Sonardyne
SOUND IN DEPTH

UM-8070
User Manual for Type 8070 / 8071 Wideband Sub-Mini (WSM) Transponder

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UM-8070

USER MANUAL FOR THE

WIDEBAND SUB-MINI TRANSPONDER / RESPONDER (WSM)

TYPE 8070 DIRECTIONAL

AND

TYPE 8071 OMNI-DIRECTIONAL

ISSUE A

REVISION 3

IMPORTANT SAFETY INFORMATION OVERLEAF

This Document Contains Safety Precautions at Revision 5

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SAFETY

It is essential that all personnel involved in the operation and servicing of this product are familiar with the details below.

This product contains hazardous voltages and must only be opened by qualified service personnel. There are no operator adjustable components inside.

SUBSEA EQUIPMENT GENERAL OPERATIONAL & SAFETY PRECAUTIONS

Operators and Service personnel must be familiar with the information below.

Not all sections will apply to all instruments.

Additional information, if applicable, is included in the relevant sections of the product operating and maintenance manuals

CONTENTS

1. HAZARD APPRECIATION

Subsea equipment remains safe in use when operated and handled within standard operating procedures and written guidelines, therefore in normal operation little threat is posed to the safety of individuals or instruments. However all subsea units are capable of posing a threat to personnel safety, particularly when pressure housings become internally pressurised. Great care must be taken when this happens, or is even suspected to have happened, since the pressures present within the instrument are likely to be **extremely** high. Internal pressure problems may also be aggravated by unknown chemical hazards if battery breakdown has also occurred.

The following non-exhaustive list gives examples of typical hazardous situations:

- a pressure housing becomes internally pressurised by water pressure, following a leak
- a pressure housing becomes internally pressurised due to battery malfunction
- attempts are made to charge non-rechargeable battery packs/cells
- using an instrument outside its design parameters
- using an instrument beyond its load bearing limits
- failing to maintain the equipment can reduce its load bearing capability
- using unauthorised components or inferior parts in critical assemblies, e.g. release systems

2. GENERAL HANDLING OF EQUIPMENT

Do not allow instruments to be dropped or exposed to shock damage which can cause sensitive internal components to fail. Note that minor damage to metal finishes often creates burrs which can present a hazard to unprotected hands or other parts of the body. Control the local environment by preventing personnel stepping into the bight of haphazardly laid ropes or cables which are attached to a unit. Do not allow an instrument to block an access or impede normal traffic flows in a gangway or on a stairway.

Water tightness of instruments depends on fine surface finishes, accurate dimensional tolerances and cleanliness of components. Generally when dismantling equipment care should always be taken, the disassembly process should be carried out in a well-ventilated area with as few personnel in the vicinity as possible. Servicing must always be carried out by competent personnel with appropriate training.

3. DISMANTLING SUB-SEA EQUIPMENT

3.1 INTRODUCTION

All sub-sea equipment fitted with pressure housings are subject to a vast range of externally applied pressures and are susceptible to internal pressure rise if, for example, a leak occurs or the unit's battery destructs. Internal pressure presents a **potentially dangerous situation** and all appropriate **safety measures must be enforced**. Note that fumes given off by deteriorated batteries, particularly lithium based types, pose a health hazard. Apply precautions as appropriate to the circumstances prevailing at the time.

Note (1) that there is likely to be *no prior indication of the presence of internal pressure*, first indications being that the endcap(s) of the unit are being forced out of the housing under pressure during the dismantling process. Symptoms that indicate a higher risk of internal pressure include:

- Equipment that failed when deployed, in transit or storage
- Equipment stored for a long time with batteries connected
- Equipment having suffered physical damage.

Note (2) that when a unit has leaked it often behaves like a valve, i.e. water pressure causes a rise in internal pressure which cannot then escape because the point of leakage becomes sealed. Complete removal of an endcap's retaining mechanism means that it becomes unconstrained and therefore free to be discharged from its housing under high internal pressure - **an uncontrolled and potentially dangerous situation**.

DO NOT TRANSPORT EQUIPMENT WHICH IS INTERNALLY PRESSURED

The following precautions & procedures are recommended.

3.2 INSTRUMENTS FITTED WITH SPRUNG VENT PLUGS

Pressure Vent Plugs are fitted into all subsea equipment housings containing batteries and incorporate a red or green bung with dual O rings and a vent hole behind the second O ring. The vent plug is designed so that it can be partially withdrawn using a M4 screw to the point where its relief hole, positioned inboard of the second O ring, becomes open to atmosphere and thus allows internal pressure to dissipate. The vent plug cannot be totally removed (and forgotten) because of a retaining spring holding the red or green bung in place.

A normal unit may emit an audible rush of air when the vent plug is retracted, but it will typically only last for 1 second maximum. A longer rush of air/gas indicates a pressurised unit, in which case ventilate the area, and let the remaining pressure out of the unit. Internal pressure dissipates to atmosphere in a very short time and may be accompanied by water, debris, noise etc. Do not allow unnecessary personnel to enter the vicinity of the work or to be anywhere near dissipating gases and debris.

3.3 PRECAUTIONS (INSTRUMENT FULLY FUNCTIONING)

The techniques for retaining endcaps in the pressure housings differ from product to product, and detailed instructions on opening the pressure housing are given in the servicing section of the individual product manuals.

To ease dismantling and release any slight internal pressure that may have built up during normal operation, the vent plug should be operated as described in 3.2.

When removing the endcap it is recommended to stand to one side, and not inline. This will avoid potential injury if the endcap is ejected by any remaining internal pressure.

3.4 PRECAUTIONS (INSTRUMENT KNOWN OR SUSPECTED TO BE PRESSURISED)

If an instrument is known, or suspected to be internally pressurised through water ingress or battery venting additional precautions must be taken.

Remove the instrument to a well - ventilated location away from other working personnel.

If the housing is hot, indicating recent or current active internal chemical action, do not attempt to open. Lower overboard into water for several hours minimum or into a secure area away from all personnel. Do not attempt to dismantle until it has cooled.

Wear protective clothing, safety glasses and gloves, and refer to battery manufacturer's material safety data sheet (MSDS).

Release the safety vent as described in section 3.2. If there is no significant pressure dissipation and no fumes indicating a battery malfunction, the unit can be dismantled using the precautions described in section 3.3 and the relevant product servicing manual.

If there are any chemical fumes when the vent plug is released, or signs of deposit around the vent exterior, these are signs that the battery has vented due to water ingress or electronic/battery malfunction. In these circumstances the battery pack and internal electronics may have been severely damaged.

Take extreme care when removing the end cap, using any additional precautions detailed in the individual product manuals. There may be a possibility of some residual pressure remaining, within the housing, if during operation of the vent valve, it becomes blocked with the products of the internal chemical reaction.

When the battery is removed it should be covered with dry sand, or preferably sodium carbonate, or a mixture of 1:1 soda ash and slaked lime. It should be placed in an approved container (after cooling if necessary) and disposed in accordance with local regulations.

The electronics, end caps and pressure housings should be thoroughly hosed down

4. ELECTRONIC HAZARDS

4.1 HIGH VOLTAGES

WARNING

High Voltages

Operation of this equipment does not present any danger to users in normal use. If the internal electronics chassis is removed from it's housing for maintenance, the user should be aware that high voltages are present, particularly on the transmitter PCB and transducer.

Storage Capacitors

Note that subsea equipment incorporates capacitors which are capable of storing large quantities of electrical energy. Avoid inadvertent discharge during dismantling.

4.2 HANDLING OF ELECTRONIC COMPONENTS

Most of the circuits in subsea equipment use CMOS logic, which is easily damaged by static discharge or excessive supply voltage. The best handling for electronics is NO HANDLING. Field servicing cannot compare in efficiency and accuracy with the original factory calibration and therefore field servicing should be limited to checking correct calibration/operation (within the limits of the test gear available) and repair by exchange of PCB's or modules.

4.3 SAFETY PRECAUTIONS FOR LITHIUM BATTERIES

WARNING

Lithium based batteries become hazardous (fire and corrosion) if exposed to air and water. If damaged they may also emit **thionyl chloride**. Consult battery manufacturer's Material Safety Data Sheets (MSDS) prior to operating lithium based battery products.

Additional information applicable to lithium cells (model LSH20) is available from:

SAFT Ltd
River Drive
South Shields
TYNE AND WEAR
NE33 2TR
UK

Tel: +44 (0) 191 456 1451
Web Site: www.saftbatteries.com

4.4 LITHIUM BASED BATTERIES, GENERAL

Special precautions and regulations apply to transport, handling and disposal of lithium based products.

Lithium batteries are powerful sources of electrical energy and should be handled with care to avoid short-circuiting.

Where a battery powered underwater instrument is suspected of flooding, extreme caution must be exercised in opening the instrument in case an internal pressure has developed, which might cause the components to fly apart, causing damage or injury. Release of cell contents within the pressure vessel is very unlikely to cause hazard but the following safety procedures should be followed.

4.5 LITHIUM BASED BATTERIES, STORAGE TEMPERATURE

Cells and batteries, and hence the whole Sonardyne instrument, should not be exposed to temperatures in excess of 70°C. Instruments should not be left on deck in strong sunlight such that they become hot to the touch.

Lithium battery packs should be stored at +20°C, and in a humidity-controlled atmosphere to prevent passivation developing, which can reduce actual operating life, and in extreme cases may cause the unit to malfunction once deployed.

Instruments should be cooled to normal room temperature or lower before being opened.

4.6 OPENING A LITHIUM POWERED INSTRUMENT

The normal procedure before opening any underwater instrument is to wash in fresh water, remove salt deposits and dry it. The instrument should only be opened in clean, well-ventilated, dry surroundings.

All **precautions outlined in paragraph 3.4 above** should be applied during dismantling processes if it is suspected that internal pressure is present.

4.7 FAULT PROCEDURES

If a cell or battery is shorted or starts to heat up, it should be disconnected from the transponder immediately and removed to the outdoors or to a well-ventilated area to cool down. Tongs, or a shovel, are recommended for this purpose. Once the temperature has dropped and it is deemed safe to do so, the cell or battery can be disposed of as below. Suitable protection clothing should be worn when handling suspect cells/batteries and if the skin has come into contact with the electrolyte, it should be washed thoroughly with water.

If a cell is ruptured, potentially flammable materials may be exposed.

WARNING

For Lithium battery packs, Class D fire extinguishers should be used. Water, CO2, Halon, dry chemical or foam extinguishers are not suitable.

4.8 DISPOSAL OF LITHIUM BASED BATTERIES

Cells and batteries in small quantities can be disposed of in a secured landfill. If a secured landfill is not immediately available then appropriate safety precautions should be taken to temporarily secure the items. Packaging suitable for the storage and transport of lithium cells/batteries must be used at all times when not installed in an instrument.

DO NOT DISPOSE OF LITHIUM BATTERIES IN A FIRE.

4.9 TRANSPORTING LITHIUM BASED PRODUCTS

The current regulations and information below is provided for guidance only. Note that data sheets concerning quantities of lithium per cell are available from cell manufactures and these may change without prior notice, therefore the quantities of lithium per battery pack cannot be verified by Sonardyne Ltd. When transporting lithium based products it is the operators responsibility to comply with local, national and international regulations in force at the time of transport.

By Road: ADR European Agreement concerning the International Carriage of Dangerous Good by Road Regulations.

By Sea: International Maritime Dangerous Goods Code

By Air: IATA Regulations UN 3090 and UN 3091

5. BATTERIES GENERAL

5.1 USE OF APPROPRIATE BATTERY TYPES

Sonardyne equipment uses a variety of battery types. In some instrument designs only one type of battery pack is authorised for use but others will accommodate NiCad rechargeable, alkaline or lithium based packs. Instruments must **NOT** be fitted with alternative battery pack types unless they are specifically designed to use them.

DO NOT FIT UNAUTHORISED BATTERY PACK TYPES INTO AN INSTRUMENT

NOTE THAT DAMAGE CAUSED BY USING BATTERY PACKS WHICH ARE NOT AUTHORISED OR ARE NOT CONSTRUCTED TO SONARDYNE'S BUILD STANDARDS INVALIDATES ANY WARRANTY

5.2 CHARGING OF BATTERIES IN SEALED CONTAINERS

Batteries/Cells may give off gases when recharged. As a general rule, sealed containers MUST be allowed to vent to atmosphere during the charging process.

Some instruments may be fitted with safety features which prevent the possibility of problems caused by gasses vented by batteries. Detailed charging procedures for the particular instrument should be carefully followed.

5.3 ATTEMPTING TO CHARGE NON-RECHARGEABLE BATTERY PACKS

DO NOT ATTEMPT TO CHARGE NON-RECHARGEABLE BATTERIES PACKS OR CELLS

All **PRIMARY BATTERIES**, i.e. alkaline-manganese dioxide, lithium-manganese dioxide, silver oxide, zinc air, zinc carbon and zinc chloride batteries are NOT designed to be charged.

Non-rechargeable cells exhibit a range of unpredictable characteristics if any attempt is made to charge them, **Very high pressures and temperatures** can occur in an instrument often some time after the attempt to charge them has terminated.

Attempts to charge a primary battery may lead to an imbalance within the cell potentially leading to gas generation and in extreme cases explosion.

Battery packs **MUST NOT** be reconfigured from one type to another, e.g. NiCad to alkaline or lithium. Alkaline or lithium cells may be inadvertently charged.

5.4 HANDLING OF USED BATTERIES

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

After recovering an instrument from the sea it should be opened, and the battery voltage(s) checked while still connected to see if above the end point voltage for that type of cell. Disconnect and mark as usable or not with date of disconnection noted both on the pack and in written records. Check the instrument for signs of corrosion, such as at solder joints, as a sign of any slight leakage.

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

5.5 RE-CONNECTING A PARTIALLY USED BATTERY

Calculate if the remaining battery life will allow your next mission to be safely accomplished. If so, note the date of re-connection, both on the battery label and in written records, against the serial number of the instrument.

5.6 FITTING A NEW BATTERY

Note the date it is connected and therefore starts to supply current. Write this date on the battery label and also in your written records.

5.7 BATTERY PACK FUSES

A number of Sonardyne battery packs have carefully selected, high-reliability fuses soldered onto the diode-board of the pack. These are "Littlefuse" devices. If you have blown a fuse due to mishandling, it may be replaced by an identical type, but the rating must not on any account be increased.

6. EQUIPMENT ENVIRONMENTAL LIMITATIONS

6.1 STORAGE TEMPERATURE LIMITS

Equipment may be stored at temperatures in the range -20 to + 60°C. It should be noted however that lines connecting pressure transducers to a transponder may become partly filled with seawater during service. This cannot easily be expelled and may therefore freeze if transponders are stored at sub-zero temperatures after recovery from the sea.

Spare battery packs should be stored at room temperature, in an environment with a controlled humidity level.

7. INSTRUMENT LOAD BEARING CAPABILITY

Navigational Transponders are NOT normally designed to take in-line loads greater than the maximum upthrust applied by the floatation equipment. The carrying straps, if fitted, are for ease of manual handling and the range of transducer guards selected for their acoustic properties.

The Safe Working Load (SWL) capability of the release mechanism, built into most instruments, can only be used for in-line lifting operations if a suitably - rated, approved, lifting strap, transducer guard, buoyancy collar eyes or other safe method is selected.

It is the operators responsibility to ensure the condition of the equipment and that a safe lifting method has been devised for any particular operation.

Sonardyne's range of Oceanographic Release Transponders have been designed specifically for in-line lifting operations.

Appropriate shackles must be used in release systems to ensure freedom from corrosion. It is important to note that instruments, their release mechanisms and shackles form part of an integrated and complete system.

8. FLOATATION EQUIPMENT

8.1 INTRODUCTION

Floatation equipment is fitted to subsea transponders in order to aid their recovery once a deployment is complete. A nett upthrust requirement is given in manuals and technical data for any particular instrument. The following guidelines are given to assist operators in their understanding of the general requirements.

8.2 MINIMUM NETT BUOYANCY OF FLOATS

Floats are described as having a minimum nett buoyancy in seawater and this is the figure quoted in Sonardyne Float Technical Data and by the float manufacturer. Total upthrust can be calculated by knowing this figure, e.g., a float with 30kgs nett buoyancy in sea water supporting a load with weight in sea water of 30kgs would result in neutral buoyancy, i.e. no nett upthrust.

8.3 FLOAT INSERTS

Float collar Inserts are used to allow floats of larger internal bore to be used with housings of nominal 6" diameter. The weight *in water* of an insert is usually slightly positive and this will be additional to the weight of the instrument being supported by the float. Two inserts will result in approximately 0.5kg reduction in nett upthrust.

8.4 NETT UPTHRUST

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

Nett Upthrust =

(Minimum nett buoyancy of the Float) - (the weight of the instrument + inserts in water)

e.g. 30 kgs - (11.2+ 0.5) kgs = 17.3 kgs nett upthrust

8.5 FLOAT STORAGE CONDITIONS

Special storage conditions are not called for if due care and attention is applied to a float. Floats are not hygroscopic and should not therefore be affected by moisture in air.

8.6 FLOAT OVER-PRESSURE

The maximum water depth quoted for a float must not be exceeded. Over-pressured floats are forced to absorb water and their weight in air thus increases. All floats should be weighed prior to use to check that they are maintaining their original manufactured weight.

9. DEFINITIONS OF VARIOUS LOADS AND LOADING TERMS

9.1 A STATIC LOAD

An unvarying long term load.

9.2 A DYNAMIC LOAD

A time varying load resulting from the motion and inertia of connected masses and forcing functions such as wave action on the vessel. This may include transient and steady state harmonically alternating loads.

9.3 MAXIMUM ULTIMATE STATIC LOAD OR BREAKING LOAD OR PARTING LOAD

The load that induces structural failure in one or more parts of the instrument causing the load to part with the release.

9.4 MAXIMUM PROOF STATIC LOAD OR MAXIMUM RATED STATIC LOAD

The maximum in-line static load the instrument can bear without suffering an unacceptable degree of permanent deformation. Ideally this should correspond with the load at which the maximum stress at any point in any component is the 0.2% proof stress for the material used in that component (in the condition that it is used).

9.5 SHOCK LOAD OR SNATCH LOAD

A time transient load generally caused by the sudden acceleration (positive or negative) of the load. Examples are the sudden snatch of a load off the deck or a sudden arrest of a load falling under gravity.

9.6 SAFE WORKING LOAD

A load set as a proportion of the Ultimate Static Load to allow for factors such as corrosion, fatigue, shock loads, harmonic loads, manufacturing defects, material defects etc. Various figures may be adopted according to the practise of the industry, risk to health and applicable legislation. Typical factors are $^1/_6$ to $^1/_3$ of the Ultimate Load.

9.7 PROOF LOAD

Normally a Load that is periodically applied to the load bearing device to demonstrate that it is still safe. Generally this is 2 times the Safe Working Load.

9.8 RELEASE LOAD

The maximum in-line load the instrument can withstand and successfully release without overloading any part of the release mechanism or demanding an unsupportable quantity of energy from the battery supply (at its specified end point).

10. IF IN DOUBT

Contact Sonardyne for advice.

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Our facsimile number is (UK) +44 (0) 1252 876100

Our email address is **support@sonardyne.co.uk**

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AMENDMENT RECORD

All amendments and additions will be issued with a copy of this sheet, recording the history of amendments.

Revision	Date	Comments
1	26.10.96	Initial Issue
2	21.03.02	
3	19.04.02	CN 7167 Modified to allow transponders to be charged in a closed environment provided safety features are provided
4	14.03.03	CN 7699 Updated to ensure safety precautions cover more general equipment
5	24.02.04	CN 8104. Transportation regulations updated. Dismantling method removed and refers to unit manual. Carrying strap not to be used for mechanical lifting.

Authorised : P V Williams

Date of Issue : 24 Feb. 2004

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LIST OF APPENDICES

LIST OF FIGURES

AMENDMENT RECORD

All amendments and additions will be issued with a new copy of this sheet, recording the history of amendments.

Issue	Revision	Date	Comments	Section	Page
A	0	07.03.05	Initial Issue	All	All
A	1	06.01.06	Add Scout compatibility Add details of 8071 Change name to Wideband Sub-Mini CN 8838		
A	2	12.05.06	Frequency corrected in test procedure Firmware V2.04F documented Screenshots from software V1.06a updated to V1.06c Delete reference to Dual Mode CN 8902	App C App F App E App E	
A	3	01.03.07	Revised to reflect WSM Terminal V2.00 Add Quickset feature Remove Scout compatibility CN 9361	App E	

SECTION 1

1. INTRODUCTION

1.1 SAFETY

W A R N I N G

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

SEE THE SAFETY PRECAUTIONS PRECEDING THIS SECTION

W A R N I N G

There are no parts inside the unit which are accessible to the equipment operator.

High voltages can be present within the transponder.

Opening the transponder, internal adjustments and replacement of parts must only be carried out by trained maintenance personnel and the procedure detailed in Section 4 must be carefully followed.

W A R N I N G

Strict rules must be followed when charging the equipment.

These are detailed in Appendix B.

1.2 PURPOSE OF SYSTEM

The Wideband Sub-Mini (WSM) 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 WSM can be powered by an external DC supply for continuous operation as a Transponder or Responder.

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

1.3 FEATURES

Sonardyne's WSM 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 8070 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 8071 Omni-directional Transponder is recommended. Type 8071 has the same functionality, but is depth rated to 1000m, and has a lower transmit power level but a wider omni-directional beam-pattern (±120º).

The WSM 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, this 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 8070 has a 3000 metre depth rating (dependent on depth sensor fitted). Type 8071 has a 1000 metre depth rating.
- Depth sensor option
- 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"

1.4 LAYOUT OF MANUAL

The manual includes an Operation Section comprising a physical description and a description of operation followed by a Maintenance Section covering general maintenance points (Section 4) and fault finding and test procedures (Section 5). The fault-finding procedures given in Section 5 are sufficient to enable diagnosis to major assembly level.

A spares list (with full order information) and the battery charging procedure are given in appendices. A table of channel frequencies is given as Appendix D.

