

T5 GNSS RECEIVER USER GUIDE




V1.0

TokNav Information Technology Co., Ltd.

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Certificate



This product has been tested and found to comply with European Council Directive 2014/53/EU, thereby satisfying the requirements for CE Marking and sale within the European Economic Area (EEA).

Revision History

Revised Edition	Revision History	Date
V1.0	Initial Release	2022-11-28

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I . Before You Start

Dear customers,

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

1. This user guide is for your device only. If the actual situation does not conform to the user guide, the actual situation shall prevail.


2. For the sake of safety and how to use the device, please read the precautions, exemptions from liability and instructions in the user guide.


3. The information in this user guide is subject to change without notice. We reserve the right to change or improve the device as well as the content in the user guide 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 caused by negligence:

 **Warning:** Precautions require 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 limitations on use. Ignoring this indication may result in personal injury or property damage.

1.1.1 Warning

1. Please do not disassemble and open the device by yourself. Only TokNav 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 TokNav 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.

1.1.2 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 check the performance of this equipment periodically.

We disclaim all liabilities 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 errors.

5. Use non-original accessories.

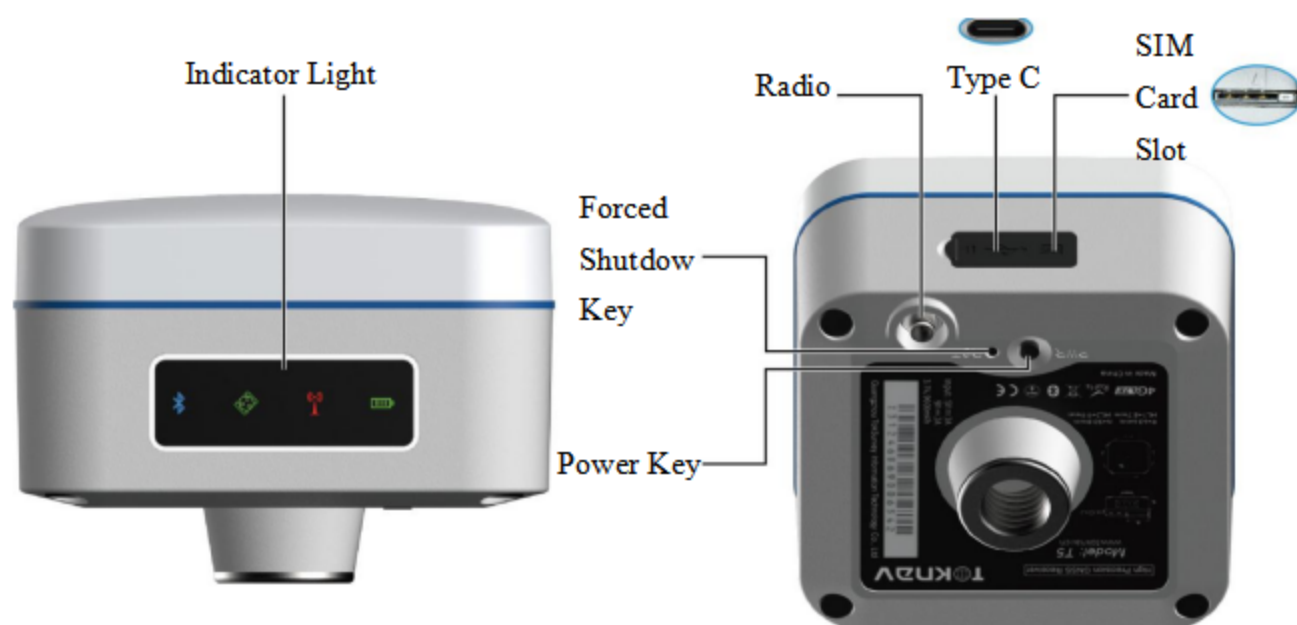
6. Operations not described in the user guide.




II. T5 At A Glance




The body of the T5 is designed with magnesium alloy material, which is durable and has better heat dissipation effect, and weighs only 800g. It supports IP65 dustproof and waterproof, and can work continuously for 16 hours when fully charged.

2.1 Appearance

The main body of T5 is as follows:







Projects	Function	Role or Status
	Power Key	Long press for 3s to turn on the device when it is off; Long press for 3s to turn off the device when it is on.
	Forced Shutdown Key	Short press to force the mainframe to power down immediately, for accidental death of the mainframe, this operation does not restore the factory settings.
	Bluetooth Indicator Light	Light on for Bluetooth connected; Light off for Bluetooth disconnected; Blink for abnormal condition.

	<p>Differential Data Indicator Light</p>	<p>Rover mode: Blink when receiving differential data; Base mode: Blink when sending differential data.</p>
	<p>Satellite Indicator Light</p>	<p>Rover/base station: 1 second interval flashing in the positioning state; Static mode: flashing according to sampling frequency.</p>
	<p>Power Indicator Light</p>	<p>Green light always on during normal operation; Red light flashes when power is low; Red light always on during charging; Green light always on when charging is complete.</p>

2.2 Battery Indicator

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

Number	Indicator Light	Battery Level
1		0% - 25%
2		26% - 50%
3		51% - 75%
4		76% - 100%

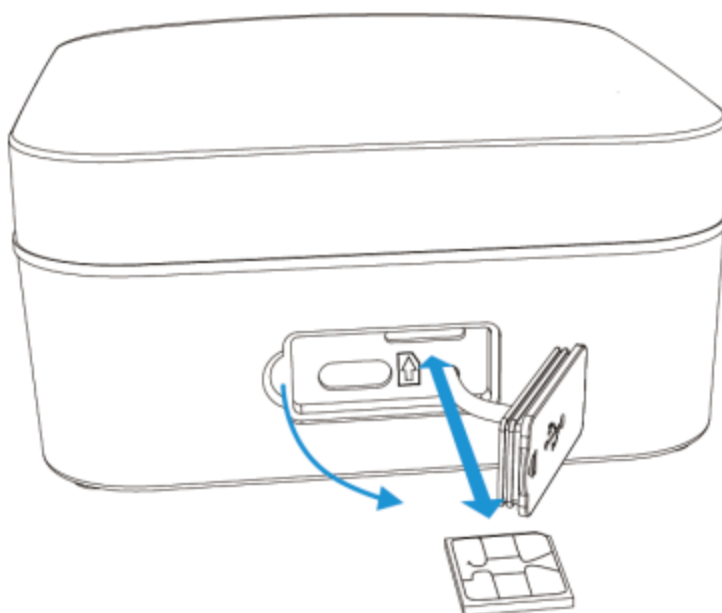
2.3 Power On And Off

Power on: Press and hold the power button for 3 seconds until the buzzer "beeps". Release the button, the device starts to power on with the panel light flashing. 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 set-top and 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 device.

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.

Note: The internal radio of T5 only supports receiving data, not sending data.

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, configure 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 is displayed:

The screenshot shows the TokNav web UI interface. At the top, there is a navigation bar with tabs: System View (selected), Device Firmware, Skyplot, Data Stream, Mode Config, Others Config, and File. Below the navigation bar is a status bar displaying: 2022-11-03 07:18:44, 41/42, 37.5 °C, 0.426 V, 3.591 V, 31%, [Advance UI], and English.

The main content area is divided into three sections:

- GNSS Status:** A table showing GNSS parameters.

Quality	RTK Fixed
Diff	1
Longitude	113.43137563° $\sigma = 0.013m$
Latitude	23.16499608° $\sigma = 0.005m$
Height	-6.4192+30.9252-0.0693=24.4366m
PDOP	1.29
HDOP	0.68
HRMSE	0.014m
VRMSE	0.040m
Refstation ID	0
- Register Info:** A table showing registration details and control buttons.

SN	Z30516867010049
Model	T5
Register Code	2C626DEC092FC32E
Expired Date	2022-11-16
Functionality	0x0000
Scheme	None
Exception	None

Buttons: Power, Refresh, Reset Config, Clean Storage, Register, Export Config, Import Config.
- Working Mode:** A table showing current working mode settings.

Working Mode	Rover Mode
Station Name	Z30516867010049
Elev Cutoff	10
Diff Age Max	60s
Data Link	Bluetooth
Diff Stream	1027 B/s 5981959 B

Meaning of icons arranged horizontally above the interface:

🕒 2022-11-25 09:42:08	📶 39/42	🌡️ 39.3 °C	🔋 5.326 V	🔋 4.271 V	🔋 100%
Time	Satellite Used/Tracked	Temperature	Supply Voltage	Battery Voltage	Battery Info

3.1 System View

- ① **GNSS Status:** Quality, Latitude, Longitude, Height, Satellite, Refstation ID;
- ② **Register Info:** SN, Expired Date, Scheme, Exception;

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, we 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 **Working Mode:** Working Mode, Elev Cutoff, Data Link.

The screenshot shows the 'System View' interface for device Z30516867010049. The top navigation bar includes 'System View', 'Device Firmware', 'Skyplot', 'Data Stream', 'Mode Config', 'Others Config', and 'File'. A status bar at the top displays: 2022-11-25 09:25:03, 39/44 satellites, 41.8 °C, 5.339 V supply, 4.274 V battery, and 100% battery level. The interface is divided into three main sections:

- GNSS Status:**

Quality	RTK Fixed
Diff	1
Longitude	113.43138776° $\sigma = 0.006m$
Latitude	23.16501998° $\sigma = 0.005m$
Height	-6.4192+32.8318-0.0693=26.3433m
PDOP	1.44
HDOP	0.65
HRMSE	0.008m
VRMSE	0.013m
Refstation ID	0
- Register Info:**

SN	Z30516867010049
Model	T5
Register Code	D573222D68658EC6
Expired Date	2022-12-18
Functionality	0x0000
Scheme	None
Exception	None

Buttons: Power, Refresh, Reset Config, Clean Storage, **Register** (highlighted with a red box), Export Config, Import Config.
- Working Mode:**

Working Mode	Rover Mode
Station Name	Z30516867010049
Elev Cutoff	10
Diff Age Max	60s
Data Link	Bluetooth
Diff Stream	1027 B/s 5981959 B

3.2 Device Firmware

- ① **Device Info:** SN, Hardware, GNSS Type, GNSS Hardware;
- ② **System Version:** System, GNSS Firmware, INS Firmware, Firmware.

Click Upgrade Firmware 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 [Upgrade Firmware];
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.

The screenshot shows the TokNav WebUI interface. At the top, there is a navigation bar with tabs: System View, Device Firmware (selected), Skyplot, Data Stream, Mode Config, Others Config, and File. Below the navigation bar, a status bar displays various metrics: Time (2022-11-03 09:37:11), Signal strength (28/39), Temperature (36.7 °C), Voltage (0.000 V), Current (3.426 V), and Battery level (17%). There are also buttons for [Advance UI] and [English].

The main content area is divided into two sections:

Device Info

SN	Z30516867010049	Feature	zGUg0RQd3F0GUsLoFQ==
Hardware	1.1.0.12011000/G1M1N1K1S1	Product Date	2020-12-16
GNSS Type	UB4B0M	Brand	TokNav
GNSS SN	HV4001202804161	Model	T5
GNSS Hardware	2330304000024	Board1 SN	6700001004
IMEI	868343043888556	Board2 SN	0000000000

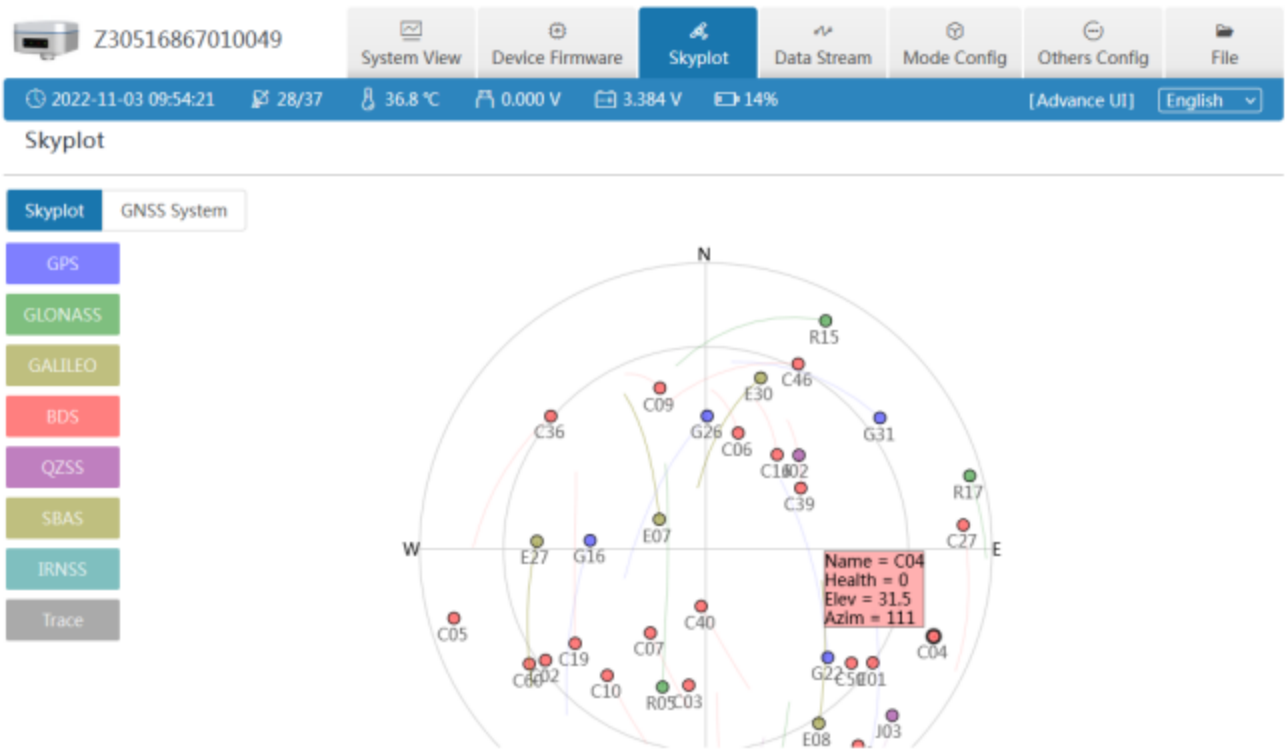
System Version

System	1.25.2109.33
Linux Version	3.18.44 Fri Dec 11 17:07:31 CST 2020
GNSS Firmware	R3.00Buld21893
INS Firmware	B1.2_A3.4_d4ccd33704e39d
Firmware	1.345.2211.1405

At the bottom of the interface, there is a blue button labeled "Upgrade Firmware".

