M68G GNSS RECEIVER USER MANUAL

V1.0

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FCC warning:

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.

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

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.

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 80 cm from all persons and must not be collocated or operating in conjunction with any other antenna or transmitter, End-Users must be provided with transmitter operation conditions for satisfying RF exposure compliance.

Revision History

Revised Edition	Revision History	Date
V1.0	Initial Release	2023-5-31

Contents

Ⅰ. Before You Start

Dear customers,

Thank you for purchasing our device. Before you start, please carefully read the following:

2. This user manual is for your device only. If the actual situation does not match with the situation in the user manual, the actual situation shall prevail.

3. For safety and instructions on how to use this device, please carefully read the precautions, exemptions from responsibility and instructions in the user manual.

4. The information in this user manual is subject to change without notice. We reserve the right to change or improve the device as well the content in the user manual without further notification.

1.1 Precautions For Safe Operation

For the safety of your products, operators and other persons, please read this part carefully before using your product.

Precautions can be divided into the following levels according to the degree of loss or injury under negligence or omission circumstances:

Warning: Precautions requiring special attention. Ignoring this indication may result in death or serious injury to the operator.

Caution: Precautions mainly for informing, such as supplementary instructions and using limitations. Ignoring this indication may result in personal injury or property damage.

2.2.1 Warning

1. Do not disassemble and open the device by yourself. Only Devecent Information Technology authorized distributors can disassemble or rebuild the device.

2. Please do not cover the charger when charging.

3. Please do not use wet charger, defective power cable, socket or plug, and other power cable which is not recommended by Devecent Information Technology. Otherwise, fire or electric shock may occur.

4. Please do not place the device near burning gas or liquid, and do not place it in an open flame or high temperature environment. Otherwise an explosion may occur.

5. Please avoid battery short circuit. Otherwise a fire may occur.

6. Please avoid the interference of severe electrostatic discharge. Otherwise, the device may experience some performance degradation, such as automatic opening/closing, etc.

2.2.2 Caution

1. Please fix the device firmly on the pole.

2. To avoid accidental damage, only use original accessories. Otherwise, the device may be damaged.

3. When transporting, please try to reduce the vibration of the equipment.

4. Do not touch the device with wet hands. Otherwise, electric shock may occur.

5. Please do not stand or sit on the carrying case, and do not turn it over, otherwise the device may be damaged.

1.2 Exemption From Liability

You should follow all operating instructions and periodically check the performance of this equipment.

We disclaim all liability for any damages and lost profits caused by:

1. False or Intentional Use or Misuse.

2. Any irresistible natural disasters, such as earthquakes, storms, floods, etc.

3. Data change, data loss, business interruption, etc.

4. Delivery error.

5. Use non-original accessories.

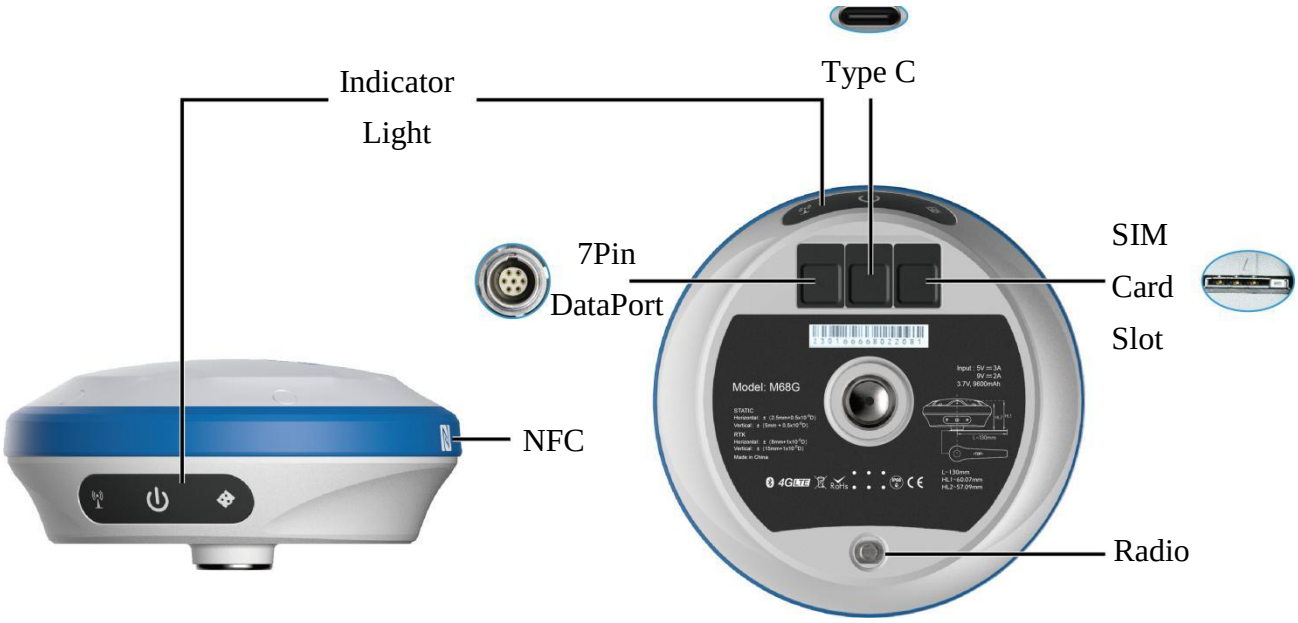
6. Operations not described in the user manual.

Ⅱ. M68G At A Glance

The body of the M68G is designed with magnesium alloy material, which is durable and has better heat dissipation effect, and weighs only 740g. It supports IP68 dustproof and waterproof, and can work continuously for 16 hours when fully charged.

2.1 Appearance

The main body of M68G is as follows:



Projects	Function	Role or Status
	1.Battery level broadcast 2.On/Off Key	Short press to broadcast power; Long press to turn on/off.
	Differential data light	Rover mode: Blink when receiving differential data; Base mode: Blink when sending differential data.
	Satellite light	Rover/base station: 1 second interval flashing in the positioning state; Static mode: flashing according to sampling frequency.
	7Pin DataPort	RS232 serial port, baudrate support 1200, 2400, 4800, 9600, 19200, 38400, 115200 and 230400bps.

	Type C charging port	Supports up to 18W PD fast charging,see 2.5.
	SIM Card Slot	Support for the whole Netcom, see 2.4 for operation.
	Radio	Low power: 0.5W High power: 1.5W

2.2 Battery Indicator

Press the power key shortly when the device is off, through the Indicator light, you can know the battery level:

Indicator light	Battery level
	67% - 100%
	34% - 66%
	0% - 33%

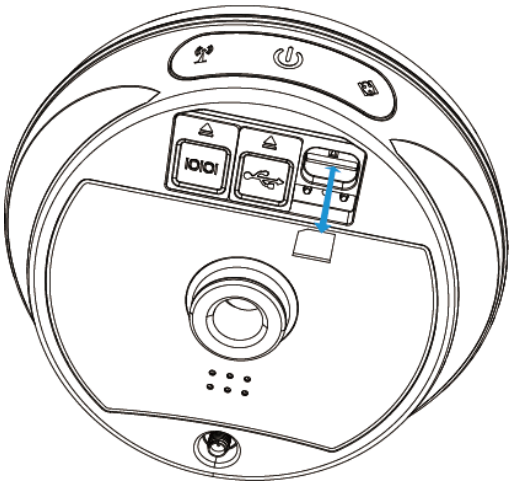
2.3 Power On And Off

Power on: Press and hold the power button for 3 seconds until the buzzer "beeps". Release the button, the device starts to power on, and the panel light flashes. The device will not start until the buzzer emits a "beep" for 3 times.

Shutdown: Press and hold the power button for 3 seconds until the buzzer "beeps". Release the button and the device starts to shut down. The unit will power off until all panel lights go out.

Forced shutdown: In case of unexpected failure, press and hold the power button for 10 seconds, and the device will automatically shut down.

2.4 Insert A SIM Card



The device supports network working mode. Insert SIM card:

1. Open the rubber cover;

2. Insert the SIM card slot according to the instructions (the chip faces the bottom center, the notch faces the card slot);

3. Cover the rubber sleeve.

2.5 Charge The Battery

The device is equipped with a Type-C charger that supports up to 18W PD fast charging.

It takes 4 hours to fully charge the battery:

1. Red light: The battery is charging.

2. Green indicator light: The battery is fully charged.

To charge the battery, open the type-C cover, connect one end of the data cable to the type-C interface, and the other end to the charger.

Note: For the safety of your device, please use the standard adapter in the package or a 3C-certified brand adapter to charge the host.

2.6 Install The Radio Antenna

The antenna is required when the datalink is set to internal radio.

To plug in radio antenna, open the cover of UHF radio, and install the radio antenna.

2.7 Packing Checklist

After the user arrives and unpacks the box, please press the list in the form to check whether all accessories and equipment are complete.

Num	Name	Model	Quantity	Image	Remark
1	GNSS receiver	M68G	1		Standard
2	450-470M radio antenna	AT0038	1		Standard
3	USB 3.0 to type-c cable	L0602-1	1		Standard
4	European 5V/2A USB power adapter (fast charging)	CG0025	1		Standard
5	Base connector	BB0031	1		Optional
6	Altimeter	BB0039	1		Optional
7	M68G yellow toolbox mobile station packaging		1		Optional
8	30 cm extension rod (yellow)	BBO036	1		Optional
9	Thin hand (5 inches) - with touch pen	DP0031	1		Optional

10	Book shelf	BB0037	1		Optional
11	7-pin to USB and serial ports	L0609-15	1		Optional

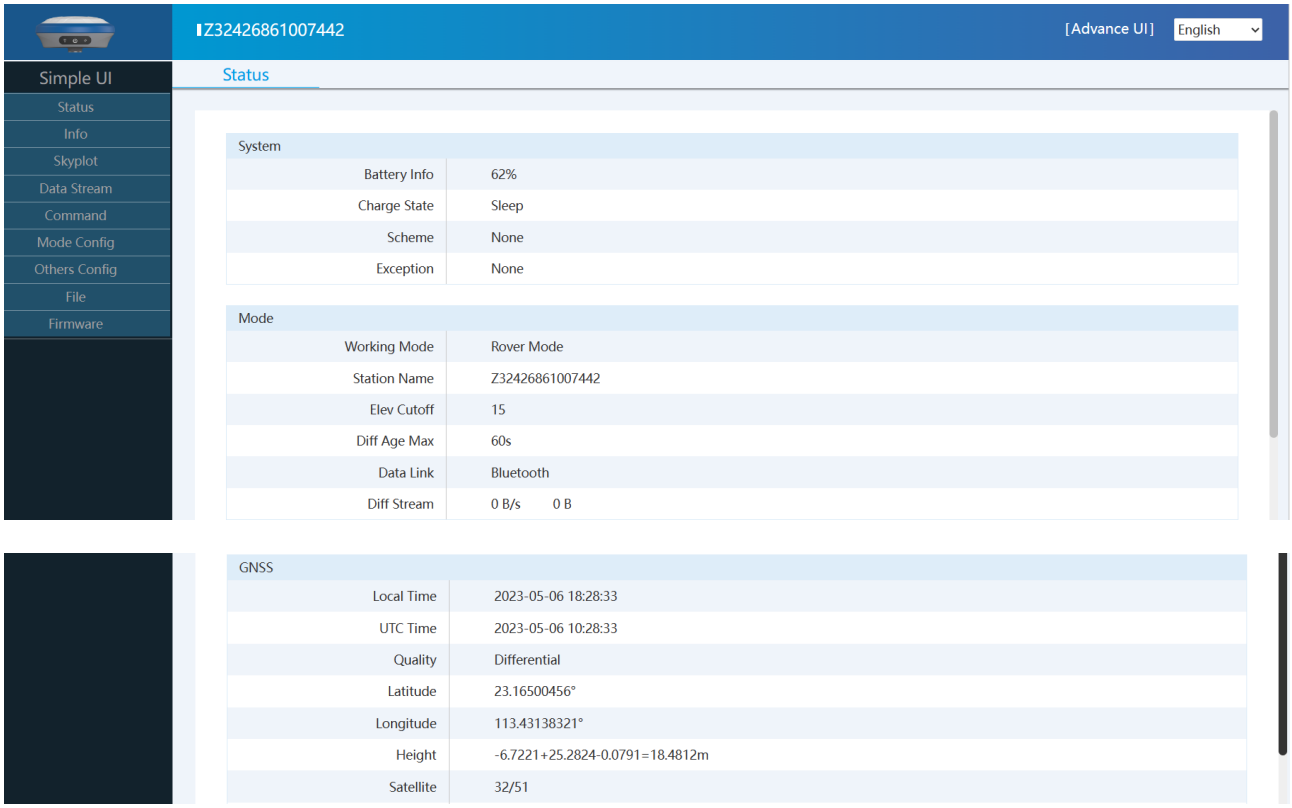
Ⅲ. Web UI

The device WIFI can be used as a hotspot, and a PC, smartphone or tablet can be connected to the hotspot. After connecting to the hotspot, you can manage the working status, change the working mode, con basic settings, download raw data, update firmware and register devices, etc.

Take the interface of your PC as an example, enter the Web UI, and perform the following operations:

1. Use the computer to find the WIFI hotspot of the device. Hotspot name: device serial number, default password is empty.

2. Open a web browser and enter the IP address 10.10.10.10. The following interface displays:

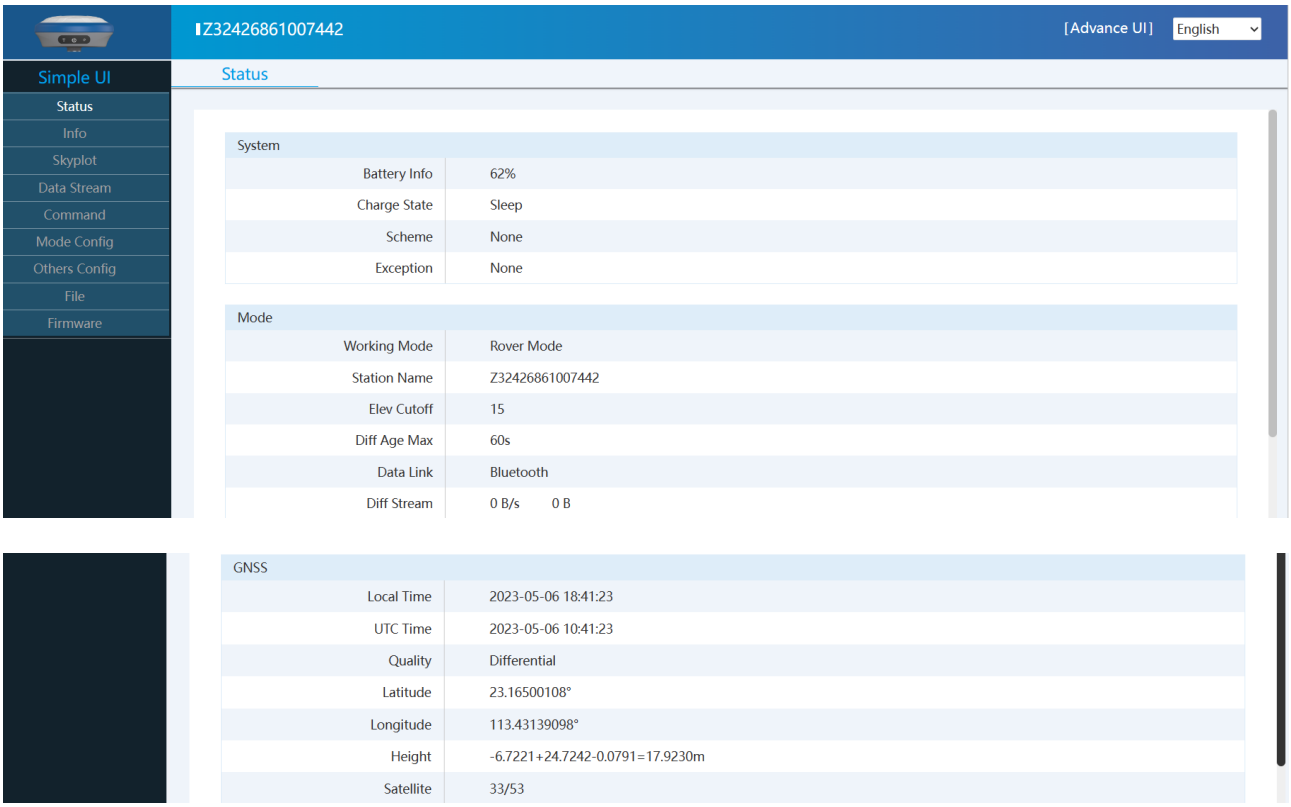


3.1 Status

① **System:** Battery Info, Charge State, Scheme, Exception;

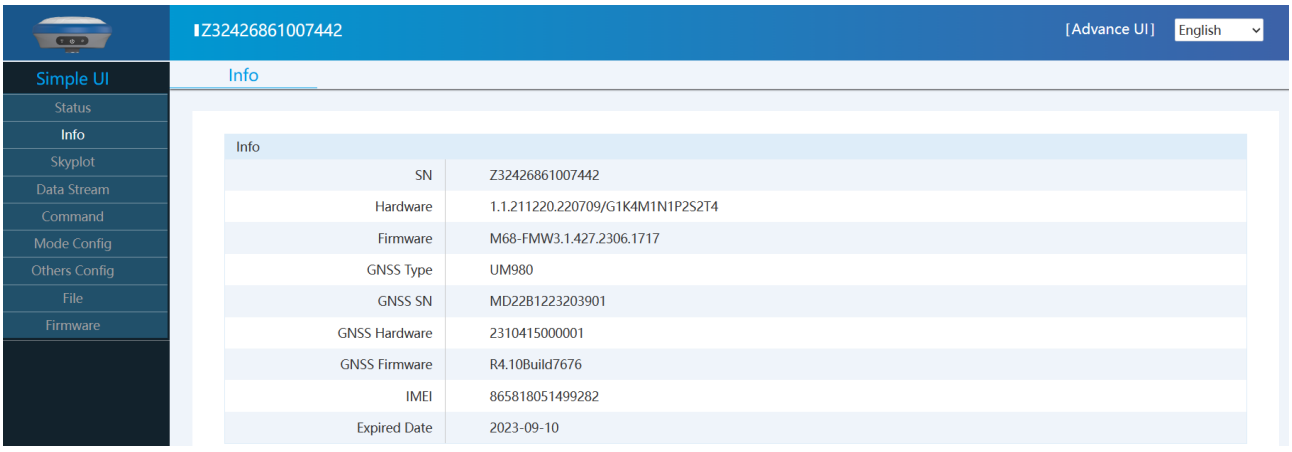
② **Mode:** Working Mode, Elev Cutoff, Data Link;

③ **GNSS:** Time, Quality, Latitude, Longitude, Height,Satellite.



