

AL16 GNSS RECEIVER USER MANUAL



Description

This document applies to AL16 GNSS receiver



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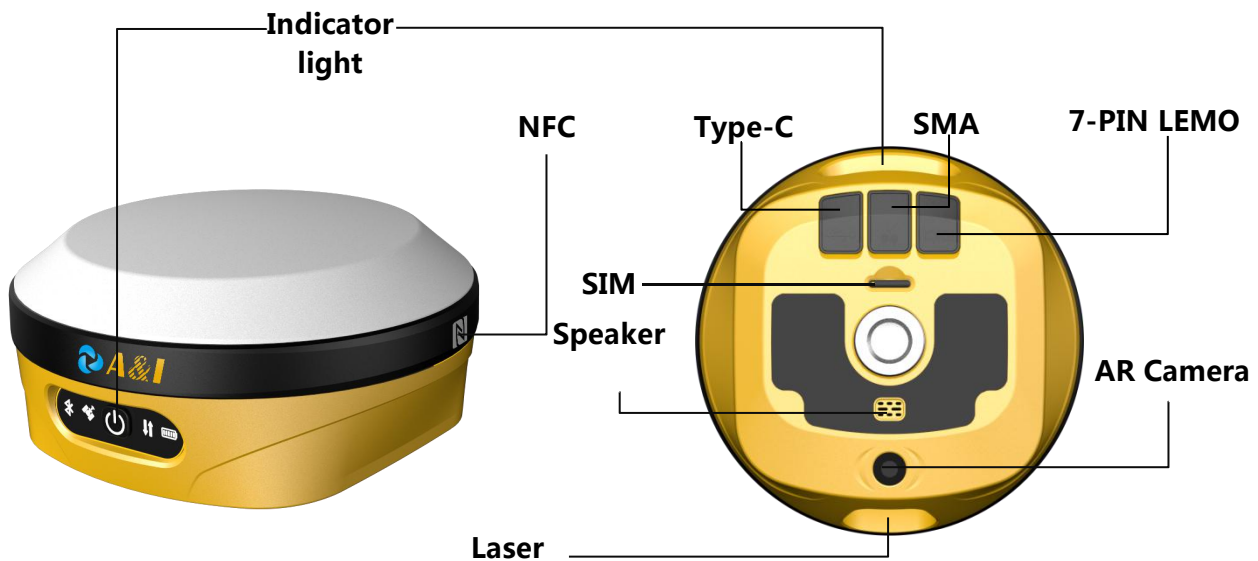
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1 AL16 At A Glance

AL16 is a portable multi-functional GNSS. It has a built-in high-precision positioning module that supports tracking satellite signals from all systems and frequency bands. It is equipped with 4G full network, Bluetooth, WIFI and built-in radio. The high-precision IMU integrates AR and Laser to achieve Laser Survey and real-time AR Stakeout, making the survey work more convenient and efficient.

1.1 Appearance

The main body of **AL16** is as follows:



Projects	Function	Role or Status
	On/Off Key	Function: When powered off, a short press for 1 second will display the battery level via the indicator light. When powered off, a long press for 3 seconds will turn the device on; when powered on, a long press for 3 seconds will turn the device off.
	Battery Level	Status: Green light stays on when the device is on and running; red light flashes when the battery is low. Red light stays on when charging; green light stays on when fully charged.
	Satellite light	Rover/base station: 1 second interval flashing in the positioning state; Static mode: flashing according to sampling frequency.
	Differential data light	Rover mode: Blink when receiving differential data; Base mode: Blink when sending differential data.

	Bluetooth	When connected, the blue indicator light stays on continuously; when not connected, the blue indicator light is off.
	SIM Card Slot	Support for 4G full network.
	USB Interface	Type-C interface, supports PD fast charging up to 33W.
	UHF Antenna (SMA Interface)	Frequency Range: 410~470MHz Low power: 1W High power: 1W
	7-pin LEMO Interface	Data transmission, external radio connection, and external power supply.
	AR Camera	Professional ultra-wide-angle camera which provides high-definition real-scene stakeout.
	Laser	Millimeter-level laser ranging module, integrated with high-precision inertial navigation.

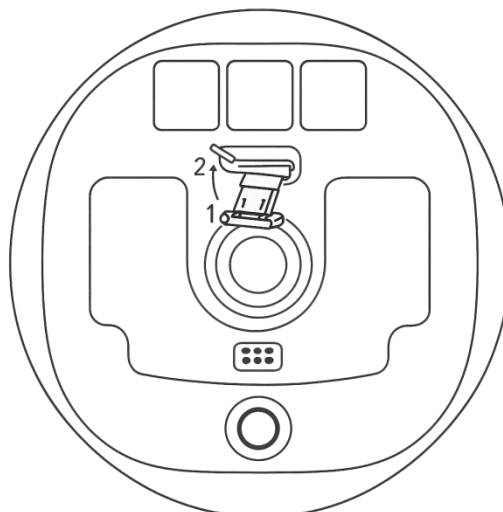
1.2 Power On And Off

Power On: In the power-off state, press and hold the power button for 3 seconds until you hear the voice prompt “waiting to start.” Release the power button and wait for the panel indicator light to stop flashing alternately. Once you hear the voice prompt “communication connection successful,” the device has completed the power-on process.

Power Off: In the power-on state, press and hold the power button for 3 seconds until you hear the voice prompt "Power off." Wait for all the panel indicator lights to go out, indicating that the device has completed the power-off process.

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

1.3 Insert A SIM Card





The device supports network working mode, a 4G full network solution based on the Linux platform, and fully supports 2/3/4G networks, with better compatibility, stronger signals and more stable connections.

How to insert a SIM card?

1. Open the slot;
2. Insert the SIM card into the slot according to the instructions (chip facing the connector and notch facing the slot);
3. Close the slot.

1.4 Charge The Battery

The device comes with a Type-C charger that supports up to 33W PD fast charging. The battery fully charges in approximately 4 hours. The power status light indicates:

Red light: the battery is charging;

Green light: the battery is fully charged.

Battery charging: Open the rubber cover, connect one end of the data cable to the Type-C port and the other end to the charger.

Note: For the safety of your device, please use the adapter that comes with the package or a brand adapter that complies with 3C certification for charging.

1.5 Abnormal Status

When the device encounters issues such as an expired registration code, failed location configuration, network errors, etc., the speaker will emit corresponding alert sounds.

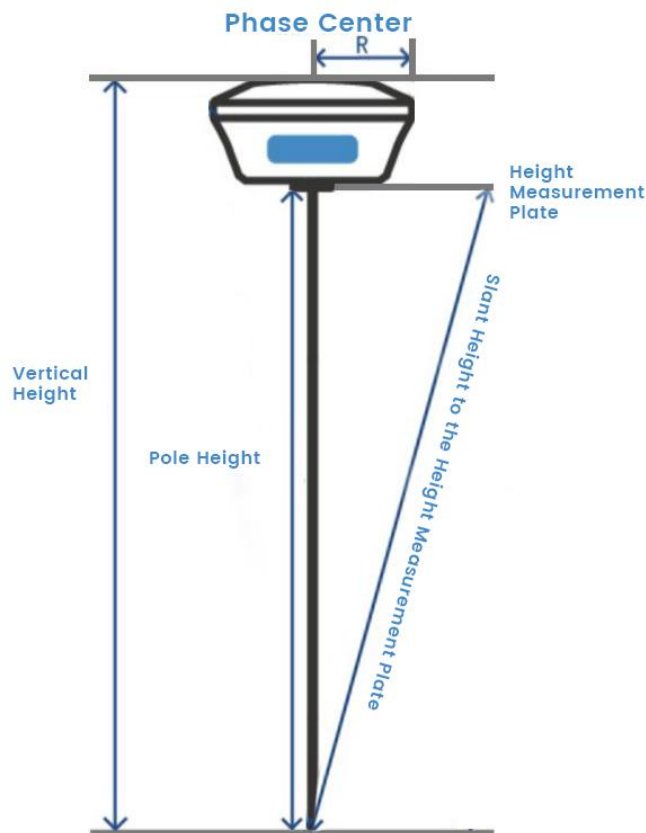
Expired registration code: First, provide the device ID to the dealer to obtain a new registration code, then refer to section 4.1 for registration.

Failed location configuration: Try restarting the device to restore it. If this does not work, please contact the dealer for assistance.

Network errors:

1. Check if the SIM card is inserted;
2. Check if the SIM card can access the internet normally;
3. Check if the APN parameters are filled in correctly.

1.6 Antenna Height Measurement



Antenna height refers to the vertical distance between the antenna phase center and the ground.

In general, the antenna height cannot be measured directly. Based on the measurement height you input and the selected measurement type, the GEOVENT software automatically calculates the antenna height.

Vertical Height: The vertical distance from the phase center to the ground.

Slant Height: The inclined distance from the height measurement line to the ground.

Pole Height: The height of the pole, that is, the vertical distance from the ground to the bottom of the device.

Slant Height to the Height Measurement Plate: The inclined distance from the height measurement plate to the ground.

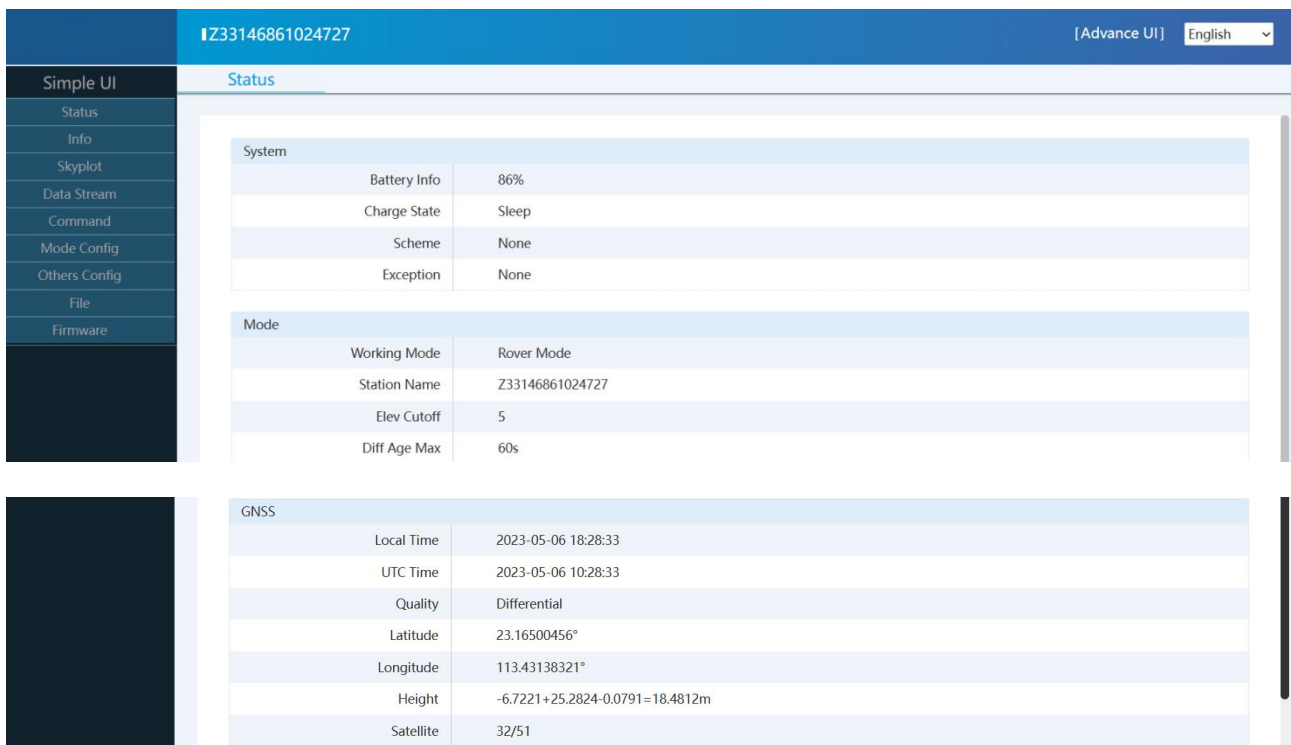
Note: Regardless of the measurement height value you enter or the measurement type you select, the calculated antenna height is unique.

