Galaxy G2 Measuring System

User Manual

Contents

Chapter Ⅰ Preface

Read this chapter, you will have a brief knowledge of South Company and Galaxy G2 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 Galaxy G2 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 Applications

Control Survey: dual-band (dual-frequency) system static measurements can accurately complete the high-precision deformation observation, photo-control point measurement.
Highway Survey: quickly complete the encryption of the control points, road topographic mapping, cross-section measurement, profile measurement with EGStar.
CORS Application: provide more stable and convenient data link for field operations. It is seamlessly compatible with all types of domestic CORS applications.
Data acquisition measurement: perfect match South's various measurement software to do quick and easy data acquisition.
***Stakeout shot*:** large-scale point, line, plane lofting.
***Electric Power Measurement*:** power line measurement orientation, ranging, angle calculation.
***Marine application*:** oceanographic research, dredging, piling, inserted row, making the marine operations more convenient and easy.

§1.3 Main Features

Intelligent Platform

New generation of embedded Linux operating system platform improves RTK performance and work efficiency. Its operating efficiency is higher; a unique core processing mechanism which can respond to more than one command at one time; it starts faster and more responsive in real time. While the stability of system is much higher, it can be adapted to the job of longer uninterrupted power.

Internal Web UI management

Embedded Web UI management platform supports WIFI and USB mode connection. Users can monitor the receiver status and configure it via the internal Web UI management platform.

Bluetooth

Galaxy G2 is equipped with dual-mode Bluetooth v4.0 standard which is able to connect the other smart devices and compatible with Bluetooth v2.1 standard. It not only enlarges the work range but also makes the data communication become more stable.

WiFi

As the new feature and technology adopted on Galaxy G2, it not only can be used as data link to access to internet, but also can be as a hotspot which can be accessed by any other smart devices to configure the receiver.

Advanced InBuilt UHF module

Galaxy G2 adopts new and excellent datalink system, which is compatible with current radio protocols in the market, and realizes the random switching of the radio range 410MHZ-470MHZ and the power level as well. And the new protocol—"Farlink" is able to achieve the working range as 8km.

Upgraded network module

Standard 4G module is integrated which supports TDD-LTE/FDD-LTE 4G network and downward compatible with 3G and 2G network. Also supports all kinds of network types to access CORS seamlessly.

Speed Dial

Smart PPP dialing technology can auto dial which makes the Galaxy G2 keeping online continuously during the survey.

Intelligent Interaction

Support to access the internal web UI manage page of receiver with WiFi and USB connection, monitor host state real-time, configure receiver freely.

Full Constellations Tracking

Equipped with most advanced GNSS boards, Galaxy G2 system can track most signal from all kinds of running satellite constellation, especially support B1, B2 and B3 signal from BeiDou, also get position result with only BeiDou signal.

Electronic Bubble & Tilt Compensation

Galaxy G2 is integrated with a new generation IMU module which makes tilt measurement more stable, accurate and fast that without strict leveling the receiver to measure the point at will, it helps surveyors boost productivity by 30 percent.

Worry-free surveying

The new generation of SoC platform gives RTK more stable performance and lower power consumption. The built-in 6800mAh high-performance battery can support 15 hours of continuous operation. G2 adopts Type-C charging interface which supports PD rapid charging, the battery can be full charged in 3 hours that lasts full-day work.

Intelligent Storage

The raw data including STH, Rinex2.01 and Rinex3.02 not only can be saved in the internal memory (8G SSD), but also can be stored into an external USB device (OTG). The configurable sample frequency is really up to 20Hz.

Amazing Housing

With highly integrated and layered design, Galaxy G2 is smaller than typical Galaxy series receivers. And coupled with the magnesium alloy body shell, the weight of G2 is only 850g including internal battery, extremely light and convenient to carry.

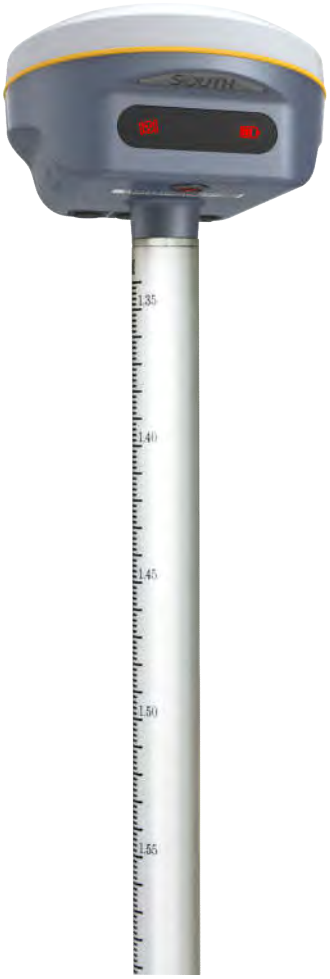
NFC Function

The internal NFC module can make the complicated Bluetooth communication easier and more simple.

Chapter Ⅱ Hardware Component

Reading this chapter, you can grasp the components, installation and the function of Galaxy G2 measuring system

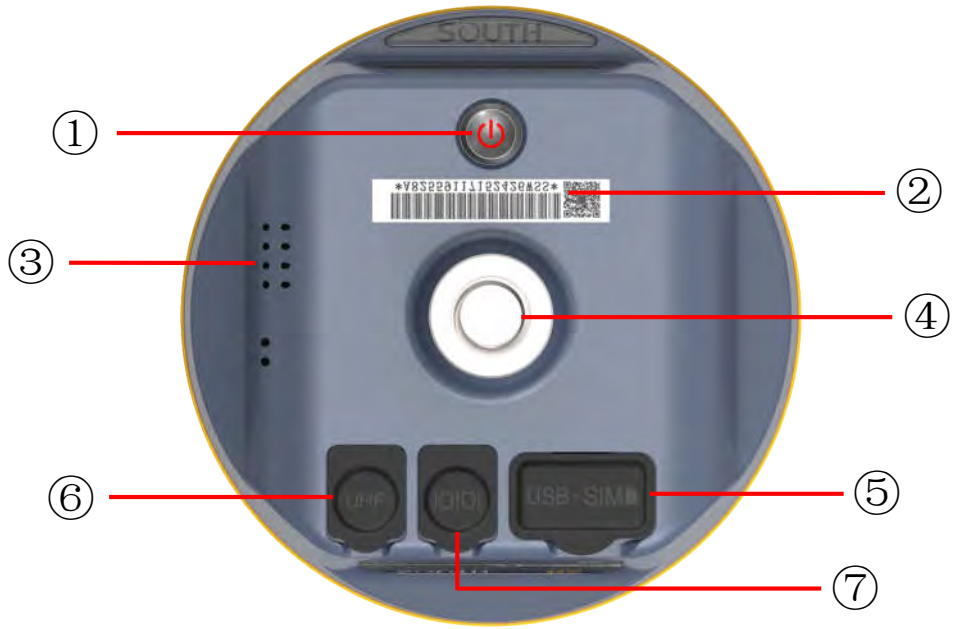
The overall appearance of Galaxy G2 is round and flat, with a height of 85mm and a diameter of 130mm. It looks elegant, strong and durable. And it adopts a combination design of voice and buttons, easier to operate. The bottom of the receiver has commonly used interfaces.



§2.1 Front Components

Ref	Component	Description
①	**GNSS Antenna**	Grasps satellites signals
②	**Satellites Indicator**	Flashes in red to indicate that the satellites are tracking by 0.2s interval, repeat in every 10s.
③	**Data Indicator**	**UHF mode:** Flashes in red to indicate that the signal is receiving/transmitting with the interval. **GPRS mode:** 1) Rapidly flashes in red to indicate that the receiver is dialing; 2) Flashes in red with the signal receiving/transmitting interval when successful dial. **WiFi mode:** 1) Rapidly flashes in red to indicate that the receiver is establishing WiFi connection; 2) Flashes in red with the signal receiving/transmitting interval when successful connection. **Static mode:** Flashes by the data sampling interval to indicate the data file is recording.
④	**Bluetooth Indicator**	Glows in red to indicate that Bluetooth connection has established between controller and receiver
⑤	**Power Indicator**	Glows in red to indicate that there is enough power for working; Flashing in red means low power.
⑥	**Charging Indicator**	Glows in blue to indicate that the battery is charging, and turning into green means the battery is full charged.

§2.2 Bottom Components



Ref	Component	Description
①	**Power button**	Power on/off receiver; Switch and confirm working mode; Perform self-check operation.
②	**SN label**	Apply for a registration code, Bluetooth ID
③	**Speaker**	Mode setting and working status prompt
④	**Screw hole**	Fix the mainframe to the tribrach or the pole
⑤	**Type-C USB port & SIM card slot**	USB for data transmission, OTG interface and Ethernet port for login web interface, battery charging port. Inserting a **Micro SIM** card when the receiver is set in GPRS mode
⑥	**UHF antenna interface**	Install UHF antenna
⑦	**5-pin LEMO port**	1, As a power port connected with an external power supply device; 2, as a differential transmission port connected with an external radio; 3, as a serial port to check data output and debug

ChapterⅢ Hardware Operation

§3.1 Power on/off

Power on

Press the power button for once, all the indicators glow in red, after few seconds (around 10 seconds), the instrument completes initializing along with voice prompt about the working mode (for example, “Rover, internal radio mode”). After a while, instrument starts to track satellites.

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.

§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”).

§3.3 Mode selection

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 Galaxy G2 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 red 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 Galaxy G2 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 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 Galaxy G2 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 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: Galaxy G2 only supports the working mode selected by control panel, without datalink configuration.

§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 Galaxy G2 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
- Network module checking (GPRS module 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.

§3.5 USB mode setting

Press and hold the power button for about 15 seconds and pass over the foregoing states (power off, mode selection, self-check), Galaxy G2 will get into USB mode setting with voice message saying “start to set USB mode”, at this moment, release power button, the instrument repeats “ USB disk” and “ USB network interface” for optional, choose the proper mode and press power button to confirm.

§3.6 Factory reset

Press and hold the power button for about 20 seconds and pass over the foregoing states (power off, mode selection, self-check, USB mode setting), Galaxy G2 will get into factory reset progress with voice message saying “start to restore factory default”, at this moment, release power button, all the indicators glows and the instrument is performing the factory reset automatically. After this progress complete, the instrument will restart automatically with the factory default settings.

ChapterⅣ Web UI Management

§4.1 Overview

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 Galaxy G2 in real-time. The accessing way is not only by WiFi connection, but also can be USB mode.

§4.2 Access by WiFi

The WIFI hotspot is default broadcasted by Galaxy G2, 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 broswer, on the login interface, apply “admin” for the username and password.

For example, search the WIFI hotspot broadcasted by a Galaxy G2 receiver using a laptop PC, choose the WIFI hotspot and click on connect button to establish the connection without password.

Run IE broswer 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.

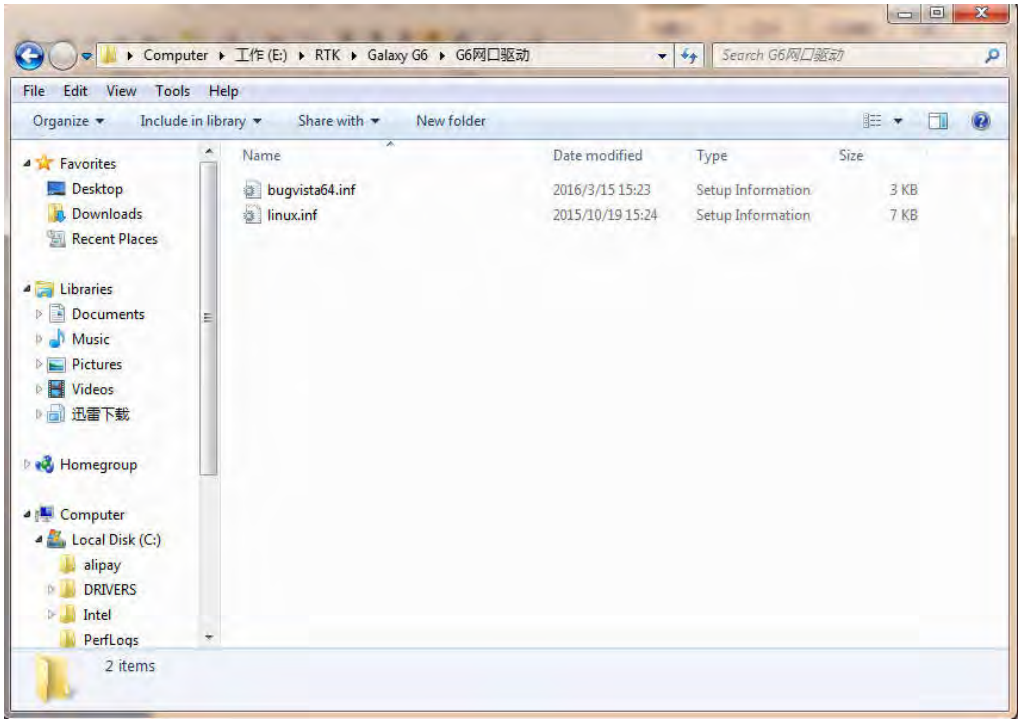
§4.3 Access by USB

On this mode, the Type-C USB port of Galaxy G2 must work as an Ethernet port, then internal web UI shall be accessed via USB cable connection with computer.

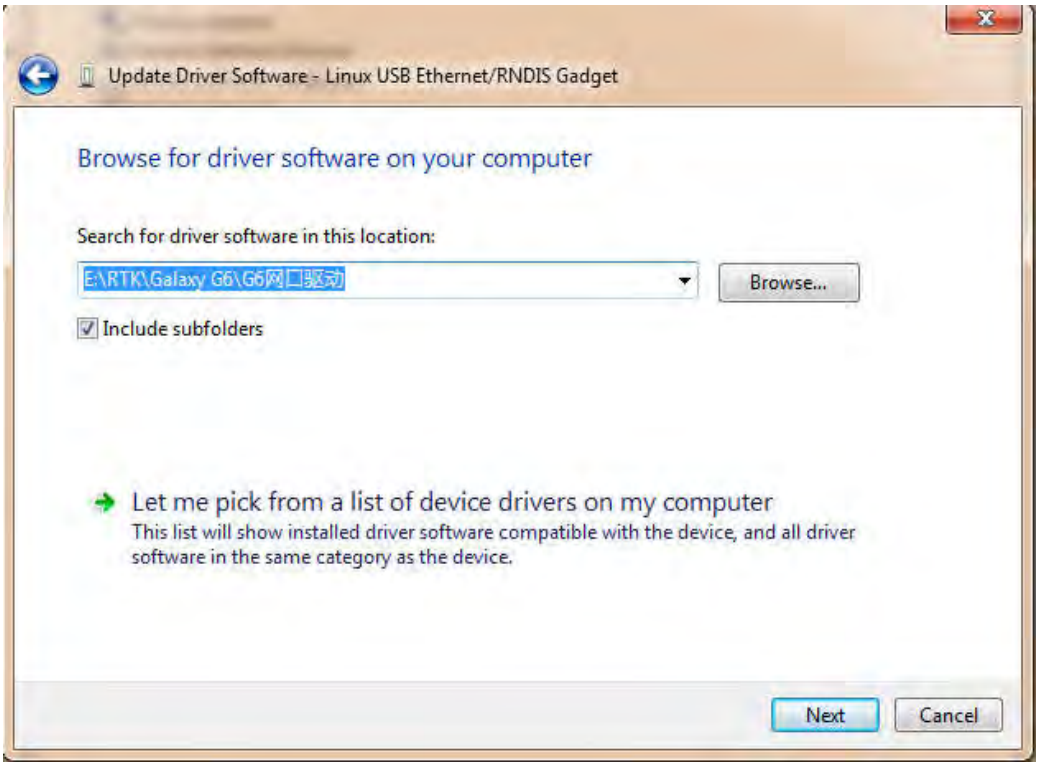
First of all, a corresponding driver is required to install to the computer, then this function could be activated.

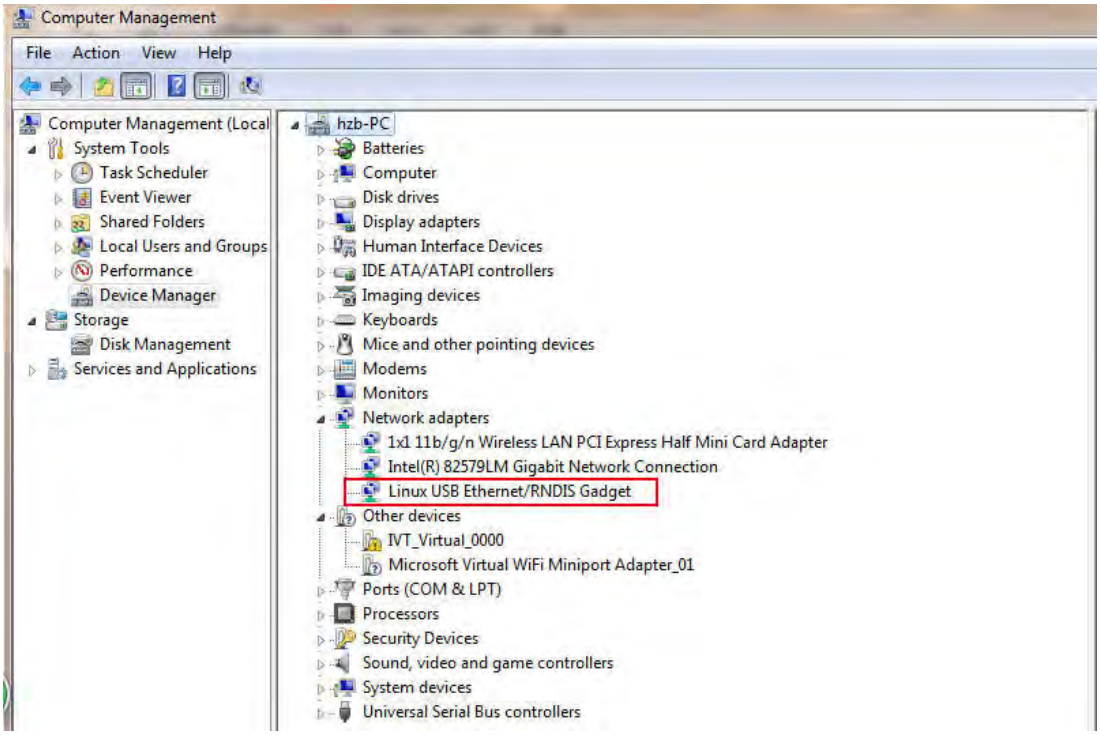
Due to different operating system is installed on computer, the drivers should be applied to a suitable one. The file bugvista64.inf is applied to 64bit operating system, and linux.inf is for 32bit operating system.

Make sure that the USB port (Type-C) is switched into USB network interface (please refer to section 3.5, USB mode setting).



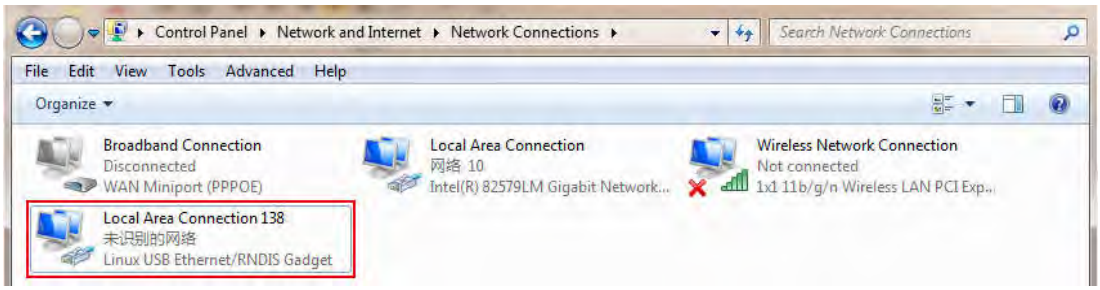
Choose the folder which contains the drivers





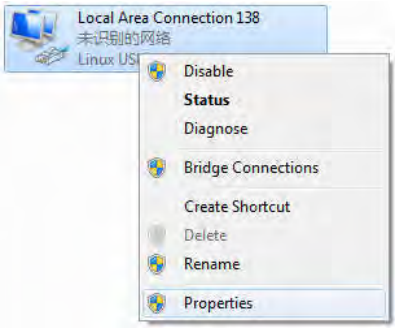
NOTE: *The driver can be downloaded from official website automatically or please contact with us for more supports.*

If the driver has been successfully installed, the USB port of Galaxy G2 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 Galaxy G2 receiver to computer via USB network interface.

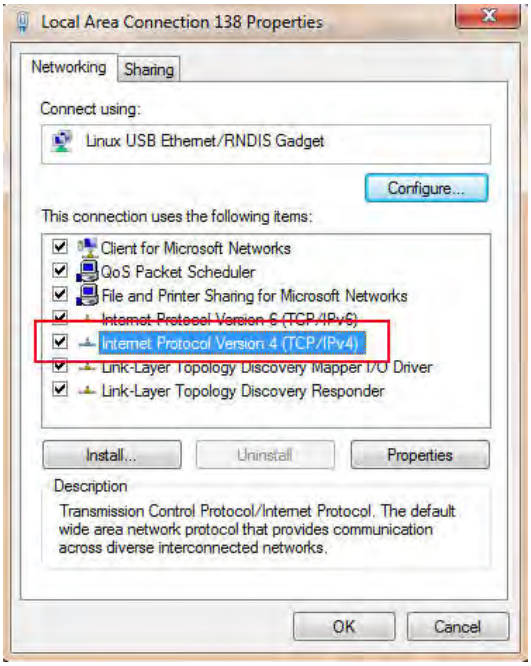


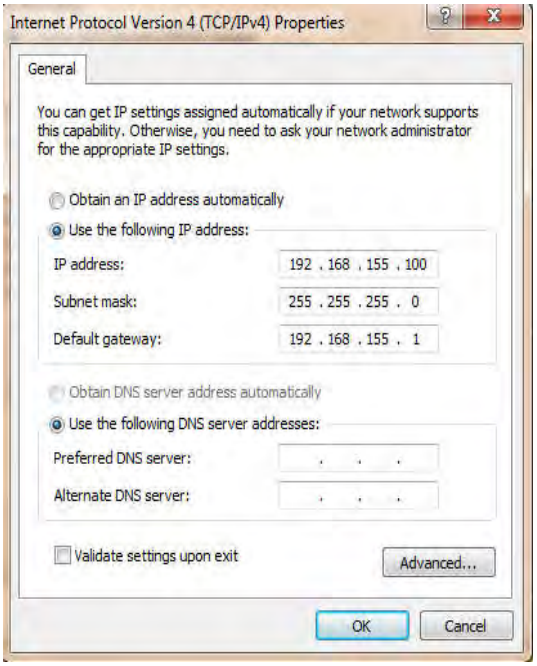
However, sometimes the computer cannot detect the receiver by USB network interface because there is something wrong with acquiring IP automatically, therefore, we need to do something to avoid such problem, that is to set a fixed LAN IP for the connection:

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 IE broswer 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.

