

RBS-1 & RBS-2

Remote Baseline Stations

Technical Reference Manual



Rev. 3
March 2001

Desert Star Systems
761 Neeson Road, Suite 9
Marina, CA 93933
(831) 384-8000
(831) 384-8062 FAX
<http://www.desertstar.com>

© Copyright 1999, Desert Star Systems

1. INTRODUCTION	3
2. UNPACKING	3
3. PREPARATIONS FOR OPERATION	4
3.1 ACTIVATING AND OPERATING THE BASELINE STATION	4
3.2. CONFIGURING THE BASELINE STATIONS	5
3.3. CHARGING THE BASELINE STATION BATTERY	5
4. BASELINE STATION MOUNTING	6
5. THE MULTI-FUNCTION CONNECTOR	ERROR! BOOKMARK NOT DEFINED.
6. BASELINE STATION MAINTENANCE	8
7. RBS-1 AND RBS-2 SPECIFICATIONS	8

1. Introduction

The RBS-1 and RBS-2 remote baseline stations are rugged instruments designed for use with the AquaMap™ long baseline survey system. The smaller RBS-1 station has a battery life of about 20 hours per charge, while the RBS-2 lasts about 130 hours. Operational life can be spread over periods of weeks, or months thanks to the instrument's sleep mode with sonar and periodic wake-up call capability. An omnidirectional 34 kHz - 41 kHz sonar transducer is hard-mounted on one end-cap, while the other end cap is occupied by a multi-function connector, a power switch, a status LED and a depth transducer. The instruments are rated for use at depths up to 1000 meters. A deep ocean version of the RBS-2, the RBS-2D is rated for use to 7000 meters depth and operates at a lower frequency range. To simplify deployment as a sub-surface buoy, the baseline stations come equipped with a bolt-on syntactic foam flotation collar.

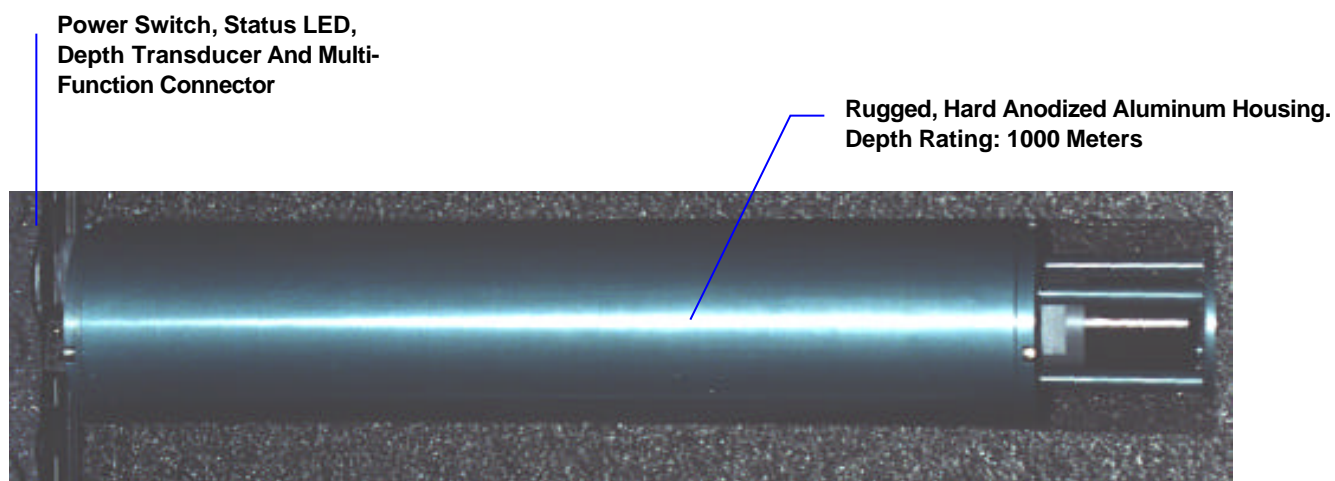


Figure 1.1: RBS-1 Baseline Station

Figure 1.1 shows the RBS-1. The cylindrical housing is manufactured from hard-anodized aluminum. A multi-function connector for power charging and data exchange is located on either end cap. A power knob, status LED and a depth transducer are mounted on the main end cap. The RBS-2 is similar in design, but larger.

2. Unpacking

Please ensure that your shipment does contain these components.