2 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:



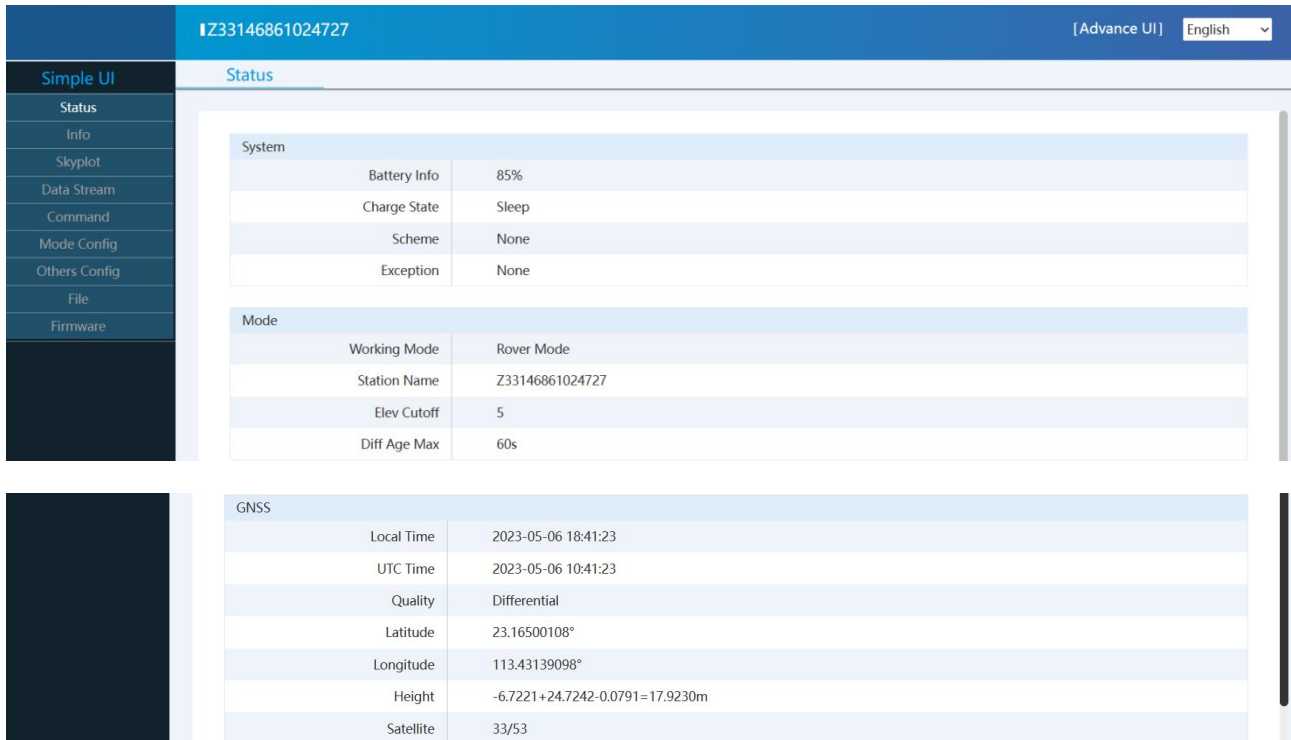
System		
Battery Info	86%	
Charge State	Sleep	
Scheme	None	
Exception	None	

Mode	
Working Mode	Rover Mode
Station Name	Z33146861024727
Elev Cutoff	5
Diff Age Max	60s

GNSS	
Local Time	2023-05-06 18:28:33
UTC Time	2023-05-06 10:28:33
Quality	Differential
Latitude	23.16500456°
Longitude	113.43138321°
Height	-6.7221+25.2824-0.0791=18.4812m
Satellite	32/51

2.1 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.



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

Z33146861024727

[Advance UI] English

Simple UI

Info

Status

Info

Skyplot

Data Stream

Command

Mode Config

Others Config

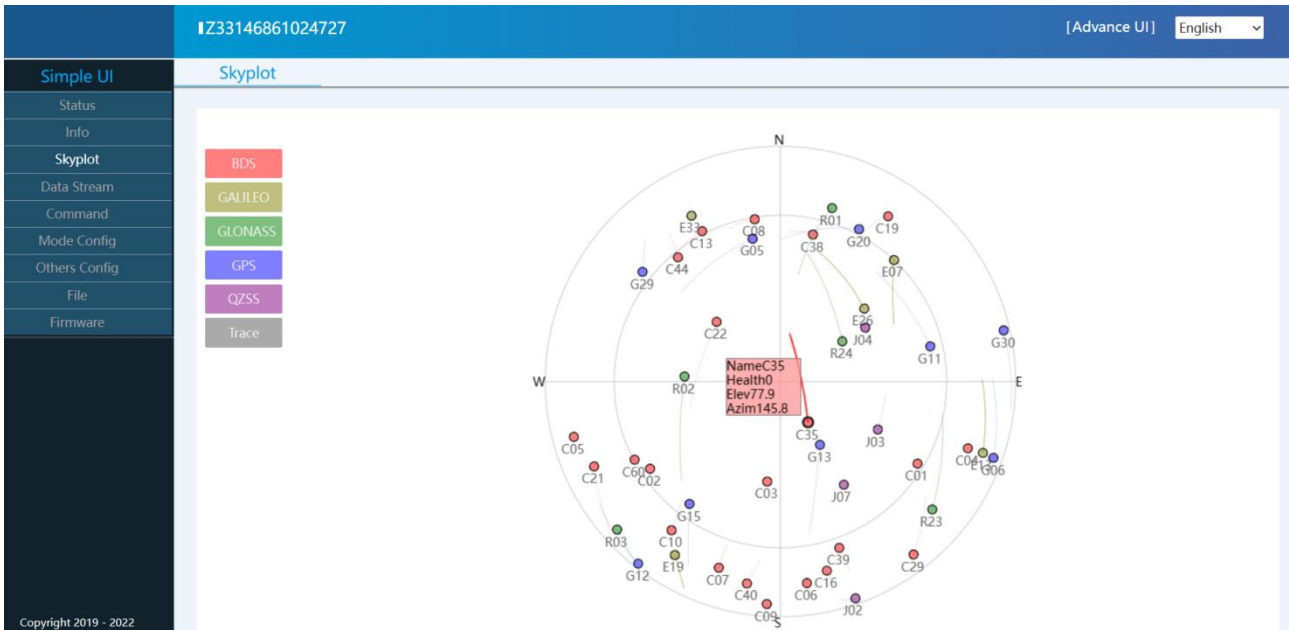
File

Firmware

Info

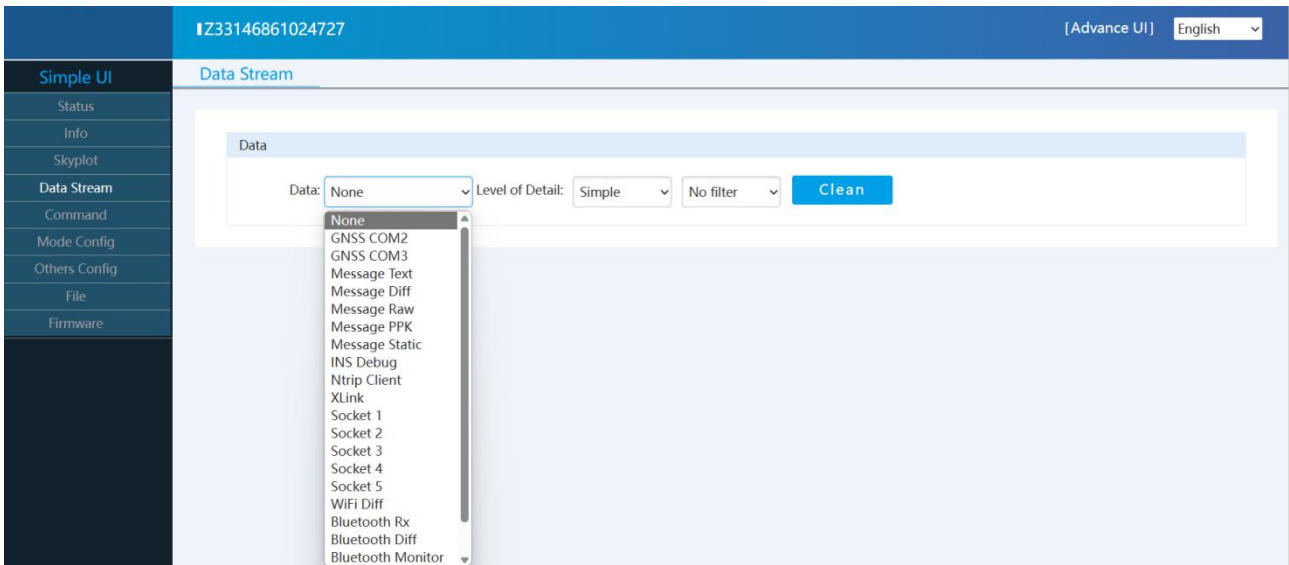
SN	Z33146861024727
Hardware	1.1.230225.230311/G4K8M1N1P2S2T7J2
Firmware	M68-FMW3.2.411.2305.1677
GNSS Type	UM980
GNSS SN	MD22B2222519122
GNSS Hardware	2310415000001
GNSS Firmware	R4.10Build7676
IMEI	865326069939737
Expired Date	2023-07-07

The skyplot mainly displays the satellite trajectory and status, including parameters such as **Trace, Name, Health, Elevation, and Azimuth**, as shown below.



2.4 Data Stream

The data stream is mainly used for debugging; 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.

I233146861024727
[Advance UI] English

Simple UI

Status

Info

Skyplot

Data Stream

Command

Mode Config

Others Config

File

Firmware

Data Stream

Data

Data: Message Text
Level of Detail: Simple
No filter
Clean

```

1: $DEVST,1,20230508033119,boot|233146861024727,sys|21,1|60,1,bat|66|7,700|0,000|sleep|0,000,mcu|33,1,gnss|4|46*63
2: $GPGST,033119.00,0.0182,0.0,0.0,0.0,0.0048,0.0070,0.0161*58
3: $GPGGA,033119.00,2309,90023221,N,11325.88308759,E,4,46,0,7,41,4468,M,-6.7221,M,01,0*77
4: $GPRMC,033119.00,A,2309.9002322,N,11325.8830876,E,0.004,223.11,080523,,D*67
5: $GPGSA,M,3,1,3,6,7,8,14,21,30,,,,,1,4,0,7,1,2*01
6: $GPGSA,M,3,75,76,77,86,87,88,,,,,1,4,0,7,1,2*21
7: $BDGSA,M,3,1,2,3,4,5,6,7,8,9,10,11,13,1,4,0,7,1,2*1C
8: $BDGSA,M,3,16,23,25,27,28,33,35,39,40,43,59,60,1,4,0,7,1,2*28
9: $GPGSV,2,1,8,1,59,37,43,3,29,125,36,6,12,216,33,7,45,195,41*74
10: $GPGSV,2,2,8,8,11,62,34,14,46,334,42,21,31,37,36,30,55,252,42*7F
11: $GPGSV,2,1,6,75,12,146,39,76,68,128,46,77,55,340,33,86,22,25,35*66
12: $GPGSV,2,2,6,87,60,319,43,88,33,245,41*50
13: $GAGSV,2,1,5,10,28,219,37,12,54,222,38,26,17,36,29,31,61,354,42*6D
14: $GAGSV,2,2,5,33,67,28,43*51
15: $BDGSV,7,1,25,1,45,123,39,2,46,233,37,3,61,187,41,4,32,109,37*63
16: $BDGSV,7,2,25,5,23,253,35,6,30,201,35,7,60,0,41,8,37,172,36*65
17: $BDGSV,7,3,25,9,39,220,40,10,53,333,39,11,22,38,30,13,29,183,39*63
18: $BDGSV,7,4,25,16,27,196,38,23,81,222,44,25,35,151,37,27,12,246,31*65
19: $BDGSV,7,5,25,28,52,279,41,33,7,142,29,34,5,49,26,38,49,160,39*52
20: $BDGSV,7,6,25,39,20,189,36,40,51,16,41,43,45,22,41,59,48,129,42*0E
21: $BDGSV,7,7,25,60,43,238,42*61
22: $GQGSV,1,1,3,194,64,94,41,195,62,52,41,199,58,148,35*41

```

2. Message Raw

I233146861024727
[Advance UI] English

Simple UI

Status

Info

Skyplot

Data Stream

Command

Mode Config

Others Config

File

Firmware

Data Stream

Data

Data: Message Raw
Level of Detail: Simple
No filter
Clean

```

1: binary: size=5328 time=2023-05-08 03:24:10.000 id= 43.RANGE amount=121
2: binary: size=5328 time=2023-05-08 03:24:11.000 id= 43.RANGE amount=121
3: binary: size=5328 time=2023-05-08 03:24:12.000 id= 43.RANGE amount=121
4: binary: size=5328 time=2023-05-08 03:24:13.000 id= 43.RANGE amount=121
5: binary: size=5328 time=2023-05-08 03:24:14.000 id= 43.RANGE amount=121
6: binary: size=5328 time=2023-05-08 03:24:15.000 id= 43.RANGE amount=121
7: binary: size=5328 time=2023-05-08 03:24:16.000 id= 43.RANGE amount=121
8: binary: size=5328 time=2023-05-08 03:24:17.000 id= 43.RANGE amount=121
9: binary: size=5328 time=2023-05-08 03:24:18.000 id= 43.RANGE amount=121
10: binary: size=5328 time=2023-05-08 03:24:19.000 id= 43.RANGE amount=121
11: binary: size= 72 time=2023-05-08 03:24:20.000 id= 42.BESTPOS type=FIXEDPOS
12: binary: size= 44 time=2023-05-08 03:24:20.000 id= 99.BESTVEL type=DOPPLER_VELOCITY
13: binary: size= 44 time=2023-05-08 03:24:20.000 id= 101.TIME st=1