1.5 LIST OF ABBREVIATIONS

ANT	Acoustic Navigation Tester
CPU	Central Processing Unit
DAS	Data Acquisition System
HPR	Hydro-acoustic Position Reference
LUSBL	Long and Ultra Short Base Line
PSU	Power Supply Unit
ROV	Remotely Operated Vehicle
SSM	Super Sub Mini transponder (WSM predecessor)
USBL	Ultra Short Base Line
WSM	Wideband Sub-Mini transponder

SECTION 2

2. DESCRIPTION

The Wideband Sub-Mini is housed in a yellow PVC sleeve, over an anodised aluminium alloy tube with an acoustic transducer built into one endcap. The other endcap shields the electrical charging socket and on/off switch - see Fig 2.1 to Fig 2.3. The end-caps are retained to the tubular housing by flexible plastic rods inserted in slots at each end of the housing.

The On/Off control on the connector endcap consists of a rotary selection switch.

The connector on the end-cap allows for a responder electrical trigger, RS232 communications to configure the unit, a battery charging input and a separate external dc power input.

All HPR-300 channels, 01 through 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 D.

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

The WSM is switched ON by operating a rotary switch on the connector end-cap. 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 WSM should always be fully charged before use.

The connector is a special Subconn Micro Connector (MCIL5M Type) manufactured for Sonardyne by MacArtney A/S and operates with a standard in-line connector MCIL5F as fitted to the Sonardyne External Power cable and Fast Charger.

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 need to open the pressure housing. If access to the electronics or battery is required, this must be carried out by **qualified maintenance personnel** and the procedures set out in Sections 4 and 5 of this manual should be followed.

The WSM 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. If the trigger line is held permanently high (4V to 24V) then the unit will only operate as a responder, and transponder mode is inhibited.

The maximum operating depth of the Type 8070 housing is 3000 metres but this may be limited by the full scale depth of the pressure sensor. For the Type 8071 WSM, the maximum operating depth is 1000m. A label on the connector end-cap identifies whether the depth sensor option is fitted, for example: “C D 3km” indicates Connector + 3000m Depth sensor options fitted; “C 1km” indicates Connector, no Depth sensor, end-cap is 1000m rated.

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.

FIG 2.1 TYPE 8070 : DIRECTIONAL WIDEBAND SUB-MINI

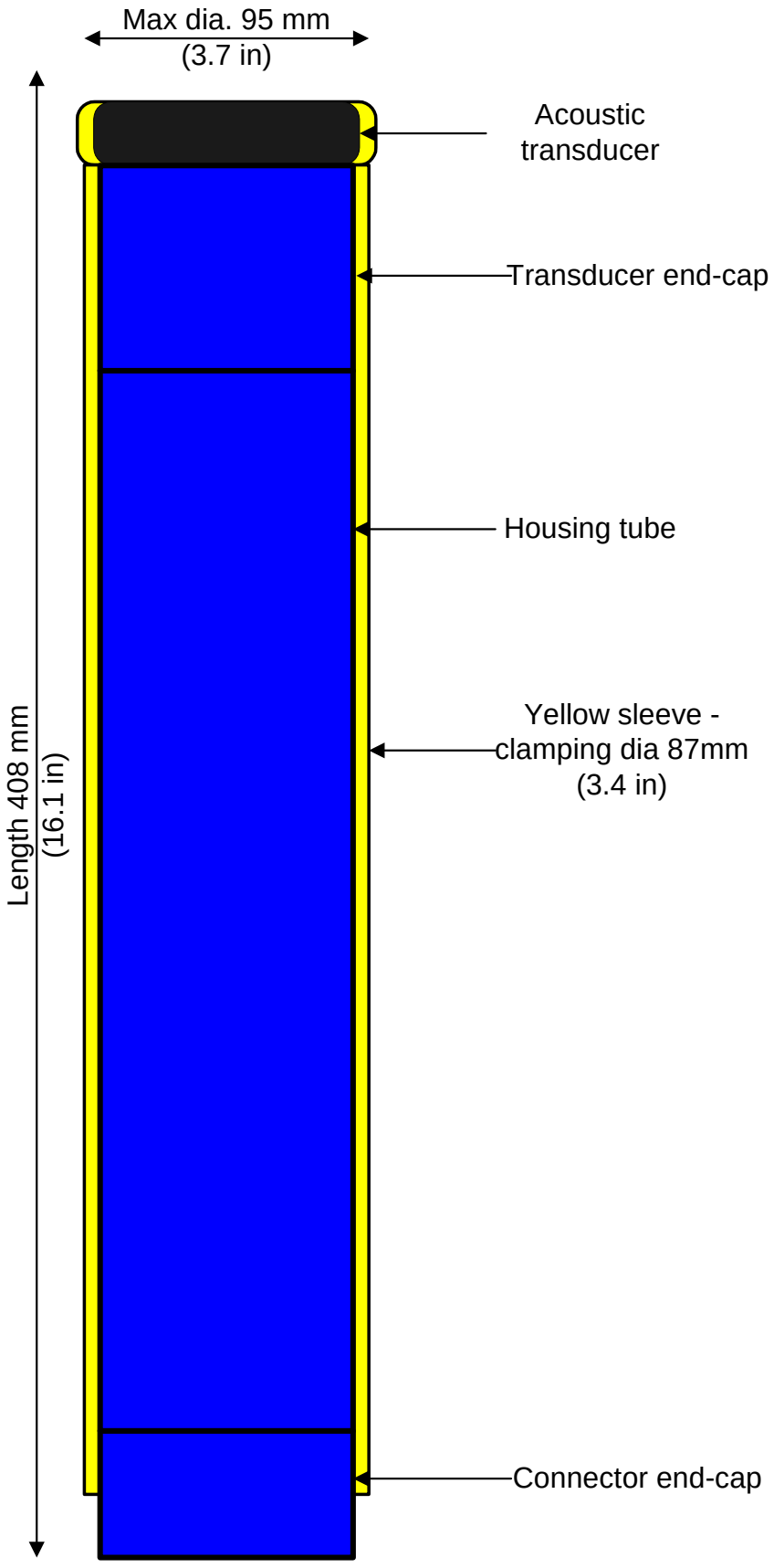


FIG 2.2 TYPE 8071: OMNI-DIRECTIONAL WIDEBAND SUB-MINI

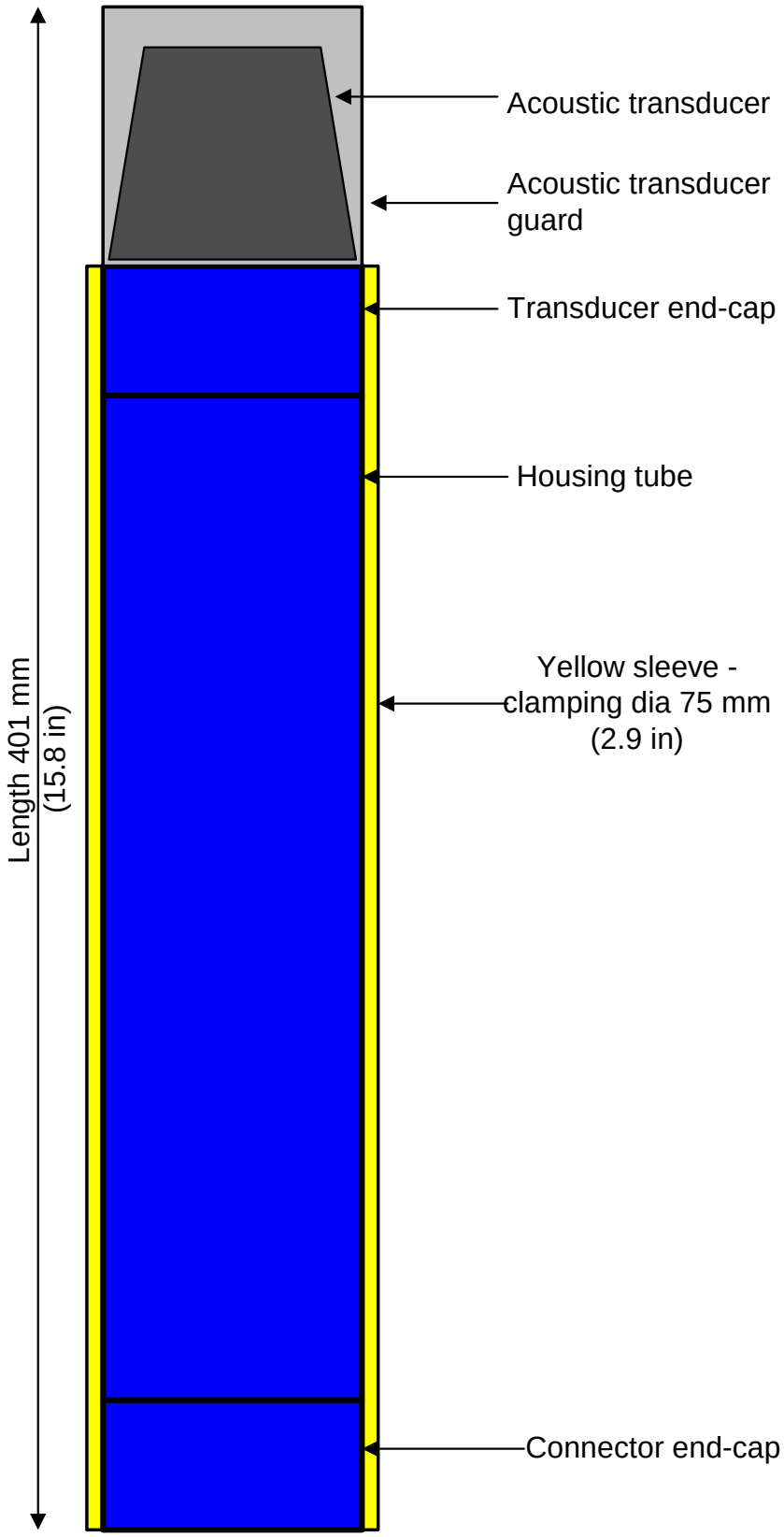
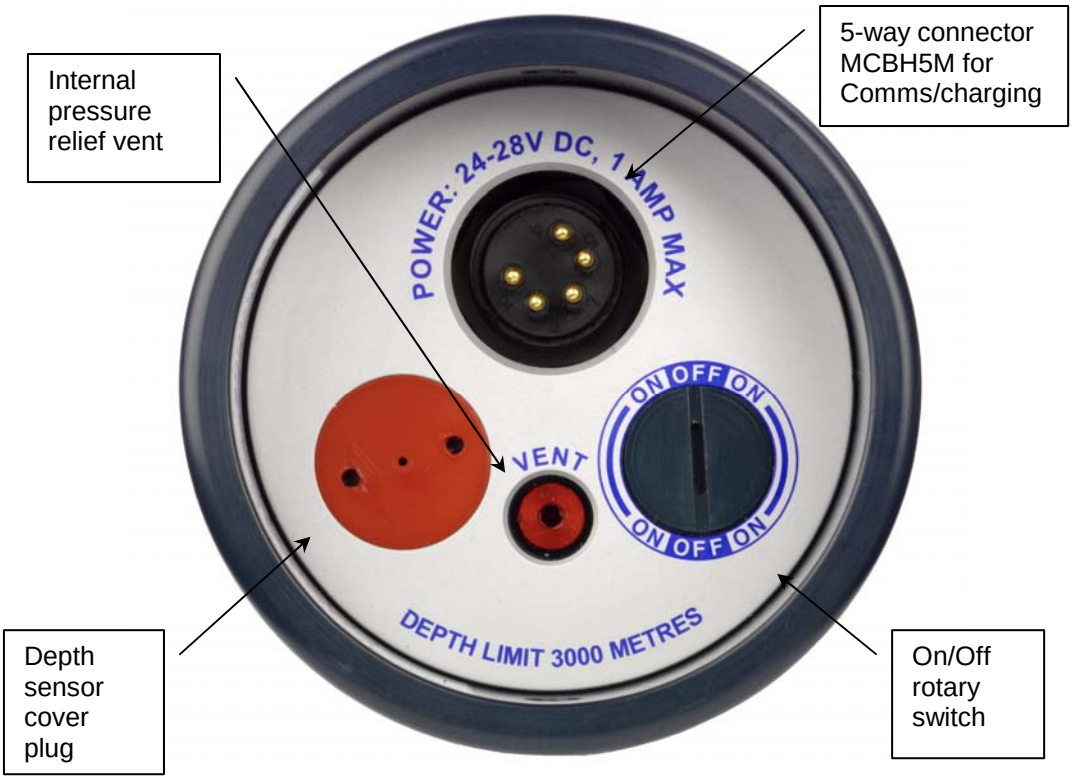
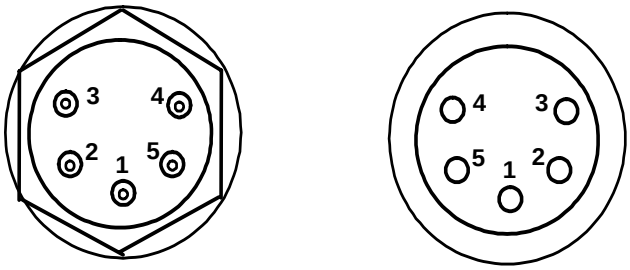


FIG 2.3 END CAP



Pin Numbering



Bulkhead male

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

SECTION 3

3. OPERATION

3.1 OPERATIONAL MODES

The Wideband Sub-Mini 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.

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 < 20º from the horizontal

These modes are described in more detail below. In all cases, the normal operational state is achieved with the appropriate channel selected via RS232 and the ON/OFF switch operated on the connector end-cap.

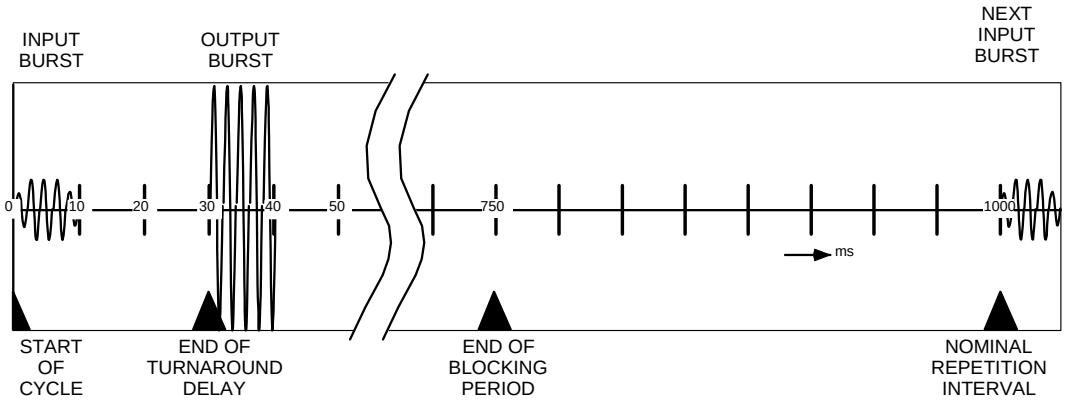
3.1.1 Transponder Mode

In this mode, the transponder is interrogated by an acoustic input. If there is no external power connection, the connector must be fitted with the dummy plug to protect the connector pins, and switched to ON.

When set to a 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, as shown in Fig 3.1 If the ambient noise level is too great for the interrogation signals to be heard, the WSM may not reply to interrogations or may reply erratically.

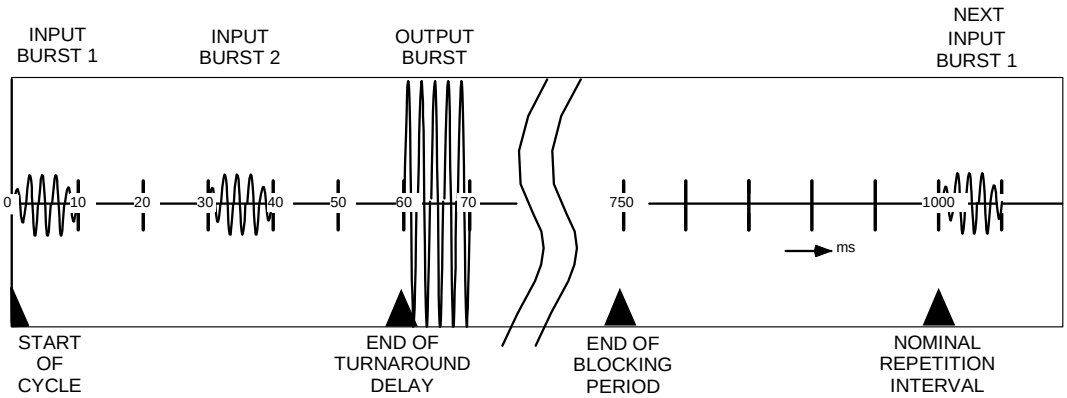
HPR Series 300 systems send a single interrogation signal as shown below:

FIG 3.1 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 as shown below:

FIG 3.2 OVERALL ACOUSTIC SEQUENCE HPR - 400 SERIES CHANNELS



In Sonardyne Tone configuration, a single interrogation tone pulse will trigger a tone reply after 125ms.

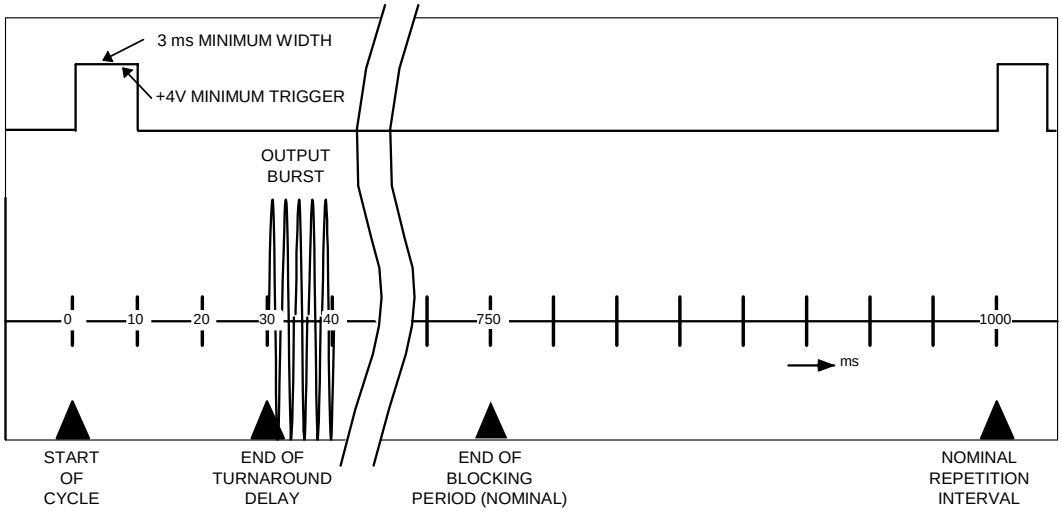
In Sonardyne Wideband configuration, a single interrogation tone pulse will trigger a wideband reply after 125ms.

3.1.2 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 period of the blocking period after which it will respond to either acoustic or electrical triggers.

As shown in Fig 3.3, the trigger pulse waveform is a positive going pulse with a pulse width between 3 and 25 ms and voltage levels between 4V minimum and 24V.

FIG 3.3 HPR RESPONDER SEQUENCE



If the trigger line is held normally high, the transponder function will be inhibited. The responder trigger will still operate off the rising edge, so the navigation system will have to generate a negative-going trigger pulse, with timing referenced to the rising edge.

3.2 PUTTING THE TRANSPONDER INTO SERVICE

3.2.1 Check Pressure Relief Valve

Check that the red pressure relief 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.

3.2.2 Charge the Battery

Do Not attempt to recharge Transponders fitted with optional Alkaline battery packs.

The standard WSM transponder is fitted with **Nickel Metal Hydride** batteries and it is recommended that the battery pack is fully charged before being put into service, otherwise time can be wasted if the battery becomes discharged before the mission ends. The Type 7972-000-04 Charger charges the battery in approximately 4 hours. Full details of the charging procedure and important safety information are given in Appendix B. Note that the unit should be switched OFF during charging.

After charging is complete and while the Charger is still connected to the transponder, disconnect or switch off the AC power.

3.2.3 Set the Interrogation Channel and Command Address

Switch the unit ON. This is achieved by using a soft, flat blade to rotate the end-cap switch away from the vertical position (i.e. aligned with the end-cap text). Note that there is a detent as the switch passes to the On position. The switch can travel further than the ON marking on the end-cap, and there is a second detent but the unit remains ON. **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 (see Appendix E). It is advisable to mark the command address and interrogation channel on the outside of the unit if either are changed from the factory set values.

3.2.4 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 Appendix E. 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.

3.2.5 Receiver Gain Level

The receiver gain is factory set to high gain.

Two levels are available, selected via the WSM Terminal software package, refer to Appendix E. 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.

3.2.6 Enable Depth Telemetry

Check and record the Firmware Version fitted and check that the depth telemetry facility is enabled or disabled as required. Note that 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 Appendix E 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)

3.2.7 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). Connections to the transponder connector are shown in Fig. 3.4.

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

As the Type 8070 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 8071 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.

3.2.8 Switch-on and Electrical Connections

Ensure the transponder is switched ON. The external connector **must be covered** while the transponder is submerged, either by the protective dummy plug (Part No. 312-6874, with locking sleeve 317-2672) 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 Fig 3.4) 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. When in "Responder" mode, the acoustic transmissions from the transponder will not be affected by ROV noise if the trigger line is held high except just before the trigger signal.

3.2.9 Test the Transponder

Test the transponder by interrogating with a test unit such as the Sonardyne ANT (Acoustic Navigation Tester) as described in Appendix C. 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 triggers if in Responder mode).

If the unit has been set up for Wideband replies, then only a suitable Wideband Interrogator can be used to fully test the WSM. Refer to Section 3.2.13.

Note that 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.

3.2.10 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 (the connector manufacturer recommends using Molycote 44 Medium, and applying half a match head per contact). Refer to Appendix G for “Care & Lubrication of Subconn and Micro-Subconn connectors”, at the end of this manual.

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.

3.2.11 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 WSM, 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. See Appendix E for details (section E.4.2).

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:-

7343 ANT with firmware V2.25 or greater,

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 cannot accept acoustic commands the following transceivers unless the first two digits of the address are changed to be in the range 01 to 14:-

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 interrogation 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

3.2.12 Interrogators

Various transceiver units are capable of interrogating WSMs, 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 WSMs and also send commands, but is only designed for pre-deployment testing and fault diagnosis. To command an WSM, the ANT firmware must be V2.25 or later. To interrogate a unit the command HIInn 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 HIInn 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).

