

# **SMAJAYU Survey software user manual**

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# I. Software Description

## 1.1 Software profile

SMAJAYU Survey software is an engineering survey application software developed by SMAJAYU(SHENZHEN) CO.,LTD. based on GNSS high-precision location application. The developers integrate based on years of surveying and mapping development and market experience accumulation, combined with the use habits of a large number of industry users and Android operation style habits. The software has a humanized operation process of simple operation and easy to use, high-precision position survey and collection, point and line setting out, powerful road design and construction setting function and CAD Figure setting function, convenient functional menu display and convenient user customized design.

The following introduces the basic functions of the software: The software mainly includes four parts: Projects, Device, survey, and tools.

### 1.1.1 Projects

This part is mainly for project Device, project data management and software setting and other related operations, mainly including Project Manager, Localization, Calibrate Point, Coordinate system, Point Database, Code library manager, Import data, Export data, Survey Range Settings, software setting, About Software and other functions.

### 1.1.2 ConFigure

This part is mainly aimed at the Communication of high-precision GNSS equipment and equipment setting and other related operations, mainly including the Communication, Rover, Base, Static, Inspection accuracy, Device Setting, Restart Positioning, Device information and other functions.

### 1.1.3 survey

This part is mainly using GNSS location for field data survey, setting out and industry application related operations, mainly including point survey, fragmentation survey, control point survey, Point Stakeout, CAD, straight line setting out, DSM Stakeout, Stake Road and other functions.

### **1.1.4 Tools**

This part is mainly related to survey of some common utility tools, mainly includes Coordinates Converter, transformation, Angle Converter, Perimeter and Area, Calculator, file sharing, coordinate inversion calculation, point and line calculation, spatial distance, angle calculation, intersection calculation, rear intersection, forward intersection, coordinate point calculation, extended point calculation, equal point calculation and other functions.

## **1.2 Installation and uninstallation of the software**

Installation process:

1. Download the SMAJAYU Survey software installation program (\*.apk) .
2. Copy the Mapping Pass software installation program to the mobile phone (Data controller) device. Find the software installer in the file management of the manual device, and click the installer for installation.
3. Click the desktop mapping tong software to enter the software (the first entry needs to create the first project, and then the software will automatically open the final use project for each start).

Uninstall process:

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

## II. The Project

Enter the main software interface and click [Project] for the corresponding function menu as shown in Figure 2-1. The project includes Project Manager, Localization, Calibrate Point, Coordinate system, Point Database, Code library manager, Import data, Export data, Survey Range Settings, software setting, About Software, etc.

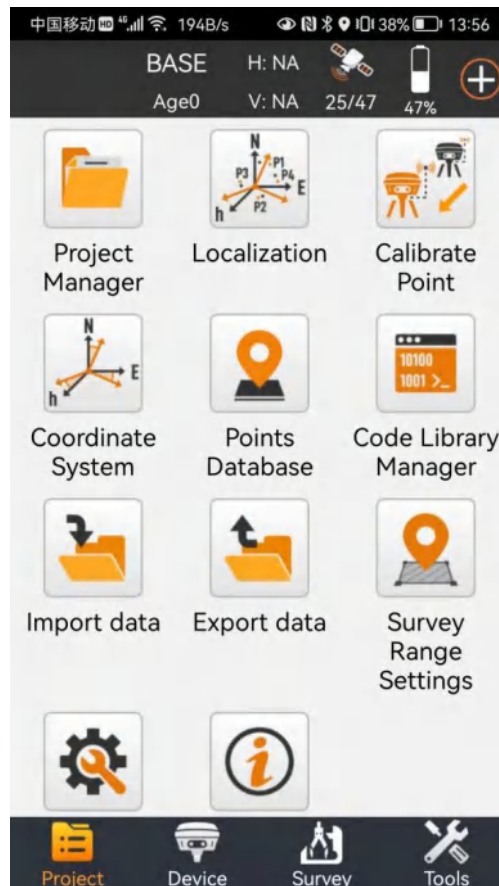


Figure 2-1

All data and operations of the software are stored and managed by a project. After the first time of entering the software, a project must create a project first. Each time you enter the software, the software will automatically load the project used for the last time. Each item is stored in the project name folder (default-> AlyNav Survey-> Project) and the basic project base information is stored in the Project Name. In job, the other data is stored under the corresponding directory file.

## 2.1 Project Manager

Click [Project] -> [Project Manager], as shown in Figure 2.1-1. Project Manager includes the new and open other project functions.

Click on the item shown in the item list for the removal and opening functions, as shown in Figure 2.1-2. Click Remove, as shown in Figure 2.1-3, you can remove the project from the list. If the data file is deleted at the same time, the data on the disk will be deleted. If the data file is not deleted at the same time, but only removed from the list, the project can be opened in opening other projects, as shown in Figure 2.1-4.

Click the new project, as shown in Fig. 2.1-5, the new project needs to fill in the project name, operator, project description and other basic project information, you can also modify the path of the project on disk (default in the internal storage-> AlyNav Survey-> Project directory), click next, fill in the coordinate system parameters used for modifying the project, as shown in Fig. 2.1-6, and then click to complete to complete the new project.

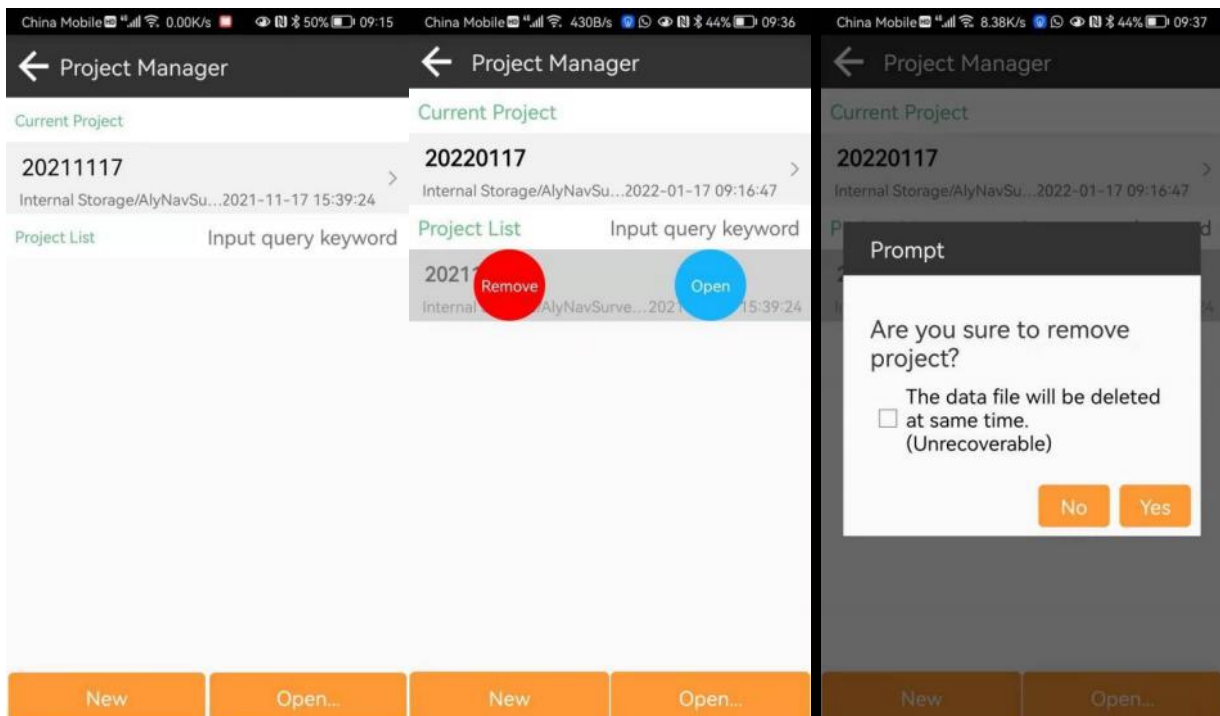


Figure 2.1-1

Figure 2.1-2

Figure 2.1-3

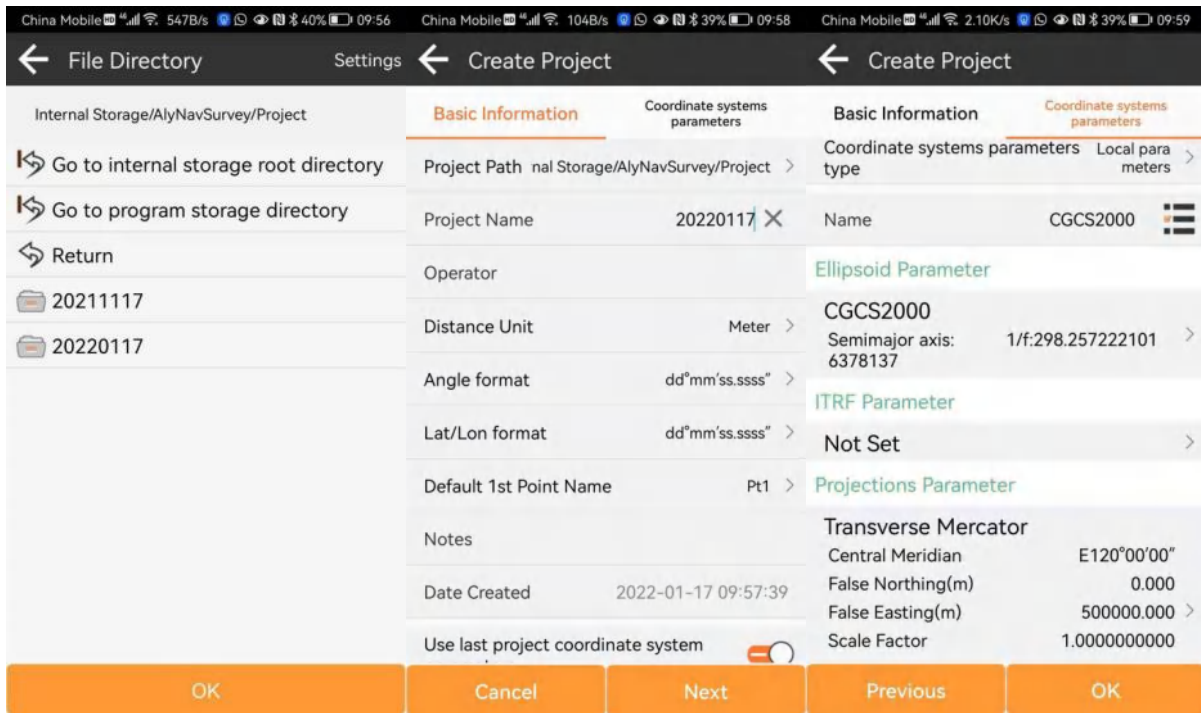


Figure 2.1-4

Figure 2.1-5

Figure 2.1-6

## 2.2 Localization

Click [Project] -> [Localization], as shown in Figure 2.2-1. The high-precision position obtained by the software from the GNSS equipment is the latitude and longitude coordinates of the satellite positioning, while in the actual engineering operation, the plane coordinate of the ground ultimately needs to be used for the survey and application effect. If the customer has Coordinates Converter parameters on hand, he can directly set the coordinate system parameter values in the coordinate system (detail 2.4). If the customer does not have specific coordinate system parameters in hand, but the corresponding values of latitude and longitude coordinates and plane coordinates, we call the control point. In the presence of control point data, the conversion parameters can be calculated by this function and can be applied to the project.

In the Localization, the added control points can be manually entered, as shown in Figure 2.2-2. The control point parameters of various formats can also be Import dataed, as shown in Figure 2.2-3, listed are common formats. A format can be set or cancelled in format management according to user needs, as shown in Figure 2.2-4, and a custom format can also be added, as shown in Figure 2.2-5.

After editing the control point parameters, the coordinate data was collected at the corresponding control point, and then the corresponding known coordinates and



GNSS coordinates were added to the conversion parameters, as shown in Figure 2.2-6. Click "Calculation" to have the calculation parameter condition settings pop up, as shown in Figure 2.2-7. The parameter conversion process includes an ellipsoid reference conversion, horizontal correction, and vertical correction. After configuring the calculation conditions, click OK to show the calculation results of the conversion parameters, as shown in Figure 2.2-8. After the conversion parameters are calculated, the calculation report can be Export dataed for the project review and inspection. If the conversion parameters are qualified, the parameters are applied to the project, and the operation can be measured normally.

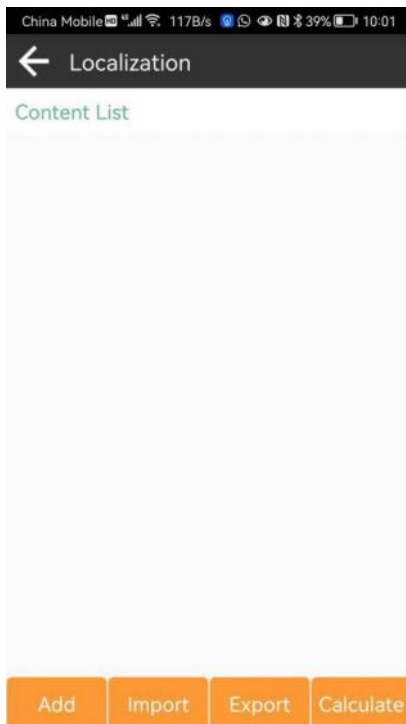


Figure 2.2-1

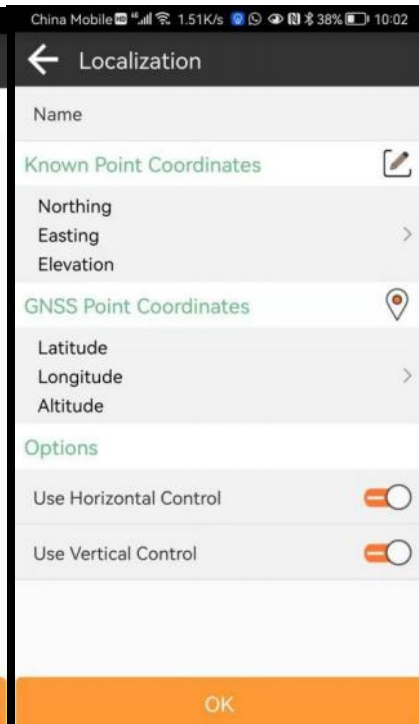


Figure 2.2-2

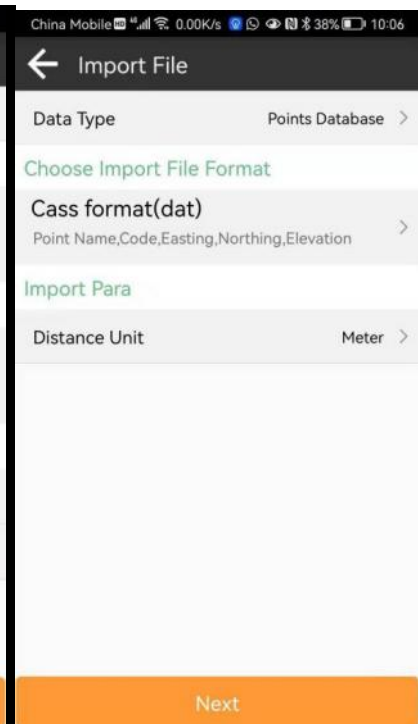


Figure 2.2-3

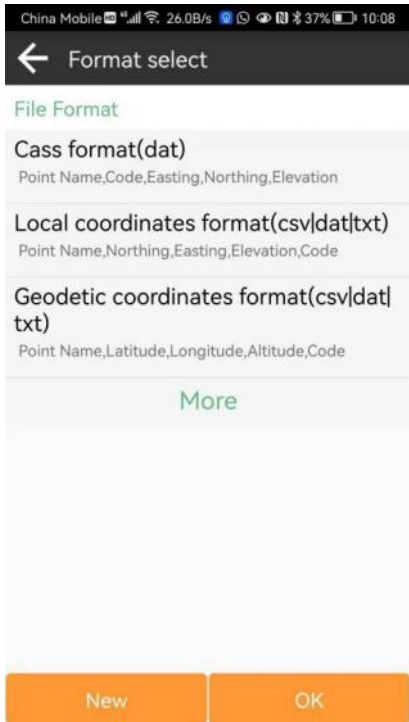


Figure 2.2-4

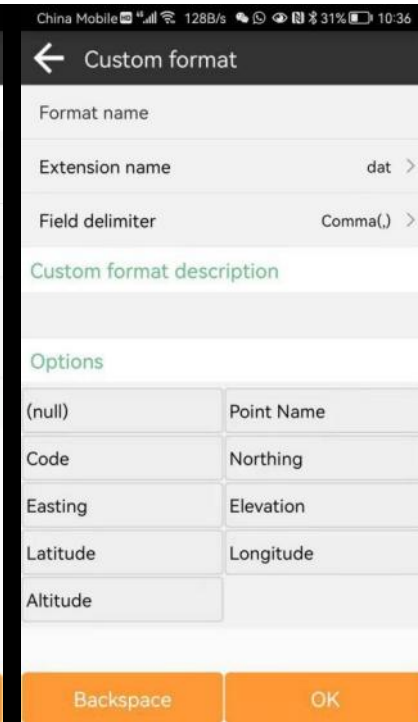


Figure 2.2-5

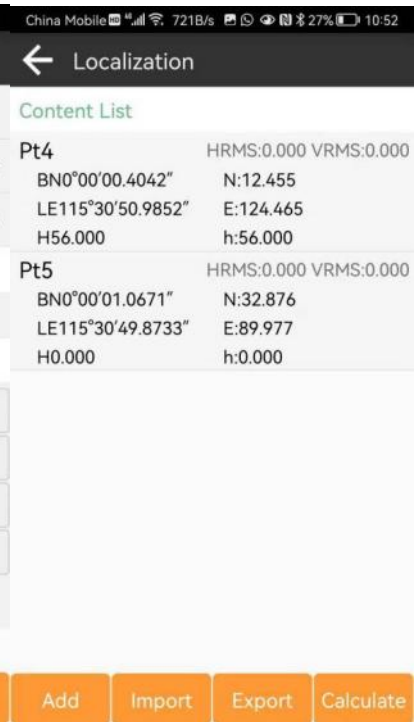


Figure 2.2-6

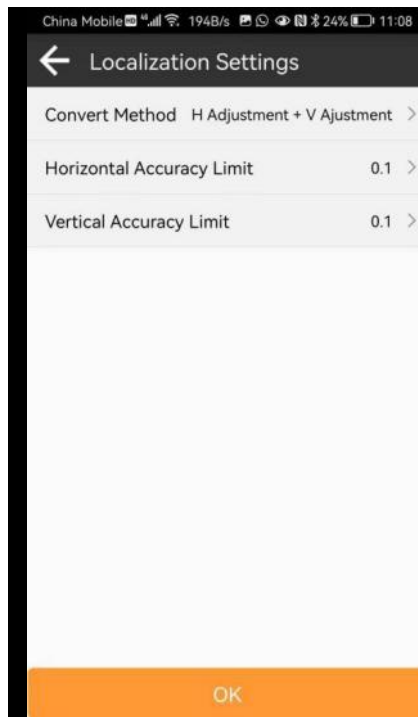


Figure 2.2-7



Figure 2.2-8

## 2.3 Calibrate Point

Click [Project] -> [Calibrate Point], as shown in Figure 2.3-1, in practical application, GNSS equipment is the high accurate position obtained through the difference data of the base station. Here we believe that the coordinate position of the reference station is known. In fact, the high accurate position of GNSS equipment output is the relative position of the reference station. In the practical application process, In addition to the differential data for a fraction of users using CORS reference stations, There is also a significant number of users launching base station difference data using their own GNSS devices, When launching the differential data using your own station-building method, A project may involve multiple initiation of reference stations, When the base station is started, The starting location and start coordinates of the base station may change, And the starting coordinates are not necessarily correct, In the absence of a calibration, The mobile station coordinates obtained using these base station differences may be wrong (at the same location, Coordinates measured using previous differential data are different from those obtained from the new differential data), Therefore, the translation calibration is required when the mobile station receives the new base station differential data for the survey work, The coordinates obtained by the software match the coordinates obtained by connecting the last base station.

