Sonardyne
SOUND IN DEPTH

UM-8220

User Manual for the Type 8220 Series AvTrak 6 Transceivers

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AMENDMENT HISTORY

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	28/10/10	First Release	All	All
B	0	8/02/2013	Re-written to comply with new branding	All	All
B	1	3/10/2013	Section 4.1.1, Figure 4-2 added. Section 13.5, table heading reformatted. ECN12326 Raised: Section 13.10, Sensor specification updated.	4.1.1, 13.5, 13.10	19, 69, 70

SECTION 1 – INTRODUCTION

1. Introduction

This User Manual describes the safe installation, operation and maintenance of the Type 8220 Wideband Transponder. The information and procedures within this manual are based on Sonardyne's experience and knowledge.

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

1.1 Related Publications

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

The related publications are:

Table 1-1 – Related Publications

Publication	Title
Safety Manual	Safety Manual

SECTION 2 – SAFETY

2. Introduction

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

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

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

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

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

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

2.1 Procedures

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

WARNINGS

⚠ **High pressure risk when dismantling the equipment. Dismantling the sub-sea equipment must only be carried out by trained personnel.**

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

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

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

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

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

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

WARNINGS

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

⚠ **Risk of injury. Do not stand in line with the end-cap when removing from the transponder.**

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

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

CAUTIONS

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

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

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

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

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

2.2 Handling Procedures for CMOS Devices and Circuit Boards

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

Severe electrical transient voltages can be generated during handling.

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

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

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

Operators must comply with safety precautions.

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

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

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

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

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

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

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

SECTION 3 – TECHNICAL DESCRIPTION

3. General

The Type 8220 AvTrak 6 is a 6G® Wideband®2 compatible multimode underwater acoustic transceiver/transponder designed for fitting to Autonomous Underwater Vehicles (AUVs). The AvTrak 6 uses a multi-threaded design technique that allows near simultaneous transceiver and transponder mode operations. It can be asynchronously interrogated or sent data, from a surface system or other AvTrak 6, while it is being used as a transceiver by the AUV host. Its main function is to provide acoustic ranges to seabed transponders at known positions to determine the position of the AUV accurately and rapidly. This is done by simultaneously interrogating an array of seabed transponders, receiving their reply signals and measuring the time of each reply relative to its initial transmission. This information is then sent to the AUV computer via the inter-connecting cable, allowing the position of the AUV to be determined relative to the transponder array.

All units supplied operate over the Medium Frequency (MF) band (19-36 kHz).

The AvTrak 6 is fully compatible with Sonardyne's Wideband® 2 range of integrated acoustic products.

3.1 6G® Wideband®2 Product Range

The 8220 series AvTrak 6Transceivers can be fully integrated with other products from the 6G® Wideband®2 range:

a. Compatt 6 Transponder (Type 8300 red band), is Sonardyne's range of full sized transponders designed specifically for full LBL subsea deployments. The Compatt 6 is clearly identified by the red band at the bottom of the transponder housing, and the 8300 type number.

Figure 3-1 – Compatt 6 (Type 8300) Transponder

b. Dynamic Positioning Transponder 6 (Type 8301). The DPT6 is a range of full sized transponders designed specifically for seabed deployment or large target tracking. The DPT is clearly identified by an orange band at the bottom of the Transponder housing with DPT and the 8301 type number. This band also contains information regarding the battery pack installed.

Figure 3-2 – DPT 6 (Type 8301) Transponder

c. Autonomous Monitoring Transponder, AMT (Type 8305). The AMT has the same capability as a Compatt 6 and an additional capability to periodically logger sensors and make acoustic baseline measurements. The AMTs can be acoustically configured using a 6G Transceiver interface to Sonardyne's MTL Software. The AMT is clearly identified by a yellow band at the bottom of the Transponder housing with AMT and TYPE 8305.

Figure 3-3 – AMT 6 (Type 8305) Transponder

d. Wideband Mini Transponder, WMT (Type 8190). The WMT is a mini-sized transponder and provides full two-way Wideband interrogation and reply which without interference from other users and to other users.

Figure 3-4 – WMT (Type 8190) Transponder

e. High Performance Transceiver, HPT USBL (Type 8142). The HPT Ultra-Short Base Line (USBL) and telemetry transceiver is a high performance instrument which supports Sonardyne's Wideband ®2 instruments.

Figure 3-5 – HPT (Type 8142)

f. Remotely Operated Navigation Transceiver, ROVNav 6 (Type 8310). The ROVNav6 LBL and telemetry transceiver is a high performance instrument which supports Sonardyne's Wideband ®2 instruments and is primarily intended for installation on work class ROVs.

Figure 3-6 – ROVNav 6 (Type 8310)

3.2 System Description

3.2.1 Type 8220 AvTrak 6

The AvTrak 6 supports two transponder operating modes:

- Sonardyne Wideband® 2
- SIMRAD HPR400.

The AvTrak 6 can be interrogated by a USBL system on a surface vessel or by another AvTrak 6 system using Sonardyne Wideband® 2. The Sonardyne Wideband® 2 interrogation channel is linked to the AvTrak 6 acoustic address which is user programmable. The AvTrak 6 listens for its Individual Interrogation Signal (IIS) and, when interrogated, replies with its Common Reply Signal (CRS). The AvTrak 6 also has a synchronisation output to enable the host computer and position updates to be synchronised. The synchronisation output can also be used as a responder input trigger when responder mode is enabled.

The AvTrak 6 system is capable of sending and receiving Sonardyne SMS text messages. These messages can be used to pass data between AvTrak 6 transceivers.

Not all features are available in all units. Some features are controlled by the units “Functionality Level”. Details of “Functionality Level” and pricing are available from Sonardyne.

Refer to document: Sonardyne Command Language PV1.04 for details of functionality.

AvTrak 6 can be supplied in a single transceiver housing with integral acoustic transducer or as a split electronics bottle with a short cable to a smaller remote transducer. Only the remote transducer needs to be mounted outside the envelope of the AUV hull.

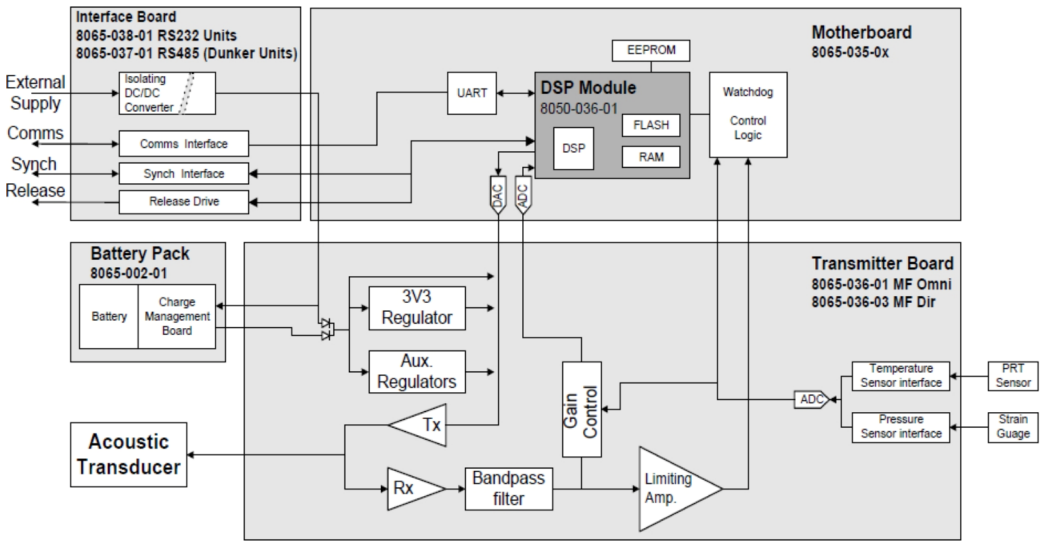
An anodised aluminium alloy housing is used to protect the electronics. Aluminium end-caps seal the housing at each end, these end-caps are fitted with underwater connectors. On the MF Omni-directional version the transducer is protected by a plastic guard. Remote transducer versions have a separate housing for the acoustic transducer with an integral cable and 3 pin male connector. The corresponding housing has a 3 pin female connector located in the top end-cap of the main electronics bottle.

All AvTrak 6 units are, by default, configured to use RS-232C communications protocols.

An underwater connector is fitted to the bottom end-cap to provide power and serial comms to the electronics bottle. The connections are provided for External Power In, Synch In/Out, Release Drive Out and RS232 comms.

Internally, the unit comprises an electronics assembly suspended between the two end-caps, refer to **Figure 3-7**.

Figure 3-7 – AvTrak 6 Block Diagram



3.3 Housing Labelling

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

- SERIAL No 213245-006
- TYPE No 8220-XXXX
- Housing Limit 3000 m max
- UNIT ID 00047D
- Address 2010 (factory default)

3.3.1 Serial Number

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

3.3.2 Type Number

Four digit number beginning with an 8 e.g. 8300 is Compatt 6 and 8305 is the AMT. The following four digits indicate the depth rating, material, housing size and transducer type as indicated in the table below: e.g. 8220-3111.

- 8220 = AvTrak 6
- 3 = Depth rating 3000m
- 1 = Material Aluminium 6082
- 1 = Standard Housing
- 1 = Transducer Type MF Omni

Table 3-1 – Type Number Identification

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

3.3.3 Housing Limit

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

3.3.4 Unit ID

The Unit ID box shows the unique identification number for the transceiver or transponder. The unit ID number is required to upgrade the functionality of the transceiver or transponder. The unit ID cannot be changed and is stored on the CPU/Rx board.

3.3.5 Address Box

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

Table 3-2 – Address Range

Address Range	Signal Type	Purpose
0101 – 1514	Wideband®1	Backward compatibility with 5G (Compatt 5 and GDT USBL
1702 – 3114	Wideband®2 standard	Standard Navigation 6G
5001 – 6314	Wideband®2 advanced	Advanced navigation and telemetry for harsh environments, noisy and reverberant.

3.4 Modes of Operation

The AvTrak 6 unit is capable of multiple simultaneous modes of operation:

- Sonardyne Wideband ® 2 Transponder Mode.
- Simrad HPR400 Transponder Mode.
- Transceiver Mode.
- Sonardyne Acoustic Messaging Mode.
- Sleep Mode.

The simultaneous modes of operation use multi-threaded programming techniques within the AvTrak 6. This does not overcome problems of simultaneous acoustics and the unit will not be able to receive incoming acoustics when it is transmitting because of a previous transponder or transceiver event. Simultaneous transmissions from unrelated events are not possible. For a good multi-mode performance the user can reduce acoustic collisions by making sure the transponder mode interrogation cycles are run asynchronously to transceiver mode cycles.

3.4.1 Sonardyne Wideband®2 Transponder

In this mode the unit behaves as a basic Wideband ® 2 transponder by listening for its IIS signal and replying with its CRS signal. This mode of operation makes the unit compatible with all Sonardyne Wideband ® 2 transceivers including the transceiver mode of AvTrak 6.

An AvTrak 6 unit cannot be woken up from sleep mode by a HPR400 interrogation. It must be woken up using a Sonardyne wideband interrogation preceded by a suitable wakeup pulse.

3.4.2 Simrad HPR400 Compatible Transponder

In this mode the unit operates as a basic Simrad HPR400 transponder and supports a total of 56 possible two pulse interrogation channels (B12 to B87). This mode is configured and enabled/disabled under host control. If the transponder is not interrogated, by either HPR400 or Sonardyne Wideband ® 2, for a period exceeding its stay awake time (AT value) the transponder will go into sleep mode.

An AvTrak 6 unit cannot be woken up from sleep mode by a HPR400 interrogation. It must be woken up using a Sonardyne wideband interrogation preceded by a suitable wakeup pulse.

3.4.3 Transceiver Mode

In this mode the AvTrak 6 will respond to all defined AvTrak 6 serial commands.

The serial commands available consist of configuration/status commands and acoustic/transceiver commands.

Any invalid serial command received will be echoed back by the AvTrak 6 with an indication that the command is invalid.

3.4.4 Sonardyne Acoustic Messaging

In this mode the AvTrak 6 is capable of sending and receiving text messages using SMS (Sonardyne Messaging Service).

3.4.5 Sleep Mode

In this mode the AvTrak 6 enters a low power state. Sleep mode is activated by a set period of inactivity, which is set using the parameter of the Configured Status (CS) command. Sleep mode is automatically over-ridden when the unit senses serial activity or receives a valid wideband acoustic interrogation or SMS message preceded by a AvTrak 6 wakeup signal.

An AvTrak 6 unit cannot be woken up from sleep mode by an HPR400 interrogation.

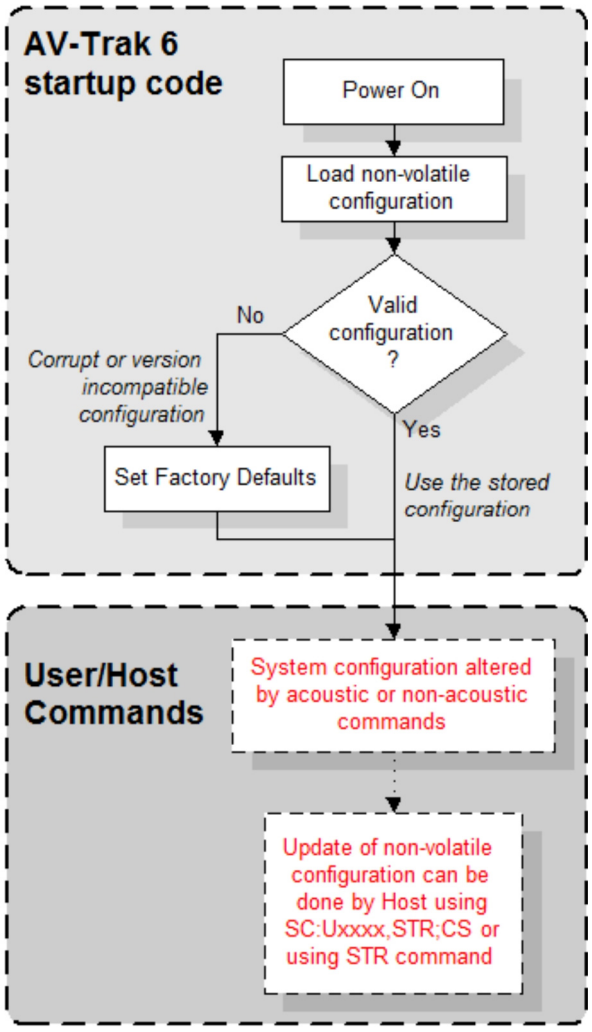
Once awake the AvTrak 6 will stay awake for a set time set by the AT command. The stay awake time is reset on any serial activity or acoustic interrogation including HPR400.

3.5 System Configuration

Most configuration parameters are fixed in firmware but some may be reassigned new values using the appropriate AvTrak 6 serial commands. The system configuration is loaded from non-volatile memory (EEPROM) at power-up. The factory default configuration can be set by using the RSFD command. Users can update the non-volatile system configuration by using the store command STR or SC:Uxxxx, STR;CS or by setting a new device address using SC:Uxxxx, Address. All settings will be retained even after power cycling.

Refer to for the start-up sequence and recommended user/host configuration.

Figure 3-8 – Start-Up Sequence System Configuration



3.6 Basic Principles Of Transponder Interrogation And Reply

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

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

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

The equipment calculates the range as follows:

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

A – B = C
C x D = E

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

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

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

To make sure of maximum battery life, the transponder goes into a sleep mode. To wake the transponder from this mode a wake up signal is sent before interrogation. The transceiver which generates the interrogation can be instructed to transmit a wake-up signal immediately before sending the interrogation signal. When the transponder has replied to the interrogation signal it will return to sleep mode after a controllable period of inactivity. The transponder can be programmed with an inactivity time, the length of the inactivity time required depends on the task the transponder is being used. The activity time is restarted after each valid interrogation. If the transponder has not gone into its sleep mode a wake up signal is not required.

3.7 Interrogators

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

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

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

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

3.8 Command And Telemetry Functions

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

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

When the command function has been executed by the transponder, a telemetry signal is transmitted to acknowledge the operation is complete. If a data acquisition command was sent the reply will include sensor readings for the internal temperature and pressure. These readings are shown by the surface transceiver in standard engineering units. Error detection and correction give the best acoustic reception reliability.

3.9 Communicating via RS232

The transceiver or transponder can be configured and tested via the RS232 link from a PC running the Sonardyne Wideband Test Terminal software.

3.10 Acoustic Navigation System Principles

3.10.1 Long Baseline Principles

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

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

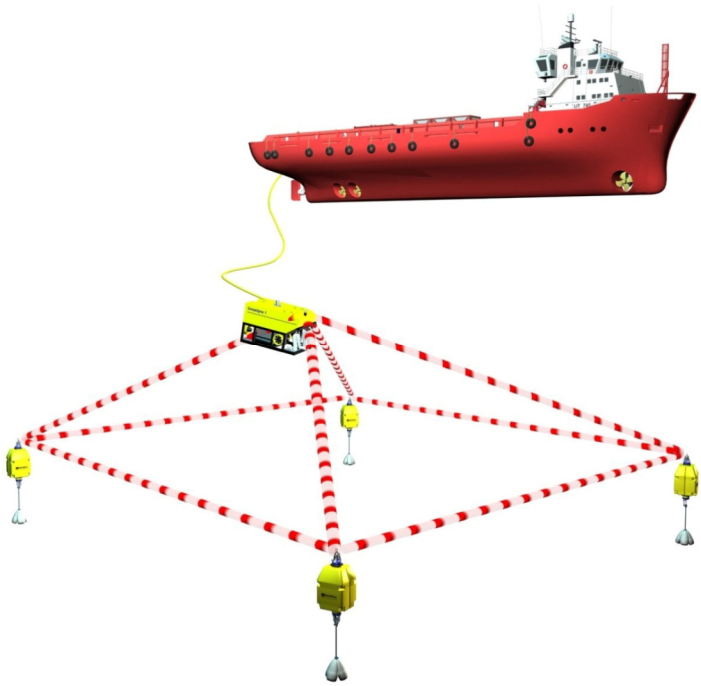
The second segment comprises an acoustic transducer on a transceiver which is temporarily installed on the vessel, or on a Towfish. The distance from a transducer to a transponder can be measured by causing the transducer to transmit a short acoustic signal which the transponder detects and causes it to transmit an acoustic signal in response.

