TOKNAV

tBase GNSS RECEIVER USER GUIDE

TOKNAV

www.toknav.cn

Certificate

Contents

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1. tBase Overview

tBase is developed for professional base station applications. It is equipped with a high-precision positioning module and supports full-system, multi-frequency satellite signal tracking. It is also equipped with 4G full-network, Bluetooth, WiFi, 5W large radio and large-capacity battery to meet the needs of base station concurrent data links, solve the battery life problem of the built-in radio working mode, and make operations more convenient and efficient.

1.1 Appearance

Main body of tBase is as follows:
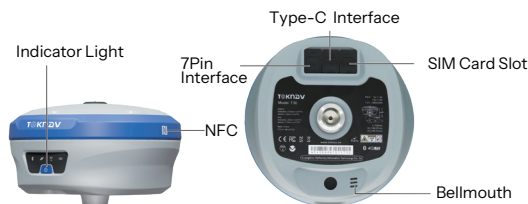
project	Function	Function or status
⏻	Power Button	FunctioBrief press for 1s to display the battery level; Long press for 3s to turn on the device when it is off; Long press for 3s to turn off the device when it is on.n or status
✳	Bluetooth Light	Light on for Bluetooth connected; Light off for Bluetooth disconnected; Blink for abnormal condition.
🛰	Satellite Light	Rover/base station: 1 second interval flashing in the positioning state; when not searching for satellites, the light goes out; Static mode: flashes at intervals based on the sampling frequency.

	Differential Light	Rover mode: Blink when receiving differential data; Base mode: Blink when sending differential data.
🔋	Power Light	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 completed.
⊙	7Pin interface	RS232 serial port, baud rate supports 1200, 2400, 4800, 9600, 19200, 38400, 115200 and 230400bps.
▭	USB interface	Type-C interface, supports PD fast charging up to 33W, please refer to 1.5.
▭	SIM Card Slot	External SIM card, supports 4G full network access.
◎	UHF antenna interface	Built-in radio: supports low power (1W), medium power (2W) and high power (5W) options.

1.2 Battery Indicator

Press the power button for one second when the device is off; and the battery level can be informed based on the quantity of lights on.

Indicator Lights	Battery level
	0 % – 25 %
	26 % – 50 %
	51 % – 75 %
	76 % – 100 %

1.3 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.

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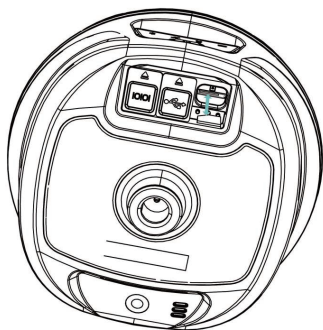
The device supports network working mode, a 4G full network solution based on the Linux platform, and fully supports China Mobile/China Unicom/China Telecom 2/3/4G networks, with better compatibility, stronger signals and more stable connections.

How to insert a SIM card?

1. Open the rubber cover;

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

3. Put on the rubber cover.

1.5 Charging

The device comes with a Type-C charger that supports up to 33W PD fast charging. The battery can be fully charged in just 4 hours, and the power status light shows:

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.

1.6 Packing List

After receiving and unpacking the package, please check whether the device and all accessories are complete according to the following table.

Serial number	name	model	quantity	picture	Remark
1	Geodetic GNSS Receiver	tBase	1		Standard
2	450-470M Radio Antenna	AT0038	1		Standard
3	CC Data Cable	L0602-1	1		Standard
4	33W PD Power Adapter	CG0004	1		Standard
5	Base connector	BB0031	1		Optional
6	Height measuring film	BB0039	1		Optional
7	tBase yellow PP box packaging		1		Standard
8	30cm extension rod (yellow)	BB0036	1		Optional
8	30cm extension rod (yellow)	BB0036	1		Optional
8	P9N controller bracket	BB0037	1		Optional
8	Type-C Data Cable	L0602-2	1		Standard
8	5V/2V USB Power Adapter	CG0003	1		Standard
8	7-pin USB and serial cable	L0609-15	1		Optional

2. WEB UI

The device WIFI can be used as a hotspot, which can be connected with a PC, smartphone or tablet. After connecting to the hotspot, you can log in to the device's Web UI Manage work status, change work mode, modify basic settings, download raw data, update firmware, and register devices, etc.

Taking your computer's interface as an example, enter the Web UI and do the following:

1. Use a computer to find and connect to the device's WIFI hotspot. Hotspot name: device serial number, and the default password is empty.

2. Open the web browser and input the IP address 10.10.10.10. The interface is shown in Figure 2-1.

Figure 2-1

3. Meaning of icons arranged horizontally above the interface:

📡 45/50	🌡 33.2 ℃	⊘ 0.000 V	🔌 0.000 V	🔋 7.875 V	🔋 75%
Satellite Used/Tracked	Temperature	Extended Voltage	Supply Voltage	Battery Voltage	Battery Info

2.1 System View

① GNSS Status: Quality, diff, Longitude, latitude, Height, accuracy, Ref station ID;

② Register info: SN, Model, Register Code, Expired Date, Functionality, Scheme, Exception;

③ Working mode: working mode, Station name, Elev cutoff, Diff Age Max, Data Link, Diff Stream.

④ Device Operation:

1) System command: shut down and restart the device

2) Configuration and data: reset configuration, clean storage, export configuration, and import configuration;

3) Registration code: The registration code is a valid time code that authorizes the device positioning function. When the registration code is found to have expired and the device positioning function is unavailable, you can obtain a new registration code from the supplier by providing the device number, enter it into this page, and click [Register] to register. The page effect is shown in Figure 2.1-1.
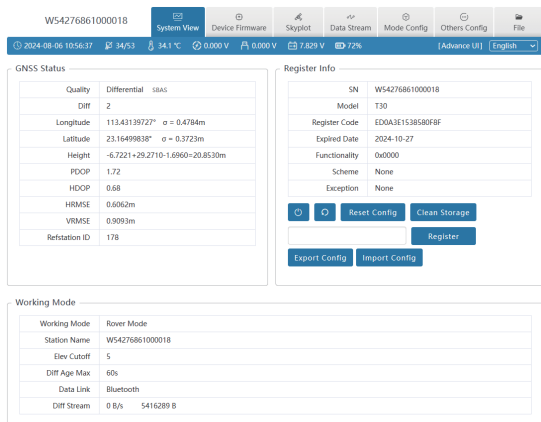
Figure 2.1-1

2.2 Device Firmware

The device firmware displays the Device Info, System Version and a local upgrade button, as shown in Figure 2.2.

① Device Info: SN, Hardware, GNSS Type, GNSS SN, GNSS Hardware, IMEI, Feature, Product Date, Brand, Model, and Board SN.

② System Version: system, Linux Version, positioning board, tilt module, radio firmware version, device firmware version.

