

RovR

ROV mountable Ultrasonic Reciever Operation Manual



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RovR: ROV Mountable Ultrasonic Receiver

The RovR is a small, lightweight ROV mountable submersible ultrasonic receiver designed to detect and report in real time the presence of pulsed ultrasonic transmitters or “pingers”. The RovR a system consisting of a microprocessor, hydrophone, ultrasonic receiver, and 3V compatible RS-232 serial port, relying on clean DC power from an external source. The receiver may be used to listen to up to 15 different frequencies from 30kHz to 100kHz, and optionally may be configured to invoke an onboard decoding engine capable of interpreting and reporting coded sequences from multiple vendors.

Specifications:

Weight:	<i>0.7kg, Positively Buoyant</i>
Sensitivity:	<i>>35dB (S+N)/N with 10uV input</i>
Length:	<i>27cm (end cap to end cap)</i>
Diameter:	<i>60mm</i>
Depth Rating:	<i>300m</i>
Power:	<i>4.5 - 24VDC, 11ma typical</i>
Communications:	<i>3V level RS232</i>

Basic Operation:

Similar to a ‘police scanner’, the RovR may scan up to 15 different frequencies, measuring and reporting the intervals between successive pings from individual transmitters, allowing multiple ‘continuous pinging’ transmitters to be used by the RovR as well as passive receivers, such as the Sonotronics SUR, and other active tracking receivers such as USR14 deck receiver and UDR diver held receiver. The RovR 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. In addition, the RovR may optionally be configured to directly decode P2M encoded transmitters such as r64k transmitters available from multiple vendors.

Communications Port



Note the Communications Port end cap is reverse threaded, This makes the RovR body act as a turnbuckle to reduce the twisting of the internal wiring. Both Comm port cap and Hydrophone cap have tool holes to allow use of a screwdriver or similar tool to aid in screwing/unscrewing end caps if required.

The standard RovR is provided with an IKELITE 9104.54 type connector (mates with IKELITE 9104.14), along with a 2m unterminated underwater rated cable for attachment to the ROV onboard systems.

Alternative connectors such as the SubConn MCBH5M or Seacon VSG-4-BCL may be ordered from Sonotronics. These connectors are provided as a replacement endcap.

Hydrophone

<u>Pinout:</u>	<u>internal</u>	<u>external</u>
1 GND	[black]	[black]
2 RX (SUR input)	[white]	[brown]
3 V+ (5V)	[red]	[red]
4 TX (SUR output)	[green]	[orange]



Connector: IKELITE

Connection:

Power: 4.5 - 24 VDC, 11mA average

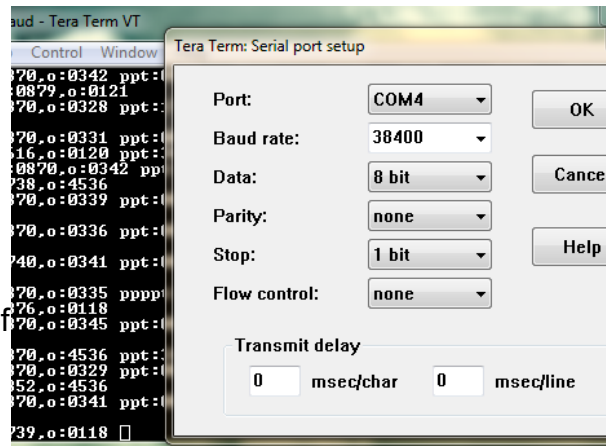
Data: 3V RS232 (0 = 0V, 1 = +3V), 38400 baud, 8 bit, no parity, 1 stop

Communications Interface:

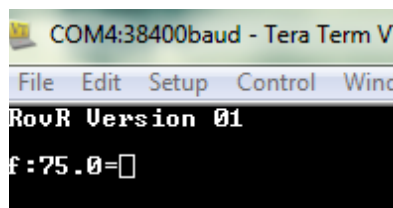
RovR communicates real-time detection information via its onboard serial interface. Also supplied is an FTDI serial port cable with drivers for Windows PCs, and a terminal emulator to allow quick bench tests.

Note that in-air bench tests will require test transmitters be held within several inches of the hydrophone.

The RovR communicates via its serial port with parameters fixed at 38.4K baud, 8 bit, and no parity.



