be instructed to send Depth information at each interrogation.

When this feature is **ON**, the Transponder transmits a reply signal to each interrogation as normal, plus a second signal on a different frequency at a later time. The time difference between the two transmission signals is dependent on the depth measured by the sensor in the Bottom End-cap.

When this feature is **OFF**, the Transponder transmits only a single reply signal to each interrogation.

NOTE



Turn Depth OFF to preserve battery life, when not required.

From the main screen, when the **Get Status** button is pressed, the Depth Status will read as **Depth On/Off/Not fitted**.

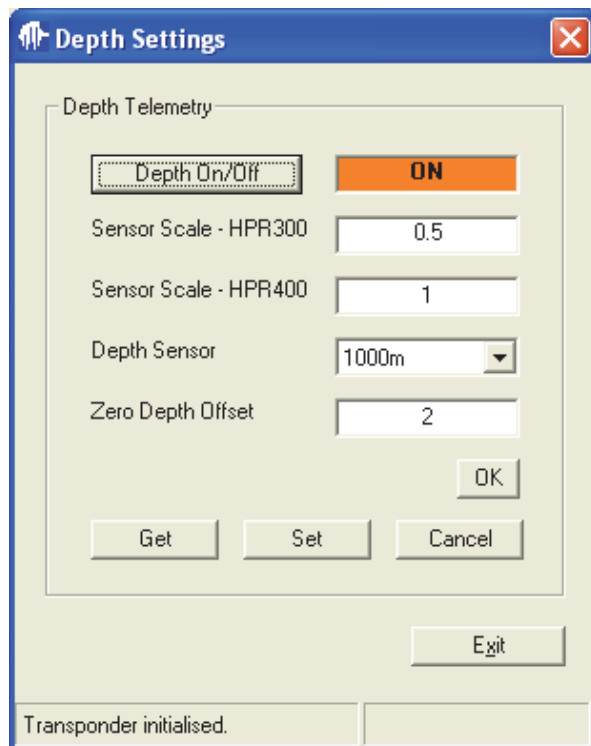
Unless the Depth Sensor was detected as **Not fitted**, the user is allowed access to further depth parameters by pressing the **More...** button on the **General Status** screen.

When pressed, the following screen is displayed.

Figure 7-13 – Depth Settings

To switch the **Depth Sensor ON**, press the **Depth On/Off** button to display **ON**, then press **Set**.

Figure 7-14 – Depth On/Off Settings

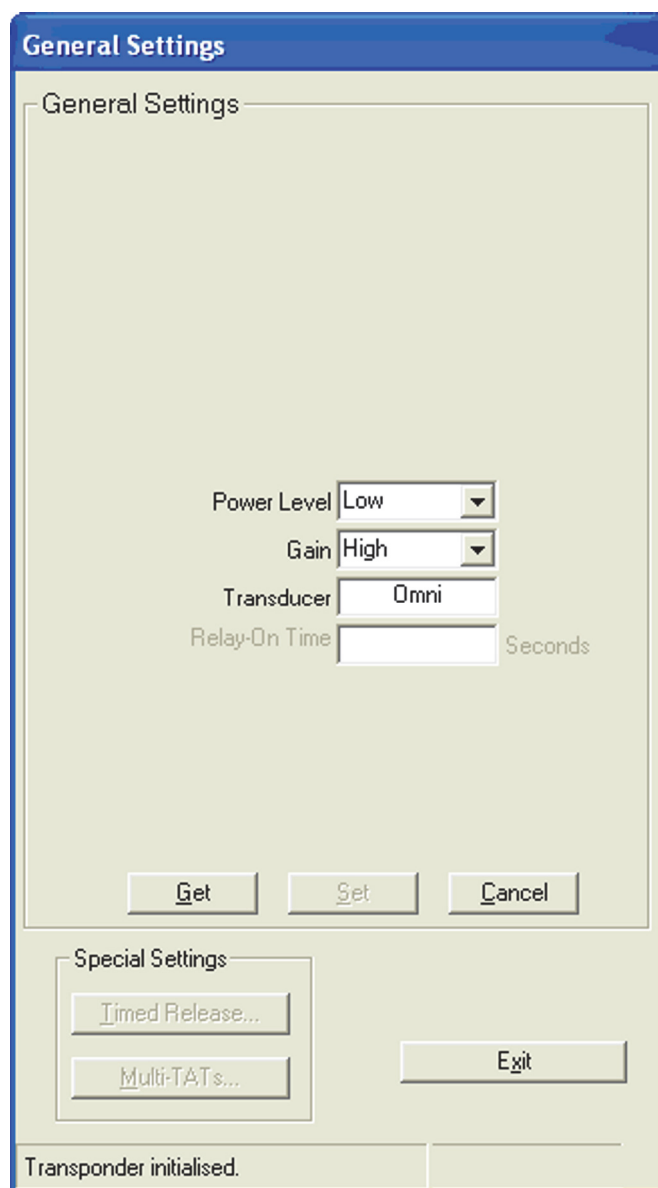


7.7 Transponder Settings

To set the Transponder settings proceed as follows:

1. In the **Main Screen**, press the **Settings** button
2. Select **Get** to read the parameters.
3. For a Sonardyne Wideband Scheme, pressing the **Advanced** button from the **Quickset Wideband** window will access this display

Figure 7-15 – General Settings – HPR



The image shows a software dialog box titled "General Settings" with a blue header bar. The main area is titled "General Settings" and contains four controls: "Power Level" with a dropdown menu set to "Low", "Gain" with a dropdown menu set to "High", "Transducer" with a text box containing "Omni", and "Relay-On Time" with a text box and the label "Seconds" to its right. Below these controls are three buttons: "Get", "Set", and "Cancel". At the bottom of the dialog is a "Special Settings" section containing two buttons: "Timed Release..." and "Multi-TATs...". To the right of these is an "Exit" button. At the very bottom of the dialog is a status bar with the text "Transponder initialised.".

General Settings

General Settings

Power Level Low

Gain High

Transducer Omni

Relay-On Time Seconds

Get Set Cancel

Special Settings

Timed Release...

Multi-TATs...

Exit

Transponder initialised.

Figure 7-16 – General Settings - Address

General Settings

General Settings

Sonardyne Channels

Blocking Period 0.5 Seconds

Reply Pulse Width 4.0 mSec

Turn-Around-Time 125.0 mSec

Address 4601

Power Level Low

Gain Low

Transducer Directional

Get Set Cancel

Special Settings

Timed Release...

Multi-TATs...

Exit

Transponder Initialized

The WSM **Address** defines the **Individual Reply Signal (IRS)**, changing the **Address** changes the **IRS**.

1. To change the **Address**, type in a new command **Address** in the range **3301 – 4714** (**101 – 1514** when using old transceivers).
2. Click **Set**. After a **Set** operation, the **NAV Scheme** and **Reply** type fields are greyed out.

NOTE



The Wideband IRSs used by WSM have a parallel set of signals, duplicating those used by Compatt 5. Subtract 3200 from the WSM Address to give the equivalent Compatt 5 IRS, e.g. WSM Address 3310 uses the same IRS as a Compatt 5 set to address 110.

Figure 7-17 – General Settings Sonardyne Interrogate

General Settings

General Settings

Sonardyne Channels

Blocking Period 0.5 Seconds

Reply Pulse Width 8.0 mSec

Turn-Around-Time 160.0 mSec

Interrogate MF9

Address 2702

Reply IRS 2702

Power Level Low

Gain High

Transducer Directional

Get Set Cancel

Special Settings

Timed Release...

Multi-TATs...

Quickset Wideband™

Exit

Transponder Initialized

The Sonardyne Channel groups contain 3 parameters that apply if a Sonardyne **Interrogation** mode is selected:

- **Blocking Period** is the time in seconds the receivers are left disabled following an interrogation
- **Reply Pulse Width** will be 4ms if in Tone, or 8ms if in Wideband
- **Turn-Around-Time** is selected by the drop-down list for all Sonardyne modes

The **Interrogate** channel and **Address** are only available when in a Sonardyne Wideband scheme. The **Interrogate** channel can be selected from the drop down list.

Command **Addresses** 3301 to 4714 use a different third command pulse frequency compared to **Addresses** 0101 to 1514.

Power Level is the signal strength of the Transponder replies. The options are High or Low. Transponders should use the lowest power level that works reliably in the operational environment.

NOTE

Setting low power will increase battery life by an approximate factor of 2.

Gain is the amplification level used in the Transponder pre-amplifier. For short-range operations, or in high-noise environments, **Low Gain** should be used.

Transducer is the transducer type fitted on the unit and is determined by the version of Tx card fitted – do not alter this setting.

NOTE

Other parameters on this page do not normally have to be altered.

7.7.1 Release

This feature is not supported in the WSM in general, and when the WSM does support the external release feature it does not need configuring through the serial link. The release features are greyed out when a WSM firmware version is detected by the WSM terminal.

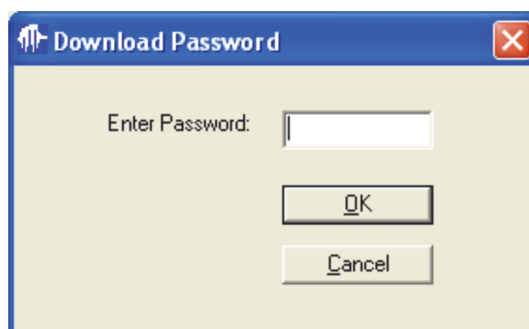
7.8 Firmware Upgrade Download

WSM6s are capable of accepting firmware upgrades from a PC, via the Type 7972-000-04 Charger/Interface, thus eliminating the need to dismantle the Transponder.

To download a firmware upgrade, proceed as follows:

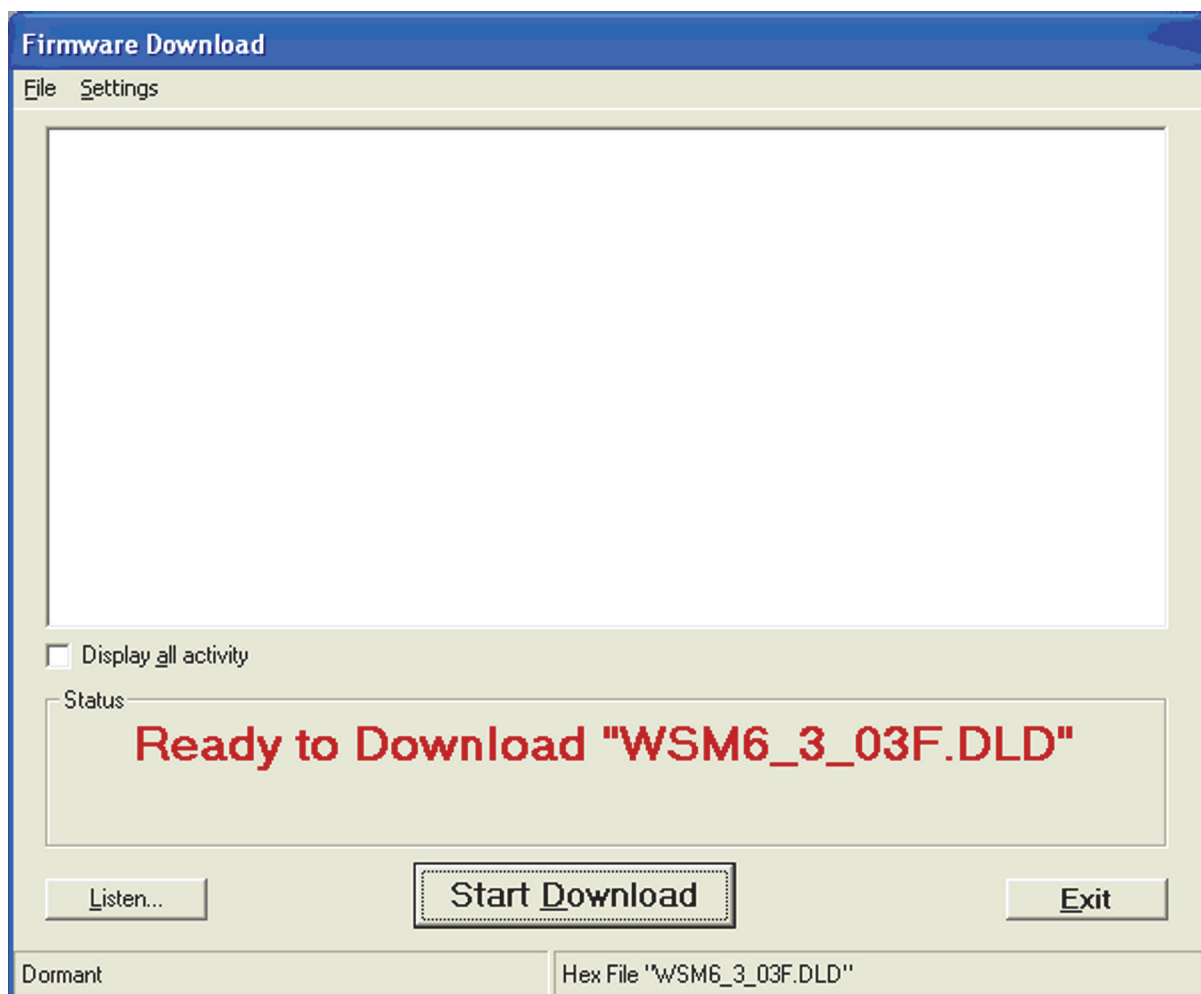
1. From the WSM Terminal main screen, press **Download**.
2. The following password prompt screen will display.

Figure 7-18 – Download Password prompt



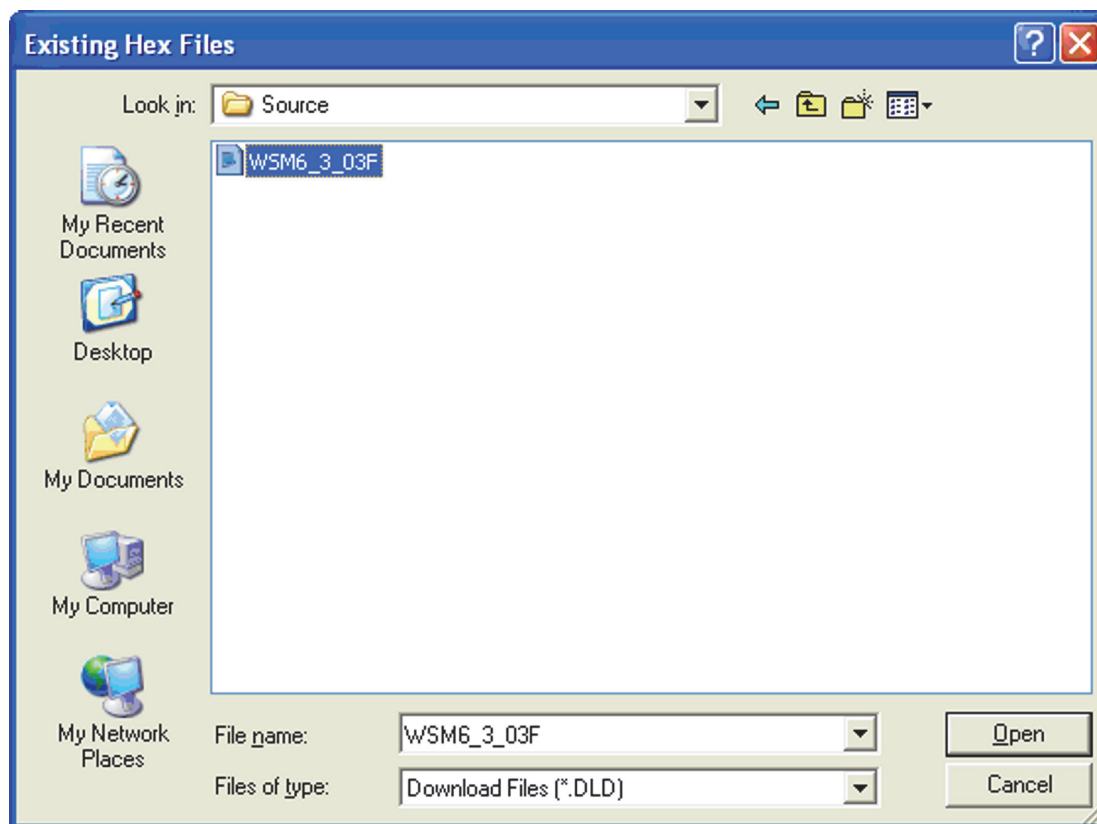
3. Enter the password – **super**. The password is case sensitive.
4. The Firmware Download screen will appear.