Click the local upgrade below to automatically identify the positioning board firmware, tilt module firmware and device firmware that need to be upgraded. The specific steps are as follows:

1. Click [Local Upgrade];

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

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

4. Reconnect the device to WIFI, enter the WEB UI, and check whether the firmware is upgraded successfully.
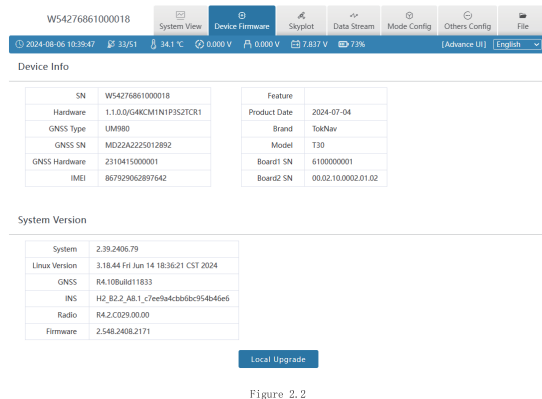
Figure 2.2

2.3 Skyplot

This diagram mainly displays satellite tracks and satellite status diagrams, for example, traces, satellite lists, status, etc., as shown in Figure 2.3-1:
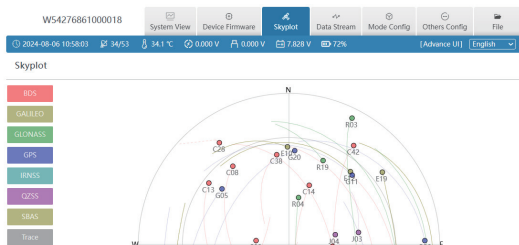
Figure 2.3-1

① GNSS System: Elev Cutoff: Set the Elev Cutoff;

② Satellite List: There are many satellite systems available, such as BDS, GALILEO, GPS, GALONASS, etc. If you find that the device receives fewer satellites under normal conditions, you can enter the page to check whether all satellite systems are turned on, click the small box at the back to turn on/off the corresponding satellite system.

③ SBAS: Choose to turn on or off the satellite-based augmentation system;

④ PPP: Select to disable or enable PPP mode, as shown in Figure 2.3-2
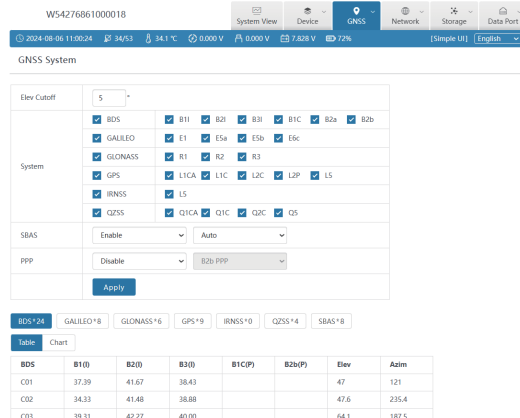
Figure 2.3-2

2.4 Data Stream

Data stream is mainly used to debug data information. You can view the status of current data, as shown in Figure 2.4-1:

Figure 2.4-1

For example:
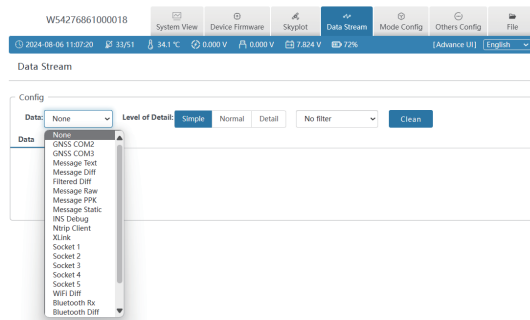
1.Message Text: see 2.9 in this section for the configuration of message text, and the output is shown in Figure 2.4-2:

Figure 2.4-2

2.Message Raw: as shown in Figure 2.4-3:

Figure 2.4-3

3.Message Diff: when the device is a base station, you can check here whether there is differential data output, as shown in Figure 2.4-3:

Figure 2.4-4

4. Message Static: When the device is in static mode, you can check here whether there is static data output, as shown in Figure 2.4-5:

Figure 2.4-5
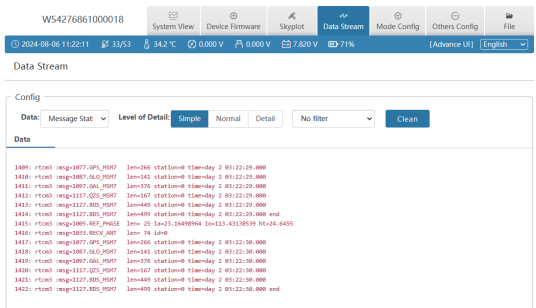
2.5 Mode Config

① **Working mode**: You can select 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, as shown in Figure 2.5-1:

Figure 2.5-1

2. Base Mode: You can configure parameters (Station Name, Elev Cutoff, Station ID, PDOP Threshold, Diff Type, Base Mode, Height Type, Antenna Height, Record), as shown in Figure 2.5-2:

Figure 2.5-2

3. Static mode: the following parameters (Station Name, Elev Cutoff, PDOP Threshold, Sample Interval, Height Type, Antenna Height, Record) can be configured, as shown in Figure 2.5-3:

Figure 2.5-3

② Data link: You can choose No Data link/Bluetooth/WIFI /Built-in Network/Built-in Radio /External radio /XLink/PPP, as shown in Figure 2.5-4:
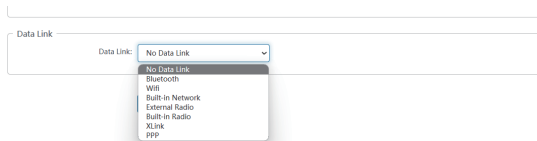
Figure 2.5-4

1. Bluetooth: the device obtains the differential data of tSurvey2.0 software accessed by the controller network through Bluetooth connection;

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

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

2.6 Others Config

① WIFI : You can choose from three types: Disable/AP /Station, and you can set the WIFI name and password by yourself. When the device WIFI is used as the Station, you can access the network by entering the name and password of the external hotspot.

② Others: You can select the device's UTC time and set it according to your region. The interface is shown in Figure 2.6-1:
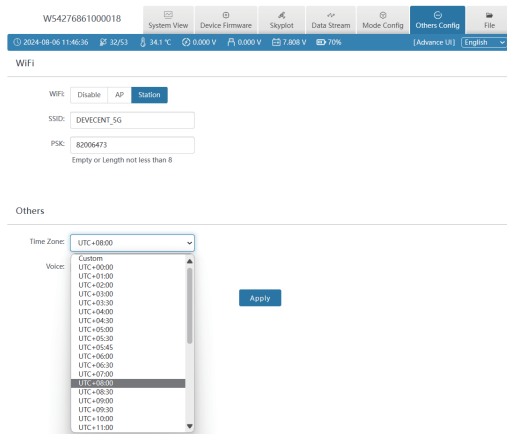
Figure 2.6-1

2.7 File

In this interface, you can batch delete the data folders in the device, as shown in Figure 2.7.1; enter the file directory and you can choose to download the data of each channel, as shown in Figure 2.7.2.

