Resolute User Manual

Telemetered GNSS Receiver

Version 3.0

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Shipped From

Contact Us

Email	support@xeostech.com
Phone	+1 (902) 444-7650
Website	xeostech.com

Specifics

This manual version is written with respect to Resolute firmware build 12923. To acquire the latest firmware for your device, contact support@xeostech.com

Version History

Version No.	Firmware Ver.	Date	Description
1.1	1.1.4147	Nov 2017	RTK Details Added
1.3	1.1.4641	July 2018	Tunnel Details Added, New Firmware Features added
1.4	1.1.4769	Sept 2018	ASCII External Sensor Recording Added
1.5	1.1.4769	Jan 2019	Improved manual graphics
2.0	1.1.5205	Jan 2019	File Stream Buffering, XBD
2.1	1.1.5222	March 2019	Real Time Streaming: RTCM over cell
2.2	1.1.5504	June 2019	Ethernet functionality added
2.4	1.1.6272	Feb 2020	Memory Management functionality added
2.5	1.1.6702	Oct 2020	Hardware version upgrade
3.0	1.1.12923	Aug 2025	Rewrite and rebrand

Table of Contents

Overview

The Resolute GNSS Receiver is an autonomous low power GNSS receiver with L1/L2 GPS and GLONASS tracking abilities. Optionally, other satellite constellations and frequencies may be added. The Resolute is driven by a flexible GNSS modem capable of RTK or Standalone data collection.

Telemetry options aside from the installed GNSS hardware include:

- Iridium 9523 transceiver
- Cellular modem
- 900 MHz Radio

The Resolute is housed in a rugged enclosure and includes redundant SD cards capable of logging outputs from external sensors along with GNSS data.

The Resolute records GNSS data in the **Septentrio Binary Format (SBF)**. Any blocks listed in the SBF Reference Guide can be recorded at a configurable rate.

Device Configurations

The Resolute is a flexible and powerful platform that comes in many different configurations. Therefore, this manual will cover varying subjects that do not apply in all applications.

Separate permission files are required for specific Resolute GNSS features, such as raw measurements, Base station corrections, or some signals such as Galileo.

Note: Not all Resolutes contain the same permissions; configuring the GNSS to record specific message types or track specific signals without these permissions will cause the Asterx to fail at configuration. Changing these settings where appropriate will restore operation.

Contact sales or support for further clarification on which units contain which features.

Polar

The Polar Resolute is designed to operate in cold environments, utilizing internal heaters to allow for such a deployment. Telemetry typically utilizes an Iridium 9523 modem for RUDICS Tunnel and SBD telemetry, but can also be ordered with a Cell modem for Cell XBD and Tunnel in place or in addition of the standard.

Reference

The Resolute Reference Receiver is a GNSS receiver capable of recording raw GNSS measurements along with standalone PVT (Position, Velocity, Time) data and many other SBF blocks. It is designed to operate without any real-time corrections and can record data for post processing. It does not utilize the other telemetry systems.

RTK Base Receiver

The RTK Base station is a correction generator for RTK (real time kinetic) measurements. A single base station properly configured can broadcast a correction service to one or more RTK Rovers, equipped with a 900MHz radio or a connection to the internet via Ethernet.

An RTK Base roughly measures an initial base position and then measures deviations from this position to generate corrections. The Base operates on the assumption that the Base antenna is **not** moving.

RTK Rover Receiver

The RTK Rover is the measurement and data collection sensor companion to the RTK Base Receiver. Depending on the data filter length (at receiver) and response time necessary, it is capable of measuring deviations on centimeter or millimeter levels, when properly serviced with corrections. The RTK Rover should be mounted to the desired landmark of whose movement is to be measured.

NorthStar

The NorthStar is a correction repeater and communications unit that has two primary functionalities relating to RTK receivers:

- A correction relay unit to overcome geographical issues such as distance and topography between the RTK Base and RTK Rover.
- A collection point for RTK Rover data; the NorthStar can be attached to a server or doghouse computer and relay 30-second averaged positions from any RTK Rovers in the radio network.

While the theory of operation is similar and related to the Resolute, the NorthStar is covered in a separate manual.

Device Theory of Operation

The Resolute at its heart is an embedded peripheral control unit. Each enabled peripheral, including the GNSS, is controlled by the scheduler, which can be configured by the user.

Each peripheral has three separate timer settings to build the schedule:

- *duration*, the length of time the peripheral is on
- *interval,* how often a peripheral is on
- *offset*, moves the start of the task by the specified amount of time.

Using these three parameters, the timing of powering the peripherals can be controlled.

Some peripherals (ex. GNSS) can be set to always-on by setting the duration to **zero**:

$gnssSetDuration 0s

GNSS Receiver Theory of Operation

The GNSS receiver onboard the Resolute outputs configurable Septentrio Binary Format (SBF) blocks at a configurable rate. The Resolute can subdivide these outputted blocks into four file **streams**. Individual streams are recorded to their own files, and have the ability to record SBF blocks at different rates across streams.

The files produced from streams are individually configurable in length. Data generated by the GNSS receiver are saved to the SD cards installed inside the Resolute.

Use the $gnssSetMessageType command to configure streams.

XeosOnline can be used to set GNSS settings easily; see the section lower in this document.

SD Cards & SRAM Theory of Operation

To upgrade to firmware version 5200+ from a lower version number, please verify SRAM is installed on the device to be updated by contacting Xeos.

Data written to the SD cards is initially written to circular buffers in SRAM as of firmware version 5200. SRAM buffering allows for higher data recording rates, and greater data verification. Data is assigned a buffer based on the configuration of the data streams, with Streams 1 and 3 writing to Card 1, and Streams 2 and 4 writing to Card 2.

An SRAM buffer will empty its contents to its respective SD card when the buffer reaches **70%** full. While the file is being written to, the file is 'open' on the device; this makes it extremely important to notify the device when it is to be shut it down.

Proper shut down etiquette is to either send the device a **$resetnow** command or to hold the test button for 3+ seconds. Failure to do so will cause the file to be left open. Open files are partially recoverable on a computer provided they are not written over.

Files written to the SD card use a naming convention with an ASCII representation of BASE-36 characters with the following name format:

SSFYYMDH.sbf

SS	Two-character representation of device serial number
F	Stream Source (1-4, D (Diagnostics))
YY	Two-character representation of year
M	Month of year
D	Day of Month
H	Hour of Day

Example: **2T10FATC.sbf**

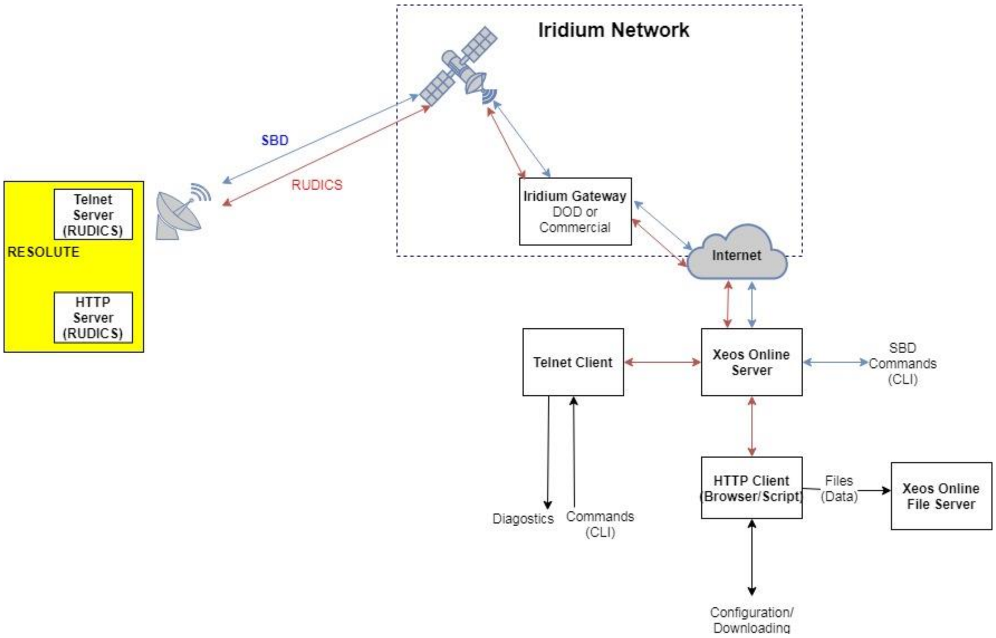
Serial #	2T = 101
Stream	1 = 1
Year	0F = 15 (2015)
Month	A = 10 (October)
Day	T = 29
Hour	C = 12

The GNSS SBF files follow the format outlined in the Septentrio SBF Reference Guide.

Data recorded to the SD card is by default managed by a memory management task. Data is recorded until the memory management task detects the card is 90% full, at this point the oldest 10% of data will be deleted. This task can be turned off on a per card basis. Read about this in the SD Memory management Section of the manual.

Tunnel Theory of Operation

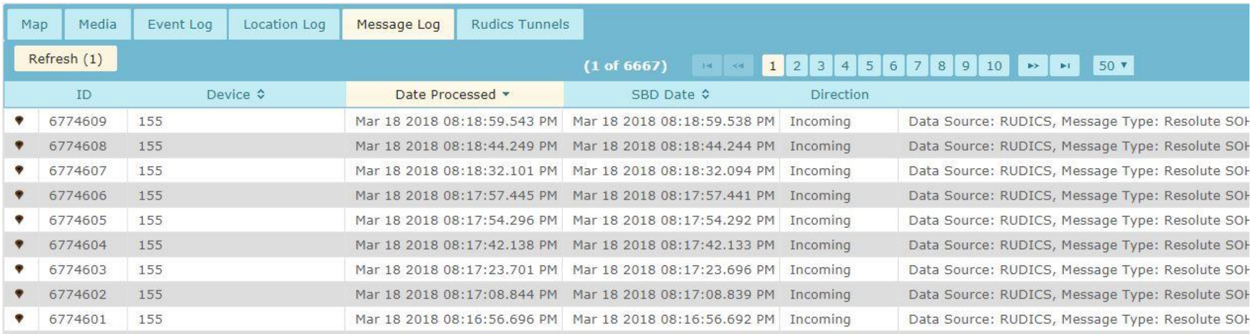
If the Resolute is equipped with a cellular modem or Iridium modem and a data or RUDICS plan, your unit is capable of remotely connecting to the Xeos Tunnel. The Tunnel is useful for configuring your unit remotely and retrieving data and diagnostics from the SD card remotely. It is also useful for diagnosing potential issues on units deployed in the field.



Iridium Tunnel and SBD Network Diagram

Upon reaching its start time, the tunnel will power on the configured modem and will attempt to open a two way connection to XeosOnline (XO). The tunnel confirms two way operation to XO via a heartbeat message known as a “keep alive”. A keep alive is a small data packet sent from the unit to the XO server every 15 seconds and acknowledged by the server. This “keep alive” message manages the connection between the unit and XO irrespective of any sockets being opened by the user or a script. If two packets are unacknowledged in a row, the unit closes the connection and tries to reestablish it.

Keep alive data packets include SOH information about the receiver, including voltage and temperature conditions. Keep alive data packets are also the best way to verify the tunnel is connected when your unit is in a remote location. If keep alives are coming in to the Message Log of the unit every 15 seconds, the tunnel is connected.


Map | Media | Event Log | Location Log | Message Log | Rudics Tunnels

Refresh (1)

(1 of 6667) 1 2 3 4 5 6 7 8 9 10 50

ID	Device	Date Processed	SBD Date	Direction	
6774609	155	Mar 18 2018 08:18:59.543 PM	Mar 18 2018 08:18:59.538 PM	Incoming	Data Source: RUDICS, Message Type: Resolute SOH
6774608	155	Mar 18 2018 08:18:44.249 PM	Mar 18 2018 08:18:44.244 PM	Incoming	Data Source: RUDICS, Message Type: Resolute SOH
6774607	155	Mar 18 2018 08:18:32.101 PM	Mar 18 2018 08:18:32.094 PM	Incoming	Data Source: RUDICS, Message Type: Resolute SOH
6774606	155	Mar 18 2018 08:17:57.445 PM	Mar 18 2018 08:17:57.441 PM	Incoming	Data Source: RUDICS, Message Type: Resolute SOH
6774605	155	Mar 18 2018 08:17:54.296 PM	Mar 18 2018 08:17:54.292 PM	Incoming	Data Source: RUDICS, Message Type: Resolute SOH
6774604	155	Mar 18 2018 08:17:42.138 PM	Mar 18 2018 08:17:42.133 PM	Incoming	Data Source: RUDICS, Message Type: Resolute SOH
6774603	155	Mar 18 2018 08:17:23.701 PM	Mar 18 2018 08:17:23.696 PM	Incoming	Data Source: RUDICS, Message Type: Resolute SOH
6774602	155	Mar 18 2018 08:17:08.844 PM	Mar 18 2018 08:17:08.839 PM	Incoming	Data Source: RUDICS, Message Type: Resolute SOH
6774601	155	Mar 18 2018 08:16:56.696 PM	Mar 18 2018 08:16:56.692 PM	Incoming	Data Source: RUDICS, Message Type: Resolute SOH

Tunnel Keep-Alives in the XeosOnline Message Tab

Tunnel connections over cellular are normally stable (in good cellular coverage). Tunnel connections over Iridium RUDICS will have interruptions under normal operation. The maximum data transfer rate of Iridium RUDICS is 17 KB/min.

The user of the remote device can interact with the device through a number of interface (sockets) into the tunnel. These include an embedded HTTP (Web) Server, automatic download scripts and a Telnet Server. It is possible to open only one socket of the tunnel at a time. Multiple open connections to the tunnel will result in the tunnel disconnecting. The tunnel will reconnect after disconnecting provided the tunnel end time is not met. See Appendix I for information on setting up Iridium Service.

SBD: Theory of Operation

SBD (Short Burst Data) is a low cost, low power method of communicating remotely with a Resolute if an Iridium modem is installed. SBDs are the Iridium equivalent of a text message (SMS).

The Resolute schedules SBD message checks using the scheduler. At the scheduled interval, the unit will transmit Status of Health (SOH) data, then check for commands from the Iridium gateway.

SBDs cannot be sent at the same time as RUDICS tunnels are scheduled. If an SBD message check is scheduled during a tunnel connection, it will be executed upon the tunnel reaching its end time. Any messages sent to the Resolute between SBD tasks will wait at the Iridium gateway for the unit to check in.

The Resolute requires an unlock code with any commands prevent undesired control. Unlock codes are sent out to the provisioned addresses of the modem on start-up. Unlock codes are automatically included with SBD commands sent via XeosOnline.

XBD: Theory of Operation

XBD (Xeos Burst Data) is Xeos' cellular answer to the Iridium SBD (Short Burst Data). XBD utilizes the IP connection of the cell modem to send short amounts of data remotely with the Resolute if a cellular modem is installed.

XBD has the advantage, in contrast to SMS, of having responses logged on XeosOnline for later analysis or graphing. XBD commands can also be sent to the Resolute from any country in the world without an international texting plan; only a local data plan is required.

The Resolute schedules XBD tasks using the scheduler in the same manner as other tasks. At a scheduled interval, the unit will check transmit messages, and check for commands at the XeosOnline server.

XBDs cannot be sent at the same time as a tunnel is scheduled. If an XBD task is scheduled during a tunnel connection, it will be executed upon the tunnel reaching its end time. Any messages sent by the user between XBD tasks will wait on the XeosOnline server for the unit to check in.

The Resolute requires an unlock code with any commands prevent undesired control. Unlock codes are sent out to the provisioned addresses of the modem on start-up. Unlock codes are automatically included with XBD commands sent via XeosOnline.

Interfacing for Device Configuration

All of the settings on the Resolute can be configured either by connecting one of the diagnostic ports to a serial port terminal, the USB port, or by sending configuration commands from a remote location over the Iridium Satellite Network or Cellular, depending on installed telemetry options. If configuring the unit locally, USB is recommended.

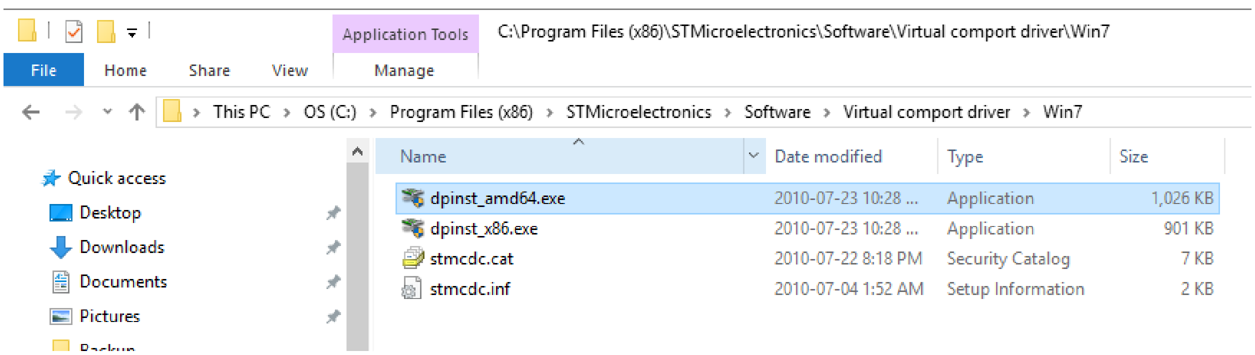
USB Diagnostic Port

All the settings on the Resolute can be configured by connecting the USB diagnostic port to a USB port on a computer.

