



875-0357-D

User Guide

Revision: A6

August 08, 2017

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 Part2
- FCC Part22H
- FCC Part24E

IC Compliance

- ICES-003:2012 Issue5
- RSS-247 Issue 1
- RSS-GEN Issue 4
- RSS 132 Issue 3
- RSS 133 Issue 6

Certifications

S321 UHF

- Model: S321.UHF
- FCC ID:ZC8S321UHF
- IC:9586A-S321UHF

S321 Non-UHF

- Model: S321 Network
- FCC ID:ZC8S321Network
- IC: 9586A-S321Network

⚠ 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 Satel™, 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 <http://www.hc-sc.gc.ca/rpb>.

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://hemispheregns.com/About-Us/Quality-Commitment>

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6111549	6876920	7400956	8000381	8214111	2002244539
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:

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8515 East Anderson Drive
Scottsdale, AZ 85255 USA
Phone: (480) 348-6380
Fax: (480) 270-5070
precision@hgns.com www.hgns.com

Technical Support

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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.

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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 designed by and for surveyors. The S321 delivers robust performance and high precision in the field 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 in a network or crew. Use the S321 as a precise base station sending RTK or Atlas L-band corrections 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 UI is used to control, manage, and upgrade the S321 with new firmware and activations. S321 is Athena enabled and Atlas capable.



Athena RTK

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 (primary receiver) that broadcasts corrections over a wireless link to the rover (secondary receiver). The localized corrections are processed on the rover to achieve superior accuracy and repeatability. Performance testing has shown positioning accuracy at the centimeter level.

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

Atlas L-band corrections are available worldwide. 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 is Hemisphere's industry leading correction service, which can be added as a subscription. Atlas L-Band has the following benefits:

- Positioning accuracy - Competitive positioning accuracies down to 2 cm RMS in certain applications
- Positioning sustainability - Cutting edge position quality maintenance in the absence of correction signals, using Hemisphere's patented technology
- Scalable service levels - Capable of providing virtually any accuracy, precision and repeatability level in the 2 to 100 cm range
- Convergence time - Industry-leading convergence times of 10-40 minutes

S321 is supported by our easy-to-use Atlas Portal (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: <http://hemispheregnss.com/Technology> For more information about Atlas L-band, see: <http://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 as a few seconds), the receiver is able to operate in the absence of either correction source, or in other words, and the receiver is able to continue generating RTK positions in case the land-based RTK correction source becomes unavailable for a period of time.

Note: In order to use aRTK, you are required to change the RTK timeout to: 2700 s. This can be accomplished by following the web UI directions outlined in the Setup and Configuration section of this document.

SureFix RTK Position

In order 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	940-2145-0 S321U	940-2146-0 S321N	940-2163-0 S321U Int'l	940-2164-0 S321N Int'l
S321 UHF Smart Antenna	752-0006-0	1	-	1	-
S321 Network Smart Antenna	752-0007-0	-	1	-	1
S321 Serial Cable	051-0390-0	1	1	1	1
GSM/WCDMA External Antenna	150-1023-0	1	1	1	1
UHF External Antenna	150-1024-0	1	-	1	-
Athena dFreq RTK Bundle*	163-1045-0	1	1	-	-
Smart Battery	427-0058-0	2	2	2	2
Battery Charger Adapter	427-0060-0	1	1	1	1
Battery Charger	427-0063-0	1	1	1	1
S321 Cigarette Lighter Adapter	427-0064-0	1	1	1	1
Tape Measure	699-0006-000	1	1	1	1
Quick Release	699-0015-0	1	1	1	1
Carry Case	750-0183-1	1	1	1	1
8 GB SD Card	750-1169-0	1	1	1	1
Accessory Kits	Part Number	940-2155-0 Base Acc	940-2156-0 Rover Acc	Accessory Only	
S321 Power Cable (Alligator Clips)	054-0171-0	1	-	-	
S321 5-Pin Power Cable (PacCrest/Rcvr)	054-0172-0	-	-	1	
S321 5-Pin Power Cable (Satel/Rcvr)	054-0173-0	-	-	1	
S321 5-Pin Power Cable (Receiver)	054-0178-0	1	-	-	
S321 5-Pin Power cable (Serial/Rcvr)	054-0180-0	-	-	1	
S321 UHF Antenna (TNC)	150-1026-0	1	-	-	
Mini Rotary Table	699-0014-0	-	1	-	
S321 External UHF Antenna Bracket Kit	710-0136-6	1	-	-	
Controller/Option Kits	Part Number	940-2149-0 Cntrlr (NA)	940-2150-0 Cntrlr (EU)	940-2165-0 Int'l Option	
XF3 Pole Bracket Mount	750-0159-0	1	1	1	
XF3 (EU)	750-0177-0	-	1	1	
XF3 (NA)	750-0178-0	1	-	-	
Carlson SurvCE v5.04+ (w/ NA)	750-2022-0	1	-	-	
Carlson SurvCE 5.04+ (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 Micro SD/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 Data Port (LEMO)	Data cable for serial or USB (Item 7 in Table 1-1)
5-pin Power/Radio Port (LEMO)	External Power and Radio devices (Item 5 and 6 in Table 1-1)
GSM Antenna Connector	External GSM antenna (Item 9 in Table 1-1)
UHF Antenna Connector	External antenna (Item 8 in Table 1-1)
Mounting hole	Pole or tripod mount

Installing/Connecting S321

Installing Batteries

The S321 allows for one battery (11.1 V - 37.74 Wh) to be installed at a time. When installing the 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. The projected run time of the battery is 6 hours, while running in UHF receive mode. The S321 kit provides two batteries, as noted in the [“What’s Included?”](#) portion of this user guide.



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 Tribach

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 Tribach

Vertical Extension for the Base

The vertical extension is a 25cm aluminum pole that mounts to the top of a tripod tribrach. This allows the S321 to have a similar height to the rover and provides better access to the bottom of the S321 unit. Having more access to the bottom of the S321 makes for easier cable connections and adjustments to UHF or GPRS antennas.



Figure 2-5: Vertical Base Extension

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 2-6: Range Pole Installation

Connecting to a Power Source

The S321 has two main power sources. The first being an internal, removable battery which is 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 2-7: External Power Connector

Connecting to an External Device

The 7-pin connector is available for troubleshooting, debugging, and USB log downloads.



Figure 2-8: External Device 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 2-9: 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 Micro SD 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 Micro SD 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 Micro SD 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 Micro SD 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 2-10: SIM Card Slot

Resetting the S321

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



Figure 2-11: S321 Reset Button

Chapter 3: Setup and Configuration

Control Panel Overview

Setting up the S321

Installing the Base

Installing the Rover

Bluetooth Communication

Hemisphere Web UI

Web UI Settings

Firmware Update

Downloading Static Data

Calibrating S321 Internal Sensors

Setup and Configuration

Control Panel Overview

You 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)

It 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 will illuminate.



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 Web UI. For more information on the Web UI, please see section [Web UI](#).



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.

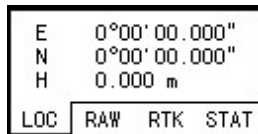
Table 3.1: Definition of icons on the S321 menu

Type	Icon	Explanation
Operating mode		Rover mode
		Base mode
		Static mode
Power status		Full battery power or external power supply
		Battery power remaining 3/4
		Battery power remaining 2/4
		Battery power remaining 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

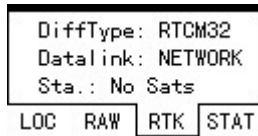
S321 Menu Structure and Information



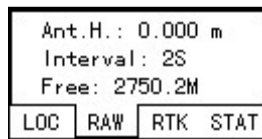
Home Page



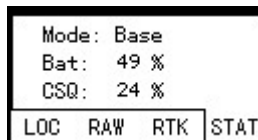
Coordinate Information



Current Data Link Status

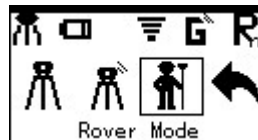


File Information



Device Status

Operating Mode Settings



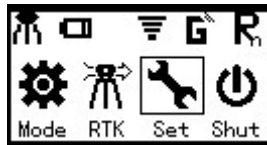
Switch Operating Modes

Operating Mode Settings (continued)



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.

If you want to take very accurate measures (few cm), we recommend you using a tripod and put the rover on it.

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:

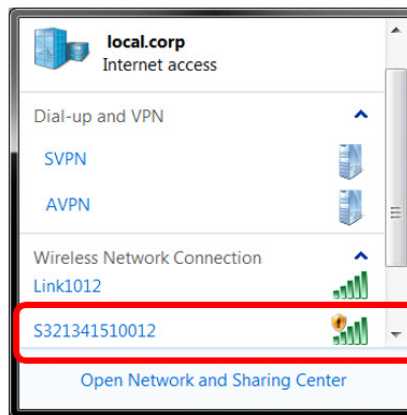
S321 XXXXXX
where “XXXXXX” is the serial number

Hemisphere Web UI

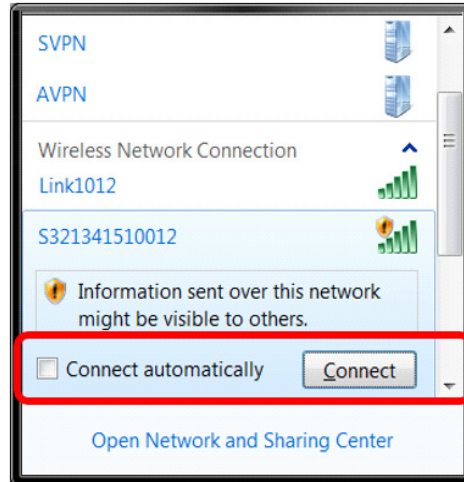
The Web UI can work on any PC, Tablet, or Phone that has Wi-Fi network capabilities.

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

- User Name: admin
- Password: s321

Web UI Start-up

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

The screenshot shows the Hemisphere S321 web interface. At the top right, the device ID 'S321' is displayed, along with its serial number (S/N: S321341510014), firmware version (FW: 1.23.161213), IP address (IP: 192.168.10.1), and the current time (2016-12-20 17:05:51). Below this is a navigation bar with tabs for 'Status', 'Information', 'Download', and 'Management'. The 'Status' tab is active, showing various GNSS parameters in two columns. The left column includes System Mode (Base), Longitude (-111.895423862°), Height (454.275 m), Satellites (20), HDOP (0.596), HRMS (1.192 m), and GNSS Time (2016-12-20 17:05:54). The right column includes Current Datalink (UHF), Latitude (33.643316451°), Status (Single), PDOP (0.979), TDOP (0.473), and VRMS (1.564 m). At the bottom, there is a contact email (techsupport@hgnss.com) and a copyright notice for Hemisphere GNSS.