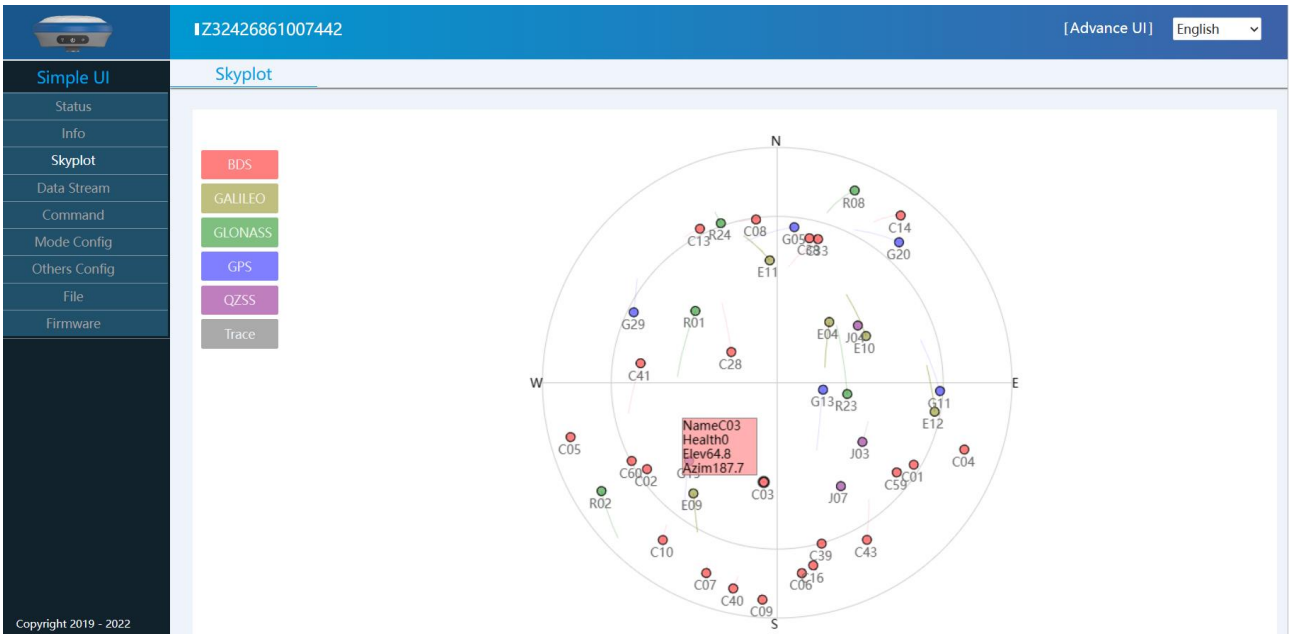
3.2 Info

The info mainly displays the device information. For example, SN, GNSS Type, GNSS Hardware, IMEI, Expired Date, as shown below:



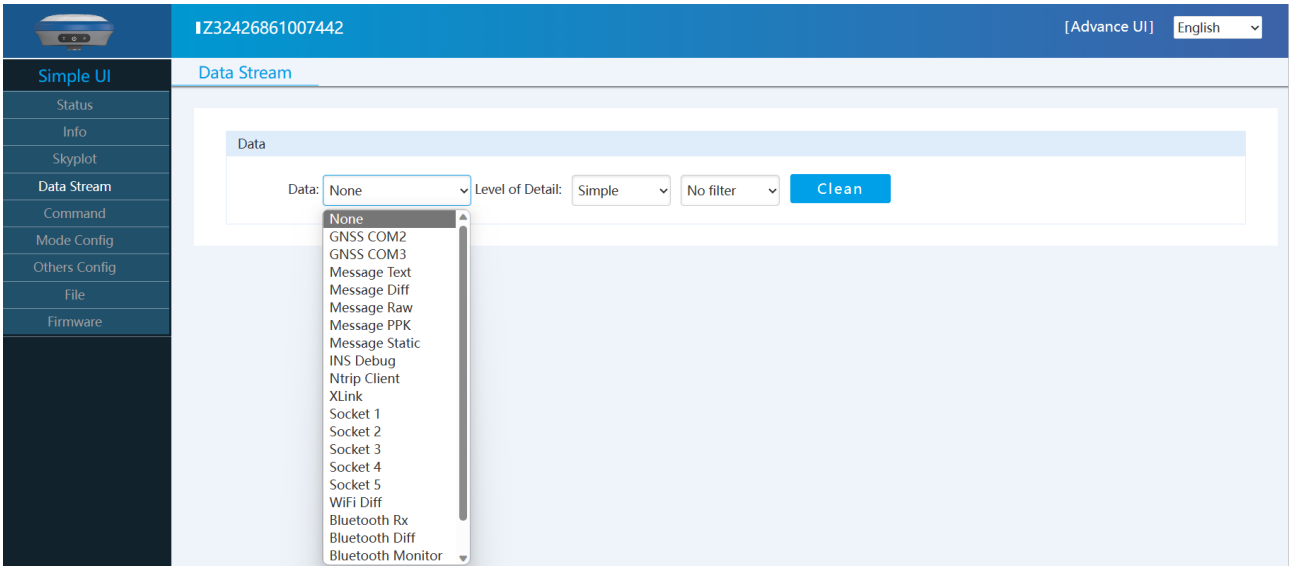
3.3 Skyplot

The skyplot mainly shows the satellite trajectory satellite status map. For example, Trace, Name, Health, Elev, Azim, as shown below:



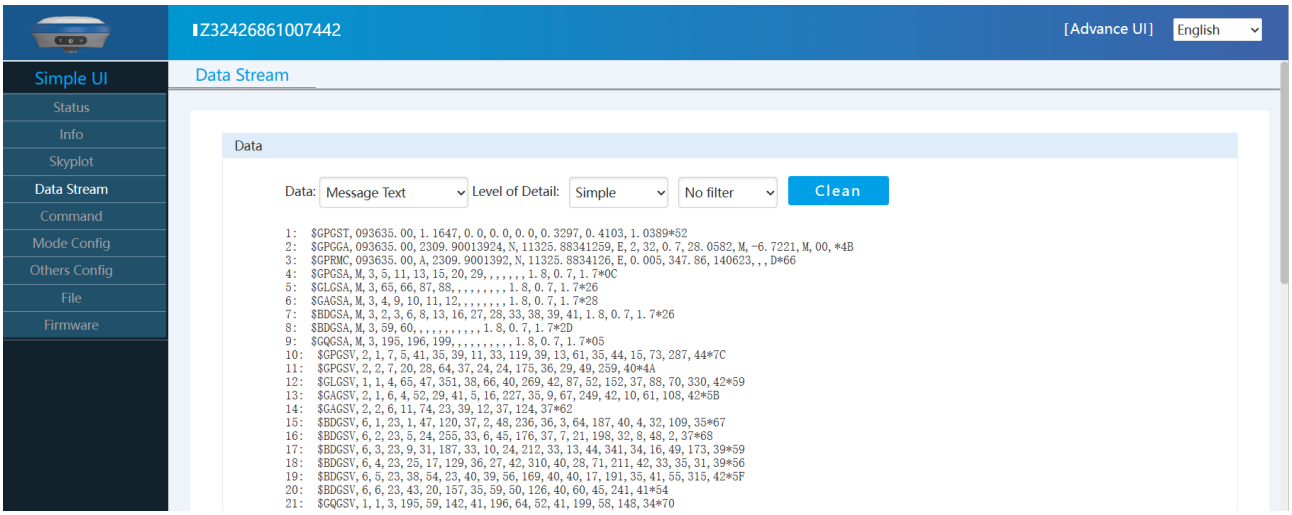
3.4 Data Stream

The data stream is mainly used to debug data information; you can view the current data status, as shown below:

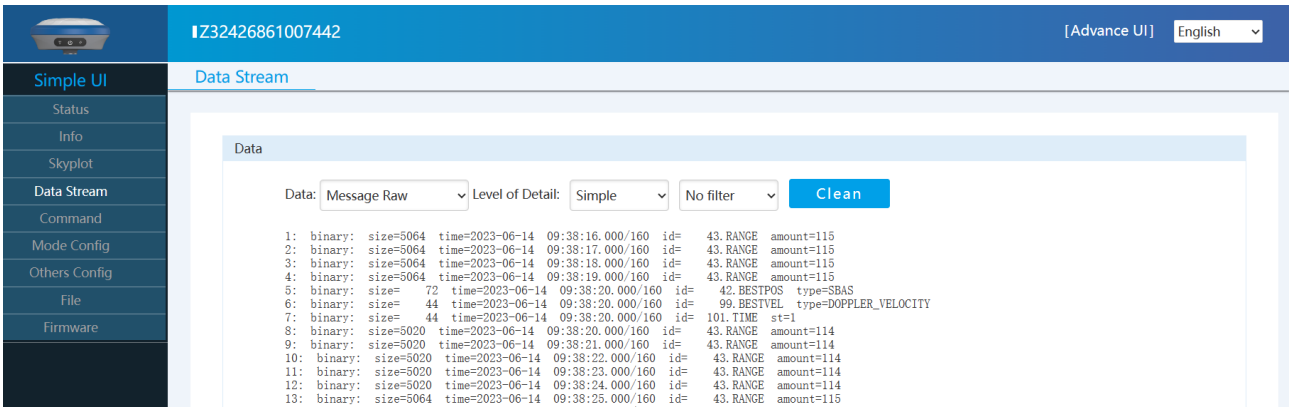


For example:

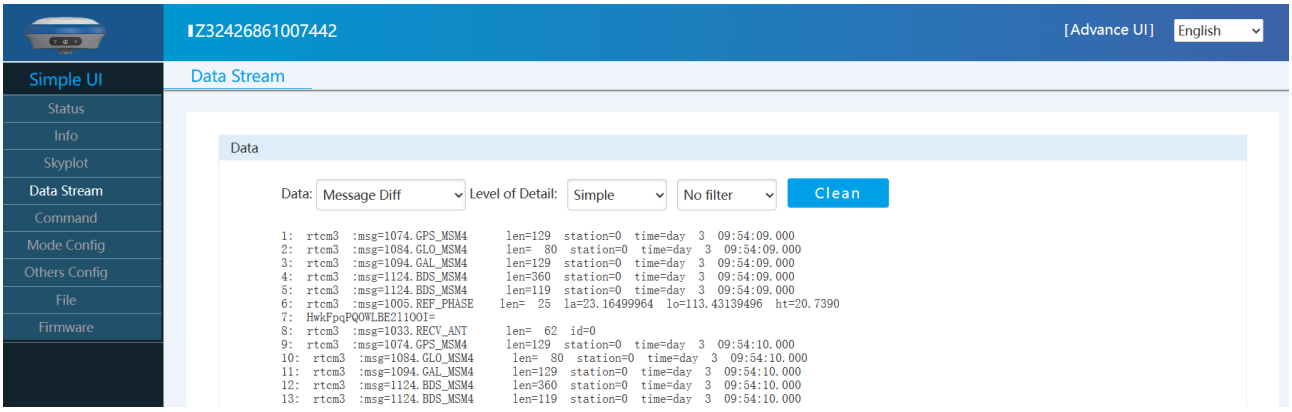
1. Message Text: see 3.11 in this section for the configuration of text data.



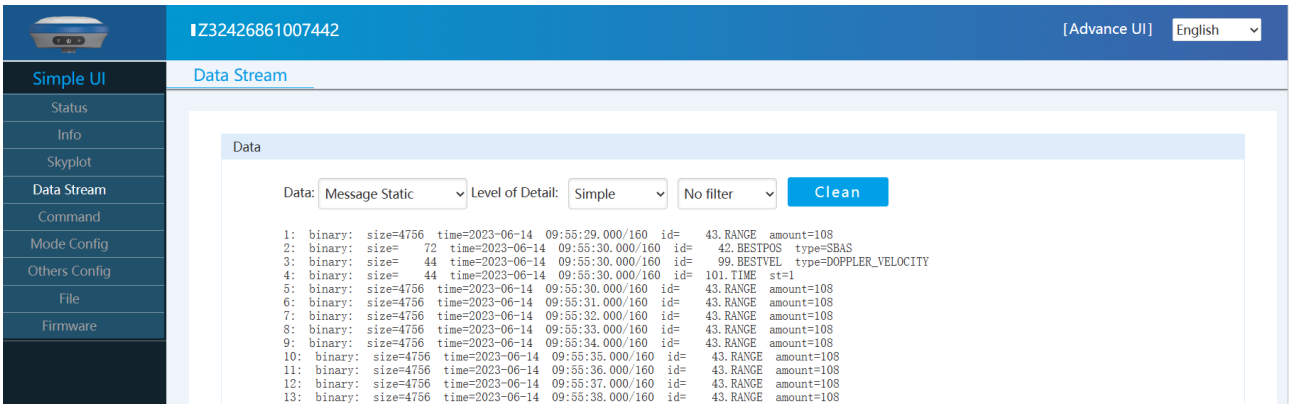
2. Message Raw



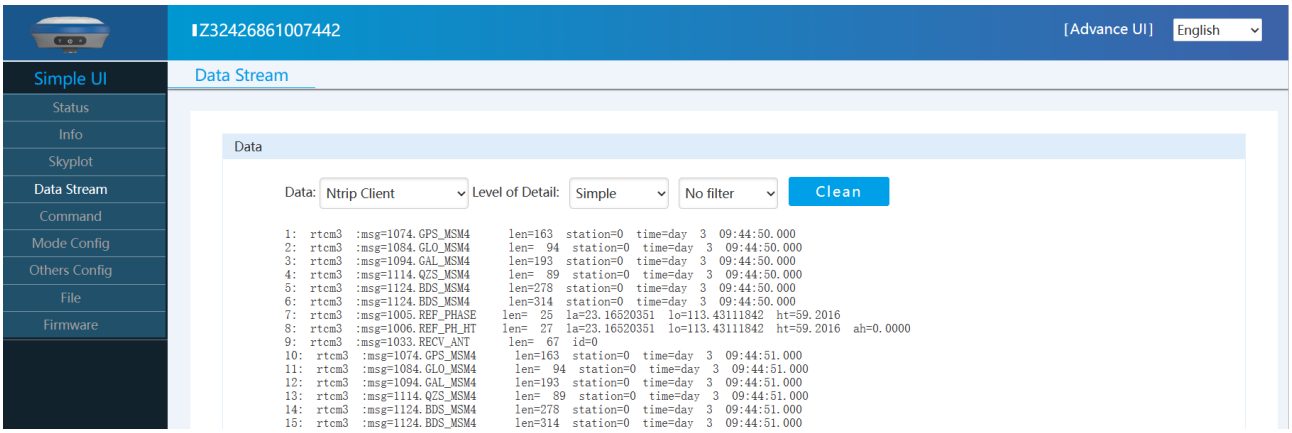
3. Message Diff: when the device is the base station, you can check whether there is differential data output here.



