User Manual

Rover

Surface Iridium Satellite Beacon with GPS location

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GENERAL DESCRIPTION

The ROVER Surface Iridium satellite mooring location beacon continuously monitors location for mobile surface assets and/or instrument moorings. ROVER makes use of the bi-directional, global, real time Iridium satellite Short Burst Data (SBD) network in combination with GPS position location. Rover's sleek tubular design and internal dual Iridium/GPS antennas located at each end cap allow it to be easily retrofitted into a variety of surface mounts. Even surface installations which capsize may be able to transmit location information.

Inside the ROVER is a 9603 Iridium satellite Short Burst Data core radio transceiver, a specialized low power Xeos digital controller with GPS, Iridium antenna and GPS antennas.

ROVER is intended for surface deployments and should not be deployed in situations which exceed 10 m in depth. Xeos Technologies Inc. (Xeos) manufactures other specific products for either surface, or subsurface applications to depths of 11,000 m.

See www.xeostech.com for details or call (902) 444-7650.

THEORY OF OPERATION

The ROVER is intended for providing regular location information on high value assets at the surface, drifting or moored. After being activated, the Rover is deployed at the surface and begins sending location messages as per the user settings. The internal battery pack provides over 8000 messages or up to a 2 year deployment.

Operators can communicate with the surface deployed Rover via Iridium using email commands. Status information can be obtained, including the health of the GPS system and battery voltage. Timings are settable and the default is one message every 3 hours. If you need to make a change to settings, the ROVER will receive the command to change the timing when it next checks for messages, as much as 3 hours after the command is sent.

The ROVER will continue to send position messages based on the timings, until it is manually turned off or the battery pack drops below the minimum voltage requirement of 7v.

Due to the location of dual Iridium/GPS antennas at BOTH ends of the enclosure, the ROVER will continue to try and send position messages, even if it is inverted or capsized.

OPERATING INSTRUCTIONS

SETTING UP YOUR IRIDIUM ACCOUNT

ROVER makes use of the Iridium satellite system's (www.iridium.com) Short Burst Data (SBD) service for the 9603 transceiver. This service is a global (including the polar regions), two-way, real-time, email-based data delivery service that has a maximum outbound (from beacon) message size of 340 bytes and a maximum inbound (to beacon) message size of 270 bytes.

ROVER end users must set up an approved data delivery account with their preferred service provider. This can only be done once Xeos has provided the user with an International Mobile Equipment Identity (IMEI) number. Each ROVER (9603 modem) has a unique IMEI number that must be registered with the preferred service provider. For a list of service providers in your area please contact Iridium for recommendations. Xeos Technologies is also able to provide Iridium SBD data service and accounts. Please contact activations@xeostech.com for more information or use the online form on our website: www.xeostech.com.

Each IMEI number is capable of being associated with up to five (5) unique email addresses. This may vary between service providers. When registering your IMEI number, please provide the service provider with a temporary Xeos testing account email address.

This account is: **xeostesting@gmail.com**

This temporary email testing account can be deleted or replaced at any time after delivery of the ROVER. Once the SBD account has been activated, please contact your Xeos representative and confirm this.

ROVER makes use of a simple and robust, binary email protocol. Any email application can be used to send and receive messages to the ROVER, however, they are not human readable. Xeos Online is a web based monitoring system which will allow users to view and manage information from the Rover on a mapping system, as well as view the messages in a human readable format. Xeos Online allows setup of multiple kinds of message forwarders which can forward certain (or all) messages to a group of email addresses in a human readable form.

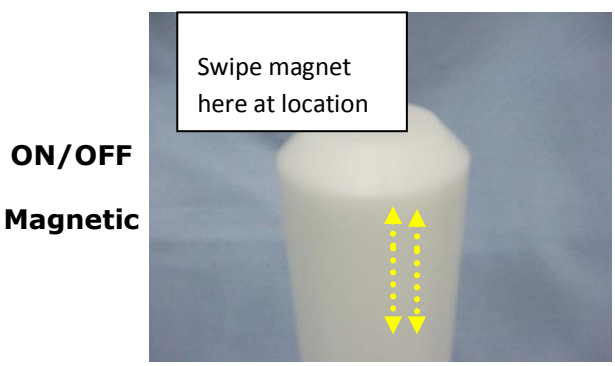
Sending messages and changing configuration can also be done through Xeos Online. See www.xeostech.com or your account manager for more information.

