



Hades User Manual

SUBMERSIBLE GNSS / LED FLASHER



Shipped From



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Specifics

This manual version is written with respect to Hades firmware build 6458. If you wish to acquire the latest firmware for your device, contact support@xeostech.com

Version History

Version No.	Date	Description
1.0	Dec 2020	Base document, split from Hades Manual

Regular checks for the latest manual are suggested. Be sure to check [Xeos Technologies' manuals page](#) to compare versions and download the latest version.

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Overview

The Hades is a submersible GNSS receiver and LED flasher, designed to provide position to an AUV and surface visibility for recovery. It is a main-source powered, integrated remote head portion of a beacon that does not include Iridium capabilities. Track the asset's position as it surfaces and is provided a location by the Hades. The GNSS module also allows the user to track the path taken by the asset and a velocity at which it is traveling. The GNSS and LED combo provides a multi-dimensional recovery aid which delivers unparalleled visibility in even the worst conditions.

A descendant of the Hades beacon, the Hades is fully submersible and has been rated to 7,500m (11,000 m option available) below surface. The solid-state surface sensor provides a measure of reliability unavailable in mechanical methods.

See www.xeostech.com for details or call +1 (902) 444-7650.

Hades Operation

The Hades is designed to run with as little user-input as possible. NMEA operation will begin approximately 30 seconds after power has been connected, however the time to first fix (TTFF) can vary, with most cases generating a TTFF of 30 – 60 seconds.

Using the Magnetic Switch

While the Hades can be turned on and off by simply removing power, this is not always a feasible option. The Hades beacon can be turned on or off via an external magnet near an internal magnetic reed switch, and operation can be identified by viewing the LED through the top of the Hades.

To turn the Hades on, press the magnet against the glass ring for a 1/2 second and then remove it for a 1/2 second. Do this twice, and the Hades will respond by showing a dim LED, then a bright LED, followed by several flashes (self-test period) before strobing begins normally.

To turn the Hades off, repeat the above procedure with the magnet. Contact with the magnet will show the bright solid LED, and after two taps, will show a bright LED, followed by a dim LED before turning off. For Hades using firmware lower than build 6411, [see below](#).

Note: If after turning the Hades ON, the self-test period described above lasts noticeably longer than 10 seconds, this indicates a **SELF-TEST FAILURE**. Contact support@xeostech.com if this occurs.



Operational Tips

- It is important to let all LEDs stop illuminating before initiating another action.
- Cycling power for any reason, such as using the magnetic switch or removing the bottom end cap, will initiate start-up mode.
- The beacon requires a good view of the sky for any test. It is necessary that any tests be done outside of a building, far from potential obstructions.

Installation

When installing the Hades there are several factors that can influence performance.

- The Hades' head should be pointing toward the sky.
- GNSS performance may suffer if large angles of the horizon are blocked, such as if the Hades is next to a wall.
- Do not use conductive material at the top of the Hades around the glass lens; this will cause the water sensor to fail.

Hades Communication

There are four methods of communication associated with the Hades:

1. Locally over the RS-232 connection for diagnostic command and control
2. NMEA output from Hades
3. Pulse per second (1-PPS) output from the Hades
4. Locally with [Bluetooth](#)

For local connections, see the [Pinouts](#) near the end of this document.

RS-232 Connection

The Hades has a diagnostic RS-232 port with which users can send commands to the Hades for command and control, as well as receive responses to those commands. Limited NMEA data can be also be streamed from this port if the diagnostics are off, or full NMEA data can be streamed if diagnostics are turned on for a limited time.

Port settings for the RS-232 diagnostic port are as follows:

Baud Rate	57.6k
Parity	None
Data Bits	8
Stop Bits	1

All commands sent to the Hades must begin with a dollar sign (\$) and end with a carriage return, line feed, or both.

Diagnostic State

On start-up, diagnostics will be disabled on the Hades, but can be enabled by issuing the command **\$diag 1**, and disabled with **\$diag 0** (this also applies when communicating via Bluetooth, but is handled by the application on connection). The Hades will accept commands and send appropriate responses in either “diag” state, but not stream more detailed diagnostic data when diagnostics are off with the exception of some NMEA sentences (GGA and VTG) if that setting is enabled and running.

