

RBS-100 & RBS-101

Listening Stations

Technical Reference Manual



Rev. 1
October 2006
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1. INTRODUCTION TO THE RBS-100/101	3
2. UNPACKING.....	4
3. PREPARATIONS FOR OPERATION	5
3.1 Configuring and Operating The Listening Stations	6
4. RBS-100/RBS-101 CONNECTORS.....	7
5. LISTENING STATION MAINTENANCE	8
6. RBS-100/101 SPECIFICATIONS	9

1. Introduction To The RBS-100/101

The RBS-100/101 are broadband listening stations designed for use with the RangeNav system. They both gather ping information and send that to the surface station via the RS-485 copper based RPD cable. The difference between the two is that the RBS-101 also has the ability to record raw acoustic data on an internal CF FLASH card (1 GB standard and 8 GB optional). Stored acoustic data can then be uploaded to the PC as bandwidth is available. Though you do have the capability to send the raw acoustic data straight to the PC, these data are treated as lower priority by the system (to maintain tracking capabilities at all times) and uninterrupted real-time transmissions may not be possible.

The RBS-100/102 listening stations are linked in a daisy-chain fashion, with up to one hundred stations per chain. The maximum supported chain length is twenty nautical miles if they are spaced in 1km intervals. In the future, the support of multiple chains by RangeNav™ will extend coverage up to a 20nm x 20nm.

The listening stations receive acoustic signals from the pingers of the targets to be tracked through the broadband hydrophone. A combined hydrophone and transmit transducer assembly is attached to the listening stations for this purpose. The attachment is by a 1.2m cable, and a flotation sphere allows the transducer to float above the listening station on the sea floor for better reception of acoustic signals. The listening stations filter and process all acoustic data using their powerful on-board digital signal processor (DSP). Processing is done per instructions from the surface station, and the stations need only report brief 'ping descriptor packages' via the cabled link to the surface. On-board signal processing greatly reduces the amount of data that needs to be transmitted to the surface station, thus allowing RangeNav™ to rely on inexpensive and rugged copper cables as compared to the expensive fiber & copper technology used by many tracking ranges. At the same time, the on-station processing greatly reduces the performance requirements of the surface station, allowing a powerful PC to perform that job. Overall, a RangeNav™ system with its distributed and DSP powered listening stations can be considered a networked supercomputer for acoustic signal processing under the sea.

The stations also include an array self-survey capability. They simply use their acoustic transmitter and transducer, which operate at 16kHz-24kHz, to measure distances among station pairs. Each station is also equipped with a pressure sensor of 500 PSIA, supporting their 300m depth rating while reading station depth with an accuracy of 0.3m. The stations run at 50/60Hz AC power and are factory configured along with the STM-100 surface station junction box to operate at 880VAC or 440VAC. The lower voltage (440VAC) is the safest solution when tracking targets in an area where human contact is a possibility. The 880VAC option provides greater range.

2. Unpacking

Please ensure that your shipment does contain these components.

RBS-100/101 Component List

- RBS-100 or RBS-101 Remote Baseline Station
- Hydrophone assembly with cable
- Metal strong-back
- Two stainless shackles for securing the strain relief system
- Two 5lb lead weights
- Two rubber pieces (works as washer between RBS and strong-back)
- Two hose clamps
- One trawl float, providing 3.8lb flotation for the hydrophone assembly.

Table 1: Components List

If a shipment is incomplete, please immediately contact Desert Star Systems. If you are missing any components required for system operation, obtain these components before proceeding.



Figure 1: Listening Station and STM-100 with Hydrophones

3. Preparations For Operation

Follow these steps to get the listening station ready for operation.

- Unpack the baseline station and make sure you've got all the parts.
- Run a system test on the stations prior to deployment by wiring them up and operating on shore.
- Mount the metal strong-back, fasteners, and weights.
- Attach the Hydrophone with its cable and trawl float.
- Activate and deploy the baseline station.

Refer to the RangeNav™ Operator's Manual for detailed instructions of connecting the listening stations.

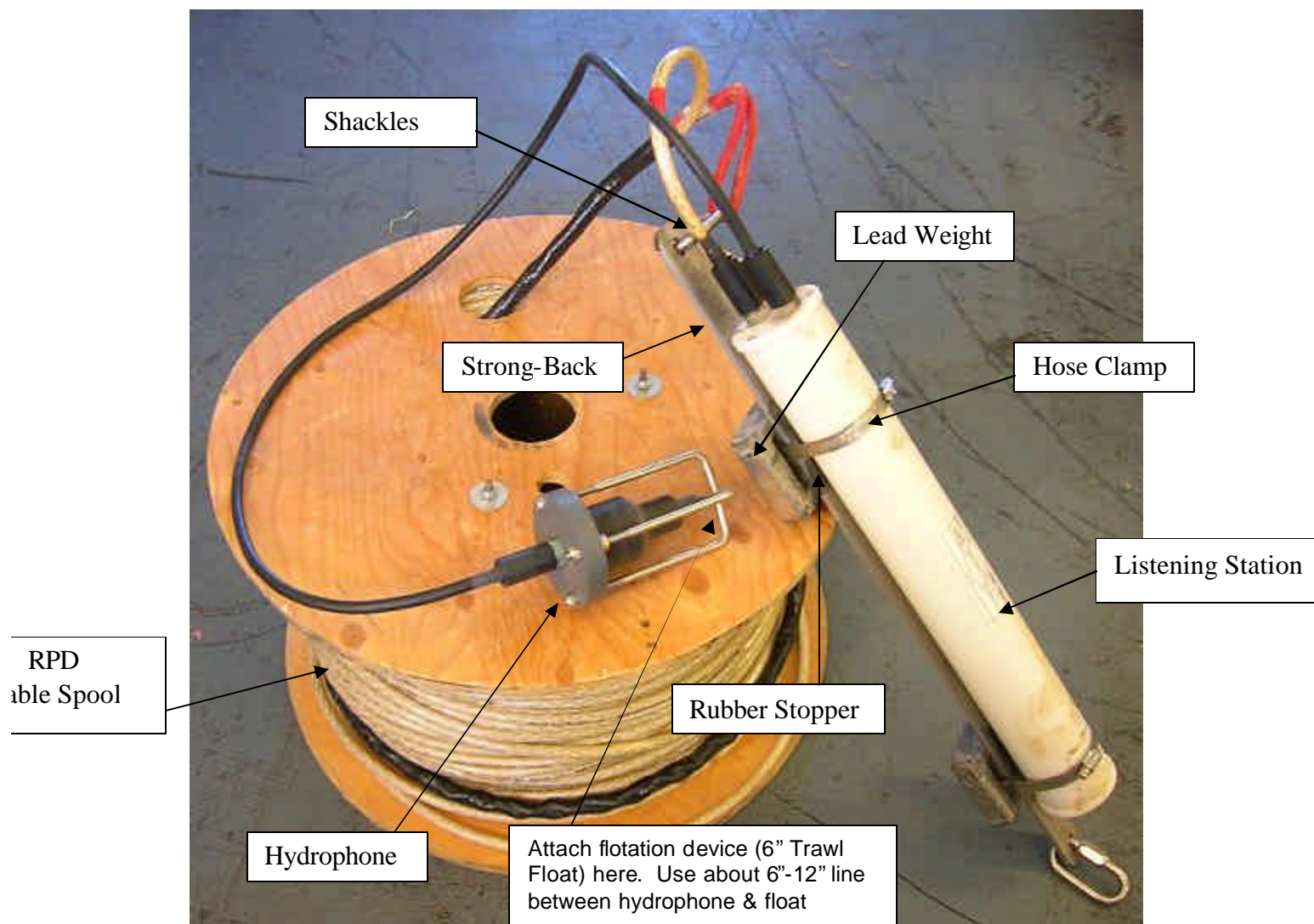


Figure 2: Listening station components

3.1 Configuring and Operating The Listening Stations

The listening stations are configured by the surface station to perform specific operations such as the detection and decoding of pinger signals or array survey functions. The surface station also directs the power-up sequence and guides firmware update downloads to the array. Please refer to the RangeNav™ Operator's Manual for details.

4. RBS-100/RBS-101 Connectors

The listening stations are equipped with three connectors:

1. The upstream data & power connector links the listening station via a section of RPD cable to the next station upstream, i.e. closer to the surface station. This connector receives power and it is therefore (for electric hazard safety purposes) male. The connector has six pins and is a SEACON model MCBH6M.
2. The downstream data & power connector links the listening station via a section of RPD cable to the next station downstream, i.e. closer to the end of the chain. This connector transmits power and it is therefore (for electric hazard safety purposes) female. The connector has six pins and is a SEACON model MCBH6F.
3. The hydrophone connector links the listening station via a 1.2m cable to its combined hydrophone and transmit transducer unit. This connector carries the supply voltage for the hydrophone pre-amplifier, the hydrophone signal and the transmit sonar transducer driver signal. The female connector has four pins and is a SEACON model MCBH4F.

The following diagrams provide the pin assignment of the connectors.

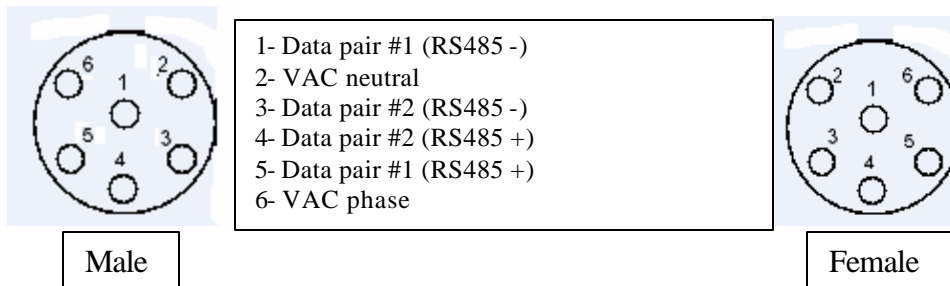


Figure 3: Data/Power Cable Connectors

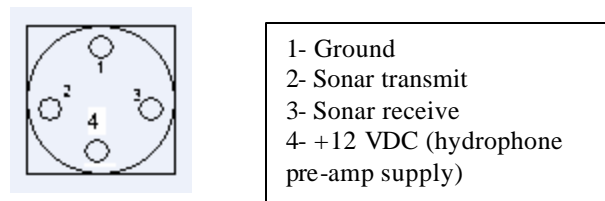


Figure 4: Hydrophone Connector

5. Listening Station Maintenance

Your RBS-100/101 is a rugged instrument that requires only little maintenance. However, please do observe the following points to ensure long and proper operation.

- Rinse the instrument with fresh water after each deployment. Pay special attention to the area around the connectors and transducers on the end caps. The transducers, connectors, screws, mounting ring, and other hardware are brass and stainless steel. Even though the housing is of Derlin plastic, some corrosion may still occur at the points where the metal meets the plastic if the station is not cared for properly. This corrosion can be minimized through proper rinsing and drying. Corrosion around this area will rarely be severe enough to affect operation. It may however be a cosmetic consideration.
- Make sure that debris does not block the hole in the depth sensor on the connector end cap. If this should happen, rinse the sensor with a strong stream of water in order to dislodge the debris. Do not try to pick it out with a pin or something with a sharp end, you could damage the sensor.
- The listening station's housing is sealed with a number of O-rings. The O-ring rubber has a limited lifetime. **We recommend that you return your listening station to Desert Star Systems every three years for service.**