After the start coordinate or start position of the base station changes, the coordinates need to be calibrated correctly using a known position. Select a known point in the point library (using the coordinates of the last base station at a location) and place the GNSS device to the location to measure a new location to calculate the deviation value, as shown in Figure 2.3-2. After the point is determined, the coordinates received by the software match the last survey.

The base station coordinate change reminds whether to be re-corrected. If it is the difference signal of the self-built base station that is received, the base station coordinate changes, which shows that the Calibrate Point calibration is needed, and the translation calibration needs to be re-conducted.

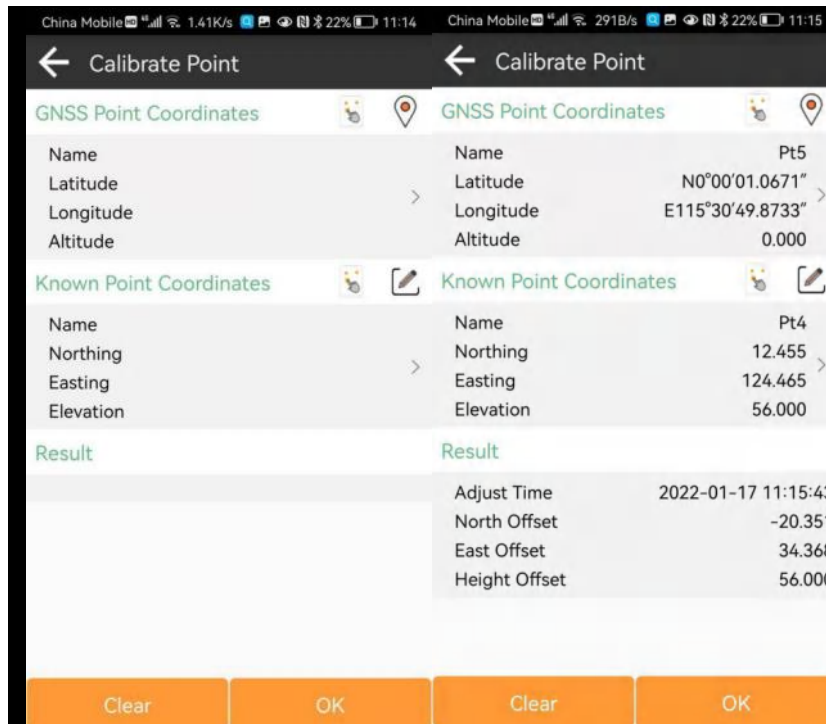


Figure 2.3-1

Figure 2.3-2

## 2.4 Coordinate system

Click [Project] -> [Coordinate system], as shown in Figure 2.4-1, the coordinate system parameters are to convert the latitude, longitude and longitude coordinates received by GNSS equipment to the plane coordinates needed by users through a certain algorithm calculation. This calculation is converted to set the corresponding parameters, with different parameters. The entire calculation conversion process is:

1. Original latitude and longitude coordinates-> spatial right-angle coordinates of WGS84 ellipsoid: use WGS84 ellipsoid parameters;
2. Space right coordinates of WGS84 ellipsoid-> Space right right coordinates of target ellipsoid: use benchmark conversion parameters;
3. Spatial right Angle coordinates of the target ellipsoid-> target latitude and longitude coordinates: use the target ellipsoid parameters;
4. Target latitude and longitude coordinates-> projection plane coordinates: use the target ellipsoid + projection parameters;
5. Projective plane coordinate-> target plane coordinate: use plane correction + vertical correction parameters;

Click "Ellipsoid Parameters" to enter the ellipsoid management interface, as shown in Figure 2.4-2. Select the desired ellipsoid from the ellipsoid list, and the ellipsoid parameters can also be added and deleted.


Click "Projection Parameters" to enter the projection parameter editing interface, as shown in Figure 2.4-3. You can choose the Gaussian projection, UTM projection, Mercator projection, inclined red level projection, double red level projection and other projection methods, if it is a Gaussian projection, input the correct central meridian, north plus constant, east plus constant, projection scale, reference latitude and other parameters.

Click "Ellipsoid Baseline Conversion Parameters" to enter the benchmark conversion parameter editing interface, as shown in Figure 2.4-4. The conversion model includes Boolsha, Boolsha (with origin parameters), Boolsha rigorous algorithm, Helmert, three parameters and other conversion models.

Click "Plane Correction Parameters" to enter the editing interface as shown in Figure 2.4-5. The transformation model contains a four-parameter model and a horizontal translation model. It also supports grid conversion file conversion, Import datas grid offset files, and corrects the coordinates according to the conversion point in the grid.

Click "Vertical Correction Parameters" to enter the vertical correction parameter editing interface, as shown in Figure 2.4-6, 2.4-7. The transformation model contains fixed difference, surface fitting, and vertical translation models. It also supports geoid file conversion, and Import datas geoid files to correct the coordinate elevation according to the conversion point in the location of the level. Level file management interface, as shown in Figure 2.4-8, users can Import data the removal and other operations, and select the required level file for parameter setting.

Click the "translation parameter" to enter the translation parameter editing interface. In a small-range job, sometimes there is only one control point, requiring only a translation conversion from the projected plane coordinate to the target plane coordinate, which can be set up here. The difference between the translation parameter here and the Calibrate Point calibration is that the coordinate system parameter setting here will affect all the data of the whole project, and if it changes, the conversion of the conversion latitude and longitude coordinates and the plane coordinates will be recalculated, while the Calibrate Point calibration will only affect the survey coordinates after the calibration operation.

In addition to manually entering the coordinate system parameters, you can also click behind the name, as shown in Figure 2.4-9.  Select the coordinate system parameters from the list of common coordinate systems. Common Coordinate system can add, Import data, or select to add from the template, or remove long presses from the list.

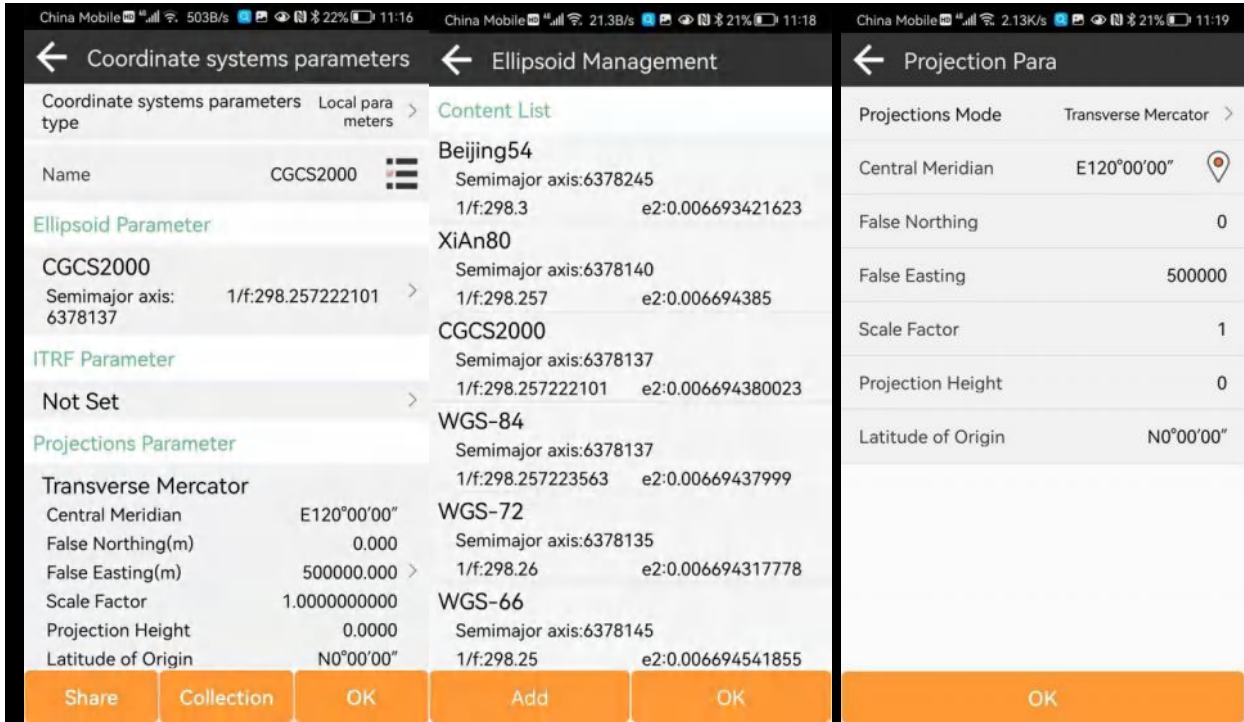


Figure 2.4-1

Figure 2.4-2

Figure 2.4-3

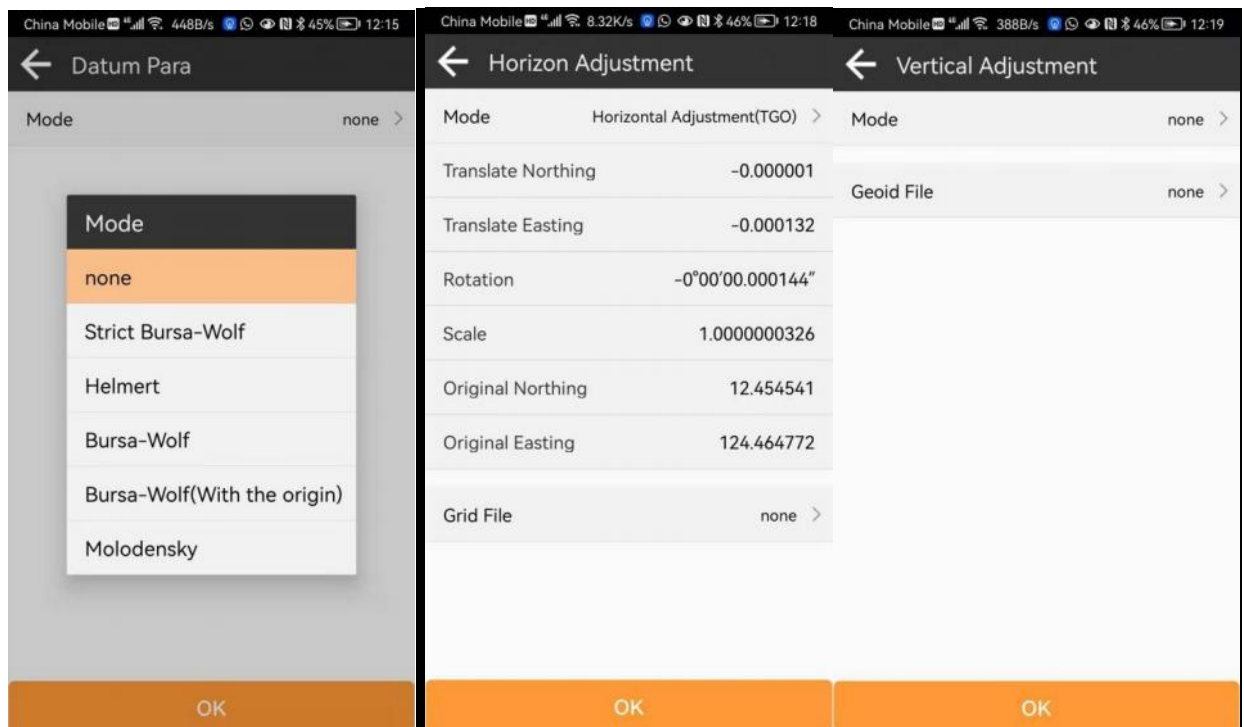


Figure 2.4-4

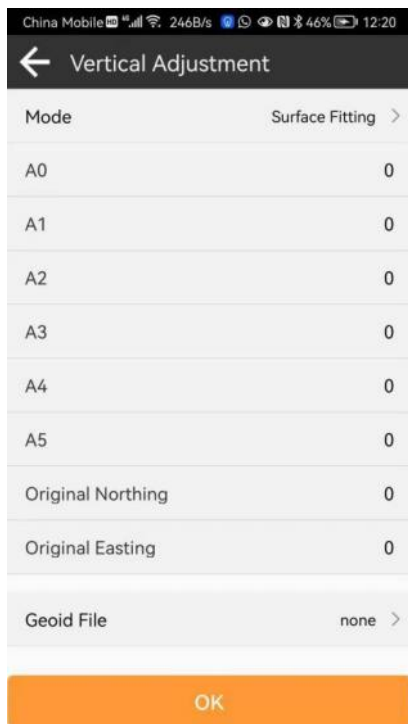


Figure 2.4-7

Figure 2.4-5

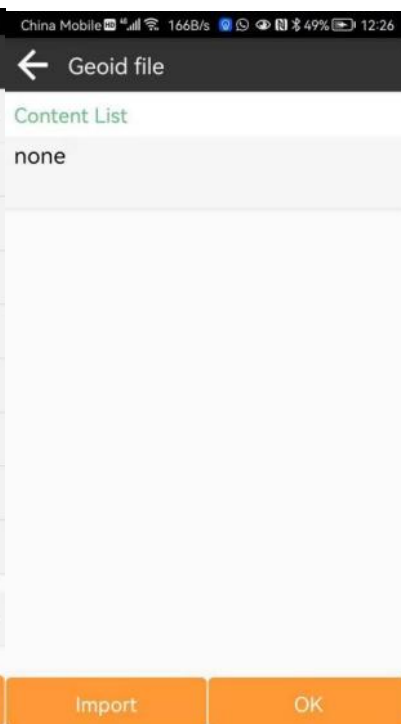


Figure 2.4-8

Figure 2.4-6

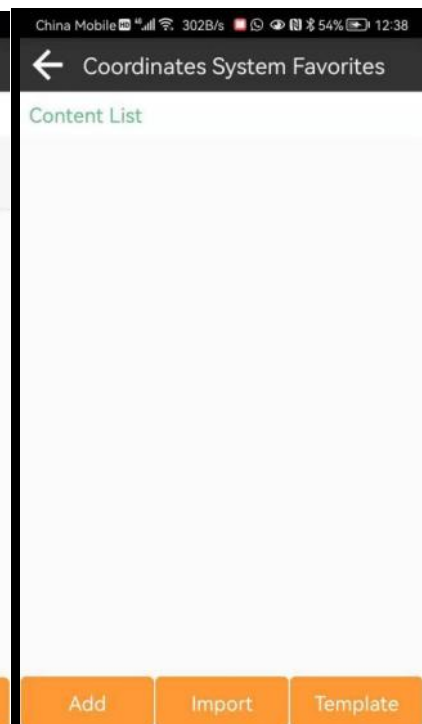


Figure 2.4-9

## 2.5 Point Database

Click [Project] -> [Point Database], as shown in Figure 2.5-1. Here to view the point data in the project, including increase, delete, recovery, point details view, Import data, Export data and other functions.

Add: As shown in Figure 2.5-2, manual entry of roll call, coding and corresponding coordinates;

Delete: As shown in Figure 2.5-3, it can be deleted by a long batch selection point;

Recovery: As shown in Figure 2.5-4, recover the misdeleted point data;

Point details: click the data items in the list to view the point details, as shown in Figure 2.5-5 (smoothing point) and 2.5-6 (control point); modify the roll coding information. For the control point, generate a report from the control point.

Import data: As shown in Figure 2.5-7, select the format of the required to Import data point data, and next select the data file to complete the data Import data. Data formats can also set common formats in format management, add and delete custom formats.

Export data: As shown in Figure 2.5-8, select the data format (more than optional) to Export data, select the Export data location, and input the Export data file name, and the point Export data can complete the data Export data.If you choose to Export data multiple formats, they is generated into one folder.