RBS-1 & RBS-2 Component List

- 1 ea. RBS-1/RBS-2 Remote Baseline Station
- 1 ea. protective cap for multi-function connector
- 1 ea. data exchange cable
- 1 ea. cable adapter
- 1 ea. battery charger
- This manual

In order to configure your baseline station, you will also need a personal computer.

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. Preparations For Operation

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

- Unpack the baseline station and make sure you've got all the parts.
- Charge the internal battery of the baseline station.
- Configure the baseline station.
- Activate and deploy the baseline station.

3.1 Activating And Operating The Baseline Station

The RBS-1 and RBS-2 baseline stations offer two 'power ON' options:

- 'Permanent ON' is achieved by rotating the power knob to the ON position. In this mode, the baseline station will not fall asleep if no diver activity is detected. Permanent ON is appropriate for single day surveys that will not exhaust the battery capacity of the station.
- 'Standby' is achieved by rotating the knob to the ON position, waiting until the status LED starts blinking, and then moving the knob another 90 degrees to one of the positions half way between ON and OFF. The baseline station will fall asleep if no diver activity is detected. A wake-up call issued by the diver or surface station is required to activate a sleeping station. Use this position for multi-day surveys where battery power must be conserved between dives.

3.2 The Status LED

Once a baseline station is active, observe the status LED. After a few seconds, the LED should settle into a pattern of one short blink every second. If you don't see this pattern, the station may indicate a special condition or it may not be running SmartDive. Refer to the following table.

Status LED Pattern	Description
LED is OFF	The baseline station is OFF, the battery is dead or it is not running any application software (no application software installed, baseline station is connected to DiveTerm for maintenance functions)
LED is always ON	Not a valid blink pattern. A hardware problem may exist, the baseline station battery may be discharged.
Single short blink once per second	Baseline station is operating fine.
Double blink once per second	A position fix has been received.
Triple blink once per second	Baseline station self test failed. Run DiveTerm on the PC and start SmartDive from DiveTerm. Watch the error code. Look in next table to interpret the error code.
1/2 sec ON, 1/2 sec OFF	The baseline station is not configured, configure the station (see next section for details). This signal may also indicate that a different application is running. Use DiveTerm to verify that SmartDive is running.
1 sec ON, 1 sec OFF	Charging of the baseline station battery is under way.
1 sec ON, 3 sec OFF	Battery charging is complete.
Other blink patterns	A different application is running on the baseline station. Use DiveTerm to select SmartDive as the active application.

Figure : SmartDive Blink Patterns

RBS-1 & RBS-2: Remote Baseline Stations

The status LED of the baseline station will triple blink if the self-test failed. Connect the baseline station to the PC and run DiveTerm. Switch the baseline station OFF and ON again. After a link is established, run SmartDive. After a few seconds, a TEST FAIL message will appear. Use the table below to interpret the error code(s) in [brackets] after the message.

Error Code	Description
1	Memory Error. The transponder memory is defective.
2	RTC Error. The real-time clock is not running. The clock battery may be low or the clock may be defective. Try setting the clock in DiveTerm.
3	VFO Error. The variable frequency oscillator, a part of the sonar transmitter and receiver, is not working.
4	ADC Error. The analog to digital converter is not working or is out of calibration. The transponder may still work, though depth sensing and battery charging may fail.
5	Depth sensing error. The depth sensor is not working or is out of calibration. The rest of the transponder may still work.
6	Sonar transmitter error. The sonar transmitter is not working, or the sonar transducer is not plugged in or is defective. CAUTION: In SmartDive V1.80X, this test may fail without a problem actually existing.
7	Sonar receiver error. The sonar receiver is not working, or the sonar transducer is not plugged in or is defective. CAUTION: In SmartDive V1.80X, this test may fail without a problem actually existing.

Figure 3: SmartDive Self Test Error Codes

Note again that the blink patterns are specific to the application running on the baseline station. The status LED blink pattern can provide you with important information. Always check the baseline station LED immediately before deployment. You should see the standby blink pattern (unless it has already fallen asleep).

After recovering a baseline station, switch the knob to the OFF position so that the battery will not be drained.

3.3. Configuring The Baseline Stations

Follow these instructions to configure a baseline station:

Configuring A Baseline Station

- Connect the baseline station to a serial port of a PC using the supplied data exchange cable and connector adapter. When using the STM-10, connect the baseline station to the CONFIGURE port. Switch the TRACK/OFF/CONFIGURE switch of the STM-10 to the configure position. Switch the TRACK/CHARGE switch to the TRACK position.
- Switch the baseline station ON and make sure that SmartDive is running.
- Start the configuration file download process using either the DiveTerm or DiveBase utility on the PC.

