

SM-7832

System Manual for Type 7832 ROV-Homer System (4,000m)

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SM-7832
INSTALLATION AND OPERATION MANUAL
FOR THE
ROV-HOMER SYSTEM

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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	09.08.95	09.08.95	All	All
A	1	25.01.96	Additions for RS422, firmware changes and specification changes	All	All
B	0	08.04.97	Corrections + changes for new 7815 Transponder		
C	0	10.04.97	Inclusion of Maintenance section	8	10

SECTION 1

1. NATURE AND PURPOSE OF THE SYSTEM

The System consists of three parts:

a. Type 7832 ROV Unit

This is a cylindrical unit, manufactured from Duplex Stainless Steel rated to 4000 metres water depth or HE30 Aluminium Alloy rated to 3000 metres and is mounted on the ROV, with electrical connections to the Surface Control Unit via the ROV's multiplexer (if available) and umbilical. The ROV unit is supplied with 12 to 24 volts DC power from the ROV. Under surface control, the ROV unit interrogates a selected HF Miniature Transponder and measures its slant range, and indicates to the pilot via the surface control unit, the direction to turn in order to guide the ROV towards the selected Transponder.

b. The Surface Control Unit

This is mounted on board the ship, near to the ROV pilot. It is connected via the umbilical to the ROV unit and is used to select the desired Transponder for interrogation. The Surface Control Unit displays the slant range, and whether the Transponder is to the right or left of the direction in which the ROV is heading.

c. Type 7815 or 7835 Miniature Marker Transponders

Up to 89 of these units may be deployed on the seabed within a small area, for marking seabed locations, each transponder is individually identified and interrogated by the ROV-HOMER system. The Type 7815 and 7835 Transponders have depth ratings of 400 metres and 4000 metres respectively. The system can be set-up to interrogate additional transponders (up to 207) if required.

SECTION 2

2. MOUNTING THE TYPE 7832 ROV UNIT ON THE ROV

- 2.1 The unit should be mounted at the front of the ROV, with the black plastic face of the red Transducer Endcap facing forwards. The central axis of the cylindrical housing should be aligned parallel with the ROV's fore-aft axis as accurately as possible. The axis of the Homer's cylindrical housing should be approximately horizontal, but may be pointed downwards towards Transponders mounted at seabed level, to improve range performance when the ROV is high above the seabed. The index mark on the Transducer Endcap should be at the 12 o'clock position in order to sense direction correctly (a 0.1 inch plate can be placed into this slot to improve rotational alignment).
- 2.2 ROV's tend to generate considerable acoustic noise over a wide frequency band. The ROV unit has good directional discrimination against noise arriving through the water from behind it. However, noise from hydraulic pumps and spool valves can give problems if conducted through the ROV's structure into the unit's body. Therefore, the Aluminium Alloy or Stainless Steel body of the unit should be insulated from the structure of the ROV by rubber wrapped around the housing under the clamp. If the ROV is likely to undergo severe shock, for example on landing on deck in heavy seas, then the Homer unit should be shock mounted.
- 2.3 If the ROV's acoustic noise should reduce the slant range achievable with the Miniature Marker Transponders, some form of acoustic shielding may prove effective. Syntactic foam can attenuate sound at depths down to a few hundred metres, but the deeper-rated syntactic materials appear to be almost perfectly transparent to sound. If the unit is mounted above the buoyancy, it may attenuate the noise sufficiently to improve performance by a useful margin. However, it is suggested that a mounting position be chosen for operator convenience as a first attempt, rather than for ultimate acoustic performance.

SECTION 3

3. ELECTRICAL INTERFACE BETWEEN THE ROV UNIT AND THE ROV

- 3.1 The ROV-HOMER system as standard supports RS232 communications. An option of half-duplex RS422 communications protocols is available on order. On larger ROVs where communication up the umbilical is controlled by an communications multiplexer then RS232 coms. can/should be used. If no multiplexer is available then RS232 is only capable of driving approx. 100 metres max. of high quality cable. Therefore on smaller ROVs it may be necessary to use RS422 communications.

The ROV-HOMER system provides a bi-directional data interface between the ROV unit and Surface Display unit. The ROV unit's acoustic circuits are designed to be galvanically isolated from the ROV's electrical system, this is in order to minimise the likelihood of electrical noise on the ROV's communications and power supply systems affecting the systems acoustic performance. This isolation is achieved by 2 separate DC-DC converters within the ROV unit's housing, providing separate isolated power supplies for the RS232 interface and the acoustic circuits, and with 2 opto-isolated data interfaces.