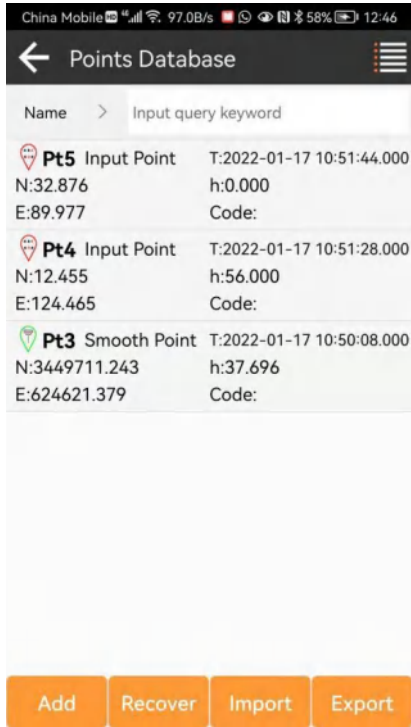


Figure 2.5-1

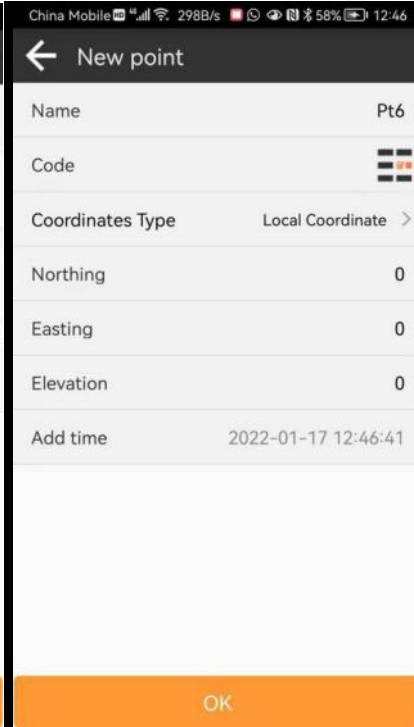


Figure 2.5-2

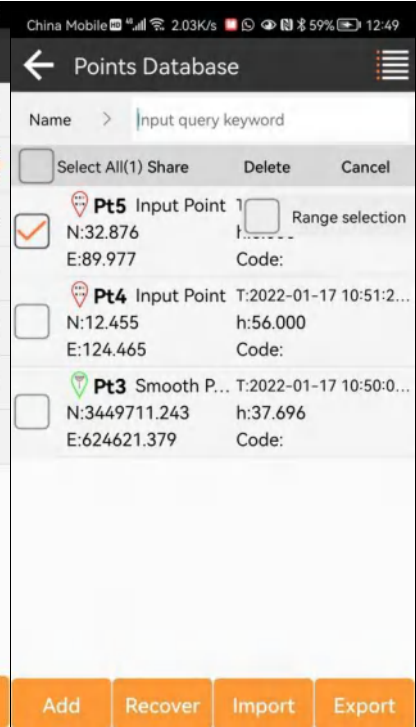


Figure 2.5-3

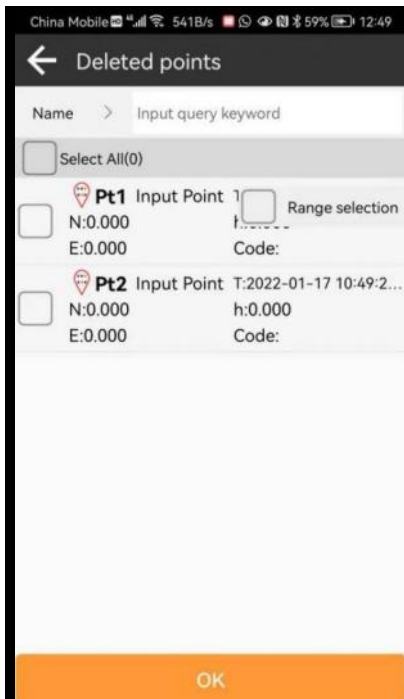


Figure 2.5-4



Figure 2.5-5

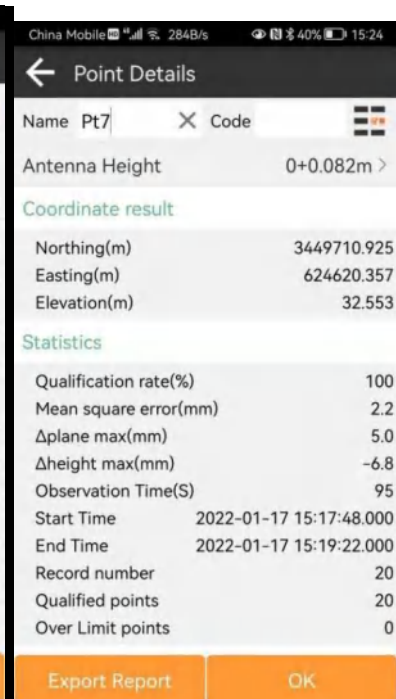


Figure 2.5-6



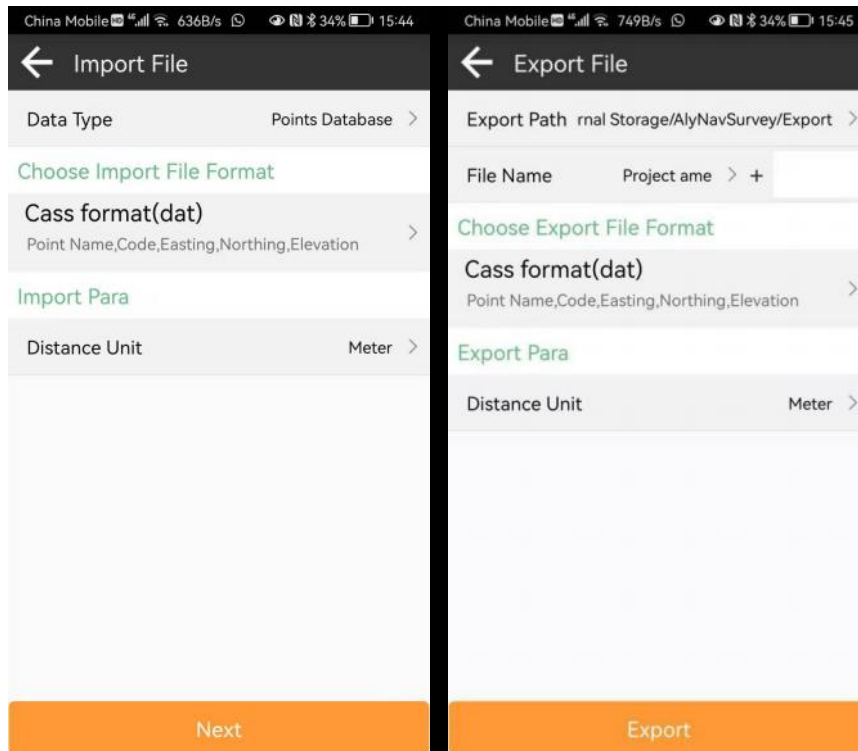


Figure 2.5-7

Figure 2.5-8

## 2.6 Code library manager

Click [Project] -> [**Code library manager**], as shown in Figure 2.6-1. The coding library is the predefined coding attribute of the field acquisition point, and quickly fills in the coding value by selecting the name description of the image.

In the enCode library manager, as shown in Figure 2.6-2, the encoding library that needs to be used for the project is selected. The encoding library can be Import dataed, as shown in Figure 2.6-3, or manually input and added, as shown in Figure 2.6-4, 2.6-5.

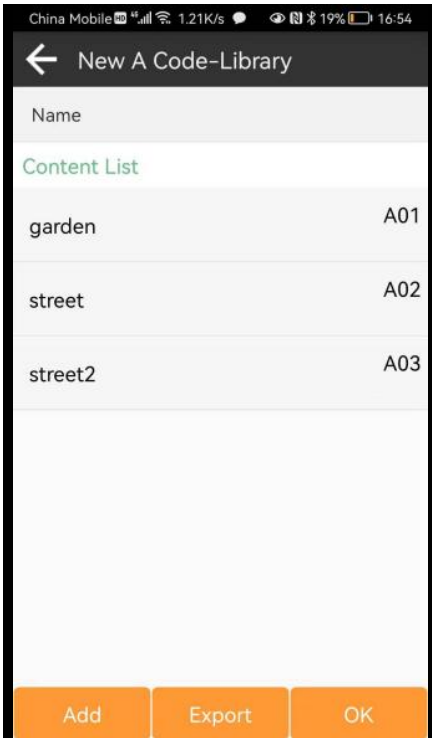


Figure 2.6-1

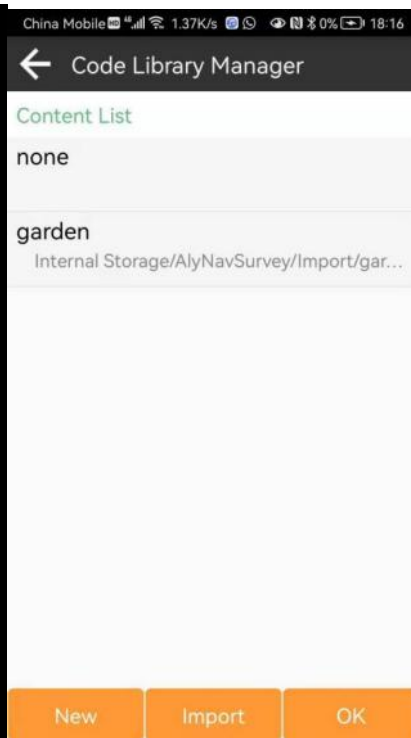


Figure 2.6-2

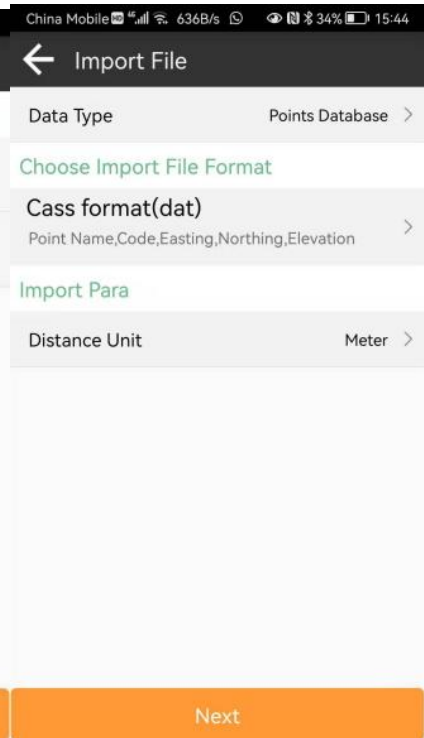


Figure 2.6-3

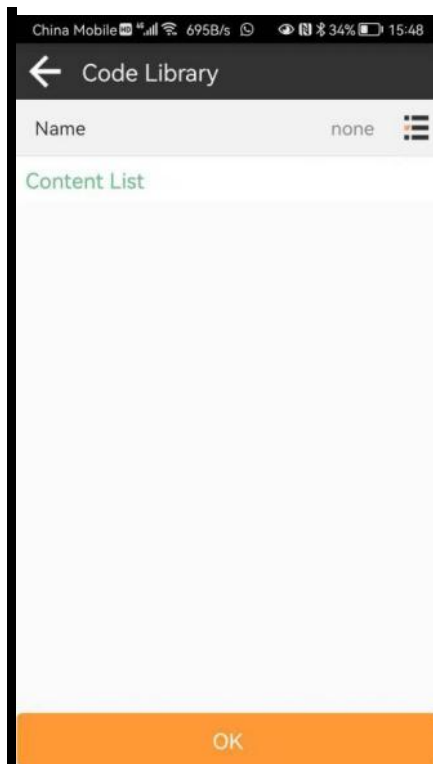


Figure 2.6-4

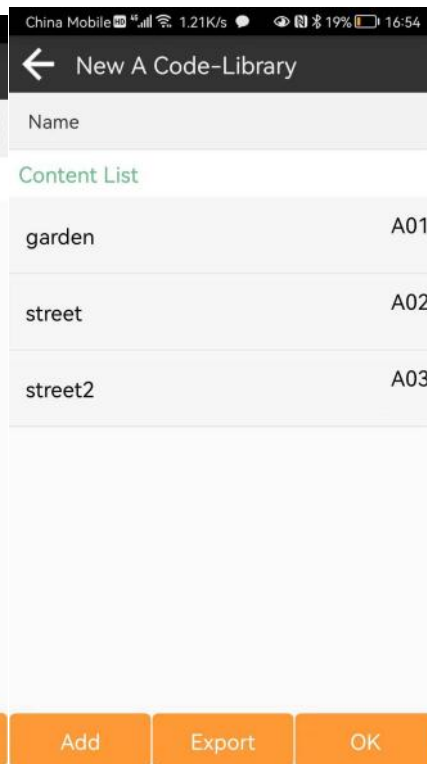


Figure 2.6-5

## 2.7 Survey Range Settings

Click [Project] -> [Survey Range Settings] as shown in Figure 2.7-1. This function is to determine whether the current positioning position is within the range

of the survey area in the real process of the survey operation. If this scope is exceeded, timely remind the scope of the work, so as to avoid the user from doing work beyond the scope of work.

For the editing management of the test area range, coordinates can be selected from the point library, as shown in Fig. 2.7-2, and Import data and Export data the coordinates of the test range. The test area range can preview the general drawing of the range, as shown in Figure 2.7-3.

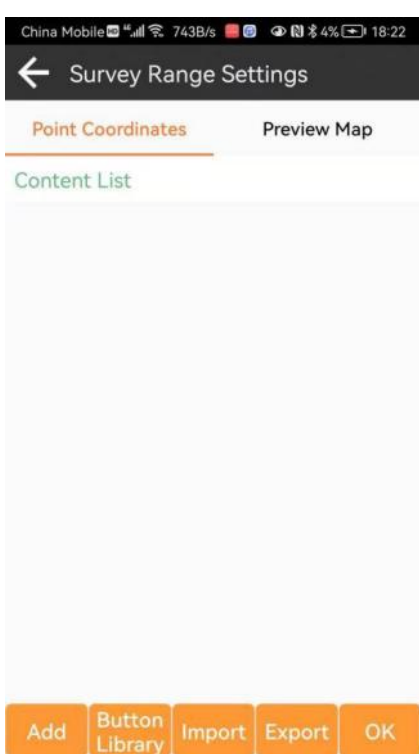


Figure 2.7-1

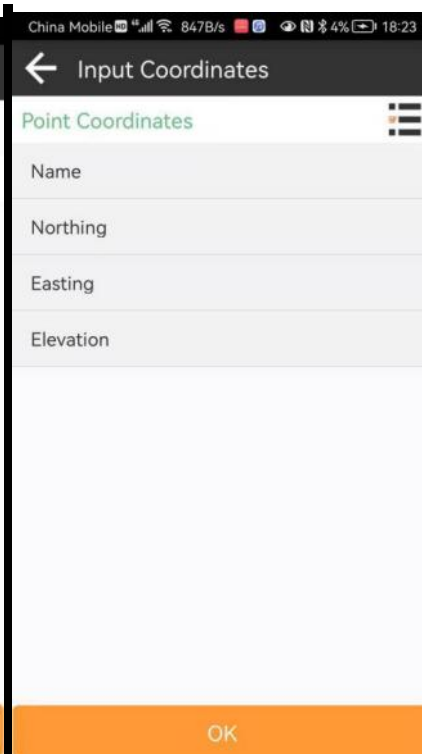


Figure 2.7-2

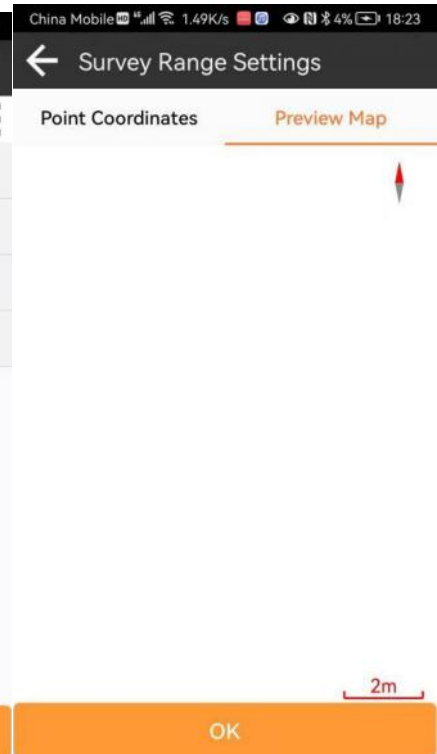


Figure 2.7-3

## 2.8 Software settings

Click on [Project] -> [Software Settings], as shown in Figures 2.8-1、 2.8-2、 2.8-3 is set for the system, voice, shortcut keys.

**System:** As shown in Figure 2.8-1, it mainly includes length unit, angular display format, mileage display format, language, text coding, etc.

**Voice:** As shown in Figure 2.8-2, it mainly includes the voice broadcasting function when measuring the data.

**Shortcut key:** As shown in Figure 2.8-3, here the predefined manual thin physical keyboard triggers the corresponding function.

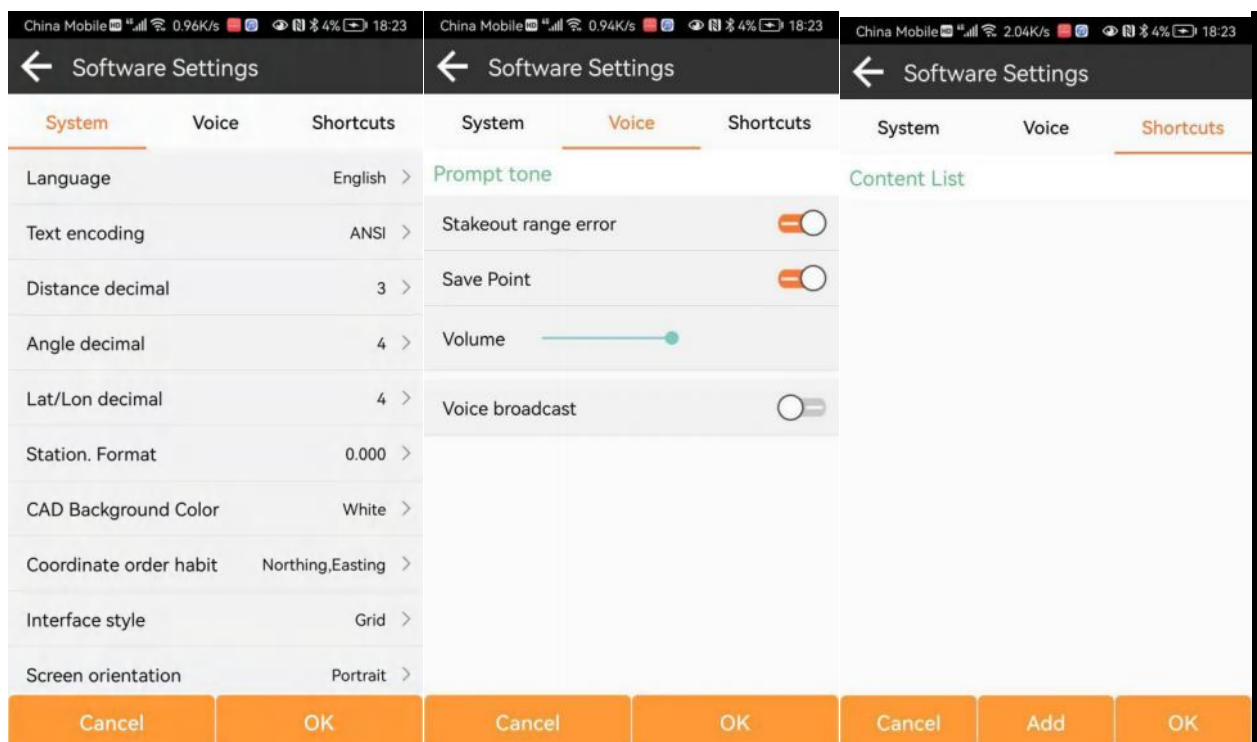


Figure 2.8-1

Figure 2.8-2

Figure 2.8-3

## 2.9 About Software

Click [Project] -> [About Software], as shown in Figure 2.9-1. Software registration and authorization information, software version information, copyright information, etc. Here, conduct software authorization activation, authorization transfer, check new versions, and feedback.