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

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

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

Figure 3-9 – LBL System



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

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

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

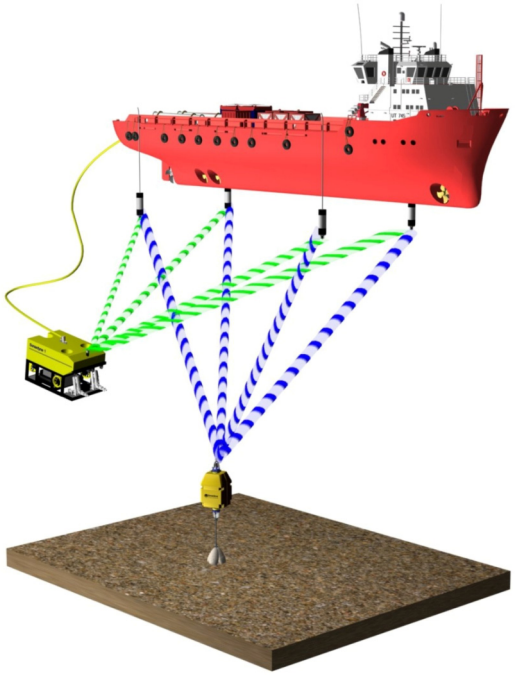
3.10.2 Short Baseline Principles

A SBL system can be fitted to a vessel such as a barge, semi-submersible or a large drilling vessel. A number at least three or four acoustic transducers are fitted in a triangle or a square on the lower part of the vessel. The distance between the transducers is the base line and is made as large as is practical.

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

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

Figure 3-10 – SBL System



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

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

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

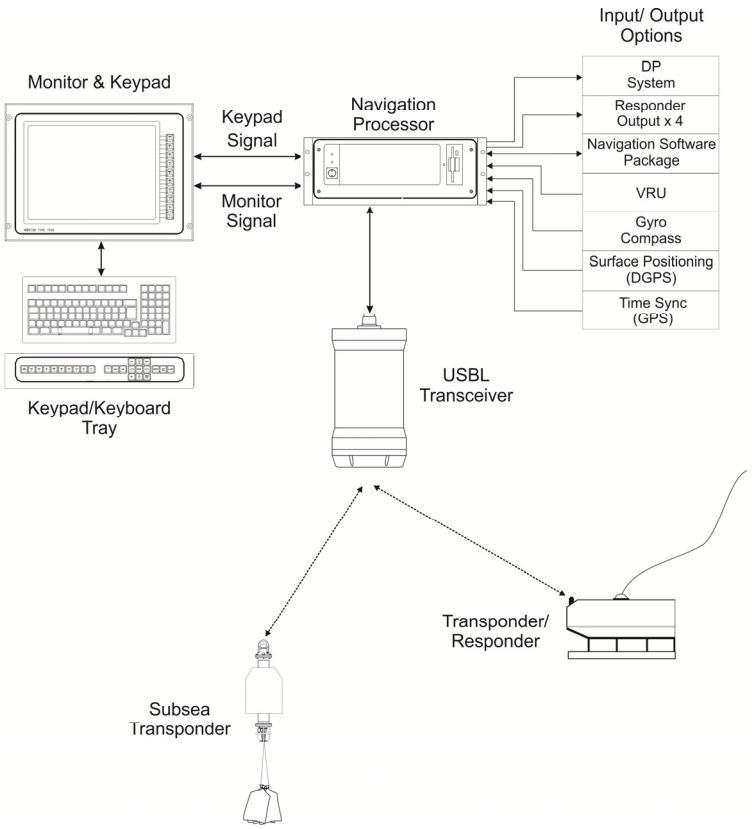
3.10.3 Ultra Short Baseline Principles

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

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

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

Figure 3-11 – USBL System



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

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

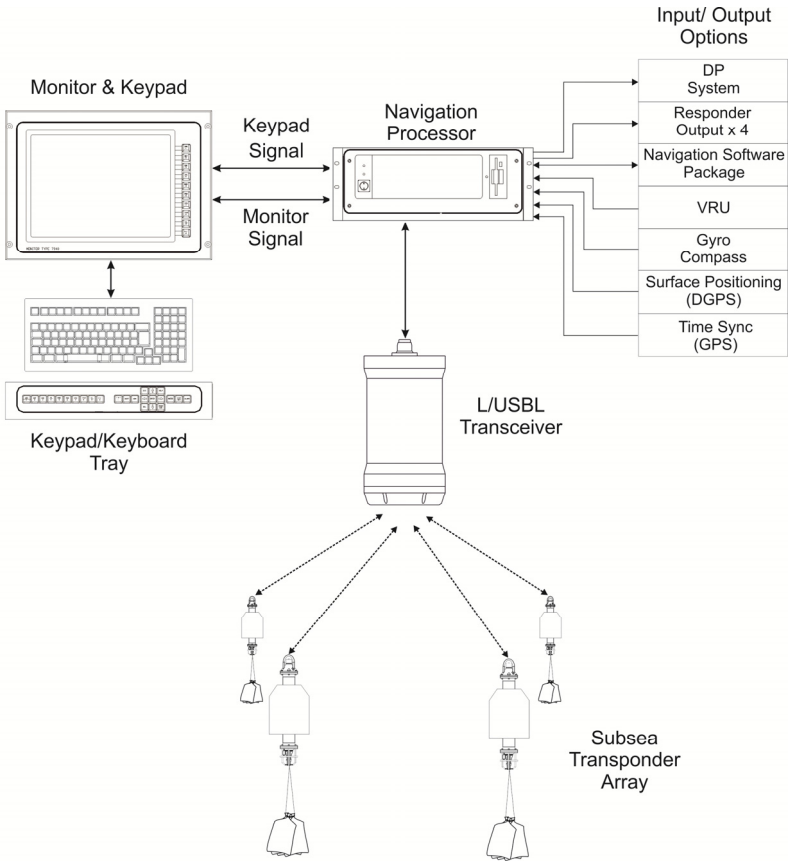
3.10.4 Long Ultra Short Baseline Principles

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

The range and bearing in the LUSBL system is measured as for a basic USBL system. A larger number of transponders are deployed on the seabed to achieve greater accuracy.

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

Figure 3-12 – LUSBL System



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

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

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

SECTION 4 – INSTALLATION

4. Introduction

The AvTrak 6 is a multimode underwater acoustic transceiver/transponder designed for fitment to Autonomous Underwater Vehicles (AUVs).

4.1 Installation Transceivers 8220 Series

4.1.1 Transducer Location on an AUV

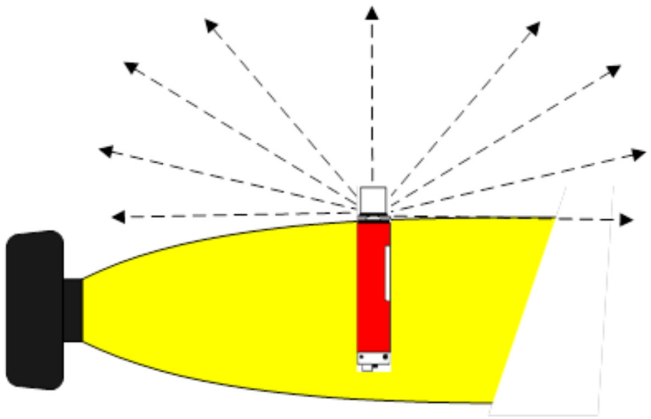
If the AvTrak 6 is to be used to interrogate a transponder array, the transducer is to be mounted clear of the Autonomous Underwater Vehicle (AUV) hull.

The position chosen must give a line-of-sight 'view' of the transponder array or other transceiver.

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

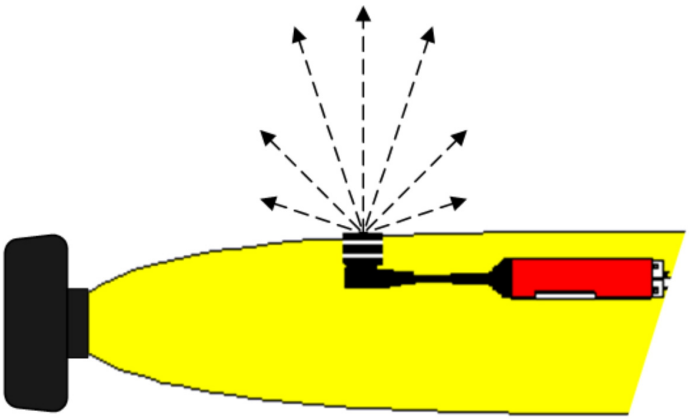
The Omni-directional transducer should be mounted with the acoustic transducer outside the hull profile.

Figure 4-1 – Omni-Directional Installation Positioning



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

Figure 4-2 – Directional Transducer



SECTION 5 – DEPLOYMENT

5. Introduction

Before deploying an AvTrak 6, make sure all Warnings and Cautions in **Section 2 – Safety** are read and understood.

5.1 Pre-Deployment Checks

1. Inspect the AvTrak 6 for any signs of external damage to the transponder and external sensors.

2. Make sure the vent valve is fully pushed in so it is flush with the face of the end cap.

3. Inspect for any signs of leakages around the transducer.

5.1.1 Configuration

Carry out the following procedures to configure the AvTrak 6 ready for deployment.

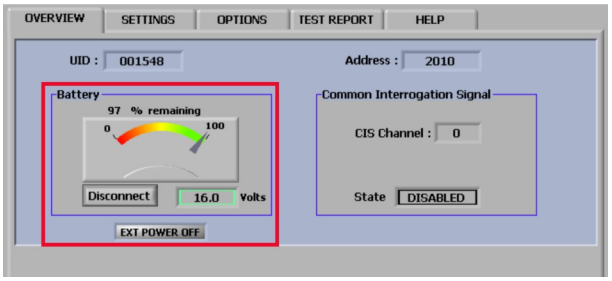
1. Remove the dummy blanking connector from the AvTrak 6 end-cap.

2. Connect the AvTrak 6 to the PC using either the test cable and PSU.

3. Open the Wideband Test Terminal program by clicking on the icon.

4. On the **Overview** tab, check the battery level is sufficient for the application.

Figure 5-1 – Check Battery Level before Deployment



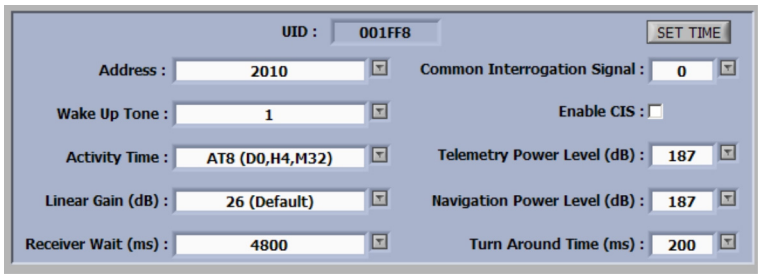
5. Click on the **Settings** tab.

6. Make sure the Unique Identity (UID) and address are correct.

NOTE

The UID should match the UID printed on the AvTrak 6 housing label.

Figure 5-2 – Settings



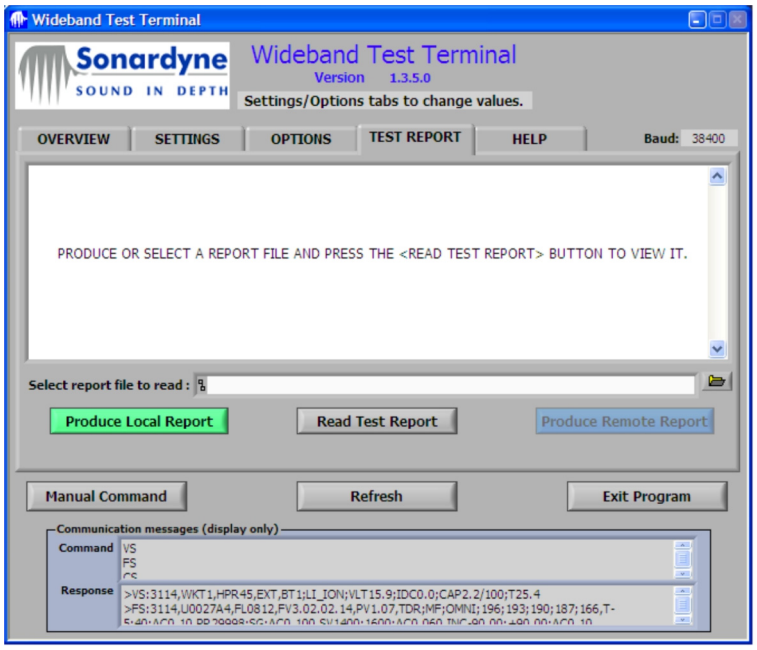
7. Check all the settings are correct and pay particular attention to the following parameters:

   - Linear Gain (dB)
   - Telemetry and Navigation Power levels (dB)
   - Activity Time

5.1.2 Report Production

1. In the WTT software, select the **Test Report** tab.

Figure 5-3 – Test Report

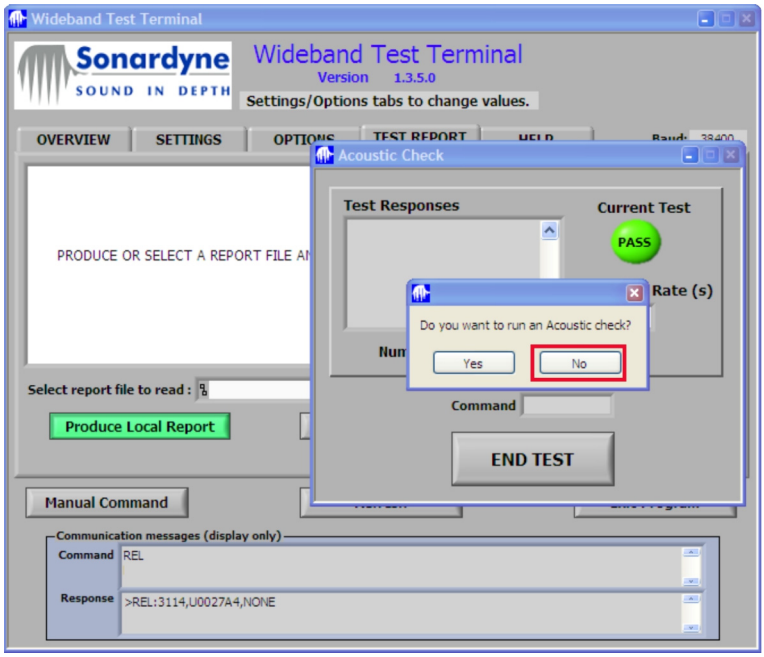


2. Click the **Produce Local Report** button.

3. A window will appear indicating that the AvTrak 6 does not support the Release Function. Click **OK**.

4. Click the **No** button on the resulting pop-up dialogue prompt to run an Acoustic Check.

Figure 5-4 – Acoustic Check Request Option



5. Generation of the local report will now start. The WTT will carry out a sequence of checks and store the results in a text file in C:\Sonardyne\. The file name will comprise the unit Unique ID number and the date and time with the extension txt, e.g. 001767 090221235830.txt. (The date and time is in the format YYMMDDHHMMSS).

NOTE

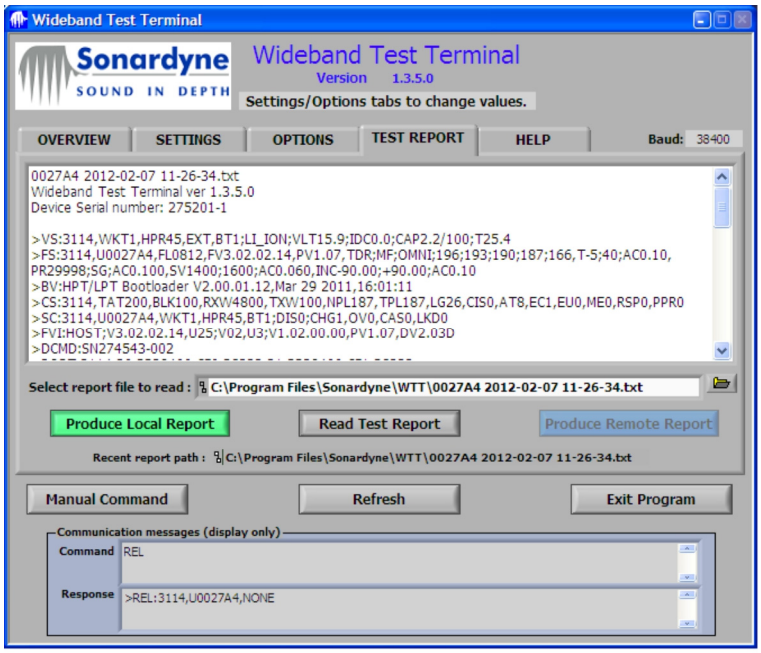
The AvTrak 6 status is not changed by this operation.

6. The Report Production sequence performs the following:

   - Compiles the full set of fixed and configurable status parameters.
   - Retrieves details of each PCB fitted.
   - Reads various measurements on the sensors fitted.

7. Once complete, click the **Read Test Report** button.

Figure 5-5 – Read Test Report



8. View the contents and make sure the sensors fitted are reporting.

9. Click the **Exit Program** button to close the WTT program.

10. Remove the test cable from the AvTrak 6 connector.

11. Make sure the dummy blanking connector is replaced and secure.

SECTION 6 – OPERATION

6. Introduction

In its simplest form the AvTrak 6 can be operated as a stand alone 6G® Wideband®2 compatible transponder. In this form it can be operated using external power via the end-cap connector or battery powered in which case a dummy connector blanking socket should be used.

Maximum benefit of the AvTrak 6 is achieved when operated as a vehicle host transceiver. Commands from the vehicle host are routed through the external RS232 Communications port.

