MM-8000

Maintenance Manual for Type 8000 & 8100 MF Omni Compatt 5

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MM-8000

MAINTENANCE MANUAL

FOR THE

TYPE 8000 & 8100 COMPATT 5

MF OMNI-DIRECTIONAL TRANSPONDER

ISSUE A

REVISION 11

IMPORTANT SAFETY INFORMATION OVERLEAF

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Sonardyne
SOUND IN DEPTH

SAFETY

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

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

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

SUBSEA EQUIPMENT GENERAL OPERATIONAL & SAFETY PRECAUTIONS

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

Not all sections will apply to all instruments.

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

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

CAUTIONS

⚠ **High pressure hazard risk when dismantling the equipment, refer to Safety Precautions section, point 3 "DISMANTLING SUB-SEA EQUIPMENT". Must only be carried out by trained personnel.**

⚠ **Electric shock hazard risk when dismantling the equipment, refer to Safety Precautions section, point 4.1 "HIGH VOLTAGES". Must only be carried out by trained personnel.**

⚠ **Mechanical hazard risk when release mechanism operates or is being load. Refer to section 3, point 3 "DEPLOYMENT" and particularly point 3.4 before carrying out any operation on it. Must only be carried out by trained personnel.**

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1. HAZARD APPRECIATION

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

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

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

2. GENERAL HANDLING OF EQUIPMENT

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

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

3. DISMANTLING SUB-SEA EQUIPMENT

3.1 INTRODUCTION

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

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

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

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

DO NOT TRANSPORT EQUIPMENT WHICH IS INTERNALLY PRESSURED

The following precautions & procedures are recommended.

3.2 INSTRUMENTS FITTED WITH SPRUNG VENT PLUGS

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

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

3.3 PRECAUTIONS (INSTRUMENT FULLY FUNCTIONING)

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

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

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

3.4 PRECAUTIONS (INSTRUMENT KNOWN OR SUSPECTED TO BE PRESSURISED)

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

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

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

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

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

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

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

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

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

4. ELECTRONIC HAZARDS

4.1 HIGH VOLTAGES

WARNING

High Voltages

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

Storage Capacitors

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

4.2 HANDLING OF ELECTRONIC COMPONENTS

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

4.3 SAFETY PRECAUTIONS FOR LITHIUM BATTERIES

WARNING

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

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

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

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

4.4 LITHIUM BASED BATTERIES, GENERAL

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

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

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

4.5 LITHIUM BASED BATTERIES, STORAGE TEMPERATURE

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

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

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

4.6 OPENING A LITHIUM POWERED INSTRUMENT

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

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

4.7 FAULT PROCEDURES

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

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

WARNING

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

4.8 DISPOSAL OF LITHIUM BASED BATTERIES

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

DO NOT DISPOSE OF LITHIUM BATTERIES IN A FIRE.

4.9 TRANSPORTING LITHIUM BASED PRODUCTS

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

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

By Sea: International Maritime Dangerous Goods Code

By Air: IATA Regulations UN 3090 and UN 3091

5. BATTERIES GENERAL

5.1 USE OF APPROPRIATE BATTERY TYPES

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

DO NOT FIT UNAUTHORISED BATTERY PACK TYPES INTO AN INSTRUMENT

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

5.2 CHARGING OF BATTERIES IN SEALED CONTAINERS

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

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

5.3 ATTEMPTING TO CHARGE NON-RECHARGEABLE BATTERY PACKS

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

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

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

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

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

5.4 HANDLING OF USED BATTERIES

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

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

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

5.5 RE-CONNECTING A PARTIALLY USED BATTERY

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

5.6 FITTING A NEW BATTERY

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

5.7 BATTERY PACK FUSES

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

6. EQUIPMENT ENVIRONMENTAL LIMITATIONS

6.1 STORAGE TEMPERATURE LIMITS

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

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

7. INSTRUMENT LOAD BEARING CAPABILITY

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

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

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

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

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

8. FLOATATION EQUIPMENT

8.1 INTRODUCTION

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

8.2 MINIMUM NETT BUOYANCY OF FLOATS

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

8.3 FLOAT INSERTS

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

8.4 NETT UPTHRUST

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

Nett Upthrust =

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

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

8.5 FLOAT STORAGE CONDITIONS

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

8.6 FLOAT OVER-PRESSURE

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

9. DEFINITIONS OF VARIOUS LOADS AND LOADING TERMS

9.1 A STATIC LOAD

An unvarying long term load.

9.2 A DYNAMIC LOAD

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

9.3 MAXIMUM ULTIMATE STATIC LOAD OR BREAKING LOAD OR PARTING LOAD

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

9.4 MAXIMUM PROOF STATIC LOAD OR MAXIMUM RATED STATIC LOAD

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

9.5 SHOCK LOAD OR SNATCH LOAD

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

9.6 SAFE WORKING LOAD

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

9.7 PROOF LOAD

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

9.8 RELEASE LOAD

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

10. IF IN DOUBT

Contact Sonardyne for advice.

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AMENDMENT RECORD

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

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

Authorised :

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AMENDMENT RECORD

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

Issue	Revision	Date	Comments	Section	Page
A	0	02/05/03	Provisional Issue	All	All
A	1	30/06/03	CN7859 Transfer from Provisional to Master Copy	All	All
A	2	06/11/03	CN8006 Show ORT as release transponder. Update firmware history	3 AppC	All All
A	3	26/02/04	CN8101 Inclinometer details added. Sound speed sensor details added	App G 4.30 App B.3 App B.4	All
A	4	29/10/04	CN8363 Firmware History updated Gyro interfacing details added Inclinometer scaling details added Battery power figures revised	App C App B App G 6	All B.5 G.3 6.4
A	5	13/05/05	CN 8568 V1.05 firmware added Wideband receiver card added		
A	6	26/10/05	CN 8787 Add Mini configuration Add new Figures DAS V3.05 added to Firmware History Wideband Acoustic check added	 All Figs App C App B	
A	7	29/06/06	CN 9054 Add V10.06 firmware release Add transducer to pressure port offsets Test Terminal V2.03.008 covered Add battery life graphs	 App C Fig 18 App B 6	
A	8		Not issued		

Issue	Revision	Date	Comments	Section	Page
A	9	21/09/07	CN 9457 Test Terminal V3.00.011 covered DASCAL V3.00.09 covered DASC CAL Box added Firmware V10.07 added 5000m rated Type 8100 added	 App B App B App B App C 1	
A	10	27/03/09	CN10181 Added Max unit	 All	
A	11	22/09/11	CN11380 Add para's to 2nd Safety paragraph Insert warning labels and risk information Depth sensor added Cross reference B.2.3.9 changed to B.2.3.10 Set depth reading para added Technical Specs covered Max unit alkaline figures changed to N/A Environmental ratings added Depth reading para added Refill with fresh 60000 covered V10.08I & V10.09c added	 Safety Safety 2.1 4.23 4.26 6.1 6.4.3 6.7 B.2.3.1 0 B.3.4 App C	

SECTION 1

1. INTRODUCTION

Sonardyne's family of Computing and Telemetering Transponders (Compatt) includes models for various frequency bands to optimise range/accuracy performance. Type 8000 is a medium frequency model, operating in the 19 to 36 kHz band, intended for general purpose use, offering the best compromise between range, accuracy and operation in high levels of noise. The operating depth of individual units depends on the sensitivity of the depth sensor fitted, which is chosen to optimise accuracy for a customer's particular application.

1.1 PHYSICAL DESCRIPTION AND IDENTIFICATION

1.1.1 Standard Unit: Type 8000-000-01

The Standard length Compatt 5 is a one-piece instrument, packed in a shipping case with a pair of Opening Tools and a CD containing this manual and some software utilities. It is approximately 1035 mm overall length and comprises a dark blue, hard-anodised pressure housing approximately 135 mm diameter, protected by a yellow sleeve. One end has a braced sheet steel guard protecting a black acoustic transducer. The other end may have a stainless steel mechanism for releasing an anchor weight. The flanges at either end of the pressure housing are retained by two bolts which hold the clamp rings together.

1.1.2 Midi Unit: Type 8000-000-03

The Midi Compatt 5 is a one-piece instrument, packed in a case with a pair of Opening Tools and a CD containing this manual and some software utilities. It is approximately 784 mm overall length and comprises a dark blue, hard-anodised pressure housing approximately 135 mm diameter, protected by a yellow sleeve. One end has a braced sheet steel guard protecting a black acoustic transducer. It has a Lithium battery that has approximately 30% of the capacity of the standard Lithium unit, but otherwise has the same functionality.

1.1.3 Mini Unit: Type 8000-000-05

The Mini Compatt 5 is a one-piece instrument, packed in a shipping case with a pair of Opening Tools and a CD containing this manual and some software utilities. It is approximately 566 mm overall length and comprises a dark blue, hard-anodised pressure housing approximately 135 mm diameter, protected by a yellow sleeve. One end has a braced sheet steel guard protecting a black acoustic transducer. It has a Lithium battery that has approximately 30% of the capacity of the standard Lithium unit, but does not include a DAS card or any sensors. The acoustic performance is the same as the standard unit.

1.1.4 MAX Unit: Type 8003-000-07

The MAX is a one-piece instrument, packed in a shipping case with a pair of Opening Tools and a CD containing this manual and some software utilities. It is approximately 1575mm overall length and comprises a dark blue, hard-anodised pressure housing approximately 135 mm diameter, protected by a yellow sleeve. One end has a steel rod guard protecting a black acoustic transducer. It has a larger battery than the standard unit, but otherwise has the same functionality.

1.1.5 Deep Unit: Type 8100-000-01

The Deep Compatt 5 is the same as the standard unit, except that the deeper rated housing is red in colour, and the pressure sensor is 5000m rated.

1.2 HOUSING LABELLING

There are waterproof labels on the housing, which uniquely identify the instrument by "Type Number", "Serial Number", "Address", "HPR" channel and electronic "Unit ID".

From 2006, the labels changed to a wrap-around style giving improved visibility.

The housing label shows the following information. For example:

SERIAL No	:	212345-006
TYPE No	:	8000-000-01/WM21A103
Housing Limit	:	3000m (also refer to end-cap)
UNIT ID	:	00047D
Address/HPR	:	807 B56

The **Serial Number** uniquely identifies the unit and should be quoted in all communications with Sonardyne or agents to allow quick cross-referencing with production documentation.

The **Type Number** is a four digit number beginning with an 8, (e.g. 8000). Following the slash, there is a configuration number which defines the depth rating, housing length, battery type and sensor end-cap details (see Fig 1.1).

The **Housing Limit** is the nominal pressure rating of the transponder housing, (default is 3000m). The sensor end-cap may be rated to less than this, depending on the sensor options fitted. So to find the unit depth rating, it is necessary to check the end-cap label, and use the lower of the 2 figures.

The Unit **ID** boxes show the unique identification number for the instrument. This is required by software issued to upgrade the functionality of the unit (via serial data connection), and can also be used to acoustically command a unit of unknown command address. The Unit ID cannot be changed, and is defined in hardware on the CPU/Rx board.

The **Address** boxes contain the acoustic command identity of the unit, plus the HPR beacon channel number (which follows the B character). The acoustic command address is used by the transceiver to communicate with the unit. The last 2 digits of the address define the "Channel" number, and the first 2 digits define the "Code", or family group. This can be changed via the RS232 serial link using the Test Terminal software utility (see Appendix B) or via acoustic command. It is **important** that the address information on the external label is kept up to date. To allow this, the 2 address boxes are covered by a separate transparent over-laminate sheet that can be removed without disturbing the permanent information on the label.

Following the address is the HPR Beacon channel number that the unit is set to. Compatt 5 supports all HPR 300, HPR 400 and HiPap channels. They can be altered via serial set-up, or acoustic command. Again, it is important that the external label reflects the current setting.

FIG 1.1 CONFIGURATION INFORMATION

Configuration Example	WM		2		1		A		1		03
First digit		Second digit		Third digit		Fourth digit		Fifth digit		Last two digits	
Frequency		Transducer		Housing		Battery		Sensor endcap		Depth sensor	
LF	L	Omni, 2500m (EHF only)	1	Long 3000m	1	Alkaline	A	Connector only (Mini) C	0	None (e.g.Mini)	00
MF	M	Omni	2	Long 5000m	2	Lithium	L	Release,Temp,Depth RTP	1	**Strain Gauge**	
Wideband MF	WM	Directional	3	Long 7000m	5			Release, Sound Speed RTPS	2	SG-500m	05
EHF	E	Super-Directional	4					Non Rls, Temp, Depth TP	3	SG-1000 m	01
				Mini/Midi 3000m	3					SG-3000 m	03
				Mini/Midi 5000m	4			Non-Rls, Sound Speed TPS	4	SG-5000 m	06
				Mini/Midi 7000m	6			Non-Rls, Inclinometer TPI	5	SG-7000 m	07
								Non-Rls, Snd Spd, Inclin. TPSI	6	**High Precision SG**	
				Max 3000m	7					HSG-500m	15
										HSG-1000 m	11
										HSG-3000 m	13
										HSG-5000 m	16
										HSG-7000 m	17
										Quartz	
										Q-1350 m	31
										Q-2000 m	32
										Q-3000 m	34
										Q-7000 m	37

Unshaded options are available for 8000 or 8100 configurations

1.2.1 Sensor End-Cap

The sensor end cap is a separate, inter-c hangeable Data Acquisition Sub-assembly (DAS), and has its own serial number, and label, of the form:

Serial No: xxxxxx-xxx	
Config: T P I2 S	(for example)
Depth sensor cal: 1000 m	(for example)
Max depth: 2000m	(only shown if depth rating is < tube rating)

The CONFIGuration lists the sensors and features fitted to the end cap, selected from the following list:

R = Release mechanism
T = Temperature sensor
P = strain gauge Pressure sensor
HP = Hi-precision strain gauge Pressure sensor
Q = Quartz pressure sensor
S = Sound speed sensor
I2 = dual-axis Inclinometer

Examples:

Serial No: xxxxxx-xxx Config: T Q I2 Depth sensor cal: 2050 m Max depth: 2450m	Temperature (PRT), 2000m Quartz pressure, Inclinometer.
Serial No: xxxxxx-xxx Config: R T P S Depth sensor cal: 3000 m	Release, Temperature (PRT), 3000m Strain Gauge, Sound Speed.

Depth: This is the full-scale rating of the pressure sensor fitted. **Note:** Strain gauges can be over-pressured by 100% without damaging the sensor, however Quartz sensors will be damaged if over-ranged by only 20%.

Inclinometer: The sensor fitted have a range of ±90°, however the AN5 command emulates a range of ±14.5°, ±90° or ±5° depending on the configuration of the DAS card – ref. Appendix G.

Endcaps supporting external sensors, which require non-standard modifications to the DAS PCB, wiring or firmware will be marked with a special additional label.

1.3 COMPATT ACCESSORIES

• Compatt 5 Opening Tool	-	641-3332	one pair supplied per unit
• Compatt 5 to PC dual serial cable	-	8000-157	ordered separately
• Release Guard kit	-	650-2135	ordered separately
• Floatation Collars	-	Several depth options available	ordered separately
• Pocket Test terminal	-	8049-000	ordered separately
• Remote Inclinometer	-	8008	ordered separately

1.4 FUNCTIONAL DESCRIPTION

1.4.1 Basic Principles of Transponder Interrogation and Reply

The interrogation signal transmitted to a transponder such as Compatt is an acoustic 'tone burst', typically 100 cycles of a specific frequency. The acoustic transducer converts the received weak acoustic signal to a low-level alternating voltage. It also converts all ambient noise 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 attenuate frequencies outside the band occupied by all of the transponder channels used in the system. The receiver has a narrow-band filter which detects the presence of the interrogation frequency, even in the presence of a moderate amount of noise and other tone bursts of different frequencies.

Logic circuits in the transponder then cause the transmitter to generate a powerful acoustic tone-burst as a reply, after a specific time-interval known as the "turn-around time". The reply is usually on a different frequency to the interrogation, but of similar duration. By detecting the arrival of the reply tone-burst, the equipment which emitted the interrogating tone-burst can measure the distance (range) to the transponder by measuring the total time delay, subtracting the turn-around delay and multiplying by the speed of sound in the water to give the 2-way distance.

Sound is reflected strongly by the sea surface, seabed and other reflecting surfaces, causing a received tone-burst to appear to be of much longer duration than the original transmission, but with random phase and random, decreasing average amplitude. This is known as reverberation. To prevent multiple replies being transmitted in response to a single interrogation, the transponder logic incorporates a programmable 'blocking period'. This inhibits the receiver logic after the reply transmission starts allowing the reverberation to die away before the receiver is re-activated.

The Compatt can be set by acoustic command into any one of several interrogation modes. The Individual Interrogation Frequency (IIF) determines the Channel Number mentioned earlier. If the unit received a valid pulse on this frequency it will reply on the Common Reply Frequency (CRF) after a turn-around time. This is commonly used during array calibration. The usual tracking mode of operation is to interrogate on the Common Interrogation Frequency (CIF) which the unit will reply to again after a turnaround of delay, on its Individual Reply Frequency (IRF). The IRF defaults to the channel number but can be changed to any other channel number via the interrogating unit. The Compatt can alternatively be set to reply to HPR300 or HPR400 interrogations.

Compatt 5 can also be set up to use advanced wideband acoustic signals, which offer much greater ranging precision, and noise immunity. In the wideband architecture, an interrogation can be received on the Common Interrogate Signal (CIS) and the reply sent on it's Individual Reply Signal (IRS); or it can be interrogated by it's Individual Interrogation Signal (IIS), in which case it replies on a Common Reply Signal, (CRS). The IRS and IIS are determined by the command address of the unit and can only be changed by changing the address.

1.4.2 Interrogators

Compatt 5 is designed for use with Sonardyne Fusion systems. New features added to Compatt 5 will only be available through the use of these interrogators. The operational interrogators designed for Fusion systems are:

- Type 8010 RovNav 5
- Type 8021 and 8023 series of USBL transceivers

In addition, the Compatt 5 is backwards compatible with previous generation transceivers. These are outlined below.

- Type 7145 Programmable Acoustic Navigator (PAN) which has receivers tuned to CRF and ten reply frequencies and has full command and telemetry decoding facilities. The PAN must be fitted with firmware Version 7 or later.
- Type 7807 RovNav Mk4 can be used to interrogate Compatts but rely on a serial link from a computer, or hand-held terminal for the operator interface.
- Type 7663 Lightweight Command Unit can also be used for testing and to command recovery.
- Type 7707 LUSBL system has full command and navigation processing capability.
- Type 7842 MF Mini RovNav also has full command and navigation processing capability.

For testing and maintenance, the new Type 8063 Deck Test Unit can perform Wideband and tone interrogations, and command downlink checks.

The Type 7343 Acoustic Navigation Test unit (ANT) can also be used to interrogate Compatts and receive replies, but not using the newer Wideband signals.

1.4.3 Command and Telemetry Functions

'Command' is the remote control of operating modes of a transponder by coded acoustic signals, generally transmitted from a surface vessel. The basic applications are to 'ENABLE' and 'DISABLE' the transponder (to allow, or prevent interrogation replies in order to conserve the battery) and to release the transponder from its anchor weight. The essential requirement is high security with a very low probability of false actuation.

The traditional Sonardyne technique is a pulse position code using 3 tone bursts of different frequencies. The 3 pulses uniquely define the address of the commanded Compatt, and the command function to execute. Refer to the PAN operating manual OM-7145 for full details of Compatt commands and reply display formats.

Additional downlink schemes are tone-based digital telemetry and wideband digital telemetry which are quicker and include error-correction techniques to improve reliability and security.

When the commanded function has been executed by the Compatt, a telemetry burst is transmitted to acknowledge the operation is complete. If a data acquisition command was sent, the reply also includes 24 data bits, for example a reading from the internal pressure sensor, which the surface system decodes into a meaningful display message. Error checks are made on all parts of this telemetry message, and the result is included in the display message. Again, there are tone and wideband up link schemes selected via the navigation software.

1.4.4 Communicating via RS232

In addition to the acoustic command and navigation features, the unit can be configured and tested via an RS232 link from a PC running the Sonardyne Test Terminal software. A serial test cable is needed for this, refer to Appendix B.

1.4.5 Basic Deployment

Prior to deployment, a functional checkout should be made, as in Section 3.2. This includes fitting a shackle into the release hook if applicable.

SECTION 2

2. ROUTINE MAINTENANCE

To prolong the life of the unit, regular main tenance must be carried out, and a logbook kept covering deployments, re-batterying and running repairs which helps to identify potential problems.

2.1 INSPECTION AND EXTERNAL MAINTENANCE

Immediately after recovery from the sea, the Compatt should be washed in fresh water, paying particular attention to the clamp rings and the release mechanism (where fitted). The items to be inspected include:

Guard	:	Check it is not so distorted that protection of transducer is impaired.
Transducer	:	Check the rubber boot is not split or squashed. Check the metal band is secure and the rubber is free from grease or oil. Check the brass filling screw is in place and has not been tampered with. Avoid exposure to strong sunlight for long periods. The open circuit capacitance of the transducer should be measured on an annual basis to monitor long term performance of the ceramic element. Refer to Section 4.22.5.
Housing	:	Check for damage to the anodising showing areas of exposed metal. If damaged, clean with a degreaser and treat with Alocrom for 2 minutes or until the aluminium goes golden brown, then wash off with water. Dry and cover the exposed metal with 2-part epoxy.
Release	:	Ensure the release mechanism is free of corrosion and marine organic deposits. If the hook is open it should be held fully open by the positive spring action. It should be possible to push the hook towards the locking position under firm finger pressure. The hook-retaining jaw should be stationary with its radial centre-line exactly parallel with the release side plates. If not the micro-switches may be out of adjustment or the shaft may be damaged.
Vent Plug	:	Check it is fully home and sits flush on the sensor end-cap.
Connector	:	Check the contacts for signs of corrosion. Always fit the blanking plug supplied before deployment. Ensure the connectors are lubricated - the recommended lubricant is Molykote 44 Medium -but use sparingly. Half a match head dose per contact is adequate, smeared over the sockets prior to mating. Avoid long exposure to heat or sunshine.
Anodes	:	Check there is sufficient zinc remaining. Clean with a nylon brush. Do not brush with a metal-wire brush as iron contamination of the zinc will impair cathodic protection.
Clamp rings	:	Check the bolts are free of corrosion, and are serviceable. Check the plastic insulators are fitted in each clamp ring hole to isolate the bolts from the clamp rings.
Depth Sensor	:	Check there is still silicone oil behind the red pressure port bung, and refill if necessary. Refer to Appendix B.3.4

2.2 FUNCTIONAL CHECK-OUT

Many functions can be tested via the RS232 link, which is simpler to run and includes features not available via acoustic commands. The RS232 link can be controlled by a PC running the Test Terminal software, or a hand-held Pocket Test Terminal, Type 8049.

The three-stage test below will have checked out all the major sub-systems in the Compatt; acoustic transducer, pre-amplifier, tone receiver circuitry, transmitter synthesizer, transmitter output circuitry, wideband receiver circuitry, coaxial cable, release motor and sensors.

A blank Test Results Sheet is included on the CD.

2.2.1 Tone Acoustics

The unit can be tested acoustically on deck by using a suitable transceiver. If the unit is being checked out via RS232 (see below) then only a minimal amount of in-air acoustic testing is required.

Deck Test Unit: use the Interrogation Test and hold the test transducer against the top face of the Compatt transducer. If a serial connection between the Compatt and the DTU is used, the DTU can extract the current status of the unit to simplify setting up.

ANT: hold the end of the ANT Test Transducer (part no. 640-7058) against the top face of the Compatt transducer. An ANT test loop around the middle of the transducer will also work, but this does not test the acoustic performance of the Compatt transducer.

PAN: wrap the Test Loop 3-4 times around the middle of the transducer. A PAN Test Transducer can also be used (7145-251 PAN Test Transducer Interface Box + 7935-000 Test Transducer).

Rovnav 5 or LCU: place the transducer at an angle of about 45° to the Compatt 5 transducer, and get them as close as possible.

Send the ENABLE command, ENnnn, where nnn is the Compatt address. A good reply will have E: 0 at the end.

This test will verify the acoustic transducer, the pre-amp, the tone receivers, and the transmitter.

It is also possible to test the tone acoustics by using 2 Compatts to test each other using the <Acoustic Check> function described below.

2.2.2 Wideband Acoustics

The Deck Test Unit is the only test equipment that has Wideband capability.

An alternative method is to use 2 Wideband-equipped Compatts to range to each other. Use the Sonardyne Test Terminal button <Set as Test Transponder> for one unit and the <Acoustic check> button for the second unit, which will attempt to range to the first. Refer to Appendix B.2 for a more detailed description.

This test will verify the Wideband receiver circuitry, and the coaxial cable connecting it to the pre-amplifier, in both units.

The status of the Compatts will be altered by using these test buttons. After use, use <Initialise Transponder> button to put the units back to default settings.

2.2.3 Using RS232 Interface

When using the Test Terminal software, the <Produce Test Report> button will carry out a sequence of checks, and store the results in a text file in C:\Sonardyne\C5Status, and the filename will be the unit serial number with the extension .txt, e.g. 213456-004.txt. Note that the Compatt status is not changed by this method. Refer to Appendix B.2 for more details. The sequence includes: <General Status>; <Release test> which will operate the release motor; <Hardware self-test> which will exercise the all the receiver and transmitter circuitry; <Read Sensors> makes a measurement on all the sensors fitted.

2.3 BATTERY LIFE

There are several steps that can be taken to maximise the life of the battery:

- Operate at the lowest transmit power that conditions allow
- Use a slower update rate (longer interrogation interval)
- Disable the unit via acoustic command when on the sea-bed and not being used for navigation
- Use RS232 function <Initialise Transponder> to disable the unit if on deck, especially if it will be going into storage

2.3.1 Standard Unit

The standard length unit is powered by a battery pack made up of 40 'D' cells. The alkaline pack is arranged in four parallel stacks of 10 cells in series, and the lithium pack in 10 stacks of four cells. The stacks are diode or-ed together on a diode board inside the battery, which is not interchangeable between battery types. A new alkaline cell will have a nominal voltage of 1.5V, and this will fall during operati ons linearly to an end of life voltage of 1.0V. Thus the battery pack will start life at 15V and at the end of life be 10V. The plateau voltage characteristic of Lithium cells means that there will only be a fall in voltage at the very end of life.

2.3.2 Midi and Mini Units

These units are powered by a battery pack made up of 12 lithium 'D' cells. The pack is arranged in three parallel stacks of 4 cells in series. These stacks are diode or-ed together on a diode board inside the battery. The plateau voltage characteristic of Lithium cells means that there will only be a fall in voltage at the very end of life

2.3.3 MAX Unit

The Max unit contains 3 separate battery packs, which combine to provide 22 parallel stacks of Lithium cells, or 8 parallel stacks of Alkaline cells. These stacks are diode or-ed together on a diode board inside each battery. The 3 packs are connected via a wiring loom that incorporates a battery interconnect pcb that is mounted on the chassis bulkhead. The reported voltage will apply to all packs, and the master battery count is summed from all three packs as well.

2.3.4 Battery Status

Compatt 5 measures the battery voltage which falls slowly with alkaline batteries. For Lithium batteries, which have a flat voltage characteristic, the voltage does not indicate remaining life. Hence it is necessary to continuously monitor the discharge current drawn from the battery. This totaliser, or Battery Count, runs from zero when a new pack is manufactured, up to a theoretical limit at which point certain functions will cut-out i.e. range replies and sensor reading replies. At this point the unit is ready for rebatteryering, however if the unit is currently deployed and in use, the cut-out can be over-ridden by sending the acoustic command OV. Note: the unit will no longer be guaranteed to function or release once the battery count limit is exceeded.

Battery Type	Start of Life Voltage	Battery Limit Voltage	Battery Count Limit
Alkaline	15.5 V	11.3 V	540
Lithium	14.5 V	13.0 V	950
Lithium (Midi/Mini)	14.5 V	13.0 V	285
Lithium Max	14.5 V	13.0 V	2090

The battery count value is stored within the battery pack. This allows packs to be disconnected and stored, or swapped between units.

The percentage of life remaining can be easily determined using the battery count and the battery count limit above.

The acoustic command Battery Check (BC) displays the two indications of battery life; battery voltage and battery count. This can also be read via the serial link.

2.3.5 Replacement Battery Packs

Replacement battery packs are available as follows:

Unit Type	Battery Type	Drawing No.	Order Code
Standard	Alkaline	8000-002-01	641-2278
	Lithium	8000-006-01	641-2801
Midi / Mini	Lithium	8000-402-01	641-2922
Max	Lithium	8000-006-01	641-2801 (x1)
Max	Lithium	8003-008	641-3324 (x2)

WARNING: Under no condition should a pack have its cells replaced.

2.4 SENSOR RECALIBRATION

The Compatt is fitted with both a depth and temperature sensor as standard. Due to ageing effects, the sensor and/or the signal conditioning circuitry will need a regular service to maintain the calibration of the measurements, see Section 4 for details.

Sensor Type	Recalibration Interval
Depth (strain gauge)	1 year
Depth (quartz)	1 year
Inclinometer	2 years
Temperature, PRT	2 years
Sound Speed	5 years

SECTION 3

3. DEPLOYMENT

The best positioning accuracies are achieved when the array Compatts are held in a rigid support structure. Care should be taken to avoid metal to metal contact with the structure, as accelerated corrosion of the Compatt may result. The integral tilt switch can be used to indicate whether a frame has fallen over on its side.

If the Compatt is to be deployed using a floatation collar and released for recovery, follow the guidelines listed below.

3.1 FLOATATION

No floatation accessories are provided with Compatt, and as it has a net weight in **water of several kilograms, buoyancy must be added. Refer to Section 6 for weights in water and air for the different versions. Glass spheres or syntactic foam with a suitable depth rating can be used and must be able to give a net upthrust of 3kg or more** , allowing for the weight of the shackle and strop also. Syntactic foam floats are usually in the form of "collars" which clamp around the pressure housing. Glass spheres or other floats should be attached to the top guard by a rope long enough to minimise "shadowing" of the transducer. Sonardyne supply a range of suitable floatation collars of different depth ratings.

Max Unit only : fit the floatation collar mid-way along the tube. This will allow the transducer to remain in the water when the unit is at the surface.

Ensure the label with the acoustic command address and the Unit ID number are clearly visible with the floatation fitted.

3.2 ANCHOR WEIGHTS

To take the Compatt to the seabed and hold it there an anchor weight is required for each deployment. A minimum of four times the net Compatt/float buoyancy is recommended. As the anchor weight will be left on site after recovery of the Compatt, some operators have specified "bio-degradable" anchor weights which take the form of gravel inside a double or treble skin of hessian sacks.

3.3 STROPS

The suspension rope or strop between the anchor weight and the shackle in the release mechanism should be long enough to allow 'line of sight' between the Compatts in the array over any topographical features in between. The minimum strop length should be 1.5 m to ensure the momentum of the falling Compatt does not carry it down onto the weight when the weight reaches the seabed, hence possibly damaging the release. Allowance should also be made for any currents which may deflect the Compatt from floating straight above the anchor weight.

If a wire strop is used, particular attention should be paid to the materials used, as electrolytic action between dissimilar metals could result in the strop parting and the Compatt drifting away unnoticed. The eye of the wire strop **must** be electrically insulated from the release mechanism to minimise corrosion.

Usually polypropylene strops are used. Note, that once the Compatt has been released, the shackle on the strop will fall leaving a floating loop of rope above the seabed, which can be a hazard to ROVs.

3.4 SHACKLE

Before deployment, a functional check should be carried out. See Section 3.2. This includes operation of the release mechanism, which gives an opportunity to install the shackle. A 10mm or 3/8-inch diameter "D" shackle made of stainless steel is recommended. “D” shackles rated to a minimum of 250kg SWL (Safe Working Load) must be used. Before fitting the shackle, check the hook is being held in the fully open position but will swing under light pressure, so that it will spring fully open when required. If the hook is locked into position, send the release sequence to open the mechanism, allowing the hook to spring open.

To hold the hook closed, insert a suitable screwdriver or a M5 bolt into the tapped hole located about 3 cm below the top of the release hook and lever the hook closed.

Insert the curved end of the shackle into the hook as it is closed.

The pin of the shackle can be used to lock the mechanism while the release is operated to close the hook. Insert the shackle pin as shown.

Send the RL release command to close the mechanism, or use the <Release Test> function in Test Terminal.

Once the Compatt starts the motor, the shaft rotates and the Compatt pings until the rotation is complete (180°) or until 30 seconds is up. It is essential to hold the hook fully closed until the release mechanism has rotated fully to the closed position, otherwise the leading edge of the rotary retaining jaw may jam against the side of the hook shaft and damage the internal mechanism.

The shackle bolt can now be removed and fitted into the shackle. Always "mouse" the bolt with stainless steel locking wire or a nylon tie-wrap to ensure it cannot rotate loose.

The shackle will now be retained and the transponder is ready for deployment.

3.5 LONG TERM DEPLOYMENTS

In warm waters, marine growth around the release mechanism can build up and impede the release operation if deployed for months at a time. Painting the release casting with marine anti-fouling paint may prolong operation under these conditions. Do **not** paint the zinc anodes.

3.6 DEPLOYMENT FROM SHIP

The recommended method of deploying a Compatt from a surface vessel is as follows:

Thread a loop of rope through an eye in the anchor weight. Make fast one end of the rope. Take the strain on the free end.

Lower the Compatt and float to the water so that they stream behind the ship as it approaches the drop position.

Lower the weight to the water line, allowing the rope to slip through the eye. When on location let go the free end of the rope. The weight will sink immediately, pulling the Compatt with it.

Recover the free end of the rope.

Other deployment scenarios are shown on the following pages. Take care to ensure the Safe Working Load of the Compatt is not exceeded. (See Section 6)

3.7 LIFTING

The Compatt can be lifted using the shackle on the Transducer guard. Safe Working Loads are defined in Section 6. Alternatively, lifting eyes on the floatation collar can be used, if fitted.

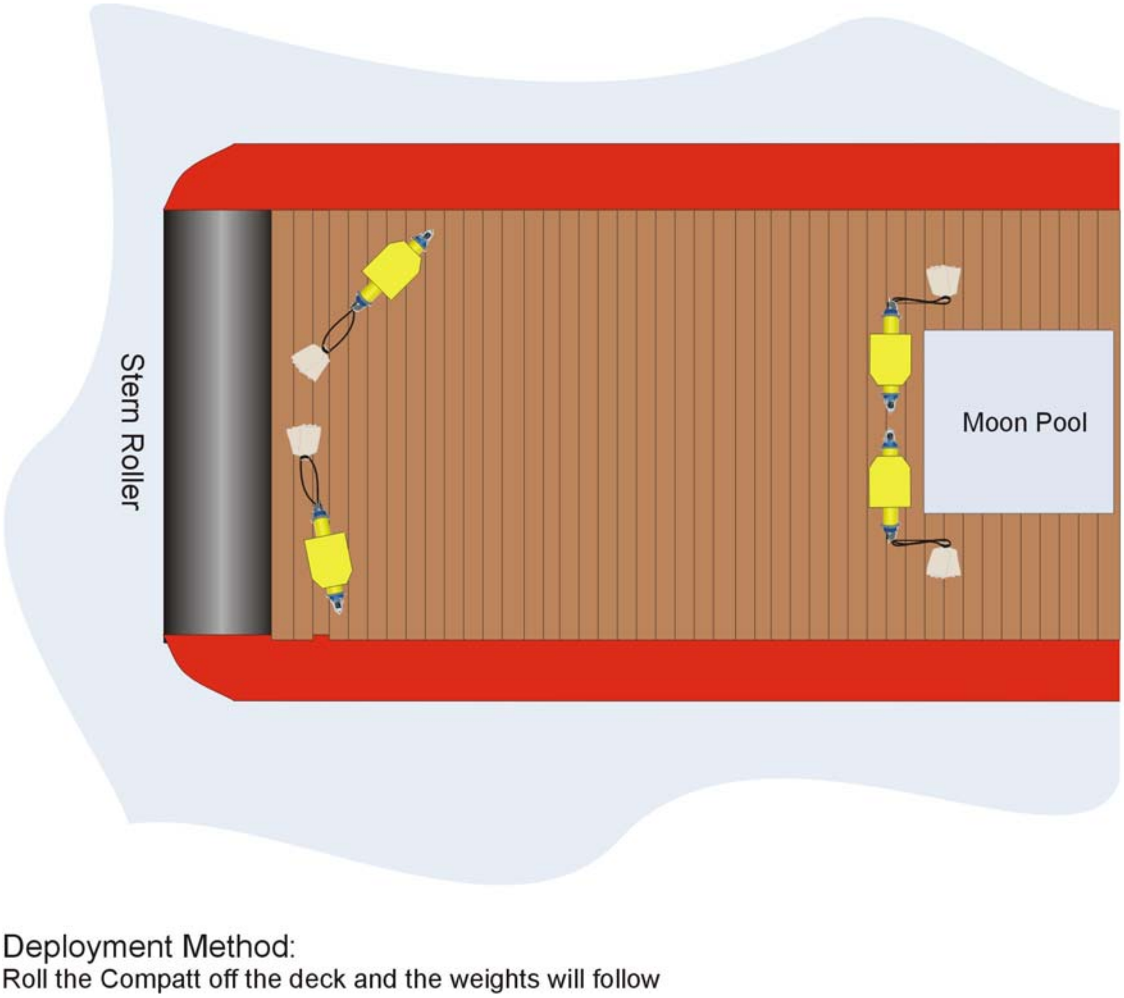
Use the specified shackle types only – see Appendix A.

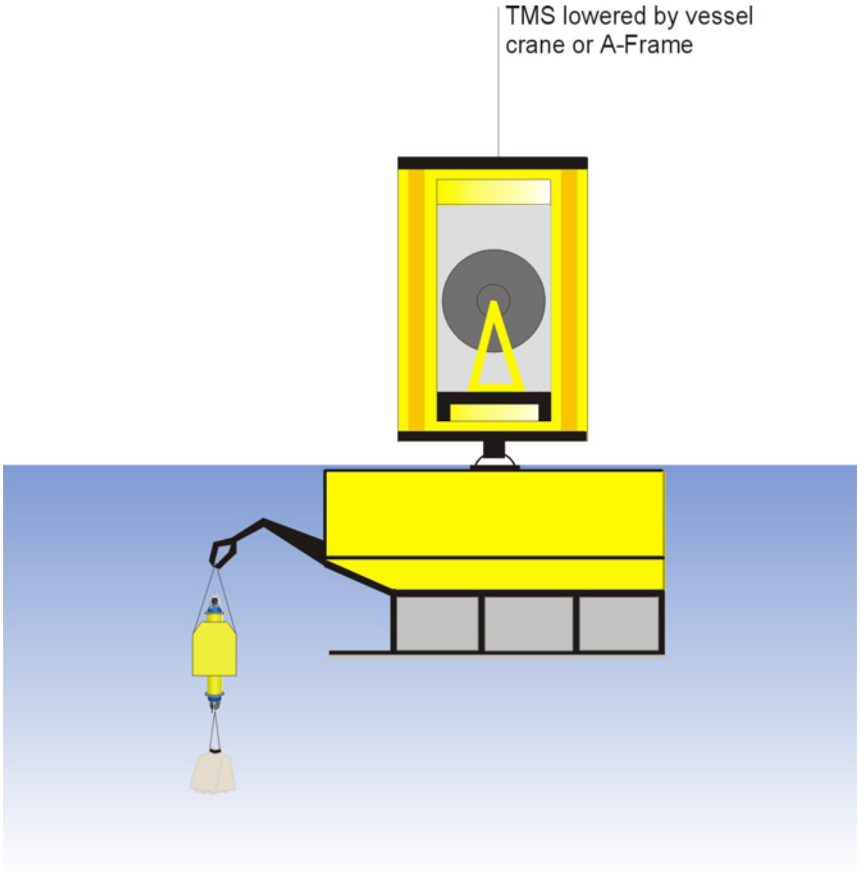
Be aware that snatch loads can easily exceed the Safe Working Load.