Figure 7-19 – Firmware Download



5. Select the firmware to download by selecting **File** option from the **Menu bar**.
6. Choose the appropriate **.DLD** file.

Figure 7-20 – Firmware Download file selection

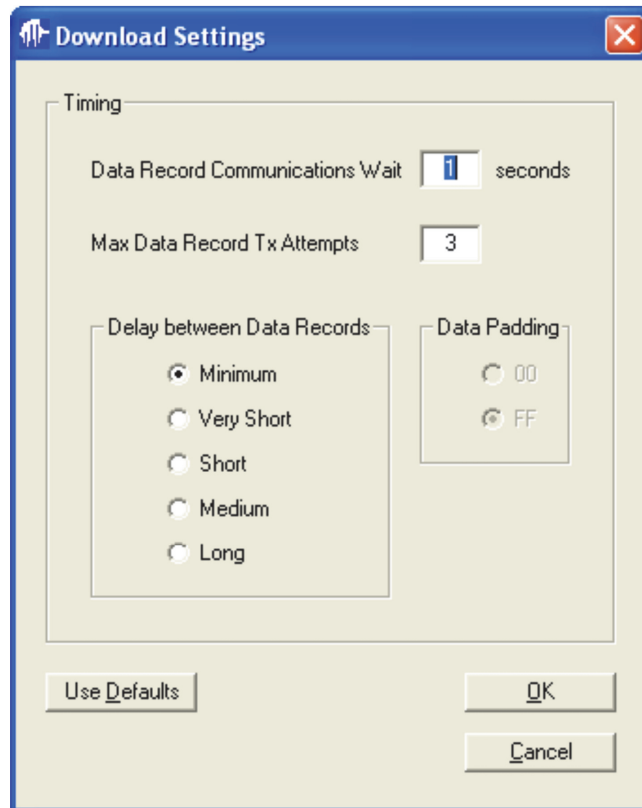


7. When the download file has been selected, it will appear on the **Firmware Download** screen. The download file must be selected before attempting to download.

7.8.1.1 Download Settings

1. Select the Settings option from the Firmware Download screen drop-down menu.
2. Choose the appropriate download settings.
 - **Data Record Communications Wait** is the maximum time the software waits for a Transponder reply following transmission of each line of code.
 - **Max Data Record Tx Attempts** is the number of attempts the software makes to transmit (and receive a valid Transponder reply) to a line of code.
 - **Delay between Data Records** is the time between transmission of lines of code, in order to cater for different PC speeds.
3. The **Use Defaults** button resets all parameters to those shown below.

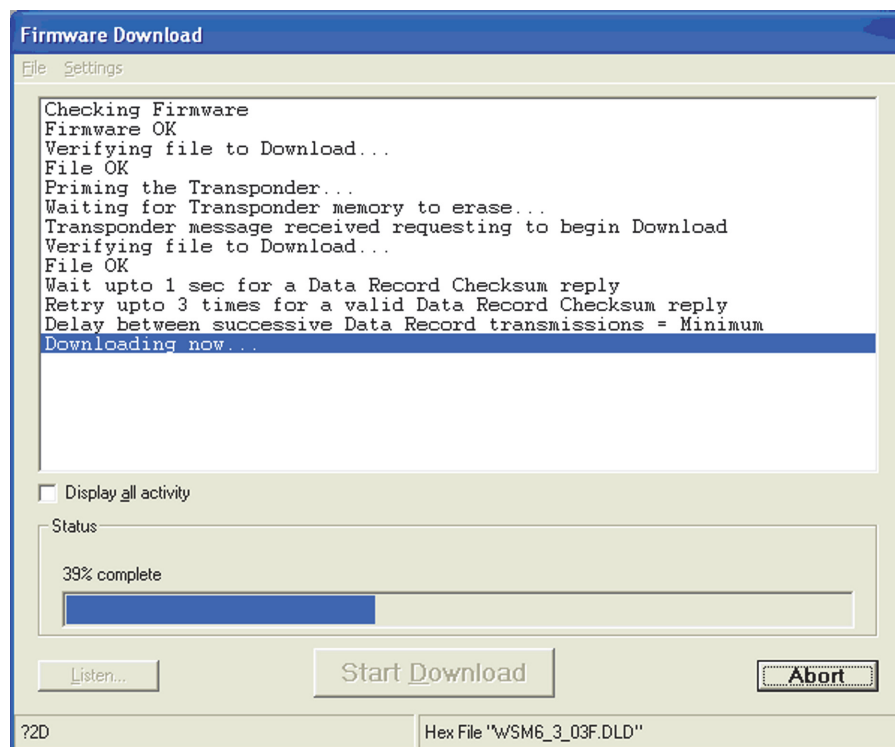
Figure 7-21 – Download settings



7.8.1.2 Downloading

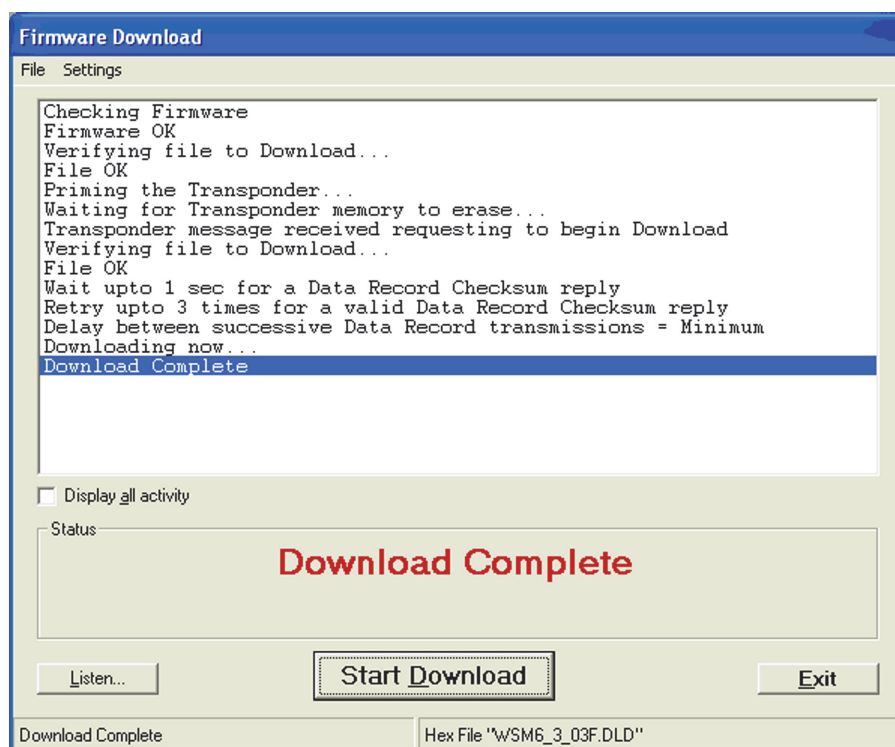
1. With a **.DLD** filename selected, and Download Settings confirmed, press **Start Download** to begin the firmware download.
2. Assuming the Transponder firmware supports the Downloading function, the Transponder will reply to the **Download** request following the erasure of its Program memory in EEPROM, a few seconds later.
3. The **bootloader** code will remain intact.
4. Following erasure, the Transponder requests the PC for new code.

Figure 7-22 – Firmware downloading status



5. When all lines have been sent (typically a few minutes), the operator will be informed the download is complete.

Figure 7-23 – Firmware download complete



6. If problems are experienced attempting to download, the **Display all activity** box can be ticked.
7. All communication between Transponder and PC will now be displayed.
8. This feature can assist Sonardyne to diagnose faults, if the entire window contents are copied and pasted into an email to **support@sonardyne.com**.
9. Check the underwater connector is clean.

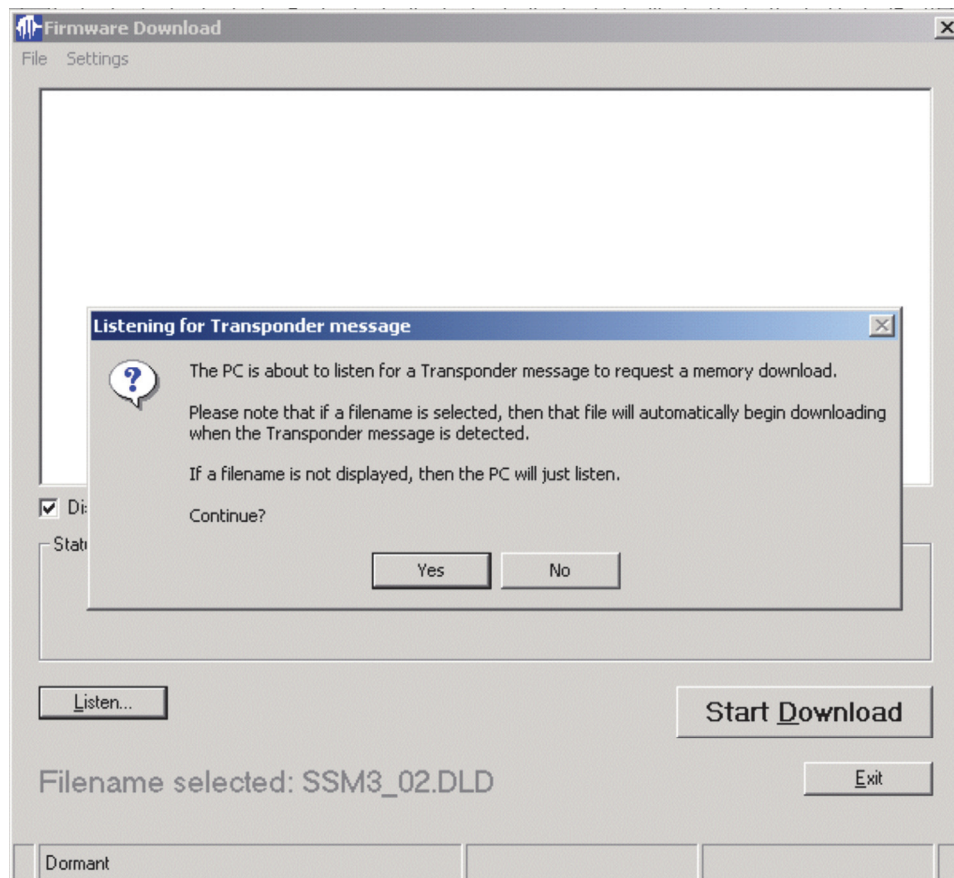
7.8.1.3 Checking a successful download

1. Following download, return to the **Main Screen**.
2. Press the **Get Status** button to confirm the new firmware has been implemented.

7.8.1.4 Downloading to an already-erased Transponder

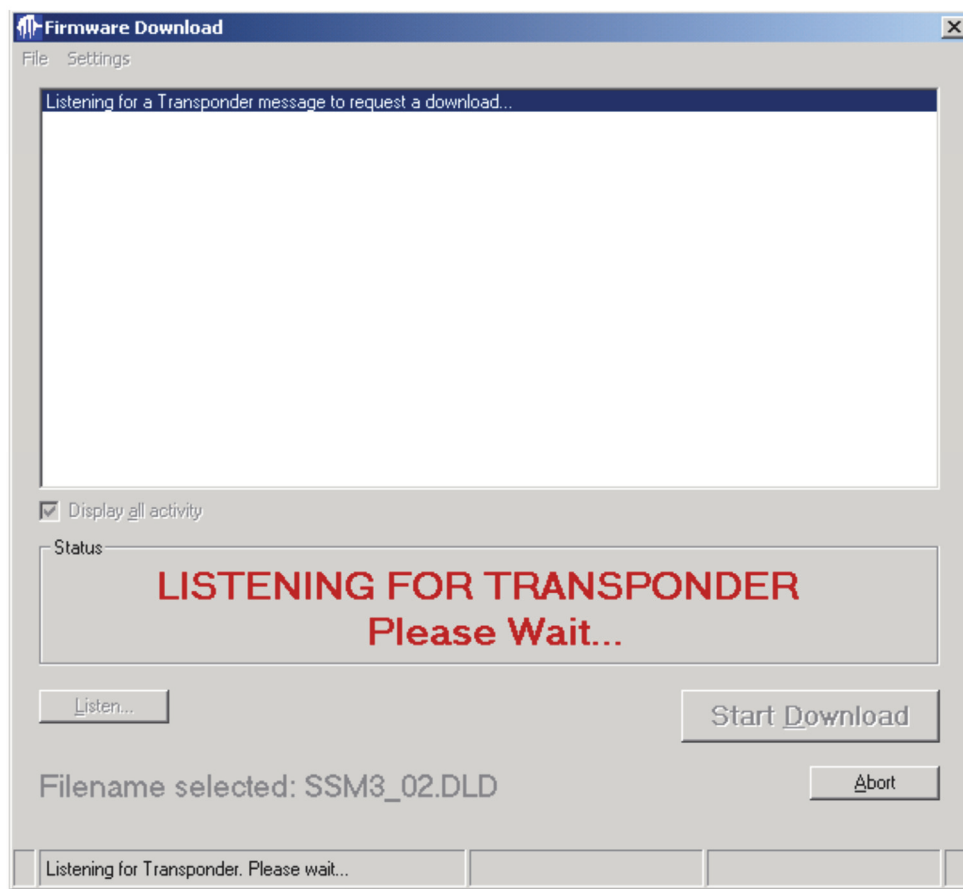
1. If a Transponder's memory has already been erased but firmware has not been downloaded (probably due to a previously unsuccessful Download attempt), the Transponder will transmit a message every few seconds from its RS232 output.
2. This indicates to the PC the Transponder is ready for download.
3. The normal procedure of pressing the **Start Download** button will not work in this condition.
4. Press the **Listen** button.

Figure 7-24 – Listening for Transponder message



5. To begin downloading, press **Yes**. Make sure an appropriate **.DLD** file has been selected.
6. The software now listens for the next **Download** command, and on reception starts the download procedure in the normal way.

Figure 7-25 – Listening for Transponder download



7.9 Transponder Testing

These features allow various functions of the Transponder to be tested. If an ANT unit is available, the Transponder can be fully tested independently.

From the **Main Menu**, select the **Diagnostics** pull-down menu option to display the following options:

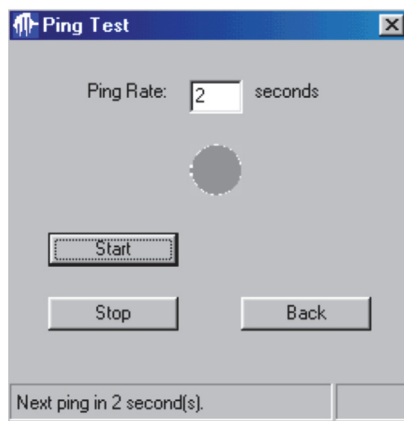
- Responder Trigger (Ping) test (does not require an ANT)
- Channel Range Test
- Channel Depth Test (greyed out on units without a depth sensor)
- Transponder to Transponder Test (not supported)
- Reset Transponder

7.9.1 Diagnostics – Responder Trigger (Ping) Test

1. Select **Start** to ping in Responder mode, triggered by use of the Transponder RS232 serial data link.
2. Press **Stop** to stop pinging.