To connect to the USB diagnostic port, if using a Windows PC, you may need to download a driver for the STM32 USB chip contained in the unit. The driver can be found here:

HTTP://www.st.com/en/development-tools/stsw-stm32102.html

Windows 10 Users: The Windows 7 and 8 drivers are functional for Windows 10, but will not auto install. Download the drivers and install the dpinst_amd64.exe file located at:
C:\Program Files (x86)\STMicroelectronics\Software\Virtual comport driver\Win7\dpinst_amd64.exe



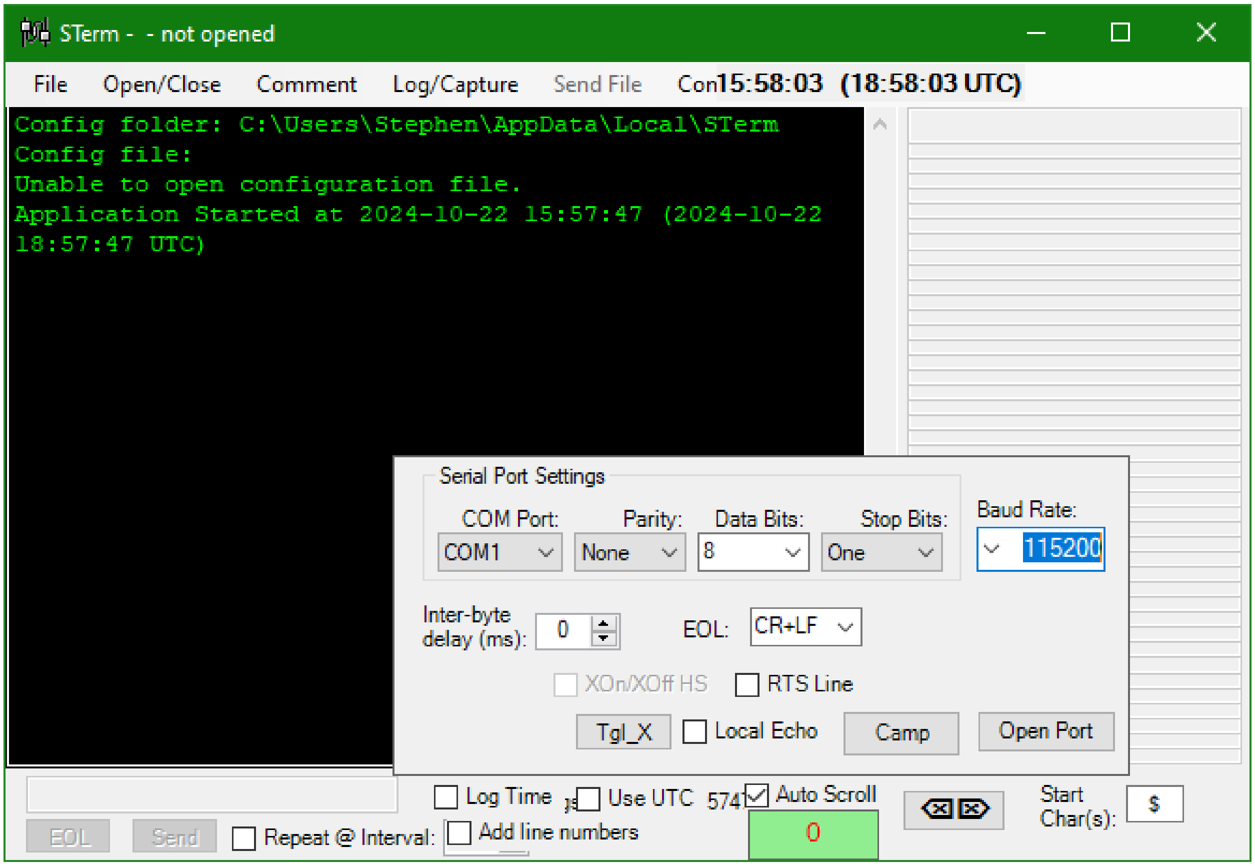
Modern Linux and Mac operating systems already support the driver.

After downloading and installing the driver, connect the supplied USB mini cable between the Resolute and your computer. Your computer will assign the Resolute a COM port number (Windows only) that will show up under ports in the Windows Device Manager. If the device is not recognized, check the driver the device is implementing.

To communicate with the Resolute, a serial port terminal program is required. **Xeos recommends STerm, a Windows-only product**. A free alternative for Linux and Mac is PuTTY. STerm can be downloaded here:

Port Settings - USB	
Baud Rate	Any
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	Disabled

Using STerm and Sending Commands



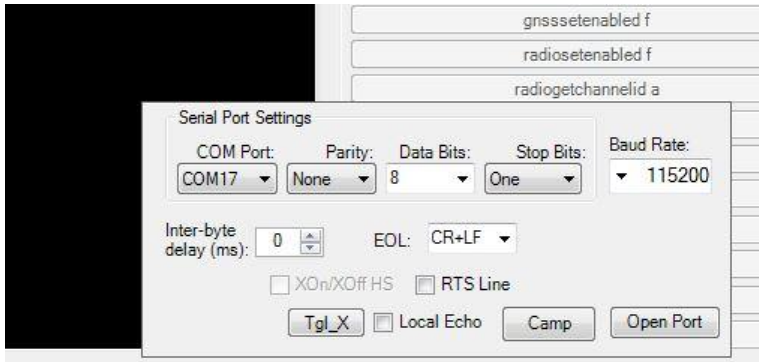
An STerm Window

STerm is the officially supported serial port terminal program of Xeos.

STerm can load configuration files to allow the commands for Xeos products to appear as buttons on the right side of the window. This can be done through the **FILE > OPEN** menu and opening the Resolute Config File.stm file. This is available to download here:

To open a connection to the device, power it on by applying 12V power using the supplied power cable and a DC power source. LEDs will flash on power up.

Wait for the computer to recognize the device driver. Select the COM port of the device from the Serial Port Settings menu in the bottom right corner of the screen. Click the open port button to connect to the unit. The buttons that appear on the right side of the window can be clicked and will send commands to the unit.



STerm Serial Port Settings Menu

The buttons on the right side of the window can be edited to change the input variable you are sending to the device. This is done by hovering over the right side of the button and then clicking the green edit button. Type your changes into the button then move your mouse away to end the edit.

The Edit icon of the command buttons

When connecting to a device, the diagnostics can flow too quickly to read, especially when not familiar with the output. To confirm commands are correctly received by the unit, it is recommended to disable the Radios and GNSS, which are the primary diagnostic generating peripherals in the unit. This can be done with the commands **$radioSetEnabled f** and **$gnssSetEnabled f.**

If the radio or GNSS does not disable within 30 seconds (the diagnostics should almost completely stop), reset the unit. Resetting the unit require re-plugging the USB connector and reopen the COM port, depending on the version of Windows.

After disabling the peripherals, send the desired commands and wait for the unit to reply. Re-enable the radio **$radioSetEnabled t,** GNSS **$gnssSetEnabled t** and reset the unit with the **$resetNow** command.

Configuration Commands

Time & Schedule Methodology

The timers on the device are powered by an onboard battery backed up by a real time clock (RTC). The RTC is updated from GNSS time to compensate for drift. The RTC continues to tick while the device is powered off and operates in the UTC timeframe.

Note: It is possible to shift to the GPS/GNSS time scale (i.e. discount leapseconds) by utilizing the command **$gnssSetUseGnssTime T**

All scheduled peripherals are controlled by four separate settings: ***enabled***, ***duration***, ***interval*** and ***offset***.

- **Enabled** controls if the peripheral is active and scheduled.
- **Duration** is the length of time the peripheral is on.
- **Interval** is the how often the device comes on.
- **Offset** offsets the interval by the specified amount of time.

Peripherals must be enabled or disabled using **$(peripheral)SetEnabled T/F**. For example, the following setting will enable the GNSS module:

$gnssSetEnabled T

When adjusting the scheduled settings, the time input can take form of seconds (s), minutes (m), hours (h) or days (d). If no units are given, the value is interpreted as **seconds.** For example, **3 hours** would be entered as **3h**.

To set the duration to be infinite (always on), simply set the duration time to **0**.

The next start and end time of various peripherals and tasks can be queried using the **$schedule** command over the serial connection (not available over Iridium/Cell). If a task or peripheral is not on the schedule, it is not enabled. If no scheduled tasks or peripherals are enabled, the Resolute will return **No Tasks Running!** While previous versions of firmware will return no response.

Using the Scheduler Commands

Below are examples of configuring scheduled tasks. While the GNSS is being used in these examples, the same commands with different identifiers (tunnel, radio, sdi12Master etc.) are used for all other system scheduling.

The *duration* parameter specifies the length of time a peripheral is on. This timer can range from 30 seconds to always on (infinite). To change this timer, issue the following command:

$gnssSetDuration *[duration]*

$gnssSetDuration 3h

The *interval* timer is the length of time between the on-periods of the task (start of one period to start of next).

$gnssSetInterval *[interval]*

$gnssSetInterval 1d

The *offset* timer is the length of time the interval timer is offset from the top of the hour or UTC Day, depending on the already set task interval.

$gnssSetOffset *[offset]*

For example, to start a task using a daily interval at **13:20 UTC**, this command would be used:

$gnssSetOffset 800m

Working Example:

A Resolute is required to record data for **20 minutes** every **two hours** for plate subsidence. For this application, the GNSS duration would be set to **20m** while the interval would be set to **2h**. The following commands would be sent to achieve this:

$gnssSetEnabled T

$gnssSetDuration 20m

$gnssSetInterval 2h

SD Memory Management

Auto-Deletion of Data

The data collected by the Resolute is written to two microSD cards. As the data generated by the Resolute fills the card, the default memory management scheme will automatically delete files.

The memory management system measures the filled space on the cards. If an SD card is over 90% full, the Resolute deletes the oldest dated files until the SD card is less than 80% full.

Memory management can be disabled, but comes with its own risks:

$SdSetMemoryManagement F

If Memory Management is disabled and the memory cards are full, **no new data will be written to the SD Cards**. If the task is enabled, the task can be assigned specific cards to operate on, on a per card basis:

$MemoryManagementSetDisks value

Value	SD Card Auto Delete
1	Card 1 Only
2	Card 2 Only
3	Both Cards (Default)

Before firmware 6272, the memory management task could be enabled or disabled with $SDSetdeleteoldest [T/F]. This command does not exist in 6272 or later.

The lifespan of the files on the card before they are deleted depends on how quickly the card is filling. If only a small amount of GNSS data is being recorded, for instance 1 Hz PVT/PNT data, the files will be present for months. If GNSS data is being recorded at 5 Hz, the data may be present for weeks.

SD Card Reformatting

While it is not necessary for operation, it is possible to re-format the SD cards. This can be done using the **"$formatSD [card#] [filesystem]"** command. It is recommended this be done before deployment to maximize available space.

card#	SD Card to Format, 1 or 2.
filesystem	1: Fat32 2: exFAT; **must be used for card sizes over 32GB**

To format card 1 as Fat32, the following command would be issued:

$formatSD 1 1

Auto-Shutdown Voltage

If operating the Resolute from a low voltage disconnect (LVD), power interruptions can result in the corruption of the SD cards. To protect the cards, the Resolute can be configured to unmount at a set voltage, before the low voltage disconnect cuts power to the device. This setting is **enabled** by default.

The lower shutdown voltage can be set (default 11.5V)

$setShutdownVoltage value

The shutdown voltage should be set higher than the disconnect voltage of the LVD.

Inversely, Resolutes can also be configured to restart blocked tasks and remount the cards at a higher voltage as power recovers (default 11.699V)

$setRestartVoltage value

This should be set a few hundred millivolts above the shutdown voltage. The example below works together to protect the SD cards in a case where shutdown voltage is 10.5V and restart voltage is 10.8V.

$SetShutdownVoltageEnabled T

$SetShutdownVoltage 10.5

$SetRestartVoltage 10.8

This entire feature can be disabled, allowing for the cards to remount and the tasks to resume, in the event tasks must be run:

$setShutdownVoltageEnabled F

If an SD card value in transmitted messages is **-1**, that card is not mounted to the Resolute; either it is not installed, the door is reading as open, or the voltage is low.

GNSS Configuration

All tasks must be confirmed as enabled to be utilized.

$gnssSetEnabled T

The current ability of a task to run can be queried by directly requesting, or locally using the **$schedule** command.

$gnssGetEnabled

The GNSS antenna type can be configured using

$gnssSetAntennaType value

This command configures the Antenna Reference Point (ARP) and other settings needed for accurate GNSS measurements. Type is a number corresponding to an antenna index. Common antennas supplied with the Resolute have the following numbers for this command:

Talisman TW3870/2 (default)	**0**
Septentrio PolaNt-x MF	**1**

Consult Appendix B for the complete list of antennas. The example below would configure the receiver correctly for the Talisman TW3872:

$gnssSetAntennaType 0

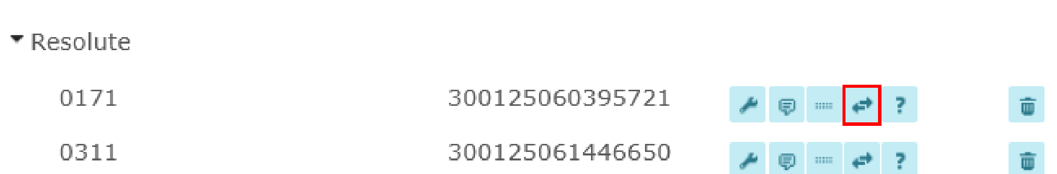
The standard antenna voltage supply is 3.3V, however **some antennas require a different voltage supply**. Voltage can be increased to 5V using

$gnssSet5vAnt T

Configuring GNSS Settings with XeosOnline

Command line messages can be sent to configure the GNSS blocks the Resolute records, and the signals used to create them. Since these values are given in the form of bitmaps or hex values, they are best formed on XeosOnline using the **Admin** option.

To configure and send the command to a unit, click on the two-directional arrow button under the **Admin** page next to the target device to open the Resolute Configuration window.

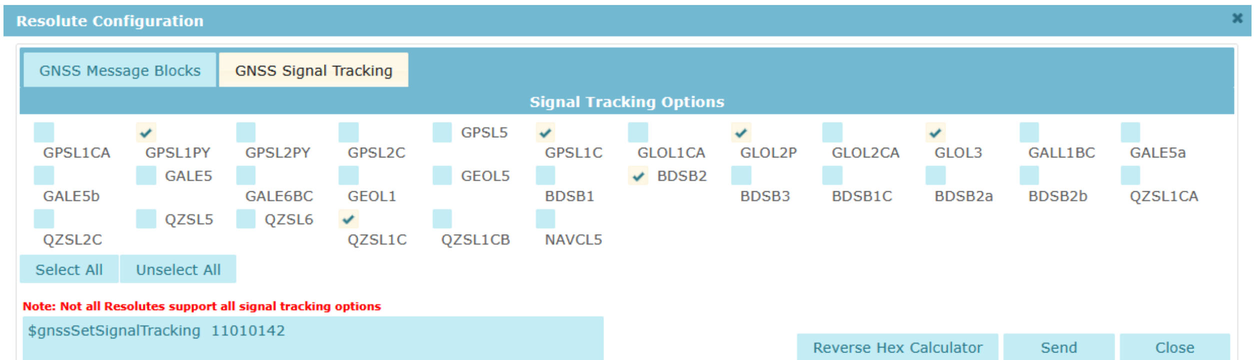


GNSS Signal Tracking

Signals that are to be utilized when recording data blocks are configured with:

$gnssSetSignalTracking HEX

The hex value can be formed and sent by clicking on the **GNSS Signal Tracking** tab, and checking the available signals. The command can be sent directly to the unit through this window using the **Send** button. This command, like any other sent via XeosOnline, is shown in the Message Log of the device.



The currently used signals can be recovered by entering the response from **$gnssGetSignalTracking** into XeosOnline's reverse hex calculator button on the bottom of the window. Clicking on **update** under the calculator will check the boxes of the signals that are currently tracked.

GNSS Message Types

Like the configuration of signals, the messages and intervals can also be configured under the **GNSS Message Blocks** tab in the Resolute Configuration window. Below is the command used for configuring the recording of messages:

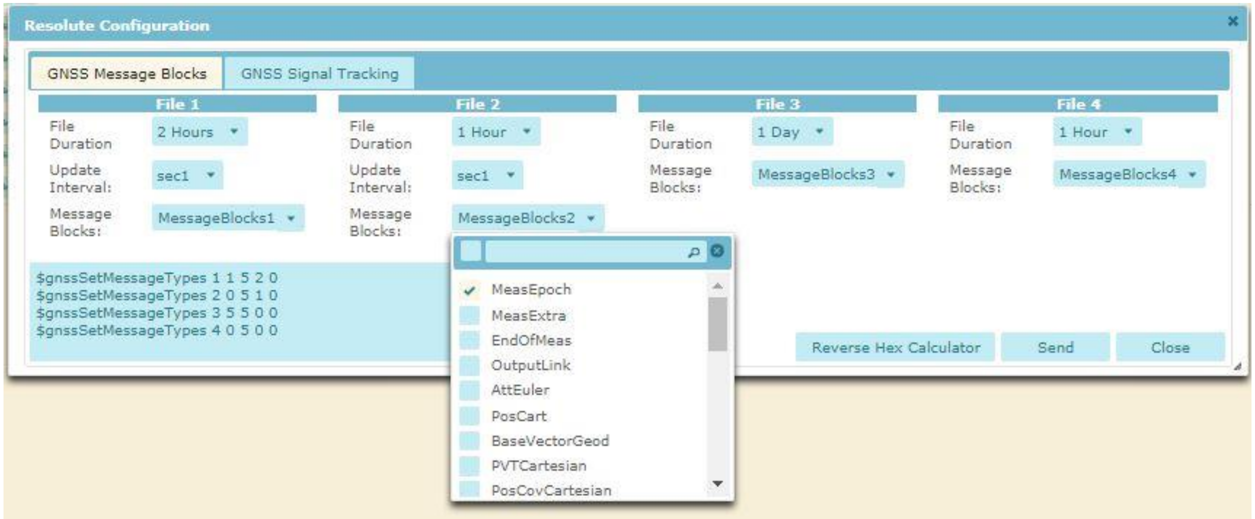
$gnssSetMessageTypes [stream] [duration] [update interval] [Bitmap A] [Bitmap B]

Stream is for file streams 1 through 4. The numerical value of the stream is contained within the SBF file name that is saved on the SD card, which can then be downloaded from the device over a tunnel connection.

File Duration and **Update Interval**, as shown in the Resolute Configuration window below, are indices corresponding to the values either provided in the calculator or entered manually in the window. The durations of the files for each stream can be set differently from one another. File streams 1 and 2 can be recorded at different update intervals, while streams 3 and 4 are locked as they are recorded only when the details of the block have changed, or a new file has opened

Bitmaps A and **B** are configurations used to choose message blocks of interest. Blocks can be chosen from the drop-down menu given under each file (as seen below) or by using the reverse hex calculator. By selecting values in the calculator or drop-down menus, the message to send to the unit is formed. Note that different streams have different blocks that can be recorded.

Note: When using the calculator to send the commands, messages to configure all four streams are sent; verify the settings for each stream! Alternatively, the line for a single stream can be copied from the text box and sent with the usual Send Command tool.



Again like the configuring signals interface, the currently used blocks can be recovered by entering bitmap the response from **$gnssgetMessageTypes** into XeosOnline's reverse hex calculator button on the bottom of the window. Clicking on **update** under the calculator will check the boxes of the signals that are currently tracked.