3.2.13 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.

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WIDEBAND SUB-MINI: PRE-DEPLOYMENT CHECKLIST

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

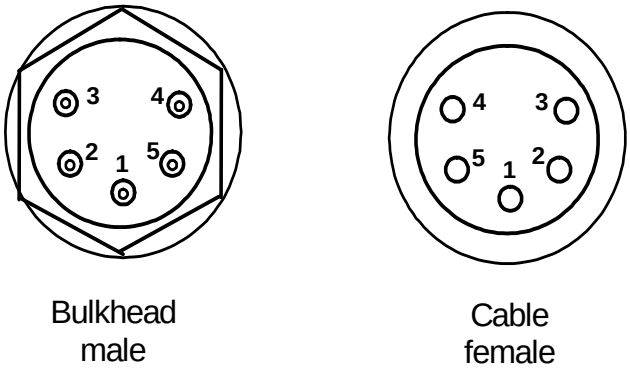
	Test	**Tick / Comment**
3.2.1	Check Pressure Relief Valve	
3.2.2	Charge battery	
3.2.3	Set Interrogation and Reply channels	
3.2.3	Set Command Address	
3.2.4	Set Transmit Power (Hi / Lo)	
3.2.5	Set Receiver Gain (Hi / Lo)	
3.2.6	Depth Telemetry (On / Off)	
3.2.7	Secure Mounting checked	
3.2.8	Switch ON	
3.2.9	Test on battery power: Transponder Operation	
	Test on battery power: Responder Operation	
	Test on external power: Responder Operation	

W A R N I N G

If the relief vent is not flush when inspected, it indicates that a pressure build up has occurred causing the unit to vent. Residual internal pressure may still be present.

DO NOT DEPLOY THE UNIT AND REFER TO THE MANUFACTURER.

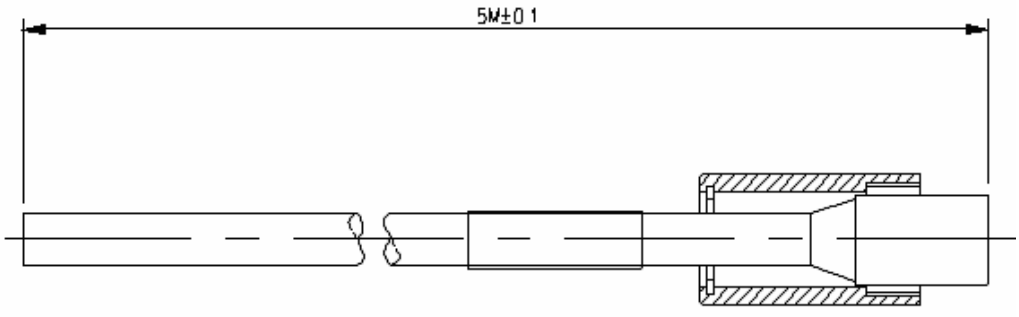
FIG 3.4 CONNECTOR PIN-OUT AND MATING TAIL



Face view of the WSM connectors.

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

Pin-out of WSM connector
(Note: there is no On-Off link required).



Mating in-line female connector
(Part No. 820-5163)

SECTION 4

4. MAINTENANCE

W A R N I N G

There are no parts inside the unit which are accessible to the equipment operator.

High voltages can be present within the transponder.

Opening the transponder, internal adjustments and replacement of parts must only be carried out by trained maintenance personnel.

4.1 GENERAL MAINTENANCE

After in-water operations, the WSM 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 socket can be removed to wash the external socket. When dry, lubricate the connector with a light coating of lubricant (the connector manufacturer recommends Molycote 44 medium). 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.

Following the above actions and if the unit has been returned because it is believed to be unserviceable, it is good practice to put it on charge for at least two hours (if a rechargeable battery pack is fitted) before proceeding with any maintenance activity - assuming that it will take charge at all. Procedures for charging the battery are set out in Appendix B.

Should internal attention be required, the unit can be dismantled easily and the battery exchanged or any of the major assemblies replaced. All internal, adjustable components are factory set and not field serviceable.

During the Warranty Period, the unit must be returned to Sonardyne or one of its overseas representatives if in need of attention. Thereafter, the customer may decide to service the unit and should refer to the maintenance procedures set out below and in Section 5.

A list of spares is given in Appendix A.

4.2 CAUTIONS

It is important to make sure you are familiar with Section 4.5 - Dismantling and Re-Assembly - before attempting to carry out any work on the unit's internal assembly.

4.3 CIRCUIT FUNCTION

The primary function of the circuit is to respond to an incoming acoustic interrogation signal (or pair of signals on different frequencies in the case of HPR-400). Having detected the incoming signal, the circuit responds, after a set interval of time, by transmitting a corresponding "reply" outgoing acoustic signal with one particular, selected "reply" signal (or pair of reply signals if depth replies are enabled).

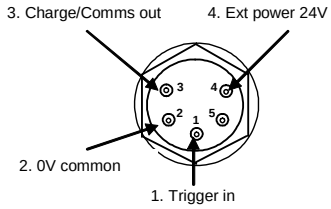
The unit also has a responder mode - in which it can be triggered to reply by an externally-applied electrical signal.

The way in which the circuit achieves these functions is described below with reference to circuit block diagram Fig 4.1.

4.3.1 External Connections

External connections to the transponder are made via a 5 pin connector - as illustrated in the external view of the connector to the right. If the transponder is to be powered externally, a nominal +24V dc supply is applied to pin 4 with respect to pin 2, the COMMON pin. The externally applied voltage must be in the range 22-28V. With the transponder switched ON, the WSM will operate from the external supply so long as the output from the internal voltage regulator is above the internal battery voltage. The battery voltage is nominally 18.75V, but can be above 20 V immediately after charging. If the external power supply voltage falls below 22V or fails, or the electrical connection to the WSM is broken, the transponder continues operating from the internal battery. This provides an emergency transponder facility if an ROV's umbilical breaks.

Bulkead Plug Contact View



An external supply connected as described above will cause the battery to be trickle-charged.

Connections to a battery charger (see Appendix B for battery charging procedures) and to an external trigger circuit are made also through the same 5-pin connector. As before, the COMMON 0 V pin is used as the circuit return for power, trigger and communications.

A PC can be connected to the transponder using the Type 7972-00-04 Charger / Interface Unit. Connect a standard 9-way cable between the PC and the Charger as shown in Appendix B. The power pack must be switched off or disconnected from the Charger to enable PC communications. The PC communications allows the test program WSM Terminal to be run to assist in configuration and testing of the transponder. The operation of the test programs is explained in Appendix E.

4.3.2 Power Supplies

The circuit is powered either from an external 24V source or from the internal 18V Nickel Metal Hydride battery. A simple diode OR circuit ensures that the external supply, if connected, takes over from the internal battery. This supply feeds the output stage of the transmitter circuit directly and also provides the input for two regulators. The first provides an output of 12.5V and this is further regulated down to 5V to supply the receiver and logic circuits.

4.3.3 Receive Chain

Only incoming acoustic bursts at particular, selected frequencies will cause a response from the transponder. HPR 300 channels use single frequency interrogations but HPR400 and Sonardyne Scout systems use two tone bursts on different frequencies separated by a fixed delay. The HPR channels and frequencies are described in Appendix D. The channel on which the transponder is set to receive is determined by the configuration set by the software.

The incoming acoustic burst is detected by the transducer and amplified through the pre-amplifier - which incorporates a band-pass filter to reduce unwanted noise. The pre-amplifier output provides a second input to the homodyne receiver. The output of the receiver is rectified and compared to a detection level using a comparator. If the receiver output is high enough to trigger the comparator, the comparator output interrupts the micro-controller.

If the unit is configured to receive a single interrogation, the micro-controller initiates a reply sequence. In the case of HPR-400 or Scout channels, the receiver reference frequency is switched to the second interrogation frequency. Only if this is received at the correct time window will the micro-controller initiate a reply sequence.

4.3.4 Reply Chain

The transponder times a set turn-around delay before enabling the transmitter to transmit the reply signal or signals The reply signal or signals are produced by the transmitter signal generator on the CPU card. All navigation schemes use a single reply signal, unless depth telemetry is enabled (see below) when a second signal on a different frequency is transmitted after a time proportional to the depth reading.

The signal generator feeds the Output Driver, which drives through a step-up transformer to a series-tuned output circuit which generates a 3kV peak-to-peak output signal to drive the transducer.

4.3.5 External Responder Trigger

An externally-applied trigger signal (in the form of a positive going pulse of ≥ 4 V, with a minimum duration of 3 ms) will initiate the reply sequence, independent of the receiver operation.

4.3.6 Serial Communication

A feature of WSM is the ability to communicate with the micro-controller via a serial data link. The input signal is shared with the responder trigger line. Providing baud rates over 1200 are used the Micro-controller can distinguish between a trigger pulse and a serial data character.

Serial replies are superimposed on the Charge Line so communication is only possible when the unit is not being charged. External power input, however, does not affect this function.

Sonardyne supply PC software on the same CD as the soft copy of this manual to assist the operator to set up the transponder and to help maintenance personnel to test transponder operation. Details of the PC software programs are given in Appendix E. The latest software can also be downloaded from the Sonardyne web site: www.sonardyne.com.

4.3.7 Depth Measurement

Another optional feature of WSM is the depth sensor fitted to the connector end-cap. If enabled (using a serial data command, or acoustic command), the depth is measured at each interrogation and a second reply signal is transmitted at a time delay from the first reply which is proportional to the depth reading.

The micro-controller switches power to the Data Acquisition System (DAS) section of the PCB on the connector end-cap. A constant current supply is provided for the depth sensor. The temperature compensated sensor output is fed to a conditioning amplifier and then to an A-to-D converter. This communicates the reading to the micro-controller.

4.3.8 EEPROM Data Storage

Calibration data for the depth sensor is stored in EEPROM located on the PCB fitted to the connector end-cap. This communicates serially with the micro-controller, sharing the serial bus with the A-to-D converter.

4.4 INSPECTION

Inspect the outside of the transponder for mechanical damage before attempting to dismantle. Particular points to watch for are:

- If the pressure relief vent is proud of the connector end-cap surface, it is possible that the battery has developed a fault, or has been damaged by water ingress, causing the production of gas inside the transponder. The pressure relief vent must always be removed during charging and before disassembly of the transponder
- Damage to, or corrosion of, the anodised surface treatment to the housing. If this is not in good condition, it may be necessary to change the housing. Failure to do so could cause the transponder housing to collapse when next operated at full working depth. In cases of slight corrosion, clean with a degreaser and treat with Alocrom for 2 minutes, or until the aluminium goes golden brown, then wash off with water. Dry and cover the exposed metal with 2 part epoxy.
- Signs of corrosion on the connector - this may result in problems charging or operating the unit on external power, using responder trigger or using serial comms.
- Check to see if the connector is secure by fitting a locking sleeve (from the mating half of the connector) and check for rotation of the connector. If movement is detected, then refer to the dismantling procedure for correction.
- Mechanical damage and/or corrosion in the jointing faces between the end-caps and the main housing - this may indicate leakage of seawater into the transponder.

4.5 DISMANTLING AND RE-ASSEMBLY

4.5.1 External Electrical Tests

Before starting work on the dismantling of the transponder, external electrical tests should be carried out. The procedures for these tests are given in Section 5.4, but the tests involved are listed here together with an indication of possible causes for any failure which may be detected.

Battery Charging Performance

If the battery does not take current when the Type 7972-000-04 charger is plugged in, this could indicate failure of the battery itself, the Charge Control circuit or the wiring. If fast charging operates normally but no trickle charge is taken after fast charge switches off, the external power supply wiring or the trickle charge regulator may be at fault.

Transponder Operation

Assuming the battery is sufficiently charged, the transponder's acoustic performance, tested in conjunction with its response to an electrical trigger can provide some clue to the circuit area which may have failed. A transponder which responds normally to an electrical trigger over the full range of channels but does not respond to an acoustic input has probably failed somewhere in the acoustic receive chain, either in the preamplifier or in the receiver.

4.5.2 Dismantling Procedure

Care must be taken to follow the procedure exactly as set out below. Failure to do so may necessitate additional repair cost before the unit can be restored to a serviceable condition. Refer to Fig 4.2 in this Section.

- ❑ Disconnect all cables and switch the transponder OFF.
- ❑ Check the pressure relief vent. If it is proud of the connector end-cap surface, this could indicate an internal pressure, possibly due to vented gasses from the battery pack. In this case proceed with extra caution.
- ❑ Remove the protective plastic sleeve. This can be assisted by blowing compressed air from an air line between the housing and sleeve. If no air line is available, liquid detergent may be used as a lubricant. If it is necessary to cut the sleeve, take great care not to damage the anodising of the transducer housing or end-caps.
- ❑ If there is a gap between the end-caps and the housing, this again could indicate internal pressure and extra caution should be observed.
- ❑ REMOVE THE PRESSURE VENT PLUG CAREFULLY. Stand to one side of the transponder, not in line with its axis and ensure that no other personnel are in the vicinity. Extinguish all naked flames (gas produced by a faulty battery can form an explosive mixture) and ensure good ventilation in the area. Screw an M3 bolt into the tapped hole in the surface of the vent plug and carefully withdraw it. There is a retaining device fitted to prevent the plug coming out more than 1cm. Two 'O' rings should be visible when the plug is fully withdrawn. Check the 'O' rings are clean and wrap a short length of electrical tape around the plug to keep the 'O' rings clean.
- ❑ Place the transponder vertically on a firm surface with the connector end-cap downwards.
    - A flexible plastic retaining rod is used to hold the connector end-cap in place.

- Insert the tapered end of a tie-wrap (or similar) under one end of the retaining rod holding the connector end-cap in place - so that the rod end is lifted clear of its groove. Using a tool with a narrow rounded end, push on the other end of the retaining rod, causing it to slide out of its groove. When clear of the groove, grip the end of the rod with a pair of pliers and pull out completely. Discard the rod if it shows any sign of damage or stressing.

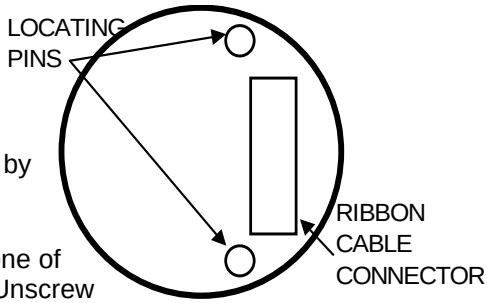
  Take care in this operation not to scratch, or mark in any way, the surface finish of the housing.

- Without twisting the connector end-cap, rock it to and fro while pulling firmly on it to withdraw it from the housing. Alternatively, prise open using the dedicated Opening Tool (Part No. 810-1262). Take care not to jerk it as it comes free, otherwise damage may occur to the internal wiring. Take care also not to damage the seal surfaces on the inside of the housing bore.

- Lay the housing and end-cap down on a clean surface with the internal side of the end-cap facing up.

- Remove the ribbon cable connector by rocking it gently out from its socket.

- There is a nylon retaining cord fitted to one of the connector end-cap locating pillars. Unscrew the pillar to release the cord.



- ❑ The transponder may now be turned upside down so that it stands on the transducer end-cap. Release this end-cap using the same process as described above.

- ❑ The transducer end-cap is an integral assembly with the electronics assembly and the battery pack. As this whole internal assembly comes free of the O-ring seals it should be possible to slide it out until it is free of the housing.

- ❑ Lay the internal assembly down on a clean surface with the battery pack downwards. Set the housing to one side.

- ❑ Having separated the major components, 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.

- ❑ If the transponder has been opened to refit a loose end cap connector, proceed to section 4.5.3, and then re-assemble the transponder.

- ❑ As may be required by the fault-finding procedure, 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). Lever the retaining tab of the battery connector on the Rx/Tx PCB gently to one side and pull the connector out. To finally 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.

- ❑ As may be required by the fault-finding procedure, 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.

- ❑ As may be required by the fault-finding procedure, the lower board may be removed by disconnecting the transducer and unscrewing the six fixing screws holding the lower board to the chassis. The 2 flying leads to the tuning coil must be de-soldered to finally remove the board.

- Two M4 bolts fix the electronics chassis to the transducer end-cap. Remove these and also remove the 3-pin Molex connector close to the transducer end of the chassis. Take care at this point as high voltages are present on this connector during transmission. As the transponder should be switched OFF, no transmission can be initiated by the microcontroller.

- 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.

4.5.3 End-cap Connector Tightening Procedure

Tools required: 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 unit as detailed in section 4.5.2.

2. Place the socket over the external part of the connector, the long internal clearance is required to avoid damage to the pins. Ensure that 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 Appendix A for parts list.

5. Connect the torque wrench to the socket and tighten the socket to a torque setting of 5Nm (44.3lbf-in. or 3.7lbf-ft.)

6. Re-assemble the unit as described in the following section.

4.5.4 Re-Assembly Procedure

- Before re-assembling the unit, remove the O-rings and clean them and the grooves in which they are located. Examine the O-rings and use new ones if they appear to be flattened more than superficially or cut. Re-grease the O-rings and the grooves lightly with petroleum jelly and fit the O-rings back into the grooves.

- The assembly procedure is then the reverse of the dismantling procedure given. Remember to apply a fillet of silicon rubber each side of the battery pack to help hold it in place. Briefly the order of re-assembly is as follows:

  - Ensure that no cable or blanking plug is connected to the external connector.

  - Reconnect the battery plug to the CPU PCB.

  - Fit a fresh silica gel bag.

  - Insert the transducer / chassis assembly into the housing and insert the flexible plastic retaining rod to fix the transducer end-cap to the housing.

  - Screw the pin on the end of the nylon retaining cord to the stud on the connector end-cap, forming the second locating pin.

- Connect the ribbon cable to the connector end-cap PCB.

- Offer the connector end-cap to the housing using the notches in the end-cap and housing to ensure correct alignment. As the end-cap is inserted into the housing, the ribbon cable should fold down neatly without needing any special action. Insert the flexible plastic retaining rod to fix the connector end-cap to the housing.

❑ Unless the battery is to be charged immediately, remove the protective tape from the pressure vent plug, clean and lightly grease the 'O' rings and push the vent plug carefully home.

❑ Fit the plastic sleeve over the whole unit by placing over the transducer and pushing downwards.

❑ Ensure that the connector is lubricated with a light coating of lubricant covering the mating rubber parts (the connector manufacturer recommends Molycote 44 medium). The application of lubricant should be a light one as over application can lead to a build-up of grease in the female connector, which can affect connection integrity after lubrication has been applied a number of times.

❑ Carry out a functional test as described in Section 4.6.