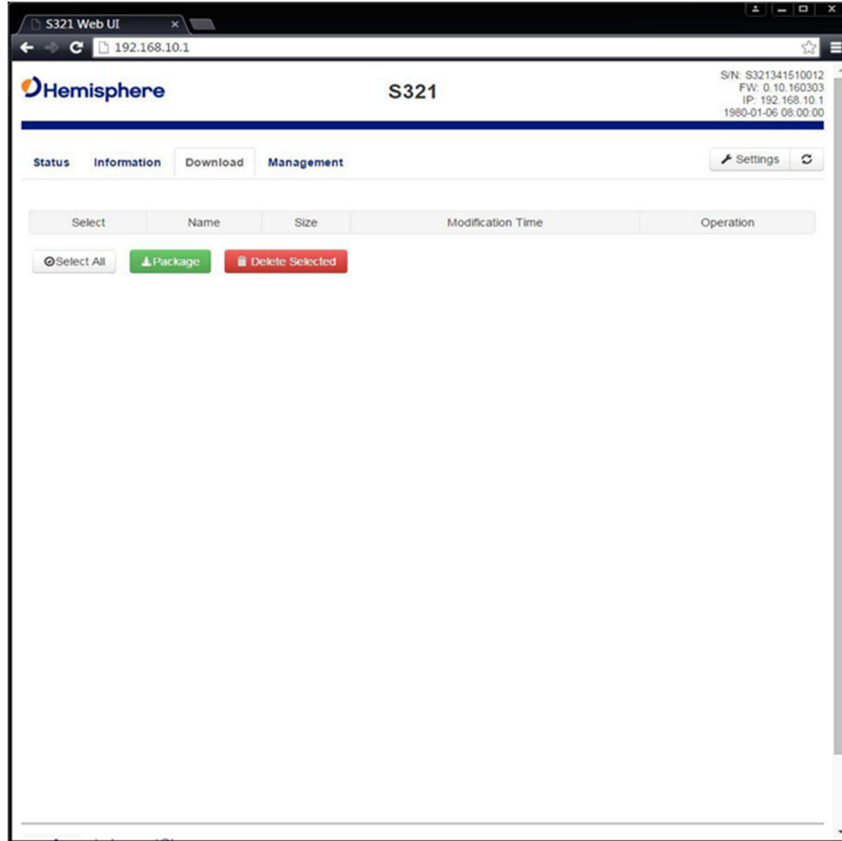
Parameter	Value
System Mode	Base [Started] [Stop] [Recording] [Stop Record]
Longitude	-111.895423862 °
Height	454.275 m
Satellites	20 [GPS: 12, Glonass: 6]
HDOP	0.596
HRMS	1.192 m
GNSS Time	2016-12-20 17:05:54
Current Datalink	UHF
Latitude	33.643316451 °
Status	Single
PDOP	0.979
TDOP	0.473
VRMS	1.564 m

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

The screenshot shows the Hemisphere S321 web interface with the 'Information' tab selected. The top right corner displays the device ID 'S321', S/N: S321341510014, FW: 1.23.161213, IP: 192.168.10.1, and time: 2016-12-21 15:47:11. The navigation bar shows 'Status', 'Information', 'Download', and 'Management'. The 'Information' tab displays detailed device and module information in two columns. The left column includes Device Model (S321), Hardware Version (S321-V1.1), Firmware Version (1.23.161213), MCU Version (1.08), Battery Power (76%), Used Memory (Internal Storage), and Manufacture Date (2015-8-26). The right column includes Device Serial (S321341510014), BOOT Version (4.02), OS Version (4.10), Sensor Version (01.08), Power Source (battery), and Data Memory (Total 3.16 GB, Free 3.16 GB). Below these are GNSS details: GNSS Model (P306), GNSS Hardware Version (1), GNSS Serial (18804149), and GNSS Firmware Version (5.3Aa13). Radio details include Radio Model (SATEL), Radio Firmware Version (V07.27.2.0.6.3), Radio Mode (PC1), and Serial (1519000422). Channel information shows Channel: 1 [469.55 MHz]. At the bottom, contact information and copyright notice are present.

Parameter	Value
Device Model	S321
Hardware Version	S321-V1.1
Firmware Version	1.23.161213
MCU Version	1.08
Battery Power	76%
Used Memory	Internal Storage
Manufacture Date	2015-8-26
Device Serial	S321341510014
BOOT Version	4.02
OS Version	4.10
Sensor Version	01.08
Power Source	battery
Data Memory	Total 3.16 GB, Free 3.16 GB
GNSS Model	P306
GNSS Hardware Version	1
GNSS Serial	18804149
GNSS Firmware Version	5.3Aa13
Radio Model	SATEL
Radio Firmware Version	V07.27.2.0.6.3
Radio Mode	PC1
Serial	1519000422
Channel	1 [469.55 MHz]

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



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:

The screenshot displays a web-based configuration interface for the S321 device. It is organized into several sections:

- Install New Firmware:** Features a file selection area with a "Choose File" button (showing "No file chosen") and a green "Upload File" button.
- GNSS Registration:** Shows "GNSS Functionality" with a long alphanumeric string. Below it is an "Auth Code" input field and a "Submit" button.
- Security:** Includes a checked checkbox for "Enable Login Authentication". Below this are input fields for "Old Password:", "New Password:", and "Confirm Password:", along with a "Change" button.
- View Logs:** Lists two log types: "1. APP Log" and "2. OS Log". Each has "Download" and "View" buttons.
- Format Internal Disk:** Has an "OK" button.
- Self Test:** Has an "OK" button.
- Restore Factory Settings:** Has an "OK" button.
- Reset:** Has an "OK" button.

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).

Web UI 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' dialog box with the 'Satellites' tab selected. The 'Current Datalink' is set to 'UHF'. A red box highlights the 'Advanced UHF Settings' section, which includes: Cutoff Angle (5), GLONASS (Enable), Beidou (Enable), SBAS (Disable), L-Band (Disable), RTK Timeout (30 s), and Athena Log (NO). The 'Save' button is highlighted in green.

- **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
- **SBAS:** Enable or Disable the use of SBAS for DGNSS corrections
- **L-Band:** Enable to use Atlas corrections or aRTK
- **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.)
- **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

Pdop 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 Pdrop 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**.

Hemisphere S321

S/N: S321341510014
FW: 1.23.161213
IP: 192.168.10.1
2016-12-20 17:05:51

Status Information Download Management Settings

- System Mode: Base [Started] Stop **[Recording]** Stop Record
- Longitude: -111.895423862 °
- Height: 454.275 m
- Satellites: 20 [GPS: 12, Glonass: 6]
- HDOP: 0.596
- HRMS: 1.192 m
- GNSS Time: 2016-12-20 17:05:54
- Current Datalink: UHF
- Latitude: 33.643316451 °
- Status: Single
- PDOP: 0.979
- TDOP: 0.473
- VRMS: 1.554 m

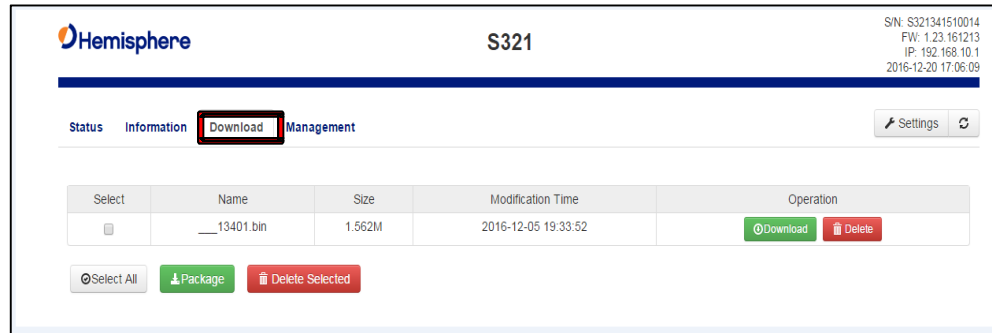
techsupport@hgns.com
© 2015 Hemisphere GNSS. All Rights Reserved.

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.

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**.



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:** 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

Base Position Single BaseLink Repeat Position

Coordinate: Degrees/Minutes/Seconds

Base Longitude: -111 53 43.49840

Base Latitude: 33 38 35.93490

Base Height: 453.876 m

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.

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

System Mode Static Rover Base

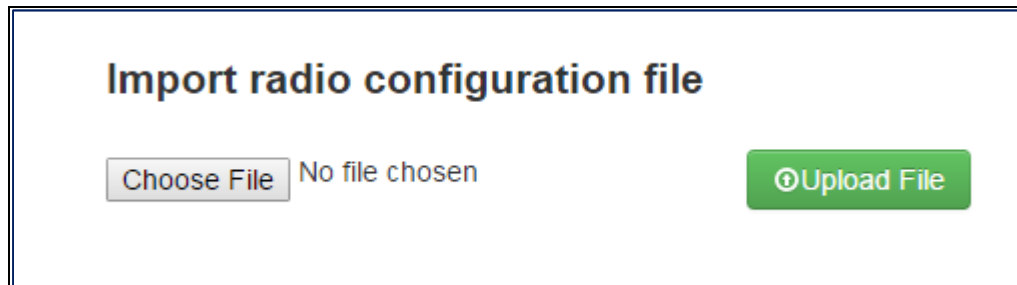
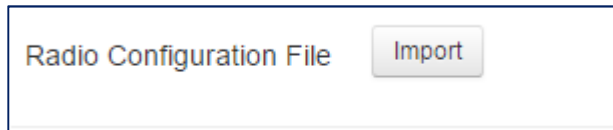
Current Datalink UHF Network External Bluetooth

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.

Radio Channel 2 469.55MHz, 12.5kHz Spacing, 1000mW TX

Radio Mode PC5

FEC ON

Radio Power 1000

Advanced UHF Settings

Radio Configuration File Import

- **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 4800 bps – 115200 bps.)

External Serial Port Baud Rate 38400

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 caster.

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:

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

- APN: isp.cingular
- APN User: (empty)
- APN Password: (empty)
- Connect Mode: Ntrip (dropdown menu)
- IP Address: rtcn-ntrip.org
- Port: 2101
- Mountpoint: MOUNTPOINT (highlighted in yellow)
- Password: (masked with dots)
- Auto Connect: YES (radio button selected)

Buttons for 'Save' and 'Cancel' are visible at the bottom right.