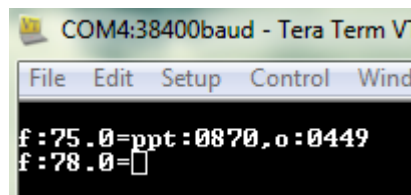
Upon power up, the RovR will emit a sign-on message, and immediately begin listening for transmitters at the first frequency defined in its scan list:



Sign-on = "RovR Version 01\r\n"

Start of scan = "\n\r f:xx.x=" where xx.x is the detection frequency in kHz.

When a transmitter is detected, the following is a typical response:



Where "p" is the response to a single ping detected, and once a second ping ("p") is detected, the RovR will respond with "t:xxxx,o:yyyy" where xxxx is the time in mSecs between the detected pings, and yyyy is a relative signal strength of the detected ping. After the channel listening timer is exhausted, the RovR will switch to listening to the next frequency in its list and will respond with "\n\r f:zz.z=" where zz.z is the new frequency expressed in kHz.

ROV Installation:

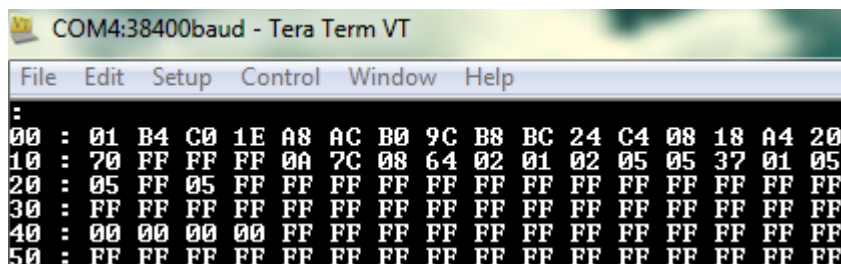
RovR should be mounted on the ROV platform with the hydrophone pointing along the direction of forward motion, provided ROV speeds do not exceed 5 knots as high speed may create noise that will interfere with the RovRs ability to detect faint transmitters. In addition, it is advised to mount the RovR with some mechanical insulation from the frame of the ROV: the use of closed cell foam like neoprene is recommended to reduce interference caused by mechanical noise.

To minimize loading of the ROV, the RovR is positive buoyant: weight may be added if desired to balance the RovR with other loads on the ROV.

RovR Operation:

RovR is intended to be used to located transmitters within a range of 1-2 km. Although longer ranges are possible depending on environmental conditions and signal strength of the transmitters, it is generally advised to first verify the presence of a tagged object by using a deck receiver prior to the launch of an ROV to search for the tagged object. The on-board hydrophone of the RovR is directional, with peak output obtained while forward looking, and minimal output from 90 to 270 degrees (side to back to side).

Most operating parameters of the RovR are controlled by setting internal EEPROM constants using commands sent via the com port. Commands sent to the RovR are always prefaced with "<esc>" (hexadecimal 0x1b) to which the RovR responds with ":" indicating it is ready to listen to subsequent commands. To get a list of EEPROM values, the user may send the command "<esc>w?" where the "w" is case sensitive, and no additional characters are required. The typical response is:



```
COM4:38400baud - Tera Term VT
File Edit Setup Control Window Help
:
00 : 01 B4 C0 1E A8 AC B0 9C B8 BC 24 C4 08 18 A4 20
10 : 70 FF FF FF 0A 7C 08 64 02 01 02 05 05 37 01 05
20 : 05 FF 05 FF FF FF FF FF FF FF FF FF FF FF FF FF
30 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
40 : 00 00 00 00 FF FF FF FF FF FF FF FF FF FF FF FF
50 : FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
```

A summary of commands and EEPROM values are listed in the following tables.