Remote Login

If users would like to remote login the web UI of Galaxy G2, then Galaxy G2 has to connect to the internet and forward its 80 port to the public network. For example, if the IP address 222.196.35.76 is the public network IP which Galaxy G2 has connected, and the 80 port of Galaxy G2 has been bounded with 8000 in public network, then users can input the public network IP address into IE explorer along with the forwarding port for login. (http:// 222.196.35.76:8000)

NOTE: The IE explorer is recommended to use for the Web UI login.

§4.4 Web UI main interface

After login the Web UI management of Galaxy G2 by WIFI or USB connection, the main interface appears with displaying configuration items and positioning. As shown at following figures.

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

Ref	Component	Description
	Status	Positioning information, satellite tracking and the others will be displayed in this page
	Configuration	It contains registration for receiver, base configuration, antenna configuration, satellite configuration, receiver configuration and system configuration.
	Satellite Information	Display and control the satellites are used or not
	Data Record	Configure the parameters for static mode and raw data download
	Data Transfer	Contains NTRIP configuration, TCP/IP configuration and data transferring with PC
	Network Config	Contains network parameters configuration, WIFI configuration and the other functions

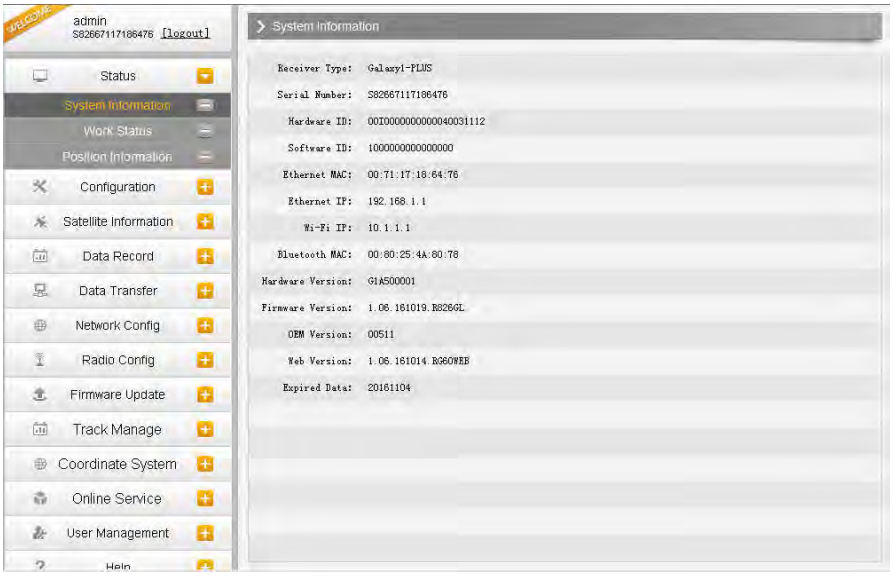
	Radio Config	Configure the parameters and frequency for radio modem
	Firmware Update	It is used to upgrade the firmware for receiver and each modem
	Track Manage	Record track file while doing measurement
	Coordinate System	Setup a local coordinate system for Galaxy G2
	Online Service	Upload data onto a server in real-time
	User Management	Add and manage the Web UI users
	Help	Offers solutions

§4.4.1 Status

System Information, Work Status and Position Information are listed under Status menu.

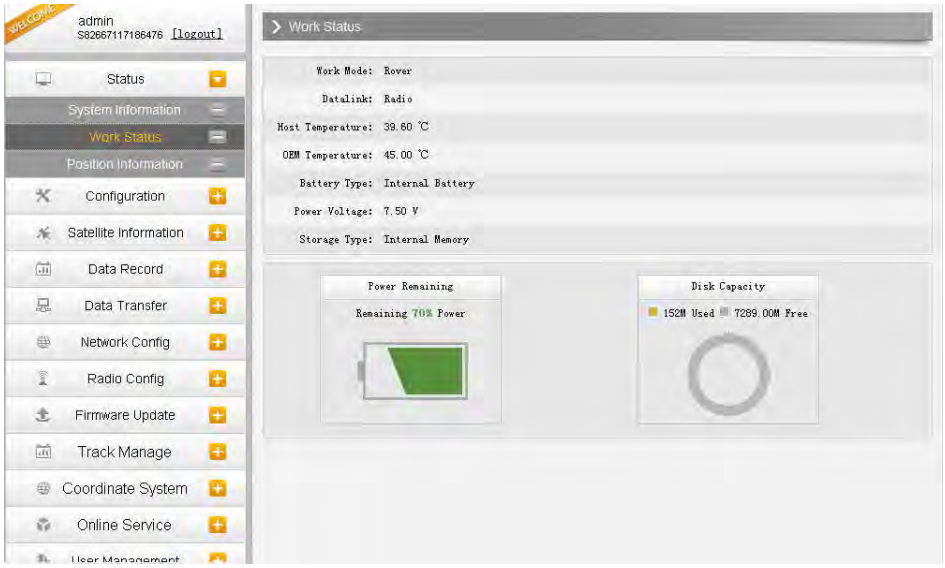
System Information

In this page, all the information of Galaxy G2 is diplayed such as serial number, hardware ID, MAC address, firmware version and so on.



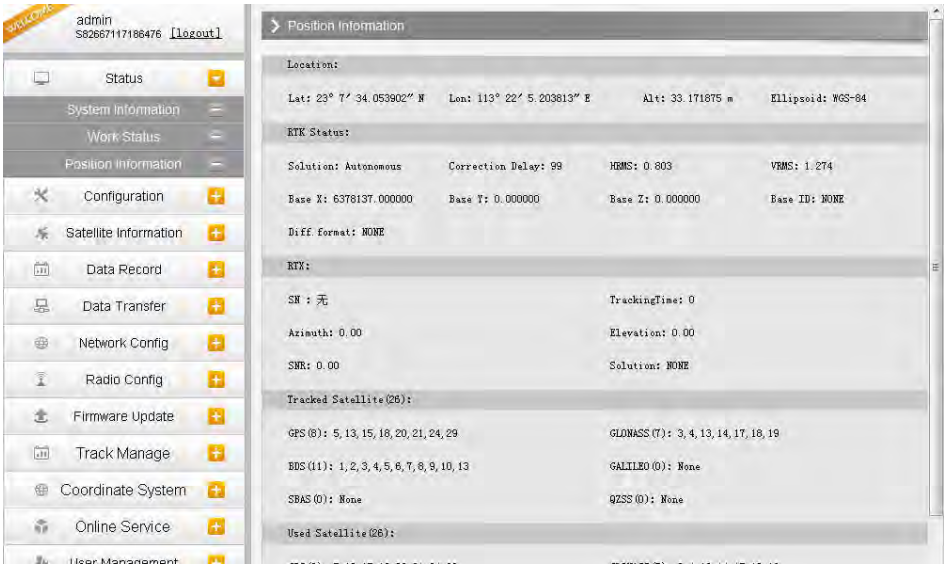
Work Status

The physical state of Galaxy G2 such as working mode, datalink, host temperature, remaining power and the free memory is obtained from this page



Position Information

In this page, users can be clear at a glance on current position information and satellite information

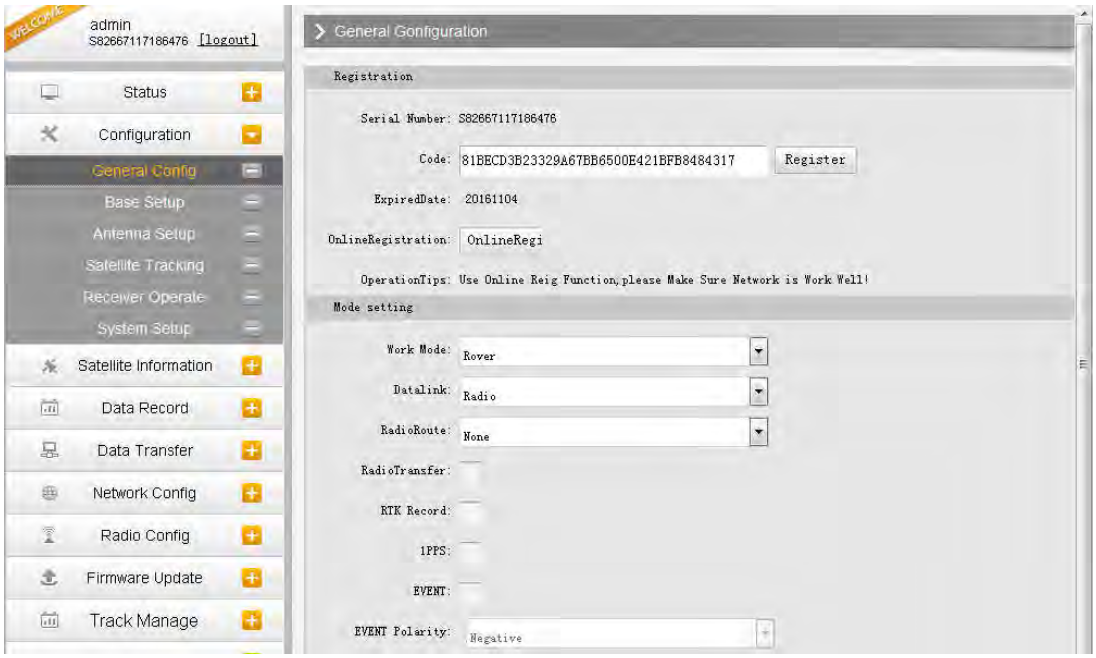


§4.4.2 Configuration

General Config, Base Setup, Antenna Setup, Satellite Tracking, Receiver Operate and Default Language are contained under Configuration menu. Users are able to configure all kinds of parameters for Galaxy G2 under Configuration menu, and all the settings are immediate effect after saving.

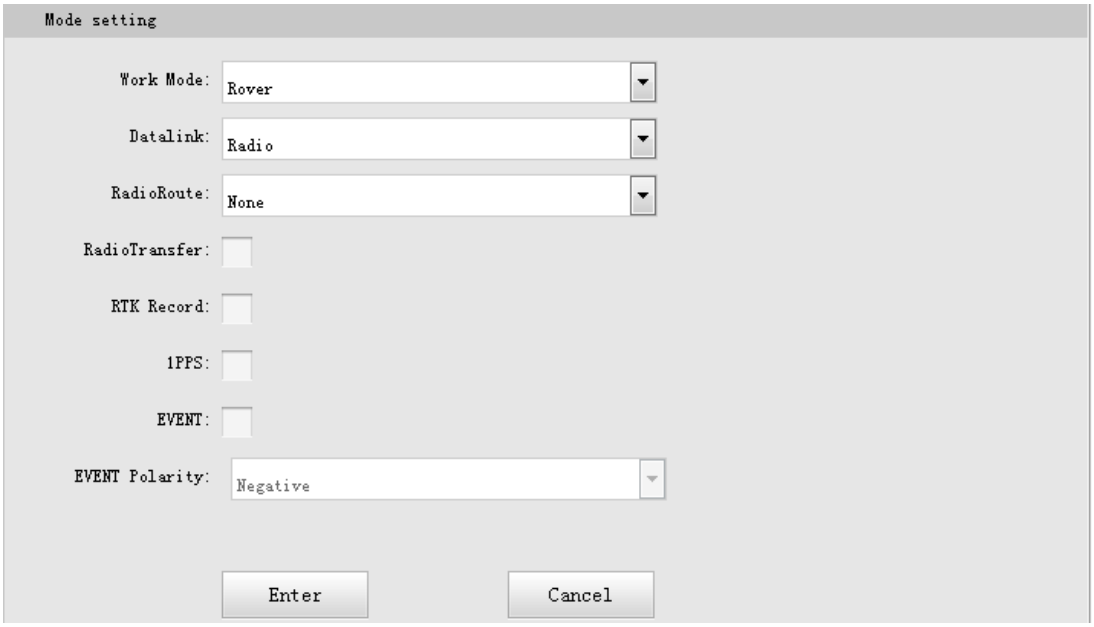
General Config

The registration for receiver working mode setting can be completed in this general configuration page.



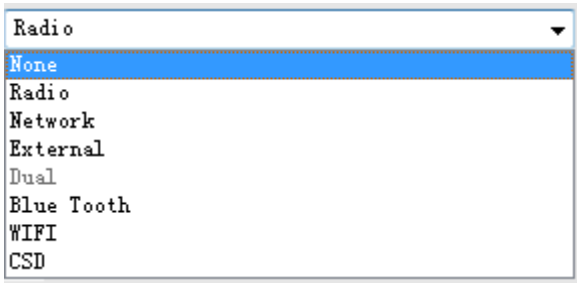
If the code of Galaxy G2 has expired or is going to be run out, please provide the serial number of your Galaxy G2 for us to apply for another available code, then input the code into the blank or register the receiver online.

Galaxy G2 allows users to setup the working mode and datalink from this Web UI that only need the mobile phone or tablet PC is able to connect the wifi hotspot of Galaxy G2.



Work Mode: There are Rover, Base and Static contained in this dropdown list

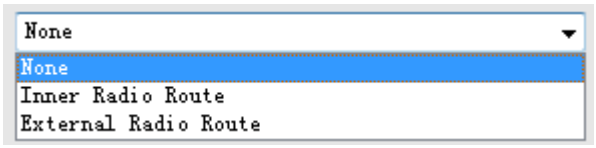
Datalink: Pull down the list, there will be all kinds of options for datalink, such as radio, Network, External, Bluetooth, WIFI and CSD.

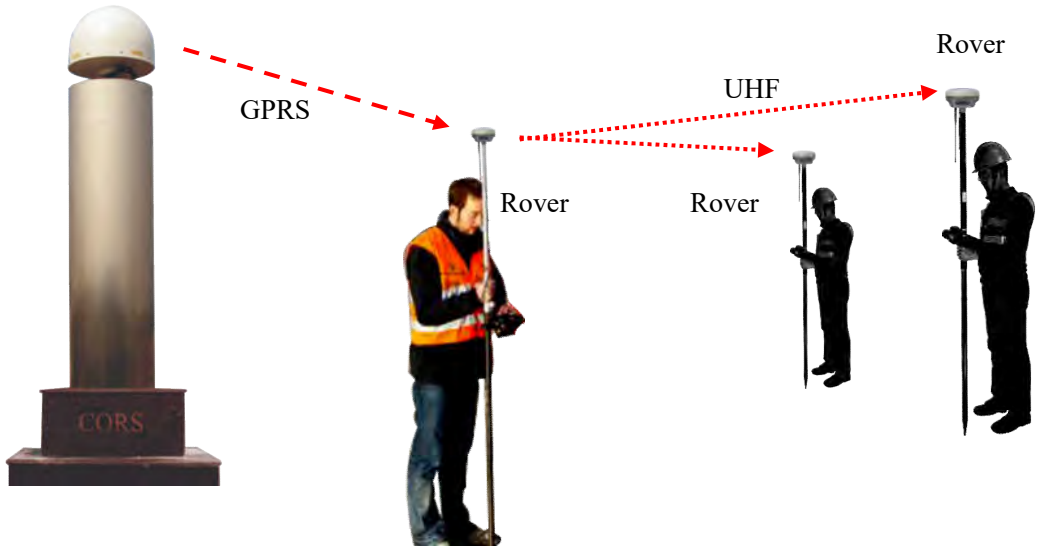


Radio Route: This feature is used to transfer the correction which from the reference station to the other rover by radio, the rovers will have the same reference coordindates. This is in the case of working in some places where there is poor signals from reference station or there is only a SIM card for a few rovers.

It is able to use internal radio or connect an external radio to transfer the correction.

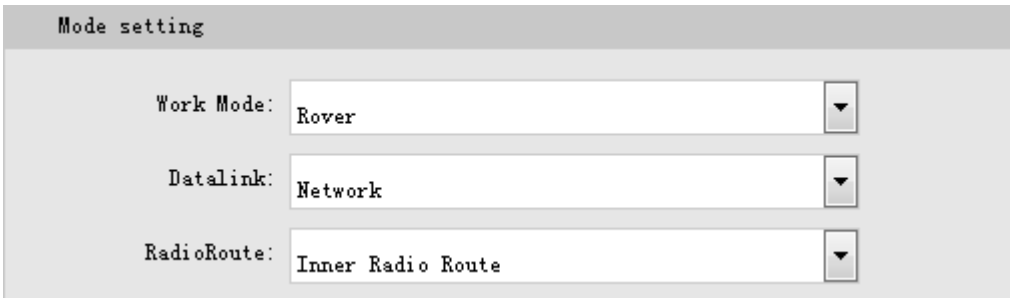
This feature is only available on Rover mode.



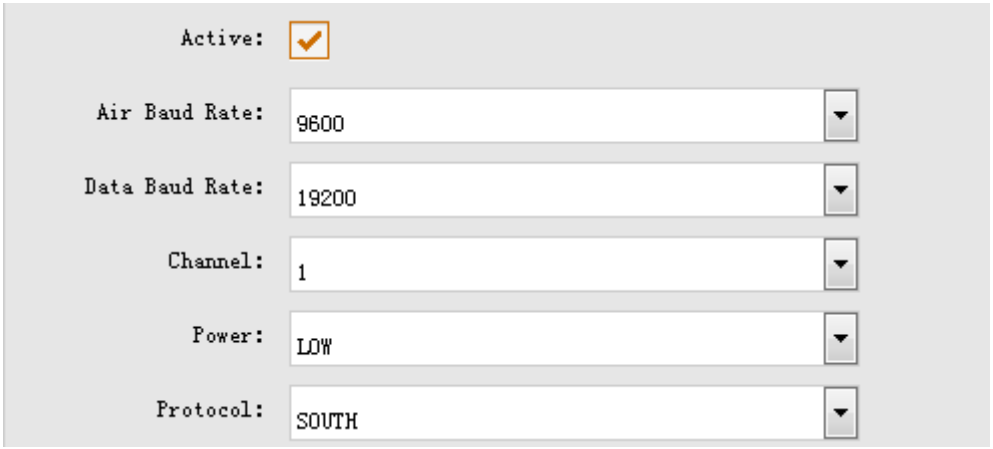


Operation:

1, choose “Inner Radio Route” and click “Enter” button to confirm the settings.

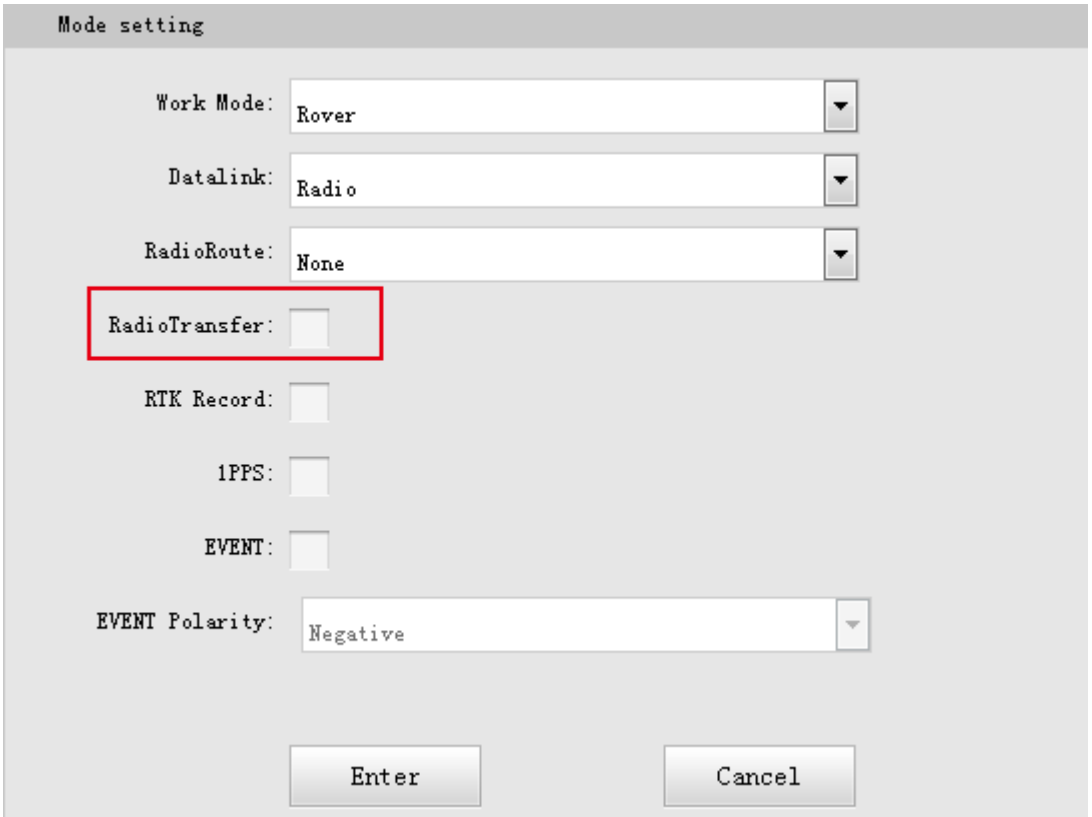


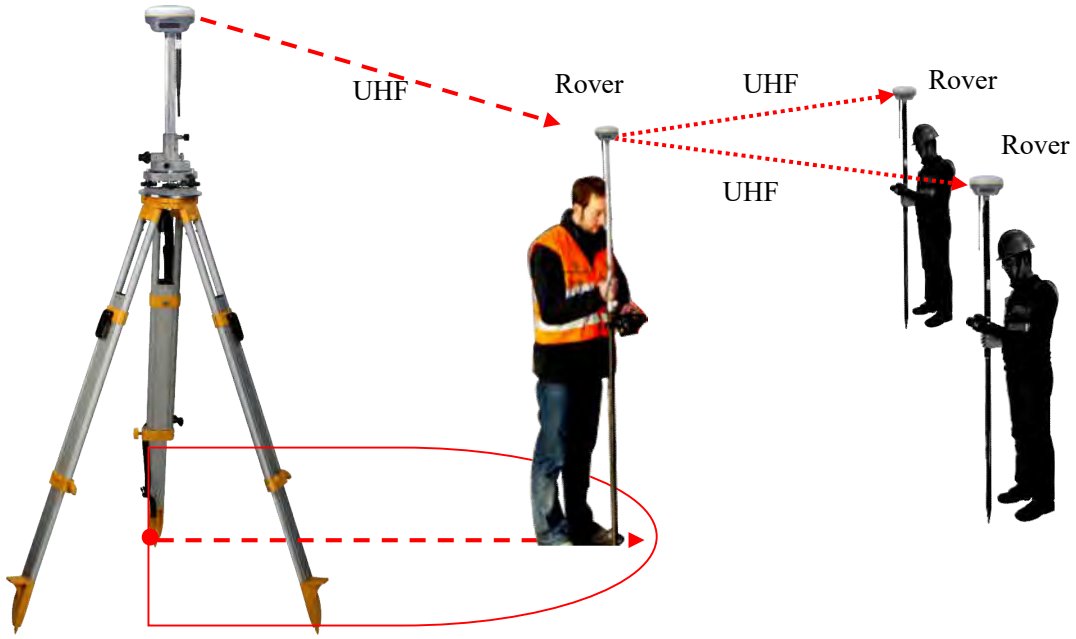
2, go to “Radio Config” page, check the channel, communication protocol and the frequency point of each channel.