3.8 RECOVERY PLANNING

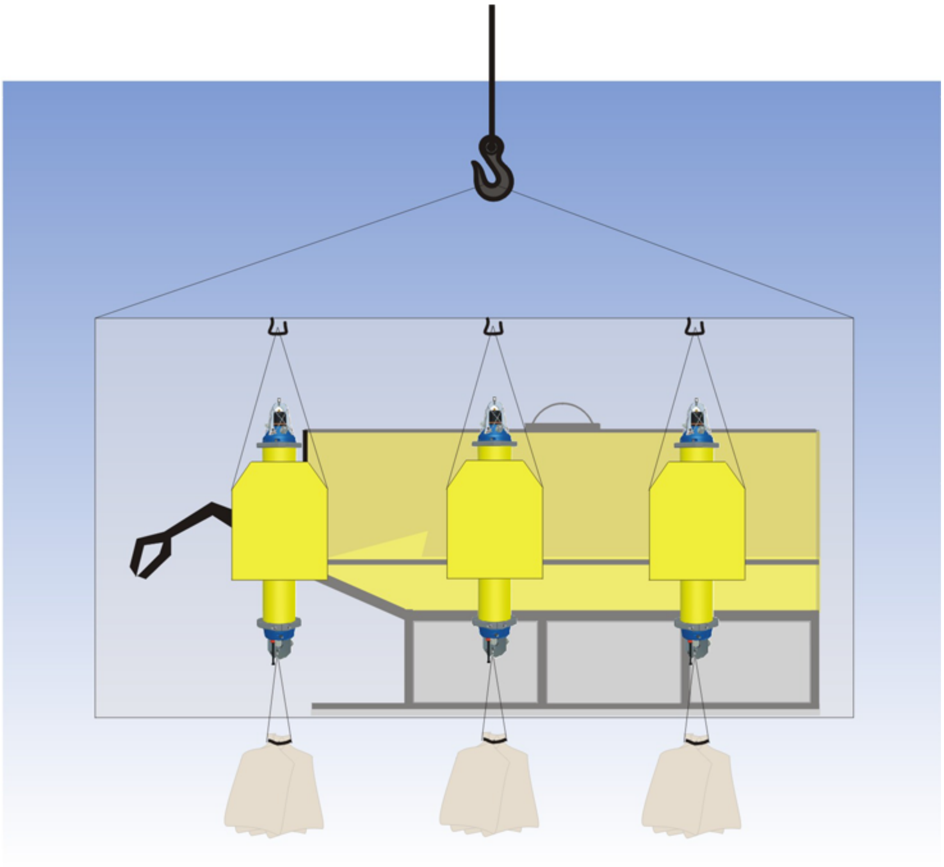
Before deployment, consider the likely recovery procedure. Recovery using ROV manipulators or grappling with boat hooks can easily result in major damage to the transducer, so a dedicated loop of rope fitted to the Transducer guard shackle, or the floatation will reduce this risk. For ROV handling, consider adding a metal ring to this rope loop. The rope loop must be long enough such that the ring will fall below the acoustic transducer. Two holes in the plastic floatat ion bump-stop ring may be used to fit a floating rope loop, to assist later recovery, but this MUST NOT be used to lift more than the Compatt and float collar.

A Compatt floating to the surface can be tracked during its ascent by ranging to it, or by making repeated depth readings.



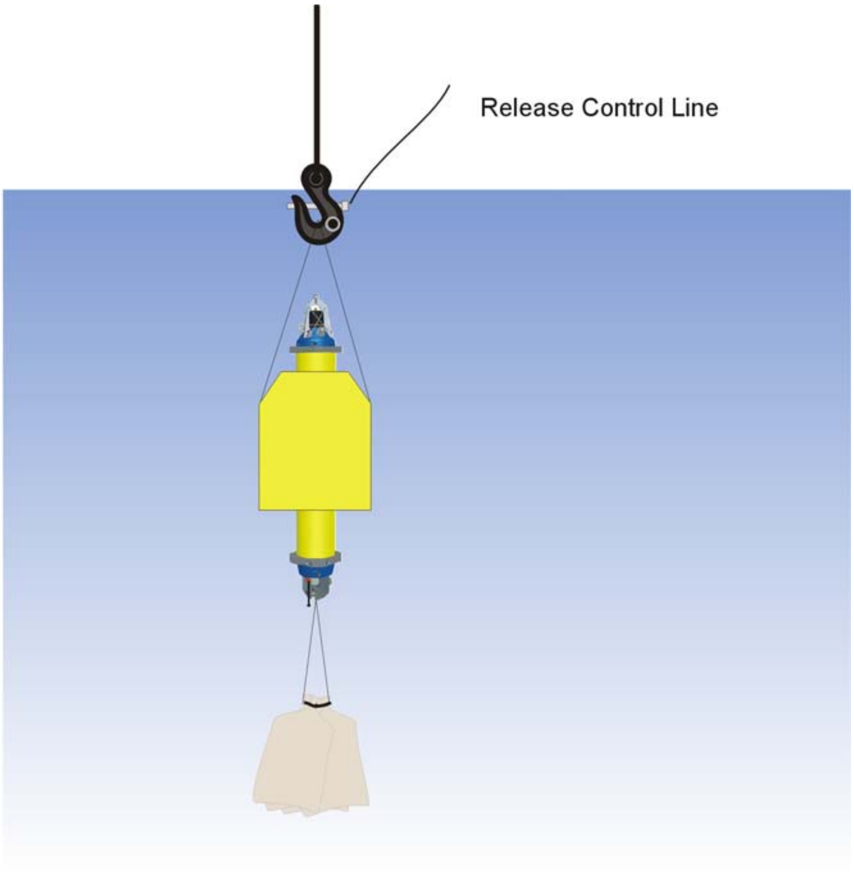


Deployment Method
The ROV grabs a 1m loop of rope attached to the top guard or the float.

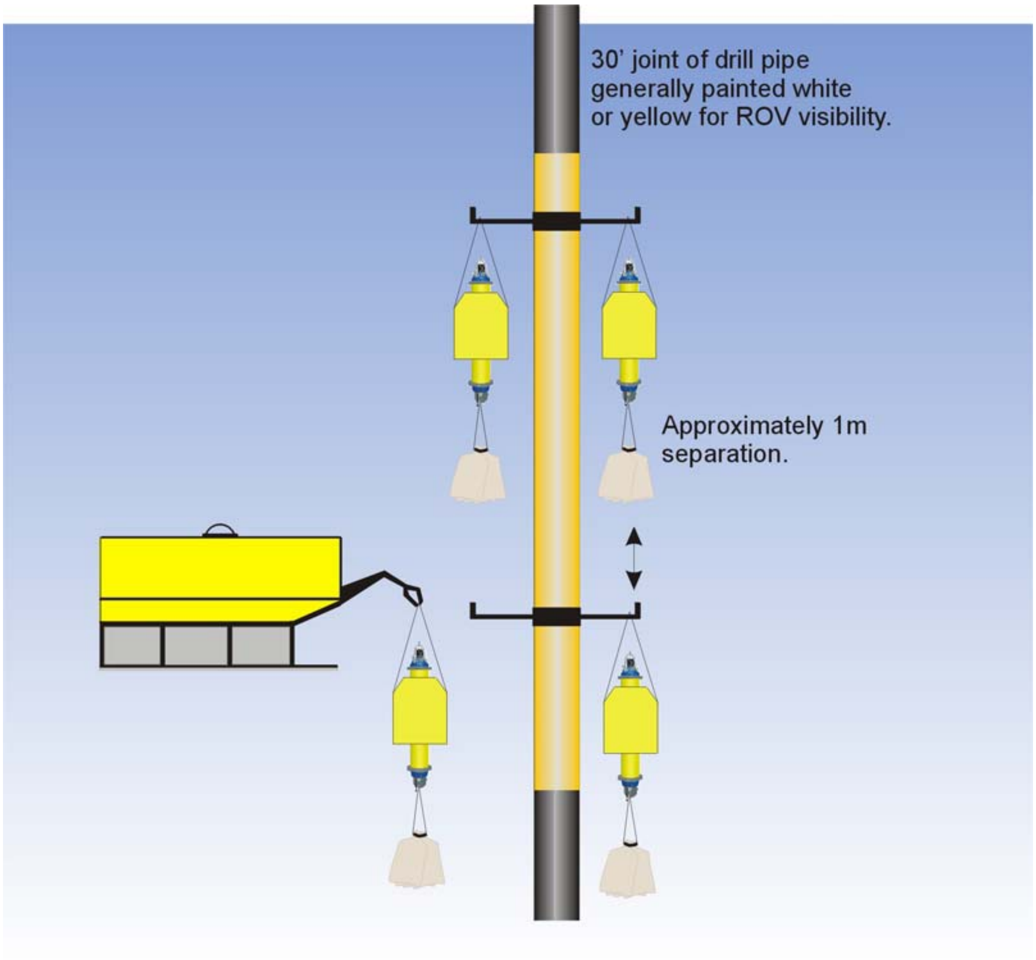


Deployment Method
The ROV grabs a 1m loop of rope attached to the top guard or the float.

Deployment Method
An acoustic release is used as a crane hook..Typically the release will need to be 15-20m under water for a survey boat and 35-50m for a semi-sub.



Deployment Method:
Slip hook with integral swivel and D shackle to Compatt to be released



Deployment Method
The ROV grabs a 1m loop of rope attached to the top guard or the float.

3.9 RECOVERY FROM THE SEA

When a released Compatt reaches the surface, it will float approximately horizontal, depending on the float collar fitted. A boat hook can be used to hook:

- A rope loop attached to the Transducer Guard shackle
- A rope loop attached to the floatation bump stop
- A lifting point fitted to the floatation collar
- The release guard if fitted.

The transducer guard itself MUST NOT be used to hook the Compatt as this can easily result in major damage to the transducer.

If recovered into a small boat, the Compatt should be lifted on board the mother vessel using a crane attached to the lifting shackle or the lifting point on the float.

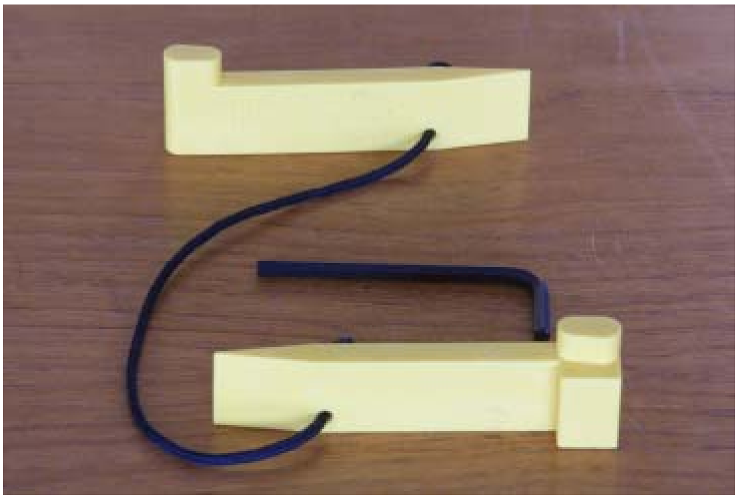
The Compatt should be immediately washed with fresh water and inspected, as described in section 2.1, before storage or re-deployment.

SECTION 4

4. SERVICING

4.1 RECOMMENDED TOOL KIT

- 17mm open spanners – for floats
- 8mm nut spinner
- Molykote 44 Medium silicone grease or Vaseline petroleum jelly
- Metric Allen keys (hex keys)
- 100 ohm, 25W discharge resistor
- Earthing wrist strap
- Digital Multimeter
- Loctite 243 threadlock (to be used sparingly on all internal screws during reassembly)
- Compatt 5 opening tool (order code 641-3332)



4.2 DISMANTLING

WARNINGS:

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

In particular, the Transmitter is capable of generating several thousand volts which can be dangerous if touched.

Service personnel must be familiar with the Safety Information at the beginning of this manual.

It is advisable to disable the Compatt by sending the <Initialise Tpdr> serial command, or Compatt command 'DS' from an ANT, PAN or Rov Nav so that the unit will not transmit while being dismantled. If the unit fails to respond, it may indicate a hazardous condition such as a pressurised housing due to water ingress and/or battery failure. Proceed with caution and refer to the Safety Precautions contained within this document

Before working on the unit ensure the handling precautions for CMOS and circuit boards listed in Appendix F have been observed.

IMPORTANT: Using an M4 screw, pull the green vent plug out 1cm from its seat on the sensor end cap, until the second O ring is visible. This will allow the internal pressure to equalise with atmospheric pressure. If the pressure takes longer than 1 second to equalise, the housing may have been pressurised due to a faulty battery pack, in which case let the pressure escape fully, then proceed with extreme caution. Refer to the **Safety Precautions** at the front of this manual.

4.2.1 End-cap Removal if Compatt is suspected of being internally pressurised

Place the unit in a ***safe working area***, preferably in the open air, do not leave unattended until all is safe. Have a water hose available if possible.

Make the unit as safe as possible by restricting lower endcap travel as follows:

Using two ropes tie the ends of the instrument together. Run one rope down the side of the unit and tie one end to the bottom endcap, tying the other end to the transducer guard. Tie the second rope in a like manner to the first but along the other side of the unit, thus constraining endcap travel in the event of pressure discharge.

Stand alongside not in-line with the unit.

Using an Allen Key (hex key), slowly remove the two M5 hexagon socket head cap screws holding the clamp halves together on the transducer end cap. Attempt to remove just one clamp ring. The clamp ring will probably be difficult to remove, as internal pressure will be forcing the transducer end-cap outwards, or grit inside the groove may be jamming the ring.

With one clamp ring removed, any internal pressure will probably cock the end-cap but it will be held in place by the second clamp ring. Full pressure relief may not have been achieved.

Removing the second clamp ring may result in a gas and/or liquid discharge. Refer to the **Safety Precautions** section.

An alternative method of venting the unit is to remove the transducer guard and then unscrew the transducer to vent the unit. This will destroy the transducer in the process.

4.3 <u>TRANSDUCER END CAP REMOVAL IF UNIT IS KNOWN TO BE FULLY FUNCTIONING</u>

Position the Compatt on a pair of rollers, or a cradle, to make working on the unit easier. It is essential to remove the transducer end cap fi rst before any of the components such as the chassis, battery or sensor end cap can be removed from the pressure housing.

Using an Allen Key (hex key), remove the two M5 hexagon socket head cap screws holding the clamp halves together on the transducer end cap.

Remove the two clamp halves which may need to be levered out using the tapered ends of the Opening Tool.

Do not use metal objects to prise the clamps apart as the hard anodising is easily damaged.

Clean around the grooves to remove any dirt or water from the grooves in the pressure housing and end cap.

Hold the end cap flange between the wrists and push against the clamp ring groove in the pressure housing to remove the transducer end cap. To overcome stiction, some form of blunt levers may be necessary. The non-tapered end of the Opening Tool can be used to lever the end-cap out of the tube by twisting to tool.

When the end cap has withdrawn about 1 cm, wipe around the exposed faces and also the 'O' ring bore seals to remove any water or dirt before fully opening the unit. A drop of water falling into the housing may contact the live electronics and cause considerable damage.

Withdraw the end cap further until both 'O' rings are visible and wipe around the seals again. Use the Opening Tool width ways to lever the end-cap out the remaining distance.

Ensure that the earthing spring gasket located in the groove inside the transducer end cap is not damaged during withdrawal.

The transducer assembly is connected to the rest of the chassis by a short 2-wire lead. Remove the end-cap in a controlled fashion, with a maximum travel of 10cm otherwise it is possible that the connector crimps may be damaged during removal.

Support the transducer and disconnect the red and blue transducer cable with the white connector from the Tx/Pre-amp PCB. Store the transducer end cap in a clean, dry area.

4.4 TRANSDUCER REPLACEMENT

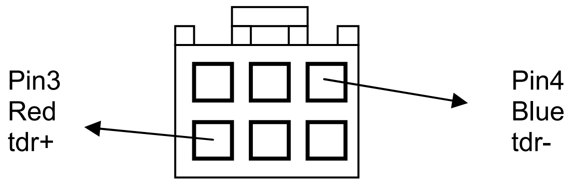
To replace a damaged or faulty transducer, remove the 4 hex bolts that hold the guard, and remove the guard. Note the nylon insulators that separate the stainless steel guard from the aluminium end-cap.

Unscrew the transducer assembly. Note the 2 ‘O’ rings.

To remove the transducer connector, it is necessary to remove the crimped wire ends from the connector shell (Molex Mini-Fit Junior extraction tool, part number 11-03-0044) or, if the transducer is a beyond repair, cut the wires.

Grease the ‘O’ rings of the spare transducer using Vaseline or Molykote 44 Medium.

Feed the replacement transducer connector through the end-cap and screw the transducer fully home. The diagram below shows the rear (wiring) face of the flying transducer connector.



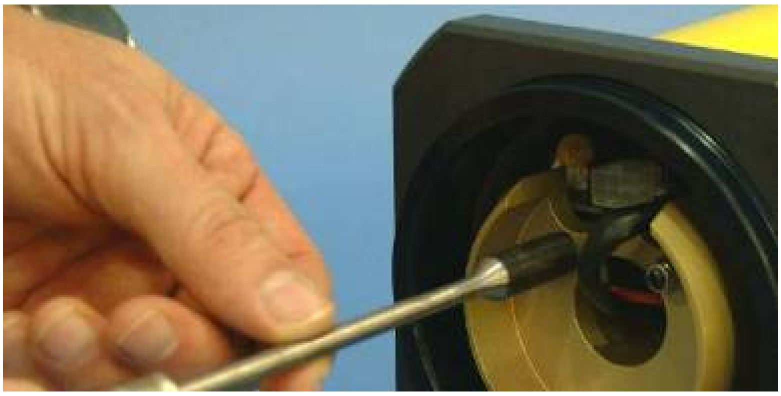
4.5 BATTERY PACK REMOVAL

4.5.1 Standard Unit

Remove the transducer end cap as detailed in Section 4.3 above.

Disconnect the black battery pack flying lead connector from the Tx/Pre-amp PCB.

Using an 8mm nut spinner, remove the two M5 nuts and plain washers securing the end plate to the chassis.



Carefully pull the end plate off ensuring the battery flying lead is not damaged.

Rotate the pressure housing until the battery pack is located at the top of the housing.

Hook a finger through the red battery withdrawal strap and pull the battery pack out of the pressure housing supporting the end nearest the housing with the other hand.

4.5.2 Battery Pack Removal - Midi and Mini Unit

Remove the transducer end cap as detailed in Section 4.3 above.

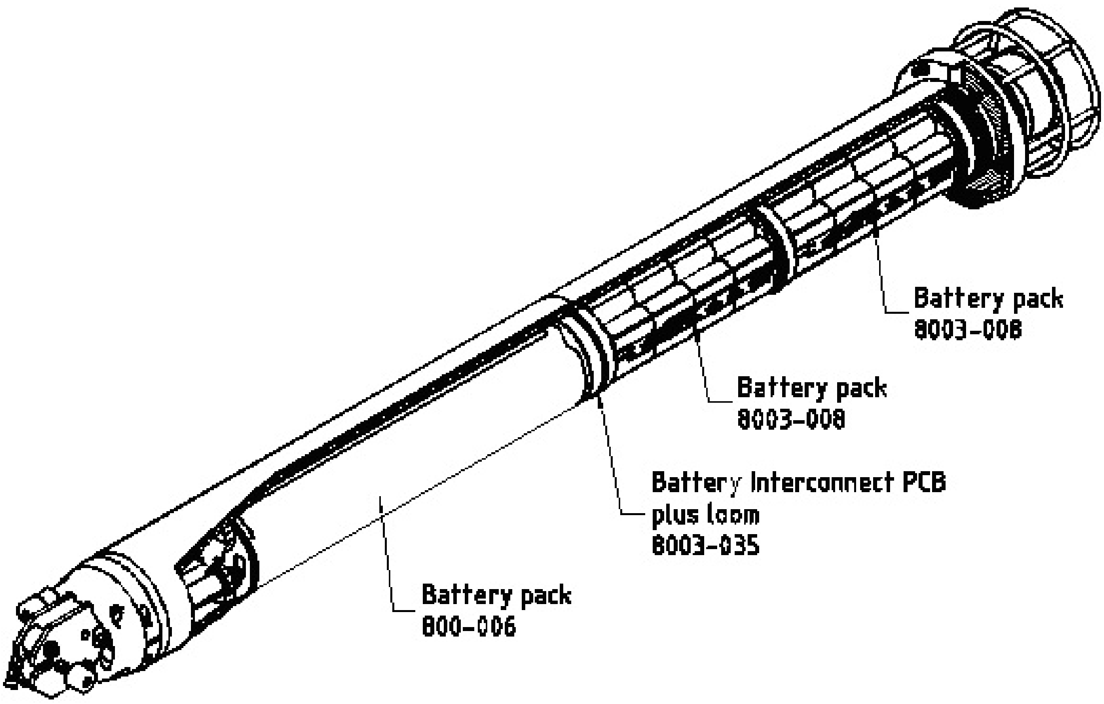
Disconnect the black battery pack flying lead connector from the Tx/Pre-amp PCB.

Using an 8mm nut spinner remove the four M5 nuts and plain washers securing the end plate to the chassis and carefully pull the end plate off ensuring the battery flying lead is not damaged.

Hook a finger through the red battery withdrawal strap and pull the battery pack out of the chassis supporting the battery with the other hand.

4.5.3 <u>Battery Pack Removal - MAX Unit</u>

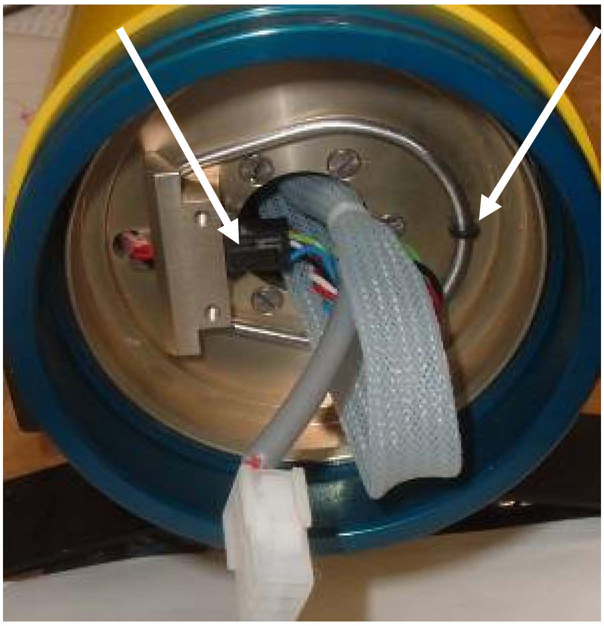
The MAX contains three separate battery packs. Two grey packs are fitted from the transducer end-cap end, and linked to the chassis via a wiring loom. The third is attached to the electronics chassis and is fitted via the sensor end-cap end of the tube.



Note that because of the length of the housing plus the chassis, a work bench/area at least 4m long will be needed.

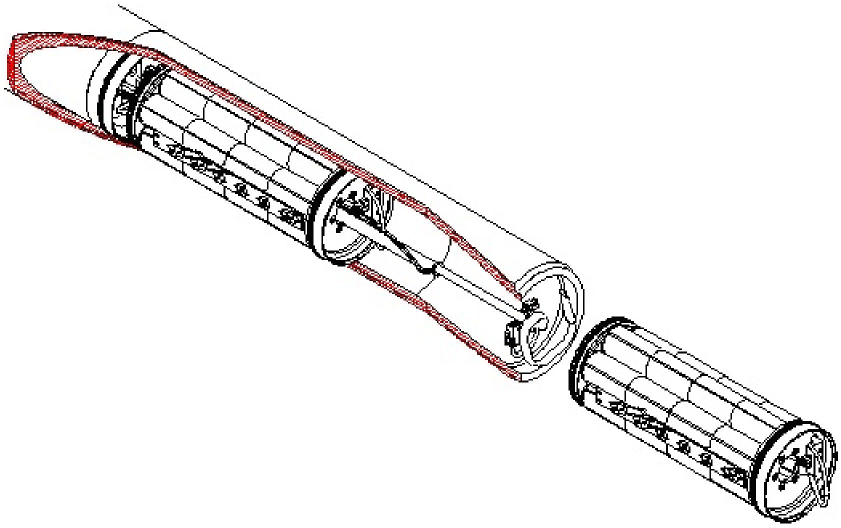
Remove the transducer end cap as detailed in Section 4.3 above.

Disconnect the black battery lead from the top battery pack, and pull up the metal handle.



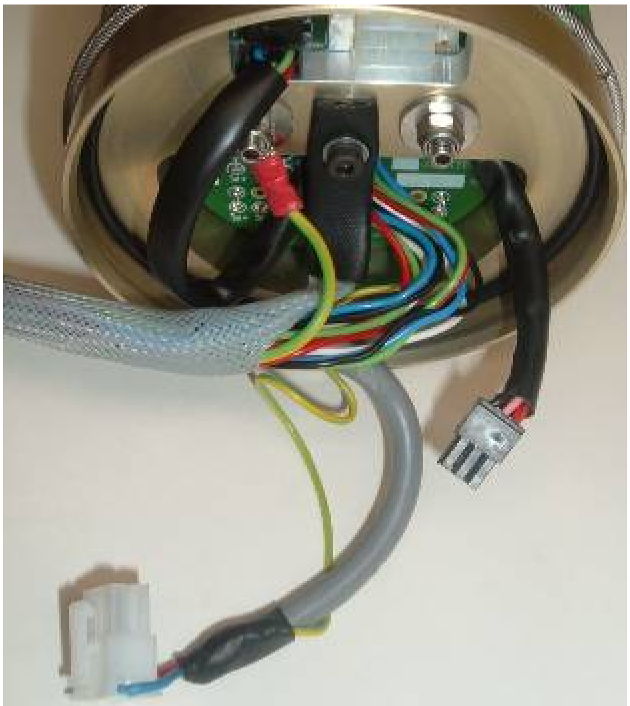
Carefully feed the connectors and wiring loom th rough the central hole in the battery pack, while pulling the pack out. The wiring loom stays in situ.

With the first pack removed, reach inside the tube to disconnect the second, identical battery pack. Pull up the metal handle, and slowly withdraw the pack from the housing.



To remove the third and final battery pack, withdraw the chassis assembly from the housing following the method described in the next section. In the case of the Max, the electronics will still be powered up during this step, as the final battery pack is still connected.

Once the chassis is removed, disconnect the black battery pack lead from the battery interconnection pcb that is mounted on the chassis bulkhead. The unit is now de-powered.



Remove the 2 nyloc nuts, the earthing lead eyelet, and the two washers that hold the chassis bulkhead in place. Slowly, slide t he bulkhead along the studs until the battery pack is free to be separated from the chassis.

4.6 CHASSIS ASSEMBLY REMOVAL

Remove transducer end cap as detailed in Section 4.3 above.

Note 1: The battery pack does not need to be removed before performing this operation.

Using an Allen Key (hex key), remove the two M5 hexagon socket head cap screws holding the clamp halves together on the sensor end cap.

Remove the two clamp halves, which may need to be levered out using the tapered end of the Opening Tool.

Note 2: Do not use metal objects to prise the clamps apart as the hard anodising is easily damaged.

Clean around the grooves to remove any dirt or water from the grooves in the pressure housing and end cap.

Hold the end cap flange between the wrists and push against the clamp ring groove in the pressure housing to remove the sensor end cap. Pushing the bottom of the battery pack from inside the housing helps if the battery pack is still in place (Push against the end of the chassis on the short unit). To overcome stiction, the non-tapered end of the Opening Tool can be used to lever the end-cap out of the tube by twisting the tool.

When the end cap has withdrawn about 1 cm, wipe around the exposed faces and also the 'O' ring bore seals to remove any water or dirt before exposing any of the electronic circuitry.

Note 3: A drop of water falling onto the live electronics can cause considerable damage.

Withdraw the end cap further until both 'O' rings are visible and wipe around the seals again. Use the Opening Tool width ways to lever the end-cap out the remaining distance.

Once the second bore 'O' ring is visible, the pivoted sensor end cap must be supported from below, to avoid it falling and straining the ribbon connector.

Rotate the pressure housing until the chassis rails are at the bottom of the housing.

Continue withdrawing the chassis assembly from the pressure housing. As the assembly slides out, support the chassis but do not touch the printed circuit boards. Continue to slide the assembly out in a controlled fashion, and with gentle anti-clockwise rotation to help the spring gaskets stay in position.

Ensure that the earthing spring gaskets located in the grooves on the sensor end cap and lower bulkhead are not damaged during withdrawal. Lay the complete chassis assembly on a clean dry surface.

Note 4: to avoid damaging the earthing spring gaskets, support the battery by placing an object underneath to raise the chassis up a few centimetres, ideally an anti-roll cradle, although a clamp ring is adequate.

4.7 END CAP REMOVAL

4.7.1 Sensor End-Cap Removal - Standard Unit

Remove transducer end cap as detailed in Section 4.3 above.

Note 1: The battery pack does not need to be removed before performing this operation.

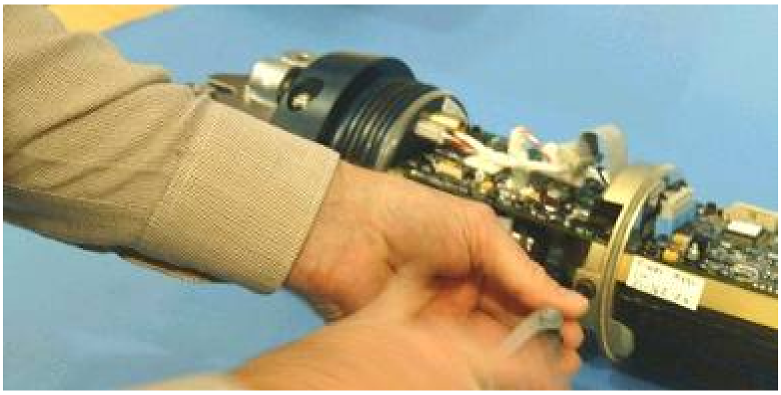
Withdraw chassis assembly from pressure housing as detailed in Section 4.6 above.

Note 2: If only working on the sensor end cap or DAS PCB, the chassis assembly only needs to be withdrawn far enough to allow access to the ribbon cable connector and two M3 pivot screws securing the sensor end cap to the lower bulkhead of the main electronics chassis.

Ensure that the earthing spring gaskets loca ted in the grooves on the sensor end cap and lower bulkhead are not damaged during withdrawal.

Disconnect the ribbon cable connecting the DAS PC B to the CPU PCB by using the latch levers on the connector. Tilt the sensor end cap if the connector proves difficult to remove.

Using a 3mm Allen key (hex key) remove the two M5 screws securing the sensor end cap to the lower bulkhead.



Store the sensor end cap in a clean, dry area.

4.7.2 Sensor End Cap Removal - Midi Unit

Remove transducer end cap as detailed in Section 4.3 above.

Note 1: The battery pack does not need to be removed before performing this operation.

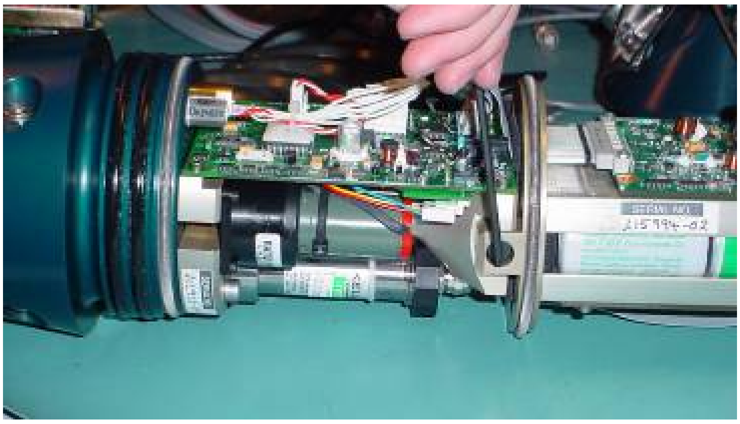
Withdraw chassis assembly from pressure housing as detailed in Section 4.6 above.

Note 2: If only working on the sensor end cap or DAS PCB, the chassis assembly only needs to be withdrawn far enough to allow access to the ribbon cable connector and two M3 pivot screws securing the sensor end cap to the lower bulkhead of the main electronics chassis.

Ensure that the earthing spring gaskets located in the grooves on the sensor end cap and lower bulkhead are not damaged during withdrawal.

Disconnect the ribbon cable connecting the DAS PC B to the CPU PCB by using the latch levers on the connector. Tilt the sensor end cap if the connector proves difficult to remove.

Using a 3mm Allen key (hex key) remove the two M5 screws securing the sensor end cap to the lower bulkhead.



Store the sensor end cap in a clean, dry area.

4.7.3 Connector End Cap Removal - Mini Unit

The same procedure is followed as for the Midi unit described above, with the exception that there is no sensor end-cap, just a plain connector end-cap.

4.7.4 <u>Max Unit</u>

Remove transducer end cap as detailed in Section 4.3 above.

Note 1: The two grey battery packs need to be removed before performing this operation, as detailed in Section 4.3.3.

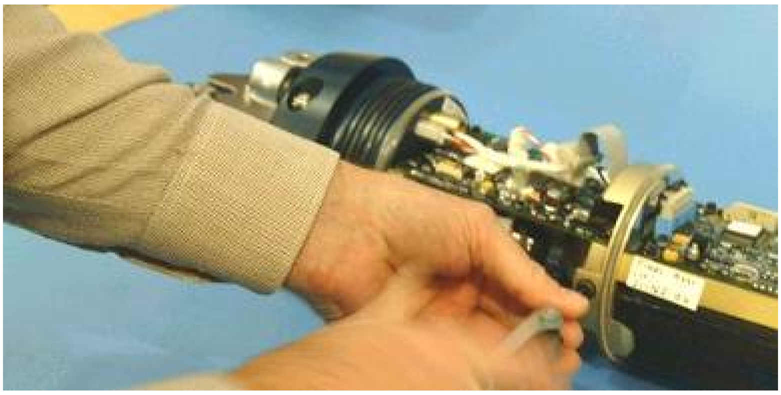
Withdraw chassis assembly from pressure housing as detailed in Section 4.6 above.

Note 2: If only working on the sensor end cap or DAS PCB, the chassis assembly only needs to be withdrawn far enough to allow access to the ribbon cable connector and two M3 pivot screws securing the sensor end cap to the lower bulkhead of the main electronics chassis.

Ensure that the earthing spring gaskets located in the grooves on the sensor end cap and lower bulkhead are not damaged during withdrawal.

Disconnect the ribbon cable connecting the DAS PCB to the CPU PCB by using the latch levers on the connector. Tilt the sensor end cap if the connector proves difficult to remove.

Using a 3mm Allen key (hex key) remove the two M5 screws securing the sensor end cap to the lower bulkhead.



Store the sensor end cap in a clean, dry area.

4.8 TX/PRE-AMP CIRCUIT BOARD REMOVAL

4.8.1 Standard Unit and Max Unit

Remove transducer end cap as detailed in Section 4.3 above.

Remove battery pack as detailed in Section 4.5 above.

Remove the complete chassis assembly from the pressure housing as detailed in Section 4.6 above.

Using a 2.5mm Allen (hex) key, unscrew the two M3 screws and crinkle washers securing the capacitor guard to the Tx/Pre-amp and chassis then remove the guard.

The large storage capacitors on the Tx/Pre-amp PCB should be discharged before proceeding. This can be done by connecting a 100 ohm wire-wound resistor between the pins of the large, horizontally mounted capacitor (22000 µF, 35V) on the card for 20 seconds. The voltage remaining can be monitored using a voltmeter across the capacitor. With less than 0.5V remaining, the unit is safe to handle.

Disconnect the coax cable from PL1 (if fitted), using pliers to grip the body of the connector. DO NOT pull on the cable, as the conductor is fragile.

Remove the middle bulkhead by unscrewing the two countersunk M4 securing screws from underneath using a 2mm Allen key (hex key).

Remove the two remaining M3 anchor screws and crinkle washers holding the Tx/Pre-amp PCB in place.

Gently pull Tx/Pre-amp PCB away from CPU PCB unplugging the connector.

Place Tx/Pre-amp PCB on a clean dry anti-static surface.

4.8.2 Tx/Pre-amp circuit board removal - Midi and Mini Unit

Remove transducer end cap as detailed in Section 4.3 above.

Remove the battery pack as detailed in Section 4.5 above.

Remove the complete chassis assembly from the pressure housing as detailed in Section 4.6 above.

Using a 2.5mm Allen (hex) key, unscrew the two M3 screws and crinkle washers securing the capacitor guard to the Tx/Pre-amp and chassis then remove the guard.

The large storage capacitors on the Tx/Pre-amp PCB should be discharged before proceeding. This can be done by connecting a 100 ohm wire-wound resistor between the pins of the large, horizontally mounted capacitor (22000 µF, 35V) on the card for 20 seconds. The voltage remaining can be monitored using a voltmeter across the capacitor. With less than 0.5V remaining, the unit is safe to handle.

Disconnect the coax cable from PL1 (if fitted), using pliers to grip the body of the connector. DO NOT pull on the cable, as the conductor is fragile.

Remove the two M3 screws and crinkle washers holding the Tx/Pre-amp PCB in place.

Gently pull Tx/Pre-amp PCB away from interface PCB connector.

Place Tx/Pre-amp PCB on a clean dry anti-static surface.

4.9 WIDEBAND CIRCUIT BOARD REMOVAL

From April 2005 all MF Compatt 5s are fitted with the extra Wideband daughter card, which is mounted above the CPU/Rx card.

Remove transducer end cap as detailed in Section 4.3 above.

Disconnect the battery connector, then remove the chassis assembly as detailed in Section 4.6 above.

Remove the 3 anchor screws using a 2.5mm Allen key (hex key), and the 3 crinkle washers.

Disconnect the coaxial cable from SK1 by pu lling up on the connector body using pliers. DO NOT pull on the coaxial cable as the conductor is easily damaged.

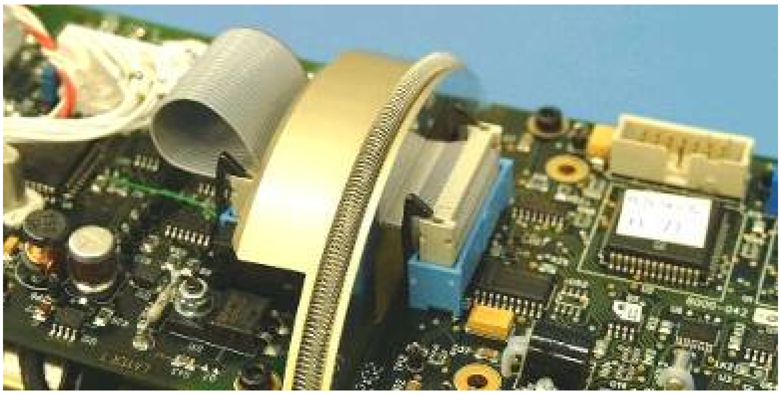
Hold the PCB at the PL2 end, and gently pull up until the connector just starts to separate. Then, start to separate PL4. Work back and forth between the 2 ends of the PCB until both ends are free, then pull to separate PL5.

4.10 CPU CIRCUIT BOARD REMOVAL

4.10.1 CPU circuit board removal - Standard Unit and Max Unit

Remove the Tx/Pre-amp PCB as detailed in Section 4.8 above.

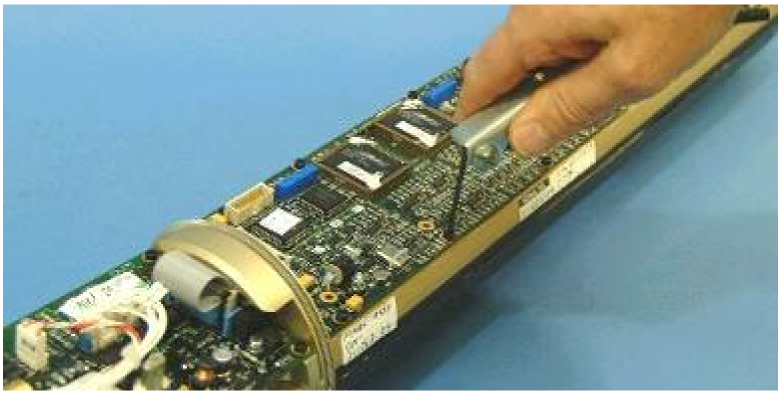
Disconnect the ribbon cable connecting the CPU PCB to the DAS PCB by using the latch levers on the connector.



