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UM-8220

Issue A Rev 0

User Manual for: Type 8220 Series AvTrak6 Transceivers



Sonardyne Wideband2® 6 Generation (6G®)

Issuing Office

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CUSTOMER CHANGE REQUEST FORM 0-2

Use this form to tell Sonardyne Int Ltd of any errors or omissions that you find when you use this manual. Your request will be acknowledged and Sonardyne Int Ltd will inform you of any action to be taken.

To: Sonardyne Int Ltd Blackbushe Business Park Yateley Hampshire GU46 6GD – United Kingdom			Fax +44 (0) 1252 876100 e-mail: support@sonardyne.com
Publication: Type 8220 Transceivers AvTrak 6 - User Manual			
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All amendments and additions will be issued with a new copy of this sheet,
Recording the history amendments.

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INTRODUCTION 0-4

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1 **GENERAL**

This User Manual is issued by Sonardyne International Limited.

This User Manual contains all the information necessary to operate and maintain the equipment in an operational environment.

This User Manual contains the technical data, operating instructions, maintenance schedules, maintenance procedures, spares information and all applicable drawings and parts lists.

This User Manual is divided into the sections that follow:

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2 OBSERVANCE OF THE USER MANUAL

This User Manual must only be used by trained and qualified maintenance personnel that are familiar with the equipment included in this User Manual.

It is the responsibility of the customer, to make sure that all operation and maintenance personnel that will operate and maintain the equipment included in this User Manual are correctly trained and qualified.

Before you operate or do any work on the equipment you must read and obey all sections of this User Manual.

You must keep the Equipment Log Book up to date and current.

The procedures and instructions in this User Manual have been provided to maintain the integrity and serviceability of this equipment only.

You must follow all procedures and instructions in this User Manual as they are given. If you do not follow the procedures / instructions correctly, you can cause damage to the equipment, its assemblies, components or parts.

Only the procedures and instructions given in this User Manual have the approval of Sonardyne International Limited. If a necessary procedure or instruction is not given in this User Manual, before you continue you must contact Sonardyne International Limited.

Only the parts given in this User Manual have the approval of Sonardyne International Limited.

You must read and obey all WARNINGS and CAUTIONS given in this User Manual.

For all consumable materials you must also read and obey the manufacturers' health and safety instructions. If the WARNINGS and CAUTIONS given in this User Manual are different to those given by the manufacturer, you must obey those given by the manufacturer.

All operations and work done on this equipment must be done in accordance with the local health and safety and environmental regulations and the safe working practices of the applicable site, installation or operational environment.

3 **WARRANTY**

Sonardyne International Ltd warrants, subject to the following conditions, upon the return of the goods to its works or with prior approval to a local agent, carriage paid, to examine it or them and should any fault due to defective design, material or workmanship be found, to repair the defective part or parts or, at its own discretion, to supply a new part or parts in place of the same free-of-charge.

Any claim under this warranty must be lodged in writing with Sonardyne within twelve months and the part or parts returned to Sonardyne within thirteen months of the commencement of the warranty. The warranty will commence upon the commissioning or putting into service of the equipment or one month from shipment from Sonardyne, whichever is the sooner.

No claim can be accepted for damage due to fair wear and tear, misuse, neglect, dirt, accident, overloading, or other similar causes, and Sonardyne International Ltd judgement in all matters relating to claim shall be final and conclusive and the buyer agrees to accept Sonardyne International Ltd decision on all questions as to defects and as to the exchange of any part or parts.

Goods supplied to buyer's drawings or designs are not warranted by Sonardyne International Ltd to be fit for any particular purpose.

The foregoing warranty is rendered void in any of the following circumstances:

- a) If any seal, safety device, identification, or instruction plates are deliberately broken or removed from the goods.
- b) If any pressure housing has been opened.
- c) If the goods are worked beyond their rated capacity.
- d) If any parts or accessories other than those approved by Sonardyne International Ltd, have been fitted to the goods.

These contractual warranties are in addition to and shall not be construed to modify or limit in any manner any rights or actions which the buyer may otherwise have against Sonardyne by law or statute, or in equity. In the event that agreement cannot be reached the matter will be placed in the hands of an independent arbitrator appointed by the London Chamber of Commerce whose decision shall be binding on both parties.

4 **HOW TO USE THIS USER MANUAL**

Look on the Title page. Make sure this User Manual is applicable to the equipment that you will operate and do work on.

Use the Table of Contents (TOC) to find the applicable section of the User Manual.

Use the applicable sections of this User Manual to do the necessary task.

Before you start a task, read and obey the applicable WARNINGS and CAUTIONS.

To find the applicable part of an assembly or component, refer to [Section 14 – Spares](#).

This User Manual is designed so that you can remove separate sections to make a copy to help you do the task. You must make sure that you return any section or part of the User Manual that you remove.

You must keep this User Manual clean, readable and complete.

You must tell Sonardyne International Limited of any errors that you find when you use this User Manual.

The content of each section of the User Manual is described in the following paragraphs:

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3.1 Technical and Functional Description

Description of the assemblies that make up the equipment and how they operate.

3.2 Technical data

All the equipment Specifications included in the User Manual.

3.3 Operating instructions

This section gives the information necessary to operate the equipment.

3.4 Maintenance

This section gives all the necessary information to maintain the equipment. It includes the recommended lubricants, maintenance codes, schedules and maintenance tasks. The maintenance section also includes any applicable inspections or adjustments. The maintenance tasks do not include any schedule or frequency information.

3.5 Fault Finding and Testing

This section gives the necessary information for the purpose of identifying faults with the equipment. It also includes any necessary functional tests of equipment with test equipment.

3.6 Removal

This section gives the necessary procedures to remove the equipment, assemblies, sub-assemblies or components for the purpose of maintaining the equipment.

3.7 Repairs

This section includes any applicable repair procedures necessary to return the equipment to a serviceable condition.

3.8 Installation

This section gives the necessary procedures to install the components, sub-assemblies, assemblies and equipment, for the purpose of maintaining the equipment.

3.9 Spares

This section gives the recommended spares necessary to operate the equipment in addition to a detailed list of all the replaceable parts installed on the equipment.

3.10 Drawings and Parts Lists

This section gives all the drawings and Parts Lists applicable to the equipment.

3.11 Appendices

This section gives any additional information that is a supplement to the User Manual, but may be necessary to operate and maintain the equipment.

5 **UNITS OF MEASUREMENT**

All dimensions, weights, pressure, torque values, etc. in the User Manual are normally given in metric units. But, when required they will be followed by imperial units in parentheses.

6 **VERIFICATION**

All technical data, descriptive, operational and procedural information given in this User Manual has been approved by Sonardyne International Limited.

7 **GLOSSARY OF TERMS**

NOTE: The terms that follow are general and are not specific to this User Manual.

NOTE: The table that follows contains User Operator Terms, Sonardyne Systems, Signal Processing and Communication Terms and General Terms.

User Operator Terms	
Term	Definition
Acoustic (Transceiver)	An instrument that emits acoustic signals. Used to mark a point on the seabed , or fixed to a mobile for tracking or positioning
Acoustic (Transponder)	An instrument that emits an acoustic signal when it detects an interrogating acoustic signal.
Acoustic (Responder)	An instrument that emits an acoustic signal in response to an electrical signal carried to it by cable
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 Transducer	A device that converts electrical signals into acoustic signals and vice-versa
Acoustic Transceiver	Generates electrical signals for conversion to acoustic signals. It can detect received signals and extract information from them. Transceivers can measure the time it takes a signal to travel from a transducer to a transponder and return. Some can encode and send data in a message and extract digital data from a message (Acoustic Telemetry)

User Operator Terms	
Term	Definition
Acoustic Transponder (Intelligent Transponder)	A type of transponder that is managed by a micro-controller. It is referred to as a COMPATT (COMPUting And Telemetry Transponder). 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. The instrument is 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. Can be fitted with a release mechanism so it can return, on command, back to the surface e.g. if battery power is low. The intelligent transceiver can be a remotely operated.
Acoustic Signal	Information carried by sound pressure waves through water. The Sonardyne acoustic signal has a finite length
Common Reply Signal (CRS)	A reply signal common to a complete family of addressed transponders.
COMPATT	COMPUting And Telemetry Transponder (see Acoustic Intelligent Transponder).
Data Acquisition Sub-Assembly (DAS)	A micro – controlled data acquisition and logging sub assembly located within a transponder.
Database	A body of data stored in a computer memory, magnetic disc media e.g. embedded hard disc or portable floppy disc
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
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.

User Operator Terms	
Term	Definition
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.
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 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 telegram (DP Telegram)	The report an acoustic positioning system sends to a DP system over a serial interface
Geodetic Co-ordinates	The position of any point on or near the earth surface is defined by an angle of latitude and an angle of longitude. For a point on earth P: Latitude is defined as the angle between the normal plane at P and the plane of the earth's equator. Longitude is defined as the angles between the meridians plane through P and the defined zero meridian plane or "Greenwich" plane. (Ref. Geodesy, fourth edition, Bomford, Oxford, sections 2.03 and 4.10(d)).
Gyro Compass	A gyro compass is similar to a gyroscope. It is a compass that finds true north by using an (electrically powered) fast-spinning wheel and friction forces in order to exploit the rotation of the Earth. Gyro compasses are widely used on ships. They have two main advantages over magnetic compasses: They find true north, i.e., the direction of Earth's rotational axis, as opposed to magnetic north. They are far less susceptible to external magnetic fields, e.g. those created by ferrous metal in a ship's hull.
Inclinometer	An analogue device, which measures the angle of the transponder.
Individual Interrogation Signal (IIS)	Signal used to uniquely address a transponder, based on the transponders acoustic address.
Individual Reply Signal (IRS)	Signal used to uniquely identify a reply from a transponder.
Mobile	An object that can move freely between the seabed and the sea surface.

User Operator Terms	
Term	Definition
Monitor/Keypad	A monitor contains a 12 inch colour graphics display and has a keypad for operator input. A later version of this unit has a 17 inch high resolution monitor. The monitor and keypad are split into two separate units. Both are designed for 19 inch rack mounting
Marine Riser Angle Monitoring System (MRAMS)	Used for measuring the angle between the Blow-Out Preventer (BOP) on the seabed and the Riser.
Navigation Sensor Hub (NSH)	The NSH is the interface between the in-water acoustic instruments, sensors and the Navigation Computer which runs the acoustics positioning software.
Remotely Operated Vehicle (ROV)	A vehicle controlled and powered by a cable connection so it can travel between the sea surface and the seabed
Roll, Pitch and Heading (RPH)	Is a compensated vessel frame. This is a frame sharing the same origin as the vessel frame but with the z axis vertical and the y axis parallel with a meridian passing through the origin (points true north)
Seabed	The surface of the earth covered by sea water. The seabed is considered stationary
Spread Spectrum (SS)	Spread-spectrum techniques are methods by which a signal (e.g. an electrical, electromagnetic, or acoustic signal) generated in a particular bandwidth is deliberately spread in the frequency domain, resulting in a signal with a wider bandwidth. These techniques are used for a variety of reasons, including the establishment of secure communications, increasing resistance to natural interference and jamming, to prevent detection, and to limit power flux density.
Unit Identification Number (UID)	Each product produced by Sonardyne Int Ltd contains a unique 24bit address.
Wideband Test Terminal (WTT)	PC software for testing transponders.
Sonardyne Wideband®2	6G® transponders and transceivers use Sonardyne Wideband® 2 which has ultra-wide bandwidth signals giving a faster and robust transmission of data, more precise ranging and mitigation from multipath in shallow water and amongst steel structures in deepwater.
6 Generation (6G®)	6G® technology gives a better performance, easier to use, more functions, equipment flexibility and compatibility with aided inertial technologies.

Sonardyne Systems	
Term	Definition
Long-Base-Line (LBL) System	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. It is can be to as a range-range system
Short-Base-Line (SBL) System	A system where three or more transducers are fixed to a vessel and connected to a single transceiver. The position of each transducer is measured and co-ordinated in the vessel frame. By measuring the time of arrival of the signal from a transceiver at each transducer the position of the transceiver in the vessel frame can be computed.
Ultra-Short-Base-Line (USBL) System	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 system.
Long-Ultra-Short-Base-Line (LUSBL) system	A hybrid of an LBL and a USBL system. It utilises USBL equipment in an LBL configuration.
Dual-Redundant LUSBL System	Two complete sets of LUSBL equipment working in tandem on a master/slave basis. The two sub-systems are cross-linked so that, in the event of a failure of any major elements, system operation will continue without the need for operator intervention. Operation of the dual-redundant version is identical to that of the standard version.
EHF	Extra-High Frequency (50-110kHz)
HF	High Frequency (35-55kHz)
LF	Low Frequency (7.5-15kHz)
MF	Medium Frequency (18-36kHz)
Sound Speed	If seawater is at a constant temperature, salinity and pressure the speed at which sound travels in seawater is constant

Sonardyne Systems	
Term	Definition
Sound Speed Profile	At different depths the temperature, salinity and pressure vary, so the local sound speed varies. Depth cannot be measured directly. So pressure measurements are taken, and the depth calculated, using knowledge of density. Derivation of density requires knowledge of temperature and salinity. Salinity cannot be measured directly but conductivity can be measured. A method of measuring the sound speed profile is from a profile of pressure, temperature and conductivity and a formula to compute depth and sound speed.
Submersible	A vehicle that operates below the seas surface. It can carry men in a one atmosphere environment with one man piloting the craft. It has a supply of air for the crew and a supply power for propulsion etc. It can operate autonomously form a vessel for a limited time.
True North	The direction of the shortest line that can be drawn, across the surface of the earth, from the observer and the north pole. (The north pole is where the north end of the spin axis of the earth meets the surface.)
Universal Transverse Mercator (UTM)	A Projection system that is used to transform Geodetic co-ordinates into an orthogonal two dimensional system suitable for representation on a plane such as a chart. The co-ordinates are called easting and northing which are equivalent to x and y respectively. The UTM system is a world wide system. Each projection covers 6 degrees of longitude with the central meridian at 3, 9 degrees etc east of Greenwich and from 84 degrees north to 80 degrees south. The scale factor on a central meridian is 0.9996 (with some exceptions). The projection is orthomorphic this means at a point the scale in all directions is the same there is no local distortion. NOTE: Scale factors change with distance from the central meridian. For points away from the central meridian grid north and true north diverge. The difference is called the CONVERGENCE which is positive when grid north is east of true north. The point where the central meridian meets the spheroid equator is given a false easting of 500,000 m. Many countries' mapping systems are based on the same system but use a particular reference spheroid.

Sonardyne Systems	
Term	Definition
Vertical Reference Gyroscope (VRG)	A gyroscopically stabilised VRU.
Vertical Reference Unit (VRU)	Measures the instantaneous roll and pitch of a vessel
Vessel	A body floating in the sea with at least part of it penetrating the surface. It is free to move and rotate relative to the seabed.

Signal Processing and Communications Terms	
Term	Definition
Bore-Sight	The axis about which the transducer maximum power gain is being directed.
Capture Area	The effective aperture size of the array. It is directly related to the array gain.
Configuration Status (CS)	
Directivity Index	This is the ratio of the radiation intensity in the direction of interest compared with an isotropic radiator.
False Alarm	An invalid signal which has satisfied all of the detection criteria, and the detection process incorrectly declares a valid signal.
False Alarm Number	Predicts the average number of possible decisions between false alarms
False Alarm Probability	The resultant probability of all the false alert probabilities.
False Alarm Rate	Predicts the number of false alarms that will occur in a specified time.
False Alert	An invalid signal has satisfied one detection criteria and the detection process incorrectly declares a valid signal.
False Alert Rate	Predicts the number of false alerts that will occur in a specified time.
Front to Back Ratio for a Transducer	Is the ratio of power transmitted in the forward hemisphere of the polar diagram to that transmitted in the reverse hemisphere of the polar diagram.
Kalman Filter	An adaptive filter that provides optimum filtering of a signal that has been subjected to a non-stationary environment (i.e. when the data is significantly changing during the filter convergence time).
Signal to Noise Ratio (SNR)	This is the ratio of the signal power to noise power in unit bandwidth generally quoted in dB.

General Terms	
Term	Definition
Access	A procedure to get to an assembly, component or part to do a specific task
Adjust	To change the position of a part to get a specified setting
Align	To make two or more parts come together
Applicable	That which is correct
Assemble	To put together a set of components or parts to make a sub-assembly or assembly
Attaching Parts	Parts such as nuts, washers and bolts that connect two units together
Calibrate	To check and set the accuracy of a unit or item of equipment against a known specification
Check	To visually examine fluid level, or assembly, sub-assembly, component or part to make sure it is correct
Consumable Materials	Materials such as fuels, oils, lubricants, greases, adhesives, paints, primers, cleaning agents etc., which can be used during the servicing and maintenance of equipment
Disassemble	To take apart an assembly or sub-assembly to its individual components or parts
Discard	To throw away an item that can only be used once
Examine	To look carefully at
Fault Finding	To investigate a malfunction or problem to find its cause
Inspect	Examine a component or part against a specific set of limits
Install	To correctly and tightly attach one assembly, sub-assembly, unit, component or part to another
Lubricate	To apply an oil, grease or lubricant to an assembly, sub-assembly, unit, component or part to reduce friction and wear
Maintain	To keep equipment or an item in its original condition
Maintenance	A set of periodic schedules to maintain equipment in a serviceable condition
Malfunction	A condition of equipment or a component that prevents it from working correctly
Operate	To make an item of equipment work

General Terms	
Term	Definition
Overhaul	Maintenance operation to completely return an assembly, sub-assembly or component to a serviceable condition
Pack	The procedure required to prepare equipment for storage and or transportation
Preserve	To prepare equipment for storage and transportation that keeps it in a serviceable condition
Remove	To correctly detach one assembly, sub-assembly, unit, component or part
Repair	A procedure to return a damaged or worn assembly or component to a serviceable condition by replacing a non-repairable part. A procedure to return a damaged or worn part to a serviceable condition by the process of welding, grinding, priming or painting
Replace	To remove an unserviceable assembly, component or part and to install a new or serviceable assembly, component or part
Replenish	To keep the quantity of fluids or gases to a specific level
Serviceable	The condition of a part, component or assembly that makes it correct for use
Test	A procedure to make sure that equipment operates in its specified limits
Unpack	A procedure to remove equipment or a component from transportation cases or packaging
Wet Assemble	To apply applicable oils, greases or lubricants to attaching parts or components or parts before assembly

General Terms	
Abbreviation	Definition
AC/DC	Alternating Current / Direct Current
Ah	Amperes Per Hour
A/R	As Required
Assy	Assembly
Aux	Auxiliary
Baud	Bd
BOP	Blow Out Preventer
bps	bits per seconds
BS	British Standard
Cg / COG	Centre of Gravity
cm	Centimetre
COR	Centre of Rotation
COSHH	Control of Substances Hazardous to Health
dB	Decibel
°C	Degree Centigrade /Celsius
°F	Degree Fahrenheit
DWG	Drawing
<i>f</i>	Frequency
Fig.	Figure
g	gram
GA	General Arrangement
HDR	High Data Rate
Hz	Hertz
in.	Inch
kg	Kilogram
kHz	Kilo Hertz

General Terms	
Abbreviation	Definition
kN	Kilo Newton
lb	Pound
lbf in.	Pounds force inches
lbf/in ²	Pounds force / square inch
m	Metre
m/s	Metres per second
Max.	Maximum
μs	Microsecond
mg	Milligram
Min.	Minimum
mm	Millimetre
ms	Millisecond
mW	Milliwatt
Nm	Newton Metre
No.	Number
OEM	Original Equipment Manufacturer
OIM	Offshore Installation Manager
UM	User Manual
PM	Phase Modulation
PPE	Personal Protective Equipment
ppm	Parts per million
psi	Pounds per square inch
s	Second
STBD	Starboard
SV	Sound Velocity m/s
SWL	Safe Working Load

General Terms	
Abbreviation	Definition
t	tonne
T	Ton
V	Volt
Wh	Watt hour
<	Less than
≤	Less than or equal to
>	More than
≥	More than or equal to

8 **GENERAL SAFETY PRECAUTIONS**

The general safety precautions that follow are not specific to any installation or equipment.

You must read and obey all the operator's local Health and Safety regulations and Safe Working Procedures or Practices.

You must read and obey all procedures and instructions contained in this User Manual.

It is the RESPONSIBILITY of ALL PERSONS that work on or near an installation to make sure that they:

- DO Work with and obey all persons that have responsibilities for the safe operation of the applicable installation.
- DO Report any defect of any equipment that can cause danger to the safety, health and welfare of persons that work on or near the installation.
- DO Use equipment only for the purpose for which it is provided.
- DO NOT Act in a way on or near the installation, that can cause a danger to you or other persons that work on or near the installation.
- DO NOT Cause any equipment used on or near an installation to be unsafe.
- DO NOT Remove any WARNING signs without permission.
- DO NOT Remove any safety equipment without permission.
- DO NOT Disconnect or connect any power source without permission.

When you do a procedure or task you must make sure that:

- a) You wear all applicable Personal Protective Equipment (PPE).
- b) You do not cause injury to you or other persons.
- c) All applicable cranes and lifting equipment are serviceable and calibrated and have the correct Safe Working Load (SWL) for the task.
- d) You use only the approved tools, consumable materials and spares to operate and maintain the equipment.
- e) You turn off and isolate all applicable power sources and that applicable WARNING signs are put in a position so that they are easy to see and read.
- f) You read and obey all applicable WARNING signs.
- g) You and other persons necessary to do the task have the correct serviceable communication equipment.
- h) All work areas are clean and clear of unwanted tools, equipment and materials.
- i) All unwanted consumable materials are discarded in accordance with local health and safety and environmental regulations.

9 HAZARD APPRECIATION

Subsea equipment is safe in use when operated and handled within standard operating procedures and written guidelines, in normal operation no threat is posed to the safety of individuals or instruments.

All subsea units when internally pressurised are capable of posing a threat to personnel safety. Great care must be taken when this happens, or is even suspected to have happened. The pressures present within the instrument are extremely high. Internal pressure may also be caused by unknown chemical hazards if battery breakdown has also occurred.

- a) Possible hazardous situations are listed as follows:
- b) Pressure housing becomes internally pressurised by water pressure, following a leak
- c) Pressure housing becomes internally pressurised due to battery malfunction
- d) Attempting to charge non-rechargeable battery packs/cells
- e) Using an instrument outside its design parameters
- f) Failing to maintain the equipment
- g) Using unauthorised components.

10 GENERAL HANDLING OF EQUIPMENT

Do not drop or expose instruments to shock damage this can cause sensitive internal components to fail. Minor damage to metal finishes creates burrs which present a hazard to unprotected hands or other parts of the body. Do not allow an instrument to block an access or impede normal traffic flows in a gangway or on a stairway.

11 DISMANTLING SUB-SEA EQUIPMENT

All sub-sea equipment fitted with pressure housings are subject to a vast range of externally applied pressures and may have an internal pressure rise if, a leak occurs or the unit's battery destructs. Internal pressure is dangerous situation and all applicable safety measures must be enforced. Fumes given off by deteriorated batteries, particularly lithium based types, are health hazard. Use all applicable safety precautions.

There is likely to be no indication to the presence of internal pressure. First indications will be the end-cap(s) of the unit forced out of the housing under pressure during the dismantling process.

Indications of high internal pressure are as follows:

- a) Equipment that failed when deployed, in transit or storage
- b) Equipment stored for a long time with batteries connected
- c) Equipment suffering from physical damage.

When a unit has leaked it behaves like a valve, i.e. water pressure causes a rise in internal pressure which cannot then escape as the point of leakage becomes sealed. Complete removal of an end-cap's retaining mechanism means that it becomes unconstrained and therefore free to be discharged from its housing under high internal pressure a potentially lethal situation.

CAUTION

Do not transport equipment which is internally pressured.

11.1 INSTRUMENTS FITTED WITH SPRUNG VENT PLUGS

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

A normal unit may emit an audible rush of air when the vent plug is retracted, but it will only last for 1 second maximum. A longer rush of air/gas indicates a pressurised unit, ventilate the area, and let the remaining pressure out of the unit. Internal pressure dissipates to atmosphere in a short time and may be accompanied by water, debris, noise etc. Only authorised personnel may enter the vicinity of the work.

11.2 PRECAUTIONS (INSTRUMENT FULLY FUNCTIONING)

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

11.3 PRECAUTIONS (INSTRUMENT KNOWN OR SUSPECTED TO BE PRESSURISED)

If an instrument is known, or suspected to be internally pressurised through water ingress or battery venting use the safety precautions that follow:

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

Wear the applicable protective clothing, safety glasses and gloves, and refer to battery manufacturer's Material Safety Data Sheet (MSDS).

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

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

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

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

12 INSTRUMENT LOAD BEARING CAPABILITY

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

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

It is the operator's responsibility to make sure the condition of the equipment and a safe lifting method is being used for any operation.