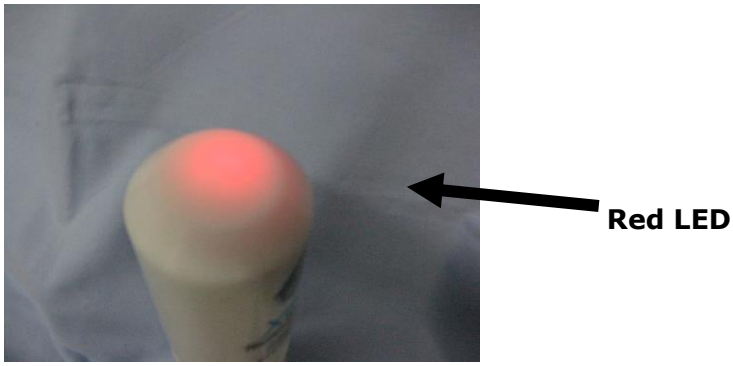
As a secondary method or one of last resort, command files can be sent directly using email to the Rover. They are found on the Xeos Technologies website (www.xeostech.com), or can be emailed directly by contacting sales@xeostech.com . Once downloaded to the PC, unzip the file, which contains four (4) command files that have ".sbd" extensions used to communicate with the ROVER. You are now ready to test the ROVER beacon and prepare it for deployment.

ON/OFF MODES

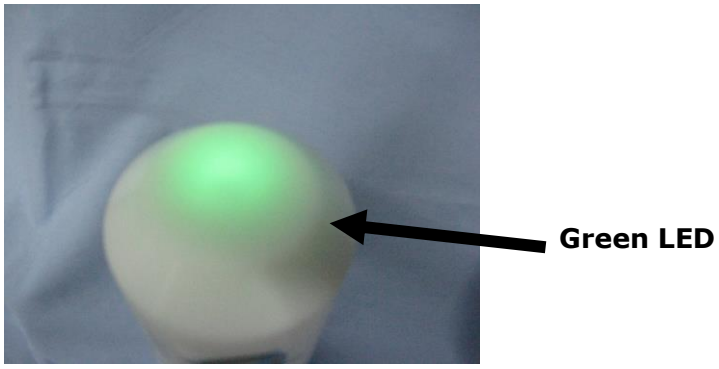
The ROVER beacon is turned ON and OFF through the use of an external magnet near an internal magnetic reed switch, and operation can be identified by viewing the LED through the top of the ROVER. To turn the ROVER ON, begin swiping the magnet quickly up and down at the location of the reed switch. The reed switch is located directly behind the Xeos Technologies Logo.

Note: **if the initial color of the LED is Green that means that the ROVER is already in the on position.**





A flashing green LED indicates the device is in the process of powering up, continue to swipe the magnet until you see a solid green LED. A solid green LED indicates that the device is powered and operational.



Note: It is important that the beacon has a good view of the sky during any test, so it is necessary to test the beacon outside of a building.

To turn the ROVER OFF, repeat the above procedure with the magnet and watch the LED change from green to red. A red flashing LED indicates the device is powering down, continue to swipe the magnet until you see a solid red LED. A solid red LED indicates that the device is turned OFF.

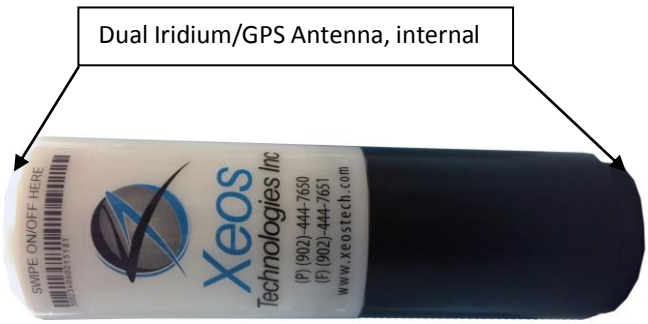
At any time the magnet can be placed against the location of the reed switch *once* to see which mode the beacon is currently in. A red LED indicates the device is turned OFF. A green LED indicates the device is turned ON.