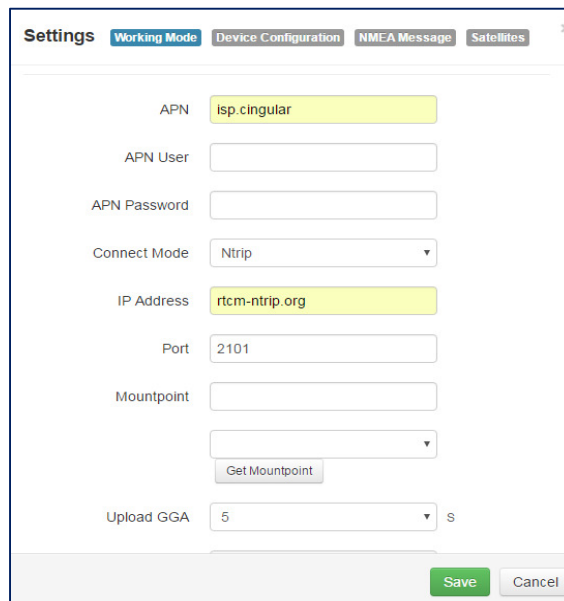
If configuring NTRIP for a Rover, click **Get Mountpoint** to generate a list of available mount points.

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 the 'Device Configuration' tab selected. The configuration fields are as follows:

- APN: isp.cingular
- APN User: (empty text box)
- APN Password: (empty text box)
- Connect Mode: Ntrip (dropdown menu)
- IP Address: rtcn-ntrip.org
- Port: 2101
- Mountpoint: (empty text box)
- Mountpoint: (empty dropdown menu)
- Get Mountpoint: (button)
- Upload GGA: 5 (dropdown menu) s

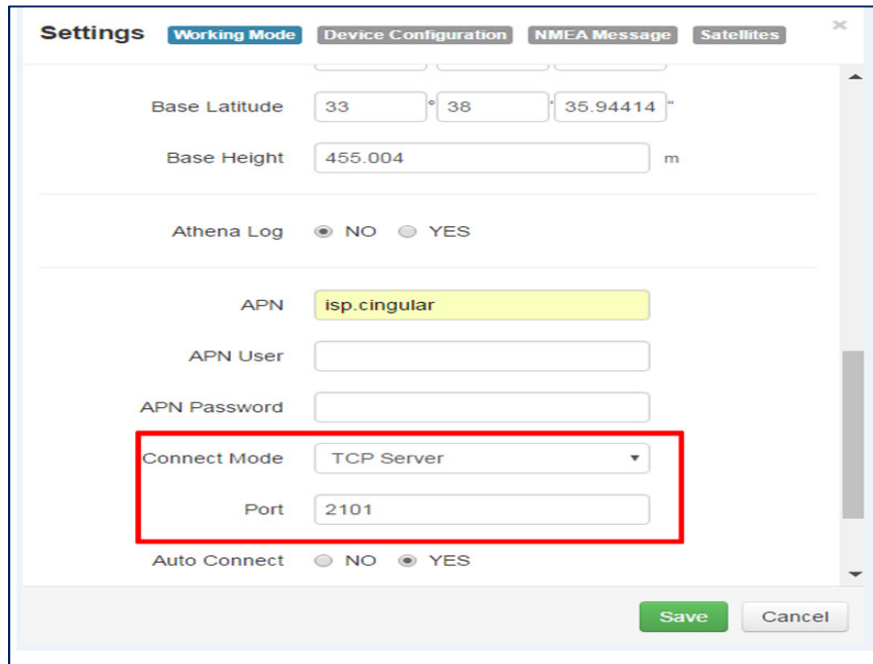
At the bottom right, there are 'Save' and 'Cancel' buttons.

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.

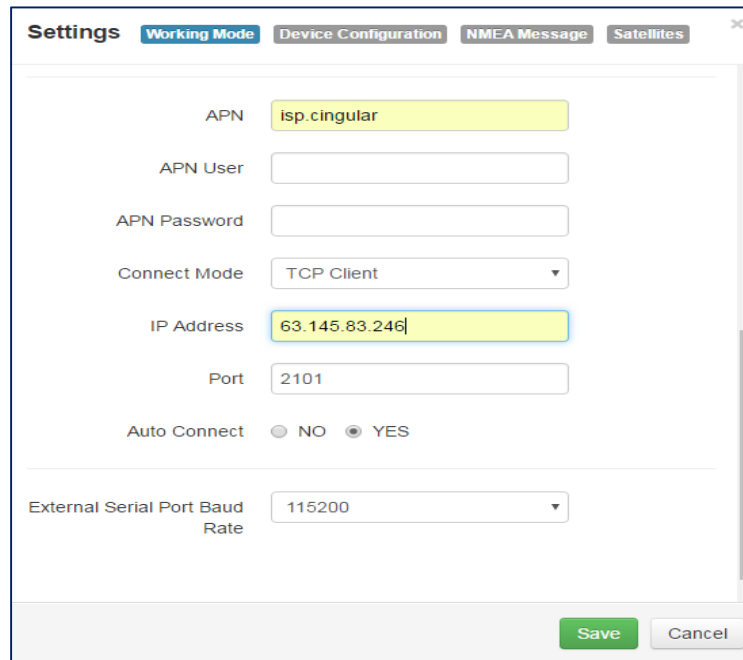
Note: The **Auto Connect** identifies that the receiver connects to the network when powered up.



The screenshot shows the 'Settings' window with the 'Device Configuration' tab selected. The 'Connect Mode' dropdown menu is set to 'TCP Server' and the 'Port' field contains the value '2101'. A red rectangular box highlights these two fields. 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). 'Save' and 'Cancel' buttons are at the bottom right.

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.



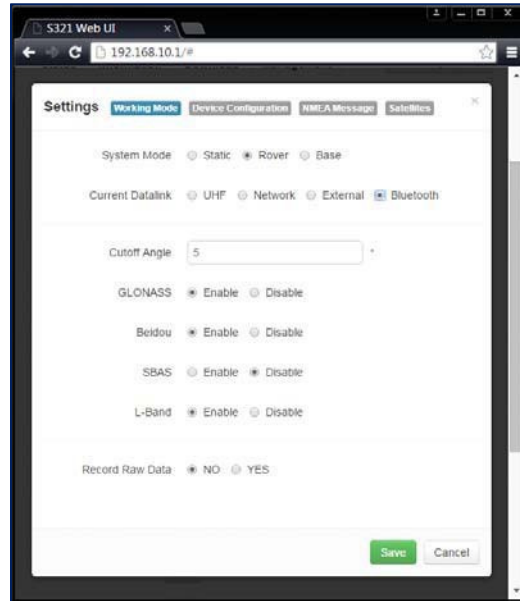
The screenshot shows a software window titled "Settings" with a close button (X) in the top right corner. The window has four tabs: "Working Mode" (selected), "Device Configuration", "NMEA Message", and "Satellites". The "Device Configuration" tab is active, displaying several configuration fields:

- APN: A text input field containing "isp.cingular".
- APN User: An empty text input field.
- APN Password: An empty text input field.
- Connect Mode: A dropdown menu currently set to "TCP Client".
- IP Address: A text input field containing "63.145.83.246".
- Port: A text input field containing "2101".
- Auto Connect: Two radio buttons, "NO" and "YES", with "YES" selected.
- External Serial Port Baud Rate: A dropdown menu currently set to "115200".

At the bottom right of the window, there are two buttons: a green "Save" button and a grey "Cancel" button.

Rover/Bluetooth

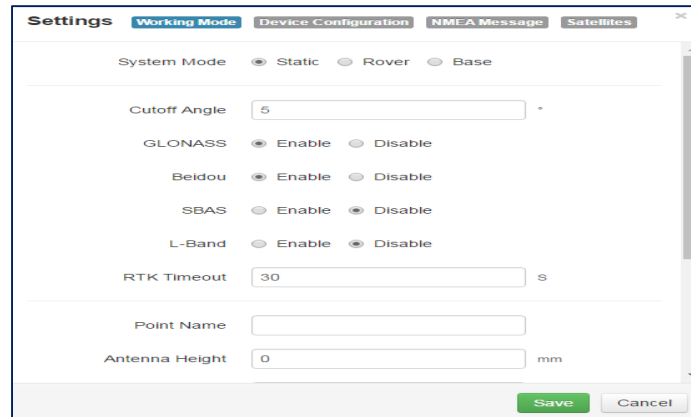
The Rover/Bluetooth is typically used with third-party software when streaming network corrections to the data collector internet and then sending them to the S321 via the Bluetooth communication port.



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).



The screenshot shows a software window titled "Settings" with four tabs: "Working Mode", "Device Configuration", "NMEA Message", and "Satellites". The "Device Configuration" tab is active. It contains the following settings:

- System Mode:** Three radio buttons are present: "Static" (selected), "Rover", and "Base".
- Cutoff Angle:** A text input field containing the number "5".
- GLONASS:** Two radio buttons: "Enable" (selected) and "Disable".
- Beidou:** Two radio buttons: "Enable" (selected) and "Disable".
- SBAS:** Two radio buttons: "Enable" and "Disable" (selected).
- L-Band:** Two radio buttons: "Enable" and "Disable" (selected).
- RTK Timeout:** A text input field containing "30" followed by a unit indicator "s".
- Point Name:** An empty text input field.
- Antenna Height:** A text input field containing "0" followed by a unit indicator "mm".

At the bottom right of the dialog, there are two buttons: "Save" (highlighted in green) and "Cancel".

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.

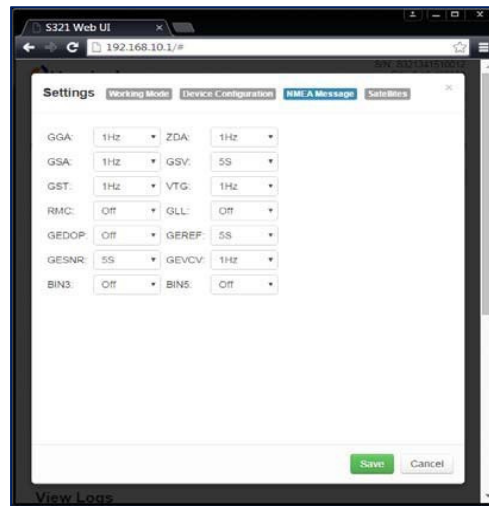
Direct Link Mode enables certain troubleshooting features for Hemisphere GNSS and certified Hemisphere GNSS dealers. In addition, the easy-to-use radio buttons allow you to use tracker and select which mode of data logging storage you wish to use, SD or Internal.



NMEA Message

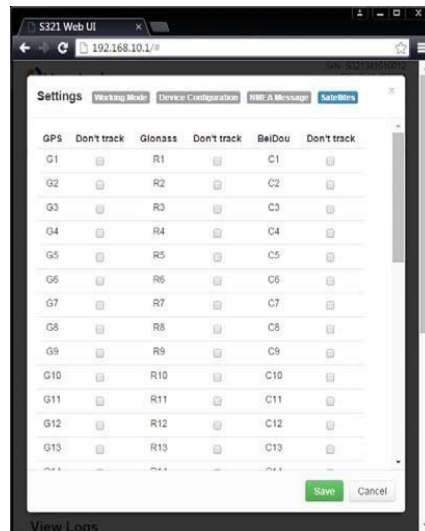
Turn the NMEA messages on.