```

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

I233146861024727
[Advance UI] English

Simple UI

Status

Info

Skyplot

Data Stream

Command

Mode Config

Others Config

File

Firmware

Data Stream

Data

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

```

1: rtm3 :msg=1074.GPS_MSM4 len=115 station=0 time=day 1 03:18:28.000
2: rtm3 :msg=1084.GLO_MSM4 len=109 station=0 time=day 1 03:18:28.000
3: rtm3 :msg=1094.GAL_MSM4 len=100 station=0 time=day 1 03:18:28.000
4: rtm3 :msg=1124.BDS_MSM4 len=360 station=0 time=day 1 03:18:28.000
5: rtm3 :msg=1124.BDS_MSM4 len=202 station=0 time=day 1 03:18:28.000
6: rtm3 :msg=1074.GPS_MSM4 len=115 station=0 time=day 1 03:18:28.000
7: rtm3 :msg=1084.GLO_MSM4 len=109 station=0 time=day 1 03:18:28.000
8: rtm3 :msg=1094.GAL_MSM4 len=100 station=0 time=day 1 03:18:28.000
9: rtm3 :msg=1124.BDS_MSM4 len=360 station=0 time=day 1 03:18:28.000
10: rtm3 :msg=1124.BDS_MSM4 len=202 station=0 time=day 1 03:18:28.000
11: rtm3 :msg=1005.REF_PHASE len= 25 la=23.16498711 lo=113.43139835 ht=25.3060
12: MrRdHLV6StHxvraS
13: rtm3 :msg=1033.RECV_ANT len= 73 id=0

```

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



IZ33146861024727 [Advance UI] English

Simple UI Data Stream

Data

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

1:	binary:	size=5416	time=2023-05-08	03:26:41.000	id=	43.	RANGE	amount=123
2:	binary:	size=5416	time=2023-05-08	03:26:42.000	id=	43.	RANGE	amount=123
3:	binary:	size=5416	time=2023-05-08	03:26:43.000	id=	43.	RANGE	amount=123
4:	binary:	size=5416	time=2023-05-08	03:26:44.000	id=	43.	RANGE	amount=123
5:	binary:	size=5416	time=2023-05-08	03:26:45.000	id=	43.	RANGE	amount=123
6:	binary:	size=5416	time=2023-05-08	03:26:46.000	id=	43.	RANGE	amount=123
7:	binary:	size=5460	time=2023-05-08	03:26:47.000	id=	43.	RANGE	amount=124
8:	binary:	size=5460	time=2023-05-08	03:26:48.000	id=	43.	RANGE	amount=124
9:	binary:	size=5460	time=2023-05-08	03:26:49.000	id=	43.	RANGE	amount=124
10:	binary:	size=	72	time=2023-05-08	03:26:50.000	id=	42.	BESTPOS type=SBAS
11:	binary:	size=	44	time=2023-05-08	03:26:50.000	id=	99.	BESTVEL type=DOPPLER_VELOCITY
12:	binary:	size=	44	time=2023-05-08	03:26:50.000	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.

IZ33146861024727 [Advance UI] English

Simple UI Data Stream

Data

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

1:	rtcm3	:msg=1005.REF_PHASE	len=	25	la=23.16582210	lo=113.42943440	ht=57.0433
2:	rtcm3	:msg=1033.RECV_ANT	len=	81	id=0		
3:	rtcm3	:msg=1074.GPS_MSM4	len=103	station=0	time=day 1	03:30:00.000	
4:	rtcm3	:msg=1084.GLO_MSM4	len=	65	station=0	time=day 1	03:30:00.000
5:	rtcm3	:msg=1124.BDS_MSM4	len=351	station=0	time=day 1	03:30:00.000	
6:	rtcm3	:msg=1074.GPS_MSM4	len=103	station=0	time=day 1	03:30:01.000	
7:	rtcm3	:msg=1084.GLO_MSM4	len=	65	station=0	time=day 1	03:30:01.000
8:	rtcm3	:msg=1124.BDS_MSM4	len=351	station=0	time=day 1	03:30:01.000	
9:	rtcm3	:msg=1074.GPS_MSM4	len=103	station=0	time=day 1	03:30:02.000	
10:	rtcm3	:msg=1084.GLO_MSM4	len=	65	station=0	time=day 1	03:30:02.000
11:	rtcm3	:msg=1124.BDS_MSM4	len=351	station=0	time=day 1	03:30:02.000	

2.5 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.

IZ33146861024727 [Advance UI] English

Simple UI Command

System

Reboot Shutdown

Config and Data

Reset Config Clean Storage Export Config Import Config

Feature Code

Write

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Gnss Auth

HRPT00-S10C-P

Register Code

sn=Z33146861024727 date=2023-07-07

2.6 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 configured.

Simple UI

Status

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Skyplot

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Command

Mode Config

Others Config

File

Firmware

Z33146861024727
[Advance UI] English

Mode Config

Working Mode

Mode:
Rover Mode

Station Name
Z33146861024727

Elev Cutoff:
5
Degree

Diff Age Max:
60
Second

Height Type:
Bottom

Antenna Height:
0
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.

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I Z33146861024727
[Advance UI] English

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Working Mode

Mode: Base Mode

Station Name: Z33146861024727

Elev Cutoff: 5 Degree

Station ID: 0

PDOP Threshold: 3.0

Diff Type: RTCM32

Base Mode: Auto

Height Type: Bottom

Antenna Height: 0 Meter

Record: Enable

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

I Z33146861024727
[Advance UI] English

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Working Mode

Mode: Static Mode

Station Name: Z33146861024727

Elev Cutoff: 5 Degree

PDOP Threshold: 3.0

Sample Interval: 1 s

Height Type: Bottom

Antenna Height: 0 Meter

Record: Enable

File Type: GNSS

② **Data link :** You can choose No Data link/ Bluetooth/ WIFI/ Built-in Network/ Built-in Radio/ PPP.

Data Link

Data Link: PPP

PPP Mode:

No Data Link
 Bluetooth
 Wifi
 Built-in Network
 Built-in Radio
PPP

Apply



1. **Bluetooth:** the device receives differential data from the tSurvey software via a Bluetooth connection to the handheld controller;
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.

2.7 Others Config

① **WIFI :** You can choose from three modes: Disable, AP, or Station. The WIFI name and password can be set manually. When using Station mode, the device connects to an external hotspot by entering its name and password.

② **Others :** Time Zone, Voice.

IZ34436861000154 [Advanced UI] English

Simple UI Others

WiFi

WIFI: AP

SSID: Z34436861000154

PSK: Empty or Length not less than 8

Others

Time Zone: UTC+08:00

Voice: ☒ Enable

Apply

2.8 File

File management allows batch deletion and download of data from each channel, as shown below:

IZ33146861024727 [Advance UI] English

Simple UI File

Root/

	Name	Size	Operation
☐	20230428/		Delete
☐	20230429/		Delete
☐	20230502/		Delete
☐	20230504/		Delete
☐	20230505/		Delete
☐	20230506/		Delete

Batch Delete



2.9 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.

I Z33146861024727

[Advance UI] English

Simple UI

Firmware

Status

Info

Skyplot

Data Stream

Command

Mode Config

Others Config

File

Firmware

Version	
System	2.11.2305.21
Linux Version	3.18.44 Fri Apr 14 15:26:12 CST 2023
GNSS	R4.10Build7676
INS	B2.2_A5.4_f525125fe42789f8a9232
Radio	R4.C029.00.00
Firmware	2.411.2305.1677

Local Upgrade

2.10 Log

It allows you to download the operation log of the device. When the device malfunctions during use, you can download the log generated at the corresponding time and send it to the supplier for troubleshooting. As shown below:

I Z33146861024727

[Simple UI] English

General

Log

Device Status

Device Info

Command

Marker Info

Local

Power

Scheme

Log

Firmware

GNSS Status

GNSS Config

Network

Storage

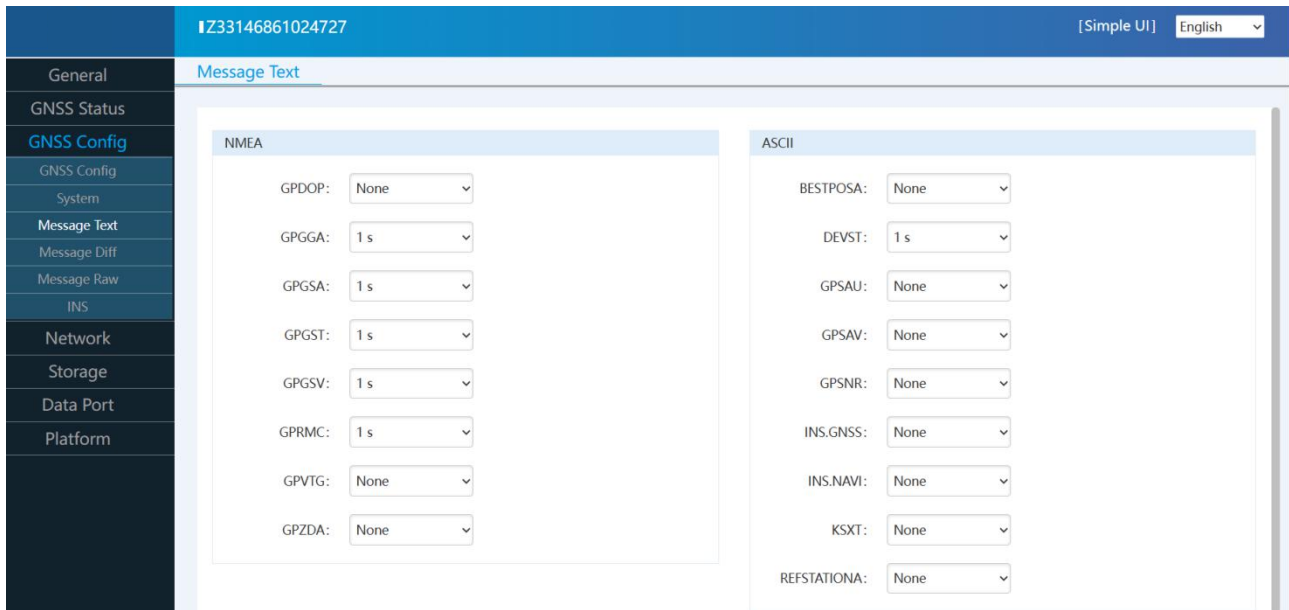
Data Port

Platform

File Name	Size	Time Modified	Operation
Z33146861024727-0033.zlog	97.38kB	2023-05-06 19:25:52	Download
Z33146861024727-0032.zlog	397.21kB	2023-05-06 16:50:56	Download
Z33146861024727-0031.zlog	194.60kB	2023-05-05 09:25:18	Download
Z33146861024727-0030.zlog	76.67kB	2023-05-04 21:22:35	Download
Z33146861024727-0029.zlog	617.66kB	2023-05-04 21:05:09	Download
Z33146861024727-0028.zlog	86.53kB	2023-05-02 16:15:41	Download
Z33146861024727-0027.zlog	89.78kB	2023-05-02 15:49:57	Download
Z33146861024727-0026.zlog	180.91kB	2023-04-30 03:36:46	Download
Z33146861024727-0025.zlog	74.61kB	2023-04-29 16:40:39	Download
Z33146861024727-0024.zlog	71.04kB	2023-04-29 16:01:42	Download
Z33146861024727-0023.zlog	85.90kB	2023-04-29 15:48:27	Download
Z33146861024727-0022.zlog	69.61kB	2023-04-29 14:05:50	Download
Z33146861024727-0021.zlog	110.31kB	2023-04-29 13:58:54	Download

2.11 Message Text

You can set the type and frequency of the output data in text format, as shown below. After configuration, you can check if the corresponding text data is being output in Section 3.4.



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>,<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.

2.12 Data Config

The device has 4G storage space (recyclable storage) and supports five channels (CH01/CH02/CH03/CH04/CH05) to save various files, as shown below. You can configure the data source, file duration, file name, and file format for each channel as needed.

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

I Z33146861024727
[Simple UI] English

General

GNSS Status

GNSS Config

Network

Storage

Status

Data Config

FTP Upload

File

Data Port

Platform

CH01
CH02
CH03
CH04
CH05

CH01
☒ Enable

Data:

Message Raw

Period:

Single File

Name:

SITE-CH-yyyyMMdd-hhmmss

Format:

*.gnss

Apply

Data:

Message Raw

None
GNSS COM2
Message Text
Message Diff
Message PPK
Message Static
INS Debug
Ntrip Client
XLink
Socket 1
Socket 2
Socket 3
Socket 4
Socket 5
WiFi Diff
Bluetooth Rx
Bluetooth Diff
Bluetooth Monitor
Built-in Radio

Period:

Single File

1 hour
2 hours
3 hours
4 hours
6 hours
8 hours
12 hours
24 hours

Name:

SITE-CH-yyyyMMdd-hhmmss

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
RINEX3.05
RINEX3.05 (.D)
RINEX3.05 (.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, the device will automatically configure the corresponding channel for data storage by default.