3, configure the datalink of the other rovers into internal UHF mode, then make sure the channel, protocol and frequency point are same as “Route” rover.

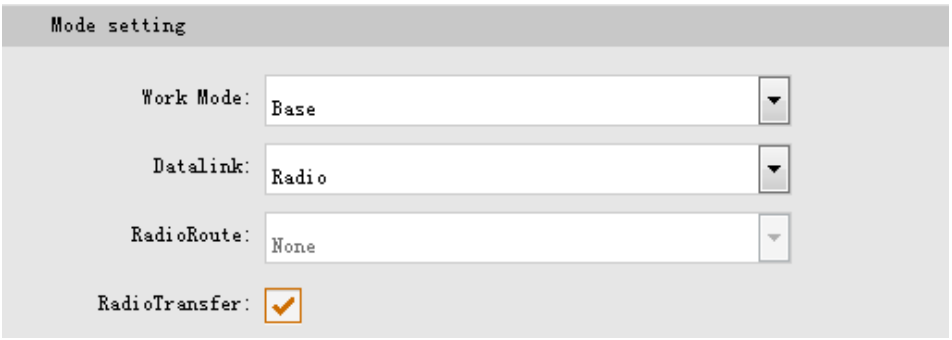
RadioTransfer: This is the function that Galaxy G2 is able to transfer the correction from Base station to the other rovers with the internal UHF, definitely, Galaxy G2 can work as a radio repeater.



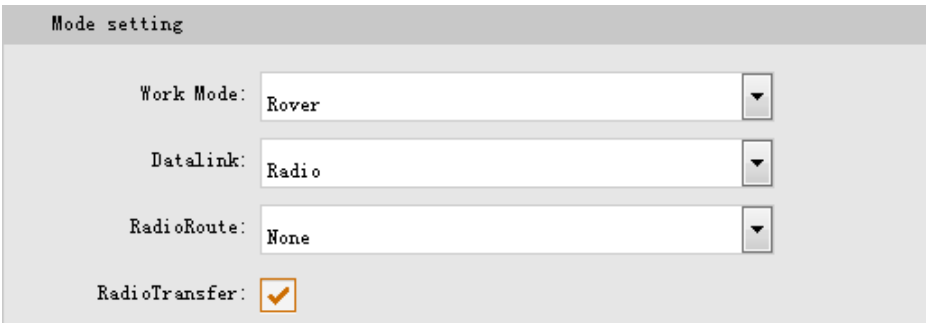


Operation:

1, check the box of "RadioTransfer" on "General Config" dialog for Base station.



2, open the same function for Rover in critical status (when the Rover is close to working distance of Base internal UHF).



3, configure the datalink of the other rovers into internal UHF mode, then make sure the channel, protocol and frequency point are same as “Repeater” rover.

Note: please take in mind that the “Repeater” rover should keep away from Base station to avoid signal interference.

RTK Record: This is used to enable raw data recording in base mode or rover mode for post-processing

1 PPS: This option is for the 1 pulse per second output

EVENT: This option is for the EVENT marker input

EVENT Polarity: EVENT input method.

Base Setup

When Galaxy G2 works as a base, the basic configuration for base can be setup in this page. Users can input the correct coordinates or capture a current position for the base. Also users can define what kind of correction format is transmitted.

CMR ID/RTCM2.X ID/RTCM3.X ID: Users can specify the ID for transmitting correction.

Position: Click this button to capture the coordinates for current position

Spare: This is used to the repeat station

Base Start Mode: Here contains 3 methods to start the Base, manually start base, automatically start base by fixed point, automatically start base by current point.

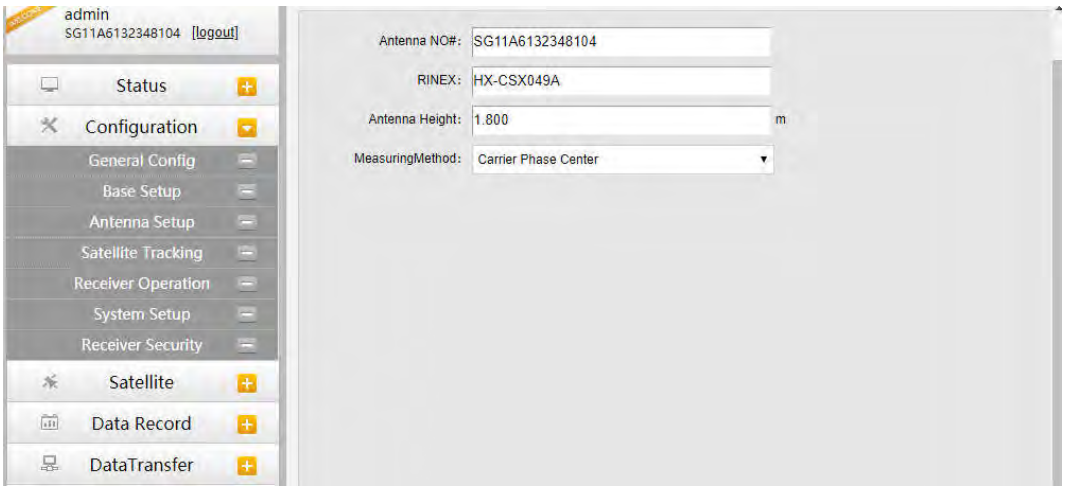
Correction: Here contains the global general used correction formats including RTD,RTCM23, RTCM30, RTCM32, CMR and SCMRx

POP Value: This value is setup for the PDOP limitation.

Status: Here will display the status for base in real-time.

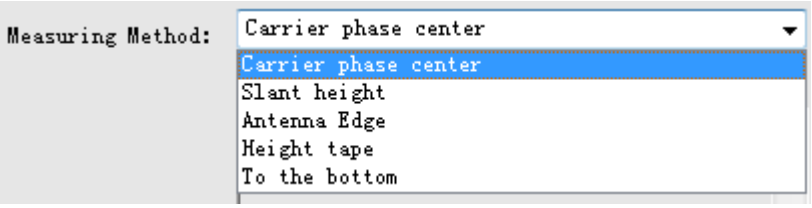
Antenna Setup

The antenna parameters are configured in this page including the antenna height, measuring method.



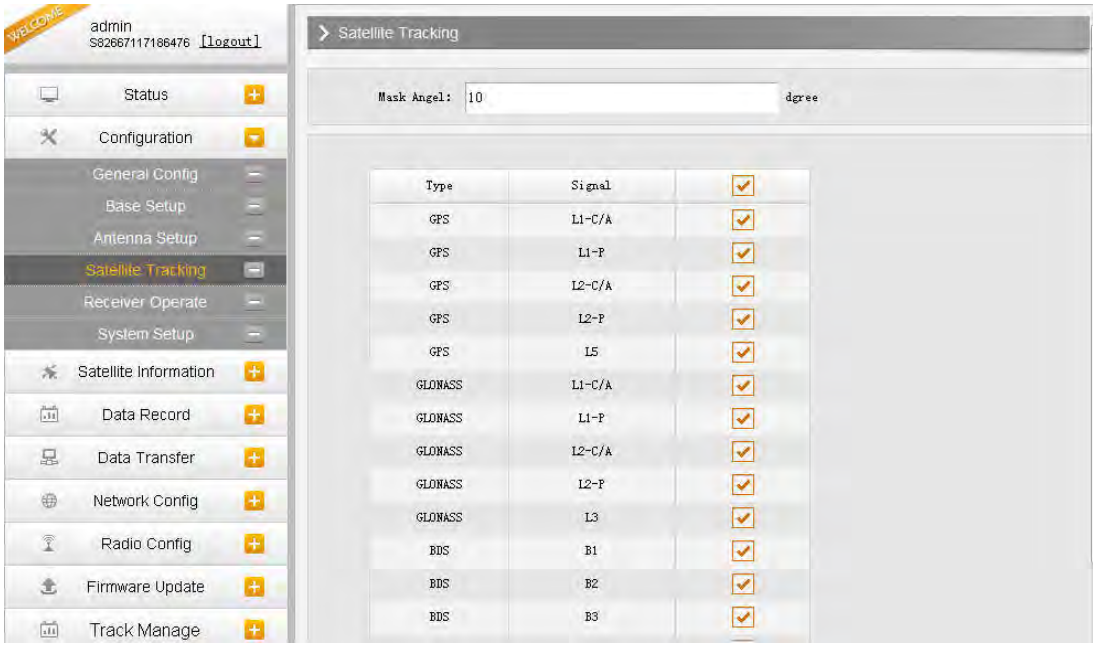
Antenna Height: This is the value for height of antenna while surveying.

Measuring Method: Here provides several methods for measuring the antenna height such as carrier phase center, slant height, antenna edge, height plate and to the bottom.



Satellite Tracking

In this page, users can define the mask angle for satellite tracking, and check on the box of corresponding band from the constellation that to use this band or not



Receiver Operate

The page provides all kinds of operations to control the receiver such as self-check operation, clean epochs, factory reset, reboot and power off.

Self-check: 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.

Clean EPH: Click this button to clear the remaining epochs to let recever track the satellites better.

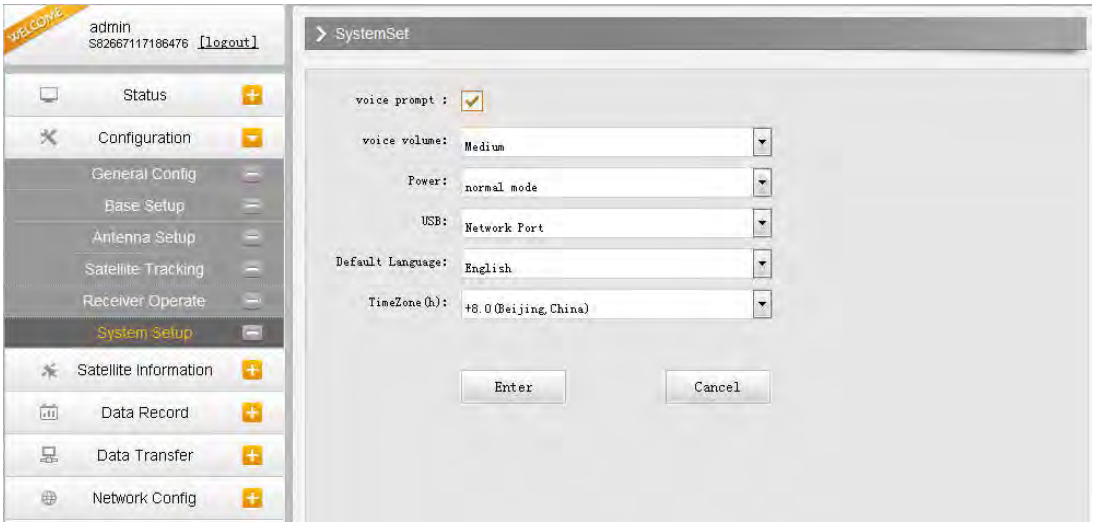
Factory Default: Click this button to bring the receiver back to factory default setting.

Reboot: Click this button to restart the receiver.

Power Off: Click this button to power off the receiver.

System Setup

This page is used to control Voice prompt, volume of voice, power saving, USB mode and the default language for receiver.



Voice Prompt: Check on this box to turn on the voice guide for Galaxy G2, uncheck it to turn off the voice guid.

Voice Volume: Define the voice volume for Galaxy G2's speaker.

Power: Configure the receiver to use the power saving mode or not.

USB: This is used to configure Galaxy G2 what kind of USB mode output from 7-pin port when connect the receiver with computer via USB cable. USB and network port for optional.

Default Language: Configure the default language for Galaxy G2 which associates with voice guid.

Note: This is not the language setup for web UI, the Web UI only supports Chinese and English.

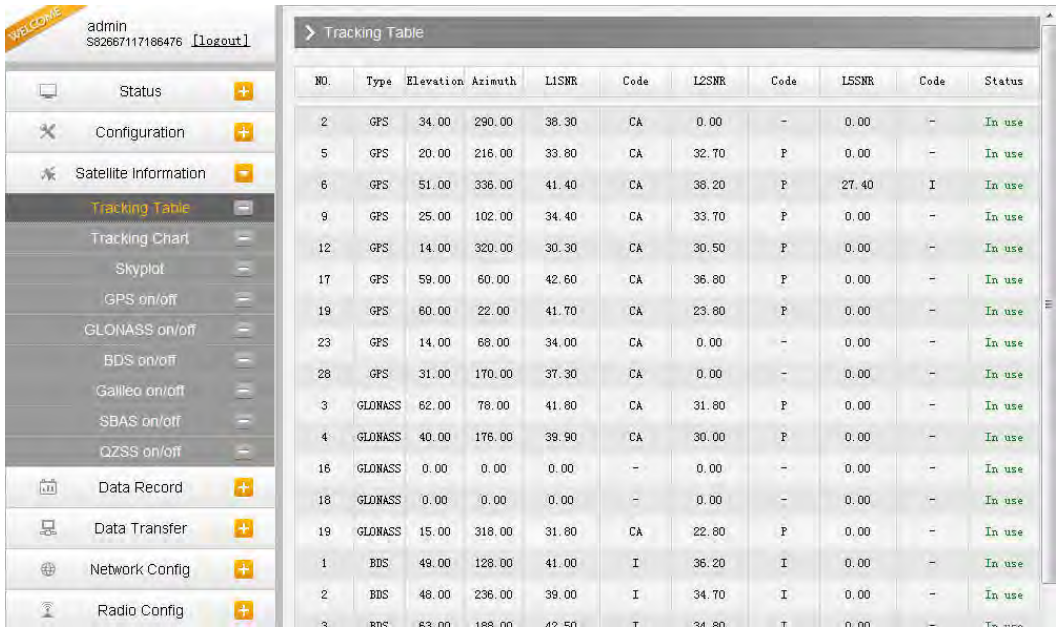
TimeZone(h): Use this to setup the corresponding time zone for your country or area.

§4.4.3 Satellite Information

The “Satellite Information” provides all kinds of tables, graph and the skyplot to view the information of tracking satellites. And it is allowed to configure to use which satellite in constellation on/off page by checking on the corresponding box.

Tacking Table

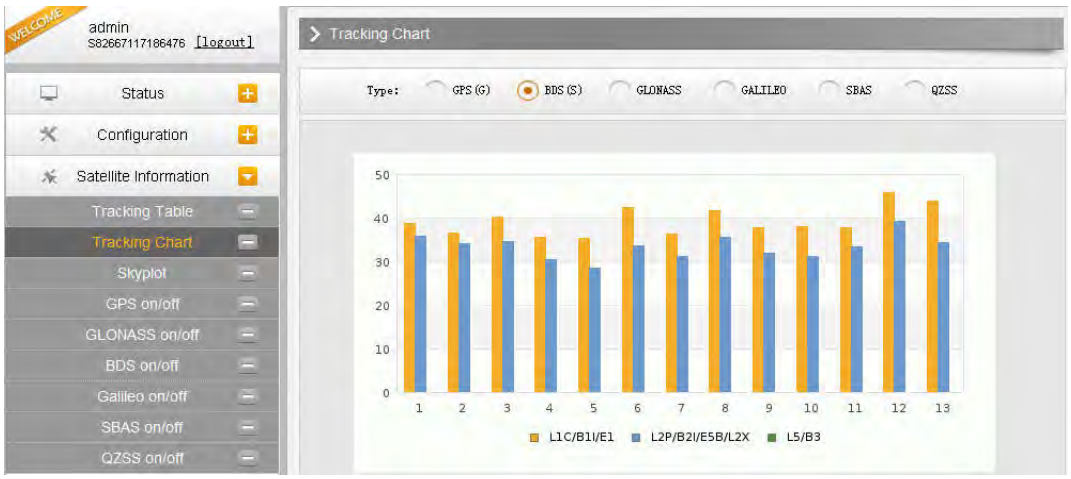
Here is the table to list all current used satellites and the other information for these satellites.



NO.	Type	Elevation	Azimuth	L1SNR	Code	L2SNR	Code	L5SNR	Code	Status
2	GPS	34.00	290.00	38.30	CA	0.00	-	0.00	-	In use
5	GPS	20.00	216.00	33.80	CA	32.70	P	0.00	-	In use
6	GPS	51.00	336.00	41.40	CA	38.20	P	27.40	I	In use
9	GPS	25.00	102.00	34.40	CA	33.70	P	0.00	-	In use
12	GPS	14.00	320.00	30.30	CA	30.50	P	0.00	-	In use
17	GPS	59.00	60.00	42.60	CA	36.80	P	0.00	-	In use
19	GPS	60.00	22.00	41.70	CA	23.80	P	0.00	-	In use
23	GPS	14.00	68.00	34.00	CA	0.00	-	0.00	-	In use
28	GPS	31.00	170.00	37.30	CA	0.00	-	0.00	-	In use
3	GLONASS	62.00	78.00	41.80	CA	31.80	P	0.00	-	In use
4	GLONASS	40.00	176.00	39.90	CA	30.00	P	0.00	-	In use
16	GLONASS	0.00	0.00	0.00	-	0.00	-	0.00	-	In use
18	GLONASS	0.00	0.00	0.00	-	0.00	-	0.00	-	In use
19	GLONASS	15.00	318.00	31.80	CA	22.80	P	0.00	-	In use
1	BDS	49.00	128.00	41.00	I	36.20	I	0.00	-	In use
2	BDS	48.00	236.00	39.00	I	34.70	I	0.00	-	In use

Tracking Chart

In this page, the histogram will indicate the signals from those used satellites, and allow to check each constellation separately.



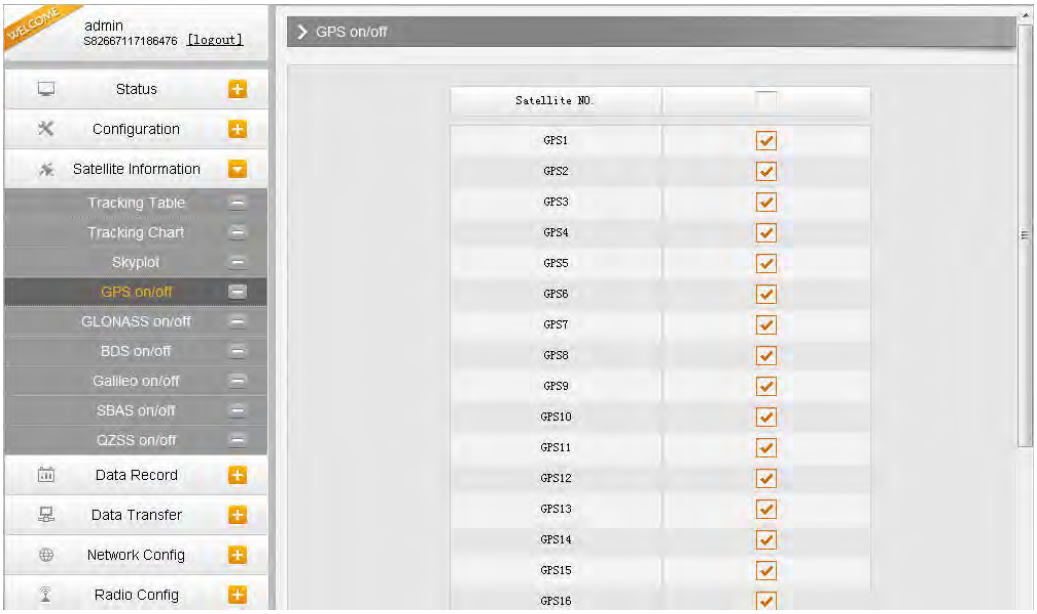
Skyplot

In this page, all the tracking satellires are shown on the skypolt, this let users intuitively view and know where the current position of satellite is.

GPS on/off

For all the running GNSS constellations or the augmentation system, Galaxy G2 allows to configure to use which satellite or not.

In gnss on/off page, all the running satellites are listed, and unselect the box corresponding to the satellite to not use it.