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.



Satellites

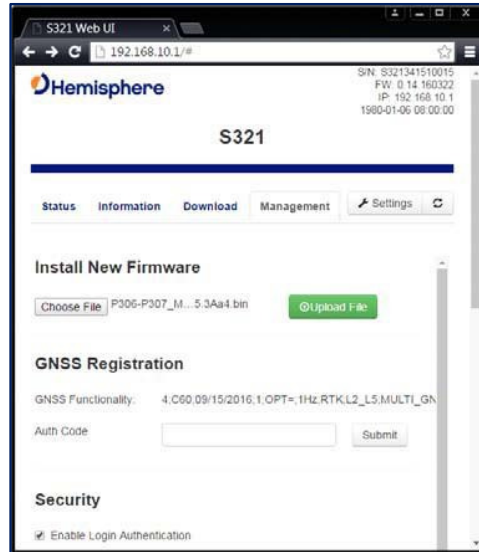
If you wish to exclude a specific satellite, select the **Don't track** checkbox next to that satellite in the list.



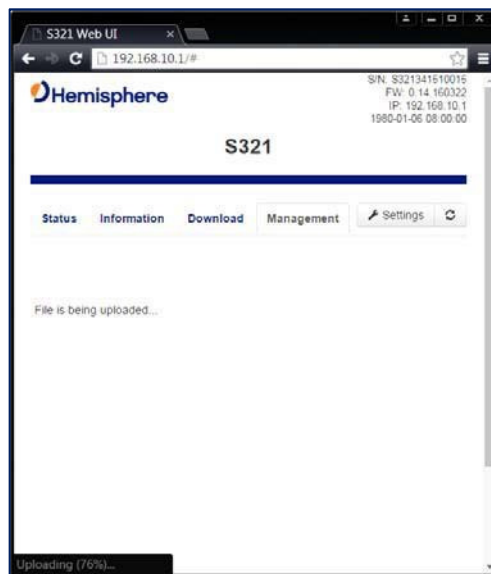
Firmware Update

Updating Firmware via Web UI

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

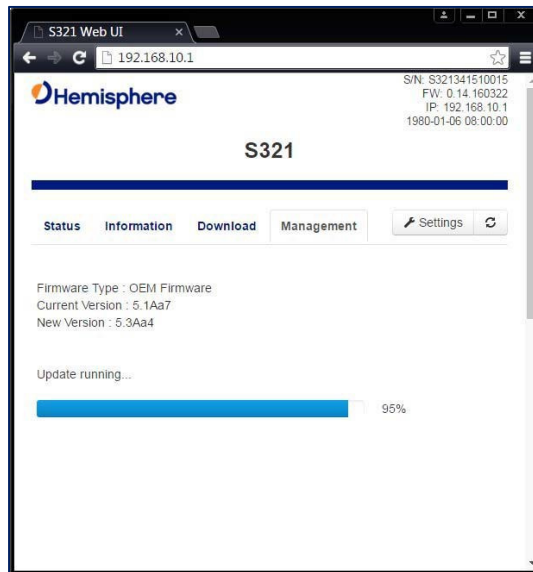


After selecting the correct firmware/software file, click the green “**Upload File**” button.

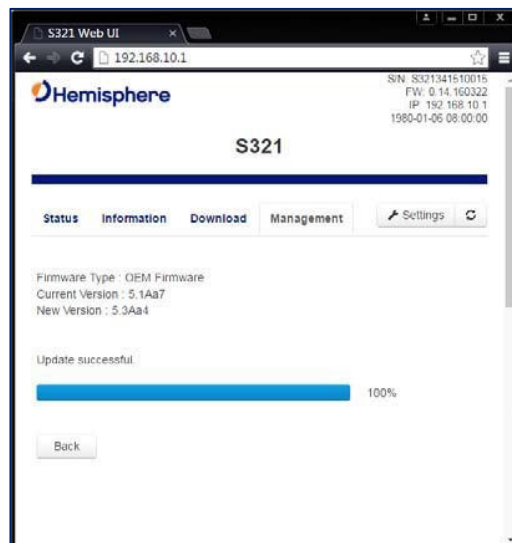


When the file is uploaded, be sure to check the current firmware version versus the new firmware version. When you have ensured the correct files are in place, click “OK” button.

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



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



Updating Firmware via Micro SD Card

Using the Web UI, 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 Micro SD 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

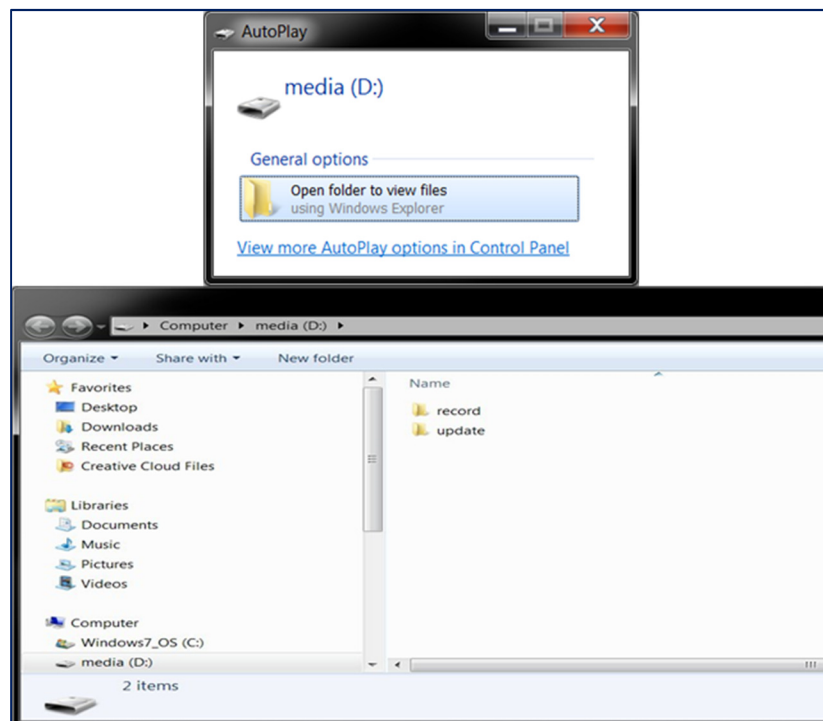
3G module firmware: PHS_update_XXXXX.bin XXXXX: version
e.g. PHS_update_03.001.bin

How to Download Static Data

You can download static data by Web UI “Download” tab and by USB. This allows the user to download internal logs via the USB port on the 7-pin connector. For a correct connection between receiver and PC, follow the procedure described below.

At first turn off the receiver, then connect the cable to the communication interface of the receiver (7-pin Lemo), then insert the USB port in the PC. Turn the S321 back on and the following task- bar will show as follows:

The PC considers the receiver as a “media disk”, so open the “media disk”, to retrieve the data files in the memory.



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	Vertical Rotation Bracket

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)	X		
Calibration Tool (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 <i>In Step 1, the tribrach can be set on a solid table or tripod</i>	X <i>In Step 2, the tribrach should be mounted on a solid tripod</i>	
Solid pole (not less than two meters long with calibrated vial)			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	
Fully charged S321 battery	Not battery dependent	X <i>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. Step 2 should be repeated for each battery that you will later use in the S321.</i>	X <i>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. Step 3 should be repeated for each battery that you will later use in the S321.</i>
An open area free of strong magnetic fields and free of potential for high multipath. Note: The farther away you are from a magnetic interference source increases performance. For example, it is better to be 20 meters (60 feet) from your vehicle than 5 meters (15 feet).			

*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/support/knowledge-base/?action=display_topic&topic_id=1066.
- 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 **1Job** button.



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



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

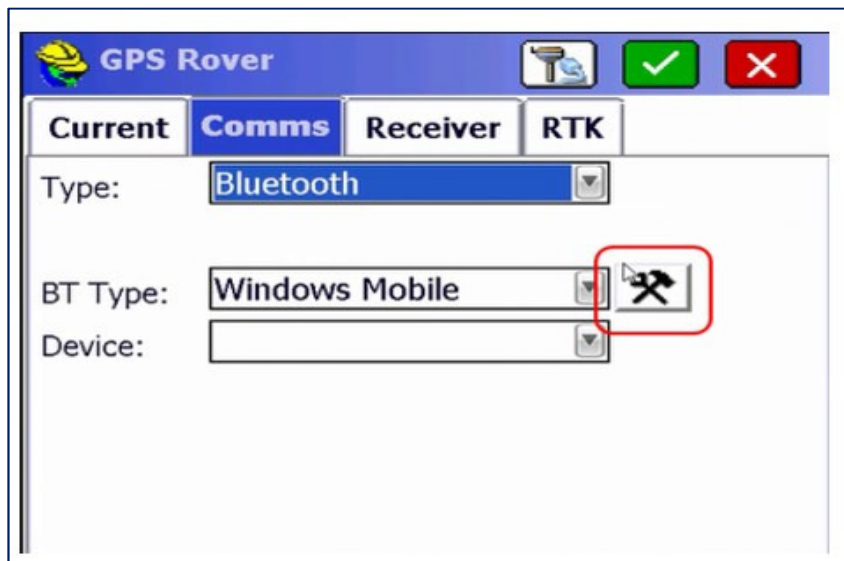
To calibrate your S321, select “**Hemisphere GNSS**” from the **Manufacturer** drop-down list. Select “**S321**” from the **Model** drop-down list.



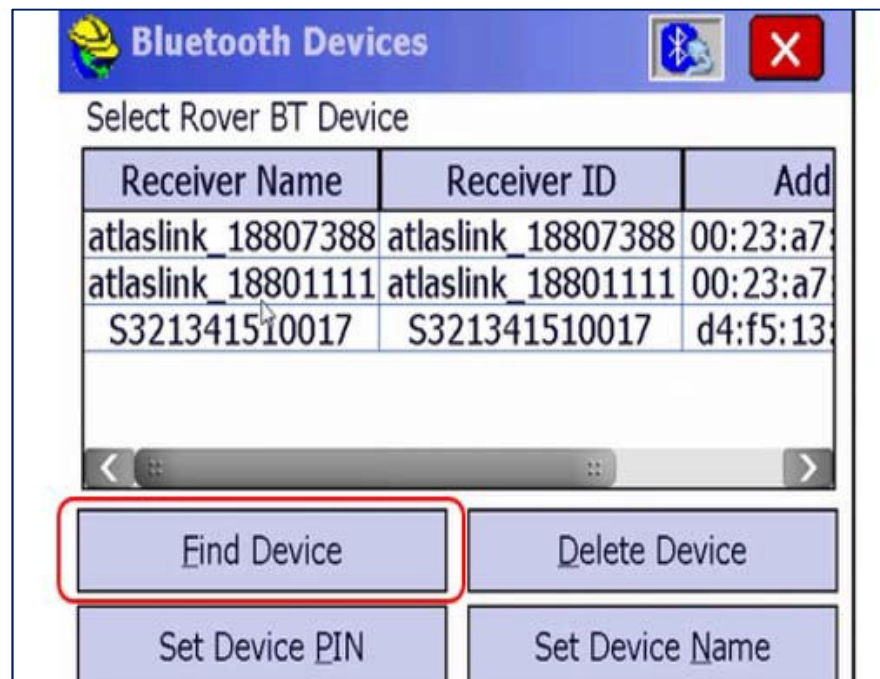
On the **Comms** tab, select **Bluetooth** from the **Type** drop-down list. Select the “**Windows Mobile**” **BT Type**.