NMEA Output

The Hades is outfit with a dedicated serial output line, to provide continuous NMEA-0183 updates to a connected device. The port settings of this line are:

Baud Rate	9600
Parity	None
Data Bits	8
Stop Bits	1

GNSS updates can include both NMEA sentences and a connection to the GNSS receiver's PPS pin (if [pin availability allows](#)). Enabled NMEA Strings include:

PSRFEPE	Estimated position errors
GGA	Fix information
GNS	GNSS Fix Data
GLL	Geographical Position-Latitude/Longitude
GSV	GNSS Satellites in View
ZDA	UTC Date/Time and Local Time Zone Offset
RMC	Recommended Minimum Specific GNSS Data
VTG	Course over Ground and Ground Speed

The above sentences may come with Talker IDs of GP (GPS) GL (GLONASS) or GN (Global Navigation/Multi-constellation).

Operation

The Hades' GNSS receiver will initialize approximately 30 seconds after power-up, provided other tasks are not currently underway, such as a Bluetooth connection.

If the device has recently submerged but not yet entered Underwater Mode, NMEA will be on, but not have useful data if the device cannot see GNSS constellations.

The Hades will also output NMEA sentences from the regular diagnostic line. When diagnostics are on, all sentences are output. When diagnostics are off, only GGA and VTG sentences are sent.

If NMEA is to be turned off immediately, over serial, use the command:

\$pwr g 0

To resume NMEA streaming, issue the command:

\$pwr g 1

1-PPS Output

1-PPS is a one pulse per second signal which is enabled after the receiver has achieved a position fix. Using the falling edge of the pulse to indicate the time mark, this time mark is within 1 μ s of epoch and normally within 100 ns. Pulse width is 250 ms.

The 1-PPS output is disabled 5 seconds after the position fix becomes invalid, such as when the Hades is underwater.

Xeos Beacon Bluetooth App

Select Xeos products can be configured locally using the [Xeos Beacon Android App](#). This method of communication requires no disassembly.

The Bluetooth app allows for communication, configuration, logging and firmware updates. A detailed document on how to use the application can be found [here](#).

See the [Bluetooth](#) section for Bluetooth functionality as it pertains to the Hades.

Acquiring Firmware Version

The **\$ver** command will return a summary of both firmware and hardware versions. This is useful when verifying if the version in the device is the latest version:

```
Apollo_NMEA v1.27-6458. dev:6 Hw:3.1-0 SN=274 IMEI: GPS: IRD:
Reset: Count=6, Current=(S), Prev=(cleared)
```

Version Readout	
Firmware Version	Product; Major, minor, build of firmware
Hardware Revision	Hardware revision, set during assembly
Serial	The unit's serial number
GPS Firmware Version	Firmware version of GPS chip
Iridium Version	Firmware version of Iridium modem (Not Applicable)
Reset Count	The number of resets since firmware was uploaded
Current	Cause of last power off
Previous	Cause of previous power off, not used in Hades

Resetting the Device

In the event the device requires a soft reset, the command

\$resetnow

Will restart the device and wipe non-persistent settings (magnet/strobe time disabling, diagnostic state).

Restoring Factory Defaults

In the event the device requires a restoration of default settings, the command

\$factorydefaults

Will restart the device and wipe all settings changed from the original configuration.

Strobe Configuration

Strobe Number and Interval

There are two parameters available for configuring the Hades' flasher, the period and the pulse count. At default settings, the Hades' LED will flash twice every ten seconds, each LED pulse lasts for 50 milliseconds

The period setting determines the number of seconds between flashes, while the pulse count determines the number of pulses with each flash. Both parameters are set using the following command:

\$strobe [number of pulses] [period in seconds]

The number of pulses can be up to 4, while the period is limited to a maximum 60 seconds. This command is written as:

\$strobe X Y

Example	Command	Pulse Number	Strobe Interval
1	\$strobe	1	20
2	\$strobe	2	50

Sending the commands in Example 1 would set the flasher to pulse once for 50ms every 20 seconds. While Example 2 would set the flasher to pulse 2 times every 50 seconds.

A response from the Hades would be as follows, using Example 1:

Flash:strS=20;strN=1;strFlashUW=n

Underwater Strobing

By default, the Hades' strobe discontinues flashing once the device is submerged. This can be changed to flash continuously regardless of submergence by issuing the command:

\$StrFlashUw 1

Which yields the following response:

Flash:strS=20;strN=1;strFlashUW=Y

The opposite setting is restored by sending:

\$StrFlashUw 0

Which consequently yields this response:

Flash:strS=20;strN=1;strFlashUW=n

Strobe Disable

Semi-permanent Disabling

Some users may prefer to disable the Hades' strobe regardless of environment. To disable the regular operation of the strobe, issue the following command:

\$switch B 0

Which will prompt the following response on the diagnostic port:

Switch: Y = ULG, N = TB

User Enable / Disable Settings: (Switch)

e.....UnderwaterMode(U): YES

e.....Light(L): YES

e.....GPS(G): YES

e.....Tilt Activate(T): no

e.....Strobe(B): no

To re-enable the strobe, issue:

\$switch B 1

Which will yield the same response in the affirmative for the Strobe feature:

Switch: Y = ULGB, N = T

User Enable / Disable Settings: (Switch)

e.....UnderwaterMode(U): YES

e.....Light(L): YES

e.....GPS(G): YES

e.....Tilt Activate(T): no

e.....Strobe(B): YES

With this feature, the strobe will not pulse according to its settings according to the **\$strobe** command. The strobe will only illuminate if the magnetic reed switch is acted upon, as the LED is the visual aid used to indicate the Hades' power status.

Using the \$switch method to disable the strobe is saved in memory. This means the strobe will remain in a disabled state through resets unless commanded otherwise.

Timed Disabling

If there is a need to disable the strobe temporarily, **\$StrDisbl** can be used to disable the feature in the following ways:

\$StrDisbl 1	Disables the Strobe for 1 hour
\$StrDisbl 0	Enables the Strobe immediately (Default strobe setting is ENABLED)
\$StrDisbl 1 6h	Disables the Strobe for 6 hours

The Maximum time the strobe can be disabled is **24 hours (\$StrDisbl 1 24h)** which would yield this response:

Strobe disabled for 1d00:00:00

Disabling the Magnetic Switch

To avoid inadvertent triggers of the magnetic switch, **\$MagDisbl** can be used to disable the feature in the following ways:

\$MagDisbl 1	Disables the Magnetic Switch for 1 Hour
\$MagDisbl 0	Enables the Magnetic Switch (Default switch setting is ENABLED)
\$MagDisbl 1 6h	Disables the Magnetic Switch for 6 hours

The **maximum** time the magnetic switch can be disabled is **24 hours (\$MagDisbl 1 24h)** which would yield this response:

Magnet disabled for 1d00:00:00

The Hades' Sensors

Water Sensing

The Hades' water sensor is used to detect a change from underwater to surface. The sensor measures capacitance between the antenna and electronics head, based on the dielectric constant of either air or water.



The Hades' water sensor will make continuous checks as to its surfaced state. Once submerged, the device's LED will no longer flash ([by default](#)).

Once the water sensor measures that the Hades is above water, strobing of the LED will resume, provided the area is dark enough. At no point will the Hades discontinue NMEA streaming, though there will only be valid data at the surface.

The Hades' water sense mechanism is programmatically set to operate optimally in salt water environments. To operate the device in fresh water, the water sense threshold value must be **increased** to trigger a water sense surfacing event.

To change the water sense threshold, use the following commands in order:

```
$engmode 2009  
$wsthresh X
```

Where **X** is the new value of the threshold.

The water sense reading has to be **lower** than the threshold number when submerged, and **higher** than the threshold number when surfaced for surfacing to take place. Fresh water environments can vary in the reading given, therefore testing should be done ahead of fresh water deployments to ensure proper operation.

The water sense reading can be interrogated via a Bluetooth connection via the **\$wsr** command.

Light Sensing

The Hades' light sensor measures illuminance every 15 seconds. If the light level is below the set threshold, the strobe will begin flashing according to its Strobe settings.

The light sensor can be disabled so the Hades treats the environment as permanently dark, or permanently light using the following command:

\$switch L 0

Which will yield this response for the Light feature:

Switch: Y = UGB, N = LT

User Enable / Disable Settings: (Switch)

e.....UnderwaterMode(U): YES

e.....Light(L): no

e.....GPS(G): YES

e.....Tilt Activate(T): no

e.....Strobe(B): YES

Care must be taken when disabling the light sensor; upon disabling, the LED will take on the characteristics based on the last light sensor reading. It is suggested to reset the device after disabling the light sensor if permanent strobing is desired.

Tilt Sensing

The Hades' tilt sensor takes an accelerometer reading every 15 seconds when enabled (disabled by default). If the Hades is tilted beyond its threshold, the Hades not will strobe until returning to an upright position. The Hades does not stop running NMEA while inverted.

To activate the Hades' tilt capability, use the command:

\$switch T 1

Which will yield the response in the affirmative for the Tilt feature:

Switch: Y = ULGTB, N =

User Enable / Disable Settings: (Switch)

e.....UnderwaterMode(U): YES

e.....Light(L): YES

e.....GPS(G): YES

e.....Tilt Activate(T): YES

e.....Strobe(B): YES

Bluetooth

The Hades has integrated Bluetooth hardware to facilitate local communication with the user for configuration, flash memory dumps and firmware upgrades via the Xeos Beacon Android App.