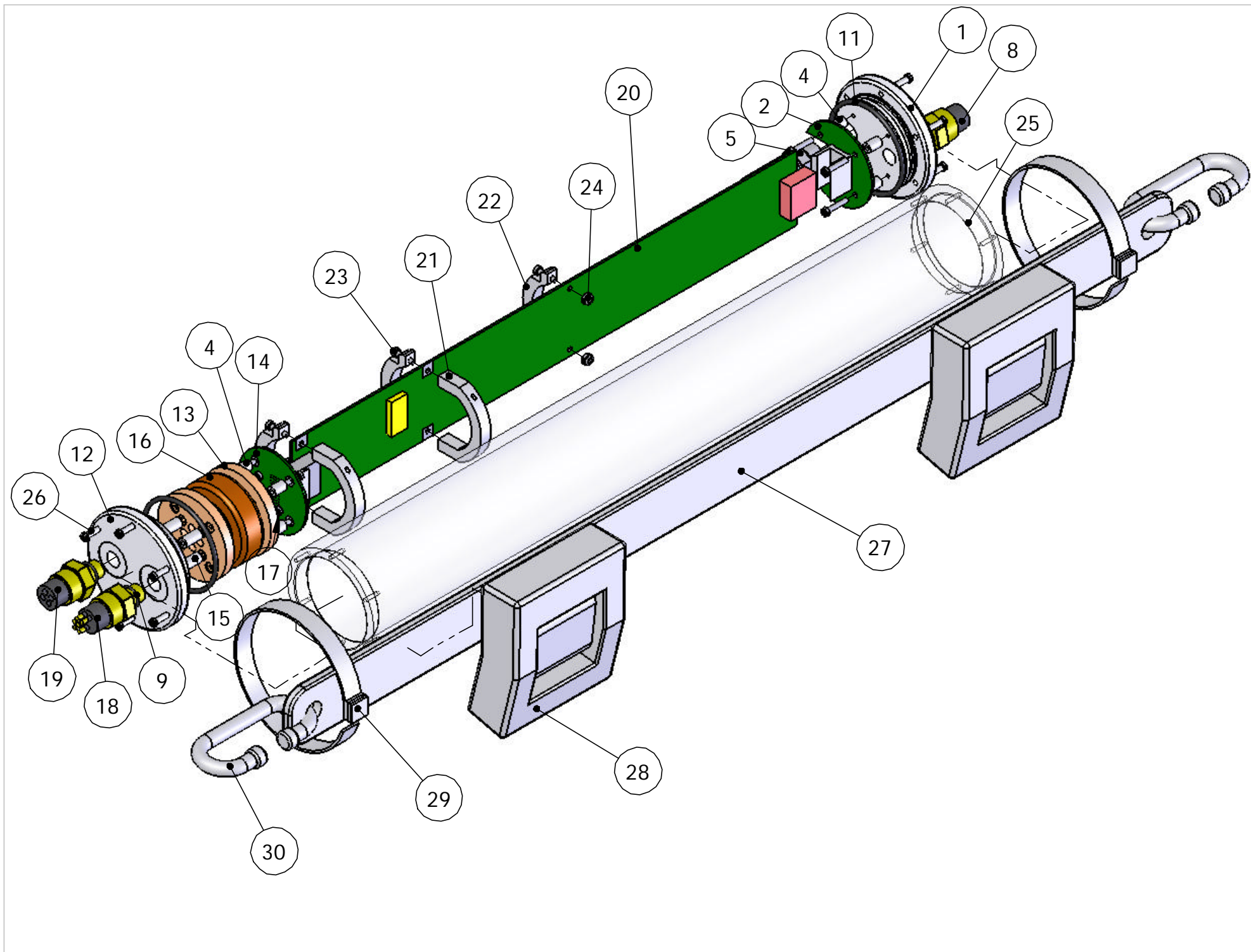
6. RBS-100/101 Specifications

Size:	425 mm L x 75 mm D (20.75" L x 3" D)		
Weight:	Weight of the RBS-100/101	2.04 kg (on land)	-.27 kg (in water)
	Weight of supplied equipment (fasteners, hydrophone, cable, strong-back):	2.353 kg (on land)	.379kg (in water)
Depth Rating:	300 meters (1000 feet)		
Operating temperature:0-70 degrees Celsius			
Power Supply:	Power supplied via RPD series data/power cable Factory configured for 440VAC or 880VAC operation, 50/60 Hz. Approx. 6 Watt consumption		
Data I/O:	Four independent RS-485 data channels, each operating at up to 900 kbit/sec. <ul style="list-style-type: none">Two data channels on the upstream end of the stationTwo data channels on the downstream end of the station		
Status Indicator:	Via surface station PC		
Depth Sensor:	500 PSIA, 0.1% FSO accuracy (300m max. depth, 0.3m accuracy)		
Processors:	Texas Instruments MSP430F149 microcontroller for supervisory functions Texas Instruments TMS320C6203 DSP for signal processing (2 Billion Operations per Second max.)		
Data Storage:	RBS-101 ONLY---1GB CF Flash card (8GB option) for raw acoustic data intermediate storage		
Sonar transmitter:	For array self-survey purposes. 192 dB acoustic power, 16-24 kHz		
Sonar receiver:	Broadband, 100 Hz– 80 kHz		
Sonar transducers:	Combined hydrophone & transmit transducer assembly connected via 1.2m cable		
Sonar range:	Designed for station spacing of 250m, 500m or 1000m depending on acoustic conditions and water depth.		
Sonar demodulation:	Software defined demodulator. Currently supported is demodulation of signals from Desert Star's Frequency-hopping, pulse position depth encoded pingers.		
Sonar navigation:	Range measurement repeatability approx. 0.15m RMS		

Note: all specifications are subject to change without notice



To test your listening station's durability, we executed various tests such as dropping them from high elevations. To preserve your stations, DO NOT repeat those tests yourself.



ITEM NO.	PartNo	DESCRIPTION	QTY.
1	HOU01393	RBS-100 Downstream Endcap	1
2	EMBD100	EMBD-100 PCB Assembly	1
4	HDW00224	HDW-NYLON-.375" (3/8")- Spacer	8
5	SSP1	Small Smart Pressure Transducer	1
8	CON00345	6-PIN, 3/4" POST, FEMALE, BRASS	1
9	ORI00006	O-Ring 2-014 E515	3
10	HDW00345	HDW-SS-4-40-5/8-Socket Cap	8
11	ORI00008	O-Ring 2-139 E515	2
12	HOU01392	RBS-100 Upstream Endcap	1
13	HOU01394	RBS-100 Transformer Cradle	2
14	EMBU100	EMBU-100 PCB Assembly	1
15	HDW00225	HDW-Nylon-(1/2")-SPACER #4 Thread	4
16	XFTLP100	TLP-100 XFM 8-16 kHz 5P 550S	1
17	HDW00576	4-40-1 3/4 Socket Cap SS	4
18	CON00346	6-PIN 3/4" Post, Male, Brass	1
19	CON00482	4-Pin BULKHEAD 3/4" Post, Brass	1
20	EM100PCA	EM100 Listening Station Module	1
21	HOU01395	RBS-100 PCB Support Ring Top Side	2
22	HOU01396	RBS-100 PCB Support Ring Bottom S.	3
23	HDW00295	HDW-SS-4-40-1/2-Socket Cap	6
24	HDW00298	4-40 Nylon Locknut SS	2
25	HOU01391	RBS-100 Housing	1
26	HDW00186	HDW-SS-4-40-3/4-SOCKET CAP	12
27	HOU01412	HOU-EM100 StrongBack	1
28	WHT00000	5LB Hard Dive Weight	2
29	HDW00619	Hose Clamp 2- 13/16" to 3-3/4"	2
30	HDW00620	Oval Threaded Connector 3/8 Dia	2

RPD-275/550/1100

RangeNav Power & Data Cable

Technical Reference Manual



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November 2006
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1. Introduction Of RPD-275/550/1100	3
2. Unpacking.....	3
3. Connector Termination	4
3. Preparations For Operation	4
4. RPD-275/550/1100 Specifications	5

1. Introduction Of RPD-275/550/1100

The RPD-275/550/1100 (RangeNav Power & Data cable) is designed for use with the RangeNav™ system, where it serves to interconnect the RBS-100 listening stations. The RPD comes available in 3 different sizes: 275 meters, 550 meters, and 1100 meters. This includes 10% slack for nominal station spacing of 250m, 500m, and 1000m. The cable sections weigh 85lbs, 170lbs, 340lbs each respectively.

The copper based cable carries both data and power. Two twisted wire pairs are support two RS-485 formatted independent data channels. Controlled by the systems firmware, one pair may carry data in the downstream and one in the upstream direction, or a single pair may switch between the downstream and upstream direction to route data around a failure affecting the other pair. The system's supply voltage is carried by the final two conductors. The cable supply voltage rating is 900 VAC and 50/60 Hz power is used. The cables polyurethane jacket provides strong abrasion and cut resistance. A Kevlar braid and additional strength member yield a working load of 500lb and a breaking strength of 2000lb. The cable sections are equipped with a "chinese-finger" strain relief system that protects its connectors and the listening stations. . When pulling on each end it tightens up, and when released it releases the pressure. Through the cable's clear jacket you can visibly see the water swelling tape whose job it is to slow down water intrusion in case of damage.



Figure 1: deployment, shore section, spools of cable, and yet another caught fish hook

2. Unpacking

Please ensure that your shipment does contain these components.

RPD-275/550/1100 Component List

- Section of desired cable (ie-275m, 550m, 1100m)

Table 1: Components List

If a shipment is incomplete, please immediately contact Desert Star Systems. If you are missing any components required for system operation, obtain these components before proceeding.

3. Connector Termination

The RPD cable sections are terminated with SEACON micro series six-pin underwater mateable connectors. The male MCIL6M connector is used on the upstream end, and the female MCIL6F version on the power carrying downstream end. The pin assignment is as follows.

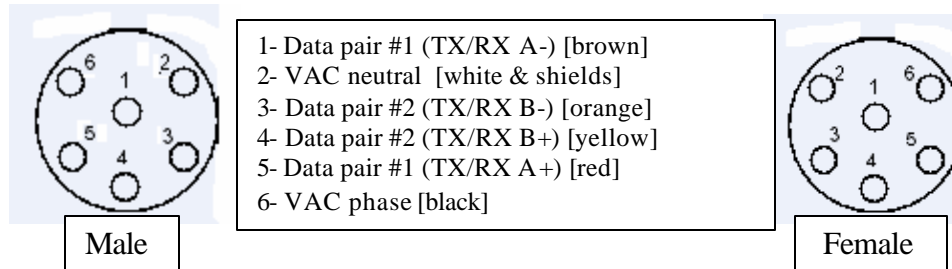


Figure 2: Data/Power Cable Connectors and Adapters

3. Preparations For Operation

Follow these steps to get the cable ready for operation.

- Depending on your method of deployment, gather the cable and ready it (mount it on spool, etc.). Keep in mind that one section is needed for each listening station.
- Connect the first listening station. Apply a thin film of silicone grease before mating the connector, mate all the way and ensure the locking sleeve is threaded to a full stop.
- Securely fasten the cable to the strong back using cable ties. This is essential to prevent failure of the connector termination due to repeated flexing at the connector.
- Link the loop of the strain relief system to the strong back using a stainless steel shackle.
- Link the listening station to the next cable section using the same method.
- Attach the hydrophone and float to the listening station.
- Lead the boat in the desired direction, letting the cable feed into the water over the stern.
- Follow this process until all the listening stations are in the water.
- The upstream end of the first listening station must be connected to the STM-100 junction box.

