OM-7815-000-06

OPERATING MANUAL

FOR THE

TYPE 7815-000-06 TZ /OBC TRANSPONDER

ISSUE B

REVISION 0

Prepared by : G Brown

Authorised by :

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S O N A R D Y N E I N T E R N A T I O N A L L I M I T E D
Blackbushe Business Park, Yateley, Hampshire, GU46 6GD, United Kingdom
Tel: (0) 1252 872288 Fax : (0) 1252 876100 www.sonardyne.co.uk

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Fig.1 - Type 7815-000-06 TZ/OBC Transponder

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	10.10.01	Initial Issue	All	All
A	1	22.01.02	Section 3.4.3.3 change from RV4 to RV5.	All	All
B	0	18.06.03	CN 7846 Update for new Injection Moulded Housing	All	All

SECTION 1

1. INTRODUCTION

The Type 7815 transponder has been designed for seismic Transition Zone (TZ) and Ocean Bottom Cable (OBC) applications, where large numbers of small long-life transponders are required to enable the acoustic positioning of hydrophone and geophone ground stations.

The transponder has been specifically designed to meet the tough environment associated with deployment and recovery of shallow water seismic cables. The electronics assembly is shock mounted and housed in a tough plastic housing.

The Type 7815 transponder operates on the Sonardyne HF frequency band from 35 to 50kHz.

The transponders are acoustically programmable for interrogation address and reply code. The type 7815-000-06 transponders have 401 interrogation addresses (1-401) and 9 reply codes (1-9). This allows 3609 (401 x 9) individual transponder identities.

The transponders can use either an optional built-in or co-located RFID (Radio Frequency IDentification) tag, allowing automatic remote-reading of the acoustic identity, serial number, battery date etc and other associated information.

Operational water depth is limited to 500 metres. Maximum slant range depends on surface signal-to-noise ratio but is typically 750m (noisy vessel) to 1500m.

The transponder is easy to maintain. All major parts, transducer, electronics and battery pack are field replaceable.

The Alkaline battery pack has a maximum ‘listening’ life of 18 months to 24 months. Typical operational life on seismic crews (working 365 days a year) is 12 to 15 months. Replacement battery packs are available from Sonardyne.

The transponder can be programmed, tested and its battery voltage read on deck using the Type 7967 Transponder Programming/Test unit. With the addition of a remote transducer the deck unit can be used to range to selected transponders in the water, ranges are displayed in meters.

The transponders are typically either attached on to the cable temporarily and permanently using the Sonardyne supplied ‘Carapace’ a plastic shell that clamps on to the cable and contains the transponder and optional RFID tag.

The transponder is compatible with Sonardyne’s Homer-Pro system, a hand-held relocation system for use by divers. The unit gives range and direction to swim to guide a diver towards the transponder. ROV-Homer, the remote vehicle mounted version can also be used in a tow-fish for relocation sweeps.

The transponder is also compatible with the Type 7986 Lightweight Release Transponder (LRT). This incorporates a release mechanism that on command from the surface deck unit and remote transducer actuates the release motor so releasing the anchor weight. These devices with the optional rope canister can be used to recover ocean bottom cables within constricted waterways.

SECTION 2

2. OPERATION

2.1 INITIAL CHECKS

On receipt the unit will be in a fully working condition, with the internal battery pack fitted and connected, the unit being ON. Note that some special shipping regulations dictate that the battery pack is shipped separately – if this is the case the shipping documentation will acknowledge this.

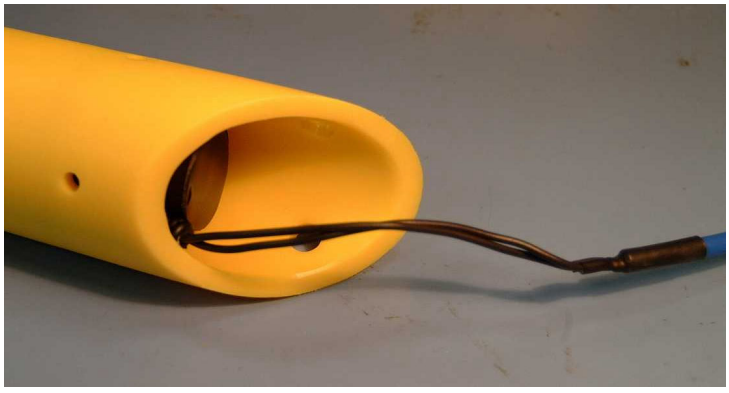
2.2 PROGRAMMING

The unit will be programmed to the default acoustic identity which is 005-5 (interrogation address 005, frequency 5). Unless the default identity is to be used you will need to program the unit to an identity of your choice. Try to ensure that the same identity is not already used within the operational area.

To program the transponder use the Type 7967 Transponder Programming/Test Unit. Select the interrogation address (1-401) and then the reply code/frequency (1-9). Place the programming loop tightly around the black transducer inside of the yellow housing as shown below and press the PROGRAM button. The surface unit will program and then test the transponder, it will display **PASS** and beep once to confirm successful programming. **FAIL** will be display and no beep will be heard if unsuccessful. An additional test can be carried out by pressing the TEST button if required, although not necessary.

Follow the instructions on short-form instruction sheet inside the lid of the Type 7967 yellow box.

The programmed acoustic identity is stored in non-volatile memory, therefore if the battery is disconnected for any period of time the programmed identity is not lost.



