tSurvey1.0 User Manual

（Android platform）

Catalog List

Ⅰ Overview

1.1 Introduction

tSurvey1.0 software is an engineering surveying application software developed based on GNSS high-precision position application. The developers have accumulated years of surveying and marketing experience, combined with the usage habits of a large number of industry users and the integration of Android operating habits, developed high-precision position survey collection, point stakeout, line stakeout, road design and stakeout, CAD mapping and stakeout, and simple operation. The software has the characteristics of simple and user-friendly operation process, powerful road design and construction stakeout functions, powerful CAD mapping functions, and convenient display of function menus for users to customize designs.

The following is an introduction to the basic functions of the software: the software mainly includes four parts: project, Device, Survey, and tools.

1.1.1 Project

This section mainly focuses on project configuration, project data manager, and software settings related operations, including Project manager, Localization, Calibrate Point, Coordinate system, Points library, Code library manager, Import data, Export data, Offset point correction, Grid to ground, Survey range settings, Layers settings, Software settings, About software, other functions.

1.1.2 Device

This section mainly focuses on connecting high-precision GNSS devices and setting up related operations, including Communication, Rover, Base, Static, Device information, Device settings, satellite star maps and positioning information viewing, and other functions.

1.1.3 Survey

This section mainly uses GNSS location for field data survey, stakeout, and industry application related operations, including Point Survey, Detail Survey, Control point Survey, Point stakeout, CAD mapping, CAD stakeout, Polyline survey, Polygon survey, Line stakeout, DSM stakeout, Road design and stakeout, Electric lines survey, Electric Towers stakeout, Function customization, and other functions.

1.1.4 Tools

This section mainly includes some commonly used practical tools related to measurement field work, including Coordinates converter, Angle Converter, Perimeter and area, Volume calculation, File sharing, Calculator, Average calculation, Coordinate positive calculation, Coordinate inverse calculation, Point line calculation, Circle center calculation, Add offset to points at specified period, Vector, Two lines angle, Intersection calculation, Resection, Forward intersection, Offset point calculation, Extension point calculation, Equal point calculation and other functions.

1.2 Installation and uninstallation

Installation process:

1. Download the Android tSurvey 1.0 software installer (*. apk).

2. Copy the tSurvey 1.0 software installation program to your phone (PDA) device. Find the software installation program in the file management of the handheld device and click on it to install.

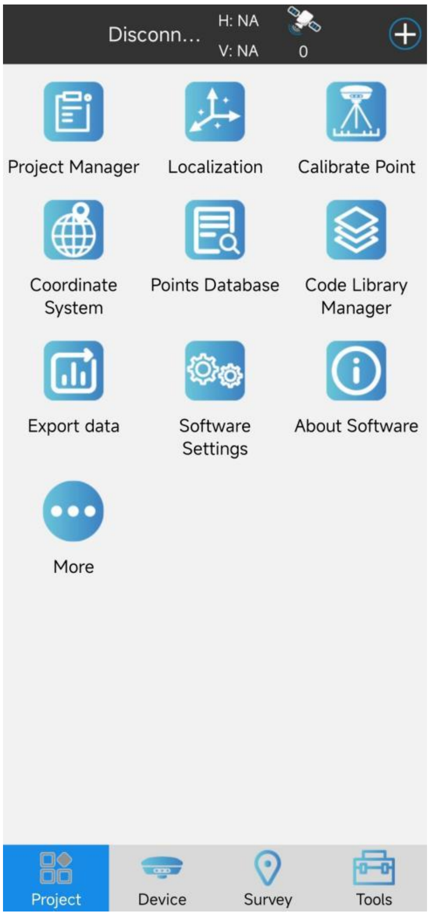
3. Click on the desktop tSurvey software to enter the software (the first time you enter, you need to create a project first, and after each startup, the software will automatically open and use the project finally).

Uninstallation process:

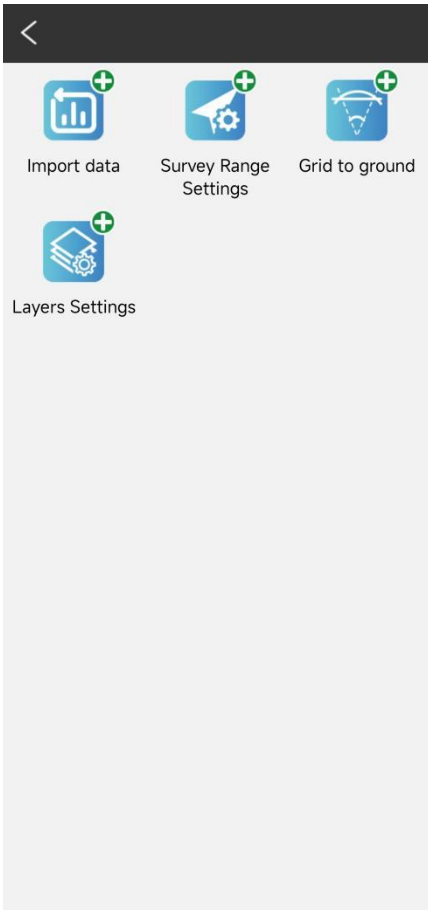
Method 1: Long press the icon of the software on the desktop, drag it to the [Uninstall] option box, and click "OK" to complete the software uninstallation.

Ⅱ Project

Enter the main interface of the software and click on [Project], as shown in 2-1 and 2-2. The project includes project manager, Localization, Calibrate Point, Coordinate system, Points library, Code library manager, Import data, Export data, Offset point correction, Grid to ground, Survey range settings, Layers settings, Software settings, About software, other functions.The interface layout can be edited. Long press the function icon to remove the function, drag the function position order, and click "More" to add the function to the main interface, as shown in 2-2.



2-1



2-2

All data and operations of the software are stored and managed on an engineering project basis. After entering the software for the first time, a project must be created first. Every time you enter the software in the future, the software will automatically load the last used project. Each project is stored in the corresponding directory (default location: internal storage ->tSurvey ->Project) as a folder with the project name. The basic information of the project is stored in the "<Project Name>.Job", and other data is stored in the corresponding directory file.

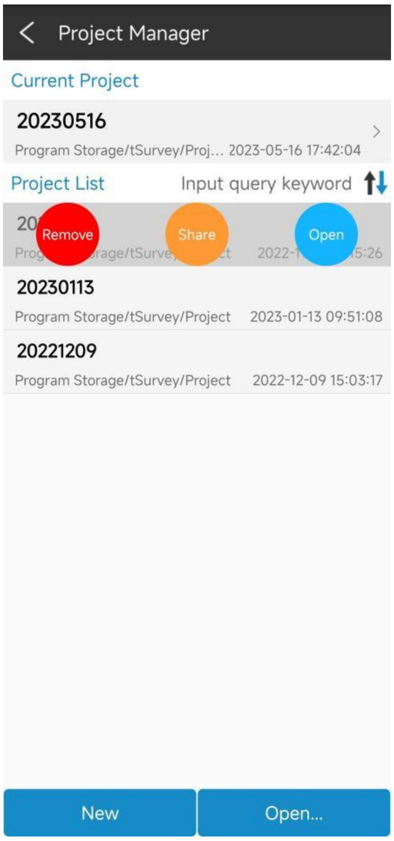
2.1 Project Manager

Click on [Project] ->[Project Manager], as shown in 2.1-1. Project manager includes functions such as creating new projects, removing projects, opening projects, and opening disk projects outside of the list.

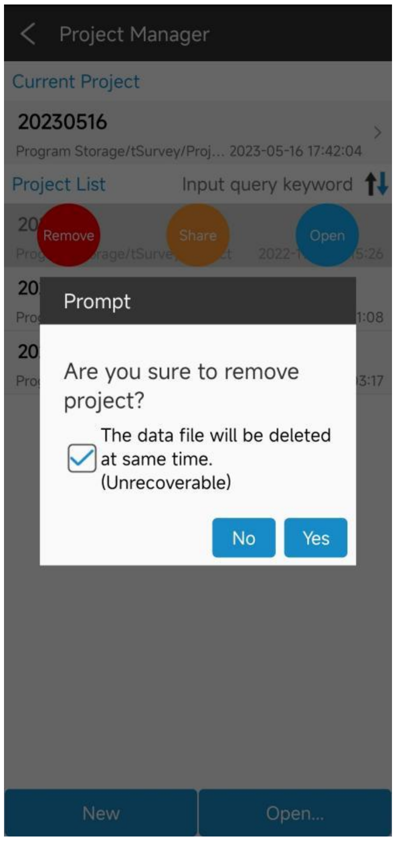
Clicking on the project shown in the project list will bring up the functions of remove, share, and open, as shown in 2.1-2. Click on "Remove", as shown in 2.1-3, to remove the item from the list. If you check "The data file will be deleted at the same time.", the data of the item on the disk will be deleted. Otherwise, it will only be removed from the list and can be opened in other projects in the future; Click on "Share", as shown in 2.1-4. Other PDA can obtain project data through share code or scan QR code.

Click no "New", as shown in 2.1-5. To create a new project, you need to fill in basic information such as project name, operator, and project description. You can also modify the project's path on the disk (default to internal storage ->tSurvey ->Project directory), click Next, fill in the coordinate system parameters used to modify the project, as shown in 2.1-6. Click "OK" to complete the project creation.

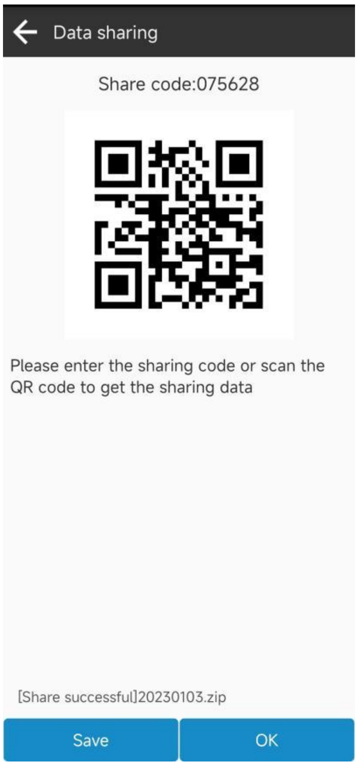
2.1-1



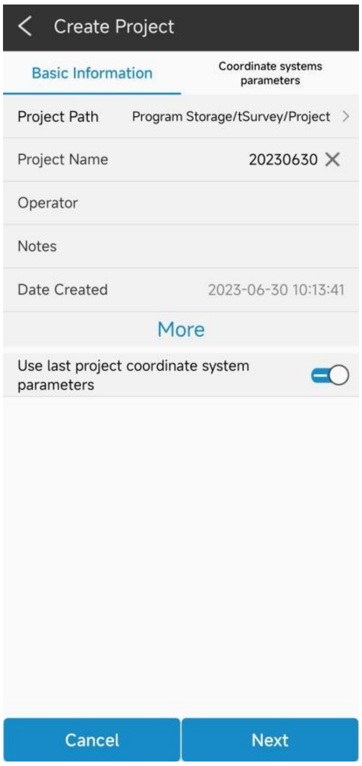
2.1-2



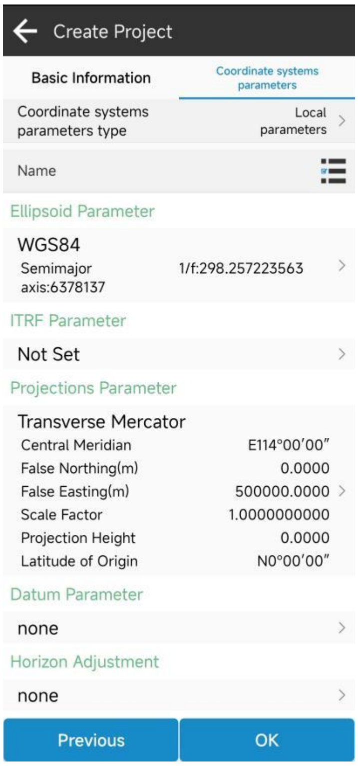
2.1-3



2.1-4



2.1-5



2.1-6

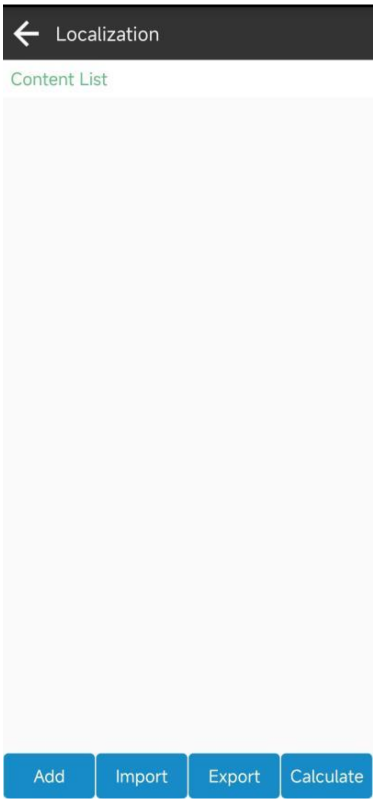
2.2 Localization

Click on [Project] ->[Localization], as shown in 2.2-1. The high-precision position obtained by the software from GNSS equipment is the latitude and longitude coordinates of positioning, but in practical engineering operations, the final use of ground plane coordinates for survey and applications is necessary. If the customer has coordinate conversion parameters, they can directly set the coordinate system parameter values in the coordinate system (detailed 2.4). If the customer does not have specific coordinate system parameters, but the corresponding values of longitude and latitude coordinates and plane coordinates are called control points. In the presence of control point data, conversion parameters can be calculated through this function and applied to engineering projects.

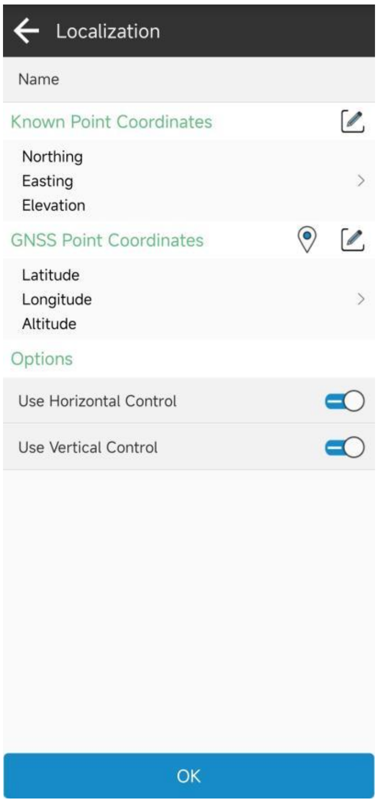
In the Localization, you can manually enter and add control points, as shown in 2.2-2. You can also import control point parameters in multiple formats, as shown in 2.2-3. The commonly used formats are listed, and you can set or cancel a certain format in the format management according to user needs, as shown in 2.2-4. You can also add custom formats, as shown in 2.2-5. In the control point list, click on the data item to modify and edit the control point parameters. Long press on the data item to select multiple and all data items. After selecting, the entire data item can be deleted, as shown in 2.2-6. You can also export control point data as a file and provide it to third-party software for use.

After editing the control point parameters, calculate the conversion parameters for the control point, click "Calculate", and the calculation parameter condition settings will pop up, as shown in 2.2-7. The parameter conversion process includes ellipsoidal reference conversion, horizontal correction, and vertical correction. The conversion parameters that can be calculated can be all or partial combinations, and as long as the corresponding accuracy is achieved within the allowable range of accuracy, the calculated conversion parameters are considered available. The ellipsoidal datum transformation is usually seven parameters, which is the transformation parameter of spatial Cartesian coordinate system between two ellipsoids. The horizontal correction method includes four parameters and horizontal difference parameters, and the elevation correction method includes weighted average, plane fitting, surface fitting and vertical adjustment. Usually, if the work scope is very wide, it is necessary to use ellipsoidal reference conversion to meet the accuracy requirements of all control points. If the work scope is relatively small, the corresponding accuracy can be achieved through plane correction.

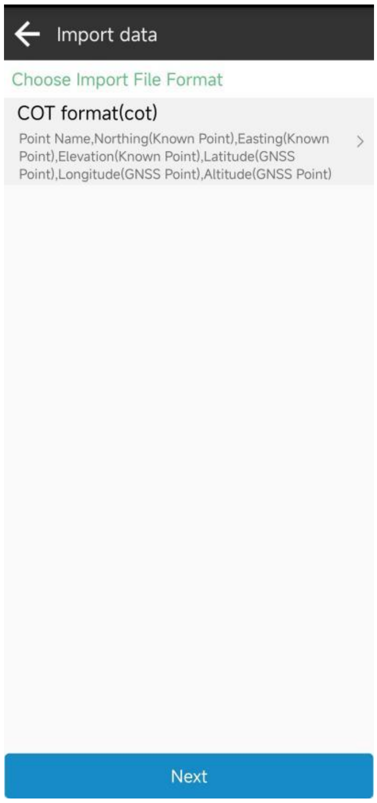
After configuring the calculation conditions, click "Apply" to display the conversion parameter calculation results and the residuals for each control point, as shown in 2.2-8. After calculating the conversion parameters, a calculation report can be exported for project review and inspection. If the conversion parameters are qualified, the parameters can be applied to the engineering project and normal survey and stakout operations can be carried out.



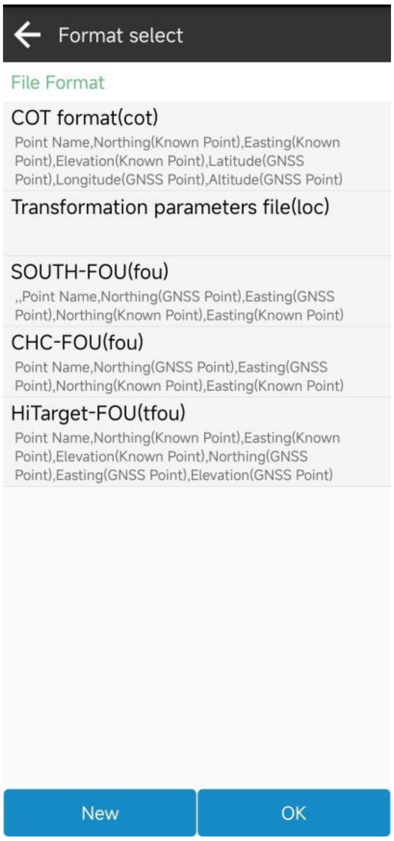
2.2-1



2.2-2



2.2-3



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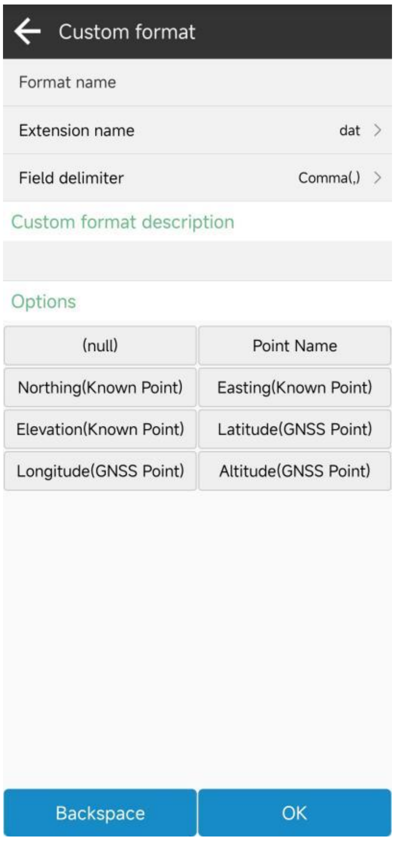

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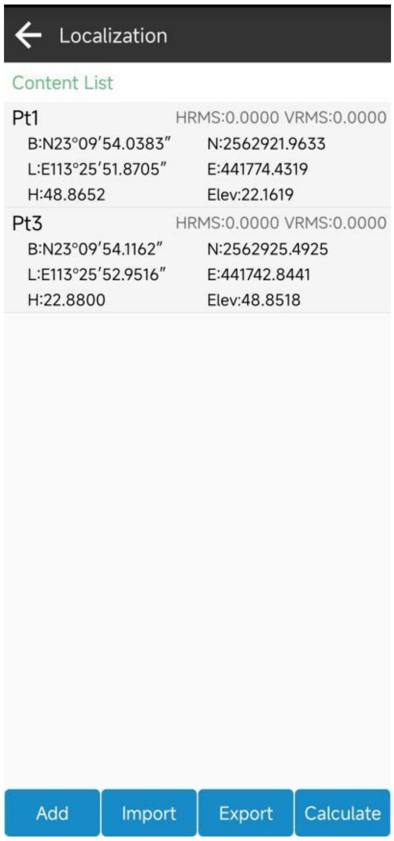
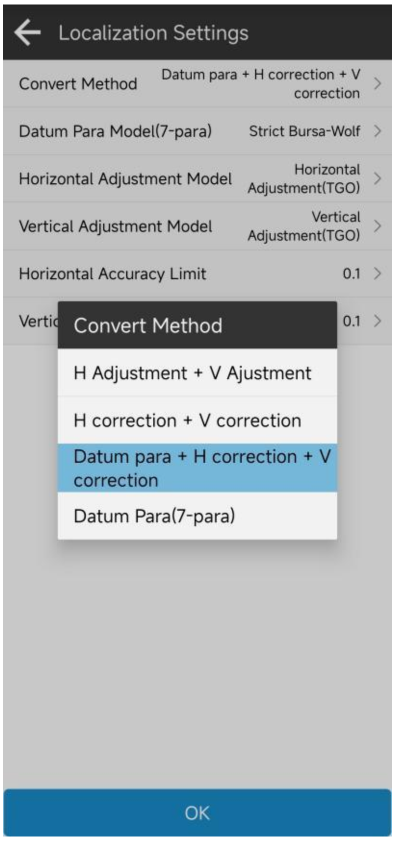
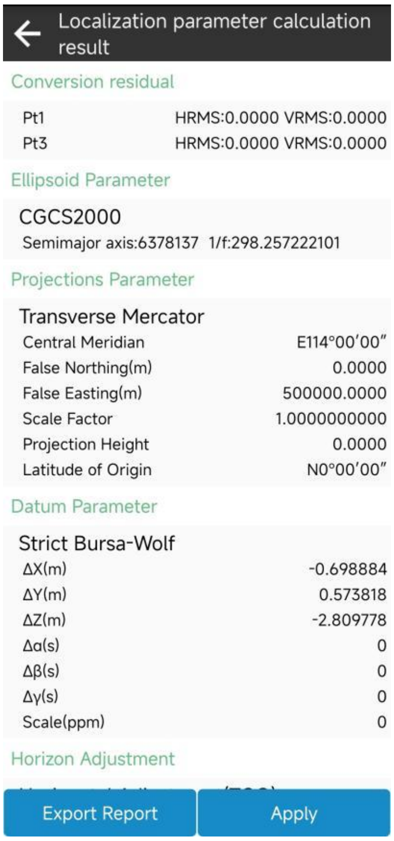


2.2-6



2.2-7



2.2-8

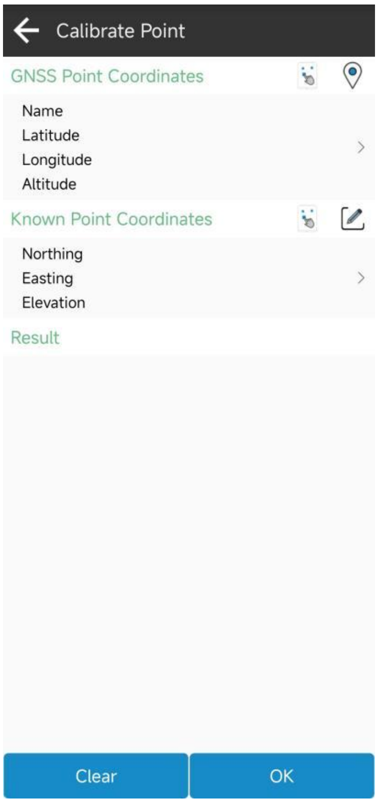
2.3 Calibrate Point

Click on [Project] ->[Calibrate Point], as shown in 2.3-1. In practical applications, the GNSS device obtains high-precision positions through the combination of differential data from the reference station. Here, we understand that the coordinate positions of the reference station are known. In fact, the high-precision positions output by the GNSS device are the relative positions of the reference station. In the actual application process, in addition to some users using differential data from CORS reference stations, there are also a considerable number of users using their own GNSS equipment to transmit differential data from reference stations. When using their own station building method to transmit differential data, a project may involve multiple starts of the reference station. When starting the reference station, the starting position and coordinates of the base station may change, and the starting coordinates may not be correct, In the absence of calibration, the coordinates of the rover station obtained using these base station differentials may be incorrect (in the same location, the coordinates survey using previous differential data are different from those obtained using new differential data). Therefore, when the rover station receives new base station differential data for measurement operations, translation calibration needs to be performed to ensure that the coordinates obtained by the software match those obtained by connecting to the previous base station.

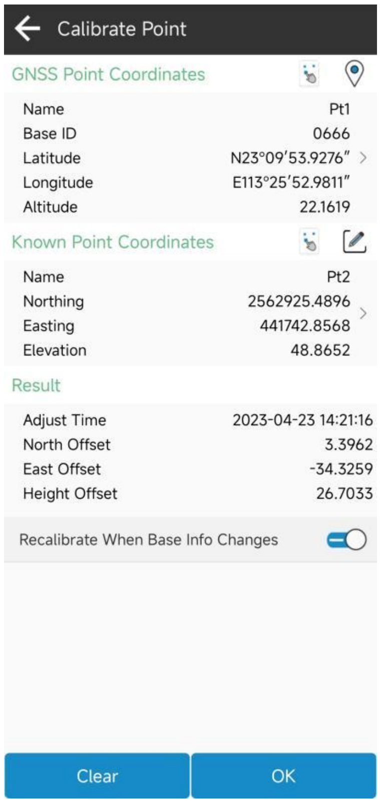
After the start coordinate or start position of the base station changes, it is necessary to use a known position to calibrate the coordinates correctly. Select a known point in the point library (using the coordinates measured by the last base station at a certain location), and then place the GNSS device at the location where the known point is located to survey a new positioning point. Calculate the deviation value, as shown in 2.3-2. After confirming the point, the coordinates received by the software match the coordinates measured last time.

<Recalibrate when base info changes>, If the base station coordinate changes after receiving the differential signal from the self built reference station, it indicates that the base station translation calibration needs to be carried out, and a new translation calibration needs to be carried out.

Note: The CORS Virtual Reference Station is a long-term reference station whose position and starting coordinates will not change. If the differential data of the VRS is used, although the received coordinates may change, the obtained coordinates are still correct, and translation calibration is not required.



2.3-1



2.3-2

2.4 Coordinate System

Click on [Project] ->[Coordinate System], as shown in 2.4-1. The coordinate system parameters are used to convert the longitude and latitude coordinates received by the GNSS device into the plane coordinates required by the user through a certain algorithm. This calculation is converted to set the corresponding parameters, and the conversion results vary depending on the parameters. The entire calculation conversion process is:

1. Original BLH coordinates ->XYZ coordinates of WGS84: use WGS84 ellipsoid parameters;

2. XYZ coordinates of WGS84 ->XYZ coordinates of target ellipsoid: use datum parameters;

3. XYZ coordinates of target ellipsoid ->target BLH coordinates: use target ellipsoid parameters;

4. Target BLH coordinates ->Projection plane coordinates: Use target ellipsoid+projections parameters;

5. Projection plane coordinates ->Target plane coordinates: Use Horizon adjustment+Vertical adjustment parameters;

Click on "Ellipsoid Parameters" to enter the ellipsoid management interface, as shown in 2.4-2. Select the desired ellipsoid from the ellipsoid list, or add or delete ellipsoid parameters.

Click on "Projection Parameters" to enter the projection parameter editing interface, as shown in 2.4-3. You can choose Transver mercator projection, UTM projection, oblique stereographic projection, double stereographic projection and other projection methods. If it is Transver mercator projection, enter the Central meridian, False northing, False easting, Scale factor, Projection Height and other parameters.

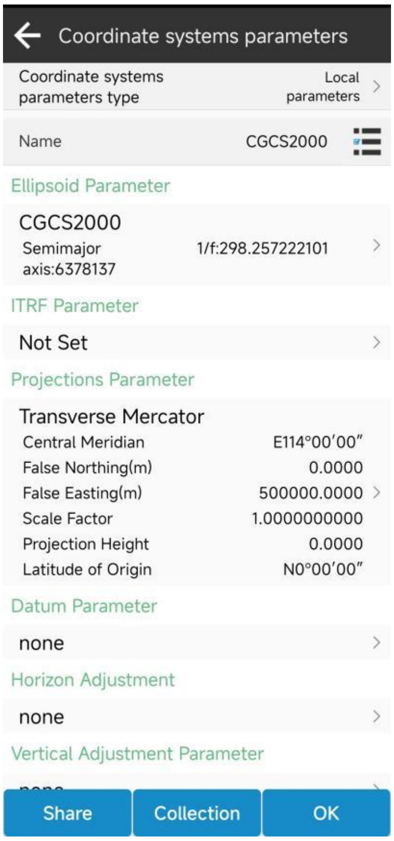
Click on "Datum Parameters" to enter the Datum Parameter Editing interface, as shown in 2.4-4. The transformation model includes Bursa-Wolf, Bursa-Wolf (with the origin), Strict Bursa-Wolf, Helmert, Molodensky, etc.

Click on "Horizon Adjustment" to enter the horizon adjustment parameter editing interface, as shown in 2.4-5. The transformation model includes four-parameters and a horizontal adjustment(TGO) model. It also supports grid conversion file conversion, importing grid offset files, and correcting coordinates based on the location of the conversion point in the grid.

Click on "Vertical Adjustment Parameters" to enter the vertical adjustment parameter editing interface, as shown in 2.4-6 and 2.4-7. The conversion model includes Fixed height correction, Surface fitting, and Vertical adjustment(TGO) models. It also supports the conversion of geoid files, importing geoid files, and correcting coordinate elevations based on the conversion point at the location of the geoid. The geoid file management interface, as shown in 2.4-8, allows users to import, remove, and other operations, and select the geoid file to use for parameter settings.

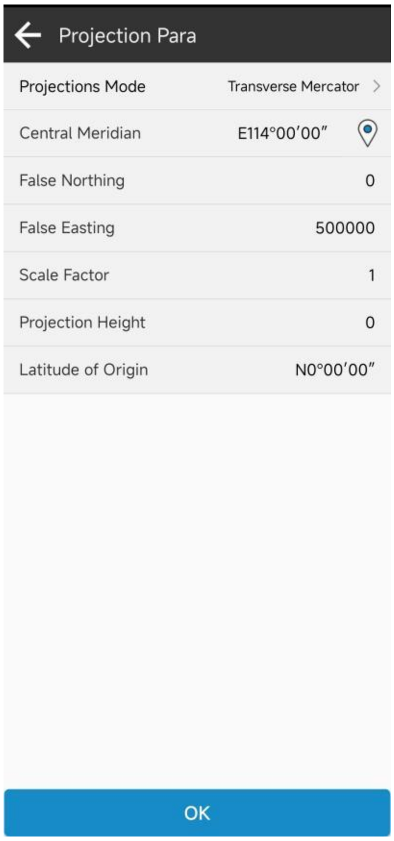
Click on "Local Offsets" to enter the local offsets parameter editing interface. In small-scale operations, sometimes there is only one control point, which can be converted from the projection plane coordinates to the target plane coordinates by simply performing translation transformation. This can be set here. The difference between the translation parameters here and the base station translation calibration is that the coordinate system parameter settings here will affect all data of the entire project. If there is a change, the conversion of longitude and latitude coordinates to plane coordinates will be recalculated, while the base station translation calibration will only affect the survey coordinates after the calibration operation.

In addition to manually entering coordinate system parameters, you can also click  after the name to select coordinate system parameters from the list of coordinates system favorites. Coordinates system favorites management can be added, imported, or selected from templates, or can be removed by long pressing from the list.