3.3 Skyplot

① **Skyplot : Trace, Name, Health, Elev, Azim;**



② **GNSS System : Elev Cutoff, System, Table, Chart.**

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.

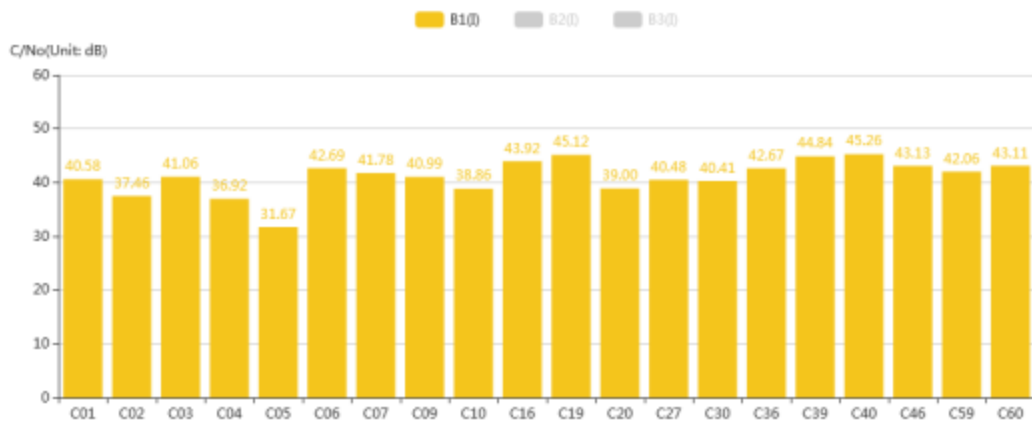
BDS*20 GALILEO*4 GLONASS*4 GPS*6 QZSS*3

Table Chart

BDS	B1(D)	B2(D)	B3(D)	Elev	Azim
C01	40.85	38.15	39.47	45.1	124.3
C02	37.72	39.25	39.40	47	235.2
C03	41.31	38.54	40.61	61.3	187.1
C04	37.16	33.43	38.14	31.5	111
C05	31.67	34.24	34.24	24.1	254.6
C06	42.66	38.31	40.50	65.1	15.6
C07	41.93	39.32	41.98	69.4	213.4
C09	40.90	38.63	39.85	54.2	344.1

BDS*20 GALILEO*4 GLONASS*5 GPS*6 QZSS*3

Table Chart



3.4 Data Stream

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

The screenshot displays the TokNav software interface. At the top, there is a navigation bar with icons for System View, Device Firmware, Skyplot, Data Stream (which is highlighted), Mode Config, Others Config, and File. Below the navigation bar, a status bar shows system information: 2022-11-22 09:08:15, 28/41, 43.1 °C, 5.173 V, 4.026 V, 82%, [Advance UI], and English. The main content area is titled "Data Stream" and contains a "Config" section. In this section, a dropdown menu for "Data" is open, showing a list of options: None (selected), GNSS COM2, GNSS COM3, Message Text, Message Diff, Message Raw, Message PPK, Message Static, INS Debug, and Ntrip Client. To the right of the dropdown, there are buttons for "Level of Detail" (Simple, Normal, Detail), a "No filter" dropdown, and a "Clean" button.

For example:

1. Message Text: see 3.9 in this section for the configuration of text data.

The screenshot shows the TokNav Data Stream interface. At the top, there are navigation tabs: System View, Device Firmware, Skyplot, Data Stream (selected), Mode Config, Others Config, and File. Below the tabs, a status bar displays: 2022-11-22 08:49:12, 28/41, 42.6 °C, 5.185 V, 3.977 V, 76%. The main area is titled 'Data Stream' and contains a 'Config' section with a dropdown menu set to 'Message Text', 'Level of Detail' buttons for Simple, Normal, and Detail, a 'No filter' dropdown, and a 'Clean' button. Below the config is a 'Data' section displaying 12 lines of hexadecimal data, such as: 1: \$GPGST,084751.00,1.760,0.0,0.0,0.0,0.476,0.571,1.595*56.

2. Message Raw

The screenshot shows the TokNav Data Stream interface with the 'Data' dropdown set to 'Message Raw'. The status bar shows: 2022-11-22 08:55:58, 28/41, 42.7 °C, 5.198 V, 4.003 V, 79%. The 'Data' section displays 10 lines of raw data, such as: 1: binary: size=4052 time=2022-11-22 08:56:03.000 id= 43.RANGE amount=92.

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

Z30516867010049

System View Device Firmware Skyplot **Data Stream** Mode Config Others Config File

2022-11-22 09:49:16 28/44 42.4 °C 5.191 V 4.159 V 97%

[Advance UI] English

Data Stream

Config

Data: Message Diff Level of Detail: Simple Normal Detail No filter Clean

Data

```

1: rtc3 :msg=1074.GPS_MSMA len=144 station=666 time=day 2 09:49:09.000
2: rtc3 :msg=1084.GLO_MSMA len= 86 station=666 time=day 0 09:49:09.000
3: rtc3 :msg=1094.GAL_MSMA len=115 station=666 time=day 2 09:49:09.000
4: rtc3 :msg=1124.BDS_MSMA len=395 station=666 time=day 2 09:49:09.000
5: rtc3 :msg=1005.REF_PHASE len= 25 la=23.16499321 lo=113.43140620 ht=21.5752
6: brywtBFGrbe3HlUnIkE=
7: rtc3 :msg=1033.RECV_ANT len= 82 id=666
    
```

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

Z30516867010049

System View Device Firmware Skyplot **Data Stream** Mode Config Others Config File

2022-11-22 09:53:37 28/45 42.4 °C 5.181 V 4.161 V 97%

[Advance UI] English

Data Stream

Config

Data: Message Static Level of Detail: Simple Normal Detail No filter Clean

Data

```

1: binary: size=4404 time=2022-11-22 09:53:43.000 id= 43.RANGE amount=100
2: binary: size=4404 time=2022-11-22 09:53:44.000 id= 43.RANGE amount=100
3: binary: size=4404 time=2022-11-22 09:53:45.000 id= 43.RANGE amount=100
4: binary: size=4404 time=2022-11-22 09:53:46.000 id= 43.RANGE amount=100
5: binary: size=4404 time=2022-11-22 09:53:47.000 id= 43.RANGE amount=100
6: binary: size=4404 time=2022-11-22 09:53:48.000 id= 43.RANGE amount=100
7: binary: size=4448 time=2022-11-22 09:53:49.000 id= 43.RANGE amount=101
8: binary: size= 72 time=2022-11-22 09:53:50.000 id= 42.BESTPOS type=SINGLE
9: binary: size= 44 time=2022-11-22 09:53:50.000 id= 99.BESTVEL type=DOPPLER_VELOCITY
10: binary: size= 44 time=2022-11-22 09:53:50.000 id= 101.TIME st=1
    
```

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

Z30516867010049
 System View
Device Firmware
Skyplot
Data Stream
Mode Config
Others Config
File

2022-11-22 10:01:08
40/44
43.0 °C
5.192 V
4.203 V
100%
[Advance UI]
English

Data Stream

Config

Data: Ntrip Client
 Level of Detail: Simple Normal Detail
No filter
Clean

Data

```

1: rtc3 :msg=1005.REF_PHASE len= 25 la=23.16583818 lo=-113.42943727 ht=48.7322
2: rtc3 :msg=1033.RECV_ANT len= 81 id=0
3: rtc3 :msg=1074.GPS_HSM4 len=124 station=0 time=day 2 10:01:20.000
4: rtc3 :msg=1084.GLO_HSM4 len= 71 station=0 time=day 0 10:01:20.000
5: rtc3 :msg=1124.BDS_HSM4 len=324 station=0 time=day 2 10:01:20.000
6: rtc3 :msg=1074.GPS_HSM4 len=130 station=0 time=day 2 10:01:21.000
7: rtc3 :msg=1084.GLO_HSM4 len= 71 station=0 time=day 0 10:01:21.000
8: rtc3 :msg=1124.BDS_HSM4 len=324 station=0 time=day 2 10:01:21.000
    
```

3.5 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 configured.

Z30516867010049
 System View
Device Firmware
Skyplot
Data Stream
Mode Config
Others Config
File

2022-11-22 09:37:40
28/46
43.3 °C
5.187 V
4.100 V
90%
[Advance UI]
English

Mode Config

Working Mode

Mode: Rover Mode Base Mode Static Mode

Station Name:

Elev Cutoff: Degree

Diff Age Max: Second


Height Type: Bottom

Antenna Height: Meter

Record: Enable

PPK: Disable not affect by Record

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 configured.

 Z30516867010049
 System View
Device Firmware
Skyplot
Data Stream
Mode Config
Others Config
File

2022-11-22 09:47:36
28/44
42.6 °C
5.183 V
4.159 V
97%
[Advance UI] English

Mode Config

Working Mode

Mode: Rover Mode Base Mode Static Mode

Station Name:

Elev Cutoff: Degree

Station ID:

PDOP Threshold:

Diff Type: RTCM32


Base Mode: Auto

Height Type: Bottom

Antenna Height: Meter

Record: Enable

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

 Z30516867010049
 System View
Device Firmware
Skyplot
Data Stream
Mode Config
Others Config
File

2022-11-22 09:51:14
28/45
42.4 °C
5.182 V
4.173 V
99%
[Advance UI] English

Mode Config

Working Mode

Mode: Rover Mode Base Mode Static Mode

Station Name:

Elev Cutoff: Degree

PDOP Threshold:

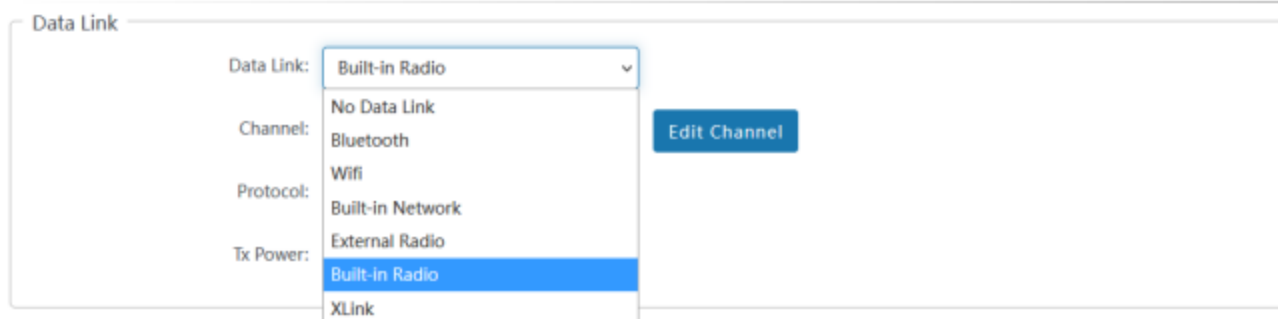
Sample Interval: 1 s

Height Type: Bottom

Antenna Height: Meter

Record: Enable

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.

3.6 Others Config

① **GNSS System:** The small box behind a single point can turn on or off the corresponding satellite system;

② **WiFi:** You can choose three types of Disable/AP/Station, and you can set the WiFi name and password by yourself;

Note: 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.