Note old style of housing shown in image

You can only program the transponder using the loop not the remote transducer. This is an interlock to ensure that no transponders already deployed in the water are accidentally programmed.

With a waterproof label or permanent pen mark the acoustic identity clearly on the yellow housing. Make a permanent note of the transponder identity (& serial number if required) on file.

NOTE: For use with Sonardyne's Homer-Pro and/or ROV-Homer system, only use address groups 004 to 013, all reply frequencies (81 unique IDs). See Appendix A.

WARNING: Once deployed there is no way to automatically read a transponder's programmed identity without cycling through all available identities.

Type 7967 Programming/Test Unit

2.3 MEASURING THE BATTERY VOLTAGE

The internal battery voltage of the transponder can be read by connecting the loop around the transducer and pressing the BATTERY button. The transponder reads its own battery voltage and sends an acoustic telemetry message to the surface unit.

The voltage is accurate to 0.25 volts.

	Alkaline Pack
Initial Voltage	**12.5-12.75**
Nominal Start Voltage	**12**
End of Life Voltage	**9**

2.4 TEST RANGING

Deploy the remote transducer over the side of the vessel, ensure that it is well below the keel and as far away from the propellers or other sources of acoustic noise as possible.

Select the correct acoustic identity on the surface unit. Press the TEST / RANGE button. The range in meters to transponder will be displayed and a beep will be heard if a valid reply is received.

The maximum slant range from which the transponder can be ranged to depends on the water depth and the local acoustic environment. If the water is shallow and/or if the local noise from the vessel etc is great then the range could be significantly reduced.

The RS232 port on the surface unit can be used to automatically send continuous ranging commands to the LRT on the seabed and log the range data returned. See the short-form manual on the inside lid of the Type 7967 unit for interface language.

2.5 ATTACHMENT USING 'CARAPACE'

The transponders can be attached on to the cable section using the Sonardyne manufactured 'Carapace'. This is a Polyethylene plastic shell that protects the transponders from damage, co-locates the transponder and RFID tag and eliminates the need for large numbers of tie-wrap and tape that require regular maintenance.

Open the Carapace and place the cable into the hinge section. The Carapace is designed to fit cable of 1.42 inches (36.1mm) to 1.57 inches (39.9mm) diameter. Cable of smaller diameter will require some additional packing with tape etc as can be seen in the picture to the left.

Put the 2 o-rings provided around the outside diameter of the transponder and place the transponder inside the Carapace. Put the RFID tag (optional) into the slot provided and close the shell of the Carapace.

The clamp to the cable insert the stainless steel U bolts with clamp plates as shown. Note that depending on the cable diameter only 1 clamp plate may be needed – place this on the side of the nuts to ensure they do not wear through the plastic.

For reference mark the acoustic identity of the transponders in black permanent marker on the outer shell.

2.6 OTHER ATTACHMENT METHODS

Transponders temporarily 'looped' onto the fixing point as the cable is deployed.

Flotation Collar

This transponder is designed to be attached to a dragged cable section. The transponder must float above the cable to ensure that it is not damaged or ripped of as the cable is dragged across the seafloor.

The flotation collar is designed to be low cost. It is attached to the cable and held in the float collar by the rope.

There is minimal buoyancy in the float to ensure that the transponder does not pull the cable off the seafloor so degrading the coupling. The total up-thrust is 0.3kg.

The flotation collars are available from Sonardyne (7815-102 CPN 870-0263).

SECTION 3

3. MAINTENANCE

3.1 HEALTH AND SAFETY

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 explosion
- using an instrument outside its design parameters or beyond its load bearing limits
- using unauthorised components or inferior parts in critical assemblies, eg release systems

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 units 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.

Note (2) that when a unit has leaked it often behaves like a one-way valve, ie. water pressure causes a rise in internal pressure which cannot then escape because the point of leakage becomes sealed. Complete removal of an endcaps 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**.

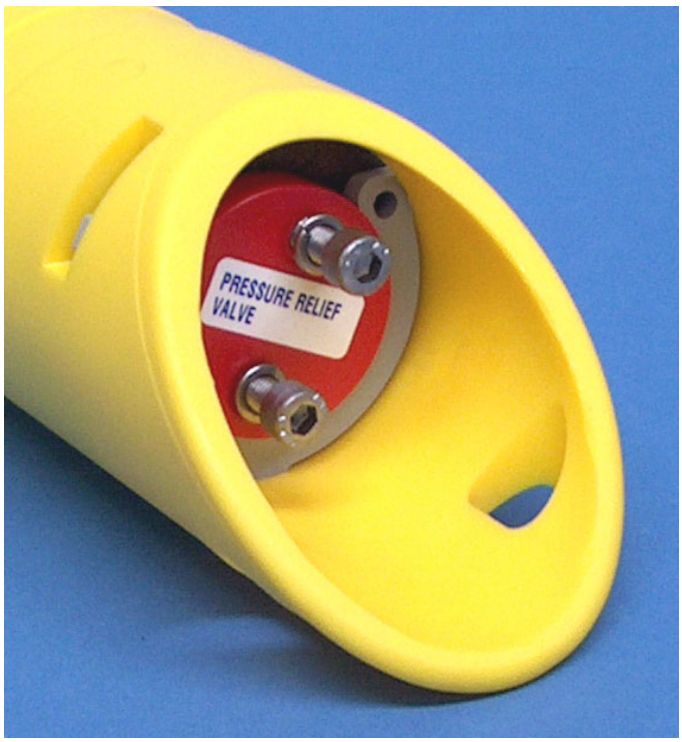
DO NOT TRANSPORT EQUIPMENT WHICH IS INTERNALLY PRESSURED

- **Sealed devices containing battery packs can produce dangerous high internal pressures. Treat all units with care and ensure all safety guidelines are followed.**
- **Wear protective clothing and glasses during dismantling.**
- **Ensure the transponder is pointed away from the body and face.**
- **Ensure that dismantling takes place in a well-ventilated area to prevent the inhalation of possible of harmful gasses.**

3.2 BATTERY CHANGING

The battery packs can be changed in the field without any specialist equipment. It is very important to ensure that a clean and dry environment is available when dismantling the unit.