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

Shackles must be used in release systems to make sure freedom from corrosion. It is important that instruments, their release mechanisms and shackles form part of a complete system.

13 FLOATATION EQUIPMENT

Floatation equipment is fitted to subsea transponders to aid their recovery after a deployment is complete. A nett upthrust requirement is in the technical data for any particular instrument.

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

02 TECHNICAL AND FUNCTIONAL DESCRIPTION TYPE 8220 WIDEBAND TRANSCEIVERS (AVTRAK 6)

Contents

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<u>3</u>	<u>MODES OF OPERATION</u>
<u>3.1</u>	<u>SONARDYNE WIDEBAND®2 TRANSPONDER</u>
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1 **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. (Ref: 4)

2 **SYSTEM DESCRIPTION**

2.1 **TYPE 8220 AVTRAK 6**

The AvTrak 6 supports two transponder operating modes: Sonardyne Wideband® 2 and 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.

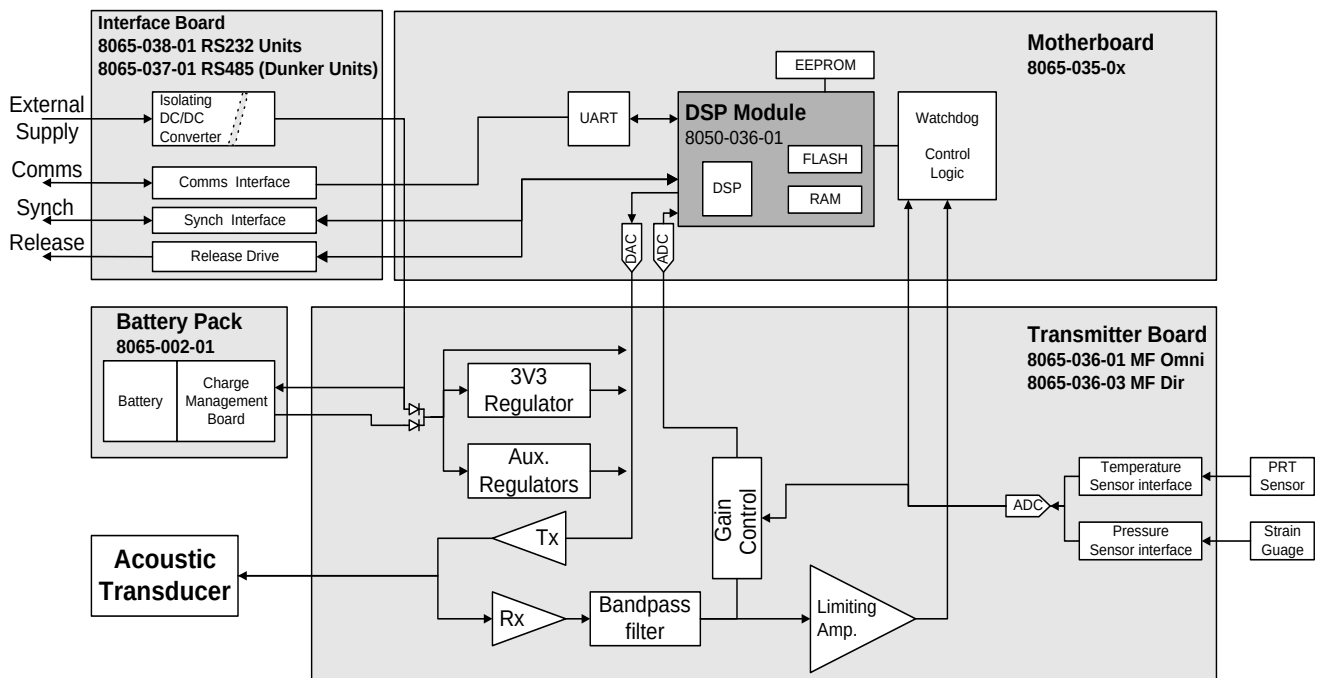
All AvTrak 6 units are, by default, configured to use RS-232C communications protocols.

An underwater connector is fitted to the bottom end-cap to provide power and serial comms to the electronics bottle. The connection are provided for External Power In, Synch In/Out, Release Drive Out and RS232 comms. For details of this connector (Ref: [03 Technical Data](#)).

For outline drawings of the current versions (Ref: [15 Drawings](#)).

The full interfacing details including communications, power and operating modes (Ref: [04 Operating Instructions](#)).

Internally, the unit consists of an electronics assembly suspended between the two end-caps. A block diagram of the electronics assembly is shown (Ref: [Fig 1](#)).



AvTrak 6 Block Diagram
 Figure 1

3 MODES OF OPERATION

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

- a) Sonardyne Wideband ® 2 Transponder Mode.
- b) Simrad HPR400 Transponder Mode.
- c) Transceiver Mode.
- d) Sonardyne Acoustic Messaging Mode.
- e) 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 ensuring that transponder mode interrogation cycles are run asynchronously to transceiver mode cycles.

3.1 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.

3.2 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.

3.3 TRANSCIEVER 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 SONARDYNE ACOUSTIC MESSAGING

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

3.5 **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.

4 **6G® WIDEBAND®2 PRODUCT RANGE**

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

- a) Compatt 6 (Type 8300 red band), is Sonardyne's standard LBL and USBL acoustic 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.



- c) Autonomous Monitoring Transponder, AMT (Type 8305). The AMT has the same capability as a Compatt 6 and an additional capability to periodically log 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.



- 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.



- 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.



- f) Remotely Operated Navigation Transceiver, ROVNav6 (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.



03 TECHNICAL DATA

TYPE 8220 WIDEBAND TRANSCEIVERS (AVTRAK 6)

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1 8220 SERIES TRANSCIVERS

1.1 MECHANICAL – TYPE 8220-3111

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

1.2 MECHANICAL – TYPE 8220-7211

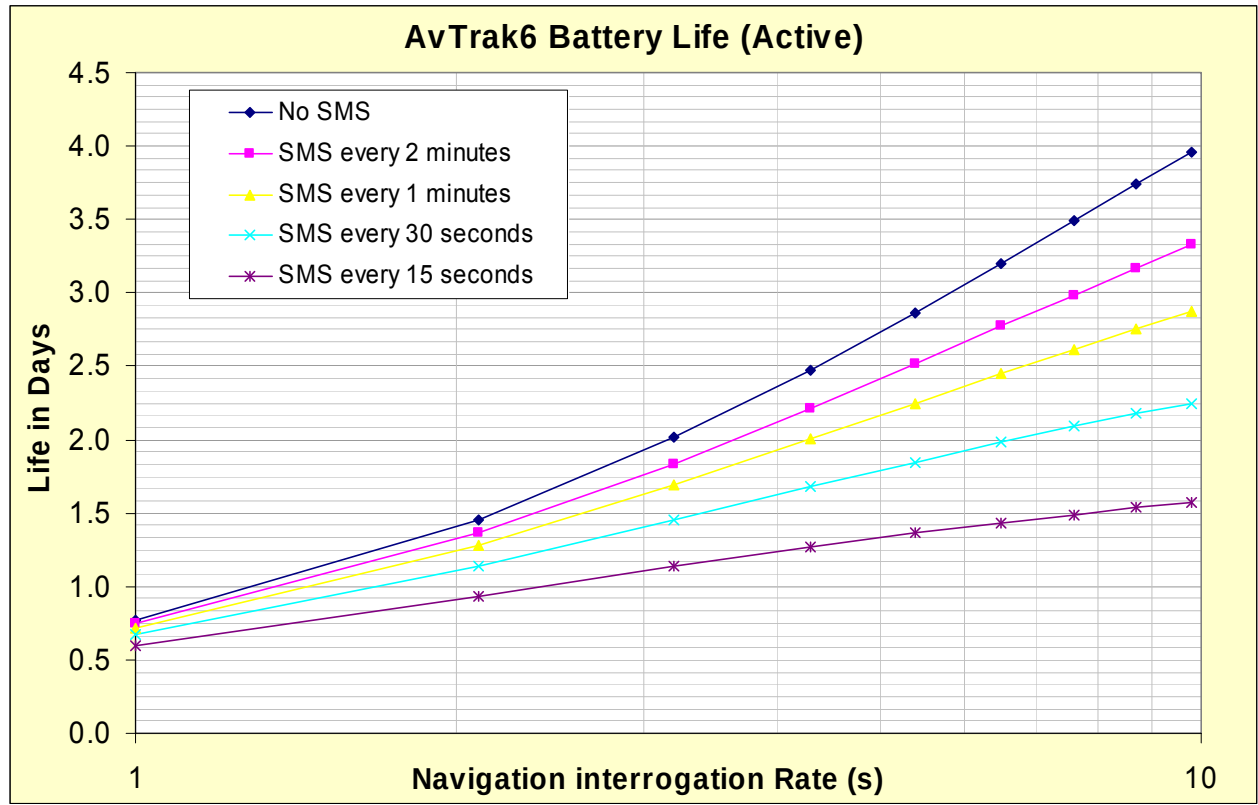
MF Directional Unit	
Parameter	Specification
Diameter	98mm (3.9ins)
Overall length	511mm (20.1ins)
Weight in air	7.0kgs (15.4lbs)
Weight in water	3.5kgs (7.7lbs)
Max Operating Depth	7000m

1.3 MECHANICAL – TYPE 8220-3161

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

1.4 POWER

External Supply Operating Range	18V to 50V DC
Quiescent Power	<2W over supply voltage range <6W when battery is charging
Peak Power	50W
Battery Life (Shutdown State)	~30 days
Battery Life (Navigation cycle every 4 seconds and short SMS every 2 minutes) (Active Ref: Fig 1)	~2 days
Battery Type	15V Lithium-ion (Li-ion), 2.35 Ah, 35.25Wh
Battery Pack Features	The battery pack is formed of 4 series connected Lithium Ion cells. 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 (Ref: 10 BATTERY SAFETY)
Battery Charge Rate	Fast charge to 85%- Approximately 10Hours Top off charge to 100% – Additional 10 Hours.



AvTrak 6 Battery Life (Active)
Fig 1

1.5 ACOUSTIC

Transducer Type		Omni-Directional	Semi-Directional
Transducer beam shape	@ 25kHz	+/- 120 Degrees Hemispherical	+/-35 Degrees
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·@1m	187/181/169	193/187/169
Pulse length, Tone	ms	10	10
Pulse length, Wideband	ms	8	8
CIS Turn-around delay (Default)	ms	200	200
Time resolution	μs	1	1
Typical Range Repeatability/Accuracy (Wideband)		1cm/3cm	1cm/3cm

1.6 ENVIRONMENTAL

Parameter	Specification
Temperature Operation	-5° to 50° C (23° to 122° F)
Temperature Storage	-20° to 50° C (-4° to 122° F)

1.7 SYNCHRONISATION OUTPUT (SYNC PIN)

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

1.8 RESPONDER INPUT TRIGGER (SYNC PIN)

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

1.9 COMMUNICATION PORT

Type	RS 232
Baud Rate (default)	9600 baud (8 data bits, no parity, 1 bit stop) Configurable to 115200 baud

1.10 SENSORS

Depth/Pressure Accuracy	$\pm 0.2\%$ Full Scale	
Pressure Reporting Units	(PRESS command)	psi
	(SENS command)	kPa
Depth Reporting Units	(DEPTH command)	metre
Depth scaling	(DEPTH command)	0.68525 m/psi
Temperature Accuracy	(TEMP/SENS command)	± 0.25 °C -10 to +40 (± 77 °F 14 to 104)

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

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

1.12 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 AvTrak6 or Fusion Ultra-Short BaseLine (USBL) transceiver. When activated, this output produces a regulated positive +12 volt pulse of 15 minutes duration with a current capability of 300mA. The output is on Subconn Pin 2 relative to the Comms Ground on Subconn Pin 4.

Short circuit protection is provided a by a resettable polymeric device.

1.13 NETT UPTHURST

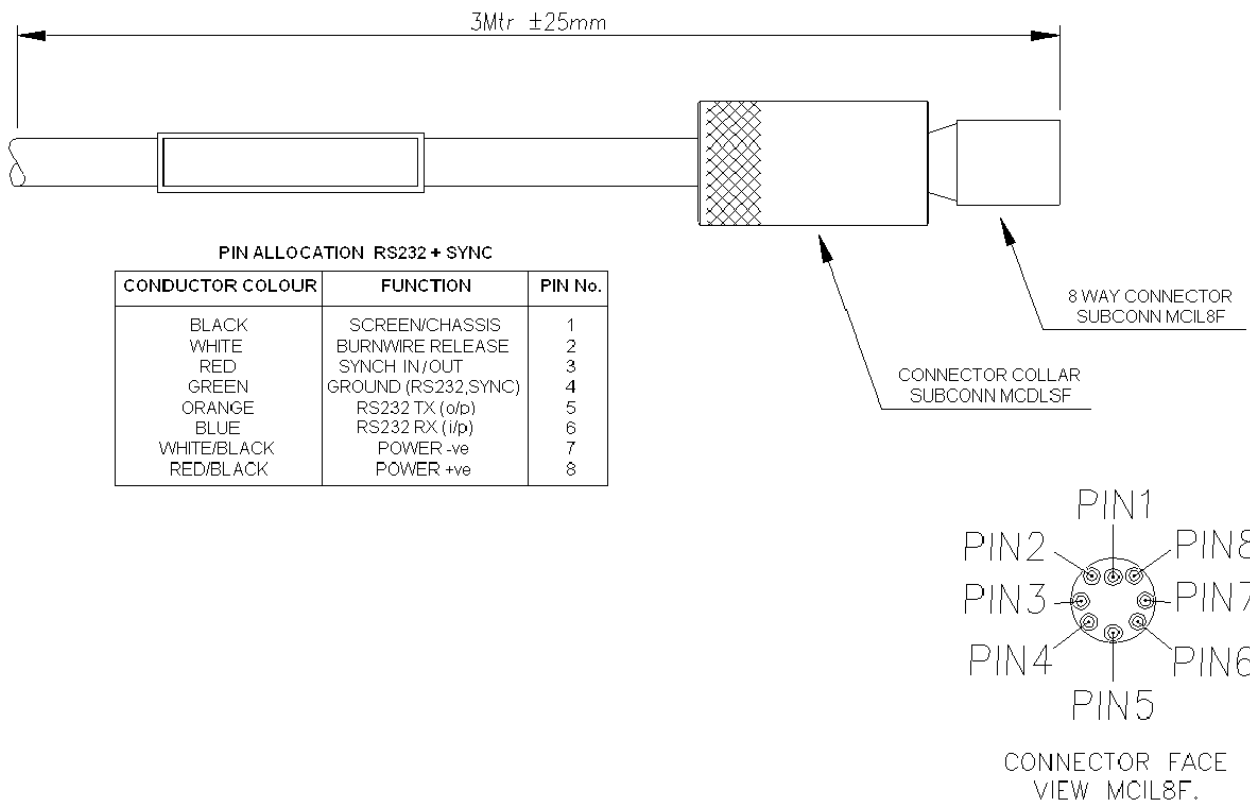
Is the difference between the net buoyancy of the float and the total weight of an object, or objects, in water that it is supporting, e.g.

Nett Upthrust = (Minimum nett buoyancy of the Float) - (the weight of the instrument)

1.14 EXTERNAL CONNECTIONS

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

Mating Cable Tail



2 **HOUSING LABELLING**

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

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

2.1 **SERIAL NUMBER**

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

2.2 **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

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

2.3 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.

2.4 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.

2.5 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.

Address Range	Signal Type	Purpose
0101 – 1514	WBv1	Backward compatibility with 5G (Compatt 5 and GDT USBL)
1701 – 3114	WBv2	Standard Navigation 6G
5001 – 6314	WBv2+	Advanced navigation and telemetry for harsh environments; noisy and reverberant.

3 **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 eight 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 'turn around time' logic circuits in the transponder and transmitter generate a powerful acoustic reply. The reply is on a different channel to the interrogation signal, but 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:

- a) Measures the total time delay = A
- b) Subtracts the turn around delay = B
- c) This gives the true time delay = C
- d) Multiplies by the speed of sound in water = D
- e) This equals the two way range = E.

$$A - B = C$$

$$C \times D = E$$

Sound is reflected by the sea surface, seabed and other reflecting surfaces. This causes a received signal to appear much longer in duration than the 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 turn around time is fixed to 320ms.

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 turn around 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 turn around 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.

3.1 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.

3.2 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.

3.3 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.

04 OPERATING INSTRUCTIONS

TYPE 8220 WIDEBAND TRANSCEIVERS (AVTRAK 6)

Contents

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<u>4</u>	<u>WATCHDOG FUNCTION</u>
<u>5</u>	<u>SYSTEM CONFIGURATION</u>
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1 **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 (Ref: [14 Recommended Spares](#)).

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

2 **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:

- a) Command Language V1.04

3 **HARDWARE RESET AND STARTUP**

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 20ms 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 hardware reset the AvTrak 6 firmware is reloaded from 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).

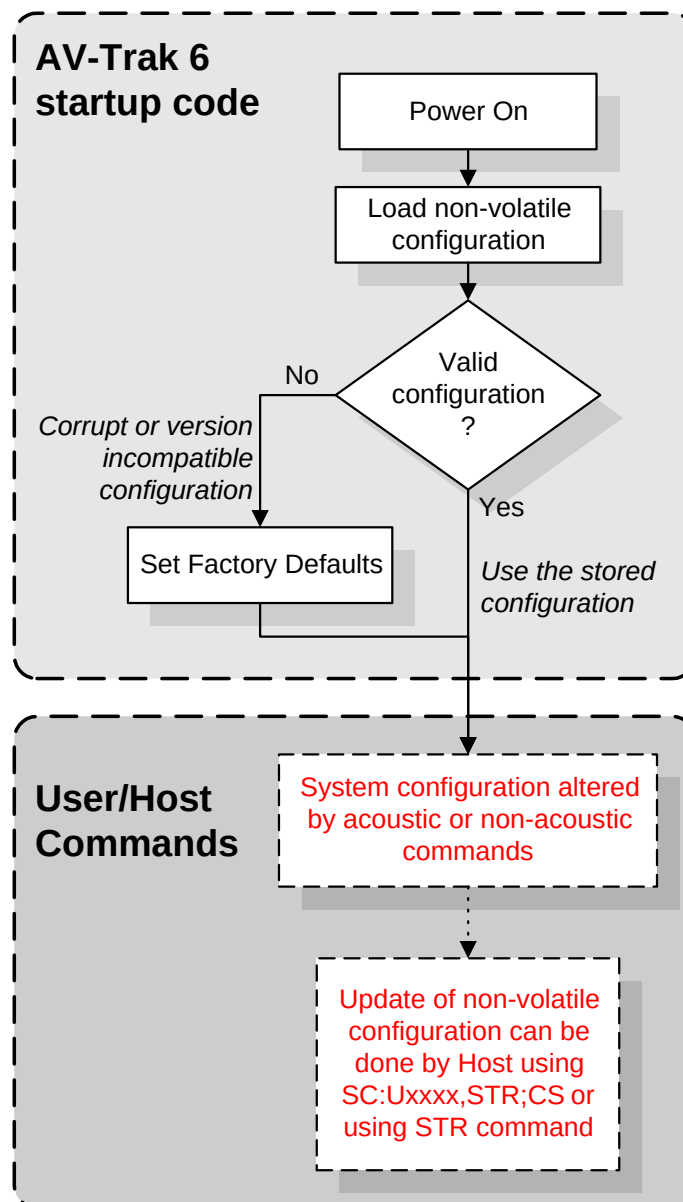
4 **WATCHDOG FUNCTION**

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 wake-up message. The configuration will be reloaded from non-volatile memory (EEPROM).

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 (except debug mode) will be retained even after power cycling.

The start-up sequence and recommended user/host configuration (Ref: [Fig1](#))



Start up Sequence
Fig 1

6 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:

1. CMD text is case sensitive.
2. 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.
3. Because the command protocol supports parameter persistence, the C13 parameter must be explicitly reverted back to C0 to send standard text SMS.
4. 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

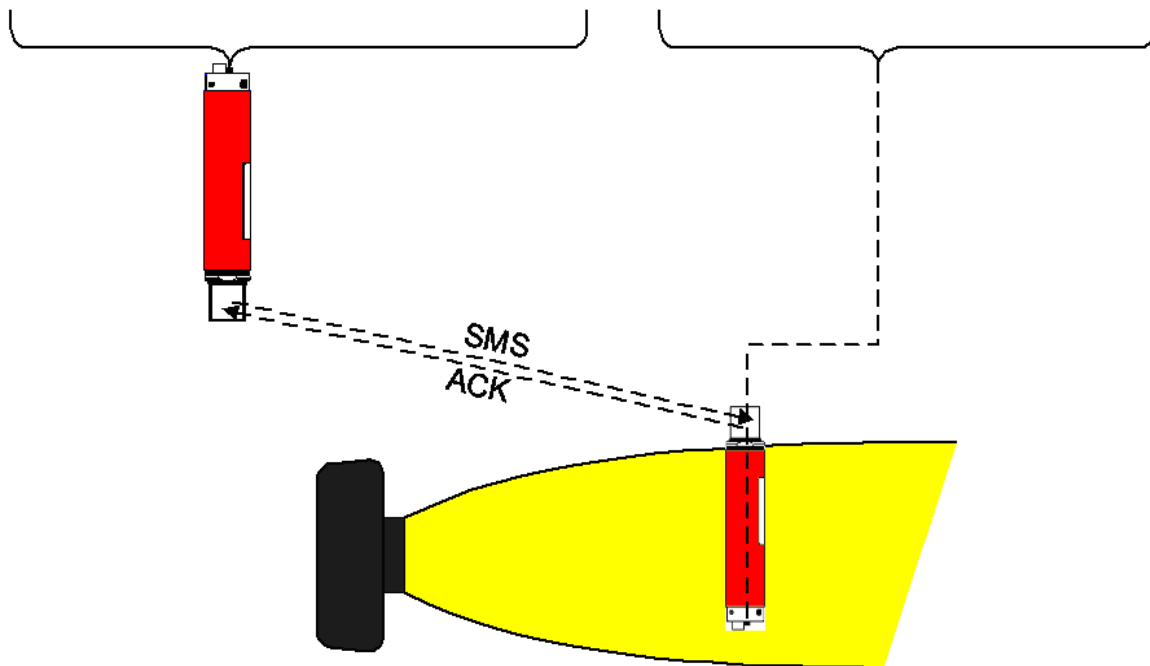
Example: SMS:1013;W1,P0,C13,A1,R0|CMD:BURN

6.1 EXAMPLE COMMAND TRANSACTION

The sending transceiver must be an SMS enabled Sonardyne transceiver such an AvTrak 6 or Fusion Ultra-Short Baseline (USBL) 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:

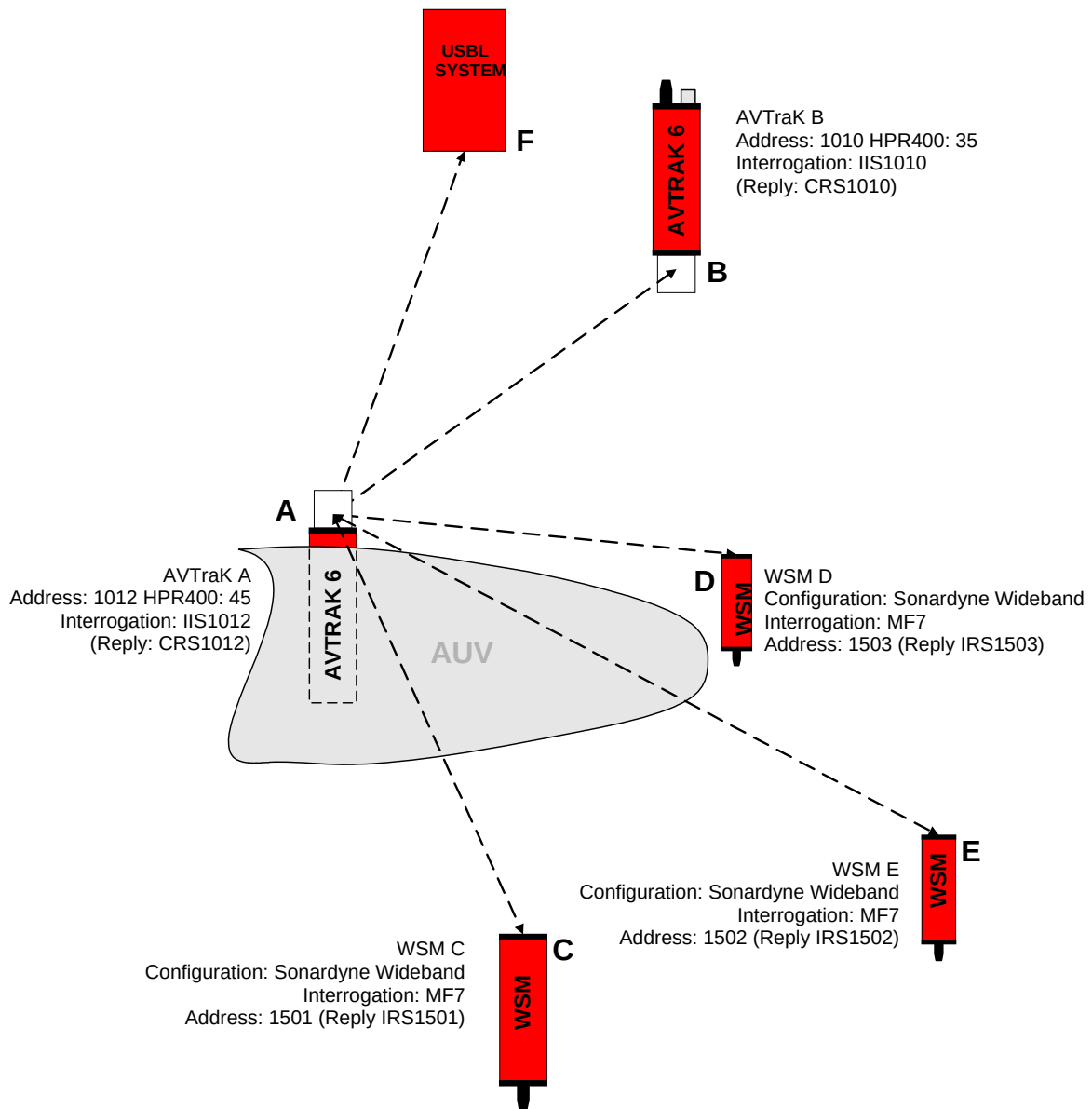
Sending Transceiver	AvTrak 6
SMS: 1001,PO,C13,A1,W1,R0 CMD:ABORT SMS: 1001,ACK	SMS:1001,C13 CMD:ABORT
SMS: 1001,PO,C13,A1.W1,R0 CMD:BURN SMS: 1001,ACK	SMS:1001,C13 CMD:BURN
SMS: 1001,PO,C13,A1,W1,R0 CMD:Burn SMS: 1001,ACK	Invalid command not delivered to Host "Burn" is incorrect case.