Figure 2.7-1

File

Root/ 20240705/ ch01/

W54276861000018-01-20240705-081124.gnss	418.23 kB	Download
W54276861000018-01-20240705-081236.gnss	1.943 MB	Download
W54276861000018-01-20240705-081739.gnss	56.63 kB	Download
W54276861000018-01-20240705-081744.gnss	2.718 MB	Download
W54276861000018-01-20240705-082544.gnss	7.027 MB	Download
W54276861000018-01-20240705-084333.gnss	6.400 MB	Download
W54276861000018-01-20240705-085926.gnss	6.551 MB	Download
W54276861000018-01-20240705-091547.gnss	4.061 MB	Download
W54276861000018-01-20240705-092526.gnss	418.02 kB	Download

Figure 2.7-2

2.8 Log

It provides the download of equipment operation logs. When an abnormality occurs during the use of the equipment, you can download the logs generated at the corresponding time and provide them to our company so that we can troubleshoot the problem for you, as shown in Figure 2.8:

2.9 Message Text

You can set the type and frequency of text format output data, as shown in Figure 2.9. After the configuration, you can check whether there is corresponding text data output in 2.4 of this section.

Log

File Name	Size	Time Modified	Operation
W54276861000018-0185.zlog	178.63 kB	2024-08-06 11:53:43	Download
W54276861000018-0184.zlog	341.16 kB	2024-08-05 19:22:42	Download
W54276861000018-0183.zlog	150.12 kB	2024-08-05 11:48:07	Download
W54276861000018-0182.zlog	63.58 kB	2024-08-01 18:52:03	Download
W54276861000018-0181.zlog	66.55 kB	2024-08-01 17:52:25	Download
W54276861000018-0180.zlog	66.28 kB	2024-08-01 17:14:40	Download
W54276861000018-0179.zlog	61.33 kB	2024-08-01 16:05:21	Download
W54276861000018-0178.zlog	76.75 kB	2024-08-01 15:37:32	Download
W54276861000018-0177.zlog	155.90 kB	2024-08-01 14:21:34	Download
W54276861000018-0176.zlog	80.31 kB	2024-08-01 19:52:38	Download
W54276861000018-0175.zlog	61.34 kB	2024-07-31 19:31:58	Download
W54276861000018-0174.zlog	75.36 kB	2024-07-31 19:26:40	Download
W54276861000018-0173.zlog	148.59 kB	2024-07-31 18:21:11	Download
W54276861000018-0172.zlog	77.49 kB	2024-07-31 16:31:35	Download
W54276861000018-0171.zlog	94.96 kB	2024-07-30 17:56:30	Download
W54276861000018-0170.zlog	86.86 kB	2024-07-30 16:24:17	Download
W54276861000018-0169.zlog	79.97 kB	2024-07-30 12:08:56	Download
W54276861000018-0168.zlog	67.21 kB	2024-07-30 09:49:08	Download
W54276861000018-0167.zlog	96.74 kB	2024-07-29 18:52:21	Download

Figure 2.8

Message Text

NMEA

GPDOP:	15 s
GPGGA:	2 s
GPGSA:	15 s
GPGST:	5 s
GPGSV:	15 s
GPRMC:	2 s
GPVTG:	2 Hz
GPZDA:	10 s

ASCII

BESTPOSA:	2 s
DEVST:	10 s
GPSAU:	20 s
GPSAV:	10 s
GPSNR:	5 s
INS.ARST:	5 s
INS.CALI:	5 s
INS.GNSS:	5 s
INS.NAVI:	5 s
KSXT:	5 s
LASER:	5 s
REFSTATIONA:	5 s

Apply

Figure 2.9

The following are the formats of several common message text:

$GPGGA
Example:
$GPGGA,092204.999,4250.5589,S,14718.5084,E,1,04,24.4,19.7,M,,,,0000*1F
Field 0: $GPGGA, statement ID, indicating that the statement is Global Positioning System Fix Data (GGA) GPS positioning information
Field 1: UTC time, hhmmss.sss, in hour, minute, second format
Field 2: Latitude ddmm.mmmm, in degree and minute format (if the leading digits are insufficient, fill them with 0)
Field 3: Latitude N (North) or S (South)
Field 4: longitude dddmm.mmmm, in degree and minute format (if the leading digit is insufficient, add 0)
Field 5: Longitude E (East) or W (West)
Field 6: GPS status, 0 = not positioned, 1 = non-differential positioning, 2 = differential positioning, 3 = invalid PPS, 6 = estimating
Field 7: Number of satellites in use (00 - 12) (if the leading digit is insufficient, fill it with 0)
Field 8: HDOP horizontal dilution of precision (0.5 - 99.9)
Field 9: Altitude (-9999.9 - 99999.9)
Field 10: The height of the Earth's ellipsoid relative to the geoid
Field 11: Differential time (seconds from the last differential signal received, empty if not differential positioning)
Field 12: Differential station ID number 0000 - 1023 (if the leading digit is insufficient, it will be filled with 0, and it will be empty if it is not differential positioning)
Field 13: Checksum
$GPGSV
Example: $GPGSV,3,1,10,20,78,331,45,01,59,235,47,22,41,069,13,32,252,45*70
Field 0: $GPGSV, statement ID, indicating that the statement is GPS Satellites in View (GSV) visible satellite information
Field 1: The total number of GSV statements this time (1 - 3)

Field 2: This GSV statement is the number of this GSV statement (1 - 3)
Field 3: Total number of currently visible satellites (00 - 12) (if the leading digit is insufficient, add 0)
Field 4: PRN code (pseudo-random noise code) (01 - 32) (if the leading digit is insufficient, add 0)
Field 5: Satellite elevation angle (00 - 90) degrees (if the leading digit is insufficient, fill it with 0)
Field 6: Satellite azimuth (00 - 359) degrees (if the leading digit is insufficient, fill it with 0)
Field 7: Signal-to-noise ratio (00-99) dbHz
Field 8: PRN code (pseudo-random noise code) (01 - 32) (if the leading digit is insufficient, add 0)
Field 9: Satellite elevation angle (00 - 90) degrees (if the leading digit is insufficient, fill it with 0)
Field 10: Satellite azimuth (00 - 359) degrees (if the leading digit is insufficient, fill it with 0)
Field 11: Signal-to-noise ratio (00-99) dbHz
Field 12: PRN code (pseudo-random noise code) (01 - 32) (if the leading digit is insufficient, fill it with 0)
Field 13: Satellite elevation angle (00 - 90) degrees (if the leading digit is insufficient, fill it with 0)
Field 14: Satellite azimuth (00 - 359) degrees (if the leading digit is insufficient, fill it with 0)
Field 15: Signal-to-noise ratio (00-99) dbHz
Field 16: Checksum

2.10 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 below. We can control the data source, file period, file name and file format of each channel for storage as needed. The naming rules page has detailed instructions, as shown in Figure 2.10-1.