Step 1



If the battery pack has failed or water has penetrated the internal housing the battery pack may vent gasses causing the build up of internal pressure.

The endcap contains an interlocked safety system that prevents the unit being opened unless all internal pressure has been released.

If the internal pressure is very high, the transducer endcap may have dislodged from the top of the yellow housing and so vented any large build up of gas.

If the unit is not functioning after recovery, you should be aware that it may be pressurised.

Carefully unscrew the two stainless steel M5 cap head screws in the bottom endcap and allow the red plate to float off the endcap. A 4mm Allen key is required.

Any low pressure build up of gas will be vented as the unit it taken apart, gasses being expelled from the circumference of the red plate.

As the screws are released the red plate releases the pressure on a face seal o-ring so venting any build up of pressure in the internal housing.

Step 2

Remove the screws and pressure relief plate.

Ensure the sealing surface (opposite side to the label), is not damaged during storage.

Ensure the o-ring remains in the o-ring groove in the endcap.

Step 3

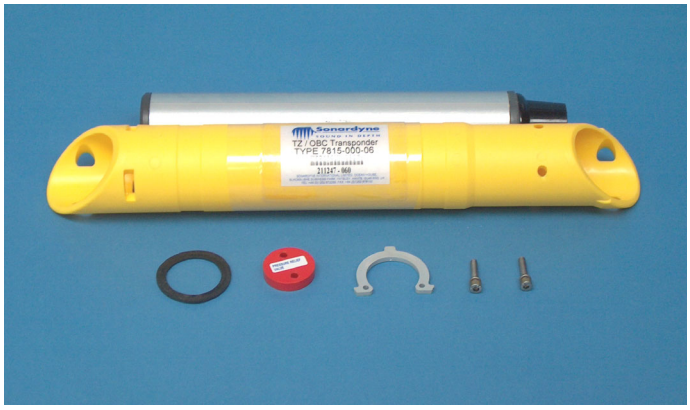
Using a pair of needle nosed pliers remove the grey clip from the rectangular slots in the yellow outer housing.

Now remove the flat rubber washer which is underneath the grey clip. Note this washer is not used for sealing; it is required for compression of the assembly only.

Step 4

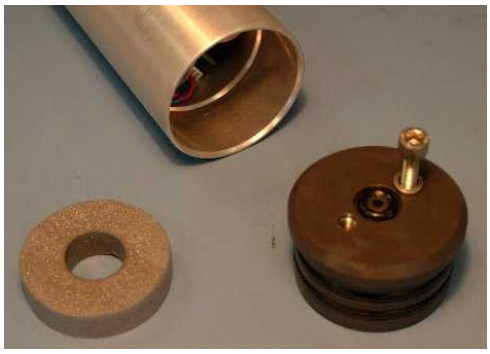
Push on the transducer to partially push out the inner housing assembly as shown. You can now see the anodised aluminium pressure housing.

Step 5 - Optional



If required for maintenance or inspection the complete inner assembly can be removed from the outer housing as shown. This is not necessary for battery replacement only.

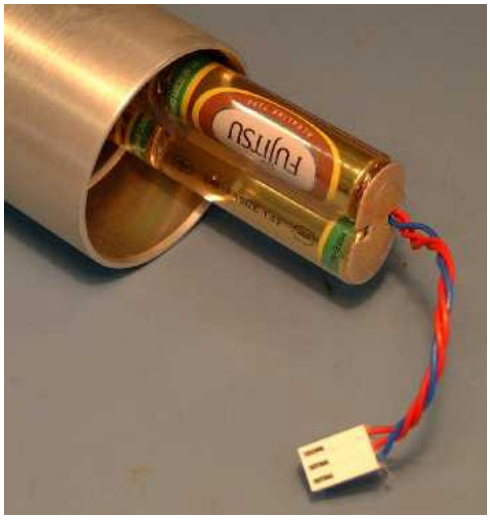
Step 6



Remove the endcap from the housing by twisting and pulling. Note that as shown one of the M5 screws can be used in the endcap to help grip the endcap during removal.

Remove the foam packing ring from the internal assembly to uncover the battery pack and connection onto the electronics.

Step 7



Using a pair of needle nosed pliers grip the battery connector (to the left of the electronics PCB with the PCB at the top) or wires and pull, so removing the old battery pack from the pressure housing.

Measure the voltage of the old battery pack, end of life is 9 volts.

Measure the voltage of the new battery pack, this should be >12.4volts.

Slide the new battery pack back into the pressure housing, ensure the battery pack does not jam against the transducer lead.

Using the needle nosed pliers reconnect the white molex connector onto the battery connector on the PCB (marked BATTERY). Ensure the connector 'snaps' in place.

Now immediately test the transponder on its programmed identity, ensure that an audible 'click' can be heard from the transducer and a beep from the programming unit. Press the BATTERY button to measure the battery voltage via the transponder.