Example Command Transaction
Fig 2

7 OPERATING SENARIO

The following drawing (Ref: [Fig 3](#)) outlines a typical multiple asset operating situation.



A possible operating scenario
Fig 3

7.1 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)

7.2 ASSET CONFIGURATION

The two AvTrak 6s are configured with different device addresses. Three Wideband Sub-Mini Transponders 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 (Note 1)
D	WSM	Configure using WSM Terminal: Nav Scheme: Sonardyne Reply Type: Wideband Interrogation: MF7 Address:1502	Tone interrogate on MF7 WSM Replies in IRS1502 (Note 1)
E	WSM	Configure using WSM Terminal: Nav Scheme: Sonardyne Reply Type: Wideband Interrogation: MF7 Address : 1503	Tone interrogate on MF7 WSM Replies in IRS1503 (Note 1)
F	USBL System	Set to interrogate on HPR400 B45(AvTrak on AUV)	

Note 1: For compatibility with 6G® Wideband®2 the WSM wideband address must be ≤ 1514 .

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 MF7 as 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 note 2.	AvTrak B interrogate AvTrak A on its Individual interrogation Signal.
A	B	MR:1010 See note 2.	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

NOTE 1: 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.

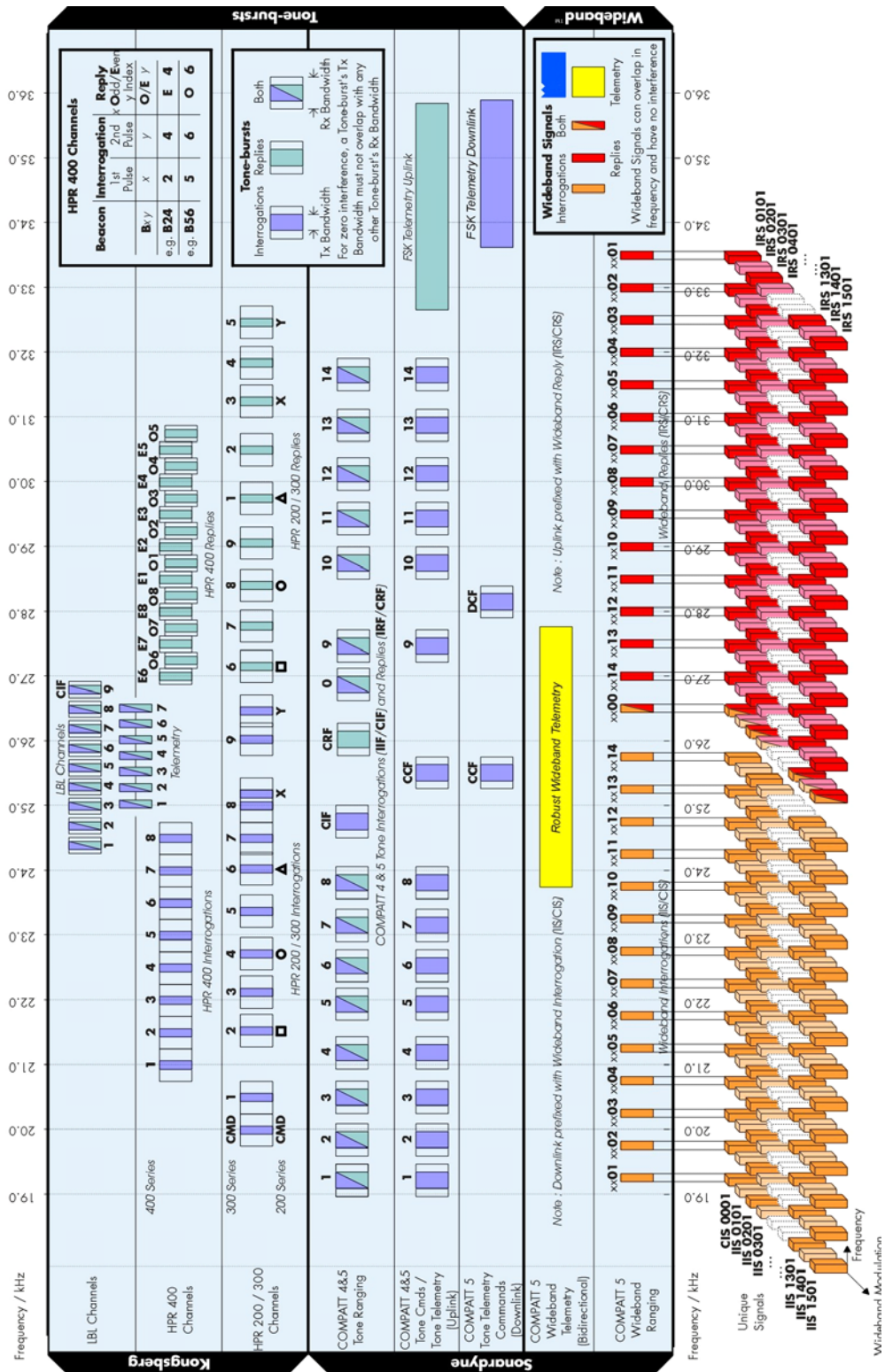
NOTE 2: If the remote AvTrak 6 is in sleep mode then the master should send the MR command with the default wakeup signal enabled for example: MR:1010;W1.

8 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. For further details (Ref: [08 Operational Test](#)).

9 TONE AND WIDEBAND SIGNAL CHART

Sonardyne Wideband™



05 MAINTENANCE AND STORAGE TYPE 8220 WIDEBAND TRANSCEIVERS (AVTRAK 6)

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13 RECOMMENDED LUBRICANTS

14 MAINTENANCE CODES AND SCHEDULE

1 8220 TRANSCIVER MAINTENANCE

1.1 TOOLS

Part Number	Description
641-3332	Opening Tool End-cap
N/A	Allen keys 2.5mm, 4mm
N/A	Nut Spinner 8mm
N/A	Screw M4

1.2 CONSUMABLE MATERIALS

Specification	Description	Qty
Local Supply	Fresh water	A/R
Local Supply	Clean Lint Free Cloths	A/R
Local Supply	Petroleum jelly	A/R
Local Supply	Loctite 243 threadlock	A/R
Local Supply	Rope	A/R

1.3 PREPARATION.

1. Before you do this task, read and obey the General Safety Precautions (Ref: [0-4 Introduction, Section 8](#)).
2. Before you do this task, disconnect the electrical power to the equipment.
3. Make sure there is sufficient access to the work area.
4. Make sure you wear the correct protective clothing and equipment.
5. Make sure the work area is clean and clear of unwanted equipment and materials.

1.4 CLEAN

6. Hose down the transceiver with fresh water.
7. Remove any unwanted marine growth.
8. Dry the transceiver with clean lint free cloths.

1.5 EXAMINE

1. Check all cables and connections, for abrasion, cracks and splits.
2. Check the guard for distortion.
3. Check the anodised area of the housing for exposed metal (Ref: [09 Repair](#)).
4. Check the vent plug is sitting flush on the sensor end-cap.
5. Check the connector contacts for corrosion.
6. Check the clamp ring bolts for corrosion.
7. Check the plastic clamp ring insulators are in place.

2 BATTERY LIFE

2.1 EXTENDING

1. Use the lowest transmit power that conditions will allow.
2. Use a slower update rate.
3. If the AvTrak is to be put into storage, disconnect the battery by sending the appropriate SC: command directly or use the Wideband Test Terminal (Ref: [08 Operational Test, Sub-Para 1.4.5](#)).

2.2 RECHARGING

NOTE: The AvTrak 6 contains a rechargeable Li-Ion battery. (Ref: [10 Battery Safety](#))

4. Use the WTT application to determine the status of the Battery and to ensure it is electronically connected. (Ref: [08 Operational Test, Sub-Para 1.2 and 1.3](#)) as shown in [Fig 1](#). If the battery is electronically disconnected an external supply will be required to power-up the AvTrak6.

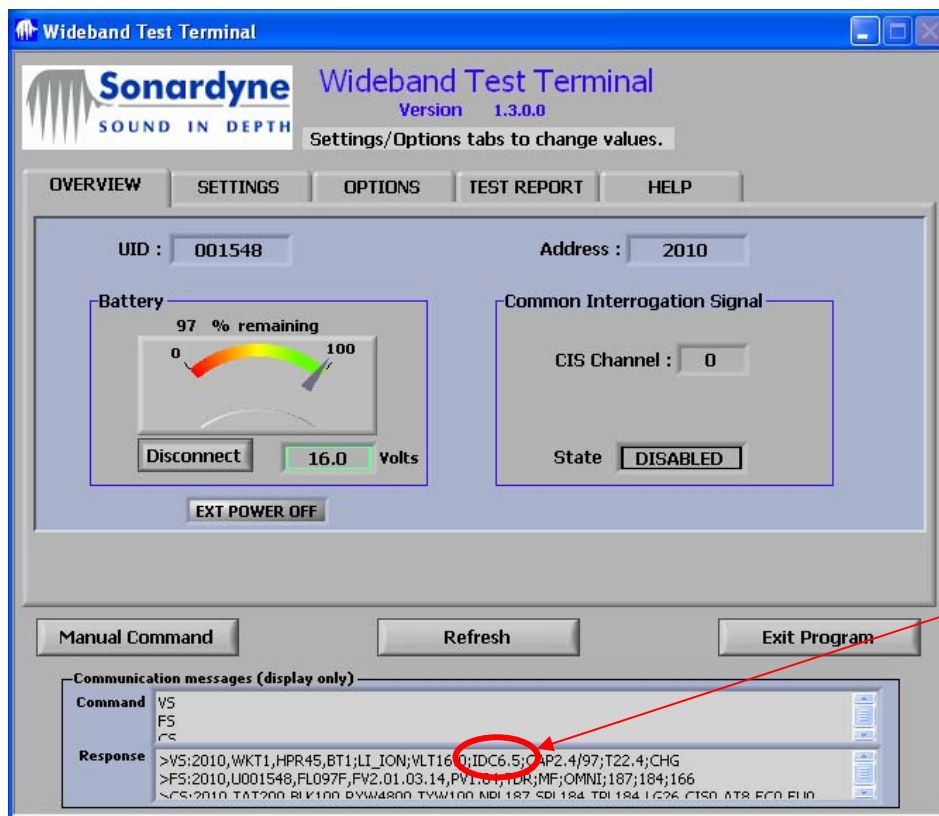
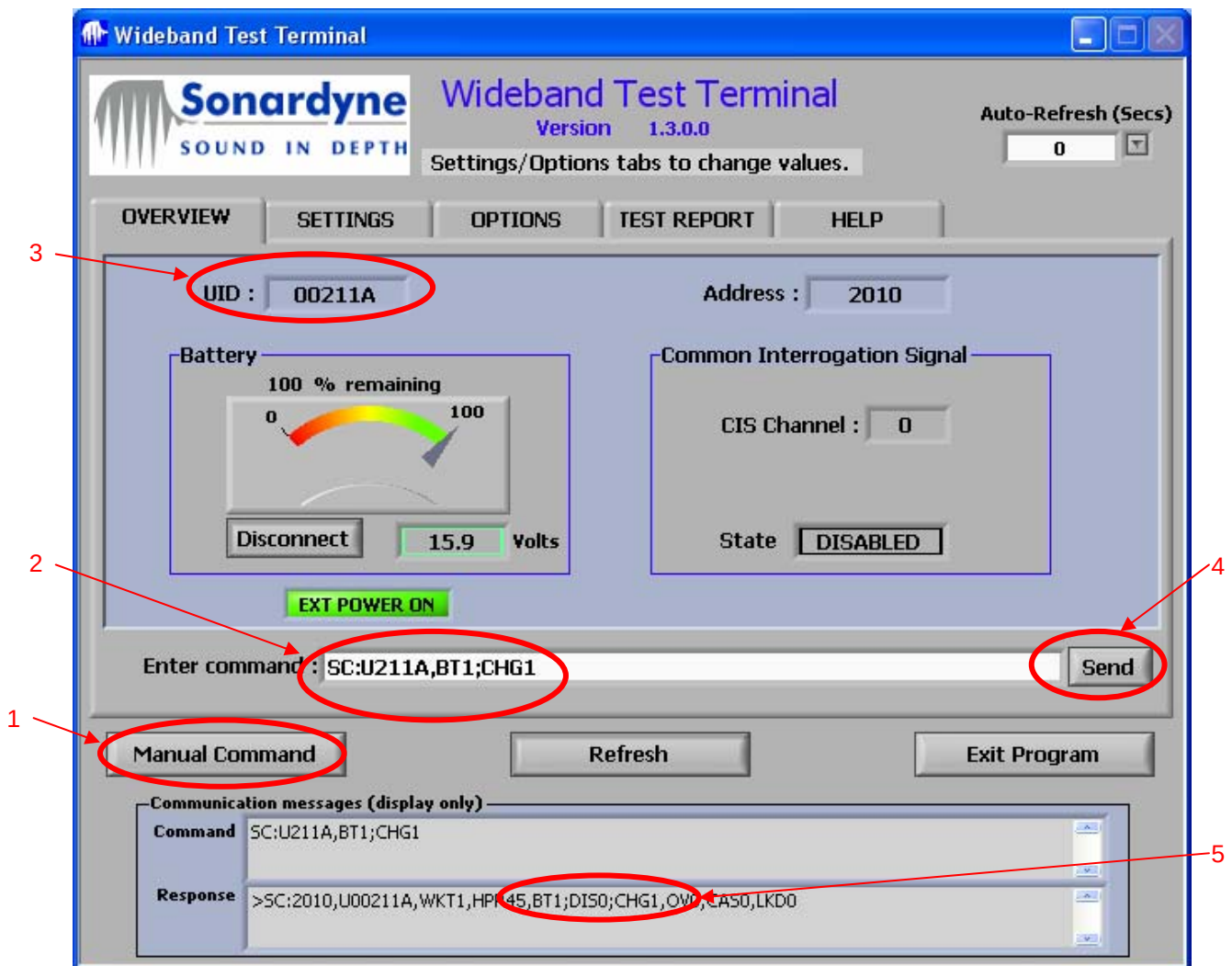


Fig 1.

5. AvTrak 6 is shipped with the Battery Pack electronically disconnected but with charging enabled. A disconnected battery will be indicated by a 0.0 Volts Battery value and the battery button will be labelled **<Connect>**. Clicking the **<Connect>** button will electronically connect the AvTrak 6 internal battery pack. The battery panel will now show a Volts reading and the battery button will now be labelled **<Disconnect>** (Ref: Fig 1).
6. To recharge the AvTrak 6 battery, connect an external supply via the Subconn connector on the end cap. (Ref: 03 Technical Data) for connection details and power supply requirements. The external supply input has reverse polarity protection.
7. Turn on the supply. If the power supply is fitted with a current meter the current drawn should be less than 400mA during charging.
8. If the current drawn is less than 50mA the battery may be nearly fully charged or the charge function may be turned off. Use the WTT to ensure that battery charging is enabled in the AvTrak 6. Click the **<Manual Command>** button (1, Ref: Fig 3). In the Enter Command input box (2, Ref: Fig 3) type the command :"**SC:U##### ,BT1;CHG1**" where ##### is the UID of AvTrak 6 (3, Ref: Fig 3) and then click the **<Send>** button (4, Ref: Fig 3). The response will indicate that the Battery is not disconnected and that charging is now enabled (5, Ref: Fig 3).
9. Electronics within the internal battery pack monitors and controls the charging of the battery. The charging progress can be monitored using the **<Refresh>** button in WTT to update the display.
10. The AvTrak 6 can be left connected to the charger and it will trickle charge the battery as required.

11. Full charge can be confirmed by clicking the **<Refresh>** button in WTT to update the display. Confirm the following:
 - i. Battery voltage reported is close to 16.0 Volts.
 - ii. Charge current reported in IDC field of the VS response string, is less than 40 (1,Ref:Fig 1).
 - iii. Capacity indicator displays close to 100%.



Enable Battery Charging
Fig 3.

12. To terminate charging. switch off the external supply.
13. Click the **<Exit Program>** button on the WTT.

3 TRANSCEIVER SAFETY PRECAUTIONS

3.1 EQUALISING THE PRESSURE

WARNING

Before attempting to open the pressure housing the pressure difference must be equalised.

CAUTION

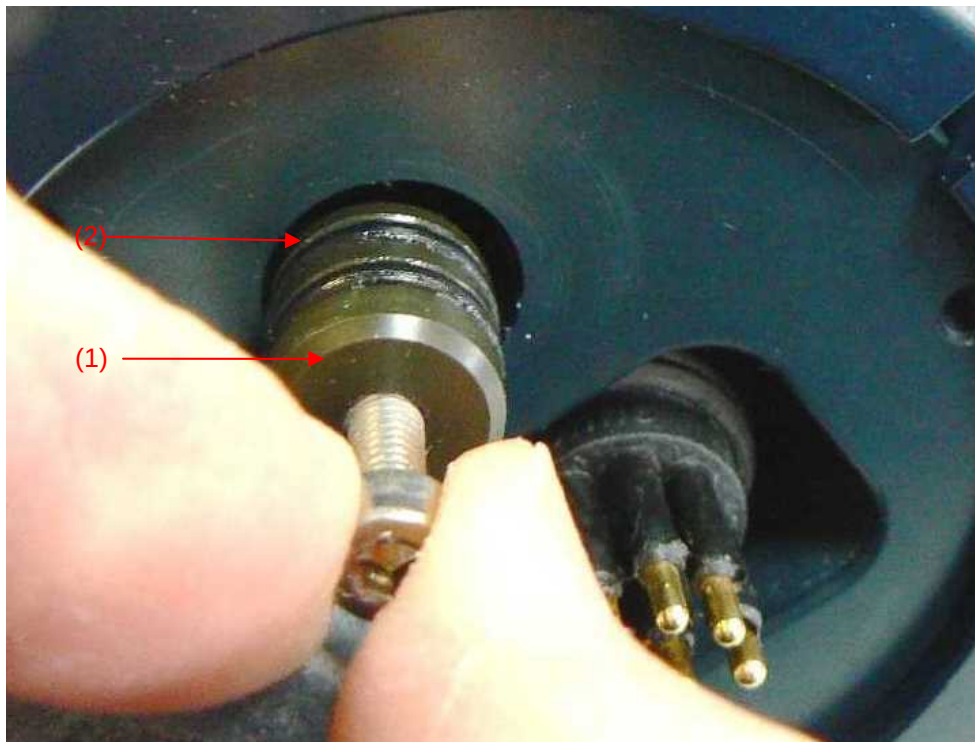
The pressure housing may be internally pressurised because of one of the following:

- A leak is present.
- The battery has malfunctioned.
- Re-charging and non-rechargeable battery pack.
- Using the instrument outside of its design parameters.
- Passing the load bearing limits of the instrument.
- Poor maintenance
- Using unauthorised components.

CAUTION

- Always change the battery in a well ventilated area.
- Do not change the battery pack if the housing is hot. Lower overboard and wait for housing to cool.
- Always stand to one side never in line with the end-cap.

1. Make sure [Sub - Para's 1.3, 1.4 and 1.5](#) have been completed.
2. Before continuing (Ref: [Section 10 Battery Safety](#))
3. Place the transceiver in a safe working area.
4. Insert an M4 screw into the vent plug (1, [Ref: Fig 1](#)).
5. Pull the vent plug out until the second O-ring seal (2, [Ref: Fig 1](#)) is exposed.
6. Wait until the pressure has equalised.
7. If pressure does not equalise or is suspected of not equalising (Ref: [Sub – Para 3.2](#)).



Vent Plug
Fig 1

3.2 INTERNALLY PRESSURISED

1. Secure both ends of the transceiver together using the rope.
2. Secure with a minimum of two ropes wrapped around the length of the transducer body.
3. Use an Allen key (2, [Ref Fig 1, Para 4](#)) to remove the two M5 socket head cap screws (1, [Ref Fig 1, Para 4](#)) holding the clamp ring internal pressure may cause the screw to be difficult to remove.

NOTE: Internal pressure may move the end-cap, but full pressure relief may not have been achieved.

4. Untie the ropes from the transducer body make sure no one is stood in line with the end-cap.

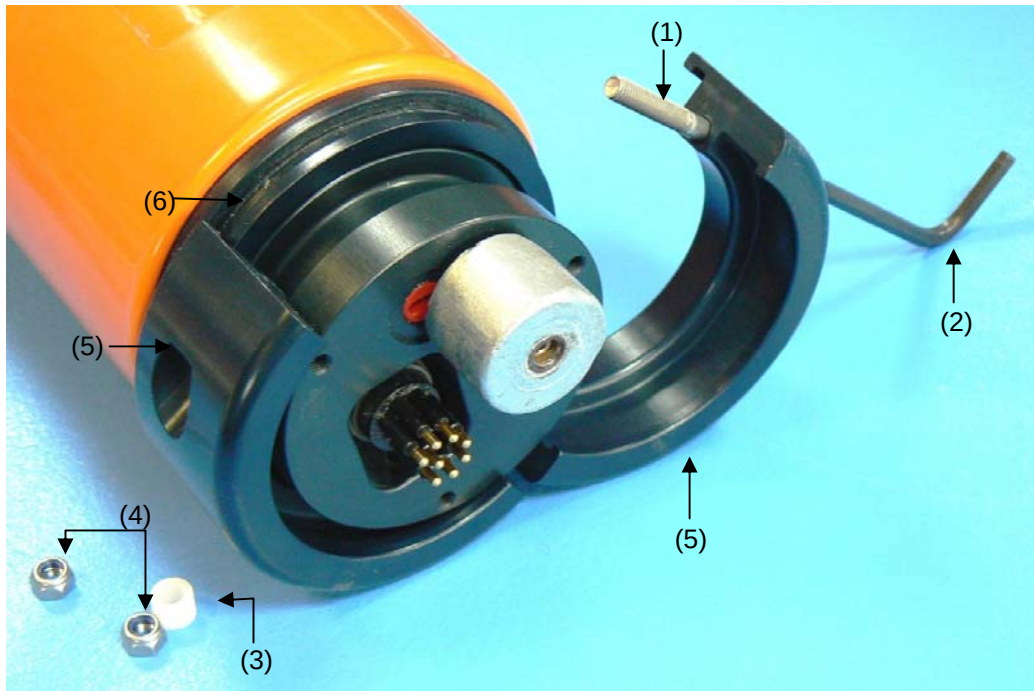
4 TRANSCIVER END-CAP

4.1 REMOVAL

WARNING

Subsea equipment has capacitors which can store large amounts of electrical energy, avoid accidental discharge during dismantling.