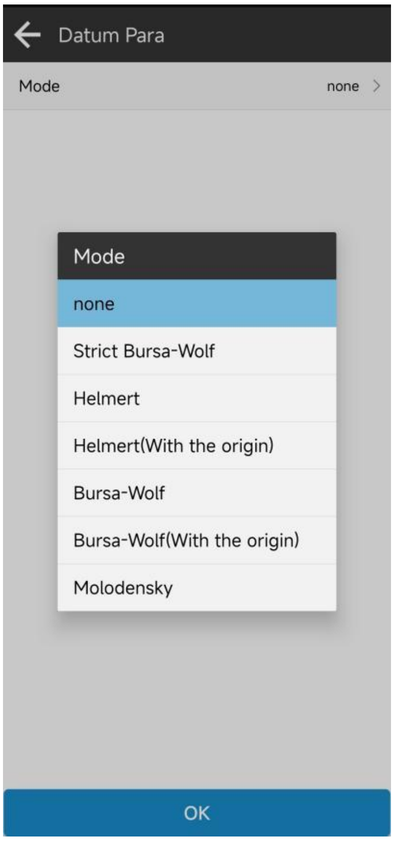


2.4-1

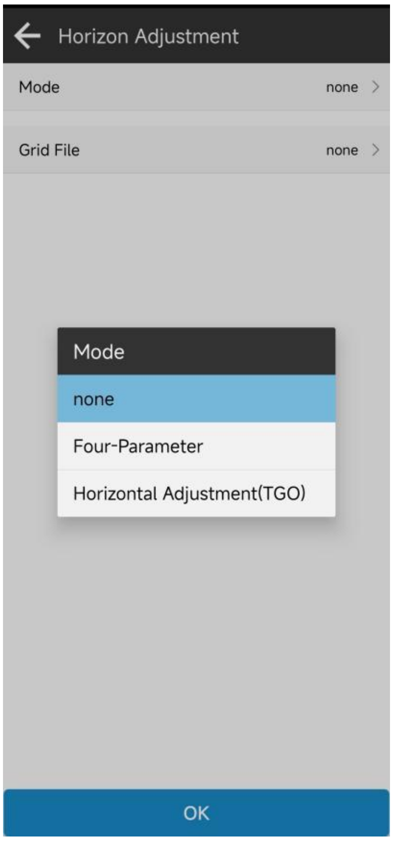
2.4-2



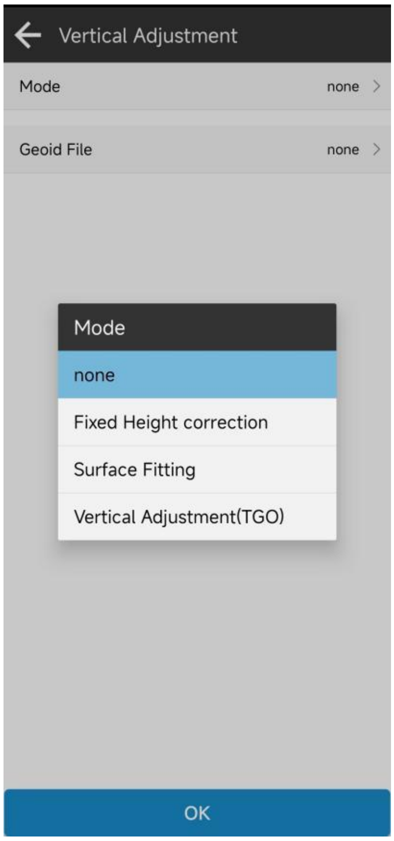
2.4-3



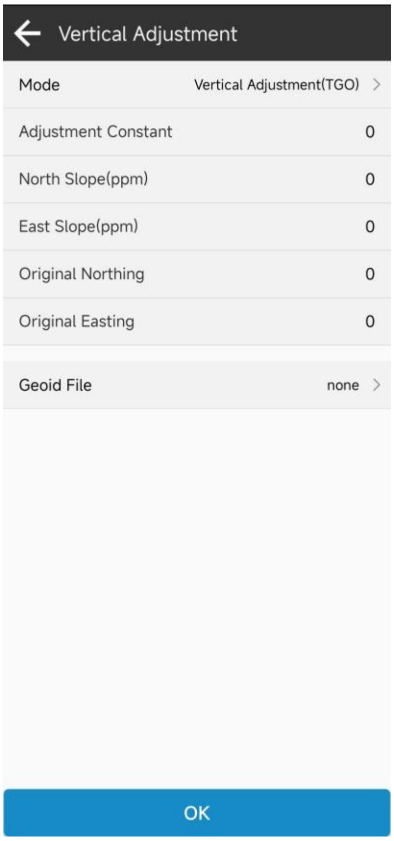
2.4-4



2.4-5



2.4-6



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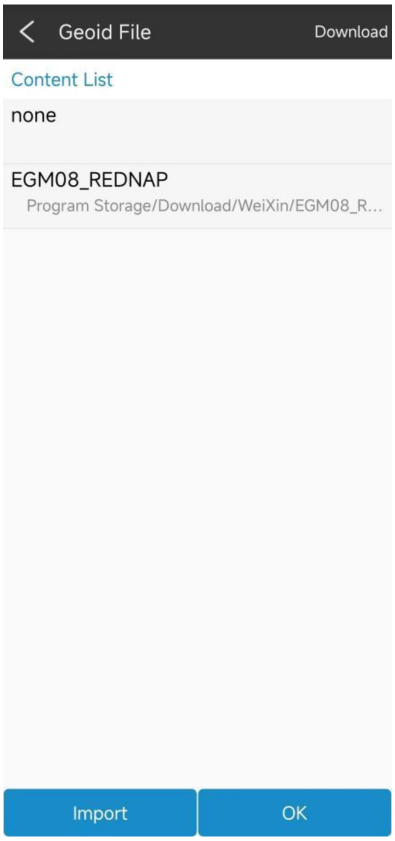
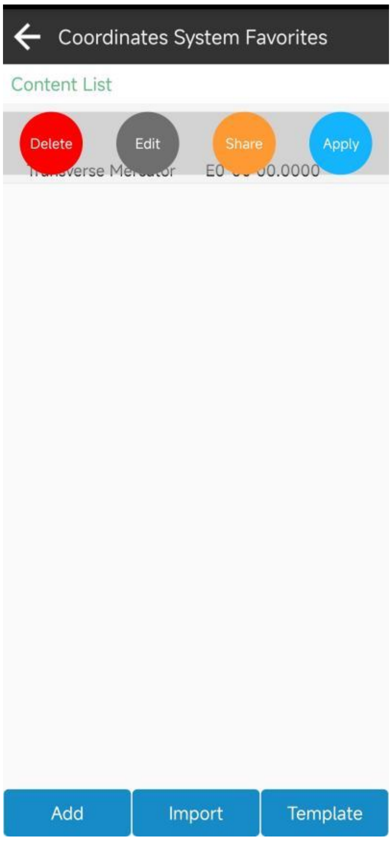


2.4-8



2.4-9

2.5 Points Database

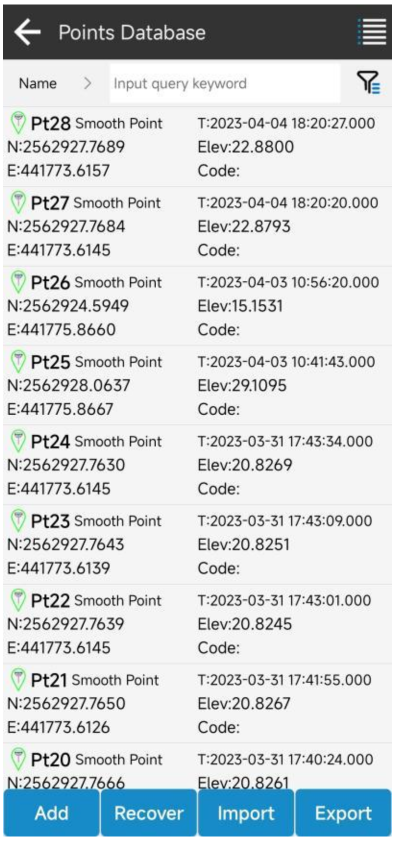
Click on [Project] ->[Points Database], as shown in 2.5-1 and 2.5-2. Here, you can view and manage the point data in the project (you can switch the view mode through the icon in the upper right corner), including functions such as Add, Delete, Share, Recover, View point details, import, and export.

Add: as shown in 2.5-3, manually enter the point name, code, and corresponding coordinates;

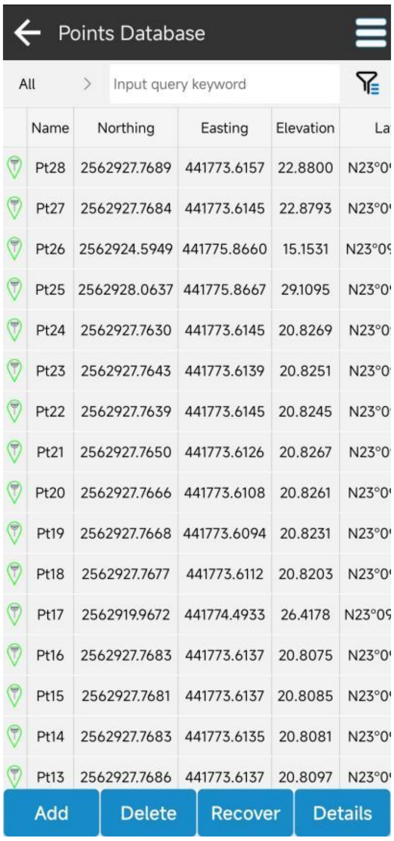
Share and delete: As shown in 2.5-3, you can press and hold to batch select points for deletion and sharing;

Recover: Restore point data that was accidentally deleted;

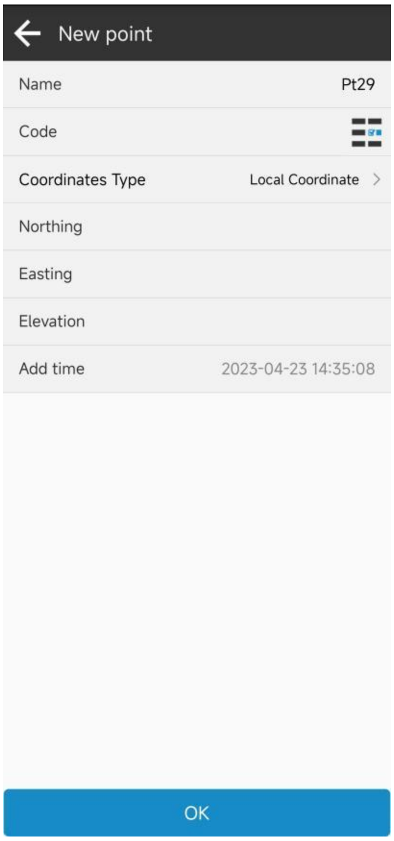
View point details: Click on the data item in the list to view point details, as shown in 2.5-5 (smooth point) and 2.5-6 (control point); You can also modify the point name and code information, and for control points, you can also export and generate control point reports here.



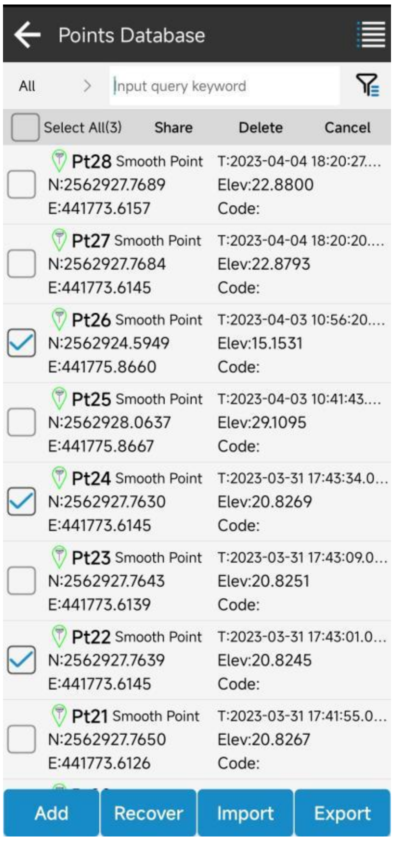
2.5-1



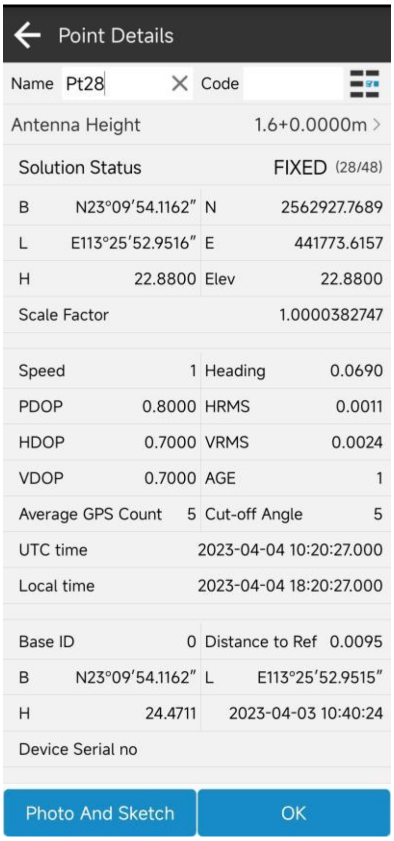
2.5-2



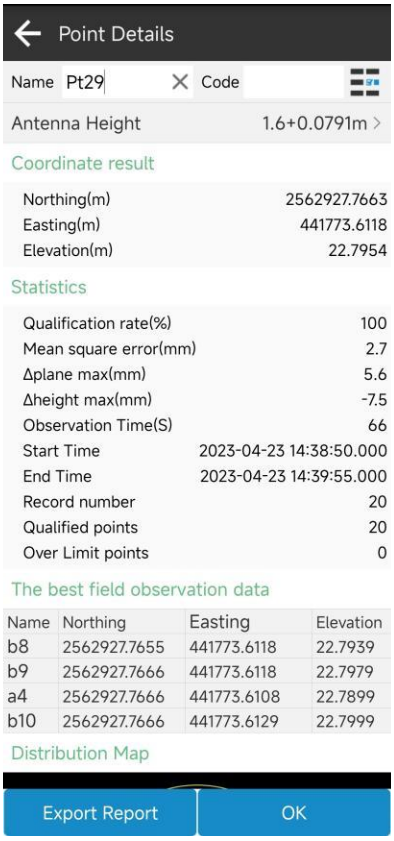
2.5-3



2.5-4



2.5-5

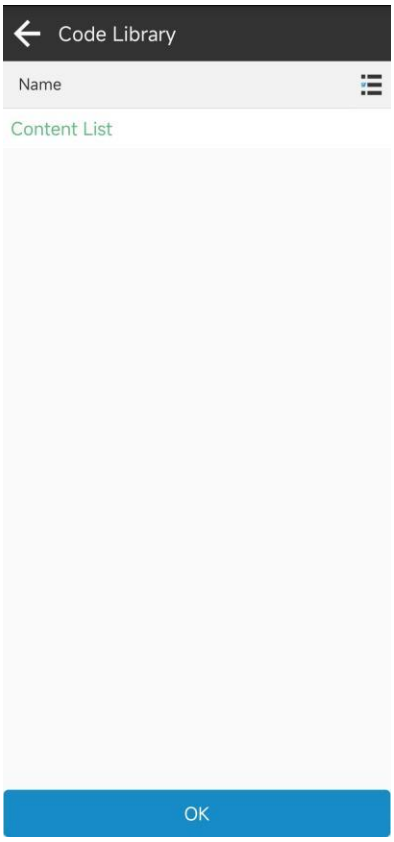


2.5-6

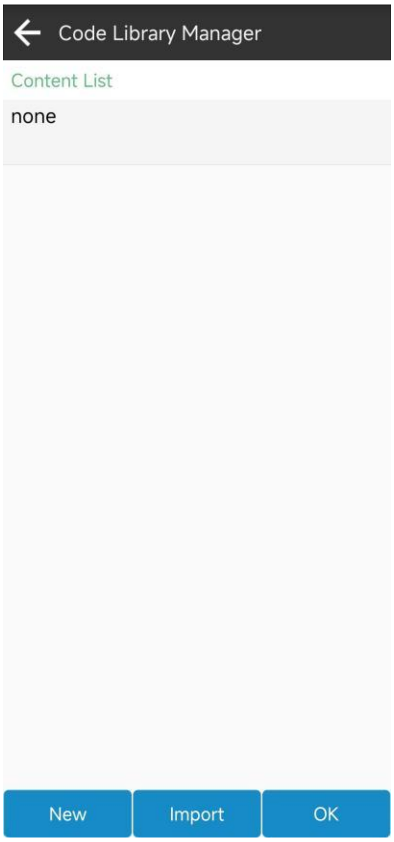
2.6 Code Library Manager

Click on [Project] ->[Code Library Manager], as shown in 2.6-1. The code library is a predefined collection point code attribute for external businesses, which can be quickly filled in with code values through visual name description selection.

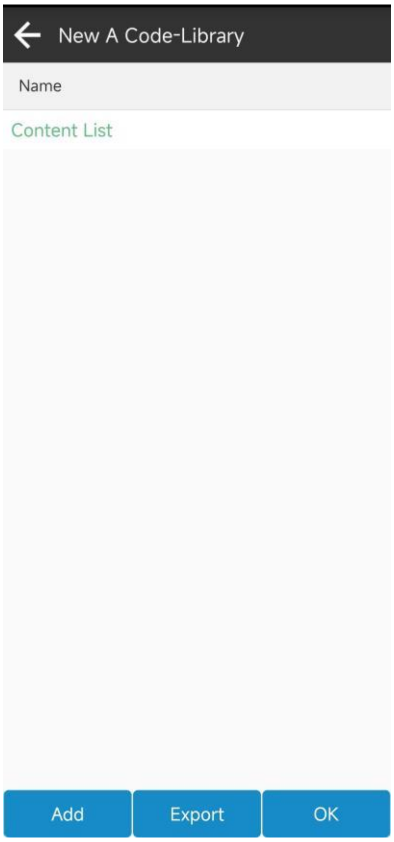
In the code library manager, as shown in 2.6-2 and 2.6-3, select the code library that needs to be used in the application project. You can add, import, delete, share, apply, and other management operations to the code library, manually enter and add the code library, as shown in 2.6-4 and 2.6-5. In addition to filling in the collection points for coding, you can also set the corresponding symbols, coding groups, and automatic mapping settings for coding. After defining the coding mapping type, you can automatic mapping of line, polyline, and polygon while survey points. You can also set the layer and color of the map.



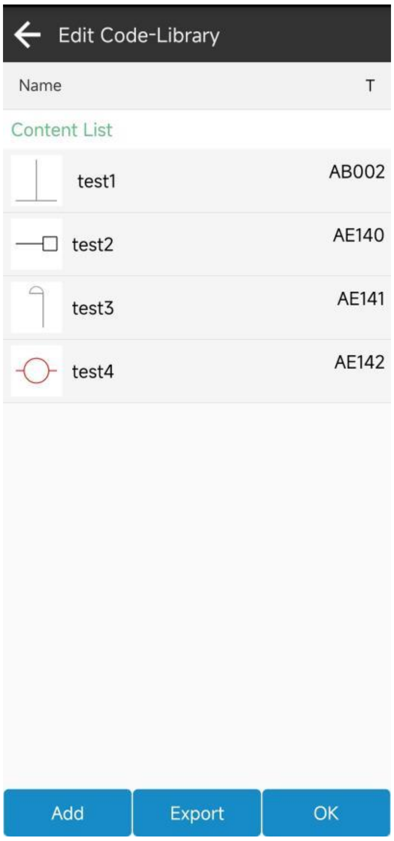
2.6-1

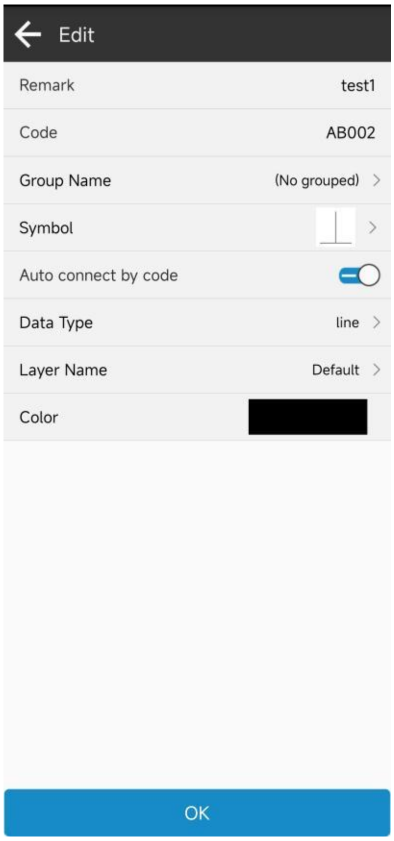


2.6-2



2.6-3

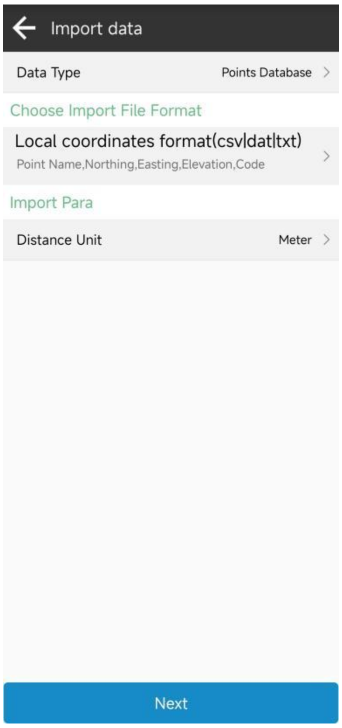




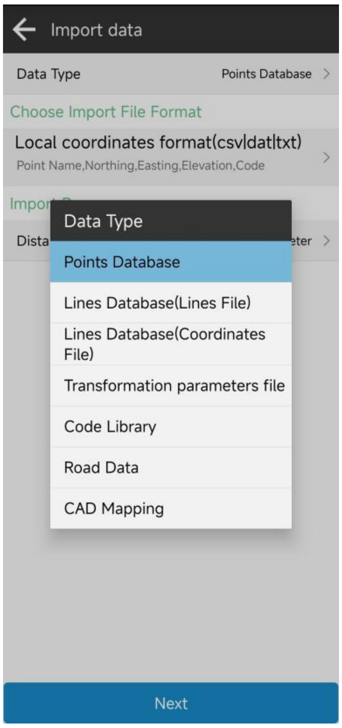
2.6-4 2.6-5

2.7 Import data

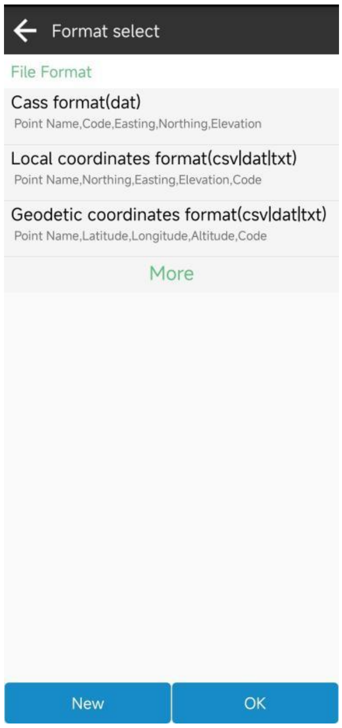
Click on [Project] ->[Import data]. This function is a unified entry point for data import, where you can import coordinate Points database, Line database, Transfermation parameter files, Code library, Road data, etc. Select the import data type and import format, and then select the import file to import the relevant data. You can also import corresponding data into the corresponding functions. as shown in 2.7-1, 2.7-2 and 2.7-3.



2.7-1



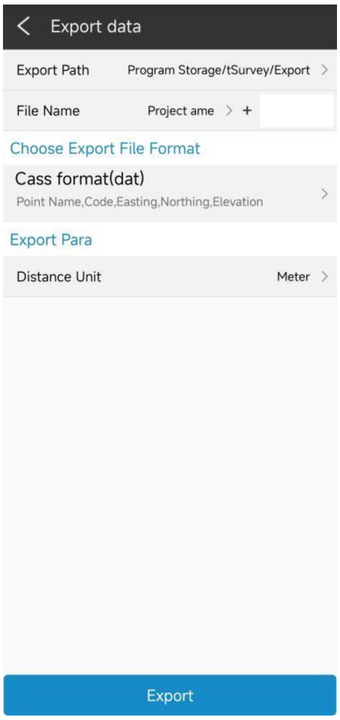
2.7-2



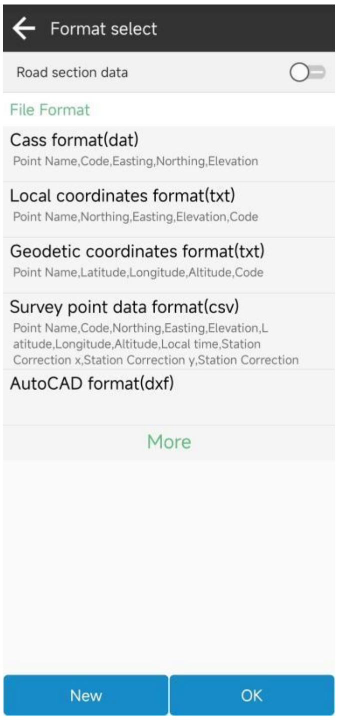
2.7-3

2.8 Export data

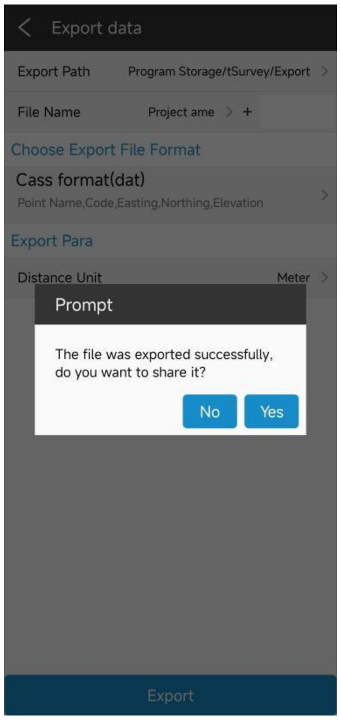
Click on [Project] ->[Export data]. This function is the same as the export function in the coordinate points Database, except for the function entry at different positions, as shown in 2.8-1, 2.8-2 and 2.8-3.



2.8-1



2.8-2

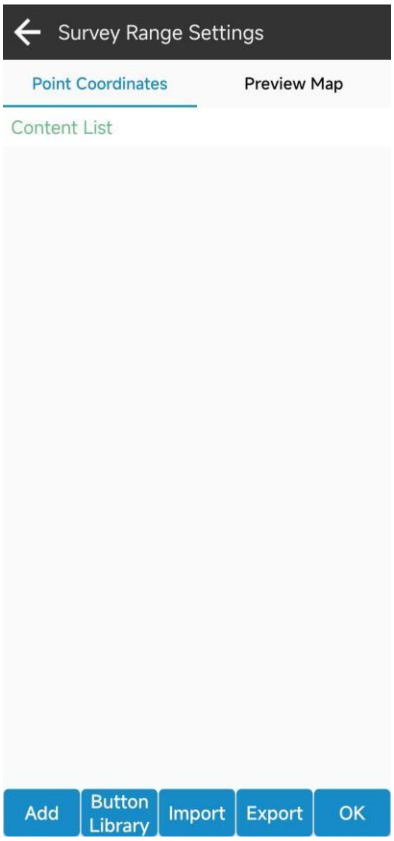


2.8-3

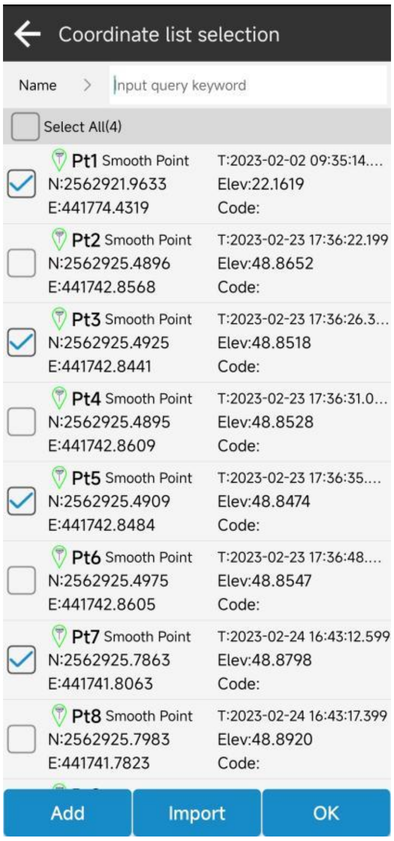
2.9 Survey Range Settings

Click on [Project] ->[Survey Range Settings], as shown in 2.9-1. This function sets a certain coordinate range to determine in real time whether the current position is within the range of the field survey operation. If it exceeds this range, it promptly reminds the user of the scope of the operation that has already been exceeded, avoiding the user from doing work beyond the scope of work.

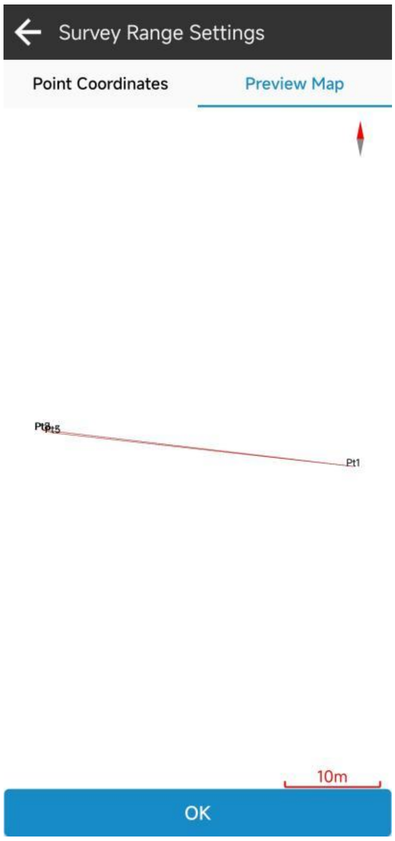
The editing and management of the survey range can include adding coordinates, batch selecting from the points database, as shown in 2.9-2, and importing and exporting the coordinates of the survey range; The range of the survey area can be previewed through a preview image, as shown in 2.9-3.



2.9-1



2.9-2



2.9-3

2.10 Grid to Ground

Click on [Project] ->[Grid to Ground], as shown in 2.10-1. This function is to calculate the grid correction factor of this position through a datum reference point, correct other points in the coordinate point library, make the points of GNSS survey coordinates match with the points of total station, and export the corrected coordinates in data export.

2.10-1

2.11 Layers Setting

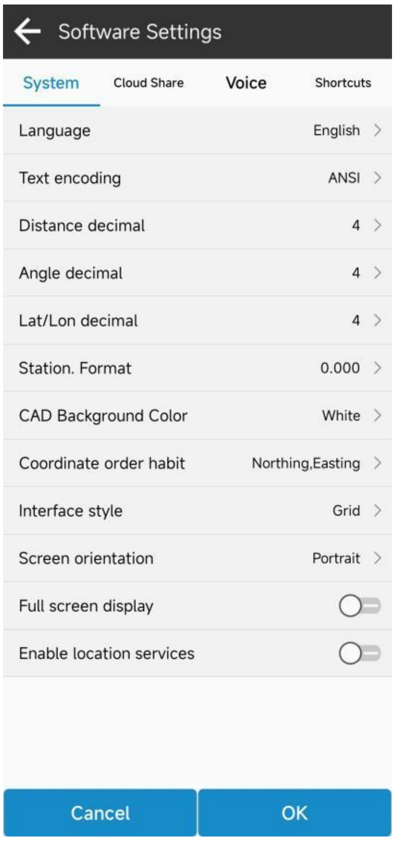
Click on [Project] ->[Layers Settings]. This function is to import a background map as a reference map for survey operations, supporting formats such as dxf/dwg, shp, and xml.

2.12 Software Settings

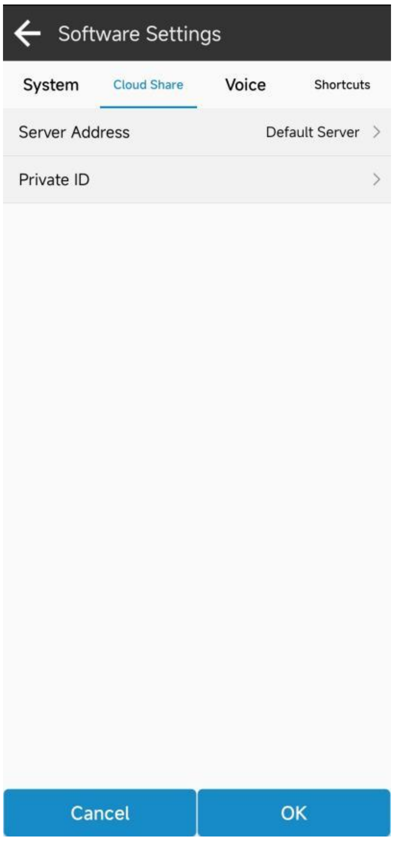
Click on [Project] ->[Software Settings], as shown in 2.12-1, 2.12-2, 2.12-3, and 2.12-4. Settings include system settings, cloud sharing settings, voice settings, and shortcuts settings.

