

DiMap Pro Surveying Software

(Android platform)



Instruction

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Guangzhou Alpha Surveying Technology Co.,Ltd.

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1 DiMap Pro Overview

1.1 Introduction

DiMap Pro 4.3 software is an engineering surveying application software developed by Guangzhou Alpha Surveying Technology Co.,Ltd. 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, including **[Project Manager]**, **[Localization]**, **[Calibrate Point]**, **[Coordinate System]**, **[Points Database]**, **[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]**, **[Static and collect points]**.

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]**, **[Electric Lines Survey]**, **[Electric Towers Stakeout]**, **[Function Customization]**.

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]**, **[Extend point calculation]**, **[Equal point calculation]**.

1.2 Installation and uninstallation

Installation process:

1. Download the Android DiMap Pro 4.3 software installer (*.apk).
2. Copy the DiMap Pro 4.3 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 DiMap Pro 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 latest project).

Uninstallation process:

Long press the icon of the software on the desktop, drag it to the Uninstall option box, and click OK to complete the software uninstalatio1

2 Project

Enter the main interface of the software and click on **[Project]**, as shown in Figure 2-1 and Figure 2-2. The project includes **[Project Manager]**, **[Localization]**, **[Calibrate Point]**, **[Coordinate system]**, **[Points Database]**, **[Code Library Manager]**, **[Import data]**, **[Export data]**, **[Offset point correction]**, **[Grid to ground]**, **[Survey Range Settings]**, **[Layers Settings]**, **[Software Settings]**, **[About Software]**. 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 Figure 2-2.



Figure 2-1

Figure 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: Program Storage → DiMap Pro → Project) as a folder with the project name. The basic information of the project is stored in the Project, and other data is stored in the corresponding directory file.

2.1 project manager

Click on **[Project]** → **[Project Manager]**, as shown in Figure 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 Figure 2.1-2. Click on **[Remove]**, as shown in Figure 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 Figure 2.1-4. Other PDA can obtain project data through share code or scan QR code.

Click on **[New]**, as shown in Figure 2.1-5. To create a new project, you need to input basic information such as Project Name, Operator. You can also modify the Project Path on the disk (default location: Program storage → DiMap Pro → Project), click **[Next]**, fill in the coordinate system parameters used to modify the project, as shown in Figure 2.1-6. Click **[OK]** to complete the project creation.

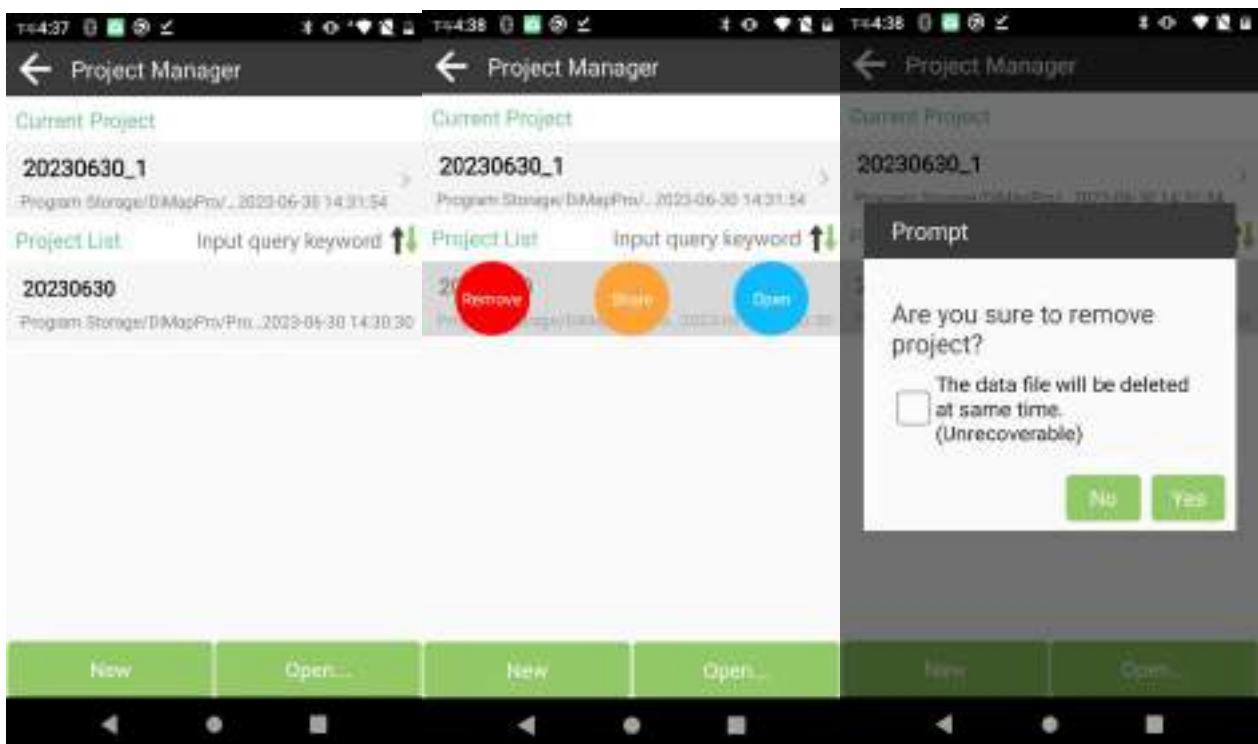


Figure 2.1-1

Figure 2.1-2

Figure 2.1-3

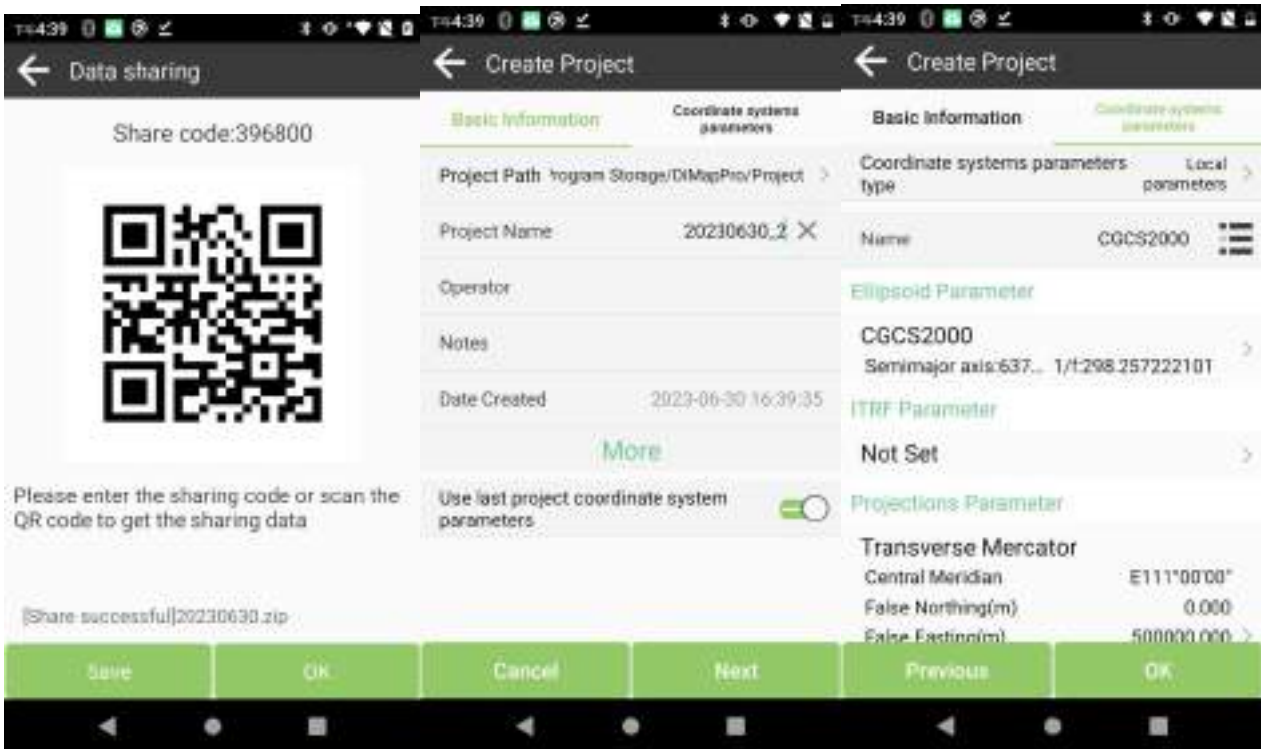


Figure 2.1-4

Figure 2.1-5

Figure 2.1-6

2.2 Localization

Click on **[Project]** → **[Localization]**, as shown in Figure 2.2-1. The high-precision position obtained by the software from GNSS device 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 you have conversion parameters of coordinates, you can directly set the coordinate system parameter values in the coordinate system (detailed in 2.4). If you do not have specific coordinate system parameters, but the corresponding values of longitude and latitude coordinates and plane coordinates are called control point data. 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 Figure 2.2-2. You can also import control point parameters in multiple formats, as shown in Figure 2.2-3. The commonly used formats are listed, click Import File Format then enter the interface of Format select, as shown in Figure 2.2-4. You can also add custom formats, as shown in Figure 2.2-5. Back to **[Localization]**, in Content 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 Figure 2.2-6. You can also export control point data as a file and provide it to other surveying software for using.

After editing the control point parameters, calculate the conversion parameters for the control point, click **[Calculate]**, and the interface of Localization Settings will pop up, as shown in Figure 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 Figure 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 stakeout operations can be carried out.