1. Complete [Equalising the Pressure Sub - Para 3.1](#).
2. Use an Allen key (2, [Ref: Fig 1](#)) to remove the two M5 socket head cap screws (1, [Ref: Fig 1](#)) and the two nuts (4, [Ref: Fig 1](#)) holding the clamp rings (5, [Ref: Fig 1](#)).
3. Lever out the clamp rings using the tapered ends of the opening tool ([Ref: Fig 4](#)).
4. Keep the four nylon isolation washer (3, [Ref: Fig 1](#))
5. Clean the clamp seating (6, [Ref: Fig 1](#)) to remove any dirt or water.



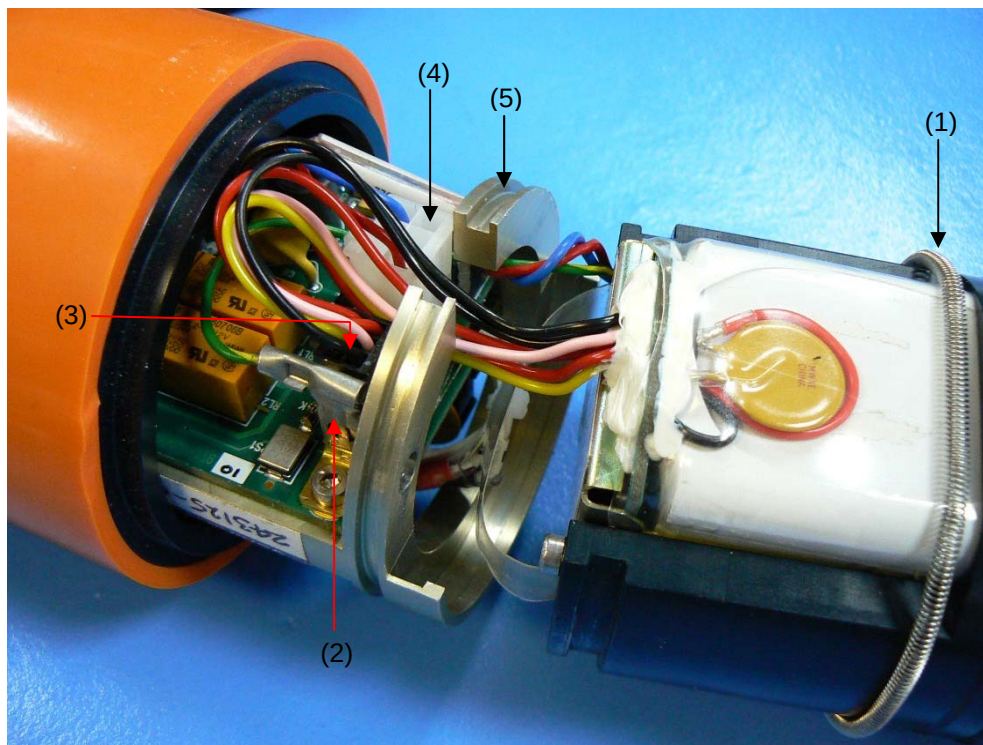
Clamp Rings
Fig 1

6. Push the end-cap into the pressure housing this will push the transducer end-cap out of the pressure housing ([Ref: Fig 2](#)).



End – Cap
Fig 2

7. This will expose the transducer end-cap O-ring seals.
8. Clean the O-ring seals as they are exposed to remove any dirt or water.
9. Push the end-cap in to the pressure housing until the transducer end-cap connections are accessible ([Ref: Fig 3](#)).



Transducer End – Cap Connections
Fig 3

10. Lift the earthing spring (1, [Ref: Fig 3](#)) out of its locating groove (5, [Ref: Fig 3](#)) and position at the top of the battery ([Ref: Fig 3](#)).
11. Remove the transducer end–cap out of its locating groove.
12. Disconnect the battery connector (3, [Ref: Fig: 3](#)).
13. Disconnect the transducer connector (4, [Ref: Fig: 3](#)).
14. Disconnect the earth lead (2, [Ref: Fig: 3](#)).
15. Remove the transducer end–cap and store in an applicable container in a clean, dry area.



Opening Tool
Fig 4

4.2 **REPLACE**

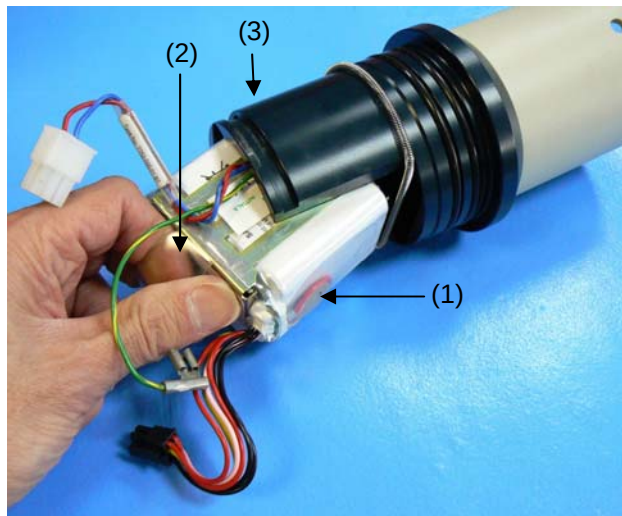
1. Make sure the grooves on the transducer pressure housing ([Ref: 6, Fig 1](#)) and end-cap are clean
2. Make sure the earthing spring gasket is serviceable.
3. Make sure the O-rings seals are clean and serviceable.
4. Make sure the chassis is exposed enough from the pressure housing so the connections can be made ([Ref: Fig 3](#)).
5. Check the grey anti–rotation ring is the correct position.
6. Put the transducer end – cap next to the chassis ([Ref: Fig 3](#)).
7. Connect the earth lead (2, [Ref: Fig: 3](#)).
8. Connect the transducer connector (4, [Ref: Fig: 3](#)).
9. Connect the battery connector (3, [Ref: Fig: 3](#)).
10. Lubricate the O-ring seals with petroleum jelly.
11. Put the transducer end-cap into its locating groove and check the locating pin is correctly seated.
12. Put the earthing spring (1, [Ref: Fig 3](#)) into its locating groove (5, [Ref: Fig 3](#)).
13. Push the transducer end – cap back into the pressure housing until it is correctly seated.
14. Position the clamps in the grooves on the end-cap make sure the gap between the ends of each clamp is equal.

15. Use an Allen key (2, [Ref: Fig 1](#)) the two M5 socket head cap screws (1, [Ref: Fig 1](#)), the two nuts (4, [Ref: Fig 1](#)) four nylon isolation washer (3, [Ref: Fig 1](#)) and the two the clamp rings (5, [Ref: Fig 1](#)) to secure the end-cap.
16. Tighten the clamps evenly but leave a 2-3mm gap at each end of both clamps.

5 BATTERY PACK

5.1 REMOVAL

1. Complete [Removal Sub - Para 4.1](#).
2. Pull the clear plastic strap (2, [Ref: Fig 5](#)) to remove the battery pack (1, [Ref: Fig 5](#)) from the transducer end-cap (3, [Ref: Fig 5](#)).



Battery Pack-Remove/Replace
Fig 5

5.2 REPLACE

1. Push the battery pack (1, [Ref: Fig 6](#)) into the transducer end-cap (3, [Ref: Fig 5](#)) until it is firmly located.
2. Complete [Replace Sub - Para 4.2](#).

6 HANDLING PROCEDURES FOR CMOS DEVICES AND CIRCUIT BOARDS

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

Present CMOS gate protection structures can protect against over-voltages. This is sufficient except in the very high cases.

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

Operators must obey all safety precautions.

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

Low impedance equipment (pulse generators, etc) should be connected to CMOS inputs only after the CMOS is powered up. This 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 that soldering irons are grounded.

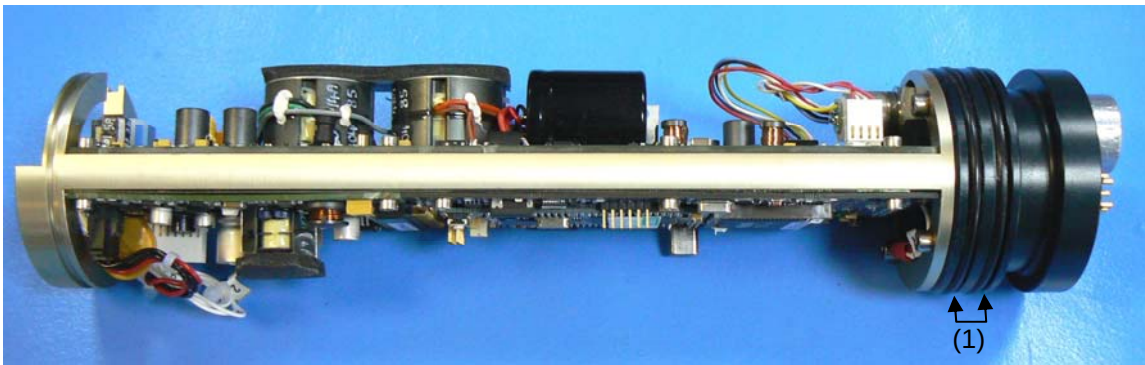
7 CHASSIS ASSEMBLY

7.1 REMOVAL

WARNING

Subsea equipment has capacitors which can store large amounts of electrical energy, avoid accidental discharge during dismantling.

1. Read [Para 6](#).
2. Complete [Removal Sub - Para 4.1](#).
3. When the transducer end-cap is removed the chassis can be carefully pushed back through the pressure housing and removed.
4. Put the chassis assembly on a clean dry surface.
5. Check the spring gaskets for damage.



Chassis Assembly
Fig 6

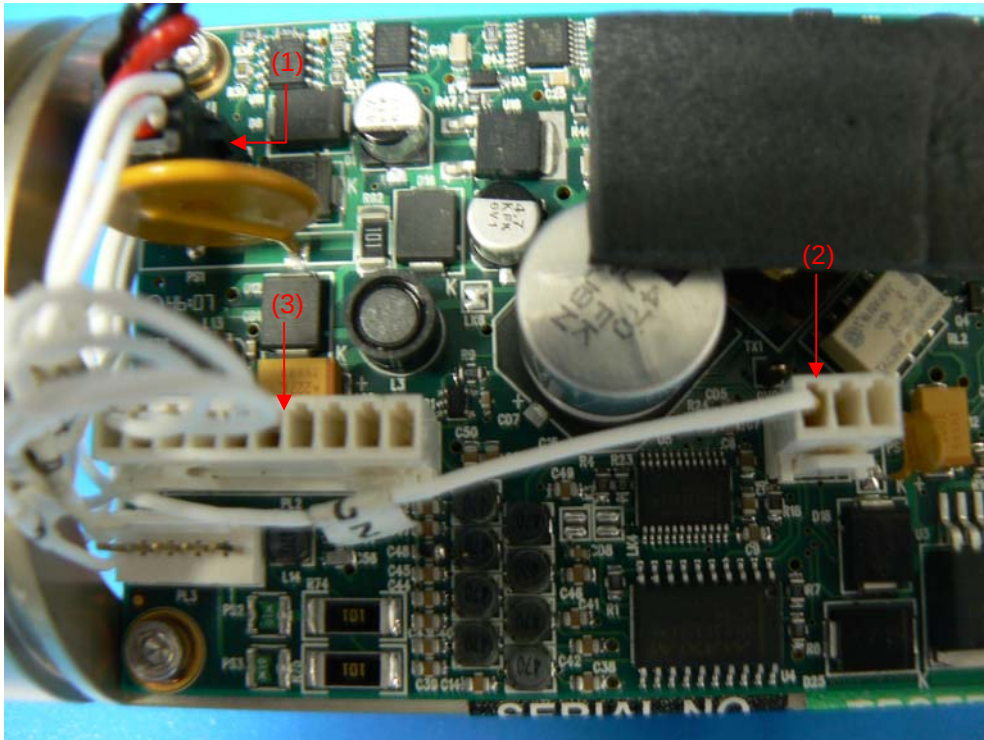
7.2 REPLACE

1. Read [Para 6](#).
2. Make sure the earthing spring gasket is serviceable.
3. Make sure the O-rings seals (1, [Ref: Fig 6](#)) are clean and serviceable.
4. Lubricate the O-ring seals (1, [Ref: Fig 6](#)) with petroleum jelly.
5. Slide the chassis into the pressure housing taking care not to damage the electronics.
6. Complete Replace Sub-Para 4.2.

8 INTERFACE CIRCUIT BOARD

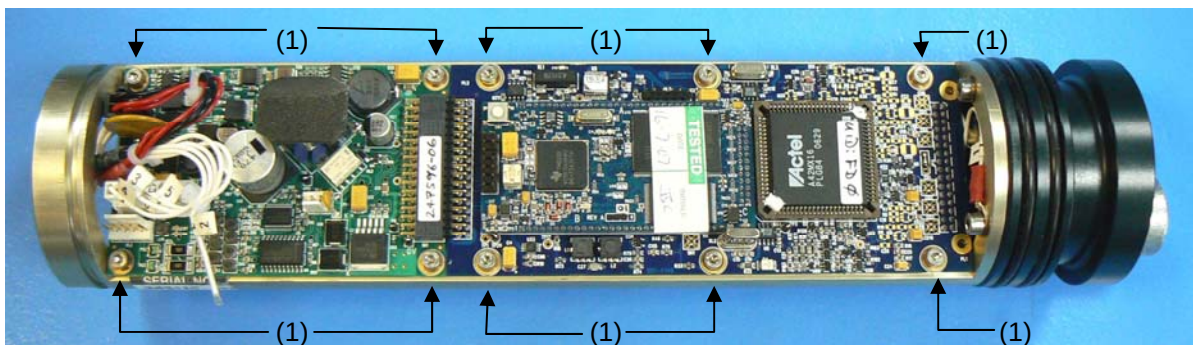
8.1 REMOVAL

1. Read [Para 6](#).
2. Complete Removal [Sub-Para 7.1](#).
3. Disconnect the power Supply (1, [Ref: Fig 1](#)), Sync/Release (2, [Ref: Fig 1](#)) and the Comms (3, [Ref: Fig 3](#)).



Interface Board Connections
Fig 1

1. Use an Allen key to remove the ten anchor screws and washers (1, [Fig 1](#)) securing the circuit board.



Chassis Assembly
Fig 2

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

2. Carefully lift the Interface board away from the chassis until it can be disconnected from the mother board, support the motherboard as the interface board is lifted.
3. Store the interface board in an applicable container in a dry secure area.

8.2 **REPLACE**

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

1. Lift the mother board so the interface board can be connected to the mother board.
2. Place the interface board and the mother board on the chassis.
3. Use an Allen key to secure the interface and mother board to the chassis using the ten anchor screws and washers (1, [Ref: Fig 1](#)) make sure the interface and mother board do not twist during tightening.
4. Connect the power Supply (1, [Ref: Fig 1](#)), Sync/Release (2, [Ref: Fig 1](#)) and the Comms (3, [Ref: Fig 1](#)).
5. Complete Replace Sub-Para 7.2.

9 **TRANSMITTER BOARD AND MOTHERBOARD**

The AvTrak 6 transceiver contains sensors that are interfaced via the Transmitter board however calibration data is stored in EEPROM on the Motherboard this means that replacement of either board requires a recalibration or manually copying the calibration data from the old motherboard to the new motherboard. Therefore replacement of either the Transmitter Board or Motherboard should be referred to a Sonardyne office.

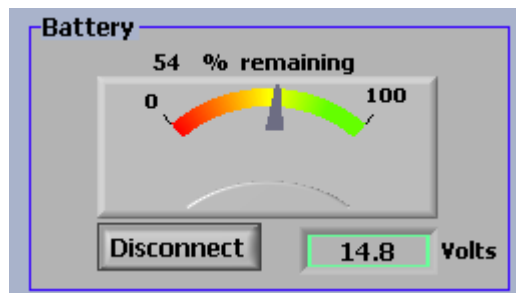
10 **SENSORS**

10.1 **RECALIBRATION**

Transceivers are to be returned to Sonardyne Int Ltd for calibration checks.

11 STORAGE

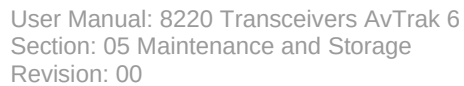
1. Dry transponder with clean lint free cloths.
2. Lubricate and blank off all connections.
3. Store the transponder in an applicable container in a dry secure area.
4. If the unit is to be stored for a long time is is recommended that the battery is electronically disconnected to improve the safety and life of the battery pack. The battery can be electronically disconnected by sending the serial command: SC:Uhhhhhh,BT1;DIS1 where hhhhhh is the devices Unique Identification (UID). (Note: Battery reconnection will require an external power supply to initially power the unit). An alternative method is to use the Wideband Test Terminal software (WTT) to disconnect by using the **<Disconnect>** button ([Ref: Screen Shot 1](#)).



Screen Shot 1

12 POST TASK PROCEDURES

1. Make sure the work area is clean and clear of all unwanted, tools, equipment and materials.
2. Discard all unwanted consumable materials in accordance with the local health and safety regulations.



13 RECOMMENDED LUBRICANTS

Assembly	Recommended
Transceiver O-ring seals	Molykote 44 medium silicone grease or Petroleum jelly

14 MAINTENANCE CODES AND SCHEDULE

Maintenance Frequency Codes									
A	Weekly	B	2 Weekly	C	Monthly	D	3 Monthly	E	6 Monthly
F	9 monthly	G	Annually	H	2 Years	I	5 Years		

[illegible]

06 FAULT FINDING

TYPE 8220 WIDEBAND TRANSCEIVERS (AVTRAK 6)

Contents

- 1 TRANSCEIVER DOES NOT REPLY TO INTERROGATIONS OR COMMANDS**
- 2 TRANSCEIVER REPLIES TO COMMANDS, BUT NOT TO INTERROGATIONS**
- 3 TRANSCEIVER REPLIES TO COMMANDS, BUT TELEMETRY ERRORS ARE DETECTED**
- 4 SONARDYNE INT LTD EMERGENCY HELPLINE**

Head Office

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

1 TRANSCEIVER DOES NOT REPLY TO INTERROGATIONS 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 to high.	Lower the dunking transducer/transceiver or towfish and reduce the surface transceiver gain settings.
		Do a noise check using the applicable transceiver noise check command.
		Increase the transponder power level using the Navigation Power Level (NPL) in the Configuration Status (CS) command.
	Transponder has low battery power or battery is electronically disconnected.	Check battery output before deployment. (Ref 08 Operational Test)
		Check battery levels since deployment.
	Surface currents maybe streaming the transducer away from transponder location.	Add 20Kg of ballast on a 1m strop from the transducer guard.

TRANSCEIVER DOES NOT REPLY TO INTERROGATIONS OR COMMANDS (CONT)

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

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.	

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
		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.

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>.

07 REMOVAL TYPE 8220 WIDEBAND TRANSCEIVERS (AVTRAK 6)

Contents

1 REMOVAL TRANSCEIVERS 8220 SERIES

1 REMOVAL TRANSCEIVERS 8220 SERIES

For Removal (Ref: Section 5 Maintenance and Storage).

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www.sonardyne.com

08 OPERATIONAL TEST TYPE 8220 WIDEBAND MINI TRANSPONDER

Contents

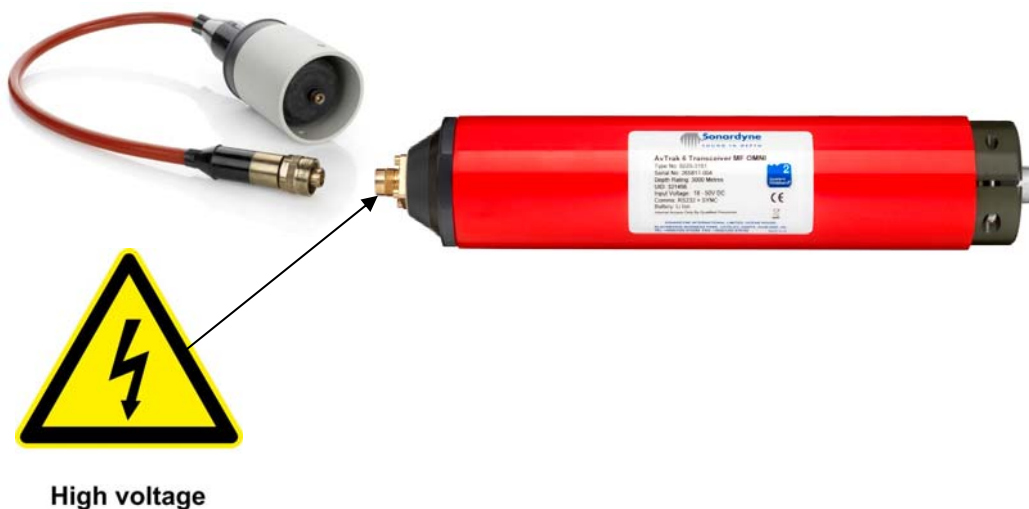
- 1** **OPERATIONAL CHECK OUT**
 - 1.1** **HIGH VOLTAGE SAFETY WARNING**
 - 1.2** **TEST EQUIPMENT**
 - 1.3** **TEST EQUIPMENT SET UP**
 - 1.4** **CHECKING GENERAL OPERATION**
 - 1.5** **CHECKING WIDEBAND ACOUSTICS**
 - 1.6** **CHECKING RESPONDER FUNCTION**
 - 1.7** **READING THE SENSORS**
- 2** **PRE-DEPLOYMENT CHECKS**
 - 2.1** **CONDITION**
 - 2.2** **CONFIGURATION**
 - 2.3** **REPORT PRODUCTION**

1 OPERATIONAL CHECK OUT

1. Many functions of the AVTRAK 6 can be tested via the RS232 link including features not available via acoustic commands.
2. The RS232 link can be controlled by a PC running the Wideband Test Terminal software. This application is available on the AVTRAK 6 Utilities CD.
3. The test procedures that follow, are designed to check all 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

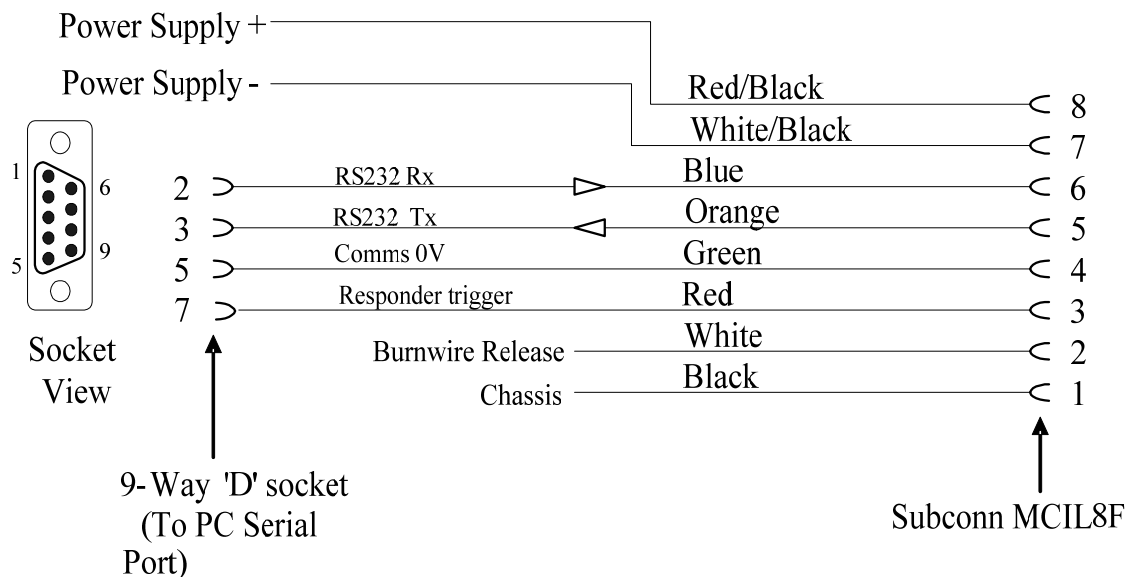
1.1 HIGH VOLTAGE SAFETY WARNING

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 as shown in [Fig 1](#). Ensure that the remote transducer is fully connected to the transceiver housing before operating.



