

# Insight V2 Operation Manual

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# Chapter I Getting Started

*Read this chapter, you will have a brief knowledge of South Company and Insight V2 measurement system.*

## 1.1 Introduction

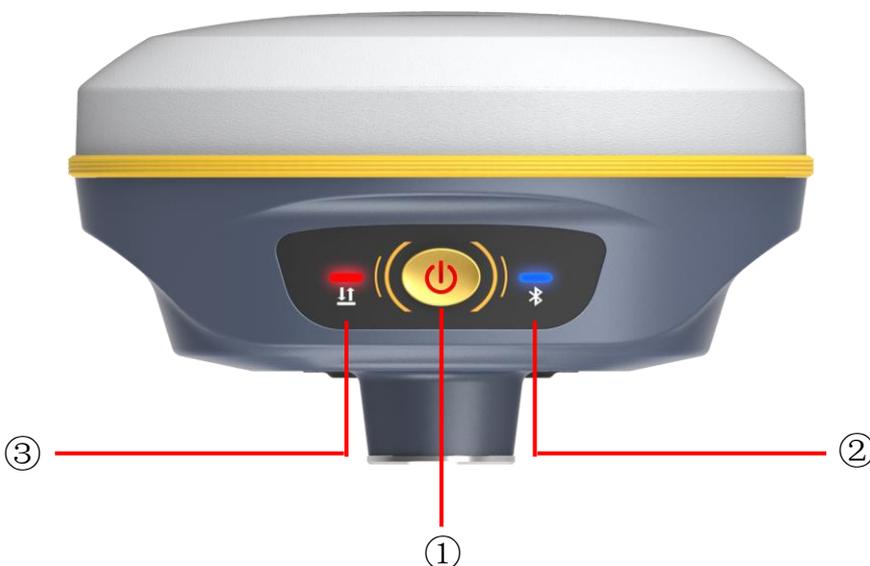
Welcome to South Surveying&Mapping Instruments Co., Ltd, which is China's leading manufacturer of surveying equipment including GNSS receivers and Total Stations. To know more about SOUTH, please visit our official website <http://www.southinstrument.com/>

This manual takes Insight V2 measuring system for example, to explain how to install, set up and uses the RTK system as well as the use of the accessories. We recommend that you read these instructions carefully before using the instrument.

## 1.2 Hardware Components

The overall appearance of Insight V2 is round and flat, with a height of 80mm and a diameter of 131mm. It looks elegant, strong and durable. And it adopts a combination design of voice and buttons, easier to operate. The bottom of the receiver has commonly used interfaces.

### 1.2.1 Front Components



Ref	Component	Description
①	<b>Power Button</b>	Power on/off receiver; Switch and confirm working mode; Perform self-check operation.
②	<b>Bluetooth Indicator</b>	Glow in <b>blue</b> to indicate that Bluetooth connection has established between controller and receiver.
③	<b>Data Indicator</b>	<p>Glow in <b>orange</b> while the receiver is being powered on, after finishing the initialization, it turns into <b>red</b> flashing once, then off.</p> <p>Flashes in <b>red</b> to indicate that the signal is transmitting with the interval in Base mode.</p> <p>Flashes in <b>red</b> to indicate that there is coming the differential data but the receiver doesn't achieve a fixed solution while in Rover mode.</p> <p>Flashes in <b>green</b> to indicate that there is coming the differential data and the receiver does achieve a fixed solution while in Rover mode.</p>

### 1.2.2 Rear Components



Ref	Component	Description
①	<b>NFC label</b>	Realizing Bluetooth close range automatic pair between receiver and controller with NFC

### 1.2.3 Bottom Components



Ref	Component	Description
①	<b>Battery indicator</b>	Checks the battery life in real-time.
②	<b>SN label</b>	Apply for a registration code, Bluetooth ID.
③	<b>Camera</b>	Provides real-time live image for stakeout target.
④	<b>Speaker</b>	Mode setting and working status prompt.
⑤	<b>USB</b>	1.Use Type-C interface, support access the WebUI interface and the static data transmission of the receiver at the same time. 2.Battery charging port.
⑥	<b>UHF antenna interface</b>	Installs UHF antenna.

## 1.3 Hardware Operation

### 1.3.1 Power on/off

#### Power on

Press the power button for a few seconds, while glowing the Bluetooth indicator (blue) and data indicator (orange) accompany with one beep, after a few seconds (around 10 seconds), the instrument completes initializing along with voice prompt about the working mode (for example, “Rover, Bluetooth mode”).



#### Power off

Press the power button and hold for a while, after 3 beeps and the “Power off” voice prompt at the third beeping, release power button, the instrument will switch off.

### 1.3.2 Check working mode

Press the power button for once in the state of power-on, the instrument will prompt with voice message about current working mode (for example, “Rover, internal radio mode”), and display the battery life at the bottom of receiver at the same time.



### 1.3.3 Working mode settings

#### Rover

Press and hold the power button for about 5 seconds and pass over the state of power off (do not release the button even the instrument says power off), then Insight V2 will say “start to set work mode”, at this moment, release power button, the working mode will be repeated from Rover to Static on control panel. When the **Bluetooth indicator** glows in **Blue** accompany with “Rover” voice message, press the power button to confirm.



#### Base

Press and hold the power button for about 5 seconds and pass over the state of power off (do not release the button even the instrument says power off), then Insight V2 will say “start to set work mode”, at this moment, release power button, the working mode will be repeated from Rover to Static on control panel. When the **data indicator** glows in **Red** accompany with “Base” voice message, press the power button to confirm.



## Static

Press and hold the power button for about 5 seconds and pass over the state of power off (do not release the button even the instrument says power off), then Insight V2 will say “start to set work mode”, at this moment, release power button, the working mode will be repeated from Rover to Static on control panel. When the **power indicator** glows in **Red** accompany with “Static” voice message, press the power button to confirm.



After that, press the power button for once to make sure if the working mode is correctly setup.

**Note:** *Insight V2 only supports the working mode selected by control panel, without datalink settings.*

## 1.3.4 Self-check

Self-check is an useful operation to simply check the main hardware components if the instrument is abnormal or not working properly.

Press and hold the power button for about 10 seconds and pass over the state of power off and mode selection (do not release the button even the instrument says power off and start to set work mode), then Insight V2 will say “start to self-check”, at this moment, release power button, the instrument will perform self-check automatically for the modules one by one. The sequence of modules checking is:

- OEM board checking
- UHF module checking
- Sensors checking
- WiFi module checking
- Bluetooth module checking

If all the modules are normal during self-check, the instrument will get into the state of power-on.



### 1.3.5 Restore factory default

Press and hold the power button for about 20 seconds and pass over the foregoing states (power off, mode selection, self-check), Insight V2 will get into factory reset progress with voice message saying “start to restore factory default”, at this moment, release power button, all the indicators glow and the instrument is performing the factory reset automatically. After this progress complete, the instrument will restart automatically with the factory default settings.



### 1.3.6 Charging

If V2 is in low battery, please connect USB cable to adapter and plug to 220V power socket for battery charging, the battery indicators display in red while battery is being charged, when green indicators light up means the battery is full charged.



Charging



Full charged

# Chapter II Web UI Operation

## 2.1 Web UI Login

Because of using the smart embedded Linux operating system and SOUTH intelligent cloud technology, the web UI allows users to configure and monitor the status of Insight V2 in real-time. The accessing way is not only by WiFi connection, but also can be USB mode.

### 2.1.1 Accessing by WiFi

The WiFi hotspot is default broadcasted by Insight V2, search the WiFi hotspot which named with SOUTH\_xxxx using smartphone, tablet or laptop, then establish the WiFi connection, input the **default IP (10.1.1.1)** into browser, on the login interface, apply “admin” for the username and password.

For example, search the WiFi hotspot broadcasted by a Insight V2 receiver using a laptop PC, choose the WiFi hotspot and click on connect button to establish the connection without password.



Run browser on computer and input the **default IP (10.1.1.1)** into address bar, after a while, the system login interface is refreshed, then apply “**admin**” for username and password to login.

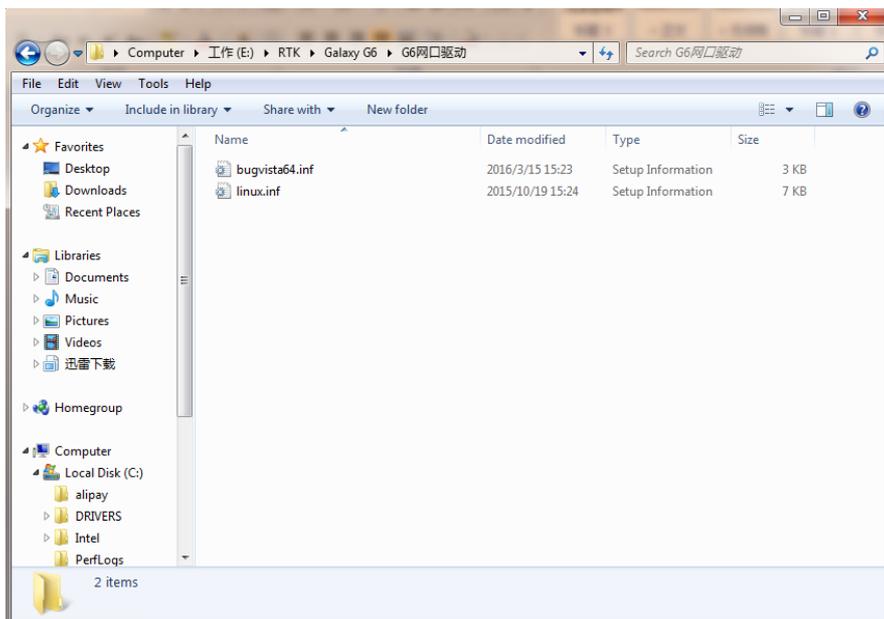


## 2.1.2 Accessing by USB

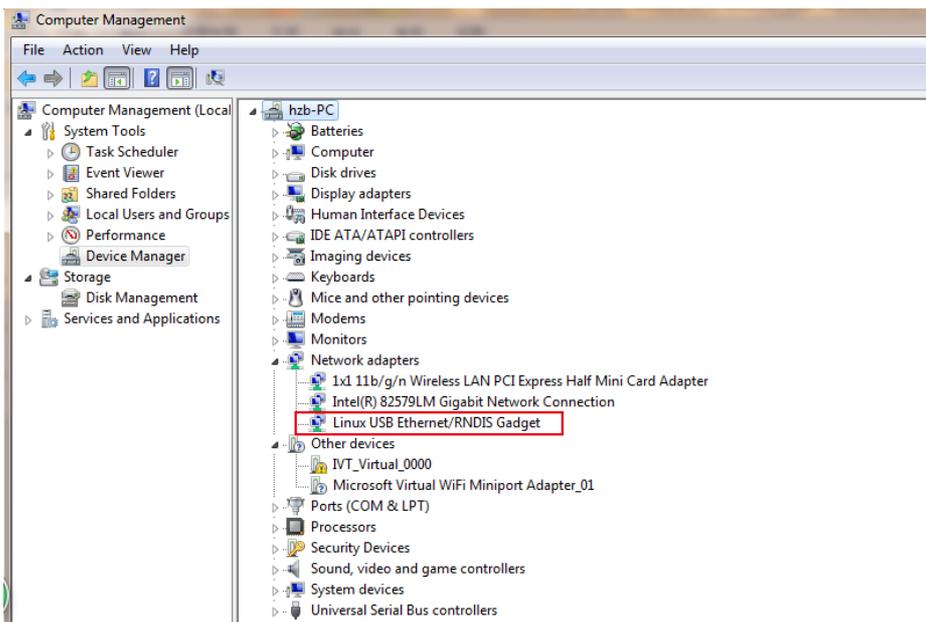
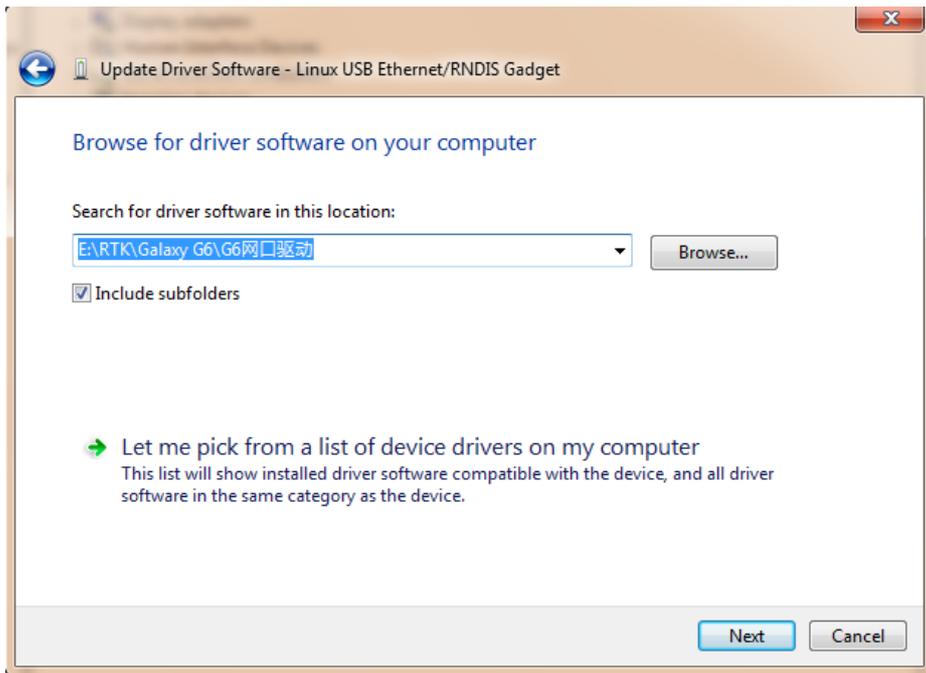
The Type-C USB port of Insight V2 can work as an Ethernet port and normal USB port simultaneously, then user no more needs to switch the USB mode, as long as connect the USB cable to computer, web interface login and internal memory of V2 are available.