Z30516867010049

System View Device Firmware Skyplot Data Stream Mode Config Others Config File

2022-11-03 10:13:11 28/40 36.7 °C 0.000 V 3.342 V 11% [Advance UI] English

GNSS System

System	Enable
GPS	<input checked="" type="checkbox"/> Enable
GLONASS	<input checked="" type="checkbox"/> Enable
BDS	<input checked="" type="checkbox"/> Enable
GALILEO	<input checked="" type="checkbox"/> Enable
QZSS	<input checked="" type="checkbox"/> Enable
SBAS	<input checked="" type="checkbox"/> Enable

WiFi

WiFi: Disable AP Station

SSID:

PSK:

Empty or Length not less than 8

Others

Time Zone:

3.7 File

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

Z30516867010049

System View Device Firmware Skyplot Data Stream Mode Config Others Config File

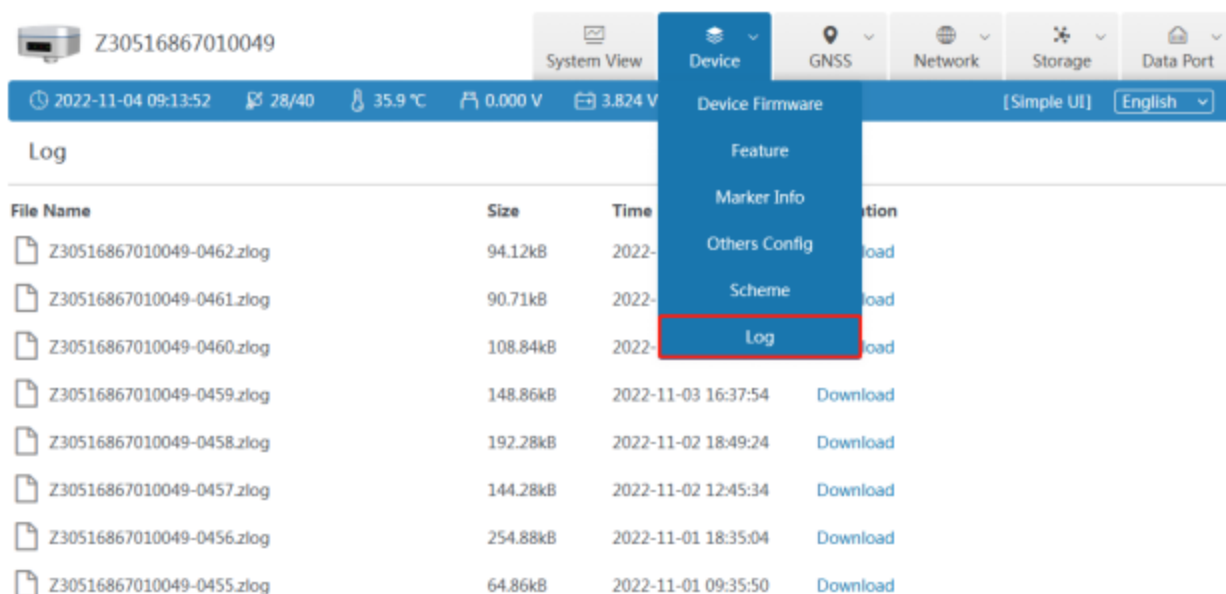
2022-11-03 10:14:05 28/39 36.7 °C 0.017 V 3.348 V 11% [Advance UI] English

File

Root/	
<input type="checkbox"/> Select All	Batch Delete
<input type="checkbox"/> 20220922/	Delete
<input type="checkbox"/> 20220923/	Delete
<input type="checkbox"/> 20220924/	Delete
<input type="checkbox"/> 20220925/	Delete
<input type="checkbox"/> 20220926/	Delete
<input type="checkbox"/> 20220927/	Delete
<input type="checkbox"/> 20220928/	Delete
<input type="checkbox"/> 20220929/	Delete
<input type="checkbox"/> 20220930/	Delete

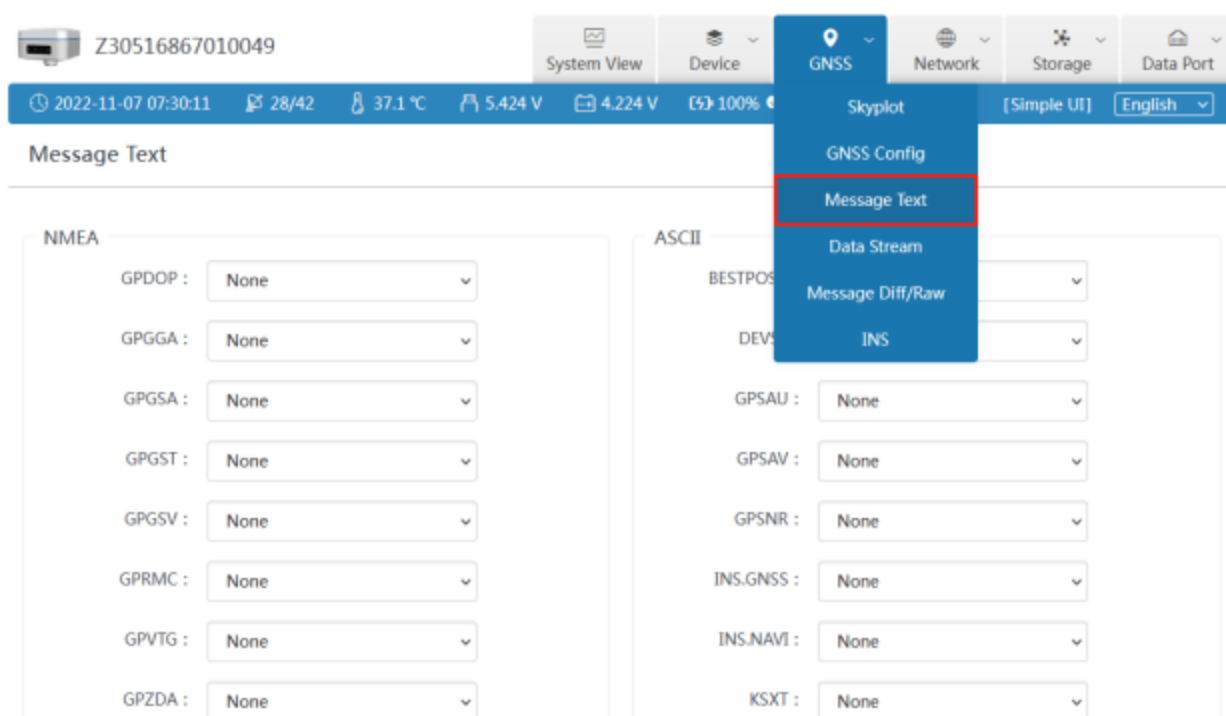
3.8 Log

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:



3.9 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 (the previous 0 will also be transmitted)
<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 (the previous 0 will also be transmitted)
<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

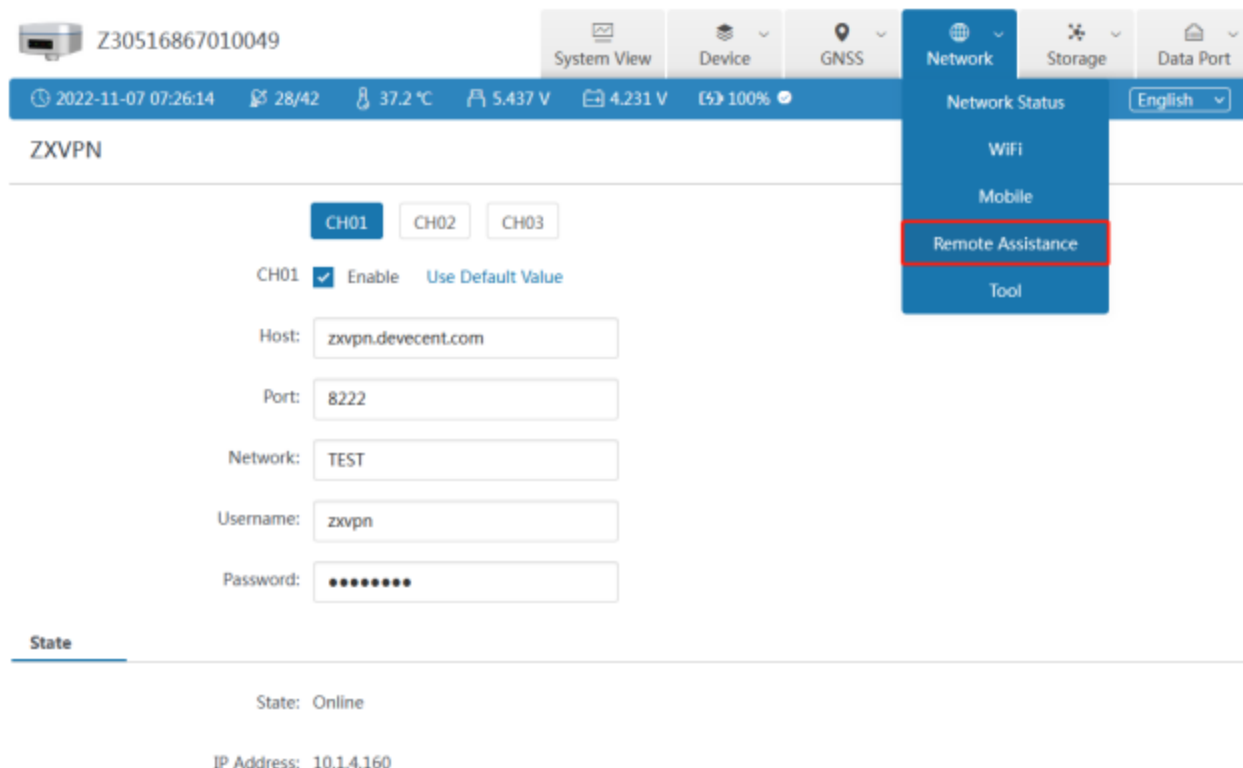
<2>	Positioning type, 1=no positioning, 2=2D positioning, 3=3D positioning
<3>	PRN code (pseudo-random noise code), the satellite number (01~32, the previous 0 will also be transmitted) being used to calculate the position.
<4>	PDOP position precision factor (0.5~99.9). The spatial geometric intensity factor of satellite distribution. Generally, the better the satellite distribution is, the smaller the PDOP value is, which is generally less than 3.
<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.
<p>Note: <4>,<5>,<6>,<7>information will be displayed circularly according to each satellite, and each GSV statement can display information of up to 4 satellites. Other satellite information will be output in the next sequence of NMEA0183 statements.</p>	

3.10 Remote Assistance

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.



3.11 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 figure below. We can configure 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.

Z30516867010049

System View Device GNSS Network Storage Data Port

2022-11-07 06:27:35 28/42 37.2 °C 5.473 V 4.253 V 100%

Channel Config

CH01 CH02 CH03 CH04 CH05

Storage Status
Data Config
FTP Upload
File

CH01 Enable

Data: Message Raw

Period: Single File

Name: SITE-CH-yyyyMMdd-hhmmss

Format: *.gnss

Apply

Data:

- None
- GNSS COM2
- Message Text
- Message Diff
- Message Raw
- Message PPK
- Message Static
- INS Debug
- Ntrip Client
- XLink
- Socket 1

Period:

- Single File
- 1 hour
- 2 hours
- 3 hours
- 4 hours
- 6 hours
- 8 hours
- 12 hours
- 24 hours

Name:

- SN-CH-yyyyMMdd-hhmmss
- SN-yyyyMMdd-hhmmss
- SITE-SSSS-yyyyMMdd-hhmmss
- yyyyMMddhhmmss
- SSSSDOYX
- SITEDOYhhmm
- SITEDOYX
- SITEDOYXmm
- SITEDOYhh
- SITE-CH-yyyyMMdd-hhmmss

Format:

- *.gnss
- *.data
- *.txt
- *.dev
- RINEX2.10
- RINEX2.11
- RINEX3.02
- RINEX3.03
- RINEX3.04
- RINEX3.04 (.D)
- RINEX3.04 (.gz)

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 through the TSURVEY software, the device will automatically configure the corresponding channel for data storage by default.

1. Rover (CH01)

When the device is set as a rover station through the tSurvey software, the device will automatically configure CH01 to store and locate the original data by default. If PPK is enabled, CH05 will also be automatically configured by default to store post positioning data, as shown in the following figure.

Z30516867010049


System View Device GNSS Network Storage Data Port

2022-11-23 09:31:55 44/45 38.9 °C 5.243 V 4.269 V 100%

[Simple UI] English

Storage Status

General



Capacity: 4.00 GB
 Occupy: 3.88 GB
 Free: 119.697 MB
 Write Speed: 25.23 kB/s

File List

Channel	Data	Name	Size
CH01	Message Raw	Z3051686701004 ... 23-093210.gnss	37.37 kB
CH04	Bluetooth Monitor	Z3051686701004 ... 123-093050.txt	174.80 kB
CH05	Message PPK	Z3051686701004 ... 23-093210.gnss	32.83 kB

2. Base (CH02)

When the device is set as the reference station through the tSurvey software, the device will automatically configure CH02 to store and locate the original data by default. If PPK is enabled, CH05 will also be automatically configured by default to store location post-processing data, as shown in the following figure.

