

SOUTH

INNO 7

USER MANUAL

Version 1.0

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SOUTH SURVEYING & MAPPING TECHNOLOGY CO., LTD

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Chapter 1 Main features

This manual introduces Inno 7 receiver features, components, touch screen menu, WEB UI menu and basic operation for RTK survey.

Main features with Inno 7 receiver:

- **5G support(optional)**
- **New inbuilt radio:** it can cover 15km range with Farlink radio protocol
- **AI voice control:** switch working mode by voice command
- **All constellations support**
- **Internal 64G + OTG (external storage)**

Support auto-overwrite in case of storage insufficiency

- **e-SIM support**
- **Dual cellular network antenna**

In most of scenarios, the inbuilt cellular network antenna can meet requirement of survey, and in very weak signal area, the external cellular network antenna brings better signal tracking performance.

- **IMU support**
IMU sensor make the survey work much faster and brings better accuracy compared to traditional tilt sensor.
- **NFC:** it enables faster and sampler Bluetooth connection.
- **WIFI Datalink and AP hotspot**
- **1.54-inch Touch screen:** easy to operate receiver by swiping the screen.
- **Satellite-link (optional)**

Within 25-30 minutes, a single unit receiver can achieve 4cm accuracy.

In those area where there is no any known point (like desert, ocean, forest, etc.), the Base receiver can take the coordinates stored in Satellite-link mode as known point and transmit correction data to rover receiver.

➤ **XTRa (Optional):**

XTRa technology supports additional 3-4 minutes correction duration when datalink (radio signal or cellular network signal) get lost.

➤ **Radio relay**

Rover unit receives differential correction data from the base receiver through radio datalink and in mean time it can also relay the received correction data to other rover units by radio datalink thus extend the base receiver's radio coverage range.

➤ **Radio route**

Rover unit receives correction data from network (Like CORS system) and meanwhile it can also relay the received differential correction to nearby rover units by radio, thus the other rover units can utilize and share the same differential correction data.

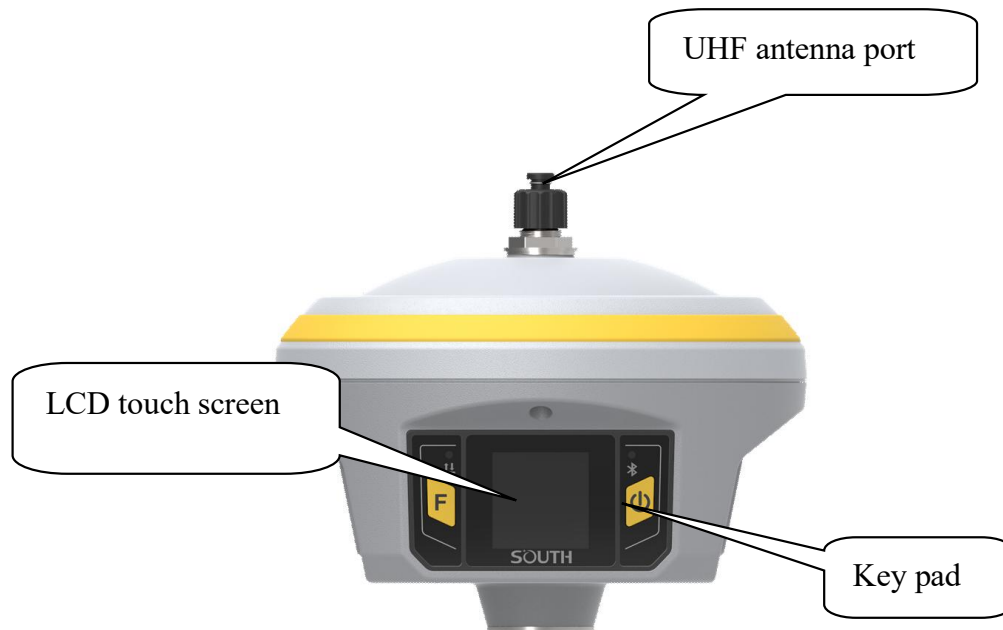
➤ **Intelligent Linux platform:**

Intelligent Linux platform makes remote control, registration, cloud service and interaction possible now.

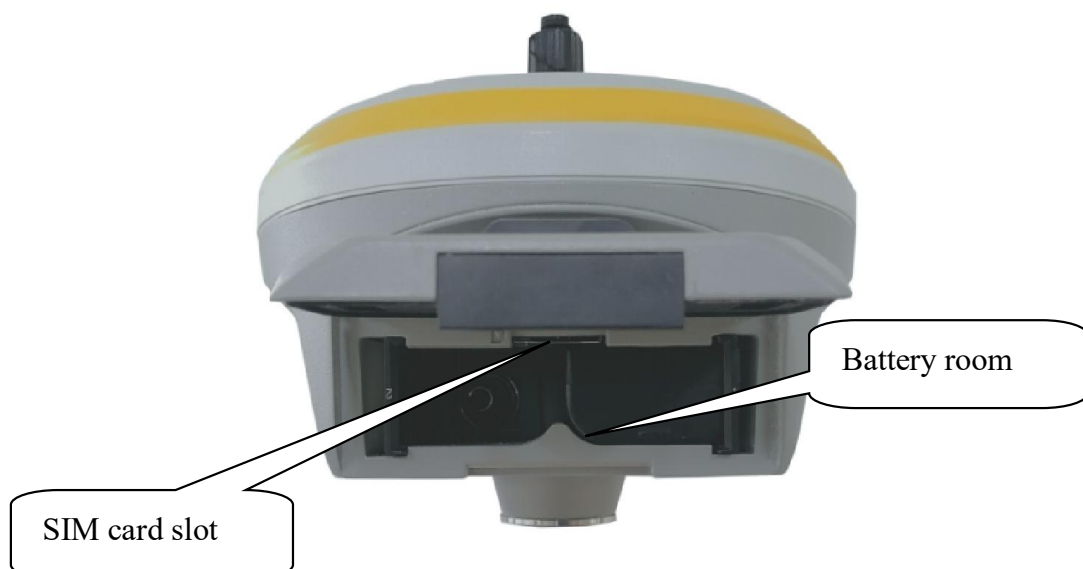
Chapter 2 Inno 7 receiver introduction

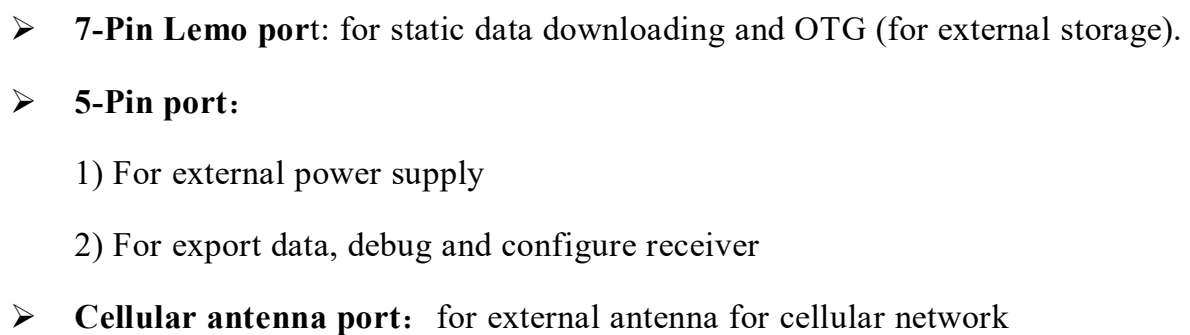
§2.1 Receiver components

Receiver front view



Receiver back view









§2.2 Keypad and indicating light



Keypad and indicating light

	Function	Remarks
	Function key	Shift between menus
	Power key	1) Power on/off 2) Select menu 3) In lowest menu: short press for select, long press for confirmation
	Bluetooth light	Light on when Bluetooth connected
	Datalink light	In radio (UHF) mode: it flashes every second In network mode: 1) It flashes fast(10Hz) during dialing to network or start WIFI datalink 2) It flashes every second when access to cellular network successfully.

Keypad operation:

Fn key: to shift between options

PWR key:

- 1) Short press: select the option
- 2) Long press: to Power off (Reset, Set default, Self-check) receiver
- 3) Long press: to accept the configuration (when at the lowest menu), just like swiping down the touch screen.

Press any key (or click on touchscreen) will wake up screen if screen sleeps.

§2.3 Touch screen

The receiver can be operated from both keypad and touch screen. By swiping the screen, receiver can be configured.



1. Swipe right /left: to shift between options (or press Fn key to shift between options)

2. Tap screen: for selection (or short press PWR key for selection)

3. Swipe down:

----To bring up system menu [Power off], [Reset], [Set default], [Self-check] when it is at main display interface

---- In lowest level menu: swipe screen down to accept the configuration (or long press PWR key to accept the configuration).

4. Swipe up

Return from submenu to previous menu.

§2.4 Receiver menu

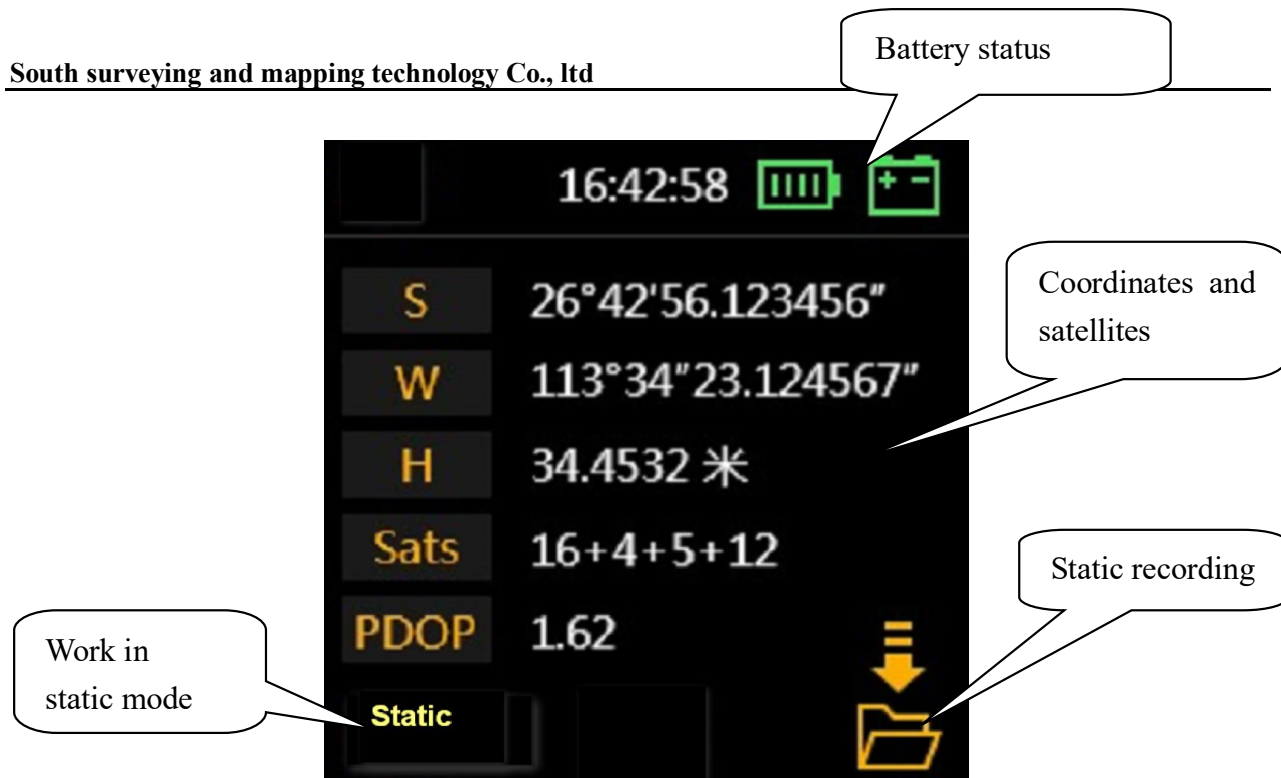
§2.4.1 Main display interface

There are 2 main display interfaces: [Coordinates display interface], [Satellite display interface],

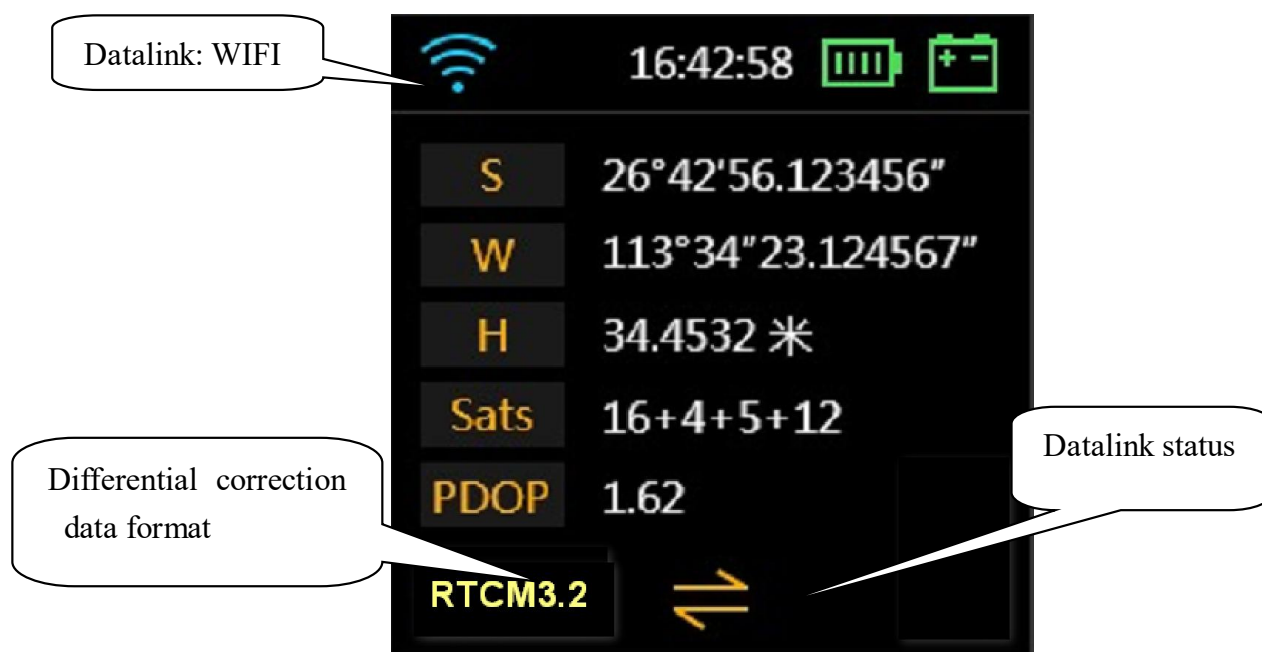


Icons in the Coordinates display interface

1) In static mode:



2) In Base mode:



3) In Rover mode:



Datalink icon is on the higher left conner:



: UHF (inbuilt radio) as datalink



: Cellular network (via SIM card) as datalink



: Dual transmit (inbuilt radio and cellular network)



: External radio as datalink



: Bluetooth datalink (also called controller network datalink)



: WIFI datalink



: Slink(Satellite link)



: No datalink

§2.4.2 Main menu

Main menu: by swiping screen right or press F key to bring them out.



[Work mode],

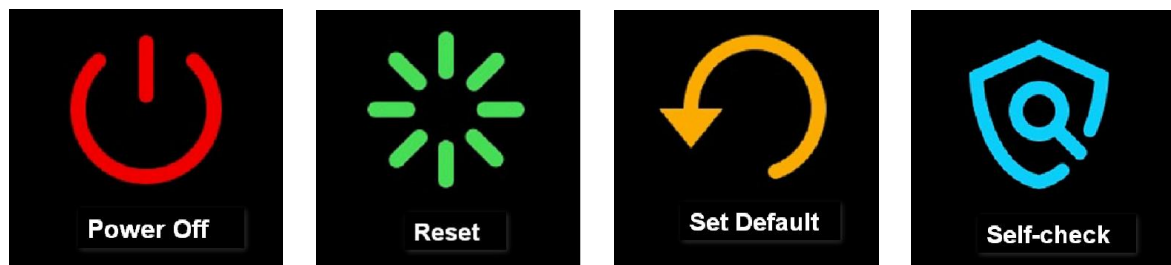
[Set Datalink],

[System option],

[Receiver information]

System menu: [Power off], [Reset], [Set default], [Self-check]

By swiping screen down to bring system menu out (when it is at main display interface).



§2.4.2.1 Main menu

[Work mode], [Set Datalink], [System option], [Receiver information], there are two methods to bring them up:

Method 1: by touch screen

From main display interface, directly swipe screen right, the LCD screen will show below menus circularly as below.

[Work mode], [Set Datalink], [System option], [Receiver information], [Satellites display interface], [Coordinates display interface] ... [Work mode], [Set Datalink] ...

Tap screen to select the main menu in your need (or press PWR key to select).

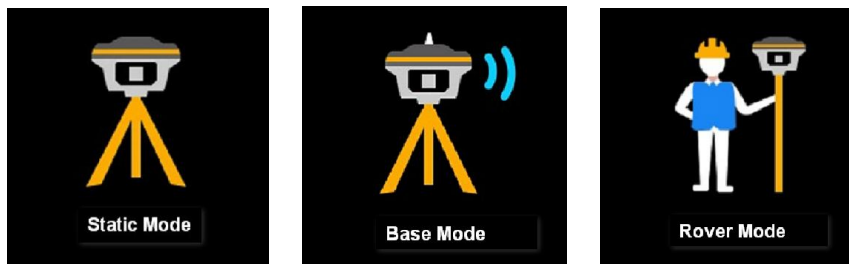
Method 2: by Keypad

From main display interface, Press FN key, the LCD screen will show above menus circularly and press PWR key to select the main menu (or tap screen to select).

When the receiver switched on, there are two main display interfaces: coordinates display interface and satellite display interface. Swipe left or right to switch between the two main display interfaces.

3) Work mode

To switch work mode between Static mode, Base mode and Rover mode.



4) Set Datalink

To configure datalink and there are 7 datalink modes as below:





: Cellular network (via SIM card) as datalink



: Dual transmit (inbuilt radio and cellular network)



: External radio as datalink



: Bluetooth datalink (also called controller network as datalink)



: WIFI datalink



: Slink(Satellite link)



: No datalink

5) System option

[AI voice control]: to switch on/ off voice alarm

[WIFI config]: to set WIFI mode. There are two WIFI mode: AP mode and Client mode.
For details please refer to §2.4.5

[Power saving mode]: to switch off the LCD display to save power.

[Other option (USB mode, Ethernet mode, Language)]: to change language and set USB mode. For details please refer to §2.4.6

6) Receiver information

To show key information of receiver: serial number, firmware version, Expiry date.

ID:

SG70A41333442

Version:

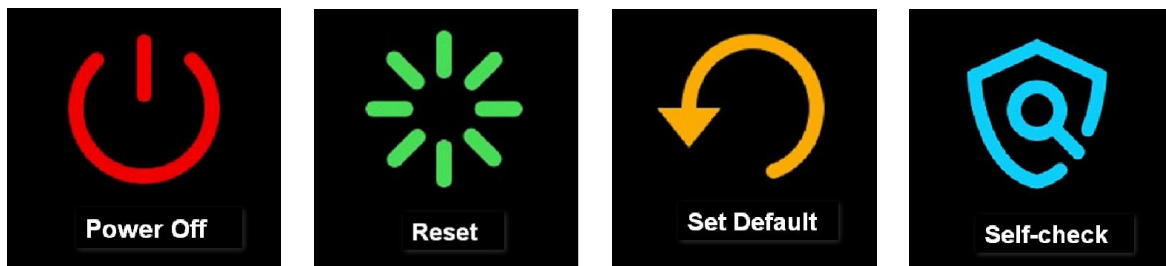
1.09.200318.RG70GL

Expiry date:

20200801

§2.4.2.2 System menu

Anytime when it is in **main display interface**, swipe screen down will bring them up.



[Power off]: to power off receiver.

[Reset]: to restart receiver.

[Set default]: to restore to default settings.

[Self-check]: to do self-check for receiver.

§2.4.2 Set work mode

Swipe right (or Press F key) to select [work mode], then tap screen (or press PWR key) to accept.



There are three work modes: Static mode, Base mode, Rover mode (as below image):



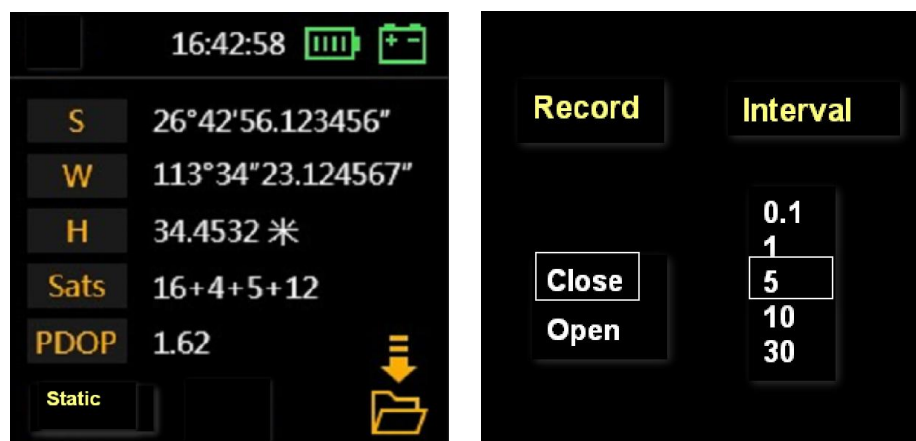
1. Static mode

1.1) Select static mode

Swipe right and select [work mode], then select [Static mode] (or press F key to select and press PWR key to accept), the receiver will enter Static mode.

1.2) Static mode settings


Tap screen to bring up settings interface (or Press PWR key to bring settings interface)



Set [**Record: open**] and your required recording Interval, then swipe down to accept (or press and hold PWR key to accept) the settings.

Set [**Record: close**] to stop recording when your field record complete.

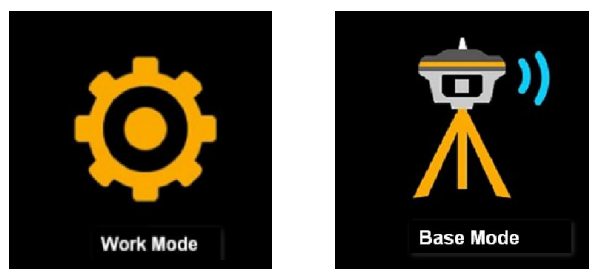
After make the settings, swipe screen down to accept (or long press PWR key (press PWR key and hold it for 3 seconds))

Icon  on lower right corner shows it is recording static data.

2. Base mode

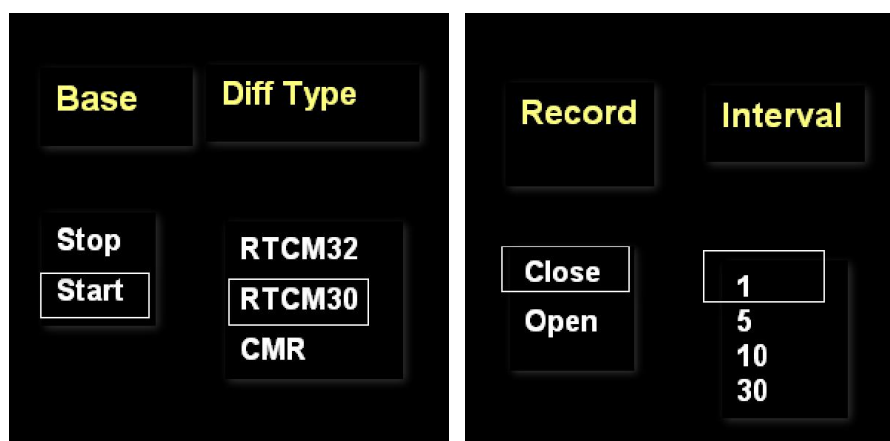
2.1) Enter Base mode

Swipe right to select [Work mode], then select [Base mode] ((or press F key bring out main menu and press PWR key to select [Work mode], then select [Base mode])), the receiver will enter Base mode.



1.2) Base mode settings

Tap the screen to enter Base mode settings (or Press PWR key to bring up settings)

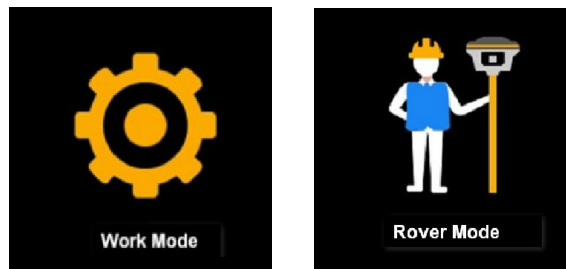


In coordinates display interface, you can also tap screen to enter Base mode settings.

3. Rover mode

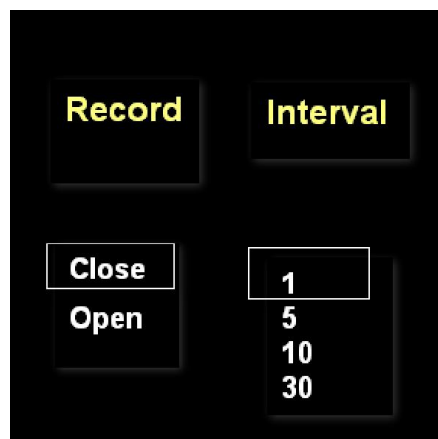
3.1) Enter Rover mode

Swipe right to select [Work mode], then select [Rover mode] ((or press F key bring out main menu and press PWR key to select [Work mode], then select [Rover mode])), the receiver will enter Rover mode.



3.2) Rover mode settings

Tap the screen to enter Rover mode settings (or Press PWR key to bring up settings)



If you want the receiver to record static data during Rover mode, please set **[Record: open]** and select recording interval.

Any time, you can view or change the settings of related work mode by tap the screen.

§2.4.3 Set datalink mode

There are 7 different type of datalink modes as below:



: UHF(Inbuilt radio) as datalink



: Cellular network (via SIM card) as datalink



: Dual transmit (inbuilt radio and cellular network)



: External radio as datalink



: Bluetooth datalink (also called controller network as datalink)



: WIFI datalink



: Slink(Satellite link)

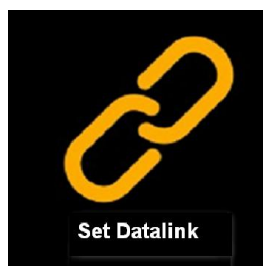


: No datalink

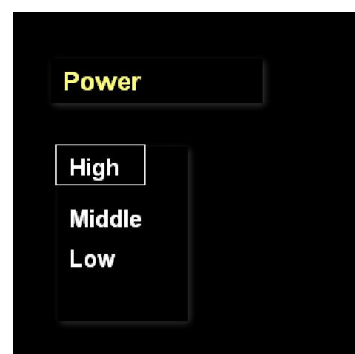
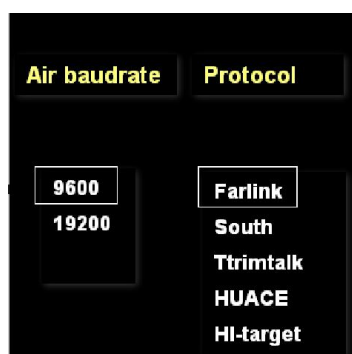
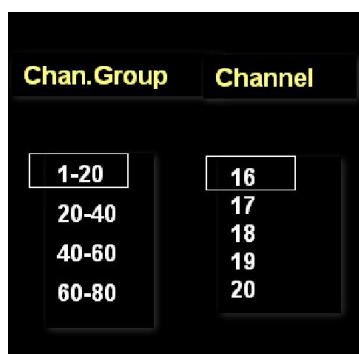
1. UHF (inbuilt radio)

Firstly, set receiver to [Base mode] or [Rover mode], then enter Set datalink:

Swipe right and select [Set datalink], then select [UHF(inbuilt radio)] as below.



Tap the screen (or press PWR key) to make other settings for selected datalink.



Air baud rate: Normally, it is recommended to take default air baud rate. If need to change it, please make the same change for both base and rover receiver. More air baud rate, more data can be transmitted per second.

Radio protocol: Normally, it is recommended to take default protocol (Farlink). If need to change it, please make same change for both base and rover receiver.

Radio power: to set the base inbuilt radio transmission power.

Note: In Base mode, to cover longer work range, please select radio transmission power as high. To maximized the battery working time, please select as middle or low.

2. Cellular network

Utilizing the inserted SIM card, the receiver can access to cellular network and transmit the differential correction data. Below icon shows the current datalink is cellular network.

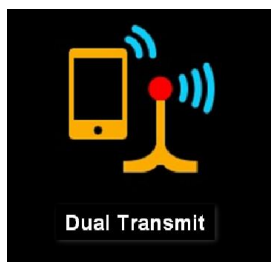


3. Satellite datalink



4. Dual transmit datalink

It means both inbuilt radio datalink and cellular network datalink: correction data is transmitted simultaneously by both inbuilt radio and cellular network via SIM card.



5. Bluetooth datalink (also called controller network datalink)

Controller access to internet firstly and be connected to receiver by Bluetooth. Thus, receiver can receive correction data by utilizing controller's network.

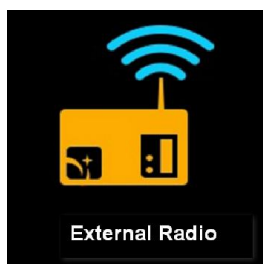


6 WIFI datalink



Receiver access to WIFI network and transmit or receive differential correction data. It needs to make setting: [System option]-[WIFI config]-[Work mode: client] Please refer §2.4.5.

7. External radio datalink



If an external radio is connected to receiver, then external radio datalink can be chosen as datalink.

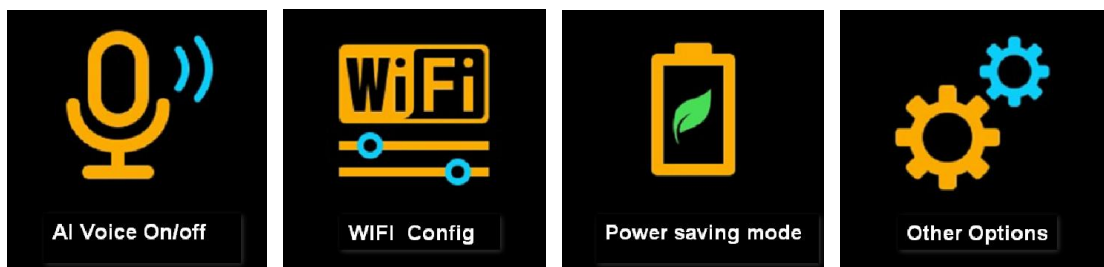
8. Close datalink



Choose this option to close all datalink. Usually it is used only for test or debugging receiver.

§2.4.4 System option

Swipe right to select [System option] (or press F key to select), then tap it to accept (or press PWR key to accept).



1. AI Voice On/ off

To switch on/ off AI voice.



How to use AI voice control?

1) Set [AI voice: on]

2) Speak to receiver [****], the receiver will reply [*****]

For example, give a voice command: Inno7, rover mode, internal radio (refer to below voice command list), then receiver will to be set to related work mode and datalink or start [Power off], [Reset], [Set default], [Self-check].

已有词汇
小南小南
移动站电台
移动站网络
移动站蓝牙
基准站内置
基准站外挂
基准站网络
静态模式
自检主机
恢复出厂设置
已有词汇
关闭电源
调高音量
调低音量

(语音指令图)

Note:

- 1) Please make sure not try this function in noisy environment when give voice command to receiver.
- 2) Sometimes it might be difficult to for receiver to recognize the voice command due to someone's strong local accent. In such a case, you can operation receiver in normal way rather than voice command.
- 3) Only the voice command in list will be recognized, not your arbitrary voice command.

To avoid battery consumption, it is suggested to switch off AI voice control when receiver work in Base mode.

2. WIFI config

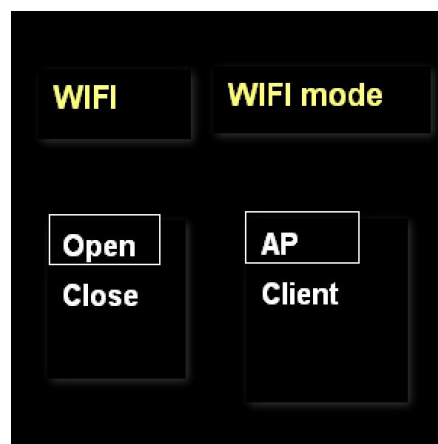
[WIFI work mode: AP/ Client]

AP mode: the receiver will generate hotspot so that your computer or mobile phone can connected to it and visit receiver's WEB UI.

Client mode: with the receiver's inbuilt network module, it can connect other WIFI hotspot to access to internet so that the WIFI datalink can be used.

Note: suggest to close WIFI client mode if there is no need to use WIFI datalink. By default, it is set as AP mode.