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

Note: Do not change the mode after the device data configuration is completed, otherwise the default storage configuration will be restored.
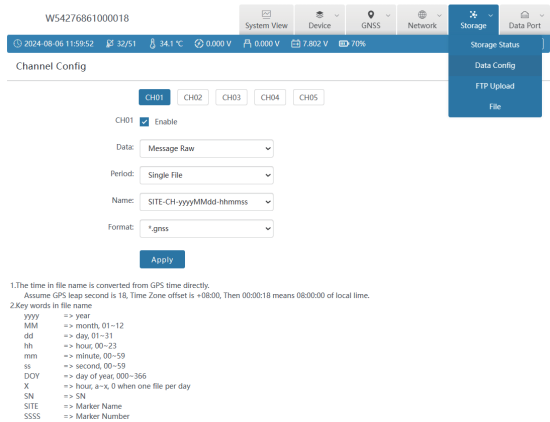
Figure 2.10-1

1. Rover (CH01)

When the device is set as a rover station, 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 to store the post positioning data by default, as shown in Figure 2.10-2:
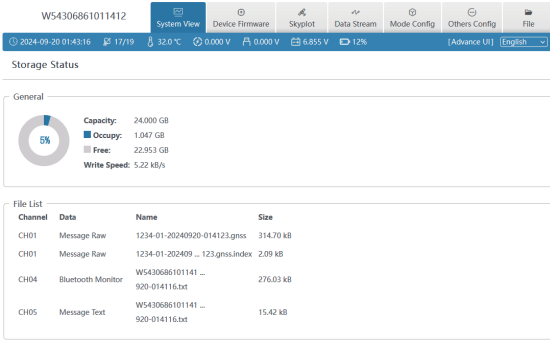
Figure 2.10-2

2. Base (CH02)

When the device is set as a base station, the device will automatically configure CH02 to store and locate raw data by default. If PPK is enabled, CH05 will also automatically configure the storage location for post-processed data by default, as shown in Figure 2.10-3:
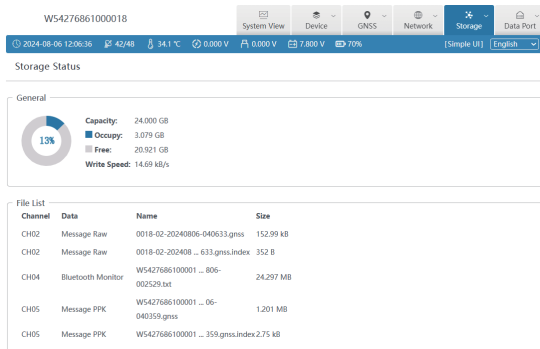
Figure 2.10-3

3. Static (CH03)

When the device is set to static mode, the device will automatically configure CH03 to store static positioning data by default, as shown in Figure 2.10-4:

Figure 2.10-4

Note: Whenever the tSurvey2.0 software is connected to the device via Bluetooth, the device will automatically configure CH04 to store Bluetooth monitor data. If there are any problems with the settings of the Bluetooth connected device, you can download the recorded Bluetooth monitor data for troubleshooting, as shown in Figure 2.10-5:

Figure 2.10-5
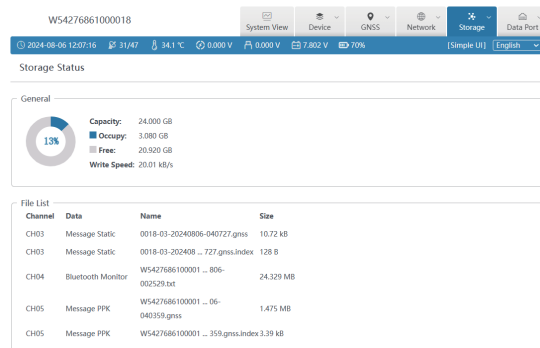
2.11 ZXVPN

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

1. Insert a SIM card into the device;

2. Turn on the mobile network and make sure it is connected to the Internet, or connected to the WIFI;

3. Click [Use default value] to apply, as shown in Figure 2.11.
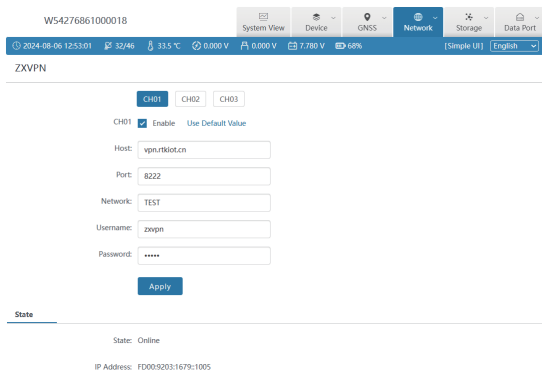
Figure 2.11

3. tSurvey2.0 Basic Operations

3.1 Software Installation and Uninstallation

Installation process:

1. Download the Android tSurvey2.0 program (*.apk);

2. Copy the tSurvey2.0 program to your mobile phone (controller);

3. Find the program in the file management of the controller and install it;

4. Click on the tSurvey2.0 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. Project manager includes functions such as creating a new project, importing a project, exporting a project, deleting a project, and opening a project.
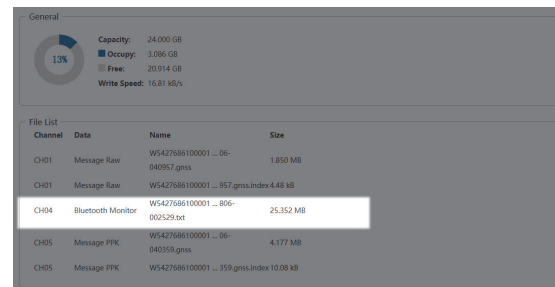
Click [Project Path] to modify the path of the project on disk. The default path is in the internal storage → tSurvey2.0 > Project directory.

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).