To present an example, **$gnssSetMessageTypes 1 1 5 2 0** would record only **MeasExtra** message blocks in **File 1** for **2 hours** with an update interval of **1 second**. Conversion of the chosen *File Duration*, *Update Interval* and *Message Blocks* from the drop-down menus to their respective codes is done internally by XeosOnline.

Collecting RINEX Data

The Resolute does not naturally record in RINEX (Receiver Independent Exchange) format, but native SBF files can be converted to RINEX.

- To log the SBF equivalent of RINEX observation files, enable the **MeasEpoch** SBF message in GNSS stream 1 or 2.
- To log the equivalent of the Navigation RINEX files, log the **GPSNav** or **GloNav**, or respective Nav SBF block for the satellite constellations enabled in GNSS stream 3 or 4.
- To populate the RINEX header, enable the **ReceiverSetup** SBF block (more information can be found in the SBF Reference Guide). This block must be concatenated onto the observation file before converting with SBF converter. Xeos has tools to handle concatenation, and can auto-concatenate full days of data if downloading to Xeos' tunnel server.

RINEX conversion can be accomplished using either sbf2rin, or Septentrio's SBF Converter. The details of the RINEX header can be filled out with the following commands.

Command	Variables	Antenna Value for RINEX Heater
$gnssSetAntennaType	See Appendix B	Reference point
$gnssSetAntennaOffsets	To four decimal places [E-Offset] [N-Offset] [U-offset]	Antenna offset
$gnssSetAntennaSerialnumber	20 characters	Serial number
$gnssSetAntennaSetupId	20 characters	Setup ID
$gnssSetMarkerName	20 characters	Marker name
$gnssSetMarkerNumber	20 characters	Marker number
$gnssSetMarkerType	20 characters	Marker type
$gnssSetObserverName	20 characters	Observer name
$gnssSetObserverAgency	20 characters	Observer agency
$gnssSetObserverComment	20 characters	Observer comment

Configuring Base Station GNSS Correction Output

The Resolute can, for units enabled with Base Station GNSS Permissions, send RTCM corrections and data out of various modems and ports. The majority of base station users will use the Base station corrections over the built in Radio, the default correction output method. However, these corrections can also be output over the Serial 2 port, as well as streamed over a cellular tunnel connection to a port on XeosOnline (Beta Feature).

To configure the output of the RTCM corrections a bitmap parameter must be set:

$rtcmSetOutputBitmap value

Value	Output Medium
1	Radio (Default)
2	Serial 2
3	Reserved
4	Cell Tunnel Streaming

Note: A unit restart is advised after updating the output bitmap.

Radio Configuration

The radios as configured from the factory will work for a single Base, multiple Rover RTK network. If a NorthStar Repeater was included in your order, the Rovers will be configured to receive from a single NorthStar. Multiple NorthStar Repeaters in series will require reconfiguration of the Rovers.

To configure the radio channel on a Resolute use the command:

$RadioSetChannelid [identifier] [channel]

The identifier for a Resolute is always "**A**" and is not case sensitive. The 'channel' is a value between and inclusive of **0** and **7**.

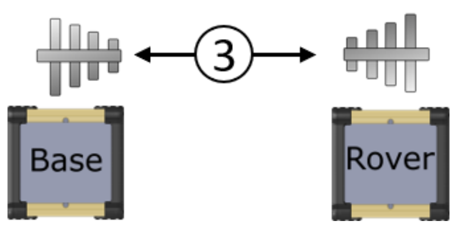
To configure the radio to broadcast or receive on channel 7 the following command would be sent.

$RadioSetChannelid A 7

RTK Radio Network Design

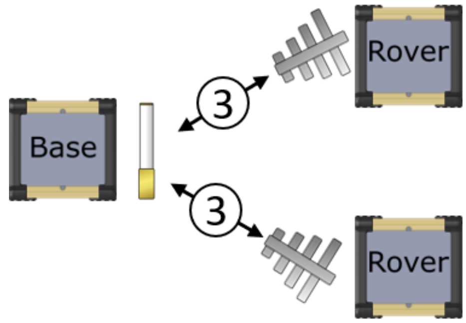
The Resolute RTK units contain an embedded radio peripheral for sending and receiving RTK corrections. The radio peripheral included with RTK and NorthStar units operate on a channel basis, with 8 possible channels (0-7).

For a simple single-Base-single-Rover network, all radios should operate on the same channel to receive corrections. The default channel from the factory for this is channel 3. The Base broadcasts corrections to the Rover, and the Rover receives the corrections. For this configuration, the use of Yagi antennas is recommended.



An example of a Single-Base-Single-Rover network.

For a Single-Base-Multiple-Rover network, the Base needs to be equipped with an Omni antenna to allow strong radio signal in all directions. This is the only change required as the base broadcasts. All Rovers should be configured on the same channel as the Base.



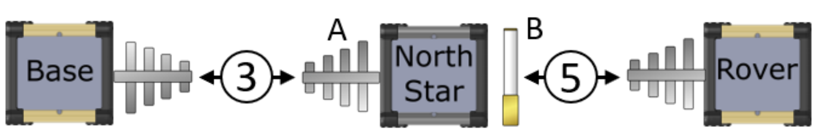
An example of a Single-Base-Multiple-Rover configuration.

If the Base radio does not have line of sight to all Rovers required for your application, additional NorthStar Repeater(s) can be added into the Network. A NorthStar Repeater is equipped with two radios identified as Radio A and Radio B.

Radio A receives the corrections broadcasted from the Base. In this configuration, Radio A operates as a Rover and should be configured to the same channel as the Base, in this case the default channel 3.

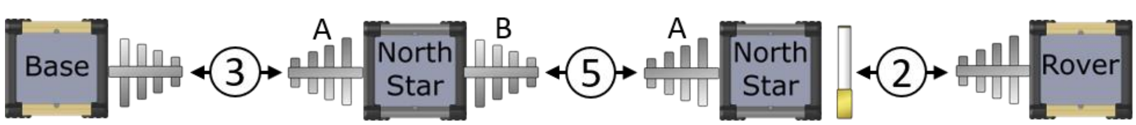
Radio B rebroadcasts the corrections like a Base. Since Radio B is a second broadcasting radio on the same network it must be on a different channel to the Base it is receiving corrections from. The factory default for Radio B is channel 5. Any Rovers that require the NorthStar for line of sight to receive corrections should be on the same channel as the NorthStar Radio B.

In the configuration where a base is only broadcasting to a single NorthStar, the Base would need to be equipped with a Yagi antenna pointed at the NorthStar. NorthStar Radio A would be equipped with a Yagi Antenna pointed at the Base, while NorthStar Radio B would be equipped with an Omni Antenna to broadcast to multiple Rovers.



An example of a single NorthStar network (only one Rover shown).

It is possible to add multiple NorthStars in sequence for a long baseline connection to an RTK Rover. To add an additional NorthStar to the network mentioned above, Radio A would be configured to channel 5 to interface with the original NorthStar, while Radio B could be configured to channel 2 to interface with the Rovers. Rovers interfacing to the new NorthStar would be configured to channel 2.

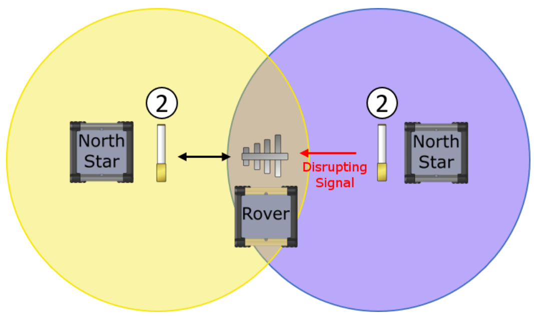


An example of a chained NorthStar network.

For best performance, connect Rovers to the Base as directly as possible. Each NorthStar in series adds ½ second of delay in the corrections. Baseline length can also degrade the RTK results resulting in an additional +/- 1mm error per kilometer of baseline. Multiple-Base-Multiple-Rover setups are the best way to collect the most accurate results possible.

Bases cannot be configured on the same network; separate channels are required.

Bases or NorthStar Radio Bs cannot transmit on the same channel, when they are within communication distance of one another. **This means up to seven kilometers (4.3 miles) line of sight.** Rovers should be configured to receive from the Base closest to them, within line of sight. The maximum number of units linked to one Base or NorthStar is 28.



Avoid overlapping base coverage boundaries.

When setting up a large RTK network, draw a radio network map. Examples of such a map can be found in Appendix E.

Configuring the Cell Modem

If a cell modem is installed, it requires a micro-SIM from a local carrier to operate. Cell Tunnel and XBD tasks require a Data plan. SMS is currently only functional for North American phone numbers.

The cell modem also requires setting the APN (Access Point Name) specific to the plan procured from the local cell carrier. This can be set with

$cellsetAPN APN

For example, data plans for the Canadian provider Bell would use the following:

$cellsetAPN pda.bell.ca

The device must be reset after updating the APN. Make sure to enable/disable SMS or Data features on the Resolute, depending on the plan and application.

$smsSetEnabled T

$xbdSetEnabled T

$tunnelSetEnabled T

The remainder of cell configuration is covered below in the IP Tunnel Configuration and SBD, SMS & XBD Configuration sections.

IP Tunnel Configuration

Note: The IP Tunnel task is incompatible with the Ethernet system; enabling the Tunnel while Ethernet is already enabled will disable Ethernet.

Data transfer is accomplished with the embedded telemetry (Cell Tunnel or Iridium RUDICS) over what will be referred to here as an **IP Tunnel**. The tunnel grants access to the embedded servers on the Resolute, and manages the connection to the XeosOnline server.

Tunnel timer settings (duration and interval) are used to moderate the connection amount. Setting appropriate values for each to acquire consistent data depends upon:

- The cost limitations for the user (Iridium RUDICS is billed by the minute, for example)
- The sustainable power draw
- The data amount being collected (size and quantity of files on the SD card)

Tunnel timers operate the same as all other tasks, with *enabled*, *duration*, *interval* and *offset*. Adjusting these values is discussed in the schedule section.

Most Resolutes may use the Iridium DOD/DISA gateway to operate both SBD and RUDICS service. However, this may not always be the case. If using the Iridium Commercial gateway, the user **must** configure into the Resolute the RUDICS dial number (DNIS) of the installed (and activated) Iridium SIM's **RUDICS GROUP**. This is a separate value from an individual SIM's number (MSISDN). If the incorrect number is set, SBD will still function, but RUDICS will not.

The Resolute must also be explicitly set to use this number when making calls using the IP tunnel. The DOD number always remains the same and therefore never needs to be set.

$irdSetDod F	**T** Enables Iridium DISA/DOD Gateway (default) **F** Disables DISA gateway to use Commercial Gateway
$iridiumSetCommercialNumber 00898811112222	If DOD is set to **False**, set the Iridium RUDICS dial number (DNIS) of the installed SIM to allow RUDICS operation

The Resolute is configured to determine which modem should be prioritized for connections to the tunnel. The priority list can be changed with **$TunnelSetModem**

$TunnelSetModem priority modem

Priority is limited from 0 to 3, with 0 as the highest priority.

Modem values represent various telemetry options. Any slots in the priority list that are not used are simply shown as **Unconfigured.**

Modem Value	Modem
0	Reserved
1	Reserved
2	Cellular
3	Iridium

To prioritize the cellular modem **before** the Iridium modem the following commands would be entered:

$TunnelSetModem 0 2
$TunnelSetModem 1 3

Working Example:
A Resolute records data continuously and requires **one hour** of Tunnel time to transmit the collected data **daily**. The operators of this station need data to start downloading at **12 PM UTC**. Users will use Iridium on the Commerical Gateway for the tunnel interface. The following commands would be sent to the unit:

$irdSetDod F
$iridiumSetCommercialNumber 00898811112222
$TunnelSetEnabled T
$TunnelSetDuration 1h
$TunnelSetInterval 24h
$TunnelSetOffset 12h

Using IP Tunnel

The IP Tunnel (Iridium RUDICS or Cell) can open sockets to both the HTTP and Telnet servers on the device. Only one socket per server can be connected. Scripts that are used for downloading data use the HTTP socket and must be disabled by Xeos to allow other use of the HTTP socket.

Contact Xeos for more information about connecting to the embedded servers over the tunnel; the accessing IP must be cleared to access devices when working through XeosOnline.

Automatic File Retrieval (Auto-Downloader)

To retrieve files from the embedded HTTP server on a consistent basis, a script can be run to download all new files on the unit either through the Tunnel to the Xeos Server or over the local Ethernet connection to the device operating the script. **This is especially recommended for retrieving files over Iridium**.

The script will automatically start downloading files for the duration of the connection. This script acts as the one HTTP socket connection. Xeos must enable and disable the script at this time when operating over the Tunnel. Contact Xeos for further details.

SBD, SMS & XBD Configuration

If equipped with Iridium and/or cellular modems, it is possible to use **SBD** (Short Burst Data, Iridium), **XBD** (Xeos Burst Data, Cell) or **SMS** (Short Message Service, Cell) to receive periodic Status of Health (SOH) information, and/or send commands to configure the Resolute.

Commands sent to the Resolute via any of these telemetry options are not received by the Resolute until the scheduled task is run. In the case of Iridium, commands waiting in the queue are held by the Iridium Gateway for five days before being deleted. Cell telemetry can hold commands in their queues for significantly longer such as several months. Commands that are not prepended with the correct unlock code are ignored.

SBD, XBD and SMS can be configured individually using the *interval* and *offset* timer commands; **SBD and XBD durations are locked at 3 minutes.** The commands to configure the timers operate on the same principles outlined in the schedule section.

SBD, XBD and SMS-capable units will send a power-up message several minutes after the unit is powered or reset to confirm operation at deployment and to notify users of remote stations of unexpected power loss.

SBD, XBD and SMS cannot occur simultaneously to their respective tunnels; if scheduled to run during a tunnel session, a flag is set and the respective task will occur at the conclusion of the tunnel.

Ethernet Configuration

Specific IP and other settings of the Resolute's ethernet interface can be modified.

Note: The Resolute **MUST** be reset in order for any changes to Ethernet settings (including enabling) to take effect. Power cycling or the $resetnow command can be used to achieve this.

Command	Description	Example
$ethernetSetEnabled	Enables/disables the ethernet peripheral	$ethernetSetEnabled y
$ethernetSetIP	Sets the ethernet IP address	$ethernetSetIP 192 1 168 2
$ethernetSetNetMask	Sets the ethernet netmask	$ethernetSetNetMask 255 255 255 0
$ethernetSetMac	Sets the mac address	$ethernetSetMac F1 3A 83 3C 6F BF
$ethernetGetGateway*	Returns the gateway IP of the Resolute	$ethernetGetGateway
All values relating to ethernet IP and MAC settings are **space delimited**.		
* The gateway address is set according to the IP address automatically and cannot be set manually.		

Note: The Ethernet task is incompatible with the IP Tunnel Task; enabling the Ethernet while Tunnel is already enabled will disable the Tunnel.

Ethernet Latency Configuration

In situations where the Ethernet port of the Resolute is connected to high latency telemetry (BGAN, Some Ethernet Radios, etc), a higher data rate may be achieved by implementing

$IPSetHighLatency T

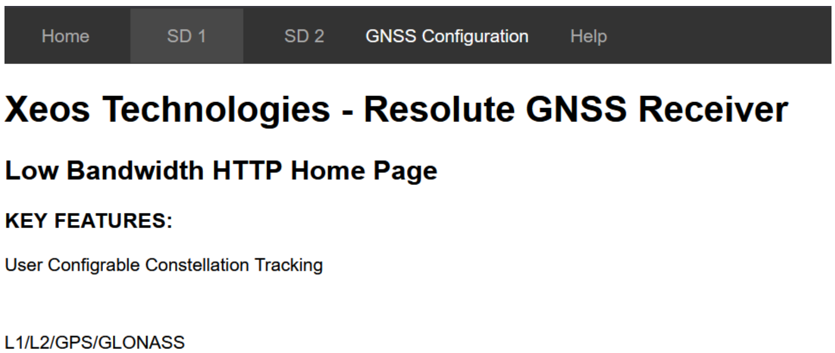
This setting allows more packets to be sent without ACKs when transferring data.

Note: Enabling this setting on a low latency connection will result in slower performance.

Accessing the HTTP Server

Over Ethernet, the HTTP server can be accessed on port 80 by typing the IP of the Resolute into a connected computer using any standard web browser while the Resolute is on the network.

Operating the HTTP Client



Navigation can be done via the top menu. Wait for the pages to load fully (spinning wheel disappears) before loading another page or starting another operation.

Manual File Retrieval via Ethernet

Files from mounted cards can be downloaded after navigating to the appropriate SD card. Choose the files to download, one at a time, and wait for the downloads to finish before clicking on the next file. Downloads cannot be queued by clicking multiple files and will cause the tunnel disconnect. Do not cancel a partial download as this function is not built into the Resolute**.**

GNSS Configuration via Ethernet

Changing signals and GNSS message types can be done through this page in the same vein as the method used via XeosOnline using **GNSS CONFIGURATION > SIGNAL TRACKING** and **GNSS CONFIGURATION > MESSAGE TYPES**, respectively. Click on the check boxes corresponding to the blocks to record under the streams to record and click **Save** to send the new configuration to the unit.

Resolute Telnet Server via Ethernet

Over Ethernet, the Telnet server can be accessed on port 23 using the set IP on freely available programs such as PuTTy. The telnet server acts identically to the regular diagnostic port of the Resolute, accepting any command. Once connected, diagnostic output needs to be enabled to read responses to commands:

$telnetSetDiagnostics T

To close the connection, close the telnet client. Otherwise, the connection will time out after 3 minutes.

Switch Power Configuration

The Resolute has two switched power pins to power external devices. Voltage output from these switches is (Input voltage – 0.7V) with a maximum current draw of 1.8A per switch. These pins can be configured on either a non-scheduled basis, or via the scheduler. Both power switches are located on the 14-pin connector:

Switch Number	Pin
1	H
2	M

Scheduled Switched Power

To enable the switch power via the scheduler, send the command

$Pwr#Setenabled [T/F]

With the appropriate switch number.

Once scheduled switching has been enabled, the usual settings associated with other scheduled tasks can be adjusted:

$Pwr#Setduration *[time]*
$Pwr#Setinterval *[time]*
$Pwr#Setoffset *[time]*

To leave the switch always on, even after restarts, set the duration to 0:

$Pwr#Setduration 0

One-Time Switching

To enable the switch on a one-time basis without scheduling, the command

$pwrsetswitch [1/2] [T/F]

enables the switch until the switch is turned off, or the device's power is reset.