First of all, a corresponding driver is required to install to the computer, then this function could be activated.

Due to different operating system is installed on computer, the drivers should be applied to a suitable one. The file [bugvista64.inf](#) is applied to 64bit operating system, and [linux.inf](#) is for 32bit operating system.

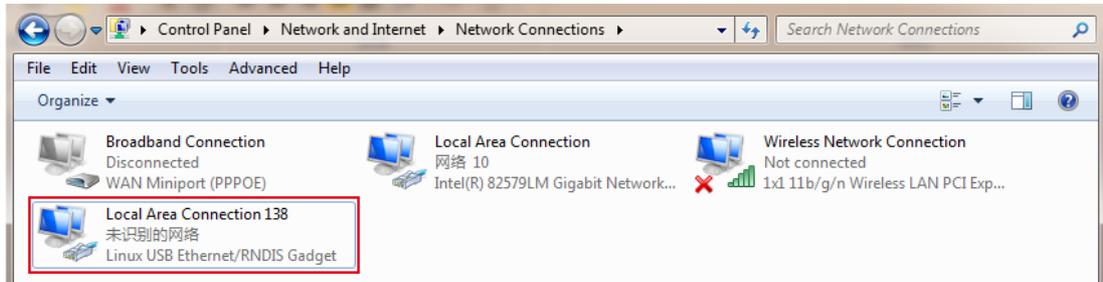


Choose the folder which contains the drivers



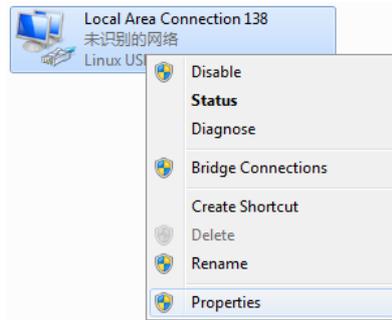
**Note:** The driver can be downloaded from official website automatically or please contact with us for more supports.

If the driver has been successfully installed, the USB port of Insight V2 will be recognized as **Linux USB Ethernet/RNDIS Gadget**, and a local area connection will generate in **Network Connections** on the computer. For example, Local Area Connection 138 generates after connecting Insight V2 receiver to computer via USB network interface.

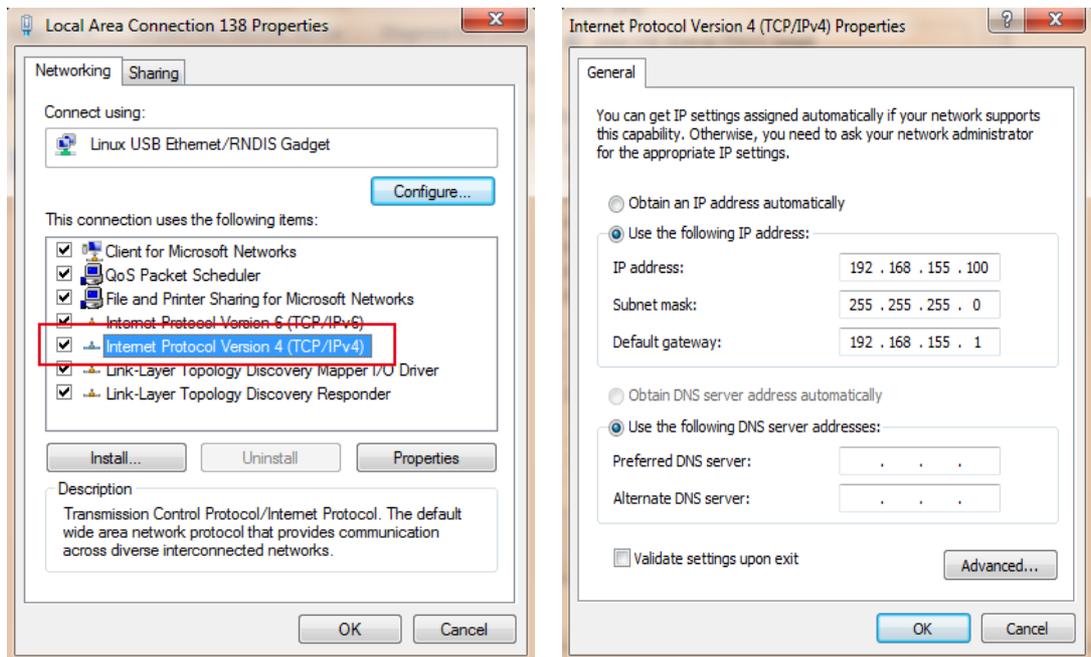


However, sometimes the computer cannot detect the receiver by USB network interface because there is something wrong with acquiring IP automatically, therefore, we need to do something to avoid such problem, that is to set a fixed LAN IP for the connection:

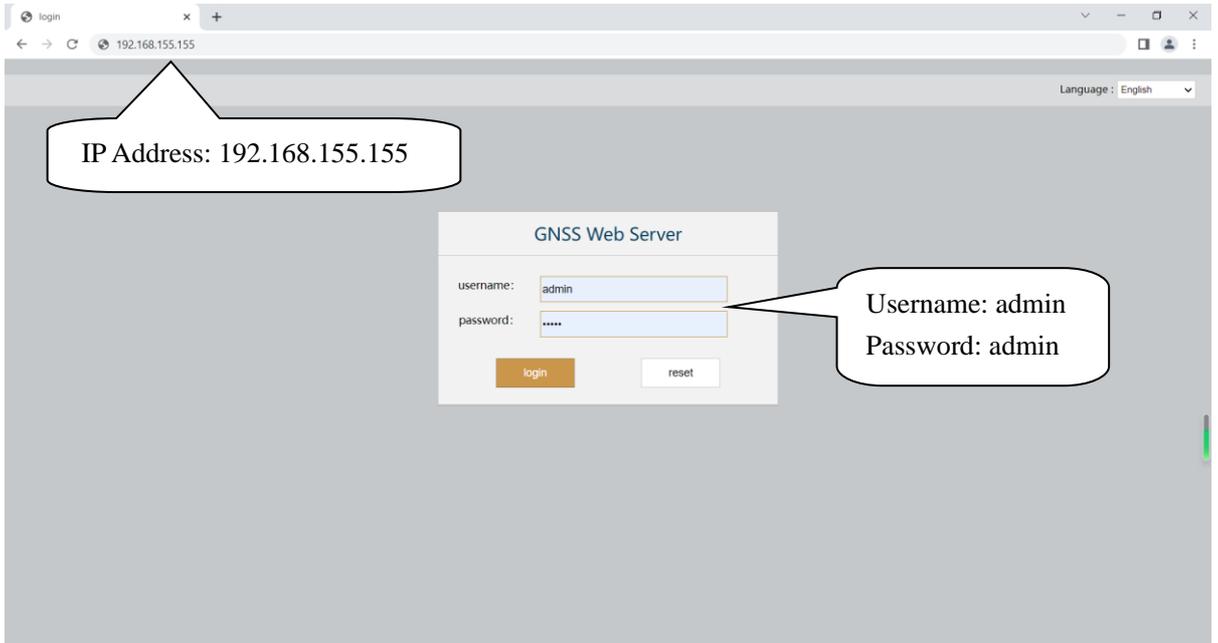
Right click on the local area connection which newly generates, choose properties to call out the local area connection properties window.



Then double click on Internet Protocol Version 4 (TCP/IPv4) option or click on properties button to call out Internet Protocol Version 4 (TCP/IPv4) properties window, set the fixed LAN IP address as shown in following, then click OK button and confirm the settings, return to the IE browser and use the IP address 192.168.155.155 to access the internal web UI.



Run browser on computer and input the **default IP (192.168.155.155)** into address bar, after a while, the system login interface is refreshed, then apply **“admin”** for username and password to login.



## 2.2 Web UI Main Interface

After login the Web UI management of Insight V2 by WiFi or USB connection, the main interface appears with displaying configuration items and positioning. As shown at following figures.

<div style="display: flex; justify-content: space-between; align-items: center;"> <span>admin</span> <span>1318</span> </div> <div style="display: flex; justify-content: space-between; align-items: center;"> <span>SF61D3148671318</span> <span>[logout]</span> </div> <ul style="list-style-type: none"> <li>Status <span style="float: right;">+</span></li> <li>Configuration <span style="float: right;">+</span></li> <li>Satellite Information <span style="float: right;">+</span></li> <li>Data Record <span style="float: right;">+</span></li> <li>Data Transfer <span style="float: right;">+</span></li> <li>Network Config <span style="float: right;">+</span></li> <li>Radio Config <span style="float: right;">+</span></li> <li>Firmware Update <span style="float: right;">+</span></li> <li>Track Manage <span style="float: right;">+</span></li> <li>Coordinate System <span style="float: right;">+</span></li> <li>Online Service <span style="float: right;">+</span></li> <li>User Management <span style="float: right;">+</span></li> <li>Frequency Spread <span style="float: right;">+</span></li> <li>System Log <span style="float: right;">+</span></li> </ul>	<h3>Position Information</h3> <p><b>Location:</b></p> <table border="0"> <tr> <td>Lat: 0°0'0.000000"S</td> <td>Lon: 0°0'0.000000"W</td> <td>Alt: 0.000000m</td> <td>Ellipsoid: WGS-84</td> </tr> <tr> <td>X: 0.000000</td> <td>Y: 0.000000</td> <td>Z: 0.000000</td> <td></td> </tr> </table> <p><b>RTK Status:</b></p> <table border="0"> <tr> <td>Solution: Invalid</td> <td>CorrectionDelay: 0</td> <td>HRMS: 1414212</td> <td>VRMS: 999999.</td> </tr> <tr> <td>base X: 0.000000</td> <td>base Y: 0.000000</td> <td>base Z: 0.000000</td> <td>base ID: 0</td> </tr> </table> <p>DiffFormat: NONE</p> <p><b>SLink:</b></p> <table border="0"> <tr> <td>SN: None</td> <td>TrackingTime: 0</td> </tr> <tr> <td>Azimuth: 0.00</td> <td>Elevation: 0.00</td> </tr> <tr> <td>SNR: 0.00</td> <td>Solution: 0</td> </tr> </table> <p><b>Tracked Satellite(1):</b></p> <table border="0"> <tr> <td>GPS(0): None</td> <td>GLONASS(0): None</td> </tr> <tr> <td>BDS(1): 38</td> <td>GALILEO(0): None</td> </tr> <tr> <td>SBAS(0): None</td> <td>QZSS(0): None</td> </tr> <tr> <td>IRNSS(0): None</td> <td></td> </tr> </table>	Lat: 0°0'0.000000"S	Lon: 0°0'0.000000"W	Alt: 0.000000m	Ellipsoid: WGS-84	X: 0.000000	Y: 0.000000	Z: 0.000000		Solution: Invalid	CorrectionDelay: 0	HRMS: 1414212	VRMS: 999999.	base X: 0.000000	base Y: 0.000000	base Z: 0.000000	base ID: 0	SN: None	TrackingTime: 0	Azimuth: 0.00	Elevation: 0.00	SNR: 0.00	Solution: 0	GPS(0): None	GLONASS(0): None	BDS(1): 38	GALILEO(0): None	SBAS(0): None	QZSS(0): None	IRNSS(0): None	
Lat: 0°0'0.000000"S	Lon: 0°0'0.000000"W	Alt: 0.000000m	Ellipsoid: WGS-84																												
X: 0.000000	Y: 0.000000	Z: 0.000000																													
Solution: Invalid	CorrectionDelay: 0	HRMS: 1414212	VRMS: 999999.																												
base X: 0.000000	base Y: 0.000000	base Z: 0.000000	base ID: 0																												
SN: None	TrackingTime: 0																														
Azimuth: 0.00	Elevation: 0.00																														
SNR: 0.00	Solution: 0																														
GPS(0): None	GLONASS(0): None																														
BDS(1): 38	GALILEO(0): None																														
SBAS(0): None	QZSS(0): None																														
IRNSS(0): None																															

In the Web UI home page, the configuration items are listed at left side. And the positioning information including coordinates information and satellites are displayed at right side.

Ref	Component	Description
	<b>Status</b>	Positioning information, satellite tracking and the others will be displayed in this page
	<b>Configuration</b>	It contains registration for receiver, base configuration, antenna configuration, satellite configuration, receiver configuration and system configuration.
	<b>Satellite Information</b>	Display and control the satellites are used or not
	<b>Data Record</b>	Configure the parameters for static mode and raw data download
	<b>Data Transfer</b>	Contains NTRIP configuration, TCP/IP configuration and data transferring with PC
	<b>Network Config</b>	Contains network parameters configuration, WIFI configuration and the other functions
	<b>Radio Config</b>	Configure the parameters and frequency for radio modem
	<b>Firmware Update</b>	It is used to upgrade the firmware for receiver and each modem
	<b>Track Manage</b>	Record track file while doing measurement
	<b>Coordinate System</b>	Setup a local coordinate system for Insight V2
	<b>Online Service</b>	Upload data onto a server in real-time
	<b>User Management</b>	Add and manage the Web UI users
	<b>Frequency Spread</b>	Reserves to check the frequency status of satellites
	<b>System Log</b>	Record data log files for problem analysis.