A "Sea Connections Systems LTD" 5-pin female bulkhead underwater connector, Model AWL - 5S - BC W/7/16 - 20, is fitted on the rear endcap of the ROV unit. A mating plug, Model AWL - 5 - MP and dummy plug, Model AWL - 5 - MPD are provided. The customer must make the connection from the mating plug into the ROV's communication port and stabilised DC power port. The pin allocations are as follows:-

3.2 RS232 Communications Interface

Connect or Pin Number	Wire Colour	Description
Pin 1	White	DC Power Input +12VDC to +24VDC at 100mA max to be supplied by the ROV
Pin 2	Black	DC Power Common
Pin 3	Green	RS232 Data output from the ROV unit to surface
Pin 4	Red	RS232 Data input for control of the ROV unit from the surface via the ROV's umbilical comms
Pin 5	Orange	Data common. This may be optionally connected to Power common or preferably kept separate according to what suits the ROV comms. system

3.3 RS422 Communications Interface

Connector Pin Number	Wire Colour	Description
Pin 1	White	DC Power Input +12VDC to +24VDC at 100mA max to be supplied by the ROV
Pin 2	Black	DC Power Common
Pin 3	Green	RS422 - A Differential bus
Pin 4	Red	RS422 - B Differential bus
Pin 5	Orange	Data common. This may be optionally connected to Power common or preferably kept separate according to what suits the ROV comms system

SECTION 4

4. SURFACE CONTROL UNIT

4.1 The unit incorporates a keypad and LCD display for selection of the Transponder to be 'homed' into. Any Transponder is interrogated on one of 23 different "Addresses" and each can reply on one of 9 separate reply frequencies. The Addresses and frequencies of the transponder are set up in a programming operation, which can be carried out in the field with extra equipment, but is normally factory programmed, as there is no need to change the identity.

4.2 When the operator has selected the required "Transponder Number" or identity, i.e. the number printed on the housing of the Transponder which defines the address and reply frequency, the Surface Control Unit repetitively sends out interrogation instructions as an ASCII message via the data interface and the umbilical to the ROV unit. The slant range and direction information is sent back up the umbilical and enters the Surface Control Unit via the RS232/422 interface. The information is then displayed on the LCD display for use by the ROV pilot.

The ASCII Interface Protocol of the ROV-HOMER system is available from Sonardyne so that the system be incorporated into the customers ROV software control system. This will then automatically allow the range and direction information to be incorporated onto ROV pilot displays.

4.3 Surface Control Unit Connections

The Surface Control Unit has either 1 or 2 electrical cables emerging from the box depending on which model it is. The later model has one cable with 4 wires and a screen and supports both RS232 and 422, where as the earlier version has two cables and supports only RS232.

Old two cable version:-

The upper cable is the power cable and the connections are:-

<u>Wire Colour</u>	<u>Function</u>
Red	+9 volts DC to +36 volts DC stabilised power
Blue	Power common

The lower cable is the data cable and the connections are:-

<u>Wire Colour</u>	<u>Function</u>
Red	RS232 data-out to ROV unit
Blue	RS232 data-in from ROV unit
Screen	Data common - 0 volts

Current one cable version:-

<u>Wire Colour</u>	<u>Function</u>
Red	+12 volts to 24 volts DC
Black	Power common
Yellow	RS232 data-out to ROV unit or RS422 - A.
Green	RS232 data-in from ROV unit or RS422 - B
Screen	Data common - 0 volts

Note that there is no isolation similar to that in the ROV unit since a clean electrical environment is expected in the ROV control cabin.

SECTION 5

5. OPERATION

5.1 START-UP

Once the system has been installed with DC power and communication available to both the ROV unit and surface display unit, then the surface display can be switched on by pressing the ON button on the membrane keypad on the front panel. The following messages will be displayed on the 1*20 character alphanumeric display:-

SONARDYNE ROV HOMER

delay - 2 second

ROM ver X.XX

delay - 2 second

ENTER TPDR 10 to 99

The message prompts you to input the number of the HF Miniature Transponder you wish to locate - ie. for transponder 10, (channel 1 address 0) type 10 followed by ENTER on the membrane keypad.

The surface unit now quickly runs through the function key operations:-

<A> change CONTRAST

delay 2 seconds

** change BACKLIGHT**

delay 2 seconds

<C> change TPDR No.

delay 2 seconds

<D> change INTERVAL

delay 2 seconds

The surface unit will now send down the interrogation address and reply frequency to the Homer unit which will send out interrogations. If there is a fault with the communications to the ROV unit through the umbilical etc. then the unit will display a Comms Error message. If this happens the communication line should be carefully checked. Ensure that the wires are connected the right way around, RS232 OUT from the ROV unit to RS232 IN on the Surface Control unit.