4. Message Static: When the device is static mode, you can check whether there is static data output here.



5. Ntrip Client: When the device is a rover station and uses Ntrip Client to obtain differential data, you can check whether there is differential data output here

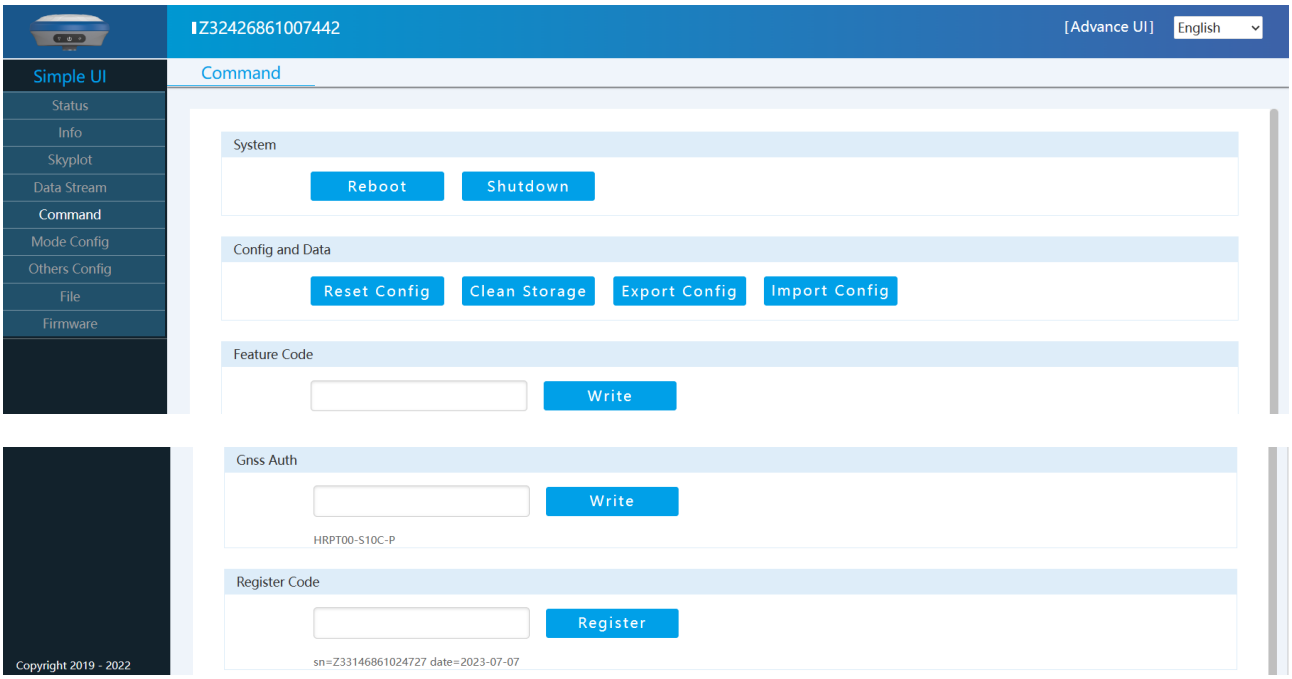


3.5 Command

① **System :** Reboot, Shutdown;

② **Config and Data :** Reset Config, Clean Storage, Export Config, Import Config;

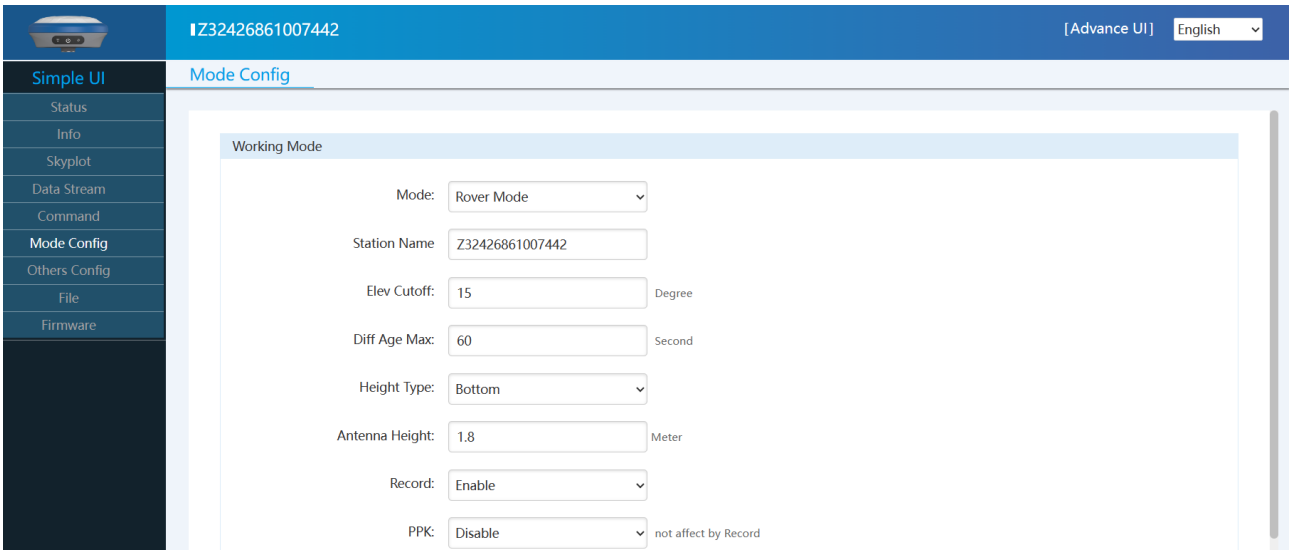
③ **Register Code :** The registration code is a valid time code that authorizes the location function of the device. When it is found that the registration code has expired and the device positioning function is unavailable, you can obtain a new registration code from the supplier by providing the device SN, and enter it on this page and click [Register] to register.



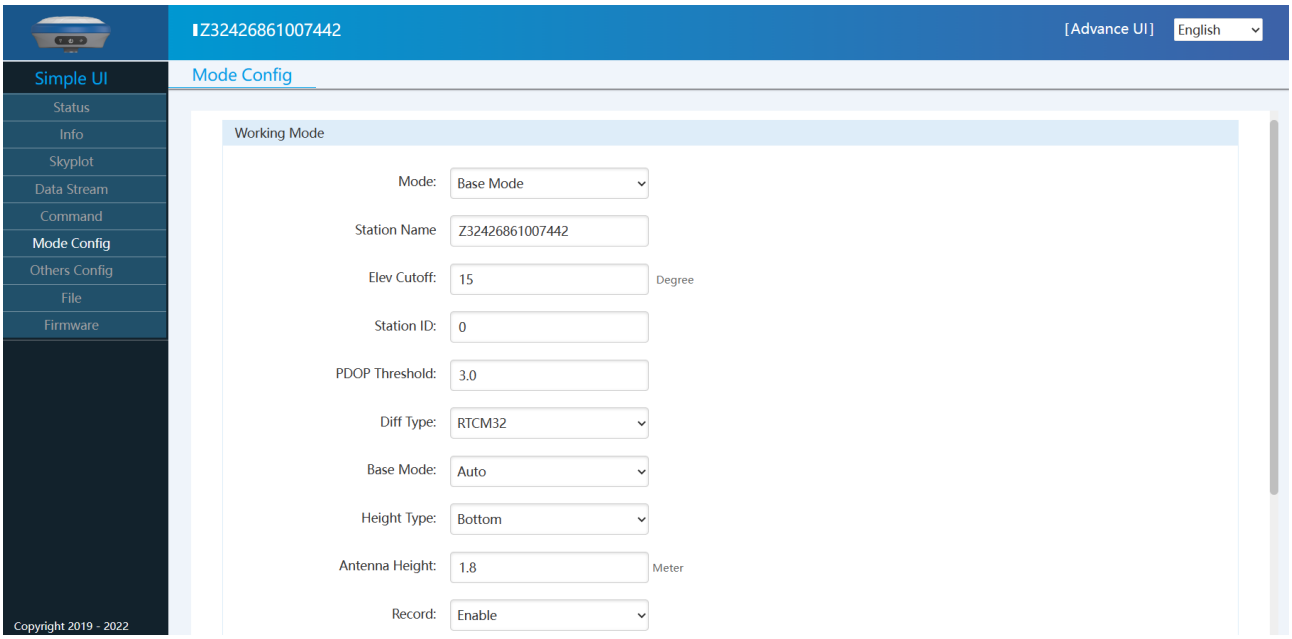
3.6 Mode Config

① **Working Mode :** You can choose Rover Mode/ Base Mode/ Static Mode, and select the Elev Cutoff at the same time;

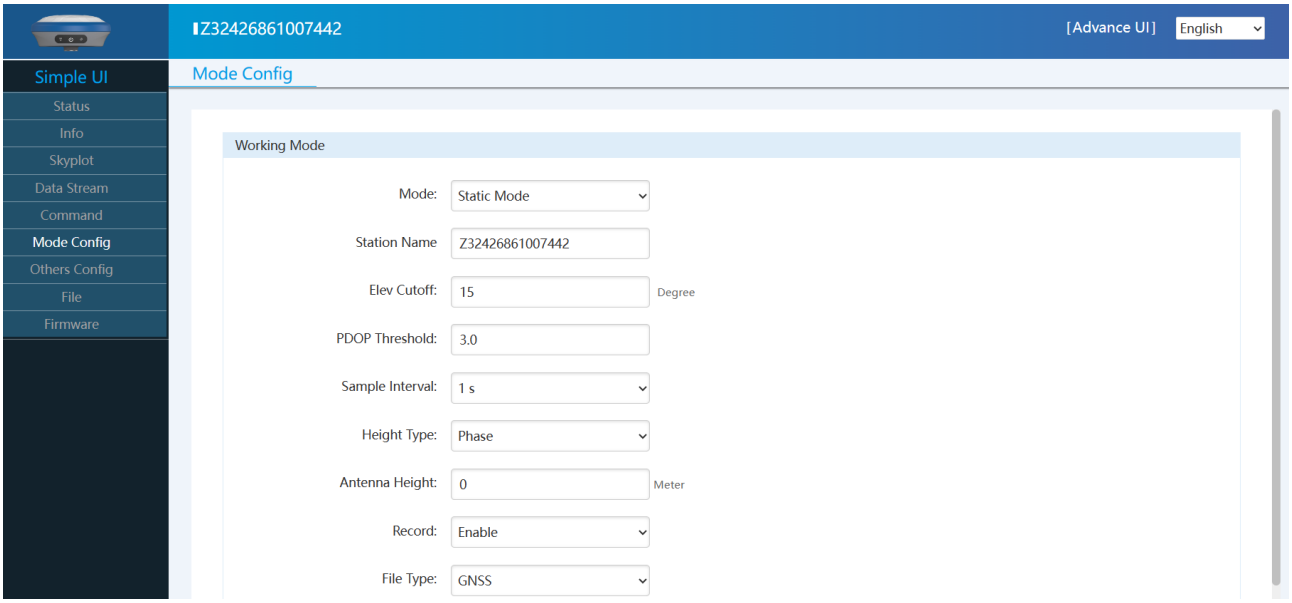
1. Rover Mode: the following parameters (Station Name, Elev Cutoff, Diff Age Max, Height Type, Antenna Height, Record, PPK) can be cond.



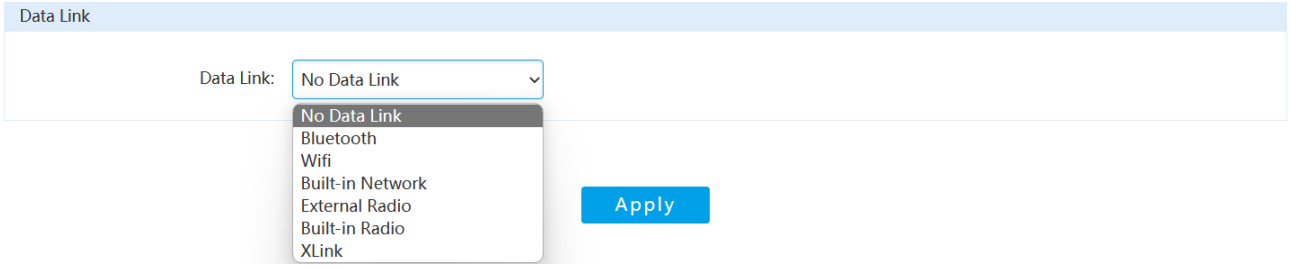
2. Base Mode: the following parameters (Station Name, Elev Cutoff, Station ID, PDOP Threshold, Diff Type, Base Mode, Height Type, Antenna Height, Record) can be cond.



3. Static Mode: the following parameters (Station Name, Elev Cutoff, PDOP Threshold, Sample Interval, Height Type, Antenna Height, Record) can be cond.



② **Data link :** You can choose No Data link/ Bluetooth/ Wifi/ Built-in Network/ Built-in Radio/ External Radio/ XLink.



1. Bluetooth: the device obtains the differential data of tSurvey software accessed by the manual network through Bluetooth connection to the manual;

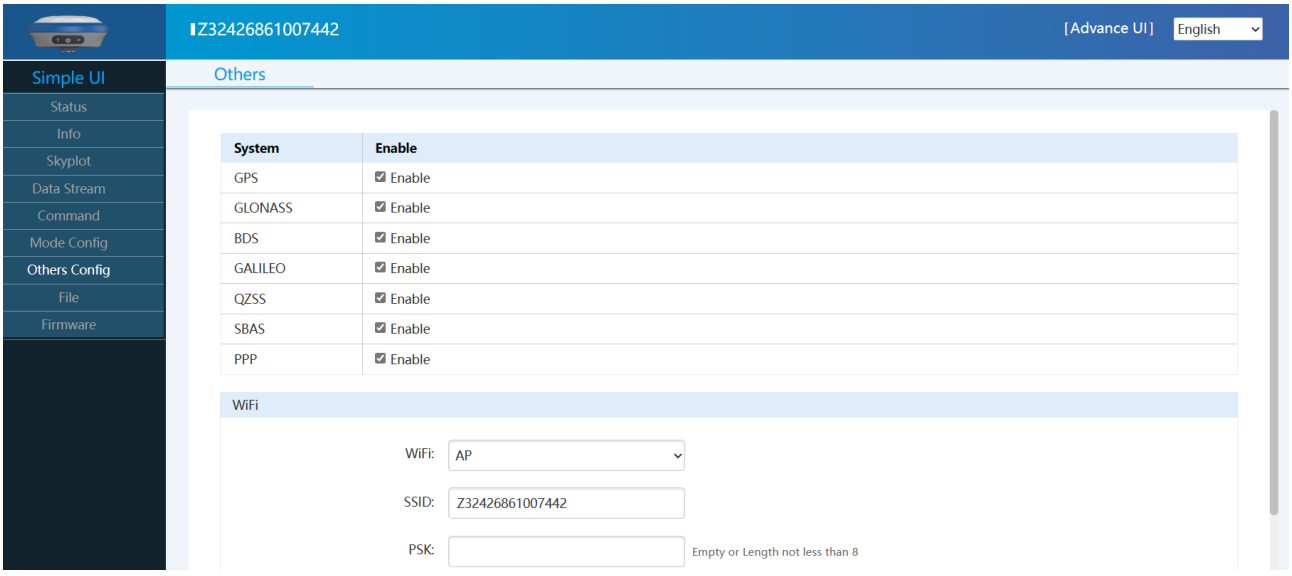
2. Built-in Network: the device receives or sends data through the built-in network. To select this data link, first insert the SIM card into the device;

3. Built-in Radio: the device receives data through the built-in radio. To select this data link, first connect the radio antenna to the device.

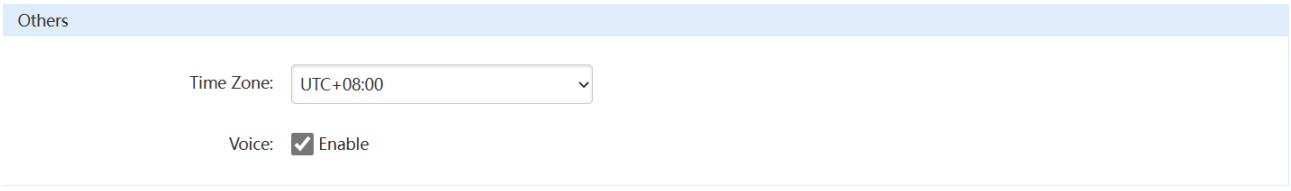
3.7 Others Config

① **GNSS System :** The small box behind a single point can turn on or off the corresponding satellite system. If it is found that the device receives fewer satellites under normal environment, you can enter this page to check whether all satellite systems have been turned on.

② **WiFi :** You can choose three types of Disable/AP/Station, and you can set the WiFi name and password by yourself. When the device WiFi is used as the Station, you can access the network by entering the name and password of the external hotspot.

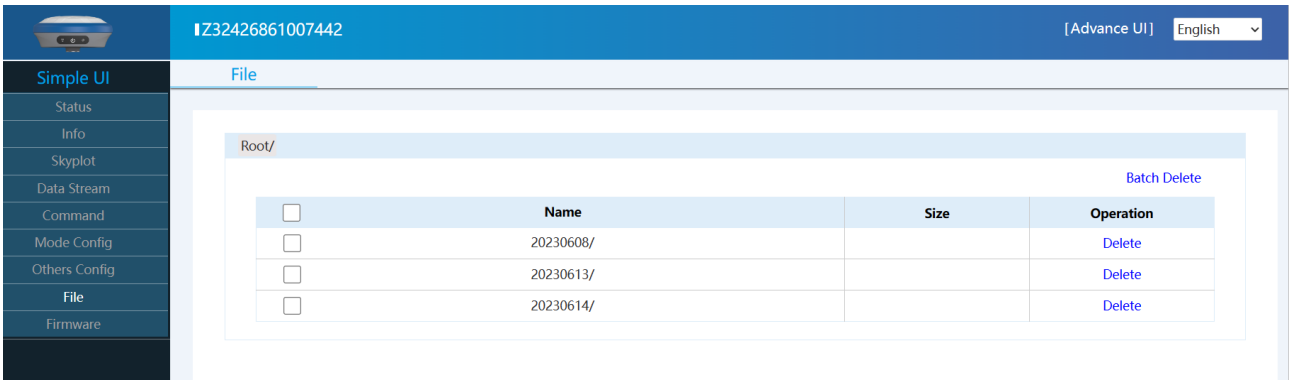


③ **Others :** Time Zone, Voice.



3.8 File

File management can delete and download data of each channel in batches , as shown below:



3.9 Firmware

① **Version :** System, GNSS, INS, Radio, Firmware.