## 2.2.1 System Information

In this page, all the information of Insight V2 is displayed such as serial number, hardware ID, MAC address, firmware version and so on.

welcome admin 1318  
 SF61D3148671318 [logout]

- ☰ Status ▼
- ☰ System Information -
- ☰ Work Status -
- ☰ Position Information -
- ✕ Configuration +
- ✕ Satellite Information +
- 📅 Data Record +
- 📡 DataTransfer +
- 🌐 Network Config +
- 📶 Radio Config +
- 📶 Firmware Update +
- 📅 Track Manage +

> System Information

Model:	InsightV2
Serial Number:	SF61D3148671318
Hardware ID:	NNN0EY0N0N10008003135G048F61
Software ID:	2100110000000000
Ethernet MAC:	00:00:00:00:00:00
Ethernet IP:	192.168.1.1
WiFi IP:	10.1.1.1
Bluetooth MAC:	90:CD:1F:58:CF:64
Hardware Version:	0
Firmware Version:	1.09.230323.RF61PY
OEM Version:	610T5-22A02-1
Web Version:	1.09.230313.RG60WEB
Expire:	20231030

## 2.2.2 Work Status

The physical state of Insight V2 such as working mode, datalink, host temperature, remaining power and the free memory is obtained from this page

welcome admin 1318  
 SF61D3148671318 [logout]

- ☰ Status ▼
- ☰ System Information -
- ☰ Work Status -
- ☰ Position Information -
- ✕ Configuration +
- ✕ Satellite Information +
- 📅 Data Record +
- 📡 DataTransfer +
- 🌐 Network Config +
- 📶 Radio Config +
- 📶 Firmware Update +
- 📅 Track Manage +
- 🌐 Coordinate System +

> Work Status

Work Mode:	Rover
Datalink:	None
Host Temperature:	43.00 °C
OEM Temperature:	N/A
Power Type:	Internal Battery
ExtPower Voltage:	0.00 V
BatteryVoltage:	7.53 V
Storage Type:	Internal Memory

Battery Remaining

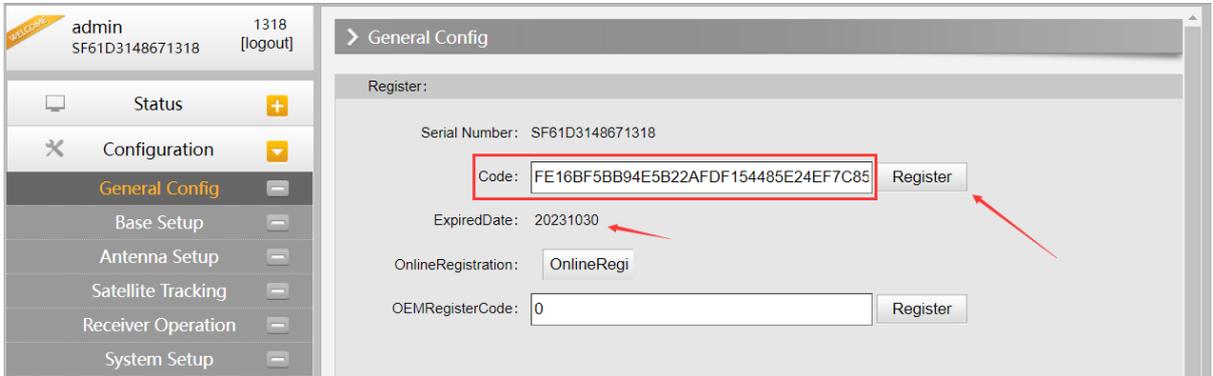
Battery Remaining 65%

Disk Capacity

0M Used 60M Free 4024.00M

## 2.3 Receiver Registration

If the code of Insight V2 has expired or is going to be run out, please provide the serial number of your Insight V2 to us, then we will apply for another available code for you, when you get the code, enter the code into the code box, then click “Register” button to complete the registration.

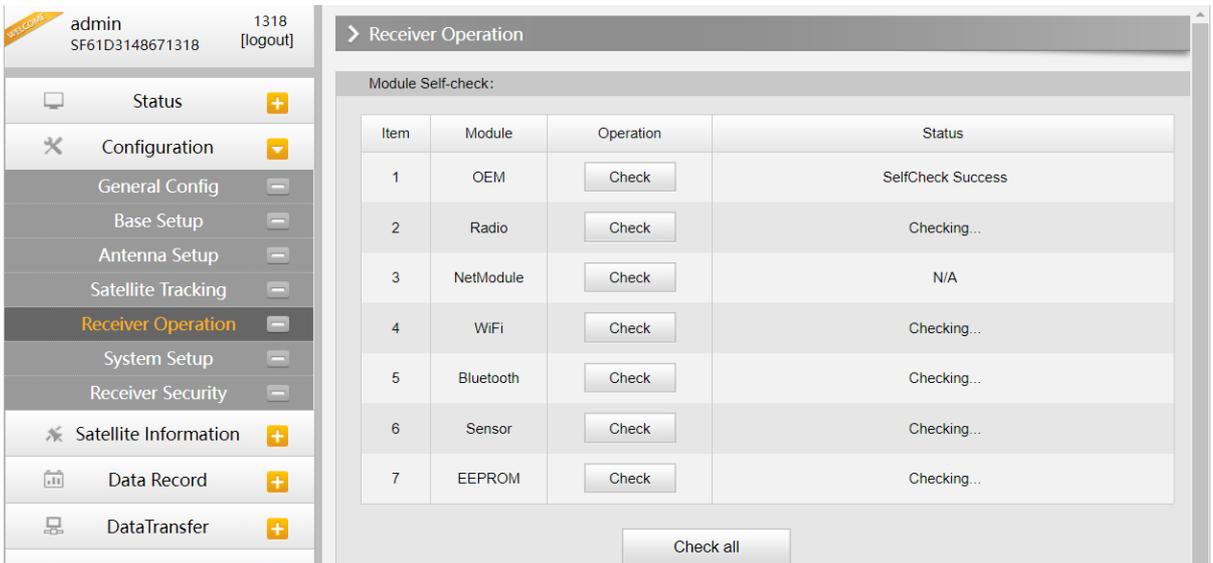


## 2.4 Receiver Operation

### 2.4.1 Self-check

Self-check operation not only can be executed on control panel of receiver, but also on web interface. We can execute self-check operation to check the main hardware components if the instrument is abnormal or doesn't work properly.

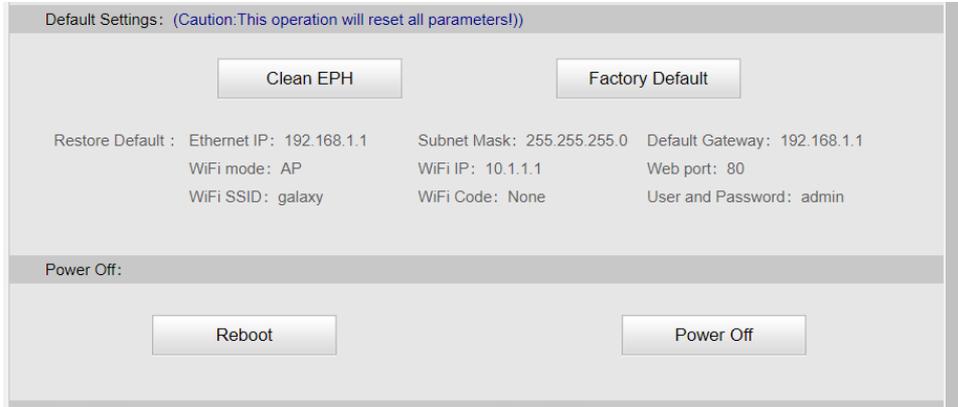
Users can also do the self-check from this configuration page, click on the “Check all” button to check all the modems or click on the check button corresponding to the modem to check one by one.



## 2.4.2 Restore factory default

Login web interface and go to “Receiver Operate” page, we can execute factory default to restore the factory default settings for receiver.

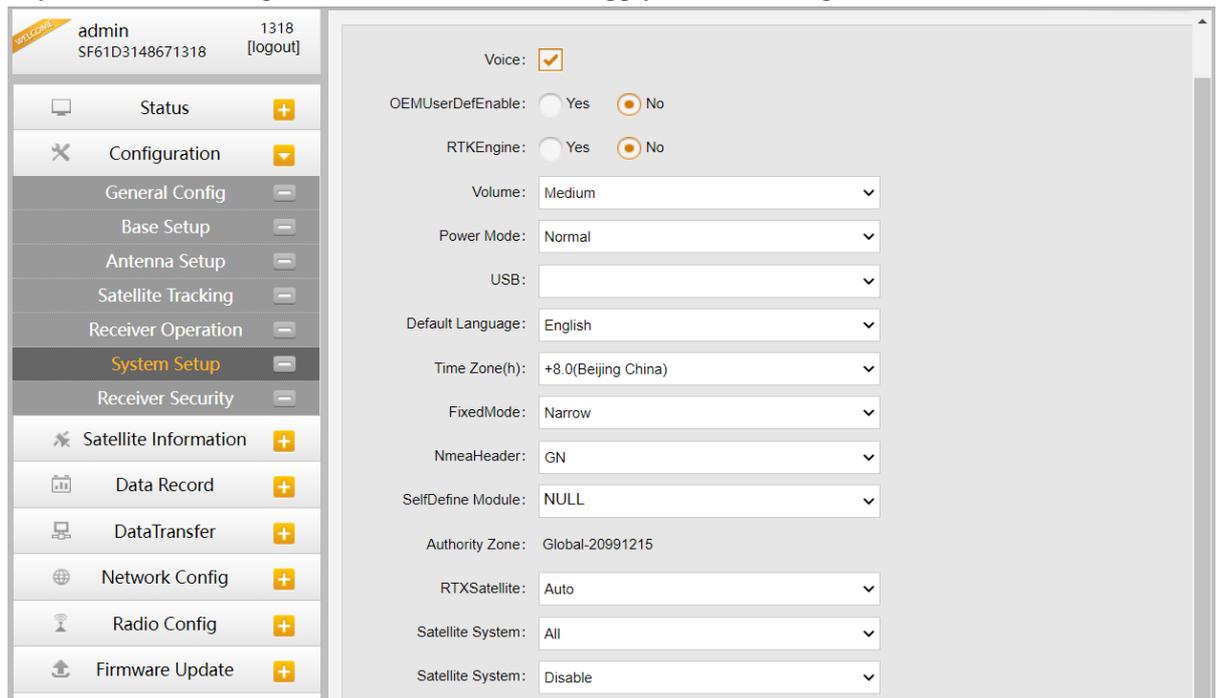
We also can execute “Clean EPH”, “Reboot”, “Power Off” operations at this page.



## 2.5 Receiver System Settings

### 2.5.1 Voice setting

Enable or disable voice prompt at this page, and adjust the voice volume to “Low”, “Medium” or “Lound” as you want. Don’t forget to click “Enter” button to apply the new settings.



## 2.5.2 Language setting

Configure the default language for Insight V2 which associates with voice guide, after selecting the language, click “Enter” button to save the new settings.

The screenshot shows the web management interface for Insight V2. On the left is a navigation menu with options like Status, Configuration, General Config, Base Setup, Antenna Setup, Satellite Tracking, Receiver Operation, System Setup (highlighted), Receiver Security, Satellite Information, Data Record, Data Transfer, Network Config, Radio Config, Firmware Update, Track Manage, and Coordinate System. The main area displays various system settings. The 'Default Language' dropdown menu is open, showing a list of languages: Chinese, English (highlighted), Russian, Turkish, Spanish, Korean, French, Portuguese, and Italian. Other settings include Voice (checked), OEMUserDefEnable (No), RTKEngine (No), Volume (Medium), Power Mode (Normal), USB (empty), FixedMode (empty), NmeaHeader (empty), SelfDefine Module (empty), Authority Zone (Global-20991215), RTXSatellite (Auto), Satellite System (All), and another Satellite System (Disable). 'Enter' and 'Cancel' buttons are at the bottom.