SDI-12 Master Interface

As of build 12923, the Resolute can act as the requester (Master) of data over the SDI-12 port for other sensors on a scheduled basis. Data acquired during this task is integrated into SBF files under the ASCII-In Data Block. This data format is compatible with SBFConverter for conversion back to ASCII. This task is locked to a duration of 60 seconds.

Since data blocks fall under the GNSS task, **data is only saved to SBF blocks when the GNSS task is running**.

There are several requirements to implement the collection of SDI-12 Sensor data:

- As always, the feature must be enabled

$SDI12MasterSetEnabled T

- The ASCII-In Data Block must be enabled in the GNSS Message Types settings. This data block is only present in File/Streams 3 or 4. Configuration is easiest to implement when utilizing the interface on XeosOnline but can also be done through serial commands.
- The typical scheduling criteria as with other scheduled tasks are used to set up the task (ex. **$SDI12MasterSetInterval value**).

Additional criteria can be given to augment the operation of this task.

- The Resolute can be used to power the external device during the SDI-12 Master task via the one of the two available pins of the Switched Power Output.

$SDI12SetPowerControlEnabled value

Value	Power Switch
0	None
1	1 (Pin H)
2	2 (Pin M)

- Some instruments will require time to boot before useful information can be requested. Setting a power-up delay in the Resolute will allow the switched power to run for a set time before the command string is sent. This value is in milliseconds.

$SDI12SetPowerUpDelay value

- The SDI-12 task has a default command string (**0R0!**) that will make the request through addresses 1 – 9, recording the results that arrive. This can be overridden by first enabling the override, and inputting the string to be used in place of the default value.

SDI12SetExtSenCmdEnabled T
$SDI12SetExtSenCmdString string

ASCII External Sensor Interface

The Resolute is equipped via the Serial 2 port to acquire, on a scheduled basis, external sensor data. Data acquired during this task is integrated into SBF files under the ASCII-In Data Block. This data format is compatible with SBFConverter for conversion back to ASCII.

Since data blocks fall under the GNSS task, **data is only saved to SBF blocks when the GNSS task is running**.

There are several requirements to implement the collection of ASCII External Sensor (AES) data:

- As always, the feature must be enabled

$AESSetEnabled T

- The ASCII-In Data Block must be enabled in the GNSS Message Types settings. This data block is only present in File/Streams 3 or 4. Configuration is easiest to implement when utilizing the interface on XeosOnline but can also be done through serial commands.
- The Serial 2 port must be enabled, along with the correct port settings to match the external device connected.
- The AES task must be configured with the correct outgoing command from the Resolute to the external device such that an appropriate response will be received.

$AESSetCommandString string

- The typical scheduling criteria as with other scheduled tasks are used to set up the task (ex. **$AESSetInterval value**)

Additional criteria can be given to augment the operation of this task.

- The Resolute can be used to power the external device during the AES task via the one of the two available pins of the Switched Power Output.

$ AESSetPowerControlEnabled value

Value	Power Switch
0	None
1	1 (Pin H)
2	2 (Pin M)

- Some instruments will require time to boot before useful information can be requested. Setting a power-up delay in the Resolute will allow the switched power to run for a set time before the command string is sent. This value is in milliseconds.

$AESSetPowerUpDelay value

Serial 2 Data Relay

The Resolute can act as a serial data relay, by which external devices can transmit and receive data via Iridium SBD or Cell XBD.

This feature is not scheduled; data that is transmitted to the Resolute from an external device is received immediately. The diagnostic port prints the amount of data in bytes that it has received. Data received is then transmitted.

Receiving data through the Resolute is tied to the telemetered task (Iridium SBD or Cell XBD). Once received, data is passed to the external device according to the port settings.

The data contained in the payload is not saved to the SD cards.

There are several requirements to implement the use of the Serial 2 Port:

- As always, the feature must be enabled

$serial2SetEnabled T

- The correct port settings to match the external device connected.

$Serial2SetBaud value

- The Serial 2 port by default utilizes RS-232; RS-485 can also be utilized.

$Serial2SetPortMode value

- The CTS/RTS Flow control can be enabled if necessary for the external device.

$serial2SetFlow T

- In addition, Full or Half-Duplex can be specified for RS-485.

$serial2SetCommsMode value

Data transmitted through the Serial 2 Port to the Resolute must be pre-pended with a **start byte** (0xFC) and a two-byte **size** value in **little endian**. This value specifies the size of the **payload**, not including the header itself.

For a message with a payload of 1750 bytes (size 0x06 D6), the format would be as follows:

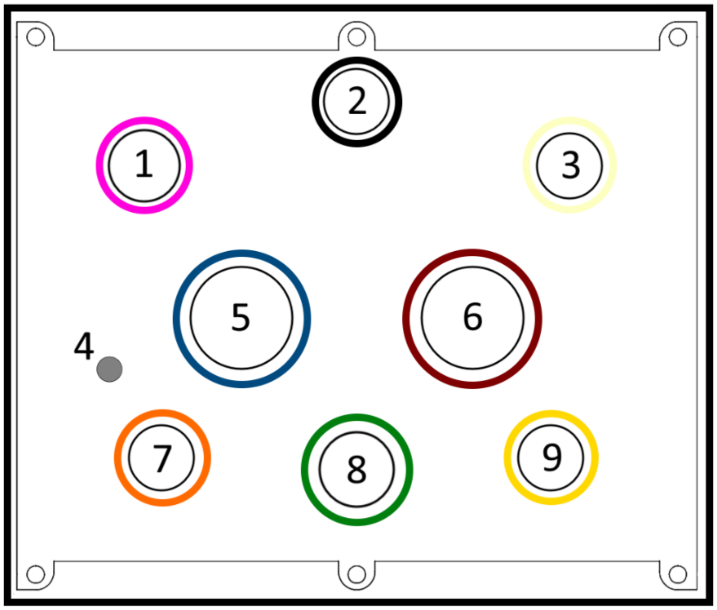
`FC` `D6 06` `PAYLOAD`

- If the size value is **less** than the actual payload sent, the transmitted message will be truncated.
- If the size value is **greater** than the payload sent, the Resolute will wait until **all bytes expected are received**.

Sending Data Relay information to a Resolute can be done on XeosOnline via the **Menu > Send Data Relay** option. XeosOnline adds the header information automatically. Size limits for modems will prevent large data payloads from being sent.

Device Preparation

Physical Interfaces



When a Resolute is ordered, each cable ordered alongside it will come with a colored indicator, where possible, on each end to assist in cable hookup.

No.	Name	Function(s)
1	USB-Mini	Provides access for configuration of device for deployment via PC. **Note:** USB COM Port does not mount when Resolute is unpowered or reset.
2	Test Button	Used as a check on the currently running tasks, turning appropriate LEDs on. Hold the button to reset the device.
3	Radio TNC	Connection to 900 MHz Radio antenna
4	2 BA Ground Stud	Grounding connection for lightning and surge protection
5	Serial/SDI-12/SW LOAD (14-Pin Female)	RS-232 Diagnostic output (Serial 1) Connection to peripheral device via Serial 2 or SDI-12 Switched power for peripheral device
6	Power/ENET/CBUS (10-Pin Female)	Power Input Ethernet Interface CBUS
7	Iridium TNC	Connection to Iridium antenna
8	GNSS Type N	Connection to GNSS antenna
9	Cellular TNC	Connection to Cellular antenna

The front panel of the Resolute has up to seven connectors, depending on the installed telemetry, to connect to various antennas.

Pinouts for the main connectors are at the bottom of this document.

Installing Power

The power leads on the 10-Pin connector **(A and B)** are connected to the **red** (+) and **black** (-) flying leads on the supplied cable, respectively.

The Resolute requires a DC power supply of **11V (minimum) to 28V (maximum),** with a supply capable of sourcing **3A surge currents at 12V** if equipped with Cellular or Iridium telemetry. This can be reduced to **one amp** if no Iridium or Cellular modem is present. Appendix G outlines average power consumption requirements for various configurations of the Resolute.

The majority of Resolutes in the field will be powered by battery and solar panel. It is recommended to utilize a charge controller for a battery equipped with a low voltage disconnect to increase the lifespan of the station battery.

It is also important to ground the Resolute for lightning and surge protection. The ground stud is located to the left of the serial connector and is pictured below. The thread of the grounding stud is **2 BA**

2 BA Threaded Ground Stud

Removable Door: SD Card Access and SIM Installation

The Resolute has a removable door on its right (labelled) that allows access to the SD cards (shipped with the Resolute) and SIM slots for optional Cell and/or Iridium Telemetry.

To prevent corruption of SD card data due to removal, the Resolute will unmount the SD cards when the removal of the door is detected. LEDs will illuminate on the Resolute as though the **TEST** button were pressed when the door is opened.

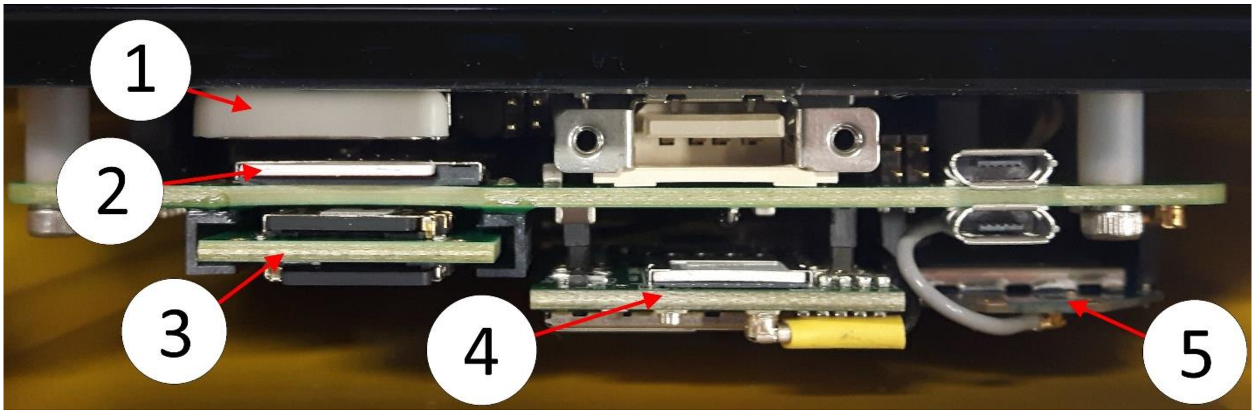
Ensure the SD Card LED is RED to confirm the memory cards have been unmounted before removal. No data will be written while the door is removed, but tasks will still run on their schedules.

To resume recording after accessing the SD cards, return the cartridge with the cards to its holder and close the door.

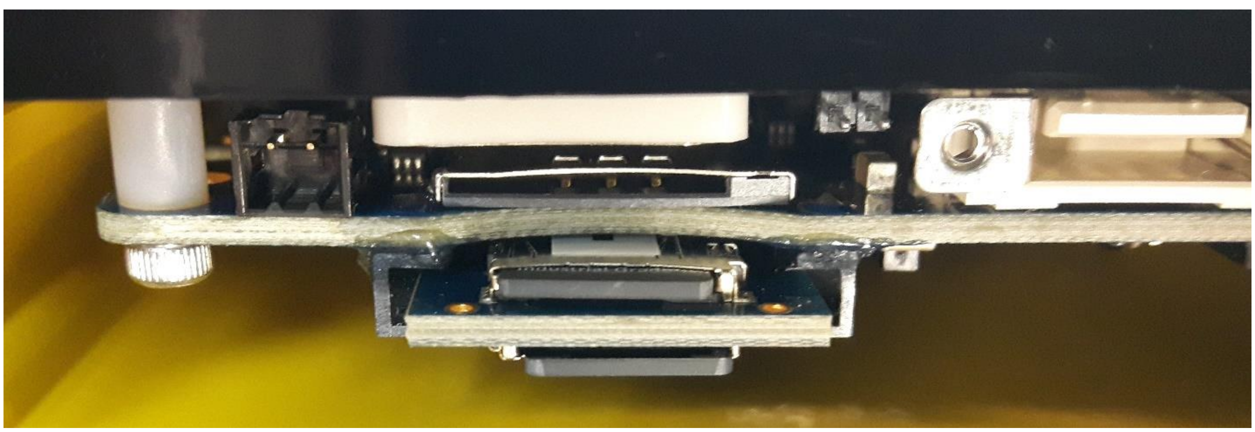
Check that the SD LED is GREEN (or YELLOW if using a single SD Card) to ensure both cards were mounted properly. Screw in the fasteners to ensure the door is retained by the enclosure.

A 3/32 inch hex driver can be used to open the door. Four captive screws will remain attached to the door itself.

The image below shows the various components of the Resolute that can be viewed when the door is open. Not all components may be present based on loadout.



No.	Name	Function
1	Clock Battery	Used to maintain the internal clock of the Resolute
2	Iridium SIM Holder	SIM Card mandatory for use with Iridium is inserted here
3	SD Card Holder	PCB holding both the MicroSD cards is stored here
4	Cell Micro SIM	Module for holding a cellular Micro SIM card is installed here
5	Radio	Radio module is mounted at this point (if applicable)



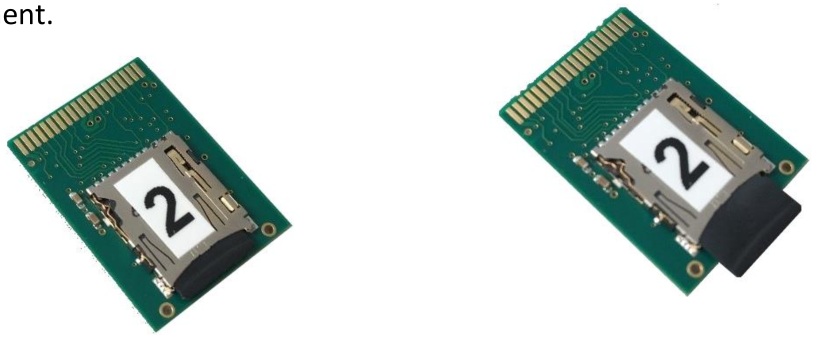
Retrieving SD Cards

The SD cartridge fully mounted on the PCB chassis.

The two SD cards are of the microSD form factor and are mounted on either side a single removable cartridge. The SD cartridge can be removed by hand by pulling in the direction of the opening of the enclosure. The SD cartridge itself is symmetrical and labelled so as to not swap card placement.

- SD 1 facing **UP** records GNSS SBF data.

- SD 2 facing **DOWN** serves as a backup to overflow to when turning off memory management.



SD 2 Mounted on Left, Push Ejected on Right

The SD holders are push-type. Pushing the SD card further into the holder until a click is heard will allow removal of the card. Push again until a click is heard to mount.

If the SD cards are placed in the incorrect SD holders or the holder itself is inserted upside down, the data will become mixed (diagnostic and GNSS data on the same card). This has no effect on the performance of the unit but may cause GNSS data to be removed from the card sooner than desired; read about the memory management later in this section for more information.

It is recommended to only use SLC industrial rated microSD cards. For firmware builds equal to or greater than 4641, any capacity microSD is compatible. If using an earlier firmware version, there is a storage capacity requirement of 4GB.

Installing the Iridium SIM

If the Resolute comes equipped with an Iridium modem, it requires an Iridium SIM to operate. Iridium SIMs can be purchased through Xeos, an Iridium Value Added Reseller.

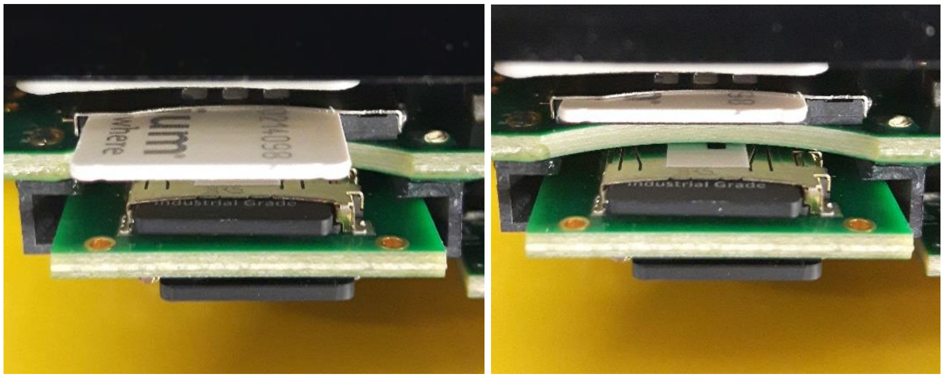
If only using SBD, a register-only SIM is required. Register-only is an Iridium SIM plan which does not require a paid SIM subscription, but allows a modem to register with the network.

If using RUDICS, the SIM will need to be activated on a paid Iridium Telephony plan.

Before inserting or removing the Iridium SIM, verify no power applied to the unit. To access the Iridium SIM slot, open the SD card door of the Resolute. The Iridium SIM slot is immediately above the SD Cards.

The contact plates of the SIM card must face the SD cards. Insert the SIM by pushing the SIM in place until a click is heard. A fully installed SIM is flush with the SIM holder.

Tip: It may be easier to insert or remove the SIM if the SD cartridge is removed first.



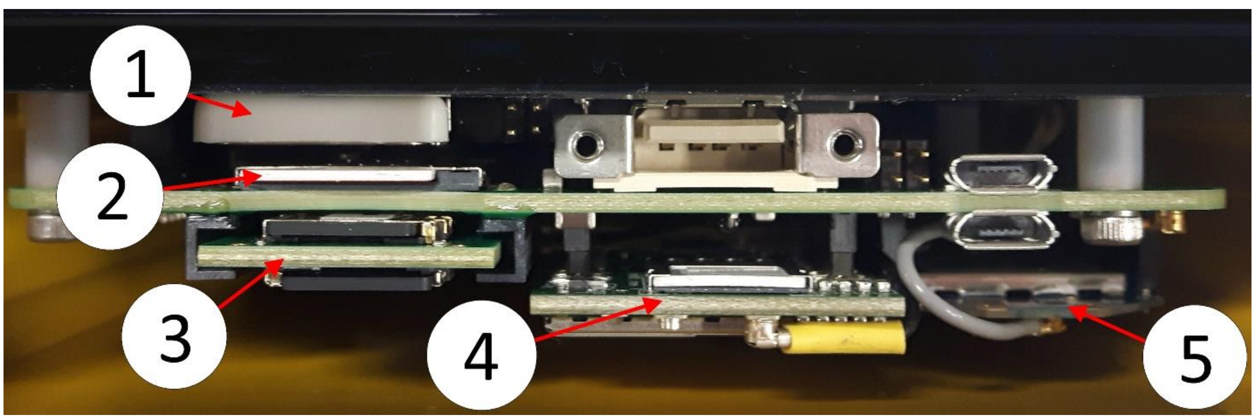
Iridium SIM Ejected (Correct Orientation) on Left, Seated on Right

Installing the Cell micro-SIM

If the Resolute is equipped with a cell modem, it requires a cellular micro-SIM to operate. Cell SIMs can be purchased from a local cellular carrier.