Software activation: As shown in Figure 2.9-2, enter the authorization code here or scan the QR code of the authorization code here for software activation.

Check the new version: If there is a new version, the new version will bounce information, click Update to update the software to the latest version. If there is no new version, it is prompted for the latest version.

Feedback: As shown in Figure 2.9-3, in order to better provide services to users, if you have any problems while using the software, you can feedback the problems to our technology here, and we will provide support for you in the first time. Note: Be sure to leave the contact information (mainly by email), the problem description is as complete as possible, if there is an attachment (icon, video, documents, etc.), you can submit it together, thank you!



Figure 2.9-1

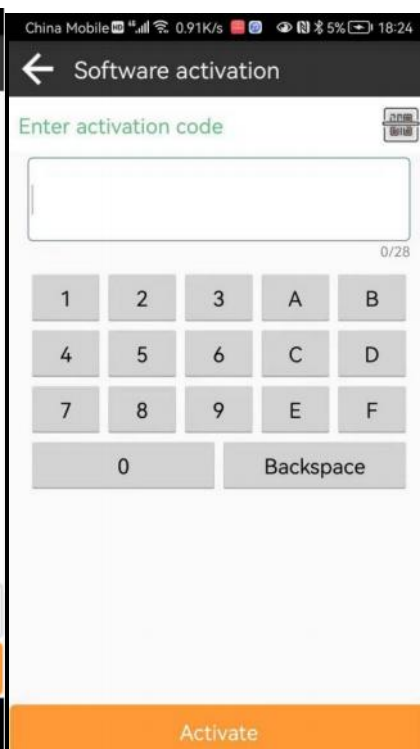


Figure 2.9-2

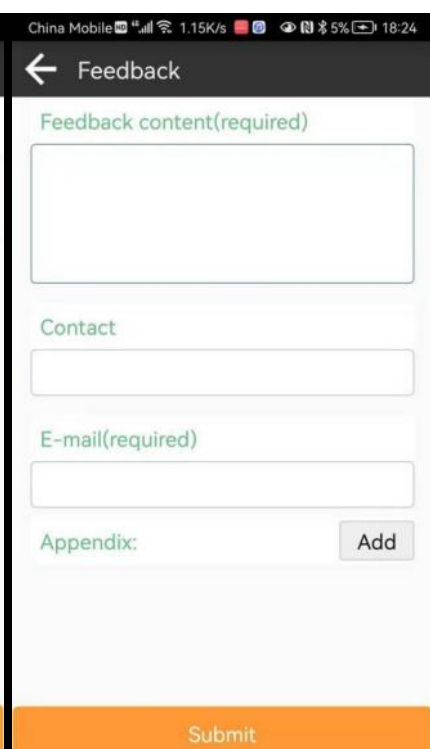


Figure 2.9-3

## III. Device

At the main software interface, click [Device] on the corresponding function menu, as shown in Figure 3-1. The instrument includes Communication, Rover, Base, Static, Inspection accuracy, Device Setting, Restart Positioning, Device information and other functions.

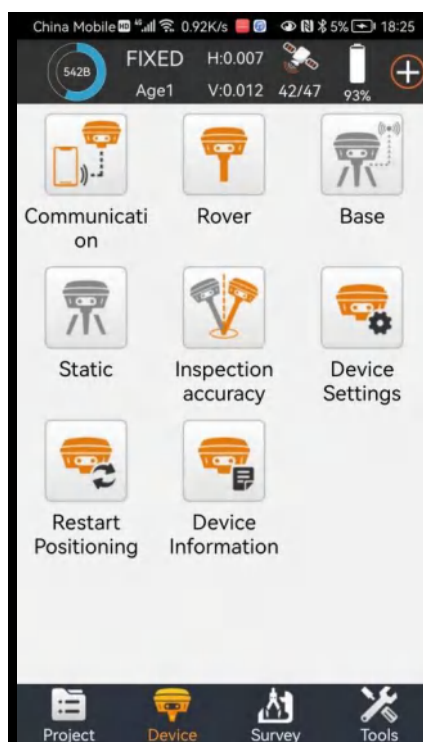


Figure 3-1

### 3.1 Communication

Click [Device] -> [Communication], as shown in Figure 3.1-1. Select the instrument manufacturer, instrument type and Communication mode, then select the equipment parameters, and click "Connect" to complete the equipment Communication. After the device is successfully connected, it will return directly to the main interface of the software, as shown in Figure 3-2. Enter the communication setting, as shown in Fig. 3.2-2, click Stop the section equipment Communication.

1. Selection of the instrument manufacturer: the software supports the joint navigation and the positioning equipment access of many other GNSS instrument and equipment manufacturers, as shown in Figure 3.2-3.

2. Instrument type: usually RTK, equipment of some manufacturers according to equipment type.

3. Communication mode includes Bluetooth Communication, TCP client Communication, etc. The way supported by each instrument manufacturer may be different. The basic Bluetooth mode is basically supported by all manufacturers.

4. Click on the equipment parameters, enter the Bluetooth search and selection, as shown in Figure 3.1-4, and click on the equipment to choose the equipment needed to connect. The list of common equipment will display the 5 devices with the most Communication frequency, to facilitate users to quickly find the connected equipment.

5. After the equipment is successfully connected, click "debug" to view the communication data between the software and the equipment. As shown in Figure 3.1-4, the equipment debugging commands can be sent to the equipment to investigate the problems related to the equipment positioning through the communication data.

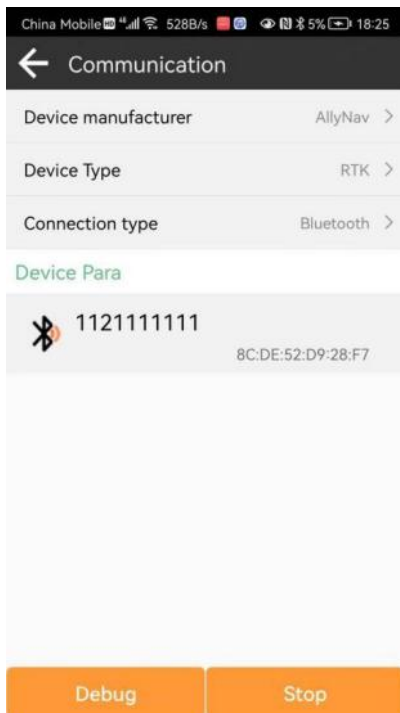


Figure 3.1-1

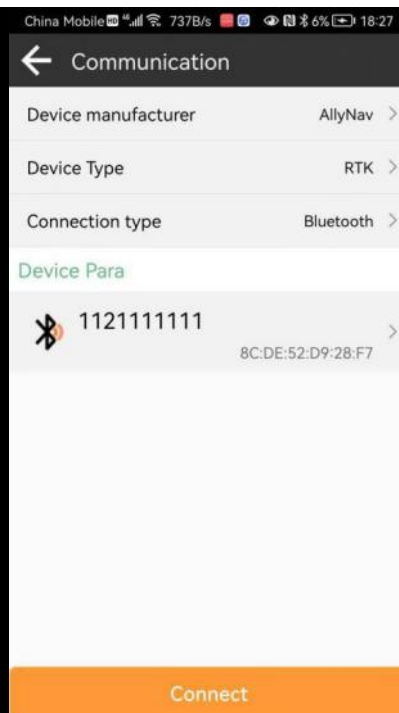


Figure 3.1-2

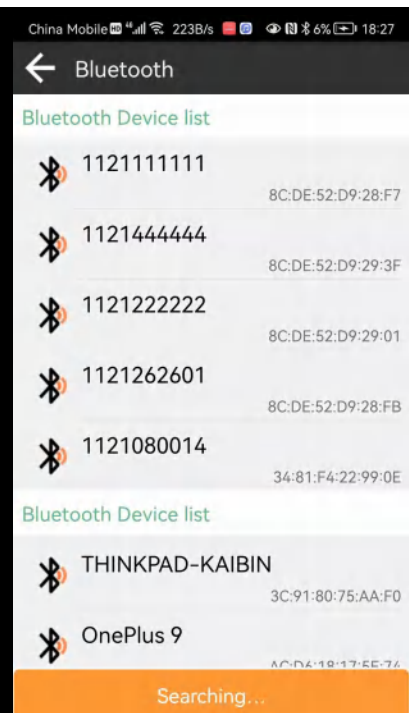


Figure 3.1-3

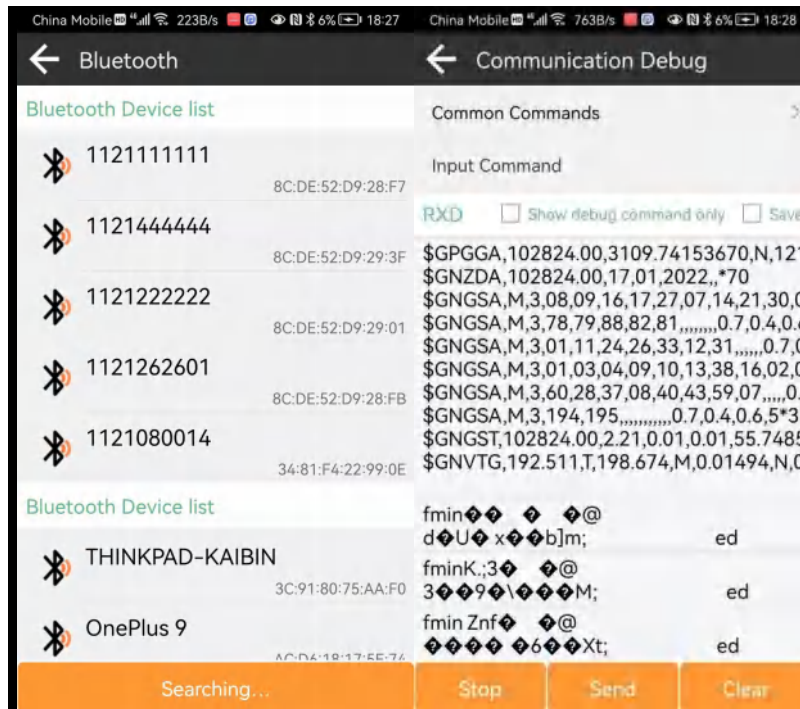


Figure 3.2-4

Figure 3.2-5

## 3.2 Rover

Click [Device] -> [Rover]. The data chain mode mainly includes built-in radio station, host network, thin hand network and other ways.among:

1. Built-in radio station: As shown in Figure 3.2-1, click on the default radio setting to modify and edit the parameters, as shown in Figure 3.2-2. Normal receiving station data must be received by ensuring that the agreement and frequency are the agreement of the transmitting radio station. Click on the icon to select the corresponding channel frequency Device from the predefined channel management list, as shown in Figure 3.2-3.

2. Host network: as shown in Figure 3.2-4, click on the parameters to modify and edit the parameters, as shown in Figure 3.2-5. The Communication mode is the transmission protocol of differential data, usually by NRTIP, TCP client, input server IP, port, user name password and other Communication parameters. SIM network is a special network, requiring APN parameters. CORS server parameters can be selected from the server management list, as shown in Figure 3.2-6. After configthe server



address correctly, obtain the list of access points and select the corresponding access points to obtain differential data.

3. Data controller network: As shown in Figure 3.2-7, click on the parameters to modify and edit the parameters. The parameter Device is similar to the host network, without allocating the APN parameters, configure the parameters, select the access points to be connected, as shown in Fig. 3.2-8, to obtain differential data. The point starts to connect and if the Device is no problem, the data receiving progress bar is around. If the progress bar has no data, you need to confirm that the parameter Device is correct.

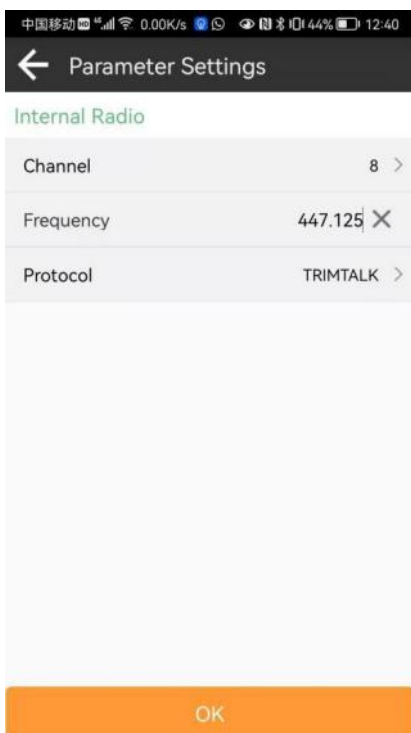


Figure 3.2-1



Figure 3.2-2



Figure 3.2-3

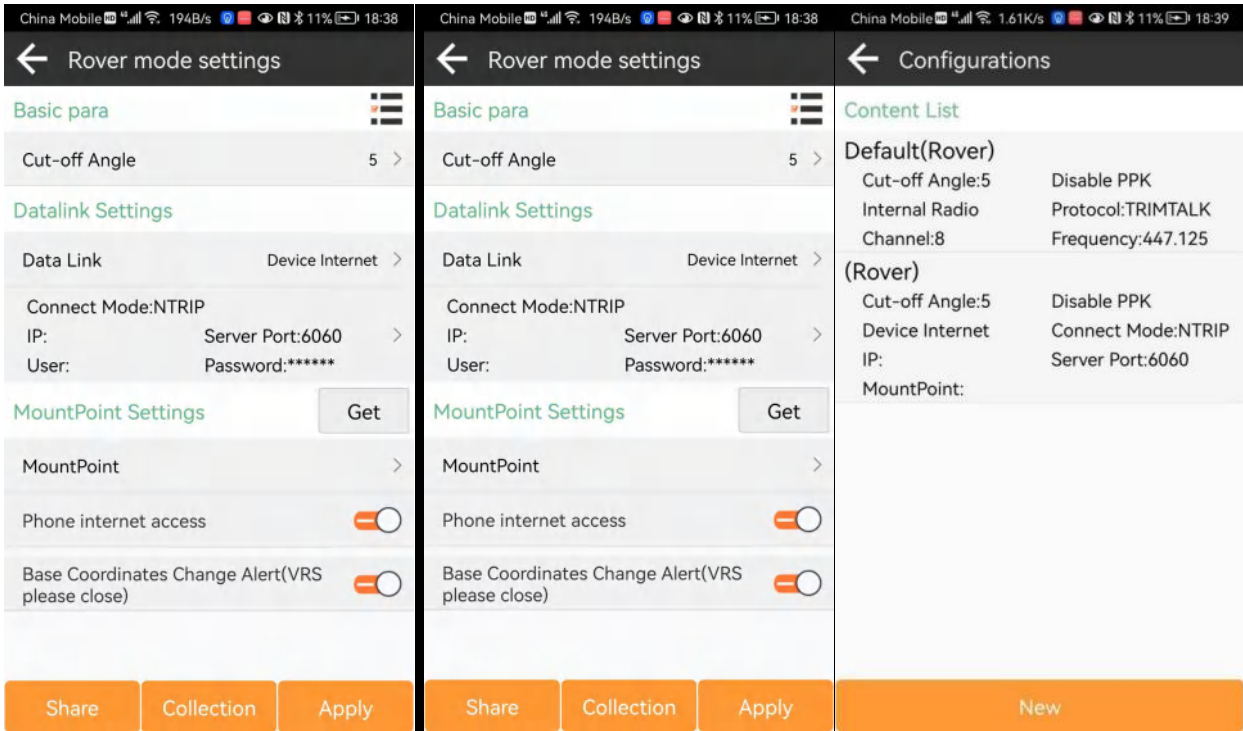


Figure 3.2-4

Figure

3.2-5 Figure 3.2-6

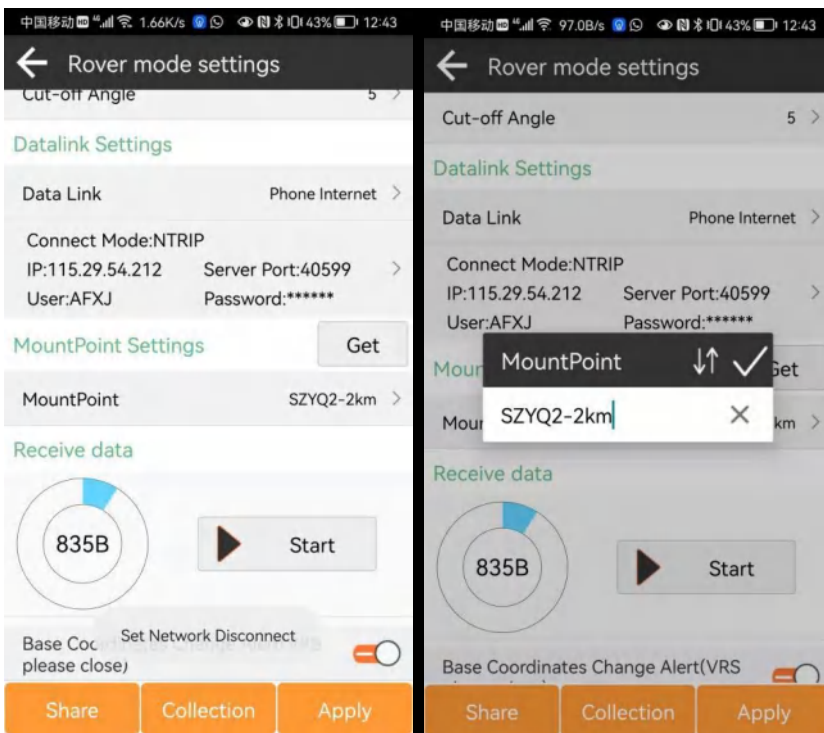


Figure 3.2-7

Figure 3.2-8

### 3.3 Benchum station setting

Click [Device] -> [Base], as shown in Figure 3.3-1,

Start mode includes single point positioning start, specified base station coordinate start, survey point coordinate start, in which:

1. Single-point positioning start: refers to the GNSS device to output differential broadcast data to the starting coordinate according to the current positioning value (low accuracy);
2. Known point start: As shown in Figure 3.3-2, it refers to the equipment erection location of the user, where the user knows the coordinate position in advance, and uses this coordinate value as the starting coordinate to output the differential broadcast data.
3. Positioning coordinates of survey points, as shown in Figure 3.3-3, refers to the user collecting a real-time point according to certain positioning data according to the current GNSS equipment, through which the real-time point is started according to the designated coordinate.