Remove the wideband receiver card as detailed in Section 4.9 above (if fitted).

Locate the eight M3 anchor screws securing the board to the chassis.

Remove the anchor screws using a 2.5mm Allen key (hex key), and the eight crinkle washers.



Remove the CPU PCB and place on a clean dry anti-static surface.

4.10.2 CPU circuit board removal - Midi and Mini Unit

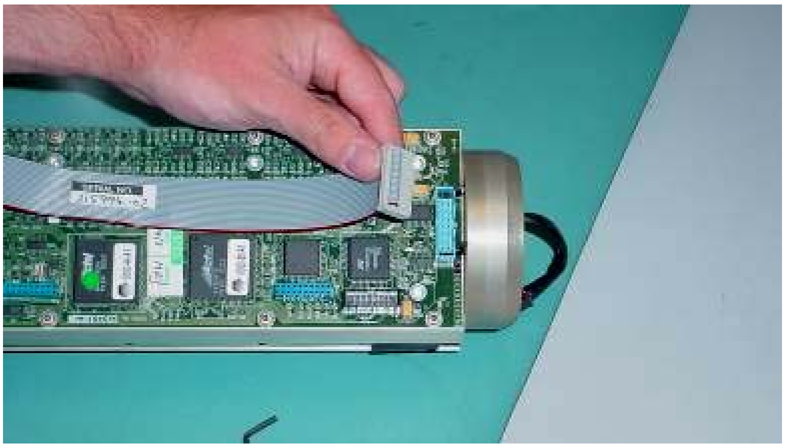
Remove transducer end cap as detailed in Section 4.3 above.

Remove the battery pack as detailed in Section 4.5 above.

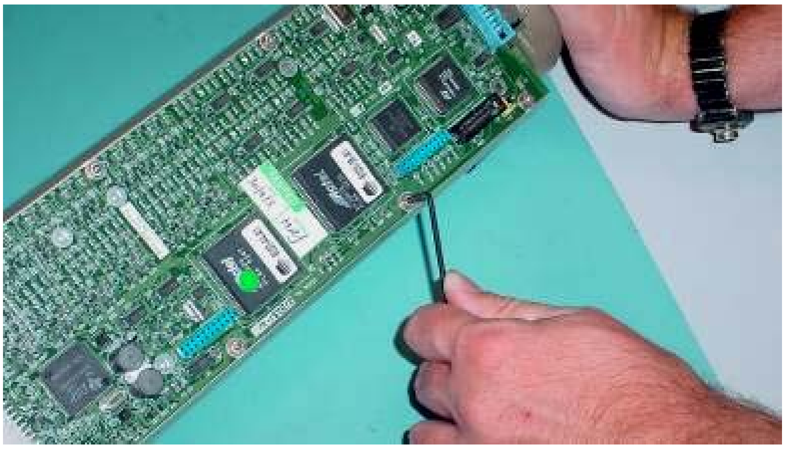
Remove the complete chassis assembly from the pressure housing as detailed in Section 4.6 above.

Remove the wideband receiver card as detailed in Section 4.9 above (if fitted).

Disconnect the ribbon cable connecting the CPU PCB to the end-cap by using the latch levers on the connector.



Locate the eight M3 anchor screws securing the board to the chassis. Remove the anchor screws using a 2.5mm Allen key (hex key), and the eight crinkle washers.



Gently pull CPU PCB away from interface PCB connector.

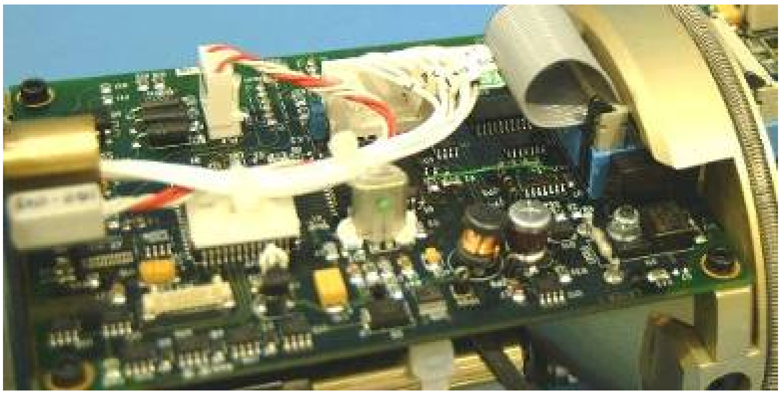
Remove the CPU PCB and place on a clean dry anti-static surface.

4.11 DAS CIRCUIT BOARD REMOVAL

Remove transducer end cap as detailed in Section 4.3 above.

Remove complete assembly from the pressure housing as detailed in Section 4.6 above.

Disconnect the ribbon cable connecting the DAS PCB to the CPU PCB by using the latch levers on the connector.



Cut the cable tie securing the two sets of cables to the white anchor pad on the PCB.

Disconnect the two connectors on the component side of the PCB.

Disconnect the connectors on the underside of the PCB.

Locate the four M3 anchor screws securing the PCB to the chassis.

Remove the anchor screws using a 2.5mm Allen key (hex key), and the four crinkle washers.

Remove the DAS PCB and place on a clean dry anti-static surface.

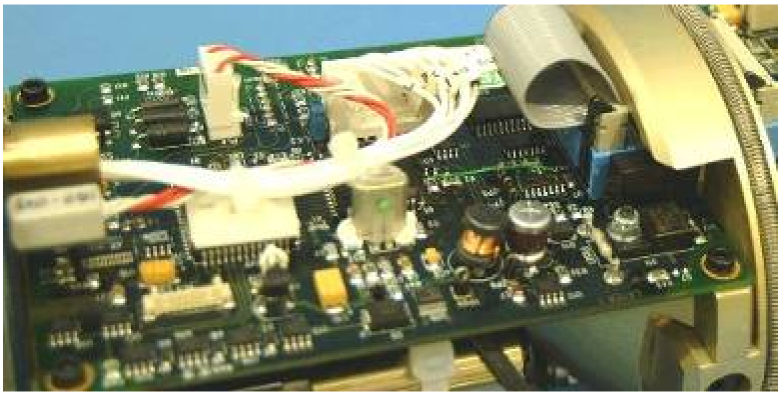
4.12 RE-ASSEMBLY

Prior to re-assembly, all the 'O' rings should be removed, cleaned and inspected for damage e.g. cuts or flats. Refer to Figure 14 for the 'O' ring removal technique. The 'O' ring grooves and tube bore should also be cleaned. The 'O' rings and tube bore should be re-greased with Vaseline or Molykote 44 Medium silicone grease to give a light, even spread. Ordinary grades of silicone grease tend to crystallise and are not recommended. Refit both bore 'O' rings to the end caps.

4.13 DAS CIRCUIT BOARD REPLACEMENT

Lay the chassis on a clean dry surface.

Place the DAS PCB on the chassis with the connector for the ribbon cable positioned near the lower chassis bulkhead.



Secure to the chassis using four M3 anchor screws and crinkle washers.

Note: The crinkle washers are required as they provide earthing for the board.

Tighten all the anchor screws evenly using a 2.5 mm Allen key (hex key). Ensure the PCB is not distorted during tightening.

Connect the connectors on the underside of the PCB.

Connect the two connectors on the top of the PCB.

Secure the two sets of cables to the white anchor pad on the PCB using a cable tie.

Connect the ribbon cable connecting the DAS PCB to the CPU PCB.

4.14 CPU CIRCUIT BOARD REPLACEMENT

4.14.1 CPU circuit board replacement - Standard Unit and Max Unit

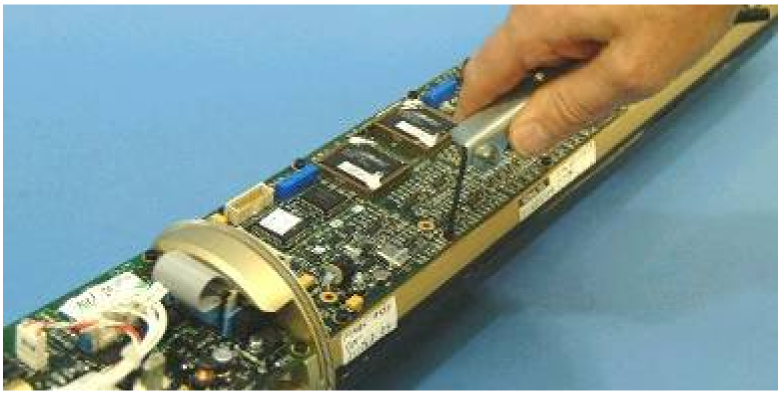
Lay the chassis assembly on a clean dry surface.

Ensure the Tx/Pre-amp PCB is not attached to the chassis. If it is, it must be removed as detailed in Section 4.8.

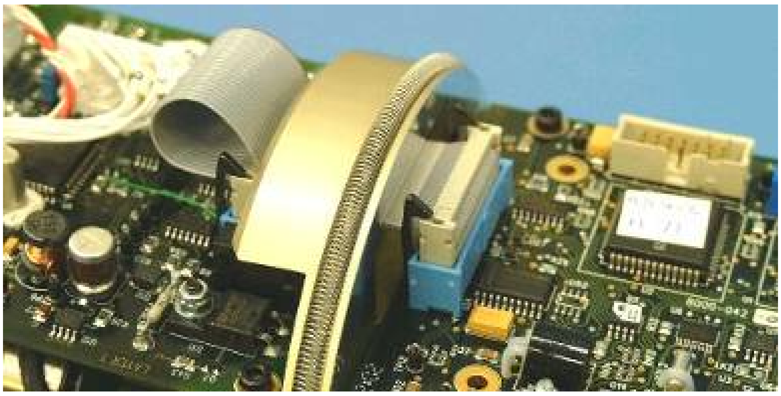
Position the CPU PCB on the chassis with the ribbon cable connector positioned where the lower chassis bulkhead is located.

Secure to the chassis using eight M3 anchor screws and crinkle washers.
Note: The crinkle washers are required as they provide earthing for the board.

Tighten all the anchor screws evenly using a 2.5 mm Allen key (hex key). Ensure the PCB is not distorted during tightening.



Connect the ribbon cable connecting the CPU PCB to the DAS PCB.



Note that the CPU PCB is programmed with the unit serial number and ID. A replacement card will give the unit a new ID, which will need to be shown on the housing tube label. The unit serial number can be pre-programmed in advance. Contact Sonardyne for details.

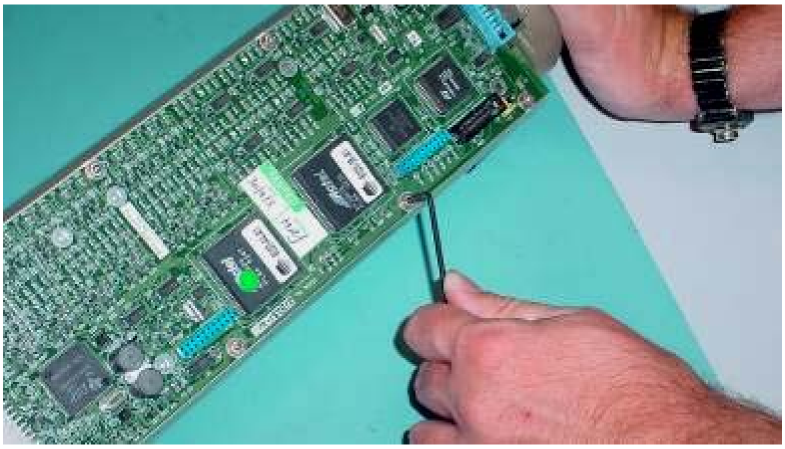
4.14.2 CPU circuit board replacement - Midi and Mini Unit

Lay the chassis assembly on a clean dry surface.

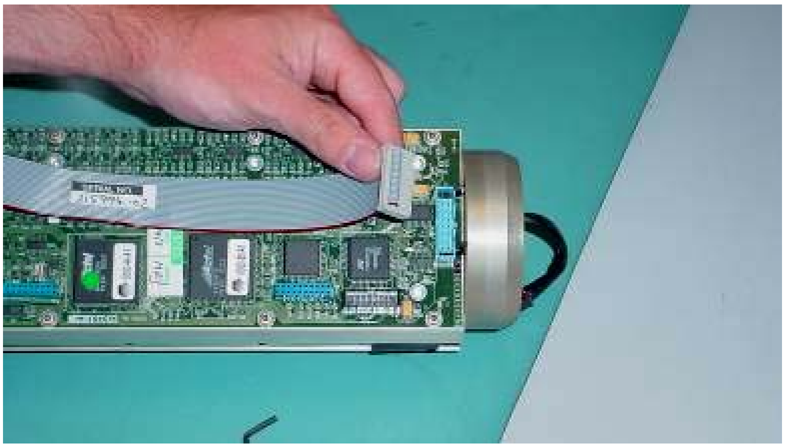
Position the CPU PCB on the chassis. Locate the PCB end connector against the Interface PCB, and carefully push together.

Secure to the chassis using eight M3 anchor screws and crinkle washers.
Note: The crinkle washers are required as they provide earthing for the board.

Tighten all the anchor screws evenly using a 2.5 mm Allen key (hex key). Ensure the PCB is not distorted during tightening.



Connect the ribbon cable connecting the CPU PCB to the end-cap.



Note that the CPU PCB is programmed with the unit serial number and UNIT ID. A replacement card will give the unit a new ID, which will need to be shown on the housing tube label. The unit serial number can be pre-programmed in advance. Contact Sonardyne for details.

4.15 TX/PRE-AMP CIRCUIT BOARD REPLACEMENT

4.15.1 Tx/Pre-Amp circuit board replacement - Standard Unit and Max Unit

Lay the chassis assembly on a clean dry surface.

Ensure the CPU PCB has already been secured to the chassis.

Position the Tx/Pre-amp on the chassis and plug into the connector on the CPU PCB then check the connection is secure.

Screw in the two centre M3 anchor screws and crinkle washers. Do not tighten fully at this point.

Place the middle bulkhead over the connector at the end of the PCB and secure from underneath with two M4 anchor screws. Ensure that if one side of the middle bulkhead is labelled '**TX SIDE'** it is facing towards the Tx board.

Ensure the two M5 screws securing the end plate to the chassis have been slackened.

Connect the coaxial cable (if fitted) to PL1. DO NOT pull on the coaxial cable as the conductor is easily damaged.

Fit the capacitor guard and insert two M3 anc hor screws and crinkle washers into the two remaining holes in the PCB.

Tighten all the anchor screws evenly using a 2.5mm Allen key (hex key). Ensure the PCB is not distorted during tightening.

Fit chassis assembly in pressure housing as detailed in Section 4.18 below.

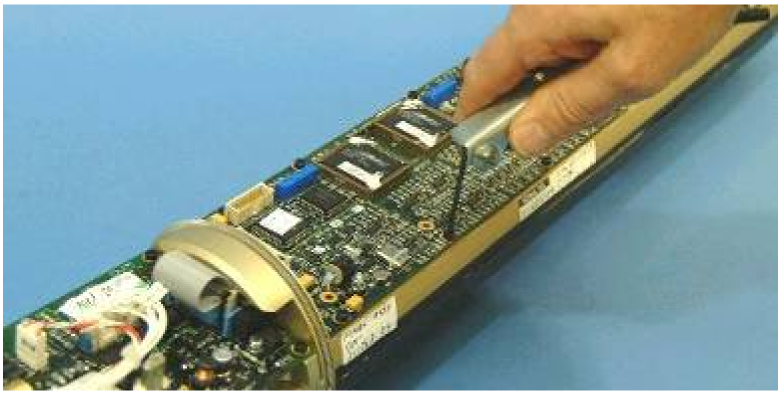
Replace the battery pack as detailed in Section 4.19 below.

4.15.2 Tx/Pre-Amp circuit board replacement - Midi and Mini Unit

Lay the chassis assembly on a clean dry surface.

Position the Tx/Pre-amp on the chassis and carefully plug onto the connector on the Interface PCB. Then check the connection is secure.

Screw in the two centre M3 anchor screws and crinkle washers. Do not tighten fully at this point.



Connect the coaxial cable (if fitted) to PL1. DO NOT pull on the coaxial cable as the conductor is easily damaged.

Fit the capacitor guard and insert two M3 anchor screws and crinkle washers into the two remaining holes in the PCB.

Tighten all the anchor screws evenly using a 2.5mm Allen key (hex key). Ensure the PCB is not distorted during tightening.

Fit chassis assembly in pressure housing as detailed in Section 4.18 below.

Replace the battery pack as detailed in Section 4.19 below.

4.16 WIDEBAND CIRCUIT BOARD REPLACEMENT

Lower the card carefully onto the 3 connectors on the CPU/Rx card, checking that the rows of pins are aligned.

Gently push all 3 connectors down, taking care not to bend the card excessively which can damage components and solder joints.

Secure to the chassis pillars using three M3 anchor screws and crinkle washers.
Note: The crinkle washers are required as they provide earthing for the board.

Tighten the three anchor screws evenly using a 2.5mm Allen key (hex key). Ensure the PCB is not distorted during tightening.

The coaxial cable assembly connects between PL1 on the Tx/Pre-amp circuit board, and SK1 on the Wideband receiver circuit board. Handle with care as the inner conductor is fragile. Coil up excess cable and secure with a tie-wrap.

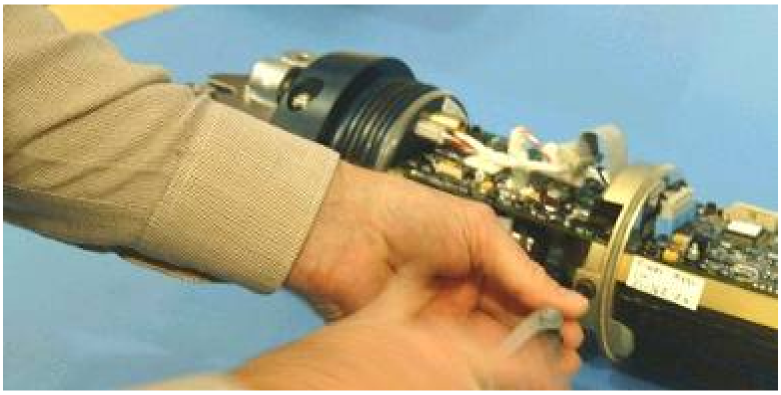
4.17 SENSOR END CAP REPLACEMENT

Ensure the “O" rings have been fitted and are not damaged.

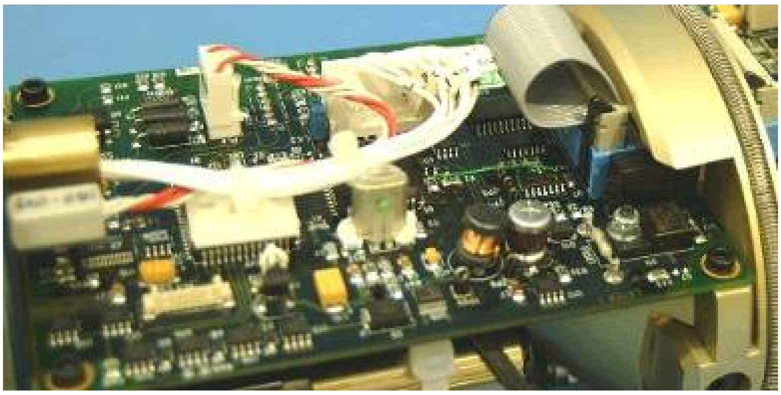
Check that the earthing spring gasket located in the groove on the sensor end cap is fitted and is not damaged.

Position the chassis assembly battery side down and offer the sensor cap end up to the chassis assembly.

Using a 3 mm Allen key (hex key), secure the sensor end cap to the chassis lower bulkhead with the two M5 pivot screws. The screws are cushioned by captive ‘O’ rings, and only have to be fitted finger tight.



Connect the ribbon connector from the adjacent CPU PCB. Tilt the sensor end cap if the connector proves difficult to connect.



Check the ‘O’ rings on the vent plug on the sensor end cap are clean, and the vent plug is fully home. Check also that no screw has been left fitted in the tapped hole.

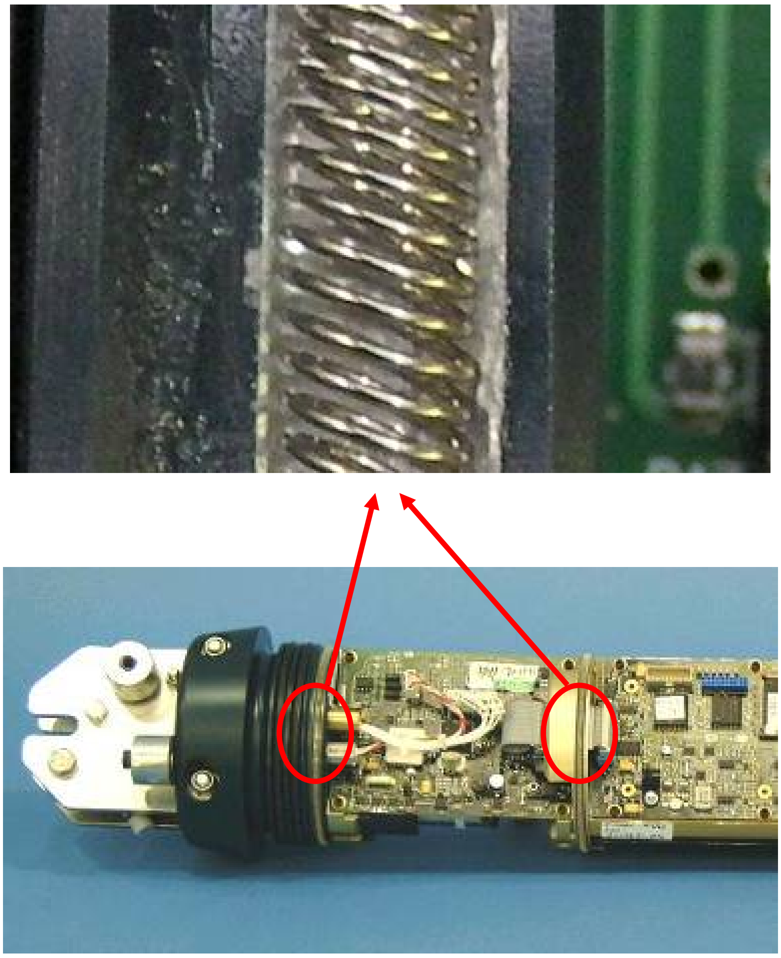
4.18 CHASSIS ASSEMBLY REPLACEMENT IN PRESSURE HOUSING

4.18.1 Chassis Assembly replacement in pressure housing - Standard Unit

Ensure sensor end cap has been replaced on the chassis assembly as detailed in Section 4.17 above.

Position the pressure housing on a pair of rollers, or a cradle, to make working on the unit easier.

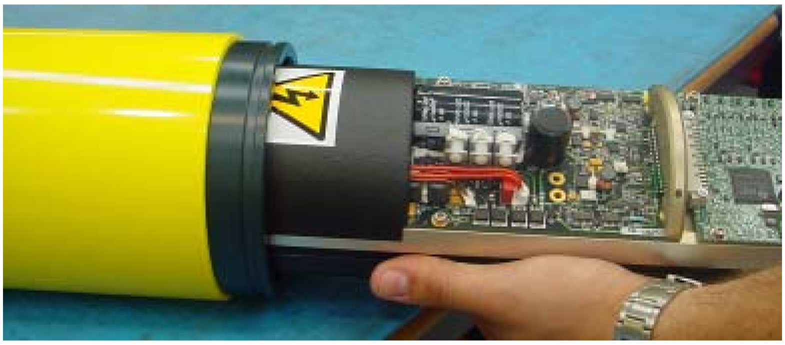
Check that the earthing spring gaskets located in the grooves on the sensor end cap and lower bulkhead are not damaged. The correct orientation is shown below:



Offer the chassis assembly up to the pressure tube and slide into the tube. Take care not to knock the electronics against the housing. .

Check the ribbon cable connectors are fully home and the latches are in a fully vertical position.

Check that any flying leads do not get trapped and the earthing spring gaskets are not damaged. Use a gentle anti-clockwise rotation as the chassis slides in to assist the “lean” of the spring gaskets



Place two dry silica gel bags over the CPU PCB, and two more tucked under the wiring loom of the DAS PCB.

Note: It is possible to measure the state of a silica gel bag by using a 500V Megger test, if the resistance is >50MΩ it is still dry.

During 2004 Sonardyne switched to fitting self-indicating silica gel bags. These start off orange when dry, and will change to green. REPLACE IF GREEN.

Carefully inspect the 'O' rings again for dirt or fibres before gently push the assembly fully home.

Ensure the clamp grooves on the pressure housing and sensor end cap are clean.

Fit the two clamp halves to the grooves ensuring they are evenly spaced.

Fit the two M5 hexagon socket head cap screws and Nyloc nuts that secure the clamp halves.

Using a 5mm Allen Key (hex key), tighten the clamp halves evenly.

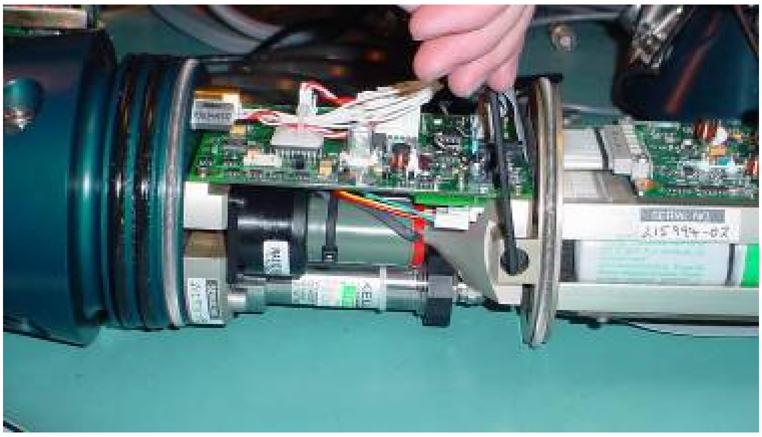
Note: the clamp rings are not designed to abut together. Leave a 2-3mm gap between them when tightening.

4.18.2 Chassis Assembly replacement in pressure housing - Midi and Mini Unit

Ensure sensor end cap has been replaced on the chassis assembly as detailed in Section 4.17 above.

Position the pressure housing on a pair of rollers, or a cradle, to make working on the unit easier.

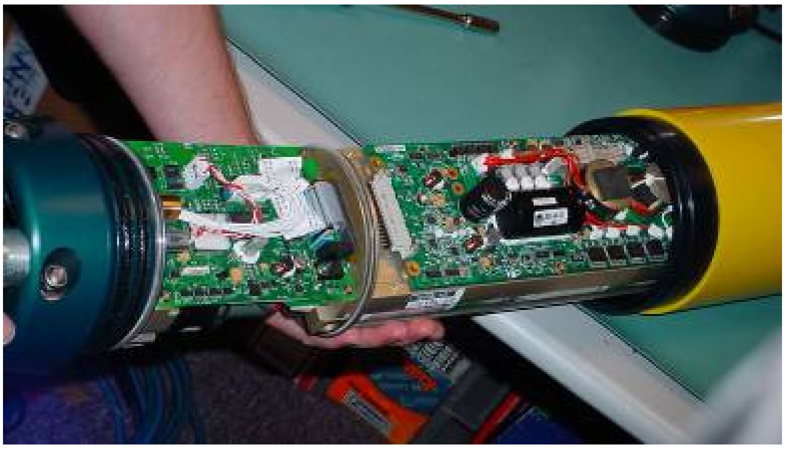
Check that the earthing spring gaskets located in the grooves on the sensor end cap and lower bulkhead are not damaged.



Offer the chassis assembly up to the pressure tube and slide into the tube. Take care not to knock the electronics against the housing.

Check the ribbon cable connectors are fully home and the latches are in a fully vertical position.

Check that any flying leads do not get trapped and the earthing spring gaskets are not damaged. Use a gentle anti-clockwise rotation as the chassis slides in to assist the “lean” of the spring gaskets



Place two dry silica gel bags over the CPU PCB, and two more tucked under the wiring loom of the DAS PCB.

Note: It is possible to measure the state of a silica gel bag by using a 500V Megger test, if the resistance is >50MΩ it is still dry.

During 2004 Sonardyne switched to fitting self-indicating silica gel bags. These start off orange when dry, and will change to green. REPLACE IF GREEN.

Carefully inspect the 'O' rings again for dirt or fibres before gently push the assembly fully home.

Ensure the clamp grooves on the pressure housing and sensor end cap are clean.

Fit the two clamp halves to the grooves ensuring they are evenly spaced.

Fit the two M5 hexagon socket head cap screws and Nyloc nuts that secure the clamp halves.

Using a 5mm Allen Key (hex key), tighten the clamp halves evenly.

4.18.3 Max Unit

Ensure sensor end cap has been replaced on the chassis assembly as detailed in Section 4.17 above.

Check that the earthing spring gasket located in the groove on the sensor end cap is fitted and is not damaged.

Fit the new, black battery pack under the chassis, and then refit the chassis bulkhead onto the 2 studs protruding from the chassis. Feed the flying lead from the battery through the central hole in the bulkhead, along with the red handle loop. Fit the washers over the studs, add the earthing lead eyelet over one stud, then secure with two M5 nyloc nuts using a nut spinner.

Check that the flying lead from the battery interconnect pcb is still connected to the Tx card.

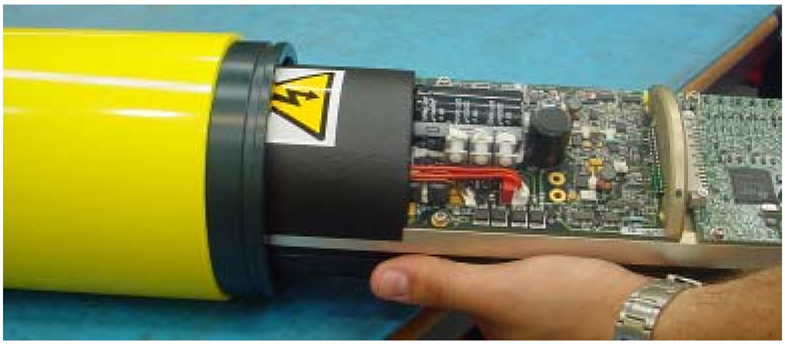
Connect the black battery pack to the battery interconnect pcb. The electronics are now powered. Exercise caution against accidental short circuits.

Check that the flying, white Transducer connector is still connected to the Tx card.

Feed the wiring loom into the tube, then offer the chassis assembly up to the pressure tube and slide into the tube. Take care not to knock the electronics against the housing.

Check the ribbon cable connectors are fully home and the latches are in a fully vertical position.

Check that any flying leads do not get trapped and the earthing spring gaskets are not damaged.



Place two dry silica gel bags over the CPU PCB, and two more tucked under the wiring loom of the DAS PCB.

Note: It is possible to measure the state of a silica gel bag by using a 500V Megger test, if the resistance is >50MΩ it is still dry.

During 2004 Sonardyne switched to fitting self-indicating silica gel bags. These start off orange when dry and will change to green. REPLACE IF GREEN.

Carefully inspect the 'O' rings again for dirt or fibres before gently pushing the assembly fully home. The connectors on the end of the wiring loom should just protrude from the open end of the tube.

Ensure the clamp grooves on the pressure housing and sensor end cap are clean.

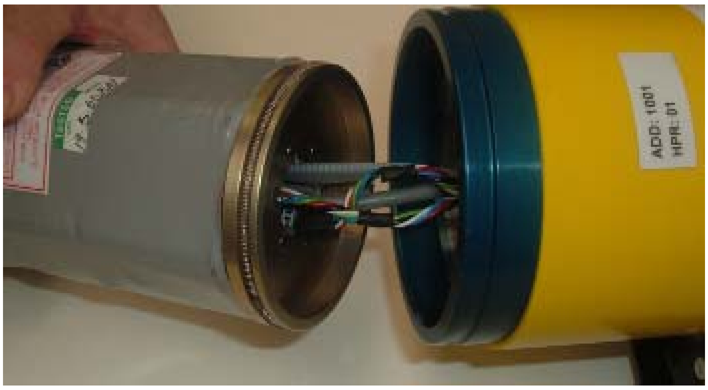
Fit the two clamp halves to the grooves ensuring they are evenly spaced.

Fit the two M5 hexagon socket head cap screws and Nyloc nuts that secure the clamp halves.

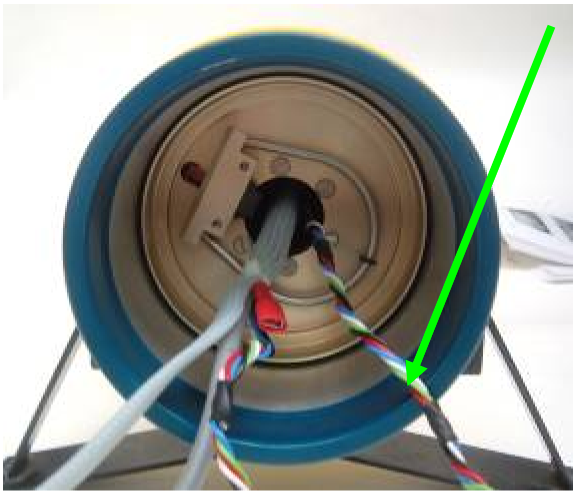
Using a 5mm Allen Key (hex key), tighten the clamp halves evenly.

Note: the clamp rings are not designed to abut together. Leave a 2-3mm gap between them when tightening.

Feed the wiring loom through the central hole in one of the grey battery packs, starting at the non-connector end.



Push the battery pack into the tube and pull through the wiring loom until it is possible to identify the longer of the two battery connection leads, which must now be connected to the battery pack.



Push the battery fully home, until it engages with the spring gasket on the chassis bulkhead. Ensure the wiring loom service loop does not bunch up during this step.

Feed the remaining loom through the last battery pack. Push the battery pack full home into the tube, such that it engages with the spring gasket on the middle pack. Feed the excess sleeving back down the hole. Connect the final battery connector to the last pack.

Note: it is very important to use the < **Initialise Transponder**> function via the RS232 lead and Test Terminal software before the unit is put into service. Refer to Appendix B.

4.19 BATTERY PACK REPLACEMENT

4.19.1 Battery Pack replacement - Standard Unit

Fit chassis assembly into pressure housing as detailed in Section 4.22 above.

Rotate pressure housing until the battery compartment is at the top of the pressure housing.

Offer battery pack up to pressure housing and carefully slide home.

Rotate pressure housing until the battery pack is at the bottom of the pressure housing.

Hold the end cap up in front of the battery and feed the black battery pack flying lead and connector through the central hole of the end cap.

Place the end cap on the chassis studs, fit the M5 plain washers and secure with M5 nuts using a nut spinner.

Connect the black battery pack flying lead to the Tx/Pre-amp PCB. Check the connection is secure.

After 15 seconds, relays should be heard to click a few times then stop. This indicates that the processor has initialised successfully.

If no relays are heard, then disconnect the battery for 60 seconds, and repeat. If no relays are heard the second time, there is a fault that requires investigation.

4.19.2 Battery Pack replacement - Midi and Mini Unit

Fit chassis assembly into pressure housing as detailed in Section 4.18 above.

Offer battery pack up to pressure housing and carefully slide home between the chassis rails.

Place the end cap on the chassis studs, fit the four M5 plain washers and secure with M5 nuts using a nut spinner.

Hold the end cap up in front of the battery and feed the black battery pack flying lead and connector through the central hole of the end cap.

After 15 seconds, relays should be heard to click a few times then stop. This indicates that the processor has initialised successfully.

If no relays are heard, then disconnect the battery for 60 seconds, and repeat. If no relays are heard the second time, there is a fault that requires investigation.

4.19.3 Max Unit

When the Max unit is to be re-batteried, all 3 battery packs must be replaced at the same time.

The Chassis Assembly Replacement procedure in the Section 4.18.3 includes the battery replacement.

Note: it is very important to use the < **Initialise Transponder**> function via the RS232 lead and Test Terminal software before the unit is put into service. Refer to Appendix B.

4.20 TRANSDUCER END CAP REPLACEMENT

Ensure the chassis assembly has been replaced into the pressure housing as detailed in Section 4.18 above.

Ensure battery pack has been replaced as detailed in Section 4.19 above. Check the connection is secure.

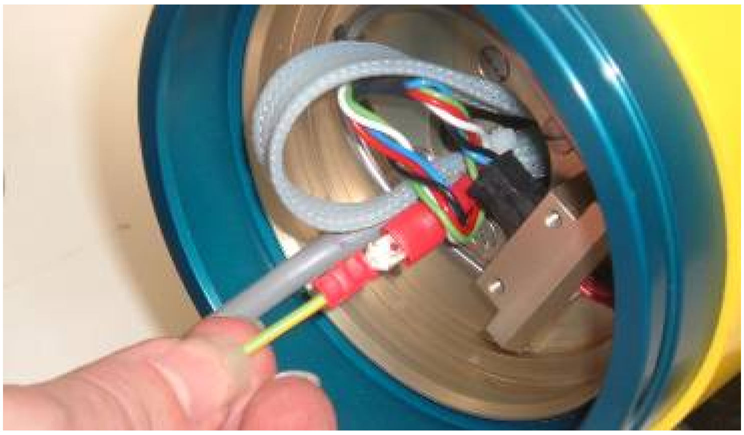
Carefully inspect the 'O' rings again for dirt or fibres before gently push the assembly fully home.

Ensure the grooves on the pressure housing and transducer end cap are clean.

Ensure that the earthing spring gasket located in the groove in the transducer end cap was not damaged during withdrawal.

Connect the white transducer connector on the red and blue transducer cable to the Tx pre-amp PCB. Check the connection is secure.

Max Unit only: reconnect the earthing lead via the in-line spade connector.



Give the end-cap a 180° twist to encourage the cable to coil inside the cut-out of end-plate, then offer the transducer end cap up to the pressure housing and gently push home ensuring that the transducer cable is not trapped.

Fit the two clamp halves to the grooves ensuring they are evenly spaced.

Fit the two M5 hexagon socket head cap screws and Nyloc nuts that secure the clamp halves.

Using a 5mm Allen Key (hex key), tighten the clamp halves evenly.

Note: the clamp rings are not designed to abut together. Leave a 2-3mm gap between them when tightening.

4.21 TESTING OF ASSEMBLED UNIT

Ensure the Compatt is horizontal, i.e. tilted.

Run through the functional check-list in Section 2.2.

If a new battery has been fitted, check the Battery Count is zero, and the voltage agrees with the Start of Life voltage in Section 2.3.

4.22 ELECTRONIC FAULT FINDING - POWER CHECKS AND ACOUSTIC SIGNAL TRACING

The following procedure will allow major faults to be located to board level. Board replacement is the recommended repair policy. The following checks and the waveform and timing diagrams give sufficient information to trace a fault to board level.

The test equipment assumed to be available comprises a multi-meter, an oscilloscope, an Type 7343 ANT, and a PC with a serial port.

The unit should be out of its housing for these tests, refer to Section 4.6.

4.22.1 DC Voltage Measurement Checks

Using the voltmeter, measure the battery voltage at Test Point 6 of the Tx/Pre-amp PCB, with reference to the Test Point TP0V1, see Fig 7. For an alkaline pack, the voltage falls linearly with usage, enabling a voltage reading to give an indication of the remaining life of the battery. Typical voltage characteristics are given in Section 2.3.

As the voltage approaches 11.3V, replace the battery pack, see Section 2.3.

Note: Alkaline batteries have increasing internal impedance with discharge which results in a greater voltage drop during heavy load periods such as during a telemetry transmission. Discharged batteries operati ng beyond the battery count limit may, therefore, be unable to supply sufficient current for certain operations.

Using the voltmeter again, measure the permanent 5V rail on the Tx/Pre-amp PCB on the positive side of C17, see Fig.7. This should be 5.0V ± 0.1V.

Using the voltmeter again, measure the permanent 3V9 supply on the Tx/Pre-amp PCB on the cathode of D21, see Fig.7. This should be 3.9V ± 0.1V.

Using the voltmeter again, measure the permanent 3V3 rail on the CPU PCB on TP+3V3, see Fig.9. This should be 3.3V ± 0.1V.

4.22.2 Frequency Measurement Checks

On power up, there should be a permanent 100kHz square wave of 3V3 amplitude on the CPU PCB TP 38, see Fig 9.