EEPROM definitions

Address (hex)	Data (decimal)	Comment
0	VERSION	
1	(75-30)*4	Channel 1 frequency: 75.0kHz
2	(78-30)*4	Channel 2 frequency: 78.0Khz
3	(37.5-30)*4	Channel 3 frequency: 37.5kHz
4	(72-30)*4	Channel 4 frequency
5	(73-30)*4	Channel 5 frequency
6	(74-30)*4	Channel 6 frequency
7	(69-30)*4	Channel 7 frequency
8	(76-30)*4	Channel 8 frequency
9	(77-30)*4	Channel 9 frequency
A	(36-30)*4	Channel 10 frequency
B	(79-30)*4	Channel 11 frequency
C	(32-30)*4	Channel 12 frequency
D	(36-30)*4	Channel 13 frequency
E	(71-30)*4	Channel 14 frequency
F	(38-30)*4	Channel 15 frequency
10	'p'	"Ping" detection character (default = "p")
11	10	Min PI (50mS units)
12	30	Max PI (50mS units)
14	30	Time (seconds) listening to channel
15	200	Echo suppression (*1.5mS)
18	0	Number of channels to scan (add 1)
19	2	# of PI intervals to compare
1A	0x02	Flags: Bit 0 set -> debug mode Bit 1 set -> \n added to \r Bit 2 set -> AutoCode enabled bit 6 set -> 75kHz test
1B	5	Compare tolerance (in 0.62mS ticks)
1C	63	Gain (0 = min, 127 = max)
1D	25	PLL (DO NOT CHANGE)
1F	6	iFilter, # consecutive positives for detection

RovR Signal Processing:

Of special interest are the options available for extracting desired signals from transmitters while limiting the effect of unwanted sound and noise. The RovR electronics provides an overall gain of about 90db over a frequency range of 30.0 - 100.0 kHz, and the ability to sample this spectrum with a narrow band filter having a 500Hz bandwidth. To accomplish this, sound presented to the front end hydrophone is first amplified, then heterodyned with a local oscillator to produce a 455kHz intermediate frequency and filtered to block the effects of unwanted sounds. This IF signal is then further amplified and presented to a detector that signals the onboard microcomputer of the presence of sound within +/- 250Hz of the selected receive frequency. Emissions from most acoustic transmitters have a duration of 10-20mS, and to verify that a detected signal may be from a transmitter, the microcomputer continuously samples the detector output at a rate of 1600 times per second (every 625 microseconds). When a number of consecutive samples of this detector agree, the computer logs this as the leading edge of an incoming sound source, recording the time this detection occurred and the relative strength of the detected signal. The number of samples required to pass this threshold test is defined as *iFilter* and may be adjusted by changing the appropriate EEPROM location (see location 1F). The computer then stops listening to avoid processing echoes of this signal for 250mS (configurable), and once a subsequent signal is detected, the time between these signals is computed with a resolution of 0.6mS. At this time, depending on the selected mode, the RovR will report this time interval between pings as an integer value of milliseconds, along with the logged signal strength. Additionally, the RovR may be instructed to measure multiple samples of the incoming sound, and require that these intervals all measure the same within a selected tolerance (3mS nominal, configurable) before reporting this as a valid transmission. Furthermore, the RovR may be instructed to automatically identify and decode transmitters that use common coding sequences such as ACT and r-code data.

RovR command interface (v0.1)

1.0 Description

The RovR contains a simple command/response interface, and due to the limited resources available to the single chip microcomputer, it is important to recognize a few considerations:

- a) The RovR commands are prefixed with the <esc> character, and the RovR will respond to this single character with “:”, the host must wait to continue transmitting the remaining characters until after the receipt of the single character “:”.
- b) The RovR may take up to 200mS to service other processes before returning to check its uart for characters, consequently the host application should start a command sequence by transmitting a maximum of 2 characters, followed by a minimum delay of 200mS before completing the command sequence. If the host ever ‘looses sync’ with the RovR (no response is heard from the SUR from a command after 5 seconds), sending a series of 8 <cr> characters (0x0d), followed by a 2 second delay, will restore the RovR to an ‘idle’ state.
- c) The RovR serial data format is 38400 baud, no parity, 8 bit, 1 stop bit