Figure 3.2-1

Figure 3.2-2
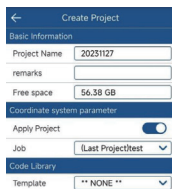
Figure 3.2-3
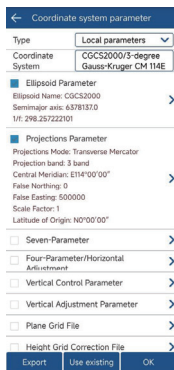
Figure 3.2-4
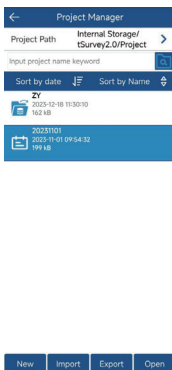
Figure 3.2-5
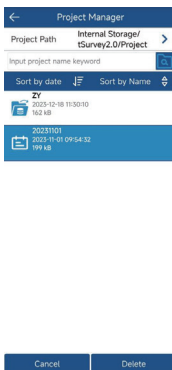
Figure 3.2-6

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), and 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.
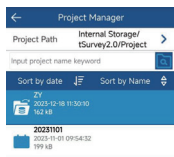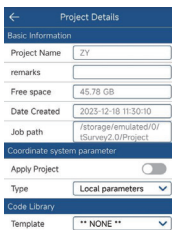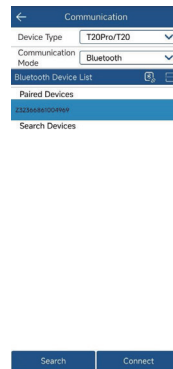

Figure 3.3-1
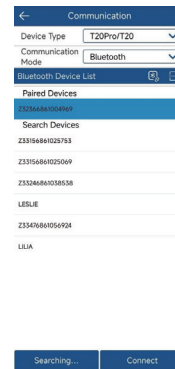
Figure 3.3-2
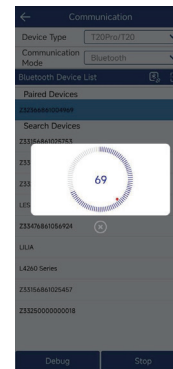
Figure 3.3-3
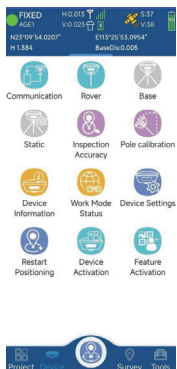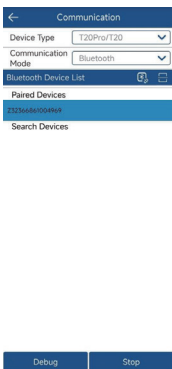
Figure 3.3- 4   Figure 3.3- 5   Figure 3.3- 6

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 the influence of the atmosphere on the signal is basically the same within a certain area, when the coordinate position of the reference signal is known, the two sets of GNSS can calculate the high-precision position. The GNSS device with a fixed position is called the base, and the GNSS device with a

non-fixed position is called the rover. Relative to the GNSS satellite signal of the rover, the data transmitted by the base is called differential data, and the data transmission method is called data link. The rover mode setting is to set the GNSS as a rover, 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 cutoff angle, differential delay, and whether to enable PPK and other basic information, as shown in Figure 3.4-1. Adjust 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 parameter records the original GNSS observation data to the GNSS receiver and uses the post-processing algorithm to calculate 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 coordinate change alert 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.
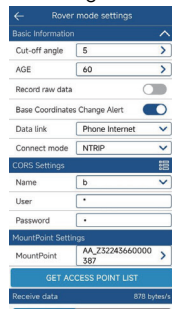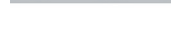

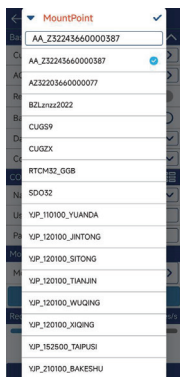Figure 3.4-1   Figure 3.4-2   Figure 3.4-3

MountPoint ✓

AA_Z32243660000587
AA_Z32243660000587 ✓
AZ3220366000077
BZLznzz2022
CUGS9
CUGZX
RTCM32_GGB
5DO32
YJP_110100_YUANDA
YJP_120100_JINTONG
YJP_120100_SITONG
YJP_120100_TIANJIN
YJP_120100_WUQING
YJP_120100_XIQING
YJP_152500_TAIPUSI
YJP_210100_BAKESHU

Figure 3.4- 4

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

Figure 3.4-5

Operator Manager

Add   Edit   Delete   OK

Figure 3.4-6

Rover mode settings
Basic Information ∧
Cut-off angle   5   >
AGE   60   >
Record raw data   ◯
Base Coordinates Change Alert ●
Data link   Internal Radio ∨
Channel   1   ∨
Frequency   463.125
Protocol   TrimTalk 450S(9600) ∨
SET RADIO FREQUENCY
ADVANCED   APPLY

Figure 3.4- 7

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 3.4-8

Rover mode settings
Basic Information ∧
Cut-off angle   5   >
AGE   60   >
Record raw data   ◯
Base Coordinates Change Alert ●
Data link   XLINK   ∨
APN Settings
Operator   ∨
Name
User
Password
ADVANCED   APPLY
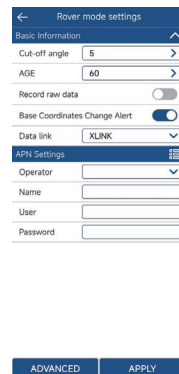
Figure 3.4-9

3.5 Base Mode Setting

Click [Device]→ [Base], as shown in Figure 3.5-1. This function is that the GNSS device acts as a base to send satellite information data in a certain way and provide it to the rover to receive it, providing it with high-precision solution conditions. The host needs to set the startup condition parameters, startup mode and data broadcast parameters as a base.

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

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: This means that the GNSS device outputs differential broadcast data for the startup coordinates based on the current positioning value (with low accuracy).

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 ![icon] 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. Device Internet NTRIP protocol, the base station is the base station access point that sets the start of transmission, as shown in Figure 3.5-1, and the rover obtains the access point list and selects the corresponding base station access point to connect.

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.

Figure 3.5- 1
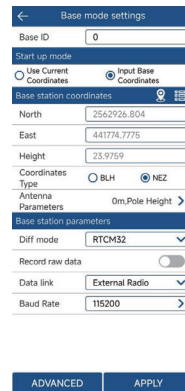

Figure 3.5- 2

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 is to store the original satellite observation data of the GNSS device into the set disk file, record the observation data of a period of time for the use of static post-processing software to solve the high-precision coordinate position, usually used for control point acquisition. To start the static mode, you need to set the static file point name, PDOP limit, cut-off angle, Collection interval, antenna parameters and 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: During static recording, the device is not allowed to move, otherwise it will cause errors in the coordinates calculated by post-processing.
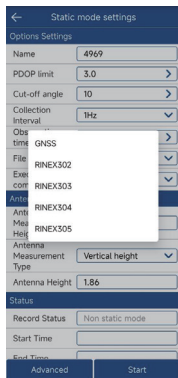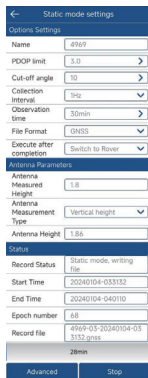

Figure 3.6- 1   Figure 3.6- 2   Figure 3.6- 3

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 demand. In point survey, the north-east high coordinates and base station distance information are displayed by default. The middle area is the measurement data drawing information, and the network map can also be set to display.

