



**875-0388-0**

User Guide  
Revision: A3  
September 27, 2018

**S321+**  
**Smart Antenna**

## **Environmental**

Temperature – operating -30°C to +60°C Temperature – storage -40°C to +80°C Humidity MIL-STD-810F Method 5-7.4 Vibration MIL-STD- 810FG Method. 514.6E-1 Loose cargo MIL-STD- 810F FIG. 514.5C-5

## **Regulatory Compliance CE**

### **Compliance**

- IEC 60950-1:2005
- EN 301 113-1 / EN 301 113-2
- EN 301 489-1 v1.9.2
- EN301 489-3v1.6.1
- EN301 489-7v1.3.1
- EN 301489-17v2.2.1
- EN301 489-24v1.5.1
- EN55022:2010
- EN55024:2010
- EN 300440-1 v1.6.1 / EN 300440-2 v1.4.1
- EN 300 328 V1.9.1
- EN 301 511 v9.0.2
- EN 301 908-1 v6.2.1 / EN 301 908-2 v6.2.1

### **FCC Compliance**

- FCC Part 15, SubpartB
- FCC Part 15, Subpart C :2015
- FCC Part 15, Subpart C:2014
- FCC Part 2
- FCC Part 22H
- FCC Part 24E

### **IC Compliance**

- ICES-003:2012 Issue 5
- RSS-247 Issue 1
- RSS-GEN Issue 4
- RSS 132 Issue 3
- RSS 133 Issue 6

## **Certifications**

### **S321+ UHF**

- Model: S321+UHF
- FCC ID:ZC8S321+UHF
- IC:9586A-S321+UHF

### **S321+ Non-UHF**

- Model: S321+Network
- FCC ID:ZC8S321+Network
- IC: 9586A-S321+Network

**⚠ WARNING:** If your S321+ is equipped with a 400 MHz radio you may be required to obtain a valid radio license for your jurisdiction. Only set the radio to the frequency and power you are licensed to use at your location.

### USA- Federal Communication Commission (FCC)

Radio frequency radiation exposure information:

*This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. GSM*

*Mode*

- *When using the GSM to receive correction data, this equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.*

*UHF Radio Mode*

- *When using the 400 MHz radio, M3-TR4 from Sate1™, this equipment should be installed and operated with a minimum distance of 24cm.*

*This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.*

Modifications not expressly approved by Hemisphere GNSS could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instructions, it may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by tuning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the distance between the equipment and the receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

**Caution:** Exposure to Radio Frequency Radiation.

This device must not be co-located or operating in conjunction with any other antenna or transmitter.

### Canada - Industry Canada (IC)

This device complies with RSS 210 of Industry Canada. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of this device.

L' utilisation de ce dispositif est autorisée seulement aux conditions suivantes: (1) il ne doit pas produire d'interférence et (2) l' utilisateur du dispositif doit être prêt à accepter toute interférence radioélectrique reçue, même si celle-ci est susceptible de compromettre le fonctionnement du dispositif.

**Caution:** Exposure to Radio Frequency Radiation.

The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit RF field in excess of Health Canada limits for the general population; consult Safety Code 6, obtainable from Health Canada's website.

### Europe – Declaration of Conformity

This device is in compliance with the essential requirements of the R&TTE Directive 1999/5/EC.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

This product complies with the essential requirements and other relevant provisions of Directive 2014/53/EU. The declaration of conformity may be consulted at <https://hemispheregnss.com/About-Us/Quality-Commitment>

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U.S. Patents				Australia Patents	
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6397147	7142956	7429952	8018376	8217833	2002325645
6469663	7162348	7437230	8085196	8265826	2004320401
6501346	7277792	7460942	8102325	8271194	
6539303	7292185	7689354	8138970	8307535	
6549091	7292186	7808428	8140223	8311696	
6711501	7373231	7835832	8174437	8334804	
6744404	7388539	7885745	8184050	RE41358	
6865465	7400294	7948769	8190337		

Other U.S. and foreign patents pending.

## Notice to Customers

Contact your local dealer for technical assistance. To find the authorized dealer near you:

Hemisphere GNSS, Inc.  
8515 East Anderson Drive  
Scottsdale, AZ 85255 USA  
Phone: (480) 348-6380  
Fax: (480) 270-5070  
[precision@hgns.com](mailto:precision@hgns.com) [www.hgns.com](http://www.hgns.com)

## Technical Support

If you need to contact Hemisphere GNSS Technical Support:

Hemisphere GNSS, Inc.  
8515 East Anderson Drive  
Scottsdale, AZ 85255 USA  
Phone: (480) 348-6380  
Fax: (480) 270-5070  
[techsupport@hgns.com](mailto:techsupport@hgns.com)

## Documentation Feedback

Hemisphere GNSS is committed to the quality and continuous improvement of our products and services. We urge you to provide Hemisphere GNSS with any feedback regarding this guide by writing to the following email address: [techsupport@hgns.com](mailto:techsupport@hgns.com).

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## Terms and Definitions

The following table lists the terms and definitions used in this document.

Term	Definition
Activation	Activation refers to a feature added through a one-time purchase. For features that require recurring fees, see <a href="#">Subscription</a>
aRTK	aRTK is a Hemisphere GNSS exclusive service that uses Atlas to extrapolate the last RTK correction during an RTK outage so that the length of time an RTK position can be used after an RTK outage is extended
Atlas	Atlas is a subscription based service provided by Hemisphere.
Base Station	The Base Station is a receiver placed over a familiar point. The base station then provides real-time observations and sends these to nearby RTK rovers via UHF radio or the internet.
BeiDou	BeiDou is a Chinese satellite based navigation system. Global coverage is expected by 2020.
Datalink	Datalink is the device used to send RTK or DGNSS corrections from a base station to one of more rovers. Common datalinks are UHF radio or Ntrip (see <a href="#">Ntrip</a> )
DGPS/DGNSS	Differential GPS/GNSS refers to a receiver using Differential Corrections.
EGNOS	European Geostationary Navigation Overlay Service (EGNOS) is a satellite-based augmentation system (SBAS) that provides free differential corrections over satellite in parts of Europe.
Elevation Mask	Elevation Mask is the minimum angle between a satellite and the horizon for the receiver to use that satellite in the solution.
Firmware	Firmware is the software loaded into the receiver that controls the functionality of the receiver and runs the GNSS engine.
GALILEO	Galileo is a global navigation satellite system implemented by the European Union and European Space Agency.
GAGAN	GPS Aided Geo Augmented Navigation is a satellite based augmentation system (SBAS) that provides free differential corrections over satellite in India.
GLONASS	Global Orbiting Navigation Satellite System (GLONASS) is a Global Navigation Satellite System (GLONASS) deployed, and maintained, by Russia. It is comparable to the United States' GPS system.



## Terms and Definitions (continued)

Term	Definition
GNSS	Global Navigation Satellite System (GNSS) is a system that provides autonomous 3D position (latitude, longitude, and altitude) along with very accurate timing globally by using satellites. Current GNSS providers are: GPS, GLONASS and Galileo.
GPS	Global Positioning System (GPS) is a global navigation satellite system implemented by the United States.
Mountpoint	Mountpoints are the specified data streams in Ntrip. Multiple base stations may send data to an Ntrip caster.
Multipath	Multipath occurs when the GNSS signal reaches the antenna by two or more paths. This causes incorrect pseudorange measurements and leads to less precise GNSS solutions.
NMEA	National Marine Electronics Association (NMEA) is a marine electronics organization that sets standards for communication between marine electronics. NMEA 0183 is the electrical and data specification for communications between many various marine electronics, such as GNSS receivers.
Ntrip	Networked Transport of RTCM via Internet Protocol (Ntrip) is a protocol for streaming GNSS data over the internet. Ntrip is most often used to stream RTK or DGNSS corrections over the internet.
Ntrip Server	The Ntrip server sends data from the Ntrip source (base station) to the Ntrip caster.
QZSS	Quasi-Zenith Satellite System (QZSS) is a satellite navigation system currently under development in Japan.
ROX	ROX is a Hemisphere GNSS propriety RTK message format that can be used as an alternative to RTCM3 when both the base and rover are Hemisphere branded.
RTCM	Radio Technical Commission for Maritime Services (RTCM) is a standard used to define RTK message formats so that receivers from any manufacturer can be used together.
RTK	Real-Time-Kinematic (RTK) is a real-time differential GPS method that provides better accuracy than differential corrections.
SBAS	Satellite Based Augmentation System (SBAS) is a system that provides differential corrections over satellite throughout a wide area or region.
Subscription	A subscription is a feature that is enabled for a limited time. Once the end-date of the subscription has been reached, the feature will turn off until the subscription is renewed.
WAAS	Wide Area Augmentation System (WAAS) is a satellite-based augmentation system (SBAS) that provides free differential corrections over satellite in parts of North America.



## **Chapter 1: Introduction**

Overview and Features

What's Included

## Introduction

### Overview and Features

The S321+ is an all-new multi-GNSS, multi-frequency, smart antenna. The S321+ provides robust performance and high precision in a compact and rugged package. With multiple wireless communications ports and an open GNSS interface, the S321+ can be used in a variety of operating modes.

Use the S321+ as a precise base station sending RTK to your existing rover network. Turn S321+ into a lightweight and easy-to-use rover by connecting it to your base via UHF radio or Wi-Fi network. The built-in web user interface (WebUI) is used to control, manage, and upgrade the S321+ with new firmware and activations. S321+ is Athena-enabled and Atlas-capable.

Powered by the Eclipse™ P326 OEM board, the S321+ supports 394 channels and can simultaneously track all satellite signals including GPS, GLONASS, BeiDou, Galileo, and QZSS, making them robust and reliable. S321+ comes standard with two long-life lithium batteries providing up to 12 hours of operation. The batteries are hot-swappable, and may be changed while working, maximizing your efficiency and ROI.

The S321+ combines Hemisphere's Athena GNSS engine and Atlas L-band correction technologies with a new WebUI, offering an unparalleled level of customer-friendly performance.

The ruggedized antenna is designed for the most challenging environments and meets IP67-standard requirements. The S321+ comes in two versions, with 4G LTE optimized for either North American or international locations.

Powered by Athena GNSS engine, the S321+ provides best-in-class, centimeter-level RTK. Athena excels in virtually every environment where high-accuracy GNSS receivers can be used. Tested and proven, Athena's performance with long baselines, in open-sky environments, under heavy canopy, and in geographic locations experiencing significant scintillation is nothing short of cutting edge.

The S321+ is the ideal positioning system for use in applications such as land or marine survey, GIS, mapping, and construction. Together with SureFix™, Hemisphere's advanced processor, the S321+ delivers high-fidelity RTK quality information that results in guaranteed precision with virtually 100% reliability.



## Athena RTK

The S321+ receiver is powered by the Athena RTK technology. With Athena, S321+ provides state-of-the-art RTK performance when receiving corrections from a static base station or network RTK correction system. With multiple connectivity options, the S321+ allows for RTK corrections to be received over radio, cell, modem, Wi-Fi, Bluetooth, or serial connection. S321+ delivers centimeter-level accuracy with virtually instantaneous initialization times and cutting-edge robustness in challenging environments.

Athena RTK (Real Time Kinematic) technology is available on Eclipse-based GNSS receivers. Athena RTK requires the use of two separate receivers: a stationary base station that broadcasts corrections over a wireless link to the rover. The localized corrections are processed on the rover to achieve superior accuracy and repeatability. Performance testing has shown exceptional positioning accuracy even in harsh environments.

Athena RTK has the following benefits:

- **Improved Initialization time** - Performing initializations in less than 15 seconds at better than 99.9% of the time
- **Robustness in difficult operating environments** - Extremely high productivity under the most aggressive of geographic and landscape oriented environments
- **Performance on long baselines** - Industry-leading position stability for long baseline applications

## Atlas L-band

The S321+ receiver also enables users to work with the Atlas service. Atlas is Hemisphere's industry leading global correction service, which can be added as a subscription to the S321+.

The Atlas system delivers world-wide centimeter-level correction data over L-band communication satellites. With Atlas, S321+ users are able to experience sub-decimeter positioning performance anywhere on earth, without the need to be near a GNSS or communication infrastructure.

With Atlas, the positioning accuracy does not degrade as a function of distance to a base station, as the data content is not composed of a single base station's information, but an entire network's information.

Atlas L-band has the following benefits:

- **Positioning accuracy** - Competitive positioning accuracies down to 2 cm RMS in certain applications
- **Positioning sustainability** - Advanced position quality maintenance in the absence of correction signals, using Hemisphere's patented technology

The S321+ is supported by our easy-to-use Atlas Portal ([www.atlasgnss.com](http://www.atlasgnss.com)), which empowers you to update firmware and enable functionality, including Atlas subscriptions for accuracies from meter to sub-decimeter levels.

For more information about Athena RTK, see: <https://hemispheregnss.com/Technology> For more information about Atlas L-band, see: <https://hemispheregnss.com/atlas>

**⚠ WARNING:** If your S321+ is equipped with a 400 MHz radio, you may be required to obtain a valid radio license for your jurisdiction.

## aRTK Position Aiding

aRTK is an innovative feature available in Hemisphere's S321+ smart antenna that greatly mitigates the impact of land-based communication instability. Powered by Hemisphere's Atlas L-band system service, aRTK provides an additional layer of communication redundancy to RTK users, assuring that productivity is not impacted by intermittent data connectivity.

S321+ receives the aRTK augmentation correction data over satellite, while also receiving the land-based RTK correction data. With this, the receiver internally operates with two sources of RTK correction, creating one additional layer of correction redundancy as compared to typical RTK systems. Once that process is established (which takes as less than a few seconds), the receiver is able to operate in the absence of either correction source, or in other words, the receiver is able to continue generating RTK positions in case the land-based RTK correction source becomes unavailable for a period of time.

## SureFix™ RTK Position

To provide high fidelity quality indicators to the users, Hemisphere created an additional processor that runs in combination with the RTK engine, called the SureFix™ processor. The SureFix™ processor takes several inputs, such as GNSS data, data preprocessing results, and generated RTK solutions. The SureFix™ processor takes all available information and, by using functional and stochastic analysis methods, determines the quality of the current RTK engine solution. These are shown as “SureFix™ quality indicators”. The SureFix™ indicators are then combined with the RTK solution before being provided to the user. At the end of the process, the user has access to high fidelity information about the quality of the RTK solution.

## What’s Included

As per Table 1.1 below, the S321+ is available in a variety of kits, with supplementary products sold as “controller/option kits”, “accessory kits” or simply as separate accessories. Contents can change without prior notice. Check the official price list to confirm contents.

**Important: Charge your Li-on battery upon receipt of shipment.** According to the 2017 IATA Dangerous Goods Regulations and supplemental IATA Lithium Battery Guidance, batteries must be charged to less than 30% to meet international air freight requirements.

**Table 1-1: S321+ parts list**

Main Kits	Part Number	940-2180-10 S321+ (NA) Kit	940-2181-10 S321+ (Int'l) Kit
S321+ (NA) Smart Antenna	752-0020-10	1	-
S321+ (Int'l) Smart Antenna	752-0021-10	-	1
Power Cable (Alligator Clips)	054-0171-0	1	1
Power Cable (Receiver)	054-0178-0	1	1
UHF Antenna	150-1024-0	1	-
GPRS/900MHz Antenna	150-1029-0	1	1
3-Cell Battery	427-0058-0	2	2
Battery Charger Adapter	427-0060-0	1	1
Battery Charger	427-0063-0	1	1
Cigarette Lighter Adapter	427-0064-0	1	1
Quick Release	699-0015-0	1	1
Tape Measure	699-0015-0	1	1
Carry Case	750-0183-1	1	1

Accessory Kits	Part Number	940-2155-0 Base Acc	940-2156-0 Rover Acc	Accessory Only
5-pin Power Cable (PacCrest/Rcvr)	054-0172-0	-	-	1
5-pin Power Cable (Satel/Rcvr)	054-0173-0	-	-	1
5-pin Power Cable (Serial/Rcvr)	054-0180-0	-	-	1
UHF Antenna (TNC)	150-1026-0	1	-	-
Mini Rotary Table	699-0014-0	-	1	-
External UHF Antenna Bracket Kit	710-0136-0	1	-	-
Controller/Option Kits	Part Number	940-2149-0 Cntrlr (NA)	940-2150-0 Cntrlr (EU)	940-2165-0 Int'l Option
Carlson SurvCE v5 (w/ NA)	750-2022-0	1	-	-
Carlson SurvCE v5 (w/o NA)	750-2023-0	-	1	1
Athena dFreq RTK Bundle*	163-1045-0	-	-	1

\* feature activation

## **Chapter 2: Installation**

Ports and Connections

Installing /Connecting S321+

Installing UHF and GSM Antennas

Installing S321+ on a Tribach

Installing S321+ on a Range Pole

Connecting to a Power Source

Connecting to an External Device

Powering the S321+ On/Off

Inserting and Removing the MicroSD/SIM Card

Resetting the S321+



## Installation

### Ports and Connections

All ports and connections are located on the bottom of the unit, as shown in Figure 2-1. Table 2-1 provides additional information about each port/connection.



**Figure 2-1: S321+ ports and connectors**

**Table 2-1: S321+ ports and connections**

Port	What to connect
7-pin Diagnostic Port (LEMO)	Diagnostic cable for serial or USB
5-pin Power/Data Port (LEMO)	External Power, data and radio devices
GSM Antenna Connector	External GSM antenna
UHF Antenna Connector	External UHF antenna
Mounting hole	Pole or tripod mount

## Installing/Connecting S321+

### Installing Batteries

The S321+ comes standard with two long-life lithium batteries (see [What's Included](#)) providing up to 12 hours of operation. The batteries are hot-swappable, and may be changed while working, maximizing your efficiency and ROI. **Note:** Batteries should be changed within 30 seconds.

The S321+ allows for one battery (11.1 V - 37.74 Wh) to be installed at a time.

When installing a battery, ensure the contact points are facing up towards the “Hemisphere” logo. Slide the battery into the designated spot until the “battery tension bar” clicks into place.



Figure 2-2: Battery installation

### Installing UHF and GSM Antennas

To install the UHF portion of the S321+ antenna, locate the UHF antenna (150-1024-0) from the kit list under [“What's Included”](#). Insert the connector end of the UHF antenna and rotate clockwise to secure the antenna to the S321+. To install the GSM portion of the S321+ antenna, locate the GSM antenna (150-1023-0) from the kit list under [“What's Included”](#). Insert the connector end of the GPRS antenna and rotate clockwise to secure the antenna to the S321+.