Differential data parameters are mainly that the differential data output by the equipment after starting the base station is transmitted in a certain way and received and used by the mobile station. The main methods include the host network, built-in station and external station. The parameter settings are similar to the mobile station parameters, where the difference is:

1. The built-in station will have the transmission power. The higher the launch function, the farther the distance, and the greater the power consumption.
2. Host network NTRIP protocol, the base station is the access point to start the transmission, and the mobile station is the list of access points, from which the corresponding base station access point is selected for Communication.
3. The benchmark station does not use the manual network for differential data broadcasting.



Figure 3.3-1

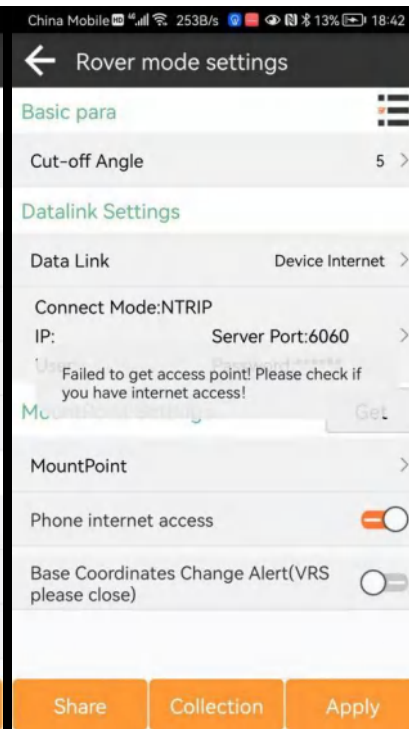


Figure 3.3-2

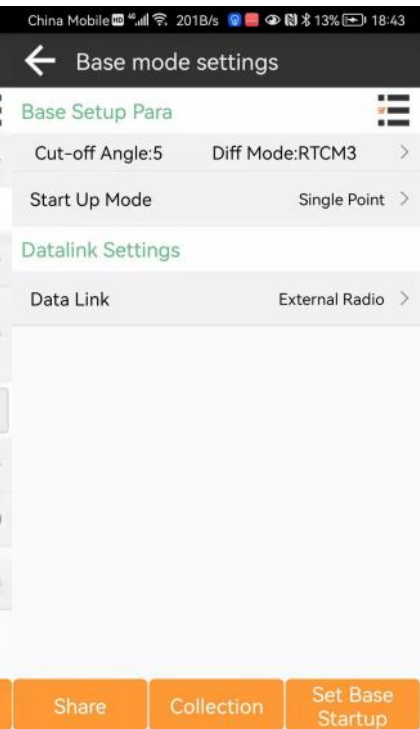


Figure 3.3-3

### 3.4 Static

Click [Device] -> [Static], as shown in Figure 3.4-1. This function is to store the raw satellite observation data of the GNSS device into the setup disk file, recording a time of observation data used to solve high-precision coordinate positions using static post-processing software, usually for control point acquisition. The height cutoff angle needs to be set



Figure 3.4-1

### 3.5 Device information

Click [Device] -> [Device information], as shown in Figure 3.5-1. This function can view the basic information of the instrument serial number, firmware version, motherboard type, and motherboard serial number of the GNSS equipment.

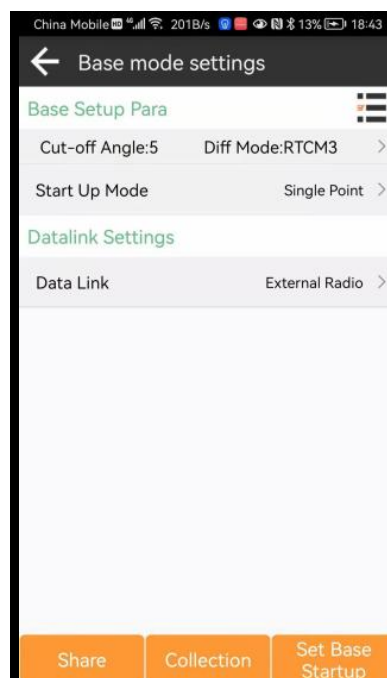


Figure 3.5-1

### 3.6 Device Settings

Click [Device] -> [Device Settings], as shown in Figure 3.6-1. Set the location data output frequency.

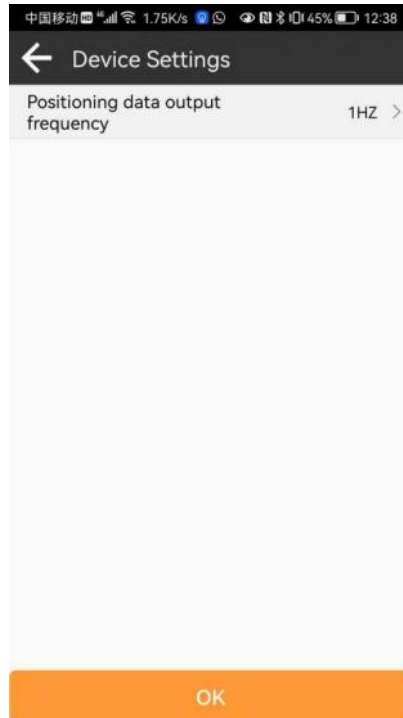
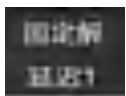


Figure 3.6-1

### 3.7 Other



1. Click the [power icon] in the title column of the software to view the battery power of the equipment, as shown in Fig. 3.7-1.



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



3. Click on the position of the title bar of the software to enter the positioning coordinates of the output of the equipment, as shown in Figure 3.7-2. You can switch to view the base station information, and the star chart information, as shown in FIG. 3.7-3, 3.7-4, 3.7-5. Since there are no antenna parameters of the transmission base station in the differential data, only the transmit-center coordinates of the base station transmission phase are transmitted. In order to obtain the

corresponding ground coordinates of the base station startup, the antenna parameters corresponding to the base station can be input.



4. Click on the position of the title bar of the software to enter the information received by the equipment satellite, as shown in Figure 3.7-5.

5. In the star chart table, click "Settings" in the title bar to set the satellite system switch, as shown in Fig. 3.7-6.

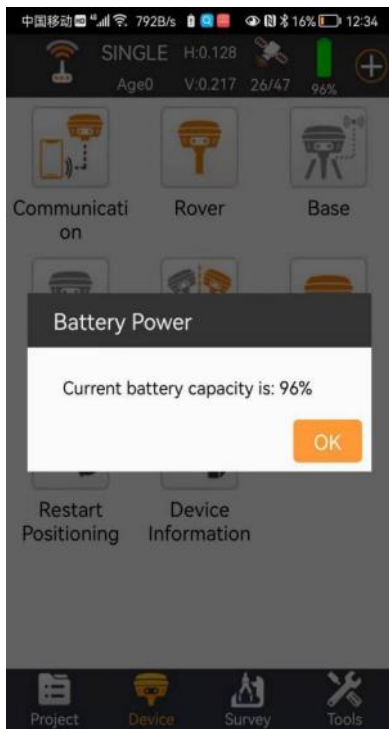


Figure 3.7-1

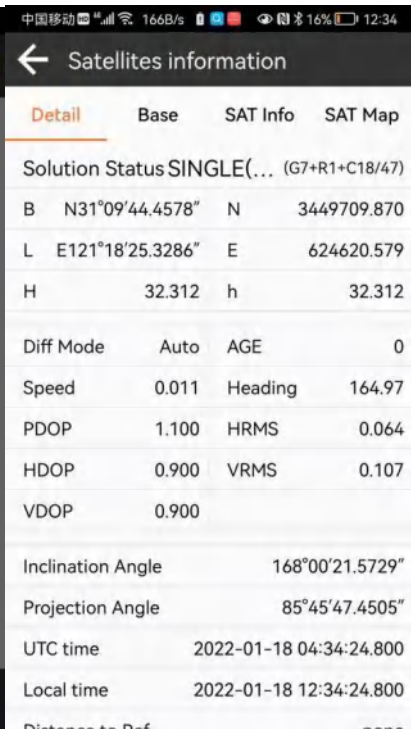


Figure 3.7-2

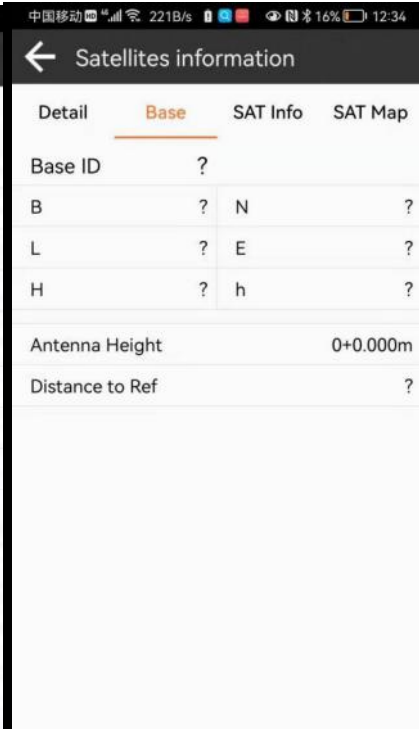


Figure 3.7-3

中国移动 214B/s 16% 12:34

← Satellites information Settings

Detail	Base	SAT Info	SAT Map
G03	L1:40	L2:38	L5:0
	Elevation:20	Azimuth:302	Used
G16	L1:40	L2:35	L5:0
	Elevation:31	Azimuth:226	Used
G22	L1:36	L2:31	L5:0
	Elevation:0	Azimuth:0	Visible
G25	L1:35	L2:36	L5:0
	Elevation:17	Azimuth:44	Used
G26	L1:46	L2:44	L5:0
	Elevation:68	Azimuth:251	Used
G29	L1:41	L2:37	L5:0
	Elevation:31	Azimuth:71	Used
G31	L1:45	L2:43	L5:0
	Elevation:59	Azimuth:10	Used
G32	L1:48	L2:45	L5:0
	Elevation:56	Azimuth:136	Used
G33	L1:42	L2:41	L5:0
	Elevation:48	Azimuth:160	Visible
G34	L1:44	L2:45	L5:0

Figure 3.7-4

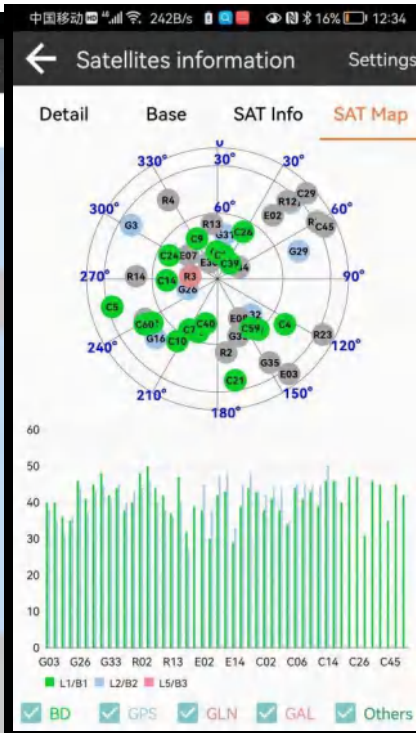


Figure 3.7-5

中国移动 0.00K/s 16% 12:34

← Satellites System Settings

- GPS
- GLONASS
- BEIDOU
- GALILEO
- SBAS
- QZSS

OK

Figure 3.7-6



## IV. Survey

In the main software interface, click [Survey] for the corresponding function menu as shown in Figure 4-1. The survey includes the Point Survey and Detail Survey, Control Point Survey, Point Stakeout, CAD, Line Stakeout, DSM Stakeout, Stake Road and so on.

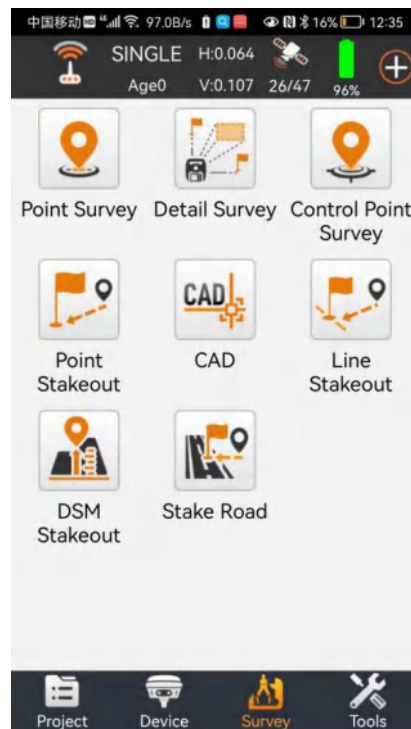


Figure 4-1

### 4.1 Point Survey

Click [Survey] -> [Point Survey], as shown in Figure 4.1-1. The positioning of GNSS device output is measured and collected into the coordinate point library under certain precision limits. In the point survey interface, the title bar displays the basic information of the positioning output of the current GNSS equipment, the current solution status, the difference delay, the positioning accuracy evaluation value of HRMS and VRMS, and the number of received satellites. Title bar is other Import dataant information status bar, display content can be set according to the user content, in the point survey default display high coordinates and base station distance information, the middle area is measuring data drawing information, can also set display network map, the upper right corner of the electronic compass for thin compass display, convenient users to judge the direction when needed. The bottom

left side of the drawing area is the display of the function collection, these function menu can also display the required functions here according to the needs of the user to quickly operate some functions, the bottom right corner of the area shows the drawing scale, the icon above the scale is the trigger survey acquisition function button, the button can be moved according to the user's use habits, in a more convenient place to operate. Click the key to start the survey function, as shown in Figure 4.1-2. Below the drawing area are the survey attribute naming and encoding input locations, as well as the antenna height setting and the entrance to the coordinate point library.

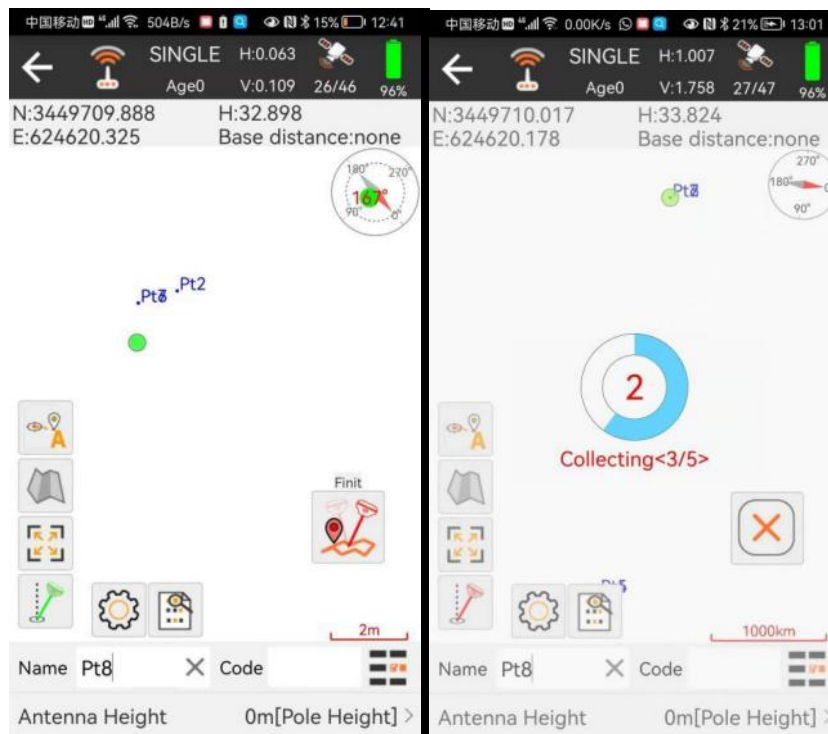



Figure 4.1-1

Figure 4.1-2



Click the setting icon to enter the survey setting interface, as shown in Figure 4.1-3. Here, we set the collection restrictions for survey and collection, such as solution state, HRMS, VRMS, PDOP, difference delay, etc. Users set the restrictions according to the accuracy requirements of the job. Setting the number of smoothing points is to average multiple sites to indicate accuracy. In addition, you can also set the default roll call and the default encoding. The information display setting is to set the display content of the status information bar, and the user can display it according to his own key information setting, as shown in FIG. 4.1-4. Function menu setting is that the user displays the common function Settings to the left menu bar according to the needs of their own homework process, so that the user can quickly and easily call

some functions. These functions include: tilt survey switch, network map selection switch, drawing zoom in and reduce the whole map positioning center, screen point, CAD text annotation, length and area calculation, drawing background color setting, CAD layer setting, Coordinates Converter tools, Calculator tools and other functions, click the menu icon on the left to trigger the corresponding functions.

 survey collection points usually require name call and coding, and clicking the icon can select the preset coding in the coding library to quickly fill in the ground properties, as shown in Figure 2.1-6.

Click on the antenna high to display the content, and you can modify and edit the antenna high information, as shown in Figure 2.1-7. The antenna height is set to subtract the phase center coordinates of the GNSS from the antenna height to measure the actual target position on the ground. If the antenna information is incorrect, click the antenna information can select the correct antenna type in the antenna management (used when the GNSS equipment does not output the antenna information or uses the external antenna), as shown in Fig. 2.1-8.