Tap the wrench and hammer icon.

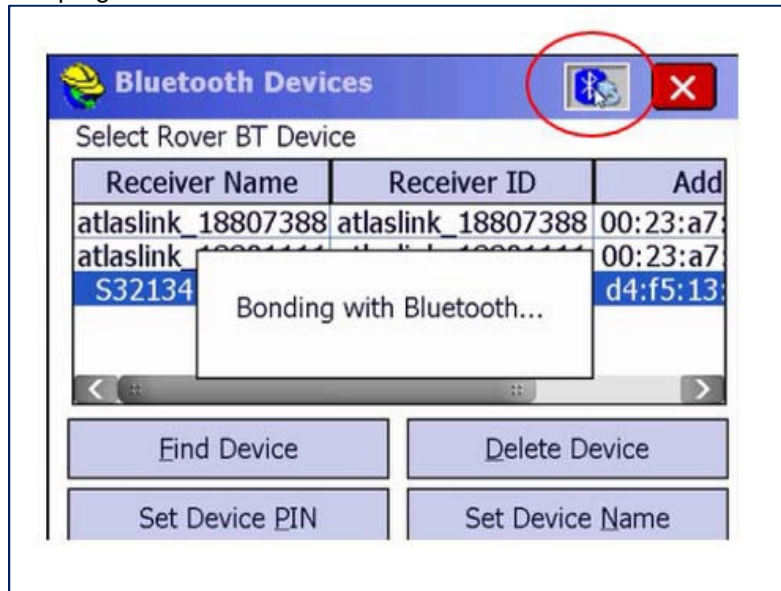
Note: The wrench and hammer icon allows you to find your S321 device.



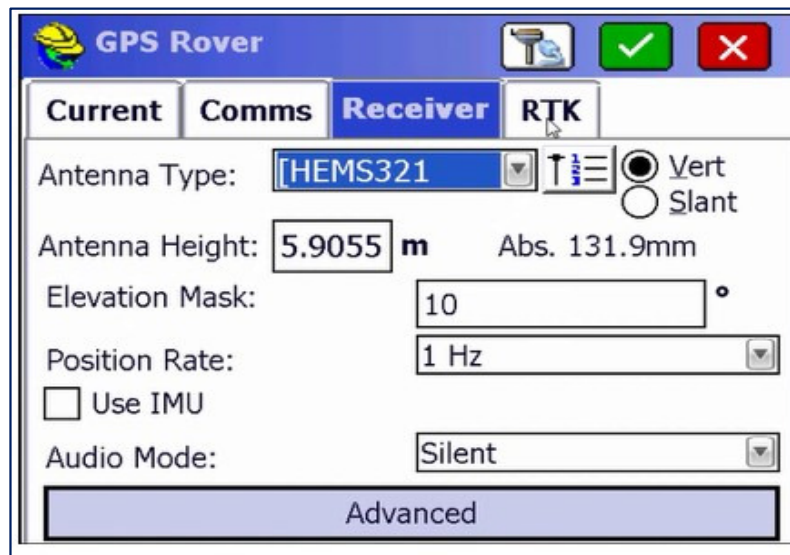
Tap the **Find Device** button and wait for a complete list of devices to generate.



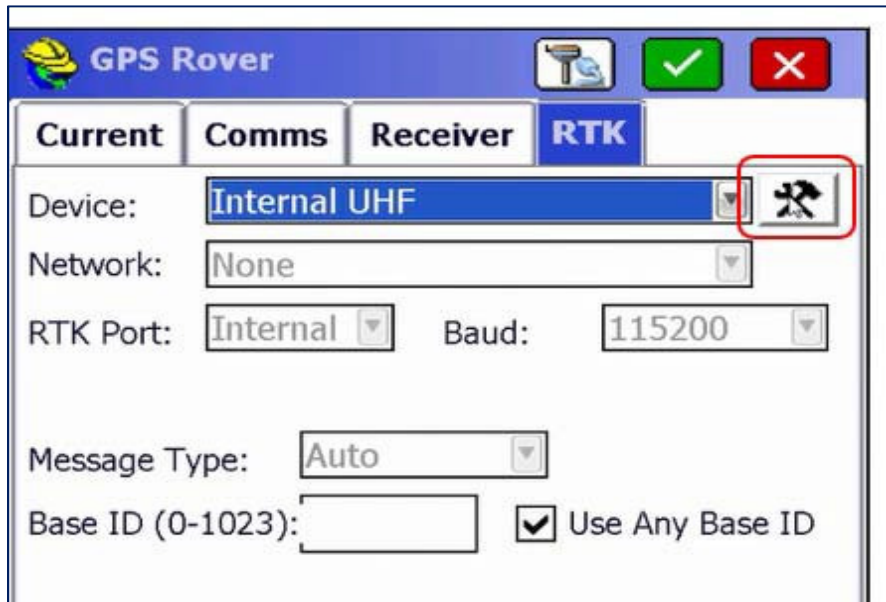
When you see your device on the list, tap the **device name** to highlight it. Then press the **Bluetooth Connect** icon at the top right of the screen.



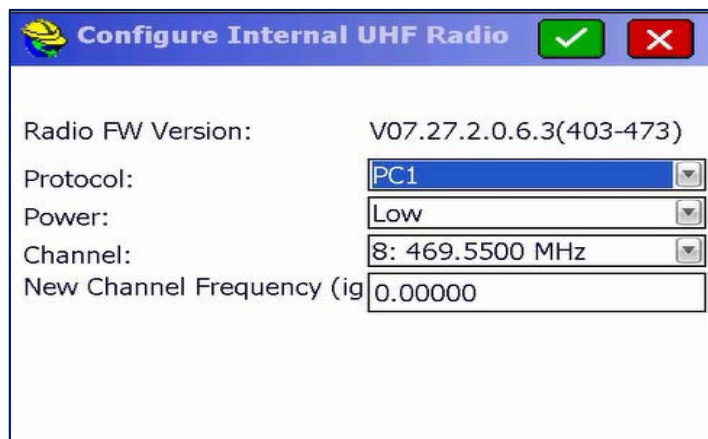
Once Bluetooth has bonded with your device, tap the **Receiver** tab. Under **Antenna Type**, ensure **HEMS321** is selected from the drop-down list.



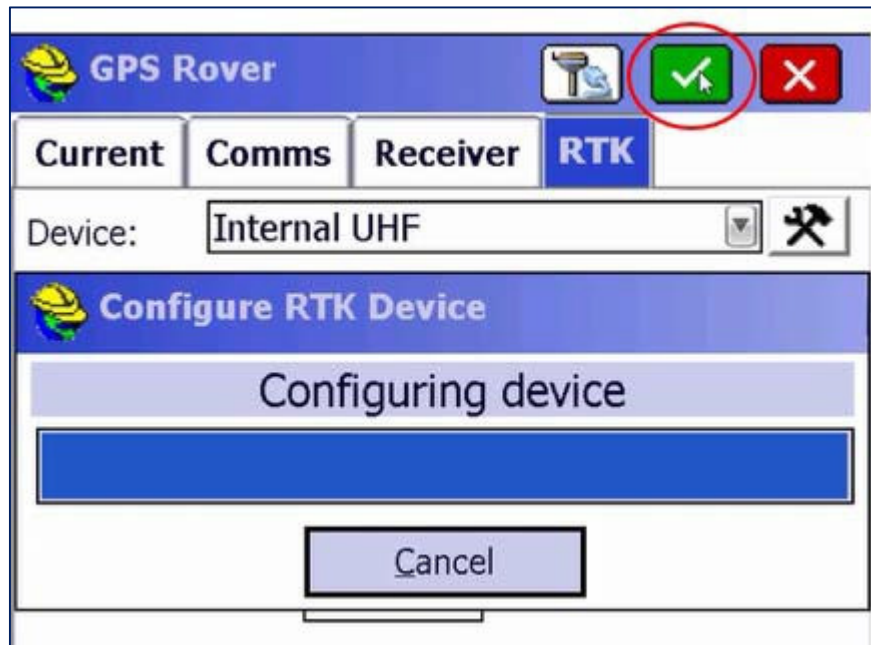
Tap the **RTK** tab. Under **Device**, select “**Internal UHF**” from the drop-down list. Tap the wrench and hammer icon.



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



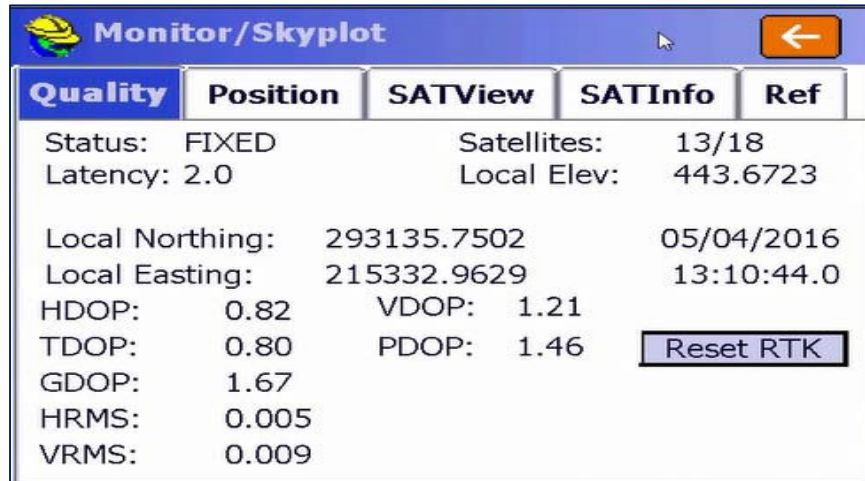
When your desired protocol has been selected, tap the green checkmark at the top of the screen.



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.