The Hades' Bluetooth will advertise after a successful self-test pass using a Bluetooth name set at the factory. By default, advertisement will only run for the **first 5 minutes** after power-up and/or reset. After this time, the device will need to either be reset, or the Bluetooth power-on command (**\$btpwr 1**) must be sent to the device over the RS-232 port for Bluetooth to resume advertising.

If the Bluetooth power-on command is received, the Hades will **always** advertise its name for connection (except when in underwater mode) until the Bluetooth power-off (**\$btpwr 0**) command is received. **If the Bluetooth was commanded on, Bluetooth will also advertise while the device is off.**

Since the Bluetooth in the Hades shares the same antenna as GNSS, connection can be interrupted if NMEA is engaged.

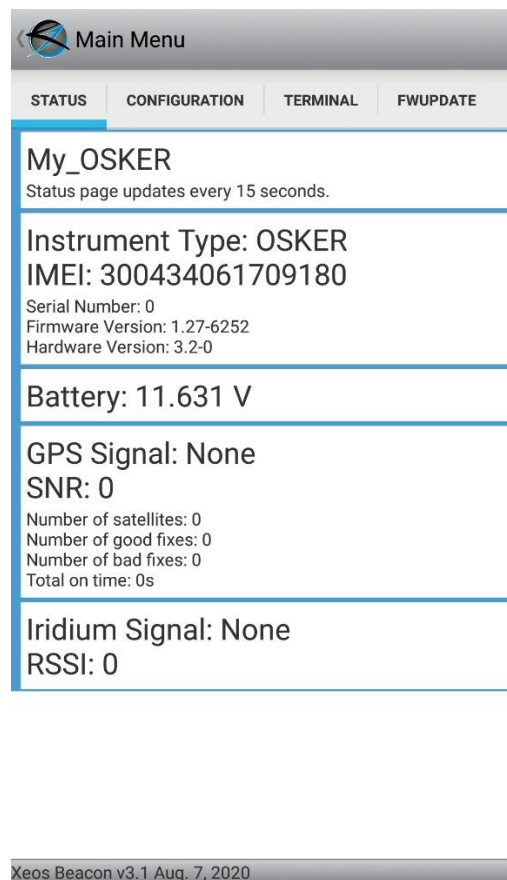
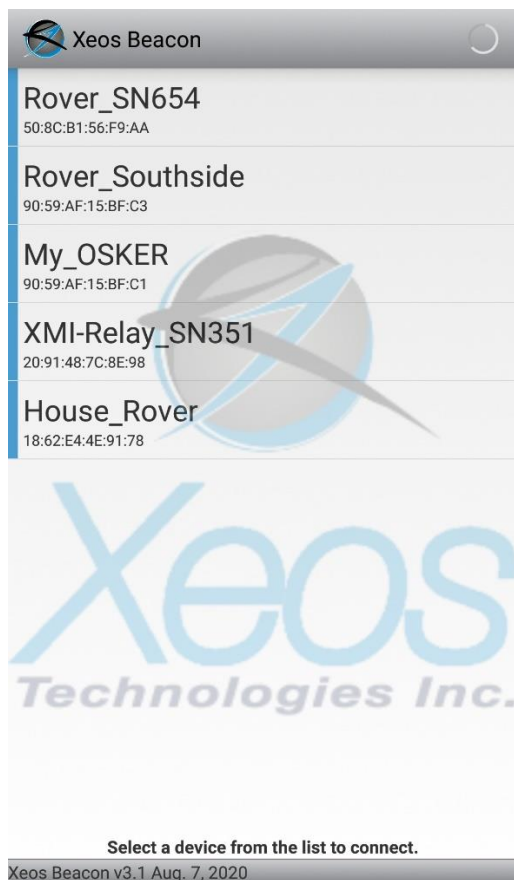
Firmware Updates

Hades can be updated using the [Xeos Beacon Bluetooth App](#). This application requires an Android device to operate. It is important to disable NMEA (\$pwr g 0) while doing so as the integrated antenna is required.

Hades can also be updated using their diagnostic Serial Port.