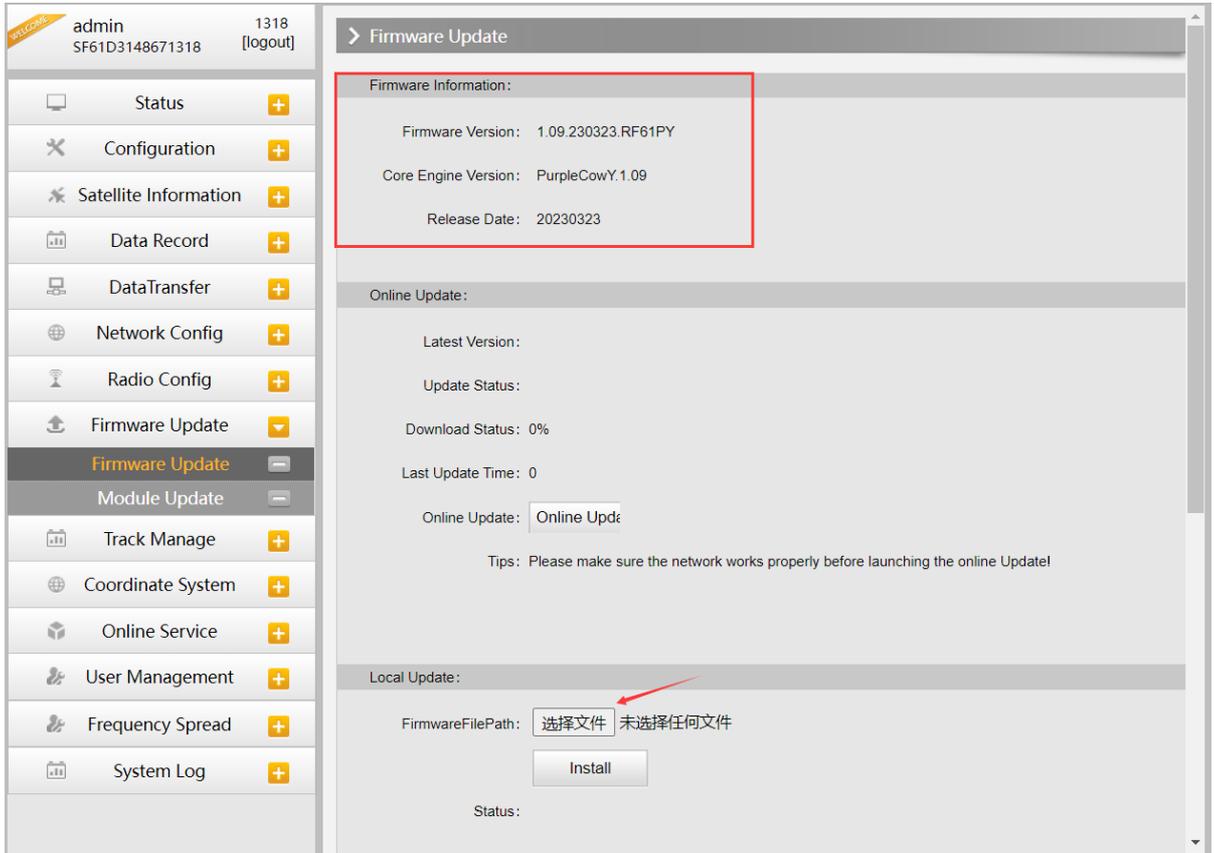
## 2.6 Firmware Update

### 2.6.1 Update receiver firmware

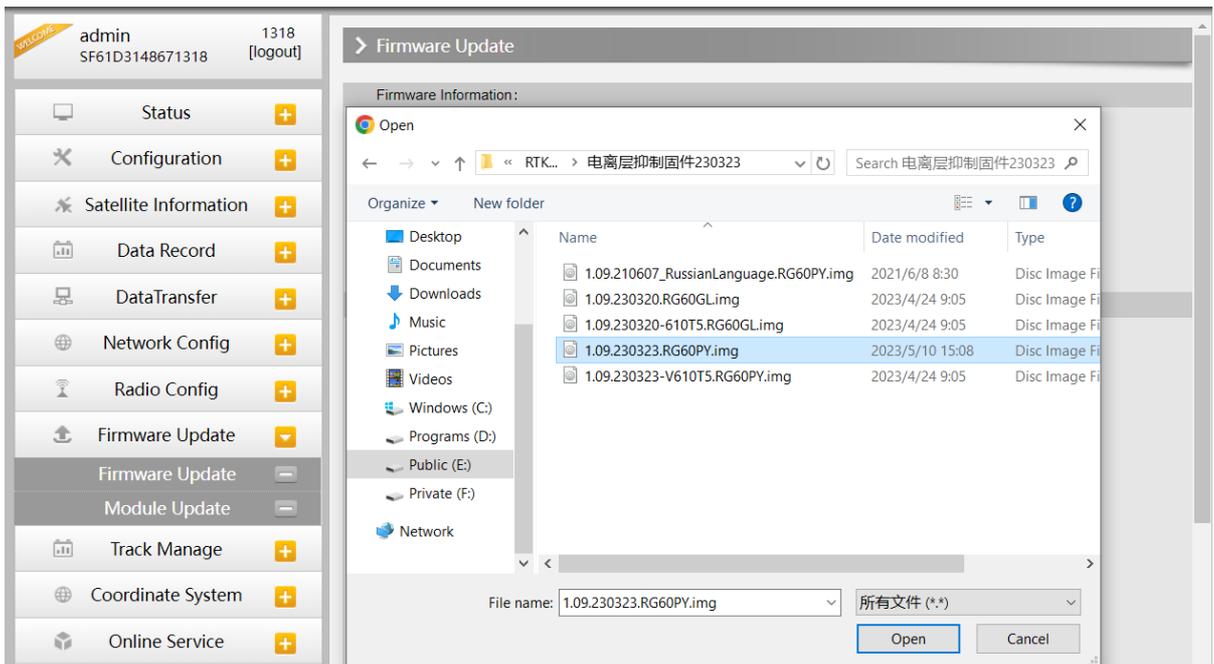
This section will explain how to update the firmware for Insight V2, detail steps are written below.

Login the web UI management of Insight V2 with WiFi or USB network connection.

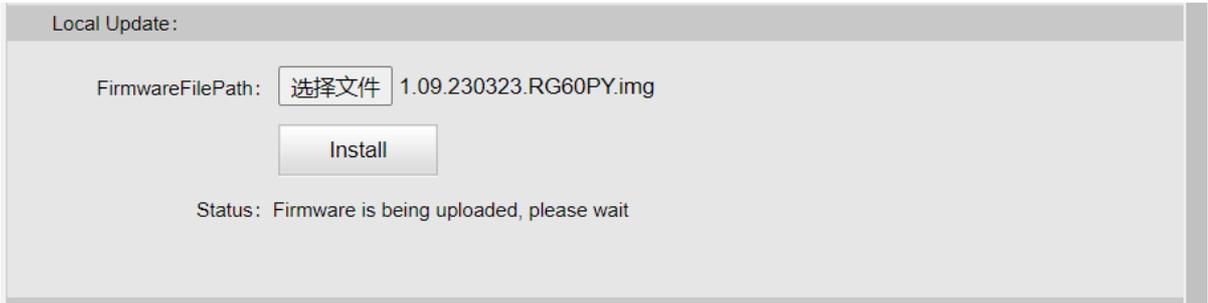
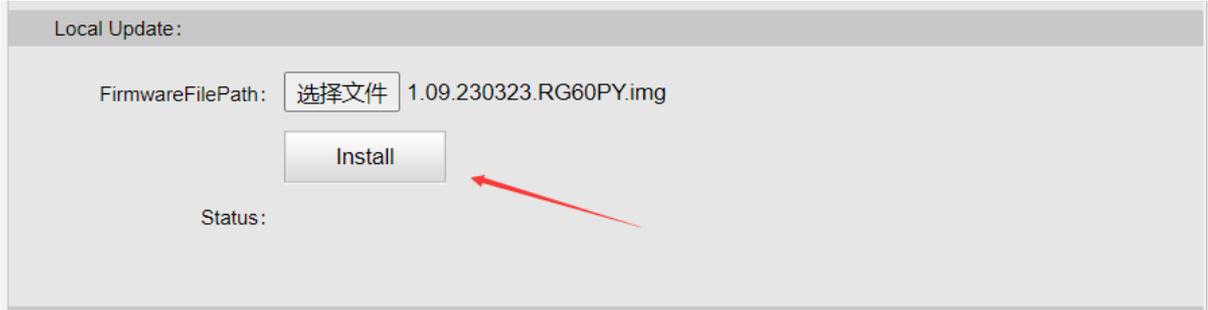
Go to “Firmware Update—Firmware Update” configuration page, all the information of the firmware which current installed on Insight V2 would be displayed here.



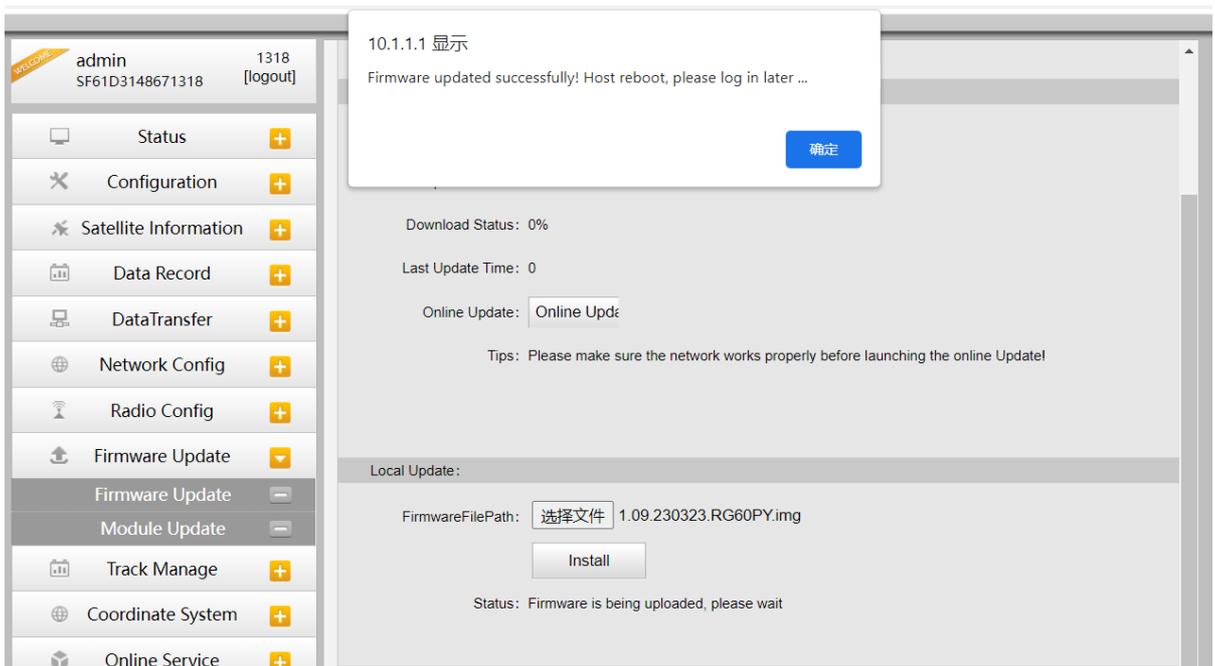
Click on “Browse” button to load firmware file (Please take in mind that the firmware is ended with **PY.img** as the extension name).



And then click “Install” button to start upgrading.



After the firmware is completed upgrading, a dialog will appear saying “Firmware updated successfully! Host reboot, please log in later...”, then the receiver will restart automatically.



## 2.6.2 Update OEM board firmware

The OEM board firmware can be updated here on web interface, no more to use the assigned or special program to update the OEM firmware.

Contact with the technical support team for the OEM firmware, then click “Browse” button to load the

correct firmware file, after loading the file, click “Install” button to start updating. Time of updating OEM firmware will take longer than receiver firmware updating, and different time will be taken according to the different model of OEM board.

Reboot the receiver after finishing the updating!



## 2.6.3 Update UHF module firmware

- 1, Load the firmware file then click “Install” button to start updating firmware for UHF module.
- 2, After finishing the procedure, reboot the receiver, then execute self-check operation for UHF module.



## 2.6.4 Update sensor firmware

1, Load the correct sensor firmware file with .img extension name, then click “Install” button to start updating the firmware.

2, After finishing the procedure, reboot the receiver, then execute self-check operation for sensor.

The screenshot displays the Insight V2 web interface. On the left is a sidebar with navigation items: Data Record, DataTransfer, Network Config, Radio Config, FirmWare Update, FirmWare Update, Module Update, Track Manage, Coordinate System, Online Service, User Management, Frequency Spread, and System Log. The main content area is split into two sections: 'Radio Update' and 'Sensor Update'. The 'Sensor Update' section is highlighted with a red border and contains the following information:

- FirmwareFilePath:  未选择任何文件
- 
- Update Status: No Action
- SensorType: THREEAXIS\_M82
- Firmware Version: M8-2\_V20221123

# Chapter III Measuring Operation

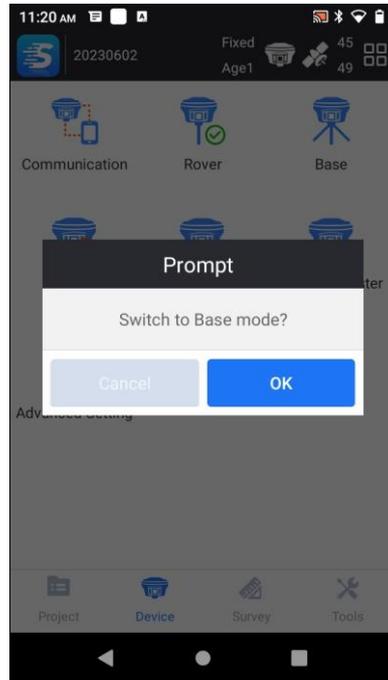
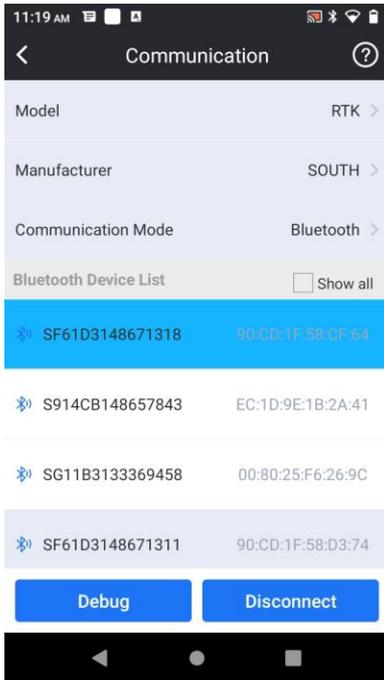
## 3.1 Base station settings

Base station shall be set up in the broad view, unobscured and higher places; avoid the vicinity of the high-voltage power transmission equipment, the shade of trees, and the sides of waters, all of which will produce different degrees of impact on the GPS signal reception and transmission of radio signals.