System settings: As shown in 2.12-1, it mainly includes settings such as Language, Text encoding, Station. format, Coordinate order habit, Interface style, Screen direction, etc.

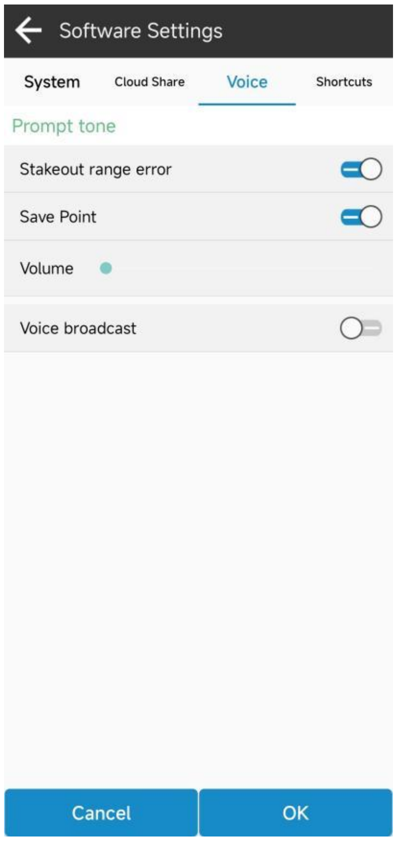
Shortcuts settings: As shown in 2.12-4, the corresponding functions are triggered by the predefined physical keyboard of the notebook, and the shortcut keys are added, as shown in 2.12-5 and 2.12-6. Select the function that needs to define shortcut keys. You can also long press and select to delete a defined shortcuts.



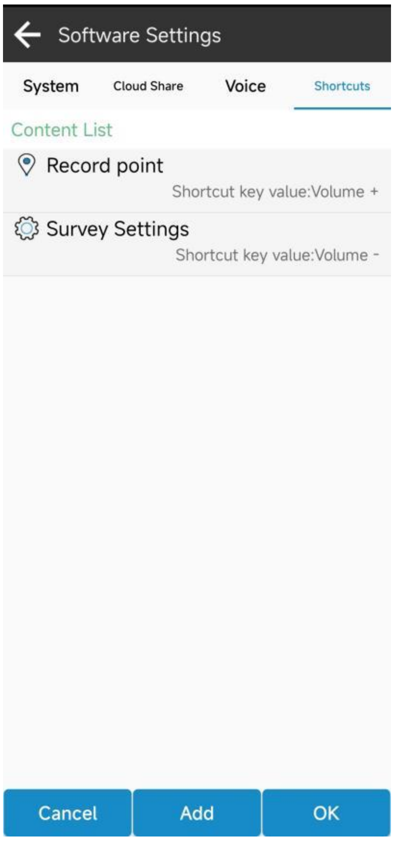
2.12-1



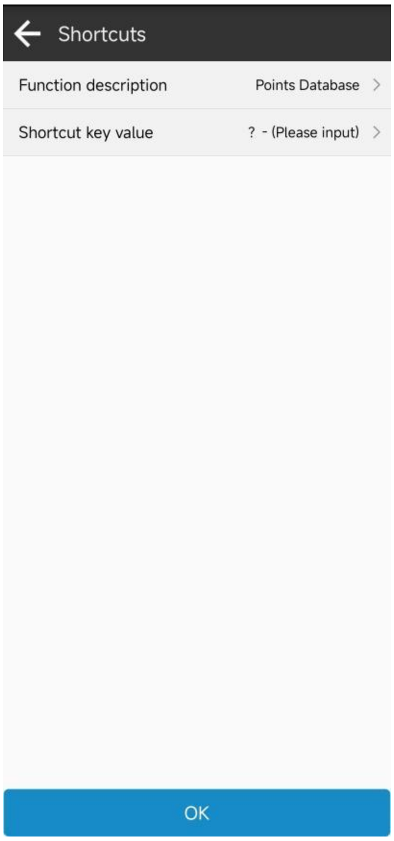
2.12-2



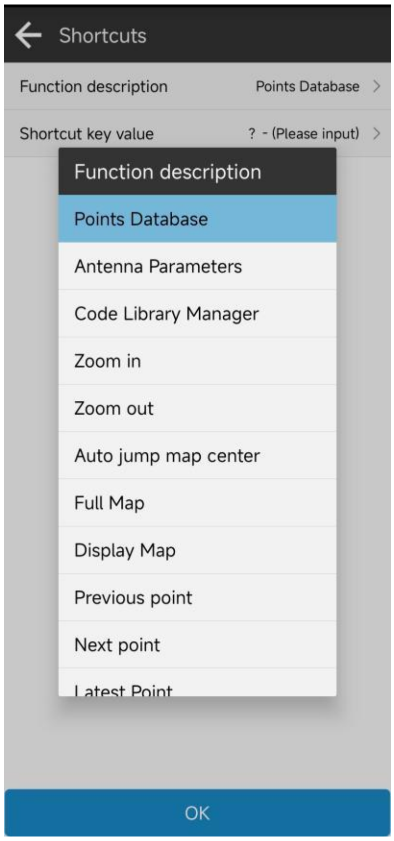
2.12-3



2.12-4



2.12-5



2.12-6

2.13 About Software

Click on [Project] ->[About Software], as shown in 2.14-1. The registration information, version information, copyright information, etc. of the software.

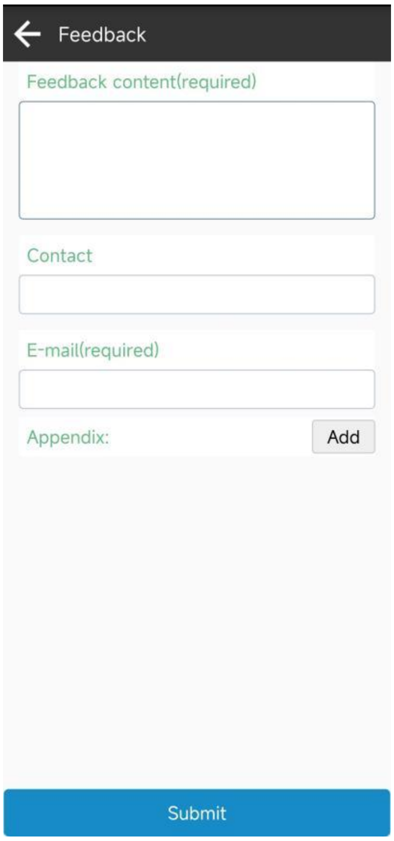
Software activation: As shown in 2.14-2, enter the authorization code here or scan the QR code of the authorization code to activate the software.

Check Latest version: If there is a new version, a new version message will pop up, and clicking Update will update the software to the latest version. If there is no new version, it will prompt that it is already the latest version.

Feedback: As shown in 2.14-3, in order to provide better service to users, if you have any questions during the use of the software, you can feedback them to our technology here, and we will provide you with support as soon as possible. Note: Please leave your contact information (mainly via email), and the problem description should be as complete as possible. If there are attachments (icons, videos, documents, etc.), you can submit them together. Thank you!

2.14-1

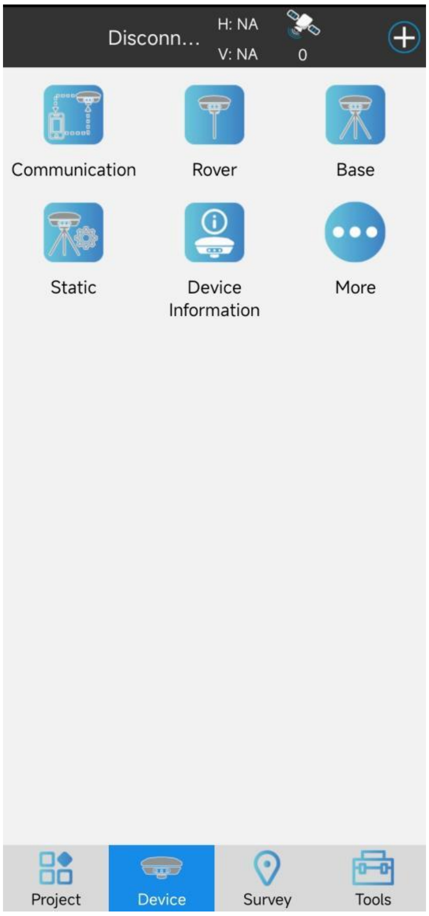
2.14-2



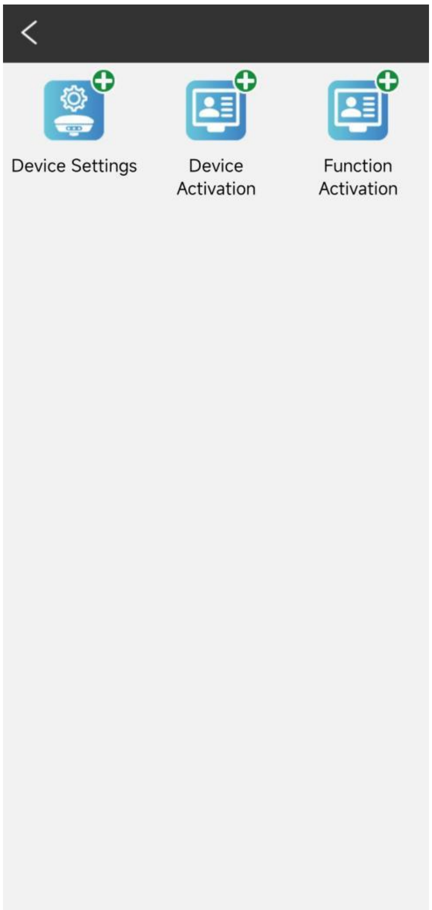
2.14-3

Ⅲ Device

On the main interface of the software, click on [Device], as shown in 3-1 and 3-2. The device includes functions such as Communication, Rover, Base, Static, Inspection accuracy, Device information, Device settings, Restart Positioning, and Device registration.



3-1



3-2

3.1 Communication

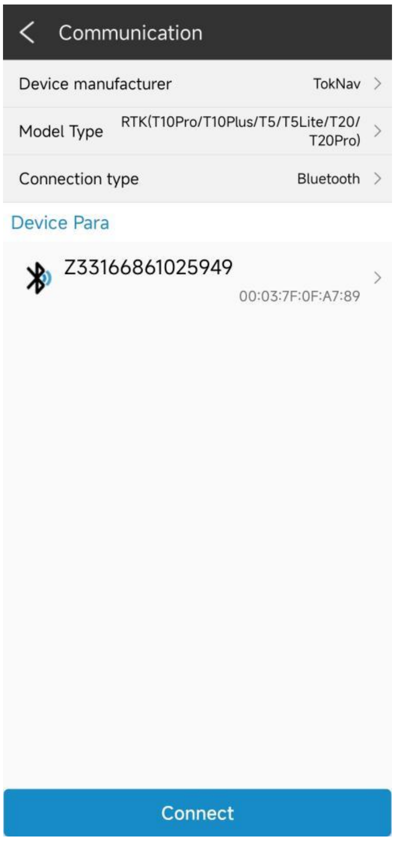
Click on [Instrument] ->[Communication], as shown in 3.1-1. Select the Device manufacturer, Model type, and connection type, then select the device parameters, and click "Connect" to complete the device connection. After successfully connecting the device, it will directly return to the software main interface, as shown in 3.1-4. Enter the communication again, as shown in 3.2-3, and click Stop to connect the device.

1. Device manufacturer: The software supports the access of positioning devices from multiple GNSS manufacturers.

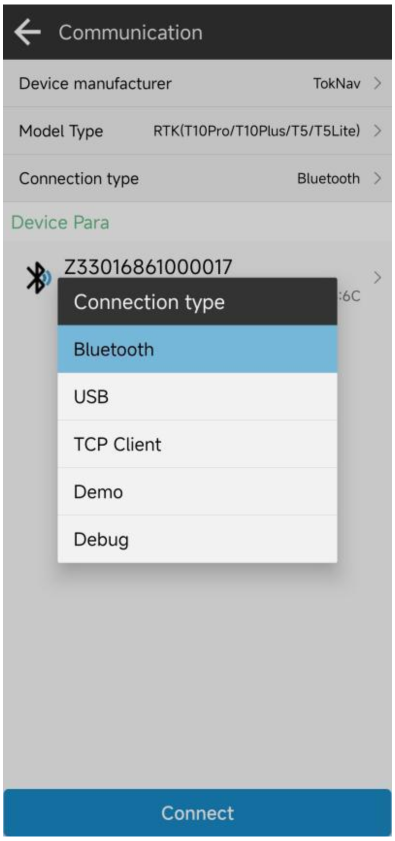
2. Connection type: Include Bluetooth, WIFI, serial port, TCP client, etc., as shown in 3.2-2.

3. Click on the device parameters to enter Bluetooth search and selection, as shown in 3.1-5. You can click on the device to select the device you want to connect to. The list of commonly used devices will display the 5 devices with the highest connection frequency.

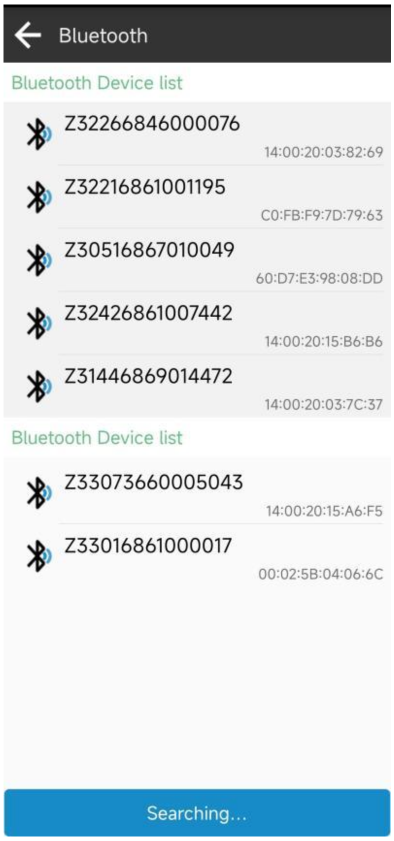
4. After the device is successfully connected, click "Debug" to view the communication data between the software and the device, as shown in 3.1-6. You can send device debugging commands to the device and troubleshoot issues related to device positioning through communication data.



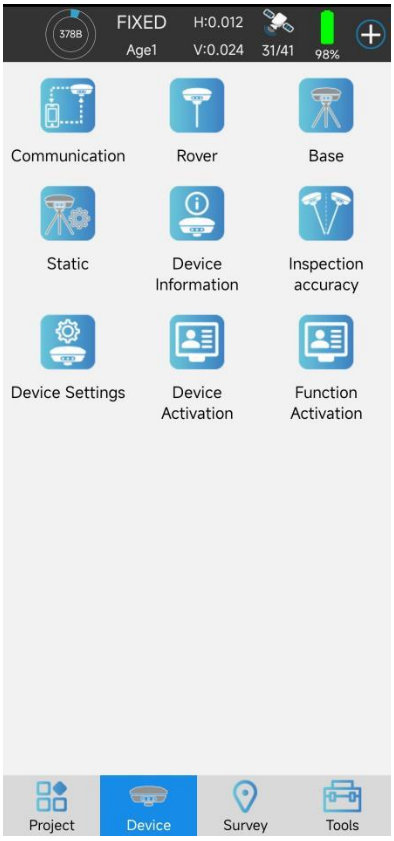
3.1-1



3.1-2

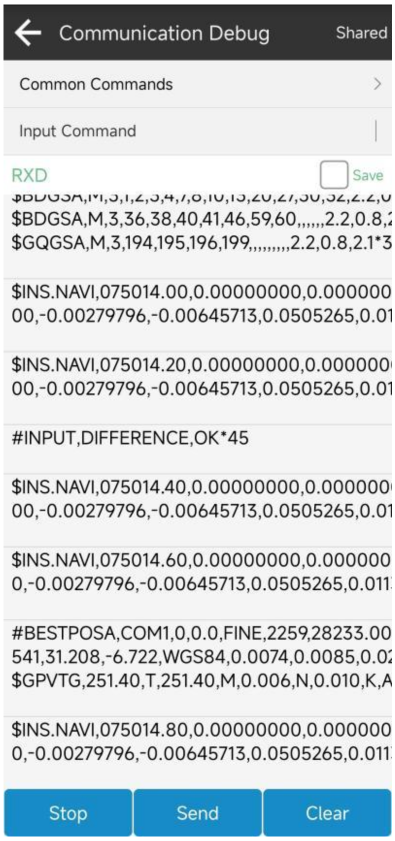


3.1-3



3.1-4

3.1-5

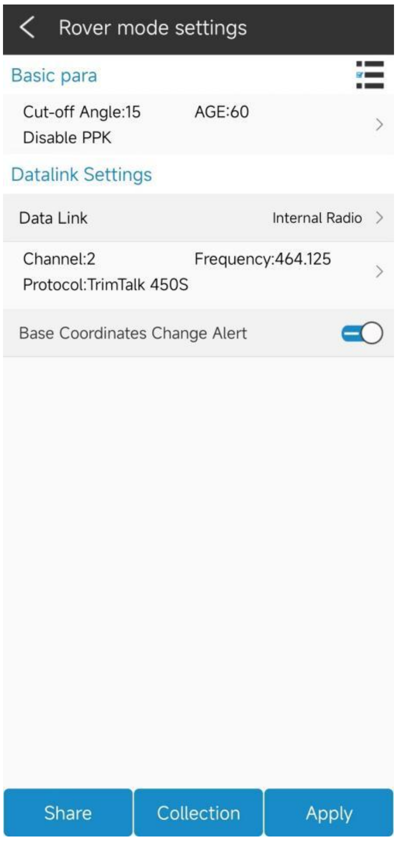


3.1-6

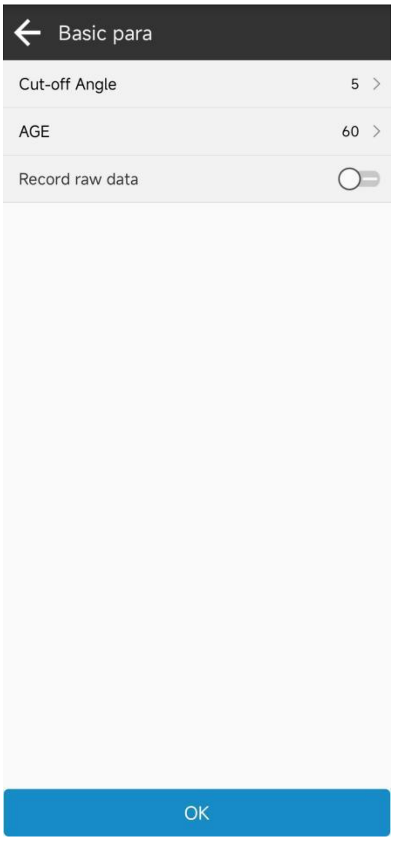
3.2 Rover

Click on [Device] ->[Rover], as shown in 3.2-1. GNSS positioning equipment can calculate positioning coordinates by receiving satellite signals. In the absence of other conditions, due to the influence of the atmosphere on the signal, the positioning equipment can only obtain the coordinate position of a single point solution, with low accuracy. To ensure that GNSS can obtain high-precision positions, in addition to receiving satellite signals to calculate the position, GNSS equipment also needs to receive signals from another fixed GNSS equipment nearby, Using the signal of another device as the reference signal, as the influence of the atmosphere on the signal is basically consistent within a certain area, two sets of GNSS can calculate high-precision positions when the coordinate position of the reference signal is known. The fixed position GNSS device is called the reference station, and the unfixed position GNSS device is called the mobile station. Compared to the GNSS satellite signal of the mobile station, the data transmitted from the reference station is called differential data, The data transmission method is called a data link. The mobile station mode setting is to set GNSS as a mobile station, configure certain parameters to transmit the GNSS satellite signal of the reference station to the GNSS device through certain methods, so that the GNSS device can obtain high-precision positioning positions.

In addition to differential data transmission configuration, basic parameters such as the cut-off angle of GNSS and whether to enable PPK can also be set. Click on the basic parameter content to enter the editing parameter interface, as shown in 3.2-2. When the altitude angle is lower than a certain value, it can be set not to receive the satellite signal. In the case of low angle satellite signal difference, it is beneficial for accuracy calculation. The PPK parameter records the original GNSS observation data to the GNSS receiver, and uses a post-processing algorithm to calculate high-precision coordinates.



3.2-1



3.2-2

The main purpose of setting differential data parameters is to transmit the differential data of the reference station to the current device in a certain way, providing necessary calculation conditions for the device to solve high-precision coordinates. The Datalink method includes Internal radio, Device network, and Phone network, etc.

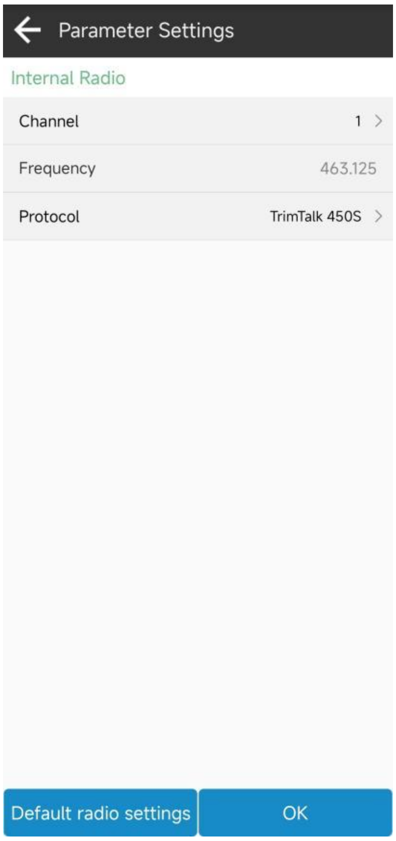
1. Internal radio: As shown in 3.2-1, it refers to the internal radio of GNSS equipment that receives differential data of the radio station according to a certain protocol and frequency for high-precision calculation. Click on the parameters to modify and edit them, as shown in 3.2-3. It is necessary to ensure that the protocol and frequency of the radio station are consistent with the protocol and frequency of the transmitting station in order to receive normal radio data. If the frequency corresponding to the channel is not consistent with the channel frequency of the

transmitting station, you can click on "Default Radio Settings" to modify the frequency corresponding to each channel of the radio station, as shown in 3.2-4. Click on the icon to select the corresponding channel frequency configuration from the predefined channel management list, as shown in 3.2-5.

2. Device network: As shown in 3.2-6, it refers to the SIM card network of GNSS devices that obtains differential data from a specified server address according to a certain protocol for high-precision calculation. Click on the parameters to modify and edit them, as shown in 3.2-7. The connection mode is a differential data transmission protocol, usually composed of NRTIP, TCP clients, etc., and the connection parameters such as server IP, port, username and password are input. The SIM network is a dedicated network and APN parameters need to be configured. The CORS server parameters can be selected from the server management list, as shown in 3.2-8. After correctly configuring the server address, obtain a list of access points and select the corresponding access point to obtain differential data. Access points can be obtained not only through the host network, but also through the corresponding network of the mobile phone if there is a network available.

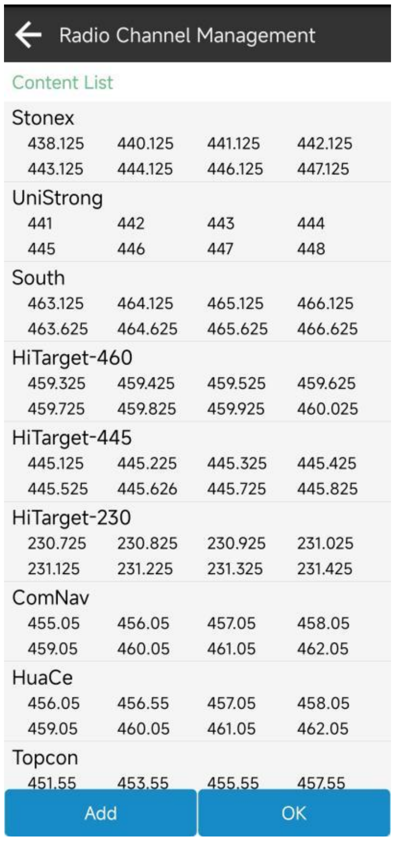
3.Phone network: As shown in 3.2-9, it refers to obtaining differential data from a specified server address through the network of the device where the software is located according to a certain protocol, and then sending it to the device through the communication connection between the software and the GNSS device for high-precision calculation. Click on the parameters to modify and edit the parameters. The parameter configuration is similar to the host network, without the need to configure APN parameters. After configuring the parameters, obtain the access point, select the access point that needs to be connected, as shown in 3.2-10, and connect to obtain differential data. Click to "Start" the connection. If the configuration is correct, the data receiving progress bar will move. If the progress bar has no data, you need to confirm whether the parameter configuration is correct.

Note: The radio datalink can be set to indicate whether the base station coordinates have changed. This is mainly because the radio station is transmitting in a one-way manner, and there may be multiple radio transmission sources at the same frequency, which can cause radio signal interference. If other signals are received, it may cause inaccurate positioning and remind users to check and confirm.

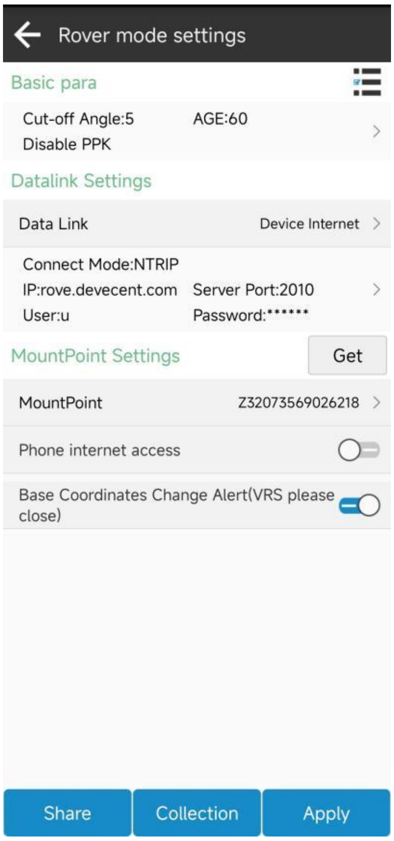


3.2-3

3.2-4

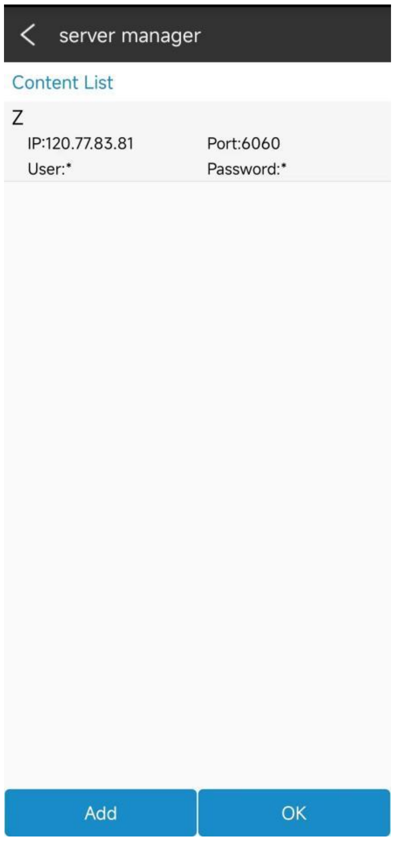


3.2-5

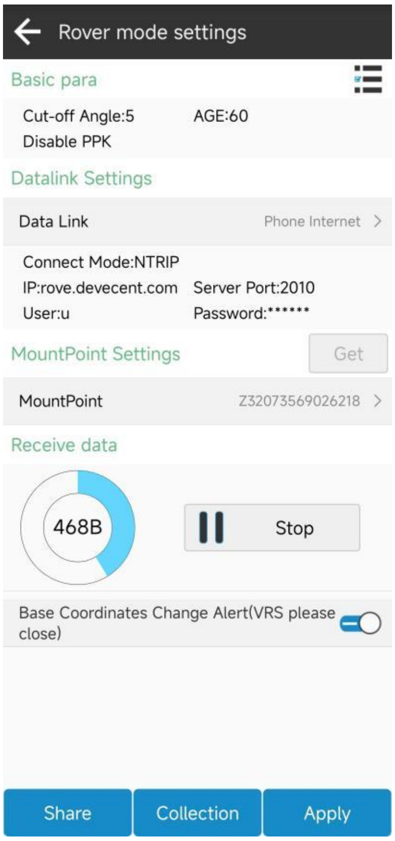


3.2-6

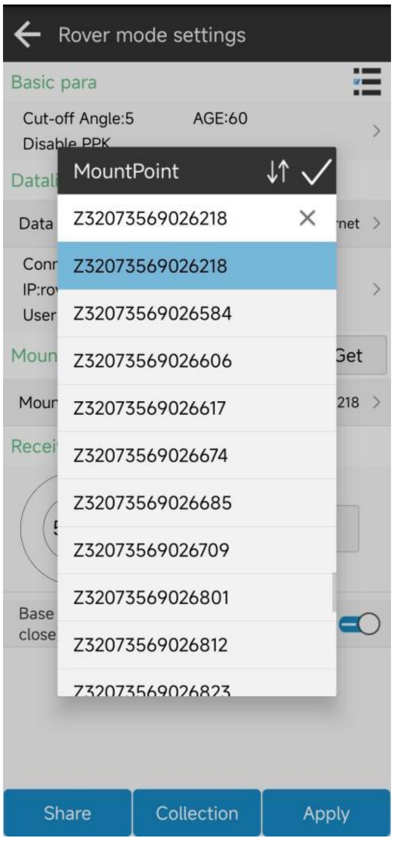
3.2-7



3.2-8



3.2-9



3.2-10

3.3 Base

Click on [Device] ->[Base], as shown in 3.3-1. This function is for GNSS equipment to serve as a reference station to send satellite information data through a certain method and provide it to the rover for reception, providing high-precision calculation conditions. It is necessary to set the starting condition parameters, starting mode, and data broadcast parameters of the reference station.

Note: During the startup of the base station, the device is not allowed to move, otherwise it may cause errors in the coordinates calculated by the rover.

The startup conditions include parameters such as base ID, Cut-off angle, Diff mode, PDOP limit, delayed startup, etc. Click on the parameter content to enter the editing parameter interface, as shown in 3.3-4. The differential data formats include commonly used differential data encoding formats such as RTCM2.3, RTCM3, CMR, CMR+, DGPS, RTCM3.2, etc.

The startup mode includes single point startup, Input base coordinate startup, and Use current point coordinate startup.

1. Single point startup: refers to the GNSS device outputting differential broadcast data based on the current positioning value (with low accuracy) for the startup coordinate;

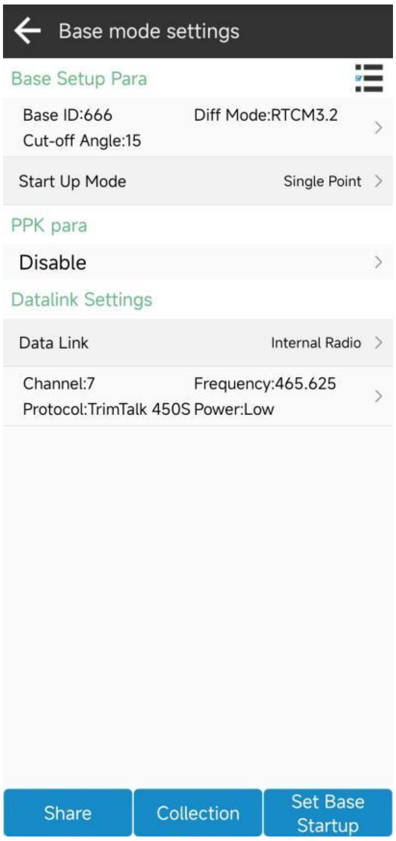
2. Input base coordinate startup: As shown in 3.3-2, it refers to the location where the early user sets up the device. The user knows the coordinate position in advance and uses this coordinate value as the startup coordinate to output differential broadcast data; Click on the coordinate parameter content to enter the editing parameter interface, as shown in 3.3-5. You can click on the survey icon to survey a point in real-time, or you can click on the coordinate content to select a coordinate value from the point library.