On the CPU PCB TP14, there should be 2.4576MHz for the first 30 seconds, and also. TP36 will go high following any serial or acoustic command, enabling the 2.4576 MHz clock onto the main processor.

If the above are all correct, then next stage is to determine if the unit is failing to receive the command signals, or whether it is failing to generate the reply.

4.22.3 Receiver Checks

To check receiver and transmitter operation, use a free running oscilloscope to monitor the following functions. The acoustic transducer should be connected for these tests.

Firstly, enable the Compatt by sending the command 'EN' .

Secondly, send the Compatt command 'RD'. Repeat this command to check the following.

Monitor Test Point 1 on the CPU PCB. This is normally low but a 614kHz clock should be present for about 6 seconds during the Compatt command ‘RD’ and its reply. Refer to Figure 13.

If TP1 stays on for just 120ms, the unit may be being affected by a rogue emission on its IIF from some nearby equipment, typically VDUs, and aborting the command reception. IIF channels that have been affected by such equipment include MF 3, 5, 12, and 14. Try switching off nearby VDUs or move away. Even Compatts that are fully bottled up can be affected by nearby VDU radiation.

If the Test Point 9 goes to mid-rail (1.5V) for about 1.5s (with the transmit signal super-imposed during tx going to 3V3), the receivers have correctly validated the command pulses and the CPU has attempted to transmit a reply. Proceed to the Transmitter Checks.

If Test Point 9 fails to go high, check the 3 pulses were correctly received. Each should generate a negative pulse of about 4 ms duration on TP20 (the XIRQ interrupt).

If no pulse is present on TP9, use the ANT to generate a continuous wave (CW) at 40kHz, and check P14 on the Tx/Pre-amp PCB also shows 40kHz. If the pre-amp output on P14 does not show 40kHz, replace the Tx/Pre-amp PCB.

Wideband receiver checks cannot be traced with an oscilloscope, as all the signal processing is done digitally. The 8.0MHz clock should be present on TP35 on the Daughter card when the Compatt has been enabled in wideband mode (EN+EW commands).

4.22.4 Transmitter Checks

In response to the RD command, a stream of 49 tone bursts of the telemetered reply should be seen on Test Point 25.

If the tone burst is not present, replace the CPU PCB.

On the Tx/Pre-amp PCB, monitor the tone burst on the cathode (bar end) of D23 and D24, which should be the same as on CPU TP25, but with the same amplitude as the battery voltage. If the signal is not present, replace the Tx/Pre-amp PCB.

4.22.5 Transducer Checks

If no acoustic output is heard, nor picked up by a 'scope' probe on the surface of the transducer, check the acoustic transducer. Disconnect the transducer from the Tx/Pre-amp PCB referring to Section 4.3.

A faulty transducer can be detected by measuring the capacitance between the 2 leads when disconnected from the circuitry. A normal transducer will measure between 4.3 and 6.1nF. The original capacitance will be engraved on the external band around the transducer boot. It may be necessary to clean the band with an abrasive such as Scotchbrite to be able to read the engraving.

Transducer replacement is described in Section 4.4.

4.22.6 DAS Checks

All the functions concerned with acoustic operation have been covered above. The following checks cover the operations controlled from the DAS PCB.

To power up the board, send the command 'CT'. Test Point 6 on the DAS PCB should go to the battery voltage for 2 seconds, and TP7 should go to between 13 to 15V, with reference to TP0V on the DAS PCB.

If this is not present, check the ribbon cable for signs of damage. If this seems undamaged, change the CPU PCB.

Check for 614kHz clock on TP1 being present during the measurement.

The release motor drive can be monitored on TP8, which should ramp to 2V during release, to switch the battery volts onto the release motor drive. (The 8000-057 DAS Board is for a non-release Compatt therefore this does not apply).

4.22.7 3V3 Current Monitor Set-up

The <Hardware self-test> includes a check on the 3V3 current monitoring circuit, which has been found to false detect on some units. The following method describes how to setup the adjuster pot, RV2 on the Tx card to remove the false detection.

Firstly, use the Test Terminal software to **<Initialise transponder>**, then **<Enable transponder>**. Secondly wait 30 seconds for the serial communications circuit to power down before using a DVM to monitor TP11 on the Tx card, wrt TP0V. Thirdly adjust RV2 to get 2.050 V on Tx pcb TP11 if the Tx pcb is Issue F or earlier, or 2.20V if Issue G or later

Run <Hardware self-test> and confirm "`High 3V3 current warning`"(or Error 8) is no longer reported. Ref Appendix B.2.3.3.

4.23 STRAIN GAUGE PRESSURE SENSOR RECALIBRATION

Strain gauge sensors can alter their characteristics with time and usage, so recalibration is necessary. The frequency of recalibration depends on usage, but should be carried out at least annually. The largest error will be an offset rather than a span or scaling error.

An offset error can be zeroed quickly and easily using the RS232 function <Set Depth reading to Zero>, refer to Appendix B.2.3.10.

A scaling error requires a calibrated dead weight tester with an appropriate operating range. The procedure is covered in Appendix B.3.

Also, it is possible to calibrate the sensor for best accuracy at a known working depth, by setting the span adjuster for correct reading at the required pressure. This removes any non-linearity errors in the sensor, at the defined pressure.

The span calibration procedure requires use of the DasCal.exe program to control the Compatt. Refer to Appendix B.

4.24 TEMPERATURE SENSOR RECALIBRATION

The Platinum Resistance Thermometer (PRT) has very stable characteristics and so recalibration should not be necessary more fr equently than every 24 months, unless a fault is suspected.

To perform the recalibration, a calibrated resistance box with 0.01ohm resolution will be required.

Contact Sonardyne International Ltd for the calibration procedure.

4.25 SOUND SPEED SENSOR CHECK

The sensor has a recalibration interval of 5 years – contact Sonardyne International Ltd for details.

Ensure that the transducer and reflector faces are kept clean by washing in fresh water.

The Sound Speed Sensor is a direct reading 'time of flight' device with a calibrated sensor path length of 50mm. A +12V supply is switched on to the sensor for 0.5s before a reading is requested using an RS232 command. The sensor returns an RS232 ASCII text reply.

The Compatt will return a measured sound speed within the legal range of 1400 - 1600 m/s.

The sensor can be read in one of three ways:

Using the RS232 test lead – the "Read Sensors" button will make a measurement of all sensors fitted if the Compatt main firmware is V1.05 or above.

Using a Rovnav 5 fitted with V7.04 or later – use the manual command mnemonic SS (for sound speed) to return a reading in metres/second.

Using a PAN- set up the Compatt address using the AD command. Send the EN command. Enter the following: G35,1,6,1,4,50,1,2

The reply will be in the format 02850538C**148670**4

Ignore the last character, and read the preceding 6 characters which are the sound speed in cm/s.

02850538C **148670** 4 = 1486.70 m/s

Error codes - If the Compatt returns a sound speed greater than 9000 this is an error code.

9998.0 m/s =	no reply from the sensor, or sensor not in water
9999.00 m/s =	illegal data char

4.26 QUARTZ PRESSURE SENSOR CHECK

These sensors are very fragile, and have a limited over-range capability. Each end-cap with this option is supplied with a sheet of Calibration Coefficients that are needed to convert the measurements made by the Compatt into an absolute pressure reading.

A +12V supply is switched on to the sensor when the CQ, TQ or CPR command is received by the Compatt. On the blue lead, PL5.2, the pressure signal is a square wave of between 30 - 40kHz. On the white lead, PL5.3, the temperature compensation output is a square wave of approximately 172kHz.

The CQ and TQ commands count the respective frequencies for a period of 9 seconds, and return the count made during the 9 second period. The CPR command powers the sensor for a similar length of time but the Digiquartz computations are carried out in the DAS board and an absolute pressure value is returned in kilo Pascal (kPa), to 2 decimal places, which gives a resolution of roughly 1 millimetre of water.

Paroscientific do not provide any method to "calibrate" the sensor other than removing small offset errors. This is achieved by recalculating the coefficients C1 and T1.

Note that under normal conditions a zero adjustment calibration will correct for normal component ageing. This should be checked annually. A zero offset can be trimmed by re-computing the coefficients supplied with the sensor – contact Sonardyne International Ltd for details.

Consequently, the only calibration undertaken at Sonardyne involves a single point calibration at atmospheric pressure, to a limit of 0.01%, using a calibrated barometer to measure the atmospheric pressure to an accuracy greater than the 0.01% FSD.

Further testing is then carried out at nominal 20% steps of the sensor's pressure range, to ensure the sensor functions correctly over the full range. In order to confirm the calibration to the full accuracy of the sensor, a pressure source with an accuracy of an order of magnitude better than the accuracy of the sensor would be required; such equipment is not commercially available. As these tests are to prove functionality, a suitable test limit is used for this phase of the testing.

The Test Certificate supplied with the Compatt is a record of the zero offset adjustment and the functional tests at higher pressures. It is not a calibration certificate. Hence wider test limits than the quoted accuracy of the sensor are used on the Test Certificate.

Paroscientific provide a Certificate of Conformity for all of their sensors and have provided written confirmation that long term drift on their sensors is negligible so their original factory calibration remains valid for the life of the sensor. The Certificate of Conformity from Paroscientific guarantees that the sensors meet the required specifications and can be provided if required.

Use of the <Set Depth Reading to Zero> function in Test Terminal is not recommended for use with precision sensors such as Digiquartz. If an offset is reported in the <Read Sensors> report, it should be removed using the add-in test command button <Clear Depth Offset>. Offsets should only be corrected as part of the regular workshop recalibration procedure, where the C1 and T1 coefficients get adjusted and stored.

4.27 INCLINOMETER SENSOR CHECK

Option I2 end-caps are fitted with a pair of inclinometers mounted orthogonally.

A bipolar supply is generated, nominally ±12V, and the sensors output a voltage of ±5V. The sensors are allowed about 8 seconds to settle after power-up before the readings are made. Further scaling is carried out in firmware, to generate the ±4.000V range returned by an AN5 command. Refer to Appendix G.

Calibration of the sensors requires specialist test equipment, and is recommended to be carried out every 24 months. Contact Sonardyne International Ltd for details.

SECTION 5

5. OPERATIONAL TROUBLE-SHOOTING

This section deals with various possible fault symptoms that may occur following Compatt deployment.

5.1 COMPATT DOES NOT REPLY TO INTERROGATIONS OR COMMANDS

Check all connectors to the surface transducer.

Is the correct Compatt address set in the surface transceiver?

If operating at long range, is the surface transceiver in high power?

Are ray-bending effects stopping the Compatt from receiving. The acoustic propagation of pulses travelling through a known velocity profile can be predicted using the PC based application software package "RAY_TRACE" available from Sonardyne.

A surface thermocline may be refracting the Compatt reply signals away from the surface transducer. Lower the transducer below the thermocline.

Is the noise level at the surface transducer too high? Lower the dunking transducer or towfish and/or reduce the PAN gain setting. Do a noise check by using the appropriate Transceiver Noise Check command (e.g. PAN command XRX, Rovnav RX) to see if any channels are validating on noise.

The Compatt may have a low battery voltage that reduces acoustic output power. Check the log for the battery voltage prior to deployment.

Surface currents may be streaming the surface transducer, such that it is directed away from the Compatt location. Adding 20kg ballast on a 1m strop from the transducer guard may reduce this.

If a low gain setting has been commanded, the unit may be unable to receiver further commands or interrogations. Wait for 3 minutes with no interrogations being made, then send the command CG4 to program high gain.

Other acoustic systems, e.g. free-running pingers or echo-sounders, may be operating in the same frequency band. Check for signals validating by using the Noise Check command on the surface transceiver.

If operating in air, check VDU emissions are not radiating on IIF. See Section 4.22.3.

5.2 COMPATT DOES REPLY TO COMMANDS, BUT NOT TO INTERROGATIONS

Is the Compatt enabled? Check which interrogation mode is enabled, by reading the Transponder Status reply.

- EDD signifies CIF is the current tone in terrogation channel. Is the Compatt set to the expected reply frequency?
- DED signifies IIF is the current tone interrogation channel
- DDE signifies HPR is the current tone interrogation channel

- WDD signifies CIS is the current Wideband interrogation channel
- DWD signifies IIS is the current Wideband interrogation channel

Is the battery count above the cut-off limit, i.e. the letter 'B' shown in the Transponder Status reply? If so over-ride the limit by sending the command 'OV' and release the transponder to recover and replace battery.

In the 'Transponder Status' reply, is the letter 'J' shown? This indicates the tilt switch is open (i.e. tilted) and the Compatt may have been physically moved from its original position.

5.3 COMPATT REPLIES TO COMMANDS, BUT TELEMETRY ERRORS ARE DETECTED

Re-establish the uplink telemetry baud rate by sending an ES, EN or EF command.

The noise level at the surface transducer may be too high, see Section 5.1. Set the Compatt to high power telemetry transmission using the CPA2 command.

Other acoustic systems may be operating on the telemetry frequencies e.g. certain echo sounders on 33kHz.

5.4 COMPATT DOES NOT CHANGE STATUS

If commands are replied to but the status does not change, for example sending a Reset Default command is acknowledged but the reply shows the various parameters have not been changed. The Compatt may have had its STATUS LOCKED. The unit must first be commanded to the UNLOCKED state using the system software to drive the transceiver.

5.5 SONARDYNE EMERGENCY HELPLINE TEL. + 44 (0) 1252 877600

Sonardyne run a 24-hour emergency help-line, where a call during office hours (08:30 - 17:00 UK time) will be answered on a priority basis. Outside of office hours, an agency will take your message and alert the appropriate Sonardyne person. The aim is to ensure that emergency requests are dealt with immediately during office hours, and responded to within 30 minutes at all other times. Alternatively, email us at **support@sonardyne.co.uk**.

SECTION 6

6. TECHNICAL SPECIFICATION: TYPE 8000 COMPATT 5

6.1 COMPLIANCE

This product complies with the requirements of the EMC Directive 2004/108/EC and carries the CE marking accordingly.

6.2 ACOUSTICS

Transducer Beam shape: Hemispherical (±120 degrees)

Frequency Range: MF 19 - 36 kHz

Acoustic Sensitivity (dB re 1 µPa):

< 90 dB	gain level 4 (maximum range)
95 ±4 dB	gain level 3
110 ±4 dB	gain level 2
125 ±4 dB	gain level 1 (minimum range)

Acoustic Output (dB re 1 µPa @ 1 m):

193 ±2 dB	power level 4 (maximum power)
188 ±3 dB	power level 2 (high power)
184 ±3 dB	power level 1 (low power)

Pulse Length:

Sonardyne tone	4 ms
HPR	10 ms
Wideband	8 ms

Turn-Around Delay 125 ms (default) 30ms for HPR

Timing Resolution 1.6 microsecond

6.3 SENSORS

6.3.1 Depth Measurement (Strain Gauge)

Span (options)	5000m	3000m	1000m	500m
Resolution using CD	1.2m	0.75m	0.25m	0.12m
Resolution using CPR	0.01kPa	0.01kPa	0.01kPa	0.01kPa
Accuracy	±5.0m	±3.0m	±1.0m	±0.5m

6.3.2 Depth Measurement (High Precision Strain Gauge)

Span (options)	5000m	3000m	1000m	500m
Resolution using CD	1.2m	0.75m	0.25m	0.12m
Resolution using CPR	0.01kPa	0.01kPa	0.01kPa	0.01kPa
Precision	±0.5m	±0.3m	±0.1m	±0.05 m

6.3.3 Depth Measurement (Quartz option)

Span (pressure)	0-6000psi	0-3000psi	0-2000 psi
Span (depth)	0-4100m	0-2050m	0-1360m
Resolution using CQ and TQ	< 15cm	< 7cm	< 5cm
Resolution using CPR	0.01kPa	0.01kPa	0.01kPa
Precision	±0.42m	±0.21m	±0.14 m

Note:- 0.01 kPa is approximately equal to 1mm

6.3.4 Temperature Measurement

Range	-5°C to + 40°C
Resolution	0.01°C
Accuracy	±0.1°C

6.3.5 Inclinometer Measurement (option)

Option I2 – Dual Axis High Accuracy Inclinometer

Range:	± 90°	(refer to Appendix G)		
Resolution:	0.01°	(over the range ± 14.5°)	0.05°	(over the range ± 45°)
Accuracy:	±0.05°	(over the range ± 14.5°)	±0.2°	(over the range ± 45°)

6.3.6 Tilt Switch

Internal 45° tilt switch indicates vertical position

6.3.7 Sound Speed Sensor

Resolution:	0.01 m/s
Range:	1400 – 1600 m/s
Overall accuracy:	± 0.06 m/s

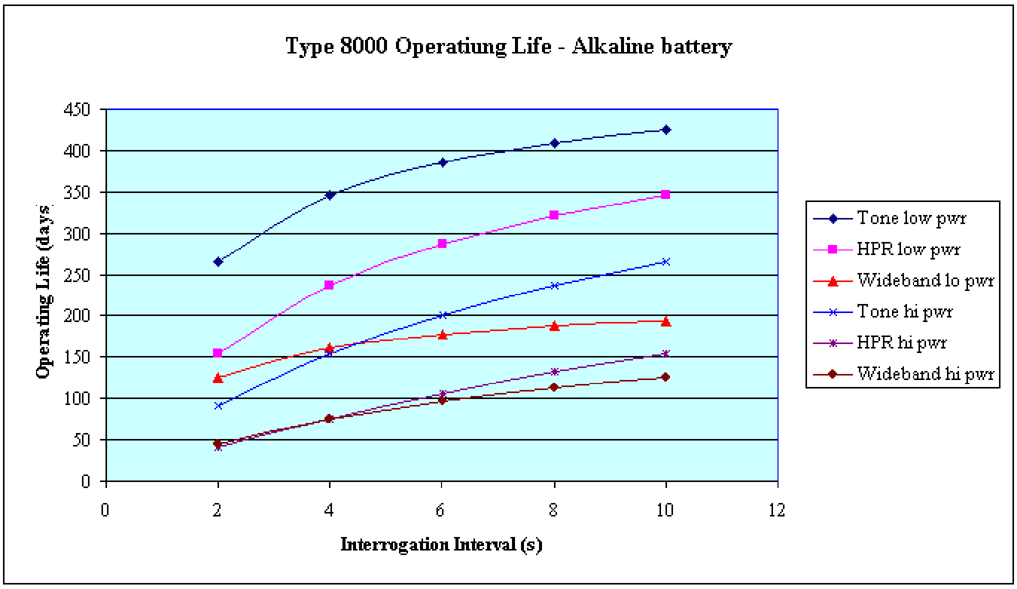
6.4 BATTERY LIFE

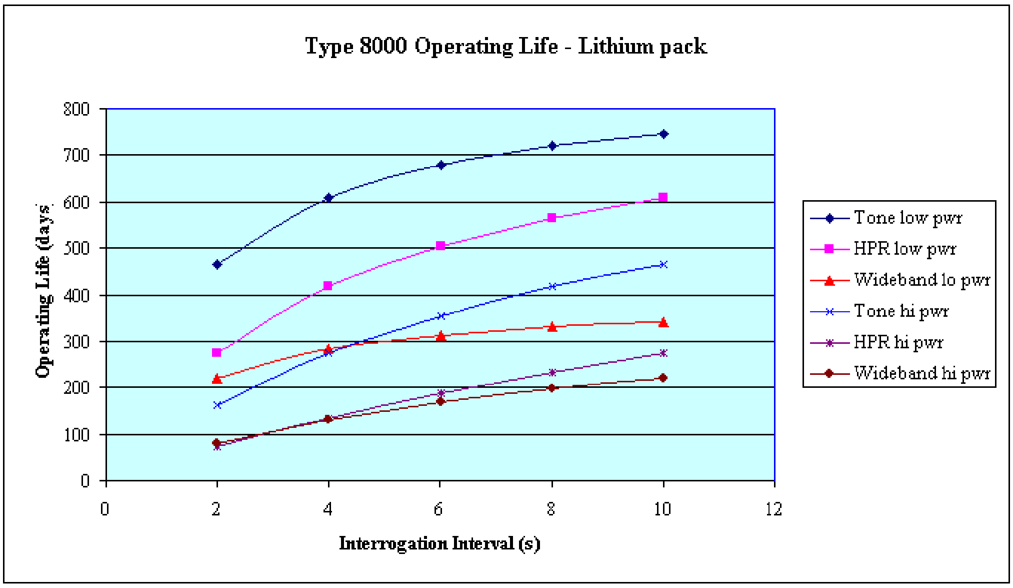
Compatt 5 measures the battery voltage which falls slowly with alkaline batteries. For Lithium batteries, which have a flat voltage characteristic, the voltage does not indicate remaining life. Hence it is necessary to continuously monitor the discharge current drawn from the battery. This totaliser, or Battery Count, runs from zero when a new pack is manufactured, up to a theoretical limit at which point certain functions will cut-out. The Count limits against battery type are detailed below.

Battery Type	Start of Life Voltage	Battery Limit Voltage	Battery Count Limit
Alkaline	15.5 V	11.3 V	540
Lithium	14.5 V	13.0 V	950
Lithium (Midi/Mini)	14.5 V	13.0 V	285
Lithium (Max)	14.5V	13.0V	2090

6.4.1 Standard Unit

Battery Type	Alkaline	Lithium
Listening Only when disabled (days)	833	1390
LBL reply at High Power	4,300,000	7,600,000
LBL reply at Low Power	15,000,000	27,000,000
Wideband reply at Low Power	7,500,000	13,100,000
Data Telemetry High Power	109,000	192,000
Data Telemetry Low Power	328,000	577,000





Refer to Section 2 for more information concerning battery life.

6.4.2 Midi and Mini Unit

Battery Type	Alkaline	Lithium
Listening Only when disabled (days)	N/A	417
LBL reply at High Power	N/A	2,300,000
LBL reply at Low Power	N/A	8,200,000
Wideband reply at Low Power	N/A	3,900,000
Data Telemetry High Power	N/A	57,000
Data Telemetry Low Power	N/A	173,000

6.4.3 Max Unit

Battery Life	Alkaline	Lithium
Listening Only when disabled (days)	N/A	3056
LBL reply at High Power	N/A	9,300,000
LBL reply at Low Power	N/A	71,000,000
Wideband reply at Low Power	N/A	34,000,000
Data Telemetry High Power	N/A	680,000
Data Telemetry Low Power	N/A	5,000,000

6.5 EXTERNAL POWER

Externally supplied power will by-pass the battery pack if within a set voltage range. For standard and Midi units (i.e. with DAS card) the range is 15-30V. For Mini units (i.e. without DAS cards) the range is 10-15V. Ref to Fig. 16 for connector wiring. Draws approximately 30mA quiescent, 250mA peak. Will switch over to battery automatically during high drain transmissions such as during telemetry.

6.6 COMMUNICATIONS

Type RS-232 (half-duplex)
Baud Rate 9600, 8 data bits, 1 stop bit, no flow control, no parity.

6.7 ENVIRONMENTAL

Temperature:	Operation:	–5°C to +30°C
	Storage:	–20°C to +70°C

For storage of batteries, room temperature is recommended, and a controlled-humidity environment.

Rated for: Outdoor use
Relative Humidity 100%
IP 68
Maximum depth 3000m

6.8 MECHANICAL

6.8.1 Standard Unit

Length:	1035 mm	(40.7 ins)
Diameter:	135 ± 2 mm	(5.3 ± 0.1 ins) over plastic sleeve
Weight in air:	22.8 kg	(50.3 lbs.) [1.5kg less if a Lithium battery is fitted]
Weight in water:	11.6 kg	(25.6 lbs.) [1.5kg less if a Lithium battery is fitted]

Release Mechanism: Safe Working Load (SWL): 250 kg

Transducer Guard Shackle: Safe Working Load (SWL): 250 kg

SWLs are only applicable if the unit is used with a suitably rated, approved lifting strap, guard or other approved lifting method.

Max Operating Depth, 3000m - but may be limited by depth sensor (see Sensor End Cap label)

If Transponder is fitted with Inclinometer Endcap, refer to Fig 3 for dimensions.

If Transponder is fitted with Sound Speed Sensor, refer to Fig 5 for dimensions.

6.8.2 Midi Unit

Length:	784 mm	(30.9 ins)
Diameter:	135 ± 2 mm	(5.3 ± 0.1 ins) over plastic sleeve
Weight in air:	14.8 kg	(32.6 lbs.)
Weight in water:	6.8 kg	(15.0 lbs.)

Release Mechanism: Safe Working Load (SWL): 250 kg

Transducer Guard Shackle: Safe Working Load (SWL): 250 kg

Max Operating Depth, 3000m - but may be limited by depth sensor (see Sensor End Cap label)

If Transponder is fitted with Inclinometer Endcap, refer to Fig 3 for dimensions.

If Transponder is fitted with Sound Speed Sensor, refer to Fig 5 for dimensions.

6.8.3 Mini Unit

Length:	566 mm	(22.7 ins)
Diameter:	135 ± 2 mm	(5.3 ± 0.1 ins) over plastic sleeve
Weight in air:	11.0 kg	(24.2 lbs.)
Weight in water:	5.0kg	(11.0 lbs.)

Transducer Guard Shackle: Safe Working Load (SWL): 250 kg

Max Operating Depth, 3000m.

6.8.4 Type 8000-000-07- Max Unit

Length:	1647 mm	(64.8 ins)
Diameter:	135 ± 2 mm	(5.3 ins) over plastic sleeve
Weight in air:	35.8kg	(78.9lbs.) with Lithium battery packs
Weight in water:	15.2kg	(33.5lbs.) with Lithium battery packs

Release Mechanism: Safe Working Load (SWL): 250 kg

Max Operating Depth, 3000m - but may be limited by depth sensor (see Sensor End Cap label).

6.8.5 Deep Unit

Length:	1041 mm	(41.0 ins)	
Diameter:	137 ± 2 mm	(5.4 ± 0.1 ins)	over plastic sleeve
Weight in air:	24.3 kg	(53.5 lbs.)	[1.5kg less if a Lithium battery is fitted]
Weight in water:	12.0 kg	(26.4 lbs.)	[1.5kg less if a Lithium battery is fitted]

Release Mechanism: Safe Working Load (SWL): 250 kg

Transducer Guard Shackle: Safe Working Load (SWL): 250 kg

SWLs are only applicable if the unit is used with a suitably rated, approved lifting strap, guard or other approved lifting method.

Max Operating Depth, 5000m - but may be limited by depth sensor (see Sensor End Cap label)

6.9 CONNECTORS

Sensor Endcap connector Micro-Subconn MCBH-8FAL
Mating Connector Micro-Subconn MCIL-8M with locking sleeve MCDLS.

Connector Pin Allocations: See Figure 16.

6.10 EXTERNAL TRIGGER

Compatt 5 can be used as a Responder, using a positive trigger signal. This feature has to be enabled via serial set-up command, or acoustic command. Contact Sonardyne for details.