2.0 Commands

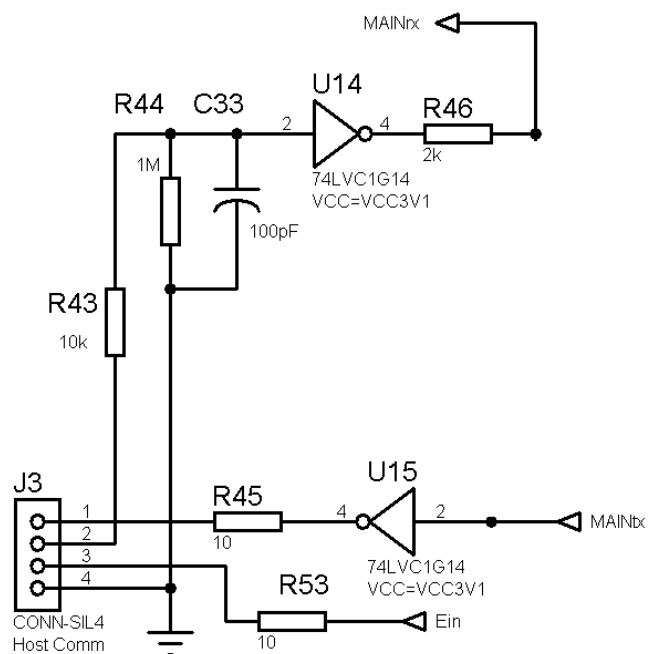
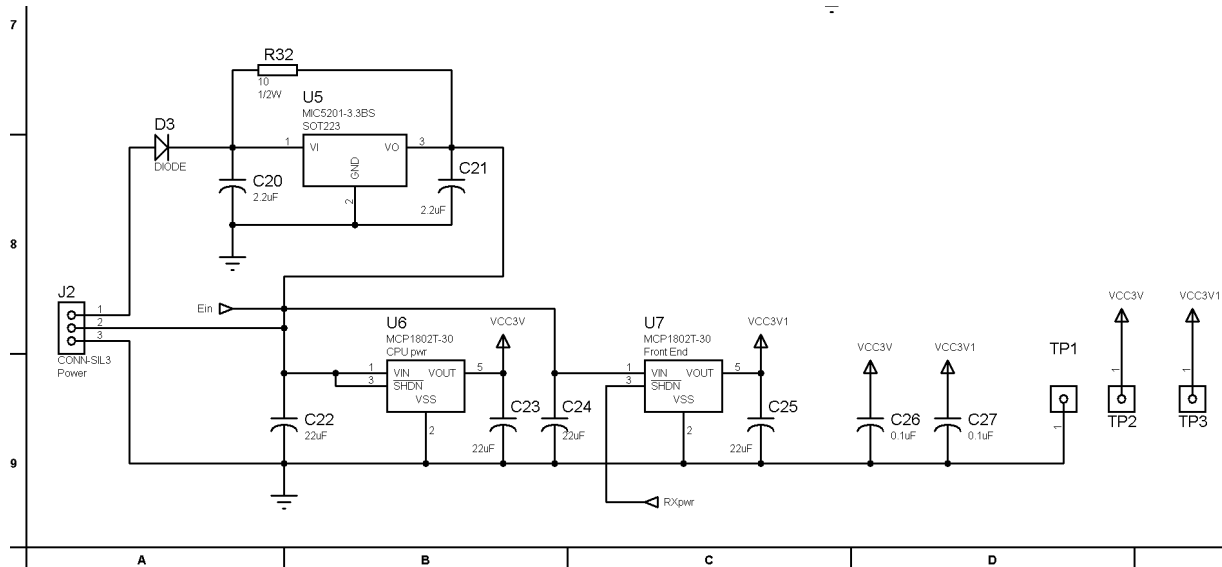
The following are a synopsis of available commands (<esc> is 0x1b)

Command	Response	Comments
<esc><cr>	-	useful serial communication test
<esc>-	-	Stop scanning
<esc>+	+	Resume scanning
<esc>cn	f:xx.x\n\rLED:\n\r	Channel detection test
<esc>g	g:xx\n\rro:xxxx\n\r	Set gain, report signal strength
<esc>hn	[none]	iFilter value, 1-9 (hex value permitted). Number of positive samples for detection
<esc>mn	[none]	n=0: process 1 interval, n=1: process 3 intervals; n=2 process at least 3 intervals & autodecode
<esc>p	[note LED blinking]	Device reset
<esc>w?	[hex dump of eeprom values]	
<esc>w>aadd	[none]	Set eeprom address [dd] to [aa} (hexadecimal values) ***
<esc>w<dd	<cr><lf>aa:dd	Displays contents of eeprom address [aa] (hexadecimal values)
<esc>x	[note LED solid ON]	Re-flash with new firmware
<esc>zn<dd	[debug data]	Debug disable: n=0, Debug enabled for n>0 Debug levels for n=1,2

Relevant Schematic Diagrams

The following page shows diagrams that may be helpful in testing, troubleshooting and connecting the RovR.

Power Supply Com Port



NOTES:

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