TPDR10 * Comms Error

If the surface unit has communications with the ROV unit but there are no replies from the transponder selected then NO REPLY will be displayed.

TPDR10 NO REPLY

If replies are received from the transponders then the following typical information will be displayed:- Interrogating transponder 10 on address 0 reply frequency 1, reply received, slant range 178.6 metres, steer left to come on track towards transponder. The “*” and the “φ.” symbol alternate to show that interrogation commands are being sent from the surface unit.

TPDR10 * 178.6 m <<--

Interrogating transponder 11 on address 1 reply frequency 1, reply received, slant range 90.2 metres, steer right to come on track towards transponder.

TPDR11 * 90.2 m -->>

Interrogating transponder 22 on address 2 reply frequency 2, reply received, slant range 78.7 metres, straight ahead - on track towards transponder.

TPDR22 * 78.7 m ||

5.2 FUNCTION KEYS:-

To alter the set-up during navigation, the function keys A to F can be used:-

“A” for Angle - this controls the display contrast angle. Pressing function key A will prompt the following message:-

USE <ENTER> TO RETRN

delay 1 second

CONTRAST USE 8 & 9

8 equals down, 9 equals up to change the contrast angle, press ENTER at desired level to store value.

“B” for Brightness - this controls the LED backlight illumination level. There are eight levels of illumination for operation in different ambient light level environments. Pressing function key B will prompt the following message:-

USE <ENTER> TO RETRN

delay 1 second

B`LIGHT 8 dec 9 inc

8 equals down, 9 equals up to change the brightness level, press ENTER at desired level to store value. On power up the unit will reset to a medium brightness.

“**C**” for Channel - this allows the operator to select the transponder to interrogate. Pressing function key C will prompt the following message:-

USE <ENTER> TO RETRN

delay 1 second

ENTER TPDR 10 TO 99

Enter the number of the transponder (TPDR) you wish to interrogate and press ENTER> The surface unit will then resume navigation towards the selected transponder.

“**D**” for Delay - this allows the operator to change the interrogation interval. Pressing function key C will prompt the following message:-

USE <ENTER> TO RETRN

delay 1 second

1.5s INTVAL Use 8&9

Use the up and down arrows to change the interrogation interval from 1 to 2.5 seconds. The longer the interrogation interval, the longer the batteries in the transponders will last. Note - that when set to 1 second interval, the NO REPLY message will not appear although ranges will, this is due to timing constraints in firmware.

SECTION 6

6. DEPLOYMENT OF TRANSPONDERS

Adequate range may be obtained by simply laying the transponders on the seabed. However range will be much improved by elevating the transponders above the seabed on syntactic foam, glass-sphere flotation or static frames, with the black transducer end vertically upwards. What is operationally satisfactory will have to be determined by experimenting with different transponder and flotation configurations, in different environments. If the topography of a very rocky seabed is so difficult that an acoustic path to the transponders is hard to achieve, then the short-range performance can be improved by flying the ROV slightly higher off the seabed.

On recovery from the water the transponders should be washed in fresh water and areas of corrosion cleaned up and protected with epoxy or paint. If the units are left for long periods as permanent markers, then the galvanic protection may be required.

SECTION 7

7. TESTING

The ROV-HOMER system can achieve ranges of upto 700 metres or more, depending on the environment and ambient noise level of the particular ROV. If poor ranges are achieved then check the battery replacement date of the transponder and if necessary open the transponder to test or replace the battery. See Maintenance section for Transponder battery replacement.

The system can be checked in air by connecting the system up and interrogating a transponder held near the ROV unit, the display unit should display the range from the transponder to the ROV-HOMER in air up to about 0.3 - 0.4 metres or more away. Note that the range is longer than actual due the difference in speed of sound in water and air.

If the system is to be used for accurate distance measurement then there are a few useful "calibration" techniques that can be used:-

- i. The system may have a positive offset, i.e. when a transponder is next to the ROV unit the range displayed shows a positive value rather than zero (e.g. 0.3m). This offset can be found by separating the transponder and ROV unit by a fixed known distance of 3-6 metres and sampling the range displayed. Take the average value of the sample and calculate the offset.

Note: Try not to physically connect the transponder and ROV unit as the acoustics will 'couple' through the structure and effect the offset calculated.

- ii. Over larger distances changes in Speed of Sound in seawater may need to be accounted for. The ROV units calculate distances based on a fixed Speed of Sound of 1500m/s.