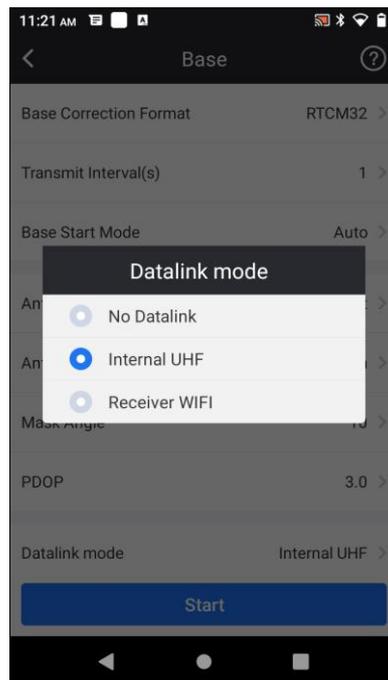
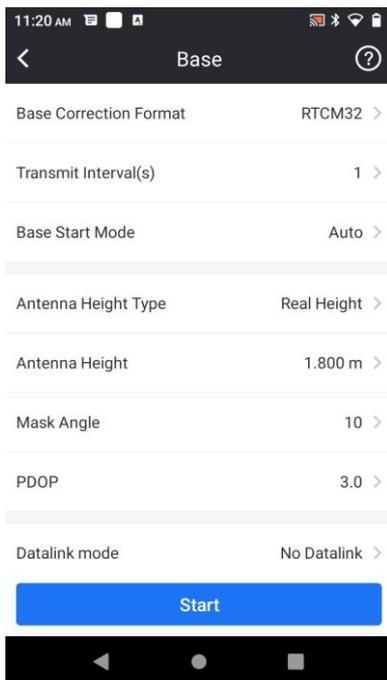
- 1) Set a tripod to the location with known coordinates (or unknown), attach base receiver to the tribrach adapter set (the measuring plate is recommended to install under base receiver).
- 2) Install the UHF antenna onto the receiver.
- 3) Make sure all connections are alright, then power on receiver.



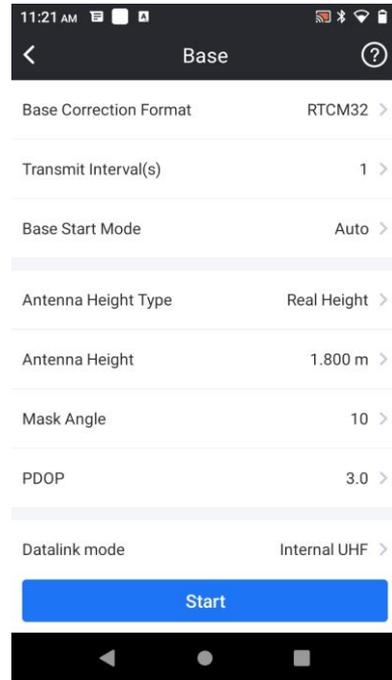
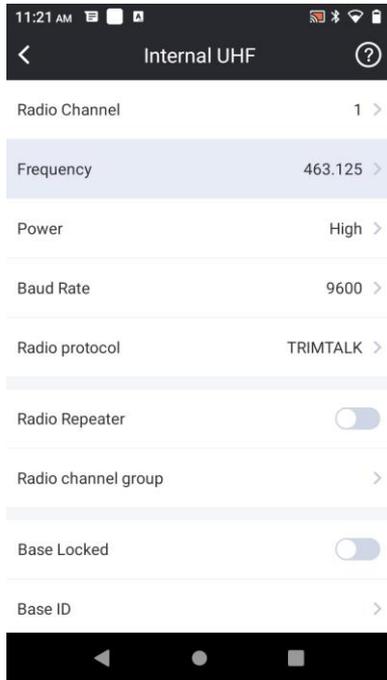
- 4) Establish Bluetooth connection between receiver and controller, then click “Base” icon to switch base working mode for receiver.



- 5) Get into base setting page, and set parameters for base differential format, transmitting interval, base start mode, antenna height type, antenna height value, then choose datalink mode as “Internal UHF”.



- 6) After datalink mode is determined, “Datalink Config” appears under datalink mode, then get into “Datalink Config” interface set more parameters, such as radio channel, confirm the frequency, radio power, air baud rate for base and rover communication, the communication protocol (the most important parameter), etc., after that return to Base setting interface, and click “Start” button to apply the settings and start the base station, and the base says “Base is transmitting”.



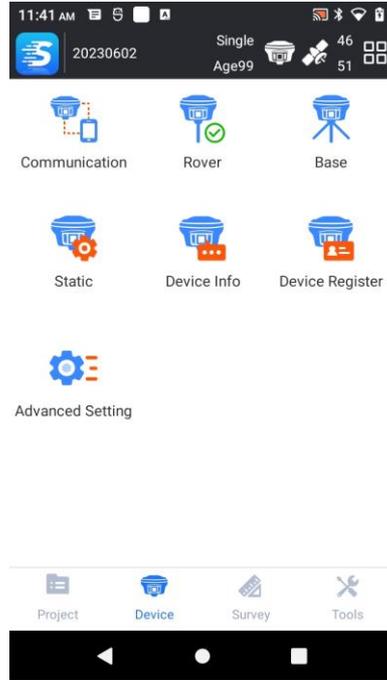
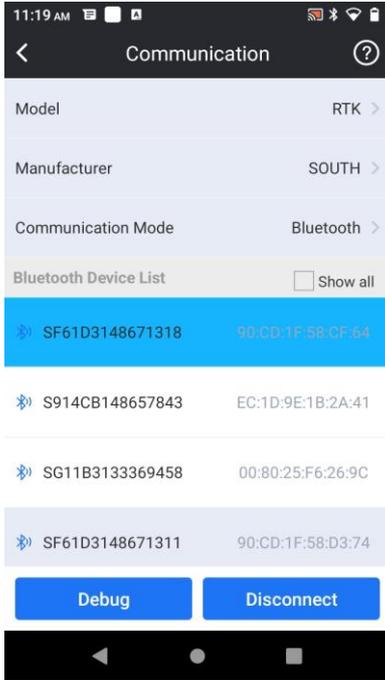
## 3.2 Rover settings

### 3.2.1 Using UHF link

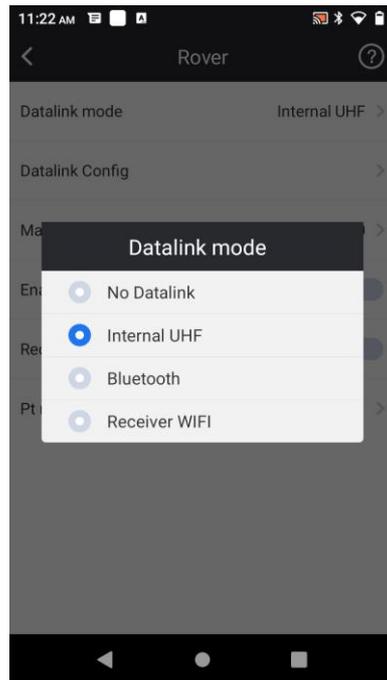
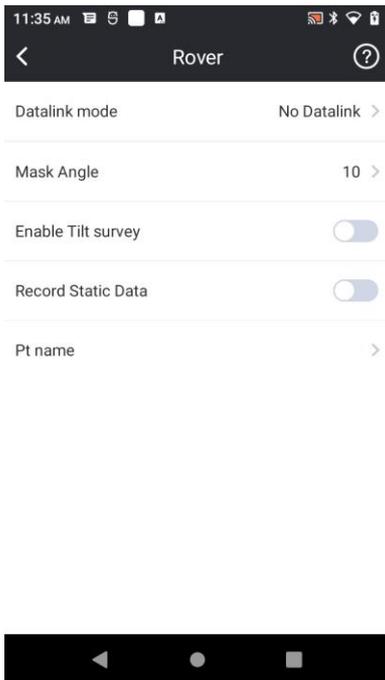
After verifying the successful transmitting of the Base station, the rover station shall be set up at this moment.

- 1) Install the UHF antenna onto the rover receiver, and screw the receiver into the carbon fiber pole, then power on the receiver.
- 2) Install the bracket holder onto the carbon fiber pole, and fix the controller into the bracket, then power on the controller.
- 3) Establish Bluetooth connection between receiver and controller, then click “Rover” icon to switch rover working mode for receiver.

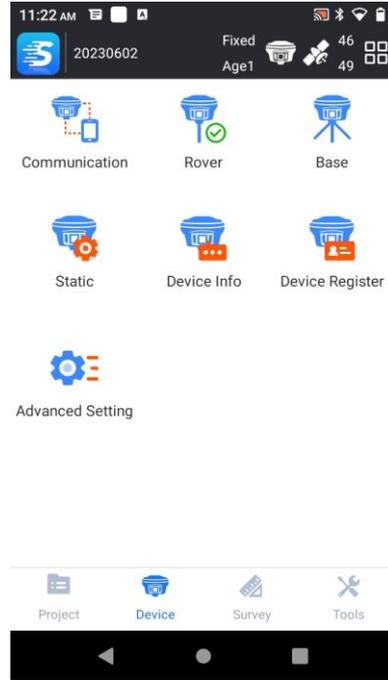
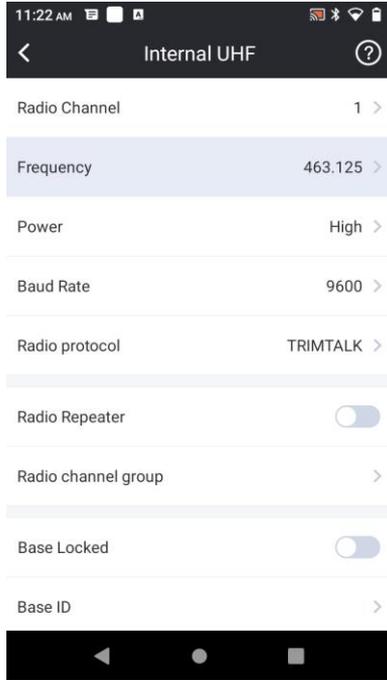




4) Get into rover setting page, and choose datalink mode as “Internal UHF”.

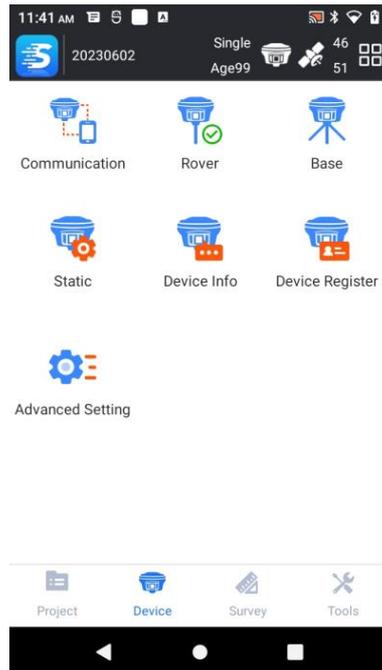
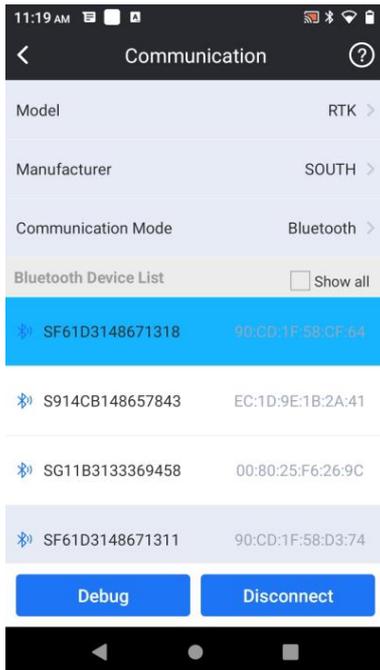


5) After datalink mode is determined, “Datalink Config” appears under datalink mode, then get into “Datalink Config” interface set the same radio channel, frequency, radio power, air baud rate communication protocol as base station, after that return to rover setting interface to check the age and solution type, as long as age value changes between 1~3s, that means the differential data stream is coming from base station, when the rover gets fixed solution, go to point survey interface.