3. Use current coordinates startup: As shown in 3.3-3, refer to the real-time point collected by the user based on the positioning data of the current GNSS device and certain collection and measurement conditions. The real-time point is activated according to the specified coordinate activation method. Click on the parameter content to enter the editing parameter interface, as shown in 3.3-6.

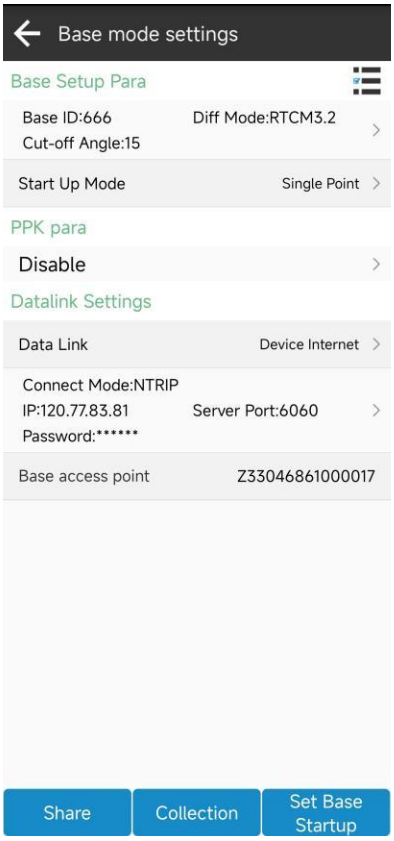
Differential data parameters mainly refer to the transmission of differential data output by the device after starting the base station, which is received and used by the rover station through certain methods, including device network, Internal radio, External radio, and Dual transmitter combination. The parameter settings are similar to those of rover stations, with the following differences:

1. The internal radio will have transmission power, and the higher the transmission function, the farther the operating distance, and the higher the power consumption.

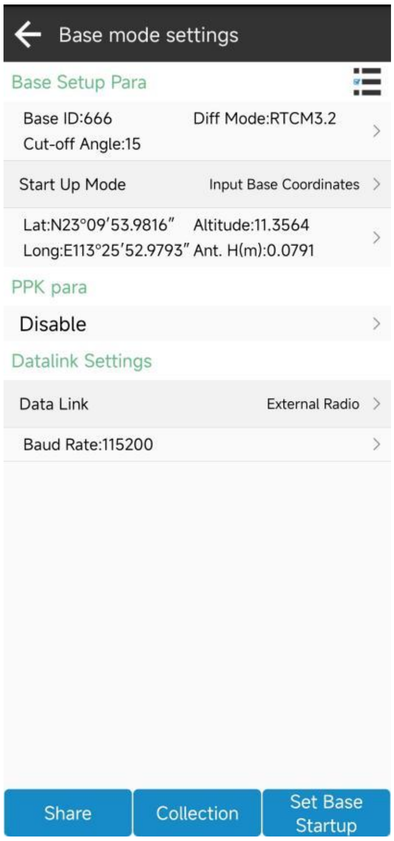
2. In the device network NTRIP protocol, the reference station is the access point that initiates transmission, while the rover station obtains a list of access points and selects the corresponding base station access point to connect, as shown in 3.3-2.



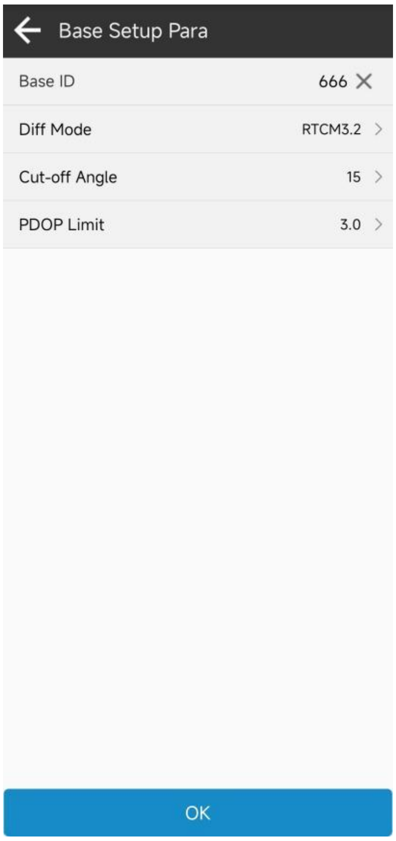
3.3-1



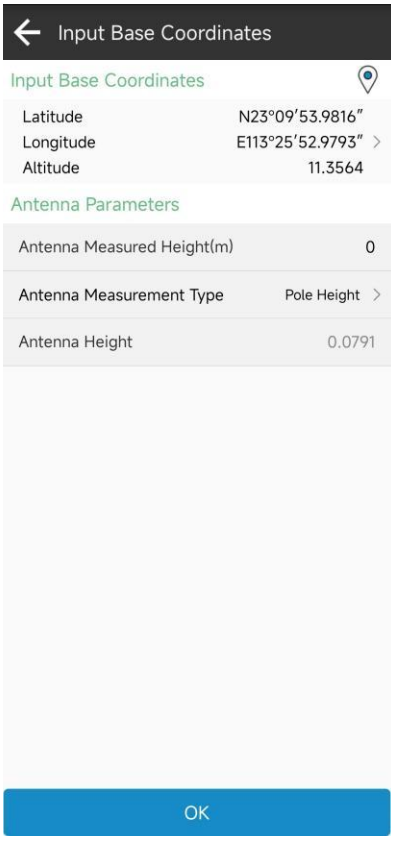
3.3-2



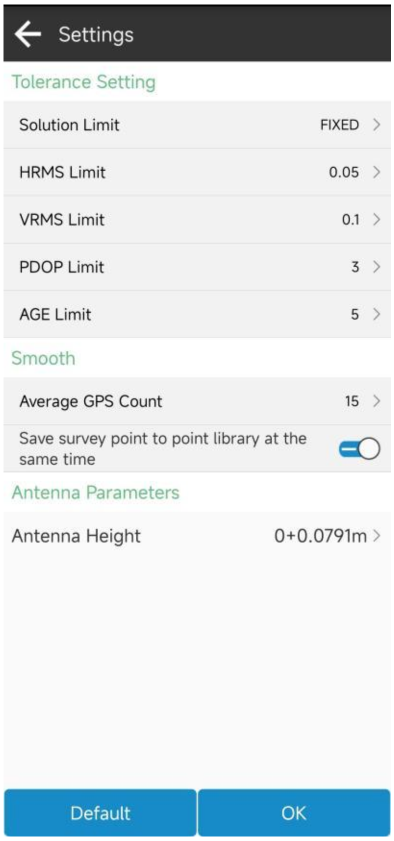
3.3-3



3.3-4



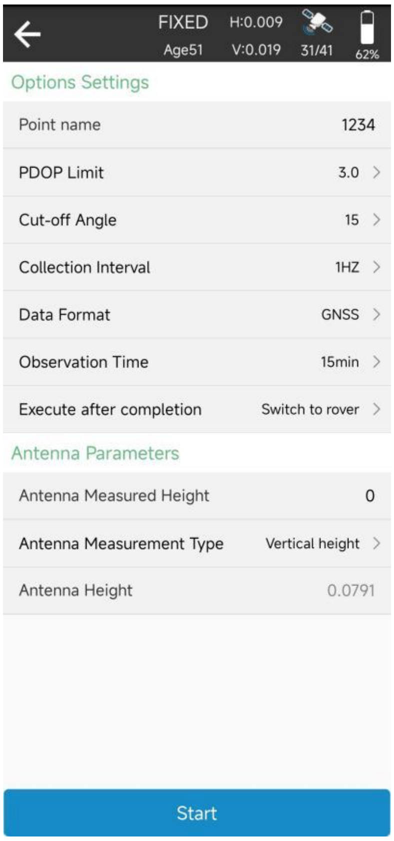
3.3-5



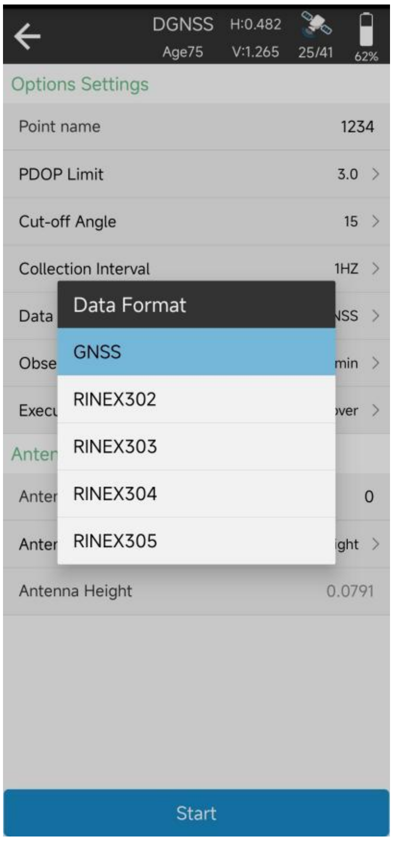
3.3-6

3.4 Static

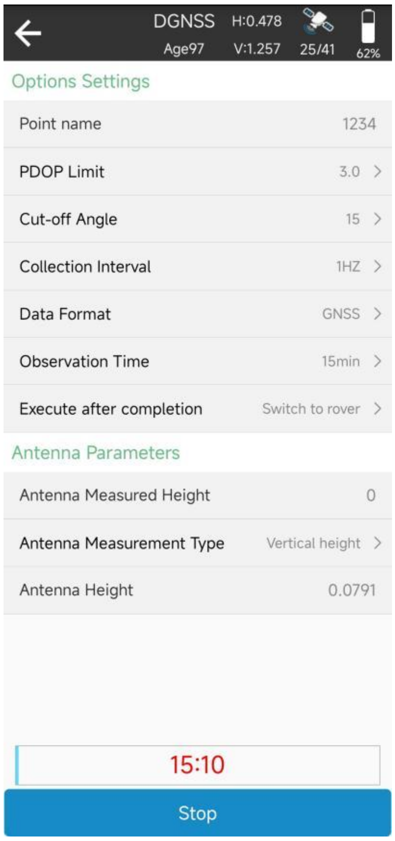
Click on [Device] ->[Static], as shown in 3.4-1 and 3.4-3. This function is to store the original satellite observation data of GNSS/ RINEX302/ RINEX303/ RINEX304/ RINEX305 equipment in the setting disk file, as shown in 3.4-2, record the observation data for a period of time, and use static post-processing software to calculate high-precision coordinate positions, usually used for control point collection. It is necessary to set static file Name, PDOP limit, Cut-off angle, Record interval, Antenna parameters, and other recording conditions.



3.4-1



3.4-2

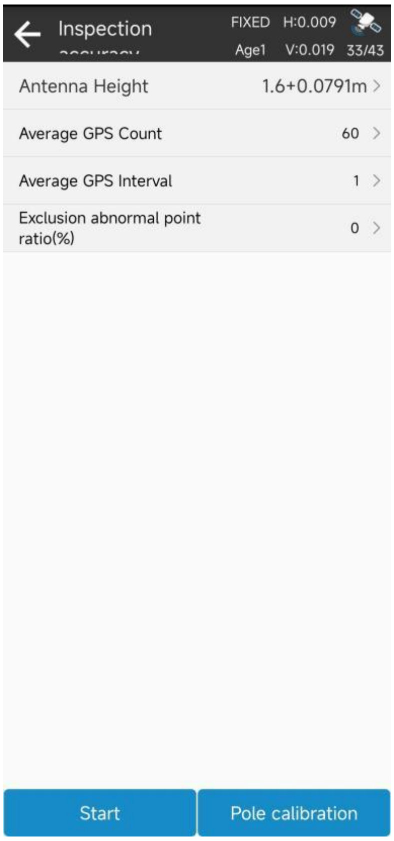


3.4-3

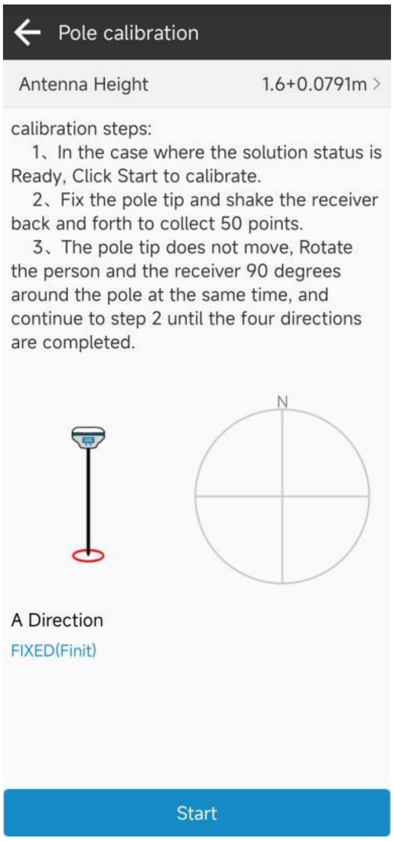
Note: During the static recording period, the device is not allowed to move, otherwise it may cause errors in the coordinates calculated by the post-processing.

3.5 Inspection accuracy

Click on [Device] ->[Inspection accuracy], as shown in 3.5-1. This function is to use the IMU survey function at a fixed position to collect a certain amount of tilt measurement points, calculate the maximum difference in coordinates of the collected points, and thus reflect the accuracy of the equipment using the IMU survey function. If the test results show poor accuracy, the calibration function of the center rod can be used to correct the IMU survey error caused by the center rod error, as shown in 3.5-2.



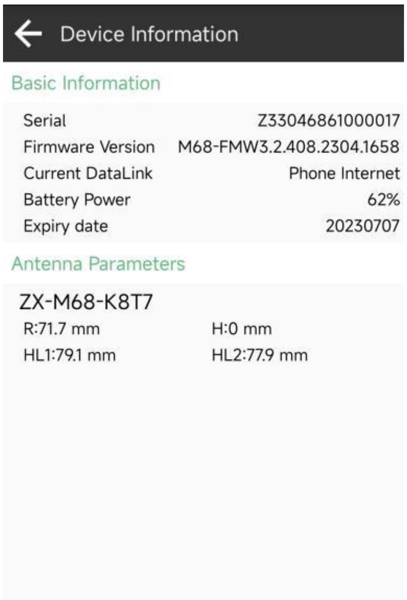
3.5-1



3.5-2

3.6 Device Information

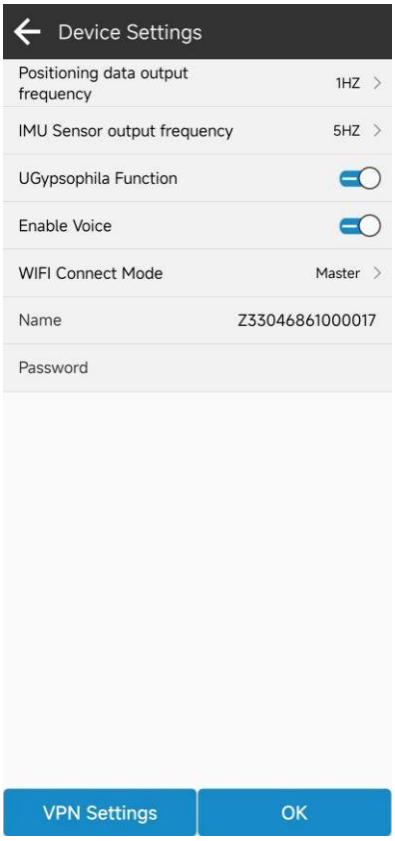
Click on [Device] ->[Device Information], as shown in 3.6-1. This function allows you to view the basic information of GNSS devices such as Device serial, firmware version, GNSS type, and GNSS serial number.

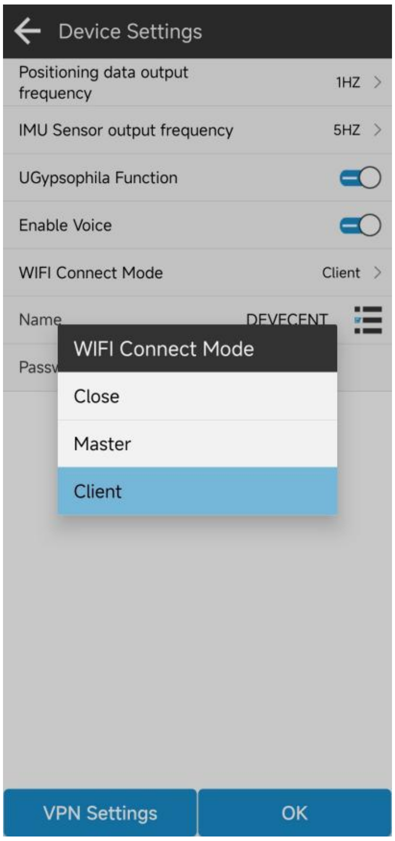


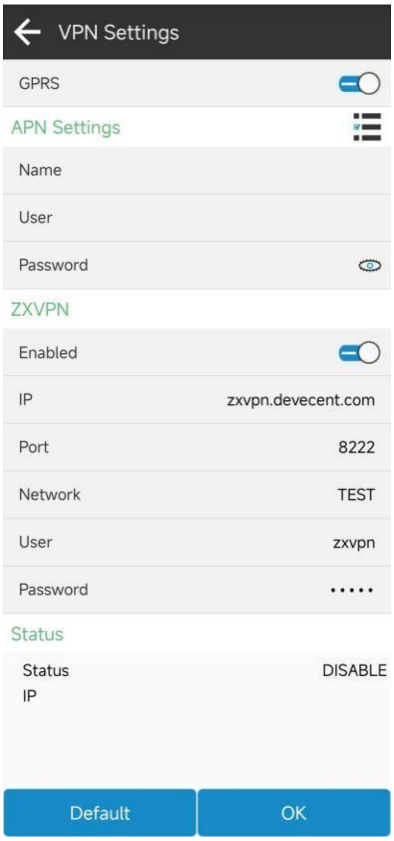
3.6-1

3.7 Device Settings

Click on [Device] ->[Device Settings] to configure some features of the device, as shown in 3.7-1, 3.7-2 and 3.7-3.



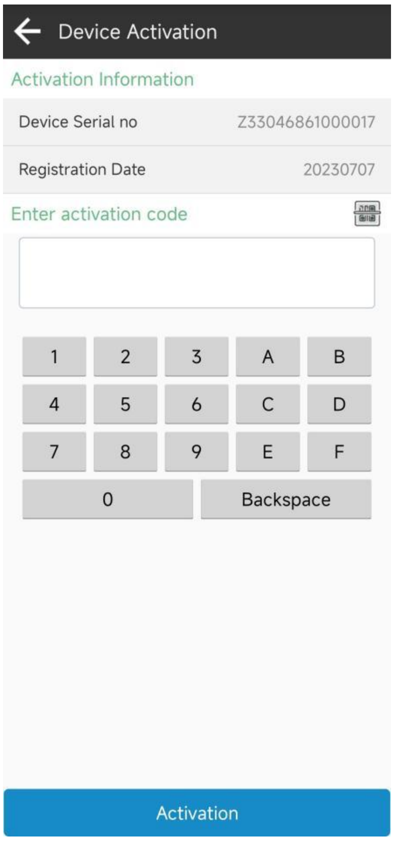




3.7-1 3.7-2 3.7-3

3.8 Device Activation

Click on [Device] ->[Device Activation], as shown in 4.8-1. If the GNSS device has expired, you can obtain the registration authorization code from the dealer and authorize the registration of the device here.



3.8-1

3.9 Other

1. Click on the  in the software title bar to enter the share code or scan QR code data shared by other devices, as shown in 3.9-1.

2. Click on the 

in the software title bar to enter the communication settings function, as shown in 3.1-4.

3. Click on the 

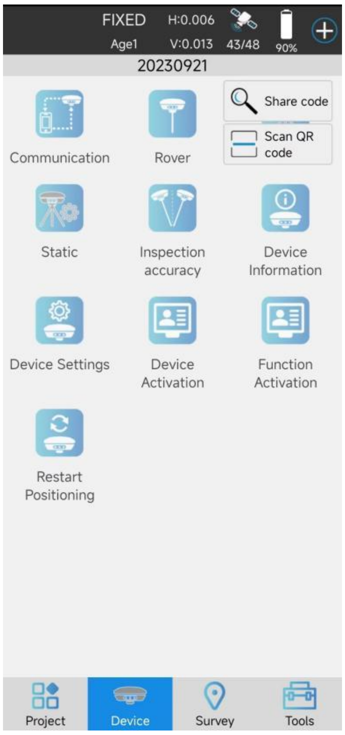
in the software title bar to enter and view the positioning coordinates output by the device, as shown in 3.9-2. You can switch between viewing base station information and star map and catalog information, as shown in 3.9-3, 3.9-4 and 3.9-5. Due to the lack of transmitting antenna parameters for the base station in the differential data, only the phase center coordinates of the base station transmission are transmitted. In order to obtain the ground coordinates corresponding to the start of the base station, the antenna parameters corresponding to the base station can be input.

4. Click on the 

in the software title bar to enter and view the device's satellite reception information, as shown in 3.9-5.

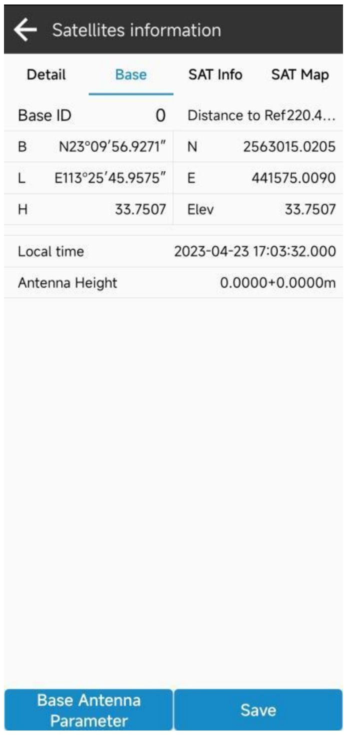
5. In the star map and catalog, click "Settings" in the title bar to set the satellite system switch, as shown in 3.9-6.

6. Click on the  in the software title bar to enter the rover settings, as shown in 3.2-1.



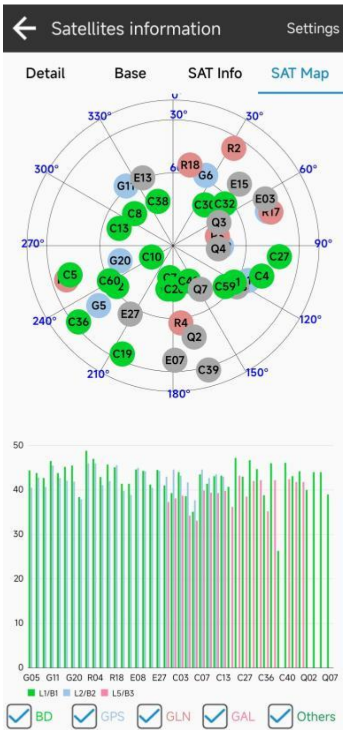
3.9-1

3.9-2

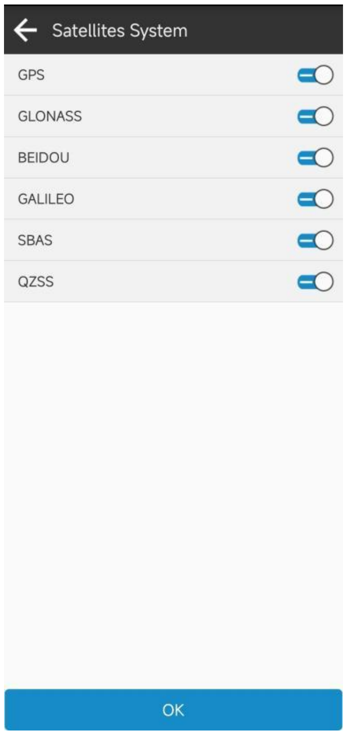


3.9-3

3.9-4



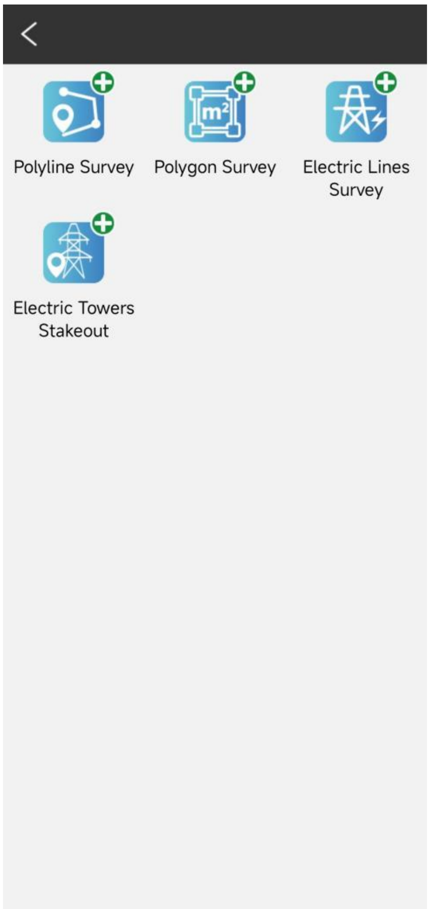
3.9-5



3.9-6

Ⅳ Survey

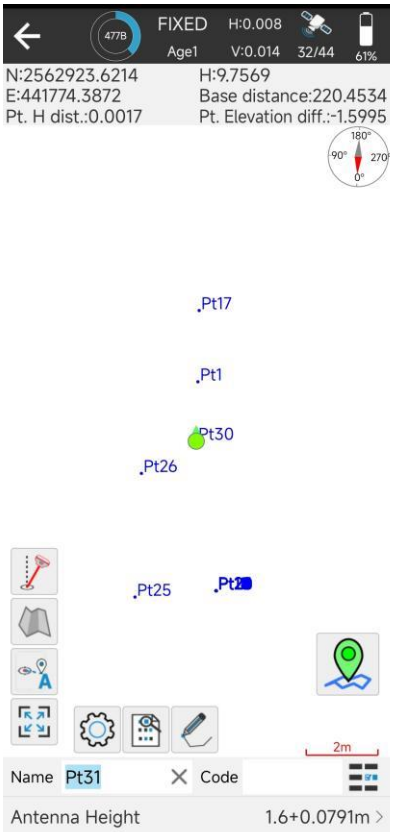
On the main interface of the software, click on [Survey], as shown in 4-1 and 4-2. Survey includes high-precision position based survey and application functions such as Point Survey, Detail Survey, Control point Survey, Point stakeout, CAD mapping, CAD stakeout, Polyline survey, Polygon survey, Line stakeout, DSM stakeout, Road design and stakeout, Electric lines survey, Electric Towers stakeout, Function customization, and other functions.

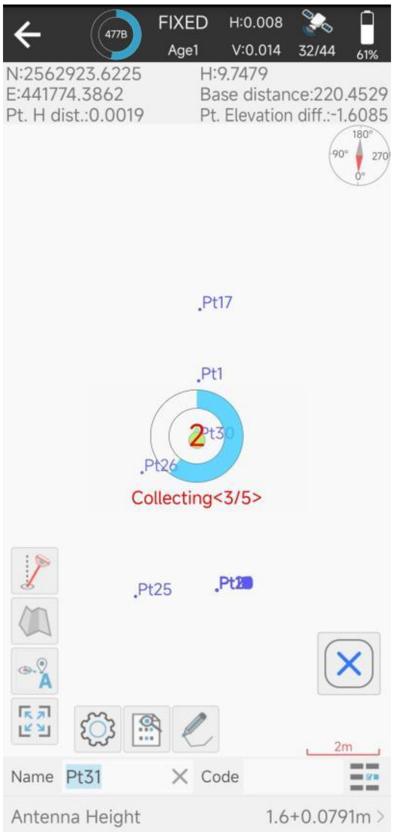


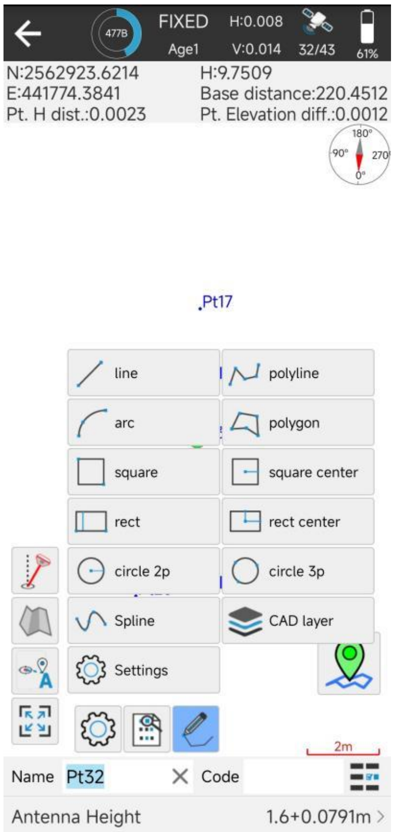
4-1 4-2

4.1 Point Survey

Click on [Survey] ->[Point Survey], as shown in 4.1-1. Record and store the positioning output from GNSS equipment in a coordinate point library according to certain accuracy limitations. In the point survey interface, the title bar displays the basic information of the positioning output by the current GNSS device, including the current solution status, differential delay, HRMS, VRMS, and other positioning accuracy evaluation values, as well as the number of received satellites. Below the title bar is the status bar for displaying other important information. The displayed content can be set according to the user's attention in the settings. In point survey, the default display is the coordinate and base station distance information. The middle area is the survey data drawing information, and the network map can also be displayed. The electronic compass in the upper right corner of the drawing area is displayed as a compass in the notebook, making it convenient for users to determine the direction when needed. The bottom left corner of the drawing area is the display of function acquisition. These function menus can also be displayed here to quickly operate certain functions according to the user's needs in the settings. The scale bar of the drawing is displayed in the bottom right corner of the area, and the icon above the scale bar is the trigger survey acquisition function button. 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 4.1-2. Below the drawing area are the attribute point names and coding input positions, as well as the setting of antenna height and the entrance to the points database.

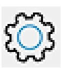






4.1-1 4.1-2 4.1-3

Click on  to enter CAD survey, as shown in 4.1-3. During the process of survey points, they can be drawn into data graph types such as line, polyline, arcs, polygon, circle, spline, etc.

Click  to enter the survey settings interface, as shown in 4.1-4. Set the collection limitations for survey and collection here, such as solution status, HRMS limit, VRMS limit, PDOP limit, differential delay, etc. Users can set the limit based on the accuracy requirements of the job.

Setting the number of smoothing points is to collect multiple positioning points and calculate the average value to indicate accuracy. In addition, you can also set default point names and default encoding. The information display setting is to set the display content of the status information bar, which users can display according to their key information settings, as shown in 4.1-5. Function menu settings refer to users displaying commonly used function settings in the left menu bar according to their needs during the homework process, allowing users to quickly and conveniently access certain functions, as shown in 4.1-6. These functions include: tilt survey, Display map, Auto jump map center,Full map, Take screen point, CAD text, length and area measure, background color setting, CAD layer setting and other functions. Click the menu icon on the left to trigger the corresponding functions.

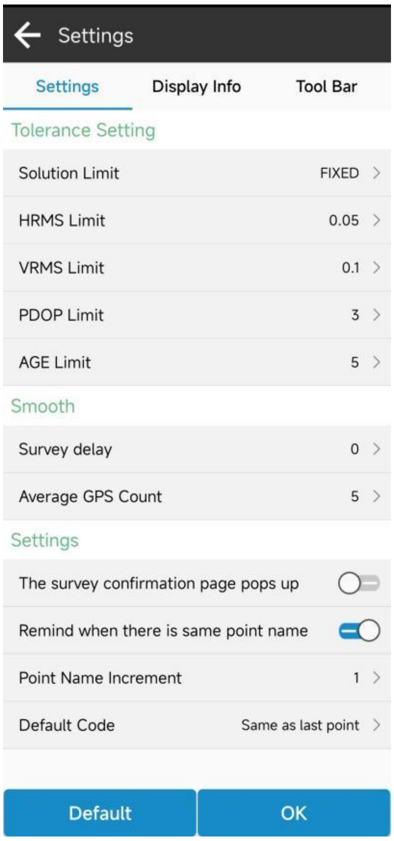
Click on  to enter the points database function, where you can view the status of survey points.