1. Rover (CH01)

When the device is set to rover mode, it will automatically configure CH01 to log the original observation data. If ppk is enabled, CH05 will also be automatically configured by default to store post positioning data, as shown below:

Z34436861000154

[Simple UI] English

General

GNSS Status

GNSS Config

Network

Storage

Status

Data Config

FTP Upload

File

Data Port

Platform

Storage Status

General

Flash: 8.000 GB
Capacity: 4.000 GB
Occupy: 1016.570 MB
Free: 3.007 GB
Occupy Rate: 24.82%
Write Speed: 13.29 kB/s

File List

	Channel	Data	Name	Size
1	CH01	Message Raw	Z3443686100015 ... 20-071912.gnss	73.11 kB
2	CH01	Message Raw	Z3443686100015 ... 912.gnss.index	160 B
3	CH05	Message PPK	Z3443686100015 ... 20-071912.gnss	73.11 kB
4	CH05	Message PPK	Z3443686100015 ... 912.gnss.index	160 B

2. Base (CH02)



When the device is set as the reference station, it 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 below:

General

GNSS Status

GNSS Config

Network

Storage

Status

Data Config

FTP Upload

File

Data Port

Platform

I Z33146861024727

[Simple UI] English

Storage Status

General

Capacity: 24.000000 GB
Occupy: 186.847 MB
Free: 23.817532 GB
Occupy Rate: 0.76%
Write Speed: 9.95 kB/s

File List

	Channel	Data	Name	Size
1	CH02	Message Raw	Z3314686102472 ... 08-060451.gnss	299.63 kB
2	CH05	Message PPK	Z3314686102472 ... 08-060115.gnss	1.365 MB

3. Static (CH03)

When the device is set to the static mode, the device will automatically configure CH03 to store static positioning data by default, as shown below:

General

GNSS Status

GNSS Config

Network

Storage

Status

Data Config

FTP Upload

File

Data Port

Platform

I Z33146861024727

[Simple UI] English

Storage Status

General

Capacity: 24.000000 GB
Occupy: 188.438 MB
Free: 23.815979 GB
Occupy Rate: 0.77%
Write Speed: 4.80 kB/s

File List

	Channel	Data	Name	Size
1	CH03	Message Static	Z3314686102472 ... 08-060825.gnss	63.63 kB

Note: Whenever the GEOVENT software connects to the device via Bluetooth, the device will automatically configure CH04 to log Bluetooth monitoring data. If there is any issue with the configuration of the Bluetooth-connected device, you can download the recorded monitoring data for troubleshooting.

I233146861024727
[Simple UI] English

- General
- GNSS Status
- GNSS Config
- Network
- Storage
- Status
- Data Config
- FTP Upload
- File
- Data Port
- Platform

Storage Status

General

Capacity: 24.000000 GB
 Occupy: 190.994 MB
 Free: 23.813482 GB
 Occupy Rate: 0.78%
 Write Speed: 514 B/s

File List

	Channel	Data	Name	Size
1	CH04	Bluetooth Monitor	Z3314686102472 ... 508-061320.txt	191.87 kB

2.13 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. Enable the mobile network and confirm that the mobile network is online;
3. Click [Use Default Value] to apply the configuration.

I233146861024727
[Simple UI] English

- General
- GNSS Status
- GNSS Config
- Network
- Storage
- Data Port
- Platform
- ZXVPN

ZXVPN

CH01
CH02
CH03

CH01 ☒ Enable

Host: [Use Default Value](#)

Port:

Network:

Username:

Password:

Apply

State

State: Online

IP Address: 10.1.4.146

3 GEOVENT Basic Operations

3.1 Software Installation and Uninstallation

Installation process:

1. Download the Android GEOVENT program (*.apk);
2. Copy the GEOVENT program to your mobile phone (controller);
3. Locate the program in the controller's file manager and install it;
4. Click on the GEOVENT software on the desktop (you need to create a project for the first time, and the last project used will be automatically opened each time the software is started).

Uninstallation process:

Uninstall method: Long press the software icon on the desktop, drag to the [Uninstall] option box, and click " OK " to complete the software uninstallation.

3.2 Project Manager

Click [**Project**] -> [**Project Manager**], as shown in Figure 3.2-1. The project manager includes functions such as creating a new project, importing a project, exporting a project, deleting a project, and opening a project.

Click [**Project Path**] to modify the path of the project on disk. The default path is in the internal storage -> GEOVENT -> Project directory.

Click [**Details**], as shown in Figure 3.2-2, to modify the basic properties of the project, such as Basic Information, Coordinate system parameter, and Code Library.

Click [**New**], as shown in Figure 3.2-3. To create a new project, you need to fill in the basic properties such as project name, whether to apply the project, and select the coding template. Click [**OK**] and fill in the coordinate system parameters used to modify the project, as shown in Figure 3.2-4. Click [**OK**] to complete the creation of the project.

Click on other items in the list, and the open function will appear, as shown in Figure 3.2-5. Long press on an item in the list, and the delete function will appear, as shown in Figure 3.2-6 (**Note:** you cannot delete a project that is in use).

← Project Manager

Project Path Internal Storage/ GEOVENT/Project >

Input project name keyword

Sort by date Sort by Name

20250603
2025-06-03 11:08:55
97.47 kB

test
2025-06-03 10:50:21
95.82 kB

New Import Export Details

Figure 3.2-1

← Project Details

Basic Information

Project Name 20250603

remarks

Free space 98.19 GB

Date Created 2025-06-03 11:08:55

Job path /storage/emulated/0/ GEOVENT/Project

Coordinate system parameter

Apply Project

Job test

Code Library

Template ** NONE **

Cancel OK

Figure 3.2-2

← Create Project

Basic Information

Project Name test

remarks

Free space 98.19 GB

Coordinate system parameter

Apply Project

Job (Last Project)20250603

Code Library

Template ** NONE **

Cancel OK

Figure 3.2-3

← Coordinate system parameter

Type Local parameters

Coordinate System CGCS2000

Ellipsoid Parameter

Ellipsoid Name: CGCS2000

Semimajor axis: 6378137.0

1/f: 298.257222101

Projections Parameter

Projections Mode: Gauss Kruger

Projection band: 3 band

Central Meridian: E0°00'00"

False Northing: 0

False Easting: 500000

Scale Factor: 1

Projection Height: 0

Latitude of Origin: N0°00'00"

Seven-Parameter

Four-Parameter/Horizontal Adjustment

Vertical Control Parameter

Vertical Adjustment Parameter

Export Use existing Share OK

Figure 3.2-4

← Project Manager

Project Path Internal Storage/ GEOVENT/Project >

Input project name keyword

Sort by date Sort by Name

test2
2025-06-03 11:21:26
97.80 kB

20250603
2025-06-03 11:08:55
97.47 kB

New Import Export Open

Figure 3.2-5

← Project Manager

Project Path Internal Storage/ GEOVENT/Project >

Input project name keyword

Sort by date Sort by Name

test2
2025-06-03 11:21:26
97.80 kB

20250603
2025-06-03 11:08:55
97.47 kB

Cancel Share Delete

Figure 3.2-6

3.3 Communication

Click [**Device**]-> [**Communication**] to enter the communication settings interface, as shown in Figure 3.3-1. Select the device type (RTK), communication mode (Bluetooth), then click [Search], as shown in Figure 3.3-2. View the Bluetooth device list, select the corresponding device serial number, and click [Connect] to complete the device connection, as shown in Figure 3.3-3. After the device is successfully connected, it will directly return to the device interface, as shown in Figure 3.3-4. Enter the communication settings again, as shown in Figure 3.3-5, and click [Stop] to disconnect the device. Click [Debug] to view the data of the software and device communication, as shown in Figure 3.3-6.

1. Communication mode includes Bluetooth, serial port, TCP client port, etc.;
2. Click [Search] and select the device you want to connect according to the device serial number;
3. After the device is successfully connected, click [Debug] to view the data of communication between the software and the device. You can also send debugging commands to the device to troubleshoot and analyze issues related to device positioning.

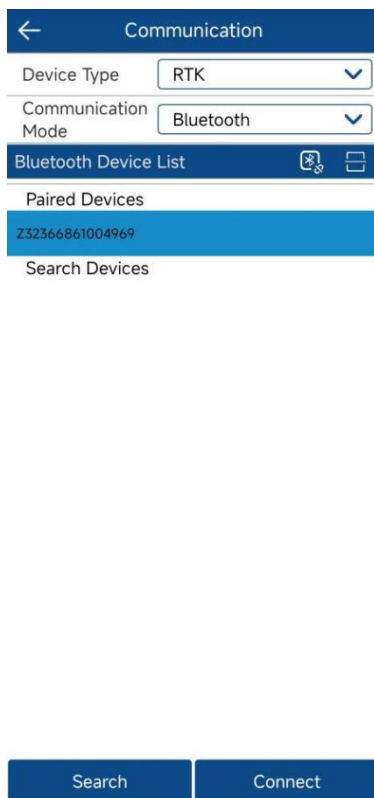


Figure 3.3-1

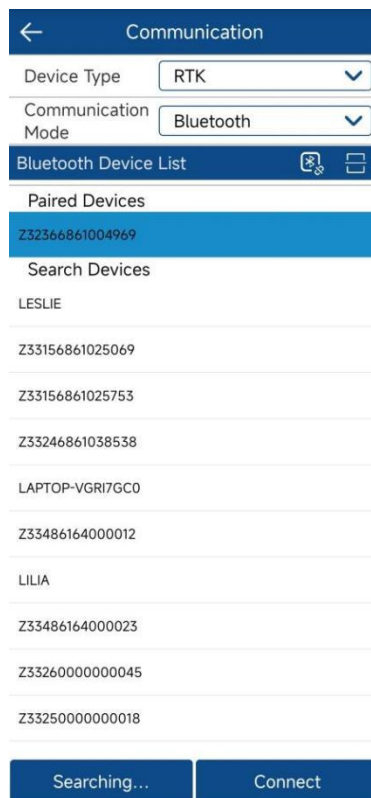


Figure 3.3-2

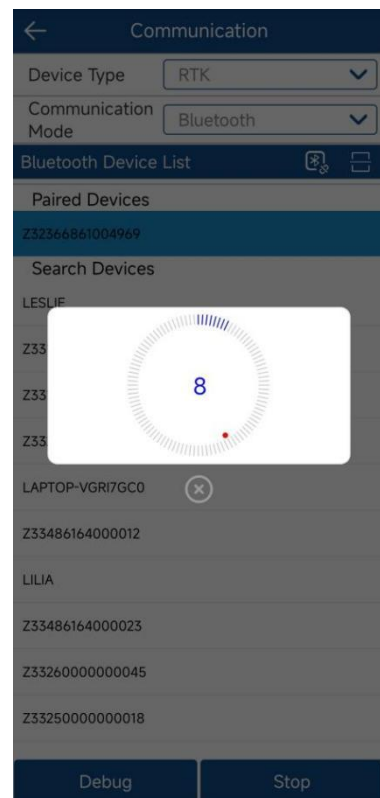


Figure 3.3-3

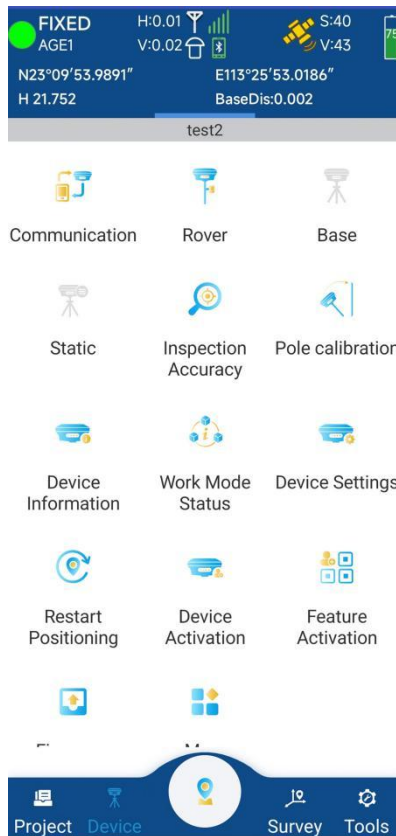


Figure 3.3-4

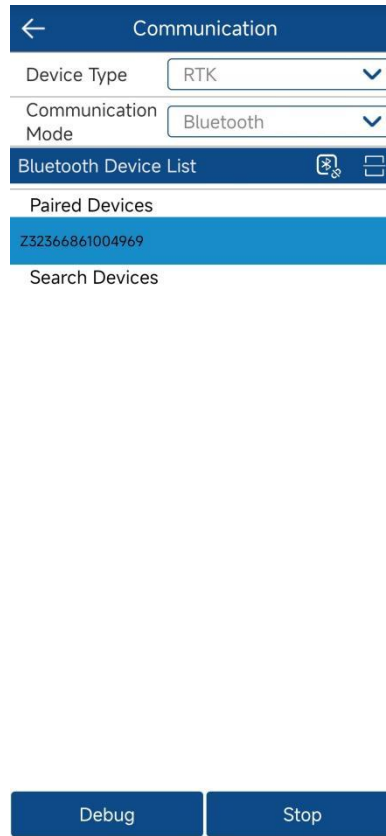


Figure 3.3-5



Figure 3.3-6

3.4 Rover Mode Setting

Click [**Device**] -> [**Rover**], as shown in Figure 3.4-1. GNSS positioning equipment can calculate positioning coordinates by receiving satellite signals. In the absence of other interferences, the positioning equipment can only obtain the coordinate position of a single point solution due to the interferences of the atmosphere on the signal, and the accuracy is low. In order to ensure that GNSS devices can obtain high-precision positions, in addition to the GNSS device itself receiving satellite signals to calculate the position, it is also necessary to receive the signal of another nearby fixed-position GNSS device, and use the signal of the other device as the reference signal. Since atmospheric effects are nearly uniform within a certain area, knowing the position of the reference station allows the GNSS system to calculate high-precision coordinates. The GNSS device at a fixed position is called the base, while the mobile device is called the rover. The data transmitted from the base to the rover is called differential data, and the transmission method is referred to as the data link. The rover mode setting is to set the GNSS as a rover, configure certain parameters to transmit the GNSS satellite signal of the base station to the GNSS device in a certain way, so that the GNSS device can obtain a high-precision positioning. In addition to differential data transmission configuration, you can also set the GNSS altitude cutoff angle, differential delay, and whether to enable PPK and other basic information, as shown in Figure 3.4-1. Set the altitude angle to not receive the satellite signal when it is lower than a certain value. In the case of poor satellite

signals at low angles, it is beneficial to precision calculation. The PPK setting records raw GNSS observation data in the receiver for post-processing to compute high-precision coordinates.