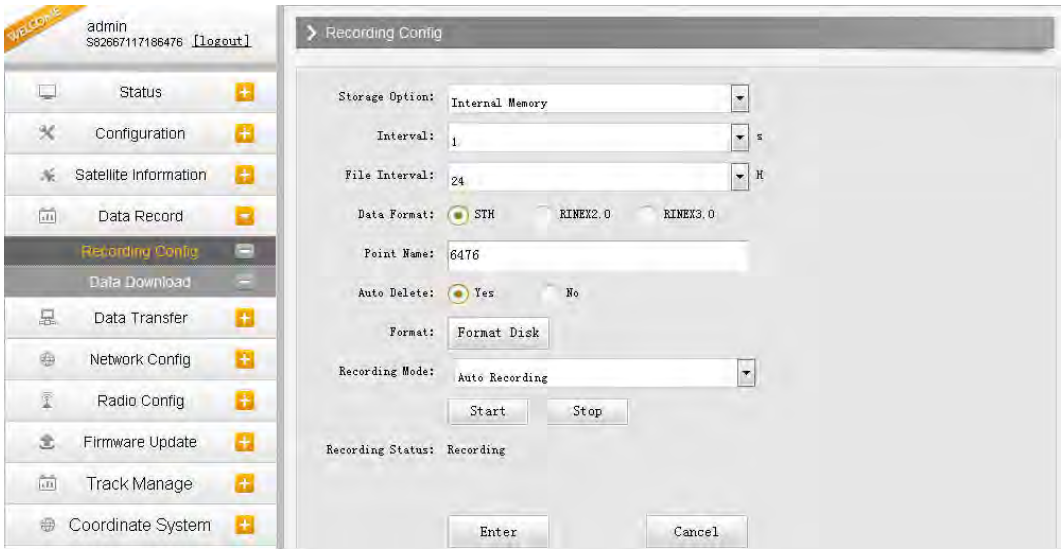


§4.4.4 Data Record

The “Data Record” performance is mainly used to configure all the parameters for receiver in static mode. Much more operations can be done on Galaxy G2 such as storage path, interval, data format and data files download.

Recording Config

The page provides more practical operations for raw data storage.



Storage Option: Here are the options to be selected for where the raw data will be stored, internal memory or external memory.

Interval: This is the sampling interval for data storage, 50Hz(0.02s) sampling interval now is available for Galaxy G2.

File Interval: This is used to defined the data storage time for the static file.

Data Format: Here are 3 options to selected for Galaxy G2 to store what kind of format data, STH, Rinex2.0 and Rinex3.0.

Point Name: A point name is required, the last 4 digits of SN is default setting for the point name.

Auto Delete: This is used to configured Galaxy G2 to delete the previous data files automatically if the memory is full.

Format: Click this button to format the internal memory for Galaxy G2.

Recording Mode: Here are 2 options to configure Galaxy G2 to record raw data automatically or not if it achieves the sampling conditions.

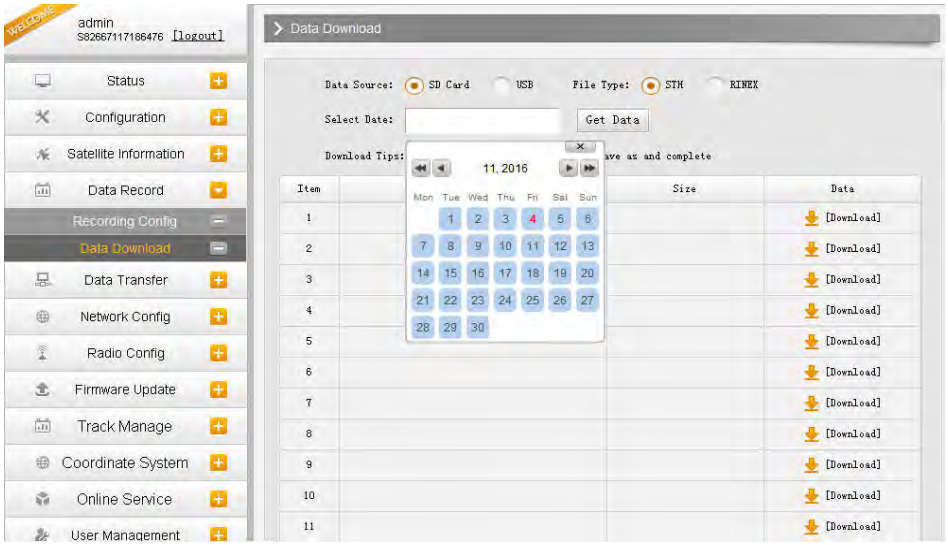
Start/Stop: Click these buttons to start recording or strop recording the raw data.

Recording Status: Here shows the status of static data storage.

Data Download

This page provides the data files to download

Choose the storage where the static data recorded, and file type, then click on the blank of "Select Date" to choose what date the data was recorded and click "Get Data" button, all the files recorded in the date you choose will show in the table, tap download button to download the data files.

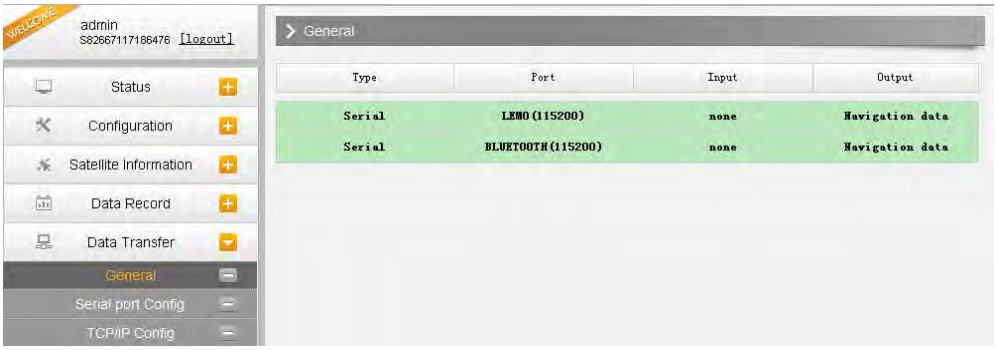


§4.4.5 Data Transfer

This performance contains General, Serial Port Config, TCP/IP Config, NTRIP Config and Data Flow Config. The "Data Transfer" allows to configure the output mode for raw observation data and differential data, as well as to the NTRIP performance configuration.

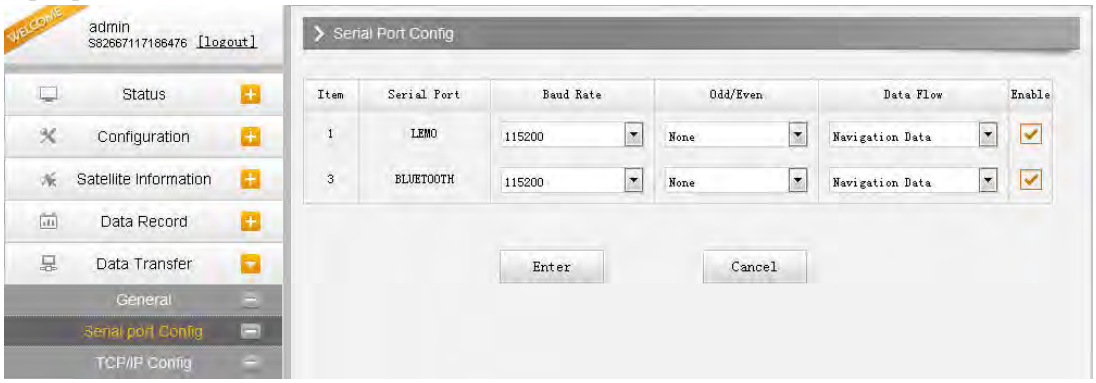
General

This page shows the service condition and the output contents of the ports, if the port item display in green, that means the port is being used, and the port is not used while the item display in red.



Serial port Config

This page is allowed to configure the baud rate, odd-even check and the data flow for serial port (5-pin port) and Bluetooth.



CAUTION: do not change the default value in this page for each item, if you want to change the settings, please contact with SOUTH technician for further support.

In the dropdown list of data flow, there shows 4 items for selection.

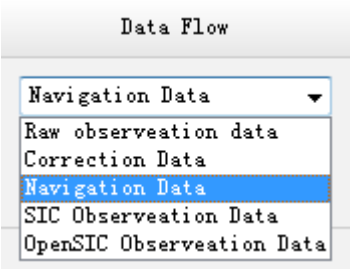
Raw observation data: This is the raw observation data straight from OEM board.

Correction Data: This is the correction data straight from OEM board.

Navigation Data: This is the navigation data output from receiver such as NMEA-0183, GSV, AVR, RMC and so on. It is configured in Data Flow Config page.

SIC Observation Data: This is the user-defined format observation data from SOUTH.

OpenSIC Observation Data: This is the open version of SOUTH user-defined format observation data for secondary development.

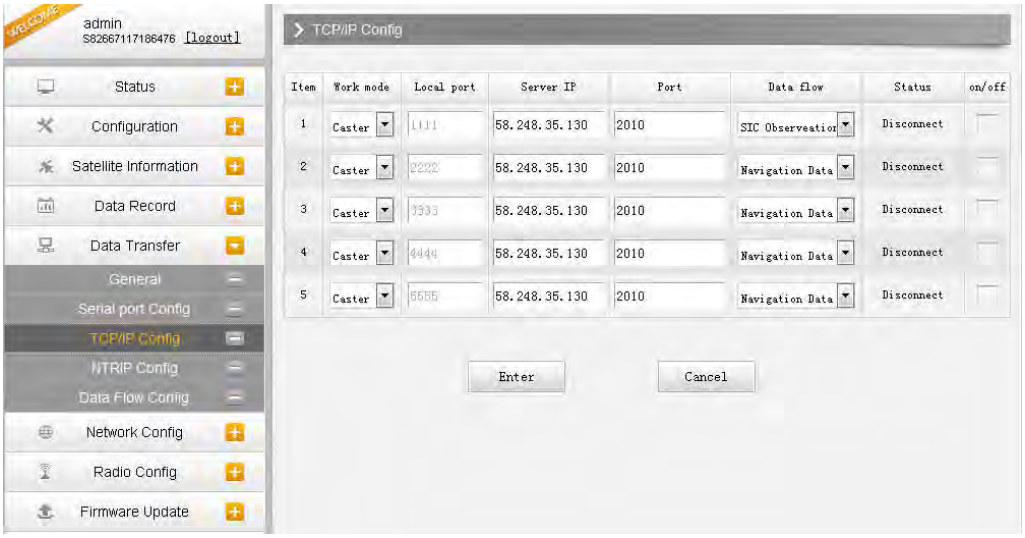


TCP/IP Config

This is used to configured the raw data or navigation data to be uploaded or transferred to a server. And there are Caster and Server working mode for this performance.

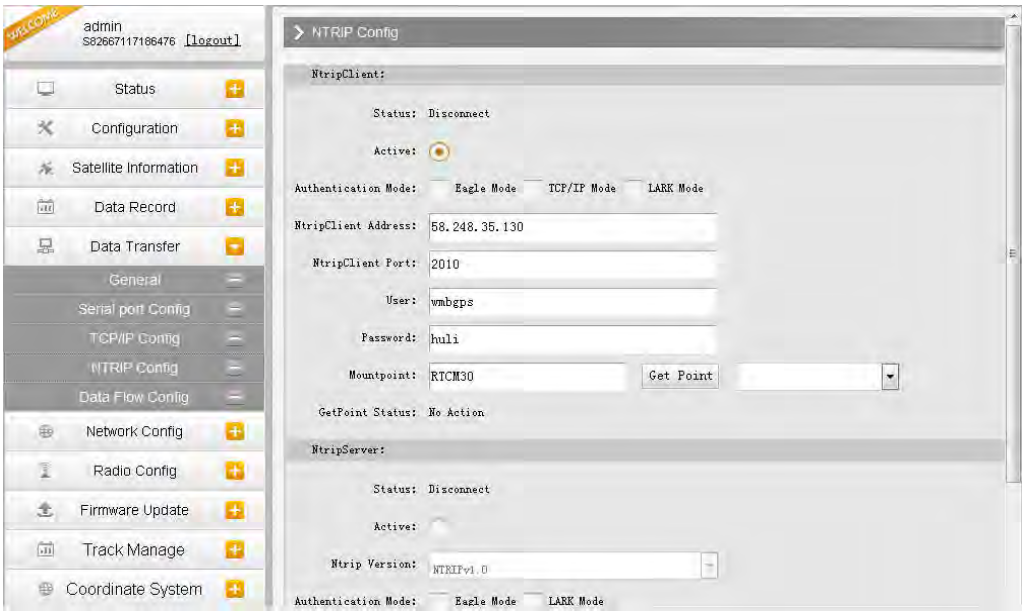
Caster: If this working mode is selected, GALAXY G2 will be a client to upload the data to a specify server if it connects to the internet by WIFI or GPRS connection with SIM card inserted. Input the specified IP and port for server, and the data format what is uploaded. Then users are able to see the uploaded data on server.

Server: Galaxy G2 will upload the data onto internet by the static WIFI if server is selected, then users are able to obtain its dynamic data by accessing to GALAXY G2 through the IP from receiver.



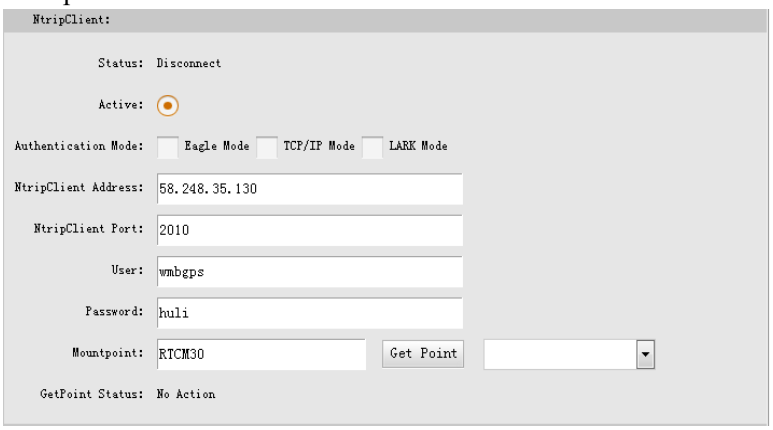
NTRIP Config

This is used to configure the NTRIP performance while receiver is going to connect to internet. Galaxy G2 supports complete NTRIP performance including NTRIP Client, NTRIP Server and NTRIP Caster.



NtripClient

This is the general used function for rover set in GPRS mode. At the field of NtripClient, the specify IP address, access port of reference station, as well as the assigned username and password shall be input for the NTRIP connection.



Status: This field will display the status of NTRIP connection, connect or disconnect.

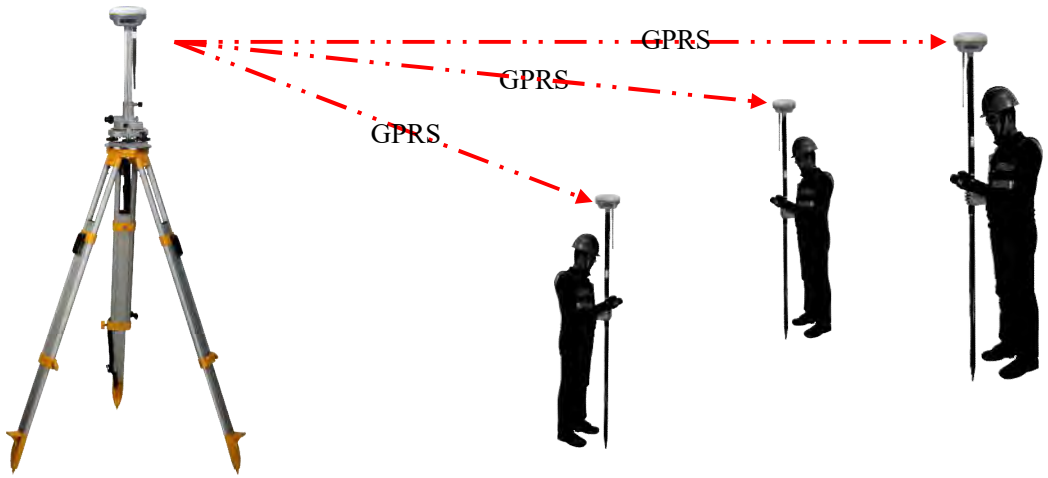
Active: Check on this circle to activate this function.

Authentication Mode: This includes Eagle Mode, TCP/IP Mode and LARK Mode.

① Eagle Mode is SOUTH standard mode, usually, this mode is used on the case of both Base and Rover are using GPRS mode.

② TCP/IP Mode is for private network use.

③ LARK Mode, which is a new technology on GPRS use, it is similar to GSM dial. This mode no longer rely on a CORS server that the corrections are transmitted by GPRS network. Besides, it is different from the feature of Caster.



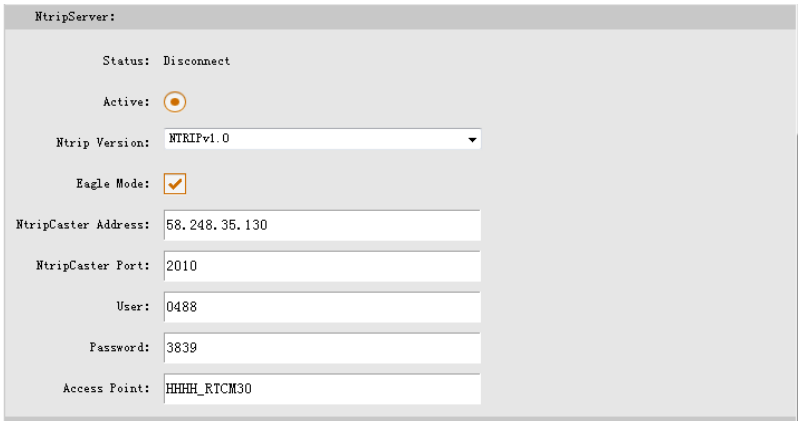
The other fields are the standard configuration for NTRIP connection, IP, port, username and password, after this information is input into the corresponding field, click on Get Point button to download the source table from server, then choose a proper mountpoint to access.

NtripServer

This configuration is used in Base+GPRS mode that Base station will transfer its correction onto the server as long as it connects to internet, then Rover can download the base's correction from server for use. Or use the LARK mode.

Ntrip Version: This field provides NTRIPv1.0 and NTRIPv2.0 for optional.

Access Point: This field is allowed to user-defined the correction format which base will transfer to the server, such as HHHH_RTCM30

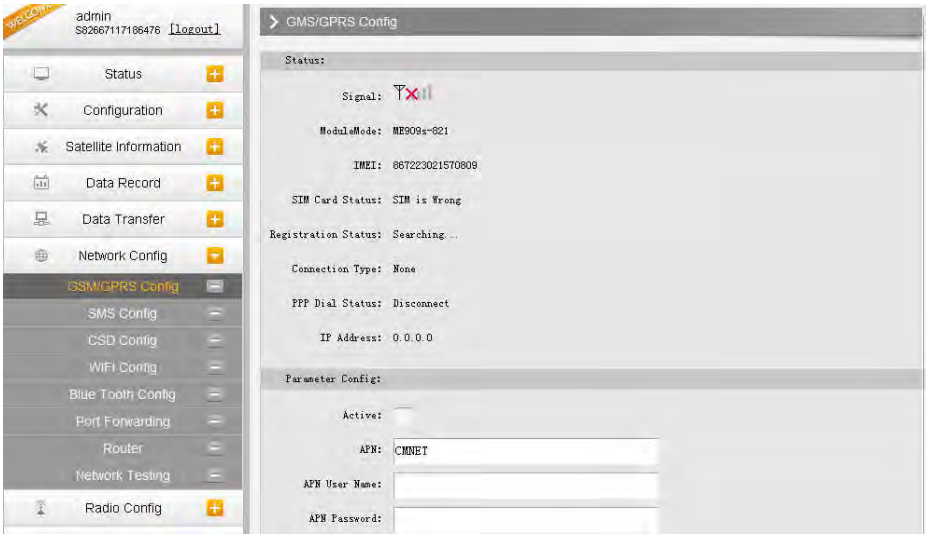


Operation on LARK

a) Setup the Base station on a known position or an unknown position.

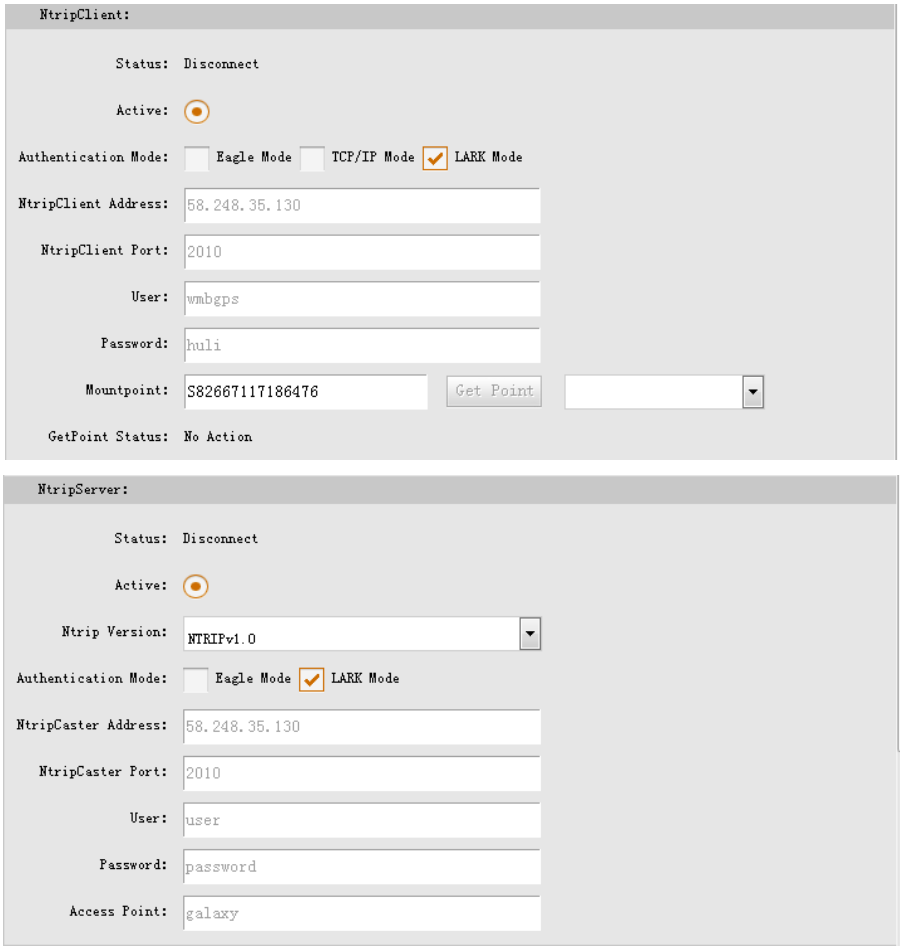
b) Insert SIM cards into both Base and Rover receiver

c) Input the correct APN and the assigned username and password on Network Config page, then make sure both of them have connected to internet.



d) Check the box of LARK for both Base and Rover, then we can notice that after checking LARK for Base, all the fields turn into grey and unable to input anything, and there is only Mountpoint field available for Rover.

e) The key step is that input the **Serial Number** of Base into Mountpoint field, then click "Enter" button to confirm all the settings.