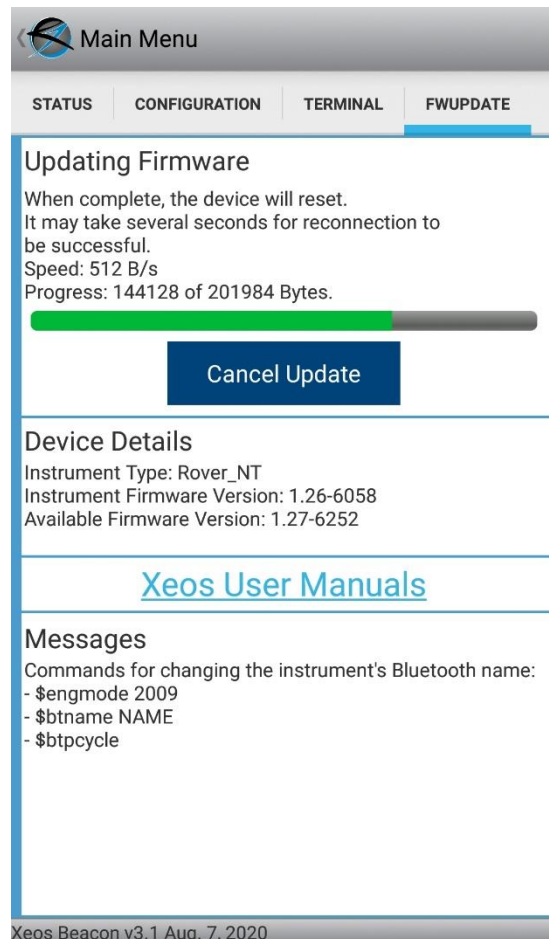
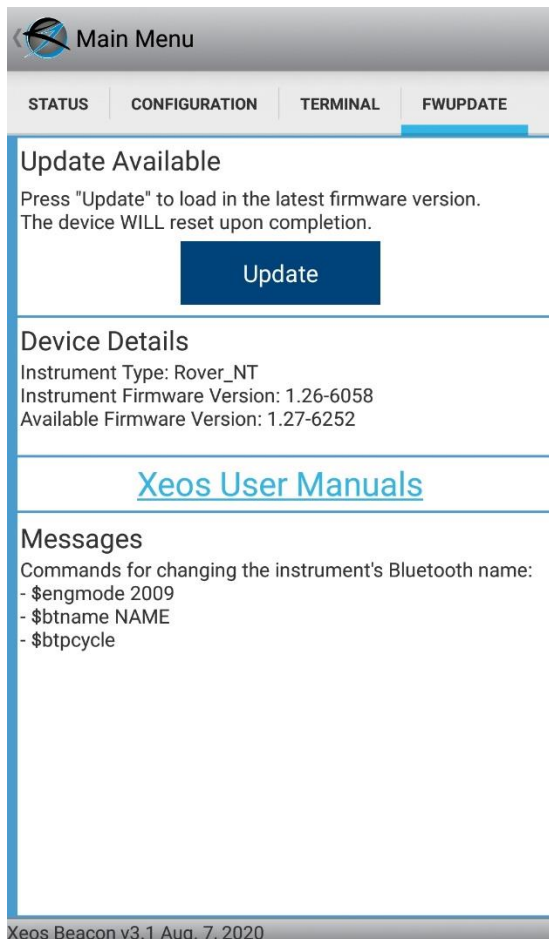
Updating via Bluetooth

Connect to the device using the Bluetooth App while the device is on by selecting its name from the menu when it appears. You will be brought to the Status Page.



Navigate to the **FWUpdate** Page. Here, the build version of your device will be compared with that offered by the application. If the versions differ, an update can be chosen.

Press **Update** to begin the process.



The application will upload a new firmware image at 500 bytes per second, showing a progress bar. Once the upload is complete, reset the device. The device will perform a firmware upgrade on its next power-up. If the update is interrupted for any reason, simply restart the process.

Updating via Serial

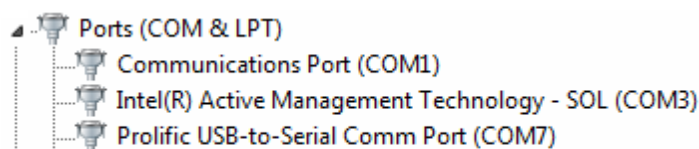
Using the RS-232 port on the Hades, firmware can be updated.