The differential data parameter setting is mainly to set a way to transmit the differential data of the base station to the current device, so as to provide the necessary solution conditions for the device to solve high-precision coordinates. The data link methods mainly include Phone Internet, Device Internet, Internal Radio and other methods.

1. **Phone Internet:** As shown in Figure 3.4-1, it refers to obtaining differential data from the specified server address through the network of the device where the software is located according to a certain protocol, and then sending it to the device through the communication connection between the software and the GNSS device for high-precision solution. Click on the right side of CORS settings  to enter the CORS server management interface, as shown in Figure 3.4-2. You can directly select, edit, and delete existing CORS servers, or manually add CORS server parameters, as shown in Figure 3.4-3. After correctly configuring the server address, obtain the access point list, as shown in Figure 3.4-4, and select the corresponding access point to obtain differential data. Click [Start], if the configuration is correct, the data reception progress bar will move. If there is no data in the progress bar, you need to confirm whether the parameter configuration is correct.

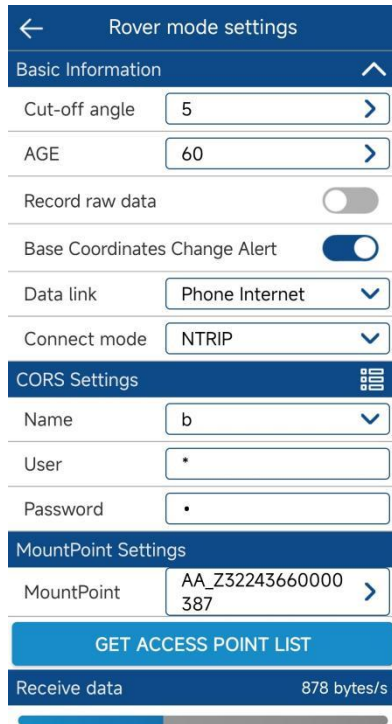
2. **Device Internet:** As shown in Figure 3.4-5, it refers to obtaining differential data from a specified server address through the SIM card network of the GNSS device according to a certain protocol for high-precision solution. The connection mode is the transmission protocol of differential data, usually by NRTIP, TCP client, etc., enter the server IP, port, username and password and other connection parameters. The SIM network is a dedicated network and needs to configure APN parameters, as shown in Figure 3.4-6. The CORS setting is similar to the Phone Internet. After correctly configuring the server address, obtain the access point list and select the corresponding access point to obtain differential data. In addition to obtaining access points through the Device Internet, it can also be obtained through the network corresponding to the mobile phone if there is a mobile phone with a network.

3. **Internal Radio:** As shown in Figure 3.4-7, it means receiving the differential data of the radio station according to a certain protocol and frequency through the internal radio of the GNSS device, and performing high-precision calculation. At this time, it is necessary to ensure that the protocol and frequency of the built-in radio station are consistent with the protocol and frequency of the transmitting radio station, so that the radio station data can be received normally. If the frequency corresponding to the channel is inconsistent with the channel frequency of the transmitting radio station, you can click [Set Radio Frequency] to modify the frequency corresponding to each channel of the radio station, as shown in Figure 3.4-8.

4. **XLINK:** As shown in Figure 3.4-9, it is a differential forwarding system built based on the CORS network of Qianxun/Liufen/China Mobile. After configuring the Xlink data link, the host can access the differential normally if it can access the Internet, without the need for the customer to manually fill in the CORS account.



Note: Each data link has the base station coordinate change prompt turned on by default, because if the wrong base station signal is received, the coordinates may be inaccurate, reminding the user to check and confirm.



Rover mode settings

Basic Information

Cut-off angle: 5

AGE: 60

Record raw data: ☐

Base Coordinates Change Alert: ☒

Data link: Phone Internet

Connect mode: NTRIP

CORS Settings

Name: b

User: *

Password: *

MountPoint Settings

MountPoint: AA_Z32243660000387

GET ACCESS POINT LIST

Receive data: 878 bytes/s



START ADVANCED APPLY

Figure 3.4-1



CORS server manager

1	b
IP	120.77.83.81
Port	6060
User Name	*
Password	*****



Add Edit Delete OK

Figure 3.4-2



Server Address

Name:

IP:

Port:

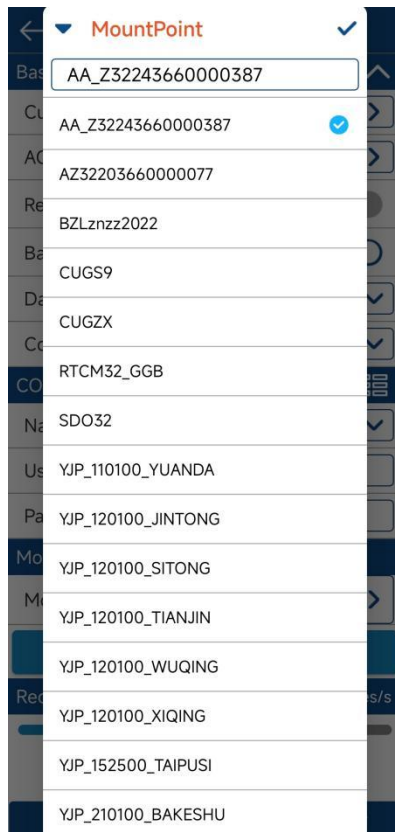
User:

Password:



Cancel OK

Figure 3.4-3



MountPoint

AA_Z32243660000387

AA_Z32243660000387

AZ32203660000077

BZLznzz2022

CUGS9

CUGZX

RTCM32_GGB

SDO32

YJP_110100_YUANDA

YJP_120100_JINTONG

YJP_120100_SITONG

YJP_120100_TIANJIN

YJP_120100_WUQING

YJP_120100_XIQING

YJP_152500_TAIPIUSI

YJP_210100_BAKESHU



Rover mode settings

Basic Information

Cut-off angle: 5

AGE: 60

Record raw data: ☐

Base Coordinates Change Alert: ☒

Data link: Device Internet

APN Settings

Operator: Auto

Connect Options

Connect mode: NTRIP

CORS Settings

Name: b

User: *

Password: *

MountPoint Settings

MountPoint: RTCM32

Phone internet access: ☐

GET MOUNTPOINT (DEVICE INTERNET)

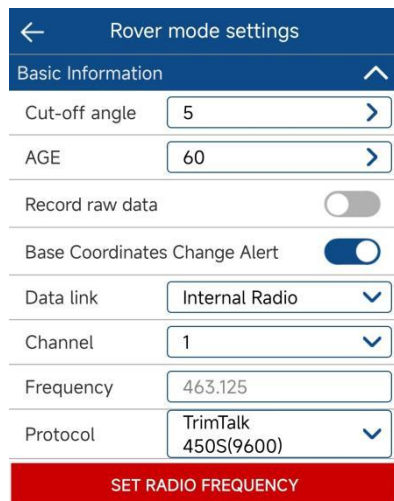
ADVANCED APPLY



Operator Manager

Add Edit Delete OK

Figure 3.4-4



← Rover mode settings

Basic Information ^

Cut-off angle 5 >

AGE 60 >

Record raw data ☐

Base Coordinates Change Alert ☒

Data link Internal Radio v

Channel 1 v

Frequency 463.125

Protocol TrimTalk 450S(9600) v

SET RADIO FREQUENCY

ADVANCED APPLY

Figure 3.4-5



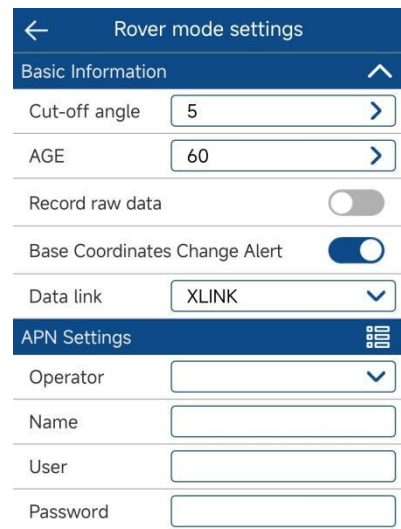
← Set Radio Frequency

Channel1	463.125
Channel2	464.125
Channel3	465.125
Channel4	466.125
Channel5	463.625
Channel6	464.625
Channel7	465.625
Channel8	466.625
Channel9	463.375
Channel10	464.375
Channel11	465.375
Channel12	466.375
Channel13	463.875
Channel14	464.875
Channel15	465.875

Fre Start Interval Calculate

Read Settings Default Clear Close

Figure 3.4-6



← Rover mode settings

Basic Information ^

Cut-off angle 5 >

AGE 60 >

Record raw data ☐

Base Coordinates Change Alert ☒

Data link XLINK v

APN Settings 

Operator v

Name

User

Password

ADVANCED APPLY

Figure 3.4-7

Figure 3.4-8

Figure 3.4-9

3.5 Base Mode Setting

Click [**Device**]-> [**Base**], as shown in Figure 3.5-1. This function allows the GNSS device to act as a base, broadcasting satellite data to the rover to support high-precision positioning. The host needs to set the startup condition parameters, startup mode and data broadcast parameters as a base.

Note: The base station must remain stationary during startup; otherwise, the rover's calculated coordinates may be inaccurate.

The start-up conditions include Base ID, Diff Mode, cut-off angle, PDOP limit and other parameters. Click [Advanced], as shown in Figure 3.5-2, to configure cut-off angle, PDOP limit and other parameters. The differential data format includes CMR, RTD, RTCM23, RTCM30, RTCM32, RTCM33 and other commonly used differential data encoding formats.

The startup mode includes using Current coordinates, inputting Base coordinates, etc., among which:

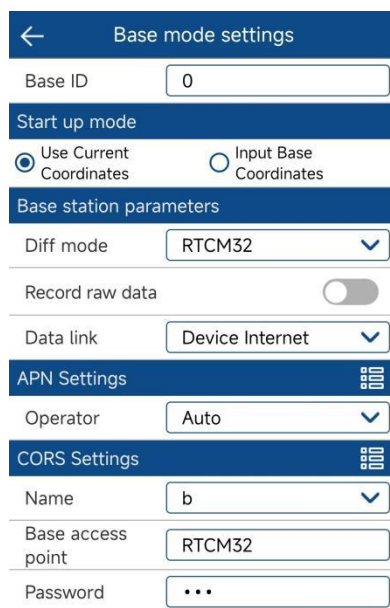
1. **Use Current coordinates:** The GNSS device uses its current (low-accuracy) position as the base station coordinate to output differential data;
2. **Input Base Coordinates:** refers to the location where the user sets up the equipment. The user knows the coordinates of this location in advance and uses this coordinate value as the starting coordinate to output



differential broadcast data. Click [Specify Base Station Coordinates] to enter the interface for setting base station coordinates, as shown in Figure 3.5-3. You can click  the measurement icon to measure a point in real time, or click  to select a coordinate value from the coordinate point library.

The data broadcast parameters are mainly the differential data output by the device after starting the base station, which is transmitted through a certain method and received and used by the rover. The main methods include device Internet, built-in radio, external radio, etc. The parameter settings are similar to those of the rover, with the following differences:

1. The internal radio has a transmission power. The higher the transmission power, the longer the effective distance, and the greater the power consumption;
2. For the Device Internet NTRIP protocol, the base station acts as the access point for broadcasting data, as shown in Figure 3.5-1. The rover retrieves the access point list and connects to the corresponding base;
3. The base station uses an external radio to broadcast differential data, as shown in Figure 3.5-4. The baud rate must be consistent with the connected external radio;
4. For CORS settings, refer to the rover data link for corresponding configuration.



Base mode settings

Base ID: 0

Start up mode

☒ Use Current Coordinates ☐ Input Base Coordinates

Base station parameters

Diff mode: RTCM32

Record raw data: ☐

Data link: Device Internet

APN Settings

Operator: Auto

CORS Settings

Name: b

Base access point: RTCM32

Password: ...