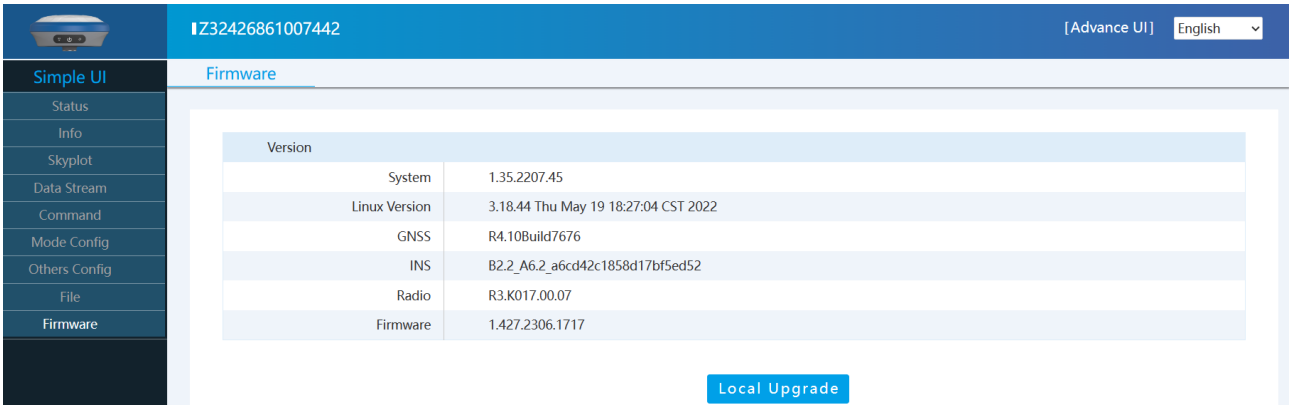
② **Local Upgrade :** Click Local Upgrade below to automatically identify and upgrade the positioning board firmware, tilt module firmware, and device firmware. There will be a prompt below during the upgrade process, and the device will restart after the upgrade is complete. The operation steps are as follows:

1. Click [Local Upgrade];

2. Select the correct device firmware in the pop-up window, flash the firmware and wait for the device to restart;

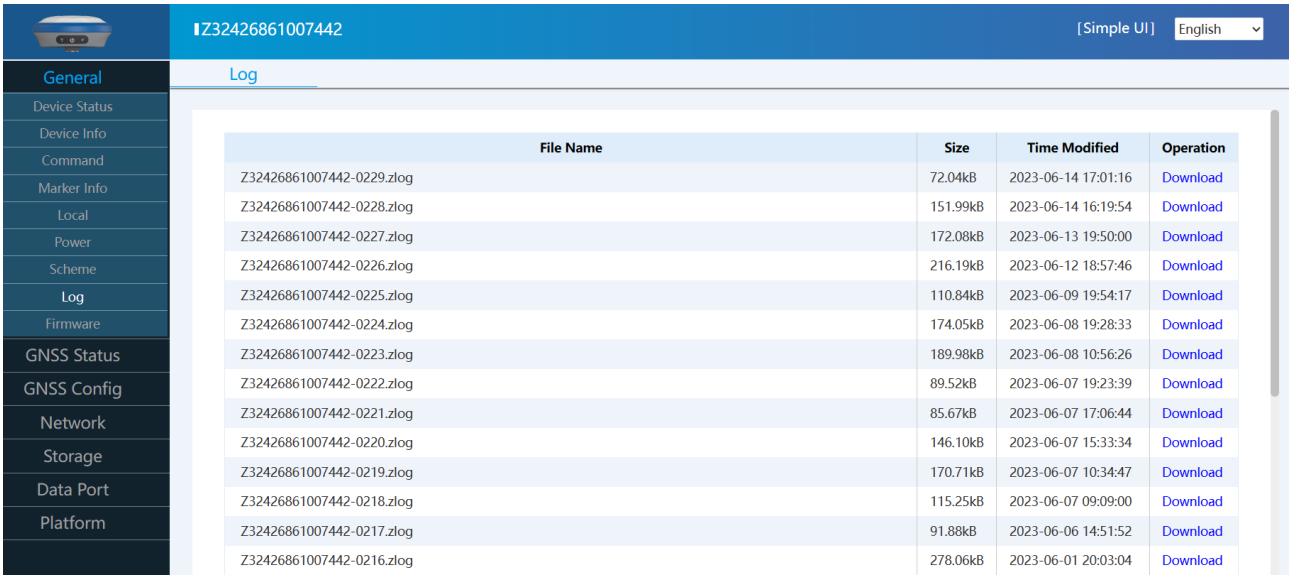
3. After the restart is complete, the firmware upgrade is completed;

4. Reconnect the device WiFi, enter the webui, and check whether the firmware has been upgraded successfully.



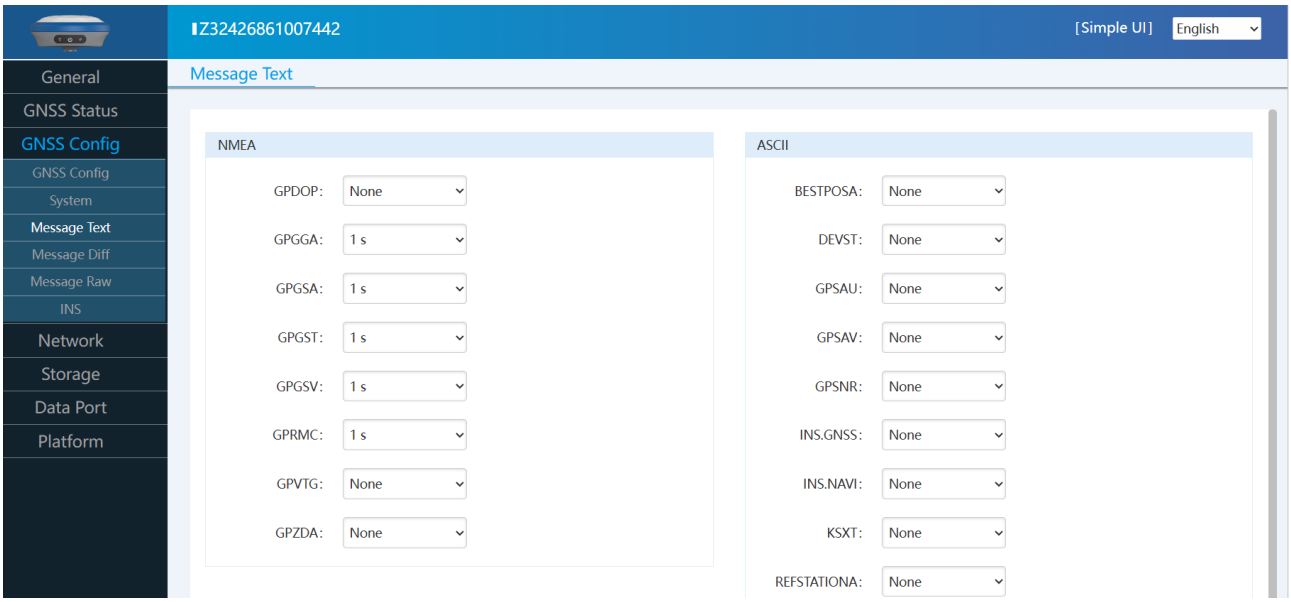
3.10 Log

It provides the download of the operation log of the device. When the device is abnormal during use, you can download the log generated at the corresponding time here to the supplier for troubleshooting. As shown below:



3.11 Message Text

You can set the type and frequency of output data in text format, as shown below. After configuration, you can check whether there is corresponding text data output in 3.4 of this section.



The following are the formats of several common message text:

GPGGA	$GPGGA,<1>,<2>,<3>,<4>,<5>,<6>,<7>,<8>,<9>,M,<10>,M,<11>,<12>*hh
<1>	UTC time, hhmmss (hour minute second) format, 8 hours different from Beijing time
<2>	Latitude ddmm.mmmm (degrees and minutes) format (the previous 0 will also be transmitted)
<3>	Latitude Hemisphere N (Northern Hemisphere) or S (Southern Hemisphere)
<4>	Longitude dddmm.mmmm (degrees and minutes) format
<5>	Longitude Hemisphere E (East Longitude) or W (West Longitude)
<6>	GPS status: 0=no positioning, 1=single point positioning, 2=SBAS differential positioning, 4=RTK fixed solution, 5=RTK floating point solution, 6=inertial navigation positioning
<7>	The number of satellites (00~12) using the solution position
<8>	HDOP horizontal precision factor (0.5~99.9)
<9>	Altitude (- 9999.9~99999.9)
<10>	Height of earth ellipsoid relative to geoid
<11>	Differential time (the number of seconds since the last differential signal was received. If it is not differential positioning, it will be null)
<12>	Differential station ID No. 0000~4095 (the previous 0 will also be transmitted, otherwise it will be null)

GPGSA	$GPGSA,<1>,<2>,<3>,<3>,<3>,<3>,<3>,<3>,<3>,<3>,<3>,<4>,<5>,<6>*hh
<1>	Mode, M=manual, A=automatic
<2>	Positioning type, 1=no positioning, 2=2D positioning, 3=3D positioning
<3>	PRN code (pseudo-random noise code), the satellite number (01~32, the previous 0 will also be transmitted) being used to calculate the position.
<4>	PDOP position precision factor (0.5~99.9). The spatial geometric intensity factor of satellite distribution. Generally, the better the satellite distribution is, the smaller the PDOP value is, which is generally less than 4.

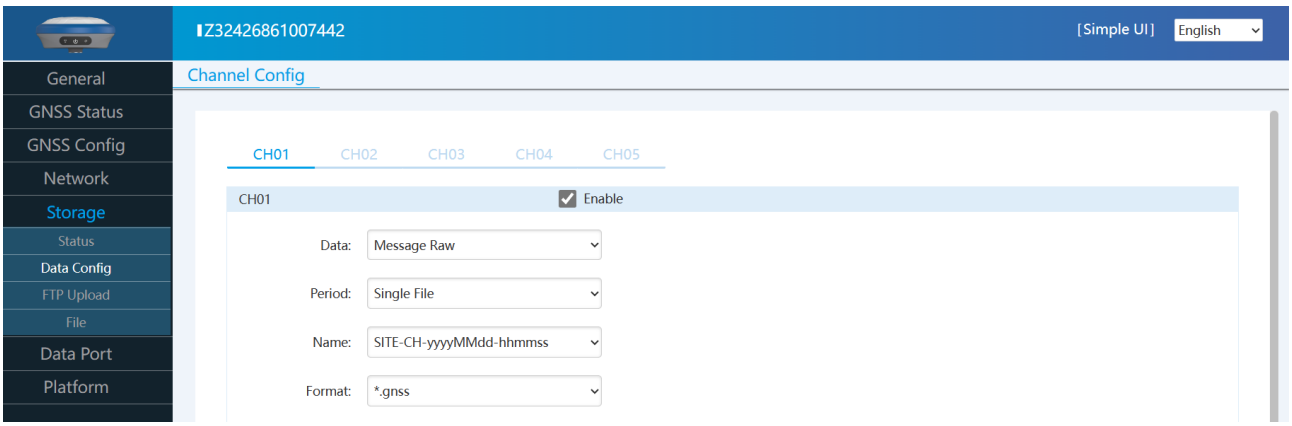
<5>	HDOP horizontal precision factor (0.5~99.9)
<6>	VDOP vertical precision factor (0.5~99.9)

GPGSV	$GPGSV,<1>,<2>,<3>,<4>,<5>,<6>,<7>,…<4>,<5>,<6>,<7>*hh
<1>	Total number of GSV statements
<2>	Number of GSV in this sentence
<3>	Total number of visible satellites (00~12, the previous 0 will also be transmitted)
<4>	PRN code (pseudo-random noise code) (01~32, the previous 0 will also be transmitted), which can be understood as satellite number.
<5>	Satellite elevation (00~90 degrees, the front 0 will also be transmitted)
<6>	Satellite azimuth (000~359 degrees, the front 0 will also be transmitted)
<7>	Signal to noise ratio (00~99dB, empty when no satellite is tracked, and the previous 0 will also be transmitted), 50 is better.

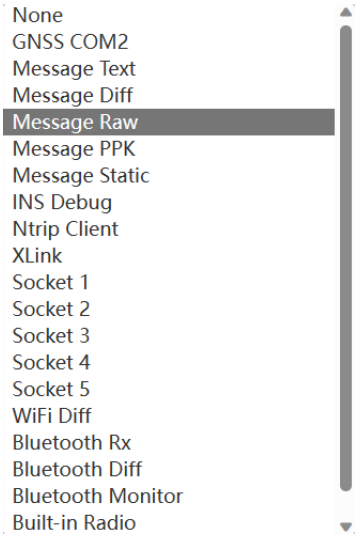
3.12 Data Config

The device has 24G storage space (recyclable storage) and supports five channels (CH01/CH02/CH03/CH04/CH05) to save various files, as shown in the below. We can con the data source, file period, file name and file format of each channel for storage as required.

Note: Do not change the mode after the device data configuration is completed, or the default storage configuration will be restored.

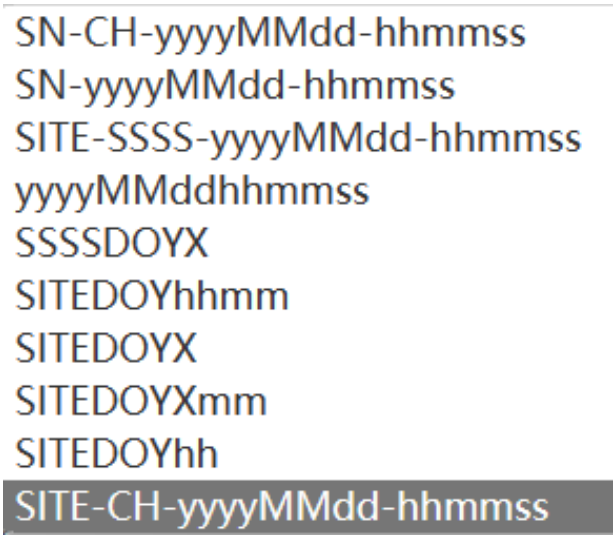


Data:

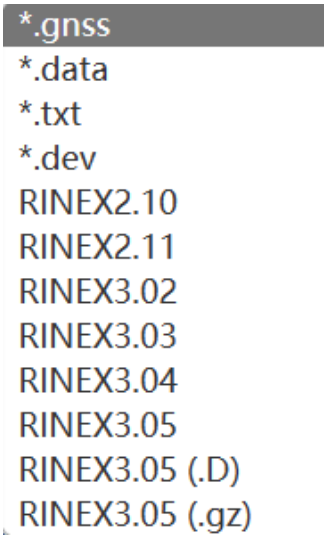


Period:

Name:



Format:



File name naming rules :

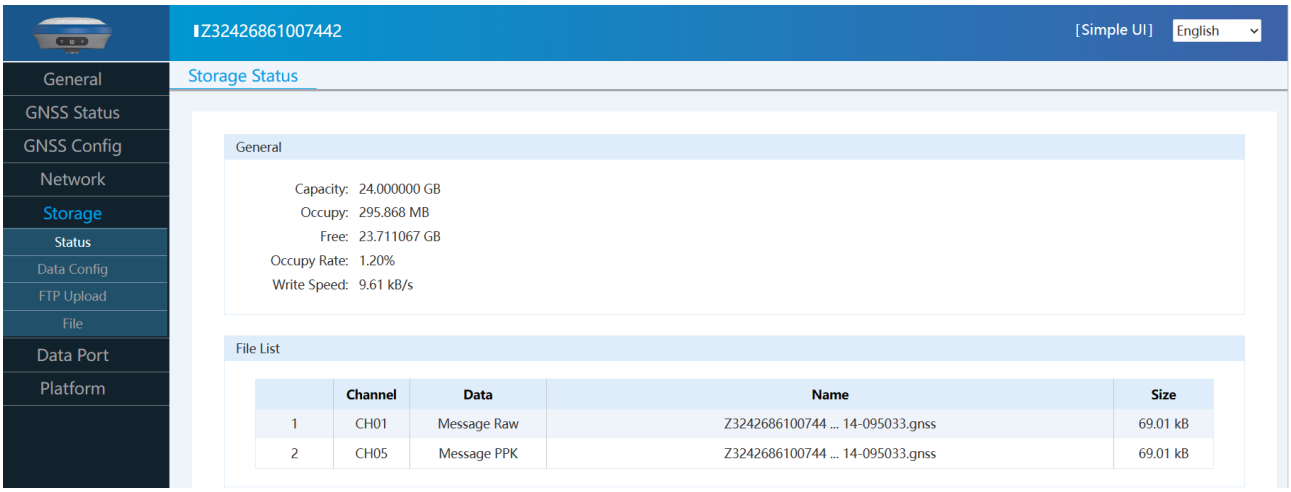
1.The time in file name is converted from GPS time directly.		Assume GPS leap second is 18, Time Zone offset is +08:00, Then 00:00:18 means 08:00:00 of local lime.	
2.Key words in file name			
yyyy	=> year	DOY	=> day of year, 000~366
MM	=> month, 01~12	X	=> hour, a~x, 0 when one file per day
dd	=> day, 01~31	SN	=> Serial Number

hh	=> hour, 00~23	SITE	=> Marker Name
mm	=> minute, 00~59	SSSS	=> Marker Number
ss	=> second, 00~59		

When the device is set to rover station, base station or static mode, the device will automatically con the corresponding channel for data storage by default.

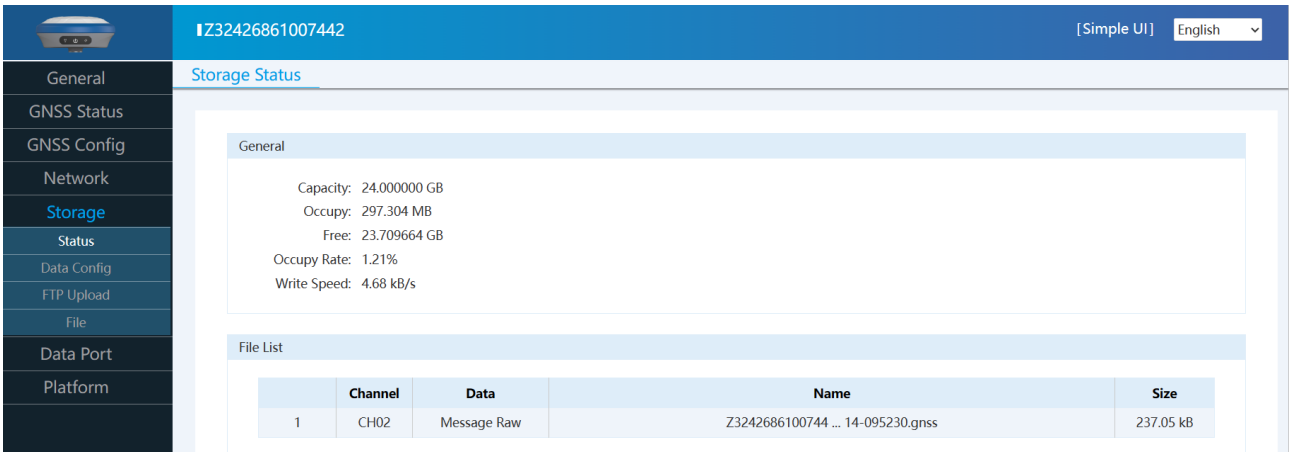
1. Rover (CH01)

When the device is set as a rover station, the device will automatically con CH01 to store and locate the original data by default. If ppk is enabled, CH05 will also be automatically cond by default to store post positioning data, as shown in the following.