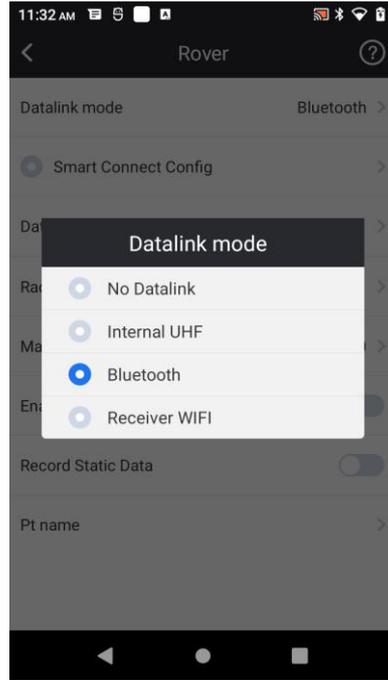
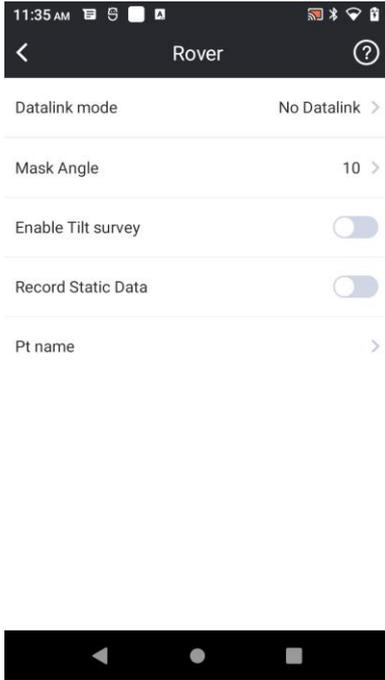


### 3.2.2 Using internet link

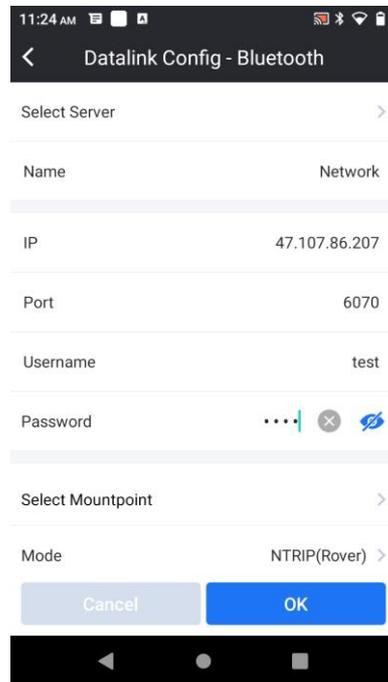
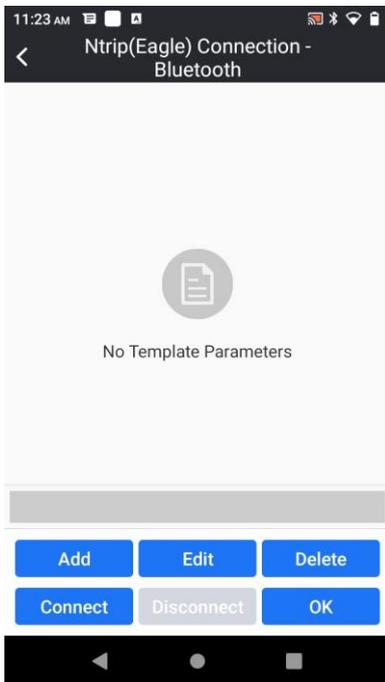
- 1) Screw the receiver into the carbon fiber pole, then power on the receiver.
- 2) Install the bracket holder onto the carbon fiber pole, and fix the controller into the bracket, then power on the controller.
- 3) Establish Bluetooth connection between receiver and controller, then click “Rover” icon to switch rover working mode for receiver.



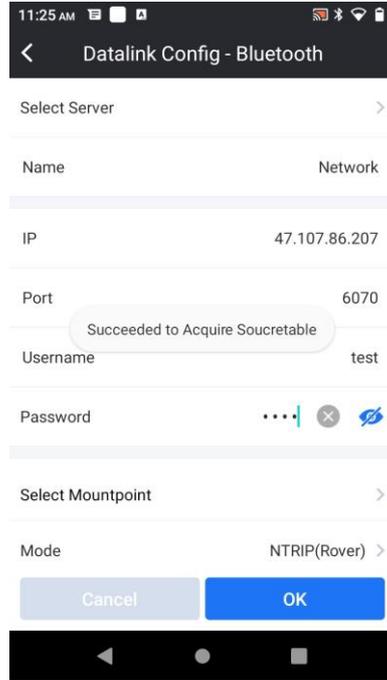
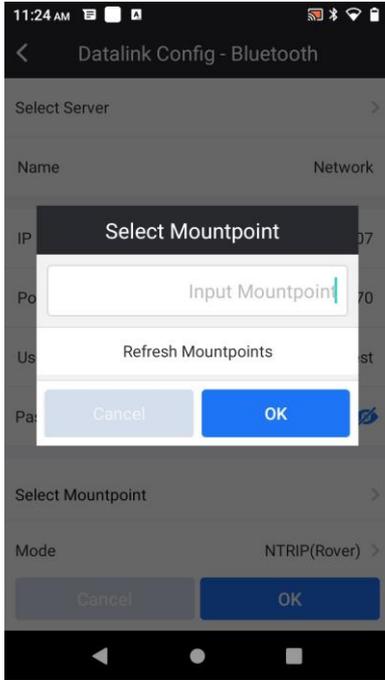
- 4) Get into rover setting page, and choose datalink mode as “Bluetooth”, that means the receiver will use the controller internet to connect to CORS station.



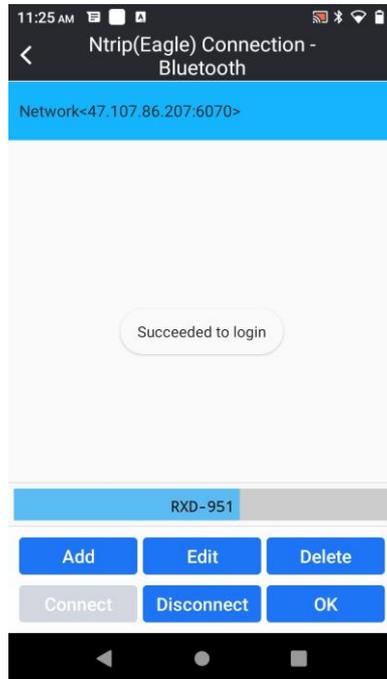
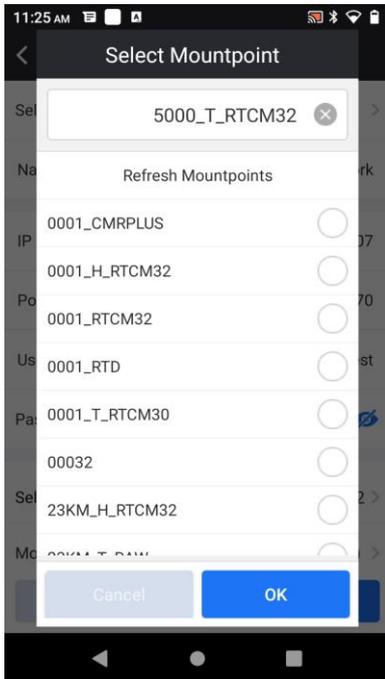
- 5) After datalink mode is determined, “Datalink Config” appears under datalink mode, then get into “Datalink Config” interface, click “Add” button to create a new network connection. Define a name for the new connection, and enter the IP address of CORS station, port, assigned user name and password.



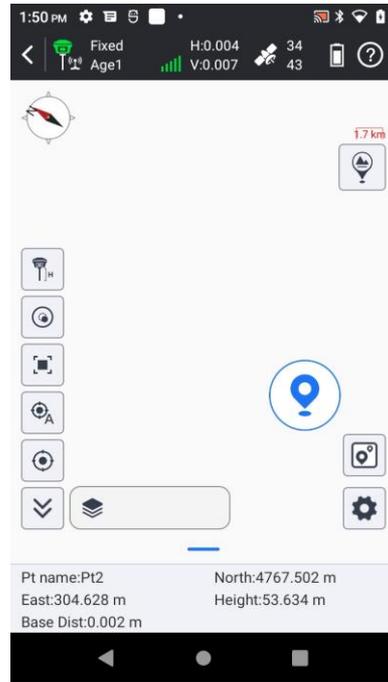
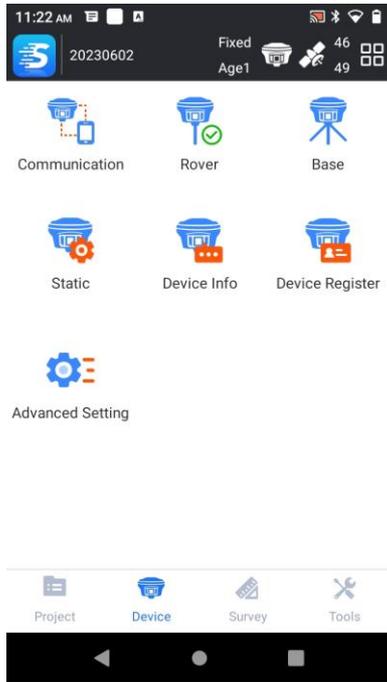
- 6) After entering the parameters, click “Select Mountpoint” to choose the mountpoint. If there is still no mountpoint to choose, click “Refresh mountpoints” to download the source table.



- 7) While the source table (mountpoint list) is downloaded, click again “Select Mountpoint” to choose a proper one, return to datalink config (Ntrip connection) interface, and click “Connect” button to the CORS, there will be a progress bar to show the coming data, click “OK” button to finish the settings.

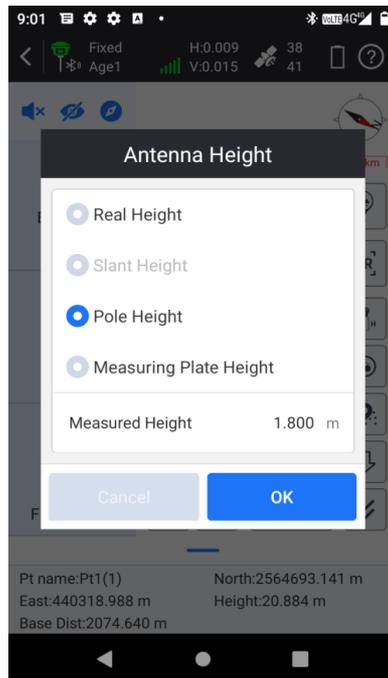
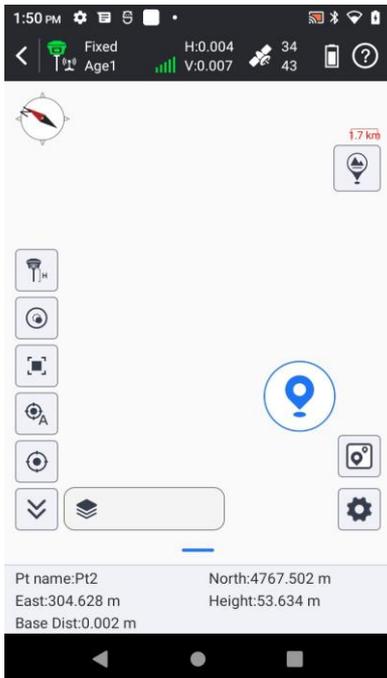


- 8) Go to point survey interface and set the antenna height, then start your job if all is ready.

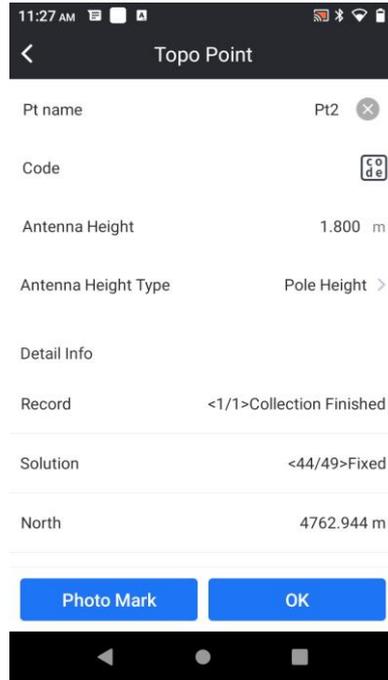
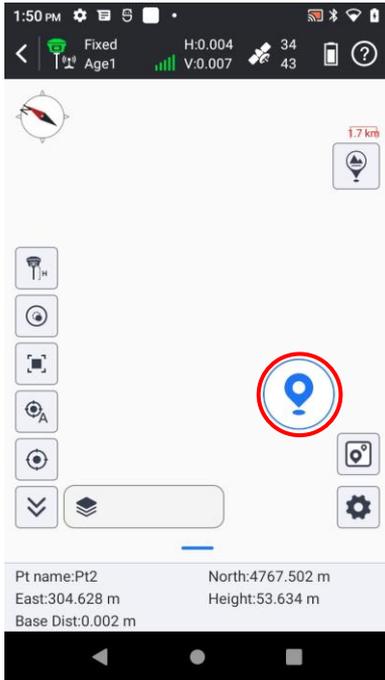


### 3.3 Point survey

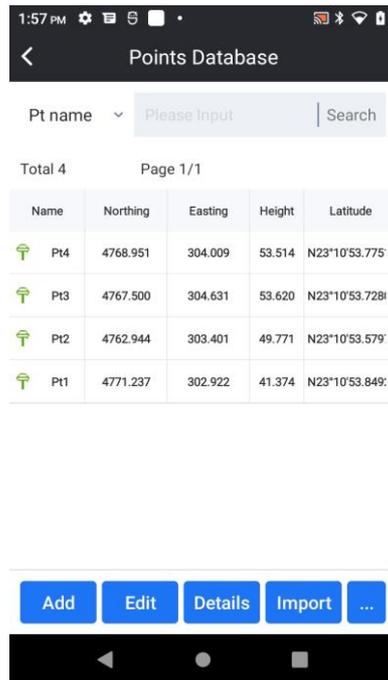
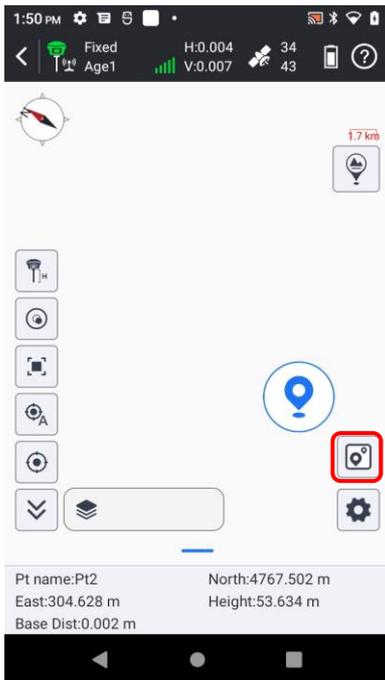
- a) While the rover is configured and gets fixed solution, then go to “Survey”—“Point survey”, check the antenna height type and antenna height value.



b) Click the positioning button to save the coordinates for a point.



c) Click the coordinate library shortcut to check the stored coordinates in real-time.