Z30516867010049

System View Device GNSS Network Storage Data Port

2022-11-23 09:33:27 44/45 39.3 °C 5.296 V 4.259 V 100%

[Simple UI] English

Storage Status

General



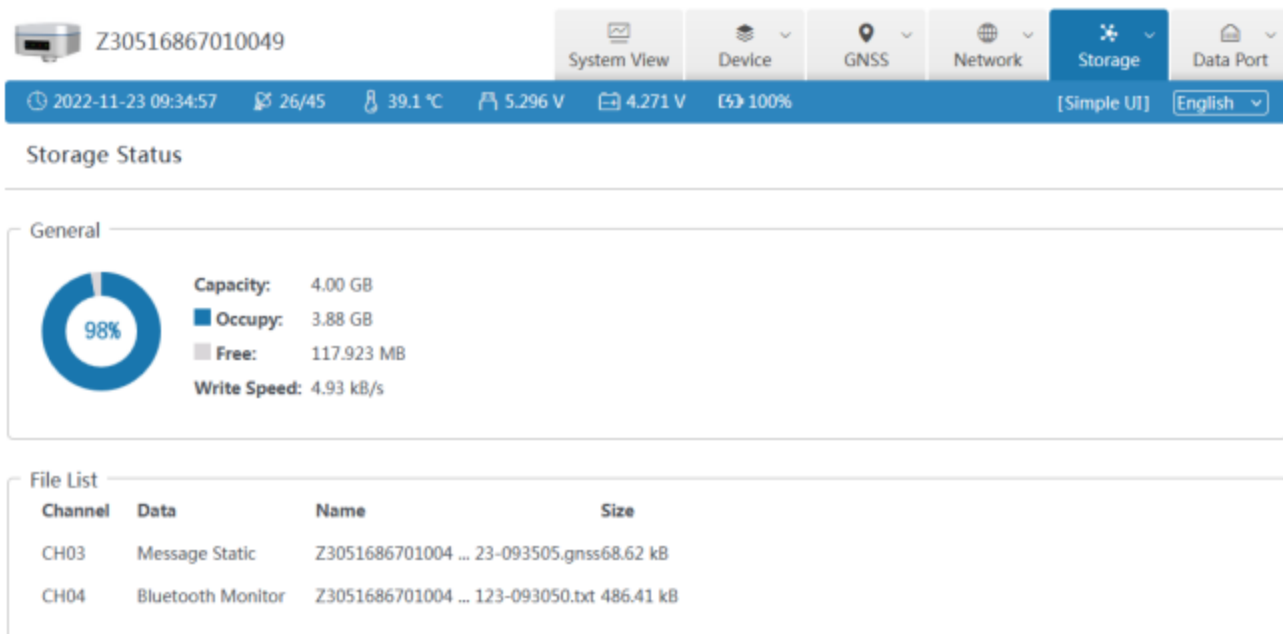
Capacity: 4.00 GB
 Occupy: 3.88 GB
 Free: 118.652 MB
 Write Speed: 10.63 kB/s

File List

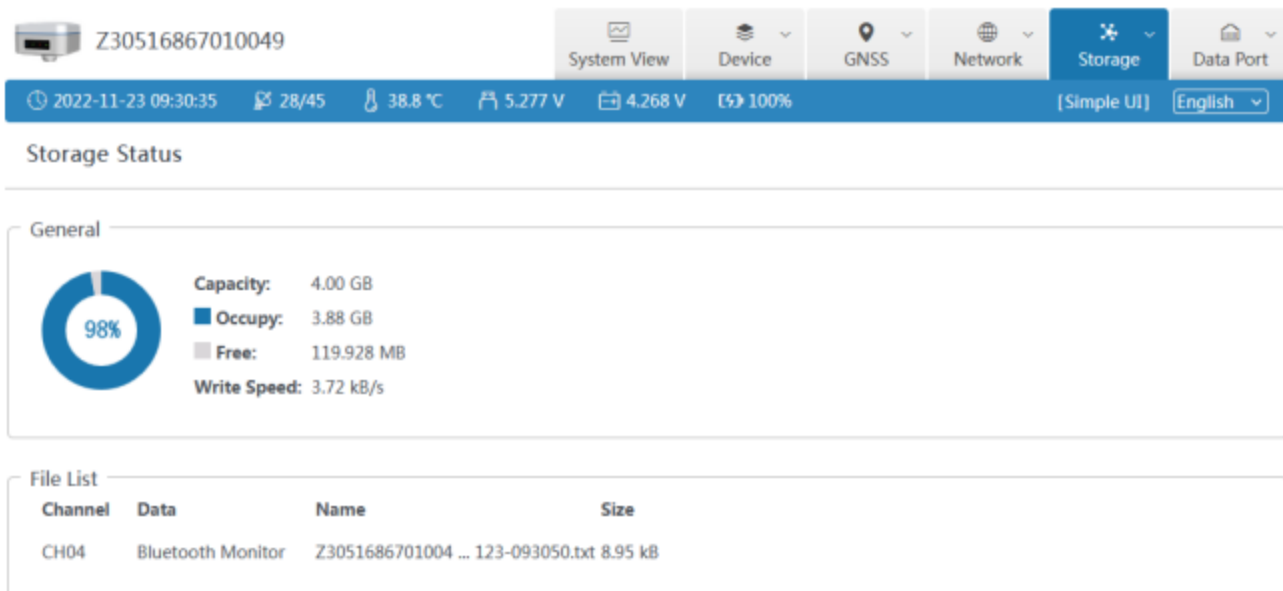
Channel	Data	Name	Size
CH02	Message Raw	Z3051686701004 ... 23-093338.gnss	47.17 kB
CH04	Bluetooth Monitor	Z3051686701004 ... 123-093050.txt	405.90 kB
CH05	Message PPK	Z3051686701004 ... 23-093210.gnss	454.12 kB

3. Static (CH03)

When the device is set as the static mode through the tSurvey software, the device will automatically configure CH03 to store static positioning data by default, as shown in the following figure.



Note: Whenever the tSurvey software connects to the device through Bluetooth, the device will automatically configure 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.



IV. tSurvey Basic Operations

It describes the basic operations to start using the device.

4.1 PCR100U Data Controller



The PCR100U Controller is a rugged multifunctional data controller with design of 5.5-inch sunlight readable HD touch screen and an alphanumerical keypad. Equipped with powerful Octa-core processor and android operating system. With professional IP67 rating, it is robust and reliable, suitable for various outdoor harsh environment. The large capacity lithium battery guarantees more than 15 hours of field working, which makes it excels at performing multiple surveying tasks throughout the day.

It's Key features:

- 5.5" sunlight-readable HD touchscreen;
- 8-core 2.0GHz processor;
- Pre-installed with Android 11 operating system
- 3GB RAM + 32GB ROM;
- 13 megapixel rear camera;
- IP67 protection, waterproof/shockproof/dustproof;
- Wi-Fi, Bluetooth, NFC;
- 4G all-network support;

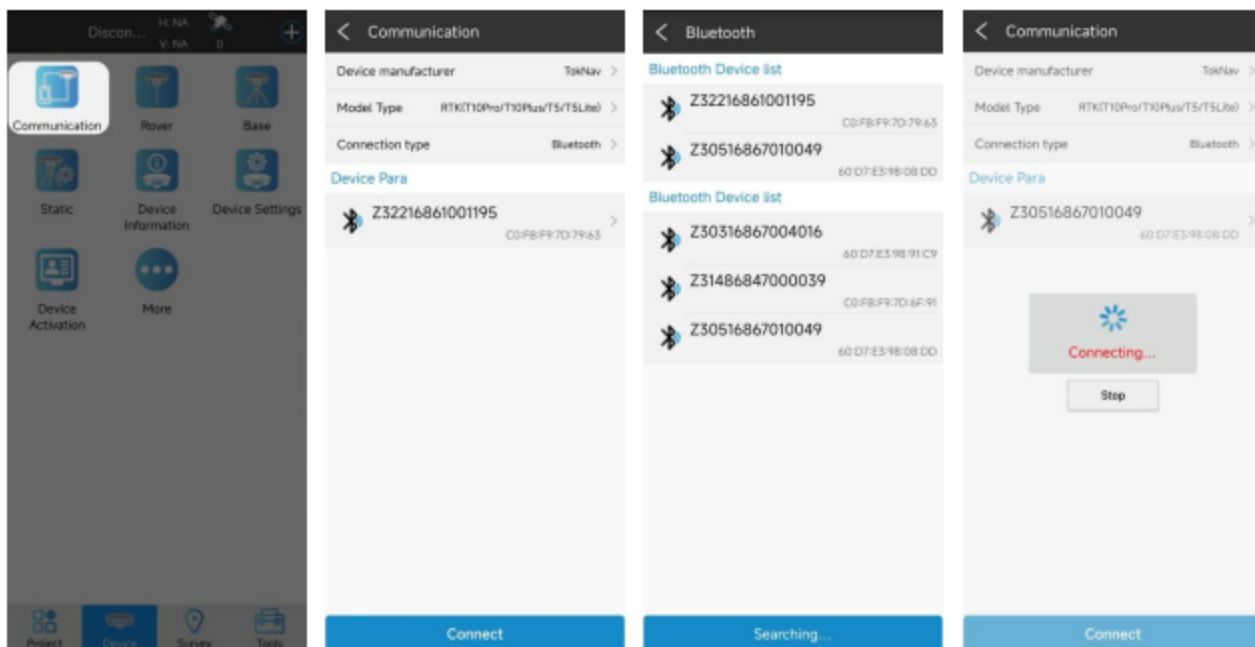
- 7700 mAh battery with 15 hours of battery life;
- Universal Type-C connector;
- Charging time: less than 4 hours (fast charging).

4.2 Communication

Operation: Device → Communication

The device manufacturer selects [TokNav], the device type defaults to [RTK(T10Pro/T10Plus/T5/T5Lite)], and the connection type selects [Bluetooth].

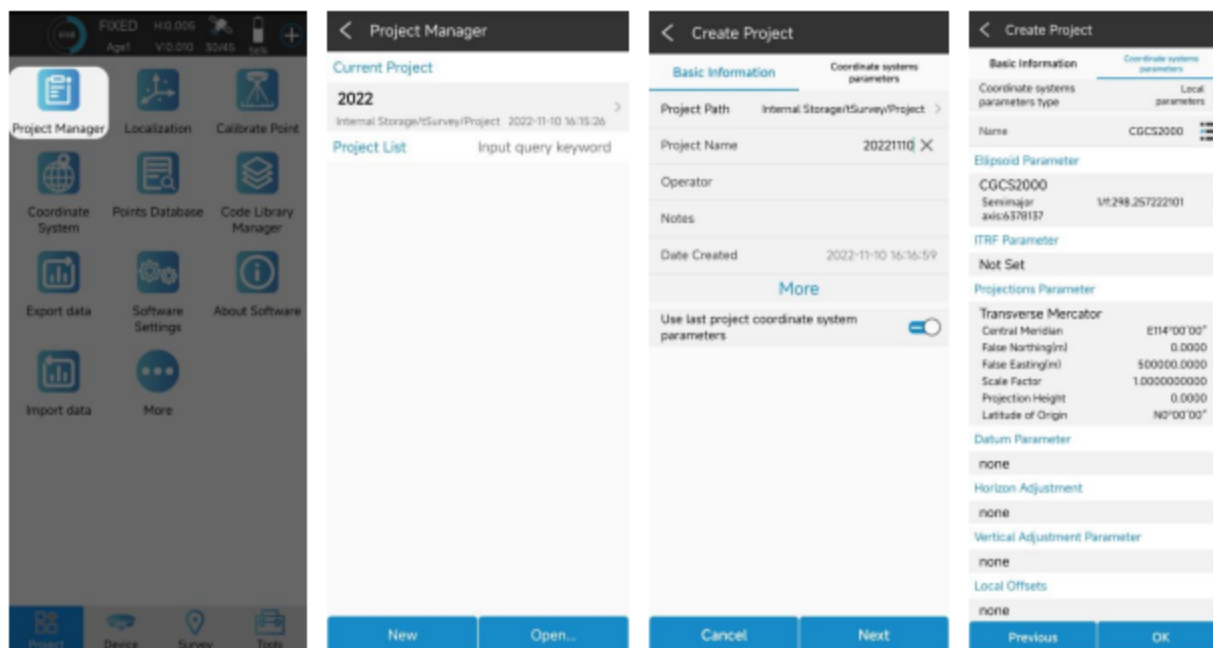
Click the Bluetooth name in the device parameters to jump to the device search interface, find the Bluetooth name of the corresponding device in the available devices (the default is the device computer number) and click to automatically return to the communication setting interface. Click Connect to pop up the connection progress box, indicating that the connection is in progress. After successful connection, automatically return to the main interface of the instrument. If the Bluetooth name of the corresponding device is not found in the available devices, click Search, switch to Refresh, and click Refresh.