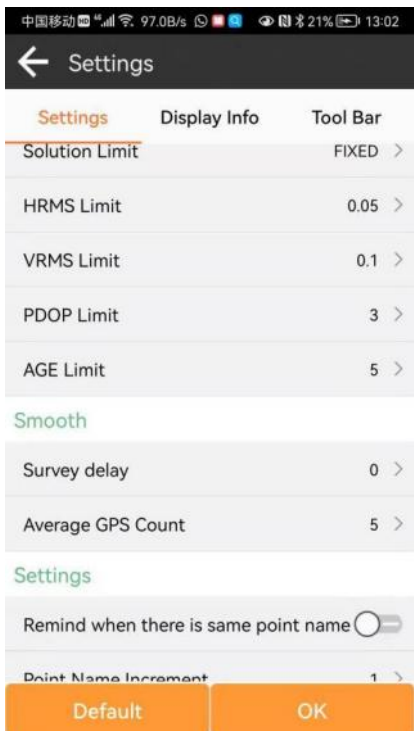


Figure 4.1-3

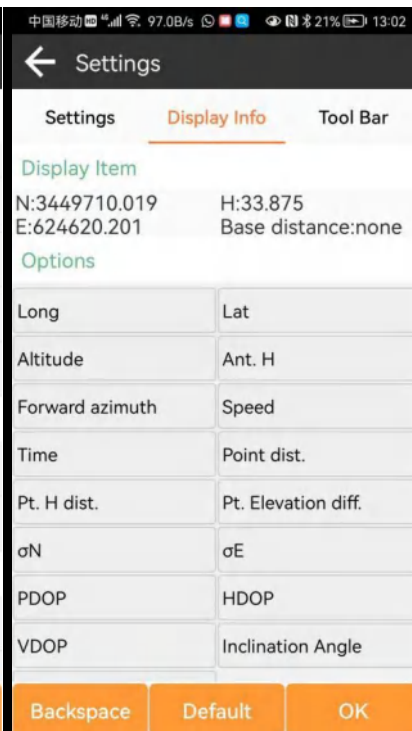


Figure 4.1-5

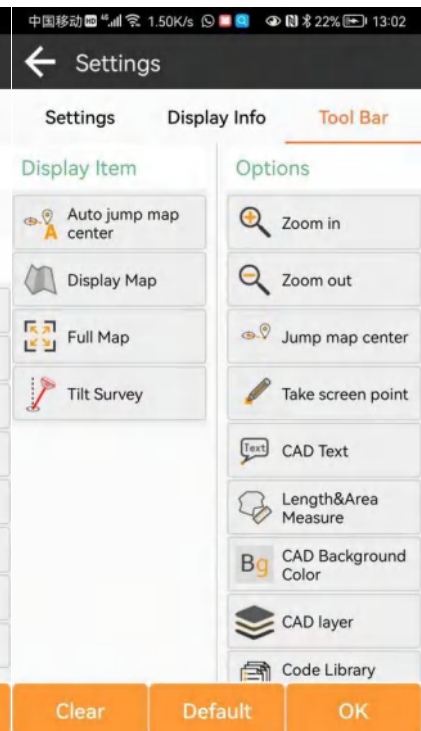


Figure 4.1-6

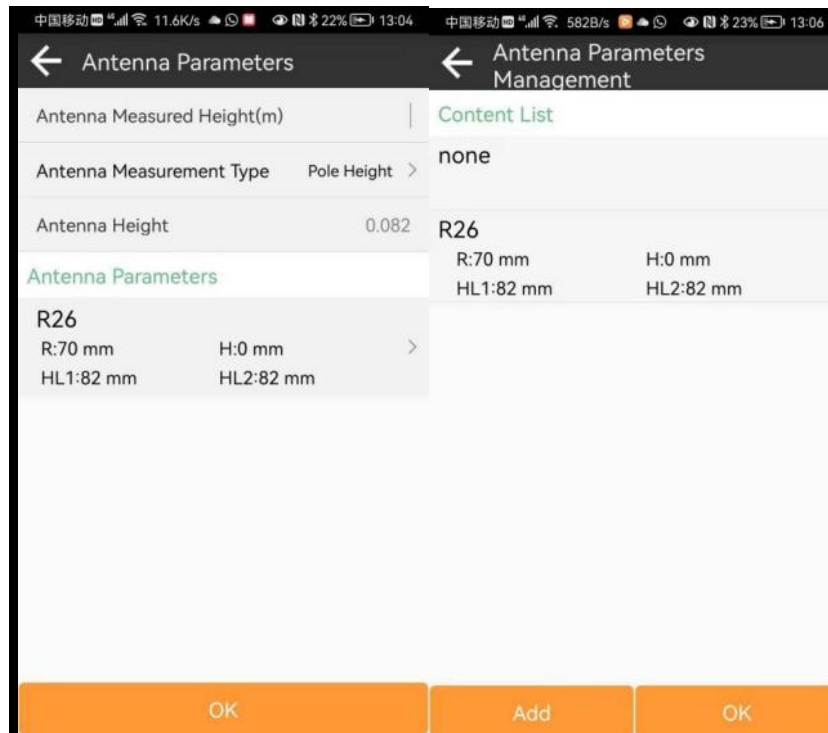


Figure 4.1-7

Figure 4.1-8

## 4.2 Detail Survey

Click [Survey] -> [Detail Survey]. As shown in Figure 4.2-1, this function is similar to the point survey effect, but there is no Figureical interface for the point survey, which shows the content needed for the survey collection point more simply and intuitively. This feature can be used to directly measure the collection points if the user does not need a drawing reference. Below the interface is the functional entrance for the survey setting, point library, and tilt survey switch.

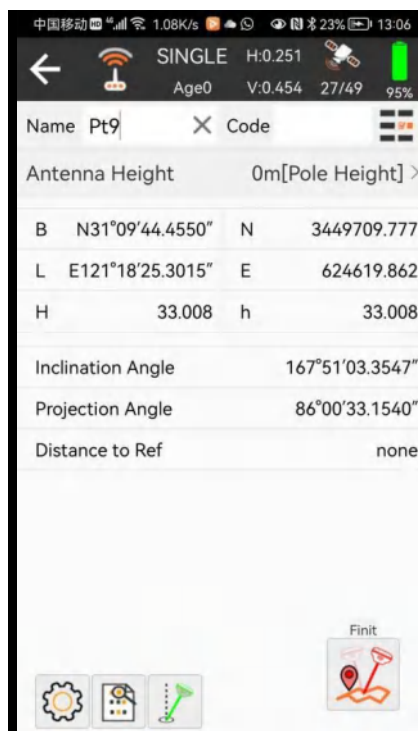


Figure 4.2-1

### 4.3 Control Point Survey

Click [Survey] -> [Control point survey], as shown in Figure 4.3-1, sometimes a high precision point is measured. Collecting this survey point requires reset the equipment many times, reaching a fixed solution for a period of time and collecting many points. Through certain calculation method, kick the points with large deviation from the average and average the basic several optimal values to obtain a high precision positioning point. In this way, the survey point has high precision guarantee. We call this type point the control point. In the survey interface of the control point, the middle area displays all the coordinate points collected by the control point in real time, the Figureical distribution of the control point can be seen, and the accuracy of the control point can be determined by a certain program. The two icons below the drawing are the survey settings and the point library function portal;

The survey setting, as shown in Figure 4.2-2, in addition to setting the collection limit, also needs to control the collection parameters of the points, such as the number of smooth points, smoothing interval, repetition number, etc.

After the survey of the control point is completed, the survey result page will pop up, as shown in Figure 4.2-3, showing the survey analysis and results of the control point, the observation time, qualified rate, whether the control point meets the accuracy requirements, etc.

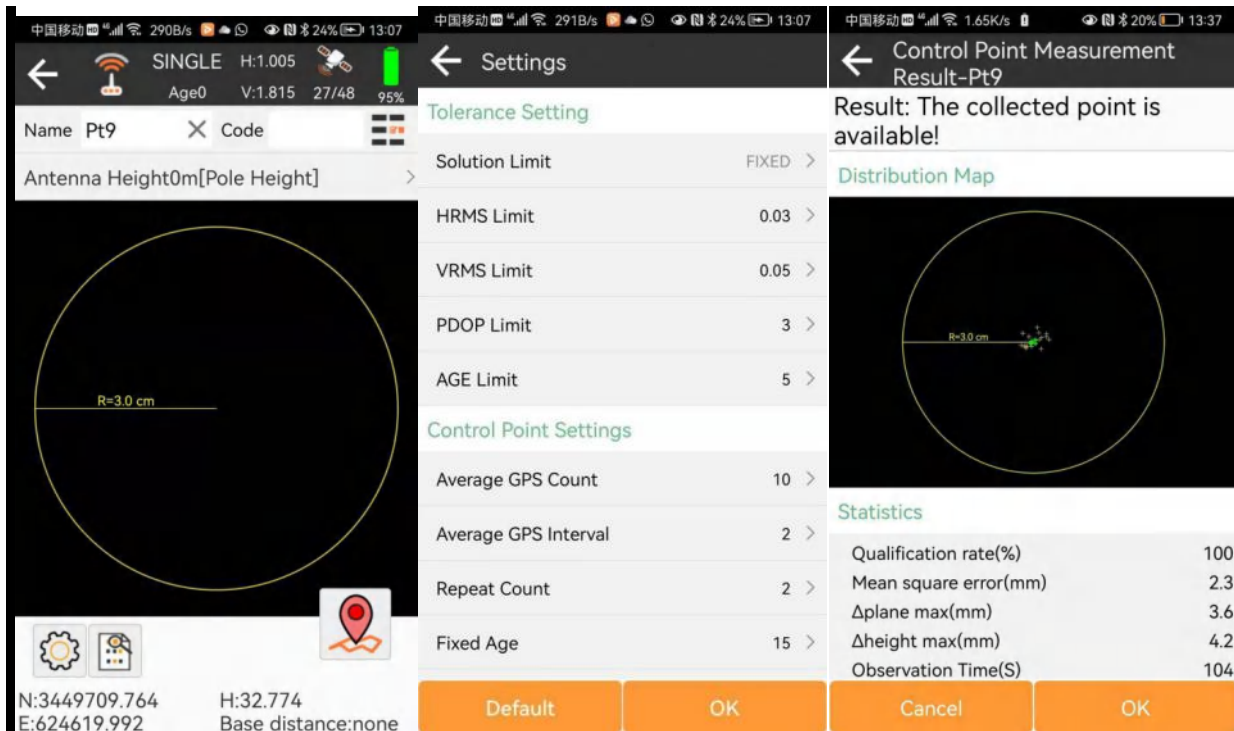


Figure 4.3-1

Figure 4.3-2

Figure 4.3-3

## 4.4 Point Stakeout

Click [Survey] -> [Point Stakeout] to enter the interface of the setting out point library, as shown in Figure 4.4-1. Point Stakeout refers to the location of the point at the field site if the point coordinates are known. In the sample point will show the sample point and put point, click the sample point to remove, view the details and sample, to sample point is part of the coordinate point library, add Import data Export data operation consistent with the coordinate point library, did not actually delete points in the point library, also can be selected in the coordinate point (all points in the coordinate point library). After selecting the point for demout, enter the point demout interface as shown in Figure 4.4-2.

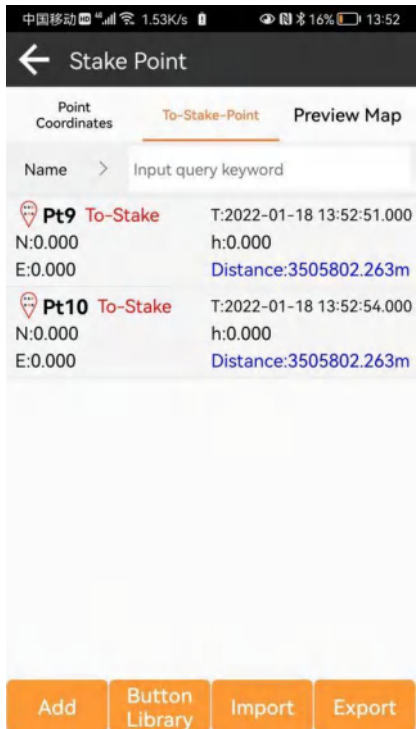
The layout of the point sample interface is similar to the point survey and is somewhat different. However, the southeast and northwest deviation value from the target is shown in the status information bar. The compass compass is not in the top right corner of the drawing area but is currently positioned together. Below the drawing area, in addition to the survey setting function, there are the nearest point, the top bit, and the next bit.

In addition to the survey setting, information display setting, and function menu setting, as shown in Fig. 4.4-3. The target can be set according to the southeast, northwest or left and right prompts, the reference direction of the front and back can be the front direction of the host or press the known reference point direction, and can also set the prompt range, setting out limit difference, etc.

## What if you get to the target point faster?

If the user has a good sense of direction, in the real-time field industry can distinguish the southeast and northwest, in the sample compass display, you can directly see the continuity of the current positioning point and the target point, which direction to the past. As shown in Figure 4.4-2, the target point Pt4 is found by walking southwest.

If the user sense of direction is not good, can not distinguish the southeast and northwest, you can see the current positioning of the small arrow, the small arrow is pointing to the thin hand when put flat, as shown in Figure 4.4-2, the current thin hand is pointing to the south. You can turn the Data controller pointing, when the Data controller point and the current point Communication overlap, that the Data controller pointing is the same with the target point orientation, at this time, press the Data controller pointing, can go forward.



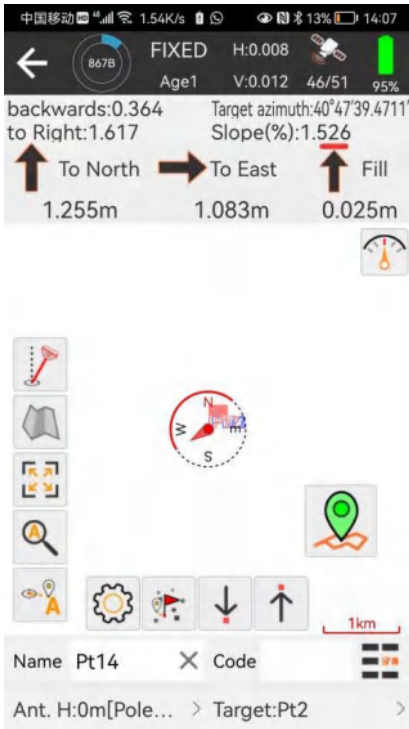


Figure 4.4-1

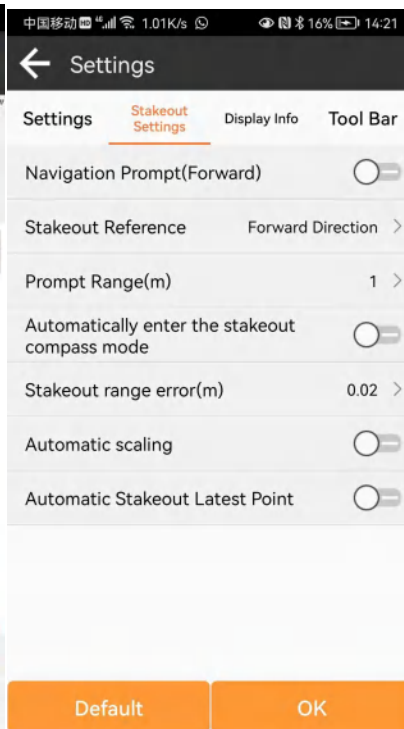


Figure 4.4-2

Figure 4.4-3

In the sample point to be released, click the data item, click the detailed information of the entry point, including the information of each setting point and the Figureical distribution map of the demout target and collection points, as shown in Figure 4.4-4, 4.4-5.

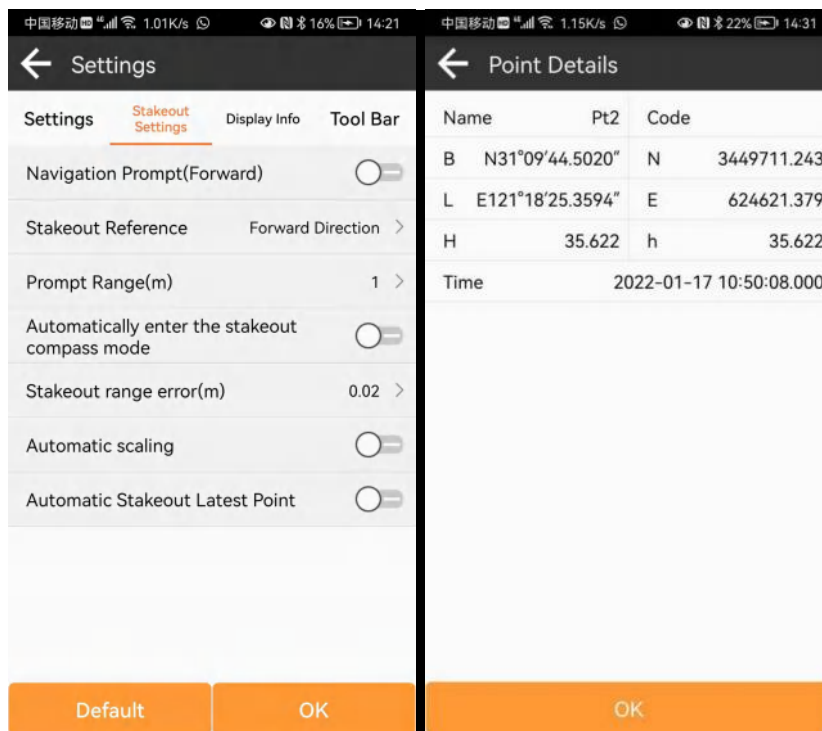


Figure 4.4-4

Figure 4.4-5



## 4.5 CAD

Click [Survey] -> [CAD]. As shown in Figure 4.5-1, CAD function is the drawing of CAD Figures display, line, fold, arc, polygon and Figure calculation, as well as the Import data and Export data of DXF, DWG Figures, layer management and demout of CAD Figures.



Click to enter the CAD Layer Management, as shown in Figure 4.5-2. You can create a new delete layer, set whether the layer is visible, Import data DXF, DWG and other drawings, Export data DXF files, and set a layer as a working layer.



Click on the New Drawing, as shown in Figure 4.5-1. It includes many types of Figures, including line segment, fold line, arc, polygon, two-point fixed square, center point + rectangular square, three-point fixed rectangle, center point + long + wide fixed rectangle, center point + radius fixed circle, three-point circle, curve and so on. You can draw a new drawing directly in the drawing area, and the point elements can select the points that already exist or take free points from the screen.



Click to perform some tool calculations for CAD, as shown in Figure 4.5-3. It includes the functions of two circle intersection, two line intersection, intersection of two arbitrary Figures, distance offset calculation, element translation, calculation point by number, calculation points by distance, element reverse and line segment extension.

After selecting the CAD drawing, as shown in Figure 4.5-4. You can delete drawings, view details, demine, and so on.

After selecting the element, click the out and enter the CAD interface as shown in Figure 4.5-5. Setting out is to find the location of the target coordinates in the actual location. The setting out operation is similar to the Point Stakeout and line setting out.