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, 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.
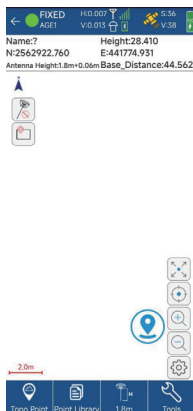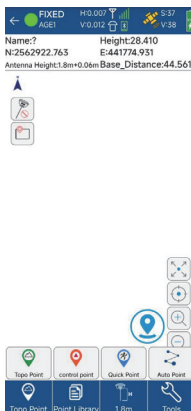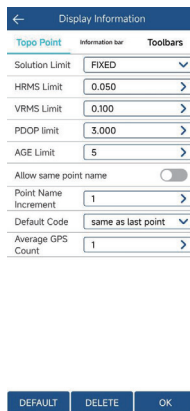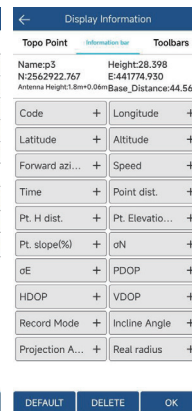
Figure 3.7- 1

Figure 3.7- 2
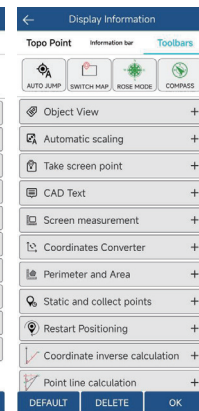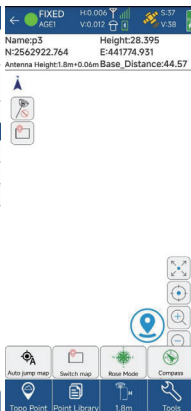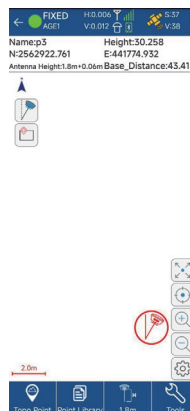
Figure 3.7- 3

Figure 3.7- 7

Figure 3.7- 8

Figure 3.7- 9

Figure 3.7- 4
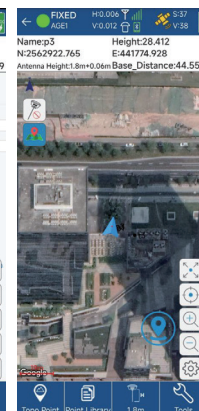
Figure 3.7- 5

Figure 3.7- 6

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 accuracy of the instrument can be maintained within 2cm within the tilt range of 60 °;

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

3. Support centering pole calibration, which can eliminate the survey error caused by the curvature of the centering pole.

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
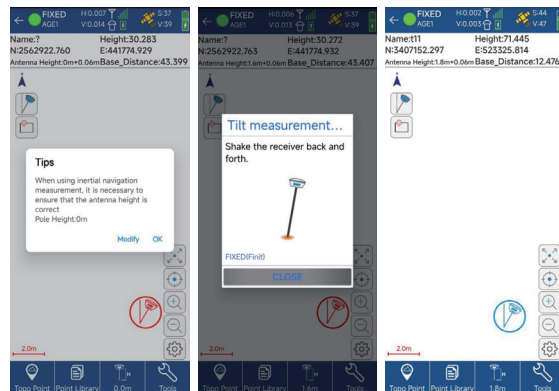
3.9 Point Stakeout

Click [Survey]→ [Point Stakeout] to enter the point stakeout library interface, as shown in Figure 3.9-1. 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 points that have been staked out will be displayed. Click the stakeout point to edit, view details, stake out, and delete the stakeout point, as shown in Figure 3.9-2. 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 3.9-3.

Click the icon ⚙ to enter the layout setting interface, as shown in Figure 3.9-4, where you can set the prompt range, layout tolerance, etc. In addition, you can set the reference direction to east, south, west, north, front, back, left, and right, as well as 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, and northeast deviation values from the target are displayed in the status information bar. The compass, the current positioning, the measurement type, coordinate point library, antenna height and tools, functions such as stake out the nearest point, stake out the previous point, and stake out the next point are displayed at the bottom of the drawing area.

Click [Nearest Point], as shown in Figure 3.9-5, to stake out the nearest point.

Click ⊕ the icon, as shown in Figure 3.9-6, to manually add stakeout points at any time.

How could we reach the destination faster?

If the user has a good sense of direction, he can distinguish between east, south, west and north in real-time field work. In the layout compass display, he can directly see the continuity between the current positioning point and the target point, and just walk to the direction it points to. As shown in Figure 3.9-3, you can find the target point Pt1 by walking in the southwest direction.

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 3.9-3, 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.
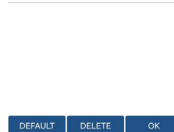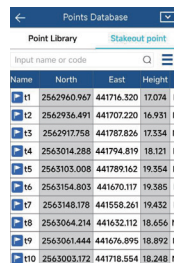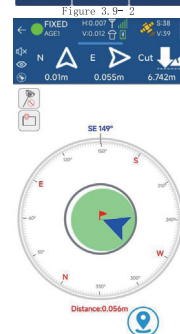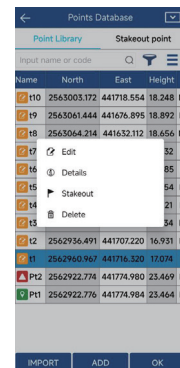

Figure 3.9-1

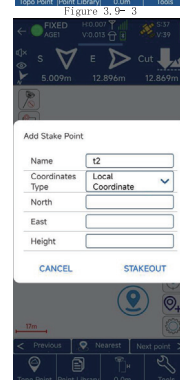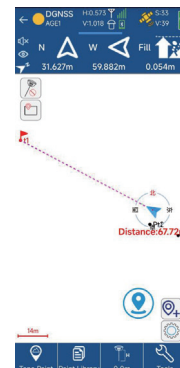Figure 3.9-2

Figure 3.9-3

Figure 3.9-4

Figure 3.9-5

Figure 3.9-6

3.10 Localization

Click [Project]→[Localization], as shown in Figure 3.10-1, you can import control point parameters in various formats, or export control point data into files for use by third-party software. The high-precision position obtained by the software from the GNSS device is the latitude and longitude coordinates of satellite positioning, but in actual project operations, the plane coordinates on the ground are ultimately required for measurement and application. If the customer has the coordinate conversion parameters, the coordinate system parameter values can be set directly in the coordinate system (details 2.3). If the customer does not have specific coordinate system parameters, but has corresponding latitude and longitude coordinates and plane coordinates, we call them control points. In the case of control point data, this function can be used to calculate the conversion parameters and apply them to project operations.