Note: It is important to let all LEDs stop illuminating before initiating another action.

Note: Cycling power for any reason, for example by using the switch to turn OFF/ON or by removing battery power, will start the Startup Alarm Mode.

DEPLOYMENT OF THE ROVER

The Rover contains custom dual GPS/Iridium antennas, one at each end of the enclosure. It also features an internal battery pack. All you need before deployment is:



1. Rover with Iridium service activated (using IMEI provided by Xeos)
2. Batteries installed in internal battery pack (18 AA)
3. Magnet for turning the Rover ON.

ANTENNAS

To deploy the Rover, ensure that one of the two cylinder ends has a clear view of the sky. For optimal deployment, the white end should be the one with a clear view of the sky since it contains the primary antennas. For a concealed deployment, the antenna surface must not be obstructed by metal or wood. Thick amounts of other materials may also cause interference. Testing of concealed installations is strongly recommended.

POWER

The power source for the Rover is its internal battery pack which holds 18 AA batteries, either Lithium or Alkaline.

The ROVER housing is split into two halves. The top half of the acetyl housing is white and the bottom half is black. In order to replace the batteries, the housing needs to be opened up.

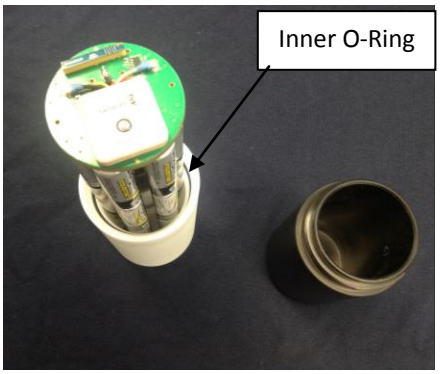
OPENING THE HOUSING & O-RINGS

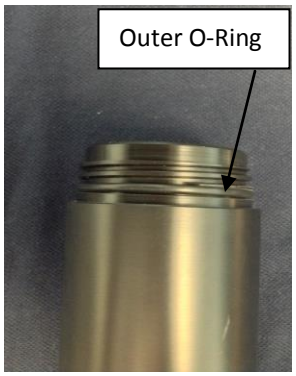
With your hands, carefully unscrew the black bottom of the housing from the white portion. Inside the ROVER's acetyl housing, there are two (2) O-rings (568-137 70A DURO BUNA).

O-rings are critical to the waterproof nature of the Rover. O-rings should be visually inspected to make sure they are properly seated in the groove or thread and to ensure there is no visible damage to the O-ring.

If the O-rings pass visual inspection and have been deployed for 2 months or less, the O-rings do not need to be replaced.

If the O-rings fail visual inspection or have been deployed for longer than 2 months, the O-rings should be replaced prior to re-deploying the Rover.





To replace the O-Ring, remove the old O-ring, and clean all dirt away from the threads and grooves where it was seated. Apply a thin layer of O-ring lube (Parker Super 'O') to the new O-ring.

For the outer ring, gently slide the new O-Ring down over the threads of the black section of enclosure and into the O-ring groove, just above the lip of the enclosure.

For the inner ring, gently slide the new O-Ring down inside the white section of enclosure until it is seated in the O-Ring groove.

Note: It is very important to be aware of where the O-ring is sitting in the two O-Ring locations. If the O-ring is not sitting perfectly in its groove, there will not be a perfect seal and could cause fatal damage to the unit.

REPLACING THE BATTERIES

The internal battery pack in the Rover holds 18 AA batteries. The batteries are configured in 6 columns of 3 batteries each. The battery pack column is magnetized to ensure the batteries stay in place properly.

To remove the old batteries, simply remove one battery from each column and then turn the Rover over to tip the other batteries out.