6.1 Serial Command Set

The command set includes:

- Non-acoustic configuration commands
- Acoustic Navigation Commands
- Sonardyne Messaging Service (SMS) Commands

For a detailed description of the Wideband®2 command set refer to Command Language V1.04.

6.2 Hardware Reset and Start-Up

The AvTrak 6 has a built-in power reset circuit and an internal watchdog reset circuit. The unit has a facility for the Host system to reset it. Asserting a serial break pulse of duration greater than 20 ms on the serial input line will force the AvTrak 6 CPU to perform a coherent hard reset/restart on release of this break signal.

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

After a hardware reset the AvTrak 6 firmware is reloaded from the system Flash memory and restarted. This reset start-up sequence takes approximately 5 seconds to complete.

The AvTrak 6 outputs the following PORT**:** text string to confirm completion of hardware reset sequence and indicates the current port settings. This start-up PORT string is always output at 9600 baud the content will depend on the stored settings.

An example of a PORT text string is as follows:

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

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

6.3 Watchdog Function

The AvTrak 6 has a watchdog timer that resets the unit every watchdog period. The watchdog timer has a period of approximately 17½ minutes. User configured system settings are retained through watchdog resets and operation of the watchdog reset will be invisible to the user with only the occasional missed interrogation reply in transponder mode. If during a watchdog reset the AvTrak 6 unit fails to warm start correctly, it will automatically cold start and display the standard port wake-up message. The configuration will be reloaded from non-volatile memory (EEPROM).

6.4 SMS Custom Commands for Mission Abort and Burn Wire

Custom commands can be sent to an AvTrak 6 via acoustic SMS. The Mission Abort and Burn Wire Release commands are implemented with the SMS special data types field set to 13. This field type allows the SMS text to be intercepted within the AvTrak 6 and decoded for special action.

Example of Command SMS

SMS:1013;W1,P0,C13,A1,R0|CMD:xxxxx

Destination Address 1013

W1 Send a wakeup 1 pulse.

Port 0

C13 (Command interception within AVTRAK 6)

A1 Sender requests an acknowledgement.

R0 Do not report range.

CMD:xxxxx is the specific command

Notes:

- CMD text is case sensitive.
- Any acknowledgement sent from an AVTRAK 6 in response to a received SMS does not indicate correct execution of a command it only indicates that the raw text SMS payload was received without errors.
- Because the command protocol supports parameter persistence, the C13 parameter must be explicitly reverted back to C0 to send standard text SMS.
- If the command is decoded as a valid command it is still routed to the AVTRAK 6 Host, via the specified port, in the same way as a standard text SMS.

The specific command for Mission Abort is CMD:ABORT

Example: SMS:1013;W1,P0,C13,A1,R0|CMD:ABORT

The specific command for Burn Wire Release is CMD:BURN

Example: SMS:1013;W1,P0,C13,A1,R0|CMD:BURN

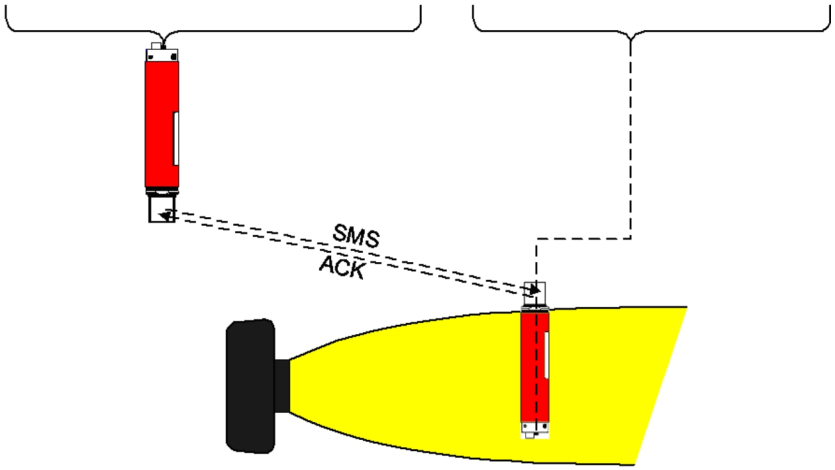
6.5 Example Command Transaction

The sending transceiver must be an SMS enabled Sonardyne transceiver such an AvTrak 6 or other 6G® transceiver.

A command sequence used to activate the Mission Abort and Burn Wire function on an AvTrak 6 is illustrated in the diagram that follows:

Sending Transceiver	AvTrak 6
SMS: 1001,PO,C13,A1,W1,R0|CMD:ABORT	SMS:1001,C13|CMD:ABORT
SMS: 1001,ACK	
SMS: 1001,PO,C13,A1.W1,R0|CMD:BURN	SMS:1001,C13|CMD:BURN
SMS: 1001,ACK	
SMS: 1001,PO,C13,A1,W1,R0|CMD:Burn	Invalid command not delivered to Host "Burn" is incorrect case.
SMS: 1001,ACK	

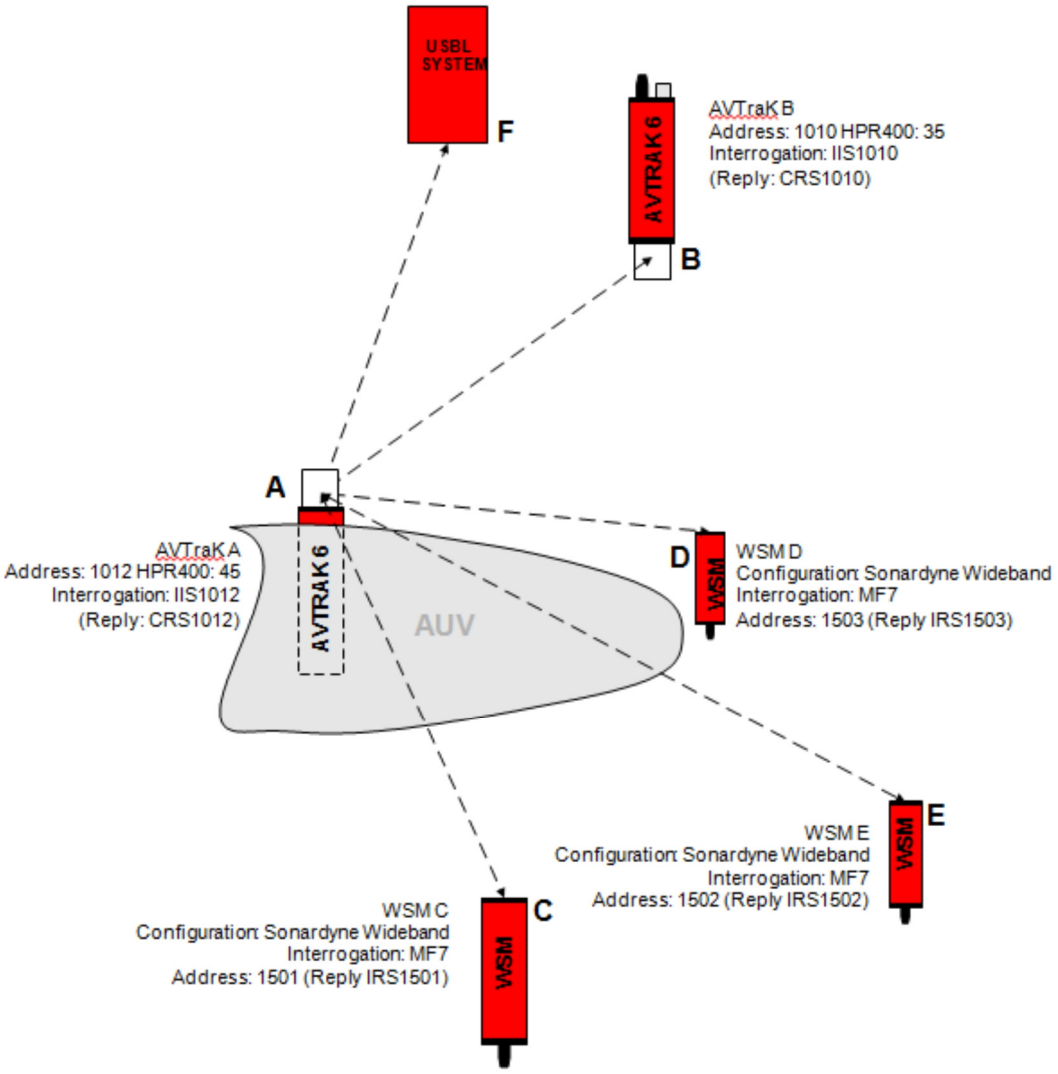
Figure 6-1 – Command Transaction



6.6 Operating Scenario

The following drawing outlines a typical multiple asset operating situation.

Figure 6-2 – Possible Operating Scenario



6.7 Asset List

Asset Reference	Description
A	AUV mounted AvTrak 6
B	Surface deployed AvTrak 6
C	Seabed mounted WSM Type 8070/8071
D	Seabed mounted WSM Type 8070/8071
E	Seabed mounted WSM Type 8070/8071
F	USBL System (Sonardyne/Simrad)

6.8 Asset Configuration

The two AvTrak 6s are configured with different device addresses. Three Wideband Sub-Mini Transponders (WSM) are configured as a seabed LBL array. They are set with the same interrogation frequency of MF7 to allow simultaneous ranging in a single acoustic cycle. The wideband addresses are set differently.

Asset Ref	Description	Configuration Command	Comment
A	AvTrak 6	RSFD\r\n FS\r\n SC:Uxxxx,HPR45 CS:EU1 SC:Uxxxx,AD1012	Set factory defaults Retrieve unit UID Use default power and gain settings. Set the AvTrak to respond to HPR Ch45 and enable it. Set device address and store configuration to non-volatile memory
B	AvTrak 6	RSFD\r\n FS\r\n SC:Uxxxx,HPR35 CS:EU1 SC:Uxxxx,AD1010	Set factory defaults Retrieve unit UID Use default power and gain settings Set the AvTrak to respond to Ch35 Set device address and store configuration to non-volatile memory
C	WSM	Configure using WSM Terminal: Nav Scheme: Sonardyne Reply Type: Wideband Interrogation: MF7 Address: 1501	Tone interrogate on MF7 WSM Replies in IRS1501
D	WSM	Configure using WSM Terminal: Nav Scheme: Sonardyne Reply Type: Wideband Interrogation: MF7 Address:1502	Tone interrogate on MF7 WSM Replies in IRS1502
E	WSM	Configure using WSM Terminal: Nav Scheme: Sonardyne Reply Type: Wideband Interrogation: MF7 Address: 1503	Tone interrogate on MF7 WSM Replies in IRS1503
F	USBL System	Set to interrogate on HPR400 B45(AvTrak on AUV)	

NOTE

For compatibility with 6G® Wideband®2 the WSM wideband address must be < = 1514.

6.9 Acoustic Operations Between Assets

The following is an example of the transceiver mode commands that could be used with the scenario described.

Acoustic Master	Acoustic Slave	Master Configuration Command	Comment
B	C,D,E	MSR:F7,IR1501,IR1502,IR1503	AvTrak B interrogates WSM array using MF7as a common interrogation signal and listens for their respective MF Individual Reply signals. When asset B is deployed from a surface vessel this command can be used to surveying the positions of the WSM array in association with a GPS system.
B	A	SMS:1012|123.45,567.89,456.67,890,12 See note 1.	AvTrak B sends data to AvTrak A using SMS. Data could be a positional update or details of the positions of WSM array.
A	C,D,E	MSR:F7,IR1501,IR1502,IR1503	AvTrak A navigates by interrogating the WSM array in the same way as AvTrak B.
A	B	SMS:1010|Pos:123.45,123.56, 87.65 See note 1.	AvTrak A sends data to AvTrak B using SMS.
B	A	MR:1012 See notes.	AvTrak B interrogate AvTrak A on its Individual interrogation Signal.
A	B	MR:1010 See notes.	AvTrak A interrogate AvTrak B on its Individual interrogation Signal.
F	A	Interrogation on Ch45	USBL surface system interrogates AvTrak A using HPR channel B45

NOTES

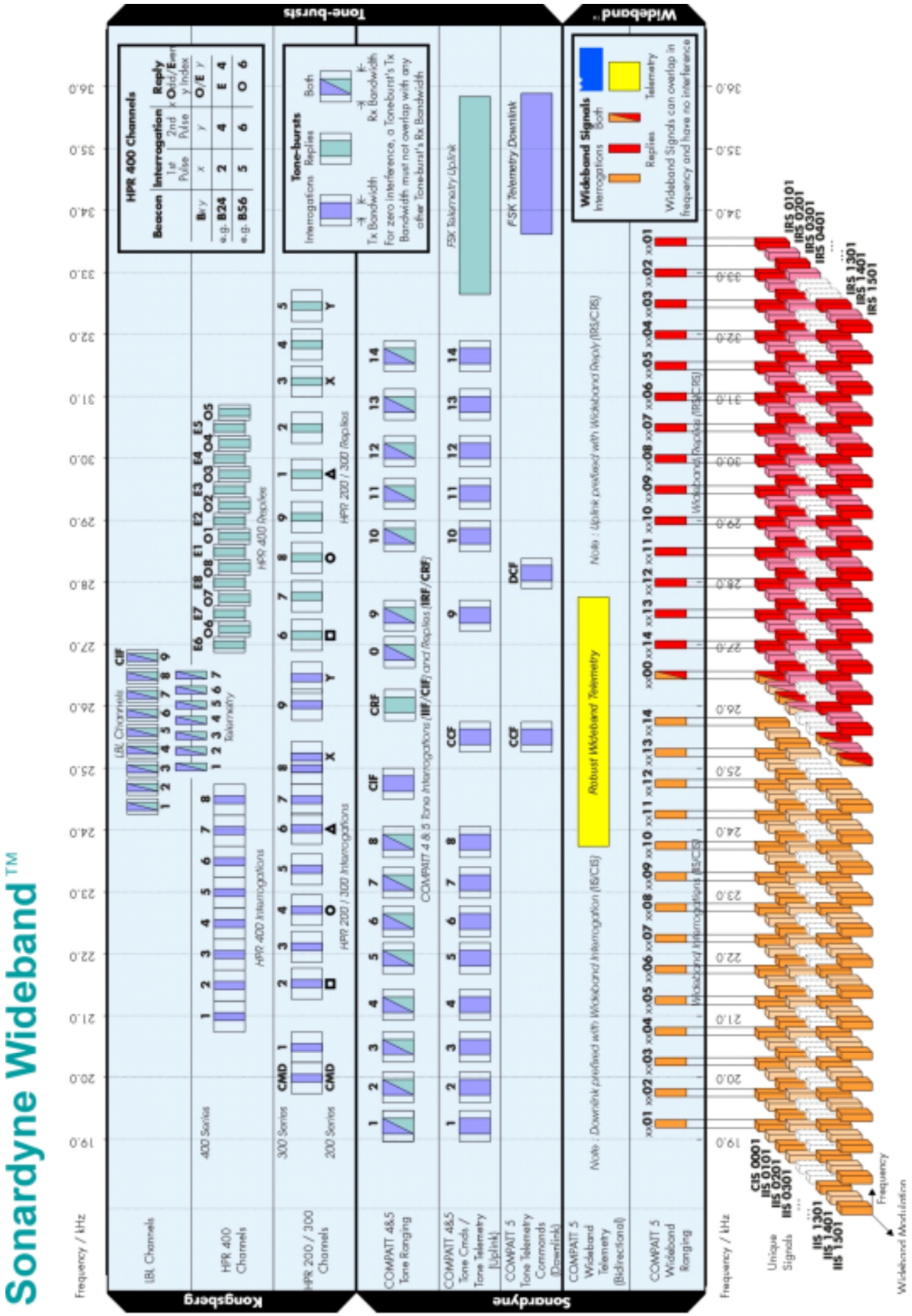
The SMS message is shown using the default parameters. If the remote AvTrak 6 is in sleep mode then the master should send the SMS with the default wakeup signal enabled for example : SMS:1012;W1.

If the remote AvTrak 6 is in sleep mode then the master should send the MR command with the default wakeup signal enabled for example: MR:1010;W1.

6.10 Configuration Using Wideband Test Terminal

Many functions of the AvTrak 6 can be configured and/or tested via the RS232 link including features not available via acoustic commands. The RS232 link can be controlled by a PC running the Wideband Test Terminal software (WTT). This application is available on the AvTrak 6 Utilities CD.

6.11 Tone and Wideband Signal Chart



SECTION 7 – MAINTENANCE AND MONITORING

7. Maintenance

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

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

7.1 Safety Precautions

WARNINGS

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

⚠ **Risk of burns. Do not carry out maintenance on the transponder if the housing is hot. Lower the AvTrak 6 into cold water and wait for the housing to cool. Make sure Personal Protective Equipment such as gloves are worn.**

⚠ **Risk of toxic gases. Make sure the work environment is well ventilated. Toxic gases may be released when the Pressure Relief Vent Valve is operated.**

⚠ **Electric shock hazard risk when dismantling the equipment. Dismantling the equipment must only be carried out by trained personnel.**

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

⚠ **Risk of toxic gases. Make sure the work environment is well ventilated when operating the Pressure Relief Vent Valve.**

CAUTION

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

7.2 Lubrication

The following lubricants are recommended for use to assist in the maintenance of the equipment.

WARNING

⚠ **Risk of irritation. Prolonged use of lubricants can cause slight irritation of the skin. Wear Personal Protective Equipment such as gloves when applying lubrication.**

Table 7-1 – Lubricants

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

7.3 General Maintenance

Before carrying out any general maintenance activity on the equipment, make sure all Warnings and Cautions in **7.1– Safety Precautions** are read and fully understood.