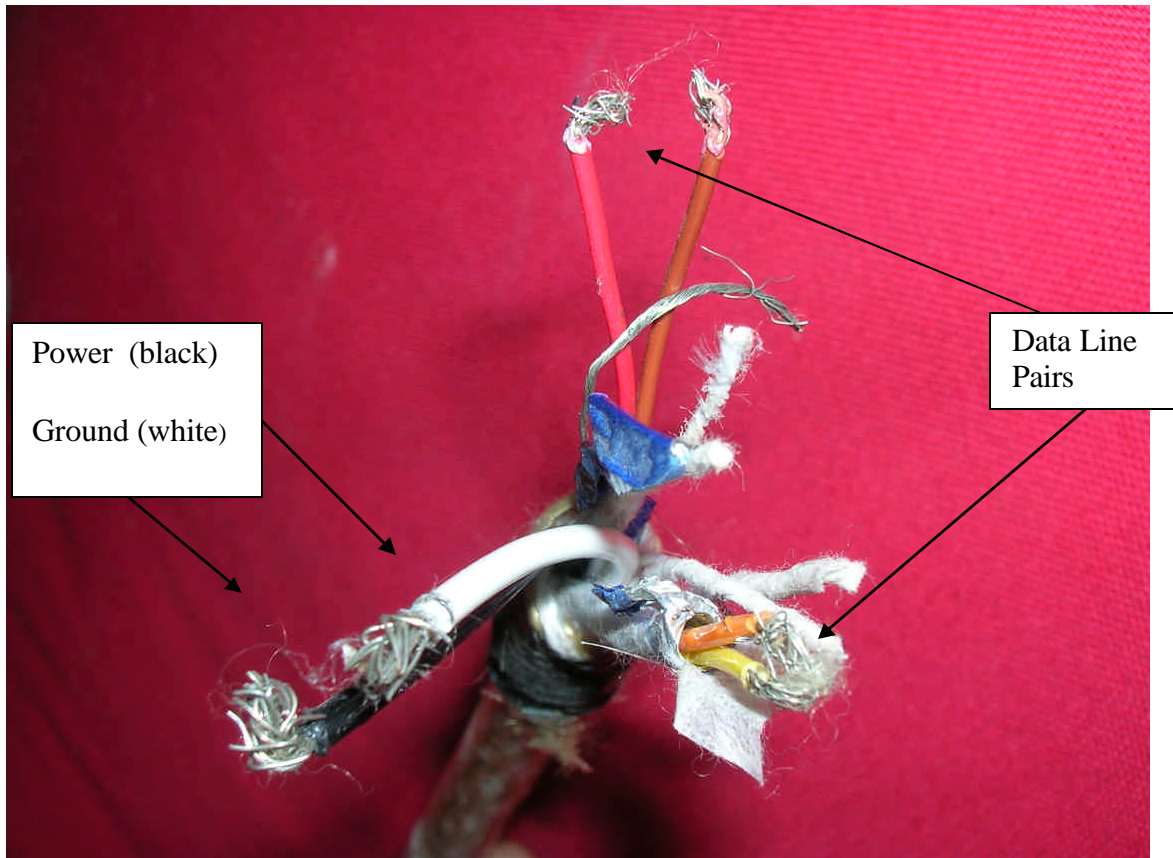


Figure 3: The inside wiring of the CABLE

4. RPD-275/550/1100 Specifications & Order Numbers

Size:	250m length	550m length	1100m length
Weight in air:	85lbs	170lbs	340lbs
Weight in water:	All cable sections are negative buoyant		
Depth Rating:	Full ocean depth		
Connectors:	SEACON MCIL6M (upstream end) and MCIL6F (downstream end), underwater mateable, secured by locking sleeves.		
Working load:	500lbs max.		
Breaking strength:	2000lbs typical		
Min. bend radius:	15 cm (6")		
Strain relief:	"Chinese finger" system, 2500lbs rating		
Design:	Polyurethane jacket, Kevlar braid and strength members, water swelling tape, conductors with Teflon insulation.		
Operating temp.:	-20 - 70 degrees Celsius		
Data conductors:	Two twisted, shielded pairs. 22AWG. For RS-485 or other signaling standards.		
Power conductor:	Two conductors (phase and neutral), 16AWG		
Max. supply voltage:	1000 VAC RMS		

Note: all specifications are subject to change without notice

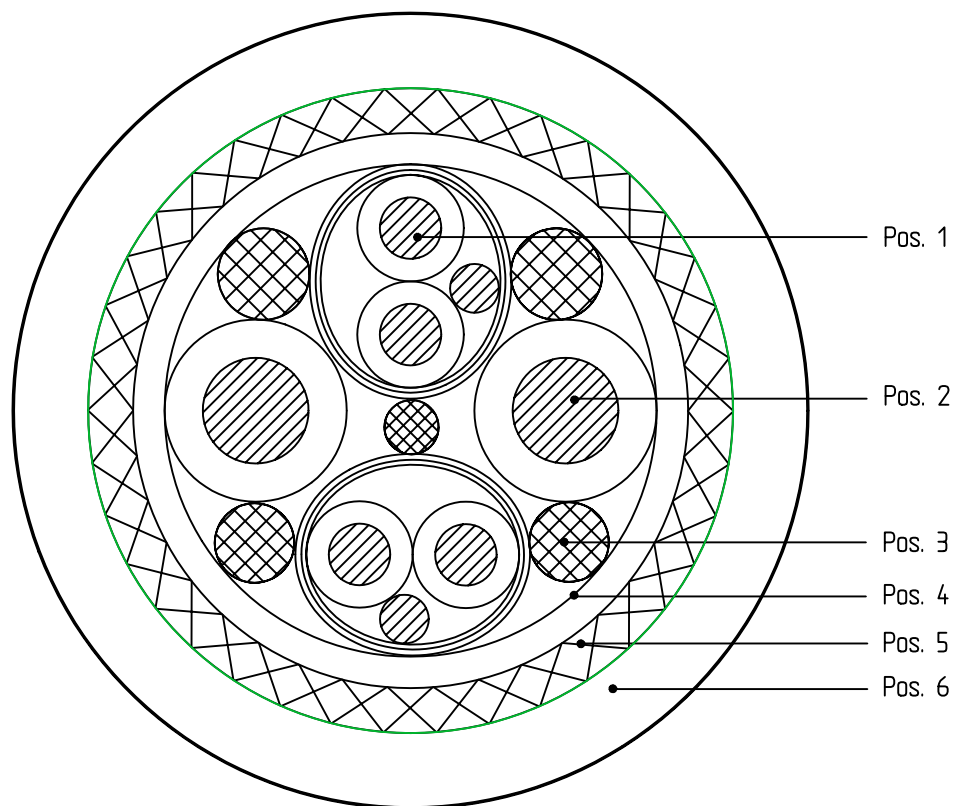
Order Numbers

RPD-275:	Cable, 275m, terminated and with Chinese finger strain relief
RPD-550:	Cable, 550m, terminated and with Chinese finger strain relief
RPD-1100:	Cable, 1100m, terminated and with Chinese finger strain relief

Hybrid Round Cable

EHRK 34594 Rev. 1

7 Dec. 2004



maximum cable diameter 10.6 mm = 0.420"

Hybrid Round Cable

EHRK 34594 Rev. 1

<u>Pos 1</u>	2 pairs of insulated wires	0.38 mm ² / AWG 22
	conductor	(19 x 0.16 mm) tin plated copper
	insulation	TPE
	colour	brown/red, orange/yellow
	drain wire	0.25 mm ² / AWG 24
	conductor	(19 x 0.127mm) tin plated copper
	screen	
	material	aluminized polyesterfoil; foil side in optical coverage 100%
	binder	polyester
<u>Pos 2</u>	2 insulated wire	1.23 mm ² / AWG 16
	conductor	(19 x 0.29 mm) tin plated copper
	insulation	TPE
	colour	black, white
<u>Pos 3</u>	fillers	water swelling; as required for roundness
<u>Pos 4</u>	binder	water swelling
<u>Pos 5</u>	braided support mesh	
	material	kevlar
	working strength	greater than 3200 N (500 lb _f)
	break strength	approx. 11000 N (2500 lb _f)
<u>Pos 6</u>	outer jacket	
	material	polyurethane
	wall thickness	1.0 mm (0.040")
	colour	clear printed with black characters
		custom print -TBD

LEONI Elocab Ltd.
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Kitchener, Ontario, N2R 1H8
Tel. (519) 893-1155
Fax (519) 893-2766
www.leoni-tailormadecable.com



LEONI Tailor-Made Cable

7 Dec. 2004

Hybrid Round Cable

EHRK 34594 Rev. 1

Technical Data:

	<u>Pos 2</u>	<u>Pos 1</u>
operating voltage:	1000 V	600 V
test voltage conductor/conductor:	5000 V/DC	3000 V/DC
test voltage conductor/shield:	3000 V/DC	2500 V/DC
operating temperature:	-50° C to +90° C [-58°F to +194°F]	
weight	107 g/m = 72 lb/1000ft	
pair nominal impedance:	55 Ohms	

Bending radius:

fixed installation:	2 x diameter
minimum bending radius at continuous flex:	5 x diameter
best bending radius at continuous flex:	10 x diameter

CABLE IS USED IN LENGTHS OF: 275 metres

REVIEWED AND APPROVED: COMPANY NAME: Deesert Star Systems LLC
SIGNATURE: _____
NAME: Marco Flagg
DATE: 07DEC04

STM-100

RangeNav™ Surface Station Junction Box

Technical Reference Manual



Rev.1
November 2006

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1. INTRODUCTION TO THE STM-100 SURFACE STATION JUNCTION BOX	3
2. UNPACKING THE SURFACE STATION	3
3. SURFACE STATION INSTALLATION AND ACTIVATION	4
3.1. INSTALLING AND CONFIGURING SURFACE STATION SOFTWARE	4
4. CONNECTORS, INDICATORS AND CONTROLS	5
5. MAINTAINING THE SURFACE STATION	6
6. MODEL STM-100 SPECIFICATIONS	7

1. Introduction to the STM-100 Surface Station Junction Box

The STM-100 surface station junction box is designed to use with the RangeNav™ system for underwater tracking. It serves as the junction between the PC and the RPD cable which supplies the array. Its main job is generation and relay of electric power for the array, power monitoring functions and the relay of data between the array and the PC. The STM-100 also includes a GPS timing signal input, through which the entire array can optionally be synchronized to GPS time. This GPS time synchronization is an option used for geo-referencing the location of the listening stations. The connection between the STM-100 and the PC is via a USB port. The STM-100 links to the upstream end of the acoustic array through a six-pin connector, which accepts the standard underwater mateable connector of a RPD cable section.

Not only is the STM-100 durable, it is also splash proof and very simple to master. With that said, it is not intended to be used as an umbrella. The STM-100 is factory configured for 440VAC or 880VAC operation, 50/60Hz.



Figure 1: STM-100 with controls: status light, fuse, power switch, power light

2. Unpacking The Surface Station

Please ensure that your STM-100 shipment contains these components.

STM-100 Component List

- STM-100 surface station
- AC Power Cable

This manual is available at www.desertstar.com/downloads

Table 1: Component List

The surface station requires that you have a PC operating on, at least, Window XP and the RangeNav software. These items are not a part of the station itself, and must be purchased separately.

Please contact Desert Star Systems immediately if you are missing any components.

3. Surface Station Installation And Activation

Connections

STM-100 installation is straightforward: Connect the station to AC power (110VAC or 220VAC as factory configured and indicated on the label), connect to the array via the Data/Power cable connector and connect to the PC via the USB port. For GPS timing synchronization (optional, refer to the RangeNav™ Operator's Manual) connect the GPS receiver using a cable that Desert Star will custom manufacture for your GPS receiver.

Activation

After that, start the RangeNav™ software on the PC, select the correct COMM port (in the hardware manager, it's designation will be a Sealink device), flip the power switch on the STM-100 and the system ready to go. Check the status and power light to make sure everything is in working order. Failure of the red power light to glow indicates no power or a blown fuse. Check and correct. The green status LED should emit a blink pattern. If that doesn't happen, then the STM-100 electronics has not booted or is not working. In that case, switch the STM-100 power switch OFF, wait 15 seconds and then switch it ON again.

3.1. Installing And Configuring Surface Station Software

DiveBase RangeNav™ Software

The STM-100 surface station junction box works in conjunction with a PC running the 'DiveBase RangeNav™' software (also referred to as simply the RangeNav™ software). This software is normally installed by Desert Star Systems on the PC shipped with your RangeNav™ system. If you are using your own PC, install the software using the DiveBase RangeNav™ install disk and following standard Windows install procedures.

STM-100 Firmware Installation

The STM-100 itself contains firmware that is stored on its internal FLASH memory. Desert Star will update that firmware on occasion or to provide custom capabilities for your system. New firmware is downloaded to the STM-100 along with the entire connected array through a function in the DiveBase RangeNav™ software. Refer to the RangeNav™ Operator's Manual for details.

STM-100 Configuration

The STM-100 operations are fully controlled by the PC through the DiveBase RangeNav™ software. So, operation of the device is limited simply to operating the ON/OFF switch.

4. Connectors, Indicators And Controls

The following tables and figures explain the STM-100 switch and connector functions.

Connector	Function
A/C	A/C power terminal for STM-100 operation. Factory configured and labeled for either 110VAC or 220VAC input voltage. 50/60 Hz.
Array Data/Power Cable Connector	Use to connect the upstream end of the listening station array to the STM-100.
USB Connector	The STM-100 connects to the PC via this port.
GPS Time Signal Connector	Optional GPS time signal input. Used for one method of geo-referenced surveying of the array.
Power Switch	Flip this switch ON to activate the STM-100. Keep it OFF for at least 15 seconds to re-start the STM-100.
Status LED (Green)	Indicates operation of the STM-100 electronics. This indicator should emit one short blink once per second. Switch the STM-100 OFF, wait 15 seconds and switch ON again if the blinking does not occur.
Power Indicator (Red)	This indicator will light when AC power is connected. Check the AC outlet, the power cable and the STM-100 fuse if this indicator does not light.
Fuse Knob	Remove to replace the fuse. Fuse rating is 5 Ampere for 110VAC operation and 2.5 Ampere for 220VAC operation.