The default modem standard of the Resolute is GSM. If a CDMA carrier is to be utilized, this must be specified at time of purchase.

The Resolute also requires an **APN** (Access Point Name) to be configured to connect to the SIM's network. See the Configuring the Cell Modem Section for more information.



Cell SIM Inserted on Cell modem (4)

Test Button

The TEST button can run different tasks based on variable length button presses. Additional confirmation feedback to these button presses is provided by the response of the LEDs.

Press Length	Unit Response	LED indication
~1s - 3s	LEDs On	All Active Task LEDs **ON**
3s - 10s	Software Reset	All Flashing **YELLOW**
10s - 20s	RTK Base – Base Position Reset & Software Reset Other Models - Software Reset	GNSS Flashing **BLUE**
20s +	Cancel Above Responses	LEDs turn **OFF**

To turn on the lights, press the test button (roughly one second press). This will light up the LEDs for 15 minutes. LEDs can be used to confirm the unit's systems are working.

Only the LEDs that represent in-progress tasks will illuminate and change color as tasks start, complete and shut down.

LED Behavior

LEDs on the Resolute are designed to assist in confirming correct operation. LEDs are automatically on after power up for 15 minutes to assist with installation. LEDs can be reactivated with a push of the TEST button.

A software reset, or power-on of a Resolute, prompts all LEDs to flash **GREEN** for several seconds.

If a task LED is not on, that particular task is not scheduled to run at this time and may not be configured to run at any time. The **$schedule** command over a local connection can be used to ensure the expected task is enabled, and when it is scheduled to run.

Power LED	
Behaviour	Meaning
Red	Reverse voltage applied
Green	Unit is powered
No LED	Unit is not powered

SD LED	
Behaviour	Meaning
Red	SD Cards unmounted. **Safe to remove**
Solid Yellow	One SD card mounted. **Not** safe to remove
Flashing Yellow	One SD card mounted, Resolute is writing to card. **Not** safe to remove
Solid Green	Two SD cards mounted. **Not** safe to remove
Flashing Green	Two SD cards mounted, Resolute is writing to card(s). **Not** safe to remove

GNSS LED	
Behaviour	Meaning
Red	GNSS receiver on, no valid positions received in last 30s, < 4 SV tracked
Yellow	Last position received is valid (non RTK), Tracking at least 4 satellites
Blue	Last position received RTK Float
Green	Last position received RTK Fixed

Iridium LED	
Behaviour	Meaning
Red	An Iridium Modem task (SBD, Tunnel) is on
Solid Green	RUDICS Tunnel confirmed connected to XeosOnline
Flashing Green	SBD successfully sent to gateway

Cellular LED	
Behaviour	Meaning
Red	A Cellular Modem task (SMS, XBD, Tunnel) is on
Green	Cell is registered to Network

Radio LED	
Behaviour	Meaning
Red	A Radio task is on
Yellow	Sending correction (RTK Base), receiving correction (RTK Rover)
Green	A Rover is registered (RTK Base), registered to Base (RTK Rover)

Ethernet LED	
Behaviour	Meaning
Red	Ethernet Enabled
No LED	Ethernet Disabled

Installing a Resolute

When installing a Resolute it is important to choose the installation site thoughtfully. It should be noted that there are differences when installing Rovers, Bases, and Reference receivers which will be highlighted in the following sub sections.

RTK Radio Network Design

Before leaving the office, if the unit includes a radio for broadcasting or receiving corrections, best practice is to determine the radio network for this device.

- Consider any already installed units to include or exclude in this network. See the example radio network drawings in the Appendix E in addition to the RTK Radio Network Design section for more information.
- It is easiest to configure the radios in the office before leaving, but configuration is possible to do in the field.
- Record the radio channel numbers of various units for future reference.
- The below installation order allows the installer to confirm corrections are being received at the Rovers before concluding install.
    - Base
    - NorthStars (if utilized)
    - Rovers

Installing the GNSS Antenna

The GNSS Antenna is the measuring point of the Resolute. Installing in the proper location will ensure increased performance.

The majority of GNSS satellites do not pass directly overhead, but travel closely to the horizon. Due to this, a GNSS antenna should ideally be installed with a 180 degree uninterrupted view of the sky. In less ideal locations, maximizing the volume of the sky in view is still paramount. Metallic objects and other reflective surfaces should not be in the immediate vicinity, and above buildings where possible.

An Iridium antenna can cause interference with the GNSS receiver so should be placed a minimum of 1 meter away from the GNSS antenna; 10 meters of distance is ideal.

For RTK Rovers and Reference stations, GNSS antenna should be mounted to the desired landmark to be measured. The antenna should be attached in such a way that if the landmark moves, the antenna will be moved by the same amount.

Keep in mind of the thermal expansion when mounting the antenna to the landmark, especially for fine deformation monitoring.

If an RTK Base is being installed, the antenna should be monumented to a piece of land that is not moving, bedrock for example would be a preferable medium. Any movement of the Base antenna will present itself as movement of the Rovers in the data.

GNSS Antenna Mount, Xeos PN A-03-058

See Appendix C for specific GNSS antenna mount installation instructions if you purchased an antenna and mount from Xeos.

Installing the Radio Antenna

If the unit is equipped and configured to send information over radio, installing a radio antenna is necessary. The radio antennas come in two flavors, Yagi and Omni antennas.

Yagi antennas are directional antennas and are best used when communicating with only one other radio.

Omni antennas are omni-directional antennas and are best used when a radio must communicate with multiple devices.

Both Yagi and Omni radio antennas work on a **line-of-sight** basis, with a range up to seven kilometers (4.3 miles) in ideal conditions. Mounting a radio antenna higher in general will allow the radio antenna to transmit over more obstacles. If line of sight is not possible between radios, NorthStars are perfect for relaying corrections over or around obstacles and are not themselves inhibited by the GNSS antenna mounting requirements.

Rovers equipped with radios only need Yagi antennas. Install the Yagi on a pole, or other high point in a horizontal orientation, and point the Yagi to the nearest source of corrections. Poles are advantageous for mounting as they allow 360 degrees of orientation. The smallest element of the antenna is the **front** of the antenna when orientating. The antenna comes equipped with mounting hardware.

Bases can be equipped with Yagi or Omni antennas depending if they are broadcasting to a single endpoint, or multiple end points. If installing a Yagi, point the Yagi to the desired endpoint for the corrections. If installing an Omni, mount in a vertical orientation, on a mast or other high point. The antenna comes equipped with mounting hardware.

Installing the Cell Antenna

If using a unit equipped with a cellular modem, install the cellular whip antenna in a vertical orientation. While a cell antenna does not have the additional stringent requirements of the other antennas, a cell antenna should not be contained in a metal box.

Installing the Iridium Antenna

If using a unit equipped with an Iridium modem, the Iridium antenna is **required**. This antenna should be installed with as clear a view of the entire sky as possible, like a GNSS antenna.

Iridium satellites travel closer to the horizon than overhead. The larger the continuous volume of the sky the antenna can see, the better.

The Iridium antenna can cause interference with the GNSS receiver so should be placed a minimum of 1 meter away from the GNSS antenna; 10 meters of distance is ideal.

Installing RF Cables

Connecting the RF cables to the antennas involves transitioning the cables through a weather protective enclosure for the Resolute and the power system. This can be done, depending on the environment, through a downspout on the enclosure, or through polyphasers in the wall of the enclosure (not supplied).

If using polyphasers, the polyphaser in line with the GNSS antenna must allow +15V DC Pass-through, as the GNSS antenna is active. RF cables supplied by Xeos are marked with a part number and color code. The color code matches the ring around the connector on the panel to allow for easy tracing of cables. For an example assembly diagram of RF cable configurations see Appendix D.

Setting the Base Position (Base Stations Only)

Setting the Base position tells the unit that the Base is configured in its final location. **This MUST be done for all RTK Base units** and should be done after installing the GNSS antenna at the base site and powering the unit.

To automatically find the Base, press and hold the **TEST** button for 10 seconds until the GNSS LED starts to flashes **BLUE**. Release the button and the unit will reset along with wiping the previously stored base position.

The GNSS modem's first task will be to calculate a new Base position that will be stored. This position will survive power resets. Automatically setting the Base position will allow the RTK Rovers attached to the Base to make relative measurements, derived from this position.

Confirming Device Operation

A summary of these behaviours with their LED colors is here.

Power to the Resolute

After plugging in the power connector, the unit will flash all of its LEDs green, with the Power LED remaining green. If red, reverse the voltage supplied to the unit.

SD Cards Mounted

Shortly after start up the processor will attempt to mount the SD cards, at which time the LED will change from Red to Green, or to Yellow if only one card is installed. If the LED is red or unexpectedly yellow, check that the cartridge and SDs are correctly mounted, or check that the door is closed with its magnet still installed.

GNSS Receiver Operation

Shortly after start-up, the GNSS receiver will power on and restore its configured settings. The GNSS LED will initially be red after configuring the GNSS receiver. The receiver will begin tracking satellites when the first valid position fix comes in (i.e. tracking 4 satellite or more) and the LED will turn yellow.

RTK Radio Operation (Base)

Shortly after start-up, the GNSS modem will power on and configure. The GNSS LED will initially be red. If it does not have a Base position stored, the GNSS receiver will use the first valid position it receives as the base position.

If this is the first time the unit has been at this location, resetting the Base is advised to ensure the Base position is correct. **Do not rely on the unit not having a Base position.**

After getting a Base position the GNSS will reset and start up. When the GNSS receiver gets valid positions to generate corrections the GNSS LED will go change to yellow. The Base GNSS LED stays yellow during normal operation.

After the GNSS LED turns yellow, the Radio LED will change to yellow to indicate the corrections are being sent over the radio. If a Rover is active in the field and configured correctly, the radio LED will turn green.

RTK Radio Operation (Rover)

Shortly after start-up, the radio will power on red, taking ~90 seconds to configure. Once configured, if the antenna is correctly pointed to a corrections source, the radio LED will turn yellow.

60 to 90 seconds after the radio LED changes to yellow, the radio confirms registration with the Base, at which point the radio LED be green, confirming two-way communication with the Base or NorthStar.

60 to 90 seconds after start-up the GNSS receiver will power on and configure. The GNSS LED will initially be red after configuring the GNSS receiver. The receiver will begin tracking satellites when the first valid position fix comes in (i.e. tracking 4 satellite or more) and the LED will turn yellow.

If the radio is receiving good quality corrections and the receiver has received the ephemeris (<5 minutes), the radio will attempt to fix ambiguities and enter float RTK mode. If the receiver enters float RTK mode, the GNSS LED will turn blue. Following this, if the GNSS antenna is well placed the ambiguities will usually fix in under 5 minutes. This results in the GNSS going green and optimal performance.

Cell Operation

If equipped with a Cell modem, there are multiple configuration options; start-up behavior will send an XBD or SMS, depending on which is configured.

After successfully sending an XBD/SMS, the Cell LED will flash green for 10 seconds to indicate the message has been sent.

To test the cell tunnel, wait for the tunnel to start or change the tunnel schedule to a time closer to the present. The Resolute will attempt to connect to XeosOnline. If the connection is successful, the Cell LED will be solid green.

Note: Testing SMS only confirms the SMS portion of the connection. The data portion of the connection, if being used should be tested either with XBD or the tunnel.

Iridium Operation

If the Resolute is equipped with Iridium, it will send an SBD message shortly after start-up. After successfully sending this SBD, the Iridium LED will flash green for 10 seconds, indicating the message been successfully sent.

To confirm RUDICS Tunnel operation, schedule the tunnel to start at the time desired. The modem will dial up a RUDICS connection at this time. If the unit is able to connect to XeosOnline via RUDICS, the Iridium LED will be solid green. Any time the Iridium modem is powered on but has not yet successfully connected the tunnel or sent an SBD the Iridium LED will be Red.

XeosOnline

XeosOnline can be used to view the state of the units' Tunnel Connection, Status of Health and for easily sending and receiving SBD/XBD messages. A comprehensive breakdown of its features can be found in its manual.

Sending XBDs and SBDs Using XeosOnline

⚠ **Each unit has a default method of sending messages. When both Iridium and Cell modems are present, Iridium is the default. Contact support to change this setting.**

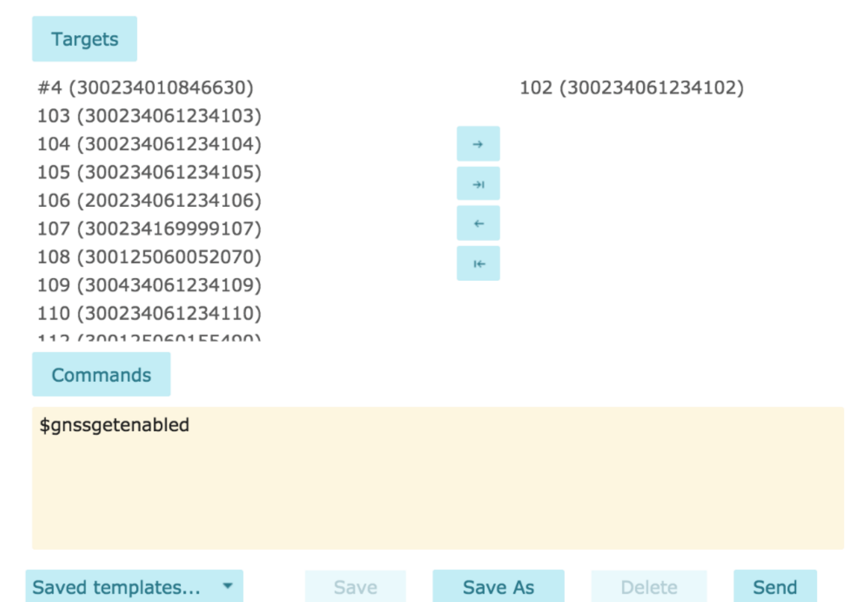
Not all commands are responded to over the air by the Resolute, such as **$schedule**. Commands that set values are responded to. Any command that responds in a multiline list will not reply. Outgoing commands can be viewed in the **Messages** tab on XeosOnline.

Remember to adhere to two rules for commands:

- Include the **$** ahead of each command.
- Enter each command on a separate line.

The **Send Command** dialog is the interface used to send messages to any number of devices within an organization.

1. Users can send Iridium SBD (Short Burst Data) or Cell XBD (Xeos Burst Data) messages to any device within the scope of their organization by going to **Menu** → **Send Command**
2. The **Send Commands** dialog will appear
3. Click the device(s) to receive the command(s) and click **->** or drag all devices from the left column into the right column.
   - Click **->|** to add **all** devices
   - Devices can be moved back to the left column with opposite action buttons or dragging.



4. Commands can be typed into the **Commands** box.

Note: The Resolute requires an **Unlock Code** before each group of commands. XeosOnline saves this unique code for each device if it has been received by the site previously, and adds it ahead of any outgoing commands.

If the outgoing command is prefixed with **$Unlock 0** in the message log, XeosOnline does not have this device's unlock code. The intended command **will be ignored by the device**; the device will instead reply with the correct code on the next Iridium/XBD check, provided XeosOnline is set to receive the device's messages.

5. Target Lists and/or Commands can be saved as templates for later use. Saved templates can be loaded from the **Saved templates** list.
6. Once the Target List and Commands are ready, click **Send**.
   - Outgoing messages are logged in the Message Log tab.
   - Sending a command will give a notification of success or failure. If an Iridium device is not active on the network, or if the message being sent is too long, the dialog box will indicate as such.
   - The target devices will process the command during their next Iridium/XBD task.
   - In the case of Iridium, commands waiting in the queue are held by the Iridium Gateway for five days before being deleted. Cell telemetry can hold commands in their queues for significantly longer such as several months. Commands that are not prepended with the correct unlock code are ignored.

Resolute Messages on XeosOnline

Excluding responses to commands, the Resolute transmits periodic messaging to display information regarding its own disposition. These messages will indicate which communication service was used to send them (SBD, XBD, or Tunnel).

Power-up

Several minutes after powering or reset, the Resolute will transmit a single message to indicate this event has occurred. This message has information that does not get transmitted with each additional message, such as the unlock code, IMEI and Iridium SIM number (ICCID).

```
Powerup: true, Timestamp: 2025-08-07T14:05:51.000Z, Serial: 546, Firmware Version: 4.1 - 12923, BatteryV: 13.7, Device Temperature (°C): 29, Ird Temp: 29, GNSS Temp: 31, Reset Reason(s): Software Reset, Pin, IMEI: 300125062020370, Sim Card #: 8988169234000214635, Unlock Code: 46776, Cell IMEI: 320187822024183
```

Status of Health

Each SBD, XBD or Tunnel task will output status of health (SOH) messages. While the periodic SBD or XBD tasks will transmit a single SOH per task, the tunnel connection will output an SOH every 15 seconds.

As of build 9299, position and altitude are also sent in SOH messages, provided one of these values has been updated since last transmission.

Data Source: IP Tunnel, Message Type: Resolute SOH, Timestamp: 2025-08-05T11:17:59.537Z, VersionMajor: 1, VersionMinor: 1, Firmware Build Number: 12923, Time: 2025-08-05T11:17:59.000Z, Device Temperature (°C): 33, Ird Temp: 33, GNSS Temp: 34, Supply Voltage: 12.36, VDD: 3.32, VMODEM: 3.94, V5V: .02, Disk 1: 0, Disk 2: -1, SVs: 12, IMEI: 300125062020370, Latitude: 44.714443272, Longitude: -63.604985831, Altitude: 24.1063, Disk 1 Percent Acc: 0.12069197, Disk 2 Percent Acc: -1.0

Values presented in order are displayed below.