**Figure 2-3: Installing UHF and GSM antennas**

**Note:** Only one antenna (UHF or GSM) can be connected to the S321+ at a time.

## Installing S321+ on a Tribrach

The S321+ mounts flush to the tribrach, by securing the 5/8-11" female metal mounting portion of the S321+ to the standard 5/8-11" male portion of the tribrach. Hand-tighten (35-40 in-lbs. of torque) to secure the S321+ onto the mount in a clockwise rotation.



Figure 2-4: Installing S321+ on a tribrach

## Installing the S321+ on a Range Pole

Using the standard 5/8-11" mount on the bottom of the S321+, you can secure the unit to a field standard 5/8-11" range pole. The S321+ should be placed carefully on the range pole, to ensure cross-threading does not occur, while rotating the unit in a clockwise direction. Hand-tighten (35-40 in-lbs. of torque) to secure the unit.



Figure 2-5: Range pole installation

## Connecting to a Power Source

The S321+ has two main power sources. The first being an internal, removable battery described in the earlier portion of this chapter. The second source of power is the external power cable (054-0171-0). The 5-pin (LEMO) connector allows 9 to 24V of power into the S321+.



Figure 2-6: External power connector

### Connecting to an External Device

The 7-pin connector is available for diagnostics.



Figure 2-7: Diagnostic connector

### Using the Device “FN” and “I” Keys

The on-device menu can be navigated by using the on-device keys. The FN key allows you to scroll through each item on the device menu display. The I key acts as an enter key for selecting to required menu option. The I key also acts as a power key when the menu option of “power” is selected. (See “Powering the S321+ on/off” below).



Figure 2-8: S321+ On-Device menu

## Powering the S321+ On/Off

The S321+ has a power-on/off the receiver function and a confirm function.

- **Power-on receiver:** Press **I** key for 1 second, the device will beep three times.
- **Power-off receiver:** Press **I** key for 0.5 seconds to navigate to the main menu screen. Once on the main menu screen push the **FN** key to work the menu box to the **I** icon. When the box is located over the **I** icon, press the **I** key for 0.5 seconds to turn the device off.

**Note:** If you hold the “I” button for longer than 0.5 seconds, the device goes into self-check mode. (See “Self-Check” below for more information).

**Self-Check:** Self Check is a procedure for verifying the correct working of the instrument devices. The program is mainly to predict whether the receiver modules works normal ahead of time or not. The self-checking includes status reviews of GPS, Wi-Fi, Bluetooth, radio, network and sensor, a total of six parts.

## Inserting and Removing the MicroSD Card/SIM Card



**Caution:** Use electrostatic discharge (ESD) protection, such as by wearing an ESD strap that is attached to an earth ground before inserting or removing the SIM card on the S321+. If an ESD strap is not available, then touch a metal object prior to accessing the SIM card holder.

The MicroSD card and the SIM card are only accessible by first opening the battery door, where:

- The “SIM” card slot is positioned on the left side of the battery opening
- The “SD” card slot is positioned on the right side of the battery opening

To remove the MicroSD card or SIM card:

1. Open the battery door.
2. Gently push the card in; it will then snap back and slightly out.
3. Remove the card.

**Note:** When you insert either card make sure the contacts on the card are facing upwards, towards the top of the unit and the side of the card with the notch first.

To insert the MicroSD card or SIM card:

1. Place the card in its appropriate card slot.
2. Gently push the card in until it clicks.
3. Close and secure the battery door.



**Figure 2-9: MicroSD/SIM card slot**

## Resetting the S321+

To reset the S321+, lift the battery door and locate the “Reset” button between the SIM card and MicroSD slots. The reset button will turn the unit off and automatically restart the unit.



Figure 2-10: S321+ Reset button



## **Chapter 3: Setup and Configuration**

Control Panel Overview

Setting up the S321+

Installing the Base

Installing the Rover

Bluetooth Communication

Hemisphere WebUI

WebUI Settings

Firmware Update

How to Download Static Data

How to Calibrate S321+ Sensors

## Setup and Configuration

### Control Panel Overview

You can operate the S321+ using the control panel shown below.



Figure 3-1: Control Panel and display

#### Satellite LED (Green)

The LED illuminates and stays a solid green color to indicate a signal/satellite lock has been achieved.



Figure 3-2: Satellite LED

#### Static LED (Green)

The Static LED switches on if the static mode is selected and it starts to blink when the receiver is recording data, with the same frequency of the sample rate.



**Figure 3-3: Static LED**

**Bluetooth LED (Blue)**

Once you have connected the receiver with the data controller, this LED illuminates.



**Figure 3-4: Bluetooth LED**

### Wi-Fi LED (Green)

This indicates the S321+ is emitting a Wi-Fi network and is ready to be paired with a Wi-Fi enabled controller or device. By connecting to the S321+ device network, you can control the S321+ via WebUI. For more information on the WebUI, please see section [WebUI](#).



Figure 3-5: Wi-Fi LED

### External Data Link or Internal UHF Radio LED (Green)

The LED is green when the device is selected as an RTK data link, via an external data link or an internal UHF radio link. It begins blinking when the S321+ is either transmitting data as a base, or receiving data as a rover.



Figure 3-6: Internal UHF Radio LED

### Network LED (Green)

The light is on when the network module is selected as RTK data link. It starts to blink when receiving and transmitting data. (Download in rover mode and upload in base mode).



Figure 3-7: Network LED




















### Power

Includes two modes of function:

1. LED Display On: Power supply is functioning at full capacity
2. Blinking LEDs and Beeping: Very low power (below 10%)

When the power is below 10%, the LEDs will flash according to sample interval (default is 1 second) and you hear three beeps every 60 seconds.

**Table 3.1: Definition of icons on the S321+ menu**

Type	Icon	Explanation
Operating mode		Rover mode
		Base mode
		Static mode
Power status		Full battery power or external power supply
		Battery power remaining $\frac{3}{4}$
		Battery power remaining $\frac{2}{4}$
		Battery power remaining $\frac{1}{4}$
		The battery needs to be replaced
Date status		The Rover station is receiving differential
		The base station is transmitting differential
Date link		UHF, number in right corner indicating the channel
		GPRS module
		External Data Link
		Bluetooth data link
Difference type		RTCM3.2
		RTCM 3.0
		RTCM 2.3
		CMR
		DGPS

## S321+ Menu Structure and Information

    		
Mo	Sats 00	ST
re	PDOP 0.00	OP
2016-01-20 18:31		

### Home Page

E	0°00'00.000"
N	0°00'00.000"
H	0.000 m
LOC	RAW RTK STAT

### Coordinate Information

DiffType: RTCM32	
Datalink: NETWORK	
Sta.: No Sats	
LOC	RAW RTK STAT

### Current Data Link Status

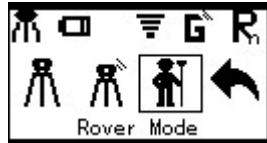
Ant.H.: 0.000 m	
Interval: 2S	
Free: 2750.2M	
LOC	RAW RTK STAT

### File Information

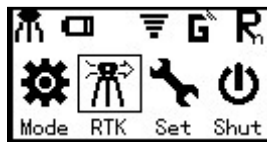
Mode: Base	
Bat: 49 %	
CSQ: 24 %	
LOC	RAW RTK STAT

### Device Status

## Operating Mode Settings



### Switch Operating Modes



### Switch Data Link

## General Settings



### Wi-Fi



### Backlight



### Language



## Setting up the S321+

The following figure shows a typical setup for both a base station unit and a rover unit (tripod and pole mount not included, data collect is optional).

The antenna is connected to the bottom of the unit; you have the option of attaching the antenna to the antenna bracket, so the antenna faces upward.



**Figure 3-8: Base and Rover setup**

### Installing the Base

1. Put a tripod on a location with known coordinates or unknown coordinates, attach the receiver to the tribrach.
2. Attach the transmitting radio antenna into the port “UHF”: using the 40cm supporting pole is better, since increases the height of the antenna.
3. Switch on the receiver and select the base working mode.

### Installing the Rover

1. Fix the bracket on the pole, fix the hand-held to the bracket, put the rover on the pole and attach the receiving antenna into the port “UHF”.
2. Power-on the receiver and select the rover working mode.
3. Open the hand-held and start the software, then you can set the instruments.

## Bluetooth Communication

If you have a Bluetooth-enabled device, such as a data collector, you can wirelessly communicate with the S321+.

When you attempt to connect the S321+ to a Bluetooth-enabled device, such as a hand-held data collector, the following S321+ Bluetooth information appears on the device:

S321XXXXXX

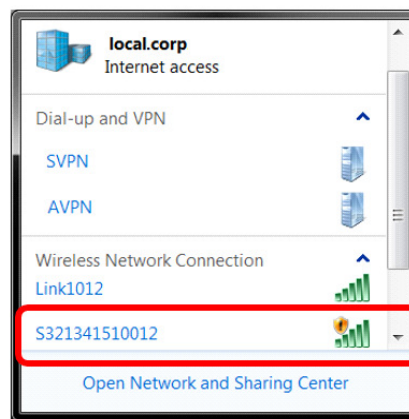
where "XXXXXX" is the serial number

## Hemisphere WebUI

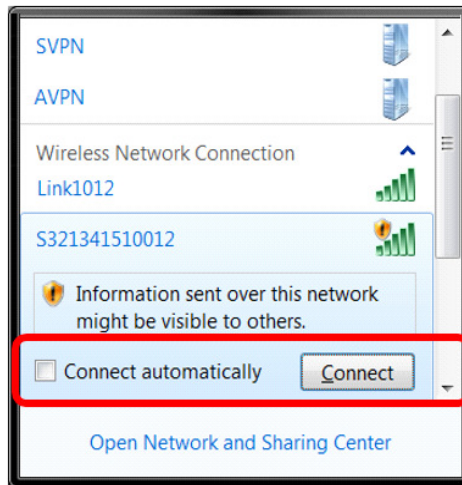
The WebUI can work on any PC, Tablet, or Phone that has Wi-Fi network capabilities.

### Initial Setup

Using the Windows Wi-Fi network, locate the Wireless Network Connection labeled S321XXXXXXXXXX.



If you want this network to automatically connect, select the **“Connect automatically”** check box before pushing the **“Connect”** button. If not, click on the **“Connect”** button.



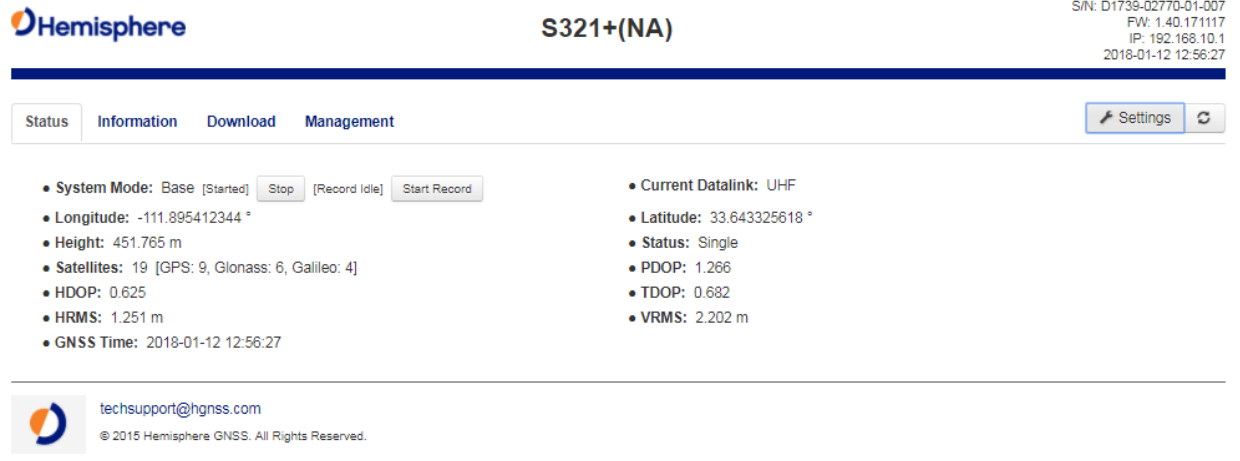
Once connected to your device. Type or copy the following IP address into your URL bar:  
<http://192.168.10.1/>

The WebUI will prompt you for a user name and password. The default user name and password are:

- User Name: admin
- Password:s321

## WebUI Start-up

The “**Status**” tab, provides general GNSS information including System mode, Latitude, Longitude, and Height.

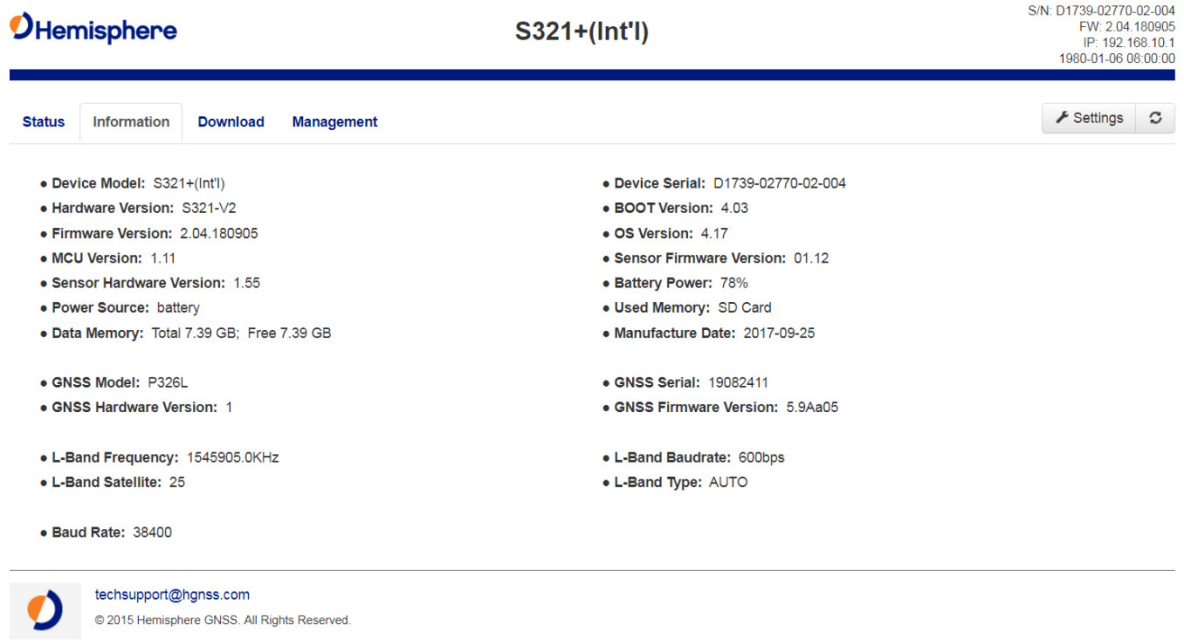


The screenshot shows the Hemisphere S321+(NA) WebUI interface. At the top right, the device information is displayed: S/N: D1739-02770-01-007, FW: 1.40.171117, IP: 192.168.10.1, and 2018-01-12 12:56:27. The main navigation bar includes 'Status', 'Information', 'Download', and 'Management', with 'Settings' and a refresh icon on the right. The 'Status' tab is active, showing the following data:

- System Mode: Base [Started] [Stop] [Record Idle] [Start Record]
- Longitude: -111.895412344 °
- Height: 451.765 m
- Satellites: 19 [GPS: 9, Glonass: 6, Galileo: 4]
- HDOP: 0.625
- HRMS: 1.251 m
- GNSS Time: 2018-01-12 12:56:27
- Current Datalink: UHF
- Latitude: 33.643325618 °
- Status: Single
- PDOP: 1.266
- TDOP: 0.682
- VRMS: 2.202 m

At the bottom, there is a contact link for techsupport@hgss.com and a copyright notice: © 2015 Hemisphere GNSS. All Rights Reserved.

The “**Information**” tab contains device and module information, in addition to current software and firmware versions.

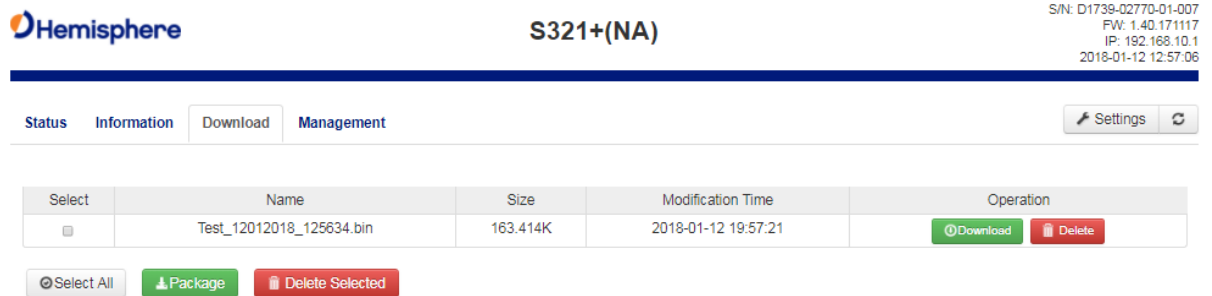


The screenshot shows the Hemisphere S321+(Int'l) WebUI interface. At the top right, the device information is displayed: S/N: D1739-02770-02-004, FW: 2.04.180905, IP: 192.168.10.1, and 1980-01-06 08:00:00. The main navigation bar includes 'Status', 'Information', 'Download', and 'Management', with 'Settings' and a refresh icon on the right. The 'Information' tab is active, showing the following data:

- Device Model: S321+(Int'l)
- Hardware Version: S321-V2
- Firmware Version: 2.04.180905
- MCU Version: 1.11
- Sensor Hardware Version: 1.55
- Power Source: battery
- Data Memory: Total 7.39 GB; Free 7.39 GB
- Device Serial: D1739-02770-02-004
- BOOT Version: 4.03
- OS Version: 4.17
- Sensor Firmware Version: 01.12
- Battery Power: 78%
- Used Memory: SD Card
- Manufacture Date: 2017-09-25
- GNSS Model: P326L
- GNSS Hardware Version: 1
- GNSS Serial: 19082411
- GNSS Firmware Version: 5.9Aa05
- L-Band Frequency: 1545905.0KHz
- L-Band Satellite: 25
- L-Band Baudrate: 600bps
- L-Band Type: AUTO
- Baud Rate: 38400

At the bottom, there is a contact link for techsupport@hgss.com and a copyright notice: © 2015 Hemisphere GNSS. All Rights Reserved.

The “**Download**” tab allows you to log and review multiple data files from the on-board memory of the device.