FIG 4.1 CIRCUIT BLOCK DIAGRAM

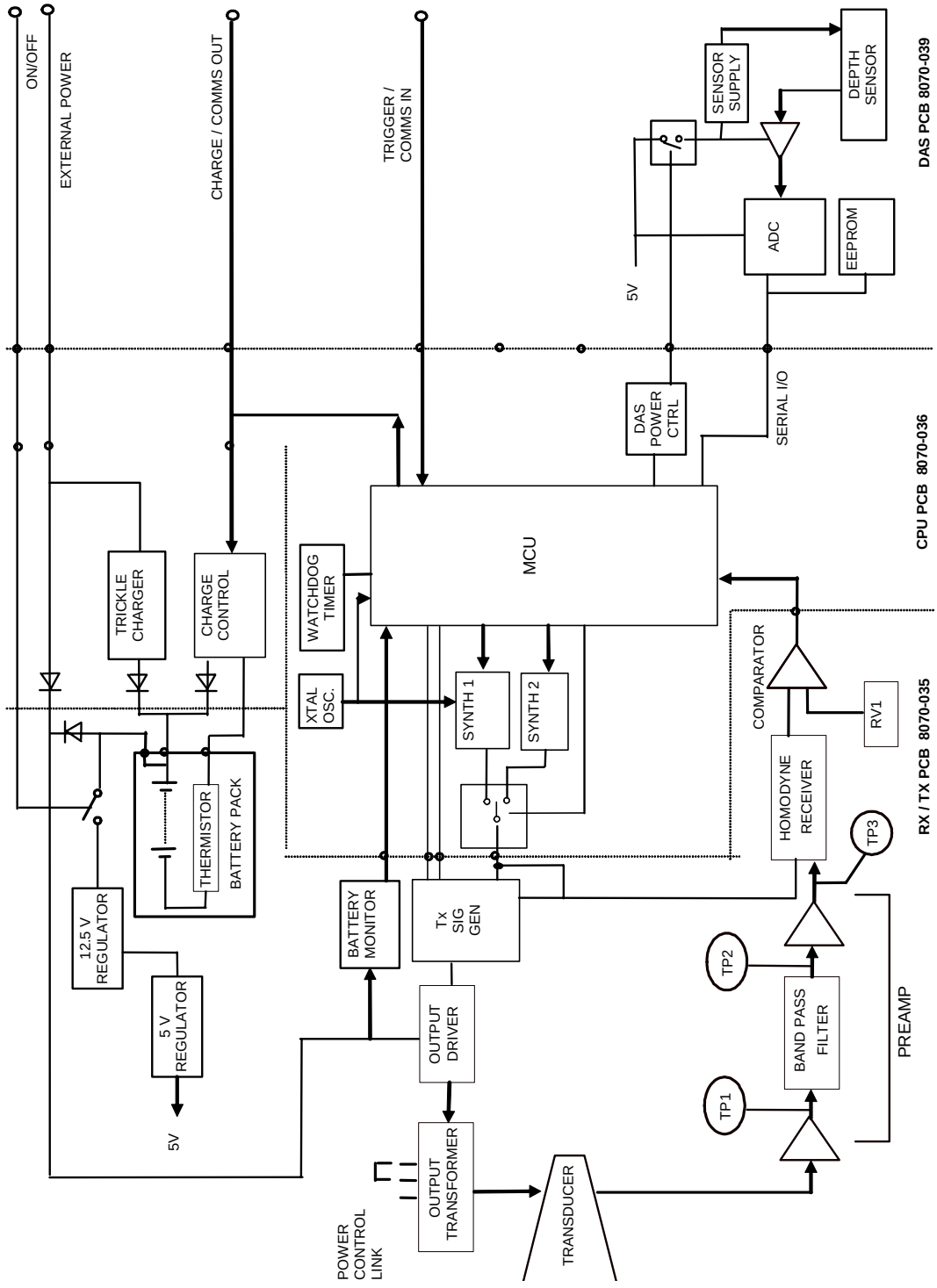
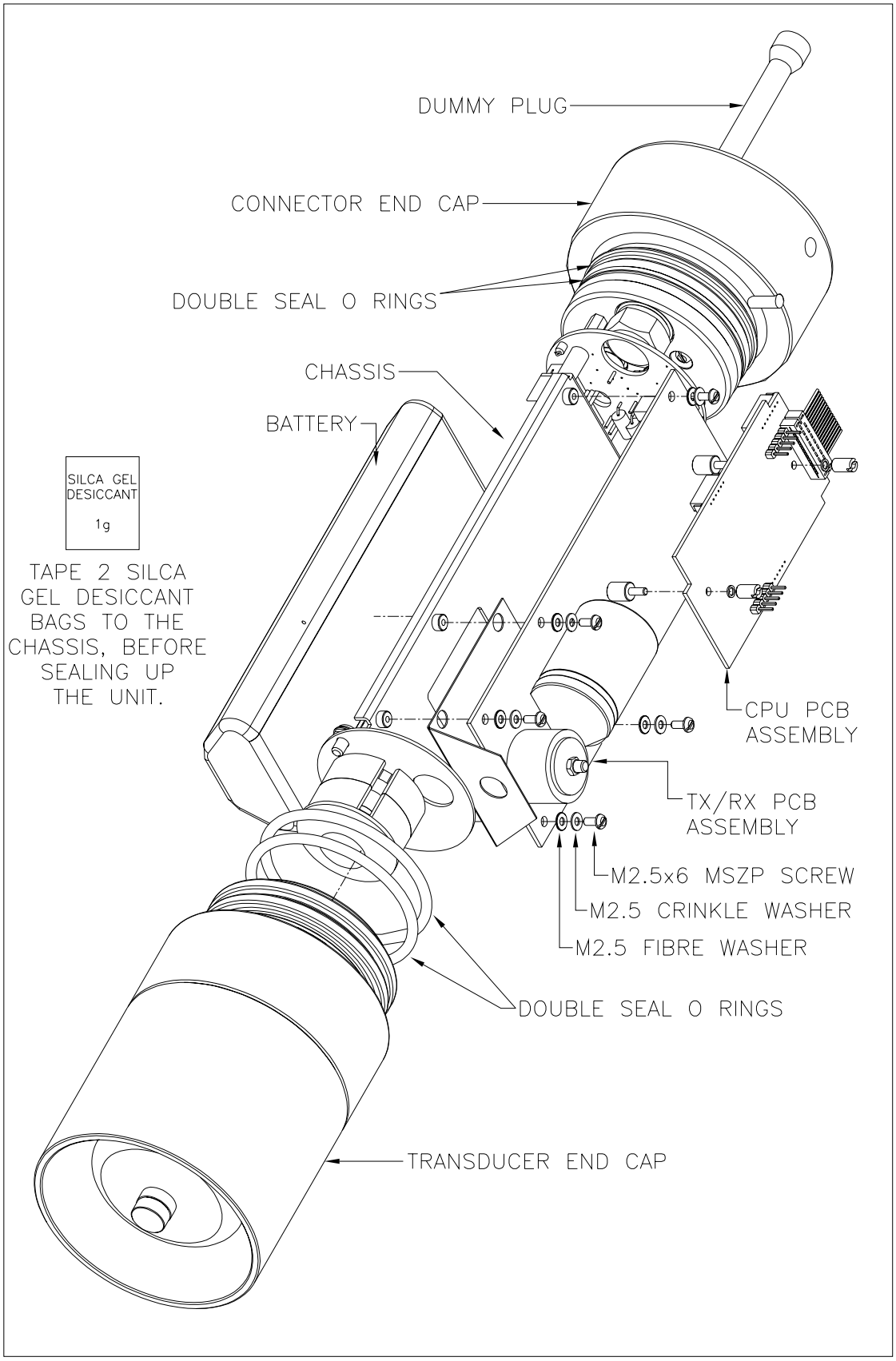


FIG 4.2 TYPE 8070 + 8071: WIDEBAND SUB-MINI ASSEMBLY



4.6 WSM FUNCTIONAL TEST

Carry out the sequence of tests described below, to check the full electronic functionality of the WSM.

4.6.1 Serial communications with PC software

Connect to a PC using the charger/comms interface, and run the WSM Terminal software. Switch the transponder on. Select <Get Status>, and check the transponder returns data. This test checks the basic operation of the microprocessor and associated crystal.

Select: Nav Scheme = HPR; HPR Channel = B21; Address = 3301.

4.6.2 Transponder Test

Connect the ANT TDR output to the transducer end cap using the Test Transducer (or coupling loop if none available). Programme the ANT as described in Appendix C.3 - "HPR CHANNEL TEST". Enter channel number 21, i.e. [HII21], to select this HPR400 channel. The ANT will generate the two-pulse interrogation used in the HPR400 scheme.

If a VALID REPLY message is shown, and the delay is between 59.5 – 60.5ms, this test has passed. This test checks both navigation receiver circuits, and the transmitter circuitry.

4.6.3 Depth Reply Test

If the end-cap has the depth option fitted, and depth replies are enabled via the software, then two reply pulses are sent, and the ANT will report a Z (depth) value, typically 124-126 ms.

4.6.4 Acoustic Command Test

Set up the ANT as described in Appendix C.4. If the ENABLED reply is seen, the command frequency receiver has been checked and the test has passed.

4.6.5 Responder Trigger Test

Using the Diagnostics pull-down menu on the WSM Terminal software, select Responder Trigger (ping) test, then click on <Start>. If an audible ping is heard, then the triggering circuitry is functioning, and the test has been passed.

The above tests have checked the full electronic performance of the WSM, excluding battery charging. To prepare the unit for operations, set the Nav Scheme and Address as required. To prepare for storage, switch the unit Off.

SECTION 5

5. FAULT FINDING

5.1 TEST 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 25 V 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 10 MHz 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= -).

5.2 QUICK VOLTAGE CHECKS

With the unit switched ON, measure the battery voltage using a Digital Multimeter, across the terminals of the large capacitor, C16 on the Tx board, see Fig 5.2b.

Measure the voltage of the CPU logic rail by moving the positive probe to pin 3 of JP3, which should read 5V ± 0.1V. JP3.3 is the unsoldered pad of JP3, closest to the central fixing screw on the upper board, see Fig 5.2a.

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.

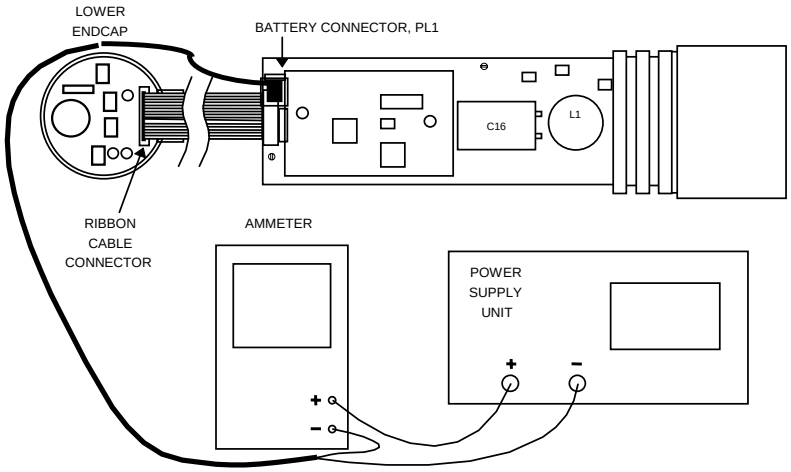
5.3 DIAGNOSTIC SET-UP

Check the On/Off switch is in the OFF position. Ensure that the Power Supply Unit (PSU) is off. Connect Test Cable 1 to the external connector on the end-cap.

Disconnect the battery pack from the Tx card by disconnecting PL1. Connect Test Cable 2 to PL1 on the Tx card. Connect Test Cable 2 Molex pin 4 to the PSU -ve terminal. Connect an ammeter (100mA dc range) between the PSU +ve terminal, and Molex pin 2 - see Fig 5.1 below. The connection to an ammeter will not be necessary if the PSU has a built-in ammeter or output current display.

Re-connect the end cap to the main electronics assembly via the ribbon cable. Set the current limit on the bench PSU to 100mA and its voltage to 18V.

FIG 5.1 TEST CONFIGURATION



5.4 DIAGNOSTIC PROCEDURES

WARNING

Each of the checks described in this section will involve some re-positioning of test connections. In order to avoid risk of damage to the circuit by the test procedure, it is **very important** to start all testing with the ON/OFF switch on the end-cap set to OFF and to switch it ON only for the duration of the test. The procedures given below assume that this practice is followed - no further reminder to switch ON and OFF is given.

Note

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

5.4.1 Quiescent Checks

5.4.1.1 Quiescent Current

Switch ON the WSM. Check the quiescent current on the Multimeter. This should be less than 1.5 mA - it may be necessary to wait for 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 that a fault condition exists. Occasional excursions above this value are normal. If the current is much higher than this, a fault has occurred in the electronics.

5.4.1.2 18V Supply Voltage

Reconnect the Multimeter, set up as a voltmeter on a 25V dc range, to monitor the voltage on the positive tag of the large capacitor (C16) on the lower PCB (printed circuit board) - positive terminal to C16, negative to C16 –ve - see Fig 5.2b which follows.

This voltage should be approximately 17.4V. If it is zero, the lower board is faulty.

If the C16 voltage is less than 17V, but not zero, a fault on the lower board is indicated.

5.4.1.3 5V Regulator Output

Transfer the positive lead of the Multimeter to U19 pin 8 (the via hole closest to TP3 of the lower board). This voltage should be 5V ± 0.2 V dc.

If this voltage is outside these limits, either the 5V regulator or some part of the circuit loading the 5V regulator could be faulty. The only way to resolve this is to remove the upper board and repeat the test. If the fault persists, the lower board is faulty. If it clears, the upper board is faulty.

FIG 5.2 PRINTED CIRCUIT BOARD LAYOUTS

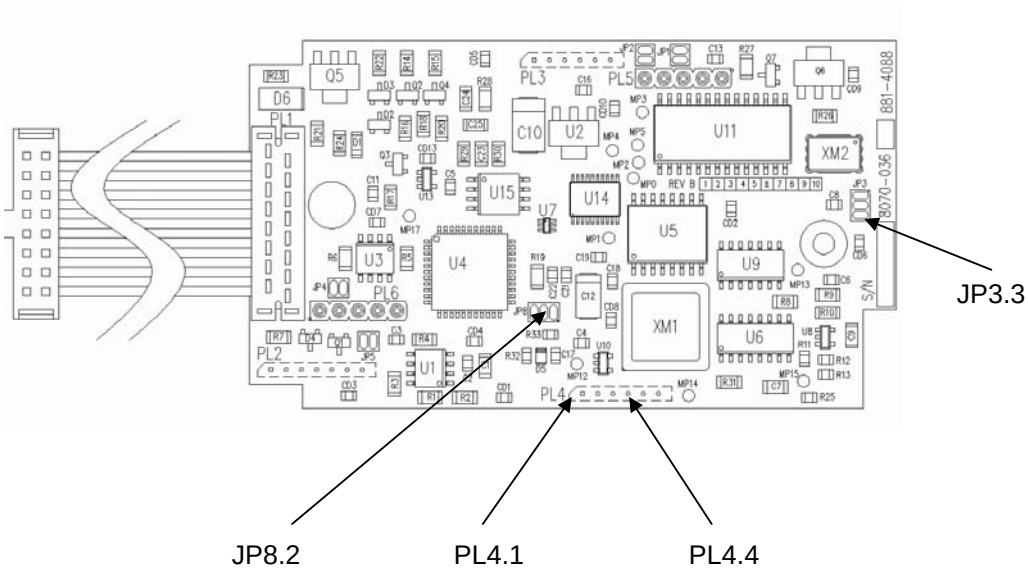


Fig 5.2a - CPU Board 8070-036

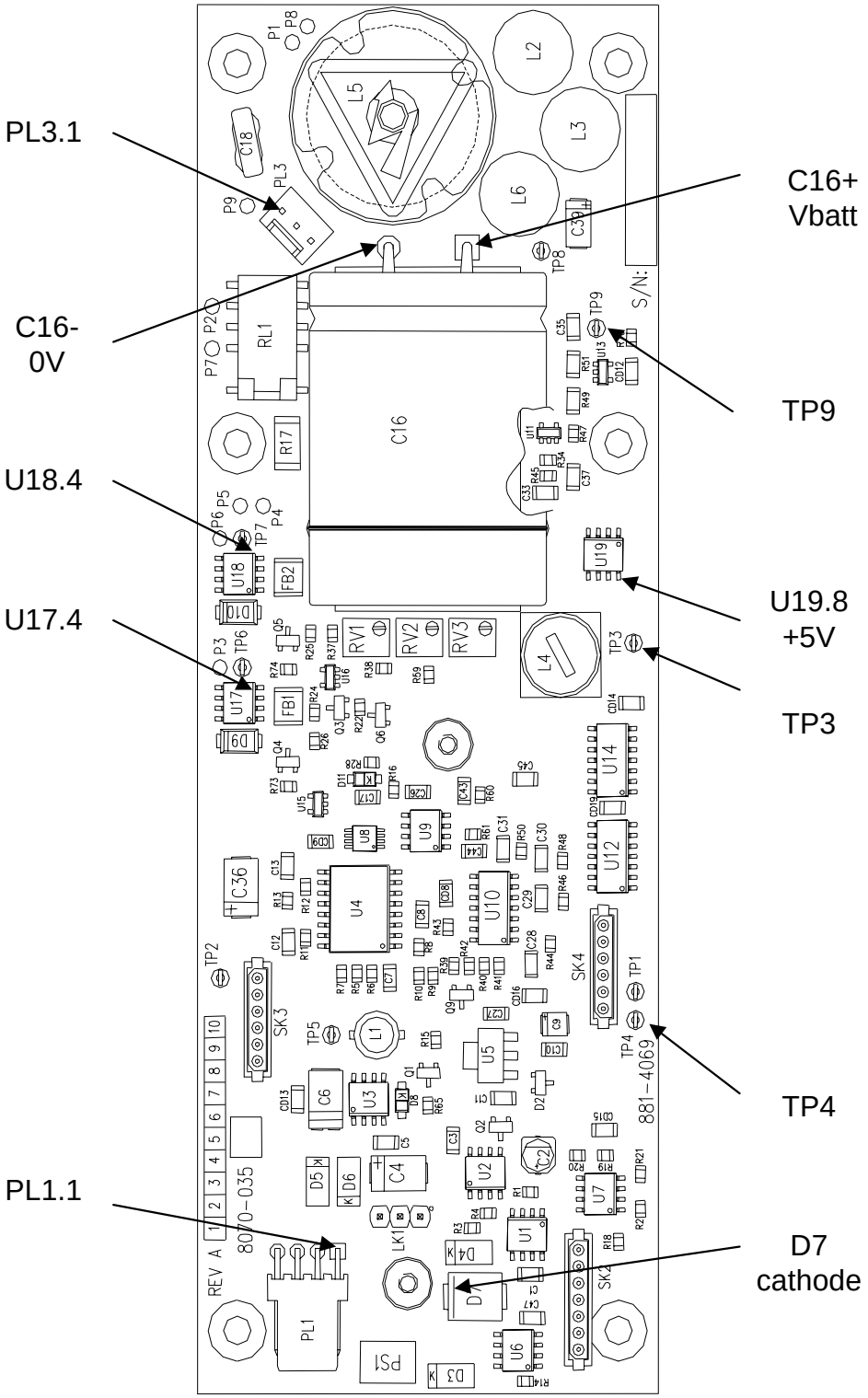


Fig 5.2b - Tx/Rx Board 8070-035

5.4.1.4 **100kHz Oscillator**

Using a x10 probe and the frequency counter, check a 5V 100kHz square wave is present on the middle pad of JP8, see Fig 5.2a.

5.4.1.5 CPU Operation

Connect to a PC using the charger/comms interface, and run the WSM Terminal software. Switch the transponder on. Select <Get Status>, and check the transponder returns data. This proves the basic operation of the micro-controller and associated crystal.

5.4.1.6 24 V Input Test

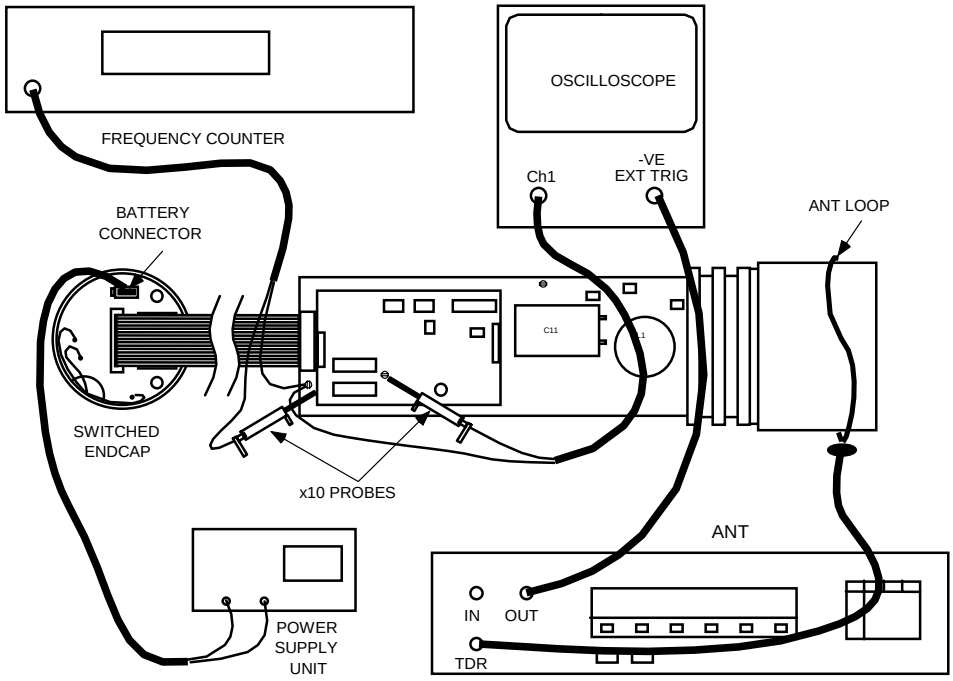
Using test cable 1, (MCIL5F), connect the +24V (pin 4 - red wire) to the PSU +ve output and the 0V (pin 2 -black wire) to the PSU -ve output. Set the PSU voltage to 24V and check the voltage on C16 again (as described in paragraph 5.4.1.2). This voltage should be approximately 23.4V, and the circuit should be drawing a current of approximately 85 mA.

If less than 23.4V, or zero, a fault on the connector, DAS card or interconnections is indicated.

5.4.2 Functional Checks - Transponder Mode

Change the test configuration to include the ANT as shown in Fig 5.3.

FIG 5.3 FUNCTIONAL TEST CONFIGURATION



Connect to a PC using the charger/comms interface, and run the WSM Terminal software. Switch the transponder on. Select <Get Status>, and check the transponder returns data. This proves the basic operation of the micro-controller and associated crystal.

Select: Nav Scheme = HPR; HPR Channel = B33; Address = 3301.

Program the ANT to produce a continuous sequence of tone bursts at the B33 frequency, by following the procedure in Appendix C.1. On pressing the START key, the ANT will produce the following sequence of interrogation signals:

- Tone burst 10 ms wide
- Frequency 23923Hz (channel B33)
- Amplitude 15 V p/p (0 dB attenuation)
- Repetition Rate 750 ms

Pressing the STOP key on the ANT at any time will stop the sequence. If programmed as described in Appendix C.1, the ANT will also produce a trigger output for the oscilloscope, referred to the start of the simulated burst. Connect the Trigger OUT terminal on the ANT to the trigger input of the oscilloscope and switch the oscilloscope to negative trigger. Tighten the coupling loop supplied with the ANT around the transducer end cap and connect the other end of the loop cable to the TDR output of the ANT. The position of the loop on the end cap may have to be adjusted during the following tests to achieve optimum coupling.

Use the oscilloscope to check the waveforms obtainable at the various points around the circuit described in the following paragraphs. Adjust the position of the ANT loop on the end cap if good coupling is not being achieved and output amplitudes are very small.

These checks should be carried out in the order given. Failure at any point will then indicate the source of the fault.

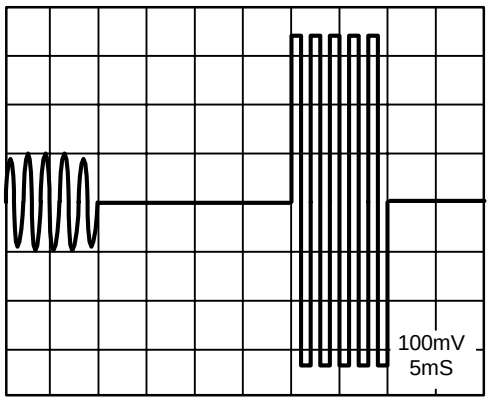
NOTE All of the oscilloscope screen sketches which follow ignore the scaling change which a x10 or x100 probe would cause.

5.4.2.1 Pre-amplifier First Stage Output

This waveform may be monitored at TP9 on the lower board. It should resemble that given here as Fig 5.4. Again, both input and reply signals should appear here - the input one starting at 0 ms and the reply starting at approximately 30 ms. The signals are on a level of 2.5 V and >2 V in amplitude.

If the input signal is not present, then it is most likely that U15 or one or both of the long tailed pairs (Q7 & Q8) are faulty. There is a small possibility that the CPU board or connector SKT2 & 4 (or its mating connector) may be faulty instead and the easiest way of checking this is to change the upper board anyway and observe the result. Again, the absence or otherwise of the reply signal is inconclusive at this stage.