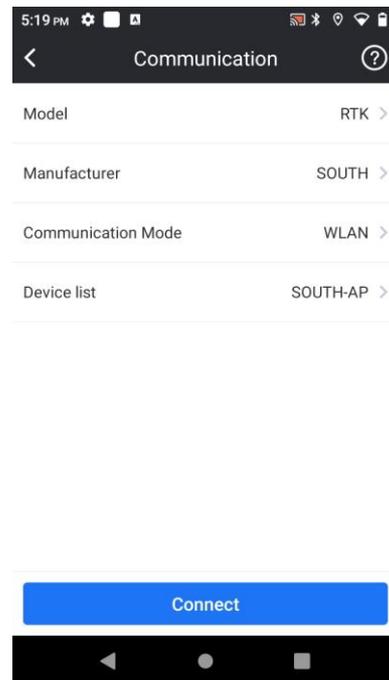
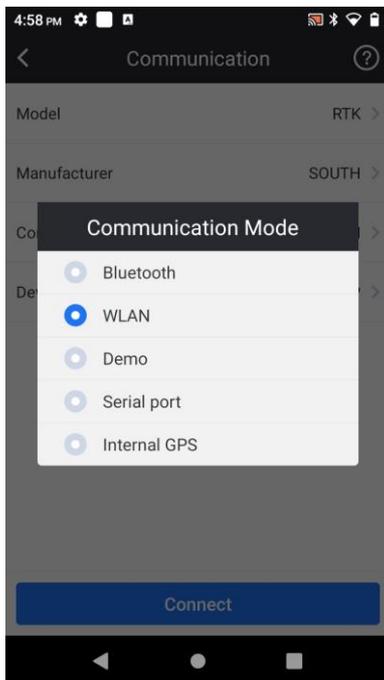


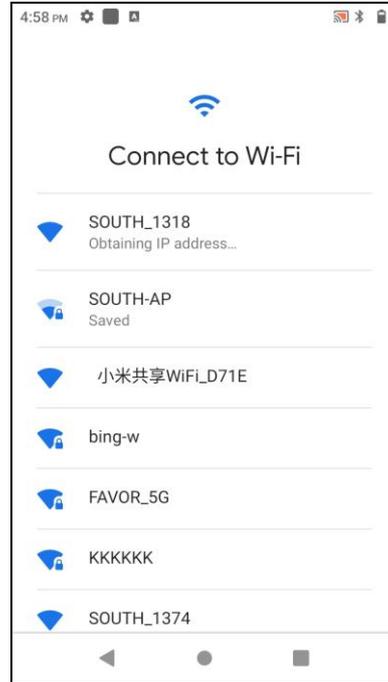
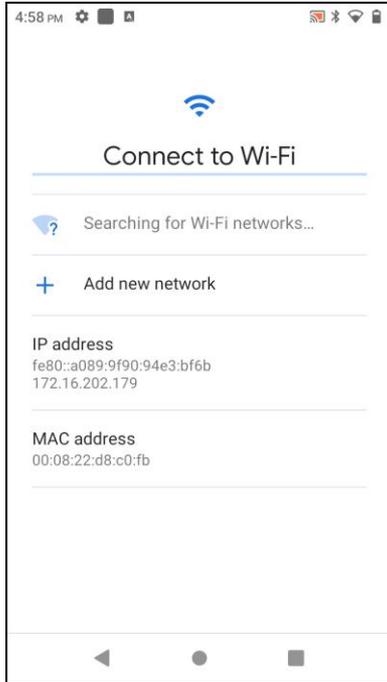
## 3.4 AR Stake-out

Traditional stakeout uses a guideline on the map and three arrows to point the direction. It could be simple for experienced surveyors, but it may confuse novices. AR stakeout makes up this gap. Beginners or veterans can directly follow what they see on the screen to reach the target. Benefiting from this, users can save more time on stakeout and be less confused about the direction.

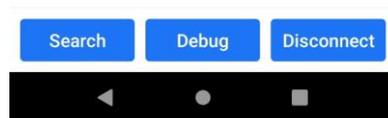
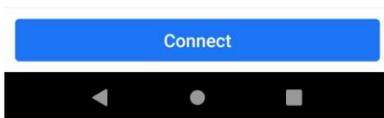
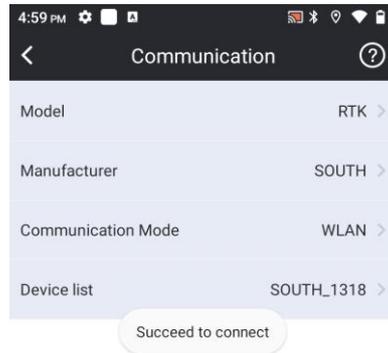
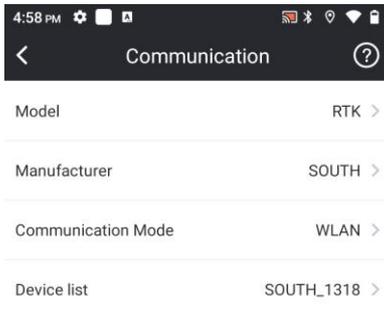
Before we start, we need to prepare following devices: an Insight V2, a H6 data controller with at least one available SIM card and the software SurvStar installed on H6. All right, now we get everything prepared. Let's start.

- 1) Turn on all the devices and run SurvStar. Go to “Communication”, select “Communication Mode” as “WLAN”.
- 2) Click “Device list” and it will jump to WiFi connection setting. Then choose the device name consistent with the last four serial numbers of V2, SOUTH\_1318 for example. In this step, please make sure the receiver WLAN setting is AP mode in order to pair with H6.

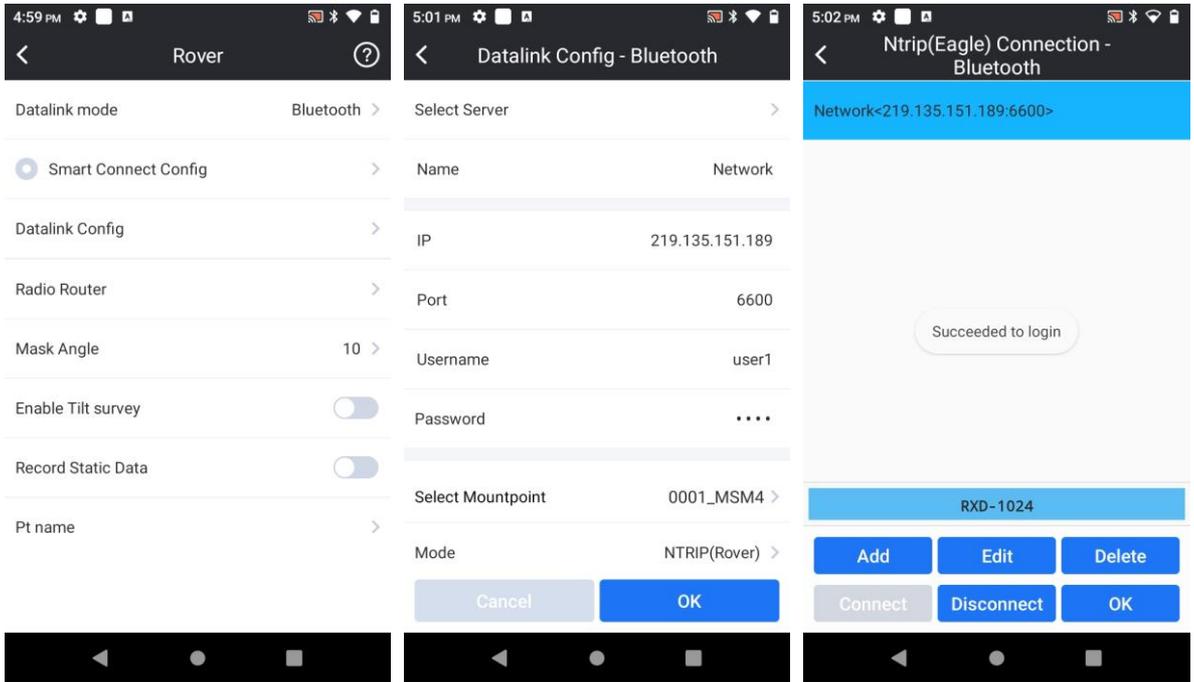




- 3) After the WiFi of V2 is connected at WiFi connection setting interface, return to communication interface on SurvStar, and click again the “Connect” button to complete the WiFi connection between receiver and controller.

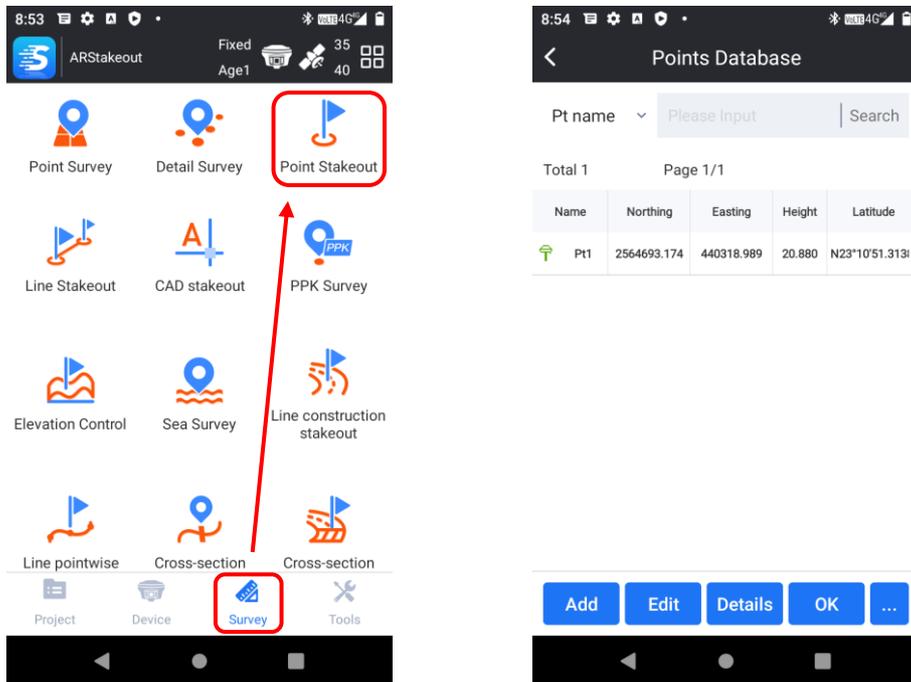


- 4) Go to “Device”--“Rover”--“Datalink mode” and select “Bluetooth” as the datalink. Then go to “Datalink config” to set parameters for a network connection to CORS, add a CORS account to obtain corrections and wait till you can get Fixed solution.

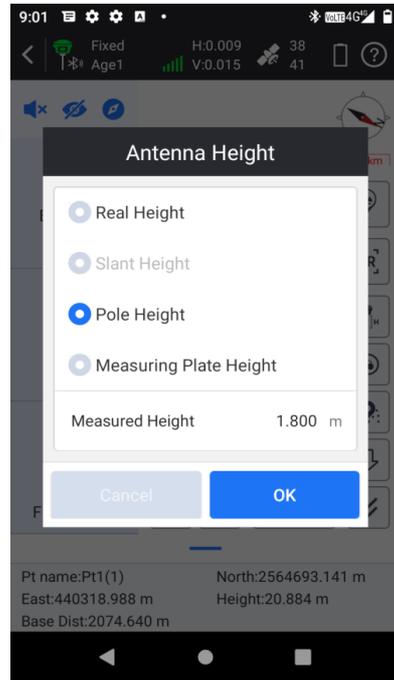


**Notice:** DO NOT choose “Receiver WiFi”, otherwise, its WLAN mode will change to client mode and its WiFi hotspot will disappear, then you need to reset it on Web UI or restore to factory default.