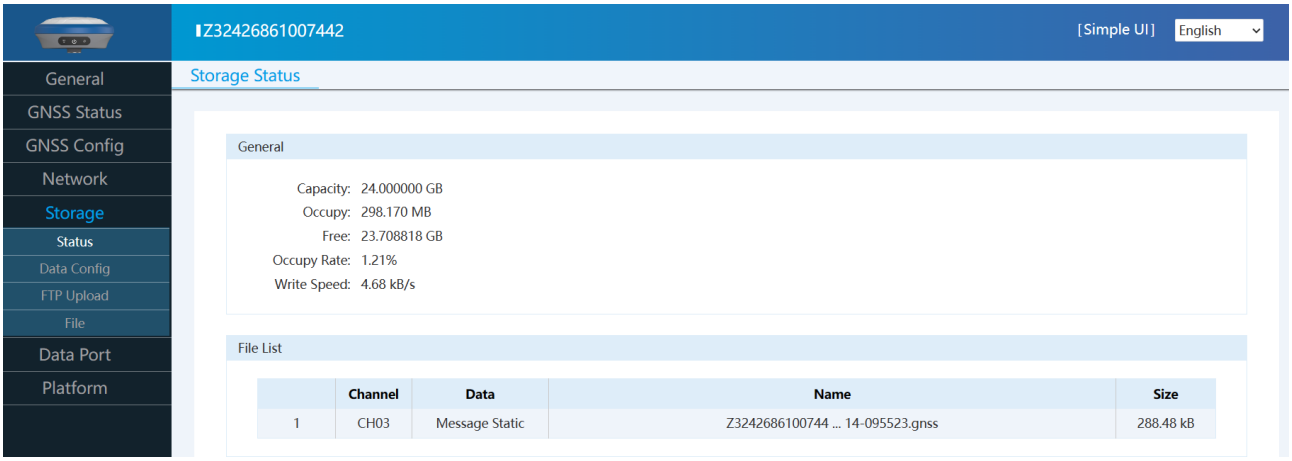
2. Base (CH02)

When the device is set as the reference station, the device will automatically con CH02 to store and locate the original data by default. If ppk is enabled, CH05 will also be automatically cond by default to store location post-processing data, as shown in the following .

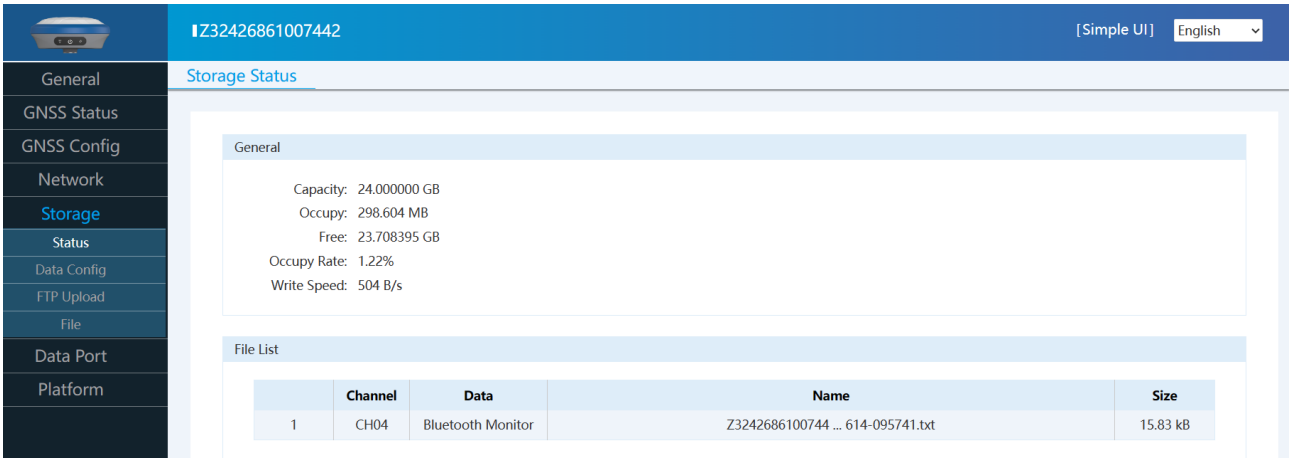


3. Static (CH03)

When the device is set to the static mode, the device will automatically con CH03 to store static positioning data by default, as shown in the following .



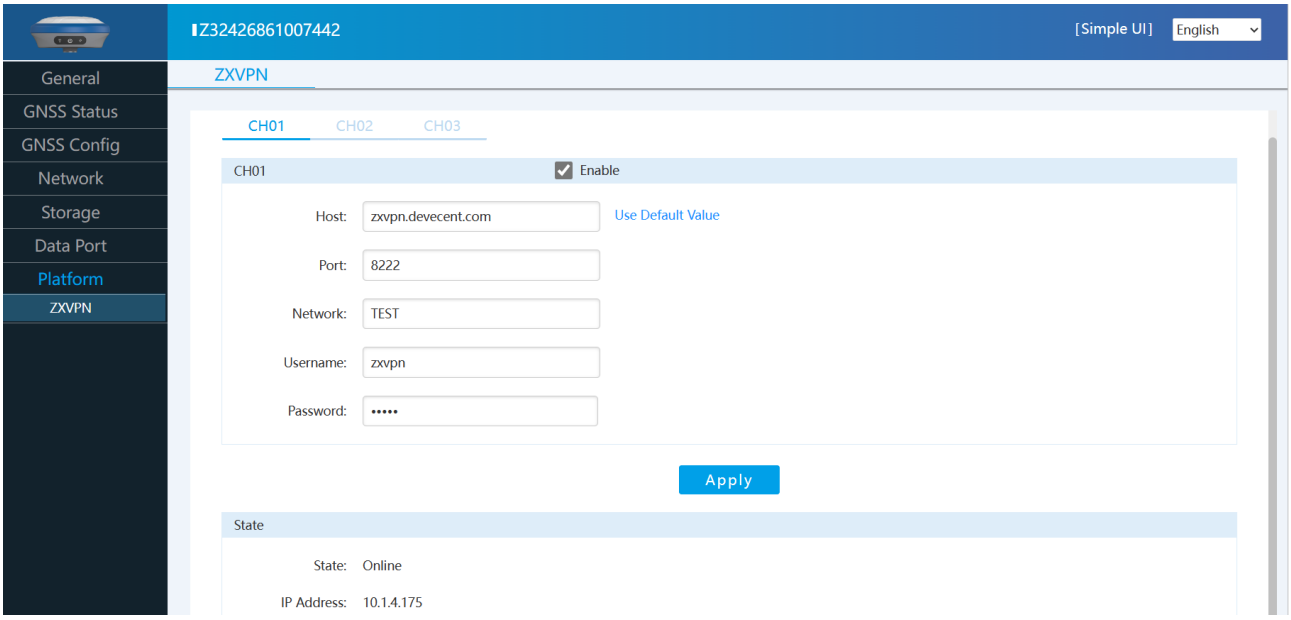
Note: Whenever the QTSurvey software connects to the device through Bluetooth, the device will automatically con CH04 to store Bluetooth monitor data. If there is any problem with the settings of the Bluetooth connection device, you can download the recorded Bluetooth monitor data for troubleshooting.



3.13 ZXVPN

ZXVPN can provide a virtual LAN, connect the device to the server, and conduct WEBUI access in the background to provide corresponding remote technical support and services.The operation steps are as follows:

1. Insert the mobile network card into the device;
2. Open the mobile network and confirm that the mobile network is online;
3. Click [Use Default Value] to apply.



Ⅳ. QTSurvey Basic Operations

It describes the basic operations to start using the device.

4.1 DP0031 Data Controller

The DP0031 TD-LTE wireless computer is a rugged, multi-function wireless computer designed with a 5-inch sunlight readable HD touch screen and alphanumeric keypad, equipped with a powerful octa-core processor and Android operating system for perfect adaptability with measuring handbook software. The DP0031 TD-LTE has professional IP68 grade protection, which is suitable for harsh outdoor environments. The large-capacity lithium battery can guarantee more than 10 hours of field work and complete multiple survey tasks throughout the day.

It's Key features:

- 5" sunlight-readable HD touchscreen;
- Octa-core 2.0GHz CPU;
- Pre-installed with Android 8.1 operating system
- 4GB RAM + 64GB ROM;
- 5 megapixel front + 13 megapixel rear camera;

- IP68 protection, waterproof/shockproof/dustproof;
- Wi-Fi, Bluetooth, NFC;
- 4G all-network support;
- 7000 mAh battery with 14 hours of battery life;
- Universal Type-C connector;
- Charging time: less than 4 hours (fast charging).

4.2 Device Connect

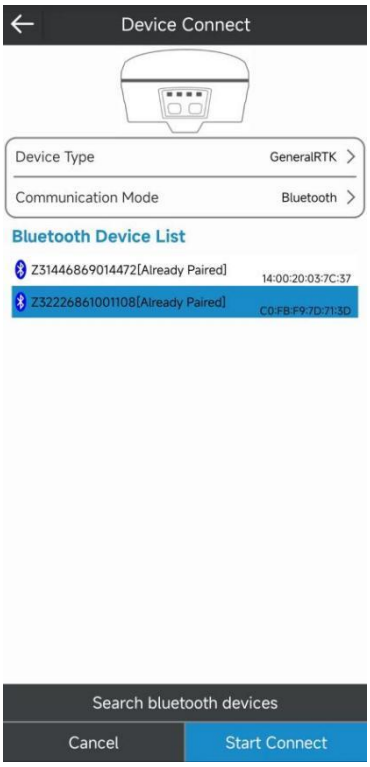
Click [Configure]->[Device Connect], enter the device connection interface, as shown in 4.2-1. Select device type (GeneralRTK), Communication Mode (Bluetooth) , click again [Search bluetooth devices], as shown in 4.2-2. View a list of bluetooth devices, select the corresponding device SN number, click [Start Connect] complete the device connection, as shown in 4.2-3. After connecting the device successfully, it will directly return to the main configuration interface, as shown in 4.2-4. Then enter the device connection, Click [Disconnect] will disconnect the device, as shown in 4.2-5. Click [Communication Debug] to view the data of the communication between the software and the device, as shown in 4.2-6.

1. The types include [Local GPS], [General/Horizon/TokNav/Meridian RTK], and [GeneralRTK] is selected by default.

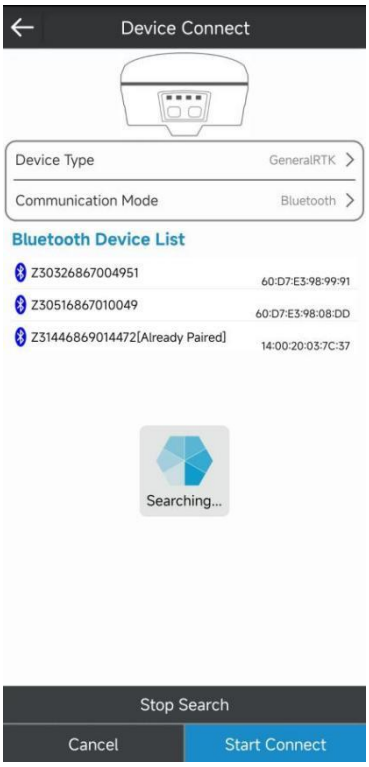
2. Connection Methods include [Bluetooth], [TCP], [Serial port], [Demo mode].

3. Click [Search bluetooth devices] to search for Bluetooth, enter Bluetooth search and selection, and click the corresponding device serial number to select the device to be connected.

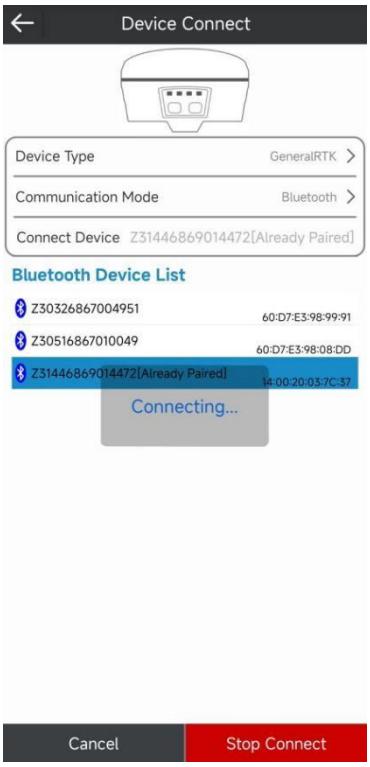
4. After the device is successfully connected, click [Communication Debug] to view the data of the communication between the software and the device, or send debugging commands to the device to troubleshoot and analyze the problems related to device positioning.



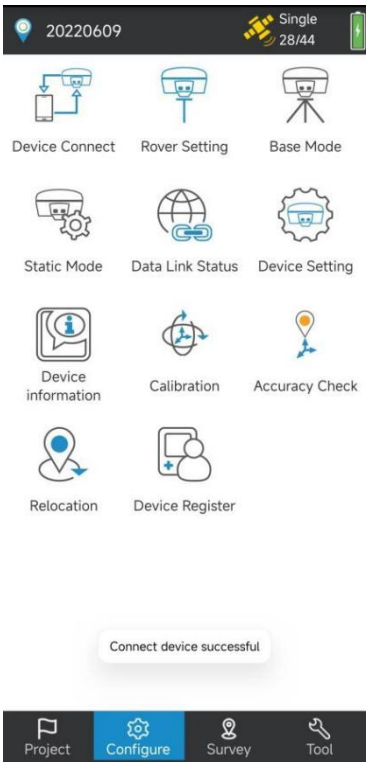
4.2-1



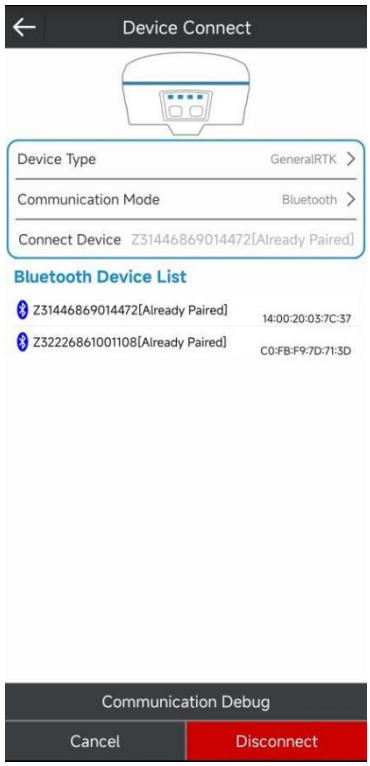
4.2-2



4.2-3



4.2-4



4.2-5

4.2-6

4.3 Project Manage

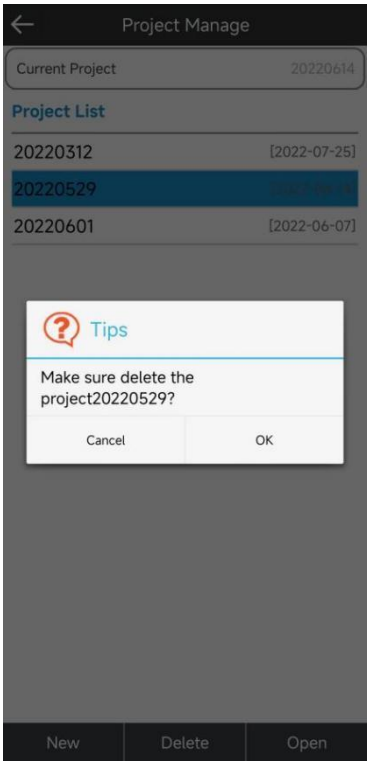
Click [Project] -> [Project Manage], as shown in 4.3-1. Project management includes functions such as new, delete, and open.

Click the project shown in the project list, and the delete and open functions will appear, as shown in 4.3-2. Click [Delete], as shown in 4.3-3, click [Cancel], the project will not be deleted from the list. If you click [OK], the project will be deleted from the list, as shown in 4.3-4.

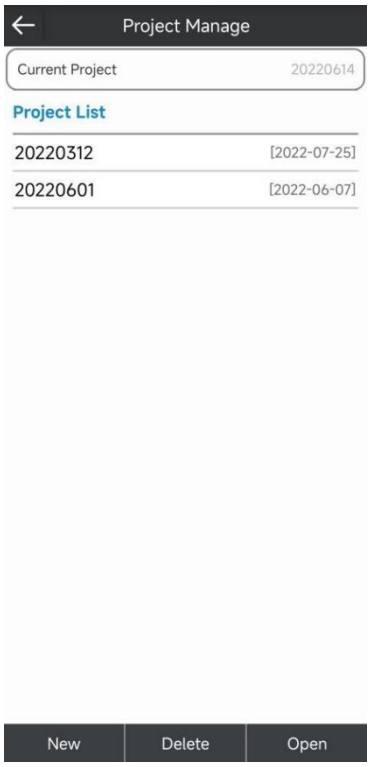
Click [New], as shown in 4.3-5, to create a new project, you need to fill in basic project information such as project name, operator, device, etc., click [OK] to set the coordinate system parameters used by the project, as shown in 4.3-6, Then click [OK] to complete the new project.