Figure 2.2-1



Figure 2.2-2



Figure 2.2-3



Figure 2.2-4



Figure 2.2-5

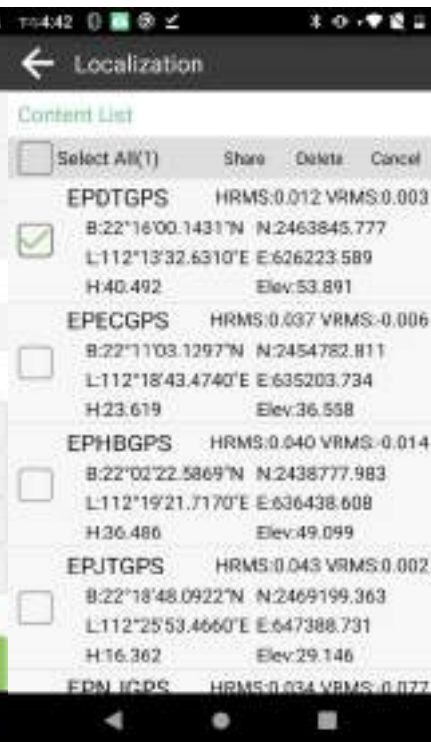


Figure 2.2-6

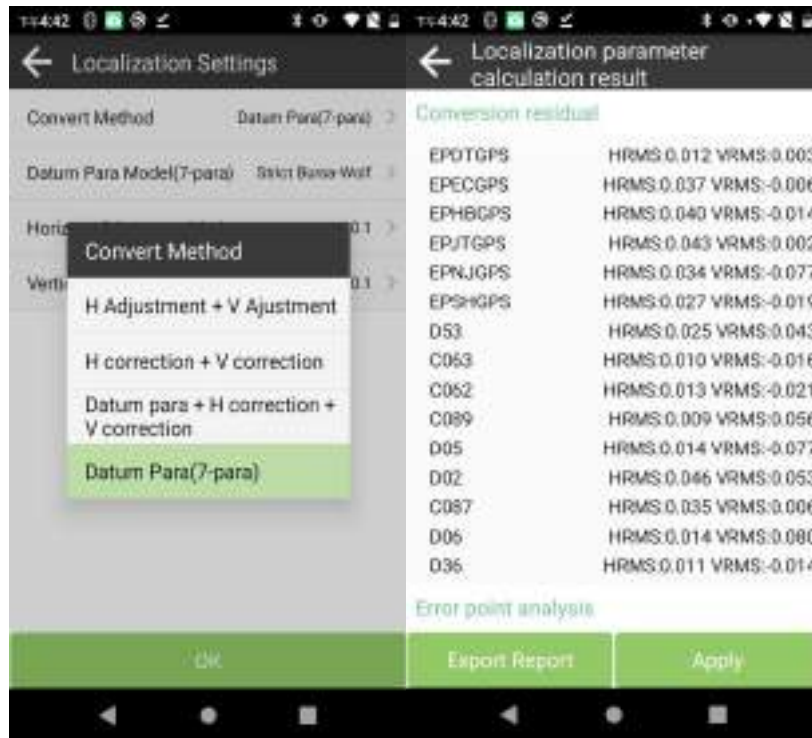


Figure 2.2-7

Figure 2.2-8

2.3 Calibrate point

Click on **[Project]** → **[Calibrate]**, as shown in Figure 2.3-1. In practical applications, the GNSS device obtains high-precision positions through the combination of differential data from the base station. Here, we know that the coordinate positions of the base station are known. In fact, the high-precision positions output by the GNSS device are the relative positions of the base 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 device to transmit differential data from base stations. When using their own base station to transmit differential data, a project may involve multiple starts of the base station. When starting the base station, the starting position and coordinates of the base station may change, and the starting coordinates may not be inconsistent with previous, In the absence of calibration, the coordinates of the rover station obtained using these base station differential data 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 Figure 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 base 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.

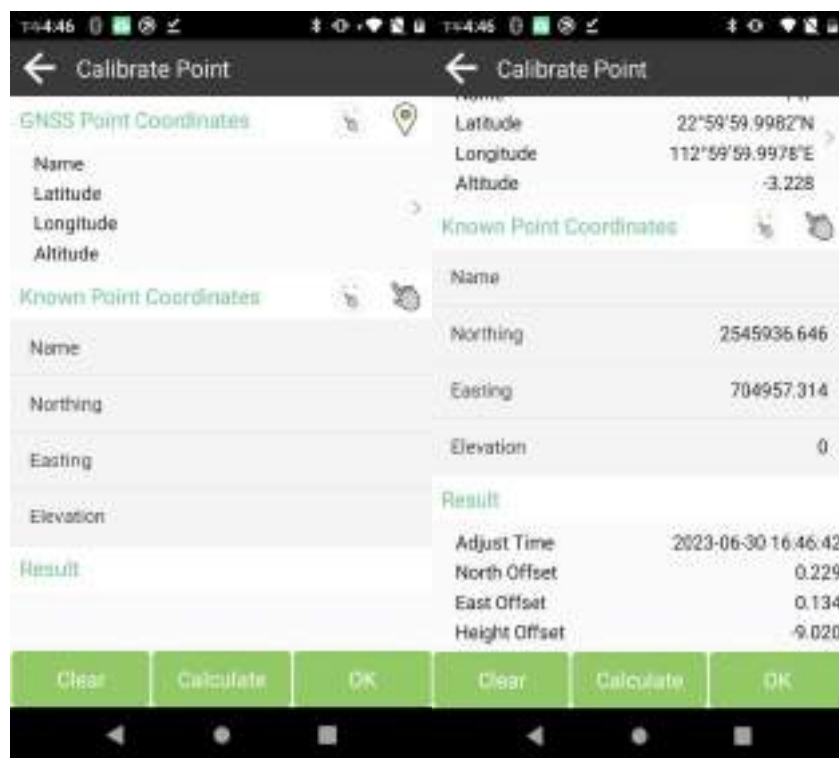


Figure 2.3-1

Figure 2.3-2

2.4 Coordinate System

Click on **[Project]** → **[Coordinate System]**, as shown in Figure 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 Figure 2.4-2. Select the desired ellipsoid from the ellipsoid list, also can add or delete ellipsoid parameters.

Click on **[Projection Parameters]** to enter the Projection Parameter editing interface, as shown in Figure 2.4-3. You can choose Transverse Mercator projection, Transverse Mercator projection, UTM projection, Lambert Conic Conformal (1sp), Lambert Conic Conformal (2sp), Oblique Stereographic (Double), Romania Stereographic 1970, Romania Stereographic 1930, Cassini Soldner, Oblique Mercator, Hotine Oblique Mercator, Krovak Oblique Conic Conformal. If choose Transverse Mercator projection, please 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 Figure 2.4-4. The transformation model includes Strict Bursa-Wolf, Bursa-Wolf (with the origin), Bursa-Wolf, Helmert, Helmert (with the origin), Molodensky.

Click on **[Horizon Adjustment]** to enter the Horizon Adjustment Parameter editing interface, as shown in Figure 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 Figure 2.4-6 and Figure 2.4-7. The conversion model includes Fixed height correction, Plane fitting, 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 Figure 2.4-8, allows users to import, download, 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. It 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.



Figure 2.4-1

Figure 2.4-2

Figure 2.4-3



Figure 2.4-4



Figure 2.4-5



Figure 2.4-6

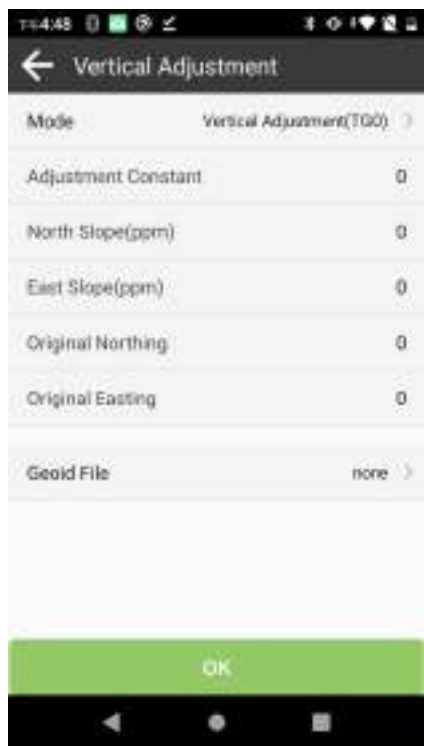


Figure 2.4-7

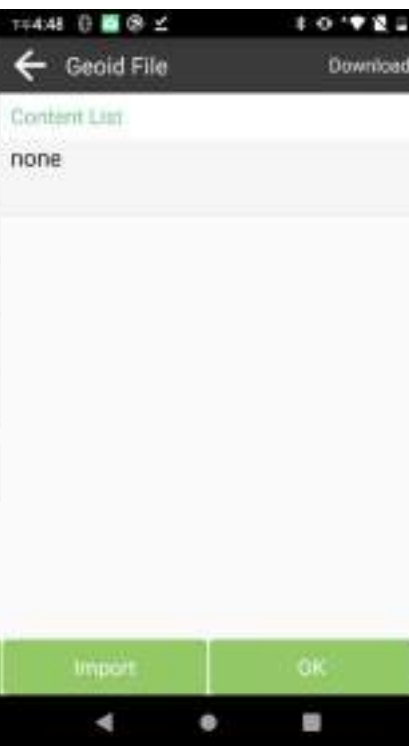


Figure 2.4-8



Figure 2.4-9

2.5 Points Database

Click on **[Project]** → **[Points Database]**, as shown in Figure 2.5-1 and Figure 2.5-2. 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 Figure 2.5-3, manually enter the point name, code, and corresponding coordinates;

[Share] and **[delete]**: As shown in Figure 2.5-4, 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 Figure 2.5-5 (smooth point) and Figure 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.

[Import]: As shown in Figure 2.5-7, select the format of the point data to be imported, and then select the data file to complete the data import. You can add, delete, and share custom formats in the format selection.

[Export]: As shown in Figure 2.5-8, select the data format to export, select the export location, and enter the export file name. Click **[Export]** to complete the data export. You can also add, delete, and share custom formats in the format selection, as shown in Figure 2.5-9.

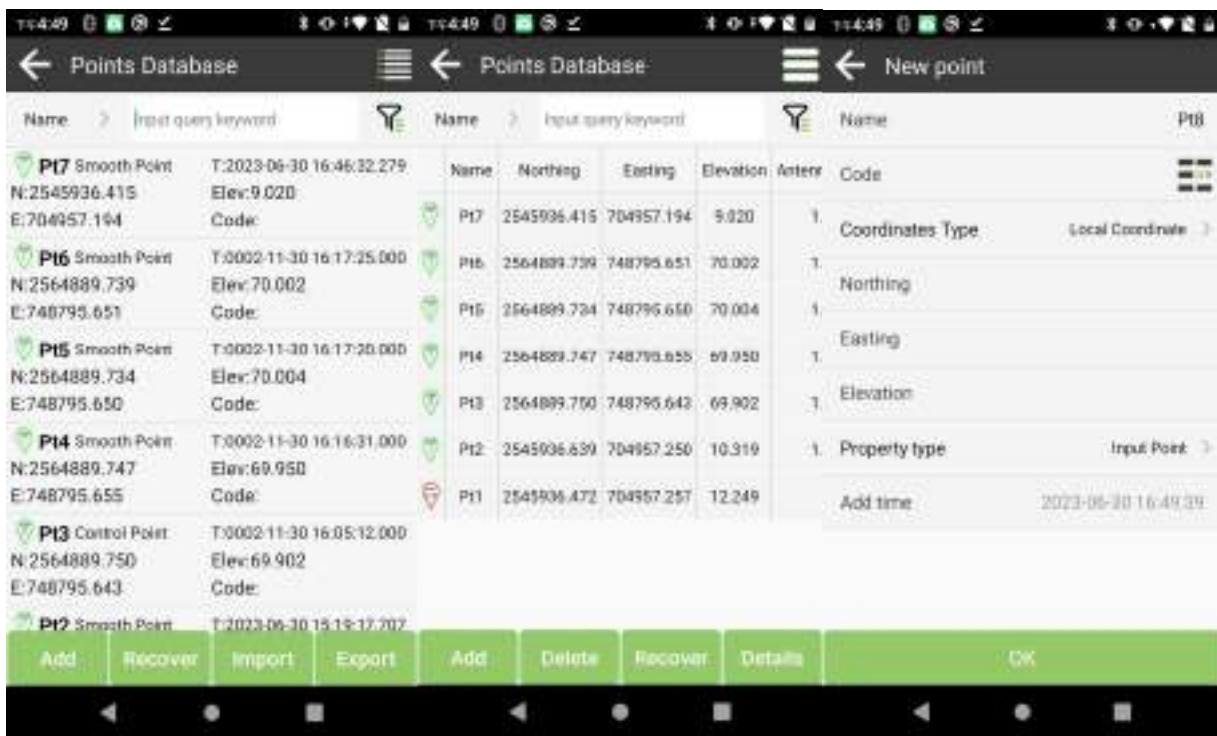


Figure 2.5-1

Figure 2.5-2

Figure 2.5-3

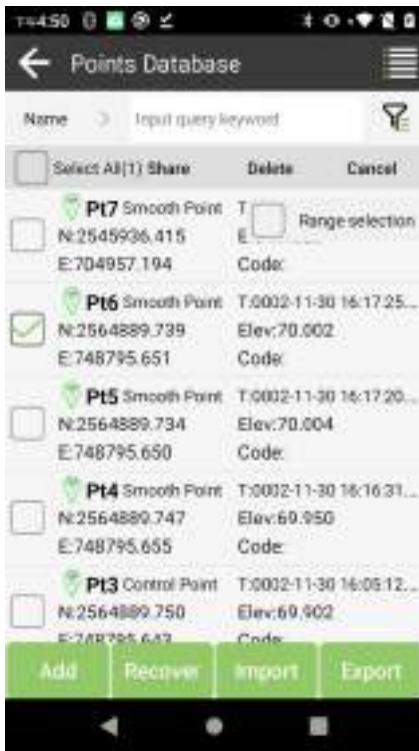


Figure 2.5-4



Figure 2.5.5



Figure 2.5-6



Figure 2.5-7



Figure 2.5-8



Figure 2.5-9

2.6 Code Library Manager

Click on **[Project]** → **[Code Library Manager]**, as shown in Figure 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, select the code library that needs to be used in the application project. You can **[New]**, **[Import]**, **[Delete]**, **[Edit]**, **[Share]**, **[Apply]**, and other management operations to the code library, as shown in Figure 2.6-2. You can manually edit or add the code library, as shown in Figure 2.6-3 and Figure 2.6-4. In New A Code-Library interface, click **[Add]** to create new code library, then fill **[Remark]**, **[Code]**, **[Group Name]**, choose **[Symbol]**, **[Point Color]**, if you want to make the same code automatically mapping, can open **[Auto connect by code]**, then you can define Data Type, Layer Name, Color, Style, Line Width.