Table 2: Connector Functions

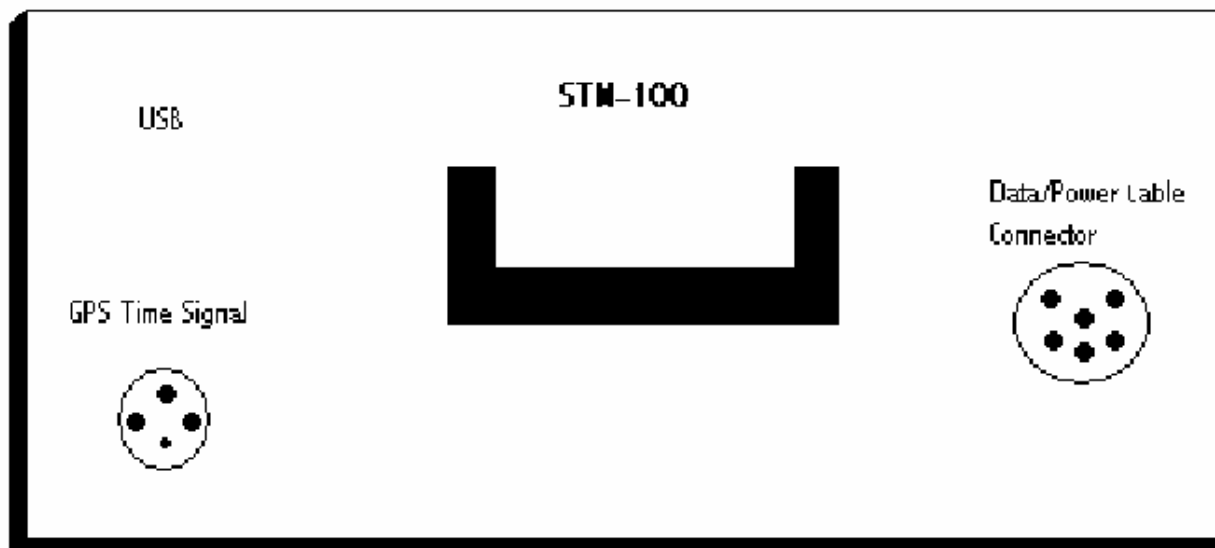
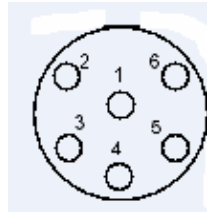


Figure 2: STM-100 Front Panel Connectors



- 1- Data pair #1 (RS485 -)
- 2- VAC neutral
- 3- Data pair #2 (RS485 -)
- 4- Data pair #2 (RS485 +)
- 5- Data pair #1 (RS485 +)
- 6- VAC phase

Figure 3: Data/Power Cable Adapter



- 1: Ground
- 2: GPS Time Signal Input (3V or 5V TTL or short to ground)
- 3: Not In Use

Figure 4: GPS Time Signal port



Figure 5: STM-100 Power Inlet (30Ampere Marine Style)

5. Maintaining The Surface Station

The STM-100 is virtually maintenance free. Always make sure that the connectors remain free of debris and use a dry or somewhat damp cloth to remove dust. With the STM-100 panel closed, the station is rather water resistant and should operate fine even in ongoing rain. With the panel open, water resistance is more limited and any standing water should be mopped up at once.

If the station should come in contact with significant quantities of salt water (such as it gets completely swamped by a wave), you have some chance of rescuing it by instantly removing it from the power source, rinsing it thoroughly with fresh water and shaking it dry.

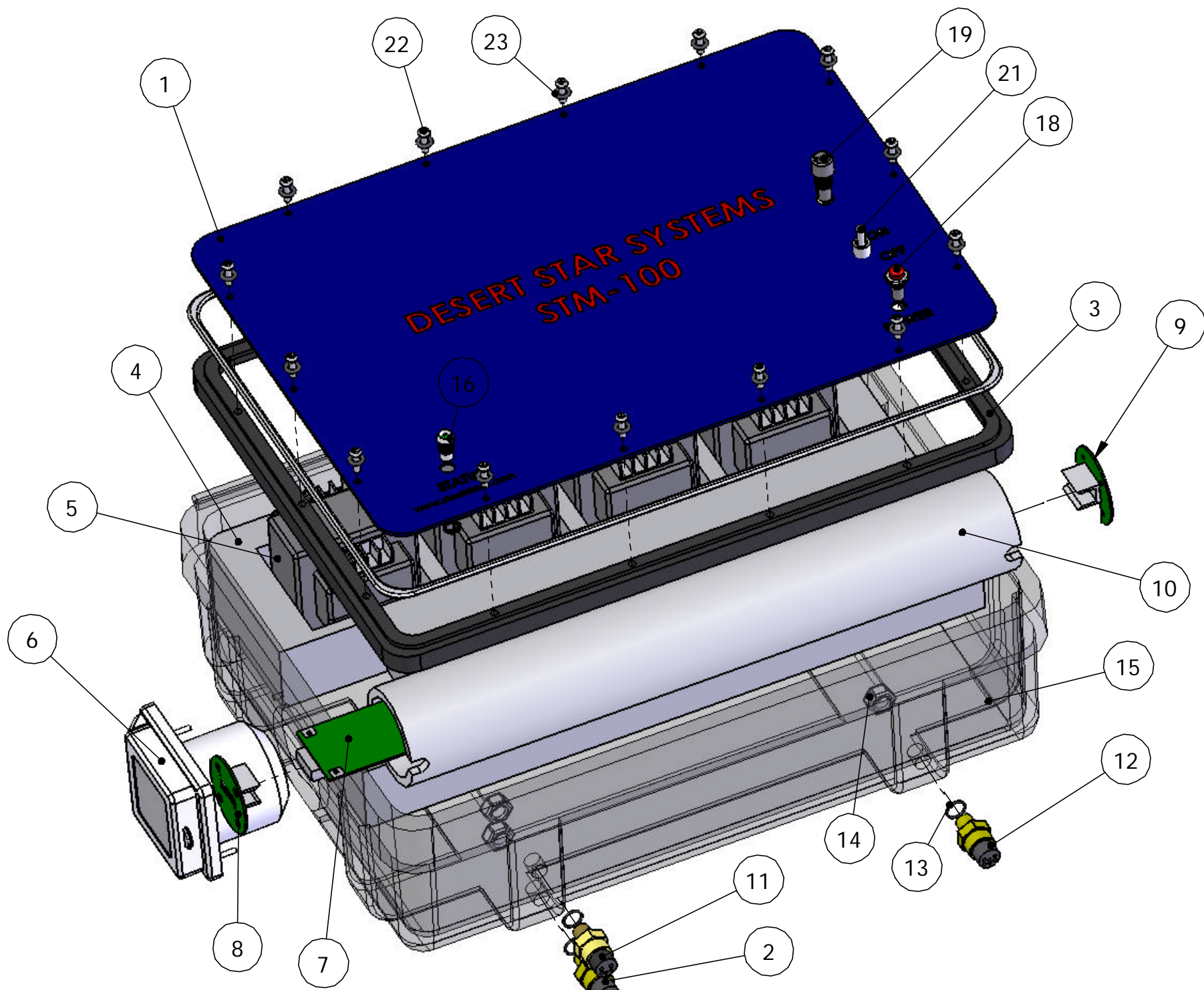
6. Model STM-100 Specifications & Order Numbers

Size:	49cm L x 19cm W x 36cm H Housed in a rugged, splash-proof carrying case
Weight:	16kg
Operating temperature:	0-50 degrees Celsius
Data I/O:	Connected and controlled via USB port from PC RS-485 interface to the listening station array GPS Time Signal port (3V TTL, 5V TTL or short to ground – open collector)
Status Indicators:	Power indicator on main panel (red) Processor system status LED on main panel (green)
External power input:	Factory configured for 110VAC or 220VAC operation, 50/60 Hz WARNING: Do not operate at voltage other than indicated on the STM-100 label. Wrong voltage may damage equipment.
Power to array:	Factory configured for 440VAC or 880VAC nominal. WARNING: The voltage configuration of the RBS listening stations and the STM-100 must match. Mismatch may result in equipment damage.
Array power monitoring:	STM-100 monitors current on phase and neutral line to array Listening stations report AC voltage at each node
Ground Fault Interruptor:	STM-100 cuts power to the array when the mismatch between the phase and neutral conductor exceeds a specified limit.

Note: all specifications are subject to change without notice

Order Numbers

STM-100:	Surface Station Junction Box
CBL00046:	U.S. Power Cord for STM-100 (110V Single-Phase power plug to 30Ampere Marine Plug)



ITEM NO.	PartNo	DESCRIPTION	QTY.
1	HOU01440	STM-100-PANNEL	1
2	CON00380	3-Pin BULKHEAD 3/4" Post, Brass	1
3	CAS00003	PANNEL RING KIT STM-10	1
4	CAS00056	STM-100 Internal Foam	1
5	XFM00320	Harsh Environmen 240/480V Input	4
6	CON00517	50A 125/250V Non-Metallic Inlet	1
7	EM100PCA	EM100 Listening Station Module	1
8	EMBU100	EMBU100 PCB Assembly	1
9	EMBD100	EMBD100 PCB Assembly	1
10	HOU01391	RBS-100 Housing	1
11	CON00302	5-PIN-CONN	1
12	CON00345	6-PIN, 3/4" POST, FEMALE, BRASS	1
13	ORI00006	O-Ring 2-014 E515	3
14	HDW00245	HDW-SS-7/16-20-LG HEX MACH NUT	3
15	CAS00002	CASE PELICAN STM-10 NO RING	1
16	LED00314	LED-STM-10	1
18	LED00326	Red Indicator Light-Neon 105- 125V	1
19	FUS00261	Screw-Cap Panel-Mount Fuse Holder	1
21	SWT00320	D.P.D.T. ON-OFF-ON Toggle Switch	1
22	HDW00617	8-32 5/8" Button Head Socket Cap	14
23	ORI00056	O-Ring 2-104	14

TLP-100/101/102

Depth Encoded Pingers

Technical Reference Manual



Rev. 1
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1. Introduction to the TLP-100/101/102	2
2. Unpacking	3
3. Preparations For Operation	4
3.1 Charging The Battery	4
3.2 Pinger Activation	5
3.3 Status LED Blink Patterns	5
3.4 Configuring and Testing the TLP-100/101/102	6
3.5. Firmware Update	9
4. Pinger Mounting	9
5. The Multi-Function Connector	11
6. TLP-100/101/102 Maintenance	11
7. TLP-100/101/102 Specifications	12

1. Introduction to the TLP-100/101/102

The TLP-100/101/102 (Target Locating Pinger) are depth encoded pingers designed primarily for use with the RangeNav™ underwater tracking range. They are suitable for tracking targets such as submarines, torpedoes, AUV/UUV and ROV. The three pingers use the same operating procedures and are in many aspects identical. Other than visible differences, the main distinction is that each operates within a different frequency range, thus offering more channels for multiple target tracking and suitable selections for both long and short distance operations. The TLP-100 operates in the lowest frequency range (8-16 kHz), which allows its signal to travel the farthest. Yet at 475mm L x 127mm D and 7.4 kg in air, it is also the largest and heaviest of the family. The TLP-101 and TLP-102 operate at 16-24kHz and 34-42kHz respectively. They use the same housing measuring 300mm L x 82.5mm D, and have a weight of approximately 1.8 kg. All pingers offer a 'high power' transmit mode of 192 dB, and can also be operated at regular power of about 182 dB. Battery life is 12 hours in high power mode at one transmission per second, and exceeds 24 hours in regular power mode. All pingers have internal, re-chargeable batteries which charge in about 12 hours. The three pingers are equipped with precision depth sensors. The depth sensors offer a resolution of 0.3 meters and read correctly up to the pinger family's operational depth of 300m. The pingers are equipped with a rugged, waterproof on and off power switch. The configuration and installation of each pinger is quite easy and can be accomplished onsite or offsite. Simply mount the pinger on the target in a vertical orientation using suitable brackets or clamps.

TLP-100/101/102 Characteristics

- Target Locating Pinger, designed to track targets from a variety of sizes and depths.
- Straightforward installation and configuration in minutes.
- Rechargeable batteries provide the luxury of less maintenance resulting in more field time.
- Simple yet rugged design allows for maximum uses yet minimizing installation and configuration time.
- Frequency specific pingers allow for accurate measurements of up to eight targets.
- GPS time signal availability provides the opportunity to coordinate land and sea targets together.
- Equipped with a precision 500 PSIA depth sensor, which has an accuracy of 0.5 PSI, allows for better pinpoint accuracy.

Figure 1 shows the TLP-100/101/102 (in order 102-100-101). The sonar transducer is located toward the bottom of the pinger, protected by a cage. The depth sensor is located on the top portion of the pinger. Also located on top, is the power switch and a two-color status LED. The pingers were designed so that all controls are readily available.



Figure 1: TLP-100/101/102

2. Unpacking

Please ensure that your shipment does contain these components.

TLP-100/101/102 Component List

- Target Locating Pinger (TLP-100/101/102)
- Multi-function adapter plug
- This manual is available at www.desertstar.com/downloads

Accessory Kit (sold separately)

- MCU-5 (multiple charging unit with 5 adapters. This unit also has a built in USB plug (hooks directly to the PC with only a USB cable) suitable for configuration and firmware download.