Step 8

Carefully clean with tissue paper the inside sealing surface of the pressure housing. Inspect the sealing surface for scratches/damage – replace housing if corroded or damaged. Wipe with thin coat of Vaseline Petroleum Jelly or equivalent non-corrosive grease to aid assembly.

Carefully remove the o-rings from the bottom endcap – clean, inspect, replace and re-grease as necessary. Any damaged o-rings should be replaced. Carefully clean and inspect o-ring grooves in endcap. Endcaps with damaged o-ring grooves should be replaced.

Step 9

Retrace Steps 6 to 1 to re-assemble the transponder.

NOTE

Take particular care that you do not trap part of the flat rubber washer underneath the red vent plug as this will cause the unit to flood with water.

3.3 REPLACING TRANSDUCER AND PCB

Step A

From Step 7 in section above:

Remove the complete internal pressure housing assembly and remove the battery pack as shown.

Using a pair of needle nosed pliers remove the transducer lead connection (to the right of the electronics PCB with the PCB at the top) marked 'TRDR'.

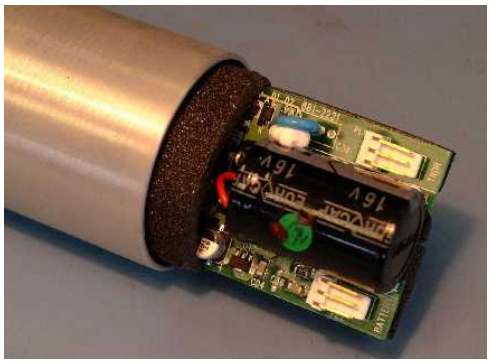
Step B

Carefully remove the transducer endcap by twisting and pulling.

Inspect for damage.

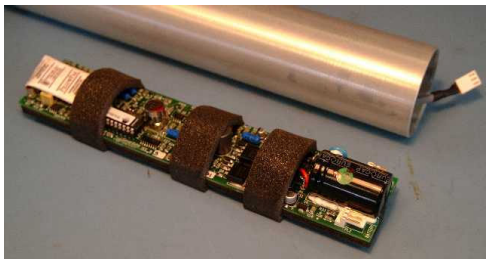
Carefully clean and inspect all o-rings and sealing surface for damage. If damaged replace o-rings / endcap.

Step C



Remove the foam packed PCB by carefully pushing the end of the PCB to expose past the end of the pressure housing.

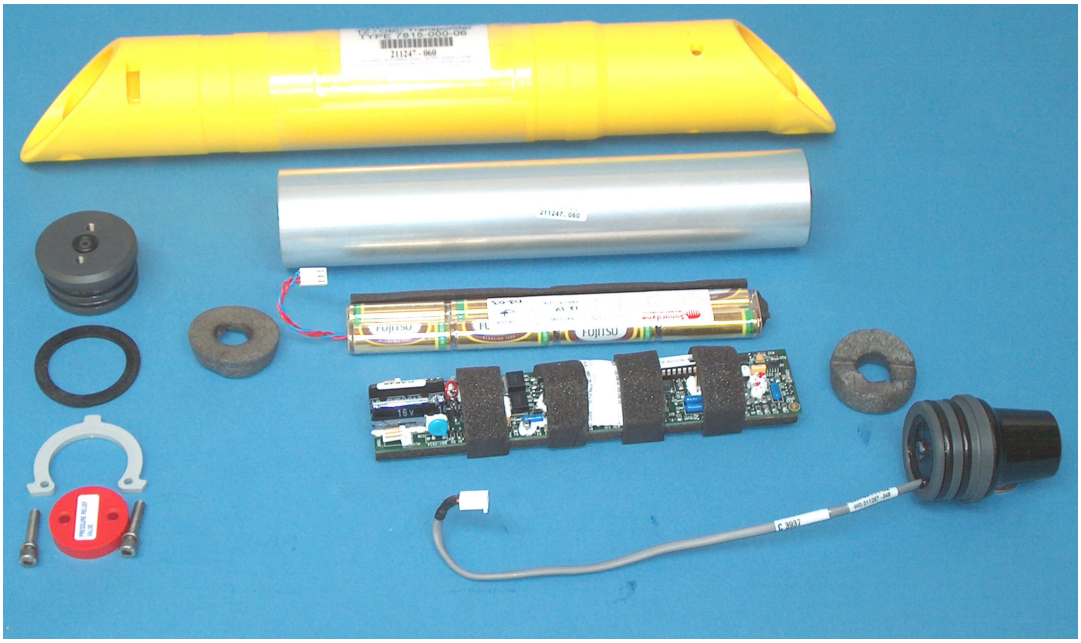
Step D



Grip the PCB and remove from the tube.

Note the white silica gel bag. If this is 'damp' then the PCB has been exposed to water/vapour and may be damaged. Check that the PCB has not been damaged by water ingress – check under the foam tape on the under side of the PCB.

Check that no components are damaged.



The picture above shows all the component parts of the Type 7815-000-06 transponder.

3.4 GENERAL MAINTENANCE

Periodically remove the inner transponder assembly to reveal the anodised aluminium pressure housing. Check for any signs of corrosion due to damage or pitting of the anodising. If corroded replace or clean with wire brush, de-grease and paint with etching primer and paint to protect area. Alternatively replace the housing.

Ensure that the transducer is visibly undamaged. Any significant damage to the polyurethane coating can cause a leakage path to the piezo electric ceramic causing acoustics failure of the transducer. Any leakage of water can also possibly enter the inner pressure housing through the transducer causing damage to the PCB.

