SONOTRONICS

USR-96
Narrow Band
Scanning Receiver

SONOTRONICS

Updated 11/12/2007

INTRODUCTION

SONOTRONICS is a leader in the manufacture of ultrasonic tracking transmitters and receiving equipment. From its start in 1971, SONOTRONICS has earned an excellent reputation world wide for quality and performance. First to develop long-life coded ultrasonic tags, SONOTRONICS' receivers and hydrophones offer superior range and ease of use for both manual and automatic tracking systems.

The USR-96 is a manual tracking receiver, and is typically used along with a directional hydrophone and a pair of headphones in order to locate and identify targets while on a boat or pier or any other location that provides access to water of at least 1 meter in depth. In addition to tracking, the integral display of the USR-96 may be used to provide telemetry information from tags such as pressure or temperature by showing the interval between successive pings, and this data is also available in machine readable form via the integral RS-232 port. Furthermore, the rugged construction of the USR-96 and internal NiCd batteries allow operation in remote areas, away from normal power sources.

OPERATION

Generally the USR-96 is operated with a directional hydrophone first by selecting a particular operating frequency, rotating the hydrophone through 360º while listening for pings with attached headphones, and repeating this procedure for each frequency of interest. A unique feature of the USR-96 is its ability to scan preselected frequencies, significantly reducing the labor involved in tracking tags utilizing multiple frequencies. The various modes of the USR-96 are set by the 3 position switch on the front panel:

Scan
With the mode switch set to SCAN, the USR-96 passes through preset frequencies, pausing before moving to the next preset if no transmission is detected. Once a sufficiently strong signal is received on the indicated frequency, the interval between successive "pings" is displayed on the bottom line of the LCD, and if enabled, the frequency and interval are transmitted out the RS-232 port via the DE9P connector. Scanning is paused for about 4 seconds before proceeding to the next frequency providing the operator time to interrupt this process by moving the mode switch to NORMAL, and the current frequency will remain active as long as neither the mode switch or frequency control knob is moved.

Normal
With the mode switch set to NORMAL, the USR-96 acts like a conventional receiver - the LCD displays the active frequency, and turning the control knob marked FREQUENCY changes the current setting by 250Hz steps. It is important to note that the LO of the USR-96 is offset by 1kHz, consequently when the receiver is set to 75kHz, a tag transmitting at 75kHz will sound in the headphone as a 1kHz note (approximately 1 octave above middle c).

Furthermore, the USR-96 employs a 500Hz wide filter, as a result tags physically near each other but on similar but different frequencies do not interfere with each other: tags set to 75kHz and 76kHz are not heard simultaneously (unless they are very near the hydrophone). If the USR-96 is powered on with the mode switch set to NORMAL, then the control knob is read to determine the correct frequency, however if the USR-96 was powered up with the mode set to SCAN, and later moved to the NORMAL position, the active frequency is not altered until either the mode switch is changed or the control knob is moved. Tags detected on the active frequency will show the measured interval between pings on the second line of the LCD and, if enabled, cause a string indicating frequency and interval to be transmitted out the RS-232 port.

Next
This position of the mode switch is active only as a momentary function: when engaged and subsequently released, the active frequency is set to the next one of the preset frequencies on the scan list, regardless of the previous switch setting.

Engaging and holding the mode switch to NEXT while the sign-on screen is shown on power-up places the USR-96 into programming which allows the user to change such parameters as the number of frequencies scanned, the particular frequencies scanned, and others.

DETECTION

When a received signal from a transmitter is of sufficient strength and duration, it is "detected" by the the USR-96. The time interval between successive detections is displayed on the bottom line of the LCD and transmitted out the RS-232 port if enabled. By careful use of the GAIN control of the USR-96, it is possible to both obtain telemetry information from sensing tags at long ranges, or separate signals from multiple tags transmitting on the same frequency.
The GAIN control varies how much an input signal is amplified: for tags at far distance from the receiver, the GAIN may be turned clockwise to achive maximum amplification. Conversely, when a transmitter is very close to the receiver, or multiple tags are heard in the headphones, reducing GAIN by turning the knob counterclockwise will produce a more pleasant tone, and allow discrimination of several tags. In general, it is best to leave the volume control at the 12 o'clock position, and then adjust the gain for just above the minimum necessary to observe the interval displayed on the LCD. At very close ranges, reducing the gain also increases the apparent directivity of a directional hydrophone, making locating of a target easier.

CONNECTIONS
Hydrophone
Please review the installation guide of the appropriate hydrophone prior to connecting it to the USR-96.

The front panel BNC connector is used as the hydrophone input, and the DH-4 directional hydrophone is typically used as it provides superior range and directionality. This latter characteristic allows detection of tags from 3 km under excellent conditions.

Signals received from the hydrophone may be as small as 1 microvolt, consequently care of the coax cable between the hydrophone and the USR-96 is extremely important.

Use extreme care when unwinding and winding the hydrophone coaxial cable. Your successful use of the hydrophone is dependent upon a coaxial cable in perfect condition. In the salt water environment, the smallest cut or pin hole in the coax will lead to water intrusion and failure of the unit.

The hydrophone should be laid down and the cable played out hand over hand rather than just pulling the coils off of the end. The hand over hand method eliminates kinks in the cable than can lead to it's failure. The reverse procedure should be followed when re-winding the cable.

Headphone

The headphone jack is a standard "large" (1/4 inch) stereo audio jack, and may be used with a mini-jack adapter frequently provided with stereo headphones.   Note that the volume control knob on the front panel is used to control the sound level to the headphone *only*, and has no other affect on the rest of the receiving system. Choose headphones that provide adequate comfort and reduce wind noise or other sources of distraction.