4.3-1

4.3-2

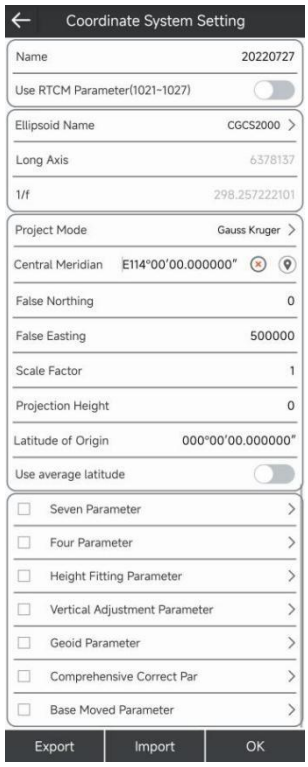


4.3-3



4.3-4

4.3-5



4.3-6

4.4 Points Library

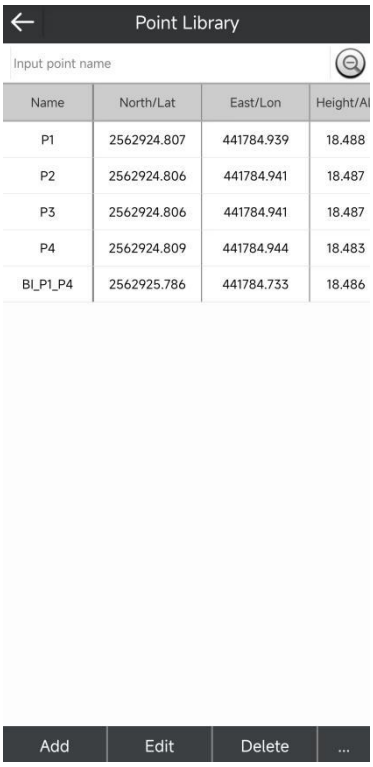
Click [Project] -> [Points Library], as shown in 4.4-1. Here, you can view and manage the point data in the project, including functions such as add, edit, delete, import, and delete tape numbers.

Click [Add], as shown in 4.4-2, you can manually enter the point name, code and corresponding coordinates;

Select the coordinate point, click [Edit], as shown in 4.4-3, you can edit and modify the name and code of the coordinate point; Select the coordinate point, click [Delete] and [OK], as shown in 4.4-4, you can delete the corresponding coordinate point;

Click [...] in the lower right corner, an operation will pop up, as shown in 4.4-5, you can select import point library, Batch Delete, Delete All, Delete B and Number and other functions as needed;

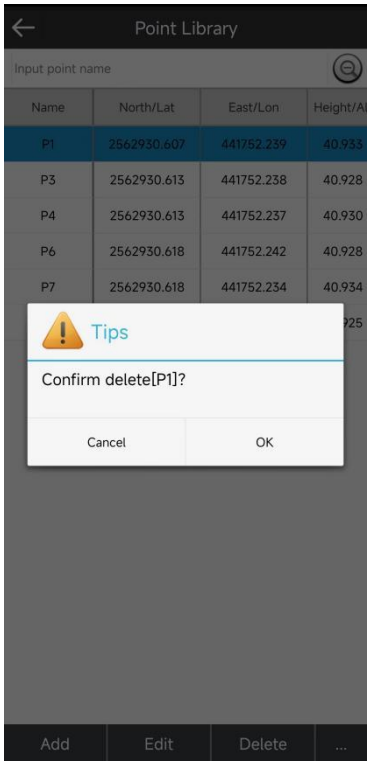
Click [Import from data file], as shown in 4.4-6, select the file format to import point data, and then select the data file to complete the data import.



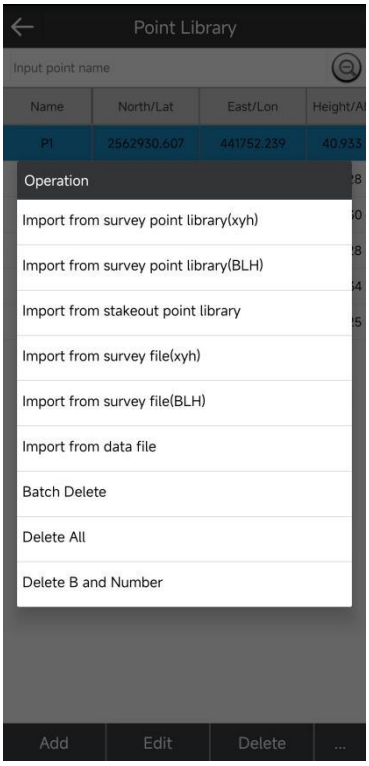
4.4-1

4.4-2

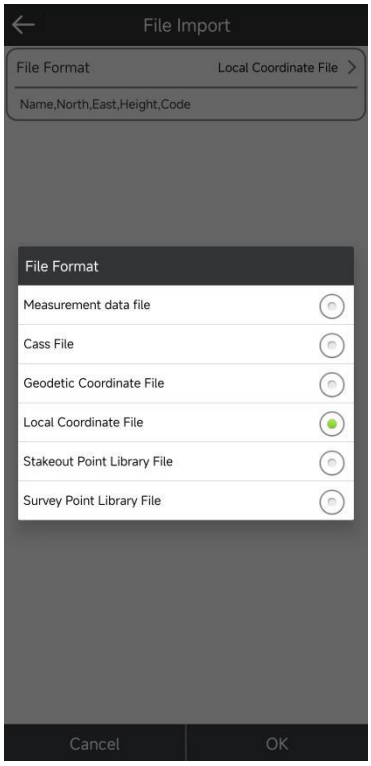
4.4-3



4.4-4



4.4-5

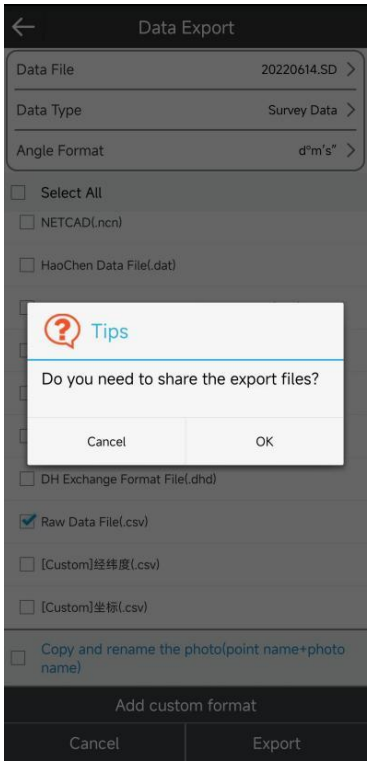


4.4-6

4.5 Data Export

Click[Project]->[Data Export], as shown in 4.5-1, choose to export Data File, Data Type and Angle Format as required. Click [Export], as shown in 4.5-2, enter the name, select the path to export the file, click [OK], and a prompt to share the file will

pop up, as shown in 4.5-3, click [OK], you can use Bluetooth, WeChat, etc. to instantly share the exported data files.



4.5-1 4.5-2 4.5-3

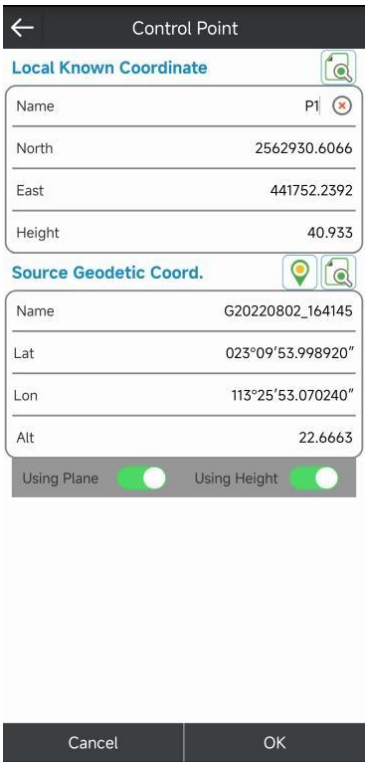
4.6 Localization

Click [Project]->[Localization], as shown in 4.6-1. The high-precision position obtained by the software from the GNSS device is the latitude and longitude coordinates of satellite positioning. In actual engineering operations, the plane coordinates of the ground are ultimately used for measurement and application. If the customer has coordinate conversion parameters, they can directly set the coordinate system parameter values in the Coordinate System (detailed 4.3). If the customer does not have specific coordinate system parameters, but has the corresponding latitude and longitude coordinates and the corresponding values of the plane coordinates, we call for the control point. In the presence of control point data, conversion parameters can be calculated through this function and applied to engineering operations.

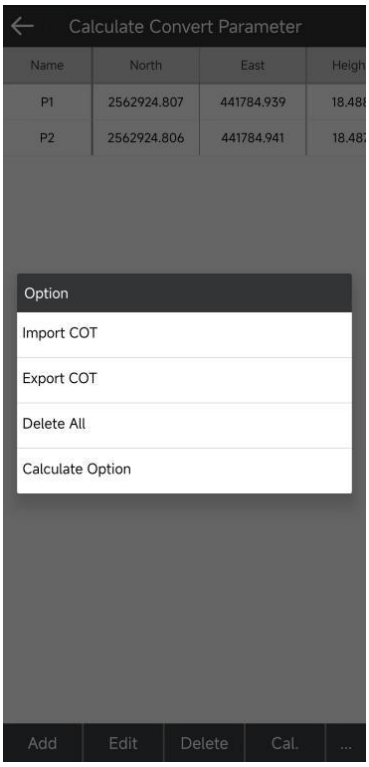
In the calculation of conversion parameters, click [Add] to manually input the added control point, as shown in 4.6-2. Select the data item and click [Edit] to modify the coordinates of the edit control point; click [Delete] to delete the control point. Click [...] in the lower right corner, options will pop up, as shown in 4.6-3, click

[Import COT], you can import control point parameters, click [Export COT], you can also export the control point data into a file, Provided to third-party software for use;Click [Calculate Option] to enter the conversion parameter setting, as shown in 4.6-4 and 4.6-5, you can set parameters such as Mode, Plane Mode, Height Mode, Horizontal Accuracy Limitation and Height Accuracy Limitation.After editing the coordinates of the control point and selecting the calculation option, calculate the conversion parameters of the control point, click [Cal.], and the calculation result of the conversion parameters will be displayed, as shown in 4.6-6, the horizontal and elevation accuracy meet the requirements. After the parameters are applied to the project, the normal measurement operation can be performed.The parameter conversion process includes ellipsoid datum conversion, horizontal correction and vertical correction. The conversion parameters that can be calculated can be combined in whole or in part. As long as the corresponding accuracy is achieved within the allowable accuracy range, the calculated conversion parameters are considered to be available.The ellipsoid datum transformation is usually seven-parameter, which are the transformation parameters of the spatial cartesian coordinates between two ellipsoids, The plane mode includes four-parameter and horizontal adjustment,the height mode includes weighted mean、 plane fitting, surface fitting and vertical adjustment. Under normal circumstances, if the working range is very wide, it is necessary to use the ellipsoid datum transformation to meet the accuracy requirements of all control points. If the working range is relatively small, the corresponding accuracy can usually be achieved by plane correction.

4.6-1

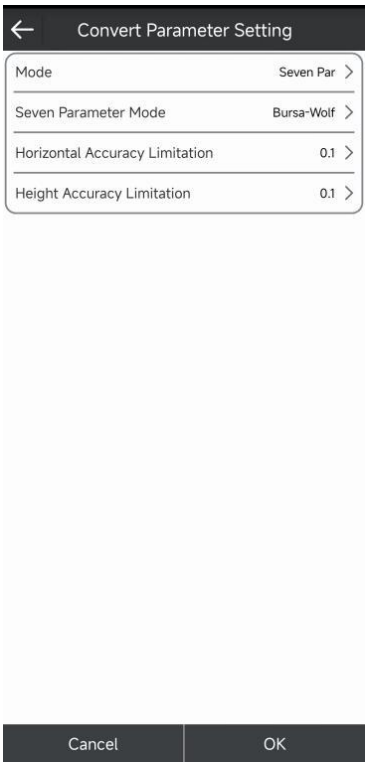


4.6-2

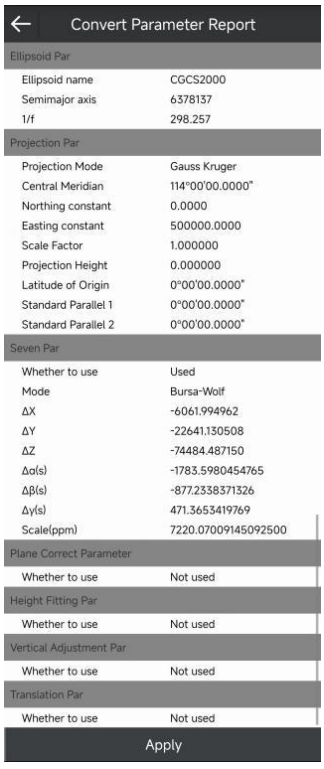


4.6-3

4.6-4



4.6-5



4.6-6

4.7 Rover Mode

Click [Configure] -> [Rover Setting], as shown in 4.7-1. GNSS positioning equipment can calculate the positioning coordinates by receiving satellite signals, In the absence of other conditions. Due to the influence of the atmosphere on the signal,

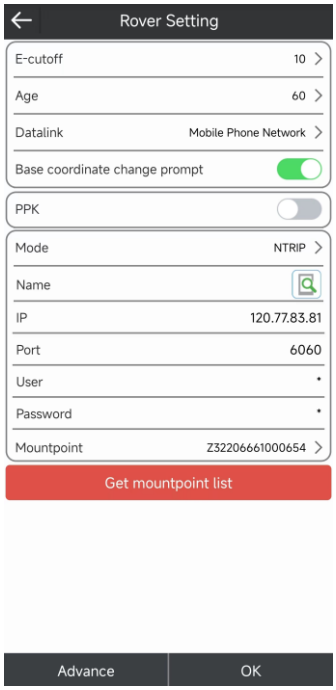
the positioning device can only obtain the coordinate position of the single-point solution, the accuracy is not high. In order to ensure that GNSS can obtain high-precision positions, in addition to the GNSS equipment itself receiving satellite signals to calculate the position, it is also necessary to receive a signal from another nearby fixed-position GNSS device. Using the signal of another device as the reference signal, since the influence of the atmosphere on the signal is basically the same in a certain area, when the coordinate position of the reference signal is known, the two sets of GNSS can solve the high-precision position. The GNSS equipment with a fixed position is called a reference station, and the position The fixed GNSS equipment is called a mobile station. Compared with the GNSS satellite signal of the mobile station, the data transmitted by the base station is called differential data, and the data transmission method is called data link. The rover mode setting is to set the GNSS as a rover, and con certain parameters to transmit the GNSS satellite signals of the base station to the GNSS device in a certain way, so that the GNSS device can obtain a high-precision positioning position.

In addition to the differential data transmission configuration, you can also set basic parameters such as the GNSS altitude cutoff angle and whether to enable PPK, as shown in 4.7-2. It can be set that the satellite signal will not be received when the altitude angle is lower than a certain value. In the case of poor satellite signals at a low angle, it is beneficial to the precision solution. The PPK parameter is to record the GNSS raw observation data to the GNSS receiver and use post-processing. The algorithm solves the high-precision coordinates.

Differential data parameter settings, the main purpose is to set the differential data of the base station to be transmitted to the current device in a certain way, so as to provide the necessary solution conditions for the device to solve the high-precision coordinates. The data link mode mainly includes built-in network, built-in radio, external radio, mobile phone network. E.g:

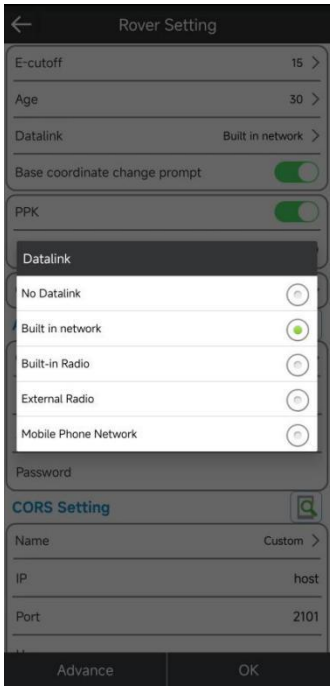
1. Built-in network: click [DataLink], select [Built-in Network], as shown in 4.7-3, refers to the SIM card network through the GNSS device, obtain differential data from the specified server address according to a certain protocol, perform high-precision solutions. The connection mode is a differential data transmission protocol,

usually NRTIP, TCP. If the SIM network is a private network, you need to con APN Setting, enter name, account, password, you can also click to the right of APN Settings, enter the operator management interface, as shown in 4.7-4. Select the corresponding APN account or click [Add], as shown in 4.7-5, fill in the operator, name, user, and password, and click [OK]. The CORS setting is to obtain differential data from the access point from the specified server address, and perform high-precision calculation.We can directly enter the corresponding server IP, port, user, password, or click on the right side of CORS settings, enter the CORS configuration management interface, as shown in 4.7-6, Click [Add], as shown in 4.7-7,Fill in the name, server IP, port, user, password and click [OK], as shown in 4.7-8, after selecting the CORS account, click [Get mountpoint list], as shown in 4.7-9, in addition to obtaining it through the RTK network, if the mobile phone has a network, it can also be obtained through the network corresponding to the mobile phone. After acquiring the access point, select the correct access point and click [OK] to complete the differential acquisition and determine if the host is fixed.