Ensure that the transducer within the outer housing is free from mud, stones and importantly grease. These can all significantly degrade the acoustic performance. If the transducer is contaminated with grease clean and wash with a mild detergent.

Always wash down the unit with fresh water after use and prior to storage, thoroughly dry the all parts and store in cool dry conditions. This will minimise any long-term corrosion problems.

To maximise battery life in storage, battery packs can be disconnected prior to long periods in storage. Store in cool dry environment - high storage temperatures significantly increase the batteries self drain characteristics and therefore remaining life.

3.5 FAULT FINDING

3.5.1 Transducer

3.5.1.1 **Inspection**

Inspect the black PU coating of the transducer for signs for damage. Impact from sharp objects may penetrate the PU coating and allow water to penetrate the transducer.

Check the white connector for signs of corrosion deposits as these may effect the electrical connection to the transducer.

3.5.1.2 **Capacitance Test**

Using a multi-meter check that there is 7 to 8.5nF capacitance across pins 1-3 and 2-3.

3.5.1.3 **Inductance Test**

Using a multi-meter check that there is 0.9 to 1.1mH inductance across pins 1-2.

3.5.1.4 **Acoustic Test**

Note – The test loop operates by electro-statically coupling to the transponders transducer. Although this tests the transponders operation it does not test the actual acoustic output from the transponder and transducer. To do this a test transducer must be used or ensure that you can hear an audible 'click' as the transponder replies.

Plug the transponder's transducer into a working electronics PCB which has been programmed to a known identity. Plug in a working battery pack.

Plug the Type 7967 remote transducer into the programming/test unit and place the remote transducer on the bench a few inches from the transducer being tested.

Alternatively place the Type 7967 remote transducer in a small bucket of water and to test the transponders transducer dip the black PU coating of the transducer just below the surface of the water. Ensure that the water does not go above the o-ring grooves.

Press the TEST button on the Type 7967 programming/test unit.

The programming / test unit will send out an acoustic interrogation. If the interrogation is received the transponder will respond and this will be confirmed by a 'beep' and PASS displayed.

Check that when the transponder replies you can here an audible 'click' from the transducer.

3.5.2 Battery Pack

Check the connection within the battery pack and the integrity of the crimps within the Molex connector shell.

Check voltages across the 3-way Molex connector.

Pin Number	Voltage (Un-used)	Use	Notes
1	0	Ground	
2	>12.4	5 volt supply rail	
3	>12.4	12 volt supply rail	10 ohm in-line resistor

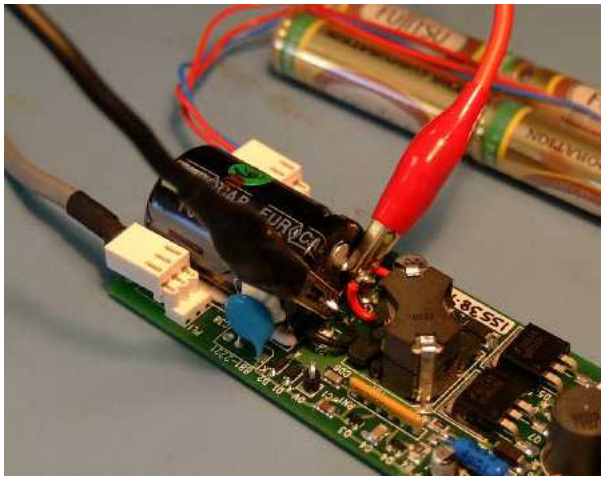
In-line with Pin 3 is a 10 ohm fusible resistor, this limits the recharge rate of the main reservoir capacitor C40. If the battery has been subject to damage or has been connected to a faulty PCB drawing high current then this may have fused causing the resistance to increase dramatically. This will have the effect of only very slowly recharging the reservoir capacitor, therefore the reply power will be lower and/or the transponder will only occasionally reply.

Check that there is 10 ohms between pins 2 and 3.

3.5.3 Electronics PCB

The following tests should be made with reference to 0 volts ground, this can be by attaching the voltmeter to the black wire of the main reservoir capacitor C40.

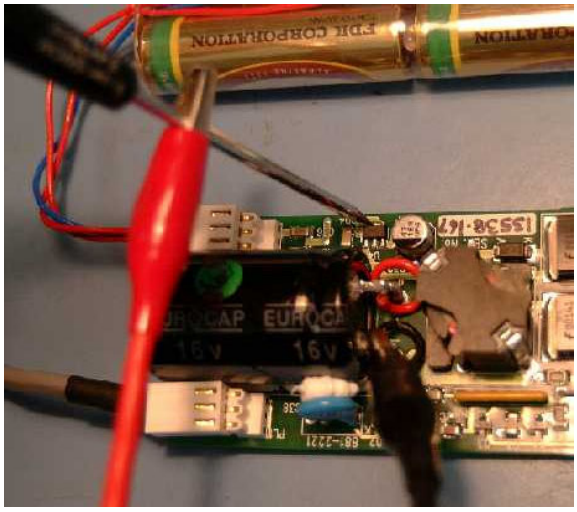
3.5.3.1 **Main Capacitor**



With a known good battery pack connected, check that there is 9-12 volts DC across the red and black wires soldered to the large black capacitor C40.

3.5.3.2 **5 Volt Rail**

The 5 volt rail is supplied by regulator U4.