On retrieval of the transponder the following general maintenance must be carried out:

CAUTION

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

1. Thoroughly clean the AvTrak 6 in clean fresh water to remove any accumulations of salt, sand and silt.
2. Clean the anodes with a nylon brush.
3. Dry the transponder with a lint free cloth.
4. Check the Pressure Relief Vent Valve is flush with the Sensor end-cap. If it is protruding it indicates internal pressure build up in the transponder housing. Refer to **7.3.1 – Operation of the Pressure Relief Vent Valve.**
5. Inspect the paint finish for any signs of corrosion such as flaking, cracking or delamination.
6. Inspect all cables and connections for signs of abrasion, cracks or splits.
7. If a guard is fitted check for any signs of damage.
8. Check there is sufficient zinc remaining on the anodes, replace if necessary.
9. Inspect the rubber boot on the transducer for signs of splitting.
10. Inspect the connector contacts for signs of corrosion.
11. Inspect the clamp ring bolts for signs of corrosion.

7.3.1 Operation of the Pressure Relief Vent Valve

Before operating the Pressure Relief Vent Valve, make sure all Warnings and Cautions in the Safety Precautions are read and understood. Refer to **Section 2 – Safety**.

WARNINGS

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

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

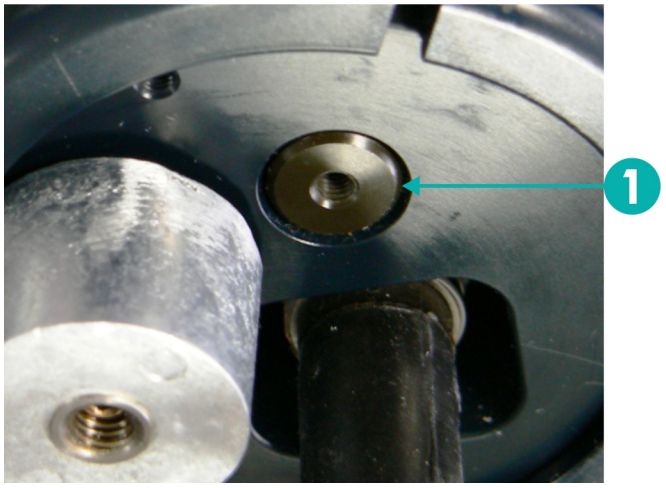
To release any build-up of internal pressure, the Pressure Relief Vent Valve must be operated as follows:

1. Before carrying out operation of the Pressure Relief Vent Valve, carry out general maintenance where necessary. Refer to **7.3 – General Maintenance**.

2. Make sure any marine growth around the Pressure Relief Vent Valve is removed.

3. Check the position of the Pressure Relief Vent Valve. If the vent valve is not flush, i.e. sticking out, this would indicate a build-up of internal pressure.

Figure 7-1 – Check the Pressure Relief Valve

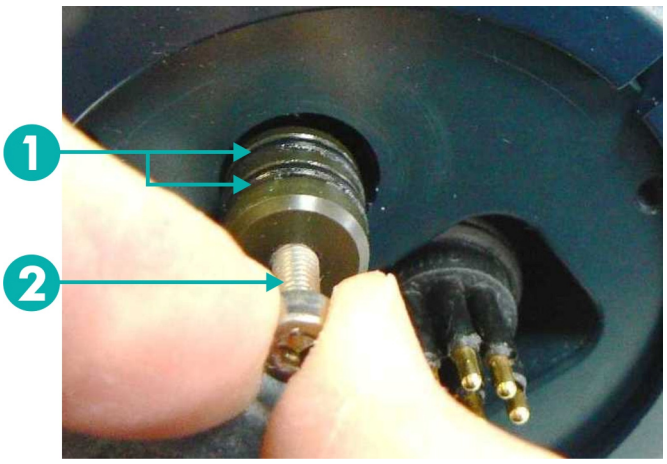


1 Pressure Relief Vent Valve

4. Insert an M4 screw into the Pressure Relief Vent Valve and pull out until the second O-ring seal is revealed.

5. Wait for any internal pressure to be released.

Figure 7-2 – Operating the Pressure Relief Valve



1 O-rings 2 M4 screw

7.4 Battery

7.4.1 Electronically Connecting and Disconnecting the battery

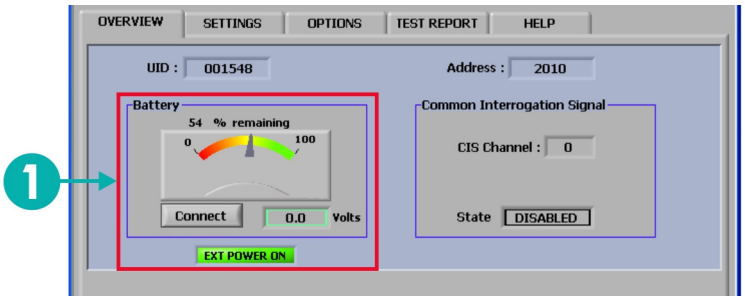
To electronically connect or disconnect the AvTrak 6, proceed as follows:

1. Select the WTT software by clicking on the icon.

Figure 7-3 – WTT software icon

2. On the WTT Overview tab is the battery status, as indicated by 0.0 volts battery value and the battery button will be labelled **<Connect>.**

Figure 7-4 – Battery Connect

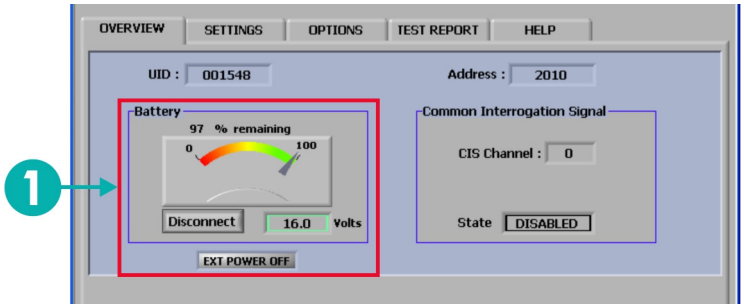


1 Battery status

3. Click on the **<Connect>** button to electronically connect the AvTrak's internal battery pack.

4. The battery pack will now show a Volts reading and the battery button will now be labelled **<Disconnect>**.

Figure 7-5 – Battery Disconnect



1 Battery status

5. To electronically disconnect the battery, click on the **<Disconnect>** button.

7.4.2 Extending Battery Life

To obtain maximum operating life from a fully charge battery, follow the guidelines below:

1. Use the lowest transmit power conditions will allow.

2. Use a slower update rate

3. Use the acoustic command to disable the transponder when not in use on the seabed.

7.4.3 Recharging

The AvTrak 6 contains a rechargeable Lithium Ion battery; all safety precautions to do with Lithium Ion Batteries must be adhered to, refer to **Section 2 – Safety** of this manual and the Safety Manual.

Use the Wideband Test Terminal software to determine the status of the battery and to make sure it is electronically connected.

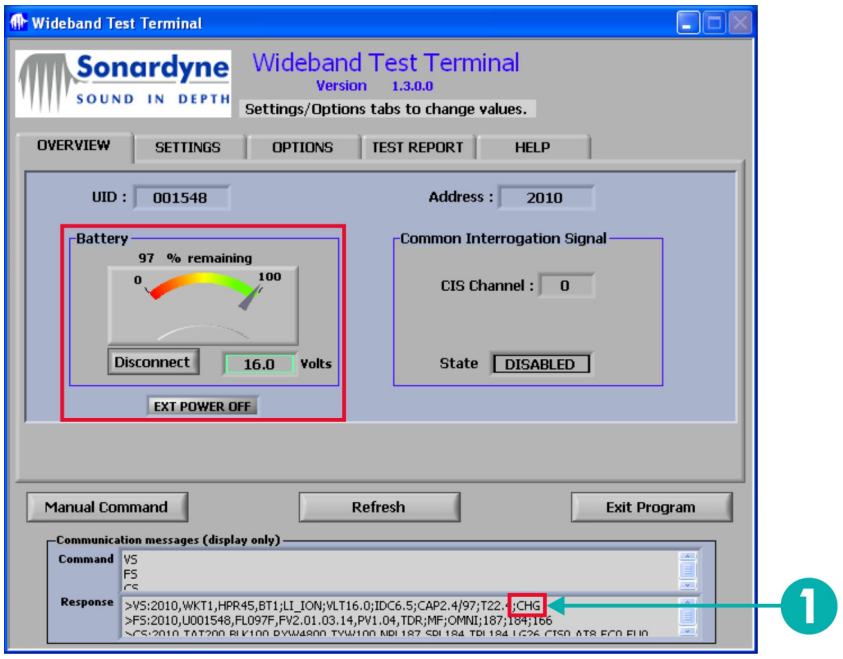
The AvTrak 6 is shipped with the Battery Pack electronically disconnected, but with charging enabled – as indicated by the presence of the 'CHG' flag (refer to **Figure 7-6**, item 1). A disconnected battery will be indicated by a 0.0 Volts battery value and the battery button labelled <**Connect**>.

1. Clicking on the **<Connect>** button will electronically connect the AvTrak's internal battery pack. The battery pack will now show a Volts reading and the battery button will now be labelled **<Disconnect>**.

2. To recharge the AvTrak 6 battery, connect an external supply via the Subconn connector on the end-cap.

3. Turn on the supply. If the power supply is fitted with a current meter, the current drawn should be less than 400 mA during charging.

Figure 7-6 – Battery Recharging

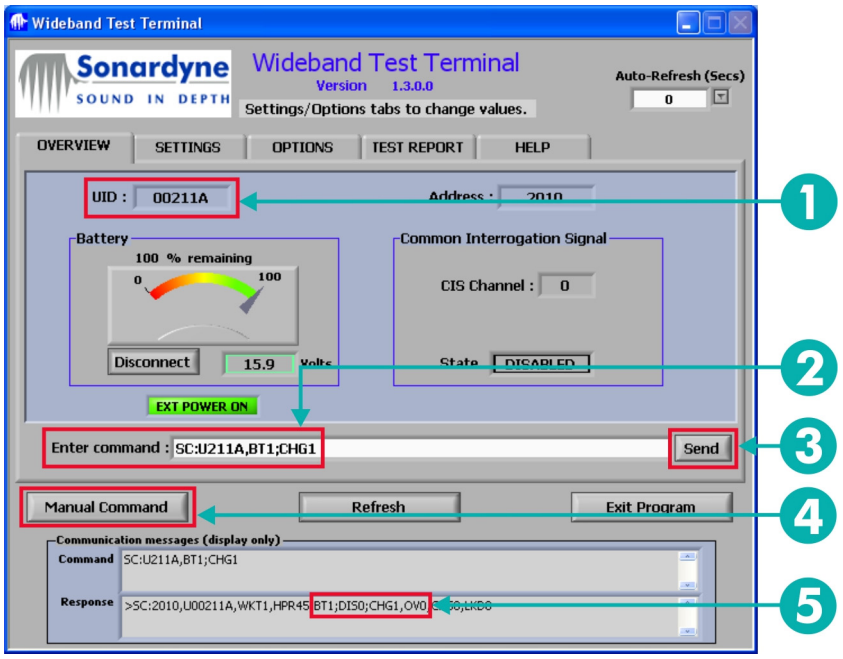


1 Charging

4. If the current drawn is less than 50 mA the battery may be nearly fully charged or the charge function may be turned off.

5. Use the WTT to make sure battery charging is enabled in the AvTrak 6.

Figure 7-7 – Enable Battery Charging



1 Unit ID number
2 Command input box
3 Send button
4 Manual Command
5 Battery Disconnected, charging

6. Click the <**Manual Command**> button.

7. In the Enter Command input box, type the command: "`SC:U#####, BT1; CHG1`" – where ##### is the UID of AvTrak 6 – then click the **<Send>** button. The response will indicate that the battery is not disconnected and that charging is now enabled.

8. Electronics within the internal battery pack monitors and controls the charging of the battery.

9. The AvTrak 6 can be left connected to the charger and it will trickle charge the battery as required.

10. Click the **<Refresh>** button on the WTT to get the current status of the battery. Full charge can be confirmed by a reported battery voltage close to 16.0 Volts, a charging current reported in the IDC field of the VS response of less than 40 and a reported capacity close to 100%.

11. To terminate charging switch off the external power supply.

12. Click the **<Exit Program>** button on the WTT.

7.4.4 Transducer End-Cap Removal

Before any maintenance activity is carried out on the transponder, make **Section 2 – Safety** is read and fully understood.

Make sure all general maintenance activities are carried out on the transponder, refer to **7.3 - General Maintenance**.

WARNINGS

⚠ **High pressure risk when dismantling the equipment. Dismantling the sub-sea equipment must only be carried out by trained personnel.**

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

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

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

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

⚠ **Do not stand directly in line with the end-cap when removing it from the transponder.**

⚠ **Make sure the equipment is dry before dismantling.**

1. Make sure the transponder has been cleaned with clean fresh water and any marine growth removed. Refer to **7.3 - General Maintenance**.

2. Operate the Pressure Relief Vent Valve in accordance with 7.3.1 - Operation of the Pressure Relief Vent Valve.

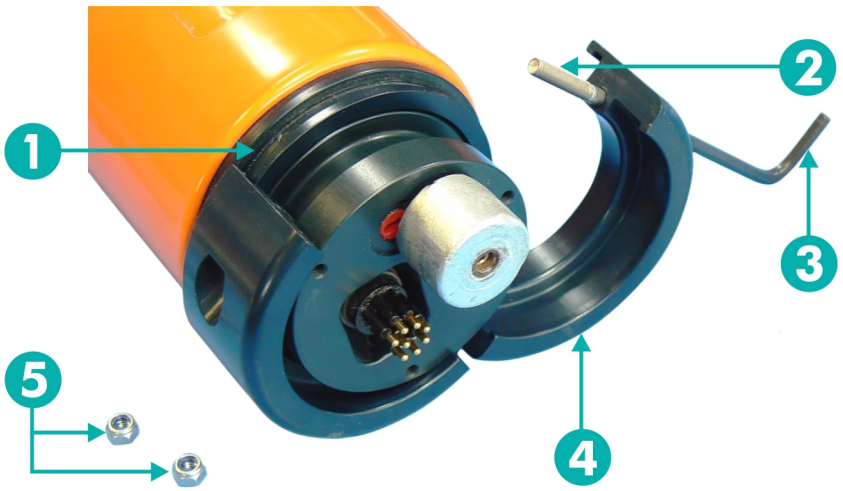
3. Refer to **Figure 7-8**. Use an Allen Key ❸ to remove the two M5 socket head cap screws ❷ and nuts ❺ retaining the clamp rings ❹.

4. Refer to **Figure 7-8**. Lever out the clamp rings ❹ using the tapered end of the opening tools.

5. Keep the four nylon isolation washers.

6. Refer to **Figure 7-8**. Remove any dirt, silt or water from the clamp seating ❶.

Figure 7-8 – Remove the clamp rings



❶ Clamp Seating
❷ M5 socket head cap screws
❸ Allen Key
❹ Clamp rings
❺ Nuts

7. Push the end-cap into the pressure housing.

Figure 7-9 – Push in End-cap

8. The transducer end-cap will be pushed out of the pressure housing and expose the O-ring seals.

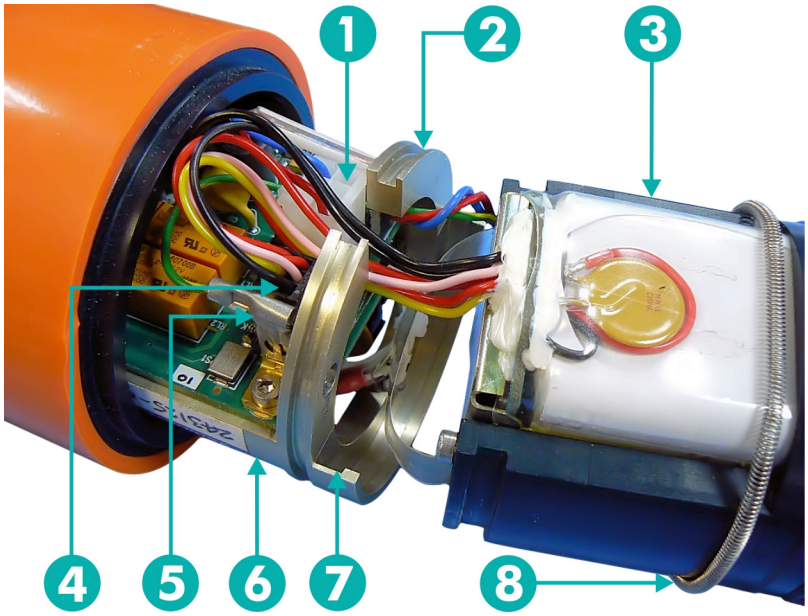
9. Remove any accumulation of silt and water.

10. Clean the O-ring seals, or replace if necessary.

11. Continue to push the end-cap into the housing until the transducer end-cap connections are exposed.

12. Refer to **Figure 7-10**. Lift the spring gasket ❽ from its locating groove ❷ and position over the battery pack ❸.

Figure 7-10 – Transducer End-cap connections exposed



❶ Transducer Connector
❷ Locating Groove
❸ Battery
❹ Battery Connection
❺ Earth lead
❻ Main Chassis
❼ Transponder locating groove
❽ Spring Gasket

13. Refer to **Figure 7-10**. Lift the transducer end-cap out of its locating groove ❼ in the main chassis ❻.

14. Refer to Figure 7-10. Disconnect the battery connector ❹.

15. Refer to Figure 7-10. Disconnect the transducer connector ❶.

16. Refer to Figure 7-10. Disconnect the earth lead ❺.

17. Remove the transducer end-cap and store in a suitable container in a clean, dry area.

7.4.5 Transducer End-Cap Fitment

Before any maintenance activity is carried out on the transponder, make sure **Section 2 – Safety** is read and fully understood.

Make sure all general maintenance activities are carried out on the transponder, refer to **7.3 - General Maintenance**.

WARNINGS

⚠ **High pressure risk when dismantling the equipment. Dismantling the sub-sea equipment must only be carried out by trained personnel.**

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

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

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

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

⚠ **Do not stand directly in line with the end-cap when removing it from the transponder.**

⚠ **Make sure the equipment is dry before dismantling.**

1. Inspect the pressure housing for any signs of damage.
2. Inspect the pressure housing grooves and make sure they are clean.
3. Make sure the spring gasket is clean – replace if necessary.
4. Make sure the O-ring seals are clean and serviceable. Replace if necessary.
5. Make sure easy access to the connection points on the main chassis are available.
6. Make sure the grey bump guard collar is correctly positioned on the transducer end-cap.
7. Position the transducer end-cap next to the end of the main chassis.
8. Connect the earth lead.
9. Connect the transducer connector.
10. Connect the battery connector.
11. Lubricate the O-ring seals with Molykote 44 medium silicone grease or petroleum jelly.
12. Position the transducer end-cap into the locating groove at the end of the main chassis.
13. Put the spring gasket into the locating groove.