1.2 TEST EQUIPMENT

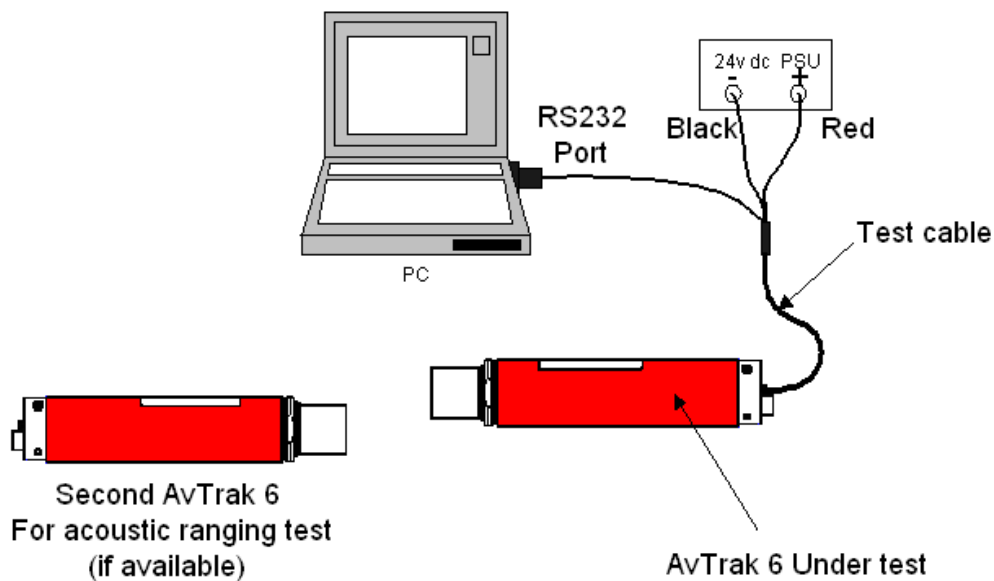
Description	Sonardyne Drawing No	Sonardyne Order Code
PC with spare Comm Port	-	-
AVTRAK 6 Utilities CD-ROM	8220-200	-
A second AVTRAK 6 or other Sonardyne 6G® Wideband Transponder. (Required for back to back acoustic checks only)		
PSU: 24V DC output @ 500mA (preferably with built in Ammeter)		
Test cable as detailed in Fig 2 .		



Test Cable Wiring
Fig 2

1.3 TEST EQUIPMENT SET UP

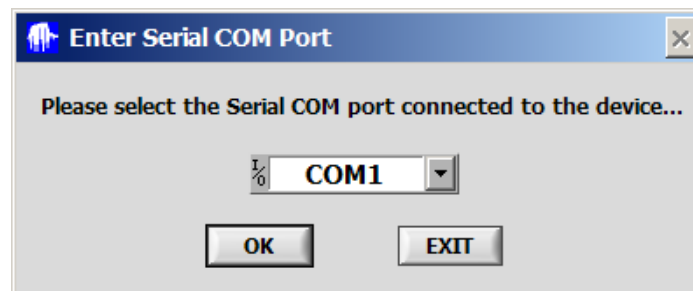
1. Remove the dummy blanking connector from the end cap of the AVTRAK 6.
2. Connect the AVTRAK 6 to the PC the test cable and PSU as listed in the section 1.1 above and shown in Fig 3.
3. Switch 'ON' the PSU.
4. Run the WTT.exe program file.



Test Cable Wiring
Fig 3

1.4 CHECKING GENERAL OPERATION

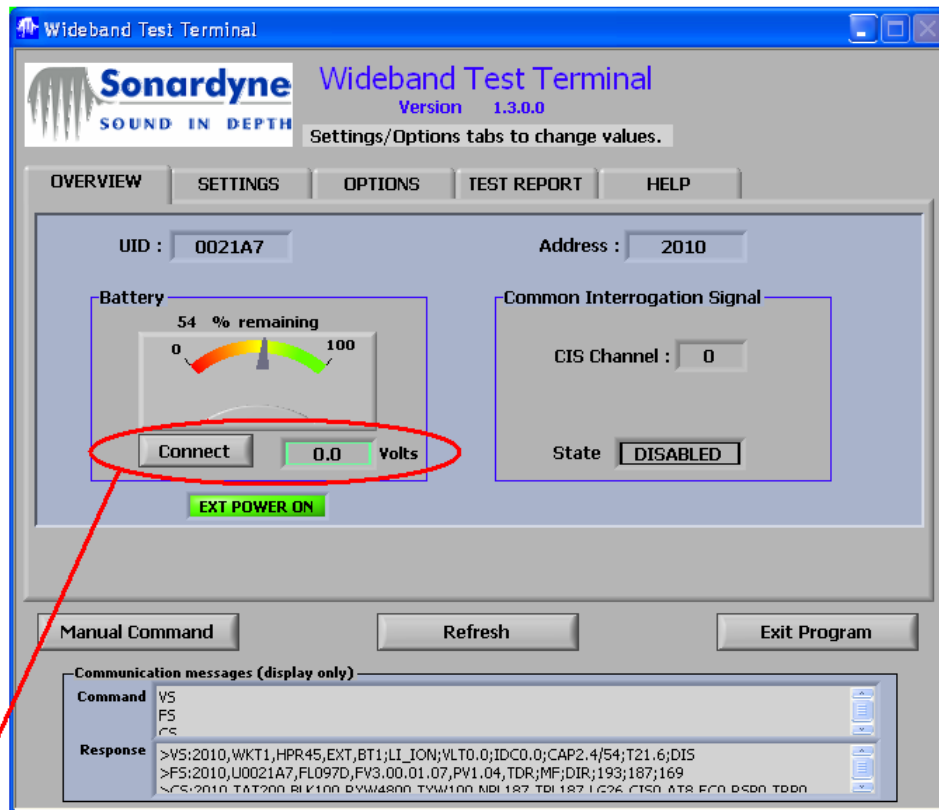
1. The WTT is for performing basic tests on the AVTRAK 6 and for changing its address, channel and functionality.
2. When the terminal has loaded, select the correct serial COM port and click OK (Ref Screen Shot 1).



Screen Shot 1

3. On establishing a communication link with the AVTRAK 6, the WTT serially interrogates it to determine the current settings of the AVTRAK 6. Screen Shot 2 is then displayed.

4. When the terminal has loaded, select the correct serial COM port and click OK (Ref Screen Shot 1).



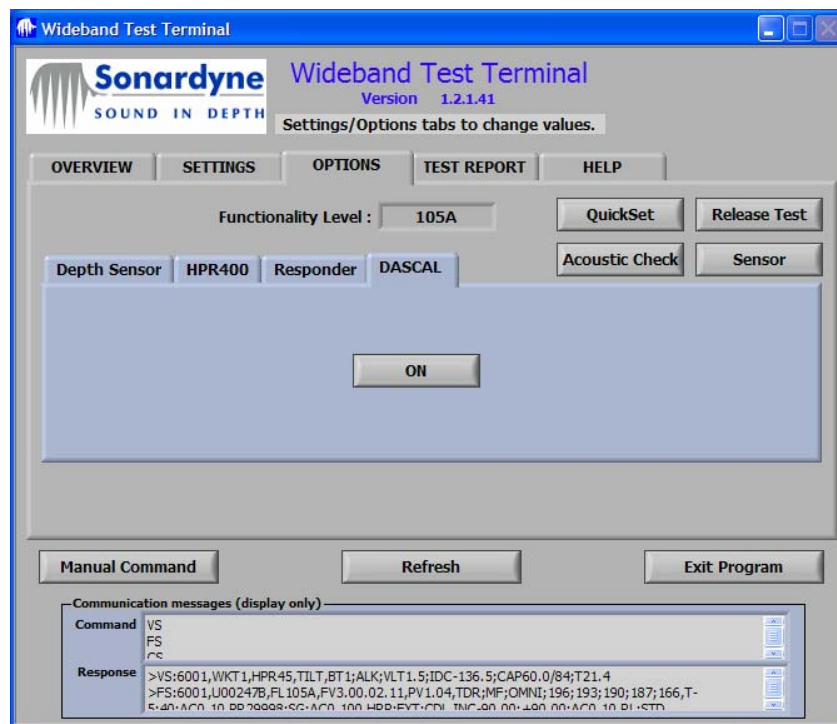
Indicates the battery is disconnected

Screen Shot 2

5. **Note:** AvTrak 6 is shipped with the Battery Pack disconnected. This is shown in Screen Shot 2 by the 0.0 Volts Battery value and the **<Connect>** button.
6. Select **<Connect >** button to enable the battery pack. When connected the battery voltage will be visible. The pack may be disconnected by selecting the **<Disconnect>** button. A warning will appear prior to disconnection.

1.5 CHECKING WIDEBAND ACOUSTICS

1. Acoustic checks can only be done if a second AVTRAK 6 or other 6G® Wideband Transponder is available. Tests may be carried out in air, best results are usually obtained using an offset axial alignment as shown in Fig 2. Click on the **OPTIONS** tab and then click **<Acoustic Check>** (Ref: Screen Shot 3)



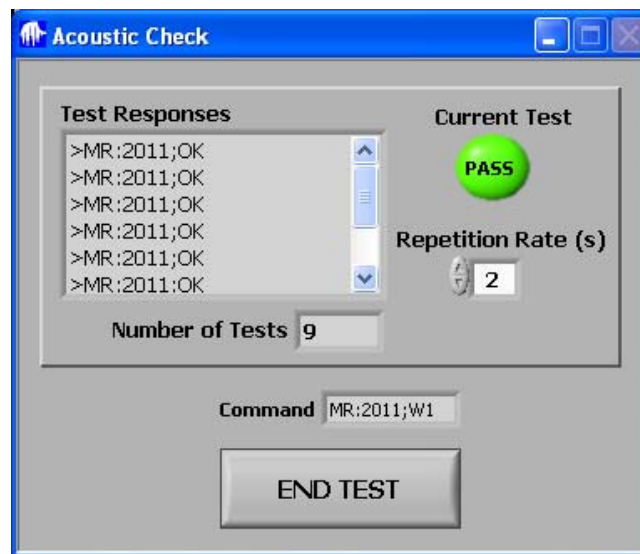
Screen Shot 3

2. Enter the address and the wakeup tone (usually 1) of the spare Sonardyne 6G® Wideband transponder or transceiver and then click **<OK>** (Ref: [Screen Shot 4](#))



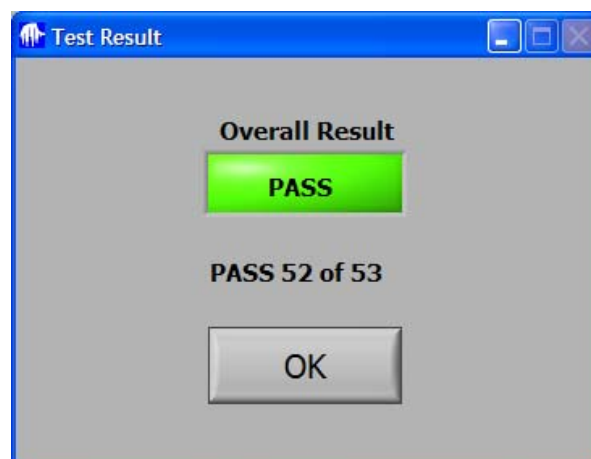
Screen Shot 4

3. The WTT will now command the AVTRAK 6 to begin ranging to the selected acoustic address and to monitor for the replies. The WTT will display **PASS or FAIL** as appropriate for each interrogation cycle. The relative position and orientation of the two acoustic instruments may require varying to optimise the acoustic comms through air. Click **<END TEST>** to finish the acoustic testing (Ref: [Screen Shot 5](#))



Screen Shot 5

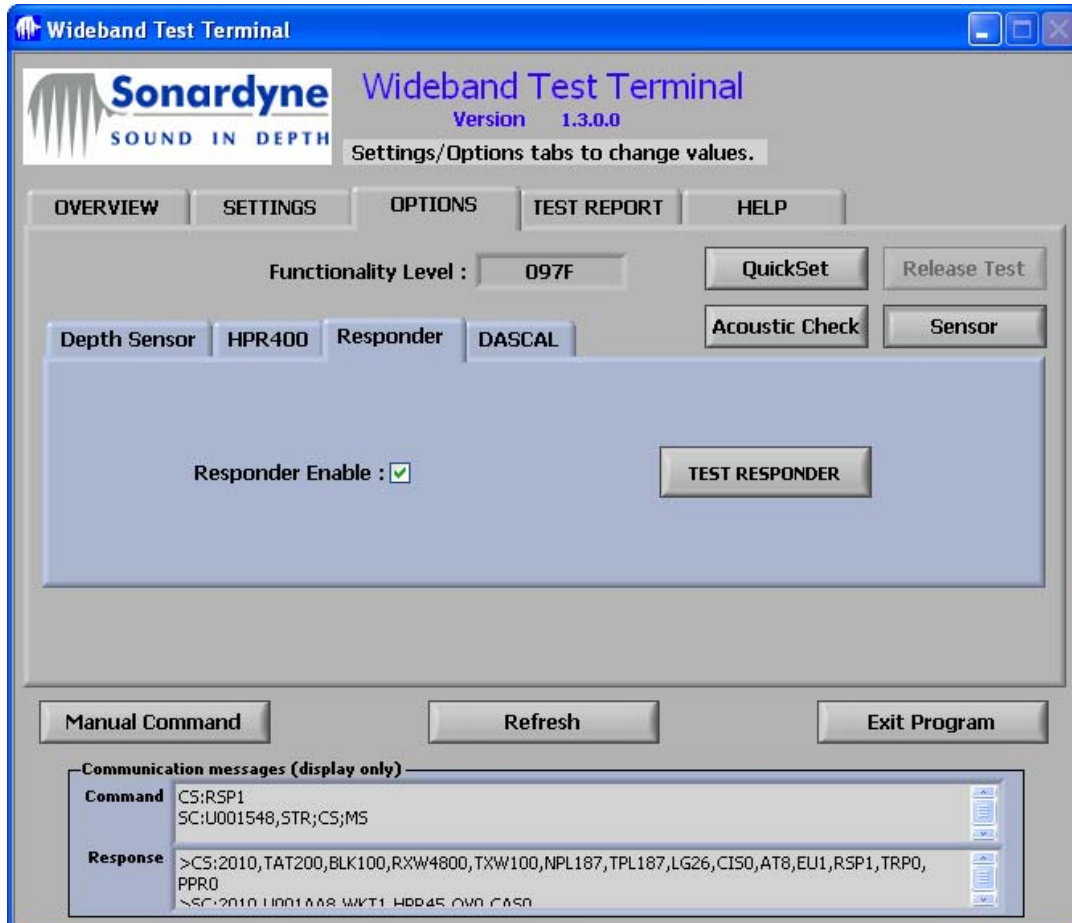
4. On completion a summary of the acoustic testing will be displayed (Ref: [Screen Shot 6](#))



Screen Shot 6

1.6 CHECKING RESPONDER FUNCTION

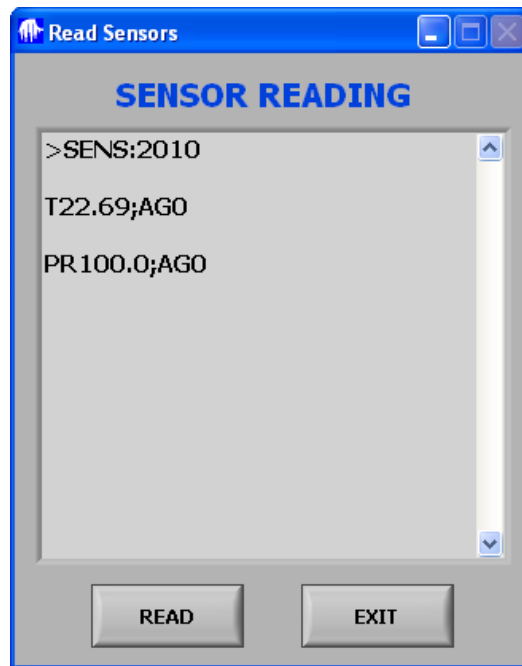
1. Click on the **OPTIONS** tab and then select the **Responder** sub-tab. (Ref: [Screen Shot 7](#))
2. Check the **Responder Enable** tick box. Now every time the **TEST RESPONDER** button is clicked, a short acoustic ping should be heard from the AVTRAK 6.
3. Now uncheck the **Responder Enable** tick box. The AVTRAK 6 should no longer transmit anything when a responder trigger is sent to it.



Screen Shot 7

1.7 READING THE SENSORS

1. Click on the **OPTIONS** tab and then click **<Sensor>** (Ref: [Screen Shot 3](#))
2. Click **<READ>** (Ref: [Screen Shot 8](#))
3. The raw sensor replies will be displayed. Pressure is displayed in kPa. Temperature is displayed in degrees Celsius. All sensor values have an associated age value reported as AG# (Ref: [Screen Shot 8](#))



Screen Shot 8

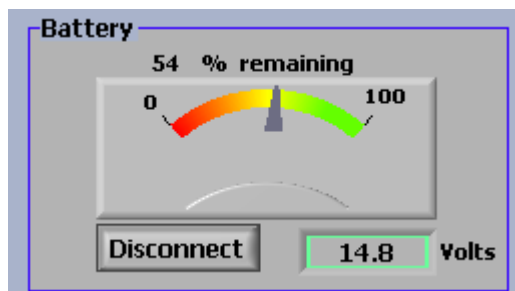
2 PRE-DEPLOYMENT CHECKS

2.1 CONDITION

1. Inspect the transponder for any sign of mishandling.
2. Check for excess damage to the transducer and any external sensors.
3. Check for oil leakage around the transducer.
4. Make sure that external sensors are clear of any silt or bio-fouling.

2.2 CONFIGURATION

1. Perform the test setup operations detailed in [Sub – Para 1.2](#)
2. Check the battery is enabled (<Disconnect> button must be visible) and the level is sufficient for the application (Ref: [Screen Shot 9](#)).

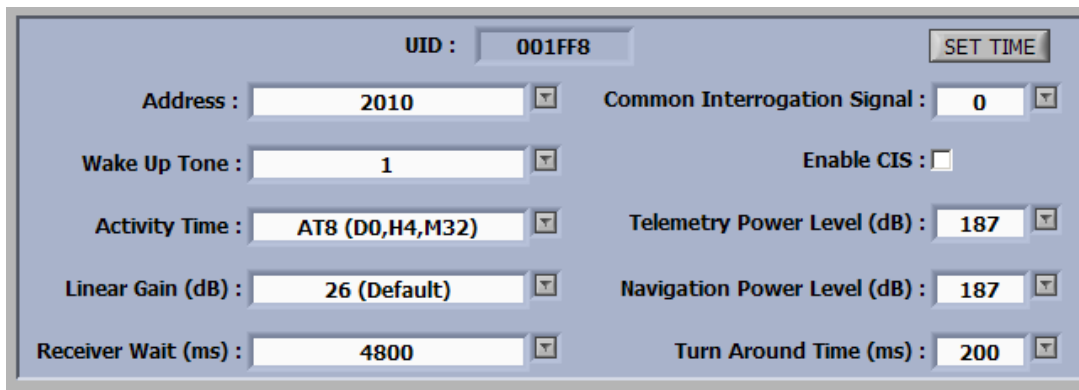


Screen Shot 9

3. Click on the **SETTINGS** tab.
4. Make sure that the unique Identity, (UID), and address are correct.

NOTE: The UID should match the UID printed on the AVTRAK 6 housing label.

5. Check the settings are correct and pay particular attention to the parameters that follow (Ref: [Screen Shot 10](#)):
 - a) Linear Gain (dB)
 - b) Telemetry and Navigation Power levels (dB)
 - c) Activity time.

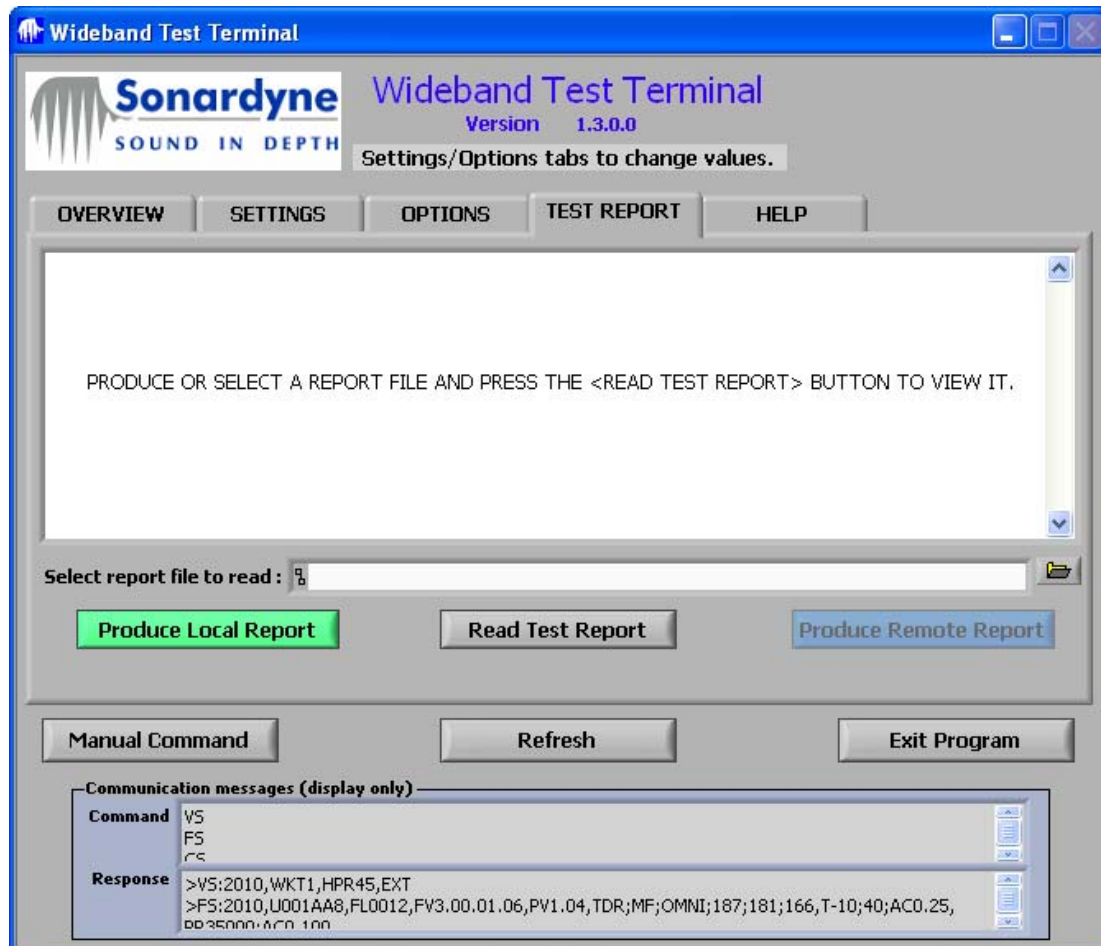


UID : 001FF8		SET TIME
Address :	2010	Common Interrogation Signal : 0
Wake Up Tone :	1	Enable CIS : ☐
Activity Time :	AT8 (D0,H4,M32)	Telemetry Power Level (dB) : 187
Linear Gain (dB) :	26 (Default)	Navigation Power Level (dB) : 187
Receiver Wait (ms) :	4800	Turn Around Time (ms) : 200

Screen Shot 10

2.3 REPORT PRODUCTION

1. Click the **TEST REPORT** tab (Ref: [Screen Shot 11](#)).
2. Click the **Produce Local Report** button (Ref: [Screen Shot 11](#))



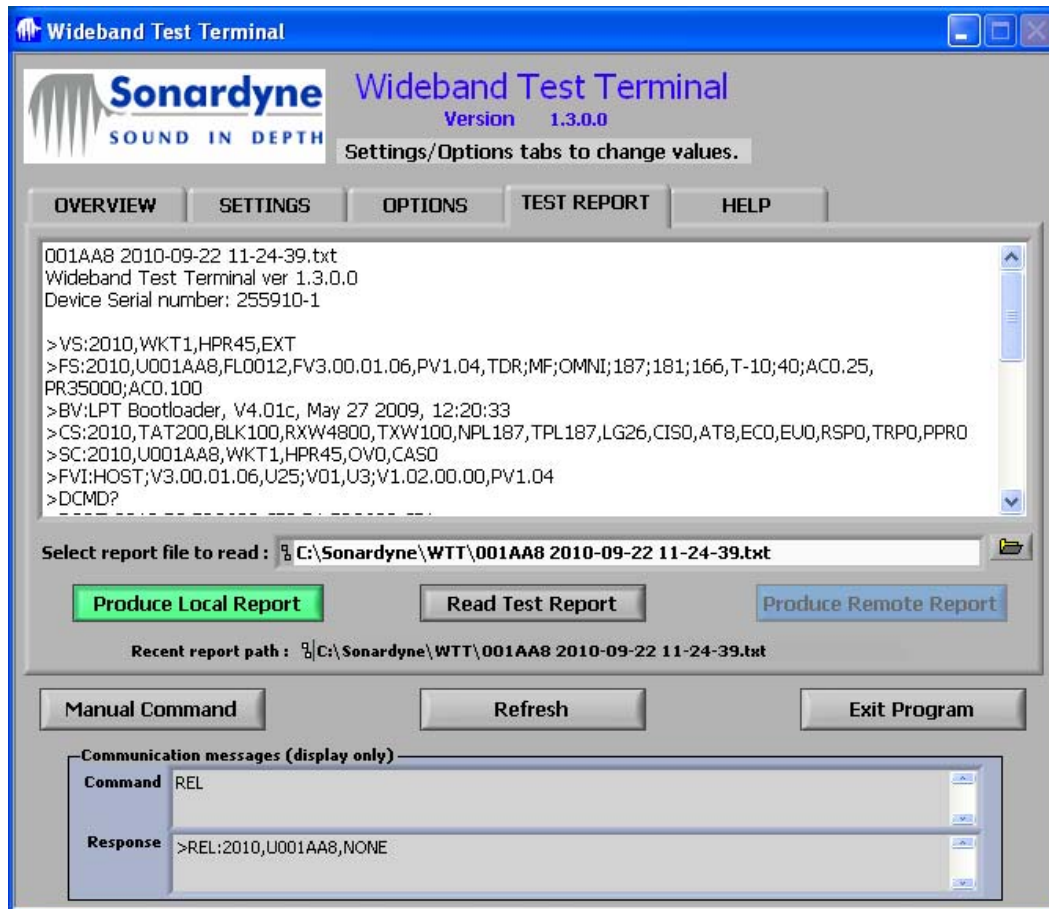
Screen Shot 11

3. Click the **<OK>** button on the resulting pop-up dialog indicating that the AVTRAK 6 does not support the Release function. This error refers to a type a integrated mechanically release that is fitted to larger Sonardyne 6G® Transponders.
4. Click the **<NO>** button on the pop-up prompt for Acoustic check.
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:
 - a) Compiles the full set of fixed and configurable status parameters.
 - b) Retrieves details of each PCB fitted.
 - c) Reads various measurements on the sensors fitted.