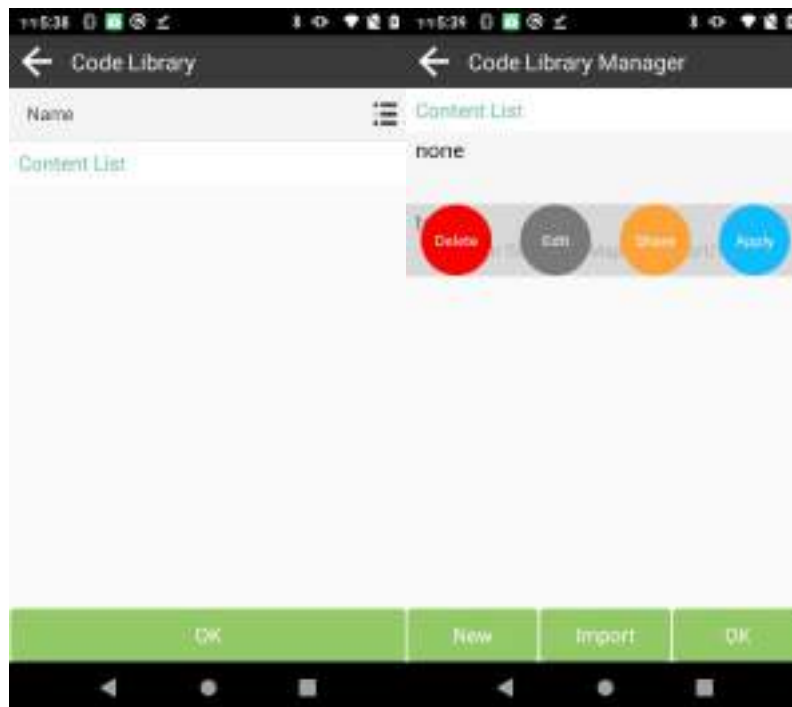


Figure 2.6-1

Figure 2.6-2



Figure 2.6-3

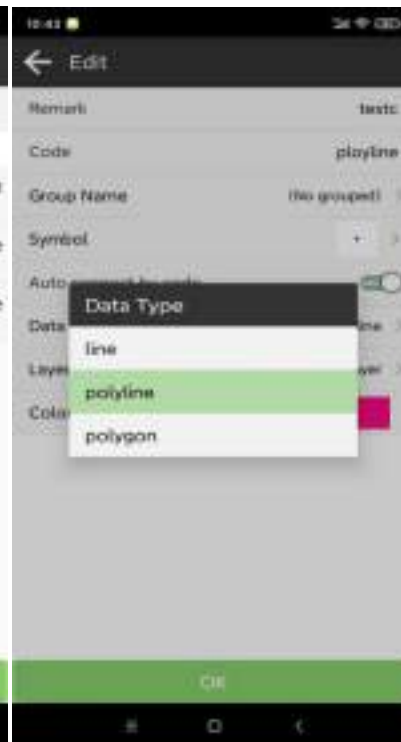


Figure 2.6-4

2.7 Import data

Click on **[Project]** → **[Import data]**, as shown in Figure 2.7-1. This function is a unified entry point for data import, where you can import coordinate to Points Database, Lines Database (Lines File or Coordinates File), Transformation parameter file, Code Library, Road Data. Select the import data type and import file format, and then select the import file to import the relevant data. You can also import corresponding data into the corresponding functions.

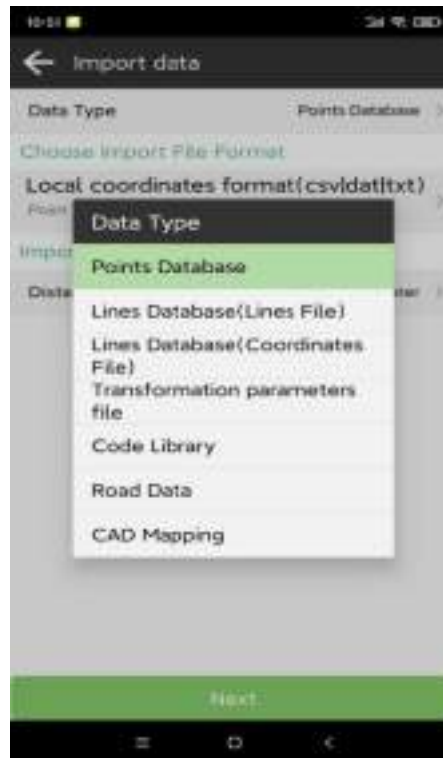


Figure 2.7-1

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 Figure 2.5-8 and Figure 2.5-9.

2.9 Survey Range Settings

Click on **[Project]** → **[Survey Range Settings]**, as shown in Figure 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 Figure 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 Figure 2.9-3.

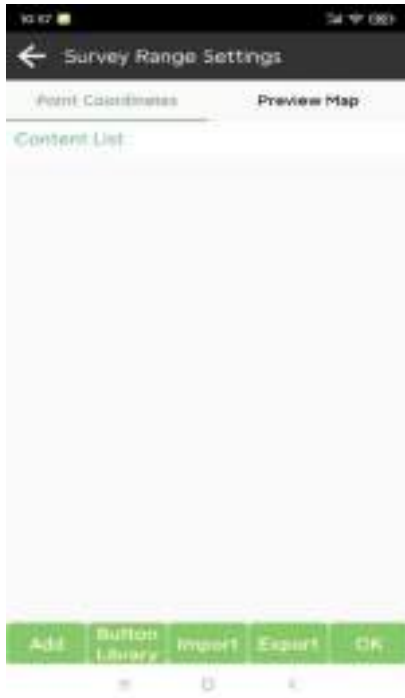


Figure 2.9-1



Figure 2.9-2

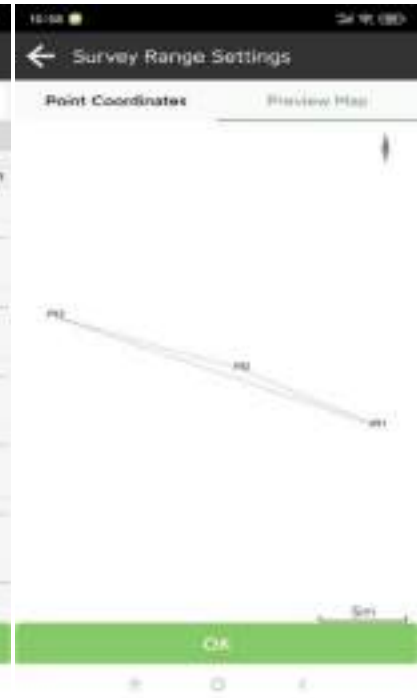


Figure 2.9-3

2.10 Grid to Ground

Click on **[Project]** → **[Grid to Ground]**, as shown in Figure 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.



Figure 2.10-1

2.11 Offset point correction

Click on **[Project]** → **[Offset point correction]**, as shown in Figure 2.11-1. This function is to use the heading angle to position and correct the GNSS installed on the top of the construction machine to the construction position, as shown in Figure 2.11-2. The host is used to install GNSS equipment on construction machines for piling construction, pipeline construction, slope construction, land leveling construction, and other construction processes.

The positioning method includes using the heading angle (dual antenna), using auxiliary receiver, and using electronic compass with PAD. The current GNSS positioning and construction position positioning are used for correction, and the current GNSS positioning is corrected to the construction position for construction stakeout, allowing real-time inspection of whether the construction has been completed in place.



Figure 2.11-1



Figure 2.11-2

2.12 Software Settings

Click on **[Project]** → **[Software Settings]**, as shown in Figure 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 Figure 2.12-1, it mainly includes settings: Language, Text encoding, Distance decimal, Angle decimal, Lat/Lon decimal, Station. format, CAD Background Color, Coordinate order habit, Interface style, Screen orientation, Full screen display, Enable location services.

[Cloud sharing settings]: as shown in Figure 2.12-2, includes Server Address (Default), Private ID, and **[Using third-party software to share Export data]** is open by default.

[Voice settings]: as shown in Figure 2.12-3, you can choose turn on/off these switches: Stakeout range error, Save Point, Low battery warning and the volume can be change. The Voice broadcast can be turned on, then you can choose options to broadcast such as Work mode, Data Link Status.

[Shortcuts settings]: as shown in Figure 2.12-4, the corresponding functions are triggered by the predefined physical keyboard of the controller or your phone, and the shortcut keys are added, as shown in Figure 2.12-5. Select the function that needs to define shortcut keys. You can also long press and select to delete a defined shortcut.



Figure 2.12-1



Figure 2.12-2



Figure 2.12-3



Figure 2.12-4

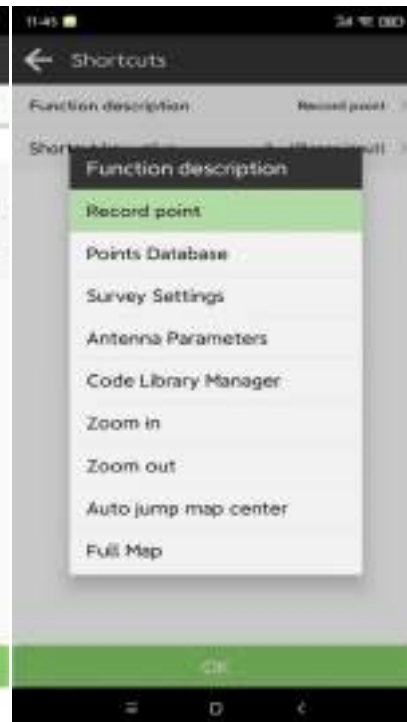


Figure 2.12-5

2.13 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, kml, txt, shp, and xml.

2.14 About Software

Click on **[Project]** → **[About Software]**, as shown in Figure 2.14-1. Includes:

[Software activation]: as shown in Figure 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.