14. Push the transducer end-cap into the pressure housing until correctly seated.

15. Position the clamps in the grooves in the end-cap. Make sure the gap between the ends of each clamp is equal.

16. Use an Allen Key, the two M5 socket head cap screws, the two nuts, four nylon isolation washers, and the two clamp rings to secure the end-cap.

17. Tighten the clamps evenly but make sure a 2-3 millimetre gap is available between the ends of both clamps.

7.5 Battery Pack Replacement

7.5.1 Battery Pack Removal

Before any maintenance activity is carried out on the transponder, make sure **Section 2 – Safety** is read and fully understood.

Make sure all general maintenance activities are carried out on the transponder, refer to **7.3 - General Maintenance**.

WARNINGS

⚠ **High pressure risk when dismantling the equipment. Dismantling the sub-sea equipment must only be carried out by trained personnel.**

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

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

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

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

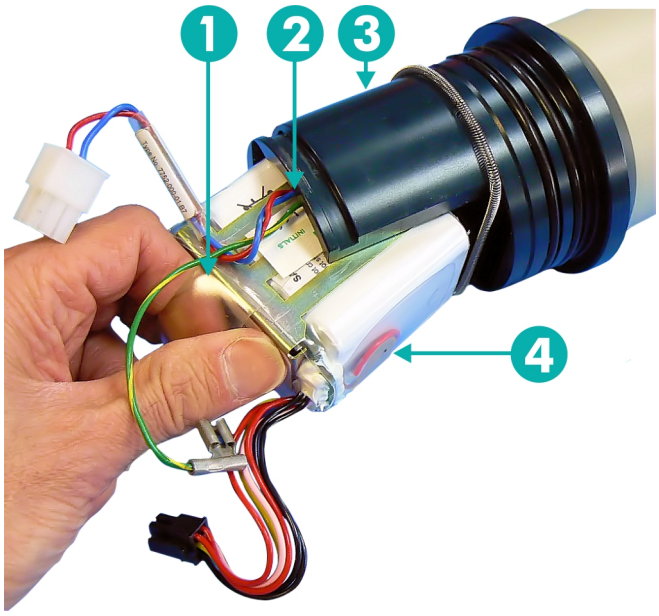
⚠ **Do not stand directly in line with the end-cap when removing it from the transponder.**

⚠ **Make sure the equipment is dry before dismantling.**

1. Remove the transducer end-cap in accordance with 7.4.4 - Transducer End-Cap Removal.

2. Pull the clear plastic strap to remove the battery pack from the transducer end-cap.

Figure 7-11 – Battery Pack Remove/Replace



1 Clear plastic strap
2 Transducer wiring
3 Transducer End-cap
4 Battery Pack

7.5.2 Battery Pack Fitment

Before any maintenance activity is carried out on the transponder, make sure **Section 2– Safety** is read and fully understood.

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

2. Fit the Transducer end-cap in accordance with 7.4.5 -Transducer End-Cap Fitment.

7.6 Chassis Assembly Replacement

7.6.1 Chassis Assembly Removal

Before any maintenance activity is carried out on the transponder, make sure **Section 2– Safety** is read and fully understood.

Make sure all general maintenance activities are carried out on the transponder, refer to **7.3 - General Maintenance**.

WARNINGS

⚠ **High pressure risk when dismantling the equipment. Dismantling the sub-sea equipment must only be carried out by trained personnel.**

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

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

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

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

⚠ **Do not stand directly in line with the end-cap when removing it from the transponder.**

⚠ **Make sure the equipment is dry before dismantling.**

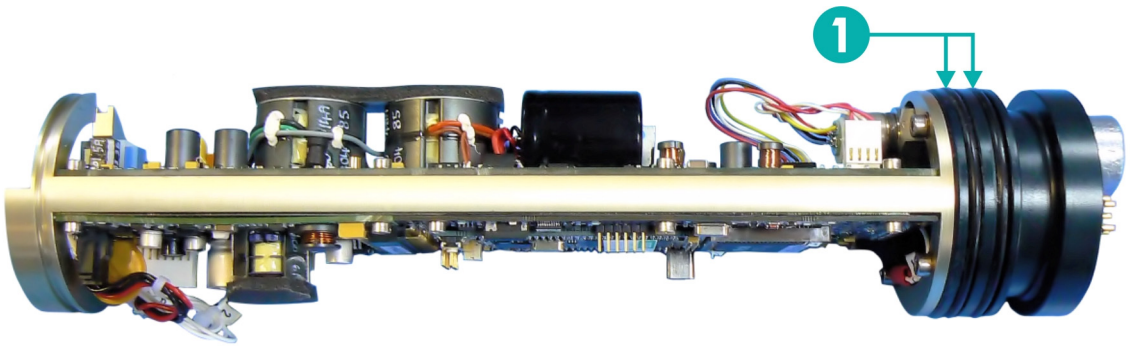
1. To remove the chassis remove the transducer end-cap in accordance with 7.4.4 - Transducer End-Cap Removal.

2. With the transducer end-cap removed, the chassis can be carefully pushed back through the pressure housing and removed.

3. Place the chassis on a dry clean surface.

4. Refer to **Figure 7-12**. Check the O-rings ❶ and replace if necessary.

Figure 7-12 – Chassis Assembly



❶ O-rings

7.6.2 Chassis Assembly Fitment

Before any maintenance activity is carried out on the transponder, make sure **Section 2– Safety** is read and fully understood.

Make sure all general maintenance activities are carried out on the transponder, refer to **7.3 - General Maintenance**.

WARNINGS

⚠ **High pressure risk when dismantling the equipment. Dismantling the sub-sea equipment must only be carried out by trained personnel.**

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

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

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

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

⚠ **Do not stand directly in line with the end-cap when removing it from the transponder.**

⚠ **Make sure the equipment is dry before dismantling.**

1. Inspect the pressure housing for any signs of damage.
2. Inspect the pressure housing grooves and make sure they are clean.
3. Make sure the spring gasket is clean – replace if necessary.
4. Make sure the O-ring seals are clean and serviceable. Replace if necessary.
5. Lubricate the O-ring seals with Molykote 44 medium silicone grease or petroleum jelly.
6. Support the chassis and insert into the pressure housing. Take care not to damage the electronics.
7. Fit the Transducer End-Cap in accordance with 7.4.5 - Transducer End-Cap Fitment.

7.7 Interface Circuit Board Replacement

7.7.1 Interface Circuit Board Removal

Before any maintenance activity is carried out on the transponder, make sure **Section 2– Safety** is read and fully understood.

Make sure all general maintenance activities are carried out on the transponder, refer to **7.3 - General Maintenance**.

WARNINGS

⚠ **High pressure risk when dismantling the equipment. Dismantling the sub-sea equipment must only be carried out by trained personnel.**

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

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

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

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

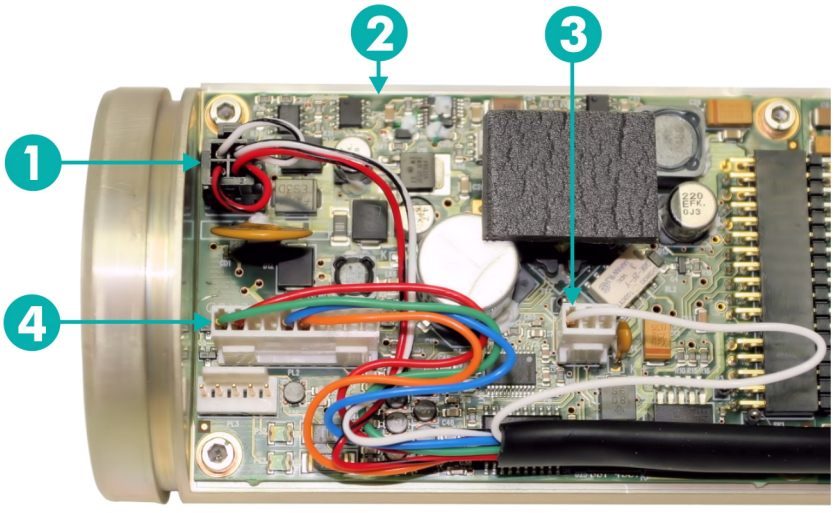
⚠ **Do not stand directly in line with the end-cap when removing it from the transponder.**

⚠ **Make sure the equipment is dry before dismantling.**

1. Remove the chassis assembly from the pressure housing in accordance with 7.6.1 – Chassis Assembly Removal.

2. On the Interface Circuit Board ❷, disconnect the Power Supply ❶, Sync/Release ❸ and Comms ❹ connections.

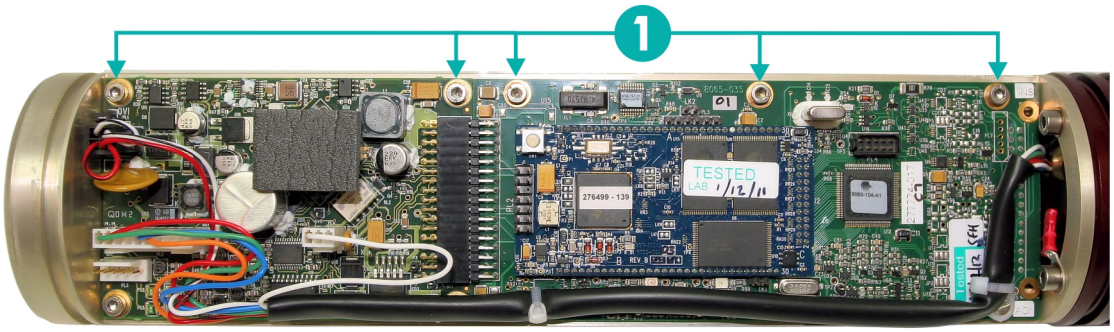
Figure 7-13 – Interface Board Connections



❶ Power Supply
❷ Interface Circuit Board
❸ Sync/Release
❹ Comms Connection

3. Refer to **Figure 7-14**. Using an Allen key, remove the screws and washers ❶ securing the circuit board to the chassis assembly.

Figure 7-14 – Chassis Assembly



1 Screws and Washers

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

7.7.2 Interface Circuit Board Fitment

Before any maintenance activity is carried out on the transponder, make **Section 2– Safety** is read and fully understood.

Make sure all general maintenance activities are carried out on the transponder, refer to **7.3 - General Maintenance**.

WARNINGS

⚠ **High pressure risk when dismantling the equipment. Dismantling the sub-sea equipment must only be carried out by trained personnel.**

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

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

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

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

⚠ **Do not stand directly in line with the end-cap when removing it from the transponder.**

⚠ **Make sure the equipment is dry before dismantling.**

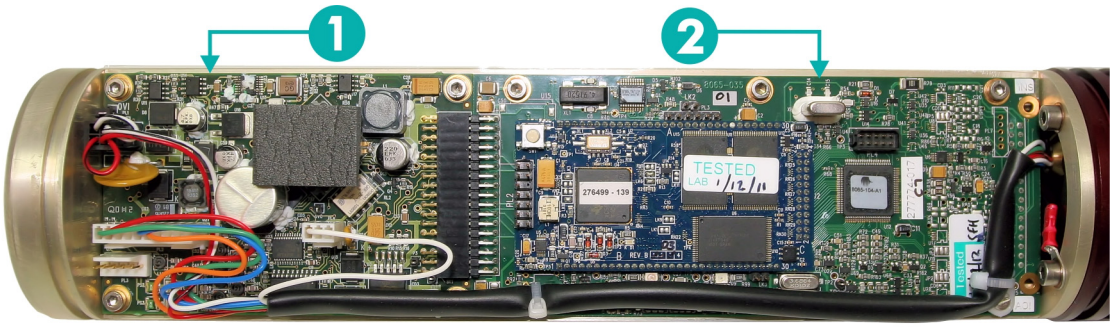
NOTE

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

1. Lift the motherboard so the interface board can be connected to the motherboard.

2. Refer to **Figure 7-15**. Place the interface circuit board ❶ and the motherboard ❷ on to the chassis.

Figure 7-15 – Circuit Boards

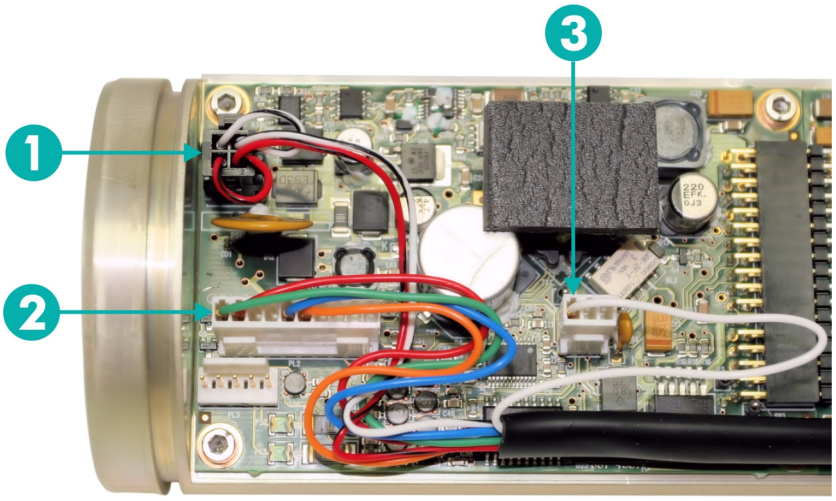


❶ Interface Circuit Board ❷ Motherboard

3. Use an allen key to secure the interface circuit board and motherboard to the chassis using the ten anchor screws and washers. Make sure the interface circuit board and motherboard do not twist during tightening.

4. Connect the power supply, Sync/Release, and comms connections.

Figure 7-16 – Interface Board Connections



❶ Power Supply
❷ Comms Connection
❸ Sync/Release

5. Refit the chassis in accordance with 7.6.2 - Chassis Assembly Fitment.

SECTION 8 – FUNCTIONAL TEST

8. Introduction

Many functions of the AvTrak 6 can be tested via the RS232 link including features not available via acoustic command.

The RS232 link can be controlled by a PC running the Wideband Test Terminal software.

The following procedures will test the major sub-systems of the AvTrak 6:

a. Acoustic Transducer

b. Pre-amplifier

c. Tone Receiver Circuitry

d. Transmitter Synthesizer

e. Transmitter Output Circuitry

f. Wideband Receiver Circuitry

g. Integrated Sensors

h. Responder Function

WARNING

⚠ **Some versions of the AvTrak 6 are designed for use with a Remote Transducer. The Transducer is driven at a high voltage via the end-cap connector. Make sure the Remote Transducer is fully connected to the transceiver housing before operating.**

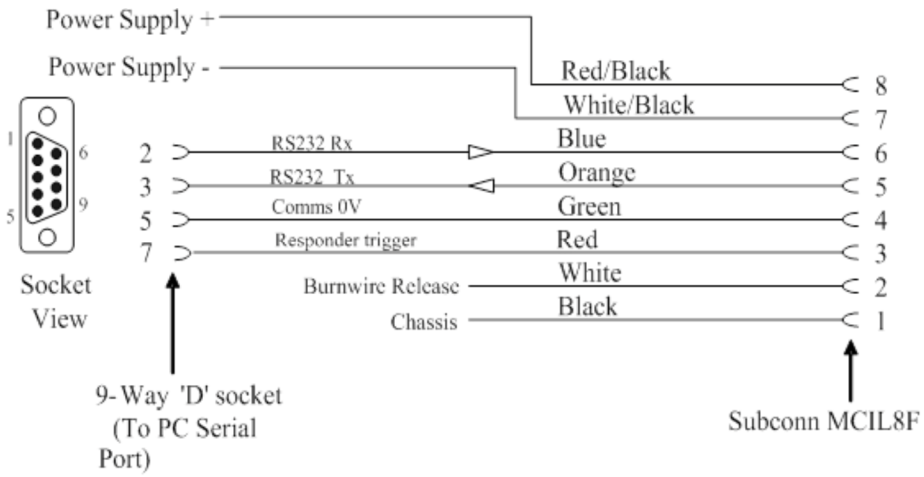
8.1 Test Equipment

The equipment required to assist in testing the AvTrak 6 is detailed in the following table:

Table 8-1 – Test Equipment

Description	Sonardyne Drawing No.	Sonardyne Order Code
PC with spare Comm Port		
AvTrak 6 Utilities CD-ROM	8220-200	
A second AvTrak 6 or other Sonardyne 6G® Wideband Transponder. (Required for back to back acoustic checks only)		
PSU: 24 VDC output @ 500 mA (preferably with built in ammeter)		
Test cable as detailed.		