Input : The input comes from the pin 2 of the battery connector. Check that the input voltage to the regulator is 9 to 12.5 volts (battery pack voltage). This can be checked on directly on the regulator as shown below.

Output : The output from the regulator should be 5 +/-0.2 volts DC. Check the 5 volt output directly on the micro-controller, U3 pin 24 as shown below.

3.5.3.3 **Turn Around Time (TAT)**

Ensure that the test loop in connector tightly around the middle of the black transducer (not around the yellow housing as this can give erroneous results).

The TAT should be 300ms. If the TAT is correct then the programming / test unit will display PASS.

If the TAT is slightly incorrect but the reply is received then the display will show 0.6, 0.7m etc.

The TAT can be reset by carefully adjusting the variable resistor RV5 until PASS is displayed on the display. The maximum adjustment that should be necessary is 2 to 3 turns anticlockwise.

SECTION 4

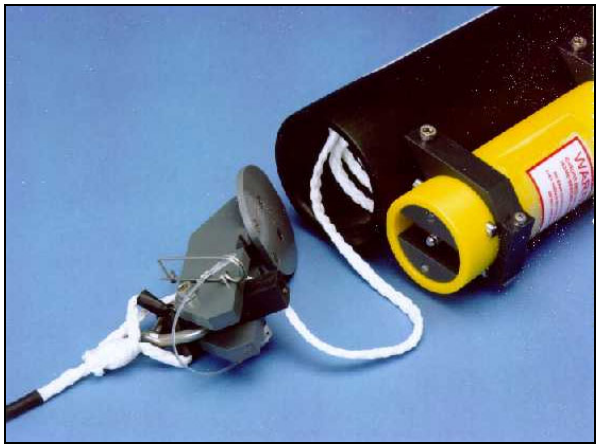
4. TYPE 7986 LRT

The Type 7986 Lightweight Release Transponder (LRT) is compatible with the TZ/OBC transponders. It can be positioned by the same surface system and released by the programming and test unit with remote transducer.

The LRTs can and have been used to recover cable section without the use of surface buoys.

An optional rope canister is available that holds 75m of high strength (1200kg) rope.

Type 7967-000-02 Programming/Test Unit with remote transducer
Type 7986 LRT, Type 7986-009 Rope Canister and 2 flotation buoys



Above picture shows the assembly after the release mechanism has actuated, allowing the rope to spool out of the canister.