FIG 5.4 PRE-AMP 1ST STAGE WAVEFORM



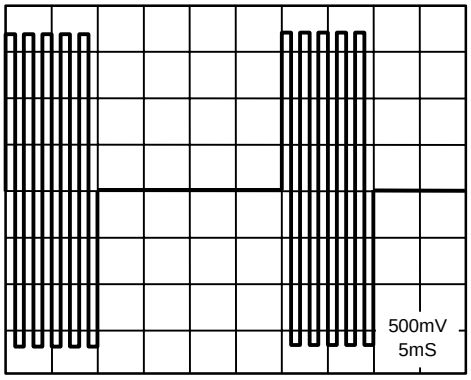
5.4.2.2 Squarer Stage Output

This waveform may be monitored at TP3 on the lower board. It should resemble that given here as Fig 5.5.

Again, both input and reply signals should appear here - the input one starting at 0 ms and the reply starting at approximately 30 ms. Both signals should have reached saturation level at the amplifier output - at an amplitude of 5.0 V p/p.

If the input signal is not present, then U13, U11 or U19 is faulty.

FIG 5.5 PRE-AMP 2ND STAGE WAVEFORM

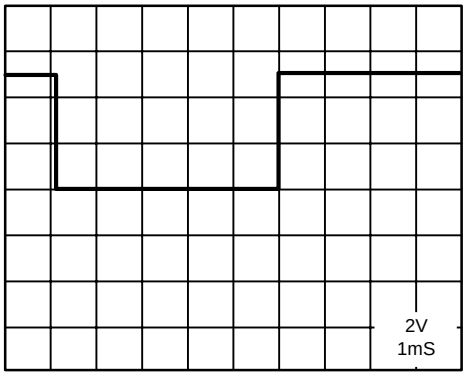


5.4.2.3 Envelope Detector Output

This waveform may be monitored at TP4 on the lower board (see Fig 5.2). It should resemble that given here as Fig 5.6.

If it does not, and assuming that the CPU board was found to be working correctly, (see paragraph 5.4.1.4, and 5.4.1.5), then the lower board is faulty.

FIG 5.6 COMPARATOR O/P WAVEFORM



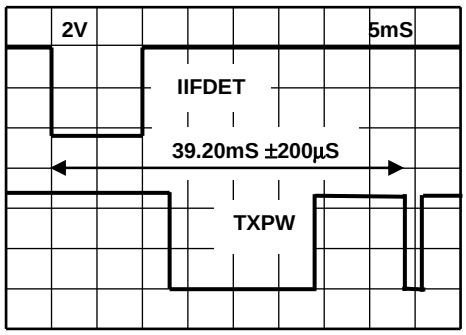
5.4.2.4 IIFDET and TXPW Output

FIG 5.7 IIFDET AND TXPW WAVEFORM

CPU PCB. These waveforms may be monitored respectively on PL4-1 & PL4-4 on the upper board. It should resemble that given here as Fig 5.7. The time between the falling edge of IIFDET and the 2nd falling edge of TXPW should be 39.2 ms +/- 200 µs.

If it does not, then it is most likely that the upper board is faulty.

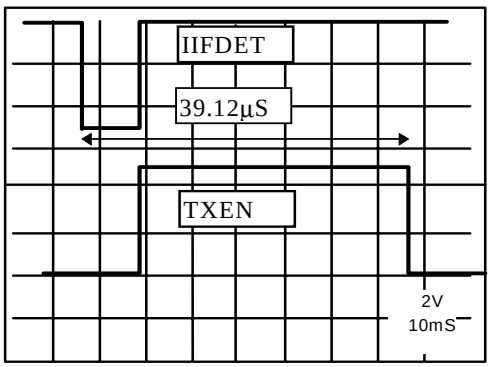
There is a small possibility that the lower board or PL4 (or its mating connector) is faulty and the easiest way of checking this is to change the lower board and observe the result.



5.4.2.5 IIFDET and TXEN Output

FIG 5.8 IIFDET AND TXEN WAVEFORM

This waveform may be monitored respectively on PL4-1 & PL4-5 on the upper board (see Fig 5.2). It should resemble that given here as Fig 5.8. The time between the falling edge of IIFDET and the falling edge of TXEN should be 39.12 ms +/- 200 µs. If the waveform does not resemble Fig 5.8, then it is most likely that the upper board is faulty. There is a small possibility that the lower board or PL2 (or its mating connector) is faulty and the easiest way of checking this is to change the lower board and observe the result.



NOTE: (See Appendix C.1 -"TONE BURST SEQUENCE")

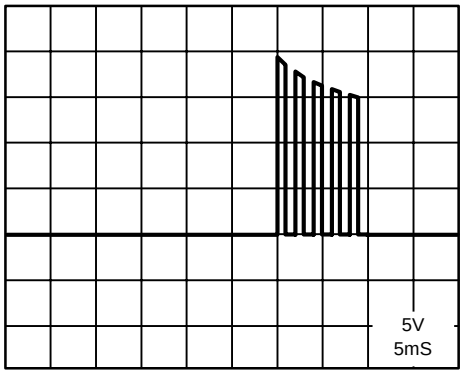
For a more accurate setting of turnaround delay use the ANT internal adjustable Trigger OUT delay to trigger the oscilloscope. Set the ANT Trigger OUT delay for 29.5 ms and the oscilloscope timebase to 0.2 ms/div giving a screen range of 29.5 ms - 31.5 ms.

5.4.2.6 Drive Amplifier Input

This waveform may be monitored on the Gates of U17 pin 4 and U18 pin 4 on the lower Tx board. It should resemble that given here as Fig 5.9.

If it does not, then the lower Tx board is faulty.

FIG 5.9 DRIVE AMP I/P WAVEFORM



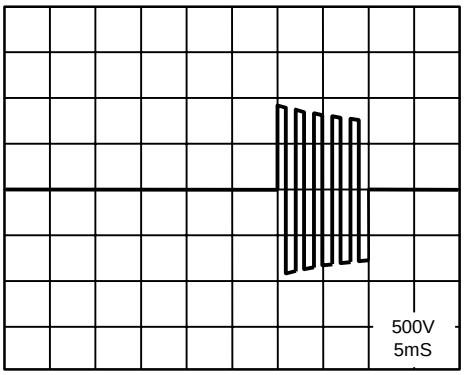
5.4.2.7 Drive Amplifier Output

This waveform may be monitored, using the x100 probe, on PL3 pin 1 on the lower board (as shown earlier on Fig 5.2). Note that the voltage is very high at this point (1800 V p/p). The waveform should resemble that given here as Fig 5.10.

If it does not, then the lower board is faulty.

If this waveform is present, it should be possible to hear the transducer “pinging” as it produces the reply burst. If there is no sign of transducer output then the transducer is faulty.

FIG 5.10 DRIVE AMP O/P WAVEFORM



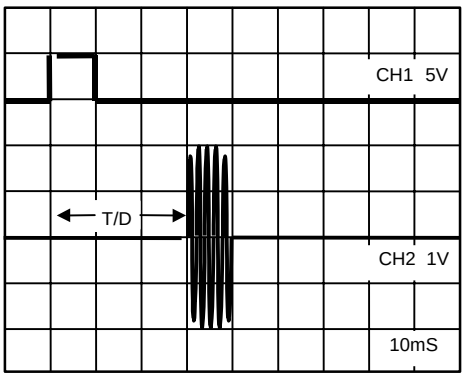
5.4.2.8 Responder Mode

Using test cable 1 apply a +ve going pulse to the pin 1 (black wire) wrt 0V (white wire). 5 V in amplitude, with a duration of 10 ms, and a repetition rate of 750 ms. (See Appendix C, Section 2)

The 10 ms trigger waveform and a normal output waveform, as shown here on Fig 5.11, should be present. If the output waveform is not present, then the upper board is faulty.

If the waveform is present, repeat the test for the full range of channel selection switch settings.

FIG 5.11 O/P FROM COUPLING LOOP



If all test results are now satisfactory, re-assemble the transponder as described in Section 4.5.3 and proceed to the Acceptance Test.

5.5 ACCEPTANCE TEST

Carry out the sequence of tests described below. At the conclusion of each test, complete the Test Results sheet given at the end of this section.

5.5.1 Battery Off Load Voltage

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

5.5.2 Battery Charge Circuit Function

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. Apply 24V supply via the test cable. Check that an approximate 85mA charging current flows and note the on-load voltage of the supply (nominally 20.5V, depending on the charge condition of the battery).

Assemble the Transponder for the remainder of tests.

5.5.3 Serial communications with PC software

Connect to a PC using the charger/comms interface, and run the WSM Terminal software. Switch the transponder on. Select <Get Status>, and check the transponder returns data. This test checks the basic operation of the micro-controller and associated crystal.

Select: Nav Scheme = HPR; HPR Channel = B21; Address = 3301.

Disconnect the charger/comms interface, and reconnect the pig tail test lead.

5.5.4 Transponder Test

Connect the ANT TDR output to the ANT Test Transducer (Type 7935-000). Hold the Test Transducer end on to the WSM transducer. Using a Test Transducer is recommended, as it will verify the WSM acoustic transducer.

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

Programme the ANT as described in Appendix C.3. Enter channel number 21, i.e. [H21], to select this 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, this test has passed. This test checks both navigation receiver circuits, and the transmitter circuitry.

5.5.5 Acoustic Command Test

Set up the ANT as described in Appendix C.4. If the ENABLED reply is seen, the command frequency receiver has been checked and the test has passed.

5.5.6 Responder Trigger Test

Using the Diagnostics pull-down menu on the WSM Terminal software, select Responder Trigger (ping) test then click on <Start>. If an audible ping is heard, then the triggering circuitry is functioning, and the test has passed.

5.5.7 Current Demand Test

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

5.5.8 Trickle Charge Function

Remove the trigger pulse from the black wire and observe that the current drops back to a steady reading of approximately 85 mA with a fully charged battery, (or higher if the battery is very low).

Switch off the bench PSU. Disconnect the test cable from the transponder. Fit the non-shorting dummy plug. Switch the WSM off.

WIDEBAND SUB-MINI: COMPLETED ASSEMBLY ACCEPTANCE TEST

Type	807…	Unit Serial No. :	

5.5.1	Battery off load voltage	_____ V
5.5.2	Battery Charge Circuit Function - 85 mA (typical)	_____ mA
	Supply voltage drops to 20.5 V (typical)	_____ V
5.5.3	Serial comms with PC	……..…
5.5.4	Transponder Response – range displayed	_____
5.5.5	Acoustic Command Test – reply detected	……..
5.5.6	Responder Response – ping heard	_____
5.5.7	Current Demand Test - input current pulse with transponder replying	_____
5.5.8	Trickle Charge Function - 85 mA (typical) with charged battery	_____
	Fit blanking socket on connector	_____

Tester _____ Date _____

SECTION 6

6. TECHNICAL SPECIFICATION FOR TYPE 8070/8071 WIDEBAND SUB-MINI

Navigation schemes	:	All HPR-300 Channels (see Appendix D) All HPR-400 Channels 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 HPR 300 HPR 400 Sonardyne	:	after interrogation pulse or responder trigger 30ms (fixed) 60ms (fixed for transponder) 30ms (fixed for responder) 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 If held high, inhibits transponder operation.
Responder Trigger, pulse width	:	3 to 25ms
Mating Connector	:	Subconn MCIL5F
Dimensions	:	Refer to dimension drawings (Section 2)

	Type 8070	Type 8071
Length	408 mm	401 mm
Clamping Diameter	87 mm	75 mm
Maximum Diameter	95 mm	75 mm

Depth Rating, housing	:	3000 metres	1000 metres
Depth rating, unit	:	Depends on depth sensor - see lower end-cap	
Depth sensor, Linearity	:	0.25% FSD typical	

Weight	:	Type 8070	Type 8071
In air		5.0 kg	2.7 kg
In water		2.6kg	1.4 kg
Transducer Type	:	Directional	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	:	(over the bandwidth	
(dB re 1 µPa @ 1 m):		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:	:	Type 8070	Type 8071
(dB re 1 µPa)			

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 (8070)	100,000 (8071)
Operating Life (4ms @ 1/sec, low power)		20 hours (8070)	28 hours (8071)

Charging time: 4 hours using Sonardyne Charger Type 7972-000-04 (Temperature must be between 10 and 40ºC)

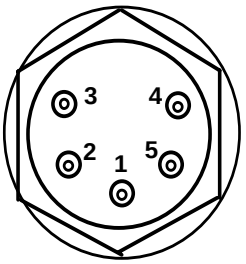
Externally Powered : Indefinite Life

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)

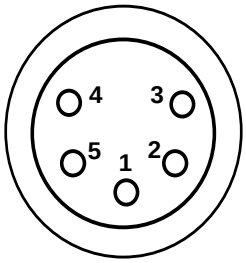
External Connector : Subconn MCBH5M with special housing

Mating cable connector : Subconn MCIL5F

Pin Numbering



Bulkhead



Cable

Connections	:	Pin 1	Trigger / Comms In
		Pin 2	0V
		Pin 3	Charge / Comms Out
		Pin 4	External Power (24V)
		Pin 5	Not used

APPENDIX A

A. SPARES LISTS

A.1 TYPE 8070 WIDEBAND SUB-MINI: DIRECTIONAL 3000M

Part No.	Dwg No	Description	QTY
LOWER ENDCAP			
641-3309	8070-010-01	Lower end cap assembly, 3000m no depth	*
641-3334	8070-010-02	Lower end cap assembly, 3000m with depth	*
317-2799		Bulkhead Connector Subconn MCBH5M AL/2-O	1
770-1749	7970-017	Pressure Relief Vent body	1
200-0081		Seal 'O' ring 200-008-5570 for pressure vent	2
200-8347		Seal 'O' ring 200-834-557 for endcap	2
312-6874		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			
631-7452	8070-035-01	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/endcap retainer), 210mm each	2
925-002C		Silica gel bag, 1g	2
CABLE OPTIONS			
820-6586	7971-050	PC to WSM comms cable	1
820-5163	7970-053	Mating cable tail, 5m, with locking sleeve	1

Part No.	Dwg No	Description	QTY
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	*
272-036C*	---	Or Power Pack AC cable, US plug	*
272-0352*	---	Or Power Pack AC cable, European plug	*

A.2 TYPE 8071 WIDEBAND SUB-MINI: 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	*
317-2799		Bulkhead Connector Subconn MCBH5M AL/2O	1
770-1749	7970-017	Pressure Relief Vent body	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
312-6874		Blanking Socket MCDCF	1
317-2672		Locking Sleeve for blanking socket, MCDLSF	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			
631-7453	8070-035-02	Rx/Tx PCB for 8071	1
631-7472	8070-036-01	CPU PCB	1
631-7471	8070-039-01	End cap PCB	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
CABLE OPTIONS			
820-6586	7971-050	PC to WSM comms cable	1
820-5163	7970-053	Mating cable tail, 5m, with locking sleeve	1

Part No.	Dwg No	Description	QTY
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	*
272-036C*	---	Or Power Pack AC cable, US plug	*
272-0352*	---	Or Power Pack AC cable, European plug	*

APPENDIX B

B. BATTERY CHARGING

Note : The safety precautions at the front of this manual **MUST** be read and understood before starting work on the disassembly of any subsea unit. Further safety information is included below. Take particular care of sections in bold text.

The following instructions apply to transponders fitted with Nickel Metal Hydride rechargeable batteries.

The WSM 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 WSM.

A flat battery will charge for approximately 4 of 6 hours at the full rate of 500mA, during which the red Fast Charge LED will illuminate. The charging current is supplied on pin 3 of the external connector.

Users familiar with the Sonardyne Super Sub Mini (SSM) Transponder family will note that 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 WSM, 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 nears 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 (30V, 85mA on pin 4) which will trickle charge the unit, and the yellow Trickle charge LED will illuminate.

B.1 CHARGING PROCEDURE

1. A pressure relief vent is provided to ensure there is no build-up of gas inside the transponder caused by the charging process. The battery manufacturer recommends that 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 WSM includes special circuitry to monitor the battery pack during charging. This safety feature ensures that the battery cannot be overcharged. For this reason it is not deemed necessary to remove the safety vent 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 that the pressure relief vent is extracted prior to charging. Use an M3 bolt to give purchase and carefully withdraw the vent plug.

   Keep well clear of the transponder endcap 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. Take care to avoid dirt contaminating the ‘O’ ring seals on the plug or entering the hole in the endcap.

2. Check that the temperature is between 10 and 40 degrees Celsius. The battery will not accept charge outside these limits.

3. Check the transponder on/off switch is set to OFF.

4. Connect the Type 7972-000-04 WSM comms/charger to the WSM charger PSU via a 2.1mm power socket. The PSU accepts a standard IEC power lead, which is available with UK, US or European plugs and can be specified at time of order.

5. 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.

   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.

   If the battery is already **fully charged**, the yellow Trickle charge LED will come on for a few seconds, then the red and yellow LEDs will both flash for about 6 minutes, then the yellow Trickle charge LED will stay on.

   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.

   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.

6. When the battery is nearing full charge the red Fast Charge LED will go out and the yellow Trickle Charge LED will illuminate.

7. Remove the AC power from the Charger to terminate the charging process. **Do not re-connect until the battery has been used or left standing for at least 24 hours.**

8. Check that the pressure relief vent is fully home (i.e. does not protrude from the endcap face).

B.2 TECHNICAL DESCRIPTION

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 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:

1. The rate of change of voltage with time indicates the pack is approaching full charge
2. The temperature of the pack rises outside limits (10-40 ºC)
3. A time limit is exceeded (in the WSM case this is 6 hours)

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 WSM 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. A fast charge time limit is set to 4 hours.

The Type 7970 and 7973 SSM use a 1300 mAh battery which can be fast charged at 1.3A. 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 that one third below full capacity.

If a SSM charger is used to charge a WSM, 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.

If, in an emergency, it is necessary to charge the WSM by means other than the Type 7972-000-04 dedicated comms/charger unit, then the charge supply should be 24V at 500mA **constant current** for 4 hours maximum. Note that the charging time must be reduced if the battery pack has been charged recently.

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.

DO NOT:

1. **Charge battery packs in any way other than that which is recommended. Failure to follow guidelines may result in a reduction of battery pack life, cause damage to the battery pack and may endanger operators.**

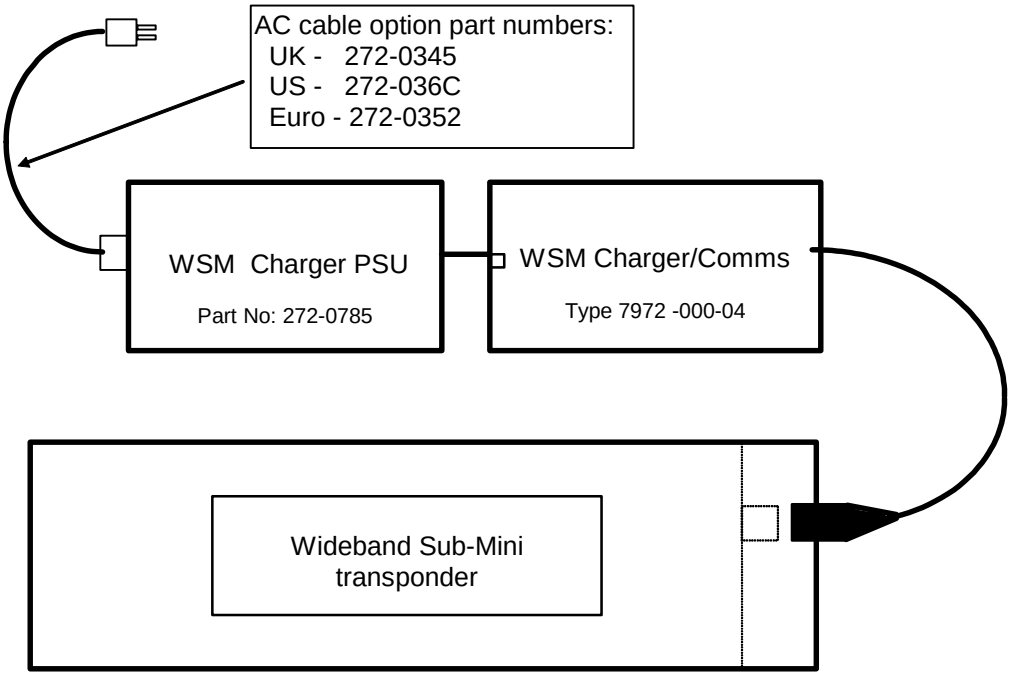
2. **Allow the WSM transponder to be cooled or heated during the charging process because the over-current protection component characteristics may change adversely.**

3. **Fast charge/discharge the WSM battery pack other than when using the Type 7972-000-04 WSM comms/charger and WSM charger PSU.**

4. **Repeatedly connect the Fast Charger to the transponder when the battery is fully charged.**

The diagram below shows the charging equipment delivered with WSM transponders.

FIG B.1 CHARGER CONNECTIONS



APPENDIX C

C. PROGRAMMING THE ANT

This Appendix contains four programming procedures for the Sonardyne Type 7343 Acoustic Navigation Tester (ANT):-

- TONE BURST SEQUENCE. For producing a continuous sequence of tone bursts at a repetition period of 750ms. This is useful during diagnostic testing.
- RESPONDER TRIGGER SEQUENCE. For producing a continuous sequence of "responder only" trigger outputs, again at a repetition period of 750ms. This enables the transponder's response to an electrical trigger input to be checked.
- HPR CHANNEL TEST. Allows any HPR channel setting to be tested, including depth replies.
- ACOUSTIC COMMAND TEST. For testing the command frequency receiver circuitry. Sends an Enable command to a given command address.

These procedures are for ANT firmware version V2.25, which is displayed on the screen at power-up.

To select a letter in the range G-Z from the ANT front panel, the **Down** and **Up** arrow keys (8 & 9) are used until the desired letter is displayed. Key **7** is then used to lock the letter. Once a valid command is entered, keys 7, 8, & 9 revert to being numeric keys. Keys 8 & 9 do not sound the bleeper.

The ANT can alternatively be controlled via a PC terminal package connected to the 25 way D type connector on the rear panel. Set the terminal for 9600 baud, 8 data bits No parity, 1 stop bit.

C.1 TONE BURST SEQUENCE

Switch the ANT OFF, then ON, and key in the following sequence of commands on the ANT keypad (square brackets [] indicate keypad keys):-

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

NOTE

For section 5.4.2.5, when a delay of 29.5ms is required for the 'scope trigger, the O/P DELAY - in ms - can be entered instead of the 0 at this point. Be sure to remove this delay when no longer required, however.