To replace the batteries, slide the first battery into each column with the correct orientation. Each column is labeled to show its orientation. Then add the second and third batteries, in the same orientation. The Rover may beep to indicate changes in the battery voltage.

Once all the batteries have been replaced, the ROVER will stop beeping. The enclosure pieces can be reassembled, taking care to inspect & seat the O-Rings first.

The ROVER is now ready for testing, and/or deployment.

NOTE: If the batteries are low, or if some of the batteries have been inserted incorrectly, the ROVER will sound a quick intermittent beep and flash the red LED at the top for 5 minutes, or until the batteries have been corrected or replaced.

POWER CONSUMPTION

The ROVER has an internal battery enclosure that holds 18 AA batteries, lithium or alkaline. The batteries should be replaced whenever the ROVER is recovered. The battery voltage can be monitored with the Status command.

Current draws are as follows:

Typical sleep current	<100µA
Iridium Transmission current	70 mA (approx.. 30 sec duration)
GPS Acquisition, current	13 mA (max.. 2 min duration)

This is the amount of current the device will draw between GPS checks and Iridium transmissions. The device has a life time of up to 2 years deployment when transmitting its position every 3 hours.

Sample Consumption Patterns

NOTE: THESE ARE CALCULATED LIFESPANS AND NOT TESTING RESULTS. ENVIRONMENTAL FACTORS INCLUDING TEMPERATURE WILL AFFECT THESE CALCULATIONS.

GPS POSITION INTERVAL	IRIDIUM CALL INTERVAL	CONSUMPTION PER CYCLE	DURATION (ALKALINE BATTERIES)	DURATION (LITHIUM BATTERIES)
10 min (default)	10 min (default)	0.6913 mA	723.27 hours 30 .13 days	1398.33 hours 58.26 days
30 min	30 min	0.7396 mA	2027.99 hours 84.50 days 2.82 months	3920.77 hours 163.37 days 5.45 months
60 min	60 min	0.7896 mA	3799.39 hours 158.31 days 5.29 months	7345.49 hours 306.06 days 10.20 months
3 hours	3 hours	0.9896 mA	9094.22 hours 378.93 days 12.63 months	17,582.15 hours 732.60 days 24.42 months
6 hours	6 hours	1.2896 mA	581.58 days 19.39 months 1.615 years	1,124.40 days 37.48 months 3.12 years
12 hours	12 hours	1.8851 mA	795.67 days 26.52 months 2.21 years	1538.29 days 51.28 months 4.27 years
24 hours	24 hours	3.0888 mA	971.25 days 32.38 months 2.70 years	1699.83 days 56.66 months 4.72 years

* Calculations subject to change without notice. Xeos conducts ongoing battery life and power consumption tests in an effort to provide more accurate information to customers.

UNDERSTANDING THE TILT SENSOR

The ROVER comes equipped with a tilt sensor which allows it to determine which antenna to use for determining GPs position and communicate with the Iridium satellite network. The Rover will automatically switch back and forth between the two antenna arrays as the tilt sensor detects shifts in position.

The tilt axis defaults to the horizontal axis, that is, if the ROVER is standing upright, it will operate using the custom dual antenna at the top of the enclosure. If the ROVER crosses the horizontal axis, i.e. orientated upside down, it will switch to using the dual antenna located at the bottom of the enclosure.

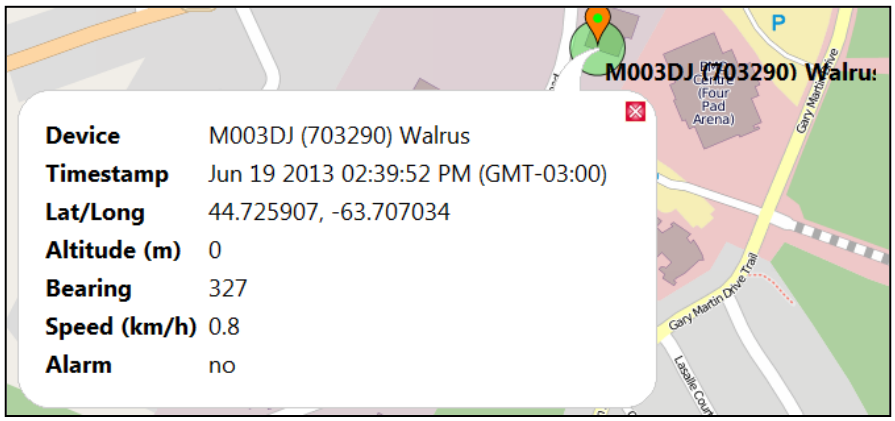
The tilt sensor is enabled by default. For more information please contact Xeos Technologies.

