SUR-BLE

Submersible
Ultrasonic
Receiver
BLE 69kHz Version

Operation Manual

SONOTRONICS

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SUR22-BLE Submersible Ultrasonic Receiver

The SUR22-BLE is a submersible ultrasonic receiver designed to detect and log to flash memory the presence and telemetry of an animal tagged with Sonotronics ultrasonic transmitters. The SUR is a stand-alone device consisting of a battery system, microprocessor, flash memory, real time clock, hydrophone, ultrasonic receiver, and Bluetooth Low Energy transceiver. Throughout this document SUR and SUR22 may be used interchangeably.

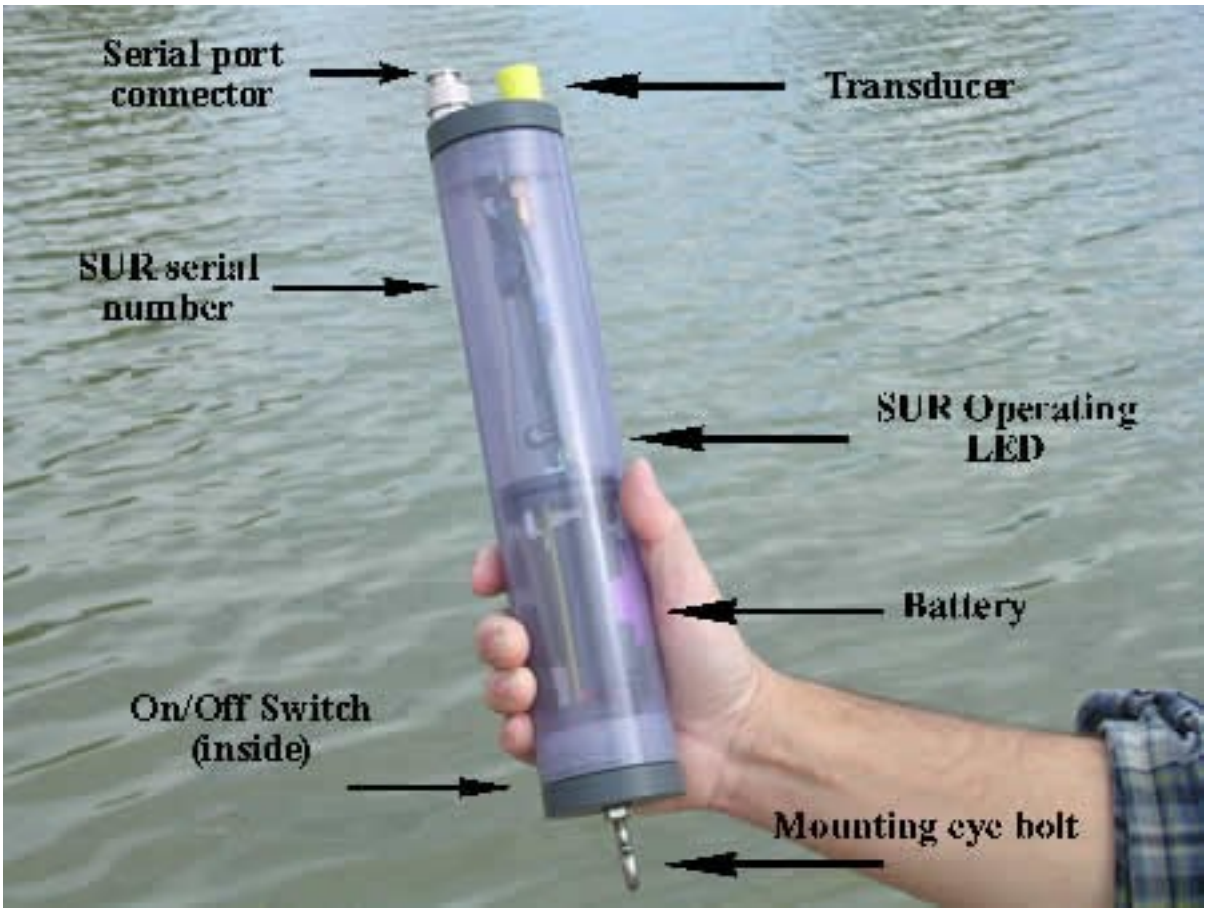
Specifications:

Weight:	***1kg, Positively Buoyant (w 2xBatteries)***
Sensitivity:	***>35dB (S+N)/N with 10uV input***
Length:	***38cm from transducer to end cap***
Diameter:	***60mm***
Memory:	***2 Megabyte—Over 180000 detections***
Lifetime[1]:	***13mo (2 batteries)***
Battery:	***Tadiran TL5930 (1 or 2 batteries)***
Depth Rating:	***200m recommended, 270m tested***

Basic Operation:

The SUR22-BLE-69kHz is a single frequency version of Sonotronics Submersible Ultrasonic Receiver. The SUR employs proprietary techniques to reduce the effects of environmental noise, and adjustable gain to allow maximum flexibility whether deployed in marine, lake or riverine systems. While the SUR is highly configurable, factory default settings are suitable for most studies: generally the user needs only verify the code types detected and the correct current time and date before deployment.

Anatomy of an SUR:



Caution!! **Never hold the transducer when opening: use the rim of the gray cap only.** **(A 'grip wrench' is recommended for loosening the SUR caps.)**

The SUR is intended to be opened on the top (connector and transducer) for replacing batteries, and opened on the bottom (eye bolt) for turning the unit on and off.

Initial Power On Sequence:

The SUR is shipped in the 'off' state - to activate, remove the bottom (eye bolt) end cap, and move the small switch toward the outside of the SUR housing. The SUR operating LED will blink 4 times, with a period of 1 second, indicating a successful power on sequence. During normal operation, this LED blinks once per complete frequency scan, and will blink twice upon successful detection of transmitter. These simple steps confirm proper operation prior to deployment.

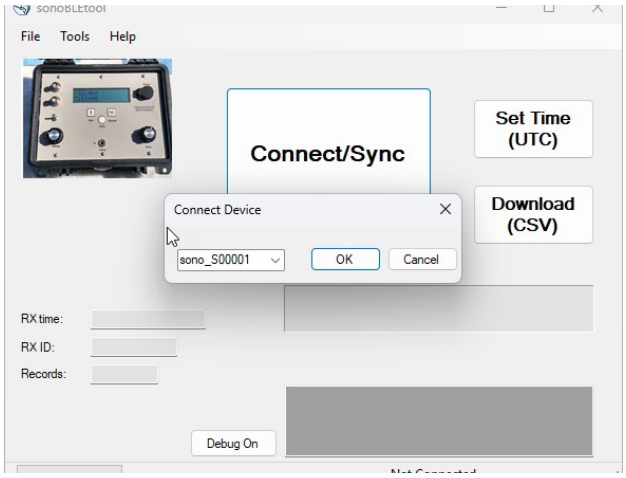
sonoBLEtool software:

sonoBLEtool is a Windows application that allows the user to download data from-BLE eneabled receivers like the SUR22-BLE, erase memory, program code types to scan, and configure several operating parameters.

Pre-Deployment:

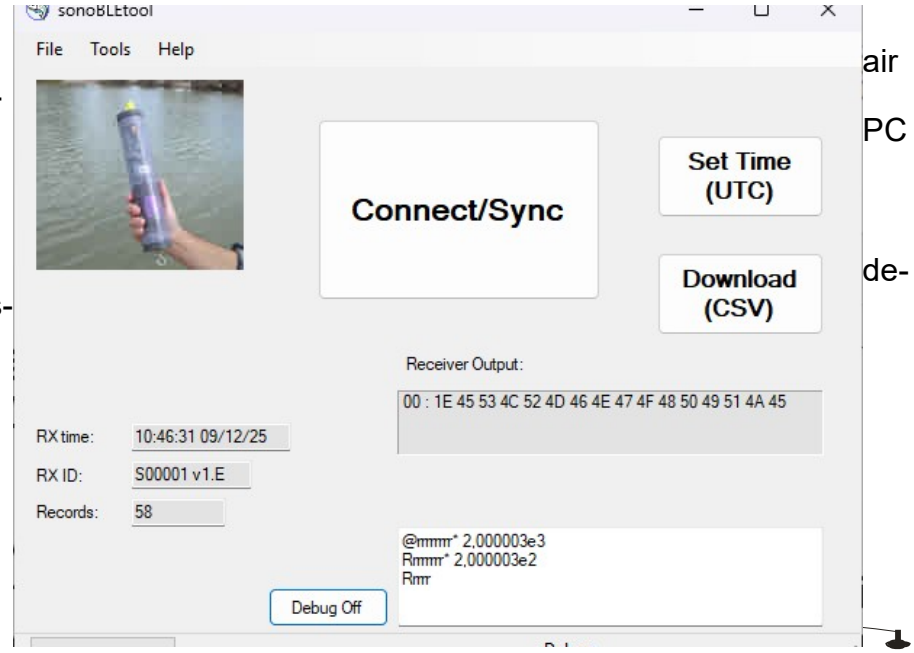
Prior to deployment, sonoBLEtool should be installed on the computer that will later be used to recover field data using either the included jump drive or from the Sono-tronics website. A PC running Windows 10/11 with a Bluetooth modem capable of connecting to Bluetooth Low Energy devices is required