S/N: D1739-02770-01-007  
FW: 1.40.171117  
IP: 192.168.10.1  
2018-01-12 12:57:06

Status Information **Download** Management Settings

Select	Name	Size	Modification Time	Operation
<input type="checkbox"/>	Test_12012018_125634.bin	163.414K	2018-01-12 19:57:21	<a href="#">Download</a> <a href="#">Delete</a>

[Select All](#) [Package](#) [Delete Selected](#)

The “**Management**” tab provides access to the firmware update tools, a terminal to register authorization codes, and password customization to properly secure your device moving forward.

### **Install New Firmware**

This feature allows you to update the menu application software. Once the correct software is selected under the Choose File browser, the Upload File button initiates the update procedure and re-starts the S321+ device.

### **GNSS Registration**

This displays the expiration date of different features which have been subscribed to the S321+.

The Atlas expiration date will be displayed under this field. In addition, the ability to update the S321+ with new subscriptions is available under the “AuthCode” field. Type the new Atlas code and the device will automatically update.

### **Security**

The Security field allows the user to enable or disable login requirements. The user can reset or customize a new password for their device. By filling in the required fields to change the password, Old Password, New Password and Confirm Password.

### **View Logs**

The View Logs field allows you to track any activity at the application and OS level. (This is important when troubleshooting any issues.)

## Formatting / Self Test / Reset:

### Install New Firmware

No file chosen

### GNSS Registration

GNSS Functionality: 475;C60;12/31/2019;0;OPT=-;20Hz;RTK;RAW\_DATA;L2\_L5;MULTI\_GNSS;ATLAS\_LBAND;ATLAS\_10cm

Auth Code

### Security

Enable Login Authentication

Old

Password:

New

Password:

Confirm

Password:

### View Logs

1. APP Log

2. OS Log

Format Internal Disk

Self Test

Restore Factory Settings

Reset

The **Format Internal Disk** button allows you to reformat the internal hard drive in the S321+.

**Self test** provides an application review to ensure the device functioning properly (See self-check for more information).

**Restore Factory Settings** returns the S321+ to all default settings and perform a full power cycle.

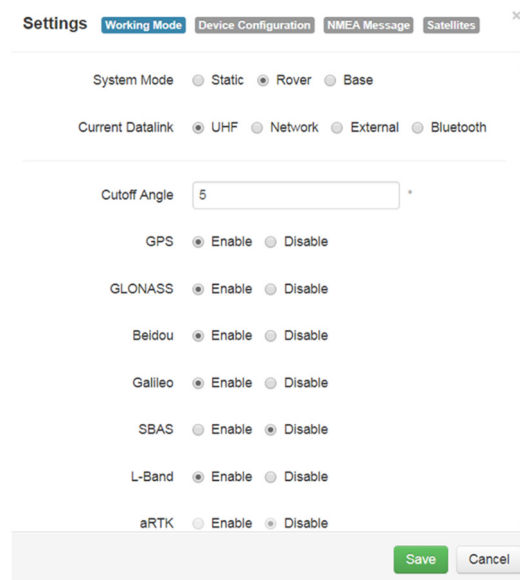
**Reset** initiates a complete device shut down, creating a hard reset to the device and stopping any application activity. (See [Resetting the S321+](#) for more information).

## WebUI Settings

### Working Mode: UHF

When using a UHF datalink, channel tables must be configured by a certified Hemisphere GNSS dealer, or by uploading a channel table file provided by a dealer.

**Important:** The Advanced UHF Settings can only be accessed by Hemisphere GNSS or certified Hemisphere GNSS dealers.



The screenshot shows the 'Settings' window with the 'Working Mode' tab selected. The 'System Mode' is set to 'Rover'. The 'Current Datalink' is set to 'UHF'. The 'Cutoff Angle' is set to 5. The 'GPS', 'GLONASS', 'Beidou', and 'L-Band' options are enabled, while 'SBAS' and 'aRTK' are disabled. There are 'Save' and 'Cancel' buttons at the bottom right.

- **Cutoff Angle:** satellites at a lower angle to the horizon than “5” are not used in the GNSS solution
- **GLONASS:** Enable or Disable the use of GLONASS satellites
- **Beidou:** Enable or Disable the use of Beidou satellites
- **Galileo:** Enable or Disable the use of Galileo satellites
- **SBAS:** Enable or Disable the use of SBAS for DGNSS corrections
- **L-Band:** Enable to use Atlas corrections or aRTK
- **Atlas Frequency:** If using Atlas, set to ‘Auto’ to automatically tune to the correct frequency, or manually tune to the correct frequency.



- **Atlas Datum:** if receiving Atlas corrections, you can use the ITRF08 datum, the GDA94 datum, or input custom X, Y, Z offsets. NOTE: this only affects Atlas positions
- **RTK Timeout:** this field indicates the amount of time an RTK correction will continue to be used after RTK corrections are lost. (**Note:** If using aRTK, the L-band needs to be set to Enable and RTK Timeout should be set to 2700.)

### System Modes

The S321+ can be configured as a Survey Rover, Base Station, or run a Static Observation.

The Base Position must be configured. Select **Base**, under System Mode, the following dialogue appears:



Automatically Start Base  NO  YES

Data Type

Site ID

Pdop Threshold  [1-99]

Base Position  Single  BaseLink  Repeat Position

- **Automatically Start Base:** Set to **Yes** if the S321+ should automatically begin broadcasting RTK upon startup. If set to **No**, you must manually start the base every time the unit is powered on.
- **Data Type:** Broadcast RTK via RTCM 2.3 (DGNSS), RTCM 3.0, RTCM 3.2, CMR, CMR+, or ROX (Hemisphere proprietary message format).
- **Site ID:** Base station ID
- **Pdop Threshold:** Only transmit RTK if the PDOP of the base station is less than this value.

To set the base location select one of the following:

- **Single:** Upon startup, the S321+ will average its position, and use that position for the base position
- **Repeat Position:** is used to input a permanent base station position into the S321+. You may type in a latitude, longitude, and altitude, or click “**Current Position**” to automatically populate the field with the current GNSS position
- **BaseLink:** (Upcoming feature) this feature requires an Atlas H10 (10-centimeter) subscription. Input a Target Accuracy. Once the accuracy of the GNSS position of the receiver has reached the Target Accuracy, the receiver will begin to output RTK based on its calculated position. The accuracy of the GNSS position may continue to improve. If it does improve, a new target accuracy may be entered, and the base position will shift to reflect the new accuracy

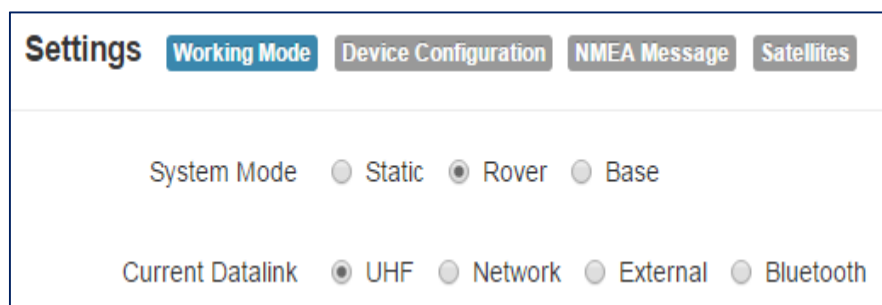


## Data Links

The S321+ supports the sending and receiving of RTK via the Internal UHF radio, external devices (such as an external radio) via serial, TCP/IP, NTRIP, and Bluetooth (rover only).

## Internal UHF

Your S321+ comes without a channel table loaded. Only Hemisphere GNSS or a Hemisphere GNSS certified dealer can create the file to upload a channel table.

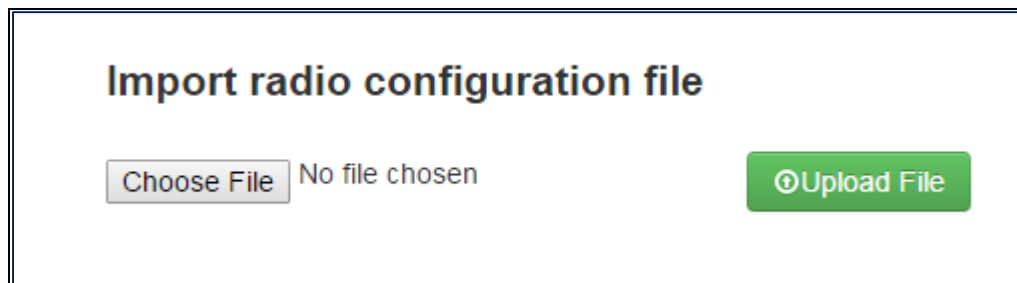


A channel table can be created through the WebUI by a certified Hemisphere GNSS dealer by clicking on **Advanced UHF Settings** and typing a password.

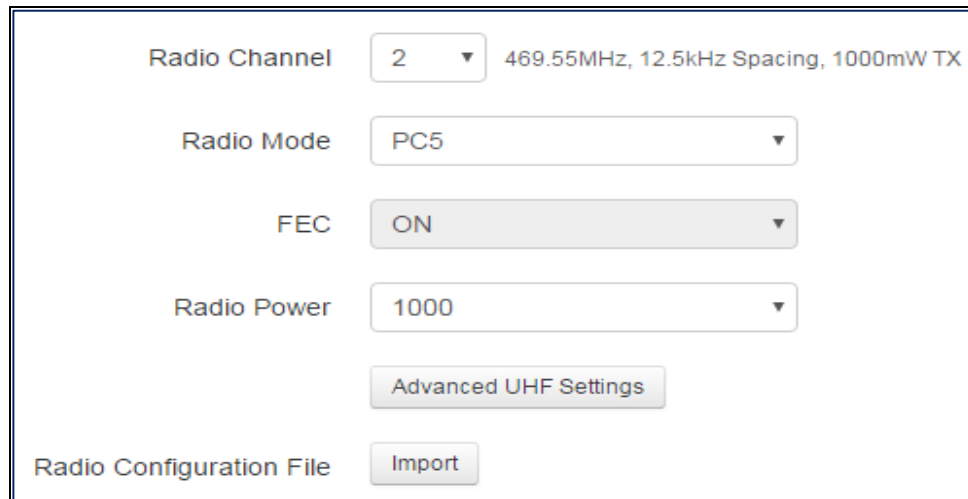
You can also upload by clicking **Import** next to **Radio Configuration File** and uploading a channel table file (.ucf) provided by your dealer.

**Note:** The radio frequency should match the transmitting base.

The following dialogue appears:



Next to **Data Link** select **UHF**. The following dialogue appears at the bottom of the page.



The screenshot shows a configuration dialog box with the following fields and buttons:

- Radio Channel:** A dropdown menu showing '2' with a small downward arrow. To its right, the text '469.55MHz, 12.5kHz Spacing, 1000mW TX' is displayed.
- Radio Mode:** A dropdown menu showing 'PC5' with a small downward arrow.
- FEC:** A dropdown menu showing 'ON' with a small downward arrow.
- Radio Power:** A dropdown menu showing '1000' with a small downward arrow.
- Advanced UHF Settings:** A button with a light blue background and rounded corners.
- Radio Configuration File:** A label followed by an **Import** button with a light blue background and rounded corners.

- **Radio Channel:** Select a channel from the channel table provided by your dealer. The frequency, bandwidth, and transmit power (base only) is shown next to the channel
- **Radio Mode:** The S321+ supports PacCrest protocols (GMSK and 4-FSK modulation), Satel protocols, and Trimtalk protocols. For a full list of protocols, with descriptions (FEC, Scrambling, over the air link rate, and modulation), please refer to [Appendix C](#).
- **FEC:** Forward Error Corrections
- **Radio Power:** Transmit RTK corrections at 100mW, 200mW, 500mW, or 1W (dependent upon the radio settings and restrictions provided by your dealer). This feature is only displayed when running as a base.

### External

If you wish to send RTK corrections out of the serial port (such as to an external UHF radio) instead of to the Internal UHF radio, as explained above, select **External** next to “Current Datalink.”

Select the **baud rate** of the external device, and plug that device into 5-pin serial port. (Baud rates range from 9600 bps – 115200 bps.)



The screenshot shows a single dropdown menu with the label 'External Serial Port Baud Rate' and the value '38400' selected.

The part numbers for the 5-pin cable are as follows:

**Table 3-1: S321+ 5-pin cables**

5-pin cable	Part Number
S321+ Power Cable (Alligator Clips)*	054-0171-0
S321+ Power Cable (PacCrest/Rcvr)	054-0172-0
S321+ Power Cable (Satel/Rcvr)	054-0173-0
S321+ Power Cable (Serial/Rcvr)**	054-0179-0

\*The above cables come with unterminated power and communication. The alligator clips cable connects to the other cables. Three variations of the cable exist: one variation has a connector (serial) to plug into Pacific Crest radios. The second variation has a connector to plug into Satel radios. The third variation has a standard DB9 connector. Please see a certified Hemisphere GNSS dealer to ensure that the pinout of these connectors matches the pinout of your radio.

\*\*Most radios may require a null-modem adapter.

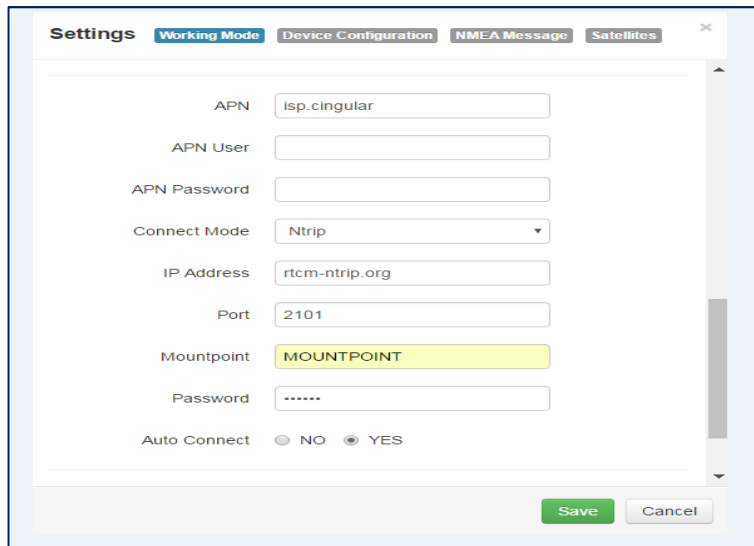
## Network

The S321+ supports TCP/IP connections for direct connection between base and rovers via cellular as well as NTRIP.

### NTRIP

NTRIP requires a specific IP address, username and password. When used as a base, the S321+ is an NTRIP server.

Type your **APN User name**, **APN Password**, **IP address**, **Port**, and **Mountpoint**. If a username and password is not required for your APN, you can leave those fields blank. The configuration of NTRIP for a Base is shown below:



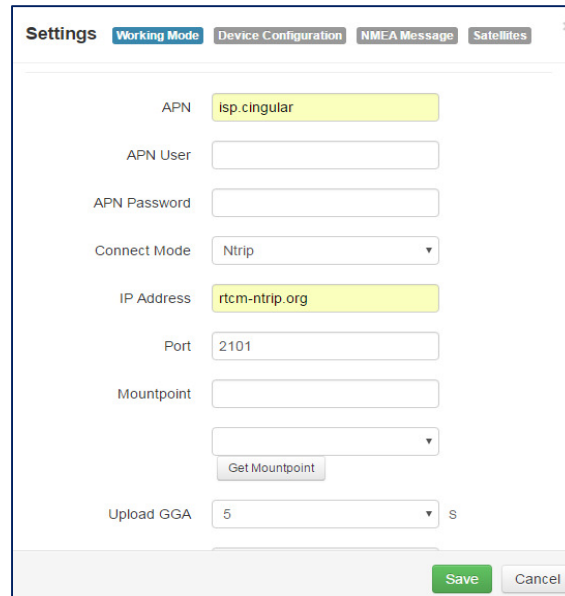
If configuring NTRIP for a Rover, click **Get Mountpoint** to generate a list of available mount points.

Some networks require a GNSS position prior to sending RTK. To send GNSS positions to the network, click on the dropdown menu next to **Upload GGA** and select a rate.

**Note:** The **Auto Connect** identifies that the receiver connects to the network when powered up.

**WARNING:** If the S321+ has not yet established an internet connection via the Internal GSM modem, the **Get Mountpoint** button will not work. You can configure the APN settings while using TCP/IP so that an internet connection is established.

After establishing an internet connection, change **Connect Mode** back to **NTRIP** and proceed with the configuration.



The screenshot shows a 'Settings' window with a 'Device Configuration' tab selected. The configuration fields are as follows:

- APN:
- APN User:
- APN Password:
- Connect Mode:
- IP Address:
- Port:
- Mountpoint:
- Mountpoint dropdown:
- Get Mountpoint:
- Upload GGA:  s

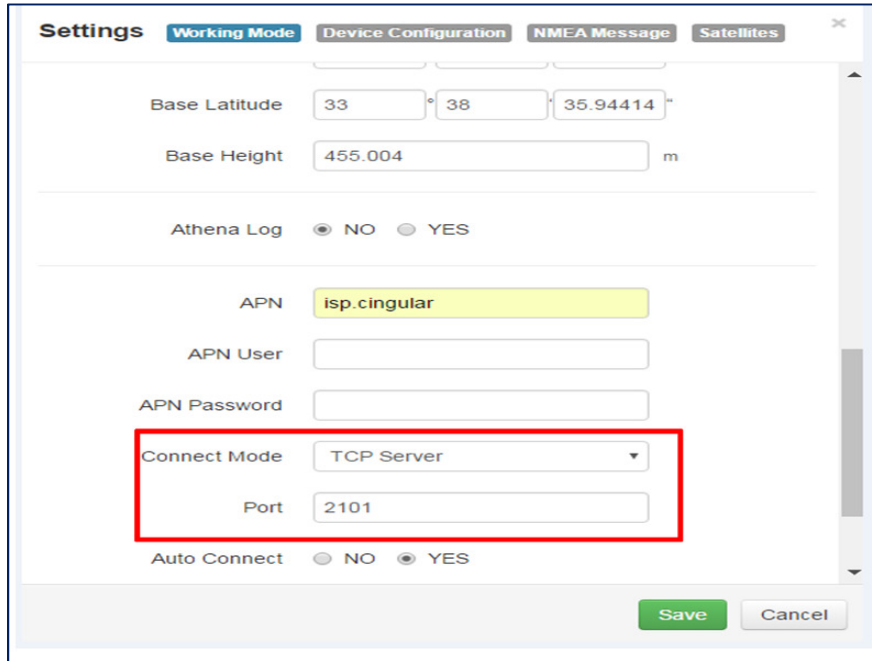
At the bottom right, there are 'Save' and 'Cancel' buttons.