PRE-DEPLOYMENT CONFIGURATION

Pre-programming of the Rover is not required since it is pre-configured for most scenarios and configurable settings can be changed over the Iridium link. For details, read the section on ***Configuration***.

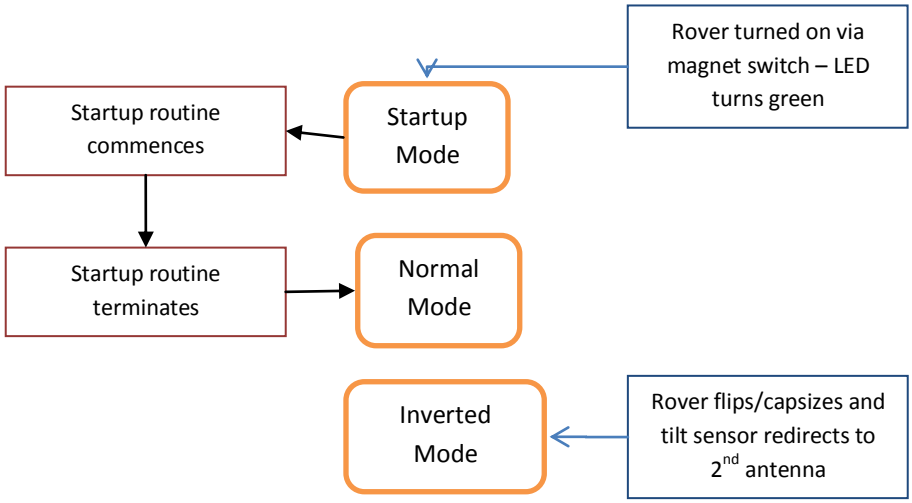
TESTING INSTALLATION

Test the installation by checking the email addresses to which the Iridium account is sending notifications or Xeos Online. Xeos Online will display the last known position of the device as well as the time stamp of the GPS position.



CONFIGURATION OF THE ROVER

The Rover has a combination of preset behaviors and configurable parameters. Here is an outline of its normal/default behavior:



- When the Rover is turned on using the magnetic switch, it goes into **Startup** mode
- **Startup** Mode lasts until the Rover has been able to obtain a GPS position and successfully transmit it to the Iridium Gateway
- Once the position is sent, the Rover goes into **Normal** Mode and stays in that mode
- If the Rover is capsized and triggers the tilt sensor, the Rover goes into **Inverted** Mode.
- **Inverted** Mode can be configured differently from Normal mode to provide indication that the Rover is inverted but the default is the same as Normal mode
- If the battery voltage drops below 7 VDC, the unit will change to **Low Battery** Mode to conserve power until the device can be retrieved.

The following are the parameters for each mode. To change the preset parameters, see ***Remote Configuration of the Rover***.