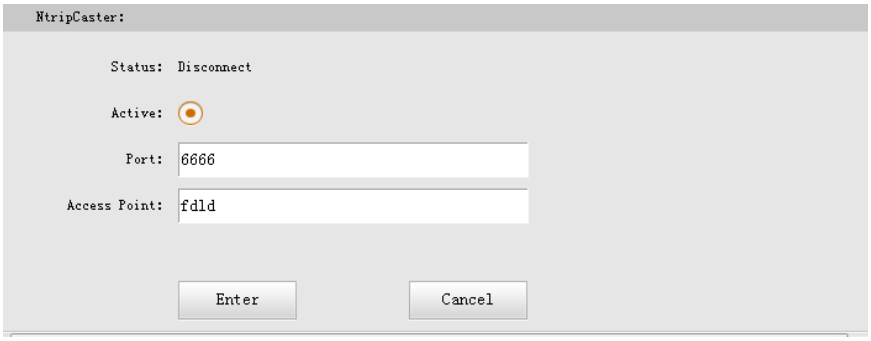


NtripCaster

This feature is finally realized on Galaxy G2, the receiver is equivalent to a CORS system that it generates and broadcasts the user-defined correction for rover if GALAXY G2 connects a static IP address.

Port: This is the specify port for the access.

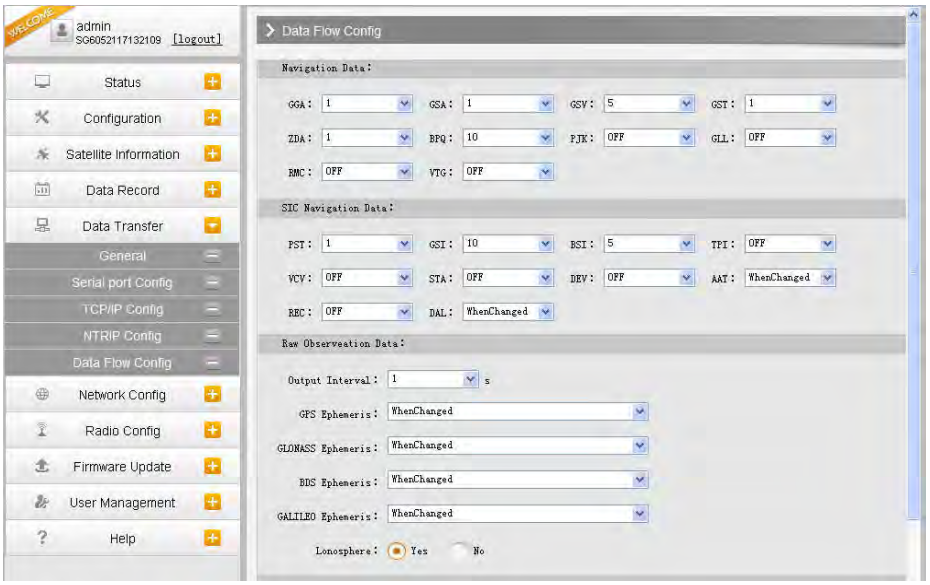
Access Point: This is mountpoint which can be user-defined.



Data Flow Config

In this page, users can optionally to configure the content and the update rate of data flow that to output or not to output what kind of data format.

Click on the dropdown list for each data format to define the update rate



§4.4.6 Network Config

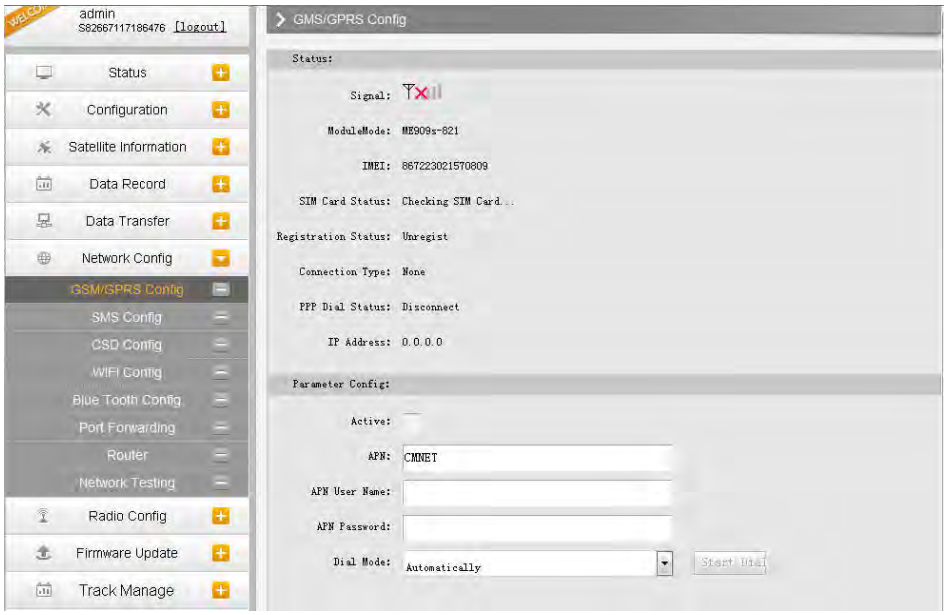
The “Network Config” is able to configure the ways and the contents for internet access of Galaxy G2. GSM/GPRS Config, CSD Config, WIFI Config, Bluetooth Config, Port Forwarding, Router and Network Testing are under the list of Network Config.

GSM/GPRS Config

In this page, all the information of receiver under GPRS mode will be displayed including the hardware information and dialing status.

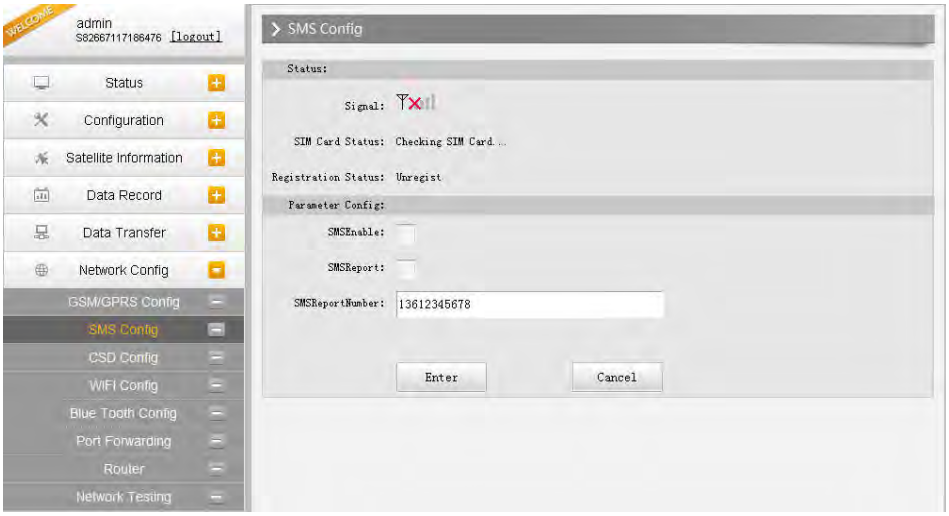
Status: The dialing status and hardware information are displayed in this field that users can intuitively to view the signal of network, module model and the IMEI number of the module.

Parameter Config: The parameters of SIM card are input in this field including APN, assigned username and password, dial mode.



MSM Config

On this configuration dialog, input a phone number into the blank, Galaxy G2 will send text message onto the phone which number is written.



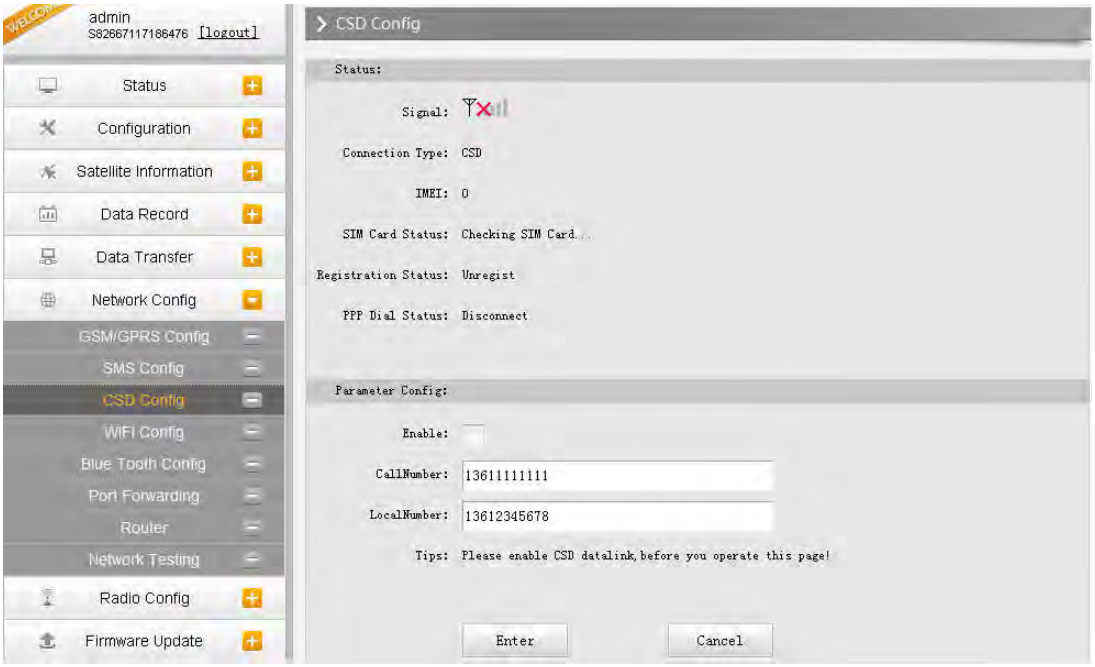
CSD Config

CSD is the meaning of direct dial between Base and Rover with SIM card inserted (the CSD function should be activated on local SIM card), this function is mainly used in the area where there is very poor internet signal coverage.

Status: This field displays the dialing status when CSD is used on Galaxy G2.

Parameter Config: To enable the CSD function with checking the box of Enable option in this field, then input the phone number for Rover and Base in CallNumber and LocalNumber.

Tips: please choose CSD as datalink for receiver in General Config.



WIFI Config

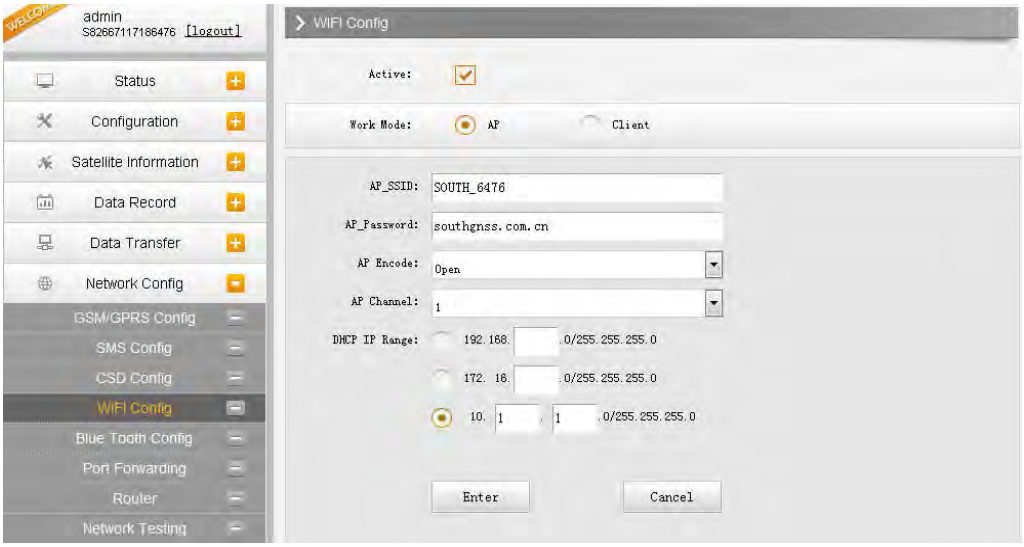
This is mainly used on the WIFI configuration for Galaxy G2, there are AP mode and Client mode for optional.

AP:

This is used to enable the WIFI hotspot for Galaxy G2 to broadcast for mobile terminals such as smartphone or tablet to connect and access the Web UI.

Check the box of AP in Work Mode to enable the WIFI hotspot for Galaxy G2, and define the SSID, password, encryption method and broadcasting channel for WIFI connection.

DHCP IP Range: This is allowed to user-defined the IP for Web UI login.



Client:

This option enables Galaxy G2 to search and connect the other WIFI hotspot which connects to the internet, the receiver is able to download and use the mountpoint from reference station.

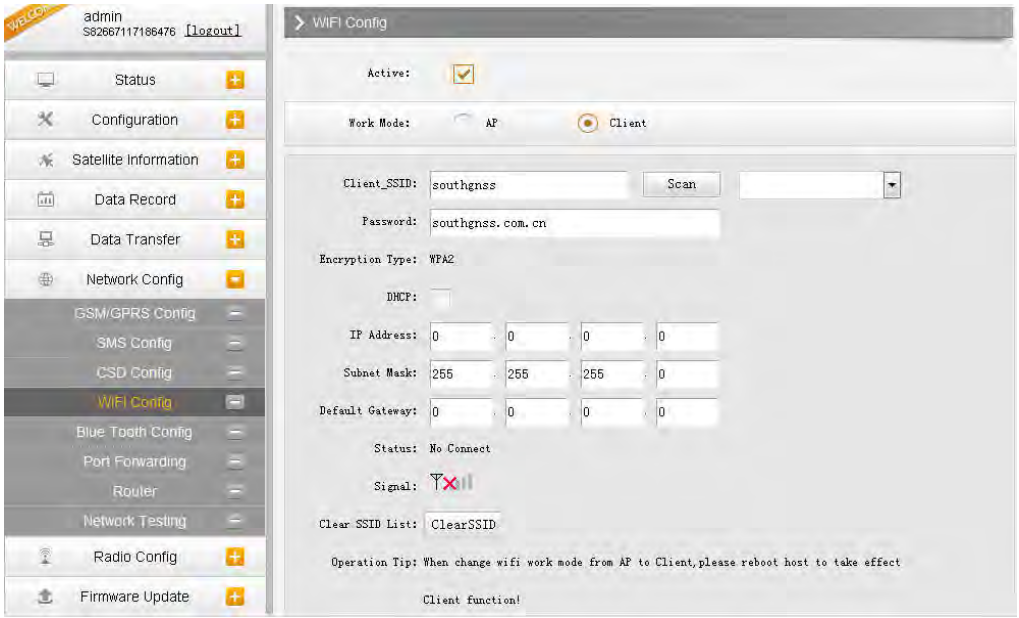
Client_SSID: This is the WIFI hotspot which Galaxy G2 is going to connect

Scan: Click this button to search the surrounding available WIFI hotspot.

Password: This is the password which the WIFI hotspot requires.

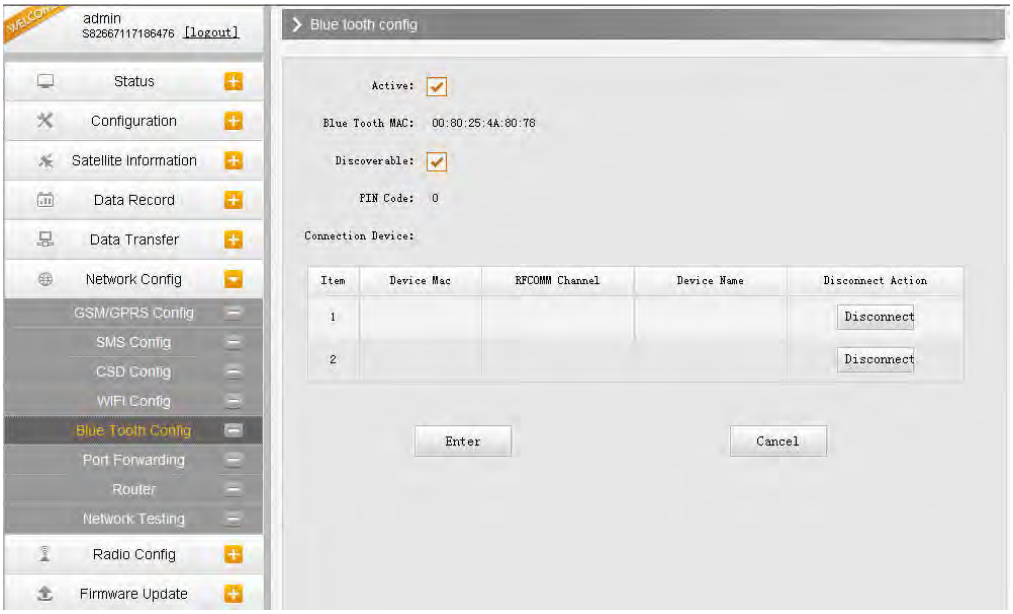
IP fields: If Galaxy G2 successfully connects to the WIFI, there will be an LAN IP address generated by Galaxy G2.

ClearSSID: Click this button to clear the SSID list.



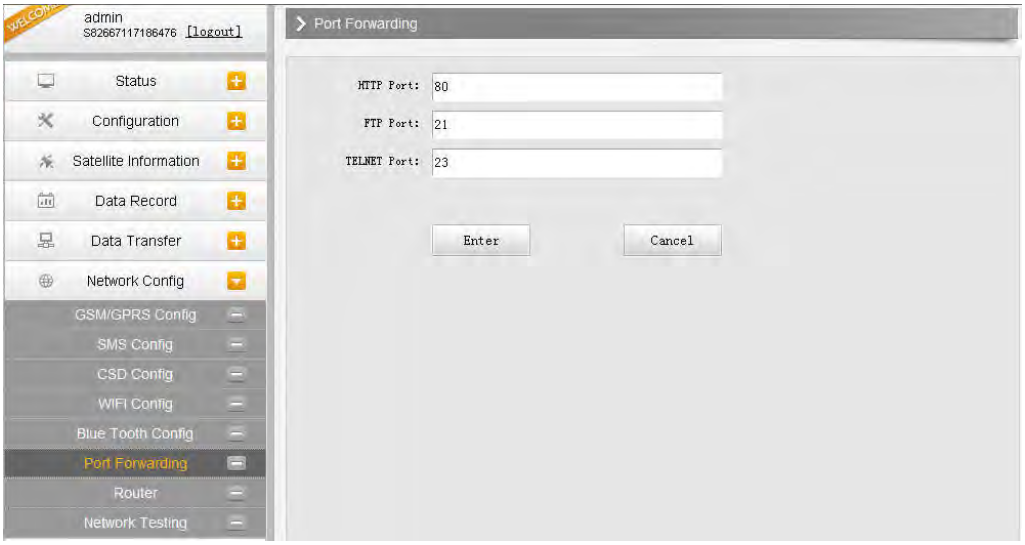
Bluetooth Config

In this page, users can view the information and connection status of Bluetooth, such the MAC of Bluetooth, discoverable or not, the PIN code, and the connection devices in following table.



Port Forwarding

This page is mainly used to view and configure the internet transmission port for Galaxy G2, customize and debug receiver.



NOTE: Usually we will keep the default setting in this page, if you would like to modify it, please contact with SOUTH technician for more supports.

Router

This is mainly used to view and configure the parameters for router, only under the condition of customize and debug receiver.

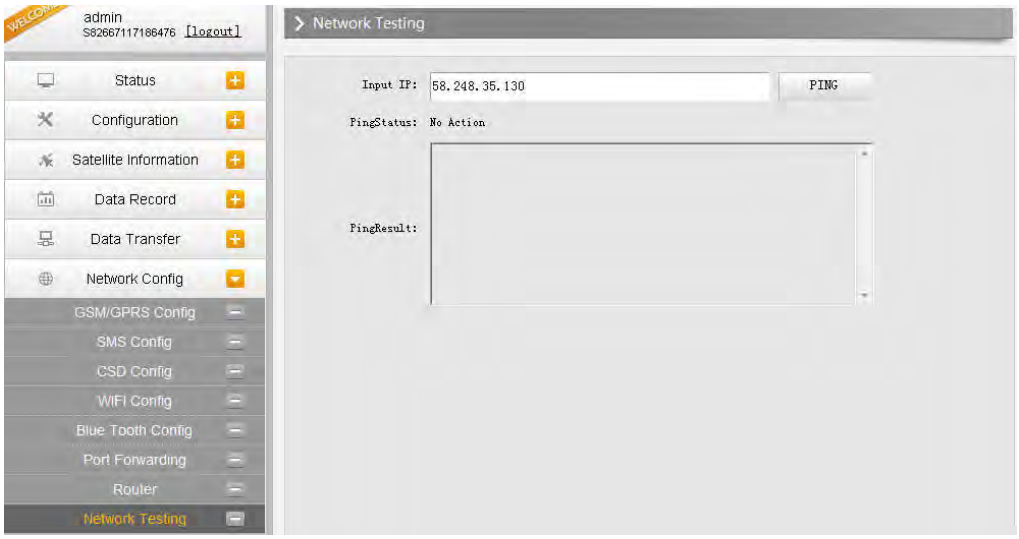
NOTE: Usually we will keep the default setting in this page, if you would like to modify it, please contact with SOUTH technician for more supports.

Network Testing

This function is mainly used to test network status for Galaxy G2 after logging on the internet.