## TCP/IP

If running as a base station, select **TCP Server** and type in a **Port**.

The TCP Server requires that the SIM card provide a public IP address. The public IP address can be found in the **“Information”** tab on the S321+ WebUI.

**Note:** The **Auto Connect** identifies that the receiver connects to the network when powered up.

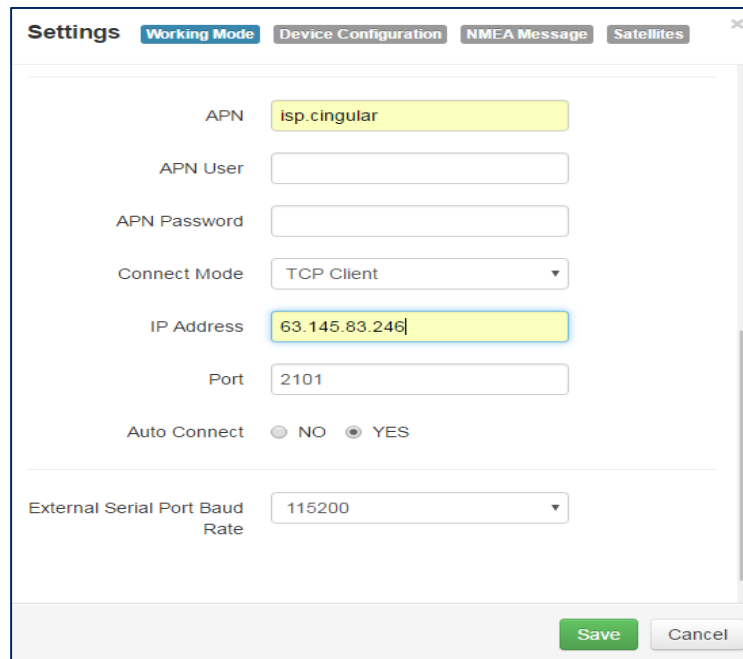


The screenshot shows the 'Settings' window with the 'Device Configuration' tab selected. The 'Connect Mode' dropdown menu is set to 'TCP Server' and is highlighted with a red box. The 'Port' field is set to '2101'. Other visible settings include 'Base Latitude' (33, 38, 35.94414), 'Base Height' (455.004 m), 'Athena Log' (NO), 'APN' (isp.cingular), 'APN User', 'APN Password', and 'Auto Connect' (YES).

Field	Value
Base Latitude	33 38 35.94414
Base Height	455.004 m
Athena Log	NO
APN	isp.cingular
APN User	
APN Password	
Connect Mode	TCP Server
Port	2101
Auto Connect	YES

If the S321+ is running as a rover, select **TCP Client** and type in the **IP address** and **Port** of the base.

**Note:** The IP address and Port of the base can be found under the “**Information**” tab of the base station.



The screenshot shows a 'Settings' dialog box with the following fields and options:

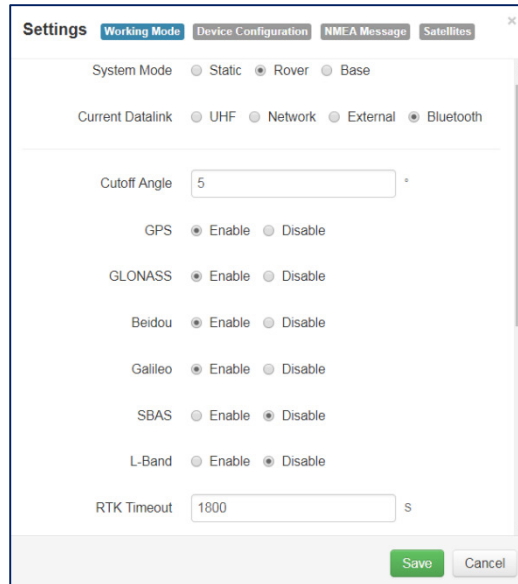
- APN:** isp.cingular
- APN User:** (empty text box)
- APN Password:** (empty text box)
- Connect Mode:** TCP Client (dropdown menu)
- IP Address:** 63.145.83.246 (text box)
- Port:** 2101 (text box)
- Auto Connect:**  NO  YES
- External Serial Port Baud Rate:** 115200 (dropdown menu)

Buttons at the bottom right: Save (green), Cancel (grey).



## Rover/Bluetooth

The Rover/Bluetooth is typically used with third-party software when streaming network corrections to the data collector internet and then sending them to the S321+ via the Bluetooth communication port.



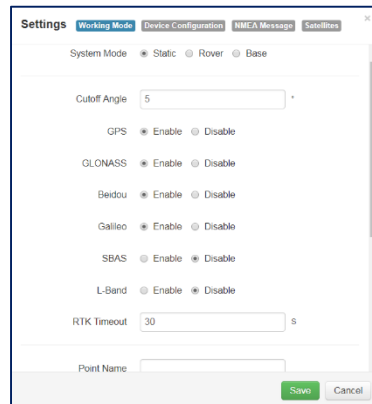
The screenshot shows a 'Settings' dialog box with the 'Device Configuration' tab selected. The 'System Mode' is set to 'Rover'. The 'Current Datalink' is set to 'Bluetooth'. The 'Cutoff Angle' is set to 5 degrees. The 'GPS', 'GLONASS', 'Beidou', and 'Galileo' options are all set to 'Enable'. The 'SBAS' and 'L-Band' options are both set to 'Disable'. The 'RTK Timeout' is set to 1800 seconds. There are 'Save' and 'Cancel' buttons at the bottom right.

Setting	Value
System Mode	Static <input type="radio"/> Rover <input checked="" type="radio"/> Base <input type="radio"/>
Current Datalink	UHF <input type="radio"/> Network <input type="radio"/> External <input type="radio"/> Bluetooth <input checked="" type="radio"/>
Cutoff Angle	5 °
GPS	Enable <input checked="" type="radio"/> Disable <input type="radio"/>
GLONASS	Enable <input checked="" type="radio"/> Disable <input type="radio"/>
Beidou	Enable <input checked="" type="radio"/> Disable <input type="radio"/>
Galileo	Enable <input checked="" type="radio"/> Disable <input type="radio"/>
SBAS	Enable <input type="radio"/> Disable <input checked="" type="radio"/>
L-Band	Enable <input type="radio"/> Disable <input checked="" type="radio"/>
RTK Timeout	1800 s

### Static

Use Static mode to take a static observation of a point, and stop logging (for both base and rover) if the position moves.

Select **Static** next to **System Mode** and configure the log file (to configure a file, refer to [Working Mode](#) for instructions).

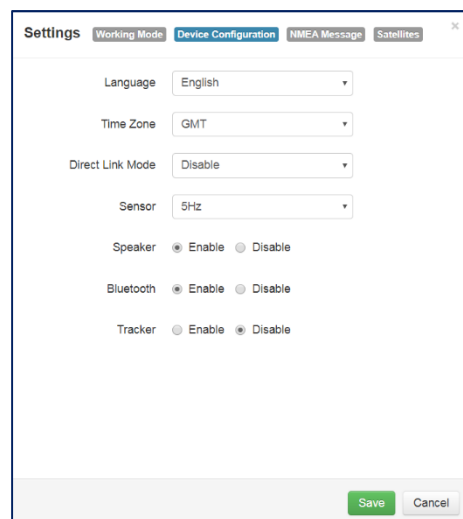


### Device Configuration

The “**Device Configuration**” tab allows for custom settings in terms of language, time zones, storage, and several other options.

When enabling the speaker, the S321+ relays the status of the positioning via voice updates. Specifically, the S321+ will audibly indicate when the receiver is in **Base** or **Rover** mode. Voice indication covers, logging data, and declaring when the S321+ has achieved RTK float and RTK fix. This is important when working in a low visibility environment.

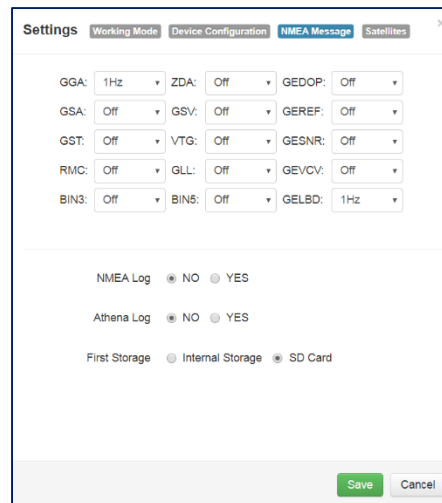
Direct Link Mode enables certain troubleshooting features for Hemisphere GNSS and certified Hemisphere GNSS dealers. In addition, the easy-to-use radio buttons allow you to use tracker and disable or enable Bluetooth. NOTE: Restore Factory Defaults re-enables Bluetooth



## NMEA Message

Turn the NMEA messages on.

**Note:** This function is only available if you have hardware version S321+-v1.1 (see “**Information**” tab) or higher, these messages will come out of the 5-pin serial port at the same baud rate as the External Serial Port Baud Rate (as shown above). This function cannot be used if you are using an external device for RTK.



Settings Working Mode Device Configuration **NMEA Message** Satellites

GGA: 1Hz ZDA: Off GEDOP: Off  
 GSA: Off GSV: Off GEREf: Off  
 GST: Off VTG: Off GESNR: Off  
 RMC: Off GLL: Off GEVCV: Off  
 BIN3: Off BIN5: Off GELBD: 1Hz

NMEA Log  NO  YES  
 Athena Log  NO  YES  
 First Storage  Internal Storage  SD Card

Save Cancel

- **NMEA Log:** Store the NMEA or binary messages that are turned on to the internal memory of the receiver or to an SD Card
- **First Storage:** Select if NMEA, binary, or Athena logs should be stored to the internal memory of the receiver or to an SD card
- **Athena Log:** Record raw data for converting to **Rinex** and post-processing. If “**Yes**” is selected, the following dialogue will display: Access the Rinex converter using the following hyperlink: <https://hemispheregnss.com/Resources-Support/Software>



Athena Log  NO  YES

Point Name

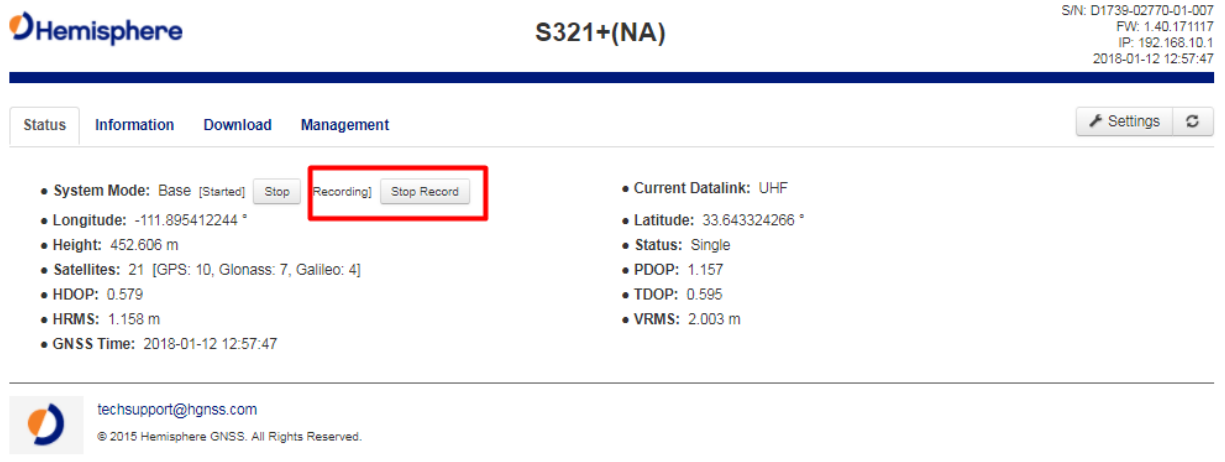
Antenna Height  mm

Pdrop Threshold  [1-99]

Interval

- **Point Name:** choose a name for the point that is occupied
- **Antenna Height:** type the height of the antenna in meters (**Note:** Older versions of firmware required millimeters (mm) as seen in the image. Please refer to the unit listed to the right-hand side of the field.)
- **Pdop Threshold:** data will not be logged if the Pdop of the receiver exceeds the user defined value (3.5 is the default value, but this can be changed.)
- **Interval:** log data at intervals of 30s, 15s, 5s, 1Hz, 2Hz, 5Hz, or 10Hz

While the receiver is logging data, the WebUI will display **[Recording]** next to **System Mode** under the **Status** tab. To stop recording, click **Stop Record**.

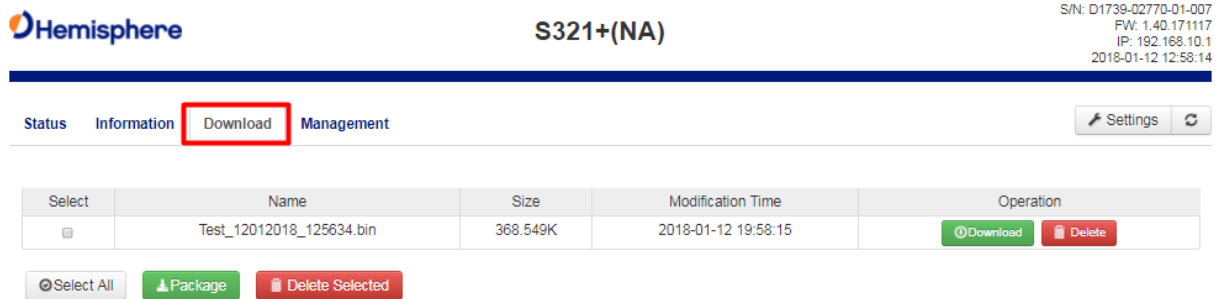


The screenshot shows the Hemisphere S321+(NA) WebUI interface. At the top right, device information is displayed: S/N: D1739-02770-01-007, FW: 1.40.171117, IP: 192.168.10.1, and 2018-01-12 12:57:47. The main navigation bar includes 'Status', 'Information', 'Download', and 'Management', with 'Status' selected. A 'Settings' button is visible on the right. The 'System Mode' section shows 'Base [Started]' with a 'Stop' button, and 'Recording' with a 'Stop Record' button. The 'Recording' button is highlighted with a red box. Other system details include Longitude: -111.895412244°, Height: 452.606 m, Satellites: 21 [GPS: 10, Glonass: 7, Galileo: 4], HDOP: 0.579, HRMS: 1.158 m, GNSS Time: 2018-01-12 12:57:47, Current Datalink: UHF, Latitude: 33.643324266°, Status: Single, PDOP: 1.157, TDOP: 0.595, and VRMS: 2.003 m. The footer contains the Hemisphere logo, techsupport@hgns.com, and © 2015 Hemisphere GNSS. All Rights Reserved.

To download the log, click the **“Download”** tab.

All logs stored on the S321+ internal hard drive will display.

Click **“Delete”** to delete the log.



The screenshot shows the Hemisphere S321+(NA) web interface. At the top right, system information is displayed: S/N: D1739-02770-01-007, FW: 1.40.171117, IP: 192.168.10.1, and 2018-01-12 12:58:14. The navigation tabs are Status, Information, **Download** (highlighted with a red box), and Management. There are also Settings and Refresh buttons. Below the tabs is a table with the following data:

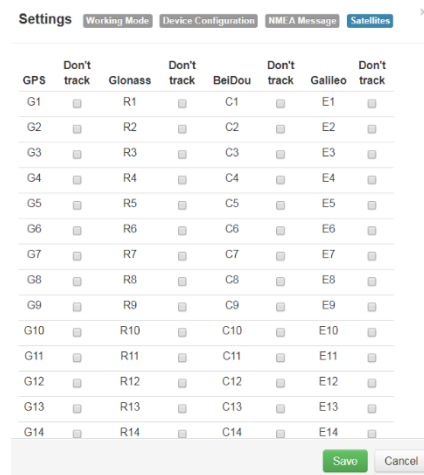
Select	Name	Size	Modification Time	Operation
<input type="checkbox"/>	Test_12012018_125634.bin	368.549K	2018-01-12 19:58:15	<input type="button" value="Download"/> <input type="button" value="Delete"/>

Below the table are three buttons: , , and .

Multiple logs can be downloaded or deleted at one time by selecting the box next to each of the logs and clicking **Package** or **Delete Selected**.

### Satellites

If you wish to exclude a specific satellite, select the **Don't track** checkbox next to that satellite in the list.



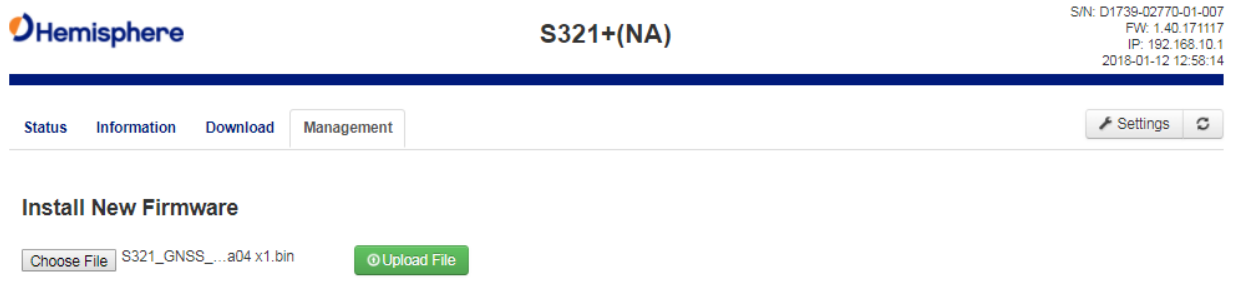
The screenshot shows the 'Settings' window with the 'Satellites' tab selected. The window contains a table for configuring satellite tracking:

GPS	Don't track	Glonass	Don't track	BeiDou	Don't track	Galileo	Don't track
G1	<input type="checkbox"/>	R1	<input type="checkbox"/>	C1	<input type="checkbox"/>	E1	<input type="checkbox"/>
G2	<input type="checkbox"/>	R2	<input type="checkbox"/>	C2	<input type="checkbox"/>	E2	<input type="checkbox"/>
G3	<input type="checkbox"/>	R3	<input type="checkbox"/>	C3	<input type="checkbox"/>	E3	<input type="checkbox"/>
G4	<input type="checkbox"/>	R4	<input type="checkbox"/>	C4	<input type="checkbox"/>	E4	<input type="checkbox"/>
G5	<input type="checkbox"/>	R5	<input type="checkbox"/>	C5	<input type="checkbox"/>	E5	<input type="checkbox"/>
G6	<input type="checkbox"/>	R6	<input type="checkbox"/>	C6	<input type="checkbox"/>	E6	<input type="checkbox"/>
G7	<input type="checkbox"/>	R7	<input type="checkbox"/>	C7	<input type="checkbox"/>	E7	<input type="checkbox"/>
G8	<input type="checkbox"/>	R8	<input type="checkbox"/>	C8	<input type="checkbox"/>	E8	<input type="checkbox"/>
G9	<input type="checkbox"/>	R9	<input type="checkbox"/>	C9	<input type="checkbox"/>	E9	<input type="checkbox"/>
G10	<input type="checkbox"/>	R10	<input type="checkbox"/>	C10	<input type="checkbox"/>	E10	<input type="checkbox"/>
G11	<input type="checkbox"/>	R11	<input type="checkbox"/>	C11	<input type="checkbox"/>	E11	<input type="checkbox"/>
G12	<input type="checkbox"/>	R12	<input type="checkbox"/>	C12	<input type="checkbox"/>	E12	<input type="checkbox"/>
G13	<input type="checkbox"/>	R13	<input type="checkbox"/>	C13	<input type="checkbox"/>	E13	<input type="checkbox"/>
G14	<input type="checkbox"/>	R14	<input type="checkbox"/>	C14	<input type="checkbox"/>	E14	<input type="checkbox"/>

At the bottom of the window are 'Save' and 'Cancel' buttons.