7. Once complete, click the **<Read Test Report>** button (Ref: [Screen Shot 12](#)).



Screen Shot 12

8. View the contents and make sure that the sensors fitted are reporting sensibly.
9. Click the **<Exit Program>** button (Ref: [Screen Shot 12](#)).
10. Remove the power/serial comms cable from the AVTRAK 6 connector.
11. Make sure that the dummy blanking connector is replaced and secure.

09 REPAIR

TYPE 8220 WIDEBAND TRANSCEIVERS (AVTRAK 6)

Contents

- 1 REPAIR THE ANODISED COATING**
 - 1.1 TOOLS AND EQUIPMENT**
 - 1.2 EQUIPMENT WEIGHTS**
 - 1.3 CONSUMABLES**
 - 1.4 PREPARATION**
 - 1.5 REPAIR THE ANODISED FINISH**
 - 1.6 POST TASK PROCEDURES**

1 **REPAIR THE ANODISED COATING**

1.1 **TOOLS AND EQUIPMENT**

Part Number	Description
Local supply	Wooden scraper

1.2 **EQUIPMENT WEIGHTS**

Part Number	Description
Omni directional	23kgs (51.8lbs)
Semi directional	24.9kgs (54.3lbs)

1.3 **CONSUMABLES**

Specification	Description	Qty
Local supply	Fresh water	AR
Local supply	Degreasing solvent	AR
Local supply	Lint free cloth	AR
Local supply	Alocrom 1200	AR
Local supply	Marine Epoxy Resin	AR

1.4 **PREPARATION**

1. Before you do this task, read and obey the General Safety Precautions in the Introduction section of this OMM (Ref: [0-4 Introduction, Section 8](#)).
2. Make sure there is sufficient access to the work area.
3. Make sure that all persons have applicable and serviceable communication equipment.
4. Make sure you wear the correct protective clothing and equipment.
5. Make sure the work area is clean and clear of unwanted equipment and materials.

WARNING

CONSUMABLE MATERIALS CAN CAUSE AN INJURY TO YOUR SKIN, EYES AND RESPIRATORY SYSTEM. BEFORE YOU USE CONSUMABLE MATERIALS, READ AND OBEY THE MANUFACTURER'S HEALTH AND SAFETY INSTRUCTIONS. WHEN YOU USE CONSUMABLE MATERIALS, YOU MUST WEAR THE APPLICABLE SAFETY CLOTHING AND EQUIPMENT. IF YOU GET CONSUMABLE MATERIALS ON YOUR SKIN OR IN YOUR EYES OR MOUTH, FLUSH IMMEDIATELY WITH CLEAN COLD WATER AND GET MEDICAL HELP IMMEDIATELY.

1.5 REPAIR THE ANODISED FINISH

1. Prepare the surface:
 - a Position the transponder on an applicable surface.
 - b Clean the transponder (Ref: 05 Maintenance and Storage).
 - c Use an applicable wooden scraper to remove any loose debris from the damaged area.
 - d Use fresh water to rinse the damaged area.
 - e Use a clean cloth and an applicable degreaser to clean the damaged area.
2. Apply the finish.
 - a Apply the Alocrom 1200 for 2 minutes or until the aluminium goes golden brown.
 - b Use fresh water to rinse the area.
 - c Use a clean, dry cloth to dry the area.
 - d Mix the marine epoxy resin and apply to the damaged area.
 - e Store the transponder in an applicable container in a dry secure area.

1.6 POST TASK PROCEDURES

1. Make sure the work area is clean and clear of all unwanted, tools, equipment and materials.
2. Discard all unwanted consumable materials in accordance with the local health and safety regulations.

10 BATTERY SAFETY

Contents

1 BATTERY SAFETY

1.1 LITHIUM BATTERIES

- 1.1.1 LITHIUM BATTERIES (GENERAL)**
- 1.1.2 LITHIUM BATTERIES STORAGE TEMPERATURE**
- 1.1.3 SHORTING/OVER-HEATING PROCEDURES**
- 1.1.4 DISPOSAL OF LITHIUM BATTERIES**
- 1.1.5 TRANSPORTING LITHIUM BATTERIES**

1.2 LITHIUM ION BATTERIES

- 1.2.1 LITHIUM ION BATTERIES (GENERAL)**
- 1.2.2 LITHIUM ION BATTERIES STORAGE TEMPERATURE**
- 1.2.3 SHORTING/OVER-HEATING PROCEDURES**
- 1.2.4 DISPOSAL OF LITHIUM ION BATTERIES**
- 1.2.5 TRANSPORTING LITHIUM ION BATTERIES**

2 BATTERIES (GENERAL)

2.1 BATTERY LIFE

2.2 USE OF INAPPROPRIATE BATTERY TYPES

2.3 CHARGING BATTERIES IN A SEALED CONTAINER

2.4 ATTEMPTING TO CHARGE NON RECHARGEABLE BATTERY PACKS

2.5 HANDLING OF USED BATTERIES

2.6 RE-CONNECTING A PARTIALLY USED BATTERY

2.7 FITTING A NEW BATTERY

2.8 BATTERY PACK FUSES

1 **BATTERY SAFETY**

1.1 **LITHIUM BATTERIES**

1.1.1 **LITHIUM BATTERIES (GENERAL)**

1. Lithium based batteries become hazardous (fire and corrosion) if exposed to air and water. If damaged they may also emit Thionyl Chloride. Consult battery manufacturers' Material Safety Data Sheets (MSDS) before operating lithium based battery products.
2. Additional information applicable to lithium cells (model LSH 20) is available from:

SAFT Ltd
River Drive
South Shields
Tyne and Wear
NE33 2TR
United Kingdom
Tel +44 (0) 191 456 1451
Web Site www.saftbatteries.com

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

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

Where a battery powered underwater instrument is suspected of flooding, caution must be used when opening the instrument in case internal pressure may have developed. This may cause the components to fly apart. If a cell leaks within a pressure vessel it is very unlikely to cause a hazard if the safety precautions ([Ref 0-4 Introduction Section 11](#)) are followed.

1.1.2 **LITHIUM BATTERIES STORAGE TEMPERATURE**

1. The Sonardyne instrument should not be exposed to temperatures exceeding 70⁰ C (158⁰ F).
2. Lithium battery packs should be stored at +20⁰ C (68⁰ F) in a humidity controlled atmosphere to prevent reduction in battery life.
3. Instruments should be cooled to room temperature or below before being opened.

1.1.3 **SHORTING/OVER-HEATING PROCEDURES**

WARNING

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

1. Put on the applicable safety clothing and equipment.
2. Disconnect the battery from the instrument immediately.
3. Remove the battery outdoors using tongs or a shovel.
4. Allow the battery to cool down and then dispose of ([Ref 1.1.4](#)).

1.1.4 DISPOSAL OF LITHIUM BATTERIES

WARNING

DO NOT DISPOSE OF LITHIUM BATTERIES IN A FIRE

1. All used or damaged lithium battery packs are to be discarded in accordance with local health and safety and environmental regulations.

1.1.5 TRANSPORTING LITHIUM BATTERIES

NOTE: The information provided below is for guidance only.

1. Read the MSDS from the manufactures' to confirm the amount lithium per battery pack, these quantities CANNOT be verified by Sonardyne Int Ltd.
2. It is the operators' responsibility to obey local, national and international regulations in force at the time of transport.

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

By Sea: International Maritime Dangerous Goods Code.

By Air: IATA Regulations UN 3090 and UN 3091.

1.2 LITHIUM ION BATTERIES

1.2.1 LITHIUM ION BATTERIES (GENERAL)

1. Lithium Ion batteries, also known as Li-ion, are a rechargeable battery technology. Use approved battery chargers for the specific pack only.
2. Additional information applicable to Li-ion cells is available from:

Saft Headquarters
12, rue Sadi Carnot
93170 BAGNOLET
France
Tel.: +33 (0)1 49 93 19 18
Fax: +33 (0)1 49 93 19 50
Web Site www.saftbatteries.com

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

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

Where a battery powered underwater instrument is suspected of flooding, caution must be used when opening the instrument in case internal pressure may have developed. This may cause the components to fly apart. If a cell leaks within a pressure vessel it is very unlikely to cause a hazard if the safety precautions ([Ref 0-4 Introduction Section 11](#)) are followed.

1.2.2 LITHIUM ION BATTERIES STORAGE TEMPERATURE

1. To preserve battery life, Lithium Ion batteries should be stored at a nominal 40% state of charge.

2. The Sonardyne instrument should not be exposed to temperatures outside the range -20°C to $+60^{\circ}\text{C}$ (-4°F to 140°F).
3. Lithium Ion battery packs should be stored at $+20^{\circ}\text{C}$ (68°F) in a humidity controlled atmosphere to prevent reduction in battery life.
4. Instruments should be cooled to room temperature or below before being opened.

1.2.3 SHORTING/OVER-HEATING PROCEDURES

WARNING

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

1. Put on the applicable safety clothing and equipment.
2. Disconnect the battery from the instrument immediately.
3. Remove the battery outdoors using tongs or a shovel.
4. Allow the battery to cool down and then dispose of (Ref [1.2.4](#)).

1.2.4 DISPOSAL OF LITHIUM ION BATTERIES

WARNING

DO NOT DISPOSE OF LITHIUM ION BATTERIES IN A FIRE

DO NOT CRUSH LITHIUM ION BATTERIES

1. All used or damaged lithium Ion battery packs are to be discarded in accordance with local health and safety and environmental regulations.

1.2.5 TRANSPORTING LITHIUM ION BATTERIES

NOTE: The information provided below is for guidance only.

1. Read the MSDS from the manufactures' to confirm the amount lithium per battery pack, these quantities CANNOT be verified by Sonardyne Int Ltd.
2. It is the operators' responsibility to obey local, national and international regulations in force at the time of transport.

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

By Sea: International Maritime Dangerous Goods Code.

By Air: IATA Regulations UN 3090 and UN 3091.

2 BATTERIES (GENERAL)

2.1 BATTERY LIFE

The transponder measures the battery voltage which falls slowly with alkaline batteries. Lithium batteries have a flat voltage the voltage does not indicate the remaining battery life. The discharge current from lithium batteries must be constantly monitored. The remaining capacity is expressed as a percentage of the original capacity Ampere per hour (Ahr) and is reported in the Volatile Status (VS) command response.

2.2 USE OF INAPPROPRIATE BATTERY TYPES

1. Sonardyne equipment uses a variety of battery types.

WARNING

DO NOT FIT UNAUTHORISED BATTERY PACK TYPES INTO AN INSTRUMENT.

DAMAGED CAUSED BY USING BATTERY PACKS WHICH ARE NOT AUTHORISED OR ARE NOT CONSTRUCTED TO SONARDYNES BUILD STANDARDS INVALIDATES ANY WARRENTY.

2.3 CHARGING BATTERIES IN A SEALED CONTAINER

1. Batteries/cells may give off gas when charged.
2. If the container is sealed it must be allowed to vent to atmosphere while it is being charged.
3. Some instruments are fitted with safety features which prevent the gas build up during charging.
4. Always follow the charging procedure for each individual instrument.

2.4 ATTEMPTING TO CHARGE NON RECHARGEABLE BATTERY PACKS

WARNING

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

1. All primary batteries cannot be re-charged, these are as follows:
 - a) Alkaline-manganese dioxide
 - b) Lithium manganese dioxide
 - c) Silver oxide
 - d) Zinc air
 - e) Zinc carbon
 - f) Zinc chloride
2. If an attempt is made to re-charge any of the above batteries **Very High Temperatures** can occur in an instrument after the attempt to re-charge has stopped.
3. An attempt to re-charge any of the above could lead to gas generation or an explosion.
4. Battery packs must not be reconfigured from one type to another e.g. NiCad to alkaline or lithium.
5. Alkaline or lithium cells may be charged by mistake.

2.5 HANDLING OF USED BATTERIES

1. Batteries should not be discharged below their end point voltage to prevent internal corrosion and leakage of the electrolyte in certain types of sulphur dioxide cells.
2. The leaking electrolyte can cause severe corrosion.
3. After recovering an instrument from the sea do the following:
 - a) Open and check battery voltages while still connected.
 - b) Check to see if the voltage is above the end point voltage for that type of cell.
 - c) Disconnect and mark usable or unusable.
 - d) Record the details on the pack and in the written records (Ref: Section 17).
 - e) Check the instrument for signs of corrosion and any signs of leakage.
4. The remaining battery life depends on both time and for a transponder the number of interrogations.
5. Transponder keep their own record of battery usage.
6. Users must keep a record of time elapsed while the battery is installed and an estimate of interrogations.

2.6 RE-CONNECTING A PARTIALLY USED BATTERY

1. Calculate if the remaining battery life will allow your mission to be accomplished safely.
2. Note the date of reconnection on the battery label and the record card against the serial number of the instrument.

2.7 FITTING A NEW BATTERY

1. Note the date it is connected.
2. Record this date on the battery label and the record card against the serial number of the instrument.

2.8 BATTERY PACK FUSES

1. Some Sonardyne battery packs have fuses soldered onto the diode board of the pack.
2. If a fuse blows due to mishandling, it can only be replaced with an identically rated fuse.
3. The fuse rating **CANNOT** be increased.

11 UPGRADING FIRMWARE TYPE 8220 WIDEBAND TRANSCEIVERS (AVTRAK 6)

Contents

- 1 HOST FIRMWARE UPGRADE PROCEDURE**
 - 1.1 PREPARATION**
 - 1.2 UPGRADE**
 - 1.3 POST TASK PROCEDURES**

1 **HOST FIRMWARE UPGRADE PROCEDURE**

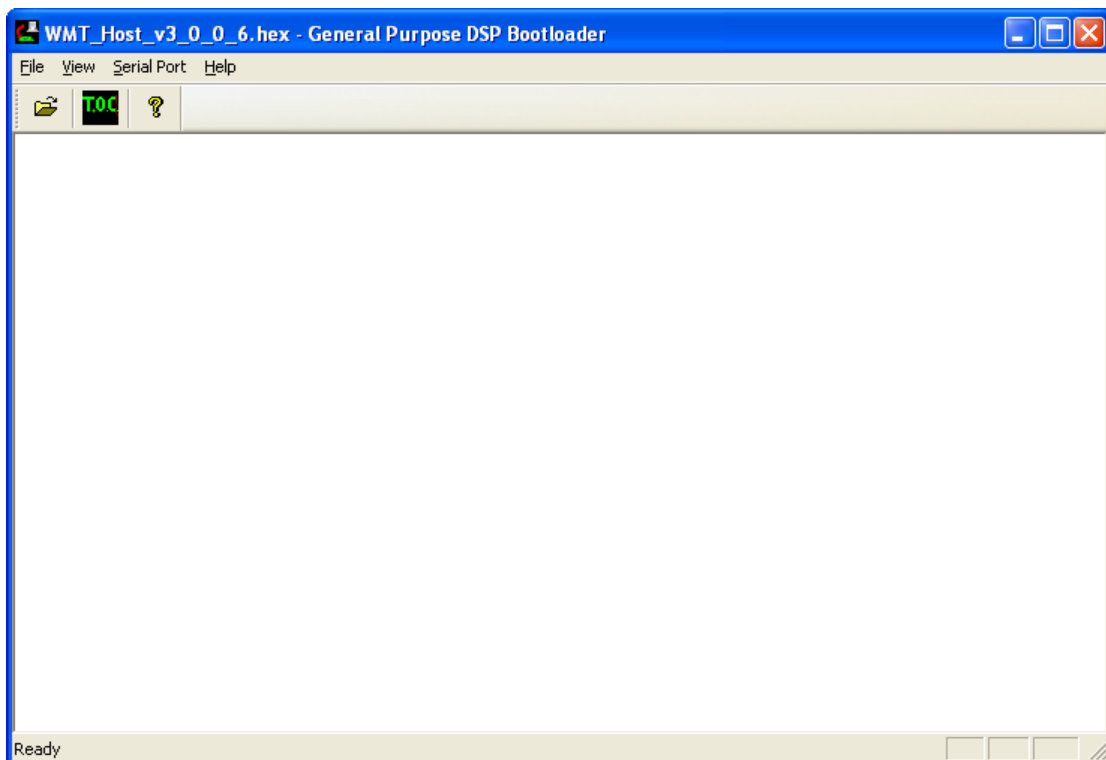
1.1 **PREPARATION**

1. Before you do this task, read and obey the General Safety Precautions in the Introduction section of this User Manual (Ref: [0-4 Introduction, Section 8](#)).
1. Make sure there is sufficient access to the work area.
2. Make sure you wear the correct protective clothing and equipment.
3. Make sure the work area is clean and clear of unwanted equipment and materials.

1.2 **UPGRADE**

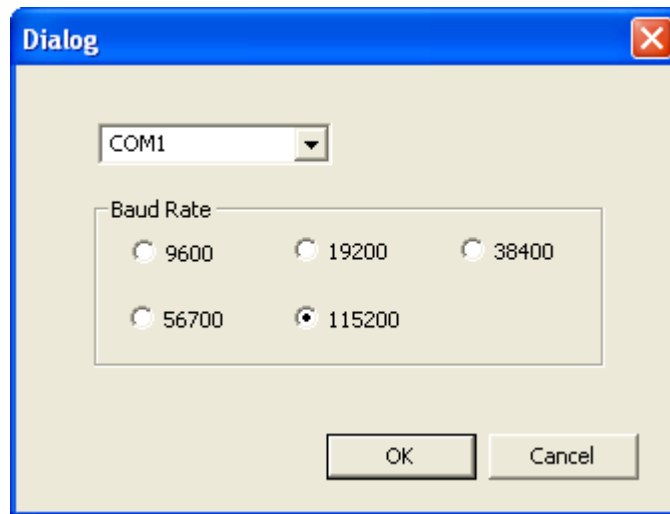
The Avtrak 6 transceiver is fitted with a bootloader so the system firmware can be upgraded in the field. Sonardyne Int Ltd supply a PC application program that talks to the transceiver and allows existing firmware to be rendered dormant and new firmware loaded. The original firmware can be re-activated as the master application if necessary. The Sonardyne Bootloader PC application is generally supplied in the form of a zip file.

1. The CD supplied with this manual contains a program called GP BootLoader.exe.
2. Connect the AvTrak 6 to the PC using a serial test cable. For RS232 units (Ref: [08 Operational Test, Sub-Para 1.2, Fig 1](#))
3. Run the program, and the DSP Bootloader main window (Ref: [Screen Shot 1](#)).



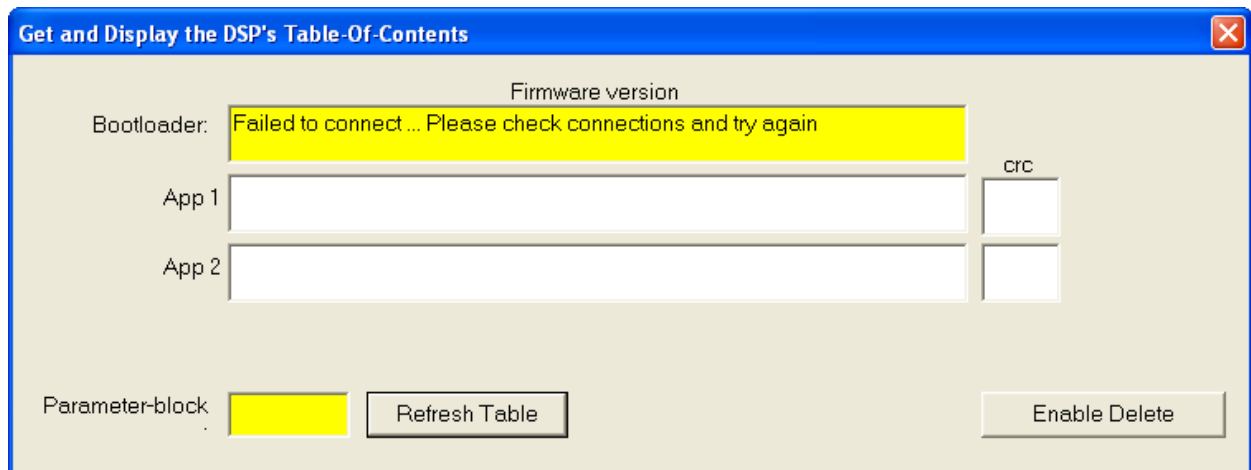
Screen Shot 1

4. Click <**Serial Port**> (Ref: [Screen Shot 1](#)) and then click <**Configure**>.
5. Choose the PC Comm port and Baud Rate to be used (Ref: [Screen Shot 2](#)).



Screen Shot 2

6. Click <**OK**> (Ref: [Screen Shot 2](#))
7. Click the <**TOC**> (Ref: [Screen Shot 1](#)).
8. If connections are not correctly made an error screen will appear (Ref: [Screen Shot 3](#)).



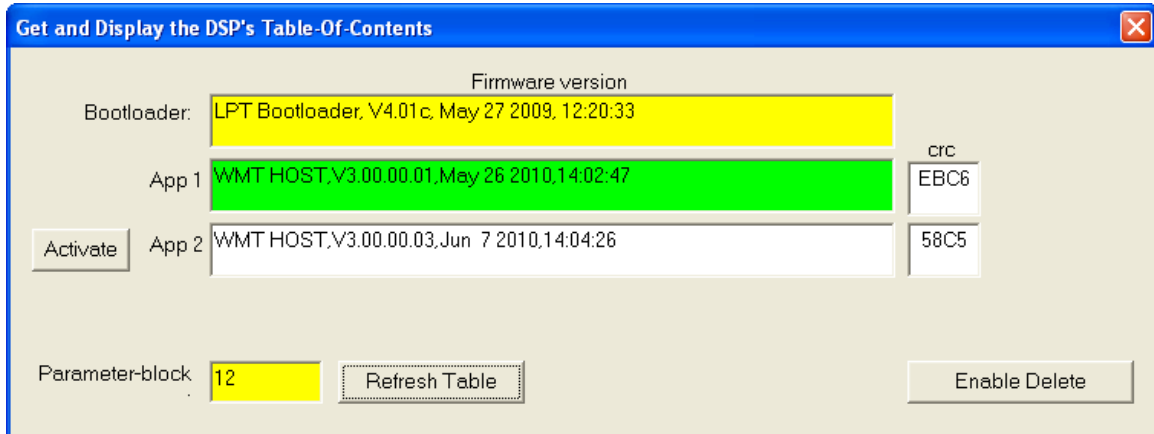
Screen Shot 3

9. Follow the instructions in the Bootloader window (Ref: [Screen Shot 3](#)).
10. Click <**Refresh Table**> (Ref: [Screen Shot 3](#)).

11. If all the cable connections have been made the window will refresh (Ref: [Screen Shot 4](#)).

NOTE: The software can store two programmes, if only one version is stored and there is a blank App go to Step 13.

NOTE: If both Apps have a programme loaded go to Step 11.