If a shipment is incomplete, please contact Desert Star Systems.

In order to operate your TLP-100/101/102 effectively you will also need the other components within RangeNav as well as the RangeNav software and a PC running Windows XP or a later version.

3. Preparations For Operation

Follow these simple steps to get your target locating pinger ready for operation.

Preparations For Operation

- Unpack the pinger and make sure you have all the components.
- Configure and test the pinger using the provided software.
- Fully charge the pinger prior to each and every deployment to insure full battery availability.
- Mount the pinger on the target by following the instructions.
- Switch the pinger on prior to releasing or launching the target.

CAUTION:

These pingers support high transmit power. Other than for brief tests, make sure to place the stations in water when pinging in order to reduce stress on the sonar transducer. When operated in air, this stress can eventually crack or otherwise destroy the sonar transducer.

3.1 Charging The Battery

Nickel Cadmium rechargeable batteries power the TLP-100/101/102. The batteries of the pinger are re-charged using a trickle charge over 12 hours. This method, while slow, assures that the batteries are at 100% charge each and every time. We recommend charging the battery prior to each use. If the pinger sits unused for an extended period of time, the battery will eventually (after a few weeks) be exhausted due to the standby current. Charging the battery prior to each deployment will prevent this.

When first receiving your pingers, we recommend that you condition the battery by charging the battery, operating the pinger until discharged (place in water, see CAUTION above) and then repeating that cycle 3-5 times.

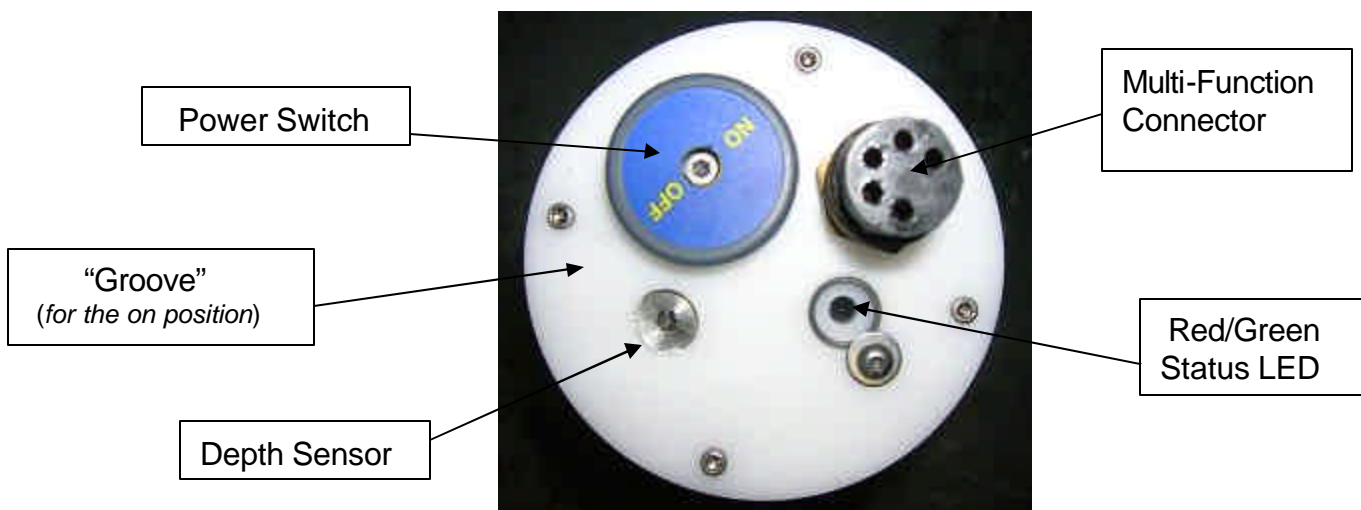


Figure 2: TLP-100/101/102 Top Profile

To charge the battery, follow these instructions.

1. Wipe the multi-function connector as well as the adapter free of debris.
2. Connect the charger cable to the multi-function connector on the pinger.
3. The green LED in the sensor emits a flash once every second signaling that it's charging.
4. When the pinger is fully charged the Green LED will emit a solid glow. The approximate charging time is 12 hours. The approximate battery life of a pinger is 12 hours in high-power mode, and more than 24 hours in regular transmit power mode.

3.2 Pinger Activation

A power switch is used to turn the TLP-100/101/102 on. It is a very simple method of just turning the power switch until the ON position on the switch meets the mark on the housing. At this point the Red LED will start to flash once every second, unless the battery is low in which case you will see rapid flashing. Do not leave the pinger on and pinging while out of water for an extended period of time. Doing so will eventually damage the sonar transducer.

3.3 Status LED Blink Patterns

The TLP-100/101/102 uses a two color (red/green) status LED. Here is a guide to the blink patterns.

Blink Pattern	Interpretation
RED rapid blinking	The battery is low. Recharge the pinger.
RED single blink once per second	The transponder is operating normally and is pinging.
RED triple blink	Hardware error. This blink patterns currently indicates a depth reading too far from zero. Causes could be a defective depth sensor, or you switched the transponder ON while submerged. Transponder functions will still work, although the depth reporting may be faulty.
GREEN single blink once per second	The pinger is charging.
GREEN continuously ON	Battery charging is completed.

Table 1: Status LED Blink Patterns

3.4 Configuring and Testing the TLP-100/101/102

The TLP-100/101/102 are configured from a PC through a serial data interface. When using the MCU-5 multi-station charger and configuration box, connect the pinger to the MCU-5 connector marked COM, and connect the USB port of the MCU-5 to the PC. Then, enter HyperTerm (a standard PC utility), select the correct COMM port on the PC and configure for 4800 baud, 8 data bits, no parity, one stop bit.

Now, switch the pinger on. You will see this print out:

```
Pinger V1.2 Current Settings:
  Ping 1 Band & Channel: HF, 1
  Time Between Pings: 2000
  Ping Length: 1
  Depth Coded Mode Set

?: This menu
#c: Configuration
#p: Print Current Configuration
#st: Self Tests
#st

EM-40 Test V2.0:
  1 = LED
  2 = High Power Test
  3 = Ping
  4 = Depth Sensor
  5 = Charge
  6 = Knob
  ? = This Menu
  x = Exit
LED Test (x=exit, t=toggle, r=red, g=green)
```

Figure 3: Print-out after power up, followed by #st user entry to initiate self tests

At this point you can enter **#c** to configure the printer, **#st** to initiate some self tests or choose a few other self-explanatory options. The primary configuration parameters of interest are the pinger's operating frequencies (channels) as well as the length of the pings. For single target tracking, always use channel 1 and set the frequency band associated with the pinger model: LF for the TLP-100, MF for the TLP-101 and HF for the TLP-102. The length of each ping for optimized tracking with RangeNav should be set to 1 ms, the default value.

The configuration menu also includes diagnostic capabilities, which are engaged through the #ST (self test) command.

The tables list the available self tests, configuration functions and ping channel frequency assignments.

Self Test Menu	
1. LED	You are able to toggle the red and the green LED on and off to check to make sure they both emit the correct glow.
2. High Power Test	You are able to make sure that your boost regulator is in proper working condition.
3. Ping	You are able to select the frequency channel and test the ping's frequency in relation to that channel. You can tweak the frequency up or down one kHz, too.
4. Depth Sensor	You are able to see at which depth and temperature the pinger is reading at the moment. Because you will be at a different elevation, there is no standard depth to watch for.
5. Charge	You are able to read the voltage that your power supply is producing to make sure that it is producing the proper voltage.
6. Knob	You are able to test the on and off power switch by simply rotating it toward the built-in groove.
? This Menu	Brings up the current menu.
X exit	Exits the current menu.

Table 2: Self-Test Menu & Screen Shot

Current Settings:
 Ping 1 Band & Channel: HF, 1
 Time Between Pings: 2000
 Ping Length: 1
 Depth Coded Mode Set

Control:
 1) Set LF Band (8-12 kHz)
 2) Set MF Band (16-24 kHz)
 3) Set HF Band (32-41 kHz)
 4) Set Channel

 5) Set Interval between Transmissions (mS)
 6) Set Ping Length (mS)
 7) Set Ping Frequency Mode
 8) Set Depth Coded Mode
 r) Reset to Factory Defaults
 x) Exit and Save Settings

Configuration Test Menu	
Option Within Configuration Test Menu	Its Purpose
1. Set LF Band (8-16 kHz) 2. Set MF Band (16-24 kHz) 3. Set HF Band (34-42 kHz)	1. Always goes with TLP100 2. Always goes with TLP101 3. Always goes with TLP102
4. Set Channel (1-8)	For single target tracking, use channel 1
5. Set Interval Between Transmissions (mS)	This allows you to change the time between pings.
6. Set Ping Lengths (mS)	This allows you to change the length of the pings. Though if running specialty ping filters on the listening stations you may have to change the ping lengths to adapt; meanwhile, leave it at 1mS.
7. Set Ping Frequency Mode	This allows you to switch from Depth Coded Mode to single ping (frequency) Mode where your application does not need to know the depth of the target.
8. Set Depth Coded Mode	This is the default mode, which is used under normal operations; unless you do not need to know the depth of your target, use it.
R Reset to Factory Defaults	In case of changing the settings unknowingly, you can revert back to the factory settings with this.
X Exit and Save Settings	Exits the screen

Table 3: Configuration Test Menu & Screen Shot

	Low Frequency kHz	Medium Frequency kHz	High Frequency kHz
Channel 1	8.4925 & 10.498	16.5289 & 18.5185	34.4828 & 36.3636
Channel 2	9.5011 & 11.4943	17.4672 & 19.5122	35.3982 & 37.3832
Channel 3	12.5000 & 14.4925	20.5128 & 22.4719	38.4615 & 40.404
Channel 4	13.5135 & 15.5039	21.5054 & 23.5294	39.604 & 41.6667
Channel 5	8.0000 & 10.0000	16.000 & 18.018	33.8983 & 36.036
Channel 6	9.00901 & 10.9890	17.0213 & 18.9573	35.0877 & 37.037
Channel 7	12.012 & 13.9860	20.000 & 21.978	38.0952 & 40.000
Channel 8	12.987 & 14.9813	21.0526 & 22.9885	38.835 & 40.8163

Note: Each 'channel' encompasses two frequencies, for the first and second ping respectively. The pingers transmit a two ping sequence to encode the depth. The time elapsed between the first and second ping is proportional to the depth.

Table 4: Channel Frequency kHz

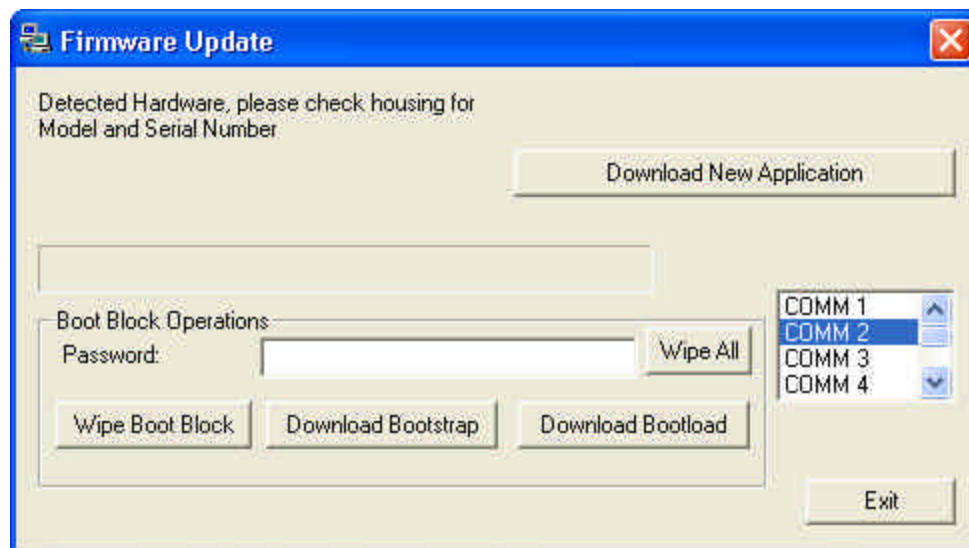
3.5. Firmware Update



FirmwareUpdate.exe

The TLP firmware determines the behavior of the device. Follow this procedure to update the firmware.

1. Link the pinger to a COM port of the PC via the MCU-5 charger and configuration box.
2. Start the **FirmwareUpdate** utility and select the COM port you are using.
3. Switch the pinger ON.
4. Hit the 'Download New Application' and select the new firmware file. Firmware files have the extension .vc and are supplied by Desert Star Systems.
5. A progress bar appears during the download process.