Figure 2.14-1



Figure 2.14-2

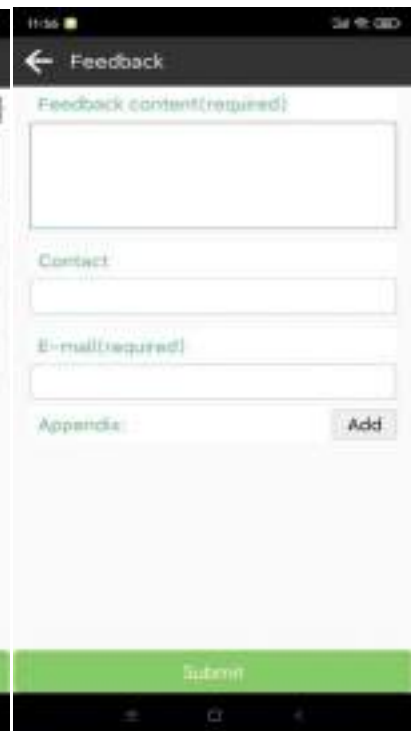


Figure 2.14-3

3 Device

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

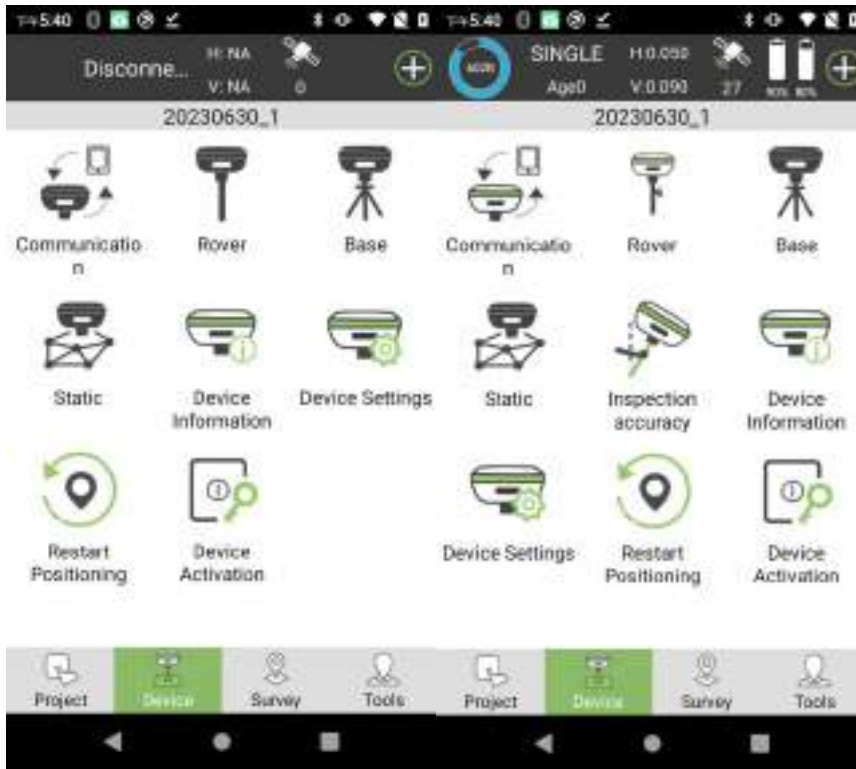


Figure 3-1

Figure 3-2

3.1 Communication

Click on **[Instrument]** → **[Communication]**, as shown in Figure 3.1-1. Select the **[Device Type]**, **[Device manufacturer]**, **[Model Type]**, and **[Connection Type]**, then click the **[Device Para]**, and choose your device serial number then click it. After successfully connecting the device, it will directly return to the software main interface, as shown in Figure 3-2. Enter the communication again, as shown in Figure 3.1-2, and click Stop to connect the device.

1. **[Device manufacturer]**: as shown in Figure 3.1-3.
2. **[Connection type]**: Include Bluetooth, WIFI, USB, Demo, Debug (Alpha 6i);
Bluetooth, USB, Demo, Debug (Alpha 5i);
Bluetooth, Demo, Debug (Alpha 4i);

3. Click on the [Device Para] to enter Bluetooth search and connection, as shown in Figure 3.1-4. Click [Searching] and connect your receiver. 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 Figure 3.1-4. You can send device debugging commands to the device and troubleshoot issues related to device positioning through communication data.

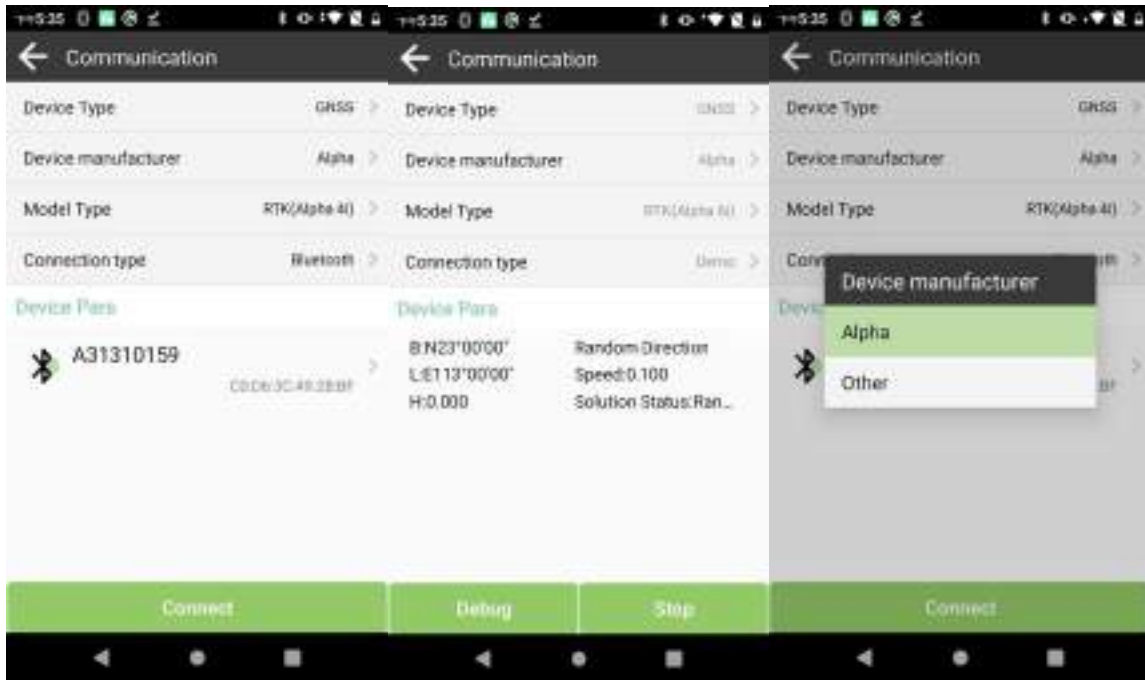


Figure 3.1-1

Figure 3.1-2

Figure 3.1-3



Figure 3.1-4

Figure 3.1-5

3.2 Rover

Click on **[Device]** → **[Rover]**, as shown in Figure 3.2-1. GNSS receiver can calculate positioning coordinates by receiving satellite signals. If only use one receiver, due to the influence of the atmosphere on the signal, the receiver can only obtain the coordinate position of a single point solution, with low accuracy. To ensure that GNSS receiver can obtain high-precision positions, in addition to receiving satellite signals to calculate the position, GNSS receiver also needs to receive signals from another fixed GNSS receiver 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 signal can calculate high-precision positions when the coordinate position of the reference signal is known. The fixed position GNSS device is called the base station, and the unfixed position GNSS device is called the rover station. Compared to the GNSS satellite signal of the rover station, the data transmitted from the base station is called differential data, The data transmission method is called a data link. The rover station mode setting is to set GNSS as a rover station, configure certain parameters to transmit the GNSS satellite signal of the base station to the GNSS receiver through certain methods, so that the GNSS receiver 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.




Figure 3.2-1



Figure 3.2-2

The main purpose of setting differential data parameters is to transmit the differential data of the base 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 Internet]**, and **[Phone Internet]**, etc.

1. **[Internal Radio]**: As shown in Figure 3.2-1, it refers to the internal radio of GNSS device that receives differential data of the radio station according to a certain protocol and frequency for high-precision calculation. Click on **[Basic Para]** to modify and edit them, as shown in Figure 3.2-2. 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 **[Internal Radio Parameter Settings]** (at the bottom of **[Data Link Internal Radio]**) to modify the frequency corresponding to each channel of the radio station, as shown in Figure 3.2-3 and Figure 3.2-4. Click on the icon  to select the corresponding channel frequency configuration from the predefined channel management list, as shown in Figure 3.2-5.

2. **[Device Internet]**: As shown in Figure 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 Figure 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 Figure 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 Internet]:** As shown in Figure 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 receiver 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 **[Start]** to connect. 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.



Figure 3.2-3



Figure 3.2-4

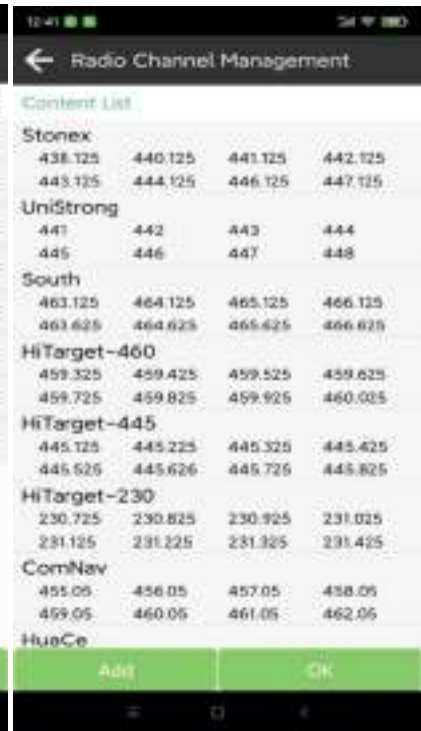


Figure 3.2-5

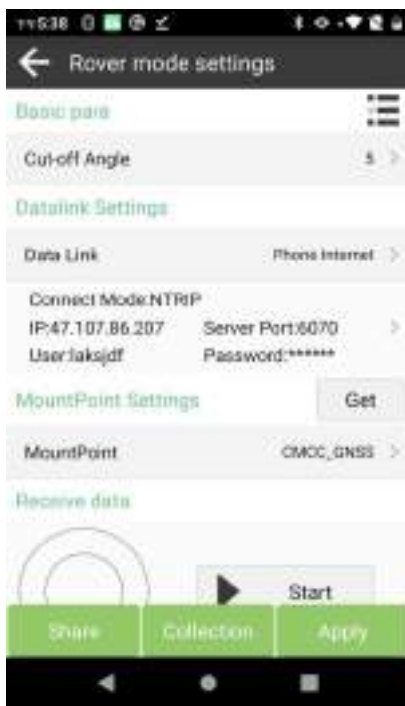


Figure 3.2-6



Figure 3.2-7

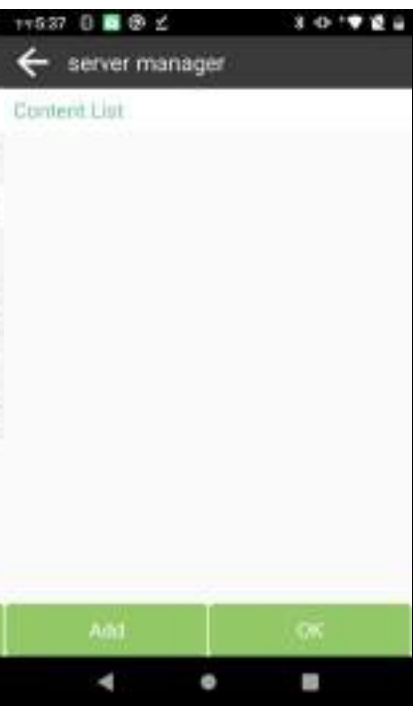


Figure 3.2-8



Figure 3.2-9

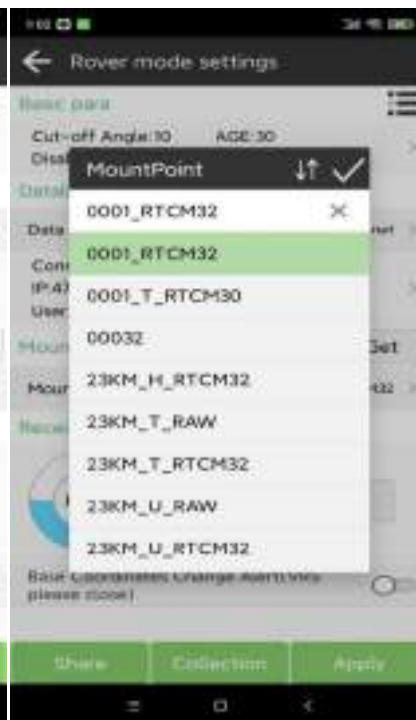


Figure 3.2-10

3.3 Base

Click on **[Device]**→**[Base]**, as shown in Figure 3.3-1. This function is for GNSS receiver 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 start, 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.