Data Source	What telemetry generated the message (SBD, XBD or Tunnel)
Message Type	Status of Health
Timestamp	XeosOnline's time record of receiving this message
VersionMajor	Major version of firmware
VersionMinor	Minor version of firmware
Firmware Build Number	Specific build number of firmware
Time	Time the Resolute generated this message
Device Temperature	Internal board temperature (°C)
Ird Temp	Temperature of the Iridium modem (°C)
GNSS Temp	Temperature of the GNSS modem (°C)
Supply Voltage	Voltage input (V)
VDD	Voltage of the VDD controller rail
VMODEM	Voltage of the modem rail
V5V	Voltage of the 5V rail
Disk 1*	Coarse reading of consumed percentage of SD Card 1
Disk 2*	Coarse reading of consumed percentage of SD Card 2
SVs	GNSS Satellites in View
IMEI	Identifier of the currently used modem's IMEI (Iridium or Cell)
Latitude	Location of the Resolute in decimal degrees
Longitude	
Altitude	Altitude of GNSS reading in meters
Disk 1 Percent Acc*	Fine reading of consumed percentage of SD Card 1
Disk 2 Percent Acc*	Fine reading of consumed percentage of SD Card 2

* If an SD card value is -1, that card is not mounted to the Resolute; either it is not installed, the door is reading as open, or the voltage is low.

Upgrading Firmware

Firmware for the Resolute can be acquired as a package from the [Xeos Respository](#).

Connect to the Resolute with a USB or Serial cable and start STerm. Open a connection at 115200 baud.

Disable the GNSS functionality and the 900 MHz radio, if installed.

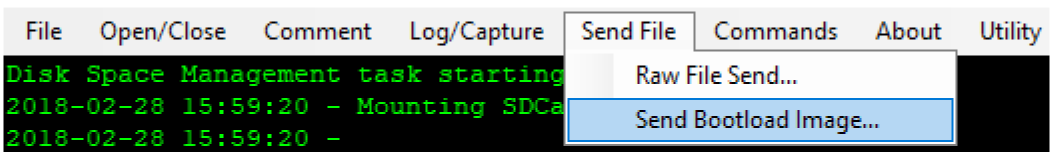
Send the following commands to turn off GNSS and Radio respectively:

$gnssSetEnabled F

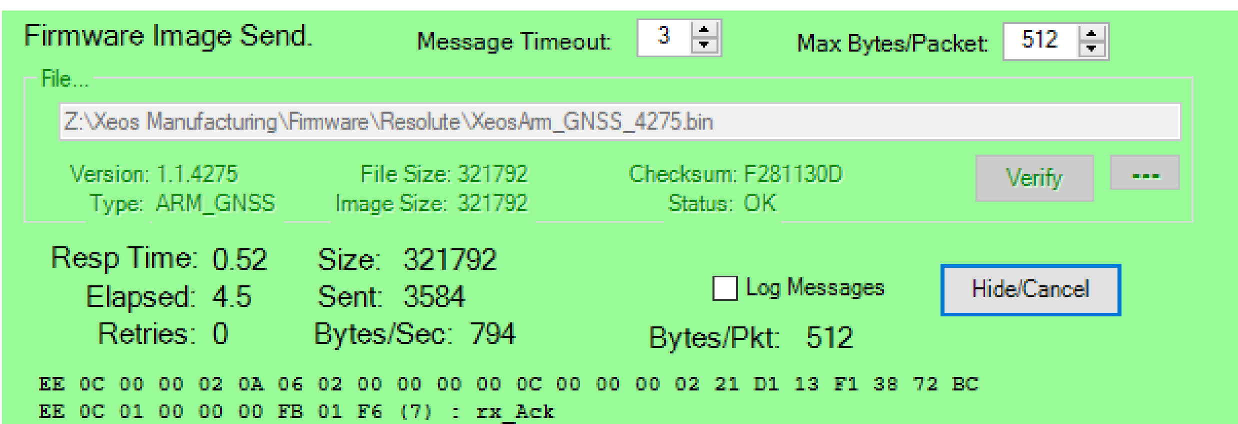
$radioSetEnabled F

```
2018-02-28 16:08:14 - GNSS On Interval Enabled: FALSE
2018-02-28 16:08:29 - Radio On Interval Enabled: FALSE
```

On the top menu bar, navigate to **Send File** and click on **Send Bootload Image**.



The **Firmware Image Send** window will open and you will need to select the new version of firmware by clicking the … and opening the .bin file. Once the **Sen***t* number matches the **Size** number, the upload is complete.



Reset the unit by sending the following command and wait for the unit to restart.

$resetnow

```
2018-02-28 16:19:02 - RESETTING - COMMANDED
2018-02-28 16:19:03 - Un-Mounting SDCard 1
2018-02-28 16:19:03 - Un-Mounting SDCard 2
```

Check the firmware version to confirm the installation was successful by entering the version command and comparing it to the number on the .bin file that was uploaded:

$ver

```
2018-02-28 16:20:34 - Ver: 1.1.4275  Boot: 1.1.4097
```

If the new version wasn't properly uploaded, resend the image.

To view all the firmware images on the Resolute, use the **$imglst 1** command.

```
2018-02-28 16:21:44 - Sctr Errs     DateTime      Size  Type   Version   Pri/Count
2018-02-28 16:21:44 -    2    0   1519833755    320512 x3000  1.01.04262  1/011
2018-02-28 16:21:44 -   81    0   1519834264    321792 x3000  1.01.04275  1/015
```

Delete the old firmware using **$imgdelete** command. In this example, firmware version 4275 was uploaded so 4262 must be the old firmware. Enter **$imgdelete** followed by the version number omitting the zeroes and replacing periods with a space:

$imgdelete 1 1 4262

Do not delete the current version of firmware.

Re-enable the GNSS functionality:

$gnssSetEnabled T

If a 900 MHz radio is installed (Resolute-PIN) re-enable the radio as well.

$radioSetEnabled T

Note: Units without 900 MHz radios installed can experience issues if the functionality is enabled. Do not enable the radio functionality if the hardware is not equipped.

If the Resolute is equipped with a cellular or Iridium tunnel, it is likely possible to update the firmware remotely. Contact Xeos for details.

Appendix A: Command Index

The below is not an exhaustive list of the entire command set installed in the Resolute; presented are the settings and commands most likely to be utilized.

Commands and arguments are **not** case-sensitive and are only given different cases for easier readability in this document. However, values being passed to other external peripherals (such as to an ASCII external sensor) could be, and should be noted when utilized.

Arguments below as <#> indicates a valid range of values.

Arguments below in [ARG] indicates separate, required arguments after the command.

Enable/disable commands use a **TRUE**/**FALSE** setup arguments in the form of **T** or **F**.

Time-based commands use a numerical value followed by an appropriate time measurement, but the Resolute will always return the value in **seconds**.

s	Seconds
m	Minutes
h	Hours
d	Days

For the most part, only **SET** commands are listed below. Note that any **SET** command has an equivalent **GET** version, that can be used, without arguments, to acquire the current state of a setting. Any **GET** commands that deviate from this scheme (ex. **$tunnelsetmodem vs $tunnelgetmodems**) are also listed.

Command	Arguments	Description	Example
Generic			
$resetNow	---	Soft reset the Resolute	$resetNow
$factoryDefaults	---	Set the device back to its default settings. Does **not** reset the device. **Enabled Tasks and Schedules are not changed.**	$factoryDefaults
$schedule	---	Returns schedule of all enabled peripherals,	$schedule

		OR displays that no tasks are enabled if applicable over local connection on current version.	
$ver	---	Returns the firmware version loaded	$ver
$getSerialNumber	---	Returns the device serial number	$getSerialNumber
$unlock	--- or [CODE] [NEW CODE<10000 – 99999>]	Returns the current unlock code for Iridium or Cell commands, or change the code to a new code.	$unlock Or $unlock 12345 62652
GNSS			
$gnssSet5vAnt	**T**/**F**	**T** Set antenna voltage to 5V **F** (Default) Set antenna voltage to 3.3V	$gnssSet5vAnt T
$gnssSetEnabled	**T**/**F**	Entirely enable or disable the GNSS task	$gnssSetEnabled t
$gnssSetDuration	**s**/**m**/**h**/**d**	Set the duration of the GNSS receiver (0 for always on)	$gnssSetDuration 1h
$gnssSetInterval	**s**/**m**/**h**/**d**	Set how often the GNSS task runs	$gnssSetInterval 1d
$gnssSetOffset	**s**/**m**/**h**/**d**	Set the time offset of the GNSS task	$gnssSetOffset 12h
$gnssSetUseGnssTime	**T**/**F**	T (true) enables GNSS time (no leap seconds), F (false) disabled	$gnssSetUseGnssTime t
IP Tunnel – RUDICS or Cell			
$irdSetDod	**T**/**F**	**T** Enables Iridium DISA/DOD Gateway **F** Disables DISA gateway to use Commercial Gateway	$irdSetDod T
$iridiumSetCommercialNumber	[number]	If DOD is set to **False**, set the Iridium RUDICS dial number (DNIS) of the installed SIM to allow RUDICS operation	$iridiumSetCommercialNumber 008988XXXXXXXX
$tunnelSetEnabled	**T**/**F**	Entirely enable or disable the IP Tunnel task	$tunnelSetEnabled T
$tunnelSetModem	[<0-3>]	Sets the priority of multiple cell and iridium	$tunnelSetModem 0 3

	[<2-3>]	modems	
$tunnelGetModems	---	Returns each modem to use for IP tunnel, and their priority.	$tunnelGetModems
$tunnelSetDuration	**s/m/h/d**	Set the duration of the IP tunnel connection	$tunnelSetDuration 600s
$tunnelSetInterval	**s/m/h/d**	Set the interval of the IP tunnel	$tunnelSetInterval 1h
$tunnelSetOffset	**s/m/h/d**	Set the time offset of the IP tunnel	$tunnelSetOffset 20m
Iridium SBD			
$sbdSetEnabled	**T/F**	Entirely enable or disable the Iridium Short Burst Data (SBD) task	$sbdsetenabled T
$sbdSetInterval	**s/m/h/d**	Set the interval of the SBD task	$sbdsetinterval 4h
$sbdSetOffset	**s/m/h/d**	Set the time offset of the SBD task	$sbdsetoffset 0
900 MHz Radio			
$radioSetEnabled	**T/F**	Returns the enabled state of the radio	$radioSetEnabled F
$radioSetChannelID A	<0 – 7>	Sets the radio channel	$radioSetChannelID A 1
GNSS			
$gnssListAntennaTypes	---	List the antenna types and their numerical values	$gnssListAntennaTypes
$gnssSetAntennaType	See Appendix B	Set the antenna reference point, also used for RINEX header	$gnsssetantennatype 0
$gnssSetAntennaOffsets	4 Dec. Places Ea. [E Offset] [N Offset] [U Offset]	Set the antenna offset for RINEX header	$gnssSetAntennaOffsets 9.1234 3.21234 0
$gnssSetAntennaSerialNumber	Max 20 Char	Set antenna offset for RINEX header	$gnssSetAntennaSerialNumber 9999
$gnssSetAntennaSetupId	Max 32-Bit Int	Set antenna setup ID for RINEX header	$gnssSetAntennaSetupId id
$gnssSetMarkerName	Max 60 Char	Set marker name for RINEX header	$gnssSetMarkerName name
$gnssSetMarkerNumber	Max 20 Char	Set marker number for RINEX header	$gnssSetMarkerNumber number
$gnssSetMarkerType	Max 20 Char	Set marker type for RINEX header	$gnssSetMarkerType marker info

$gnssSetObserverName	Max 20 Char	Set observer name for RINEX header	$gnssSetObserverName GARY
$gnssSetObserverAgency	Max 40 Char	Set observer agency for RINEX header	$gnssSetObserverAgency WWE
$gnssSetObserverComment	Max 100 Char	Set observer comment for RINEX header	$gnssSetObserverComment Res FW 4162
$gnssSetMessageTypes	[stream] [duration] [update [interval] [Bitmap A] [Bitmap B]	GNSS message configuration bitmaps	$gnssSetMessageTypes 1 0 2 1 0
$gnssSetSignalTracking	[signals (in HEX)]	GNSS signal tracking configuration bitmaps	$gnssSetSignalTracking 1f
SD Card Function/Memory			
$SDSetMemoryManagement	T/F	Enable/Disable “delete” function	$sdSetMemoryManagement F
$MemoryManagementSetDisks	<1 – 3>	1 - Enable delete on SD1 2 - Enable delete on SD2 3 - Enable delete on both disks	$memoryManagementSetDisks 2
$formatSD	[card] [format]	Format an SD card Card – 1 or 2 Format – 1 = FAT32, 2 = exFAT	$formatSD 2 1
$SetShutdownVoltageEnabled	T/F	Set if cards are unmounted at a specific voltage	$SetShutdownVoltageEnabled T
$SetShutdownVoltage	[Voltage]	Set the low voltage threshold at which cards are unmounted **This value is always set lower than restart voltage**.	$SetShutdownVoltage 11.5
$SetRestartVoltage	[Voltage]	Set the voltage threshold at which cards are remounted **This value is always set higher than shutdown voltage**.	$SetRestartVoltage 11.8

ASCII External Sensor			
$AESSetEnabled	**T/F**	Set ASCII External Sensor Logging enabled	$AESSetEnabled T
$AESSetDuration	**s/m/h/d**	Set ASCII External Sensor Logging timeout duration	$AESSetDuration 1m
$AESSetInterval	**s/m/h/d**	Set ASCII External Sensor Logging interval	$AESSetInterval 1h
$AESSetOffset	**s/m/h/d**	Set ASCII External Sensor Logging Offset	$AESSetOffset 15m
$AESSetCommandString	[string]	Set ASCII External Sensor Logging Request String	$AESSetCommandString 0R0
$AESSetPowerControlEnabled	<0 – 2>	Set whether switched power control is enabled for the ASCII external sensor 0 = OFF 1 = Power Switch 1, Pin H, 14-Pin Connector 2 = Power Switch 2, Pin M, 14-Pin Connector	$AESSetPowerControlEnabled 2
$AESSetPowerupDelay	<0 – 60000>	Set the delay (in milliseconds) before attempting to query the ASCII external sensor after switched power is applied	$AESSetPowerUpDelay 2500
Serial 2 Port			
$serial2SetEnabled	**T/F**	Set the current enabled/disabled state for the calculation serial port.	$serial2SetEnabled T
$Serial2SetBaud	[baud]	Set Serial 2 Baud Rate	$Serial2SetBaud 19200
$serial2SetCommsMode	[mode]	Set the comms mode of Serial 2 (0 = Full-Duplex, 1 = Half-Duplex)	$serial2SetCommsMode 1
$serial2SetFlow	**T/F**	Set the current enabled/disabled state of RTS/CTS flow control	$serial2Setflow T
$serial2SetPortMode	[mode]	Set the port mode of Serial 2 (0 = RS-232, 1 = RS485)	$serial2SetPortMode 0
$serial2Test	---	Transmit a test string out serial 2 for hardware testing, or send from Serial2 to test inbound to Resolute.	$serial2Test

SDI-12 Master			
$sdi12MasterSetEnabled	**T/F**	Set the enabled/disabled state of the SDI-12 interface in 'master' mode	$sdi12MasterSetEnabled T
$sdi12MasterSetInterval	**s/m/h/d**	Set the interval between SDI-12 interface requests	$sdi12MasterSetInterval 10m
$sdi12MasterSetOffset	**s/m/h/d**	Set the schedule offset for the SDI-12 Master task	$sdi12MasterSetOffset 2m
$sdi12SetAddress	<0 – 9>	Set the current local address of the SDI-12 interface	$sdi12SetAddress 1
$sdi12SetPowerControlEnabled	<0 – 2>	Set whether switched power control is enabled for the external SDI-12 sensor 0 = OFF 1 = Power Switch 1, Pin H, 14-Pin Connector 2 = Power Switch 2, Pin M, 14-Pin Connector	$sdi12SetPowerControlEnabled 2
$sdi12SetPowerUpDelay	<0 – 60000>	Set the delay (in milliseconds) before attempting to query the SDI-12 external sensor after switched power is applied	$sdi12SetPowerUpDelay 2500
$sdi12SetExtSenCmdEnabled	**T/F**	Set the ability to send custom command string to a device on the SDI-12 bus	$sdi12SetExtSenCmdEnabled T
$sdi12SetExtSenCmdString	[string]	Set the command string to send to a device on the SDI-12 bus	$sdi12SetExtSenCmdString 0R0!

Switched Power Output (14-Pin Connector, Blue Outline)			
$pwrSetSwitch	[switch] [on/off]	Use switched power on 14-Pin Connector (Blue) [switch] 1 - Power Switch 1, Pin H 2 - Power Switch 2, Pin M	$pwrSetSwitch 1 1
$pwr1SetEnabled	**T/F**	Enable/Disable schedule for Pwr Sw 1, Pin H, 14-Pin Connector (Blue)	$pwr1SetEnabled T
$pwr1SetDuration	**s/m/h/d**	Set the duration for Pwr Sw 1, Pin H, 14-Pin Connector (Blue)	$pwr1SetDuration 5m
$pwr1SetInterval	**s/m/h/d**	Set the interval for Pwr Sw 1, Pin H, 14-Pin Connector (Blue)	$pwr1SetInterval 20m
$pwr1SetOffset	**s/m/h/d**	Set the offset for Pwr Sw 1, Pin H, 14-Pin Connector (Blue)	$pwr1SetOffset 15m
$pwr2SetEnabled	**T/F**	Enable/Disable schedule for Pwr Sw 2, Pin M, 14-Pin Connector (Blue)	$pwr2SetEnabled F
$pwr2SetDuration	**s/m/h/d**	Set the duration for Pwr Sw 2, Pin M, 14-Pin Connector (Blue)	$pwr2SetDuration 1h
$pwr2SetInterval	**s/m/h/d**	Set the interval for Pwr Sw 2, Pin M, 14-Pin Connector (Blue)	$pwr2SetInterval 3h
$pwr2SetOffset	**s/m/h/d**	Set the offset for Pwr Sw 2, Pin M, 14-Pin Connector (Blue)	$pwr2SetOffset 30m

Appendix B: Antenna Type Index

The Antenna type connected to the Resolute can be added with the **$gnssSetAntennaType** command. The identity of the antenna is sent to the GNSS module for input to the SBF files for future reference. **$gnssGetAntennaList** presents this list to diagnostics.

If the GNSS antenna to be used is not in this list, contact Xeos support. Additional antennas can be added (if verified to be supported) to the index in the Resolute firmware.