For details about WIFI config, please refer to §2.4.5.



3. Power saving mode

After choosing [power saving mode], the LCD display will turn dark in 2 minutes and once you tap screen or press any keypad, the screen will be activated again. It is recommended to set receiver in power saving mode to extend battery work time.



4. Other option

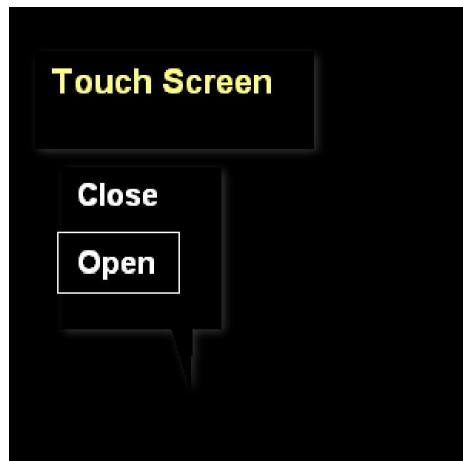
Language: select a language from here.

USB mode: USB flash disk mode and Ethernet mode.

For more introduction about USB mode, please refer to §2.4.6.

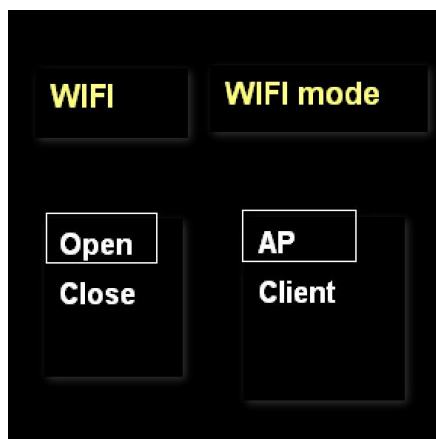
Touch screen: enable or disable touch screen (if touch screen is disabled, you can use

keypad to set receiver menu).



§2.4.5 WIFI config

[System option]- [WIFI config]



[WIFI: open/close]: to open or close WIFI function

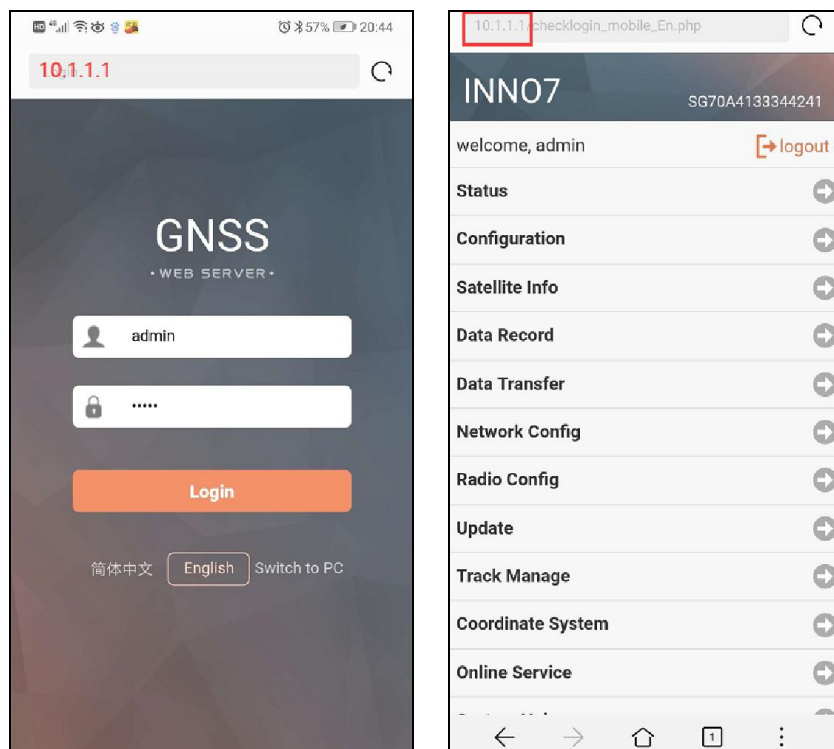
[WIFI work mode: AP/ Client]

There are two WIFI work mode: AP and client.

1. AP mode

The receiver will generate hotspot so that your computer or mobile phone can connected to receiver and visit its WEB UI.

Below image shows visiting receiver's WEB UI by WIFI AP mode from a mobile phone (method: IE, input 10.1.1.1, User name: admin, Password: admin)



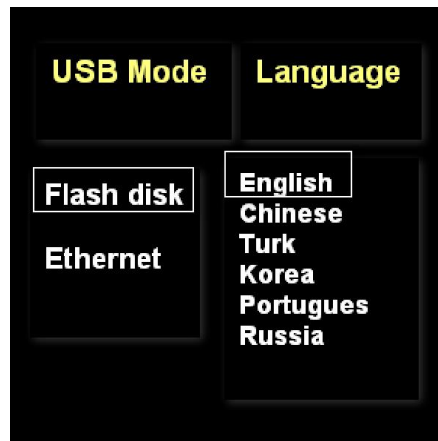
2. Client mode

With the receiver's inbuilt network module, it can connect to other WIFI hotspot and access to internet so that the WIFI datalink can be used.

Note: suggest to close WIFI client mode if there is no need to use WIFI datalink. In most of the cases, we use WIFI AP mode.

§2.4.6 USB mode config

[System option]- [Other option]- [USB mode]:



USB flash disk mode:

In this mode, the receiver works as USB flash disk. When receiver is connected to computer, this receiver's internal memory will be displayed as a removable disk in computer and all saved static data can be copied to computer, just like we are copying data from a flash disk.

Ethernet mode:

When the receiver is connected to computer by cable and ethernet mode is selected, the receiver's inbuilt network module work as ethernet adapter, so the receiver can access to WIFI network as client so that WIFI datalink can be used.

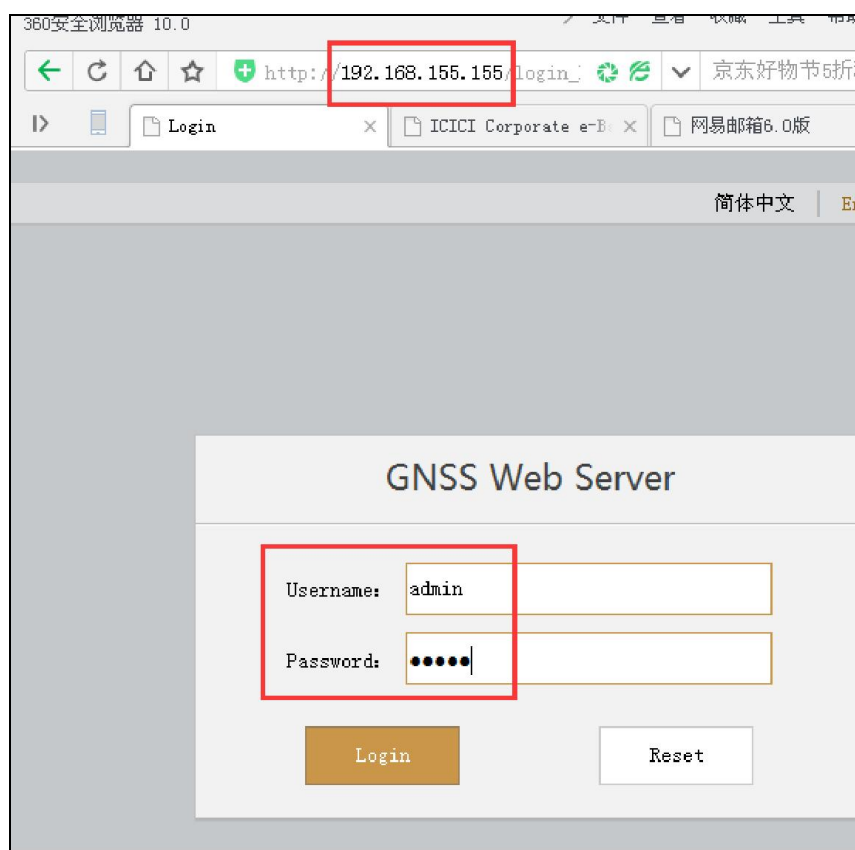
And the receiver's WEB UI can also be visited by computer via cable connection as below:

Visit the receiver's WEB UI by cable connection Method:

- 1) Connect receiver to computer by cable and install drivers for new found device (receiver's inbuilt network module).
- 2) IE: 192.168.155.155, User name: admin, Password: admin

Note: If choose ethernet mode, once receiver is connected to computer, drivers will be asked to be installed on computer.

Below images showing in ethernet mode, to visit the receiver's WEB UI by cable connection rather than WIFI connection.



For details about visit the receiver's WEB UI by cable connection, please refer to §2.5.1.

§2.4.7 Power off, Reset, Set default and Self-check

Anytime when it is in **main menu**, swipe screen down will bring them up.



[Power off]: to power off receiver.

[Reset]: to restart receiver.

[Set default]: to restore to default settings.

[Self-check]: to do self-check for receiver.

§2.5 Receiver's WEB UI

§2.5.1 Visit receiver's WEB UI

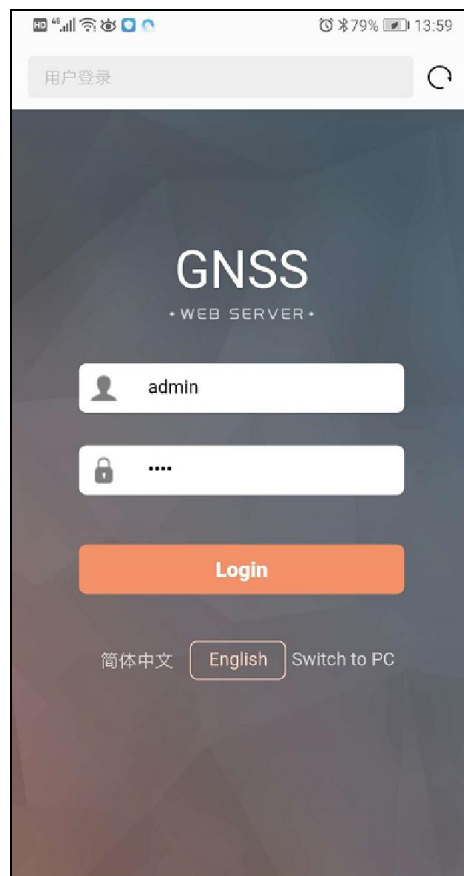
There are two methods for visiting receiver's WEB UI:

- 1) **By WIFI connection** ----this method is simple and widely used
- 2) **By cable connection (7 Pin-USB cable)**----this method is a little more complicated

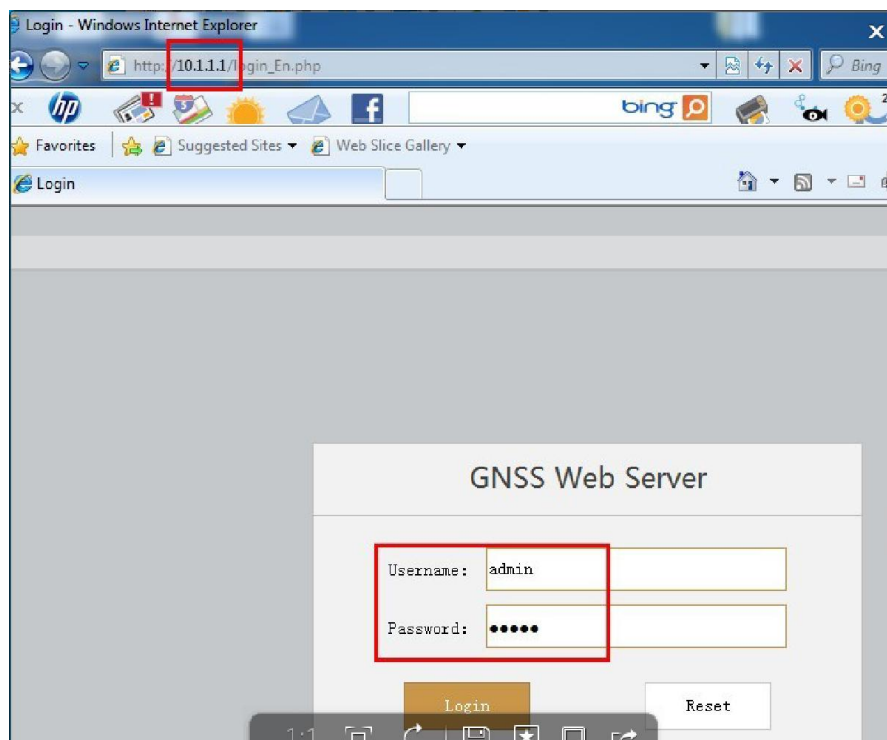


By WIFI connection method:

- 1) [System option]-[WIFI Config], select [WIFI: open] and [Work mode: AP]
- 2) Get connected to receiver WIFI hotspot and
- 3) Internet explorer to input: 10.1.1.1 (User name: admin, Password: admin)

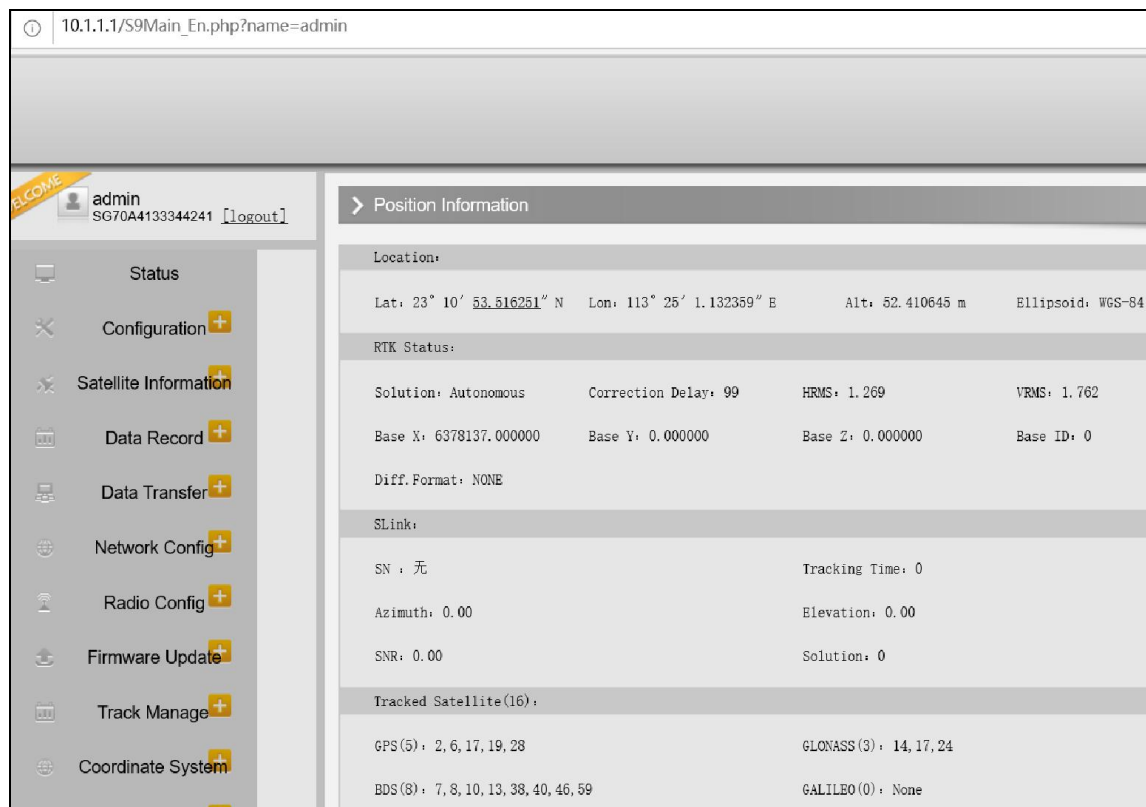


Visit receiver WEB UI from mobile phone



Visit receiver WEB UI from computer

Below is the receiver's WEB UI:

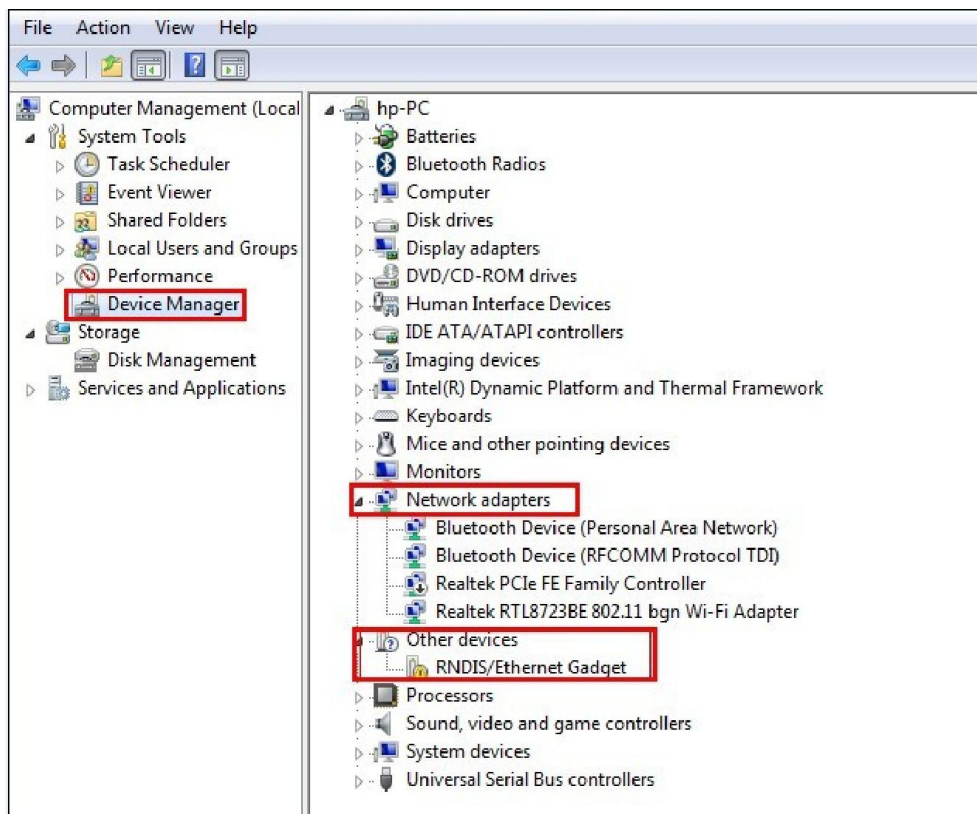


By cable connection method:

- 1) [System option]-[Other option], select [USB mode: Ethernet]
- 2) Connected receiver to computer by cable (5 Pin-USB cable)
- 3) Install drivers (instruction see below)
- 4) Internet explorer: 192.168.155.155 (User name: admin, Password: admin)

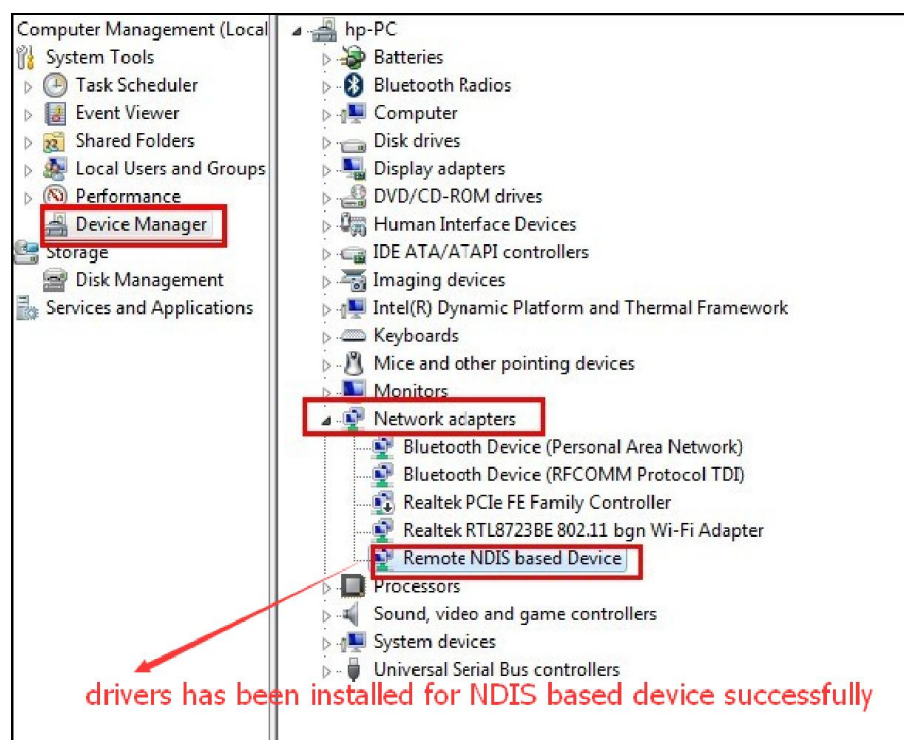
Below is instruction of how to install drivers:

- 1) [My computer]-[Device manager], there is unknown device found under Network adapters option (as below image)



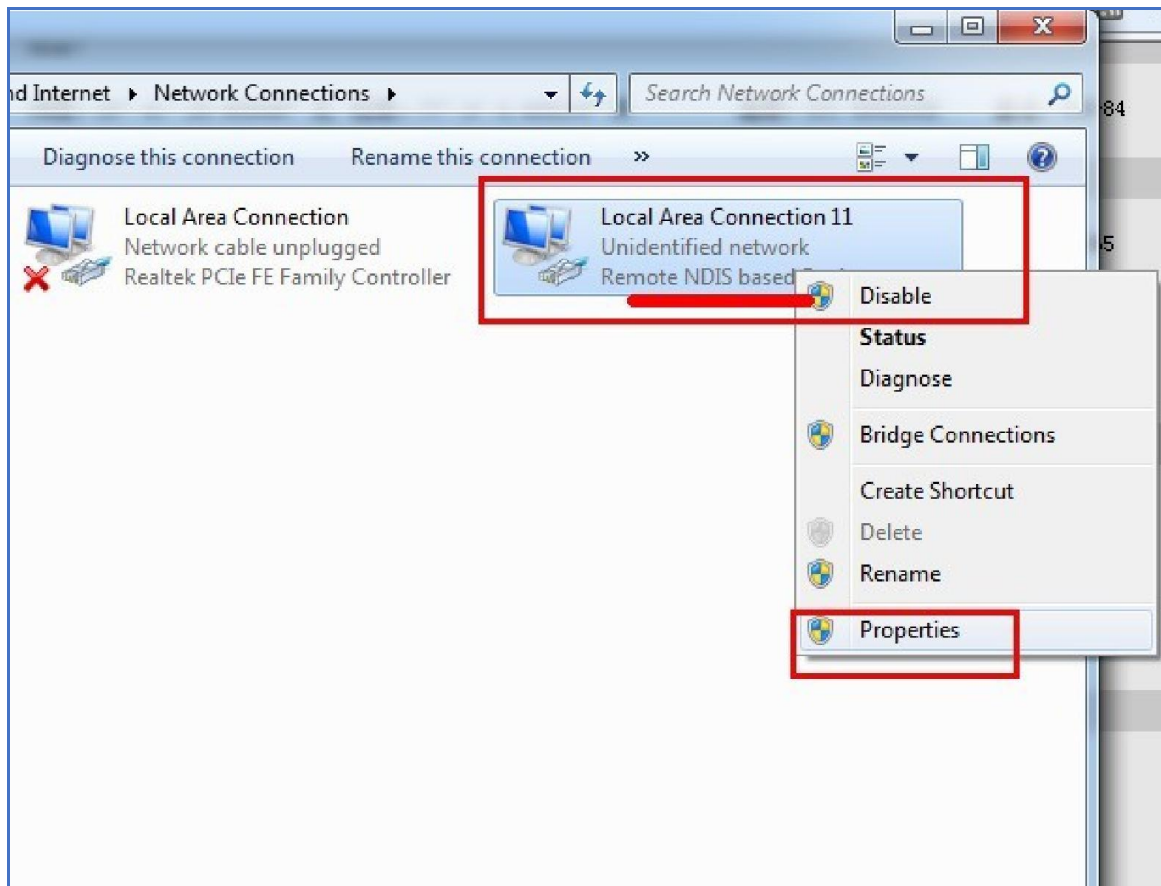
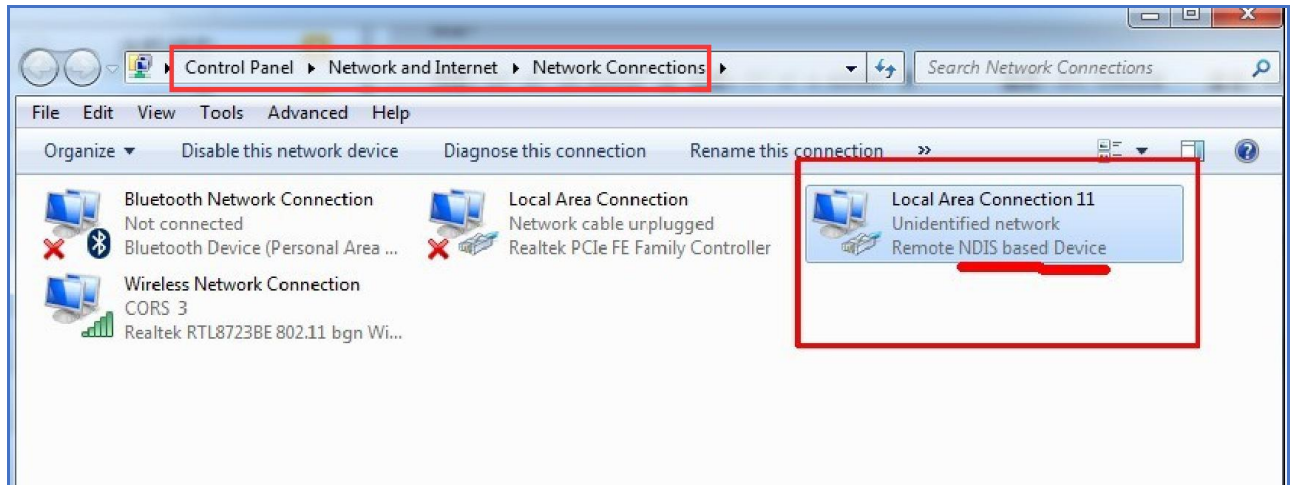
2) Right click the unknown device (RNDIS/Ethernet Gadget) showed in above image, install drivers for it.

When drivers is installed, it is shown as Remote NDIS based device (it is actually a new network adapter). See below image.

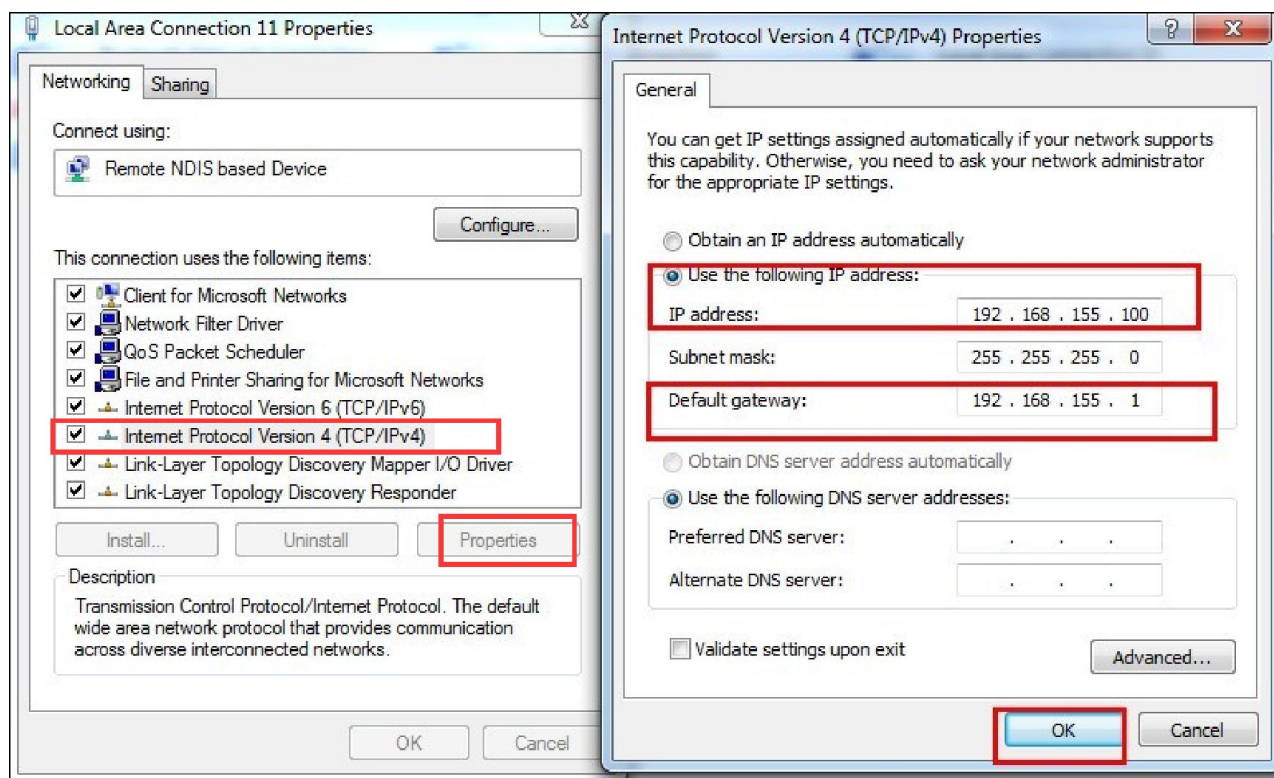


3) [Control panel]-[Network and internet]-[Network connection], right click this new

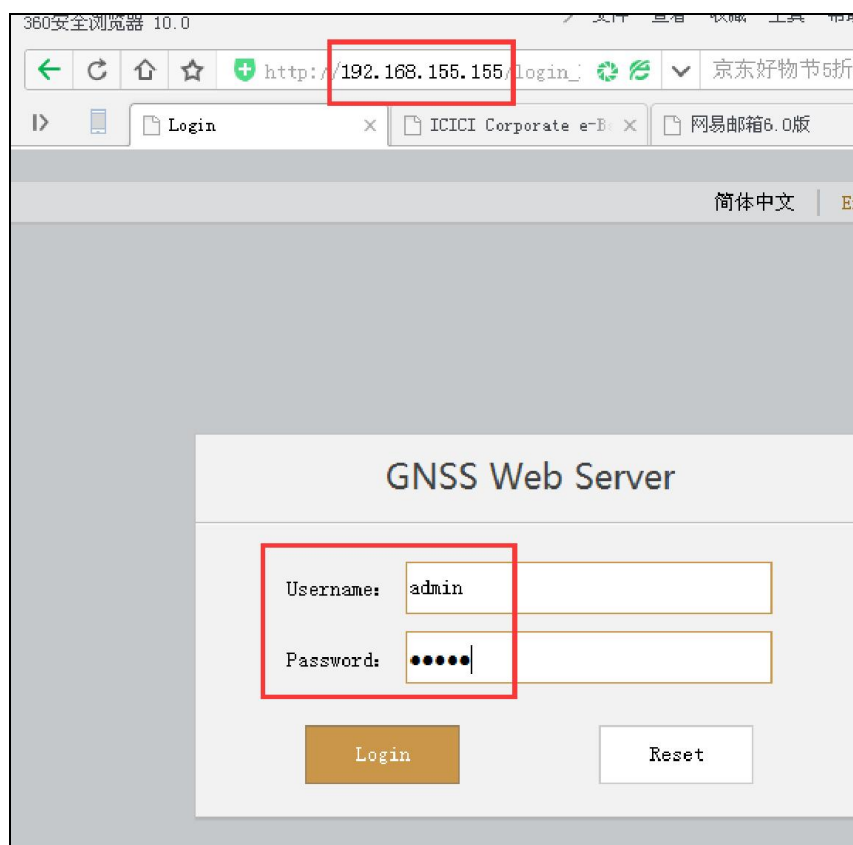
network adapter(Remote NDIS based Device), select [Properties]

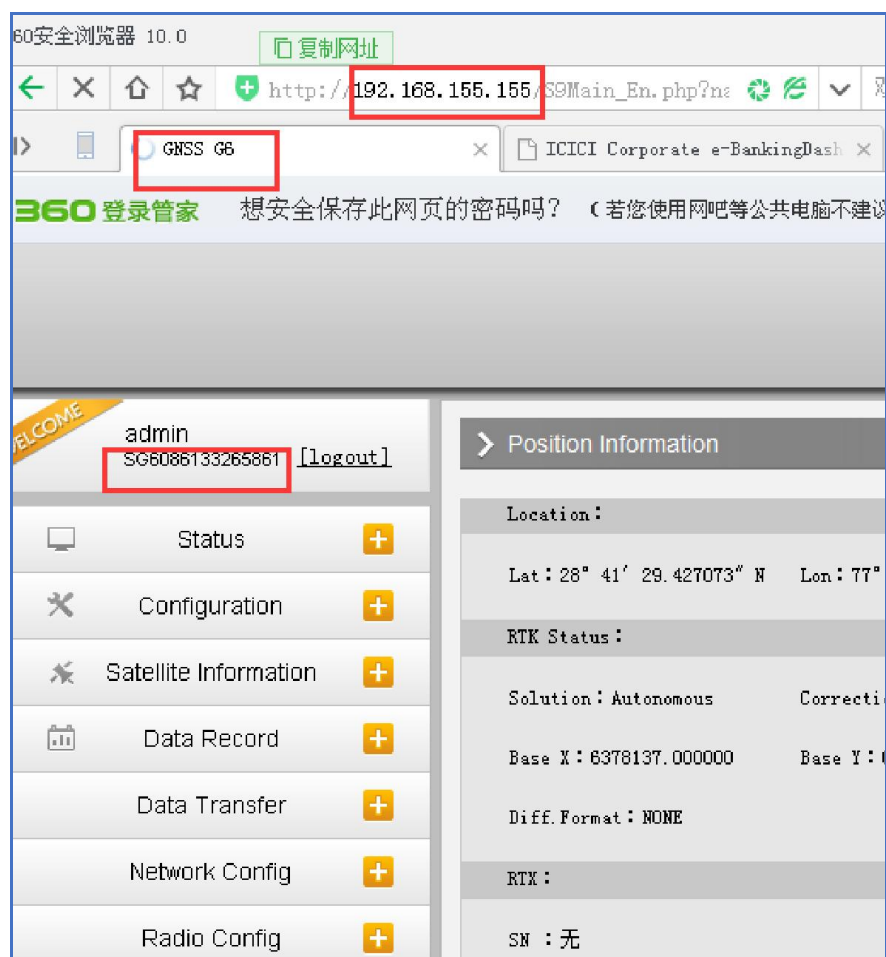


Input IP (192.168.155.100) and gateway (192.168.155.1), see below image:



4) Input: 192.168.155.155 in your computer's IE (as below image), now you can access to receiver's WEB UI by cable connection method (7 pin-USB cable).