4.3 New Project

Action: Project → Project Manager → New

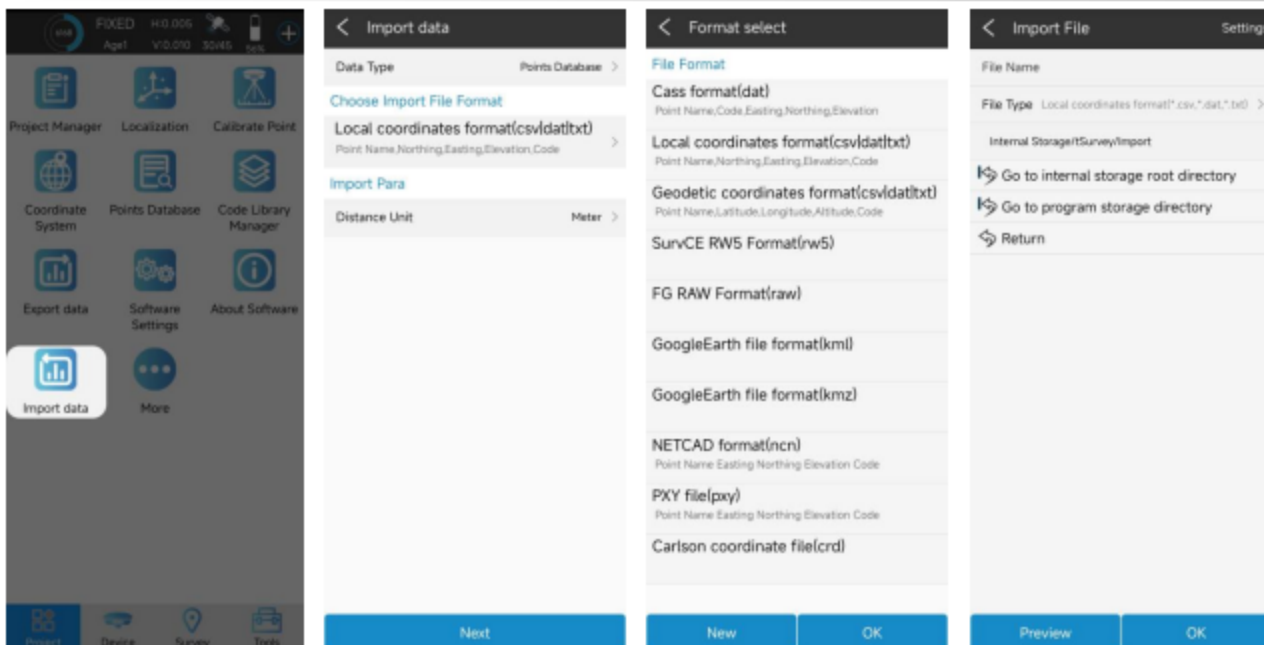
Enter the name of the item. Others are additional information and can be left blank. Fill in by default or according to actual data. Click [Next.Jump] to the coordinate system parameter interface. The ellipsoid parameter in China is CGCS2000, projected by Gauss by default. For other parameters, you can set the coordinate system according to the actual operation requirements.



4.4 Import Data

Actions: Project → Import Data

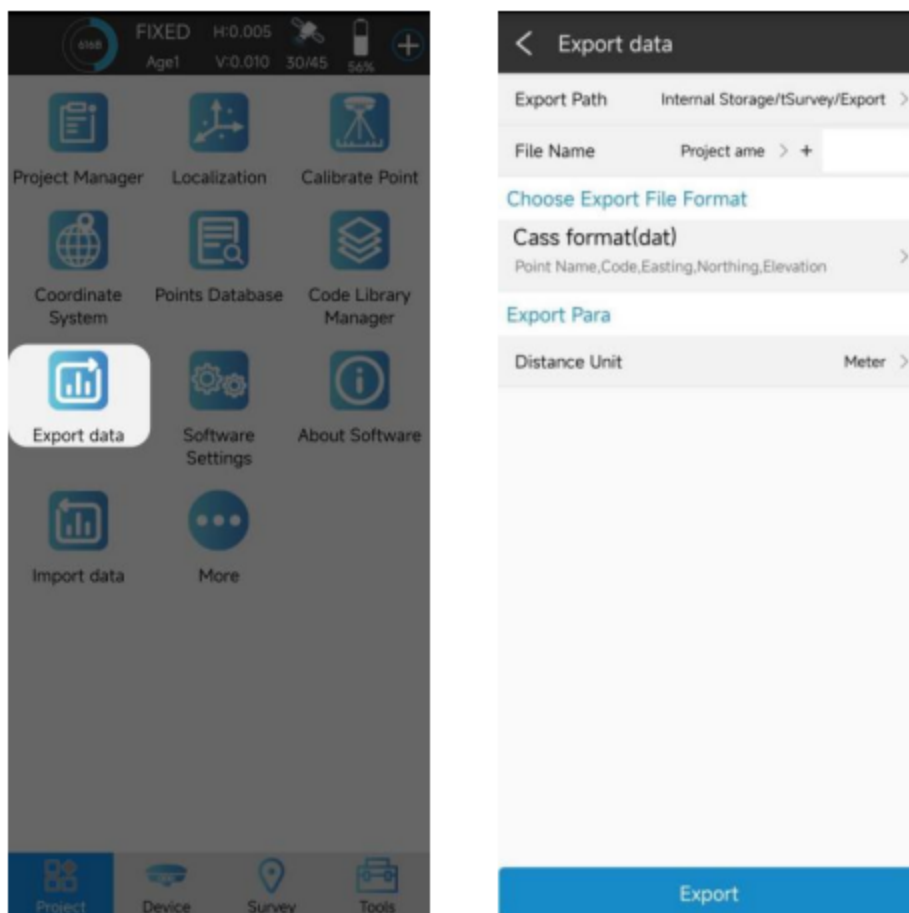
Copy the data file to be imported to the internal storage of the notebook, select the data type, length unit, angle format and data format, click "Next", go to the storage directory, select the corresponding file, and click "OK".

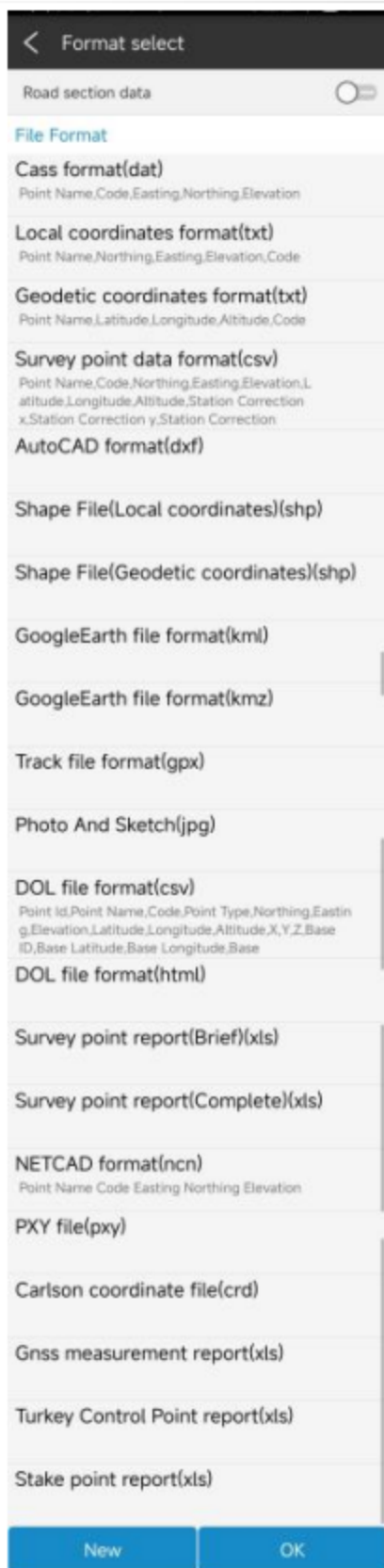


4.5 Export Data

Operation: Project→ Export Data

Confirmation export path, input file name, select length unit, angle format and data format, click export to export data file.





4.6 Localization

Example: four-parameter conversion.

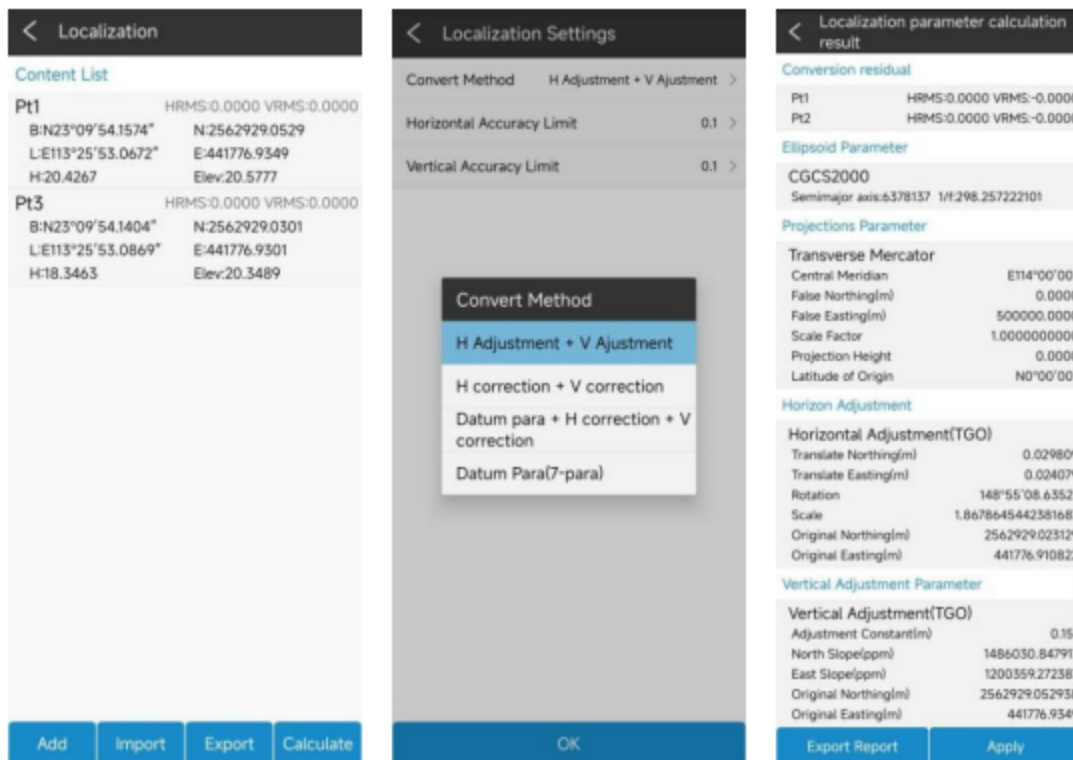
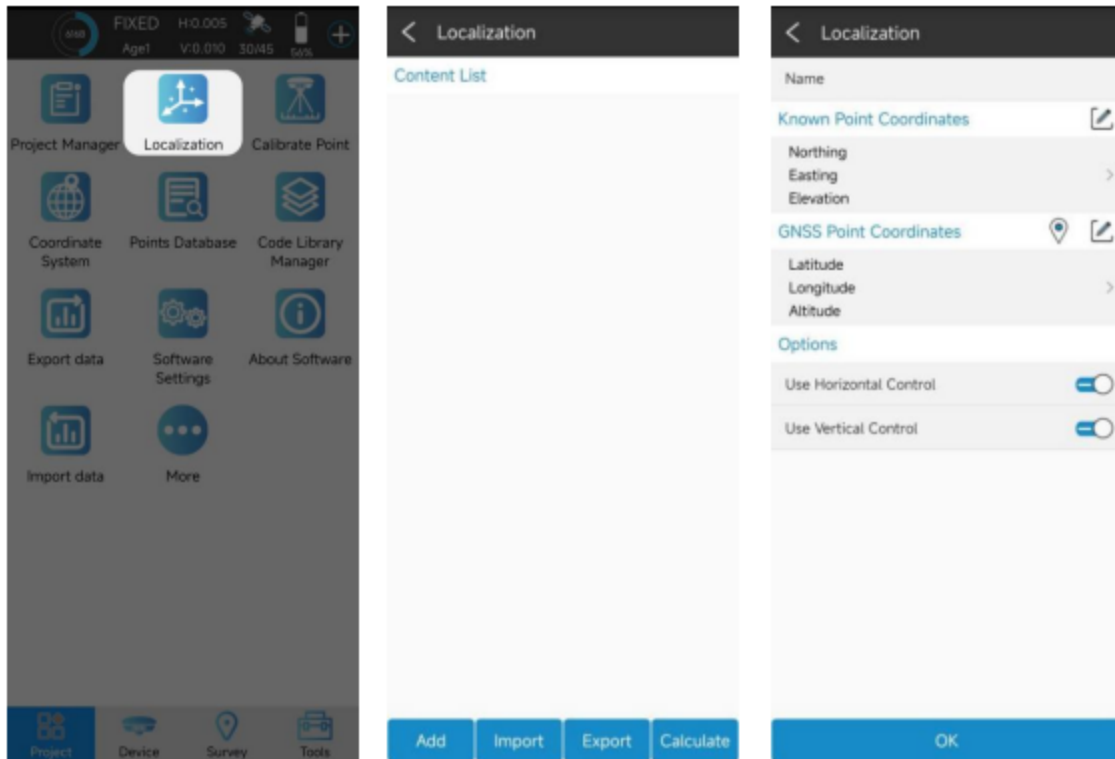
Correctly configure the rover station to obtain fixed state, click [Collect Point] to measure two known control points in the survey area.