Click on  to automatically center the current position and display it on the screen. Click again to automatically rotate the map according to the progress direction.

Click on  to turn on/off the tilt survey function.

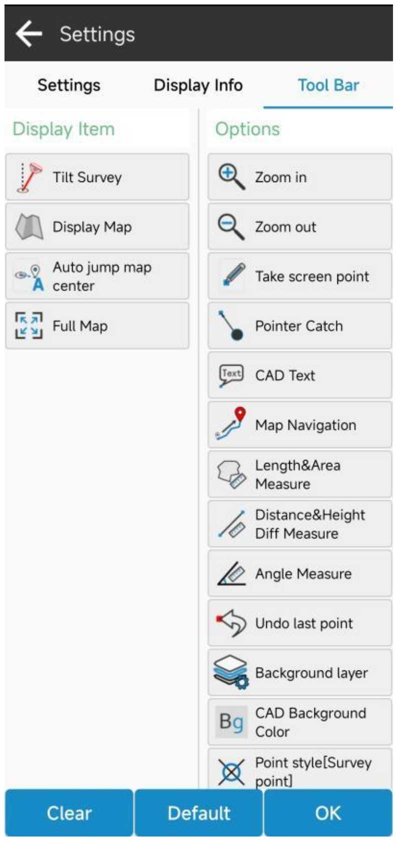
Survey collection points usually require input of point names and codes. Clicking on  allows you to select the preset code in the code library for quick filling of ground feature attributes, as shown in 4.1-7. If there are many codes in the coding library that are frequently used, they will be displayed in the front for users to quickly select.

Click on the antenna height display content to modify and edit the antenna height information, as shown in 4.1-8. The antenna height setting is to subtract the phase center coordinate of GNSS from the antenna height to obtain the actual position of the ground measurement target. If the antenna information is incorrect, clicking on the antenna information can select the correct antenna type in antenna management (used when GNSS devices do not output antenna information or when using external antennas), as shown in 4.1-9.

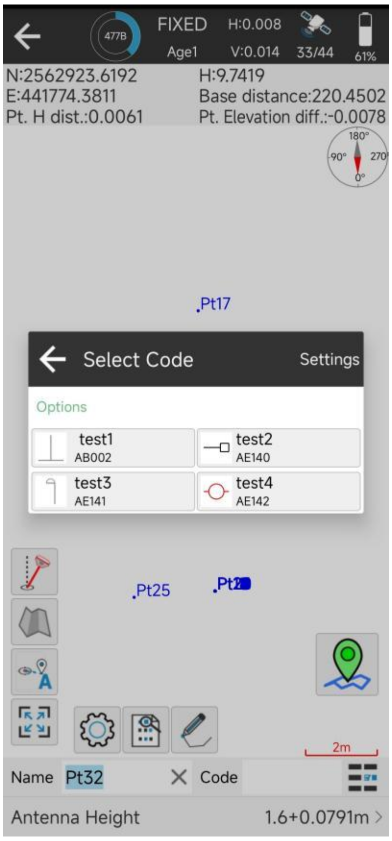


4.1-4

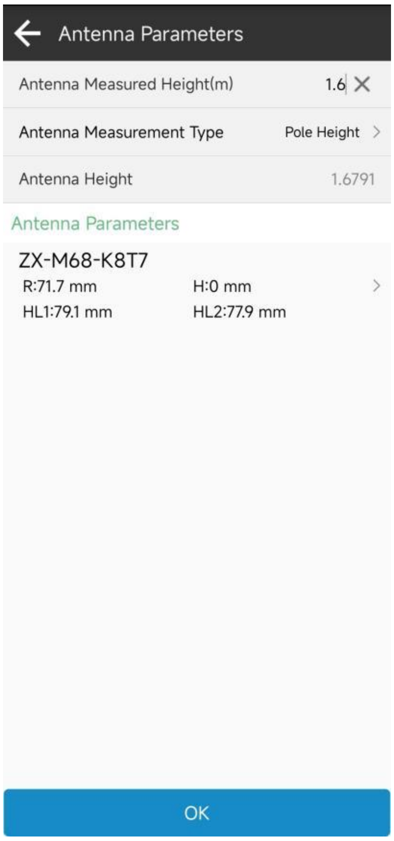
4.1-5



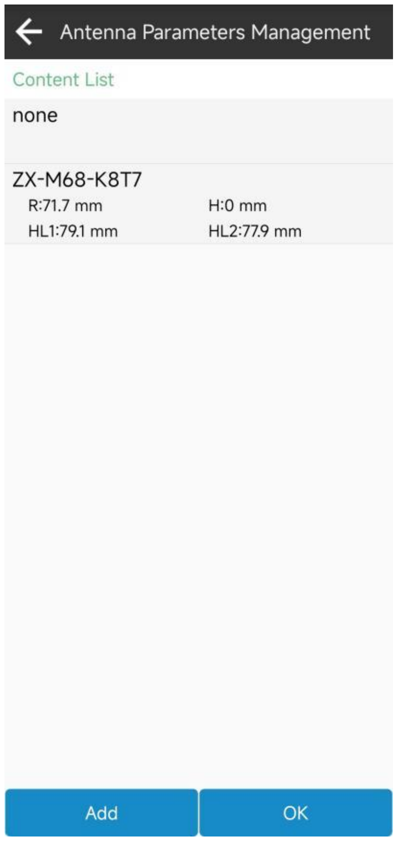
4.1-6



4.1-7



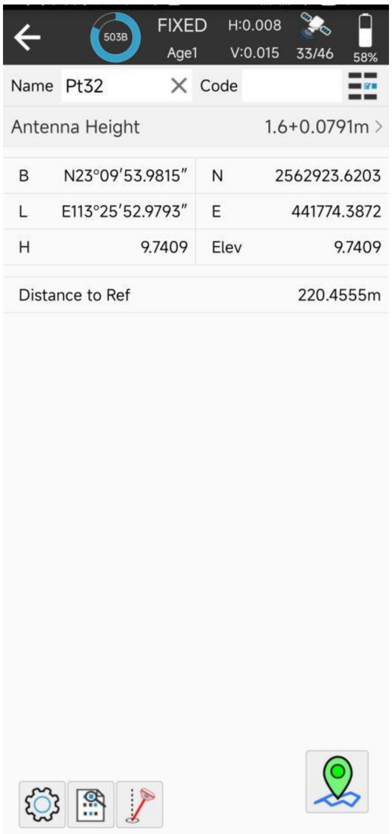
4.1-8



4.1-9

4.2 Detail Survey

Click on [Survey]->[Detail Survey], as shown in 4.2-1. This function is similar to point survey, but there is no graphical interface for point survey, which provides a more concise and intuitive display of the content required for recording and collecting points.



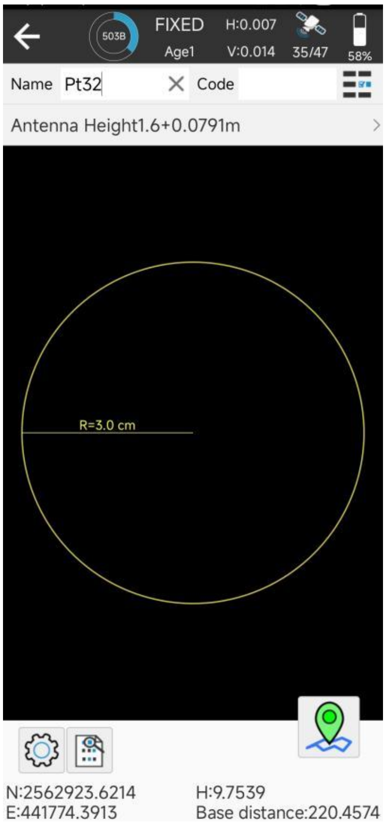
4.2-1

4.3 Control Point Survey

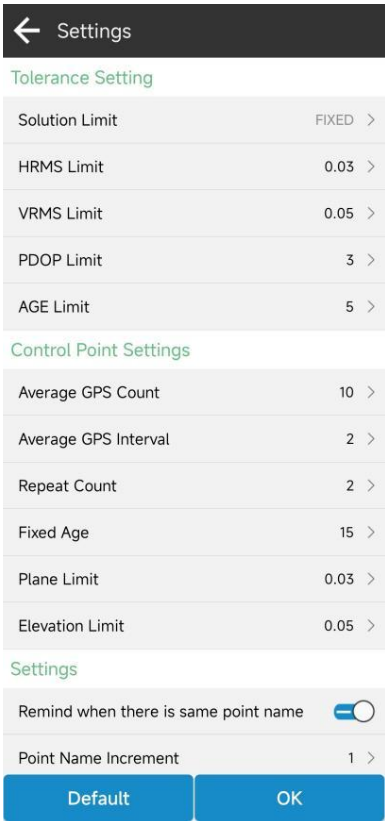
Click on [Survey]->[Control Point Survey], as shown in 4.3-1. Sometimes, it is necessary to record a point with high accuracy requirements. To collect this survey point, the device needs to be reset multiple times, requiring a fixed solution for a period of time before collecting, and many points need to be collected. By using a certain calculation method, the points with a significant deviation from the average value are kicked out, and the average value of the basic optimal values is taken to obtain a high-precision positioning point, The points collected through survey in this way have high accuracy guarantee, and we call this type of point control point. In the control point survey interface, the middle area displays all the coordinate points collected by the control point in real-time, and the graphical distribution of the survey points of the control point can be seen, which can determine the accuracy of the control point in a certain program. The two icons below the graph are survey settings and points database function entrances;

Survey settings, as shown in 4.3-2, in addition to setting collection limits, it is also necessary to control the collection parameters of points, such as smoothing points, smoothing intervals, repetition times, etc.

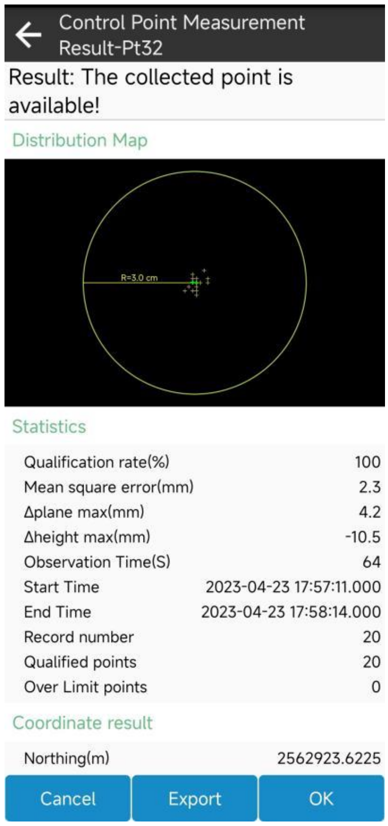
After the control point survey is completed, a survey results page will pop up, as shown in 4.3-3. The record analysis and results of the control point, observation time, qualification rate, and whether the control point meets the accuracy requirements will be displayed.



4.3-1



4.3-2



4.3-3

4.4 Point Stakeout

Click on [Survey] ->[Point Stakeout] to enter the stakout points database interface, as shown in 4.4-1. Point stakeout refers to finding the location of points on the field site through coordinate points, with known point coordinates. In the points to be lofted, both to-stake and staked points will be displayed. Clicking on the stake point can remove the stake point, view details, and stakeout it. The stakeout point is a part of the coordinate points database, and the add, remove, import, and export operations of the stakeout point are the same as those of the coordinate points database. Removing points from the stakeout points database does not actually delete them from the points database. You can also select points from the coordinate points (all points in the coordinate points database) for stakeout. After selecting points for stakeout, enter the point stakeout interface, as shown in 4.4-3.

The layout of the point stakeout interface is similar to that of point survey, but there are also some differences. The status information bar displays the filling and excavation values of the deviation values from the target's southeast, northwest, and northwest. The compass is not located in the upper right corner of the drawing area, but is currently positioned together. In addition to the survey setting function, there are also functions such as stakeout the nearest point, stakeout the previous point, and stakeout the next point at the bottom of the drawing area.

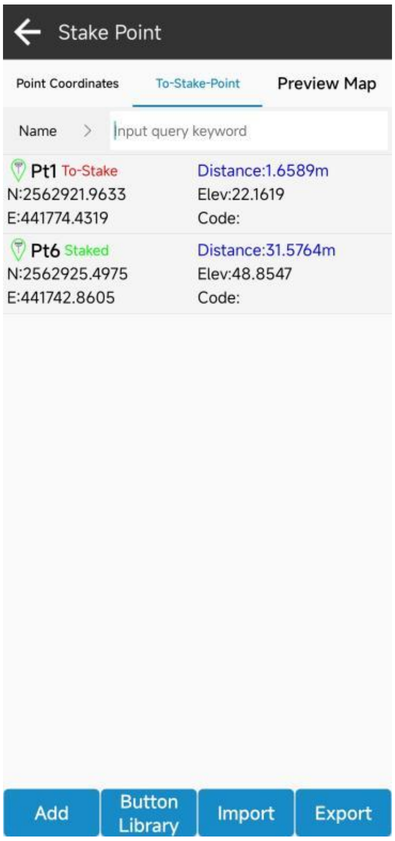
What if we get to the target point faster?

If the user has a good sense of direction, they can distinguish between the southeast and northwest in real-time field work. In the display of the stakeout compass, they can directly see the continuity between the current positioning point and the target point, and walk towards the direction they point to. As shown in 4.4-3, heading southwest can lead to the target point Pt1.

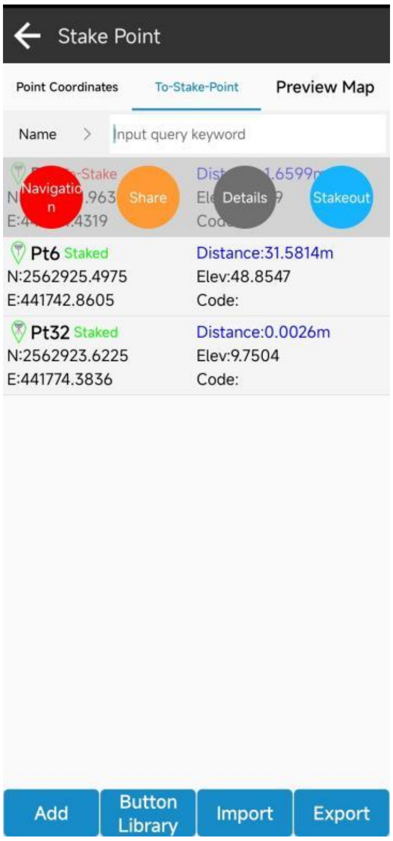
What if the user's sense of direction is not good and they cannot distinguish between the southeast and northwest?

Method 1: You can look at the currently positioned small arrow, which points towards the pad when it is flat, as shown in 4.4-3. The current pda points towards the south. You can rotate the pad pointing. When the pad heading coincides with the connection between the current point and the target point, it indicates that the pad heading is consistent with the direction of the target point. At this time, press the pad heading and walk forward.

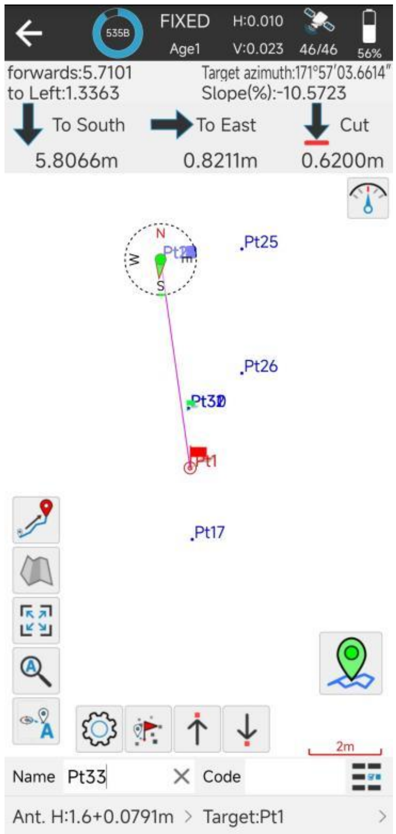
Method 2: Click twice on automatic center positioning to enter map rotation mode, rotate the receiver tilt angle, and when the target point is above the screen, move forward, as shown in 4.4-4.



4.4-1



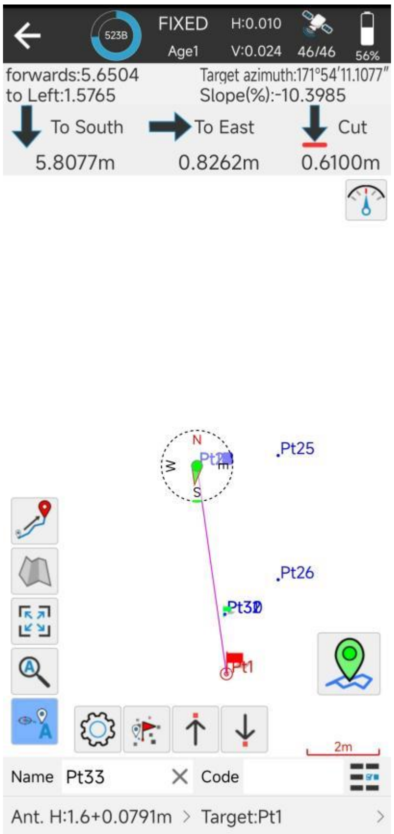
4.4-2

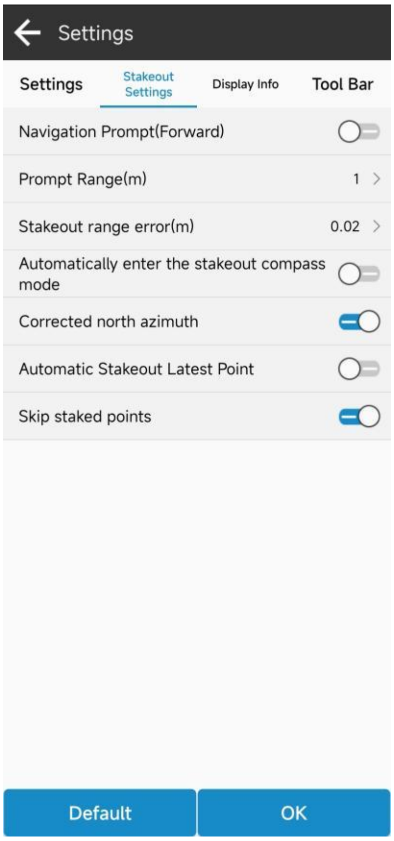


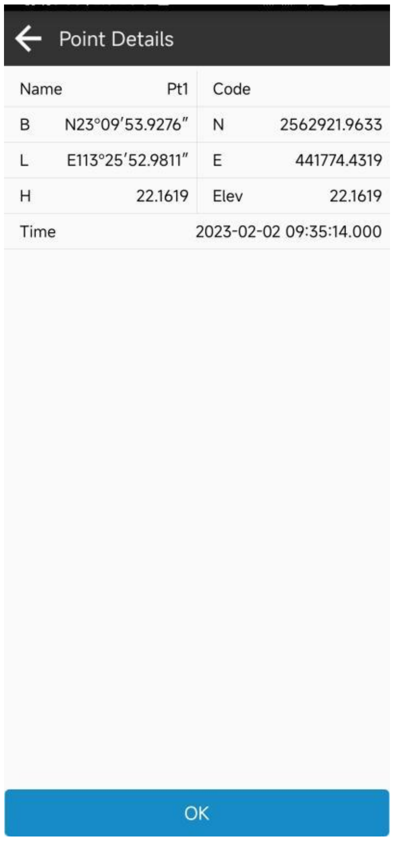
4.4-3

In the survey settings also include stakeout settings, as shown in 4.4-5. You can set the target to prompt in the southeast, northwest, front, back, left, and right directions.In addition, you can also set the prompt range, setting limits, and so on.

In the points to stakeout, click on the data item and click on the detailed information to enter the detailed information of the point stakeout, as shown in 4.4-6.







4.4-4 4.4-5 4.4-6

4.5 CAD Mapping

Click on [Survey] ->[CAD Mapping], as shown in 4.5-1. The CAD function is to display CAD map, draw such as line, polyline, arc, polygon, and calculate tools. It also includes import and export DXF and DWG file, layer manager, and stakeout operations for CAD map.

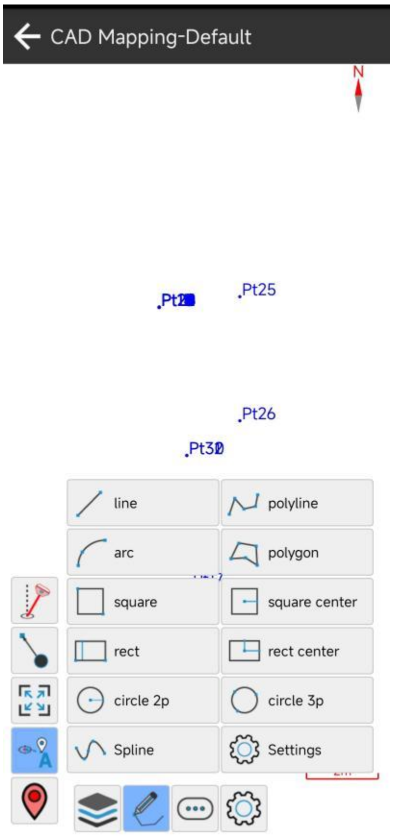
Click to  enter CAD layer manager, as shown in 4.5-2. You can create or delete layers, set whether layers are visible, import DXF, DWG, and other map, export DXF files, and set a layer as a working layer.

Click to  create a new drawing, as shown in 4.5-1. Including line, polyline, arc, polygon, square, square center, rect, rect center, circle 2p, circle 3p, spline, and other types.

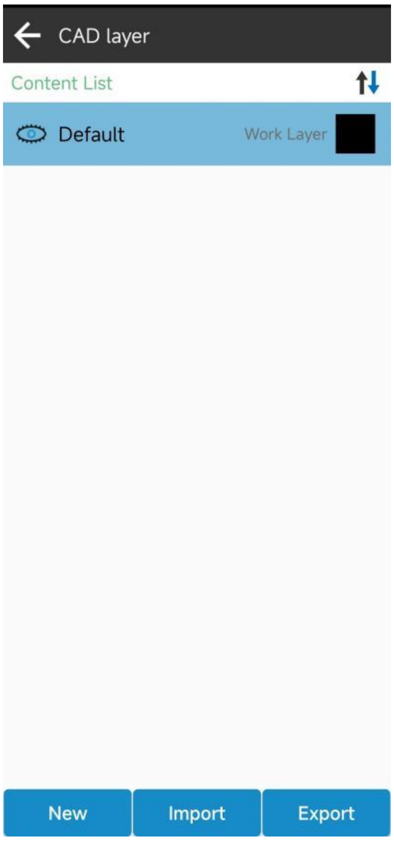
Click to  is a CAD calculation tool, as shown in 4.5-3. Including points of two circles intersect, points of two lines intersect, points of entity intersect, point of distance offset, and other tools.

After selecting the CAD drawing, You can operations such as delete, details, and stakeout.

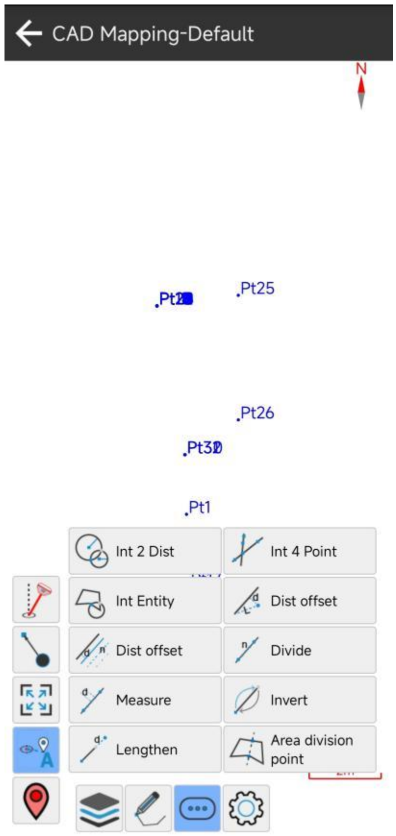
After selecting the entity, click on stakeout to enter the stakeout CAD interface, stakeout is to find the position of the target coordinate in the actual location, and the stakeout operation is similar to point stakeout and line stakeout.



4.5-1



4.5-2



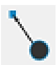
4.5-3

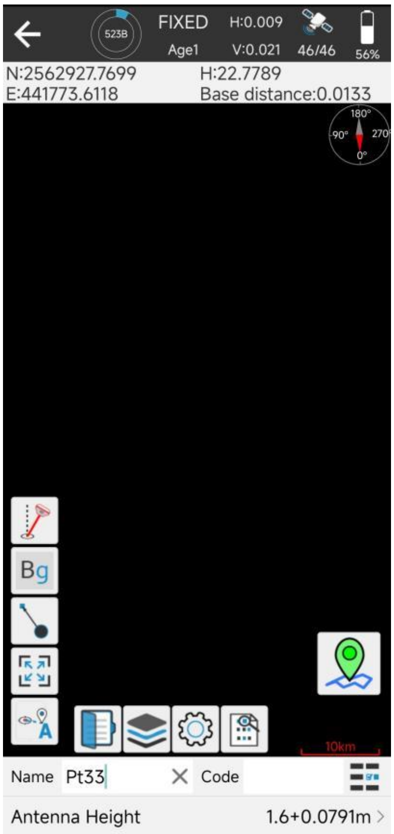
4.6 CAD Stakeout

Click on [Survey] ->[CAD Stakeout], as shown in 4.6-1. The CAD stakeout function is to load CAD drawings such as DXF and DWG for stakeout operations.

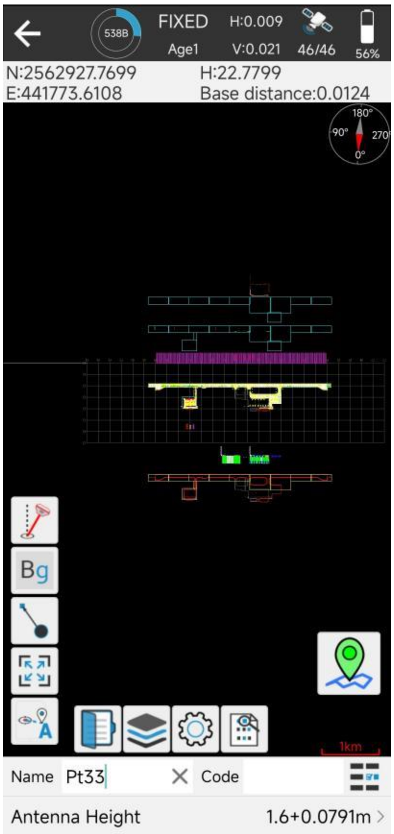
Click on  , select and open CAD drawing files.

Click on  , view the CAD drawing layer data, which can hide and display some layer data.

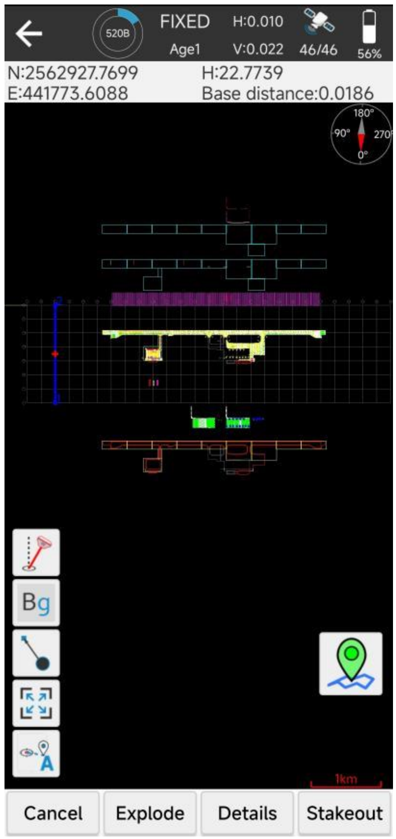
Click on  , capture the points on the CAD drawing for stakeout, as shown in 4.6-2.



4.6-1



4.6-2



4.6-3

4.7 Line Stakeout

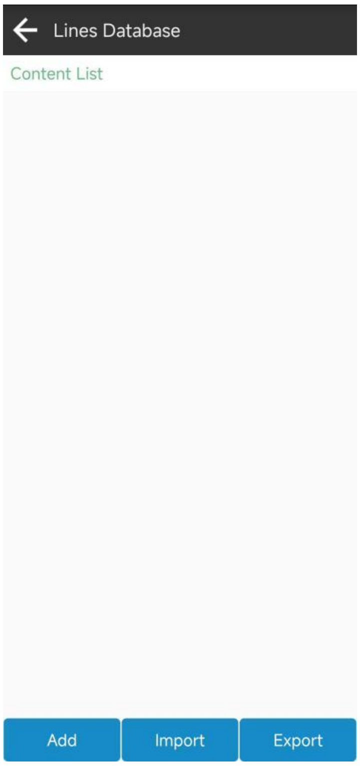
Click on [Survey] ->[Line Stakeout] to enter the lines database interface, as shown in 4.7-1. Line stakeout is to provide designed lines, input line to library, and stakeout on the lines. You can set the station, offset, height difference, etc. in real-time stakeout to the line, or divide the line into points at intervals to stakeout the points on the line by point.

Line library manager, which can add, delete, import, and export line data; Create a new line, as shown in 4.7-2. Enter the line name and set the coordinates of the starting and ending points, and create a new line by starting point+azimuth+length. Click on point information to select point data from the points database.

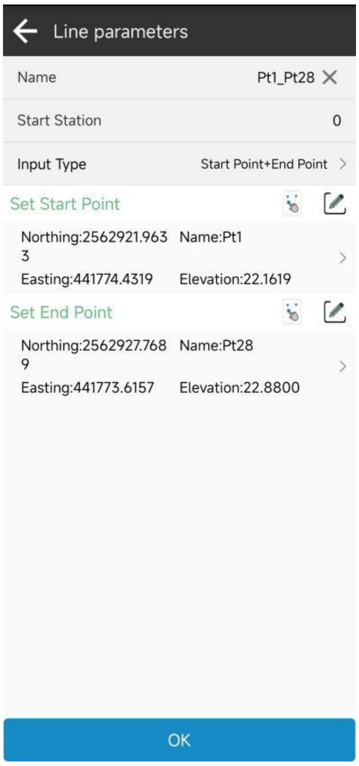
Click on the line list item to delete and edit the stakeout line. Click on the stakeout, as shown in 4.7-3. You can set whether to stakeout in the form of a line or line by point. If it is a line by point method, you need to set whether the calculation method, interval, and whether to automatically stakeout the nearest point.

Press OK again to enter the line stakeout interface, as shown in 4.7-4. You can use menu operations to stakeout the previous line, next line, previous point, next point, and so on.

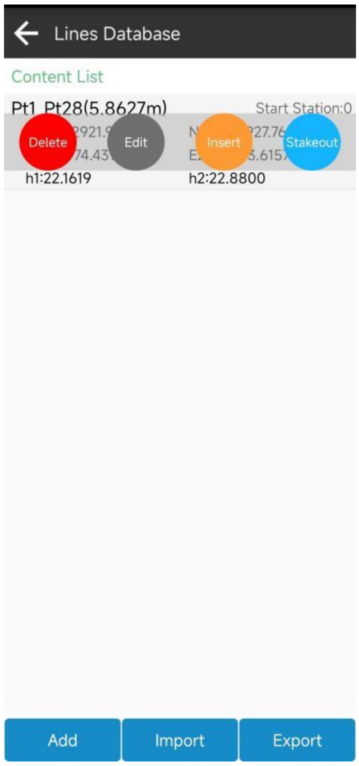
The line by point of stakeout, sometimes it is necessary to set the station and offset to stakeout a certain point. Click to  add piles for stakeout, as shown in 4.7-5 and 4.7-6.