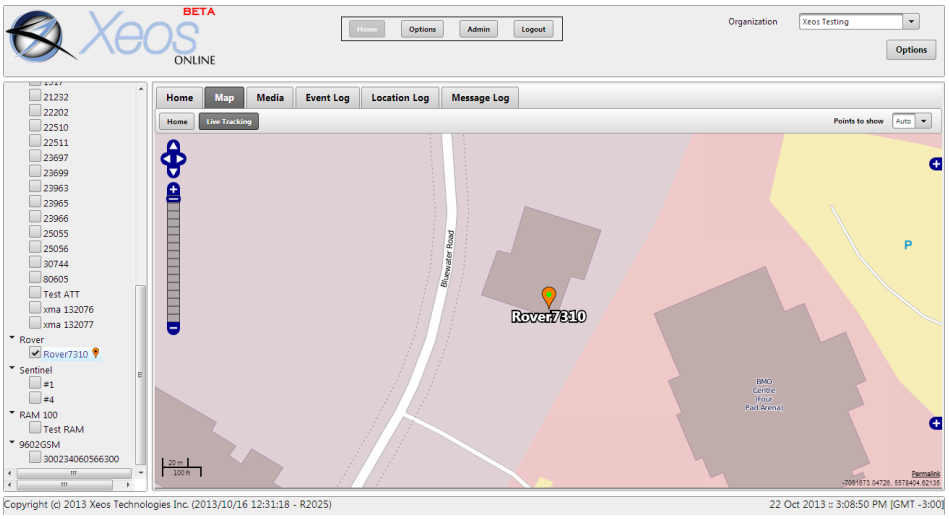
Mode	**GPS Interval**	**Iridium Report/Check for Commands**	**Duration**
Normal	10 min	10 min	Normal state
Startup	10 min	10 min	1 hour
Inverted	10 min	10 min	Until righted
Low Battery	2 hours	2 hours	Until battery dies or is retrieved

TRACKING WITH XEOS ONLINE

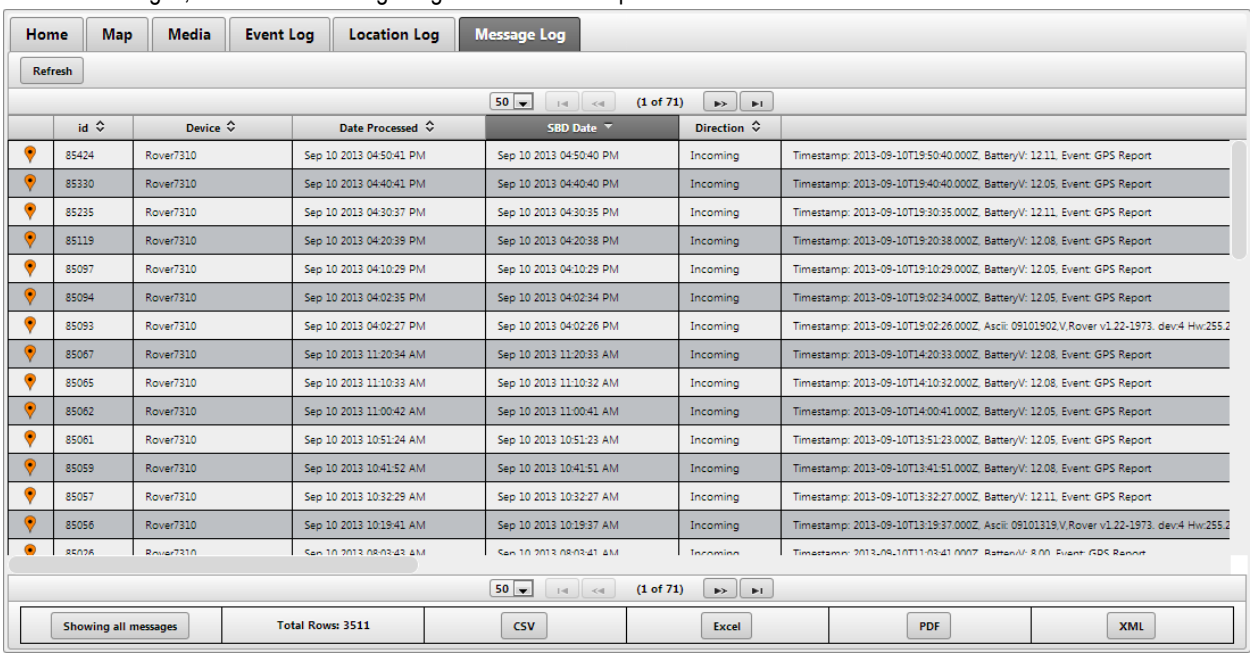
Setting up your company, usernames and devices in Xeos Online is covered in the Xeos Online User Manual, available at www.xeostech.com if you do not already have a copy.