4. Pinger Mounting

For best tracking performance, the pinger should be mounted along the bottom of the target. This ensures the best transmission of pings to the sea floor mounted listening stations. However, in many case mounting options will be restricted due to hydrodynamic considerations, available space etc. In these cases, other mounting options such as along the top are valid and may result in similar performance.

In any case, the main considerations as far as RangeNav performance is concerned is to avoid 'sonar shadows' and ensure proper alignment of the pinger's sonar transducer beam pattern with the array of listening stations. It is helpful here to consider the sonar transducer to be similar to a cell phone antenna. Some placements will yield better results than others.

- The **sonar transducer beam pattern** is strongest out the sides of the pinger (radial direction), but exhibits a dip along the length axis of the pinger. In order to most efficiently transmit energy to the listening stations, mount the pinger vertically. Mount it with the transducer facing up when on top of the vehicle, or the transducer facing down when mounted on the bottom of a vehicle.

- The body of the target that the pinger is mounted on will cast a **sonar shadow**. This shadow may prevent ping energy from reaching listening stations that are effectively located 'behind' the target. This can impact tracking performance. Ideally, mount the pinger on the bottom of the target so that it has a 'clear line of sight' in all directions and to directly below. If not practical, mount it along the top with the sonar transducer facing up. Due to the sonar shadow, you may lose the benefit of listening stations located almost directly below, but there will probably be a sufficient number of listening stations 'in sight' out to the sides.

Besides acoustics, consider issues such as mechanical stability, interference with other acoustic systems (the pingers will not receive interference, but they may disturb other systems), protection against impact during handling etc. The table provides some guidance.

Guidelines For Mounting TLP-100/101/102 Mounting On A Target

- The sonar transducer should not be shielded by any part of the target. It is ideal to mount the pinger near the bottom of the target, vertical with the transducer facing down, to obtain an unobstructed view of the listening stations. Use a placement that comes close to this ideal.
- Keep the pinger away from moving parts for both hazard avoidance and because they can sometimes generate an acoustic shield due to cavitations and possibly other physical processes as well.
- Maximize the space between the pinger's sonar transducer and other sonar transducers on the target. Interference to other systems may result if transducers are spaced too closely. If using a scanning or imaging sonar, mount the pinger out of the beam pattern of that instrument.
- Always mount the pinger vertically, typically with the transducer facing away from the target.
- Use custom manufactured brackets, hose clamps or similar means to secure the pinger. Mount securely so that the drag of water will not move the pinger.
- Consider impact areas. The pingers are quite rugged but they still prefer to be treated gently.

5. The Multi-Function Connector

The multi function connector is a SEACON model MCBH5F. This connector is used to wire the station to an umbilical (for remote power), to connect a battery charger, to configure the pinger via the PC or to supply a GPS timing signal for special applications. The connector must be terminated before the transponder is submerged to prevent corrosion. If the station is not connected to the umbilical, terminate it with the supplied dummy plug.

For GPS time synchronized pinging, apply the GPS time signal to pin 5 and the ground return to pin 1. The pinger is compatible with 3V or 5V TTL signals or an open collector (short to ground) signal. The pinger will transmit a fixed time following the rising or falling edge of the synchronization signal, depending on its configuration.

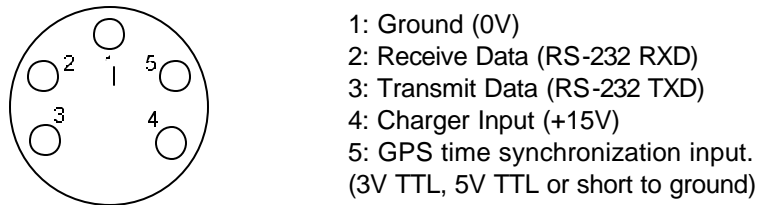


Figure 5: Multi-Function Connector Pin Assignment

6. TLP-100/101/102 Maintenance

Your pinger is a rugged instrument that requires very little maintenance. However, please do observe the following points to ensure long and proper operation.

Maintenance Instructions

- Rinse pinger with fresh water after each deployment.
- Make sure that the depth sensor access hole in the end cap of the housing does not get clogged. Rinse with fresh water after use to minimize corrosion of the metal sensor housing.
- Wipe the plug area dry as well to get rid of the possibility of corrosion.
- Charge the device before use and at least once every six months for battery maintenance purposes.

7. TLP-100/101/102 Specifications

Size:	TLP-100	475mm L x 127mm D	18.7in L x 5in D
	TLP-101	300mm L x 82.5mm D	11.8in L x 3.25in D
	TLP-102	300mm L x 82.5mm D	11.8in L x 3.25in D

Weight:		weight on Land	weight in Water
	TLP-100	7.399 kg	3.979 kg
	TLP-101	1.984 kg	.772 kg
	TLP-102	1.786 kg	.574 kg

Depth Rating: 300 meters max. working depth

Operating temperature: 0-50 degrees Celsius

Configuration & control: Power Switch and multi-function connector

Status Indicator: Dual color RED/GREEN status LED

Sensors: Depth sensor for depths of 300 meters, with accuracy of .3 meters

Sonar Transmitter: Frequency hopping, pulse-position coded. 192dB transmit power in high power mode, approx. 182dB with regular power.

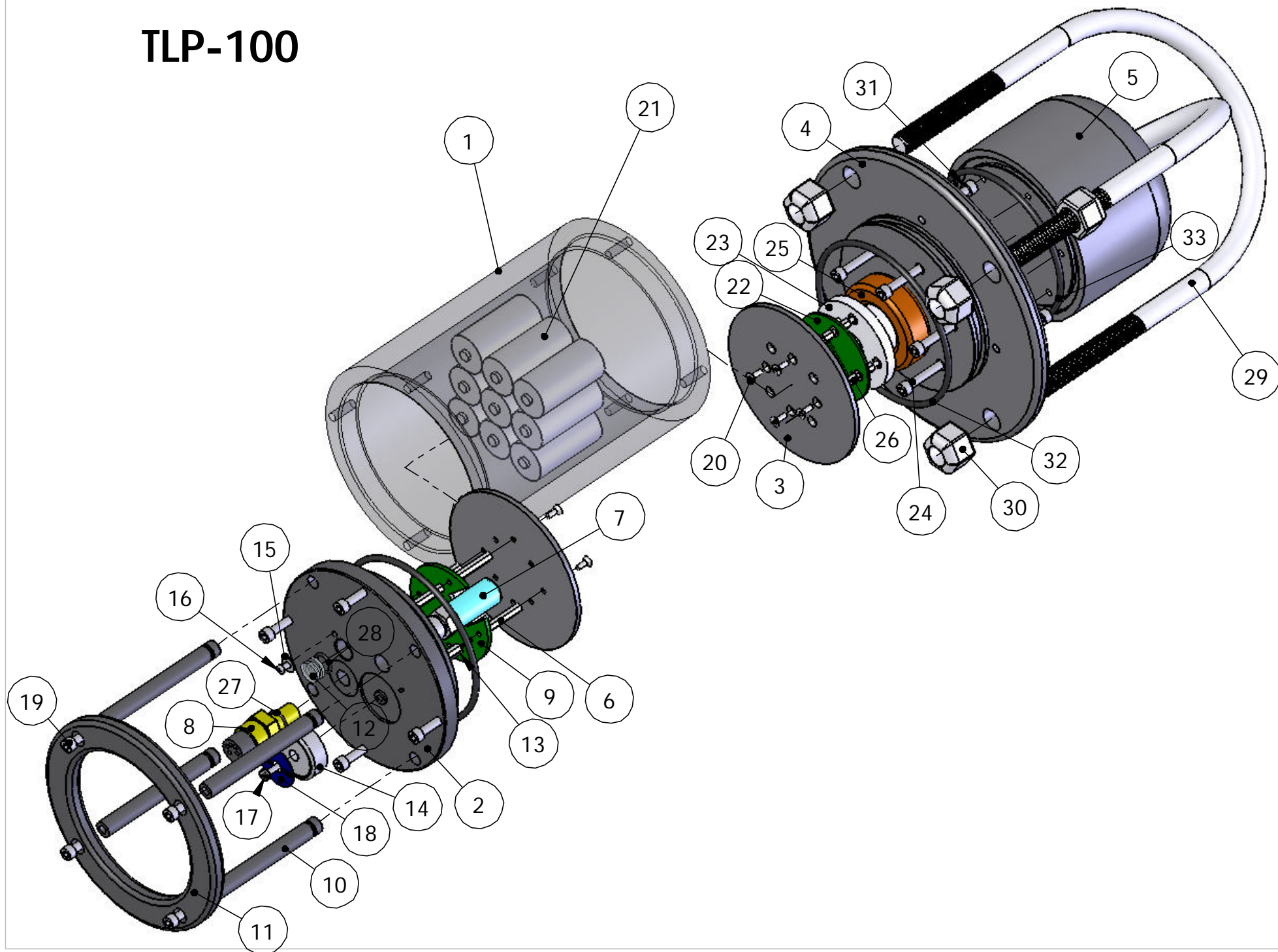
Sonar Transducer: Near omni directional transducer mounted on end cap.

Power supply: TLP-100 (9 Nickel Cadmium D-cell batteries)
TLP-101/102 (8 Nickel Cadmium C-Cell batteries)

Battery Life (approx.): TLP-100 12 HRS in high power mode, more than 24 hours in regular power mode
TLP-101 12 HRS in high power mode, more than 24 hours in regular power mode
TLP-102 12 HRS in high power mode, more than 24 hours in regular power mode

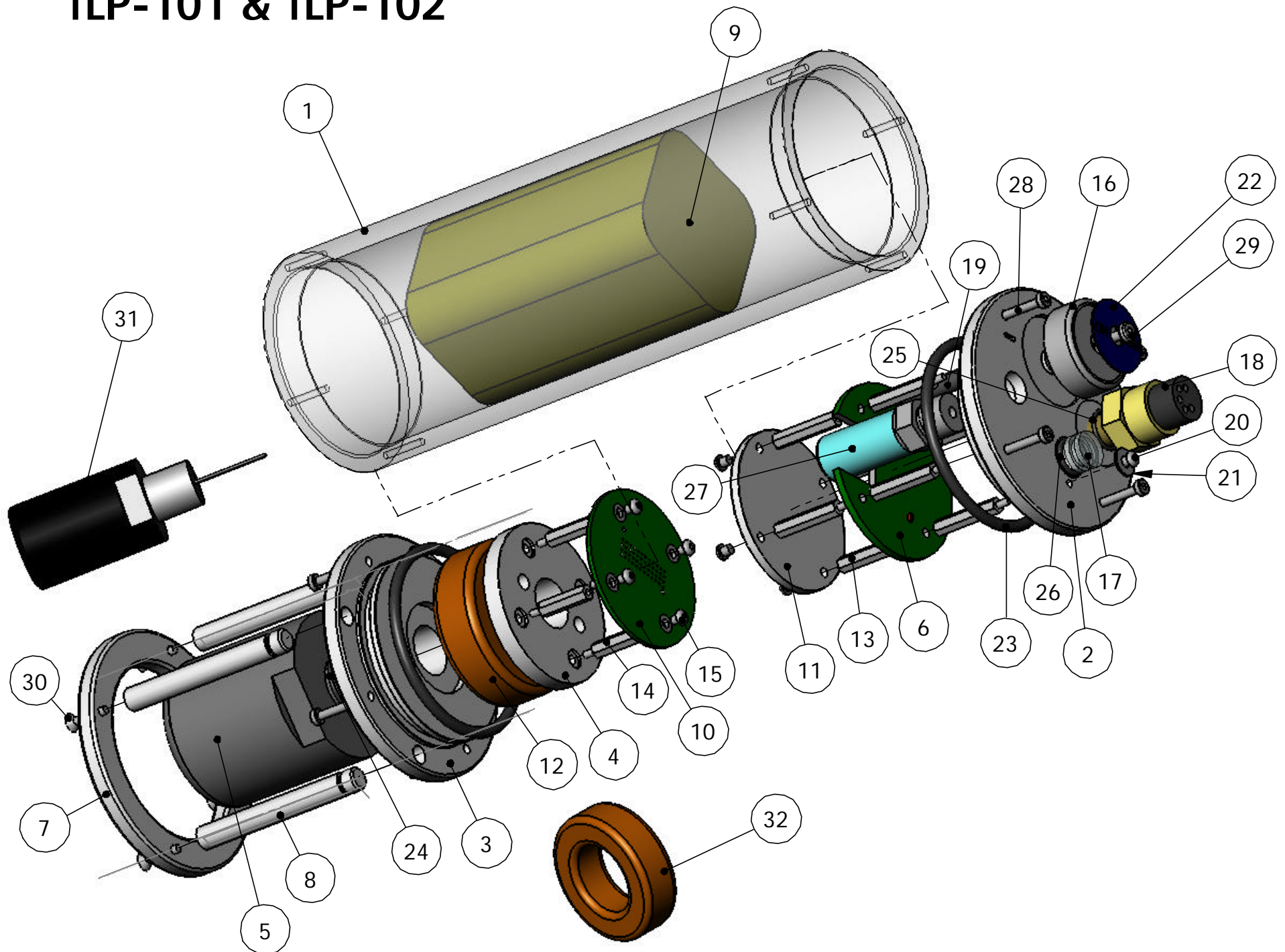
Note: all specifications are subject to change without notice