Note: to make sure the computer can visit receiver's WEB UI properly, please use Internet explorer because the other browser might not support it well.

§2.5.2 Menu in WEB UI

<div>WELCOME</div> <div>admin SG70A4133344241 [logout]</div>		<div>> Position Information</div>	
<div>Status +</div> <div>Configuration +</div> <div>Satellite Information +</div> <div>Data Record +</div> <div>Data Transfer +</div> <div>Network Config +</div> <div>Radio Config +</div> <div>Firmware Update +</div> <div>Track Manage +</div> <div>Coordinate System +</div> <div>Online Service +</div> <div>User Management +</div> <div>Help +</div>		<div>Location:</div> <div>Lat: 23° 10' 53.494217" N Lon: 113° 25' 1.130937" E Alt: 51.469727 m Ellipsoid: WGS-84</div> <div>RTK Status:</div> <div>Solution: Autonomous Correction Delay: 99 HRMS: 1.381 VRMS: 2.382</div> <div>Base X: 6378137.000000 Base Y: 0.000000 Base Z: 0.000000 Base ID: 0</div> <div>Diff.Format: NONE</div> <div>SLink:</div> <div>SN : 无 Tracking Time: 0</div> <div>Azimuth: 0.00 Elevation: 0.00</div> <div>SNR: 0.00 Solution: 0</div> <div>Tracked Satellite(15):</div> <div>GPS(4): 6, 17, 19, 28 GLONASS(3): 2, 15, 24</div> <div>BDS(8): 7, 8, 10, 13, 38, 40, 46, 59 GALILEO(0): None</div> <div>SBAS(0): None QZSS(0): None</div> <div>Used Satellite(15):</div>	

Menus in Web UI are listed in below table 2.4-1:

序号	Main menu	Submenu
1	Status	System information, Working status Position information
2	Configuration	General configuration, Base setup, Antenna setup, Satellite tracking, Receiver operation, System setup
3	Satellite information	Tracking list, Tracking chart, Sky plot, ON/OFF GPS, GLONASS, GALILEO, BDS, SBAS, QZSS

4	Date record	Record config, Data download, FTP transmission
5	Data transfer	General, Serial port config, TCP/IP config, Ntrip config, Dataflow config
6	Network config	GSM/GPRS config SMS config CSD config WIFI config Bluetooth config Port forwarding Route Network testing
7	Radio config	Radio parameters Radio frequency
8	Firmware update	Firmware update Module update
9	Track manage	Parameter setting Data download
10	Coordinate system	Coordinate system
11	Online service	Online service
12	User management	User management

Table 2.4-1 Web UI menu

§2.5.3 Receiver status

1. System information

To show key information like : receiver serial number, MAC ,receiver firware version, OEM firmware version, Code expiry date,etc.

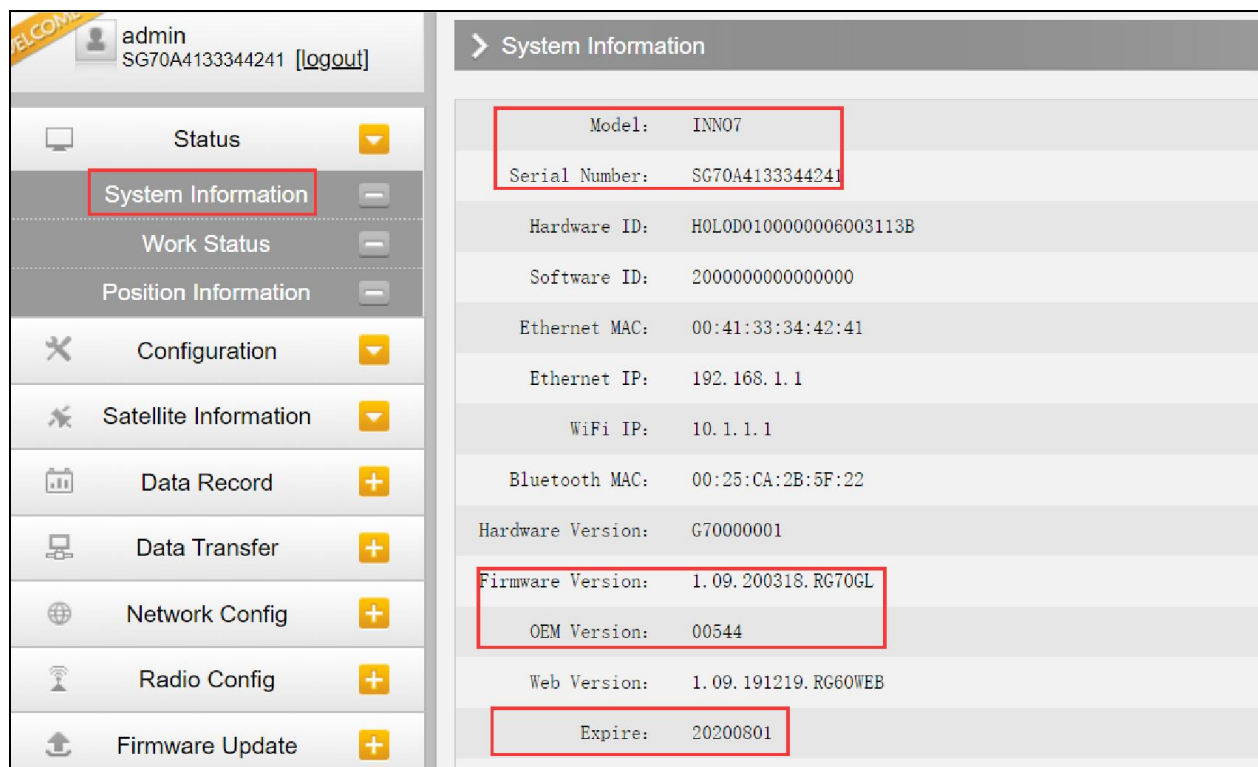


Figure 2.4.3-1 Web UI Status-system information

2. Working status

To display receiver's work mode, datalink mode, temperature inside, memory remaining, voltage ,etc.

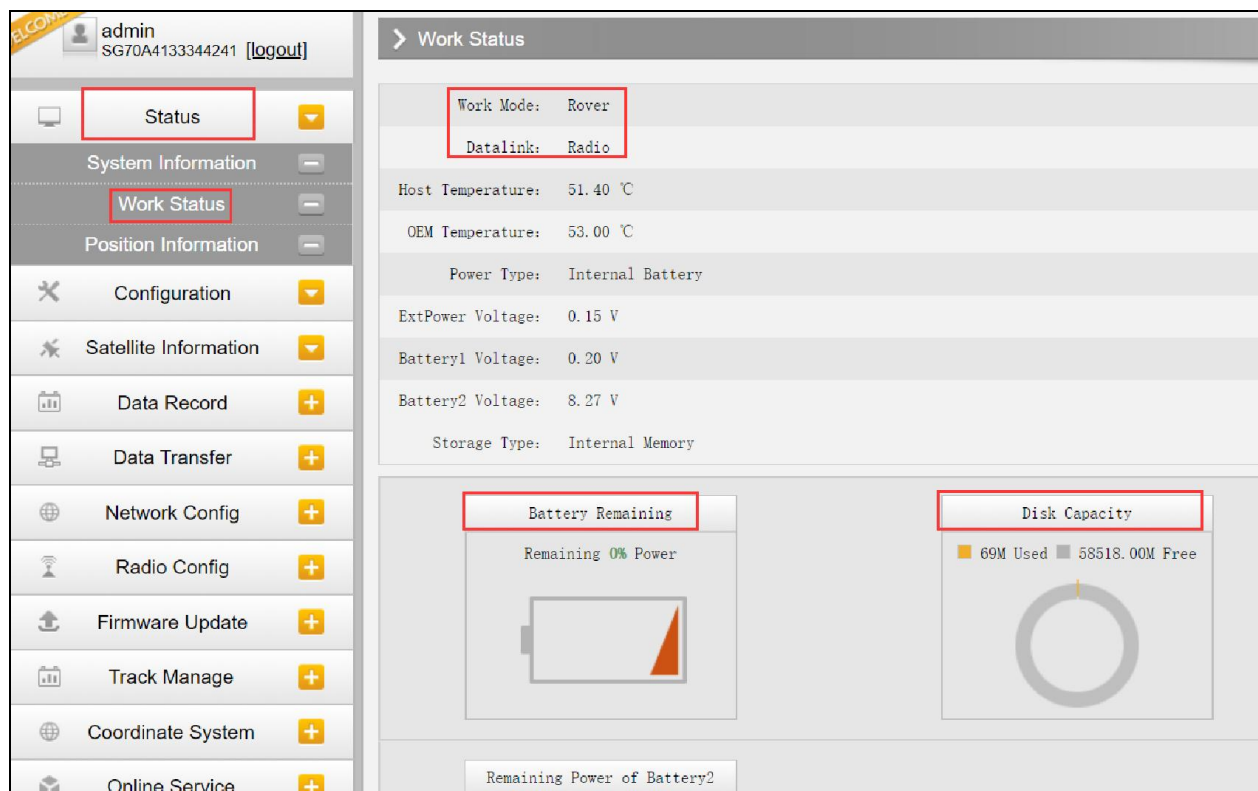


Image 2.4.3-2 Web UI Status-work status

3. Position information

To display information such as: current coordinate, solution, Base information, tracked and used satellites number, PDOP.

The screenshot shows the 'Position Information' page in a web UI. The left sidebar contains a menu with the following items: Status (selected), System Information, Work Status, Position Information, Configuration, Satellite Information, Data Record, Data Transfer, Network Config, Radio Config, Firmware Update, Track Manage, and Coordinate System. The main content area displays the following information:

Position Information			
Location:			
Lat: 23° 10' 53.508053" N	Lon: 113° 25' 1.133127" E	Alt: 56.466553 m	Ellipsoid: WGS-84
RTK Status:			
Solution: Autonomous	Correction Delay: 99	HRMS: 2.135	VRMS: 3.245
Base X: 6378137.000000	Base Y: 0.000000	Base Z: 0.000000	Base ID: 0
Diff. Format: NONE			
SLink:			
SN: 无	Tracking Time: 0		
Azimuth: 0.00	Elevation: 0.00		
SNR: 0.00	Solution: 0		
Tracked Satellite(10):			
GPS (4): 2, 6, 17, 19	GLONASS (0): None		
BDS (6): 8, 10, 13, 14, 38, 59	GALILEO (0): None		
SBAS (0): None	QZSS (0): None		

Figure 2.4.3-3 Web UI Status-position information

§2.5.4 Configuration

1. General configuration

To register receiver, register the OEM main board, set work mode, datalink mode radio relay, radio router and RTK static data record.

Radio relay function please refer to chapter 4.3.

WELCOME admin SG70A4133344241 [logout]

Status +

Configuration -

General Config -

Base Setup -

Antenna Setup -

Satellite Tracking -

Receiver Operation -

System Setup -

Receiver Security -

Satellite Information +

Data Record +

Data Transfer +

Network Config +

Radio Config +

General Configuration

Registration

Serial Number: SG70A4133344241

Code: A88D54630310A9F7C345D4BEE7B65C6FBC8F Register

ExpiredDate: 20200801

OnlineRegistration: OnlineRegi

OEMRegisterCode: 0 Register

SLink ExpiredDate: -1

Mode Setting

Work Mode: Rover

Datalink: Radio

Radio Router: None

Radio Transfer: ☐

RTK Record: ☐

Figure 2.4.4-1 Web UI Configuration-General configuration

2. Base setup

To input base known coordinates or acquire a fresh coordinates from satellite, set differential correction data format (like CMR, RTCA,RTCM23,RTCM30,RTCM32) and start Base transmission.

WELCOME admin SG70A4133344241 [logout]

Status +

Configuration -

General Config -

Base Setup -

Antenna Setup -

Satellite Tracking -

Receiver Operation -

System Setup -

Receiver Security -

Satellite Information +

Data Record +

Data Transfer +

Network Config +

Radio Config +

Firmware Update +

Base Setup

CMR ID: 17

RTCM2. x ID: 241

RTCM3. x ID: 241

Lon: 113° 25' 0.961174" ☒ E ☐ W

Lat: 23° 10' 53.700199" ☒ N ☐ S

Alt: 54.8790 m

Position Spare

Starting Mode: Auto by fixed point

SLinkBase Accuracy: L

StartBase StopBase

Correction: RTCM30

Interval: 1

PDOP Value: 3

Figure 2.4.4-2 Web UI Configuration-Base setup

3. Antenna setup

To set antenna height and measurement method.

WELCOME admin SG70A4133344241 [logout]

Status +

Configuration -

General Config -

Base Setup -

Antenna Setup -

Satellite Tracking -

Antenna Setup

Antenna NO#: SG70A4133344241

RINEX: SG70D-T970A

Antenna Height: 1.800 m

Measuring Method: To The Bottom

Figure 2.4.4-3 Web UI Configuration-Antenna setup

For details about antenna height measurement please refer to §3.3.

4. Satellite tracking setting

To setup which satellites constellation to use, which signal to use and mask angle.

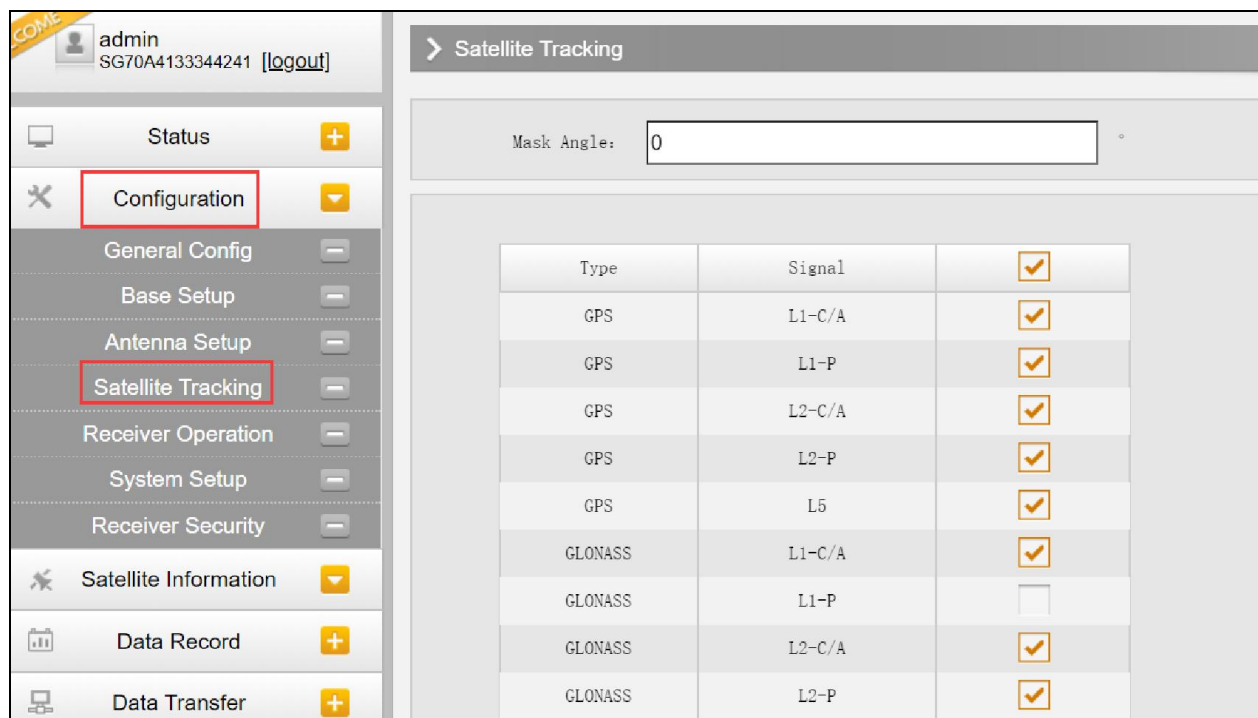


Figure 2.4.4-4 Web UI Configuration-Satellite tracking

5. Receiver operation

To setup self-check, restore to factory default and clear ephemeris.

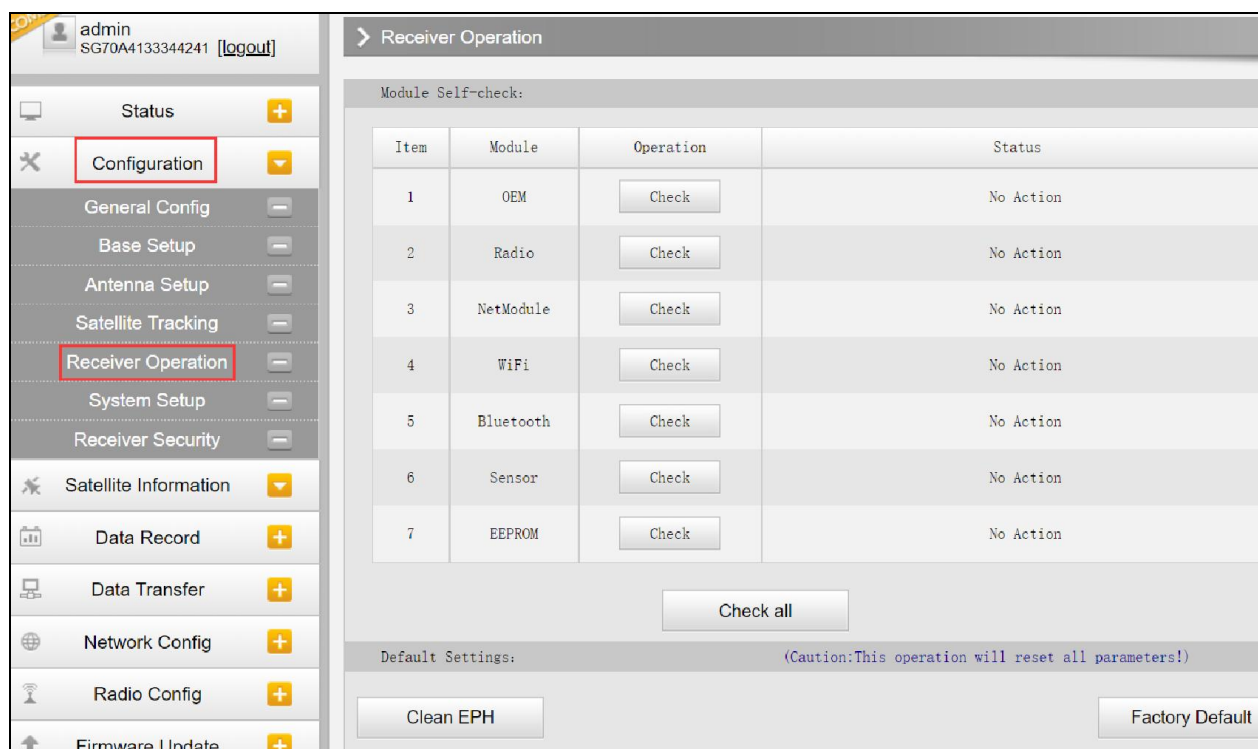


Figure 2.4.4-5 Web UI Configuration-Receiver operation

6. System setup

To setup voice message volume, USB mode, language, time zone, Fixed mode, authority code.

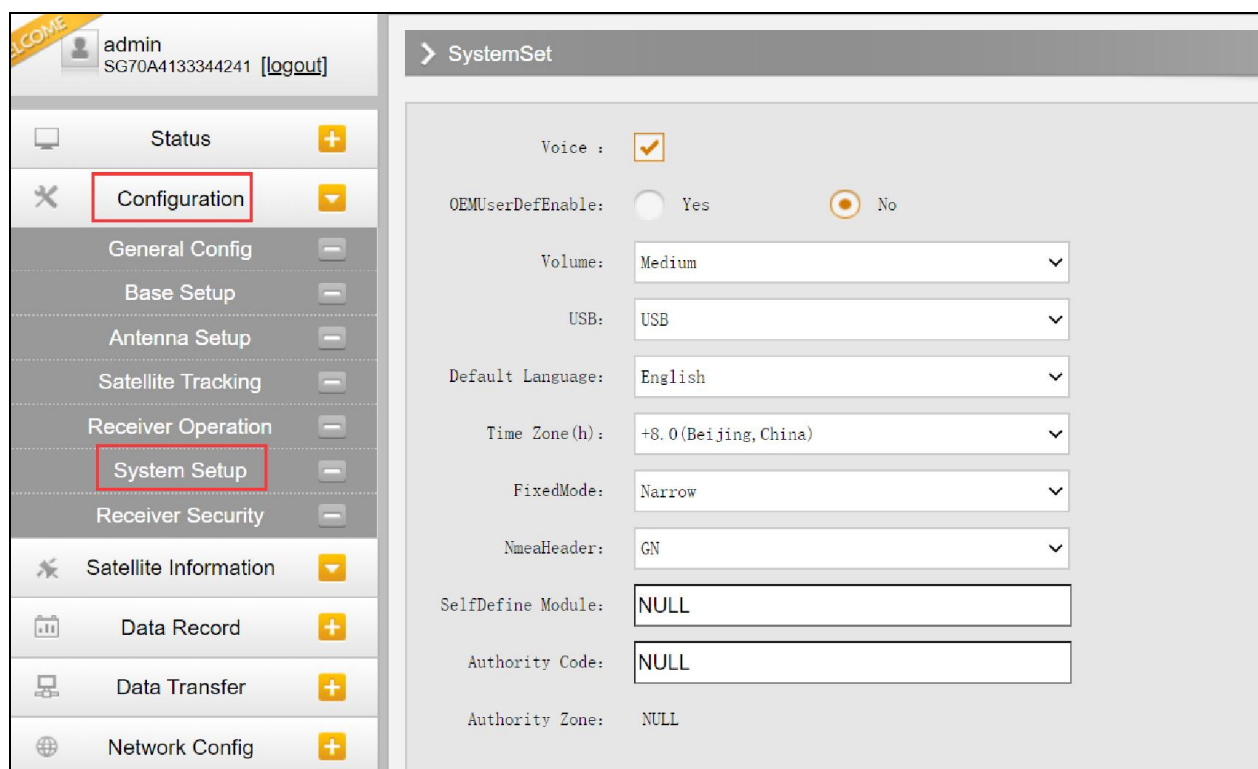


Figure 2.4.4-6 Web UI Configuration-System setup

§2.5.5 Satellite information

Tracking list

To check satellite No, SNR (Signal to noise ratio) and in use or not.

The screenshot shows the 'Tracking List' page. The left sidebar has a menu with 'Tracking List' highlighted. The main area displays a table with the following data:

NO.	Type	Elevation	Azimuth	L1SNR	Code	L2SNR	Code	L5SNR	Code	Status
2	GPS	30.00	278.00	32.60	CA	0.00	-	0.00	-	In use
6	GPS	52.00	314.00	37.30	CA	41.40	P	31.50	I	In use
17	GPS	56.00	38.00	36.40	CA	35.90	P	0.00	-	In use
2	GLONASS	41.00	138.00	34.70	CA	38.70	P	0.00	-	In use
15	GLONASS	32.00	294.00	36.00	CA	39.20	P	0.00	-	In use
17	GLONASS	30.00	332.00	34.70	CA	34.00	P	0.00	-	In use
24	GLONASS	32.00	34.00	33.90	CA	36.20	P	0.00	-	In use
8	BDS	56.00	344.00	34.20	I	36.20	I	30.60	I	In use
10	BDS	71.00	238.00	37.60	I	36.90	I	32.10	I	In use
13	BDS	53.00	296.00	35.20	I	35.00	I	30.50	I	In use

Figure 2.4.5-1 Web UI Satellite Information-Tracking list

Tracking chart

To show statistics of satellites SNR.

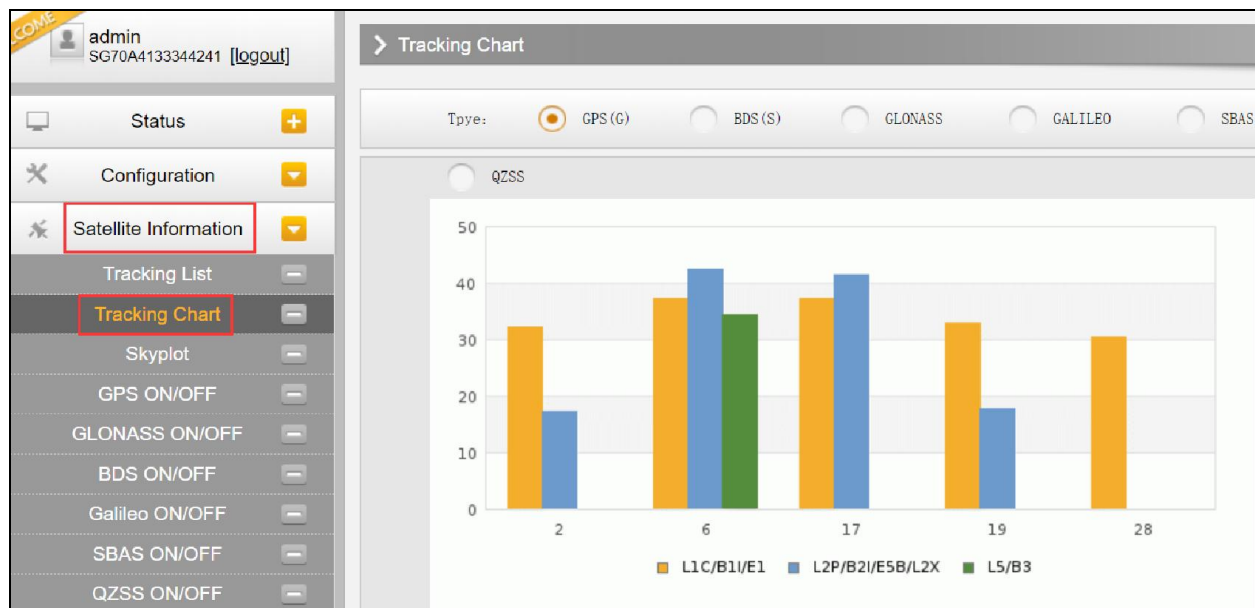


Figure 2.4.5-2 Web UI Satellite Information-Tracking chart

Sky plot

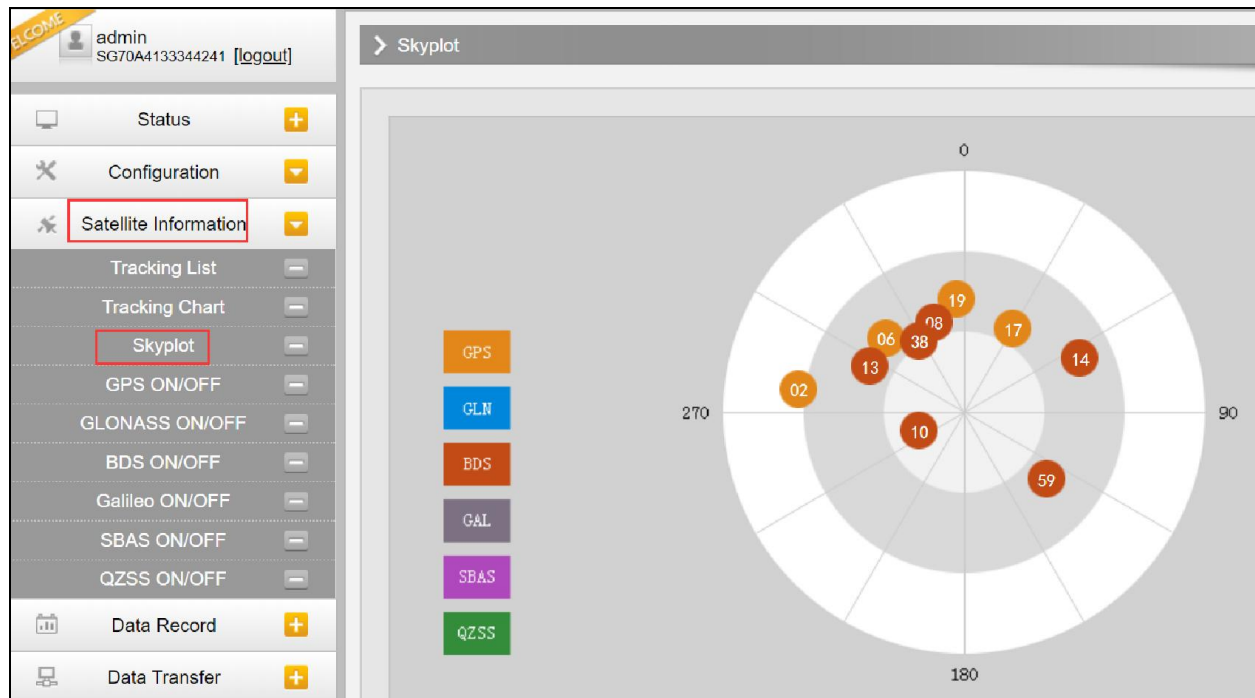


Figure 2.4.5-3 Web UI Satellite Information-Sky plot

GPS, GLONASS, GALILEO, BDS, SBAS, QZSS ON/OFF

To control a specified satellite's signal to be switch on or off.