FIGURES

FIG 1 OUTLINE DRAWING: TYPE 8000-000-01 STANDARD UNIT

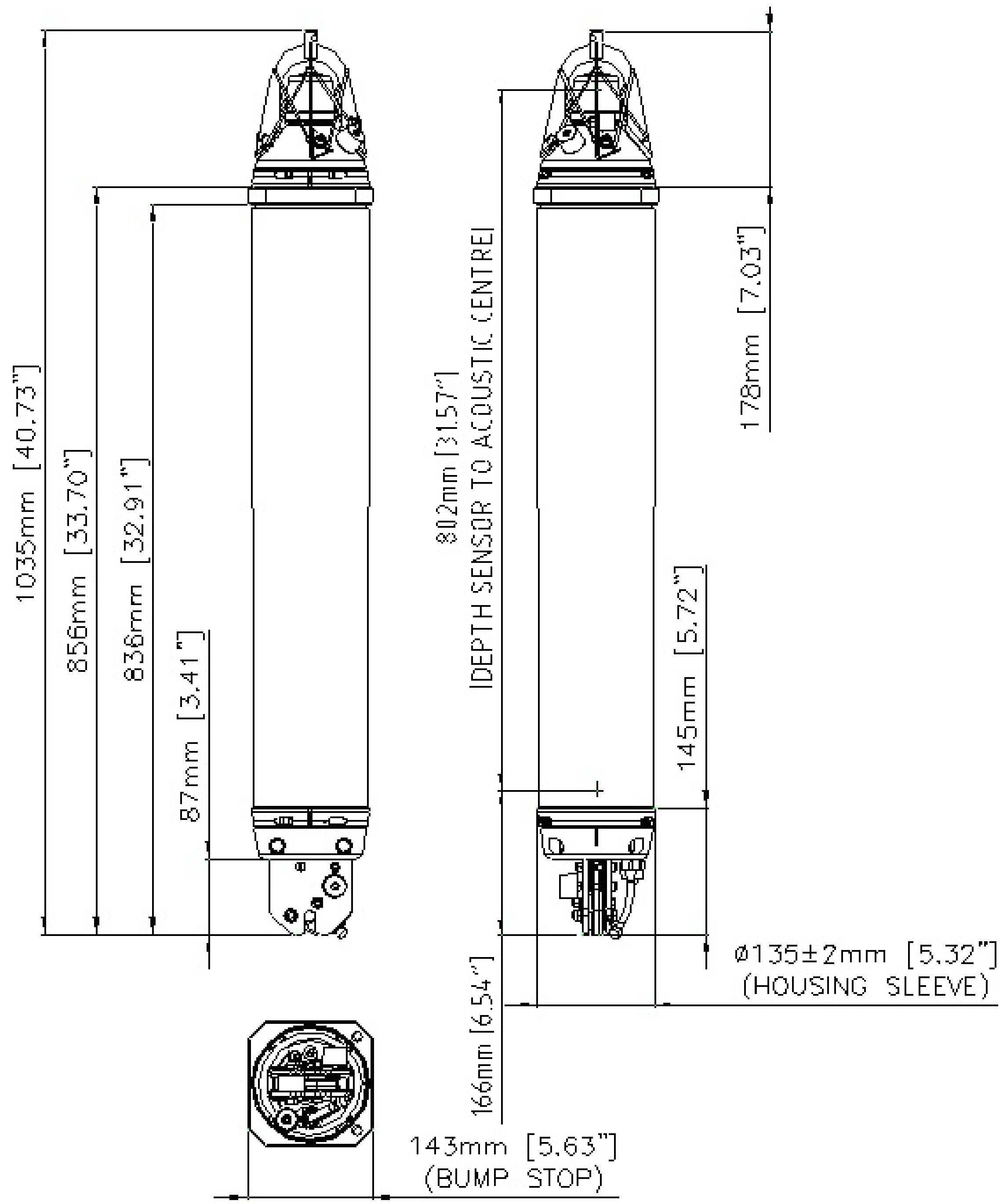


FIG 2 OUTLINE DRAWING: TYPE 8000-000-03 MIDI UNIT

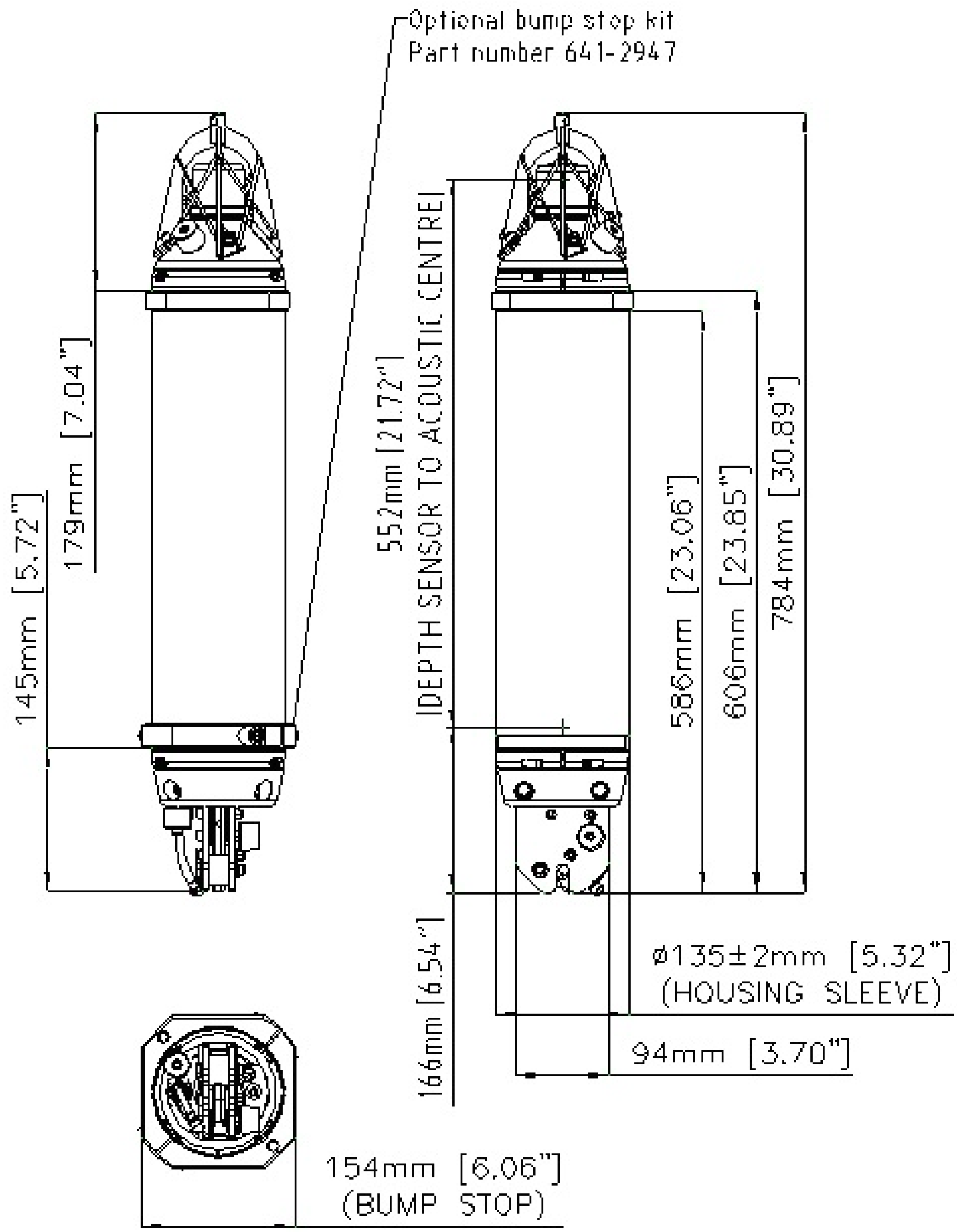


FIG 3 OUTLINE DRAWING: TYPE 8000-000-05 MINI UNIT

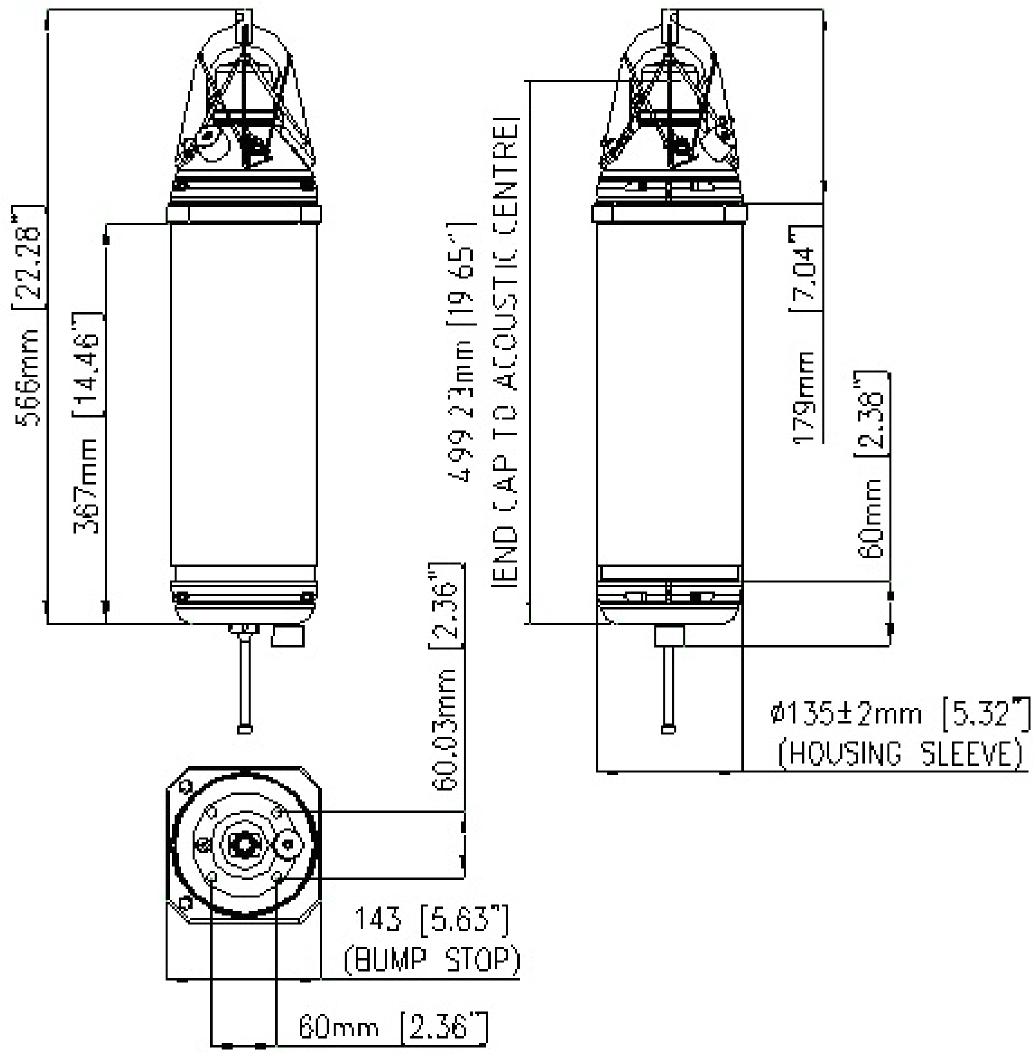


FIG 4 OUTLINE DRAWING: INCLINOMETER TRANSPONDERS

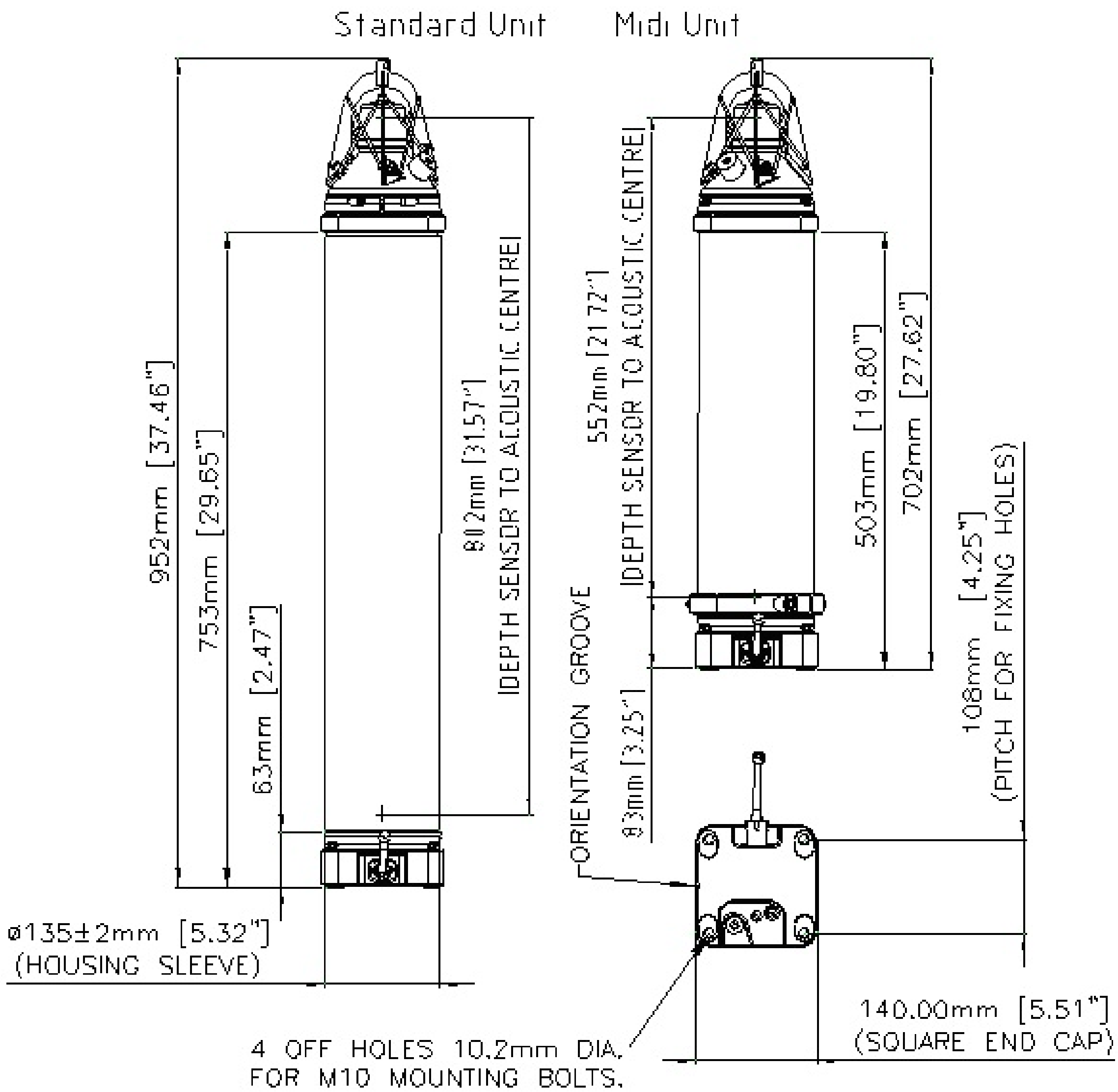


FIG 5 OUTLINE DRAWING: INTERNAL SOUND SPEED SENSOR TRANSPONDERS

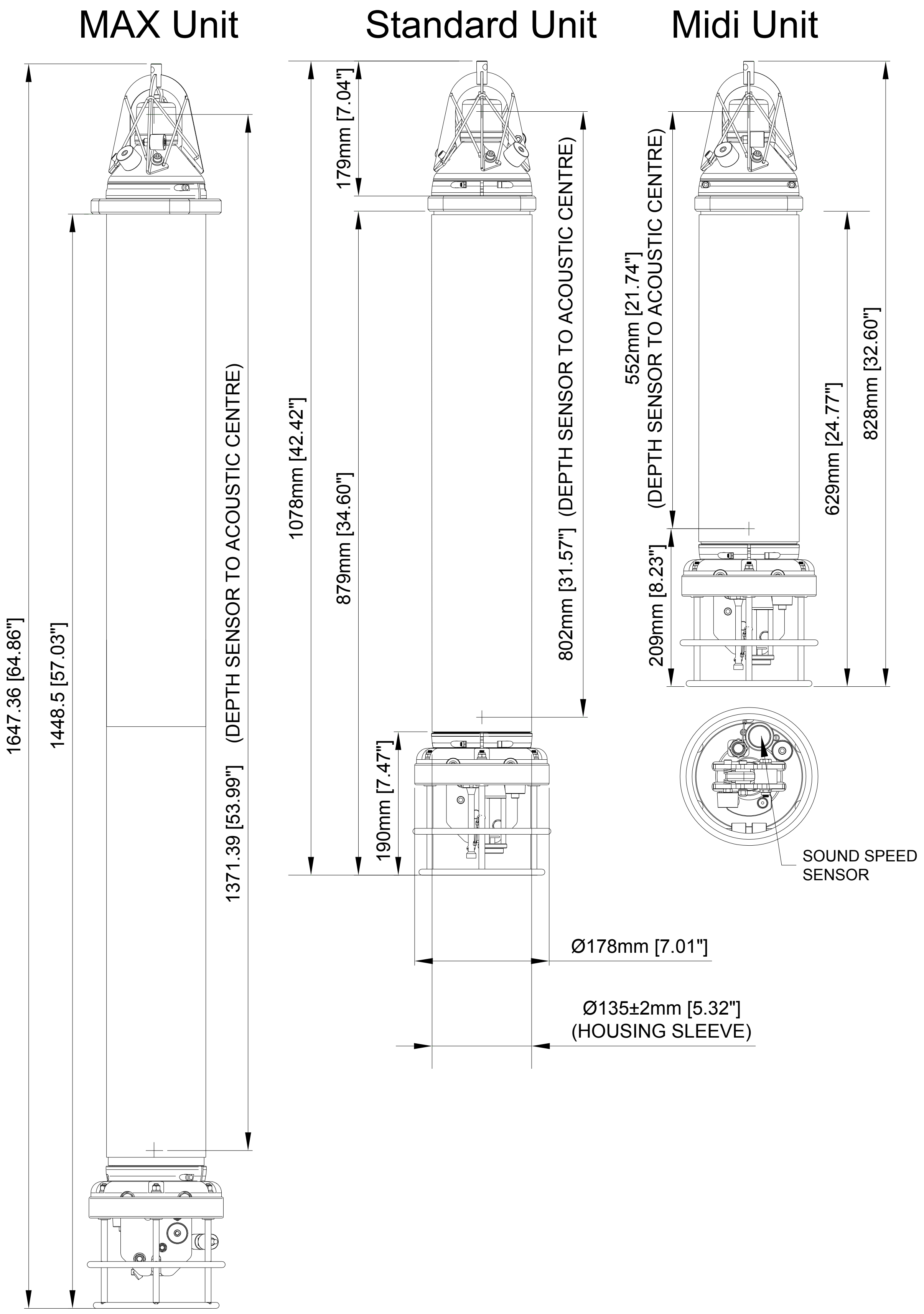


FIG 6 INTERNAL SOUND SPEED SENSOR ENDCAP

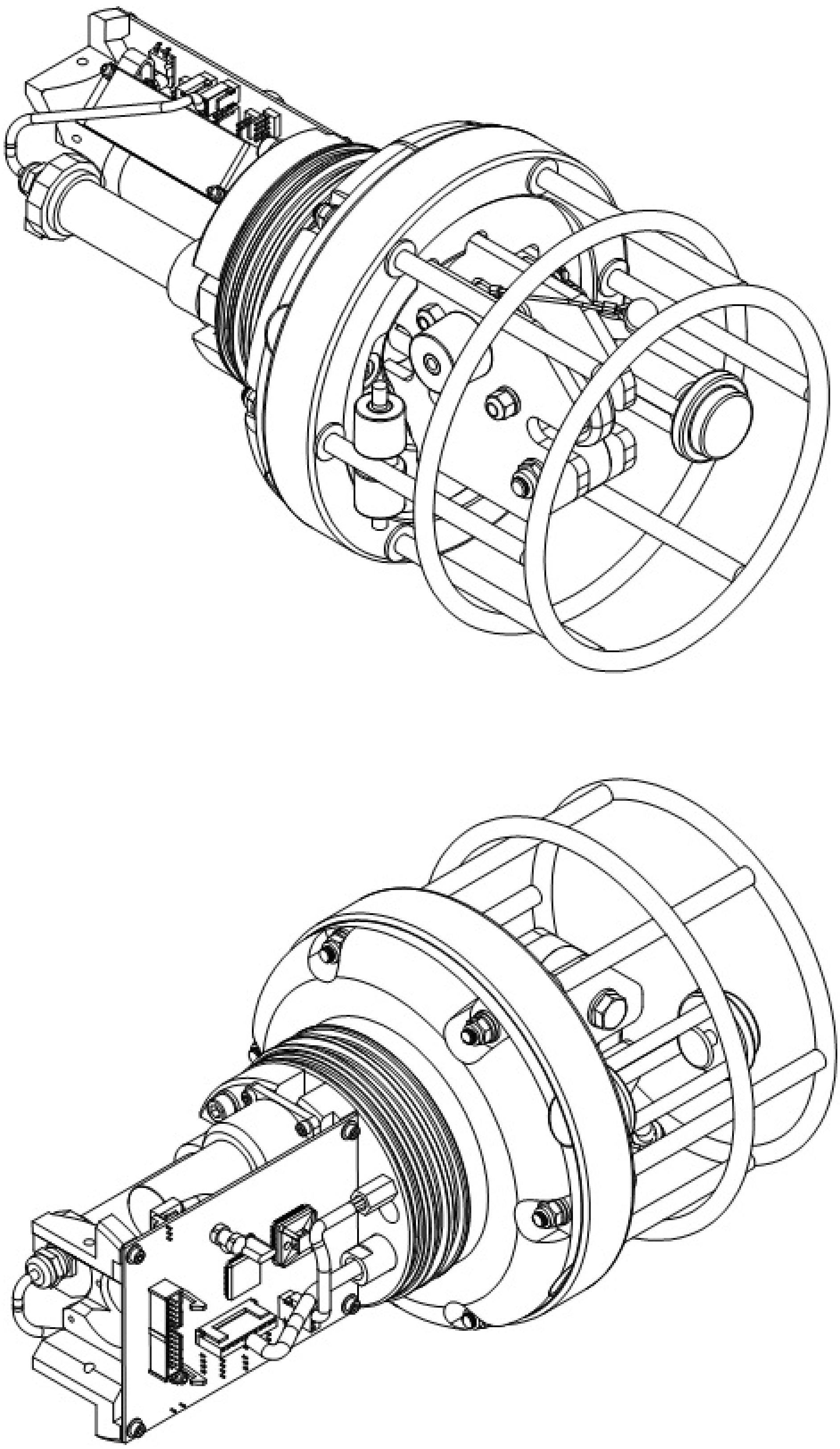


FIG 7 8000-043 TX/PRE-AMP BOARD – ISSUE C

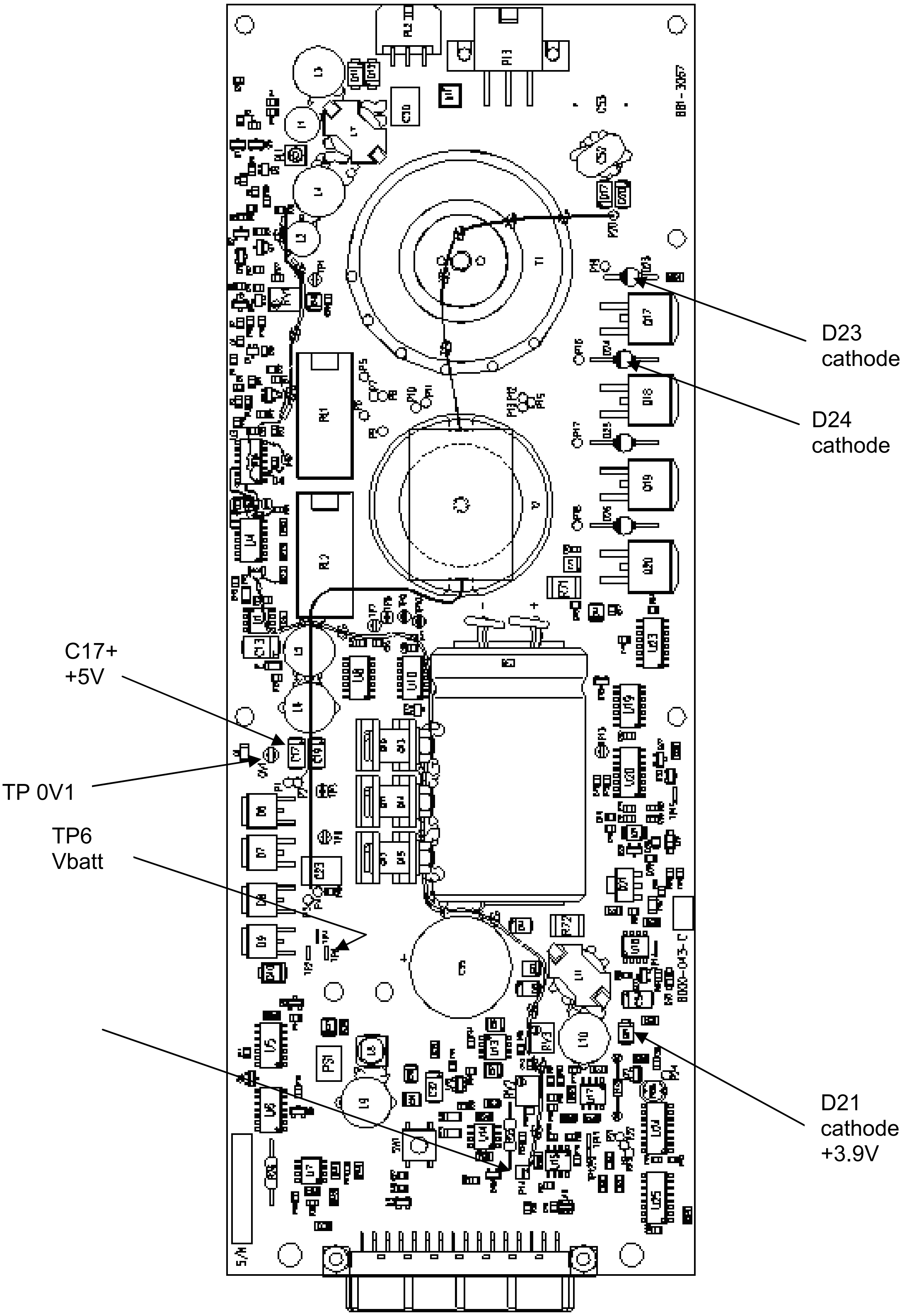


FIG 7A 8000-043 TX/PRE_AMP BOARD – ISSUE E

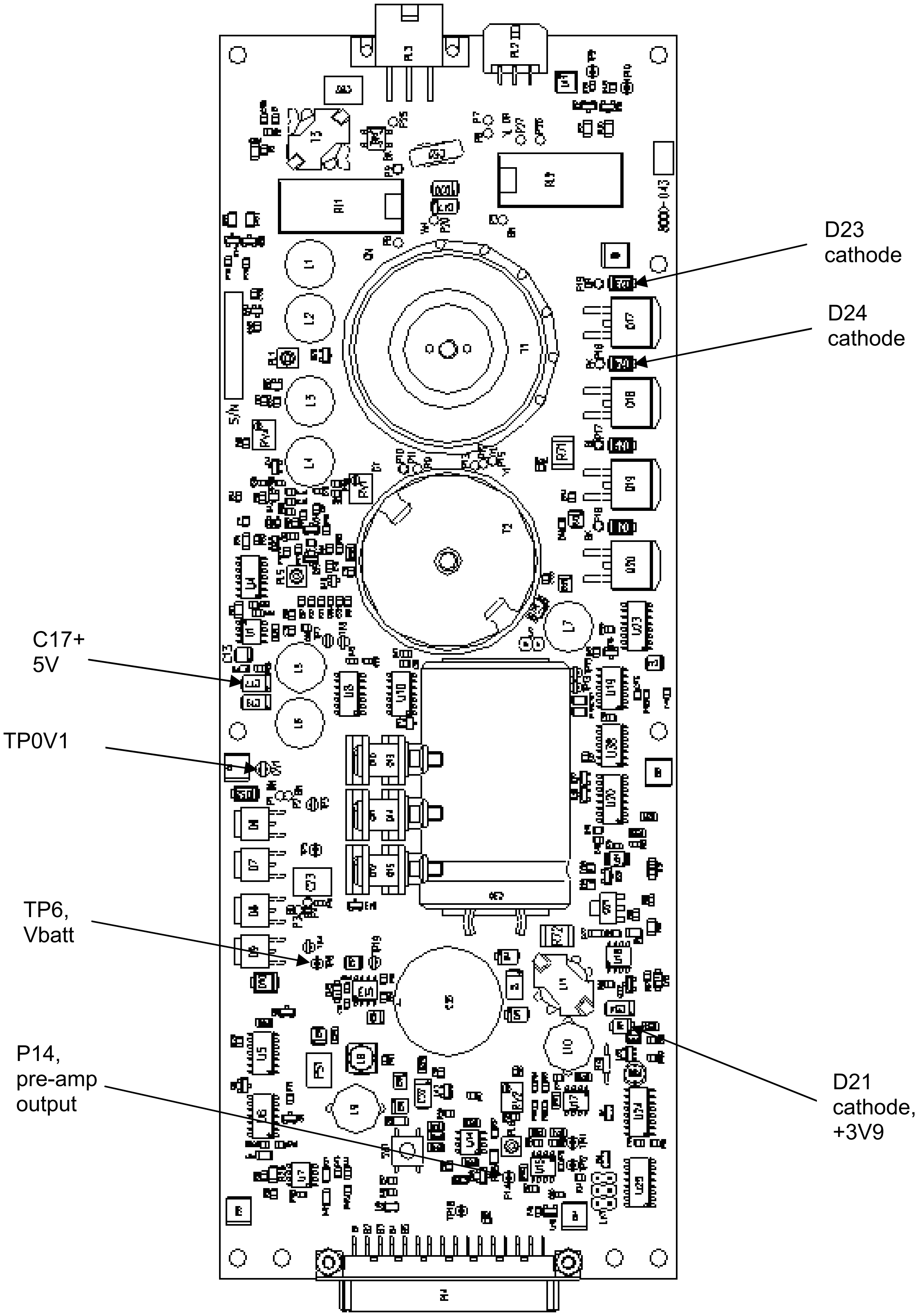


FIG 8 8000-070 WIDEBAND BOARD - ISSUE C

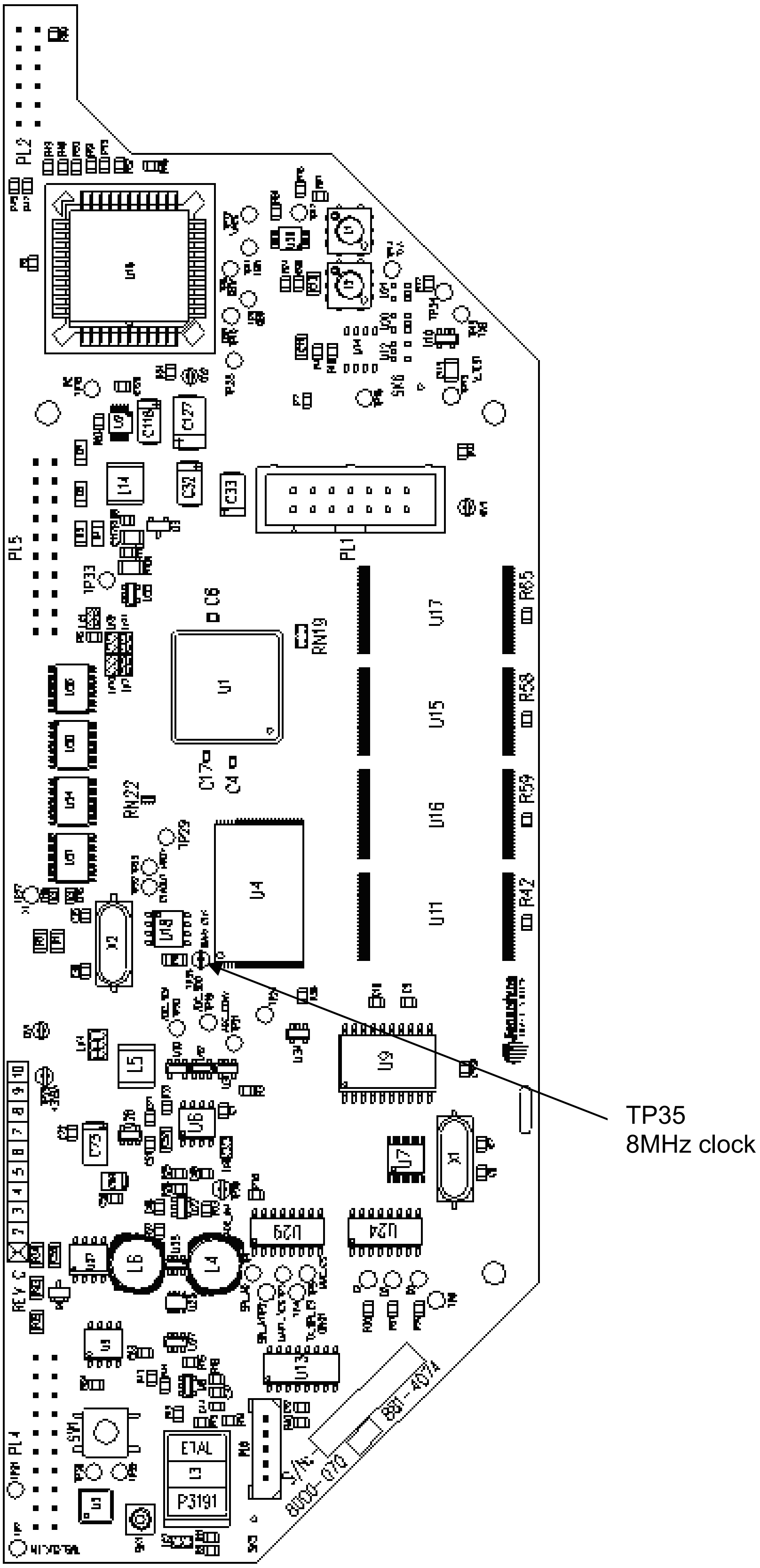


FIG 9 8000-042 CPU BOARD – ISSUE C

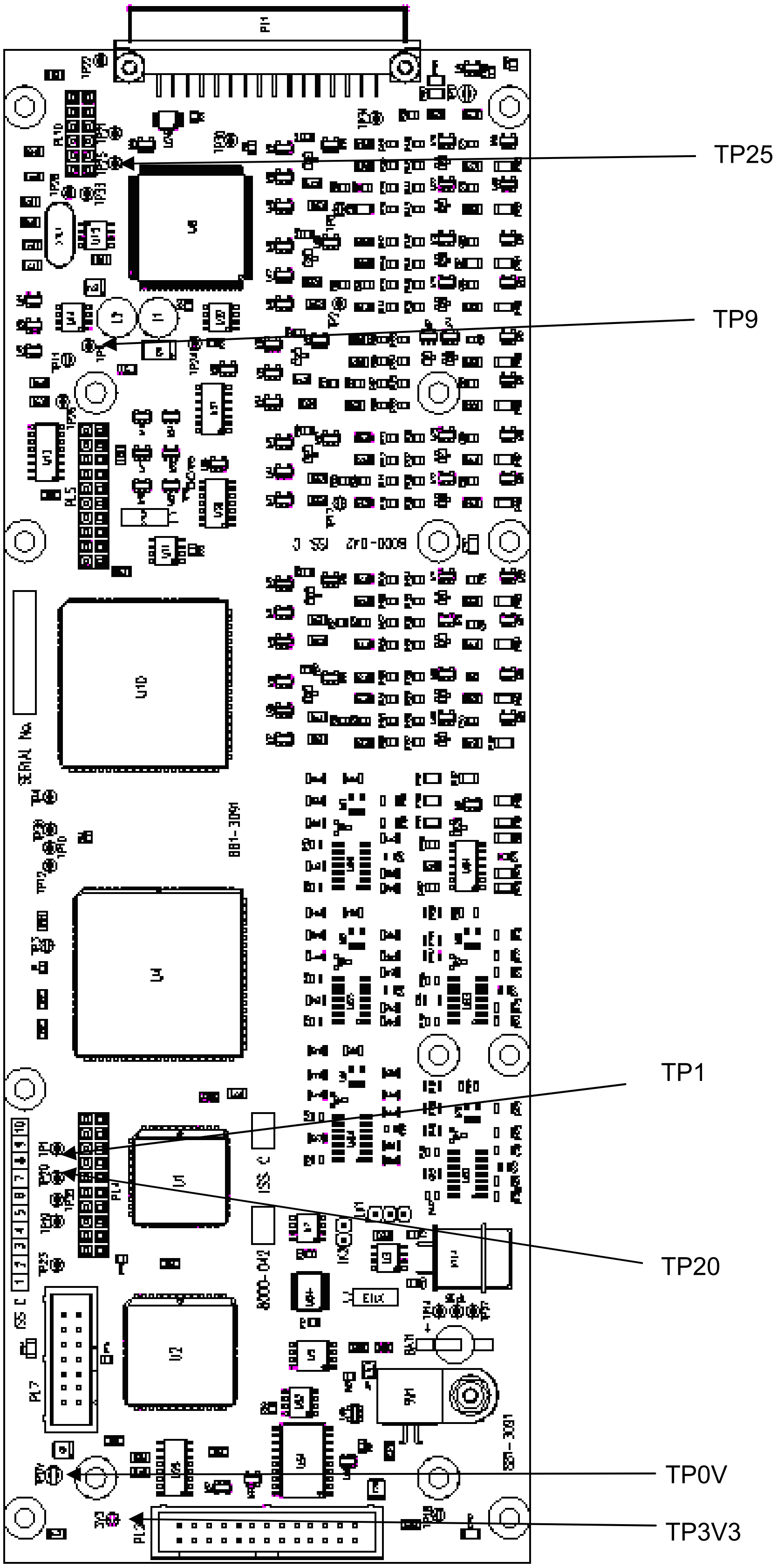


FIG 10 8000-046 DAS BOARD – ISSUE C

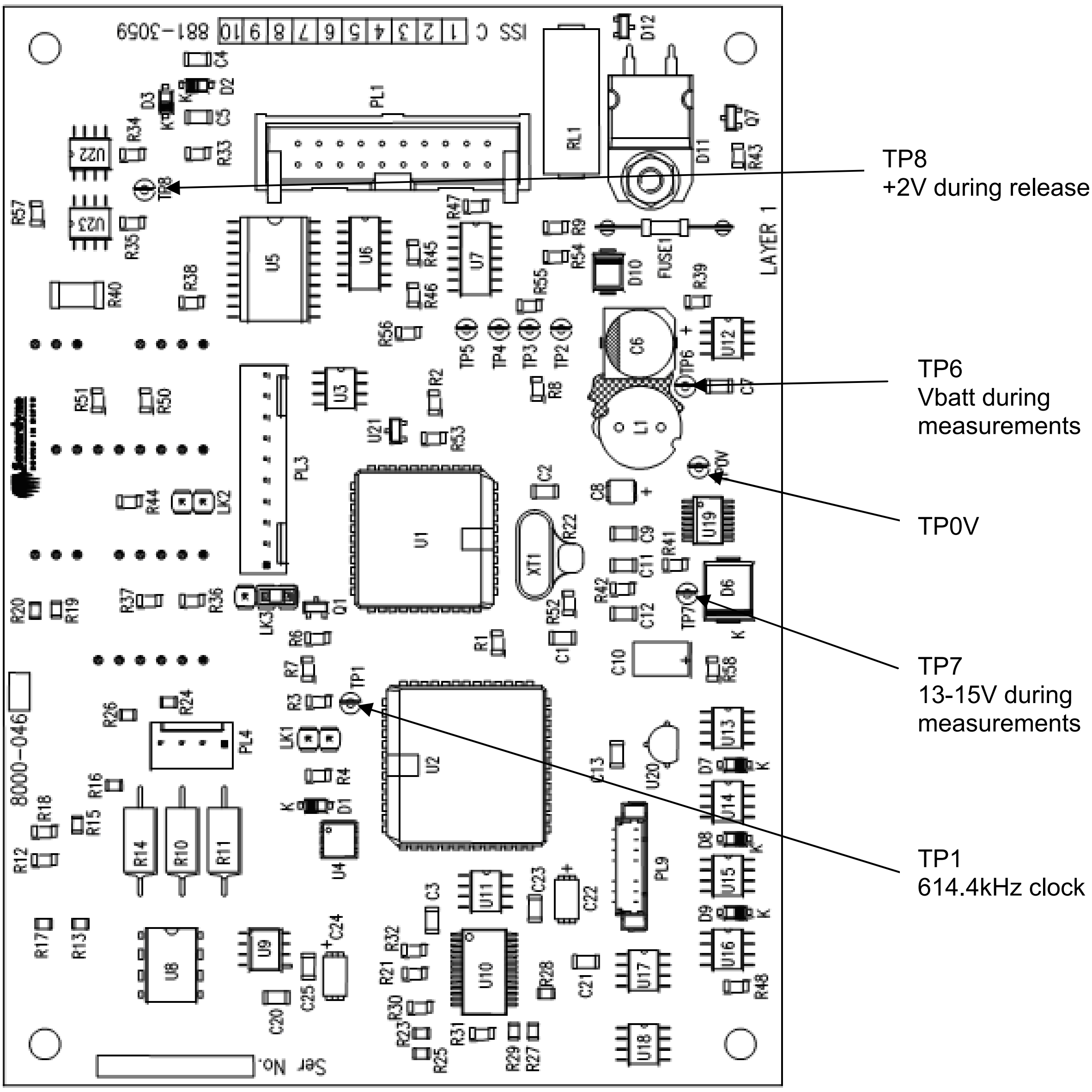


FIG 11 8000-054 DAS BOARD – ISSUE B

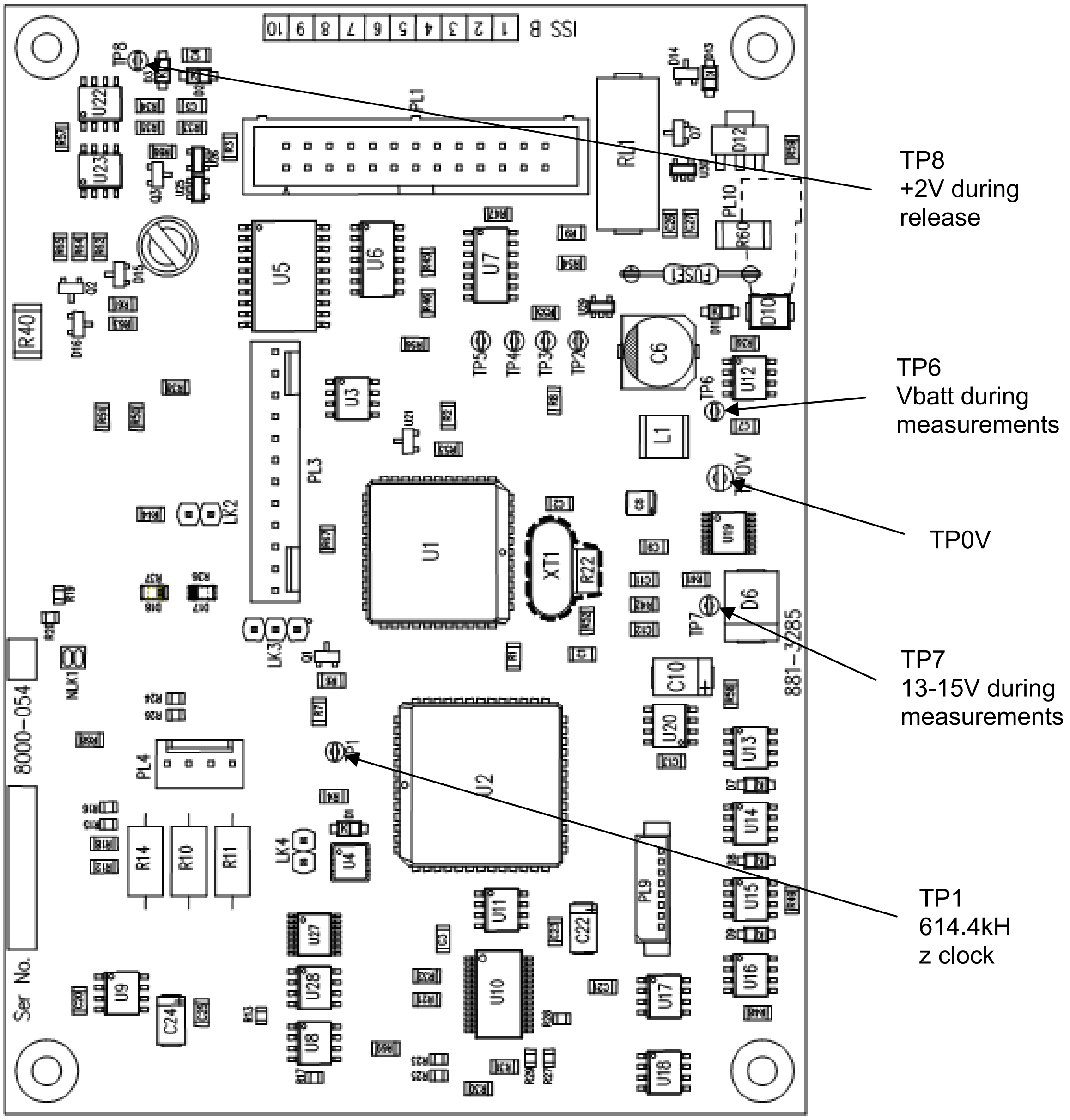


FIG 12 8000-057 INCLINOMETER DAS BOARD – ISSUE B

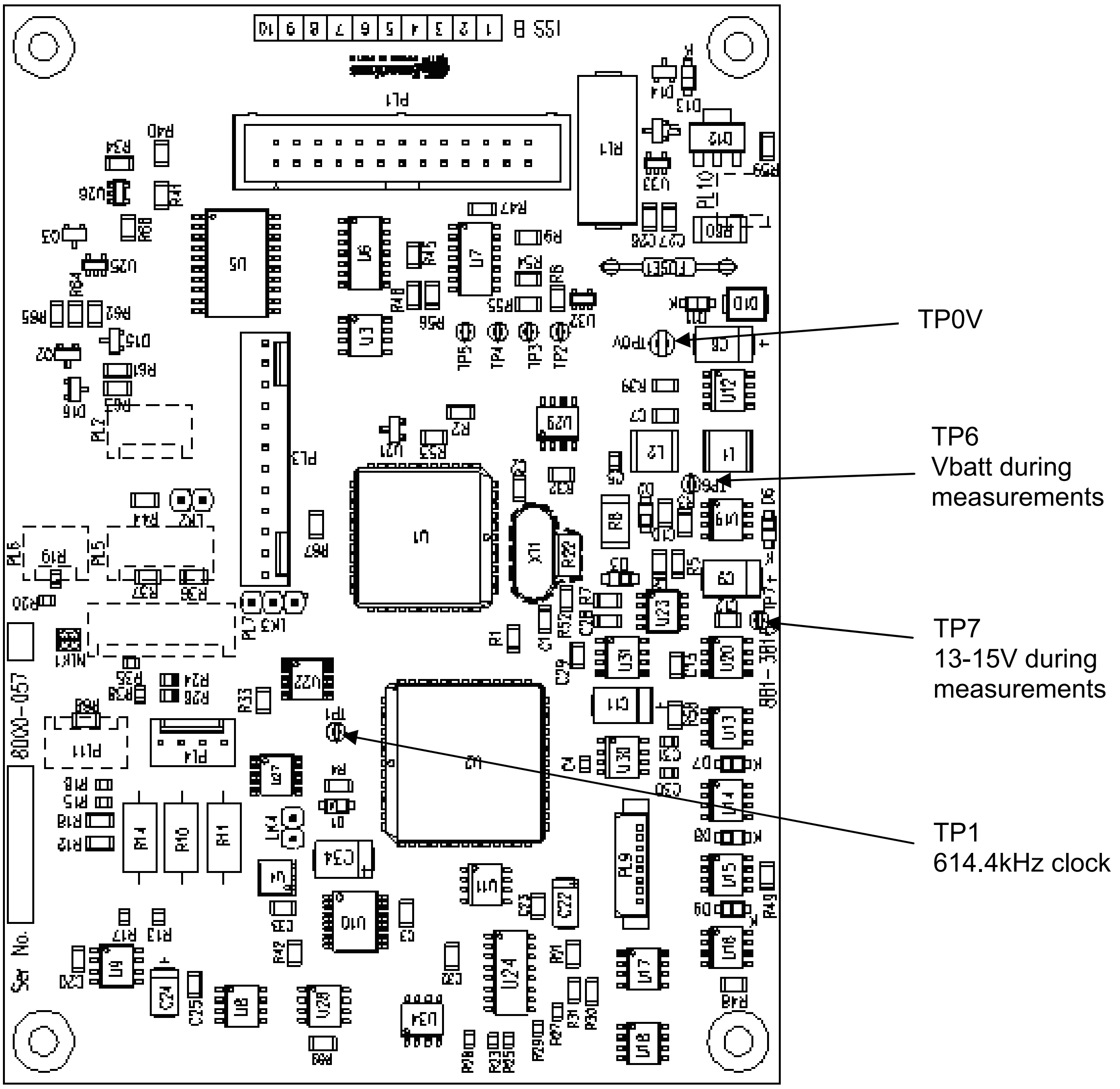
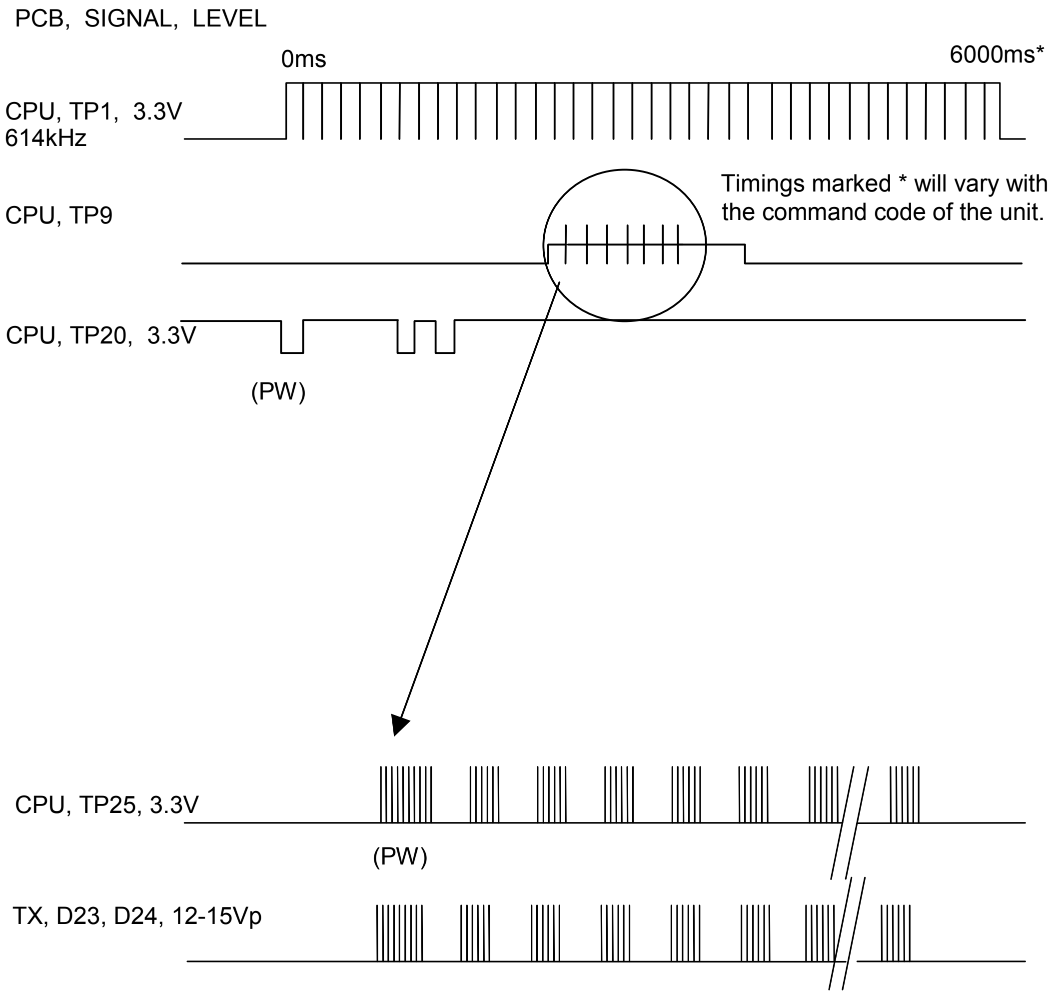