SECTION 5

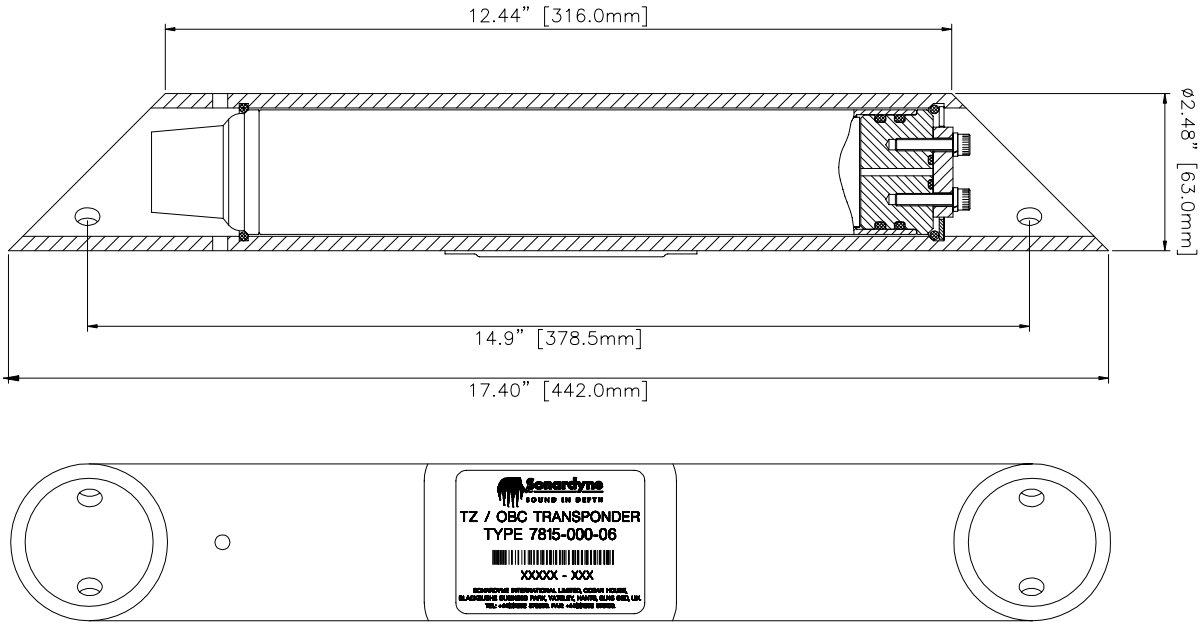
5. SPECIFICATIONS

5.1 7815-000-06 SPECIFICATIONS

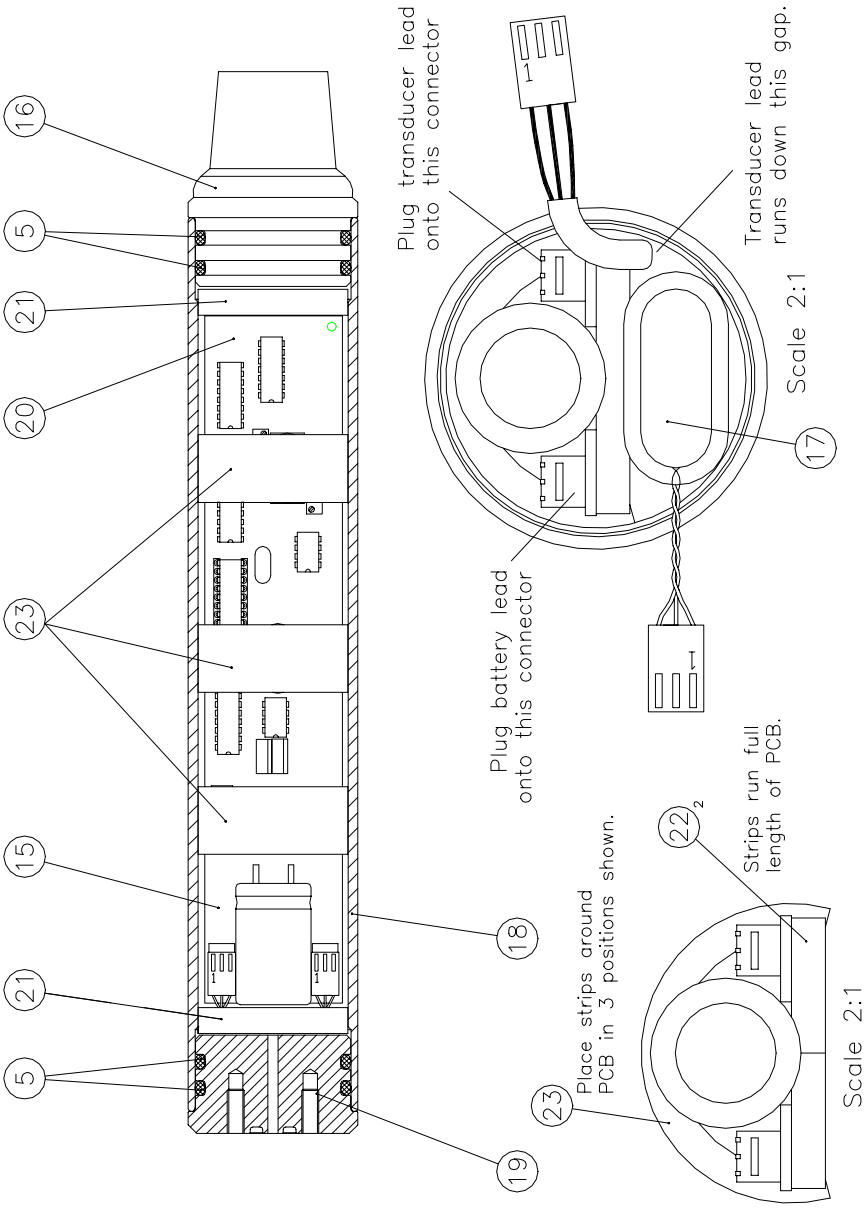
Size	63mm (2.48")Dia x 442mm (17.4") Long
Weight in air	1.1 kg
Weight in Water	0.75 kg
Depth Rating	500 metres
Construction Materials	Plastics / Aluminium Alloy (anodised)
Frequency Band	35 to 50 kHz
Source Level	184-187 dB re 1uPa @ 1 metre
Receiver Sensitivity	105-115 dB re 1uPa @ 1 metre
MAX Acoustic Range	750 to 1500 meters – Dependent on acoustic environment : Water depth / topography / ambient environmental noise / vessel noise.
MAX Listening Life	Alkaline pack = 18-24 months Listening. Typical life of 12-14 months with full OBS operational use.
Switch-on	Continuously listening
Interrogation Address	Programmable to 1 of 401
Reply Frequency/Code	Programmable to 1 of 9 (3609 Unique Identities)