COME

admin
SG70A4133344241 [logout]

Status +

Configuration

Satellite Information

Tracking List

Tracking Chart

Skyplot

GPS ON/OFF

GLONASS ON/OFF

BDS ON/OFF

Galileo ON/OFF

> GPS ON/OFF

Satellite NO.	
GPS1	<input checked="" type="checkbox"/>
GPS2	<input checked="" type="checkbox"/>
GPS3	<input checked="" type="checkbox"/>
GPS4	<input checked="" type="checkbox"/>
GPS5	<input checked="" type="checkbox"/>
GPS6	<input checked="" type="checkbox"/>
GPS7	<input checked="" type="checkbox"/>
GPS8	<input checked="" type="checkbox"/>
GPS9	<input checked="" type="checkbox"/>

COME

admin
SG70A4133344241 [logout]

Status +

Configuration

Satellite Information

Tracking List

Tracking Chart

Skyplot

GPS ON/OFF

GLONASS ON/OFF

BDS ON/OFF

> GLONASS ON/OFF

Satellite NO.	
GLONASS1	<input checked="" type="checkbox"/>
GLONASS2	<input checked="" type="checkbox"/>
GLONASS3	<input checked="" type="checkbox"/>
GLONASS4	<input checked="" type="checkbox"/>
GLONASS5	<input checked="" type="checkbox"/>
GLONASS6	<input checked="" type="checkbox"/>
GLONASS7	<input checked="" type="checkbox"/>
GLONASS8	<input checked="" type="checkbox"/>

COME

admin
SG70A4133344241 [logout]

Status +

Configuration

Satellite Information

Tracking List

Tracking Chart

Skyplot

GPS ON/OFF

GLONASS ON/OFF

BDS ON/OFF

Galileo ON/OFF

SBAS ON/OFF

QZSS ON/OFF

> BDS ON/OFF

Satellite NO.	
BDS1	<input checked="" type="checkbox"/>
BDS2	<input checked="" type="checkbox"/>
BDS3	<input checked="" type="checkbox"/>
BDS4	<input checked="" type="checkbox"/>
BDS5	<input checked="" type="checkbox"/>
BDS6	<input checked="" type="checkbox"/>
BDS7	<input checked="" type="checkbox"/>
BDS8	<input checked="" type="checkbox"/>
BDS9	<input checked="" type="checkbox"/>
BDS10	<input checked="" type="checkbox"/>
BDS11	<input checked="" type="checkbox"/>

admin
SG70A4133344241 [logout]

Status +

Configuration ▾

Satellite Information ▾

Tracking List -

Tracking Chart -

Skyplot -

GPS ON/OFF -

GLONASS ON/OFF -

BDS ON/OFF -

Galileo ON/OFF -

SBAS ON/OFF -

QZSS ON/OFF -

> GALILEO ON/OFF

Satellite NO.	<input type="checkbox"/>
GALILEO01	<input checked="" type="checkbox"/>
GALILEO02	<input checked="" type="checkbox"/>
GALILEO03	<input checked="" type="checkbox"/>
GALILEO04	<input checked="" type="checkbox"/>
GALILEO05	<input checked="" type="checkbox"/>
GALILEO06	<input checked="" type="checkbox"/>
GALILEO07	<input checked="" type="checkbox"/>
GALILEO08	<input checked="" type="checkbox"/>
GALILEO09	<input checked="" type="checkbox"/>
GALILEO10	<input checked="" type="checkbox"/>
GALILEO11	<input checked="" type="checkbox"/>

admin
SG70A4133344241 [logout]

Status +

Configuration ▾

Satellite Information ▾

Tracking List -

Tracking Chart -

Skyplot -

GPS ON/OFF -

GLONASS ON/OFF -

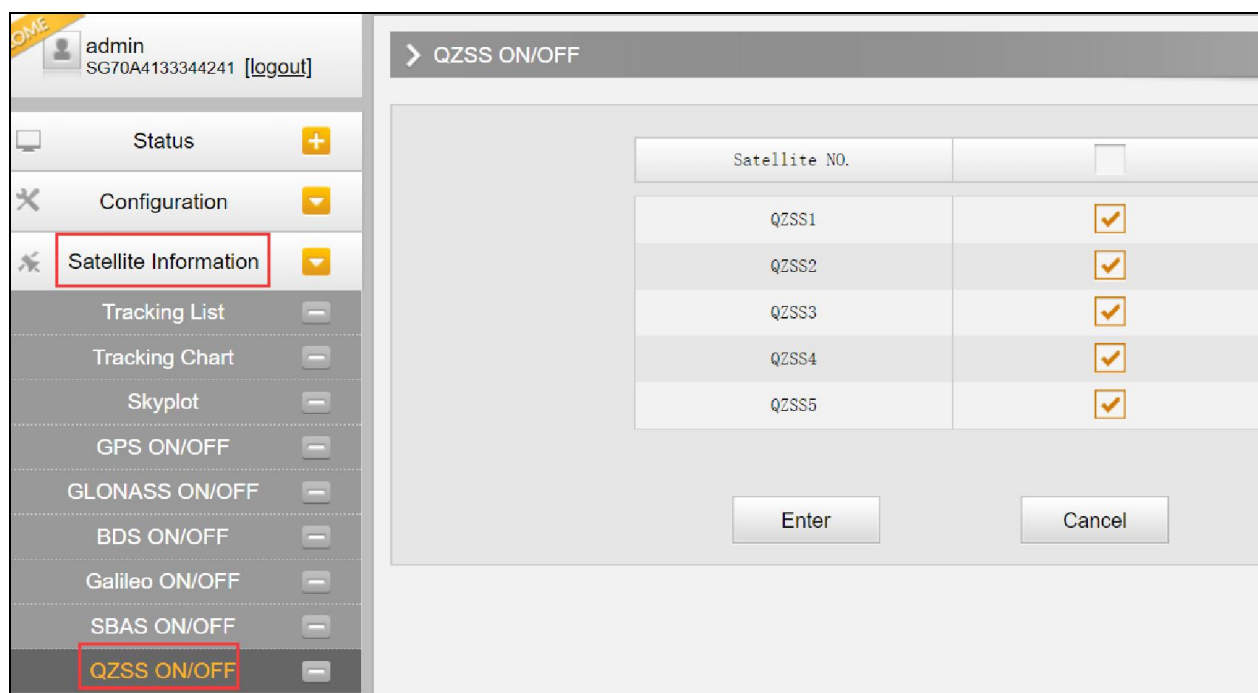
BDS ON/OFF -

Galileo ON/OFF -

SBAS ON/OFF -

> SBAS ON/OFF

Satellite NO.	<input type="checkbox"/>
SBAS120-EGNOS-AOR-E	<input checked="" type="checkbox"/>
SBAS121	<input checked="" type="checkbox"/>
SBAS122	<input checked="" type="checkbox"/>
SBAS123	<input checked="" type="checkbox"/>
SBAS124-EGNOS-ARTEMIS	<input checked="" type="checkbox"/>
SBAS125	<input checked="" type="checkbox"/>
SBAS126-EGNOS-IND-W	<input checked="" type="checkbox"/>
SBAS127-GAGAN-GSAT 8	<input checked="" type="checkbox"/>
SBAS128-GAGAN	<input checked="" type="checkbox"/>
SBAS129-MSAS-1	<input checked="" type="checkbox"/>



§2.5.6 Data record

Record config

To make static data record settings such as Internal memory/External memory, recording interval, File interval, point name (static file name), static data format (Sth, Rinex), recording mode (start record automatically or manually).

File interval means the maximum recording time for a static file (by default it is 24 hours). You may also set it for more times (for example, 30h, 48h or longer).

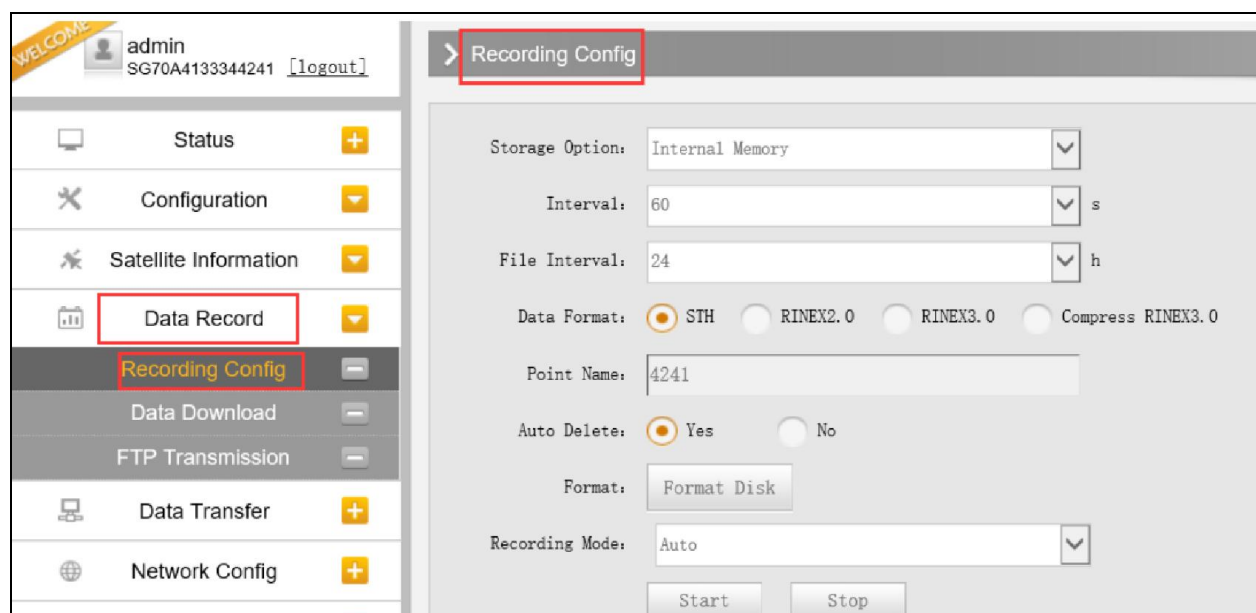


Figure 2.4.6-1 Web UI Data Record-Record config

Data download: to download static data from here.

- 1) Select data source SD card (means internal memory). USB file means external memory (USB Flash disk). By default, the static data is stored in SD card (internal memory).
- 2) Select file type (by default, it is STH format (SOUTH format))
- 3) Click the blank to select the date of static recording.
- 4) Click [get data] button, then all static data recorded on selected date will be listed below.
- 5) Select the static file and click [Download] button to save it to your computer. You can also delete static data file from here.

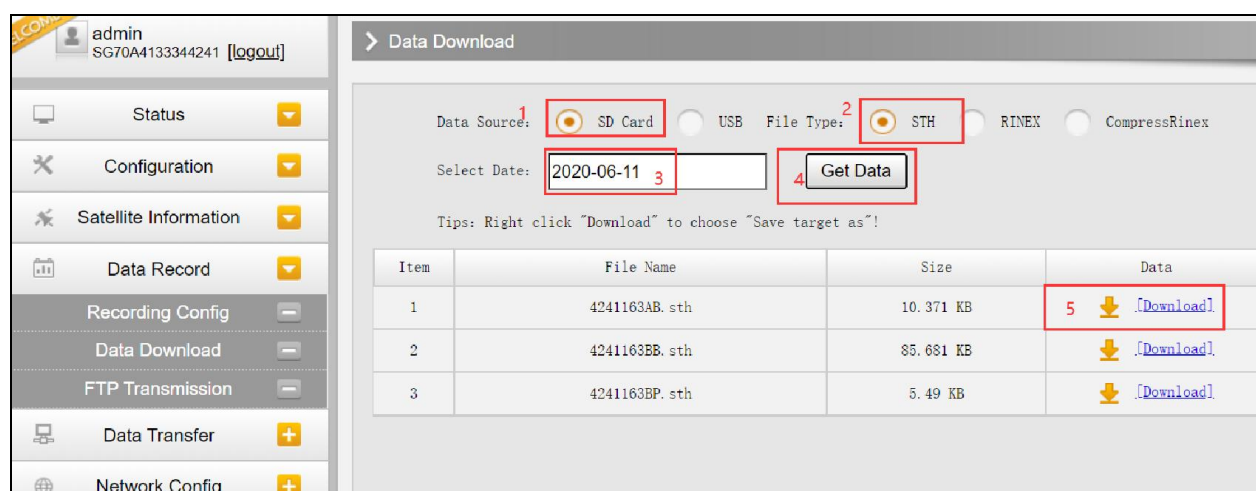


Figure 2.4.6-2 Web UI Data Record-Data download

Another method of static data downloading:

This method is more common and convenient and in practice this downloading method is more popular.

- 1) Set receiver in USB flash disk mode. [System option]- [Other option]-[USB mode: **USB flash disk**]. By default, the receiver is set in USB flash disk mode.
- 2) Connect receiver to computer by 7 Pin-USB cable. The receiver's internal memory will be found and showed as a removable flash disk in computer.
- 3) Copy the static file to your computer.

§2.5.7 Data transfer

1. General

To show serial port (DB9 port) and Bluetooth port usage status. Green color indicates the port is in use and red color for not in use)

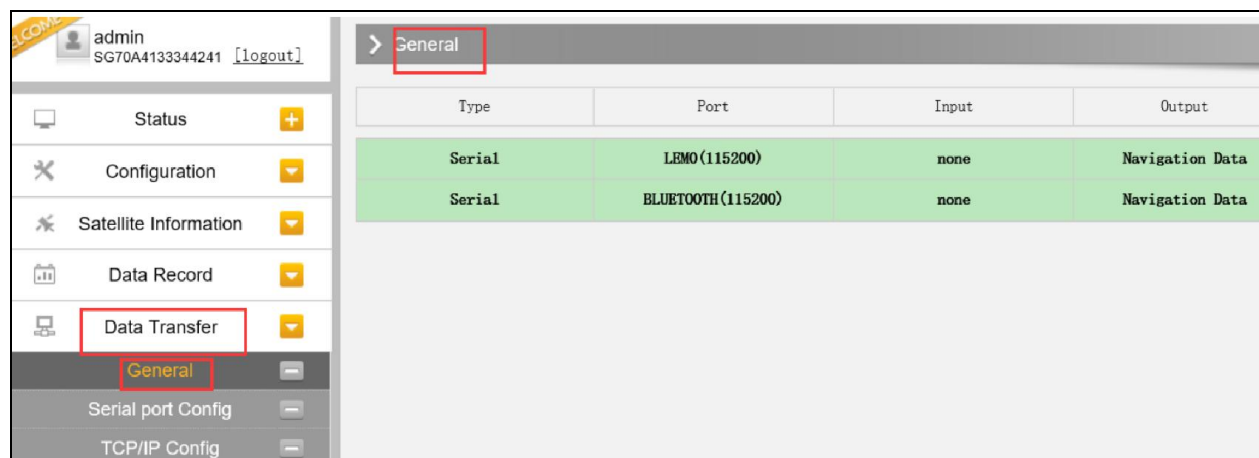


Figure 2.4.7-1 Web UI Data transfer-General

2. Serial port config

To set baud rate, parity check, data flow control for serial port (DB9 port) and Bluetooth port.

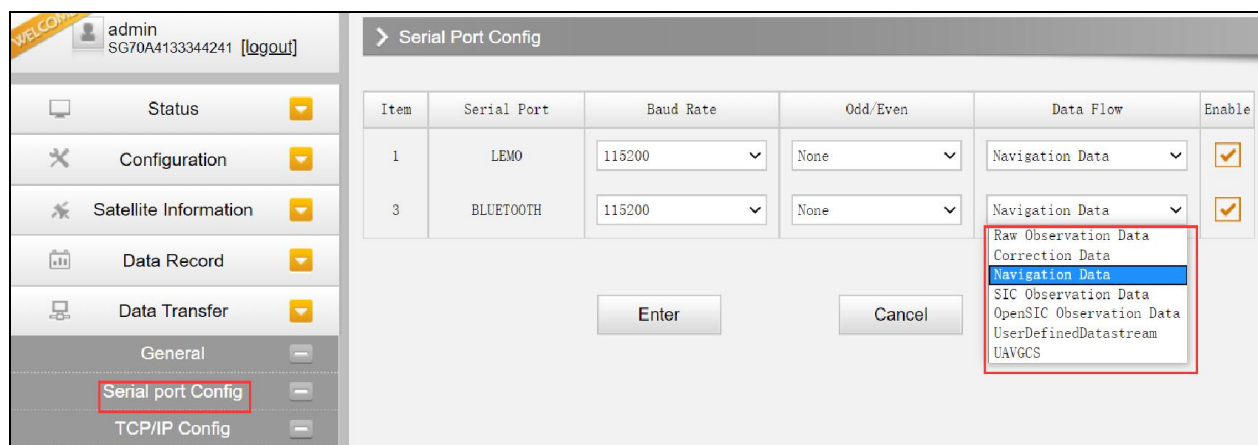


Figure 2.4.7-2 Web UI Data Transfer-Serial port config

Warning: The default setting is: baud rate (115200), parity check (None), Data flow (Navigation data). Please do not change it! If need to change, please consult South technician for support before change it.

In the data flow control list, there are 4 options:

Raw observation data: it is directly generated by OEM main board.

Correction data: it is differential correction data directly generated by OEM main board

Navigation data: navigation data such as NMEA-0183 GGA, GSV, ZDA AVR, RMC, etc. For details, please refer to chapter 2.5.7 Data Transfer-Dataflow config.

SIC observation data: South user define observation data format

OpenSIC observation data: another South user define observation data format which support program secondary development

3. TCP/IP config

Work mode: Caster(client)

Receiver work as caster(client) to send observation data to server by designated server IP and port, then user can view or utilize these observation data.

Item	Work Mode	Local Port	Server IP	Port	Data Flow	Status	ON/OFF
1	Caster	1111	58.248.35.130	2010	SIC Observation	Disconnected	<input type="checkbox"/>
2	Caster	2222	58.248.35.130	2010	Navigation Data	Disconnected	<input type="checkbox"/>
3	Caster	3333	58.248.35.130	2010	Navigation Data	Disconnected	<input type="checkbox"/>
4	Caster	4444	58.248.35.130	2010	Navigation Data	Disconnected	<input type="checkbox"/>
5	Caster	5555	58.248.35.130	2010	Navigation Data	Disconnected	<input type="checkbox"/>

Figure 2.4.7-1 Web UI Data transfer-TCP/IP config

Work mode: server

Receiver works as server and user can access to server (receiver) to view or utilize the data by visiting receiver's IP and port.

Receiver's local IP and port can be found when receiver is set as WIFI client mode.

[**Network config**]-[**WIFI config**]-[**Client mode**]: to check receiver's IP address.

Item	Work Mode	Local Port	Server IP	Port	Data Flow	Status	ON/OFF
1	Server	1111	58.248.35.130	2010	SIC Observation	Disconnected	<input type="checkbox"/>
2	Server	2222	58.248.35.130	2010	Navigation Data	Disconnected	<input type="checkbox"/>
3	Caster	3333	58.248.35.130	2010	Navigation Data	Disconnected	<input type="checkbox"/>
4	Caster	4444	58.248.35.130	2010	Navigation Data	Disconnected	<input type="checkbox"/>
5	Caster	5555	58.248.35.130	2010	Navigation Data	Disconnected	<input type="checkbox"/>

Figure 2.4.7-2 Web UI Data transfer-TCP/IP config

4. Ntrip config

Ntrip Client

This allows the Rover receiver to access to CORS server. After Inputting CORS server IP, port, user name, password and select the mount point, the rover receiver will receive correction data from CORS server, then get Fixed solution.

Active: To activate this function

Authentication Mode: Eagle mode, TCP/IP mode, Lark mode

Eagle mode is a SOUTH adopted mode, and TCP/IP Mode is for private network use. Usually, please choose the Eagle mode for the default setting.

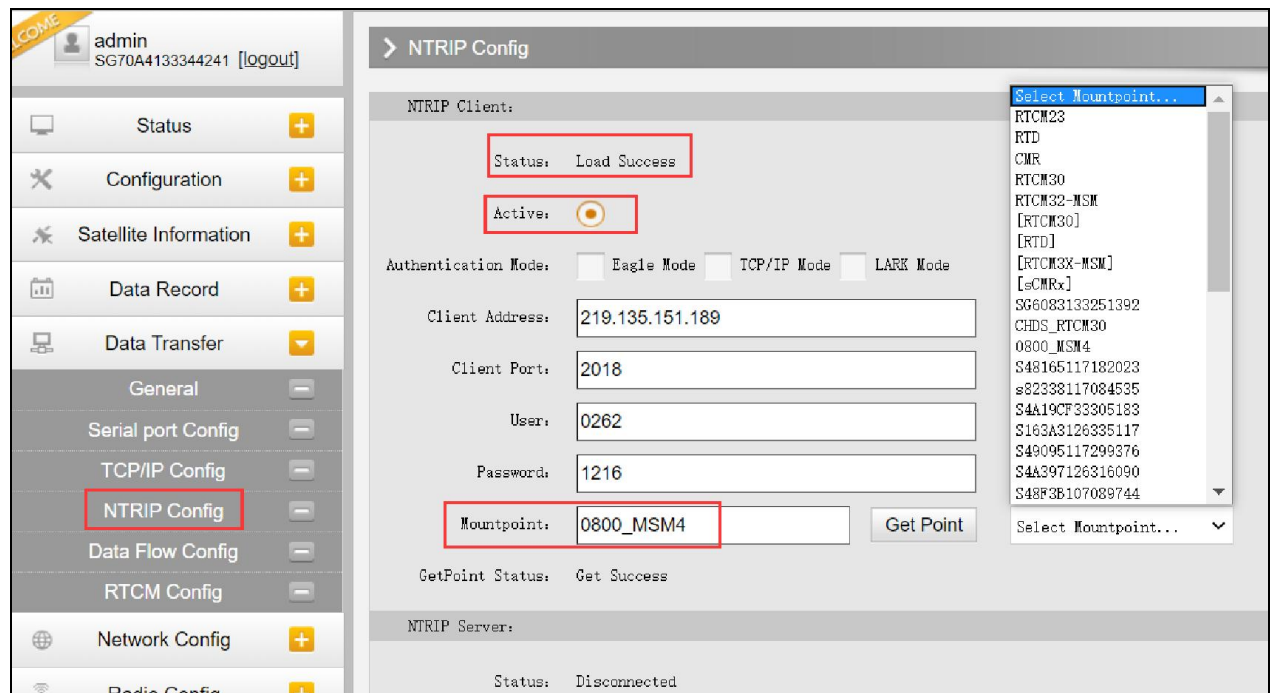


Figure 2.4.7-3 Web UI Data transfer-Ntrip config-Ntrip client

Ntrip server:

This is setting for base receiver only. Eagle mode need to be ticked on.

In this mode, the base receiver to transfer differential correction data to server so that the rover receiver can retrieve the data from server and get Fixed solution.

Operation steps in Ntrip server mode:

----Select [Eagle mode]

----Input server IP, port, user name and password.

----Give an access point name for base receiver, [Galaxy909], for example.

Access Point:

To give a name for base access point such as [galaxy909] (as below) which can be found and accessed by rover receiver.

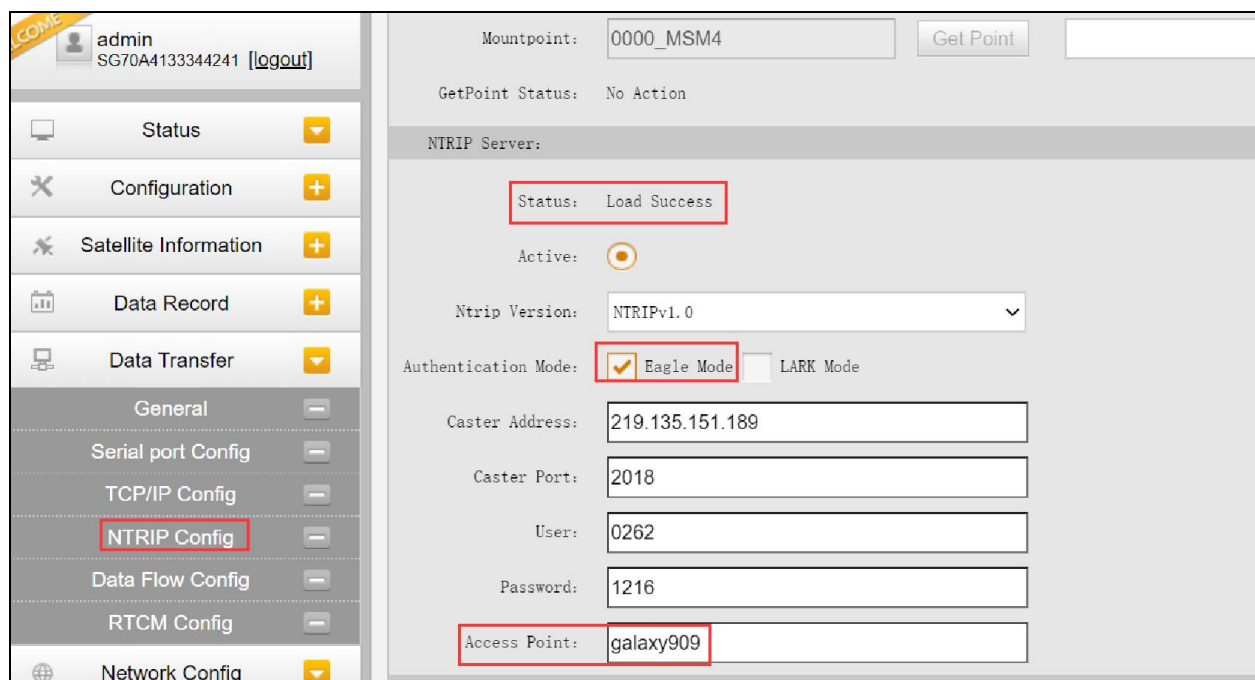


Figure 2.4.7-3 Web UI Data transfer-Ntrip config-Ntrip server

For more details about how to make settings about Eagle mode please refer to §5.1.1

5. Dataflow config

To decide which data to be output. For example, you can select GGA, GSA, ZDA on, GSV off.

Data Flow Config

Navigation Data:

CGA: OFF	GSA: OFF	GSV: OFF	GSI: OFF
ZDA: OFF	BPQ: OFF	PJK: OFF	GLL: OFF
RMC: OFF	VTG: OFF	HDT: OFF	GRS: OFF

SIC Navigation Data:

PST: 1	GSI: 5	BSI: 5	TPI: OFF
VCY: OFF	STA: 30	DEV: WhenChanged	AAT: OFF
REC: OFF	DAL: 10	EDP: OFF	SLB: OFF
TRA: OFF	PJK: OFF	AVR: OFF	TCM: OFF

Raw Observation Data:

Output Interval: 1 s

GPS Ephemeris: WhenChanged

GLONASS Ephemeris: WhenChanged

Figure 2.4.7-3 Web UI Data Transfer-Data flow config

6. RTCM config

To control which satellite constellation data to be output or not.

In RTCM3.2 data format:

1074 for GPS,

1084 for Glonass,

1094 for Galileo

1124 for BDS

RTCM Config

Enable: ☐

RTCM1004: OFF	RTCM1005: OFF	RTCM1006: OFF
RTCM1007: OFF	RTCM1008: OFF	RTCM1012: OFF
RTCM1019: OFF	RTCM1020: OFF	RTCM1033: OFF
RTCM1042: OFF	RTCM1046: OFF	RTCM1074: OFF
RTCM1084: OFF	RTCM1094: OFF	RTCM1124: OFF

Enter Cancel

Figure 2.4.7-3 Web UI Data Transfer-Data flow config

§2.5.8 Network config

1. GSM/GRPS config

To view the status or configure cellular network dialing. Below figure shows cellular network is dialed successfully.

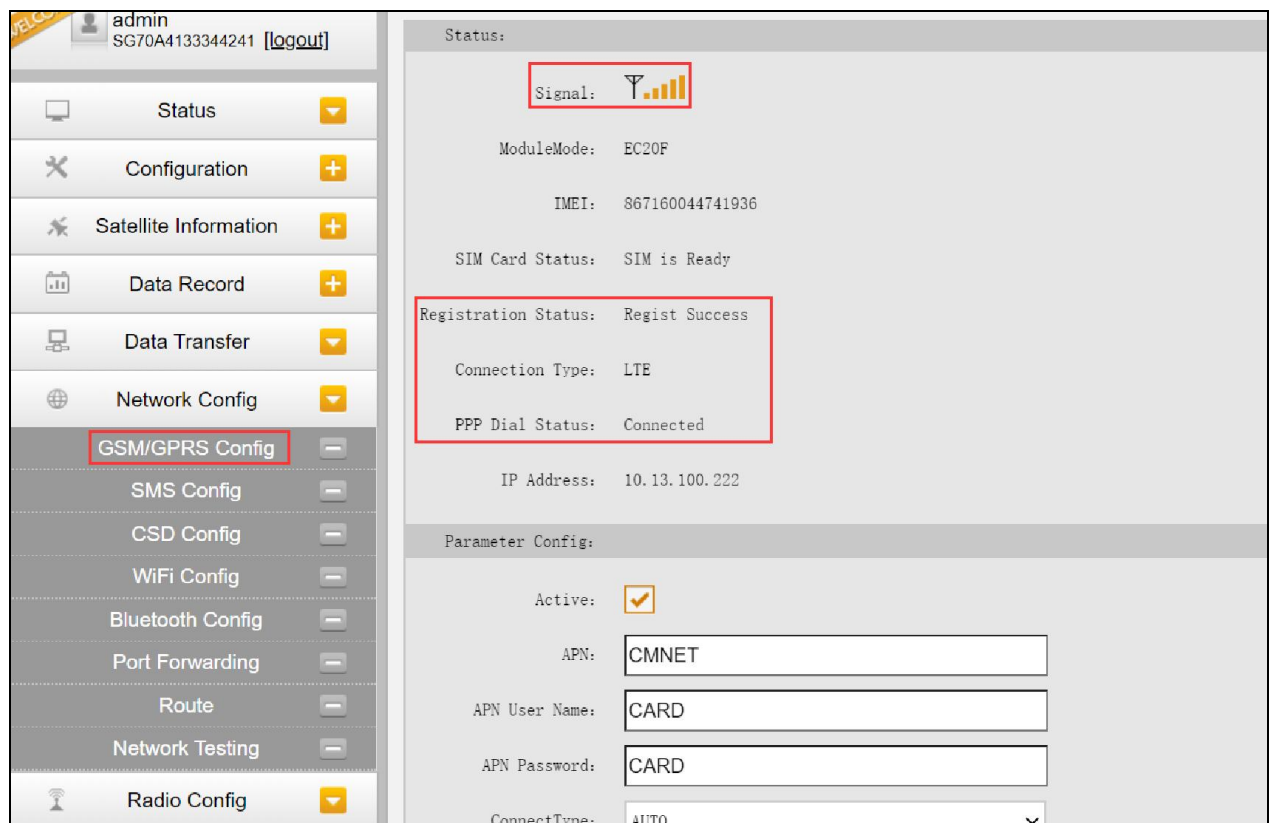


Figure 2.4.8-1 Web UI Network config-GSM/GPRS config

2. SMS config

To enable SMS function.

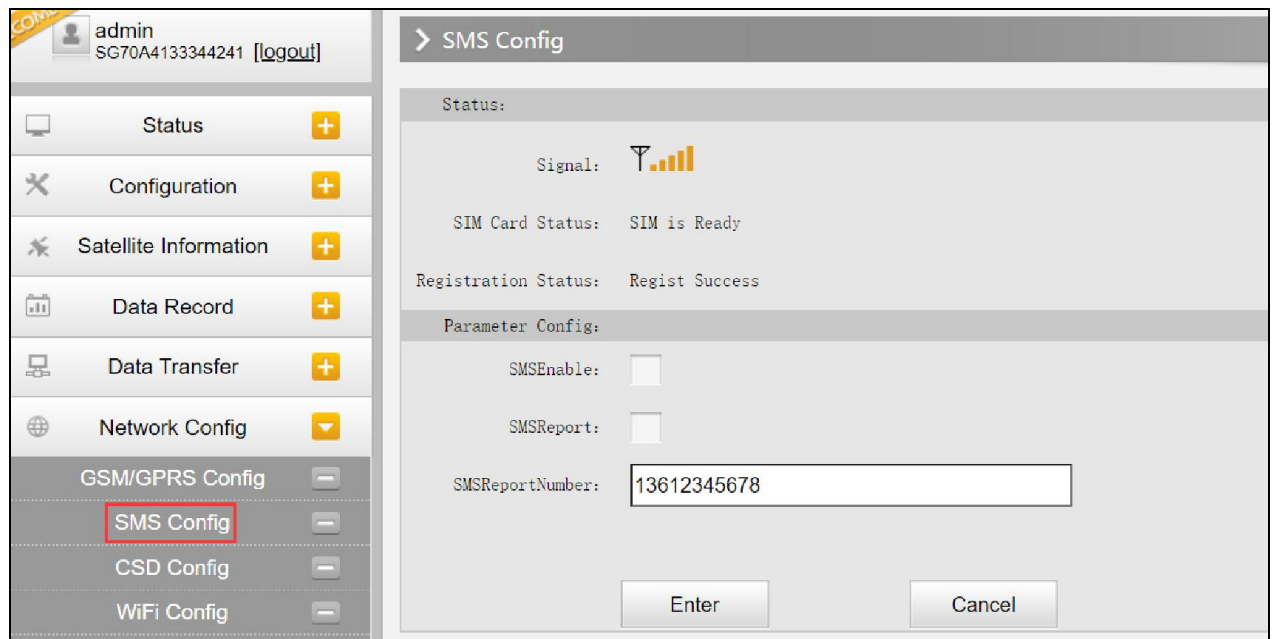


Figure 2.4.8-2 Web UI Network config-SMS config

3. CSD config

CSD (Circuit Switch Data) is a technology used in telecommunication in earlier stage. It can provide very narrow bandwidth internet access. With CSD function, the base receiver (with SIM card inside) can send differential correction data to rover receiver directly (also with SIM card inside) when datalink is selected as CSD datalink.

CSD service is provided by telecom service operator. In some country it is available and in other country this service is shut down. Please consult with your local telecom operator to find out this service is available or not if you like to try CSD datalink.

Due to 3G and 4G popularity nowadays, internet and bandwidth is very easily to have so CSD now became an out-of-date technology.

Status: to displays the dialing status of CSD.

Parameter Config: to enable the CSD function and input the phone number for Rover and Base in Call Number and Local Number.