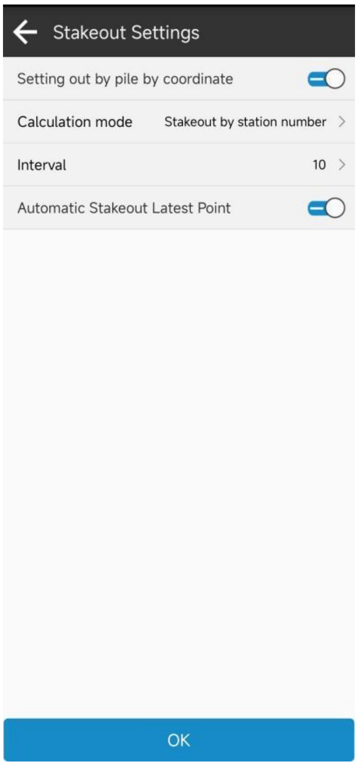
4.7-1



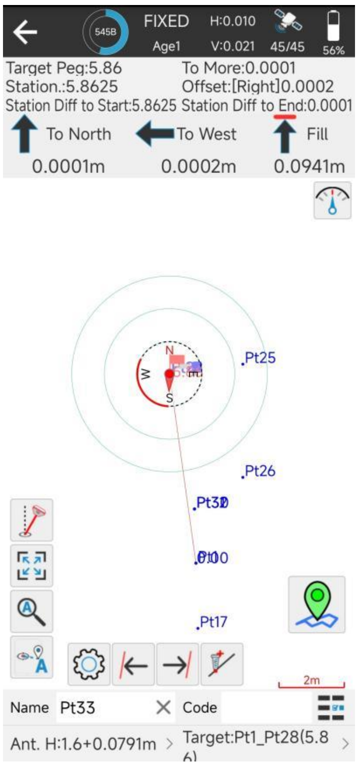
4.7-2



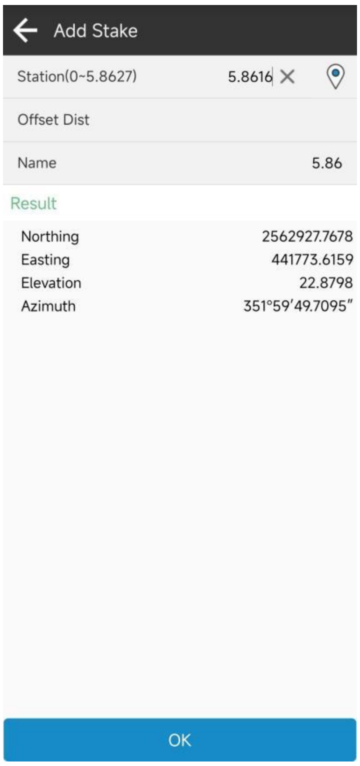
4.7-3



4.7-4



4.7-5



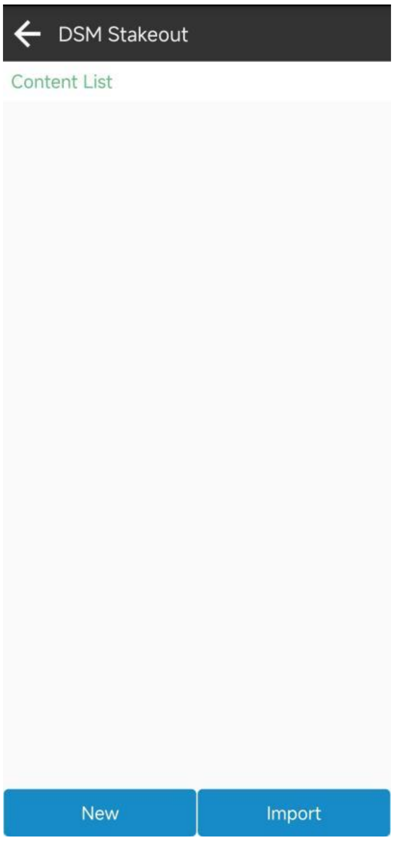
4.7-6

4.8 DMS Stakeout

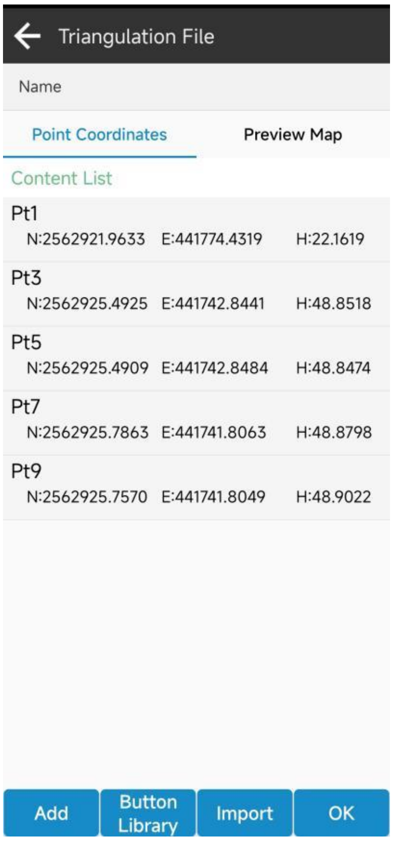
Click on [Survey] ->[DMS stakeout], as shown in 4.8-1. It uses the current positioning coordinates to stakeout the elevation of the based on existing triangulation data, and determines whether a real-time location needs to be fill or cut.

The DMS library can be create, import, or edit or delete, and a new elevation file can be created, as shown in 4.8-2. The coordinates of the triangulation file can be manually enter or select in batches from the points database. The order of point coordinates can be adjusted up and down, and coordinates can also be import.

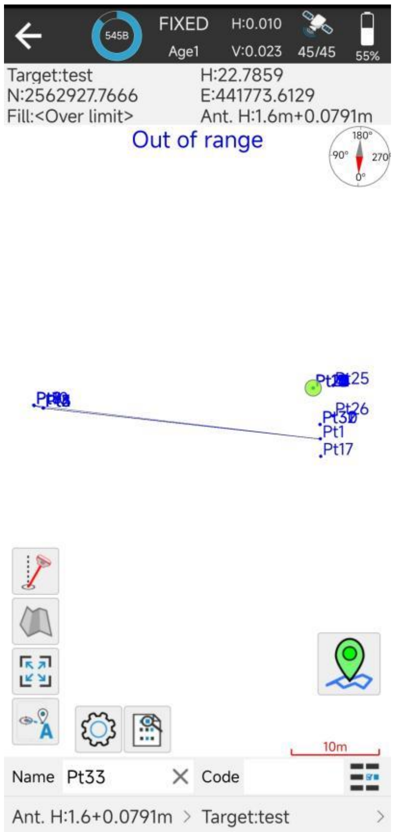
Click on the item of the DMS database to edit, delete, and stakeout. Click on the stakeout out to enter the elevation stakeout interface, as shown in 4.8-3.



4.8-1



4.8-2



4.8-3

4.9 Road Design And Stakeout

Click on [Survey]->[Stake Road] to enter the roads database interface, as shown in 4.9-1. The road design and stakeout function is to design road files based on design data such as centerline, vertical profile, broken station, standard cross section, superelevation, widening, and slopes of the road. Based on the road design file and GNSS positioning, Application related to road such as construction stakeout and section data collection for road.

The road design is shown in 4.9-2. The road design includes centerline, vertical profile, broken station, standard cross section, slope, and standard cross sections include superelevation and widening of section blocks.

1. Centerline: As shown in 4.9-3. The methods for designing centerline include line element method, intersection method, and coordinate element method. All roads are composed of a combination of road start point, line, spiral, and curve. The line element method is a design road by input the elements of the road, where the start point includes the start station and coordinates, the line includes the start azimuth and length, the spiral includes the start azimuth and start radius, end radius and length, and the curve includes the start azimuth, radius and length. Usually, in the line element method, the endpoint azimuth of the previous element is equal to the start azimuth of the next element. The radius of the connecting end of the sprial and the line is infinite, and the radius of the connecting end of the sprial and the circle is equal to the radius of the circle. The intersection method calculates the combination of road design elements through a certain algorithm based on the coordinates of control points on the road and the sprial length, sprial parameter, circle radius, and other parameters of the control points. The coordinate method calculates the combination of road design elements using a certain algorithm based on the coordinate points on the road and the radius of the arc before the coordinate points. The road generated by the coordinate method only has a start point, line, and arc, which is a simplified road without sprial.

2. Vertical profile: as shown in 4.9-4. The vertical profile is the elevation fluctuation of the road centerline at each station. It is the design height of the centerline of the line, which requires the input of the elevation to each station of the line elevation point and the arc radius to the elevation point. The software calculates the elevation values of the line at each station point based on design elements.

3. Broken station: as shown in 4.9-5. In the process of road design, sometimes a pre designed road needs to be partially modified at a certain location. After the road modification, the road may be longer or shorter than the original road. In order to modify the design station data after the road unchanged, a broken chain is used, which is divided into long chain and short chain. Start using a new station value at a certain station point, keeping the station data after this station value unchanged.

4. Standard cross section: as shown in 4.9-6. In construction roads, the centerline of the road is only the planned direction of the road, and the road includes sections such as motor lane, non motorrized vehicle, sidewalks, hard shoulder, etc. The width, slope, and other parameters of the road design for these sections are called standard cross sections. In roads, Sometimes it is necessary

to set the superelevation and widening parameters of the section. Superelevation and widening are set according to the needs of each section and added according to the station.

5. Slope data: as shown in 4.9-7. In the road construction, it may be necessary to construct slopes for mountains and lakes according to certain standards to protect roads.

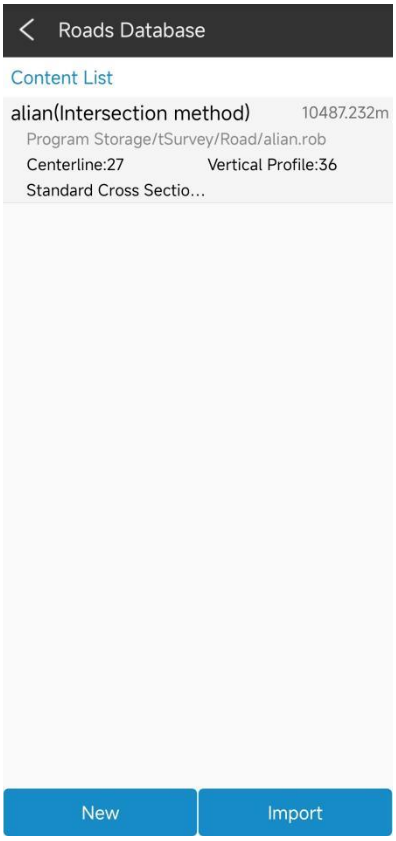
Note: For the convenience of road design editing, the software supports the import of various formats of roads.

Road stakeout: Use the designed road data for construction operations.

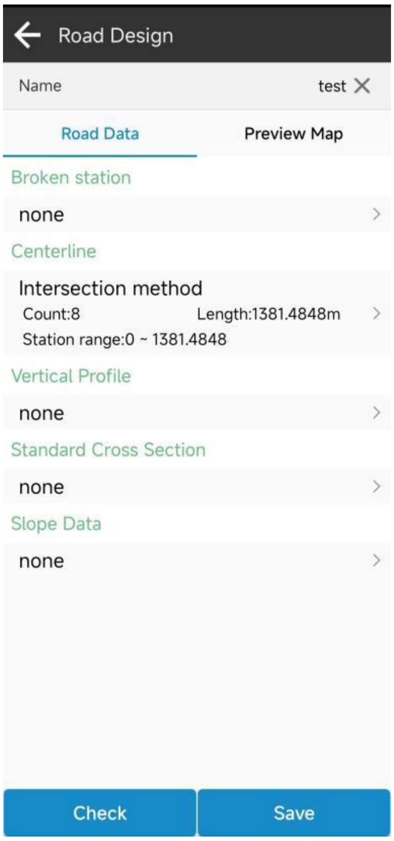
The stakeout of the road centerline: as shown in 4.9-9. The stakeout interface and operation are similar to point stakeout and line stakeout. Click on  display the cross sections map of road construction. Click on the stake road can switch to other stakeout modes, including road stakeout operation functions such as stake road by point, stake cross-sections, cross sections measurement, etc.

The stake road by point. Click on the function menu icon below to enter survey settings, enter the stakeout database, stakeout the previous point, stakeout the next point, add piles, etc. Enter the stakeout database. You can select a point in the base for stakeout, or you can automatically stakeout the nearest point. You can recalculate the pile by pile coordinate points of the road centerline.

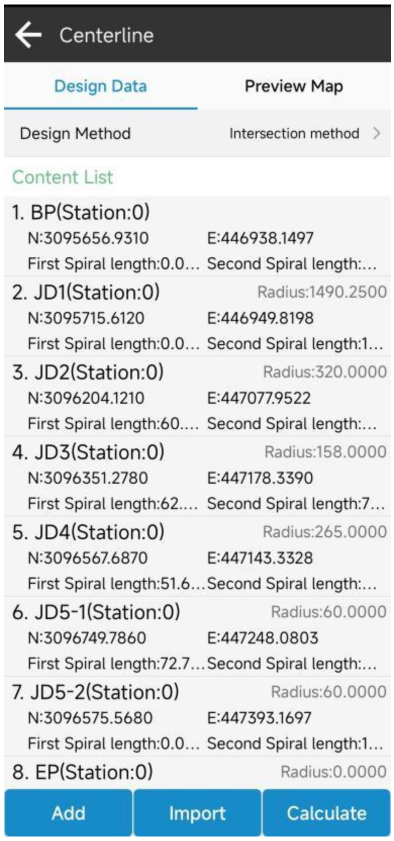
The cross section measurement. Collect cross section elevation data of road and surrounding sections at certain station intervals for preliminary survey work of road construction, calculation of road earthwork volume, evaluation of construction costs, etc.



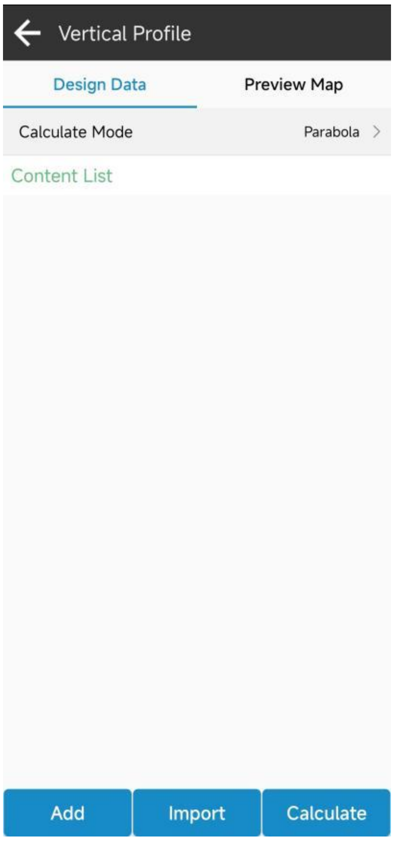
4.9-1



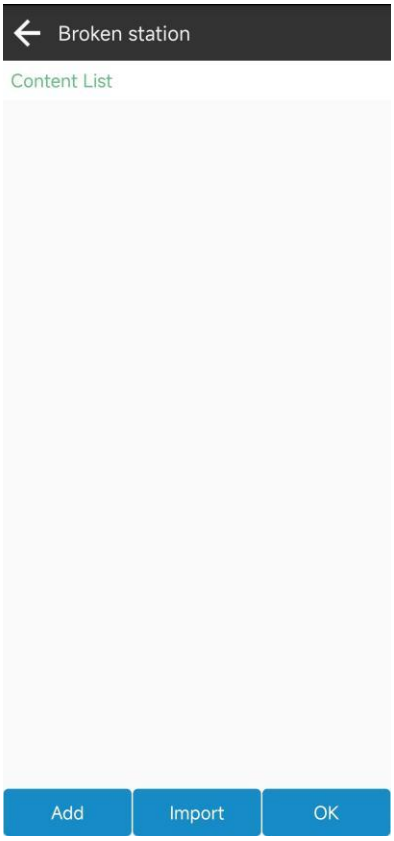
4.9-2



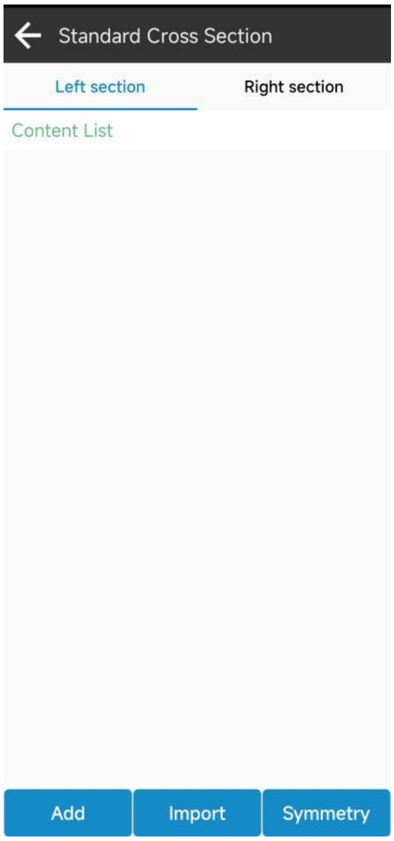
4.9-3



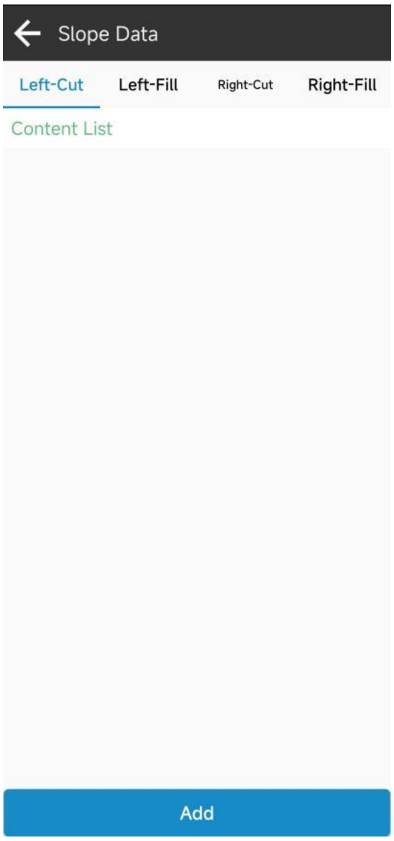
4.9-4



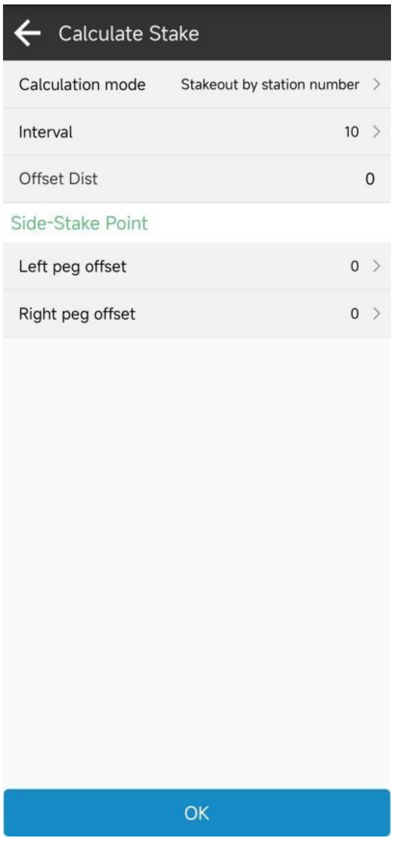
4.9-5



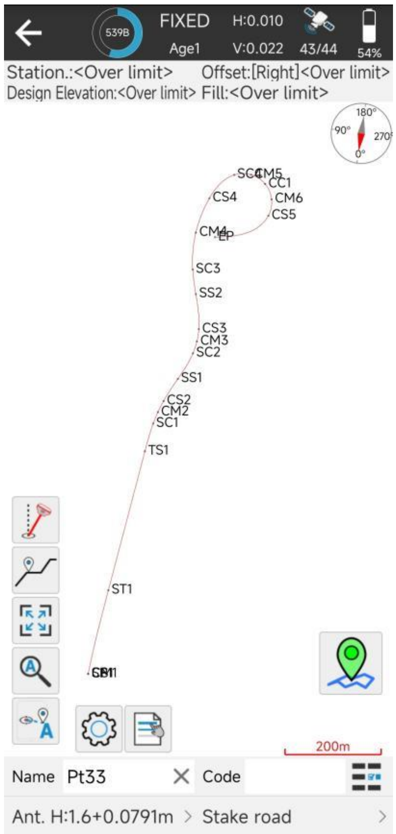
4.9-6



4.9-7



4.9-8

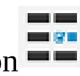


4.9-9

4.10 Electric Lines Survey

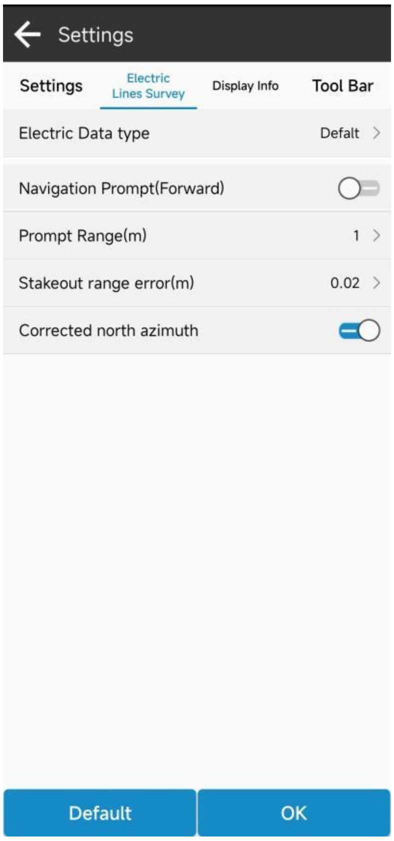
Click on [Survey] ->[Electric Lines Survey], as shown in 4.10-1. The Electric Lines Survey function is to stakeout electric lines while collecting ground object data near the electric line. The survey results are exported and used in professional electric design software to determine whether the set electric line meets the specification requirements based on the survey data.

Click on  to enter the electric line survey settings, as shown in 4.10-2. You can modify the storage type of electric survey data and the setting of stakeout prompts. Click on the electric data storage type to enter the electric data database, as shown in 4.10-3. It supports customization of ground feature data of data types, such as create, edit, sharw, and apply data types. The new edit is shown in 4.10-4 and 4.10-5.

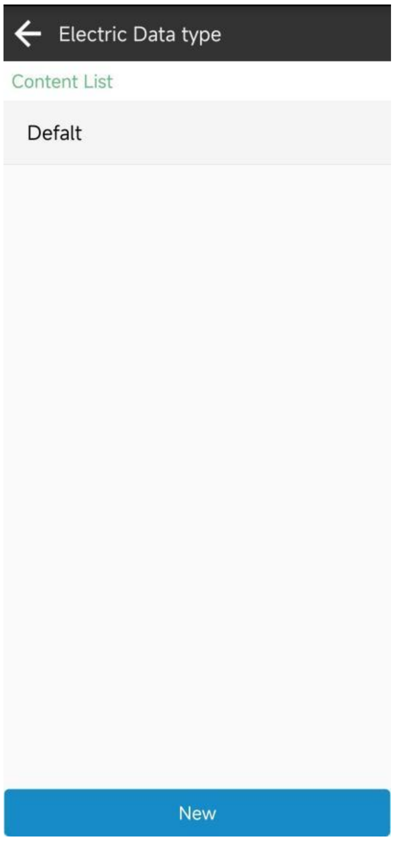
Click on  to enter the electric line library, as shown in 4.10-6. Click on  to enter the electric line database, as shown in 4.10-7. You can create, import, edit, and delete electric lines.

Click to  enter the bisector stakeout, as shown in 4.10-8 and 4.10-9, to stakeout the bisector of the electric line tower.

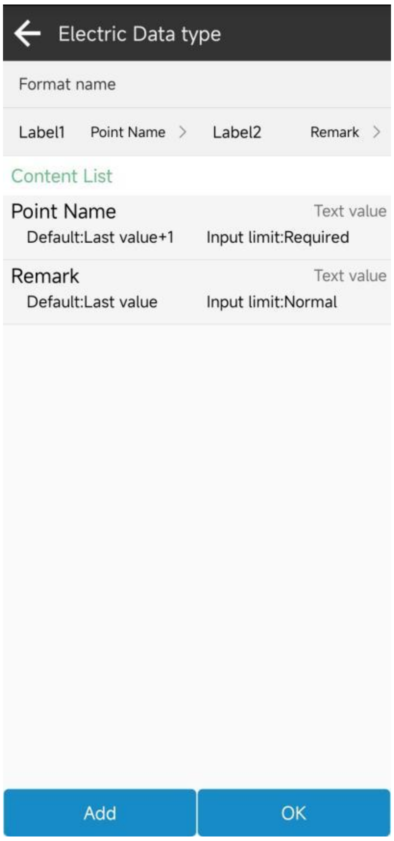
4.10-1



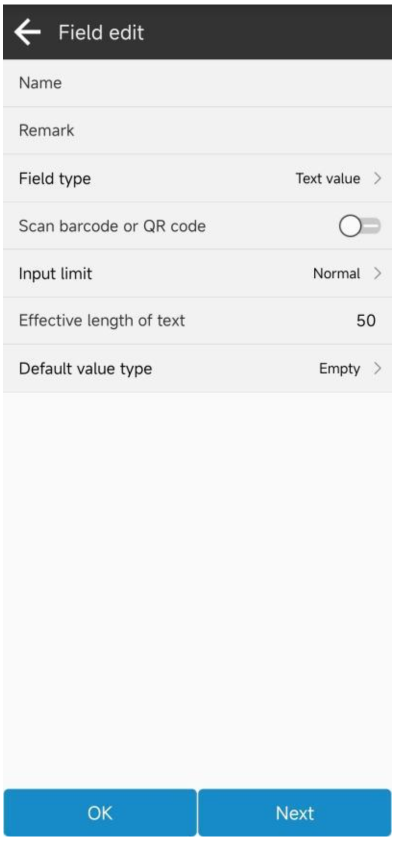
4.10-2



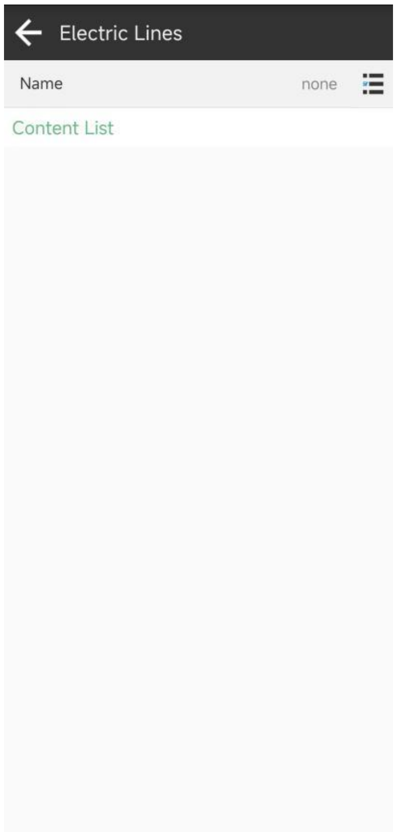
4.10-3



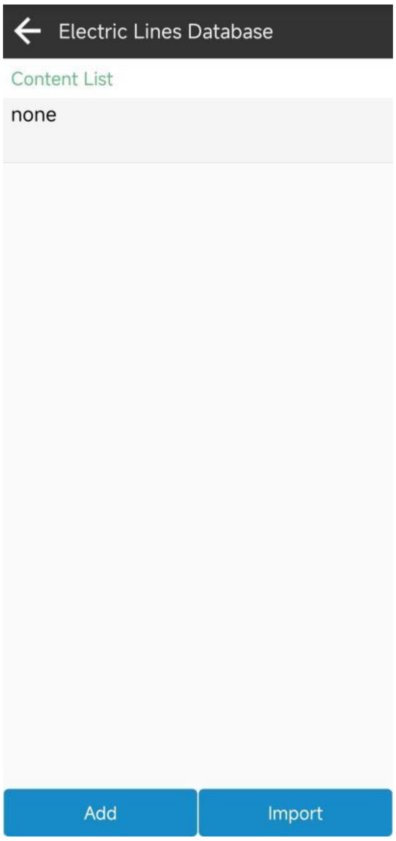
4.10-4



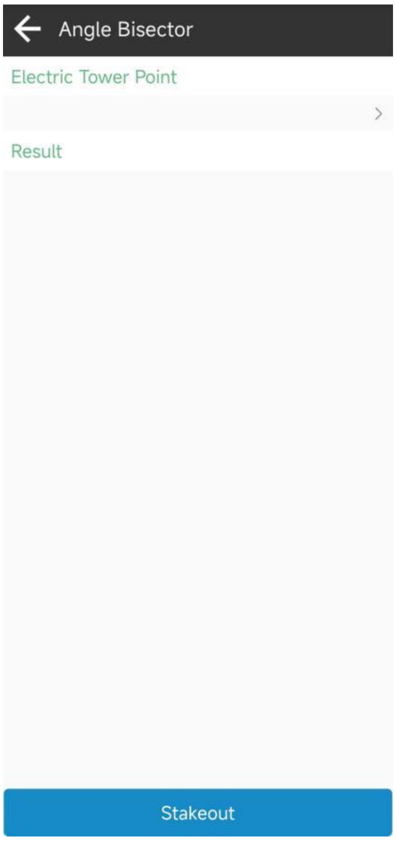
4.10-5



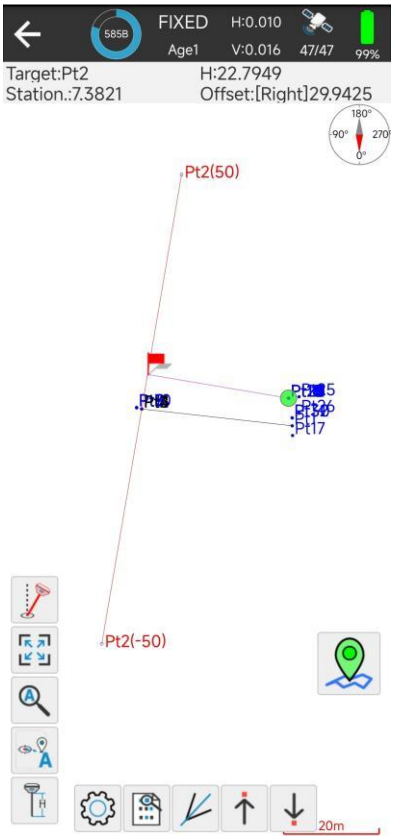
4.10-6



4.10-7



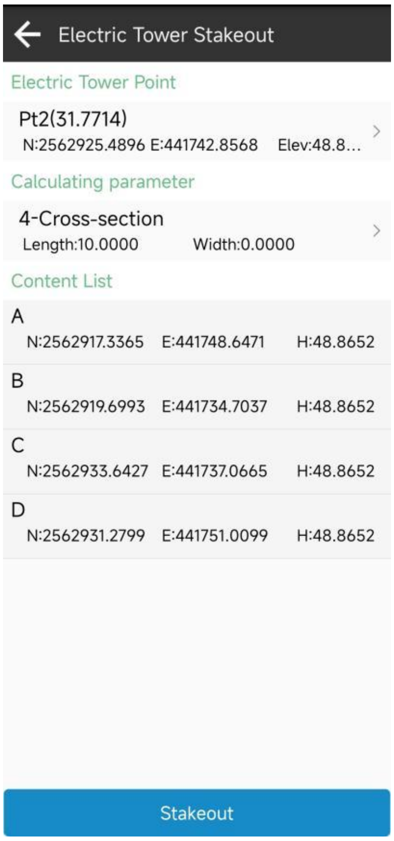
4.10-8



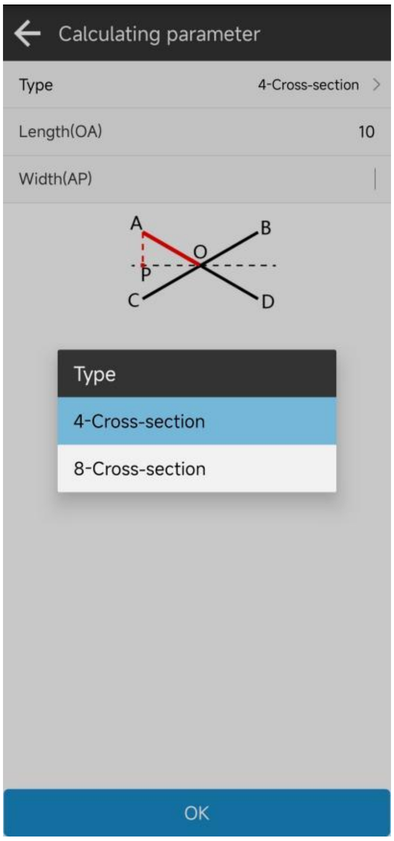
4.10-9

4.11 Electric Tower Stakeout

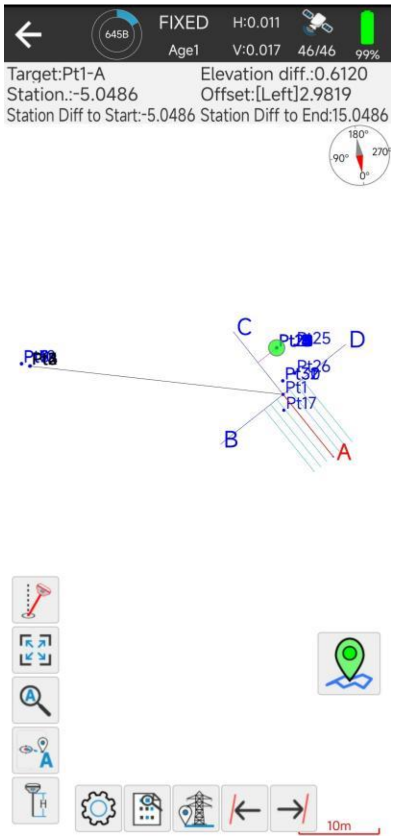
Click on [Survey] ->[Electric Tower Stakeout], as shown in 4.11-1, to stakeout the tower line and the tower point of the electric line tower. Select the tower to stakeout, set the tower parameters, calculate the tower point, support the calculation method of 4-cross-section and 8-cross-section, input the length and width of the tower, as shown in 4.11-2. Select the tower point and click on the stakeout, as shown in 4.11-3.