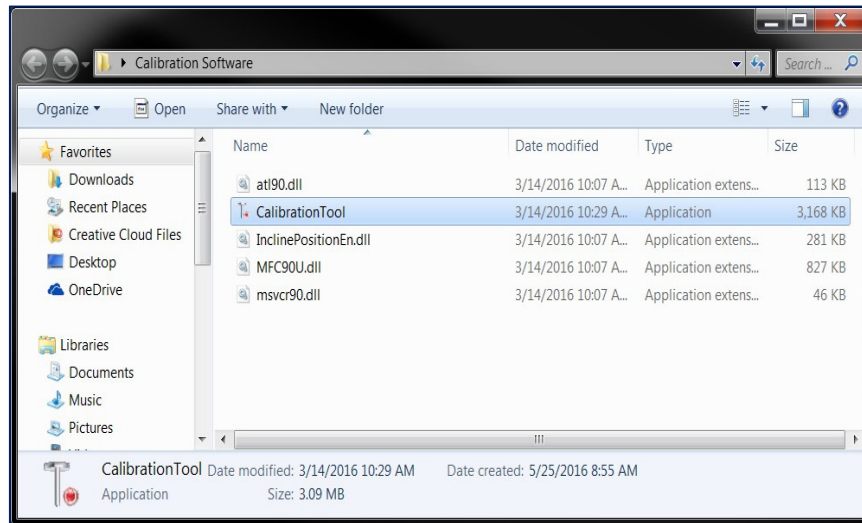
When prompted with a pop-up asking if you are sure you want to exit, tap the **Yes** button.



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.

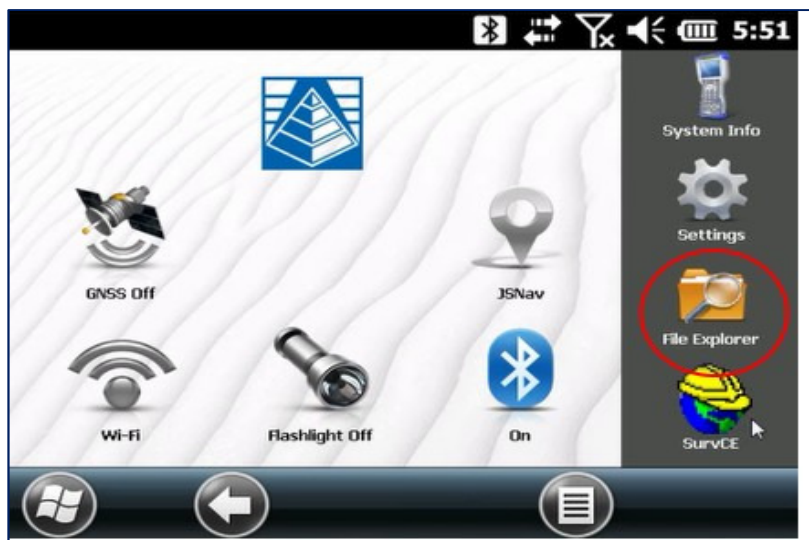


Calibration Step 1 – Electronic Bubble Calibration

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 tribach or pole that has been leveled as accurately as possible. A high quality, calibrated tribach with an accurate line level in a rotating mount as shown below will provide the best calibration.

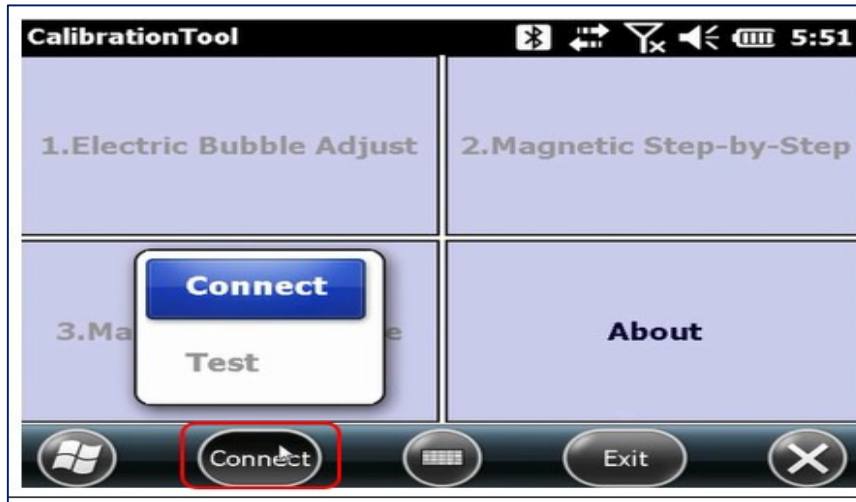
From your handheld device screen. Tap the “**File Explorer**” icon.



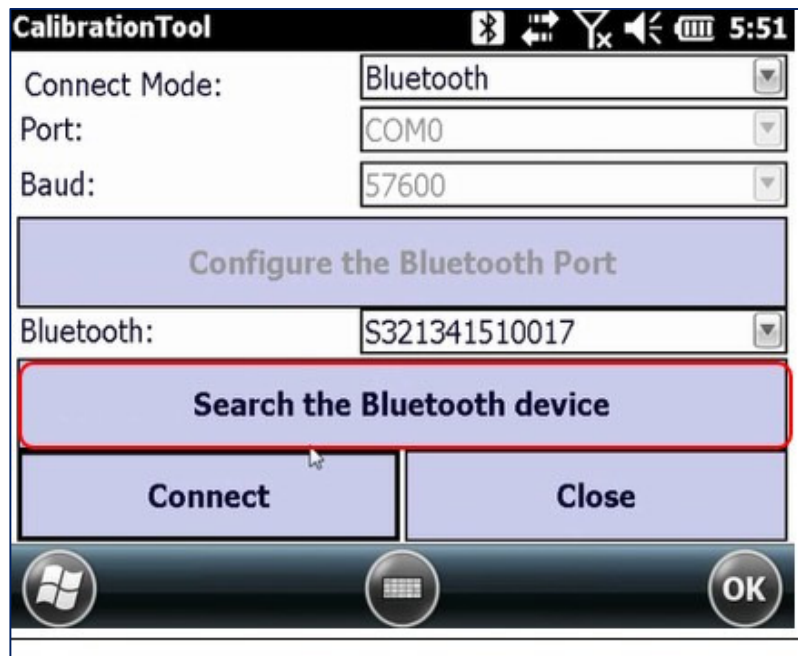
Locate the **CalibrationTool** from your list of Calibration Software. Tap the **CalibrationTool** to open the program.



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.



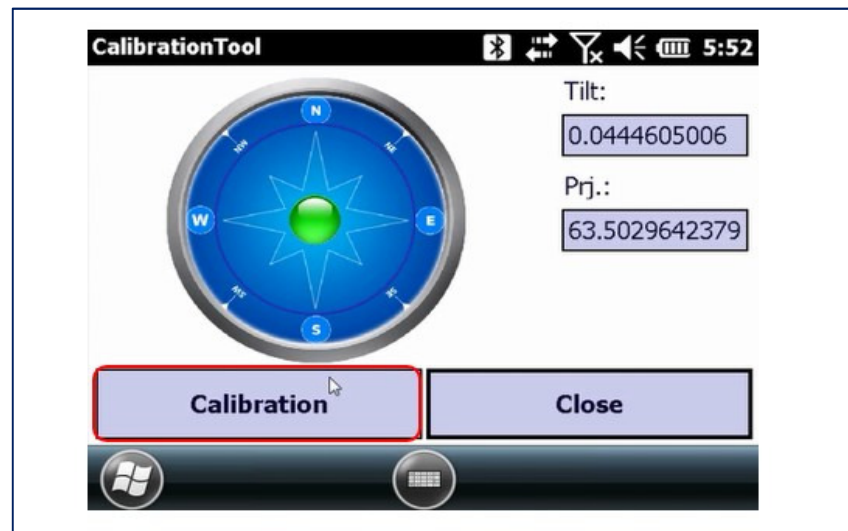
The first portion of the calibration is the **Electric Bubble Adjust**. Tap the **1.Electric Bubble Adjust** button to open the calibration screen.



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.

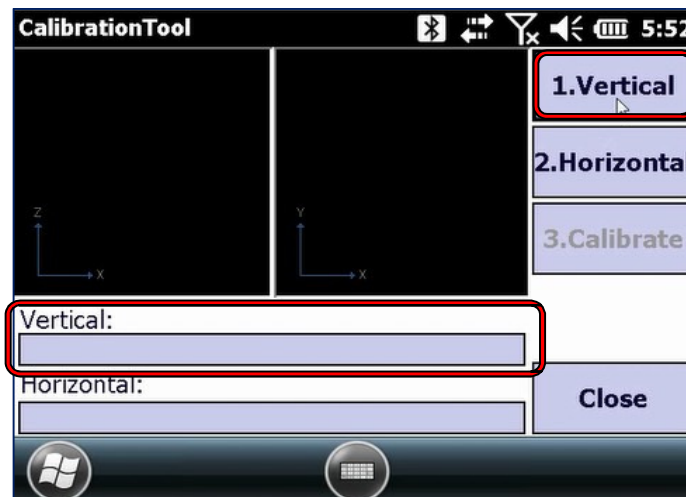
A good way to keep the pole vertical while rotating, is to grab the pole with one hand at face-height while using the fingers of your second hand to rotate the pole.

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.



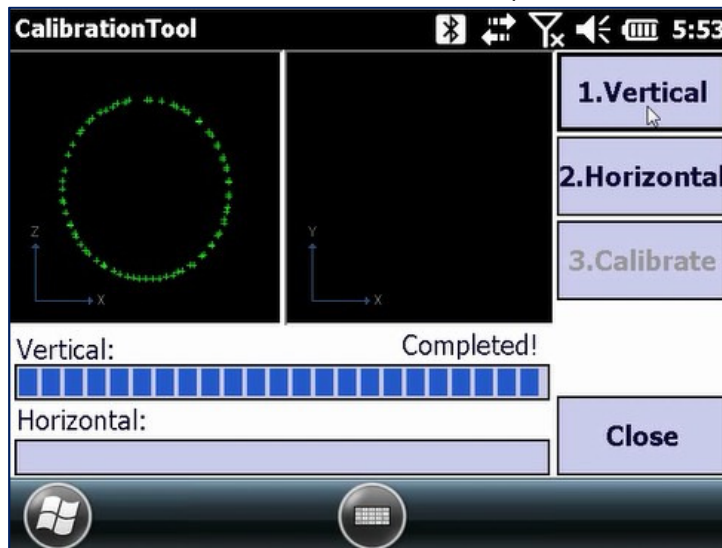
The first magnetic calibration will be the **Vertical**. Remove the S321 from the survey pole and place it on the Mini Rotary Tool. Connect the Mini Rotary Tool back to the survey pole (see picture in step below for example). Click the **1.Vertical** button and slowly rotate the device clockwise 360°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



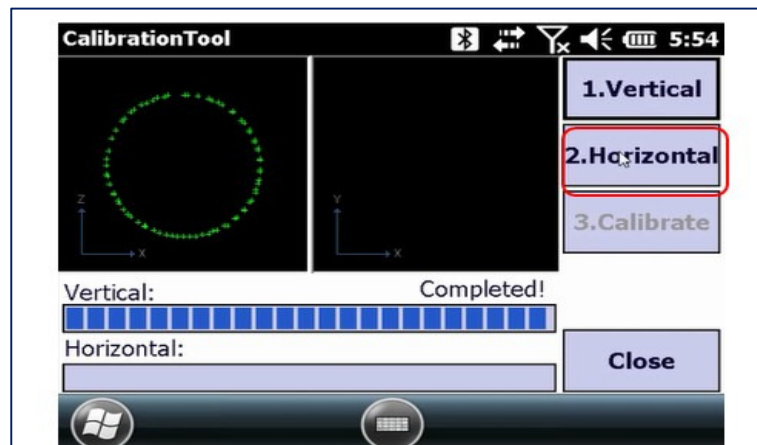
The progress bar will indicate when the Vertical calibration is complete.