TLP-100



ITEM NO.	PartNo	DESCRIPTION	QTY.
1	HOU01314	PLATTS TLP-100 Housing	1
2	HOU01211	RBS-2 Connector End Cap	1
3	HOU01415	TLP-100 Battery Plate	2
4	HOU01473	TLP-100 8KHz-16KHz Transducer Endcap	1
5	TDC00024	8KHz-16KHz Oil Filled Sonar TDCR	1
6	HDW00583	HDW-stand off-3/16D 1"L SS #4 TLP	8
7	SSP1	Small Smart Pressure Transducer	1
8	CON00302	5-PIN BULKHEAD, 1/2" POST, BRASS	1
9	EM40PCA	Module for TLP-10X Pingers	1
10	HOU01219	RBS-2/2D Cage Posts	4
11	HOU01213	RBS-2 Cage Ring	1
15	HDW00174	HDW-SS-6LG-FLAT WASHER	1
16	HDW00202	HDW-SS-6-32-1/4-BUTTON CAP	1
17	HDW00188	HDW-6-32-3/8-SS-Socket Cap	1
18	LBL00000	LBL-SPORT-TX-Knob	1
19	HDW00342	HDW-10-24 1/2" SS Socket Cap	4
20	HDW00264	HDW-SS-4-40 18-8 1/4"L Flat Head	8
21	BP-TLP-0	TLP-100 BP Ni-Cd 9 C-Cell	1
22	EMBU100	EMBU-100 PCB Assembly	1
23	HOU01407	TLP-101 Transformer Cradle	1
24	HDW00342	HDW-10-24 1/2" SS Socket Cap	6
25	TLP100XF	8-16 kHz XFM 5P 550S	1
26	HDW00582	HDW-stand off 3/16D 3/4L #4 SS TLP	8
27	ORI00006	O-Ring 2-014 E515	1
28	ORI00004	O-Ring 2-012 E515	1
29	HDW00348	SS U-Bolt 5 5/8" for RBS-2	2
30	HDW00324	SS-Nylon Lock Nut 1/2-13	6
31	HDW00196	HDW-10-24 5/8" SS Socket Cap	8
32	ORI00035	O-Ring 2-241 E515	2

TLP-101 & TLP-102



ITEM NO.	PartNo	DESCRIPTION	QTY.
1	HOU01404	TLP-101 HOUSING	1
2	HOU01405	TLP-101 Connector Endcap	1
3	HOU01408	TLP-101 Transducer Endcap	1
4	HOU01407	TLP-101 Transformer Cradle	1
5	TDC00057	16-24 KHz Omni Tdcr w/ 3/4-16 Stem	1
6	EM40PCA	Module for TLP-10X Pingers	1
7	HOU01410	TLP-101 Ring	1
8	HOU01409	TLP-101 Post	4
9	BP-RBS-1	Battery Pack RBS-1	1
10	EMBU100	EMBU-100 PCB Assembly	1
11	HOU01406	TLP-101 Battery Plate	1
12	TLP101XF	16-24 kHz XFM 10P 400S	1
13	HDW00583	HDW-stand off-3/16D 1"L SS #4 TLP	8
14	HDW00582	HDW-stand off 3/16D 3/4L #4 SS TLP	4
15	HDW00252	HDW-SS-4-40-1/4" Button Cap	4
16	HOU01204	Rotating Switch	1
17	HOU01226	LED View Port RBS, TLT	1
18	CON00302	5-PIN-CONN	1
19	SWT00316	SWITCH-Magnetic (TLT/RBS)	1
20	HDW00202	HDW-SS-6-32-1/4-BUTTON CAP	5
21	HDW00174	HDW-SS-6LG-FLAT WASHER	1
22	LBL00000	LBL-SPORT-TX-Knob	1
23	ORI00011	O-Ring 2-228 E515 or E540	2
24	ORI00007	O-Ring 2-020 E515	1
25	ORI00006	O-Ring 2-014 E515	1
26	ORI00004	O-Ring 2-012 E515	1
27	SSP1	Small Smart Pressure Transducer	1
28	HDW00168	HDW-SS-4-40-3/4-Socket Cap	8
29	HDW00188	HDW-6-32-3/8-SS-Socket Cap	1
30	HDW00378	HDW-SS-4-40X1/2"-Flat Cap	4

TLP-101 Configuration

31	TDC00006	38 kHz Omni Tdcr w/ 3/4-16 Stem	1
32	TLP102XF	34-42 kHz XFM 5P 230S	1

TLP-102 Configuration

TLP-103

Miniature Target Locating Pinger

Technical Reference Manual



Rev. 1
November 2006

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1. Introduction	2
2. Unpacking	3
3. Preparations For Operation	3
3.1 Changing The Internal Batteries	4
3.2 Station Activation and Magnet Switch Operation	5
3.3 Status LED Blink Patterns	6
3.4 Configuring The TLP-103	6
4. Pinger Mounting	7
5. TLP-103 Maintenance	8
6. TLP-103 Specifications	8

1. Introduction

The TLP-103 target locating pinger is a miniature pinger designed primarily for use with the RangeNav™ underwater tracking range. It is used in field for tracking small vehicles (AUV, UUV or ROV), divers and other underwater targets. The TLP-103 is a self-contained instrument which is housed in a cylinder measuring just 40 mm (1.6") diameter and 135 mm (5.3") long. It weighs just 50g in the water. A 9V alkaline battery powers the pinger, which is sufficient for about 8 hours of active tracking. The pinger operates in a frequency of 34kHz-42kHz. A magnetic swipe switch activates the pinger and a LED indicates instrument status. The TLP-103 is easy to install, just mount the small cylinder on some opportune part of the target using hose clamps, cable ties or even duct tape. The RangeNav™ surface station will track the position and depth of the target as soon as it enters the water.

The TLP-103 works at depths to 300 meters and RangeNav™ listening stations spaced at 250m will in most cases easily pick up the signal. Using the TLP-103 with 500m station spacing is a possibility under good conditions, but should be tested at your site first.

TLP-103 Design Characteristics

- Target Locating Pinger, for tracking of small vehicles, divers and equipment.
- Straightforward installation in minutes.
- Miniature, self-contained, rugged design.
- Designed for use with 250m listening station spacing, depth to 300 meters.
- Powered by user replaceable 9V alkaline battery.
- Supports sub-meter 3D tracking accuracy.
- Equipped with a 500 PSIA (300m) depth sensor, which has an accuracy of 5 PSI (3m).
- Selectable frequency channels for support of multiple target tracking.

Figure 1 shows the TLP-103 Target Locating Pinger. The sonar transducer and the depth sensor are integrated into the lower part of the housing. The dual-color status LED is visible through one hole in the outer cover, and the other hole designates the location of the power/configuration magnetic swipe switch. The top end cap can be removed to access and replace the 9V battery.

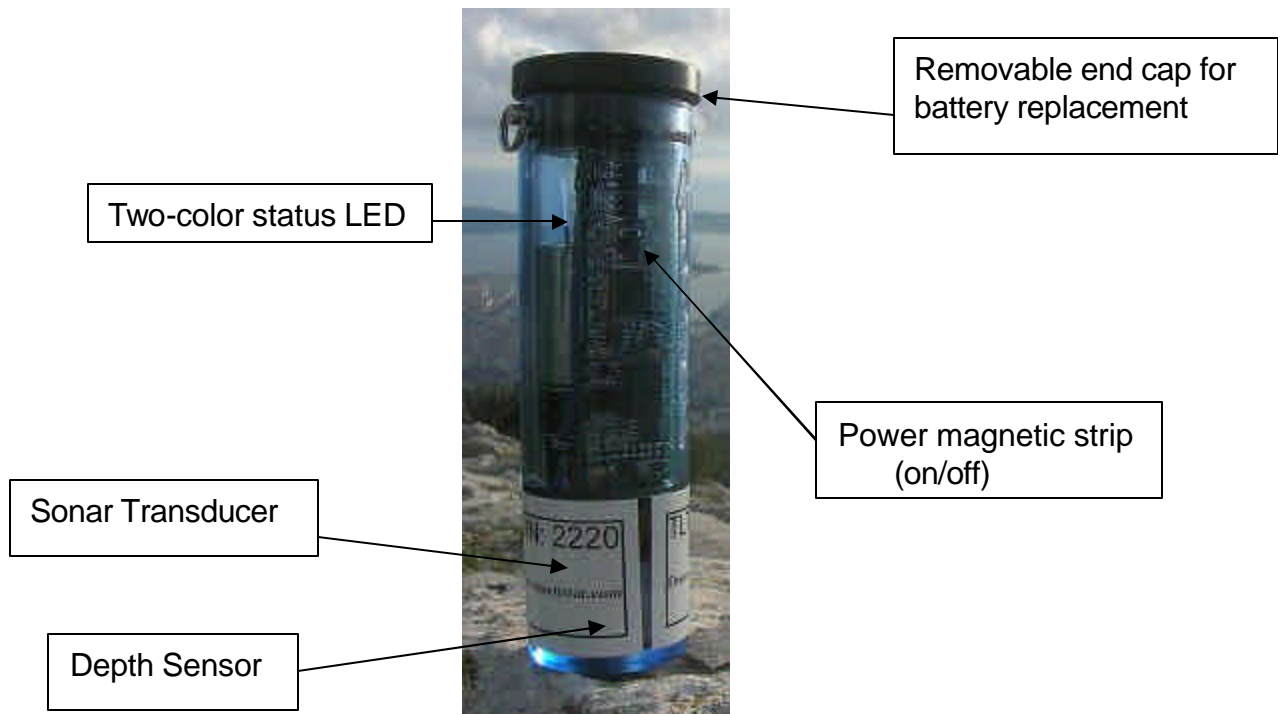


Figure 1: TLP-103 Target Locating Pinger

2. Unpacking

Please ensure that your shipment does contain these components.

TLP-103 Component List

- TLP-103 Target Locating Pinger
- Pinger equipment case (yellow box)
- Power/configuration switch actuation magnet on lanyard
- This manual is available at www.desertstar.com/downloads



Figure 2: TLP-103 Shipping Configuration

If a shipment is incomplete, please contact Desert Star Systems.

In order to operate your TLP-103 you will also need the RangeNav™ system components including the STM-100 surface station junction box, PC, RBS-100 listening stations, RPD cable sections and the DiveBase RangeNav™ software for the Windows PC.

3. Preparations For Operation

Follow these simple steps to get your target locating transponder ready for operation.

Preparations For Operation

- Unpack the pinger and make sure you've got all the parts.
- Install a 9V alkaline battery.
- Configure the TLP-103 using the magnet switch with LED feedback. (SKIP this step if you don't need to change the channel number, 1...8)
- Mount the TLP-103 on the target.
- Switch the pinger on prior to launching the target.

3.1 Changing The Internal Batteries

CAUTION!

Installing or changing the TLP-103 battery requires opening the pinger. This will expose the electronics and make them vulnerable to damage due to water intrusion, static electricity discharge, contamination, strike etc. Improper re-assembly also risks a leak in the housing and consequential flooding, which will lead to almost certain destruction of your TLP-103. Always work at a clean, reasonably static free work station when opening the transponder. Pay attention to detail. Desert Star Systems cannot accept responsibility for operator error resulting in equipment damage.

A 9V battery powers the pinger. The brand of the battery does not matter so long as it is Alkaline. We use Energizer just because we like musical rabbits.