Requirements

- Use of a computer running some version of Windows OS
 - STerm Terminal Emulator Program
- A method of powering the Hades
- RS-232 to PC cable
- Hades firmware package

Process

1. Power the Hades.
2. Connect the RS-232 cable to the Hades' diagnostic output.
3. Take note of the COM port number in Control Panel → Device Manager



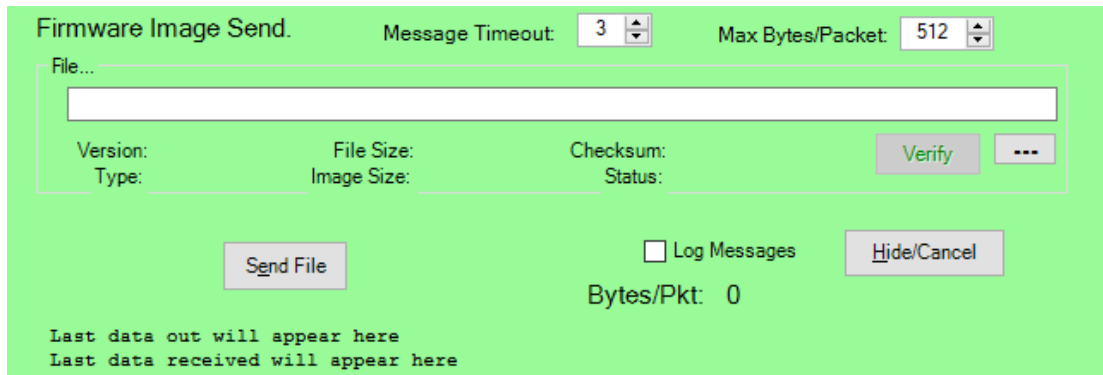
In this case: **COM 7**

4. Extract the contents of the zipped folder to a location of your choosing:
 - a. STerm.exe
 - b. Firmware .bin file
5. Open **STerm** and connect to the COM port of the Hades using these settings in the bottom-right corner of the window:

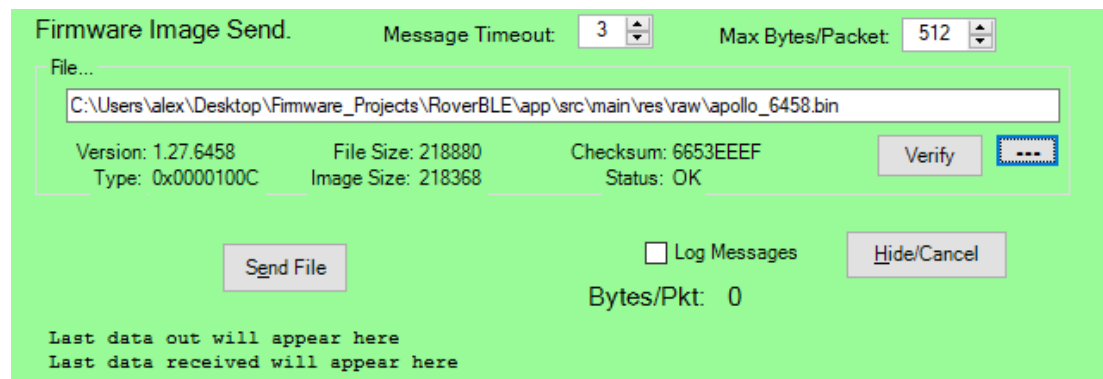
Baud Rate	57.6k
Parity	None
Data Bits	8
Stop Bits	1

6. Click **Open Port**
7. Commands can be sent to the Hades on the bottom-left. Send a **ver** command to the device to confirm communication is established.
 - All commands to Xeos devices start with a dollar sign (\$) but STerm automatically adds this to all commands.
 - A **ver** command will print out the product type and firmware version currently installed in the device.

8. At the top of the window, navigate to **Send File > Send Bootload Image**. A new inset box appears.



9. Use the “...” button next to Verify to browse to the .bin file extracted from the firmware package. Note that the firmware version of the new package will be populated on choosing the file.



10. Press **Send File**. The transfer will begin immediately and will take approximately five minutes.
 - If the transfer is interrupted for any reason (disconnect/power loss) the partial image will be discarded without corrupting the firmware. The process can be restarted without issue.
11. When the transfer is fully complete, press **Hide/Cancel**.
12. Return to where commands are issued to the device and send a **resetnow** command.
 - On resetting, the old firmware file is replaced with the new version over a period of approximately five to ten seconds.
13. Send the **ver** command to the device, confirming that the new version has been installed. On confirmation, the procedure is complete.

After Updating – Bluetooth Name

Following firmware updates, Xeos products do not retain their given Bluetooth name, and will need to be re-instated or changed to the user's needs. This can be done through the terminal tab of the app, or over the serial port, with the following commands:

\$engmode 2009	Enables ability to change Bluetooth name
\$btname X	Give the device a name to broadcast; where X is the new name (no spaces allowed in name)
\$btpcycle	Power cycle the Bluetooth; the new name will display on the next connection attempt. Communication will disconnect for a few seconds.