Figure 8-1 – Test Cable Wiring



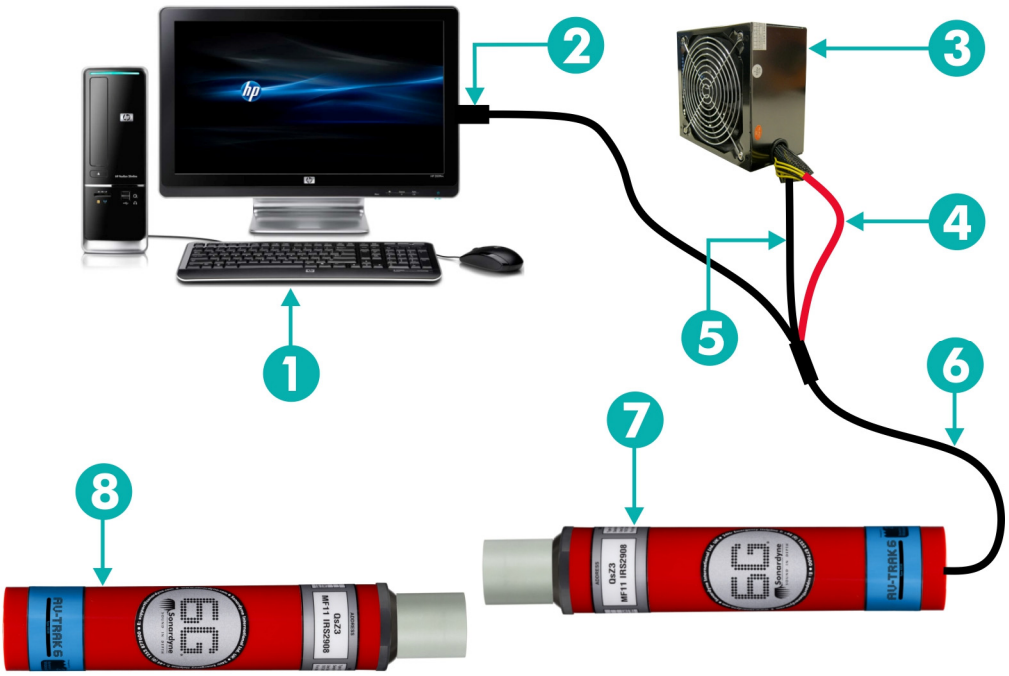
8.2 Test Equipment Set Up

Before connecting any test equipment to the AvTrak 6, make sure **Section 2– Safety** is read and understood.

1. Remove the dummy blanking connector from the end cap of the AvTrak 6.

2. Using the test cable, connect the AvTrak 6 to the PC and the PSU.

Figure 8-2 – AvTrak 6 Test Equipment Set Up



1. PC
2. RS232 Port
3. PSU
4. Red test cable connection
5. Black test cable connection
6. Test Cable
7. AvTrak 6 Under Test
8. Second AvTrak 6 for acoustic ranging test

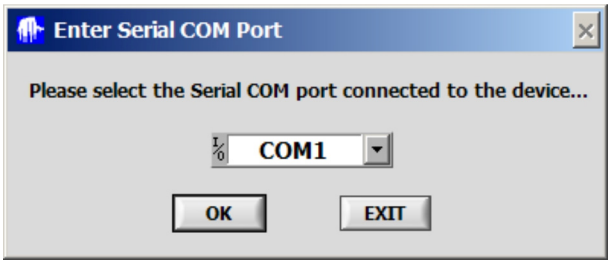
8.3 General Operation Test

The WTT software is used to perform basic tests on the AvTrak 6 and for changing its address, channel and functionality.

1. Open the **WTT** software by clicking on the icon.

2. When the software opens, select the correct serial **COM** port and click **OK**.

Figure 8-3 – Select Correct Serial COM port

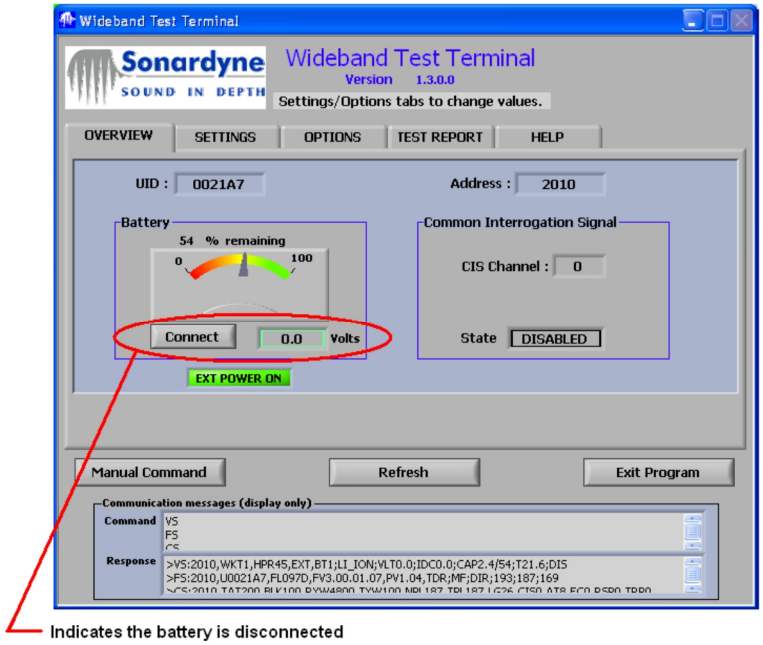


3. The WTT will display the current settings of the AvTrak 6.

NOTE

The AvTrak 6 is shipped with the battery pack disconnected as indicated by 0.0 Volts Battery value and the Connect button displayed.

Figure 8-4 – AvTrak 6 settings



4. Select **Connect** to enable the battery pack. When connecting the battery voltage will visible. The pack may be disconnected by selecting the Disconnect button. A warning will appear prior to disconnection.

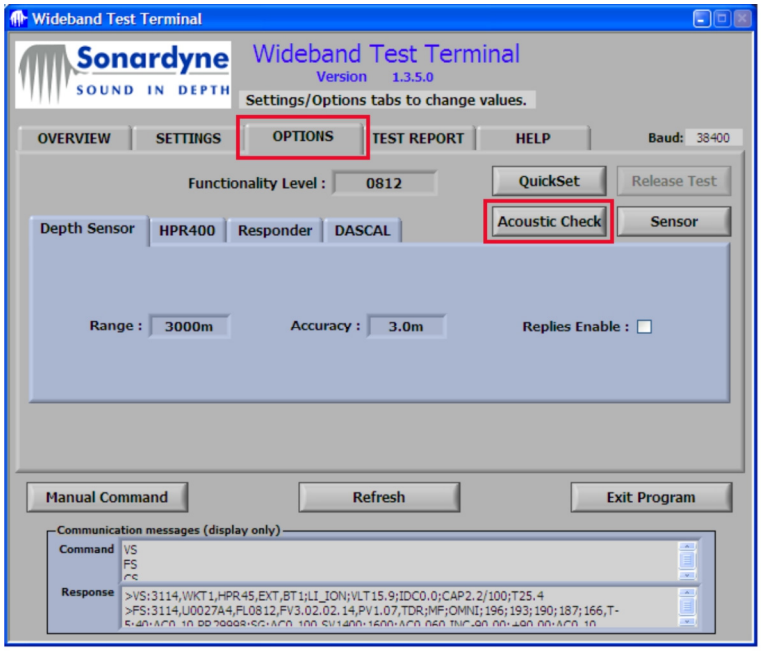
8.3.1 Checking Wideband Acoustics

Acoustic checks of the AvTrak 6 can only be carried out if a second AvTrak 6 or other 6G® Wideband Transponder is available. Tests may be carried out in air, however, best results are usually obtained using an offset axial alignment.

Carry out the following procedure to check the wideband acoustics.

1. With the WTT software open select the **Options** tab.

Figure 8-5 – Acoustic Check



2. Click on Acoustic Check.

3. Enter the **Address** and the **Wakeup Tone** of the Sonardyne Wideband transponder or transceiver and then click **OK**.

Figure 8-6 – Remote Device Information

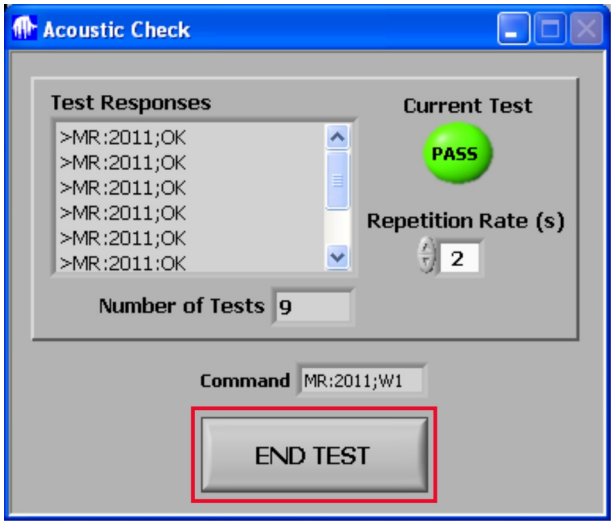
4. The WTT will now command the AvTrak 6 to begin ranging to the selected acoustic address and to monitor for the replies.

5. The WTT will display Pass or Fail as appropriate for each interrogation cycle.

6. The relative position and orientation of the two acoustic instruments may require varying to optimise the acoustic comms through air.

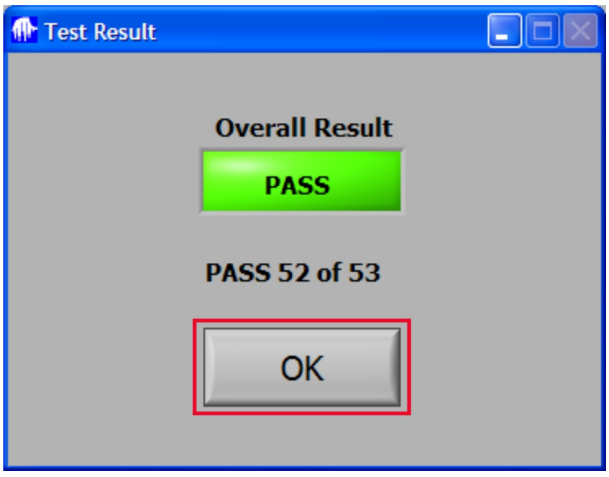
7. Click **End Test** to finish the acoustic testing.

Figure 8-7 – Acoustic Check



8. On completion a summary of the acoustic testing will be displayed.

Figure 8-8 – Test Results



8.3.2 Checking Responder Function

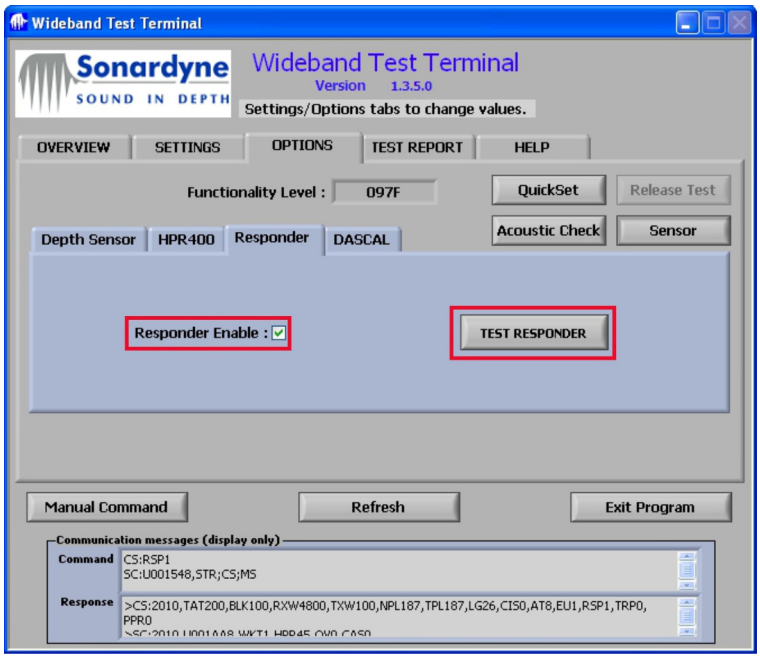
Carry out the following procedure to check the responder function.

1. Click on the **Options** tab and then select the **Responder** sub-tab.

2. Check the **Responder Enable** tick box. This will enable an audible short acoustic ping to be heard from the AvTrak 6 each time the Test Responder button is selected.

3. Uncheck the **Responder Enable** tick box to stop the AvTrak 6 transmitting when a responder trigger is sent.

Figure 8-9 – Responder Function Test



8.3.3 Reading the Sensors

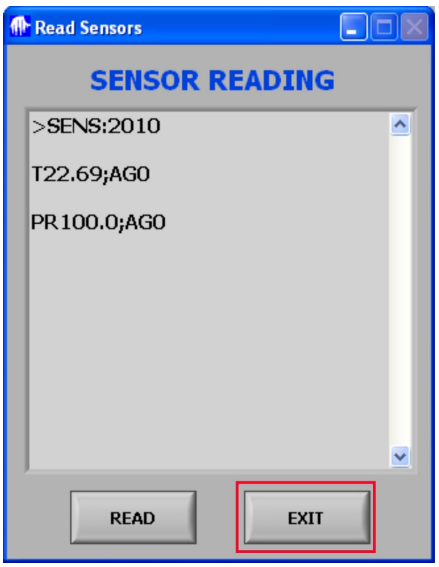
Carry out the following procedure to check the sensor function.

1. Click on the **Options** tab on the WTT software, then select **Sensor**.

2. Click on **Read**.

3. The raw sensor replies will be displayed. Pressure is displayed in kPa; temperature is displayed in °C. All sensor values have an associated age value reported as AG#

Figure 8-10 – Sensor Reading



4. Click **Exit** to close the Sensor Reading screen.

SECTION 9 – FIRMWARE UPGRADE

9. HOST Firmware Upgrade

To make sure the AvTrak 6 maintains full operation, it may be necessary to carry out an upgrade of the Host Firmware.

To upgrade the HOST firmware, proceed as follows:

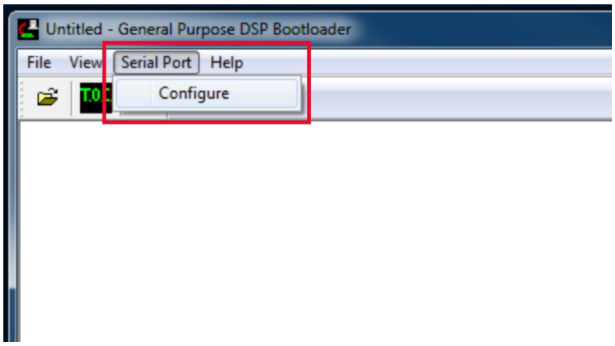
1. Make sure the AvTrak 6 is connected to the PC using the test cable.

2. Double click the GP Bootloader.exe icon to open the program.

Figure 9-1 – GP Bootloader Shortcut icon

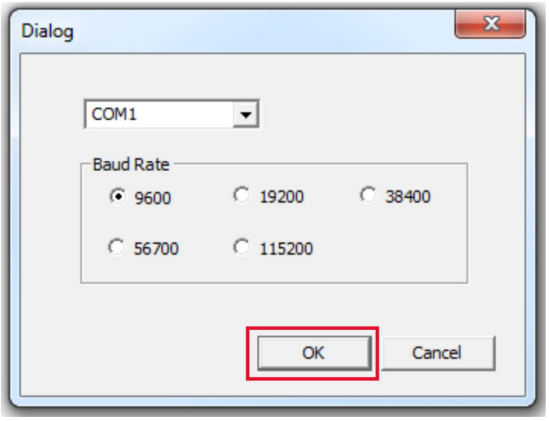
3. From the menu toolbar, select **Serial Port**, then **Configure**.

Figure 9-2 – Bootloader Serial Port Selection



4. In the Dialog screen select the correct **COM** port and **Baud Rate** (**38400**, **56700** or **115200**).

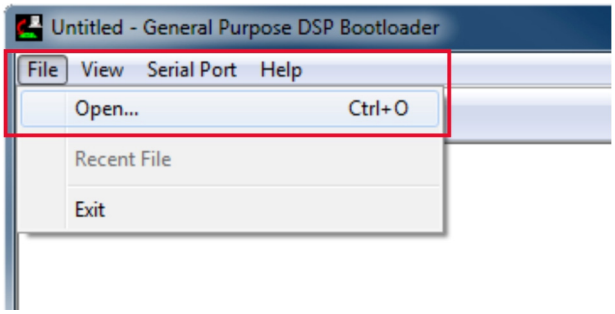
Figure 9-3 – Dialog Options



5. Click **OK**.

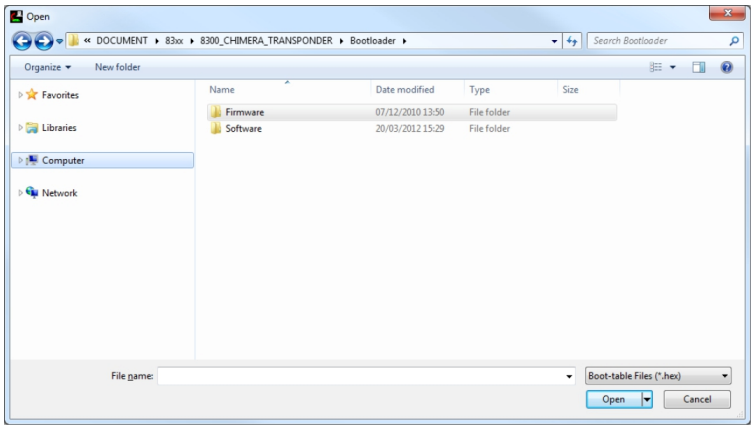
6. The Dialog window will close. On the main screen select **File**, then **Open**.

Figure 9-4 – File Open Option



7. Browse to the location where the new firmware is stored.

Figure 9-5 – New Firmware location

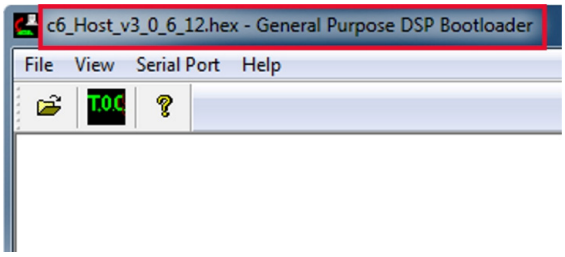


8. Select the new firmware.

NOTE

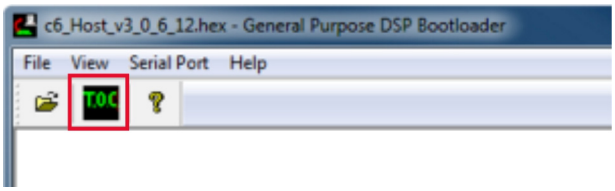
Once the new firmware has been selected it will appear in the Bootloader homepage title bar.