3. The **Ping Rate** window is used to set the repetition rate in seconds
4. Once started, an audible output should be heard every time the red button is displayed

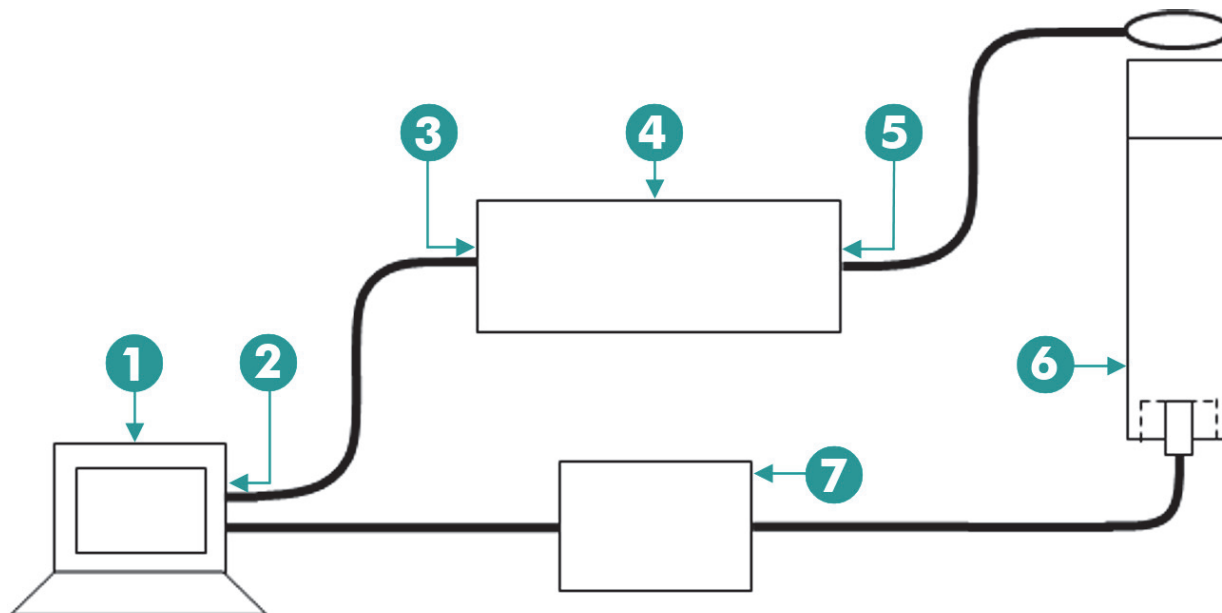
Figure 7-26 – Ping Test



7.9.2 Diagnostics – Channel Range Test using an ANT

This test requires the use of an ANT, and a second PC comm port. Connect the ANT 25 way D serial port to a free PC Comm port as shown below.

Figure 7-27 – Channel Range Test using ANT

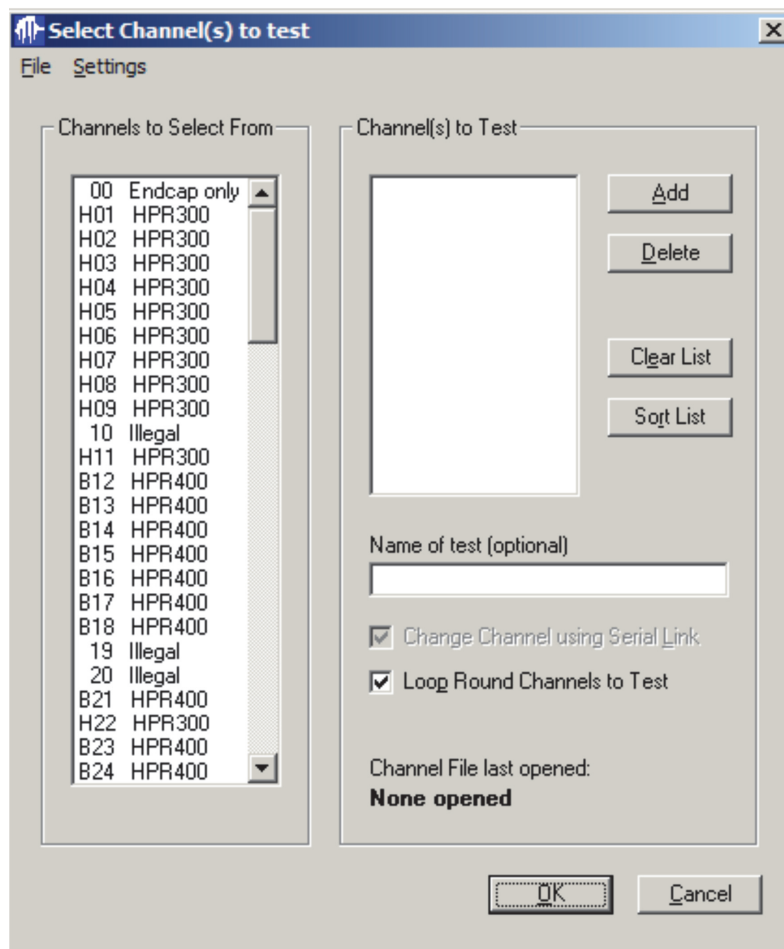


- | | |
|---|------------|
| 1 | PC |
| 2 | Comms Port |
| 3 | 25W D |
| 4 | ANT |

- | | |
|---|--------------------------|
| 5 | TDR |
| 6 | WSM6 |
| 7 | Charger/Comm's Interface |

1. Select Channel Range Test.
2. In the window choose **Select Channel(s) to test**. This displays the range of channels that can be selected from for use in the test.

Figure 7-28 – Select Channel(s) to test



3. To select a **Channel(s)-to-test**, click on a **Channels-to-Select-From**, and press **Add**, or simply double-click a **Channel(s)-to-test**.
4. Alternatively, select the **File** and then choose **New Test Channel File** menu option and specify a file name if a new custom .DAT file is to be created or choose Open Test Channel file if an existing file is to be opened.

Figure 7-29 – New Test Channel File

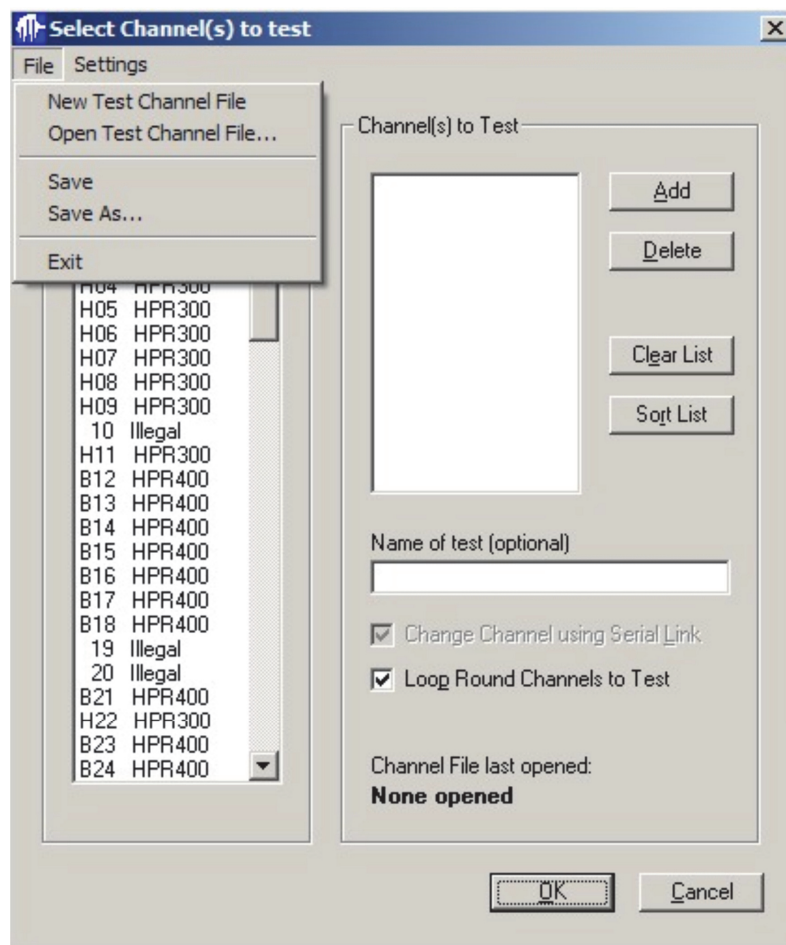


Figure 7-30 – Before setting path and file name

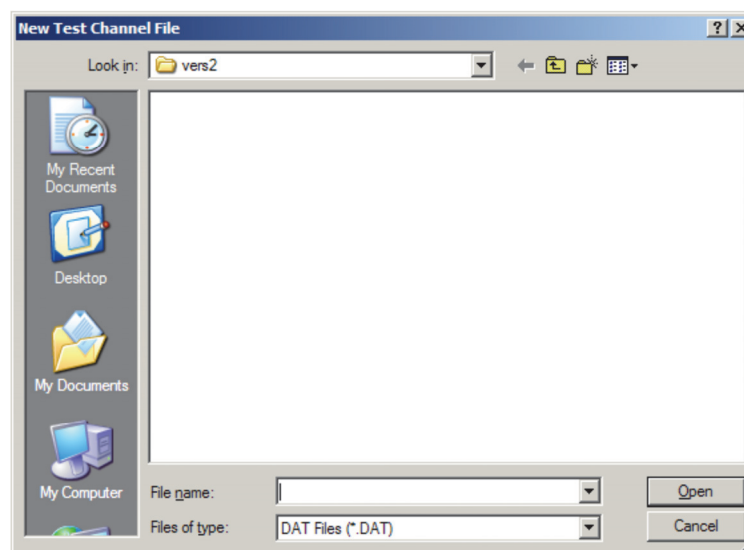
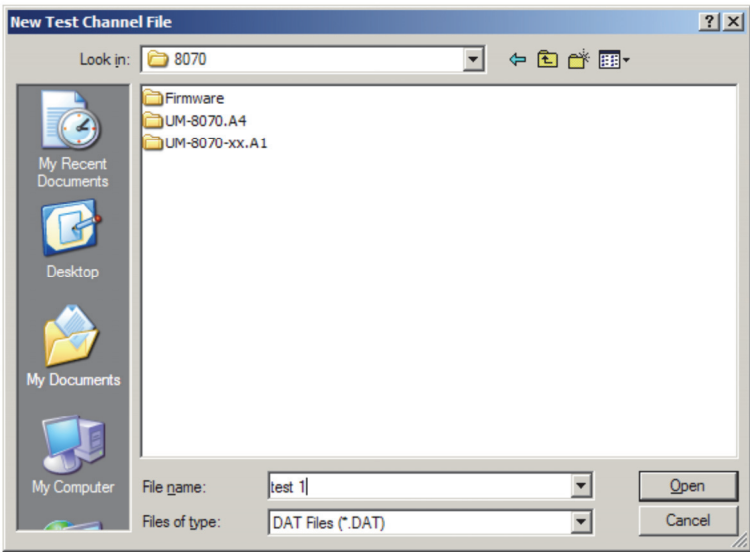
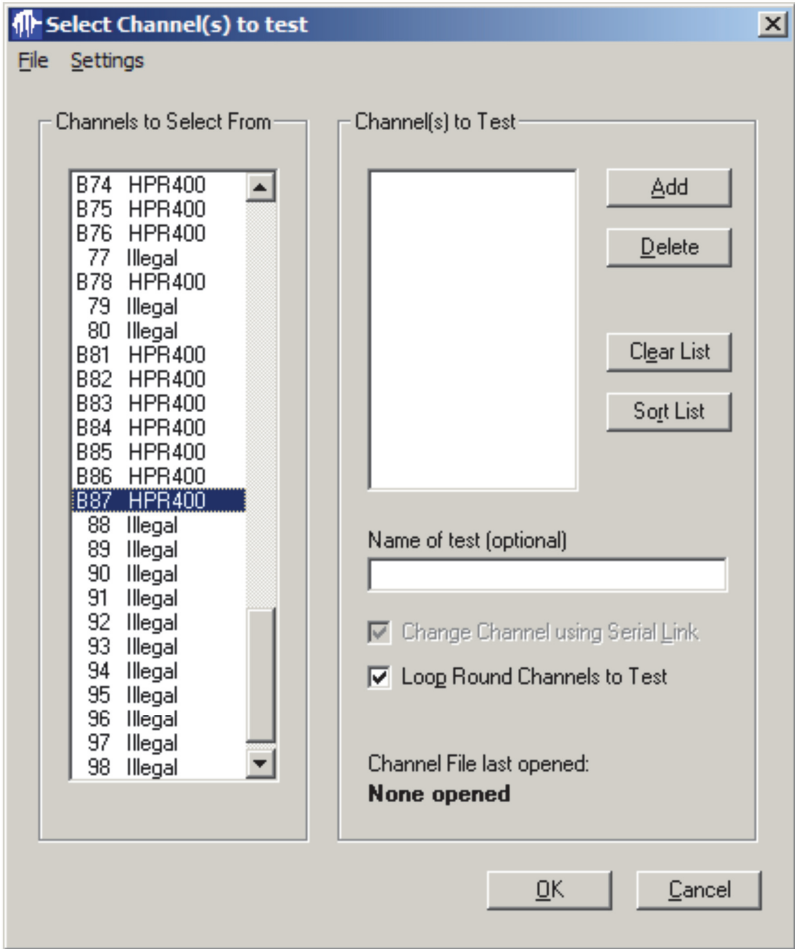


Figure 7-31 – With path and file name set



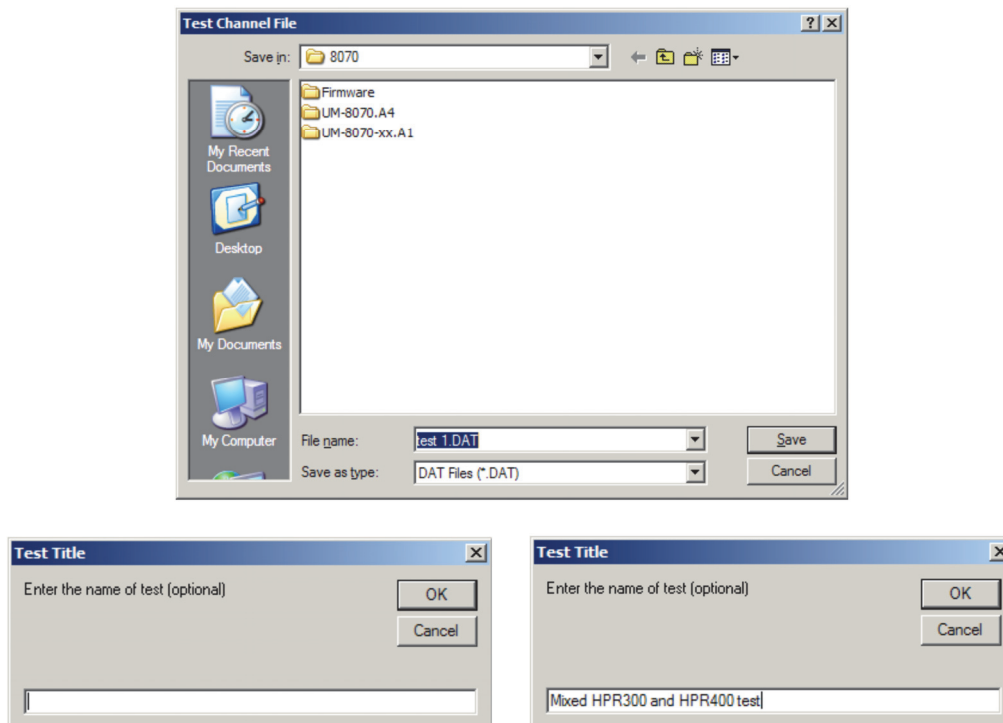
5. This results in:

Figure 7-32 – Select Channel(s) to test after entering desired channel file



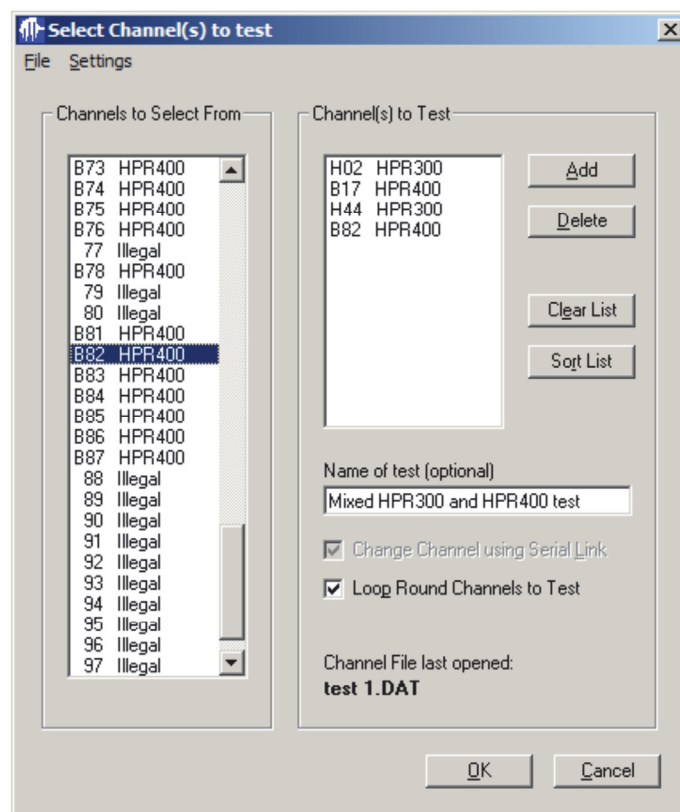
6. Input the desired channel as shown in **Figure 7-32**, then select **File** and **Save**.