4.11-1



4.11-2



4.11-3

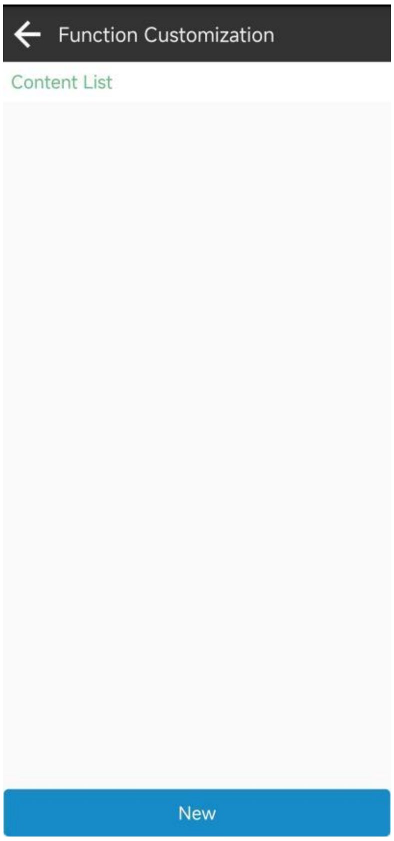
4.12 Function Customization

Click on [Survey] ->[Function Customization], as shown in 4.12-1. Users can define various point, polyline, and polygon types of feature data and their attributes required for the project according to actual project requirements, and use them as a functional module. Users can directly use this functional module to collect the data results required for the project and export the results.

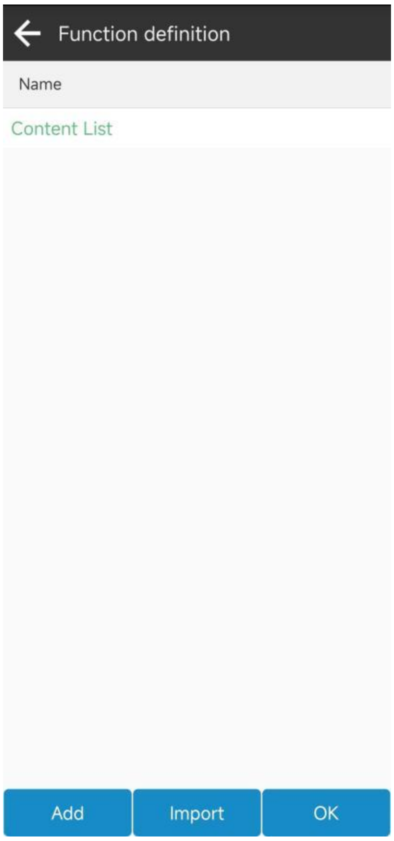
You can create, edit, delete, hide, and share functional modules. Each function can define multiple different types of features and various attribute data, as shown in 4.12-2, 4.12-3 and 4.12-4.

After defining the function, it will be displayed in the main interface, as shown in 4.12-5.

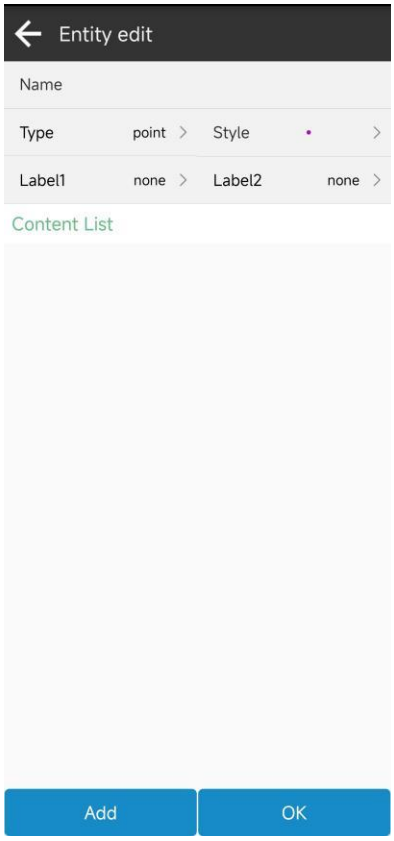
Click on the function to enter the data survey interface, as shown in 4.12-6.



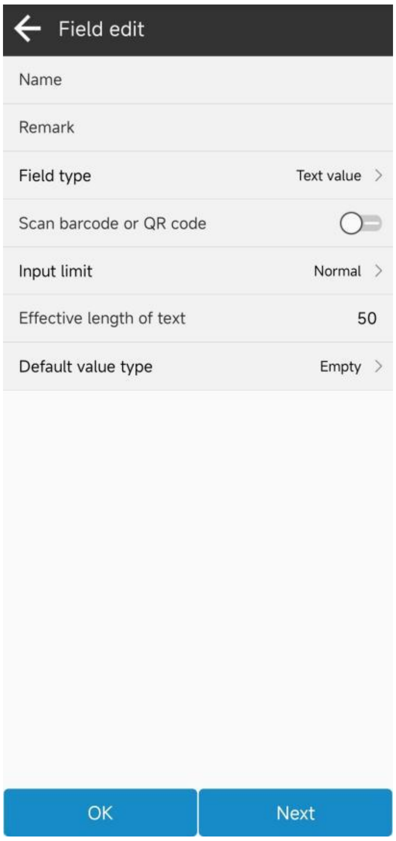
4.12-1



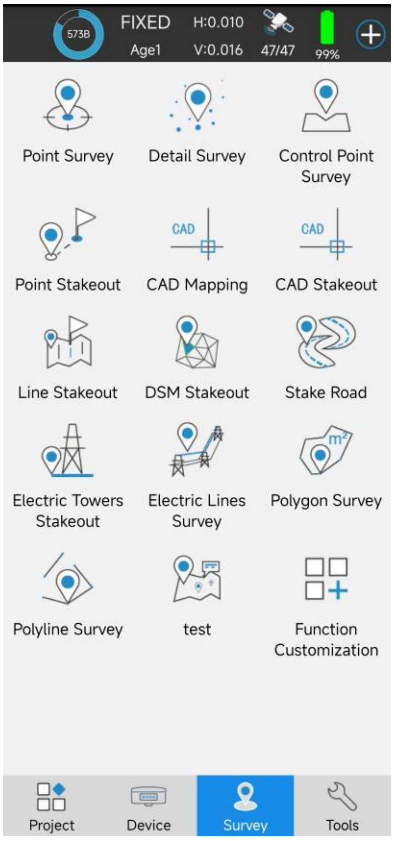
4.12-2



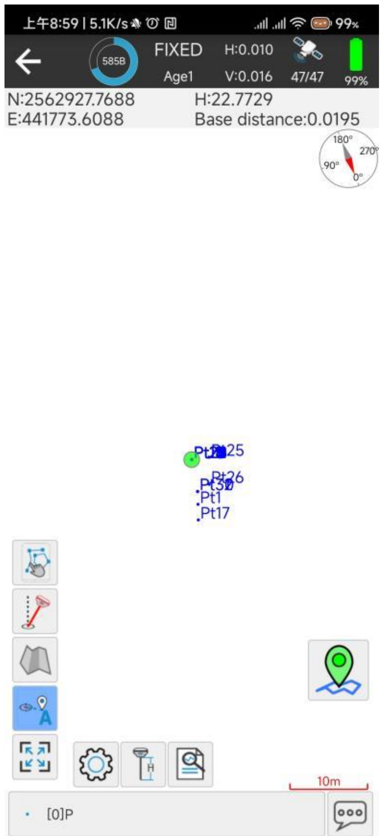
4.12-3



4.12-4



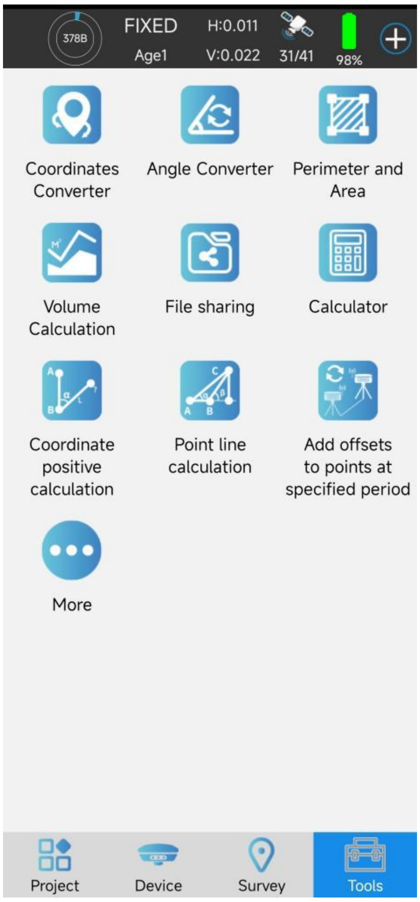
4.12-5

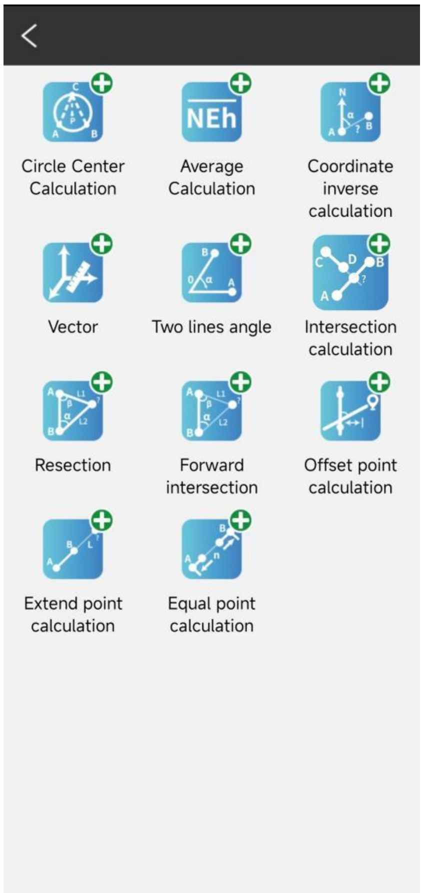


4.12-5

V Tools

On the main interface of the software, click on [Tools], as shown in 5-1. The tools include commonly used tools such as Coordinates converter, Angle Converter, Perimeter and area, Volume calculation, File sharing, Calculator, Average calculation, Coordinate positive calculation, Coordinate inverse calculation, Point line calculation, Circle center calculation, Add offset to points at specified period, Vector, Two lines angle, Intersection calculation, Resection, Forward intersection, Offset point calculation, Extension point calculation, Equal point calculation and other functions.

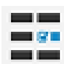


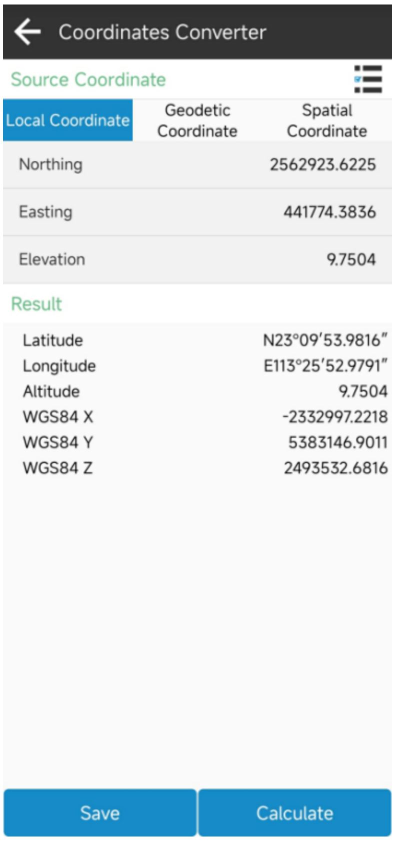


5-1 5-2

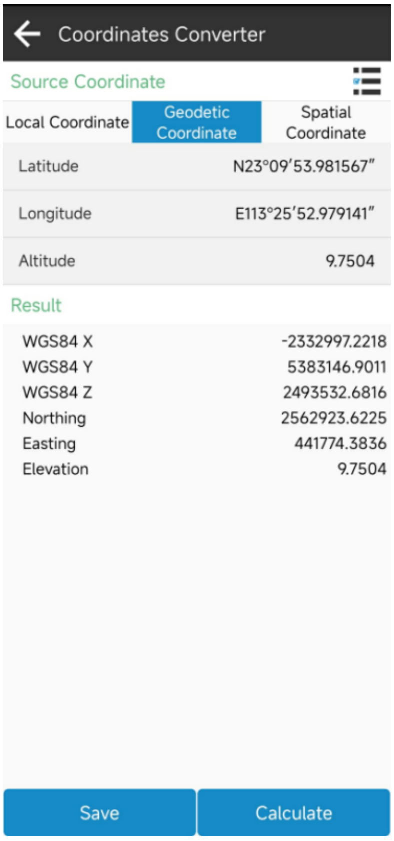
5.1 Coordinates Converter

Click on [Tools]->[Coordinates Converter], as shown in 5.1-1 and 5.1-2. By using the coordinate system parameters set in the current project, convert the coordinate points into local coordinates, geodetic coordinates, and spatial coordinates.

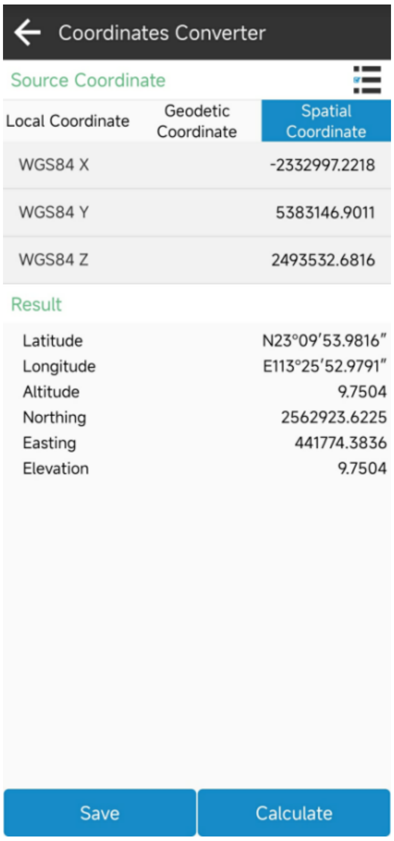
Click on  to select a point from the points database for calculation conversion, and save the calculated point to the points database.



5.1-1



5.1-2



5.1-3

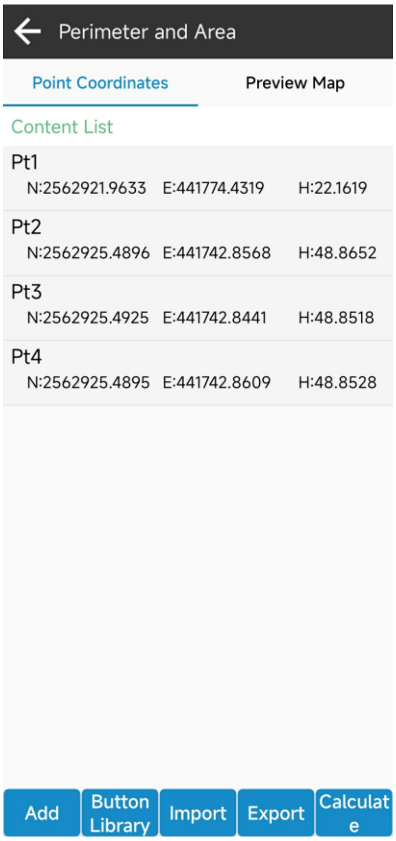
5.2 Angle Converter

Click on [Tools]->[Angle Converter], as shown in 5.2-1. Use this function to transform the formats of angles such as degrees, degrees, seconds, and radians. Select one format to input and calculate the values of the other formats.

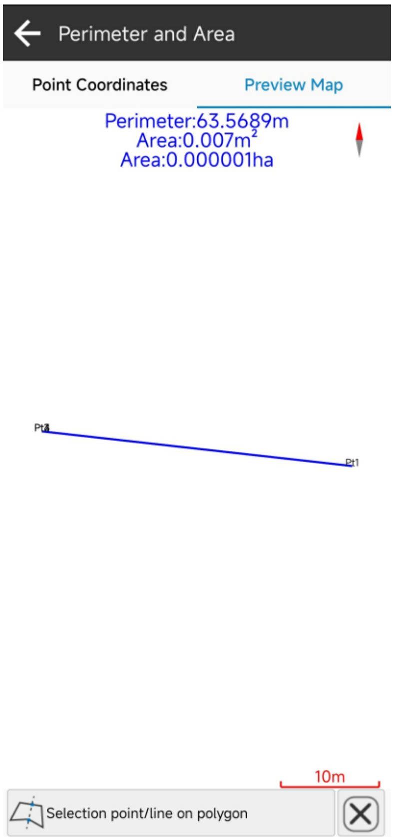
5.2-1

5.3 Perimeter And Area

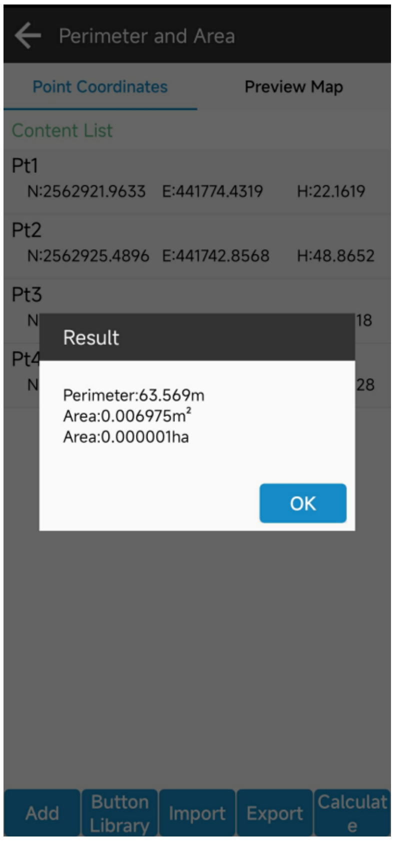
Click on [Tools]->[Perimeter And Area], as shown in 5.3-1. Manage the coordinate points of the polygon in the coordinate points, and add operations such as delete, import, and export coordinate points. View the graphics of the polygon in the preview, as shown in 5.3-2. Click Calculate, as shown in 5.3-3.



5.3-1



5.3-2

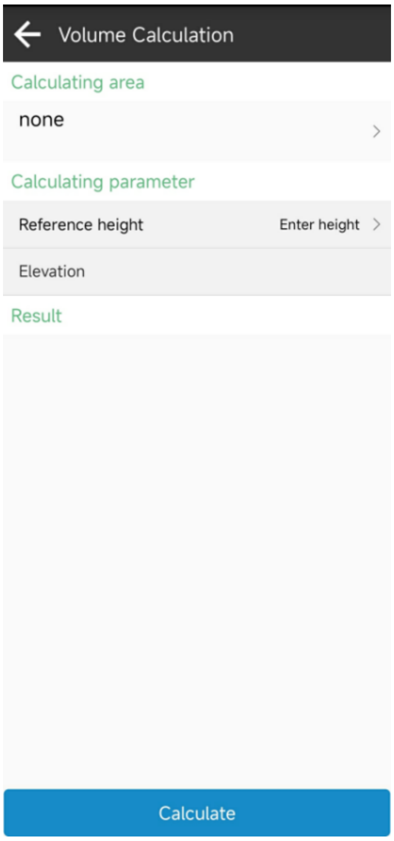


5.3-3

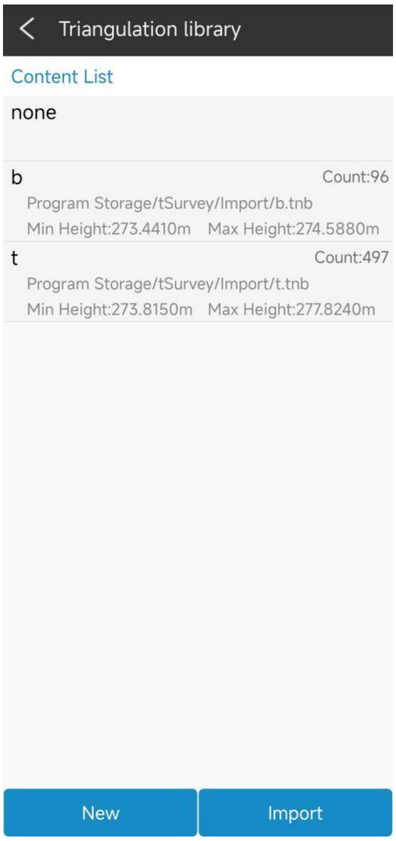
5.4 Volume

Click on [Tools]->[Volume], as shown in 5.4-1. Enter the DMS database and select the calculation surface, as shown in 5.4-2. After selecting the calculation surface, enter the reference height or select the reference surface to calculate the earthwork quantities for the fill and cut of the surface data.

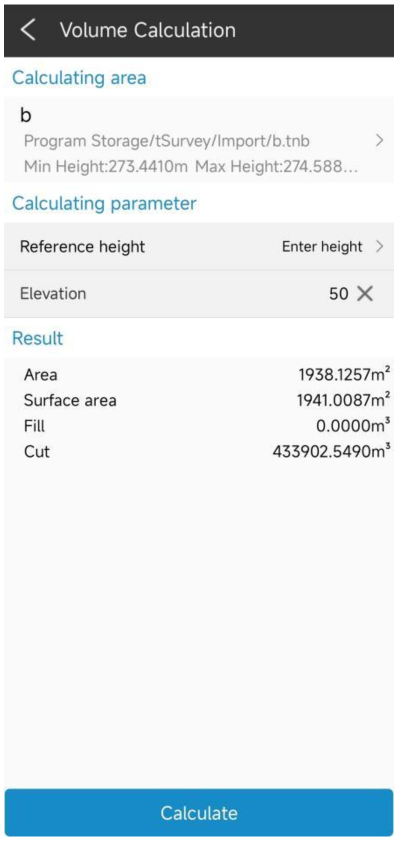
In the DMS database, you can create, import, edit, delete, and share triangulation data.



5.4-1



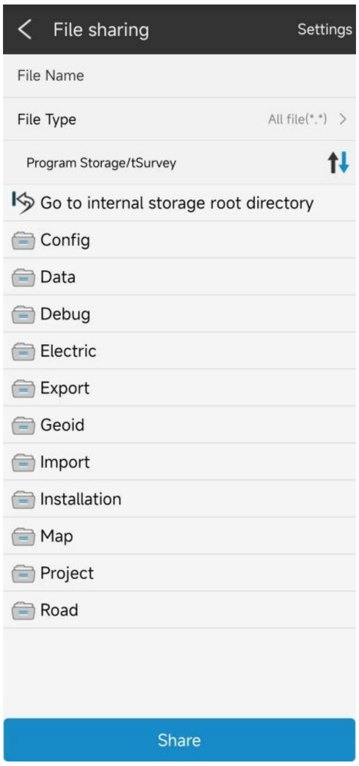
5.4-2



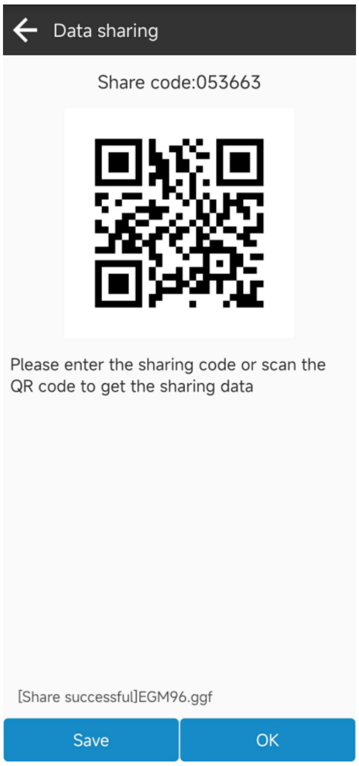
5.4-3

5.5 File sharing

Click on [Tools]->[File Sharing], as shown in 5.5-1. Select the files you want to sharing, as shown in 5.5-2. Other pda can input the share code or scan the QR code on the main interface of the software to obtain the shared files, as shown in 5.5-3.



5.5-1



5.5-2

5.5-3

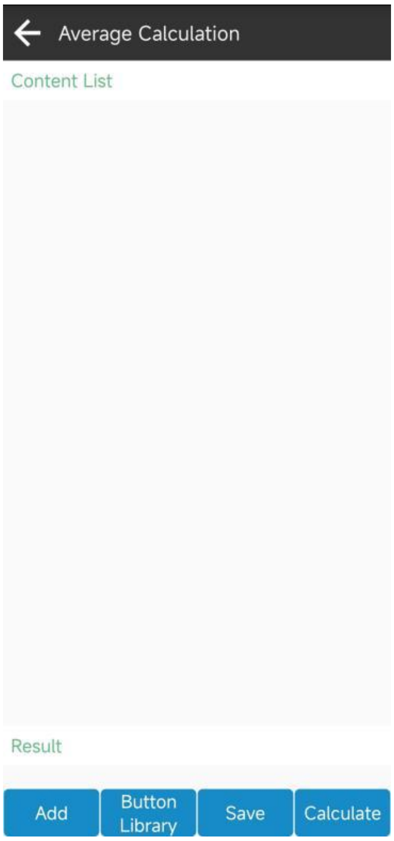
5.6 Calculator

Click on [Tools]->[Calculator], as shown in 5.6-1.

5.6-1

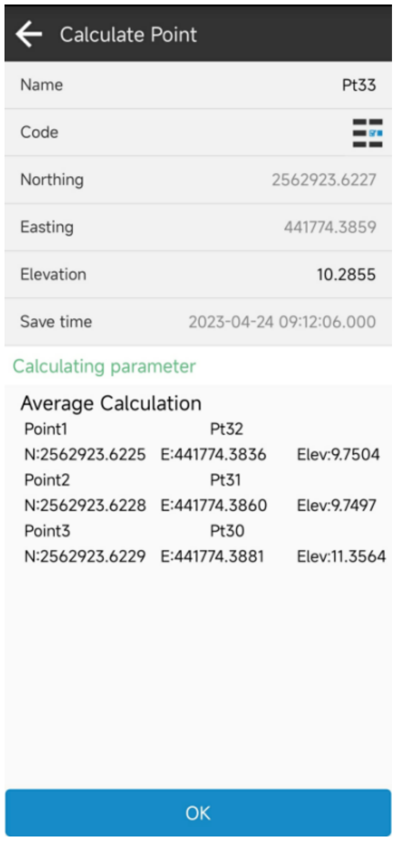
5.7 Average Calculation

Click on [Tools]->[Average Calculation], as shown in 5.7-1. The average value of N points can be calculated and the results saved to the points database, as shown in 5.7-2.



5.7-1

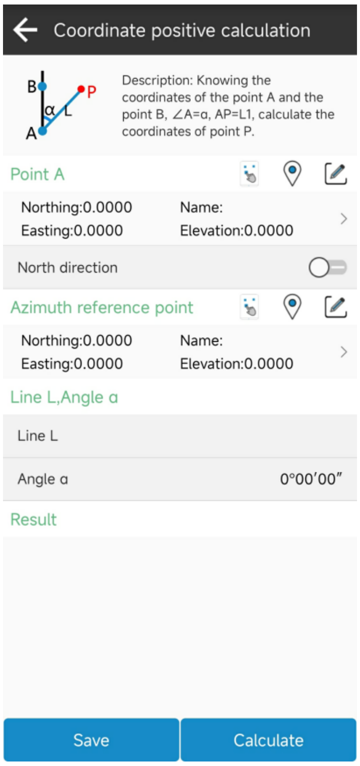
5.7-2

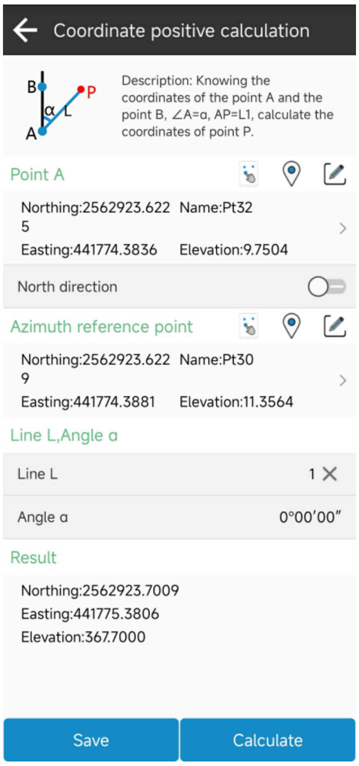


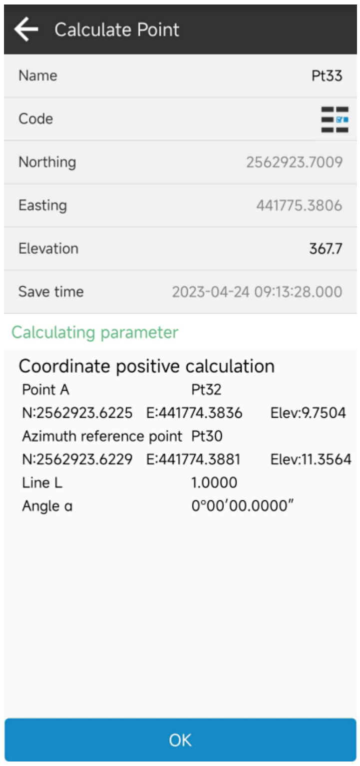
5.7-3

5.8 Coordinate positive calculation

Click on [Tools]->[Coordinate positive calculation], as shown in 5.8-1. Input/select point A and azimuth reference point B, input L and angle, calculate the point, and save the results to the points database, as shown in 5.8-2.