Click [Add], as shown in Figure 3.10-2, you can manually enter the control point, or choose to import it from the coordinate point library, as shown in Figure 3.10-3. In the control point list, select the data item to modify, edit and delete the control point parameters, as shown in Figure 3.10-4.

After editing the control point parameters, calculate the conversion parameters for the control points. Click [Calculation Method] to pop up the conversion parameter condition settings, as shown in Figure 3.10-5. Coordinate conversion methods include plane correction, vertical correction, elevation fitting and seven parameters, which can be all or part of the combination. As long as the corresponding accuracy is achieved within the accuracy range, the calculated conversion parameters are considered to be available. The plane correction model includes four parameters and horizontal adjustment. The elevation fitting method includes weighted average, plane fitting, surface fitting and vertical adjustment. Usually, if the operating range is very wide, seven parameters are needed to meet the accuracy requirements of all control points. If the operating range is relatively small, plane correction can usually achieve the corresponding accuracy.

After configuring the calculation conditions, click [Calculate] to display the calculation results of the conversion parameters and the residuals of each control point, as shown in Figure 3.10-6. After calculating the conversion parameters, you can export the calculation report for project review. If the conversion parameters are qualified, apply the parameters to the project and you can perform the measurement work normally.
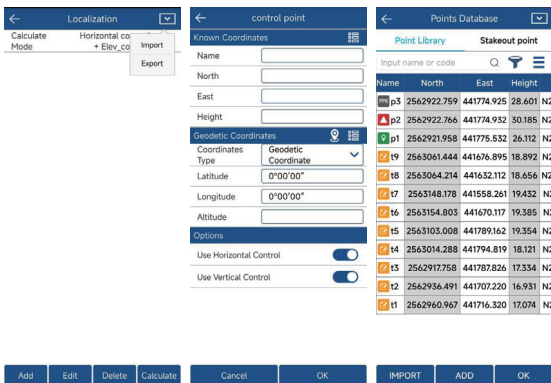

Figure 3.10-1   Figure 3.10-2   Figure 3.10-3

Figure 3.10-4

Figure 3.10-5

Figure 3.10-6

3.11 Calibrate Point

Click [Project]→ [Calibrate Point], as shown in Figure 3.11-1. In actual application, GNSS equipment obtains high-precision position by combining differential data of base station with solution. Here we know that the coordinate position of base station is known. In fact, the high-precision position output by GNSS equipment is the relative position of base station. In actual application, in addition to some users using differential data of CORS reference station, there are also quite a few users using differential data of base station transmitted by their own GNSS equipment. When transmitting differential data by building their own stations, a project may involve starting base station multiple times. When starting base station, the starting position and starting coordinates of base station may change, and the starting coordinates may not be correct. In the absence of calibration, the coordinates of mobile station obtained by using these base station differentials may be wrong (at the same location, the coordinates measured by using previous differential data are different from the coordinates obtained by new differential data). Therefore, when rover receives new base station differential data for measurement, it needs to perform translation calibration so that the coordinates obtained by software match the coordinates obtained by connecting to the last base station. After the starting coordinates or starting position of the base station changes, a known position needs to be used to calibrate the coordinates correctly.

Click [Base Point Calibration], as shown in Figure 3.11-2. Click to select a known point 📇 in the coordinate point library (use the coordinates measured by the base station at a certain location last time), click [Calculate] and apply.

Click [Marker Point Calibration], as shown in Figure 3.11-3, click 📇 select a known point in the coordinate point library (use the coordinates measured by the base station at a certain location last time), then place the GNSS device at the location of the known point, click 🔘 to measure a new positioning point, and calculate the deviation value. Click [Apply], and the coordinates received by the software will match the coordinates measured last time.

The base station coordinates change and remind you whether to recalibrate. If the base station coordinates change when receiving the differential signal from the self-built base station, it means that the base station translation calibration is required and needs to be re-calibrated.

Note: The CORS reference station is a long-term operating reference station whose position and startup coordinates will not change. If the differential data of the

CORS reference station is used, although the received coordinates may change, the obtained coordinates are still correct and no translation calibration is required.

Figure 3.11-1   Figure 3.11-2   Figure 3.11-3

3.12 Coordinate Point library

Click [Project]→ [Points Database], as shown in Figure 3.12- 1. Here you can view and manage the point data in the project, including adding, editing, deleting, importing and other functions.

Click the upper right corner ☰ , as shown in Figure 3.12-2, to switch the display style of point information.

Click [Add], as shown in Figure 3.12- 3, and you can manually enter the point name, code and corresponding coordinates.

Click [Import], as shown in Figure 3.12-4, select the file format of the point data to be imported, and then select the data file to complete the data import.

Select the coordinate point and click [Edit], as shown in Figure 3.12-5, to edit and modify the name and code of the coordinate point.

Click the upper right corner ▼ , as shown in Figure 3.12-6, to filter the point type.

Click the upper right corner ▼ and the operation will pop up, as shown in Figure 3.12-1. You can perform batch deletion, data statistics, sorting and other functions as needed.

Figure 3.12-1   Figure 3.12-2   Figure 3.12-3

Figure 3.12-4   Figure 3.12-5   Figure 3.12-6
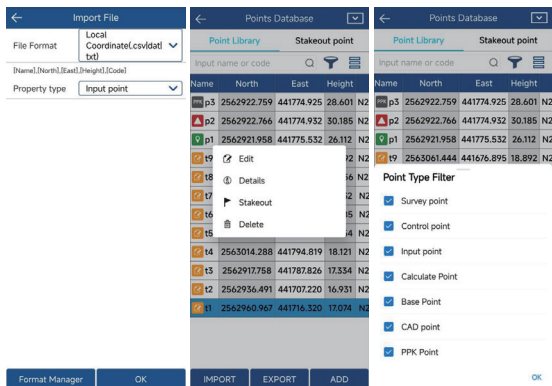
3.13 Export File

Click [Project]→ [Export File], as shown in Figure 3.13-1, and select the type, file format, and angle format of the exported data as needed. Click [Format Manager], as shown in Figure 3.13-2, select the file format of the data to be exported, and click [OK]. Click [User-defined Format], as shown in Figure 3.13-3. And you can manually create and edit the file format of the exported data.