Figure 9-6 – New Firmware version



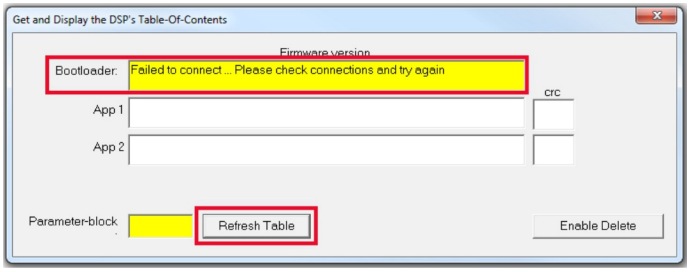
9. On the Bootloader main screen, select **TOC**.

Figure 9-7 – Select TOC on Bootloader homepage



10. If a connection is not made successfully, an error message will appear in the Bootloader Table of Contents screen.

Figure 9-8 – Bootloader Failure to Connect Notification



11. Check all cables are connected correctly to the PC.

12. Go to the Device Manager facility on the PC and check the correct Comms Port has been selected for the CPU cable.

13. Click **Refresh Table** after checking the connections.

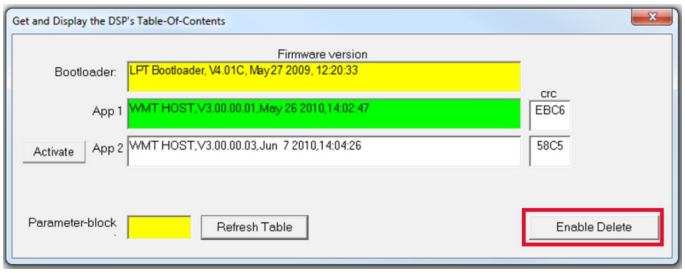
14. If all cable connections have been made successfully, the window will refresh.

NOTE

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

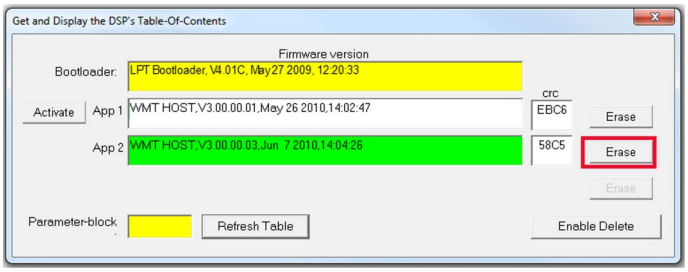
15. To erase an application, click **Enable Delete**.

Figure 9-9 – Enable and Delete Firmware



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

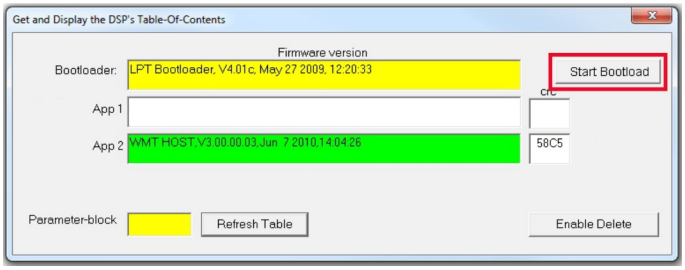
Figure 9-10 – Erase a Firmware App.



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

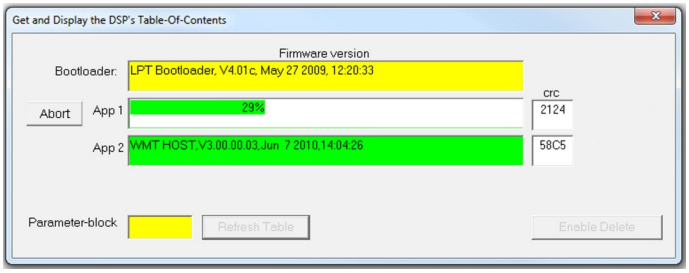
18. Click **Start Bootload** to start uploading the new firmware.

Figure 9-11 – Start Bootload



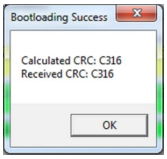
19. Once **Start Bootload** is selected, a percentage uploading bar will scroll across the App. location.

Figure 9-12 – App update bar



20. Once the upload has completed a Bootloading Success window will appear.

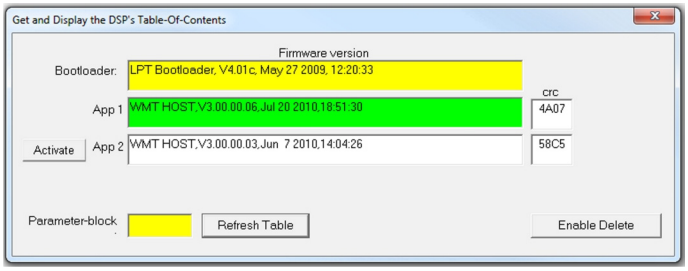
Figure 9-13 – Bootloader Installation Success Window



21. Click **OK** to confirm the installation is a success.

22. The new uploaded program will appear in the selected App Window.

Figure 9-14 – New uploaded Firmware



23. Close the Get and Display the DSP's Table of Content window.

24. To confirm the new firmware is working, on the Bootloader screen, click on the **TOC** and the new firmware should be displayed highlighted in green.

25. Close all screens.

SECTION 10 – FAULT DIAGNOSIS

10. Introduction

In the event the AvTrak 6 does not operate correctly, refer to the following Fault Finding tables to identify the fault, the possible cause and the action to take.

10.1 Transceiver Does Not Reply to Interrogation or Commands

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

Fault	Possible Cause	Action
	Low gain setting has been commanded.	Wait 3 minutes with no interrogations, and then send the command to increase the transponder gain.
	Other acoustic systems maybe operating in the same frequency band.	Check for signals validating by using the noise command on the surface transceiver.
	High electrical noise on power or comms connection may degrade acoustic sensitivity.	

10.2 Transceiver Replies To Commands, But Not To Interrogations

Fault	Possible Cause	Action
Transponder replies to commands, but not interrogations.	Transponder disabled.	Check by reading the transponder CS reply.
		EC1 indicates the transponder is enabled for CIS interrogations.
		EC0 indicates it is disabled.
	The incorrect CIS signal.	Check the transponder CS reply.
	Transponder may have been moved from original position.	

10.3 Transceiver Replies To Commands, But Telemetry Errors Are Detected

Fault	Possible Cause	Action
Transponder replies to commands, but telemetry errors are detected.	Noise level at surface transducer to high.	Lower the dunking transducer/transceiver or towfish and reduce the surface transceiver gain settings.
		Do a noise check using the applicable transceiver noise check command.
		Increase the transponder power level using the Navigation Power Level (NPL) in the Configuration Status (CS) command.
		Set the transponder to high power telemetry transmission using the SPL and TPL parameters in the CS command.
	Other acoustic systems maybe operating in the same frequency band.	Check for signals validating by using the noise command on the surface transceiver.

10.4 Sonardyne Int Ltd Emergency Helpline

Available 24hrs Phone: **+44 (0) 1252 877600**. Office hours (08:30 – 17:00 UK time). Out of hours an agent will take your details and pass them to the appropriate Sonardyne engineer. If non-urgent email mailto:support@sonardyne.com.

SECTION 11 – STORAGE

11. Storing the AvTrak 6

If the AvTrak 6 is to be placed in storage for a length of time, it is recommended that the following procedure is carried out.

1. Clean the AvTrak 6 in clean fresh water.

2. Dry the AvTrak 6 thoroughly using clean lint free cloth.

3. Lubricate and blank all connections. Refer to 7.2 - Lubrication for the correct lubricants.

4. For extended periods of storage it is recommended the battery is electronically disconnected. Refer to 7.4.1 - Electronically Connecting and Disconnecting the battery.

SECTION 12 – SPARES

12. Introduction

When ordering spare parts, the following must be provided:

- The part number of the component or item
- The drawing number
- The description

Enquiries about or orders for spare parts should be directed to the local Sonardyne Office or agent. Local agents contact details can be viewed at www.sonardyne.com and local office contact details are as follows:

Sonardyne International Ltd
Blackbushe Business Park
Yateley, Hampshire
GU46 6GD
United Kingdom
T: +44 (0) 1252 872 288
F: +44 (0) 1252 876 100
E-mail: support@sonardyne.com
www.sonardyne.com

Sonardyne International Ltd
Units 12 – 14, The Technology Centre
Claymore Drive, Bridge of Don
Aberdeen AB23 8GD
T: +44 (0) 1224 707875
F: +44 (0) 1224 707876
E-mail: sales@sonardyne.com

Sonardyne Inc
8280 Willow Place Drive North
Suite 130, Houston
Texas 77070
USA
T: +1 281 890 2120
F: +1 281 890 7047
E-mail: usa.sales@sonardyne.com

Sonardyne Asia Pte Ltd
34 Loyang Crescent
Block B
Singapore
508993
T: +65 6542 1911
F: +65 6542 6937
E-mail: asia.sales@sonardyne.com

Sonardyne Brasil Ltda
Rio das Ostras, Brasil
Av. Zen lotes 05 e 06
Quadra D
Zen, Rio das Ostras – RJ
CEP 28.890-000, Brasil
T: +55 22 2123 4950
F: +55 22 2123 4951
brasil.sonardyne.com

12.1 Recommended Spares

12.1.1 Batteries

Part No.	Dwg No	Description	Qty
641-3370	8065-002-01	Lithium-Ion Battery Pack	1

12.1.2 Miscellaneous Parts

Part No.	Dwg No	Description	Qty
641-3332	8000-905-A2	Sonardyne Opening Tool	2
650-0247	n/a	Anode kit 3000 m	1
650-0017	8065-126-A1	Ring Clamp kit (incl. screws, washers, bushes, anode)	1
201-5012	n/a	Spring Earthing EMI	1
212-0867	n/a	Screw Clamp	2
730-4592	n/a	Isolator Nylon	4
230-0535	n/a	Nut Nyloc	2
860-0725	n/a	Anode Zinc (3000 m)	1
860-2087	n/a	Anode Zinc (5 Km 90^0 Connector)	1
212-5246	n/a	Stud Anode Mounting (3000 m)	1
200-2302	n/a	Seal O-ring (Housing end-caps)	4
200-012C	n/a	Seal O-ring (Pressure relief valve)	2
830-0343	n/a	Dust cover Pressure port	1

12.1.3 Cables

Part No.	Dwg No	Description	Qty
317-2896	n/a	Subconn MCIL8F Cable Tail 0.5 m (without locking collar)	1
317-2963	n/a	Subconn MCIL8F Cable Tail 3 m (without locking collar)	1
820-5801	7995-051-A2	Subconn MCIL8F Cable Tail 3 m (with locking collar)	1
312-6924	n/a	Subconn MCDC8F Dummy	1
317-2672	n/a	Subconn Locking Collar MCDLSF	1

SECTION 13 – TECHNICAL SPECIFICATIONS

13. 8220 Series Transponders

13.1 Mechanical – Type 8220-3111

MF Omni Unit	
Parameter	Specification
Diameter (Body)	94 mm (3.7 ins)
Overall length	500 mm (19.7 ins)
Weight in air	5.1 kg (11.3 lbs)
Weight in water	2.2 kg (4.9 lbs)
Max Operating Depth	3000 m

13.2 Mechanical – Type 8220-7211

MF Directional Unit	
Parameter	Specification
Diameter (Body)	98 mm (3.9 ins)
Overall length	511 mm (20.1 ins)
Weight in air	7.0 kg (15.4 lbs)
Weight in water	3.5 kg (7.7 lbs)
Max Operating Depth	7000 m

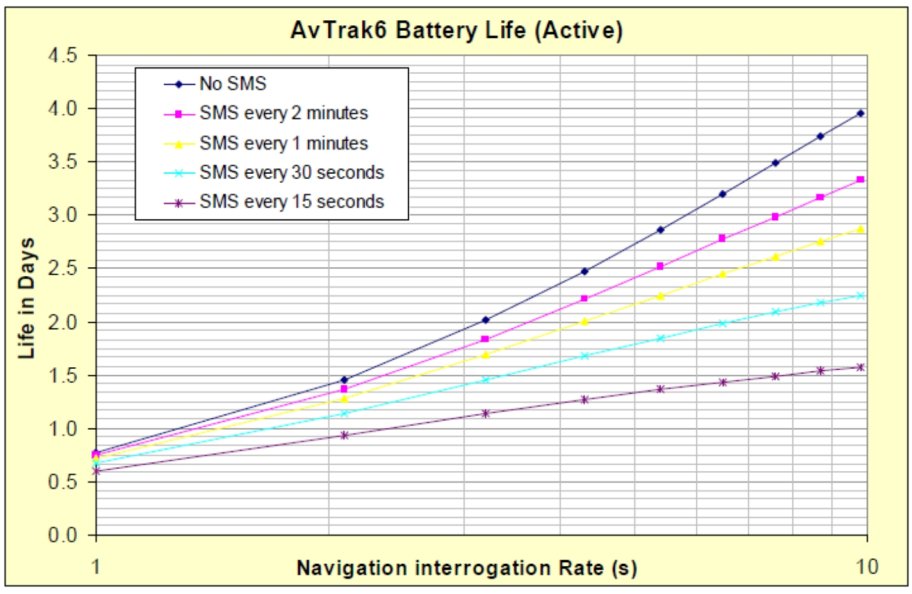
13.3 Mechanical – Type 8220-3161

MF Omni Remote Unit	
Parameter	Specification
Diameter (Body)	94 mm (3.7 ins)
Overall length	467 mm (18.4 ins)
Weight in air	4.8 kg (10.7 lbs)
Weight in water	2.1 kg (4.6 lbs)
Max Operating Depth	3000 m

13.4 Power

External Supply Operating Range	24 or 48 VDC ±10%
Quiescent Power	<2 W over supply voltage range <6 W when battery is charging.
Peak Power	50 W
Battery Life (Shutdown State)	~30 days
Battery Life (Navigation cycle every 4 seconds and short SMS every 2 minutes)	~2 days
Battery Type	15 V Lithium-ion (Li-ion), 2.35 Ah, 35.25 Wh
	The battery pack if formed of 4 series connected Lithium Ion cells.
Battery Pack Features	The pack contains a number of built in features and protection devices: • Charge management circuit and capacity monitoring. • Electronic disconnection device. • Short Circuit protection • Over-charge protection • Over-discharge protection
Battery Charge Rate	Fast charge to 85% - Approximately 10 hours. Top off charge to 100% - Additional 10 Hours

Figure 13-1 – AvTrak 6 Battery Life (Active)



13.5 Acoustic

Transducer Type		Omni-Directional	Semi-Directional
Transducer Beamshape	@25 kHz	±120° hemisphere	±35°
Frequency Range		MF 19 – 36 kHz	MF 19 – 36 kHz
Acoustic Sensitivity	dB re 1µPa	<93	<93
Acoustic Transmit Source Level (Maximum, Normal, Ultra-Low)	dB re 1µPa @1 m	187/181/169	193/187/169
Pulse length, Tone	ms	10	10
Pulse length, Wideband	ms	8	8
Time resolution	µs	1	1
Typical Range Repeatability/Accuracy (Wideband)		1 cm / 3 cm	1 cm / 3 cm

13.6 Environmental

Parameter	Specification
Temperature Operation	-5° to 50°C (23° to 122°F)
Temperature Storage	-20° to 50°C (-4° to 122°F)
Rated for outdoor use	Relative humidity 100%
	IP68
Depth Rating	Maximum depth 7000 m

13.7 Synchronisation Output (Sync Pin)

Inactive State	Low
Ground Reference	External Subconn connector pin 4
Output impedance	1 KΩ when active (500 KΩ inactive)
Sync Pulse	Nominally 16.5 V positive pulse 80 ms after receiving individual interrogation signal (IIS). The sync pulse width is 1 ms. Sync output is enabled by the SYNC command.

13.8 Responder Input Trigger (Sync Pin)

Inactive state	Low
Ground reference	External Subconn connector pin 4
Input Impedance	~47 KΩ
Trigger Pulse	Nominally positive pulse minimum 4 V maximum 24 V. Leading edge triggered. Responder mode is enabled by command CS:RSP1
Pulse Width	Nominal minimum 0.5 ms maximum 25 ms
Turnaround Delay	TAT reported by CS command is used for IRS replies. HPR replies have a fixed TAT of 30 ms
Blocking time	TAT + BLK reported by CS command.

13.9 Communication Port

Type	RS232
Baud Rate (default)	9600 baud (8 data bits, no parity, 1 bit stop) Configurable to 115200 baud

13.10 Sensors

Depth/Pressure Linearity		±0.25% Full Scale Typical
Pressure Reporting Units	(PRESS command)	psi
	(SENS command)	kPa
Depth Reporting Units	(DEPTH command)	metre
Depth scaling	(DEPTH command)	0.68525 m/psi
Temperature Range	(TEMP/SENS command)	-10°C to +40°C (14°F to 104°F)
Temperature Accuracy		±0.25°C

13.11 Mission Abort

The Mission Abort signal is provided by the existing SYNC output hardware and is activated on receipt of a specific acoustic SMS command sent from another AvTrak 6 or Fusion Ultra-Short Baseline (USBL) transceiver. When activated, this output produces a positive 16.5 Volt pulse of 1 second duration relative to the Comms Ground on Subconn Pin 4. This output has a source impedance of 1 Kohm.

NOTES

Equipment utilising this output should provide at least 50 ms of glitch filtering / debounce to prevent spurious Abort operation during AvTrak 6 code resets.

SYNC should not be enabled when Mission Abort functionality is used.