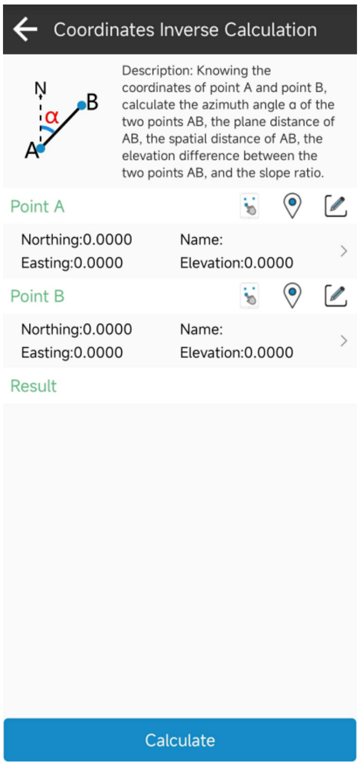


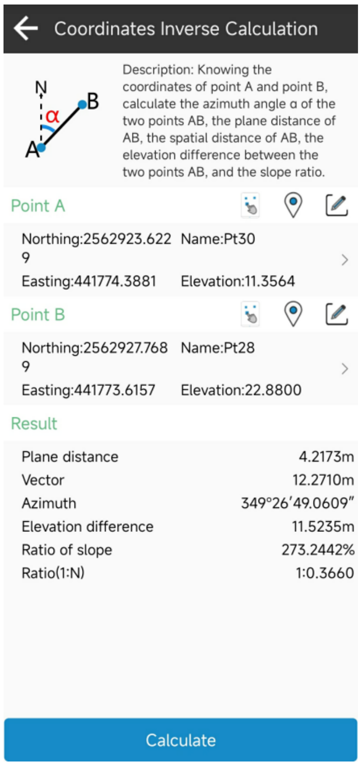


5.8-1 5.8-2 5.8-3

5.9 Coordinate inverse calculation

Click on [Tools]->[Coordinate Inverse Calculation], as shown in 5.9-1. Enter/select points A and B, calculate the distance, azimuth, slope ratio, etc. of the two points.

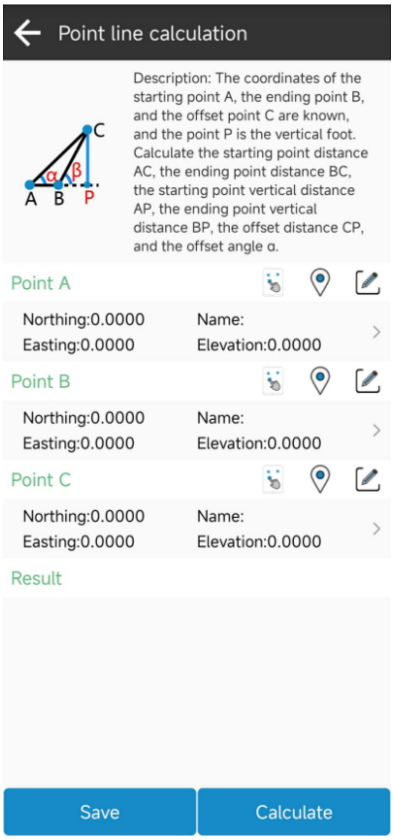




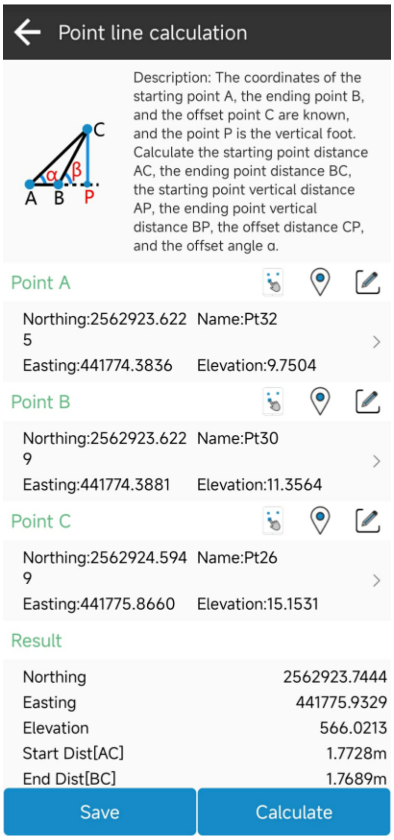
5.9-1 5.9-2

5.10 Point line calculation

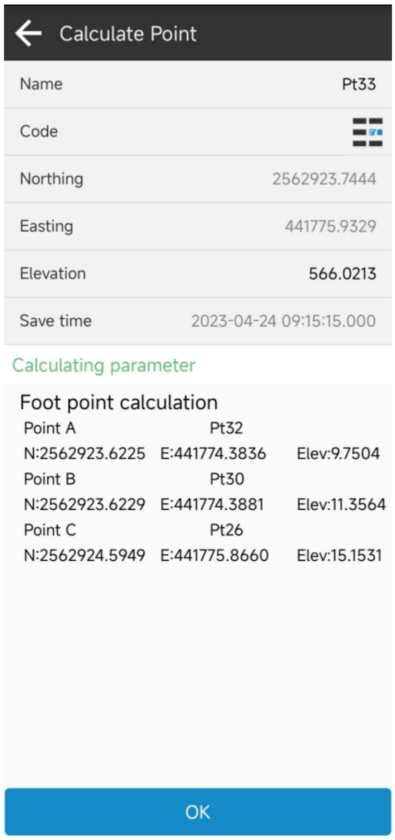
Click on [Tools]->[Point line calculation], as shown in 5.10-1. Enter/select three points, calculate the distance, vertical distance, deviation angle, corner, etc. of the points.



5.10-1



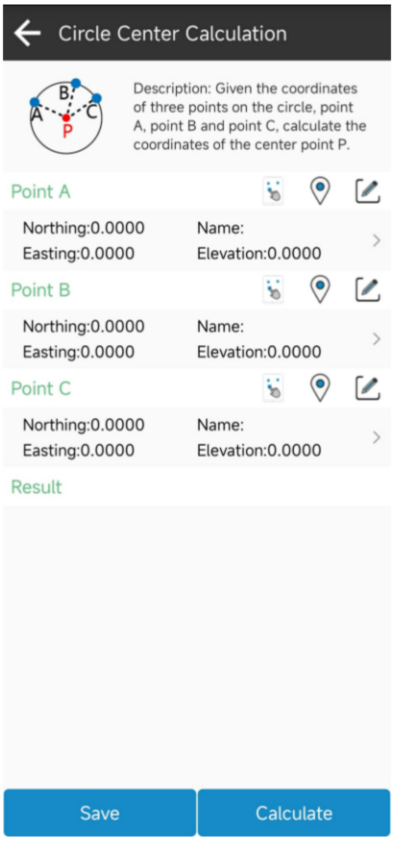
5.10-2



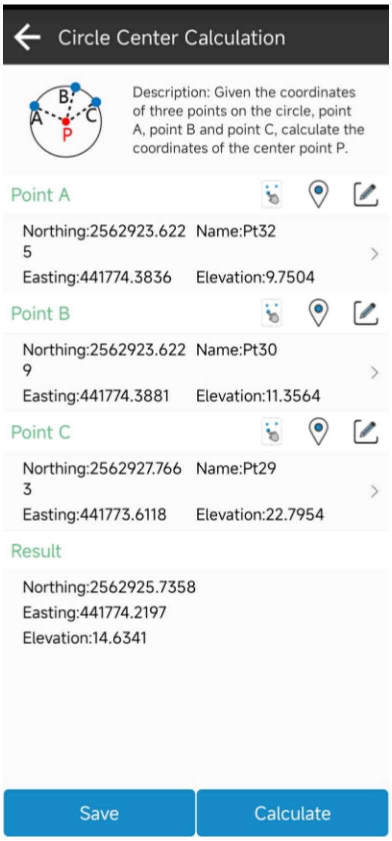
5.10-3

5.11 Circle Center Calculation

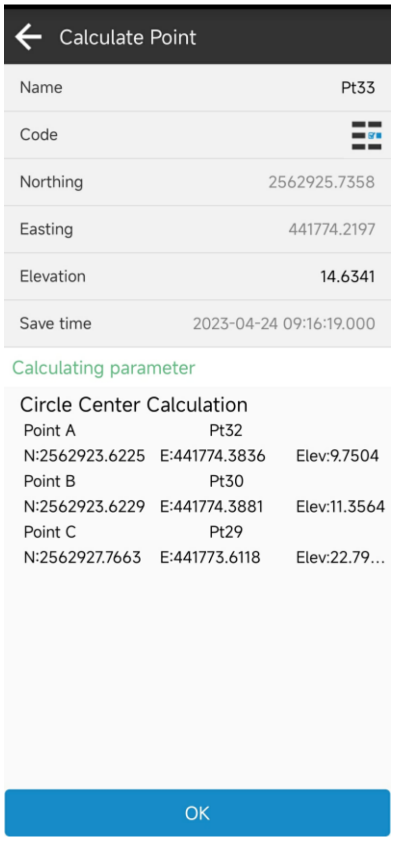
Click on [Tools] ->[Circle Center Calculation], as shown in 5.11-1. Enter/select three points and calculate the center point of the three points.



5.11-1



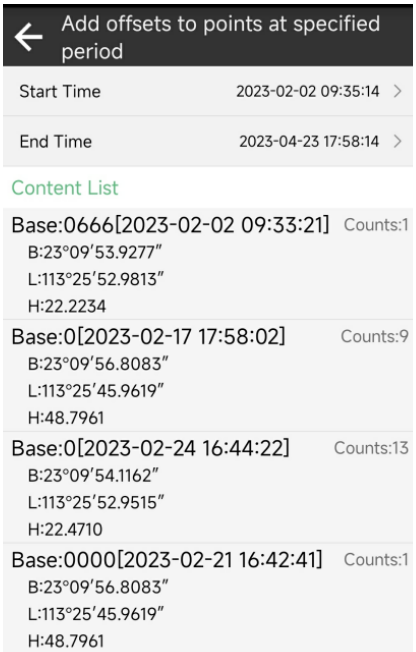
5.11-2



5.11-3

5.12 Add offsets to points at specified

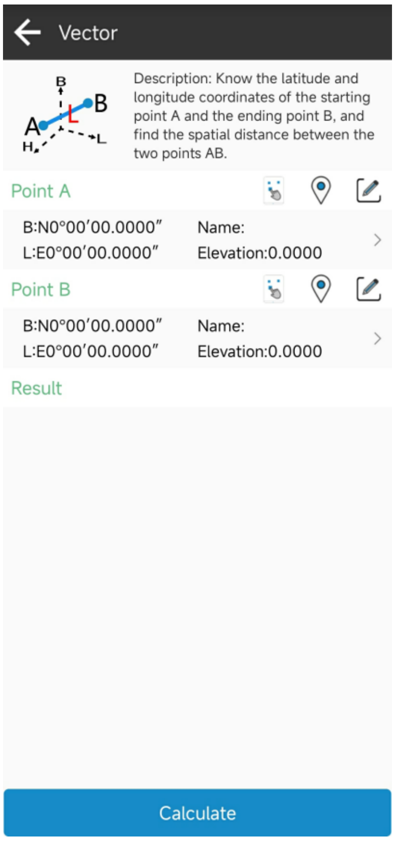
Click on [Tools]->[Add offsets to points at specified], as shown in 5.12-1. If calibration is not performed before survey, known points can be used for recalibration.



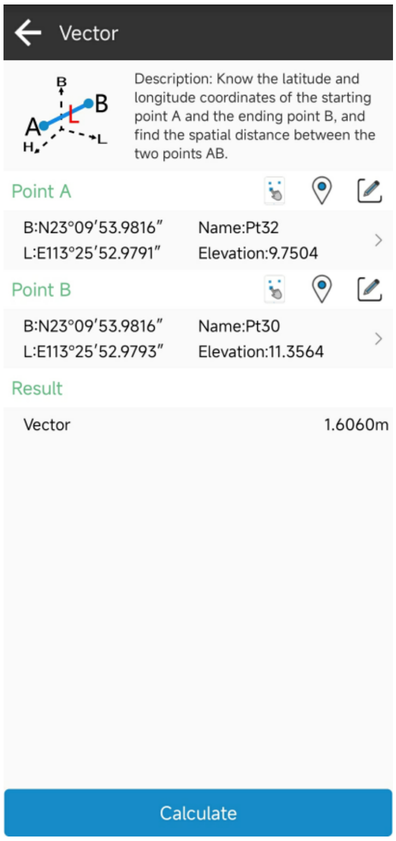
5.12-1

5.13 Vector

Click on [Tools] ->[Vector], as shown in 5.13-1. Enter/select two points to calculate the vector distance.



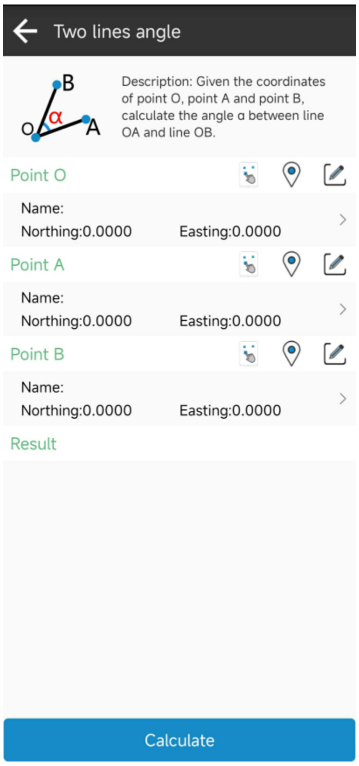
5.13-1



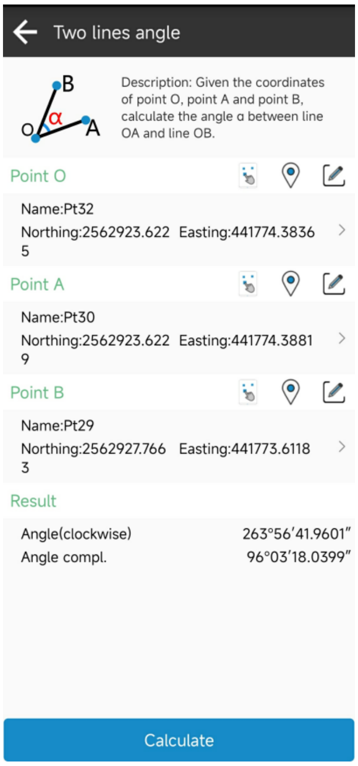
5.13-2

5.14 Two lines angle

Click on [Tools] ->[Two lines angle], as shown in 5.14-1.



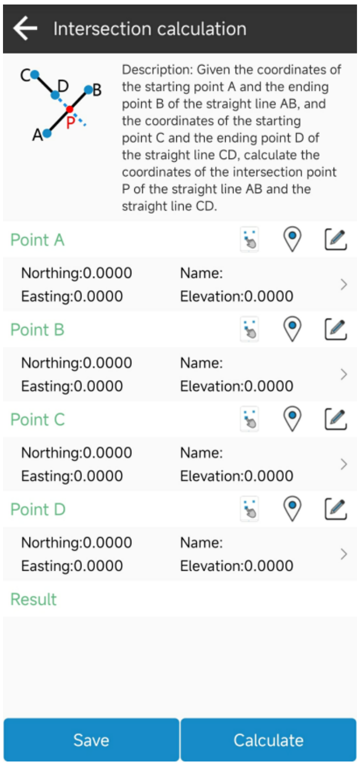
5.14-1

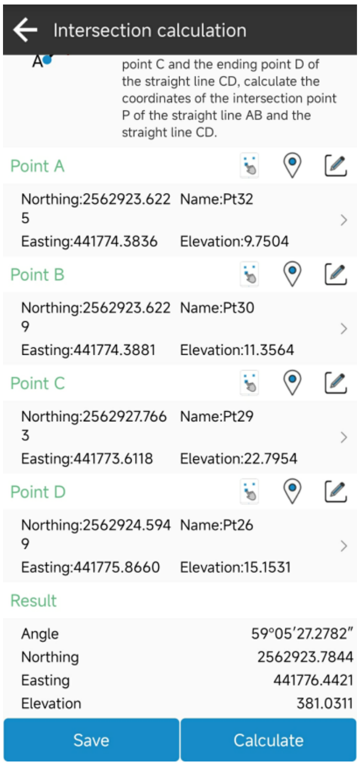


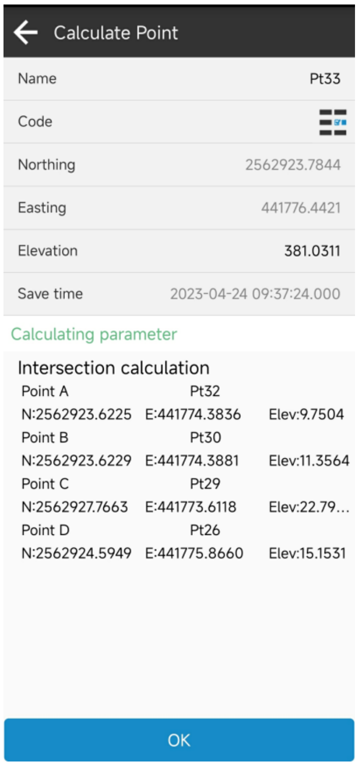
5.14-2

5.15 Intersection calculation

Click on [Tools] ->[Intersection Calculation], as shown in 5.15-1. Find the intersection point of two lines and save the result to the points database, as shown in 5.15-2.



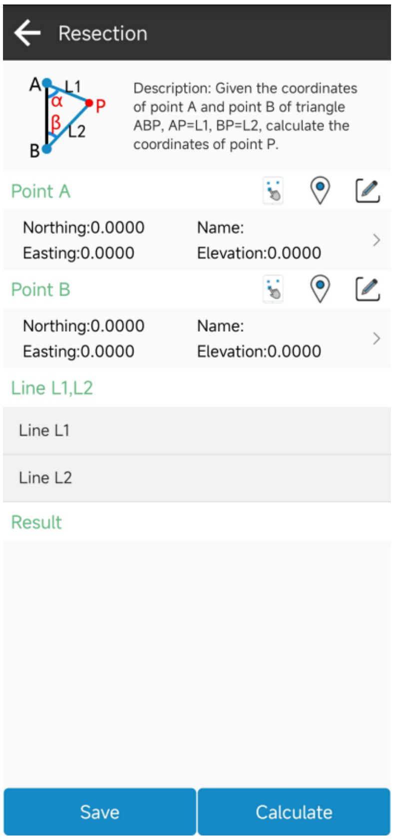


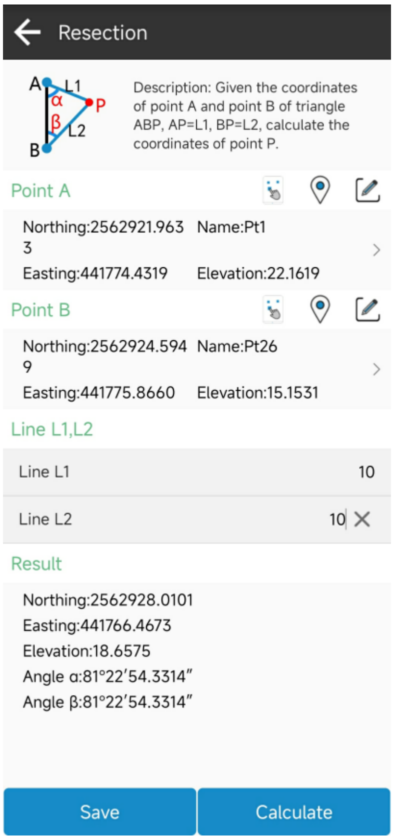


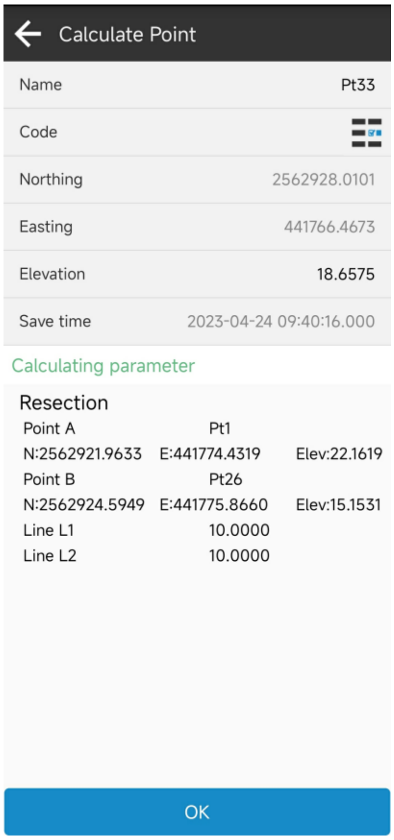
5.15-1 5.15-2 5.15-3

5.16 Resection

Click on [Tools]->[Resection], as shown in 5.16-1. Given two points and their distance to the target, calculate the target point and save the results to the points database, as shown in 5.16-2.



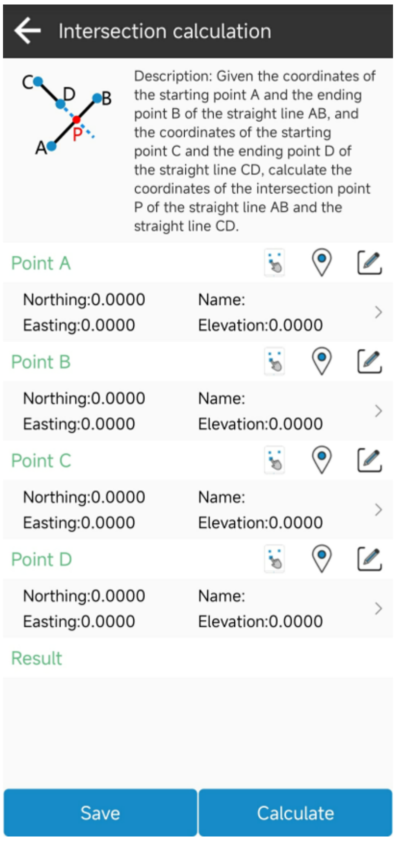




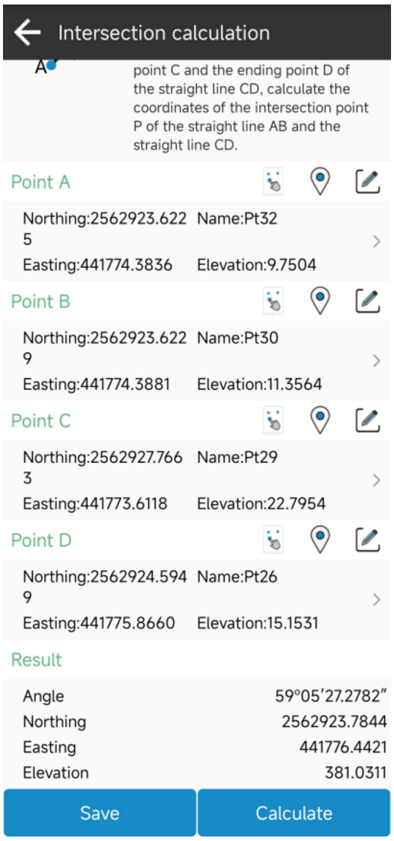
5.16-1 5.16-2 5.16-3

5.17 Forward intersection

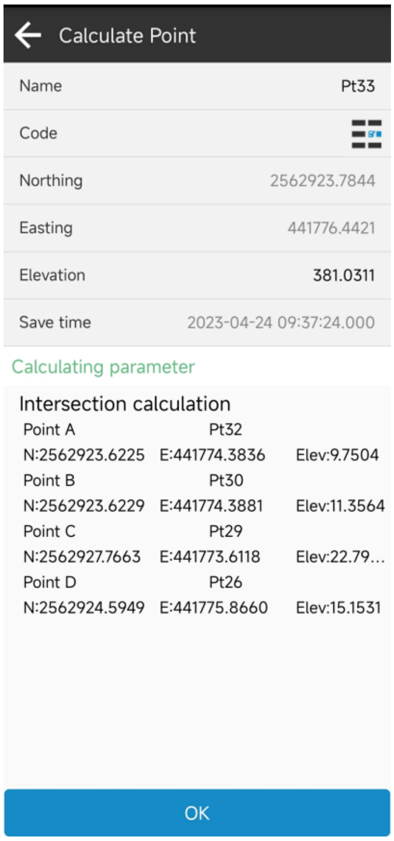
Click on [Tools] ->[Forward Intersection], as shown in 5.17-1. Given two points and their included angles, calculate the target point and save the results to the points database, as shown in 5.17-2.



5.17-1



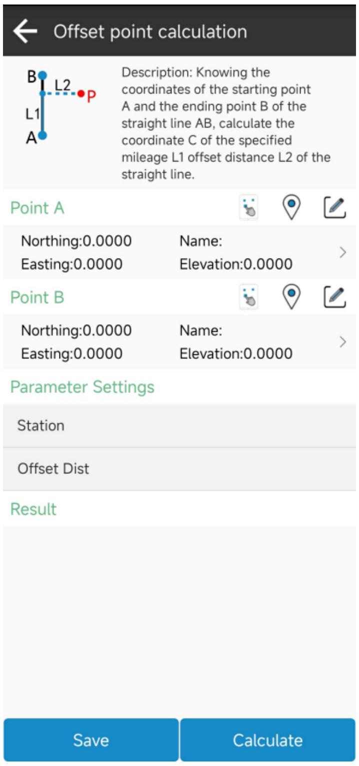
5.17-2



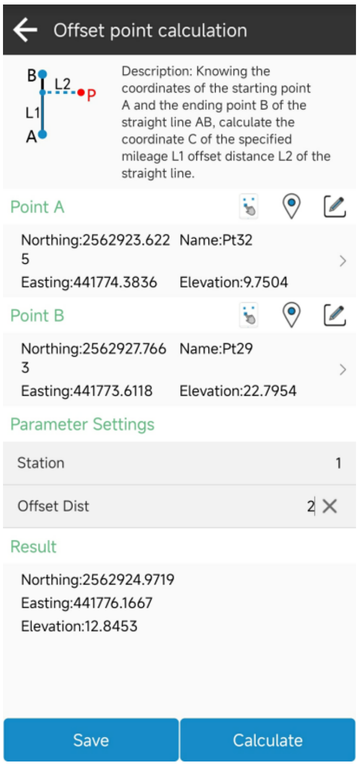
5.17-3

5.18 Offset point calculation

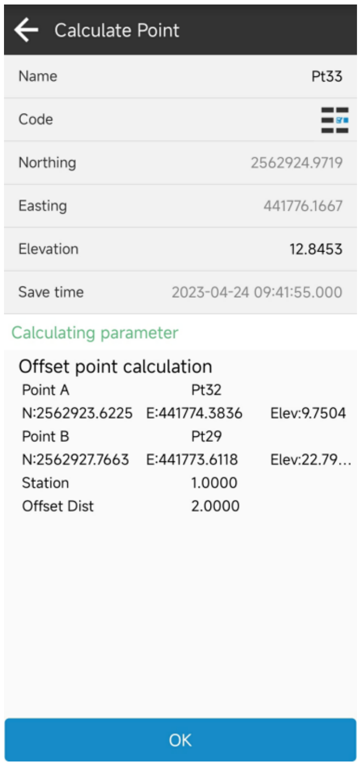
Click on [Tools] ->[Offset point calculation], as shown in 5.18-1. Given two points, calculate the offset point of the station and offset, and save the results to the points database, as shown in 5.18-2.



5.18-1



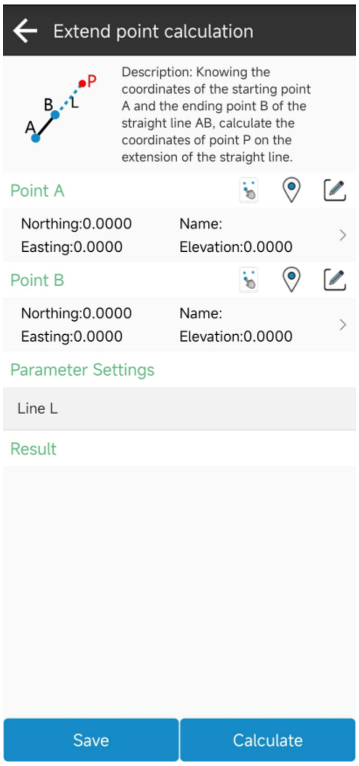
5.18-2

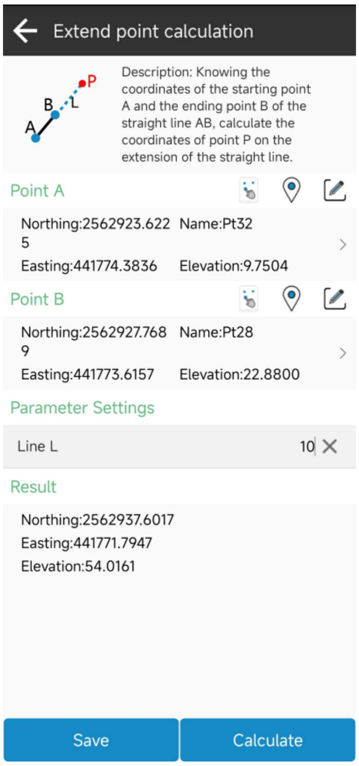


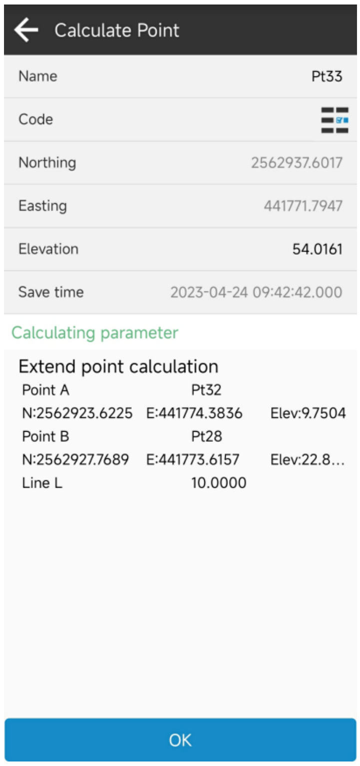
5.18-3

5.19 Extend point calculation

Click on [Tools]->[Extend point calculation], as shown in 5.19-1. Enter two points, calculate the points on the extend line, and save the results to the points database, as shown in 5.19-2.



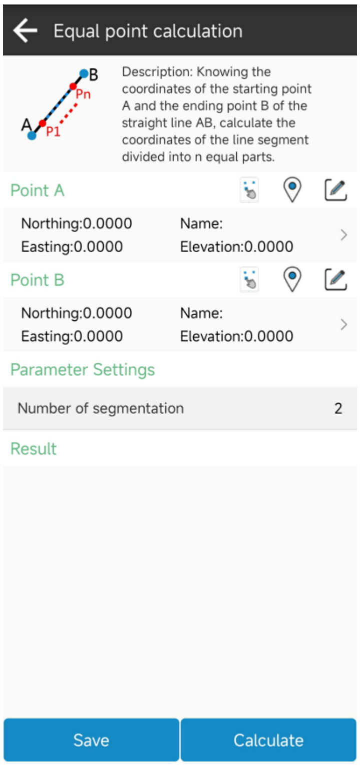


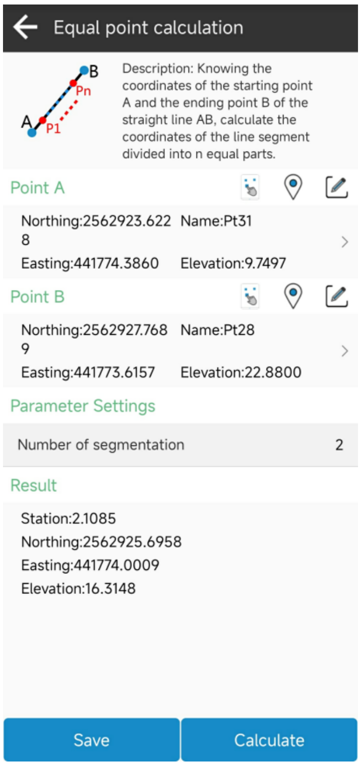


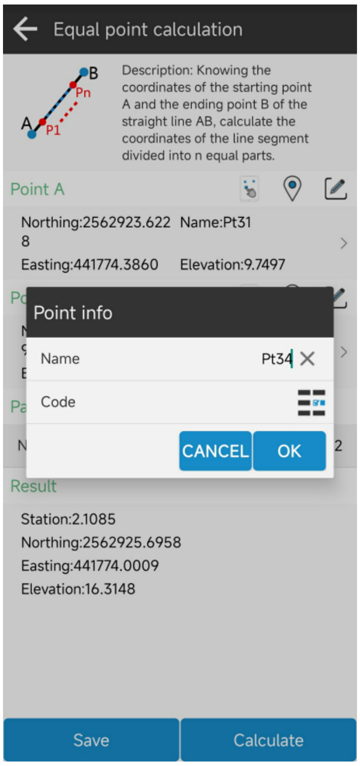
5.19-1 5.19-2 5.19-3

5.20 Equal point calculation

Click on [Tools] ->[Equal point calculation], as shown in 5.20-1. Enter two points, calculate the bisection points of the line segment, and save each bisection point to the points database, as shown in 5.20-2.







5.20-1 5.20-2 5.20-3