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
```

- [6] STOP

C.2 RESPONDER TRIGGER SEQUENCE

Switch the ANT OFF, then ON, and key in the following sequence of commands on the ANT keypad (square brackets [] indicate keypad keys):-

- [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
- [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
```

- [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.

C.3 HPR CHANNEL TEST

Switch the ANT OFF, then ON, and key in the following sequence of commands on the ANT keypad (square brackets [] indicate keypad keys):-

- [ON]
- [3] MULTI
- [4] NEW PAN
- M[F][ENTER] Set Medium Frequency Band –

  use up/down arrow keys for M then 7 to select.
- [H]**II**[2][1] where [H] is either of the blank keys on the keypad, use up/down arrows for **I**, followed by the channel number (21 in this case).
- [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]

C.4 ACOUSTIC COMMAND TEST

Switch the ANT OFF, then ON, and key in the following sequence of commands on the ANT keypad (square brackets [] indicate keypad keys):-

- [ON]
- [3] MULTI
- [4] NEW PAN
- M[F][Enter] Medium Frequency Band
  - use up/down arrow keys for M then 7 to select.
- [A][D][3][3][0][1][Enter] Set the command Address of the WSM
- [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]

APPENDIX D

D. FREQUENCY TABLES

D.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

.

D.1.1 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

D.1.2 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.

D.1.3 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 E

E. "WSM TERMINAL" TEST SOFTWARE

E.1 INTRODUCTION

Sonardyne provides software to run on a PC to assist with Configuration, Test and Calibration checks of the following Transponders:

- Type 8070, 8071 Wideband Sub-Mini Transponder
- Type 7970, 7973 Super Sub-Mini Transponder
- Type 7971, 7977, 7978 PGT - Programmable Generic Transponder

The program is stored on a CD labelled "WSM Utilities" supplied with the unit, or can be downloaded from the Sonardyne web site: 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.

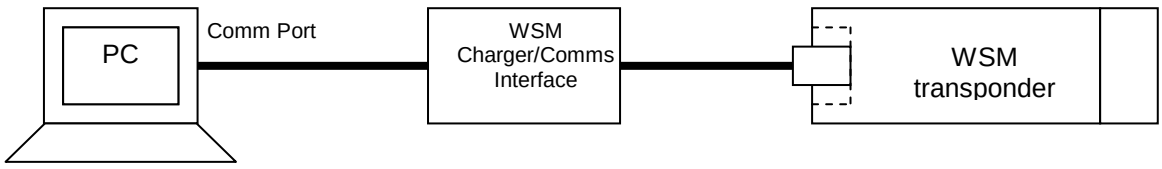
This description applies to WSM Terminal V2.00

E.2 SOFTWARE INSTALLATION

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.

E.3 ELECTRICAL CONNECTIONS

Connect the PC to the Transponder via the Type 7972-000-04 WSM Charger/Comms Interface as shown in the diagram below. **Ensure that the WSM charger PSU is NOT connected** to the Charger/Comms Interface, as this will inhibit the communication link.

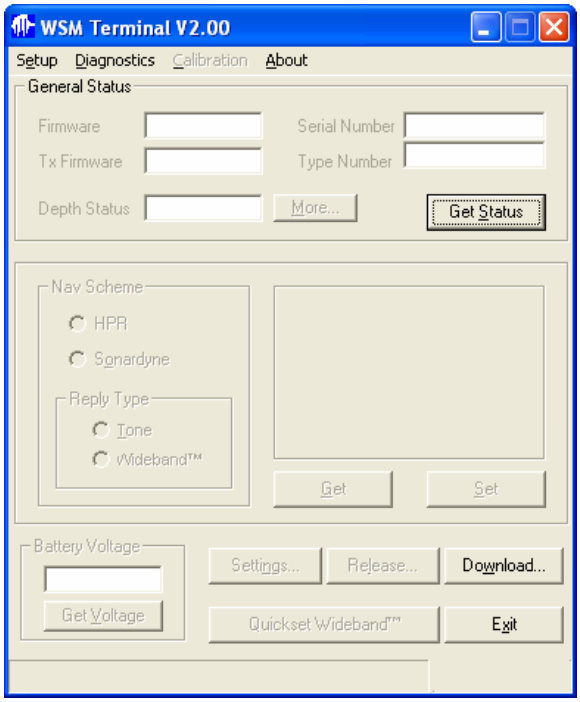


A simple PC to Transponder comms cable is also available, part number 820-6586.

E.4 SOFTWARE OPERATION

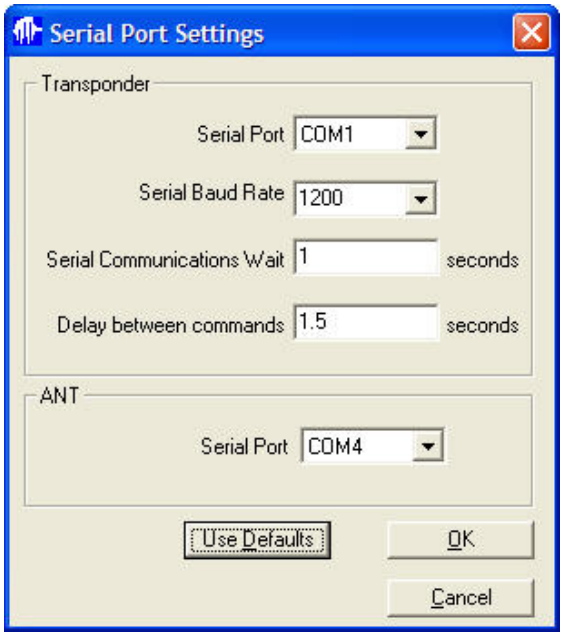
If the default setup locations were accepted during installation, then the program can be run from the **Start** button via **All Programs**, **Sonardyne**, **WSM Terminal V2.00**.

When run, the Main screen appears as shown below.



E.4.1 SERIAL PORT SETTINGS

Select the **Setup** pull-down menu option from the main screen, and then select **Serial Port Settings...** to display the window below.



Select the Transponder **Serial Port** from the appropriate pull-down list of available COM ports on the PC.

The **Serial Baud Rate** should be left at 1200 for normal operation.

Serial Communications Wait is the maximum time allowed for the Transponder to reply to an RS232 command.

Delay between commands provides a delay between adjacent commands. If reliability problems are experienced with serial communication, increase this delay to 1.0s. Once changed, the setting will be retained by the PC.

The **ANT serial port** is only used for diagnostic checks, so the port can be set to <None> if an ANT is not being used.

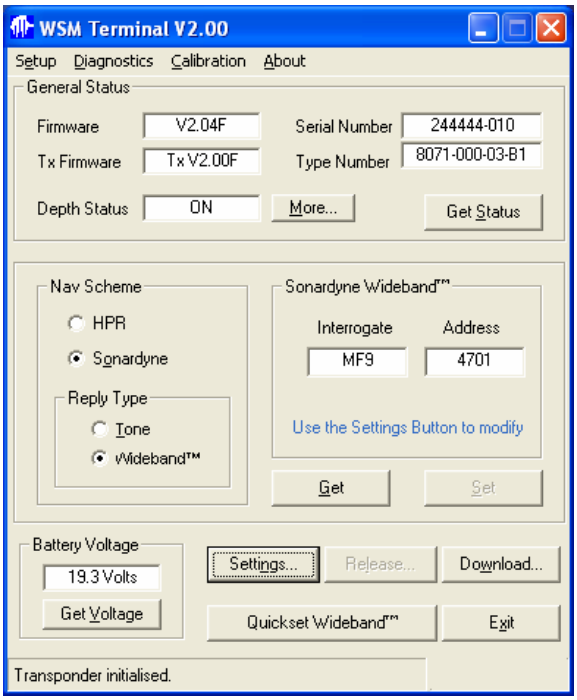
E.4.2 GENERAL STATUS

From the Main screen clicking on the **Get Status** button reads the present configuration of the currently-connected Transponder.

If there is no RS232 communication with the transponder, check the following:

- WSM is switched ON
- Serial Port settings (see section E.4.1)
- Cable connection to the WSM – clean the contacts if necessary
- Charge the WSM battery for 30 minutes in-case it is fully discharged. Refer to App. B.

If a successful reply is obtained, the white boxes will be filled. Note that the exact format of the ranging information panel will depend on the Nav. Scheme reported. An example is shown below:-



Firmware - this is the firmware version installed in the Transponder. Firmware upgrades can be installed via WSM Terminal as described in Section E.4.8. The Tx firmware refers to the transmission signal synthesiser.

Depth Status - 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. Refer to Section E.4.5.

Serial Number - this is the unique factory serial number and should be referred to in any communications with Sonardyne regarding this unit.

Type Number - is the Sonardyne drawing number for the unit, and it's build state is indicated by the last letter and digit.

The Interrogate and Reply fields are dependent on the Nav Scheme and Reply Type currently selected and may not be displayed.

Address - is the acoustic command address used to control the WSM. Note: it is important that the command address is unique to the beacon, and does not conflict with other Sonardyne beacons operating in the vicinity.

E.4.2.1 Drop-down menu structure

SetUp
- Serial Port Settings (E.4.1)

Diagnostics
- Responder Trigger (ping) test (E.4.9.1)
- Channel Range Test (E.4.9.2)
- Channel Depth Test (E.4.9.3.)
- Transponder to Transponder Test ((E.4.9.4 - not supported)
- WSM Tank Test ((E.4.9.5 - factory use only)
- Reset Transponder (E.4.9.6)
- Initialise Transponder (E.4.9.7)

Calibration
- Channel Selectors (factory use only)

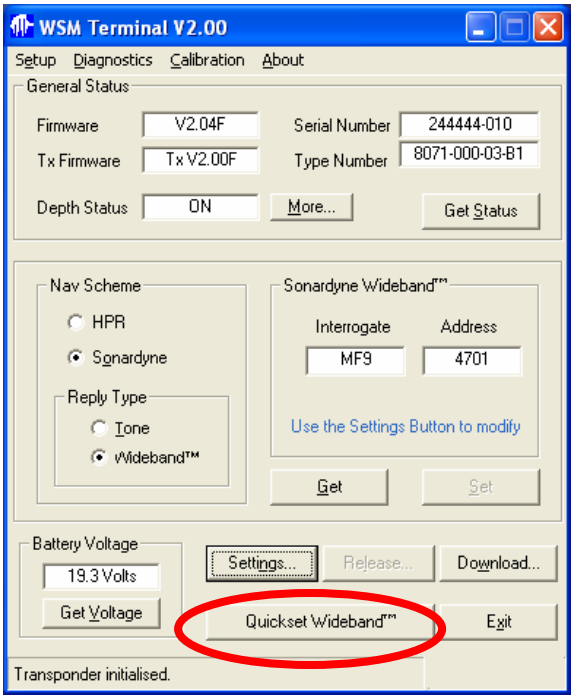
About (E.4.10)

E.4.3 NAV SCHEME

The WSM is compatible with Sonardyne Wideband, Sonardyne Tone and Simrad HPR systems, but only one can be selected at any one time. Depending on which Navigation Scheme and Reply Type is selected, the display box to the right will be titled “HPR Channel”, “Sonardyne Tone” or “Sonardyne Wideband”.

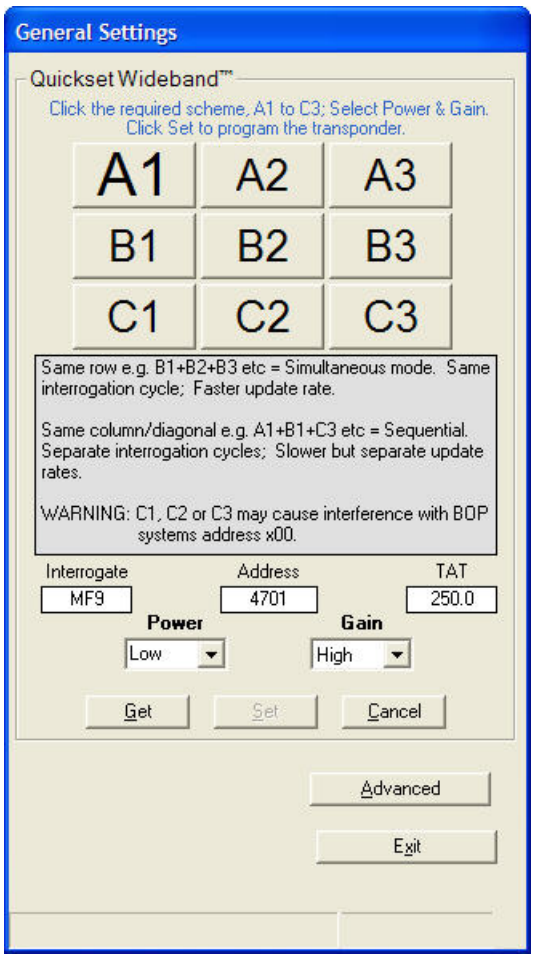
E.4.3.1 Sonardyne Wideband

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



The Interrogate and reply configuration can be changed using either the **Settings** button or the **Quickset Wideband** button. Both instances will open the Quickset Wideband window, which is a simple interface allowing one of 9 preset configurations to be programmed. This is intended to make the setting-up of a single beacon as quick as possible, and is applicable to job set-ups with only one or two beacons in the water.

One of nine preset Wideband configurations can be selected by clicking on the button **A1-A3**, **B1-B3** or **C1-C3** and pressing **Set**.



If the unit is already in a Quickset configuration, one button will have a font that will be larger than the others. In the example above, A1 is the currently selected Quickset Wideband Scheme.

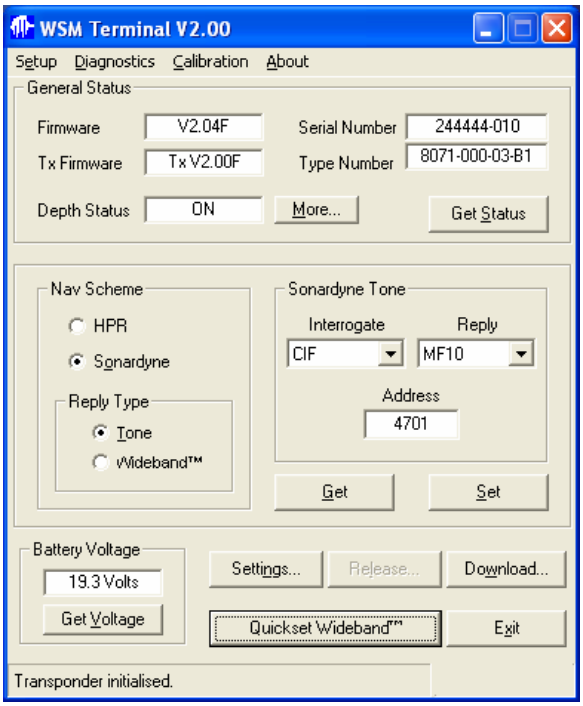
The transmission Power and receiver Gain settings can also be changed using the drop down menus and pressing **Set.**

The **Advanced** button allows users to select any available interrogate and reply signal, as well as other advanced features. Refer to section E.4.6 for an explanation of the Advanced settings.

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.

E.4.3.2 **Sonardyne Tone**

With Nav Scheme set to Sonardyne, and the Reply Type set to Tone, the Interrogate and Reply channels can be individually set to any Sonardyne MF channel using the pull-down lists. Click on **Set** to program the new channels.



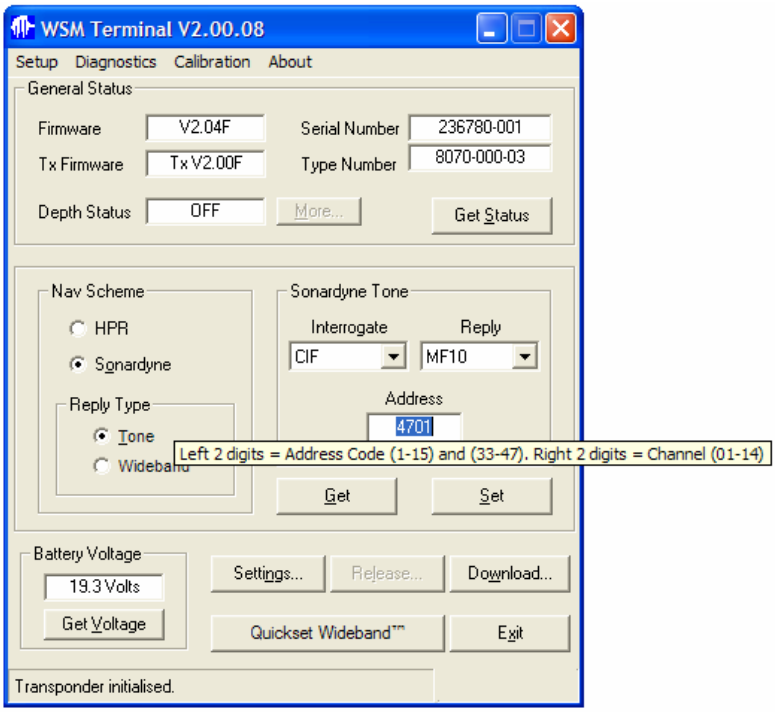
Note: CIF stands for Common Interrogation Frequency and CRF for Common Reply Frequency

Although the firmware in the WSM supports all Sonardyne tone channels, 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

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.

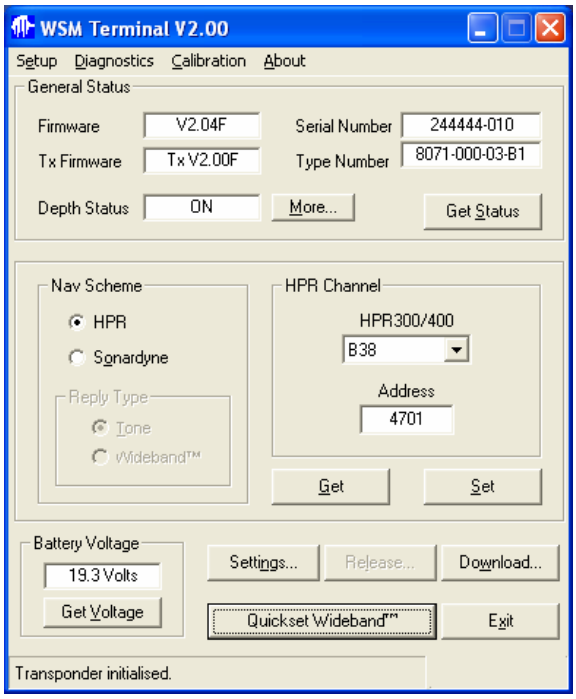
If the mouse hovers over certain data boxes on the page, a prompt will be displayed indicating legal ranges.


WSM Terminal V2.00.08
Setup
Diagnostics
Calibration
About
General Status
Firmware
V2.04F
Serial Number
236780-001
Tx Firmware
Tx V2.00F
Type Number
8070-000-03
Depth Status
OFF
More...
Get Status
Nav Scheme
HPR
Sonardyne
Reply Type
Tone
Wideband
Sonardyne Tone
Interrogate
Reply
CIF
MF10
Address
4701
Left 2 digits = Address Code (1-15) and (33-47). Right 2 digits = Channel (01-14)
Get
Set
Battery Voltage
19.3 Volts
Get Voltage
Settings...
Release...
Download...
Quickset Wideband™
Exit
Transponder initialised.

E.4.3.3 **HPR**

With the Nav Scheme set to HPR, the HPR Channel box will contain the beacon channel if it is configured for HPR300 or HPR400. The Interrogate and Reply channels are a fixed pair in HPR mode, consequently there is a single drop-down list of beacon channels. To change the HPR channel, use the pull-down list to select a different channel, and then click on **Set**. The new channel will soon appear in the HPR box.

The acoustic command Address is in the lower box. The beacon can only be commanded by a Sonardyne transceiver.



E.4.4 BATTERY STATUS

From the Main screen clicking on **Get Voltage** obtains a fresh voltage. For a Nickel Metal Hydride 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.

E.4.5 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.

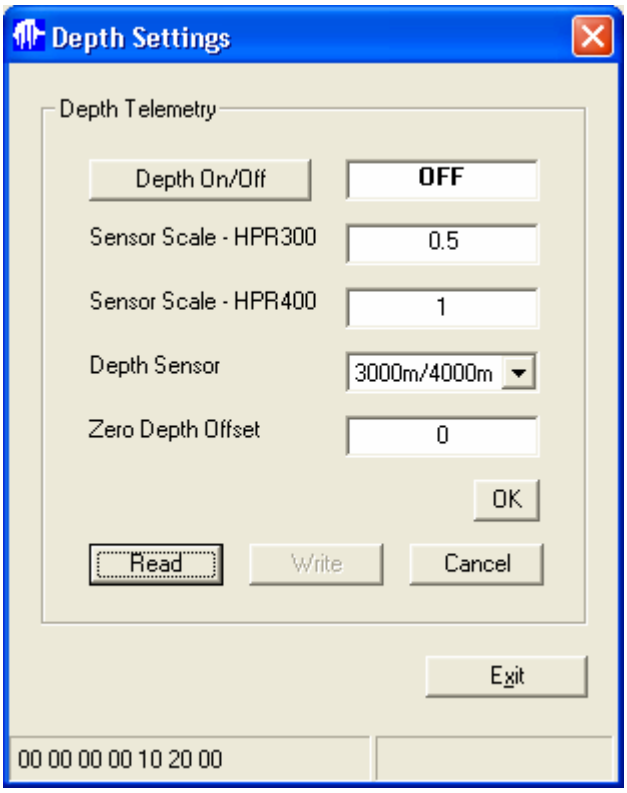
When this feature is OFF, the Transponder transmits only a single reply signal to each interrogation.

Note 1: It is prudent to turn Depth OFF to preserve battery life, when not required.