After sending these commands, move back to the device list page by hitting the back button on the handheld device to allow the beacon to broadcast its new name.

All of the above commands can also be sent over the serial port on the Hades.

Troubleshooting

LED extended blinking on start-up

Indicative of a self-test failure. As of build 6058, using the **\$status** command will show what failure code is present, but this does not survive resets.

f - Flash - Flash error is showing as a full chip; erasing the chip may resolve this issue.

No Iridium messages (assuming no self-test failure)

- Determine the nature of the issue (antenna-related, system related or location-related)
 - Ensure the device's Iridium IMEI is active on the Iridium network with your service provider.
 - Ensure the device is provisioned to send messages where intended.
 - Change the location of the device; place the device in an area with as much total view of the sky as possible.
- Dumping the flash memory will display all Iridium sessions that occurred, regardless of success.
- Ensure correct batteries are being used; Hades-3's will still strobe even if outfit with alkaline batteries, though cannot source the current to transmit.

Messages are not readable

- Check the location of the port connection to ensure the intended connection is true.
- Check the baud rates of the ports connected to ensure they are correct.
- Check that the ports have a common ground.

No GNSS/poor GNSS

- Change the location of the device; place the device in an area with as much total view of the sky as possible.

Appendix A: Technical Specifications

Electrical	
Supply Range (VDC)	6 - 28
Idle Current (mA), Bluetooth on/off, NMEA off	4.0, Diagnostics & NMEA ports connected 2.8, Diagnostics connected (Bluetooth no change)
Underwater Current (μ A)	30
GNSS Receiver Current (30s average, mA)	25
Bluetooth Connected Current (mA)	5.8 with Diagnostics connected
Device OFF Current (μ A) Bluetooth on/off	2.3mA Diagnostics & NMEA connected 1.3mA Diagnostics connected (Bluetooth no change)

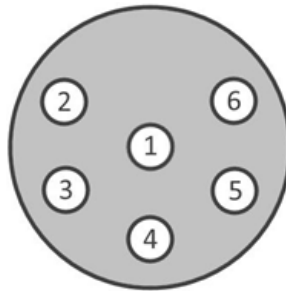
All Currents measured at 12V input

Batteries should be removed if device is entering storage.

Electronics	
Digital Controller	Xeos Apollo
GNSS Receiver	Xeos Technologies 48 channel GNSS (SiRFStarIV, SiRFStarV as of July 2017, hardware dependent)
Antenna	Xeos proprietary antenna, designed to withstand high pressure environments

Appendix B: Pinouts

Hades Pinout Options – 6-Pin Connector

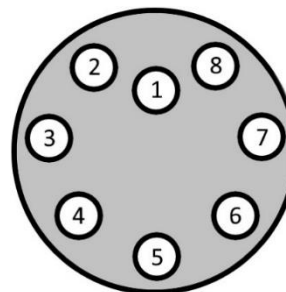


Connector: MCBH-6F-TI, External View

Option 1 – Dual Supply, no 1PPS	
Pin Number	Name
1	NMEA-TXD RS-232
2	TXD RS-232
3	RXD RS-232
4	+V Battery
5	+V External
6	Ground

Option 2 – Single Supply with 1PPS	
Pin Number	Name
1	NMEA-TXD RS-232
2	TXD RS-232
3	RXD RS-232
4	1PPS
5	+V External
6	Ground