ADVANCED APPLY

Figure 3.5- 1



Satellites System

Cut-off angle: 5

PDOP limit: 3.0

GPS: ☒

GLONASS: ☒

BEIDOU: ☒

GALILEO: ☒

SBAS: ☒

QZSS: ☒

IRNSS: ☐

Cancel OK

Figure 3.5-2

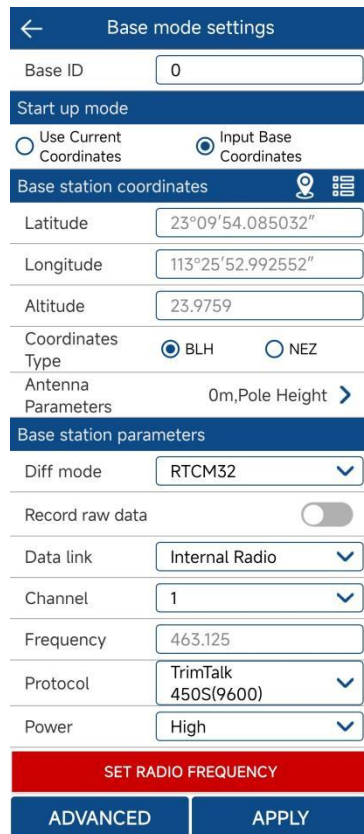


Figure 3.5-3

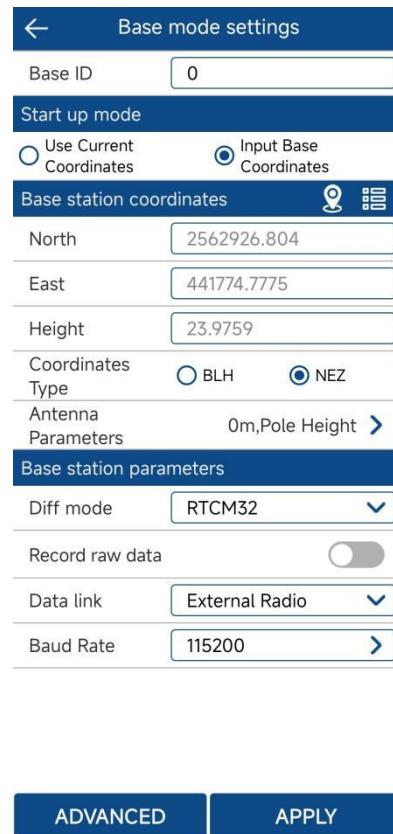


Figure 3.5-4

3.6 Static Mode Setting

Click [**Device**]-> [**Static Mode**], as shown in Figure 3.6-1. This function stores the original satellite observation data from the GNSS device into a designated disk file for use by static post-processing software to calculate high-precision coordinates. It is typically used for control point acquisition. To start static mode, you need to configure parameters such as the point name, PDOP limit, cut-off angle, collection interval, antenna settings, file format, and other recording conditions, as shown in Figure 3.6-2.

Click [**Start**] to start static collection, as shown in Figure 3.6- 3, and click [Stop] to end static collection. The status will display information such as Record Status, Start Time, Epoch number, and Record file.

Note: The device must remain stationary during static recording; otherwise, errors may occur in the post-processed coordinates.



Figure 3.6-1

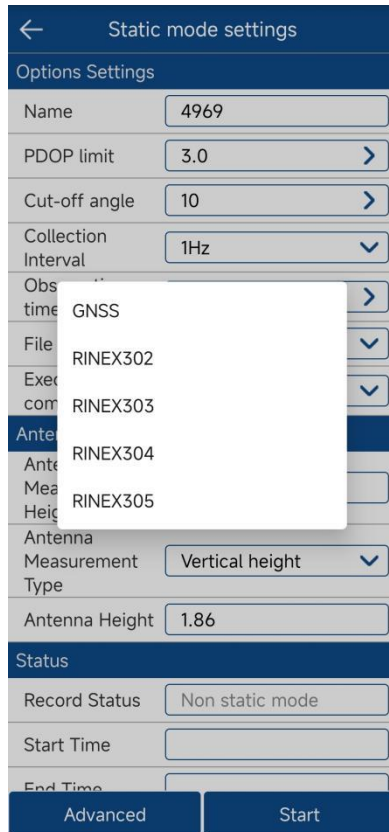


Figure 3.6-2

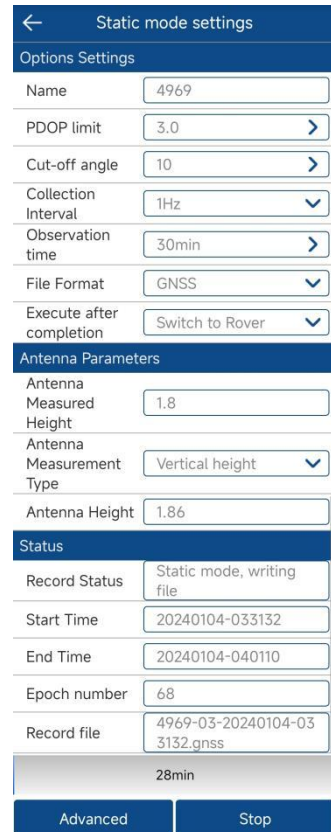


Figure 3.6-3

3.7 Point Survey

Click [**Survey**] -> [**Point Survey**], as shown in Figure 3.7-1. The positioning output by the GNSS device is measured and collected according to certain accuracy constraints and stored in the coordinate point library. In the point survey interface, the top title bar displays the basic information of the positioning output by the current GNSS device, the current solution status, differential delay, HRMS, VRMS and other positioning accuracy assessment values, and the number of received satellites. Below the title bar is the status bar that displays other important information. The display content can be configured according to the user's needs. In point survey, the northing, easting, elevation coordinates and the base station distance are displayed by default. The central area displays the measurement data graph, and the network map can also be enabled.

The icon  in the upper left corner of the drawing area indicates the direction of the map, which is convenient for users to determine the direction when needed. The lower left corner of the drawing area shows the scale of the drawing. Click the icon  or  on the right to enlarge or reduce the scale of the drawing. Below the drawing area is the display of function collection. These function menus can also be displayed here according to the needs of the user in the settings to quickly operate certain functions.



The icon  in the lower right corner of the drawing area is the button to trigger the survey collection function. This button can be moved according to the user's usage habits and placed in a more convenient place for operation. Click the button to start the survey function, as shown in Figure 3.7-2. You can enter the point name and code. Click the icon  to select the preset code in the code library to quickly fill in the attributes of the feature. If there are many codes in the code library, the codes with higher frequency of use will be displayed in the front to facilitate users to quickly select.

Below the drawing area are the measurement type selection, coordinate point library entry, antenna height setting, and tool menu.

Click [**Topo Point**], as shown in Figure 3.7-3. Four types of point will pop up: Topo Point, Control Point, Quick Point, and Auto Point. You can select the corresponding point type for surveying according to actual needs.

Click [**Point Library**] to enter the coordinate point library interface, as shown in Figure 3.7-4, where you can view the surveying point status.



Click the icon  to modify and edit the antenna height information, as shown in Figure 3.7-5. The antenna height setting is to subtract the antenna height from the phase center coordinates of the GNSS to get the actual position of the measured target on the ground. If the antenna information is incorrect, click the antenna information to select the correct antenna type in the antenna management (used when the GNSS device does not output antenna information or uses an external antenna).

Click [**Tools**], as shown in Figure 3.7-6, and you can quickly operate certain functions in the menu as needed, or you can add and delete functions in the toolbar according to user needs in the settings.



Click the icon  to enter the surveying setting interface, as shown in Figure 3.7-7. Set the measurement collection restriction conditions here, such as the solution limit, HRMS Limit, VRMS Limit, PDOP Limit, AGE Limit, etc. Users set the LIMIT conditions according to the accuracy requirements of the operation. Setting the number of smoothing points is to collect multiple positioning points and calculate the average value to indicate the accuracy. In addition, you can also set the default point name and default code, etc. The information bar is to set the display content of the status information bar. Users can set the display according to the information they focus on, as shown in Figure 3.7-8. The toolbar is for users to set common functions according to their needs during the operation, so that users can quickly and conveniently call certain functions, as shown in Figure 3.7-9. These functions include: Auto JUMP, Switch Map, ROSE mode, Take screen point, CAD text, coordinates converter, Perimeter and area, CAD background color, etc. Click the menu icon on the toolbar to trigger the corresponding function.

Click the icon  to automatically center the current position on the screen. Click the icon  to display all current measurement points on the screen.

Click the icon , as shown in Figure 3.7-10, to turn on/off the tilt measurement function.

Click the icon , as shown in Figure 3.7-11 and Figure 3.7-12, to select the network map you want to display.

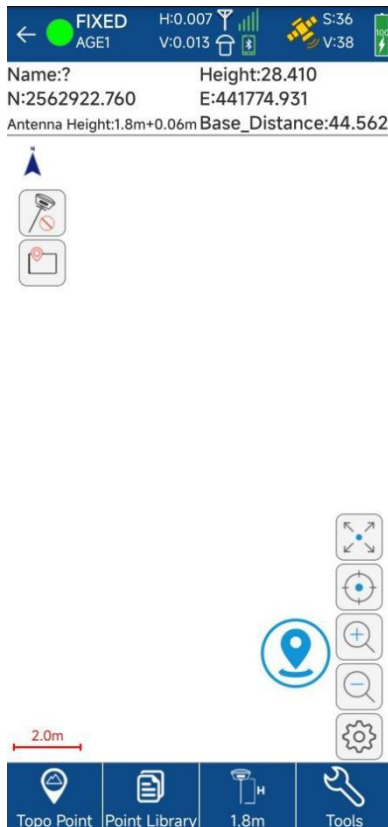


Figure 3.7-1

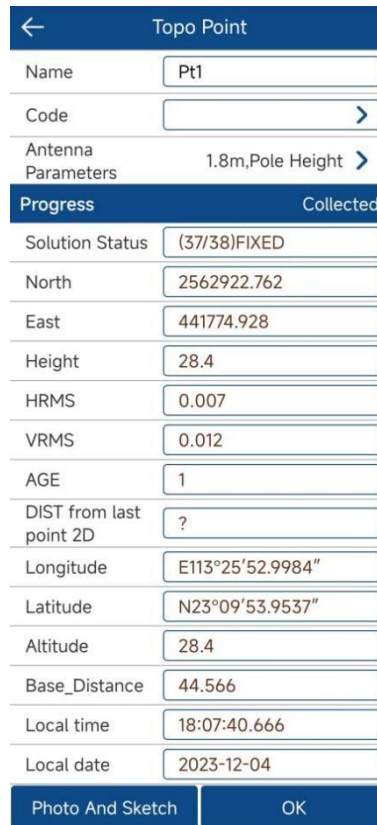


Figure 3.7-2

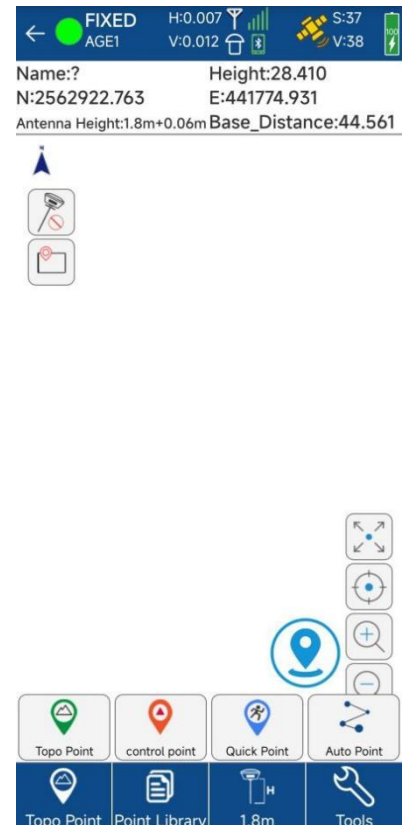


Figure 3.7-3

Points Database

Point Library Stakeout point

Input name or code

Name	North	East	Height	
PPK p3	2562922.759	441774.925	28.601	N2
p2	2562922.766	441774.932	30.185	N2
p1	2562921.958	441775.532	26.112	N2
t9	2563061.444	441676.895	18.892	N2
t8	2563064.214	441632.112	18.656	N2
t7	2563148.178	441558.261	19.432	N2
t6	2563154.803	441670.117	19.385	N2
t5	2563103.008	441789.162	19.354	N2
t4	2563014.288	441794.819	18.121	N2
t3	2562917.758	441787.826	17.334	N2
t2	2562936.491	441707.220	16.931	N2
t1	2562960.967	441716.320	17.074	N2