The startup mode includes **[Single point]** startup, **[Input base coordinates]** startup, and **[Use current point coordinates]** 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 coordinates]** startup: as shown in Figure 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 Figure 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 point coordinates]** startup: as shown in Figure 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 Figure 3.3-6.

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, these methods including Device Internet, 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 internet NTRIP protocol, the base 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 Figure 3.3-2.



Figure 3.3-1



Figure 3.3-2



Figure 3.3-3



Figure 3.3-4

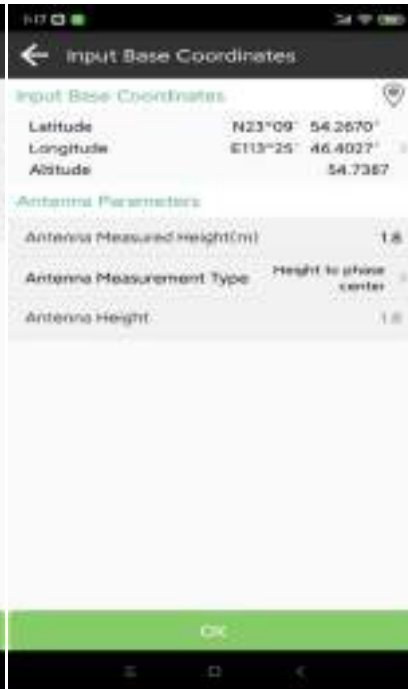


Figure 3.3-5



Figure 3.3-6

3.4 Static

Click on **[Device]** → **[Static]**, as shown in Figure 3.4-1. This function is to store the original satellite observation data of GNSS device in the setting disk file, 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 Point Name, PDOP Limit, Cut-off Angle, Collection Interval, Antenna parameters, and other recording conditions.



Figure 3.4-1

Note: During the static collection 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 Figure 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 device using the IMU survey function. If the test results show accuracy difference, 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 Figure 3.5-2.



Figure 3.5-1

Figure 3.5-2

3.6 Device Information

Click on **[Device]** → **[Device Information]**, as shown in Figure 3.6-1. This function allows you to view the basic information of GNSS devices such as Device Serial, Firmware Version, BIOS Version, GNSS Firmware Version, Current Datalink, Battery Power and other information.



Figure 3.6-1

3.7 Restart Positioning

Click on **[Device]** → **[Restart Positioning]** to clear the current GNSS satellite ephemeris and search for satellites again for positioning calculations.


3.8 Device Activation


Click on **[Device]** → **[Device Activation]**, as shown in Figure 3.8-1. If the GNSS device has expired, you can obtain the registration authorization code from the dealer and authorize the registration of the device here.





Figure 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 Figure 3.9-1.

2. Click on the  in the software title bar to enter the communication settings function, as shown in Figure 3.1-1.

3. Click on the  in the software title bar to enter and view the positioning coordinates output by the device, as shown in Figure 3.9-2. You can switch between viewing point detail information, base station information, satellite information, satellite map, as shown in Figure 3.9-2, Figure 3.9-3, Figure 3.9-4, and Figure 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 Figure 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 Figure 3.9-6.


6. Click on the  in the software title bar to enter the rover settings, as shown in Figure 3.9-1.



Figure 3.9-1

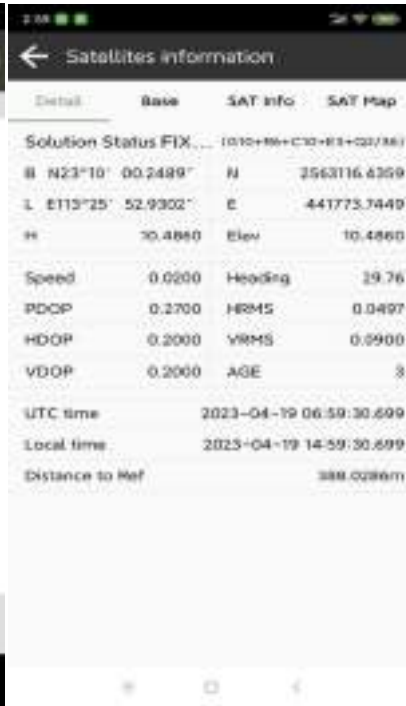


Figure 3.9-2



Figure 3.9-3

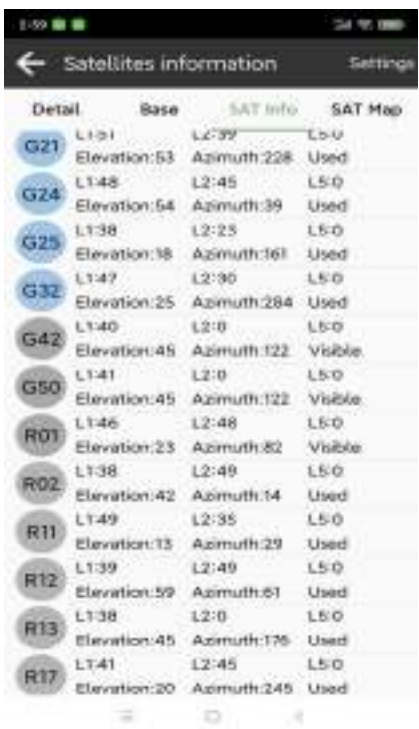


Figure 3.9-4



Figure 3.9-5



Figure 3.9-6


4 Survey

On the main interface of the software, click on **[Survey]**, as shown in Figure 4-1. Survey interface 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]**, **[Stake Road]**, **[Electric Lines Survey]**, **[Electric Towers Stakeout]**, and other functions.



Figure 4-1

4.1 Point Survey

Click on **[Survey]** → **[Point Survey]**, as shown in Figure 4.1-1. Record and store the positioning output from GNSS device 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 needs in . 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 upper right corner of the middle area is a compass, making it convenient for users to determine the direction when needed. The bottom left corner of the middle 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 map scale is displayed in the bottom right corner of the middle area, and the icon



 above the map scale 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 Figure 4.1-2. Below the middle area are the attributes includes point names and coding input positions, as well as the setting of antenna height.




Figure 4.1-1


Figure 4.1-2


Figure 4.1-3


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


Click  to enter the survey settings interface, as shown in 4.1-4. Here has three main button: Settings, Display Info and Tool Bar. In Settings, set the point collection limitations (Tolerance Setting) for survey and collection here, such as Solution Status Limit, HRMS Limit, VRMS Limit, PDOP Limit, AGE Limit, survey delay, etc. Users can set the limit based on the accuracy

requirements of the job. Setting Survey Delay (select value, and measurement will begin a few seconds that the value you have selected) and Average GPS Count (is to collect multiple positioning points and calculate the average value to indicate accuracy). In addition, you can also turn on the button of The survey confirmation page pops up and Remind when there is same point name, and you can set Point Name Increment (every time a point is measured, the selected value will be increased by the point name) and Default Code. In Display Info, display item can be customized by user, just click buttons in option to add information that user wants, and you can also choose point type, label display and display style, as shown in Figure 4.1-5. In Tool Bar, it refers to user displays commonly used functions in the bottom left of the software's middle area according to their needs during the field work process, allowing users to quickly and conveniently access certain functions, as shown in Figure 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, CAD Background Color, CAD layer and other functions. Then back to interface of point survey and can click icon in the bottom left to trigger the corresponding functions.

Click on  to enter the points database, where you can view the information 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 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 Figure 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 Figure 4.1-8. The antenna height is actually the vertical distance from the antenna phase center to the ground measurement point. If the antenna information is incorrect, clicking on the antenna information can select the correct antenna measurement type (used when GNSS devices do not output antenna information or when using external antennas), as shown in Figure 4.1-9.



Figure 4.1-4



Figure 4.1-5



Figure 4.1-6



Figure 4.1-7

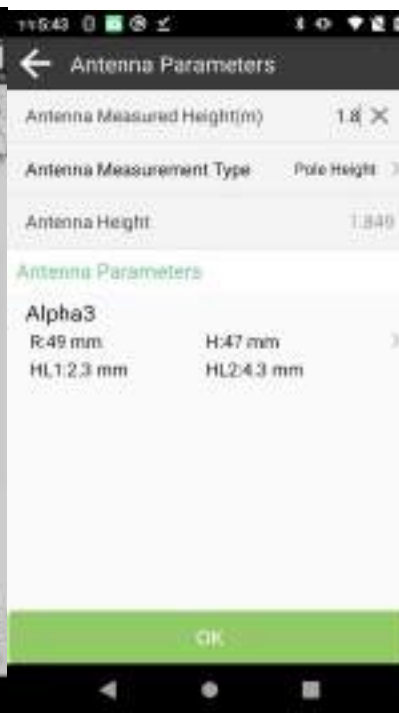


Figure 4.1-8

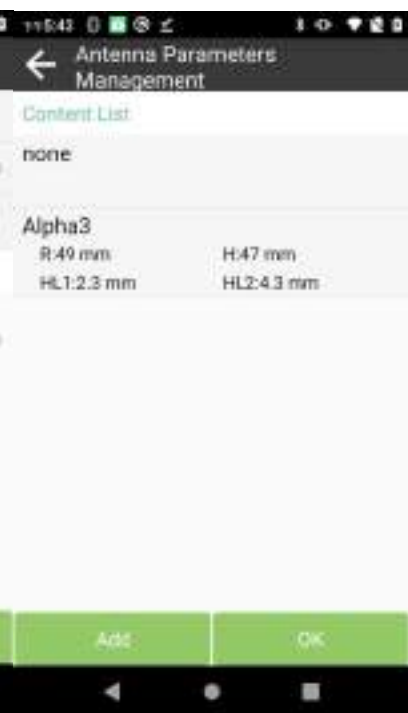


Figure 4.1-9




4.2 Detail Survey

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



Figure 4.2-1

4.3 Control point survey

Click on **[Survey]** → **[Control Point Survey]**, as shown in Figure 4.3-1. Sometimes, it is necessary to record a point with high-precision 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, needs to collect point information multiple times. By using a certain calculation method, the points with a significant deviation from the average value are rejected, 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-precision guarantee, and we call this type of point control point. In the control point survey interface, the middle black area displays all the survey points collected by the receiver in real-time, and the graphical distribution of the survey points of can be seen, click  and wait for collecting, then software will pop up the interface of result, as shown in Figure 4.3-3, and you can check whether the collected point is available, you can also check the statistics, coordinate result and the best filed observation. The two icons  and  below the middle black area are survey settings and points database function entrances;

In survey settings, as shown in Figure 4.3-2, in addition to set tolerance settings (Solution Limit, HRMS Limit, VRMS Limit, PDOP Limit, AGE Limit), it is also necessary to set control point

settings (Average GPS Count, Average GPS Interval, Repeat Count, Fixed Age, Plane Limit, Elevation Limit), and other settings.