Operation: Project → Localization

Localization is a special design of software, which is designed for specific survey work in China. When the survey is carried out in the same operation area, the position of the base station is changed due to moving the base station or re-erecting the base station, so it is necessary to calculate the translation parameters of the base station on the basis of using four or seven parameters, that is, only one common control point is used to calculate the difference between two sets of coordinate systems.

Select Item→Calculate Conversion Parameters, first click the Add button at the lower left corner, enter the name, fill in the coordinates and whether to enable the option on the page to be jumped to, click "OK" to automatically return to the previous page, then click the calculation button at the lower right corner, select the coordinate conversion method, horizontal precision limit and elevation precision limit on the page to be jumped to, click "OK" to obtain the conversion parameter calculation result, and click "Apply".



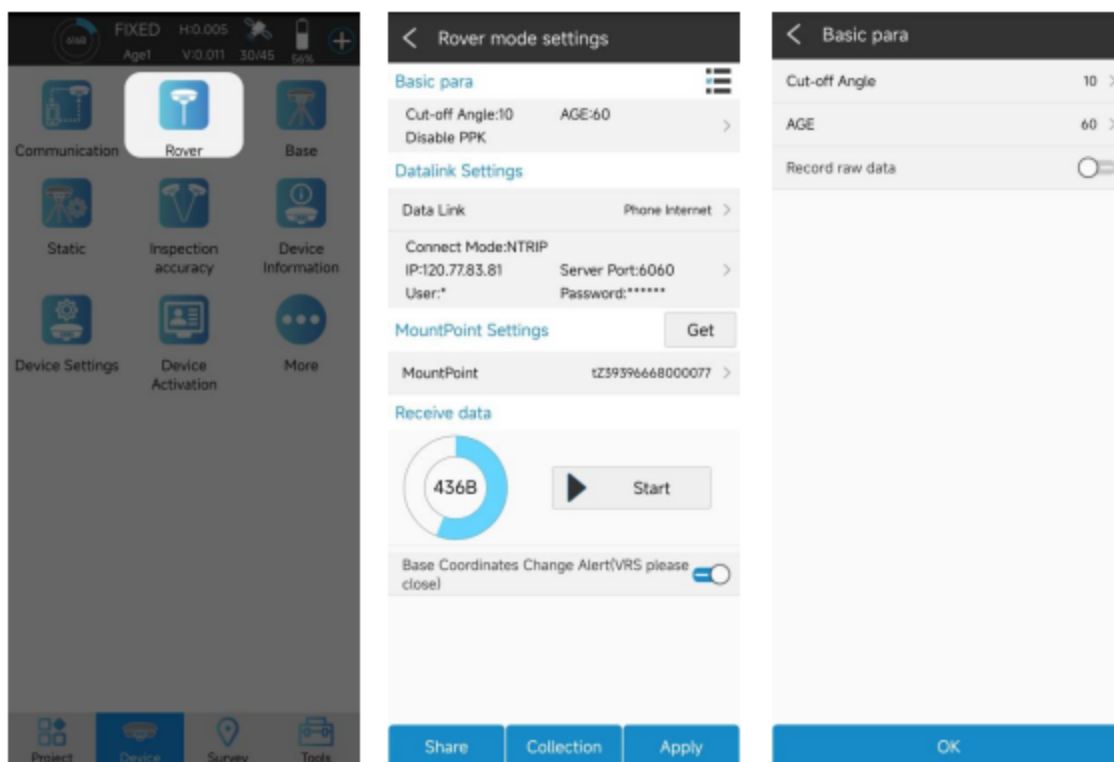
Note: In the parameter report, the plane conversion parameters and elevation conversion parameters can be checked.

The scale parameter is generally infinitely close to 1. If the value does not match, please check the operation whether there is any operation error or coordinate error in the process.

4.7 Rover Mode Setting

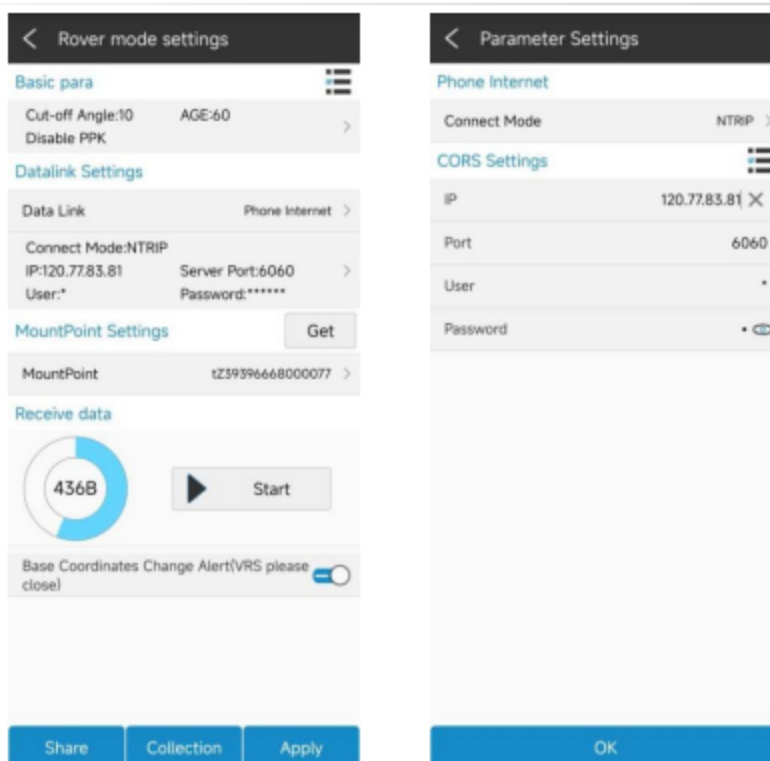
Operation: Device → Rover

Set basic parameters such as height cut-off angle, differential delay and whether PPK is enabled. Click "Data Link" to select the required data link.



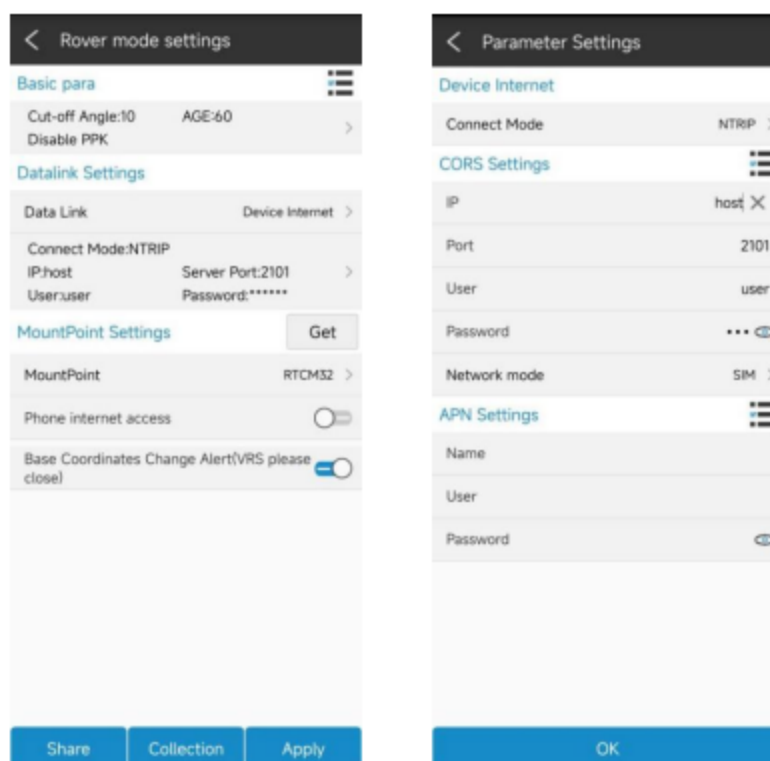
4.7.1 Phone Internet Data Link

Select "Manual network" for data link, enter parameter setting, select connection mode and CORS setting, click "OK" to automatically return to rover station setting interface, click "Get", select access point base station, click "Start" or "Apply", return to instrument main page to check whether the solution is fixed.



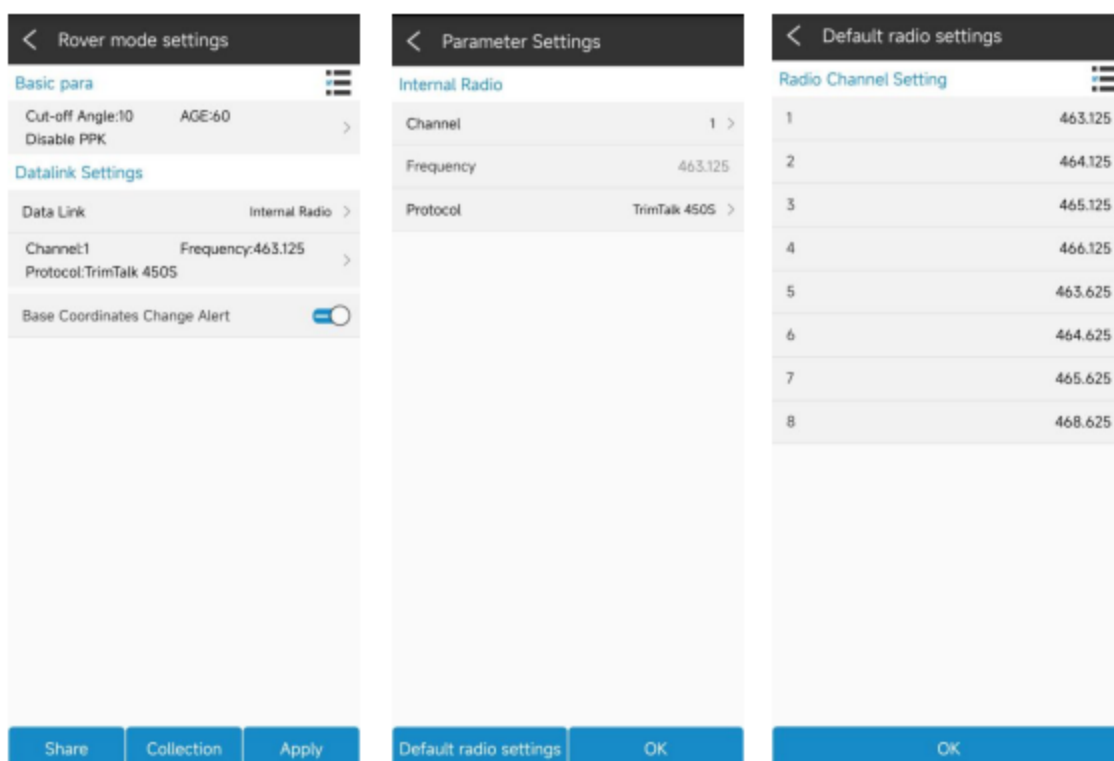
4.7.2 Device Internet Data Link

Insert the SIM card into the device, select "device Network" for the data link, enter the parameter setting, select the connection mode, CORS setting and APN setting, click "OK" to automatically return to the rover station setting interface, click "Get", select the access point base station, click "Apply" to automatically return to the instrument main page to check whether the solution is fixed.



4.7.3 Internal Radio Data Link

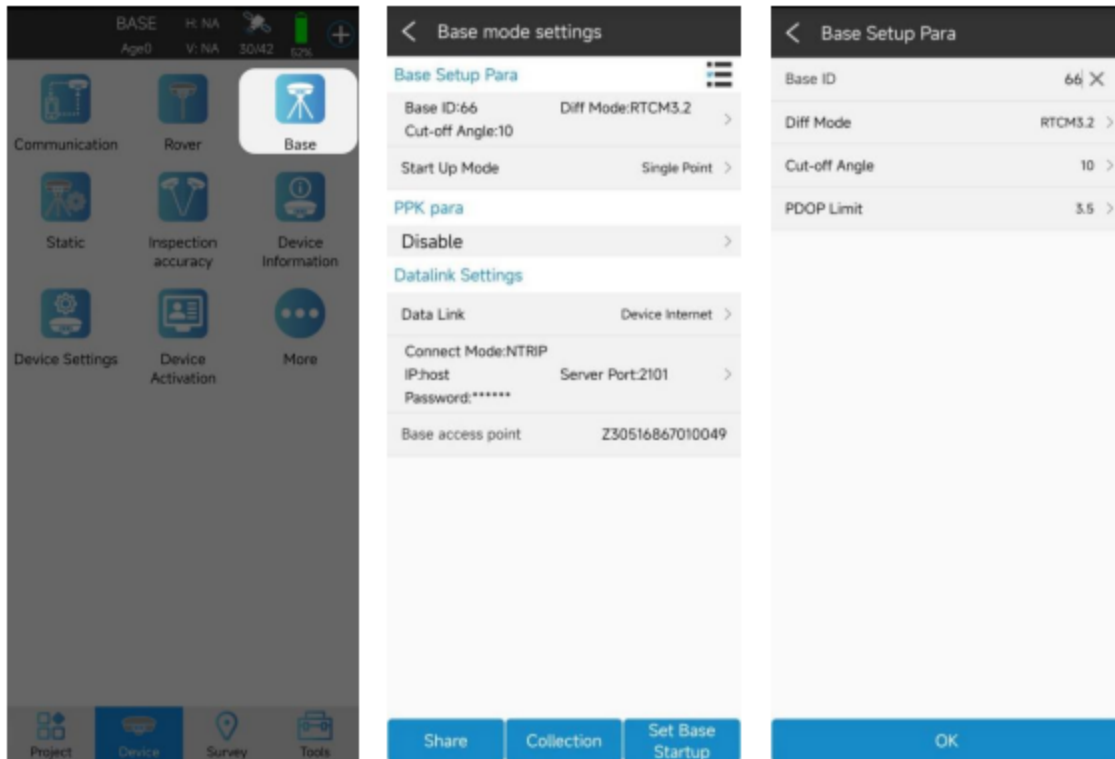
Plug in the radio antenna of the device, select "built-in radio station" for the data link, enter the parameter setting, click "Default radio station setting" in the lower left corner to configure the radio station channel, select the channel and protocol content, click "OK" to automatically return to the rover station setting interface, click "Application" to automatically return to the main page of the instrument to check whether the solution is fixed.