IMPORT EXPORT ADD

Figure 3.7-4

Antenna Parameters

Antenna Measured Height(m) 1.8

Antenna Measurement Type Pole Height

Antenna Height 1.86

Antenna Parameters

Antenna Type ZX-M68-K4T4

R(mm) 130 H(mm) 0

HL1(mm) 60.1 HL2(mm) 57.1

Antenna Sketch Map

Figure 3.7-5

FIXED AGE1 H:0.006 V:0.012 S:37 V:38

Name:p3 Height:28.395

N:2562922.764 E:441774.931

Antenna Height:1.8m+0.06m Base_Distance:44.57

Auto jump map Switch map Rose Mode Compass

Topo Point Point Library 1.8m Tools

Figure 3.7-6

Display Information

Topo Point Information bar Toolbars

Solution Limit FIXED

HRMS Limit 0.050

VRMS Limit 0.100

PDOP limit 3.000

AGE Limit 5

Allow same point name

Point Name Increment 1

Default Code same as last point

Average GPS Count 1

DEFAULT DELETE OK

Figure 3.7-7

Display Information

Topo Point Information bar Toolbars

Name:p3 Height:28.398

N:2562922.767 E:441774.930

Antenna Height:1.8m+0.06m Base_Distance:44.567

Code + Longitude +

Latitude + Altitude +

Forward azi... + Speed +

Time + Point dist. +

Pt. H dist. + Pt. Elevatio... +

Pt. slope(%) + σN +

σE + PDOP +

HDOP + VDOP +

Record Mode + Incline Angle +

Projection A... + Real radius +

DEFAULT DELETE OK

Figure 3.7-8

Display Information

Topo Point Information bar Toolbars

AUTO JUMP SWITCH MAP ROSE MODE COMPASS

Object View +

Automatic scaling +

Take screen point +

CAD Text +

Screen measurement +

Coordinates Converter +

Perimeter and Area +

Static and collect points +

Restart Positioning +

Coordinate inverse calculation +

Point line calculation +

DEFAULT DELETE OK

Figure 3.7-9

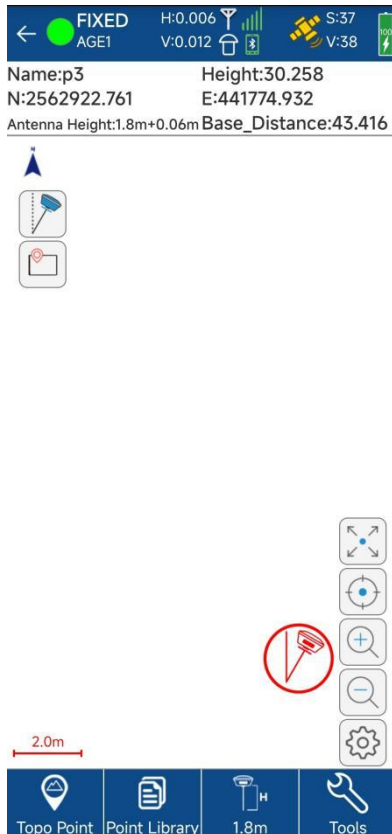


Figure 3.7-10



Figure 3.7-11

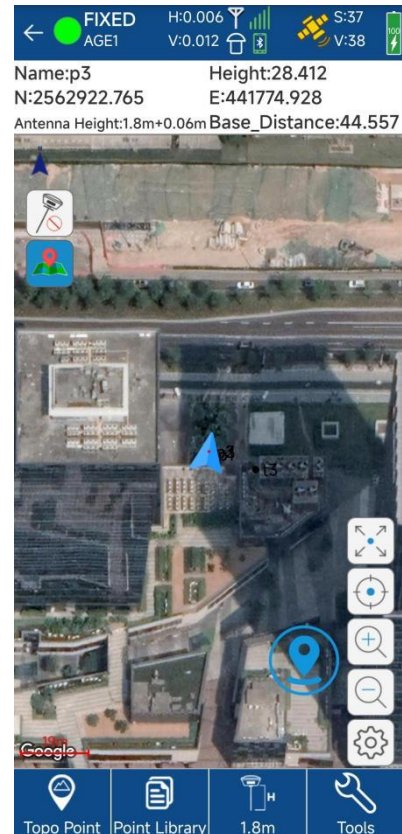


Figure 3.7-12

3.8 Tilt Survey

The tilt survey function requires the instrument to have a tilt module. Instruments with this function can do the following:

1. The instrument can maintain an accuracy within 2 cm at a tilt angle of up to 60°;
2. The calibration process is simple, just shake the centering pole back and forth in place;
3. The system supports centering pole calibration, which can eliminate surveying errors caused by pole curvature.

Click [**Survey**]-> [**Point Survey**] to enter the point Survey page, click the tilt survey icon in the upper left corner



to turn on the tilt survey function. When turned on, the icon is . Then follow the pop-up prompts, as shown in Figure 3.8-1, and enter the antenna height parameters (centering pole height) according to the actual situation.

At this time, the instrument needs to be in a fixed state. Refer to the pop-up animation, as shown in Figure 3.8-2, shake the centering pole back and forth for 5 to 10 seconds, then rotate 90° , and continue to shake the

centering rod back and forth until the measurement icon changes to  , as shown in Figure 3.8-3 , and then you can perform tilt survey.

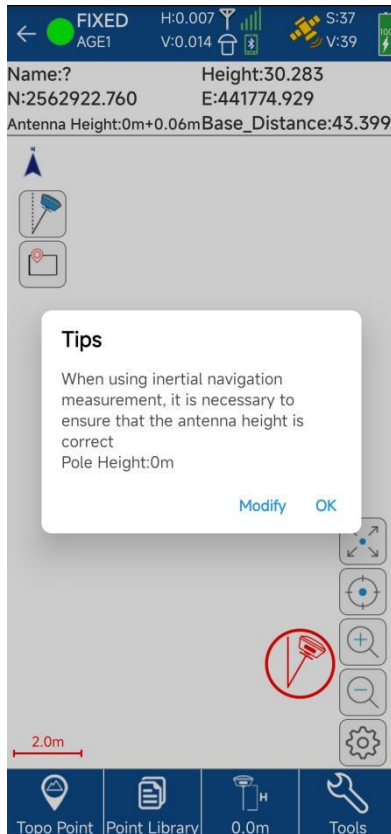


Figure 3.8-1

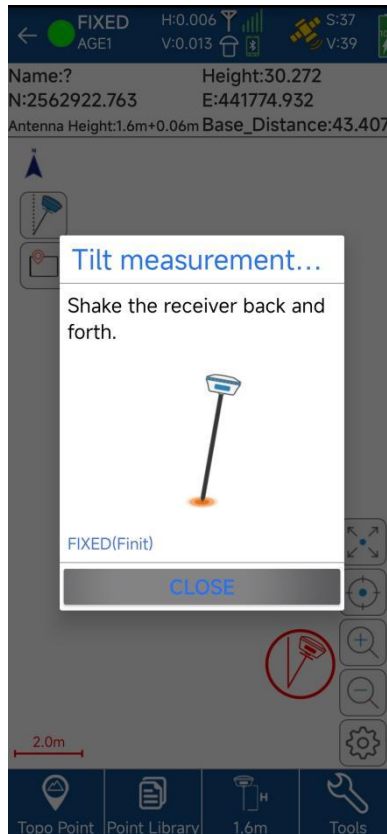


Figure 3.8-2

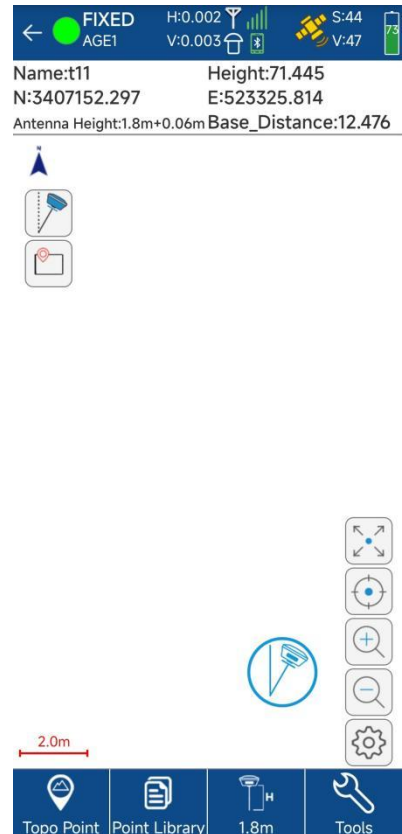


Figure 3.8-3

3.9 Laser Survey (communication mode needs to select WIFI)

Laser Survey requires connecting to a device with laser. It is a more convenient method for point surveying. It can measure wherever the laser can illuminate, and can overcome obstacles, saving time and effort. When connected to an instrument equipped with a laser function, a laser measurement icon will appear on the measurement interface. When the laser measurement interface is turned on, the instrument will emit a green laser. The coordinates of the place where the laser illuminates can be measured.

1. Click [**Device**]->[**Communication**] to enter the communication settings interface, as shown in Figure 3.9-1. Select the Device Type (RTK), communication mode (WIFI), and then click [Search], as shown in Figure 3.9-2. View the WIFI device list, select the corresponding device serial number (default device number), and click [Connect] to complete the device connection, as shown in Figure 3.9-3. After the device is successfully connected, it will directly return to the device interface.

2. Configure the rover to achieve a fixed solution state. Please refer to Section 3.4.

Note: When using Phone Internet, the controller needs to have a SIM card inserted to connect to the Internet.

3. Click [**Survey**] -> [**Laser Survey**] to enter the laser measurement interface, as shown in Figure 3.9-4. Follow the pop-up prompts and enter the antenna height parameters (pole height) according to the actual situation. At

this time, the device needs to be in a fixed state, as shown in Figure 3.9-5. Click  the icon and refer to the



pop-up animation, as shown in Figure 3.9-6, shake the centering pole back and forth for 5~10s, then rotate 90°,

and continue to shake the centering pole back and forth until the measurement icon changes to , as shown in Figure 3.9-7.

Click  the icon to complete the laser measurement data collection. In this interface, write the laser measurement point name and code, and you can see the laser measurement distance and measurement accuracy.

Click  the icon in the lower right corner to enlarge the image displayed on the interface, as shown in Figure

3.9-8. Click  the icon in the lower right corner to reduce the image displayed on the interface.

Click  the icon in the upper left corner to enter the point library to check the laser points, as shown in Figure 3.9-9.