After successful software installation, remove the protective cap from the top of the SUR. Switch on the SUR, then launch sonoBLEtool and begin communication with the SUR by selecting the Connect/Sync.



Pre-Deployment (continued):

A quick bench test may be performed in air to verify proper operation: connect to the SUR as before, and click on “Debug On” and observe real-time detections and coding of a test transmitter;



PC de-

Deployment/ Mounting:

The most common deployment configuration is shown in the diagram on the right. The eye bolt on the bottom of the SUR is intended for running a cable or rope for mooring the unit. Having two anchor points (in the picture, mushroom anchors) allows for simple recovery. The SUR outside diameter is designed so that a 2” PVC coupler may be snapped onto the top of the SUR to protect the transducer without affecting performance. Additional methods include:

Attaching the SUR to a known object, such as a dock piling or an anchor chain, using wire ties or stainless steel hose clamps to secure the SUR body. It is recommended to acoustically isolate the SUR body from a solid structure such as a piling by wrapping it in neoprene or other closed cell foam.

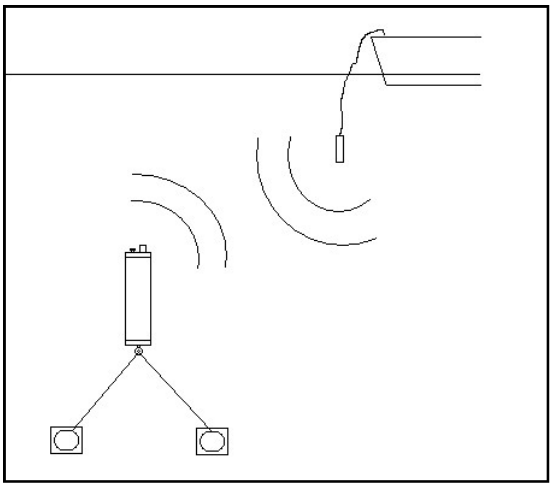
Use a single anchor attached to the SUR, and attach a rope from the anchor to shore, keeping the end just underwater where it is easy to find from shore, but hidden from casual view.

In addition, in areas where barnacles accumulate, use a simple nylon stocking as a sacrificial membrane by covering the entire SUR, and replacing the stocking during each deployment. This method may be helpful in rivers with high sediment flow: in this case, remove the protective coupler prior to using the nylon to prevent sediment build-up inside the coupler.

Ping and Response function:

The ping and Response function allows the user to determine the presence/absence of data in the SUR, and is used along with an active receiver such as the USR-23 To implement the feature, set the USR-23 to receive 32.75kHz, and lower the special interrogator transmitter (SIT) into the water within 100m of the SUR. The SUR will respond with one of the following codes:

3 pings, with no successive pings= Zero data hits
3 pings, followed by 3 fast pings= greater than 0 and less than 100 data hits
3 pings, followed by 6 fast pings = greater than 100 data hits



Replacing Batteries:

To replace the batteries in an SUR, follow these steps:

1. Unscrew the top cap of the SUR. DO NOT unscrew holding the transducer. Grip the circumference of the grey cap itself (an oil filter wrench may be helpful in loosening this cap).

2. Slide the PCB out of the SUR housing

3. Turn off the power using the switch at the end of the board. The SUR is on when the switch is towards the outside world.

4. Replace batteries, being careful to keep the same orientation. The positive end should be towards the eye bolt. Time of day and all other operating values are not affected by loss of power

5. When reassembling the unit, it should be observed that the LED on the end of the main circuit board will blink three times when the unit is powered on with the switch.