13.12 Burnwire Release

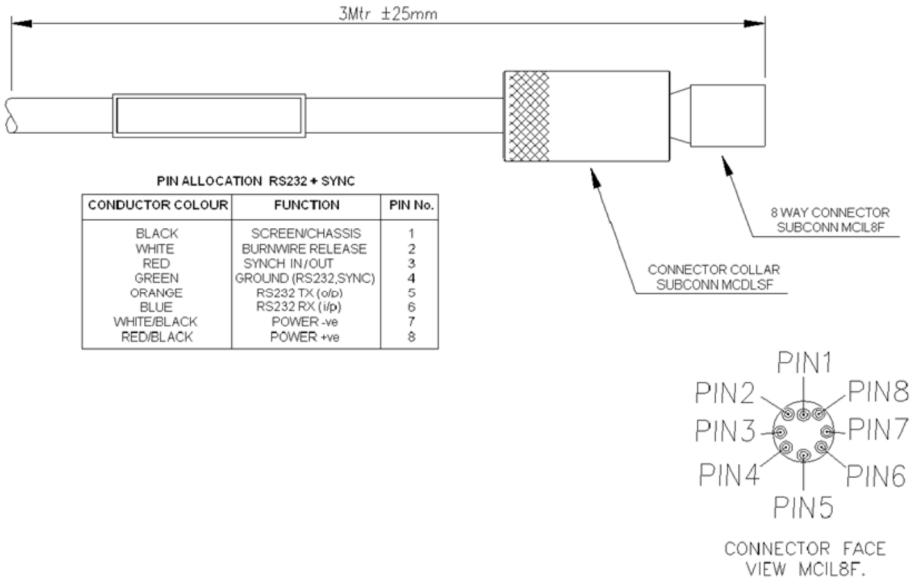
The Burnwire Release is provided by an additional connection to the external 8 way Subconn. The Burnwire Release drive is activated by an acoustic SMS command sent from another AvTrak 6 or Fusion Ultra-Short Baseline (USBL) transceiver. When activated, this output produces a regulated positive +12 V pulse of 15 minutes duration with a current capability of 300 mA. The output is on Subconn Pin 2 relative to the Coms Ground on Subconn Pin 4.

Short circuit protection is provided by a resettable polymetric device.

13.13 External Connections

External connector	Subconn (8 way male) Power, comms, synch and release

Figure 13-2 – Mating Cable Tail



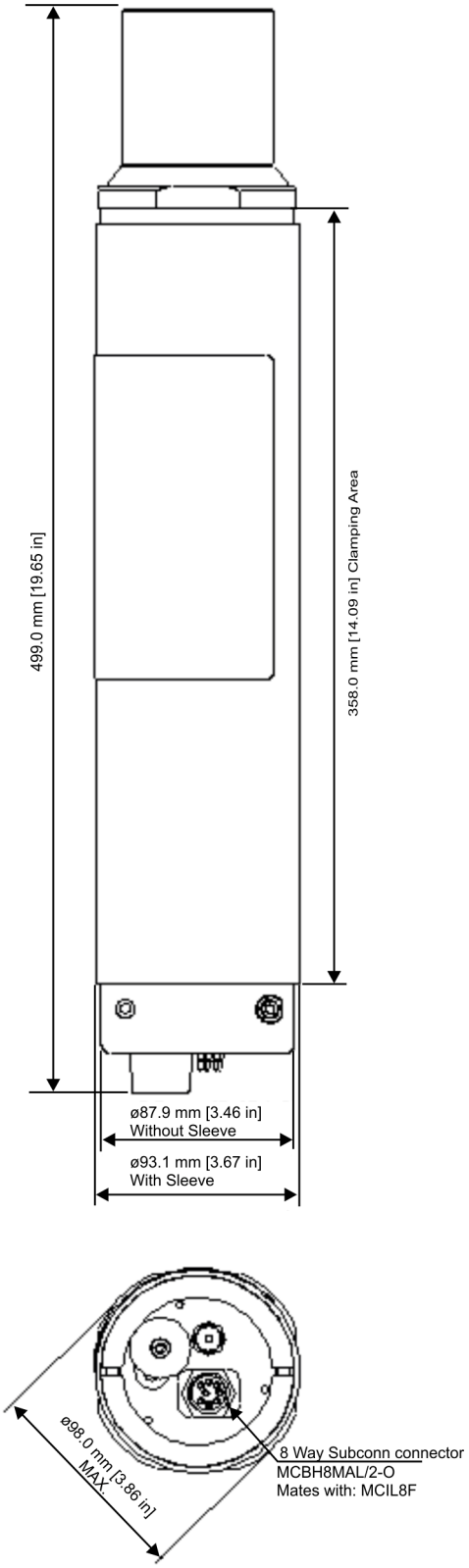
PIN ALLOCATION RS232 + SYNC

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

13.14 Drawings

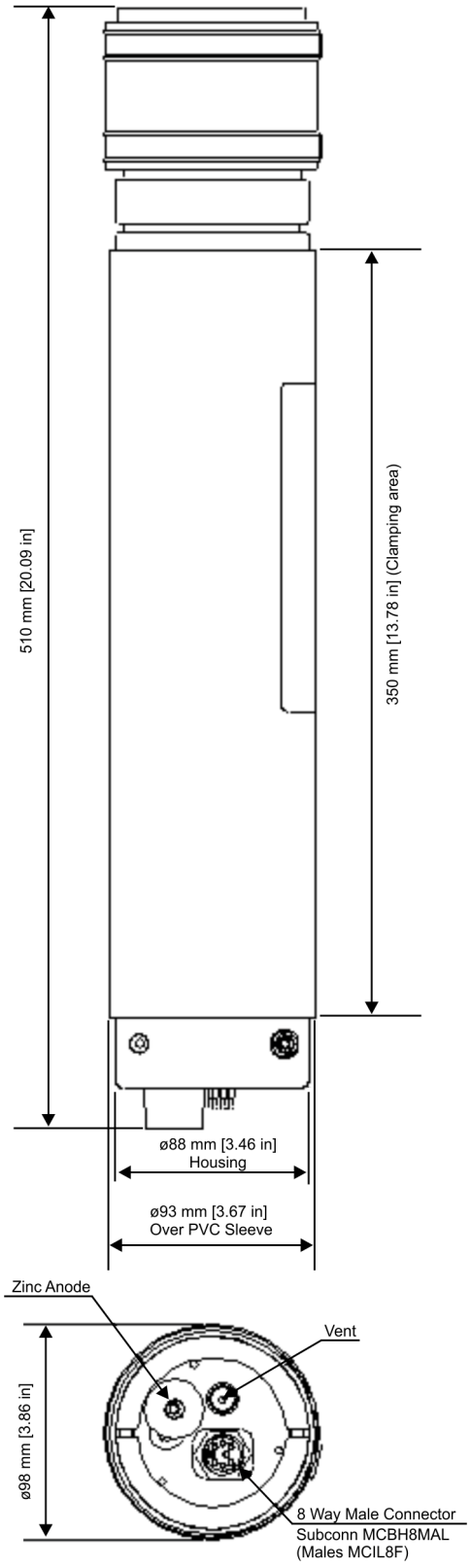
13.14.1 MF Omni AvTrak 6

Figure 13-3 – 8220-000-3111



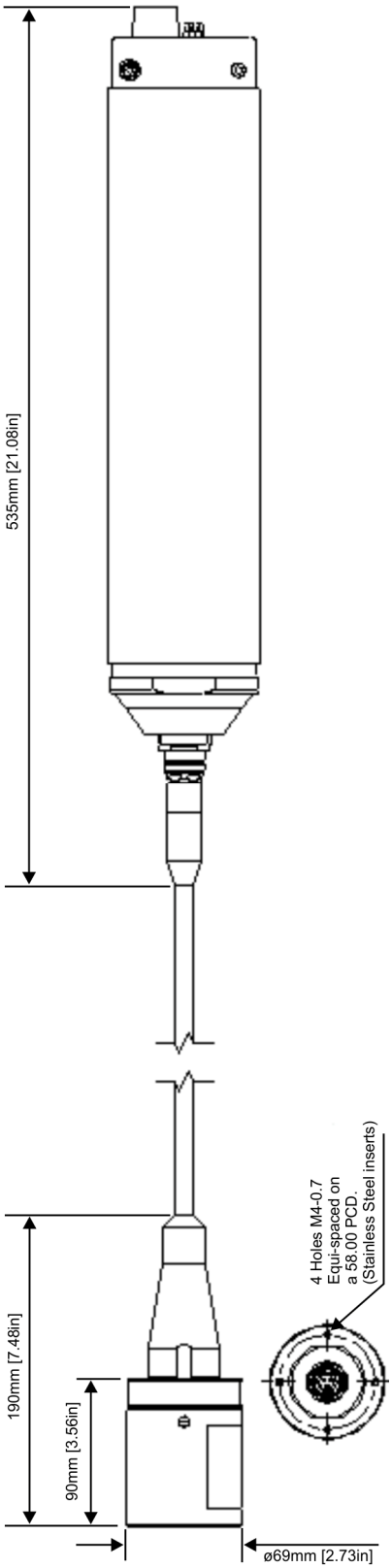
13.14.2 MF Directional AvTrak 6

Figure 13-4 – 8220-000-7211



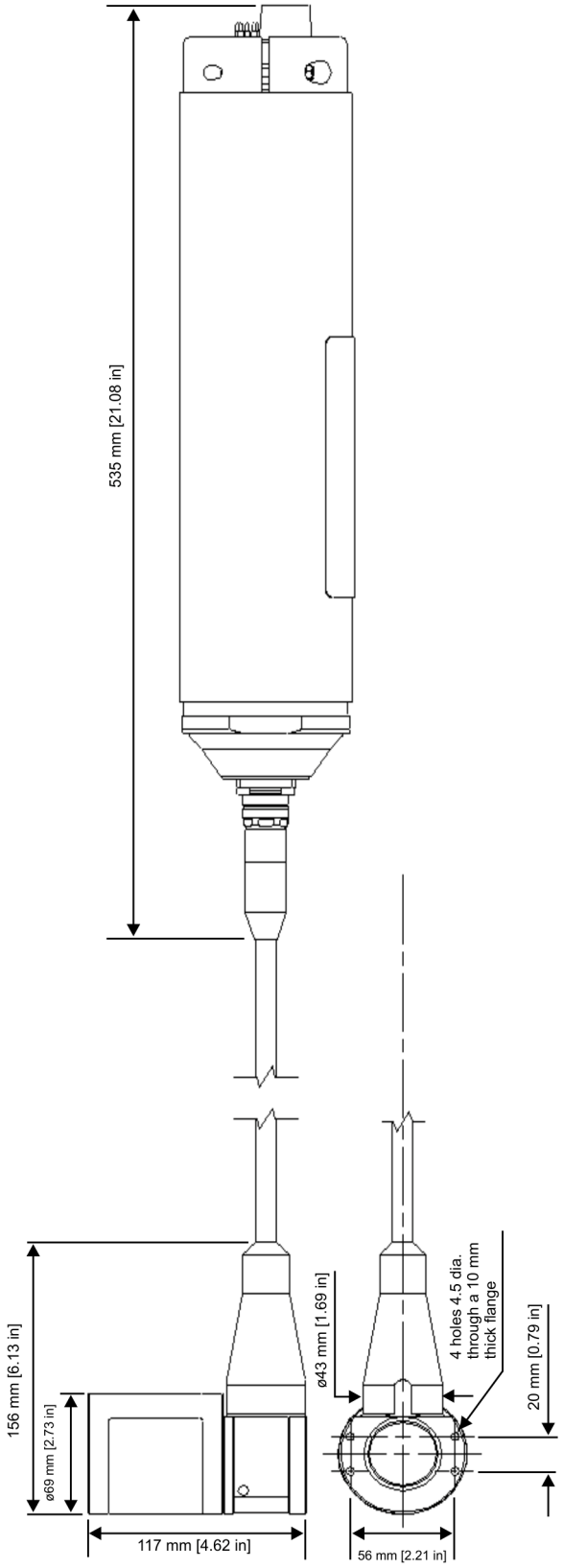
13.14.3 MF Omni AvTrak 6 with Straight Remote Transducer

Figure 13-5 – 8220-000-3161 with 8065-120 Straight Remote Transducer



13.14.4 MF Omni AvTrak 6 with Right Angled Remote Transducer

Figure 13-6 – 8220-000-3131 with 8065-121 Right Angled Remote Transducer



APPENDIX A - LOG BOOKS

A. Equipment Log Books

A.1 Deployment and Recovery

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

A.2 Battery Replacement

Date	Time	Reason for Replacement	Name Sign/Print

A.3 Battery Checks

Date	Time	Type of Check	Name Sign/Print

A.4 Repairs

Date	Time	Reason for Repair	Name Sign/Print

A.5 Servicing

Date	Time	Type of Servicing	Name Sign/Print

A.6 Sea State Table

Wave Height (metres)	Wave Height (feet)	Characteristics
0 m	0 ft	Calm (glassy)
0 to 0.1 m	0 to 0.32 ft	Calm (rippled)
0.1 to 0.5 m	0.3281 to 1.64 ft	Smooth (wavelets)
0.5 to 1.25 m	1.64 to 4.10 ft	Slight
1.25 to 2.5 m	4.10 to 8.20 ft	Moderate
2.5 to 4 m	8.20 to 13.12 ft	Rough
4 to 6 m	13.12 to 19.68 ft	Very Rough
6 to 9 m	19.68 to 29.52 ft	High
9 to 14 m	29.52 to 45.93 ft	Very High
Over 14 m	Over 45.93 ft	Phenomenal

GLOSSARY OF TERMS

Term	Definition
Acoustic Responder	An instrument that emits an acoustic signal in response to an electrical signal carried to it by cable.
Acoustic Signal	Information carried by sound pressure waves through water. The Sonardyne acoustic signal has a finite length.
Acoustic Synchronous / Precision Pinger	An instrument that emits signals regularly without an interrogating signal. A SYNCHRONOUS Pinger can be synchronised to an external master signal. A PRECISION Pinger has an accurate internal time standard.
Acoustic Transceiver	An instrument that emits and receives acoustic signals, and extracts information from them. Transceivers can measure the time it takes a signal to travel from its transducer to a transponder and return. Some can encode and send data in a message and extract digital data from a message (Acoustic Telemetry). Used on a surface vessel or to mark a point on the seabed, or fixed to a mobile for tracking or positioning.
Acoustic Transducer	A device that converts electrical signals into acoustic signals and vice versa.
Acoustic Transponder	An instrument that emits an acoustic signal when it detects an interrogating acoustic signal.
Acoustic Transponder (Intelligent Transponder)	A type of transponder that is managed by a micro-controller. Examples include the COMPATT (COMPuting And Telemetry Transponder) and the WMT (Wideband Mini Transponder). Depending on supported functionality it can: Decode acoustic telemetered commands from a transceiver and can send telemetered data to the transceiver. It can measure the distance between itself and other transponders and then telemeter the data to a transceiver. It can be capable of measuring its depth and the temperature of the water. It can be used to measure a variety of underwater parameters and telemeter these back to the surface. It can be used, as an intelligent angle-measuring device, in a Riser Angle Monitoring System. It can be fitted with a release mechanism so it can return, on command, back to the surface e.g. if battery power is low.
ANT	Acoustic Navigation Tester
ANT serial port	Used for diagnostic checks.

Term	Definition
Attitude and Heading Reference System (AHRS)	An inertial sensor that provides outputs of heading, pitch and roll.
CIF	Common Interrogation Frequency
CMOS	Complementary Metal Oxide Silicon. A major integrated circuit technology based on combinations of p-channel and n-channel field effect transistors fabricated on the same silicon substrate. Especially attractive in low-power applications since the basic CMOS logic gate only consumes significant power during switching.
COMPATT	COMPuting and Telemetry Transponder (see Acoustic Intelligent Transponder)
Common Reply Signal (CRS)	A reply signal common to a complete family of addressed transponders.
CPU	Central Processing Unit
CRF	Common Reply Frequency
DAS	A micro-controlled data acquisition and logging sub-assembly located within a transponder.
Data Fusion Engine (DFE)	Acts as the system controller, generates the display signals for the monitor, processes the data from the transceiver for the display to the operator and output to a DP system and talks to various “attitude” sensors and other navigation systems.
Delay between commands	Provides a delay between adjacent commands.
Depth Status	The transponder can be fitted with an optional depth sensor to send depth information at each interrogation.
Differential Global Positioning System (DGPS)	A 24 hour, world-wide radio navigation system. GPS receivers track and decode the data from satellites and calculate the position and speed of a vehicle.

Term	Definition
Dynamic Positioning reference (DP Reference)	Several position inputs e.g. GPS receivers, taut wire sensors, LBL, SBL or USBL acoustic positioning sensors, wind speed indicators etc.
Dynamic Positioning System (DPS)	Automatically maintains a vessel with a constant heading, and in a fixed position without an anchor and provides more flexibility in operation.
Dynamic Positioning telegram (DP Telegram)	The report an acoustic positioning system sends to a DP system over a serial interface.
Digital Signal Processing (DSP)	The representation of signals by a sequence of numbers or symbols and the processing of these signals. DSP includes subfields like: audio and speech signal processing, sonar and radar signal processing, sensor array processing.
Firmware	The firmware installed on the transponder. Firmware upgrades can be installed via WSM Terminal. The Tx firmware refers to the transmission signal synthesiser.
Global Positioning System (GPS)	A multi-user, 24-hour, worldwide radio navigation system using the NAVSTAR constellation of satellites. GPS receivers are capable of tracking and decoding data from the satellites and using it to compute the position and velocity of a vehicle.
HPR	Hydro-acoustic Position Reference
Inertial Navigation System (INS)	A navigation aid that uses a computer, motion sensors and rotation sensors to continuously calculate the position, orientation and velocity of a moving object without the need for external references.
Long Base Line Positioning System (LBL)	A system where two or more transponders are on the seabed. The positions of the transponders are established by a calibration process in a seabed frame. The distances from a transducer to each transponder are measured using a transceiver. The position of the transducer can be computed in the seabed frame. The name comes from the “baselines” joining each transponder.
LUSBL	Long and Ultra Short Base-Line
PSU	Power Supply Unit

Term	Definition
ROV	Remotely Operated Vehicle
Serial Communications Wait	The maximum time allowed for the Transponder to reply to an RS232 command.
SSM	Super Sub-Mini Transponder (WSM predecessor)
Ultra Short Base Line Positioning System (USBL\)	A system similar to an SBL system except the system uses three or more elements in a single transducer array. The measurements it makes are the differences in “time-phase” of the signals from each element. The co-ordinate frame is fixed to the transducer array which must be oriented in the vessel frame to be equivalent to the SBL.
WSM	Wideband Sub-Mini Transponder

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