## Firmware Update

### Updating Firmware via WebUI



The screenshot shows the Hemisphere S321+(NA) WebUI interface. At the top left is the Hemisphere logo. To its right is the device model "S321+(NA)". On the far right, system information is displayed: S/N: D1739-02770-01-007, FW: 1.40.171117, IP: 192.168.10.1, and 2018-01-12 12:58:14. Below this is a navigation bar with tabs for "Status", "Information", "Download", and "Management". A "Settings" button with a refresh icon is on the right. The "Management" tab is active. Underneath, the section "Install New Firmware" contains a "Choose File" button, a text input field with "S321\_GNSS\_...a04 x1.bin", and a green "Upload File" button.

Using the “**Management**” tab under the WebUI, select the “Choose File” button to find the appropriate firmware of application software for the S321+ device.


After selecting the correct firmware/software file, click the green “**Upload File**” button.



This screenshot shows the same Hemisphere S321+(NA) WebUI interface as above, but with the "Management" tab selected. The "Choose File" button is now disabled, and the text input field contains "File is being uploaded...". The "Upload File" button is still present. The system information and navigation bar remain the same.

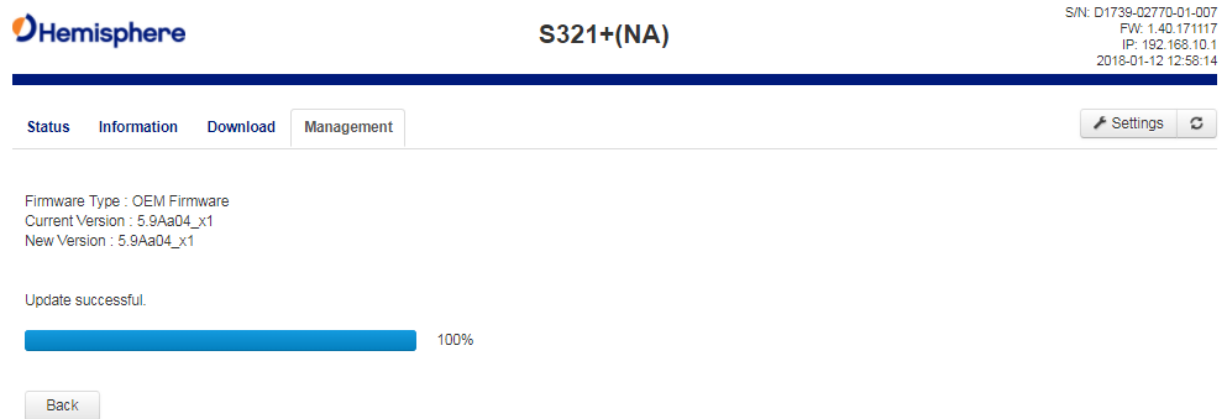
When the file is uploaded, be sure to check the current firmware version versus the new firmware version. When you have ensured the correct files are in place, click “OK” button.

A status bar indicates the level of progress for the updating firmware/software.



The screenshot shows the Hemisphere S321+(NA) WebUI interface. At the top left is the Hemisphere logo. The device model "S321+(NA)" is centered at the top. On the top right, the following information is displayed: S/N: D1739-02770-01-007, FW: 1.40.171117, IP: 192.168.10.1, and 2018-01-12 12:58:14. Below the header is a navigation bar with tabs for "Status", "Information", "Download", and "Management". To the right of the tabs are "Settings" and a refresh icon. The main content area shows "Firmware Type : OEM Firmware", "Current Version : 5.9Aa04\_x1", and "New Version : 5.9Aa04\_x1". Below this, it says "Update running..." and a progress bar is shown at 21% completion.

When the status bar reaches 100%, the upgrade is complete. The WebUI will indicate “Update successful”.



The screenshot shows the Hemisphere S321+(NA) WebUI interface after a successful update. The layout is identical to the previous screenshot, but the progress bar is now at 100% and the text above it says "Update successful.". A "Back" button is visible below the progress bar.

### Updating Firmware via MicroSD Card

Using the WebUI, select “**Settings**” and “**Device Configuration**”. Under “**Device Configuration**”, locate the “**First Storage**” option, and select the “**SD Card**” radio button. Click the “**Save**” button at the bottom right of the screen.

Place the upgrade files under “update” folder of the MicroSD card. Version info must be placed after the file name and separated by “\_”. The name must follow the naming convention listed below:

**Receiver firmware:** S321\_update\_YYMMDD.bin YY: Year  
MM: Month DD: Day  
e.g. S321\_update\_160202.bin

**Radio firmware:** SATEL\_update\_XXXXX.bin XXXXX: version  
e.g. SATEL\_update\_V07.27.2.0.8.6.bin

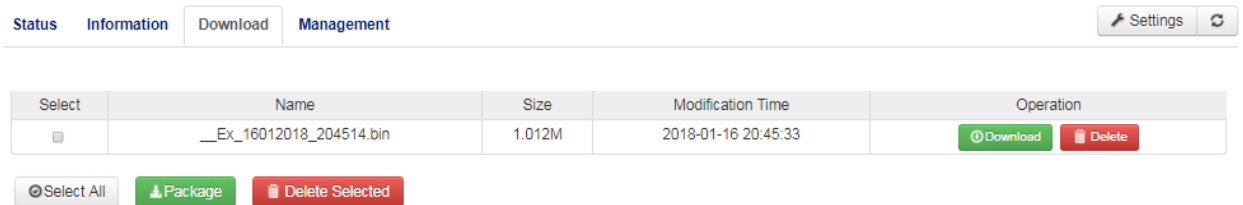
**3G module firmware:** PHS\_update\_XXXXX.bin XXXXX: version  
e.g. PHS\_update\_03.001.bin



## How to Download Static Data

Static data can be logged to the S321+ internal memory or to a MicroSD card. If “First Storage” is set to “Internal Storage” (see [Device Configuration](#)), the log files save to the internal memory of the S321+.

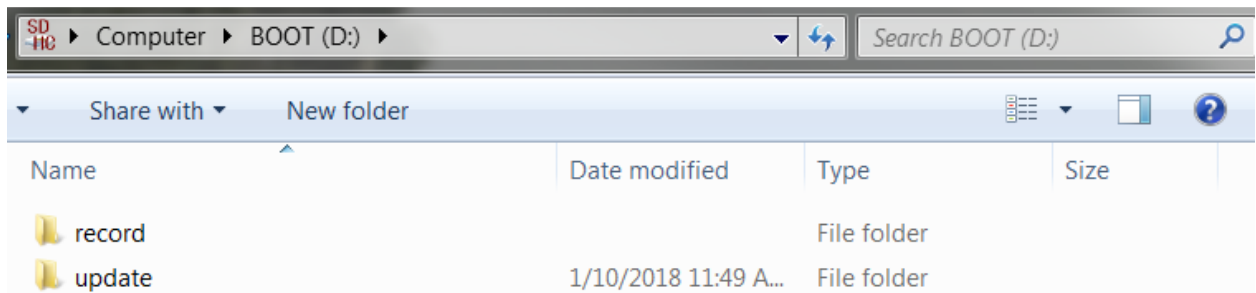
To download the logs, log into the WebUI and click Download.



Select	Name	Size	Modification Time	Operation
<input type="checkbox"/>	__Ex_16012018_204514.bin	1.012M	2018-01-16 20:45:33	<a href="#">Download</a> <a href="#">Delete</a>

[Select All](#) [Package](#) [Delete Selected](#)

If “First Storage” is set to “SD Card,” the files save to the MicroSD in the S321+. If the MicroSD is full, or the S321+ does not have a MicroSD card placed inside, the files save to the S321+ in a folder called “record.”



Name	Date modified	Type	Size
record		File folder	
update	1/10/2018 11:49 A...	File folder	

## How to Calibrate S321+ Internal Sensors

After the software has been installed, you can calibrate the S321+'s internal sensors using the **CalibrationTool** software running on a Windows Mobile/WEHH-based data collector. The complete calibration consists of three steps:

**Step 1- Electronic Bubble Calibration** - calibrates the tilt sensors necessary to use the electronic bubble or Live Digital Level (LDL) feature in **SurvCE**. The Electronic Bubble calibration is the basic, fundamental calibration for any sensor-related commands in **SurvCE**. If you only plan on using the leveling features like LDL (or electronic-bubble), level tolerance checking or auto store by leveling, then you need only perform Step 1 calibration.

The Electronic Bubble Calibration can also be performed from a SurvCE/PC configured with the S321 driver and using the Equip/GPS Utilities/Sensor Calibration/Zero Calibration function. The setup and preparation for Electronic Bubble Calibration from SurvCE/PC is the same as described below for the **CalibrationTool** software.

**Step 2 -Magnetic Calibration & Step 3- Magnetic Bias Angle** (magnetic declination) adjustment - calibrate the e-compass sensors in the S321+ and are only required if you are planning to use **SurvCE's** inclined pole compensation features while taking GNSS measurements in **SurvCE's** Store Points or Stake functions.

### Preparation

The following equipment is required to complete all three calibration steps.

Qty	Description
1	2 m Survey Pole
1	Mini Rotary Table

**Table 3-3: Calibration Equipment/Items (per step)**

Equipment/Items	Step 1 Electronic Bubble	Step 2 Magnetic	Step 3 Magnetic Bias Angle
Data Collector (running the Windows Mobile or WEHH operating system)	X		
<b>CalibrationTool</b> (should be installed on the data collector*)	X		
A quality, calibrated tribrach with accurate visuals  A line vial is usually more accurate than a spherical vial.	X  In Step 1, the tribrach can be set on a solid table or tripod	X  In Step 2, the tribrach should be mounted on a solid tripod	
Solid pole (not less than two meters long with calibrated vial attached)			X
A connection to a base station using either the S321+'s internal radio, internal GSM cell modem  For best performance, the effective distance is less than 1 kilometer (0.6 miles.)			X
Assembly that is included with the S321+ kit.  The four Mini Rotary Bracket components are shown in Figure 3-9.		X	

**Table 3-3: Calibration Equipment/Items (per step) (continued)**

Equipment/Items	Step 1 Electronic Bubble	Step 2 Magnetic	Step 3 Magnetic Bias Angle
Fully charged S321+ battery	Not battery dependent	<p style="text-align: center;"><b>X</b></p> <p>In Step 2, the e-compass calibration is tied to each individual battery in use and stored in the GNSS unit by a unique and internal battery ID.</p> <p>Step 2 should be repeated for each battery that you will later use in the S321+.</p>	<p style="text-align: center;"><b>X</b></p> <p>In Step 3, the e-compass calibration is tied to each individual battery in use and stored in the GNSS unit by a unique and internal battery ID.</p> <p>Step 3 should be repeated for each battery that you will later use in the S321+.</p>
<p>An open area free of strong magnetic fields and free of potential for high multipath.</p> <p><b>Note:</b> The farther away you are from a magnetic interference source increases performance.</p> <p>For example, it is better to be 20 meters (60 feet) from your vehicle than 5 meters (15 feet).</p>			

\*Note:

- i. A link to the **CalibrationTool** software can be found in Carlson Knowledge Base Article #1066 which is located at: <http://www.carlsonsw.com/?qs=>
- ii. Download the **CalibrationTool** software (a zip file) onto your laptop/PC using the link found in the above- mentioned Knowledge Base article. Unzip the downloaded file. This creates a folder titled: *CalibrationTool-160315-2*
- iii. Copy the contents of the *CalibrationTool-160315-2* folder to your data collector. Make a note of the location of this folder on your data collector.



**Figure 3-9: Mini-Rotary Bracket**

Using your handheld device, open the **SurvCE** application by tapping on the **SurvCE** icon.



In the **SurvCE** application, tap the **File** tab in the top left portion of the screen. Then, tap the **1 Job** button.

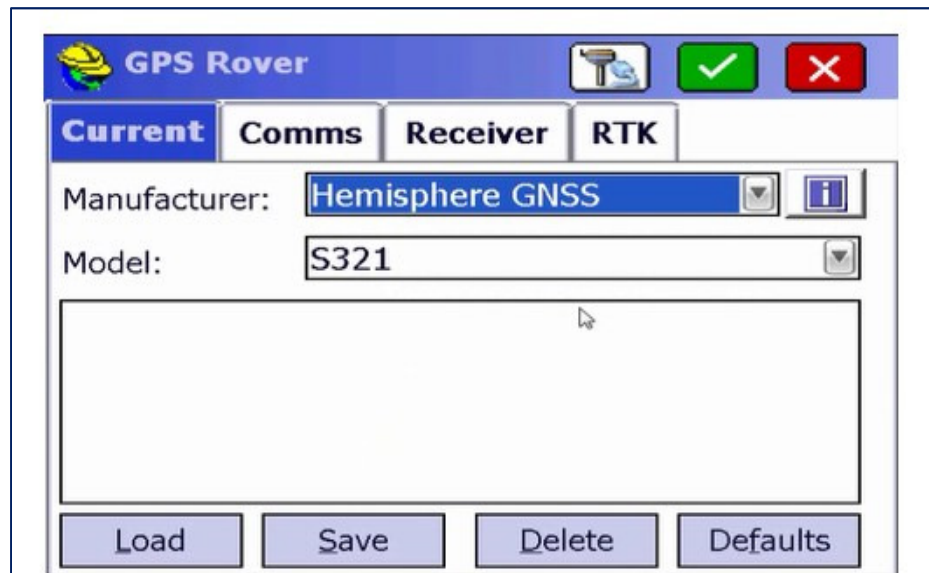


After setting or continuing a job, tap the **Equip** tab at the top of the screen. On the **Equip** tab, tap the **3 GPS Rover** button



The GPS Rover menu contains four main tabs. The **Current** tab indicates the “current” rover attached to **SurvCE**.

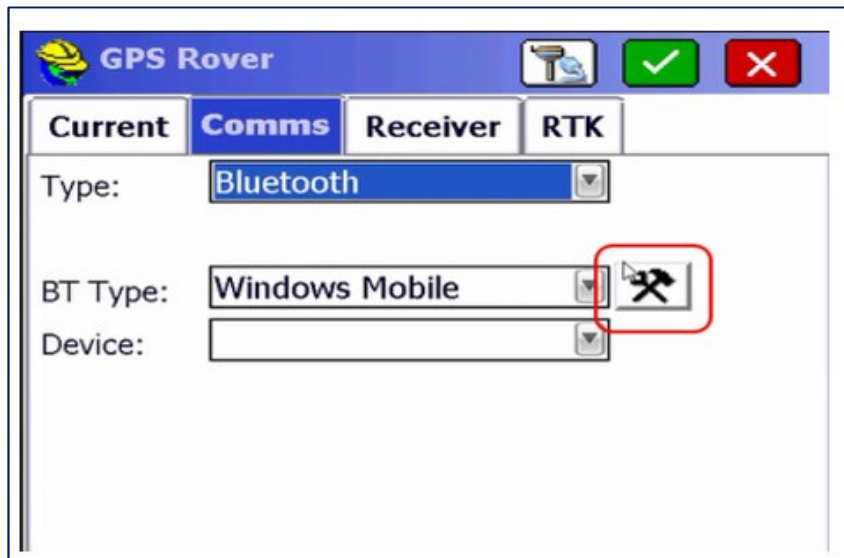
To calibrate your S321+, select “**Hemisphere GNSS**” from the **Manufacturer** drop-down list. Select “**S321**” from the **Model** drop-down list.



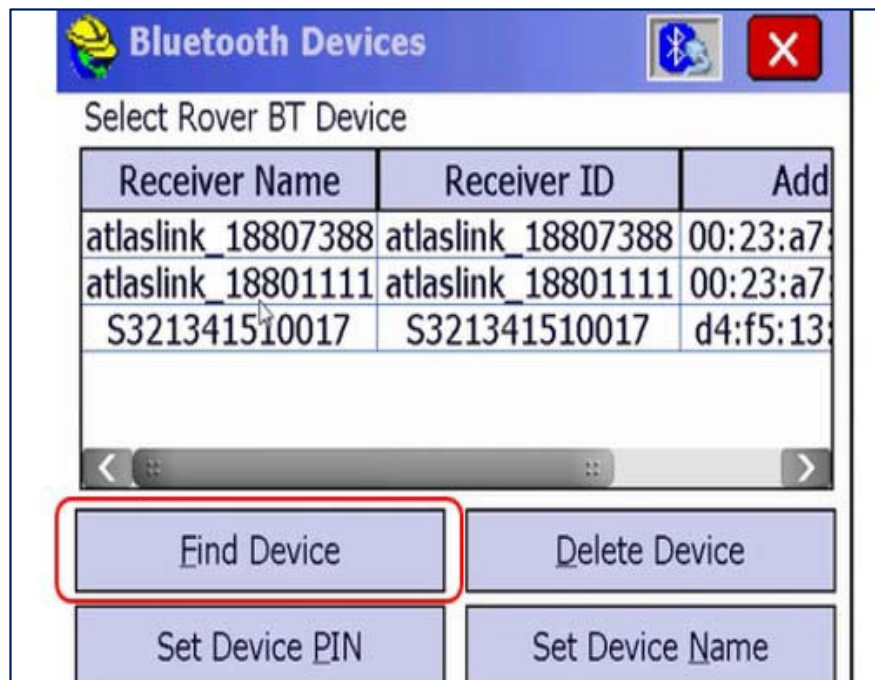
On the **Comms** tab, select **Bluetooth** from the **Type** drop-down list. Select the “**Windows Mobile**” BT Type.