How to do:

Input the IP address which Galaxy G2 already connected, then click PING button, the testing information will be displayed in the following window.

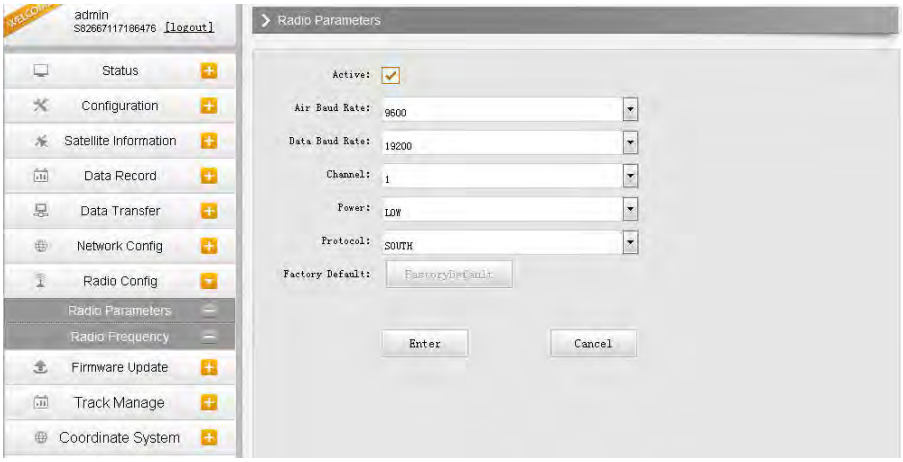


§4.4.7 Radio Config

As the name implies, the parameters of radio can be done in “Radio Config”, it is divided into Radio Parameter and Radio Frequency.

Radio Parameter

This page is mainly used to configure the parameters for internal radio module of Galaxy G2.



Air Baud Rate: This represents the data transmission rate in the air of internal radio, the higher value, the bigger of data size transmitted per second, usually keep the default setting.

Data Baud Rate: This represents the rate of data transmission port of internal radio, this rate should be the same in both Base and Rover. In general, the data baud rate of SOUTH radio module has been unified to be 19200, keep it as default.

Channel: This is the communication channels for internal UHF, the value of the channel must be the same both in Base and Rover.

Power: This appears only in Base mode, the radio transmitting power is allowed to define in High, Middle or Low power.

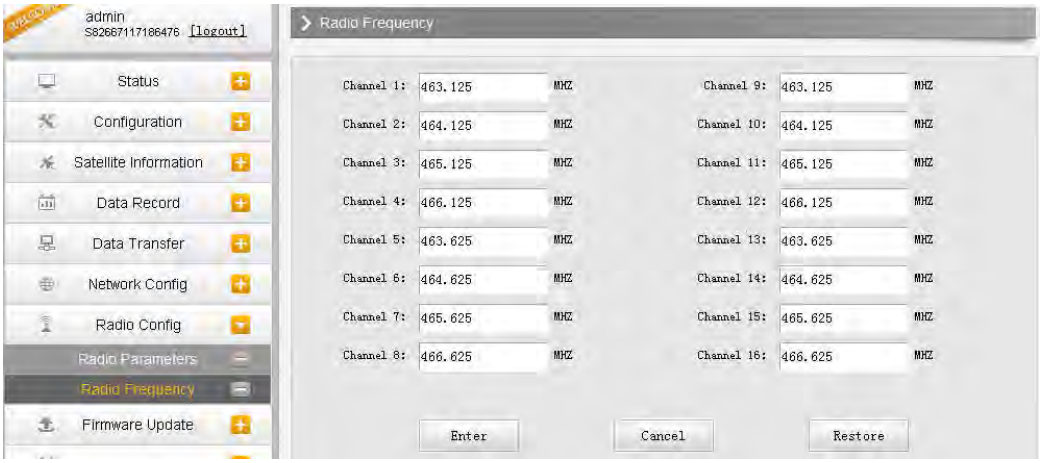
Protocol: This is radio communication protocol for data transmission, SOUTH and TRIMTALK are optional in this page and SOUTH is the default setting, if it is changed, Base and Rover must use the same protocol for communication.

Factory Default: Click this button to restore the factory default for internal UHF module.

Radio Frequency

For Galaxy G2, the powerful internal radio module supports much more radio channels apply to the legal frequency in different countries or areas.

There are 16 radio channels listed in this page after clicking on radio frequency. Users are able to change the frequency freely in the channel spacing, click Restore button to bring the frequency of each channel back to default setting.

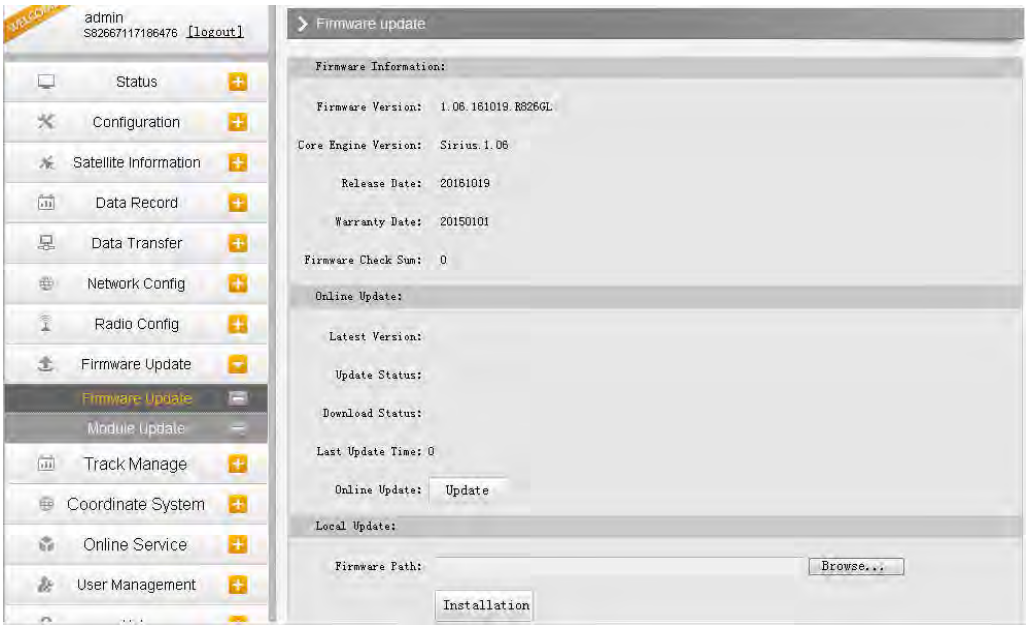


§4.4.8 Firmware Update

Update the latest firmware for receiver or for corresponding modems can be done in “Firmware Update”.

Firmware Update

This page displays all the information of the firmware which current installed on Galaxy G2, and allows to update the latest version firmware for receiver. To get latest version firmware please contact with SOUTH technician.

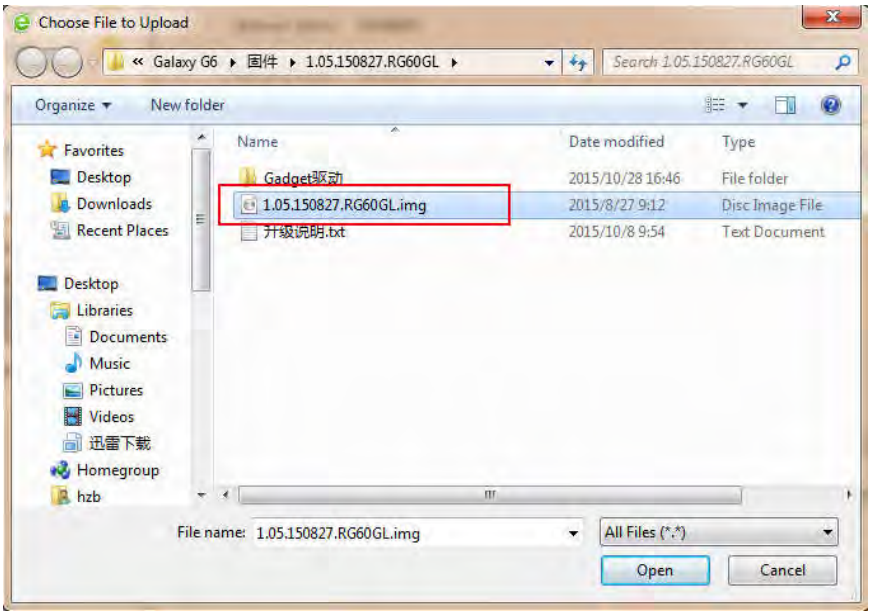


Online Update: Galaxy G2 supports to update the firmware online anytime if there is something update or optimized.

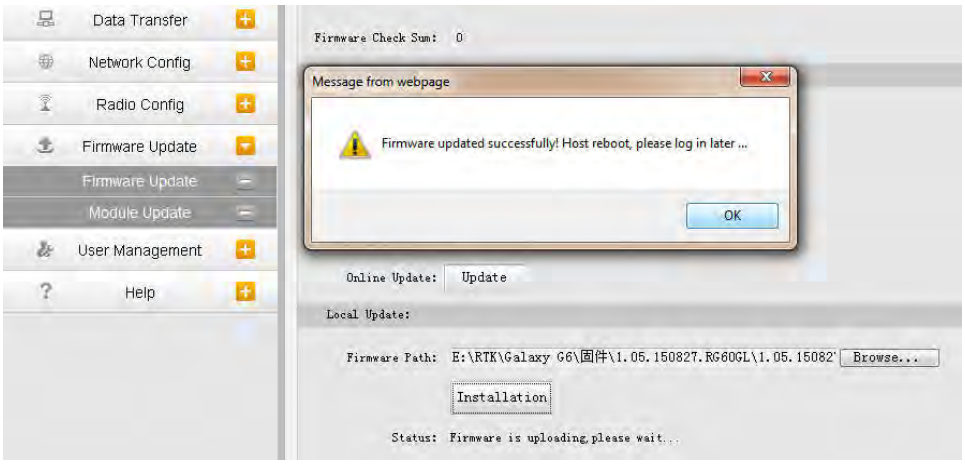
Local Update: Update the latest firmware by using a firmware file.

How to upgrade the firmware with Local Update

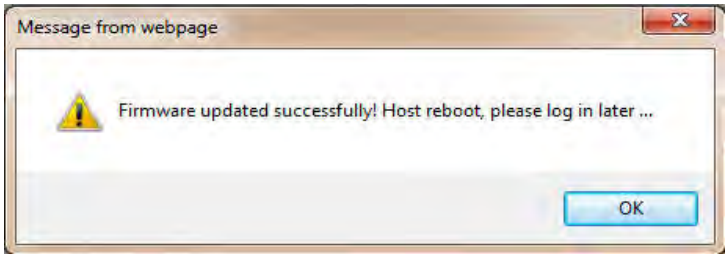
a) Click on “Browse” button to load firmware file (Please take in mind that the firmware is ended with .img as the extension name).



b) And then click “Installation” button to start upgrading.



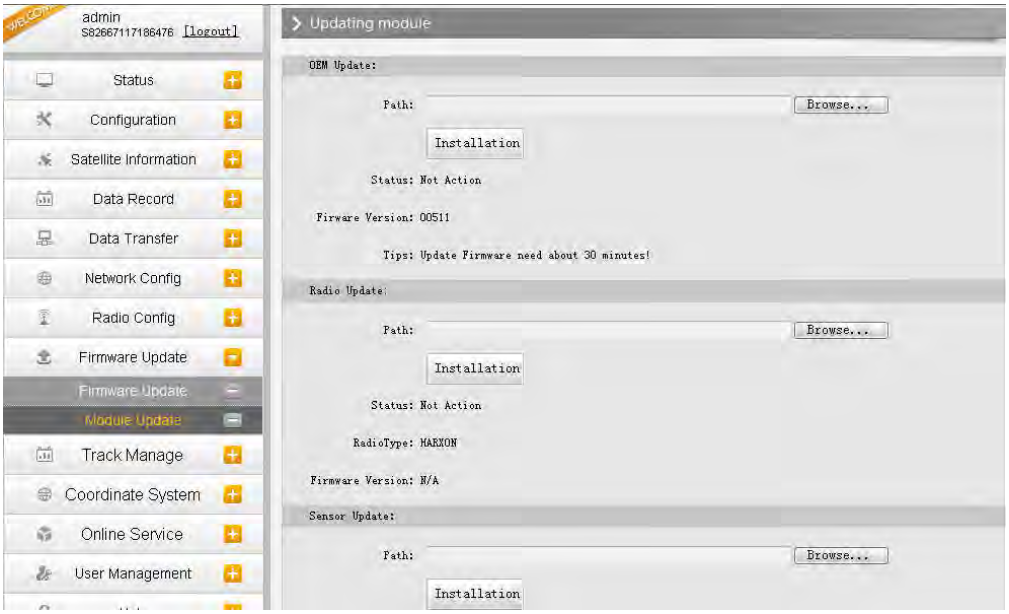
c) After the firmware is completed upgrading, a dialog will appear saying “Firmware updated successfully! Host reboot, please log in later…”, then the receiver will restart automatically.



SPECIAL REMIND: Galaxy G2 doesn't support to update the firmware with the help of INstar program any more, in the future, update the firmware for Galaxy G2 shall be done through the Web UI.

Module Update

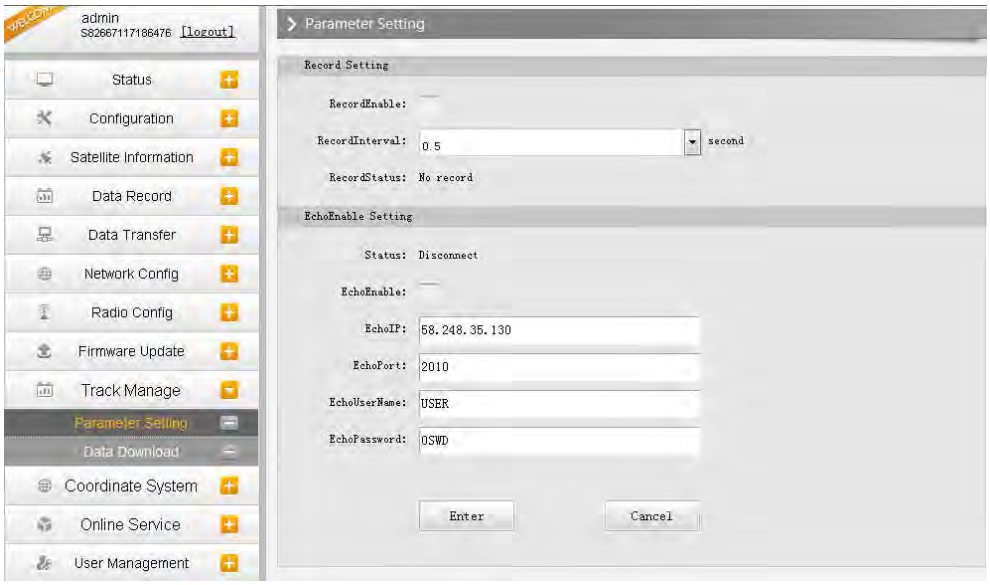
This page is used to update the firmware for corresponding modem such as OEM board, radio module and sensor.



§4.4.9 Track Manage

Galaxy G2 now supports to record the track while doing measurement, and upload the data onto the server.

Parameter Setting

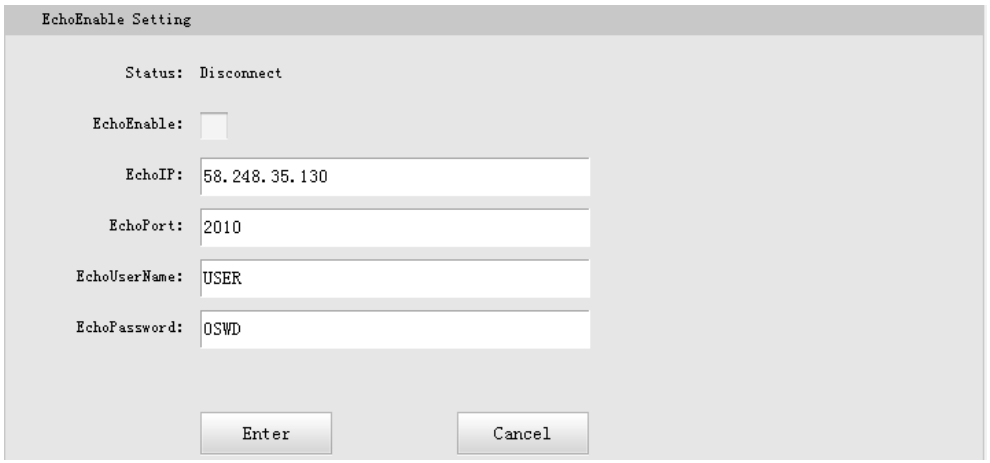


Record Setting

Check on the box of “RecordEnable” to activate track recording function, and choose a proper recording interval in dropdown list of “RecordInterval”.

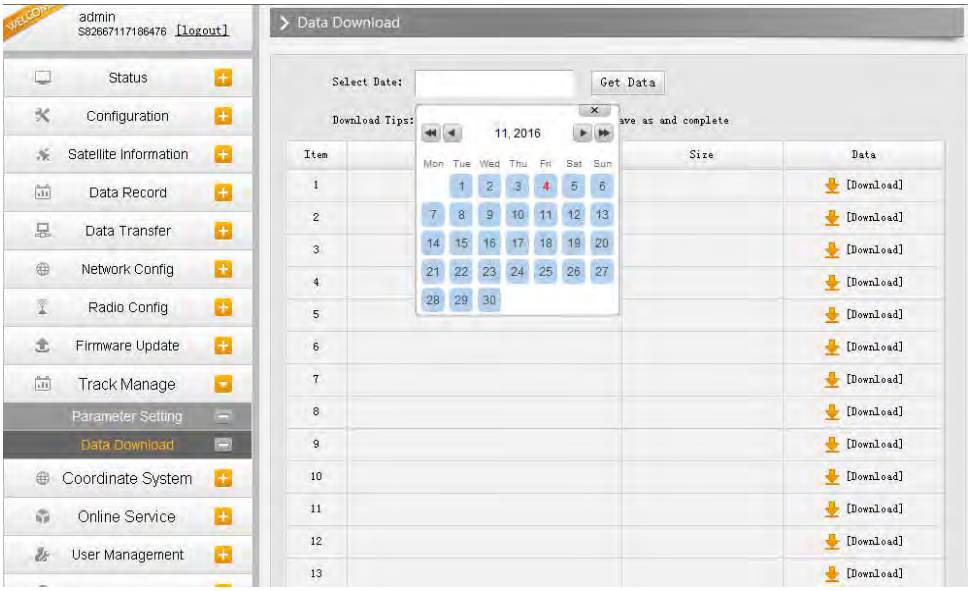
EchoEnable Setting

This configuration dialog is used to upload the recording data to a server in real-time.



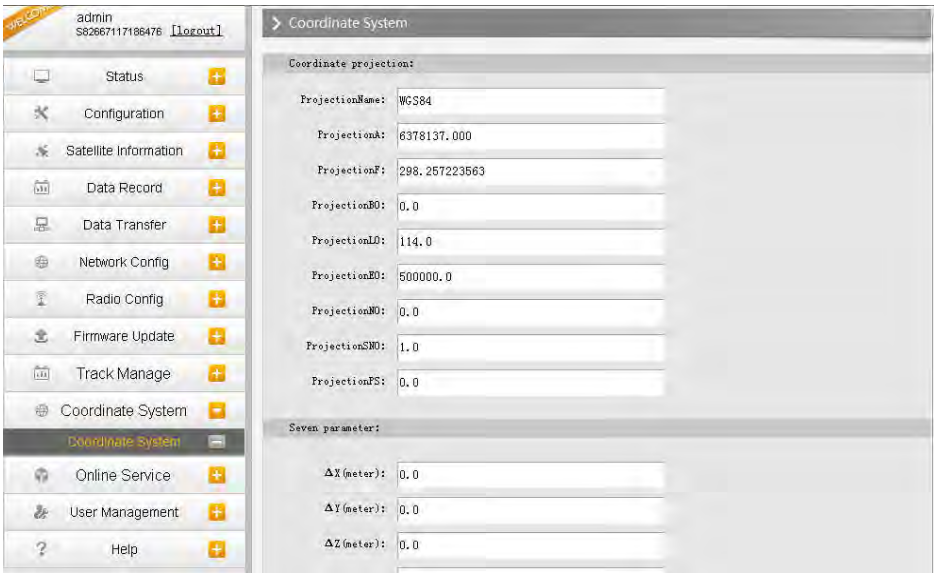
Data Download

On this page, users can download the track data file from receiver. Choose the recording date and click “Get Data” to load all the data files recorded at that day, then choose the files and click download button.



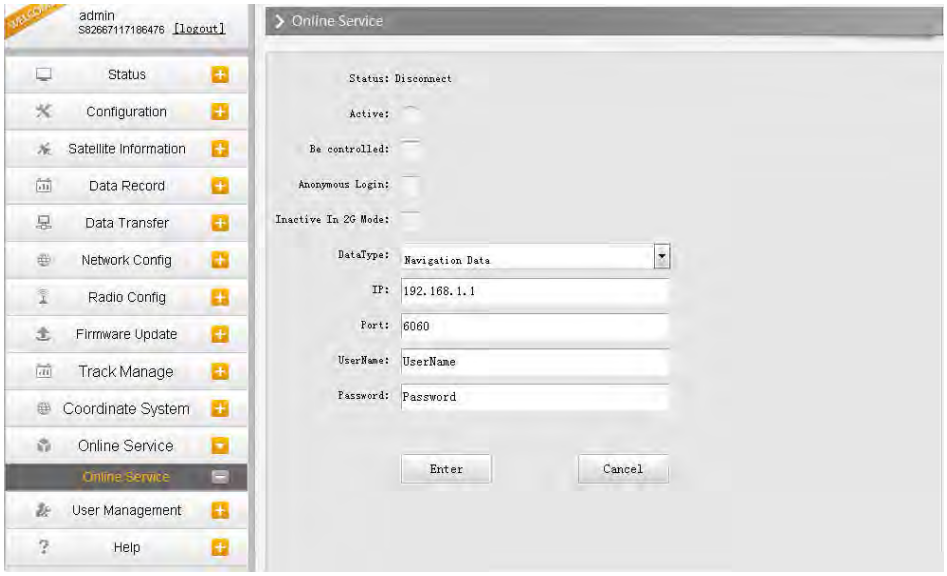
§4.4.10 Coordinate System(reserve)

Galaxy G2 allows users to setup the local coordinate system on internal web UI management. The instrument would output the local coordinates according to this coordinate system.