Figure 7-33 – Saving File and resulting screens



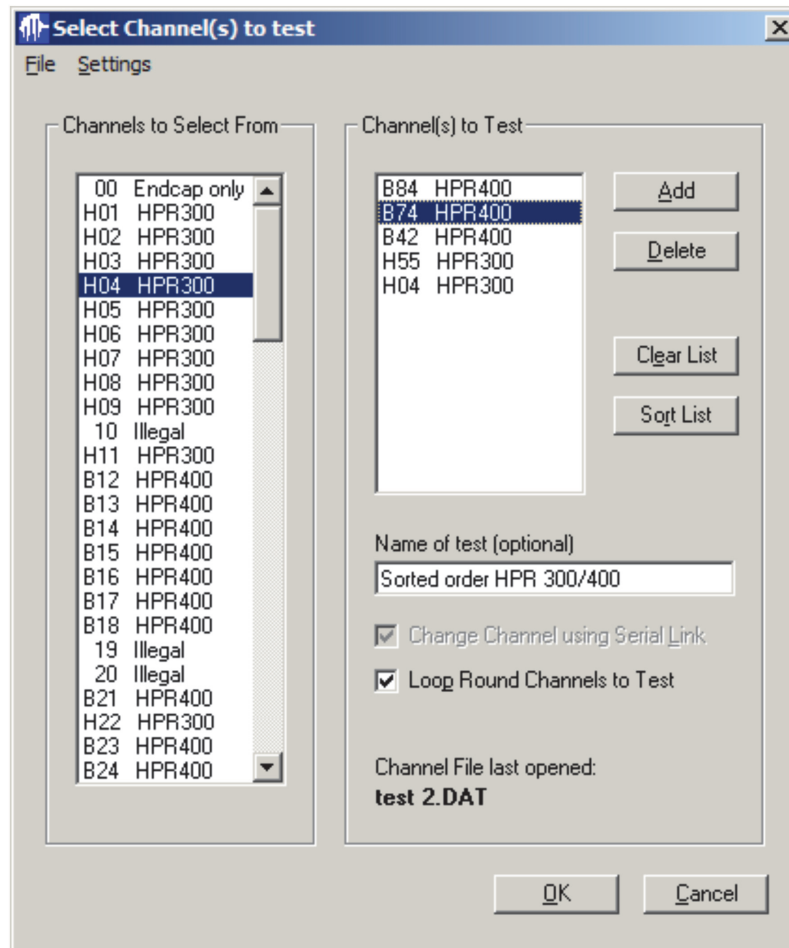
7. Pressing **OK** results in:

Figure 7-34 – Saved Channel results



8. To delete a channel from the **Channel(s) to test** list, click on the desire channel to delete to highlight it.

Figure 7-35 – Highlighting a channel to delete from Channel(s) to test list



9. When the channel to delete is highlighted, select **Delete** to remove it from the list.
10. Select **Clear List** to remove all channels from the list.
11. Select **Sort List** to sort the Channels to Test list into an ascending channel number order.

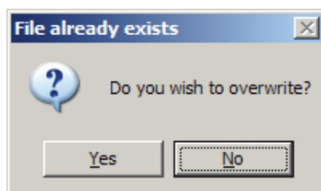
7.9.2.1 Name of Test (optional)

The Name of Test text box is an optional test string to label a custom list of Channels to Test.

7.9.2.2 Saving

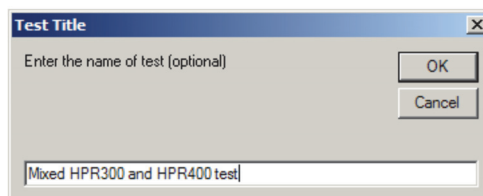
1. From the menu toolbar, select **File**, then **Save** or **Save As**, this prompts the standard save dialog. If the file name is not changed further prompts are:

Figure 7-36 – Saving File already exists prompt



2. Choosing **No** aborts the save process; **Yes** prompts the Test Title dialog:

Figure 7-37 – Test Title dialog box



7.9.2.3 Check Boxes

1. Checked **Loop Round Channels to Test** to test each channel in turn and then loop back to the first channel in the list. Unchecked runs the list without looping.
2. Checked **Change Channel using Serial Link** to automatically set the correct Channel-under-Test via the PC. **DO NOT Uncheck** for a WSM6 (unchecked implies the Channel needs to be configured by switch setting according to the channel-under-test).
3. The **Settings** menu option is for advanced configuration of the ANT through ANT Parameters.
4. The general condition is to use the default selection set by **Use Defaults**.
5. However if a unit is connected to a deadweight tester or other pressure calibrator the Depth wait may need to be increased. HPR300 125ms = 0m then 0.5ms/m thus 1s = 1750m. HPR400 125ms = 0m then Xms/m where X is the value in the HPR400 Depth Scale window.

Figure 7-38 – Setting ANT Parameters

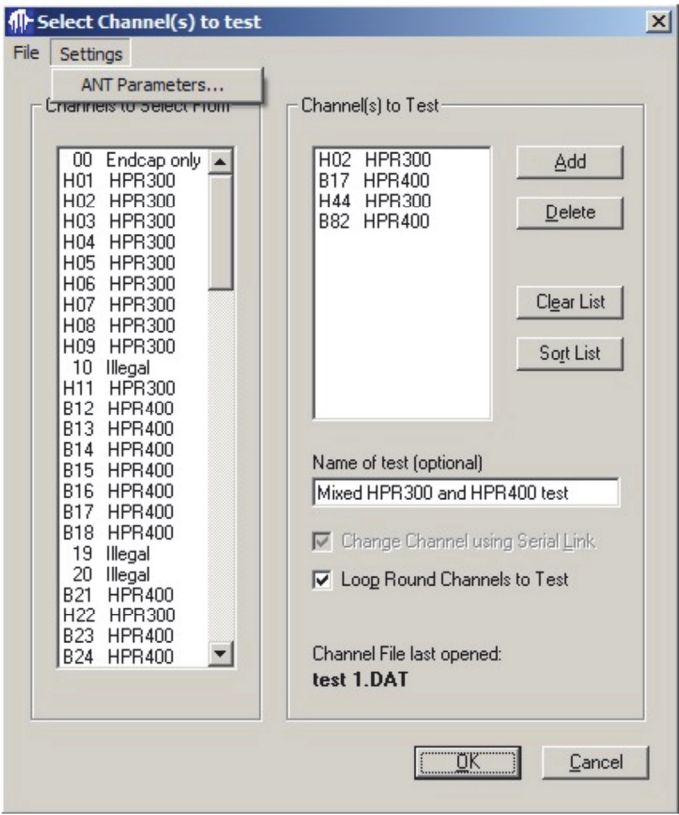
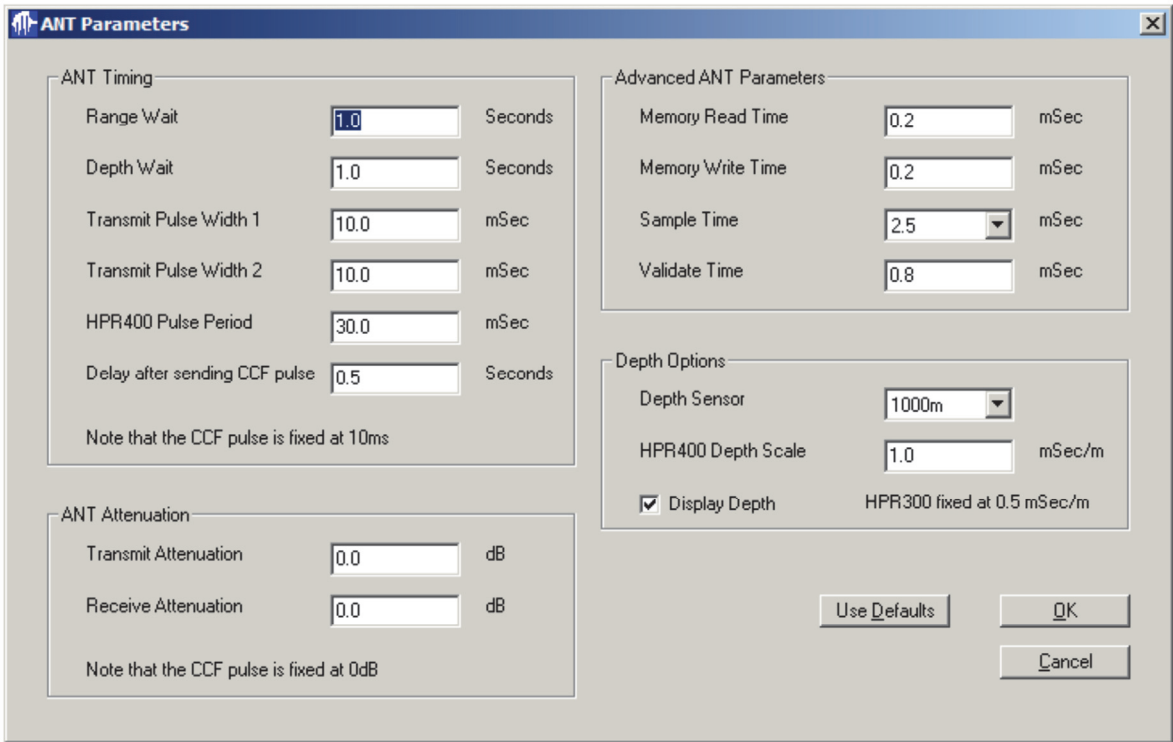


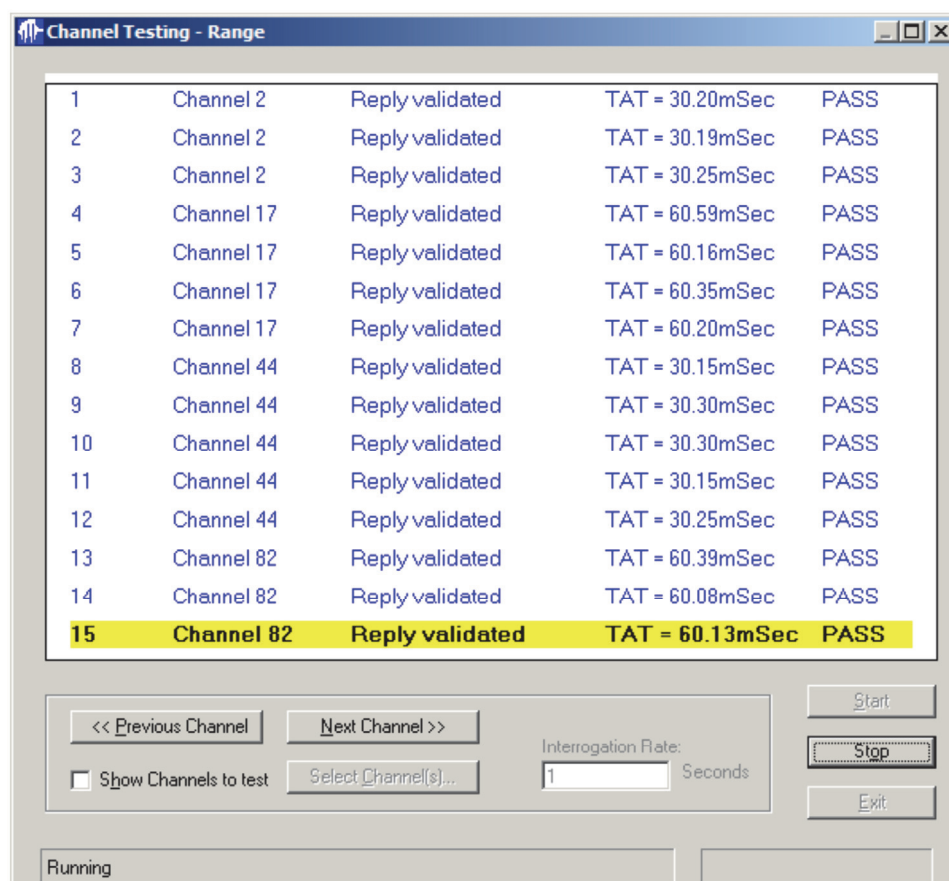
Figure 7-39 – ANT Parameters



7.9.2.4 Running the test

1. When Channel(s)-to-test have been selected, press **OK** then **Start** on the **Channel Range Testing** window.
2. The ANT will be initialised and configured with the first Channel(s)-to-test, before actual interrogations begin.
3. For each interrogation, the Transponder will either reply with a Turn-Around-Time, or indicate an invalid reply.
4. Press **Previous Channel** or **Next Channel** to respectively select lower and higher ones in the list (assuming more than one), or temporarily stop testing by checking **Show Channels to test** and display the current list of channels.
5. Press **Stop** to stop testing, and **Back** to return to the Main window.

Figure 7-40 – Channel Testing Range



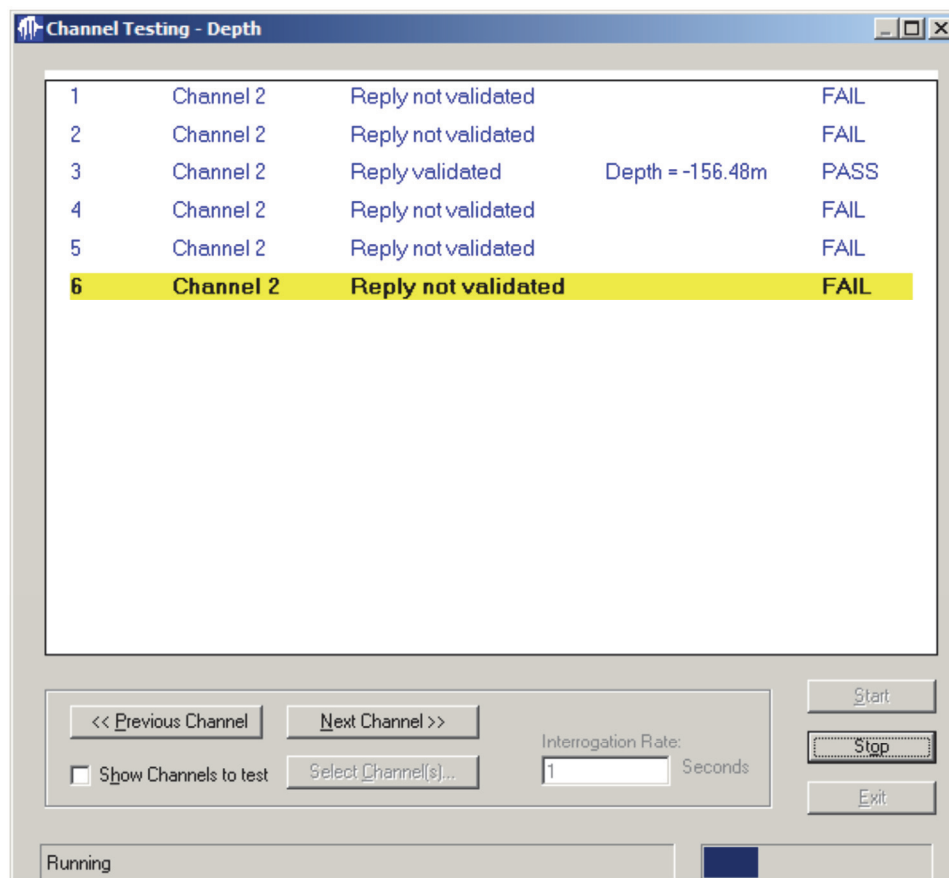
7.9.3 Diagnostics – Channel Depth Test

The following tests are only applicable if the transponder is fitted with a depth sensor, and depth replies are switched **ON** (More button under General Status). An ANT is used to detect the 2 reply signals from the WSM.