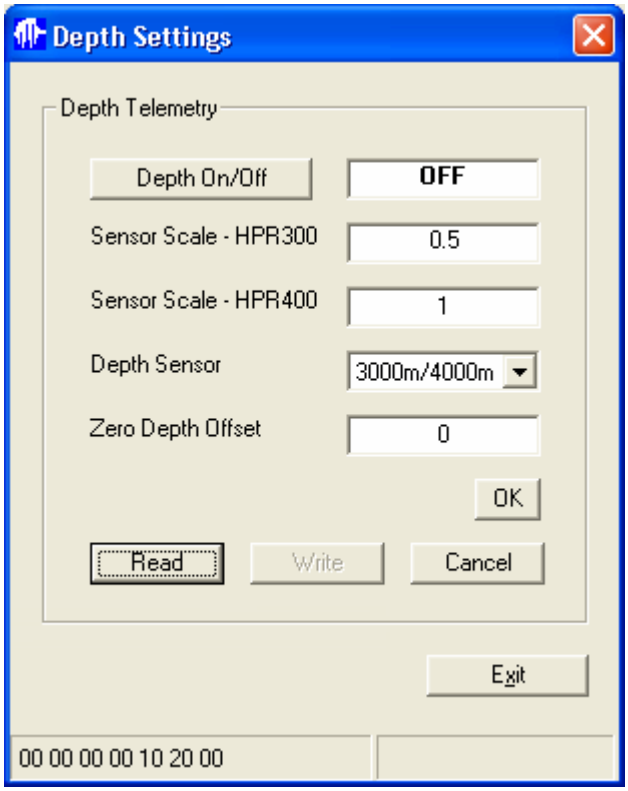
From the main screen, when the **Get Status** button is pressed, the Depth Status will read as **Depth On / Off / Not fitted**.

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

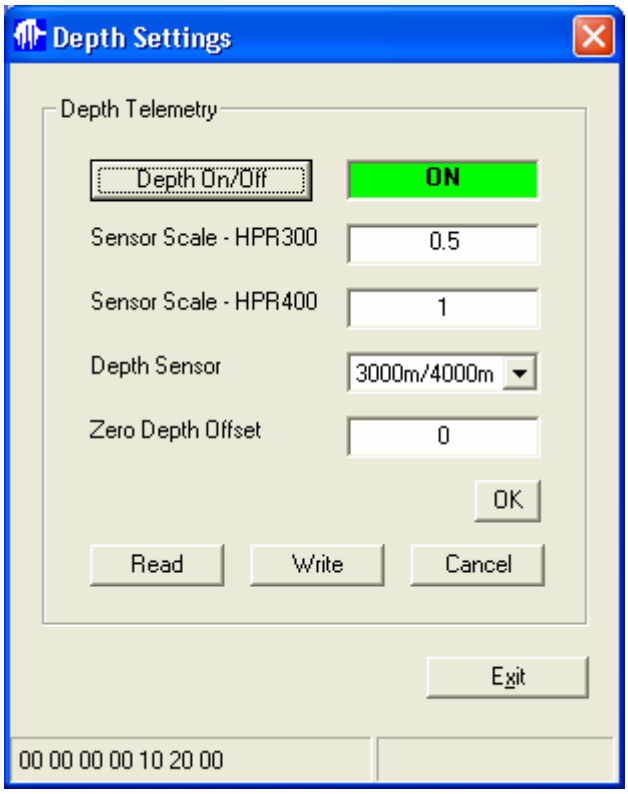
When pressed, the following screen is displayed:



Press the **Read** button to read the Depth parameters. A typical example is shown:



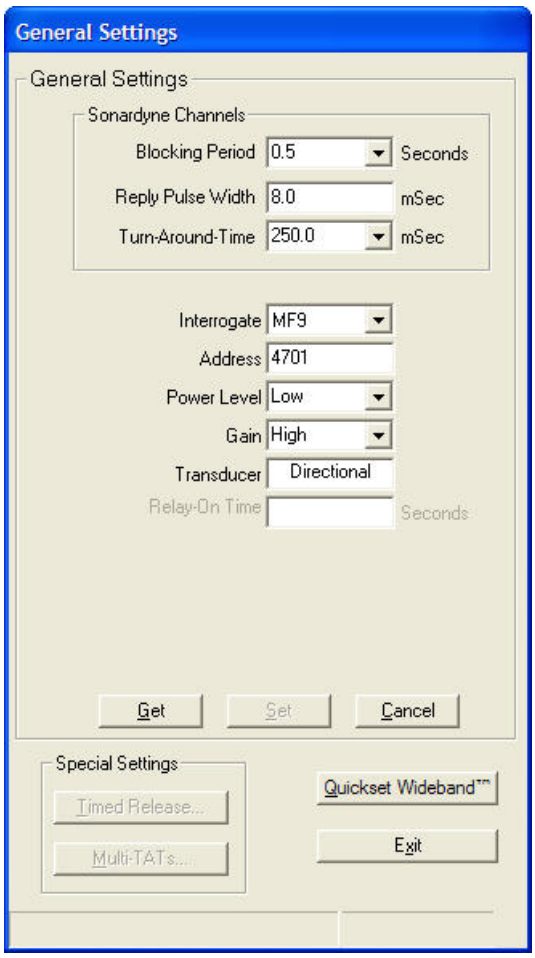
Details of each parameter follow, but in the example shown, to switch the Depth Sensor **On**, press the **Depth On/Off** button to display **On**, and then press **Write**.



Note 2: No other parameters should be altered on this page.

E.4.6 TRANSPONDER SETTINGS

If in a Sonardyne Tone or HPR scheme, press the **Settings** button from the main screen followed by **Read** to read the parameters. For a Sonardyne Wideband Scheme, pressing the **Advanced** button from the Quickset Wideband window will access this display



The Sonardyne Channels group contains 3 parameters that apply if a Sonardyne interrogation mode is selected:

- **Blocking Period** is the time in seconds that 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** defaults to 125ms 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 pull-down list. The WSM address defines the Individual Reply Signal (IRS) therefore changing the Address, changes the IRS. To do this type in a new command Address in the range 3301 – 4714, then click on **Set**. After a Set operation, the Nav Scheme and Reply Type fields are greyed out.

Note that the wideband IRSs used by a WSM are 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.

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. In general, transponders should use the lowest power level that works reliably in the operational environment.

Note that 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.

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

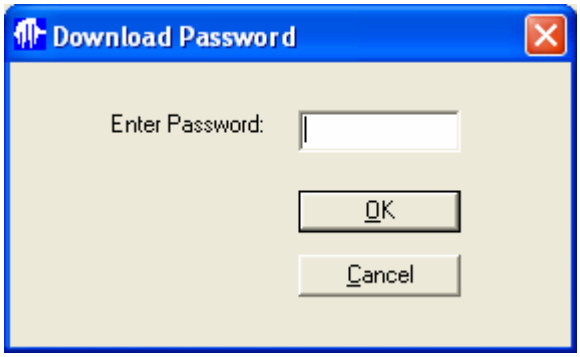
E.4.7 RELEASE

Not yet available.

E.4.8 FIRMWARE DOWNLOAD

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

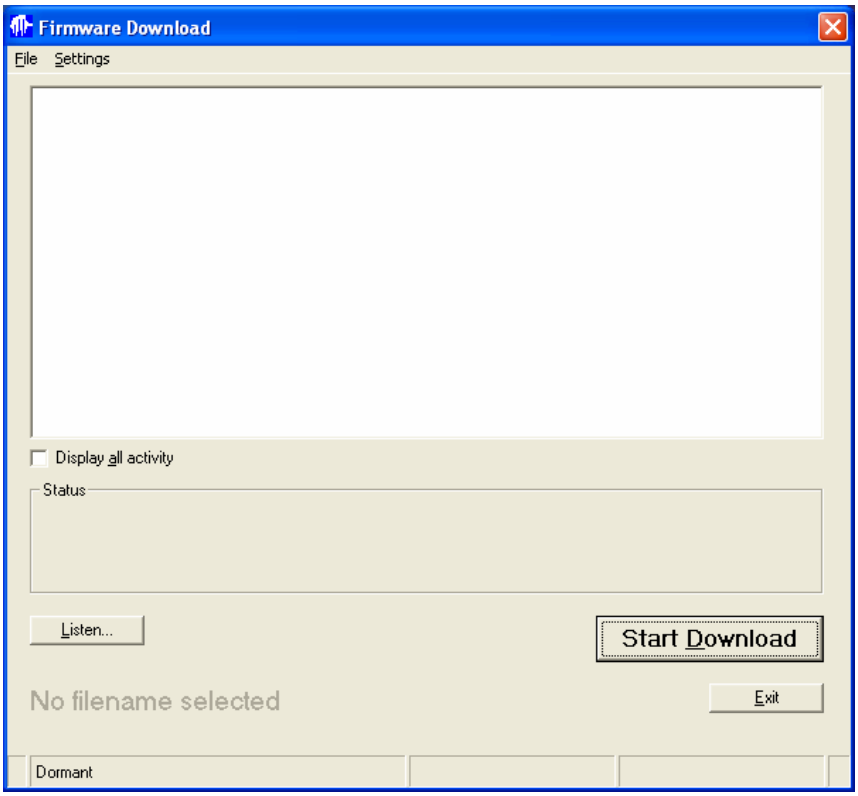
From the main screen, press **Download…**



When pressed, the following password-prompt screen is displayed:

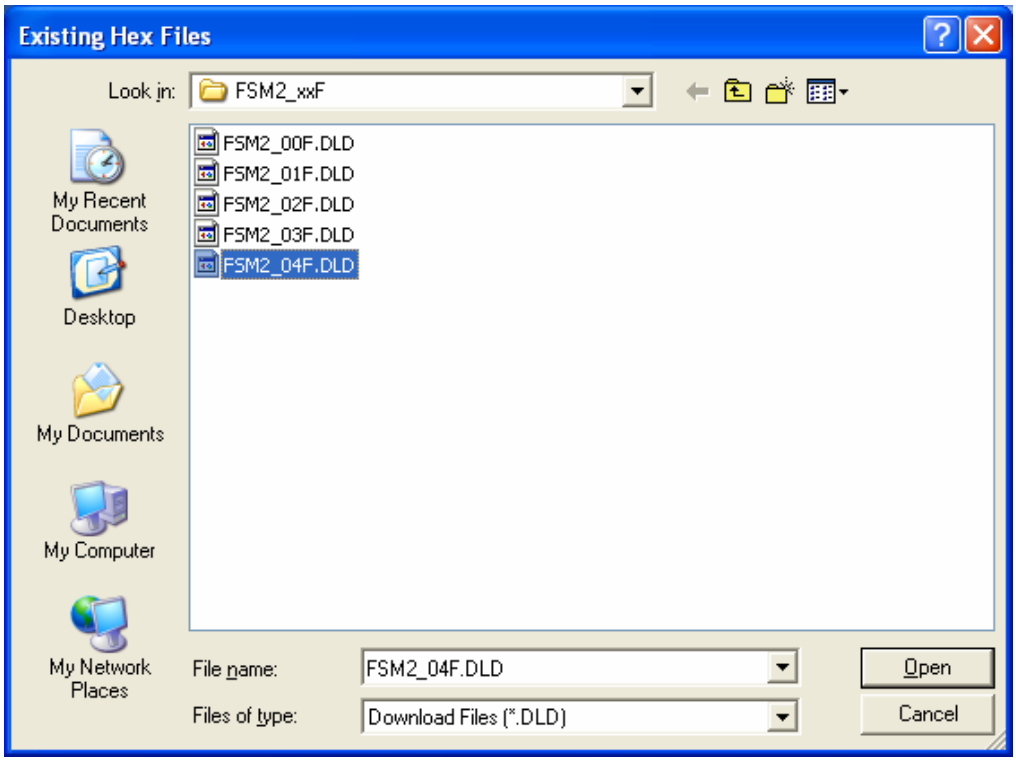
The password is **super** (note lower case).

Then the **Firmware Download** screen is displayed


Firmware Download
File
Settings
Display all activity
Status
Listen...
Start Download
No filename selected
Exit
Dormant

E.4.8.1 Selecting the Firmware to Download

Select the **File** option from the Menu bar, and choose the appropriate **.DLD** file.



When the Download file has been selected, it is reflected on the **Firmware Download** screen.

Note that a Download file must be selected before attempting to download.

E.4.8.2 Download Settings

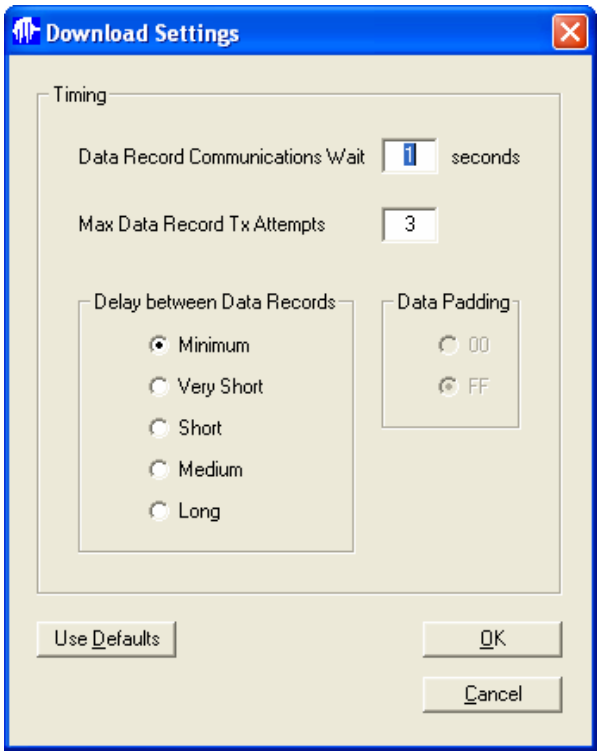
Select the **Settings** option from the Firmware Download screen pull-down menu, and choose the appropriate Download settings.

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.

The **Use Defaults** button resets all parameters to those shown below.



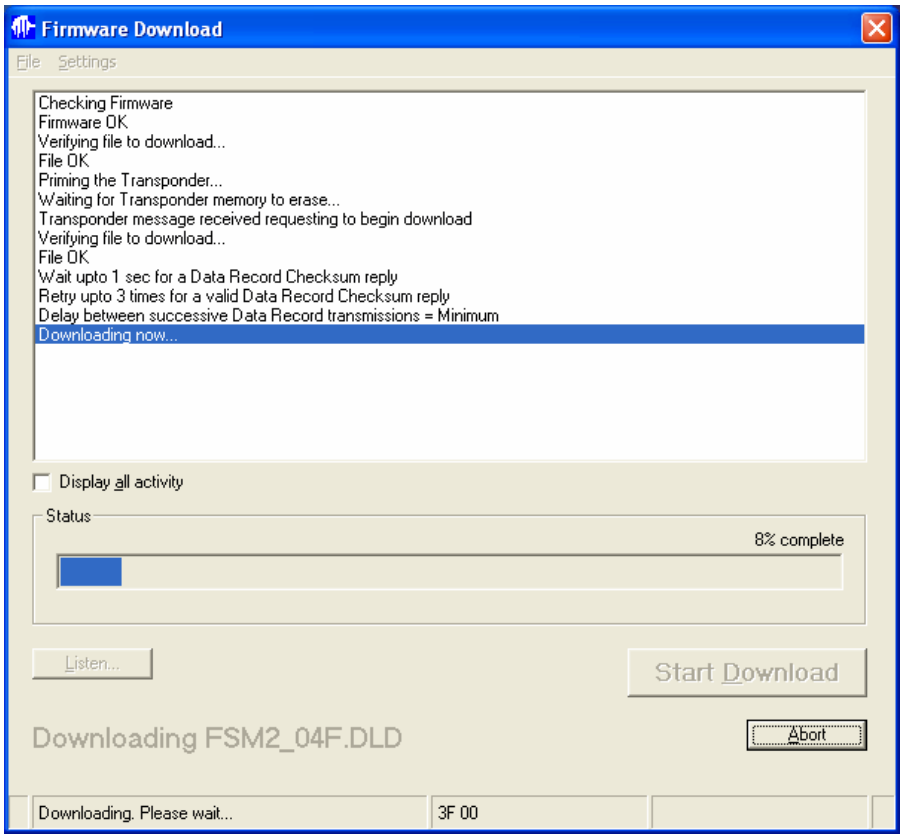
E.4.8.3 Downloading

With a **.DLD** filename selected, and Download Settings confirmed, press **Start Download** to begin the firmware download.

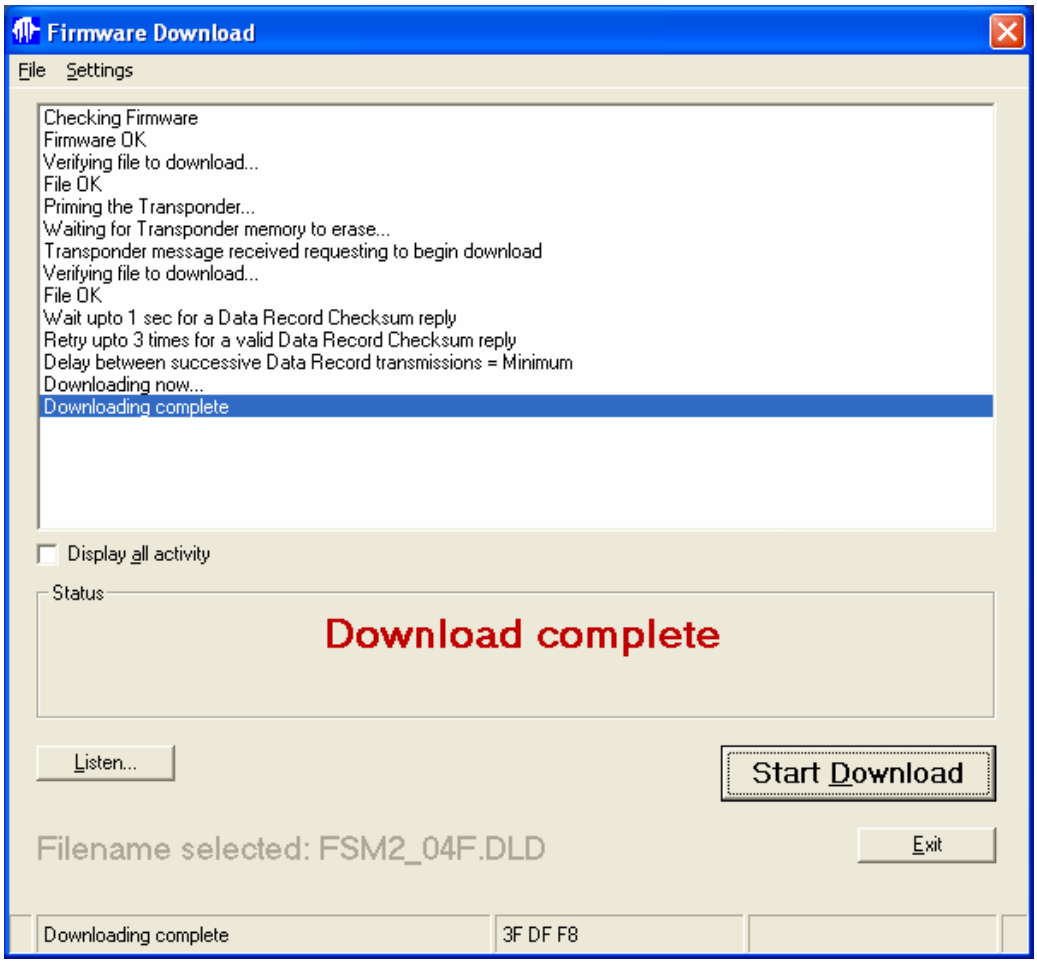
Assuming the Transponder firmware supports the Downloading function, the Transponder will reply to the **Download** request following the erasure of its Program memory in EEPROM, a few seconds later.

Note that the bootloader code will remain intact.

Following erasure, the Transponder requests the PC for new code.



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



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

E.4.8.4 Checking a successful download

Following download, return to the main screen, and press the **Get Status** button to confirm that the new firmware has been implemented.

E.4.8.5 Downloading to an already-erased Transponder

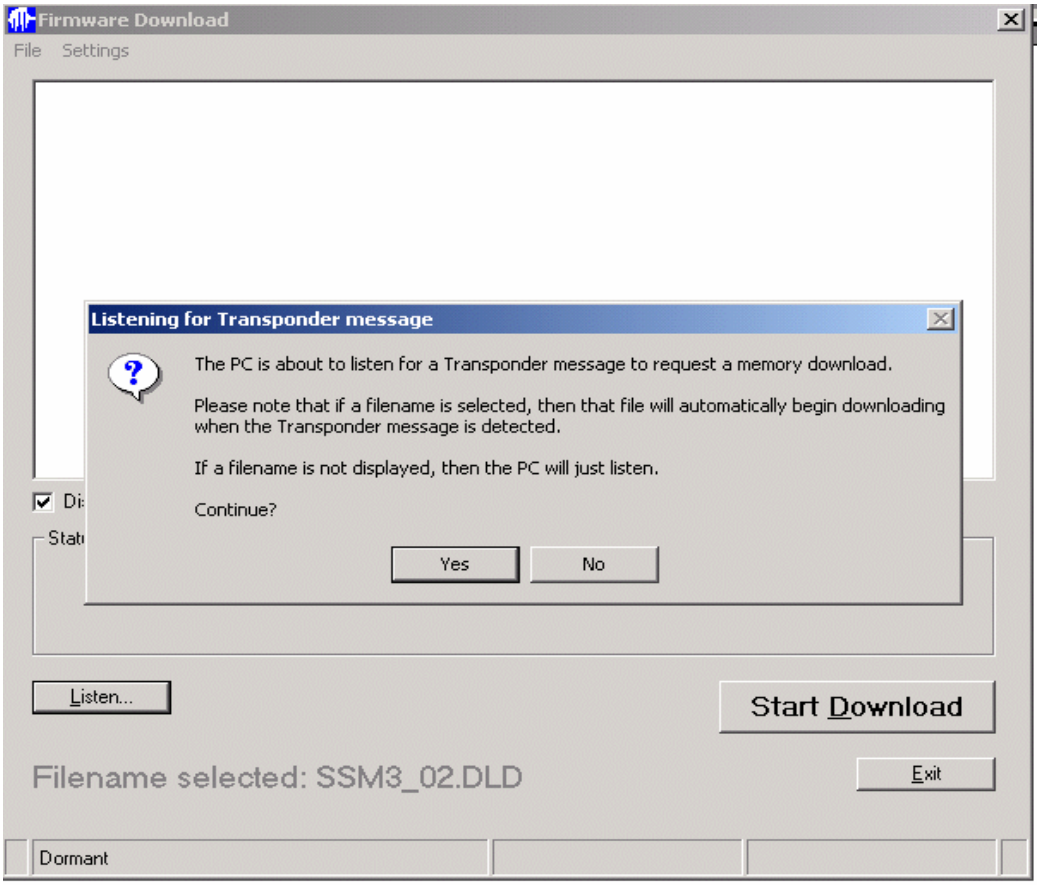
If a Transponder's memory has already been erased but firmware has not been downloaded (probably due to a previously unsuccessful Download attempt), the Transponder will transmit **Downl** every few seconds from its RS232 output.