Firmware version	
Bootloader:	LPT Bootloader, V4.01c, May 27 2009, 12:20:33
App 1	WMT HOST, V3.00.00.01, May 26 2010, 14:02:47
App 2	WMT HOST, V3.00.00.03, Jun 7 2010, 14:04:26

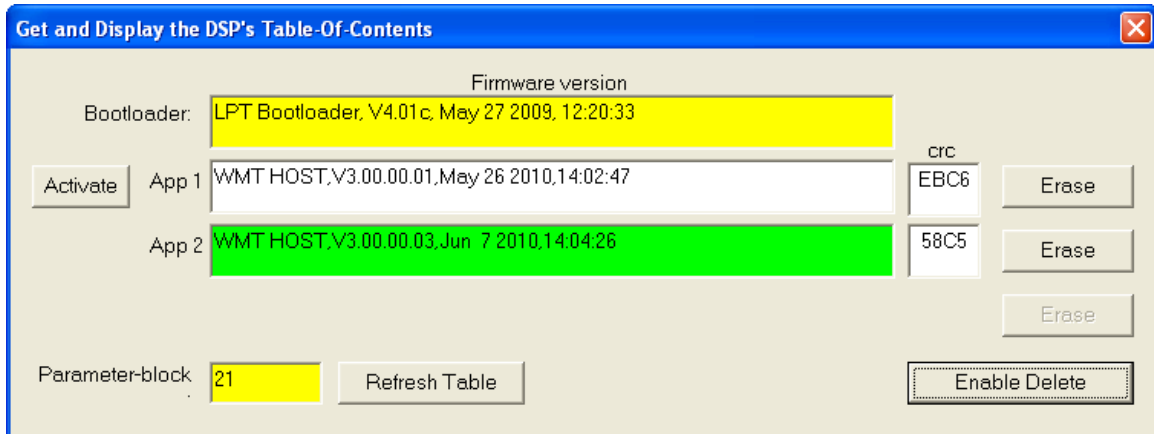
Parameter-block: 12

Refresh Table

Enable Delete

Screen Shot 4

12. Click **<Enable Delete>** (Ref: [Screen Shot 4](#)).
13. Click **<Erase>** next to the App to be deleted (Ref: [Screen Shot 5](#)).



Firmware version	
Bootloader:	LPT Bootloader, V4.01c, May 27 2009, 12:20:33
App 1	WMT HOST, V3.00.00.01, May 26 2010, 14:02:47
App 2	WMT HOST, V3.00.00.03, Jun 7 2010, 14:04:26

Parameter-block: 21

Refresh Table

Enable Delete

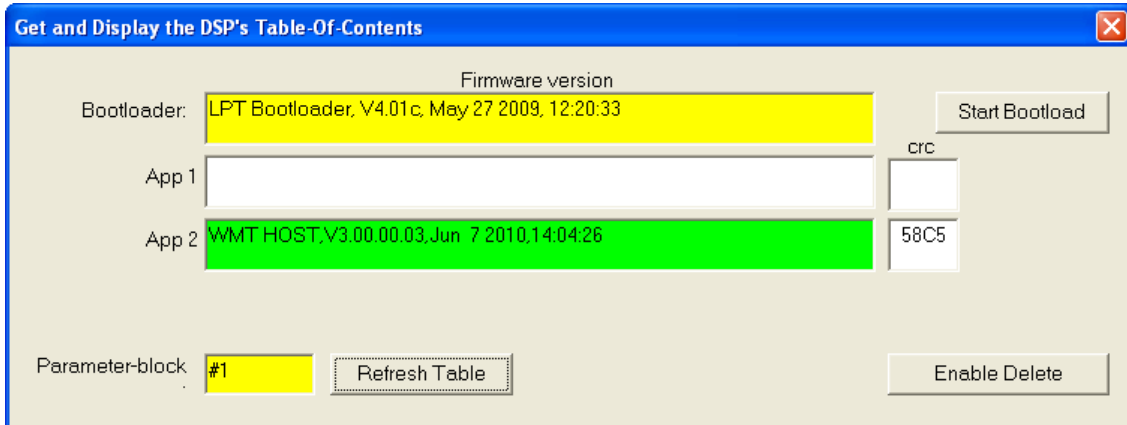
Erase

Erase

Erase

Screen Shot 5

14. Click **<Start Bootload>** (Ref: [Screen Shot 6](#)).



Get and Display the DSP's Table-Of-Contents

Firmware version	
Bootloader:	LPT Bootloader, V4.01c, May 27 2009, 12:20:33
App 1	
App 2	WMT HOST, V3.00.00.03, Jun 7 2010, 14:04:26

Parameter-block: #1

Start Bootload

Refresh Table

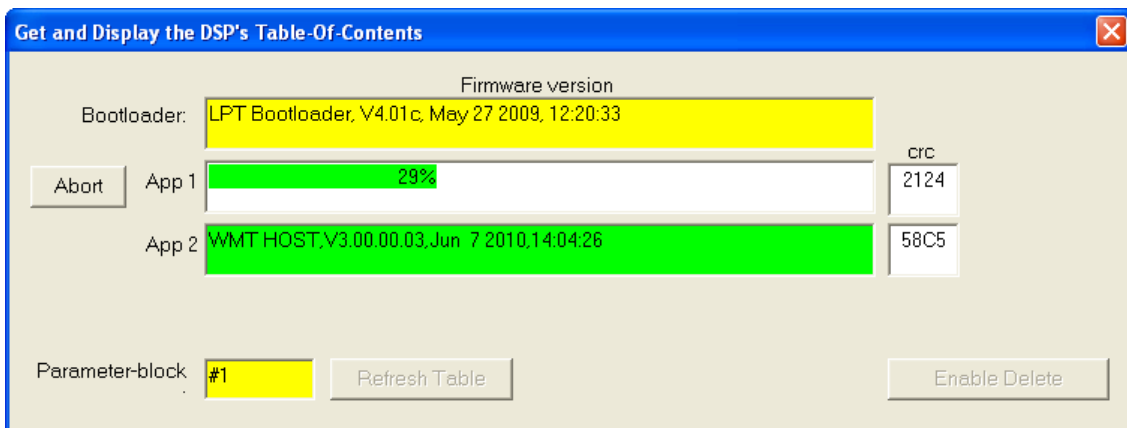
Enable Delete

crc

58C5

Screen Shot 6

15. An update bar will scroll across the App (Ref: [Screen Shot 7](#))



Get and Display the DSP's Table-Of-Contents

Firmware version	
Bootloader:	LPT Bootloader, V4.01c, May 27 2009, 12:20:33
App 1	29%
App 2	WMT HOST, V3.00.00.03, Jun 7 2010, 14:04:26

Parameter-block: #1

Abort

Refresh Table

Enable Delete

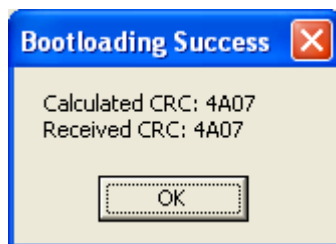
crc

2124

58C5

Screen Shot 7

16. When the upload has completed the Bootloading Success window will appear check the Calculated and Received CRC are the same (Ref: [Screen Shot 8](#)).



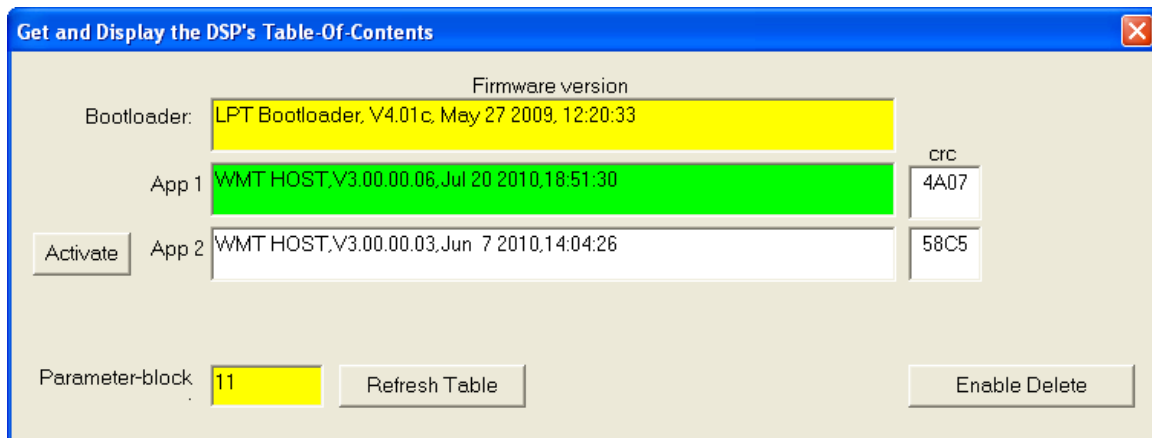
Bootloading Success

Calculated CRC: 4A07
Received CRC: 4A07

OK

Screen Shot 8

17. Click **<OK>** (Ref: [Screen Shot 8](#)).
18. A new uploaded programme will appear in the selected app window (Ref: [Screen Shot 9](#)).



Screen Shot 9

19. To confirm the new software is running click on **<TOC>** (Ref: [Screen Shot 1](#)).
20. The new software should be highlighted in green (Ref: [Screen Shot 9](#)).
21. Close all windows.

1.3 POST TASK PROCEDURES

22. Make sure the work area is clean and clear of all unwanted, tools, equipment and materials.
23. Discard all unwanted consumable materials in accordance with the local health and safety regulations.

12 INSTALLATION

TYPE 8220 WIDEBAND TRANSCEIVERS (AVTRAK6)

Contents

- 1** **INSTALLATION TRANSCEIVERS 8220 SERIES**
- 1.1** **TRANSDUCER LOCATION ON AUV**
- 1.2** **MOUNTING THE AVTRAK 6 TO THE AUV**

Head Office

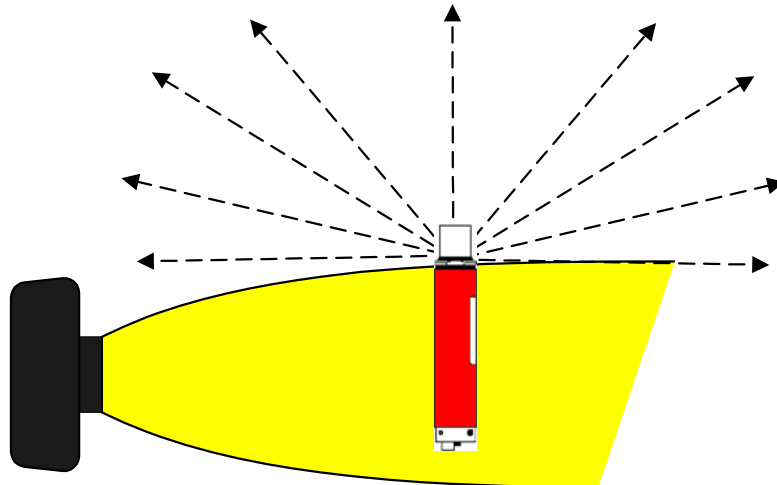
Sonardyne International Limited
Blackbushe Business Park,
Yateley, Hampshire,
GU46 6GD, UK

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

1 INSTALLATION TRANSCEIVERS 8220 SERIES

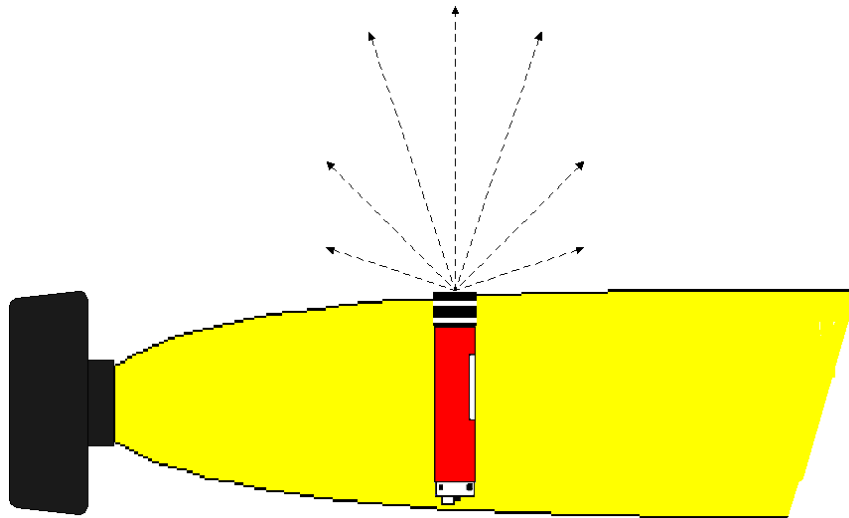
1.1 TRANSDUCER LOCATION ON AUV

1. 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.
2. The position chosen must give a line-of-sight 'view' of the transponder array or other transceiver.
3. A fin near the stern will minimise the hull reflection problems but will not provide line-of-sight to transponders ahead of and below the level of the AUV.
4. Transducers should be mounted with their axis vertical unless a directional transducer is mounted forward looking.
5. The Omni-directional transducer should be mounted with the acoustic transducer outside the hull profile (Ref: [Fig 1](#)).



Omni-directional transducer
Fig 1

6. The directional transducer can be mounted flush with the hulls surface (Ref: [Fig 2](#)).



Directional Transducer
Fig 2

1.2 **MOUNTING THE AVTRAK 6 TO THE AUV**

1. Clamps must be designed to hold the transducer and the AvTrak 6 electronics pressure housing in place.
2. The pressure housing is made of an aluminium alloy for strength and lightness.
3. The surface is hard anodised for protection but all impacts should be avoided as the metal will bend allowing corrosion to start.
4. The AvTrak 6 transceiver must acoustically and electrically isolated from the hull (high frequency vibration can have harmonics in the Medium Frequency (MF) band which can affect the acoustic operation).
5. It is recommended that the pressure housing is clamped within the AUV hull using sheet rubber.
6. The cable between the AvTrak 6 Transceiver and the Remote Transducer is 2 metres long carefully tie the cable in place.
7. Do not allow the cable to vibrate on the outside of the hull where flow may make the cable strum and fatigue.
8. The cable is flexible, but the bend radius should not be too tight.
9. Do not kink the cable.

1. Cut the power/comms cable(Ref: [Fig 3](#)) to length and mould a connector to the end for the Avtrak 6.

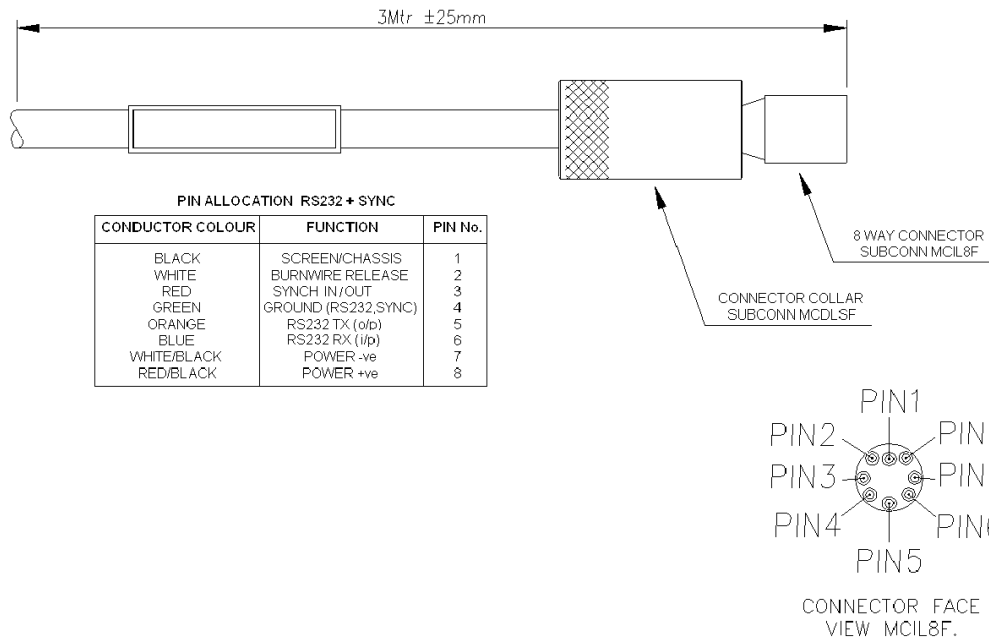


Fig 3.

2. Ensure that the pressure relief valve is pushed in and is flush with the end cap(Ref: [Fig 4](#)).

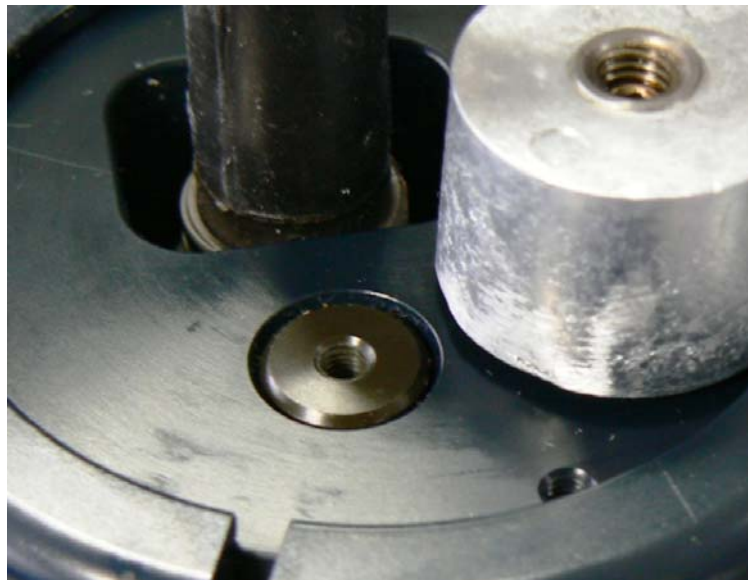


Fig 4.

3. Ref [08 Operational Test](#).

13 ACOUSTIC NAVIGATION PRINCIPLES

Contents

- 1** **ACOUSTIC NAVIGATION SYSTEM PRINCIPLES**
 - 1.1** **LONG BASE LINE PRINCIPLES (REF. FIG 1)**
 - 1.2** **SHORT BASE LINE PRINCIPLES (REF. FIG 2)**
 - 1.3** **ULTRA SHORT BASE LINE PRINCIPLES (REF. FIG 3)**
 - 1.4** **LONG ULTRA SHORT BASE LINE PRINCIPLES (REF. FIG 4)**

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GU46 6GD, UK

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

1 ACOUSTIC NAVIGATION SYSTEM PRINCIPLES

1.1 LONG BASE LINE PRINCIPLES (REF. FIG 1)

A Long-Base-Line (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 Tow Fish. 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 time from the transmission of the first signal to the reception of the second is measured. As sound travels through the water at a fixed speed, the distance between the transducer and the transponder can be estimated.

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.

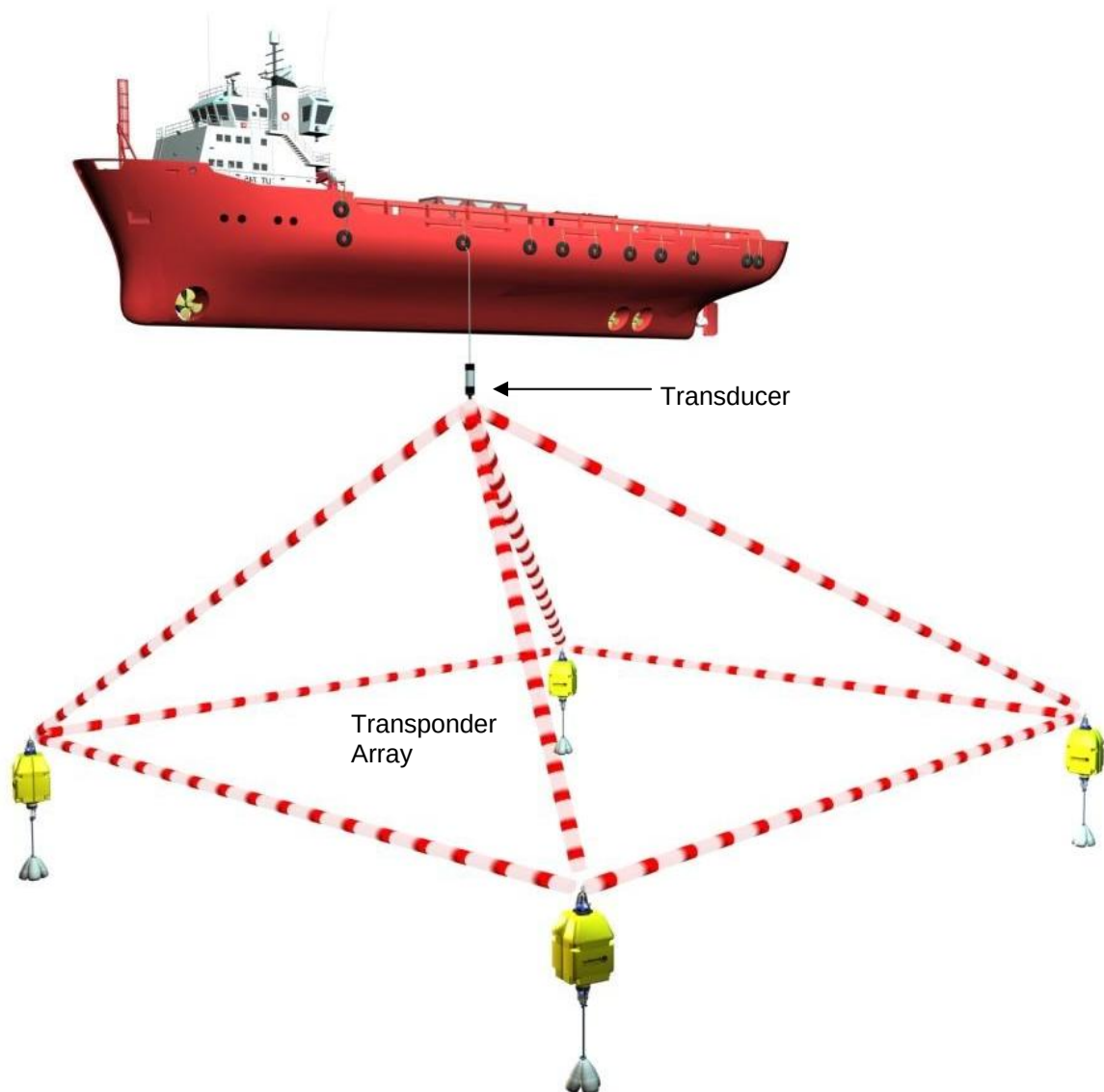
Navigation can be achieved using just two seabed transponders but in doing this there is a possible doubt as to which side of the baseline (a line drawn between the transponders) the vessel may be on, also the depth or height of the transducer has to be assumed.

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.

LBL baselines are much larger, so an LBL system is very accurate compared with the Short Base Line (SBL) and Ultra Short Base Line (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.



LBL System
Fig 1

1.2 SHORT BASE LINE PRINCIPLES (REF. FIG 2)

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 made as large as is practical, and it is this distance that is known as the base line.

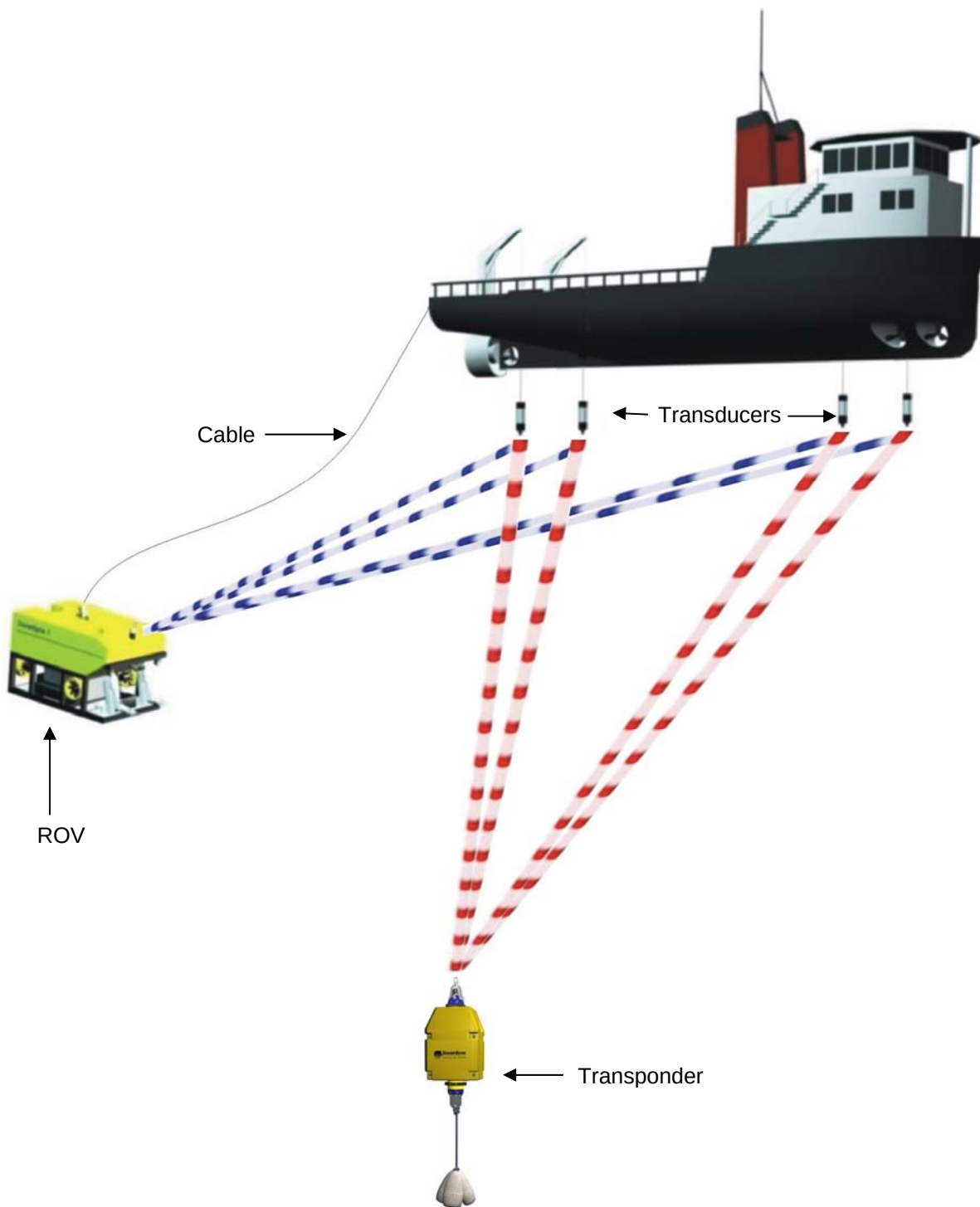
The position of each transducer within a co-ordinate frame fixed to the vessel is determined by conventional survey techniques or from the "as built" survey of the vessel.