Select **Channel Depth Test** from the **Diagnostics** drop down menu, to display the window below:

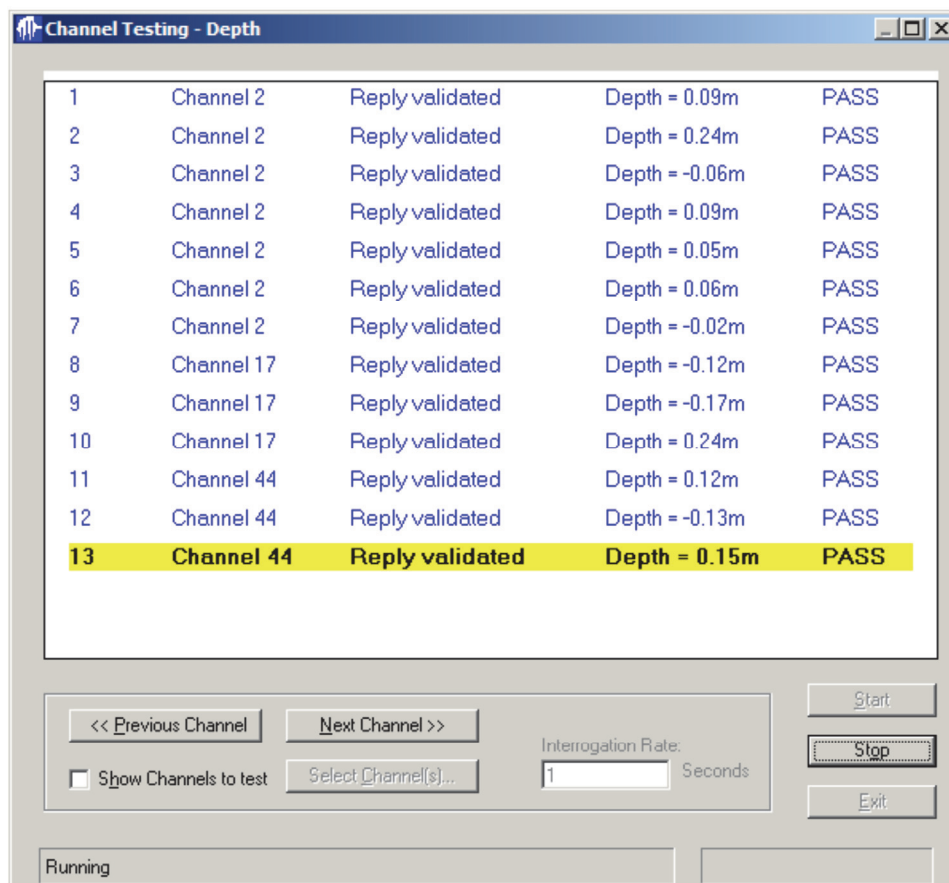
The operation is identical to Range Test, except that either the Transponder depth, or the raw time between two reply pulses are displayed.

Figure 7-41 – Channel Depth Test range



Failure to turn on the depth sensor results in:

Figure 7-42 – Failure to turn on Depth Sensor

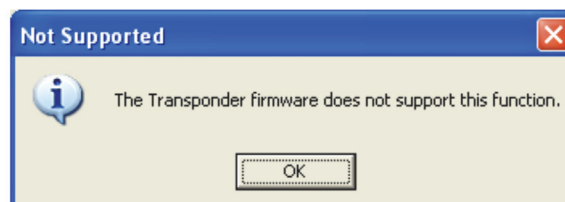


Typical depth results using the same file as for the Channel Range Test.

7.9.4 Diagnostics – Transponder to Transponder Test

This function is not available in WSM6

Figure 7-43 – Transponder not supported window



7.9.5 Diagnostics – Reset Transponder

This feature allows the unit to be put into a fixed, known state, ready for testing. The Nav Scheme will be HPR-300 and the channel B01. The address is not changed.

Figure 7-44 – Write HPR Channel

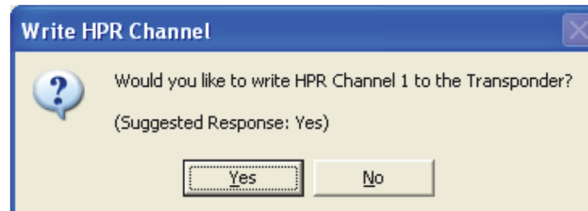


Figure 7-45 – HPR Channel written



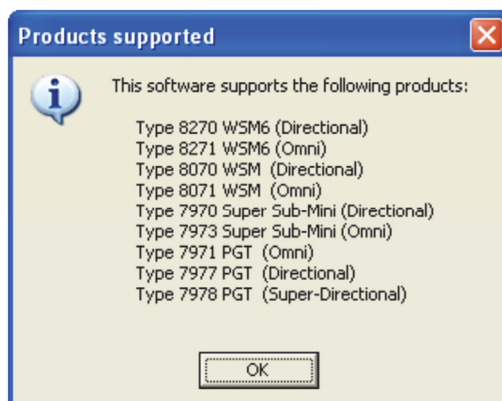
7.9.6 About

From the **Main Menu**, select **About** to display the software version:

Figure 7-46 – Sonardyne About screen



Press **Products Supported** to view which types of Transponder the software supports:

Figure 7-47 – Products Supported

For full the full licensing agreement, refer to **Appendix D – Software Copyright / License / Warranty**.

7.10 Programming the Acoustic Navigation Tester (ANT)

The Sonardyne Type 7343 ANT contains four programming procedures:

- **Tone Burst Sequence:** for producing a continuous sequence of tone bursts at a repetition period of 750ms. Useful during diagnostic testing.
- **Responder Trigger Sequence:** for producing a continuous sequence of “Responder Only” trigger outputs, at a repetition period of 750ms. Checks the transponder’s response to an electrical trigger input.
- **HPR Channel Test:** allows any HPR channel setting to be tested, including depth replies.
- **Acoustic Command Test:** tests the command frequency receiver circuitry. Sends an Enable command to a given command address.

The following four programming procedures are for ANT firmware version V2.25. The ANT can alternatively be controlled via a PC terminal package connected to the 25 way, ‘D’ type connector on the rear of the panel. Set the terminal baud rate to 9600, 8 data bits No parity, 1 stop bit.

7.10.1 Tone Burst Sequence

Switch the ANT **OFF**, then **ON** and key in the following sequence of commands on the ANT keypad ([] indicates keypad keys):

Table 7-2 – ANT Keypad sequence of operation

Keypad Key	Command	Comments
[ON]		
[2]	PULSE	
[2]	SET	
[2]	FREQ	
[2], [3], [9], [2], [3]		Interrogation frequency for HPR channel B33
[ENTER]		
[4]	PW	Pulse width set in ms
[1], [0], [ENTER]		
[5]	TRIG	
[2]	SET TRIG IN	
[2]	REP PERIOD	In ms
[7], [5], [0], [ENTER]		
[1]	EXIT	
[3]	SET TRIG OUT	
[2]	PULSE WIDTH	
[1], [ENTER]	PULSE WIDTH	In ms
[3]	O/P DELAY	
[0], ENTER	O/P DELAY	In ms

NOTE



When a delay of 29.5ms is required for the 'scope trigger', the O/P Delay – in ms – can be entered instead of 0

[1]	EXIT	
[1]	EXIT	
[1]	EXIT	
[5]	START	

The red ACTIVE light should now be flashing regularly, and the screen displays:

7=PW 8=DECR FREQ 9=INCR FREQ 6=STOP
PULSE 10 ms @ 23920 Hz & 0 dB ATTN

Keypad Key	Command	Comments
[6]	STOP	

7.10.2 Responder Trigger Sequence

Switch the ANT **OFF**, then **ON** and key in the following sequence of commands on the ANT keypad ([] indicates keypad keys):

Table 7-3 – Responder Trigger Sequence

Keypad Key	Command	Comments
[ON]		
[2]	PULSE	
[2]	SET	
[2]	FREQ	
[2], [3], [9], [2], [3]		Interrogation frequency for HPR channel B33
[ENTER]		
[4]	PW	Pulse width set in ms
[1], [0], [ENTER]		
[5]	TRIG	
[2]	SET TRIG IN	
[2]	REP PERIOD	In ms
[7], [5], [0], [ENTER]		
[1]	EXIT	
[1]	EXIT	
[1]	EXIT	
[3]	SET TRIG OUT	
[5]	START	

The red ACTIVE light should now be flashing regularly, and the screen displays:

7=PW 8=DECR FREQ 9=INCR FREQ 6=STOP
PULSE 10 ms @ 23920 Hz & 0 dB ATTN

Keypad Key	Command	Comments
[6]	STOP	

The **ANT TRIGGER OUT** signal can now be used to generate the responder trigger.

NOTE



The ANT will produce a negative going pulse of 10ms duration, every 750ms. The transponder will be triggered by the positive edge.

7.10.3 HPR Channel Test

Switch the ANT **OFF**, then **ON** and key in the following sequence of commands on the ANT keypad ([] indicates keypad keys):

Table 7-4 – HPR Channel Test

Keypad Key	Command	Comments
[ON]		
[3]	MULTI	
[4]	NEW PAN	
M [F], [ENTER]		Set Medium Frequency Band – use the up/down keys for M then 7 to select
[H],I,I,[2], [1]		Where [H] is either of the blank keys on the keypad, use up/down arrows for I, followed by the channel number (e.g. 21)
[ENTER]		

Good Reply (no depth):

HII21 2WAY MS= 60.02

Good Reply (with depth):-

HII21 2WAY MS= 59.98 Z = 124.73ms

No Reply detected:-

HII21 2WAY MS= 0.00

To repeat test, select **[Enter]**

7.10.4 Acoustic Command Test

Switch the ANT **OFF**, then **ON** and key in the following sequence of commands on the ANT keypad ([] indicates keypad keys):

Table 7-5 – Acoustic Command Test

Keypad Key	Command	Comments
[ON]		
[3]	MULTI	
[4]	NEW PAN	
M [F], [ENTER]		Set Medium Frequency Band – use the up/down keys for M then 7 to select
[A],[D],[3],[3],[0],[1],[ENTER]		Set the command Address of the WSM6
[E], N, [ENTER]		'ENABLE' command use up/down arrow keys for N then 7 to select

The ANT will then display (if working):

EN C: ENABLED E: 3

or (if not working):-

EN NO REPLY RECEIVED FROM COMPATT 3301

To repeat test, press [Enter]

SECTION 8 – FAULT DIAGNOSIS

8. Introduction

The following section assists in diagnosis of a WSM6 when fully disassembled. For instructions on disassembly refer to **Section 6.5 – Dismantling**.

8.1 Test Equipment

To assist in determining a fault with the WSM6 it is recommended to have the following list of equipment:

- Sonardyne ANT Type 7343 – firmware version 2.25 or greater, with ANT coupling loop 7343-042B or ANT test transducer Type 7935-000-B.
- Bench Power Supply Unit – which can be set to any output voltage over a range up to at least 25V dc and with a current limit facility which can be set to 100mA.
- Digital Multimeter – capable of reading at least 25V and 100mA dc.
- Dual Channel Oscilloscope – minimum 10MHz bandwidth, 10 mV/division minimum sensitivity, with a x10 probe plus a x100 probe capable of use up to 4kV. A guarded probe tip for connection to integrated circuit legs is strongly recommended.
- Frequency Counter – capable of measuring up to 200kHz minimum, accuracy 0.1%.
- Test Cable 1 – a Type MCIL5F connector with 300cm tail.
- Test Cable 2 – PSU (18V) to the battery connector (4-pin Molex, pin 2 = +, pin 4= -)

8.2 Quick Voltage Checks

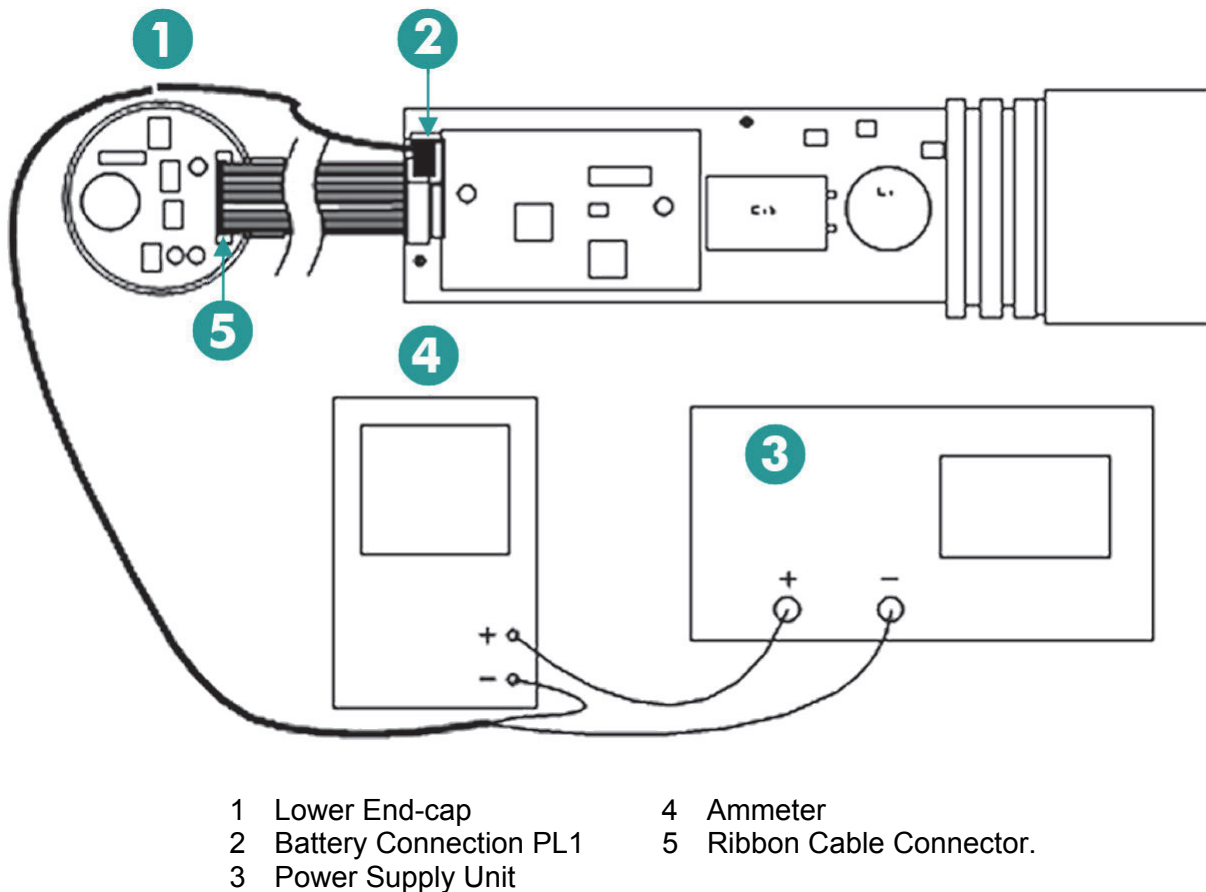
1. With the unit switched **ON**, measure the battery voltage using a Digital Multimeter, across the terminal of the large capacitor – C16 on the Tx board.
2. Measure the voltage of the CPU logic rail by moving the positive probe to pin 3 of JP3, which should read $5V \pm 0.1V$. JP3.3 is the unsoldered pad of JP3, closest to the central fixing screw on the upper board, see **Figure 8-3**.
3. Measure the 5V rail on the Tx card which is generated by a separate regulator, on the via hole closest to TP3 on the lower board, refer to **Figure 8-2**.

8.3 Diagnostic Set-up

1. Check the **ON/OFF** switch is in the **OFF** position. Make sure the Power Supply Unit (PSU) is **OFF**. Refer to **Figure 8-1**.
2. Disconnect the battery pack from the Tx card by disconnecting PL1, refer to **Figure 8-2**.
3. Connect Test Cable 2 to PL1 on the Tx card, refer to **Figure 8-2**.
4. Connect Test Cable 2 Molex pin 4 to the PSU –ve terminal.
5. Connect an ammeter (100mA dc range) between the PSU +ve terminal, and Molex pin 2.

6. The connection to an ammeter will not be necessary if the PSU has a built in ammeter or output current display.
7. Re-connect the end cap to the main electronics assembly via the ribbon cable.
8. Set the current limit on the bench PSU to 100mA and voltage to 18V.

Figure 8-1 – Test configuration



8.4 Diagnostic Procedures

To carry out full diagnostic checks, the upper board may have to be removed to access all the test points. Three flying leads are needed to connect the two boards together – PL2 to SKT2, PL3 to SKT3 and PL4 to SKT4.

CAUTION

 To avoid damage to the circuitry during testing, make sure the **ON/OFF** switch on the end-cap is set to **OFF** and only set to **ON** for the duration of the test.

8.4.1 Quiescent Checks

8.4.1.1 Quiescent Current

1. Switch **ON** the WSM6 by rotating the **ON/OFF** switch.
2. Check the quiescent current on the multimeter. This should not be less than 1.5mA. It may be necessary to wait a minute or two if the circuit has not been switched on for some time, and the electrolytic capacitors need time to re-form. A steady-state current higher than this confirms a fault condition exists. Occasional excursions above this value are normal.
3. If the current is higher, a fault has occurred in the electronics.