Tap the wrench and hammer icon.

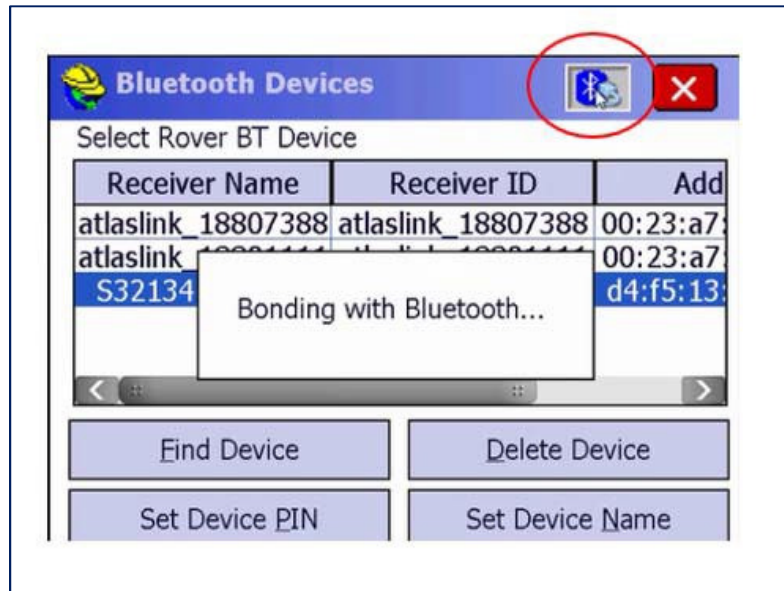
**Note:** The wrench and hammer icon allows you to find your S321+ device.



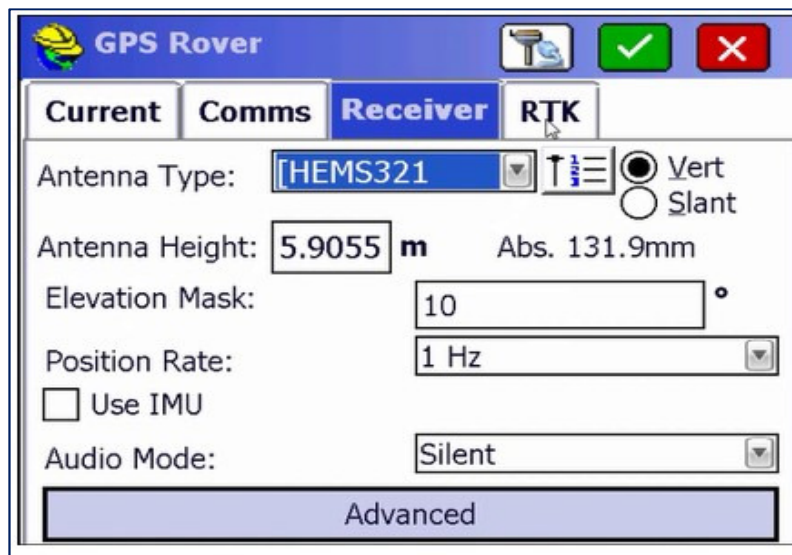
Tap the **Find Device** button and wait for a complete list of devices to generate.



When you see your device on the list, tap the **device name** to highlight it. Then press the **Bluetooth Connect** icon at the top right of the screen.

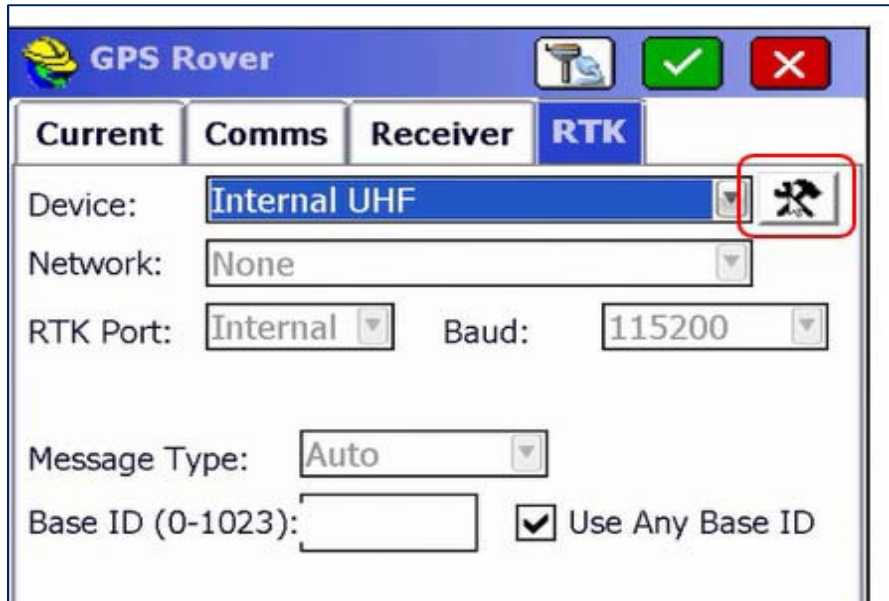


Once Bluetooth has bonded with your device, tap the **Receiver** tab. Under **Antenna Type**, ensure **HEMS321+** is selected from the drop-down list.

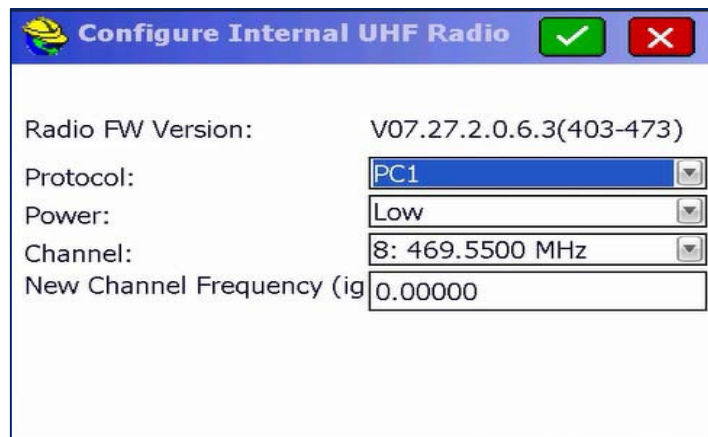




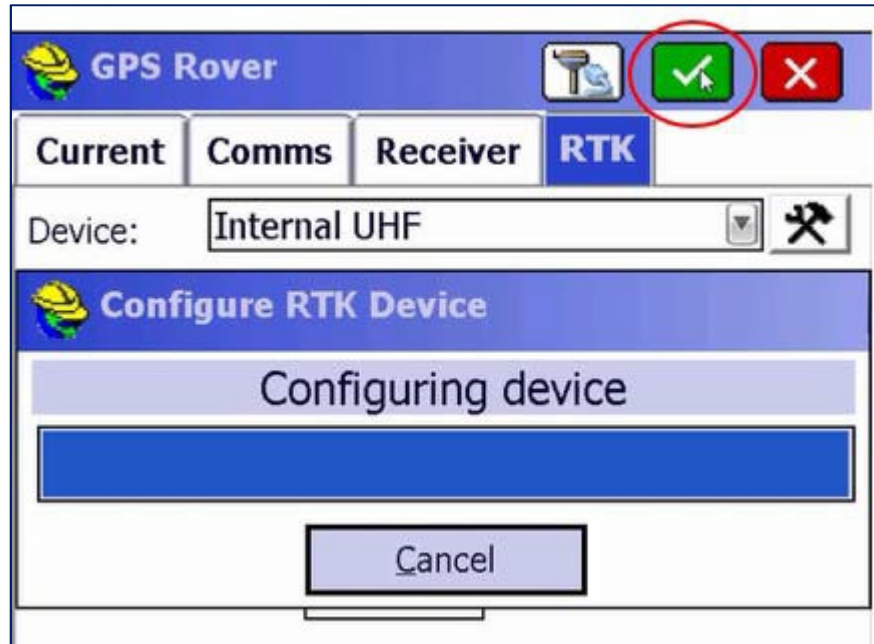
Tap the **RTK** tab. Under **Device**, select “**Internal UHF**” from the drop-down list. Tap the wrench and hammer icon.



The “**Configure Internal UHF Radio**” menu allows you to set your rover to your desired protocol required to connect to a local base.



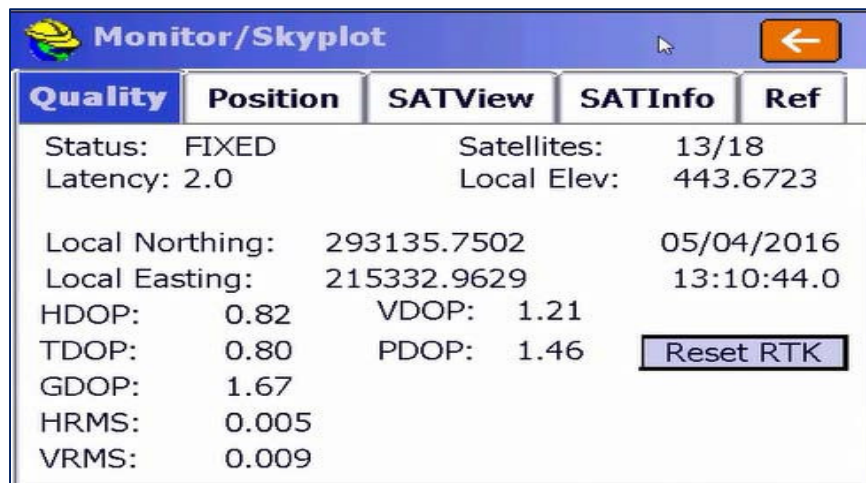
When your desired protocol has been selected, tap the green checkmark at the top of the screen.



When your UHF radio configuration is complete, tap the **Equip** tab (if not already selected) and tap **7 Monitor/Skyplot**.



Under **Monitor/Skyplot**, tap the **Quality** tab to verify you are tracking Satellites and have a **Fixed** position.



You are now ready to exit **SurvCE**. Tap the **File** tab, and tap the **Exit** button in the lower-right portion of the screen.

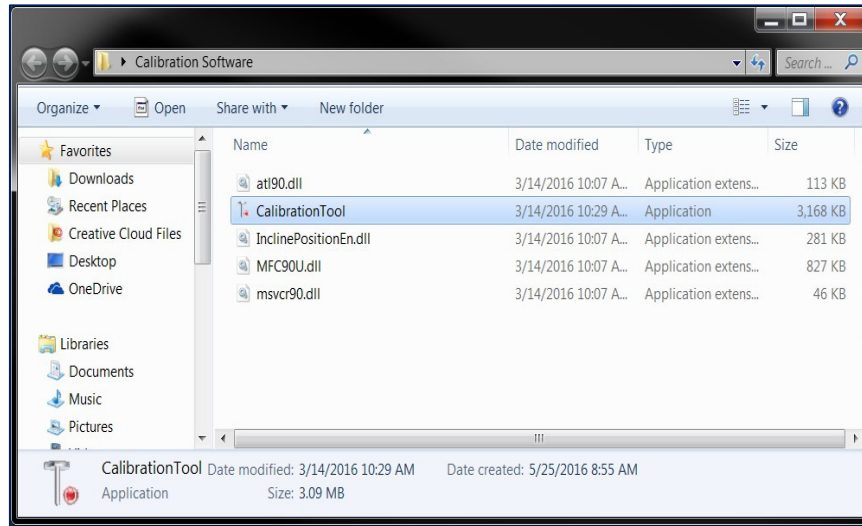
When prompted with a pop-up asking if you are sure you want to exit, tap the **Yes** button.



Connect your handheld device to your PC via the USB communication cable included with the handheld. After connecting, ensure your Mobile Device Center is open and running on your PC. This allows you to export software to the handheld device.

Select the “**CalibrationTool**” file to export the software to the desired handheld device.

**Note:** When successfully uploaded to the handheld, the software will appear under the file management section of the handheld.

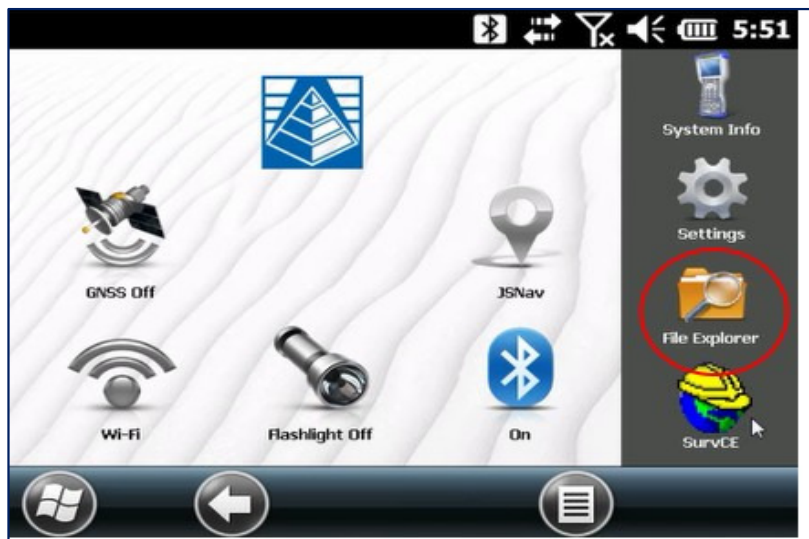


### Calibration Step 1 – Electronic Bubble Calibration

An accurate Electronic Bubble calibration will help ensure successful and accurate calibrations in Steps 2 and 3. The calibration Step #1 can be performed either indoors or outdoors, as it is NOT affected by magnetic noise, and it does not require either RTK corrections or the presence of GNSS signals.

The S321+ should be mounted on either a tribrach or pole that has been leveled as accurately as possible. A high quality, calibrated tribrach with an accurate line level in a rotating mount as shown below will provide the best calibration.

From your handheld device screen. Tap the “File Explorer” icon.



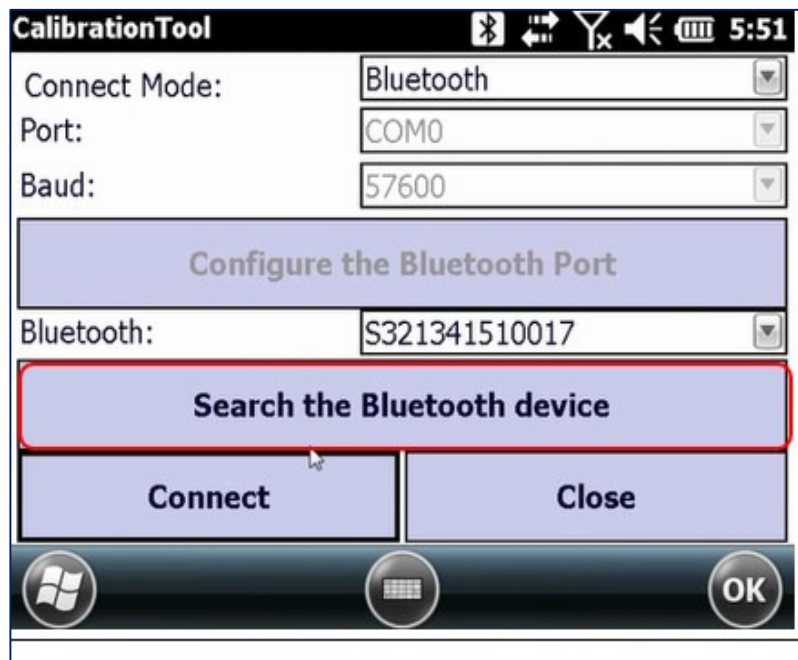
Locate the **CalibrationTool** from your list of Calibration Software. Tap the **CalibrationTool** to open the program.



When the **CalibrationTool** launches, you will be required to tap the **Connect** button located at the bottom of the screen. Select "**Connect**" from the drop-down list.



Set the **Connect Mode** to "**Bluetooth**". Next, tap the **Search for Bluetooth device** button. When you locate your S321+, press **Connect** and the calibration will be ready to start.



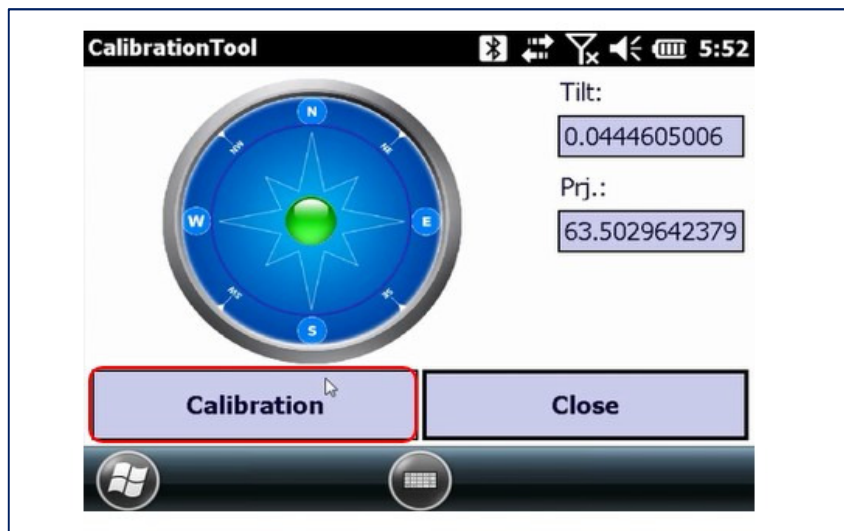
The first portion of the calibration is the **Electric Bubble Adjust**. Tap the **1.Electric Bubble Adjust** button to open the calibration screen.



Holding the survey pole as stable as possible, and keeping the green ball in the center of the compass, tap the **Calibration** button. The data collector will sound a tone when the calibration is complete.

If the Tilt values displayed are not close to zero (0.013 or less), then you should press **Calibration** again. The tilt sensors are very sensitive. If the platform is not stable when the S321+ is resetting, the tilt values will show greater variation.

Tap the **Close** button to exit out of the first calibration.



## Calibration Step 2 – Magnetic Step-by-Step Calibration

The second portion of the calibration process is the Magnetic Step-by-Step calibration. For this step, a pole or a tripod and tribrach with a small pole extender can be used. If a pole is used, you will need to keep the pole as vertical as possible while rotating the pole.