4.7-1

4.7-2

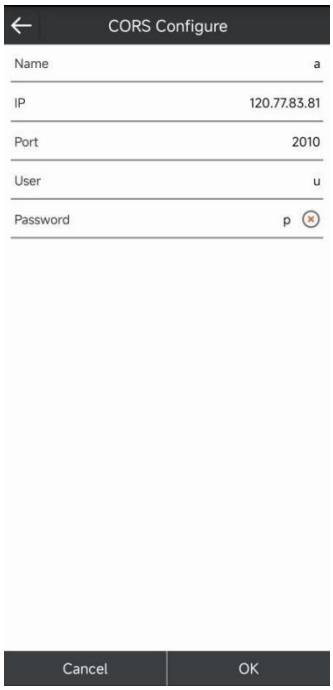


4.7-3

4.7-4

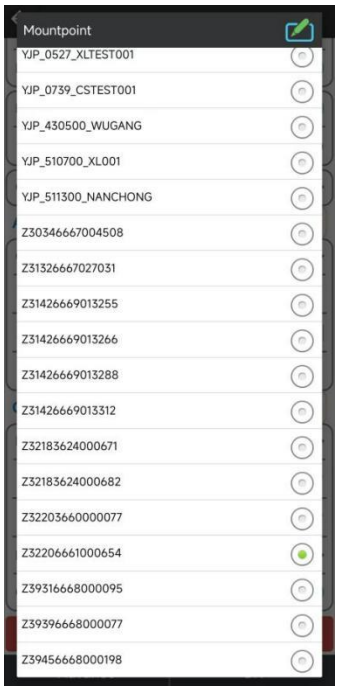
4.7-5

4.7-6



4.7-7

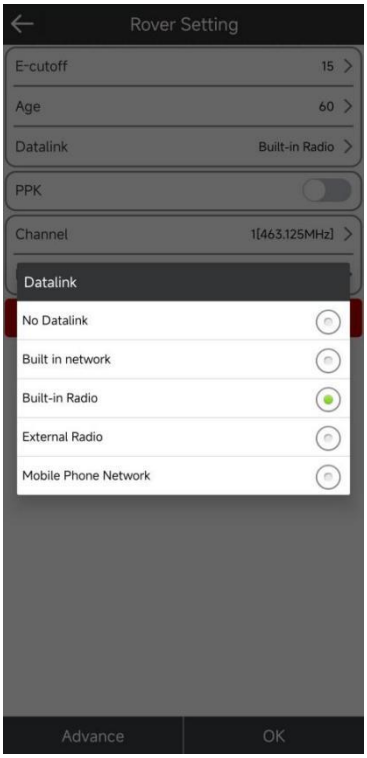
4.7-8



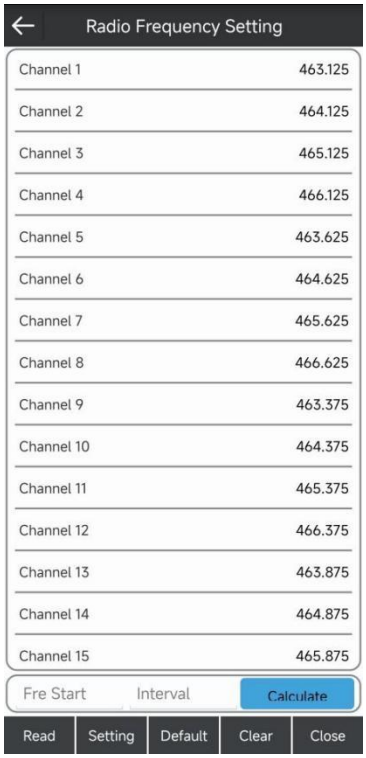
4.7-9

2．Built-in radio: Click [Data Link],Select [Built-in radio], as shown in 4.7-10,It refers to receiving the differential data of the radio station according to a certain protocol and frequency through the built-in radio of the GNSS device, and performing high-precision calculation. It must be ensured that the protocol and frequency of the radio station are consistent with the protocol and frequency of the transmitting station, so that the normal receiving station data can be received. If the frequency corresponding to the channel is inconsistent with the channel frequency of the

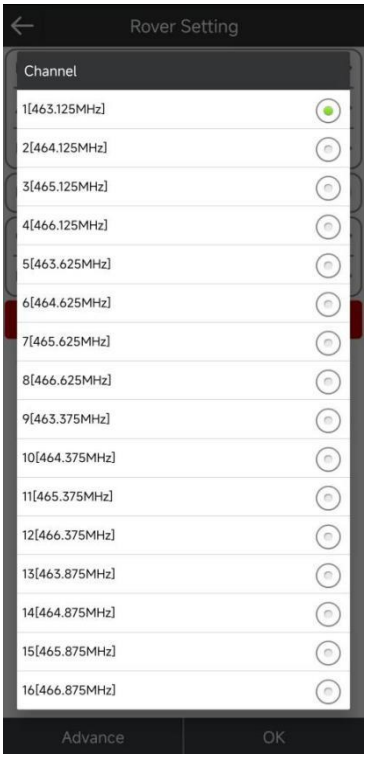
transmitting station, you can click [Radio Frequency Setting], as shown in 4.7-11, modify the frequency corresponding to each channel of the radio. Click [Channel] to select the corresponding radio transmission channel frequency, as shown in 4.7-12; click [Protocol] to select the corresponding radio transmission protocol, as shown in 4.7-14.



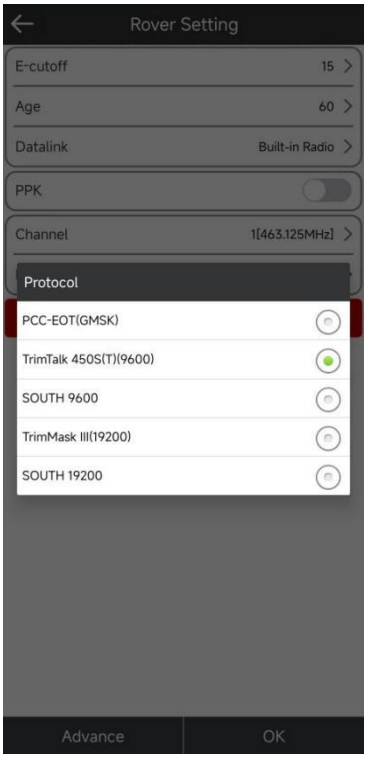
4.7-10



4.7-11

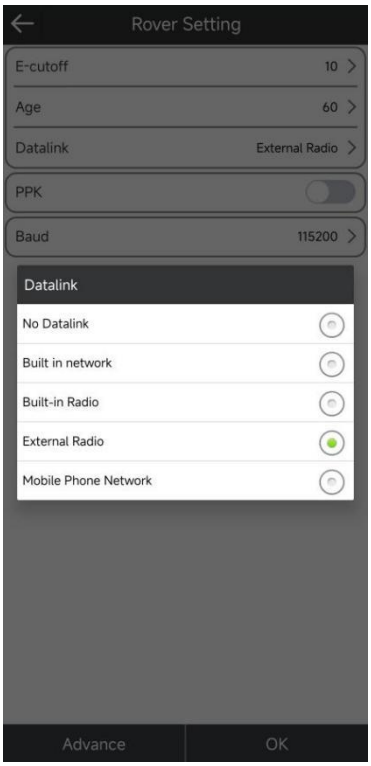


4.7-12

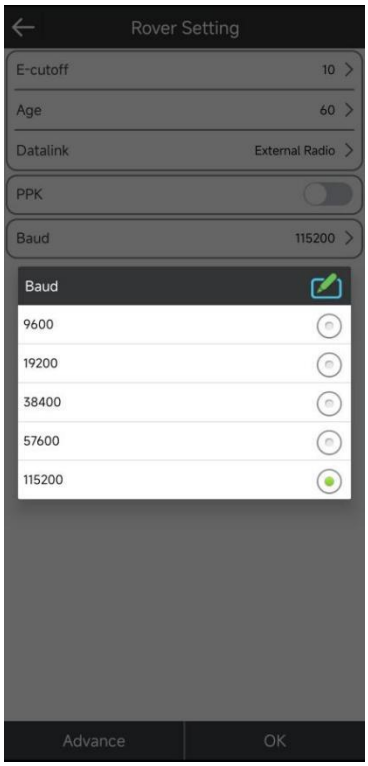


4.7-13

3. External radio: Click [Datalink], select [External Radio], as shown in 4.7-14, it means that the GNSS device is connected to an external independent radio device through the serial port, and after the external radio device receives the differential data Introduce into GNSS equipment for high-precision solution. Click [Baud] to select the corresponding serial port baud rate, as shown in 4.7-15, in addition to ensuring that the serial port parameters of the device connected to the external radio are correct, it is also necessary to ensure that the protocol and frequency of the external radio are the same as those of the transmitting radio. The protocol and frequency remain the same.

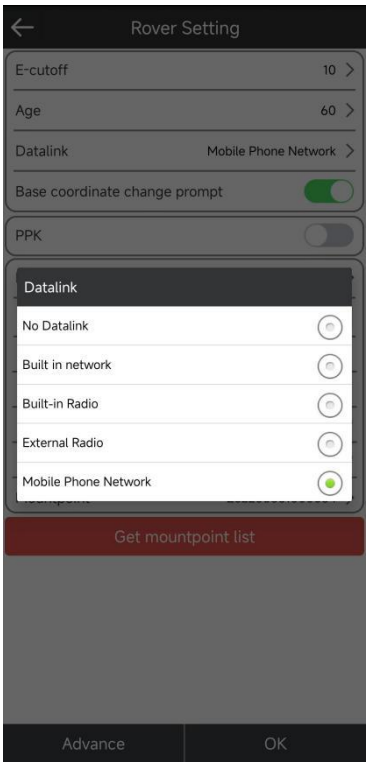


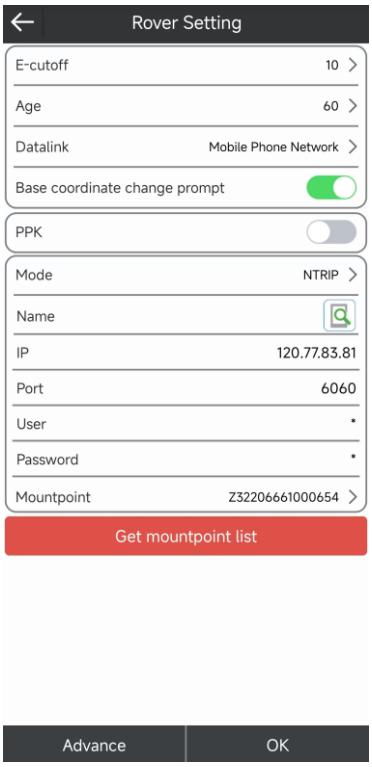
4.7-14



4.7-15

4. Moblile Phone Network: Click [Datalink], select [Handbook Network], as shown in 4.7-16, it means to obtain differential data from the specified server address according to a certain protocol through the network of the device where the software is located. Then, it is sent to the device through the communication connection between the software and the GNSS device for high-precision calculation. The CORS configuration is similar to the host network. You can directly enter the CORS account, or click on the right side of the name to select a server or add a differential server, as shown in 4.7-17. After configuration, select the corresponding name, as shown in 4.7-18, click [Get mountpoint list], select the correct access point, and click [OK] to complete the differential acquisition and determine if the host is fixed.





4.7-16 4.7-17 4.7-18

Note: The built-in radio and the external radio data link can be set to indicate whether the coordinates of the base station change, mainly because the radio is one-way transmission. There may be multiple radio transmission sources on the same frequency, which will cause the radio signal to interfere. If other radio sources are received signal, may cause the coordinates to be inaccurate, and remind the user to check and confirm.

4.8 Base Mode

Click [Configure]-> [Base Mode], as shown in 4.8-1,This function is that the GNSS device acts as a reference station to send satellite information data through a certain method, and provides it to the mobile station for reception, providing it with high-precision solution conditions. The host as the base station needs to set the start condition parameters, start mode and data broadcast parameters.

Note: During the startup of the base station, the device is not allowed to move, otherwise the coordinates calculated by the mobile station will be wrong.

The starting conditions include parameters such as base station ID, height cutoff angle, differential data format, PDOP restriction, etc. The differential data format

includes CMR, RTD, RTCM23, RTCM30, RTCM32, RTCM33 and other common differential data encoding formats, as shown in 4.8-2;

The startup mode includes using single-point coordinates, specifying base station coordinates, etc., among which:

1. Use single-point coordinates: It means that the GNSS equipment outputs differential broadcast data for the start coordinates according to the current positioning value (not high accuracy);

2. Designated base station coordinates: Refers to the location where the user sets up the equipment. The user knows the coordinate location in advance, and uses this coordinate value as the starting coordinate to output differential broadcast data. Click [Using Specify Coordinates],Enter the interface for setting base station coordinates,As shown in 4.8-3, click  The measure icon measures a point in real time,You can also click  Select a coordinate value from the point library.

The data broadcast parameters are mainly that the differential data output by the device after starting the base station is transmitted through a certain method and received and used by the mobile station. The main methods include host network, built-in radio, and external radio. The parameter setting is similar to that of the mobile station, and the differences are:

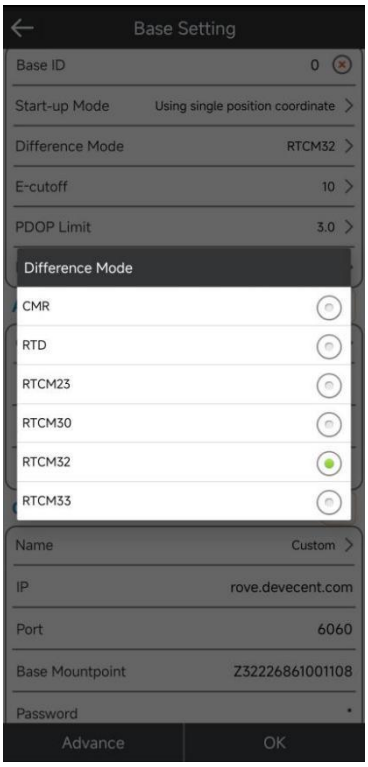
1. The built-in radio will have transmit power. The higher the transmit power, the longer the working distance and the greater the power consumption;

2. The Built-in network NTRIP protocol, the base station is the base station access point that is set to start transmission, and the mobile station is to obtain the access point list, and select the corresponding base station access point to connect, as shown in 4.8-4;

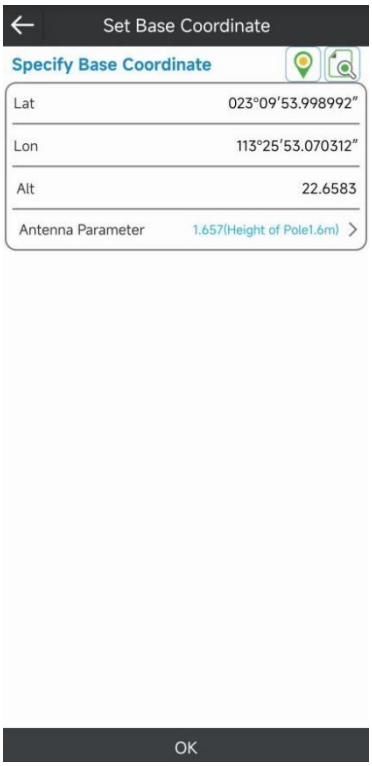
3. The base station cannot use the handbook network to broadcast differential data;

4. Other data link configurations refer to the mobile station data link for corresponding configuration.

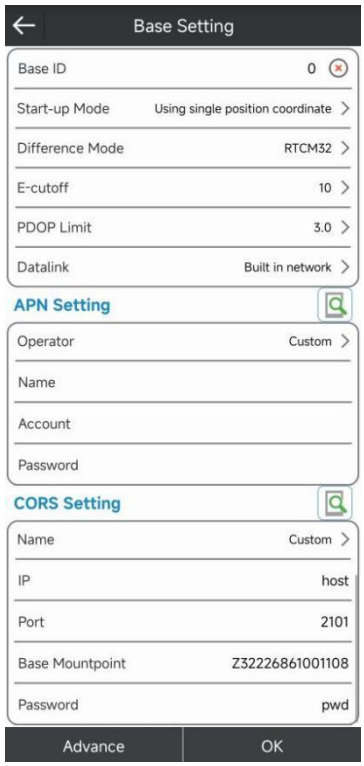
4.8-1



4.8-2



4.8-3



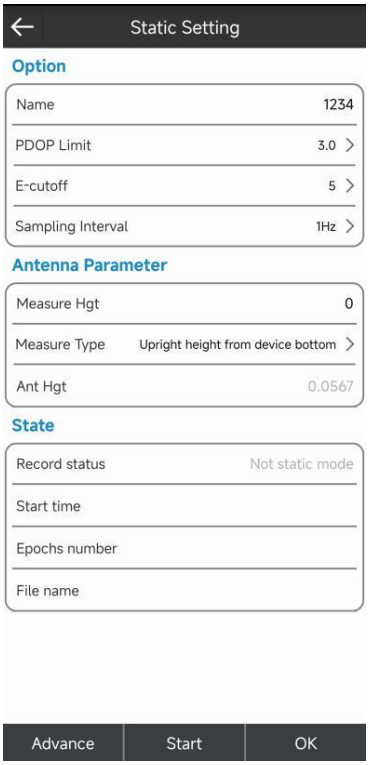
4.8-4

4.9 Static Mode

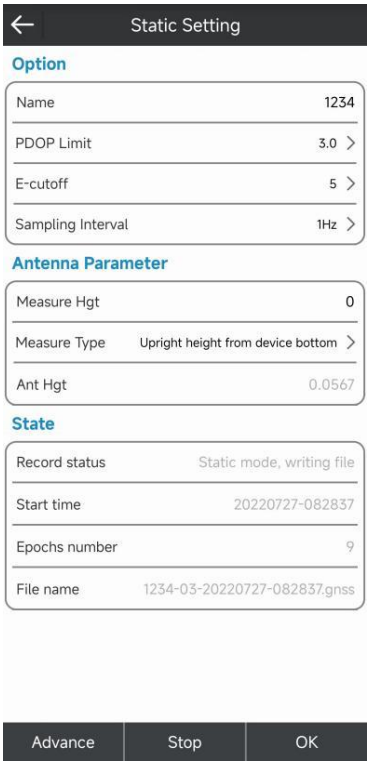
Click [Configure]-> [Static Mode], as shown in 4.9-1. This function is to store the satellite raw observation data of GNSS equipment in the setting disk file, and record the observation data of a time for calculating the high-precision coordinate

position using static post-processing software, which is usually used for control point acquisition. To start the static mode, you need to set the static file point name and recording conditions such as PDOP limit, E-cutoff, Sampling Interval, and Antenna Parameters. The status will display the record status, start time, number of epochs, record file name and other information. Click [Start] or [OK] to start static collection, and click [Stop] to end static collection, as shown in 4.9-2.