This indicates to the PC that the Transponder is ready for download.

Note that the normal procedure of pressing the **Start Download** button will not work in this condition - it will not even reply to the simple **Get Firmware** command.

Instead, press the **Listen** button.

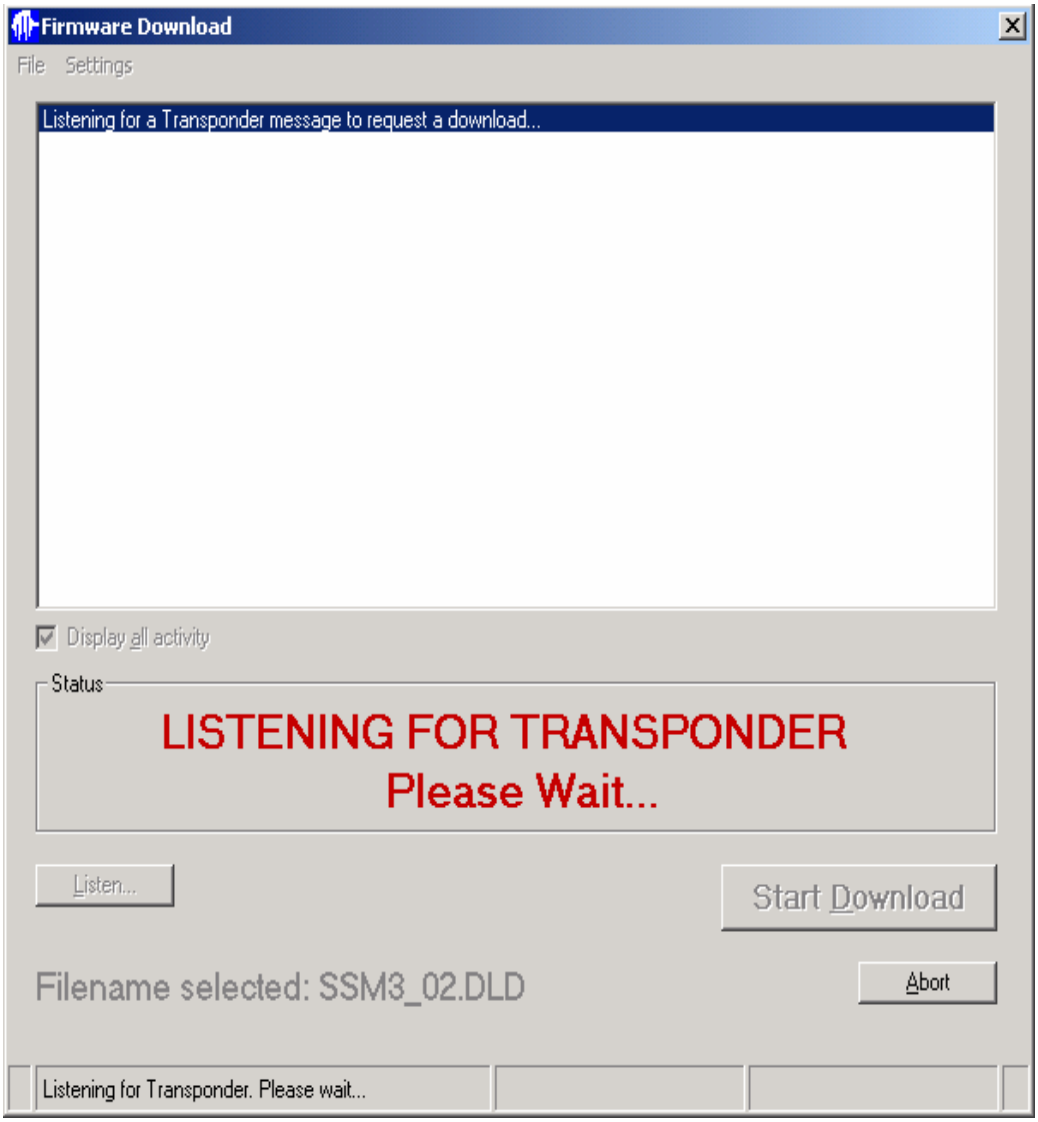
The following message is displayed.



To begin downloading, press **YES**.

- Note: remember to have selected the appropriate .DLD file.

The software now listens for the next **Download** command, and on reception starts the download procedure in the normal way.



E.4.9 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
- Transponder to Transponder Test (not supported)
- WSM Tank Test (factory use only)
- Reset Transponder
- Initialise Transponder

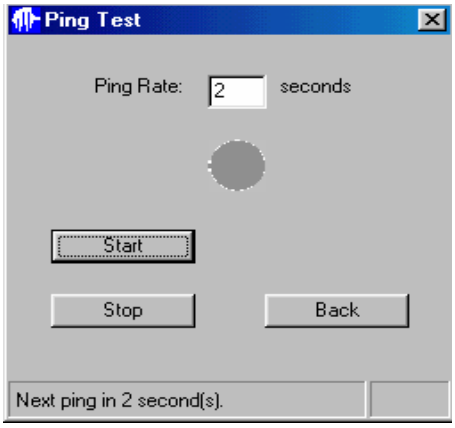
E.4.9.1 Diagnostics - Responder Trigger (Ping) test

Select **Start** to ping in Responder mode, triggered by use of the Transponder RS232 serial data link.

Press **Stop** to stop pinging.

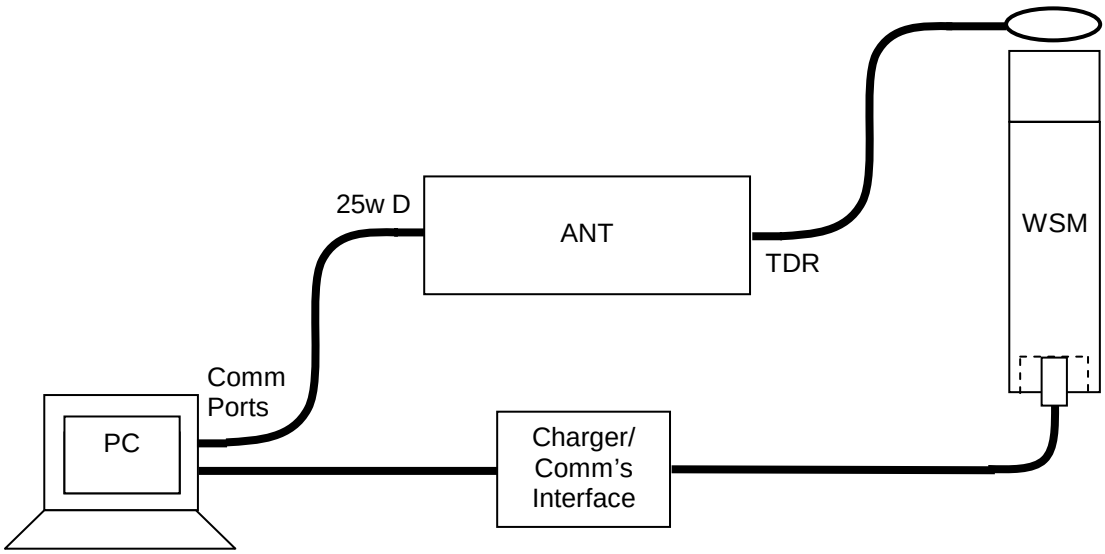
The **Ping Rate** window is used to set the repetition rate in seconds

Once started, an audible output should be heard every time the red button is displayed.

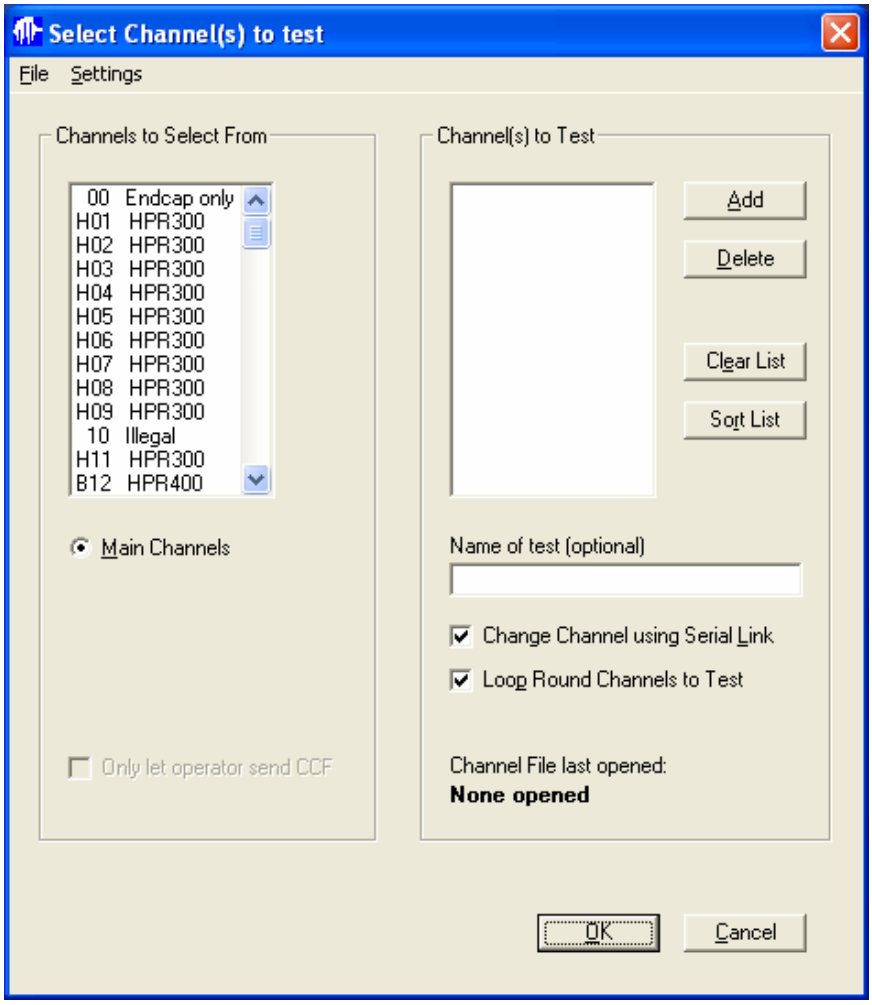


E.4.9.2 Diagnostics - Channel Range Test using an ANT

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.



Select **Channel Range Test** and at the next window select **Select Channel(s)...** to select the Channel(s) to Test.



To select a Channel-to-Test, click on a **Channel-to-Select-From**, and press **Add**, or simply double-click a Channel-to-Test.

Alternatively, select the **File | Open** menu option to load a custom Channel .DAT file.

Use buttons **Delete** to delete a highlighted Channel-to-Test, **Clear List** to clear all channels, and **Sort List** to sort the Channels-to-Test in ascending order.

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

Choose **File | Save**, or **File | Save As** to save the list of channels to a .DAT file.

The operator is prompted to Save after pressing **OK**, if the **Channel file last opened** contains a list which is different to that currently selected.

Check **Loop Round Channels to Test** to test each channel in turn and then loop back to the first channel in the list.

Check **Change Channel using Serial Link** to automatically set the correct channel-under-test via the PC. Unchecked implies that the Channel needs to be configured according to the channel-under-test.

The **Settings** menu option is for advanced diagnostics, and is not covered here.

When Channels-to-Test have been selected, press **OK** then **Start** on the **Channel Range Testing** window.

The ANT will be initialised and configured with the first Channel-to-Test, before actual interrogations begin.

For each interrogation, the Transponder will either reply with a Turn-Around-Time, or indicate an invalid reply.

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.

Press **Stop** to stop testing, and **Back** to return to the Main window.

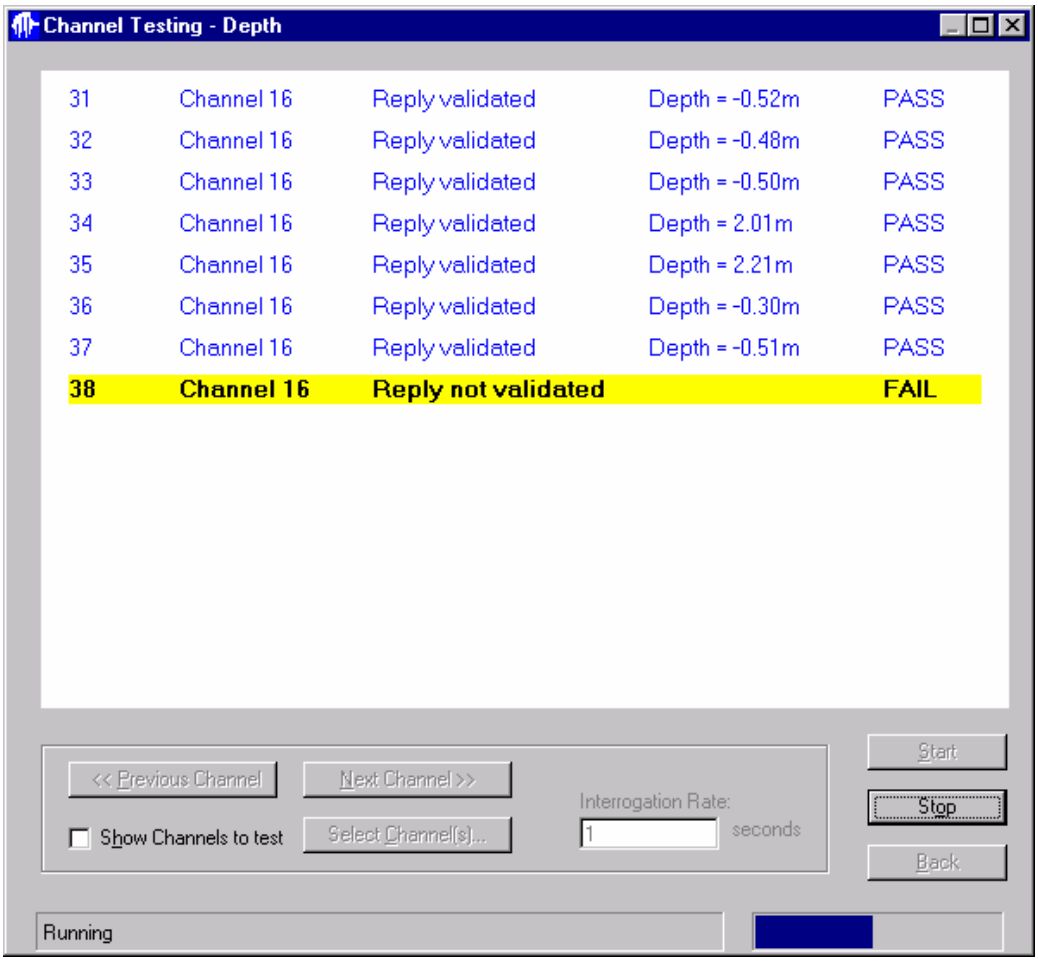
E.4.9.3 Diagnostics - Channel Depth Test

The following tests are only applicable if the transponder is fitted with a depth sensor, and depth replies are switched On. An ANT is used to detect the 2 reply signals from the WSM.

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

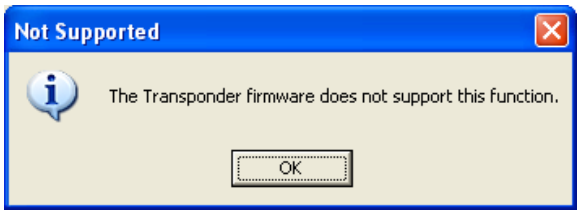
The operation is identical to Range Test, except that either the Transponder depth, or the raw time between two reply pulses are displayed.

A typical display is shown below:



E.4.9.4 Diagnostics - Transponder to Transponder Test

Not available.

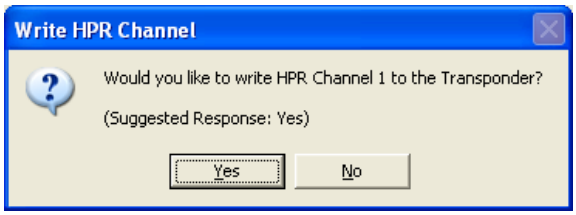


E.4.9.5 Diagnostics - WSM Tank Test

For factory use only.

E.4.9.6 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.

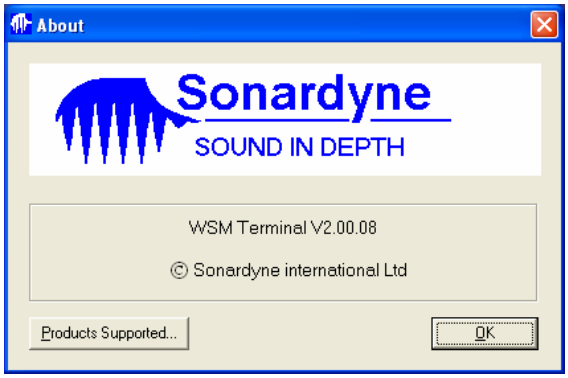


E.4.9.7 Diagnostics – Initialise Transponder

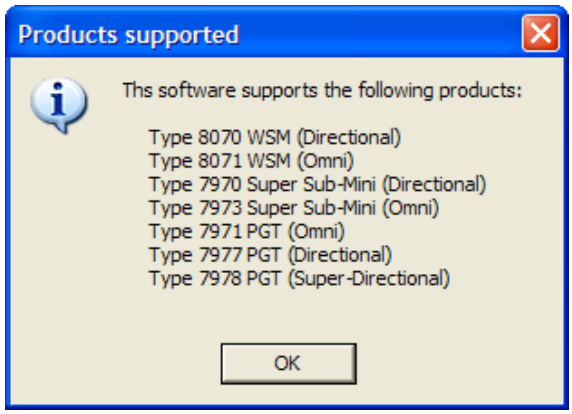
This button will refresh the configuration of the unit as per current settings by forcing an internal watchdog reset.

E.4.10 ABOUT

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



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



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SPECIAL CONDITIONS

The user is allowed to modify data files, as described in the operating instructions, to suit his own custom test routines.

APPENDIX F

F. FIRMWARE HISTORY

VERSION	DATE	DESCRIPTION
V1.00F	03/03/2005	First Issue HPR-300 Compatible HPR-400 Compatible Depth telemetry Sonardyne channels Sonardyne Wideband replies
V2.00F	12/10/2005	Wideband signal changes Unit ID added
V2.01F	05/12/2005	Issue B CPU card supported
V2.02F	23/12/2005	Scout support added
V2.03F	23/02/2006	Fixed occasional lock-up bug
V2.04F	03/03/2006	Fixed bug affecting HPR B08 operation

APPENDIX G

G. CARE & LUBRICATION OF SUBCONN AND MICRO-SUBCONN CONNECTORS

Sonardyne Technical Bulletin TB-04-010-D (09/11/05)

Warning

Subconn and Micro-Subconn connectors should **not** be mated dry as this can lead to delamination of the rubber from the connection pins and connector failure. The following handling procedure is recommended by the manufacturer. For the latest information, go to the Subconn website:
http://www.subconn.com/fronts.asp?active=notes2

Best Practice

- First ensure that the connectors are clean. Any accumulation of sand or mud in the female contact should be removed with fresh water. Failure to do so could result in the splaying of the female contact and damage to the O-ring seals.
- Then ensure that the connectors are lubricated - The connector manufacturer's recommended lubricant is Molykote 44 Medium -but use sparingly. A small amount on the finger should be wiped evenly across the female connector every time the connectors are mated. This will allow a small amount of grease to enter the connector as the pair are mated. The application should be a **light** one as over-application can lead to a build-up of grease in the female connector which can affect connection integrity after lubrication has been applied a number of times.

- When mating the connectors, the cable connector should be pushed full home, using visual inspection where possible, before tightening the locking sleeve. The locking sleeve should not be used to pull the connector halves together.
- Avoid sharp bends at cable entry. When disconnecting, pull straight, not at an angle. Do not pull on the cable.
- Do not mix connector halves from different manufacturers. The tolerances and sealing arrangements differ slightly and this can lead to damage and connector failure.
- The connector should not be exposed to long term heat or sunshine. If this occurs, and the connectors are very dry, soak in fresh water before use.

Health and Safety Information

The manufacturer of Molykote 44 is Dow Corning. Their Product Safety Data Sheet is available on the Internet at:
http://www.dowcorning.com/applications/Docs/DocOptions.asp?strSearch=01889818&Country=GBR&doc=SDS&App=prod_finder

In brief the grease is “slightly irritating” on contact with the eye and it “can irritate on prolonged or repeated contact” with the skin. Eye protection and chemical protection gloves are recommended.

Product Applicability

The following current and recent Sonardyne Products are fitted with Subconn or Micro-Subconn connectors.

This list is complete at the time of preparation but this bulletin applies to all future products using these series of connectors.

Older products, which are no longer made, may also have these connectors fitted. This bulletin applies to all products using these series of connectors.

Type Number	Product
7291	Towfish System
7675	SIPS Towfish System
7685	Dual Axis Inclinometer
7832	Prospector (RovTrak) Transceiver
7866	Deep Sub Mini Transponder
7901	Dual band Compatt IV (MF / EHF)
7921	Deep Sub Mini Transponder
7929	Long Life Super-Directional Compatt IV
7968	Prospector (RovTrak) System
7970	Super Sub Mini - Directional
7971	PGT Omni
7973	Super Sub Mini - Omni
7977	PGT Directional
7978	PGT Super-Directional
7995	AvTrak system
7998	AvTrak Remote Transducer (directional)
8000	Compatt 5 MF Omni
8001	Compatt 5 EHF
8003	Compatt 5 MF Directional
8008	Compatt 5 Remote Inclinometer
8017	RF ID system
8044	Lightweight Actuation Transponder
8045	Heavy Duty Release, Compatt 5 MF
8048	High Strength Deep Ocean Release Transponder (HS DORT)
8067	OBC Responder
8070	Fusion Sub-Mini Transponder (FSM-3000)
8071	Fusion Sub-Mini Transponder (FSM-1000)
8100	Deep Compatt 5 MF Omni
8103	Deep Compatt 5 MF Directional
8104	Lightweight Compatt 5 EHF

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