Note: please choose CSD as datalink in WEB UI: [Configuration]--[General Config]--[Mode select]-- [Datalink: CSD] if you want to try this function

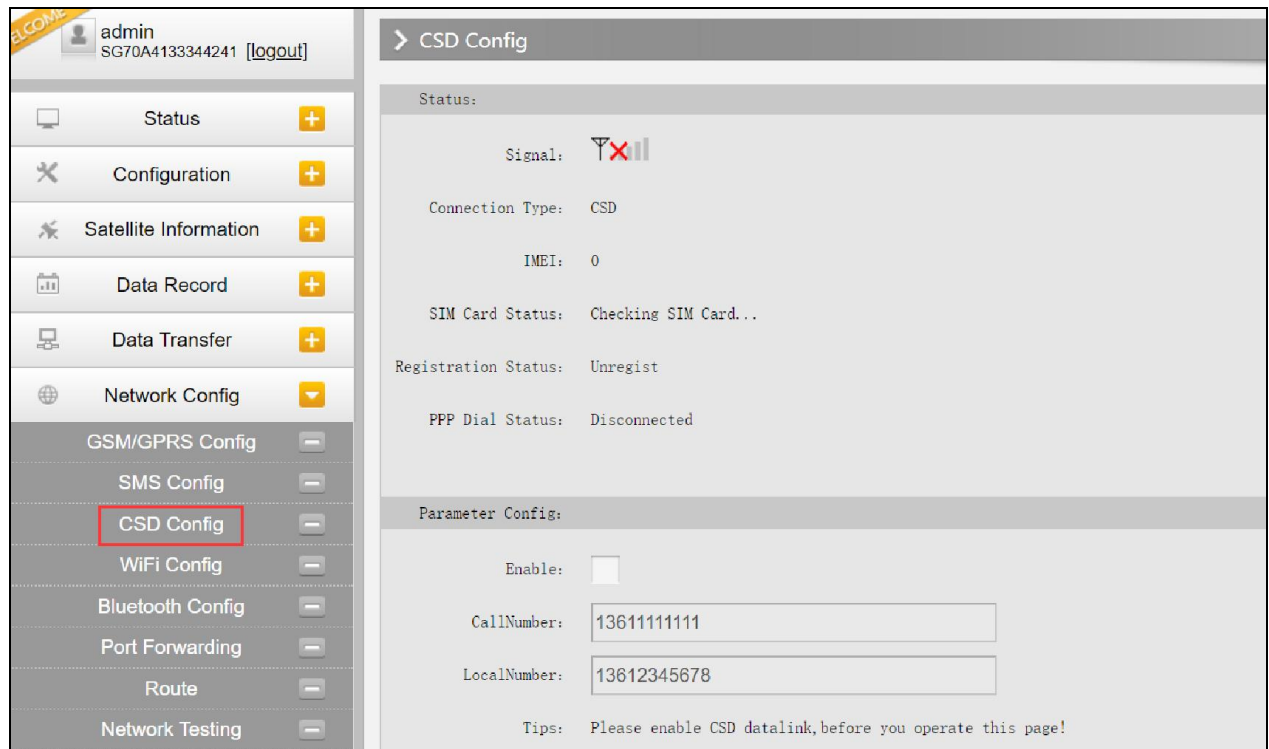


Figure 2.4.8-3 Web UI Network config-CSD config

4. WIFI config

There are two WIFI work mode: AP mode and Client mode (see below image).

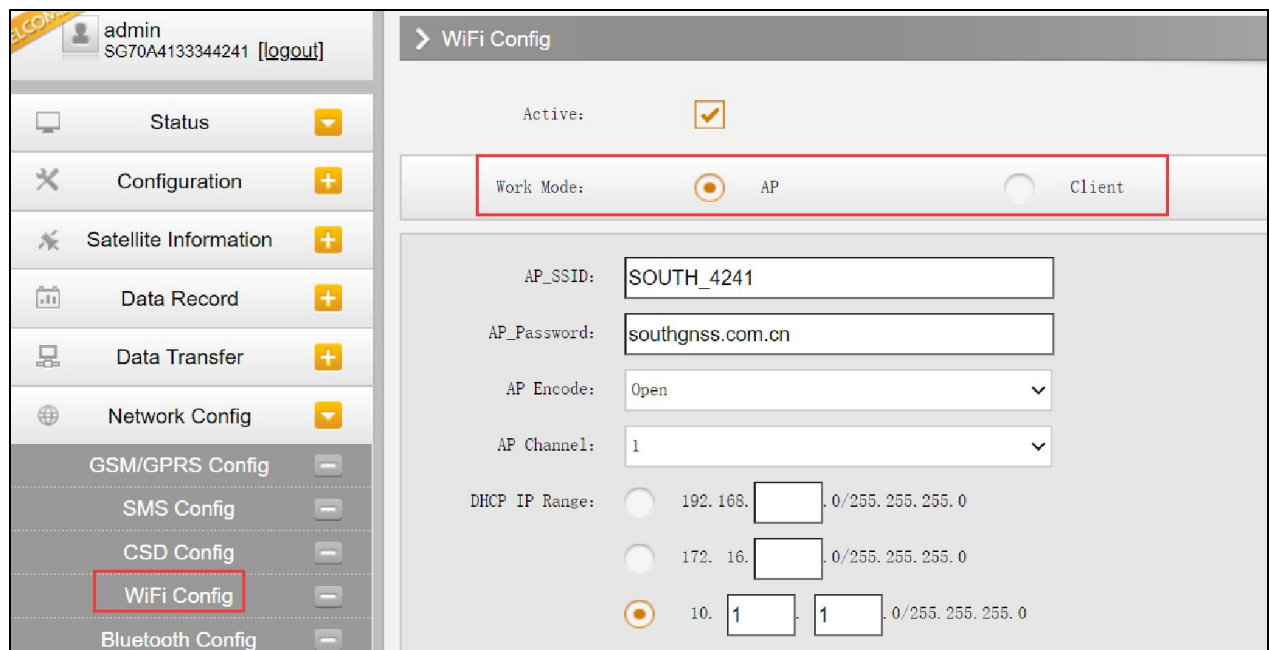


Figure 2.4.8-4 Web UI Network config-WIFI config

AP mode: the receiver will generate WIFI hotspot so that your computer or mobile phone can connected to receiver and visit its WEB UI. Below figure shows mobile phone has

connected to the receiver hotspot.

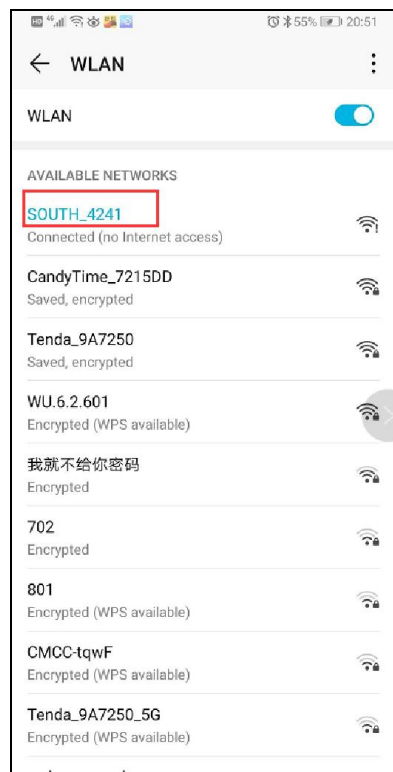


Figure 2.4.8-5 Receiver hotspot

Below image shows how to visit receiver's WEB UI by WIFI (AP mode) from a mobile phone.

Method to visit receiver' WEB UI through WIFI:

For IE, input 10.1.1.1,

User name: admin, Password: admin

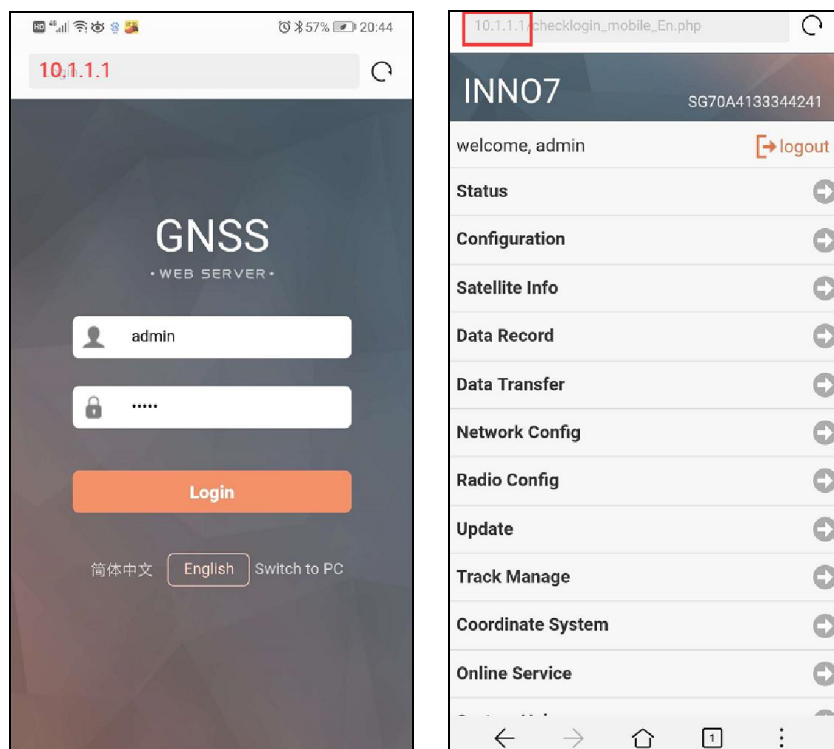


Figure 2.4.8-5 Visit receiver WEB UI from mobile phone

Client mode: with the receiver's inbuilt network module, it can connect to other WIFI hotspot to access to internet. When receiver WIFI configuration is set in client mode, WIFI datalink can be used.

In client mode, clicking SCAN button to search for nearby WIFI hotspot. Below figure shows the hotspot [southgnss] has been found and connected. Receiver local IP can also be found from this interface.

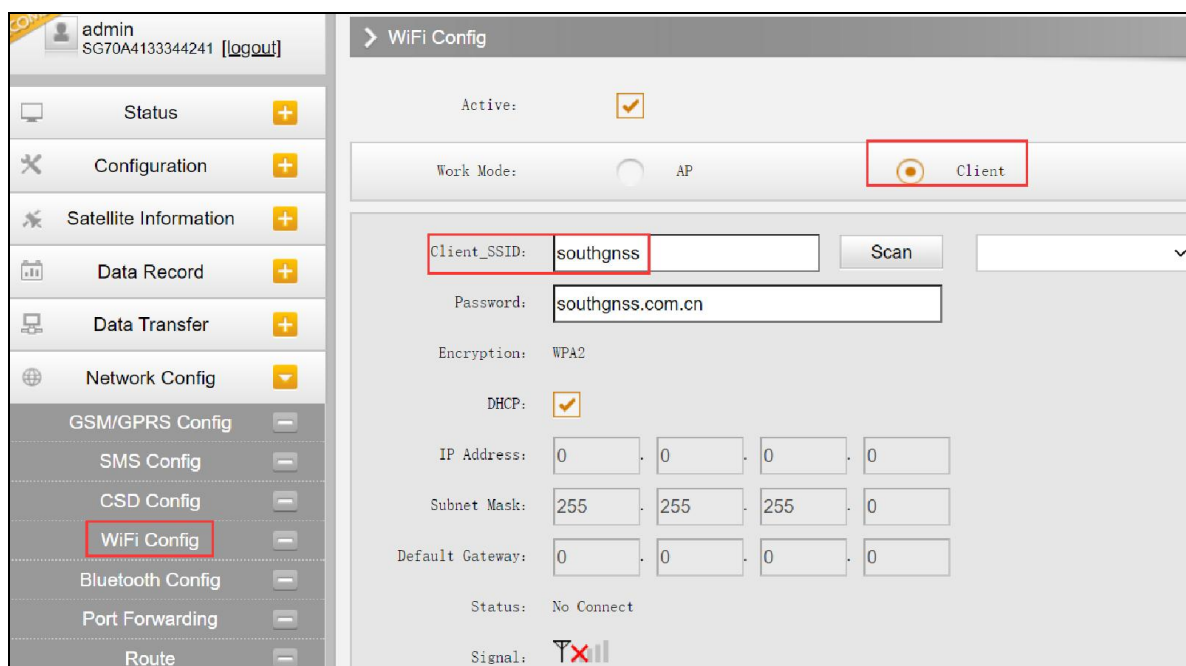


Figure 2.4.8-6 Web UI Network config-WIFI config-Client

Note: suggest to close WIFI client mode if there is no need to use WIFI datalink. In most of the cases, we use WIFI AP mode

5. Bluetooth config

To check receiver Bluetooth information and connection status.

Bluetooth config

Bluetooth config:

Active: ☒

Bluetooth MAC: 00:25:CA:2B:5F:22

Discoverable: ☒

PIN Code: 0

Connected Device:

Item	Device Mac	RFCOMM Channel	Device Name	Disconnect Action
1				<button>Disconnect</button>
2				<button>Disconnect</button>

Enter Cancel

Figure 2.4.8-7 Web UI Network config-Bluetooth config

6. Port forwarding

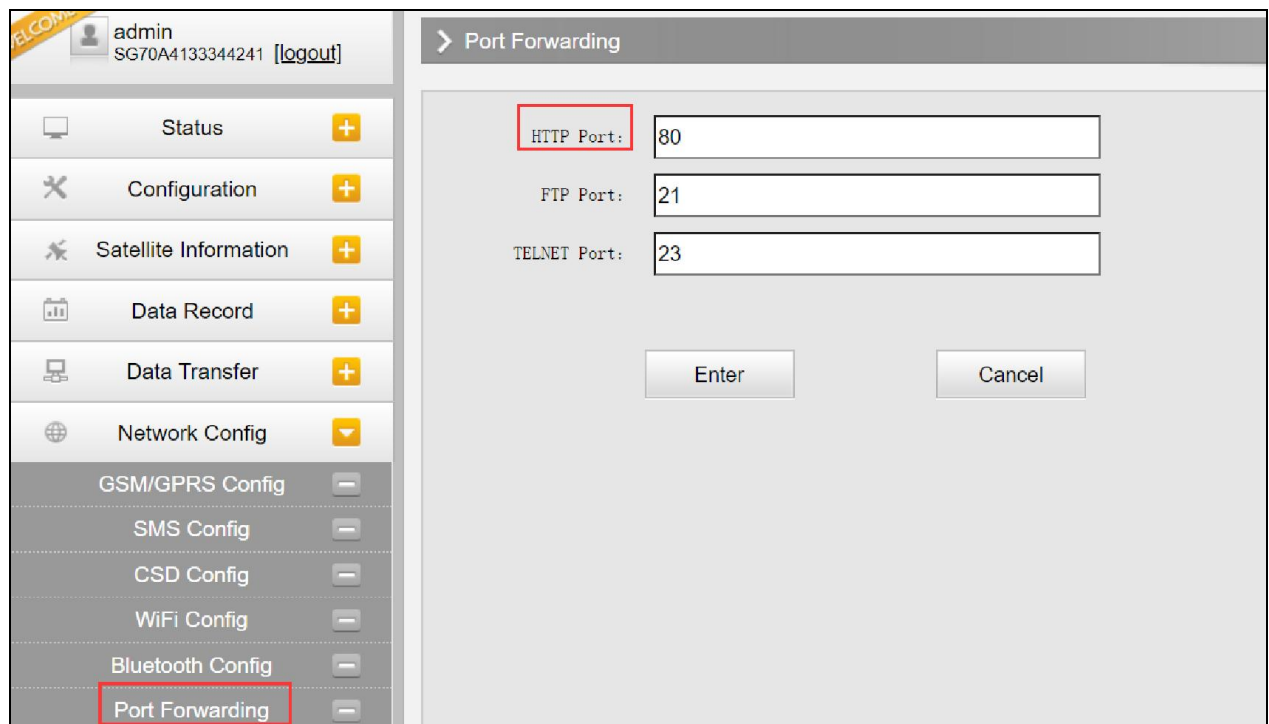


Figure 2.4.8-8 Web UI Network config-Port forwarding

Http port: 80

It is mainly used for remote visiting receiver WEB UI. To realized remote visit, firstly we need to make settings to your office router. Below is example for forwarding receiver's local IP (192.168.1.123) and port (80) to router's public IP (202.136.33.78) and port (8000).

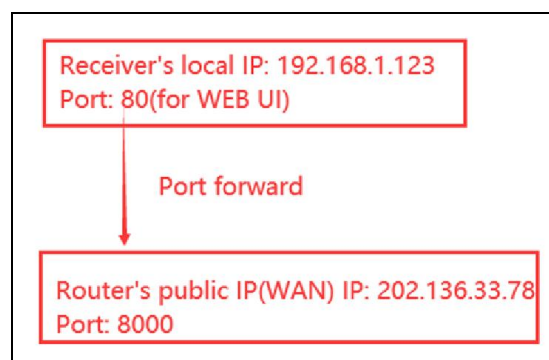


Figure 2.4.8-9 Port forward setting

After port forwarding setting, the computer or mobile phone can remote visit the receiver WEB UI as below.

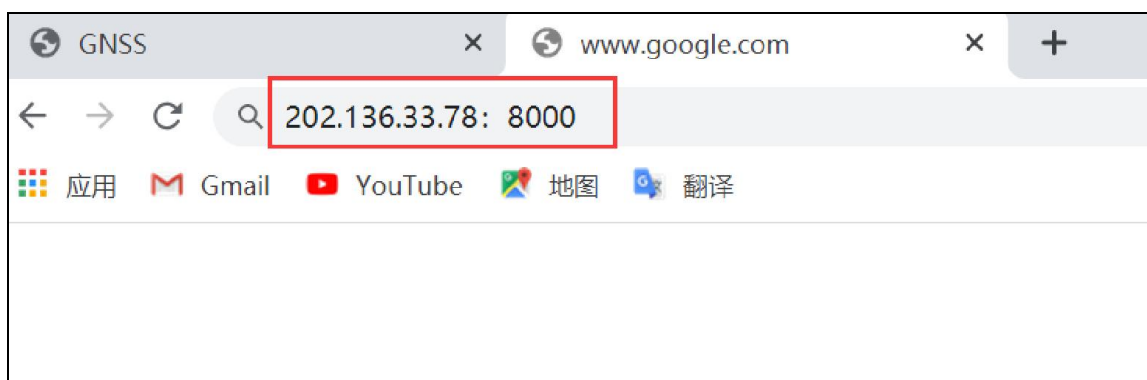


Figure 2.4.8-10 Remote visit to receiver WEB UI

Warning: Please do not change the port in Port forwarding config.

7. Route

To view and set route parameter for customizing or debugging receiver and this is mainly used by developer or senior engineer.

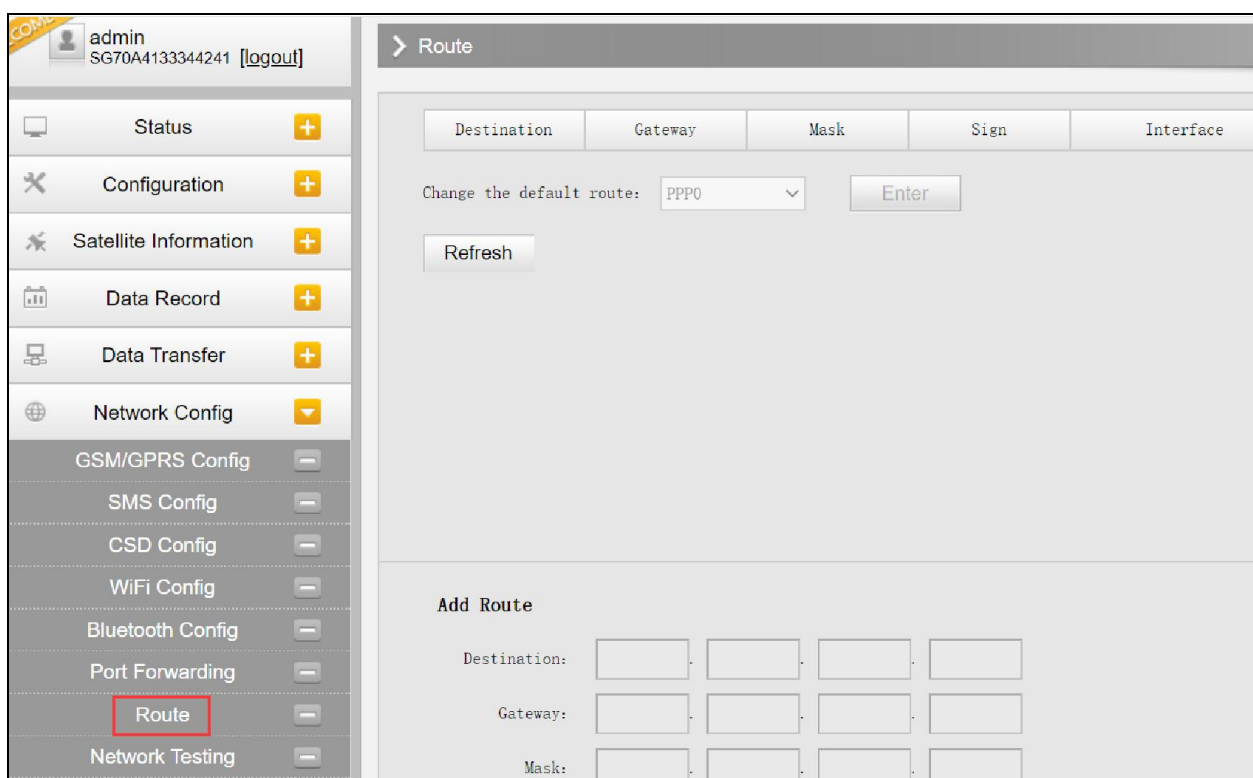


Figure 2.4.8-9 WEB UI-Network config-Route

Warning: Please do not change the port in Port config.

8. Network testing

To test the network is through or not when receiver work in **[WIFI: client mode]**.

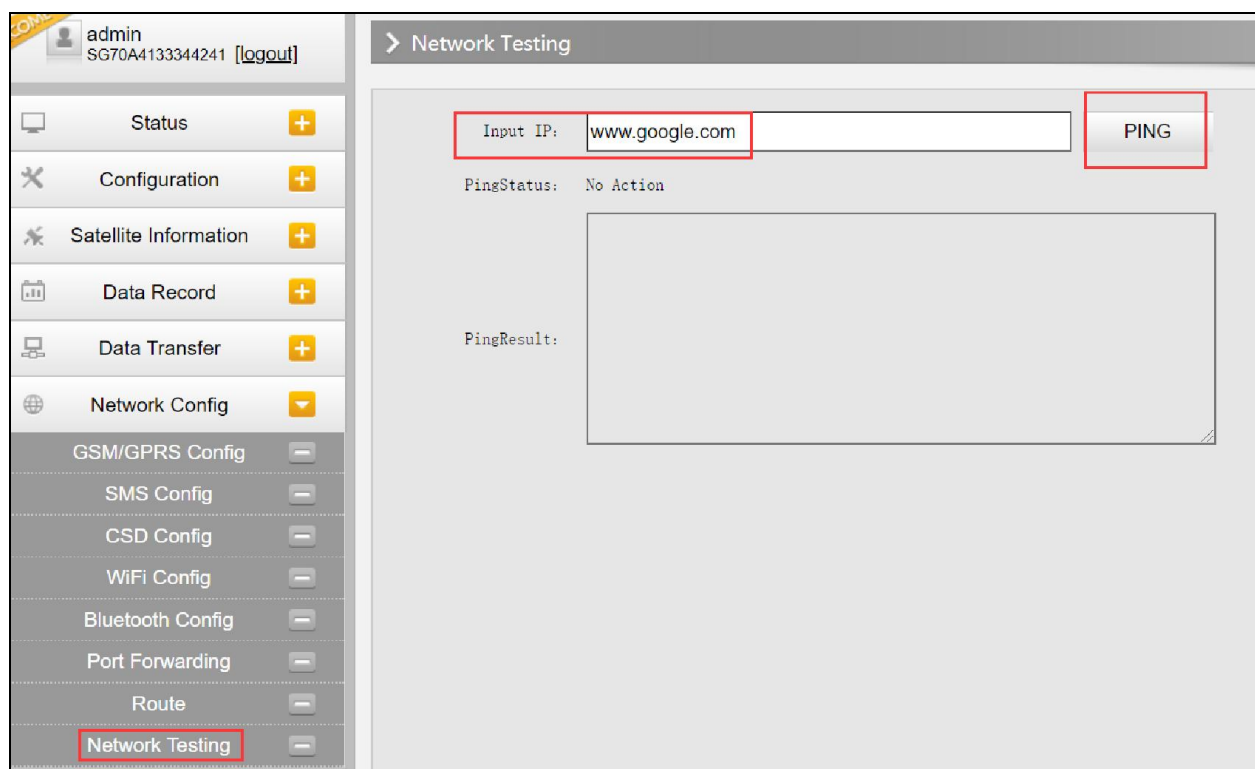


Figure 2.4.8-10 WEB UI-Network config-Network testing

§2.5.9 Radio config

1. Radio parameter

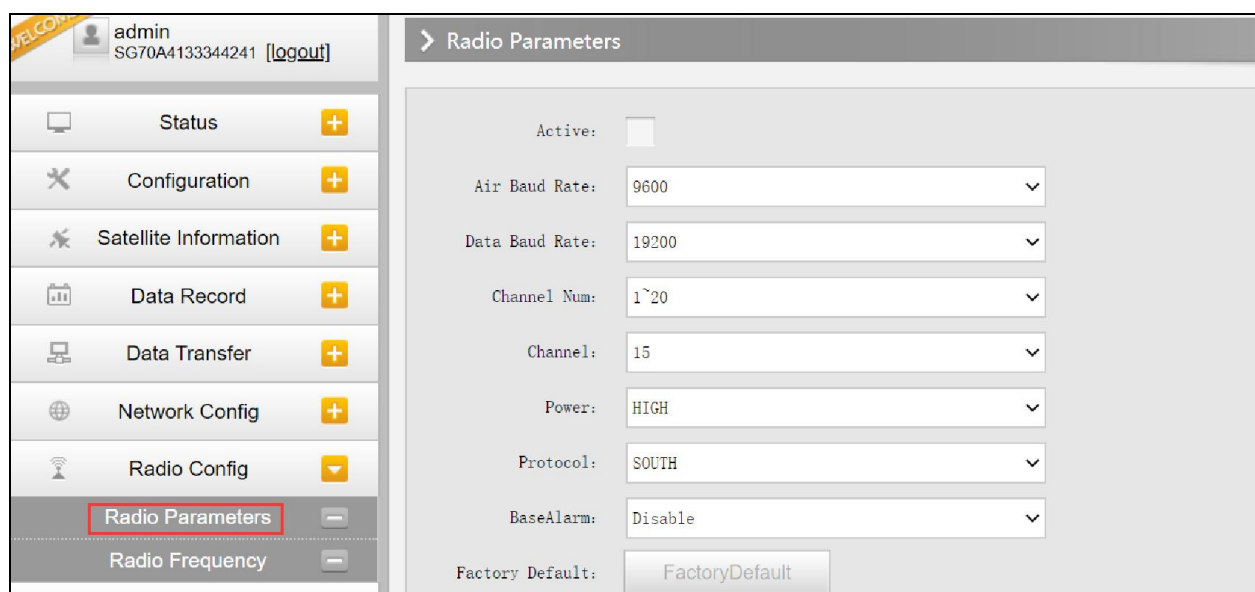


Figure 2.4.9-1 WEB UI-Radio config-Radio parameters

Air baud rate: the data transmission baud rate in inbuilt radio datalink mode. The higher baud rate, the more load of data per second. Default setting is 9600.

Data baud rate: the data transmission baud rate between receiver circuit board and radio module. Default setting is 19200.

Channel: there are totally 120 channels supported which divided into 6 group, with 20 channels in each group.

Radio Power: to set the transmission power for inbuilt radio. Normally in base mode, the radio power is set as [High] so as to have longer coverage distance and in rover mode, the radio power is set as [Low].

Protocol: it supports radio protocol of **Trimtalk, Huace, South, South+, Satel, Hi-target, Farlink** as below figure. By default, Inno 7 receiver's datalink protocol is set in Farlink protocol. In need, you may also change other protocol like Trimtalk for radio communication between base and rover receiver.

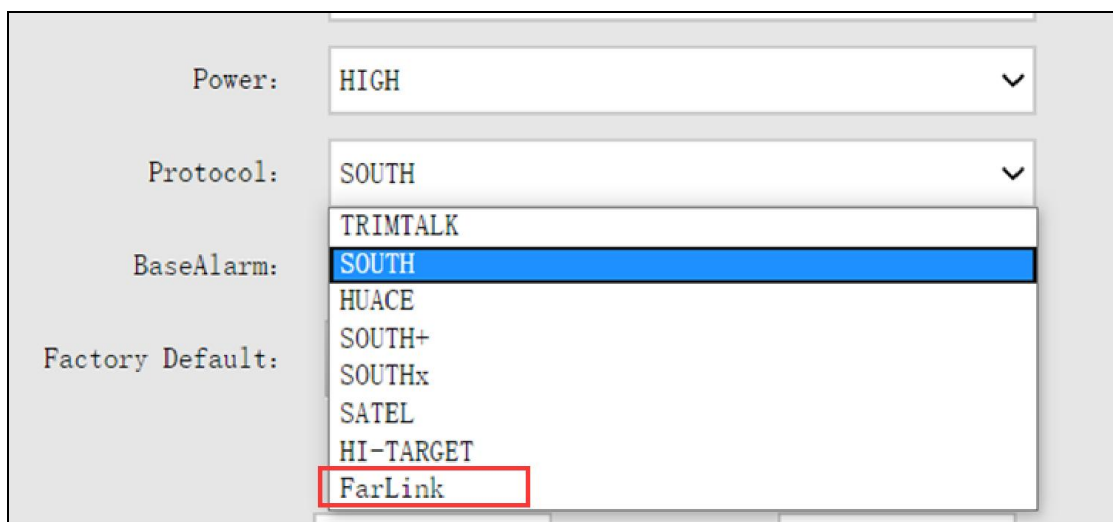


Figure 2.4.9-1 WEB UI-Radio config-Radio parameters-Radio protocol

For base and rover receiver, the same **Air baud rate, Data baud rate, Channel, Protocol** shall be applied, otherwise they cannot communicate with each other.

2. Radio frequency

To set the radio frequency which shall be the same for base and rover receiver.

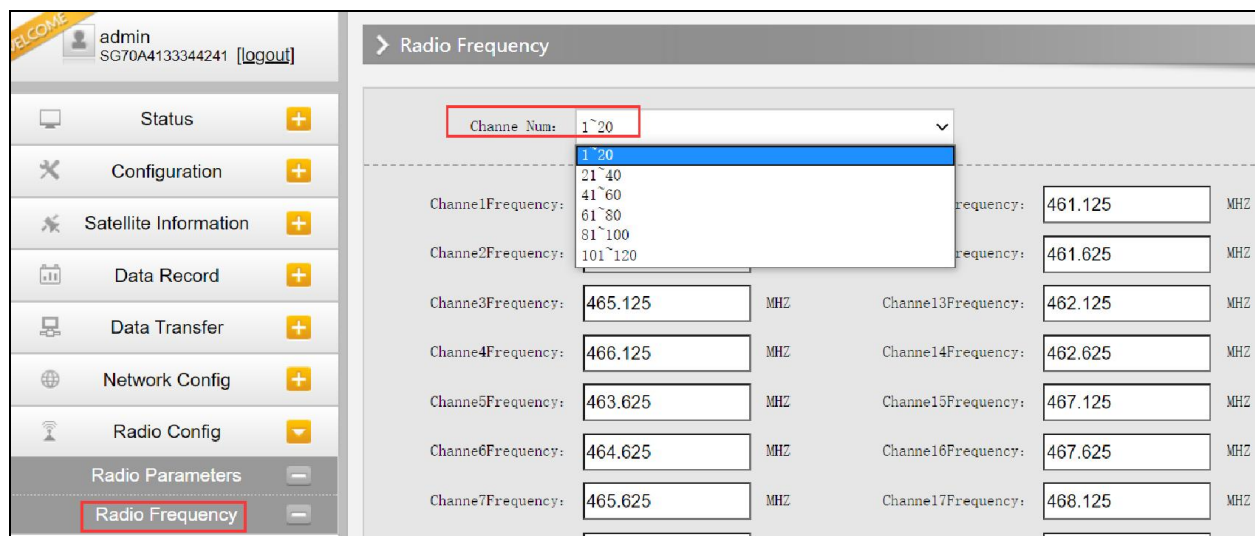


Figure 2.4.9-1 WEB UI-Radio config-Radio frequency

There are totally 120 channels in 6 radio channel groups and in each group there are 20 channels to choose.

§2.5.10 Firmware update

1. Firmware update

To update the receiver firmware. It supports local update and online update. It is suggested to take local update method. Please contact South technician to confirm the firmware file version.

Method for local update from WEB UI:

----Select the firmware file by click on [**Firmware file**] button

----Click [**Install**] button to begin update process.