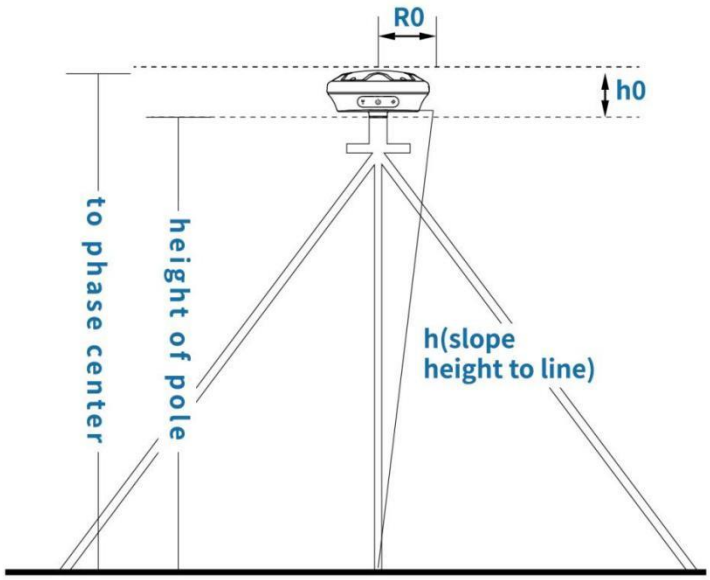
Note: During static recording, the device is not allowed to move, otherwise the coordinates calculated by the post-processing will be wrong.



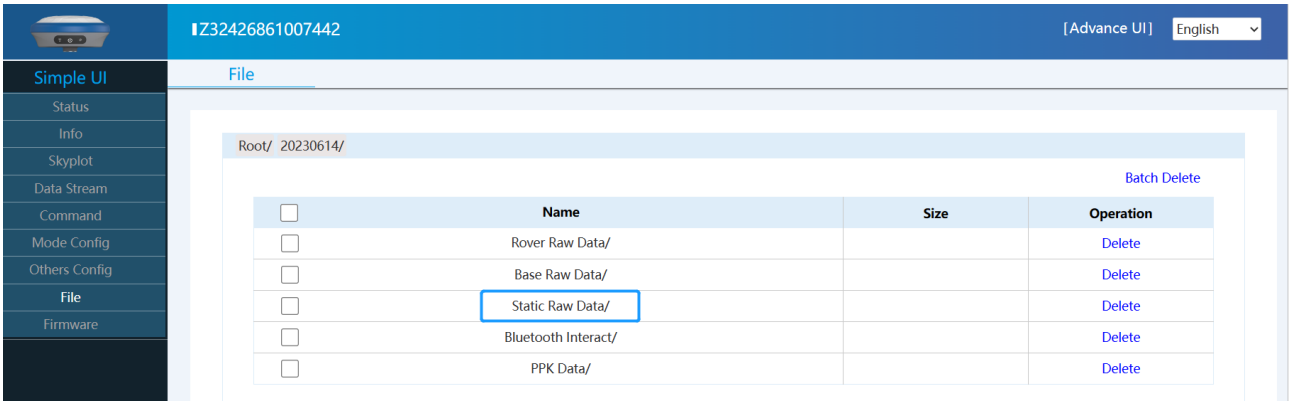
4.9-1



4.9-2



Log in to the device web page (see Ⅱ.**WebUI** for details), click [File]. Find the folder corresponding to the time to download the static data.



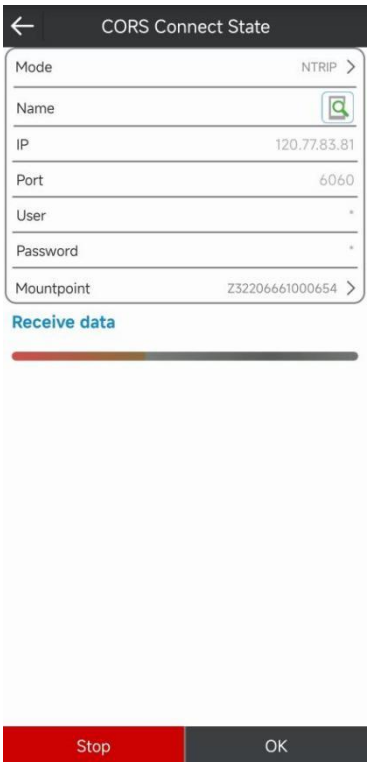
4.10 Collect Point

Click [Survey] -> [Collect Point] to enter the point measurement interface, as shown in 4.10-1. In the top column of the point measurement display interface, you can view the current positioning accuracy of the host (H: horizontal accuracy, V: elevation accuracy), CORS connection status (as shown in 4.10-2), and positioning information status. The left side of the following column shows the point name currently to be collected, click to enter the acquisition setting, as shown in 4.10-3 , set the point name, point name accumulation step and default code; the right side shows the antenna height parameter setting, click to enter Antenna parameters, as shown in 4.10-4 , take the height according to the actual operation input and select the corresponding measuring method. There are six display columns at the bottom of the interface. The display order and display content of these display columns can be set according to your own needs (the stored coordinates of the measurement will not change). Click the display column, and a selection box will appear: North Coordinates, East Coordinates, Elevation, Longitude, Latitude, Geodetic Height, Speed, Time, Upper Point Slope Distance, Upper Point Horizontal Distance, Upper Point Height Difference and Base Station Distance, as shown in 4.10-5 , select the desired display content.

Collect Point display interface are as follows:

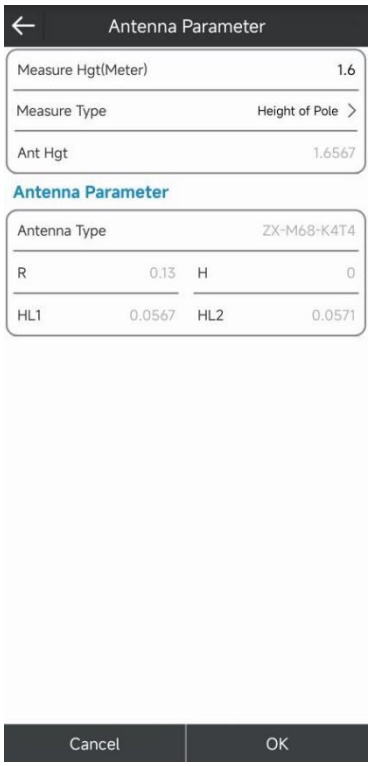
	Control point measurement (as shown in 4.10-6) : Currently RTK technology can be applied to primary and secondary traverse, root traverse measurement and root elevation measurement. Since RTK data has certain contingency, we have implemented the function of control point measurement to improve the reliability of the data.
	Set the acquisition parameters for the control point measurement.
	Quick point: Click to directly collect and save the measurement point information.
	Take pictures: Take pictures at the measurement site and add annotations.
	Entity record (as shown in 4.10-7) : collect data such as point, line, surface, etc. , click [OK] to save the collected measurement data to the record list and stakeout point library.
	Full image: Click the full image icon to display all measurement points in the view.
	Positioning: Click the positioning icon to position the map to the current device location.
	Record list (as shown in 4.10-8) : View the point coordinates of the current project "Coordinate Management Library", which is the same as the "Measurement Data" function in "Project".
	Settings (as shown in 4.10-9) : Set the current acquisition parameters, including state limit, HRMS limit, VRMS limit, PDOP limit, delay limit, smooth points , network map, etc.

4.10-1

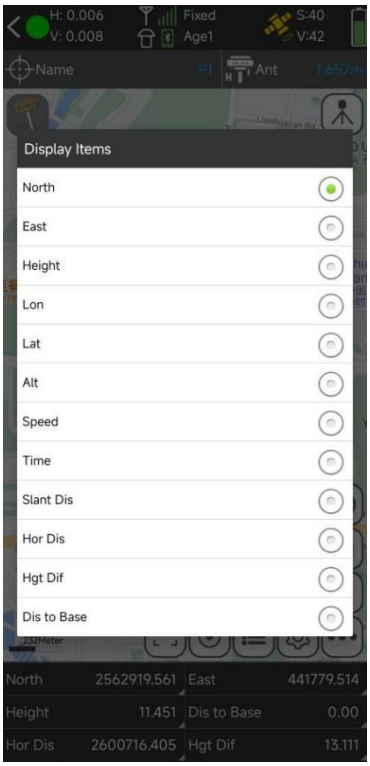


4.10-2

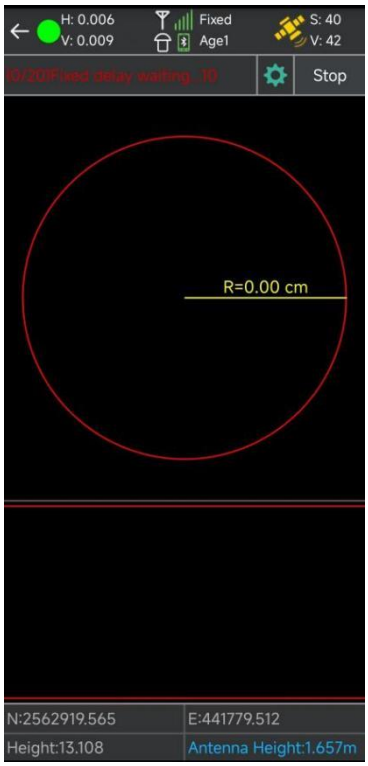
4.10-3



4.10-4



4.10-5



4.10-6

4.10-7 4.10-8 4.10-9

4.11 Tilt measurement

Click [Survey] -> [Collect Point] to enter the Collect Point page, click the upper right corner to input the Antenna Parameter (Height of pole), and then light the tilt measurement icon  in the upper left corner to enable the tilt measurement function. Red, as shown in 4.11-1 or 4.11-2, at this time, the host needs to be in the fixed state, shake back and forth for 5~10s, then rotate 90 °, continue to shake the centering rod back and forth, until the tilt measurement icon turns green, as shown in 4.11-3 , the tilt measurement can be performed.

Alignment rod calibration For the same mainframe and the same alignment rod, only one calibration is required. Each mainframe has been calibrated before leaving the factory. If the configuration remains unchanged in the future, no further alignment is required. Rod calibration.

Note: The tilt measurement function requires the host to have a tilt module. A host with this function can do:

2. It can ensure that the accuracy of the host is maintained within 2cm in the 60 ° tilt range;

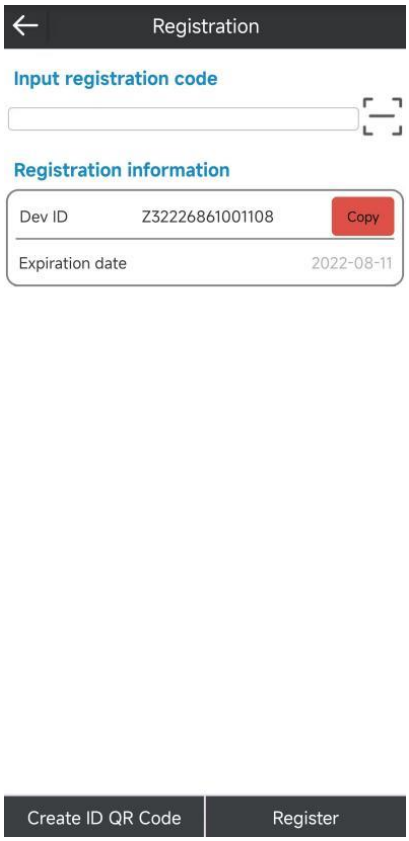
3. The calibration process is simple, just shake the centering rod back and forth in place;

4. Support alignment rod calibration, which can eliminate the measurement error caused by the curvature of the alignment rod.

4.11-1 4.11-2 4.11-3

4.12 Device Register

Click [Configure]-> [Device Register], Check the device ID and expiration date as shown in 4-12. If the GNSS device has expired, you can authorize the device here after obtaining the registration authorization code from the dealer.



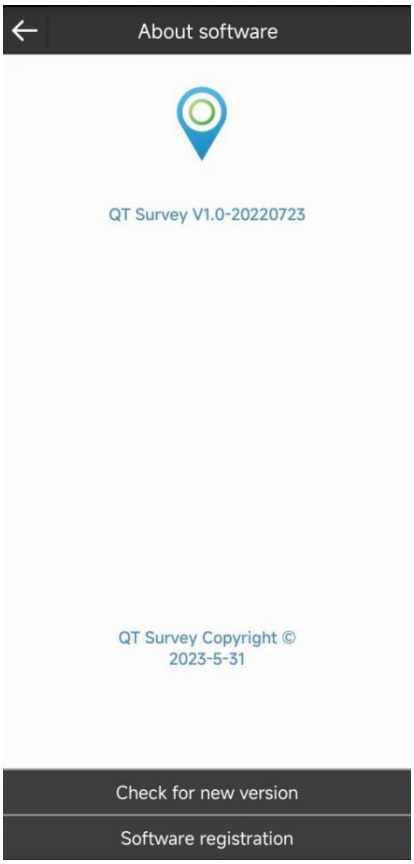
4-12

4.13 About Software

Click[Project]->[About software], as shown in 4.13-1, you can view software version information and copyright information.

Click [Check for new version], if there is a new version, the new version update information will pop up, click Update to update the software to the latest version. If there is no new version, it will prompt that it is already the latest version.

Click [Software registration], it will jump to the software registration interface, as shown in 4.13-2, check the software ID and the corresponding software expiration time, click [Create ID QR Code] in the lower left corner to obtain the corresponding authorization code more conveniently, enter the authorization code above or scan the QR code of the authorization code and click [Register] to activate the software.



4.13-1

4.13-2

Ⅴ. Internal Radio

M68G is equipped with 1.5 watt internal radio. User can select the transmission power 0.5 watt or 1.5 watt. There are 16 default channel frequency and the frequency of each channel is changeable. With new firmware update, lots of mainly used protocols in survey industrial are supported.

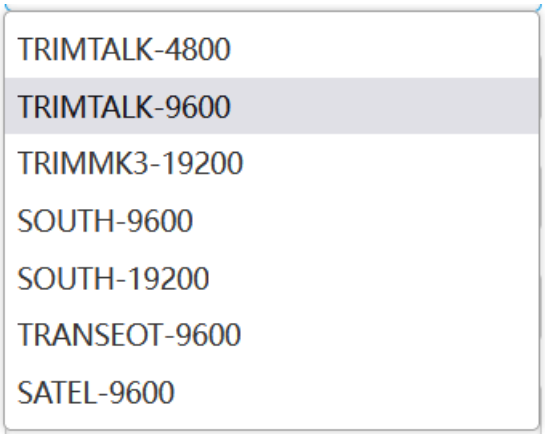
5.1 Default Channel Frequency

Channel	Frequency/MHz
1	463.125
2	464.125
3	465.125
4	466.125
5	463.625
6	464.625

7	465.625
8	466.625
9	463.375
10	464.375
11	465.375
12	466.375
13	463.875
14	464.875
15	465.875
16	466.875

5.2 Supported Radio Protocol

Some of the protocols may require firmware update.



Ⅵ. Technical Indicator

Item		Specification	remarks
Hardware		Qualcomm Cortex-A7	
OS		Linux	
GNSS	GPS	L1C/A, L1C, L2P(Y), L2C, L5	
	GLONASS	L1, L2, L3	
	BDS	B1I, B2I, B3I, B1C, B2a, B2b	
	GALILEO	E1, E5a, E5b, E6	
	QZSS	L1, L2, L5	
	SBAS	L1	
	NavIC(IRNSS)*	L5*	IRNSS support in future
	Channel	1408	
	Data format	NMEA-0183	
	Correction I / O Protocol	RTCM3.X	
	Data update frequency	5Hz(max)	
	Recapture Time	<1s	
	Cold Boot	≤40s	
POSITIONING ACCURACY	Single(RMS)	Horizontal : 1.5m Vertical : 2.5m	
	DGPS(RMS)	Horizontal : 0.4m Vertical : 0.8m	
	RTK(RMS)	Horizontal :±(8mm+1ppm) Vertical :±(15mm+1ppm)	
	Time Accuracy(RMS)	20ns	
	Static Accuracy(RMS)	Horizontal :±(2.5mm+0.5ppm) Vertical :±(5mm+0.5ppm)	
	Speed Accuracy(RMS)	0.03m/s	
	Tilt compensation Accuracy(within 60°)	≤2cm	
SYSTEM	Bluetooth	BR+EDR+BLE	
	WIFI	802.11 b/g/n	
	Network	LTE FDD: B2/B4/B5/B7/B12/B13/B25/B26 LTE TDD: B38/B41 WCDMA: B2/B4/B5 GSM: 850MHz PCS: 1900MHz	
	Data Radio	Frequency : 410~470MHz Protocol : TRIMTALK, TRIMMK3, SOUTH, TRANSEOT RF transmit power : 0.5W/1.5W Air baud rate : 9600 / 19200bps	
	Storage	32GB, User Storage Space 24GB	
INDICATOR	Power Indicator	Show power status	
	Bluetooth Indicator	Show Bluetooth status	
	Network Indicator	Show network signal status	
	Satellite Indicator	Show position status	
	Data link Indicator	Show differential signal status	
BATTERY	Battery	3.7V, 9600mAh	
	Work time	More than 16 hours (Typical, Rover, GSM)	The static working mode supports continuous data collection for 24 hours under full power
	Charge	MTK PE+ 1.1/2.0 9V/2A USB PD 12V/1.25A 5V/3A	Support fast charging adapter and adaptively and dynamically adjust charging current
ENVIRONMENTAL	Work Temperature	-20℃~+60℃	

	Storage Temperature	-40℃~+85℃	
	Shock	Withstand 1.5M pole drop	
	Protection	IP68	
PHYSICAL	Material	Magnesium alloy main body, ABS/PC top cover	
	Dimension	Φ147.9mm*68mm	
	Weight	≤0.74kg	
A Full Set	M68G Device	1 SET	
	USB power adapter	1 PCS	
	USB A To Type-C	1 PCS	
	Radio Antenna	1 PCS	