4.8 Base Mode Setting

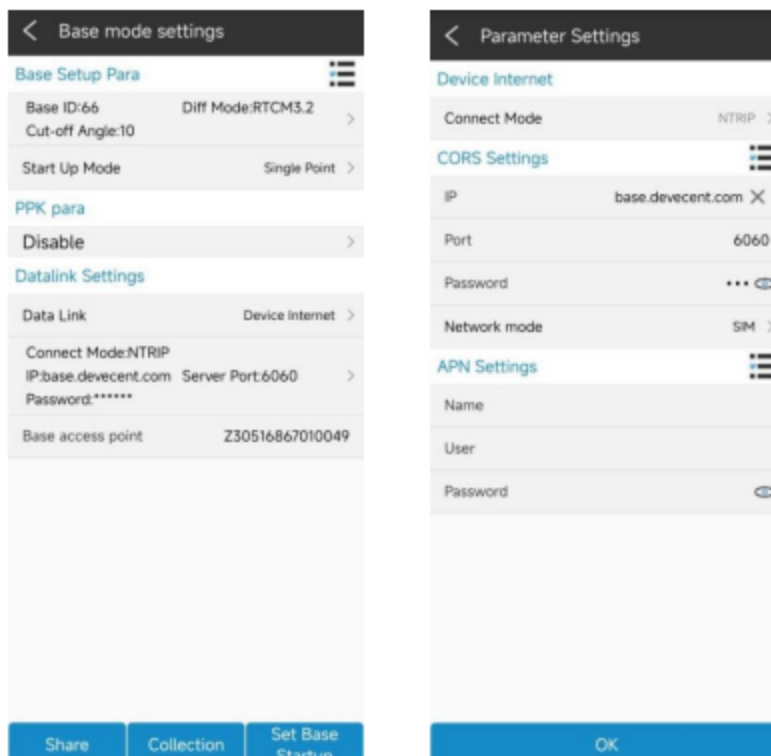
Operation: Device → Base

Enter base ID, set differential mode, altitude cutoff angle, PDOP limit, start mode parameter, whether to enable PPK, click "Data Link", and select the required data link.



4.8.1 Device Internet Data Link

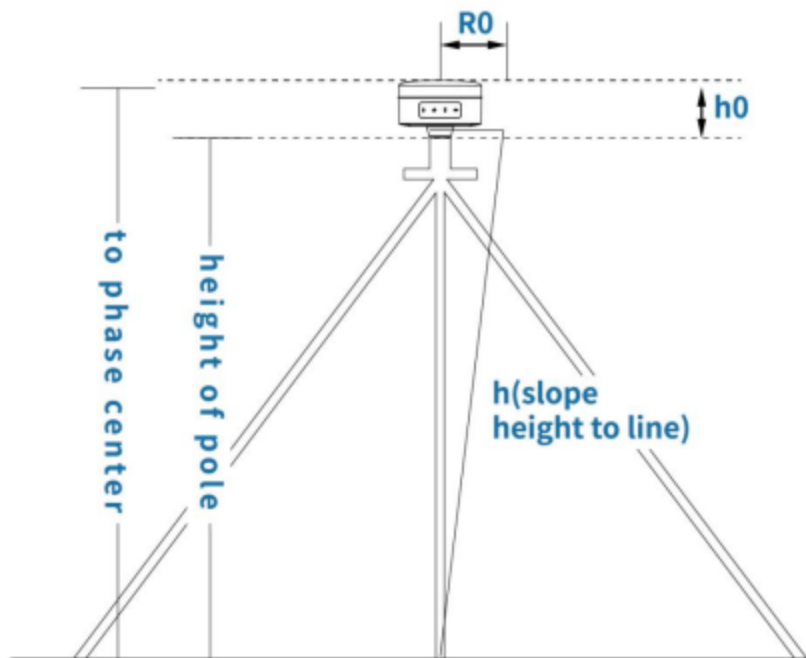
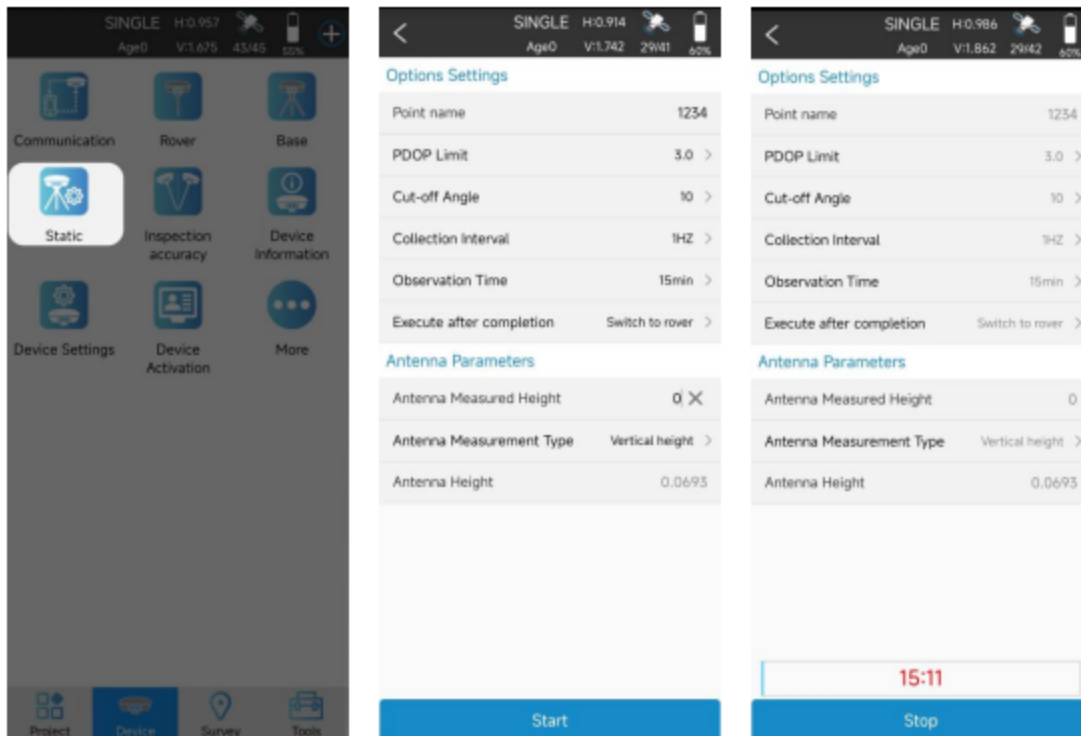
Insert the SIM card into the device, select "device Network" for the data link, enter the parameter setting, select CORS setting and APN setting, click "OK" to automatically return to the reference station setting interface, the base station access point is the machine number by default, click "Start Base Station" to automatically return to the instrument main page and check whether the base station is started.



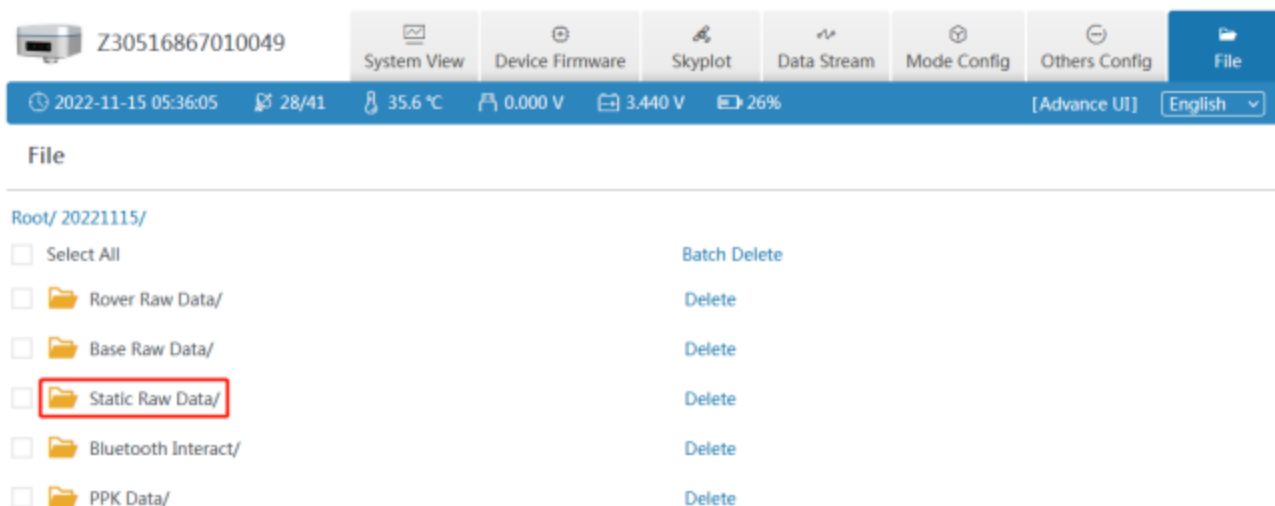
4.9 Static Mode Setting

Operation: Device → Static

Set options such as point name (the default is the equipment number), PDOP limit, altitude cut-off angle, acquisition interval, observation time, and operation after completion, input antenna survey to take altitude, select antenna survey mode, click "Start", switch to "Stop", and "Wait for recording" change to countdown to start static data acquisition. Click "Stop" to finish static data collection.



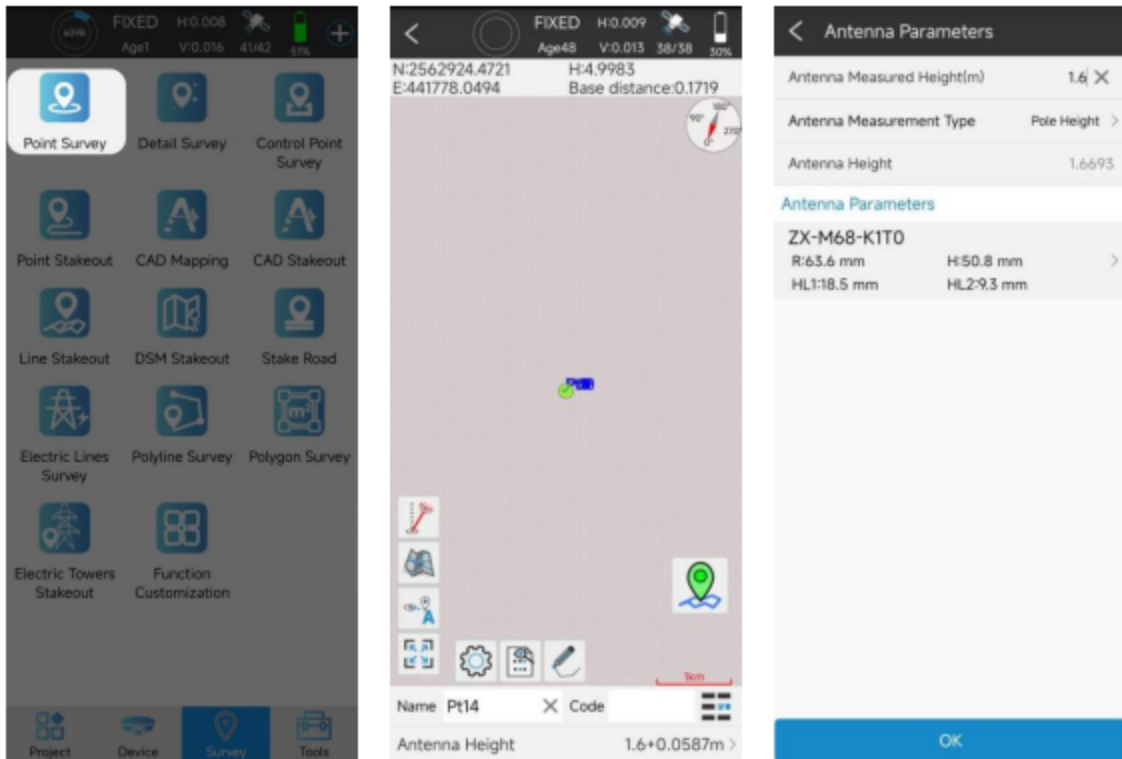
Log in to the device web page (see III WebUI for details), click [File]. Find the folder corresponding to the time to download the static data.