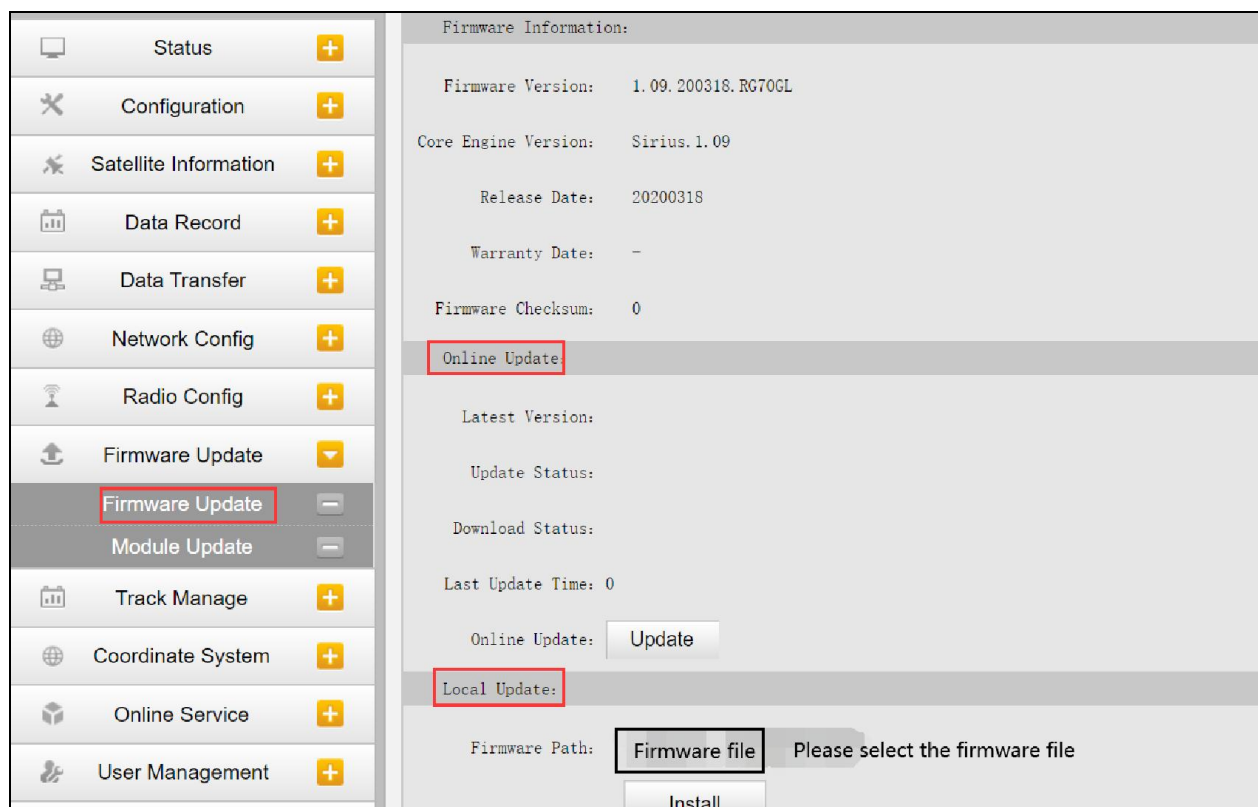


Figure 2.4.10-1 WEB UI-Firmware update

In addition to WEB UI update firmware method, there is another simpler way:

Directly copy firmware file to receiver internal memory, restart receiver, the firmware will be upgraded automatically

2. Module firmware update

To update the firmware of OEM board, radio module, Sensor module.

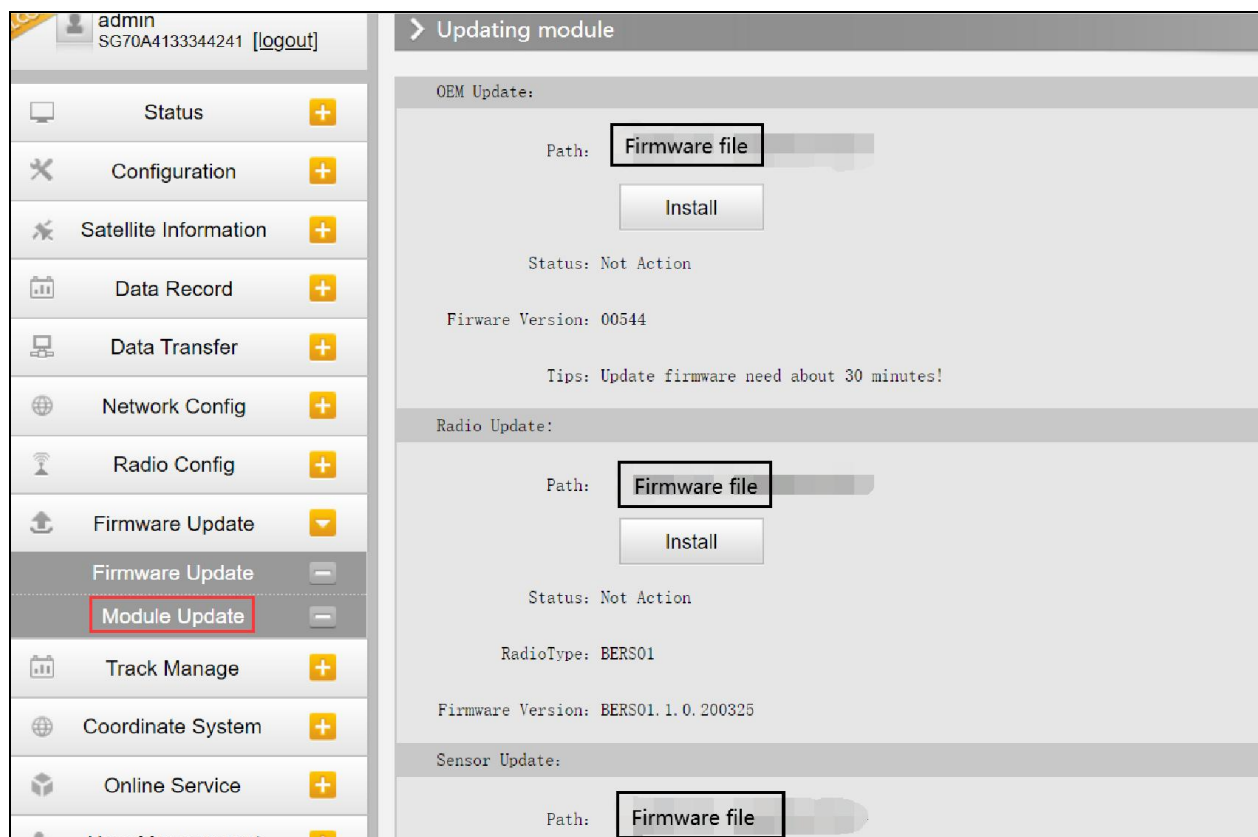


Figure 2.4.10-2 WEB UI-Firmware update-module update

§2.5.11 Track manage

To manage the track of receiver. Receiver record GGA data and upload it to server, then the receiver track can be viewed from server.

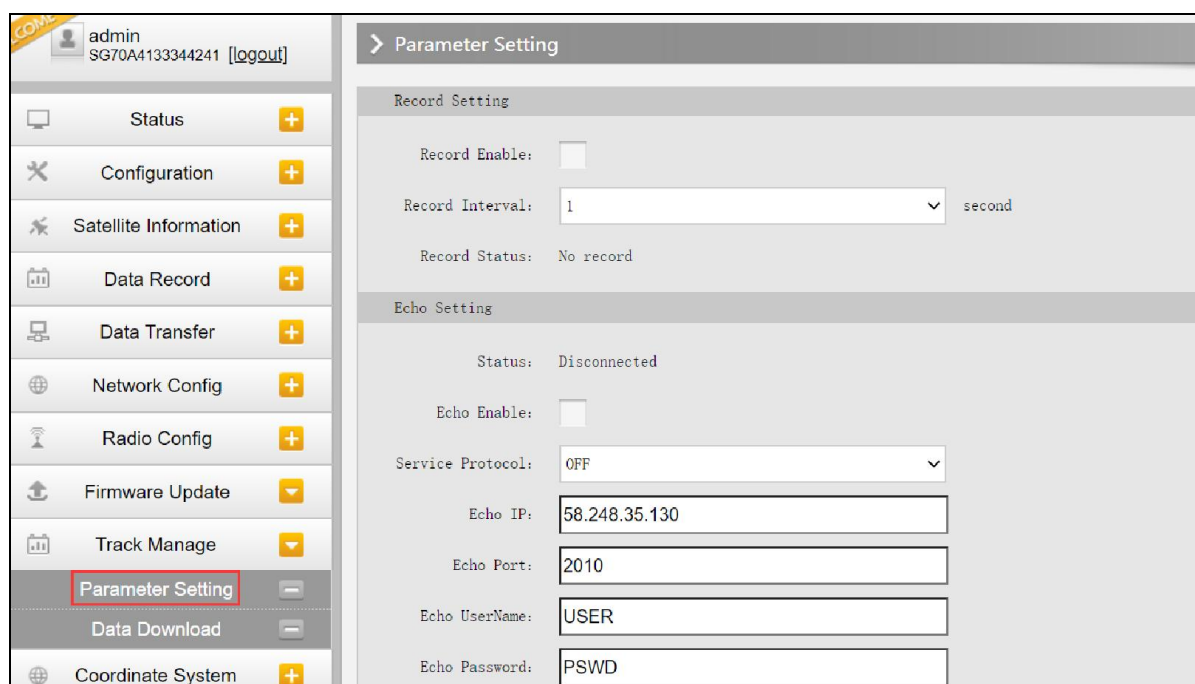


Figure 2.4.11-1 WEB UI-Track mange

Data download: to select date then click **[Get data]** to download the data.

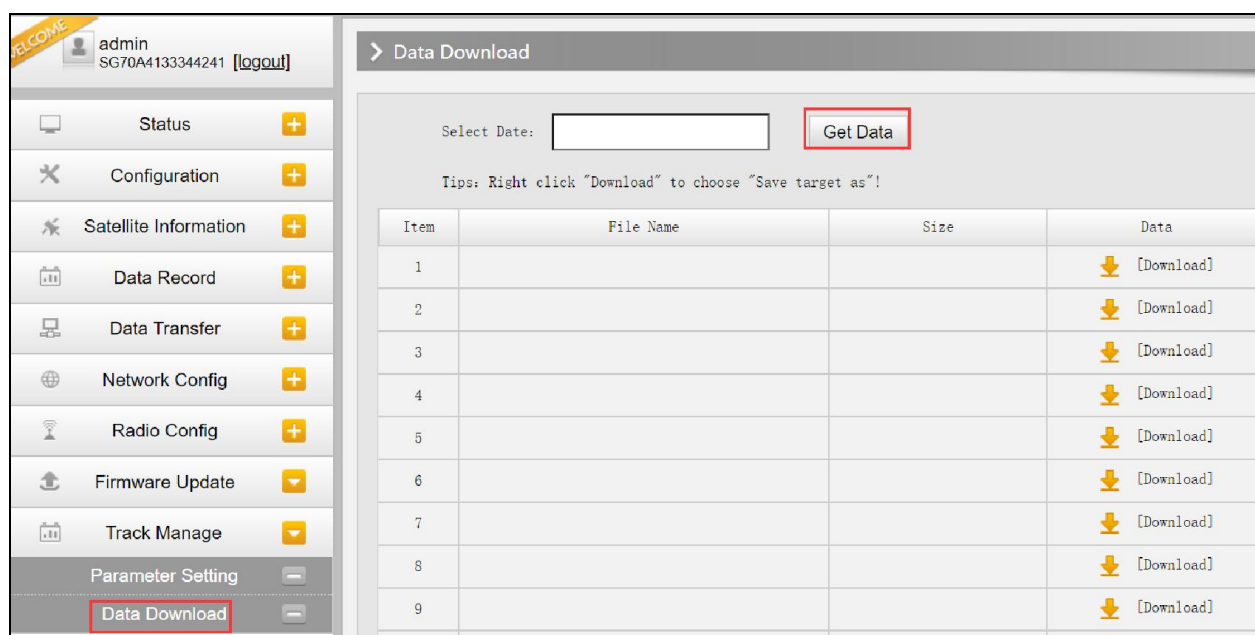
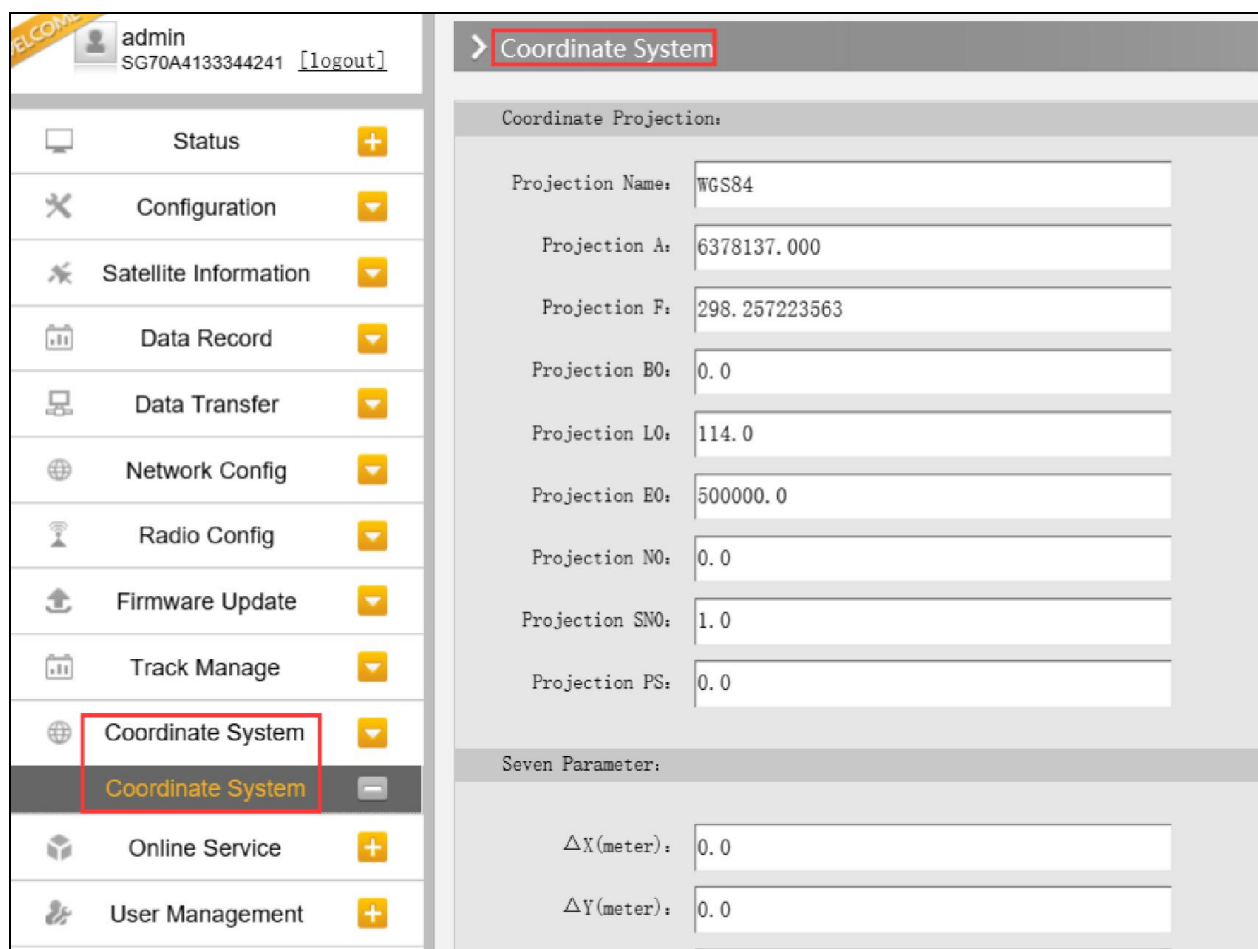


Figure 2.4.11-2 WEB UI-Track mange

§2.5.12 Coordinate system

To set the coordinate system, including ellipsoid, projection, seven parameters.



admin
SG70A4133344241 [logout]

Status +

Configuration ▾

Satellite Information ▾

Data Record ▾

Data Transfer ▾

Network Config ▾

Radio Config ▾

Firmware Update ▾

Track Manage ▾

Coordinate System ▾

Coordinate System -

Online Service +

User Management +

Coordinate System

Coordinate Projection:

Projection Name: WGS84

Projection A: 6378137.000

Projection F: 298.257223563

Projection B0: 0.0

Projection L0: 114.0

Projection E0: 500000.0

Projection N0: 0.0

Projection SNO: 1.0

Projection PS: 0.0

Seven Parameter:

$\Delta X(\text{meter})$: 0.0

$\Delta Y(\text{meter})$: 0.0

Figure 2.4.12-1 WEB UI-Coordinate system

§2.5.13 Online service

To set online service type, IP, port, username and password.

WELCOME admin SG70A4133344241 [logout]

Online Service

Status: Disconnected

Active: ☐

Be controlled: ☐

Anonymous Login: ☐

Inactive In 2G Mode: ☐

Data Type: Navigation Data

IP: 192.168.1.1

Port: 8060

UserName: UserName

Password:

Enter Cancel

Figure 2.4.13-1 WEB UI-Online service

§2.5.14 User management

To manage user who visit receiver's WEB UI.

WELCOME admin SG70A4133344241 [logout]

User Management

Add user

Name	Limits of authority	Status	Operating	Operating
admin	Administrator	online	delete	edit
Administrator	Administrator	Offline	delete	edit
Auditor	Administrator	Offline	delete	edit
User1	Administrator	Offline	delete	edit

Figure 2.4.14-1 WEB UI-User management

§2.6 Accessories

§2.6.1 Instrument case

Inside the hard case, it is soft foam compartments for different accessories as below figure.



§2.6.2 Battery and mobile battery case

1. Battery and charger

Battery: Li-ion battery, Capacity: 3400mAh.





Red light: under charging

Green light: fully charged

2. Mobile battery case

With receiver battery put inside, it can provide external power supply. Supporting 4 batteries by maximum and it also supports one or two battery to put inside.



7 Pin-5 Pin Lemo port cable is used for power supply as below image.

7 Pin port for mobile battery case and 5 Pin port for receiver.



§2.6.3 UHF antenna and Cellular network antenna



Cellular network antenna for cellular network as datalink.

In good cellular network signal environment, no need to use cellular network antenna because there is inbuilt cellular antenna, but in bad cellular network signal environment it is recommended to use this cellular network antenna.

UHF antenna for radio datalink mode.

§2.6.4 Communication cable

1. 7 Pin-USB port cable

There are three main usage for this cable:

----For static data downloading

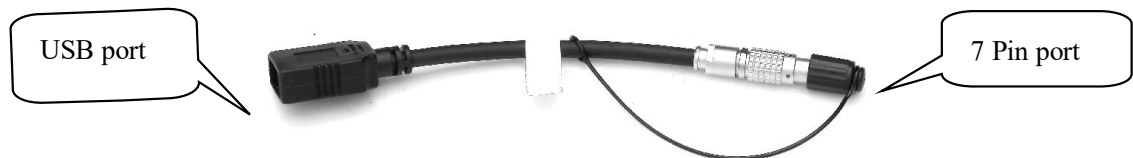
----For firmware update when receiver is set in USB flash disk mode.

----For receiver WEB UI access when receiver is set in Ethernet mode.



2. 7 Pin-OTG cable

To connect external USB flash disk to receiver to extend the memory. The receiver supports directly record static data to external flash disk.



3. 5 Pin-serial port (BD9) cable

For output NMEA-0183 data or debugging receiver.



Chapter 3 Static survey

§3.1 Static survey requirements

- 1) Away from high radio interference area at least 200 meters, such as high-power radio transmission tower, high voltage transmission wire, etc.
- 2) Away from large area water, like lake to mitigate multi-path effect.
- 3) Work area shall have open sky view.
- 4) Receiver observation site shall be on the place where there is convenient transportation nearby and sight shall not be blocked so as to enable other instrument (such as Total station, Auto level) to work on this site in future.

§3.2 Static survey procedure

1. Preparation

- 1) Check the working area from paper map or online map (like google map) and draw draft control network.
- 2) Visit the field to check and decide where to put receiver.
- 3) Build survey monument: build cement monument or put simple monument (put survey nail to hard ground surface)
- 4) According accuracy requirement and baseline length to design approximate observation time for different observation site.
- 5) Check if the receiver working properly or not, check tripod and calibrate tribrach.

2. Start field observation

- 1) Plan the observation order (plan which person to take which receiver to be put on which site, after this observation, which person to carry which receiver to shift another site)
- 2) Record key information on paper for each observation such as site name, receiver ID, measured antenna height, start time, end time, session, operator.

- 3) Download static data from all receivers every day. To give the correct static file name according to field paper record. Import the static data to Post-process software to check there is mistake or not.
- 4) Start next day observation and do the same as 3)
- 5) When all observation is complete, put all data in one folder and start Post-process software to process the data.

Note: all receivers shall be set in same recording interval, mask angle and antenna height shall be measured and recorded for every observation.

3. Download static data file

Please refer to §3.5 for static data downloading.

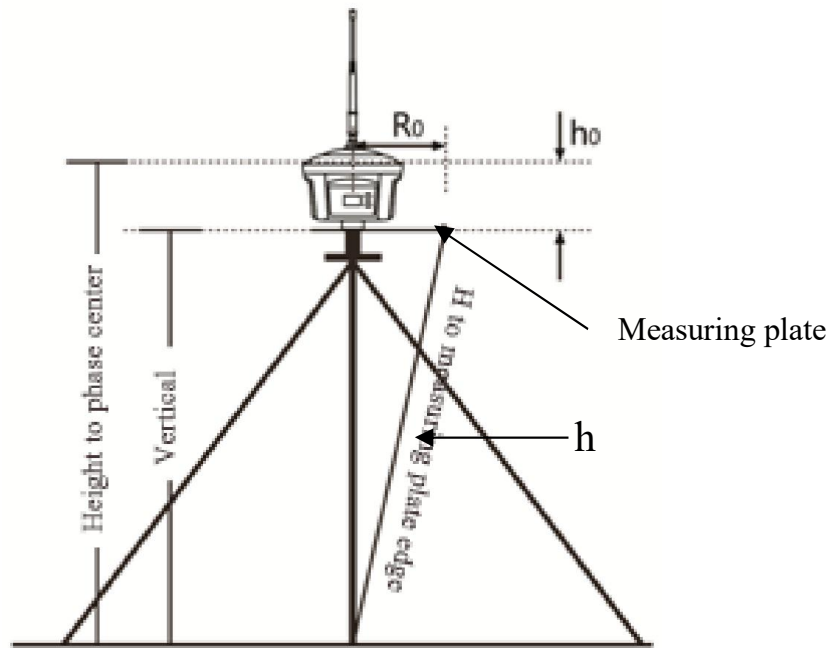
4. Process static data by Post process software

Very important note:

- 1) Static file name shall be input correctly in software according to field paper record.
- 2) Antenna height shall be input correctly in software according to field paper record.

§3.3 Antenna height measurement

Set receiver on tribrach and make centering and levelling. Measure the distance from the ground survey monument mark to the edge of the metal measuring plate. Record the measured antenna height on field recording paper and input the measured antenna height in post-process software, the software will calculate the real antenna height (from ground survey monument mark to receiver's phase center).



h_0 = the distance from receiver bottom to phase center

H_m =measured antenna height (from the ground survey monument mark to the edge of the metal measuring plate)

h_0 = the distance from receiver bottom to phase center

$$H_v = \sqrt{H_m^2 - R_0^2} \quad \text{Vertical height (from ground survey monument to receiver bottom)}$$

Real antenna height H:

$$H = \sqrt{H_m^2 - R_0^2} + h_0$$

§3.4 GPS control network design principle

- 1) Network shall be closed network which are formed by many connected triangles.
- 2) In this network, there shall be at least three known points which better be distributed evenly in this network so as to precisely calculate transformation parameters between GPS control network and local coordinates system.
- 3) In this network, there shall be some known points with accurate H value (MSL ((Mean

sea level) Height is better, the more such points the better accuracy for H value control.

- 4) Control points shall be set on place where there is open sky view, less radio interference and easy to access to.
- 5) To set one point nearby the GPS control points on place where there is no sight obstruction between them. The set point shall be away from GPS control point at least 300 meters to ensure it is convenient to for total station to utilize them for survey.

§3.5 Static data file download

There are two methods to download static data file from receiver:

----by cable connection (7 Pin-USB cable)

----by WIFI connection

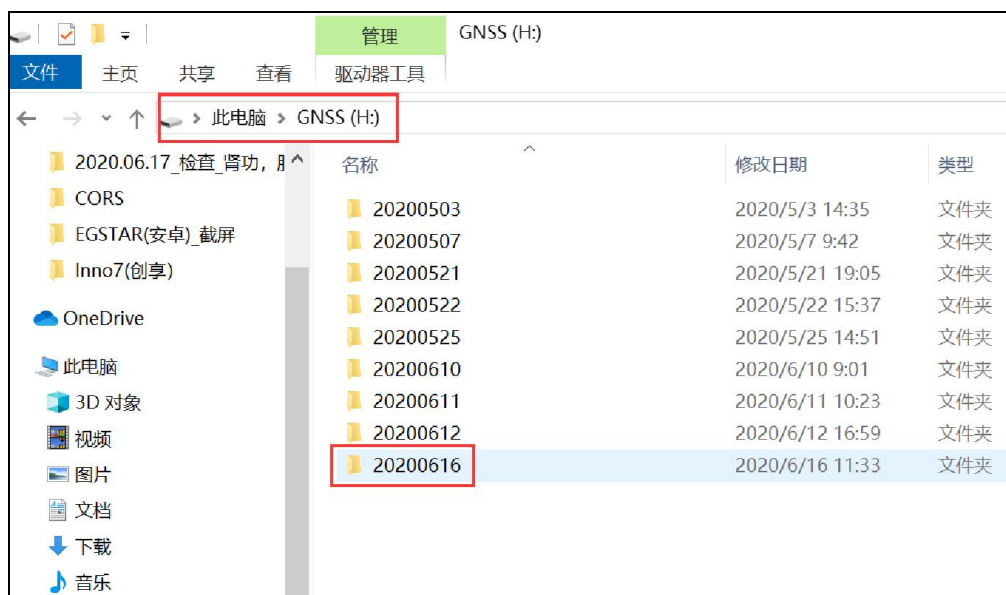
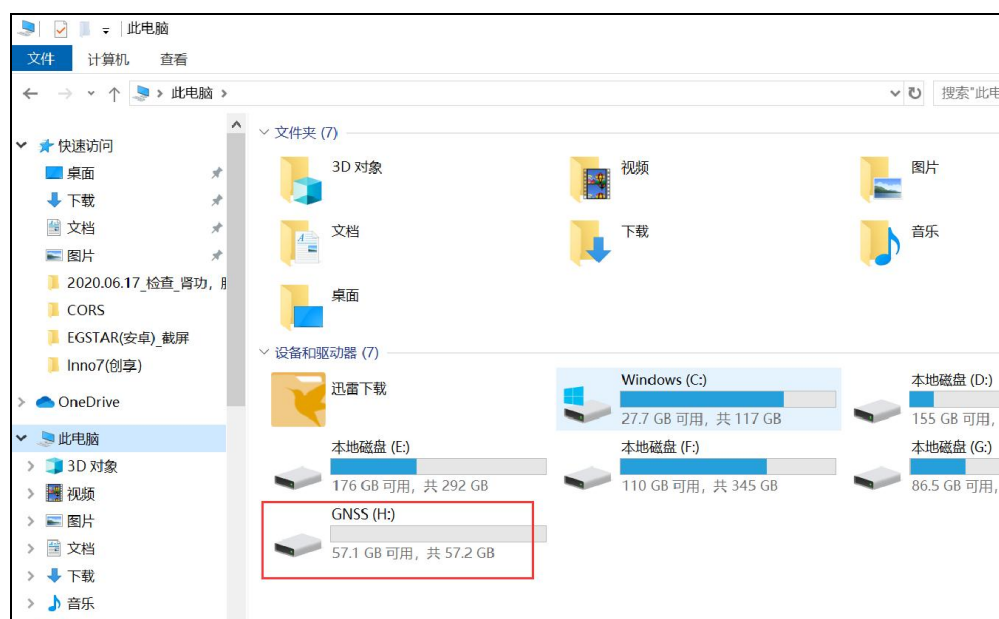
In receiver default setting, both methods are supported.

1. By cable connection (7 Pin-USB cable)

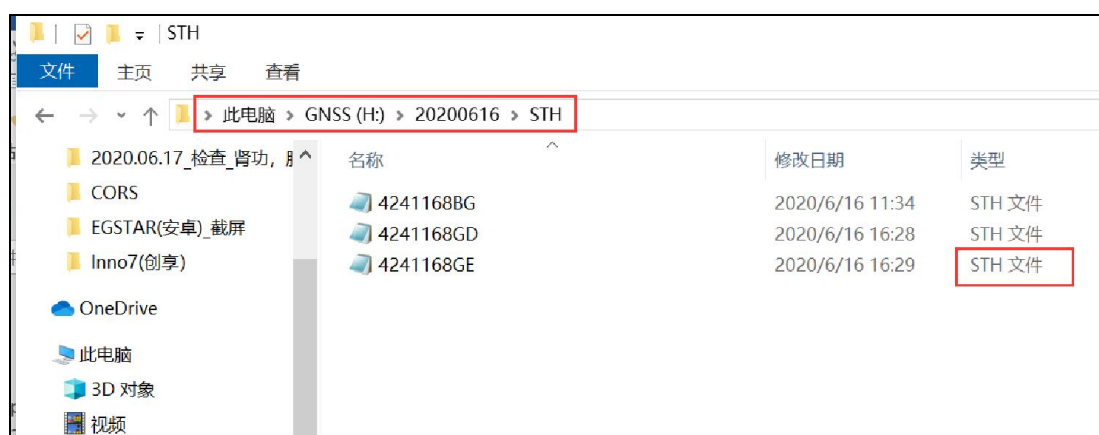
This is a very simple and most widely adopted method

The receiver works as USB flash disk if it is connected to computer by 7 Pin-USB cable as below figure.





Above figure shows the recorded static data file inside the receiver internal memory. Static files are stored by date (for example, folder 20200616 means all static file recorded in on June 16, 2020). If folder 20200616 is opened, there are three static files inside as below figure.

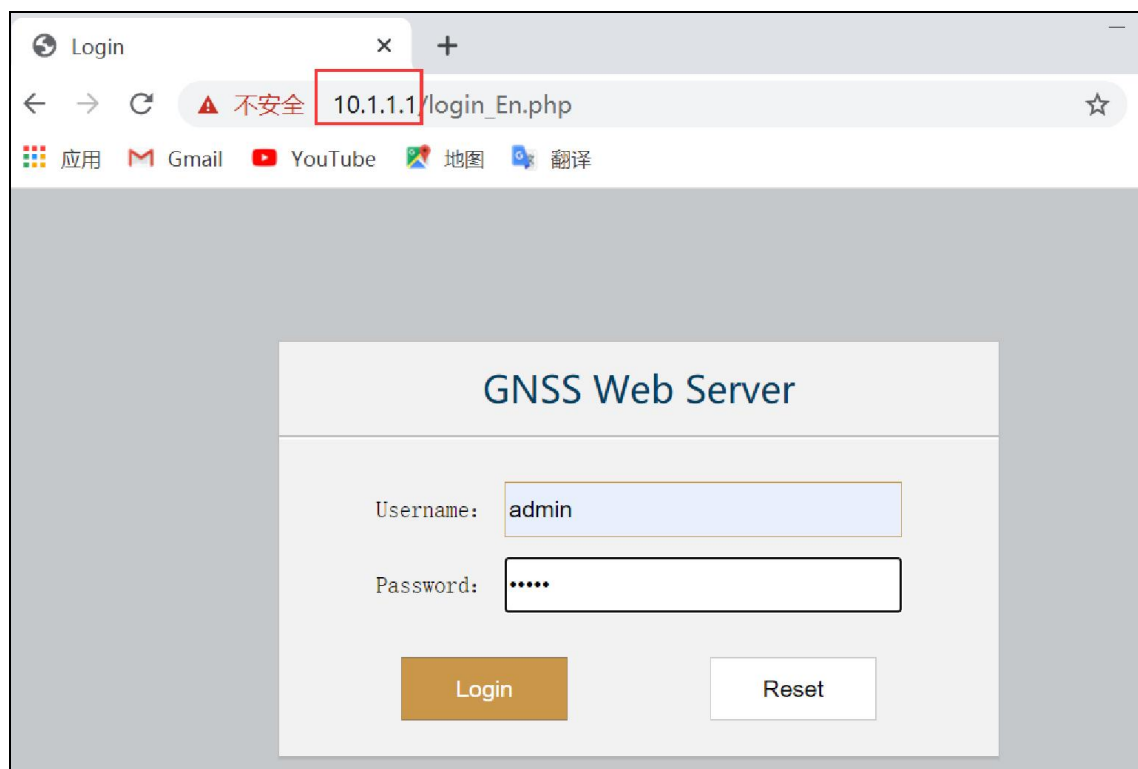


2. By WIFI connection

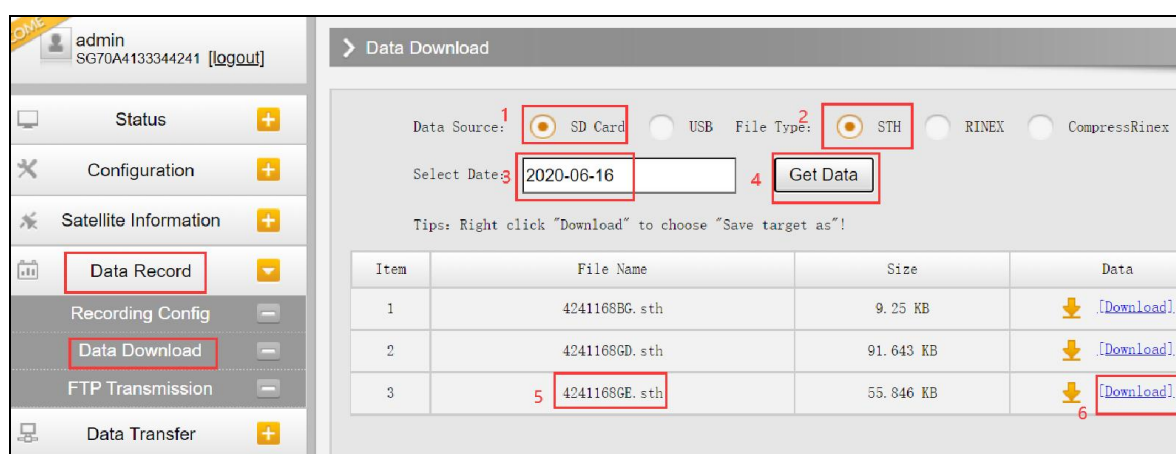
Connect to receiver's WIFI hotspot: SOUTH_4241.