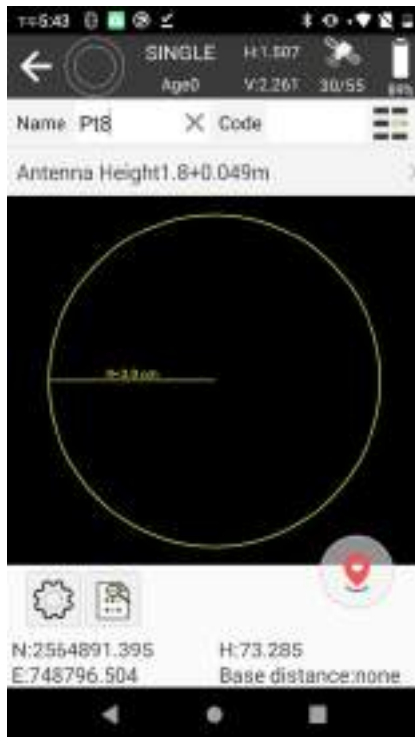


Figure 4.3-1



Figure 4.3-2

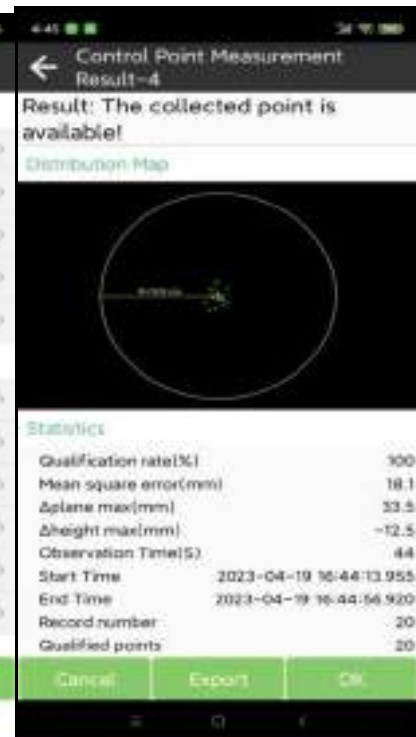






Figure 4.3-3

4.4 Point Stakeout

Click on **[Survey]** → **[Point Stakeout]** to enter the stakeout points database interface first, as shown in Figure 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 stake point interface, displays point coordinate, to-stake-point and preview map. In point coordinates, if there has points in database, you can click one point, then it will display button of navigation, share, details and stakeout. In to-stake-point interface, you can choose points to stakeout from button library. 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. After selecting points for stakeout, enter the point stakeout interface, as shown in Figure 4.4-2.

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 azimuth deviation from the target (forward, backward, left, right, also slope) and deviation from the target (to south, to north, to east, to west,

also fill and cut). The compass is currently positioned with receiver's location and display together, or you can click the button  in the top right of middle area to change display to compass. In the bottom left of middle area, has some buttons, you have learned about of them in point survey.  is the latest point, click it and will choose the latest point to stakeout.   is the previous point and next point.

What if we get to the target point faster?

If the user has a good sense of direction, they can distinguish between the south, north, east and west 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 4.4-2, heading northeast can lead to the target point Pt4.

What if the user's sense of direction is not good and they cannot distinguish between the south, north, east and west. Here has two methods.

Method 1: You can look at the currently positioned small arrow, which points towards the target point, as shown in Figure 4.4-2. The current arrow is facing south. You can rotate the controller pointing. When the controller heading coincides with the connection between the current point and the target point, it indicates that the controller heading is consistent with the direction of the target point. At this time, advance towards the target point in that direction until it is reached.

Method 2: Click settings button, enter settings and click stakeout settings, turn on navigation prompt (forward), click OK, then the display of deviation will change as shown in Figure 4.4-3.



Figure 4.4-1



Figure 4.4-2



Figure 4.4-3

Stakeout settings, as shown in Figure 4.4-4. Just like point survey settings, there has settings, display information and tool bar. In stakeout settings, you can turn on navigation prompt (forward), automatically enter the stakeout compass mode, etc. And you can set prompt range (m) and stakeout range error (m).

In the points to stakeout, click on the data item and click on Details to enter the detailed information of the point stakeout, as shown in Figure 4.4-5 and 4.4-6.




Figure 4.4-4


Figure 4.4-5


Figure 4.4-6

4.5 CAD Mapping

Click on **[Survey]** → **[CAD Mapping]**, as shown in Figure 4.5-1. The CAD Mapping 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 Figure 4.5-2. You can create or delete layers, set whether layers are visible, import DXF, DWG, and other file types, export DXF files, and set a layer as a working layer.

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

Click to  is a CAD calculation tool, as shown in Figure 4.5-3. Including Int 2 Dist, Int 4 Point, Int Entity, Dist offset, etc.

After selecting the CAD drawing, as shown in Figure 4.5-4. You can click cancel, delete, details, or stakeout to execute the functions.

After selecting the entity, click on stakeout to enter the stakeout CAD interface, as shown in 4.5-5. 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.

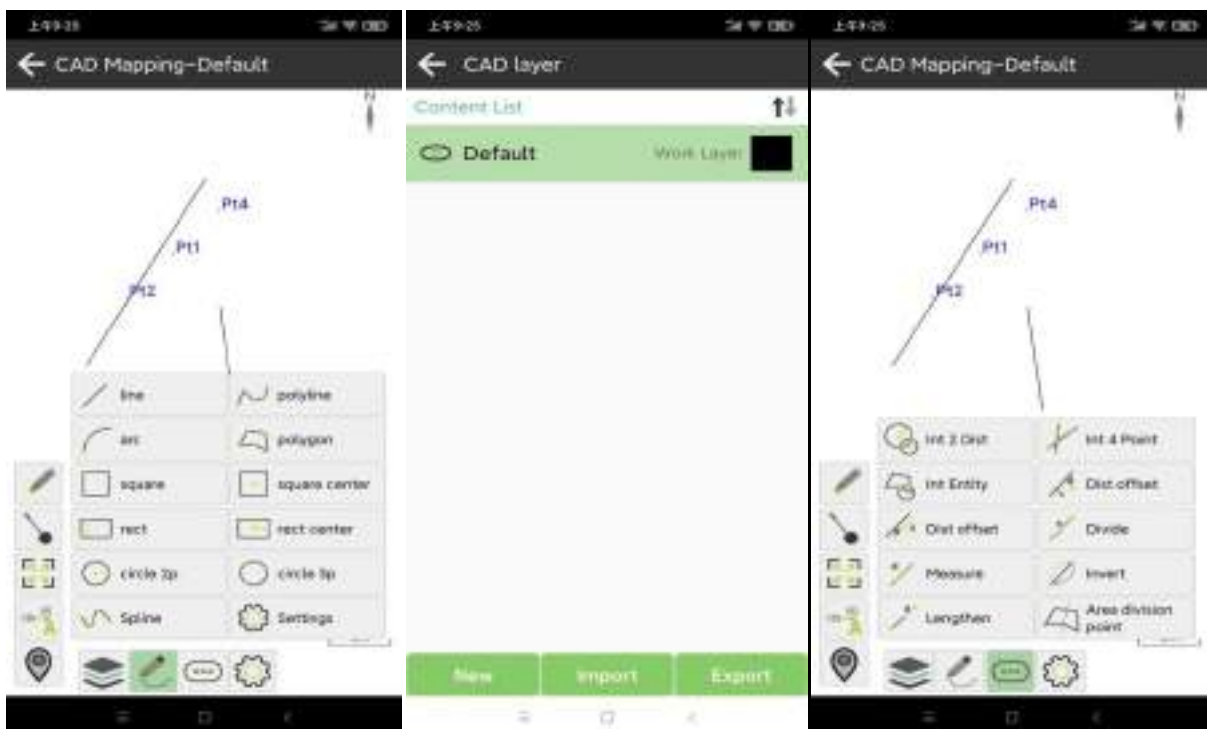


Figure 4.5-1

Figure 4.5-2

Figure 4.5-3





Figure 4.5-4

Figure 4.5-5

4.6 CAD Stakeout

Click on **[Survey]** → **[CAD Stakeout]**, as shown in Figure 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 (.dxf, .dwg).

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 Figure 4.6-2.



Figure 4.6-1

Figure 4.6-2

4.7 Line Stakeout

Click on **[Survey]** → **[Line Stakeout]** to enter the lines database interface, as shown in Figure 4.7-1. Line stakeout is to provide designed lines, input line to library, and line stakeout. You can set the start station, start point and end point coordinates, azimuth and length, 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 Figure 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 4.6-3. 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 on  add piles for stakeout, as shown in 4.7-5.



Figure 4.7-1

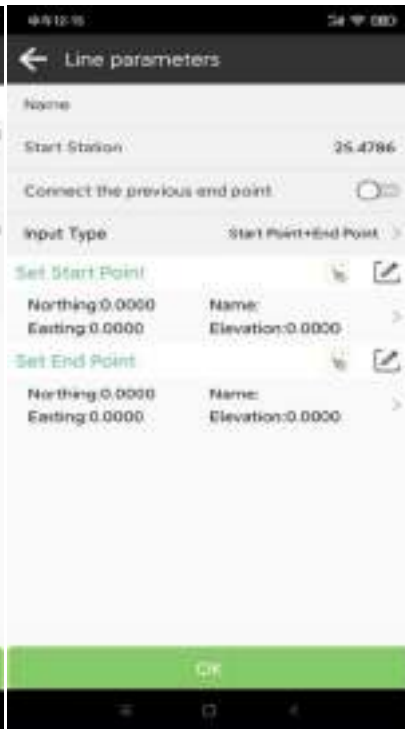


Figure 4.7-2



Figure 4.7-3



Figure 4.7-4



Figure 4.7-5

4.8 DSM Stakeout

Click on **[Survey]** → **[DSM stakeout]**, as shown in Figure 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 DSM library can be created, imported, edited or deleted, and a new elevation file can be created, as shown in Figure 4.8-2. The coordinates of the triangulation file can be manually entered or selected in batches from the points database. The order of point coordinates can be moved up or down, and coordinates can also be imported.

Click on the item of the DSM database to edit, delete, view details and stakeout. Click on the stakeout to enter the elevation stakeout interface, as shown in Figure 4.8-3.



Figure 4.8-1



Figure 4.8-2



Figure 4.8-3

4.9 Stake Road

Click on **[Survey]** → **[Stake Road]** to enter roads database interface, as shown in Figure 4.9-1. Stake Road function are 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 project such as construction stakeout and section data collection for road.

The road design is shown in Figure 4.9-2. The road design includes Broken Station, Centerline, Vertical Profile, Standard Cross Section and Slope Data. The road data's preview map can be view.

1. Centerline: As shown in Figure 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 start point, line, curve, and spiral. 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, start radius, end radius, heading 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 spiral and the line is infinite, and the radius of the connecting end of the spiral 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 spiral length, spiral 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 spiral.

2. Vertical profile: as shown in Figure 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 road, 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 Figure 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 Figure 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-motorized 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, as shown in Figure 4.9-7. Superelevation and widening are set according to the needs of each section and added according to the station.