SECTION 6

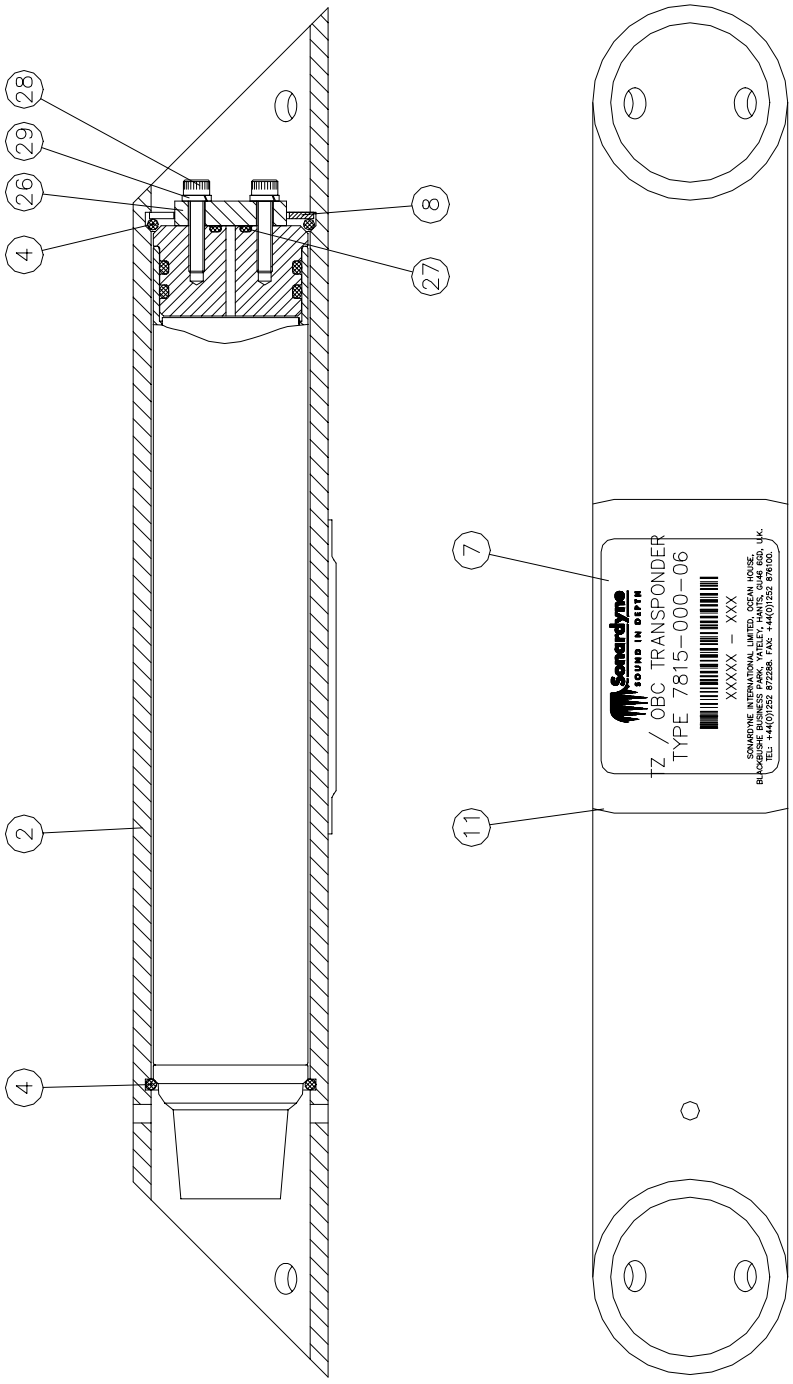
6. DRAWINGS



7815-000-06 Outline Drawing



7815-000-06 Inner-Assembly



7815-000-06 Outer-Assembly

SECTION 7

7. PARTS LIST

7.1 7815-000-06

Item #	CPN	Drawing #	Description	Qty
2	710-2542	7815-130	Outer Housing -Yellow Polypropylene COP	1
5	200-2223	/	O-ring seal 200-222-5570	4
7	950-0873	/	Housing Label	1
8	890-4523	7815-131	Internal Clip – Grey Plastic	1
11	950-0941	/	Label over-laminate	1
15	631-5931	7815-048	Electronics PCB	1
16	641-1824	7815-055	Transducer Assembly	1
17	641-0795	7815-044	Alkaline Battery Pack	1
18	710-2347	7815-051	Inner Housing – Aluminium Alloy Anodised	1
19	700-4718	7815-050-02	Bottom Endcap	1
20	925-002C	/	Silica Gel Bag	1
21	730-3702	7815-019	Foam packing tube	2
22	730-3726	7815-020	Foam strip 5mm thick – large	2
23	730-3737	7815-023	Foam strip 5mm thick – small	3
26	800-5182	7815-053	Pressure vent plate - red PVC plastic	1
27	200-1080	/	O-ring seal 200-108-5570	1
28	212-0826	/	Screw socket cap S/S M5x25mm	2
29	230-1297	/	Spring washer S/S M5	2

APPENDIX A

A. ADDRESS FREQUENCY GROUP CONVERSION TABLE

Sonardyne's Type 7797 Homer-Pro and Type 7832 ROV-Homer systems operator with a shorten form of the acoustic identities that the Type 7986 LRT and Type 7815 transponders operate on. There are also fewer acoustic identities available to the Homer systems, see the conversion table below.

A.1 HOMER-PRO AND ROV-HOMER ADDRESS/FREQUENCY CONVERSION TABLE

Homer-Pro ROV-Homer IDs	Address	Reply Frequency Code
10	004	1
11	005	1
12	006	1
13	007	1
14	008	1
15	009	1
16	010	1
17	011	1
18	012	1
19	013	1
20	004	2
21	005	2
22	006	2
23	007	2
24	008	2
25	009	2
26	010	2
27	011	2
28	012	2
29	013	2
30	004	3
31	005	3
32	006	3
33	007	3
34	008	3
35	009	3
36	010	3
37	011	3

Homer-Pro ROV-Homer IDs	Address	Reply Frequency Code
38	012	3
39	013	3
40	004	4
41	005	4
42	006	4
43	007	4
44	008	4
45	009	4
46	010	4
47	011	4
48	012	4
49	013	4
50	004	5
51	005	5
52	006	5
53	007	5
54	008	5
55	009	5
56	010	5
57	011	5
58	012	5
59	013	5
60	004	6
61	005	6
62	006	6
63	007	6
64	008	6
65	009	6

Homer-Pro ROV-Homer IDs	Address	Reply Frequency Code
66	010	6
67	011	6
68	012	6
69	013	6
70	004	7
71	005	7
72	006	7
73	007	7
74	008	7
75	009	7
76	010	7
77	011	7
78	012	7
79	013	7
80	004	8
81	005	8
82	006	8

Homer-Pro ROV-Homer IDs	Address	Reply Frequency Code
83	007	8
84	008	8
85	009	8
86	010	8
87	011	8
88	012	8
89	013	8
90	004	9
91	005	9
92	006	9
93	007	9
94	008	9
95	009	9
96	010	9
97	011	9
98	012	9
99	013	9