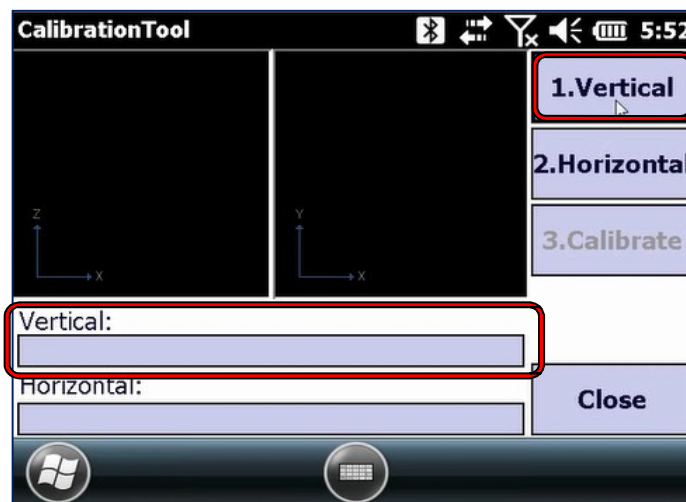
A good way to keep the pole vertical while rotating, is to grab the pole with one hand at face-height while using the fingers of your second hand to rotate the pole.

If your pole is extendable, you can use a bipod to keep the pole vertical, and if you don't lock the extendable top portion of the pole, you can rotate it.

Tap the **2.Magnetic Step-by-Step** button to begin.



The first magnetic calibration will be the **Vertical**. Remove the S321+ from the survey pole and place it on the Mini Rotary Tool. Connect the Mini Rotary Tool back to the survey pole (see picture in step below for example). Click the **1.Vertical** button and slowly rotate the device clockwise 360° (or more, depending on the progress bar).

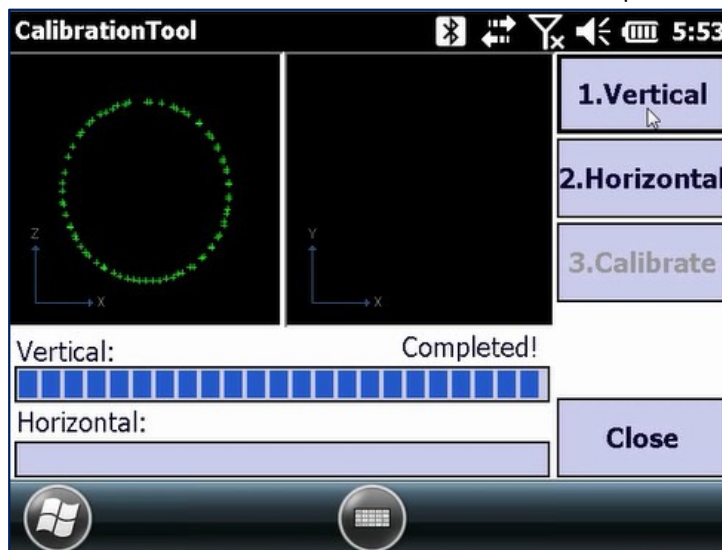




Slowly rotate the S321+ so that it takes at least 30 seconds to make one complete rotation. The progress bar will start to move as the calibration marks the points.



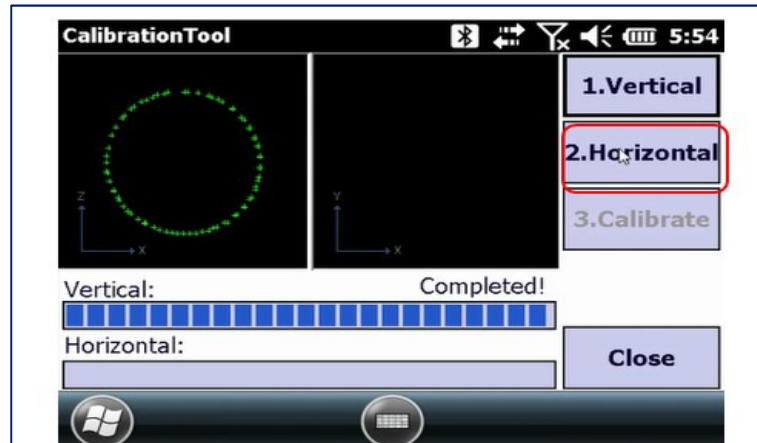
The progress bar will indicate when the Vertical calibration is complete.



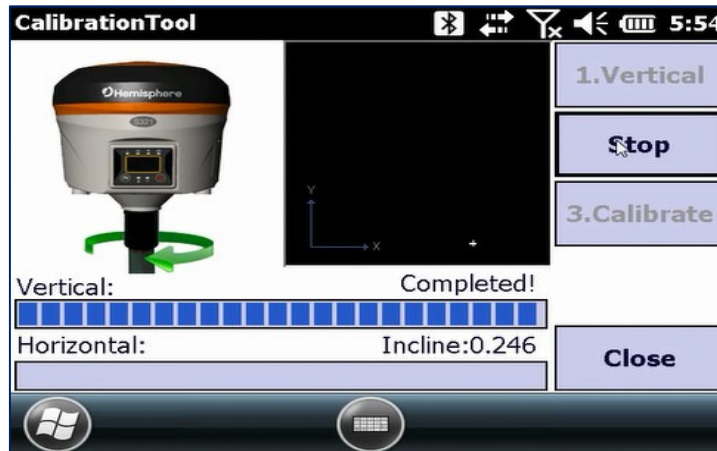
The second magnetic calibration is the **Horizontal**. Place the S321+ back onto the survey pole, in the normal orientation.

Click the **2.Horizontal** button and slowly rotate the device clockwise 360° (or more, depending on the progress bar).

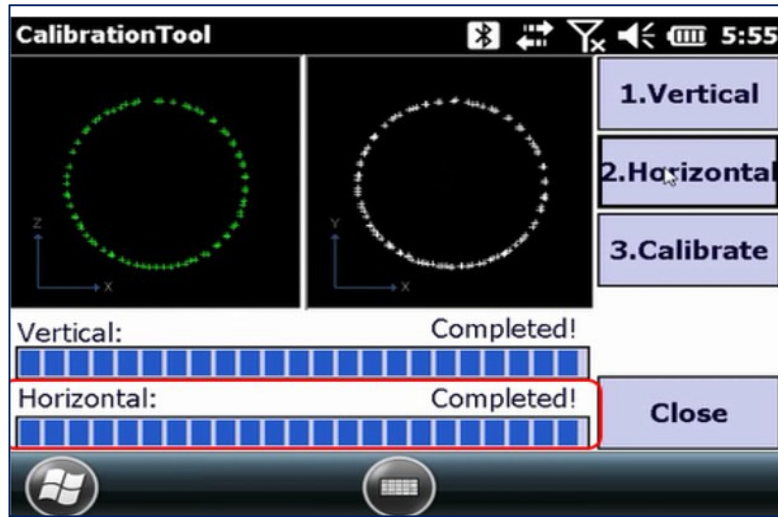
Slowly rotate the S321+ so that it takes at least 30 seconds to make one complete rotation.



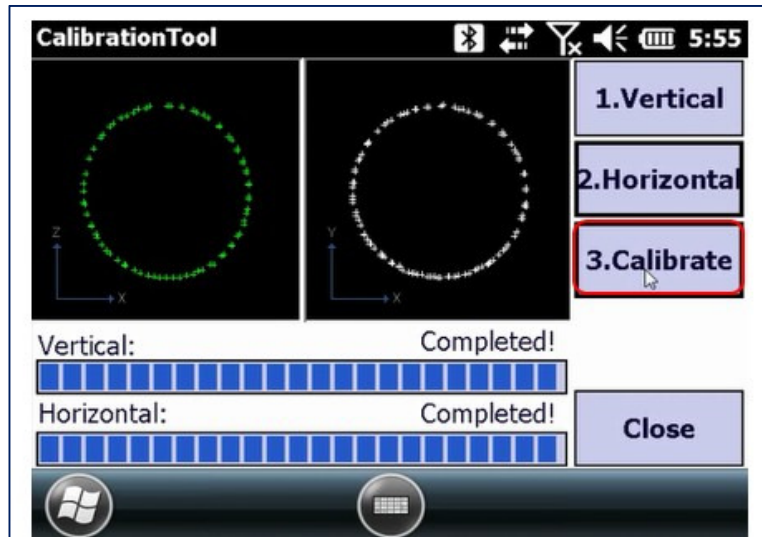
The progress bar will start to move as the calibration marks the points.



The progress bar will indicate when the Horizontal calibration is complete.



When the Vertical and Horizontal calibrations show complete, tap the **3.Calibrate** button.



A list of messages will confirm the magnetic calibration was successful. Tap the **OK** button.



### Calibration Step 3 – Magnetic Bias Angle Calibration

The third and final portion of the calibration process is the Magnetic Bias Angle calibration. Before continuing, make sure the unit is receiving an RTK FIX and is mounted on a pole.

This RTK link must be independent of the data collector. This means you will need to use one of the next two RTK methods: Radio UHF or Internal GSM in receiver.

**Note:** NEVER use any DCI method, as the NTRIP connection will always drop after exiting **SurvCE**.

**IMPORTANT:** When setting the NTRIP connection from **SurvCE** in the Receiver tab, set the position refresh rate to 1HZ. Setting it to 5Hz has negative effects on a later use of the **CalibrationTool**.

If you are sure the S321+ is FIXED, tap the **3.Magnetic Bias Angle** button.



Even though the S321+ is in Fixed mode and receiving corrections, the receiver status is not displayed in this version of the tool. The first part of the Magnetic Bias Angle calibration is recording a center point. Hold the device as stable and upright as possible. Tap the **Center Point** button. The center point will record 10 points.



**Note:** If the receiver is not level or not FIXED, the points will not be captured and a warning message will be displayed. If points are not being captured, make the necessary adjustments as prompted on the display.

**Important:** The S321+ display should be facing the user at all times.

The second part of the Magnetic Bias Angle calibration is **Inclined Point**. If you're using a bipod, remove the bipod, leaving the pole on the same point.

**Note:** There is no restriction regarding in which direction the display should be facing during the complete Magnetic Bias Angle calibration process, but it must be facing the user at all times.

Tap the **2.Incline Pt** button, and hold the survey pole and S321+ at the required angle.



The calibration tool requires you to tilt the S321+ and survey pole to the **EAST** at approximately 25° to 35° angle.

**Note:** The tilt needs to be between 25° and 35° to collect points, and the device also needs to be tilted in the correct direction to within +/- 10° (eg, between 80°-100° for east, 170°-190° for south,...).

Below you will see "Tilt" is the angle of the unit, and the "Prj" is the direction in which the device is facing.

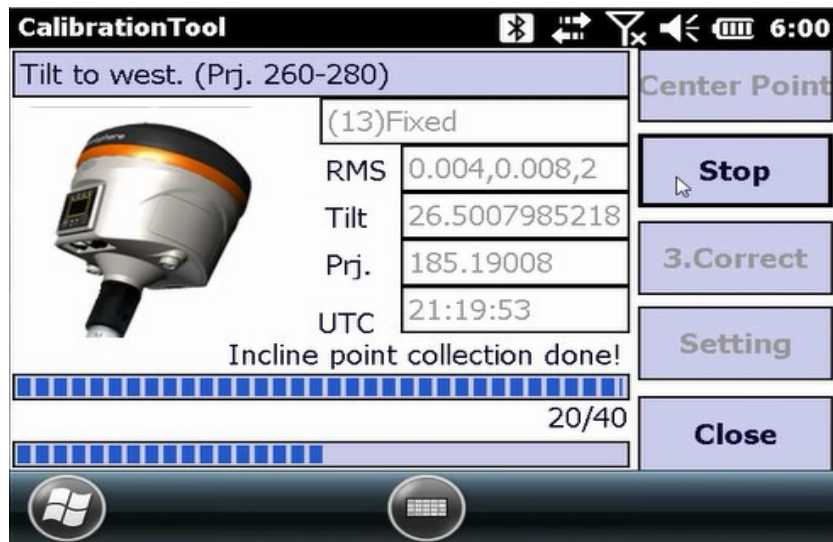


**Note:** Each direction (East, South, West, and North) will log 10 points. Keep the device in place until all 10 points are logged.

Tilt the S321+ and survey pole to the **SOUTH** at approximately 25° to 35° angle. Below you will see “Tilt” is the angle of the unit, and the “Prj” is the direction in which the device is facing.



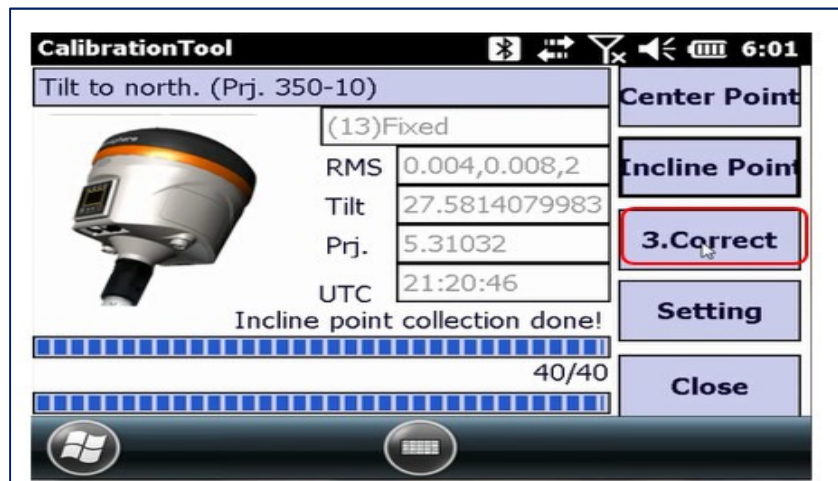
Tilt the S321+ and survey pole to the **WEST** at approximately 25° to 35° angle. Below you will see “Tilt” is the angle of the unit, and the “Prj” is the direction in which the device is facing.



Tilt the S321+ and survey pole to the **NORTH** at approximately 25° to 35° angle. Below you will see “**Tilt**” is the angle of the unit, and the “**Prj**” is the direction in which the device is facing.

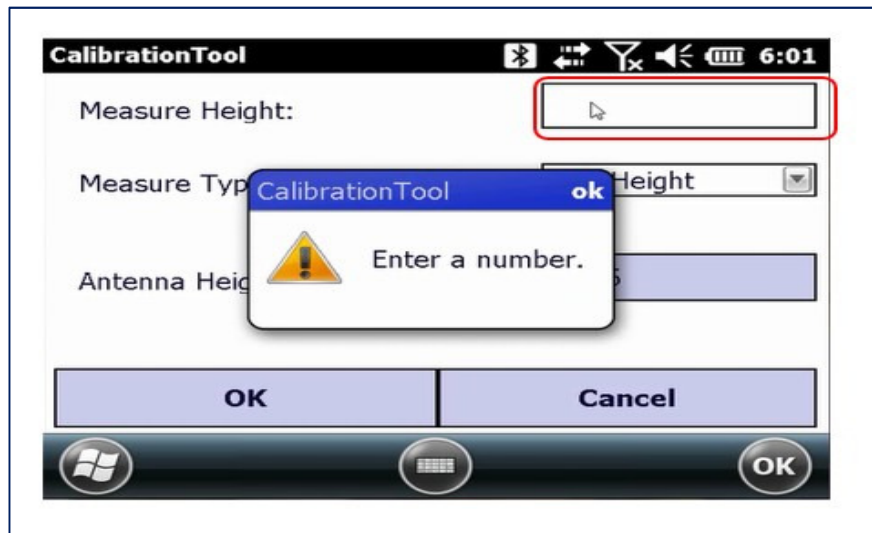


When the Incline Point calibration is complete, tap **3. Correct** to submit the calibration to the S321+.

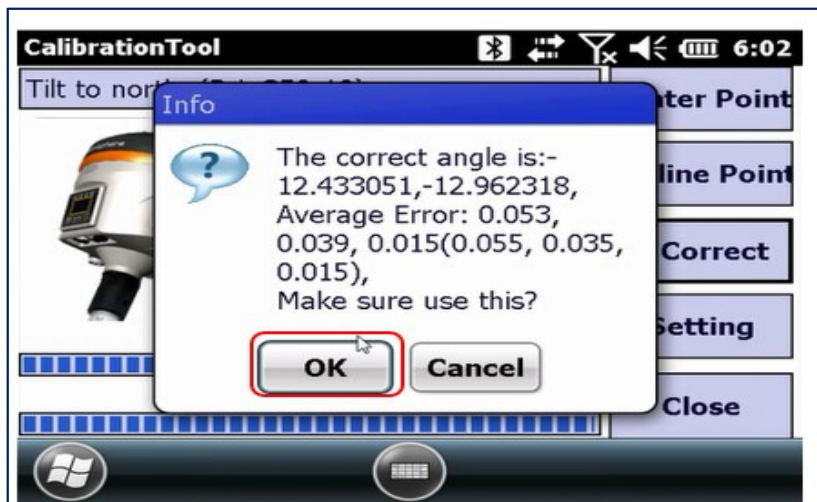




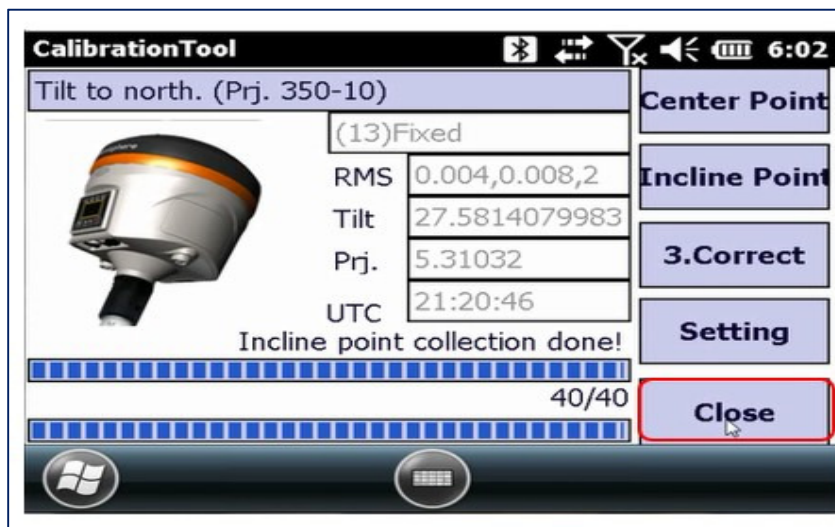
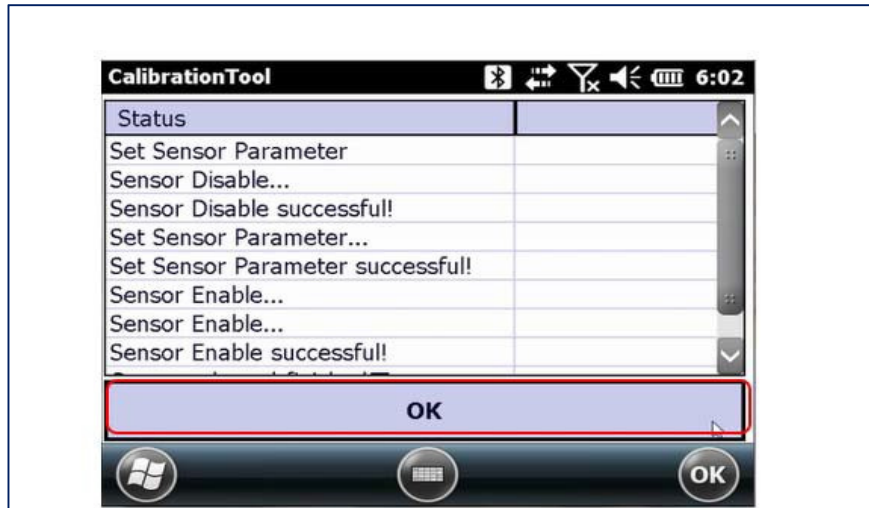
Enter the height of the survey pole (in meters) used for calibration in the “**Measure Height**” field below. Then tap **OK**.