SECTION 8

8. MAINTENANCE

8.1 ROV Unit

The ROV units require little maintenance. Ensure that the 5-pin power and communication connector is free from corrosion. Use Vaseline on connector pins to easy insertion and protect from corrosion. Do not immerse ROV unit if connector is open i.e. cable not connected. Ensure a dummy plug is inserted if immersed and the cable not attached.

All other maintenance should be carried out by Sonardyne engineers only.

8.2 Type 7815 Transponder

Ensure transducer (black end) if free from grease and dirty. Clean with soapy water and cloth.

8.3 Battery Replacement.

Replacement battery packs are available from Sonardyne International.

Note: RFID tag is used for automatic identification of transponder identity.

Carefully unscrew M8 Nylon or Stainless bolt and black RFID tag (if fitted). Do not separate RF tag from the transponder as this hold the transponders identity. Remove first stage endcap. Now remove first stage o-ring (DOWTY size 326), CAUTION, do not damage sealing surfaces of plastic endcaps. If necessary use a plastic implement to remove o-ring NOT metal. Screw bolt into second stage endcap and use as handle to pull out the second stage endcap and o-ring (DOWTY size 222).

Now remove foam pad from inside pressure housing. Looking into end of the transponder with the electronics PCB at the top, remove the left-hand side Molex connector (red and blue wires) from PCB. It may be necessary to use a pair of long nosed pliers for this. CAUTION, do not damage the inside sealing area of pressure housing. Pull out battery pack. Replace new battery pack in same orientation and re-connect white Molex connector. Replace foam pad and second stage endcap - ensure o-rings are undamaged and free from dirt.

Replace any o-rings that are damaged, remove and clean o-rings that are dirty. DO NOT Vaseline any o-rings.

Push second stage endcap home and while holding in place insert first stage o-ring and push into place. Insert first stage endcap, RFID tag and turn and tighten screw.

Now re-program RFID tag with new battery date - store in page 5 of tag.

Now test transponder using either the Type 7009-410 Test/Program Box and Type 7343 ANT or system Transceiver.

SECTION 9

9. SPECIFICATIONS

TABLE 9.1 - 400M VERSION MARKER TRANSPONDER, SPECIFICATIONS

Type 7815 Miniature Marker Transponder - 400 metre version	
Size	63mm Dia * 440mm Long
Weight in air	1.6 kg
Weight in Water	0.95 kg
Depth Rating	400 metres
Materials of Construction	Plastics
Source Level	185 dB re 1uPa at 1 metre
Frequency Band	35 to 55 kHz
MAX Listening Life	2 years Alkaline 3 years Standard Lithium 4.5 years Long-Life Lithium
Switch -on	Continuously listening
Interrogation Mode	Sequential
Interrogation Address	Programmable to 1 of 23
Reply Frequency	Programmable to 1 of 9

TABLE 9.2 - 4000M VERSION MARKER TRANSPONDER, SPECIFICATIONS

Type 7835 Deep Miniature Marker Transponder - 4000 metre version	
Size	64mm Dia * 343mm Long (2.5a * 13.5)
Weight in air	1.9 kg
Weight in Water	1.2 kg
Depth Rating	4000 metres
Materials of Construction	Aluminium Alloy (HE30), and plastics
Source Level	185 dB re 1uPa at 1 metre
Frequency Band	35 to 55 kHz
MAX Listening Life	2 years Alkaline 3 years Standard Lithium 4.5 years Long-Life Lithium
Switch -on	Continuously listening
Interrogation Mode	Sequential
Interrogation Address	Programmable to 1 of 23
Reply Frequency	Programmable to 1 of 9

TABLE 9.3 - 4000M ROV UNIT SPECIFICATION

Type 7832 ROV-Homer - 3000 / 4000 metre version	
Size	72mm Dia * 330mm Long
Weight in air	3.96 kg Duplex Stainless Steel 2.4 kg HE30 Aluminium Alloy
Weight in Water	2.57 kg Duplex Stainless Steel 1.5 kg HE30 Aluminium Alloy
Depth Rating	4000 metres Duplex Stainless Steel 3000 metres HE30 Aluminium Alloy
Materials of Construction	Stainless Steel / HE30 and plastics
Source Level	190 dB re 1uPa at 1 metre
Frequency Band	35 to 55 kHz
Listening Life	Continuous when powered from ROV
Number of replies	Infinite
Switch-On	Continuously operating
Direction Indication	Standard AHEAD sector 10 degrees wide LEFT / RIGHT indicated outside sector
Range resolution	~ 0.1 metre

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