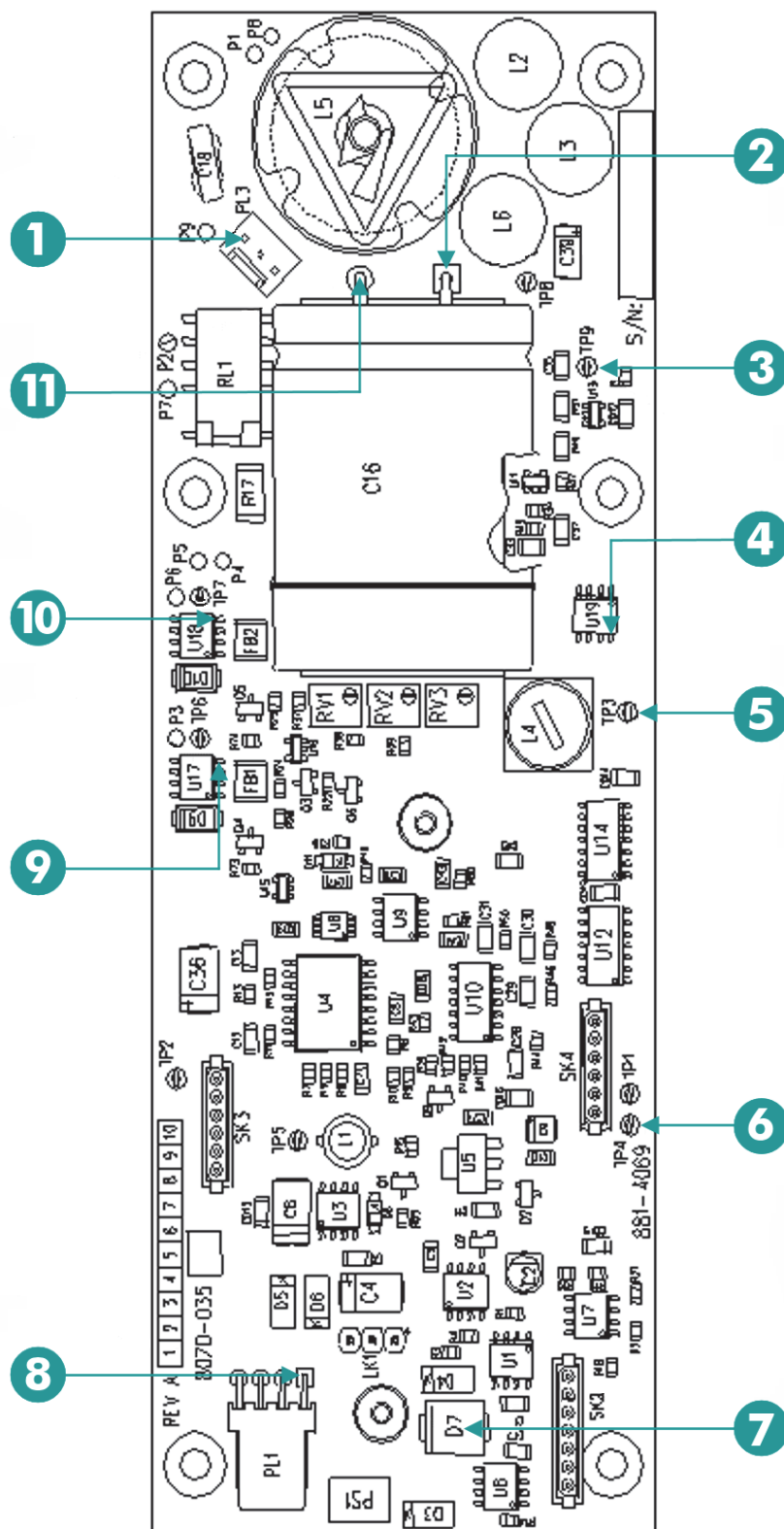
8.4.1.2 18V Supply Voltage

1. Set the multimeter as a voltmeter on a 25V dc range.
2. Connect the multimeter to monitor the voltage on the positive tag of the large capacitor (C16) on the lower printed circuit board (PCB) – positive terminal to C16, negative to C16 –ve.
3. The voltage should be approximately 17.4V. If it is zero the lower board is faulty.
4. If the C16 voltage is less than 17V, but not zero, the lower board is faulty.

8.4.1.3 5V Regulator Output

1. Connect the positive lead of the Multimeter to U19, pin 8 (use the hole closest to TP3 of the lower board). This voltage should be $5V \pm 0.2V$ dc.
2. If the voltage is outside the limits, either the 5V regulator or part of the circuit loading the 5V regulator is faulty.
3. To determine absolute fault, remove the upper board and repeat the test. If the problem persists the lower board is at fault. If the problem clears the upper board is faulty.

Figure 8-2 – Tx/Rx Board 8270-035

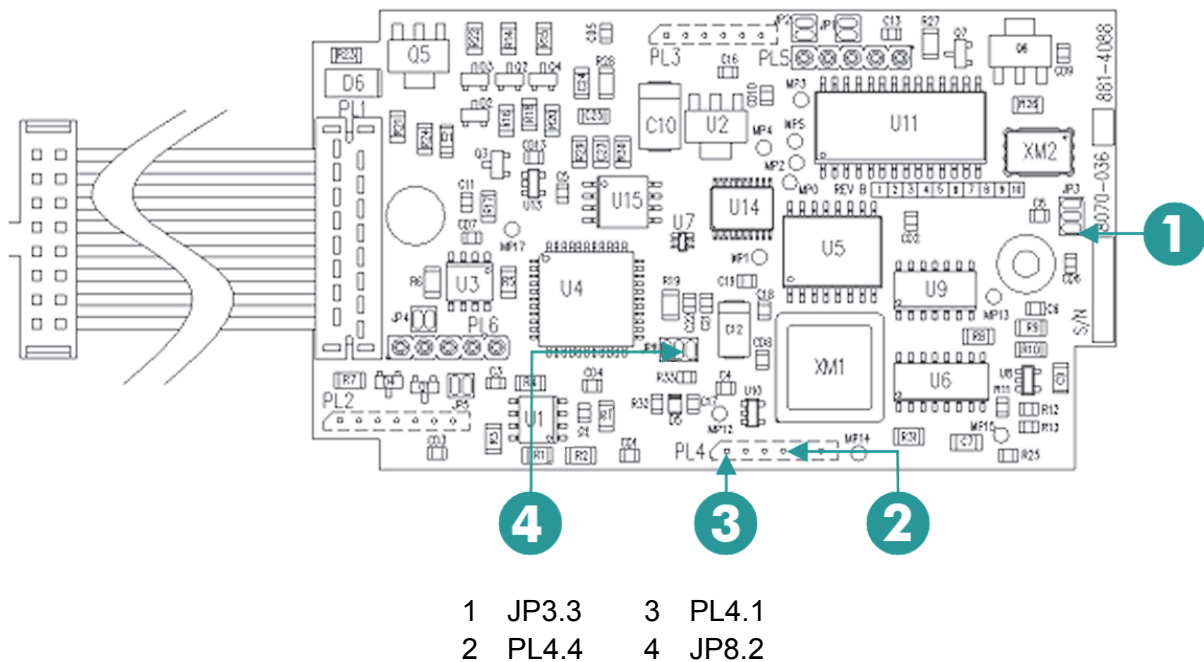


1	PL3.1	4	U19.8 +5V	7	D7 cathode	10	U18.4
2	C16+ Vbatt	5	TP3	8	PL1.1	11	C16 0V
3	TP9	6	TP4	9	U17.4		

8.4.1.4 100kHz Oscillator

1. Use a x10 probe and frequency counter, check a 5V 100kHz square wave is present on the middle pad of JP8. Refer to **Figure 8-3**.

Figure 8-3 – CPU Board 8270-036



8.4.1.5 CPU Operation

1. Connect a PC using the charger/comms interface.
2. Run WSM Terminal Software.
3. Switch the WSM6 **ON**.
4. Select **Get Status** on the software main page.
5. Check the transponder returns data by populating the boxes on the screen.
6. This proves the operation of the micro-controller and associated crystal.

8.4.1.6 24V Input Test

1. Using test Cable 1 (MCIL5F) connect the +24V (pin 4 – red wire) to the PSU +ve output, and the 0V (pin 2 – black wire) to the PSU –ve output.
2. Set the PSU voltage to 24V.
3. Check the voltage on C16. This should be approximately 23.4V and the circuit should be drawing a current of approximately 85mA.

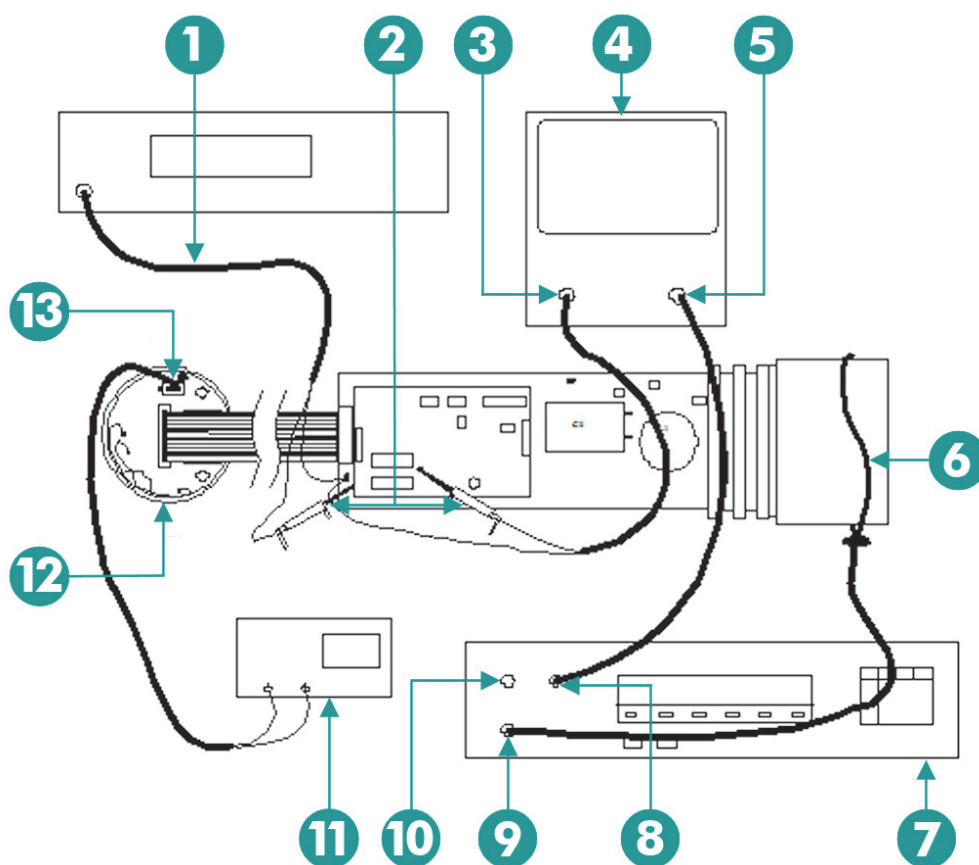
4. If less than 23.4V, or zero, a fault on the connector, DAS card or interconnections is indicated.
5. See **Section 3.5.1 – 8270-000-11 WSM6**, and **Section 3.5.2 – 8270-000-07 WSM6** for wiring configurations for variant transponders.

8.5 Functional Check

8.5.1 Transponder Mode

1. Check the **ON/OFF** switch on the transponder is in the **OFF** position.
2. Disconnect the battery pack from the Tx card by disconnecting PL1.

Figure 8-4 – Functional Test Configuration



1	Frequency	6	ANT Coupling	11	Power Supply Unit
2	X10 Probes	7	ANT	12	Switched End cap
3	Ch1	8	Out	13	Battery Connector
4	Oscilloscope	9	TDR		
5	Ext	10	In		

3. Connect a PSU to the battery connection.
4. Connect to a PC using the charger/comms interface.
5. Run the WSM Terminal software.
6. Switch the transponder **ON**.
7. On WSM Terminal, select **Get Status**.
8. Check the transponder populates the data fields. This confirms the basic operation of the micro controller and associated crystal.
9. On the WSM Terminal software, select the following:
 - NAV Scheme = HPR
 - HPR Channel = B33
 - Address = 3301
10. Refer to the Program the ANT Tone Burst set procedure and program the ANT as necessary to get tone bursts of B33 frequency.
11. Press the START key on the ANT to produce the following sequence of interrogation signals.
 - Tone Bursts 10ms wide
 - Frequency 23923Hz (channel B33)
 - Amplitude 15V p/p (0 dB attenuation)
 - Repetition Rate 750ms
12. Press STOP on the ANT to stop the sequence at any time.
13. If programmed correctly the ANT will produce a trigger output for the oscilloscope Tone Burst simulation.
14. Connect the Trigger OUT terminal on the ANT to the Trigger input of the oscilloscope.
15. Switch the oscilloscope to negative Trigger.
16. Tighten the coupling loop supplied with the ANT around the transducer end-cap
17. Connect the other end of the coupling loop to the TDR output of the ANT.

NOTE

The position of the loop on the end-cap may have to be adjusted to achieve optimum coupling.

18. Use the oscilloscope to check the waveforms obtained at the various points in the circuit. Failure at any point through the operation will indicate the source of the fault.

8.5.1.1 Pre-amplifier First Stage Output

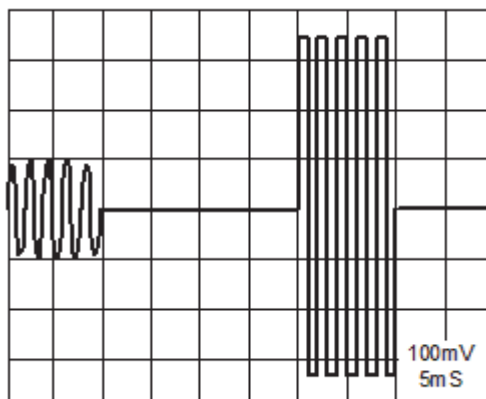
1. This waveform is monitored at TP9 on the lower board. Refer to Figure 8-5.
2. Both input and output signals are shown. The input starting at 0ms and the reply starting at approximately 30ms.
3. The signals are on a level 2.5V and >2V in amplitude.
4. If the input signal is not present, then possibly U15 or one of both of the long tailed pairs (Q7 and Q8) are faulty.

NOTE



It is possible the CPU board or connector SKT2 and 4 (or mating connector) may be faulty; change the upper board and observe the result. A definitive diagnosis is not possible at this stage.

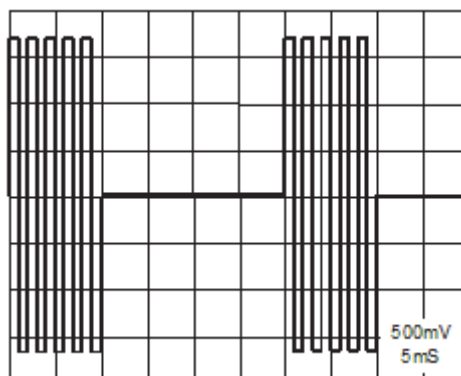
Figure 8-5 – Pre-Amp 1st Stage Waveform



8.5.1.2 Squarer Stage Output

1. This waveform is monitored at TP3 on the lower board. Refer to **Figure 8-6**.
2. Both input and reply signals should appear. The input starts at 0ms, and the reply starts at approximately 30ms.
3. Both signals should reach saturation level at the amplifier output – an amplitude of 5.0V p/p.
4. If the input signal is not present, U13, U11 or U19 is faulty.

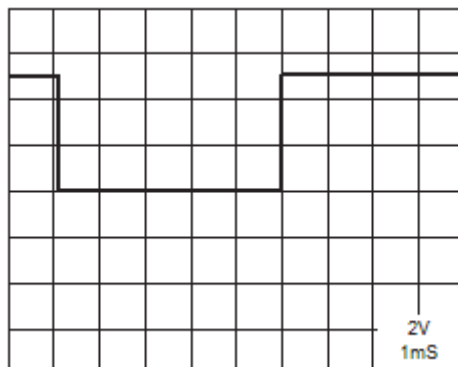
Figure 8-6 – Pre-Amp 2nd Stage Waveform



8.5.1.3 Envelope Detector Output

1. This waveform is monitored at TP4 on the lower board. Refer to **Figure 8-7**.
2. If the waveform does not appear as shown, and assuming the CPU board was found to be working correctly, the lower board is faulty.