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.

It is impractical to transmit a signal from each SBL transducer in turn. So the systems that use transponders transmit from one transducer but receive 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 then 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.



SBL System
Figure 2

1.3 ULTRA SHORT BASE LINE PRINCIPLES (REF. FIG 3)

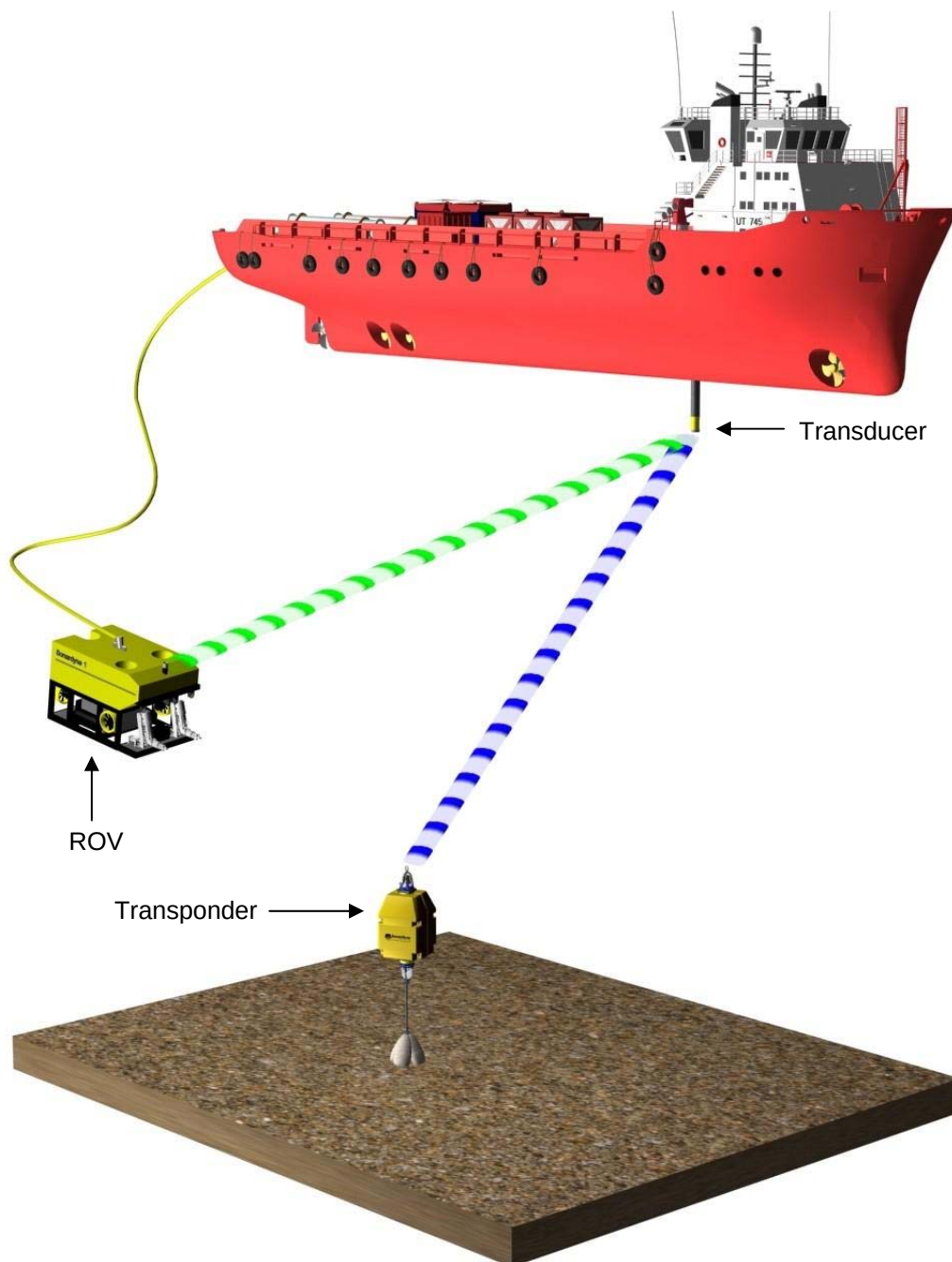
USBL transducers are all built into a single transceiver assembly - or the array of transducers is replaced by an array of transducer elements in a single transceiver assembly.

The distances or ranges are measured as they are in an 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 that systems using three elements (or groups of elements) 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 and so on.

Another restriction is that if an unambiguous position within a hemisphere is required 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.

Another difference is that 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 case.



USBL System
Figure 3

1.4 LONG ULTRA SHORT BASE LINE PRINCIPLES (REF, FIG 4)

The Long Ultra Short Base Line (LUSBL) system is a variation of a USBL system. It uses USBL hardware in a configuration similar to the one described for the LBL system.

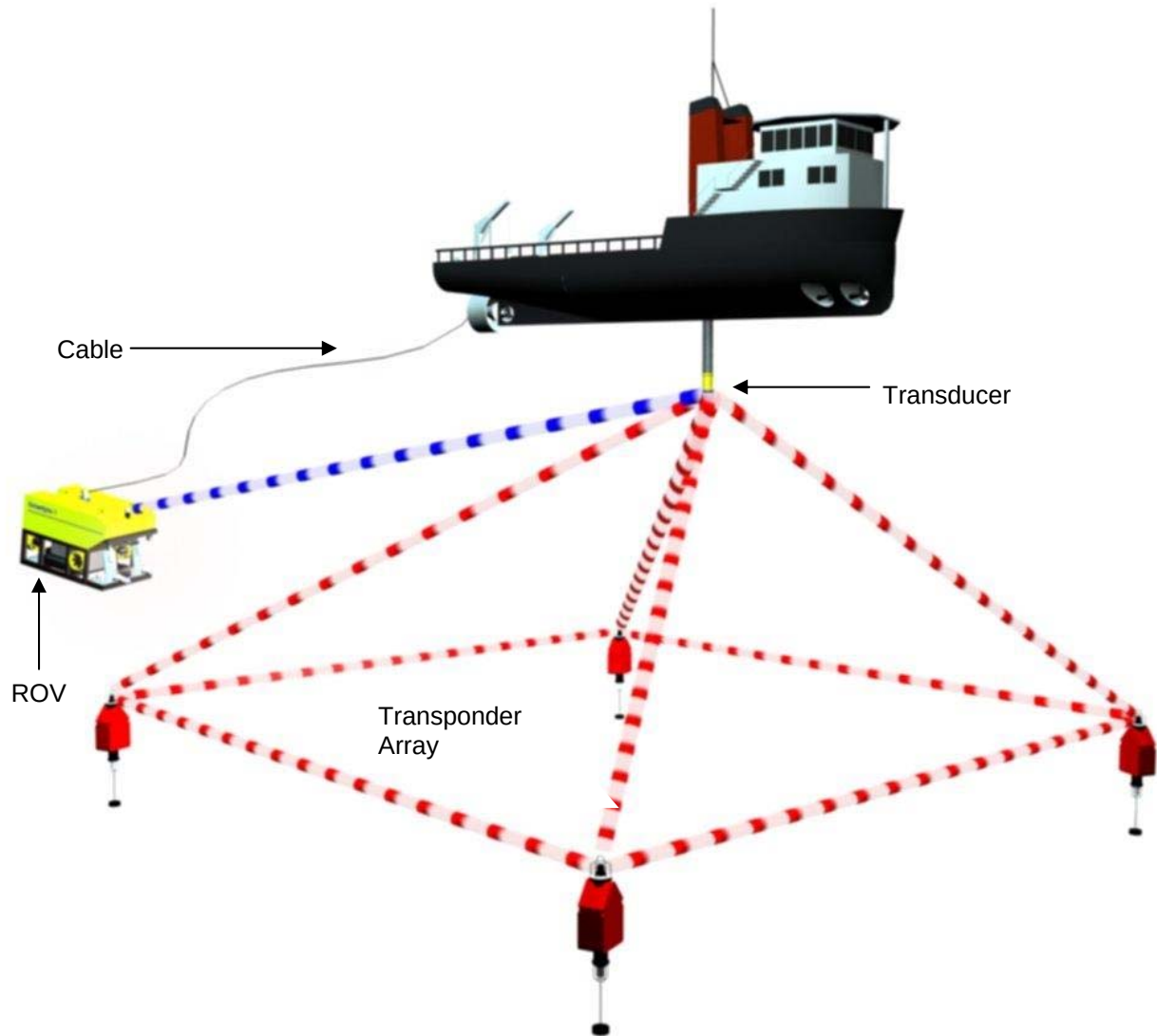
The range and bearing in a LUSBL system is measured as for a basic USBL system. But a larger number of transponders are deployed on the seabed, so a greater accuracy can be achieved.

In a LUSBL system, the seabed array must be calibrated separately and the baseline 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.

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 operation of 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 that the "master system" is not functioning.



LUSBL system
Figure 4

14 RECOMMENDED SPARES TYPE 8220 WIDEBAND TRANSCEIVERS (AVTRAK 6)

Contents

- 1** **HOW TO ORDER PARTS**
- 2** **RECOMMENDED SPARES**
 - 2.1** **BATTERIES**
 - 2.2** **MISCELLANEOUS PARTS**
 - 2.3** **CABLES**

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E. support@sonardyne.com
www.sonardyne.com

1 **HOW TO ORDER PARTS**

When ordering spare parts, you must provide:

1. The parts number
2. The drawing number
3. The description.

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

Sonardyne Int Limited
Blackbushe Business Park
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UNITED KINGDOM
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E-mail: support@sonardyne.com
www.sonardyne.com

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2 **RECOMMENDED SPARES**

2.1 **BATTERIES**

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

2.2 **MISCELLANEOUS PARTS**

Part No.	Dwg No	Description	Qty
641-3332	8000-905-A2	Sonardyne Opening Tool	2
650-0247	n/a	Anode kit 3000m	1
650-0017	8065-126-A1	Ring Clamp kit	1
201-5012	n/a	Spring Earthing EMI	1
212-0867	n/a	Screw Clamp	2
730-4592	n/a	Isolater Nylon	4
230-0535	n/a	Nut Nyloc	2
860-0725	n/a	Anode Zinc (3000m)	1
860-2087	n/a	Anode Zinc (5Km 90° Connector)	1
212-5246	n/a	Stud Anode Mounting (3000m)	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

2.3 **CABLES**

Part No.	Dwg No	Description	Qty
317-2896	n/a	SUBCONN MCIL8F Cable Tail 0.5m (without locking collar)	1
317-2963	n/a	SUBCONN MCIL8F Cable Tail 3m (without locking collar)	1
820-5801	7995-051-A2	SUBCONN MCIL8F Cable Tail 3m (with locking collar)	1
312-6924	n/a	SUBCONN MCD8F Dummy	1
317-2672	n/a	SUBCONN LOCKING COLLAR MCDLSF	1

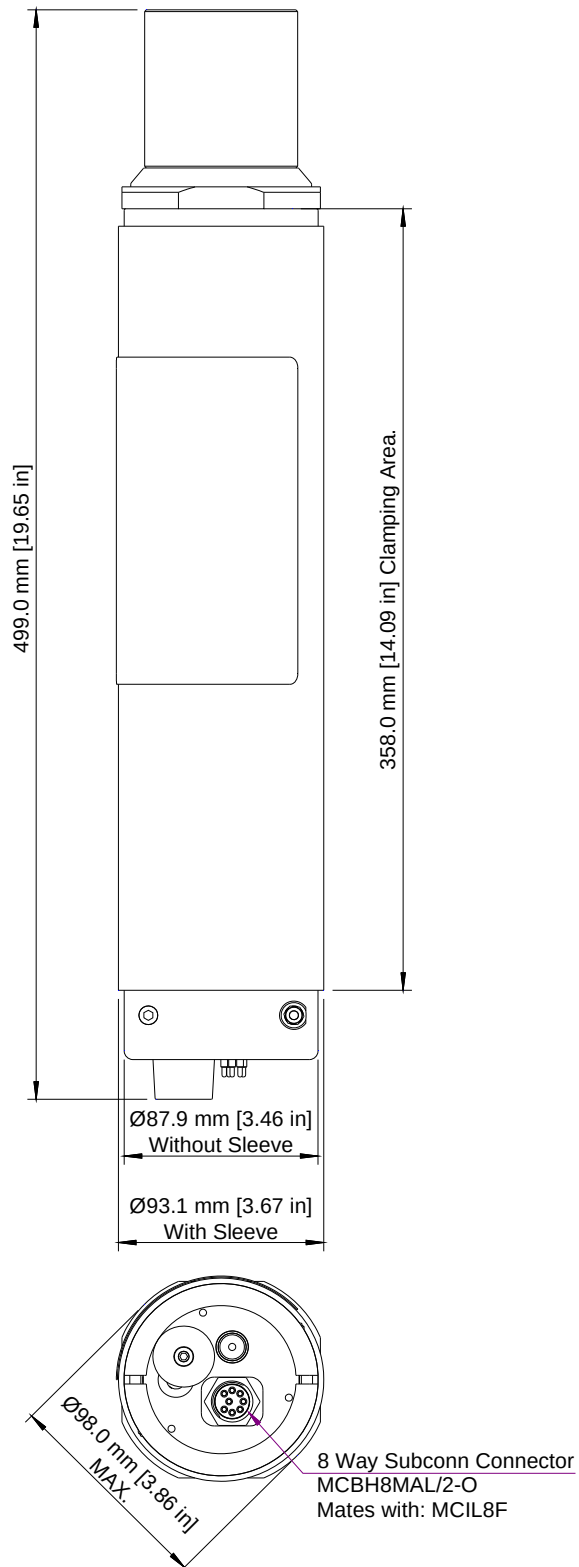
15 DRAWINGS

TYPE 8220 WIDEBAND TRANSCEIVERS (AVTRAK 6)

Contents

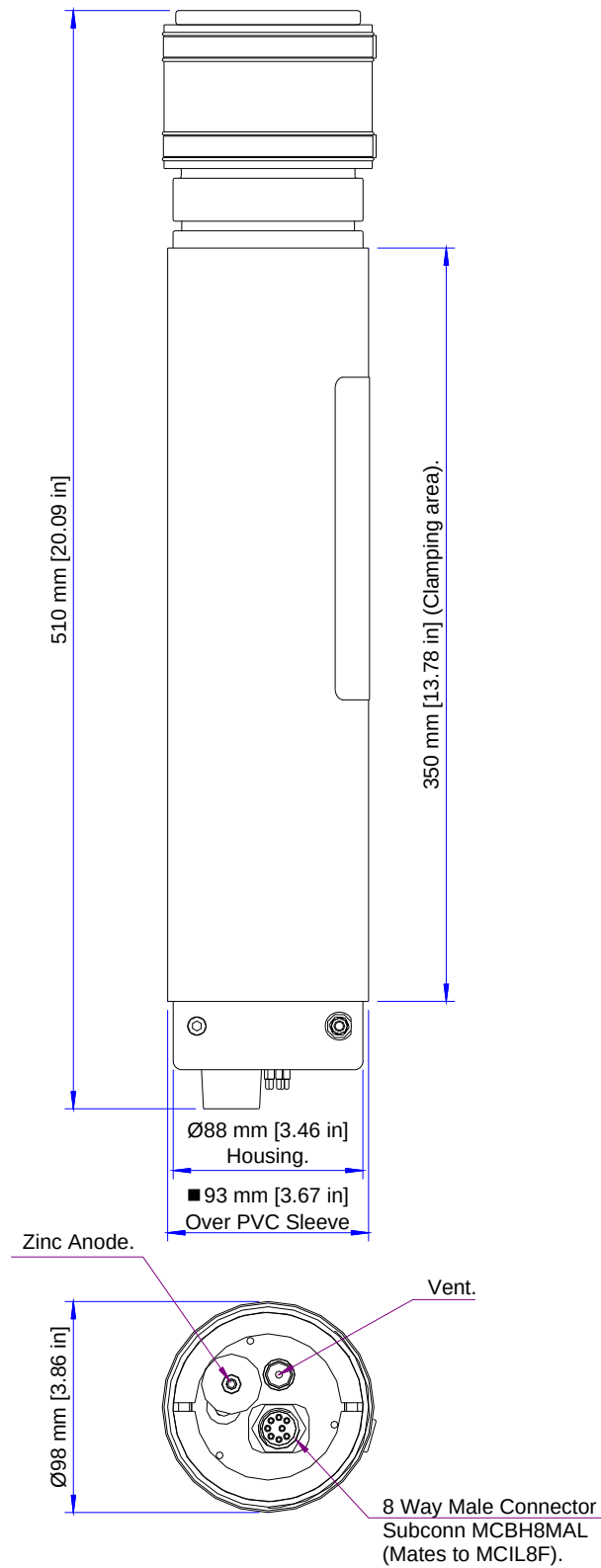
- 1 MF OMNI AVTRAK6**
- 2 MF DIRECTIONAL AVTRAK6**
- 3 MF OMNI AVTRAK6 WITH STRAIGHT REMOTE TRANSDUCER**
- 4 MF OMNI AVTRAK6 WITH RIGHT ANGLED REMOTE TRANSDUCER**

1 MF OMNI AVTRAK6



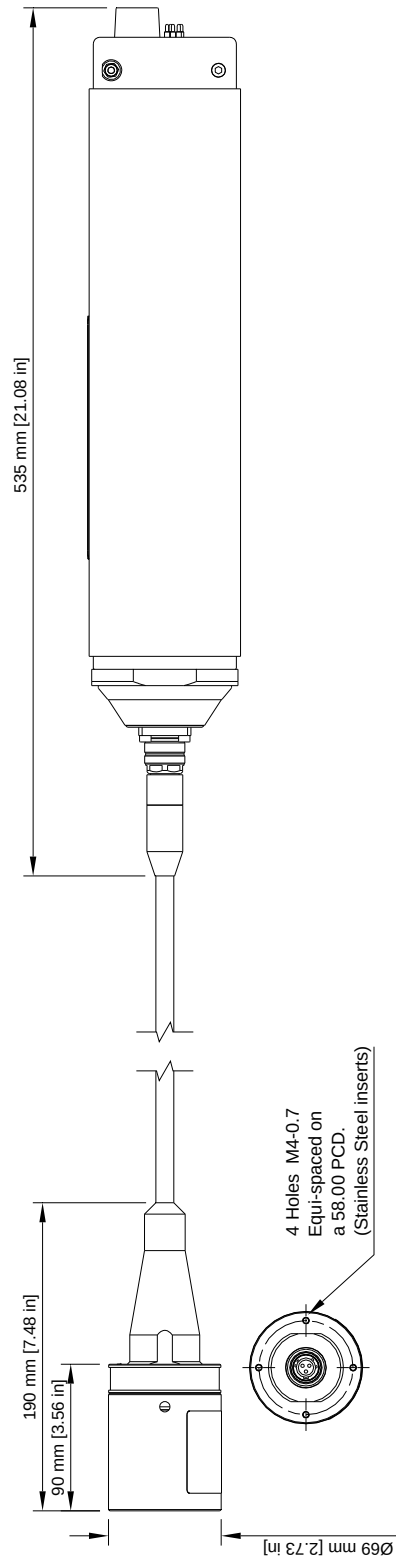
Type 8220-000-3111
Fig 1

2 MF DIRECTIONAL AVTRAK6



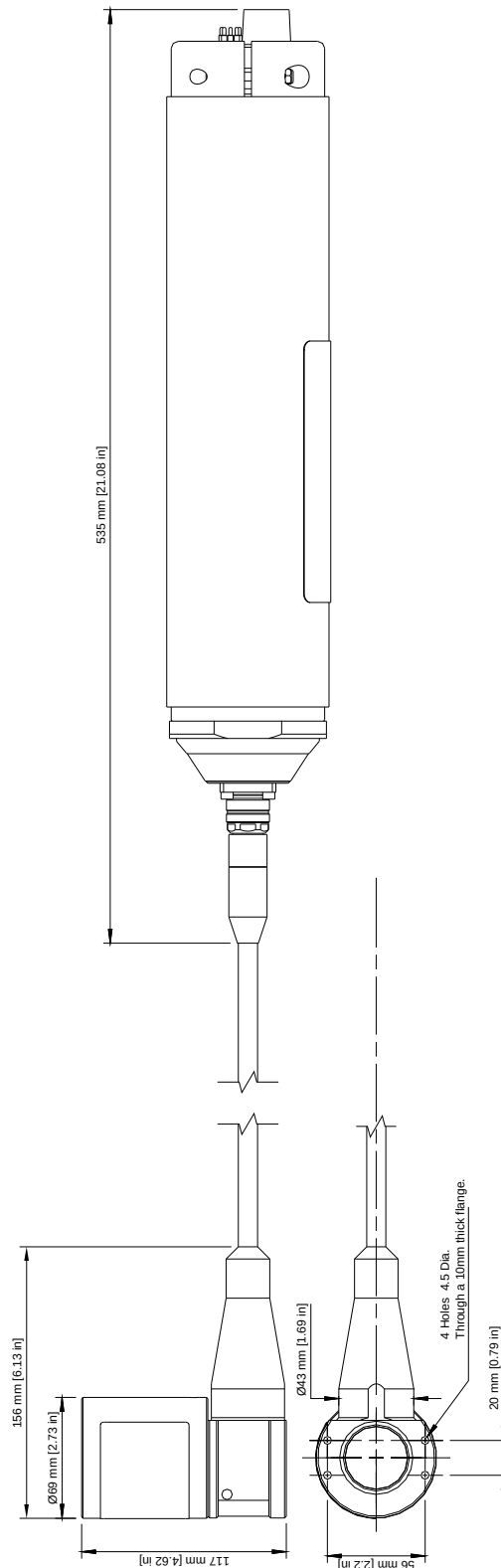
Type 8220-000-7211
Fig 2

3 MF OMNI AVTRAK6 WITH STRAIGHT REMOTE TRANSDUCER



Type 8220-000-3161 with 8065-120 Straight Remote Transducer
Fig 3

4 **MF OMNI AVTRAK6 WITH RIGHT ANGLED REMOTE TRANSDUCER**



Type 8220-000-3161 with 8065-121 Right Angled Remote Transducer
Fig 4

16 DEPLOYMENT

TYPE 8220 WIDEBAND TRANSCEIVERS (AVTRAK 6)

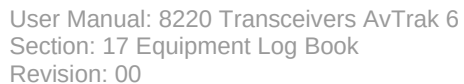
Contents

For Deployment Ref ([12 Installation](#))

17 EQUIPMENT LOG BOOK TYPE 8220 WIDEBAND TRANSCEIVERS (AVTRAK 6)

Contents

- 1 DEPLOYMENT AND RECOVERY**
- 2 BATTERY REPLACEMENT**
- 3 BATTERY CHECKS**
- 4 REPAIRS**
- 5 SERVICING**
- 6 SEA STATE TABLE**



1

Note: Print pages as required

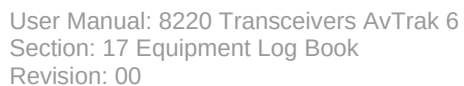
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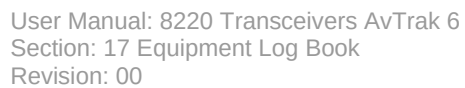


BATTERY REPLACEMENT

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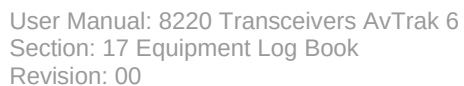
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6 SEA STATE TABLE

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