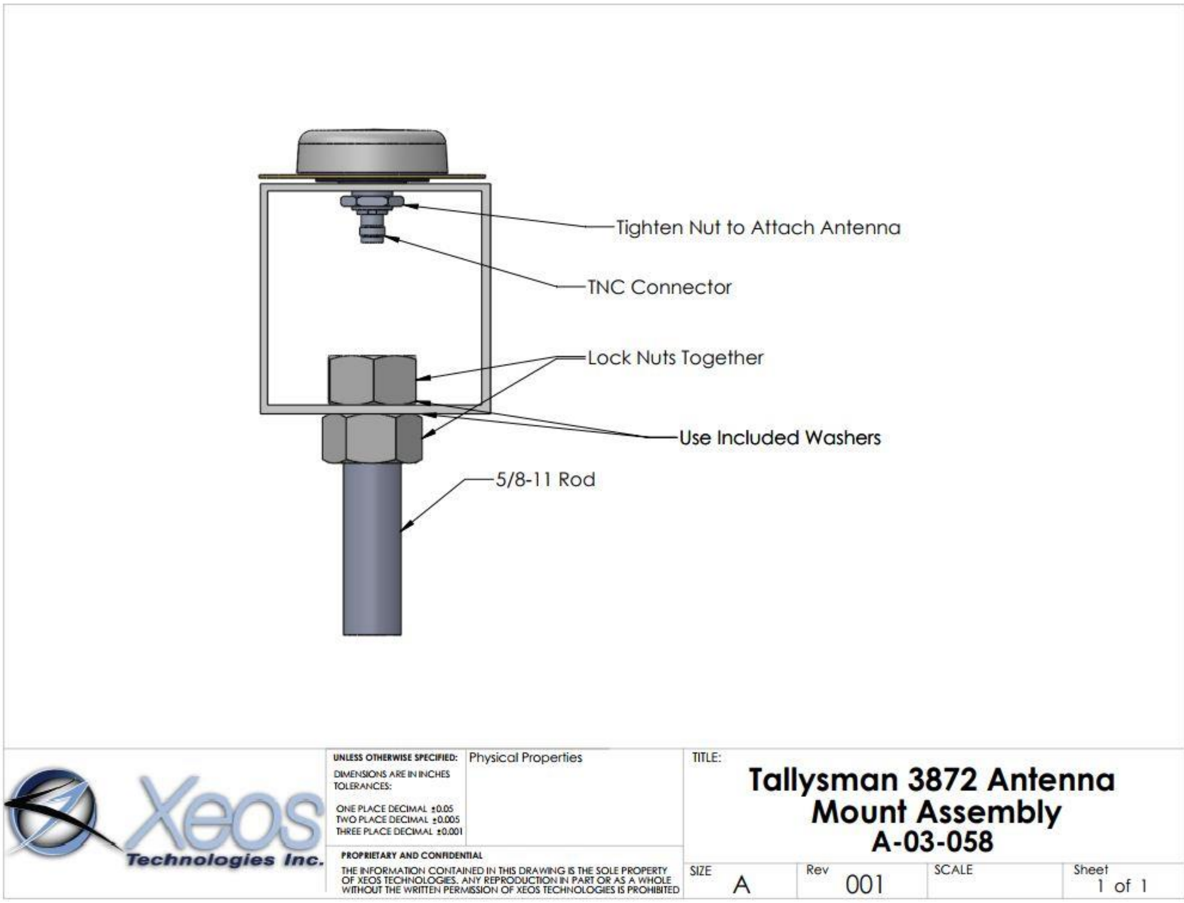
0: TWI3870+GP
1: SEPPOLANT_X_MF
2: 3S-02-TSADM
3: 3S-02-TSATE
4: ACC123CGNSSA_XN
5: ACC2G1215A_XT_1
6: ACC3G1215A_XT_1
7: ACC42G1215A_XT1
8: ACC4G1215A_XT_1
9: ACC53G1215A_XT1
10: ACC53GO1215AXT1
11: ACC72CGNSSA
12: ACC72GNSSA_XT_1
13: ACCG3ANT_3AT1
14: ACCG3ANT_42AT1
15: ACCG3ANT_52AT1
16: ACCG5ANT_123CAN
17: ACCG5ANT_2AT1
18: ACCG5ANT_3AT1
19: ACCG5ANT_42AT1
20: ACCG8ANT-CHOKES
21: ACCG8ANT_3A4TB1
22: ACCG8ANT_3A4_M1
23: ACCG8ANT_52A4T1
24: ACCG8ANT_52A4TC
25: ACC_G5ANT_52AT1
26: ACC_G5ANT_72AT1
27: AERAT1675_120
28: AERAT1675_120 SPKE
29: AERAT1675_180
30: AERAT1675_182
31: AERAT1675_200
32: AERAT1675_200 SPKE
33: AERAT1675_29
34: AERAT1675_300
35: AERAT1675_300 SPKE
36: AERAT1675_304
37: AERAT1675_32
38: AERAT1675_382
39: AERAT1675_39
40: AERAT1675_504
41: AERAT1675_80
42: AERAT1675_81
43: AERAT2775_150
44: AERAT2775_159
45: AERAT2775_159 SPKE
46: AERAT2775_160
47: AERAT2775_270
48: AERAT2775_382
49: AERAT2775_41
50: AERAT2775_42
51: AERAT2775_42+CR
52: AERAT2775_43
53: AERAT2775_43 SPKE
54: AERAT2775_443
55: AERAT2775_443 SPKE
56: AERAT2775_62
57: AERAT3075_460
58: AOA7490582.2
59: AOAD/M_B
60: AOAD/M_R
61: AOAD/M_T
62: AOAD/M_TA_NGS
63: AOARASCAL
64: APSAPS-3
65: APSAPS-3L
66: APSAPS-NR2
67: APS_APS-3
68: APS_APS-3 SCIT
69: ASH110454
70: ASH111660
71: ASH111661
72: ASH700228A
73: ASH700228B
74: ASH700228C
75: ASH700228D
76: ASH700228E
77: ASH700699.L1
78: ASH700700.A
79: ASH700700.B
80: ASH700700.C
81: ASH700718A
82: ASH700718B
83: ASH700829.2 SNOW
84: ASH700829.3 SNOW
85: ASH700829.A SNOW
86: ASH700829.A1 SNOW
87: ASH700936A_M
88: ASH700936A_M SNOW
89: ASH700936B_M
90: ASH700936B_M SNOW
91: ASH700936C_M
92: ASH700936C_M SNOW
93: ASH700936D_M
94: ASH700936D_M SCIS
95: ASH700936D_M SNOW
96: ASH700936E
97: ASH700936E SNOW
98: ASH700936E_C
99: ASH700936E_C SNOW
100: ASH700936F_C
101: ASH701008.01B
102: ASH701023.A
103: ASH701073.1
104: ASH701073.3
105: ASH701933A_M
106: ASH701933A_M SNOW
107: ASH701933B_M
108: ASH701933B_M SNOW
109: ASH701933C_M
110: ASH701933C_M SCIS
111: ASH701933C_M SCIT
112: ASH701933C_M SNOW
113: ASH701941.1
114: ASH701941.2
115: ASH701941.A
116: ASH701941.B
117: ASH701941.B SCIS
118: ASH701945B_M
119: ASH701945B_M SCIS
120: ASH701945B_M SCIT
121: ASH701945B_M SNOW
122: ASH701945C_M
123: ASH701945C_M OLGA
124: ASH701945C_M PFAN
125: ASH701945C_M SCIS

126: ASH701945C_M SCIT
127: ASH701945C_M SNOW
128: ASH701945D_M
129: ASH701945D_M SCIS
130: ASH701945D_M SCIT
131: ASH701945D_M SNOW
132: ASH701945E_M
133: ASH701945E_M SCIS
134: ASH701945E_M SCIT
135: ASH701945E_M SNOW
136: ASH701945G_M
137: ASH701945G_M SCIS
138: ASH701945G_M SCIT
139: ASH701945G_M SNOW
140: ASH701946.2
141: ASH701946.2 SNOW
142: ASH701946.3
143: ASH701946.3 SNOW
144: ASH701975.01A
145: ASH701975.01AGP
146: ASH701975.01B
147: ASH701975.01BGP
148: ASH802129
149: ASH802147_A
150: ASH_LOCUS
151: AYIHY-BGLRB06RT
152: CHANV3
153: CHATK2
154: CHATKO
155: CHCA220GR
156: CHCA300GNSS
157: CHCC220GR CHCD
158: CHCC220GR
159: CHCX900B
160: CHCX900R
161: CHCX900S-OPUS
162: CHCX90D-OPUS
163: CHCX91+S
164: CHCX91B
165: CHCX91R
166: CNTT300
167: CNVC-NAV286
168: DGR_QEDGE
169: FOIA30
170: GDCGS1HX-BS601
171: GMXZENITH10
172: GMXZENITH20
173: GMXZENITH25
174: GMXZENITH25PRO
175: GUTGPSL1L2A
176: HEMA21
177: HEMA325
178: HEMA42
179: HEMA45
180: HEMA52_WB
181: HEMS320
182: HGGCYH8321 HGGC
183: HGGCYH8321
184: HITV30
185: HITV60
186: HRZK2007224V3.0
187: HXCCA7607A
188: HXCCG7601A HXCG
189: HXCCG7601A
190: HXCCG7602A HXCG
191: HXCCG7602A
192: HXCCGX601A HXCS
193: HXCCGX601A
194: HXCCSX601A
195: HXCGG486A HXCS
196: HXCGG486A
197: HXCGS488A
198: ITT3750323
199: ITT3750323 SCIS
200: JAVGISMORE
201: JAVGRANT_G3
202: JAVGRANT_G3+GP JVGR
203: JAVGRANT_G3+GP
204: JAVGRANT_G3TJ
205: JAVGRANT_G3TJ+G JVGR
206: JAVGRANT_G3TJ+G
207: JAVGRANT_G5T
208: JAVGRANT_G5T+GP JVGR
209: JAVGRANT_G5T+GP
210: JAVRINGANT_DM JVDM
211: JAVRINGANT_DM
212: JAVRINGANT_DM SCIS
213: JAVRINGANT_DM SCIT
214: JAVRINGANT_G5T JAVC
215: JAVRINGANT_G5T
216: JAVTRIANT_A
217: JAVTRIUMPH_1M
218: JAVTRIUMPH_1MR
219: JAVTRIUMPH_2A
220: JAVTRIUMPH_LSA
221: JAVTRIUMPH_VS
222: JAV_GRANT-G3T
223: JAV_GRANT-G3T+G JVGR
224: JAV_GRANT-G3T+G
225: JAV_RINGANT_G3T JAVC
226: JAV_RINGANT_G3T
227: JAV_TRIUMPH-1
228: JAV_TRIUMPH-1R
229: JNSCHOKERING_DM
230: JNSCR_C146-22-1
231: JNSCR_C146-22-1 SCIS
232: JNSMARANT_GGD
233: JPLD/M_R
234: JPLD/M_RA_SOP
235: JPSLEGANT_E
236: JPSMARANT_GGD
237: JPSODYSSEY_I
238: JPSREGANT_DD_E
239: JPSREGANT_DD_E1
240: JPSREGANT_DD_E2
241: JPSREGANT_SD_E
242: JPSREGANT_SD_E1
243: JPSREGANT_SD_E2
244: KOLK9_T
245: LEIAR10
246: LEIAR20 LEIM
247: LEIAR20
248: LEIAR25 LEIT
249: LEIAR25
250: LEIAR25 SCIS
251: LEIAR25 SCIT
252: LEIAR25.R3 LEIT
253: LEIAR25.R3
254: LEIAR25.R3 SCIS
255: LEIAR25.R3 SCIT
256: LEIAR25.R4 LEIT
257: LEIAR25.R4
258: LEIAR25.R4 SCIS
259: LEIAR25.R4 SCIT
260: LEIAS05
261: LEIAS10
262: LEIAT202+GP
263: LEIAT202-GP
264: LEIAT302+GP
265: LEIAT302-GP
266: LEIAT303 LEIC
267: LEIAT303
268: LEIAT502
269: LEIAT503 LEIC
270: LEIAT503
271: LEIAT504 LEIS
272: LEIAT504
273: LEIAT504 OLGA
274: LEIAT504 SCIS
275: LEIAT504GG LEIS
276: LEIAT504GG
277: LEIAT504GG SCIS
278: LEIAT504GG SCIT
279: LEIATX1230
280: LEIATX1230+GNSS
281: LEIATX1230GG
282: LEIAX1202
283: LEIAX1202A
284: LEIAX1202GG

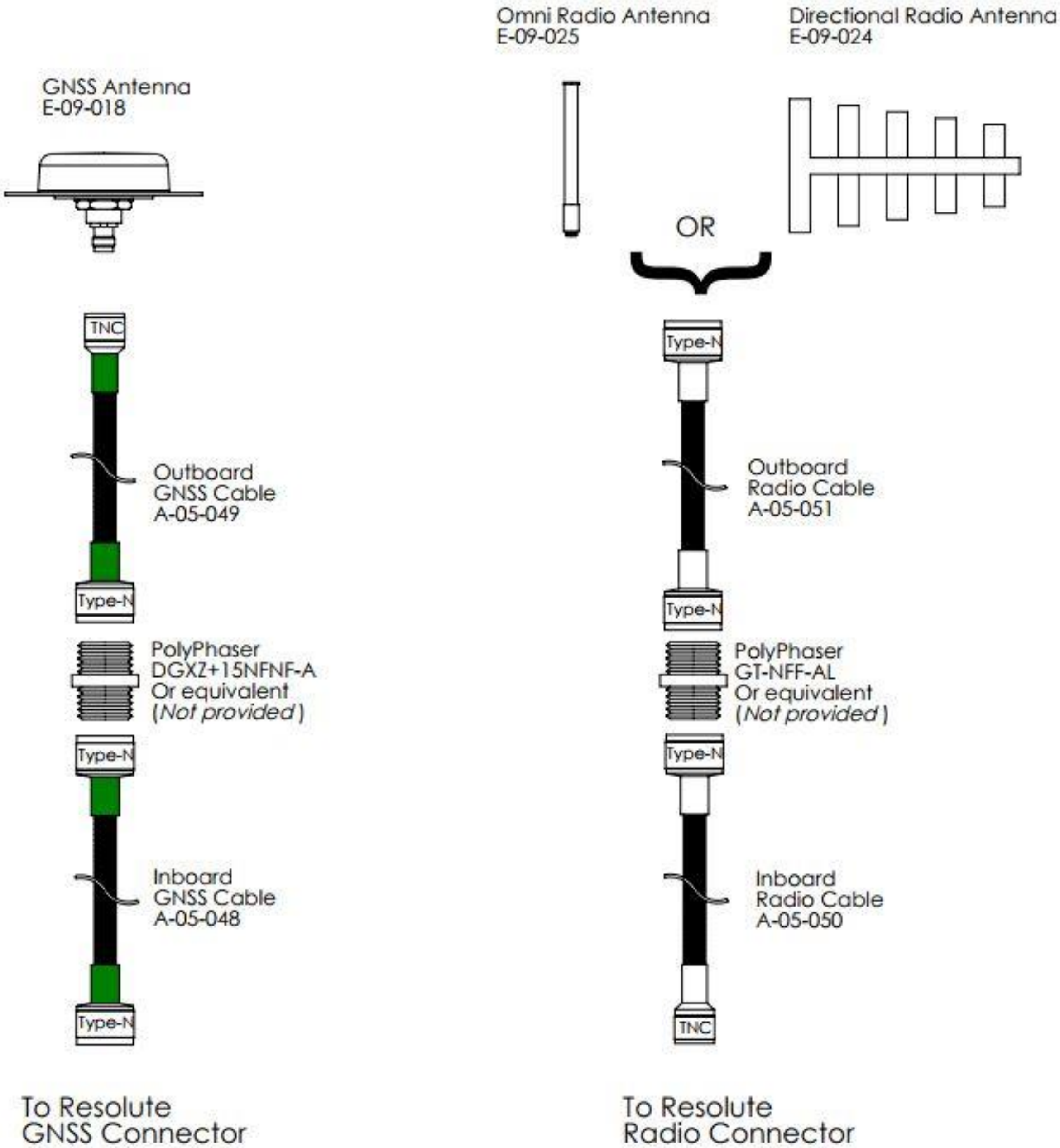
285: LEIAX1203+GNSS
286: LEIGG02PLUS
287: LEIGG03
288: LEIGS08
289: LEIGS08PLUS
290: LEIGS09
291: LEIGS12
292: LEIGS14
293: LEIGS15
294: LEIICG60
295: LEIMNA950GG
296: LEISR299_INT
297: LEISR399_INT
298: LEISR399_INTA
299: MAC4647942 MMAC
300: MAC4647942
301: MAG105645
302: MAG111406
303: MAG990596
304: MPL1230
305: MPL1370W
306: MPLL1/L2_SURV
307: MPL_WAAS_2224NW
308: MPL_WAAS_2225NW
309: NAVAN2004T
310: NAVAN2008T
311: NAVANT3001A
312: NAVANT3001B
313: NAVRT3010S
314: NAVSF2040G
315: NAVSF3040
316: NAV_ANT3001BR SPKE
317: NAV_ANT3001R
318: NAX3G+C
319: NGSD/M+GP60
320: NOV501
321: NOV501+CR
322: NOV502
323: NOV502+CR
324: NOV503+CR
325: NOV503+CR SPKE
326: NOV512
327: NOV531
328: NOV531+CR
329: NOV533 RADM
330: NOV533+CR NOVC
331: NOV600
332: NOV701GGL
333: NOV701GG_1.03
334: NOV702
335: NOV702GG
336: NOV702GGL_1.01
337: NOV702GG_1.02
338: NOV702GG_1.03
339: NOV702L_1.01
340: NOV702L_1.03
341: NOV702_2.02
342: NOV702_3.00
343: NOV703GGG.R2
344: NOV750.R4
345: NOV750.R4 NOVS
346: NOV750.R4 SCIS
347: NOV750.R4 SCIT
348: NOV750.R5 NOVS
349: NOV_WAAS_600
350: RNG80971.00
351: SEN67157514
352: SEN67157514+CR
353: SEN67157549
354: SEN67157549+CR
355: SEN67157596
356: SEN67157596+CR
357: SEPCHOKE_MC
358: SEPCHOKE_MC SPKE
359: SEPPOLANT_X_MF
360: SEPPOLANT_X_SF
361: SEP_POLANT+
362: SEP_POLANT+_GG
363: SLGSL600_V1
364: SMICR3B
365: SMICR3B SPKE
366: SOK502
367: SOK600
368: SOK702
369: SOKA110
370: SOKA120
371: SOKGRX1
372: SOKGRX1+10
373: SOKGRX2
374: SOKGRX2+10
375: SOKGSX2
376: SOKGSX2+10
377: SOKSTRATUS
378: SOK_GSR2700IS
379: SOK_GSR2700ISX
380: SOK_LOCUS
381: SOK_RADIAN_IS
382: SPP39105.90
383: SPP571212238+GP
384: SPP571908273+CR
385: SPP571908273+CR SPKE
386: SPP67410_42
387: SPP67410_44
388: SPP67410_46
389: SPP68410_10
390: SPP89823_10
391: SPP91564_00
392: SPP91564_1
393: SPP91564_2
394: STH82VHX-BS601A
395: STHCR3-G3
396: STHCR3-G3 STHC
397: STHS82HX-BS601A
398: STHS82_7224V3.0
399: STHS86HX-BS611A
400: STHS86_7224V3.1
401: STXG5ANT_72AT1
402: STXS8BS603A
403: STXS8PX003A
404: STXS9+X001A
405: STXS9BS604A
406: STXS9PX001A
407: STXS9SA7224V3.0
408: THA800961+REC
409: THA800961+RTK
410: THA800961RECUHF
411: THA800961RTKUHF
412: THANAP002
413: TIAPENG2100B
414: TIAPENG2100R
415: TIAPENG3100R1
416: TIAPENG3100R2
417: TIASMT888-3GV3
418: TOP700779A
419: TOP72110
420: TPSCR.G3
421: TPSCR.G3 SCIS
422: TPSCR.G3 SCIT
423: TPSCR.G3 TPSH
424: TPSCR.G5
425: TPSCR.G5 SCIS
426: TPSCR.G5 SCIT
427: TPSCR.G5 TPSH
428: TPSCR3_GGD CONE
429: TPSCR3_GGD
430: TPSCR3_GGD OLGA
431: TPSCR3_GGD PFAN
432: TPSCR4 CONE
433: TPSCR4
434: TPSG3_A1
435: TPSG3_A1 TPSD
436: TPSGR3
437: TPSGR5
438: TPSHIPER_GD
439: TPSHIPER_GGD
440: TPSHIPER_II
441: TPSHIPER_II+10
442: TPSHIPER_LITE
443: TPSHIPER_PLUS