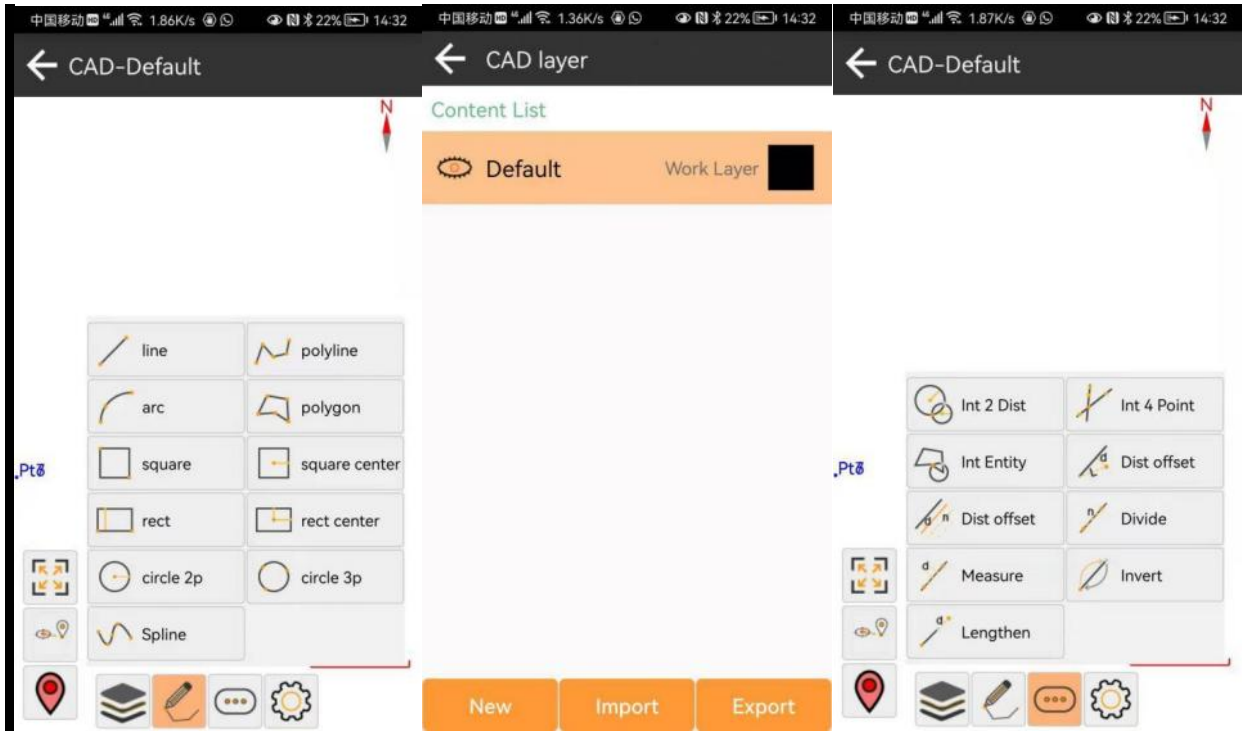


Figure 4.5-1

Figure 4.5-2

Figure 4.5-3

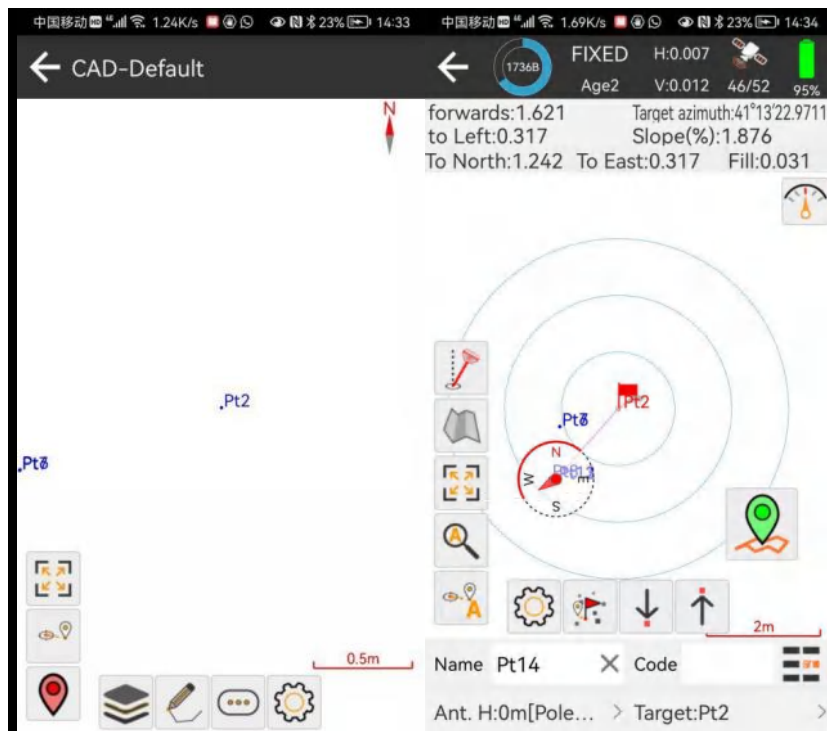



Figure 4.5-1

Figure 4.5-2

## 4.6 Line Stakeout


Click [Survey] -> [Line Stakeout] to enter the interface of straight line library. As shown in Figure 4.6-1, straight line demenout is a designed straight line, input into

the straight line library, and field sample the straight line. You can sample in real-time, mileage, deviation, height difference according to the straight line, or the straight line can be divided into points at a certain interval to sample the point on the straight line point by point.

Line library management, you can add, delete, Import data, and Export data the line data; create a new line, as shown in Figure 4.6-2. Output the line name and set the starting point and ending coordinates, and build a new straight line according to the starting point + azimuth + length mode. Click to select point data from the coordinate point library and click on point information to enter the point editing interface as shown in Figure 4.6-3. 

Click the line list item to delete and edit the sample line and click the sample, as shown in Figure 4.6-4. You can set the setting of line or point by point. If it is point by point, you need to set the calculation method by the pile number or the whole pile distance, distance interval and the automatic setting nearest point.

Enter the straight line setting out interface as shown in Figure 4.6-5. You can sample the last line, next line, next point, next point through the menu operation.

Set out point by point, sometimes need to sample outside the point calculation, need to specify the mileage and offset sample a point, this is called pile pile, click to add pile sample, as shown in Figure 4.6-6. 

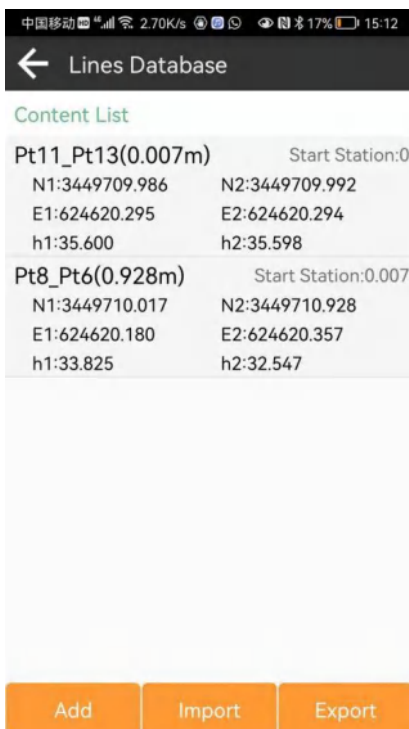


Figure 4.6-1

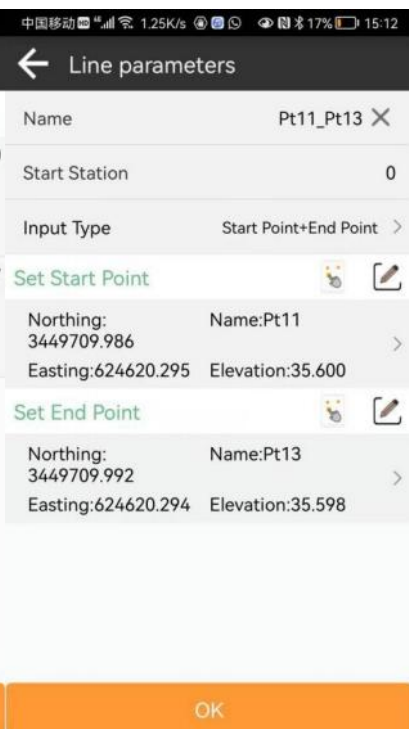


Figure 4.6-2

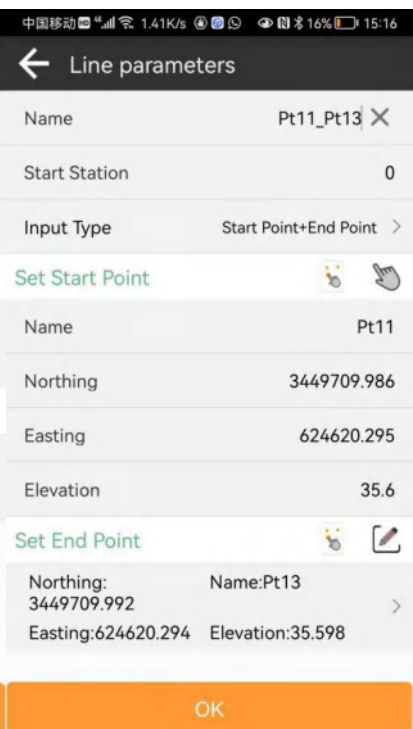


Figure 4.6-3

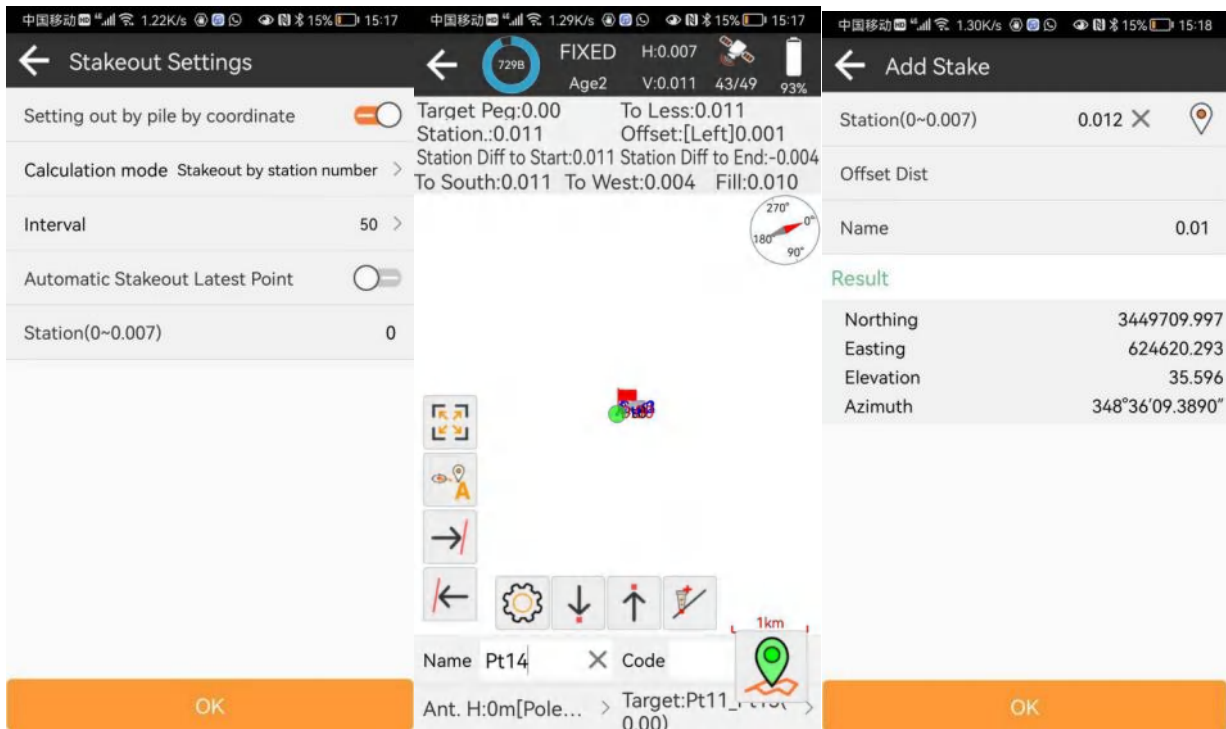


Figure 4.6-4

Figure 4.6-5

Figure 4.6-6

## 4.7 DSM Stakeout

Click [survey] -> [DSM Stakeout], as shown in Figure 4.7-1, to use the current positioning coordinates to sample the site according to the existing site triangle network data, and to determine whether the real-time location of a certain location needs to be filled or dug.

The site elevation library can be built, Import dataed, or edited and deleted. A new site elevation file is built, as shown in Figure 4.7-2, 4.7-3. The coordinates of the triangle network file can be input manually, or batch selected from the point library. The point coordinate order can be adjusted up, or the coordinates can be Import dataed.

Click on the site elevation library data item to edit, delete and demo the elevation file, and click on the demo to enter the elevation sample-setting out interface, as shown in Figure 4.7-4.

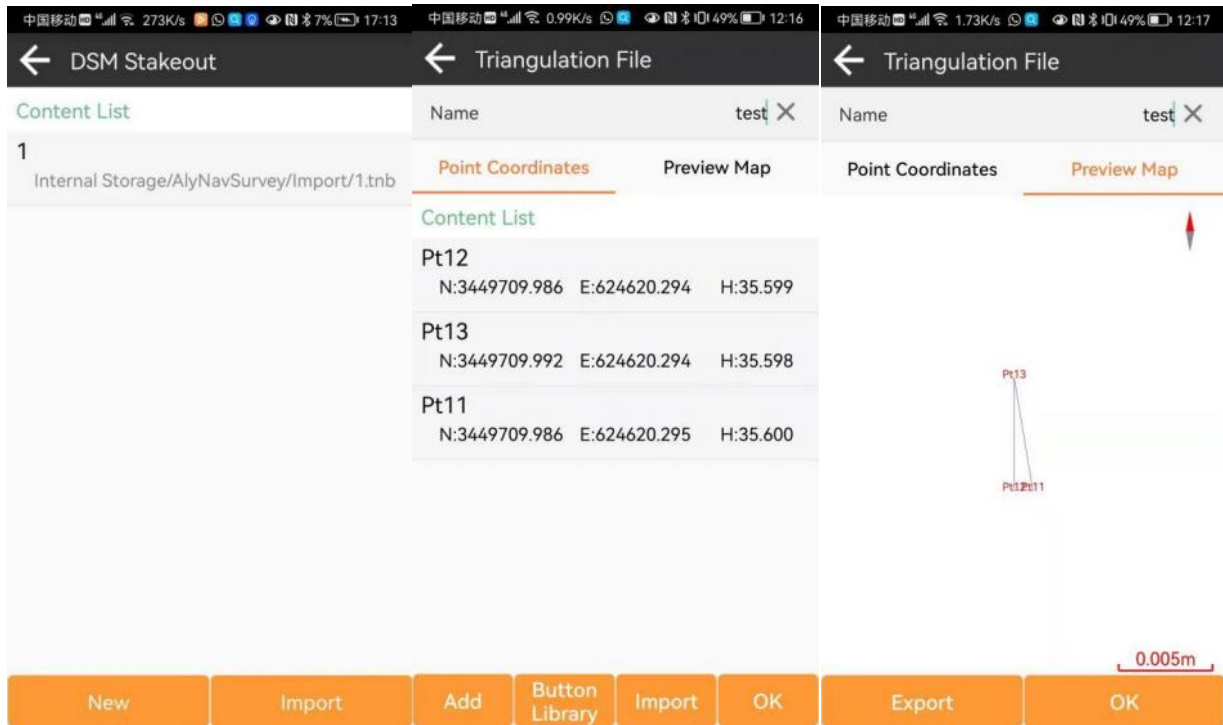


Figure 4.7-1 Figure 4.7-2 Figure 4.7-3



Figure 4.7-4

## 4.8 Stake Road

Click [survey] -> [Stake Road] to enter the road database management interface, as shown in Fig. 4.8-1. The Stake Road function is designed through flat curve, vertical curve, chain break, standard cross section, ultra-high, widening, slope, etc.

For a series of section data collection according to the line design documents and GNSS satellite positioning. It is applicable to data survey and collection, line construction and line acceptance of highway and railway lines at all levels.

Road design, as shown in Figure 4.8-2. Road design elements include flat curve, vertical curve, chain break, standard cross section, slope, and standard cross section includes ultra-high and width of section plate, etc.

1. Flat curve design: as shown in Fig. 4.8-3. The flat curve is the center line of the road, which is the direction of the entire road. The flat curve design method includes line element method, intersection method and coordinate method. All roads are made of road starting points, straight lines, relief curves, and circular curves. Line element method is a design line directly into the elements of the road, where the starting point contains the starting mileage and starting coordinates, the line contains the element starting azimuth and line length, the curve contains the element starting azimuth and starting and end radius and curve length, and the circle contains the element starting azimuth and radius and length. Usually, the end azimuth of the previous element is equal to the starting azimuth of the next element, the radius of the connecting end of the straight line is infinite, and the radius of the connecting end of the circle is equal to the circle radius. The intersection method is to calculate the combination of road design elements through the length of the control curve parameter and circle radius of the control point. The coordinate method calculates the combination of road design elements through the coordinate point on the coordinate point and the coordinate point according to a certain algorithm. The road generated by the coordinate method has only the starting point, straight line and arc, which is a simplified line with no easing curve composition.

2. Vertical curve design: as shown in Fig. 4.8-4. The vertical curve is the elevation fluctuation of the road centerline at each mileage. It is the high design of the line center line, and it needs to input the elevation corresponding to the line elevation slope point and the arc radius corresponding to the slope point. The software calculates the elevation value of the line at each mileage point based on these design elements.

3. Chain break design: as shown in Figure 4.8-5. In the process of line design, sometimes pre-designed line due to the actual construction environment conditions are not allowed to build or cost too high, have to somewhere local modification of line design, after line modification, line may be longer or shorter than the original line, at this time to modify the line behind the design mileage data unchanged, at this time, broken chain is divided into long chain and short chain. Start using a new mileage at a mileage point, keeping the mileage data behind that mileage unchanged.