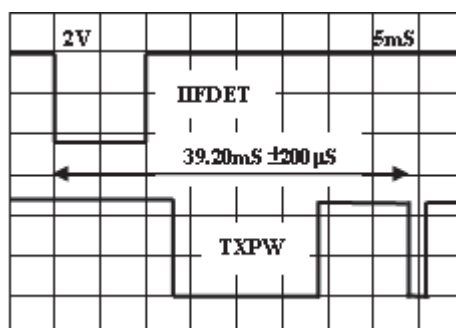
Figure 8-7 – Comparator O/P Waveform



8.5.1.4 IIFDET and TXPW Output

1. These waveforms are monitored on PL4-1 and PL4-4 on the upper board. Refer to **Figure 8-8**.
2. The time between the falling edge of IIFDET and the 2nd falling edge of TXPW should be $39.2\text{ms} \pm 200\mu\text{s}$.
3. If the times are incorrect then the upper board is faulty.
4. There is a possibility the lower board or PL4 is faulty, change the upper board for the lower board and observe the result.

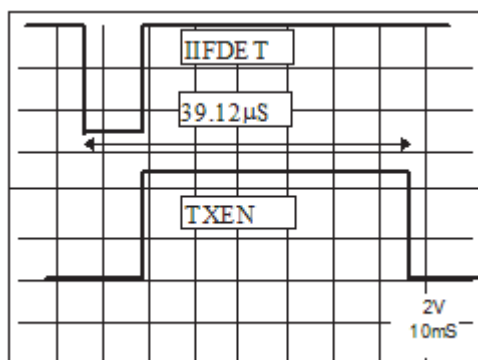
Figure 8-8 – IIFDET and TXPW Waveform



8.5.1.5 IIFDET and TXEN Output

1. This waveform is monitored on PL4-1 and PL4-5 on the upper board respectively. Refer to **Figure 8-9**.
2. The time between the falling edge of IIFDET and the falling edge of TXEN should be $39.12\text{ms} \pm 200\mu\text{s}$.
3. If the waveform does not resemble that shown in **Figure 8-9**, then the upper board is faulty.
4. It is possible for the lower board or PL2 (or mating connector) to be faulty. To determine this change the lower board and observe the results.

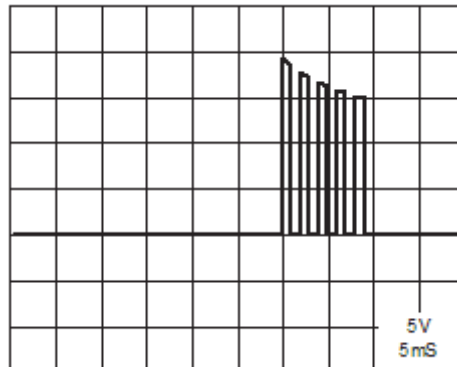
Figure 8-9 – IIFDET and TXEN Waveform



8.5.1.6 Drive Amplifier Input

1. This waveform is monitored on the Gates of U17 pin 4 and U18 pin 4 on the lower Tx board. Refer to **Figure 8-10**.
2. If it does not appear as shown in **Figure 8-10**, then the Tx board is faulty.

Figure 8-10 – Drive Amp I/P Waveform



8.5.1.7 Drive Amplifier O/P Output

1. This waveform is monitored using the x100 probe on PL3 pin 1 on the lower board. Refer to **Figure 8-11**.

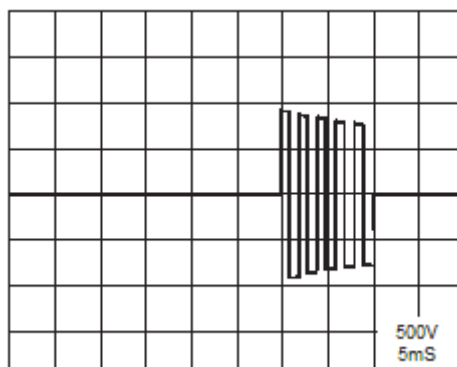
NOTE



The voltage is very high at this point – 1800V p/p.

2. If the waveform is not as shown in **Figure 8-11**, then the lower board is faulty.
3. If the waveform is present it should be possible to hear the transducer “pinging” as it produces the reply burst.
4. If there is no sign of transducer output, then the transducer is faulty.

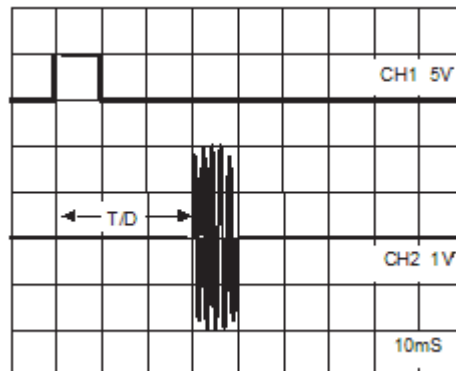
Figure 8-11 – Drive Amp O/P Waveform



8.5.1.8 Responder Mode

1. Use Test Cable 1 to apply a +ve going pulse to the Pin 1 (black wire), wrt 0V (white wire), 5V amplitude, with a duration of 10ms and a repetition rate of 750ms. Refer to **Figure 8-12**.
2. The 10ms trigger waveform and a normal output waveform should be present.
3. If the output waveform is not present, the upper board is faulty.
4. If the waveform is present, repeat the test for the full range of channel selection switch settings.

Figure 8-12 – O/P from Coupling Loop



8.6 Acceptance Test

Following successful fault diagnosis an acceptance test must be carried out. At the end of each test complete the Test Results Sheet to keep a record of all results.

8.6.1 Battery Off Load Voltage

On the Tx Board, measure the D7 Cathode wrt 0V (C16 –ve). This should be greater than 20V for a fully charged unit.

8.6.2 Battery Charge Circuit Function

1. Make power supply connections to the transponder's external 5 pin connector using the MCIL5F test cable – charging input (green, pin 4) to +24V; common (white, pin 2) to 0V.
2. Apply 24V supply via the test cable.
3. Check an approximate 85mA charging current flows. Make a note of the on-load voltage supply (nominally 20.5V, depending on the charge condition of the battery).
4. Assemble the WSM6 for the remaining tests.

8.6.3 Serial Communications with PC Software

1. Connect to a PC using the charge/comms interface.
2. Run the WSM Terminal Software.
3. Switch on the transponder.
4. Select **Get Status**, and check the transponder returns data.
5. This test checks the basic operation of the micro controller and the associated crystal.
6. Select the following:
 - Nav Scheme = HPR
 - HPR Channel = B21
 - Address = 3301
7. Disconnect the charger/comms interface, and reconnect the pig tail test lead.

8.6.4 Transponder Test

1. Connect the ANT TDR output to the ANT Test Transducer (Type 7935-000).
2. Hold the Test Transducer end on to the WSM6 transducer. The test transducer will verify the WSM6 acoustic transducer.

NOTE

If a test transducer is not available, an ANT Test Loop (Type 7343-042) can be used, but relies on electrical pick-up with the WSM rather than an acoustic coupling with the transducer, and can give good replies even if the WSM6 is damaged.

- Programme the ANT HPR Channel. Switch the ANT **OFF**, then **ON** and key in the following sequence of commands on the ANT keypad:

Keypad Key	Command
ON	
3	MULTI
4	NEW PAN
F	Set Medium Frequency Band Use up/down arrow keys for M then 7 to select
ENTER	
H	H is either of the blank keys on the keypad. Use up/down arrows for II.
21	Channel number 21
ENTER	

- Enter channel 21 as detailed, to select the HPR400 channel.
- The ANT will generate the two-pulse interrogation used in the HPR400 Nav Scheme.
- If a VALID REPLY message is shown, and the delay is between 59.5 – 60.5ms, the test has passed. The test checks both navigation receiver circuits and the transmitter circuitry.

8.6.5 Acoustic Command Test

Set up the ANT as detailed in Section 77.10 Programming the Acoustic Navigation Tester (ANT). If the **ENABLED** reply is seen, the command frequency receiver has been checked and the test has passed.

8.6.6 Responder Trigger Test

Using the Diagnostic pull-down menu on the WSM Terminal Software, select Responder Trigger (ping). Click **Start**. If an audible ping is heard, the triggering circuitry is functioning and the test has passed.

8.6.7 Current Demand Test

With the bench power supply still connected, increase the supply current limit to a maximum of 1A. Observe the current increase every time the transponder replies.

8.6.8 Trickle Charge Function

Remove the trigger pulse from the black wire and observe the current drops back to a steady reading of approximately 85mA with a fully charge battery.

8.6.9 Wideband Test

Use the 8063 Deck Test Unit (DTU), check the wideband reply mode can be made by following the instructions in the DTU manual.

1. Switch **OFF** the bench PSU.
2. Disconnect the test cable from the transponder.
3. Fit the non-shorting dummy plug.
4. Switch the WSM6 **OFF**.
5. Complete the Test Result Sheet: **Appendix C - Wideband Sub-Mini 6: .**

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SECTION 9 – RETRIEVAL AND STORAGE

9. Retrieval and Storing

1. When the WSM6 has completed its in water operations the unit must be retrieved.
2. Make sure the rotary **ON/OFF** is switched to set to **OFF**.
3. Thoroughly wash the transponder in warm clean fresh water. This is to remove accumulations of salt, sand or silt, paying particular attention to the **ON/OFF** switch and electrical connectors.
4. Remove any attached cabling or dummy plugs and wash the external socket.
5. Dry the WSM6 and any attached cabling with a clean lint free cloth.
6. Inspect the WSM6 for any signs of damage or corrosion.
7. Inspect the Pressure Relief Vent Valve for signs of protrusion. A protruding Pressure Relief Vent Valve could indicate a fault with the battery pack.
8. Lubricate the connectors as detailed in **Section 6.6 - Lubrication**.
9. Check and recharge the battery.
10. On completion of all checks the WSM6 may be placed in storage.

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SECTION 10 – SPARES

10. Introduction

The following is a list of all available spares.

10.1 Type 8270 Wideband Sub-Mini 6G: Directional 4000 Metres

Table 10-1 – Type 8270 WSM6 Component Identification Table

	Part No.	Dwg No	Description	QTY
LOWER ENDCAP				
	641-3309	8070-010-01	Lower end cap assembly, 4000m no depth	*
	641-3334	8070-010-02	Lower end cap assembly, 4000m with depth	*
	317-2799		Bulkhead Connector Subconn MCBH5M AL/2-O	1
	200-0081		Seal 'O' ring 200-008-5570 for pressure vent	2
	200-8347		Seal 'O' ring 200-834-557 for endcap	2
	641-2141		Blanking socket MCDC5F c/w locking sleeve	1
BATTERY				
	641-3264	7970-002-03	Nickel Metal Hydride Battery pack	1
TRANSDUCERS				
	641-3310	8070-005	Transducer end-cap – MF Directional	1
	200-8347		Seal 'O' ring 200-834-557 for tdr end cap	2
ELECTRONICS				
	631-7596	8070-035-01	Rx/Tx PCB for 8070 (issue B)	1
	631-7472	8070-036-01	CPU PCB (issue B)	1
	631-7471	8070-039-01	End cap PCB (issue A)	1
	850-8204	5550-020	Tx Coil Assembly	1
MECHANICAL PARTS				
	710-2763	8070-030	Housing 4000m	1
	810-0854	7866-020	Housing sleeve	1
	720-3034	7970-027	Chassis Plate	1
	222-251A		Screw-PH-SL-MSZP M2.5x6 (PCB to chassis)	6
	230-175A		Washer crinkle B/CU M2.5 (PCB to chassis)	6
	110-0487		RM nylon cord 3mm (housing/endcap retainer), 210mm each	2
	925-002C		Silica gel bag, 1g	2

MISCELLANEOUS				
	790-1053		Shipping case (holds two units)	1
CABLE OPTIONS				
	820-6586	7971-050	PC to WSM comms cable	1
	820-5163	7970-053	Mating cable tail, 5m, with locking sleeve	1
BATTERY CHARGING / PC COMMS				
	602-0544	7972-081	WSM Comms Charger Kit including:-	
	620-7106	7972-000-04	WSM Comms / Charger Unit (for 2000mAh pack)	1
	272-0785	---	WSM Charger PSU (0.5A)	1
	280-4175	---	PC Cable, 9 way D type, male-female	1
	272-0345	---	Power Pack AC cable, UK plug	1
	272-036C	---	And Power Pack AC cable, US plug	1
	272-0352	---	And Power Pack AC cable, European plug	1
See Section 10.3 - Type 8270-000-11 – Wideband Sub-Mini Directional 6G 4000m, 5-pin Female or Section 10.4 - Type 8270-000-07 Wideband Sub-Mini 6G Directional 4000m 8-pin for specific charger kit variations				

10.2 Type 8271 Wideband Sub-Mini 6G: Omni-Directional 1000 Metres

Table 10-2 – Type 8271 Wideband Sub-Mini 6G: Omni-Directional 1000M

	Part No.	Dwg No	Description	QTY
LOWER ENDCAP				
	641-3335	8071-010-01	Lower end cap assembly, 1000m no depth	*
	641-3336	8071-010-02	Lower end cap assembly, 1000m with depth	*
	641-3450	8070-010-03	Lower end cap assembly, 100m with depth	*
	317-2799		Bulkhead Connector Subconn MCBH5M AL/2O	1
	200-0081		Seal 'O' ring 200-008-557 for pressure vent	2
	200-8347		Seal 'O' ring 200-834-557 for end cap	2
	641-2141		Blanking Socket MCD CF + locking sleeve	1
BATTERY				
	641-3264	7970-002-03	Nickel Metal Hydride Battery pack	1
TRANSDUCER				
	650-0927		Transducer spares kit – (incl. O rings)	1
	750-0869	7656-076	Transducer guard	1
ELECTRONICS				
	631-7597	8070-035-02	Rx/Tx PCB for 8071 (issue B)	1
	631-7472	8070-036-01	CPU PCB (issue B)	1
	631-7471	8070-039-01	End cap PCB (issue A)	1
	851-2025	5548-029	Tx Coil Assembly	1
MECHANICAL PARTS				
	710-2772	8071-016	Housing, 1000m	1
	810-1260	8071-017	Housing sleeve	1
	720-3034	7970-027	Chassis Plate	1
	222-251A		Screw-PH-SL-MSZP M2.5x6 (PCB to chassis)	6
	230-175A		Washer crinkle B/CU M2.5 (PCB to chassis)	6
	110-0487		RM nylon cord 3mm (housing/end cap retainer) 210mm each	2
	925-002C		Silica gel bag, 1g	2

MISCELLANEOUS				
	790-1053		Shipping case (holds 2 units)	1
CABLE OPTIONS				
	820-6586	7971-050	PC to WSM comms cable	1
	820-5163	7970-053	Mating cable tail, 5m, with locking sleeve	1
REMOTE TRANSDUCER CONVERSION KIT				
	650-0014	8071-003	WSM remote transducer conversion kit*	1
* when ordering a straight or right angle transducer, and cable length of 0.6m, 1.0m, 2.0m or 3.0m need to be specified				
BATTERY CHARGING / PC COMMS				
	602-0544	7972-081	WSM Comms Charger Kit including:-	
	620-7106	7972-000-04	WSM Comms / Charger Unit for 2000mAh pack	1
	272-0785	---	WSM Charger PSU (0.5A)	1
	280-4175	---	PC Cable, 9 way D type, male-female	1
	272-0345	---	Power Pack AC cable, UK plug	1
	272-036C	---	And Power Pack AC cable, US plug	1
	272-0352	---	And Power Pack AC cable, European plug	1
See Section 10.3 - Type 8270-000-11 – Wideband Sub-Mini Directional 6G 4000m, 5-pin Female or Section 10.4 - Type 8270-000-07 Wideband Sub-Mini 6G Directional 4000m 8-pin for specific charger kit variations				

10.3 Type 8270-000-11 – Wideband Sub-Mini Directional 6G 4000m, 5-pin Female

Table 10-3 - TYPE 8270-000-11 Wideband SUB-MINI Directional 6G 4000M, 5-pin FEMALE Spares and Accessories