444: TPSHIPER_SR
445: TPSHIPER_SR+10
446: TPSHIPER_V
447: TPSHIPER_V+10
448: TPSHIPER_XT
449: TPSLEGANT
450: TPSLEGANT2
451: TPSLEGANT3_UHF
452: TPSLEGANT_G
453: TPSMAPANT_B
454: TPSMG_A2
455: TPSODYSSEY_I
456: TPSPG_A1
457: TPSPG_A1 TPSD
458: TPSPG_A1+GP
459: TPSPG_A1_6
460: TPSPG_A1_6+GP
461: TPSPG_A2
462: TPSPG_A5
463: TPSPG_F1
464: TPSPG_F1+GP
465: TPSPG_S1
466: TPSPG_S1+GP
467: TPSPN.A5
468: TPSPN.A5 SCIS
469: TPSPN.A5 SCIT
470: TPSPN.A5 TPSH
471: TPS_CR.3 SCIS
472: TPS_CR4+RD SCIS
473: TPS_MC.A5
474: TRM14177.00
475: TRM14532.00
476: TRM14532.10
477: TRM22020.00+GP
478: TRM22020.00-GP
479: TRM22020.02 TCWD
480: TRM23903.00
481: TRM27947.00+GP
482: TRM27947.00-GP
483: TRM29659.00
484: TRM29659.00 OLGA
485: TRM29659.00 SCIS
486: TRM29659.00 SCIT
487: TRM29659.00 SNOW
488: TRM29659.00 TCWD
489: TRM29659.00 UNAV
490: TRM33429.00+GP
491: TRM33429.00-GP
492: TRM33429.20+GP
493: TRM33429.20+GP TCWD
494: TRM33429.20+GP UNAV
495: TRM36569.00+GP
496: TRM39105.00
497: TRM41249.00
498: TRM41249.00 SCIT
499: TRM41249.00 TZGD
500: TRM41249USCG SCIT
501: TRM44830.00
502: TRM4800
503: TRM49700.00
504: TRM53406.00
505: TRM55970.00
506: TRM55971.00
507: TRM55971.00 SCIT
508: TRM55971.00 TZGD
509: TRM57970.00
510: TRM57971.00
511: TRM57971.00 SCIT
512: TRM5800
513: TRM59800.00
514: TRM59800.00 SCIS
515: TRM59800.00 SCIT
516: TRM59800.80
517: TRM59800.80 SCIS
518: TRM59800.80 SCIT
519: TRM59900.00
520: TRM59900.00 SCIS
521: TRM65212.00
522: TRM77970.00
523: TRM77971.00
524: TRM77971.00 SCIT
525: TRMA3_L1
526: TRMR10
527: TRMR4-2
528: TRMR4-3
529: TRMR6
530: TRMR6-2
531: TRMR6-3
532: TRMR6-4 NONE
533: TRMR8 NONE
534: TRMR8-4 NONE
535: TRMR8_GNSS NONE
536: TRMR8_GNSS3 NONE
537: TRMSPS985 NONE
538: TWI3870+GP NONE
539: UNIUA35 NONE
540: Unknown
541: SEPPOLANTXMF.V2 NONE

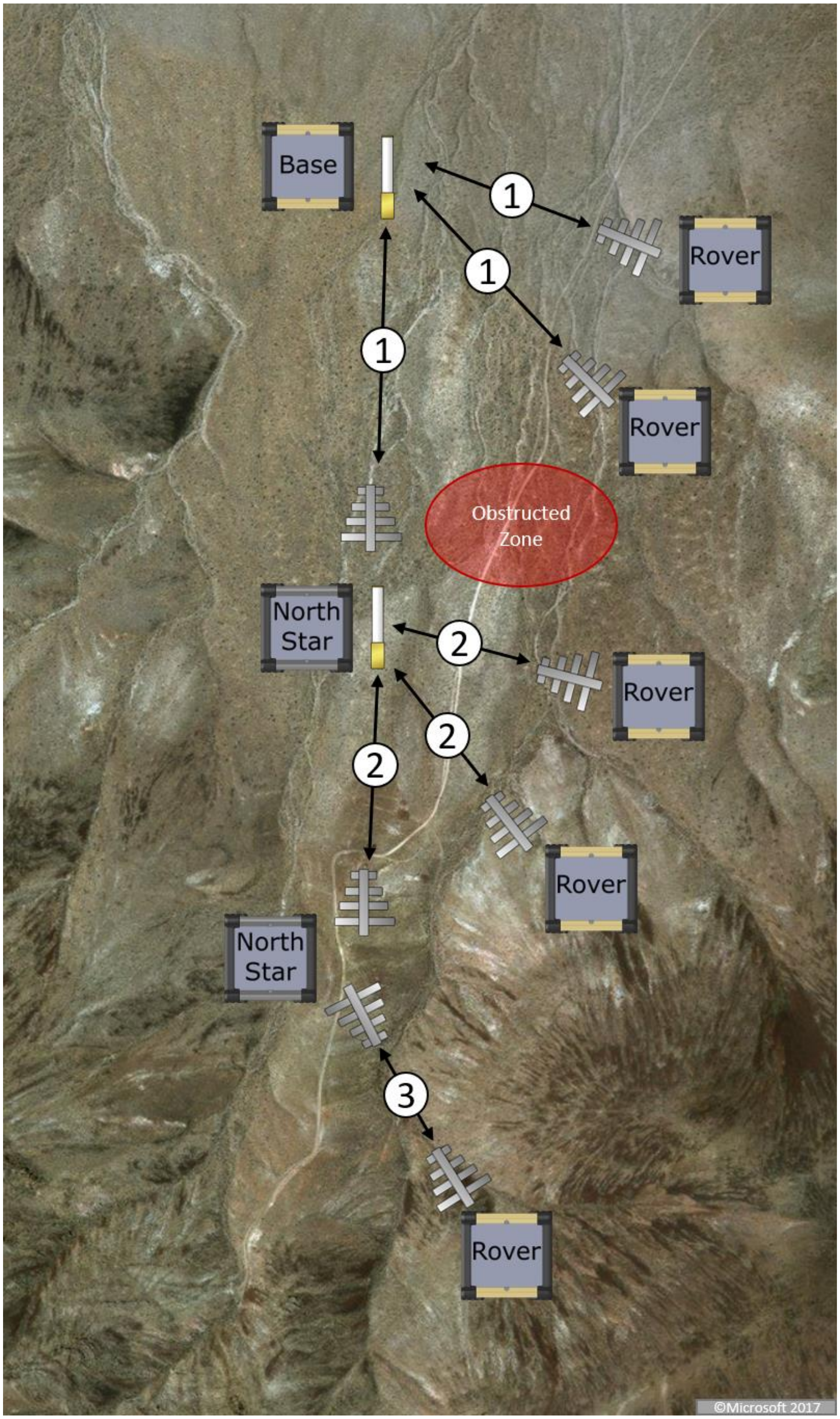
Appendix C: GNSS Antenna Mount Diagram



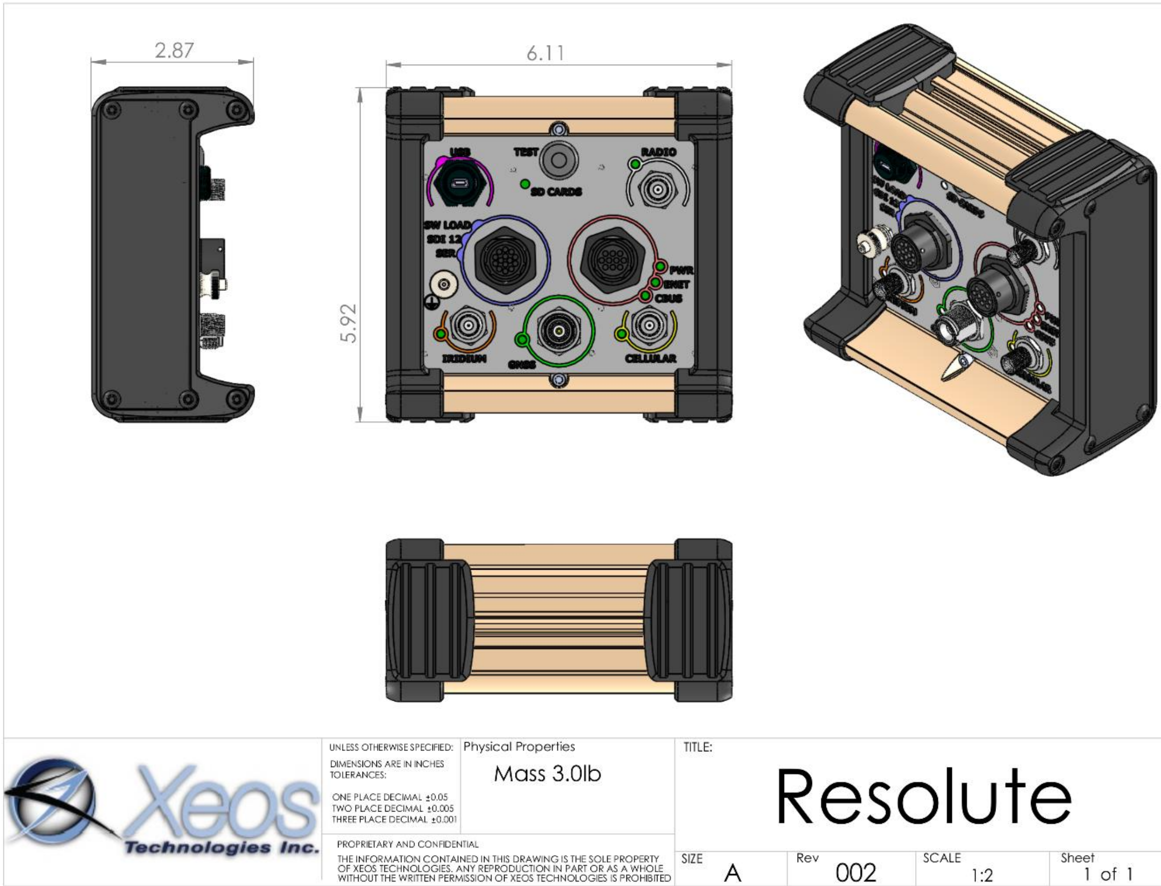
Appendix D: RF Cable Installation Diagram Example



Appendix E: Example RTK Network Map



Appendix F: Mechanical Specifications



Appendix G: Electrical Specifications

The following section specifies power requirements for various configurations of the Resolute with various use cases of duty cycling peripherals. Measurements can fluctuate as receivers and modems use varying power depending on the rate of transmitting, tracking settings and other factors.

General
Voltage Input: 5 – 27V Nominal; 32V Max
Switched Power Output: Voltage Input – 0.7V
Switched Power Output Current: Max 1.8A (Per Switch)

Continuous RTK (Resolute Pin):
Peripherals: Radio (Average Continuous), GNSS (GPS L1/L2, GLONASS L1/L2), TW3872 Antenna
Power Requirement: 1.4W

Reference Receiver
Peripherals: GNSS (GPS L1), TW3872 Antenna (Average Continuous)
Power Requirement: 1 W
Peripherals: GNSS (GPS L1 L2), TW3872 Antenna (Average Continuous)
Power Requirement: 1.25 W
Peripherals: GNSS (GPS, GLONASS, L1, L2), TW3872 Antenna (Average Continuous)
Power Requirement: 1.3 W
Peripherals: GNSS (All Signals), Nominal Antenna (Average Continuous)
Power Requirement: 1.5 W

Add Power for Configurable Length Peripherals

Iridium RUDICS (Average Continuous)
Iridium RUDICS Minimum Connection (Tunnel Connected, No Data)
Power Requirement: 1.85W
Iridium RUDICS Data Transfer
Power Requirement: 3.8W

Iridium Short Burst Data (SBD)
SBD Message Check (Average Power, per check, Average check 36 seconds)
Power Requirement: 0.5W (36 seconds)

Appendix H: RxTools Download

Download the RxTools software and manual from Septentrio.

RX Tools contains the SBF Converter to convert SBF blocks to ASCII or RINEX. SBF Block info can be found in the SBF Reference Guide also in the link above.

Appendix I: Iridium Service

If the Resolute comes equipped with a 9523 Iridium Transceiver which makes use of the Iridium satellite system's RUDICS and Short Burst Data (SBD) services.

SBD service is a global, two-way, real-time, email-based data delivery service that has a maximum outbound (from unit) message size of 340 bytes and a maximum inbound (to unit) message size of 270 bytes.

Resolute end users/integrators must set up an approved data delivery account with their preferred service provider. Xeos is also an Iridium VAR and can provide Iridium service.

Setting up service requires the modem's 15-digit International Mobile Equipment Identity (IMEI) number, which is, if a modem is installed, affixed on the front of the Resolute enclosure.

Each IMEI number is capable of being associated with up to five (5) unique email addresses and/or IP addresses.

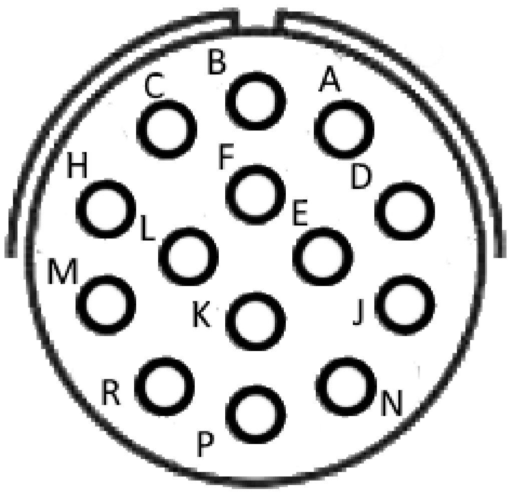
While any email application can be used to send and receive messages to the Resolute, XeosOnline is the easiest way to manage and monitor the Resolute. Messages contain a lot of information and XeosOnline presents that information in a readable format with date-filtered graphing and mapping interface.

If RUDICS is to be utilized, please contact Xeos for assistance in setting up and managing a RUDICS tunnel.

Appendix J: Connector Pinouts

Circular Connector, 14-Pin Female

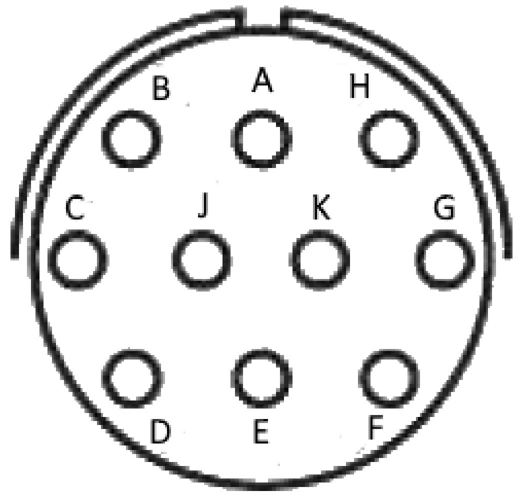
Pin	Function
A	Serial 1 RS-232-Tx
B	No Connection 1-PPS Output; **OPTIONAL UPON REQUEST**
C	SDI-12 Interface
D	Serial 1 RS-232-Rx
E	Serial 1 RS-232-CTS
F	Ground
H	Power Switch 1
J	Serial 1 RS-232-RTS
K	Ground
L	Serial 2 RS-232-RTS
M	Power Switch 2
N	Serial 2 RS-232-Tx
P	Serial 2 RS-232-Rx
R	Serial 2 RS-232-CTS



***Note**: PPS is optionally connected; this feature must be requested from the factory at time of purchase.

Circular Connector, 10-Pin Female

Pin	Function
A	Voltage Input, 5 – 27V Nominal; 32V Max
B	Ground
C	Ethernet RD-
D	Ethernet RD+
E	Ethernet TD-
F	Ethernet TD+
G	Ground
H	CANBUS-High
J	CANBUS-Low
K	Ground



Warranty, Support and Limited Liability

Xeos by Satlink warranties the Resolute 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 by Satlink 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 by Satlink entire liability and your exclusive remedy shall be at Xeos' option, either (a) return of the price paid or (b) repair or replacement of the product that does not meet Xeos' Limited Warranty and that is returned to Xeos 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 by Satlink disclaims all other warranties, either express or implied, including but not limited to implied warranties of merchantability and fitness for a 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 by Satlink 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 product, even if Xeos has been advised of the possibility of such damages.