5. Slope data: as shown in Figure 4.9-8. 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.



Figure 4.9-1



Figure 4.9-2

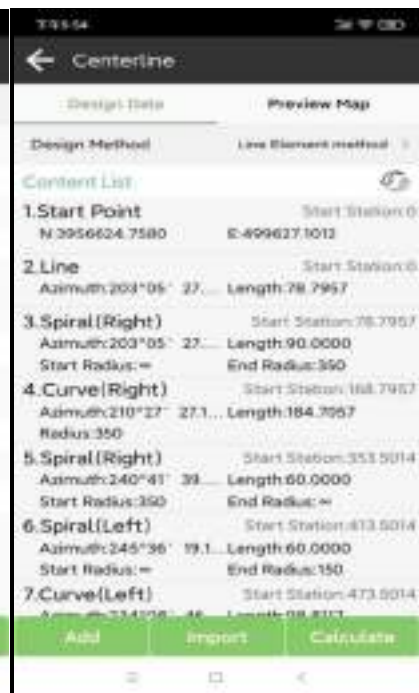


Figure 4.9-3

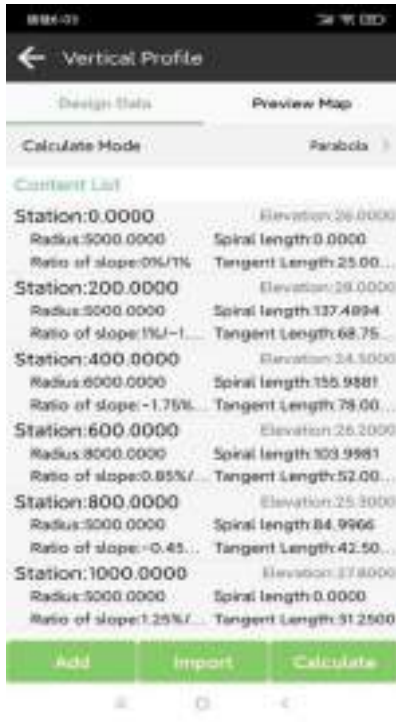


Figure 4.9-4



Figure 4.9-5



Figure 4.9-6

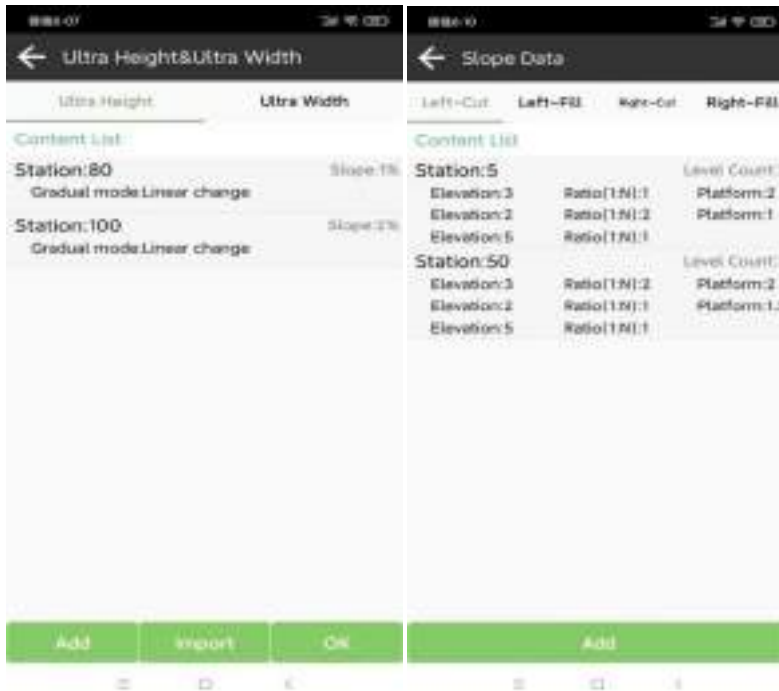



Figure 4.9-7

Figure 4.9-8

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

The stakeout of the road centerline: as shown in Figure 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, as shown in Figure 4.9-10. 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, as shown in Figure 4.9-11. 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 as shown in Figure 4.9-12. 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, as shown in Figure 4.9-13.

The cross-section measurement, as shown in Figure 4.9-14. 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.



Figure 4.9-7



Figure 4.9-8-



Figure 4.9-9



Figure 4.9-10




Figure 4.9-11





Figure 4.9-12

4.10 Electric Lines Survey

Click on **[Survey]** → **[Electric Lines Survey]**, as shown in Figure 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 Figure 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 Figure 4.10-3. It supports customization of ground feature data of data types, such as create, edit, share, and apply data types. The new edit is shown in Figure 4.10-4 and Figure 4.10-5.

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


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



Figure 4.10-1



Figure 4.10-2



Figure 4.10-3



Figure 4.10-4



Figure 4.10-5



Figure 4.10-6

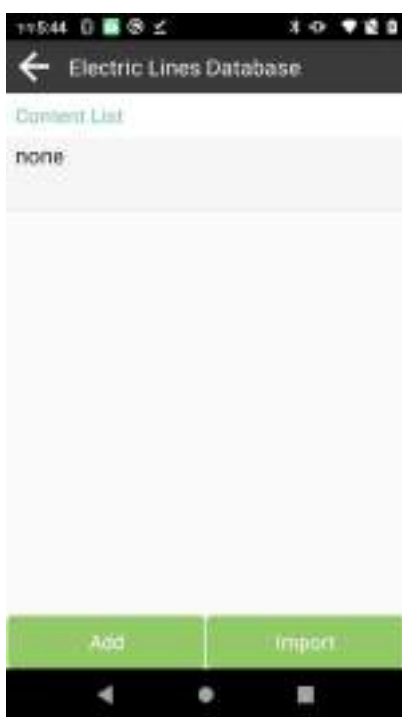


Figure 4.10-7



Figure 4.10-8



Figure 4.10-9

4.11 Electric Tower Stakeout

Click on [Survey] → [Electric Tower Stakeout], as shown in Figure 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 Figure 4.11-2. Select the tower point and click on the stakeout, as shown in Figure 4.11-3.



Figure 4.11-1

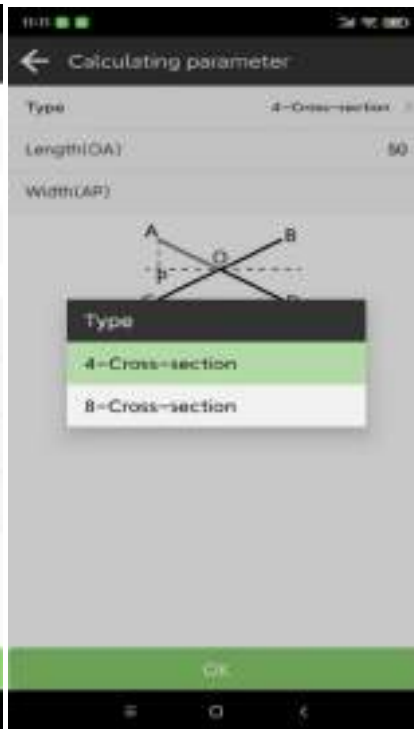


Figure 4.11-2



Figure 4.11-3

4.12 Function Customization

Click on **[Survey]** → **[Function Customization]**, as shown in Figure 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 Figure 4.12-2 and Figure 4.12-3.

After defining the function, it will be displayed in the main interface, as shown in Figure 4.12-4.

Click on the function to enter the data survey interface, as shown in Figure 4.12-5.



Figure 4.12-1



Figure 4.12-2



Figure 4.12-3



Figure 4.12-4

Figure 4.12-5

5 Tools

On the main interface of the software, click on **[Tools]**, as shown in Figure 5-1. Tools includes **[Coordinates Converter]**, **[Angle Converter]**, **[Perimeter and Area]**, **[Volume Calculation]**, **[File sharing]**, **[Calculator]**, **[Coordinate positive calculation]**, **[Circle Center Calculation]** and other common computing function.

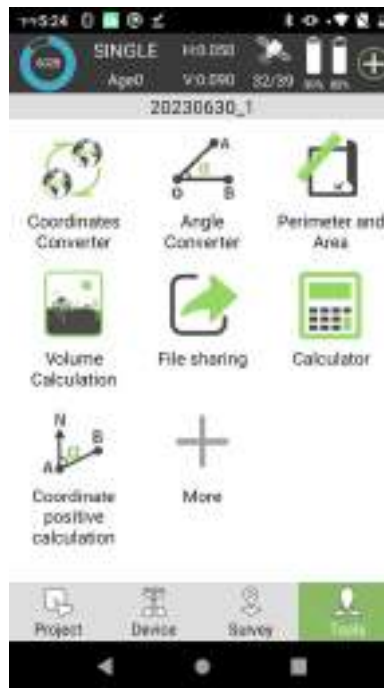


Figure 5-1

5.1 Coordinates converter

Click on **[Tools]** → **[Coordinates Converter]**, as shown in Figure 5.1-1 and Figure 5.1-2. By using the coordinate system parameters set in the current project, convert the coordinate points from local coordinates to geodetic coordinates or spatial coordinates, and view the coordinate result.


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



Figure 5.1-1



Figure 5.1-2

5.2 Angle Converter

Click on [Tools]→[Angle Converter], as shown in Figure 5.2-1. Use this function to transform the formats of angles such as decimal, radian, dd.mmssss, etc. Select one format to input and calculate the values of the other formats.



Figure 5.2-1

5.3 Perimeter And Area

Click on **[Tools]** → **[Perimeter And Area]**, as shown in Figure 5.3-1. The function refers to manage the coordinate points of the polygon in the coordinate points. Related operations such as add, button library, import, export, calculate are at the bottom of the interface. View the graphics of the polygon in the preview, as shown in Figure 5.3-2. Click Calculate, as shown in Figure 5.3-3.



Figure 5.3-1



Figure 5.3-2



Figure 5.3-3

5.4 Volume Calculation

Click on **[Tools]** → **[Volume Calculation]**, as shown in Figure 5.4-1. Enter Volume Calculation and click Calculating area to enter the interface of Triangulation library, as shown in Figure 5.4-2. After selecting the calculating area, choose the reference height (Enter height, Reference point, Reference polygon) and input the elevation to calculate the earthwork quantities for the fill or cut of the area data.

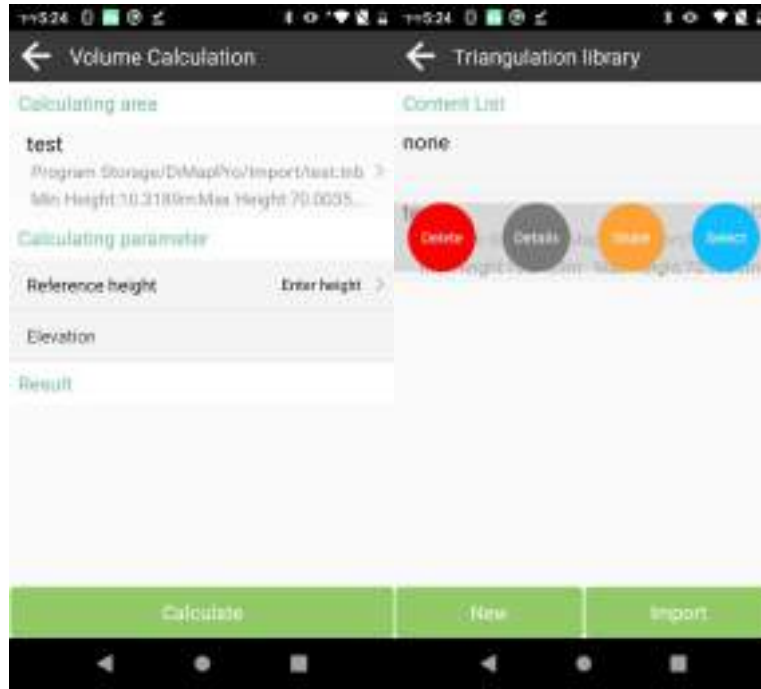


Figure 5.4-1

Figure 5.4-2

5.5 File sharing

Click on [Tools]→[File Sharing], as shown in Figure 5.5-1. Select the files you want to sharing, as shown in Figure 5.5-2. Other controllers 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 Figure 5.5-3.