1. Using your web browser, go to http://online.xeostech.com.
2. Login to Xeos Online.

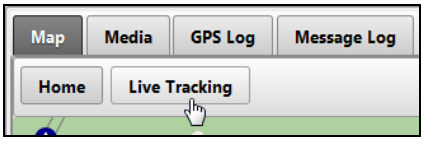
3. If you have not already setup your Rover as a device in Xeos Online, click on the Admin tab and then devices to proceed.
4. From the map view, click on your Rover in the left hand side column. The last known location will appear on the map.



5. To view messages, click on the Message Log tab above the map.



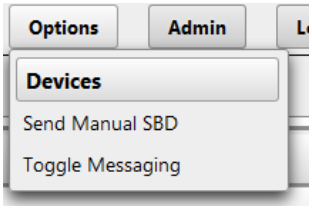
6. Multiple targets can be viewed on the map simultaneously. Just click on all the devices you wish to monitor on the left hand list. To keep them all in view on the map as they update, click on the **Live Tracking** button.



> **NOTE**:
>
> Position reports are sent based on the scheduled interval for Iridium calls **but** if the GPS interval is shorter, up to 24 GPS position locations can/will be sent in a single message from the Rover.

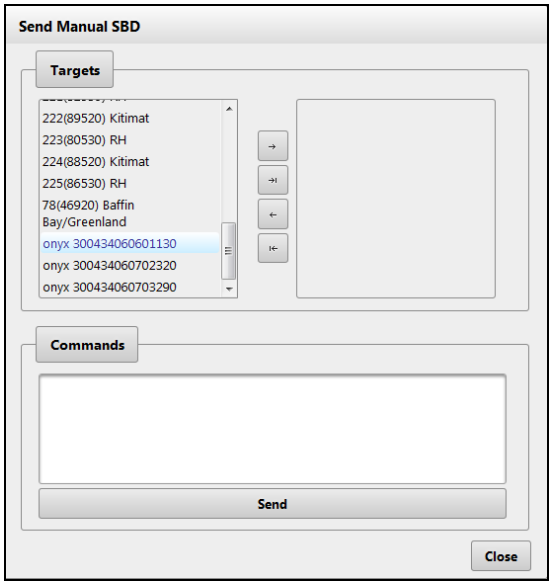
REMOTE CONFIGURATION OF THE ROVER

1. To send a command to the remote Rover, click on the Messaging tab in the top centre of the window.



2. Select **Send Manual SBD**.

3. The following window comes up:



4. Select the Rover (or multiple Rovers) which should receive the message from the **Target** list. To select more than one, hold down the CTRL button while clicking on the appropriate devices.

5. Click on the arrow to move them into the list box on the right.

6. Once you have the correct list of devices to receive the message, you need to format the command to change the parameter you are interested in.

7. The parameter options that can be changed are:

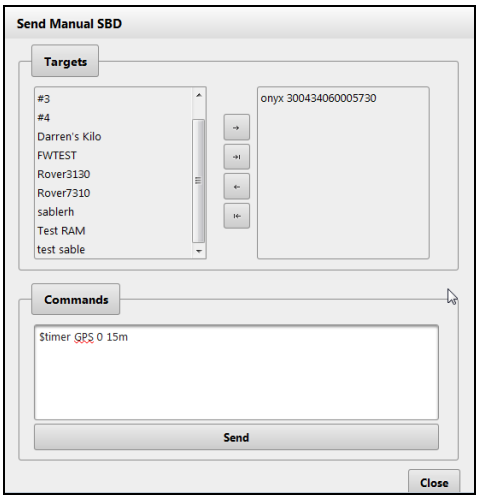
Mode	**Mode Number**	**GPS Interval** **(Parameter name: GPS)**	**Iridium Report** **(Parameter name: SBD)**
Normal	0	Default: 10 min Range: 20 seconds – 1 day	Default: 10 min Range: 1 minute – 1 day
Startup	1	Default: 10 min	Default: 10 min
Inverted	2	Default: 20 seconds Range: 20 seconds – 1 day	Default: 1 minute Range: 1 minute – 1 day
Low Battery	5	Default: 2 hours Range: 20 seconds – 1 day	Default: 2 hours Range: 1 minute – 1 day

8. To frame the command, you need the following format: **$timer <*ParameterName*> <*ModeNumber*> <*interval*>**

9. You can use seconds, minutes, hours or days for your timing interval as long as they are inside the allowable range. Indicate the time unit by using **s** for seconds, **m** for minutes, **h** for hours and **d** for days immediately after the number (no spaces). Ex. 30 seconds would be **30s**.