Hades Pinout Options – 8-Pin Connector

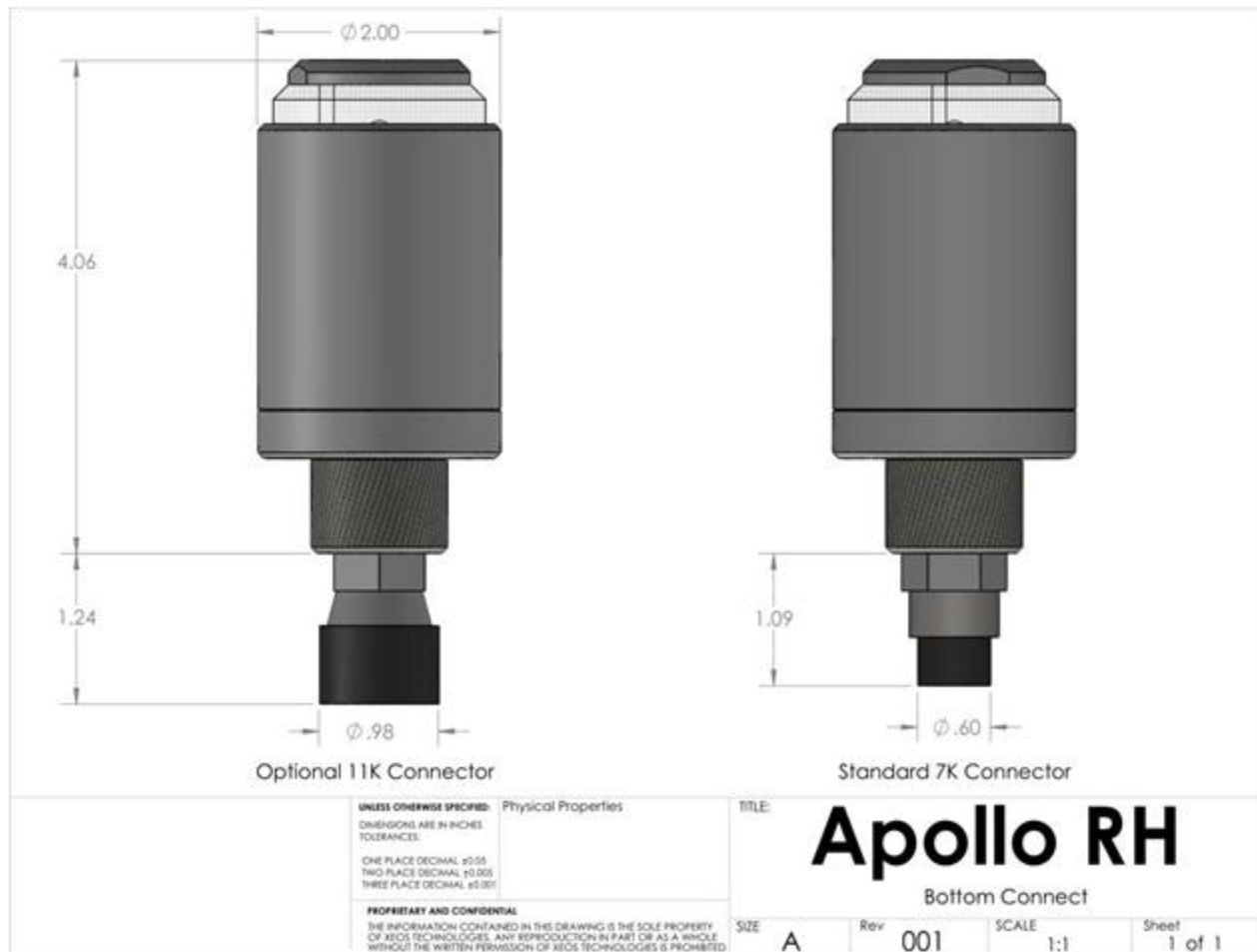


Connector: MCBH-8F-TI, External View

Option 1 – Dual Supply	
Pin Number	Name
1	NMEA-TXD RS-232
2	TXD RS-232
3	RXD RS-232
4	+V Battery
5	+V External
6	1PPS
7	Ground
8	Shield

Option 2 – Single Supply	
Pin Number	Name
1	NMEA-TXD RS-232
2	TXD RS-232
3	RXD RS-232
4	No Connection
5	+V External
6	1PPS
7	Ground
8	Shield

Appendix C: Engineering Diagrams



Material	All titanium with a non-permeable ceramic antenna component
Remote Head	
Dimensions	10.31cm L x 5.08cm D (4.06" L x 2.00" D) – Head 2.76cm L x 1.52cm D (1.09" L x 0.60" D) - Connector
Mass	370g - in water 557g - out of water
Environmental	
Operating Temperature	-40° C to +60° C (-40° F to 140° F)
Depth Rating	Submersible to 7500m (24,606 ft)

Appendix D: Legacy Features

Magnet On/Off Procedures (Pre-6411)

The Hades beacon is turned on and off via an external magnet near an internal magnetic reed switch, and operation can be identified by viewing the LED through the top of the Hades.

To turn the Hades on, press the magnet against the glass ring for a 1/2 second and then remove it for a 1/2 second. Do this twice, and the Hades will respond by showing a solid LED, followed by several flashes (self-test period) before strobing begins normally.

To turn the Hades off, repeat the above procedure with the magnet. Contact with the magnet will cause quick flashing, and after two taps, will flash for several seconds, followed by a solid LED before turning off.

Warranty, Support and Limited Liability

Xeos Technologies Inc. warrants the Hades 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.