3.4. Charging The Baseline Station Battery

RBS-1 & RBS-2: Remote Baseline Stations

The model RBS-1 and RBS-2 baseline stations are equipped with re-chargeable Nickel Cadmium batteries. Batteries of this type slowly discharge themselves, and so you may find your station's battery to be low or dead.

The batteries of the RBS-1 and RBS-2 are re-charged using a sophisticated fast-charge algorithm which is implemented in SmartDive™. The SmartDive™ application is factory implemented on your DiveTracker™ and selected as the active application.

To charge the battery of a RBS-1 or RBS-2 baseline station, follow these instructions.

Charging The RBS-1 and RBS-2 Batteries

- Remove the protective cap from the utility connector of your station.
- Plug the battery charger (DT1-CHARGE) cable into the connector. Plug the battery charger power cable into a power outlet.
- Activate the station by rotating the power knob to the ON position. The LED should come on and start blinking a pattern of one second ON followed by one second OFF.
- If the station settles into the standby blink pattern (one brief blink per second), it does not sense the charger. Make sure the charger is plugged into a life outlet and check all cable connections.
- If the station settles into a blink pattern different than those described here, it may not be running SmartDive. Use the DiveTerm™ utility to select SmartDive™.
- The charge blink pattern should persist for about 3.5 hours on the RBS-1 and 24 hours on the RBS-2 if the batteries are completely depleted. Battery charging is completed when you see a blink pattern of one second ON followed by three seconds OFF. Disconnect the station from the charger and switch it OFF.

ADVISE

If your RBS-1 or RBS-2 baseline isn't factory new, you might find that an application other than SmartDive is selected. In this case, SmartDive must be selected as the active application before charging can begin.

4. Baseline Station Mounting

Three baseline stations are normally used with an AquaMap™ system. The baseline stations serve as the reference points for navigation.

Long baseline systems require that the baseline stations are deployed before tracking can begin. Baseline station locations are surveyed automatically by AquaMap™, so there is no need for precise placing of the stations. The sleep mode allows baseline stations to be deployed for extended periods of time.

The first step of deployment is a careful selection of the site.

Baseline Station Site Selection

- Do not make your survey grids larger than necessary. Long-distance tracking results in reduced accuracy and lower position update rates.

RBS-1 & RBS-2: Remote Baseline Stations

- Place the baseline stations near the corners of the survey area. Accuracy is best when at least two of the baseline stations appear at 60 to 120 degree angles from anywhere within your survey site.
- Certain geometrical constraints apply to baseline station placement. Comply with the instructions in the AquaMap Operator's Manual

The mounting technique for the baseline stations also figures into system performance. Follow these guidelines.

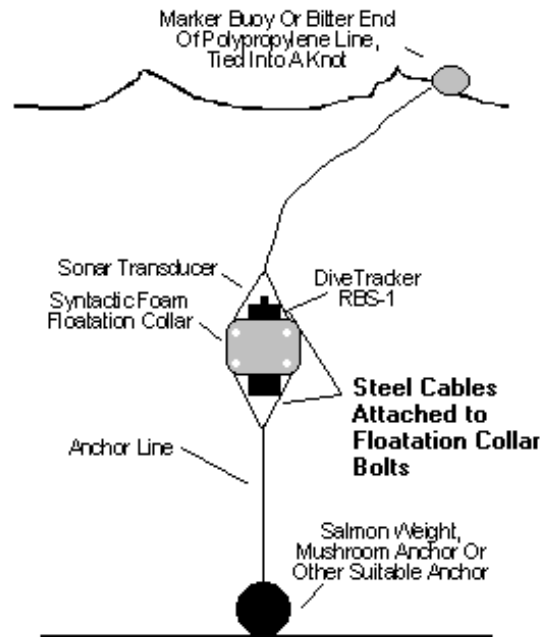


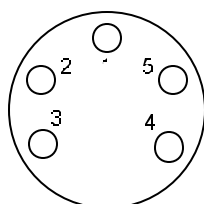
Figure 4: Mounting a Baseline Station

Baseline Station Mounting Technique

- Secure the supplied floatation collar to the station housing. The floatation collar end should be flush with the connector end-cap of the baseline station. The transducer end-cap should extend well beyond the floatation collar. This end will act as a keel, keeping the station vertical. Tighten the bolts to prevent the station from slipping out of its collar. Do not attach any unbalanced weights to the baseline station, as this will cause it to lose its vertical orientation.
- Prepare an anchor line for each baseline station. The anchor line should be sized to place the baseline station sufficiently high above the terrain to 'see' the diver anywhere in the survey area. However, in order to minimize positioning degradation due to baseline station movements, it should not be unnecessarily long. Connect the anchor line to the transducer end-cap cage of the baseline station so that the baseline station will float with the transducer pointed down (similar to a ceiling light).
- If a surface marker is desired, secure a second line with a small float to the baseline station.
- Activate the station and deploy.