6. **IMPORTANT!!** Inspect the O-ring while screwing the top end back into the unit. If the O-ring is not seated properly, the units will not be waterproof. Hand tighten securely. Occasionally it is recommended that you add Vaseline or O-ring grease to this O-ring as this will help it seat properly.

   Replacement Batteries can be ordered from Sonotronics. Do not replace the battery with a standard D cell alkaline battery. The SUR requires Lithium 3.65v battery in order to operate, and may be ordered using the ordering code SUR-BAT from Sonotronics. Due to the high energy content of these batteries, freight restrictions may apply.

It is good practice to write the date on the batteries prior to deployment, providing a helpful reminder when the next replacement should occur.

Understanding Blanking Times:

To maximize detection efficiency, the SUR22-BLE does not implement blanking times.

Ranging and Testing SUR's:

The actual range achievable with an SUR is the result of a number of factors: Transmitter power level, receiver sensitivity and SNR (signal to noise ratio), and a variety of factors in the environment. The factors in the environment are always the most difficult to characterize. This section is a simple guide to give the user some idea of what kind of range to expect, as well as techniques for quantifying the range more closely.

Here is a preliminary table of information:

Range	Transmitter Type	Depth
600m	High Power: DT, CHP, AST	>60 feet depth
400m	Medium Power: CT, CTT	>60 feet depth
200m	Low Power: IBT, PT	>60 feet depth

Depth is one of the main environmental influences that determines range. A quick way to adjust the table above is to halve the range if the depth is less than 60 feet. If you were in a deep open water environment, the ranges listed above would increase.

Some other factors that compromise range:

1. Any form of trapped air between pinger and receiver: Vegetation containing air, air mixed in water, air trapped in a log or other object.
2. Objects not containing air between pinger and hydrophone can cause scattering and reflection of signals.
3. Acoustic noise: Machinery, spill over (dam or any other source), depth finders, snapping shrimp, or any other source of noise in the water.
4. Thermal or salinity stratification in the water.
5. Turbidity caused by suspended sediments.

Test#1: Determining SUR range

1. Setting up the SUR: Be sure to set the time and date in the SUR and make sure you have a watch or clock with the same time.

Ranging and Testing SUR's continued:

2. Deploy the SUR in its actual location, and move away from the SUR periodically placing the transmitter in the water for a couple of minutes at important sample points (ie, 50m, 100m, 150m, 200m …). A GPS is the easiest tool for determining your range from the SUR. It is important to note the times at each distance so you can correlate it with the data in the SUR.

3. The final step is to correlate the data with the times at each range. You will see at which range the SUR begins to have difficulty in picking up transmitters.

Test#2: Determining SUR range—using ping and response—works well in deeper waters

1. An advantage to the ping and response feature inherent on SUR's is the fact that it can be used to aid in range testing.
2. Use your GPS to fix your position at the SUR.
3. Tune your manual tracking receiver to 32.75kHz and begin floating away from the SUR with the SIT (SUR Interrogator Transmitter) in the water.
4. Listen for the SUR to respond to the SIT and note the distance away from the SUR on the GPS.

Please contact Sonotronics for more help with range issues.

Ordering Information:

Descriptive title	Part Number	Comments
Replacement Batteries for SUR's	SUR-BAT	Tadiran TL-5930 D cell replacement batteries for SUR's.
SIT-69 SUR interrogator transmitter	SIT-69	This special pinger interrogates the SUR's, initiating the ping and response function. Only one SIT is needed to service an array of SUR's.

BLE Overview:

The Bluetooth Low energy interface of the SUR22-BLE is a short range radio designed to allow medium speed data transfers between enabled devices, including desktop and laptop PC with Bluetooth 5.0 or higher interfaces, and with Android devices running version 14 or higher.

To allow for maximum battery life, the SUR-22 BLE radio is switched off about 30 minutes after power-on, and must be re-enabled by either power cycling, or by using a magnet to active the sensor neat the small indicator label on the circuit board of the SUR:

When active, the BLE activity LED will start to blink about every 3 seconds until a connection is made with a PC or Android device:

When a Bluetooth connection is made, this LED will change to a “double-blink” about once per second, switching back to a slower single blink once this connection is disabled.

No further action is required to disable the BLE radio - after 30 minutes or so, the SUR will power down the radio to conserve power.

NOTES:

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