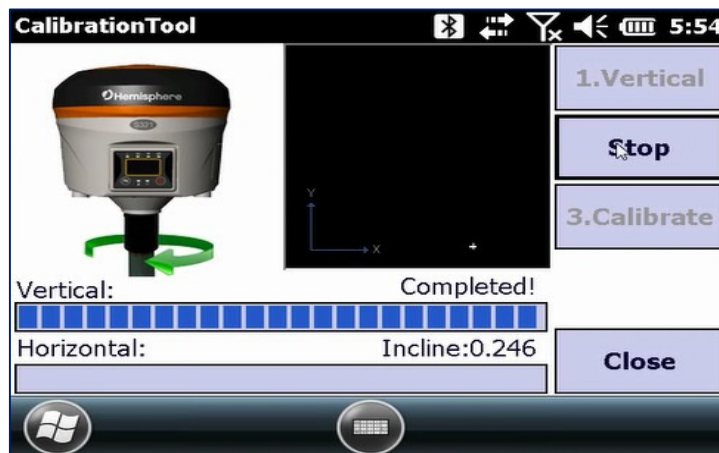
The second magnetic calibration is the **Horizontal**. Place the S321 back onto the survey pole, in the normal orientation.

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

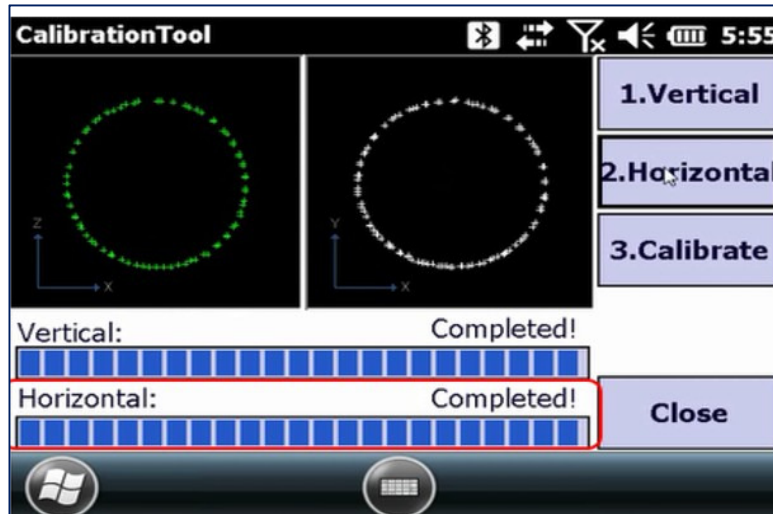
Slowly rotate the S321 so that it takes at least 30 seconds to make one complete rotation.



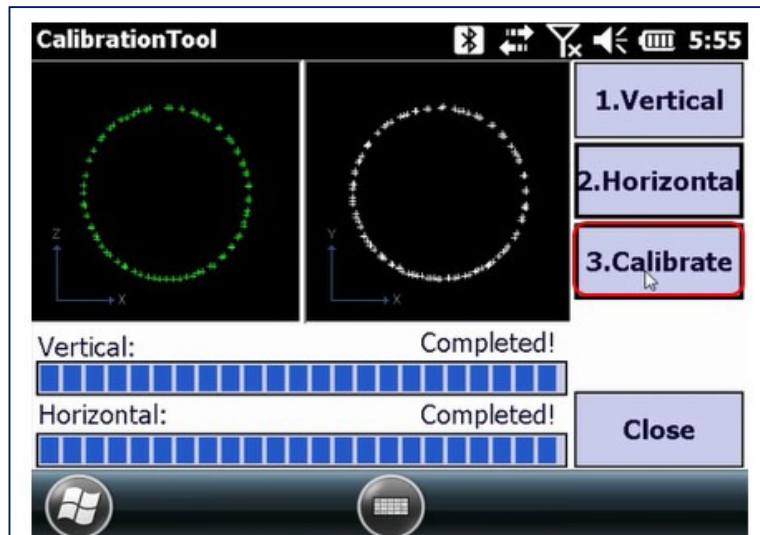
The progress bar will start to move as the calibration marks the points.



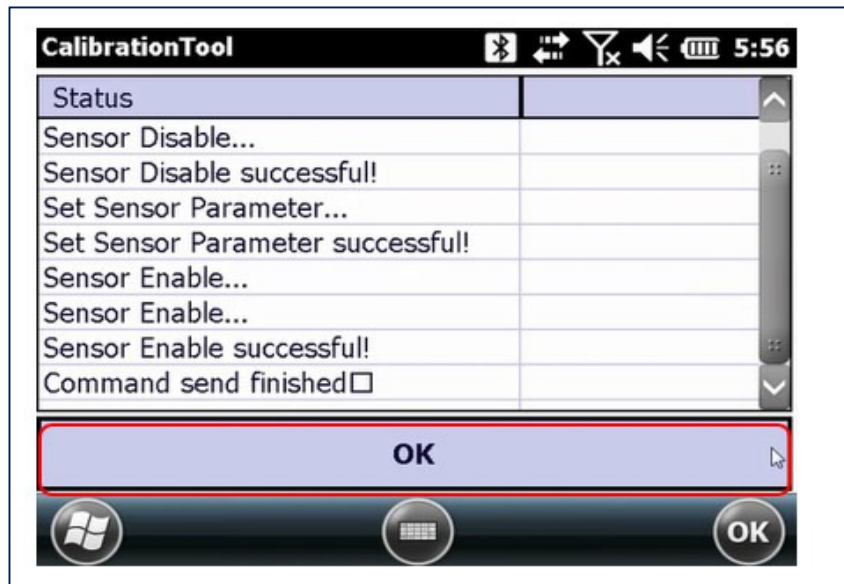
The progress bar will indicate when the Horizontal calibration is complete.



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.



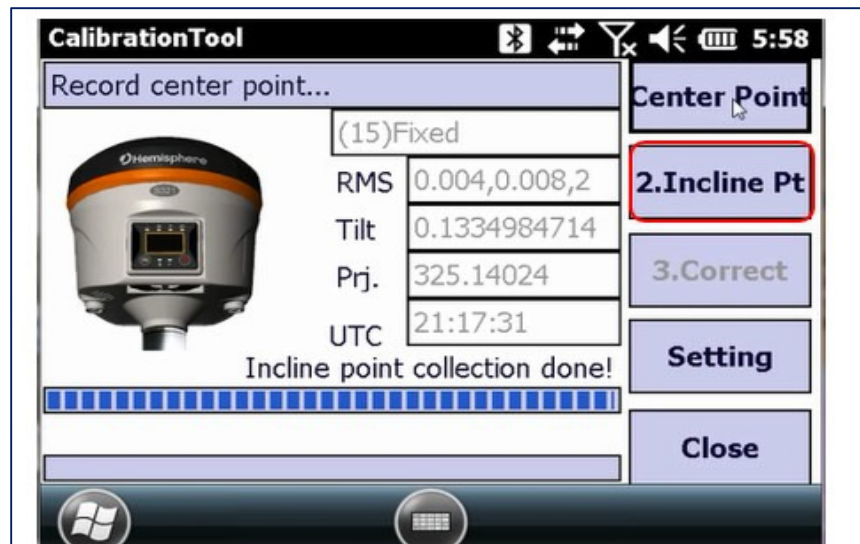
Note: If the receiver is not level or not FIXED, the points will not be captured and a warning message will be displayed. If points are not being captured, make the necessary adjustments as prompted on the display.

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.



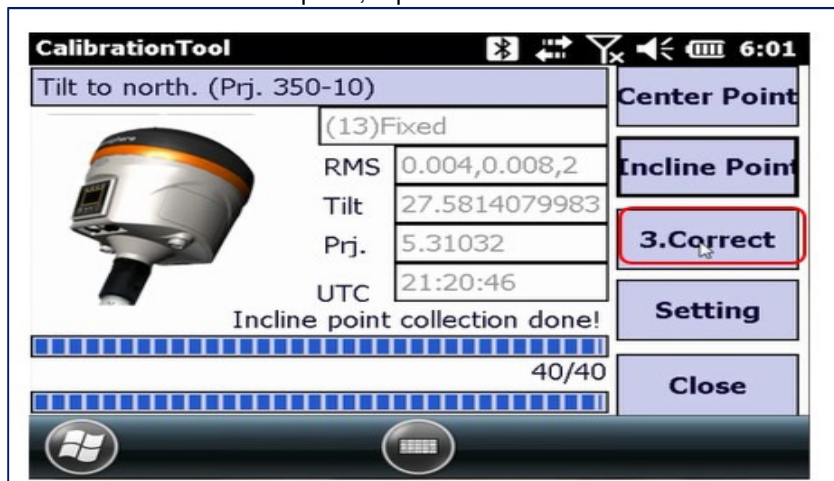
Tilt the S321 and survey pole to the **WEST** at approximately 25° to 35° angle. Below you will see “**Tilt**” is the angle of the unit, and the “**Prj**” is the direction in which the device is facing.



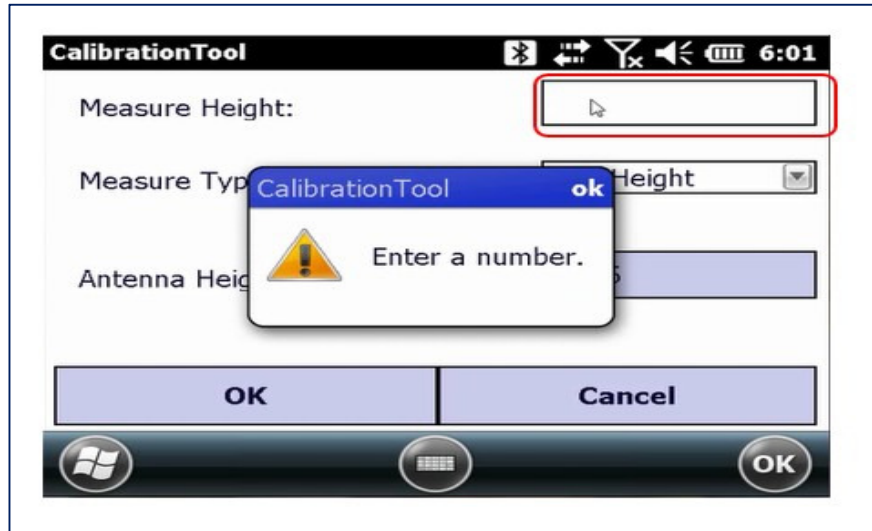
Tilt the S321 and survey pole to the **NORTH** at approximately 25° to 35° angle. Below you will see “**Tilt**” is the angle of the unit, and the “**Prj**” is the direction in which the device is facing.