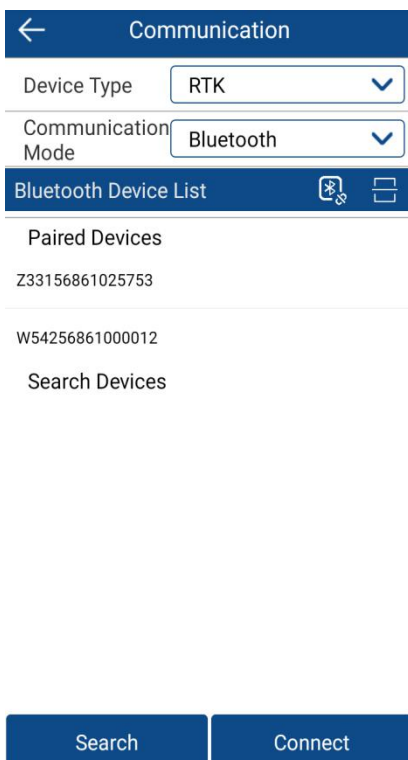


Figure 3.9-1

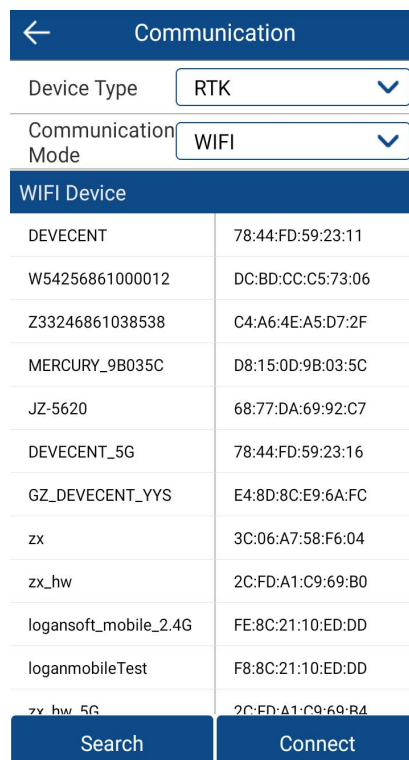


Figure 3.9-2

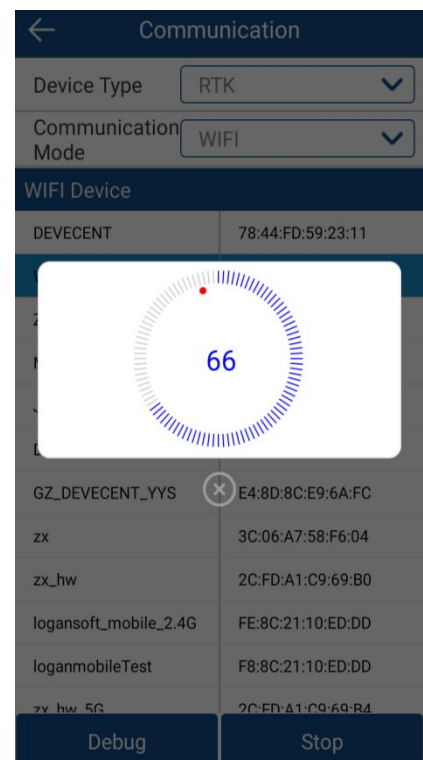


Figure 3.9-3

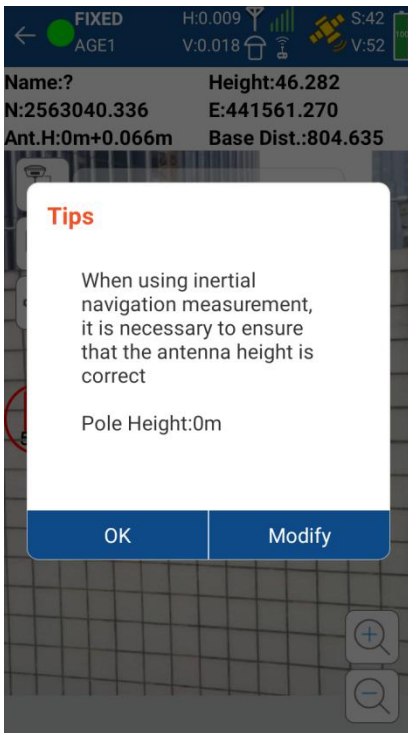


Figure 3.9-4



Figure 3.9-5

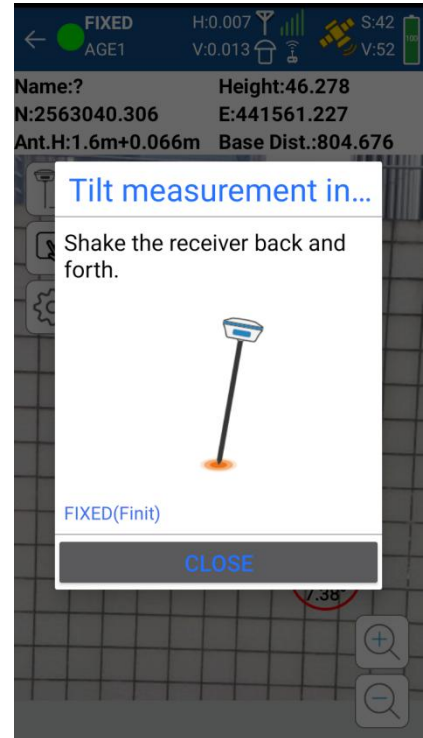


Figure 3.9-6



Figure 3.9-7

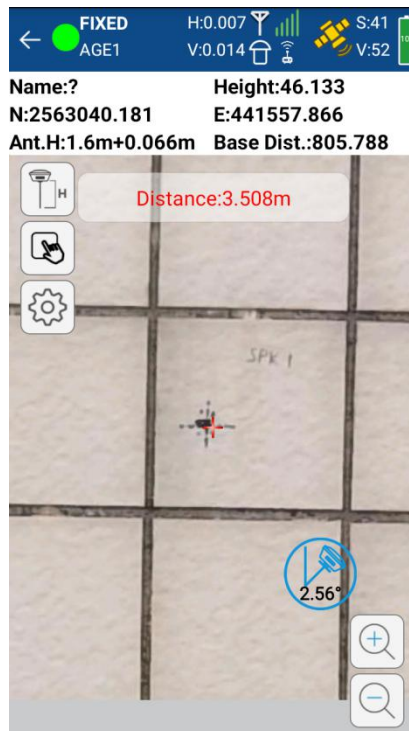


Figure 3.9-8

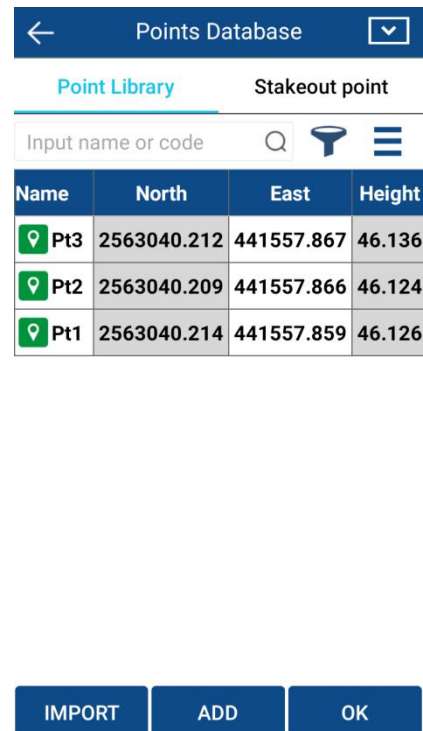


Figure 3.9-9

3.10 Point Stakeout

Click [**Survey**]-> [**Point Stakeout**] to enter the point stakeout library interface, as shown in Figure 3.10-1. Point stakeout means finding the location of a point through coordinate points at the field site when the coordinates

of the point are known. Points that have not been staked out and those staked out will be displayed. Click the stakeout point to edit, view details, stake out, or delete the stakeout point, as shown in Figure 3.10-2. The points to be staked out are part of the coordinate point library. The operations of adding, removing, importing, and exporting stakeout points are the same as those in the coordinate point library. Removing points from the points to be staked out does not actually delete points in the point library. You can also select points from the coordinate points (all points in the coordinate point library) for stakeout. After selecting points for stakeout, enter the point stakeout interface, as shown in Figure 3.10-3.



Click the icon  to enter the layout setting interface, as shown in Figure 3.10-4, where you can set the prompt range, layout tolerance, etc. You can also set the reference direction to east, south, west, north, front, back, left, right, and enable voice broadcast.

The layout of the point stakeout interface is similar to that of point measurement, but there are some differences. The fill and cut values of the southeast, northwest deviation values from the target are displayed in the status information bar. The compass is together with the current positioning. In addition to the measurement type, coordinate point library, antenna height and tools, there are also functions such as stake out the nearest point, stake out the previous point, and stake out the next point at the bottom of the drawing area.

Click [Nearest Point], as shown in Figure 3.10-5, to stake out the nearest point.



Click the icon , as shown in Figure 3.10-6, to manually add stakeout points at any time.

How to reach the destination more efficiently?

If the user has a good sense of direction, they can distinguish between east, south, west, and north during real-time field work. In the layout compass display, they can directly see the alignment between the current and target positions and simply walk in the indicated direction. As shown in Figure 3.10-3, you can find the target point Pt1 by walking in the southwest.

What if the user has a poor sense of direction and cannot distinguish between east, south, west and north? You can look at the small arrow of the current location. The direction of this small arrow is the direction of the tablet when it is placed flat. As shown in Figure 3.10-3, the current tablet is pointing to the south. You can turn the tablet to point to the same direction. When the tablet's direction coincides with the current point and the target point, it means that the tablet's direction is consistent with the target point. At this time, follow the tablet's direction and move forward.



Figure 3.10-1

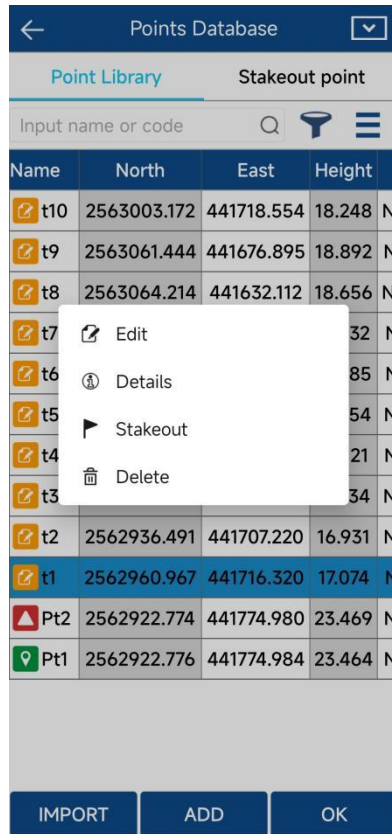


Figure 3.10-2

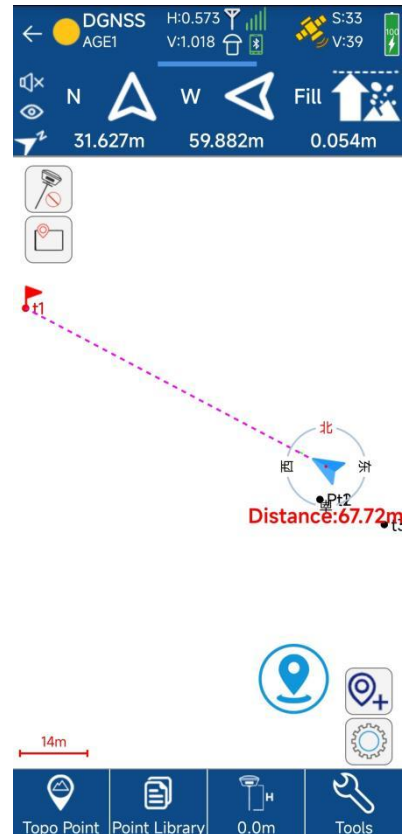


Figure 3.10-3

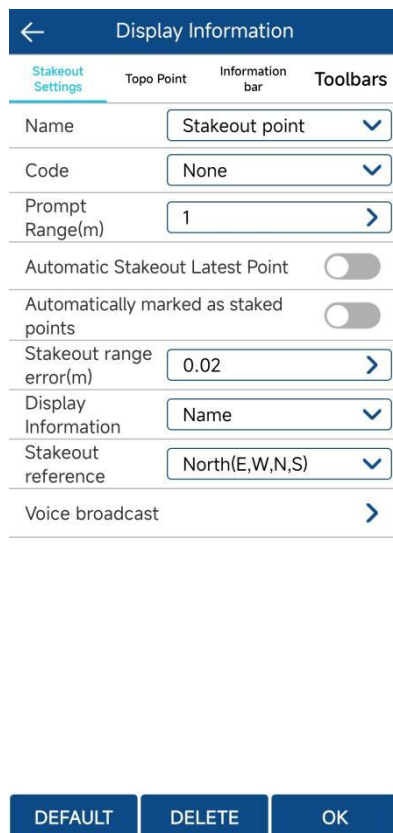


Figure 3.10-4

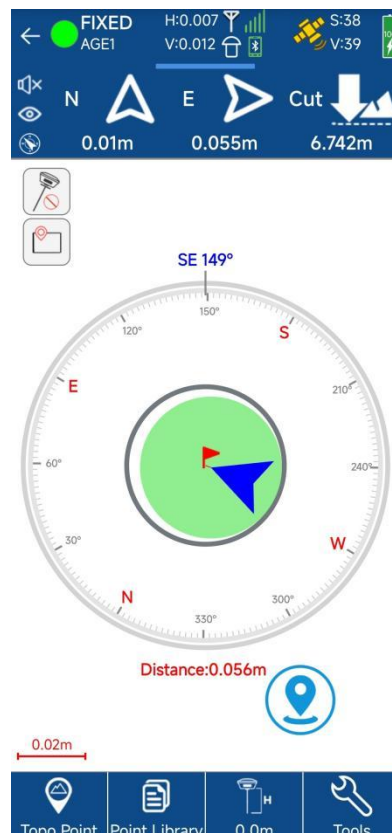


Figure 3.10-5

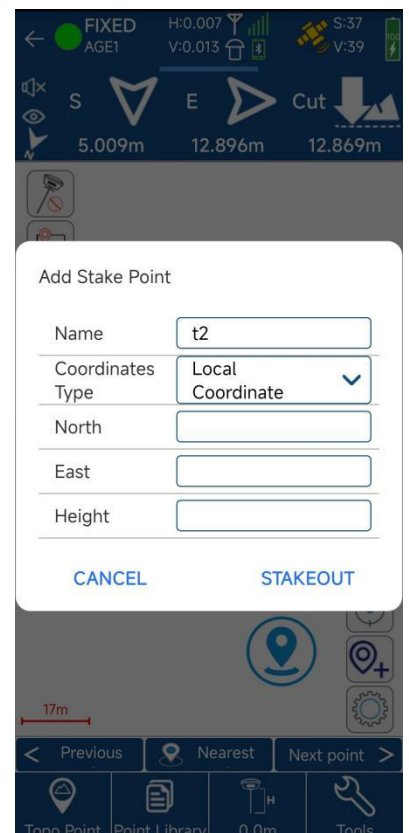


Figure 3.10-6

3.11 AR Stakeout (communication mode needs to select WIFI)

AR stakeout needs to be connected to an instrument with AR function via WIFI to be displayed. It can provide high-definition real-scene stakeout function and better real-scene stakeout application to help you stake out the target in one shot.

1. Click [**Device**]->[**Communication**] to enter the communication settings interface, as shown in Figure 3.9-1. Select the device type (RTK), **communication mode (WIFI)**, and then click [Search], as shown in Figure 3.9-2, view the WIFI device list, select the corresponding device serial number (default device number), and click [Connect] to complete the device connection, as shown in Figure 3.9-3. After the device is successfully connected, it will directly return to the device interface.

2. Configure the mobile station to achieve a fixed solution state, refer to Section 3.4.

Note: To use the Phone Internet, the controller needs to have a SIM card inserted to connect to the Internet.

Click [**Survey**]->[**Point Stakeout**] to enter the point stakeout library interface, as shown in Figure 3.11-1. The points to be staked will display the unstaked points and the staked points. Click a staked point to edit, view details, perform stakeout, or delete it, as shown in Figure 3.11-2. After selecting the point to stake out, enter the

point stakeout interface, as shown in Figure 3.11-3. Click the tilt survey icon in the upper left corner  to turn

on the tilt survey function, as shown in Figure 3.11-4. When turned on, the icon is .

Then follow the pop-up prompts and enter the antenna height parameters (centering pole height) according to the actual situation, as shown in Figure 3.11-5. At this time, the device needs to be in a fixed state, shake the centering pole back and forth for 5~10s, then rotate 90°, and continue to shake the centering pole back and

forth until the survey icon changes to , as shown in Figure 3.11-6. Click the AR icon in the upper left corner



, as shown in Figure 3.11-7, to enter AR real-scene stakeout.

Finally, follow the arrow direction and distance indication to navigate to the area close to the stakeout point, as shown in Figure 3.11-8. When the tip of the centering rod coincides with the marked point, as shown in Figure 3.11-9, the AR real-scene stakeout is completed. At this time, you can click the survey icon and choose to stake out the next point, previous point, or stake out again according to the pop-up prompt.