4.10 Point Survey

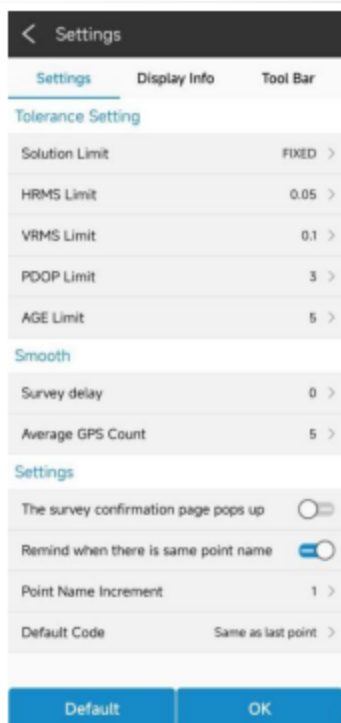
Operation: Survey → Point Survey

Open the point survey page, and view the current power of the device in the upper right of the survey display interface. Amount, CORS connection status, positioning accuracy (H: horizontal accuracy and, V: elevation accuracy), satellite information status, the following column displays the current optimal position of the device (north coordinate, east coordinate, elevation, base station distance and other information), and the bottom of the interface displays the name, code and antenna height to be collected (click to set antenna parameters).



Each icon in the point survey page has the following meaning:

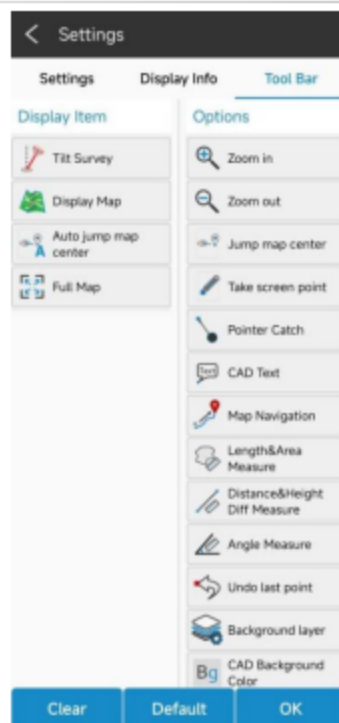
	<p>Click this icon to automatically center the current anchor point.</p>
	<p>Click the icon to display the network map.</p>
	<p>Click this icon to display all survey points in the view.</p>
	<p>Click this icon to turn tilt survey on or off.</p>
	<p>Click the icon to set acquisition parameters, information display and function menu.</p>
	<p>Click this icon to view the coordinate point library of the current project and the collected point coordinates, which are the same as the function of "coordinate point library" in "project".</p>
	<p>Click the icon to collect point, line, surface and other data.</p>



Picture Settings



Picture Display Info



Picture Tool Bar


4.11 Tilt Survey


Operation: Survey → Point Survey

The tilt survey function requires a tilt module on the device. The device with this function can:

1. The accuracy of the device machine can be maintained within 2cm within the range of tilt angle 0°~ 60°;
2. The calibration process is simple, just shake the centering rod in place;
3. Support calibration of centering rod, and eliminate survey error caused by curvature of centering rod.

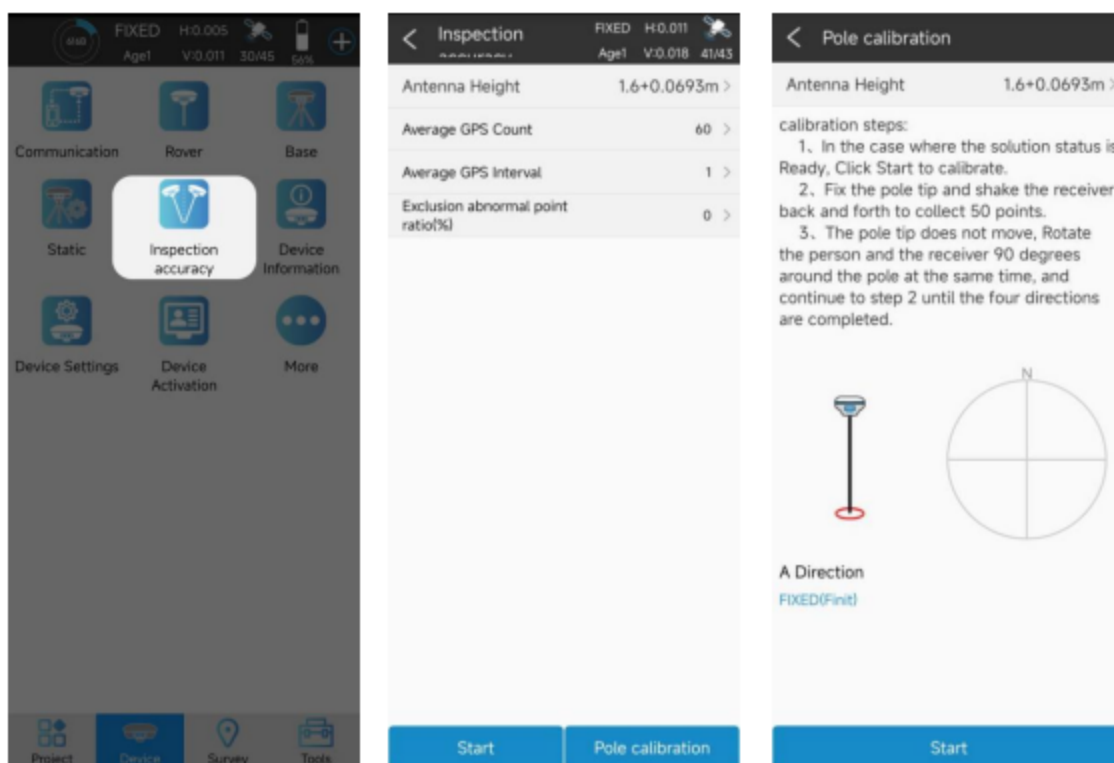
Open the point survey page, click the bottom column to input the antenna height parameter (height of the centering rod), and then light up the tilt survey icon at the lower left corner, that is, turn on the tilt survey function. The icon is green when it is turned on. At this time, the device needs to shake the centering rod 5~10S according

to the pop-up window prompt under the fixed state, until the icon  turns green

, the tilt survey can be performed.

When using the tilt survey for the first time, the alignment rod needs to be calibrated to eliminate the alignment rod curvature band for the error. Click "Device"→click "Inspection accuracy"→click "Pole calibration", then set the antenna height parameter, and calibrate the centering rod according to the calibration steps and pop-up prompt.

For the same device and the same centering rod, the centering rod calibration only needs to be carried out once, and the centering rod calibration can be eliminated when the matching is kept unchanged.



Precautions:

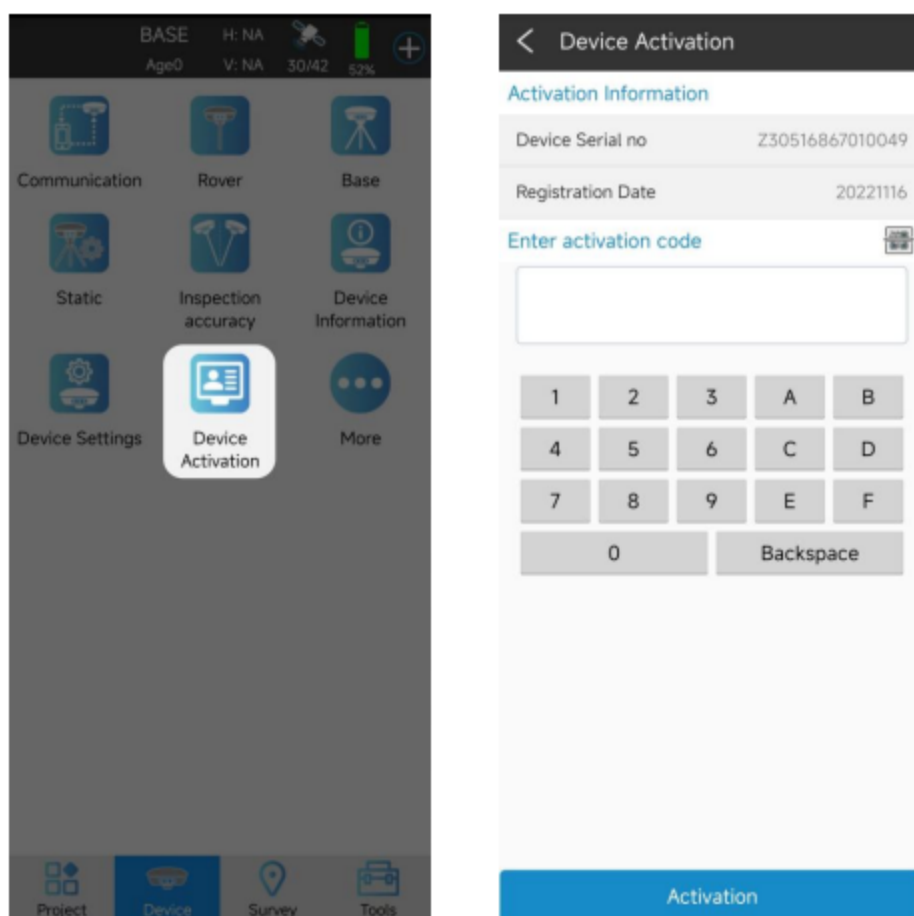
1. When the tilt survey is started, sometimes with the movement and rotation, the tilt icon will change from green to red. At this time, the centering rod needs to shake according to the prompt, and the sampling can be carried out until the icon turns green;
2. In the process of inclination survey, if the inclination is greater than 60°, it will indicate that the inclination is too large, and the accuracy of the collected points can not be guaranteed within 2cm;
3. To calibrate the centering rod, set the antenna height parameter first, otherwise the calibration data will be wrong;

4. Initialization of tilt survey can be completed only when it is in fixed solution state.

4.12 Device Activation

Operation: Device → Device Activation

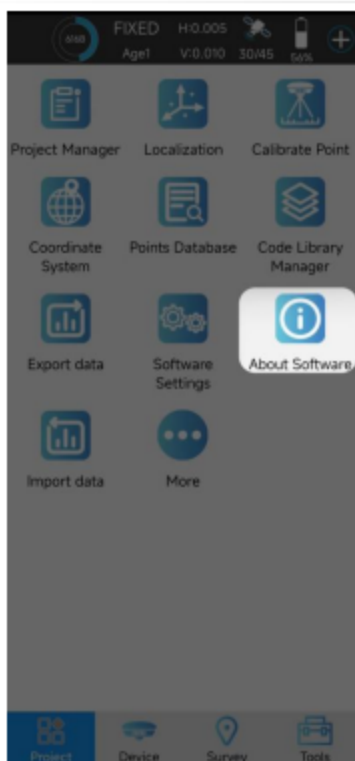
After the device Bluetooth connection is successful, you need to confirm whether the device registration code is valid. If it has expired, you need to register. Click "Device"→"Device Activation" to query the valid time of the device registration code. If it has expired, you need to input or scan the new device registration code.



4.13 Software Activation

Operation: Project → About Software

In the process of using the software, you need to pay attention to the expiration date of the software. If it has expired, you need to activate. Click "Project"→"About Software" to query the software expiration time. If it has expired, click "Software Activation" and enter or scan a new software activation code on the jump page.



V. Technical Indicator

Item	Specification	Remarks	
Hardware system	Qualcomm MDM9628 Cortex-A7		
OS	Linux		
Channel	1408 channels		
GNSS	GPS	L1 C/A, L1C*, L2P(Y), L2C, L5	IRNSS Support In Future
	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	
	Data format	NMEA-0183	
	Correction I / O Protocol	RTCM 2.X, RTCM3.X	
	Data update frequency	5Hz	
	Recapture Time	<1s	
Cold Boot	<30s		
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: B1/B3/B5/B8 LTE TDD: B38/B39/B40/B41 GSM: 900/1800MHz	
	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	
	Satellite Indicator	Show position status	
	Data link Indicator	Show differential signal status	
	Bluetooth Indicator	Show Bluetooth status	
BATTERY	Battery	3.7V, 9600mAh	
	Work time	More than 16 hours(typical, Rover Mode, Build-in network chain)	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°C~+60°C	
	Storage Temperature	-40°C~+85°C	
	Shock	Withstand 1.5M pole drop	
	Protection	IP65	
PHYSICAL	Material	Magnesium alloy main body, ABS/PC top cover	
	Dimension	100.5mm*100.5mm*72mm	
	Weight	≤0.80kg	
A Full Set	T5 Device	1 SET	
	USB power adapter	1 PCS	
	USB A To Type-C	1 PCS	
	Radio Antenna	1 PCS	

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