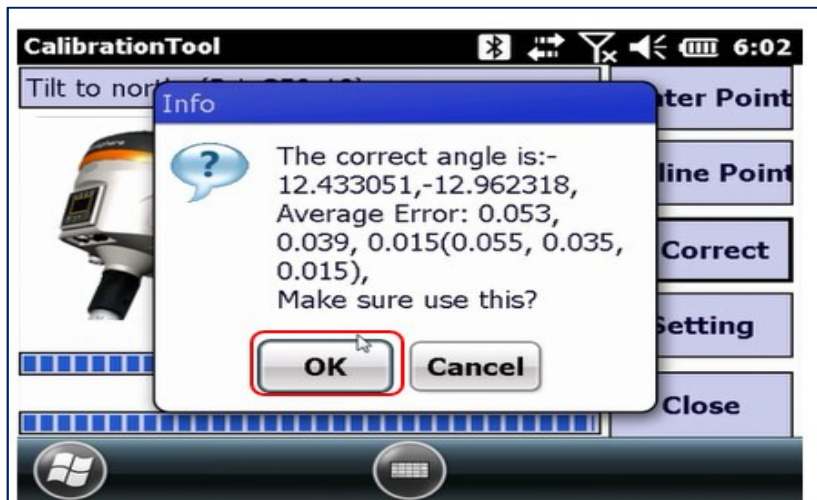
When the Incline Point calibration is complete, tap **3. Correct** to submit the calibration to the S321.



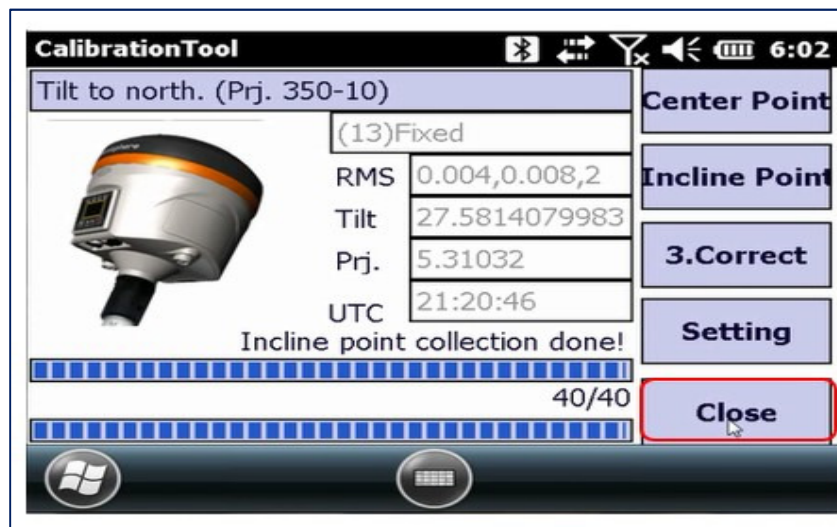
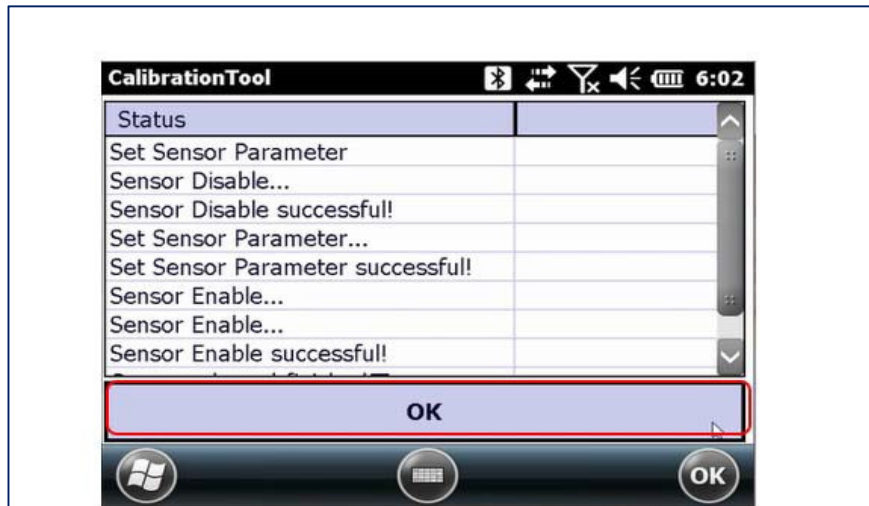
Enter the height of the survey pole (in meters) used for calibration in the “**Measure Height**” field below. Then tap **OK**.



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"> • External power is low • Check charge on external battery and the fuse on the power cable, if applicable • Internal power: Check charge on internal battery • Check all power cables and pins • Try other batteries or cables • Make sure to hold the power button down for a minimum of one full second to turn on • Ensure the battery is installed with contacts pointed in the correct direction
No data logged 1 No communication 2 No valid data	<ul style="list-style-type: none"> • Check receiver power status • Verify that it is locked to 4 or more GPS satellites • Check integrity and connectivity of power and data cable connections • Verify that the baud rate settings match in external device mode • If trying to connect over Bluetooth, ensure Bluetooth module is powered ON and device is paired prior to opening the port
Random data from Web UI or S321 Direct Link mode	<ul style="list-style-type: none"> • Verify the messages selected in the output messages in the Web UI match what you desire. • Verify the baud rate settings match • 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.
S321 Will Not Go RTK Fixed	<ul style="list-style-type: none"> • If the S321 is “RTK Float”, then it is receiving RTK or Atlas corrections. • If the RTK latency is between 10-15 seconds, these are most likely Atlas corrections. • If the RTK latency is less than 10-15 seconds, the S321 is receiving RTK, but probably will not Fix because of the environment. • If the S321 will not go RTK Float or RTK Fixed, check to ensure the base station is operating. • Verify the settings of the UHF radio at the base and at the rover are the same. • If using a network, check the Cellular Signal Quality (CSQ) under the Information tab for cellular reception. CSQ can also be viewed on the S321 display screen by pressing the FN button. • If using the internal UHF radio, ensure a valid 400MHz UHF antenna is plugged into the SMA connector labeled UHF. • If using the Internal GSM modem, ensure that the cellular antenna is screwed into the SMA connector labeled UMTS. • WARNING: The connectors are identical, always check to ensure the correct antenna is screwed into the correct slot. • If using Bluetooth, ensure RTK is reaching the data collector (check the data collector internet or data collector radio).



Appendix B: Technical Specifications

Appendix B: Technical Specifications

Table B-1: GNSS Receiver Specifications

Item	Specification
Receiver type	Multi Frequency GNSS
Channels	372
Positioning modes	RTK, L-band DGNSS, SBAS, External RTCM, Autonomous
RTK formats	RTCM2.3, RTCM3.0, RTCM3.x, CMR, CMR+, ROX
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 Specifications

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 ³	0.08 m	0.16m
SBAS Performance ¹	0.3 m	0.6 m
Autonomous, no SA ²	1.2 m	2.4 m

Table B-3: Satellite Tracking

Satellites	
GPS	L1C/A, L1P, L2P, L2C
GLONASS	L1C/A, L2C/A
BeiDou	B1, B2
QZSS	With future firmware upgrade
Galileo	With future firmware upgrade

Table B-3: Satellite Tracking (continued)

Satellites	
SBAS	MSAS, WAAS, EGNOS, GAGAN

Table B-4: Communication and Port Specifications

Item	Description
Connectors I/O	5-pin Lemo connector for external power supply and external radio devices 7-pin Lemo connector for USB OTG connection and a serial port interface 1 antenna connector for internal radio 1 antenna connector for modem module
Web UI	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	RTCM3.0, RTCM3.2, CMR, CMR+, and ROX (Hemisphere proprietary messaging format)

Table B-5: Radio Specifications

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

Table B-6: Wireless Specifications

Item	Specification
Wi-Fi	Integrated module with internal Wi-Fi antenna 802.11 bgn.
Bluetooth	Bluetooth 2.1 + EDR Integrated Bluetooth (BT) communication module with internal BT antenna

Table B-7: Cellular Specifications

Item	Description
Type	UMTS/HSPA+ (WCDMA/FDD), GSM/GPRS/EDGE
Supported Frequencies	<ul style="list-style-type: none"> UMTS/HSPA+ (WCDMA/FDD) (850, 900, 1900 and 2100 MHz) GSM (850/900/1800/1900 MHz)

Table B-8: Power Specifications

Item	Specification
Battery	Rechargeable 11.1 V - 37.74 Wh
Battery Life	6 hours with one battery and UHF radio in Rx mode
Voltage	9 to 22V DC external power input with over-voltage protection
Charge Time	Typically 7 hours

Table B-9: Memory Specifications

Item	Specification
SIM Card	Accessible SIM card slot
Memory	Internal 4GB. Accessible through USB and Wi-Fi External Micro SD card slot supports up to 64 GB.

Table B-10: Environmental Specifications

Item	Specification
Operating Temperature	-30°C to 60°C (-22°F to 140°F)
Storage Temperature	-40°C to 80°C (-22°F to 176°F)
Water / Dust Proof	IP67
Shock Resistance	MIL-STD-810G, method 516.6
Vibration	MIL-STD-810G, method 514.6E-I
Humidity	Up to 100%

Table B-11: Mechanical specifications

Item	Specification
Size	14.1 D x 14.0 H (cm) 5.5 D x 5.5 H (in)
Weight	<1.38 kg (<3.05 lbs)
Mounting	5/8"x11, 55 ° thread angle, stainless steel insert
Phase Center Offset	GPS L1 and L2 offset below 2.5mm

¹ Depends on multi-path environment, number of satellites in view, satellite geometry, and ionospheric activity

² Depends also on baseline length

³ Requires a subscription from Hemisphere GNSS



Appendix C: Radio Mode

Appendix C: Radio Mode

Table C-1: Radio Mode

Radio Mode	Link Rate	Spacing	Modulation	Scrambling	FEC
Trintalk 1	4800 bps	12.5 kHz	GMSK	On	Off
Trintalk 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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