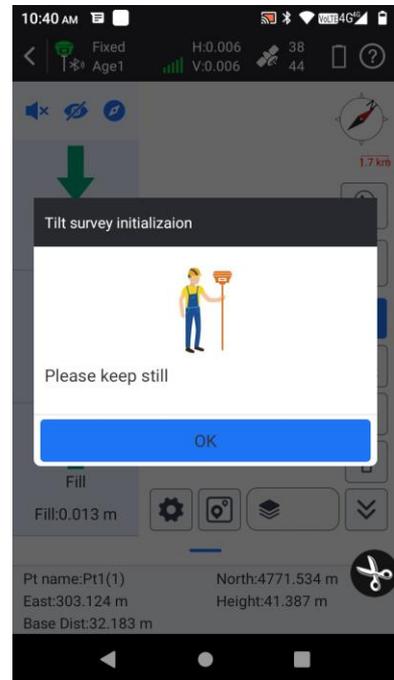
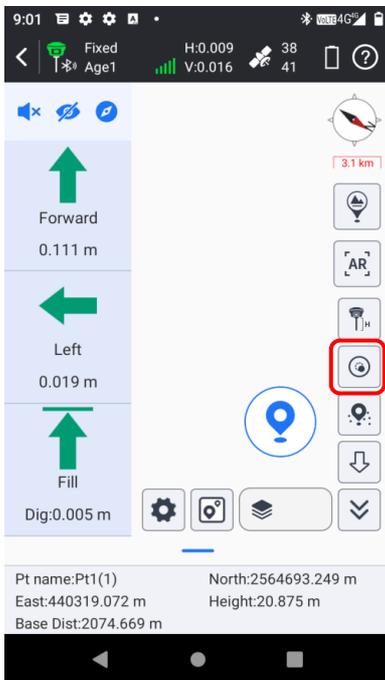
- 5) Go to “Survey”--“Point Stakeout”. Select a point you want to stake out, software will return to stakeout interface.

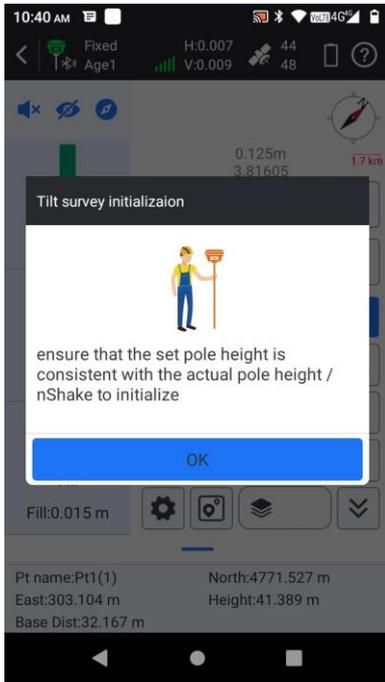


- 6) Set a correct antenna height type and value. Usually we use pole height as the antenna height type, and input a pole height value.

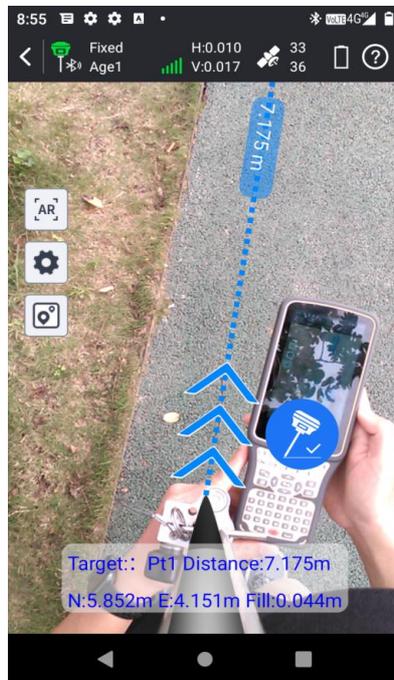


- 7) Initiate IMU tilt survey. Please remember to enable tilt survey or you cannot turn on AR, AR stakeout requires available IMU first. Click  button enable IMU, then initiate IMU according to the prompt message.





- 8) Click the  button. When we get close the target, the camera is available. Default setting is 10 meters away from the target point, when the distance is within 10 meters to the target, the camera image will appear on controller screen with guideline and arrow points to target, you can customize the distance. Follow the guidance in H6 and you can easily stakeout the point. Instead of this point, you can also try on other points stored in H6.



# Chapter IV Accessories

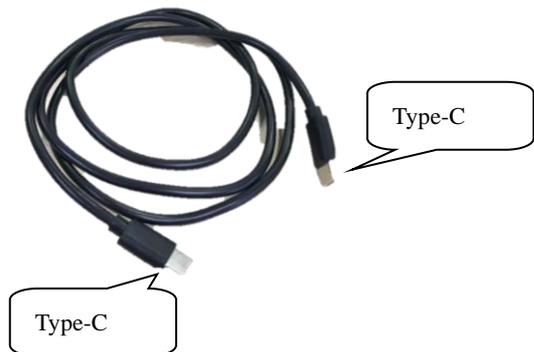
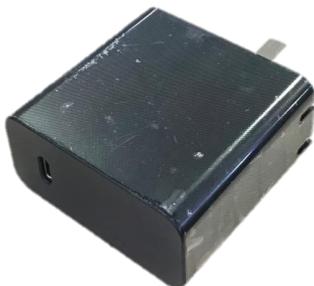
## 4.1 Instrument Case



The instrument case for Insight V2 contains two layers of packing: the inner layer is filled with anti-collision foam, the host and other accessories can be dispersed and embedded; the outer layer is a hard instrument case, sealing-strong, wear-resistant anti-wrestling. Compact, durable, can effectively prevent the impact, easy to clean

## 4.2 Charger & Adapter

Insight V2 is equipped with a rechargeable internal battery, it uses a type-c cable and a PD adapter for the charging.



## 4.3 Differential Antennas



The differential antennas are as shown above;

UHF Antenna

The UHF differential antenna is required to install to the interface at the bottom of receiver if Insight V2 is set up into internal UHF mode.

## 4.4 Cables

### Type-C cable

This cable is used to connect the receiver with computer for static data transmission, Web UI accessing and firmware update.



## 4.5 Measuring plate

The measuring plate is convenient to measure the antenna height for base station or rover.



## 4.6 Tribrach connector

Install the receiver to tribrach.



# Chapter IX Firmware Update

## Appendix A Insight V2 technical specifications

GNSS Features	
Channels	1598
GPS	L1C/A, L2C, L2P, L5
GLONASS	L1C/A, L1P, L2C/A, L2P
BDS	B1, B2, B3
GALILEO	E1, E5A, E5B, E5AltBOC*, E6
SBAS	L1C/A, L5 (Just for the satellites supporting L5)
IRNSS	L5
QZSS	L1C/A, L2C, L5
L-Band	BDSPPP <sup>[1]</sup>
Positioning output rate	1Hz~20Hz
Initialization time	< 10s
Initialization reliability	>99.99%
Positioning Precision	
Code Differential GNSS Positioning	Horizontal: 0.25 m + 1 ppm RMS      Vertical: 0.50 m + 1 ppm RMS
GNSS Static	Horizontal: 2.5 mm + 0.5 ppm RMS      Vertical: 5 mm + 0.5 ppm RMS
Real-Time Kinematic (Baseline<30km)	Horizontal: 8 mm + 1 ppm RMS      Vertical: 15 mm + 1 ppm RMS
SBAS positioning	Typically<5m 3DRMS
RTK initialization time	<10s
IMU tilt compensation	Additional horizontal pole tip uncertainty typically less than 8mm + 0.7 mm/°tilt down to 30°, 1.8m pole height.
IMU tilt angle	0°~60°
Hardware performance	
Dimension	131mm(φ)×80mm(H)
Weight	800g (battery included)
Material	Magnesium aluminum alloy shell
Operating temperature	-45°C~+75°C
Storage temperature	-55°C~+85°C
Humidity	100% Non-condensing
Waterproof/Dustproof	IP68 standard, protected from long time immersion to depth of 2m
	IP68 standard, fully protected against blowing dust
Shock/Vibration	Withstand 2 meters pole drop onto the cement ground naturally
Power consumption	4W
Power supply	6-18V DC, overvoltage protection

Battery	built-in 7.4 V 6800mAh rechargeable Lithium-ion battery
Battery life(Dual-battery)	16h (static mode)
	10h (internal UHF base mode)
	12h (rover mode)
Camera	200 MP
	75°
<b>Communications</b>	
I/O Port	UHF antenna interface
	Type-C
Internal UHF	2W radio receiver and transmitter
Frequency range	410-470MHz
Communication protocol	Farlink, Trintalk450s, SOUTH, HUACE, ZHD
Communication range	Typically 8km with Farlink protocol
Bluetooth	BLEBluetooth 4.2 standard, Bluetooth 2.1 + EDR
NFC Communication	Realizing close range (shorter than 10cm) automatic pair between receiver and controller (controller requires NFC wireless communication module else)
<b>WIFI</b>	
Modem	802.11 b/g standard
WIFI hotspot	Receiver broadcasts its hotspot form web UI accessing with any mobile terminals
WIFI datalink	Receiver can transmit and receive correction data stream via WiFi datalink
<b>Data Storage/Transmission</b>	
Storage	4GB SSD internal storage standard, extendable up to 32GB
	Automatic cycle storage (The earliest data files will be removed automatically while the memory is not enough)
	Support external USB storage
	The customizable sample interval is up to 20Hz (Reserve)
Data Transmission	Plug and play mode of USB data transmission
	Supports FTP/HTTP data download
Data Format	Differential data format: CMR(GPS only), RTCM 2.x, RTCM 3.x
	GPS output data format: NMEA 0183, PJK plane coordinate, Binary code
	Network model support: VRS, FKP, MAC, fully support NTRIP protocol
<b>Sensors</b>	
Electronic Bubble	Controller software can display electronic bubble, checking leveling status of the carbon pole in real-time
IMU	Built-in IMU module, calibration-free and immune to magnetic interference
Thermometer	Built-in thermometer sensor, adopting intelligent temperature control technology, monitoring and adjusting the receiver temperature
<b>User Interaction</b>	
Operating system	Linux
Buttons	Single-button

Indicators	3 color LED indicators, and Battery indicator
Web interaction	With the access of the internal web interface management via WiFi or USB connection, users are able to monitor the receiver status and change the configurations freely
Voice guidance	The intelligent voice technology provides status and operation voice guidance, supports Chinese/English/Korean/Spanish/Portuguese/Russian/Turkish
Secondary development	Provides secondary development package, and opens the OpenSIC observation data format and interaction interface definition
Cloud service	The powerful cloud platform provides online services like remote manage, firmware update, online register and etc.

## Appendix C Technical Terms

**Ambiguity:** unknown quantity is the integer number of cycles of the carrier phase measured from the satellite to the receiver.

**Baseline:** The connection line of the two measurement points, on which to receive GPS signals and collect observation data simultaneously.

**Broadcast ephemeris:** message released by the satellite demodulator satellite orbit parameters.

**SNR (Signal-to-noise ratio):** an endpoint signal power to noise power ratio.

**Cycle skipping:** interfere loop skips a few cycles from a balanced point, and stabilize in the new equilibrium point, this make the phase integer number of cycles to generate an error.

**Carrier:** As the carrier, Frequency, amplitude or phase modulation of the modulated wave by a known reference value.

**C / A code:** GPS coarse / acquisition code, modulate the pseudo-random binary code for the 1023 bit duplex, the bit rate of which is 023MHz, and code repetition period of 1ms.

**Difference measurement:** GPS measurements employ cross-satellite cross-receiver and cross-epoch.

**Difference Positioning:** the method of determining the relative coordinates between two or more receiver by tracking the same GPS signal.

**Geometric dilution of precision:** Describe the contribution of satellite geometry errors factor in dynamic positioning

**Eccentricity:** 
$$e = \frac{\sqrt{a^2 - b^2}}{a}$$
 where a, b of the semi-major axis and semi-minor axis.

**Ellipsoid:** mathematical graphics formed when an ellipse moves around the minor axis of rotation in Geodetic Survey.

**Ephemeris:** the position of celestial bodies over time parameters.

**Flattening:** 
$$f = \frac{a - b}{a} = 1 - \sqrt{1 - e^2}$$

a is the semi-major axis, b is the semi-minor axis, e is the eccentricity.

Geoid: similar to the mean sea level and extends to the mainland special planes. Geoid everywhere perpendicular to the direction of gravity.

Ionosphere delay: delay of radio waves through the ionosphere (non-uniform dispersion medium)

L-band: The radio frequency range of 390-1550MHz.

Multipath error: the positioning error caused by the interference between two or more radio signal propagation path.

Observing session: the use of two or more receivers at the same time to collect GPS data period.

Pseudo Range: GPS receiver in the time required to copy the code aligned with the received GPS code offset and multiplied by the speed of light to calculate the distance. This time offset is the difference between the signal reception time (time series of the receiver) and the signal emission time (satellite time series).

Receiver channel: GPS receiver RF mixer and IF channel, can receive and track satellites two carrier signals.

Satellite configuration: the configuration status of the satellite with respect to a specific user or a group of users within a specific time.

Static position: do not consider the point of measurement of the movement of the receiver.

## **FCC Statement**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the 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 and, if not installed and used in accordance with the instructions, 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 turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into 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.

Caution: Any changes or modifications to this device not explicitly approved by manufacturer could void your authority to operate this 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.