The Magnetic Bias Angle is now complete and a pop-up will show you the corrections made to the tilt sensor. Click the **OK** button.



A list of messages will confirm the magnetic calibration was successful. Click the **OK** button. Tap the **Close** button to exit the Magnetic Bias Angle screen.



You can now **Exit** the **CalibrationTool** program, and your S321+ is 100% calibrated.





## **Appendix A: Troubleshooting**

## Appendix A: Troubleshooting

Table A-1 provides troubleshooting tips for the S321+.

**Table A-1: Troubleshooting**

Issue	Possible Resolution
Receiver fails to power	<ul style="list-style-type: none"> <li>• External power is low</li> <li>• Check charge on external battery and the fuse on the power cable, if applicable</li> <li>• Internal power: Check charge on internal battery</li> <li>• Check all power cables and pins</li> <li>• Try other batteries or cables</li> <li>• Make sure to hold the power button down for a minimum of one full second to turn on</li> <li>• Ensure the battery is installed with contacts pointed in the correct direction</li> </ul>
<ul style="list-style-type: none"> <li>• No data logged</li> <li>• No communication</li> <li>• No valid data</li> </ul>	<ul style="list-style-type: none"> <li>• Check receiver power status</li> <li>• Verify that it is locked to 4 or more GPS satellites</li> <li>• Check integrity and connectivity of power and data cable connections</li> <li>• Verify that the baud rate settings match in external device mode</li> <li>• If trying to connect over Bluetooth, ensure Bluetooth module is powered ON and device is paired prior to opening the port</li> </ul>
Random data from WebUI or S321+ Direct Link mode	<ul style="list-style-type: none"> <li>• Verify the messages selected in the output messages in the WebUI match what you desire</li> <li>• Verify the baud rate settings match</li> <li>• Potentially, the volume of data requested to be output could be higher than the current baud rate supports. Try using a higher baud rate for communications</li> </ul>
S321+ Will Not Go RTK Fixed	<ul style="list-style-type: none"> <li>• If the S321+ is “RTK Float”, then it is receiving RTK or Atlas corrections.</li> <li>• If the RTK latency is between 10-15 seconds, these are most likely Atlas corrections.</li> <li>• If the RTK latency is less than 10-15 seconds, the S321+ is receiving RTK, but probably will not Fix because of the environment.</li> <li>• If the S321+ will not go RTK Float or RTK Fixed, check to ensure the base station is operating.</li> <li>• Verify the settings of the UHF radio at the base and at the rover are the same.</li> <li>• If using a network, check the Cellular Signal Quality (CSQ) under the <b>Information</b> tab for cellular reception. CSQ can also be viewed on the S321+ display screen by pressing the <b>FN</b> button.</li> <li>• If using the internal UHF radio, ensure a valid 400MHz UHF antenna is plugged into the SMA connector labeled <b>UHF</b>.</li> <li>• If using the Internal GSM modem, ensure that the cellular antenna is screwed into the SMA connector labeled <b>UMTS</b>. <b>WARNING:</b> The connectors are identical, always check to ensure the correct antenna is screwed into the correct slot.</li> <li>• If using Bluetooth, ensure RTK is reaching the data collector (check the data collector internet or data collector radio).</li> </ul>



## **Appendix B: Technical Specifications**

## Appendix B: Technical Specifications

**Table B-1: GNSS Receiver**

Item	Specification
Receiver type	Multi-Frequency GNSS
Channels	394
Positioning modes	RTK, L-band DGNSS, SBAS, Autonomous
RTK formats	RTCM3, ROX, CMR, CMR+ <sup>4</sup>
L-band formats	Atlas H100, Atlas H30, and Atlas H10
Update Rate / Recording Interval	Selectable from 1, 2, 4, 5, 10, 20 Hz

**Table B-2: Performance**

Mode	Specification	
	Horizontal	Vertical
RTK Performance	8mm + 1 ppm	15mm + 1 ppm
Static Performance (long occupation)	3mm + 0.1 ppm	3.5mm + 0.4 ppm
Static Performance (rapid occupation)	3mm + 0.5 ppm	5mm + 0.5 ppm
L-band Performance <sup>3</sup>	0.08 m	0.16m
SBAS (WAAS) Performance <sup>1</sup>	0.3 m	0.6 m
Autonomous, no SA <sup>2</sup>	1.2 m	2.4 m

**Table B-3: Satellite Tracking**

Satellites	
GPS	L1CA, L1P, L2P, L2C, L5
GLONASS	G1, G2, P1, P2
BeiDou	B1, B2
QZSS	L1C, L1CA, L2C, L5
Galileo	E1BC, E5a, E5b
SBAS	MSAS, WAAS, EGNOS, GAGAN

**Table B-4: Communication and Port**

Item	Description
Connectors I/O	5-pin LEMO connector for external power, data, and external radio devices 7-pin Lemo connector for diagnostics 1 SMA antenna connector for internal radio 1 SMA antenna connector for modem module
WebUI	To upgrade the software, manage the status and settings, data download, via smart phone, tablet, or other electronic device
TTS	Smart voice broadcast system. "Speaking" receiver
Reference Outputs	RTCM2.1, RTCM2.3, RTCM3.0, RTCM3.1, RTCM3.2, including MSM

**Table B-5: Radio**

Item	Specification
Frequency Range	410 - 470 MHz
Channel Spacing	12.5 KHz / 25 KHz
Emitting Power	0.1, 0.2, 0.5 or 1 w

**Table B-6: Wireless**

Item	Specification
Wi-Fi	Integrated module with internal Wi-Fi antenna
Bluetooth	Bluetooth 2.1 + EDR Integrated Bluetooth (BT) communication module with internal BT antenna

**Table B-7: Cellular**

Item	Description
PLS8-E (International)	<b>4G</b> - Penta Band LTE - 800/900/1800/2100/2600 MHz - FDD-Band (20, 8, 3, 7, 1) <b>3G</b> - Tri Band UMTS (WCDMA) - 900/1800/2100 MHz - FDD-Band (8, 3, 1) <b>2G</b> - Dual Band GSM/GPRS/EDGE - 900/1800 MHz
PLS8-X (North America)	<b>4G</b> - Penta Band LTE - 700/700/850/AWS(1700/2100)/1900 MHz - FDD-Band (13, 17, 5, 4,2) <b>3G</b> - Tri Band UMTS (WCDMA) - 850/AWS (1700/2100)/1900 MHz - FDD-Band (5, 4, 2) <b>2G</b> - Quad Band GSM/GPRS/EDGE - 850/900/1800/1900 MHz



**Table B-8: Power**

Item	Specification
Battery	Hot-swappable 11.1 V - 37.74 Wh intelligent lithium (2 per kit)
Battery Life	12-hour operation from two batteries with UHF radio in Rx mode
Voltage	9 to 22V DC external power input with over-voltage protection (5-pin LEMO)
Charge Time	Typically 7 hours

**Table B-9: Memory**

Item	Specification
SIM Card	User accessible SIM card slot
Memory	Internal 8GB, accessible through USB and Wi-Fi. External MicroSD card slot supports up to 64 GB.

**Table B-10: Environmental**

Item	Specification
Operating Temperature	-30°C to 60°C (-22°F to 140°F)
Storage Temperature	-40°C to 80°C (-40°F to 176°F)
Waterproof / Dustproof	IP67, Protect from temporary immersion to a depth of 1 meter
Shock Resistance	MIL-STD-810G, method 516.6 Designed to survive a 2 m pole drop on concrete floor with no damage; designed to survive a 1 m free drop on hardwood floor with no damage
Vibration	MIL-STD-810G, method 514.6E-I
Humidity	Up to 100%
Inflammability	UL recognized, 94HB Flame Class Rating (3). 1.49mm
Chemical Resistance	Cleaning agents, soapy water, industrial alcohol, water vapor, solar radiation (UV)

**Table B-11: Mechanical**

Item	Specification
Size	14.6 D x 14.8 H (cm) 5.75 D x 5.83 H (in)
Weight	<1.38 kgs (<3.05 lbs)
Mounting	5/8"x11, 55° thread angle, stainless steel insert

**Table B-12: Antenna Offsets**

Item	Specification
Phase Center Offset	L1= 132mm L2=139mm R=73mm H=105mm

- <sup>1</sup> Depends on multi-path environment, number of satellites in view, satellite geometry, and ionospheric activity
- <sup>2</sup> Depends also on baseline length
- <sup>3</sup> Requires a subscription from Hemisphere GNSS
- <sup>4</sup> CMR and CMR+ do not cover proprietary messages outside of the typical standard



**Figure B-1: Antenna Offsets**



## **Appendix C: Radio Mode**

## Appendix C: Radio Mode

Table C-1: Radio Mode

Radio Mode	Link Rate	Spacing	Modulation	Scrambling	FEC
Trimtalk 1	4800 bps	12.5 kHz	GMSK	On	Off
Trimtalk 2	9600 bps	25 kHz			
PC1	9600 bps	25 kHz	GMSK	On	On
PC5	4800 bps	12.5 kHz			
PC-4FSK	9600 bps	12.5 kHz	4FSK	On	On
	19200 bps	25 kHz			
Satel 3AS	9600 bps	12.5 kHz	4FSK	On	Off
	19200 bps	25 kHz			On
					Off
					On

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  25. **APPLICABLE LAW.** This Agreement shall be governed by the laws of the Province of Alberta, Canada, exclusive of any of its choice of law and conflicts of law jurisprudence.
  26. **CISG.** The United Nations Convention on Contracts for the International Sale of Goods will not apply to this Agreement or any transaction hereunder.
  27. **GENERAL.** This is the entire agreement between Licensee and Hemisphere relating to the Product and Licensee's use of the same, and supersedes all prior, collateral or contemporaneous oral or written representations, warranties or agreements regarding the same. No amendment to or modification of this Agreement will be binding unless in writing and signed by duly authorized representatives of the parties. Any and all terms and conditions set out in any correspondence between the parties or set out in a purchase order which are different from or in addition to the terms and conditions set forth herein, shall have no application and no written notice of same shall be required. In the event that one or more of the provisions of this Agreement is found to be illegal or unenforceable, this Agreement shall not be rendered inoperative but the remaining provisions shall continue in full force and effect.

# Warranty Notice

**COVERED PRODUCTS:** This warranty covers all products manufactured by Hemisphere GNSS and purchased by the end purchaser (the "Products"), unless otherwise specifically and expressly agreed in writing by Hemisphere GNSS.

**LIMITED WARRANTY:** Hemisphere GNSS warrants solely to the end purchaser of the Products, subject to the exclusions and procedures set forth below, that the Products sold to such end purchaser and its internal components shall be free, under normal use and maintenance, from defects in materials, and workmanship and will substantially conform to Hemisphere GNSS's applicable specifications for the Product, for a period of 12 months from delivery of such Product to such end purchaser (the "Warranty Period"). Repairs and replacement components for the Products are warranted, subject to the exclusions and procedures set forth below, to be free, under normal use and maintenance, from defects in material and workmanship, and will substantially conform to Hemisphere GNSS's applicable specifications for the Product, for 90 days from performance or delivery, or for the balance of the original Warranty Period, whichever is greater.

**EXCLUSION OF ALL OTHER WARRANTIES.** The LIMITED WARRANTY shall apply only if the Product is properly and correctly installed, configured, interfaced, maintained, stored, and operated in accordance with Hemisphere GNSS's relevant User's Manual and Specifications, AND the Product is not modified or misused. The Product is provided "AS IS" and the implied warranties of MERCHANTABILITY and FITNESS FOR A PARTICULAR PURPOSE and ALL OTHER WARRANTIES, express, implied or arising by statute, by course of dealing or by trade usage, in connection with the design, sale, installation, service or use of any products or any component thereof, are EXCLUDED from this transaction and shall not apply to the Product. The LIMITED WARRANTY is IN LIEU OF any other warranty, express or implied, including but not limited to, any warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE, title, and non-infringement.

**LIMITATION OF REMEDIES.** The purchaser's EXCLUSIVE REMEDY against Hemisphere GNSS shall be, at Hemisphere GNSS's option, the repair or replacement of any defective Product or components thereof. The purchaser shall notify Hemisphere GNSS or a Hemisphere GNSS's approved service center immediately of any defect. Repairs shall be made through a Hemisphere GNSS approved service center only. Repair, modification or service of Hemisphere GNSS products by any party other than a Hemisphere GNSS approved service center shall render this warranty null and void. The remedy in this paragraph shall only be applied in the event that the Product is properly and correctly installed, configured, interfaced, maintained, stored, and operated in accordance with Hemisphere GNSS's relevant User's Manual and Specifications, AND the Product is not modified or misused. NO OTHER REMEDY (INCLUDING, BUT NOT LIMITED TO, SPECIAL, INDIRECT, INCIDENTAL, CONSEQUENTIAL OR CONTINGENT DAMAGES FOR LOST PROFITS, LOST SALES, INJURY TO PERSON OR PROPERTY, OR ANY OTHER INCIDENTAL OR CONSEQUENTIAL LOSS) SHALL BE AVAILABLE TO PURCHASER, even if Hemisphere GNSS has been advised of the possibility of such damages. Without limiting the foregoing, Hemisphere GNSS shall not be liable for any damages of any kind resulting from installation, use, quality, performance or accuracy of any Product.

**HEMISPHERE IS NOT RESPONSIBLE FOR PURCHASER'S NEGLIGENCE OR UNAUTHORIZED USES OF THE PRODUCT.** IN NO EVENT SHALL Hemisphere GNSS BE IN ANY WAY RESPONSIBLE FOR ANY DAMAGES RESULTING FROM PURCHASER'S OWN NEGLIGENCE, OR FROM OPERATION OF THE PRODUCT IN ANY WAY OTHER THAN AS SPECIFIED IN Hemisphere GNSS's RELEVANT USER'S MANUAL AND SPECIFICATIONS. Hemisphere GNSS is NOT RESPONSIBLE for defects or performance problems resulting from (1) misuse, abuse, improper installation, neglect of Product; (2) the utilization of the Product with hardware or software products, information, data, systems, interfaces or devices not made, supplied or specified by Hemisphere GNSS; (3) the operation of the Product under any specification other than, or in addition to, the specifications set forth in Hemisphere GNSS's relevant User's Manual and Specifications; (4) damage caused by accident or natural events, such as lightning (or other electrical discharge) or fresh/ salt water immersion of Product; (5) damage occurring in transit; (6) normal wear and tear; or (7) the operation or failure of operation of any satellite-based positioning system or differential correction service; or the availability or performance of any satellite-based positioning signal or differential correction signal.

**THE PURCHASER IS RESPONSIBLE FOR OPERATING THE VEHICLE SAFELY.** The purchaser is solely responsible for the safe operation of the vehicle used in connection with the Product, and for maintaining proper system control settings. UNSAFE DRIVING OR SYSTEM CONTROL SETTINGS CAN RESULT IN PROPERTY DAMAGE, INJURY, OR DEATH. The purchaser is solely responsible for his/her safety and for the safety of others. The purchaser is solely responsible for maintaining control of the automated steering system at all times. THE PURCHASER IS SOLELY RESPONSIBLE FOR ENSURING THE PRODUCT IS PROPERLY AND CORRECTLY INSTALLED, CONFIGURED, INTERFACED, MAINTAINED, STORED, AND OPERATED IN ACCORDANCE WITH Hemisphere GNSS's RELEVANT USER'S MANUAL AND SPECIFICATIONS. Hemisphere GNSS does not warrant or guarantee the positioning and navigation precision or accuracy obtained when using Products. Products are not intended for primary navigation or for use in safety of life applications. The potential accuracy of Products as stated in Hemisphere GNSS literature and/or Product specifications serves to provide only an estimate of achievable accuracy based on performance specifications provided by the satellite service operator (i.e. US Department of Defense in the case of GPS) and differential correction service provider. Hemisphere GNSS reserves the right to modify Products without any obligation to notify, supply or install any improvements or alterations to existing Products.

**GOVERNING LAW.** This agreement and any disputes relating to, concerning or based upon the Product shall be governed by and interpreted in accordance with the laws of the State of Arizona.

**OBTAINING WARRANTY SERVICE.** In order to obtain warranty service, the end purchaser must bring the Product to a Hemisphere GNSS approved service center along with the end purchaser's proof of purchase. Hemisphere GNSS does not warrant claims asserted after the end of the warranty period. For any questions regarding warranty service or to obtain information regarding the location of any of Hemisphere GNSS approved service center, contact Hemisphere GNSS at the following address:

**Hemisphere GNSS**  
8515 E. Anderson Drive  
Scottsdale, AZ 85255, USA  
Phone: +1-480-348-6380  
Fax: +1-480-270-5070  
[techsupport@hrgnss.com](mailto:techsupport@hrgnss.com) [www.hgnss.com](http://www.hgnss.com)



Hemisphere GNSS Inc.  
8515 East Anderson Drive, Suite A  
Scottsdale, Arizona, US 85255

Phone: 480-348-6380  
Fax: 480-270-5070  
[precision@hgns.com](mailto:precision@hgns.com)  
[www.hgns.com](http://www.hgns.com)

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