Use care to avoid unnecessarily loud volume setting: during normal operation the volume control should not be set past the 12 o'clock position.

RS-232 Output (classic mode)

An RS-232 output is provided at the DE-9 connector on the front panel of the USR-96 for use with either a companion data logger or PC. These allow automated collection of pulse intervals and frequency as shown on the LCD display. Data format for this data is 1200 baud, 8 bit, no parity, 1 stop bit (1200,n,8,1). Data is sent as a fixed length record:

"FFF.FF IIIII<cr><lf>"

where the "F"s correspond to the active frequency, and the "I"s represent the measured interval between pings in milliseconds. For example, with the receiver set to 75.00kHz, a tag is detected with and interval of 850mSec, the LCD would show:

Freq = 75.00 kHz
PI = 00850

and if enabled, the data sent out the RS-232 port would be:

<space>75.00<space> 00850<cr><lf>

Pinout for the DE9P connector "looks like" a standard PC AT 9 pin serial connector, so a null modem cable is required to connect to a PC.

Pin # Function
2   Receive
3   Transmit
5   Ground

POWER

Power is supplied by 8 internal AA rechargeable NiCd batteries, and will typically operate for 8 hours on fully charged batteries. The USR-96 will also operate from 8 AA Alkaline cells, and it is good field practice to carry an extra set of Alkalines just in case. The internal NiCd are recharged via the barrel connector plug using the supplied 12VDC wall supply, requiring 14 hours for a full charge. Although internal circuitry prevents NiCd's from overcharging, NEVER ATTEMPT TO RECHARGE ALKALINE CELLS!

USR-96 Manual

ON POWERUP

When the USR-96 is powered on, an initial status screen is displayed on the LCD:

USR-96 vX.XX
Battery -* +**

The top line identifies the firmware version number of the USR-96, while the bottom line indicates the internal battery status: a display of 1 to 5 asterisks (*) form a gage where one "*" indicates minimum and five "*****" indicate full capacity.

SETUP MODE

To enter setup mode on the USR-96, hold the switch in the next position while turning the unit on. Continue to hold the switch until the display reads "Setup". You can then release the switch. You will then change settings using the next switch to cycle to the next setting, and using the frequency know to change the value of individual settings. The settings available to be changed are listed below:

Scan# - This is the number of channels to be scanned. If your tags are spread from 70 to 79kHz, you would choose 10. If your tags are on 74, 78, and 80kHz, you would choose 3.

Frequency on each channel: a frequency will be displayed on the top line of the display, and the channel number will be displayed on the bottom line. You can change the frequency for this particular channel by tuning the frequency knob. When you are ready to do the next channel, simply press the next button.

Delay: This is the amount of time in seconds that the receiver will spend on each channel. "Delay 2" means that in scan mode it will spend 2 seconds on each channel before moving on the next channel. Again, use the frequency know to change the setting, and the next button to cycle to the next parameter.

PWmin: This is the minimum pulse width necessary in order to be detected by the receiver. This can be reduced to improve detection, or increased to reduce noise. The recommended setting for most applications is 13ms.

COMM: This turns off/on the com port. The USR-96 consumes more power when the comport is on, and it is only necessary when there is an external data logger attached to the USR-96.

Fac Def: Factory Defaults. This returns the unit to the settings that it had when it shipped from our factory.

RxMODE

After placing the USR96 in setup mode as described earlier, the user may select "ID Tilt", "ID %FS", "ID Tc", or "Classic" mode. 'Classic' mode is described in the previous sections, however starting in 2007, USR96 receivers have the ability to decode ACT transmitters and associated telemetry, greatly simplifying manual tracking. The additional modes preset the receiver to scan only those frequencies used by ACT coded transmitter, and instead of displaying the actual measured intervals, the ACT ID and/or telemetry is displayed on the second line. For example, a CTT-83-2 transmitter, with an ID of 37, and located in water at 23 degrees C would alternately display:

```
     75.00kH
    ID= 37
```
then
```
     75.00kH
    Tc=23.0
```

When tracking using telemetry such as depth, tilt angle, and other non-temperature sensors, selecting "ID %FS" is suggested. The resultant display toggles between ACT ID and percent of full scale (0-100%). Alternatively, when tracking ACT transmitters not using telemetry options, selecting "ID" is   recommended. Once in setup mode, the user selects the desired mode by turning the FREQUENCY knob until the desired mode is shown, then toggling the switch to NEXT and making subsequent choices about scan delay, minimum pulse width, etc. as with normal setup in 'classic' mode.

CONSIDERATIONS

1. Keep your equipment DRY! A medium sized ice chest makes an inexpensive but effective carrying case for equipment, and limits water spray from boats or rain, as well as protecting equipment from direct sunlight.
2. Best tracking ranges occur in the morning before the sun heats the surface water.
3. Carry an extra set (8xAA) of batteries - everyone occasionally forgets to turn off the receiver!

Specifications:

FREQUENCY RANGE: 30 to 90 kHz. (250 Hz steps)
DISPLAY: 2x16 LCD, simultaneous display of frequency and Pulse Interval
SENSITIVITY: 1.0 microvolt for 40 dB (S+N)/N ratio.
SIZE: 6.3 in. wide x 6.3 in. long x 4.5 in. deep.
WEIGHT: 3.3 pounds.
POWER: Internal rechargeable battery with charger.
OUTPUT: Headphone jack (0.25in), RS-232 output of Pulse interval and frequency of detected tag.
INPUT: BNC connector.

NOTES:

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