5.1 The Multi-Function Connector

The multi function connector is a SUBCONN model MCBH5F. This connector is used to wire the station to the umbilical and to connect a battery charger. 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.



- 1: Ground (0V)
- 2: Receive Data (RXD)
- 3: Transmit Data (TXD)
- 4: Charger Input
- 5: External Power

Figure 5.1: Multi-Function Connector Pin Assignment

6. Baseline Station Maintenance

Your RBS-1 or RBS-2 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 transponder chassis is made out of aluminum, the transducers and connectors, screws, mounting ring and other hardware are brass and stainless steel. Even though the housing is hard anodized to minimize corrosion, some will still occur at the points where the two metals meet. This corrosion can be minimized through proper rinsing. Corrosion around this area will rarely be severe enough to affect operation. It may however be a cosmetic consideration.
- Make sure that the hole in the depth transducer on the connector end cap does not get blocked by debris. If this should happen, rinse the transducer with a strong stream of water in order to dislodge the debris. **DO NOT USE A SHARP OR POINTY OBJECT TO PENETRATE THE TRANSDUCER HOLE. THIS MAY WELL RESULT IN DAMAGE TO THE TRANSDUCER MEMBRANE.**
- The baseline station housing is sealed with a number of O-rings. The O-ring rubber has a limited life time. We recommend that you return your baseline station to Desert Star Systems every three years for service.

7. RBS-1 and RBS-2 Specifications

Size:	RBS-1: 419 mm L x 76 mm D (16.5" L x 3" D) RBS-2: 673 mm L x 127 mm D (26.5" L x 5" D) RBS-2D: 673 mm L x 152 mm D (26.5" L x 6" D)
Weight:	RBS-1: 1.8 kg (3.9 lb.) RBS-2: 9.2 kg (20.25 lb)
Depth Rating:	RBS-1 & RBS-2: 1000 meters (3280 feet) RBS-2D: 7000 meters (22965 feet)
Operating temperature:	0-70 degrees Celsius
Data I/O:	RS232 serial data link available on two identical multi-function connectors
Status Indicator:	Status LED
Depth Sensor:	RBS-1 & RBS-2: Available 50 PSI to 2000 PSI max. scale, accuracy +/- 1% of full scale

RBS-1 & RBS-2: Remote Baseline Stations

Microprocessor:	RBS-2D: No depth sensor MC68HC11, 1 MHz
Memory:	128 Kbyte of battery backed-up SRAM (for user data) 2.5 Kbyte of volatile SRAM (stack space) 256 Kbyte of permanent FLASH memory (for DiveCode) 24 Kbyte of EPROM (firmware storage)
Sonar transceiver:	0-160 Watt RMS output in transmit mode RX sensitivity 7 microvolt RMS @ 6 dB S/N 4th order continuous time bandpass filter Digital frequency synthesis, tunable in 0-100 kHz range, resolution 1.5 Hz
Sonar transducers:	RBS-1 & RBS-2: 34-41 kHz omni directional transducer hard-mounted on end cap RBS-2D: 8 kHz - 16 kHz oil filled unlimited depth omni-directional transducer Other frequencies available on request
Sonar range:	100-1000 meters communication range, depending on sea conditions Extended range available on special request.
Sonar modulation:	Multi frequency-shift keying (MFSK)
Sonar bitrate:	15 - 150 bits/sec
Sonar navigation:	Long baseline principle and depth sensor data yields 3D position information for mobile stations Navigation range is 100-1000 meters, depending on sea conditions. Extended range available on request. Distance measurements repeatability: +/- 0.15 m (6") typical
Power supply:	RBS-1: 2.8 Ah Nickel Cadmium Battery, 3 hour charge time RBS-2 & RBS-2D: 18 Ah Nickel Cadmium Battery, 24 hour charge time External 9V to 16V DC power supply via multi-function connector
Battery Life:	RBS-1: Approx. 20 hours operation per charge, zero-power sleep mode for extended deployments RBS-2 & RBS-2D: Approx. 130 hours operation per charge, zero-power sleep mode for ext. deployments

Note: all specifications are subject to change without notice