FIG 13 WAVEFORM AND TIMING DIAGRAM



(PW) pulse of duration "Pulse Width" ms
LF PW = 8ms
MF PW = 4ms
EHF PW = 1ms

FIG 14 'O' RING REMOVAL

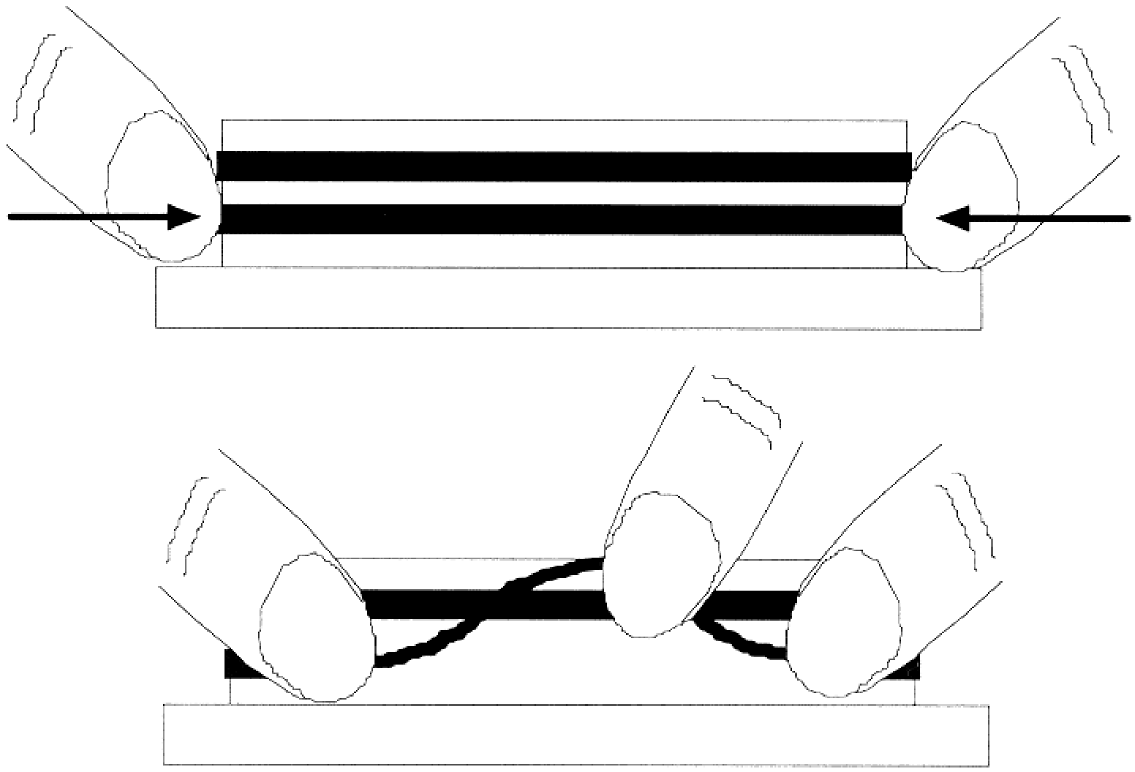
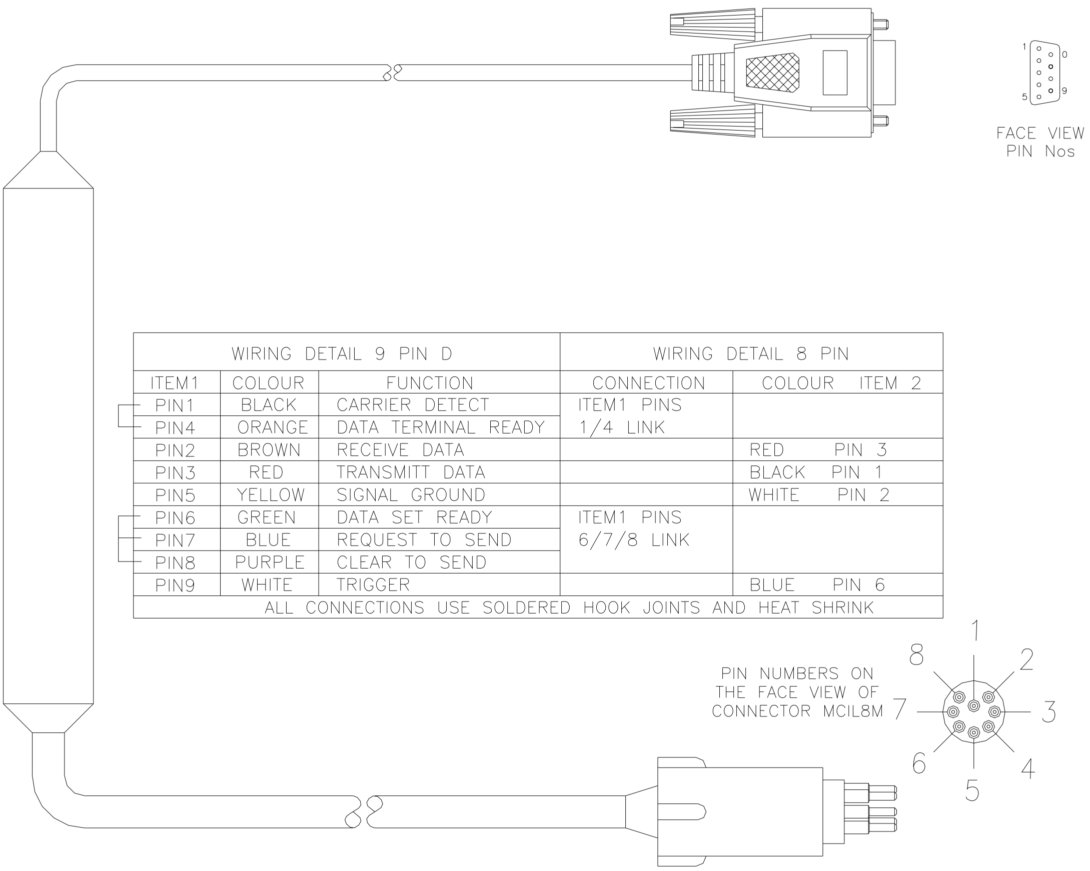


FIG 15 COMPATT 5 TO PC SERIAL CABLE: 8000-156



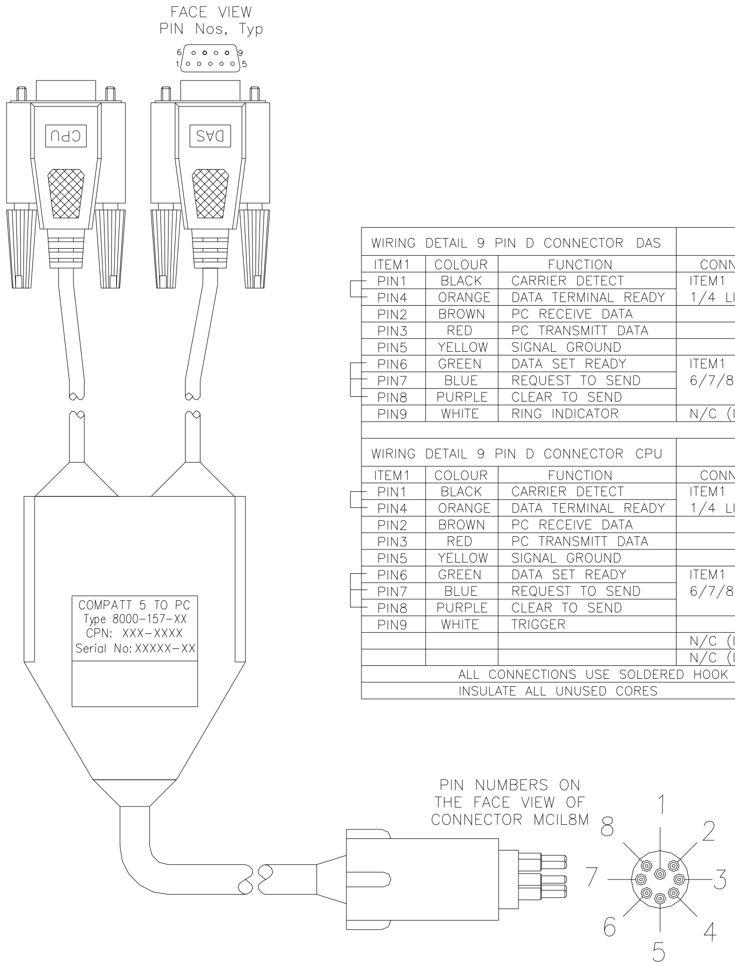
WIRING DETAIL 9 PIN D			WIRING DETAIL 8 PIN		
ITEM1	COLOUR	FUNCTION	CONNECTION	COLOUR	ITEM 2
PIN1	BLACK	CARRIER DETECT	ITEM1 PINS 1/4 LINK		
PIN4	ORANGE	DATA TERMINAL READY			
PIN2	BROWN	RECEIVE DATA		RED	PIN 3
PIN3	RED	TRANSMITT DATA		BLACK	PIN 1
PIN5	YELLOW	SIGNAL GROUND		WHITE	PIN 2
PIN6	GREEN	DATA SET READY	ITEM1 PINS 6/7/8 LINK		
PIN7	BLUE	REQUEST TO SEND			
PIN8	PURPLE	CLEAR TO SEND			
PIN9	WHITE	TRIGGER		BLUE	PIN 6
ALL CONNECTIONS USE SOLDERED HOOK JOINTS AND HEAT SHRINK					

EXTERNAL CONNECTOR PIN-OUT:

Pin Number	Function	Description
1	RS232 in	To Compatt 5 from PC
2	Ground	
3	RS232 out	From Compatt 5 to PC
4	External D.C. Power	External power will bypass the battery.
5	Analogue sensor input	Option: 0-5V or 4-20mA.
6	Sync	Trigger line
7	DAS RS232 out	From DAS to PC
8	DAS RS232 in	To DAS from PC

Note:- From Issue B1 of the cable the trigger signal is connected pin 9 of the ‘D’ type. Prior to issue B1 pin 9 of the ‘D’ type was Open Circuit.

FIG 16 COMPATT 5 TO PC DUAL SERIAL CABLE: 8000-157



WIRING DETAIL 9 PIN D CONNECTOR DAS				WIRING DETAIL 8 PIN	
ITEM1	COLOUR	FUNCTION	CONNECTION	COLOUR	ITEM 2
PIN1	BLACK	CARRIER DETECT	ITEM1 PINS 1/4 LINK		
PIN4	ORANGE	DATA TERMINAL READY			
PIN2	BROWN	PC RECEIVE DATA		WHITE/BLACK	PIN 7
PIN3	RED	PC TRANSMIT DATA		RED/BLACK	PIN 8
PIN5	YELLOW	SIGNAL GROUND		WHITE	PIN 2
PIN6	GREEN	DATA SET READY	ITEM1 PINS 6/7/8 LINK		
PIN7	BLUE	REQUEST TO SEND			
PIN8	PURPLE	CLEAR TO SEND			
PIN9	WHITE	RING INDICATOR	N/C (INSULATE)		

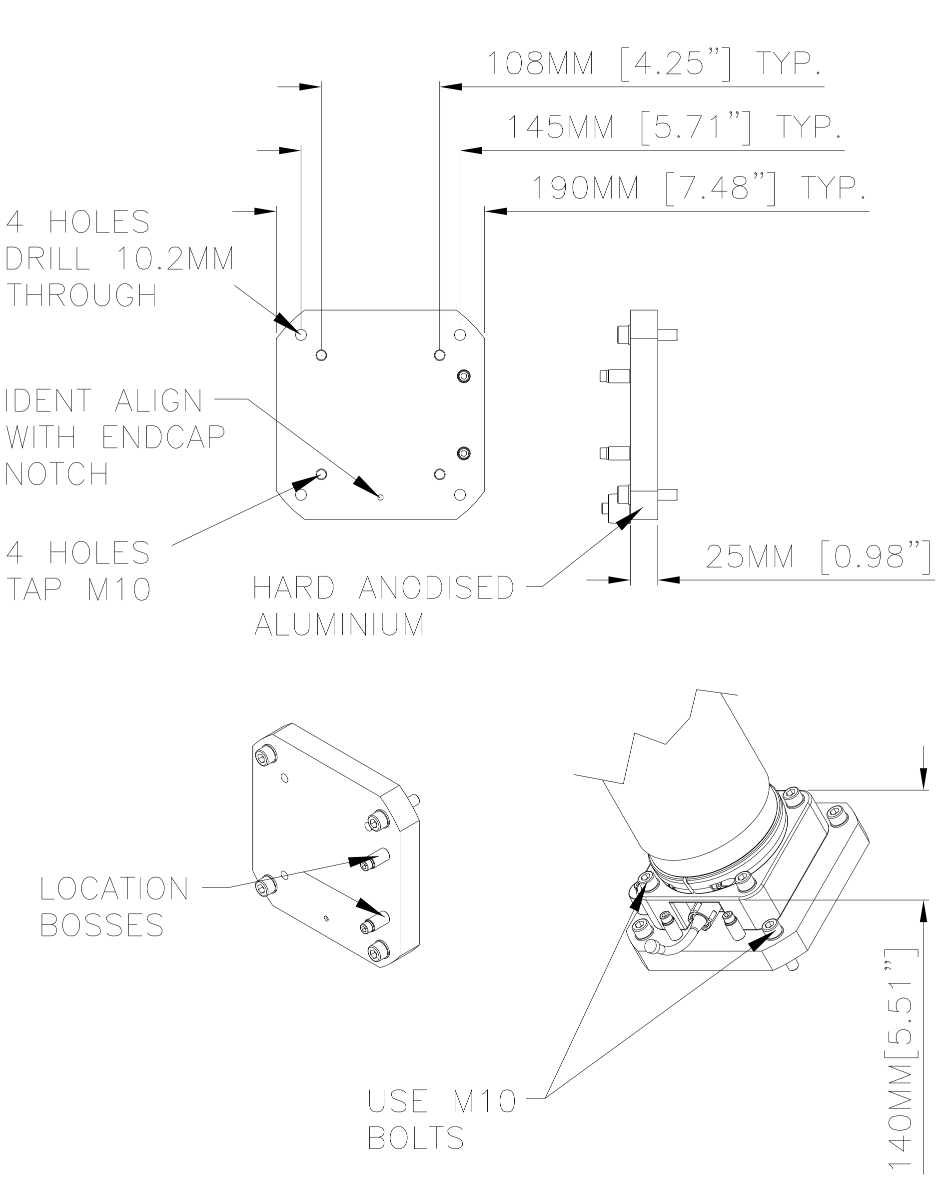
WIRING DETAIL 9 PIN D CONNECTOR CPU				WIRING DETAIL 8 PIN	
ITEM1	COLOUR	FUNCTION	CONNECTION	COLOUR	ITEM 2
PIN1	BLACK	CARRIER DETECT	ITEM1 PINS 1/4 LINK		
PIN4	ORANGE	DATA TERMINAL READY			
PIN2	BROWN	PC RECEIVE DATA		RED	PIN 3
PIN3	RED	PC TRANSMIT DATA		BLACK	PIN 1
PIN5	YELLOW	SIGNAL GROUND		WHITE	PIN 2
PIN6	GREEN	DATA SET READY	ITEM1 PINS 6/7/8 LINK		
PIN7	BLUE	REQUEST TO SEND			
PIN8	PURPLE	CLEAR TO SEND			
PIN9	WHITE	TRIGGER		BLUE	PIN 6
			N/C (INSULATE)	GREEN	PIN 4
			N/C (INSULATE)	ORANGE	PIN 5
ALL CONNECTIONS USE SOLDERED HOOK JOINTS AND HEAT SHRINK					
INSULATE ALL UNUSED CORES					

EXTERNAL CONNECTOR PIN-OUT:

Pin Number	Function	Description
1	RS232 in	To Compatt 5 from PC
2	Ground	
3	RS232 out	From Compatt 5 to PC
4	External D.C. Power	External power will bypass the battery.
5	Analogue sensor input	Option: 0-5V or 4-20mA.
6	Sync	Trigger line
7	DAS RS232 out	From DAS to PC or Gyro
8	DAS RS232 in	To DAS from PC or Gyro

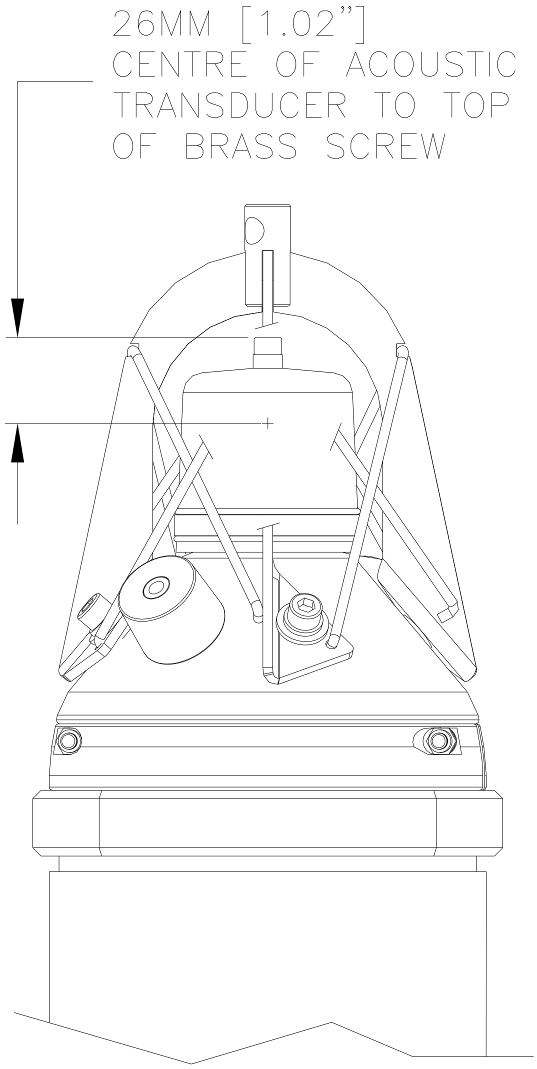
Note:- From Issue D1 of the cable the trigger signal is connected pin 9 of the CPU ‘D’ type. Prior to issue D1 pin 9 of the CPU ‘D’ type was Open Circuit.

FIG 17 RECOMMENDED INCLINOMETER ENDCAP MOUNTING PLATE



Refer to Appendix G

FIG 18 TRANSDUCER REFERENCE POINT



APPENDIX A

A. SPARE PARTS AND OPTIONS LIST

Order Code	Dwg No	Description	Qty
PCBs			
631-6995-SP	8000-042-01	CPU PCB, MF / EHF spares kit	1
631-7589-SP	8000-043-01	Tx / Pre-amp PCB, MF Omni	1
631-7584-SP	8000-070-01	Wideband Rx PCB	1
631-7104*	8000-054-01*	DAS PCB (* or similar depending on option required)	1
631-7187*	8000-057-01*	Inclinometer DAS PCB (* or similar depending on option)	1
BATTERIES			
641-2278	8000-002-01	Alkaline Battery Pack (Standard Unit)	1
641-2801	8000-006-01	Lithium Battery Pack (Standard Unit)	
641-2922	8000-402-01	Lithium Battery Pack (Midi and Mini Unit)	1
641-3324	8003-008	Lithium Battery Pack, 6 stack, (Max Unit)	2
MISCELLANEOUS PARTS			
641-3332	-	Compatt 5 Opening Tool	1
650-2334	8000-007	Transducer Spares Kit, MF Omni (incl. ‘O’ rings)	1
750-1267-SP	8000-247	Transducer guard spares kit (incl. screws, washers, bushes, anode)	1
650-2531		Anode kit – MF Omni Tdr end-cap	1
650-2533		Anode kit – Release end-cap	1
650-2318	8000-008	Clamp ring pair kit (incl. nuts, screws, insulators) 3000m	2
650-0004	8100-008	Clamp ring pair kit (incl. nuts, screws, insulators) 5000m	2
650-2135	8000-009	Release Guard kit	1
810-1136	8000-111	Housing Sleeve Yellow, (for 3000m tube)	1
810-0980	8000-340	Housing Sleeve Yellow, (for 5000m tube)	1
810-0270	8000-350	Housing Sleeve Yellow, (for Max tube)	1
200-3455		Tube ‘O’ Rings, 100-345-5570	4
201-5140		Spring Gasket, 106LB-[MW]-4.005-2	2
231-003C		Release Shackle 10mm D, s/s, Breaking load 4800kg	1
231-0118		Lifting Shackle 8mm D, s/s, SWL 500kg	1
875-2295	8000-125	Sliding Bump Stop (Float)	1
641-2947	8000-250	Clamped Bump Stop Kit	1
925-0005		Silica Gel Bag – self-indicating	4
650-2523	8000-080-03	Dummy plug spares kit	1
265-5685		Anode kit for sound speed sensor	1

CABLES			
820-6795	8000-075	SubConn 8w mating connector kit incl. locking sleeve	1
820-6713	8000-157	PC to Compatt 5 Dual Serial Cable	1
820-6652	8000-079	CPU to DAS Ribbon Cable (26-26 way Std option)	1
820-6681	8000-456	CPU to DAS Ribbon Cable (26-26 way Midi/Mini option)	1
820-6781	8000-077	CPU to DAS Ribbon Cable (20-26 way converter)	1

APPENDIX B

B. USE OF UTILITIES SOFTWARE PROGRAMS

B.1 SOFTWARE INSTALLATION

The Sonardyne Test Terminal and DASCAL programs described in this appendix are located on the CD supplied with this Manual, along with the DspBootLoader program.

To install the programs on a PC, first place the CD in the CD-ROM Drive, then view the contents of the CD. Copy and Paste all the files into a new directory on the C: drive.

For ease of operation, create shortcuts on the Desktop for the programs contained in the directory.

The most recently released issue of the Sonardyne Test Terminal program is available from the Sonardyne web-site downloads page.

B.2 COMPATT 5 TESTING

Test Terminal is a general package that allows a Compatt to be configured and checked out.

DASCAL is specifically for configuring and recalibrating the sensor end-cap.

B.2.1 Test Equipment Required

Description	Sonardyne Drawing No	Sonardyne Order Code
PC with spare Comm Port	-	-
Compatt 5 Utilities CD-ROM	8000-300	-
Compatt 5 Dual Serial Cable	8000-157	820-6713
OR Compatt 5 to PC Serial Cable	8000-156	820-6570

B.2.2 Test Equipment Set-Up

Connect the Test Equipment as shown in Fig B.1.

If using the Dual serial cable, connect the D- type connector labelled CPU to the PC serial port (as shown in Fig B.2).

B.2.3 Test Terminal Program Operation

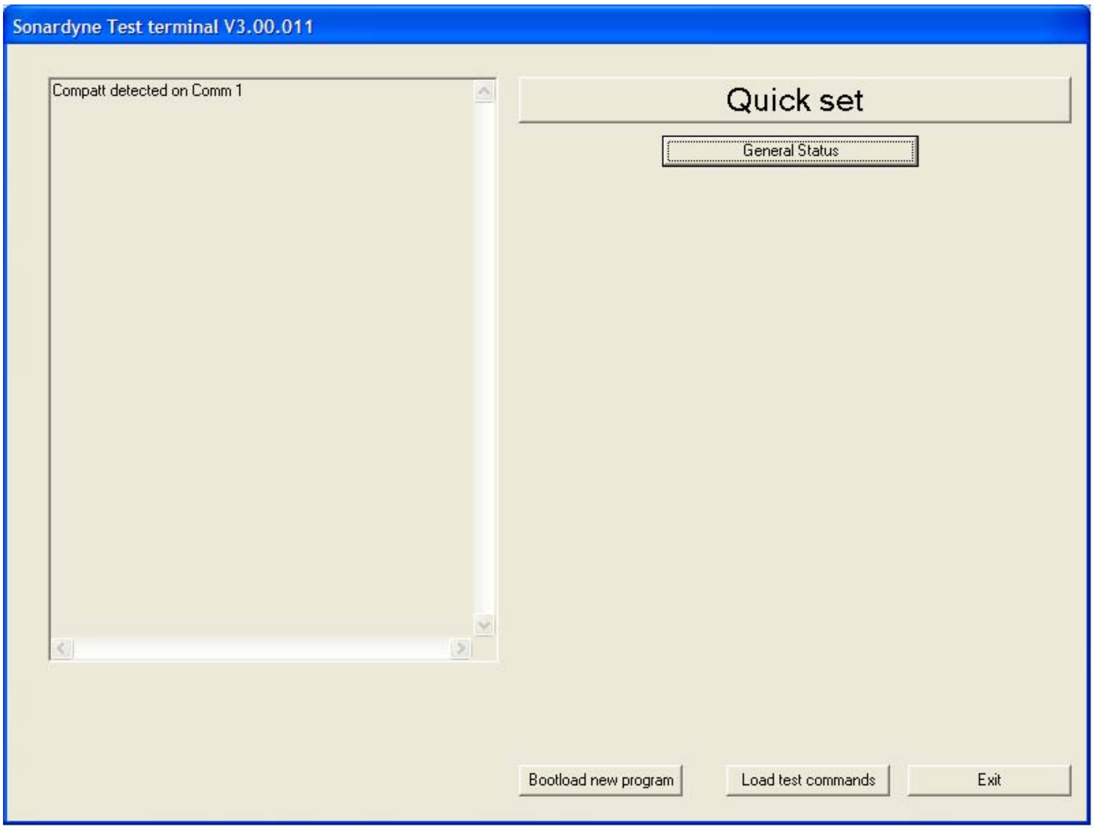
Run the TestTerminal.exe program file.

The Test Terminal program is for basic tests and changes to the Compatt 5 address, channel and functionality.

This description applies to program version V3.00.011.

B.2.3.1 Main Window

On starting the Test Terminal program, you will be prompted to select a PC serial COMM port if a Compatt is not automatically detected. If automatic detection occurs the Main Window is displayed, as shown below with the Comm port on which the detection occurred indicated. This COMM port will then be used until the program is shut down. If no available COMM port is found, an error message will be returned. This can occur if using a USB serial port adaptor on a PC that has not had the correct driver installed.



The functions on the **'Main Window'** are listed below with instruct ions for use. Most of the options will become visible after a **<General Status>** is sent.

The first time this program is run, a new directory will be created:-

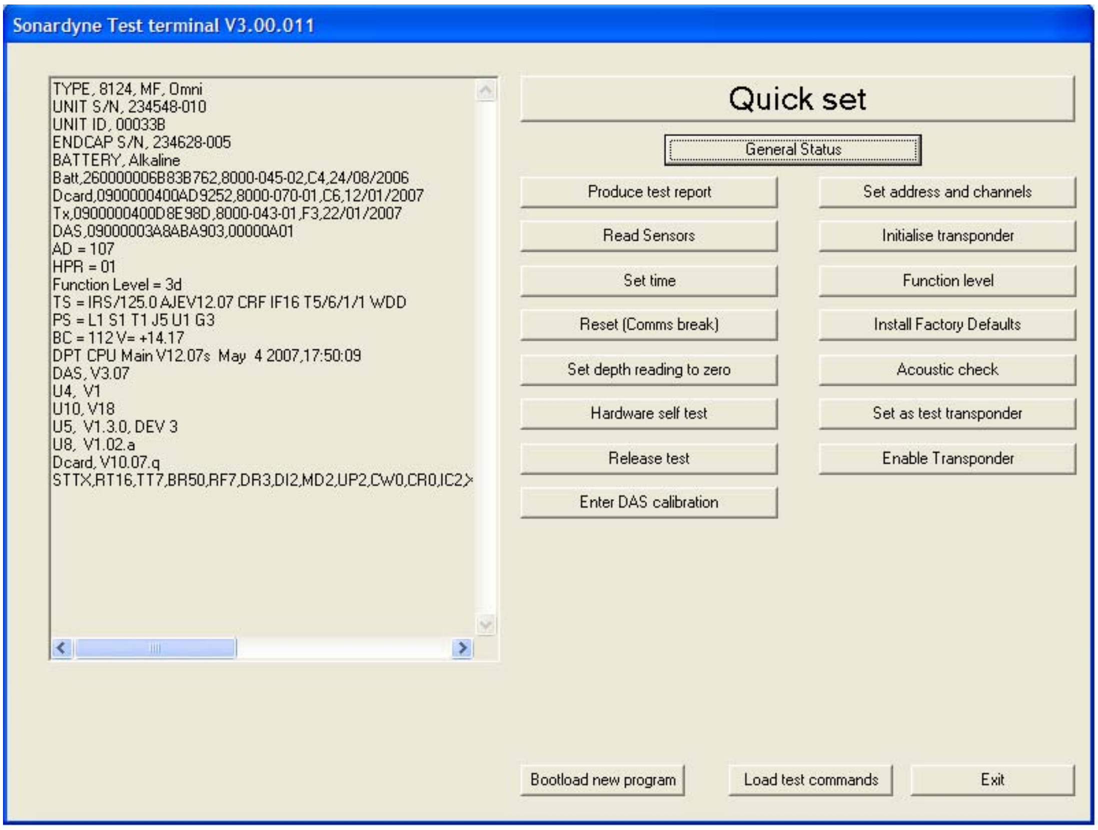
C:\Sonardyne\C5Status

Files containing status information for all Compatts will be stored in this directory.

B.2.3.2 General Status

This gets the general status information for the Compatt 5 and the display will be similar to that below. During this operation, a small animation will run, indicating what commands are being sent to the unit.

It is very useful if the contents of this window can be copied and pasted into any email correspondence with Sonardyne, as it contains a complete picture of the unit's current state.



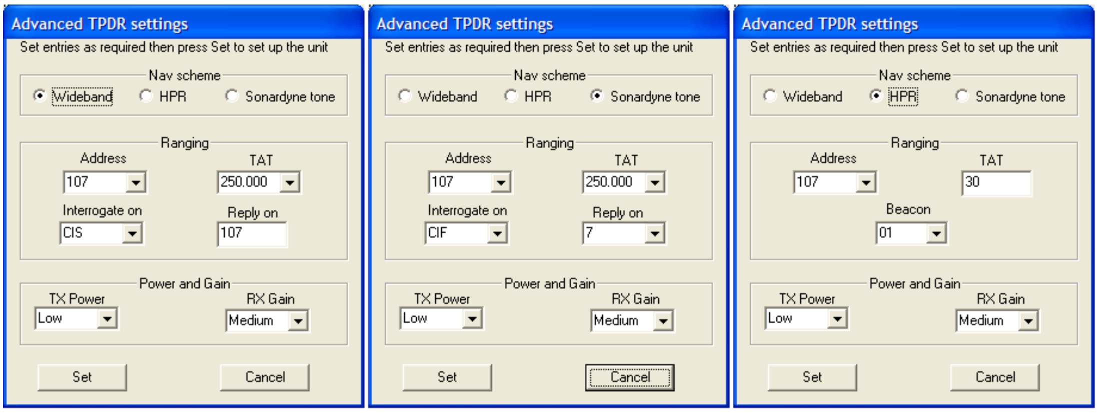
The first time a **'General Status'** is sent, a new file will be created:-

C:\Sonardyne\C5Status\Current-Status.xml

This file contains the status information for all Compatts tested, and will be updated every time the program is used to talk to a Compatt.

B.2.3.3 Quick Set

This gives the user the ability to set acoustic Nav scheme (Wideband, Sonardyne Tone or HPR), Interrogation and Reply channels, Address, Turn around Time, Transmit Power and Receiver Gain settings. These settings can al so be entered into the positioning software to be used. The <Set> button must be clicked to implement changes



B.2.3.4 Hardware Self Test

This will perform a series of internal checks of the Compatt 5 hardware and either return a message of "`Hardware self-test passed`" or "`Hardware check failed`" and further details.

```
Hardware self test passed
RX 1,2,3,4,5,6 OK
TX OK
Wideband RX check OK
```

Contact a Sonardyne office should a consistent failure be displayed after several repeat checks are run.

If the test is passed, then all 6 receiver circuits have been verified as operational, and the transmitter synthesiser, i.e. the electronics have been tested.

Note that this test does not verify the performance of the acoustic transducer – see <**Set as test transponder**> and <**Acoustic check**> below.

Note: "`High 3V3 current warning`" indicates that the 3V3 current consumption is high, but it has been found that the sensing circuit can drift with time and some units may start to false detect. Refer to Section 4.22.7 on how to readjust the circuitry.

B.2.3.5 Release Test

This will rotate the release mechanism 180 ° to check for the correct operation of the sensing switches. During normal operation, the Compatt will ping once per second for about 17 seconds while the motor is running.

If the test fails and reports Error 02, this indicates that the motor is turning too slowly, probably because the battery voltage is approaching end-of-life.

B.2.3.6 Read Sensors

All available sensors are read, and the measurements are displayed in Engineering units. The reply will be in the format:

```
Pressure = +14.54 psia
Depth    = +0.02 m
```

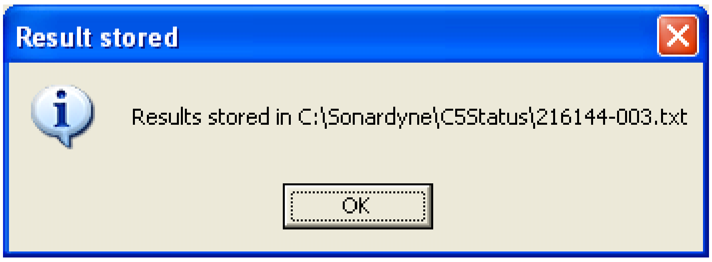
```
Offset   = +0.00 m
Range    = +2045.81 m        -full-scale of the depth sensor
Accuracy = +/-0.20 m         -nominal accuracy of the depth sensor
Temp.    = +24.88 degC

Heading  = +264.58 deg       -if external gyro is selected
Roll     = +0.61 deg         }        "
Pitch    = -0.14 deg         }        "

Int. Roll  = +0.61 deg       }if the inclinometer option is fitted
Int. Pitch = -0.14 deg       }        "

Sound Vel= +9998.00 m/s      )  if the sound speed sensor option is fitted
```

Earlier firmware versions will only display the depth and temperature readings, e.g. :

```
Pressure = +14.54 psia
Depth    = +0.02 m
Offset   = +0.00 m
Temp.    = +24.88 degC
```

B.2.3.7 Produce Test Report

This will run the <**General Status**>, <**Hardware self-test**>, <**Release test**> and <**Read Sensors**>, and put all the replies into a text file in C:\Sonardyne|C5Status using the unit serial number as the filename.



The results are also displayed in the Terminal window, and looks like this:

```
Type 8000   MF Omni Wideband
Unit ID 00018A(hex)  Serial No 215014-009
Address 806   HPR 21
Batt 14.4V 35% used
   Lithium 10 stacks  Count 353
Firmware V10.06h  May 10 2006,13:47:36
Disabled tone
TAT 125.00 ms  Rx gain 3
CPU 1  CPJ 5  CPT 1  CPS 1  CPL 1
CWT 5  CWR 6  CWC 1  Block 1
Function level 3f

Daughter card 8000-070-01 C6 fitted
Firmware V10.06.h
Detect threshold 150
Linear gain 255

Hardware self test passed
RX 1,2,3,4,5,6 OK
TX OK
Wideband RX check OK

Release Check Passed

Endcap serial number 215028-010
Das firmware V3.06
 PRT
 STR
 REL

Pressure = +14.10 psia
Depth    = -0.27 m
Offset   = +0.00 m
Range    = +2981.52 m
Accuracy = +/-2.98 m
Temp.    = +21.97 degC

Data stored at 15:49 19/06/2006
```

Selecting <**Produce Test Report**> will overwrite any previous results file for that particular Compatt. Note that the status of the Compatt is not affected by this operation, so it is suitable for creating pre-deployment and post-deployment records.

B.2.3.8 Initialise Transponder

Sets the Compatt Transponder Status to default settings, and is equivalent to sending the acoustic commands RD, EN, DS. This **MUST** be used whenever the hardware configuration has changed, e.g. when a new battery pack is installed. Responds with an "`OK`" message. This leaves the Compatt5 in the fully disabled state.

Note:- Up to firmware version V10.06 the uplink telemetry setting would not be altered by this function, but from V10.07 the telemetry uplink is set to Normal FSK. See B.2.3.20 Load test commands.

B.2.3.9 Enable Transponder

Enables replies to interrogations, and is equivalent to sending the acoustic command EN. Responds with an "`Enabled`" message.

The interrogation mode is not set by this function, but following an <Initialise Tpdr> this command will leave the unit with tone CIF enabled, allowing it to be interrogated by the LB command from an ANT.

Note:- The Enable function used here is a direct write to the Compatt and enables replies to the interrogation mode last used. From V10.07 the telemetry uplink is also set to Normal FSK. See B.2.3.20 Load test commands.

B.2.3.10 Set Depth Reading to Zero

A window will appear prompting the operator to enter the atmospheric pressure in millibars and a default value of 1000. After clicking on Enter, the Compatt will read its depth sensor and store its reading as an offset, which will be subtracted from any depth readings in future.

The reply will be in the format:

```
Pressure = +14.41 psia
Depth    = -0.06 m
Offset   = +0.21 m
Range    = +2971.58 m
Accuracy = +/-2.98 m
Temp.    = +24.80 degC
```

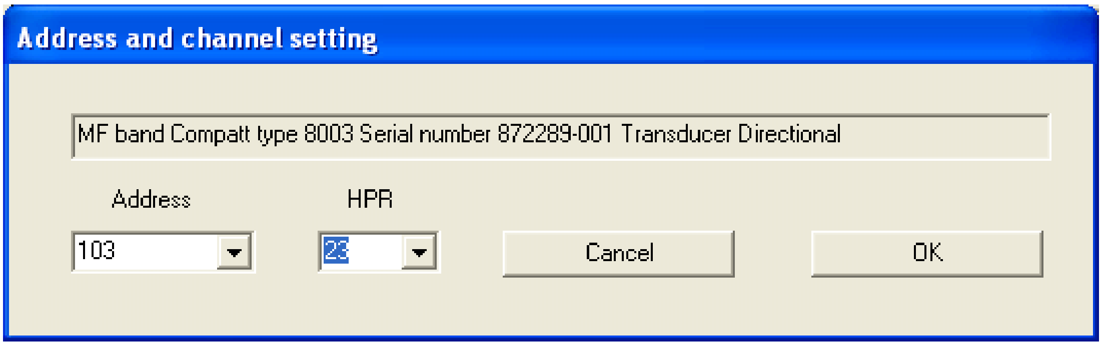
Earlier versions of Compatt firmware will only display the offset.

The transponder is fitted with a pressure sensor, and readings from it are converted into units of absolute psi (psia). When a depth reading is requested from the unit, the absolute pressure is converted to an equivalent water depth, using the scale factor 0.68525 m/psi and a nominal atmospheric pressure of 1000mbar.

Use the <Set Depth Reading to Zero> function in Test Terminal is not recommended for use with precision sensors such as Digiquartz. If an offset is reported in the <Read Sensors> report, it should be removed using the add-in test command button <Clear Depth Offset>. Offsets should only be corrected as part of the regular workshop recalibration procedure, where the C1 and T1 coefficients get adjusted and stored.

B.2.3.11 **Set Address and Channels**

This will display the current address and channel information of the Compatt with some additional relevant information. The channels and/or addresses can be changed by using the pull-down lists or simply editing the contents of the edit boxes and clicking on the <**OK**> button. There is an automatic check on the validity of the values entered and a prompt will be displayed if they are outside the valid ranges. Both buttons cause the new General Status to be displayed.



In the screen shot above, the Compatt will be programmed to operate with acoustic command address 103 and HPR channel 23.

Only MF band Compatts can support HPR navigation. HPR 300 channels Square, Circle, Triangle, X, and Y should be entered by their alternative designations 11, 22, 33, 44, and 55 respectively.

EHF Compatt 5 cannot support HPR, so zero must be entered.

As the status of the Compatt has been altered, a new file will be created

C:\Sonardyne\ New-Status.xml

The Current-Status.xml file will also have been updated.

Note:- If the Compatt 5 is to be us ed with a Non-Fusion transceiver (e.g. PAN, RovNav 4, Mini-RovNav or Analogue USBL (White Housing)), then the address selected must be less than 32##, as the command architecture on address codes 32 to 63 is different in Compatt 5 to that used in Compatt 4.

B.2.3.12 **Enter DAS Calibration**

This is used in conjunction with the DAS ca libration software DASCAL and is described in Section B.3 of the manual.

B.2.3.13 **Reset (Comms Break)**

Sends a Control+Break signal which forces a har dware reset in the Compatt. This will take about 35 seconds to complete. The message "`Comms break reset completed correctly`" will be displayed.

B.2.3.14 **Set as Test Transponder**

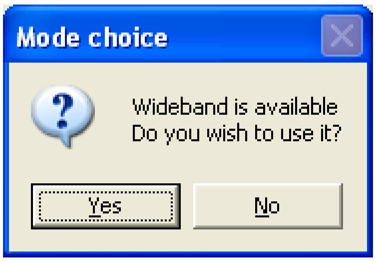
If the ranging check is to be carried out using a MF RovNav 5 skip this section and go to the end of section B.2.3.14 where the use of the RovNav 5 is described for Acoustic check.