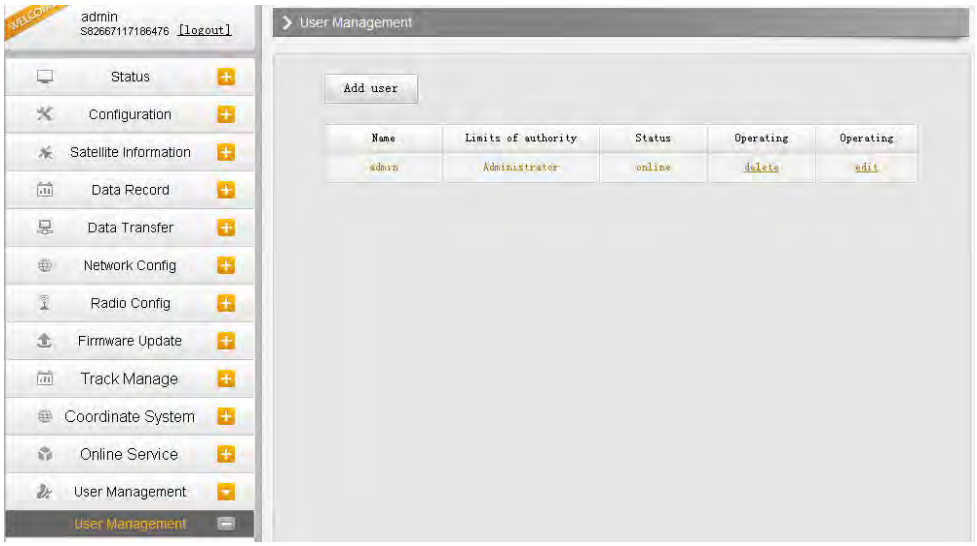
§4.4.11 Online Service(reserve)

This function is to upload the data onto a server real-time, including Navigation data, raw observation data, correction data, SIC observation data and open SIC observation data.



§4.4.12 User Management

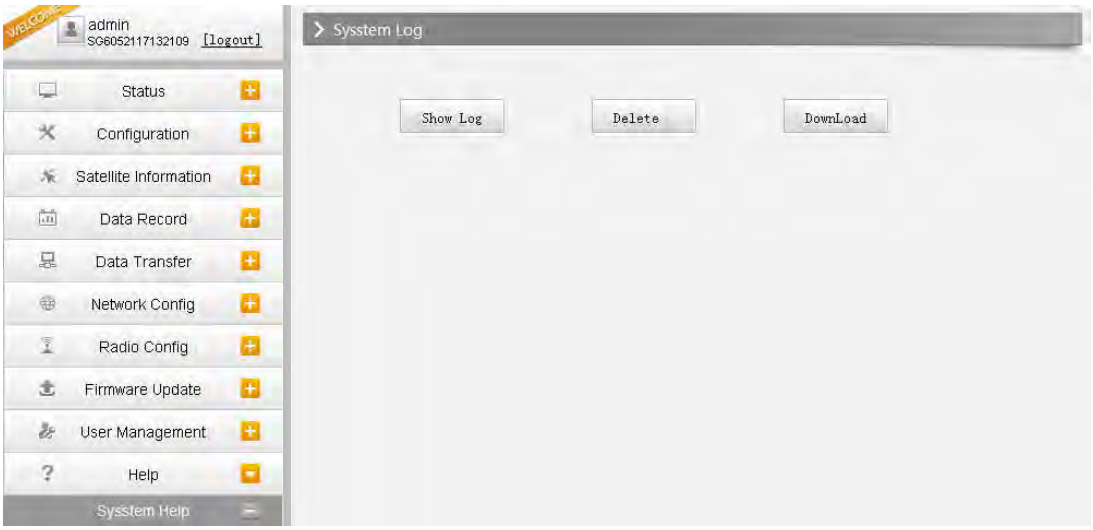
This page is used to manage the authority of login Web UI for users, including the username, password and add users.



§4.4.13 Help

In this page, users can get help and check the log book of receiver (the log book can help to backtrack the working status of receiver).

NOTE: Only the administrator can modify any parameters for receiver and manage users, and the ordinary users only have the right to view the relative parameters.



Chapter Ⅴ Data Collector -- H5

H5 is a new generation professional controller running on Android which offers state of the art smartphone capabilities combined with rugged professional quality. And the alphanumeric keypad which gives flexibility for surveyors' field work.

It adopts the 3400 mAh Li-ion battery that fulfills the long working time as customers' need. H5 controller is integrated with various sensors, like barometers, NFC, gyroscope, E-compass, G-sensor, etc. The powerful network module can provide multiple options and perfect experience of high-speed net connection. The H5 can be configured with internal Bluetooth, WiFi, Camera, GPS and cellular functionality.

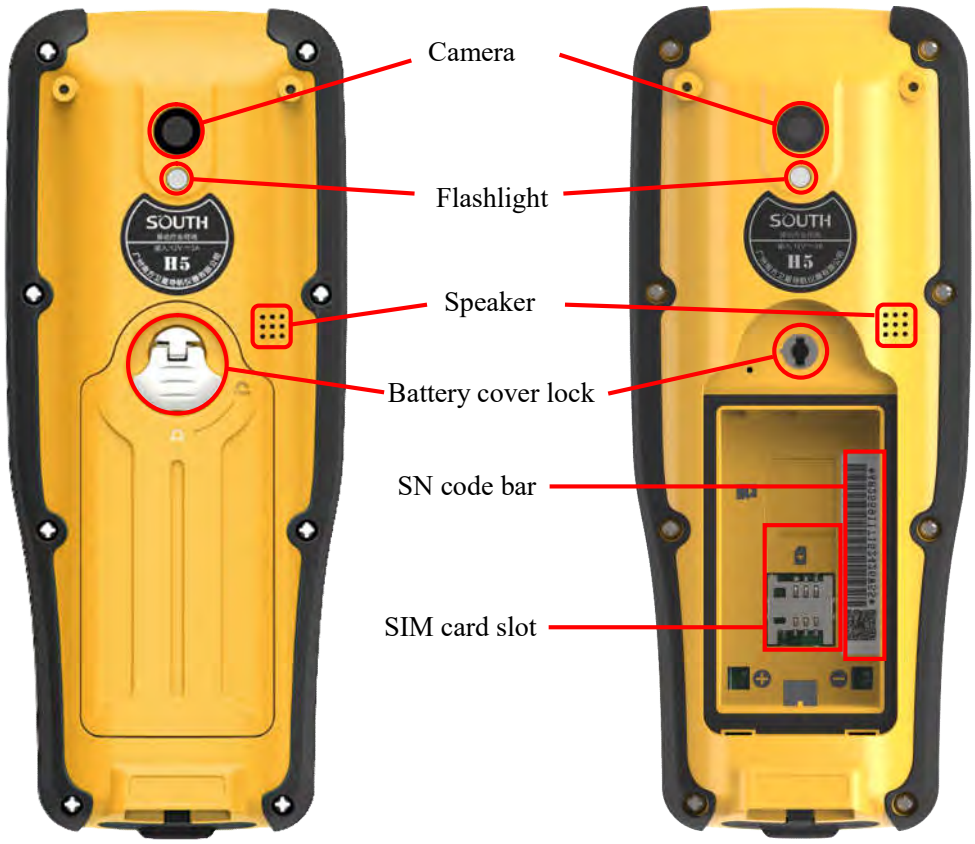
§5.1 Get to start

This section will take you to understand well the functions of each hardware component of the H5 controller.

Keyboard

Ref	Component	Description
	Home key	Return to home screen directly. Long pressing to view recent application
	Menu key	Pressing it to show the available menu in current screen
	Return key	Return to the previous screen
APP	APP key	Shortcut key of the configured application
	Capture key	Pressing it to rapidly collect coordinate
Fn	Fn key	Switch input languages

Enter	Enter key	Enter key for operation confirming
←	Backspace	Backspace and delete mistyped
Space	Space	Input the space as requirement
Shift	Shift	Switch the upper and lower case letters
⏻	Power key	Power on/off device, turn off and wake up the screen
	Arrow keys	Move the cursor
	Numeric keys	Input the numbers



§5.2 Accessories of H5

Battery & Charger

The battery of H5 adopts the same type of batteries with RTK receiver, so that it can use the same charger with RTK for controller battery charging, that means we don't need the additional charger for controller batteries.

- ✧ The Li-ion battery must be charged before use and the charging time would take about 4 hours, and the charger has the function of overcharge protection.
- ✧ The battery is charging while the indicator on the charger is red, when the indicator turns into green, it means the battery is full charged.

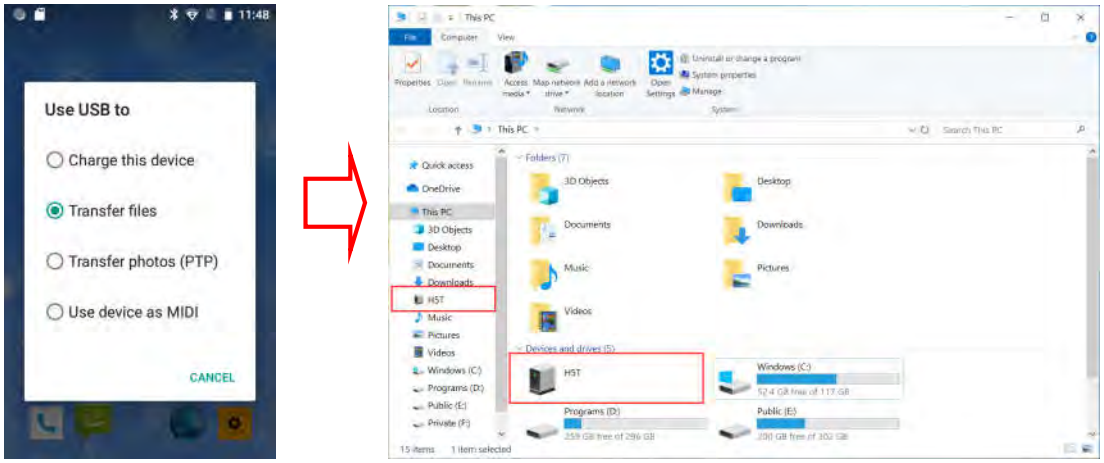
USB cable

The USB cable is mainly used for the data transmission between controller and PC.

Connect to PC

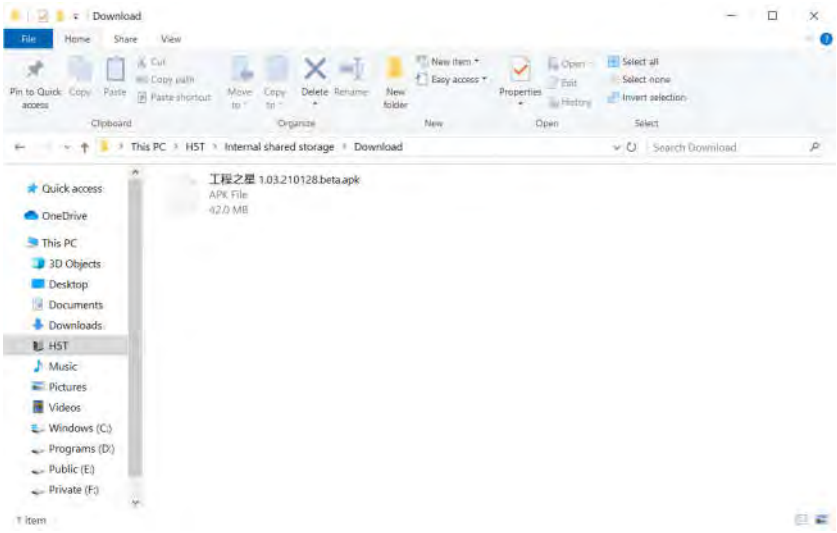
Connect H5 controller with PC by USB cable, and choose the USB connection type on the controller, after that the controller would be recognized as one of the computer devices and come with the name as H5T.

USB connection requires the USB debugging enable first in Developer options

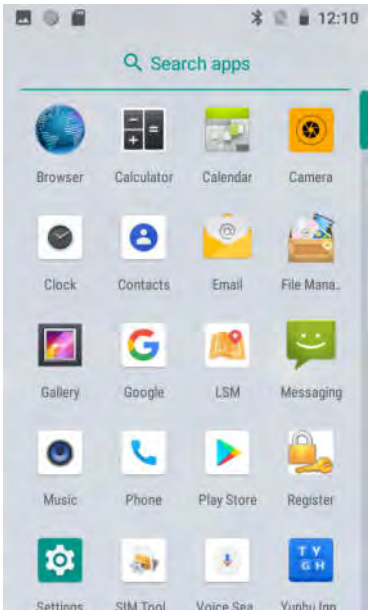


§5.3 Software installation

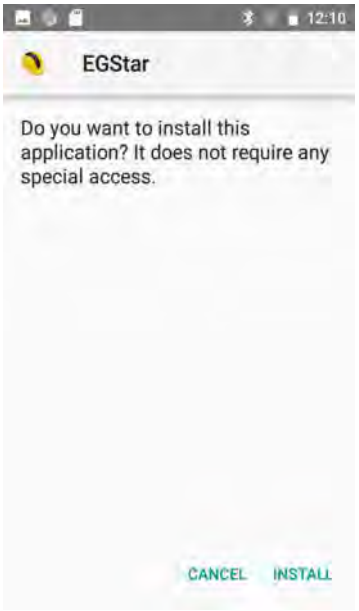
Connect H5 controller with PC by USB cable and copy the software installation file (*.apk) into a folder in the internal storage of controller where you can easy to seek.

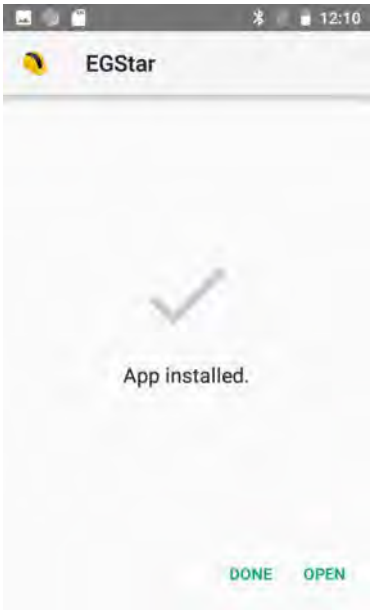


Go to find the “File Manager” on the desk of controller and click it to enter “Internal shared storage” and find the folder where the software installation file you copied to.



Click on the *.apk file to start installing the software. On some controllers, the permission to install apps from unknown sources is required, give some permissions and install the app.

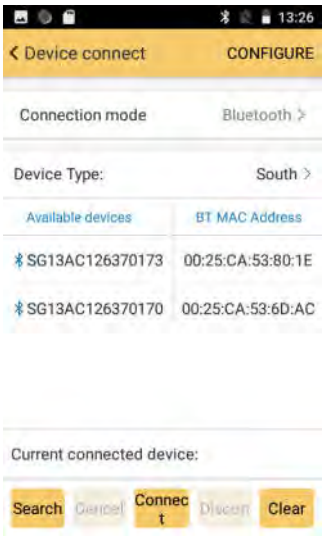




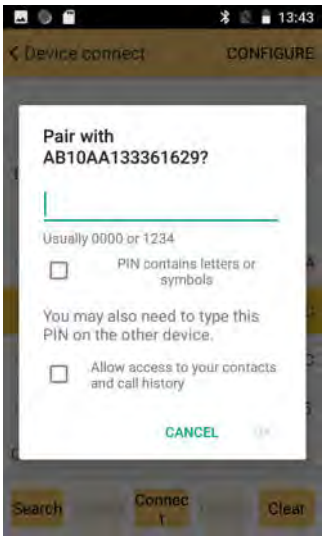
§5.4 Bluetooth Connection

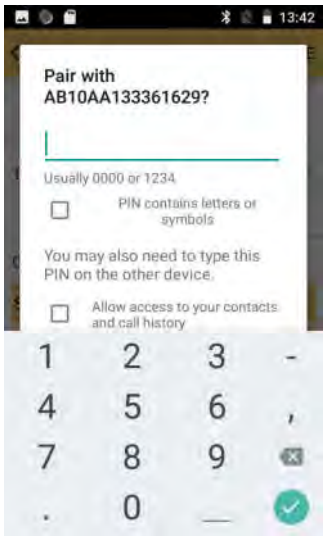
Method 1: NFC pairing connection

Both of Galaxy G2 and H5 support NFC that makes the Bluetooth connection more simpler. Run EGStar software on H5 controller and go to "Settings—Device Connect", place the back of H5 controller (The NFC reading module is on the back of the controller) close to Galaxy G2, then the Bluetooth pairing will be complete automatically.



Sometimes, a PIN code would be required for the Bluetooth pairing, usually enter 0000 or 1234 then complete the connection. After that, perform the related operations on EGStar.

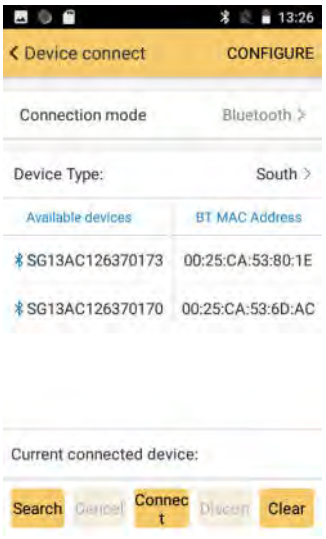


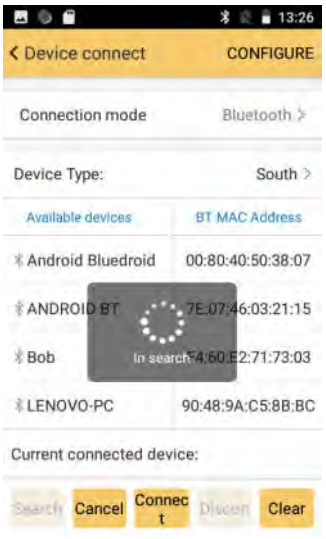


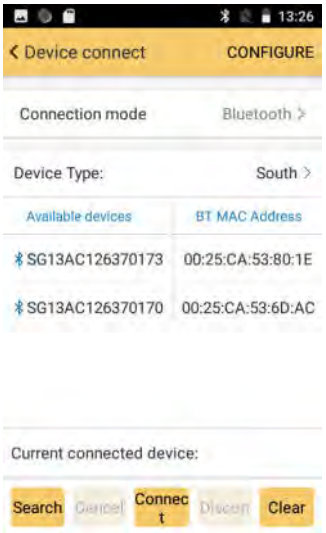
Method 2: Regular connection

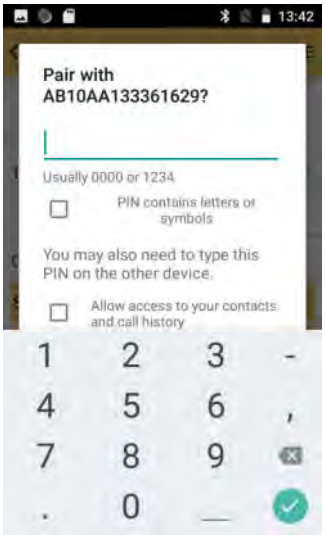
Run EGStar software on H5 controller and go to “Settings—Device Connect”, choose “Bluetooth” for connection type and then click “Search” button to search the surrounding Bluetooth devices (you can cancel searching progress as long as your Bluetooth device appears in the list), choose your Bluetooth device and click “Connect” button to complete the connection.


13:26
default
Device Connect
Rover
Base
Static Setting
Device Info
Advanced Settings
S86/S82 Setting
External Radio Setting
Project
Survey
Tools


13:26
Device connect
CONFIGURE
Connection mode
Bluetooth
Device Type:
South
Available devices
BT MAC Address
SG13AC126370173
00:25:CA:53:80:1E
SG13AC126370170
00:25:CA:53:6D:AC
Current connected device:
Search
Connect
Clear


13:26
Device connect
CONFIGURE
Connection mode
Bluetooth
Device Type:
South
Available devices
BT MAC Address
Android Bluedroid
00:80:40:50:38:07
ANDROID BT
7E:07:46:03:21:15
Bob
In search
4:60:E2:71:73:03
LENOVO-PC
90:48:9A:C5:8B:BC
Current connected device:
Cancel
Connect
Clear


13:26
Device connect
CONFIGURE
Connection mode
Bluetooth
Device Type:
South
Available devices
BT MAC Address
SG13AC126370173
00:25:CA:53:80:1E
SG13AC126370170
00:25:CA:53:6D:AC
Current connected device:
Search
Connect
Clear


13:42
Pair with AB10AA133361629?
Usually 0000 or 1234
PIN contains letters or symbols
You may also need to type this PIN on the other device.
Allow access to your contacts and call history
1 2 3 -
4 5 6 ,
7 8 9
. 0

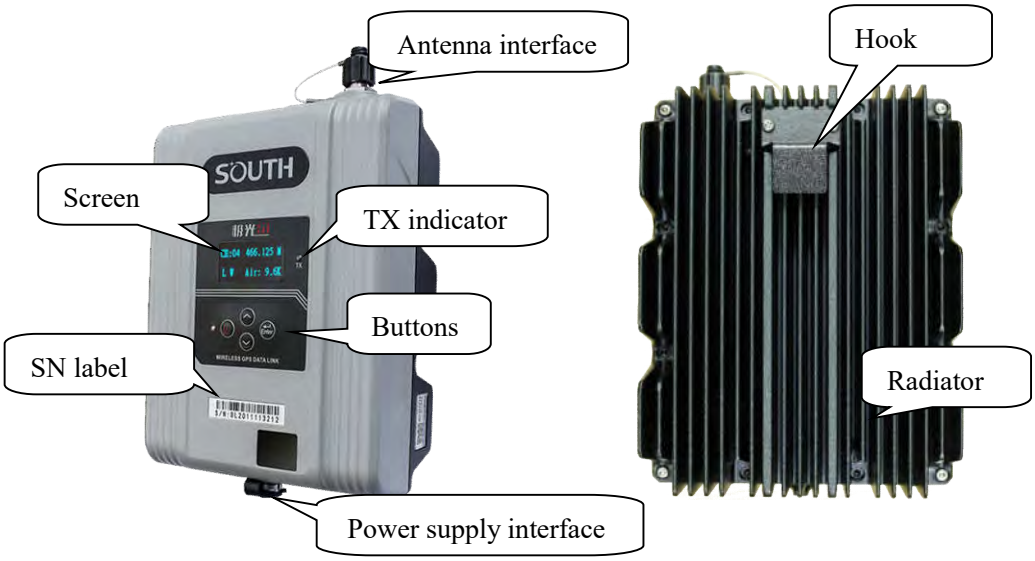

13:44
Device connect
CONFIGURE
Connection mode
Device Type:
South
Initializing device
0%
0/100
AB10AA133361629
00:25:CA:47:0C:BC
Current connected device:
AB10AA13336162
Search
Discon

Chapter Ⅵ External UHF Radio—S1

§6.1 Overview

SOUTH S1 external UHF radio is an all new design of product for the field works. It supports SOUTH / Trimtalk protocols, 410 MHz to 470 MHz. Even in the field without a computer, the 1.54-inch LCD interface makes the configuration and troubleshooting possible and visualized. This radio features with rugged housing, better cooling fins, power control, flexible and convenient settings.