	Part No.	Dwg No	Description	QTY
LOWER ENDCAP				
	641-0010	8070-010-07	Lower end cap assembly, 4000m with depth, 5-pin female	1
	317-5361		Bulkhead Connector Subconn MCBH5F AL/2-O	1
	200-0081		Seal 'O' ring 200-008-5570 for pressure vent	2
	200-8347		Seal 'O' ring 200-834-557 for end-cap	2
	317-2836		Blanking socket MCDC5M	1
	317-2672		Locking Sleeve for blanking socket, MCDLSF	1
BATTERY				
	641-3264	7970-002-03	Nickel Metal Hydride Battery pack	1
TRANSDUCERS				
	641-3310	8070-005	Transducer end-cap – MF Directional	1
	200-8347		Seal 'O' ring 200-834-557 for tdr end-cap	2
ELECTRONICS				
	631-7596	8070-035-01	Rx/Tx PCB 8070-035-01-B2	1
	631-7472	8070-036-01	CPU PCB	1
	631-7471	8070-039-01	End-cap PCB	1
	850-8204	5550-020	Tx Coil Assembly	1
MECHANICAL PARTS				
	710-2763	8070-030	Housing 4000m	1
	810-0854	7866-0020	Housing sleeve	1
	720-3034	7970-027	Chassis Plate	1
	222-251A		Screw-PH-SL-MSZP M2.5x6 (PCB to chassis)	6
	230-175A		Washer crinkle B/CU M2.5 (PCB to chassis)	6
	110-0487		RM nylon cord 3mm (housing/end-cap retainer), 210mm each	2
	925-002C		Silica gel bag, 1g	2
MISCELLANEOUS				
	790-1053		Shipping case (holds two units)	1

BATTERY CHARGING / PC COMMS /CABLE OPTIONS				
	820-6586	7971-050	PC to WSM comms cable, 5 pin	1
	317-2883		MCIL5M Mating cable tail	1
	317-2672		MCDLSF locking sleeve	1
	820-0002	8070-053-01	5 pin Male to 5 pin male 1-1 cable, 300mm	1
	602-0544	7972-081-01	WSM Comms Charger Kit including:	
	620-7106	7972-000-04	WSM Comms / Charger Unit (for 2000mAh pack, 5 pin)	1
	272-0785	---	WSM Charger PSU (0.5A)	1
	280-4175	---	PC Cable, 9 way D type, male-female	1
	272-0345	---	Power Pack AC cable, UK plug	1
	272-036C	---	Or Power Pack AC cable, US plug	1
	272-0352	---	Or Power Pack AC cable, European plug	1

10.4 Type 8270-000-07 Wideband Sub-Mini 6G Directional 4000m 8-pin

Table 10-4 – Type 8270-000-07 Wideband Sub-Mini 6 Directional 6G 4000m 8-pin Spares and Accessories

	Part No.	Dwg No	Description	QTY
LOWER ENDCAP				
	641-3417	8070-010-04	Lower end cap assembly, 4000m with depth, 8-pin	1
	317-5183		Bulkhead Connector Subconn MCBH8F AL/2-O	1
	200-0081		Seal 'O' ring 200-008-5570 for pressure vent	2
	200-8347		Seal 'O' ring 200-834-557 for endcap	2
	317-5197		Blanking socket MCDC5F	1
	317-2672		Locking Sleeve for blanking socket, MCDLSF	1
BATTERY				
	641-3264	7970-002-03	Nickel Metal Hydride Battery pack	1
TRANSDUCERS				
	641-3310	8070-005	Transducer end-cap – MF Directional	1
	200-8347		Seal 'O' ring 200-834-557 for tdr end-cap	2
ELECTRONICS				
	631-7596	8070-035-01-B2	Rx/Tx PCB for 8070	1
	631-7472	8070-036-01	CPU PCB	1
	631-7471	8070-039-01	End-cap PCB	1
	850-8204	5550-020	Tx Coil Assembly	1
MECHANICAL PARTS				
	710-2763	8070-030	Housing 3000m	1
	810-0854	7866-0020	Housing sleeve	1
	720-3034	7970-027	Chassis Plate	1
	222-251A		Screw-PH-SL-MSZP M2.5x6 (PCB to chassis)	6
	230-175A		Washer crinkle B/CU M2.5 (PCB to chassis)	6
	110-0487		RM nylon cord 3mm (housing/end-cap retainer), 210mm each	2
	925-002C		Silica gel bag, 1g	2
MISCELLANEOUS				
	790-1053		Shipping case (holds two units)	1

BATTERY CHARGING / PC COMMS /CABLE OPTIONS				
	820-6780	7971-060	PC to WSM comms cable, 8 pin	1
	820-6795	8000-075	Mating cable tail, 5m, with locking sleeve	1
	820-6794	8000-076-01	8 pin extension cable, M-F, 35m	
	602-0487	7972-080	WSM Comms Charger Kit including:-	
	620-7075	7972-000-03	WSM Comms / Charger Unit (for 2000mAh pack, 8 pin)	1
	272-0785	---	WSM Charger PSU (0.5A)	1
	280-4175	---	PC Cable, 9 way D type, male-female	1
	272-0345	---	Power Pack AC cable, UK plug	1
	272-036C	---	Or Power Pack AC cable, US plug	1
	272-0352	---	Or Power Pack AC cable, European plug	1

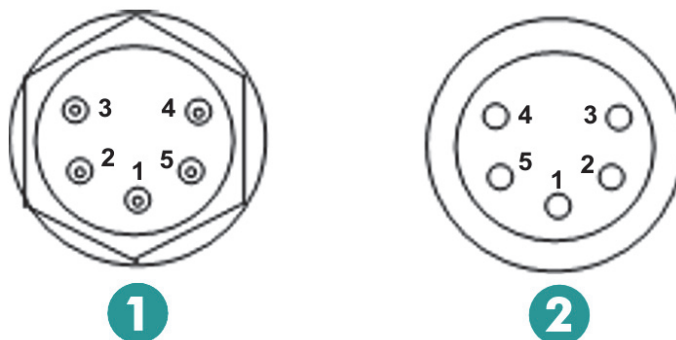
SECTION 11 – TECHNICAL SPECIFICATIONS

11. Technical Specification for Type 8270 / 8271 Wideband Sub-Mini 6G

Navigation schemes	All HPR-300 Channels (see Appendix B.1) All HPR-400 Channels (see Appendix B.2) All Sonardyne Tone Frequencies All Sonardyne Wideband signals (replies only)	
Pulse Width	10 ms for HPR (4ms on Sonardyne frequencies) (8ms for Sonardyne Wideband replies)	
Battery Type	Nickel Metal Hydride rechargeable (2000mAh)	
Turnaround Delay	after interrogation pulse or responder trigger	
HPR 300	30ms (fixed)	
HPR 400	60ms (fixed for transponder) 30ms (fixed for responder)	
Sonardyne	125ms (default)	
Maximum Repetition Period	750 milli-seconds	
Responder Trigger, voltage	Rising edge triggers transmission (from < +0.5 V to > +4 V) Maximum input 24 V	
Responder Trigger, pulse width	3 to 25ms	
Mating Connector	Subconn MCIL5F See Section 10.3 - Type 8270-000-11 – Wideband Sub-Mini Directional 6G 4000m, 5-pin Female or Section 10.4 - Type 8270-000-07 Wideband Sub-Mini 6G Directional 4000m 8-pin for specific charger kit variations.	
Dimensions	Refer to dimension drawings (Section 3)	
Length	Type 8270	Type 8271
Clamping Diameter	403 mm	399 mm
Maximum Diameter	86 mm	75 mm
	90 mm	75 mm
Standard housing	Type 8270	Type 8271
Depth	4000 metres	1000 metres
Rating,		

Special Depth Rating, housing	Type 8270-000-10 4000m	Type 8271-000-02 4000m Use 8070 Clamping diameter
Depth rating, unit	Depends on depth sensor - see lower end-cap	
Depth sensor, Linearity	0.25% FSD typical	
Ratings	Suitable for outdoor use Relative Humidity 100% Wet location IP68 Ambient temperature range “ must be at least 5°C to 40°C	
Weight	Type 8270	Type 8271
In air	5.0 kg	2.7 kg
In water	2.6kg	1.4 kg
Transducer Type	Type 8270 Directional	Type 8271 Omni Directional
TX Beam Pattern		
Low channels (19-26kHz)	±30 degrees conical	±120 degrees conical
High channels (26-32kHz)	±20 degrees conical	±120 degrees conical
TX Source Level (dB re 1 µPa @ 1 m):	(over the bandwidth 26 to 32 kHz)	
high power + ext 24V	202 dB	190 dB
high power + battery	199 dB	188 dB
low power + battery	196 dB	185 dB
Rx Sensitivity: (dB re 1 µPa)	Type 8270	Type 8271
high gain	<100 dB	<100 dB
low gain	< 110 dB	< 110 dB
Battery Life, NiMH		
Quiescent Life	60 days	
No. of replies (4ms @ low power)	72,000 (8270)	100,000 (8271)
Operating Life (4ms @ 1/sec, low power)	20 hours (8270)	28 hours (80271)
Charging time	4 hours using Sonardyne Charger Type 7972-000-04 (Temperature must be between 10 and 40°C)	

Externally Powered		Indefinite Life
External Power Requirement		Voltage: 24V dc nominal, 28V dc maximum Current: Average 100mA when transmitting 1 pulse/sec Maximum 5 Amp for 10ms (voltage should not drop below 22V)
External Connector		Subconn MCBH5M with special housing Refer to Section 3.5.1 – 8270-000-11 WSM6 , and Section 3.5.2 – 8270-000-07 WSM6 for wiring configurations for variant connections.
Mating cable connector		Subconn MCIL5F Refer to Section 3.5.1 – 8270-000-11 WSM6 , and Section 3.5.2 – 8270-000-07 WSM6 for wiring configurations for variant connections.

Figure 11-1 – Connector Pin numbering

1 Bulkhead male

2 Cable female

Pin number	Function	Colour
1	Trigger In / Comms In	Black
2	0V	White
3	Fast Charge / Comms out	Red
4	External Power 24V and trickle charge	Green
5	Not used	Orange

Refer to **Section 3.5.2 – 8270-000-07 WSM6**, and **Section 3.5.1 – 8270-000-11 WSM6** for wiring configurations for variant transponders.

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GLOSSARY OF TERMS

Term	Definition
Attitude and Heading Reference System (AHRS)	An inertial sensor that provides outputs of heading, pitch and roll.
ANT	Acoustic Navigation Tester
CIF	Common Interrogation Frequency
CPU	Central Processing Unit
CRF	Common Reply Frequency
DAS	Data Acquisition System
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
Inertial Navigation System (INS)	A navigation aid that uses a computer, motion sensors and rotation sensors to continuously calculate the position, orientation and velocity of a moving object without the need for external references.
Long Base Line Positioning System (LBL)	A system where two or more transponders are on the seabed. The positions of the transponders are established by a calibration process in a seabed frame. The distances from a transducer to each transponder are measured using a transceiver. The position of the transducer can be computed in the seabed frame. The name comes from the "baselines" joining each transponder.
LUSBL	Long and Ultra Short Base-Line
PSU	Power Supply Unit

Term	Definition
ROV	Remotely Operated Vehicle
SSM	Super Sub-Mini Transponder (WSM predecessor)
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.
WSM	Wideband Sub-Mini Transponder
Serial Communications Wait	The maximum time allowed for the Transponder to reply to an RS232 command.
Delay between commands	Provides a delay between adjacent commands.
ANT serial port	Used for diagnostic checks.
Firmware	The firmware installed on the transponder. Firmware upgrades can be installed via WSM Terminal. The Tx firmware refers to the transmission signal synthesiser.
Depth Status	The transponder can be fitted with an optional depth sensor to send depth information at each interrogation.

This table is a history and record of all firmware installed into the transponder.

[illegible]

APPENDIX B – FREQUENCY TABLES

B Frequency Tables

B.1 HPR – 300 Frequency Table

ANT CHANNEL REFERENCE	HPR CHANNEL REFERENCE	INTERROGATION FREQUENCY Hz	REPLY FREQUENCY Hz
H1	01	20492	29762
H2	02	21552	30488
H3	03	22124	31250
H4	04	22727	31847
H5	05	23364	32468
H6	06	24038	27173
H7	07	24510	27777
H8	08	25000	28409
H9	09	26042	29070
H10	11 (□ - Square)	21552	27173
H11	22 (O - Circle)	22727	28409
H12	33 (Δ - Delta)	23923	29762
H13	44 (X)	25126	31250
H14	55 (Y)	26455	32468

B.2 HPR – 400 Frequency Table

Chan	First Rx Freq.	Second Rx Freq	First Reply Freq.	Chan.	First Rx Freq.	Second Rx Freq	First Reply Freq.
B12	21000	21500	29250	B51	23000	21000	28750
B13	21000	22000	29750	B52	23000	21500	29250
B14	21000	22500	30250	B53	23000	22000	29750
B15	21000	23000	30750	B54	23000	22500	30250
B16	21000	23500	27250	B56	23000	23500	27250
B17	21000	24000	27750	B57	23000	24000	27750
B18	21000	24500	28250	B58	23000	24500	28250
B21	21500	21000	28500	B61	23500	21000	28500
B23	21500	22000	29500	B62	23500	21500	29000
B24	21500	22500	30000	B63	23500	22000	29500
B25	21500	23000	30500	B64	23500	22500	30000
B26	21500	23500	27000	B65	23500	23000	30500
B27	21500	24000	27500	B67	23500	24000	27500
B28	21500	24500	28000	B68	23500	24500	28000
B31	22000	21000	28750	B71	24000	21000	28750
B32	22000	21500	29250	B72	24000	21500	29250
B34	22000	22500	30250	B73	24000	22000	29750
B35	22000	23000	30750	B74	24000	22500	30250
B36	22000	23500	27250	B75	24000	23000	30750
B37	22000	24000	27750	B76	24000	23500	27250
B38	22000	24500	28250	B78	24000	24500	28250
B41	22500	21000	28500	B81	24500	21000	28500
B42	22500	21500	29000	B82	24500	21500	29000
B43	22500	22000	29500	B83	24500	22000	29500
B45	22500	23000	30500	B84	24500	22500	30000
B46	22500	23500	27000	B85	24500	23000	30500
B47	22500	24000	27500	B86	24500	23500	27000
B48	22500	24500	28000	B87	24500	24000	27500

B.3 Sonardyne Tone / Frequency Interrogations

All Sonardyne interrogation and reply channels can be selected using the set-up software. These use shorter pulses and will more than double the number of reply pulses available from a single battery charge. All Sonardyne transceivers can interrogate on these channels, which are compatible with the Sonardyne family of underwater navigation and positioning systems.

SONARDYNE TONE CHANNEL	CHANNEL FREQUENCY (Hz)
MF 1	19230
MF 2	19841
MF 3	20491
MF 4	21186
MF 5	21929
MF 6	22522
MF 7	23148
MF 8	23810
CIF	24750
Interrogate on lower frequencies ↑	
Reply on higher frequencies ↓	
CRF	26040
MF 0	26882
MF 9	27472
MF 10	28735
MF 11	29411
MF 12	30120
MF 13	30864
MF 14	31645

The preferred Reply channels are at the upper end of the Medium Frequency band.

If a depth reply is selected, the WSM will reply on the next navigation channel up, and if channel 14 is set, the second pulse will be on channel 0.

B.4 Sonardyne Wideband Replies

The acoustic command address set in the unit will determine the carrier frequency of the coded reply, which will be one in the range of 27.0kHz to 33.5kHz in 500Hz steps. The signals have been selected to minimise interference with frequency/tone based navigation systems.

APPENDIX C – WIDEBAND SUB-MINI 6: COMPLETED ASSEMBLY ACCEPTANCE TEST SHEET

Type	827...	Unit Serial No.	
------	--------	-----------------	--

Section	Test	Results	Value
8.6.1	Battery Off Load Voltage		V
8.6.2	Battery Charge Circuit Function		mA
	Supply voltage drops to 20.5V (typical)		V
8.6.3	Serial Communications with PC Software		
8.6.4	Transponder Test – range displayed		
8.6.5	Acoustic Command Test – reply detected		
8.6.6	Responder Trigger Test – ping heard		
8.6.7	Current Demand Test – input current pulse with transponder replying		
8.6.8	Trickle Charge Function – 85mA (typical) with charged battery		
8.6.9	Wideband Test		
	Fit blanking socket on connector		
	Tester:		Date:

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Global Headquarters, UK

T. +44 (0) 1252 872288
F. +44 (0) 1252 876100
sales@sonardyne.com

Macaé, Brazil

T. +55 22 2123 4950
F. +55 22 2123 4951
brasil.sales@sonardyne.com

Singapore, Asia

t. +65 6542 1911
f. +65 6542 6937
asia.sales@sonardyne.com

Houston, USA

T. +1 281 890 2120
F. +1 281 890 7047
usa.sales@sonardyne.com

Aberdeen, UK

T. +44 (0) 1224 707875
F. +44 (0) 1224 707876
sales@sonardyne.com

24/7 Emergency Hotline

+44 (0) 1252 877600

Email Support

support@sonardyne.com

Website

www.sonardyne.com

Twitter

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