This function, when used in conjunction with the Acoustic check function described below, allows 2 Compatts to be used to check each other out in air, by alte ring the status of the unit.

The software will get the status of the unit, and determine if the unit supports wideband operations.

If not, it configures the Compatt for tone operation, to listen on channel 1 (IF1), reply on CRF (RF15) with a Turn-Around-Time of 250ms. Can then be used to checkout another Compatt in air using the CI1 check function (also in tone mode). During the set-up, the Compatt will telemeter replies to each serial command received - these can be ignored. Displays **`"Correctly set as test transponder"`** when the unit is completely set-up.

If wideband capability exists in the Compatt, the operator is given the option to use it:



Selecting "Yes" will start the process of setting the unit up to listen for a wideband interrogation, during which some acoustic telemetry may be heard. Once ready, the following message will appear:

`"Correctly set as wideband test transponder`
`Address is xxxx"`

It is **important** to make a note of the test transponder address, as it will be needed during the Acoustic Check operation.

A text file named TestTpdr.txt will be updated in directory c:\Sonardyne\C5Status which is used by the <Acoustic check> function – see later.

Remember to return to default status after testing is complete by using the **<Initialise Transponder>** function.

B.2.3.15 **Acoustic Check**

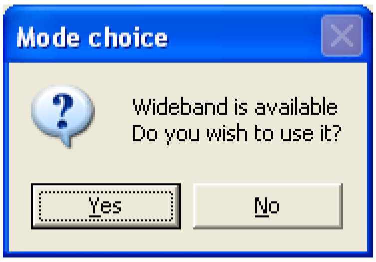
If the ranging check is to be carried out using a MF RovNav 5 skip to the end of this section.

This function, when used in conjunction with the Set as Test Transponder function described above, allows 2 Compatts to be used to check each other out in air.

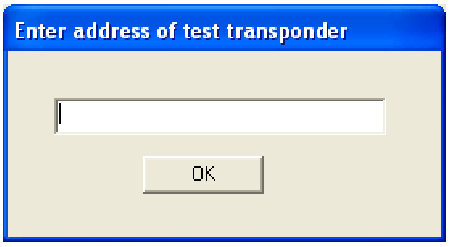
The software will get the status of the unit, and determine if the unit supports wideband operations.

If wideband operation is not available, the Compatt will make an interrogation on tone channel 1, and listen for a reply on CRF. If a second unit has been <**Set as test transponder**> and the two transducers are close enough, if it does detect a reply, it will display **`"Tone acoustic check passed"`** otherwise it may display **`"Tone acoustic check - no acoustic reply detected"`** or **`"Tone acoustic check failed - possible comms error"`**. Passing this test confirms the acoustic transducer is functioning.

If wideband capability exists in the Compatt, the operator is given the option to use it:



If Wideband is chosen, the address of the test transponder must be entered in the window below. Illegal addresses will be trapped.



The Compatt will be set up for ranging, and some acoustic telemetry may be heard. Then it proceeds to interrogating the test transponder. Several responses are possible:

`"Wideband acoustic check passed"`
i.e. a 2-way range was detected. This means **both** units have had the wideband receive and transmit checked out and both passed.

`"Wideband acoustic check - no acoustic reply detected"`
i.e. the interrogating Compatt did not pick up any response from the test transponder. There are several reasons why this may fail:-

- the acoustic coupling is not good enough – try aligning the transducers, or altering the separation, or baffle the transducers if working in a noisy environment
- the wrong test transponder address has been used
- there is a fault with one or other of the Compatts

`"Wideband acoustic check failed - possible comms error"`
i.e. the ranging did not complete, possibly due to poor serial comms to the interrogating Compatt, or a watchdog interrupted the interrogation etc. Repeat the test.

Remember to return to default status after testing is complete by using the **<Initialise Transponder>** function.

<u>Using a MF RovNav 5 firmware version 8.01.00.23 or greater for acoustic range check</u>

Interface the MF RovNav 5 to a PC at 9600 8 N 1 using a terminal package such as Procom Plus or the Windows 3.11 Terminal, or some other package that supports function keys.

Prior to test the following commands should be sent to set up the MF RovNav 5:-

1. ^P^BUNLK^J to reset
2. FVI^J to confirm the firmware version and the frequency band is MF
   Eg `FVI V8.01.00.23 MF,XC,LB,ROVNAV(GDT),INT2.04,PT,STR300`
3. PL1^J to set the Tx power level
4. PG3^J to set the Rx gain level
5. AD*address*^J to set the address

Testing the Compatt

1. EF^J to set the telemetry baud rate (EN or ES may also be used)
2. RD^J to reset the Compatt and enable Simultaneous Interrogation

3. *LBchannel number*.^J (**note the full stop**) to interrogate on CIF and listen for the specified channel only. A non zero range time is a good reply.
4. EW^J to enable Wideband, as CIF was used last CIS will be enabled
5. TWLB,*address*^J to interrogate on the CIS.

```
Eg  TWLB,1001.L;1001,OK REPLY;
    TWLB,1001.L;1001,BAD REPLY;
    TWLB,1001.L;1001, (No reply example)
```

When finished Reset the Compatt and disable the Compatt.

1. DW^J
2. RD^J
3. DS^J

B.2.3.16 Set Time

This will set the Compatt internal time to that of the PC. It is not critical for Compatt operations for this to be set accurately.

B.2.3.17 Bootload New Program

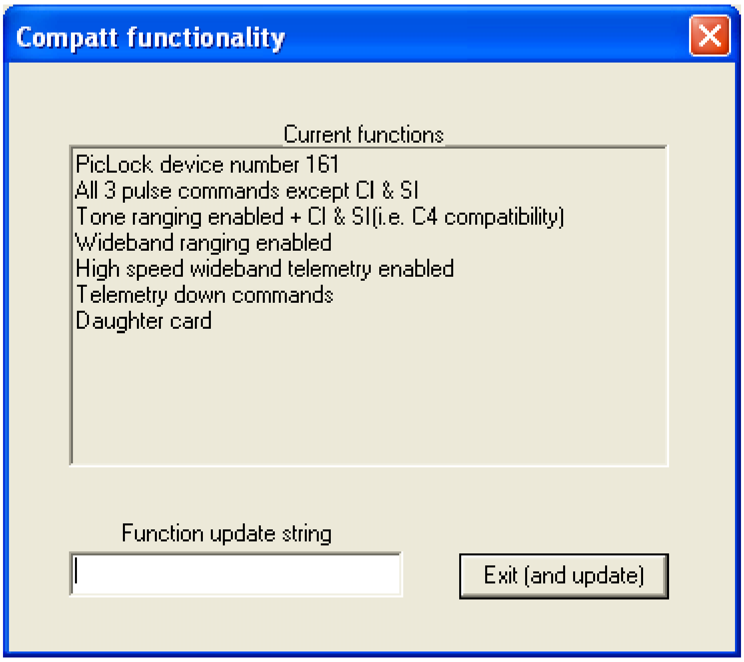
This allows for the main Compatt 5 program to be updated, without opening the pressure housing. To operate, select <**Bootload new program**>, then at the **'Open File'** dialogue select the new firmware file to load. This file must be supplied by Sonardyne International. Then simply start the process by double clicking on the file or pressing enter when the file is selected. There will be a status bar displayed showing progress. The whole process will take approximately 5-6 minutes. It is recommended that the PC is not used for other tasks while the download is in progress.

WARNING loading an incorrect file will stop correct operation of the Compatt 5 and can only be corrected by then loading the correct file.

NOTE following the bootload operation, the unit address will have reverted back to the default of 1001. To restore the unit address, use the <**Set Address and Channels**> button.

B.2.3.18 Function Level

This allows for the Function Level to be viewed and changed. Changes can only be carried out when Sonardyne International Ltd supply the correct command string for the operation. Each command string will change the Function Level of one Compatt only and uses the unique Unit ID number displayed in the Status display. The command string is simply copied from the message sent by Sonardyne into the Function update string entry box, EXACTLY as sent with no leading or trailing spaces. The update will occur when the <**Exit and update>** button is pressed. Also, the new General Status will be displayed, including the new Function Level.



B.2.3.19 Install Factory Defaults

Not normally used. Only necessary if a firmware upgrade has been performed by reprogramming the flash memory in-circuit, as opposed to via the bootloader. Will set the unit address to 1001, and default settings.

B.2.3.20 Load Test Commands

Upon operating the <Load test commands> button a browser dialog is displayed so that the desired additional key/s may be loaded from any file with the extension *.c5d. Selecting the file will generate one or more addition buttons on the Test Terminal window.

Issue 1.04 of the CD ROM includes a selection of *.c5d files which offer a set of commands that can be used for additional Compatt functions.

The files are editable in a text editor and the file extension must be c5d.

The following example generates three additional buttons for changing the global power level CPA1 or CPA2.

One button labelled CPA Pending is for the first part of the command and is always used and the other two buttons select either Low or High power only one of which is used once the Compatt5 has responded to the first button.

When the buttons are operated if they contain a Compatt command number the Compatt responds with acoustic telemetry as though it had received the command acoustically. The message seen in the C5TestTerminal display however is a hex string and not the decoded message that would be seen if the command had been done acoustically from a transceiver.

The files included on the CD ROM are:-

ClearDepthOffset.c5d

DS button.c5d

EN button.c5d

EU buttons.c5d

EW,DW buttons.c5d

OV button.c5d

Pending, CG2, CG3, CG4 buttons.c5d

Pending, CPA1, CPA2 buttons.c5d

Responder buttons.c5d

Note:- The EN button supplied sets the telemetry mode and turns on the navigation mode last used the unlike the <Enable Transponder> in B.2.3.8 and B.2.3.9 above.

B.2.3.21 **Exit**

Program will terminate and the Window will close down.

B.3 STRAIN GAUGE DEPTH SENSOR RE-CALIBRATION

To simply correct for an offset in the depth reading, refer to Section B.2.3.9.

B.3.1 Equipment Required

Description	Sonardyne Drawing	Sonardyne CPN
PC with spare serial Comm Port		
Compatt 5 Utilities CD-ROM	8000-300	
Compatt 5 dual serial cable	8000-157	820-6713
Pressure Adaptor	7431-027	860-0879
Or Extended C5 Adaptor	8000-255	760-1242
Dowty Washer		201-0216
Calibrated Aneroid Barometer		
Calibrated Dead Weight Tester		
C5 DAS Cal Box	8000-267	620-7187

B.3.2 Test Equipment Set-Up

Remove the red pressure port screw and fit the Dowty washer and adapter.

Connect the End Cap to the calibrated Dead Weight tester. Clear any air bubbles from the piping.

If the end-cap is fitted with Sound Speed Sensor and Release, then the Sound Speed Sensor may have to be disconnected from the DAS board, as shown in photograph in B.4, and reconnected at the end of the procedure.

Connect the Test Equipment as shown in Fig B. 2 if the end-cap is to be left in a Compatt, i.e. calibrated in-situ.

Or:-

If the end-cap is removed from the Compatt, connect the C5 Das Cal Box to the DAS card, as shown in Fig B.3. Connect a bench power supply set to 14V, 200mA to the Cal Box, and continue from B.3.4.

B.3.3 Pre-Calibration Procedure

On the PC run the **Test Terminal** program, as described in section B.2.2.

Click on the < **Enter DAS Calibration** > button. This will force the Compatt 5 to switch on power to the DAS. The message window should show the reply "DAS calibration mode entry".

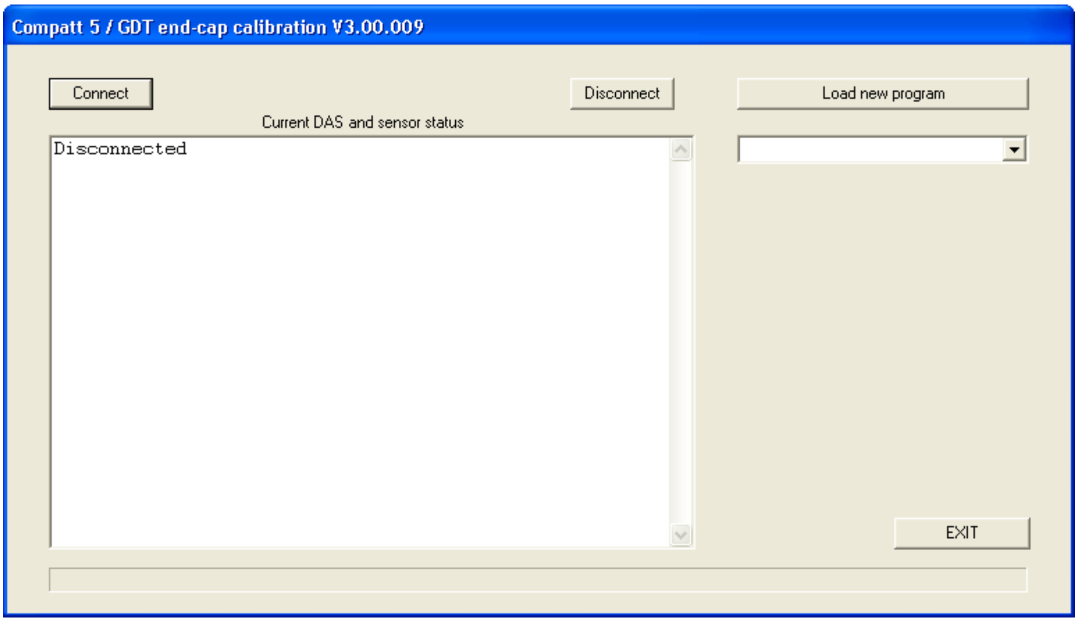
Close the Test Terminal program.

Disconnect the PC comm port from the Compatt CPU connector on the Dual serial cable 8000-157, and connect to the DAS connector.

Note: the watchdog will reset the whole Compatt after 10 minutes and abort any DAS measurement in progress at the time. Therefore, this calibration procedure must be completed in under 10 minutes, otherwise there will be an error message "Comms connection fault". Using the Cal Box avoids this restriction.

B.3.4 <u>Calibration Procedure</u>

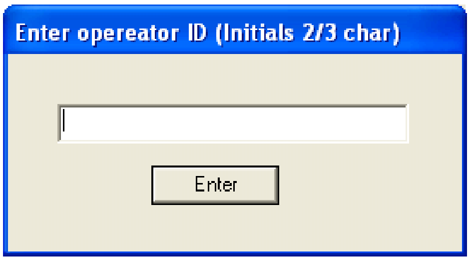
Run the Dascal.exe program from the PC. This description applies to program version 3.00.009.



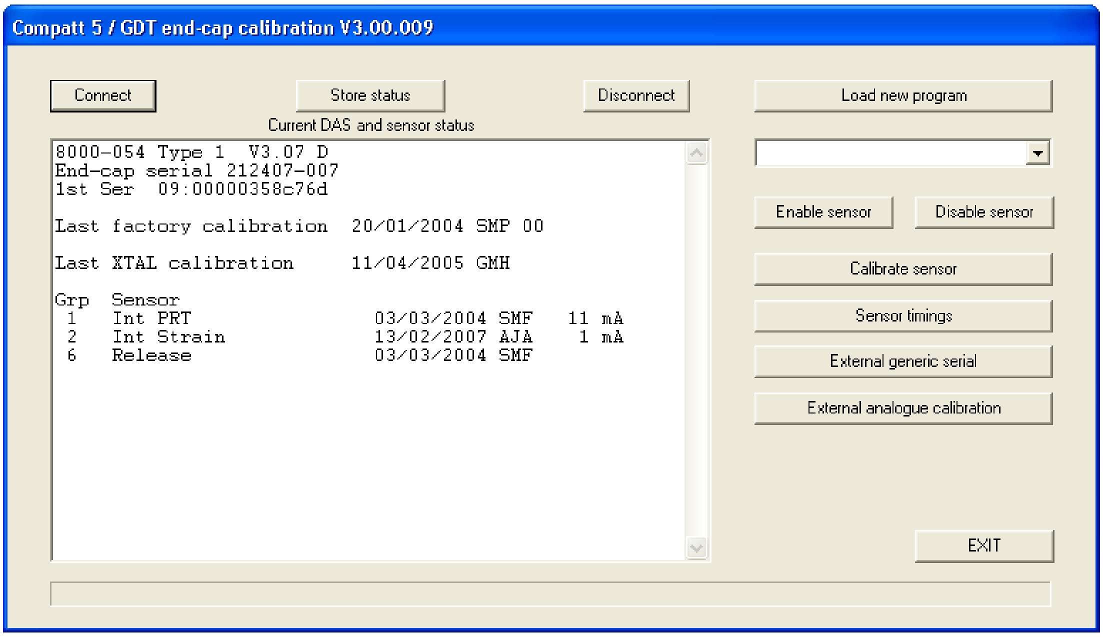
Earlier versions may show a **'No Current Measurements'** button. If present, click on this button.

Click on <**Connect**>. Select the comm port used by the PC, then click on **<OK>.**

When the following screen is displayed, enter your initials, which will then appear in the test results file stored on the PC.

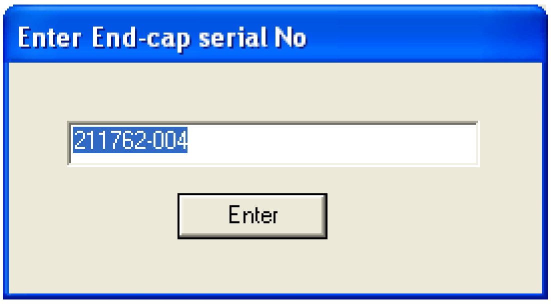


After a short period of time, the Endcap Status will appear in the window as shown below:-



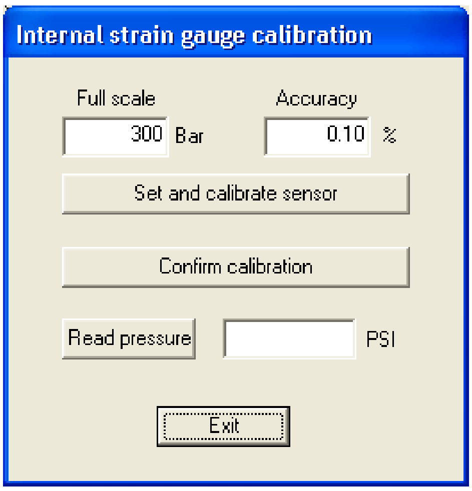
The “Current DAS and Sensor Status” window shows the sensors with Group numbers (Grp). The group number is for the type of Sensor, i.e. Strain gauge and Digiquartz are Group 2. Only one Sensor per group can be selected.

From the pull down menu, select ‘**2. Int Strain**’ and then select < **Calibrate sensor**>. The window below will appear:



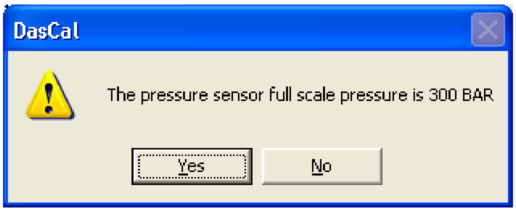
The End-cap serial number can be read from its external label, or from the second line in the main window behind this box.

The strain gauge calibration page will be displayed as shown below:

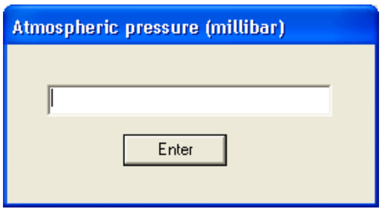


Enter the pressure range of the sensor fitted into the box labelled '**Full scale'** and then select <**Set and calibrate sensor**>.

A new window will appear asking for confirmation of the full-scale range of the pressure sensor. Click on <Yes>.



When prompted, enter the atmospheric pressure in **milli-bars**, measured from a calibrated barometer. If this is not known, enter 1000 as a default value.



The next prompt will ask for the temperature, which should be filled in.

Further prompts follow asking for Dead Weight Tester make, DWT Ident No, Strain Gauge manufacturer, Strain Gauge model and Strain Gauge serial number. It is not essential to fill these in, but all data entered will be stored in the history text file.

The software will prompt to **"Set the pressure to zero"**, i.e. open the Dead Weight Tester pressure line to atmospheric pressure. When this is done, select <**OK**>.

The software will ask for the pressure to be set to a target pressure in psi (approximately 80% of full scale pressure). Note that the exact applied pressure can be overtyped if a different calibration point is wanted. Once the Dead Weight Tester is set for the target pressure, click on <**Pressure Set**>.

'**Calibration complete**' will appear, select <**OK**>.

Select <**Disconnect**> and then <**Exit**>.

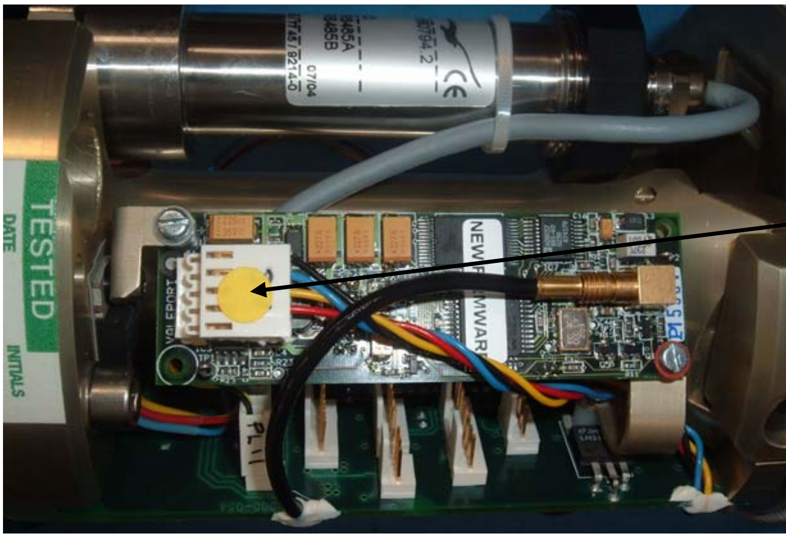
A results text file named **DasCalibration.txt** will have been generated in the same directory as the program file. If the <**Store Status**> button is selected, the contents of the 'Current DAS and sensor settings' window will be written to this file along with a timestamp.

Make sure the Dead Weight Tester is at atmospheric pressure before disconnecting the End Cap from the piping. Drain the oil from the pressure port on the End Cap and refill with fresh 60000 centistoke silicon oil. Allow to stand for several hours to let air bubbles escape from the cavity, and then refit the red pressure port screw.

B.4 DAS FIRMWARE UPGRADE PROCEDURE

This procedure allows for the firmware for the DAS to be updated, without opening the pressure housing.

However, if the Transponder is fitted with a Sound Speed Sensor and Release options, and was built before 2006, the Sound Speed Sensor may have to be disconnected from the DAS board before the RS232 communication with the DAS card can be achieved. The connector is shown arrowed in the photograph below. This is necessary as the Sound Speed sensor communicated to the DAS processor using the same DAS RS232 lines that are connected to the external sensor.



Sound Speed Sensor Connector

Firstly, run Test Terminal and select <**Enter DAS Calibration** >, then run the DASCAL program. DO NOT click on the < **Connect**> button. If DASCAL is already running, click on <**Disconnect**> before proceeding.

Select the <**Load New Program**> button then, at the **'Open File'** dialogue, select the new firmware file to load. This file must be supplied by Sonardyne International, and the file type must be *.a07. Then simply start the process by double clicking on the file or pressing Enter when the file is selected. There will be a status bar displayed showing progress. The whole process will take approximately 3-4 minutes. It is recommended that the PC is not used for other tasks while the download is in progress.

WARNING loading an incorrect file will stop correct operation of the Compatt 5 and can only be corrected by then loading the correct file.

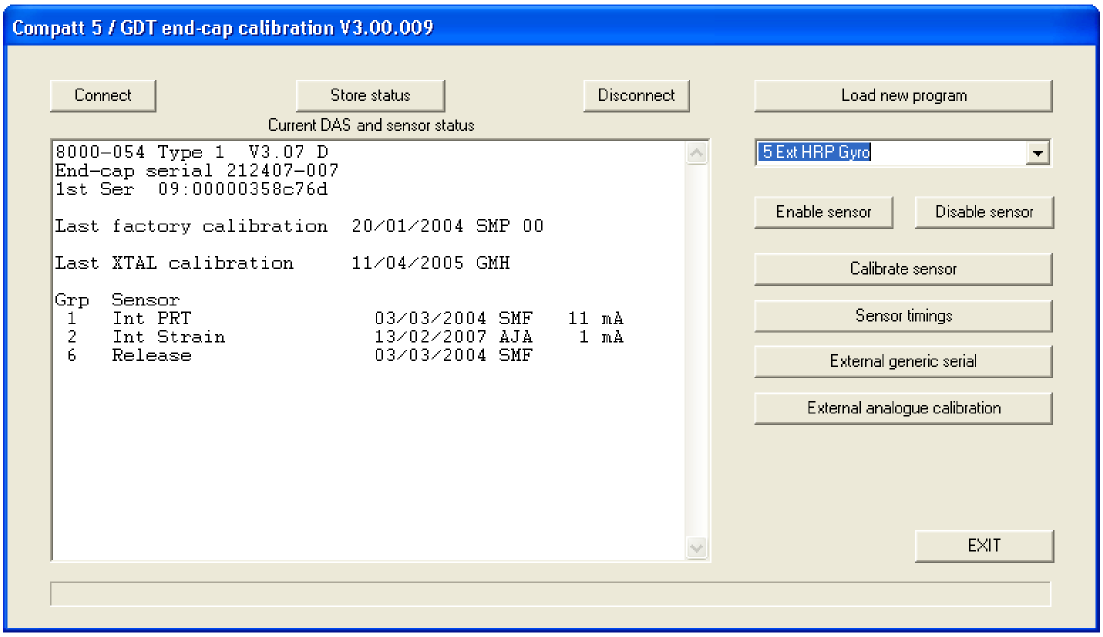
A Program Load window appears with the message "**Programming complete**", and the duration of the programming operation (typically 3-4 minutes).

The version of firmware running on the DAS can be read from the General Status read from the Test Terminal, see section B.2.3.2.

If the Sound Speed Sensor had to be disconnected previously, it must now be reconnected to the DAS board as shown arrowed in the photograph above.

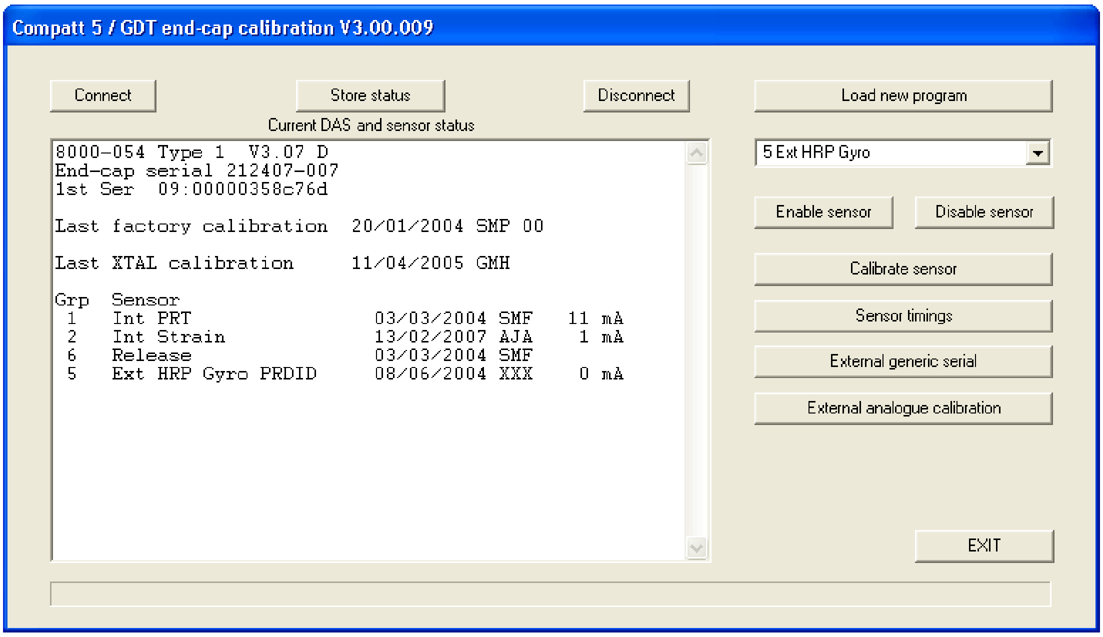
B.5 CONFIGURING DAS FOR EXTERNAL GYRO READINGS

This feature requires DAS firmware V3.02 or above, and Compatt 5 firmware V1.03 or above.

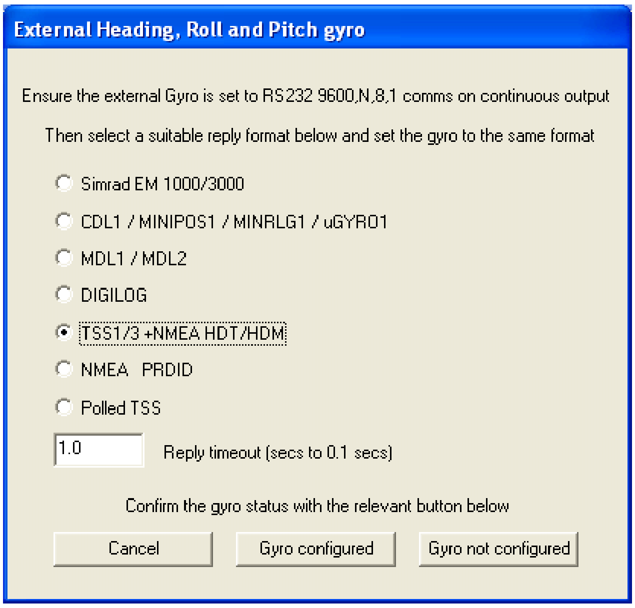


From the pull-down menu, select " **5 Ext HRP Gyro**", the click on <**Enable Sensor**>. (HRP stands for Heading, Roll & Pitch).

After entering the operator's initials, and the end-cap serial number, there should be a new sensor listed in Group 5.



Click on <**Calibrate Sensor**> and a list of gyro formats that are supported by the DAS firmware will be displayed.



Select the format supported by the subsea gyro, and make sure the " **Reply timeout**" is set to less than 3.0s which is the timeout run by the Compatt. On older end-caps, this may default to 25.5 seconds.

Click on <**Gyro Configured**>, then <**Disconnect**> and <**Exit**>. The DAS is now ready to receive RS232 data from the gyro.

To test the system, disconnect the PC comm port from the DAS connector and reconnect to the CPU connector. Run Test Terminal, and use the <**Reset (Comms Break)**> to re-initialise the DAS with its new settings, and then click on the < **Read Sensors**> button to obtain the gyro heading. Any heading value greater than 360º is an error code:

362.0° Gyro NOT READY	i.e. gyro not settled
364.0° Gyro NO REPLY	i.e. gyro not powered, not connected or not working
365.0° Gyro DATA TIMED OUT	i.e. Compatt did not receive full gyro data string in 2s
366.0° Gyro ILLEGAL DATA	i.e. non-valid character in gyro data string
367.0° Gyro INCOMPLETE DATA	e.g. TSS with NMEA string missing, R+P valid

An interlink cable will be required – see Fig. 16 for pin-out details. Remember the gyro is connected to the **DAS RS232 In** line !

Pin 2 Ground

Pin 8 Gyro RS232 Data in to Compatt DAS

The gyro must be configured to the same output format, with an update between 100ms and 1000ms. **The gyro baud rate MUST be set to 9600, 8N1**.

FIG B.1 COMPATT 5 TEST EQUIPMENT CONNECTION

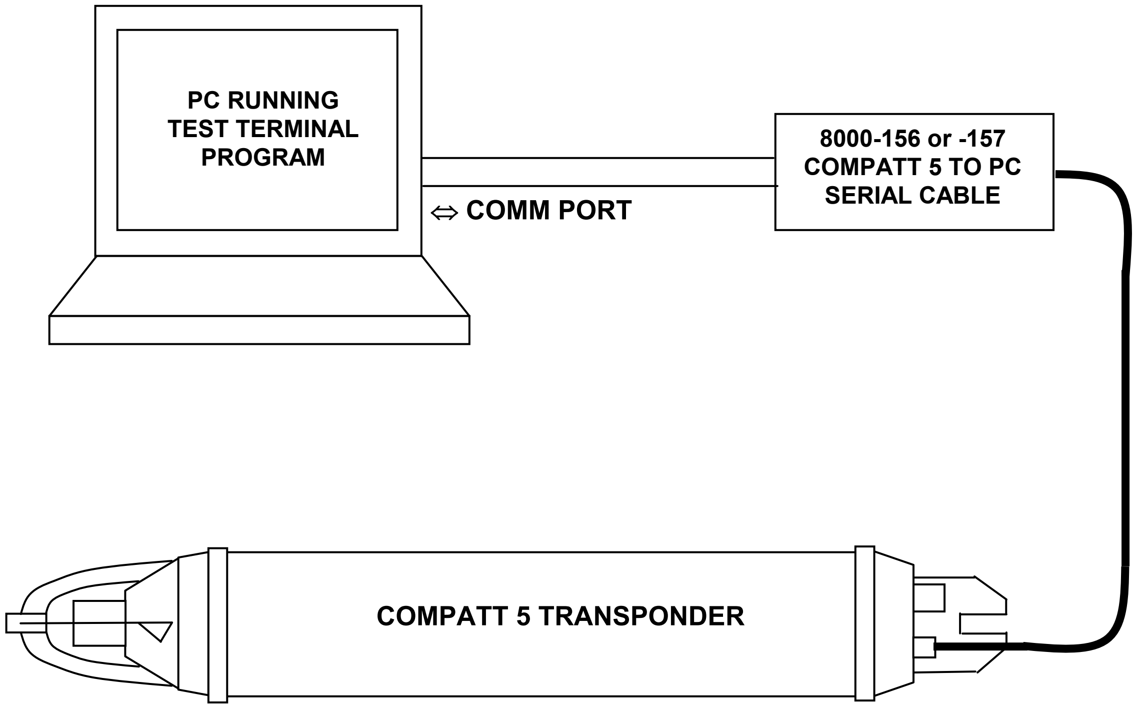


FIG B.2 IN-SITU DEPTH SENSOR RE-CALIBRATION

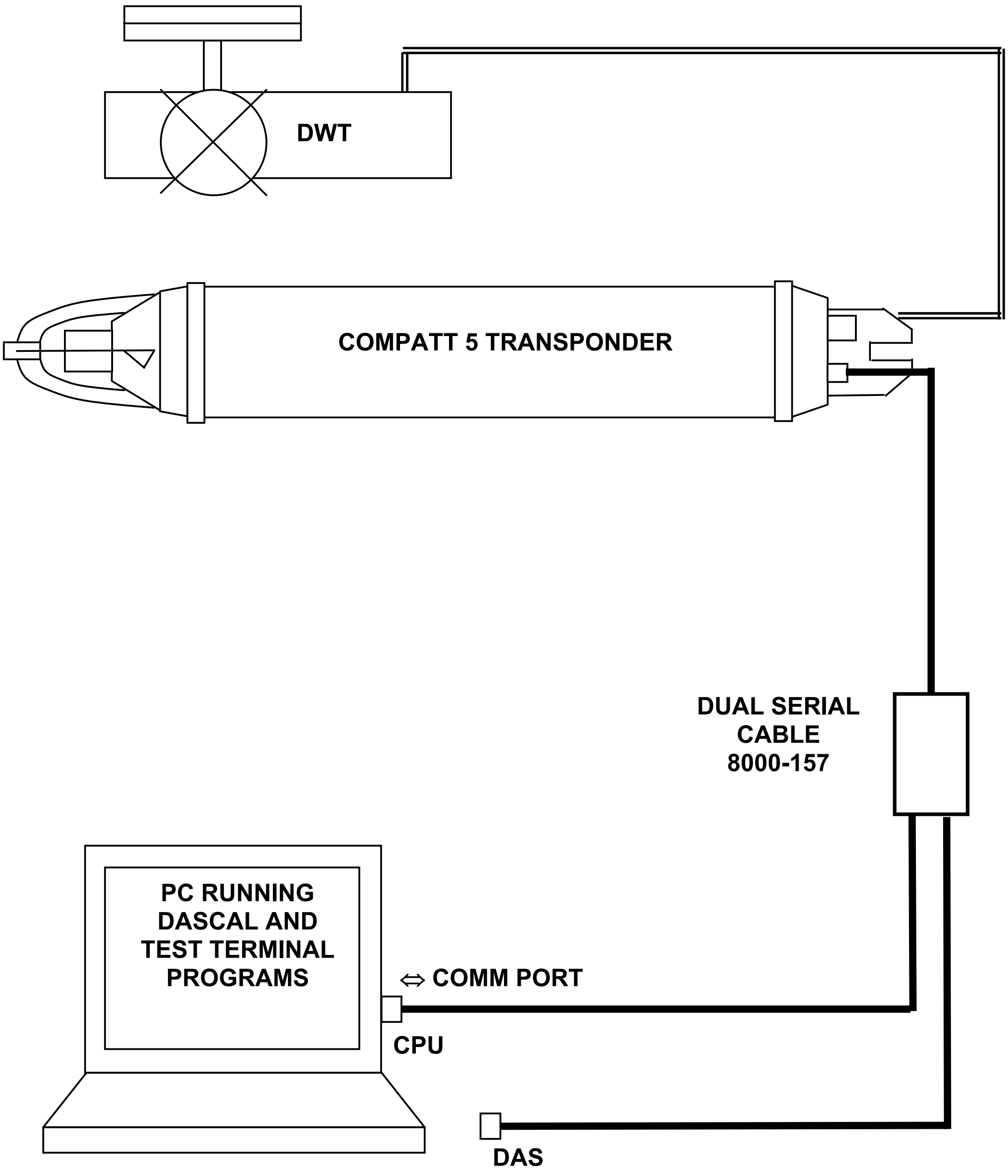
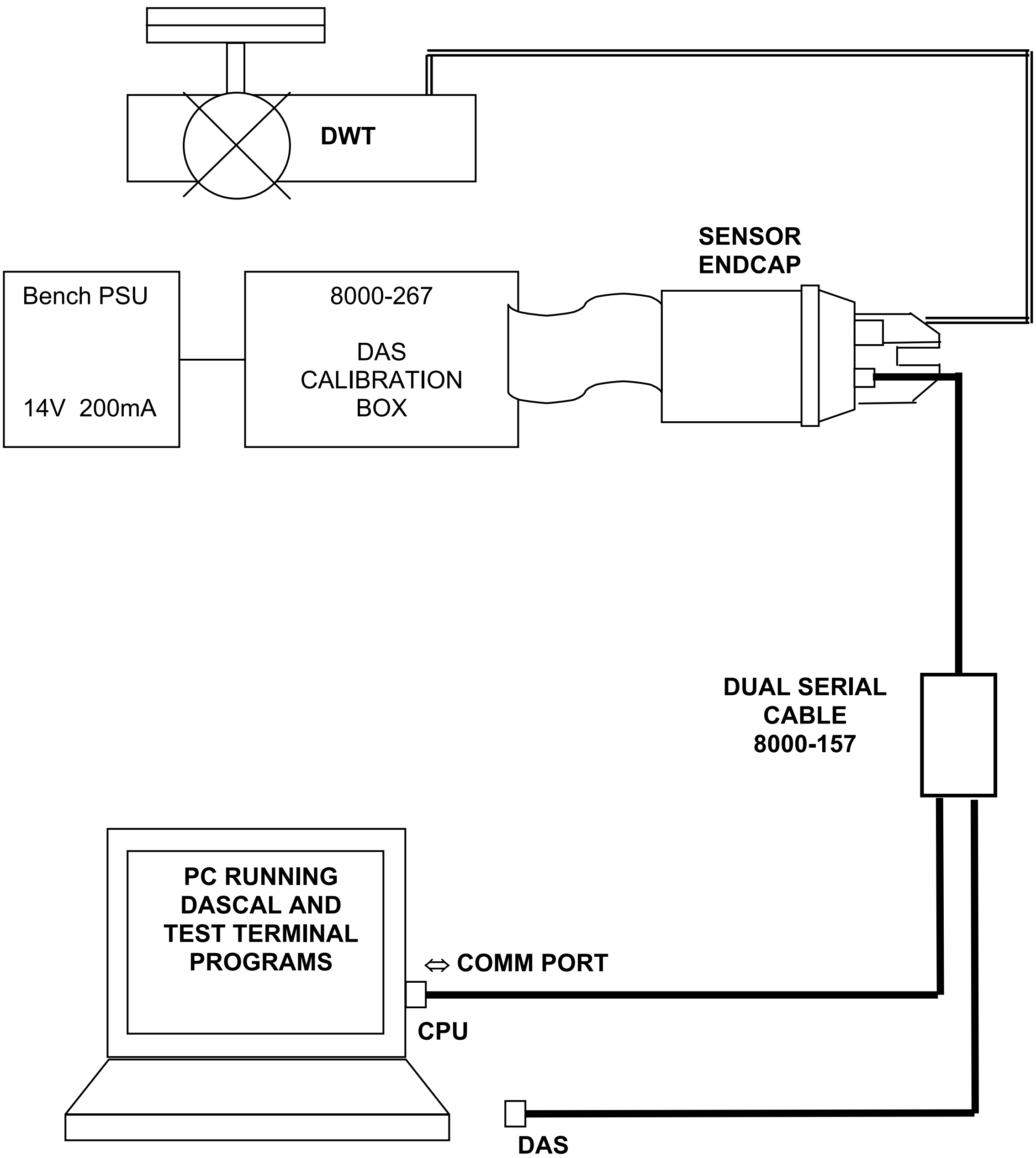