10. For example, to change the GPS Position interval during normal operation to every 15 minutes, your command would look like: **$timer GPS 0 15m**

11. Enter the command in the **Commands** text box and press **Send**.



NOTE:

Change to configuration only takes place once the Rover **receives** the email. That means that if the Rover is set to check messages hourly, it will not change its operational behavior until it has checked at its scheduled time for changes.

SPECIFICATIONS

FUNCTIONALITY

Base Function:	2-way Iridium communication
Serial Programmable Functions:	Ser Id, repetition Period, transmit intervals, data message

MECHANICAL

Material:	All Polyoxymethylene (delrin)
Dimensions:	214.12 cm L x 63.5 cm (8.43” L x 2.5” H)
Weight:	875g - with lithium batteries
	1055g - with alkaline batteries
Weight, in water:	198 g – with lithium batteries
	378 g – with alkaline batteries
O-rings:	568-137 70A DURO BUNA
O-Ring Lube:	Parker Super ‘O’

ELECTRICAL:

Digital Controller:	Xeos IRDC-3
GPS Receiver:	48 channel SiRFstarIV, GSD4e GPS chip
Supply:	18 AA batteries (Lithium or alkaline)
Operational Time:	8000 messages (or every 3 hours for 2 years)
Sleep Current:	100uA
Iridium Transmit:	70mA
GPS Acquisition:	13 mA
Voltage:	+13.5 volts nominal
Capacity:	3.0 Amp Hours (alkaline), 5.8 Amp Hours (Lithium)
Life expectancy:	2 Year Surface deployment with messages sent every 3 hours

COMMUNICATION

Iridium: 9603 modem

Antenna: Xeos Proprietary Passive Patch antennas located either end of enclosure

ENVIRONMENTAL

Operating Temperature: -40° c to +60° c

**Specifications subject to change without notice.*

WARRANTY, SUPPORT AND LIMITED LIABILITY

Xeos Technologies Inc. warranties the Kilo Beacon to be free of defects in material or manufacturing for a period of one year following delivery. Liability is limited to repair or replacement of the defective part and will be done free of charge.

LIMITED WARRANTY: Xeos Technologies Inc. warrants that the product will perform substantially in accordance with the accompanying written materials for a period of one year from the date of receipt.

CUSTOMER REMEDIES: Xeos Technologies Inc. entire liability and your exclusive remedy shall be at Xeos Technologies Inc. option, either (a) return of the price paid or (b) repair or replacement of the product that does not meet Xeos Technologies Inc. Limited Warranty and that is returned to Xeos Technologies Inc. with a copy of your receipt. This Limited Warranty is void if failure of the product has resulted from accident, abuse, or misapplication. Any replacement product will be warranted for the remainder of the original warranty period or ninety (90) days, whichever is longer.

NO OTHER WARRANTIES: Xeos Technologies Inc. disclaims all other warranties, either express or implied, including but not limited to implied warranties of merchantability and fitness for a particular purpose, with respect to the product or the accompanying written materials. This limited warranty gives you specific legal rights. You may have others, which vary from state to state.

NO LIABILITY FOR CONSEQUENTIAL DAMAGES: In no event shall Xeos Technologies Inc. or its suppliers be liable for any damages whatsoever (including, without limitation, damages for loss of equipment, for loss of business profits, business interruption, loss of business information, or other pecuniary loss) arising out of the use of or inability to use this

Xeos Technologies Inc. product, even if Xeos Technologies Inc. has been advised of the possibility of such damages.