Input 10.1.1.1 in Internet explorer and input user name(admin) and password(admin).



[Data Record]-[Data download]:



Select the date, then click [Get Data] button, all static files recorded on this date will be listed as below, then click [Download] button to download static data file to your computer.

§ Chapter 4 RTK survey (Datalink: UHF (inbuilt radio))

There are two main and widely used datalink, **radio mode and cellular network mode**. Here we take UHF(inbuilt radio) datalink as example to introduce how to setup the base and rover receiver.



Base receiver with UHF (inbuilt radio) as datalink

§4.1 Start Base

There are two methods of setup base receiver:

----Setup base receiver over unknown point.

In this method, there is **no need to measure antenna height for Base and do centering and**

levelling work. Just need to make sure tripod is fixed firmly on ground is OK.

----Setup base receiver over known point.

In this method, **it is required the centering and levelling work be done strictly** over ground survey monument and antenna height to be measured precisely.

§4.1.1 Start Base transmission manually

Below example is given upon set Base on known point method.

Set the base receiver work mode and datalink.

There are three ways to set the receiver work mode and datalink mode:

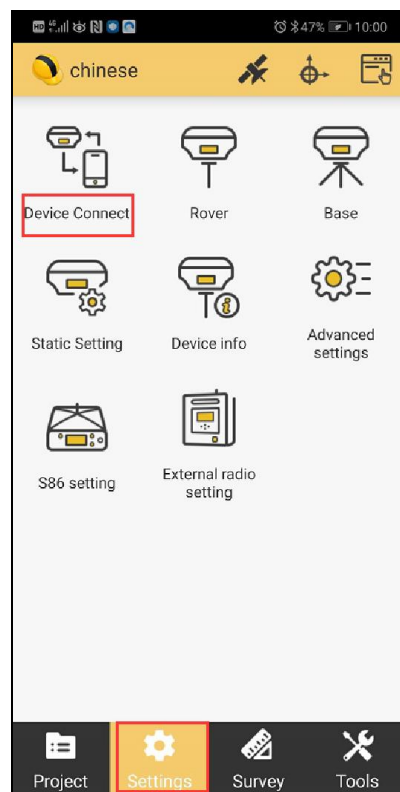
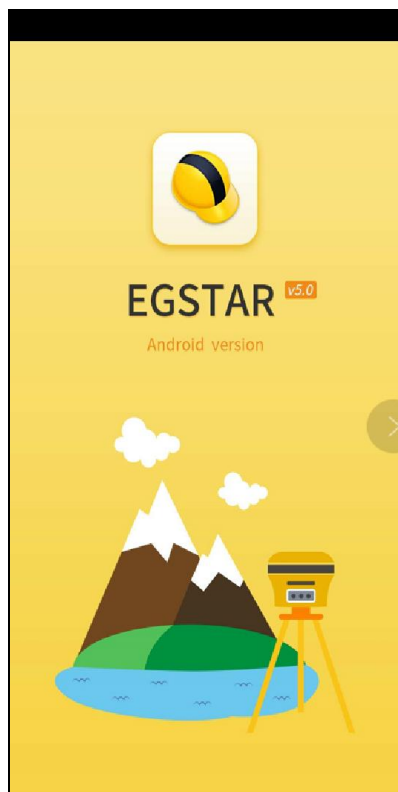
Way 1: Directly set the receiver from LCD touch screen. This is the most widely used way.

Way 2: Set the receiver from WEB UI from either computer or mobile phone.

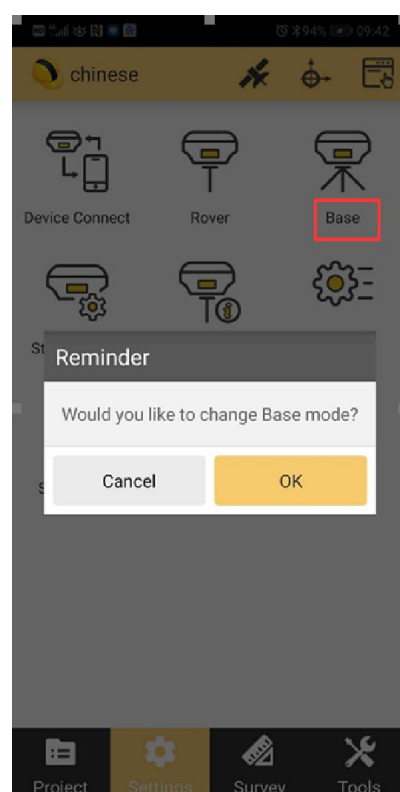
Way 3: Set the receiver from controller's field software.

Here we take way 3 for example to set receiver work mode, datalink mode and start base transmission:

1. Use field software EGStar5..0 (android) to start base



[Settings] –[Device Connect]:

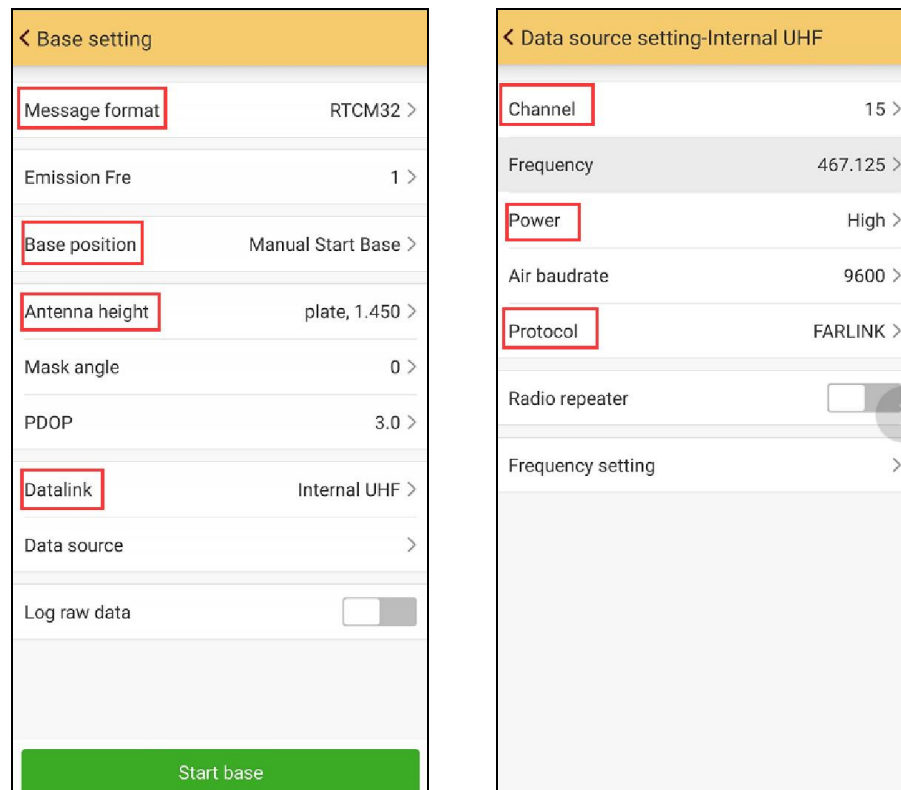


Click **[Search]** button to find Bluetooth device nearby and select the receiver and click **[Connect]** button.

After Bluetooth connection is built, then click **[Setting]--[Base]** to switch the receiver to

Base mode.

Make some settings for base receiver:



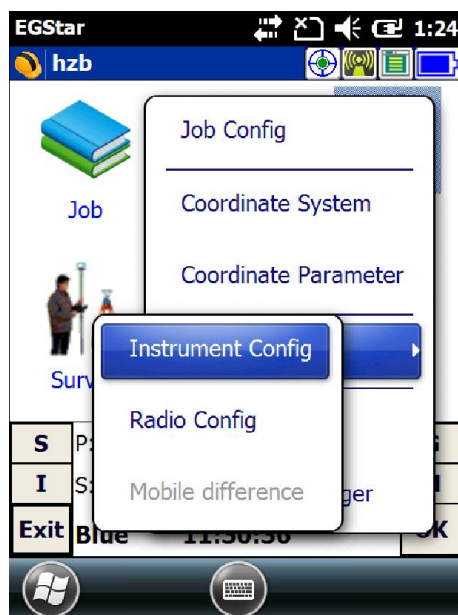
- 1) **[Message format]:** RTCM32
- 2) **[Base position]:** select [Manual start base] or to choose [Auto start base]. Here select [Manual start base] and input base known coordinates.
- 3) **[Antenna height]:** input measured antenna height. Antenna height measurement mode, please select [Plate]. [Plate] means measuring plate.
- 4) **[Datalink]:** select UHF (inbuilt radio).
- 5) **[Data source]:** select radio channel, radio power as high in base mode, radio protocol as Farlink.

[Transmission frequency]: by default, it is set as 1 second. It means the base receiver will transmit differential correction data per second.

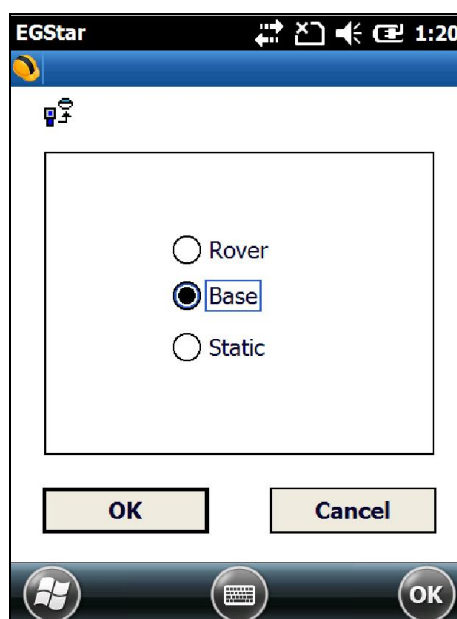
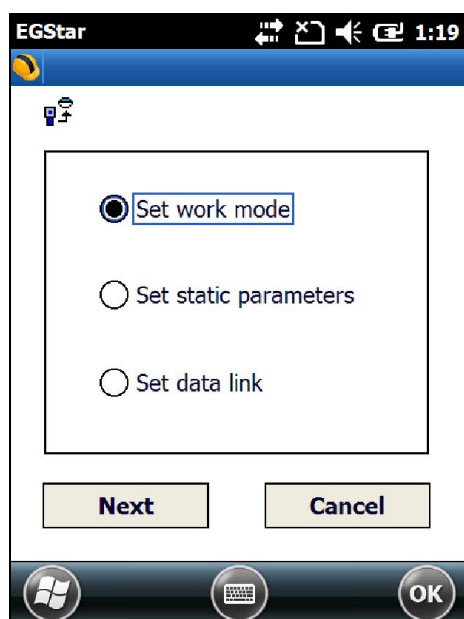
[Mask angle] and [PDOP]: keep default setting.

After the above setting is made, click **[Start base]** to start base receiver's transmission.

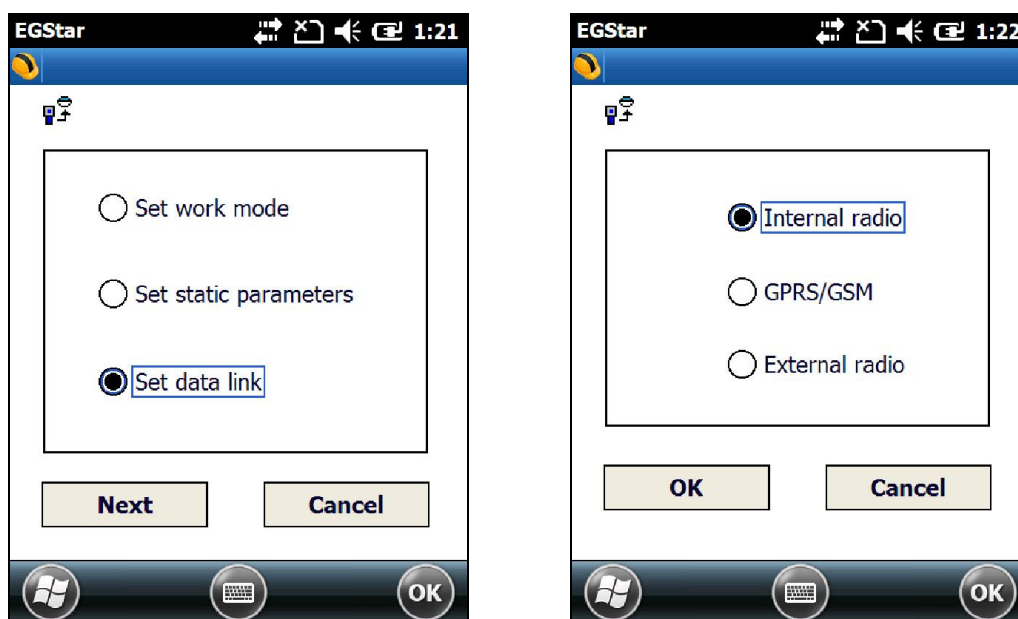
2. Use field software EGStar3.0(WM) to start base



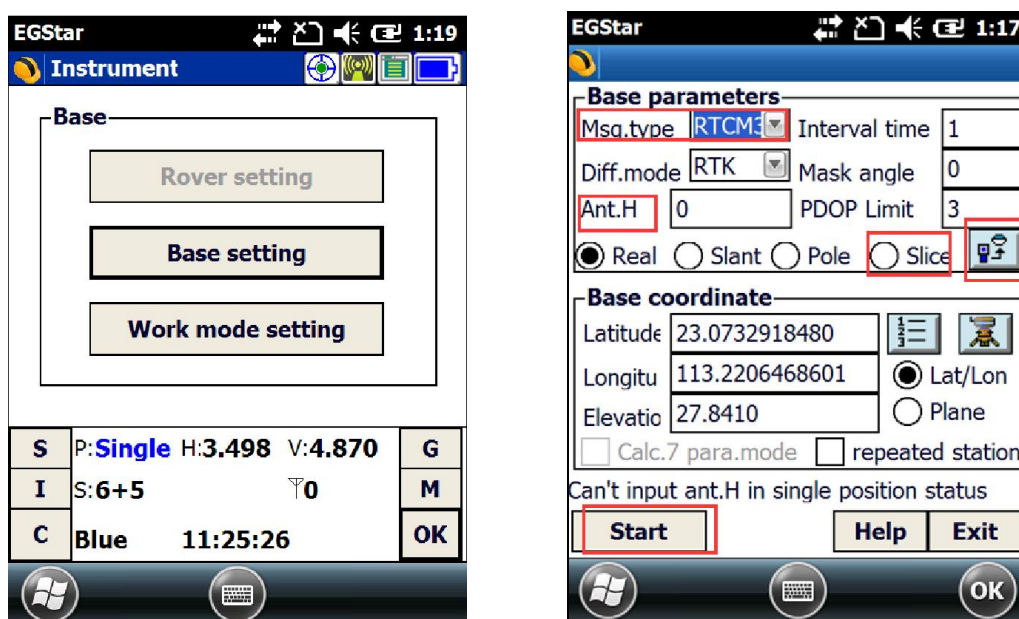
1) [Config]--[Device config]--[Instrument config]--[Work mode setting]--[Set work mode]: select [Base] and then click OK.



2) [Config]--[Device config]--[Instrument config]--[Work mode setting]--[Set data link], select **inbuilt radio**, then click OK.




3) [Config]--[Device config]--[Instrument config]--[Base setting]:



From the above image, Choose the correction data format in Msg Type(for example: RTCM32) and select the antenna measuring method(for example: Slice) and input measured antenna height in antenna height, input the radio transmission interval (by default, 1 second).

Mask angle and PDOP limit: keep default setting.

Then tap on the symbol  to save all setting parameters.

Input the coordinates for base receiver or tap on the symbol  to obtain a fresh

coordinates from satellites.

After the above settings is made, click on **[Start]** button to start the base transmission.

Note: If the base receiver is still set on the same position next time, tick on **[Repeated station]** and the base receiver will start automatically with its previously used known coordinates.

4) Set radio channel

[Config]--**[Device Config]**--**[Radio Config]**, click on **[Read]** button to read the current radio channel, or select a radio channel from the list and click on **[Switch]** button to change the radio channel.



In **[Radio power]**, click on **[Read]** button to read the current radio power, or select high/low from the list and click on **[Setup]**.

Now all settings are complete and the base receiver will soon start to transmit differential correction data in specified radio channel and selected radio power.

§4.1.2 Start Base transmission automatically

Below example is given upon set Base on known point method.

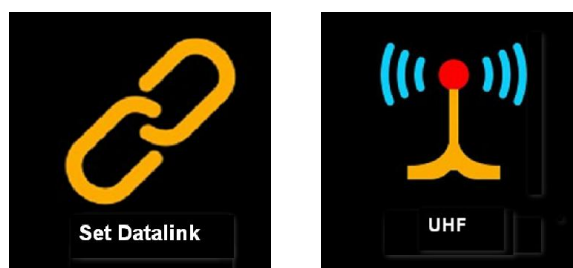
Note: if the base receiver is set on unknown point, it is much simpler for make the base settings because no need to make centering and leveling work over survey monument and no need to measure the antenna height.

We can directly set the base receiver from touch screen for work mode and datalink mode.

1) Swipe left the touch screen, **[Mode select]--[Base mode]**:



2) Swipe left the touch screen, **[Set datalink]--[UHF(inbuilt radio)]**:



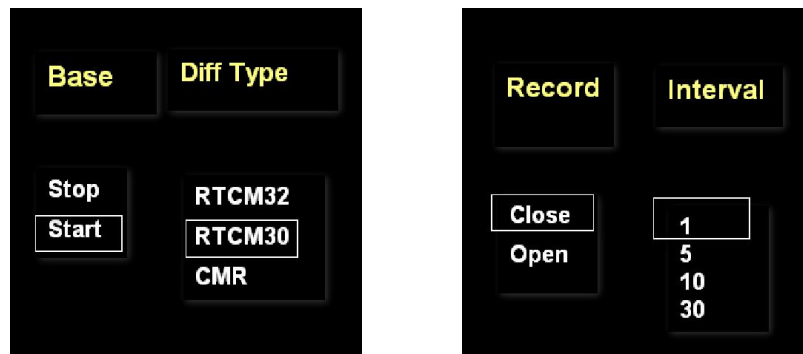
Tap the screen (or press PWR key) to make the other settings for inbuilt radio.



Select radio channel, radio protocol (Please select Farlink), air baud rate (default: 9600), and radio power.

Note: In base mode, to cover longer work range please select radio power as high or select as middle or low to maximized the battery working time.

Tap the touch screen to select differential correction data format (for example: RTCM30), then Select [Start] to start base transmission.



§4.2 Start Rover

Below is rover receiver system, including receiver, carbon fiber pole and controller.



Set the work mode and datalink mode for rover receiver:

Below is example of setting the rover receiver from its touch screen directly.

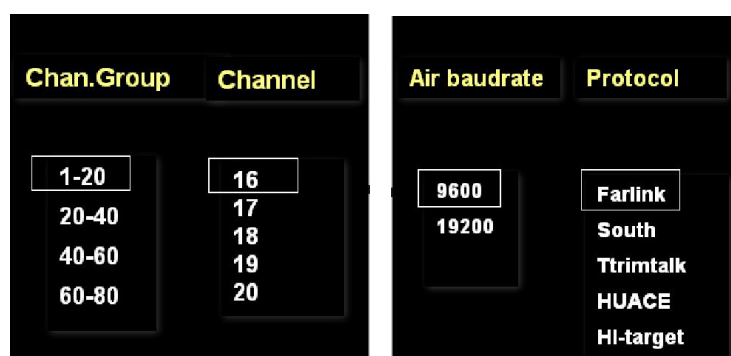
----Swipe left the touch screen, select **[Mode select]** --**[Rover mode]**



----Swipe left the touch screen, select **[Set datalink]** --**[UHF]**:



Tap the screen (or press PWR key) to make other settings. Select radio channel, radio protocol (please select Farlink) and air baud rate (by default: 9600)



Note: radio channel, radio protocol, air baud rate shall be set the same as base receiver.

There is another way to set the rover receiver through controller and the setting is almost the same as operation for the base receiver. Please refer to chapter 4.1.1.

When the above settings are complete, the rover receiver will receive radio signal which transmitted by the base receiver along with a voice message **[Fixed]** once it gets Fixed

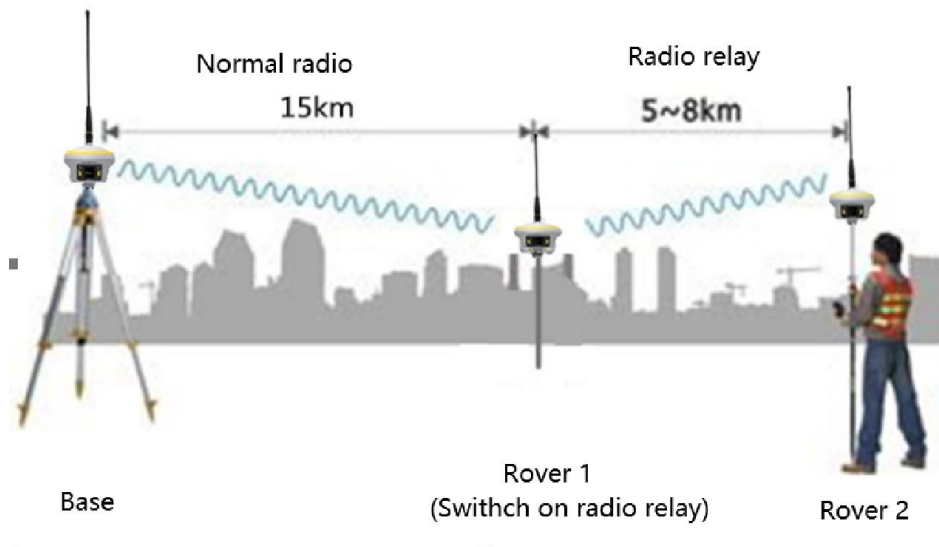
solution.

Now we can connect the controller to rover receiver by Bluetooth and begin the survey work.

§4.3 Radio relay

Radio relay

Rover 1 work as relay unit to extend radio signal to more distance so that the radio signal transmitted by Base can be received by Rover 2 as below figure.



Rover 1 has two roles in above figure:

Works as an ordinary rover receiver and in mean time works as radio relay device.

Settings for radio relay function in WEB UI.

[WEB UI]-[Configuration]- [General config], tick on [Radio transfer].

admin
SG70A4133344241 [logout]

Code: A88D54630310A9F7C345D4BEE7B65C6FBC8 Register

ExpiredDate: 20200801

OnlineRegistration: OnlineRegi

OEMRegisterCode: 0 Register

SLink ExpiredDate: -1

Mode Setting

Work Mode: Rover

Datalink: Radio

Radio Router: None

Radio Transfer: ☒

RTK Record: ☐

xFillEnable: ☐

1PPS: ☒

In which sennario the radio relay fuction is useful?

Due to the distance between base and rover is too far, the rover 2 can not receive the radio siganl trnsmitted by base. In this situation if another receiver (Rover 1) is setup between them, then the Rover 1 will receive radio signal from base and relay the radio signal to Rover 2.

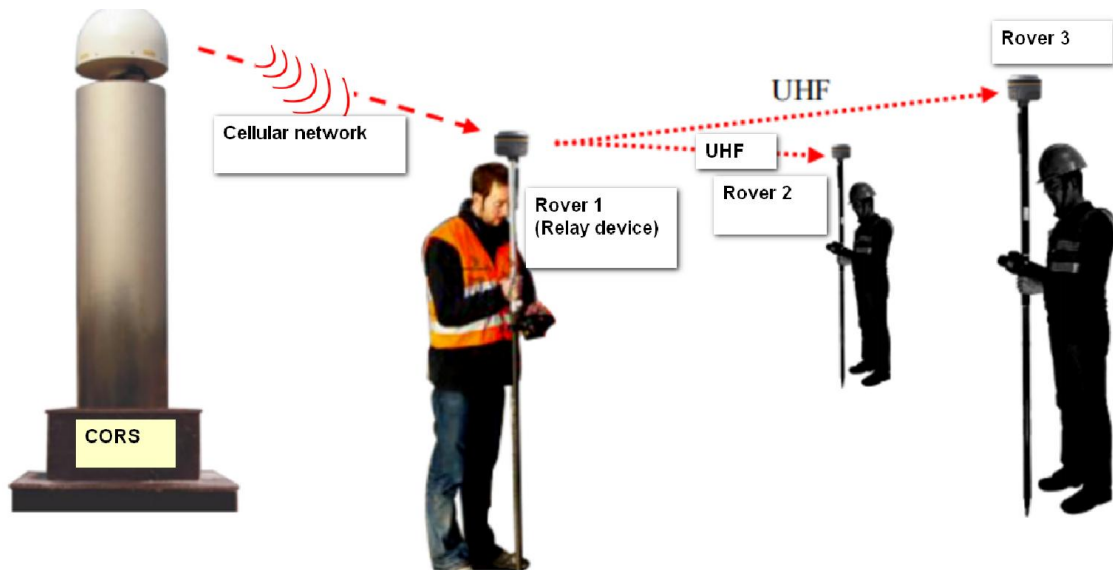
Note: radio channel in Base, Rover 1(relay unit) and Rover 2 shall be set the same.

§4.4 Radio route

Radio router

Rover 1 receiver differential correction data from CORS station or Base receiver through cellular network and relay it by UHF radio so that Rover 2, Rover 3 ...can receive the same correction data.

The only difference from radio relay is the first part transmission is by cellular network rather than UHF radio.



In which scenario the radio relay function is useful?

There is only one available SIM card which can allow only one rover receiver to access to cellular network to receive differential correction data. But more receivers work for the same project. In this scenario, Rover 1 will work as relay device and transmit correction data to other rovers by UHF radio.

§4.5 Tilt survey with IMU

Below is operation steps for tilt survey with IMU.

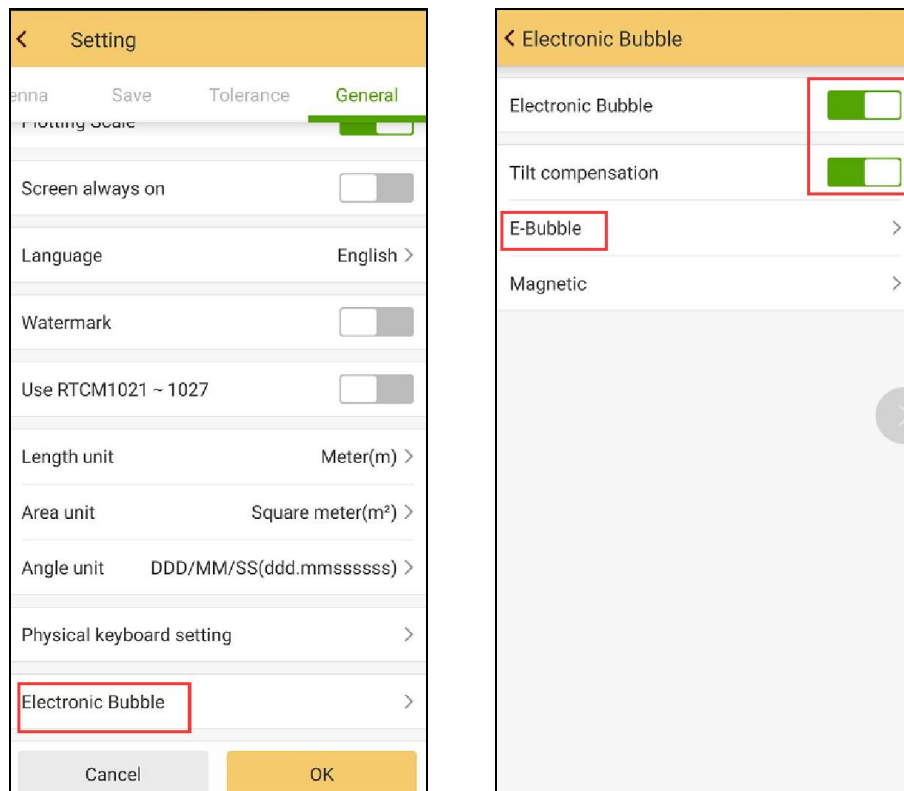
1. Set pole height

[Project]-[Project option]- [Antenna]: input pole height.

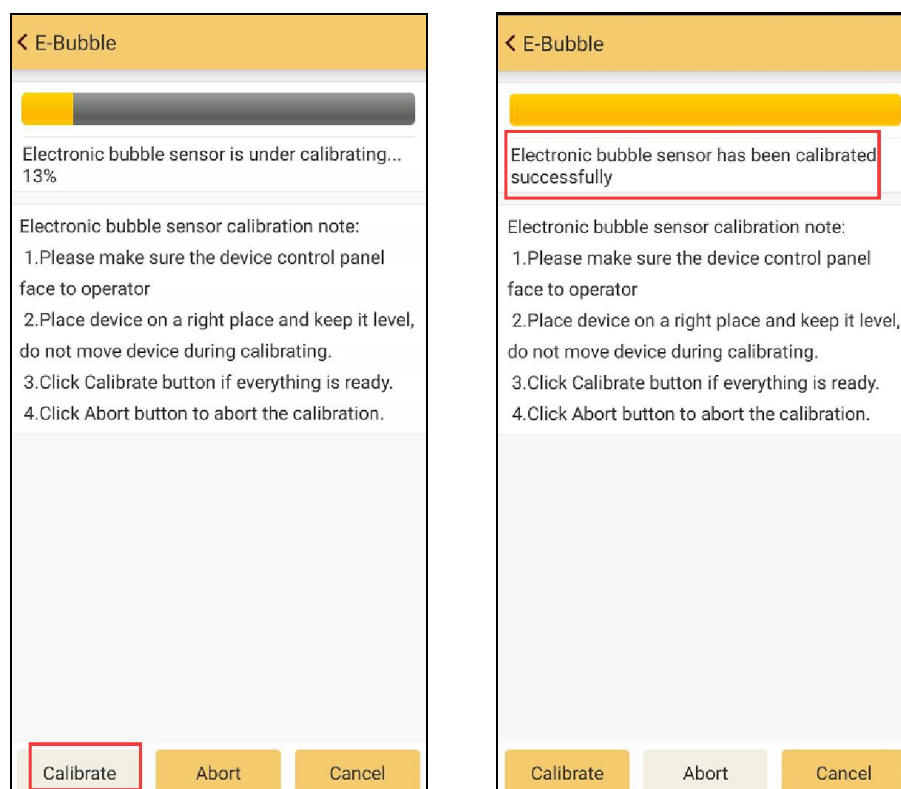
Note: during survey, if the pole height has been changed, then the tilt sensor calibration must be done again.