4. Standard cross-sectional design: as shown in Figure 4.8-6. In the actual construction road, the center line of the road is only the planned direction of the line, and the actual road includes motor vehicle lanes, non-motor vehicle lanes, green belts, sidewalks and other road plates for the middle use. These plate whole road overall

design of the plate width, slope and other parameters, we call the standard cross-section. In real-time road, due to the influence of building environmental conditions, often can not build according to the standard cross section, sometimes a plate may need to start to widen and narrow in a place, sometimes because the road bend, in order to drive safety need in a higher slope, here need to set the section of ultra high widening parameters, as shown in Figure 4.8-7. Ultra-high width is set for each plate and added by varying mileage.

5. Slope design: as shown in Figure 4.8-8. In the actual road construction process, in addition to the main road of the road, the road may pass through the mountain, lake and road height difference environment, if the mountain dug after the road may lead to the decline of the road, so need to the mountain and according to the lake according to certain standards construction slope, protect the road.

If the road is designed according to the above elements, is a complete line design, sometimes different construction units only need a part of the basic, there will not be all the design data, users according to their actual project requirements, road design can use the road design documents for construction operations.

Note: To facilitate road design editing, the software supports road Import data of various formats, as described.

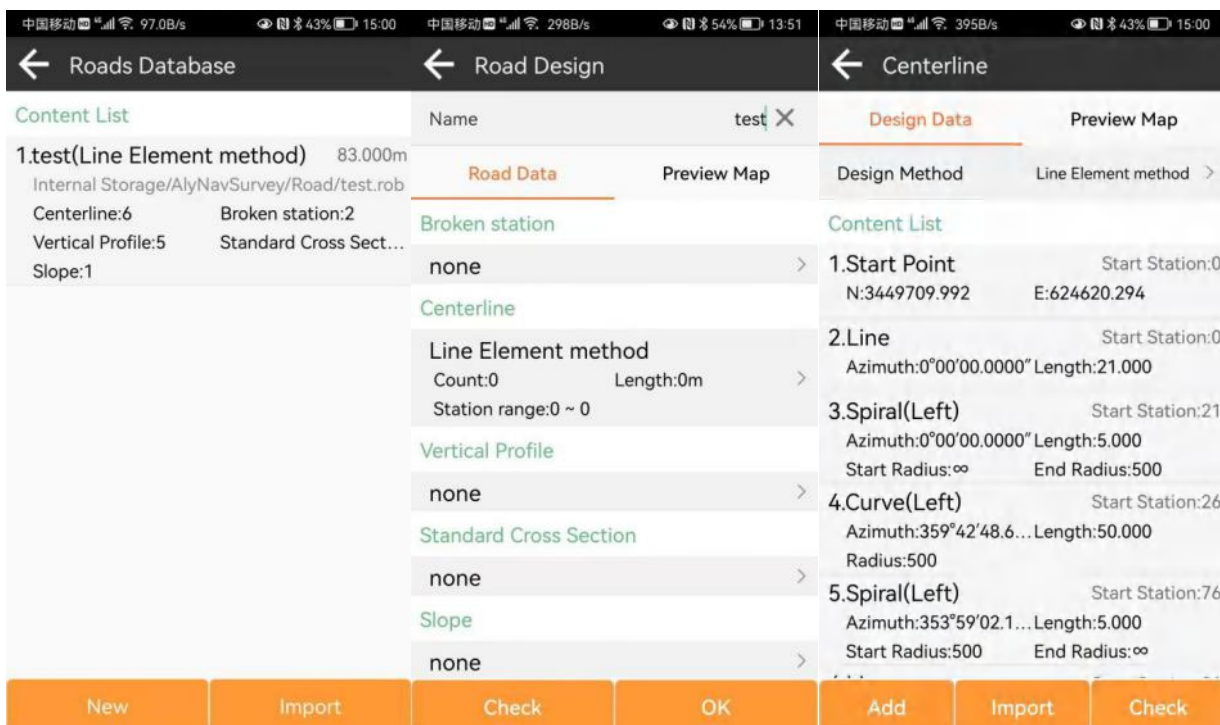


Figure 4.8-1

Figure 4.8-2

Figure 4.8-3

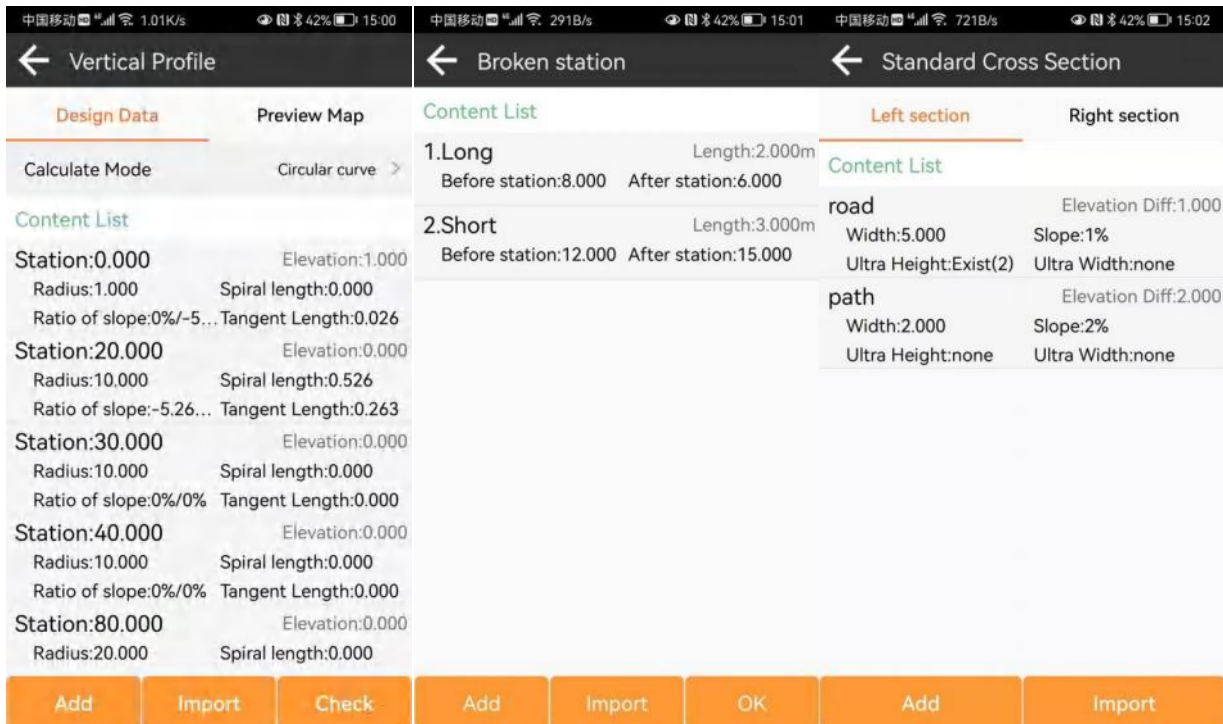


Figure 4.8-4

Figure 4.8-5

Figure 4.8-6

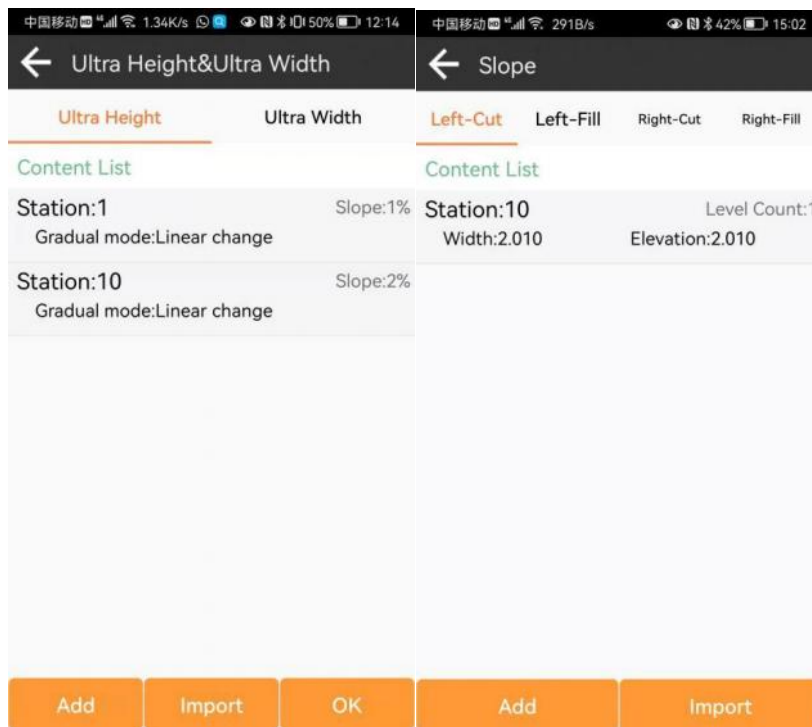


Figure 4.8-7

Figure 4.8-8

Road layout: the designed road line documents, construction work.

Set centerline of road, shown in Figure 4.8-9. Setting out interface and operation are similar to Point Stakeout and line setting out. Click the line centerline setting out



to switch to other demount modes, including point by point line setting out, cross section setting out and cross section survey.

Line lines lines point by point as shown in Figure 4.8-10. Click on the function menu icon below to enter the survey setting, the point on, the next, add pile, etc. Entry into the sample library is shown in Figure 4.8-11. You can select the base point for setting out, and you can recalculate the pile-by-pile coordinate points of the road centerline, as shown in Figure 4.8-12. Set the coordinate point according to the whole pile number or the whole pile distance, and calculate according to a certain mileage deviation. Cross section was measured as shown in Figure 4.8-13. Collect the elevation data of road lines and surrounding sections according to a certain distance interval for the preliminary survey of road construction, and calculate the cost of road earthwork assessment and construction.



Figure 4.8-9

Figure 4.8-10

Figure 4.8-11

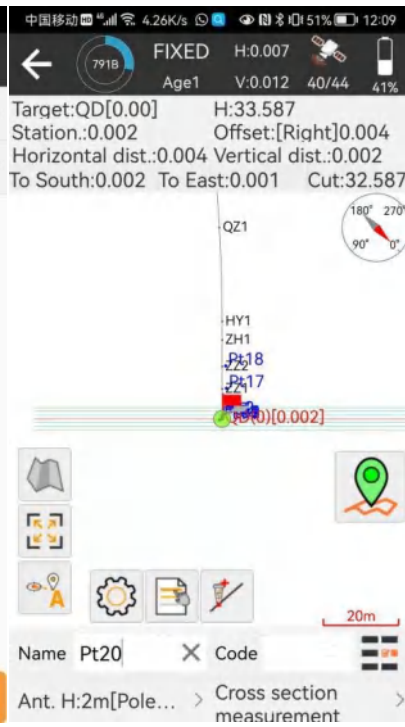
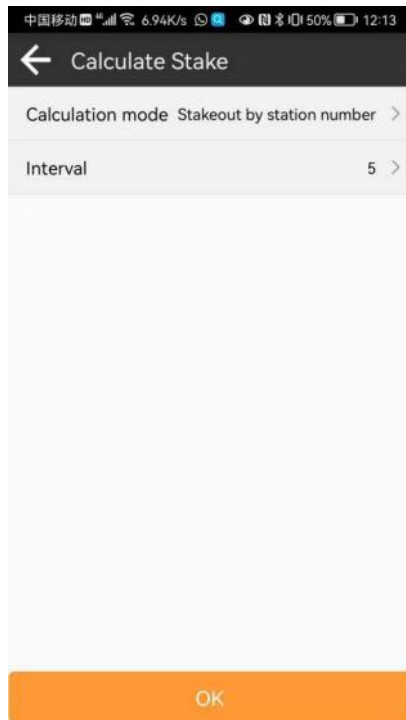


Figure 4.8-12

Figure 4.8-13

## V. Tools


At the main software interface, click [Tools] for the corresponding function menu as shown in Figure 5-1. Tools include Coordinates Converter, Angle Converter, Perimeter and Area, Calculator and other common survey tools.



Figure 5-1

### 5.1 Coordinates Converter

Click [Tools] -> [Coordinates Converter], as shown in Figure 5.1-1, 5.1-2. Coordinate points are transformed before the plane, geodetic, and spatial coordinates through the coordinate system parameters set by the current project.

 Click can select a point from the point library to make the calculation transformation, which can be saved to the point library.

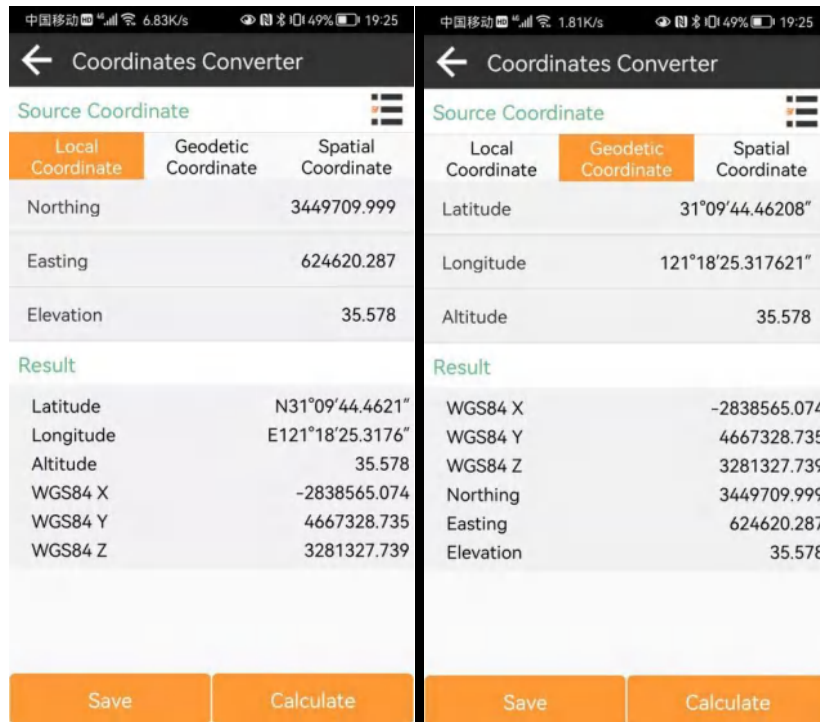


Figure 5.1-1 Figure 5.1-2

## 5.2 Angle Converter

Click [Tools] -> [Angle Converter], as shown in Figure 5.2-1. Through this function, you can perform the transformation before displaying the format from degree, seconds, radian and other angles, and select one of the formats to calculate the value of the other formats.

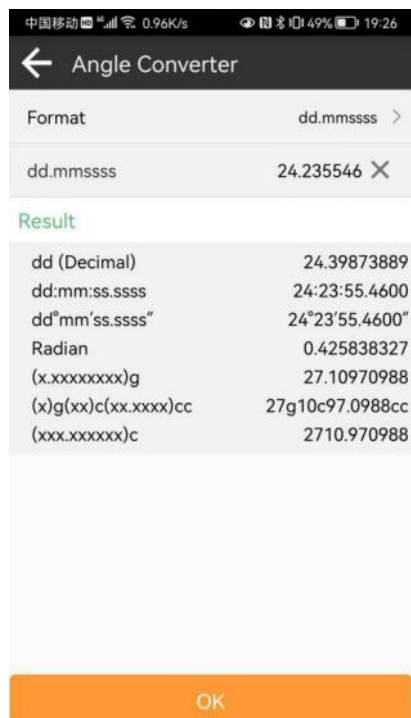


Figure 5.2-1

### 5.3 Perimeter and Area

Click [Tools] -> [Perimeter and Area], as shown in Figure 5.3-1. By managing the coordinate points of the opposite block in the coordinate point, you can increase the Import data and Export data coordinate points, and view the Figure of the face block in the preview Figure, as shown in Figure 5.3-2. Click on the calculation, as shown in Figure 5.3-3.

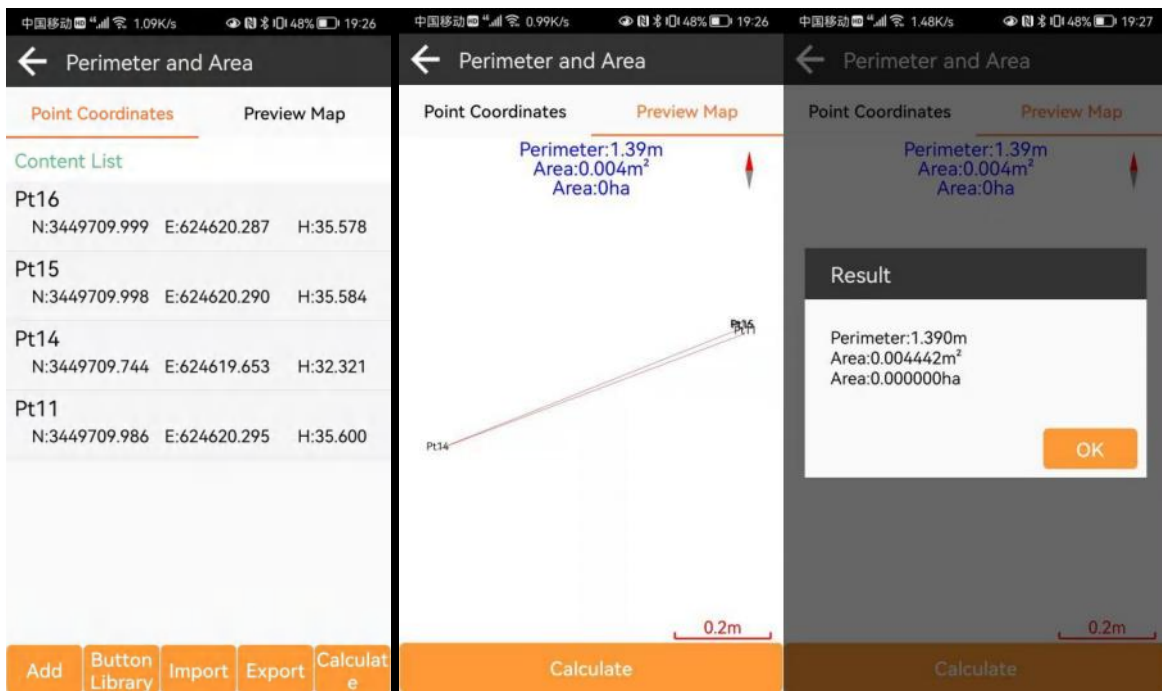


Figure 5.3-1

Figure 5.3-2

Figure 5.3-2

### 5.4 Calculator

Click [Tools] -> [Calculator], as shown in Figure 5.4-1, to perform some simple mathematical operations, in addition, other calculation tools have the corresponding text instructions.



Figure 5.4-1