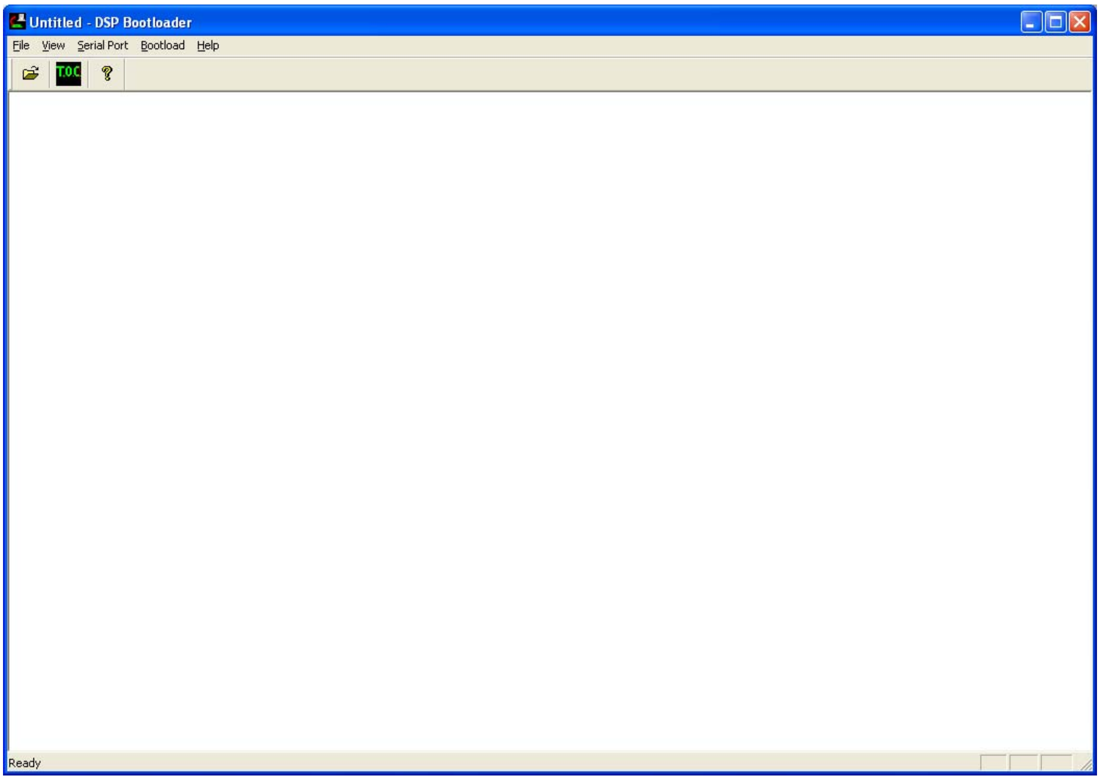
FIG B.3 DEPTH SENSOR RE-CALIBRATION USING CAL BOX



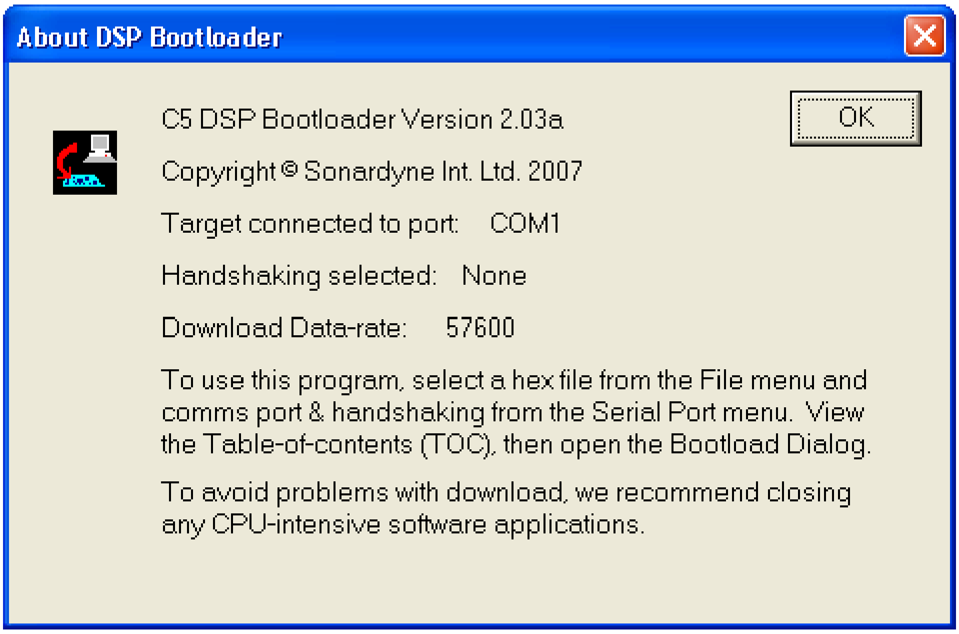
B.6 WIDEBAND CARD FIRMWARE UPGRADE PROCEDURE

The CD supplied with this manual contains a program called Dsp BootLoader.exe. This description applies to program version V2.03a.

Run the program, and the DSP Bootloader main window should be displayed, as shown below.



Click on <**Help**> then <**About**> to check the version of the software.

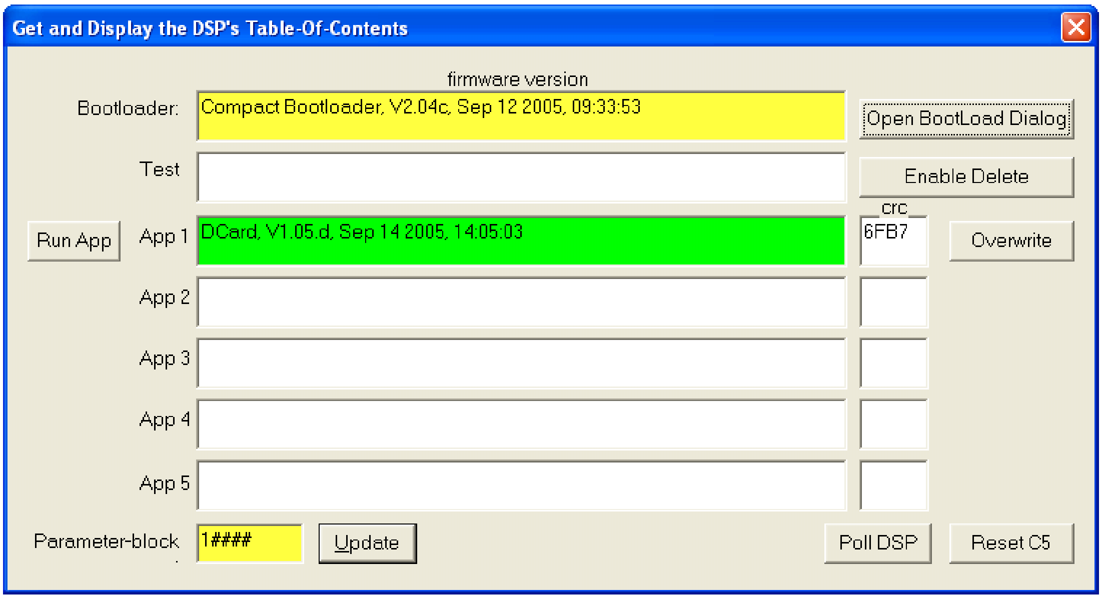


Click on <**OK**>, then <**Serial Port**>, then <**Select**> and choose the PC Comm port to be used.

Connect the Compatt to the PC using a serial test cable such as 8000-157 or 8000-156.

Choose <**File**> then <**Open**>, and select the boot-loadable file (*.hex) that will have been supplied by Sonardyne as part of the upgrade.

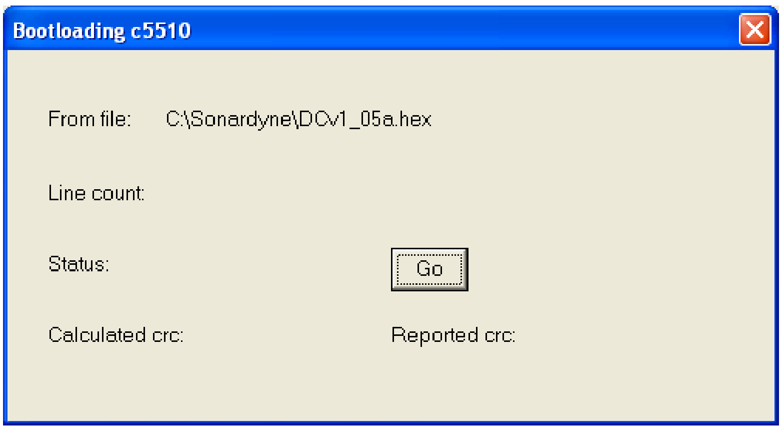
Click on the **TOC** icon (Table Of Contents) and the following should be displayed:



Note:- The Bootloader firmware version number should be V2.04c for issue C daughter cards, or V4.01 for issue D daughter cards.

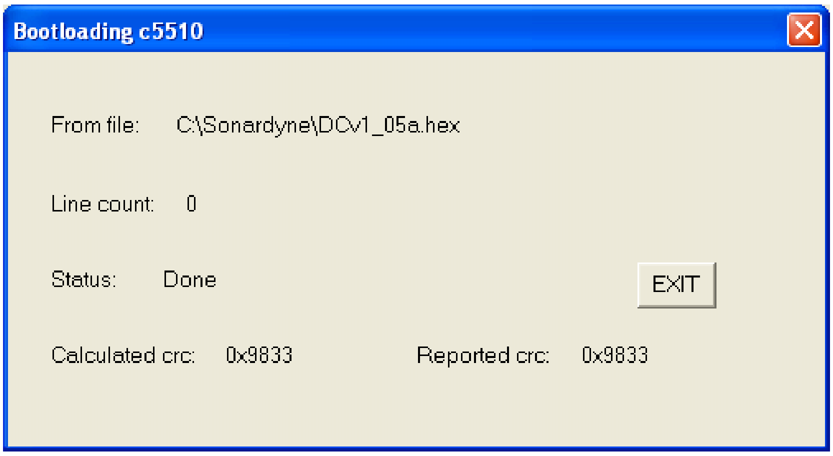
The factory installed firmware should already be installed in Application 1. Note that several programs can be stored on the card at the same time, but only one application can be selected to be run by the processor.

Click on the <**Open Bootload Dialog**> button.

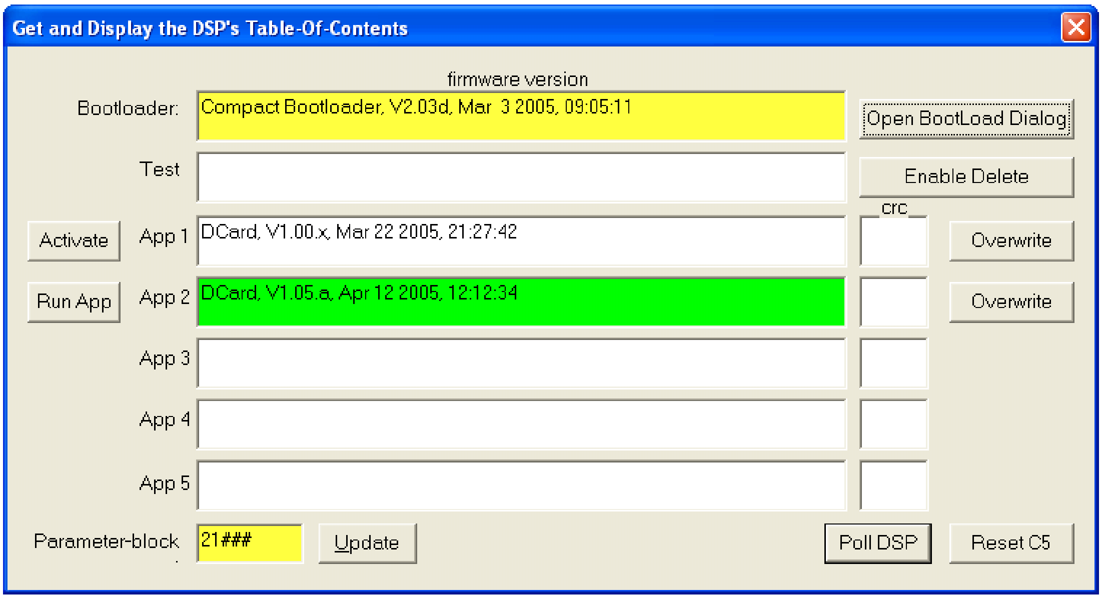


Confirm the hex filename selected earlier is displayed, then click on <**Go**>.

The software starts to download the new program into memory on the wideband card. After about 30 seconds, the following screen will be displayed:



Once the download is complete, the new and old firmware programs will both be resident in Flash memory on the card, but a successful download will automatically select the new firmware to be used.



The TOC window can be closed, and the main window also.

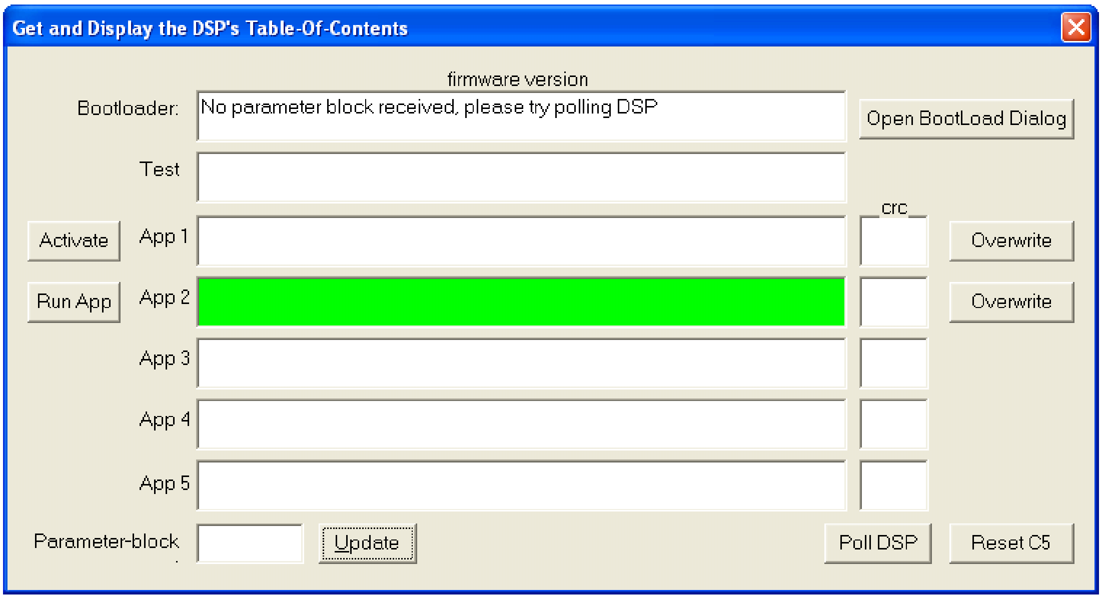
To confirm the new firmware has been installed and is running, use Test Terminal and click on <**General Status**>. Confirm that **Dcard** (daughter card) reports the new firmware version.

```
TYPE, 8003, MF, Directional
UNIT S/N, 235105-001
UNIT ID, 000462
ENDCAP S/N, 233975-003
BATTERY, Lithium
Batt,260000006D868870,8000-045-01,C4,25/04/2005
Tx,09000003BC51029D,8000-043-06,E1,14/07/2005
Dcard,09000003E3A9FA94,8000-070-01,C6,28/03/2006
DAS,09000003A88A2803,00000301
AD = 406
HPR = 01
Function Level = 3f
TS = RF6/125.0 LJDV12.06 CRF IF16 T5/6/1/1 DDD
PS = L1 S1 T1 J5 U1 G3
BC = 209 V= +14.37
C5 CPU Main V10.06h  May  3 2006,10:09:05
DAS, V3.06
U4,  V2
U10, V19
U5,  V1.3.0, DEV 3
U8,  V1.02.a
Dcard, V10.06.h
STTX,RT16,TT7,BR50,RF6,DR3,DI2,MD2,UP2,CW0,
```

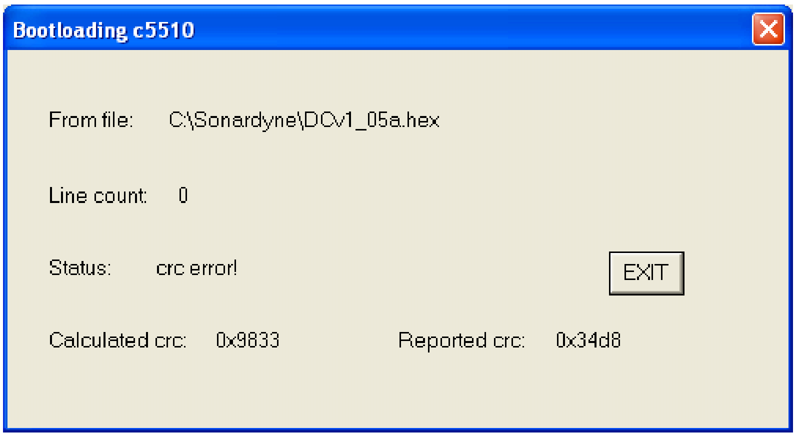
Note:- If the main firmware version number does not match the firmware version number in the daughter card then the daughter card firmware version will not be indicated on the arrowed line correctly.

B.6.1 TROUBLE-SHOOTING

If there is a problem with the comms to the Compatt during the Dsp BootLoad, click on <**Poll DSP**> then <**Update**> until the TOC is updated.



If the download failed, a Crc error status message will be displayed instead, see below. If this occurs, click on <**Exit**> and try again. If the download fails repeatedly, try cleaning the 8 way connector contacts.



Alternatively, select a lower baud rate for the serial comms. From the main window click on <**Serial Port**>, then <**Baud Rate**> and choose a rate lower than the default of 115200.

APPENDIX C

C. COMPATT 5 FIRMWARE HISTORY

C.1 CPU MAIN FIRMWARE HISTORY

Build	Date	Comments
V1.00.k1	30 Apr 2003	First release
V1.00.K3	25 Jun 2003	MF Directional now supported
V1.01i	19 Nov 2003	Remove false setting of B flag based on voltage sensing. Read Sensors serial command added Depth returned on first SI now correct format Battery Count scaling altered.
V1.02j	30 Apr 2004	Improved reliability Requires U8 V1.00p Supports address codes > 31
V1.03f	01 Jul 2004	EHF command reception improved. DAS leaves sensors powered after reading
V1.04b	05 Oct 2004	Wideband tx replies added Requires U8 V1.0.t.
V1.05y	12 May 2005	First release to support Wideband daughter card Requires U8 V1.02.a <Read Sensors> measures all options fitted <Produce Test Report> added
V10.06h	10 May 2006	Wideband command downlink added Acoustic change of address added
V10.07s	4 May 2007	EHF Not supported Supports issue G Transmitter PCB Supports DPTi DAS interfacing Amended Sensor reading period to work through a Watch Dog
V10.08l	26 Nov 2008	Withdrawn
V10.09c	17 Jun 2009	Bug Fix: Wideband nav replies would zero the release counter. Bug Fix: SI depth readings prone to be zero at fast update rates.

C.2 DAS FIRMWARE HISTORY

Build	Date	Comments
V2.03	26 Feb 2003	First production release. Depth cal. now carried out using absolute pressures. Requires DASCAL V1.01.04
V3.00	22 Oct 2003	V3 firmware is common to all 3 DAS pcb types (8000-046, -054, -057)
V3.01	08 Dec 2003	Issued for Inclinometer option only
V3.02	28 Jul 2004	Supports Gyro readings
V3.03	16 Sep 2004	Inclinometer noise filtering corrected
V3.04	4 July 2005	TSS1 gyro error status added to heading output Supports Sonardyne Remote Inclinometer
V3.05	13 Sept 2005	Improved support of RS485 strain gauges
V3.06	13 May 2006	Bug fix for inclinometer readings with reduced No. Samples Bug fix for occasional Digiquartz reading jumps with extended sampling
V3.07d	10 Oct 2006	Bug fix for end caps with Digiquartz and Inclinometer sensors

C.3 WIDEBAND DAUGHTER CARD FIRMWARE HISTORY

Build	Date	Comments
V1.05b	16 May 2005	First release Supports Wideband ranging, and telemetry uplink
V1.05d	26 Sept 2005	Lower power on shut-down when disabled. Can only be installed if DSP Bootloader firmware is V2.04c or later
V10.06h	10 May 2006	Supports Wideband downlink
V10.07q	22 April 2007	Supports issue D daughter card

C.4 TEST TERMINAL SOFTWARE HISTORY

Build	Date	Comments
V2.01.008	18 Oct 2005	Wideband Acoustic Check added
V2.03.008	10 May 2006	Added animation during commands Tests for No valid comm port Supports DP Transponders. Warning about AD change during <Install Factory Defaults> added
V3.00.011	26 Jun 2007	Quick Set mode added

C.5 DASCAL TERMINAL SOFTWARE HISTORY

Build	Date	Comments
V1.003.000	23 Nov 2003	First issue
V1.004.0016	27 Oct 2004	Dedicated offshore version created Added support for external Gyro, External Serial Digiquartz and generic serial data
V2.000.003	22 Apr 2005	Added Support for Iss C 8000-054 DAS which supports internal and external Sound Speed sensors
V2.000.006	06 Jul 2005	Added support for importing Digiquartz parameters from Paroscientific file format
V2.000.018	22 Jun 2006	Bug fixes
V3.000.009	17Jan 2007	Support for 8000-074-02 DPTi DAS Calibration

C.6 DSP BOOTLOADER TERMINAL SOFTWARE HISTORY

Build	Date	Comments
1.04b	29 Apr 2005	First released version
1.06b	11 Nov 2005	Required to correctly load V10.06
2.02a	9 Oct 2006	Improved serial comms
2.03a	2 Feb 2007	Bug fix

APPENDIX D

D. NOTES FOR COMPATT 5 WITH DIGIQUARTZ SENSOR

The Compatt will be supplied with a sheet of Calibration Coefficients for the sensor, supplied by the manufacturer, Paroscientific Inc, giving values for U0 (or X0), Y1, Y2, Y3, C1, C2, C3, D1, D2, T1, T2, T3, T4, T5.

The Calibration Coefficients are also stored in the DAS card, and can be read back using the DASCAL software. Select the “INT DQZ” sensor from the pull-down list of sensors, click on <Calibrate sensor>, enter the operator initials, and then click on <Save settings>. A text file named DasCalibration.txt in the c:\Sonardyne\C5Status directory will now contain the sensor coefficients, as shown below:

```
NDS 219120-005 12:20 28/10/2005 Opening results record file
NDS 219120-005 12:20 28/10/2005 DQZ parameters entered
NDS 219120-005 12:20 28/10/2005         Max depth 3000 PSI
NDS 219120-005 12:20 28/10/2005         Serial No 92338
NDS 219120-005 12:20 28/10/2005         U0 5.851362
NDS 219120-005 12:20 28/10/2005         Y1 -4000.341
NDS 219120-005 12:20 28/10/2005         Y2 -11524.990
NDS 219120-005 12:20 28/10/2005         Y3 0.000
NDS 219120-005 12:20 28/10/2005         C1 -15846.44043
NDS 219120-005 12:20 28/10/2005         C2 310.87460
NDS 219120-005 12:20 28/10/2005         C3 45021.71875
NDS 219120-005 12:20 28/10/2005         D1 0.047893
NDS 219120-005 12:20 28/10/2005         D2 0.000000
NDS 219120-005 12:20 28/10/2005         T1 30.328991
NDS 219120-005 12:20 28/10/2005         T2 1.071853
NDS 219120-005 12:20 28/10/2005         T3 53.596901
NDS 219120-005 12:20 28/10/2005         T4 155.580002
NDS 219120-005 12:20 28/10/2005         T5 0.000000
```

A reading of the Digiquartz sensor in Engineering units is available via RS232 using the Test Terminal <Read Sensors> button. The reply will be in the format:

```
Pressure = +14.54 psia
Depth    = +0.02 m
Offset   = +0.00 m
Range    = +2045.81 m
Accuracy = +/-0.20 m        (±0.01% of full scale)
Temp.    = +24.88 degC
```

The absolute pressure in psi (psia) includes atmospheric pressure.

Similarly, a Rovnav 5 fitted with firmware V7.04 or above can be used to get an absolute Digiquartz reading using the CPR (Compatt Pressure Reading) command, where the reply is in kPa absolute, and given to 2 decimal places (roughly 1mm resolution).

This allows the sensor accuracy to be checked at atmospheric pressure and room temperature, against a calibrated barometer.

The Compatt must be standing vertically if an accurate reading is required. Readings made with the unit horizontal will include an offset.

APPENDIX E

E. OPERATIONAL DIFFERENCES FROM COMPATT MK 4

Compatt 5 retains full compatibility with existing Compatt commands and navigation systems. However, the new design also allows for upgrade of both firmware and functionality as new acoustic systems are introduced.

E.1 RS232 OPERATION

Many testing features are now available via the Compatt 5 Test Terminal program, using the RS232 link to the Compatt. These are described in Appendix B. Other features available via RS232 link are firmware upgrades, address changing and increasing the level of functionality.

E.2 HPR CHANNELS

Mk4 Compatt could only be set to 28 out of the possible 56 HPR 400 interrogation channels. Compatt 5 can emulate all 56 channels.

E.3 12-CHANNEL SIMULTANEOUS RECEIVER

Mk4 Compatt was fitted with a 12-channel simultaneous receiver card, which fits above the CPU card. Compatt 5 uses 6 agile receiver circuits to try and emulate these 12 parallel receivers. As the Compatt does not know the sequence of arrival of the reply signals, it has to occasionally run a search to detect valid replies. As a result, there may be some range drop-outs every 16 interrogation cycles, while it executes another search.

E.4 BATTERY COUNT RESET

The battery packs used by Compatt 5 retain the battery count within the pack. New packs have the battery count set to zero in the factory. Consequently, new packs do not need to be initialised by the Compatt and the BX command is redundant in Compatt 5.

E.5 PRESSURE PORT LOCATION

See Figure 18 for the position of the nominal reference point on the acoustic transducer, and the Outline drawing figures for the offset between the acoustic centre and the pressure port for the various physical configurations of Compatt.

E.6 BATTERY COUNT INCREMENT RATE

The battery count will rise more slowly with the Compatt 5 Standard unit, when compared to a Compatt Mk4, when used with the same acoustic settings. This is due to the greater capacity of the Compatt 5 battery pack achieved by an internal rearrangement of the cells.

APPENDIX F

F. HANDLING PROCEDURES FOR CMOS DEVICES AND CIRCUIT BOARDS

CMOS devices have diode input protection against adverse electrical environments such as electrostatic discharge.

Unfortunately, severe electrical transient voltages can be generated during handling. For example, static voltages generated by a person walking across a common waxed floor have been measured in the 4 to 15kV range (depending on humidity, surface conditions, etc). These static voltages are potentially dangerous when discharged into a CMOS input, considering the energy stored in the capacity (~ 300 pF) of the human body at these voltage levels.

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

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

Workbenches should have conductive tops that are grounded to an earth ground.

Operators must comply with precautions previously explained.

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

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

A circuit board containing CMOS devices is merely 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. Plastic wrapping should be avoided.

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 be certain 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 be sure that soldering irons are grounded.

APPENDIX G

G. OPERATING NOTES FOR INCLINOMETER OPTION FOR COMPATT 5

The standard Compatt 5's can be fitted with an end-cap containing dual axis inclinometers as an option. This version of the botto m end-cap will be non-release, and will be labelled with the Config option I2.

The range of the sensors fitted is ±90°, how ever when the Compatt passes beyond 90° in pitch or roll the sensor output will show a reducing angle, as the sensor is a sine law device. Additionally the output of the cross axis sensor may report an inverted angle. There is no indication of either of these occurrences in the output from the Compatt. The tilt sensor will not help as it indicates that the Compatt 5 is either upright or inverted within a cone approximately a 45°.

The new Fusion Compatt command CRP (Compatt Roll & Pitch) will return 2 angles in degrees upto ±90, both to 2 decimal places. Note that this command is only supported by the Rovnav 5 or Digital USBL transceivers. Upon receipt of the command, the sensors are powered up and given a sensor warm-up delay, which is factory set to 8.0s. The 2 sensors are then sampled repeatedly, with the number of samples being set to 400 as the factory default. This allows any dynamic motion of the structure that affects the sensors to be removed. The telemetered reply is sent back after approximately 12-18s.

```
CRP1001 C:1001 PENDING... E: 0 C:1001 RP=+3.95,-24.86 E: 0
```

If the structure is not dynamic, or if a faster sensor reading update rate is required, the No. Samples can be reduced from 400 to 100 using DASCAL. See Section G.4.

The inclinometers orientation is marked on the bottom end-cap by a groove running up the edge of the end-cap, indicating the bow or for'ard face. The polarity follows a standard Cartesian format:

Bow Up	=	Pitch	+ve
Port Up	=	Roll	+ve

If using an External Inclinometer package, use the PAN command AN7 to obtain Roll and Pitch readings from the external sensor, and decode the reply in the same way.

G.1 MOUNTING DETAILS

An example of a mounting plate is shown in Figure 17. Four mounting holes to take M8 bolts are needed and 2 bosses to give a datum line to which the end-cap can be abutted. To offer corrosion protection, provision of zinc anodes on the plate is recommended. Note that the locking sleeve on the Compatt connector protrudes from the Port side face of the end-cap.

G.2 ON-SITE CALIBRATION METHOD

Roll and pitch corrections, to be applied when tracking a Compatt on a structure, can be measured when the Compatt is installed on the structure on land. Take 3 roll and pitch measurements and use the average as the correct ion values. These are subtracted from real-time measurements in the navigation software.

G.3 READING INCLINOMETERS USING AN5 COMMAND

When used with the old Compatt 4 command AN5 the reply is a voltage where the full-scale range of 4.000V represents either ±14.5°, ± 90° or ±5° depending on how the DAS card is configured, see G.4 below. A label on the end-cap will indicate the AN5 scaling range (the factory default is ±14.5°).

The AN5 command gives a displayed reply in the form:

```
AN5, 6 = +1.234, =2.345 E : ∅
```

Roll Pitch

The numerical data is displayed in volts and converted to an angle in degrees using the formula:

Angle, $\varnothing$ = arc sin (V / S.F.)

where V is the data displayed in volts, and S.F. is a scale factor which depends on the range of the inclinometer sensors fitted.

Compatt Mk4 Emulated Sensor Range	S.F.
± 14.5 °	16.000
± 5 °	45.895
± 90 °	4.000

If using an External Inclinometer package, use the PAN command AN7 to obtain Roll and Pitch readings from the external sensor, and decode the reply in the same way.

G.4 CHANGING THE C4 (AN5) SCALING RANGE

On the PC run the **Test Terminal** program, as described in section B.2.2.

Click on the < **Enter DAS Calibration>** button. This will force the Compatt 5 to switch on power to the DAS. The message window s hould show the reply “DAS calibration mode entry”.

Close the Test Terminal.

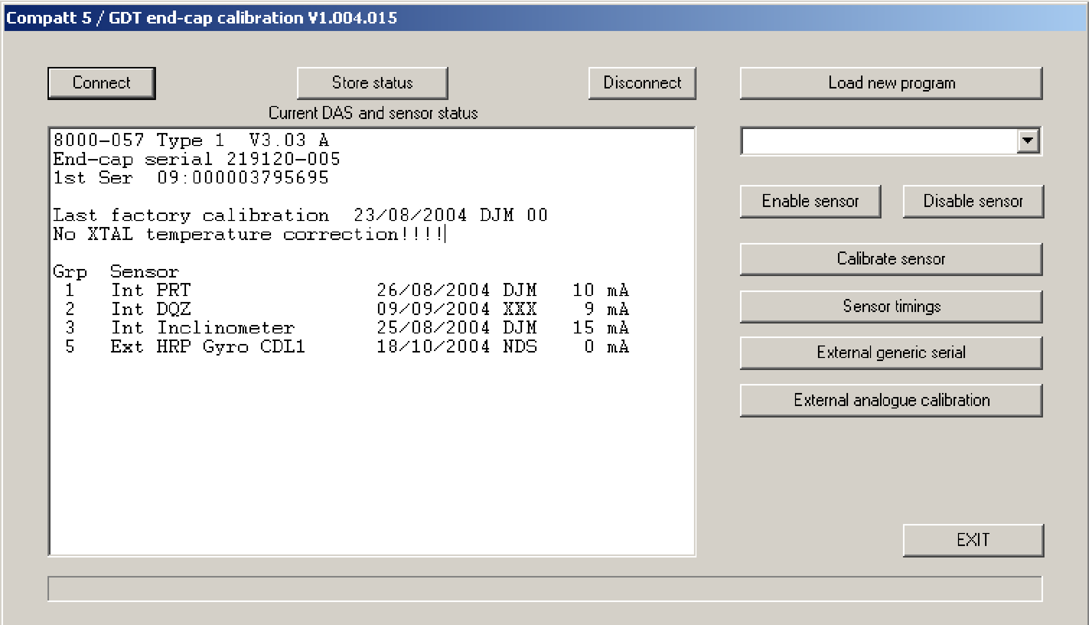
Disconnect the PC comm port from the Compatt CPU connector on the Dual serial cable 8000-157, and connect to the DAS connector.

Note: the watchdog will reset the whole unit after 10 minutes and abort any DAS measurement in progress at the time. Therefore, this procedure must be completed in under 10 minutes, otherwise there will be an error message “Comms connection fault”.

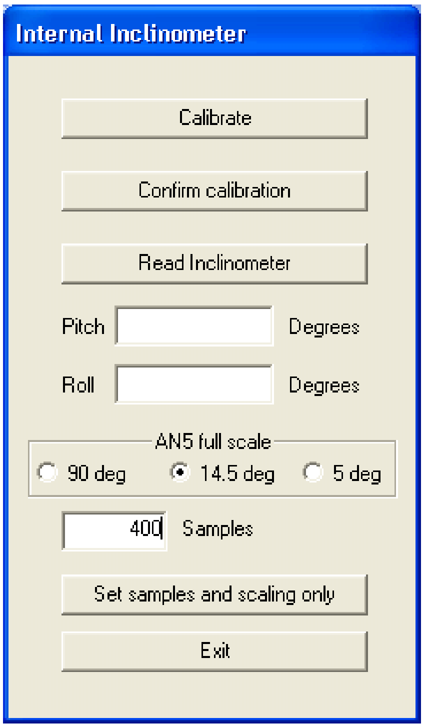
Run the Dascal program from the **‘Dascal’** icon placed on the **‘Desktop’** of the PC.

Click on **<Connect>**. Select the comm port used by the PC, then click on **<OK>.**

After a short period of time, the Endcap Status will appear in the window as shown below:-



From the pull down men, select ' **3. Int Inclinometer'** and then select < **Calibrate sensor>**. The window below will appear.



Select the C4 (Compatt 4) scaling required, then click on **<Set samples and scaling only>** then click on <**Exit>**. Note that changing the scaling does not affect the sensor calibration.

From the main DASCAL window click on **<Disconnect>** then **<Exit>**.

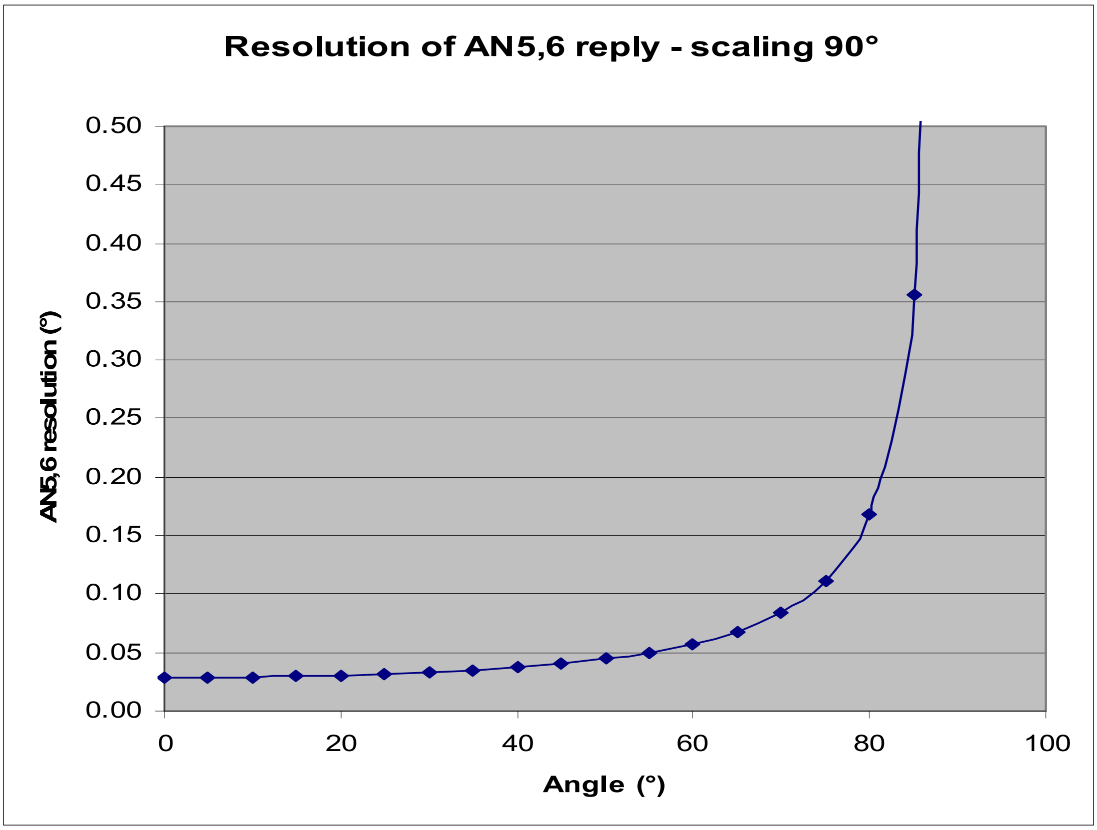
The end-cap labelling must reflect the new scaling range.

G.5 RESOLUTION

The resolution of the telemetered AN5 readings will be greatly affected by the angle when the 90° scaling range is being used, see the graph below. This is because the reported voltage is a sine function of the angle.

By comparison, the resolution when using the 14.5° scaling range is a constant 0.007° over the range.

These complications are all dealt with if the new CPR command is used instead – see G.2.



G.6 READING THE SENSORS VIA RS232

Using the RS232 link, and running the Test Terminal software, the inclinometer sensors can be read to full accuracy using the **<Read Sensors>** button. The reply is given to 2 decimal places, so there is no loss of resolution, and readings up to ± 90° can be measured. For example:

```
Int. Roll  = +25.61 deg
Int. Pitch = -2.14 deg
```

Note:- Beyond 90° the angle reduces as the sensor is a sine law device and the cross axis sensor output may become inverted.