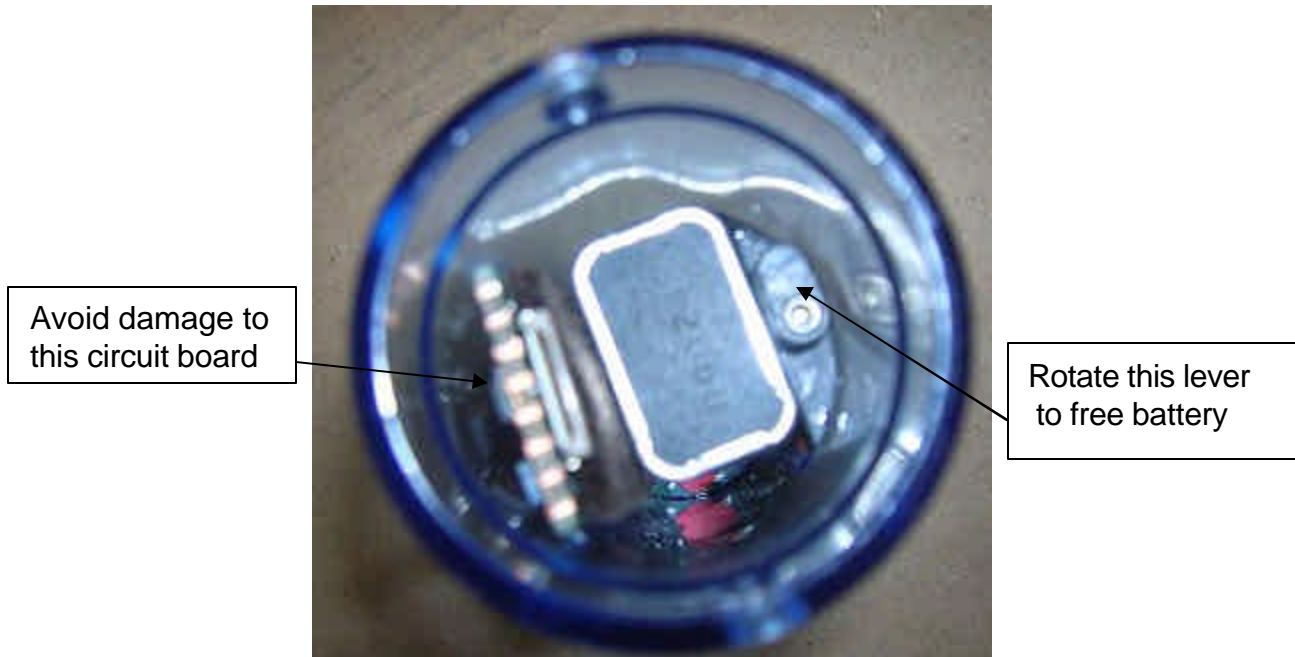


Figure 3: The Battery Compartment

To change the battery, follow these instructions.

1. Wipe the TLP-103 dry prior to opening.
2. Remove the spiral ring from the retaining pin, and remove the retaining pin.
3. Open the end-cap by combining a gentle motion of twisting and pulling. Be aware that water drops that may have accumulated just outside of the O-ring will get sucked in by a temporary relative vacuum. Prevent that by watching the O-ring area through the clear housing, wiping away drops and slowly removing the end cap.
4. Turn the lever switch that secures the battery, pull the battery out (you may have to thump the open side of the housing against the palm of your hand to encourage the battery to move) and replace. Watch the battery polarity. The + contact must match with the red post, the – contact with the black post. Reversed insertion will not do any damage, but the transponder will not work. Make sure to lock the battery by rotating the lever.

CAUTION: You will notice the configuration connector along the leading edge of the board. It incorporates a brown lever that may flip open or possibly break off if disturbed. You should avoid that from happening, but the transponder function will not be affected.

5. Clean the O-ring and apply a thin film of silicone grease if dry. Also, inspect the O-ring mating surface.
6. Insert the end-cap and secure with the retaining pin and spiral ring.
7. Inspect the O-ring through the clear housing. A proper seal is characterized by an unbroken shiny black area (the O-ring compression area). Watch for any contaminants and correct if there is a problem.

3.2 Station Activation and Magnet Switch Operation

A magnetic switch is used to switch the TLP-103 ON, OFF and. To operate the switch, swipe the magnet included with your transponder past the right marking hole in the outer cover. You may have to experiment a bit to find the best spot for actuation, but the green LED will light to indicate when you 'made contact'. If you lose the magnet do not worry, any magnet will do.

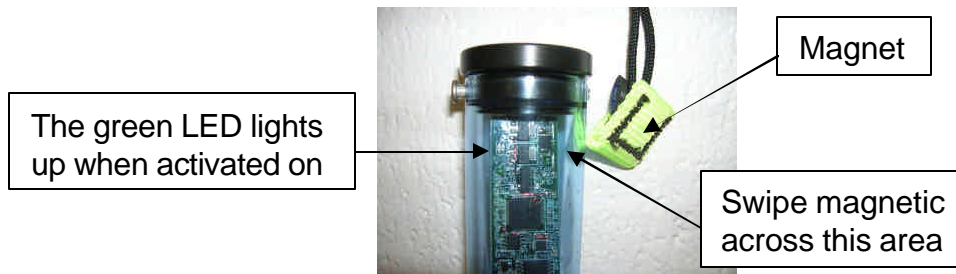


Figure 4: Operating the Magnetic Switch

Table 1 lists the various actions that can be initiated with the magnetic switch.

Action	How to initiate	Status LED feedback
Switch TLTP-103 ON	Briefly hold magnet over switch	Green LED lights when switch is actuated. Red status blink pattern when magnet is removed.
Switch TLP-103 OFF	Hold magnet over switch for 3 to 9 seconds.	Green LED lights when switch is actuated. LED OFF when magnet is removed.
Configure the TLP-103	Hold magnet over switch for 10 or more seconds.	Green LED lights when switch is actuated. Red LED lights when configuration mode is activated.
Enter a configuration parameter	When correct amount of LED blinks occur, swipe magnet.	See section 3.4

Table 1: Switch Operation

3.3 Status LED Blink Patterns

The TLP-103 uses a two color (red/green) status LED. Here is a guide to the blink patterns.

Blink Pattern	Interpretation
RED rapid blinking	The battery is low. Replace it.
RED single blink once per second	The pinger is operating normally.
RED triple blink	Hardware error. This blink patterns currently indicates a depth reading too far from zero. Causes could be a defective depth sensor, or you switched the transponder ON while submerged. Transponder functions will still work, although the depth reporting may be faulty.
GREEN LED lights solid	Magnet switch actuation has been detected
RED and GREEN LED light solid	When holding the magnet switch for 10+ seconds next to the switch, this pattern indicates that the configuration mode has been enabled.
RED one to eight blinks.	In configuration mode, indicates a current Channel setting. See section 3.4.

Table 2: Status LED Blink Patterns

3.4 Configuring The TLP-103

The TLP-103 is configured through the use of the combined power/configuration magnet switch. Use the lanyard with the magnet embedded in the yellow pouch to operate the switch. The only thing that you would actually be configuring is the channel definition. If you are tracking a single target this step is not needed.

1. To initiate transponder configuration, hold the magnet over the switch for up to ten seconds. The green LED will light as soon as the switch is triggered. Keep holding the magnet until the red LED lights solidly (not blinking), indicating that transponder configuration has been initiated. Now, remove the magnet.
2. Transponder Channel setting: The TLP-103 can be set to one of eight Channels, 1...8. This allows simultaneous tracking of up to eight TLP-103 pingers. If you are using a single pinger, always use channel #1. If you are tracking multiple transponders, assign each a unique Channel number. For best operating convenience (and least confusion), assign a solid block of Channels starting at #1. The TLP-103 will blink the red LED in an endless pattern sequence of one to eight blinks, with the number of blinks corresponding to the Channel code. Select a Channel code by triggering the switch in the pause after that Channel code has been transmitted as a blink pattern. The lighting of the green LED confirms your selection.

4. Pinger Mounting

The sonar transducer of the TLP-103 is the antenna of the system. The transducer is integrated into the bottom of the housing, in the area of the white label. Proper placement and mounting of the transducer is required for good tracking.

Mount the TLP-103 so that the sonar transducer remains un-obscured, or shielding by any nearby hardware or the acoustic shadow of the diver's body (for tracking) is minimized. The TLP-103 should also be mounted vertically, typically with the sonar transducer facing away from the surface the pinger is mounted on. This is recommended to align the doughnut shaped beam pattern of the transducer with the horizontal plane. Of course, at times vertical mounting may not be practical and so the recommendation is to come as close to that ideal as possible. The system will in general still work, but effective distance from the listening stations may be reduced, or listening stations in one particular direction may not be able to pick up the signal.

For small vehicles, the best performing mounting areas are generally the bottom or the top of the vehicle. For diver mounting, consider floating the TLP-103 above the diver (use a small float) or dropping it below the diver (consider attaching some weight). You can also attach the TLP-103 directly to the diver's tank or possibly even place it in a b/c pocket. However, due to the resulting signal shielding, the effective tracking range will probably be less (similar to the result of having your cell phone antenna in a poor location or inside a shielded building). As shown in the figure below, the pinger was attached to the diver's tank and we still tracked fine; although range may have been reduced.

Guidelines For TLP-103 Mounting on a Small Vehicle

- The sonar transducer, which is located in the bottom of the housing around the area of the white identification label, should not be shielded by any part of the vehicle. It is preferred to mount the TLP-103 near the top of the vehicle, vertical with the transducer facing up, or the bottom with the transducer facing down. This affords a near unobstructed view of the seafloor mounted listening stations.
- Keep the pinger away from the thrusters as these may produce some disturbances that could shield the pinger's signal.
- Maximize the space between the TLP-103 sonar transducer and other sonar transducers on the vehicle. While the TLP-103 will not receive or be disturbed by any interference, its signals may interfere with other acoustic systems. If using scanning or imaging sonar, mount the TLP-103 out of the beam pattern of that instrument.
- For best performance, mount the TLP-103 vertically, with the transducer facing away from the vehicle.
- Use a bracket or another rigid structure to secure the pinger. Use the area between the sonar transducer and the status LED and magnetic switch to mount securing hardware (this area does not require access).



Figure 5: Mounted TLP-103 on Diver

Though the TLP-103 is NOT mounted vertically, AND is clearly obscured by the diver's sonar shadow, we still tracked this diver over the shorter test distances.

5. TLP-103 Maintenance

Your TLP-103 is a rugged instrument that requires very little maintenance. However, please do observe the following points to ensure long and proper operation.

Maintenance Instructions

- Rinse the pinger with fresh water after each deployment.
- Remove the battery if the pinger will not be used for a significant amount of time.
- The TLP-103 chassis is sealed by a single O-ring; keep the O-ring clean and lubricate with a thin film of silicone grease if dry. Inspect for any cuts or abrasion, and replace the O-ring if damaged.
- Keep the small depth sensor hole in the bottom label free of debris. Rinse with a water stream if obstructed. DO NOT penetrate with a sharp object to clean. This tiny sensor uses a very soft gel membrane which is very easily damaged by mechanical attack.

6. TLP-103 Specifications

Size:	135 mm L x 40 mm D (5.3" L x 1.6" D)
Weight:	230g in air 50g in water
Depth Rating:	300 meters max. working depth
Operating temperature:	0-50 degrees Celsius
Configuration& control:	Magnet swipe switch
Status Indicator:	Dual color RED/GREEN status LED
Sensors:	Depth sensor for depths of 0-300 meters, calibrated to within 0.7 m in the range from 0m to 70m
Sonar Transmitter:	Frequency hopping, operating at 33.8 kHz to 42 kHz Source Level ≥ 177 dB re. 1 μ Pa
Sonar Transducer:	Near omni directional transducer (hollow cylinder) integrated in housing.
Power supply:	Powered by single 9V alkaline battery. Battery life (approximately): Tracking mode with one transmission per second: 8 hours

Note: all specifications are subject to change without notice

ITEM NO.	PartNo	DESCRIPTION	QTY.
1	HOU01101	Scout TX Housing	1
2	BRB-1	BOTTOM BOARD,TLT-REV.B	1
4	TDC00036	38kHz Omni Ceramic Element,12" lead	1
5	HOU01444	TLT-2 TRANSFORMER SUPPORT	1
6	TRB-1	TLT-1 REV. B, TOP ROUND BOARD	1
7	BAT00327	9V BATTERY FOR SPORT RX	1
8	HOU01445	TLT-2 Battery Cradle	1
9	HOU01446	TLT-2 Battery Secure	1
13	EM-41	TLT-Rev.B Main Board	1
15	XFM00319	FT-114-67 Toroidal Core Ferrite	1
16	HOU01443	TLT-2 ENDCAP	1
17	HDW00281	HDW-Clevis Pin-New Scout TX	1
19	ORI00015	O-Ring 2-122 E515 New Scout	1
20	HDW00282	HDW-SPLIT RING 0.430" FOR NEW SCOUTS	1
21	HDW00362	HDW-SS-2-56 1/2 SOCKET CAP	4
22	SSS00059	Scout Tx Bottom label & Micro TLT	1