Figure 5.5-1

Figure 5.5-2

5.6 Calculator

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



Figure 5.6-1

5.7 Average Calculation

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

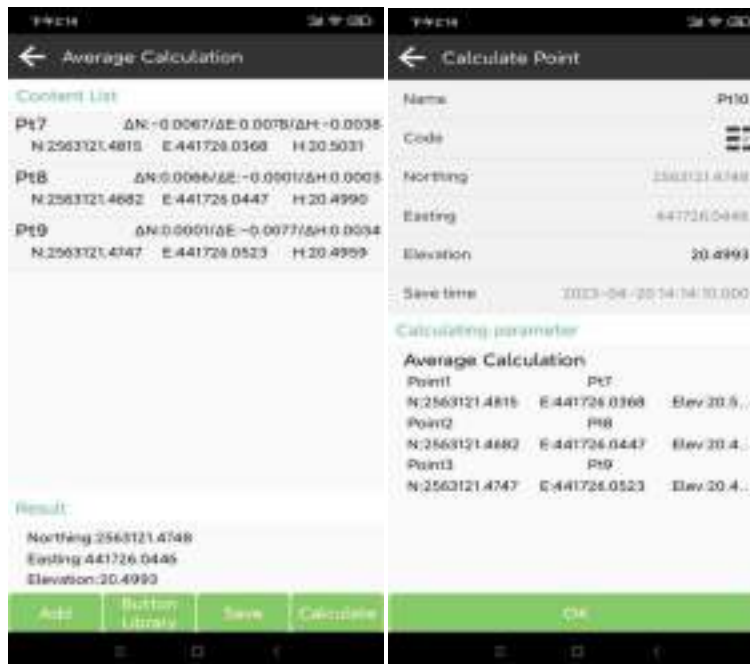


Figure 5.7-1

Figure 5.7-2

5.8 Coordinate positive calculation

Click on [Tools]→[Coordinate positive calculation], as shown in Figure 5.8-1. Description: Knowing the coordinates of the point A and the point B, $\angle A=\alpha$, $AP=L1$, calculate the coordinates of point P. Input or select point A and azimuth reference point B, input length of L and angle α , calculate the point, and save the results to the points database, as shown in Figure 5.8-2.



Figure 5.8-1

Figure 5.8-2

5.9 Coordinate Inverse Calculation

Click on [Tools] → [Coordinate Inverse Calculation], as shown in Figure 5.9-1. Description: Knowing the coordinates of point A and point B, calculate the azimuth angle α of the two points A and B, the plane distance of A and B, the spatial distance of A and B, the elevation difference between the two points of A and B, and the slope ratio. Enter or select points A and B, calculate the plane distance, vector, azimuth, elevation difference, ratio of slope, ratio (1: N) of the two points.



Figure 5.9-1

5.10 Point line calculation

Click on **[Tools]** → **[Point line calculation]**, as shown in Figure 5.10-1. Description: The coordinates of the start point A, the ending point B, and the offset point C are known, and the point P is the vertical foot, calculate the starting point distance AC, the ending point distance BC, the starting point vertical distance AP, the ending point vertical distance BP, the offset distance CP, and the offset angle α . Enter or select three points A, B and C, calculate the starting distance, ending distance, starting vertical distance, ending vertical distance, offset distance, offset angle, corner angle.



Figure 5.10-1

5.11 Circle Center Calculation

Click on **[Tools]** → **[Circle Center Calculation]**, as shown in Figure 5.11-1. Description: Given the coordinates of three points on the circle, point A, point B and point C, calculate the coordinate of the center point P. Enter or select three points A, B and C, calculate the center point coordinate of the three points.



Figure 5.11-1

5.12 Add offsets to points at specified

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



Figure 5.12-1

5.13 Vector

Click on **[Tools]** → **[Vector]**, as shown in Figure 5.13-1. Description: Knowing the latitude and longitude coordinates of the starting point A and the ending point B, and find the spatial distance between the two points A and B. Enter or select two points to calculate the vector distance.



Figure 5.13-1

5.14 Two lines angle

Click on **[Tools]** → **[Two lines angle]**, Description: Given the coordinates of point O, point A and point B, calculate the angle α between line OA and line OB. Enter or select three points O, A and B, calculate the angle α , as shown in 5.14-1.



Figure 5.14-1

5.15 Intersection calculation

Click on **[Tools]**→**[Intersection Calculation]**, as shown in Figure 5.15-1. Description: Given the coordinates of the starting point A and the ending point B of the straight line AB, and the coordinates of the starting point C and the ending point D of the straight line CD, calculate the coordinates of the intersection point P of the straight line AB and the straight line CD. Find the intersection point of two lines and save the result to the points database, as shown in Figure 5.15-2.



Figure 5.15-1

Figure 5.15-2

5.16 Resection

Click on **[Tools]**→**[Resection]**, as shown in Figure 5.16-1. Description: Given the coordinates of point A and point B of triangle ABP, $AP=L1$, $BP=L2$, calculate the coordinates of point P, calculate the target point coordinate and angle α and angle β , save the results to the points database, as shown in Figure 5.16-2.



Figure 5.16-1

Figure 5.16-2

5.17 Forward intersection

Click on [Tools] → [Forward Intersection], as shown in Figure 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 Figure 5.17-2.



Figure 5.17-1

Figure 5.17-2

5.18 Offset point calculation

Click on [Tools] → [Offset point calculation], as shown in Figure 5.18-1. Description: Knowing the starting point A and the ending point B of the straight line AB, calculate the coordinate C of the

specified mileage L1 offset distance L2 of the straight line. Enter or select points A and B, enter parameters, calculate and save the results to the points database, as shown in Figure 5.18-2.

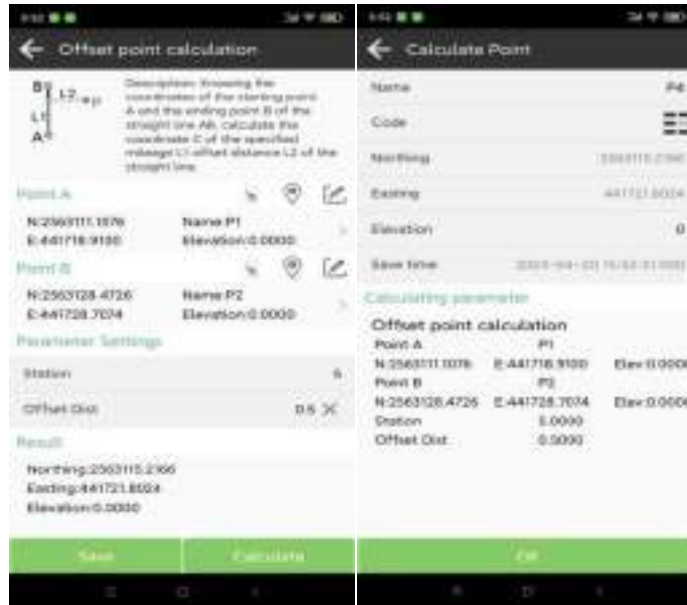


Figure 5.18-1

Figure 5.18-2

5.19 Extend point calculation

Click on [Tools]→[Extend point calculation], as shown in Figure 5.19-1. Description: Knowing the coordinates of the starting point A and the ending point B of the straight line AB, calculate the coordinate of point P on the extension of the straight line. Enter or select two points A and B, enter length of line L, calculate the point coordinate on the extend line, and save the results to the points database, as shown in Figure 5.19-2.

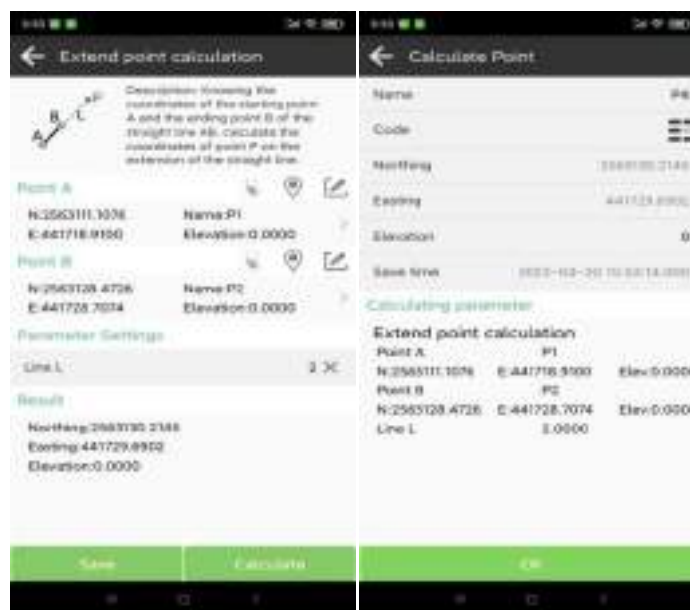


Figure 5.19-1

Figure 5.19-2

5.20 Equal point calculation

Click on **[Tools]** → **[Equal point calculation]**, as shown in Figure 5.20-1. Description: Knowing the coordinates of the starting point A and the ending point B of the straight line AB, calculate the coordinates of the line segment divided into n equal parts. Enter two points A and B, enter number of segmentation, calculate the bisection points of the line segment, and save each bisection point to the points database, as shown in Figure 5.20-2.

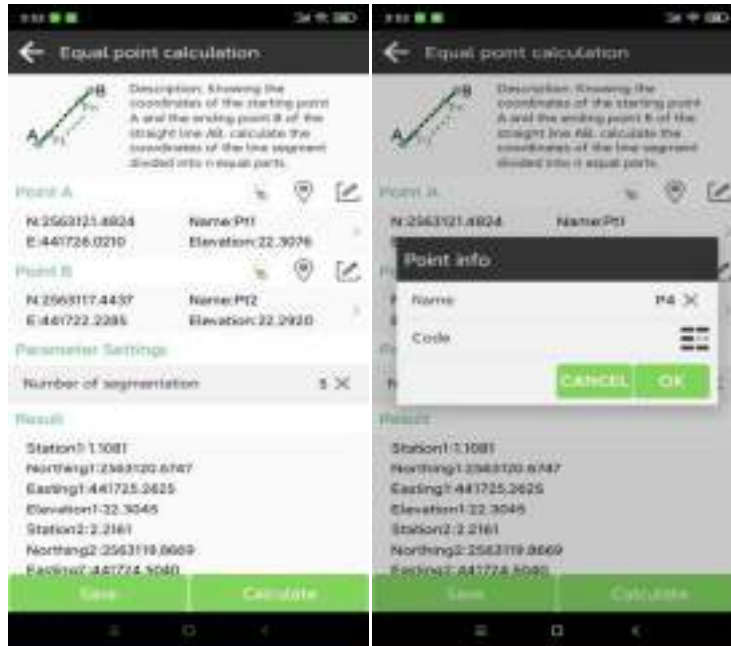


Figure 5.20-1

Figure 5.20-2