Figure 3.15-1   Figure 3.15-2   Figure 3.15-3
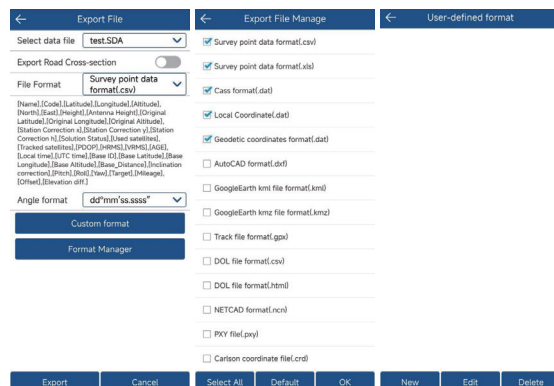
3.14 Device Information

Click [Device]→ [Device Information], as shown in Figure 3.14, to view basic information such as the GNSS device's working mode, Device Serial number, Firmware Version, Battery Power, Expiry date, Satellite System, Antenna Parameters, etc.

Details

Basic Information	∧
Working Mode	Rover
Device Serial no	Z32366861004969
Firmware	M68-FMW3.1.473.2311.1
Version	829
Current DataLink	Phone Internet
Battery Power	89%
Expiry date	20240221
IMEI	868343049829653

Satellites System	∧
Enable GPS	Enable
Enable BEIDOU	Enable
Enable GLONASS	Enable
Enable GALILEO	Enable

Antenna Parameters	∧
Antenna Type	ZX-M68-K4T4
Radius	130mm
SHMP Offset	0mm
L1 Offset	60.07mm
L2 Offset	57.09mm

OK

Figure 3.16

Device Activation

Activation Information

Device Serial no: Z32366861004969

Registration Date: 20240221

Enter activation code

1	2	3	A	B
4	5	6	C	D
7	8	9	E	F
0	·		Back	

Device Activation

Figure 4.1

4. Device Activation and Software Registration

4.1 Device Activation

Click [Device] → [Device Activation], as shown in Figure 4.1, to view the instrument serial number and expiration date. If the GNSS device has expired, you can obtain the registration code from the dealer and authorize the device here.

4.2 Software Registration

Click [Project] → [About Software], as shown in Figure 4.2-1, to view the software version information and registration authorization information.

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

Click [Software Registration] to jump to the software registration interface, as shown in Figure 4.2-2, to view the activation ID and expiration time.

When you install the software for the first time, click [Online Activation] to activate it for free for three months.

Click [Authorization Code Activation], as shown in Figure 4.2-3, enter the authorization code here or scan the QR code of the authorization code to activate the software.

If you need to replace a new controller, you can click [Transfer activation code] in the old controller, then enter the software registration of the new controller and enter the transferred activation code to activate the software.
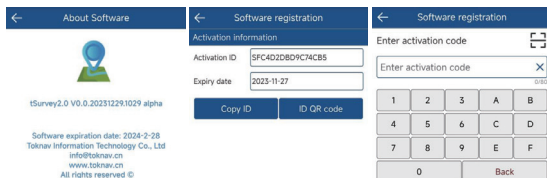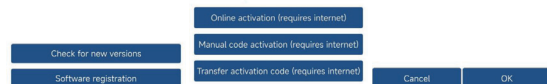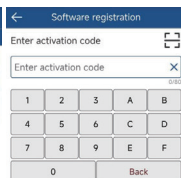
Figure 4.2-1   Figure 4.2-2   Figure 4.2-3

5. Internal Radio

tBase is equipped with a 5Watt digital radio that supports integrated transmission and reception. Users can choose to support three power levels: low power (1W), medium power (2W), and high power (5W).

Note: Each time you set the data link to the internal radio, you need to install the radio antenna in advance. Please open the UHF radio cover on the top of the hood and then install it.

5.1 Radio Protocol

The device currently supports the following 10 radio protocols, which you can change according to your needs.
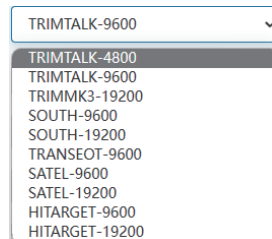
5.2 Default Channel Frequency

The device has 16 default channel frequencies, and the frequency of each channel supports custom configuration modification.

aisle	Frequency/MHz
1	463.105
2	464.125
3	465.125
4	466.125
5	463.625
6	464.625
7	465.625
8	466.625
9	463.375
10	464.375
11	465.375
12	466.375
13	463.875
14	464.875
15	465.875
16	466.875

6. Technical Indicators

ITEM		SPECIFICATION	REMARKS
HARDWARE SYSTEM		**ARM Cortex-A7 1.8GHz**	
	OS	**Linux**	
GNSS	GPS	L1 C/A, L1C, L2P(Y), L2C, L5	PPP-B2b, PPP-E6, SBAS supported
	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*	Requires firmware support
	Channel	1408	
	Standard Output	NMEA-0183	
	Correction I/O Protocol	RTCM 3.X	
	Frequency	20Hz(max)	
	Reacquisition Time	<1s	
	Cold Start Time	<40s	
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）	
	Timing Precision（RMS）	20ns	
	Static Mode Precision (RMS)	Horizontal: ±（2.5mm+1ppm）Vertical: ±（5mm+1ppm）	
	Velocity Estimation（RMS）	0.03m/s	
	Tilt Correction（Within 60°）	<2cm	
	Laser Measurement	The three-dimensional accuracy of laser tilt measurement within 5m: no more than 2.5cm	
SYSTEM PLATFORM	Bluetooth	BR+EDR+BLE	
	WIFI	802.11 b/g/n	
	Network	LTE FDD: B1/2/3/4/5/7/8/12/13/18/19/20/25/26/28 LTE TDD: B38/39/40/41 WCDMA: B1/2/4/5/6/8/19 GSM: B2/3/5/8	
	Radio	Integrated high-power transceiver Frequency Range: 410~470MHz Power: 1W/2W/5W Protocols: TRIMTALK, TRIMMK3, SOUTH, TRANSEOT Air Baud Rate: 9600, 19200	
	Storage	32GB storage	
INDICATOR	Power Indicator	Indicates power and charging status	
	Differential Signal Indicator	Indicates differential signal transmission status	
	Satellite Indicator	Indicates satellite reception status	
	Bluetooth Indicator	Indicates Bluetooth connection status	

BATTERY/CHARGE	Capacity	7.2V, 13800mAh	
	Endurance	Over 12 hours (5W Radio, Base)	TBD
	Charging	Supports USB PD 15V/2A and 5V/3A	With adaptive dynamic current adjustment
ENVIRONMENT	Operating Temperature	-20℃~+60℃	
	Storage Temperature	-40℃~+85℃	
	Shock Resistance	Can withstand a 1.5m drop at normal temperatures	
	Protection Rating	IP68	
PHYSICAL	Materials	Magnesium alloy casing with ABS/PC plastic top cover	
	Dimensions	Φ174.9 * 104.9mm	
	Weight	1500g	
ACCESSORIES	tBase	1 Unit	
	Power adapter	1 PCS	
	Type-C To Type-C	1 PCS	
	Radio Antenna	1 PCS	