2. Electronic bubble calibration

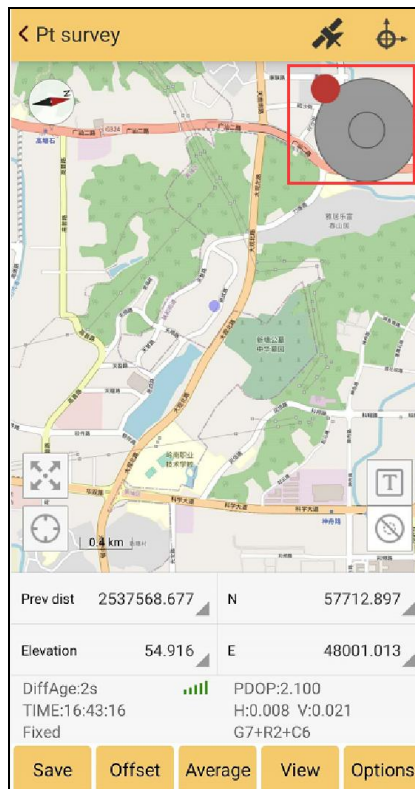
[Project]-[Project option]-[General], select E-bubble and tilt sensor , then tick on [Electronic bubble] and [Tilt compensation].



Click [Calibrate] button to start calibration process, when calibration complete it will showing electronic bubble sensor has been calibrated successfully.



Below figure showing the electronic bubble before and after calibration.



E-bubble before calibration





E-bubble after calibration

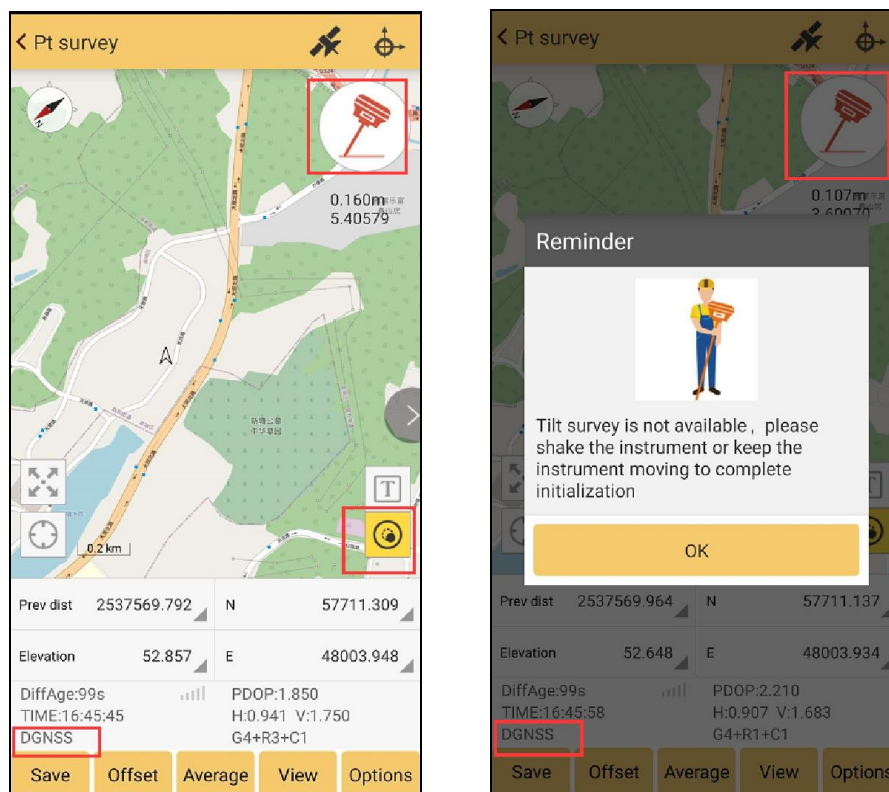
Note: it is strongly suggested to put receiver on tribrach when you do calibration and tribrach needs to be levelled strictly.

3. IMU sensor calibration

[EGStar]- [Survey]-[Point survey]:

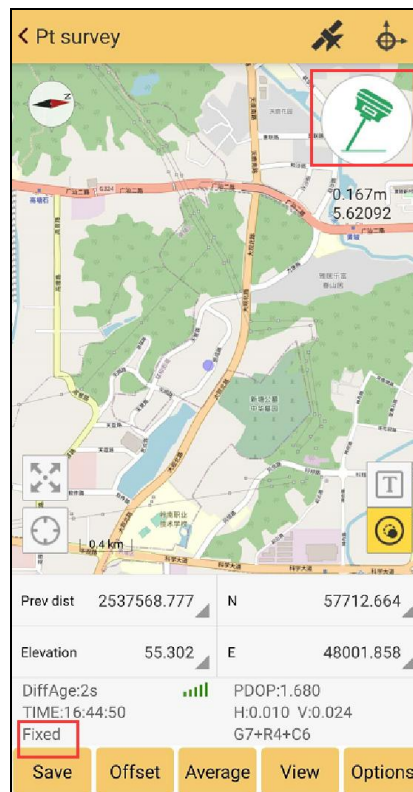
Click icon  on lower right corner to activate tilt survey, then icon  will be showed on higher right corner. This icon in red color means IMU sensor has not been calibrated.

When you click [Save] button to store point, a message will pop up to warn that tilt survey is not available and calibration need to be done.



According to the message, start IMU sensor calibration by simply shaking the pole forward and backward continuously (for 2-6 seconds).

Normally a voice message [Tilt survey is available] will come, the tilt survey sensor icon will become green color and solution status showing Fixed as below figure.



It means IMU sensor calibration has been done successfully. When the tilt survey icon become green and solution is Fixed, we can begin the survey work.

Note: If after shaking the pole 1-2 minutes, but there is still no voice message come and tilt survey icon still in red, please keep the pole still and wait for 5-6 seconds, then shake the pole forward and backward to do calibration again.

§ Chapter 5 RTK survey (Datalink: Cellular network)

If a cellular network is selected as datalink, the only difference is the differential correction data will be transmitted by cellular network rather than radio. Others operation are the totally the same.

§5.1 Set Base (Datalink: cellular network)

Below we give example of **set Base on unknown point and start base transmission automatically.**

For set Base on known point, please refer to §4.1.1

Insert a SIM card to base receiver.

Set the base receiver work mode and datalink mode from receiver's touch screen.

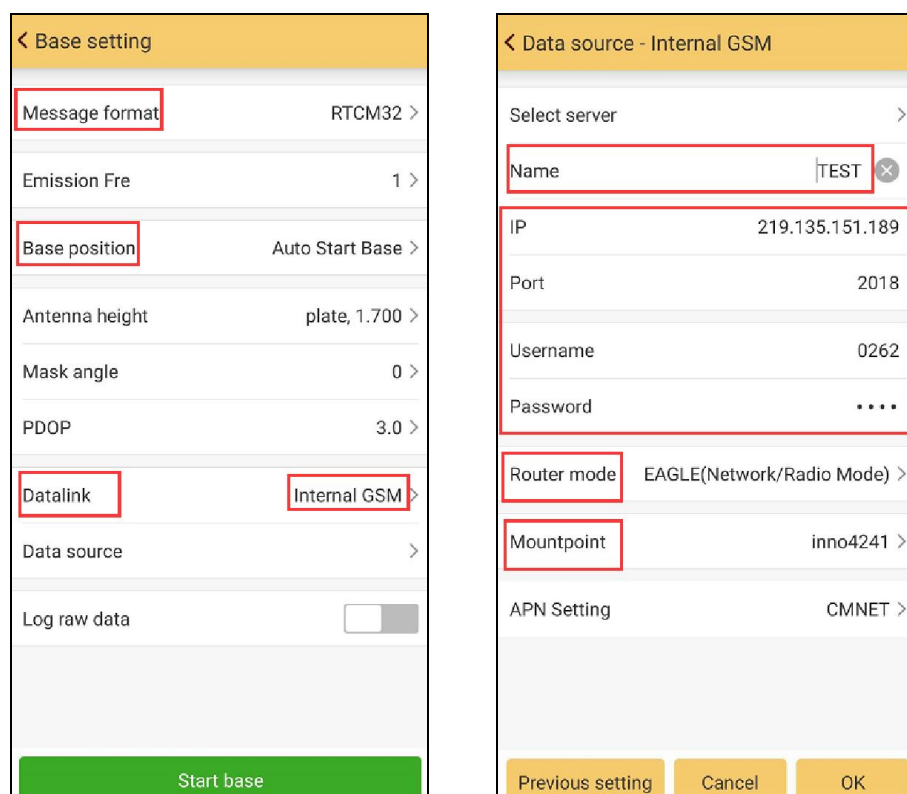
----Swipe left the touch screen, [**Mode select**] --[**Base mode**]

----Swipe left the touch screen, [**Set datalink**] --[**Cellular network**] --[**SIM card**], select external SIM card.

The work mode and datalink mode also can be set in EGStar 5.0.

Below as operation steps for Base setting:

Launch EGStar 5.0 and connect receiver and controller by Bluetooth. Then [Settings]-[Base] to make settings:



----Message format: [RTCM32]

----Base position: [Auto start base]

---- Datalink: [Internal GSM]

Then click [**Data source**]:

----Give this connection a name, for example [TEST]

----Input the server IP and port, for example: IP(219.135.151.189), Port(2018) and username(any user name) and password (any password)

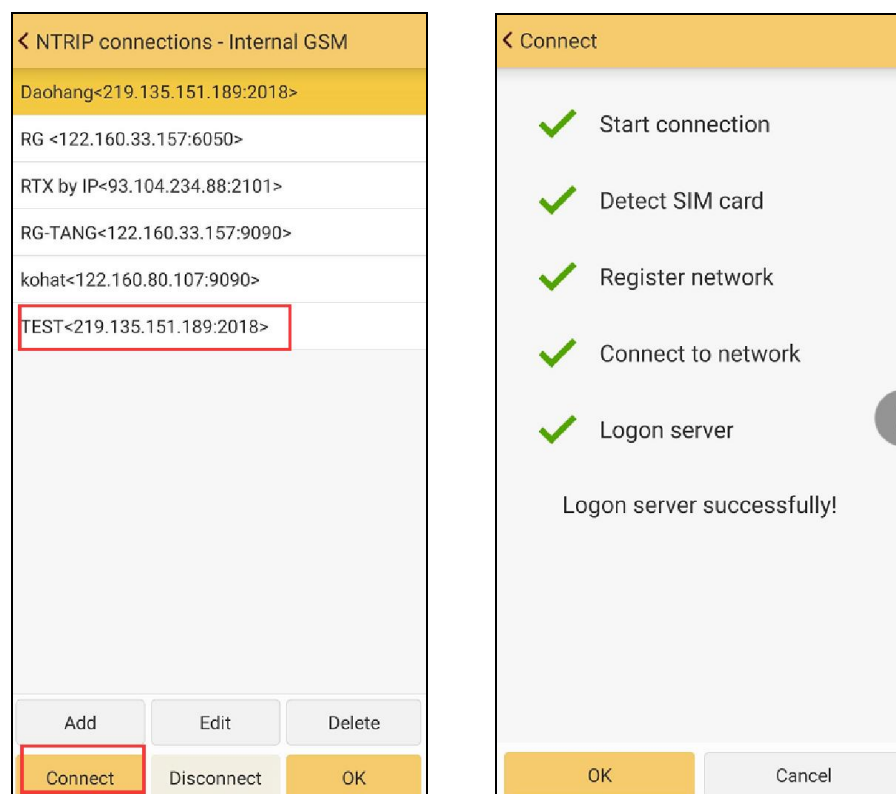
----Router mode as [Eagle mode(Network/Radio Mode)]

----Give an access point name, for example: inno4241 (Normally, give a name which is easy to remember, like Model+ last 4 digits of receiver serial number)

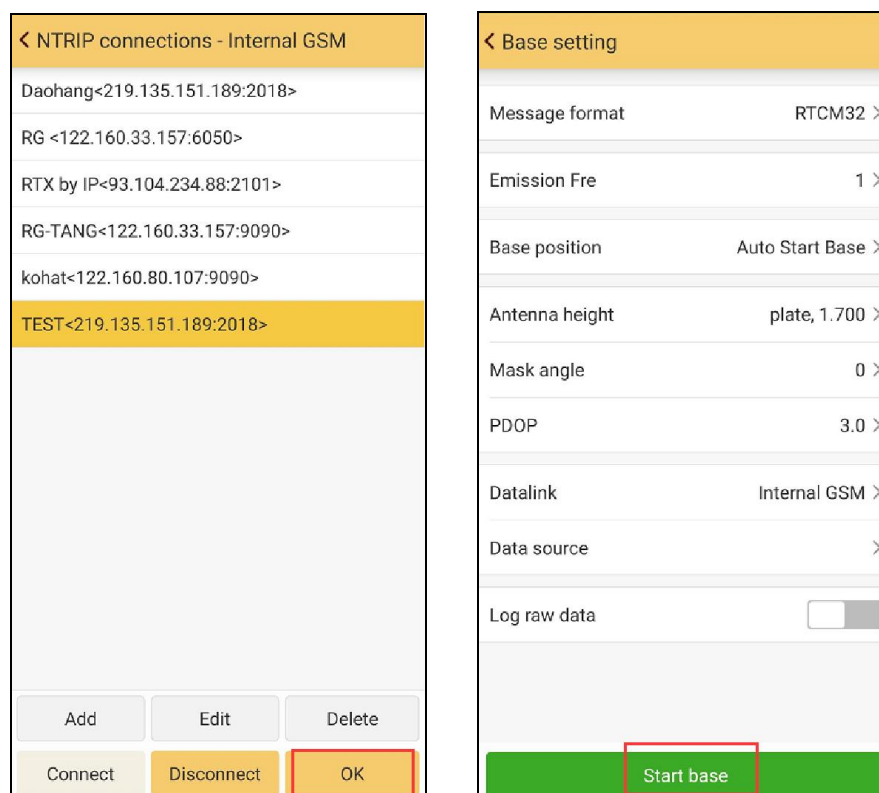
----APN: input your local APN which is used for your phone cellular network setting.

After all settings complete, click OK.

From below figure selected the connection name [**TEST**], click [**Connect**] button, then the receiver will start dialing to cellular work and connected to server.



Above figure shows the base receiver has logged on to server successfully. Meantime, voice message [Succeed to dial, succeed to log onto server] will come.



From above figure, Click OK, then click [Start base]. Now base is transmitting successfully

via cellular network and the datalink indicating light on front panel will flash regularly (it flashes every second)

Next time, when the receiver is powered on, it will automatically dial to cellular network, transmit differential correction data automatically and meantime voice message will come [Succeed to dial, succeed to log onto server].

§5.2 Set Rover (Datalink: cellular network)

Insert a SIM card to rover receiver.

Set the rover receiver work mode and datalink mode from receiver's touch screen.

----Swipe left the touch screen, [**Mode select**] --[**Rover mode**]

----Swipe left the touch screen, [**Set datalink**] --[**Cellular network**] --[**SIM card**]: select external SIM card.

The work mode and datalink mode also can be set in EGStar.

Launch EGStar 5.0 and connect the rover receiver and controller by Bluetooth. Then [**Settings**]-[**Rover**] to make below settings:

Data link: choose Internal GSM, then click [**Data source**]:

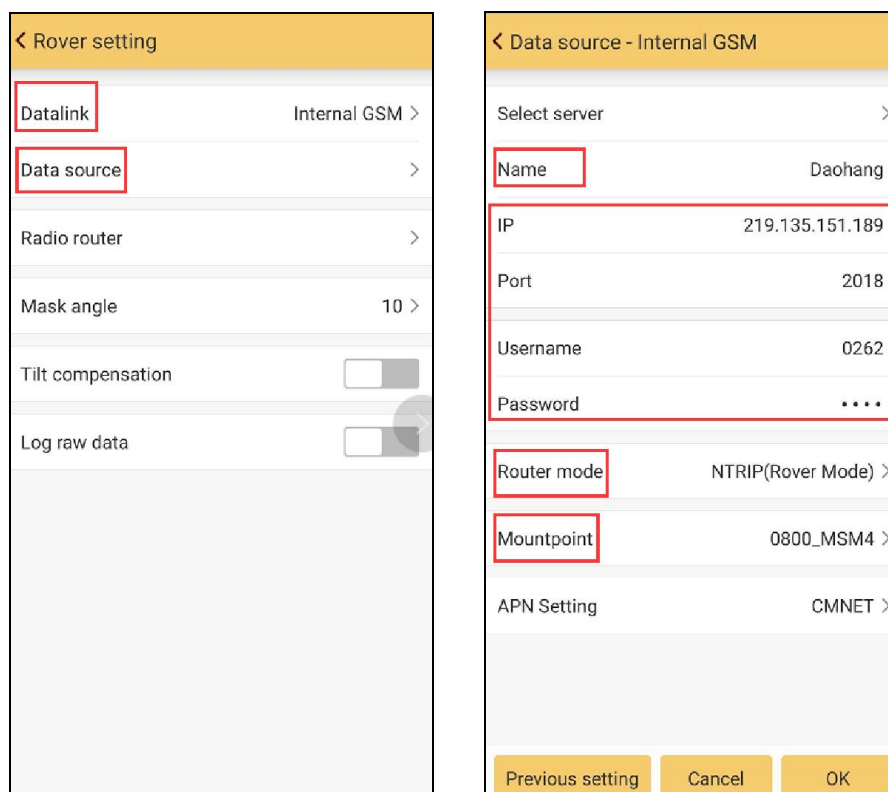
----Give this connection a name, for example [Daohang]

----Input the server IP and port (the same as the setting for base receiver), for example: IP (219.135.151.189), Port (2018) and user name and password

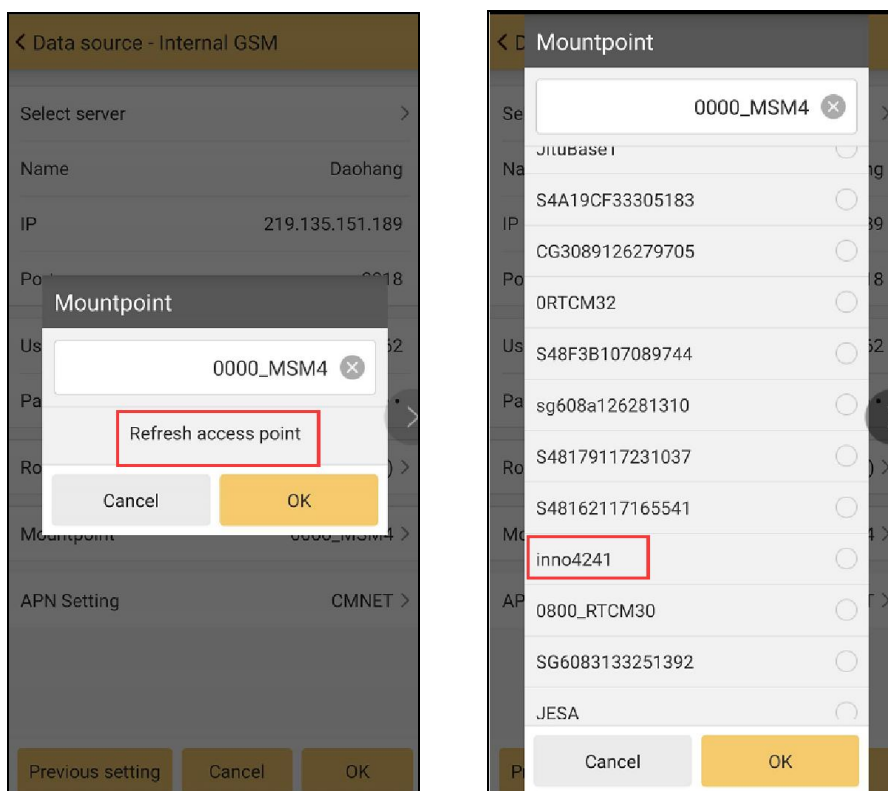
Note: User name and password: need to input the correct user name and password.

----Router mode as [NTRIP (rover mode)]

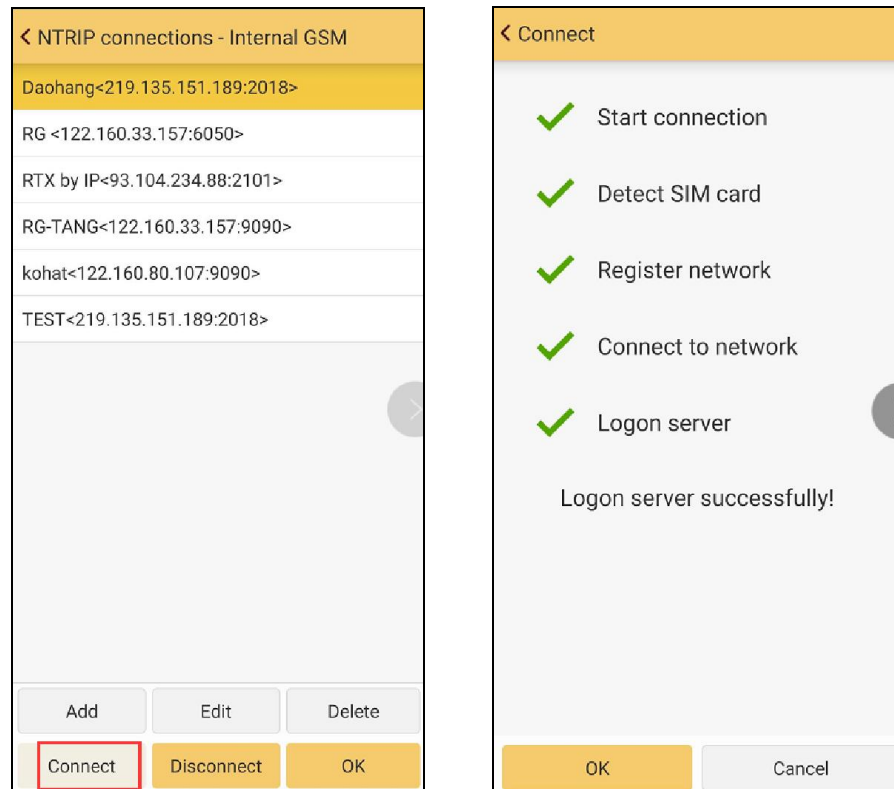
----APN: input your local APN which is used for your phone cellular network.



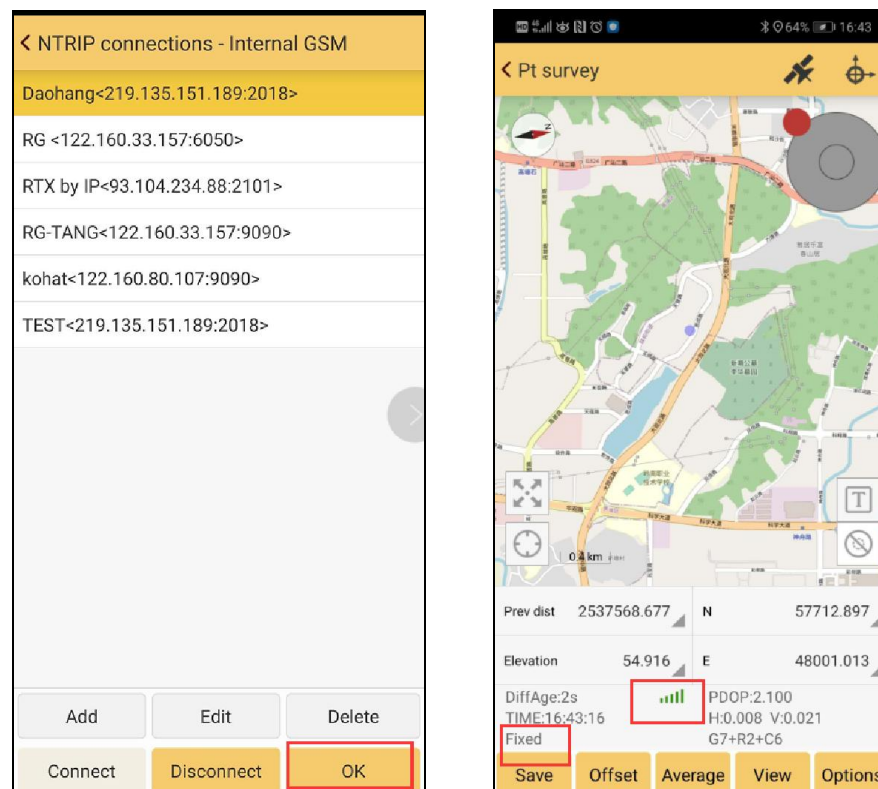
Click [**Mount point**], then click [**Refresh access point**] as below figure.




Select the Base's access point[inno4241] from the pop up access point list to connect.



From above figure, click [Connect] button, it will start dialing to cellular network and logon to server.



From above figure, click OK, now all settings complete.

Get to [Survey]-[Store point] as above figure, you will find icon  become green which means the differential correction data transmitted by base receiver has been received and the solution is Fixed (as above figure). Now we can begin the survey work.

Next time, when receiver is powered on, it will start dialing to cellular network and logon to server automatically. Within a few minutes, it will reach Fixed solution.

§5.3 Set Rover (access to CORS)

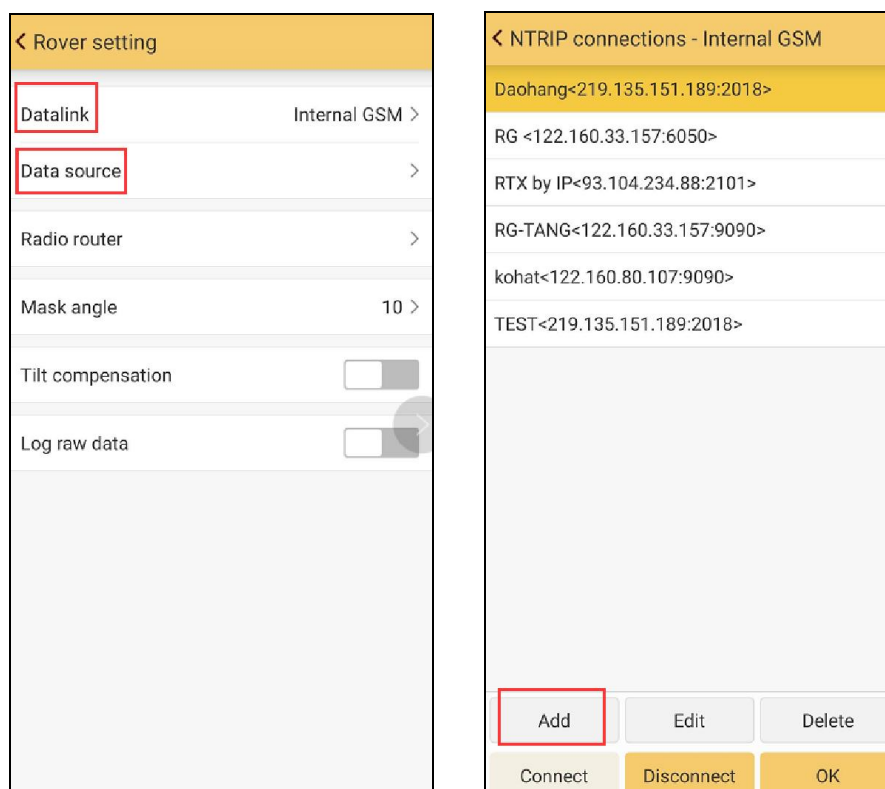
Set the rover receiver work mode and datalink mode from receiver's touch screen.

----Swipe left the touch screen, [Mode select] --[Rover mode]

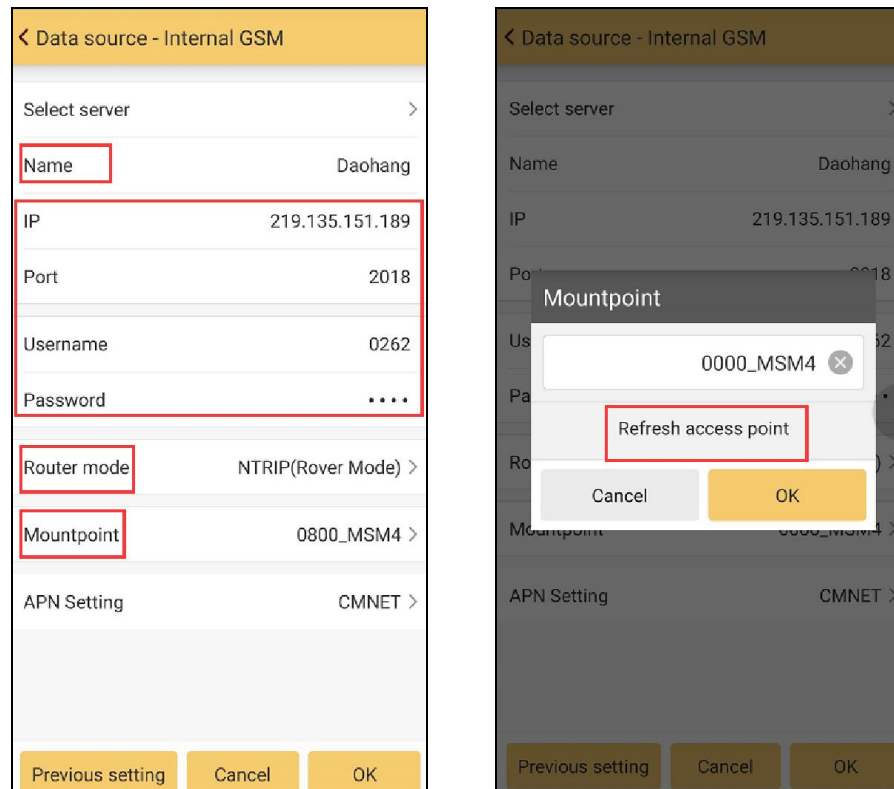
----Swipe left the touch screen, [Set datalink] --[Cellular network] --[SIM card]: select external SIM card.

The work mode and datalink mode also can be set in EGStar

Launch EGStar 5.0 and connect the rover receiver and controller by Bluetooth. Then [Settings]-[Rover] to make below settings:



Data link: choose Internal GSM, then click [**Data source**]. In below figure, click [Add] button to add a connection (for example, Daohang).



----Name: to give a name for this new connection, for example Daohang

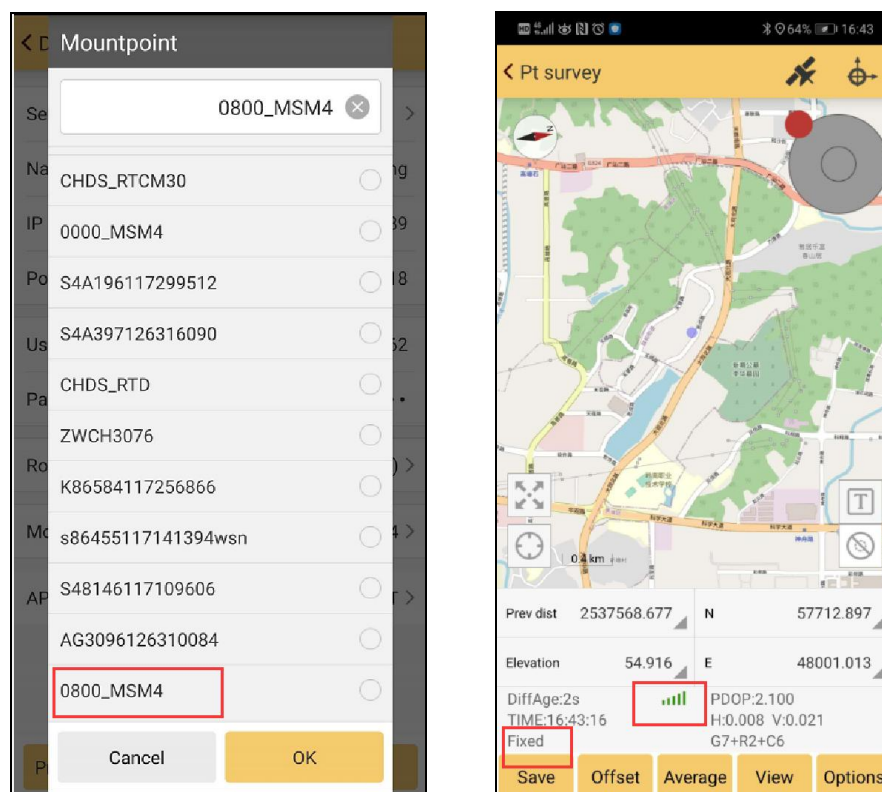
----Input the server IP and port (the same as the setting for base receiver), for example: IP (219.135.151.189), Port (2018), user name and password


Note: need to input the correct user name and password otherwise the rover can not visit the mount point.

----Router mode as [NTRIP (rover mode)]

----APN: input your local APN which is used for your phone's cellular network.

Click [**Mount point**], in above figure click [**Refresh access point**] as above figure, then select a CORS access point (for example 0800_MSM4) from the pop up access point list to connect(as below figure).



[EGStar]-[Survey]--[Store point], you will find icon  become green which means the differential correction data transmitted by base receiver has been received and the solution is Fixed (as above figure). Now we can begin the survey work.

Next time, when this rover receiver is powered on, it will start dialing to cellular network and logon to server automatically. Within a few minutes, it will reach Fixed solution.