§6.2 Hardware component



Ref	Component	Description
	Power button	Press the Power button for 3 seconds to power on the radio, press the power button for 1 second to turn off the radio
	Up	Pressing it to move the cursor to left or up
	Down	Pressing it to move the cursor to right or down
	Enter button	Pressing it to start the settings and save the settings

Power indicator: The indicator will on after turning on the radio.
TX indicator: The indicator will blink by the transmitting interval.

Low power alert: The screen will show “POWER LOW” if the power voltage is less than 10V.

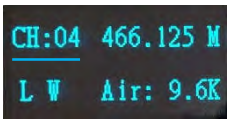
Sleep mode: If there is no any operation on the radio buttons for 10 minutes, the display will shut down to save power, the power indicator is still on, and TX indicator is still continue blinking.
Note: If the radio is in the sleep state, it is prohibited to press the power button to view the status of the radio, otherwise it will directly shut down.

§6.3 Hardware operation

This section will focus on how to make the configuration on the radio through the buttons on the control panel.

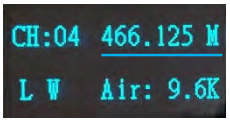
6.3.1 Channel (CH)

Press ▲ ▼ to move the cursor to CH, then press Enter to enter this parameter setting mode, press ▲ ▼ again to select the channel, and press Enter to confirm the settings and exit.



6.3.2 Frequency

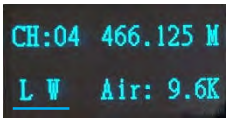
Press ▲ ▼ to move the cursor to the frequency, then press Enter to enter this parameter setting mode, press ▲ to move the cursor, and press ▼ to change the frequency, and press Enter to confirm the settings and exit.



Note: There are 2 frequency ranges of this radio, 410MHz~450MHz and 450MHz~470MHz. And the frequency of each channel should be set in the same frequency range, changing the frequency beyond the range is not allowed. For example, if channel 1 is with the frequency 411.125, and it belongs to the range of 410MHz~450MHz, then the other channels frequency should be in the same range too.

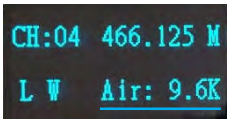
6.3.3 Power mode (L W)

Press ▲ ▼ to move the cursor to power setting, then press Enter to enter this parameter setting mode, press ▲ ▼ again to select the power level (L=low, H=high), and press Enter to confirm the settings and exit.



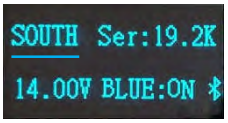
6.3.4 Air (Air baudrate)

Press ▲ ▼ to move the cursor to air baudrate setting, then press Enter to enter this parameter setting mode, press ▲ ▼ again to select the baudrate(9.6K=9600…), and press Enter to confirm the settings and exit.



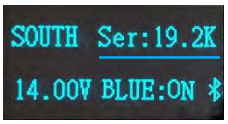
6.3.5 Protocol

Continue pressing to move the cursor to protocol setting, then press to enter this parameter setting mode, press again to select the protocol (SOUTH/Trimble), and press to confirm the settings and exit.



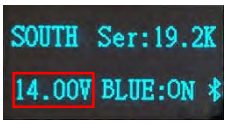
6.3.6 Serial port baudrate (Ser:)

Press to move the cursor to serial port baudrate setting, then press to enter this parameter setting mode, press again to select the baudrate(9.6K=9600, 19.2K=19200…), and press to confirm the settings and exit.



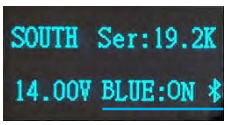
6.3.7 Power voltage

This part is only to display the current power voltage



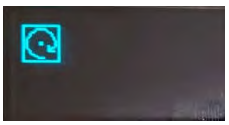
6.3.8 Bluetooth

Press to move the cursor to Bluetooth(Blue) setting, then press to enter this parameter setting mode, press again to turn on/off the Bluetooth, and press to confirm the settings and exit



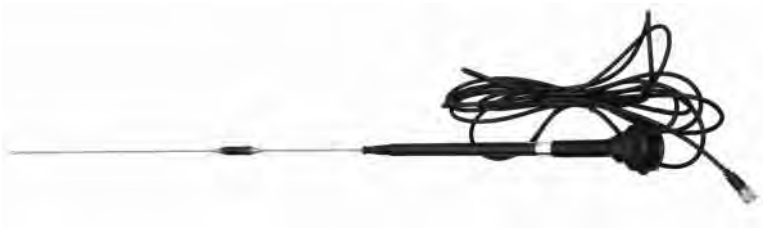
6.3.9 reset

Keep pressing to go to the next configuration page, and there is only reset setting on this page, press to confirm perform the reset operation.



§6.4 Accessories

The UHF transmitting antenna is particularly suitable for field use.



Power supply and data transmitting cable.

§6.5 Specifications

UHF	protocol	SOUTH/TRIMBLE
	Power	10W, 25W
	Frequency	410MHz~470MHz
	Interval	12.5KHz/25KHz
	Rx sensitivity	≤0.25μV(12dB SINAD)
	Air baud rate	9600/19200/38400
	Port baud rate	9600/19200/38400
	Channels	16
Interface	Display	1.54 inch LCD
	Buttons	4 buttons
	Indicator	2 indicator light
Communication	Bluetooth 4.0	
	5-pin LEMO external power port +RS232	
	TNC connector	
Physical	Operation Temp	-40°C~80°C
	Storage Temp	-40°C~85°C

	Waterproof/Dustproof	IP67
	Shockproof	1m
	Size	178*135*68mm
	Weight	2.3KG

§6.6 Application Notice

The battery power is too low: When “POWER LOW” display on the screen, that means the power voltage is less than 10V, which means the lack of battery power, replace the battery in time, otherwise there would be data link unstable or unable to launch.

Radio transmits power: radio transmits power based on the voltage of the power supply, check the voltage before use.

High and low power use: use low-power transmitter when low power can satisfy the operation as high-power transmitter will exponentially consume battery power, excessive use will reduce battery life. Install the radio station as high as possible.

Power corrugated coefficient: power ripple coefficient must be less than 40mV, the smaller the ripple factor is, the smaller will the beam spectrum be and the higher communication quality will be.

Power Connection: Power of positive and negative connected correctly.

Electromagnetic environment: Before using the radio, it is better to perform electromagnetic environment measurement, to avoid the communications blackout.

Radio match antenna: the basic parameters of the antenna selection are the band width, frequency, gain, directivity, impedance, VSWR and other indexes. Usually the effective bandwidth of the antenna is 3-5MHz,antenna selecting should be based on the frequency bands used by the to be selected channel. For the long-distance transmission, it is better to use a directional antenna and high-gain antenna, and pay attention to the impedance of the antenna and feeder to match with the Radio antenna interface (50 ohms).

We recommend:

Recommend that you use plug-in battery which is more than 12/36Ah, the use of maintain a regulated current of 10A during the operation.

Recommend that you charge it in time, do not overuse the battery, otherwise it will reduce battery life.

Recommend that you replace the batteries after six months to a year, to ensure the radio working distance.

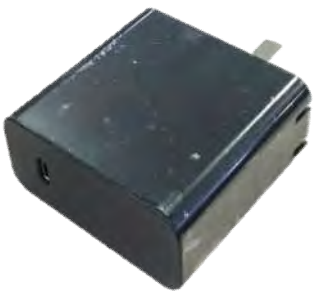
ChapterⅦ Accessories

§7.1 Instrument Case

The instrument case for Galaxy G2 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

§7.2 Charger&Adapter

Galaxy G2 is equipped with a rechargeable internal battery, it uses a type-c cable and a PD adapter for the charging.



§7.3 Differential Antennas

The differential antennas are as shown above;

The UHF differential antenna is required to install to the interface at the bottom of receiver if Galaxy G2 is set up into internal UHF mode.

§7.4 Cables

Type-C cable

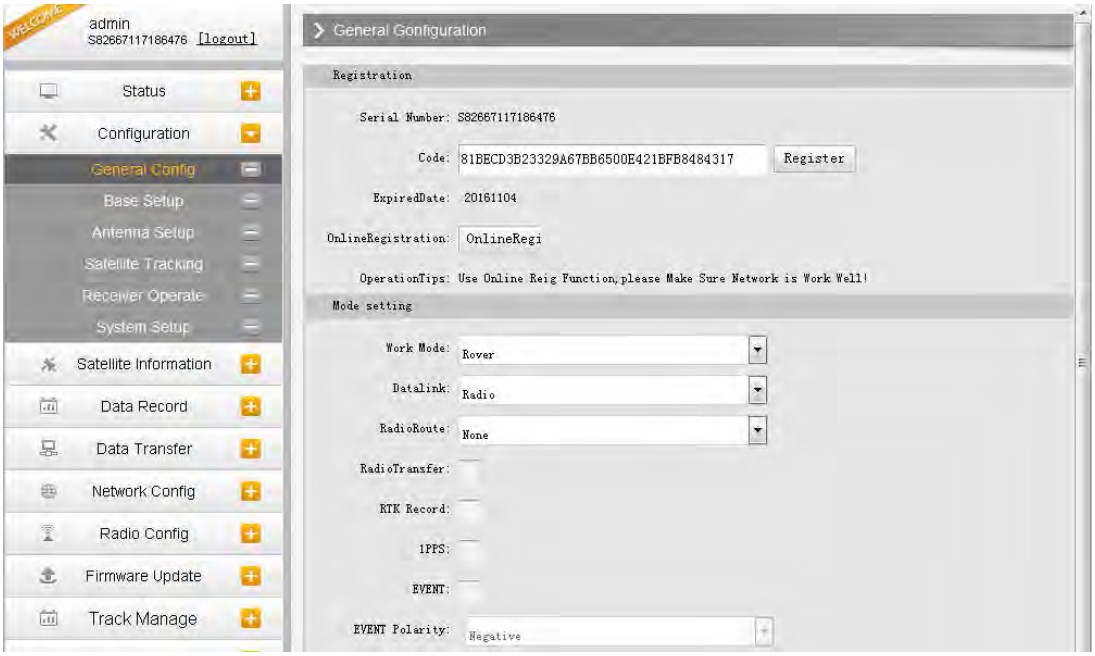
This cable is used to connect the receiver with computer for static data transmission, Web UI accessing and firmware update.

ChapterⅧ Hardware Registration

Users can get the point how to register the instrument in this chapter. Registering on Galaxy G2 is easier than operating on G1.

Login the web UI management of Galaxy G2 with WiFi or USB network connection.

Go to “Config—General Config” configuration page, the registration section is located at the top of this interface.



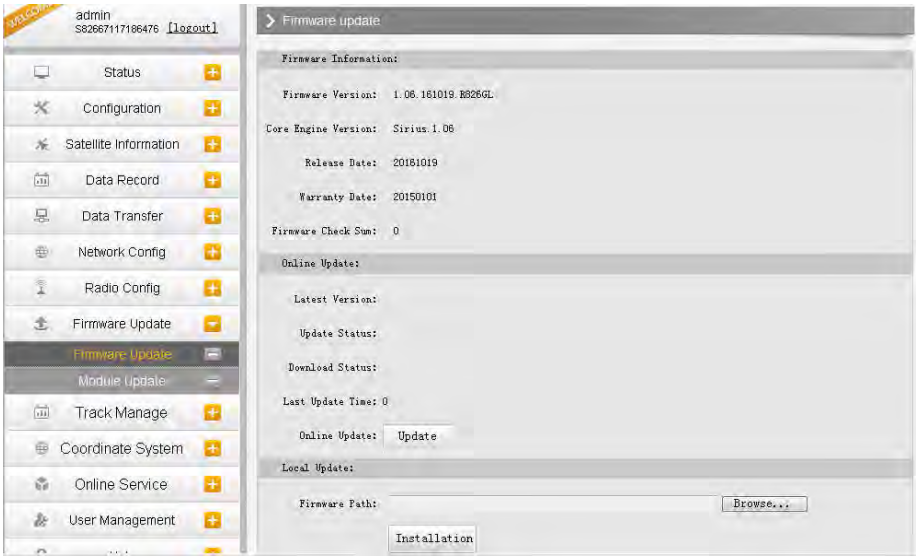
Enter the registration code and click on “Register” button, a prompt message will appear. And the ExpiredDate would be changed.

ChapterⅨ Firmware Update

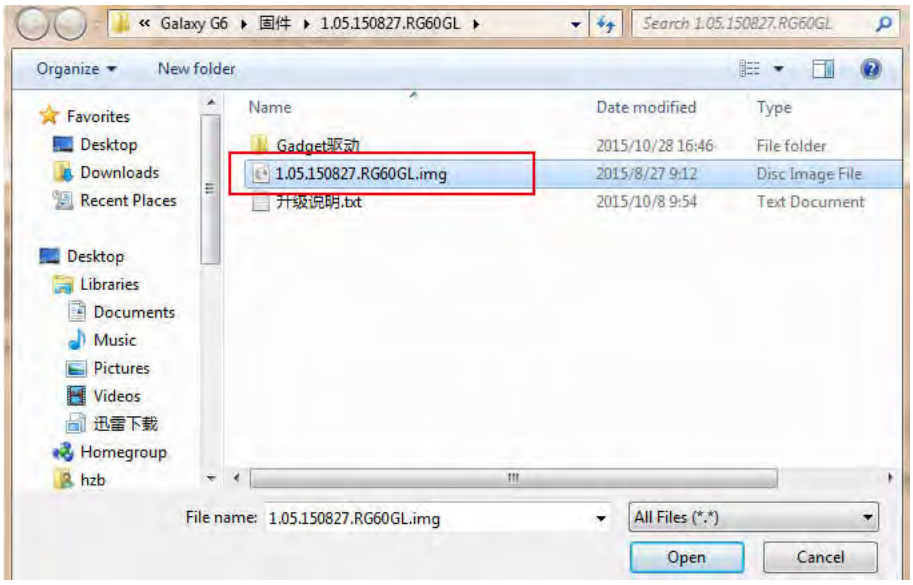
This chapter will explain how to update the firmware for Galaxy G2, detail steps are written below.

Login the web UI management of Galaxy G2 with WiFi or USB network connection.

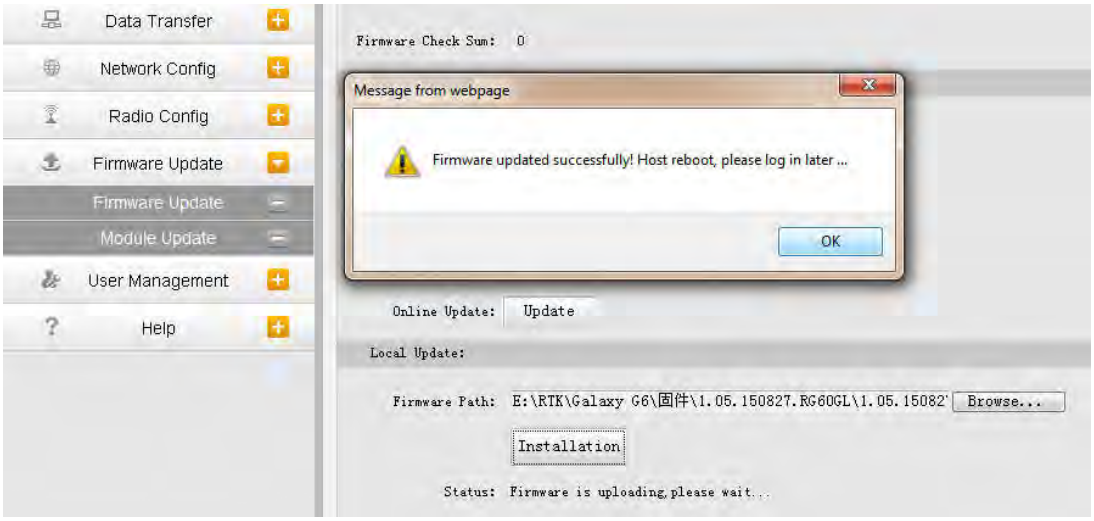
Go to “Firmware Update—Firmware Update” configuration page, all the information of the firmware which current installed on Galaxy G2 would be displayed here.



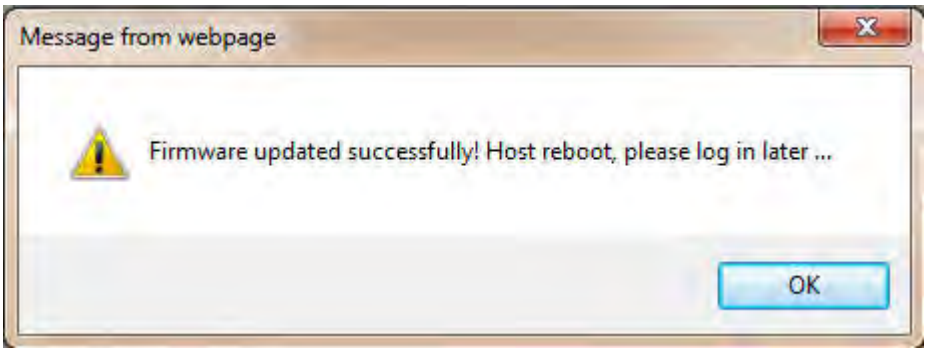
Click on “Browse” button to load firmware file (Please take in mind that the firmware is ended with .img as the extension name).



And then click “Installation” 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.



*SPECIAL REMIND: Galaxy G2 doesn’t support to update the firmware with the help of **INstar** program any more, in the future, update the firmware for Galaxy G2 shall be done through the Web UI.*

Appendix A Galaxy G2 technical specifications

GNSS Features	
Channels	965
GPS	L1, L1C, L2C, L2P, L5
GLONASS	G1, G2, G3
BDS	BDS-2: B1I, B2I, B3I BDS-3: B1I, B3I, B1C, B2a, B2b*
GALILEO	E1, E5A, E5B, E6C, AltBOC*
SBAS	L1*
IRNSS	L5*
QZSS	L1, L2C, L5*
MSS L-Band*	Reserve
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	2~8s
IMU tilt compensation	Additional horizontal pole tip uncertainty typically less than 10mm + 0.7 mm/° tilt down to 30°
IMU tilt angle	0° ~60°
Hardware performance	
Dimension	130.5mm(φ)×84mm(H)
Weight	850g (battery included)
Material	Magnesium aluminum alloy shell
Operating temperature	-25℃~+65℃
Storage temperature	-35℃~+80℃
Humidity	100% Non-condensing
Waterproof/Dustproof	IP68 standard, protected from long time immersion to depth of 1m
	IP68 standard, fully protected against blowing dust
Shock/Vibration	Withstand 2 meters pole drop onto the cement ground naturally

Power supply	6-28V DC, overvoltage protection
Battery	Inbuilt 6800mAh rechargeable Lithium-ion battery
Battery life	Single battery: 16h (static mode)
	10h (internal UHF base mode)
	12h (rover mode)
Communications	
I/O Port	5-PIN LEMO interface (external power port + RS232)
	Type-C interface (charge+OTG+Ethernet)
	1 UHF antenna interface
	SIM card slot (Micro SIM)
Internal UHF	Radio receiver and transmitter, 1W/2W/3W switchable
Frequency range	410-470MHz
Communication protocol	Farlink, Trimtalk450s, SOUTH, SOUTH+, SOUTHx, HUACE, Hi-target, Satel
Communication range	Typically 8km with Farlink protocol
Cellular mobile network	Advanced 5G network communication module, downward compatible with 4G/3G
Bluetooth	Bluetooth 3.0/4.1 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)
WIFI	
Modem	802.11 b/g/n 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
Data Storage/Transmission	
Storage	8GB SSD internal storage
	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
Data Transmission	Plug and play mode of USB data transmission
	Supports FTP/HTTP data download
Data Format	Static data format: STH, Rinex2.01, Rinex3.02 and etc.
	Differential data format: CMR, SCMRx, RTCM 2.1, RTCM 2.3, RTCM 3.0, RTCM 3.1, RTCM 3.2
	GPS output data format: NMEA 0183, PJK plane coordinate, Binary code,

	Trimble GSOF
	Network model support: VRS, FKP, MAC, fully support NTRIP protocol
Sensors	
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 immue to magnetic interference
Thermometer	Built-in thermometer sensor, adopting intelligent temperature control technology, monitoring and adjusting the receiver temperature
User Interaction	
Operating system	Linux
Buttons	Single button
Indicators	5 LED indicators
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: $e = \sqrt{\frac{a^2 - b^2}{b^2}}$ 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: $f = \frac{1}{a}(a-b) = 1 - \sqrt{(1-e^2)}$

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.